

## Exclusive Control Unit for Safety Light Curtain

### SF-C10 SERIES



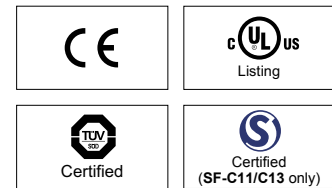
The control category differs depending on the configuration and wiring of the external circuit.

# SF-C10 SERIES



Category 4 PLe SIL3

The control category differs depending on the configuration and wiring of the external circuit.



## Less setup time for safety circuits

### Plug-in type control unit

#### Quick-connection

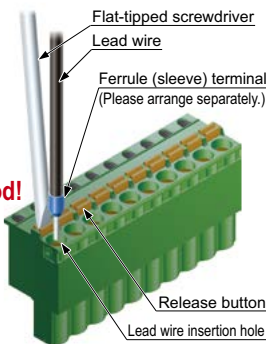
Connecting to the safety light curtain is done using plug-in connections, which shortens setup and replacement time.



#### Easy setup requiring no torque control

A spring method is used for the terminal blocks for connections other than to the safety light curtain. There is no need to control tightening torques for these terminal blocks.

Uses a spring method!

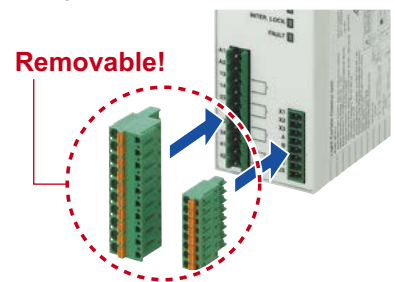


### SF-C11 / SF-C14EX(-01)

#### Removable terminal blocks reduce maintenance time

Removable terminal blocks are used. This reduces the work required for reconnecting wiring during maintenance.

Removable!



### Robust type control unit

#### SF-C12

#### Metal enclosure with a IP65 protective structure

The strong metal enclosure has a built-in safety relay. It has an IP65 protective structure, so that it can be set up individually without needing to be inserted into a control panel.

IP65 Metal enclosure



The wiring with the safety light curtain is connector connection.

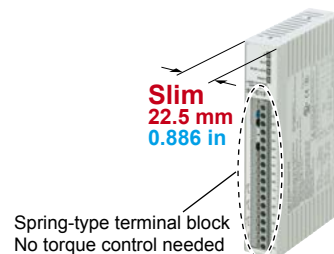
### Slim type control unit

#### SF-C13

#### Slim design

22.5 mm 0.886 in thickness, so can be inserted even into narrow spaces inside panels.

Slim 22.5 mm 0.886 in

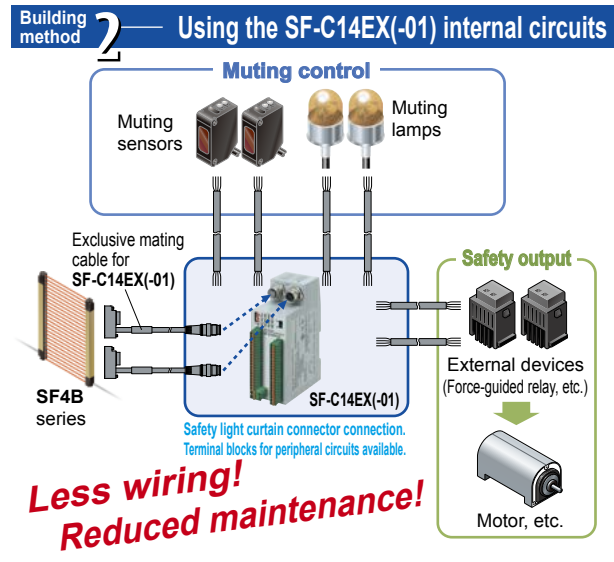
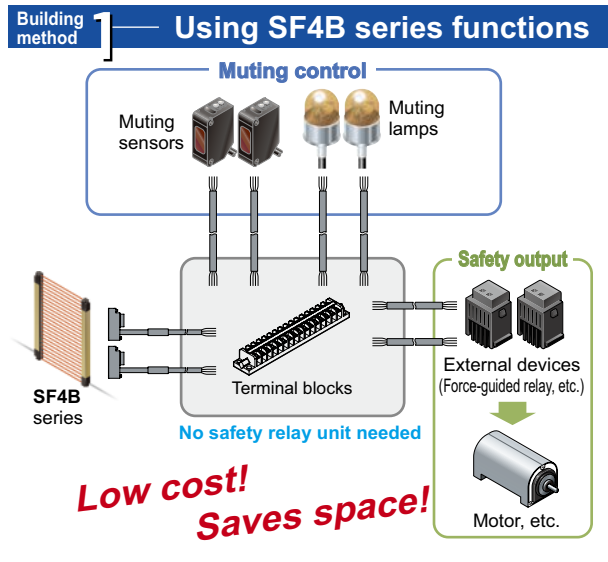


**Building of muting control circuits is easy**

**SF-C14EX(-01)**

**The method used to build the safety circuit is selectable**

It is possible to build muting control circuits using a stand-alone safety light curtain from the **SF4B / SF4B-G** series. The **SF-C14EX(-01)** application expansion unit allows the safety light curtain, muting sensors and muting lamps to be connected together directly, so that muting control circuits can be built very easily.



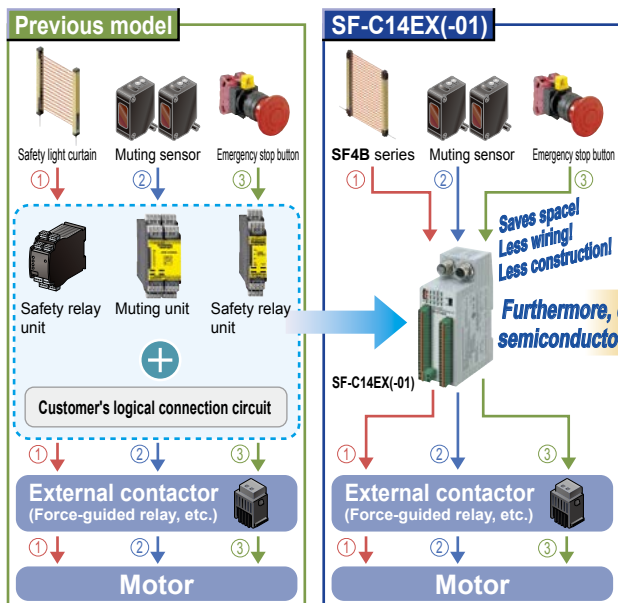
**Both safety and productivity can be obtained by stopping only one part of the device** **SF-C14EX(-01)**

**Three safety circuit systems packaged into a single unit!**

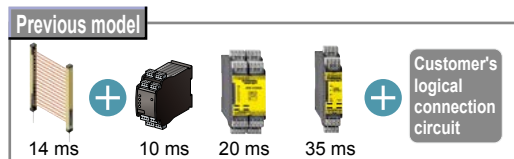
Three safety circuit systems ① Safety light curtain output circuit, ② Muting control circuit, and ③ Emergency stop circuit are packaged into a single unit. Functions that require multiple safety relay units and muting control units can be concentrated into a single unit, which results in large space savings, less wiring and less installation work.

**High-speed response 14 ms (Including safety light curtain)**

High-speed response has been achieved due to the adoption of the semiconductor output. Avoids the response delays that occur when using more than one safety relay unit, and greatly reduces the safety light curtain safety distance and improves ease of working. Of course, it is not necessary to exchange the safety relays within the unit anymore, which contributes to the reduction of running cost.



Including safety light curtain response time  
**High response speed of 14 ms!**  
**Greatly reduced safety distance!**



① Safety light curtain output circuit ② Muting control circuit  
③ Emergency stop circuit

Three safety circuit systems can be controlled independently so that equipment can be stopped all together or partially **SF-C14EX(-01)**

**Motors that use muting control and those that do not use it can be controlled independently!**

Controls the motors that use muting control (robots) and the motors that do not use muting control (turntables) with a single unit. When the workpiece comes in, the turntable can be stopped and the robot can keep operating condition, to protect the safety of the operator and to maintain productivity.

**Safety circuit 1** : Linked to safety light curtain beam received / interrupted status (partial stop)

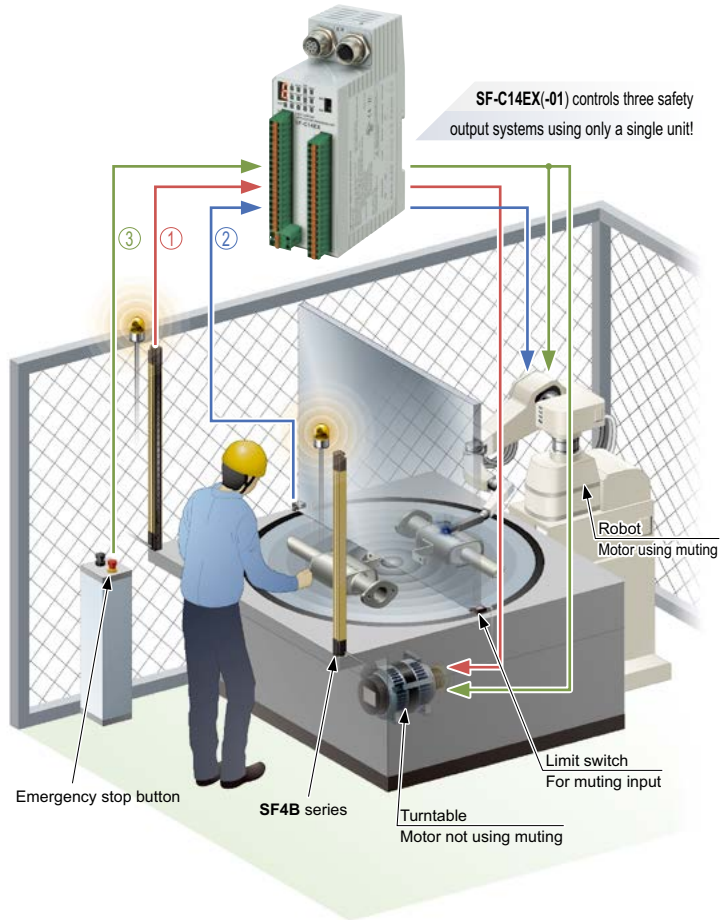
When the safety light curtain is interrupted (when an workpiece enters or a person intrudes), this circuit switches off (open) the safety output and stops the turntable.

**Safety circuit 2** : Linked to muting control (partial stop)

If an workpiece enters when the turntable has stopped normally, (muting conditions are achieved), this circuit allows the robot to operate. If an workpiece enters while the turntable is turning (muting conditions are not achieved), this circuit switches off (open) the safety output and stops the robot.

**Safety circuit 3** : Linked to emergency stop input (all stop)

When the emergency stop button is pressed, this circuit switches off (open) the safety output and stops all equipment (turntable and robot).



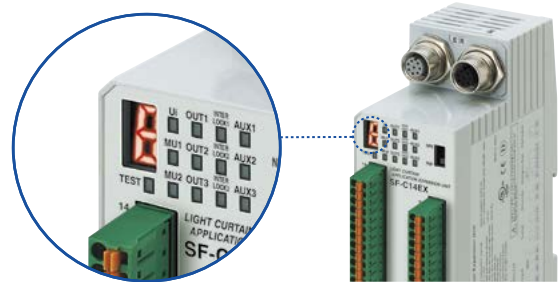
**Equipped with blown lamp output for muting lamp**

If a lamp in one of the two muting lamps that are connected to the unit blows, a warning is output. It is possible to replace the lamp before both lamps blow and the equipment stops. In addition, auxiliary output that is linked to the muting function, override function and safety light curtain control output is also available.

**Equipped with a digital indicator so that error details can be understood at a glance!**

If a problem should occur, the same output (OFF signal) as when the object was detected is maintained in order to ensure safety, and the details of the error appear on the digital display.

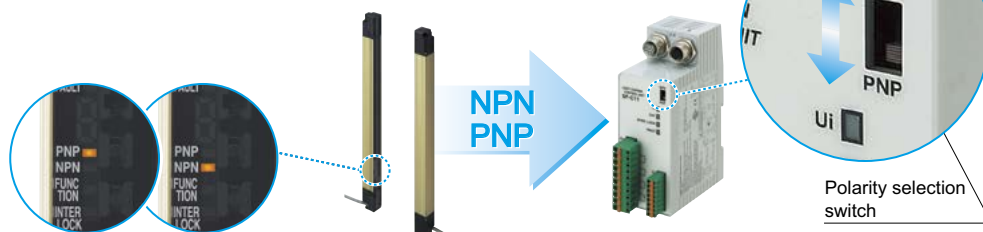
	Function	Operation
Auxiliary output 1	Muting output	ON when the muting function is invalid
Auxiliary output 2	Override output	ON when the override function is invalid
Auxiliary output 3	Blown lamp output	ON when the muting lamp is normal
Auxiliary output 4	Safety light curtain auxiliary output	ON when the safety light curtain is in light interrupted condition



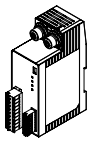
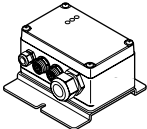
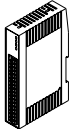
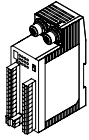
**Supports both PNP and NPN polarities**

**All Models**

A single model can be used for PNP/NPN input switching, reducing the number of parts that need to be registered.



**ORDER GUIDE**

Designation	Appearance	Model No.	Applicable cable (Note)	Description
Connector connection type control unit		<b>SF-C11</b>	Safety light curtain connection cable: <b>SFB-CB□</b> (For <b>SF4B</b> series) <b>SF2B-CB□</b> (For <b>SF2B</b> series) Extension cable: <b>SFB-CCJ10□</b>	Use 8-core cable with connector to connect to the safety light curtain. Compatible with up to Control Category 4. Interference prevention wires and muting function cannot be used.
Robust type control unit		<b>SF-C12</b>	Safety light curtain connection cable: <b>SFB-CB05-MU</b> Extension cable: <b>SFB-CCJ10□-MU</b>	Use 12-core cable with connector to connect to the safety light curtain. Interference prevention wires can be used. Compatible with up to Control Category 4. Muting function cannot be used.
Slim type control unit		<b>SF-C13</b>	Safety light curtain connection cable: <b>SFB-CCB□(-MU)</b> (For <b>SF4B</b> series) <b>SF2B-CCB□</b> (For <b>SF2B</b> series) Extension cable: <b>SFB-CC□(-MU)</b>	Use a discrete wire cable to connect to the safety light curtain. Muting function and interference prevention wires can be used. Compatible with up to Control Category 4.
Application expansion unit for <b>SF4B / SF4B-G</b> series	 <small>Handy-controller non-compatible type</small>	<b>SF-C14EX</b> <b>SF-C14EX-01</b>	Safety light curtain connection cable: <b>SFB-CB□-EX</b> Extension cable: <b>SFB-CCJ10□</b>	The muting control function and emergency stop input expand the applications of the safety light curtains. Use exclusive cable to connect to the safety light curtain. Compatible with up to Control Category 4. The handy-controller <b>SFB-HC</b> (optional) cannot be used with <b>SF-C14EX-01</b> .

Note: Refer to **SF4B / SF4B-G** series and **SF2B** series for the applicable cable.

**SF-C12 spare relay set**

A set of spare relays (2 safety relays and 1 removal tool) is available for the safety relay that is built into the **SF-C12**.  
Model No.: **SF-C12-RY**

## SPECIFICATIONS

Item	Model No.	SF-C11	SF-C12	SF-C13
Connectable safety light curtains		<b>SF4D / SF4B / SF4B-G / SF2B</b> series	<b>SF4B / SF4B-G</b> series	Safety light curtain manufactured by Panasonic Industrial Devices SUNX
Applicable standards		EN 61496-1 (Type 4), EN 55011, EN ISO 13849-1 (Category 4, PLe), IEC 61496-1 (Type 4), ISO 13849-1 (Category 4, PLe), JIS B 9704-1 (Type 4), JIS B 9705-1 (Category 4), ANSI/UL 61496-1 (Type 4), UL 1998 (Class 2) (Note 2)		
CE marking directive compliance		Machinery Directive, Low Voltage ( <b>SF-C11/C13</b> only) Directive, EMC Directive, RoHS Directive		
Control category		ISO 13849-1 (EN ISO 13849-1, JIS B 9705-1) compliance up to Category 4, PLe standards		
Supply voltage / Current consumption		24 V DC $\pm 10\%$ Ripple P-P 10% or less / 100 mA or less (without safety light curtain)		
Fuse rating		Built-in electronic fuse, Triggering current: 0.5 A or more, Reset after power down		
Safety output		NO contact $\times 3$ (13-14, 23-24, 33-34)	NO contact $\times 2$ (13-14, 23-24)	NO contact $\times 3$ (13-14, 23-24, 33-34)
Utilization		AC-15, DC-13 (IEC 60947-5-1)		
Rated operation voltage (Ue) / Rated operation current (Ie)		30 V DC / 6 A, 230 V AC / 6 A, resistive load (For inductive load, during contact protection) Min. applicable load: 10 mA (at 24 V DC) (Note 3)	24 V DC / 1 A, resistive load (For inductive load, during contact protection) Min. applicable load: 15 mA (at 24 V DC)	30 V DC / 4 A, 230 V AC / 4 A, resistive load (For inductive load, during contact protection) Min. applicable load: 10 mA (at 24 V DC) (Note 3)
Contact material / contacts		AgSnO, self cleaning, positively driven	AgNiO + 0.2 $\mu\text{m}$ 0.008 ml Au plating, self cleaning, positively driven	AgSnO, self cleaning, positively driven
Contact resistance		100 m $\Omega$ or less (initial value)	50 m $\Omega$ or less (initial value)	100 m $\Omega$ or less (initial value)
Contact protection fuse rating		6 A (slow blow)	3 A (slow blow)	4 A (slow blow)
Mechanical lifetime		10,000,000 times or more (open/close frequency of 180 times/min) (Note 4)		
Electrical lifetime		100,000 times or more (open/close frequency of 20 times/min, 230 V AC, 3 A, using resistance load) (Note 4)		
Pick-up delay (Auto reset/Manual reset)		80 ms or less / 90 ms or less	30 ms or less / 30 ms or less	80 ms or less / 90 ms or less
Response time		10 ms or less	14 ms or less	10 ms or less
Auxiliary output		Safety relay contact (NC contact) $\times 1$ (41-42) (Related to enabling path)	Safety relay contact (NC contact) $\times 1$ (31-32) (Related to enabling path)	Safety relay contact (NC contact) $\times 1$ (41-42) (Related to enabling path)
Rated operation voltage/current		24 V DC / 2 A, Min. applicable load: 10 mA (at 24 V DC)	30 V DC / 3 A, Min. applicable load: 15 mA (at 24 V DC)	24 V DC / 2 A, Min. applicable load: 10 mA (at 24 V DC)
Contact protection fuse rating		2 A (slow blow)	3 A (slow blow)	2 A (slow blow)
Semiconductor auxiliary output (AUX)		<Minus ground (Setting for PNP)> PNP open-collector transistor • Max. source current: 60 mA • Applied voltage: same as supply voltage (between the semiconductor auxiliary output and +V) • Residual voltage: 2.3 V or less (at source current 60 mA) • Leakage current: 2 mA or less	<Plus ground (Setting for NPN)> NPN open-collector transistor • Max. sink current: 60 mA • Applied voltage: same as supply voltage (between the semiconductor auxiliary output and 0 V) • Residual voltage: 1.5 V or less (at sink current 60 mA) • Leakage current: 2 mA or less	PNP open-collector transistor • Max. source current: 60 mA • Applied voltage: same as supply voltage (between the semiconductor auxiliary output and +V) • Residual voltage: 2.3 V or less (at source current 60 mA) • Leakage current: 2 mA or less
Output operation		Related to auxiliary output of safety light curtain	—————	On when the safety light curtain is interrupted
Excess voltage category		II	III	II
Indicators	Power supply (Ui)	Green LED (lights up when the power is ON)		
	Safety output [OUT (Note 5)]	Green LED (lights up when safety output is closed)		
	Interlock (INTER_LOCK)	Yellow LED (lights up when safety output is opened)	—————	Yellow LED (lights up when enabling contacts are opened)
	Fault (FAULT)	Yellow LED (blinks when fault occurs)	Orange LED (lights up when two safety light curtain input polarity selection switch settings are different)	Yellow LED (blinks when fault occurs)
External relay monitor function		Incorporated	Incorporated (Note 6)	Incorporated
Trailing edge function		Incorporated		
Polarity selection function (Note 7)		Incorporated (Sliding switch allows selection of plus/minus ground) Minus ground: Correspond to PNP output safety light curtain Plus ground: Correspond to NPN output safety light curtain		Incorporated (Cable connection allows selection of plus/minus ground) Minus ground: Correspond to PNP output safety light curtain Plus ground: Correspond to NPN output safety light curtain
Pollution degree		2		
Environmental resistance	Protection	Enclosure: IP40, Terminal: IP20	IP65	Enclosure: IP40, Terminal: IP20
	Ambient temperature	-10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: -25 to +70 °C -13 to +158 °F		
	Ambient humidity	30 to 85 % RH, Storage: 30 to 95 % RH	35 to 85 % RH, Storage: 35 to 85 % RH	30 to 85 % RH, Storage: 30 to 95 % RH
	Vibration resistance	Resistance / malfunction 10 to 55 Hz frequency, 0.35 mm 0.014 in amplitude in X, Y, and Z directions for twenty times each	Resistance 10 to 55 Hz frequency, 0.75 mm 0.030 in amplitude in X, Y, and Z directions for two hours each	Resistance / malfunction 10 to 55 Hz frequency, 0.35 mm 0.014 in amplitude in X, Y, and Z directions for twenty times each
Connection terminal		Detachable spring-cage terminal	European terminal	Spring-cage terminal
Enclosure material		ABS	Die-cast aluminum	ABS
Weight		Net weight: 320 g approx.	Net weight: 1 kg approx.	Net weight: 200 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.

2) **SF-C11** and **SF-C13** comply with UL 1998 (Class 2).

3) If several **SF-C11** or **SF-C13** units are being used in line together, leave a space of 5 mm 0.197 in or more between each unit. If the units are touching each other, reduce the rated operating current for safety output in accordance with the ambient operating temperature as shown in the graphs at right.

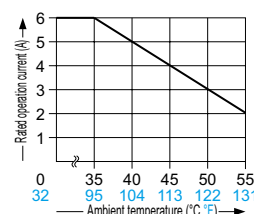
4) The life expectancy of the relay varies depending on the type of load, open / close frequency, ambient conditions and others.

5) The operation indicator is marked as "Enabling" on the unit for **SF-C12**.

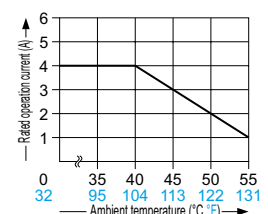
6) Terminals for utilizing the functions of the **SF4B / SF4B-G** series are available.

7) Please switch the sliding switch to the PNP side for minus ground and to the NPN side for plus ground.

**Dilating when SF-C11 units are mounted close together**



**Dilating when SF-C13 units are mounted close together**



## SPECIFICATIONS

Item	Model No.	SF-C14EX(-01) (Note 2)
Connectable safety light curtains		<b>SF4B / SF4B-G series</b>
Applicable standards		IEC 61496-1 (Type 4), EN 55011, EN ISO 13849-1 (Category 4, PL <sub>e</sub> ), IEC 61496 (Type 4), ISO 13849-1 (Category 4, PL <sub>e</sub> ), JIS B 9704-1 (Type 4), JIS B 9705-1 (Category 4, PL <sub>e</sub> ), ANSI/UL 61496-1 (Type 4), UL 1998 (Class 2)
CE marking directive compliance		Machinery Directive, EMC Directive, RoHS Directive
Control category		ISO 13849-1 (EN ISO 13849-1, JIS B 9705-1) compliance up to Category 4, PL <sub>e</sub> standards
Supply voltage		24 V DC $\pm 10\%$ Ripple P-P 10 % or less
Current consumption		0.2 A or less (Excluding safety light curtain and other external connecting device)
Safety outputs (Safety output 1 Safety output 2 Safety output 3)		PNP open-collector transistor 2 outputs $\times$ 3 or NPN open-collector transistor 2 outputs $\times$ 3 (selectable using a slider switch) <When PNP output is selected> <ul style="list-style-type: none"> <li>• Maximum source current: 200 mA</li> <li>• Applied voltage: same as supply voltage (between the safety output and +V)</li> <li>• Residual voltage: 2 V or less (at 200 mA source current)</li> </ul> <When NPN output is selected> <ul style="list-style-type: none"> <li>• Maximum sink current: 200 mA</li> <li>• Applied voltage: same as supply voltage (between the safety output and 0 V)</li> <li>• Residual voltage: 2 V or less (at 200 mA sink current)</li> </ul>
	Operation mode (Output operation)	Safety output 1: ON when the safety light curtain is in light receiving condition, OFF when the safety light curtain is in light interrupted condition (Note 3) Safety output 2: ON when the safety light curtain is in light receiving condition or the muting function is valid OFF when the safety light curtain is in light interrupted condition and the muting function is invalid (Note 3) Safety output 3: ON when the emergency stop is invalid, OFF when the emergency stop is valid
	Protection circuit (Short-circuit protection)	Incorporated
	Response time	OFF response: 14 ms or less (Safety output 1 and 2: including the response time of the safety light curtain) ON response: 90 ms or less (auto-reset) / 140 ms or less (manual reset) (Note 4)
Auxiliary outputs (Auxiliary output 1 Auxiliary output 2 Auxiliary output 3 Auxiliary output 4 (Note 5))		PNP open-collector transistor $\times$ 3 or NPN open-collector transistor $\times$ 3 (selectable using a slider switch) <When PNP output is selected> <ul style="list-style-type: none"> <li>• Maximum source current: 60 mA</li> <li>• Applied voltage: same as supply voltage (between the auxiliary output and +V)</li> <li>• Residual voltage: 2 V or less (at 60 mA source current)</li> </ul> <When NPN output is selected> <ul style="list-style-type: none"> <li>• Maximum sink current: 60 mA</li> <li>• Applied voltage: same as supply voltage (between the auxiliary output and 0 V)</li> <li>• Residual voltage: 2 V or less (at 60 mA sink current)</li> </ul>
	Operation mode (Output operation)	Auxiliary output 1: ON when the muting function is invalid, OFF when the muting function is valid Auxiliary output 2: ON when the override function is invalid, OFF when the override function is valid Auxiliary output 3: ON when the muting lamp is normal, OFF when the muting lamp is error Auxiliary output 4: ON when the safety light curtain is in light interrupted condition, OFF when the safety light curtain is in light receiving condition (Note 5)
	Protection circuit (Short-circuit protection)	Incorporated
Muting lamp output		Applicable muting lamp: 24 V DC, 3.6 to 30 W (L1, L2 of each unit)
	Protection circuit (Short-circuit protection)	Incorporated
PFH <sub>D</sub> (Note 6)		$1.66 \times 10^{-10}$
MTTF <sub>D</sub> (Note 6)		100 years or more
Environmental resistance	Protection	Enclosure: IP40, Terminal: IP20
	Ambient temperature	-10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: -25 to +70 °C -13 to +158 °F
	Ambient humidity	30 to 85 % RH, Storage: 30 to 95 % RH
	Dielectric strength voltage	1,000 V AC for one min. between all supply terminals connected together and enclosure
	Insulation resistance	20 M $\Omega$ , or more, with 500 V DC megger between all supply terminals connected together and enclosure
	Vibration resistance	10 to 55 Hz frequency, 0.35 mm 0.014 in double amplitude in X, Y and Z directions for two hours each
	Shock resistance	30 G acceleration in X, Y and Z directions three times each
Material		Enclosure: ABS
Connection terminal		Detachable spring-cage terminal
Weight		Net weight: 250 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C +68 °F.

2) The handy-controller **SFB-HC** (optional) cannot be used with **SF-C14EX-01**.

3) Both safety output 1 and 2 are OFF when the emergency stop is valid regardless of whether the safety light curtain is in the light receiving or light interrupted condition.

4) The auto-reset cannot be used with safety output 3.

5) The auxiliary output incorporated in the **SF4B / SF4B-G** series is output.

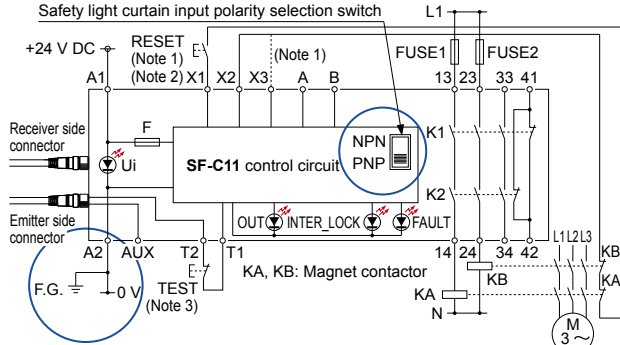
6) PFH<sub>D</sub>: Probability of dangerous failure per hour, MTTF<sub>D</sub>: Mean time to dangerous failure (in years)

## SAFETY LIGHT CURTAIN WIRING DIAGRAMS

### Wiring diagram of SF-C11 and SF4B / SF4B-G series or SF2B series (Control Category 4 or 2)

#### For PNP output (minus ground)

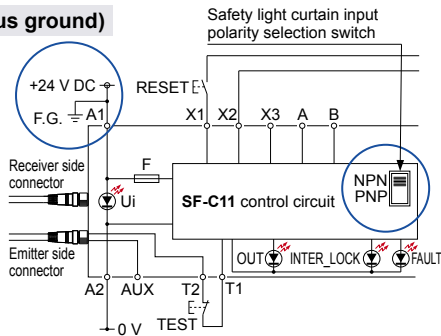
- Set the safety light curtain input polarity selection switch to the PNP side and ground the 0 V line.



- Notes:
- The above diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.
  - Use a momentary-type switch as the reset (RESET) button.
  - Emission halt occurs when the test (TEST) button is open, and emission occurs when the test (TEST) button is short-circuited. If not using the test (TEST) button, short-circuit T1 and T2. However, in case of SF2B series, use a test rod or similar to interrupt the light in order to carry out self-diagnosis separately.

#### For NPN output (plus ground)

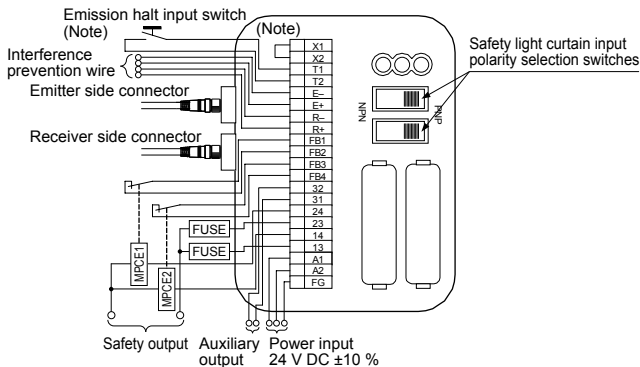
- In the above diagram, set the safety light curtain input polarity selection switch to the NPN side and ground the + side.



### Wiring diagram of SF-C12 and SF4B / SF4B-G series (Control Category 4)

#### For PNP output (minus ground)

- Set the two safety light curtain input polarity selection switches to the PNP side and connect the F.G. terminal to the 0 V line.



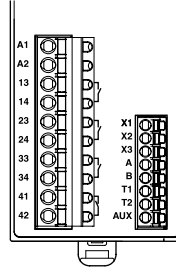
Note: The above diagram is when using manual reset. If automatic reset is used, connect a normal close-type pushbutton switch between T1 and T2 and leave between X1 and X2 open.

#### For NPN output (plus ground)

- In the above diagram, set the two safety light curtain input polarity selection switches to the NPN side and connect the F.G. terminal to the + side.

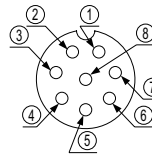
When connecting the SF-C11 to the safety light curtains, make sure to use the 8-core connection cable with a connector. Refer to the SF4B / SF4B-G series and SF2B series for details. SFB-CB□, SF2B-CB□, SFB-CCJ10□

#### Terminal arrangement diagram



Terminal	Function
A1	+24 V DC
A2	0 V
13-14, 23-24, 33-34	Safety output (NO contact × 3)
41-42	Auxiliary output (NC contact × 1)
X1	Reset output terminal
X2	Reset input terminal (Manual)
X3	Reset input terminal (Automatic)
A	Not used
B	
T1	Test output terminal
T2	Test input terminal
AUX	Semiconductor auxiliary output

#### Pin layout for safety light curtain connectors



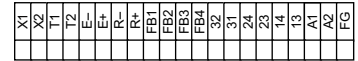
Connector pin No.	Emitter side connector	Receiver side connector
①	Interlock (Note)	OSSD2
②	+24 V DC	+24 V DC
③	Emission halt	OSSD1
④	Auxiliary output	EDM (External relay monitor)
⑤	Synchronization wire +	Synchronization wire +
⑥	Synchronization wire -	Synchronization wire -
⑦	0 V	0 V
⑧	Shielded wire	Shielded wire

Note: It is not used with the SF2B series.

When connecting the SF-C12 to the safety light curtains, make sure to use the 12-core connection cable with a connector. Refer to the SF4B / SF4B-G series for details.

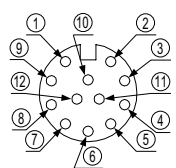
- SFB-CB05-MU (Cable length: 0.5 m 1.640 ft)
- SFB-CCJ10E-MU (Extension cable for emitter, cable length: 10 m 32.808 ft)
- SFB-CCJ10D-MU (Extension cable for receiver, cable length: 10 m 32.808 ft)

#### Terminal arrangement diagram



Terminal	Function	Terminal	Function
FG	Frame ground (F.G.) terminal	R+	Interference prevention wire - (Receiver side)
A2	0 V	R-	Interference prevention wire + (Receiver side)
A1	+24 V DC	E+	Interference prevention wire - (Emitter side)
13-14, 23-24	Safety output (NO contact × 2)	E-	Interference prevention wire + (Emitter side)
31-32	Auxiliary output (NC contact × 1)	T2	Emission halt input terminal
FB4	External relay monitor terminal 2	T1	terminal
FB3	terminal 2	X2	Automatic reset/manual reset selection terminal
FB2	External relay monitor terminal 1	X1	Manual reset: X1 - X2 short-circuited
FB1	terminal 1		

#### Pin layout for safety light curtain connectors



Note: Input and output for pin Nos. ⑩ and ⑫ are not used by this product

Connector pin No.	Emitter side connector	Receiver side connector
①	Interlock	OSSD2
②	+24 V DC	+24 V DC
③	Emission halt	OSSD1
④	Auxiliary output	EDM (External relay monitor)
⑤	Synchronization wire +	Synchronization wire +
⑥	Synchronization wire -	Synchronization wire -
⑦	0 V	0 V
⑧	Shielded wire	Shielded wire
⑨	Interference prevention wire +	Interference prevention wire +
⑩	Interference prevention wire -	Interference prevention wire -
⑪	(Override input)	(Muting input 1)
⑫	(Muting lamp output)	(Muting input 2)

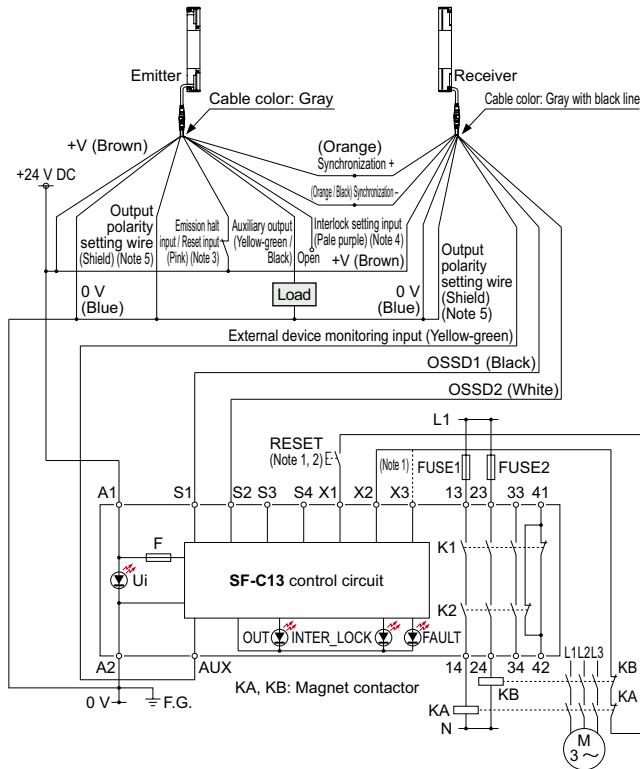


## SAFETY LIGHT CURTAIN WIRING DIAGRAMS

### Wiring diagram of SF-C13 and SF4B / SF4B-G series or SF2B series (Control Category 4 or 2)

#### For PNP output (minus ground)

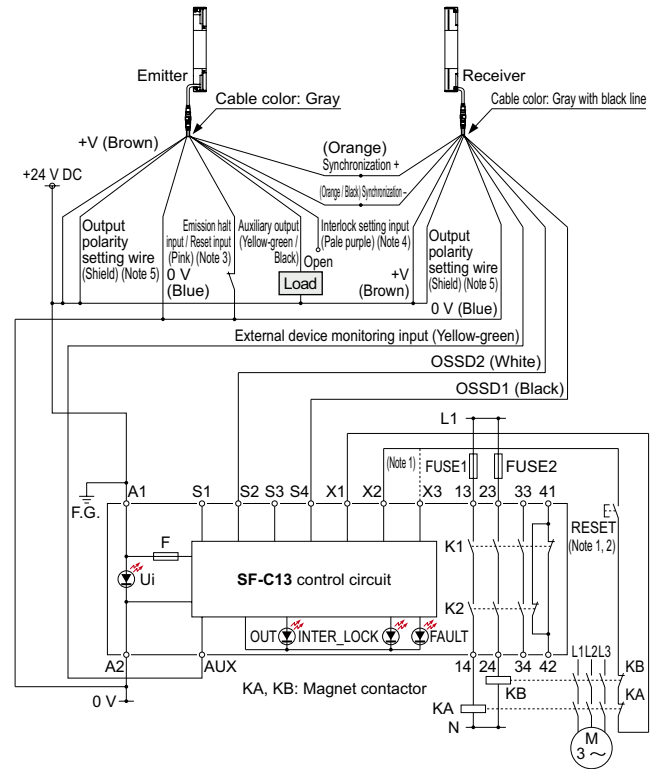
- Connect the safety light curtain control outputs OSSD1 and OSSD2 to S1 and S2 respectively.



- Notes: 1) The above diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.  
 2) Use a momentary-type switch as the reset (RESET) button.  
 3) This is a test input (pink) for the **SF2B** series.  
 4) This is not equipped on the **SF2B** series.  
 5) This is a shield for the **SF2B** series.

#### For NPN output (plus ground)

- Connect the safety light curtain control outputs OSSD1 and OSSD2 to S4 and S2 respectively and ground the + side.



- Notes: 1) The above diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.  
 2) Use a momentary-type switch as the reset (RESET) button.  
 3) This is a test input (pink) for the **SF2B** series.  
 4) This is not equipped on the **SF2B** series.  
 5) This is a shield for the **SF2B** series.

#### Terminal arrangement diagram

Terminal	Function
A1	+24 V DC
A2	0 V
S1	Safety light curtain control output (OSSD) input terminal
S2	
S3	
S4	
AUX	Semiconductor auxiliary output
X1	Reset output terminal
X2	Reset input terminal (Manual)
X3	Reset input terminal (Automatic)
13-14, 23-24, 33-34, 41	Safety output (NO contact × 3)
41-42	Auxiliary output (NC contact × 1)

Use a separate terminal block to carry out wiring for safety light curtains that cannot be connected to the **SF-C13**.

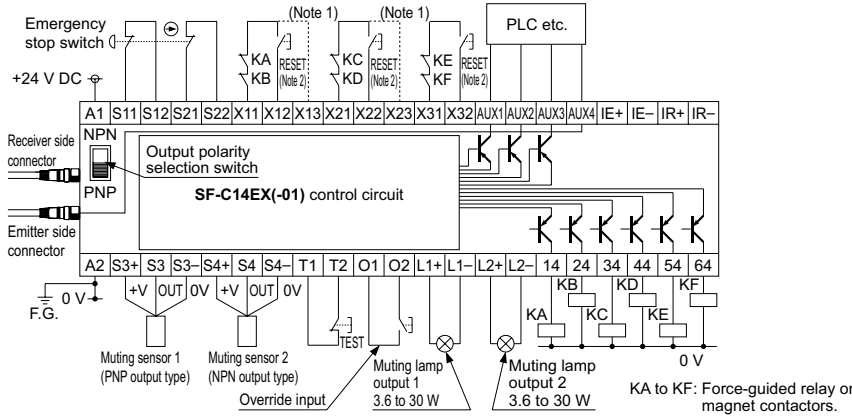
When connecting the **SF-C13** to the safety light curtains, make sure to use a discrete wire connection cable. Refer to the **SF4B / SF4B-G** series and **SF2B** series for details.  
**SFB-CCB□(-MU)**, **SF2B-CCB□**, **SFB-CC□(-MU)**

**SAFETY LIGHT CURTAIN WIRING DIAGRAMS**

**Wiring diagram of SF-C14EX(-01) and SF4B / SF4B-G series (Control Category 4)**

**For PNP output (minus ground)**

- Set the output polarity selection switch to the PNP side and ground the 0 V line.

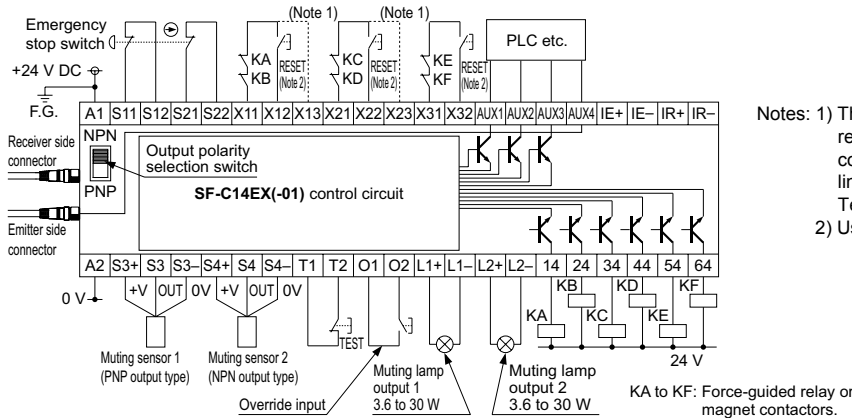


- When connecting the SF-C14EX to the safety light curtains, make sure to use the following connecting cable.  
**SFB-CB05-EX** (Cable length: 0.5 m 1.640 ft)  
**SFB-CB5-EX** (Cable length: 5 m 16.404 ft)  
**SFB-CB10-EX** (Cable length: 10 m 32.808 ft)
  - If the NO (Normally Open) contact switch is used as a muting sensor, wire it as shown in the figure below.
- 
- If the emergency stop switch is not used, short-circuit between the terminals S11 to S12 and S21 to S22 directly.

Notes: 1) The above diagram is when using manual reset. If automatic reset is used, disconnect the lead from X12 and X22, and connect them to X13 and X23 as shown by the dotted lines. In this case, a reset (RESET) button is not needed. Terminals X31 to X32 are for manual reset only.  
 2) Use a momentary-type switch for the reset (RESET) button.

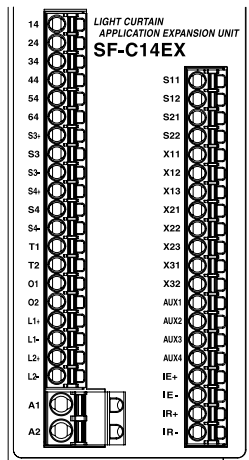
**For NPN output (plus ground)**

- Set the output polarity selection switch to the NPN side and ground the + side of the power supply input.



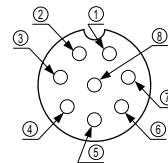
Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X12 and X22, and connect them to X13 and X23 as shown by the dotted lines. In this case, a reset (RESET) button is not needed. Terminals X31 to X32 are for manual reset only.  
 2) Use a momentary-type switch for the reset (RESET) button.

**Terminal arrangement diagram**



Terminal	Function	Terminal	Function
14	Safety output 1, Light received / Light interrupted output of the safety light curtain	S11	Emergency stop contact input
24	Safety output 2, Safety light curtain output including the muting function	S12	2 NC input
34	Safety output 3	S21	Between S11 and S12
44	Emergency stop output	S22	Between S21 and S22
S3+	Muting sensor input 1 (PNP output type)	X11	Safety output 1 reset input
S3-	S3+, S3-: Power supply	X12	X11 - X12: Manual reset
S3	S3: Sensor output	X13	X11 - X13: Auto-reset
S4+	Muting sensor input 2 (NPN output type)	X21	Safety output 2 reset input
S4-	S4+, S4-: Power supply	X22	X21 - X22: Manual reset
S4	S4: Sensor output	X23	X21 - X23: Auto-reset
T1	Test input terminal	AUX1	Auxiliary output 1, Muting output
T2	Open: Test mode	AUX2	Auxiliary output 2, Override output
O1	Override input terminal	AUX3	Auxiliary output 3, Blown lamp output
O2	Open: Invalid	AUX4	Auxiliary output 4, Safety light curtain auxiliary output
L1+	Muting lamp output 1	IE+	Interference prevention terminal, Emitter side +
L1-		IE-	Interference prevention terminal, Emitter side -
L2+	Muting lamp output 2	IR+	Interference prevention terminal, Receiver side +
L2-		IR-	Interference prevention terminal, Receiver side -
A1	+24 V DC		
A2	0 V		

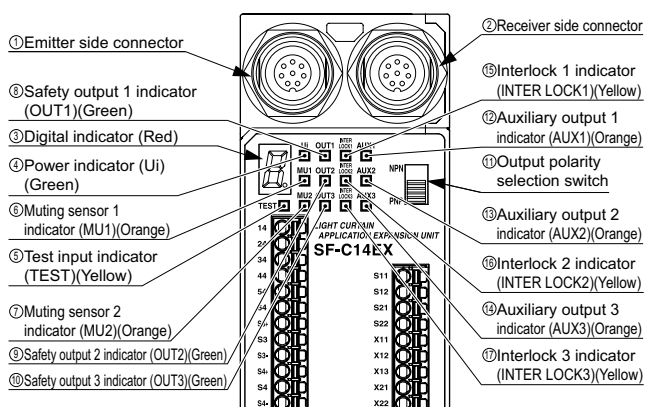
**Pin layout for safety light curtain connectors**



Connector pin No.	Emitter side connector	Receiver side connector
①	Interference prevention wire +	Interference prevention wire +
②	+24 V DC	+24 V DC
③	Interference prevention wire -	Interference prevention wire -
④	Auxiliary output	Not used
⑤	Synchronization wire +	Synchronization wire +
⑥	Synchronization wire -	Synchronization wire -
⑦	0 V	0 V
⑧	Shielded wire	Shielded wire

## PRECAUTIONS FOR PROPER USE

### Part description and function [SF-C14EX(-01)]



No.	Description	Function
①	Emitter side connector	The emitter of SF4B / SF4B-G series is connected.
②	Receiver side connector	The receiver of SF4B / SF4B-G series is connected.
③	Digital indicator (Red)	Lights up or blinks when there is a problem. Lights up when blanking function is enabled.
④	Power indicator (Ui) (Green)	Lights up when the power is ON.
⑤	Test input indicator (TEST) (Yellow)	Lights up when test input is enabled. Blinks while communication with SFB-HC (optional) handy-controller is in progress. (Excluding SF-C14EX-01)
⑥	Muting sensor 1 indicator (MU1) (Orange)	Lights up when muting sensor 1 is ON.
⑦	Muting sensor 2 indicator (MU2) (Orange)	Lights up when muting sensor 2 is ON.
⑧	Safety output 1 indicator (OUT1) (Green)	Lights up when safety output 1 is ON.
⑨	Safety output 2 indicator (OUT2) (Green)	Lights up when safety output 2 is ON.
⑩	Safety output 3 indicator (OUT3) (Green)	Lights up when safety output 3 is ON.
⑪	Output polarity selection switch	PNP (minus ground) or NPN (plus ground) can be selected. The factory setting is PNP (minus ground).
⑫	Auxiliary output 1 indicator (AUX1) (Orange)	Lights up when auxiliary output 1 is ON.
⑬	Auxiliary output 2 indicator (AUX2) (Orange)	Lights up when auxiliary output 2 is ON.
⑭	Auxiliary output 3 indicator (AUX3) (Orange)	Lights up when auxiliary output 3 is ON.
⑮	Interlock 1 indicator (INTER LOCK1) (Yellow)	Lights up when interlock 1 is ON.
⑯	Interlock 2 indicator (INTER LOCK2) (Yellow)	Lights up when interlock 2 is ON.
⑰	Interlock 3 indicator (INTER LOCK3) (Yellow)	Lights up when interlock 3 is ON.

### Wiring

- The following solid wire and twisted wires (lead wire) are recommended.

#### SF-C11

Power supply and output line connector: 0.2 to 2.5 mm<sup>2</sup> (AWG24 to 12)  
Signal line connector: 0.2 to 1.5 mm<sup>2</sup> (AWG24 to 16)

#### SF-C13

Single wire:  $\varnothing 0.4$  to  $\varnothing 1.2$  mm  $\varnothing 0.016$  to  $\varnothing 0.047$  in (AWG26 to 16)  
Twisted wire (lead wire): 0.3 to 1.25 mm<sup>2</sup> (AWG22 to 16)

#### SF-C14EX(-01)

Power supply line connector (A1, A2): 0.2 to 2.5 mm<sup>2</sup> (AWG24 to 12)  
Other connectors: 0.2 to 1.5 mm<sup>2</sup> (AWG24 to 16)

### Output waveform (Safety output ON) [SF-C14EX(-01)]

- When safety output is ON, self-diagnosis of the output circuit is carried out, so that the output transistor will periodically turn OFF. (OFF pulse width: 100  $\mu$ s or less) 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 error, and the safety output maintains OFF status.

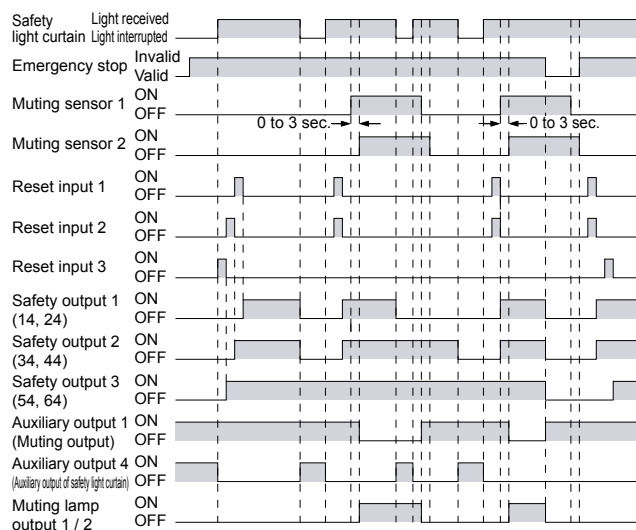


Since the OFF signal of SF-C14EX(-01) might cause malfunction, perform the connecting paying attention to the input response time of the machine to be connected to SF-C14EX(-01).

### Time chart [SF-C14EX(-01)]

#### Normal operation

- The diagram shows operation with safety outputs 1 and 2 in manual-reset mode.



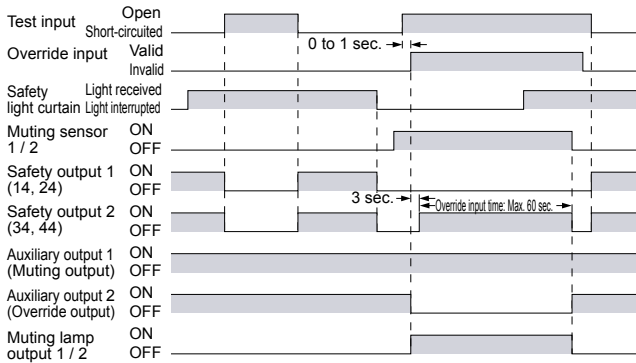
- The diagram above is the timing chart of SF-C14EX(-01) in normal operation.
- In normal operation, auxiliary output 2 (override output) is maintained in the ON state.
- In normal operation, auxiliary output 3 (muting lamp output) is maintained in the ON state.

## PRECAUTIONS FOR PROPER USE

### Time chart [SF-C14EX(-01)]

#### Test input, Override input

- The diagram shows operation with safety outputs 1 and 2 in auto-reset mode.

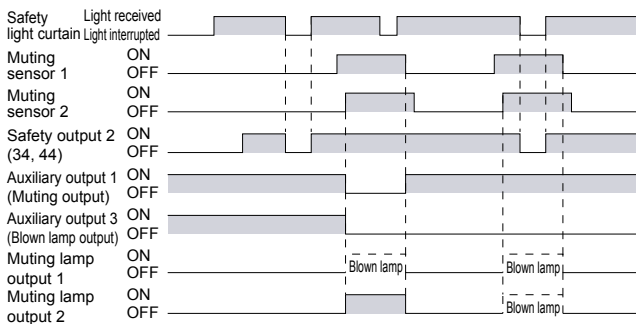


- Safety outputs 1 and 2 are OFF during test input.
- The override function becomes valid when all the conditions listed below are satisfied:
  - An incandescent lamp with 3.6 to 30 W is at least connected to either muting lamp output 1 or 2.
  - The signal is input to either muting sensor 1 or 2.
  - The override input terminal O1 and O2 is short-circuited and the test input terminal T1 / T2 is opened within 1 sec. (3 sec. continuously)

If one of the three conditions above becomes invalid or the timing exceeds 60 sec., the override function becomes invalid.

#### Blown lamp output

- The diagram shows operation with safety outputs 1 and 2 in auto-reset mode.



- The lamps are monitored during muting state, and if either of them breaks, auxiliary output 3 is turned OFF. If only one lamp breaks, the muting state is maintained, however, if both lamps break, the muting state is canceled immediately.

#### Others

- This device has been developed / produced for industrial use only.
- When connecting this product to a product other than the connectable input device, the system does not conform to the control category 4 based on ISO 13849-1 (EN ISO 13849-1, JIS B 9705-1).
- The power supply unit of **SF-C10** series uses the electronic fuse which does not require any replacement.
- When the electronic fuse trips, turn off the power supply and eliminate the cause for the overcurrent. After that, turn the power back on.

- The electronic fuse is not meant to be used for equipment that is operated continuously. Note that the specification may not be satisfied by continuous operation.
- Make sure to carry out the wiring in the power supply off condition.
- Wrong wiring will damage the product.
- Verify that the supply voltage variation is within the rating. Note that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the unit may get burnt or damaged.
- The DC power supply unit must satisfy the conditions given below:
  - Power supply unit authorized in the region where this device is to be used.
  - Power supply unit conforming to EMC Directive and Low-voltage Directive (In case CE conformity is required.)
  - Power supply unit conforming to the Low-voltage Directive and with an output of 100 VA or less.
  - The frame ground (F.G.) terminal must be connected to ground when using a commercially available switching regulator.
  - Power supply unit with an output holding time of 20 ms or more.
  - Use an isolation transformer for the DC power supply unit.
  - If surges are likely to occur, take countermeasures such as connecting a surge absorber to the origin of the surge.
  - Power supply unit corresponding to CLASS 2 (In case UL/c-UL conformity is required.)

#### <Additional information>

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

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

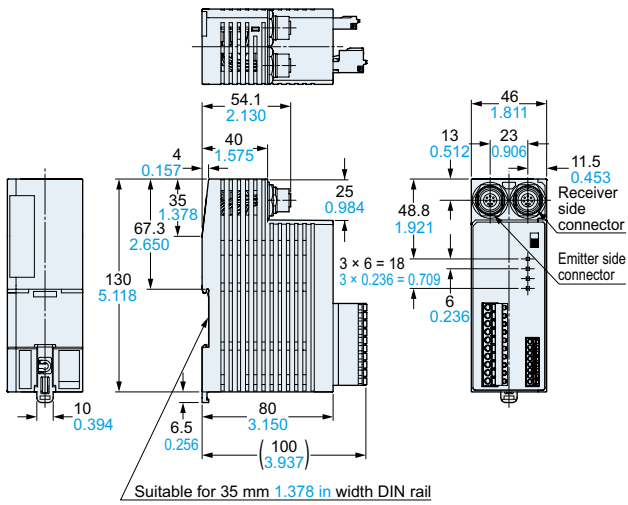
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- This product is not dust-proof / splash proof. Be sure to put this product into a control box having IP54 construction. (Excluding **SF-C12**)
- Avoid dust, dirt and steam.
- Take care that the product does not come in direct contact with oil, grease, or organic solvents, such as, thinner, etc.
- Note that this equipment is applicable only in the control circuit grounded in accordance with IEC 60204-1 and JIS B 9960-1, or in the control circuit in which the insulation monitor unit (ground fault detection unit) is included.
- This unit is suitable for indoor use only.
- The seal as shown in the drawing on the below is stuck to the engagement point of unit. If the seal is peeled off or broken, **SF-C10** series will not be certified as "Safety equipment" and will not be covered by our guarantee.

**Do not open!**  
If this seal is removed or damaged,  
the units are not recognized as safety product.

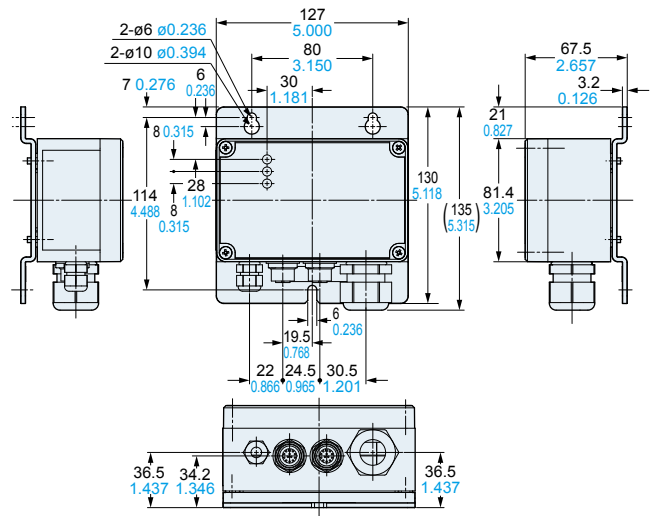
**DIMENSIONS (Unit: mm in)**

The CAD data can be downloaded from our website.

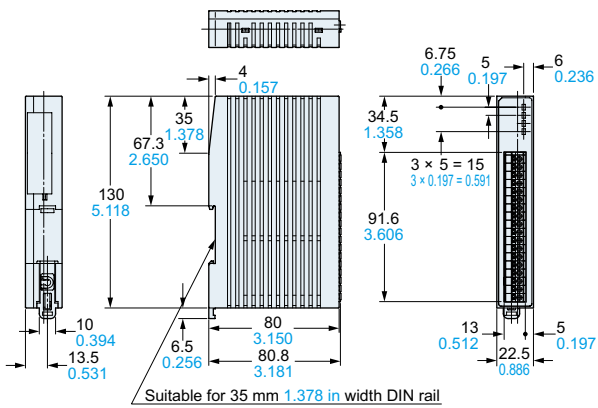
**SF-C11** Control unit



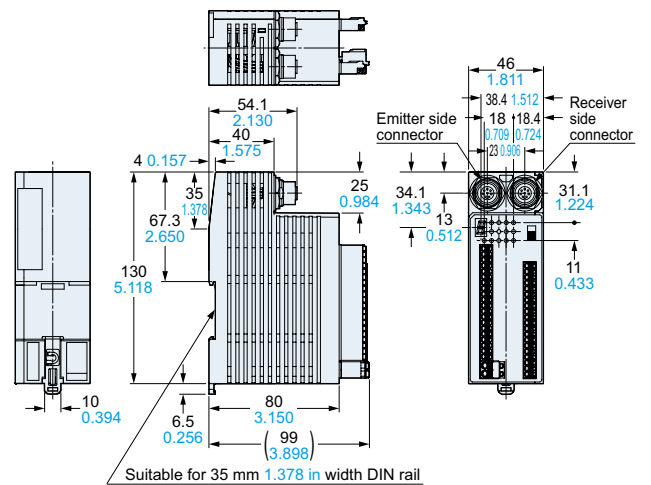
**SF-C12** Control unit



**SF-C13** Control unit



**SF-C14EX(-01)** Application expansion unit



## Disclaimer

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