Exclusive Control Unit for Safety Light Curtain

SF-C10 SERIES

Related Information
■ General terms and conditions F-3
■ **SF4B** / **SF4B-G** ..... P.501~
■ General precautions P.1595
■ **SF4D** ..... P.459~
■ **SF4C** / **SF2B** ..... P.577~ / P.603~
■ Korea's S-mark P.1602

Category 4 PLe SIL3

panasonic.net/id/pidsx/global

CE
cULus Listing
TÜV Certified
Certified (**SF-C11/C13** only)

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 — SF-C11 / SF-C14EX(-01)

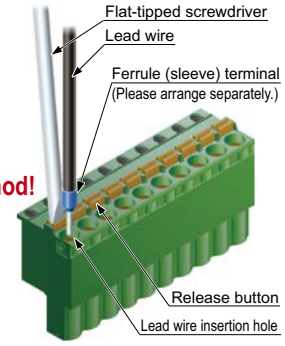
Quick-connection

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

Easy setup requiring no torque control

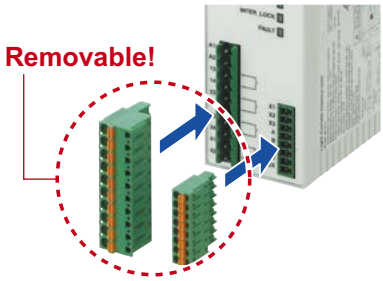
A spring method is used for the terminal blocks for connections other than to the safety light curtain. There is no need to control tightening torques for these terminal blocks.

Uses a spring method!



Removable terminal blocks reduce maintenance time

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



Robust type control unit — SF-C12

Metal enclosure with a IP65 protective structure

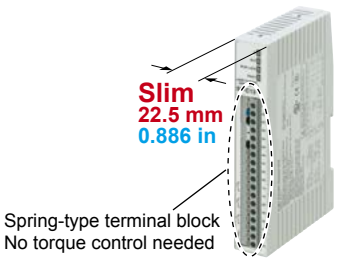
The strong metal enclosure has a built-in safety relay. It has an IP65 protective structure, so that it can be set up individually without needing to be inserted into a control panel.

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.



Spring-type terminal block
No torque control needed

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 ❶ : Linked to safety light curtain beam received / interrupted status (partial stop)

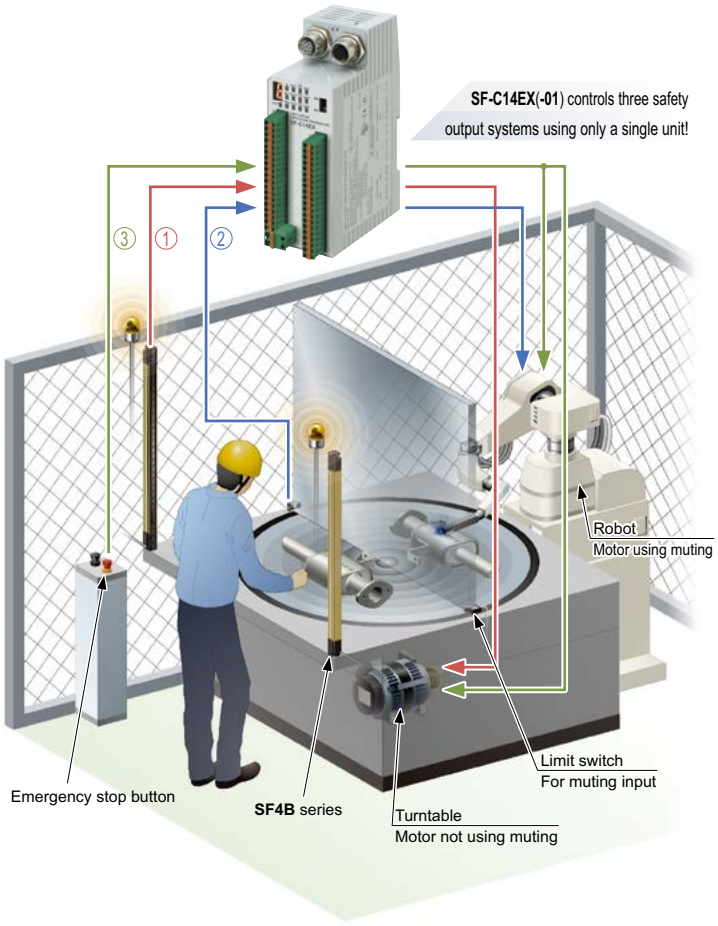
When the safety light curtain is interrupted (when an workpiece enters or a person intrudes), this circuit switches off (open) the safety output and stops the turntable.

Safety circuit ❷ : 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 ❸ : 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).



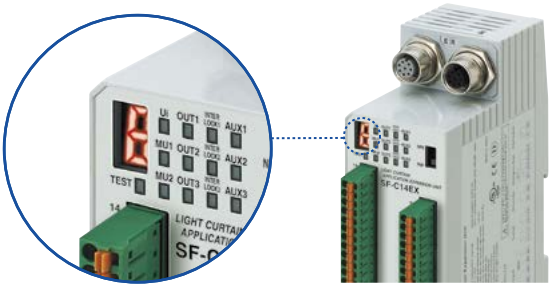
Equipped with blown lamp output for muting lamp

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.

	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

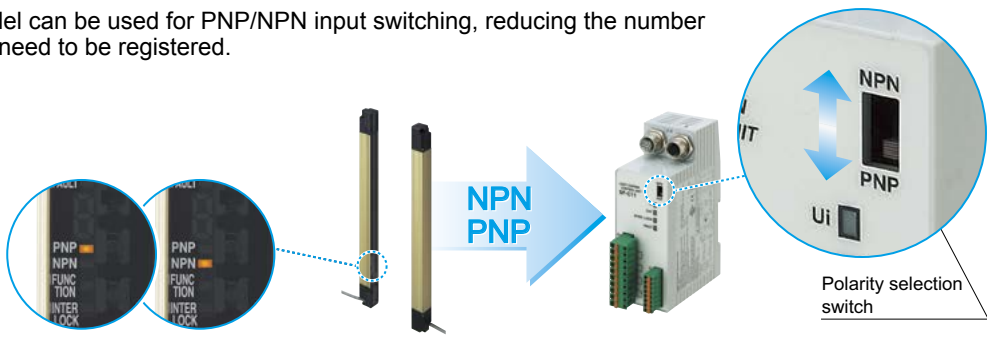
Equipped with a digital indicator so that error details can be understood at a glance!

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.



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.

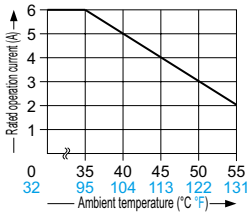


SPECIFICATIONS

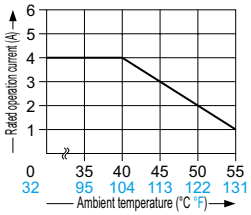
Item \ Model No.	SF-C11	SF-C12	SF-C13
Connectable safety light curtains	**SF4D** / **SF4B** / **SF4B-G** / **SF2B** series	**SF4B** / **SF4B-G** series	Safety light curtain manufactured by Panasonic Industrial Devices SUNX
Applicable standards	EN 61496-1 (Type 4), EN 55011, EN ISO 13849-1 (Category 4, 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 (**SF-C11/C13** 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 ±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 × 3 (13-14, 23-24, 33-34)	NO contact × 2 (13-14, 23-24)	NO contact × 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 µm 0.008 mil Au plating, self cleaning, positively driven	AgSnO, self cleaning, positively driven
Contact resistance	100 mΩ or less (initial value)	50 mΩ or less (initial value)	100 mΩ 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) ×1 (41-42) (Related to enabling path)	Safety relay contact (NC contact) × 1 (31-32) (Related to enabling path)	Safety relay contact (NC contact) × 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)		
Indicators: Safety output [OUT (Note 5)]	Green LED (lights up when safety output is closed)		
Indicators: Interlock (INTER_LOCK)	Yellow LED (lights up when safety output is opened)	—	Yellow LED (lights up when enabling contacts are opened)
Indicators: 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
Environmental resistance: 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		
Environmental resistance: 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
Environmental resistance: 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

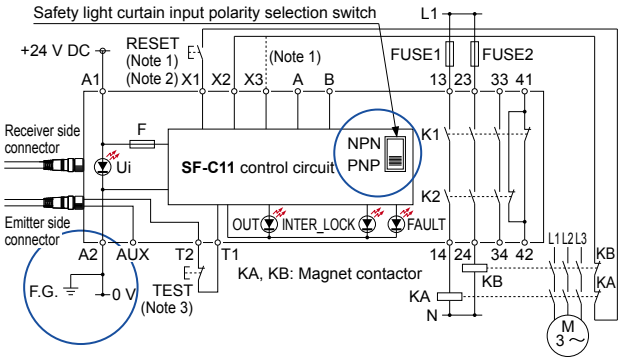


SAFETY LIGHT CURTAIN WIRING DIAGRAMS

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

For PNP output (minus ground)

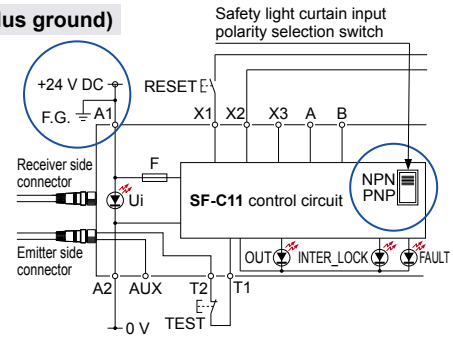
- Set the safety light curtain input polarity selection switch to the PNP side and ground the 0 V line.



Notes: 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)

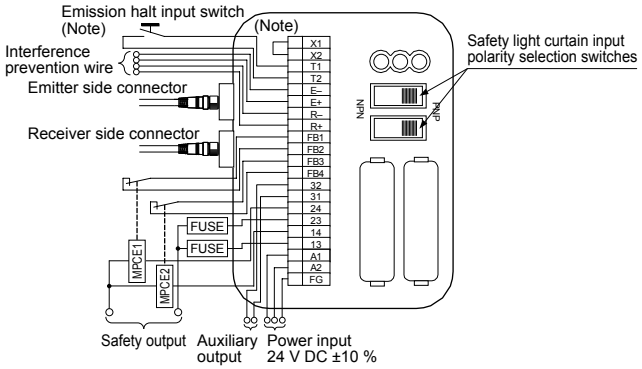
- In the above diagram, set the safety light curtain input polarity selection switch to the NPN side and ground the + side.



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.



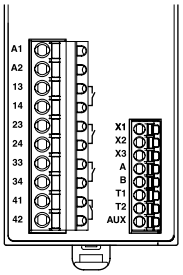
Note: The above diagram is when using manual reset. If automatic reset is used, connect a normal close-type pushbutton switch between T1 and T2 and leave between X1 and X2 open.

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.

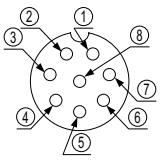
When connecting the **SF-C11** to the safety light curtains, make sure to use the 8-core connection cable with a connector. Refer to the **SF4B** / **SF4B-G** series and **SF2B** series pages for details.
SFB-CB□, **SF2B-CB□**, **SFB-CCJ10□**

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

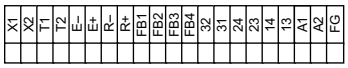


Connector pin No.	Emitter side connector	Receiver side connector
①	Interlock (Note)	OSSD2
②	+24 V DC	+24 V DC
③	Emission halt	OSSD1
④	Auxiliary output	EDM (External relay monitor)
⑤	Synchronization wire +	Synchronization wire +
⑥	Synchronization wire –	Synchronization wire –
⑦	0 V	0 V
⑧	Shielded wire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

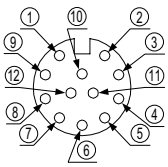
Terminal arrangement diagram



Terminal	Function
FG	Frame ground (F.G.) terminal
A2	0 V
A1	+24 V DC
13-14, 23-24	Safety output (NO contact × 2)
31-32	Auxiliary output (NC contact × 1)
FB4	External relay monitor terminal 2
FB3	
FB2	External relay monitor terminal 1
FB1	

Terminal	Function
R+	Interference prevention wire – (Receiver side)
R–	Interference prevention wire + (Receiver side)
E+	Interference prevention wire – (Emitter side)
E–	Interference prevention wire + (Emitter side)
T2	Emission halt input terminal
T1	
X2	Automatic reset/manual reset selection terminal
X1	Manual reset: X1 – X2 short-circuited

Pin layout for safety light curtain connectors



Note: Input and output for pin Nos. ⑪ and ⑫ are not used by this product

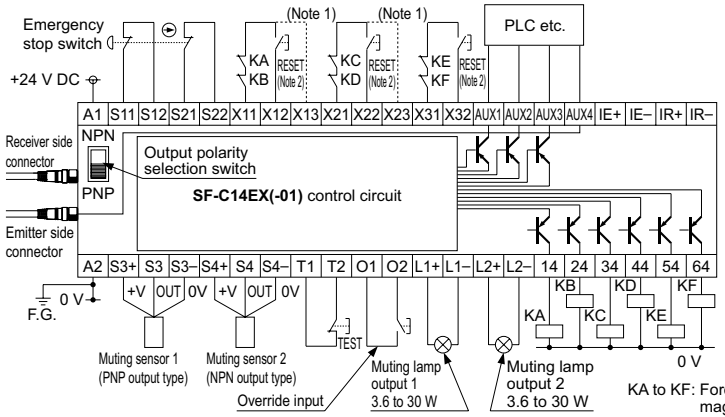
Connector pin No.	Emitter side connector	Receiver side connector
①	Interlock	OSSD2
②	+24 V DC	+24 V DC
③	Emission halt	OSSD1
④	Auxiliary output	EDM (External relay monitor)
⑤	Synchronization wire +	Synchronization wire +
⑥	Synchronization wire –	Synchronization wire –
⑦	0 V	0 V
⑧	Shielded wire	Shielded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

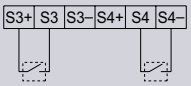
Wiring diagram of SF-C14EX(-01) and SF4B / SF4B-G series (Control Category 4)

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.

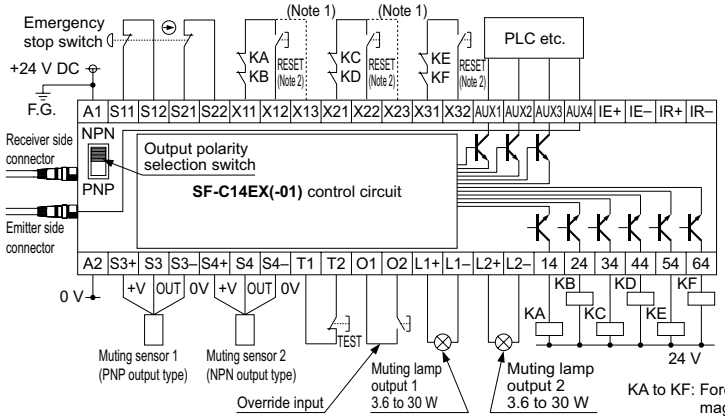


- If the emergency stop switch is not used, short-circuit between the terminals S11 to S12 and S21 to S22 directly.

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.

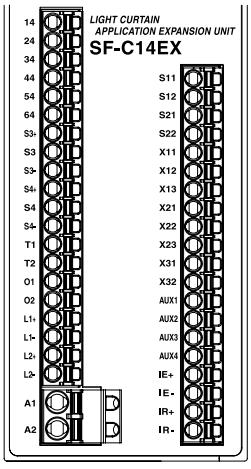
For NPN output (plus ground)

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



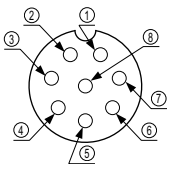
Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X12 and X22, and connect them to X13 and X23 as shown by the dotted lines. In this case, a reset (RESET) button is not needed. Terminals X31 to X32 are for manual reset only.
2) Use a momentary-type 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 2 NC input Between S11 and S12 Between S21 and S22
24		S12	
34	Safety output 2, Safety light curtain output including the muting function	S21	
44		S22	
54	Safety output 3 Emergency stop output	X11	Safety output 1 reset input X11 - X12: Manual reset X11 - X13: Auto-reset
64		X12	
S3+	Muting sensor input 1 (PNP output type) S3+, S3–: Power supply S3: Sensor output	X13	
S3		X21	Safety output 2 reset input X21 - X22: Manual reset X21 - X23: Auto-reset
S3–		X22	
S4+	Muting sensor input 2 (NPN output type) S4+, S4–: Power supply S4: Sensor output	X23	
S4		X31	Safety output 3 reset input X31 - X32: Manual reset
S4–		X32	
T1	Test input terminal Open: Test mode Short-circuit: Normal operation	AUX1	Auxiliary output 1, Muting output
T2		AUX2	Auxiliary output 2, Override output
O1	Override input terminal Open: Invalid Short-circuit: Valid	AUX3	Auxiliary output 3, Blown lamp output
O2		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

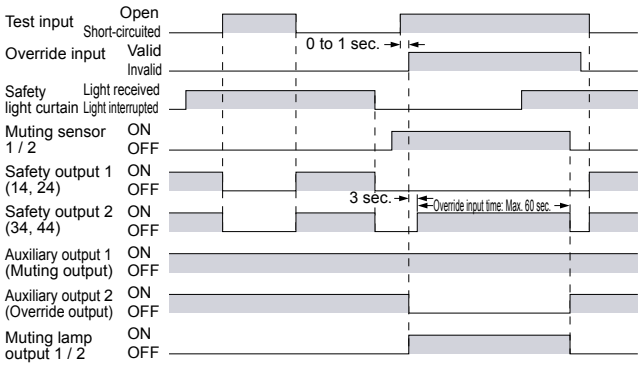
PRECAUTIONS FOR PROPER USE

Refer to p.1595 for 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.

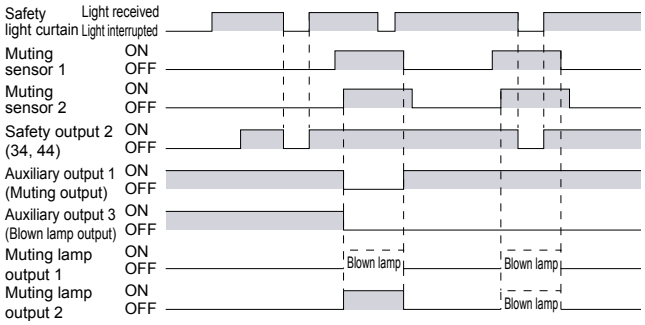


- Safety outputs 1 and 2 are OFF during test input.
- The override function becomes valid when all the conditions listed below are satisfied:
  - An incandescent lamp with 3.6 to 30 W is at least connected to either muting lamp output 1 or 2.
  - The signal is input to either muting sensor 1 or 2.
 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

- 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:
  1) Power supply unit authorized in the region where this device is to be used.
  2) Power supply unit conforming to EMC Directive and Low-voltage Directive (In case CE conformity is required.)
  3) Power supply unit conforming to the Low-voltage Directive and with an output of 100 VA or less.
  4) The frame ground (F.G.) terminal must be connected to ground when using a commercially available switching regulator.
  5) Power supply unit with an output holding time of 20 ms or more.
  6) Use an isolation transformer for the DC power supply unit.
  7) If surges are likely to occur, take countermeasures such as connecting a surge absorber to the origin of the surge.
  8) 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 Shook), 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.