

## Safety Light Curtains

- Fast and easy installation
- Resolution: 25 mm (1.01 in.)
- Range: 7 m (23 ft.)
- Protected heights: 185 to 1105 mm (7.28 to 43.50 in.)
- Very compact size: 30 x 30 mm (1.18 x 1.18 in.)
- Cross-talk prevention
- 3 m integrated cables
- A Rapid Delivery Product: Select models are available for shipment today or within 3 to 5 days



## Description

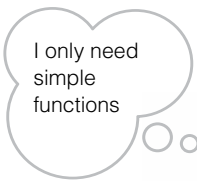
The EASY type safety light curtain is well suited for straight-forward on/off detection applications.

By carefully selecting the available functions, we have reduced man hours necessary for installation by approximately 1/2 when compared with existing STI models.

Reduced installation time means added savings to your project's budget, start with the EASY type.

### Machine safety first, narrowed down to the simplest functions:

Upon detection of personnel, the machine stops. Simple yet very optimal.



## Global Support

Omron will support you through the our global network.



Global Support

## Easy-to-view Diagnostics

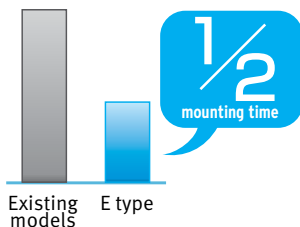
These indicators enable you to intuitively know the status and cause of any error. This allows faster installation while reducing machine down time.



Easy-to-View Diagnostics

## 1/2 the mounting time. Fixed response time makes calculation of the safety distance easier.

Reduced wiring, quick mount brackets and easy-to-view alignment beams all add up to cost savings. Additionally, with one fixed response time, it is now easier to calculate the safety distance.



Select models are available for Rapid Delivery.

Visit this product on [www.sti.com](http://www.sti.com) for details.

# Safety Light Curtain

# F3SJ-E

## EASY type reduces implementation costs with 1/2 the mounting time.

- In pursuit of simple functions: Upon detection of personnel, the machine stops.
- Can be used for simple hand intrusion detection.
- Implementation costs can be significantly reduced.

### Related information

Dimensions : Page 54 to 60  
 Function List : Page 97 to 97  
 Safety Precautions : Page 99  
 Precautions on Safety : Page 100 to 104

## Ordering Information

### Main Units

#### Safety Light Curtain

| Application     | Detection capability | Beam gap | Operating range | Protective height (mm) | Model               |               |
|-----------------|----------------------|----------|-----------------|------------------------|---------------------|---------------|
|                 |                      |          |                 |                        | PNP output          | NPN output    |
| Hand protection | Dia. 25 mm           | 20 mm    | 0.2 to 7 m      | 185 to 1,105           | F3SJ-E□□□□P25<br>*1 | F3SJ-E□□□□N25 |

Note: F3SJ-E uses a 3 m prewired discrete cable.

\*1. For S-mark compatible model, the suffix "-S" is added to the model name.  
 (Example) F3SJ-E0185P25-S

#### Safety Light Curtain Model List

Please contact our sales representative.

#### F3SJ-E Series (20 mm pitch)



| Model         |               | Number of beams | Protective height [mm] *2 |
|---------------|---------------|-----------------|---------------------------|
| PNP output *1 | NPN output    |                 |                           |
| F3SJ-E0185P25 | F3SJ-E0185N25 | 8               | 185                       |
| F3SJ-E0225P25 | F3SJ-E0225N25 | 10              | 225                       |
| F3SJ-E0305P25 | F3SJ-E0305N25 | 14              | 305                       |
| F3SJ-E0385P25 | F3SJ-E0385N25 | 18              | 385                       |
| F3SJ-E0465P25 | F3SJ-E0465N25 | 22              | 465                       |
| F3SJ-E0545P25 | F3SJ-E0545N25 | 26              | 545                       |
| F3SJ-E0625P25 | F3SJ-E0625N25 | 30              | 625                       |
| F3SJ-E0705P25 | F3SJ-E0705N25 | 34              | 705                       |
| F3SJ-E0785P25 | F3SJ-E0785N25 | 38              | 785                       |
| F3SJ-E0865P25 | F3SJ-E0865N25 | 42              | 865                       |
| F3SJ-E0945P25 | F3SJ-E0945N25 | 46              | 945                       |
| F3SJ-E1025P25 | F3SJ-E1025N25 | 50              | 1,025                     |
| F3SJ-E1105P25 | F3SJ-E1105N25 | 54              | 1,105                     |

\*1. For S-mark compatible model, the suffix "-S" is added to the model name.  
 (Example) F3SJ-E0185P25-S


\*2. Protective height (mm) = Total sensor length

## Accessories (Sold separately)

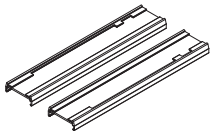
### Relays with Forcibly Guided Contacts

| Type   | Appearance  | Specifications  | Model             | Remarks   |
|--|---|---|-------------------|---|
| G7SA Relays with Forcibly Guided Contacts    |  | <ul style="list-style-type: none"> <li>Nodes: 4</li> <li>Contact type: 2A2B</li> <li>Rated switch load: 250 VAC 6A, 30 VDC 6A</li> </ul>        | <b>G7SA-2A2B</b>  | For details on other models or socket models, refer to the OMRON's website. |
|  |   | <ul style="list-style-type: none"> <li>Nodes: 4</li> <li>Contact type: 3NO+1NC</li> <li>Rated switch load: 250 VAC 6A, 30 VDC 6A</li> </ul>     | <b>G7SA-3A1B</b>  |   |
| G7S-□-E Relays with Forcibly Guided Contacts |  | <ul style="list-style-type: none"> <li>Nodes: 6</li> <li>Contact type: 4NO+2NC</li> <li>Rated switch load: 250 VAC 10 A, 30 VDC 10 A</li> </ul> | <b>G7S-4A2B-E</b> | For details on other models or socket models, refer to the OMRON's website. |
|  |   | <ul style="list-style-type: none"> <li>Nodes: 6</li> <li>Contact type: 3NO+3NC</li> <li>Rated switch load: 250 VAC 10 A, 30 VDC 10 A</li> </ul> | <b>G7S-3A3B-E</b> |   |

### Laser Pointer


| Appearance  | Output                 | Model          |
|---|------------------------|----------------|
|  | Laser Pointer for F3SJ | <b>F39-PTJ</b> |

### Spatter Protection Cover (2 cables per set, common for emitter/receiver) (10% Operating Range Attenuation)

| Appearance  | Model               |
|---|---------------------|
|  | <b>F39-HB□□□□ *</b> |

\*The same 4-digit numbers as the protective heights (□□□□ in the light curtain model names) are substituted by in the model names.

### Protective Bar

| Appearance  | Model                     | Remarks   |
|---|---------------------------|---|
|  | <b>F39-PB□□□□ *1</b>      | <ul style="list-style-type: none"> <li>2 Light Curtain brackets</li> <li>4 mounting brackets</li> <li>0 to 4 intermediate brackets for backside mounting (quantity required for the sensing width)</li> <li>0 to 4 intermediate brackets for mounting to the sides (quantity required for the sensing width)</li> </ul> |
|   | <b>F39-PB□□□□-S *1 *2</b> | <ul style="list-style-type: none"> <li>1 Light Curtain bracket</li> <li>2 mounting brackets</li> <li>0 to 2 intermediate brackets for backside mounting (quantity required for the sensing width)</li> <li>0 to 2 intermediate brackets for mounting to the sides (quantity required for the sensing width)</li> </ul>  |

**Note:** The following are not provided with the Protective Bars.

- Safety Light Curtain
- Safety Light Curtain Top/Bottom Brackets
- Wall Mounting Screw Unit


\*1. The same four digits indicating protective height that are used in the Sensor model number (□□□□) are used in the part of the Protector model number.

\*2. Purchase the F39-PB□□□□ (which contains two sets of brackets) to use Protective Bars for both the Emitter and Receiver.







### Test rod

| Diameter  | Model            |
|-----------|------------------|
| 14mm dia. | <b>F39-TRD14</b> |
| 20mm dia. | <b>F39-TRD20</b> |
| 25mm dia. | <b>F39-TRD25</b> |
| 30mm dia. | <b>F39-TRD30</b> |

## Mirrors (12% Operating Range Attenuation)

| Appearance  | Mirror material | Width (mm) | Thickness (mm) | Length (mm) | Model       | Remarks  |
|---|-----------------|------------|----------------|-------------|-------------|--|
|  | Glass mirror    | 145        | 32             | 406         | F39-MLG0406 | 2 sets of Cylindrical mounting rod, 4 screws are included. |
|   |                 |            |                | 610         | F39-MLG0610 |  |
|   |                 |            |                | 711         | F39-MLG0711 |  |
|   |                 |            |                | 914         | F39-MLG0914 |  |
|   |                 |            |                | 1,067       | F39-MLG1067 |  |
|   |                 |            |                | 1,219       | F39-MLG1219 |  |
|   |                 |            |                | 1,422       | F39-MLG1422 |  |
|   |                 |            |                | 1,626       | F39-MLG1626 |  |
|   |                 |            |                | 1,830       | F39-MLG1830 |  |
|   |                 |            |                | 2,134       | F39-MLG2134 |  |

## Sensor Mounting Bracket (Sold separately)

| Appearance  | Specifications                                   | Model           | Application  | Remarks  |
|---|--|-----------------|--|--|
|    | Top/bottom bracket                               | F39-LJB1        | Top/bottom bracket for F3SJ-E/B  | 2 for an emitter, 2 for a receiver, total of 4 per set |
|   | Intermediate bracket                             | F39-LJB2 *1 *2  | In combination use with top/bottom bracket for F3SJ-E/B<br>Can be used as free-location bracket. | 1 set with 2 pieces                                    |
|  | Quick mount bracket                              | F39-LJB3-M6 *1  | Quick mount bracket for F3SJ-E/B<br>Supports M6 slide nut for aluminum frame.                    | 1 set with 2 pieces                                    |
|   |  | F39-LJB3-M8 *2  | Quick mount bracket for F3SJ-E/B<br>Supports M8 slide nut for aluminum frame.                    |  |
|  | Quick mount M6 bracket<br>Quick mount M8 bracket | F39-LJB3-M6K *1 | Bracket to mount an intermediate bracket to the aluminum frame with a single touch.              | Hexagon socket head cap screws (M6 x 10) are included. |
|   |  | F39-LJB3-M8K *2 |  | Hexagon socket head cap screws (M8 x 14) are included. |
|  | Compatible mounting bracket                      | F39-LJB4        | Mounting bracket used when replacing existing area sensors (F3SJ-A or F3SN) with the F3SJ-E/B.   | 2 for an emitter, 2 for a receiver, total of 4 per set |
|  | Contact mount bracket                            | F39-LJB5        | Bracket to closely contact the back side of the Sensor.  | 2 for an emitter, 2 for a receiver, total of 4 per set |

**Note:** All the sensor mounting brackets for F3SJ-E are sold separately.  
 \*1. Combining F39-LJB2 and F39-LJB3-M6K makes F39-LJB3-M6.  
 \*2. Combining F39-LJB2 and F39-LJB3-M8K makes F39-LJB3-M8.

## Specifications (For details, refer to the instruction manual or User's manual.)

### Main Units

F3SJ-E□□□□P25/N25

| Model  | PNP output   | F3SJ-E□□□□P25   |
|--|--|---|
|  | NPN output   | F3SJ-E□□□□N25   |
| <b>Sensor type</b>   | Type 4 safety light curtain  |   |
| <b>Setting tool connection *1</b>                            | Parameter settings: Not available  |   |
| <b>Safety category</b>                                       | Safety purpose of category 4, 3, 2, 1, or B  |   |
| <b>Detection capability</b>                                  | Opaque objects 25 mm in diameter   |   |
| <b>Beam gap (P)</b>  | 20 mm  |   |
| <b>Number of beams (n)</b>                                   | 8 to 54  |   |
| <b>Protective height (PH)</b>                                | 185 to 1,105 mm  |   |
| <b>Lens diameter</b>   | Diameter 5 mm  |   |
| <b>Operating range *2</b>                                    | 0.2 to 7 m   |   |
| <b>Response time (under stable light incident condition)</b> | ON to OFF  | 15 ms max.  |
|  | OFF to ON  | 70 ms max.  |
| <b>Startup waiting time</b>                                  | 2 s max.   |   |
| <b>Power supply voltage (Vs)</b>                             | SELV/PELV 24 VDC±20% (ripple p-p 10% max.)   |   |
| <b>Consumption current (no load)</b>                         | PNP output   | Emitter : Up to 22 beams: 41 mA max., 26 to 42 beams: 57 mA max., 46 to 54 beams: 63 mA max.<br>Receiver : Up to 22 beams: 42 mA max., 26 to 42 beams: 47 mA max., 46 to 54 beams: 51 mA max.                             |
|  | NPN output   | Emitter : Up to 22 beams: 41 mA max., 26 to 42 beams: 57 mA max., 46 to 54 beams: 63 mA max.<br>Receiver : Up to 22 beams: 40 mA max., 26 to 42 beams: 45 mA max., 46 to 54 beams: 48 mA max.                             |
| <b>Light source (emitted wavelength)</b>                     | Infrared LED (870 nm)  |   |
| <b>Effective aperture angle (EAA)</b>                        | Based on IEC 61496-2. Within ±2.5° for both emitter and receiver when the detection distance is 3 m or over  |   |
| <b>Safety outputs (OSSD)</b>                                 | PNP output   | Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension), Leakage current 1 mA max., load inductance 2.2 H max. *3, Maximum capacity load 1 μF *4 |
|  | NPN output   | Two NPN transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension), Leakage current 1 mA max., load inductance 2.2 H max. *3, Maximum capacity load 1 μF *4 |
| <b>Output operation mode</b>                                 | Safety output: On when receiving light   |   |
| <b>Input voltage</b>   | PNP output   | ON voltage: Vs-3 V to Vs OFF voltage: 0 V to 1/2 Vs or open *5  |
|  | NPN output   | ON voltage: 0 V to 3 V OFF voltage: 1/2 Vs to Vs or open *5   |
| <b>Mutual interference prevention function</b>               | Mutual interference prevention algorithm prevents interference in up to 3 sets.  |   |
| <b>Test function</b>   | <ul style="list-style-type: none"> <li>Self test (at power-ON and at power distribution)</li> <li>External test (emission stop function by test input)</li> </ul>  |   |
| <b>Protection circuit</b>                                    | Output short-circuit protection, and power supply reverse polarity protection  |   |
| <b>Ambient temperature</b>                                   | Operating: -10 to 55°C (non-freezing), Storage: -25 to 70°C  |   |
| <b>Ambient humidity</b>                                      | Operating: 35% to 85% (no condensation), Storage: 35% to 95% RH  |   |
| <b>Operating ambient light intensity</b>                     | Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.   |   |
| <b>Insulation resistance</b>                                 | 20 MΩ min. (at 500 VDC)  |   |
| <b>Dielectric strength</b>                                   | 1,000 VAC 50/60 Hz, 1 min  |   |
| <b>Degree of protection</b>                                  | IP65 (IEC 60529)   |   |
| <b>Vibration resistance</b>                                  | Malfunction: 10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps in X, Y, and Z directions  |   |
| <b>Shock resistance</b>                                      | Malfunction: 100 m/s <sup>2</sup> , 1,000 times each in X, Y, and Z directions   |   |
| <b>Pollution degree</b>                                      | Pollution degree 3 (IEC 60664-1)   |   |
| <b>Power cable</b>   | Connection method: Pull-out type, cable length 3 m<br>Number of wires: Emitter: 5 wires, receiver: 6 wires<br>Cable diameter: Dia. 6 mm<br>Allowable bending radius: R5 mm   |   |
| <b>Extension cable</b>                                       | 30 m max. *6   |   |
| <b>Material</b>  | Case: Aluminum<br>Cap: ABS resin, PBT<br>Optical cover: PMMA resin (acrylic)<br>Cable: Oil resistant PVC   |   |
| <b>Weight (packed state)</b>                                 | Weight (g) = (protective height) x 2.6 + 800   |   |
| <b>Accessories</b>   | Instruction Manual, User's Manual (CD-ROM) *7  |   |
| <b>Applicable standards</b>                                  | IEC 61496-1, EN 61496-1, UL 61496-1, Type 4 ESPE (Electro-Sensitive Protective Equipment)<br>IEC 61496-2, CLC/TS 61496-2, UL 61496-2, Type 4 AOPD (Active Opto-electronic Protective Devices)<br>IEC 61508-1 to -3, EN 61508-1 to -3 SIL3<br>ISO 13849-1: 2006, EN ISO 13849-1: 2008 (PLe/Safety Category 4)<br>UL 508, UL 1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8 |   |

\*1. Do not use the Support Software and Setting Console for F3SJ-A. Operation cannot be guaranteed.

\*2. Use of the Spatter Protection Cover causes a 10% maximum sensing distance attenuation.

\*3. The load inductance is the maximum value when the safety output frequently repeats ON and OFF. When you use the safety output at 4 Hz or less, the usable load inductance becomes larger.

\*4. These values must be taken into consideration when connecting elements including a capacitive load such as capacitor.

\*5. The Vs indicates a voltage value in your environment.

\*6. To extend a cable of the F3SJ-E, refer to the User's Manual (SCHG-733/732).

\*7. Mounting brackets are sold separately.

## Indicator

### Emitter

| Name of indicator           | Label     | ON   | Blinking   |
|-----------------------------|-----------|--|--|
| Top-beam-state indicator    | TOP       | Turns ON when the top beam is receiving light.   | ---  |
| Stable-state indicator      | STB       | Turns ON when incidence level is more than 170% of the output ON threshold.            | Blinks when the safety output is turned OFF due to disturbance light or vibration. |
| ON/OFF-state indicator      | ON<br>OFF | Green: Turns ON when safety output is ON.<br>Red: Turns OFF when safety output is OFF. | Red: Blinks when the F3SJ-E enters a lockout due to a safety output error.         |
| Lockout indicator           | LOCKOUT   | Turns ON when the F3SJ-E enters a lockout on the receiver.                             | Blinks when the F3SJ-E enters a lockout on the emitter.                            |
| Power indicator             | POWER     | Turns ON while the power of the emitter is ON.   | Blinks when the F3SJ-E enters a lockout due to power voltage/noise.                |
| Test indicator              | TEST      | ---  | Blinks when external test is being performed.                                      |
| Bottom-beam-state indicator | BTM       | Turns ON when the bottom beam is receiving light.                                      | ---  |

### Receiver

| Name of indicator           | Label     | ON   | Blinking   |
|-----------------------------|-----------|--|--|
| Top-beam-state indicator    | TOP       | Turns ON when the top beam is receiving light.   | ---  |
| Stable-state indicator      | STB       | Turns ON when incidence level is more than 170% of the output ON threshold.            | Blinks when the safety output is turned OFF due to disturbance light or vibration.               |
| ON/OFF-state indicator      | ON<br>OFF | Green: Turns ON when safety output is ON.<br>Red: Turns OFF when safety output is OFF. | Red: Blinks when the F3SJ-E enters a lockout due to a safety output error.                       |
| Lockout indicator           | LOCKOUT   | Turns ON when the F3SJ-E enters a lockout on the emitter.                              | Blinks when the F3SJ-E enters a lockout on the receiver.   |
| Communication indicator     | COM       | Turns ON when communication between emitter and receiver is established.               | Blinks when the F3SJ-E enters lockout due to a communication error between receiver and emitter. |
| Configuration indicator     | CFG       | ---  | Blinks when the F3SJ-E enters lockout due to a model type error between receiver and emitter.    |
| Internal error indicator    | INTERNAL  | ---  | Blinks when the F3SJ-E enters a lockout due to an internal error.                                |
| Bottom-beam-state indicator | BTM       | Turns ON when the bottom beam is receiving light.                                      | ---  |

## Accessories

### Laser Pointer

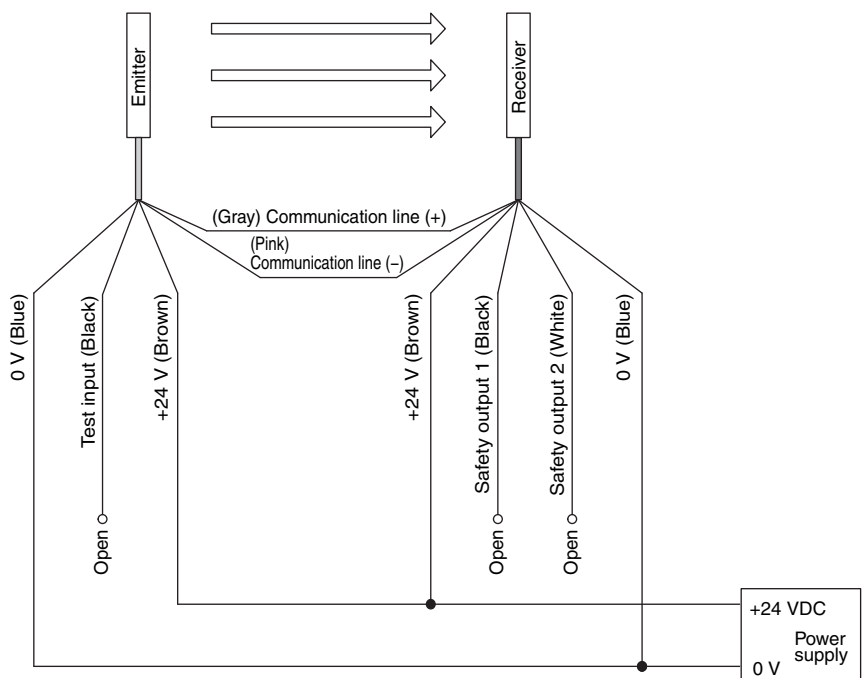
| Item                          | Model   | F39-PTJ |
|-------------------------------|---|---------|
| Applicable sensor             | F3SJ Series   |         |
| Power supply voltage          | 4.65 or 4.5 VDC   |         |
| Battery                       | Three button batteries (SR44 or LR44)   |         |
| Battery life *                | SR44: 10 hours of continuous operation, LR44: 6 hours of continuous operation                     |         |
| Light source                  | Red semiconductor laser (wavelength: 650 nm, 1 mW max. JIS class 2, EN/IEC class 2, FDA class II) |         |
| Spot diameter (typical value) | 6.5 mm at 10 m  |         |
| Ambient temperature           | Operating: 0 to 40°C Storage: -15 to 60°C (with no icing or condensation)                         |         |
| Ambient humidity              | Operating and storage: 35% to 85% (with no condensation)  |         |
| Material                      | Laser module case: aluminum Mounting bracket: aluminum and stainless                              |         |
| Weight                        | Approx. 220 g (packed)  |         |
| Accessories                   | Laser safety standard labels (EN: 1, FDA: 3) Button batteries (SR44: 3), instruction manual       |         |

\* Battery life varies depending on a battery used.

## Connections

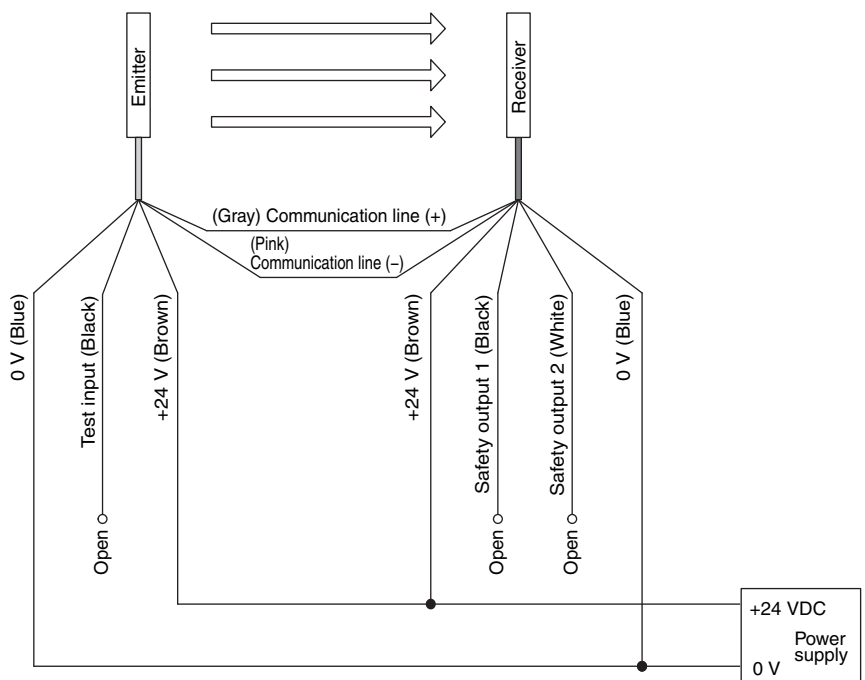
### Basic Wiring Diagram

Minimum wiring required to check the operation of the F3SJ-E [PNP Output]



**Note:** This circuit diagram is used for operation check. For an actual circuit example, refer to page 23.

Minimum wiring required to check the operation of the F3SJ-E [NPN Output]

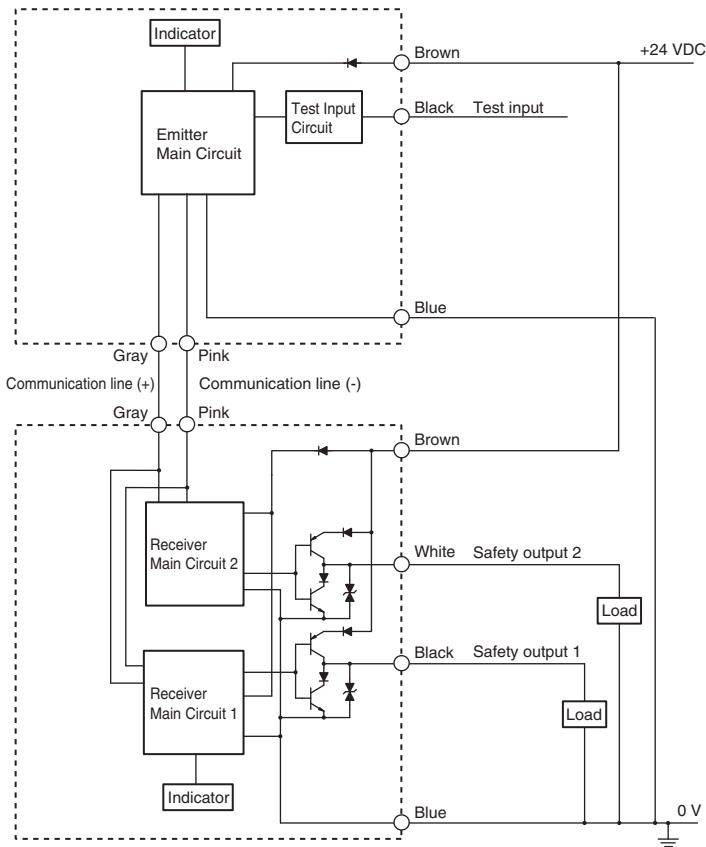


**Note:** This circuit diagram is used for operation check. For an actual circuit example, refer to page 23.

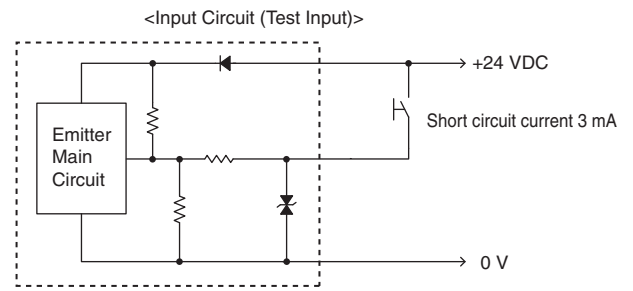
# Input/Output Circuit Diagram

[PNP Output]

Entire Circuit Diagram

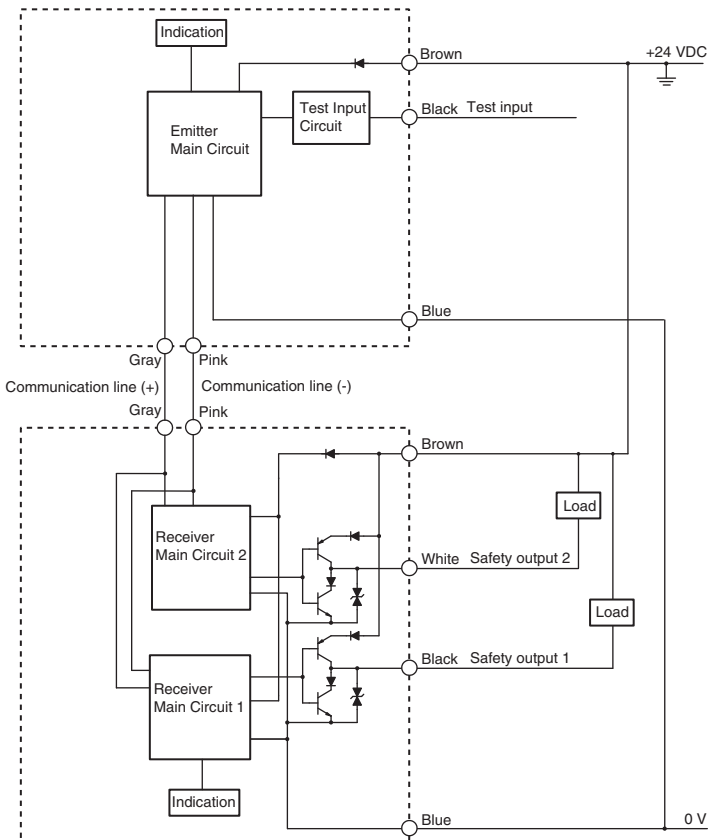


Input circuit diagram by function

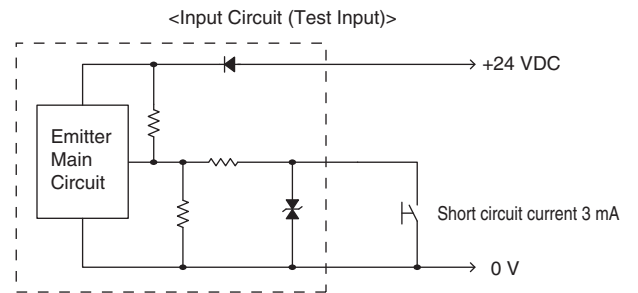


[NPN Output]

Entire Circuit Diagram



Input circuit diagram by function





# Connection Circuit Examples

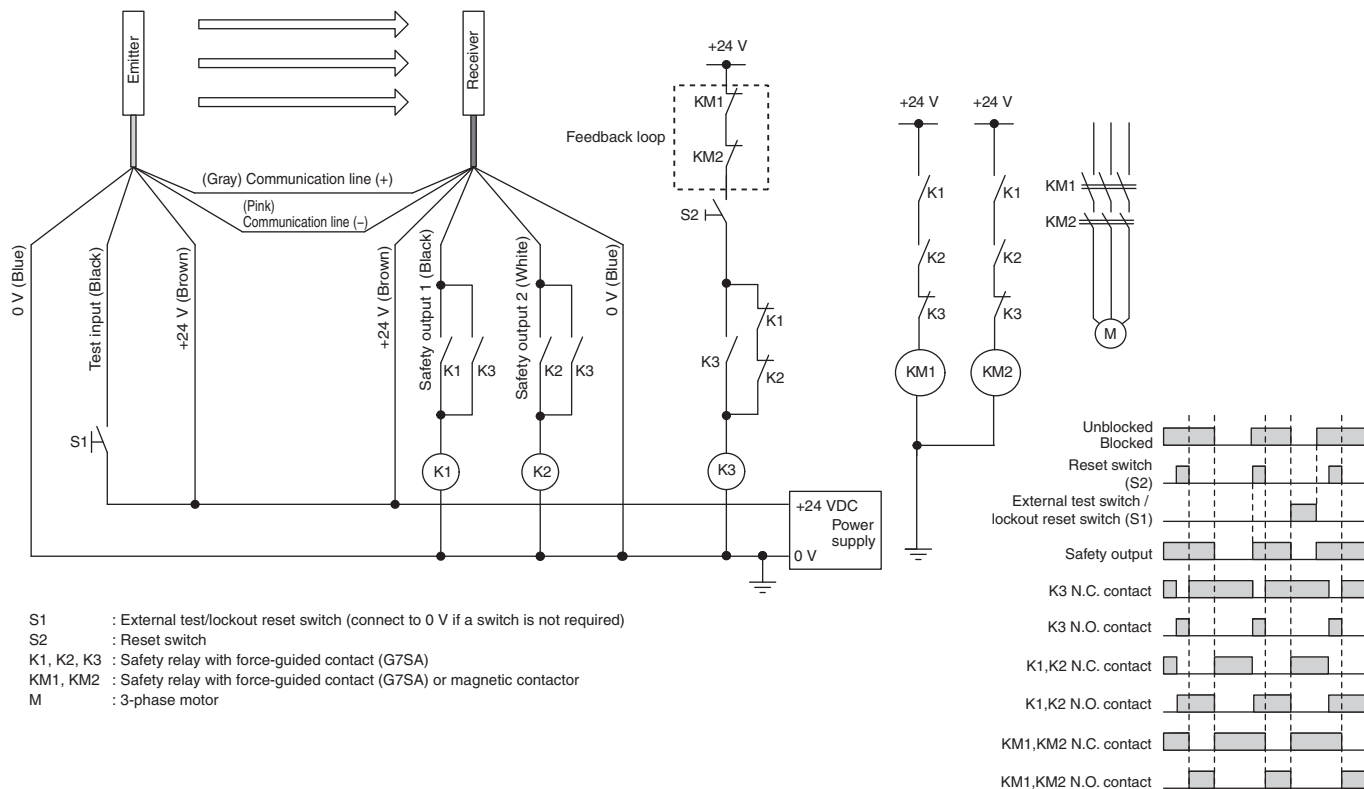
## Wiring for single F3SJ-E application [PNP Output]

| PL/safety category | Model   | Stop category | Reset  |
|--------------------|---|---------------|--------|
| PLe/4 equivalent   | Safety Light Curtain F3SJ-E□□□□P25<br>Safety Relay G7SA | 0             | Manual |

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

### ● Application Overview

- The power supply to the motor M is turned OFF when the beam is blocked.
- The power supply to the motor M is kept OFF until the beams are unblocked and the reset switch S2 is pressed.



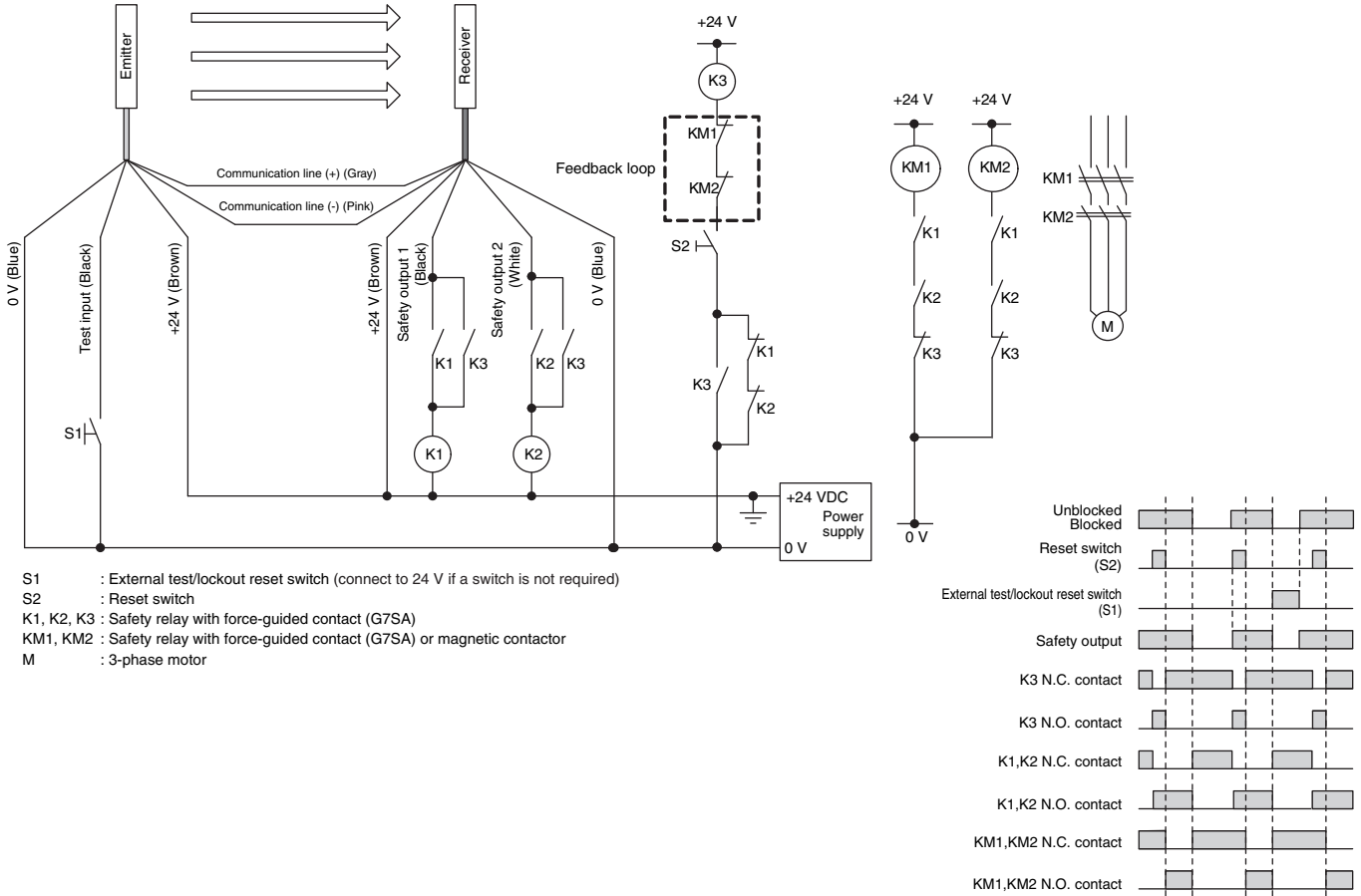
## Wiring for single F3SJ-E application [NPN Output]

| PL/safety category | Model  | Stop category | Reset  |
|--------------------|--|---------------|--------|
| PLe/4 equivalent   | Safety Light Curtain F3SJ-E□□□□□N25<br>Safety Relay G7SA | 0             | Manual |

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

### ● Application Overview

- The power supply to the motor M is turned OFF when the beam is blocked.
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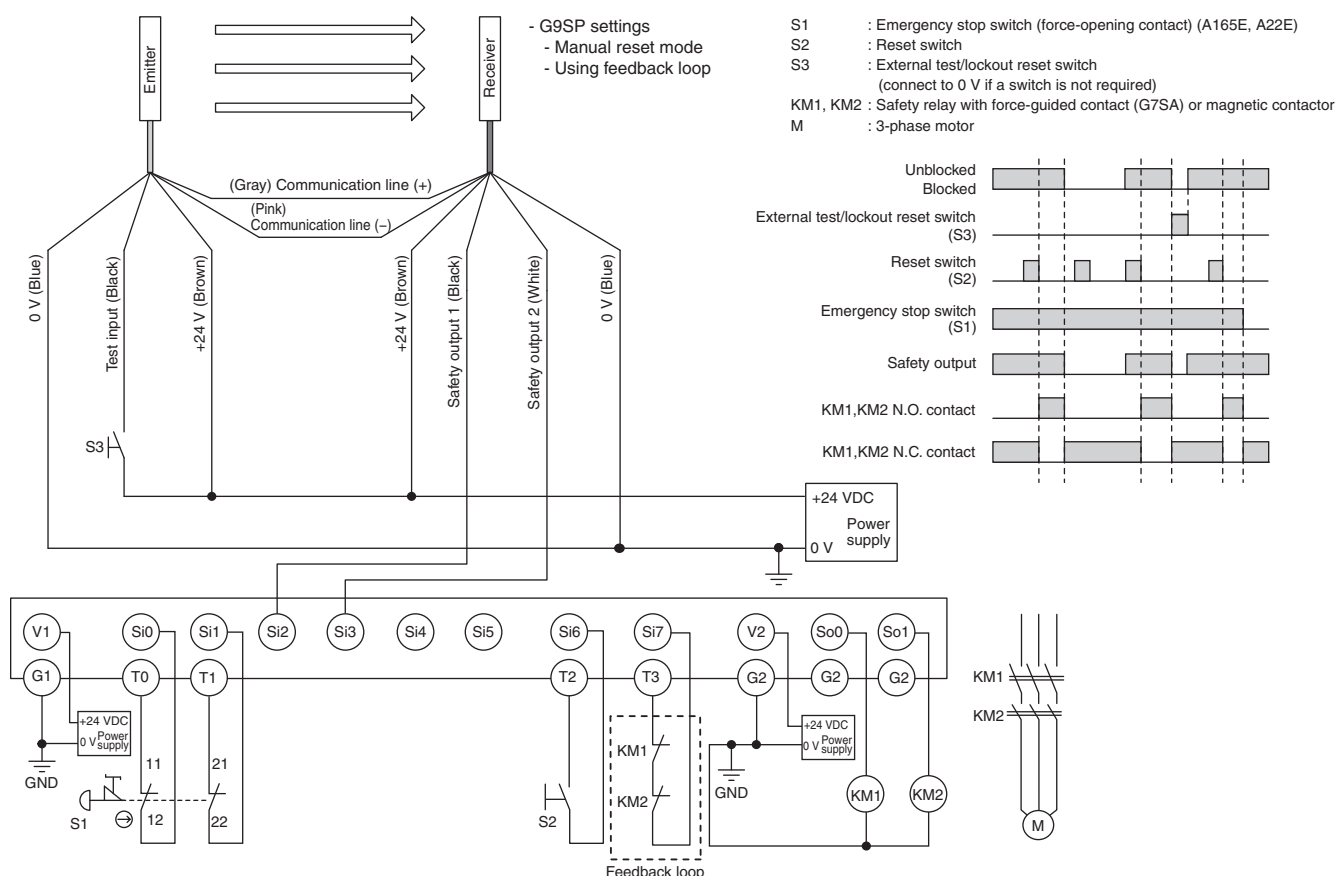
**Wiring to connect a F3SJ-E with a controller G9SP [PNP Output]**

| PL/safety category            | Model   | Stop category | Reset  |
|-------------------------------|---|---------------|--------|
| PL <sub>e</sub> /4 equivalent | Safety Light Curtain F3SJ-E□□□□P25<br>Safety Controller G9SP<br>Safety Relay G7SA<br>Emergency Stop Switch A165E/A22E | 0             | Manual |

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

● **Application Overview**

- The power supply to the motor M is turned OFF when the beam is blocked.
- The power supply to the motor M is turned OFF when the emergency stop switch is pressed.
- The power supply to the motor M is kept OFF until the beams are unblocked and the reset switch S2 is pressed while the emergency stop switch is released.



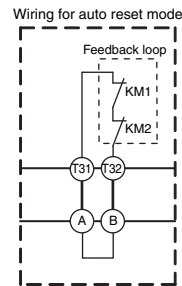
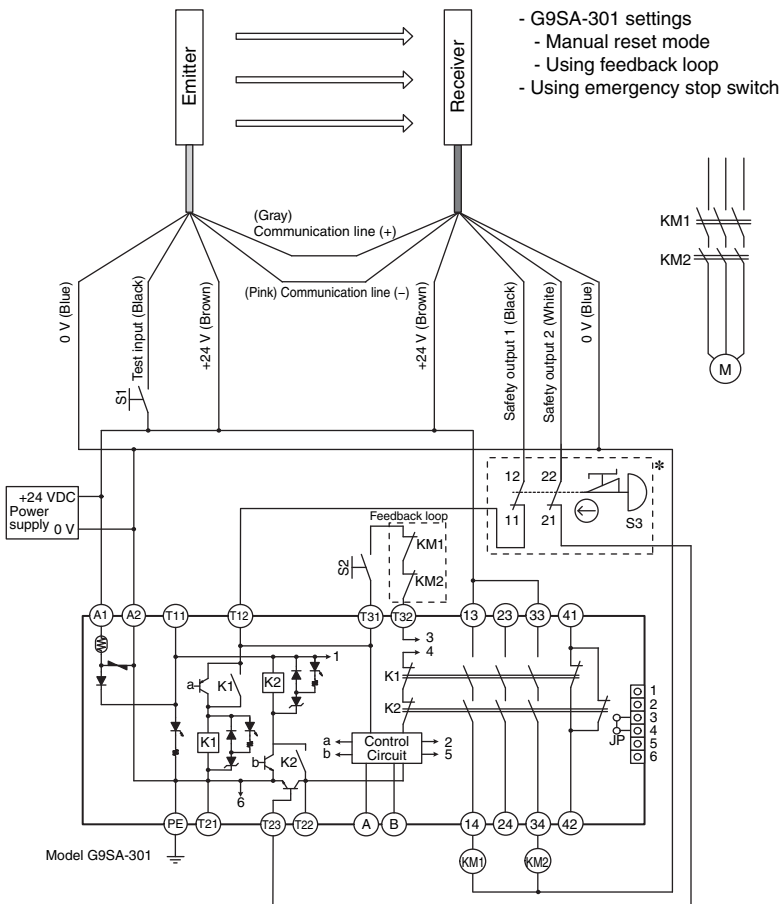
## Wiring to connect a F3SJ-E with a controller G9SA-301 [PNP Output]

| PL/safety category | Model   | Stop category | Reset  |
|--------------------|---|---------------|--------|
| PLe/4 equivalent   | Safety Light Curtain F3SJ-E□□□□P25<br>Safety Relay Unit G9SA-301 24V AC/DC<br>Safety Relay G7SA<br>Emergency Stop Switch A165E/A22E | 0             | Manual |

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

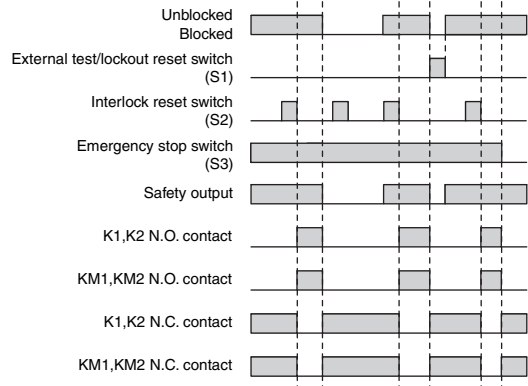
### ● Application Overview

- The power supply to the motor M is turned OFF when the beam is blocked.
- The power supply to the motor M is turned OFF when the emergency stop switch is pressed.
- The power supply to the motor M is kept OFF until the beams are unblocked and the reset switch S2 is pressed while the emergency stop switch is released.



\* If an emergency stop switch is not used, connect safety output 1 to T12 terminal and safety output 2 to T23 directly.

- S1: External test/lockout reset switch (connect to 0 V if a switch is not required)
- S2: Interlock reset switch
- S3: Emergency stop switch (force-opening contact) (A165E, A22E)
- KM1, KM2: Safety relay with force-guided contact (G7SA) or magnetic contactor
- M: 3-phase motor



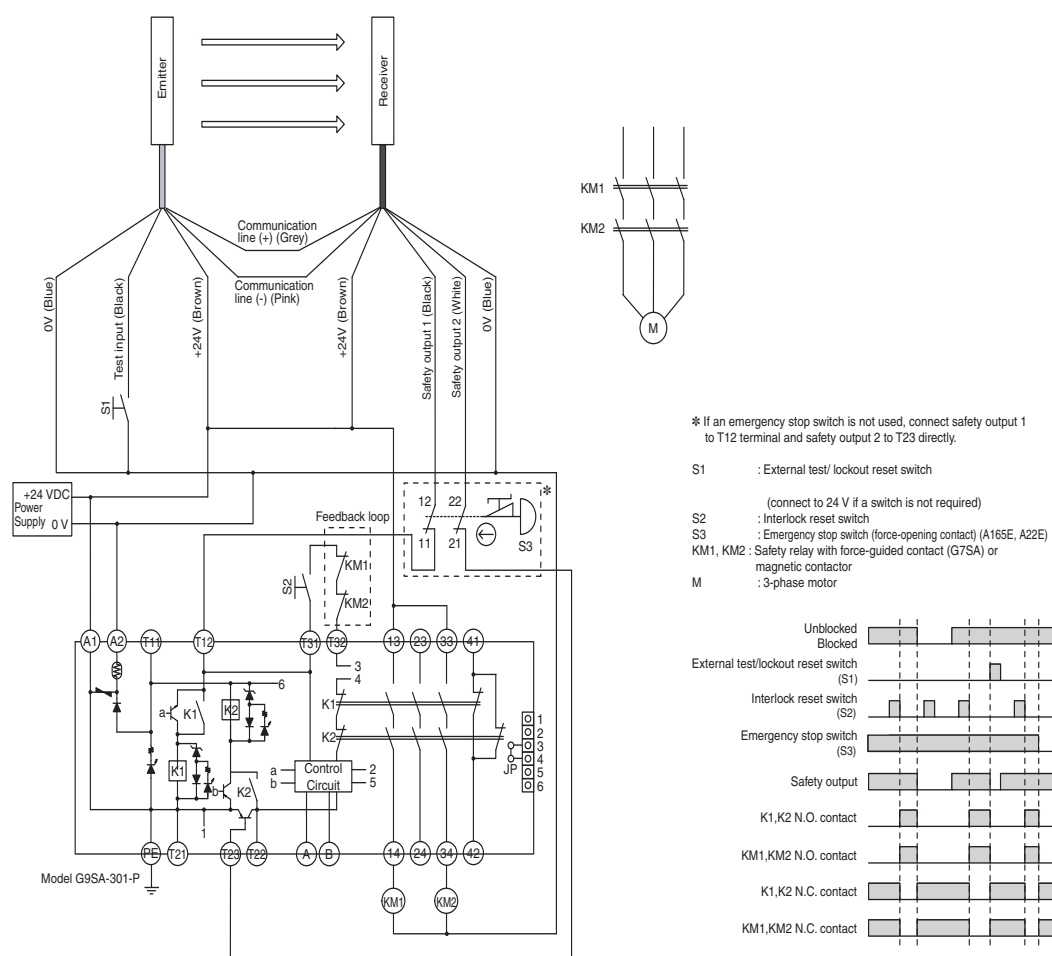
Wiring to connect a F3SJ-E with a controller G9SA-301-P [NPN Output]

| PL/safety category | Model  | Stop category | Reset  |
|--------------------|--|---------------|--------|
| PLe/4 equivalent   | Safety Light Curtain F3SJ-E□□□□N25<br>Safety Relay Unit G9SA-301-P 24V DC<br>Safety Relay G7SA<br>Emergency Stop Switch A165E/A22E | 0             | Manual |

**Note:** The above PL is only the evaluation result of the example. The PL must be evaluated in an actual application by the customer after confirming the usage conditions.

● Application Overview

- The power supply to the motor M is turned OFF when the beam is blocked.
- The power supply to the motor M is turned OFF when the emergency stop switch is pressed.
- The power supply to the motor M is kept OFF until the beams are unblocked and the reset switch S2 is pressed while the emergency stop switch is released.



\* If an emergency stop switch is not used, connect safety output 1 to T12 terminal and safety output 2 to T23 directly.

- S1 : External test/ lockout reset switch  
(connect to 24 V if a switch is not required)
- S2 : Interlock reset switch
- S3 : Emergency stop switch (force-opening contact) (A165E, A22E)
- KM1, KM2 : Safety relay with force-guided contact (G7SA) or magnetic contactor
- M : 3-phase motor

- Note:**
1. As the G9SP Safety Controller is a PNP output type, it cannot be connected to the F3SJ-E□□□□N25. Also, a Safety Controller with PNP output cannot be connected to the F3SJ-E□□□□N25.
  2. The G9SA-301-P is a safety relay unit only for NPN output.

## Function List

Functions that can be used on F3SJ are shown as follows: Refer to the F3SJ User's Manual for details. For manual number, check the "Related Manuals" at the end of the catalog.

✓: Can be used.

X: Cannot be used.

### Basic functions

| Function                            | F3SJ-E (EASY) | F3SJ-B (BASIC) | F3SJ-A (ADVANCED) |
|-------------------------------------|---------------|----------------|-------------------|
| Self-test function                  | ✓             | ✓              | ✓                 |
| External test function              | ✓             | ✓              | ✓                 |
| External device monitoring function | X             | ✓ *            | ✓                 |
| Interlock function                  | X             | ✓ *            | ✓                 |
| Auxiliary output function           | X             | ✓              | ✓                 |
| Muting function                     | X             | ✓              | ✓                 |

\* Cannot be used at muting.

### Functions for individual applications

|                                    |   |   |   |
|------------------------------------|---|---|---|
| Override function                  | X | ✓ | ✓ |
| Partial muting function            | X | X | ✓ |
| Position detection muting function | X | X | ✓ |
| Fixed blanking function            | X | X | ✓ |
| Floating blanking function         | X | X | ✓ |
| Warning zone function              | X | X | ✓ |
| Use of setting tools               | X | X | ✓ |

### Wiring/mounting related function

|  |   |   |   |
|--|---|---|---|
| Series connection function               | X | ✓ | ✓ |
| Dead space less (single connection)      | ✓ | ✓ | ✓ |
| Dead space less (series connection)      | X | X | ✓ |
| Response time integration (15 ms) *      | ✓ | ✓ | X |
| Simple wiring                            | ✓ | X | X |
| Connector cable                          | X | ✓ | ✓ |
| Quick mounting                           | ✓ | ✓ | X |
| TOP/BOTTOM indicator for beam adjustment | ✓ | ✓ | X |
| Laser Pointer                            | ✓ | ✓ | ✓ |

\* Convenient to calculate safety distance.

### Indicator related functions

|                           |   |   |   |
|---------------------------|---|---|---|
| External indicator output | X | ✓ | ✓ |
| Muting error display      | X | ✓ | X |

**Note:** The specifications of the models with the suffixes "-01TS", "-02TS" or "-TS" are different. Refer to the Specifications.

## Self-test Function

A self-test is performed to check for errors when the power is turned ON. Also, the self-test is regularly performed (within the response time) while operating.

## External Test Function

This function stops the emission using an external signal. It can be used to verify that a safety system should properly stop when F3SJ is interrupted.

## External Device Monitoring Function

This function detects malfunctions, such as welding, in external relays (or contactors) that control the hazardous part of a machine.

This function constantly monitors that a specified voltage is applied to the receiver's external device monitoring input line, and the system enters lockout state when an error occurs. The relay's operational delay can be up to 300 ms without being evaluated as an error.

For example, if the normally closed N.C. contact does not close within 0.3 s after the safety outputs turn from ON to OFF, and a specified voltage is not applied to the external device monitoring line, it is evaluated as an error and the system enters a lockout state. To utilize this function properly, use safety relays and contactors that have force guided or mechanically linked contact structure.

## Interlock Function

The F3SJ turns the safety outputs OFF when its power is turned on or its beam is interrupted and holds this state until reset input is applied. This state is called "interlock".

Two methods can be used to reset the interlock state: "auto reset that automatically turns control outputs ON when the interrupting object is removed" and "manual reset mode that keeps control outputs OFF until a reset signal is provided, if the interrupting object is removed".

## Auto Reset

When the interrupting object is removed from the detection zone, the safety outputs automatically turn ON. Auto reset is used on machines where a worker is not able to enter the area between the detection zone and the hazardous part of the machine.

## Manual Reset

When a reset input is given while no interrupting object exists in a detection zone, the safety outputs turn ON. This allows the machine to be manually reset using a reset switch after ensuring safety, preventing unexpected startup.

## Auxiliary Output Function

The auxiliary output is used to monitor the status of the F3SJ. This output can be connected to a device such as programmable controller.

## Muting Function

Muting function temporarily disables safety function of the F3SJ, keeping safety output ON even if beams are interrupted. This makes it possible to install safety light curtains for AGV passage, enabling both safety and productivity.

## Override Function

The override function turns the safety outputs ON when the muting start condition is not satisfied. If a workpiece stops while passing through the F3SJ, as shown below, causing a muting error, the normal state cannot be recovered unless the workpiece is removed from the muting sensors and the detection field of the F3SJ. However, the override function will mute the safety outputs of the F3SJ so that the conveyor can be restarted to move the workpiece out of the muting sensors and detection zone.

## Partial Muting Function

Partial muting function secures safety without enabling muting except for beams when a workpiece passes.

## Position Detection Muting

A limit switch or other means is used to detect when the robot is in a safe position, and muting is then applied.

## Fixed Blanking Function

Fixed blanking function disables a specific beam of the F3SJ. This function keeps safety output ON even when part of machinery equipment exists within a detection zone.

## Floating Blanking Function

Floating blanking function increases the diameter of the F3SJ's detection capability and turns OFF the safety output when multiple objects are detected. When there is a moving object with a fixed width in the detection area that we do not want to detect, the detection function can be disabled.

## Warning Zone Function

When an individual enters, a warning lamp lights or buzzer sounds without stopping the equipment by dividing the detection zone into the detection zone and a warning zone.

## Setting Tool

The following setting tools (sold separately) can be purchased in order to change or confirm various F3SJ-A parameters.

- F39-MC21 Setting Console
- F39-GWUM SD Manager Setting Support Software for the F3SJ

## Series Connection Function

Up to 3 sets of the F3SJ-Bs or up to 4 sets of F3SJ-As can be series-connected. Series connection allows them to be used as a safety light curtain, requiring only one set to be wired to a controller and preventing mutual interference.

## Safety Precautions

Description shown below is only a guideline to choose a safety sensor. To use the product properly, you must read its instruction manual that comes with the product.

### Legislation and Standards


1. Application of a sensor alone cannot receive type approval provided by Article 44-2 of the Industrial Safety and Health Act of Japan. It is necessary to apply it in a system.  
Therefore, when using the F3SJ in Japan as a "safety system for pressing or shearing machines" prescribed in Article 42 of that law, the system must receive type approval.
2. The F3SJ is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Index Annex V, Item 2.
3. The F3SJ-E/B is in conformity with the following standards:
  - (1) EC legislation  
Machinery Directive 2006/42/EC  
EMC Directive 2004/108/EC
  - (2) European standards  
EN 61496-1 (type 4 ESPE),  
CLC/TS 61496-2 (type 4 AOPD),  
EN 61508-1 through -3 (SIL3),  
EN 61000-6-4,  
EN ISO 13849-1:2008 (PLe/Safety Category 4)
  - (3) International standards  
IEC 61496-1 (type 4 ESPE),  
IEC 61496-2 (type 4 AOPD),  
IEC 61508-1 through -3 (SIL3),  
ISO 13849-1:2006 (PLe/Safety Category 4)
  - (4) JIS standards  
JIS B 9704-1 (type 4 ESPE),  
JIS B 9704-2 (type 4 AOPD)
  - (5) North American standards:  
UL 61496-1 (type 4 ESPE),  
UL 61496-2 (type 4 AOPD),  
UL 508, UL 1998, CAN/CSA C22.2 No.14,  
CAN/CSA C22.2 No.0.8
4. The F3SJ-A is in conformity with the following standards:
  - (1) EC legislation  
Machinery Directive 2006/42/EC  
EMC Directive 2004/108/EC
  - (2) European standards  
EN 61496-1 (type 4 ESPE),  
CLC/TS 61496-2 (type 4 AOPD),  
EN61508-1 through -3 (SIL3)  
EN ISO 13849-1:2008 (PLe/Safety Category 4)
  - (3) International standards  
EC 61496-1 (type 4 ESPE),  
IEC 61496-2 (type 4 AOPD),  
IEC 61508-1 through -3 (SIL3)  
ISO13849-1: 2006 (PLe/Safety Category 4)
- (4) JIS standards  
JIS B 9704-1 (type 4 ESPE),  
JIS B 9704-2 (type 4 AOPD)
- (5) North American standards:  
UL 61496-1 (type 4 ESPE),  
UL 61496-2 (type 4 AOPD),  
UL 508, UL 1998, CAN/CSA C22.2 No.14,  
CAN/CSA C22.2 No.0.8
5. The F3SJ received the following certification from the EU-accredited body, TÜV SÜD:
  - EC type test based on machinery directive  
Type 4 ESPE (EN 61496-1),  
Type 4 AOPD (CLC/TS 61496-2)
6. The F3SJ is scheduled to received certificates of UL listing for US and Canadian safety standards from the Third Party Assessment Body UL.
  - Type 4 ESPE (UL 61496-1),  
Type 4 AOPD (UL 61496-2)
7. The F3SJ is designed according to the standards listed below. To make sure that the final system complies with the following standards and regulations, you are asked to design and use it in accordance with all other related standards, laws, and regulations. If you have any questions, consult with specialized organizations such as the body responsible for prescribing and/or enforcing machinery safety regulations in the location where the equipment is to be used.
  - European standards: EN 415-4, EN 692, EN 693
  - US Occupational Safety and Health Standards: OSHA 29 CFR 1910.212
  - US Occupational Safety and Health Standards: OSHA 29 CFR 1910.217
  - American National Standards: ANSI B11.1 to B11.19
  - American National Standards: ANSI/RIA 15.06
  - Canadian Standards Association CSA Z142, Z432, Z434
  - SEMI Standards SEMI S2




## Precautions on Safety


### Indication and meaning for safe use

This instruction manual describes notification and/or warning with indication and symbols as shown below for safe use of F3SJ. This notification describes very important details for safety. You must follow the description. Shown below are indication and symbols.

|  |   |
|--|---|
|  <b>WARNING</b> | Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Also, a serious damage on property may be caused. |
|--|---|

|  |   |
|--|---|
|  <b>CAUTION</b> | If you fail to use a product properly, it may result in injuries or damage on property. |
|--|---|

### Meanings of Alert Symbols

|   |  |
|---|--|
|  | Inhibited<br>Indicates general inhibition. |
|---|--|

### Alert Statements in this Manual

**F3SJ-E** . . . . . Description applied to F3SJ-E models.

**F3SJ-B** . . . . . Description applied to F3SJ-B models.

**F3SJ-A** . . . . . Description applied to F3SJ-A models.

### For users

|  |
|--|
|  <b>WARNING</b> |
|--|

**F3SJ-E** **F3SJ-B** **F3SJ-A**

The F3SJ must be installed, set, and integrated into the mechanical control system by a qualified technician who has received the appropriate training. Failure to make correct settings may prevent detection of people and result in serious injury.

**F3SJ-A**

When changing parameters with a setting tool (F39-GWUM or F39-MC21), the change must be made and the contents of the change must be managed by the person in charge of the system. Unintentional or mistaken parameter changes may prevent detection of people and result in serious injury.

### For machines

|  |
|--|
|  <b>WARNING</b> |
|--|

**F3SJ-E** **F3SJ-B** **F3SJ-A**

Do not use this sensor for machines that cannot be stopped by electrical control. For example, do not use it for a pressing machine that uses full-rotation clutch. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.

**F3SJ-B** **F3SJ-A**

Do not use the auxiliary output or external indicator output for safety applications. Human body may not be detected when F3SJ fails, resulting in serious injury.

### For installation

|  |
|--|
|  <b>WARNING</b> |
|--|

**F3SJ-E** **F3SJ-B** **F3SJ-A**

Make sure to test the operation of the F3SJ after installation to verify that the F3SJ operates as intended. Make sure to stop the machine until the test is complete.

Unintended function settings may cause a person to go undetected, resulting in serious injury.

**F3SJ-E** **F3SJ-B** **F3SJ-A**

Make sure to install the F3SJ at the safe distance from the hazardous part of the equipment. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.

**F3SJ-E** **F3SJ-B** **F3SJ-A**

Install a protective structure so that the hazardous part of a machine can only be reached by passing through the sensor's detection zone. Install the sensors so that part of the person is always present in the detection zone when working in a machine's hazardous zones. If a person is able to step into the hazardous zone of a machine and remain behind the sensor's detection zone, configure the system with an interlock function that prevents the machine from being restarted. Otherwise it may result in heavy injury.

**F3SJ-B** **F3SJ-A**

Install the interlock reset switch in a location that provides a clear view of the entire hazardous area and where it cannot be activated from within the hazardous area.

**F3SJ-E** **F3SJ-B** **F3SJ-A**

The F3SJ cannot protect a person from a projectile exiting the hazardous zone. Install protective cover(s) or fence(s).

**F3SJ-A**

When detection of an area has been disabled by the fixed blanking function, provide a protective structure around the entire area that will prevent a person from passing through it and reaching the hazardous part of the machinery. Failure to do so may prevent detection of people and result in serious injury.

**F3SJ-A**

After setting the fixed blanking function, be sure to confirm that a test rod is detected within all areas that require detection. Failure to do so may prevent detection of people and result in serious injury.

**F3SJ-A**

When the fixed blanking function or the floating blanking function is used, the diameter for the smallest detectable object becomes larger. Be sure to use the diameter for the smallest detectable object for the fixed blanking function or the floating blanking function when calculating the safety distance. Failure to do so may prevent the machinery from stopping before a person reaches the hazardous part of the machinery, and result in serious injury.

**F3SJ-B** **F3SJ-A**

The muting and override functions disable the safety functions of the device. Additional safety measures must be taken to ensure safety while these functions are working.

**F3SJ-B F3SJ-A**

Install muting sensors so that they can distinguish between the object that is being allowed to pass through the detection zone and a person. If the muting function is activated by the detection of a person, it may result in serious injury.

**F3SJ-B F3SJ-A**

Muting lamps (external indicators) that indicate the state of the muting and override functions must be installed where they are clearly visible to workers from all the operating positions.

**F3SJ-A**

Muting times must be precisely set according to the application by qualified personnel who have received appropriate training. In particular, if the muting time limit is to be set to infinity, the person who makes the setting must bear responsibility.

**F3SJ-B F3SJ-A**

Use two independent input devices for the muting inputs.

**F3SJ-B F3SJ-A**

Install the F3SJ, Muting Sensors, or a protective wall so that workers cannot enter hazardous areas while muting is in effect, and set muting times.

**F3SJ-B F3SJ-A**

Position the switch that is used to activate the override function in a location where the entire hazardous area can be seen, and where the switch cannot be operated from inside the hazardous area. Make sure that nobody is in the hazardous area before activating the override function.

**F3SJ-E F3SJ-B F3SJ-A**

Install the sensor system so that it is not affected by reflective surfaces. Failure to do so may hinder detection, resulting in serious injury.

**F3SJ-E F3SJ-B F3SJ-A**

When using more than 1 set of F3SJ, install them so that mutual interference does not occur, such as by configuring series connections or using physical barriers between adjacent sets.

**F3SJ-E F3SJ-B F3SJ-A**

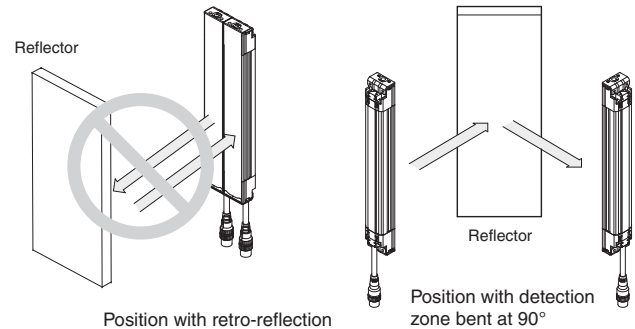
Make sure that the F3SJ is securely mounted and its cables and connectors are properly secured.

**F3SJ-E F3SJ-B F3SJ-A**

Make sure that no foreign material, such as water, oil or dust, enters the inside of the F3SJ while the cap is removed.

**F3SJ-E F3SJ-B F3SJ-A**

Do not use the sensor system with mirrors in a regressive reflective configuration. Doing so may hinder detection. It is possible to use mirrors to "bend" the detection zone to a 90-degree angle.



**F3SJ-E F3SJ-B F3SJ-A**

When using series connections, perform inspection of all connected F3SJs as instructed in the User's Manual.

**For wiring**

**WARNING**

**F3SJ-E F3SJ-B F3SJ-A**

[For PNP output]

Connect the load between the output and 0V line.

[For NPN output]

Connect the load between the output and +24V line. If +24 V and 0 V are connected, it is dangerous because operation mode is inverted to "ON when interrupted".

**F3SJ-E F3SJ-B F3SJ-A**

[For PNP output]

Do not short-circuit an output line to +24 V line. Otherwise, the output is always ON. Also, 0 V of the power supply must be grounded so that output should not turn ON due to grounding of the output line.

[For NPN output]

Do not short-circuit an output line to 0 V line. Otherwise, the output is always ON. Also, +24 V of the power supply must be grounded so that output should not turn ON due to grounding of the output line.

**F3SJ-E F3SJ-B F3SJ-A**

Configure the system by using the optimal number of safety outputs that satisfy the requirements of the necessary safety category.

**F3SJ-E F3SJ-B F3SJ-A**

Do not connect each line of F3SJ to a DC power supply higher than 24 V+20%. Also, do not connect to an AC power supply. Failure to do so may result in electric shock.

# F3SJ-E/F3SJ-B/F3SJ-A

F3SJ-E F3SJ-B F3SJ-A

For F3SJ to comply with IEC 61496-1 and UL 508, the DC power supply unit must satisfy all of the following conditions:

- Must be within rated power voltage (24 VDC±20%).
- Must have tolerance against the total rated current of devices if it is connected to multiple devices.
- Must comply with EMC directives (industrial environment)
- Double or enhanced insulation must be applied between the primary and secondary circuits
- Automatic recovery of overcurrent protection characteristics (reversed L sagging)
- Output holding time must be 20 ms or longer
- Must satisfy output characteristic requirements for class 2 circuit or limited voltage current circuit defined by UL 508
- Must comply with EMC, laws, and regulations of a country or a region where F3SJ is used. (Ex: In EU, the power supply must comply to the EMC Low Voltage Directive)

F3SJ-E F3SJ-B F3SJ-A

Double or enhanced insulation from hazardous voltage must be applied to all input and output lines. Failure to do so may result in electric shock.

F3SJ-E F3SJ-B F3SJ-A

**Note:** Keep the cable length within the rated length. Failure to do so is dangerous as it may prevent safety functions from operating normally.

F3SJ-E F3SJ-B F3SJ-A

Make sure to perform wiring while the power supply is OFF.

Others F3SJ-E F3SJ-B F3SJ-A

## WARNING

To use the F3SJ in PSDI mode (Reinitiation of cyclic operation by the protective equipment), you must configure an appropriate circuit between the F3SJ and the machine. For details about PSDI, refer to OSHA1910.217, IEC 61496-1, and other relevant standards and regulations.

Do not try to disassemble, repair, or modify this product. Doing so may cause the safety functions to stop working properly.

Do not use the F3SJ in environments where flammable or explosive gases are present. Doing so may result in explosion.

Perform daily and 6-month inspections for the F3SJ. Otherwise, the system may fail to work properly, resulting in serious injury.

Do not use radio equipment such as cellular phones, walkie-talkies, or transceivers near the F3SJ.

**Note:** For customers using the F3SJ-B□□□□P25-01TS:  
The functions available are external test, lockout reset, auxiliary output and series connection.

## Installation Conditions

Detection Zone and Approach F3SJ-E F3SJ-B F3SJ-A

### WARNING

Install a protective structure so that the hazardous part of a machine can only be reached by passing through the sensor's detection zone. Install the sensors so that part of the person is always present in the detection zone when working in a machine's hazardous zones.

If a person is able to step into the hazardous zone of a machine and remain behind the F3SJ's detection zone, configure the system with an interlock function that prevents the machine from being restarted. Failure to do so may result in serious injury.

Install the interlock reset switch in a location that provides a clear view of the entire hazardous zone and where it cannot be activated from within the hazardous zone.

The F3SJ cannot protect a person from a projectile exiting the hazardous zone. Install protective cover(s) or fence(s).

### Right positions

The hazardous zone of a machine can be reached only by passing through the sensor's detection zone.



While working, a person is inside the sensor's detection zone.



### Incorrect installation

It is possible to reach the hazardous zone of a machine without passing through the sensor's detection zone.

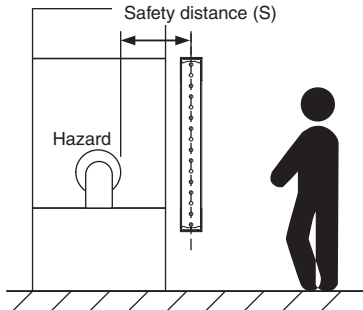


A person is between the sensor's detection zone and the hazardous zone of a machine.



**Safety Distance** F3SJ-E F3SJ-B F3SJ-A

The safety distance is the distance that must be set between the F3SJ and a machine's hazardous part to stop the hazardous part before a person or object reaches it. The safety distance varies according to the standards of each country and the individual specifications of each machine. In addition, the calculation of the safety distance differs if the direction of approach is not vertical to the detection zone of the F3SJ. Always refer to relevant standards.



**⚠ WARNING**

**Make sure to secure the safety distance (S) between the F3SJ and the hazardous part. Failure to do so may prevent the machinery from stopping before a person reaches the hazardous part of the machinery, and result in serious injury.**

**Note:** The response time of a machine is the time period from when the machine receives a stop signal to when the machine's hazardous part stops. Measure the response time on the actual system. Also, periodically check that the response time of the machine has not changed.

**How to calculate the safety distance specified by International Standard ISO 13855 (European Standard EN ISO 13855) (Reference)**

If a person approaches the detection zone of the F3SJ perpendicularly

$S = K \times T + C \dots$  Formula (1)

- S: Safety distance
- K: Approach speed to the detection zone
- T: Total response time of the machine and F3SJ
- C: Additional distance calculated by the detection capability of the F3SJ

System that has detection capability of 40 mm max. Use  $K = 2,000 \text{ mm/s}$  and  $C = 8 \times (d - 14 \text{ mm})$  in equation (1) for the calculation.

$S = 2,000 \text{ mm/s} \times (T_m + T_s) + 8 \times (d - 14 \text{ mm})$

- S = Safety distance (mm)
- $T_m$  = Machine's response time (s)
- $T_s$  = Response time of the F3SJ from ON to OFF (s)
- d = Size of F3SJ's detection capability (mm)

[Calculation example]

When  $T_m = 0.05 \text{ s}$ ,  $T_s = 0.01 \text{ s}$ , and  $d = 14 \text{ mm}$ :  
 $S = 2,000 \text{ mm/s} \times (0.05 \text{ s} + 0.01 \text{ s}) + 8 \times (14 \text{ mm} - 14 \text{ mm})$   
 $= 120 \text{ mm} \dots$  Eq. (2)

If the result is less than 100 mm, use  $S = 100 \text{ mm}$ .

If the result exceeds 500 mm, use the following formula where  $K = 1,600 \text{ mm/s}$ .

$S = 1,600 \text{ mm/s} \times (T_m + T_s) + 8 \times (d - 14 \text{ mm}) \dots$  Formula (3)

If the result of this Eq. (3) is less than 500 mm,

$S = 500 \text{ mm}$

System that has a detection capability larger than 40 mm Use  $K = 1,600 \text{ mm/s}$  and  $C = 8 \times (d - 850 \text{ mm})$  in equation (1) for the calculation.

$S = 1,600 \text{ mm/s} \times (T_m + T_s) + 850 \times (d - 14 \text{ mm}) \dots$  Formula (4)

- S = Safety distance (mm)
- $T_m$  = Machine's response time (s)
- $T_s$  = Response time of the F3SJ from ON to OFF (s)

[Calculation example]

When  $T_m = 0.05 \text{ s}$ ,  $T_s = 0.01 \text{ s}$ :  
 $S = 1,600 \text{ mm/s} \times (0.05 \text{ s} + 0.01 \text{ s}) + 850 \text{ mm}$   
 $= 946 \text{ mm}$

**How to calculate the safety distance specified by American standard ANSI B11.19 (Ref.)**

If a person approaches the detection zone of the F3SJ perpendicularly, calculate the safety distance as shown below.

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

- S: Safety distance
- K: Approach speed to the detection zone  
 (the value recommended by OSHA standard is 1,600 mm/s)
- Approach speed K is not specified in the ANSI B.11.19 standard. To determine the value of K to apply, consider all factors, including the operator's physical ability.
- $T_s$  = Machine's stop time (s)
- $T_s$  = Response time of the F3SJ from ON to OFF (s)
- $T_c$  = Machine control circuit's maximum response time required to activate its brake (s)
- $T_{bm}$  = Additional time (s)

If a machine has a brake monitor, " $T_{bm}$  = Brake monitor setting time - ( $T_s + T_c$ )". If it has no brake monitor, we recommend using 20% or more of ( $T_s + T_c$ ) as additional time.

- $D_{pf}$  = Additional distance

According to ANSI's formula,  $D_{pf}$  is calculated as shown below:  
 $D_{pf} = 3.4 \times (d - 7.0)$ : Where d is the detection capability of the F3SJ (unit: mm)

[Calculation example]

When  $K = 1,600 \text{ mm/s}$ ,  $T_s + T_c = 0.06 \text{ s}$ , brake monitor setting time = 0.1 s,  $T_r = 0.01 \text{ s}$ , and  $d = 14 \text{ mm}$ :  
 $T_{bm} = 0.1 - 0.06 = 0.04 \text{ s}$   
 $D_{pf} = 3.4 \times (14 - 7.0) = 23.8 \text{ mm}$   
 $S = 1,600 \text{ mm/s} \times (0.06 \text{ s} + 0.01 \text{ s} + 0.04 \text{ s}) + 23.8 \text{ mm} = 199.8 \text{ mm}$

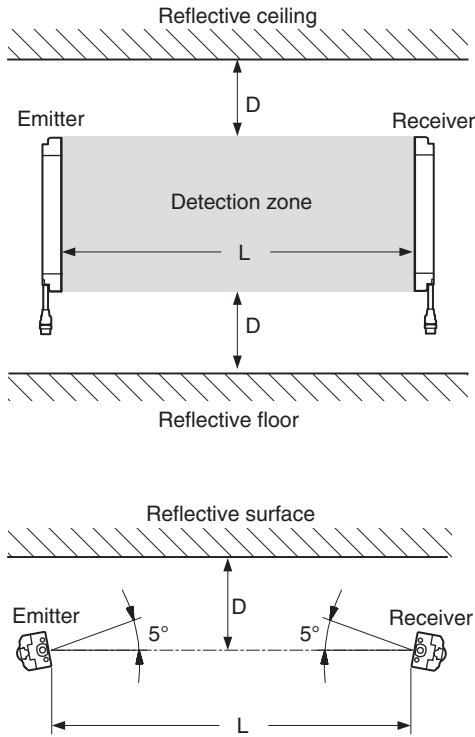
# F3SJ-E/F3SJ-B/F3SJ-A

## Distance from Reflective Surface F3SJ-E F3SJ-B F3SJ-A

### **WARNING**

Install the sensor system so that it is not affected by reflection from a reflective surface. Failure to do so may hinder detection, resulting in serious injury.

Install the sensor system at distance D or further from highly reflective surfaces such as metallic walls, floors, ceilings, or workpieces, as shown below.



| Distance between emitter and receiver (operating range L) | Allowable installation distance D              |
|---|--|
| For 0.2 to 3 m  | 0.13 m   |
| For 3 m or more   | $L/2 \times \tan 5^\circ = L \times 0.044$ (m) |

## Mutual Interference Prevention F3SJ-E F3SJ-B F3SJ-A

### **WARNING**

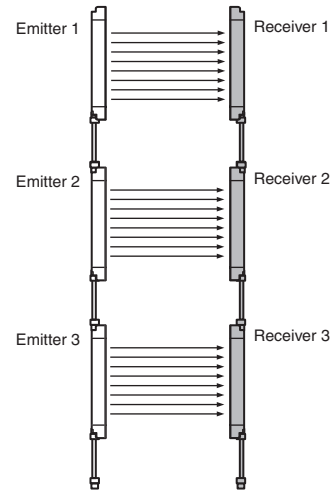
Do not use the sensor system with mirrors in a regressive reflective configuration. Doing so may hinder detection. It is possible to use mirrors to "bend" the detection zone to a 90-degree angle.

When using more than 1 set of F3SJ, install them so that mutual interference does not occur, such as by configuring series connections or using physical barriers between adjacent sets.

Mutual interference from other F3SJ is prevented in up to 3 sets without series connection.

### For series connection F3SJ-B F3SJ-A

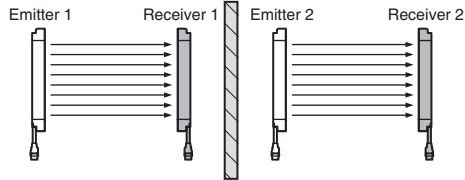
Series connection can prevent mutual interference when multiple sensors are used. Up to 3 sets with 192 beam for F3SJ-B series, or up to 4 sets with 400 beams for F3SJ-A series can be series-connected. Emission of series-connected F3SJ is time-divided, ensuring safety without occurring mutual interference.



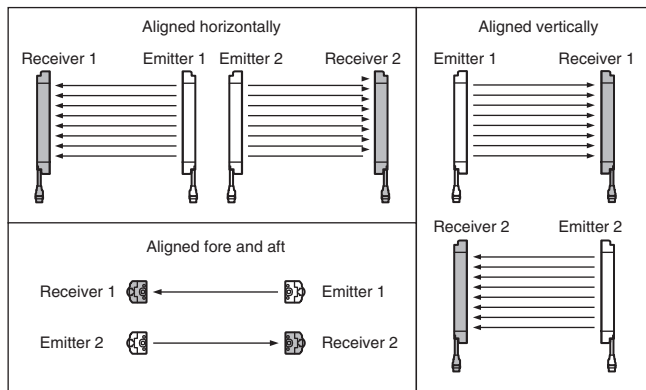
## No series connections **F3SJ-B** **F3SJ-A**

Mutual interference is prevented in up to three sets, using interference light detection and cycle shift algorithm.  
 If 4 or more sets of F3SJs are installed and are not connected to each other, arrange them so that mutual interference does not occur.  
 If two sets are installed near each other, reflection from the surface of the F3SJ may cause mutual interference. When mutual interference occurs, the safety outputs are turned OFF momentarily or the F3SJ enters lockout state. Combining countermeasures 1 to 3 shown below is effective.

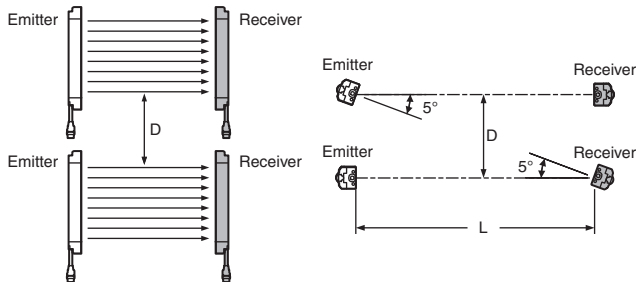
### 1. Install a physical barrier



### 2. Alternate the direction of emission (alternation)

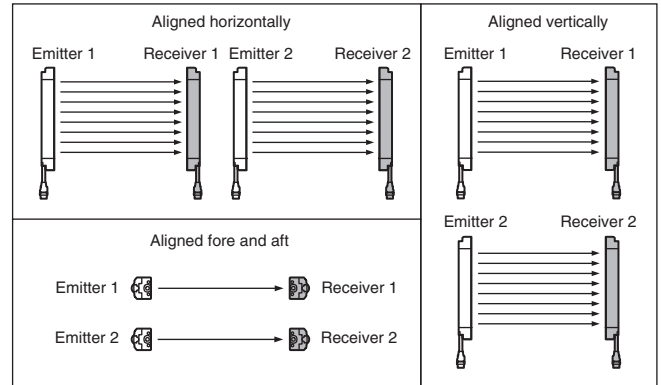


### 3. Keep sufficient distance between the F3SJs so that mutual interference does not occur



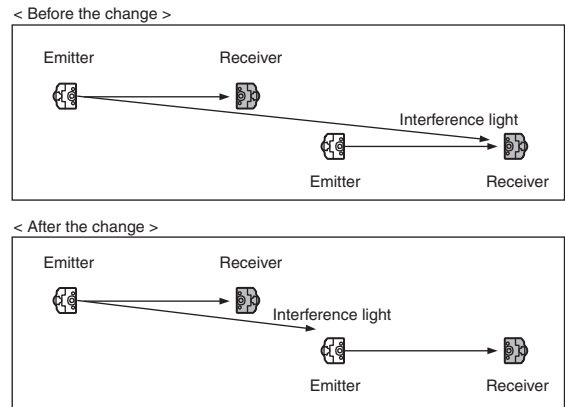
| Distance between emitter and receiver (operating range L) | Allowable installation distance D                    |
|---|--|
| For 0.2 to 3 m  | 0.26 m   |
| For 3 m or more   | $L \times \tan 5^\circ = L \times 0.088 \text{ (m)}$ |

Installation shown below may cause mutual interference. When mutual interference occurs, the safety outputs are turned OFF momentarily or the F3SJ enters lockout state.



## F3SJ-A

If two sets are installed near each other, reflection from the surface of the F3SJ may cause mutual interference. Use of F3SJ-A can improve the condition by shortening operating range with the setting tool.



# F3SJ-E/F3SJ-B/F3SJ-A

## Related Manuals

| Man. No. | Model                  | Manual name   |
|----------|------------------------|---|
| SCHG-718 | F3SJ-A□□□□P□□          | F3SJ-A□□□□P□□ (Ver.2) Safety Light Curtain User's Manual    |
| SCHG-720 | F3SJ-A□□□□P□□-TS       | F3SJ-A□□□□P□□-TS Safety Light Curtain User's Manual         |
| SCHG-722 | F3SJ-A□□□□P20-01TS     | F3SJ-A□□□□P20-01TS Safety Light Curtain User's Manual       |
| SCHG-719 | F3SJ-A□□□□N□□          | F3SJ-A□□□□N□□(Ver.2) Safety Light Curtain User's Manual     |
| SCHG-726 | F3SJ-A□□□□N□□-01T      | F3SJ-A□□□□N□□-01T(Ver.2) Safety Light Curtain User's Manual |
| SCHG-716 | F3SJ-AM□□□□            | F3SJ-AM□□□□(Ver.2) Multi-beam Safety Sensor User's Manual   |
| SCHG-734 | F3SJ-B□□□□P25-01TS     | F3SJ-B□□□□P25-01TS Safety Light Curtain User's Manual       |
| SCHG-733 | F3SJ-E□□□□N25/B□□□□N25 | F3SJ-E□□□□N25/B□□□□N25 Safety Light Curtain User's Manual   |
| SCHG-732 | F3SJ-E□□□□P25/B□□□□P25 | F3SJ-E□□□□P25/B□□□□P25 Safety Light Curtain User's Manual   |
| SCHG-712 | F39-MC21               | F39-MC21 F39-MC21 Setting Console Instruction Sheet         |
| SCHG-736 | F3SJ-B□□□□P25-02TS     | F3SJ-B□□□□P25-02TS Safety Light Curtain User's Manual       |

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