

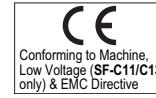
# SF-C10 SERIES

Related Information

- General terms and conditions..... F-17
- SF4C / SF4B / SF2B..... P.533~ / P.553~ / P.599~
- General precautions ..... P.1405
- Korea's S-mark..... P.1410



panasonic-electric-works.net/sunx

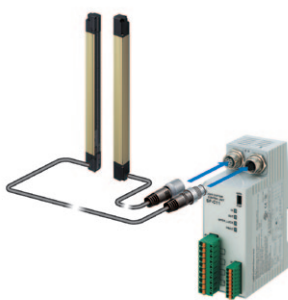


## Less setup time for safety circuits

### Plug-in type control unit

#### Quick-connection

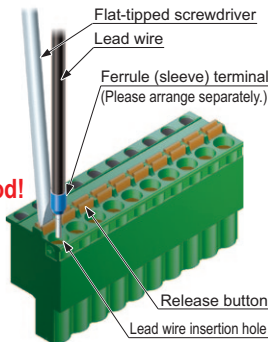
Connecting to the light curtain is done using plug-in connections, which shortens setup and replacement time.



#### Easy setup requiring no torque control

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

Uses a spring method!

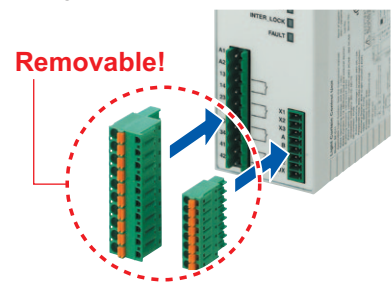


### SF-C11 / SF-C14EX(-01)

#### 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.



Connecting to the light curtain is done using plug-in connector connections

### 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.



Spring-type terminal block  
No torque control needed

- Selection Guide
- Laser Scanner
- Single Beam Sensor
- Light Curtains
- Control Units
- Optical Touch Switch
- Definition of Sensing Heights

#### SF-C10

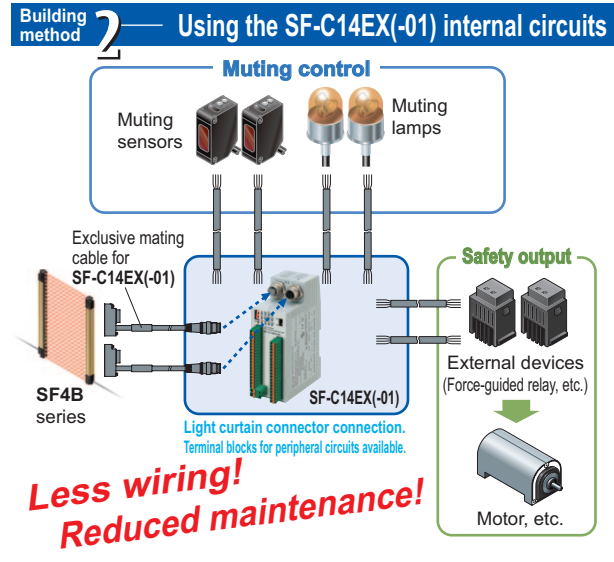
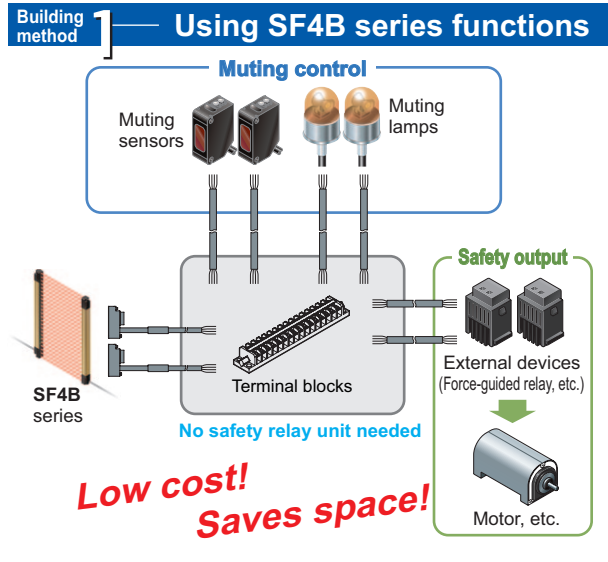
SF-CL1T264T

**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 light curtain from the **SF4B** series. The **SF-C14EX(-01)** application expansion unit allows the light curtain, muting sensors and muting lamps to be connected together directly, so that muting control circuits can be built very easily.



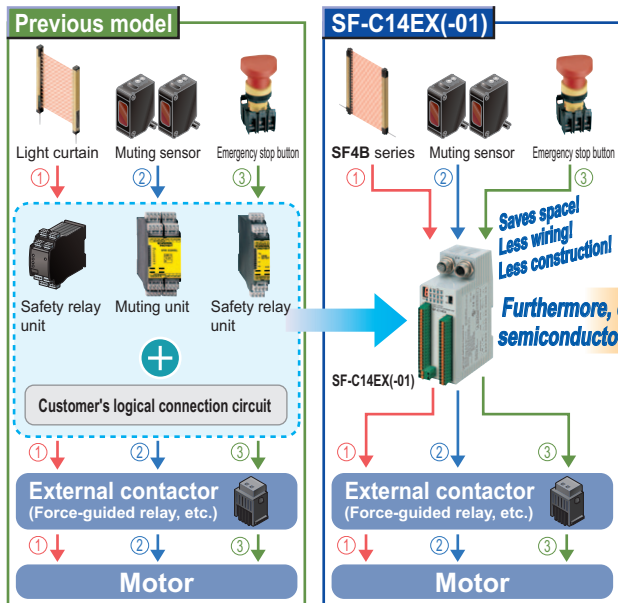
**Both safety and productivity can be obtained by stopping only one part of the device** **SF-C14EX(-01)**

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

Three safety circuit systems ① **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.

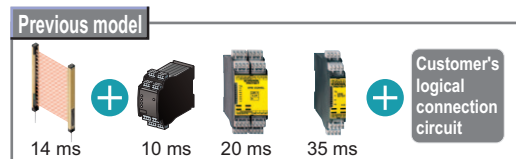
**High-speed response 14 ms (Including light curtain)**

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 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.



① Light curtain output circuit ② Muting control circuit ③ Emergency stop circuit

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



FIBER SENSORS

LASER SENSORS

PHOTOELECTRIC SENSORS

MICRO PHOTOELECTRIC SENSORS

AREA SENSORS

**LIGHT CURTAINS**

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASUREMENT SENSORS

STATIC CONTROL DEVICES

ENDOSCOPE

LASER MARKERS

PLC / TERMINALS

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ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

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**SF-C10**

SF-CL1T264T

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- SF-C10**
- SF-CL1T264T

**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 light curtain beam received / interrupted status (partial stop)**

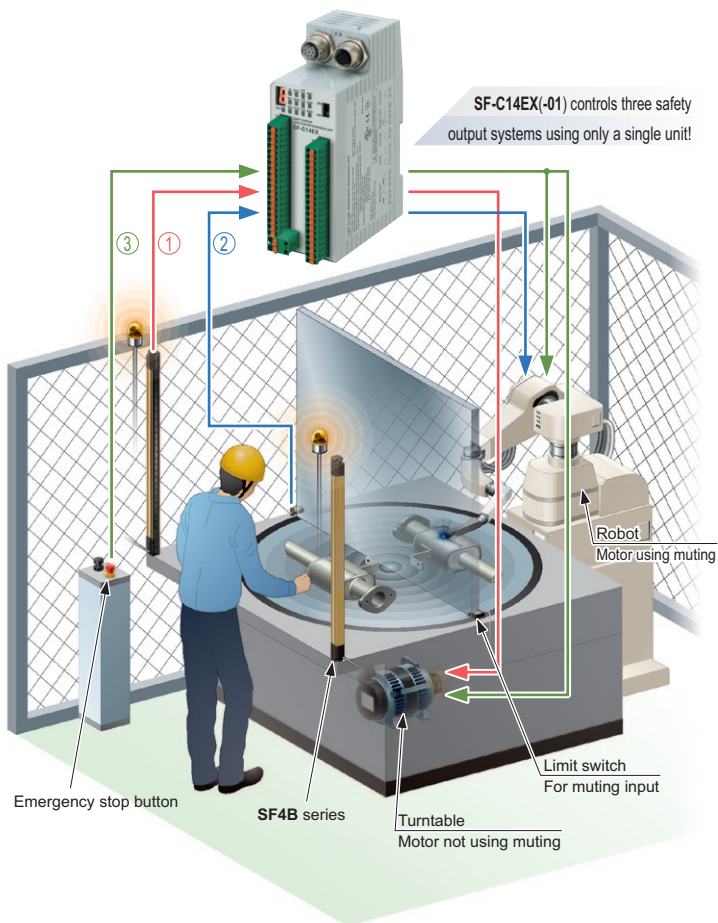
When the light curtain is interrupted (when a workpiece enters or a person intrudes), this circuit switches off (open) the safety output and stops the turntable.

**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).



SF-C14EX(-01) controls three safety output systems using only a single unit!

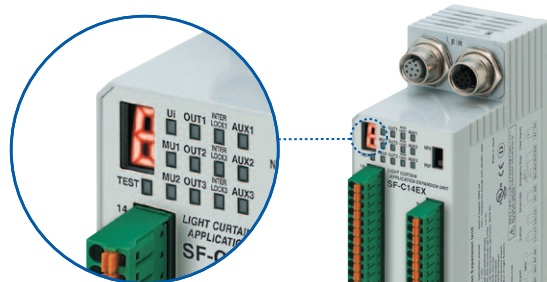
**Equipped with blown lamp output for muting lamp**

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 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.

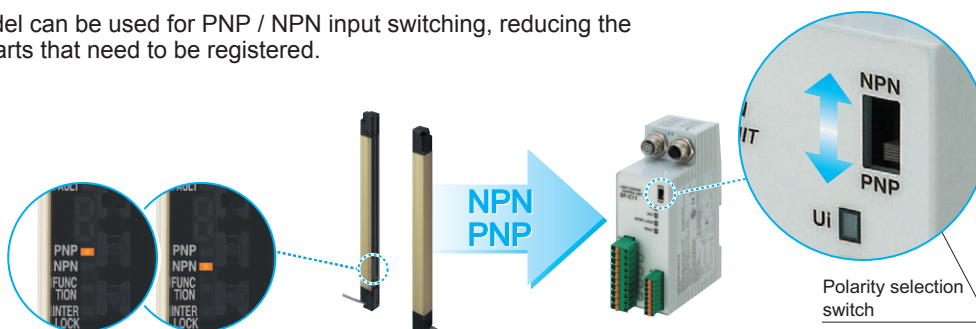
|                    | Function                       | Operation   |
|--------------------|--------------------------------|---|
| Auxiliary output 1 | Muting output                  | ON when the muting function is invalid                      |
| Auxiliary output 2 | Override output              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



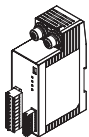
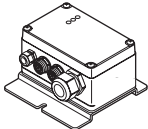

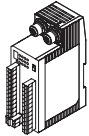
**Supports both PNP and NPN polarities**

**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>      | Light curtain connection cable:<br><b>SFB-CB□</b><br>(For <b>SF4B</b> series)<br><b>SF2B-CB□</b><br>(For <b>SF2B</b> series)<br>Extension cable: <b>SFB-CCJ10□</b>          | Use 8-core cable with connector to connect to the light curtain.<br>Compatible with up to control category 4.<br>Interference prevention wires and muting function cannot be used.  |
| Robust type control unit                          |   | <b>SF-C12</b>      | Light curtain connection cable:<br><b>SFB-CB05-MU</b><br>Extension cable: <b>SFB-CCJ10□-MU</b>  | Use 12-core cable with connector to connect to the light curtain. Interference prevention wires can be used.<br>Compatible with up to control category 4.<br>Muting function cannot be used.  |
| Slim type control unit                            |   | <b>SF-C13</b>      | Light curtain connection cable:<br><b>SFB-CCB□(-MU)</b><br>(For <b>SF4B</b> series)<br><b>SF2B-CCB□</b><br>(For <b>SF2B</b> series)<br>Extension cable: <b>SFB-CC□(-MU)</b> | Use a discrete wire cable to connect to the light curtain.<br>Muting function and interference prevention wires can be used.<br>Compatible with up to control category 4.   |
| Application expansion unit for <b>SF4B</b> series | <br><small>Handy-controller non-compatible type</small> | <b>SF-C14EX</b>    | Light curtain connection cable:<br><b>SFB-CB□-EX</b><br>Extension cable: <b>SFB-CCJ10□</b>  | The muting control function and emergency stop input are equipped, expanding the applications of the light curtains. It can be connected to the light curtains using the exclusive connection cable.<br>Compatible with up to control category 4. |
|   |  | <b>SF-C14EX-01</b> |   |   |

Note: Refer to the **SF4B** series and **SF2B** series for details of 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**

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**SF-C10**

SF-CL17284T

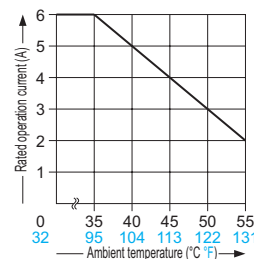
**SPECIFICATIONS**

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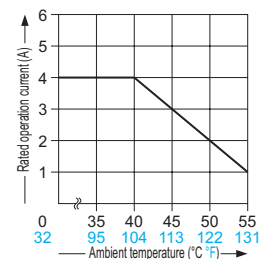
| Item  | Model No.                       | SF-C11   | SF-C12   | SF-C13   |
|---|---------------------------------|--|--|--|
| Connectable light curtains                                  |                                 | <b>SF4B / SF2B series</b>  | <b>SF4B series</b>   | Light curtain manufactured by PEW SUNX   |
| Applicable standards  |                                 | IEC 61496-1 (Type 4), EN 61496-1 (Type 4), EN 55011, JIS B 9704-1 (Type 4), ANSI/UL 61496-1 (Type 4), ANSI/UL 508, UL 1998 (Class 2, excluding <b>SF-C12</b> ), CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8, OSHA 1910.212, OSHA 1910.217(C), ANSI B11.1 to B11.19, ANSI/RIA 15.06, S1-G-35-2005 (excluding <b>SF-C12</b> ), S2-W-11-2003 (excluding <b>SF-C12</b> ) |  |  |
| 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 light curtain)  |  |  |
| Fuse rating   |                                 | Built-in electronic fuse, Triggering current: 0.5 A or more, Reset after power down  |  |  |
| Enabling path   |                                 | 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 2)  | 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 2)  |
| Contact material / contacts                                 |                                 | AgSnO, self cleaning, positively driven  | AgNiO + 0.2 $\mu\text{m}$ 0.008 mil 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 million operations or more (switching frequency 180 operations/min.) (Note 3)   |  |  |
| Electrical lifetime   |                                 | 100,000 operations or more (switching frequency 20 operations/min., 230 V AC / 3 A resistive load) (Note 3)  |  |  |
| 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)><br>PNP open-collector transistor<br>• Max. source current: 60 mA<br>• Applied voltage: same as supply voltage (between the semiconductor auxiliary output and +V)<br>• Residual voltage: 2.3 V or less (at source current 60 mA)<br>• Leakage current: 2 mA or less   | <Plus ground (Setting for NPN)><br>NPN open-collector transistor<br>• Max. sink current: 60 mA<br>• Applied voltage: same as supply voltage (between the semiconductor auxiliary output and 0 V)<br>• Residual voltage: 1.5 V or less (at sink current 60 mA)<br>• Leakage current: 2 mA or less | PNP open-collector transistor<br>• Max. source current: 60 mA<br>• Applied voltage: same as supply voltage (between the semiconductor auxiliary output and +V)<br>• Residual voltage: 2.3 V or less (at source current 60 mA)<br>• Leakage current: 2 mA or less |
| Output operation  |                                 | Related to auxiliary output of light curtain   | —————  | On when the light curtain is interrupted   |
| Excess voltage category                                     |                                 | II   | III  | II   |
| Indicators  | Power supply (Ui)               | Green LED (lights up when the power is ON)   |  |  |
|   | Enabling path [OUT (Note 4)]    | Green LED (lights up when enabling contacts are closed)  |  |  |
|   | Interlock (INTER_LOCK)          | Yellow LED (lights up when enabling contacts are opened)   | —————  | Yellow LED (lights up when enabling contacts are opened)   |
|   | Fault (FAULT)                   | Yellow LED (blinks when fault occurs)  | Orange LED (lights up when two light curtain input polarity selection switch settings are different)   | Yellow LED (blinks when fault occurs)  |
| External relay monitor function                             |                                 | Incorporated   | Incorporated (Note 5)  | Incorporated   |
| Trailing edge function                                      |                                 | Incorporated   |  |  |
| Polarity selection function (Note 6)                        |                                 | Incorporated (Sliding switch allows selection of plus / minus ground)<br>Minus ground: Correspond to PNP output light curtain<br>Plus ground: Correspond to NPN output light curtain   |  | Incorporated (Cable connection allows selection of plus / minus ground)<br>Minus ground: Correspond to PNP output light curtain<br>Plus ground: Correspond to NPN output 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) 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.  
 3) Relay switching lifetime will vary depending on factors such as the type of load, the switching frequency, and ambient conditions.  
 4) The operation indicator is marked as "Enabling" on the unit for **SF-C12**.  
 5) Terminals for utilizing the functions of the **SF4B** series are available.  
 6) 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 light curtains   |   | <b>SF4B series</b>   |
| Applicable standards   |   | IEC 61496-1 (Type 4), EN 61496-1 (Type 4), EN 55011, JIS B 9704-1 (Type 4), ANSI/UL 61496-1 (Type 4), ANSI/UL 508, UL 1998 (Class 2), CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8, OSHA 1910.212, OSHA 1910.217 (C), ANSI B11.1 to B11.19, ANSI/RIA 15.06  |
| Control category   |   | ISO 13849-1 (EN ISO 13849-1, JIS B 9705-1) compliance up to Category 4, PLe standards  |
| Supply voltage   |   | 24 V DC $\pm 10\%$ Ripple P-P 10% or less  |
| Current consumption  |   | 0.2 A or less (Excluding light curtain and other external connecting device)   |
| Safety outputs<br>(Safety output 1<br>Safety output 2<br>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)<br><When PNP output is selected><br>• Maximum source current: 200 mA<br>• Applied voltage: same as supply voltage (between the safety output and +V)<br>• Residual voltage: 2 V or less (at 200 mA source current)<br><When NPN output is selected><br>• Maximum sink current: 200 mA<br>• Applied voltage: same as supply voltage (between the safety output and 0 V)<br>• Residual voltage: 2 V or less (at 200 mA sink current) |
|  | Operation mode (Output operation)             | Safety output 1: ON when the light curtain is in light receiving condition, OFF when the light curtain is in light interrupted condition (Note 3)<br>Safety output 2: ON when the light curtain is in light receiving condition or the muting function is valid<br>OFF when the light curtain is in light interrupted condition and the muting function is invalid (Note 3)<br>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 light curtain)<br>ON response: 90 ms or less (auto-reset) / 140 ms or less (manual reset) (Note 4)  |
| Auxiliary outputs<br>(Auxiliary output 1<br>Auxiliary output 2<br>Auxiliary output 3<br>Auxiliary output 4 (Note 5)) |   | PNP open-collector transistor $\times$ 3 or NPN open-collector transistor $\times$ 3 (selectable using a slider switch)<br><When PNP output is selected><br>• Maximum source current: 60 mA<br>• Applied voltage: same as supply voltage (between the auxiliary output and +V)<br>• Residual voltage: 2 V or less (at 60 mA source current)<br><When NPN output is selected><br>• Maximum sink current: 60 mA<br>• Applied voltage: same as supply voltage (between the auxiliary output and 0 V)<br>• Residual voltage: 2 V or less (at 60 mA sink current)                   |
|  | Operation mode (Output operation)             | Auxiliary output 1: ON when the muting function is invalid, OFF when the muting function is valid<br>Auxiliary output 2: ON when the override function is invalid, OFF when the override function is valid<br>Auxiliary output 3: ON when the muting lamp is normal, OFF when the muting lamp is error<br>Auxiliary output 4: ON when the light curtain is in light interrupted condition, OFF when the 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   |
| 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 amplitude in X, Y and Z directions for two hours each  |
|  | Shock resistance                              | 30 G acceleration in X, Y and Z directions for 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) SF-C14EX-01 is Handy-controller non-compatible type.

3) Both safety output 1 and 2 are OFF when the emergency stop is valid regardless of whether the 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 series is output.

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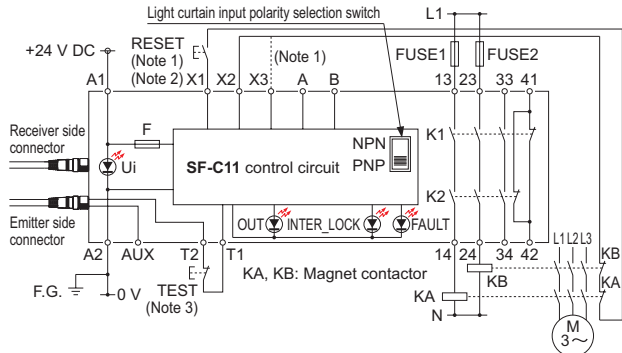
SF-CL17284T

**LIGHT CURTAIN WIRING DIAGRAMS**

**Wiring diagram of SF-C11 and SF4B series or SF2B series (Control category 4 or 2)**

**For PNP output (minus ground)**

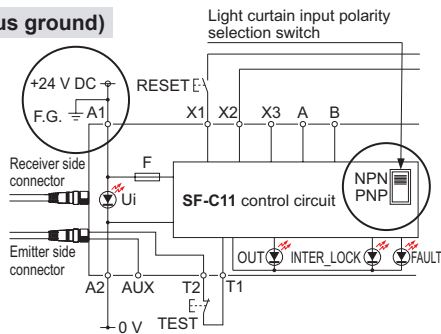
- Set the light curtain input polarity selection switch to the PNP side and ground the 0 V line.



- 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) 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)**

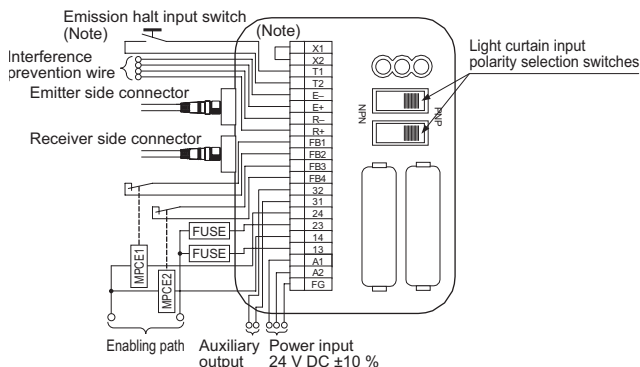
- In the above diagram, set the light curtain input polarity selection switch to the NPN side and ground the + side.



**Wiring diagram of SF-C12 and SF4B series (Control category 4)**

**For PNP output (minus ground)**

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



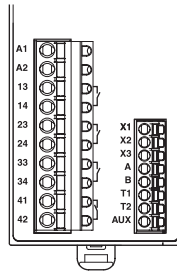
- Note: The above diagram is when using manual reset. If automatic reset is used, connect a normal close-type pushbutton switch between T1 and T2 and leave between X1 and X2 open.

**For NPN output (plus ground)**

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

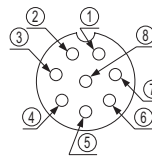
When connecting the SF-C11 to the light curtains, make sure to use the 8-core connection cable with a connector. Refer to the SF4B series and SF2B series for details.  
**SFB-CB**, **SF2B-CB**, **SFB-CCJ10**

**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 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 light curtains, make sure to use the 12-core connection cable with a connector. Refer to the SF4B series for details.

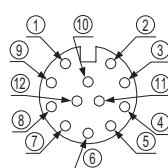
- SFB-CB05-MU** (Cable length: 0.5 m **1.640 ft**)
- SFB-CCJ10E-MU** (Extension cable for emitter, cable length: 10 m **32.808 ft**)
- SFB-CCJ10D-MU** (Extension cable for receiver, cable length: 10 m **32.808 ft**)

**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       | Emission halt input terminal                      |
| FB3          | External relay monitor terminal 1 | X2       | Automatic reset / manual reset selection terminal |
| FB2          | External relay monitor terminal 2 | X1       | Manual reset: X1 - X2 short-circuited             |
| FB1          | External relay monitor terminal 1 |          |   |

**Pin layout for light curtain connectors**



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

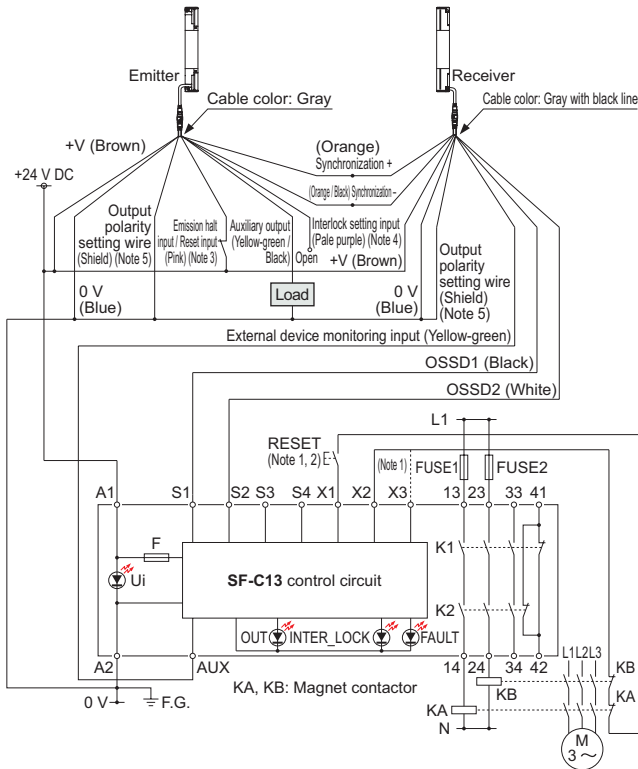
| Connector pin No. | Emitter side connector         | Receiver side connector        |
|-------------------|--------------------------------|--------------------------------|
| ①                 | Interlock                      | OSSD2                          |
| ②                 | +24 V DC                       | +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)               |

## LIGHT CURTAIN WIRING DIAGRAMS

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

#### For PNP output (minus ground)

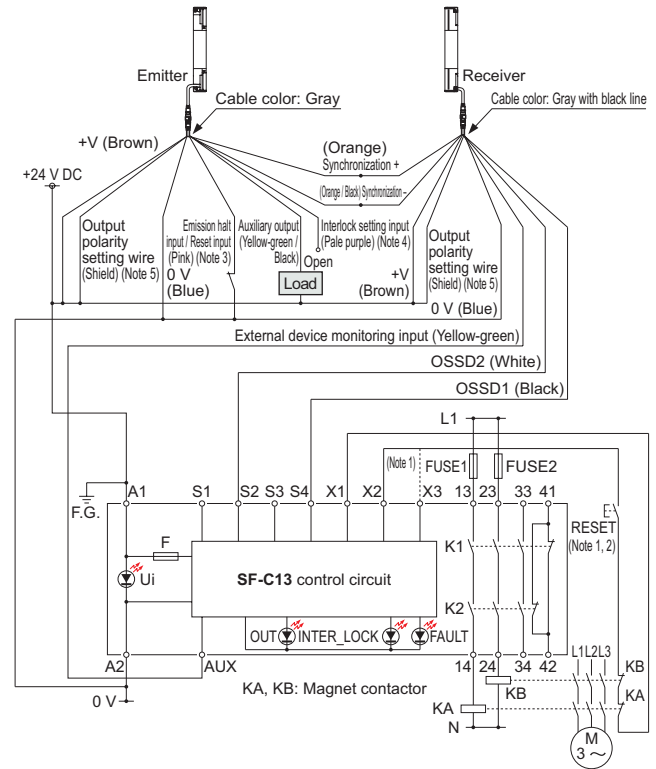
- Connect the light curtain control outputs OSSD1 and OSSD2 to S1 and S2 respectively.



- 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. Output polarity cannot be set.

#### For NPN output (plus ground)

- Connect the 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. Output polarity cannot be set.

#### Terminal arrangement diagram

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

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

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

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**SF-C10**

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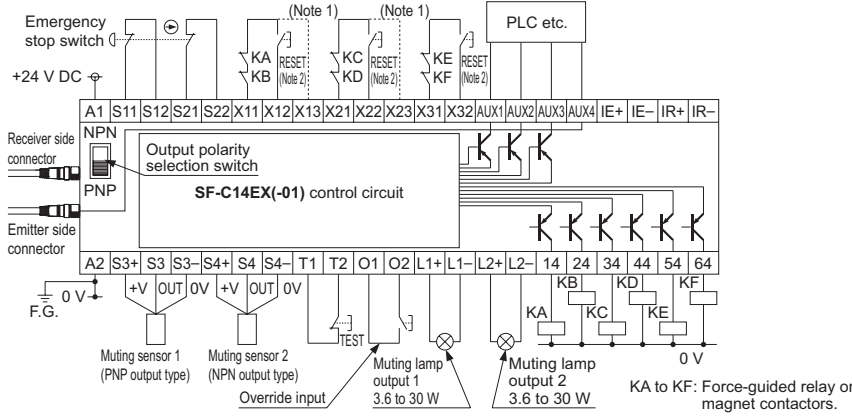


**LIGHT CURTAIN WIRING DIAGRAMS**

**Wiring diagram of SF-C14EX(-01) and SF4B 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.



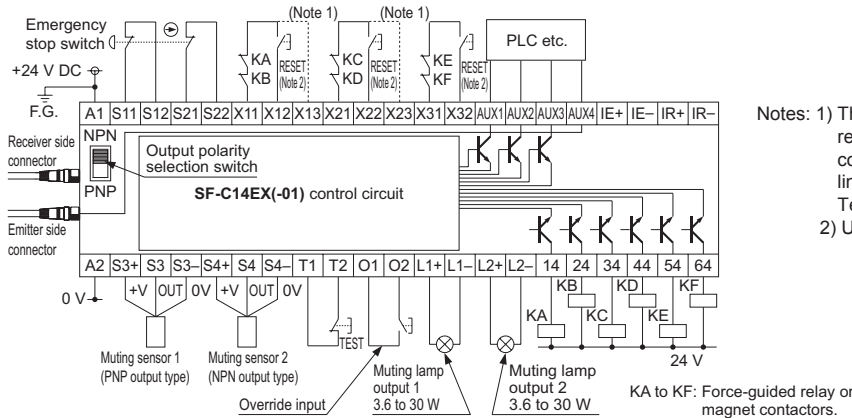
Notes: 1) The above diagram is when using manual reset. If automatic reset is used, disconnect the lead from X12 and X22, and connect them to X13 and X23 as shown by the dotted lines. In this case, a reset (RESET) button is not needed. Terminals X31 to X32 are for manual reset only.  
2) Use a momentary-type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

- When connecting the **SF-C14EX** to the 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.

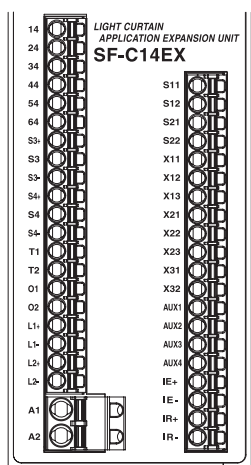
**For NPN output (plus ground)**

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



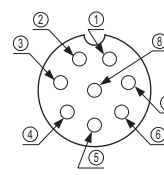
Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X12 and X22, and connect them to X13 and X23 as shown by the dotted lines. In this case, a reset (RESET) button is not needed. Terminals X31 to X32 are for manual reset only.  
2) Use a momentary-type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

**Terminal arrangement diagram**



| Terminal       | Function  | Terminal | Function  |
|----------------|---|----------|---|
| 14             | Safety output 1, Light received / Light interrupted output of the light curtain | S11      | Emergency stop contact input                        |
| 24             | Safety output 2, Light curtain output including the muting function             | S12      | 2 NC input  |
| 34             | Safety output 3   | S21      | Between S11 and S12                                 |
| 44             | Safety output 3   | S22      | Between S21 and S22                                 |
| 54             | Safety output 3   | X11      | Safety output 1 reset input                         |
| 64             | Emergency stop output   | X12      | X11 - X12: Manual reset                             |
| S3+            | Muting sensor input 1 (PNP output type)   | X13      | X11 - X13: Auto-reset                               |
| S3-            | Muting sensor input 1 (NPN output type)   | X21      | Safety output 2 reset input                         |
| S3+            | S3+, S3-: Power supply  | X22      | X21 - X22: Manual reset                             |
| S3-            | S3: Sensor output   | X23      | X21 - X23: Auto-reset                               |
| S4+            | Muting sensor input 2 (PNP output type)   | X31      | Safety output 3 reset input                         |
| S4-            | Muting sensor input 2 (NPN output type)   | X32      | X31 - X32: Manual reset                             |
| S4+            | S4+, S4-: Power supply  | AUX1     | Auxiliary output 1, Muting output                   |
| S4-            | S4: Sensor output   | AUX2     | Auxiliary output 2, Override output                 |
| T1             | Test input terminal   | AUX3     | Auxiliary output 3, Blown lamp output               |
| Open:          | Test mode   | AUX4     | Auxiliary output 4, Light curtain auxiliary output. |
| T2             | Override input terminal   | IE+      | Interference prevention terminal, Emitter side +    |
| Open:          | Invalid   | IE-      | Interference prevention terminal, Emitter side -    |
| Short-circuit: | Valid   | IR+      | Interference prevention terminal, Receiver side +   |
| O1             | Override input terminal   | IR-      | Interference prevention terminal, Receiver side -   |
| Open:          | Invalid   |          |   |
| Short-circuit: | Valid   |          |   |
| L1+            | Muting lamp output 1  |          |   |
| L1-            | Muting lamp output 1  |          |   |
| L2+            | Muting lamp output 2  |          |   |
| L2-            | Muting lamp output 2  |          |   |
| A1             | +24 V DC  |          |   |
| A2             | 0 V   |          |   |

**Pin layout for 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                  |

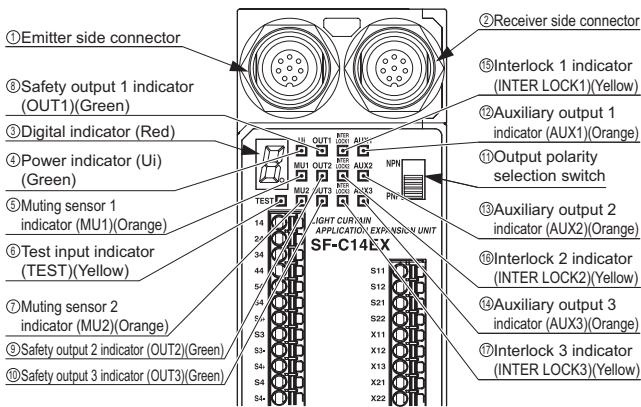
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**PRECAUTIONS FOR PROPER USE**

Refer to General precautions.

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



| No. | Description                                  | Function  |
|-----|--|---|
| 1   | Emitter side connector                       | The emitter of SF4B series is connected.  |
| 2   | Receiver side connector                      | The receiver of SF4B 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 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 2.5mm<sup>2</sup> (AWG24 to 12)  
 Signal line connector: 0.2 to 1.5mm<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 1.25mm<sup>2</sup> (AWG22 to 16)

**SF-C14EX(-01)**

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

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

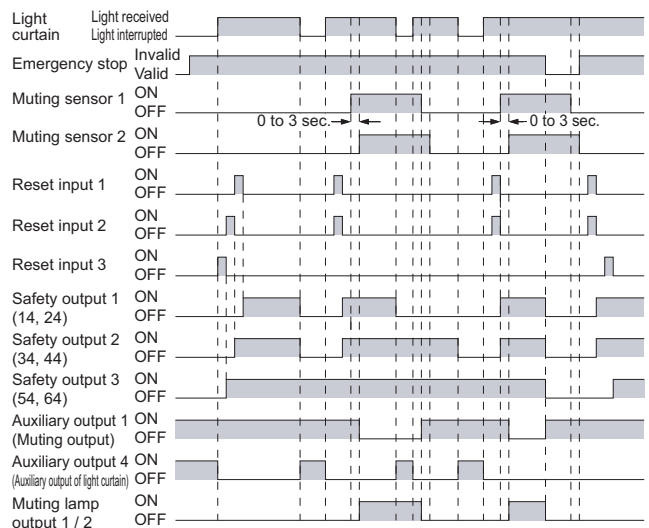
- When safety output is ON, self-diagnosis of the output circuit is carried out, so that the output transistor will periodically turn OFF. (OFF pulse width: 100  $\mu$ s or less) When the OFF signal is fed back, the receiver judges the output circuit as normal. When the OFF signal is not fed back, the 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.

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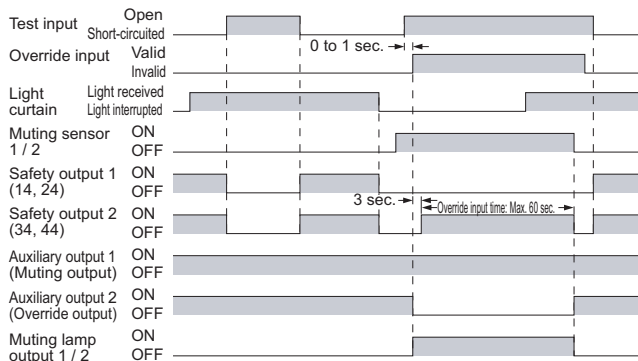
SF-CL17284T

**PRECAUTIONS FOR PROPER USE**

Refer to General precautions.

**Time chart [SF-C14EX(-01)]****Test input, Override input**

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

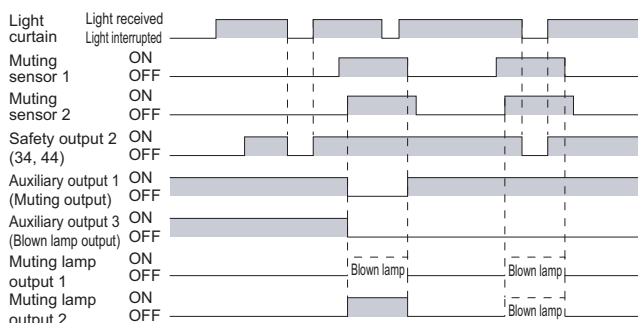


- Safety outputs 1 and 2 are OFF during test input.
- The override function becomes valid when all the conditions listed below are satisfied:
  - An incandescent lamp with 3.6 to 30 W is at least connected to either muting lamp output 1 or 2.
  - The signal is input to either muting sensor 1 or 2.
  - 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**

- 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 13849-1:1999(EN 954-1, 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.)

## &lt;Additional information&gt;

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.

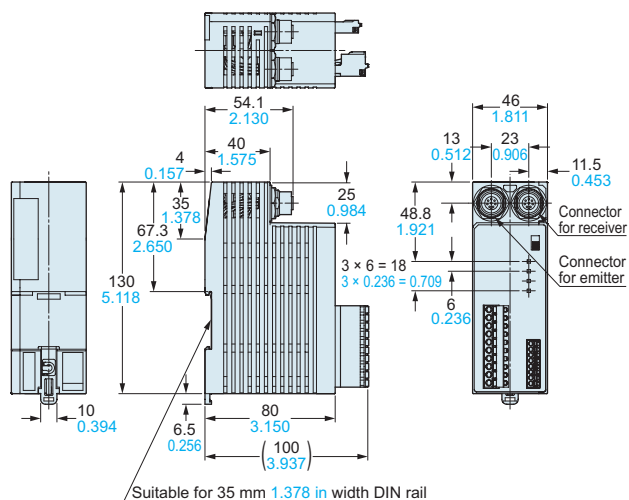
**Do not open!**

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

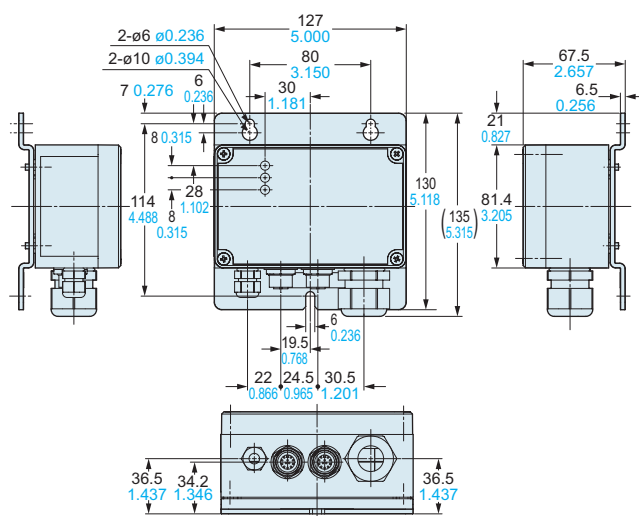
**DIMENSIONS (Unit: mm in)**

The CAD data in the dimensions can be downloaded from our website.

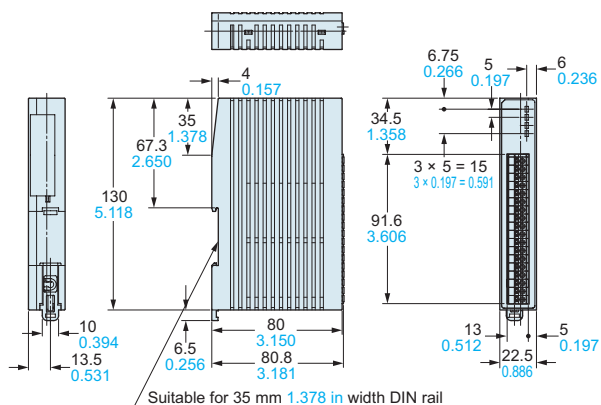
**SF-C11** Control unit



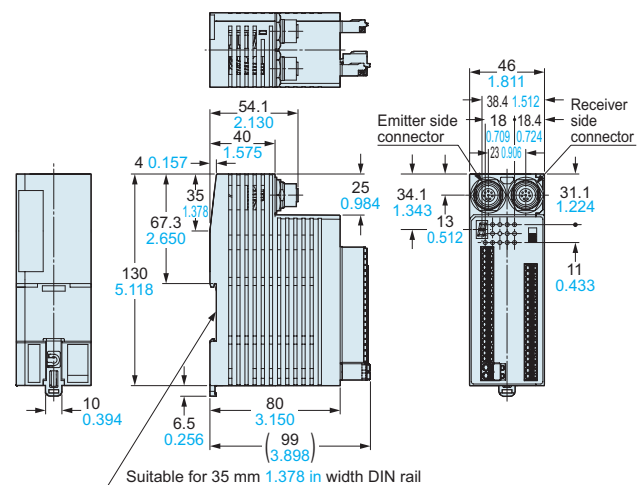
**SF-C12** Control unit



**SF-C13** Control unit



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



FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

MICRO PHOTO-ELECTRIC SENSORS

AREA SENSORS

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PRESSURE / FLOW SENSORS

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Definition of Sensing Heights

**SF-C10**

SF-CL17284T