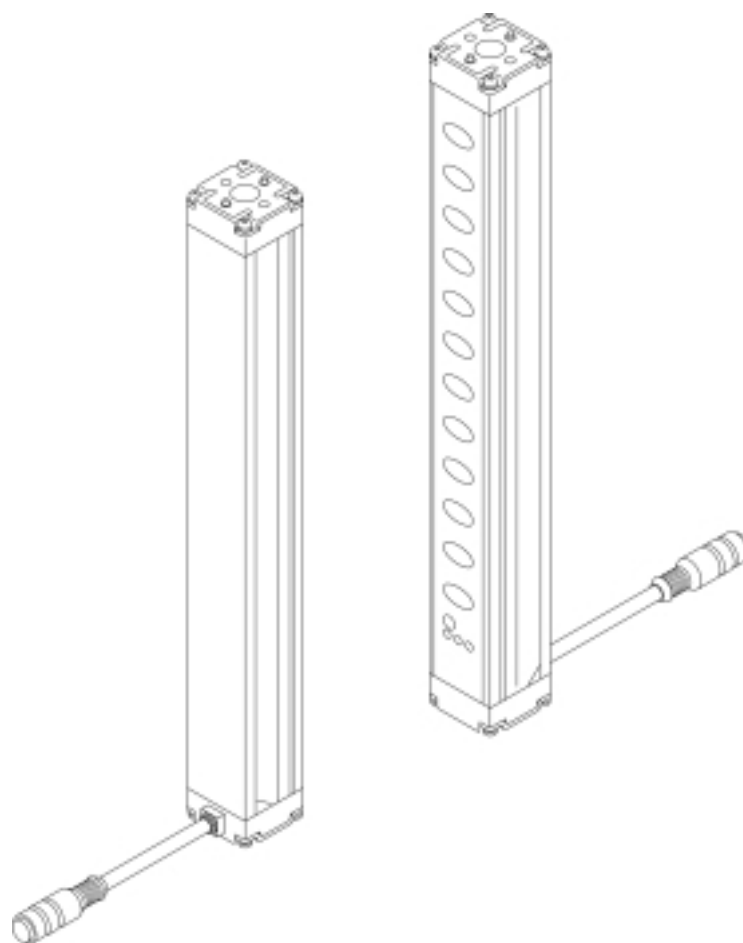




## INSTRUCTION MANUAL

**Compact /Global Safety  
Light Curtain  
SF2-EH Series**

**Model No.: SF2-EH□(-N)**



## Revision Record

First Edition	1999/8/4
Second Edition	1999/9/3
Third Edition	1999/12/15
Fourth Edition	2001/10/31
Fifth Edition	2002/7/15

### Note

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- 2) The contents of this instruction manual may be changed without prior notice for further improvement of the product.
- 3) Though we have carefully drawn up the contents of this instruction manual, if there are any aspects that are not clear, or any error that you may notice, please contact our local SUNX office or the nearest distributor.

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# Chapter 1 Introduction

## 1.1 Before Using This Product

Thank you for purchasing SUNX's Compact-Global Safety Light Curtain, **SF2-EH** Series (hereinafter called 'this device').

Please read this instruction manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

This device is a safety light curtain for protecting a person from dangerous parts of a machine which can cause injury or accident.

This manual has been written for the following personnel who have undergone suitable training and have knowledge of safety light curtains, as well as, safety systems and standards (ANSI, etc.)

- who are responsible for the introduction of this device
- who design a system using this device
- who install and connect this device
- who manage and operate a plant using this device

## 1.2 Safety Precautions

### General Cautions

Use this device as per its specifications. Do not modify this device since its functions and capabilities may not be maintained and it may malfunction.

Use of this device under the following conditions or environment is not presupposed. Please consult us if there is no other choice but to use this device in such an environment.

- 1) Operating this device under conditions and environment not described in this manual.
- 2) Using this device in the following fields: nuclear power control, railroad, aircraft, automobiles, combustion facilities, medical systems, aerospace development, etc.

When this device is to be used for enforcing protection of a person from any danger occurring around an operating machine, the user should satisfy the regulations established by national or regional security committees (Occupational Safety and Health Administration: OSHA, the European Standardization Committee, etc.). Contact the relative organization(s) for details.



In case of applying this device to particular equipment, follow the safety regulations in regard to appropriate usage, mounting (installation), operation and maintenance. The users, including the installation operator, are responsible for the introduction of this device.


Use this device by installing suitable protection equipment as a countermeasure for failure, damage, or malfunction of this device.


Before using this device, check whether the device performs properly with the functions and capabilities as per the design specifications.

In case of disposal, dispose this device as industrial waste.

## Attention Marks

This instruction manual employs the following attention marks  ,  depending on the degree of the danger to call operator's attention to each particular action. Read the following explanation of these marks thoroughly and observe these notices without fail

 If you ignore the advice with this mark, death or serious injury could result.

 If you ignore the advice with this mark, injury or material damage could result.

<Reference> It gives useful information for better use of this device.

### WARNING

- **Machine designer, installer, employer and operator**

- The machine designer, installer, employer and operator are solely responsible to ensure that all applicable legal requirements relating to the installation and the use in any application are satisfied and all instructions for installation and maintenance contained in the instruction manual are followed.
- Whether this product functions as intended to and systems including this product comply with safety regulations depends on the appropriateness of the application, installation, maintenance and operation. The machine designer, installer, employer and operator are solely responsible for these items.

- **Engineer**

- The engineer would be a person who is appropriately educated, has widespread knowledge and experience, and can solve various problems which may arise during work, such as a machine designer, or a person in charge of installation or operation etc.

- **Operator**

- The operator should read this instruction manual thoroughly, understand its contents, and perform operations following the procedures described in this manual, for the correct operation of this device.
- In case this device does not perform properly, the operator should report this to the person in charge and stop the machine operation immediately. The machine must not be operated until correct performance of this device has been confirmed.

- **Environment**

- Do not use a mobile phone or a radio phone near this device.
- Install the sensor by considering the effect of nearby reflective surfaces, and take countermeasures, such as painting, masking, roughening, or changing the material of the reflective surfaces, etc. Failure to do so may cause the sensor not to detect, resulting in death or serious body injury.
- Do not install this device in the following environments.
  - 1) Areas exposed to intense interference (extraneous) light such as direct sunlight
  - 2) Areas with high humidity where condensation is likely to occur
  - 3) Areas exposed to corrosive or explosive gases
  - 4) Areas exposed to vibration or shock of levels higher than that specified
  - 5) Areas exposed to contact with water
  - 6) Areas exposed to too much steam or dust
  - 7) Areas where the beam-receiving part of this device is directly exposed to light from high-frequency fluorescent lamp (inverter type) or rapid starter fluorescent lamp.

- **Installation**

- Always keep the correctly calculated safety distance between this device and the dangerous parts of the machine.
- Install extra protection structure around the machine so that the operator must pass through the sensing area of this device to reach the dangerous parts of the machine.
- Install this device such that some part of the operator's body always remains in the sensing area when operation is done with the dangerous parts of the machine.
- Do not install this device at a location where it can be affected by wall reflections.
- When installing multiple sets of this device, connect the sets and, if necessary, install some barriers such that mutual interference does not occur.
- Do not use this device in a reflective configuration.
- The corresponding emitters and receivers must be correctly oriented and connected.

## ⚠ WARNING

### • Equipment in which this device is installed

- Do not use this device in the 'PSDI Mode', functioning as the starter of the equipment in which this device is installed.
- In Japan, do not use this device as safety equipment for a press machine.
- Do not install this device with a machine whose operation cannot be stopped immediately in the middle of an operation cycle by an emergency stop equipment.

### • Wiring

- Be sure to carry out the wiring in the power supply off condition.
- All electrical wiring should conform to the regional electrical regulations and laws. The wiring should be done by engineer(s) having the special electrical knowledge.
- Do not run the sensor cable together with high-voltage lines or power lines or put them together in the same raceway.
- In case of extending the cable of the emitter or the receiver, each can be extended by 27m or less.
- Do not control the device only at one control output (OSSD1, OSSD2).

### • Maintenance

- When replacement parts are required, always use only genuine supplied replacement parts. If substitute parts from another manufacturer are used, the sensor may not come to detect, resulting in death or serious body injury.
- The periodical inspection of this device must be performed by an engineer having the special knowledge.
- After maintenance or adjustment, and before starting operation, test this device following the procedure specified in '**Chapter 4 Maintenance**'.
- Clean this device with a clean cloth. Do not use any volatile chemicals.

### • Others

- Never modify this product. Modification may cause the sensor not to detect, resulting in death or serious body injury.
- Do not use this device to detect objects flying over the detection area.
- Do not use this device to detect transparent objects, translucent objects or objects smaller than the specified min. sensing objects.


## 1.3 Applicable Standards


This device corresponds to the following standards.

Corresponding Territory	Standard No.	Authorizing Organization
Europe (EU)	EN 61496-1 (Type 4) IEC 61496-2 (Type 4) EN 954-1 (Category 4) EN 60204-1	DEMK
United States of America, Canada	IEC 61496-1/2 (Type 4) UL 1998 UL 491	UL
	OSHA 1910.212 OSHA 1910.217 (C) ANSI B11.1 to B11.20 ANSI/RIA R15.06-1999	—

### <Reference>

Since OSHA and ANSI are not the authorizing organizations for this device, the conformity to these standards has been evaluated by ourselves.

In Canada, the  mark has the same validity as the CSA mark.

This product conforms to the EMC directive and the Machinery directive. The  mark on the sensor main body indicates that this product conforms to the EMC directive.

## ⚠ WARNING

In Japan, never use this device as a safety equipment for any press machine or shearing machine.

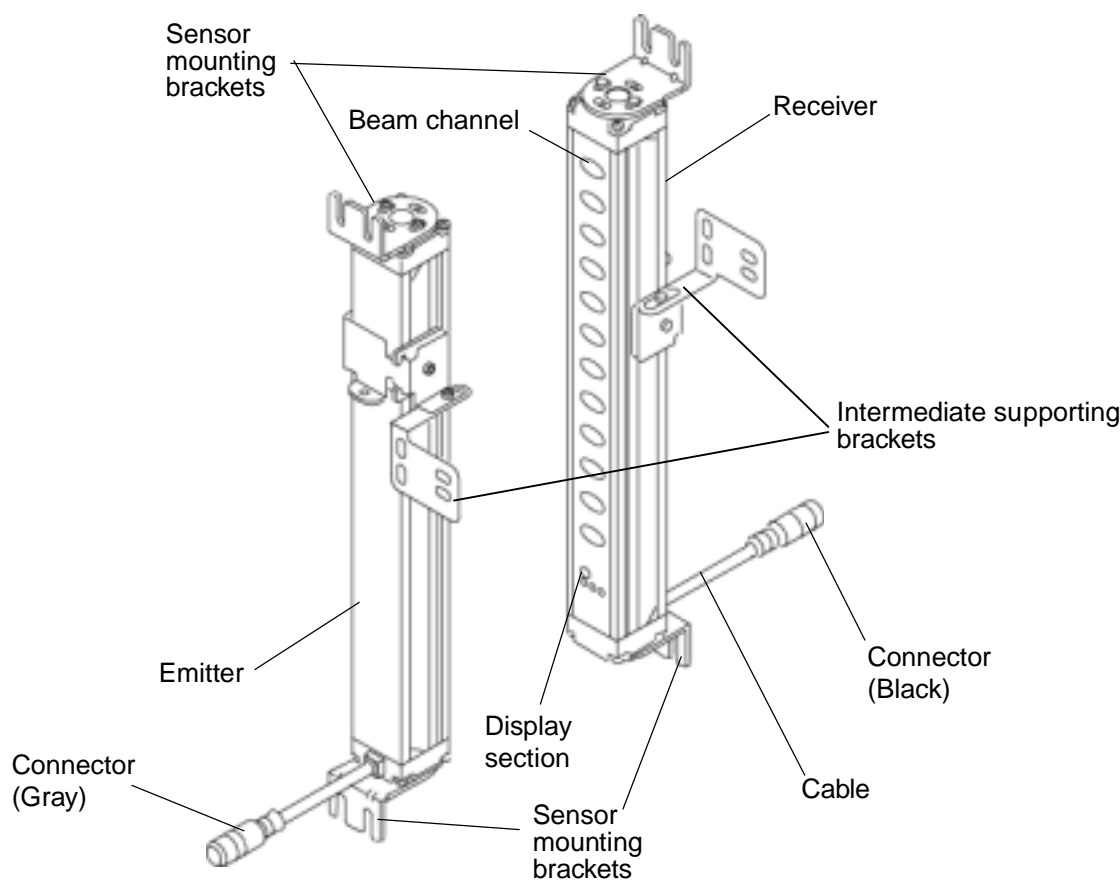
# Chapter 2 General

This chapter gives the system construction, part description, dimensions, etc., of this device.

## 2.1 Features

- This device (**SF2-EH** series) is a safety light curtain with the following features.
- It conforms to the safety standards of Europe and North America.
  - It incorporates two semiconductor outputs and requires no controller.
  - The control output (OSSD1, OSSD2) is available in two types, PNP output equivalent type and NPN output equivalent type.
  - It has a beam pitch of 20mm (detection capability: 30mm) and can have a sensing height from 220mm to 1,580mm.
  - Interference prevention is possible by series connection, parallel connection or series/parallel mixed connection.
  - Beam-axis alignment indicators which make beam-axis alignment easy are incorporated.
  - It incorporates an emission halt input (test input).

## 2.2 Part Description



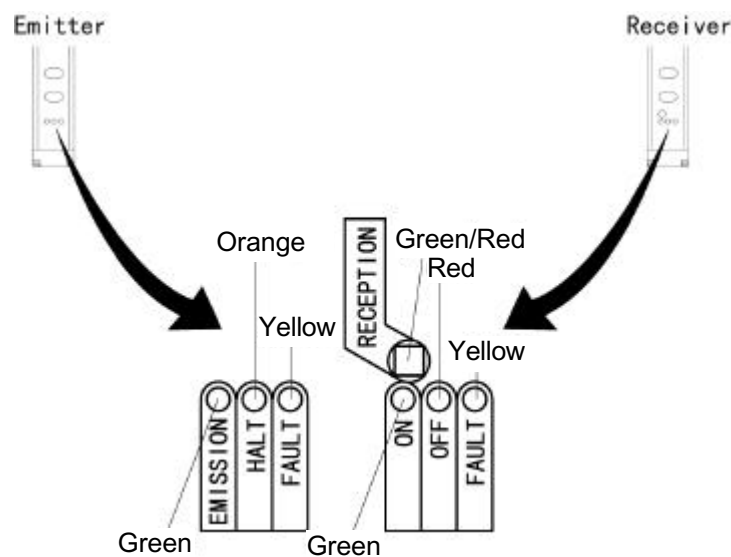
### <Reference>

• Contents of packing			
Sensor	<b>SF2-EH (-N)</b>	Emitter	1 No.
		Receiver	1 No.
Sensor mounting bracket	<b>MS-SF2-1</b>		1 set
Sensor mounting bracket: 4 Nos., Hexagon-socket-head bolt: 8 Nos.			
Intermediate supporting bracket	<b>MS-SF2-2</b>		0 to 2 sets
One set consists of intermediate supporting bracket: 2 Nos., Retaining plate: 2 Nos. Hexagon-socket-head bolt: 2 Nos., Hexagon-headed bolt 2 Nos., Washer: 2 Nos., Nut: 2 Nos.			
Note: <b>MS-SF2-2</b> (intermediate supporting bracket) is attached with the following sensors. The number attached is different depending on the sensor as follows.			
1 set: <b>SF2-EH24(-N)</b> , <b>SF2-EH28(-N)</b> , <b>SF2-EH32(-N)</b> , <b>SF2-EH36(-N)</b> , <b>SF2-EH40(-N)</b> , <b>SF2-EH48(-N)</b> , <b>SF2-EH56(-N)</b>			
2 sets: <b>SF2-EH64(-N)</b> , <b>SF2-EH72(-N)</b> , <b>SF2-EH80(-N)</b>			
Test rod	<b>SF2-EH-TR (ø30×220mm)</b>		1 No.
Instruction Manual			1 No.



Emitter:	It emits light to the receiver facing it. Further, status of the emitter and the receiver is indicated in its display section.
Receiver:	It receives light from the emitter facing it, and turns the control output (OSSD1, OSSD2) to ON when light is received from the emitter for all beam channels, and to OFF when light is blocked even for one beam channel. Further, the receiver status is indicated in its display section.
Beam channel:	The light emitting elements of the emitter and the light receiving elements of the receiver are placed at an interval of 20mm.
Sensor mounting: Bracket	The mounting direction (side face, rear face) of the sensor (emitter and receiver) can be selected by changing the direction of the brackets. The mounting angle is also adjustable.
Intermediate support- ing brackets	This bracket is to be used when the total length of the sensor is 24 beam channels or more. The orientation of the brackets can be adjusted to suit the mounting direction of the sensor (emitter and receiver).

#### Display Section:



#### <Emitter Display Section > (Refer to the figure above.)

- 1) Emission indicator (EMISSION) (Green): lights up under normal emission
- 2) Emission Halt Indicator (HALT) (Orange): lights up when light emission is halted
- 3) Fault Indicator (FAULT) (Yellow): lights up or blinks when a fault occurs in the sensor

#### <Receiver Display Section > (Refer to the figure above.)

- 1) OSSD ON indicator (ON) (Green): lights up when OSSDs are ON
- 2) OSSD OFF indicator (OFF) (Red): lights up when OSSDs are OFF
- 3) Reception indicator (RECEPTION): lights up in red with intensity proportional to the incident light intensity  
[2-color indicator (Green/Red)] for the reference beam channel (second beam channel from cable side),  
lights up in green when all beams are received
- 4) Fault indicator (Yellow): lights up when a fault occurs in the sensor

## 2.3 Specifications

### Model-wise specifications

Model No.	SF2-EH12 (-N)	SF2-EH16 (-N)	SF2-EH20 (-N)	SF2-EH24 (-N)	SF2-EH28 (-N)	SF2-EH32 (-N)	SF2-EH36 (-N)
No. of beam channels	12	16	20	24	28	32	36
Beam pitch	20mm						
Protective height (Sensing height)	220mm	300mm	380mm	460mm	540mm	620mm	700mm
Weight (total of the emitter and the receiver)	2.0kg approx.	2.2kg approx.	2.4kg approx.	2.9kg approx.	3.2kg approx.	3.4kg approx.	3.6kg approx.

Model No.	SF2-EH40 (-N)	SF2-EH48 (-N)	SF2-EH56 (-N)	SF2-EH64 (-N)	SF2-EH72 (-N)	SF2-EH80 (-N)
No. of beam channels	40	48	56	64	72	80
Beam pitch	20mm					
Protective height (Sensing height)	780mm	940mm	1,100mm	1,260mm	1,420mm	1,580mm
Weight (total of the emitter and the receiver)	3.8kg approx.	4.7kg approx.	5.1kg approx.	5.8kg approx.	6.4kg approx.	6.8kg appr x.

### Common specifications

Common specifications		Type	PNP output equivalent type	NPN output equivalent type
Item	Model No.		SF2-EH (	SF2-EH (-N
Sensing range			0.3 to 10m	
Min. sensing object			φ 30mm opaque object	
Effective aperture angle (EAA)			±2.5° or less [for a sensing range exceeding 3m (as required by IEC 61496-2)]	
Supply voltage			24V DC±15% Ripple P-P 10% or less	
Current consumption			200mA or less (total for both emitter and receiver)	
Control Outputs (OSSD1, OSSD2)			Semiconductor output (PNP output equivalent): 2 outputs • Max. source current: 300mA • Applied voltage: same as supply voltage [between control output (OSSD1, OSSD2) and +V] • Residual voltage: 2.5V or less (at 300mA source current)	Semiconductor output (NPN output equivalent): 2 outputs • Max. sink current: 300mA • Applied voltage: same as supply voltage [between control output (OSSD1, OSSD2) and 0V] • Residual voltage: 2.0V or less (at 300mA sink 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	
Response time			ON→OFF: 15ms or less, OFF→ON: 20ms or less (when light received is stable)	
Indicators	Emitter	Emission indicator: Green LED (lights up under normal emission) 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	OSSD ON indicator: Green LED (lights up when OSSDs are ON) OSSD OFF indicator: Red LED (lights up when OSSDs are OFF) Reception indicator: 2-color (Green/Red) LED [lights up in red with intensity proportional to the incident light intensity for reference beam channel (second beam channel from cable side), lights up in green when all beams are received] Fault indicator: Yellow LED (lights up or blinks if a fault occurs in the sensor)		
Interference prevention function		Incorporated	Series connection: 4 sets max., however total 192 beam channels max. Parallel connection: 4 sets max., however total 192 beam channels max. Series and parallel mixed connection: 12 sets max., however total 192 beam channels max.	
Emission halt (test input) function			Connection to +V or open (High): light emission halts Connection to 0V (Low): normal light emission	
Master/Slave switching input			Connection to 0V (Low): master mode operation Connection to +V or open (High): slave mode operation	

Type		PNP output equivalent type	NPN output equivalent type
Item	Model No.	<b>SF2-EH□</b>	<b>SF2-EH□-N</b>
Environmental resistance	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: 20,000lx at the light-receiving face Incandescent light: 3,500lx at the light-receiving face	
	EMC	Emission: EN 50081-2, Immunity: EN 50082-2 and IEC 61496-1	
	Dielectric strength voltage	1,000V AC for one min. (between all supply terminals connected together and enclosure)	
	Insulation resistance	20MΩ, or more, with 500V DC megger (between all supply terminals connected together and enclosure)	
	Vibration resistance	10 to 55Hz frequency, 0.75mm amplitude in X, Y and Z directions for two hours each	
	Shock resistance	300m/s <sup>2</sup> acceleration (30G approx.) in X, Y and Z directions for three times each	
Emitting element		Infrared LED (Peak emission wavelength: 870nm)	
Cable		8-core (0.3mm <sup>2</sup> ×4-core, 0.2mm <sup>2</sup> ×4-core) shielded cable, 0.5m long, with a connector at the end * Use together with the optional mating cables	
Cable extension		Extension up to total 27m is possible, for both emitter and receiver, with optional mating cables.	
Material		Enclosure: Aluminum, Cap: ABS	
Accessories		<b>MS-SF2-1</b> (Sensor mounting bracket): 1 set, <b>MS-SF2-2</b> (Intermediate supporting bracket): (Note) <b>SF2-EH-TR</b> (Test rod): 1 No.	
Applicable standard		EN 61496-1, IEC 61496-1/2, Type 4	

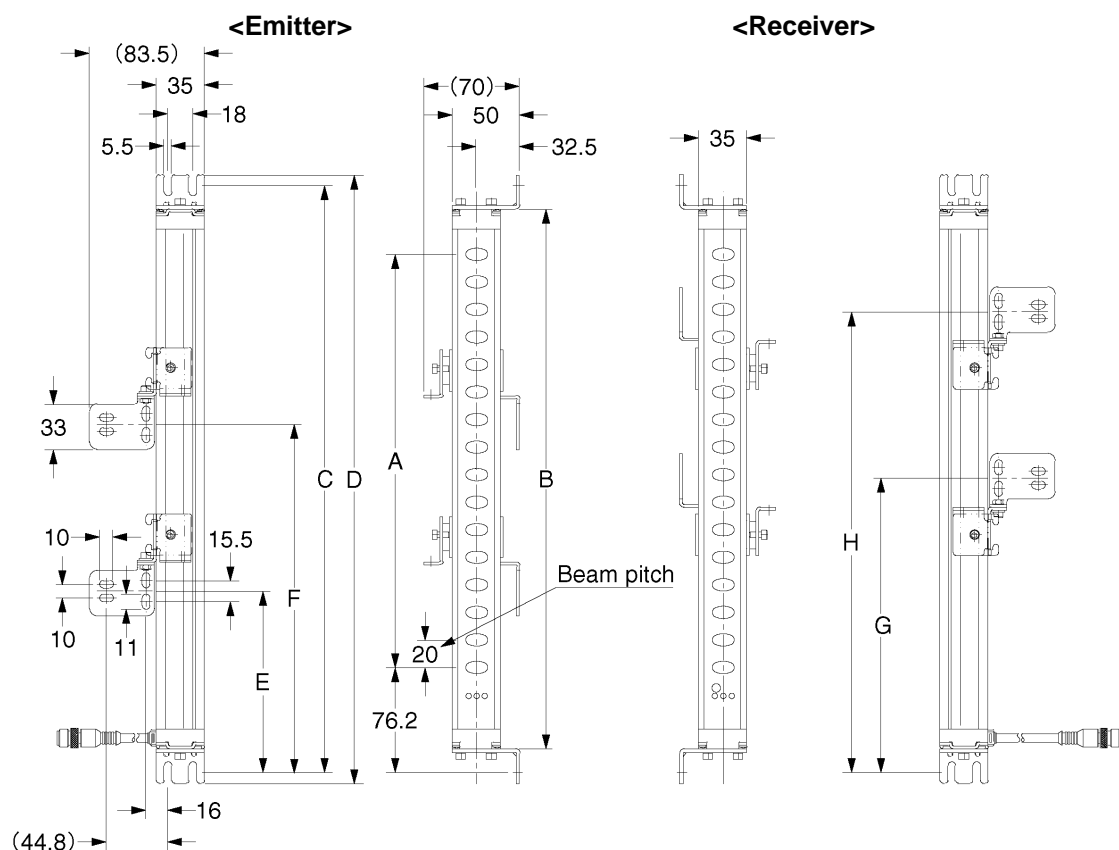
Note: **MS-SF2-2** (intermediate supporting bracket) is attached with the following sensors. The number attached is different depending on the sensor as follows.

1 set: **SF2-EH24(-N)**, **SF2-EH28(-N)**, **SF2-EH32(-N)**, **SF2-EH36(-N)**, **SF2-EH40(-N)**, **SF2-EH48(-N)**, **SF2-EH56(-N)**

2 sets: **SF2-EH64(-N)**, **SF2-EH72(-N)**, **SF2-EH80(-N)**

## 2.4 Dimensions

### 2.4.1 Side Mounting



(Unit: mm)

### **<Reference>**

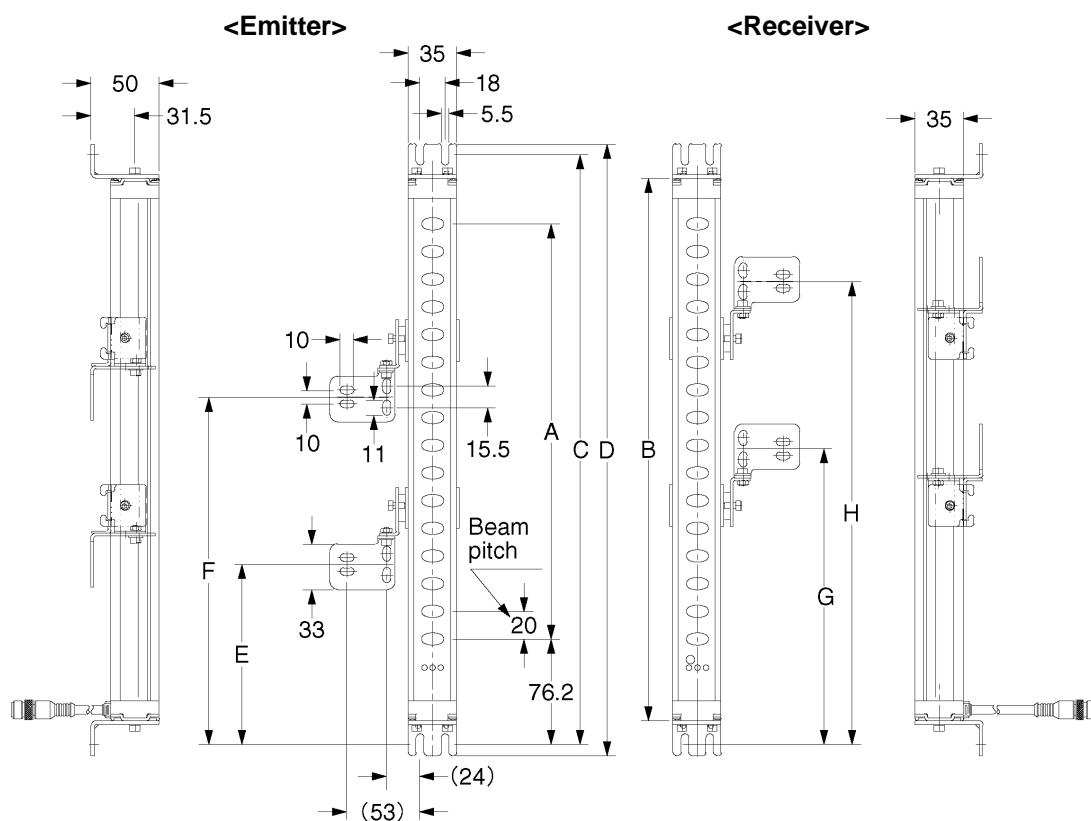
(Unit: mm)

Model No.	A	B	C	D	E	F	G	H
SF2-EH12(-N)	220	312	346	362	-	-	-	-
SF2-EH16(-N)	300	392	426	442	-	-	-	-
SF2-EH20(-N)	380	472	506	522	-	-	-	-
SF2-EH24(-N)	460	552	586	602	322	-	280	-
SF2-EH28(-N)	540	632	666	682	362	-	320	-
SF2-EH32(-N)	620	712	746	762	402	-	360	-
SF2-EH36(-N)	700	792	826	842	442	-	400	-
SF2-EH40(-N)	780	872	906	922	482	-	440	-
SF2-EH48(-N)	940	1,032	1,066	1,082	562	-	520	-
SF2-EH56(-N)	1,100	1,192	1,226	1,242	642	-	600	-
SF2-EH64(-N)	1,260	1,352	1,386	1,402	488	976	446	892
SF2-EH72(-N)	1,420	1,512	1,546	1,562	542	1,084	500	1,000
SF2-EH80(-N)	1,580	1,672	1,706	1,722	595	1,190	574	1,148

Notes: 1) **MS-SF2-2** (intermediate supporting bracket) is attached with the sensors. The number attached is different depending on the sensor.

2) The minimum bending radius of the cable is R35mm. Mount the sensor considering the cable bending radius.

## 2.4.2 Rear Mounting



(Unit: mm)

### <Reference>

(Unit: mm)

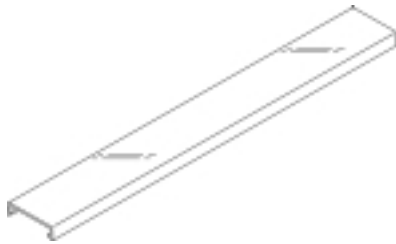
Model No.	A	B	C	D	E	F	G	H
SF2-EH12(-N)	220	312	346	362	-	-	-	-
SF2-EH16(-N)	300	392	426	442	-	-	-	-
SF2-EH20(-N)	380	472	506	522	-	-	-	-
SF2-EH24(-N)	460	552	586	602	322	-	280	-
SF2-EH28(-N)	540	632	666	682	362	-	320	-
SF2-EH32(-N)	620	712	746	762	402	-	360	-
SF2-EH36(-N)	700	792	826	842	442	-	400	-
SF2-EH40(-N)	780	872	906	922	482	-	440	-
SF2-EH48(-N)	940	1,032	1,066	1,082	562	-	520	-
SF2-EH56(-N)	1,100	1,192	1,226	1,242	642	-	600	-
SF2-EH64(-N)	1,260	1,352	1,386	1,402	488	976	446	892
SF2-EH72(-N)	1,420	1,512	1,546	1,562	542	1,084	500	1,000
SF2-EH80(-N)	1,580	1,672	1,706	1,722	595	1,190	574	1,148

Notes: 1) MS-SF2-2 (intermediate supporting bracket) is attached with the sensors. The number attached is different depending on the sensor.

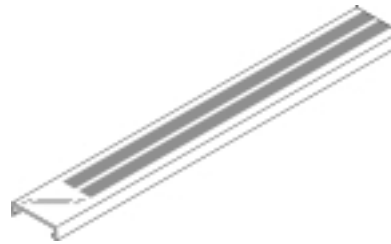
2) The minimum bending radius of the cable is R35mm. Mount the sensor considering the cable bending radius.

## 2.5 Options

### Front protection cover: 1 No.



### Slit: 1 No.



Model No.	Applicable model No.	Remarks
FC-SF2-H12	SF2-EH12(-N)	Protects the sensing surface of the sensor from dirt, etc.
FC-SF2-H16	SF2-EH16(-N)	
FC-SF2-H20	SF2-EH20(-N)	
FC-SF2-H24	SF2-EH24(-N)	
FC-SF2-H28	SF2-EH28(-N)	
FC-SF2-H32	SF2-EH32(-N)	
FC-SF2-H36	SF2-EH36(-N)	
FC-SF2-H40	SF2-EH40(-N)	
FC-SF2-H48	SF2-EH48(-N)	
FC-SF2-H56	SF2-EH56(-N)	
FC-SF2-H64	SF2-EH64(-N)	
FC-SF2-H72	SF2-EH72(-N)	
FC-SF2-H80	SF2-EH80(-N)	

Model No.	Applicable model No.	Remarks
OS-SF2-H12	SF2-EH12(-N)	Restrains the amount of beam emitted or received and hence reduces the interference between neighboring sensors
OS-SF2-H16	SF2-EH16(-N)	
OS-SF2-H20	SF2-EH20(-N)	
OS-SF2-H24	SF2-EH24(-N)	
OS-SF2-H28	SF2-EH28(-N)	
OS-SF2-H32	SF2-EH32(-N)	
OS-SF2-H36	SF2-EH36(-N)	
OS-SF2-H40	SF2-EH40(-N)	
OS-SF2-H48	SF2-EH48(-N)	
OS-SF2-H56	SF2-EH56(-N)	
OS-SF2-H64	SF2-EH64(-N)	
OS-SF2-H72	SF2-EH72(-N)	
OS-SF2-H80	SF2-EH80(-N)	

### Mating cable with connector on one end: 2 Nos./set

[1 No. for emitter (connector: gray), 1 No. for receiver (connector: black)]



Model No.	Cable length	Remarks
SF2-CC3	3m	There is a connector on one end of the cable and separate wires protrude from the other end. The latter are used for wiring. For emitter: 8-core shielded cable For receiver: 8-core shielded cable With connector on one end
SF2-CC7	7m	
SF2-CC10	10m	

### Extension cable with connector on both ends: 2 Nos./set

[1 No. for emitter (connector: gray), 1 No. for receiver (connector: black)]



Model No.	Cable length	Remarks
SF2-CCJ10	10m	Each end of the cable is equipped with a connector. This cable is used for cable extension. For emitter: 8-core shielded cable For receiver: 8-core shielded cable With connector on both ends

**Cable for series connection: 2 Nos./set**  
(common for emitter and receiver)



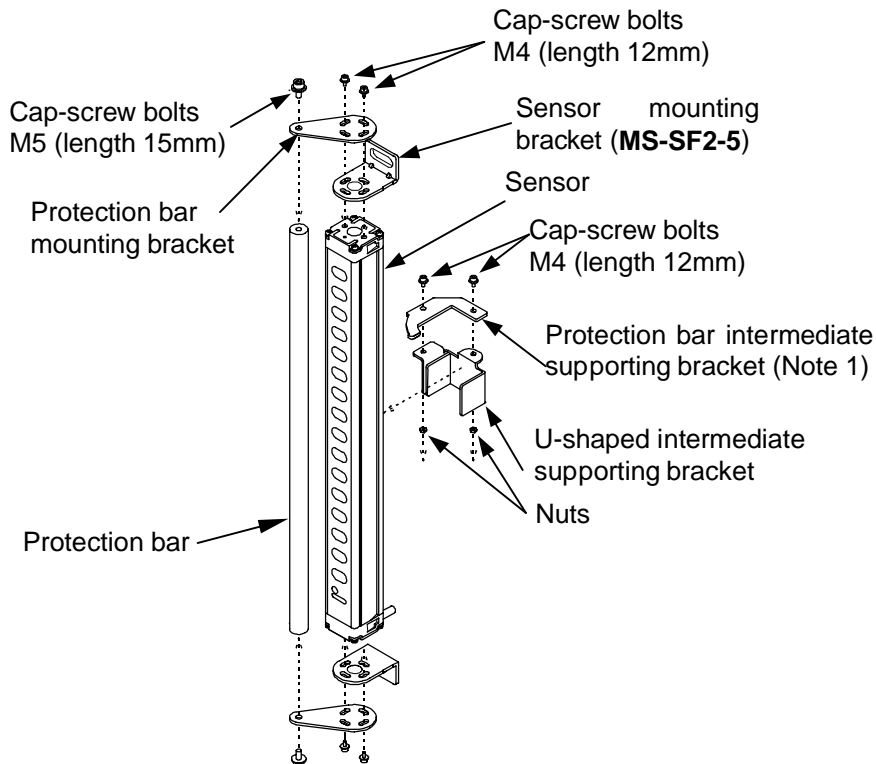
**Laser alignment tool for light curtain: 1 No.**



Model No.	Cable length	Remarks
<b>SF2-CSL02</b>	200mm	Used to connect sensors i series.
<b>SF2-CSL05</b>	500mm	Common for emitter an receiver with caps.

Model No.	Remarks
<b>SF-LAT-2E</b>	Convenient for aligning the beam channel.

**Front protection unit: 1 set**



Model No.	Applicable model No.	Remarks
<b>MC-SF2EH-12</b>	<b>SF2-EH12(-N)</b>	This unit protects th lens surface from damage.
<b>MC-SF2EH-16</b>	<b>SF2-EH16(-N)</b>	
<b>MC-SF2EH-20</b>	<b>SF2-EH20(-N)</b>	
<b>MC-SF2EH-24</b>	<b>SF2-EH24(-N)</b>	
<b>MC-SF2EH-28</b>	<b>SF2-EH28(-N)</b>	
<b>MC-SF2EH-32</b>	<b>SF2-EH32(-N)</b>	
<b>MC-SF2EH-36</b>	<b>SF2-EH36(-N)</b>	
<b>MC-SF2EH-40</b>	<b>SF2-EH40(-N)</b>	
<b>MC-SF2EH-48</b>	<b>SF2-EH48(-N)</b>	
<b>MC-SF2EH-56</b>	<b>SF2-EH56(-N)</b>	
<b>MC-SF2EH-64</b>	<b>SF2-EH64(-N)</b>	
<b>MC-SF2EH-72</b>	<b>SF2-EH72(-N)</b>	
<b>MC-SF2EH-80</b>	<b>SF2-EH80(-N)</b>	

Notes: 1) The protection bar intermediate supporting bracket is enclosed with the front protection bar set for beam channel Nos. 40 or more.

Use this bracket when the protection bar bends.

2) Refer to the instruction manual enclosed with the front protection bar for the mounting procedure.

# Chapter 3 Wiring and Mounting

This chapter describes the wiring and mounting of this device.

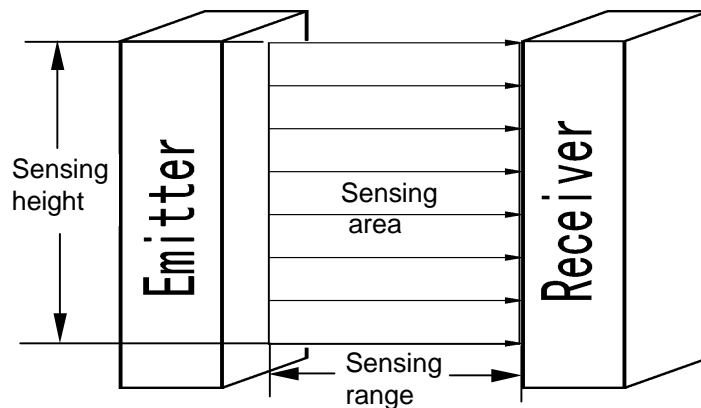
## 3.1 Protection Area

### 3.1.1 Sensing Area

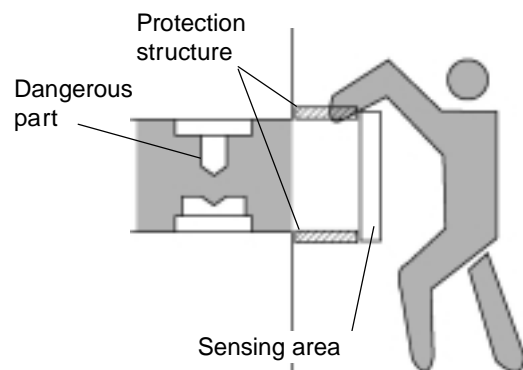
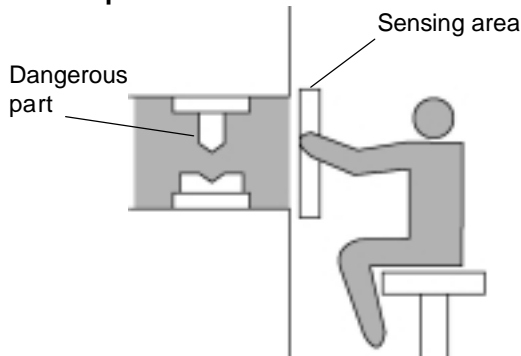


- Be sure to install protection structure around the machine so that the operator must pass through the sensing area of this device to reach the dangerous parts of the machine. Further, ensure that some part of the operator's body always remains in the sensing area when operation is done with the dangerous parts of the machine. Failure to do so can result in serious injury or death.
- Do not use any reflection type or recursive reflection type arrangement.

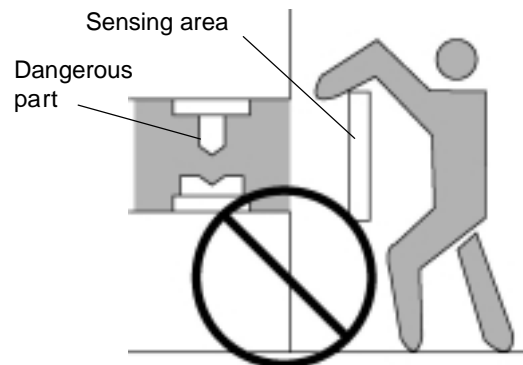
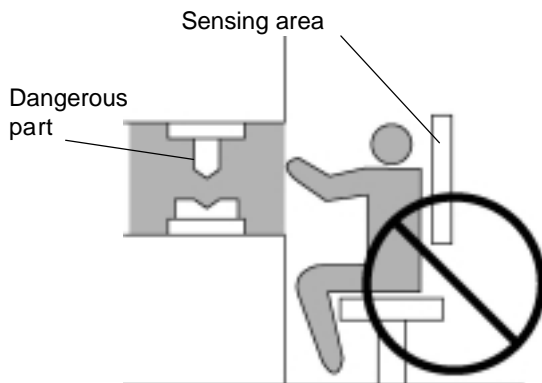
The sensing area is the zone formed by the sensing height of the sensor and the sensing range between the emitter and the receiver. The sensing height is determined by the number of beam channels. Further, the sensing range can be 0.3 to 10m.



#### <Examples of Correct Installation>



#### <Examples of Incorrect Installation>





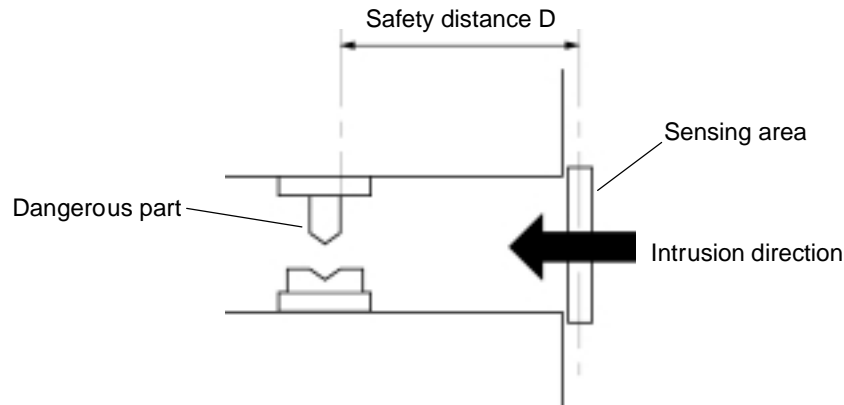
### 3.1.2 Safety Distance



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 device and the dangerous parts of the machine. If the safety distance is miscalculated or if sufficient distance is not maintained, the machine will not stop before its dangerous parts are reached, which can result in serious injury or death.

The safety distance is the minimum distance that must be maintained between the light curtain and the dangerous parts of a machine so that the machine can be stopped before a human body or an object can reach the dangerous parts.

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



Before designing the system, refer to the relevant standards of the region where this device is to be used and then install this device. Further, the equation described below is to be used only in case the intrusion direction is perpendicular to the sensing area. In case the intrusion direction is not perpendicular to the sensing area, make sure to refer to the relevant standard (regional standard, specification of the machine, etc.) for the details of the calculation.

#### [For use in Europe (EU) (as EN 999)] (For intrusion direction perpendicular to the sensing area)

- Equation ①  $D = K \times T + C$ 
  - D: Safety distance (mm)  
Minimum required distance between the sensing area surface and the dangerous parts of the machine
  - K: Intrusion velocity of operator's body (mm/s)  
Taken as 2,000 (mm/s) for calculation
  - T: Response time of total equipment (s)  
 $T = T_m + T_{SF2}$ 
    - $T_m$ : Maximum halting time of device (s)
    - $T_{SF2}$ : Response time of this device, 0.015 (s)
  - C: Additional distance calculated from the size of the minimum sensing object of the sensor (mm)  
However, the value of C cannot be 0 or less  
 $C = 8 \times (d - 14)$ 
    - d: Minimum sensing object diameter, 30 (mm)

#### <Reference>

For calculating the safety distance D, there are the following five cases  
 First calculate by substituting the value  $K=2,000$  in the equation above. Then, classify the obtained value of D into three cases, 1)  $D < 100$ , 2)  $100 \leq D \leq 500$ , and 3)  $D > 500$ . For Case 3)  $D > 500$ , recalculate by substituting the value  $K=1,600$ . After that, classify the calculation result into two cases, 4)  $D \leq 500$  and 5)  $D > 500$   
 For details, refer to 'Calculation Example For use in Europe' on P. 18.  
 For calculating  $T_m$  (maximum halt time of the device), use a special device called a brake monitor.

## <Calculation Example>

### • Calculation Example For use in Europe

First calculate with  $K=2,000$ .

$$\begin{aligned} D &= K \times T + C \\ &= K \times (T_m + T_{SF2}) + 8 \times (d - 14) \\ &= 2,000 \times (T_m + 0.015) + 8 \times (30 - 14) \\ &= 2,000 \times T_m + 2,000 \times 0.015 + 8 \times 16 \\ &= 2,000 \times T_m + 158 \end{aligned}$$

- 1) In case  $D < 100$  (mm)  
Safety distance  $D$  is taken as 100 (mm)
- 2) In case  $100 \leq D \leq 500$  (mm)  
Safety distance  $D$  is taken as  $2,000 \times T_m + 158$  (mm)

- 3) In case  $D > 500$  (mm)  
Calculate with  $K' = 1,600$ .  
$$\begin{aligned} D &= K' \times (T_m + T_{SF2}) + 8 \times (d - 14) \\ &= 1,600 \times (T_m + 0.015) + 8 \times (30 - 14) \\ &= 1,600 \times T_m + 1,600 \times 0.015 + 8 \times 16 \\ &= 1,600 \times T_m + 152 \end{aligned}$$

then, calculate again

If the result is:

- 4) In case  $D \leq 500$  (mm)  
Safety distance  $D$  is taken as 500 (mm)
- 5) In case  $D > 500$  (mm)  
Safety distance  $D$  is taken as  $1,600 \times T_m + 152$  (mm)

In case this device is installed in a system with a maximum halting time of 0.1 (s)

$$\begin{aligned} D &= 2,000 \times T_m + 158 \\ &= 2,000 \times 0.1 + 158 \\ &= 358 \end{aligned}$$

Since this value matches with Case 2) above,  $D$  is 358 (mm)

In case this device is installed in a system with a maximum halting time of 0.3 (s)

$$\begin{aligned} D &= 2,000 \times T_m + 158 \\ &= 2,000 \times 0.3 + 158 \\ &= 758 \end{aligned}$$

Since this value matches with Case 3) above,

$$\begin{aligned} D &= 1,600 \times T_m + 152 \\ &= 1,600 \times 0.3 + 152 \\ &= 632 \end{aligned}$$

Since this value matches with Case 5) above,  $D$  is 632 (mm).

**[For use in the United States of America (as 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 sensing area surface and the dangerous parts of the machine

K : Intrusion speed {Recommended value in OSHA is 63 (inch/s) [ $\approx 1,600$  (mm/s)]}

ANSI B11.19 does not define the intrusion speed (K). When determining K, consider possible factors including physical ability of operators.

$T_s$  : Halting time calculated from the operation time of the control element (air valve, etc.) (s)

$T_c$  : Maximum response time of the control circuit required for functioning the brake (s)

$T_{SF2}$  : Response time of this device, 0.015 (s)

$T_{bm}$  : Additional halting time tolerance for the brake monitor (s)

The following equation holds when the machine is equipped with a break monitor.

$$T_{bm} = T_a - (T_s + T_c)$$

$T_a$  : Setting time of brake monitor (s)

When the machine is not equipped with a break monitor, it is recommended that 20%, or more, of ( $T_s + T_c$ ) is taken as additional halting time.

$D_{pf}$  : Additional distance calculated from the size of the minimum sensing object of the sensor. (mm)

$$D_{pf} = 78.2 \text{ mm}$$

$$\left( \begin{array}{l} D_{pf} = 3.4 \times (d - 0.276) \text{ (inch)} \\ \quad = 3.4 \times (d - 7) \text{ (mm)} \\ \quad d: \text{Minimum sensing object diameter } 1.2 \text{ (inch)} \approx 30 \text{ (mm)} \\ \text{Note that the value of } D_{pf} \text{ cannot be 0 or less.} \end{array} \right)$$

**<Reference>**

Since the calculation above is performed by taking 1(inch)=25.4(mm), there is a slight difference between the representation in (mm) and that in (inch). Refer to the relevant standard for the details

**<Calculation Example>**

- Calculation Example ② For use in the United States of America

$$\begin{aligned} D &= K \times (T_s + T_c + T_{SF2} + T_{bm}) + D_{pf} \\ &= 63 \times (T_a + 0.015) + 3.4 \times (d - 0.276) \text{ (inch)} \\ &= 63 \times (T_a + 0.015) + 3.4 \times (1.2 - 0.276) \\ &= 63 \times T_a + 63 \times 0.015 + 3.4 \times 0.924 \\ &= 63 \times T_a + 4.0866 \text{ (inch)} \\ &\approx 63 \times T_a + 4.09 \text{ (inch)} \end{aligned}$$

In case this device is installed in a system with a maximum halting time of 0.1 (s)


$$\begin{aligned} D &= 63 \times T_a + 4.09 \\ &= 63 \times 0.1 + 4.09 \\ &= 10.39 \text{ (inch)} \\ &\approx 263.9 \text{ (mm)}. \end{aligned}$$

Hence, as per the calculations D is 263.9 (mm).

**<Reference>**

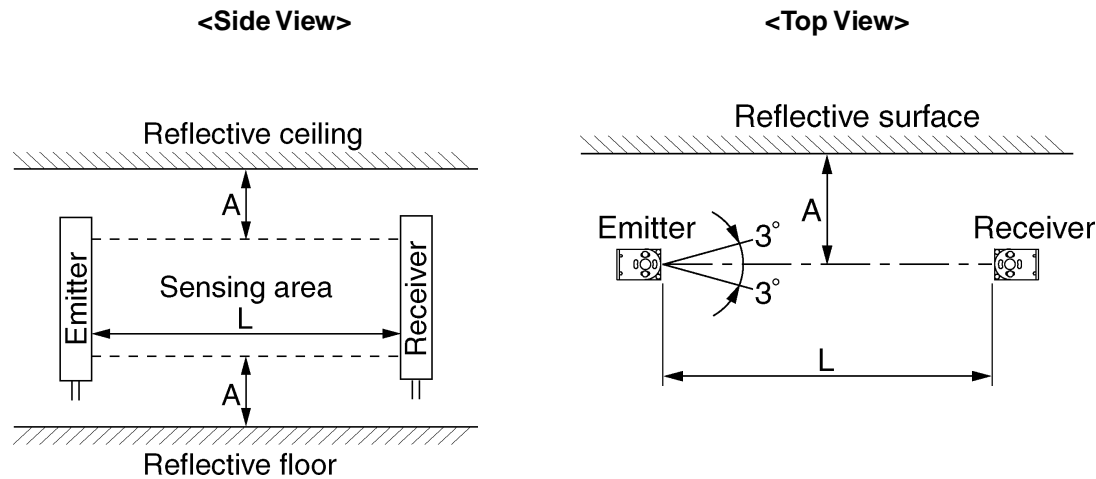
Since the calculation above is performed by taking 1(inch)=25.4(mm), there is a slight difference between the representation in (mm) and that in (inch). Refer to the relevant standard for the details

3.1.3 Influence of Reflective Surfaces

**WARNING**

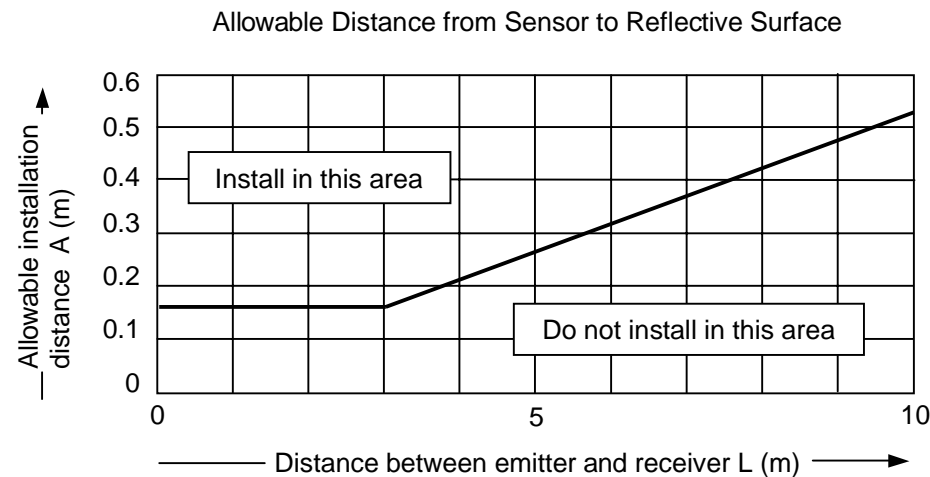
Install the sensor by considering the effect of near by reflective surfaces, and take countermeasures, such as painting, masking, roughening, or changing the material of the reflective surfaces, etc.  
Failure to do so may cause the sensor not to detect, resulting in death or serious body injury.

Install this device at a distance of at least A (given below) away from reflective surfaces, such as, metal walls, floors, ceilings, workpieces, covers, panels or glass surfaces.



Distance between emitter and receiver (Sensing range L)	Allowable installation distance A
0.3 to 3m	0.16m
3 to 10m	$L \times \tan\theta$ $=L \times 0.052 \text{ (m)} \cdot (\theta = 3^\circ)$

Note: The effective aperture angle for this device is  $\pm 2.5^\circ$  (when  $L > 3\text{m}$ ) as required by IEC 61496-2. However, install this device away from reflective surfaces considering an effective aperture angle of  $\pm 3^\circ$  to take care of beam misalignment, etc., during installation.



## 3.2 Connection Configuration

### ⚠ WARNING

- When connecting the sensor, use the correct combination of emitter and receiver (same beam pitch and number of beam channels) and match their top-bottom orientation. Combining different types of emitter and receiver could produce a non-sensing area, which may result in serious injury or death.
- Further, facing several receivers towards one emitter, or vice versa, could produce a non-sensing area or cause mutual interference, which may result in serious injury or death.

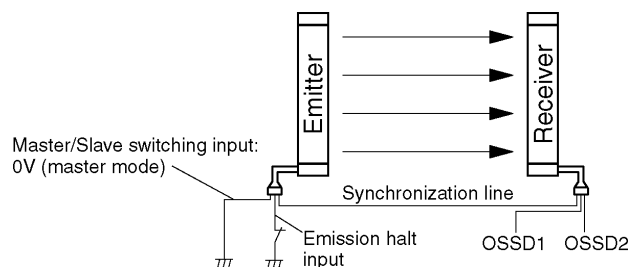
### <Reference>

Refer to '3.4.2 Sensor Wiring Diagrams' for details of the connection (wiring) method.

### 3.2.1 Normal Connection

#### Connection of One Set of Sensor

This is the common configuration using one emitter and one receiver facing each other. It is used when the dangerous area can be entered from one direction only. The control output (OSSD1, OSSD2) turns OFF if the light is blocked.



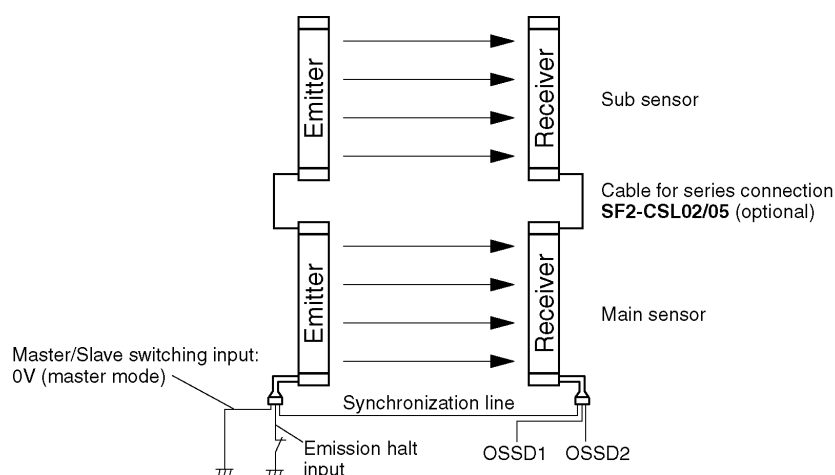
### 3.2.2 Series Connection

[Connectable up to 4 sets (however, 192 beam channels max.)]

This is the configuration when multiple sets of emitters and receivers facing each other are connected in series. It is used when the dangerous area can be entered from two or more directions. The output (OSSD1, OSSD2) turns OFF if light of any main sensor or sub sensor is blocked.

### ⚠ WARNING

For sets besides the set for which the synchronization line is to be connected, connect emitter and emitter, receiver and receiver, respectively, using the special optional cable. Wrong connection could produce a non-sensing area, which can result in serious injury or death.

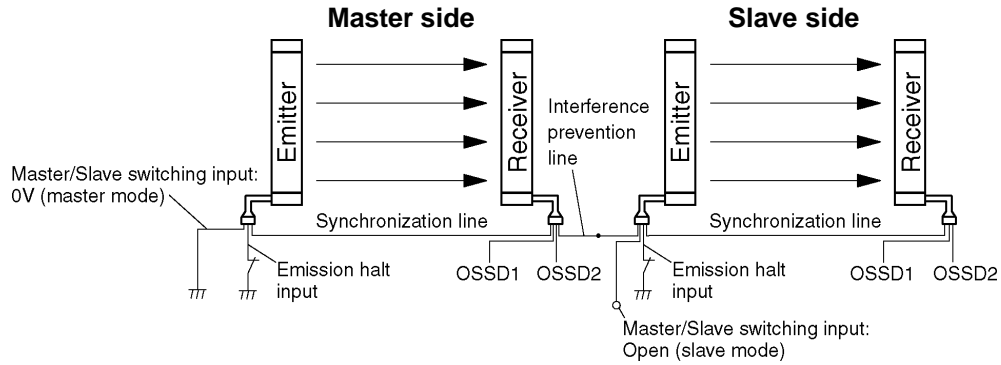


### 3.2.3 Parallel Connection

This is the configuration when multiple sets of emitter and receiver facing each other are connected in parallel. It is used when there are two, or more, dangerous areas and each dangerous area can be entered from one direction only. By connecting the interference prevention line, up to 4 sets (however, 192 beam channels max.) can be connected. Only the output (OSSD1, OSSD2) of the set whose light is blocked turns OFF.



Do not connect emitter and emitter, receiver and receiver in parallel using the interference prevention line. Wrong connection could produce a non-sensing area, which can result in serious injury or death.

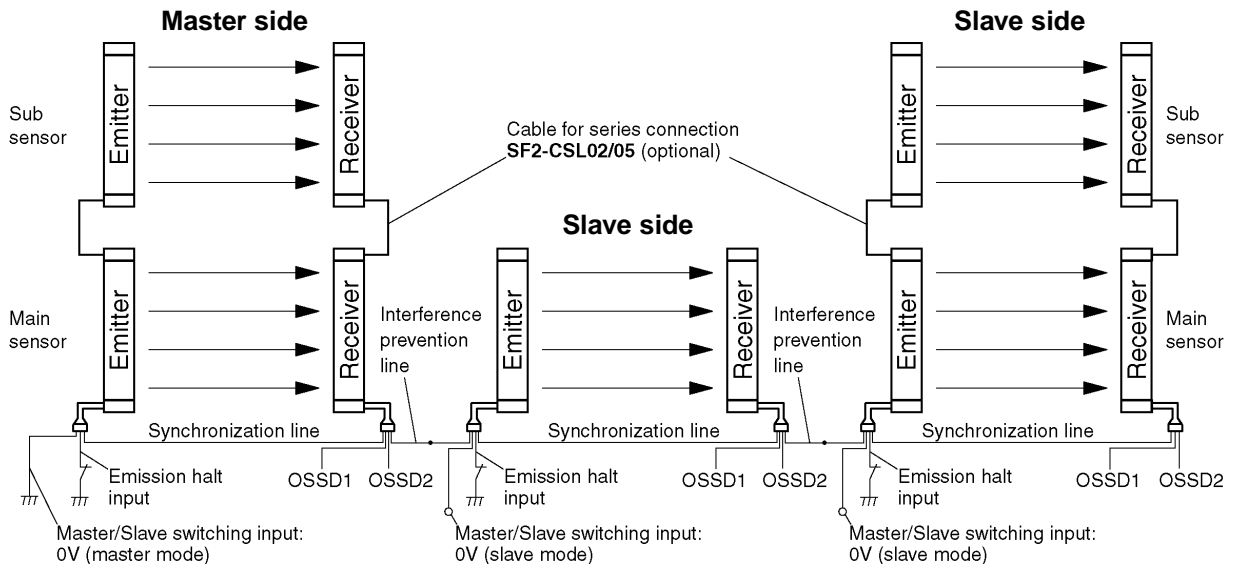


### 3.2.4 Series and Parallel Mixed Connection

This is the configuration when multiple sets of emitter and receiver facing each other are connected in mixed series and parallel combination. It is used when there are two, or more, dangerous areas that can be entered from two, or more, directions. Up to 12 sets (however, 192 channels max.) can be connected in combination. For the sensors connected in series, if the light of any main sensor or sub sensor is blocked, only their output (OSSD1, OSSD2) turns OFF.




**WARNING** Do not connect emitter and emitter, receiver and receiver in parallel using the interference prevention line. Wrong connection could produce a non-sensing area, which can result in serious injury or death.



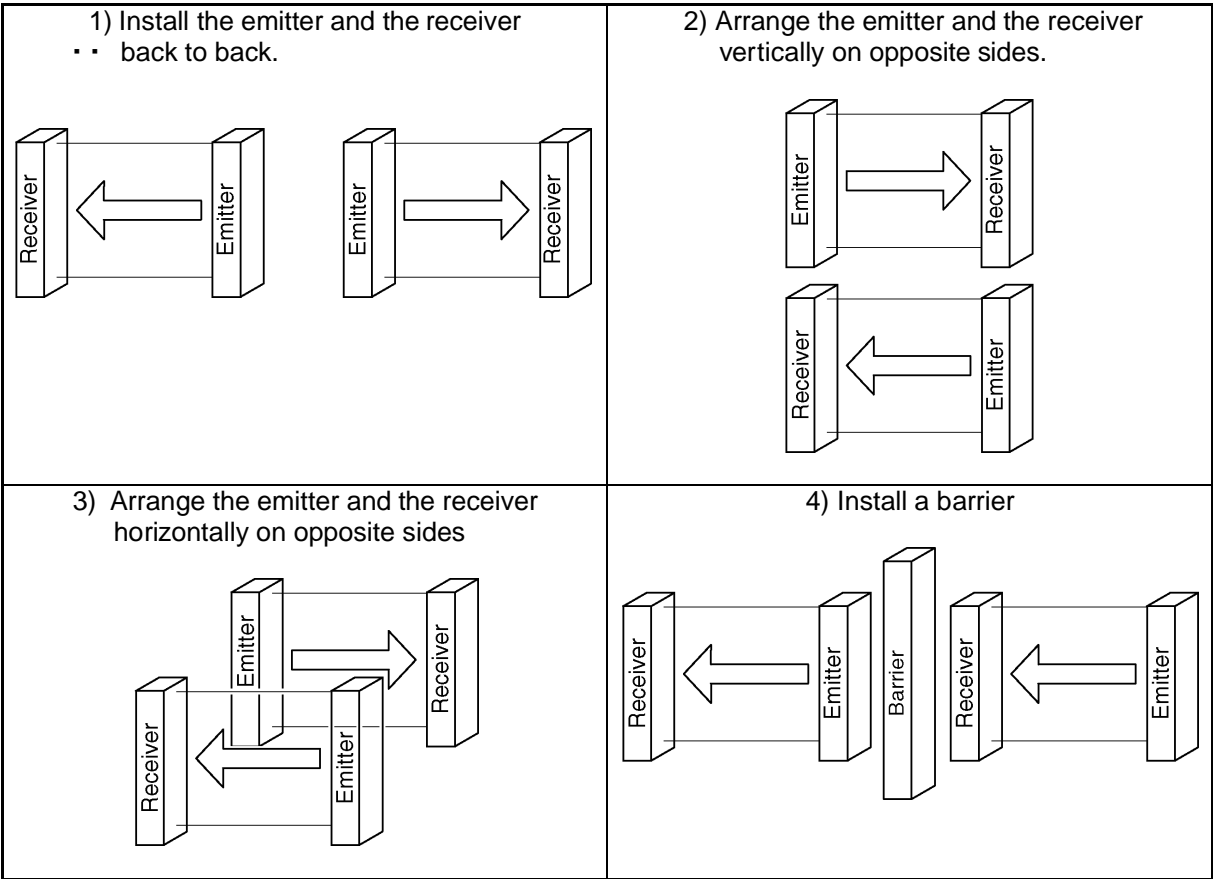
### 3.2.5 Sensor Placement

This is the configuration when two, or more, sets of emitter and receiver facing each other are placed without series connection between them. It is used if there is a problem in wiring or for system evaluation in case of addition of equipment. Perform an operation test by referring to ‘3.5.2 OperationTest’.

**WARNING**

- Refer to the examples of sensor placement given below and understand them thoroughly before installing the sensors. Improper sensor placement could cause sensor malfunction which can result in serious injury or death.
- If this device is used in multiple sets, arrange them to avoid mutual interference. If mutual interference occurs, it can result in serious injury or death.

<Examples of sensor placement>



<Reference>

The above figures are just examples of sensor placement. If there are any questions or problems, please contact our office.



## 3.3 Mounting

### 3.3.1 Mounting Procedure

#### CAUTION

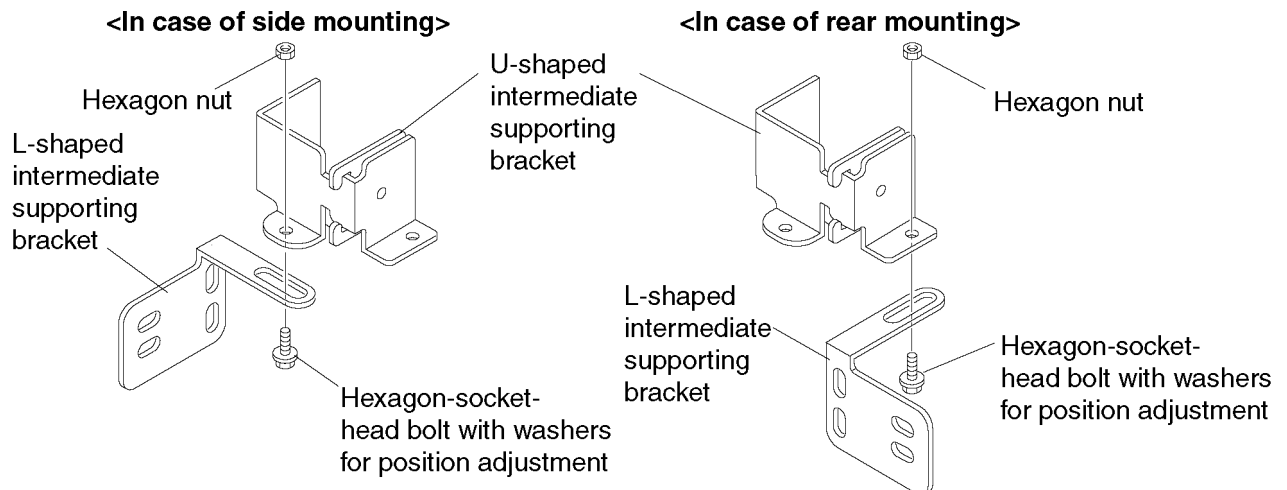
- When installing this device having 24 beam channels, or more, at places where vibration is intense, mount the U-shaped rear (side) mounting intermediate supporting bracket and L-shaped rear (side) intermediate supporting bracket
- Wire the cable of this device such that excessive force is not applied to it, and that, after the wiring, it is not subjected to any load. Applying excessive force or any load may cause wire breakage.
- The minimum bending radius of the cable is R35mm. Mount the sensor considering the cable bending radius.

#### <Reference>

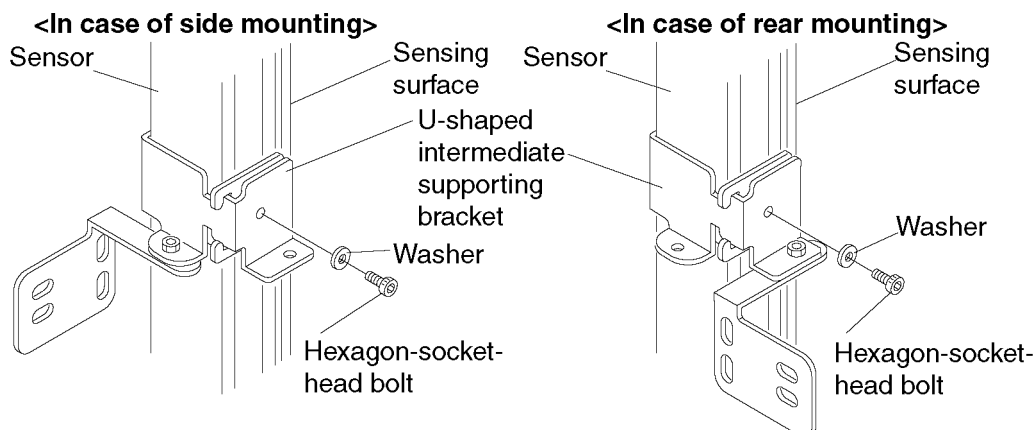
- Mount the emitter and the receiver at the same level and parallel to each other. The effective aperture angle of this device is  $\geq 2.5^\circ$  or less for a detection distance exceeding 3m.
- Unless otherwise specified, the following mounting procedure is common for both emitter and receiver. For the mounting, prepare the mounting holes on the mounting surface by referring to '2.4 Dimensions'.
- The sensor enclosure (metal) is electrically conducting with the sensor mounting bracket. For improving the noise immunity, ground the body on which the sensor mounting brackets of the emitter and the receiver are installed.
- For laser alignment, it is useful to use the beam alignment tool for light curtain (SF-LAT-2E) (optional).

#### <Mounting of intermediate supporting bracket (MS-SF2-2)>

1. Choose the mounting direction for the L - and U-shaped intermediate supporting brackets based on the mounting direction (side or rear), and temporarily tighten the mounting brackets with the hexagon-socket-head bolt with washers [M4 (length 10mm)] for position adjustment. After beam-axis alignment, tighten them securely with a tightening torque of 1.2N·m or less.



2. Clasp the sensor main body with the U-shaped intermediate supporting bracket, and temporarily tighten with the hexagon-socket-head bolt [M4 (length 6mm)] with washers. After beam-axis alignment, tighten them securely with a tightening torque of 1.2N·m or less.

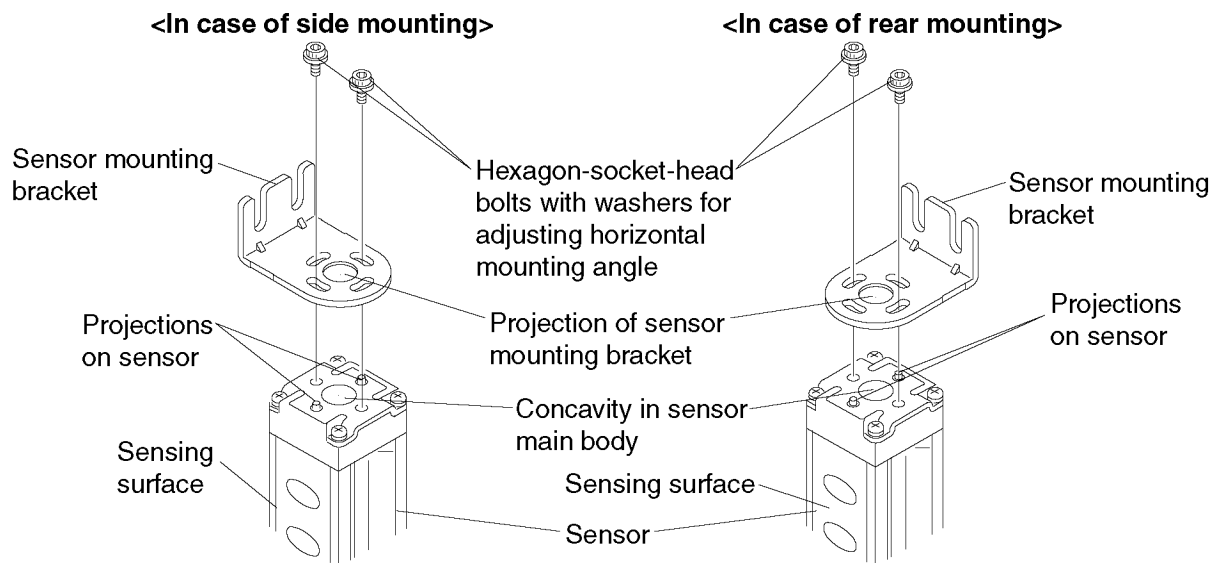


#### <Reference>

For mounting the receiver, the intermediate supporting bracket is mounted upside down

### <Mounting of sensor mounting bracket (MS-SF2-1)>

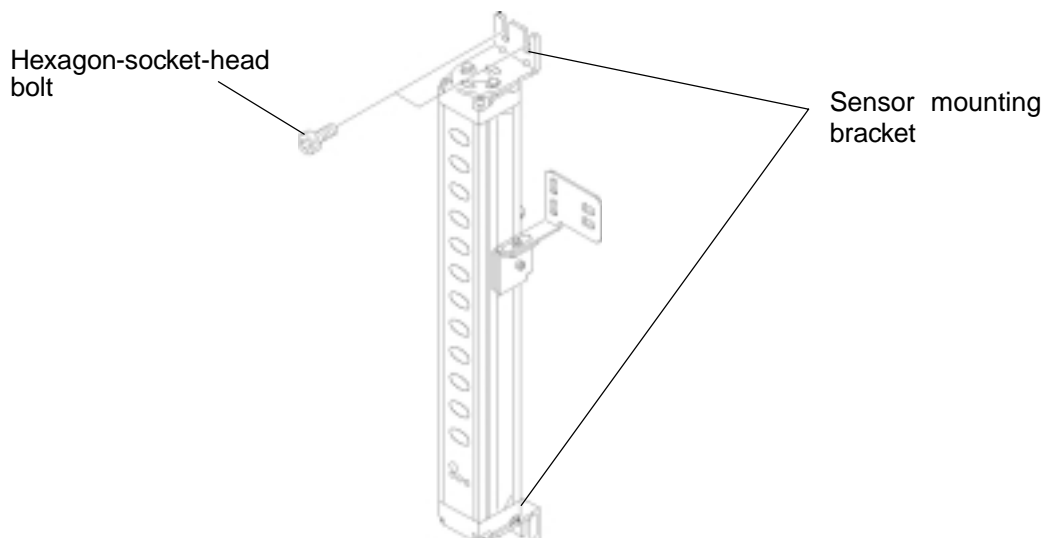
1. Choose the mounting direction for the sensor mounting bracket based on the mounting direction (side or rear), and temporarily tighten the brackets with the two hexagon-socket-head bolts with washers for adjusting the horizontal mounting angle [M4 (length 10mm)] After beam-axis alignment, tighten them securely with a tightening torque of 1.2N·m or less.



#### <Reference>

Match the projection of the sensor mounting bracket with the concavity in the sensor main body, and hook the sensor mounting bracket on the projections on the sensor, for easy installation

2. Temporarily mount the sensor mounting bracket (top and bottom) on the mounting surface with 2 Nos. hexagon-socket-head bolts [M5 (please arrange separately)].



3. Match the position of the emitter and the receiver (upper surface) to the same height, and then securely tighten the hexagon-socket-head bolts.

#### <Reference>

One method of matching the height is to put a metal plate (which does not bend in the middle) on the upper surface of the emitter and the receiver and then adjust by placing a level gauge at the middle of the metal sheet.

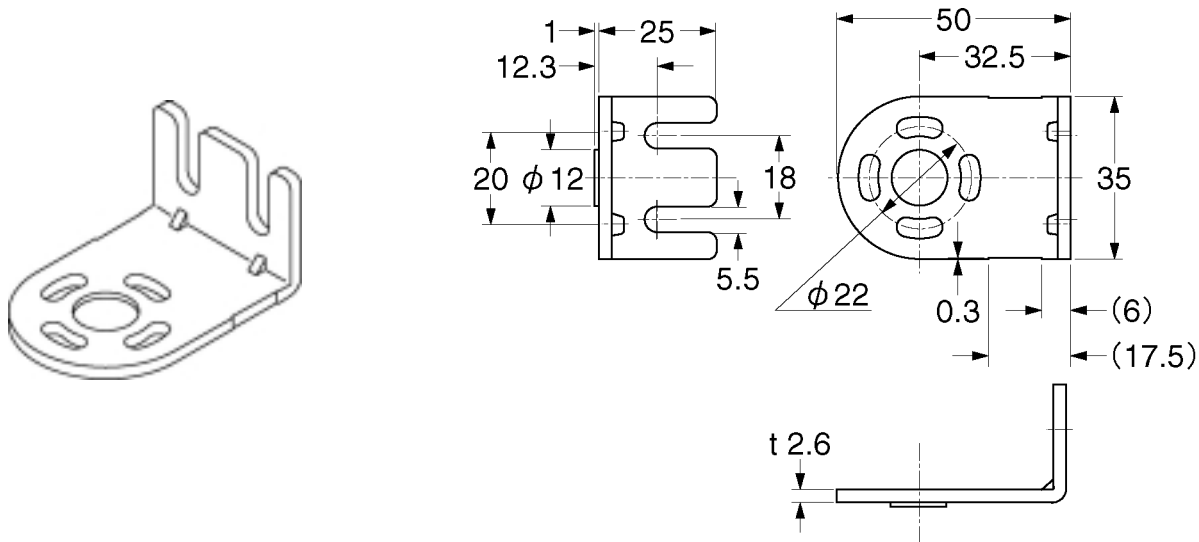
4. Fix the intermediate supporting bracket with 2 Nos. hexagon-socket-head bolts [M5 (please arrange separately)]. (Only for 24 or more beam channels)

### 3.3.2 Dimensional Drawing of Mounting Brackets (Unit: mm)

#### <Reference>

For each of the bracket, the mounting orientation can be changed to suit the mounting direction (side or rear)  
Hence the same bracket can be used.

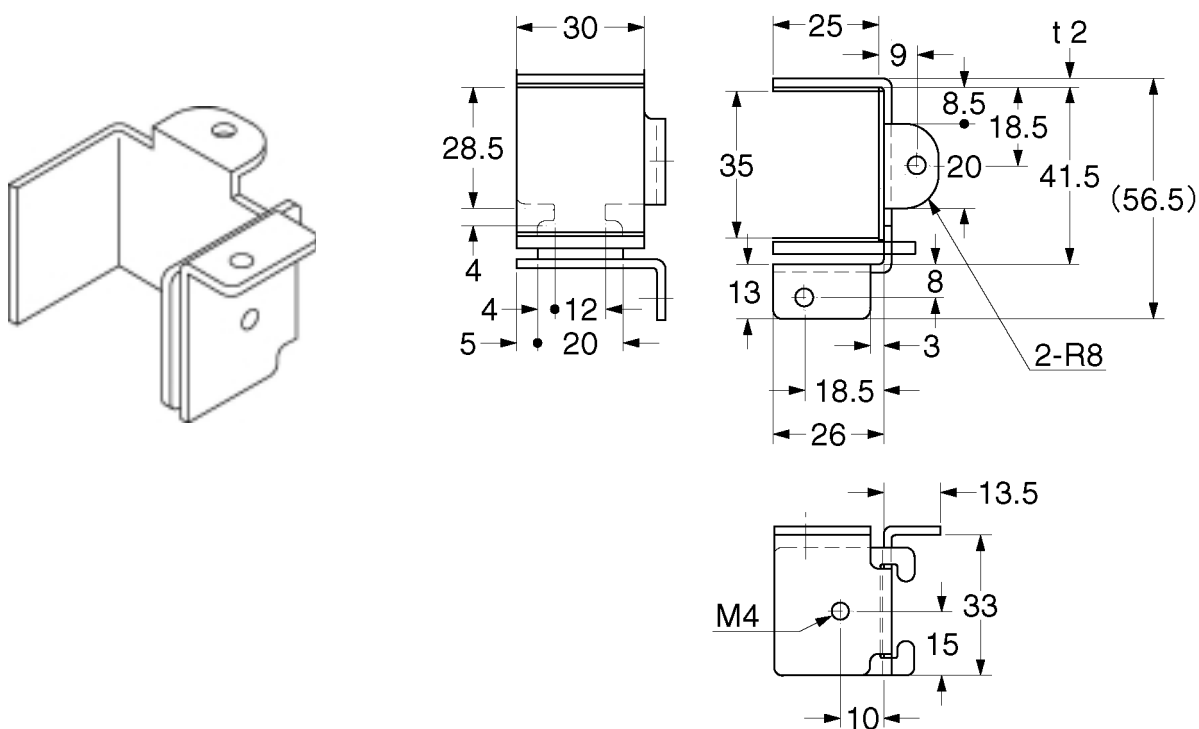
#### 1) Sensor Mounting Bracket / MS-SF2-1



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

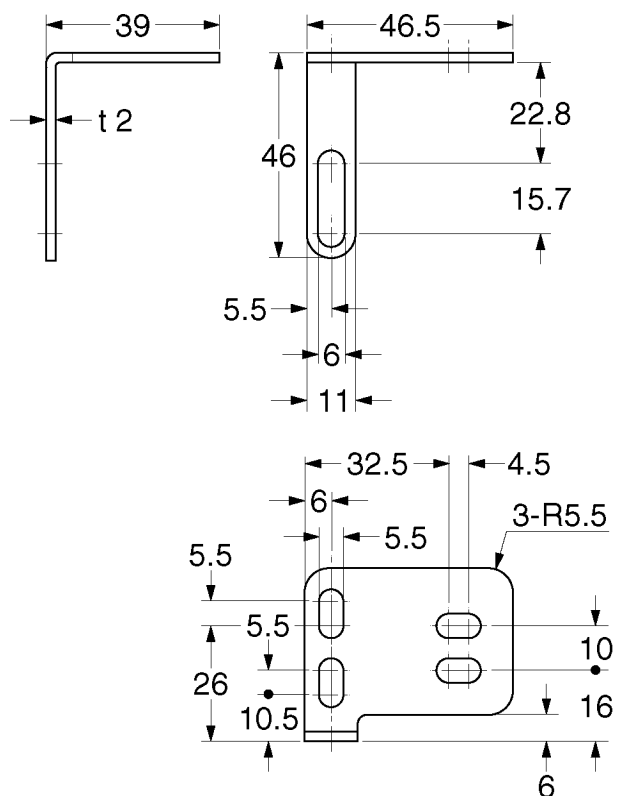
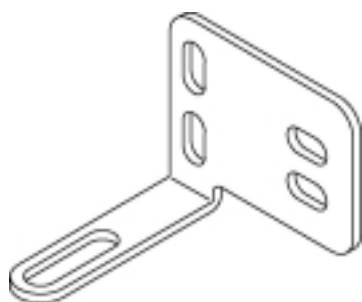
#### 2) Intermediate Supporting Bracket / MS-SF2-2

U-shaped intermediate supporting bracket



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

## L-shaped intermediate supporting bracket

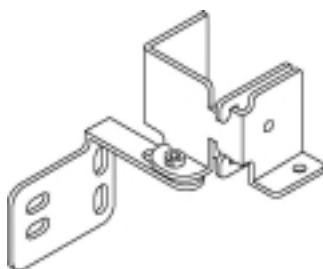


Material: Cold rolled carbon steel (SPCC) (Black chromate)

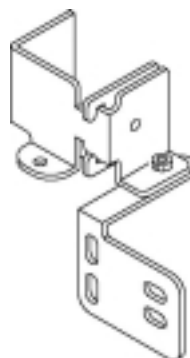
### <Reference>

When the U- and L-shaped intermediate supporting brackets are combined, the following configurations are obtained.

#### <In case of side mounting>



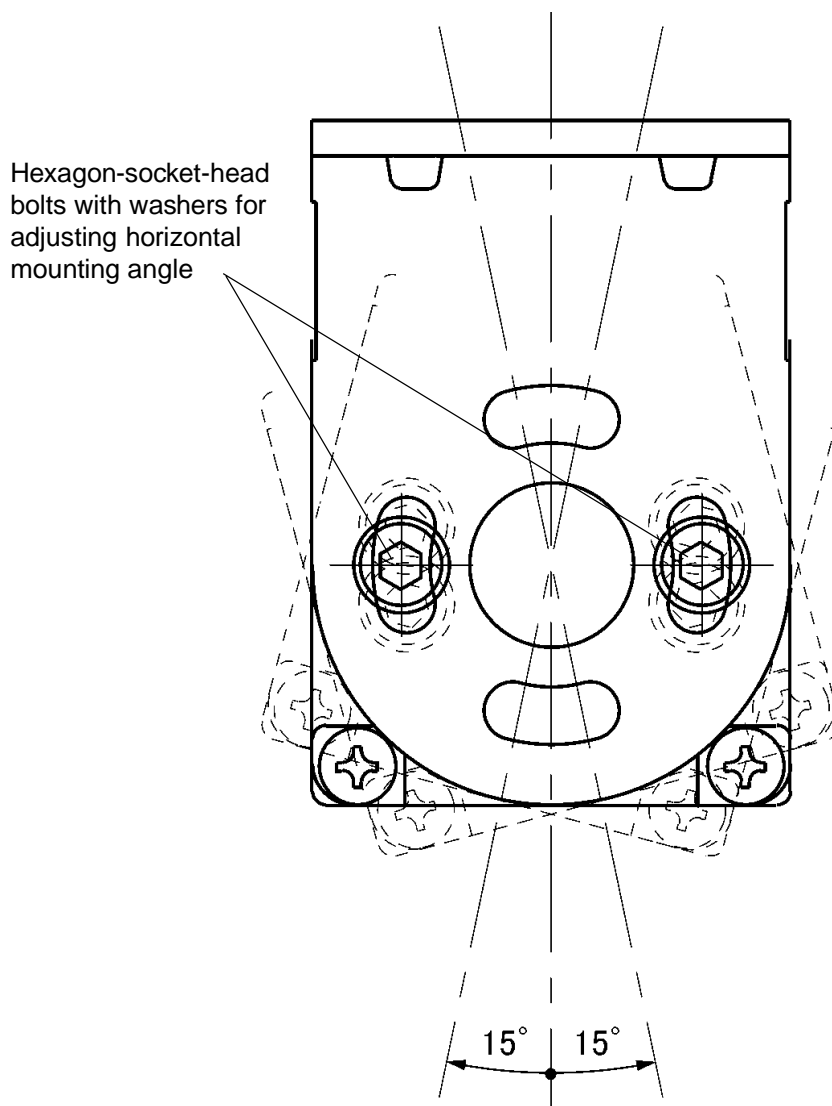
#### <In case of rear mounting>



### 3.3.3 Mounting Angle Adjustment Range

The height adjustment of the emitter and the receiver was described in '3.3.1 Mounting Procedure'. This section explains the method of adjusting the horizontal mounting angle with respect to the mounting surface.

1. Confirm that the two the hexagon -socket-head bolts with washers [M4 (length 10mm)] for adjusting horizontal mounting angle at the top and the bottom of the sensor are loosened. In case the intermediate supporting bracket is used, loosen the hexagon -socket-head bolt [M4 (length 10mm)] for position adjustment of the U -shaped intermediate supporting bracket and L -shaped intermediate supporting bracket, too.



2. Adjust the mounting angle so that the emitter and the receiver face each other, and then tighten the hexagon-socket-head bolts with washers (Tightening torque 1.2N·m or less)  
Further, firmly tighten the bolts that temporarily hold the U-shaped rear mounting supporting bracket and the L-shaped intermediate supporting bracket (Tightening torque 1.2N·m or less)

#### <Reference>

By this procedure, the mounting angle can be adjusted up to  $\pm 15^\circ$ . For accurate positioning, refer to '3.5.1 Beam-axis Alignment' for details. The same procedure is to be performed for both side, as well as, rear mounting.

## 3.4 Wiring

### 3.4.1 Power Supply Unit



Wire correctly using a power supply unit which conforms to the laws and standards of the region where this device is to be used. If the power supply unit is non-conforming or the wiring is improper, it can cause damage or malfunction of this device.

#### <Reference>

A specialist who has the required electrical knowledge should perform the wiring.

The DC power supply unit must satisfy the conditions given below:

- 1) Power supply unit authorized in the region where this device is to be used.
- 2) Power supply unit conforming to EMC Directive and Low-voltage Directive (only for use in Europe).
- 3) Power supply unit conforming to the Low-voltage directive and with an output of 100VA or less.
- 4) The frame ground (F.G.) terminal must be connected to ground when using a commercially available switching regulator.
- 5) Power supply unit with an output holding time of 20ms or more.
- 6) Use an isolation transformer for the DC power supply unit.
- 7) In case a surge is generated, take countermeasures such as connecting a surge absorber to the origin of the surge.
- 8) Power supply unit corresponding to CLASS 2 (only for use in the United States of America)

Additional information» As provided in IEC 60536 (CLASS: Protection against Electric Shock), this power supply should require no ground earth and satisfy the insulation distance called double insulation or reinforced insulation.

( In case the power supply conforms to Low-voltage directive and has an output of 100VA or less, it can be used as a suitable product. )

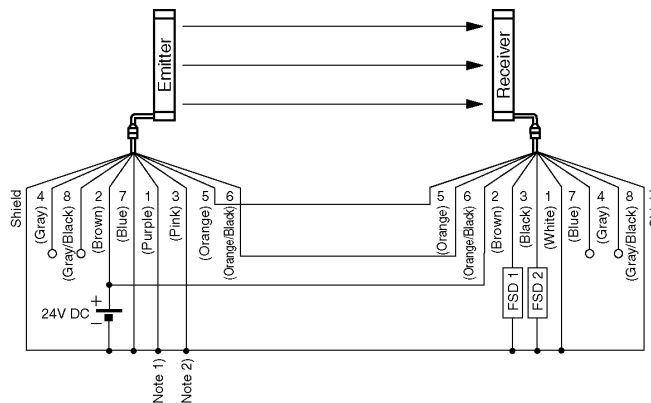
### 3.4.2 Sensor Wiring Diagrams

#### <Reference>

- This section shows examples of main wiring configurations.  
Although the connector pin No. and the cable color are shown in the figures below, refer to '3.4.3 Wiring • Connection Procedure' for connector pin arrangement and signal designation.
- There are two configurations, PNP output equivalent type and NPN output equivalent type. The only difference between them is in the connection points of the load (FSD 1, FSD 2).
- Use a safety relay unit or an equivalent control circuit in safety for FSD.

#### 1) Wiring Diagram

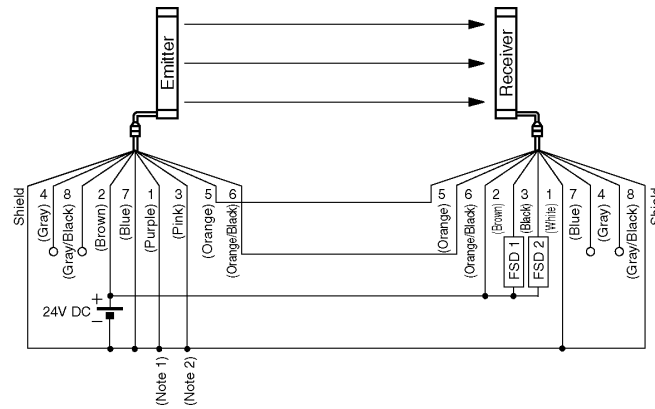
- PNP output equivalent type



Notes: 1) Connect the master/slave switching input (purple) to 0V.

2) Connect the emission halt input (pink) to 0V for normal emission, and connect it to +V or keep it open to halt emission.

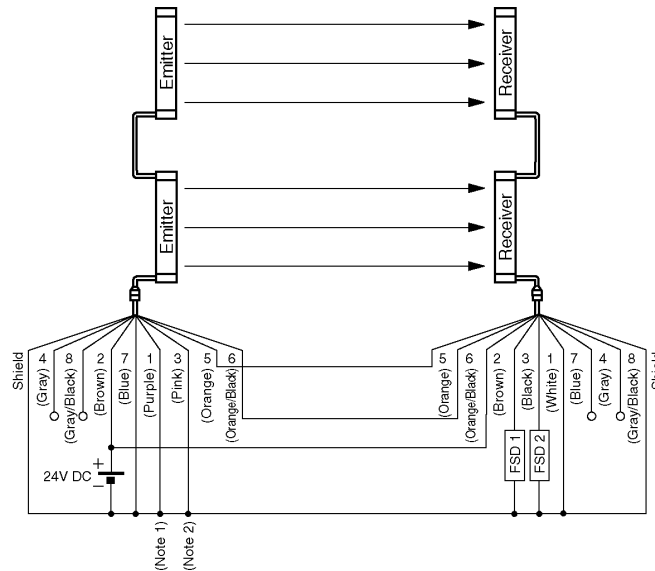
- NPN output equivalent type



- Notes: 1) Connect the master/slave switching input (purple) to 0V.  
 2) Connect the emission halt input (pink) to 0V for normal emission , and connect it to +V or keep it open to halt emission.

## 2) Wiring Diagram for Series Connection of Multiple Sets of Sensors

- PNP output equivalent type



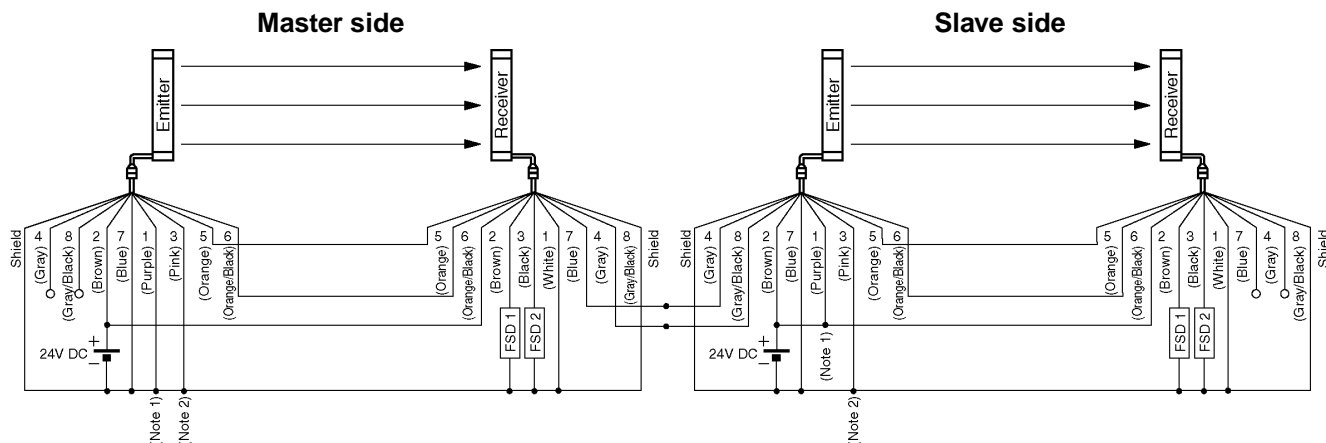
- Notes: 1) Connect the master/slave switching input (purple) to 0V.  
 2) Connect the emission halt input (pink) to 0V for normal emission , and connect it to +V or keep it open to halt emission.

### <Reference>

For details of series connection using the cable for series connection, refer to '4.2.2 Extension and Dismantling of Sensor'.

### 3) Wiring Diagram

- PNP output equivalent type



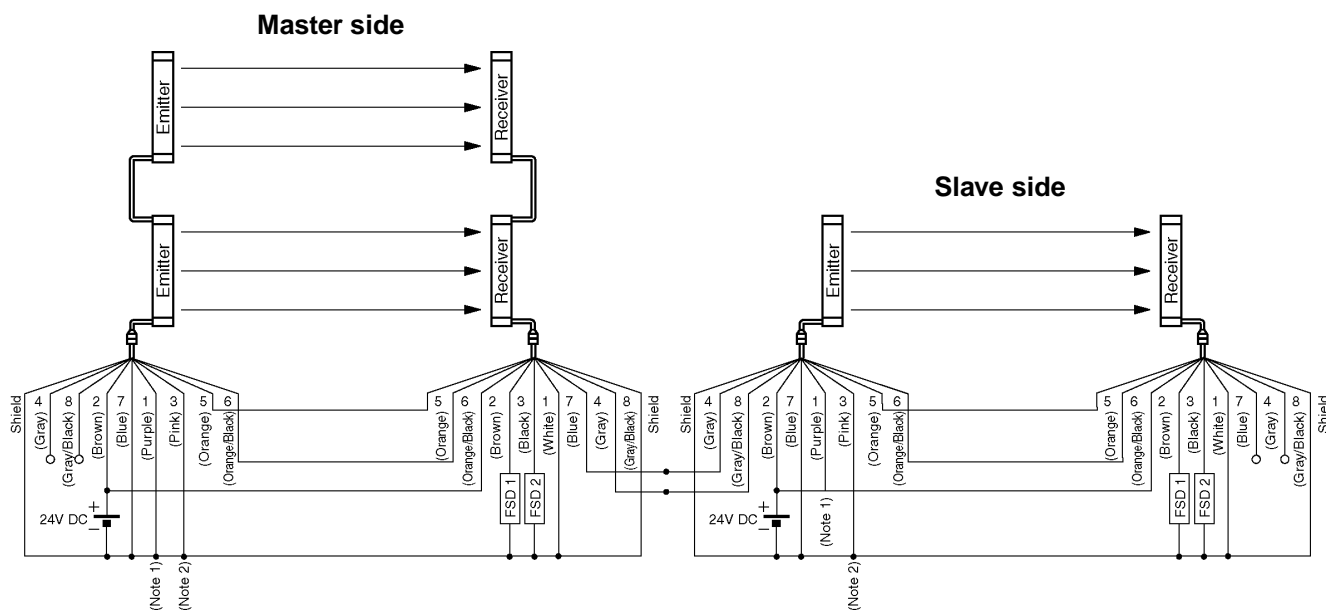
- Notes: 1) Connect the master/slave switching input (purple) to 0V for master side, and connect the switching input to + or keep it open for slave side.
- 2) Connect the emission halt input (pink) to 0V for normal emission , and connect it to +V or keep it open to halt emission.

#### <Reference>

For parallel connection, either separate power supplies for each sensor or a common power supply for all the sensors can be used.

### 4) Wiring Diagram

- PNP output equivalent type



- Notes: 1) Connect the master/slave switching input (purple) to 0V for master side, and connect the switching input to + or keep it open for slave side.
- 2) Connect the emission halt input (pink) to 0V for normal emission , and connect it to +V or keep it open to halt emission.

#### <Reference>

For parallel connection, either separate power supplies for each sensor or a common power supply for all the sensors can be used.



### 3.4.3 Wiring • Connection Procedure

Connect the mating cable (with connector on one end, or connector on both ends) to the connector of the sensor main body (emitter and receiver)

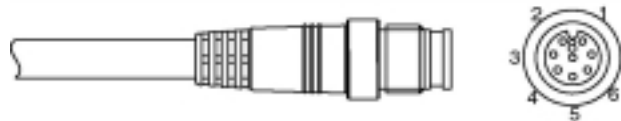
Wire the other side of the mating cable according to your application, by referring to the connector pin arrangement given below and to '3.4.2 Sensor Wiring Diagrams'.

Extension of up to a total length of 27m (for both emitter and receiver) is possible by using an exclusive cable.

#### ⚠ WARNING

- When extending the cable, extend it to a total length of 27m or less. Extending the cable to more than 27m may cause malfunction, which can result in serious injury or death.
- When the synchronization cable is extended with a cable other than the exclusive cable, use a 0.2mm<sup>2</sup>, or more, shielded twist pair cable.

#### 1) Sensor Main Body Side Connector



Connector Pin No.	Signal Name	
	Emitter	Receiver
1	Master/Slave switching input	OSSD 2
2	24V DC	24V DC
3	Emission halt input	OSSD
4	Interference prevention +	Interference prevention +
5	Sync +	Sync +
6	Sync -	Sync -
7	0V, Shield	0V, Shield
8	Interference prevention -	Interference prevention -

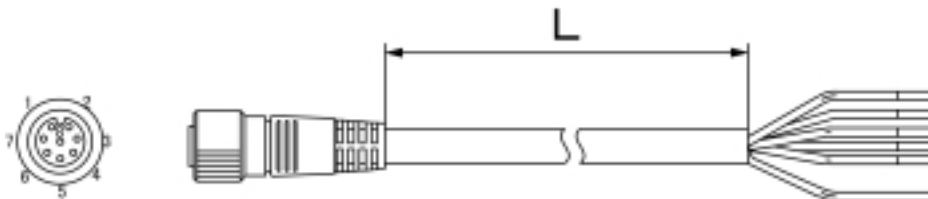
#### <Reference>

The PNP output equivalent type ( **SF2-EH□** ) and the NPN output equivalent type ( **SF2-EH□-N** ) have the same connector pin arrangement.

The connectors can be distinguished from their color as follows.

Connector for emitter: gray, connector for receiver: black

#### 2) Mating Cable (with connector on one end)



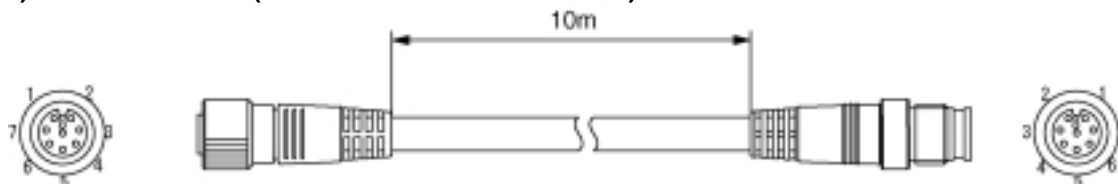
Connector pin No.	Emitter		Receiver	
	Signal designation	Wire color	Signal designation	Wire color
1	Master/Slave switching input	Purple	OSSD 2	White
2	24V DC	Brown	24V DC	Brown
3	Emission halt input	Pink	OSSD 1	Black
4	Interference prevention $\phi$	Gray	Interference prevention $\phi$	Gray
5	Sync +	Orange	Sync +	Orange
6	Sync -	Orange/Black	Sync -	Orange/Black
7	0V, Shield	Blue	0V, Shield	Blue
8	Interference prevention -	Gray/Black	Interference prevention -	Gray/Black

### <Reference>

- In the table on the previous page, Orange/Black and Gray/Black indicate that the basic wire color is orange and gray, respectively, and they have a black stripe on them.
- The length L of the connection cable is different depending on the model No.
- The connectors can be distinguished from their color as follows.  
Connector for emitter: gray, connector for receiver: black

Model No.	Cable length L (m)
<b>SF2-CC3</b>	3
<b>SF2-CC7</b>	7
<b>SF2-CC10</b>	10

### 3) Extension Cable (with connector on both ends)



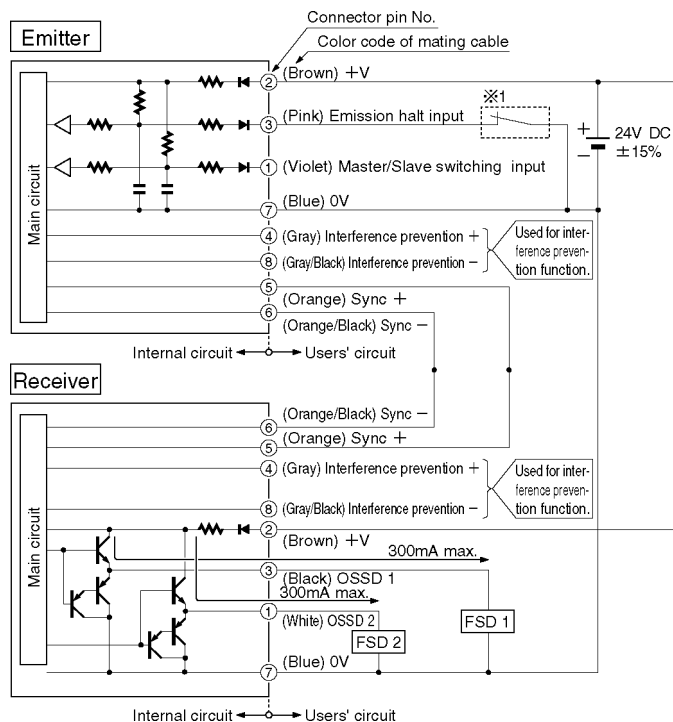
Connector Pin No.	Signal Name	
	Emitter	Receiver
1	Master/Slave switching input	OSSD 2
2	24V DC	24V DC
3	Emission halt input	OSSD
4	Interference prevention +	Interference prevention +
5	Sync +	Sync +
6	Sync -	Sync -
7	0V, Shield	0V, Shield
8	Interference prevention -	Interference prevention -

### <Reference>

The connectors can be distinguished from their color as follows.  
Connector for emitter: gray, connector for receiver: black

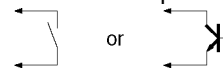
### 3.4.4 I/O Circuit Diagrams

#### <SF2-EH /PNP output equivalent type>



(1

Non-voltage contact or NPN open-collector transistor

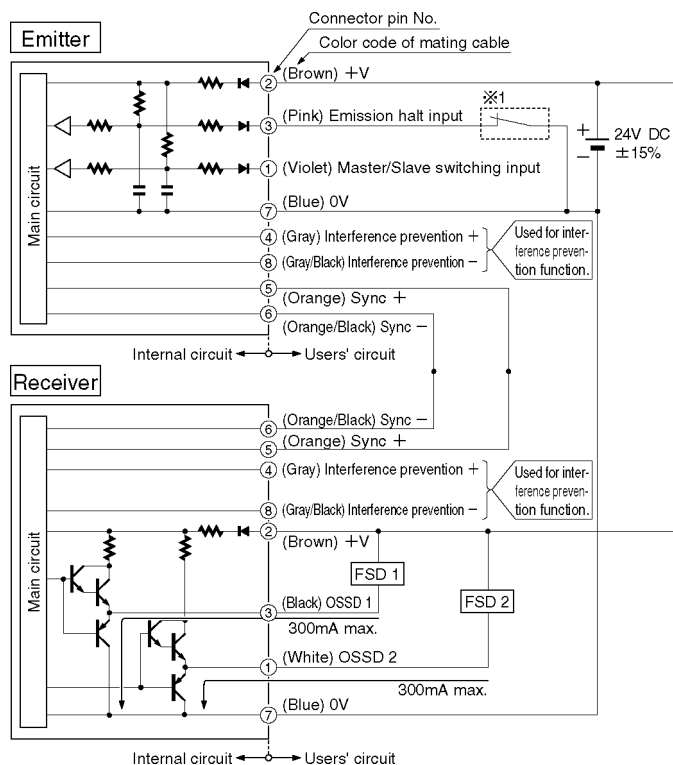


Low (0V): emission  
High (+V or open): emission stopped

#### <Reference>

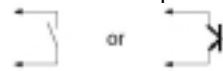
- It is possible to switch to the master mode by connecting to 0V, and to the slave mode by connecting to +V or keeping it open.
- Use a safety relay unit or an equivalent control circuit in safety for FSD.

#### <SF2-EH -N/NPN output equivalent type>



(1

Non-voltage contact or NPN open-collector transistor



Low (0V): emission  
High (+V or open): emission stopped

#### <Reference>

- It is possible to switch to the master mode by connecting to 0V, and to the slave mode by connecting to +V or keeping it open.
- Use a safety relay unit or an equivalent control circuit in safety for FSD.

**<Output waveform [when control output (OSSD1, OSSD2) is ON]>**

When the sensor is in the light received condition (ON state), the receiver self-diagnoses the output circuit. For this purpose, the output transistor goes to the OFF state periodically. (Refer to the figure below.)

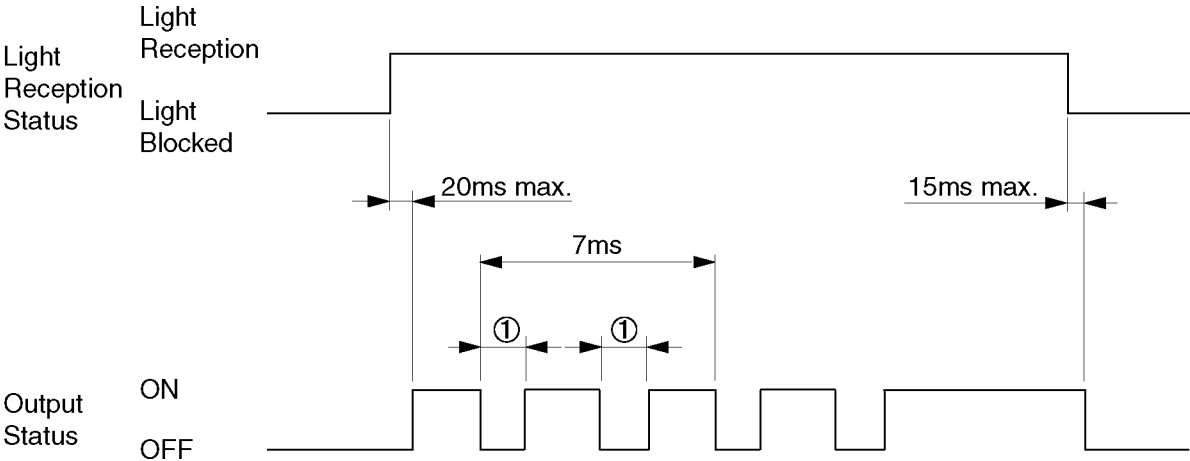
If the OFF signal is fed back, the receiver judges the output circuit as normal. If the OFF signal is not fed back, the receiver judges that the output circuit or the wiring is abnormal, and the control output (OSSD1, OSSD2) is maintained in the OFF state.

**<Reference>**

The frequency or the output width for which the output transistor turns OFF does not change even if maximum 4 sets of sensors are connected in series.



Take care of the input response time of the equipment connected to the sensor, since there is a possibility of the equipment malfunctioning due to the device OFF signal.



Number of pulses (number of ③'s in the figure) in 7ms... —	1 to 2
Pulse width (width of ① in the figure) [μs]...③	200
Total number of pulse width / 7ms (product of — and ③)	400 max.

## 3.5 Adjustment

### 3.5.1 Beam-axis Alignment

#### CAUTION

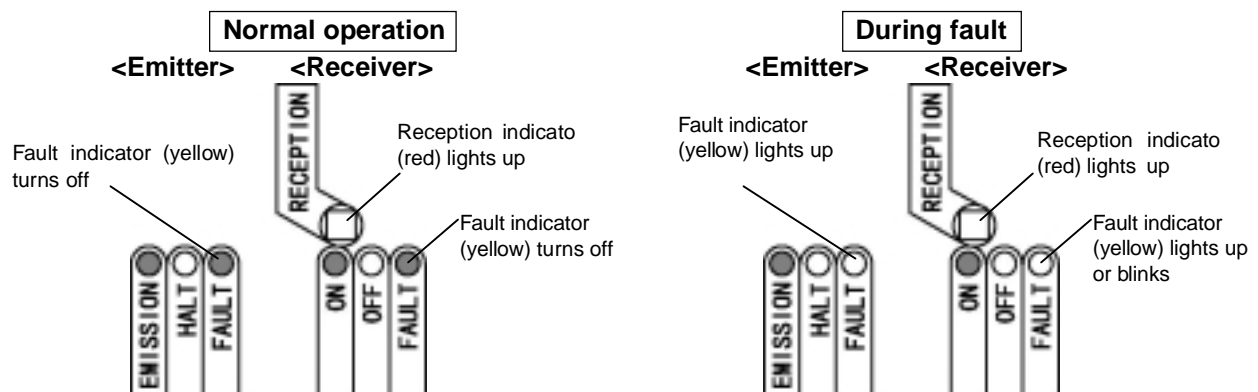
Perform this alignment only when the emission indicator (green) of the emitter lights up and the reception level indicator (green) and the OSSD ON indicator (green) of the receiver turn off.

1. Turn ON the power supply unit of this device.

#### <Reference>

If the intermediate supporting bracket has been mounted on the sensor main body, loosen the hexagon-socket-head bolt [1 No., M4 (length 6mm)] before alignment.

2. Check that the fault indicators (yellow) of the emitter and the receiver are off.
  - If the fault indicator (yellow) lights up or blinks, refer to 'Chapter 5 Troubleshooting', and report the contents to the maintenance in-charge.

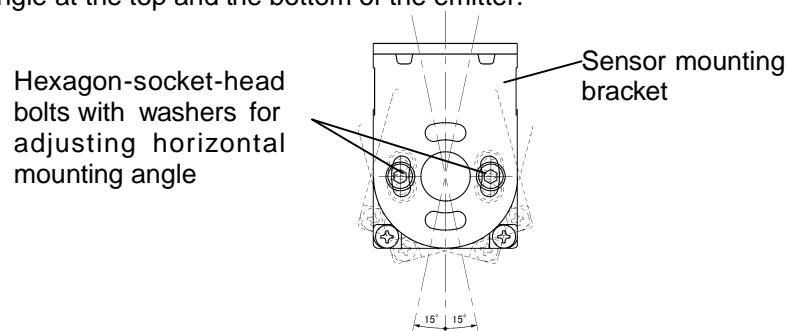


#### <Reference>

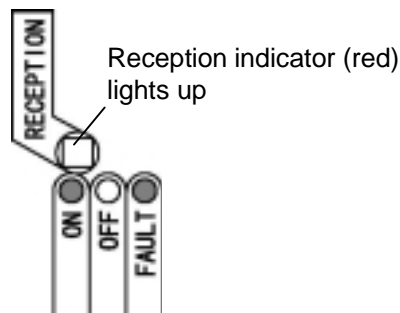
Refer to '3.3.1 Mounting Procedure' for the operations beyond this.

For laser alignment, it is useful to use the beam alignment tool for light curtain (SF-LAT-2E) (optional).

3. Loosen the two hexagon-socket-head bolts with washers [M4 (length 10mm)] for adjusting the horizontal mounting angle at the top and the bottom of the emitter.



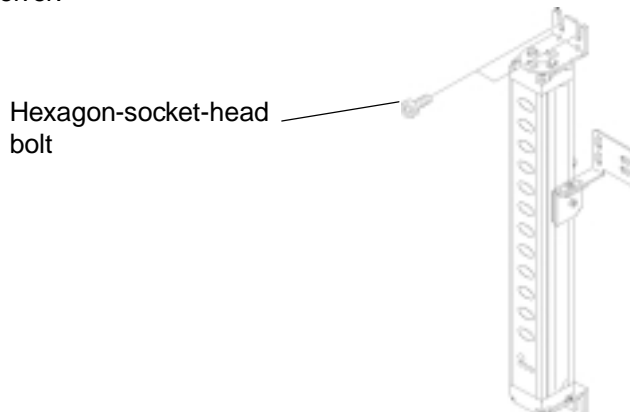
4. Adjust the position of the emitter by rotating it so that the reception indicator on the receiver lights up in strong bright red color.



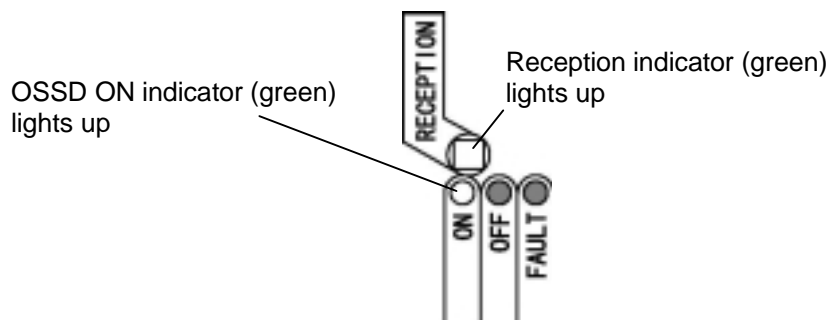
#### <Reference>

Here, 'strong bright red color' means having the same brightness as the glowing OSSD OFF indicator (red).

5. Tighten the hexagon-socket-head bolts with washers [M4 (length 10mm)] for adjusting the horizontal mounting angle, at the top and the bottom of the emitter, to fix the emitter. The tightening torque should be 1.2N·m or less.
6. Remove the two hexagon-socket-head bolts [M5 (please arrange separately)] at the top and the bottom of the receiver.



7. Adjust the position of the receiver so that the reception indicator (green) and the OSSD ON indicator (green) of the receiver light up.

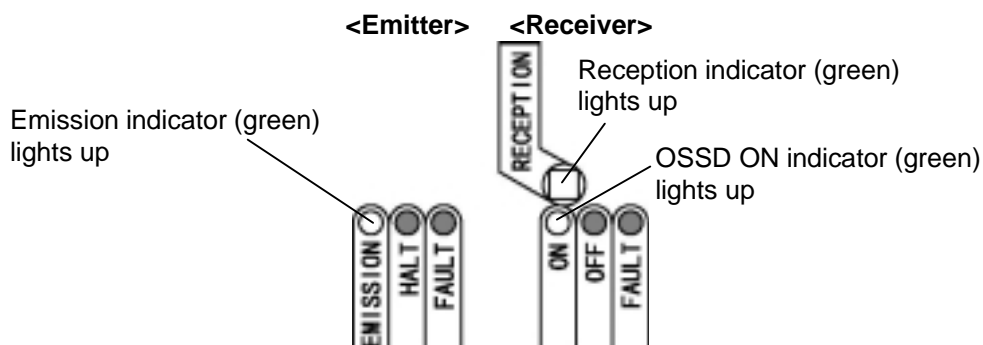


8. Tighten the two hexagon-socket-head [M5 (please arrange separately)] at both the top and the bottom of the receiver to fix the receiver.

#### <Reference>

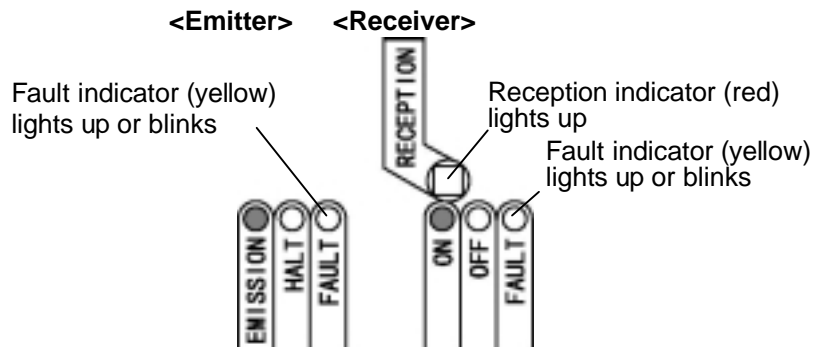
If the intermediate supporting bracket has been mounted on the sensor main body, tighten the hexagon-socket-head bolt [M4 (length 6mm)]. The tightening torque should be 1.2N·m or less.

9. Check, once again, that the emission indicator (green) of the emitter, the reception indicator (green) and the OSSD ON indicator (green) of the receiver light up.
  - In case any of these indicators is off, repeat the procedure from Step 2 onwards.

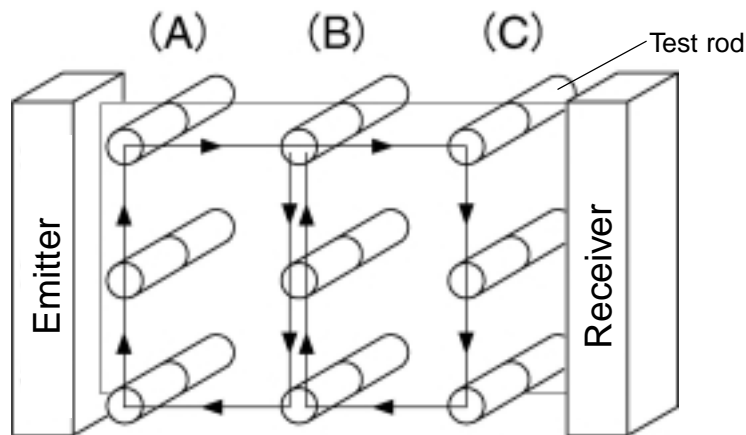


### 3.5.2 OperationTest

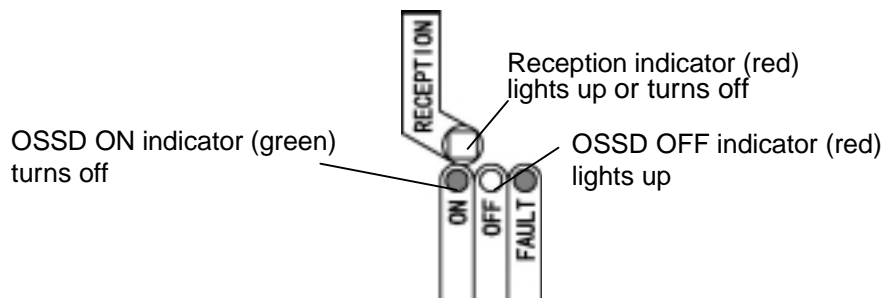
1. Turn ON the power supply unit of this device.
2. Check that the fault indicators (yellow) of the emitter and the receiver are off.
  - If the fault indicator (yellow) lights up or blinks, refer to '**Chapter 5 Troubleshooting**', and report the contents to the maintenance in-charge.



3. Move the test rod as illustrated below at three positions, just in front of the emitter (A), between the emitter and receiver (B), and just in front of the receiver (C).



4. During Step 3 above, check that the control output (OSSD1, OSSD2) is in the OFF state, and also the OSSD OFF indicator (red) of the receiver lights up while the test rod is present within the sensing area.
  - If the turning ON/OFF of the OSSD ON indicator (green) and the OSSD OFF indicator (red) of the receiver does not correspond to the movement of the test rod, refer to '**Chapter 5 Troubleshooting**', and report the contents to the maintenance in-charge.



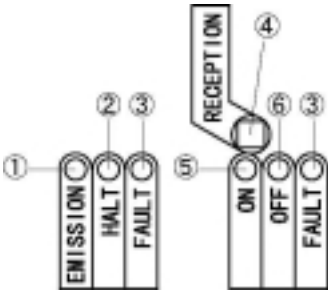
#### <Reference>

If the OSSD ON indicator (green) of the receiver lights up even though the test rod blocks the light, also check if there is any reflective object or extraneous light source near this device.

3.5.3 Operation

<Indicators>

Status of indicator	Position and color of indicator	<Emitter>	<Receiver>
□ lights up	: Emission indicator (green)		
□ blinks	: Emission halt indicator (orange)		
● □ turns off	: Fault indicator (yellow)		
	②: Reception indicator [2-color (green/red)]		
	⑤: OSSD ON indicator (green)		
	⑥: OSSD OFF indicator (red)		



<Reference>

The display on the emitter and the receiver is different (number, color, and function of indicators).  
The reception indicator of the receiver indicates the reception status of the second beam channel from the cable side. When all beam channels are received, the reception indicator lights up in green. When a beam channel except the second beam channel is blocked, it lights up in red. When beam channels including the second beam channel are blocked, this indicator turns off. When all beam channels are not received, this indicator shows, in an analog manner, the amount of light received by the second beam channel by its red color intensity.

1) Normal Operation

Device Status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
Reception status (all beams received)			ON	ON
Beam blocked status (one or more beams blocked)			OFF	OFF
Time Chart				

<Reference>

For the beam blocked status given in the table above, if the second beam channel from the cable side is blocked, the reception indicator of the receiver turns off, and if the second beam channel receives light, the indicator lights up in red.



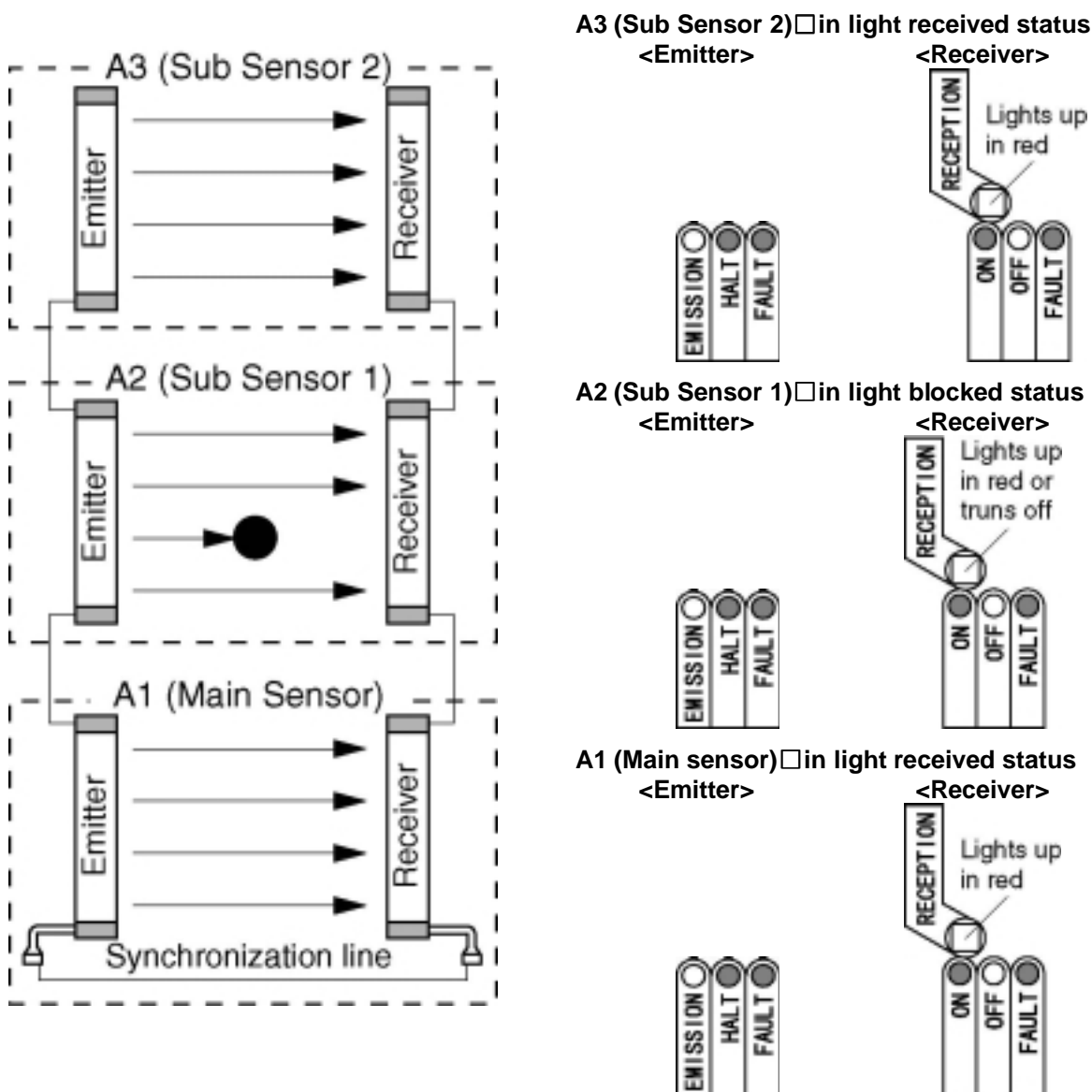
### <For series connection>

In case of series connection, if any of the sets is in the beam blocked state, the output (OSSD 1, OSSD 2) turns OFF. Moreover, the OSSD OFF indicators (red) of the receivers, connected in series, light up.

### <Reference>

The OSSD ON/OSSD OFF indicators of the receiver indicate the output status.

The following figures show the state of the indicators with A2 (Sub Sensor 1) in beam blocked status



### <Reference>


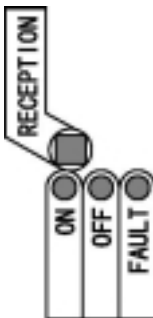
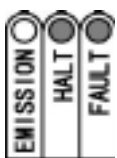
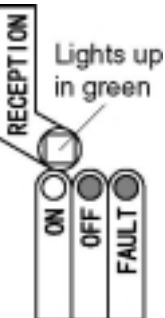

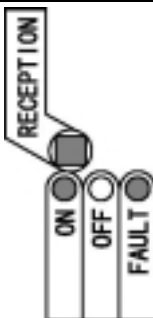
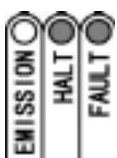
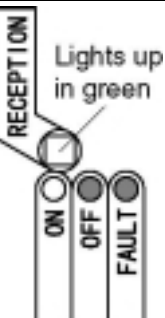
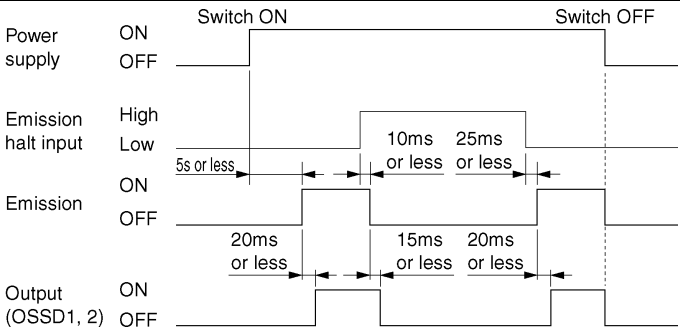
In case of series connection, it is possible to find out from the reception indicator which sensor unit causes the beam-blocked state.

## 2) In Case of Using Emission Halt Function

This device incorporates an emission halt function. Using this function, it is possible to simulate the beam blocked status

### <Reference>

When the emission halt input is connected to +V or kept open (High), the emitter stops emitting light. In this condition, if this device operates properly, the output (OSSD1, OSSD2) of the receiver turns OFF.

Operation procedure and items for confirmation		Indicators		Output	
		Emitter	Receiver	OSSD 1	OSSD 2
1	Emission halt input is Low before switching on the power supply			OFF	OFF
2	Turn on the power supply Output (OSSD1, OSSD2) of the receiver turns ON			ON	ON
3	Emission halt input is made High Output (OSSD1, OSSD2) of the receiver turns OFF			OFF	OFF
4	Emission halt input is made Low Output (OSSD1, OSSD2) of the receiver turns ON			ON	ON
Time chart					

### 3) In Case of Abnormal Operation

This device has two types of self-diagnosis functions. One self-diagnosis function detects a temporary (recoverable) fault, such as, incorrect wiring, cable-break, short-circuit, etc. The status of this device when such a fault is detected is called 'off-hold' status.

The other self-diagnosis function detects an irrecoverable internal fault of this device. The status of this device when such a fault is detected is called 'lockout' status.

#### <Off-hold status>



If the cause of the temporary fault is removed, this device can recover automatically without once switching off and then turning on the power supply. However, since it is possible that the machine could start operation immediately after this device recovers, remove the cause of the fault after turning off the power supply to prevent any accident.

#### Emitter off-hold

Device Status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
<b>Emitter off-hold</b> Emission of all beam channels stopped, synchronization output stopped			OFF	OFF
Time chart	<p>The time chart for Emitter off-hold shows the following sequence of events:</p> <ul style="list-style-type: none"> <li><b>Switch ON:</b> Power supply turns ON. Emission turns ON. Output (OSSD1, 2) turns ON.</li> <li><b>5s or less:</b> A fault occurs in the emitter, causing the emission to stop.</li> <li><b>20ms or less:</b> The emitter enters the off-hold state, and the receiver also enters the off-hold state.</li> <li><b>15ms or less:</b> The emitter is restored, and emission resumes.</li> <li><b>20ms or less:</b> The receiver is restored, and the output (OSSD1, 2) resumes.</li> <li><b>Switch OFF:</b> The power supply is turned OFF, and the device returns to its normal state.</li> </ul>			

#### <Reference>

When the emitter is in the off-hold status, emission and the synchronization output is stopped. Due to this, the receiver enters the off-hold status and judges that the emission has been stopped.

#### Receiver off-hold

Device Status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
<b>Receiver off-hold</b> Output (OSSD1, OSSD2) of the receiver turns OFF			OFF	OFF
Time chart	<p>The time chart for Receiver off-hold shows the following sequence of events:</p> <ul style="list-style-type: none"> <li><b>Switch ON:</b> Power supply turns ON. Emission turns ON. Output (OSSD1, 2) turns ON.</li> <li><b>5s or less:</b> A fault occurs in the receiver, causing the output to stop.</li> <li><b>20ms or less:</b> The receiver enters the off-hold state, and the emitter also enters the off-hold state.</li> <li><b>5s or less:</b> The receiver is restored, and the output resumes.</li> <li><b>20ms or less:</b> The emitter is restored, and emission resumes.</li> <li><b>Switch OFF:</b> The power supply is turned OFF, and the device returns to its normal state.</li> </ul>			

## <Lockout status>


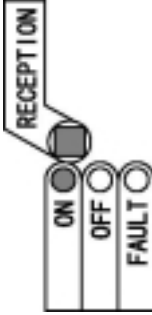
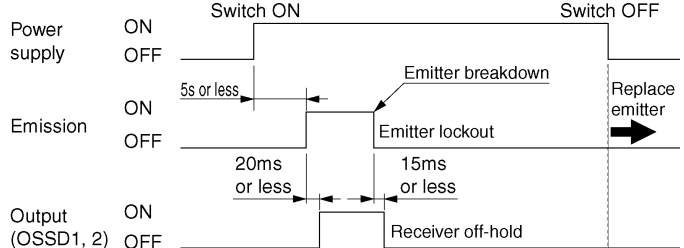
### <Reference>

If a sensor error is detected, the sensor will turn the control output (OSSD1, OSSD2) off and the fault indicator (yellow) will blink.

Since the machine will not return to normal operation automatically after the removal of the source of error, it is necessary to restart it.

Refer to 'Chapter 5 Troubleshooting', and remove the source of error.

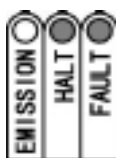
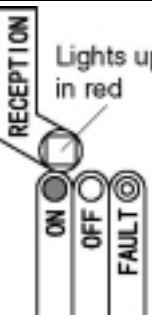
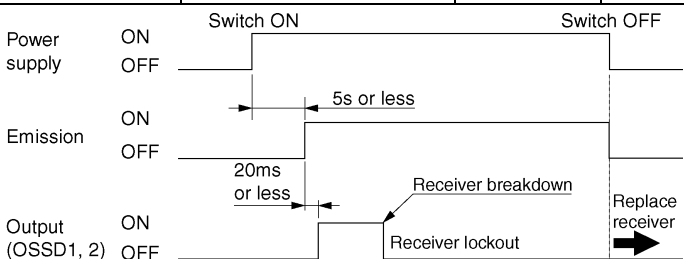
### Emitter lockout

Device status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
<b>Emitter lockout</b> Emission of all beam channels stopped, synchronization output stopped			OFF	OFF
Time chart				

### <Reference>

When the emitter is in the lockout status, the synchronization output is stopped. Due to this, the receiver enters the off-hold status and judges that the emission has been stopped.

### Receiver lockout

Device Status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
<b>Receiver lockout</b> Output (OSSD1, OSSD2) of the receiver turns OFF			OFF	OFF
Timing chart				

## Chapter 4 Maintenance

This chapter explains the method of maintenance and replacement for the proper operation of this device.

### <Reference>

When any abnormality is found, refer to '**Chapter 5 Troubleshooting**' and report the contents to the maintenance in-charge. If the rectification method is not clear, please contact our office.  
Please make a copy of this checklist, check each inspection item in the respective square, and file the list for record.

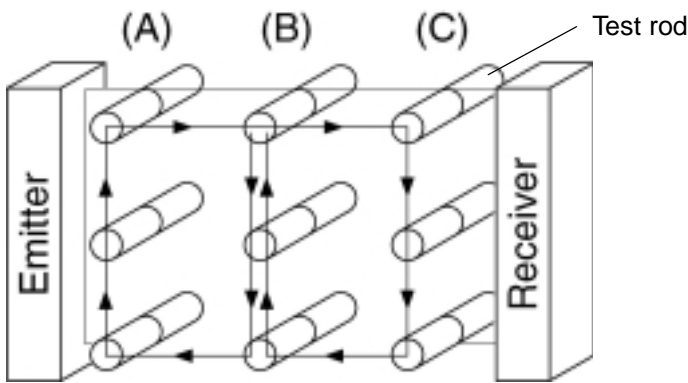
## 4.1 Inspection

### 4.1.1 Daily Inspection



Be sure to inspect the following items prior to operation and confirm that there is no abnormality. Operating this device without inspection or in an abnormal condition can result in serious injury or death.

#### Check List (Daily Inspection)

Check Column	Inspection Item
<input type="checkbox"/>	Dangerous parts of the machine cannot be reached without passing through the sensing area of this device.
<input type="checkbox"/>	Some part of operator's body remains in the sensing area when operation is done with dangerous parts.
<input type="checkbox"/>	The calculated safety distance has been maintained or exceeded during installation.
<input type="checkbox"/>	There is no damage to the safety guard or protective structure.
<input type="checkbox"/>	There is no defect, fold, or damage in the wiring.
<input type="checkbox"/>	The corresponding connectors have been connected securely.
<input type="checkbox"/>	No dirt or scratches exist on the light emitting surface.
<input type="checkbox"/>	The test rod is not deformed or defective.
<input type="checkbox"/>	The emission indicator (green) of the emitter and the OSSD ON indicator (green) of the receiver light up when no object is present in the sensing area.
<input type="checkbox"/>	<p>The test rod can be detected at three positions, directly in front of the emitter (A), midway between the emitter and the receiver (B), and directly in front of the receiver (C) The OSSD indicator (red) continues to light up as long as the test rod is present in the sensing area from (A) to (C).</p> 
<input type="checkbox"/>	With the machine in the operating condition, the dangerous parts operate normally when no object is present in the sensing area
<input type="checkbox"/>	With the machine in the operating condition, the dangerous parts stop immediately when the test rod is inserted into the sensing area at any of the three positions, directly in front of the emitter (A), midway between the emitter and the receiver (B), and directly in front of the receiver (C)
<input type="checkbox"/>	The dangerous parts remain stopped as long as the test rod is present in the sensing area

### 4.1.2 Periodic Inspection (Every Six Months)



Be sure to inspect the following items every six months and confirm that there is no abnormality. Operating this device without inspection or in an abnormal condition can result in serious injury or death.

#### Check List (Periodic Inspection)

Check Column	Inspection Item
<input type="checkbox"/>	The structure of the machine does not obstruct any safety mechanisms for stopping operation
<input type="checkbox"/>	No modification has been made in the machine controls which obstructs the safety mechanisms.
<input type="checkbox"/>	The output of this device is correctly detected
<input type="checkbox"/>	The wiring from this device is correct.
<input type="checkbox"/>	The overall response time of the complete machine is equal or less than the calculated value.
<input type="checkbox"/>	The actual number of operation cycles (time) of the limited lifetime parts (relay, etc.) is less than their rated operation cycles (time).
<input type="checkbox"/>	No screws or connectors of this device are loose.
<input type="checkbox"/>	No extraneous light source or reflective object has been added near this device.

### 4.1.3 Inspection after Maintenance

Under the following situations, perform all the inspection items mentioned in '4.1.1 Daily Inspection' and '4.1.2 Periodic Inspection (Every Six Months)'.

- 1) When any parts of this device are replaced.
- 2) When some abnormality is felt during operation.
- 3) When beam-axis alignment of the emitter and receiver is done.
- 4) When the device installation place or environment is changed.
- 5) When the wiring method or wiring layout is changed.
- 6) When FSD parts are replaced.
- 7) When FSD setting is changed.

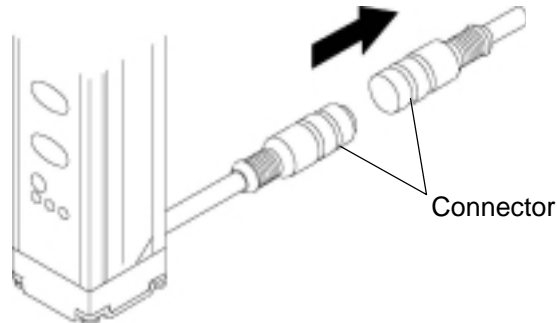
## 4.2 Replacement

### 4.2.1 Sensor Replacement

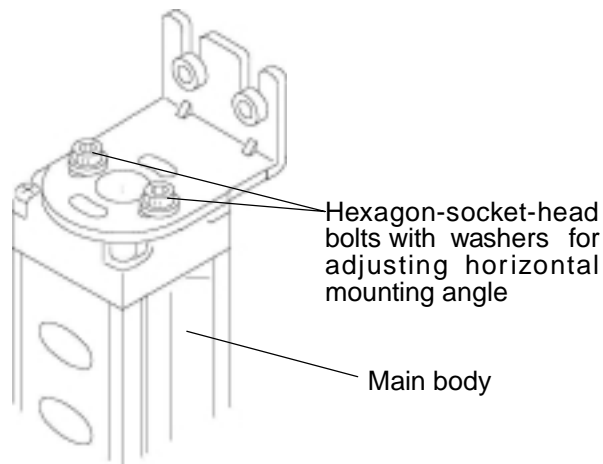
#### **CAUTION**

Be sure to connect or disconnect the cable by holding the connector. Connecting or disconnecting by holding the cable itself could result in a cable-break.

1. Disconnect the connector nearest to the main body of this device.

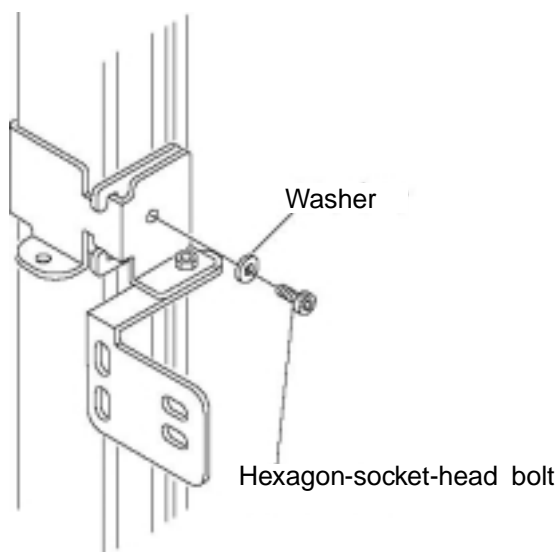


2. Remove the two hexagon-socket-head bolts with washers [M4 (length 10mm)] for adjusting the horizontal mounting angle at the bottom of this device.



#### **<Reference>**

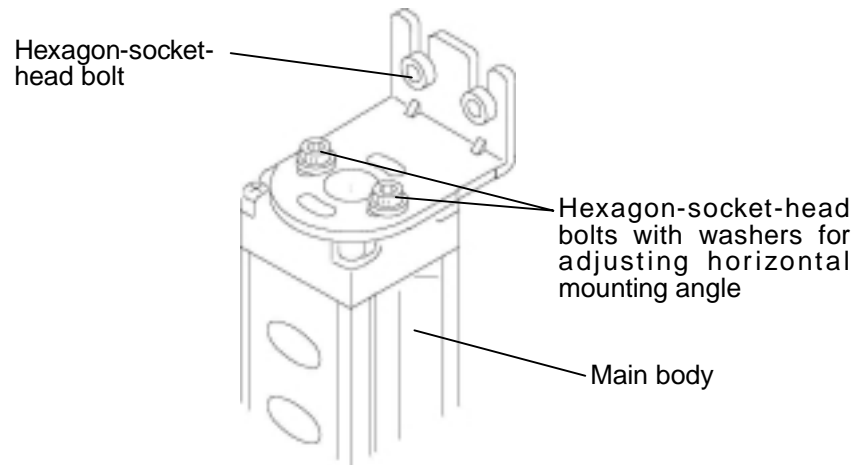
In case an intermediate supporting bracket has been mounted on this device, loosen the hexagon socket-head bolt [M4 (length 6mm)].



**CAUTION**

Be sure to carry out the operations by holding the main body firmly. Failure to do so can cause the main body to fall resulting in injury or device damage.

3. Remove the hexagon-socket-head bolt [M5 (please arrange separately)] at the top of this device, and the remove the main body from the mounting surface.



4. Remove the two hexagon-socket-head bolts with washers [M4 (length 10mm)] for adjusting the horizontal mounting angle at the top of this device, and then remove the sensor mounting bracket from the main body.

**CAUTION**

Before replacing, be sure to check whether it is an emitter or a receiver and also check the model No. Failure to do so can result in malfunction of this device.

5. Replace the removed main body with the new one.
6. Mount the new part by following the above dismantling procedure in reverse.



## 4.2.2 Extension and Dismantling of Sensor

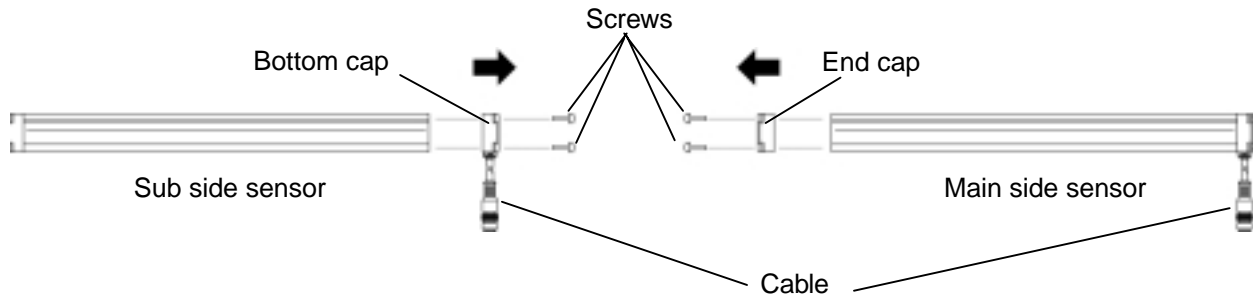
The sensor can be extended by series connection. For details, refer to '3.2 Connection Configuration'. This section explains the connection method for series connection using optional parts

### <Connection of cable for series connection>



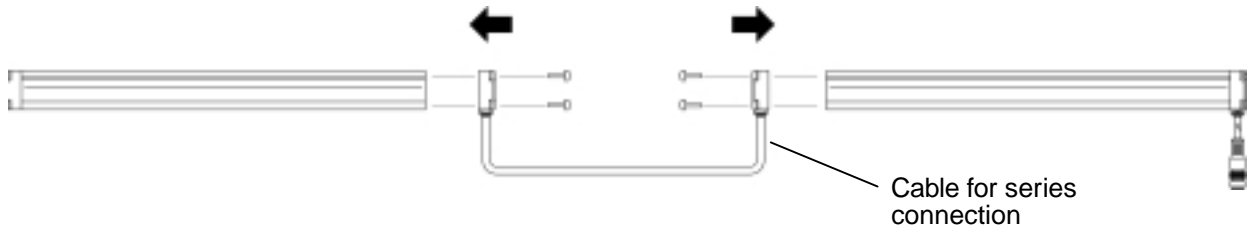
Do not lose any screws during extension/dismantling.  
Further, do not mix emitters and receivers during mounting.

1. Remove four screws [M4 (length 10mm)] from the main side sensor (emitter and receiver to which the synchronization line has been connected) to remove the end cap.
2. Remove four screws [M4 (length 10mm)] from the sub side sensor to remove the bottom cap.



Be careful of the cable direction. Mount the cable for series connection such that its direction is the same as that of the main/sub side cable. Further, take care that the cable for series connection has a main side and a sub side. The connector on the main side is male type (pin side).

3. Connect the cable for series connection with four screws [M4 (length 10mm)] at the place where parts have been removed at Steps 1 and 2 above. The tightening torque should be 1.2N·m or less.



### <Reference>

There is no difference in the cable for series connection for the emitter and the receiver.  
The length of the cable for series connection differs with the model No.

Model No.	Cable Length (mm)
<b>SF2-CSL02</b>	200
<b>SF2-CSL05</b>	500

### <Disconnection of cable for series connection>

1. For disconnection of the cable for series connection, follow the above procedure of **<Connection of cable for series connection>** in reverse.

## Chapter 5 Troubleshooting

This section explains the faults that may occur during the operation of this device. The following tables give both the 'Symptoms' and the 'Cause and Remedy' of each fault.

If any symptom not described in the tables below occurs, report it along with the model No. to our office.

The indicator status is indicated by three marks as follows

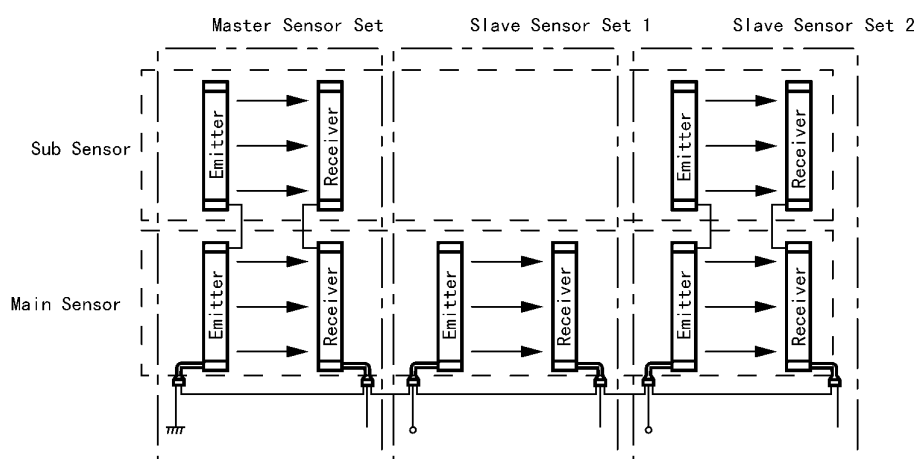
Lights up , blinks », and turns off: ●. For details, refer to '3.5.3 Operation' or '6.2 Indicator and Output Table'.

### <Reference>

Be sure to switch off the power supply before carrying out any remedy.

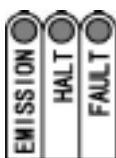

In case multiple sensors have been connected together and a fault occurs in more than one, rectify from the main sensor or the sub sensor that is nearest to the master sensor.



The following figure explains the terms used in the 'Cause and Remedy' given in the tables below:




Further, for the classifications besides the common, mentioned in the following table, refer to '3.2 Connection Configuration' to determine the current connection status, and carry out the relevant remedy.

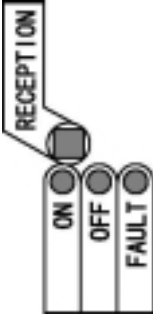
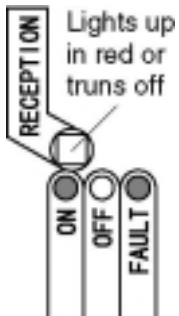
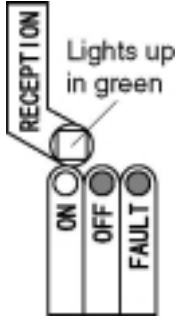
### 5.1 Troubleshooting of Emitter

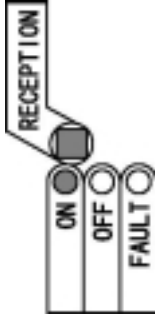
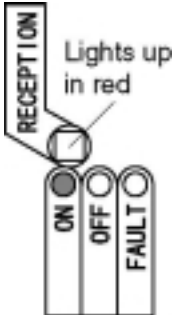
Symptoms	Cause and Remedy
No indicator lights up Emission indicator is off Emission halt indicator is off Fault indicator is off 	Cause: Incorrect power supply Remedy: Check the wiring. Check the power supply voltage. Check the power supply capacity. Check if any cable connector is loose.
Emission halt function gets activated Emission indicator is off Emission halt indicator lights up Fault indicator is off 	Cause: Incorrect power supply Remedy: Check the power supply voltage. Cause: Improper connection of, or fault in, emission halt input wire Remedy: Check that the emission halt input wire is connected to 0V. Check if the emission halt input wire is broken.

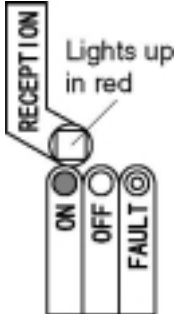
Symptoms	Cause and Remedy
<p>Emission halt indicator does not light up even when emission halt input is applied</p> <p>Emission indicator lights up</p> <p>Emission halt indicator is off</p> <p>Fault indicator is off</p> 	<p>Cause: Incorrect power supply</p> <p>Remedy: Check the power supply voltage.</p> <p>Cause: Improper connection of emission halt input wire</p> <p>Remedy: Check that the emission halt input wire is either connected to +V or is open.</p>
<p>Enters off-hold status</p> <p>Emission indicator is off</p> <p>Emission halt indicator lights up</p> <p>Fault indicator lights up</p> 	<p>Cause: Incorrect power supply</p> <p>Remedy: Check the power supply voltage.</p> <p><b>(In case of Connection of One Set of Sensor)</b></p> <p>Cause: Interference prevention line is connected</p> <p>Remedy: Check that the interference prevention line is open.</p> <p><b>(In case of Parallel Connection)</b></p> <p>Cause: Improper connection of, or fault in, interference prevention line</p> <p>Remedy: Check the wiring of the interference prevention line.</p> <p>Check if there is a break in the interference prevention line.</p> <p>Cause: Improper connection of master/slave switching input line.</p> <p>Remedy: Check that the master/slave switching input line of the master sensor set is connected to 0V.</p> <p>Cause: Master sensor set or the slave sensor set near the master sensor set is malfunctioning.</p> <p>Remedy: Check that both the master sensor set and the slave sensor set near the master sensor set operate properly.</p> <p>Cause: More than 4 sets are connected in parallel</p> <p>Remedy: Check that the number of sets connected in parallel does not exceed four.</p> <p>Cause: The number of sets connected in parallel has been changed during operation</p> <p>Remedy: Check the number of sets connected in parallel.</p>

Symptoms	Cause and Remedy
<p>Enters lockout status Emission indicator is off Emission halt indicator lights up Fault indicator blinks</p>  <p>Switch on the power supply once again, after carrying out the relevant remedies. If the symptoms persist, please contact our office.</p>	<p><b>&lt;Fault indicator blinks twice&gt;</b> Cause: The end cap is not set properly. Remedy: Check that the end cap is set properly. Cause: The end cap has got removed during operation Remedy: Check that the end cap is set properly.</p> <p><b>&lt;Fault indicator blinks 5 times&gt;</b> Cause: Incorrect power supply Remedy: Check the power supply voltage.</p> <p><b>&lt;Fault indicator blinks 6 times&gt;</b> <b>(In case of Series Connection)</b> Cause: Cable for series connection is not connected properly. Remedy: Check that the cable for series connection is connected properly.</p> <p><b>&lt;Fault indicator blinks 8 to 9 times&gt;</b> <b>(In case of Series Connection)</b> Cause: Total number of beam channels exceeds 192 Remedy: Check that the total number of beam channels is 192 or less Cause: More than 4 sets are connected in series. Remedy: Check that the number of sets connected in series does not exceed four.</p> <p><b>&lt;Fault indicator blinks 21 times&gt;</b> <b>(In case of Connection of One Set of Sensor)</b> Cause: Interference prevention wire is connected Remedy: Check that the interference prevention line is open. Cause: Improper connection of Master/Slave switching input line. Remedy: Check that the Master/Slave switching input line is connected to 0V.</p> <p><b>(In case of Parallel Connection)</b> Cause: The interference prevention line of the master sensor emitter is connected. Remedy: Check that the interference prevention line of the master sensor emitter is open Cause: The interference prevention line of the master sensor emitter has an input signal Remedy: Check that the interference prevention line of the master sensor emitter is open. Cause: Master/Slave switching input line is connected improperly. Remedy: Check that the Master/Slave switching input line of the master sensor set is connected to 0V. Check that the Master/Slave switching input line of the slave sensor set is open Cause: Signal was input to the master/slave input line during operation, and the mode (master/slave) was changed Remedy: Check the setting of master/slave status.</p>
Abnormal operation with symptoms other than the above	<p>Cause: Incorrect power supply Remedy: Check the power supply voltage.</p>

## 5.2 Troubleshooting of Receiver

Symptoms	Cause and Remedy
<p>No indicator lights up Reception level indicator is off OSSD ON indicator is off OSSD OFF indicator is off Fault indicator is off</p> 	<p>Cause: Incorrect power supply Remedy: Check the wiring. Check the power supply voltage. Check the power supply capacity. Check if any cable connector is loose.</p>
<p>All beams received state is not attained Reception level indicator lights up in red or is off OSSD ON indicator is off OSSD OFF indicator lights up Fault indicator is off</p> 	<p>Cause: Incorrect power supply Remedy: Check the power supply voltage. Cause: Beam-axis alignment is not proper. Remedy: Carry out beam-axis alignment Cause: The detection surfaces are dirty. Remedy: Check that the detection surfaces are not dirty. Cause: A light-blocking object is present in the detection zone. Remedy: Check that a light-blocking object is not present in the detection zone. Cause: Emission halt input is applied Remedy: Emission has been halted due to the emission halt input. The operation is normal <b>(In case of Series Connection)</b> Cause: Light of some other sensor that is connected in series is blocked Remedy: Light of some other sensor that is connected in series is blocked. The operation is normal.</p>
<p>OSSD OFF indicator does not light up in spite of a light blocking object being present in the detection zone. [The output (OSSD1, OSSD2) does not turn OFF.] Reception level indicator lights up in green. OSSD ON indicator lights up. OSSD OFF indicator is off Fault indicator is off.</p> 	<p>Cause: Reflected light from the machine or a workpiece is affecting the operation Remedy: The reflective surface near the detection zone must be moved to the specified distance, or more, away.</p>

Symptoms	Cause and Remedy
<p>Enters off-hold status (with reception level indicator off)  Reception level indicator is off.  OSSD ON indicator is off  OSSD OFF indicator lights up.  Fault indicator lights up.</p> 	<p>Cause: Incorrect power supply  Remedy: Check the power supply voltage.  Cause: Emitter is abnormal  Remedy: Check the emitter.</p>
<p>Enters off-hold status (with reception level indicator lighting up in red)  Reception level indicator lights up in red.  OSSD ON indicator is off  OSSD OFF indicator lights up.  Fault indicator lights up.</p> 	<p>Cause: Incorrect power supply  Remedy: Check the power supply voltage.  Cause: The end cap is not set properly.  Remedy: Check that the end cap is set properly.  Cause: The end cap has got removed during operation  Remedy: Check that the end cap is set properly.</p> <p><b>(In case of Parallel Connection)</b>  Cause: Improper connection of, or fault in, interference prevention lines  Remedy: Check the wiring of the interference prevention lines  Check that there is no break in the interference prevention lines.  Check that the interference prevention line of the emitter of the master sensor set is open.  Cause: Improper connection of, or fault in, master/slave switching input.  Remedy: Check that the master/slave switching input line of master sensor set is connected to 0V.  Check that there is no break in the master/slave switching input line of the master sensor set.  Check that the master/slave switching input line of the slave sensor set is not open.  Cause: Signal was input to the master/slave input line during operation, and the mode (master/slave) was changed.  Remedy: Check the setting of master/slave status.  Cause: Master sensor set or the slave sensor set near the master sensor set is malfunctioning.  Remedy: Check that both the master sensor set and the slave sensor set near the master sensor set operate properly.  Cause: More than 4 sets are connected in parallel  Remedy: Check that the number of sets connected in parallel does not exceed four.  Cause: The number of sets connected in parallel has been changed during operation  Remedy: Check the number of sets connected in parallel.  Cause: The bottom cap for the emitter is connected  Remedy: Check that the correct bottom cap is connected.</p>

Symptoms	Cause and Remedy
<p>Enters lockout status  Reception level indicator lights up in red.  OSSD ON indicator is off  OSSD OFF indicator lights up.  Fault indicator blinks</p>  <p>Switch on the power supply once again, after carrying out the relevant remedies. If the symptoms persist, please contact our office.</p>	<p><b>&lt;Fault indicator blinks twice&gt;</b>  Cause: The output lines are mutually short-circuited.  Remedy: Check that the output lines are not mutually short-circuited.  Cause: Bottom cap for the emitter has been connected on the receiver side.  Remedy: Connect the bottom cap for the receiver.</p> <p><b>&lt;Fault indicator blinks 9 times&gt;</b>  <b>(In case of Series Connection)</b>  Cause: Total number of beam channels exceeds 192  Remedy: Check that the total number of beam channels is 192 or less.  Cause: More than 4 sets are connected in series.  Remedy: Check that the number of sets connected in series does not exceed four.</p> <p><b>&lt;Fault indicator blinks 10 times&gt;</b>  Cause: Incorrect power supply  Remedy: Check the power supply voltage.</p> <p><b>&lt;Fault indicator blinks 11 or 15 times&gt;</b>  Cause: The load connected to the output is short-circuited.  Remedy: Check that the connected load is proper.</p> <p><b>&lt;Fault indicator blinks 12 times&gt;</b>  Cause: Improper connection of, or fault in, the synchronization line.  Remedy: Check that the synchronization line is connected properly.  Check that there is no break in the synchronization line.</p> <p><b>&lt;Fault indicator blinks&gt;</b>  <b>(In case of Series Connection)</b>  Cause: The number of beam channels of the emitter and the receiver are different.  Remedy: Check that the combination of the emitter and the receiver is correct.  Cause: The number of sets connected in series has been changed during operation  Remedy: Check the number of sets connected in series.  Cause: Improper connection of the emitter and receiver of the sub side sensor.  Remedy: Check that the connection of the emitter and receiver is correct.</p>
<p>Abnormal operation with symptoms other than those above</p>	<p>Cause: Incorrect power supply  Remedy: Check the power supply voltage.</p>

## Chapter 6 Others

This section gives additional information for the effective use of this instruction manual.

### 6.1 Glossary

EN 61496-1 IEC 61496-1/2	The standard that pertains to machine safety, especially electro-sensitive protective equipment (ESPE). EN 61496-1 or IEC 61496-1 gives general rules for failure mode and effect analysis, EMC requirements, etc. IEC 61496-2 specifies effective aperture angle, protection against extraneous light sources, etc., for active opto-electronic protective devices (AOPDs).
UL1998	UL standard for safety-related software in programmable components.
ESPE	The abbreviation for Electro-Sensitive Protective Equipment.
OSSD	The abbreviation for Output Signal Switching Device. A component of the light curtain that turns off when light of the light curtain is blocked.
FSD	The abbreviation for Final Switching Device. The component of the machine's safety related control system that open-circuits the MPCE circuit when the OSSD operates due to the light from the light curtain being blocked.
MPCE	The abbreviation for Machine Primary Control Element
Test rod	This is a rod for checking the detection capability of this device. It has dimensions corresponding to the minimum sensing object for this device.
Master side/ Slave side	For parallel connection, the sensor set whose master/slave input is connected to 0V to Slave control the timing of the light emission/reception process for the whole system is called the master side, and the others are called the slave side.
Master/Slave Input	It is possible to switch to the slave mode by keeping the terminal open or by connecting it to +V, and to the master mode by connecting it to 0V.
Main side/ Sub side	For series connection, the side where the power supply or the output is connected is called the main side, and the others are called the sub side.
Lockout	It is one of the safe states of this device. Operation is stopped if the self-diagnosis function determines that an irrecoverable failure (OSSDs do not operate normally, etc.) has occurred. If an emitter is in lockout condition, it will stop emitting light. If a receiver is in lockout condition, output from the receiver will be turned OFF. Normal operation cannot be resumed after lockout. In this case, terminate operation immediately, and replace the locked out end with a new part.
Safety distance	It is the minimum distance that must be maintained between the area sensor and the dangerous parts of a machine so that the machine can be stopped before a human body or an object can reach the dangerous parts.
Protective height (Sensing height)	The length between the first beam channel and the last beam channel.
Operating range (Sensing range)	The distance between the facing emitter and receiver.
Sensing area	The area over which intrusion by people or objects can be detected by one set of sensor. It is given by the product of the sensing height and the sensing range.
Emission Halt Function	This function enables checking of the receiver operation by turning off light emission. It is possible to halt emission by keeping the terminal open or by connecting it to +V, and to have normal emission by connecting it to 0V.
PSDI	Abbreviation of the Presence Sensing Device Initiation. The safety device that restarts automatically without any operation by the operator after the device detects danger status and halts for a while.




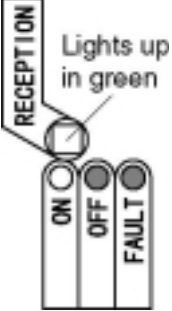

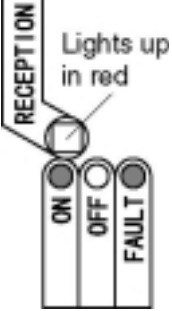

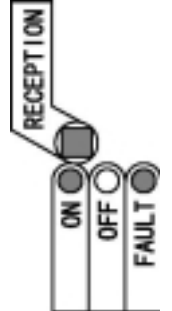

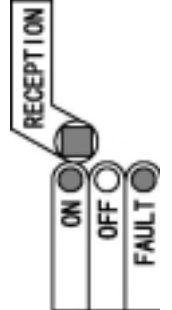
## 6.2 Indicator and Operation Status Table


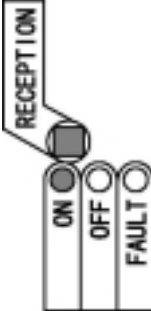

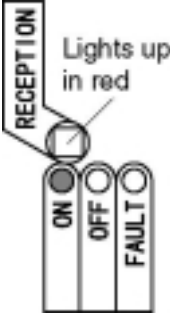

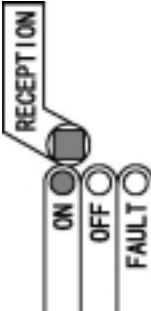

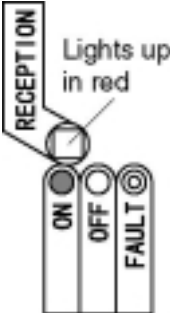
### <Indicator Status>

○ : lights up

◎ : blinks

● : turns off

Device Status		Indicators		Output	
		Emitter	Receiver	OSSD 1	OSSD 2
All beams received				ON	ON
One or more beams blocked	Second beam channel from cable side received			OFF	OFF
	Second beam channel from cable side blocked			OFF	OFF
Emission halt				OFF	OFF

Device Status	Indicators		Output	
	Emitter	Receiver	OSSD 1	OSSD 2
Emitter off-hold (Emitter abnormal)			OFF	OFF
Receiver off-hold (Receiver abnormal)			OFF	OFF
Emitter lockout (Emitter breakdown)			OFF	OFF
Receiver lockout (Receiver breakdown)			OFF	OFF

### ■ Warranty Period

SUNX warrants this product for twelve (12) months from the date of shipment or delivery to the purchaser's appointed warehouse.

### ■ Scope of Warranty

During the above mentioned period, if a failure of the product occurs under normal use and operation, and if it is found by SUNX that it is responsible for the failure, it shall remedy the defect or tender substitution for exchange at its cost and expense.

However, in no event shall SUNX be liable for the failure, damage or loss stipulated below

- 1) Failure caused by instructions, standards, or handling specified by the customer
- 2) Failure caused by modifications done in the structure, capabilities, specifications, etc. , without consulting SUNX, after the purchase or the delivery of the product
- 3) Failure caused by a development which could not be foreseen based upon the technology in practice at the time of purchase or contract
- 4) Failure caused by use which deviates from the conditions/environment given in the product catalog or specifications
- 5) In case this product is used by being incorporated in the customer's machine, failure which could be avoided if the customer's machine had functions and structure commonly accepted in the industry
- 6) Failure due to happening of Force Majeure

Further, the warranty given here is limited only to this product which has been purchased or delivered. SUNX shall not be responsible for any consequential damage or loss arising out of the failure of this product.

### ■ Scope of Service

The cost of the delivered product does not include the cost of dispatching an engineer, etc. In case any such service is needed, it should be separately requested

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技術相談FAXサービス ☎ 0120-336-394

受付時間：月曜日から金曜日の9時～12時および13時～17時（但し、祝日、年末年始等を除く）  
MJE-SF2EH No.6033-02 Rev. 02 Jul. 15

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PRINTED IN JAPAN