

Panasonic[®]

SAFETY LIGHT CURTAIN

SF4C

Instruction Manual

BEFORE BEGINNING

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Important Symbols

One or more of the following symbols may be used in this documentation:



DANGER!

The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be fatal or critical injury.



◆ **CAUTION**

Indicates that you should proceed with caution. Failure to do so may result in injury or significant damage to instruments or their contents, e.g. data.



◆ **NOTE**

Contains important additional information.



◆ **EXAMPLE**

Contains an illustrative example of the previous text section.



◆ **Procedure**

Indicates that a step-by-step procedure follows.



◆ **REFERENCE**

Indicates where you can find additional information on the subject at hand.

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Chapter 1

Introduction

1.1 Target Group

Thank you for purchasing the Safety Light Curtain from the SF4C series. 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.

The SF4C is a 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 light curtains as well as safety systems and standards.
- who are responsible for the introduction of this device
- who design systems using the SF4C
- who install and connect the SF4C
- who manage and operate a plant using the SF4C

Machine designer, installer, employer and operator

The machine designer, installer, employer and operator are solely responsible for ensuring 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 device functions as intended and systems including the SF4C comply with safety regulations depend 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 must be a person who is appropriately trained, has widespread knowledge and experience, and can solve various problems which may arise in his field of work, e.g. 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 machine operation immediately. The machine must not be used until correct performance of this device has been confirmed.

1.2 Safety Instructions



DANGER!

Please adhere to the following safety instructions when you install and operate the SF4C. Failure to do so can result in fatal or critical injury during unprotected use of hazardous machinery.

- Use the SF4C as per its specifications. Do not modify the safety light curtain since its functions and capabilities may not be maintained and it may malfunction.
- The SF4C has been developed/produced for industrial use only.
- Do not use the SF4C under conditions or in environments not described in this manual. Please consult us if there is no other choice but to use this device in such an environment.
- Do not use the safety light curtain in fields such as nuclear power control, railroad, aircraft, automobiles, combustion facilities, medical systems, aerospace development, e.g. in applications where failure could result in large-scale damage to society or people.
- When the safety light curtain is to be used for enforcing protection of a person from any danger occurring around an operating machine, the user must satisfy the regulations established by national or regional security committees.
- No matter what kind of equipment you use the device with, follow the safety regulations in regard to appropriate usage, mounting (installation), operation and maintenance.
- Use the safety light curtain by installing suitable protective equipment as a countermeasure for failure, damage, or malfunction of this device.
- Before using this light curtain, check whether it performs properly and has the functions and capabilities as stated in the design specifications.
- Dispose of the safety light curtain as industrial waste.

Environment

- Do not use a mobile phone or a radio phone near the SF4C.
- If the safety light curtain is installed in a place where there are reflective surfaces, make sure to install it so that reflected light from the reflective surfaces does not affect the receiver. Alternatively, take countermeasures such as painting, masking, roughening, or changing the material of the reflective surfaces, etc. Failure to do so may cause the SF4C not to detect properly, which may result in death or serious injury.
- Do not install the safety light curtain in the following environments:
 - Areas exposed to intense interference light such as direct sunlight

- Areas with high humidity where condensation is likely to occur
- Areas exposed to corrosive or explosive gases
- Areas exposed to vibration or shock at levels higher than those specified
- Areas exposed to contact with water
- Areas exposed to excessive steam or dust
- Areas where the beam-receiving part of this device is directly exposed to light from a high-frequency fluorescent lamp (inverter type) or rapid-starter fluorescent lamp.

Installation

- Always keep the correctly calculated safety distance between the safety light curtain and the dangerous parts of the machine.
- Install an extra protective structure around the machine so that the operator must pass through the sensing area of the safety light curtain to reach the dangerous parts of the machine.
- Install the safety light curtain in a manner that some part of the operator's body always remains in the sensing area until the operator has finished working with the dangerous parts of the machine.
- Do not install the safety light curtain at a location where it can be affected by wall reflection.
- When installing multiple sets of the SF4C, connect the sets and, if necessary, install some barriers so that mutual interference does not occur.
- Do not use any reflection type or recursive reflection type arrangement.

Equipment in which this device is installed

- When the safety light curtain is used in the PSDI (see page 134) mode, an appropriate control circuit must be configured between this device and the machinery. For details, be sure to refer to the standards or regulations applicable in each region or country.
- In Japan, do not use the SF4C as safety equipment for a press machine.
- Do not install the SF4C with a machine whose operation cannot be stopped immediately in the middle of an operation cycle by an emergency stop.
- The SF4C provides safety 2 seconds after the power has been switched ON. Make sure that the control system takes the time delay into consideration.

Wiring

- Switch off the power before wiring the safety light curtain.
- All electrical wiring should conform to the regional electrical regulations and laws. The wiring should be done by skilled personnel with the required 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 you need to extend the cable of the emitter or the receiver, each can be extended up to 40.5m by using the exclusive cable. Furthermore, if the cable is extended and the muting lamp is used, the allowed total extendable length is reduced (see "Connecting Procedure and Pin Assignment" on page 40).
- Do not control the device at only one control output (OSSD 1, OSSD 2) (see page 133).
- To ensure that the output is not turned ON due to an earth fault of the control output (OSSD 1, OSSD 2), ground the device on the 0V side (for PNP output) or +24V side (for NPN output).

Maintenance

- When you need to replace parts, always use only genuine replacement parts from the supplier. If you use substitute parts from another manufacturer, the safety light curtain may fail to detect properly, which may result in death or serious body injury.
- The device must be inspected periodically by an engineer with the required knowledge.
- When you have adjusted or maintained the SF4C, test the device following the procedure specified in the maintenance chapter (see page 97) before you switch the system back on.
- Clean this device with a clean cloth. Do not use thinner-based cleaners.

Others

- Never modify this device. If you modify the SF4C, the safety light curtain may fail to detect properly, which may result in death or serious injury.
- Do not use the safety light curtain to detect objects flying over the sensing area.
- Do not use this device to detect transparent objects, translucent objects or objects smaller than the specified minimum sensing size.

1.3 Applicable Standards and Regulations

This device complies with the following standards and regulations.

- EU Machinery Directive 98/37/EC, EU Machinery Directive 2006/42/EC, EMC Directive 2004/108/EC
- EN 61496-1 (Type 4), EN 55011
- IEC 61496-1/2 (Type 4), ISO 13849-1:2006 (Category 4, PLe), IEC 61508-1 to 7 (SIL3)
- JIS B 9704-1/2 (Type 4), JIS B 9705-1 (ISO 13849-1) (Category 4), JIS C 0508-1 to 7 (SIL3)
- UL 61496-1/2 (Type 4), UL 508, UL 1998 (Class 2), CSA 61496-1 / 2 (Type 4), CSA C22.2 No.14
- OSHA 1910.212, OSHA 19 10.217(C), ANSI B11.1 to B11.19, ANSI/RIA 15.06



◆ NOTE

- **Conformity to JIS, OSHA and ANSI for this device has been evaluated by us.**



- **CE**: This device conforms to the EMC directive and the Machinery directive. The CE-mark indicates that this product conforms to the EMC directive.



- **TUV SUD**: This device is certified by TÜV Süd.



- **C-UL US**: The C-CL US Listing Mark indicates compliance with both Canadian and U.S. requirements.
- **If you want to use this device in a location other than already described (see page 3), confirm first that the intended use complies with the standards or regulations applicable in your region or country.**

Chapter 2

Before Using this Device

2.1 Confirmation of Packed Contents

Check mark	Number	Package content
<input type="checkbox"/>	1 piece	Sensor with 1 emitter and 1 receiver
<input type="checkbox"/>	1 piece	Test rod
<input type="checkbox"/>	1 piece	Instruction manual (this manual)

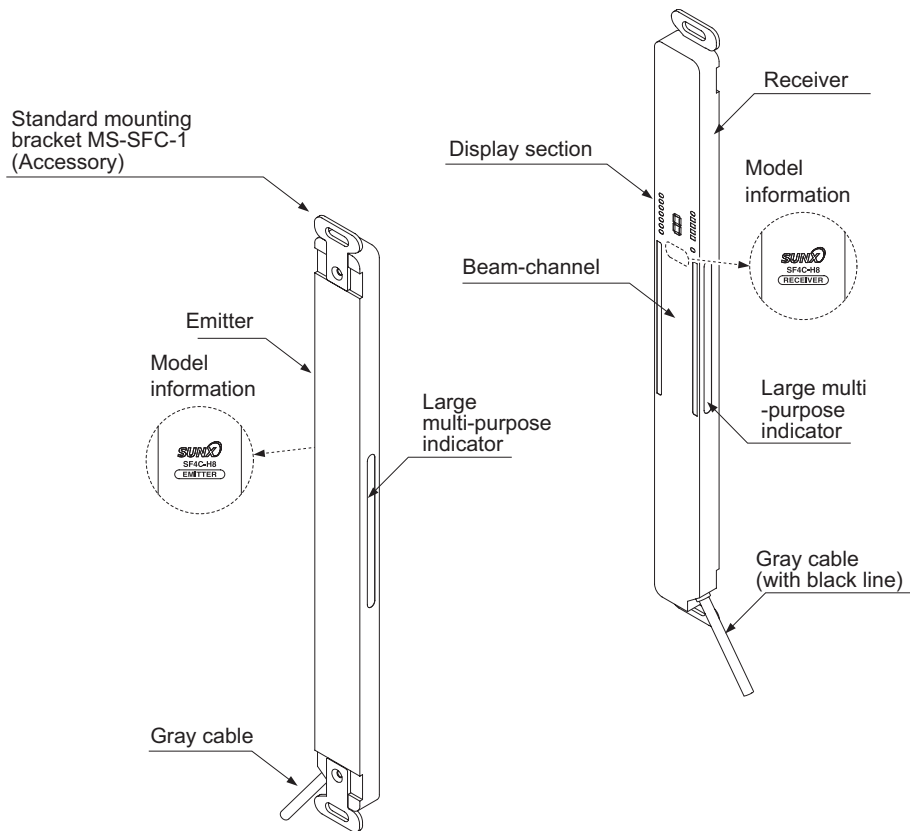
2.2 Features

This device is the light curtain with the following features.

No special controller is required.

- Cable type or pigtailed type is available.
- The control output (OSSD 1/2) is a PNP / NPN output switching type.
- Large multi-purpose indicators (red, green) which are bright and easy-to-see are incorporated.
- Each function can be set by using the handy controller SFC-HC (optional), see page 84.
- For details of options, see "Options" on page 117.

2.3 Part Description



Parts of the safety light curtain

Part	Description
Emitter	Emits light to the receiver facing it. Furthermore, the status of the emitter is indicated on its display section.
Receiver	Receives light from the emitter facing it. Simultaneously the control output (OSSD 1, OSSD 2) turns ON when the all beam channels receive light from the emitter, and the control output (OSSD 1, OSSD 2) turns OFF when one or more beam channels are blocked. (Except when using the muting function, see note).
Beam channel	The light-emitting elements of the emitter and the light-receiving elements of the receiver are placed at the intervals of 20mm.
Standard mounting bracket MS-SFC-1 (accessory)	Use these brackets to mount both the emitter and receiver.

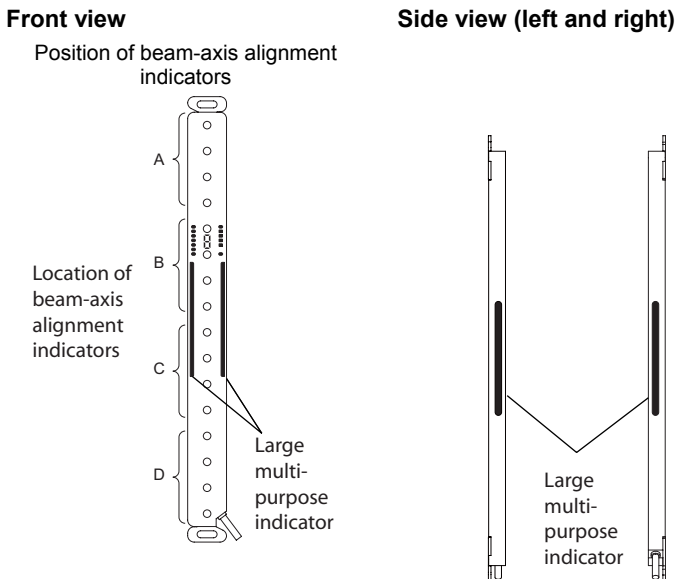


◆ **NOTE**






- In case of using the muting function, muting sensors and a muting lamp are required. Please purchase these items separately.









- The blanking function is set with the handy controller SFC-HC (optional), see page 84. Please purchase the handy controller separately.

2.3.1 How the Display Works

















The description given in [] is marked on the sensor.

Emitter	
Function	Description
Large multi-purpose indicator (Note 1)	Lights up in red when the large multi-purpose indicator input is ON. Lights up in green when the large multi-purpose indicator input is ON. There is no color display, when the input is OFF. With the optional handy controller you have further setting possibilities, see "Operation of Large Multi-Purpose Indicator" on page 14.
Incident light intensity indicator (green/orange) [STB]	 Lights up in green when stable light is received. Lights up in orange when unstable light is received. Turns OFF when light is blocked. (Note 2)
Beam-axis alignment indicator (green/red) [RECEPTION]	A  When the control output (OSSD 1/2) is ON: lights up green. When the top block receives light: lights up red. When the top end receives light: blinks red.
	B  When the control output (OSSD 1/2) is ON: lights up green. When the upper middle block receives light: lights up red.
	C  When the control output (OSSD 1/2) is ON: lights up green. When the lower middle block receives light: lights up red.
	D  When the control output (OSSD 1/2) is ON: lights up green. When the bottom block receives light: lights up red. When the bottom end receives light: blinks red.

Emitter	
Function	Description
Operation indicator [OSSD] (green/red), (Note 3)	 Lights up when the sensor operation is as follows (OSSD 1/2): When the control output (OSSD 1/2) is ON: lights up green. When the control output (OSSD 1/2) is OFF: lights up red.
Digital error indicator (red)	 When the safety light curtain is in the lockout state, the error contents are displayed here.
Fault indicator [FAULT] (yellow)	 When a fault occurs in the sensor: lights up or blinks.
PNP indicator [PNP] (orange)	 When the PNP output is set: lights up
NPN indicator [NPN] (orange)	 When the NPN output is set: lights up
Test input indicator [TEST] (orange)	 Lights up when test input is active. Turns OFF when test input is inactive.
Safety input 1 indicator [S1] (orange)	 Lights up when safety input 1 is active. Turns OFF when safety input 1 is inactive.
Safety input 2 indicator [S2] (orange)	 Lights up when the safety input 2 is active. Turns OFF when the safety input 2 is inactive.

The description given in [] is marked on the sensor.

Receiver	
Function	Description
Large multi-purpose indicator (Note 1)	Lights up in red when the large multi-purpose indicator input is active. Lights up in green when the large multi-purpose indicator input is active. Turns OFF when the input is inactive.
Incident light intensity indicator (green/orange) [STB]	 Lights up in green when stable light is received. Lights up in orange when unstable light is received. Turns OFF when light is blocked. (Note 2)
Beam-axis alignment indicator (green/red) [RECEPTION]	A  When the control output (OSSD 1/2) is ON: lights up green. When the top block receives light: lights up red. When the top end receives light: blinks red.
	B  When the control output (OSSD 1/2) is ON: lights up green. When the upper middle block receives light: lights up red.
	C  When the control output (OSSD 1/2) is ON: lights up green. When the lower middle block receives light: lights up red.

Receiver		
Function	Description	
		When the control output (OSSD 1/2) is ON: lights up green. When the bottom block receives light: lights up red. When the bottom end receives light: blinks red.
OSSD indicator [OSSD] (green/red), (Note 3)		Lights up when the sensor operation is as follows (OSSD 1/2): When the control output (OSSD 1/2) is ON: lights up green. When the control output (OSSD 1/2) is OFF: lights up red.
Fault indicator [FAULT] (yellow)		When a fault occurs in the sensor: lights up or blinks.
Digital error indicator (red)		When the safety light curtain is in the lockout state, the error contents are displayed here.
PNP indicator [PNP] (orange)		When the PNP output is set: lights up
NPN indicator [NPN] (orange)		When the NPN output is set: lights up
Function setting indicator (orange) [FUNCTION]		Blinks when the handy controller is connected. Lights up when blanking function is active. (Note 4)
Interlock indicator [INTERLOCK] (yellow)		Lights up when interlock is active. Turns OFF, when interlock is inactive.
Muting input 1 (orange) [MU1]		Lights up when the muting input 1 is active. Turns off when the muting input 1 is inactive.
Muting input 2 indicator (orange) [MU2]		Lights up when the muting input 2 is active. Turns off when the muting input 2 is inactive.



◆ NOTE

The operation of the large multi-purpose indicator (lights up, blinks or turns OFF) can be set by using the handy controller SFC-HC (optional), see page 84.

The status "when light is blocked" refers to the status when there is an obstacle in the sensing area.

Since the color of the operation indicator changes according to whether the control output (OSSD 1/2) is ON or OFF, the operation indicator on the sensor is marked "OSSD".

The blanking function is set by using the handy controller SFC-HC (optional), see page 84.

The threshold where the control output (OSSD 1/2) changes from OFF to ON is applied as "100% incident light intensity".

2.3.2 Operation of Large Multi-Purpose Indicator

You have different settings available for the large multi-purpose indicator with the handy controller SFC-HC (optional), see page 84. One mode can be selected from the following eight mode numbers. Factory setting is mode 0.

Mode	Large multi-purpose indicator input 1/2				OSSD 1/2		Muting function	Override function
	PNP output: ON	NPN output: OFF	PNP output: OFF	PNP output: ON	ON	OFF	Active	Inactive
0	Lights up red		Lights up green		--	--	--	--
1	Blinks red		Blinks green		--	--	--	--
2	Lights up red		Blinks green		--	--	--	--
3	Blinks red		Lights up green		--	--	--	--
4	Lights up red		Blinks red		--	--	--	--
5	Blinks green		Lights up green		--	--	--	--
6	--		--		Lights up green	Lights up red	Blinks green	--
7	Lights up red		Blinks red		--	--	Lights up green	Blinks green



◆ REFERENCE

Further information regarding the functionality of the handy controller you find in the operation manual for the handy controller or see page 84.

2.4 Protection Area

2.4.1 Sensing Area



DANGER!

Install a protective 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.

Furthermore, ensure that some part of the operator's body always remains in the sensing area while the operator works on the dangerous parts of the machine.

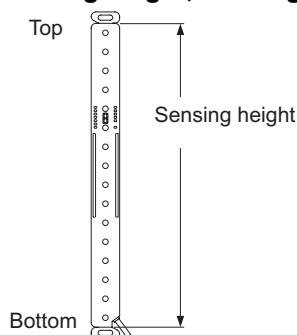
Do not use any arrangement using reflection or recursive reflection.

Follow the below descriptions carefully. Failure to do so may result in serious injury or death.

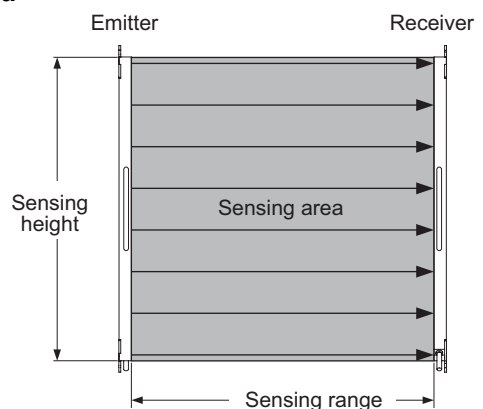
The sensing area is the zone formed by the sensing height of the sensor and the sensing range between the emitter and the receiver. The sensing height is determined by the number of beam channels.

The sensing range depends on the device type: 0.1 to 3m. Also remember that if the sensing range is less than 0.1m, malfunction may occur due to the optical structure.

Sensing height, sensing range, and sensing area



The sensing height is the area between the line indicated in the top part and line indicated in the bottom part.



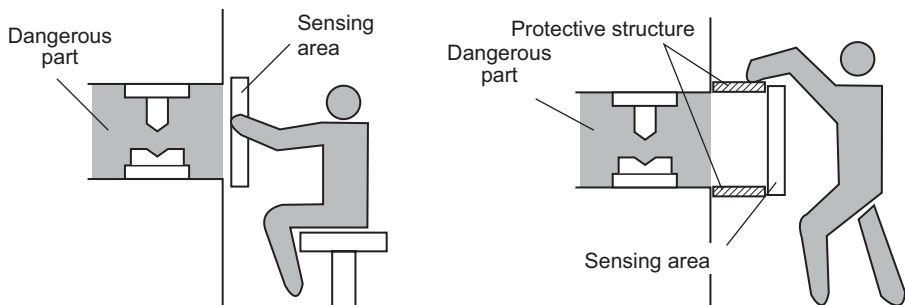
When connecting the sensor, use the correct combination of emitter and receiver (same beam pitch and number of beam channels) and match their top-bottom orientation. Combining different types of emitters and receivers may produce a non-sensing area.

Do not arrange several receivers facing one emitter, or vice versa, as this could produce a non-sensing area or cause mutual interference.

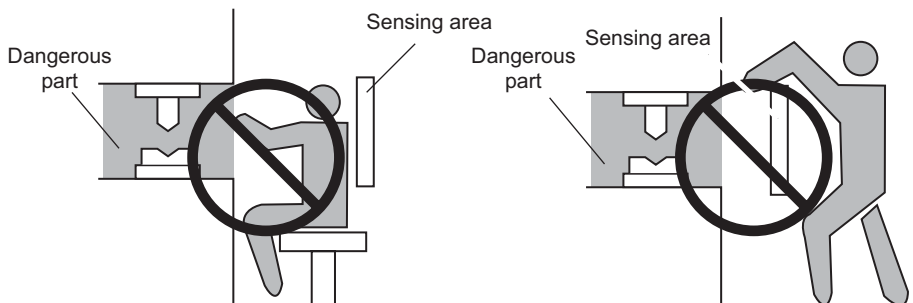


◆ **EXAMPLE**

Correct installation



Incorrect installation



2.4.2 Safety Distance



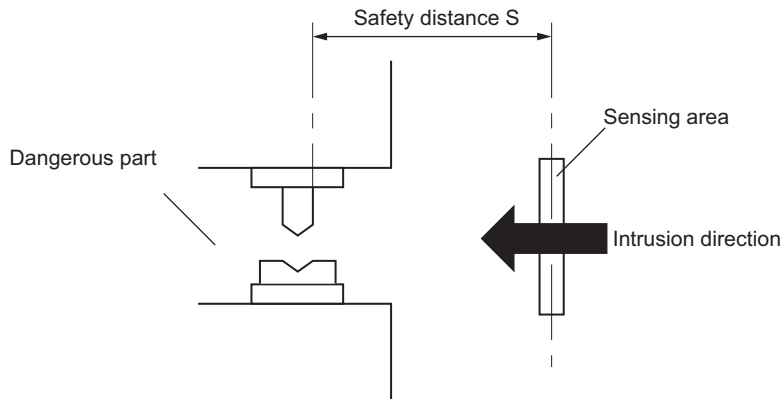
DANGER!

Calculate the safety distance correctly and always maintain a distance 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 not sufficient, the machine will not stop quickly enough when a human body or an object reaches the dangerous parts, which may 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 the 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 equation described on the next page when a person moves (normal intrusion) at a straight angle into the sensing area of the sensor.

In case the intrusion direction is not perpendicular to the sensing area, be sure to refer to the relevant standard for details of the calculation (regional standard, specification of the machine etc.)



Safety distance



DANGER!

Before designing the system, refer to the relevant standards of the region where this device is to be used and then install this device. Furthermore, the equation described on the next pages is to be used only when the intrusion direction is perpendicular to the sensing area, i.e. at a straight angle. If the intrusion direction is not perpendicular to the sensing area, refer to the relevant standard (regional standard, specification of the machine, etc.) for details of the calculation.

The max. response time of the machine is from the point when the machine receives the halt signal from this device to the point when the dangerous part of the machine stops. The max. response time of the machine should be timed with the actual machine.

The minimum size of the objects to be detected by the safety light curtain varies depending on whether the floating blanking function is used or not, see page 84. The equation differs depending on the case whether the minimum object to be sensed is larger than $\varnothing 40\text{mm}$ or not. Calculate the safety distance with the correct minimum size and the appropriate equation.

	Floating blanking not active	Floating blanking active at (Note)		
		1 beam channel	2 beam channels	3 beam channels
Number of beam channels				
Minimum object to be sensed	$\varnothing 25\text{mm}$	$\varnothing 45\text{mm}$	$\varnothing 65\text{mm}$	$\varnothing 85\text{mm}$



◆ NOTE

For details of the floating blanking function, see page 84.

2.4.2.1 Calculation Example for Europe

The equation for the safety distance S is calculated in accordance with EN 999 and ISO 13855.

Formula in case that the minimum sensing object is Ø40mm or less:

$$S = K \times T + C$$

S: Safety distance (mm)

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

K: Intrusion velocity of operator's body or object (mm/s). The equation assumes an intrusion direction perpendicular to the sensing area.

T: Response time of total equipment (s). $T = T_m + T_{SF4C}$

T_m : Maximum halt time of device (s). For determining T_m , refer to the machine documentation or take a measurement using a special device called a 'brake monitor'.

T_{SF4C} : Response time of this device (s)

C: Additional distance calculated from the minimum size of the object to be detected by the sensor (mm). C has to be 0 or more. $C = 8 \times (d - 14)$

d: Minimum object diameter (mm)



◆ Procedure

1. Calculate the safety distance S with a velocity $K = 2,000\text{mm/s}$

There are 3 possibilities (1-3):

- | | |
|-----------------------------------|---|
| 1. $S < 100\text{mm}$ | Use 100mm as the safety distance. |
| 2. $100 \leq S \leq 500\text{mm}$ | Use the calculated result as the safety distance. |
| 3. $S > 500\text{mm}$ | Continue with the next step in the procedure |

2. Recalculate S with $K' = 1,600\text{mm/s}$

There are 2 possibilities (4-5):

- | | |
|--------------------------|---|
| 4. $S > 500\text{mm}$ | Use the calculated result as the safety distance. |
| 5. $S \leq 500\text{mm}$ | Use 500mm as the safety distance. |

When this device is used in the 'PSDI Mode', an appropriate safety distance S must be calculated. For details, be sure to refer to the standards or regulations applicable in each region or country.



◆ EXAMPLE

Calculate the safety distance with the following values:

K: 2,000 mm/s

T_m : 0.1s

T_{SF4C} : 0,7ms

d: 25mm

With these values, the calculation is as follows:

$$\begin{aligned} S &= K \times T + C \\ &= K \times (T_m + T_{SF4C}) + 8 \times (d - 14) \\ &= 2,000 \times (0.1 + 0.007) + 8 \times (25 - 14) \\ &= 302 \end{aligned}$$

As 302 matches possibility 2 listed above, 302mm is the safety distance.



◆ EXAMPLE

Calculate the safety distance with the following values:

K: 2,000mm/s

T_m : 0.4s

T_{SF4C} : 7ms

d: 25mm

With these values, the calculation is as follows:

$$\begin{aligned} S &= K \times T + C \\ &= K \times (T_m + T_{SF4C}) + 8 \times (d - 14) \\ &= 2,000 \times (0.4 + 0.007) + 8 \times (25 - 14) \\ &= 902 \end{aligned}$$

As 902 matches possibility 3 listed above, recalculate the safety distance with $K' = 1,600\text{mm/s}$.

$$\begin{aligned} S &= K' \times T + C \\ &= K \times (T_m + T_{SF4C}) + 8 \times (d - 14) \end{aligned}$$

$$= 1,600 \times (0.4 + 0.007) + 8 \times (25 - 14)$$

$$= 739.2$$

As 739.2 is > 500mm, use this recalculated result as the safety distance.

Formula in case that the minimum sensing object is Ø40mm or more:

$$S = K \times T + C$$

- S:** Safety distance (mm)
Minimum distance required between the sensing area surface and the dangerous parts of the machine.
- K:** Intrusion velocity of operator's body or object (mm/s). The equation assumes an intrusion direction perpendicular to the sensing area.
- T:** Response time of total equipment (s). $T = T_m + T_{SF4C}$
- T_m:** Maximum halt time of device (s). For determining T_m, refer to the machine documentation or take a measurement using a special device called a 'brake monitor'.
- T_{SF4C}:** Response time of this device (s)
- C:** Additional distance calculated from the minimum size of the object to be detected by the sensor (mm). C = 850 mm (Constant)

2.4.2.2 Calculation Example for US

The equation safety distance S is calculated in accordance with ANSI/RIA B15.06 with the formula:

$$S = K \times (T_s + T_c + T_{SF4C} + T_{bm}) + D_{pf}$$

- S:** Safety distance (mm)
Minimum distance required between the sensing area surface and the dangerous parts of the machine.
- K:** Intrusion velocity of operator's body or object. The recommended value in OSHA is 63inch/s ≈ 1,600mm/s.
ANSI/RIA B15.06 does not define the intrusion velocity 'K'. When determining K, consider possible factors including the physical ability of operators.
- T_{bm}** Additional halting time tolerance for the brake monitor (s)
 $T_{bm} = T_a - (T_s + T_c)$
- T_a:** Setting time of brake monitor (s)
When the machine is not equipped with a brake monitor, it is recommended that 20% or more of (T_s + T_c) is taken as additional halt time.
- T_s:** Halt 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 the brake (s)

T_{SF4C} Response time of this device (s)

D_{pf} Additional distance calculated from the minimum size of the object to be detected by the safety light curtain (mm) with the formula:

$$D_{pf} = 61.2\text{mm}$$



◆ NOTE

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



◆ EXAMPLE

Calculate the safety distance with the following values:

$$\begin{array}{ll} T_{SF4C} & 7\text{s} \\ d: & 0.985\text{inch} \approx 20\text{mm} \end{array}$$

With these values, the calculation is as follows:

$$\begin{aligned} S &= K \times (T_s + T_c + T_{SF4C} + T_{bm}) + D_{pf} \\ &= 63 \times (T_a + 0.014) + 3.4 \times (d - 0.276)\text{inch} \\ &= 63 \times (T_a + 0.014) + 3.4 \times (0.985 - 0.276) \\ &= 63 \times T_a + 63 \times 0.007 + 3.4 \times 0.709 \\ &= 63 \times T_a + 0.441 + 2.4106 \\ &\approx 63 \times T_a + 2.85\text{inch} \end{aligned}$$

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

$$\begin{aligned} S &= 63 \times T_a + 2.85 \\ &= 63 \times 0.1 + 2.85 \\ &= 9.15\text{inch} \approx 232.41\text{mm} \end{aligned}$$

Hence, as per the calculations D_s is 9.15inch \approx 232.41mm.



NOTE

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

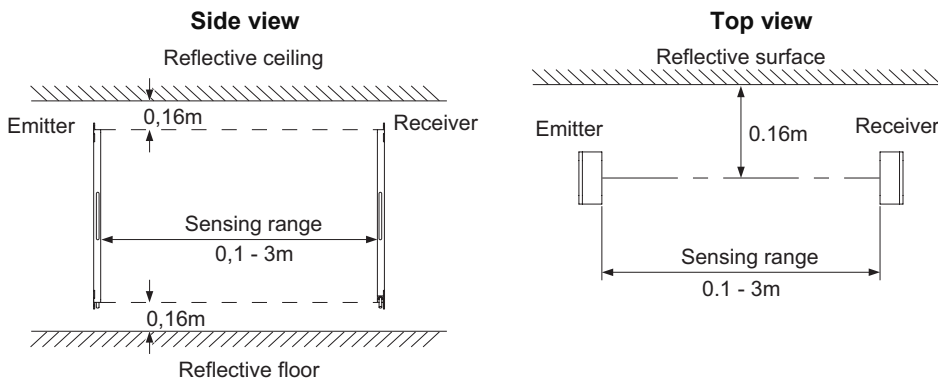
2.4.3 Influence of Reflective Surface



DANGER!

If the device is installed in a place where there are reflective surfaces, make sure to install this device so that reflected light from the reflective surfaces does not affect the receiver. Alternatively, 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 properly, which may result in death or serious injury.

Install this device at a distance of at least 0,16m away from reflective surfaces such as metal walls, floors, ceilings, workpieces, covers, panels or glass surfaces.



2.4.4 Device Placement

If there is a problem with the wiring or when you need to evaluate the system before you add further equipment, place two or more sets of emitters and receivers facing each other without series or parallel connection between them. Perform an operation test (see page 56).



DANGER!

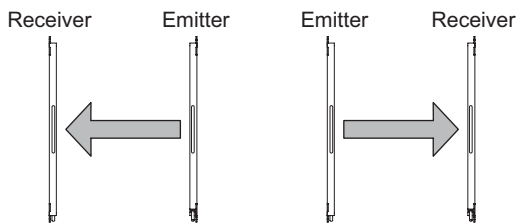
Refer to the examples of sensor placement as follows and understand them thoroughly before installing the sensors. Improper sensor placement could cause the sensor to malfunction, which may result in serious injury or death.

If this device is used in multiple sets, arrange them so that mutual interference is avoided. If mutual interference occurs, it can result in serious injury or death.

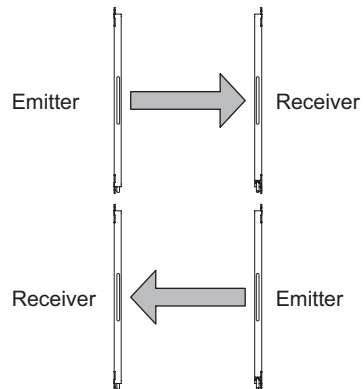


◆ EXAMPLE

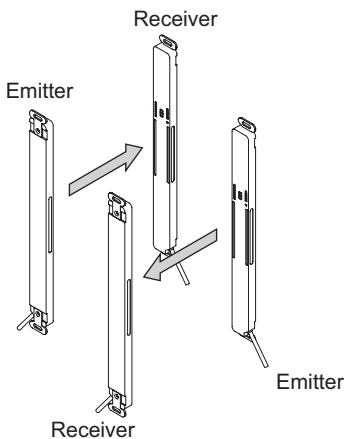
1) Install the emitters or the receivers back to back.



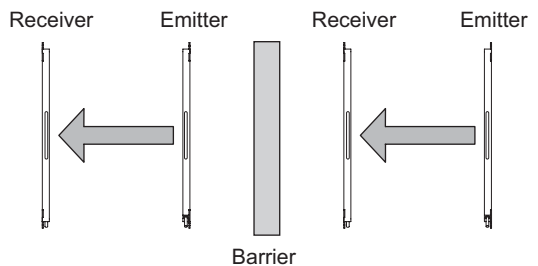
2) Arrange the emitters and the receivers vertically on opposite sides.



3) Arrange the emitters and the receivers horizontally on opposite sides.



4) Install a barrier





◆ NOTE

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

2.5 Mounting

The standard mounting bracket MS-SFC-1 is included with the device. Other mounting brackets appropriate for your installation environment, has to be purchased separately. Please, also purchase the hexagon socket head bolts separately. They are not part of the product.

- Standard mounting bracket (MS-SFC-1)
- NA2-N compatible mounting bracket (MS-SFC-2)
- Multifunctional Mounting Bracket MS-SFC-3 (see page 119)

2.5.1 Mounting with Standard Mounting Bracket

Before you start mounting the device, read the following important notes carefully.



◆ NOTE

- **Do not bend the cable of this device. Applying improper loads to the cable could cause the wire to break.**
- **The minimum bending radius of the cable is 6mm. Mount the sensor accordingly.**
- **Mount the emitter and the receiver at the same level and parallel to each other. The effective aperture angle of this device is $\pm 2.5^\circ$ or less for a sensing distance exceeding 3m.**
- **Unless otherwise specified, the mounting procedure is common for both emitters and receivers. To prepare the mounting holes, refer to the dimension diagrams.**

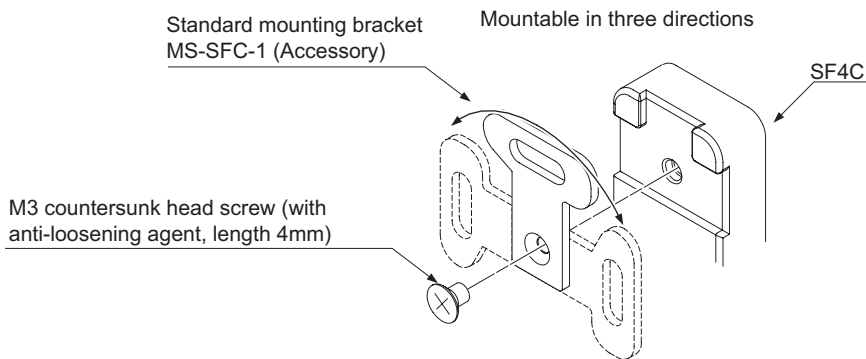
Unless otherwise specified, the following mounting procedure is common for both emitters and receivers. The direction of the standard mounting bracket MS-SFC-1 (accessory) which is attached to this device can be changed depending on the mounting position of the device.



◆ Procedure

1. Loosen the M3 countersunk head screw (with anti-loosening agent, length 4mm) which is attached to the back of the device
2. Rotate the bracket to adjust the installation direction of emitter and receiver
3. Tighten the M3 countersunk head screw

The tightening torque should be 0,3N•m or less.



4. Install the standard mounting brackets on the mounting surface with two hexagon-socket head bolts (M5)

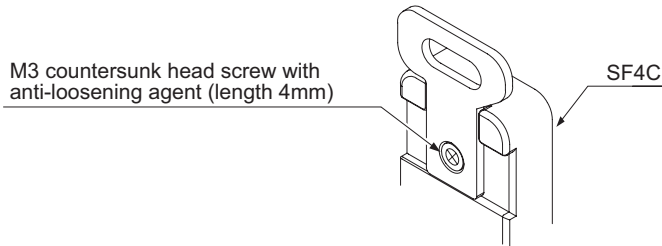
2.5.2 Mounting with Multifunctional Mounting Bracket MS-SFC-3 (optional)

The following procedure shows how to mount the safety light curtain with the multifunctional mounting bracket MS-SFC-3.

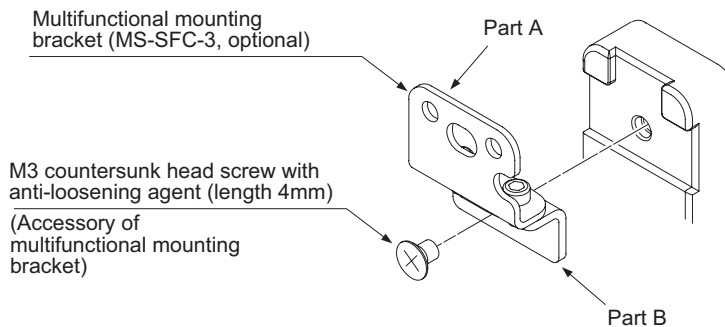


◆ Procedure

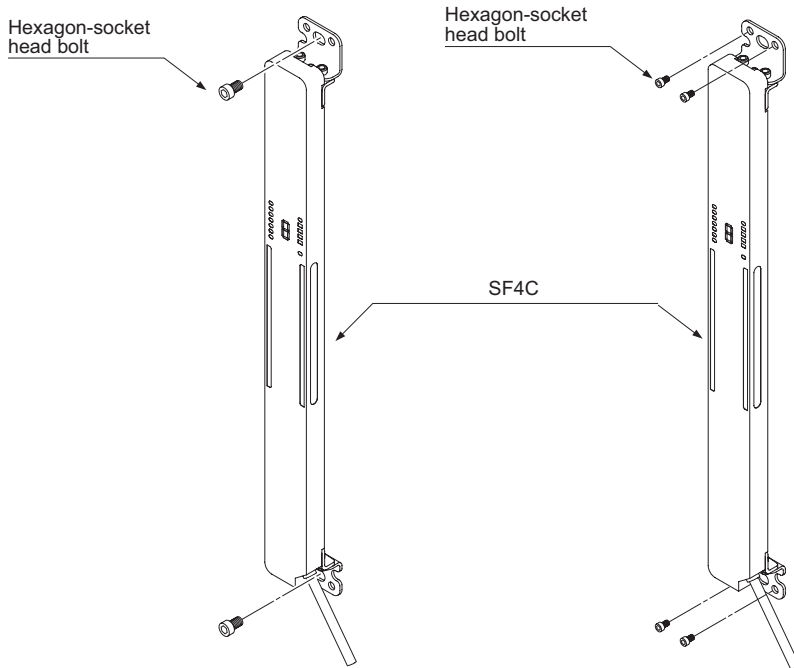
1. Remove the M3 countersunk head screw with anti-loosening agent (length 4mm) which is attached to the back of the device



2. Then remove the standard mounting bracket MS-SFC-1
3. Mount the multifunctional mounting bracket using the M3 countersunk head screw with anti-loosening agent (length 4mm) (accessory of the multifunctional mounting bracket). The tightening torque should be 0.3N·m



4. Set the multifunctional mounting bracket on the mounting surface using either two hexagon-socket head bolts (M6) or four hexagon-socket head bolts (M4)



◆ **NOTE**

SF4C-H28□ and SF4C-H32□ require the multifunctional intermediate supporting bracket MS-SFC-4 (optional) (see page 31).

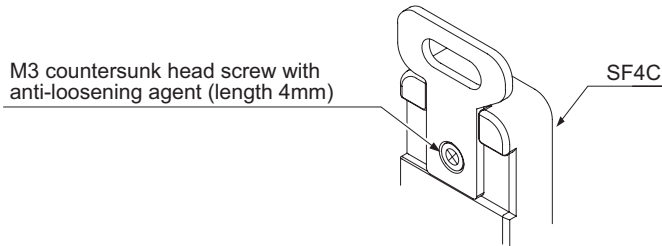
2.5.3 Dead Zoneless Mounting

You can mount the safety light curtain with the multifunctional mounting bracket MS-SFC-3 so that no dead zone exists, follow this procedure.

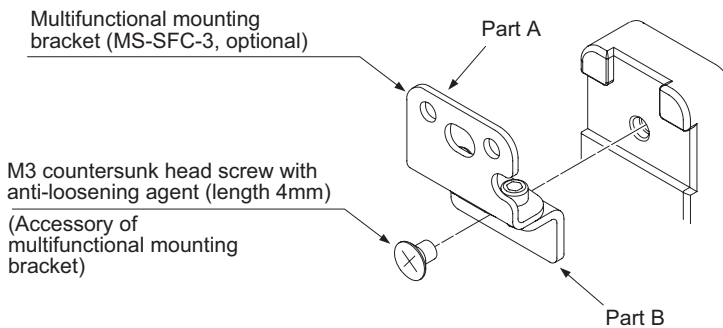


◆ Procedure

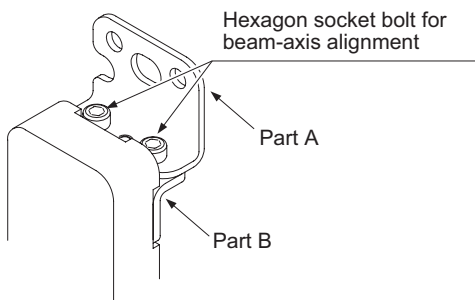
1. Remove the M3 countersunk head screw with anti-loosening agent (length 4mm) which is attached to the back of the device



2. Mount the multifunctional bracket using the M3 countersunk head screw with anti-loosening agent (length 4mm) (accessory of multifunctional mounting bracket). The tightening torque should be 0.3N·m

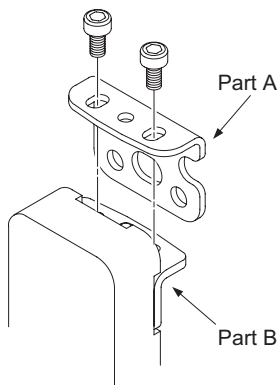


3. Remove the two of the hexagon-socket head bolts for beam-axis alignment M3 (length 5mm) on part A.

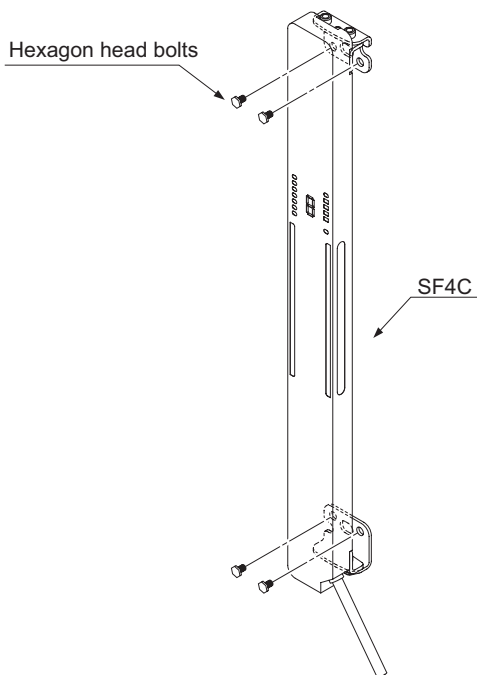
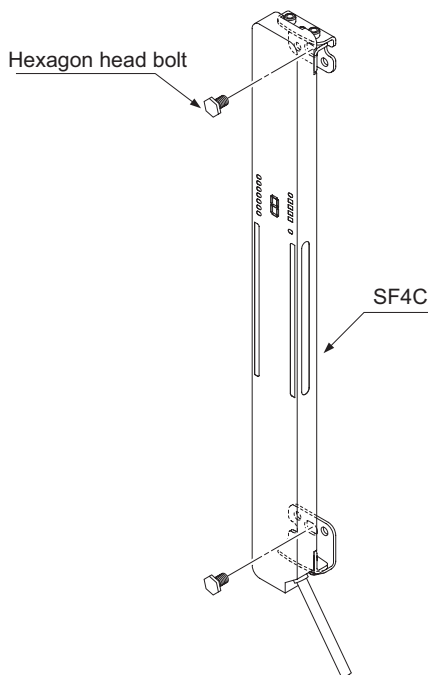


4. Separate part A from part B and change the direction of the part A of the multifunctional mounting bracket.

5. Tighten the two hexagon-socket head bolts for beam-axis alignment M3 (length 5mm). The tightening torque should be 0.2N·m



6. Set the multifunctional bracket on the mounting surface using either two hexagon head bolts (M6) or four hexagon head bolts (M4).



◆ NOTE

SF4C-H28□ and SF4C-H32□ require the multifunctional intermediate supporting bracket MS-SFC-4 (optional) (see page 31).

2.5.4 Mounting the Intermediate Supporting Bracket MS-SFC-4

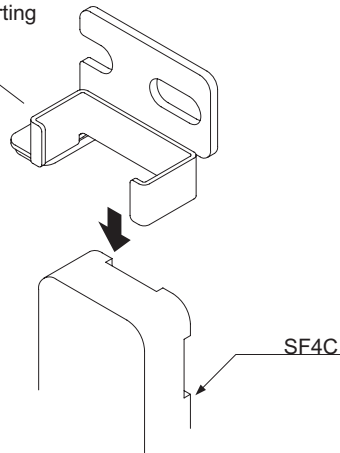
If you want to mount the multifunctional intermediate supporting bracket MS-SFC-4, follow this procedure:



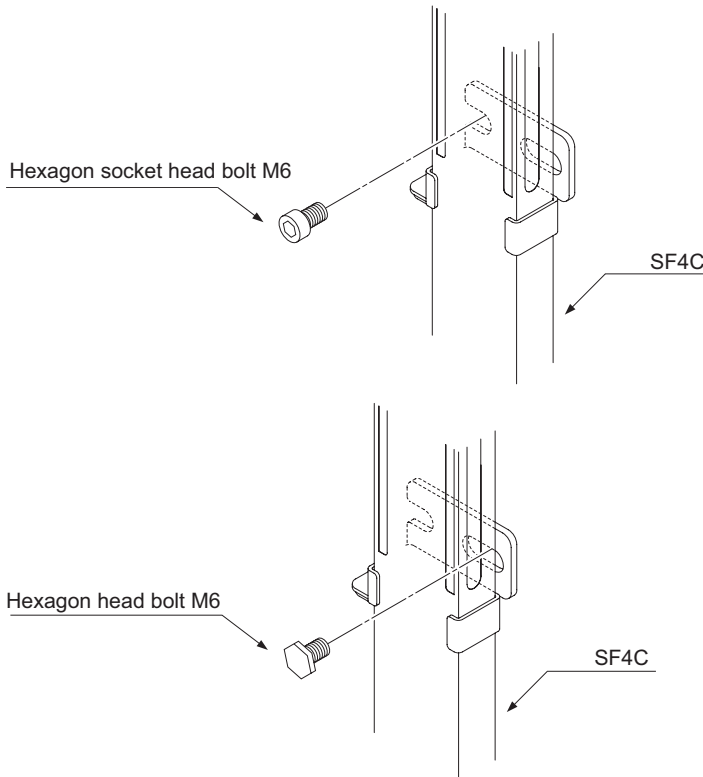
◆ Procedure

1. **Make sure that the standard mounting bracket (MS-SFC-1) is not attached at the safety light curtain, otherwise loosen it.**
2. **Slip on the multifunctional intermediate supporting bracket MS-SFC-4 (optional) from the top or from the bottom of the device.**

Multifunctional
intermediate supporting
bracket MS-SFC-4
(Optional)



3. Fix the multifunctional intermediate supporting bracket on the safety light curtain using a hexagon head bolt (M6) or a hexagon socket head bolt (M6).



You can use the multifunctional intermediate supporting bracket MS-SFC-4 (optional) in combination with the multifunctional mounting bracket MS-SFC-3 (optional). It cannot be mounted in combination with the standard mounting bracket.

2.5.5 Mounting the Protective Metal Case

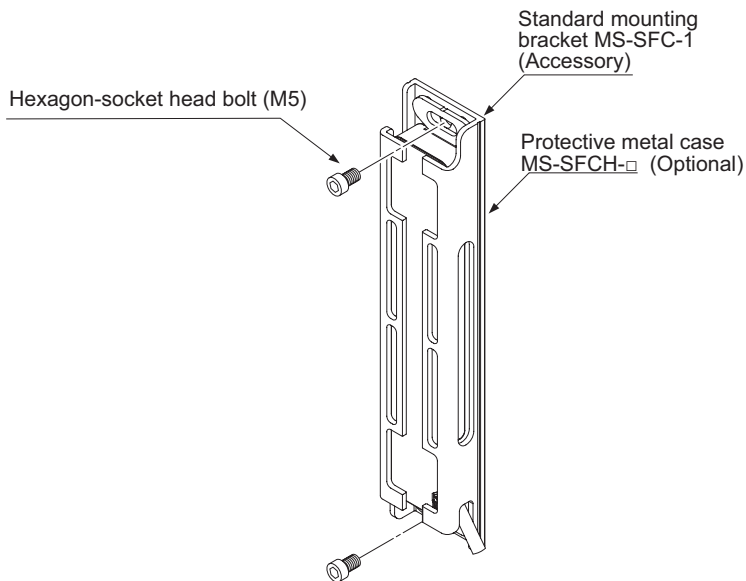
If you want to mount the protective metal case, follow this procedure.



◆ Procedure

1. Make sure that the standard mounting bracket MS-SFC-1 (accessory), mounted to this device, is fixed in the center
2. Slip on the protective metal case from the top of the safety light curtain

3. **Position and adjust the mounting holes of the protective metal case and the standard mounting bracket. Tighten them with two hexagon-socket head bolts (M5) on the mounting surface**



◆ CAUTION

- Use the protective metal case MS-SFCH-□ (optional) in combination with the standard mounting bracket MS-SFC-1 (accessory). It cannot be mounted in combination with the multifunctional mounting bracket MS-SFC-3 (optional).
- When mounting the protective metal case MS-SFCH-□ (optional) to this device, make sure that the standard mounting bracket MS-SFC-1 (accessory) is mounted centered. When the standard mounting bracket is mounted as dead zoneless mounting, the protective metal case MS-SFCH-□ (optional) can not be mounted to this device.

2.6 Wiring



DANGER!

Switch off the power before wiring the device.

All electrical wiring should conform to the regional electrical regulations and laws. The wiring should be done by engineer(s) having the required electrical knowledge.

Do not run the sensor cable together with high-voltage lines or power lines or put them together in the same raceway.

Connect the machine or the support where the sensor is mounted to the frame ground (F.G.). Failure to do so may cause the product to malfunction due to noise, resulting in serious injury or death.

The wiring should be done in a metal box connected to the frame ground (F.G.).

Take countermeasures regarding the system to ensure that dangerous performance caused by the earth failure cannot occur. Failure to do so could cause jeopardize the system stop, resulting in serious bodily injury or death.

Ground the 0V side (PNP output)/24V side (NPN output) to ensure that the output is not turned ON by accident due to an earth fault of the control output (OSSD 1, OSSD 2).

When this product is used in a situation where it has to conform to the Korean S-mark, make sure to ground the 0V side (PNP output).

Make sure to insulate the ends of the unused lead wires.

Use a safety relay unit or an equivalent safety control circuit as a final switching device (FSD).

2.6.1 Power Supply Unit

The wiring of the power supply unit should be performed by a specialist who has the required electrical knowledge.

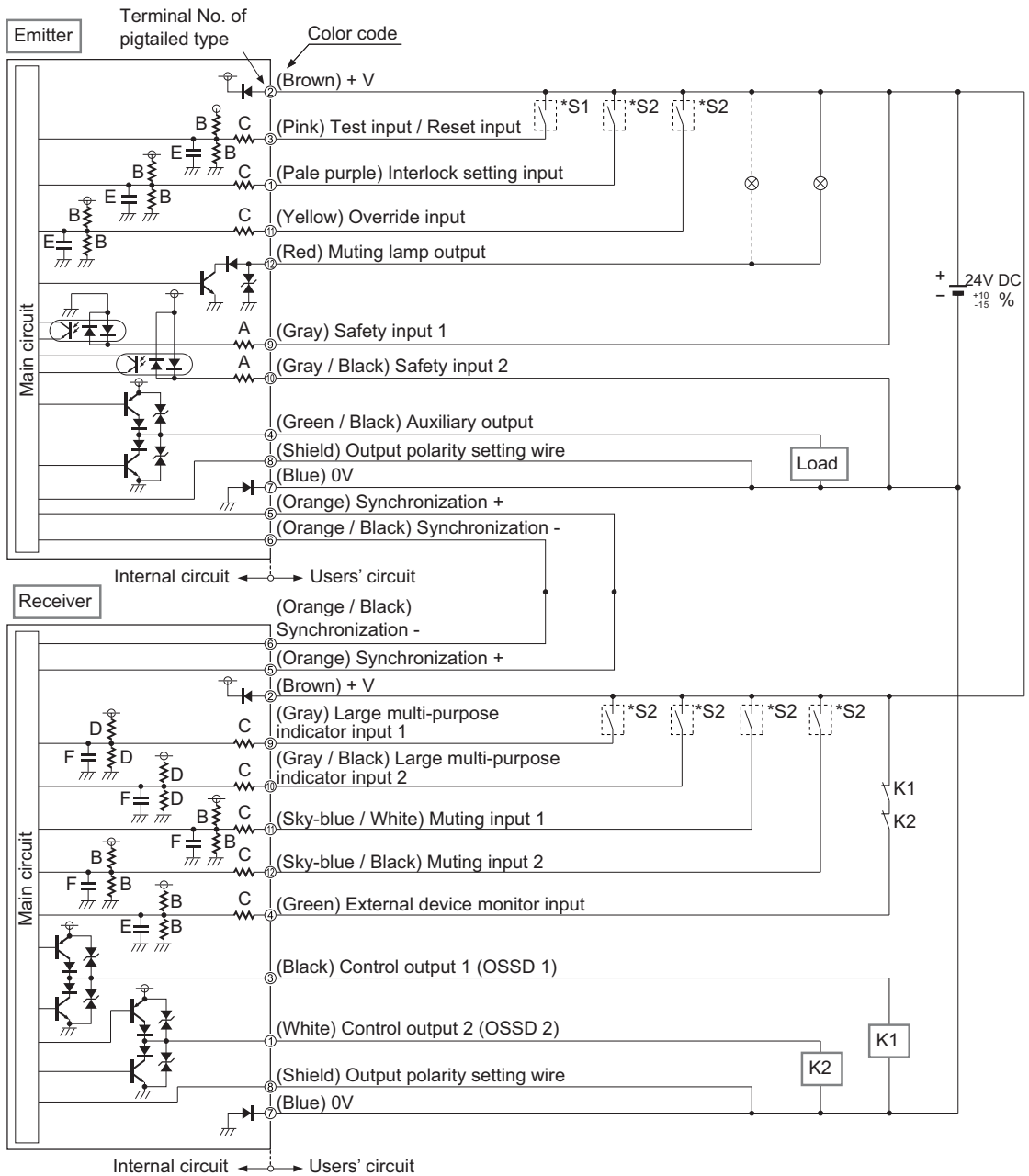
**DANGER!**

Wire correctly and use 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 does not conform to regional requirements or the wiring is improper, this device may malfunction or be damaged, which can result in serious injury or death.

The DC power supply unit must satisfy the following conditions.

- The power supply unit must be authorized for use in the region where this device is to be used.
- The power supply unit must conform to the EMC Directive and Low-Voltage Directive (where CE certification is required). The power supply unit must conform to CLASS 2 (where UL/cUL certification is required).
- If the power supply conforms to the Low-Voltage Directive and has an output of 100VA or less, it is suitable.
- The frame ground (F.G.) terminal must be connected to ground when using a commercially available switching regulator.
- The power supply unit must have an output holding time of 20ms or more.
- If there is a possibility of surge, take countermeasures such as connecting a surge absorber to the origin of the surge.

2.6.2 PNP Output





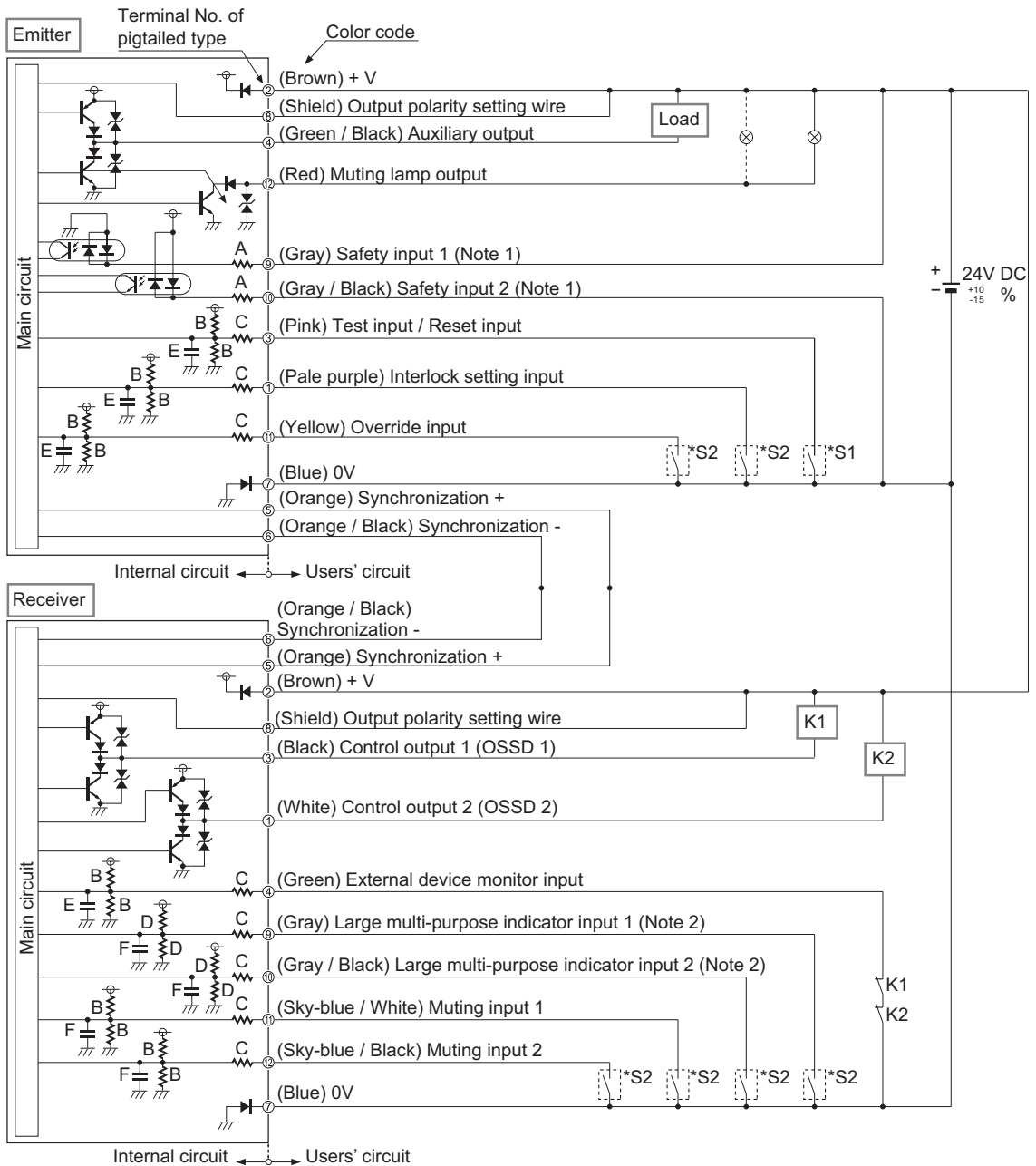
◆ NOTE

- For wiring the safety input 1 wire (gray) and the safety input 2 wire (gray/black), see "Inactive External Device Monitor Function (Control Category 4)" on page 49.
- The large multipurpose indicator lights up in red when connecting the large multi-purpose indicator input 1 wire (gray) and +V, and it lights up in green when connecting the large multi-purpose indicator input 2 wire (gray/black) and +V.

Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	When manual reset is activated: <ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): OFF • Open: ON When auto-reset is activated: <ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): ON • Open: OFF
Switch S2	<ul style="list-style-type: none"> • Interlock setting input, Override input, Large multi-purpose indicator input 1/2, Muting input 1/2, External device monitor input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5 V (sink current: 5mA or less): ON • Open: OFF
K1, K2	External device (forcibly guided relay or magnetic contactor)	
Resistance A	3kΩ	
Resistance B	6.8kΩ	
Resistance C	470Ω	
Resistance D	47kΩ	
Condenser E	0.47μF	
Condenser F	0.1μF	

Vs = Applied supply voltage

2.6.3 NPN Output





◆ NOTE

- For wiring the safety input 1 wire (gray) and the safety input 2 wire (gray/black), see "Inactive External Device Monitor Function (Control Category 4)" on page 49.
- The large multipurpose indicator lights up in red when connecting the large multi-purpose indicator input 1 wire (gray) and 0V, and it lights up in green when connecting the large multi-purpose indicator input 2 wire (gray/black) and 0V.

Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	When manual reset is activated: <ul style="list-style-type: none"> • Vs to Vs - 2.5V (source current: 5mA or less): OFF • Open: ON When auto-reset is activated: <ul style="list-style-type: none"> • Vs to Vs - 2.5V (source current: 5mA or less): ON • Open: OFF
Switch S2	<ul style="list-style-type: none"> • Interlock setting input, Override input, Large multi-purpose indicator input 1/2, Muting input 1/2, External device monitor input 	<ul style="list-style-type: none"> • Vs to Vs - 2.5 V (source current: 5mA or less): ON • Open: OFF
K1, K2	External device (forcibly guided relay or magnetic contactor)	
Resistance A	3kΩ	
Resistance B	6.8kΩ	
Resistance C	470Ω	
Resistance D	47kΩ	
Condenser E	0.47μF	
Condenser F	0.1μF	

Vs = Applied supply voltage

2.6.4 Output Signal during Self-Diagnosis

Since the receiver performs the self-diagnosis of the output circuit when the sensor is in light-receiving status (ON status), the output transistor turns OFF periodically (see following figure).

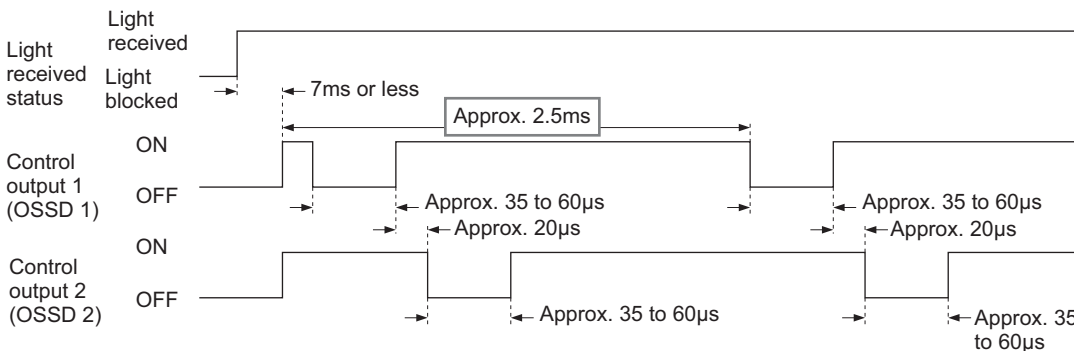
When the OFF signal is fed back, the receiver judges the output circuit as normal. When the OFF signal is not fed back, the receiver judges either the output circuit or wiring as faulty, and the control output (OSSD 1, OSSD 2) stays OFF.



DANGER!

Since the OFF signal of this device may cause a malfunction, pay attention to the input response time of the machine to be connected to this device when you perform the wiring.

Time chart



2.6.5 Connecting Procedure and Pin Assignment

Connect the mating cable (with a connector on one end or a connector on both ends) to the pigtailed type connector of the safety light curtain (emitter and receiver) according to the customer's application and the connector pin assignment following.

In the case you are using a cable type (emitter and receiver), wire the cables according to the customer's application referring to the connector pin assignment following.



DANGER!

Extending the cable longer than the length specified in the following table may cause malfunction, which can result in serious injury or death.

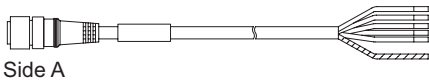


◆ NOTE

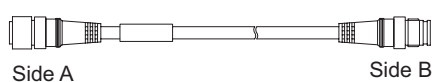
- When extending the cable, use the exclusive cable up to the total length of 40.5m or less (for each emitter and receiver). Extending the cable longer than 40.5m may cause malfunction, which can result in death or serious injury.
- In case of using the muting lamp, a total length should be 30.5 or less (for each emitter and receiver).
- When you need to extend the synchronization wire with a cable other than the exclusive cable, use a shielded twisted-pair cable with a diameter of 0.2mm² or more.

- When this device is used in conformity with the Korean S-mark, the power wire to be connected to this device should be less than 10m long.

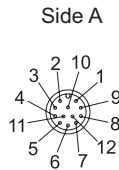
Extension cable with connector on one end



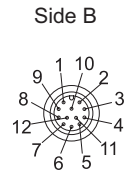
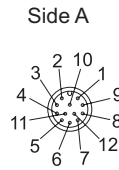
Extension cable with connectors on both ends



Pin arrangement for emitter and receiver



Pin arrangement for emitter and receiver



Pin assignment on the A and B side connectors

	Cable/connector color	Pin No.	Lead wire color	Description
Emitter	Gray/Gray	1	Pale purple	Interlock setting input
		2	Brown	+V
		3	Pink	Test input/Reset input
		4	Green/Black	Auxiliary output
		5	Orange	Synchronization +
		6	Orange/Black	Synchronization -
		7	Blue	0V
		8	(Shield)	Output polarity setting wire
		9	Gray	Safety input 1
		10	Gray / Black	Safety input 2
		11	Yellow	Override input
		12	Red	Muting lamp output
Receiver	Gray (with black stripe)/Black	1	White	Control output 2 (OSSD 2)
		2	Brown	+V
		3	Black	Control output 1 (OSSD 1)
		4	Green	External device monitor input
		5	Orange	Synchronization +
		6	Orange/Black	Synchronization -
		7	Blue	0V
		8	(Shield)	Output polarity setting wire
		9	Gray	Large multi-purpose indicator input 1
		10	Gray / Black	Large multi-purpose indicator input 2
		11	Sky-blue / White	Muting input 1
		12	Sky-blue / Black	Muting input 2



◆ NOTE

The connectors can be distinguished by their color as follows:

- Connector for emitter: gray
- Connector for receiver: black

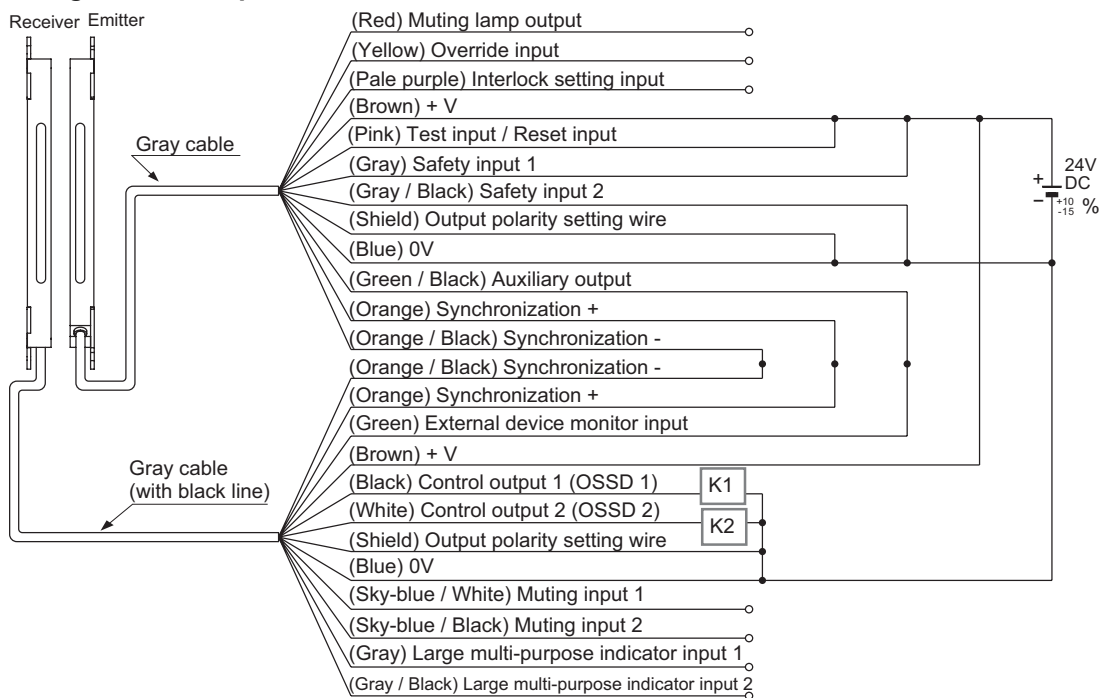
2.6.6 Basic Wiring

This is the general configuration using one set of an emitter and a receiver facing each other. The control output (OSSD 1, OSSD 2) turns OFF if the light is blocked, while it automatically turns ON if the light goes through.

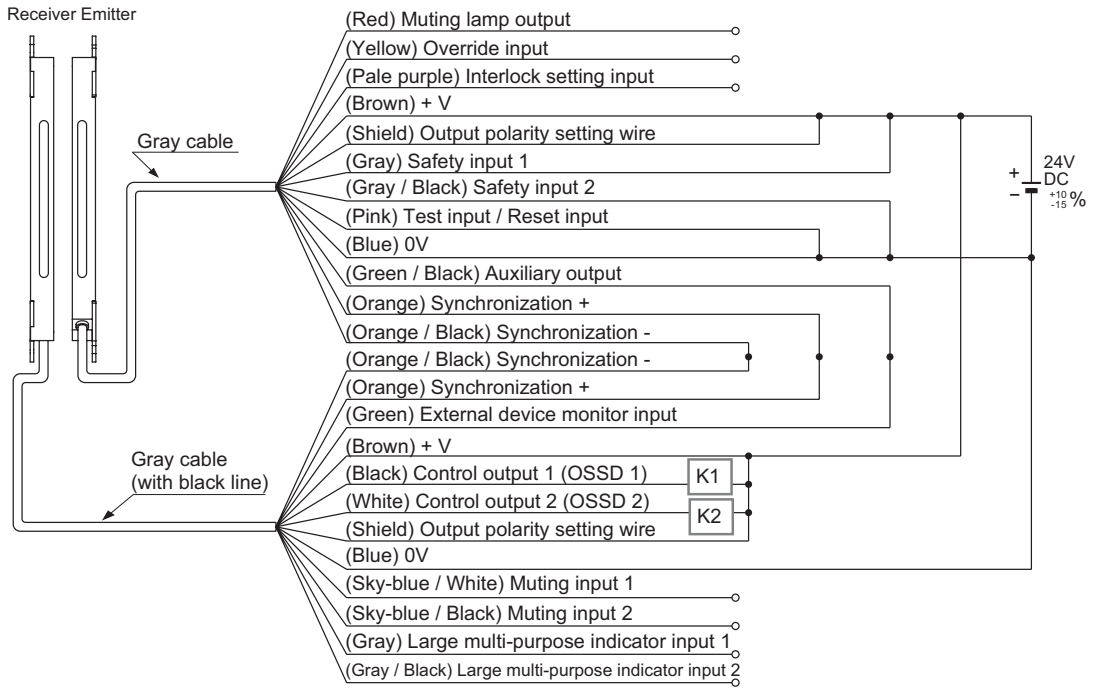
The auxiliary output (Green/Black) has to be connected with the external device monitor function (Green).

Feature	Setting
Interlock function	Inactive (Auto-reset)
External device monitor function	Inactive
Auxiliary output	Not available

Wiring for PNP output



Wiring for NPN output



2.7 Wiring Examples

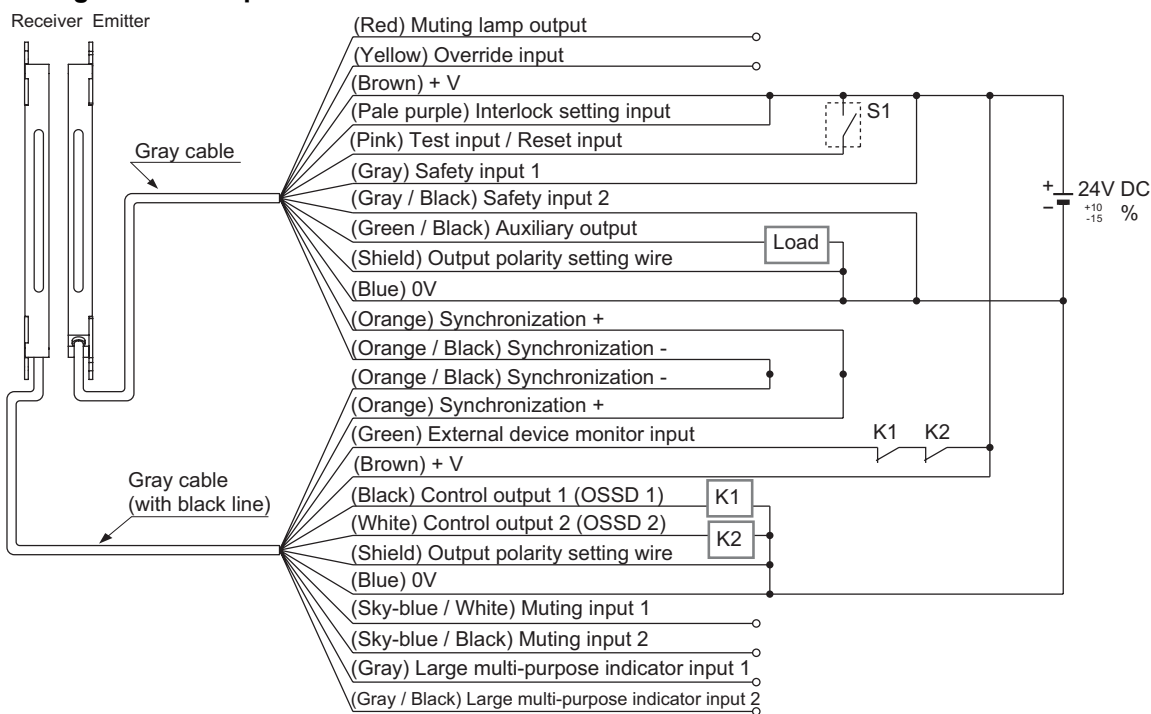
The following examples show how this device should be wired depending on the connection method and which function is used.

2.7.1 Manual Reset When Interlock is Active

This is the general configuration using one set of the emitter and receiver facing each other. The control output (OSSD 1/2) turns OFF if the light is blocked.

Feature	Setting
Interlock function	Active (Manual reset)
External device monitor function	Active
Auxiliary output	Available

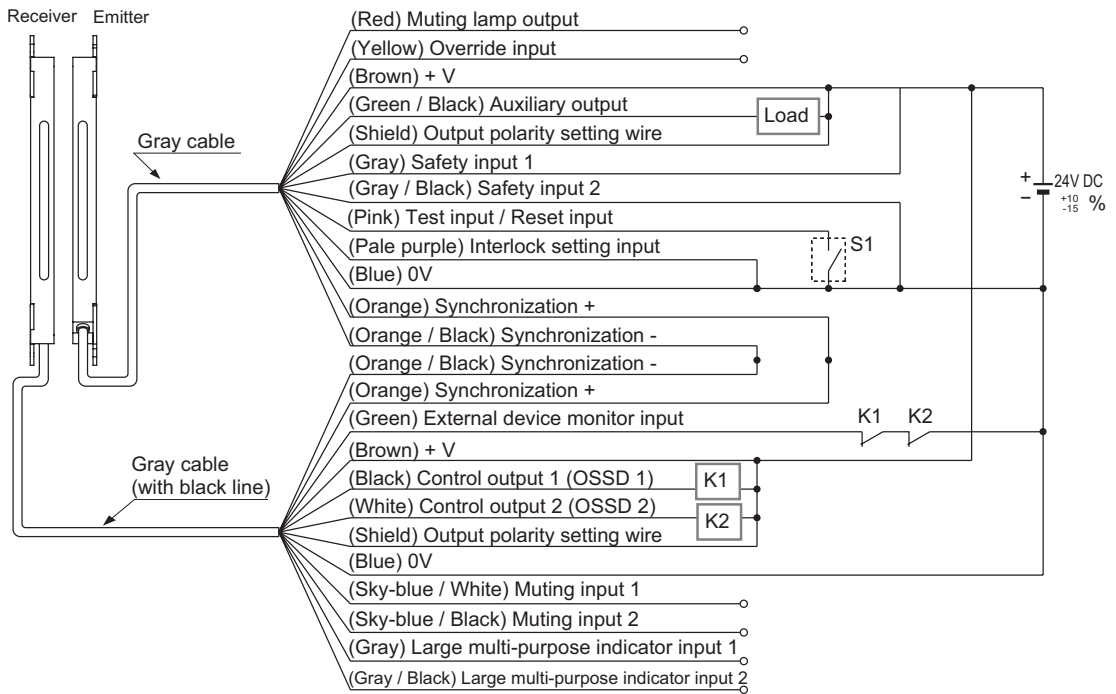
Wiring for PNP output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage

Wiring for NPN output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> Test input/Reset input 	<ul style="list-style-type: none"> 0 - 2.5V (source current: 5mA or less): OFF Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage



◆ NOTE

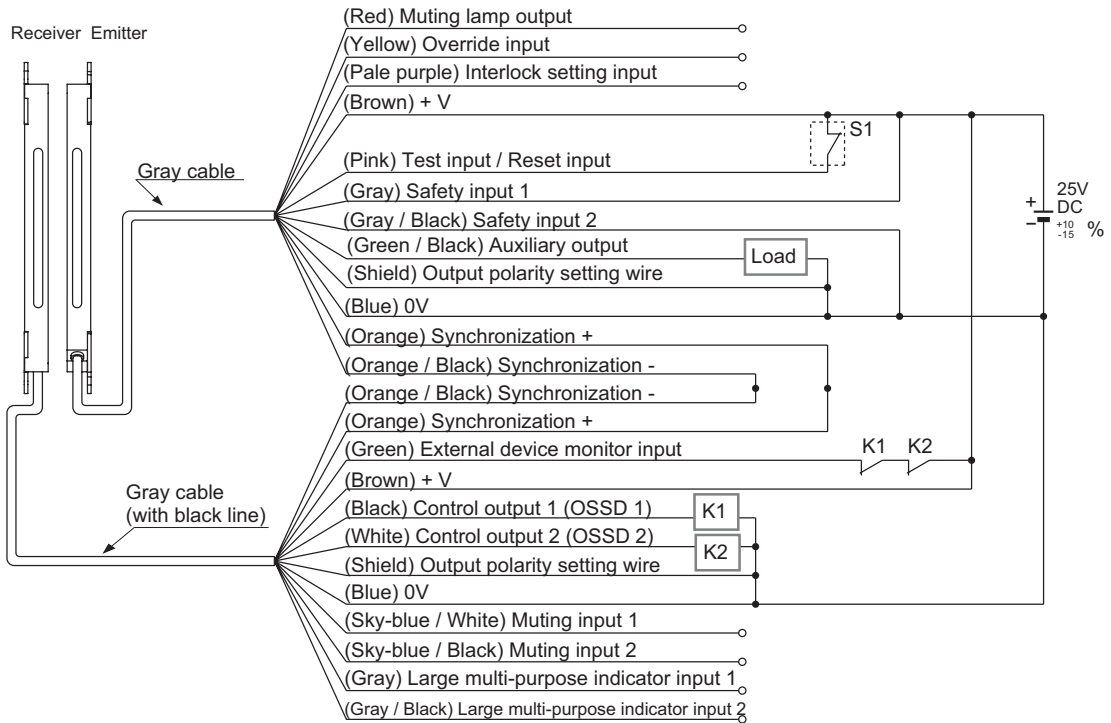
The OSSD output type (PNP or NPN) is determined by the connecting state of the shield wire. Incorrect wiring may cause a lockout.

2.7.2 Auto-Reset When Interlock is Inactive (Control Category 4)

This is the general configuration using one set of the emitter and receiver facing each other. The control output (OSSD 1/2) turns OFF if the light is blocked.

Feature	Setting
Interlock function	Inactive (Auto reset)
External device monitor function	Active
Auxiliary output	Available

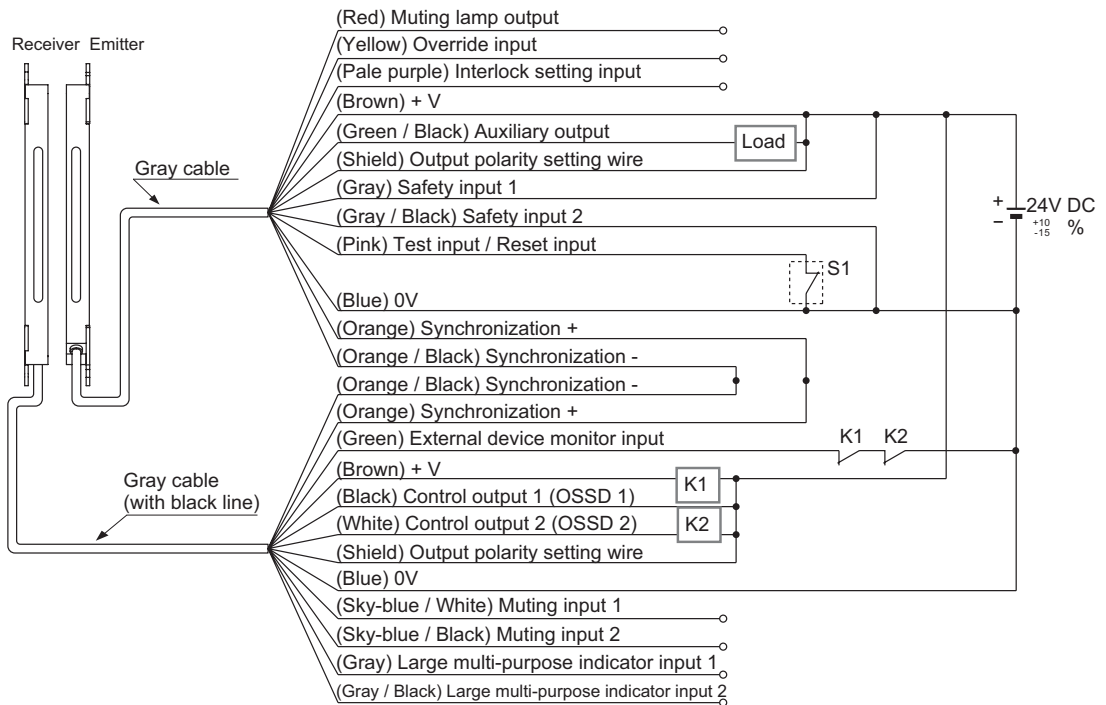
Wiring for PNP output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage

Wiring for NPN output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • 0 - 2.5V (source current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage



◆ NOTE

- The OSSD output type (PNP or NPN) is determined by the connecting state of the shield wire. Incorrect wiring may cause a lockout.

2.7.3 Active Safety Input Function (Control Category 4)

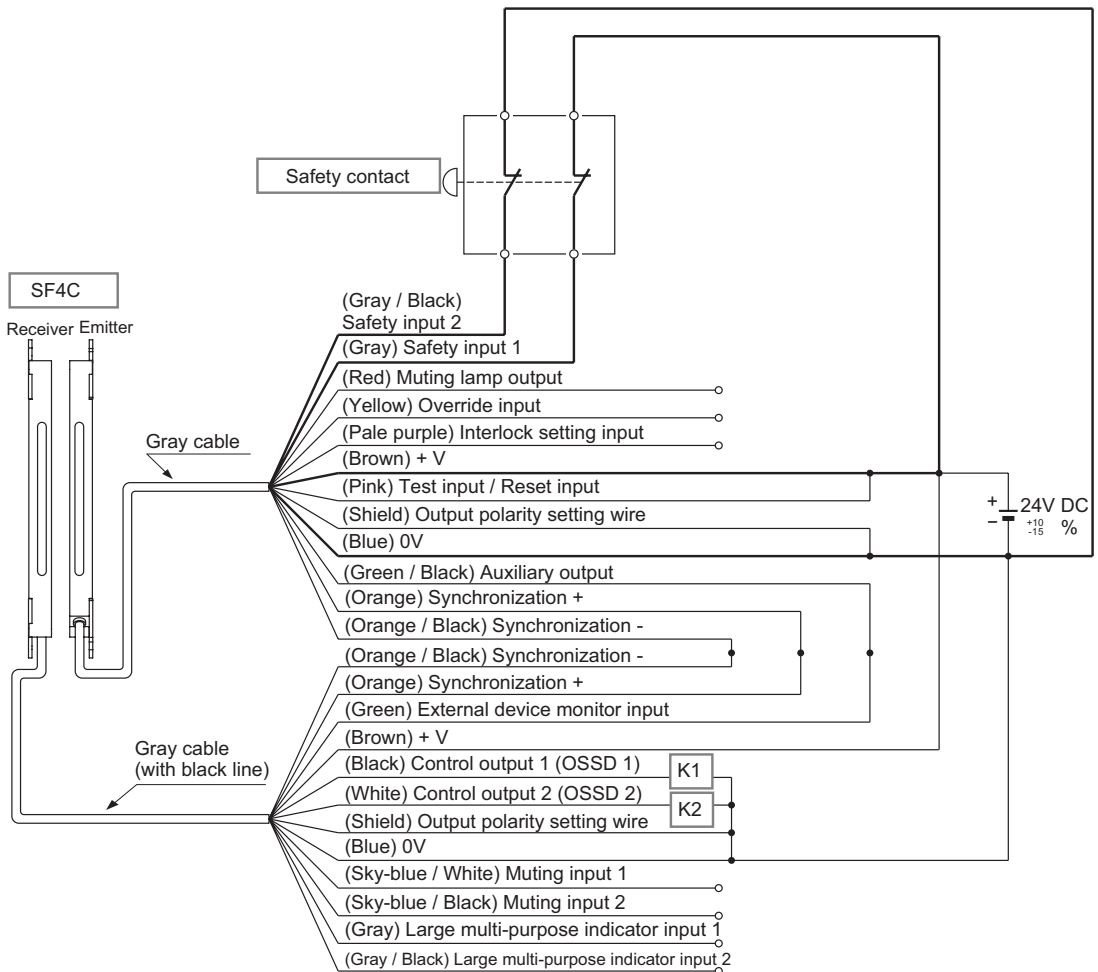
The safety input function can be activated when connecting a safety contact to the safety input 1 wire (gray) and the safety input 2 wire (gray/black) of the emitter; for details see "Safety Input Function" on page 63. You can also connect a safety sensor, if you use the handy controller SFC-HC (optional). By connecting a safety sensor to the safety input 1 (gray) and the safety input 2, this device and the safety sensor can be used in a series connection.

For details, see page 84.

Feature	Setting
Interlock function	Inactive (Auto-reset)
External device monitor function	Inactive

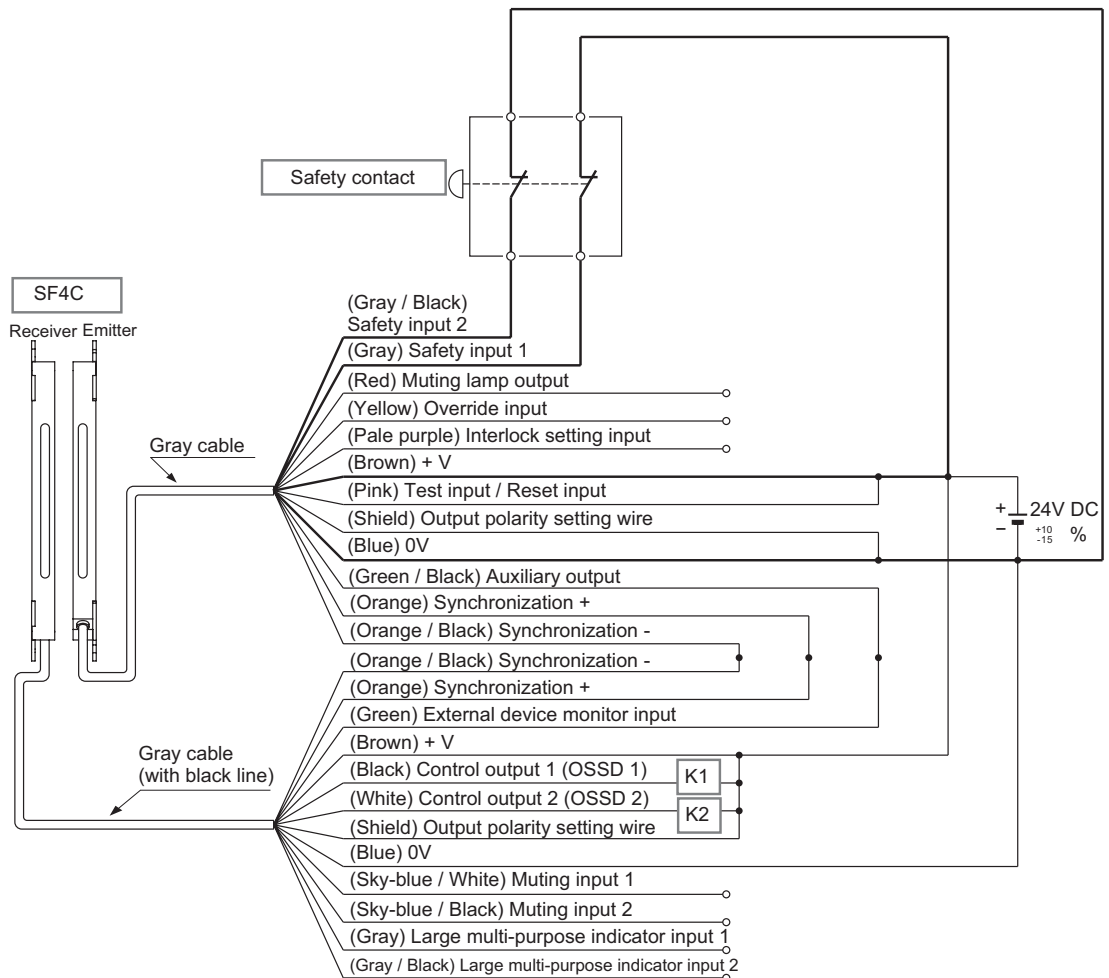
Feature	Setting
Auxiliary output	Not available

Wiring for PNP output



Symbols in the wiring diagram	
Safety input	<ul style="list-style-type: none"> • Short circuit (sink current: 5 to 10 mA), Source current 5 to 10mA: ON • Open: OFF

Wiring for NPN output



Symbols in the wiring diagram

Safety input	<ul style="list-style-type: none"> • Short circuit (sink current: 5 to 10mA), Source current 5 to 10mA: ON • Open: OFF
--------------	--



◆ NOTE

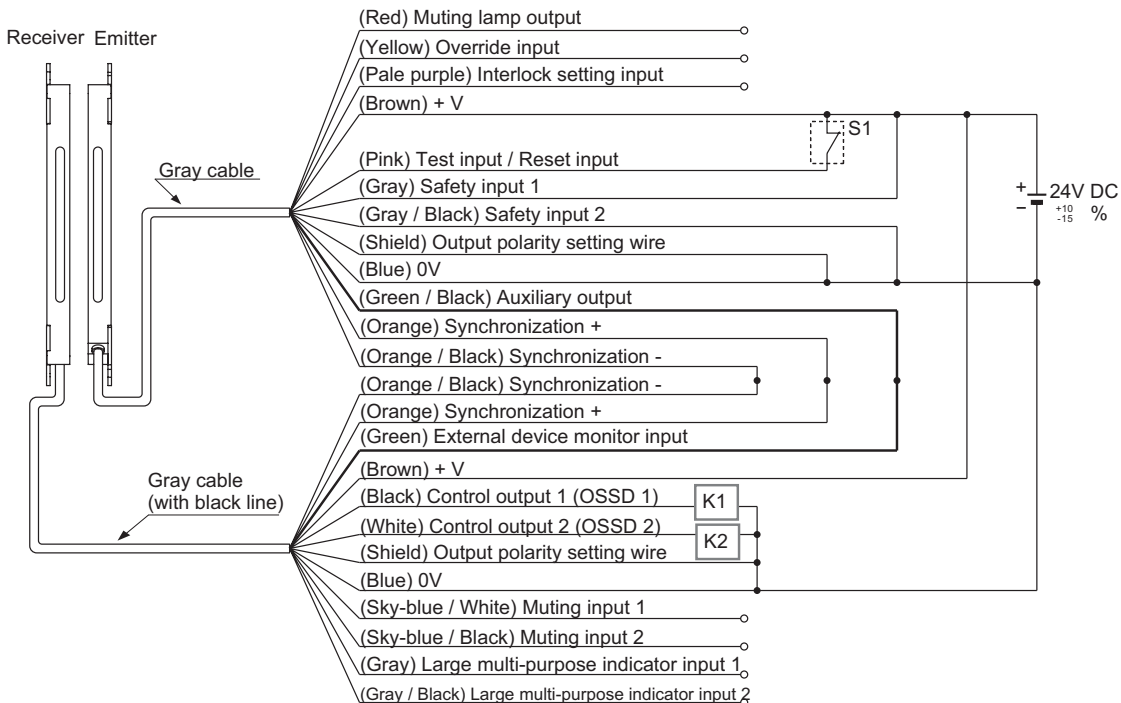
- The OSSD output type (PNP or NPN) is determined by the connecting state of the shield wire. Incorrect wiring may cause a lockout.

2.7.4 Inactive External Device Monitor Function (Control Category 4)

This is the configuration for connecting an auxiliary output and external device monitor input. The auxiliary output cannot be connected to external devices.

Feature	Setting
Interlock function	Inactive (Auto-reset)
External device monitor function	Inactive
Auxiliary output	Not available

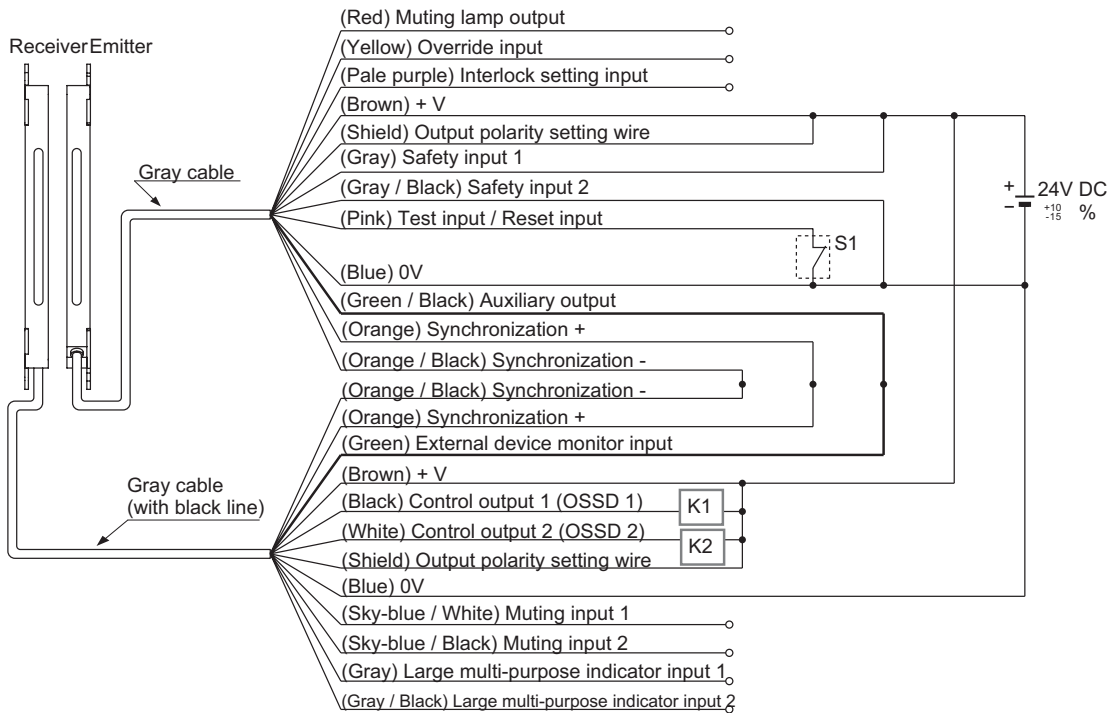
Wiring for PNP output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): ON • Open: OFF
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage

Wiring for NPN output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • Vs to Vs - 2.5V (source current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage



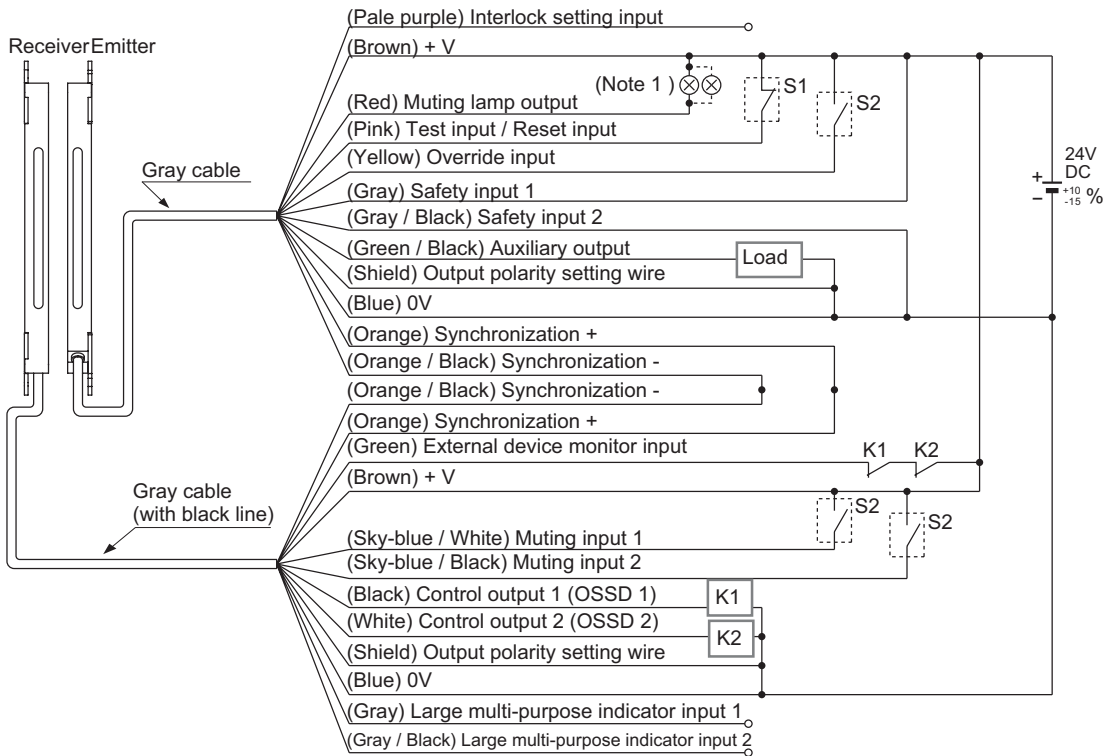
◆ NOTE

The OSSD output type (PNP or NPN) is determined by the connecting state of the shield wire. Incorrect wiring may cause a lockout.

2.7.5 Active Muting Function (Control Category 4)

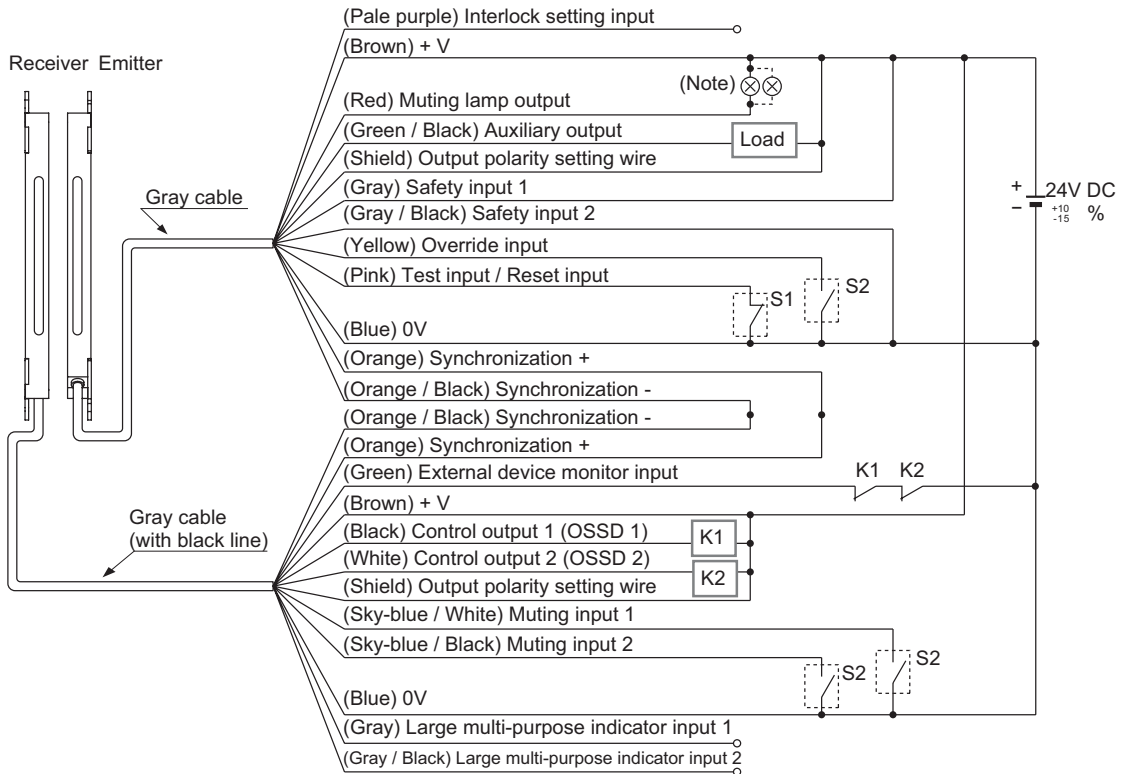
Feature	Setting
Interlock function	Inactive (Auto reset)
External device monitor function	Active
Auxiliary output	Available

Wiring for PNP output



Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): OFF • Open: ON
Switch S2	<ul style="list-style-type: none"> • Muting input/Override input 	<ul style="list-style-type: none"> • Vs to Vs - 3.5V (sink current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage



Wiring for NPN output

Symbols in the wiring diagram		
Switch S1	<ul style="list-style-type: none"> • Test input/Reset input 	<ul style="list-style-type: none"> • 0 - 2.5V (source current: 5mA or less): OFF • Open: ON
Switch S2	<ul style="list-style-type: none"> • Muting input/Override input 	<ul style="list-style-type: none"> • 0 - 2.5V (source current: 5mA or less): OFF • Open: ON
K1, K2	External device (forcibly guided relay or magnetic contactor)	

Vs = Applied supply voltage



◆ NOTE

- **The OSSD output type (PNP or NPN) is determined by the connecting state of the shield wire. Incorrect wiring may cause a lockout.**

The following sections contain information about the proper adjustment and operation of the safety light curtain.

You have to align the beam axis and test the light curtain in your application environment.

2.7.6 Beam-axis Alignment

The beam-axis alignment differs depending on the mounting bracket used (MS-SFC-1 or MS-SFC3). Follow either of the both procedures depending on which mounting bracket you use. To align the beam axis, please proceed as follows:

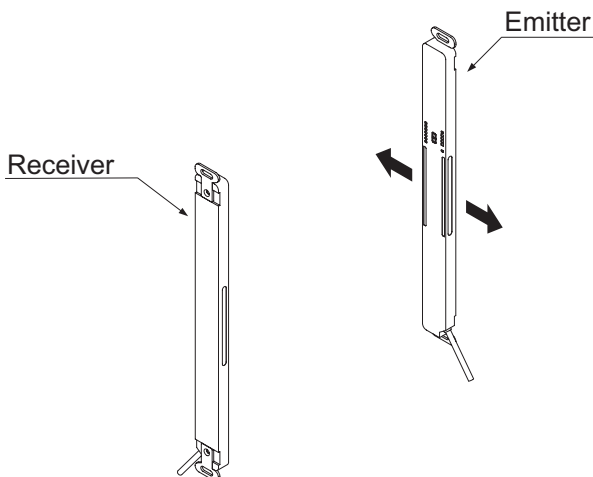
For MS-SFC-3:



◆ Procedure

1. Turn ON the power supply unit of the safety light curtain
2. Check that the digital error indicator (red) and the fault indicator (yellow) of the emitter and receiver are off

If the digital error indicator (red) or the fault indicator (yellow) lights up or blinks, refer to the chapter on troubleshooting (see page 103) and report this to the maintenance staff in charge.
3. In case of using the standard mounting bracket MS-SFC-1 (accessory), loosen the hexagon-socket head bolts (M5) which holds the standard mounting bracket MS-SFC-1
4. Move the emitter to the left and right in order to determine the range of the light received condition with the help of the beam-axis alignment indicator (red)
5. Then, set the emitter in the center of this range
6. Similar to the step 4, perform the beam-axis alignment for the receiver
7. Tighten the standard mounting bracket MS-SFC-1 by the hexagon-socket head bolt (M5)
8. Confirm that the beam-axis alignment indicators (green) in the display of the emitter and receiver, operation indicator (green) and OSSD indicator (green) light up



For MS-SFC-3 and MS-SFC-4:

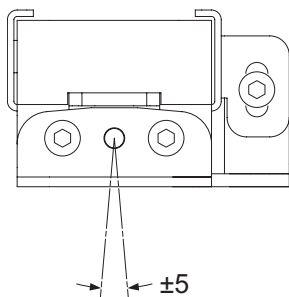


◆ Procedure

1. Turn ON the power supply unit of the safety light curtain
2. Check that the digital error indicator (red) and the fault indicator (yellow) of the emitter and receiver are off

If the digital error indicator (red) or the fault indicator (yellow) lights up or blinks, refer to the chapter on troubleshooting (see page 103) and report this to the maintenance staff in charge.
3. In case of using the multifunctional mounting bracket MS-SFC-3 (optional), loosen the four hexagon-socket head bolts (M3, length: 5mm) which hold the multifunctional mounting bracket
4. In case of using also the multifunctional intermediate supporting bracket MS-SFC-4, loosen a hexagon-socket head bolt (M3, length: 5mm) for beam-axis alignment of multifunctional intermediate supporting bracket
5. Then, adjust the emitter/receiver so that the beam-axis alignment indicators on the display of the emitter and receiver light up

The emitter and the receiver can be fine-adjusted by ± 5 degrees.



6. After the adjustment, tighten the hexagon-socket head bolt for beam-axis alignment of the multifunctional mounting bracket MS-SFC-3

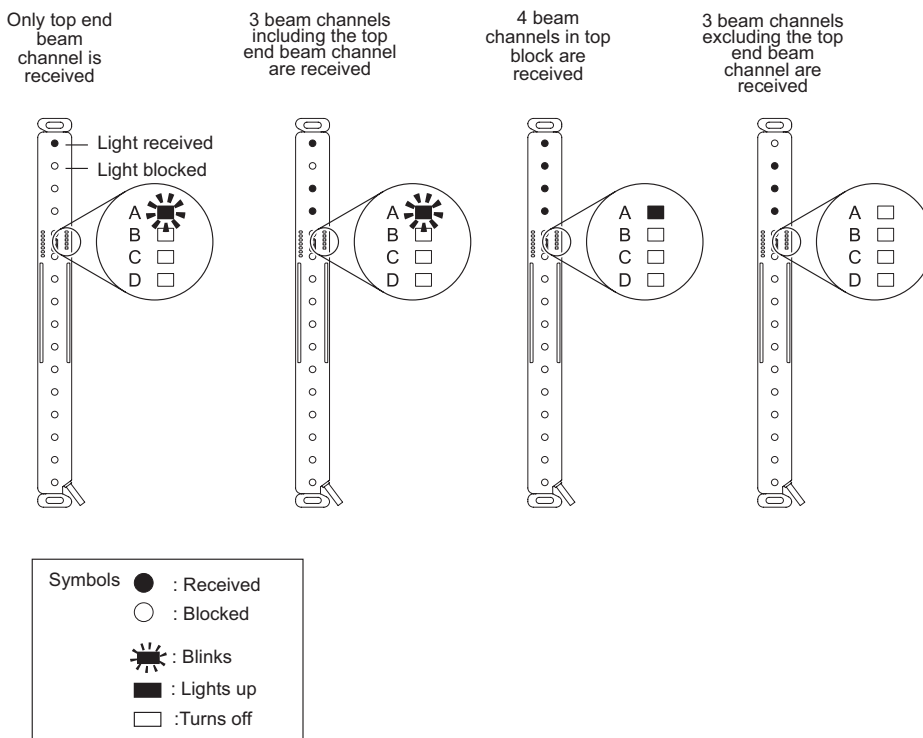
The tightening torque should be 2N·m or less.
7. Tighten the hexagon-socket head bolt of the multifunctional intermediate supporting brackets MS-SFC-4 (M3, length: 5 mm)
8. Confirm that the beam-axis alignment indicators (green) on the display of the emitter and receiver, the operation indicator (green) and the OSSD (green) indicator light up



◆ REFERENCE

The beam-axis alignment indicator indicates the reception status for each section of a receiver. The receiver is divided into 4 sections. Also, the A (D) of the beam-axis alignment indicates the light-receiving status of the top end (bottom end)

beam channel. For example, when using a 16-beam channel sensor, there are 4 beam channels per section (i.e., $16/4=4$). When the top end (bottom end) beam channel is received, the indicator A (D) of the beam-axis alignment blinks red. The following figure shows an example with 16 beam channels.



When all 4 beam channels of one of the 4 sections are received, the beam-axis alignment indicator lights up in red. The indicators corresponding to the different sections light up in red, one by one, when the beam channels of the respective sections are received. When all beam channels are received and the control output (OSSD1/2) turns ON, all the four indicators of the beam-axis alignment turn into green. For information on testing the operation (see page 56).

2.7.7 Operation Test

To test the installation, please proceed as follows:

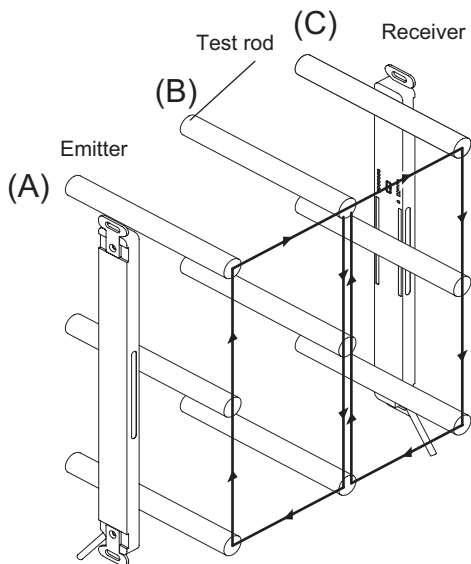


◆ Procedure

1. Turn ON the power supply unit of the safety light curtain.
2. Check that the digital error indicator (red) and the fault indicator (yellow) of the emitter and the receiver are off.

If the digital error indicator (red) or the fault indicator (yellow) lights up or blinks, refer to the chapter on troubleshooting (see page 103) and report this to the maintenance staff in charge.

3. Move the test rod up and down at three positions, just in front of the emitter (A), in the middle between the emitter and receiver (B), and just in front of the receiver (C).



4. When you carry out step 3, check that the control outputs (OSSD 1, OSSD 2) are OFF and that both the OSSD indicator (red) of the receiver and the operation indicator (red) of the emitter light up as long as the test rod is present within the sensing area.

If the behavior of the control outputs (OSSD 1, OSSD 2) and the turning ON/OFF of the emitter/receiver indicators do not correspond to the movement of the test rod, refer to the chapter on troubleshooting (see page 103) and report this to the maintenance staff in charge.



◆ NOTE

If the indicators show reception of light even though the test rod blocks the light, check whether there is a reflective object or extraneous light source near this device.

Chapter 3

Functions

3.1 Self-Diagnosis Function

The safety light curtain is equipped with a self-diagnosis function. Self-diagnosis is carried out when the power is turned ON and periodically during the operation.

In case an abnormality is detected during self-diagnosis, the device is immediately put in the lockout state and the control output (OSSD 1, OSSD 2) is set to OFF state. Find and remove the cause of the abnormality (see page 103).

3.2 Interlock Function

When the light curtain has been interrupted and control output (OSSD1, OSSD2) is OFF, the interlock function keeps the control output at OFF until a reset signal is input.

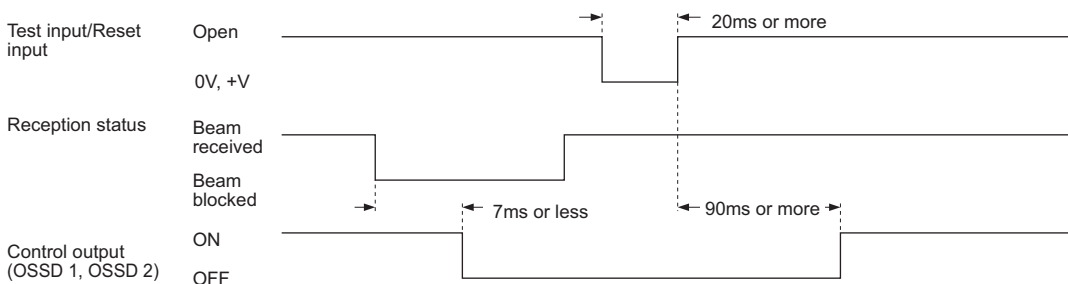
You can select whether interlock is enabled (manual reset) or disabled (automatic reset) by the way in which the interlock setting input line (pale purple) is connected.

You have to wire the safety light curtain accordingly to activate the interlock function and the manual reset. Without wiring the interlock function is disabled and auto reset is active.

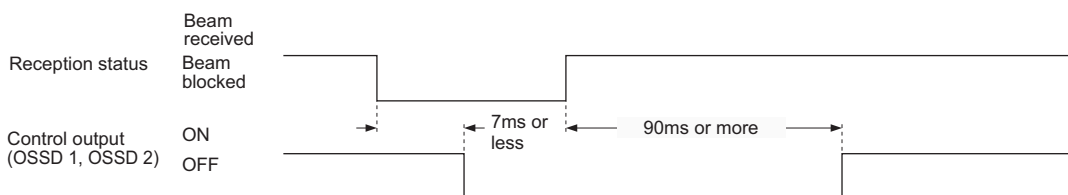
Interlock function	Reset operation	Interlock setting input (pale purple)
Active	Manual reset	0V, +V connection
Inactive	Auto reset	Open

Manual reset: The control output (OSSD 1, OSSD 2) is not turned ON automatically even though this device receives light. When there is a signal at the reset input, the control output (OSSD 1, OSSD 2) is turned ON.

Auto reset The control output (OSSD 1, OSSD 2) is turned ON automatically when this device receives light.



Time diagram for manual reset



Time diagram for auto reset



◆ NOTE

If this device is used with auto-reset, avoid an auto-restart after the safety output stop of the system by using a safety relay unit etc. (EN 60204-1).

3.3 Test Input Function



Danger!

Do not use the test input function for the purpose of stopping the machine in which the SF4C series is installed. Failure to do so could result in death or serious injury.

This function enables to check the device operation by forcibly turning ON/OFF the control output (OSSD 1/2) of the receiver in the state "beam received".

The ON/OFF switching of the output is available by opening or short circuiting the test input/reset input wire (pink).

Interlock function	Test input/Reset input wire (pink)	Test input	Output status
Manual reset	Open	Inactive	ON
	PNP output: Connect to +V NPN output: Connect to 0V	Active	OFF
Auto reset	Open	Active	OFF
	PNP output: Connect to +V NPN output: Connect to 0V	Inactive	ON

When the test input is activated, the control output (OSSD1/2) becomes OFF. By using this function, malfunction due to extraneous noise or abnormality in the control output (OSSD 1/2) and the auxiliary output can be determined even from the equipment side.

- In case of PNP output: Normal operation is restored when the test input/reset input wire (pink) is connected to +V (for manual reset: open).
- In case of NPN output: Normal operation is restored when the test input/reset input wire (pink) is connected to 0V (for manual reset: open).

3.4 Safety Input Function



DANGER!

When extending the cable of other SF4C series which is connected to the safety input 1/2, use the exclusive cable. The total cable length should be 40.5m or less (for each emitter/receiver). If the total cable length is exceeding 40.5m, the device may malfunction, resulting in death or serious injury.

This function controls the control output (OSSD 1/2) of this device by receiving the detection signal of a safety contact or a safety sensor which is connected to the safety input 1 wire (gray) and the safety input 2 wire (gray/black).

The control output (OSSD 1/2) forcibly turns OFF when the safety input 1/2 is OFF.



◆ NOTE

- The temporal difference between the switching from OFF to ON and ON to OFF during the output operation of the safety input should be 1s or less.
- A safety contact can be connected with the factory setting of this device.
- When connecting a safety sensor, the handy controller SFC-HC (optional) is required. The maximum number of safety sensors which can be connected to this device is 2 (only with version 2.1 of this device). For details see page 84.

Output operation of a safety contact and a safety sensor

As safety contact you can use an emergency stop switch with two NC (Normally Closed) contact points. As safety sensor you can use another safety light curtain or a safety switch with semiconductor output.

	NC (Normally Closed)	ON-state operation	OFF-state operation
Safety contact	ON: Status is safe (emergency stop switch, etc.)	PNP output: Connect to +V NPN output: Connect to 0V	Open
Safety sensor	ON: "Beam received" status (light curtain, etc.) ON: "Door closed" status (safety switch etc.)		



◆ NOTE

- When using the PNP output type (or NPN output type) of this device take care that also the safety sensor is of the same type (PNP/NPN output). The control output becomes OFF, if you use the wrong type of sensor.

- Use a safety sensor which incorporates a crossover short-circuit function in the control output and connect both the safety input 1 wire (gray) and the safety input 2 wire (gray/black). Take care that if only one wire is connected, the device may not operate normally.
- Use a safety contact point which incorporates two NC (Normally Closed) contacts and connect both the safety input 1 wire (gray) and the safety input 2 wire (gray/black). Take care that if only one wire is connected, the device may not operate normally.
- If you do not want to use the safety input function make sure to connect +V or 0V.

	PNP output		NPN output	
	Safety input 1 wire (gray)	Safety input 2 wire (gray/black)	Safety input 1 wire (gray)	Safety input 2 wire (gray/black)
Safety contact	Connect to +V	Connect to 0V	Connect to +V	Connect to 0V
Safety sensor	Connect to +V	Connect to +V	Connect to 0V	Connect to 0V

- It is possible to change the setting of the input mode by using the handy controller, so you can switch between a safety contact and a safety sensor see page 84.

3.4.1 Serial Connection and Response Time

Serial connection and response time



DANGER!

This device does not incorporate the interference prevention function. Thus, take sufficient care when installing the devices in series.

The series connection is also available when connecting other SF4C safety light curtains to the safety input 1 wire (gray) and the safety input 2 wire (gray/black).



◆ NOTE

Use a 0.2mm² or more shielded cable when connecting other SF4C series cable to the safety input 1/2.

Overall Response time

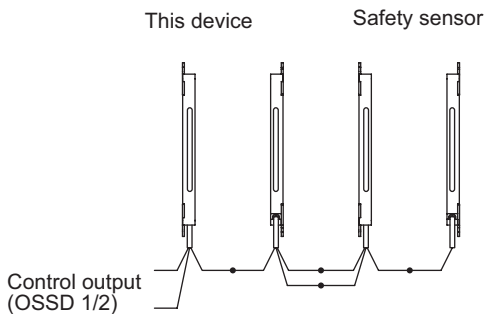
The overall response time is composed of the response time of the safety light curtain and the response time of the safety sensor. In the case of a serial connection the safety sensor is also another safety light curtain.



◆ EXAMPLE

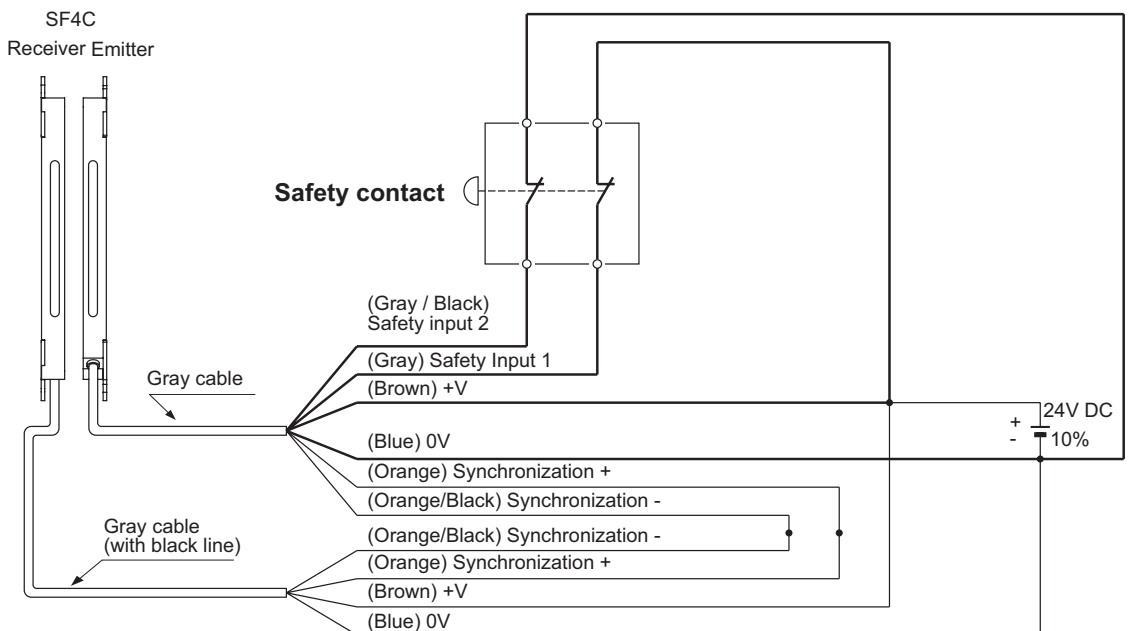
In case of using SF4C in series or as a safety sensor:

Response time of this device + response time of safety sensor = 7ms + 7ms = 14ms.



3.4.2 Wiring Example for Safety Contact

Connect the emitter of this device and the safety contact as follows. In case of using lead wires other than those described below, perform the wiring depending on your application. For details on wiring, see "Wiring" on page 34.



3.4.3 Wiring Example for Safety Sensor

If you want to wire a safety sensor you have to consider if you use the PNP and NPN type of SF4C.

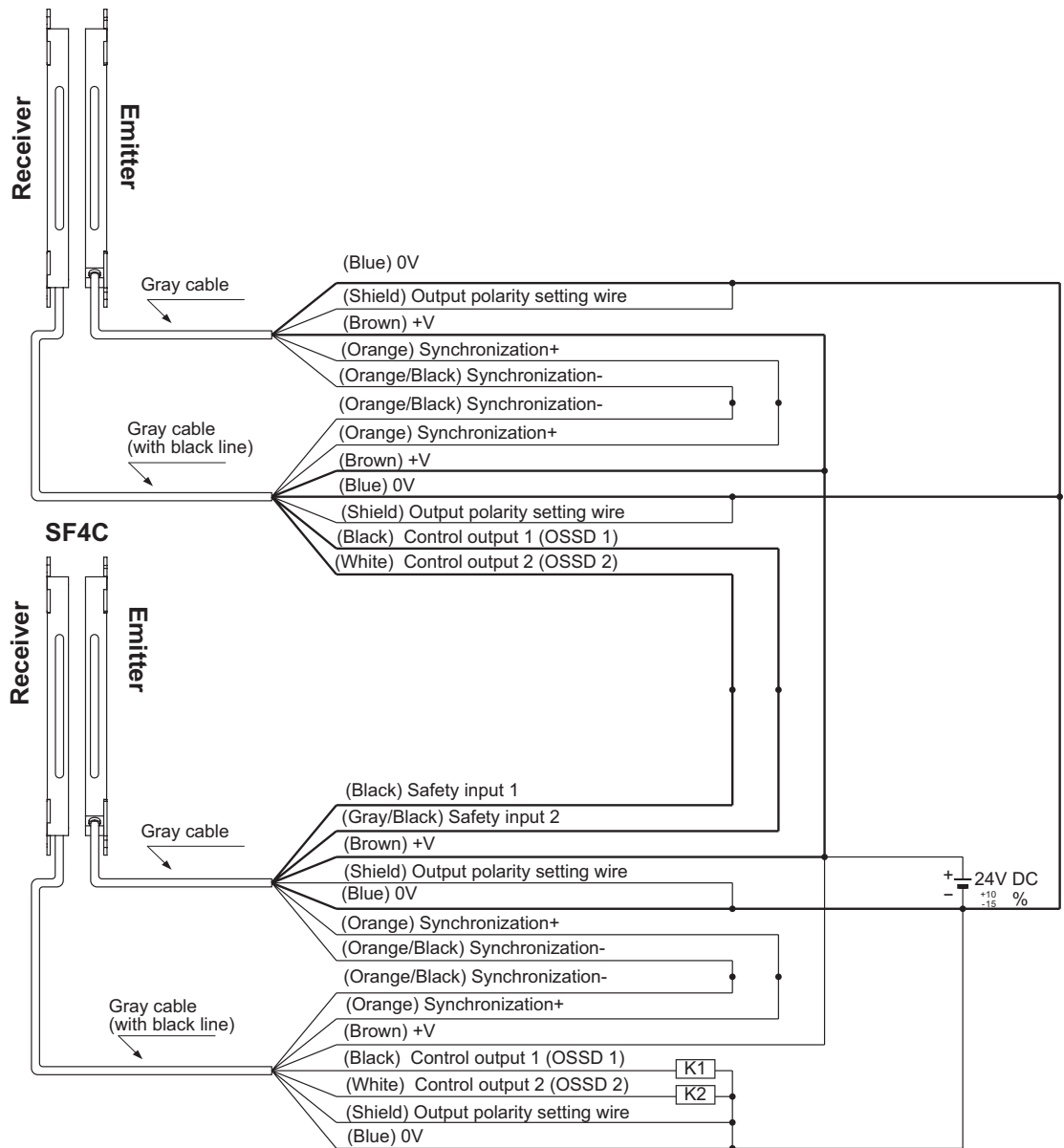
Wiring for PNP output

When using this device with PNP output, connect a PNP output type safety sensor. Connect the emitter of the SF4C and the receiver of the safety sensor as follows.

In case of using lead wires other than those described below, perform wiring depending on your application. For details on wiring, see "Wiring" on page 34.

Emitter of SF4C	Receiver of the safety sensor
Safety input wire 1 (gray)	Control output 1 (OSSD 1) wire (black) or control output 2 (OSSD 2) wire (white)
Safety input wire 2 (gray/black)	Control output 2 (OSSD 2) wire (white) or control output 1 (OSSD 1) wire (black)
+V wire (brown)	+V wire (brown)
0V wire (blue)	0V wire (blue)

Safety sensor



◆ NOTE

Safety input: Short-circuit (source current 5 to 10mA): Active, Open: Inactive.

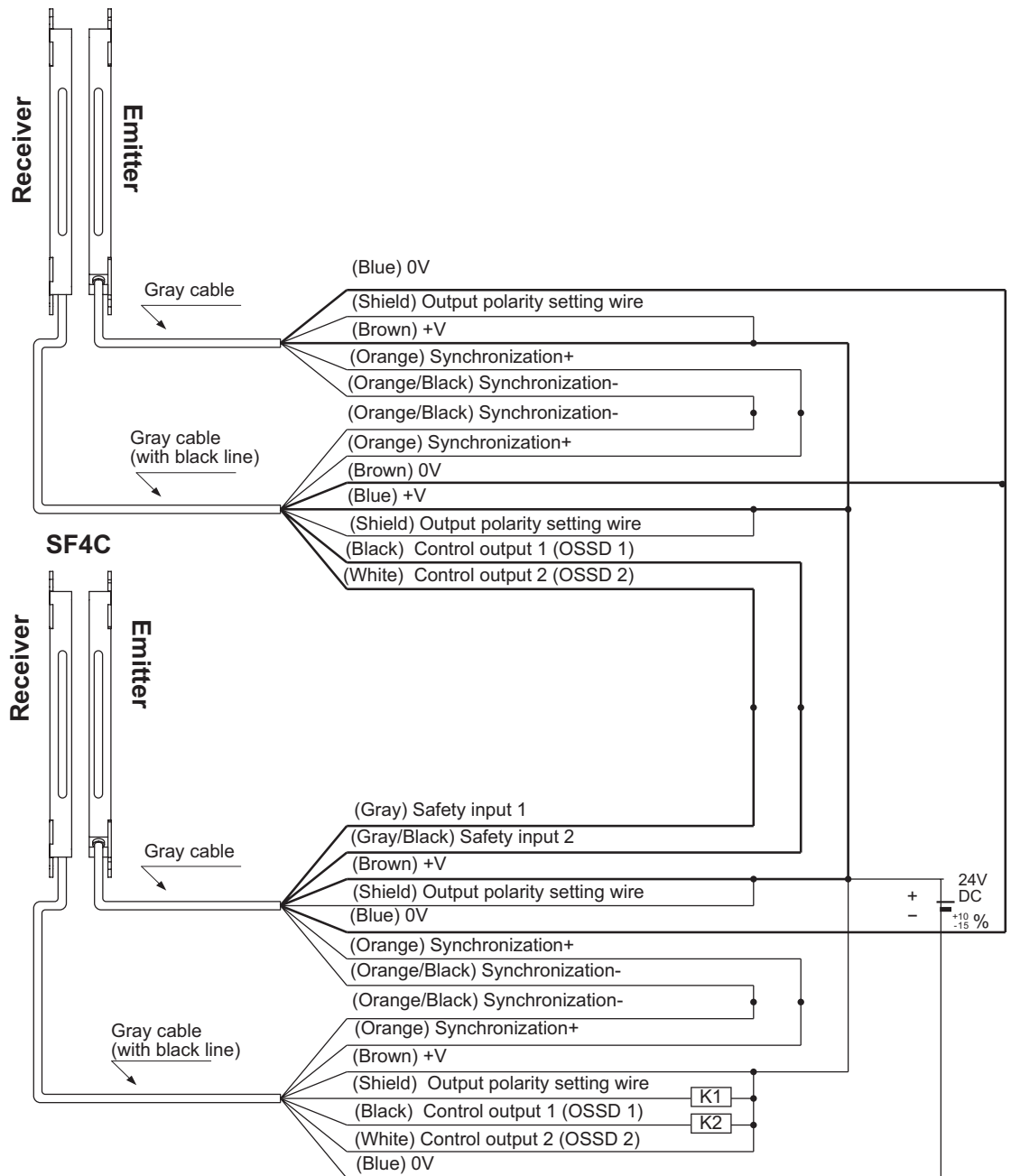
Wiring for NPN output

When using this device with NPN output, connect a NPN output type safety sensor. Connect the emitter of the SF4C and the receiver of the safety sensor as follows.

In case of using lead wires other than those described below, perform wiring depending on your application. For details on wiring, see "Wiring" on page 34.

Emitter of the device	Receiver of the safety sensor
Safety input wire 1 (gray)	Control output 1 (OSSD 1) wire (black) or control output 2 (OSSD 2) wire (white)
Safety input wire 2 (gray/black)	Control output 2 (OSSD 2) wire (white) or control output 1 wire (black)
+V wire (brown)	+V wire (brown)
0V wire (blue)	0V wire (blue)

Safety sensor



◆ NOTE

Safety input: Short-circuit (source current 5 to 10mA): Active, Open: Inactive.

3.5 Large Multi-purpose Indicator Function

You can choose, if the large multi-purpose indicator should light up or not by wiring the large multi-purpose indicator input 1 wire (gray) or the large multi-purpose indicator input 2 wire (gray/black).

Large multi-purpose indicator function		Operation of the large multi-purpose indicator
Large multi-purpose indicator input 1 (gray)	PNP output: Connect to +V NPN output: Connect to 0V	Lights up red
	Open	Turns OFF
Large multi-purpose indicator input 2 (gray/black)	PNP output: Connect to +V NPN output: Connect to 0V	Lights up green
	Open	Turns OFF

By wiring the large multi-purpose indicator input 1 wire (gray) and the large multi-purpose indicator input 2 wire (gray/black) to the auxiliary output wire (green/black) or the muting lamp output wire (red), the outputs operate accordingly.

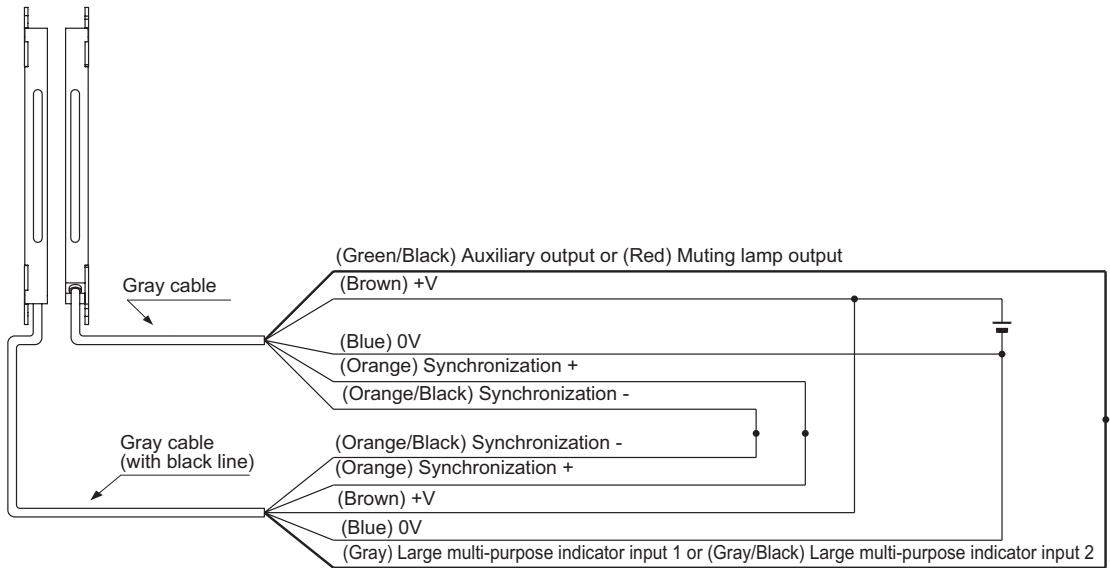
Large multi-purpose indicator function		Operation of the large multi-purpose indicator
Large multi-purpose indicator input 1 (gray)	Auxiliary output wire (green / black)	Lights up in red when the auxiliary output is ON Turns OFF when the auxiliary output is OFF
	Muting lamp output wire (red)	Lights up in red when the muting output is ON Turns OFF when the auxiliary output is OFF
	Open	Turns OFF
Large multi-purpose indicator input 2 (gray/black)	Auxiliary output wire (green / black)	Lights up in green when the auxiliary output is ON Turns OFF when the auxiliary output is OFF
	Muting lamp output wire (red)	Lights up in green when the muting output is ON Turns OFF when the auxiliary output is OFF
	Open	Turns OFF

It is possible to change the three operation modes of the large multi-purpose indicator (lights up, blinks or turns OFF) by using the handy controller SFC-HC (optional) see page 84.

3.5.1 Wiring Example of the Large Multi-Purpose Indicator

Wire the large multi-purpose indicator input 1 wire (gray) or the large multi-purpose indicator input 2 wire (gray/black) as follows.

If you use other lead wires than below perform the wiring depending on your application. For details, see "Wiring" on page 34.



3.6 Auxiliary Output (Non-Safety Output)

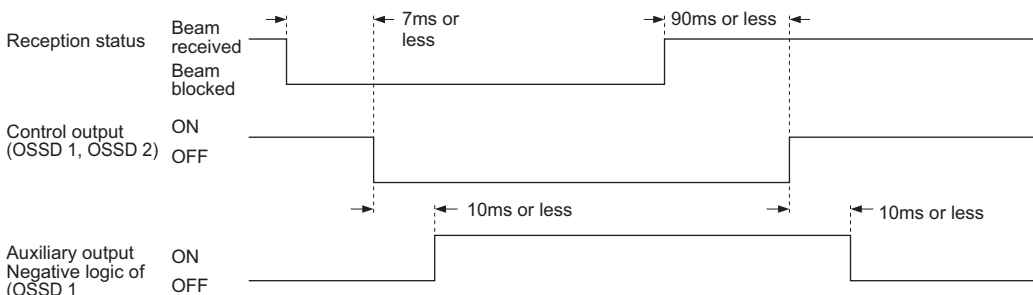
The SF4C is equipped with an auxiliary output for non-safety-related purposes. The auxiliary output is incorporated with the emitter.

Auxiliary output setting	Normal mode			Lockout
	Test input activated	Control output (OSSD 1, OSSD 2) status		
		Beam received	Beam blocked	
Negative logic of OSSD (factory setting)	ON	OFF	ON	ON



◆ NOTE

You can switch the output operation for auxiliary output with the handy controller.



Time diagram



DANGER!

Do not use the auxiliary output to stop the machine as this could result in serious injury or death.

3.7 External Device Monitor Function

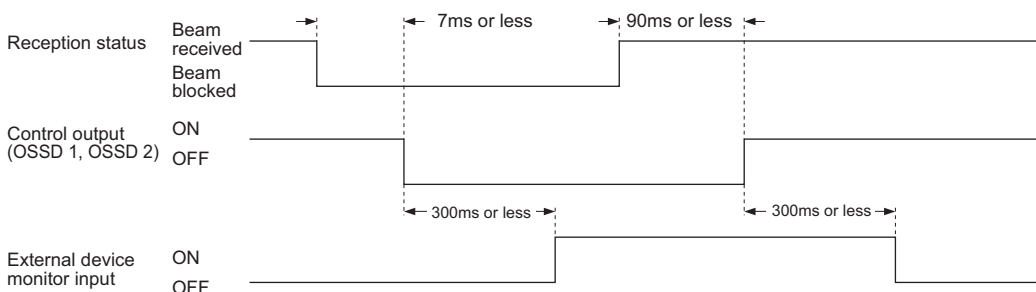
This is the function for checking whether the external safety relay connected to the control output (OSSD 1, OSSD 2) performs normally in accordance with the control output (OSSD 1, OSSD 2) or not. If any abnormality such as a deposit on the contacting point, etc. is detected, the status of the sensor changes to lockout and the control output (OSSD 1, OSSD 2) is turned off.

- When the external device monitor function is activated:**
 Connect the external device monitor input to the external safety relay of the control output (OSSD 1, OSSD 2).
- When the external device monitor function is deactivated:**
 Connect the external device monitor input to the auxiliary output. By default, the auxiliary output is set to negative logic of the control output (OSSD 1, OSSD 2). The setting can be changed with the handy controller. In this case, the auxiliary output cannot be connected to external devices.



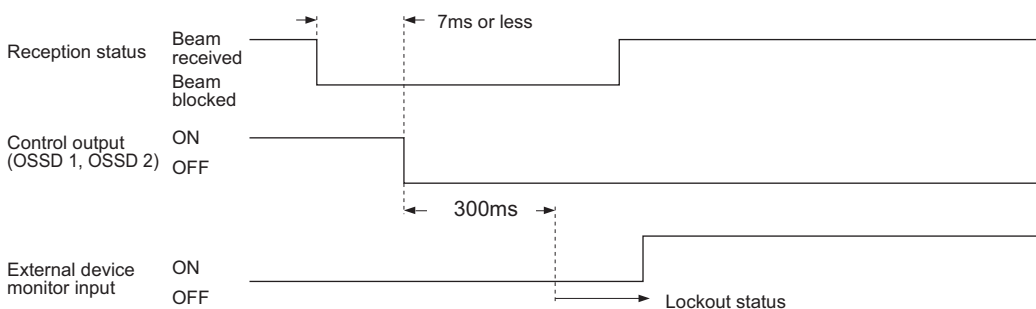
◆ NOTE

You can deactivate the external device monitor function or change the time range with the handy controller.

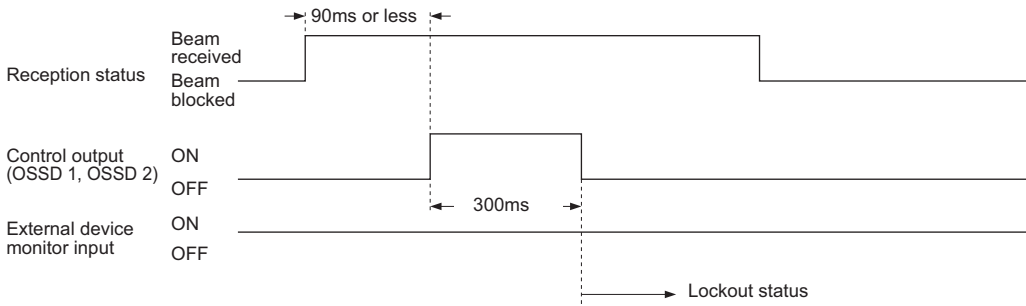


Time diagram - normal operation

The setting time of the device monitor is 300ms or less. Exceeding 300ms turns the device into the lockout status.



Time diagram - error 1



Time diagram - error 2

3.8 Muting Function



DANGER!

Incorrect use of the muting function may cause accidents. Please study the muting function carefully before you use it.

Use the muting function while the machine cycle is not in danger mode. Maintain safety by using other measures while the muting control is activated.

For applications where the muting function is used when a work piece passes through, place the muting sensors at such a distance so that personnel do not accidentally activate the muting function.

Be sure to check that the muting function is working properly before you use it in live operation. Check the state of the muting lamp for cleanliness, brightness, etc.

Always connect a muting lamp and use the preset muting lamp diagnosis function.

Install the muting lamp in a position where it can always be seen by operators who configure or adjust the machine.

The muting function deactivates the safety function of the light curtain temporarily. You can activate the muting function only if no workpiece is in the sensing area, this means the control outputs (OSSD 1, OSSD 2) have to be ON.

This function is useful for passing workpieces through the sensing area of the light curtain without stopping the machinery.

The muting function complies with the requirements defined in the following international standards:

- **ISO 13849-1 (EN 954-1/JIS B 9705-1): 'Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, Article 5.9 Muting'**
- **IEC 61496-1 (UL 61496/JIS B 9704-1): 'Safety of machinery - Electro sensitive protective equipment - Part 1: General requirements and tests' Annex A, A.7 Muting**
- **IEC 60204-1 (JIS B 9960-1): 'Safety of machinery - Electrical equipment of machines - Part 1: General requirements, 9.2.4 Overriding safeguards'**
- **EN 415-4: 'Safety of packaging machines part 4. Palletizers and depalletizers' Annex A, A2.2 Muting'**
- **ANSI B11.19-1990: 'for Machine Tools-Safeguarding When Referenced by the Other B11 Machine Tool Safety Standards-Performance Criteria for the Design, Construction, Care, and Operation' 4.2.3 Presence-Sensing Devices: Electro-Optical and Radio Frequency (R.F.)**

- **ANSI/RIA R15.06-1999: 'for Industrial Robots and Robot Systems - Safety Requirements, 10.4.5 Muting'**

The muting function is active when all the conditions listed below are satisfied:

- The control output (OSSD 1, OSSD 2) is ON.
- The safety output 1/2 is ON
- The time frame in which the muting input 1/2 switches from OFF to ON and vice versa should be between 0.03 to 3s.(Note 1)
- The incandescent lamp with 1.5 to 6W is connected to the muting lamp output. (The muting lamp diagnosis function is inactive at the time of factory setting.) (Note 2)



◆ NOTE

1. Only 0 to 3s is allowed if you connect the NO (Normally Open) type muting sensor to input 1 and the NC (Normally Closed) type muting sensor to input 2. For these settings you can use the handy controller SFC-HC (optional).
2. The muting lamp diagnosis function can be set with the handy controller SFC-HC (optional).
3. If the muting lamp diagnosis function is activated and the lamp is not connected or burnt out, the muting function becomes inactive.
4. Although the muting time at the factory setting has no limit, the muting time can be changed in units of 1s in the range of 1 to 600s by the handy controller SFC-HC (optional).
5. Photoelectric sensors with semiconductor output, inductive proximity sensors, position switches on NO (Normal Open) contacting point, etc. can be used as muting sensors.

3.8.1 Specification for the Muting Sensor

The muting sensors can be photoelectric sensors, inductive proximity sensors, or position switches etc. They have to be in the ON state if an object is sensed. For NPN output this means 0V, for PNP output +V.

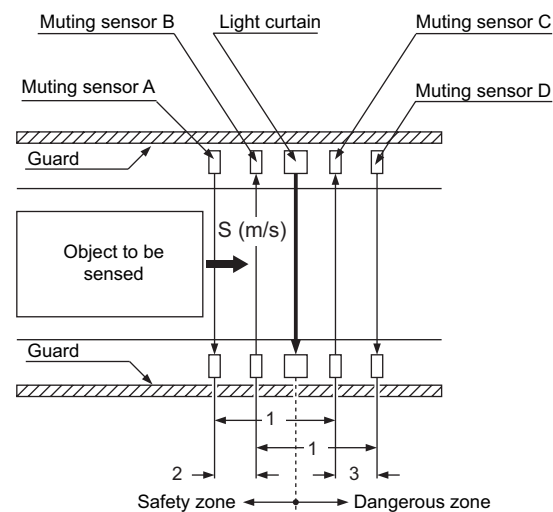


DANGER!

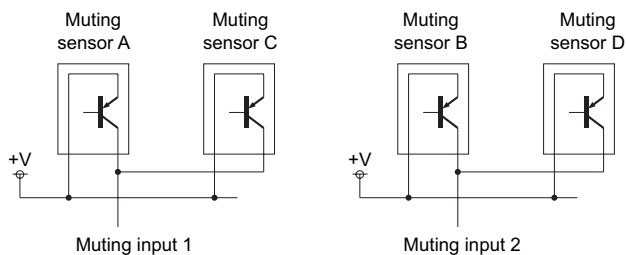
Only use a device that satisfies the specification for the muting sensor mentioned above. If you use a different device that does not meet the requirements of a muting sensor, the muting function may operate with a different timing than expected, which could result in serious injury or death.

Always connect a muting lamp to make the status of the function visible. It is forbidden to activate the muting function if no muting lamp is connected.

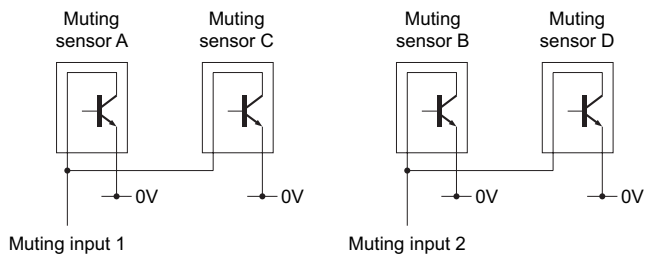
3.8.2 Installation of the Muting Sensor



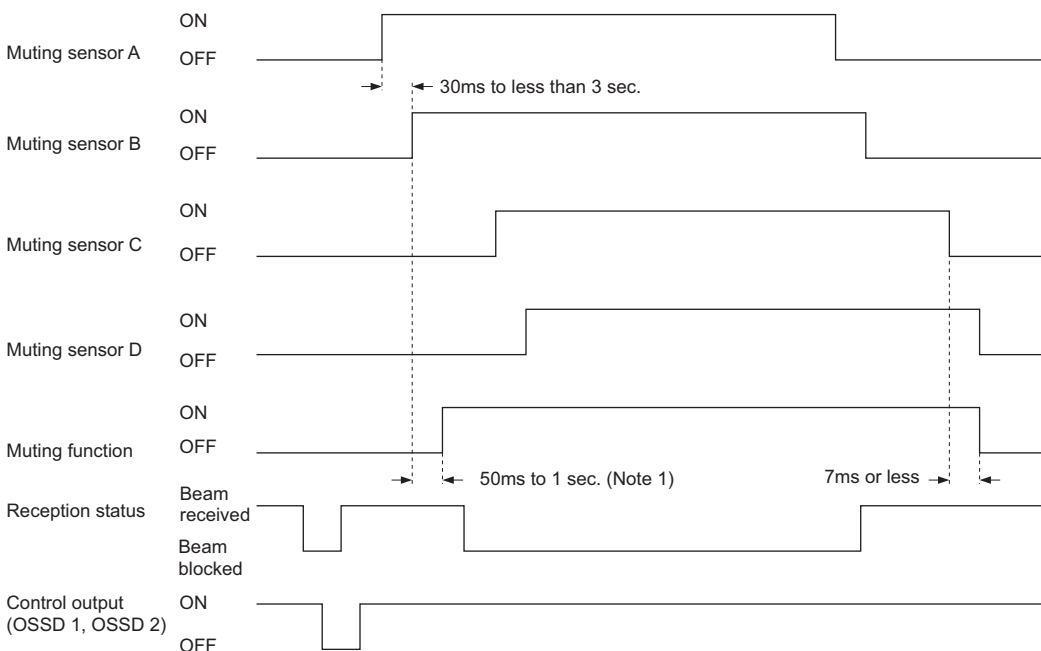
1. The distance between muting sensors A to C and between B to D must be shorter than the whole length of the object to be sensed.
2. The distance between muting sensors A to B has to be covered by the object to be sensed in 30ms to 3 seconds. ($S = \text{speed}$)
Distance between A and B: $S \times 3 \text{ (s)}$
3. The distance between muting sensors C to D has to be covered by the object to be sensed in less than 3 seconds.
Distance between C and D: $S \times 3 \text{ (s)}$



Installing the muting sensor with PNP output



Installing the muting sensor with NPN output



Time diagram of the muting function



◆ NOTE

- 1. When the diagnosis function for the muting lamp is active:** If the muting lamp does not light up after 1s, the muting function is deactivated.
When diagnosis function for the muting lamp is not active: The muting function is activated with a delay of 50ms after the input conditions of the muting sensor A (C) and B (D) are satisfied.
- 2. We recommend connecting two muting lamps in parallel. Do not exceed 6W.**

3.8.3 Installation Only for the Exit of the Object

With the handy controller version 2.0 the muting function can be set only for the exit of the object to be sensed. In this case install the muting sensors only in the dangerous zone; the installation in the safety zone is not required.

This kind of installation is only applicable if the following conditions are met:

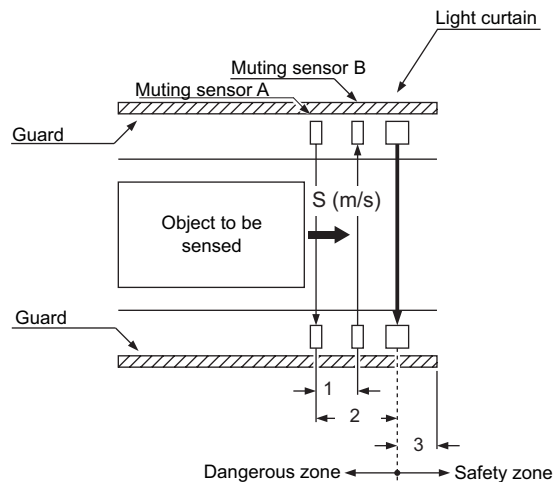
- The object to be sensed should move to one side.
- The object to be sensed should move from the dangerous zone to the safety zone.
- The object to be sensed should pass through the sensing area within 4 seconds after the muting sensor turns OFF. (Note)



◆ NOTE

The time setting can be done from 0 to 4s in steps of 0.1ms by the handy controller see page 84.

Installation example only for the exit of the object to be sensed



- | | |
|---|--|
| 1. The object to be sensed shall pass through the muting sensors A to B in 0.03 to 3s. | Distance between A and B: $S \times 3s$
S = Moving speed (m/s) of the object. |
| 2. The object to be sensed shall pass from muting sensor A to the light curtain in 4s or less. | Distance between muting sensor A and light curtain (m) B:
$S \times 4s$
Distance between muting sensor A and the light curtain < Total length of the object (m)
S = Moving speed (m/s) of the object. |
| 3. The object to be sensed shall pass from the safety light curtain to the end of the guard zone in 4s or less. | Distance between the light curtain and the end of the guard zone < $S \times 4s - 0.2$
S = Moving speed (m/s) of the object. |

**◆ NOTE**

The number of the necessary muting sensors between both installation types differs:

- **4 sets for the muting functions**
- **2 sets for the muting function used only for the exit of the object to be sensed.**

3.9 Override Function

This function enables you to override the machine stop signal and to enter the muting state. It is used to restart the system smoothly when the sequence of operations is incorrect or in case of power loss.

If this function is used, it forcibly deactivates the safety function of the light curtain. The override function is used when the muting function is active, something happened which stopped the operation (as described above) and the operation then needs to be restarted again with the control output (OSSD 1, OSSD 2) in OFF status (e.g. there is still some material in the detection field of this device which needs to be moved out of the detection field before the safety function can be reactivated).



DANGER!

Incorrect use of the muting function may cause accidents. Please study the muting function carefully before you use it.

Use the muting function while the machine cycle is not in danger mode. Maintain safety by using other measures while the muting control is activated.

For applications where the muting function is used when a work piece passes through, place the muting sensors at such a distance so that personnel do not accidentally activate the muting function.

Be sure to check that the muting function is working properly before you use it in live operation. Check the state of the muting lamp for cleanliness, brightness, etc.

Always connect a muting lamp and use the preset muting lamp diagnosis function.

Install the muting lamp in a position where it can always be seen by operators who configure or adjust the machine.

If you use the override function make sure that there is no operator in the dangerous zone, otherwise this could result in serious injury or death.



◆ NOTE

The muting function complies with the requirements defined in the following international standards:

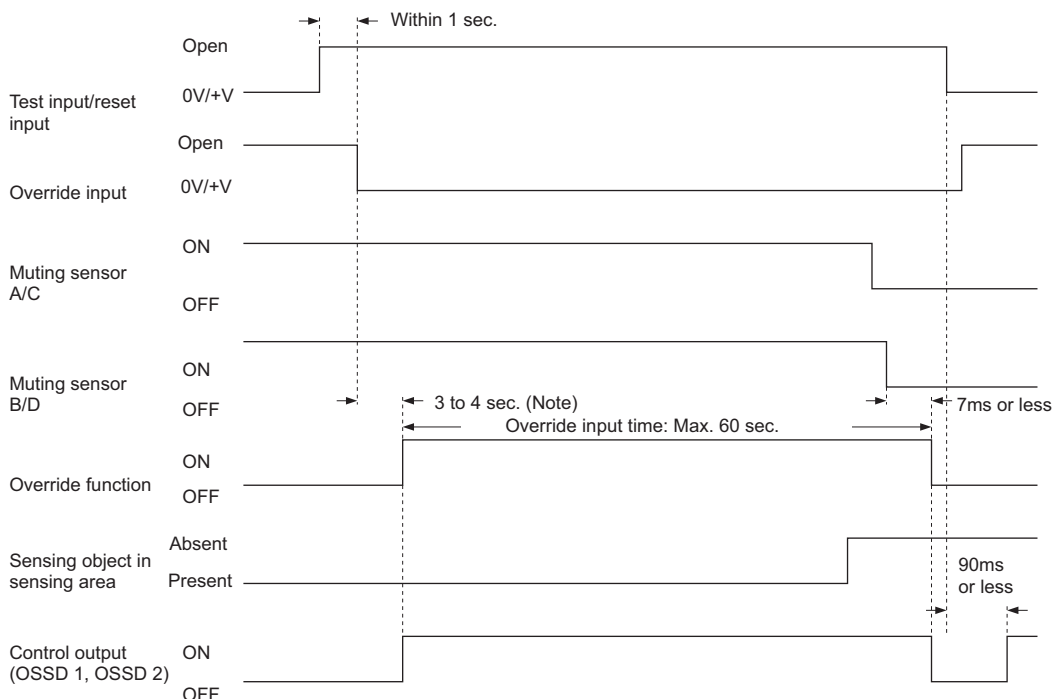
- ISO 13849-1 (EN 954-1/JIS B 9705-1): 'Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, Article 5.9 Muting'
- IEC 61496-1 (UL 61496/JIS B 9704-1): 'Safety of machinery - Electro sensitive protective equipment - Part 1: General requirements and tests' Annex A, A.7 Muting

- **IEC 60204-1 (JIS B 9960-1): 'Safety of machinery - Electrical equipment of machines - Part 1: General requirements, 9.2.4 Overriding safeguards'**
- **EN 415-4: 'Safety of packaging machines part 4. Palletizers and depalletizers' Annex A, A2.2 Muting'**
- **ANSI B11.19-1990: 'for Machine Tools-Safeguarding When Referenced by the Other B11 Machine Tool Safety Standards-Performance Criteria for the Design, Construction, Care, and Operation' 4.2.3 Presence-Sensing Devices: Electro-Optical and Radio Frequency (R.F.)**
- **ANSI/RIA R15.06-1999: 'for Industrial Robots and Robot Systems - Safety Requirements, 10.4.5 Muting'**

The override function is active when all the conditions listed below are satisfied:

- The safety output 1/2 is ON.
- The signal is input to either muting input 1 or 2 or to both of the inputs.
- The override input is connected to 0V (for NPN output) or +V (for PNP output), and the test input/reset input is opened (for 3 seconds).

If any of the three conditions above is not satisfied or takes longer than 60 seconds, the override function is deactivated.



Time diagram for the override function



◆ **NOTE**

- **When the diagnosis function for the muting lamp is active: If the muting lamp does not light up after 1s, the muting function is deactivated.**

- **When the diagnosis function for the muting lamp is inactive: The muting function starts 3s after the input conditions of the muting sensor A (C) and B (D) are satisfied.**

3.10 Functions of the Optional Handy Controller SFC-HC

You can set the following functions with the handy controller SFC-HC Ver. 2.0 (optional). For details, refer to the instruction manual enclosed with the handy controller.



DANGER!

Please note that the safety distance, the size of the minimum object to be sensed, the response speed, etc. may differ depending on the selected function. When you set each function, recalculate the safety distance and install the device at a distance larger than the safety distance. Not keeping the distance may result in a situation where the machine does not stop quickly enough, resulting in serious bodily injury or death.

Function	Details
Fixed blanking [Fixed blanking]	This function prevents the control output (OSSD 1, OSSD 2) from turning OFF even though the specific beam channel is blocked. By default, the fixed blanking function is not active. (Note 1)
Floating blanking [Floating blanking]	<p>This function prevents the control output (OSSD 1, OSSD 2) from turning OFF as long as not more than the set number of beam channels are blocked. The position of the blocked beam channels does not matter. You can set the floating blanking function for 1, 2, or 3 beam channels. By default, the floating blanking function is not active. (Note 1)</p> <p>If you use the muting function for the exit of the object to be sensed together with the floating blanking function at the same time, make sure that the following settings are true:</p> <p>The number of the beam channel for the floating blanking function can only be 0 or 1.</p> <p>If you used both end beam channels for the active floating blanking function, make sure that the muting function is also active for this both end beam channels.</p>
Auxiliary output switching (non-safety output) [Auxiliary output]	<p>The auxiliary output can be switched to execute the following functions:</p> <ol style="list-style-type: none"> 0. Negative logic of the control output (OSSD 1, OSSD 2) (factory setting) 1. Positive logic of the control output (OSSD 1, OSSD 2) 2. Active test input: output OFF; inactive test input: output ON 3. Active test input: output ON; inactive test input: output OFF 4. For unstable incident beam: OFF (Note 2) 5. For unstable incident beam: ON (Note 2) 6. For muting: ON 7. For muting: OFF 8. For beam reception: ON, for beam blocked: OFF (Note 3) 9. For beam reception: OFF, for beam blocked: ON (Note 3) 10. Active safety input: ON 11. Active safety input: OFF 12. For lock out: OFF 13. For lock out: ON
Muting setting [Muting]	<p>You can make the following settings for the muting function:</p> <ul style="list-style-type: none"> • You can activate the muting function per beam channel (Note 4). By default, the muting function is active for all beam channels. • The maximum continuous effective time for the muting function can be set within a range of 1 to 600s in steps of 1s or without limits. The factory setting is without limitation.

Function	Details
	<ul style="list-style-type: none"> The switching order of the muting sensor 1 and 2 can be set to define when the muting function shall become active. The factory setting is, that the muting function is active at whichever sensor switches first. If you use the function only for the exit of the object to be sensed you can define a time setting from 0 to 4s. The input operation of the muting input of the <SunxSF_Product> can be set with the SFC-HC: The factory setting is NONO (Normally Open, Normally Open), (Note 5).
Override setting [Safety input]	You can set the maximum time for the override function in the range of 1 to 600 seconds in steps of 1 second.
Muting lamp diagnosis [Muting]	The diagnosis function for the muting lamp can be active or inactive (Note 6). The factory setting is active.
Safety input setting [Safety input]	You can select between the safety contacting point input mode (factory setting) or the safety sensor input mode, to connect one of the both. Furthermore you can deactivate the function; then no safety contact or sensor can be connected. For further information see "Safety Input Function" on page 63.
Large multi-purpose inductor setting [Large multi-purpose indicator]	One mode can be selected from eight modes: The factory setting is mode 0. Furthermore it can be set to blink red in lock out status.
Interlock setting [Interlock]	<p>You can choose between three settings:</p> <p>Start/Restart interlock: The sensor goes into interlock state after the power is turned on or when the light is blocked. This is the factory setting.</p> <p>Start interlock: The sensor goes into interlock state when the power supply is turned on. Once this interlock state is reset, the SF4C does not go into the interlock state again.</p> <p>Restart interlock: The sensor does not go into the interlock state when the power supply is turned on. Only when the control output (OSSD 1, OSSD 2) turns ON and the light is blocked, the sensor goes into the interlock state.</p>
External device monitor setting [Device monitor]	You can make the following settings for the external device monitor: Permissible response time: 100 to 600ms (unit: 10ms). The factory setting is 300ms. The external device monitor function can be active or inactive. The factory setting is active.
Password protection [Sub-protect Monitor]	When this function is active, you need to enter the password to change the settings of the sensor. The factory setting is inactive.



◆ NOTE

- The fixed blanking function and floating blanking function can be set at the same time.**
- The auxiliary output cannot be used when the functions fixed blanking, floating blanking or muting are activated.**
- Functions 8 and 9 cannot be used when you have activated one of the following functions: fixed blanking, floating blanking, and muting.**

4. If a beam channel is blocked that is not set during the muting function, the muting function will be deactivated and the control output (OSSD 1, OSSD 2) is turned off.
5. The factory setting for the input operation is NONO (Normally Open, Normally Open). You can set the input operation to NONC (Normally Open, Normally Closed). Connect a sensor or switch with an output operation of NO (Normally Open) to muting input 1 and a sensor or switch with an output operation of NC (Normally Closed) to muting input 2. To activate the muting function, the time between the muting input 1 turning ON from OFF (= open state) and the muting input 2 turning OFF (= open state) from ON must be no longer than 3 seconds. The output operation for NONC works as follows:

	Muting input	Operation at ON state	Operation at OFF state
NO (Normally Open) type: <ul style="list-style-type: none"> • ON when no light is received (photoelectric sensor, etc.) • ON when object is approaching (inductive proximity sensor, etc.) • ON when object has contact (position switch, etc.) 	1	0V or 24V DC	Open
NC (Normally Closed) type: <ul style="list-style-type: none"> • ON when light is received (photoelectric sensor, etc.) • ON when no object is approaching (inductive proximity sensor, etc.) • ON when no object has contact (position switch, etc.) 	2		

6. If the muting lamp diagnosis function is inactive, the muting function is maintained even if a lamp blows or a lamp is not connected.

Chapter 4

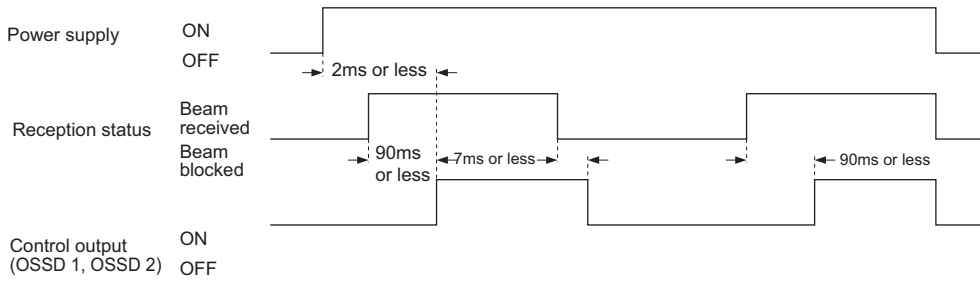
Operation

4.1 Normal Operation

The status of the emitter/receiver indicators during normal operation is as described as follows.

Indicator symbol	Explanation
	Blinks red
	Lights up red
	Lights up orange
	Lights up green
	Turns off

Reception state	Indicators				Control output (OSSD 1, OSSD 2)	
	Emitter		Receiver			
All beams received	FAULT PNP NPN TEST S1 S2	 	STB A B C D OSSD RECEPTION	FAULT PNP NPN FUNCTION INTERLOCK MU1 MU2 	STB A B C D OSSD RECEPTION	ON
One or more beams blocked	FAULT PNP NPN TEST S1 S2	 	STB A B C D OSSD RECEPTION	FAULT PNP NPN FUNCTION INTERLOCK MU1 MU2 	STB A B C D OSSD RECEPTION	OFF
Only top end blocked	FAULT PNP NPN TEST S1 S2	 	STB A B C D OSSD RECEPTION	FAULT PNP NPN FUNCTION INTERLOCK MU1 MU2 	STB A B C D OSSD RECEPTION	OFF
Only bottom end blocked	FAULT PNP NPN TEST S1 S2	 	STB A B C D OSSD RECEPTION	FAULT PNP NPN FUNCTION INTERLOCK MU1 MU2 	STB A B C D OSSD RECEPTION	OFF



Time diagram



◆ NOTE

1. The figure shows the status of the emitter/receiver indicators during operation when you are using a PNP output. When you are using an NPN output, the NPN indicator lights up orange.
2. Since the color of the operation indicator changes according to whether the control outputs (OSSD 1, OSSD 2) are ON or OFF, the operation indicator on the light curtain is marked 'OSSD'.

4.2 Using the Test Input Function

The safety light curtain incorporates the test input function. With this function you can simulate the status when the beam is blocked.

Indicator symbol	Explanation
	Lights up red
	Lights up orange
	Lights up green
	Turns off

Setting procedure		Indicators				Control output (OSSD 1, OSSD 2)		
		Emitter		Receiver				
1	Before the power is on connect the test input to Vs (Note 1)	FAULT <input type="checkbox"/> PNP <input type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input type="checkbox"/> S2 <input type="checkbox"/>	 	<input type="checkbox"/> STB <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D RECEPTION	FAULT <input type="checkbox"/> PNP <input type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 	<input type="checkbox"/> STB <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D RECEPTION <input type="checkbox"/> OSSD	OFF
2	After the power is on the control output (OSSD 1/2) of the receiver is on (normal operation). (Note 2)	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 	<input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 	<input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	ON
3	Open the test input/reset input to switch the receiver's control output (OSSD 1/2) to off. (Note 3)	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input checked="" type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 	<input type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 	<input type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	OFF
4	Connect the test input/reset input to Vs (Note 1) to switch the receivers control output back to on (normal operation). (Note 2)	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 	<input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 	<input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D RECEPTION <input checked="" type="checkbox"/> OSSD	ON



◆ NOTE





1. Vs is the applied supply voltage.























































- 2. The figure shows the status of the emitter/receiver indicators during operation when you are using a PNP output. When you are using an NPN output, the NPN indicator lights up orange.**
- 3. Since the color of the operation indicator changes according to whether the control outputs (OSSD 1, OSSD 2) are ON or OFF, the operation indicator on the light curtain is marked 'OSSD'.**

4.3 When an Error Occurs

If a sensor error is detected, the sensor will turn the control output (OSSD 1, OSSD 2) OFF. Then the digital error indicator (red) on the receiver lights up and the fault indicator (yellow) on the emitter and receiver lights up or blinks.

- If an emitter error is detected, the emitter will be locked out, stopping its emission, and the control output (OSSD 1, OSSD 2) will be turned OFF.
- If a receiver error is detected, the receiver will be locked out, and the control output (OSSD 1, OSSD 2) will be turned OFF. Also, the test input indicator (orange) of the emitter lights up.

Indicator symbol	Explanation
	Blinks yellow
	Lights up orange
	Lights up green
	Turns off

Setting procedure	Indicators		Control output (OSSD 1, OSSD 2)		
	Emitter	Receiver			
Normal state (Note 1 and 2)	FAULT  PNP  NPN  TEST  S1  S2  	 STB  A  B  C  D RECEPTION  OSSD	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2  	 STB  A  B  C  D RECEPTION  OSSD	ON
Error state (Note 1 and 2)	FAULT  PNP  NPN  TEST  S1  S2  	 STB  A  B  C  D RECEPTION  OSSD	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2  	 STB  A  B  C  D RECEPTION  OSSD	OFF






◆ NOTE

















































































































1. The figure shows the status of the emitter/receiver indicators during operation when you are using a PNP output. When you are using an NPN output, the NPN indicator lights up orange.
2. Since the color of the operation indicator changes according to whether the control outputs (OSSD 1, OSSD 2) are ON or OFF, the operation indicator on the light curtain is marked 'OSSD'.
3. To remove the source of the error (see page 103).

4.4 Using the Muting Input Function

The muting function deactivates the safety function of the light curtain temporarily. You can activate the muting function only if no work piece is in the sensing area, this means the control outputs (OSSD 1, OSSD 2) have to be ON.

This function is useful for passing work pieces through the sensing area of the light curtain without stopping the machinery.

Indicator symbol	Explanation
	Lights up orange
	Lights up green
	Turns off

Setting procedure	Indicators				Control output (OSSD 1, OSSD 2)		
	Emitter		Receiver				
The muting sensor is OFF (Note 1, 2)	FAULT  PNP  NPN  TEST  S1  S2 	 	 STB  A  B  C  D RECEPTION	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2 	 	 STB  A  B  C  D RECEPTION  OSSD	ON
Muting sensor is ON Muting input 1: ON Muting input 2: ON	FAULT  PNP  NPN  TEST  S1  S2 	 	 STB  A  B  C  D RECEPTION	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2 	 	 STB  A  B  C  D RECEPTION  OSSD	ON
Muting sensor is ON Muting input 1: ON Muting input 2: OFF	FAULT  PNP  NPN  TEST  S1  S2 	 	 STB  A  B  C  D RECEPTION	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2 	 	 STB  A  B  C  D RECEPTION  OSSD	ON
Muting sensor is ON Muting input 1: OFF Muting input 2: ON	FAULT  PNP  NPN  TEST  S1  S2 	 	 STB  A  B  C  D RECEPTION	FAULT  PNP  NPN  FUNCTION  INTERLOCK  MU1  MU2 	 	 STB  A  B  C  D RECEPTION  OSSD	ON



◆ NOTE

1. The figure shows the status of the emitter/receiver indicators during operation when you are using a PNP output. When you are using an NPN output, the NPN indicator lights up orange.

- 2. Since the color of the operation indicator changes according to whether the control outputs (OSSD 1, OSSD 2) are ON or OFF, the operation indicator on the light curtain is marked 'OSSD'.**

4.5 Using the Safety Input Function



As safety sensor, use a sensor which incorporates a crossover short-circuit function in the control output and connect both the safety input 1 wire (gray) and the safety input 2 wire (gray/black). If only one wire is connected, the device may not operate normally.

The safety light curtain incorporates the safety input function. This function controls the control output (OSSD1/2) of this device by receiving the detection signal of a safety contacting point which is connected to the safety input 1 or 2.

Indicator symbol	Explanation
	Lights up red
	Lights up orange
	Lights up green
	Turns off

Setting procedure	Indicators				Control output (OSSD 1, OSSD 2)		
	Emitter		Receiver				
Safety input ON (Note 1)	FAULT <input type="checkbox"/> PNP <input type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input type="checkbox"/> S2 <input type="checkbox"/>	 <input type="checkbox"/> STB <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	FAULT <input type="checkbox"/> PNP <input type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 <input type="checkbox"/> STB <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	ON
Safety input OFF (Note 2)	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 <input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 <input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	OFF
Safety input error Safety input 1: Connected Safety input 2: Not connected	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input checked="" type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 <input type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 <input type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	OFF
Safety input error Safety input 1: Not connected Safety input 2: Connected	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> TEST <input type="checkbox"/> S1 <input checked="" type="checkbox"/> S2 <input checked="" type="checkbox"/>	 <input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	FAULT <input type="checkbox"/> PNP <input checked="" type="checkbox"/> NPN <input type="checkbox"/> FUNCTION <input type="checkbox"/> INTERLOCK <input type="checkbox"/> MU1 <input type="checkbox"/> MU2 <input type="checkbox"/>	 <input checked="" type="checkbox"/> STB <input checked="" type="checkbox"/> A <input checked="" type="checkbox"/> B <input checked="" type="checkbox"/> C <input checked="" type="checkbox"/> D <input checked="" type="checkbox"/> OSSD	RECEPTION RECEPTION RECEPTION RECEPTION	OFF

**◆ NOTE**

1. The figure shows the status of the emitter/receiver indicators during operation when you are using a PNP output. When you are using an NPN output, the NPN indicator lights up orange.
2. Since the color of the operation indicator changes according to whether the control outputs (OSSD 1, OSSD 2) are ON or OFF, the operation indicator on the light curtain is marked 'OSSD'.

Chapter 5

Maintenance

5.1 Daily Inspection List

If there is a problem with the wiring or when you need to evaluate the system before you add further equipment, place two or more sets of emitters and receivers facing each other without series or parallel connection between them. Perform an operation test (see page 56).

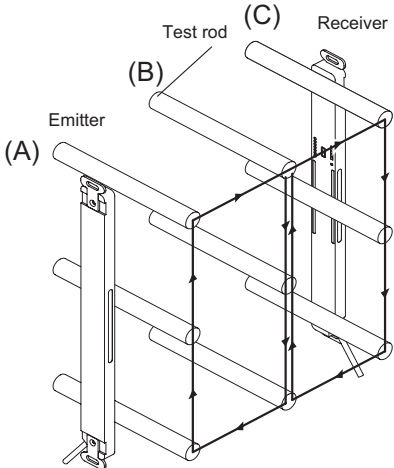


DANGER!

Improper sensor placement could cause the sensor to malfunction, which may result in serious injury or death.

If the SF4C is used in multiple sets, arrange them so that mutual interference is avoided. If mutual interference occurs, it can result in serious injury or death.

Check column	Inspection item
<input type="checkbox"/>	Dangerous parts of the machine cannot be reached without passing through the sensing area of SF4C.
<input type="checkbox"/>	Some part of the operator's body remains in the sensing area when the operator is working 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"/>	There is no dirt or scratches on the light emitting surface.
<input type="checkbox"/>	The test rod is not deformed or defective.
<input type="checkbox"/>	The operation indicator (green) of the emitter and the OSSD indicator (green) of the receiver light up when there is no object present in the sensing area. The control output (OSSD 1, OSSD 2) is in ON status. At this time, the effect of external noise can be inspected. In case external noise affects the operation, remove its cause and repeat the inspection.
<input type="checkbox"/>	The test rod (Ø25mm) for SF4C moving 1.600mm/s can be detected at three positions: <ul style="list-style-type: none"> • Directly in front of the emitter (A), • Midway between the emitter and the receiver (B) • Directly in front of the receiver (C). The OSSD indicator (red) of the receiver and the operation indicator (red) of the emitter continue to light up as long as the test rod is present in the sensing area from (A) to (C).

	
<input type="checkbox"/>	<p>With the machine in operating condition, the dangerous parts operate normally when no object is present in the sensing area.</p>
<input type="checkbox"/>	<p>With the machine in 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).</p>
<input type="checkbox"/>	<p>The dangerous parts remain stopped as long as the test rod is present in the sensing area.</p>
<input type="checkbox"/>	<p>The dangerous parts stop immediately when the power supply of this device is turned OFF.</p>
<input type="checkbox"/>	<p>The control output (OSSD 1, OSSD 2) must turn OFF when the test input/reset input wire (pink) is open (for manual reset: connected to 0V, +V). At this time, the effect of external noise can be inspected. In case external noise affects the operation, remove its cause and repeat the inspection.</p>
<input type="checkbox"/>	<p>Be sure to check the operation of the muting function before using it. Check the state of the muting lamp (cleanliness, brightness, etc.)</p>

5.2 Periodic Inspection Checklist (Every Six Months)



DANGER!

Be sure to inspect the following items every six months and confirm that there is no error. Operating the SF4C without inspection or in an error condition can result in serious injury or death.

Check column	Inspection item
<input type="checkbox"/>	The structure of the machine does not obstruct any of the safety mechanisms designed for stopping the operation.
<input type="checkbox"/>	No modification has been made in the machine controls which obstructs the safety mechanisms.
<input type="checkbox"/>	The output of the SF4C is detected correctly.
<input type="checkbox"/>	The wiring from the SF4C is correct.
<input type="checkbox"/>	The overall response time of the complete machine is equal to 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 the SF4C are loose.
<input type="checkbox"/>	No extraneous light source or reflective object has been added near the SF4C.

5.3 Inspection after Maintenance

In the following situations, inspect all items mentioned in Daily Inspection Checklist (see page 98) and Periodic Inspection Checklist (Every Six Months) (see page 100).

- When any part of this device needs to be replaced.
- When abnormalities occur during operation.
- When you perform beam-axis alignment of the emitter and receiver.
- When the installation place or environment of this device is changed.
- When the wiring method or wiring layout is changed.
- When FSD (Final Switching Device) parts are replaced.
- When FSD (Final Switching Device) settings are changed.

Chapter 6

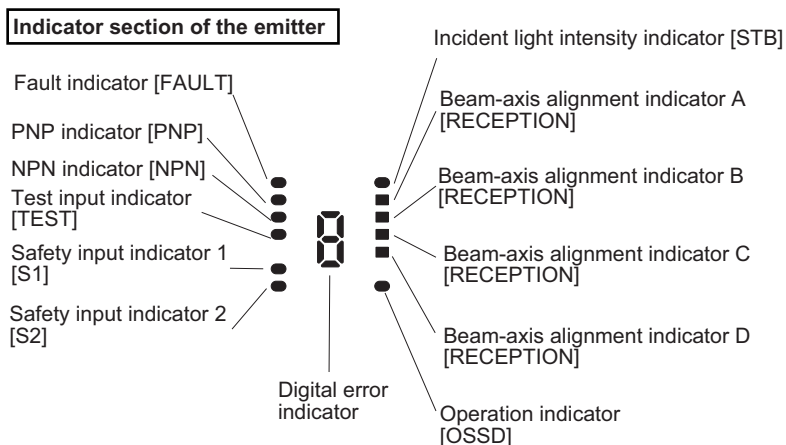
Troubleshooting

6.1 Emitter-Related Problems

When a problem occurs, please check the following items first:

- Check the wiring.
- Check the power supply voltage and the power supply capacity.
- If the SF4C does not work normally after checking the items listed below, please consult your local dealer.

6.1.1 Indicator Section of the Emitter



6.1.2 All Indicators Are OFF

Cause	Remedy
No power.	Check that the power supply capacity is sufficient. Connect the power supply correctly.
Supply voltage is outside the specified range.	Set the supply voltage correctly.
Connector is not connected securely.	Connect the connector securely.

6.1.3 Digital Error Indicator (Red) Lights Up or Blinks

Error	Cause	Remedy
[Digital error indicator: 0] Error in the setting data of SF4C	Noise is outside the specified range.	Check the noise status around this device.
	Internal error	Replace this device.
[Digital error indicator: 3] System error between emitter and receiver	Different types of emitter and receiver have been connected	Only pair up emitters and receivers of the same type, i.e. with the same number of beam channels.

Error	Cause	Remedy
[Digital error indicator: 4] Interlock setting error	The voltage of the interlock setting input wire (pale purple) or test input/reset input wire (pink) is unstable.	Wire the interlock setting wire (pale purple) and test input/reset input wire (pink) correctly. For details "Wiring" on page 34.
[Digital error indicator: 5] Safety input crossover short-circuit	The safety input 1 wire (gray) or the safety input 2 wire (gray/black) is connected to 0V/+V	Wire the safety input 1 wire (gray) or the safety input 2 wire (gray/black) correctly. Make sure there is no damage at the safety contacting point.
[Digital error indicator: 6] Wiring error of the output polarity setting wire (shield)	<ul style="list-style-type: none"> The output polarity setting wire (shield) comes down or short-circuits with other I/O wires. The output polarity setting wire (shield) connection of the emitter/receiver is incorrect. 	Wire the wire output polarity setting (shield) correctly. (0V: PNP output, +V: NPN output)
[Digital error indicator: 7] Safety input error	The safety input 1 (gray) or safety input 2 (gray/black) is not correctly wired.	Wire the safety input 1 (gray) and the safety input 2 (gray/black) correctly. For details, "Wiring" on page 34 and "Safety Input Function" on page 63 .
[Digital error indicator: 8] Supply voltage error	The specified voltage is not supplied.	Check the wiring status, the supply voltage, and the power supply capacity.
[Digital error indicator: 9] Muting lamp error	<p>Muting lamp output is short-circuited with +V or 0V.</p> <p>Muting lamp output is short-circuited with other I/O wires.</p> <p>Excessive current flows at the muting lamp output.</p> <p>The output polarity setting wire (shield) and the muting lamp output (red) are not correctly wired.</p> <p>Output circuit error.</p>	<p>Wire the muting lamp correctly, for details "Wiring" on page 34.</p> <p>The current value should be within the specified range for muting lamp output.</p> <p>Wire the output polarity setting wire (shield) correctly. (0V: PNP output, +V: NPN output)</p> <p>Wire the muting lamp output wire (red) to +V.</p> <p>For details "Wiring" on page 34</p> <p>The output circuit is damaged. Replace this device.</p>

Error	Cause	Remedy
[Digital error indicator: F] Effect from noise/power supply or failure of internal circuit	Affected by noise. The internal circuit is broken.	Check the noise status of this device. If the error cannot be solved, contact our sales office.
[Digital error indicator: r] Receiver error	The receiver is in lockout state.	Check the error indicator (yellow) of the receiver.

6.1.4 Setting Indicator Lights Up

The following problems can cause the digital error indicator ϵ to light up:

Error	Cause	Remedy
Synchronization wire error	Synchronization wire is short-circuited or disconnected.	Connect the synchronization wire properly.
Receiver error		Check whether the receiver side works properly.

6.1.5 Test input Indicator (Orange) Lights Up

Error	Cause	Remedy
The SF4C is in the test input condition. (Device error or interlock setting error)	Error indicator (yellow) lights up or blinks.	Check the contents of the digital error indicator.
	The test input/reset input wire (pink) is open when selecting auto-reset.	Wire the test input/reset input wire (pink) to 0V or +V "Wiring" on page 34.
	Test input/reset input wire is connected to +V or 0V at the time when manual reset is activated.	Open the test input/reset input "Wiring" on page 34.

6.1.6 Operation Indicator Remains Lit in Red

When the operation indicator remains lit in red, it means that no light is received.

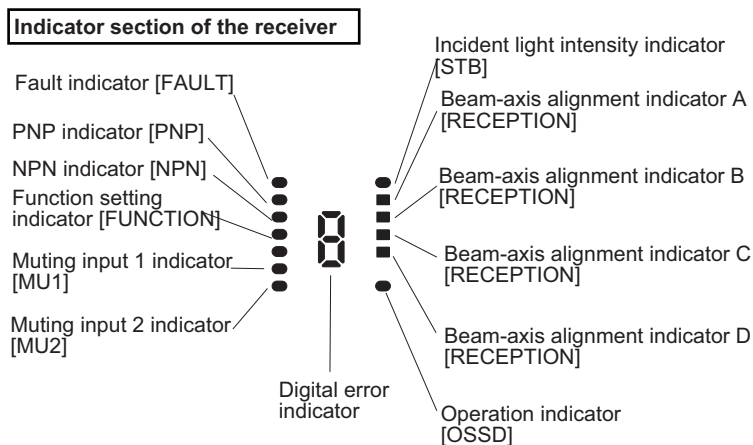
Cause	Remedy
The beam channels are not correctly aligned.	Align the beam channels properly, especially the top and bottom ends between emitter and receiver.

6.2 Receiver-Related Problems

When a problem occurs, please check the following items first:

- Check the wiring.
- Check the power supply voltage and the power supply capacity.
- If the device does not work normally after checking the items listed below, please consult your local dealer.

6.2.1 Indicator Section of the Receiver



6.2.2 All Indicators Are OFF

Cause	Remedy
No power.	Check that the power supply capacity is sufficient. Connect the power supply correctly.
Supply voltage is outside the specified range.	Set the supply voltage correctly.
Connector is not connected securely.	Connect the connector securely.

6.2.3 Setting Indicator "C" Lights Up

The following problems can cause the digital error indicator ϵ to light up:

Error	Cause	Remedy
Synchronization wire error	Synchronization wire is short-circuited or disconnected.	Connect the synchronization wire properly.
Emitter error		Check whether the emitter side works properly.

6.2.4 Fault Indicator (Yellow) Lights up or Blinks

Error	Cause	Remedy	
[Digital error indicator: 0] Error in the setting data of SF4C	Noise is outside the specified range.	Check the noise status around this device.	
	Internal error	Replace this device.	
[Digital error indicator: 3] System error between emitter and receiver	Different types of emitter and receiver have been connected	Only pair up emitters and receivers of the same type, i.e. with the same number of beam channels.	
[Digital error indicator: 4] Extraneous light error	Extraneous light is entering or light from other model is entering.	When the power is on, prevent any extraneous light from entering the receiver, if the extraneous light is coming from other models see "Device Placement" on page 22.	
[Digital error indicator: 5] Control output (OSSD1/2) data error	Control output 1 (OSSD 1) wire (black) or control output 2 (OSSD 2) wire (white) is short-circuited.	Wire the control output 1 (OSSD 1) wire (black) and the control output 2 (OSSD 2) (white) correctly. The current value for the control outputs should be within the specified range "Wiring" on page 34.	
	Control output 1 (OSSD 1) wire (black) or control output 2 (OSSD 2) wire (white) is not correctly wired or is wired with other I/O wires.		
	Excessive incoming current flows in control output 1 (OSSD 1) wire (black) or control output 2 (OSSD 2) wire (white).		
	The output polarity setting wire (shield), the control output 2 (OSSD 2) wire (white) is not correctly wired.	Wire the output polarity setting wire (shield) correctly. (0V: PNP, +V: NPN output) Wire the output polarity setting wire (shield) of the receiver correctly "Wiring" on page 34.	
	Output circuit error.	The output circuit is damaged. Replace this device.	
[Digital error indicator: 6] Wiring error of the output polarity setting wire (shield)	<ul style="list-style-type: none"> The output polarity setting wire (shield) comes down or short-circuits with other I/O wires. The output polarity setting wire (shield) connection of the emitter/receiver is incorrect. 	Wire the wire output polarity setting (shield) correctly. (0V: PNP output, +V: NPN output)	
[Digital error indicator: 7] External device error	When using the safety relay	Relay contact is welded.	Replace the relay.
		Response time of the relay is slow.	Replace the relay with a proper response time (see page 73).
		Contact point "b" of the relay is not wired.	Wire the contact point correctly.

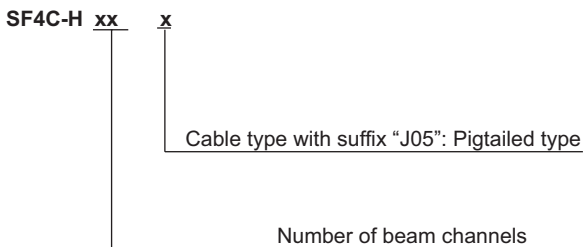
Error	Cause		Remedy
	The external device monitor function is active	The auxiliary output wire (green/black) and the external device monitor input wire (green) are not wired.	Connect the auxiliary output wire (green/black) and the external device monitor input wire (green).
		The auxiliary output wire is not correctly operated.	Check if the auxiliary output wire is disconnected or short-circuited.
[Digital error indicator: 8] Supply voltage error	The specified voltage is not supplied.		Check the wiring status, the supply voltage, and the power supply capacity.
[Digital error indicator: 5] Emitter error	The emitter is in lockout state.		Check the error indicator (yellow) of the emitter.
[Digital error indicator: F] Effect from noise/power supply or failure of internal circuit	Affected by noise. The internal circuit is broken.		Check the noise status of this device. If the error cannot be solved, contact SUNX.

Chapter 7

Specifications and Dimensions

7.1 Specifications by Model Numbers

The model nos. contain information about the cable type and the number of beam channels:



◆ EXAMPLE

The model number SF4C-H32-J05 represents the type with 32 beam channels and a pigtailed connector type cable.

The specifications listed hereafter are sorted by cable type and number of beam channels in ascending order.

7.1.1 Model Numbers SF4C-Hxx<V2> with 20mm Beam Pitch

		SF4C-H8	SF4C-H12	SF4C-H16	SF4C-H20
No. of beam channels		8	12	16	20
Sensing height		160mm	240mm	320mm	400mm
Current consumption	Large multi-purpose indicator OFF	Emitter: 70mA or less Receiver 85mA or less	Emitter: 70mA or less Receiver: 90mA or less		Emitter: 70mA or less Receiver : 95mA or less
	Large multi-purpose indicator ON	Emitter: 120mA or less Receiver: 135mA or less	Emitter: 120mA or less Receiver: 140mA or less		Emitter: 120mA or less Receiver: 145mA or less
PFHd*		1.66 x 10 ⁻⁹	1.90 x 10 ⁻⁹	2.10 x 10 ⁻⁹	2.33 x 10 ⁻⁹
MTTFd*		More than 100 years			
Weight (emitter and receiver together)		630g approx.	700g approx.	760g approx.	820g approx.
		SF4C-H24	SF4C-H28	SF4C-H32	
No. of beam channels		24	28	32	
Sensing height		480mm	560mm	640mm	
Current consumption	Large multi-purpose indicator OFF	Emitter: 70mA or less Receiver: 95mA or less	Emitter: 70mA or less Receiver: 100mA or less		

		SF4C-H24	SF4C-H28	SF4C-H32
	Large multi-purpose indicator ON	Emitter: 120mA or less Receiver: 145mA or less	Emitter: 120mA or less Receiver: 150mA or less	
PFHd [*]		2.54 x 10 ⁻⁹	2.77 x 10 ⁻⁹	2.89 x 10 ⁻⁹
MTTFd [*]		More than 100 years		
Weight (emitter and receiver together)		880g approx.	950g approx.	1000g approx.

* PFHd: Probability of dangerous failure per hour, MTTFd: Mean time to dangerous failure

7.1.2 Model Numbers SF4C-Hxx with Pigtailed Type

		SF4C-H8-J05	SF4C-H12-J05	SF4C-H16-J05	SF4C-H20-J05
No. of beam channels		8	12	16	20
Sensing height		160mm	240mm	320mm	400mm
Current consumption	Large multi-purpose indicator OFF	Emitter: 70mA or less Receiver: 85mA or less	Emitter: 70mA or less Receiver: 90mA or less		Emitter: 70mA or less Receiver: 95mA or less
	Large multi-purpose indicator ON	Emitter: 120mA or less Receiver: 135mA or less	Emitter: 120mA or less Receiver: 140mA or less		Emitter: 120mA or less Receiver: 145mA or less
PFHd [*]		1.66 x 10 ⁻⁹	1.90 x 10 ⁻⁹	2.10 x 10 ⁻⁹	2.33 x 10 ⁻⁹
MTTFd [*]		More than 100 years			
Weight (emitter and receiver together)		240g approx.	300g approx.	360g approx.	420g approx.

		SF4C-H24-J05	SF4C-H28-J05	SF4C-H32-J05
No. of beam channels		24	28	32
Sensing height		480mm	560mm	640mm
Current consumption	Large multi-purpose indicator OFF	Emitter: 70mA or less Receiver: 95mA or less	Emitter: 70mA or less Receiver: 100mA or less	
	Large multi-purpose indicator ON	Emitter: 120mA or less Receiver: 145mA or less	Emitter: 120mA or less Receiver: 150mA or less	
PFHd [*]		2.54 x 10 ⁻⁹	2.77 x 10 ⁻⁹	2.89 x 10 ⁻⁹
MTTFd [*]		More than 100 years		
Weight (emitter and receiver together)		490g approx.	550g approx.	610g approx.

* PFHd: Probability of dangerous failure per hour, MTTFd: Mean time to dangerous failure

7.2 Common Specifications

	Type	Cable type	Pigtailed type
	Model No.	SF4C-H-□	SF4C-H-□-J05
Sensing range	0,1 to 3m		
Beam pitch	20mm		
Detecting capability (Min. object to be sensed)	Ø25mm opaque object		
Effective aperture angle (EAA)	±2.5° or less for sensing range exceeding 3m (required by IEC 61496-2/UL 61496-2)		
Supply voltage	24V DC $\begin{matrix} +10 \\ -15 \end{matrix}$ %. Ripple P-P 10% or less		
Control output (OSSD 1, OSSD 2)	<p>PNP open-collector transistor/NPN open-collector transistor (switching type)</p> <ul style="list-style-type: none"> • For PNP output: Max. source current 200mA • For NPN output: Max. sink current 200mA <p>Applied voltage: same as supply voltage (for PNP output: between the control output (OSSD 1/2) and +V, for NPN output between the control output (OSSD 1/2) and 0V).</p> <ul style="list-style-type: none"> • Residual voltage: 2.5V or less (For PNP output: source current 200mA, for NPN output: sink current 200mA) (when using 10m length cable) • Leakage current: 200µA or less, when power supply is OFF • Maximum load capacity: 1µF (no load to maximum output current) • Load wiring resistance: 3Ω or less • Operation mode: ON when all beams are received, OFF when one or more beams are interrupted (Note 1, 2), OFF when fault occurs in the sensor or the synchronization signal error, too. • Protection circuit: Incorporated 		
Response time	In normal operation: OFF: 7ms or less, ON: 90ms or less		
Auxiliary output (Non-safety output)	<p>PNP open-collector transistor/NPN open-collector transistor (switching type)</p> <ul style="list-style-type: none"> • For PNP output: Max. source current 100mA • For NPN output: Max. sink current 100mA <p>Applied voltage: same as supply voltage (for PNP output: between the auxiliary output and +V, for NPN output between the auxiliary output and 0V)</p> <ul style="list-style-type: none"> • Residual voltage: 2.5V or less (In case of selecting PNP output: source current 100mA, in case of selecting NPN output: sink current 100mA) (when using 10m length cable) • Operation mode: When OSSDs are ON: OFF, When OSSDs are OFF: ON (factory setting). This setting can be changed with the optional handy controller SFC-HC. • Protection circuit: Incorporated 		

	Type	Cable type	Pigtailed type
	Model No.	SF4C-H-□	SF4C-H-□-J05
Degree of protection	IP65 and IP67 (IEC)		
Degree of pollution	3		
Ambient temperature	-10 to +55°C (No dew condensation or icing allowed), storage: -25 to +60°C		
Ambient humidity	30 to 85% RH, storage: 30 to 95% RH		
Allowed ambient light	Incandescent lamp: 5,000lx or less at the light-receiving surface		
Operating altitude	2,000m or less		
Withstand voltage	1,000V AC for one min. (between all supply terminals connected together and enclosure)		
Insulation resistance	20MΩ or more with 500V DC (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 ² acceleration (30G approx.) in X, Y, and Z directions for three times each		
Emitting element	Infrared LED (Peak emission wavelength: 855nm)		
Connection method	Connection with connectors		
Cable	0.15mm ² 12-core heat resistant PVC cable, 5m long	0.15mm ² 12-core heat-resistant PVC cable with connector, 0.5m long	
Cable extension	An extension up to a total of 40.5m is possible for cables with a strength of 0.2mm ² or more (note 3)		
Material	Enclosure: Polycarbonate alloy Sensing surface: Polycarbonate alloy MS-SFC-1 (standard mounting bracket): stainless steel		
Accessory	MS-SFC-1 (Standard mounting bracket): 1 set SF4C-TR25 (test rod): 1 pc.		
Applicable standard	EN 61496-1 (Type 4), EN 55011, EN 61000-6-2, EN50178, EN ISO 13849-1: 2006 (Category 4, PL _e), IEC 61496-1/2 (Type 4), ISO 13849-1: 2006 (Category 4, PL _e), IEC 61508-1 to 7 (SIL3), JIS B 9704-1/2 (Type 4), JIS B 9705-1 (Category 4), JIS C 0508 (SIL3), ANSI/UL 508, UL 1998 (Class 2)		



◆ NOTE

1. The beam channel is not turned OFF during muting even if it is blocked.
2. When the blanking function is activated, the operation mode is changed.
3. When the muting lamp is used, the cable can be extended up to 30.5m (for emitter/receiver).

**DANGER!**

The functions of this device can be set with the optional handy controller SFC-HC. Please note that the safety distance, the size of the minimum object to be sensed, the response speed, etc. may differ depending on the function. When you set each function, recalculate the safety distance and install the device at a distance larger than the safety distance. Not keeping the distance may result in a situation where the machine does not stop quickly enough, resulting in serious bodily injury or death.

**◆ NOTE**

- You can use the handy controller SFC-HC (optional) to set the functions (see page 84).
- Both emitter and receiver are adjusted before shipment; please use the emitter and receiver with the same serial number together. The serial number is indicated on the plates of both emitter and receiver. The last five digits under the model is the serial number.

7.3 Options

The following options are available:

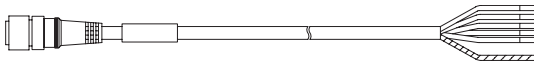
- Different types of cables (see page 117)
- Different types of brackets (see page 118)
- Protective metal case
- Handy controller
- Test rod

7.3.1 Cables

Various cables are available.

7.3.1.1 Extension Cable with Connector on One End

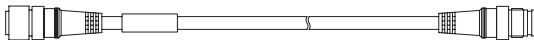
12-core extension cable. You receive 2 pieces/set, one for the emitter (gray connector) and one for the receiver (black connector).



Model No.	Cable length	Remarks
SFB-CC3-MU	3m	Used for wiring. The connector is attached on one end of the cable and the other end is discrete wire. For emitter: Gray connector, 12-core shield cable For receiver: Black connector, 12-core-shield cable
SFB-CC7-MU	7m	
SFB-CC10-MU	10m	

7.3.1.2 Extension Cable with Connectors on Both Ends

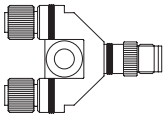
You receive 1 piece.

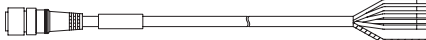


Model No.	Cable length	Remarks
SFB-CCJ10E-MU	10m	Used for extending cable. The connectors are attached on both ends of the cable. For emitter: Gray connector, 12-core shield cable For receiver: Black connector, 12-core shield cable
SFB-CCJ10D-MU		

7.3.1.3 Y-Type Connector

You receive 1 piece.



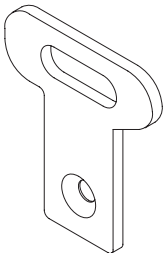
Model No.	Remarks
SFC-WY1	<p>This is a connector which can organize the emitter and receiver cables of the intermediate connector type of the light curtain SF4C-H□-J05. When connecting to the control unit SF-C13 or a safety PLC, it is allowed to connect as wire-saving.</p> <p>Use it with one of the cables shown below:</p> <p>Cable with the connector on one end WY1-CCN3, WY1-CCN10: 1 pc.</p> 

7.3.2 Brackets

The following brackets are available.

7.3.2.1 Standard Mounting Bracket MS-SFC-1

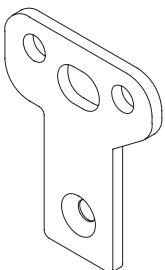
You receive 4 pieces/set.



Model No.	Remarks
MS-SFC-1	Fix it with one hexagon-socket head bolt [M5].

7.3.2.2 NA2_N Compatible Mounting Bracket

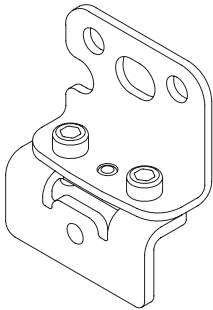
You receive 4 pieces/set.



Model No.	Remarks
MS-SFC-2	Fix it with two M4 screws and one hexagon-socket head bolt [M6]

7.3.2.3 Multifunctional Mounting Bracket MS-SFC-3

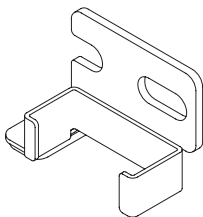
You receive 4 pieces/set.



Model No.	Remarks
MS-SFC-3	Use this mounting bracket to adjust the beam axis or to avoid dead spaces. Fix it with hexagon-socket head bolts [M5] or two hexagon-socket head bolts [M3].

7.3.2.4 Mounting Bracket MS-SFC-4

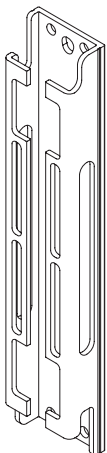
You receive 2 pieces/set.



Model No.	Remarks
MS-SFC-4	Use this bracket to prevent bounce when using multifunctional mounting bracket MS-SFC-3 (optional). When mounting the multifunctional bracket MS-SFC-3 (optional) to SF4C-H28-□ or SF4C-H32-□, you must use it.

7.3.3 Protective Metal Case

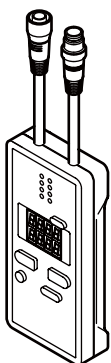
You receive 1 piece.



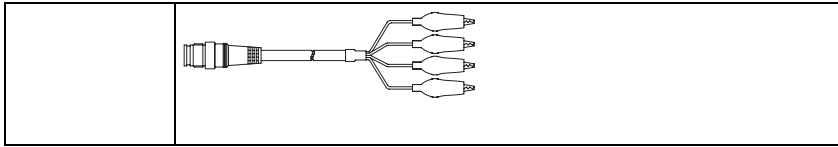
Model No.	Applicable model		Remarks
MS-SFCH-8	SF4C-H8	SF4C-H8-J05	Protect this device from shocks and vibrations
MS-SFCH-12	SF4C-H12	SF4C-H12-J05	
MS-SFCH-16	SF4C-H16	SF4C-H16-J05	
MS-SFCH-20	SF4C-H20	SF4C-H20-J05	
MS-SFCH-24	SF4C-H24	SF4C-H24-J05	
MS-SFCH-28	SF4C-H28	SF4C-H28-J05	
MS-SFCH-32	SF4C-H32	SF4C-H32-J05	

7.3.4 Handy Controller

You receive 1 piece.

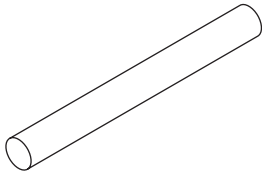


Model No.	Remarks
SFC-HC	Handy controller for setting each function. If you use a cable type SF4C-H□, the cable shown below is useful. Cable with connector on one end: SFC-WNC1: You receive 1 piece.



7.3.5 Test Rod

You receive 1 piece.



Model No.	Remarks
SF4C-TR25	Use the test rod when applying the floating blanking function $\varnothing 25\text{mm}$.

Chapter 8

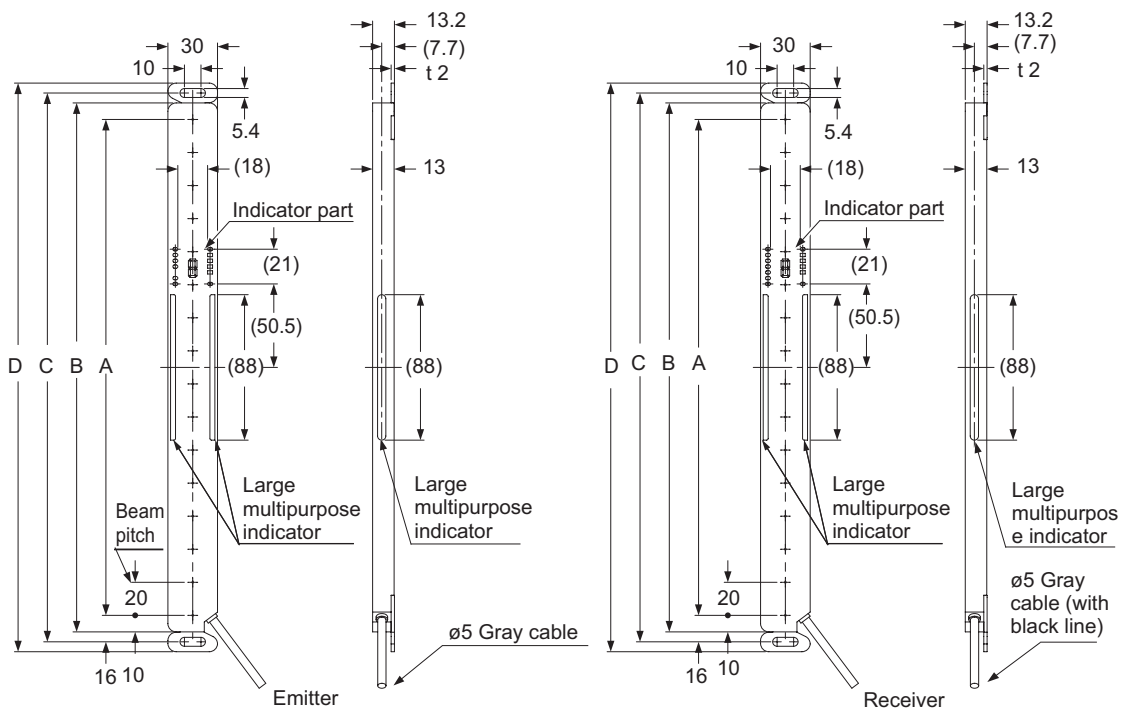
Dimensions

8.1 Mounting Dimensions

The following dimension diagrams show the centered mounting and the mounting without dead zone with the standard mounting bracket and the multifunctional mounting bracket as well as the mounting of the protective metal case.

8.1.1 Centered Mounting with Standard Mounting Brackets

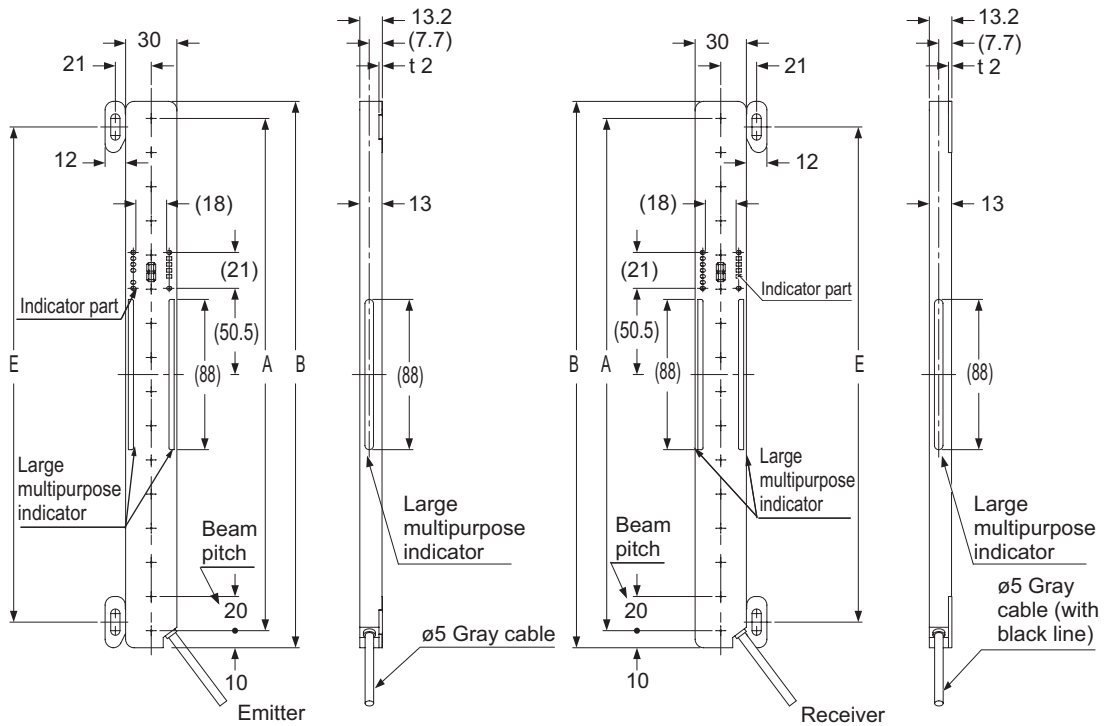
Unit: mm



Model No.		A	B	C	D
SF4C-H8	SF4C-H8-J05	140	160	172	184
SF4C-H12	SF4C-H12-J05	220	240	252	264
SF4C-H16	SF4C-H16-J05	300	320	332	344
SF4C-H20	SF4C-H20-J05	380	400	412	424
SF4C-H24	SF4C-H24-J05	460	480	492	504
SF4C-H28	SF4C-H28-J05	540	560	572	584
SF4C-H32	SF4C-H32-J05	620	640	652	664

8.1.2 Standard Mounting Bracket without Dead Space

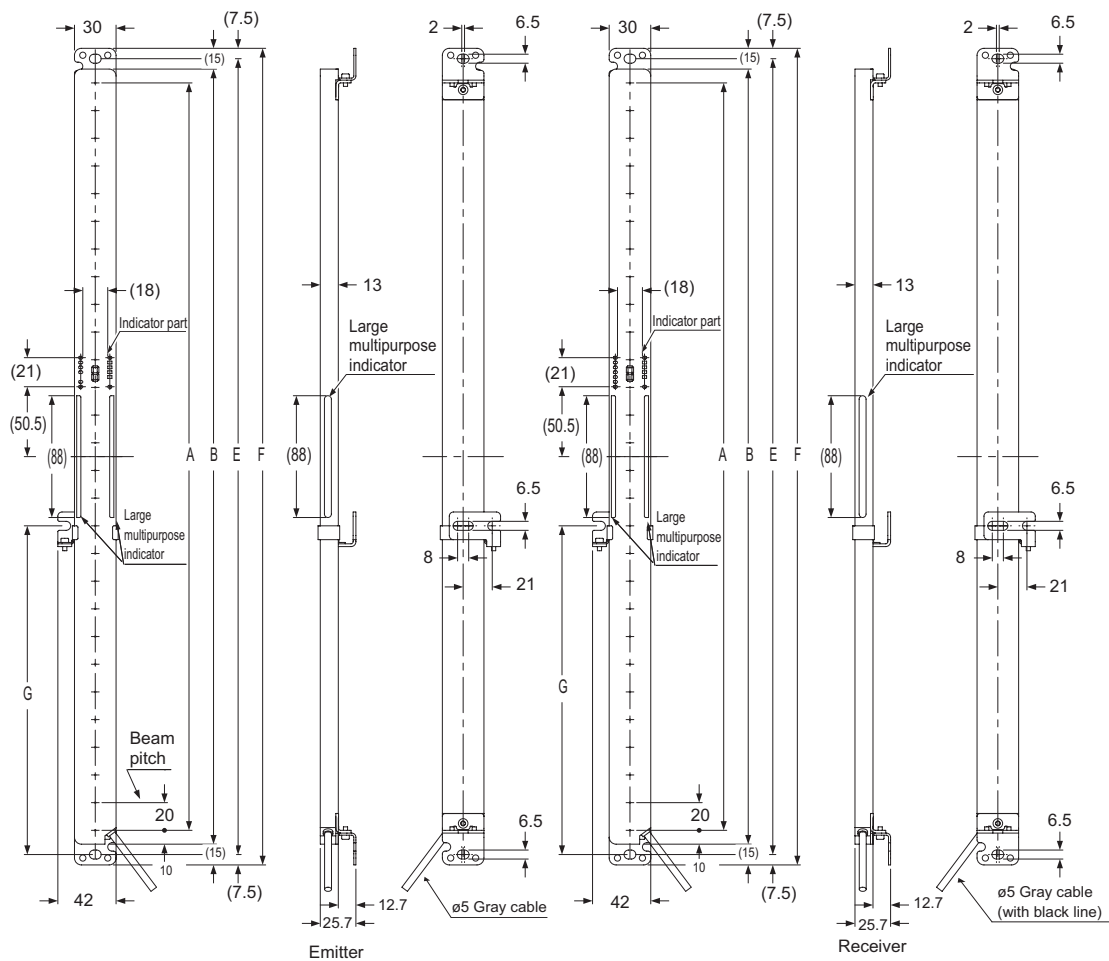
Unit: mm



Model No.		A	B	E
SF4C-H8	SF4C-H8-J05	140	160	130
SF4C-H12	SF4C-H12-J05	220	240	210
SF4C-H16	SF4C-H16-J05	300	320	290
SF4C-H20	SF4C-H20-J05	380	400	370
SF4C-H24	SF4C-H24-J05	460	480	450
SF4C-H28	SF4C-H28-J05	540	560	530
SF4C-H32	SF4C-H32-J05	620	640	610

8.1.3 Multifunctional Mounting Bracket

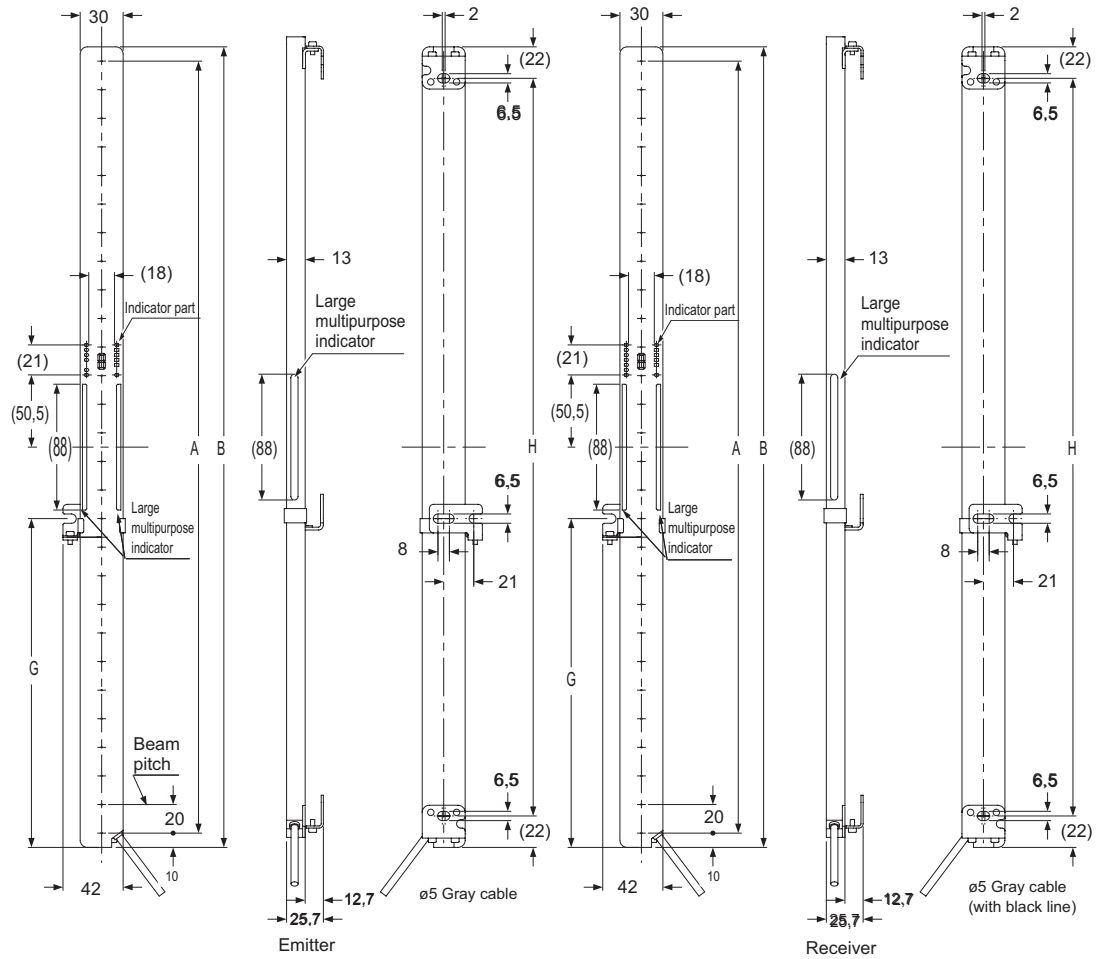
Unit: mm



Model No.		A	B	E	F	G
SF4C-H8	SF4C-H8-J05	140	160	175	190	–
SF4C-H12	SF4C-H12-J05	220	240	255	270	–
SF4C-H15	SF4C-H16-J05	300	320	335	350	–
SF4C-H20	SF4C-H20-J05	380	400	415	430	–
SF4C-H24	SF4C-H24-J05	460	480	495	510	–
SF4C-H28	SF4C-H28-J05	540	560	575	590	238/338
SF4C-H32	SF4C-H32-J05	620	640	655	670	278/378

8.1.4 Multifunctional Mounting Bracket without dead zone

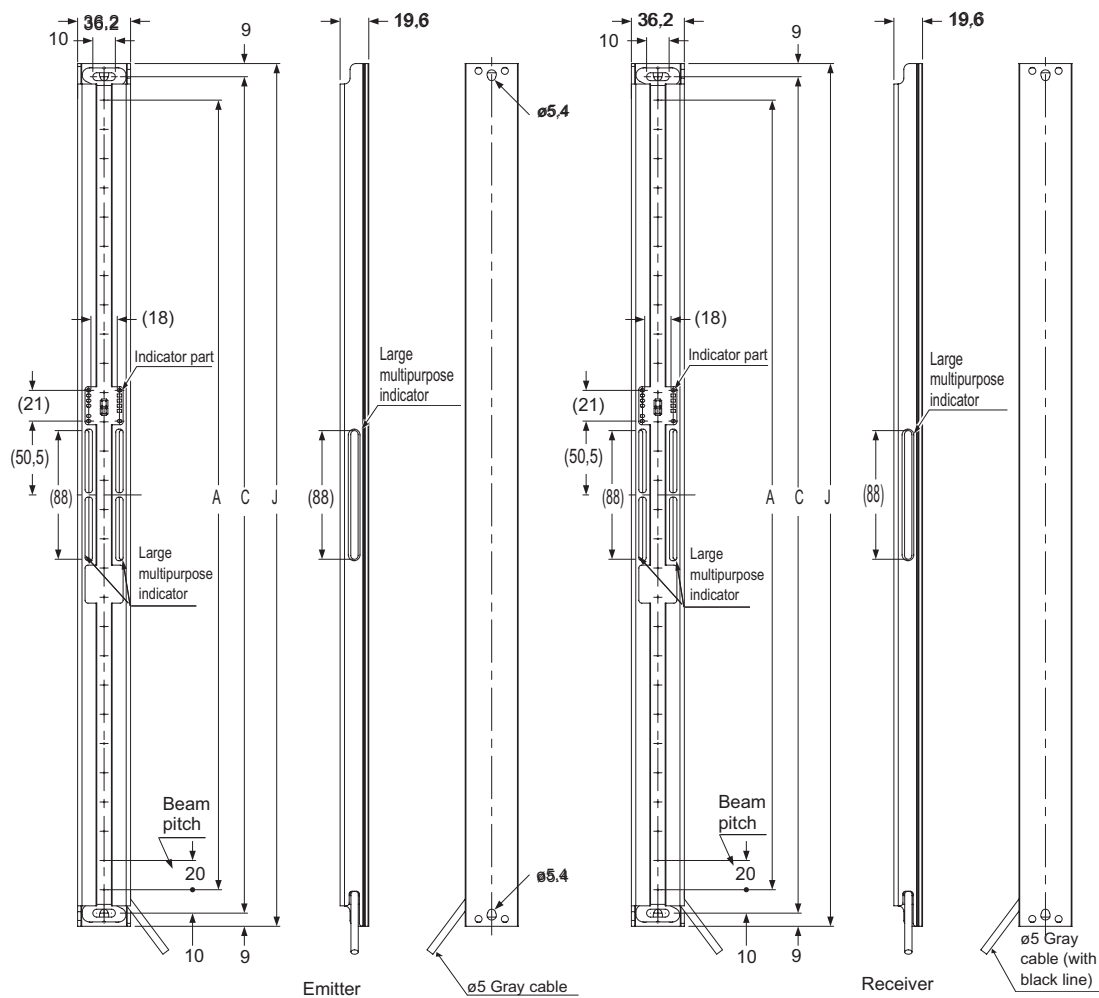
Unit: mm



Model No.		A	B	G	H
SF4C-H8	SF4C-H8-J05	140	160	-	116
SF4C-H12	SF4C-H12-J05	220	240	-	196
SF4C-H16	SF4C-H16-J05	300	320	-	276
SF4C-H20	SF4C-H20-J05	380	400	-	356
SF4C-H24	SF4C-H24-J05	460	480	-	436
SF4C-H28	SF4C-H28-J05	540	560	238/338	516
SF4C-H32	SF4C-H32-J05	620	640	278/378	596

8.1.5 Mounting of the Protective Metal Case

Unit: mm

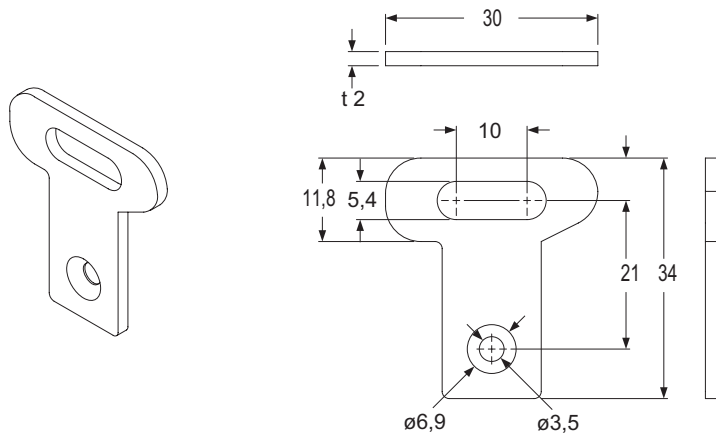


Model No.		A	C	J
SF4C-H8	SF4C-H8-J05	140	172	190
SF4C-H12	SF4C-H12-J05	220	252	270
SF4C-H16	SF4C-H16-J05	300	332	350
SF4C-H20	SF4C-H20-J05	380	412	430
SF4C-H24	SF4C-H24-J05	460	492	510
SF4C-H28	SF4C-H28-J05	540	572	590
SF4C-H32	SF4C-H32-J05	620	652	670

8.2 Mounting Brackets

8.2.1 Standard Mounting Bracket MS-SFC-1

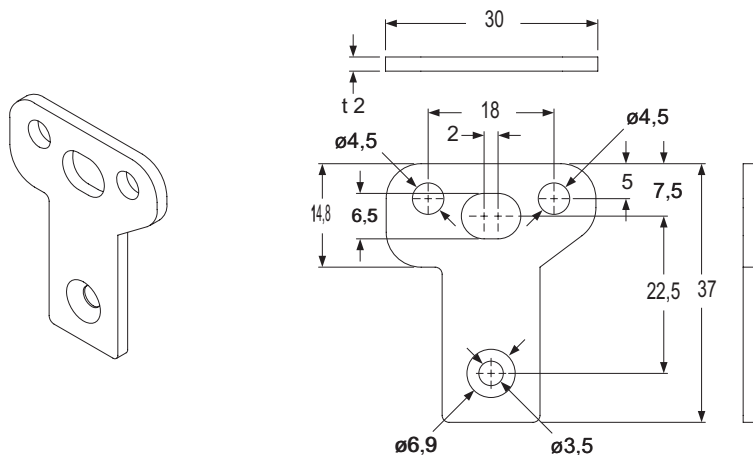
Unit: mm



Material: Stainless steel

8.2.2 Mounting Bracket MS-SFC-2

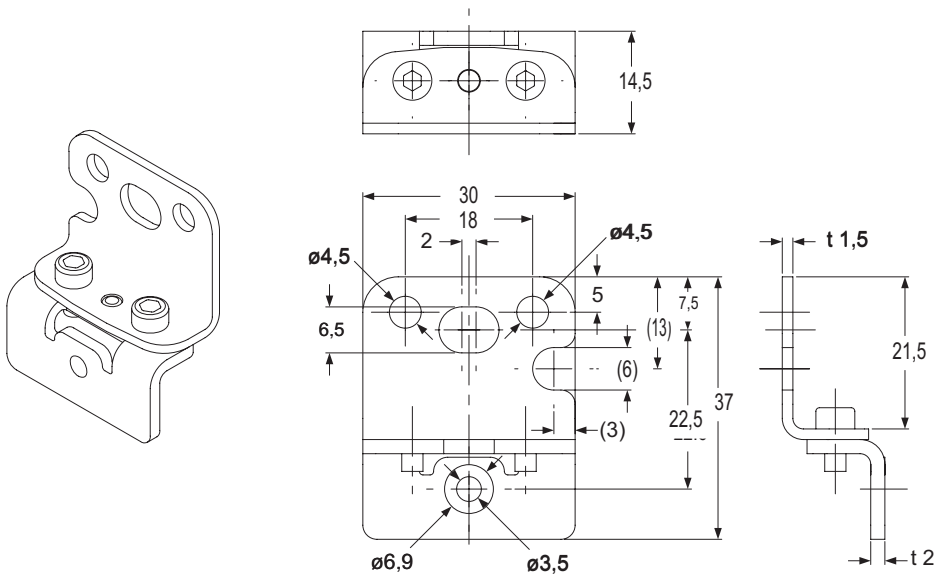
Unit: mm



Material: Stainless steel

8.2.3 Multifunctional Mounting Bracket MS-SFC-3

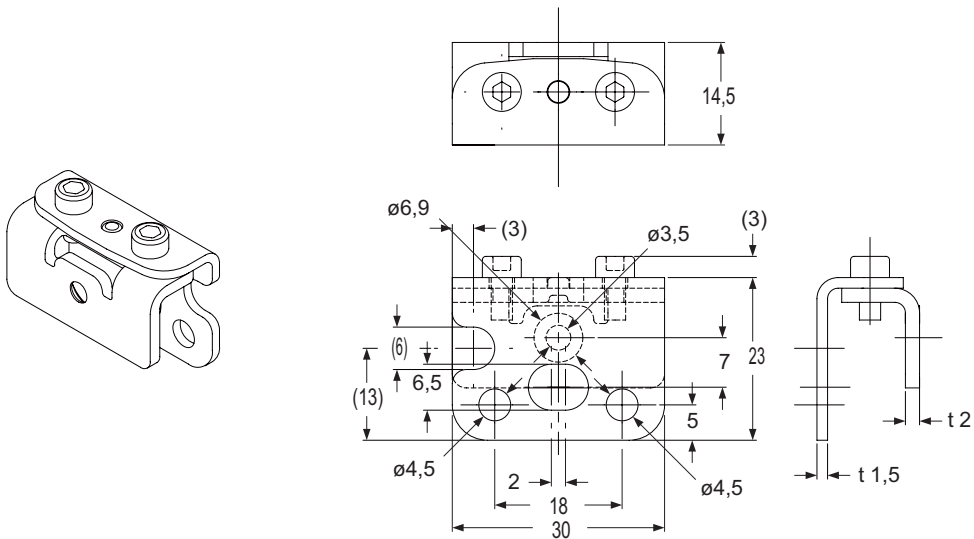
Unit: mm



Material: Stainless steel

8.2.4 Multifunctional Mounting Bracket MS-SFC-3 (without Dead Zone)

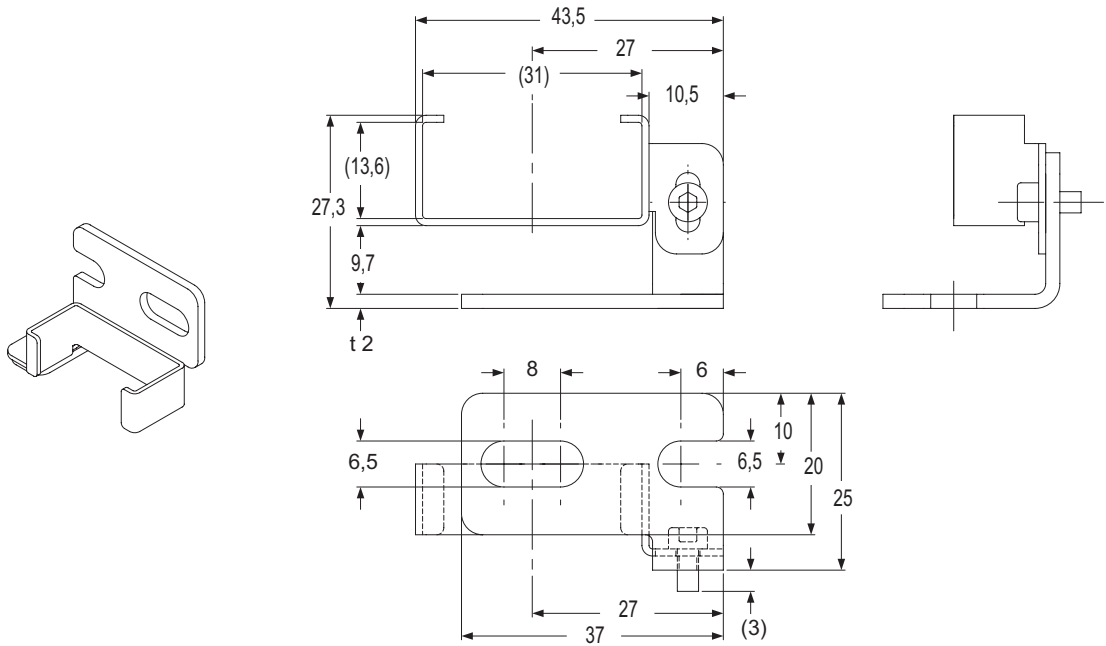
Unit: mm



Material: Stainless steel

8.2.5 Multifunctional Intermediate Supporting Bracket MS-SFC-4

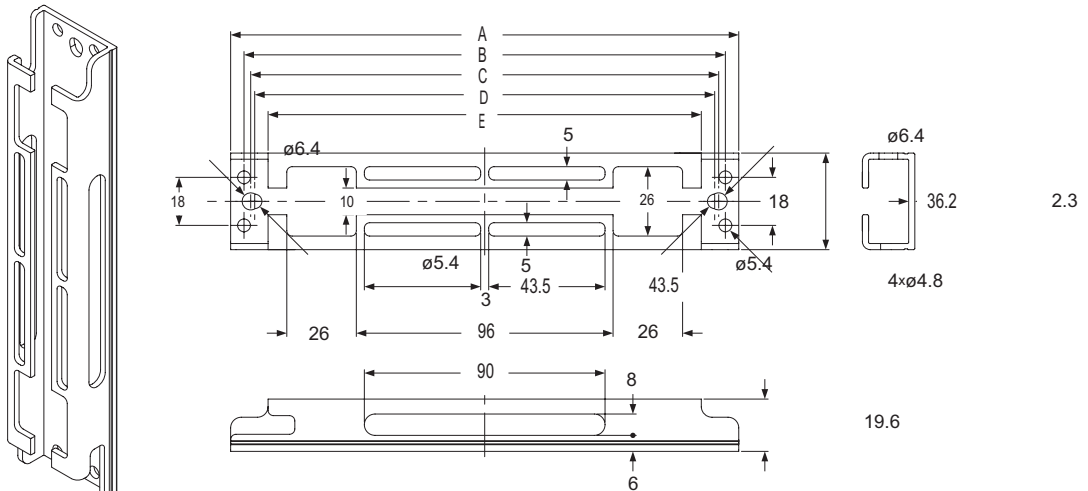
Unit: mm



Material: Stainless steel

8.2.6 Protective Metal Case

Unit: mm



Material: Stainless steel

Model No.	A	B	C	D	E
MS-SFCH-8	190	180	175	172	162
MS-SFCH-12	270	260	255	252	242
MS-SFCH-16	350	340	335	332	322
MS-SFCH-20	430	420	415	412	402
MS-SFCH-24	510	500	495	492	482
MS-SFCH-28	590	580	575	572	562
MS-SFCH-32	670	660	655	652	642

Glossary of Terms

Control Output (OSSD)

Output Signal Switching Device. A component of the light curtain that turns off when light of the light curtain is blocked.

EMC Directive

On the one hand, the directive relating to electromagnetic compatibility (EMC) governs the electromagnetic emissions of this equipment in order to ensure that, when used as intended, such equipment does not disturb radio, telecommunication or other equipment. On the other hand, the directive also governs the immunity of such equipment to ensure that this equipment is not disturbed by radio emissions normally present when used as intended.

EN 55011

This standard specifies the limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.

EN 61496-1, IEC 61496-1/2, UL61496-1/2, JIS B 9704-1/2

These standards pertain to machine safety, especially electro-sensitive protective equipment (ESPE). EN 61496-1, IEC 61496-1, UL 61496-1 or JIS B 9704-1 define general requirements, examinations and effect analysis, EMC requirements, etc. IEC 61496-2, UL 61496-2 or JIS B 9704-2 specifies effective aperture angle, protection against extraneous light sources, etc, for Active Opto-electronic Protective Devices (AOPDs).

ESPE

Electro-Sensitive Protective Equipment.

FSD

Final Switching Device. Additional relays between the outputs of the controller and the machinery.

IEC 61508-1 to 7

The standards that pertain to electrical / electronic / programmable electronic safety-related systems. They give roles for methods of reducing the risk to be acceptable and the safety integrity level (SIL).

ISO-13849-1 (JIS B 9705-1)

This standard specifies the safety-related matters of machine safety (control system).

Lockout

Lockout is one of the safe states of the SF4C. 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 the lockout condition, it will stop emitting light. If a receiver is in the lockout condition, the OSSDs are turned OFF.

Machinery Directive

"Machinery" means an assembly of linked parts or components, at least one of which moves, energized by electricity, compressed air, oil pressure, etc. The latest amendment to the directive introduces safety components, placed on the market separately, into its scope. These are defined as components which are placed on the market "to fulfill a safety function when in use and the failure or malfunctioning of which endangers the safety or health of exposed persons".

PSDI

Presence Sensing Device Initiation. The safety configuration that restarts automatically without any operation by the operator after the device detects the danger status and halts for a while.

Safety Distance

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.

Sensing Area

The range in which the SF4C is able to detect objects. The actual size of this range depends on the SF4C model.

Sensing Height

The sensing height is determined by the number of beam channels +10mm (+5mm at the bottom and +5mm at the top).

Sensing Range

The range between the emitter and receiver.

Test input Function

This function enables to check the device operation by forcibly turning ON /OFF the control output (OSSD 1 / 2) of the receiver when the emitting light is received.

Test Rod

This is a rod for checking the detection capability of this device. Its dimensions correspond to the minimum size of the object to be sensed by this device.

UL1998

UL standard for safety-related software in programmable components.

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DoC No. CE09-002-02

EC Declaration of Conformity

We SUNX Limited
of 2431-1, Ushiyama-cho, Kasugai, Aichi 486-0901, Japan

declare that:

Product Active Opto-electronic Protective Device (Light Curtain)
Model name SF4C Series
Trade name SUNX

in accordance with the following Directives:

98/37/EC Machinery Directive (Valid until 29 December 2009)
 2006/42/EC Machinery Directive (Valid from 29 December 2009)
 2004/108/EC EMC Directive

has been designed and manufactured to the following specifications:

EN 61496-1 : 2004	IEC 61508-4: 1998
IEC 61496-2 : 2006	EN ISO 13849-1: 2008
IEC 61508-1: 1998	EN 50178 : 1997
IEC 61508-2: 2000	EN 55011 : 2007 +A2 :2007
IEC 61508-3: 1998	EN 61000-6-2: 2005

I hereby declare that the product named above has been designed to comply with the relevant sections of the above referenced specifications. The product complies with all essential requirements of the Directives.

TÜV Certificate

Certificate No. Z10 09 08 19003 032 (Date 20-August-2009)
 (by TÜV SÜD Product Service GmbH, Ridlerstrasse 65 80339 München Germany)

Year of CE Marking : 2009

Issued on : 2-September-2009

Signed by the manufacturer :



Name : Takanobu Yada

Position : Divisional General Manager, Sensor Division

Contact :

(Date) : 23. December 2009
 (Signature) : i.v. Christoph Oehler
 (Printed name) : Christoph Oehler, Senior Manager IPS
 (Company name) : Panasonic Electric Works Europe AG
 (Address) : Rudolf-Diesel-Ring 2
 83607 Holzkirchen, Germany

We, Panasonic Electric Works SUNX Co., Ltd.
of 2431-1, Ushiyama-cho, Kasugai, Aichi 486-0901, Japan

comprehensively declare, regardless of previous corporate name, trade name, brand name,
and/or brand logo listed below:

The enclosed DoC remains unchanged valid unless it is revised with the present corporate
name, trade name, brand name, and/or brand logo.

This declaration concerns the product at hand.

As from 1 October, 2010, corporate name, trade name, brand name, and brand logo are
recognized as follows:

Corporate Name

Present:	Previous:
Panasonic Electric Works SUNX Co., Ltd.	SUNX Limited

Trade and Brand Name

Present:	Previous:
Panasonic	SUNX

Logo

Present:	Previous:
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The logo consists of the word "Panasonic" in a bold, sans-serif font, followed by "SUNX" in a larger, bold, italicized sans-serif font. A stylized, curved line or swoosh is positioned behind the "X" in "SUNX", starting from the top right and curving under the letter.

Issued on: 1 October 2010

Record of changes

Manual No.	Date	Description of Changes
MEUEN-SF4C-V1	May 2010	1st edition

North America

Europe

Asia Pacific

China

Japan

Panasonic Electric Works Global Sales Companies

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