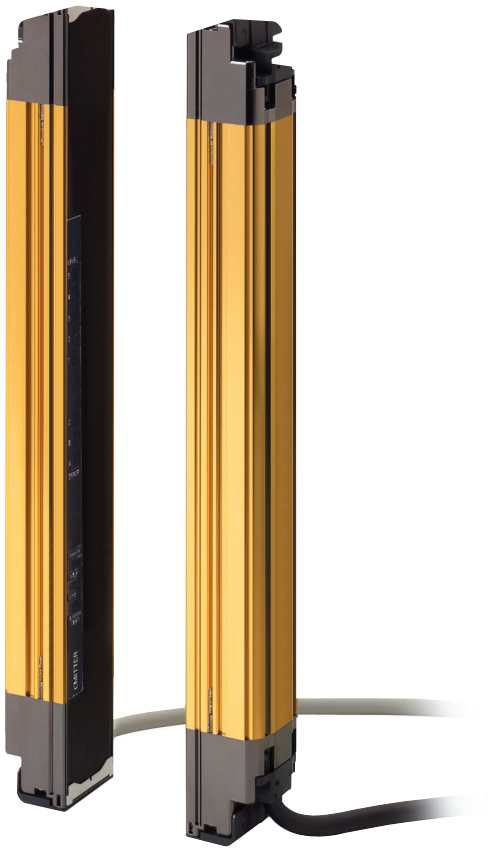
OMRON

F3SJ-A□□□□P□□Series

User's Manual

Safety Light Curtain



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Cat. No. SCHG-710C

Introduction

Thank you for purchasing the F3SJ Series Safety Light Curtain (hereinafter referred to as the "F3SJ").
This is the instruction Manual describing the use of F3SJ.
Always heed the following points when using the F3SJ:

- Be sure to have F3SJ be handled by a "Responsible Person" who is well aware of and familiar with the machine to be installed.
- The term "Responsible Person" used in this Instruction Manual means the person qualified, authorized and responsible to secure "safety" in each process of the design, installation, operation, maintenance services and disposition of the machine.
- It is assumed that F3SJ will be used properly according to the installation environment, performance and function of the machine. Responsible Person should conduct risk assessment on the machine and determine the suitability of this product before installation.
- Read this Manual thoroughly to understand and make good use of the descriptions before installing and operating the product.
- Keep this Manual at the place where the operator can refer to whenever necessary.

Legislation and Standards

1. Application of a F3SJ-A sensor alone cannot receive type approval provided by Article 44-2 of the Labour Safety and Health Law of Japan. It is necessary to apply it in a system. Therefore, when using the F3SJ-A 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-A is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Index Annex IV, B, Safety Components, Item 1.

3. The F3SJ-A complies with the following legislation and standards:
   (1) EU legislation
   Machinery Directive 98/37/EC
   EMC Directive 89/336/EEC
   (2) European standards
   EN61496-1 (Type 4 ESPE), prEN61496-2 (Type 4 AOPD), EN61508-1 through -7 (SIL3)
   (3) International standards
   IEC61496-1 (Type 4 ESPE), IEC61496-2 (Type 4 AOPD), IEC61508-1 through -7 (SIL3)
   (4) JIS standards
   JIS B 9704-1 (Type 4 ESPE), JIS B 9704-2 (Type 4 AOPD)

4. The F3SJ-A received the following approvals from the EU accredited body, TÜV-PS:
   - •EC Type-Examination in accordance with the EU Machinery Directive, Type 4 ESPE (EN61496-1), Type 4 AOPD (prEN61496-2)
   - •EMC Competent Body Certificate (Power supply for test: OMRON S82K)
   - •TÜV-PS Type Approval, Type 4 ESPE (EN61496-1), Type 4 AOPD (prEN61496-2), SIL1, 2, 3 (EN61508-1 through -7), Application: EN954-1 Category B,1,2,3,4

5. The F3SJ-A received the certificates of UL listing for US and Canadian safety standards from the Third Party Assessment Body UL.
   - •Both are: Type 4 ESPE (UL61496-1), Type 4 AOPD (UL61496-2)

6. The F3SJ-A 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: EN415-4, EN692, EN693
   - •U.S. Occupational Safety and Health Standards: OSHA 29 CFR 1910.212
   - •U.S. 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
   - •Ministry of Health, Labour and Welfare "Guidelines for Comprehensive Safety Standards of Machinery", Standard Bureau's Notification No. 501 dated June 1, 2001.

READ AND UNDERSTAND THIS DOCUMENT

Please read and understand this document before using the products. Please consult your OMRON representative if you have any questions or comments.

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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In no event shall responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the product.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.
NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PERFORMANCE DATA

Performance data given in this document is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the product may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

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Precautions on Safety

Regarding the alert symbols and meanings used for the safe uses

In order for our customers to use the F3SJ-A in safety, precautions are indicated in this manual with the alert symbols and statements such as the followings. Those safety precautions relate to the important descriptions that must be obeyed for the safe uses and operations. Be sure to obey the precautions.
The following indictions and symbols are used for the descriptions.

⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.

Meanimgs of Alert Symbols

	Indicates prohibited actions.

Alert Statements in this Manual

For users

⚠ WARNING

The F3SJ must be installed, configured, and incorporated into a machine control system by a sufficiently trained and qualified person. An unqualified person may not be able to perform these operations properly, which may cause a person to go undetected, resulting in serious injury.

For machines

⚠ WARNING

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.

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

⚠ WARNING

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.

Make sure to secure the safety distance between the F3SJ and the hazardous parts. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.

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 areas. If a person is able step into the hazardous area 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 area and where it cannot be activated from within the hazardous area.

The F3SJ cannot protect a person from an object flying from a hazardous area. Install protective cover(s) or fence(s).

The muting and override functions disable the safety functions of the device. You must ensure safety using other method when these functions are operating.

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.

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.

Install the switch that activates the override in a location that provides a clear view of the entire hazardous area and where it cannot be activated from within the hazardous area. Make sure that nobody is in the hazardous area before activating the override function.

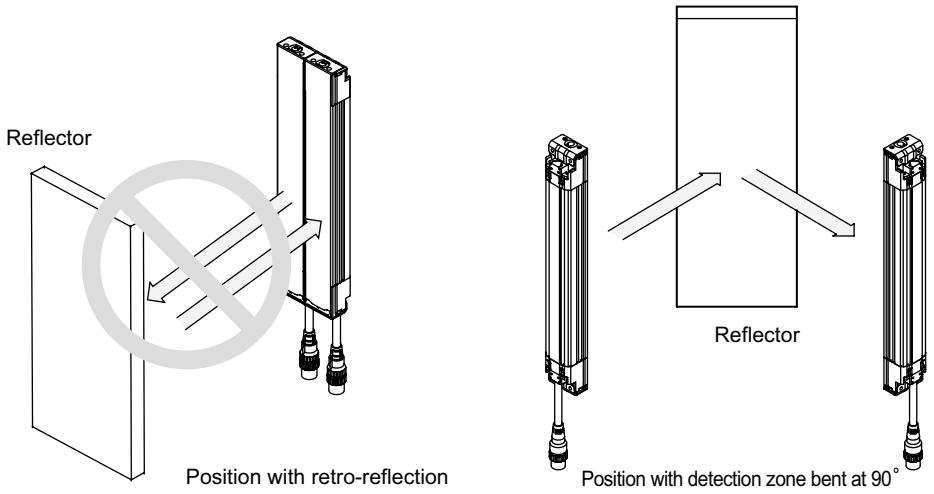
Install the sensor system so that it is not affected by reflective surfaces. Failure to do so may hinder detection, resulting in serious injury.

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.

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

Make sure that foreign objects such as water, oil, or dust do not enter the inside of the F3SJ while the cap is removed.

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



When using series connections, perform inspection for all connected F3SJ as described in "Chapter 5 Checklists".

For wiring

⚠ WARNING

Connect the load between the output and 0V line (PNP output). Connecting the load between the output and +24V line will result in a dangerous condition because operation is reversed to "ON when blocked".

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

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

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

For the 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 the rated power voltage (24V DC ± 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 reinforced insulation must be applied between the primary and secondary circuits
- Automatic recovery of overcurrent protection characteristics (reversed L sagging)
- Output holding time must be 20ms or longer
- Must satisfy output characteristic requirements for class 2 circuit or limited voltage current circuit defined by UL508
- Must comply with laws and regulations, regarding EMC and electrical equipment safety, of the country or region where the F3SJ is used (Ex: In EU, the power supply must comply with the EMC Directive and the Low Voltage Directive.)

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

Extension of the cable must be within a specified length. If it isn't, safety function may not work properly, resulting in danger.

Other

⚠ 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, IEC61496-1, 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.

Precautions for Safe Use

Make sure to observe the following precautions that are necessary for ensuring safe use of the product.

- Thoroughly read this manual and understand the installation procedures, operation check procedures, and maintenance procedures before using the product.
- Loads must satisfy both of the following conditions:
  - -Not short-circuited
  - -Not used with a current that is higher than the rating
- Do not drop the product.
- Dispose of the product in accordance with the relevant rules and regulations of the country or area where the product is used.

Precautions for Correct Use

Observe the precautions described below to prevent operation failure, malfunctions, or undesirable effects on product performance.

■ Installation environment

Do not install the F3SJ in the following types of environments:

- •Areas exposed to intense interference light, such as direct sunlight
- •Areas with high humidity where condensation is likely to occur
- •Areas where corrosive gases are present
- •Areas exposed to vibration or shock levels higher than in the specification provisions
- •Areas where the product may come into contact with water
- •Areas where the product may get wet with oil that can solve adhesive

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

■ Wiring and installation

- •Make sure to perform wiring while the power supply is OFF. Otherwise, the F3SJ may fail to operate due to the diagnosis function.
- •When extending the communication line with a cable other than the dedicated cable (F39-JC□□), use a cable with the same or superior specification. Connect the shield to the 0V line.

Cable specification (extension cable) p.12

- •When replacing the cable connectors with other types of connectors, use connectors that provide a protection grade of IP54 or higher.
- •Properly perform the wiring after confirming the signal names of all the terminals.
- •Do not operate the control system until 2 seconds or more (2.2 seconds or more in case of series connection) after turning ON the power of the F3SJ.
- •Be sure to route the F3SJ cable separate from high-potential power lines or through an exclusive conduit.
- •When using a commercially available switching regulator power supply, make sure to ground the FG terminal (frame ground terminal).
- •Install the emitter and receiver so that their vertical direction should match.

■ Cleaning

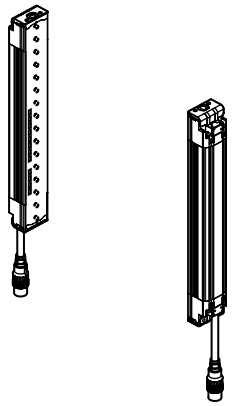
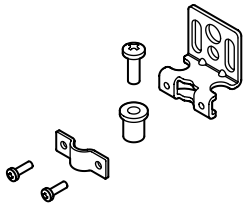
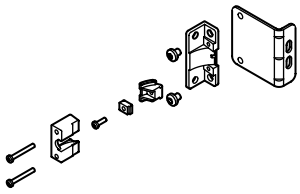
Do not use thinner, benzene, or acetone for cleaning, because they affect the product's resin parts and paint on the case.

■ Object detection

The F3SJ cannot detect transparent and/or translucent objects.

Checking the Contents

Before use, confirm that the items below were shipped with the product.
If you find that an item is missing, please contact your local branch office or distributor.

Product	Quantity
F3SJ-A□□□□□P□□ main unit	Emitter x 1, Receiver x 1 
Top/bottom mounting brackets	4 sets 
Intermediate mounting brackets	Intermediate brackets are included when the protective height of the F3SJ is 600mm or longer. The number of brackets included depends on the total length of the F3SJ. (4 sets maximum for each emitter/receiver) 
Test rod	1 F3SJ-A□□□□P14 Series ... Diameter 14mm F3SJ-A□□□□P20 Series ... Diameter 20mm F3SJ-A□□□□P30 Series ... Diameter 30mm
Error mode label	1 pair of Japanese and English
Instruction sheet	1 pair of Japanese and English
User's manual (CD-ROM)	1

How to Read This Manual (Explanation of Symbols)

Indicates the description of an essential point regarding a function, such as an important point regarding operation or advice on how to use it.

Indicates the page number for related content.

Indicates a reference for when there is trouble, or an explanation of difficult words.

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Contents

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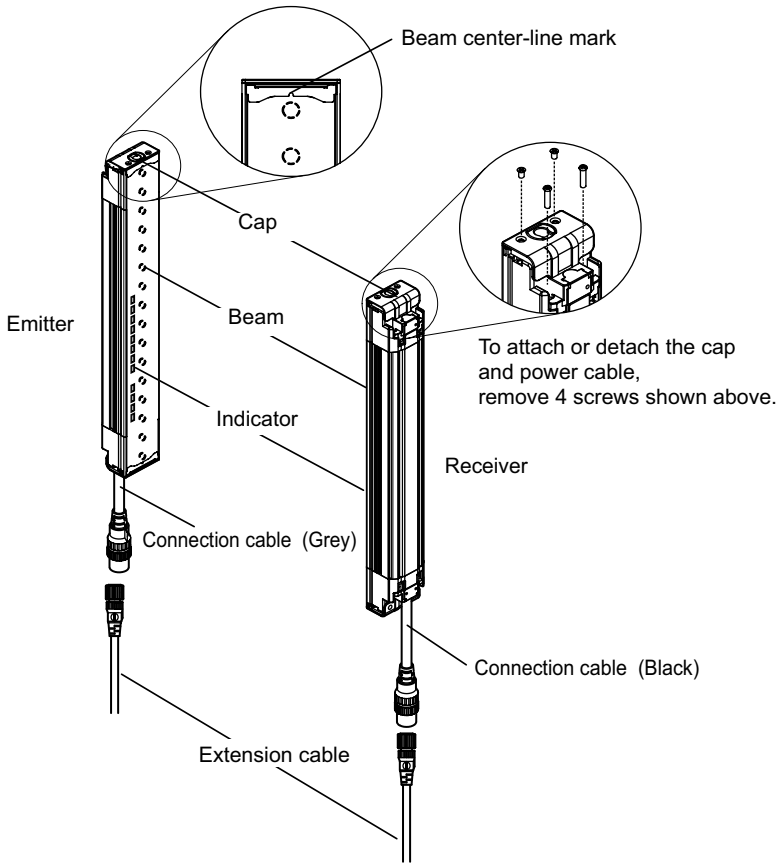
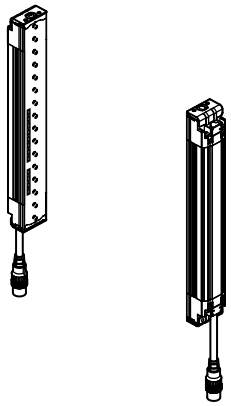
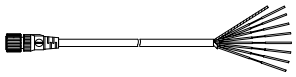
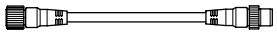
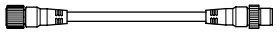
Chapter1 Overview and Specifications

Basic Configuration and Names

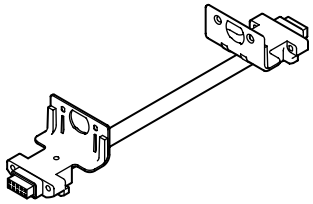
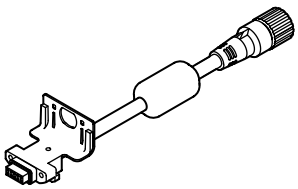
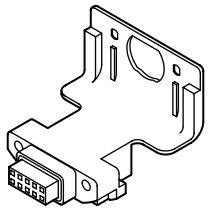
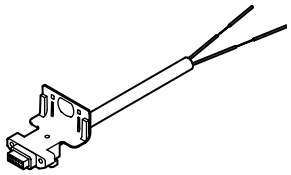
F3SJ



Component	Model name	Description
Emitter, receiver 	F3SJ-A□□□□P□□□	Select a model name based on the required protective height and detection capability. (Cap and connection cable are included.) The model name can be understood as follows: F3SJ-A□□□□P□□-□ 1 2 3 4 1: Protective height (mm) 2: Output type (P=PNPoutput type) 3: Detection capability (mm) 4: L is emitter, D is receiver, blank is a set of an emitter and a receiver

Component		Model name	Description
Extension cable	Cable with connector on one end 	F39-JC□A	This extension cable is used to connect the F3SJ to a controller with discrete terminals (e.g. F3SX, G9SA, G9SB, G9SX) or to a safety processing system (e.g. DeviceNet safety).
	Cable with connectors on both ends 	F39-JC□B	This extension cable is used when the length of the connection cable is insufficient or for plug and play connection to the F3SP-B1P controller. The length can be selected.
	Cable with connectors on both ends 	F39-JC□C	This connection cable is used for plug and play connection to the G9SA-300-SC controller. The length can be selected.

Components to be selected if necessary

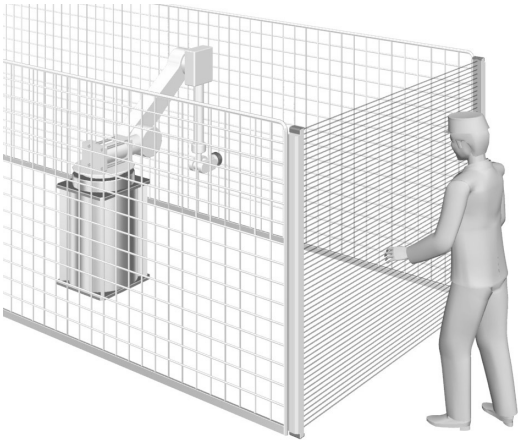
Component	Model name	Description
Optional bracket	-	Use this bracket (sold separately) for dedicated applications.
Series connection cable for close contact 	F39-JJR15L	Required for connecting multiple sets of F3SJ in a series. It is used when you wish to perform series connection with minimum length. Refer to: Connection Procedure p.56
Series connection cable for extension 	F39-JJR3W	Required for connecting multiple sets of F3SJ in a series. The F39-JJR3W can be used for extension with cable with connectors on both ends(F39-JC□B). Refer to: Connection Procedure p.58
Key cap for muting 	F39-CN6	Required when using muting function. Refer to: Muting System page in Chapter 2
Indicator cable 	F39-JJ3N F39-A01P□-PAC	Required when attaching external indicator(s) to the F3SJ.

Application Examples

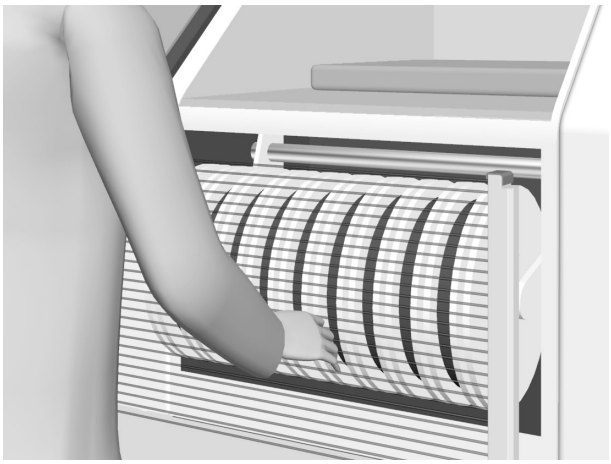
Detect the approach to a hazardous area

The F3SJ should be installed where workers require frequent access in order to perform tasks such as maintenance, and where physical barriers are difficult to install.

■ Detect the approach of a person

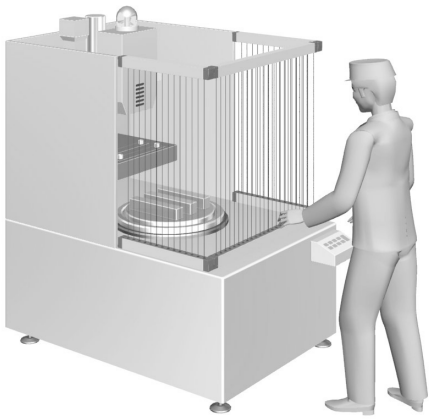


■ Detect a person's limbs



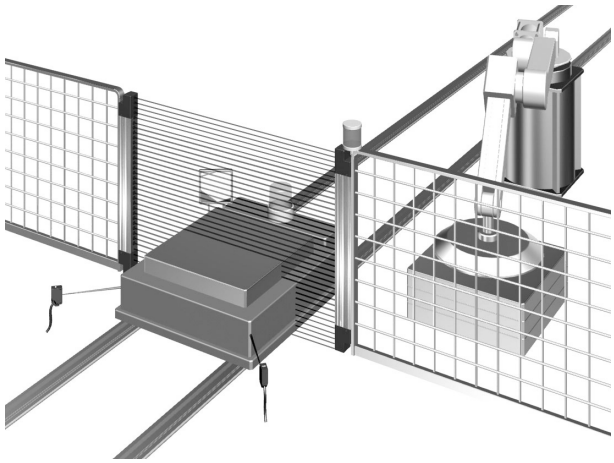
Using multiple sets in combination

By installing sensors on both sides of a machine as well as in front, you can move workpieces in and out more efficiently than when a physical barrier is installed. If the sensors are aligned in a U-shape, series-connection cables can be used between sets (up to 4 sets), so that only one control device is used, drastically reducing the amount of wiring in the panel.



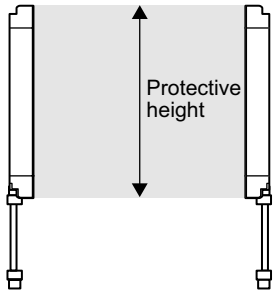
Muting Function:
For a system in which a workpiece crosses detection zone

Enter of a workpiece can be detected by a sensor and the detection zone can be temporarily disabled only while the workpiece is crossing the area. This function is called muting.



Features

Protective height available in incremental sizes



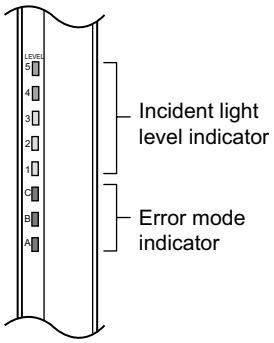
Series	Protective height	Detection capability
F3SJ-A□□□□P14	245mm to 2117mm (in 9mm increments)	Dia. 14mm
F3SJ-A□□□□P20	245mm to 2,495mm (in 15mm increments)	Dia. 20mm
F3SJ-A□□□□P30	245mm to 2,495mm (in 25mm increments)	Dia. 30mm

Easy-to-read light level and error mode display

Beam alignment is simplified using 5 LEDs that display the incident light level.

Error status is indicated on 3 additional LEDs when an error occurs.

Indicator Display Patterns p.8



Additional safety functions

- External test (light emission stop)
- External device monitoring function
- Interlock function

Enhanced mutual interference prevention

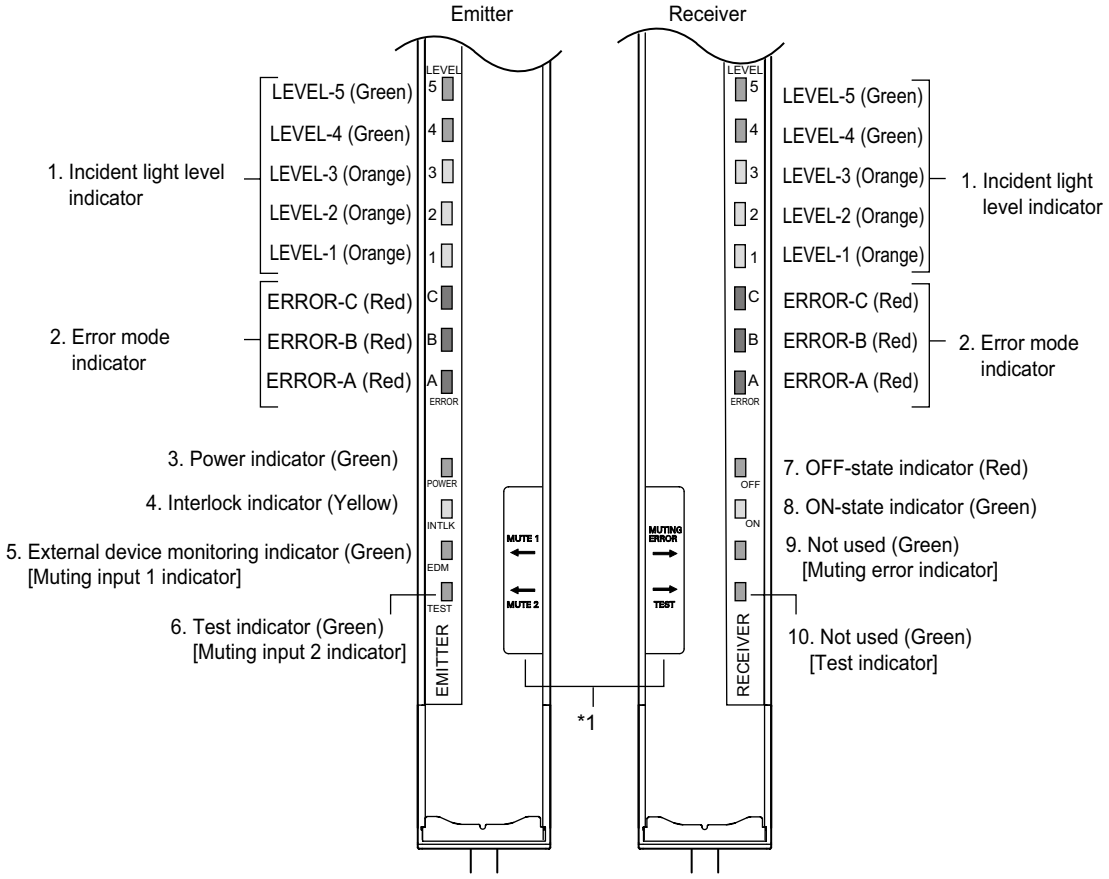
Mutual interference is prevented in up to 3 sets, using newly designed interference light detection and frequency shift algorithm. The series connection function can prevent mutual interference in up to 400 beams in 4 sets.

p.52

Muting/Override Function are Provided

A sensor by itself can operate with muting or override function without using a controller.

Indicator Display Patterns



A set of square brackets, [ ], indicates name of an indicator under muting system.

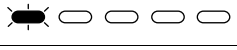
*1 This label comes with a key cap for muting F39-CN6.
It must be attached to your sensor when the muting function is used.

No.	Indicators		Description	
			For basic system	For muting system
1	Incident light level indicator (LEVEL-1 to 5)		Indication status of LEVEL-1 to 5 shows the incident light level status of the F3SJ. (*1)	
2	Error mode indicator (ERROR-A to C)		Turns ON or blink only on the sensor where the error occurred when the F3SJ enters lockout. The error mode indicators remain OFF on sensors (emitters or receivers) where an error did not occur, or on other series-connected sensors. The indication status of ERROR-A to C shows the cause of the error (*2). Affix the error mode label (included) near the F3SJ to allow for quick troubleshooting when errors occur.	
3	Power indicator (POWER)		Turns ON while the power is ON.	
4	Interlock indicator (INTLK)	ON	Turns ON when F3SJ is in interlock state.	Not used
		Blinking	Blinks when in lockout.	
5	External device monitoring indicator (EDM) Muting input 1 indicator (MUTE1)	ON	Turns ON when an input is given to external device monitoring input.	Turns ON when an input is given to muting input 1.
		Blinking	Not used	Not used
6	Test indicator (TEST) Muting input 2 indicator (MUTE2)	ON	Not used	Turns ON when an input is given to muting input 2.
		Blinking	Blinks when external test is being performed.	Not used
7	OFF-state indicator (OFF)	ON	Turns ON when safety outputs are OFF.	
		Blinking	Blinks when in lockout.	

No.	Indicators		Description	
			For basic system	For muting system
8	ON-state indicator (ON)		Turns ON when safety outputs are ON.	
9	Muting error indicator (MUTING ERR)	ON	Not used	Turns ON when a muting error occurs.
		Blinking	Not used	Not used
10	Test indicator (TEST)	ON	Not used	Not used
		Blinking	Not used	Blinks when external test is being performed.

*1. Indication patterns and incident light levels of the incident light level indicator

ON OFF

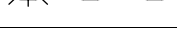
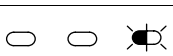
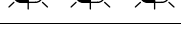
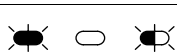
1 2 3 4 5	Incident light level
	170% or higher of safety output ON level
	From 130 to 170% of safety output ON level
	From 100 to 130% of safety output ON level
	From 75 to 100% of safety output ON level
	From 50 to 75% of safety output ON level
	Less than 50% of safety output ON level

CHECK!

Operation is possible with incident light level of 100% or more, but to ensure stability, operate when all incident light level indicators

*2. Indication patterns of error mode indicator and causes of errors

OFF Blinking ON

A B C	Cause of error
	Incorrect wiring or breakage of interlock selection input line or reset input line.
	Relay is welded or recovery time is too long. Incorrect wiring or breakage of external device monitoring line.
	Incorrect wiring of safety output 1 or 2. Failure of safety output circuit.
	Incorrect wiring or breakage of series-connection cable.
	Effect of noise. F3SJ Failure of internal circuit.
	Breakage, incorrect wiring of communication line, disconnection of series connection cable, influence of noise, or other errors.
	Mutual interference or disturbance light.
	Emitter and receiver have different F3SJ model names or number of series connections.
	Muting wiring failure.
	End cap is not attached. Failure of internal circuit of F3SJ.

A B C	Cause of error
	Power supply voltage of F3SJ is out of rated range. Insufficient current capacity of power supply.

Ratings

Ratings/Specifications

In the model names in this table, the □□□□ contain the 4 digits indicating the protective height (mm).

		F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30
Detection capability		Opaque objects	Opaque objects	Opaque objects
		Diameter 14mm	Diameter 20mm	Diameter 30mm
Beam gap		9mm	15mm	25mm
Number of beams		26 to 234	16 to 166	10 to 100
Protective height		245 to 2,117mm	245 to 2,495mm	245 to 2,495mm
Lens diameter		Diameter 5mm		
Operating range		0.2 to 9m (for protective height up to 1649 mm) 0.2 to 7m (for protective height 1655 mm or greater)		
Response time		ON to OFF: 10ms to 27.5ms max., OFF to ON: 40ms to 110ms max. (when incidence is stable). Refer to p.14 for details.		
Startup waiting time		2s max. (2.2s max in case of series connection)		
Power supply voltage		24VDC ± 20% (ripple p-p10% max.)		
Current consumption (no load)	Emitter	Up to 50 beams: 78 mA max., 51 to 100 beams: 113 mA max., 101 to 150 beams: 140 mA max., 151 to 200 beams: 163 mA max., 201 to 234 beams: 177 mA max.		
	Receiver	Up to 50 beams: 66 mA max., 51 to 100 beams: 83 mA max., 101 to 150 beams: 101 mA max., 151 to 200 beams: 118 mA max., 201 to 234 beams: 130 mA max.		
Light source		Infrared LED (870nm wavelength)		
Effective aperture angle (EAA)		Within ±2.5 ° for the emitter and receiver at a detection distance of at least 3 m according to IEC61496-2		
Safety outputs(OSSD)		PNP transistor outputs x 2, Load current 300mA max, Residual voltage 2V max. (except for voltage drop due to cable extension), Maximum capacity load 2.2 μF, leakage current 1 mA max. (This may be different from previously used logic (ON/OFF) because safety circuit is used.)		
Auxiliary output 1 (Non-safety output)		PNP transistor output x 1, Load current 300mA max., Residual voltage 2V max. (except for voltage drop due to cable extension), Maximum capacity load 2.2 μF, leakage current 1mA max.		
External indicator output (Non-safety output)		Connectable external indicator - Incandescent lamp : 24VDC, 3 to 7W - LED lamp : Load current 300mA max. Maximum capacity load 2.2μF, Leakage current 1mA max. (An indicator cable F39-JJ3N or F39-A01P□-PAC is required when using an external indicator.)		
Output operation mode		Safety outputs : ON when receiving light Auxiliary output 1 : Reverse output of safety output External indicator output 1: Reverse output of safety output (for basic system), ON during muting/override (for muting system) External indicator output 2: ON in lockout (for basic system), ON during muting/override (for muting system)		
Input voltage		Test input, interlock selection input, reset input, external relay monitoring input, and inputs input are all performed at the voltages below: ON voltage: 9 to 24V (sink current 3mA max.) OFF voltage: 0 to 1.5V, or open		

		F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30
Indicators	Emitter	Incident light level indicators (green LED x 2, orange LED x 3): ON based on the amount of incident light Error mode indicators (red LED x 3): Blink to indicate error details Power indicator (green LED x 1): ON while power is ON Interlock indicator (yellow LED x 1): ON when in interlock/Blinks when in lockout External device monitoring indicator (muting input 1 indicator), Test indicator (muting input 2 indicator) (green LED x2): ON/Blink according to function		
	Receiver	Incident light level indicators (green LED x 2, orange LED x 3): ON based on the amount of incident light Error mode indicators (red LED x 3): Blink to indicate error details OFF-statet indicator (red LED x 1): ON when safety outputs are OFF/ Blinks when in lockout ON-state indicator (green LED x 1): ON when safety outputs are ON Muting error indicator, Test indicator (green LED x 2): ON/Blink according to function		
Mutual interference prevention function		Interference light avoidance algorithm		
Series connection		Time division emission by series connection - Number of connections: Up to 4 sets - Total number of beams: Up to 400 - Maximum cable length between 2 sets of sensors: 15m For total extension length (cable extension length) p.19		
Test function		- Self-test (After power ON, and during operation) - External test (light emission stop function by test input)		
Safety-related functions		- Start interlock, restart interlock (Not usable when muting function is used) - External device monitoring - Muting (Includes override functions. F39-CN6 key cap for muting is required)		
Connection method		Connector method (M12, 8-pin)		
Protection circuit		Output short-circuit protection, and power supply reverse polarity protection		
Ambient temperature		During operation: -10 to 55°C (without freezing), During storage: -30 to 70°C		
Ambient humidity		During operation: 35 to 85%RH (no condensation), During storage: 35 to 95%RH		
Ambient light intensity		Incandescent lamp: receiving-surface light intensity of 3,000 lx max., Sunlight: receiving-surface light intensity of 10,000 lx max.		
Insulation resistance		20MΩ or higher (500VDC)		
Dielectric strength voltage		1, 000VAC, 50/60Hz, 1min		
Degree of protection		IP65 (IEC60529)		
Vibration resistance		Malfunction: 10 to 55Hz, Multiple amplitude of 0.7mm, 20 sweeps each in X, Y, and Z directions		
Shock resistance		Malfunction: 100m/s^2, 1,000 times each in X, Y, and Z directions		
Connection cable, Series connection cable (F39-JJR15L, JJR3W)		Dia. 6 mm, 8-wire (0.15mm^2 x 8) with braided shield, Allowable bending radius R5mm		
Extension cable (F39-JC□A, JC□B,JC□C)		Dia. 6.6 mm, 8-wire (0.3mm^2 x 4P, conductor resistance 0.058 ohm/m), with braided shield, Allowable bending radius of R36mm. (To extend a cable, use an equivalent or higher-performance cable, and do not use the cable in the same duct as that for high-voltage cables or power cables) For details about extension lengths (cable extension length) p.19 For details about twisted pair wire (single connector cable) p.81		
Material		Casing (including metal parts on both ends): Aluminum, zinc die-cast Cap: ABS resin Optical cover: PMMA resin (acrylic) Cable: Oil resistant PVC		

	F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30
Weight (packaged)	- F3SJ-A□□□□P14 Weight (g)=(protective height) x 1.7+ α - F3SJ-A□□□□P20/F3SJ-A□□□□P30 Weight (g)=(protective height) x 1.5+ α The values for α are as follows: When protective height is between 245 and 596mm, α=1100 When protective height is between 605 and 1130mm, α=1500 When protective height is between 1136 and 1658mm, α=2000 When protective height is between 1667 and 2180mm, α=2400 When protective height is between 2195 and 2495mm, α=2600		
Accessories	Test rod, instruction sheet, top and bottom mounting brackets, intermediate mounting brackets (*), error mode label, user's manual (CD-ROM) * The number of intermediate mounting brackets depends on the total length of the F3SJ. - F3SJ total length is from 605 to 1,130mm: 1 set for each the emitter and receiver is included - F3SJ total length is from 1136 to 1,658mm: 2 sets for each the emitter and receiver are included - F3SJ total length is from 1667 to 2,180mm: 3 sets for each the emitter and receiver are included - F3SJ total length is from 2195 to 2495mm: 4 sets for each the emitter and receiver are included		
Applicable standards	IEC61496-1, EN61496-1 Type 4 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2 Type 4 AOPD (Active Opto-electronic Protective Devices) IEC61508 SIL3		

Model Name List/Response Times

F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30	Number of beams	Response time (ON to OFF)	Response time (OFF to ON)
-	-	F3SJ-A0245P30	10 beams	10ms	40ms
-	-	F3SJ-A0270P30	11 beams	10ms	40ms
-	-	F3SJ-A0295P30	12 beams	10ms	40ms
-	-	F3SJ-A0320P30	13 beams	10ms	40ms
-	-	F3SJ-A0345P30	14 beams	10ms	40ms
-	-	F3SJ-A0370P30	15 beams	10ms	40ms
-	F3SJ-A0245P20	F3SJ-A0395P30	16 beams	10ms	40ms
-	F3SJ-A0260P20	F3SJ-A0420P30	17 beams	11ms	44ms
-	F3SJ-A0275P20	F3SJ-A0445P30	18 beams	11ms	44ms
-	F3SJ-A0290P20	F3SJ-A0470P30	19 beams	11ms	44ms
-	F3SJ-A0305P20	F3SJ-A0495P30	20 beams	11ms	44ms
-	F3SJ-A0320P20	F3SJ-A0520P30	21 beams	11ms	44ms
-	F3SJ-A0335P20	F3SJ-A0545P30	22 beams	11ms	44ms
-	F3SJ-A0350P20	F3SJ-A0570P30	23 beams	11ms	44ms
-	F3SJ-A0365P20	F3SJ-A0595P30	24 beams	11ms	44ms
-	F3SJ-A0380P20	F3SJ-A0620P30	25 beams	11ms	44ms
F3SJ-A0245P14	F3SJ-A0395P20	F3SJ-A0645P30	26 beams	11ms	44ms
F3SJ-A0254P14	F3SJ-A0410P20	F3SJ-A0670P30	27 beams	11ms	44ms
F3SJ-A0263P14	F3SJ-A0425P20	F3SJ-A0695P30	28 beams	11ms	44ms
F3SJ-A0272P14	F3SJ-A0440P20	F3SJ-A0720P30	29 beams	11ms	44ms
F3SJ-A0281P14	F3SJ-A0455P20	F3SJ-A0745P30	30 beams	12ms	48ms
F3SJ-A0290P14	F3SJ-A0470P20	F3SJ-A0770P30	31 beams	12ms	48ms
F3SJ-A0299P14	F3SJ-A0485P20	F3SJ-A0795P30	32 beams	12ms	48ms
F3SJ-A0308P14	F3SJ-A0500P20	F3SJ-A0820P30	33 beams	12ms	48ms
F3SJ-A0317P14	F3SJ-A0515P20	F3SJ-A0845P30	34 beams	12ms	48ms
F3SJ-A0326P14	F3SJ-A0530P20	F3SJ-A0870P30	35 beams	12ms	48ms
F3SJ-A0335P14	F3SJ-A0545P20	F3SJ-A0895P30	36 beams	12ms	48ms
F3SJ-A0344P14	F3SJ-A0560P20	F3SJ-A0920P30	37 beams	12ms	48ms
F3SJ-A0353P14	F3SJ-A0575P20	F3SJ-A0945P30	38 beams	12ms	48ms
F3SJ-A0362P14	F3SJ-A0590P20	F3SJ-A0970P30	39 beams	12ms	48ms
F3SJ-A0371P14	F3SJ-A0605P20	F3SJ-A0995P30	40 beams	12ms	48ms
F3SJ-A0380P14	F3SJ-A0620P20	F3SJ-A1020P30	41 beams	12ms	48ms
F3SJ-A0389P14	F3SJ-A0635P20	F3SJ-A1045P30	42 beams	12ms	48ms
F3SJ-A0398P14	F3SJ-A0650P20	F3SJ-A1070P30	43 beams	13ms	52ms
F3SJ-A0407P14	F3SJ-A0665P20	F3SJ-A1095P30	44 beams	13ms	52ms
F3SJ-A0416P14	F3SJ-A0680P20	F3SJ-A1120P30	45 beams	13ms	52ms
F3SJ-A0425P14	F3SJ-A0695P20	F3SJ-A1145P30	46 beams	13ms	52ms
F3SJ-A0434P14	F3SJ-A0710P20	F3SJ-A1170P30	47 beams	13ms	52ms
F3SJ-A0443P14	F3SJ-A0725P20	F3SJ-A1195P30	48 beams	13ms	52ms
F3SJ-A0452P14	F3SJ-A0740P20	F3SJ-A1220P30	49 beams	13ms	52ms
F3SJ-A0461P14	F3SJ-A0755P20	F3SJ-A1245P30	50 beams	13ms	52ms
F3SJ-A0470P14	F3SJ-A0770P20	F3SJ-A1270P30	51 beams	13ms	52ms
F3SJ-A0479P14	F3SJ-A0785P20	F3SJ-A1295P30	52 beams	13ms	52ms
F3SJ-A0488P14	F3SJ-A0800P20	F3SJ-A1320P30	53 beams	13ms	52ms

F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30	Number of beams	Response time (ON to OFF)	Response time (OFF to ON)
F3SJ-A0497P14	F3SJ-A0815P20	F3SJ-A1345P30	54 beams	13ms	52ms
F3SJ-A0506P14	F3SJ-A0830P20	F3SJ-A1370P30	55 beams	13ms	52ms
F3SJ-A0515P14	F3SJ-A0845P20	F3SJ-A1395P30	56 beams	14ms	56ms
F3SJ-A0524P14	F3SJ-A0860P20	F3SJ-A1420P30	57 beams	14ms	56ms
F3SJ-A0533P14	F3SJ-A0875P20	F3SJ-A1445P30	58 beams	14ms	56ms
F3SJ-A0542P14	F3SJ-A0890P20	F3SJ-A1470P30	59 beams	14ms	56ms
F3SJ-A0551P14	F3SJ-A0905P20	F3SJ-A1495P30	60 beams	14ms	56ms
F3SJ-A0560P14	F3SJ-A0920P20	F3SJ-A1520P30	61 beams	14ms	56ms
F3SJ-A0569P14	F3SJ-A0935P20	F3SJ-A1545P30	62 beams	14ms	56ms
F3SJ-A0578P14	F3SJ-A0950P20	F3SJ-A1570P30	63 beams	14ms	56ms
F3SJ-A0587P14	F3SJ-A0965P20	F3SJ-A1595P30	64 beams	14ms	56ms
F3SJ-A0596P14	F3SJ-A0980P20	F3SJ-A1620P30	65 beams	14ms	56ms
F3SJ-A0605P14	F3SJ-A0995P20	F3SJ-A1645P30	66 beams	14ms	56ms
F3SJ-A0614P14	F3SJ-A1010P20	F3SJ-A1670P30	67 beams	14ms	56ms
F3SJ-A0623P14	F3SJ-A1025P20	F3SJ-A1695P30	68 beams	15ms	60ms
F3SJ-A0632P14	F3SJ-A1040P20	F3SJ-A1720P30	69 beams	15ms	60ms
F3SJ-A0641P14	F3SJ-A1055P20	F3SJ-A1745P30	70 beams	15ms	60ms
F3SJ-A0650P14	F3SJ-A1070P20	F3SJ-A1770P30	71 beams	15ms	60ms
F3SJ-A0659P14	F3SJ-A1085P20	F3SJ-A1795P30	72 beams	15ms	60ms
F3SJ-A0668P14	F3SJ-A1100P20	F3SJ-A1820P30	73 beams	15ms	60ms
F3SJ-A0677P14	F3SJ-A1115P20	F3SJ-A1845P30	74 beams	15ms	60ms
F3SJ-A0686P14	F3SJ-A1130P20	F3SJ-A1870P30	75 beams	15ms	60ms
F3SJ-A0695P14	F3SJ-A1145P20	F3SJ-A1895P30	76 beams	15ms	60ms
F3SJ-A0704P14	F3SJ-A1160P20	F3SJ-A1920P30	77 beams	15ms	60ms
F3SJ-A0713P14	F3SJ-A1175P20	F3SJ-A1945P30	78 beams	15ms	60ms
F3SJ-A0722P14	F3SJ-A1190P20	F3SJ-A1970P30	79 beams	15ms	60ms
F3SJ-A0731P14	F3SJ-A1205P20	F3SJ-A1995P30	80 beams	15ms	60ms
F3SJ-A0740P14	F3SJ-A1220P20	F3SJ-A2020P30	81 beams	17.5ms	70ms
F3SJ-A0749P14	F3SJ-A1235P20	F3SJ-A2045P30	82 beams	17.5ms	70ms
F3SJ-A0758P14	F3SJ-A1250P20	F3SJ-A2070P30	83 beams	17.5ms	70ms
F3SJ-A0767P14	F3SJ-A1265P20	F3SJ-A2095P30	84 beams	17.5ms	70ms
F3SJ-A0776P14	F3SJ-A1280P20	F3SJ-A2120P30	85 beams	17.5ms	70ms
F3SJ-A0785P14	F3SJ-A1295P20	F3SJ-A2145P30	86 beams	17.5ms	70ms
F3SJ-A0794P14	F3SJ-A1310P20	F3SJ-A2170P30	87 beams	17.5ms	70ms
F3SJ-A0803P14	F3SJ-A1325P20	F3SJ-A2195P30	88 beams	17.5ms	70ms
F3SJ-A0812P14	F3SJ-A1340P20	F3SJ-A2220P30	89 beams	17.5ms	70ms
F3SJ-A0821P14	F3SJ-A1355P20	F3SJ-A2245P30	90 beams	17.5ms	70ms
F3SJ-A0830P14	F3SJ-A1370P20	F3SJ-A2270P30	91 beams	17.5ms	70ms
F3SJ-A0839P14	F3SJ-A1385P20	F3SJ-A2295P30	92 beams	17.5ms	70ms
F3SJ-A0848P14	F3SJ-A1400P20	F3SJ-A2320P30	93 beams	17.5ms	70ms
F3SJ-A0857P14	F3SJ-A1415P20	F3SJ-A2345P30	94 beams	17.5ms	70ms
F3SJ-A0866P14	F3SJ-A1430P20	F3SJ-A2370P30	95 beams	17.5ms	70ms
F3SJ-A0875P14	F3SJ-A1445P20	F3SJ-A2395P30	96 beams	17.5ms	70ms
F3SJ-A0884P14	F3SJ-A1460P20	F3SJ-A2420P30	97 beams	17.5ms	70ms
F3SJ-A0893P14	F3SJ-A1475P20	F3SJ-A2445P30	98 beams	17.5ms	70ms
F3SJ-A0902P14	F3SJ-A1490P20	F3SJ-A2470P30	99 beams	17.5ms	70ms
F3SJ-A0911P14	F3SJ-A1505P20	F3SJ-A2495P30	100 beams	17.5ms	70ms

F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30	Number of beams	Response time (ON to OFF)	Response time (OFF to ON)
F3SJ-A0920P14	F3SJ-A1520P20	-	101 beams	17.5ms	70ms
F3SJ-A0929P14	F3SJ-A1535P20	-	102 beams	17.5ms	70ms
F3SJ-A0938P14	F3SJ-A1550P20	-	103 beams	17.5ms	70ms
F3SJ-A0947P14	F3SJ-A1565P20	-	104 beams	17.5ms	70ms
F3SJ-A0956P14	F3SJ-A1580P20	-	105 beams	17.5ms	70ms
F3SJ-A0965P14	F3SJ-A1595P20	-	106 beams	17.5ms	70ms
F3SJ-A0974P14	F3SJ-A1610P20	-	107 beams	17.5ms	70ms
F3SJ-A0983P14	F3SJ-A1625P20	-	108 beams	17.5ms	70ms
F3SJ-A0992P14	F3SJ-A1640P20	-	109 beams	17.5ms	70ms
F3SJ-A1001P14	F3SJ-A1655P20	-	110 beams	17.5ms	70ms
F3SJ-A1010P14	F3SJ-A1670P20	-	111 beams	17.5ms	70ms
F3SJ-A1019P14	F3SJ-A1685P20	-	112 beams	17.5ms	70ms
F3SJ-A1028P14	F3SJ-A1700P20	-	113 beams	20.0ms	80ms
F3SJ-A1037P14	F3SJ-A1715P20	-	114 beams	20.0ms	80ms
F3SJ-A1046P14	F3SJ-A1730P20	-	115 beams	20.0ms	80ms
F3SJ-A1055P14	F3SJ-A1745P20	-	116 beams	20.0ms	80ms
F3SJ-A1064P14	F3SJ-A1760P20	-	117 beams	20.0ms	80ms
F3SJ-A1073P14	F3SJ-A1775P20	-	118 beams	20.0ms	80ms
F3SJ-A1082P14	F3SJ-A1790P20	-	119 beams	20.0ms	80ms
F3SJ-A1091P14	F3SJ-A1805P20	-	120 beams	20.0ms	80ms
F3SJ-A1100P14	F3SJ-A1820P20	-	121 beams	20.0ms	80ms
F3SJ-A1109P14	F3SJ-A1835P20	-	122 beams	20.0ms	80ms
F3SJ-A1118P14	F3SJ-A1850P20	-	123 beams	20.0ms	80ms
F3SJ-A1127P14	F3SJ-A1865P20	-	124 beams	20.0ms	80ms
F3SJ-A1136P14	F3SJ-A1880P20	-	125 beams	20.0ms	80ms
F3SJ-A1145P14	F3SJ-A1895P20	-	126 beams	20.0ms	80ms
F3SJ-A1154P14	F3SJ-A1910P20	-	127 beams	20.0ms	80ms
F3SJ-A1163P14	F3SJ-A1925P20	-	128 beams	20.0ms	80ms
F3SJ-A1172P14	F3SJ-A1940P20	-	129 beams	20.0ms	80ms
F3SJ-A1181P14	F3SJ-A1955P20	-	130 beams	20.0ms	80ms
F3SJ-A1190P14	F3SJ-A1970P20	-	131 beams	20.0ms	80ms
F3SJ-A1199P14	F3SJ-A1985P20	-	132 beams	20.0ms	80ms
F3SJ-A1208P14	F3SJ-A2000P20	-	133 beams	20.0ms	80ms
F3SJ-A1217P14	F3SJ-A2015P20	-	134 beams	20.0ms	80ms
F3SJ-A1226P14	F3SJ-A2030P20	-	135 beams	20.0ms	80ms
F3SJ-A1235P14	F3SJ-A2045P20	-	136 beams	20.0ms	80ms
F3SJ-A1244P14	F3SJ-A2060P20	-	137 beams	20.0ms	80ms
F3SJ-A1253P14	F3SJ-A2075P20	-	138 beams	20.0ms	80ms
F3SJ-A1262P14	F3SJ-A2090P20	-	139 beams	20.0ms	80ms
F3SJ-A1271P14	F3SJ-A2105P20	-	140 beams	20.0ms	80ms
F3SJ-A1280P14	F3SJ-A2120P20	-	141 beams	20.0ms	80ms
F3SJ-A1289P14	F3SJ-A2135P20	-	142 beams	20.0ms	80ms
F3SJ-A1298P14	F3SJ-A2150P20	-	143 beams	20.0ms	80ms
F3SJ-A1307P14	F3SJ-A2165P20	-	144 beams	20.0ms	80ms
F3SJ-A1316P14	F3SJ-A2180P20	-	145 beams	22.5ms	90ms
F3SJ-A1325P14	F3SJ-A2195P20	-	146 beams	22.5ms	90ms
F3SJ-A1334P14	F3SJ-A2210P20	-	147 beams	22.5ms	90ms

F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30	Number of beams	Response time (ON to OFF)	Response time (OFF to ON)
F3SJ-A1343P14	F3SJ-A2225P20	-	148 beams	22.5ms	90ms
F3SJ-A1352P14	F3SJ-A2240P20	-	149 beams	22.5ms	90ms
F3SJ-A1361P14	F3SJ-A2255P20	-	150 beams	22.5ms	90ms
F3SJ-A1370P14	F3SJ-A2270P20	-	151 beams	22.5ms	90ms
F3SJ-A1379P14	F3SJ-A2285P20	-	152 beams	22.5ms	90ms
F3SJ-A1388P14	F3SJ-A2300P20	-	153 beams	22.5ms	90ms
F3SJ-A1397P14	F3SJ-A2315P20	-	154 beams	22.5ms	90ms
F3SJ-A1406P14	F3SJ-A2330P20	-	155 beams	22.5ms	90ms
F3SJ-A1415P14	F3SJ-A2345P20	-	156 beams	22.5ms	90ms
F3SJ-A1424P14	F3SJ-A2360P20	-	157 beams	22.5ms	90ms
F3SJ-A1433P14	F3SJ-A2375P20	-	158 beams	22.5ms	90ms
F3SJ-A1442P14	F3SJ-A2390P20	-	159 beams	22.5ms	90ms
F3SJ-A1451P14	F3SJ-A2405P20	-	160 beams	22.5ms	90ms
F3SJ-A1460P14	F3SJ-A2420P20	-	161 beams	22.5ms	90ms
F3SJ-A1469P14	F3SJ-A2435P20	-	162 beams	22.5ms	90ms
F3SJ-A1478P14	F3SJ-A2450P20	-	163 beams	22.5ms	90ms
F3SJ-A1487P14	F3SJ-A2465P20	-	164 beams	22.5ms	90ms
F3SJ-A1496P14	F3SJ-A2480P20	-	165 beams	22.5ms	90ms
F3SJ-A1505P14	F3SJ-A2495P20	-	166 beams	22.5ms	90ms
F3SJ-A1514P14	-	-	167 beams	22.5ms	90ms
F3SJ-A1523P14	-	-	168 beams	22.5ms	90ms
F3SJ-A1532P14	-	-	169 beams	22.5ms	90ms
F3SJ-A1541P14	-	-	170 beams	22.5ms	90ms
F3SJ-A1550P14	-	-	171 beams	22.5ms	90ms
F3SJ-A1559P14	-	-	172 beams	22.5ms	90ms
F3SJ-A1568P14	-	-	173 beams	22.5ms	90ms
F3SJ-A1577P14	-	-	174 beams	22.5ms	90ms
F3SJ-A1586P14	-	-	175 beams	22.5ms	90ms
F3SJ-A1595P14	-	-	176 beams	22.5ms	90ms
F3SJ-A1604P14	-	-	177 beams	25.0ms	100ms
F3SJ-A1613P14	-	-	178 beams	25.0ms	100ms
F3SJ-A1622P14	-	-	179 beams	25.0ms	100ms
F3SJ-A1631P14	-	-	180 beams	25.0ms	100ms
F3SJ-A1640P14	-	-	181 beams	25.0ms	100ms
F3SJ-A1649P14	-	-	182 beams	25.0ms	100ms
F3SJ-A1658P14	-	-	183 beams	25.0ms	100ms
F3SJ-A1667P14	-	-	184 beams	25.0ms	100ms
F3SJ-A1676P14	-	-	185 beams	25.0ms	100ms
F3SJ-A1685P14	-	-	186 beams	25.0ms	100ms
F3SJ-A1694P14	-	-	187 beams	25.0ms	100ms
F3SJ-A1703P14	-	-	188 beams	25.0ms	100ms
F3SJ-A1712P14	-	-	189 beams	25.0ms	100ms
F3SJ-A1721P14	-	-	190 beams	25.0ms	100ms
F3SJ-A1730P14	-	-	191 beams	25.0ms	100ms
F3SJ-A1739P14	-	-	192 beams	25.0ms	100ms
F3SJ-A1748P14	-	-	193 beams	25.0ms	100ms
F3SJ-A1757P14	-	-	194 beams	25.0ms	100ms

F3SJ-A□□□□P14	F3SJ-A□□□□P20	F3SJ-A□□□□P30	Number of beams	Response time (ON to OFF)	Response time (OFF to ON)
F3SJ-A1766P14	-	-	195 beams	25.0ms	100ms
F3SJ-A1775P14	-	-	196 beams	25.0ms	100ms
F3SJ-A1784P14	-	-	197 beams	25.0ms	100ms
F3SJ-A1793P14	-	-	198 beams	25.0ms	100ms
F3SJ-A1802P14	-	-	199 beams	25.0ms	100ms
F3SJ-A1811P14	-	-	200 beams	25.0ms	100ms
F3SJ-A1820P14	-	-	201 beams	25.0ms	100ms
F3SJ-A1829P14	-	-	202 beams	25.0ms	100ms
F3SJ-A1838P14	-	-	203 beams	25.0ms	100ms
F3SJ-A1847P14	-	-	204 beams	25.0ms	100ms
F3SJ-A1856P14	-	-	205 beams	25.0ms	100ms
F3SJ-A1865P14	-	-	206 beams	25.0ms	100ms
F3SJ-A1874P14	-	-	207 beams	25.0ms	100ms
F3SJ-A1883P14	-	-	208 beams	25.0ms	100ms
F3SJ-A1892P14	-	-	209 beams	27.5ms	110ms
F3SJ-A1901P14	-	-	210 beams	27.5ms	110ms
F3SJ-A1910P14	-	-	211 beams	27.5ms	110ms
F3SJ-A1919P14	-	-	212 beams	27.5ms	110ms
F3SJ-A1928P14	-	-	213 beams	27.5ms	110ms
F3SJ-A1937P14	-	-	214 beams	27.5ms	110ms
F3SJ-A1946P14	-	-	215 beams	27.5ms	110ms
F3SJ-A1955P14	-	-	216 beams	27.5ms	110ms
F3SJ-A1964P14	-	-	217 beams	27.5ms	110ms
F3SJ-A1973P14	-	-	218 beams	27.5ms	110ms
F3SJ-A1982P14	-	-	219 beams	27.5ms	110ms
F3SJ-A1991P14	-	-	220 beams	27.5ms	110ms
F3SJ-A2000P14	-	-	221 beams	27.5ms	110ms
F3SJ-A2009P14	-	-	222 beams	27.5ms	110ms
F3SJ-A2018P14	-	-	223 beams	27.5ms	110ms
F3SJ-A2027P14	-	-	224 beams	27.5ms	110ms
F3SJ-A2036P14	-	-	225 beams	27.5ms	110ms
F3SJ-A2045P14	-	-	226 beams	27.5ms	110ms
F3SJ-A2054P14	-	-	227 beams	27.5ms	110ms
F3SJ-A2063P14	-	-	228 beams	27.5ms	110ms
F3SJ-A2072P14	-	-	229 beams	27.5ms	110ms
F3SJ-A2081P14	-	-	230 beams	27.5ms	110ms
F3SJ-A2090P14	-	-	231 beams	27.5ms	110ms
F3SJ-A2099P14	-	-	232 beams	27.5ms	110ms
F3SJ-A2108P14	-	-	233 beams	27.5ms	110ms
F3SJ-A2117P14	-	-	234 beams	27.5ms	110ms

For series connections, use the calculations below.

When 2 sets are series-connected:

Response time (ON to OFF) :Response time of 1st unit + Response time of 2nd unit -1 (ms)

Response time (OFF to ON) :Response time (ON to OFF) x 4 (ms)

When 3 sets are series-connected:

Response time (ON to OFF) :Response time of 1st unit + Response time of 2nd unit + Response time of 3rd unit - 5 (ms)
Response time (OFF to ON) :Response time (ON to OFF) x 5 (ms)

When 4 sets are series-connected:
Response time (ON to OFF) :Response time of 1st unit + Response time of 2nd unit + Response time of 3rd unit + Response time of 4th unit - 8 (ms)
Response time (OFF to ON) :Response time (ON to OFF) x 5 (ms)

Cable Extension Length

Total extension length must be within a length specified by the table below, including length of series connection cable.

When there is no relay unit, or when power is supplied from an external power source

Condition	Single	2 connected	3 connected	4 connected
Incandescent display lamps are used by auxiliary output and/or external indicator output	45m	40m	30m	20m
Incandescent display lamps are not used	100m	60m	45m	30m

When connected to F3SP-B1P

Condition	Single	2 connected	3 connected	4 connected
Incandescent display lamps are - used by external indicator output 2	40m	30m	25m	20m
Incandescent display lamps are - used by external indicator output 1 and/or, - used by auxiliary output 1	60m	45m	30m	20m
Incandescent display lamps are not used	100m	60m	45m	30m

⚠ WARNING

Extension of the cable must be within a specified length. If it isn't, safety function may not work properly, resulting in danger.

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Chapter2 System Configuration and Functions

How to Select a System

System Selection

The required system configuration depends on the functions to be used. Decide the system to use based on the following:

When not using the muting function ... Basic system
When using the muting function ... Muting system

Function List

O: Available
x: Unavailable

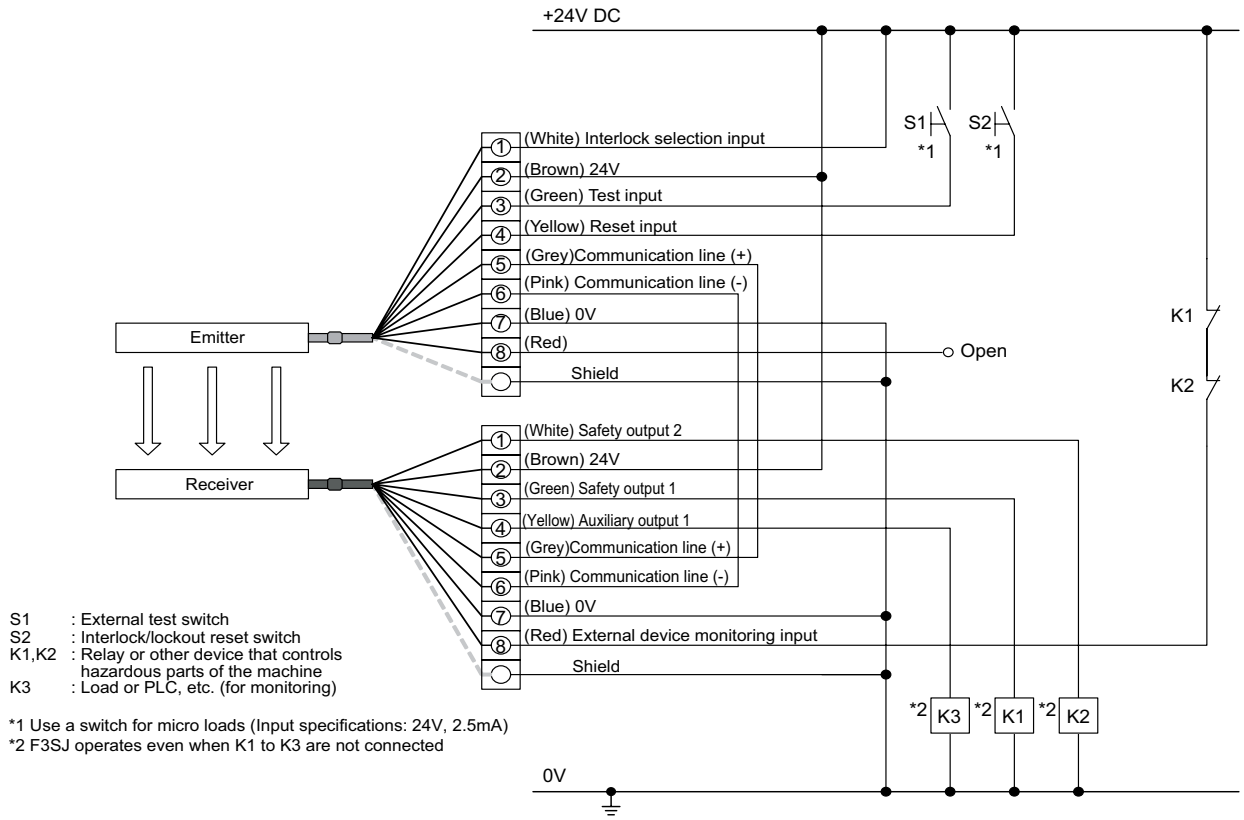
Function		Basic system (Factory settings)	Muting system
Interlock function	Auto reset	O (p.25)	O
	Start interlock Restart interlock	O (p.26)	x
External test function		O (p.27)	O (p.45)
Auxiliary output		O (p.28)	O (p.45)
External indicator output		O	O
External device monitoring function		O (p.30)	O (p.46)
Muting function		x	O (p.34)
Override function		x	O (p.43)

Basic System

Basic system indicates the F3SJ with its default factory settings.
The basic system provides basic safety light curtain functions. Most functions can be used without performing additional configuration.

Wiring Diagrams

■ Wiring using manual reset mode, external device monitoring

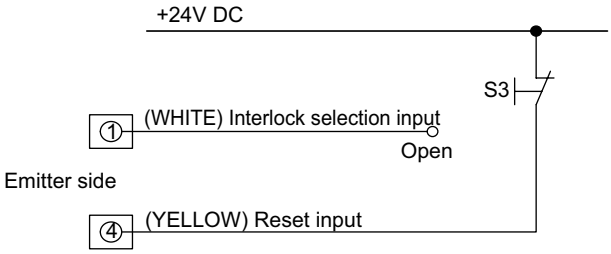


S1 : External test switch
S2 : Interlock/lockout reset switch
K1,K2 : Relay or other device that controls hazardous parts of the machine
K3 : Load or PLC, etc. (for monitoring)

*1 Use a switch for micro loads (Input specifications: 24V, 2.5mA)
*2 F3SJ operates even when K1 to K3 are not connected

■ Wiring for auto reset mode

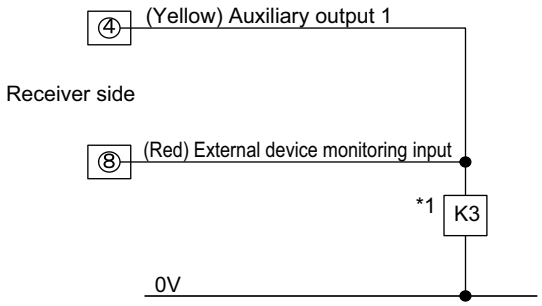
Wiring the emitter's circuit as shown below provides auto reset mode.



S3 : Lockout reset switch
(connect to 24V if a switch is not required)

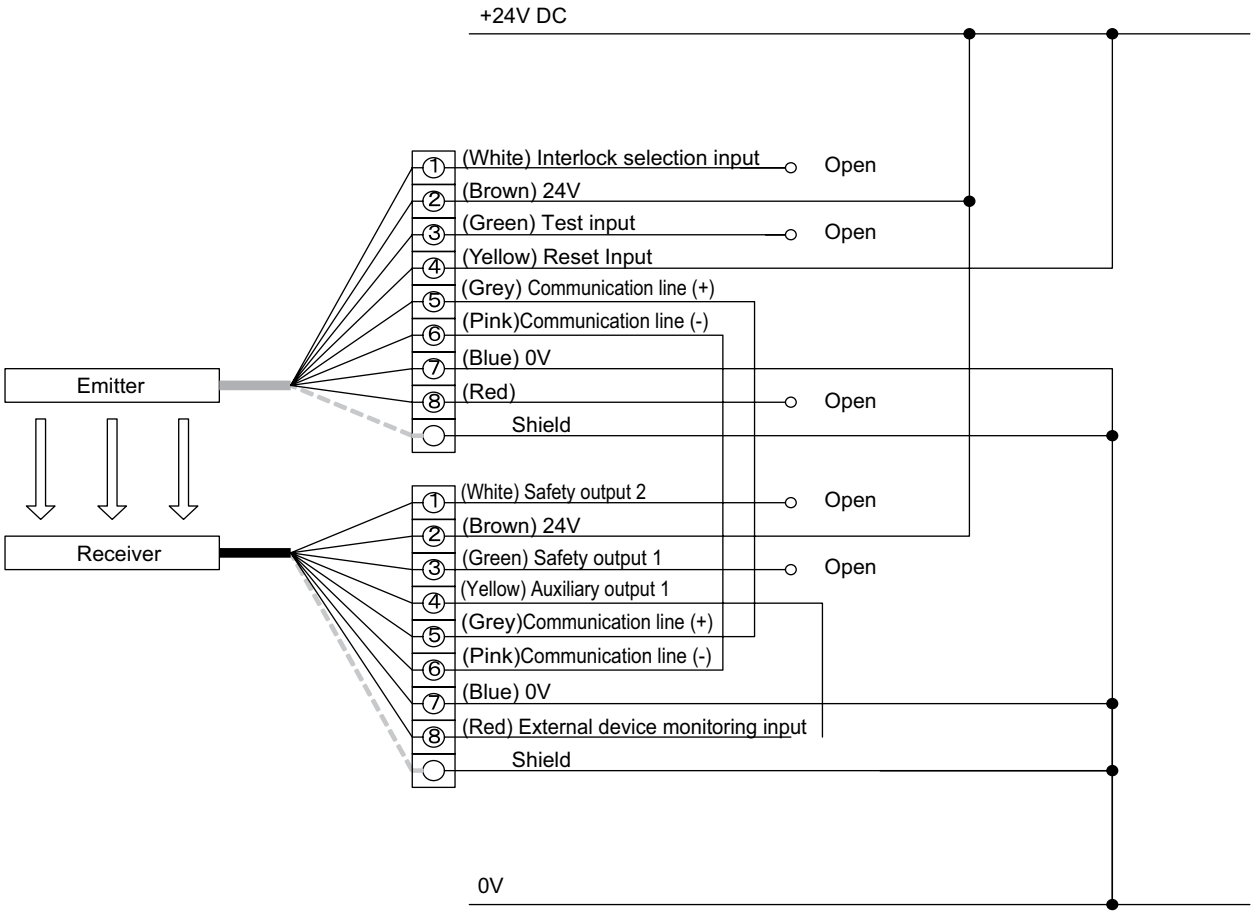
■ Wiring when external device monitoring function is not used

Disable the external device monitoring function by connecting auxiliary output 1 and the external device monitoring input as shown in the diagram below.



*1 If K3 is not required, connect auxiliary output 1 to external device monitoring input only.

■ Ref.: Minimum wiring required to check the operation of the F3SJ
(Wiring for auto reset mode and deactivated external device monitoring)



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

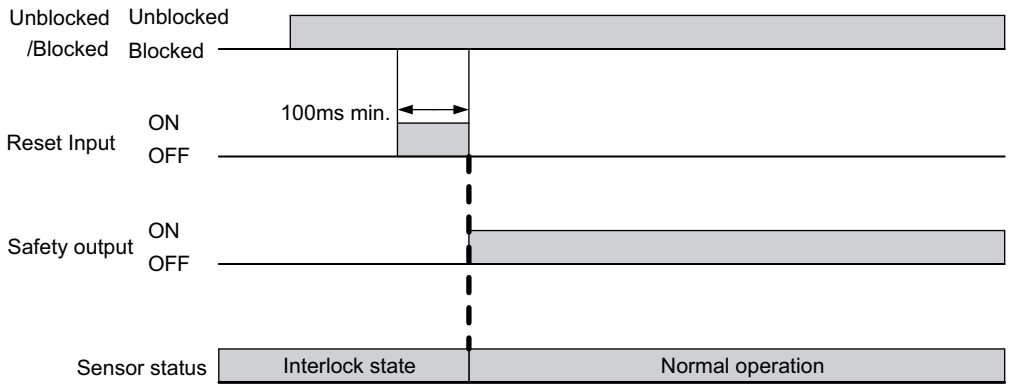
When the interrupting object is removed from the detection zone, the safety outputs automatically turn ON. Auto reset is used on machines where a worker is not able to enter the area between the detection zone and the hazardous part of the machine.

To wire auto reset:

1. Open the interlock selection input line, or short-circuit it to 0 to 1.5V (pin 1/white).
2. Short-circuit the reset input line to 9 to 24V (pin 4/yellow).
3. Turn ON the power to the F3SJ.

■ 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 (EN1037).



A sensor enters interlock state when:

- The power is turned ON (start interlock). This is useful if you want to keep the machine stopped until start inspection is completed after the power is turned ON.
- F3SJ is blocked (restart interlock). After the F3SJ is blocked and the machine stops, the machine can be restarted after safety is ensured.

Manual reset wiring procedure:

1. Connect the interlock selection input line to 9 to 24V. (pin 1/ white)
2. Connect the reset input line to 9 to 24V via a reset switch (N.O. contact). (pin 4/ yellow)
3. Keep the reset switch contact open, and turn ON the power to the F3SJ.

To reset:

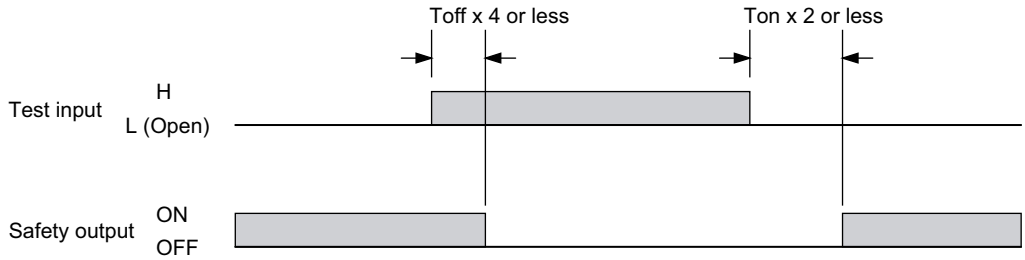
1. Cycle the reset switch to apply a voltage of 9 to 24V for 100ms or longer to the reset input, and then open the switch to apply a 0 to 1.5V signal or open circuit.

CHECK!

A reset switch must be installed outside of the hazardous area in a location that provides a clear view of the hazardous area.

External Test Function

This function forcibly stops the emission using an external signal. It can be used to verify that a safety system should properly stop when F3SJ is interrupted.
To stop the emission, apply 9 to 24V to the emitter's test input line. The voltage must be applied for a period 4 times that of Toff or longer.



Ton: Response time of safety output's OFF to ON, Toff: Response time of safety output's ON to OFF

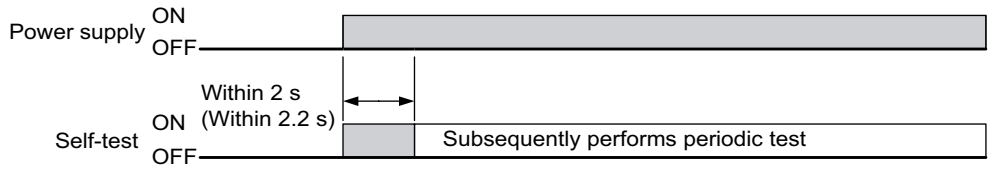
Response time p.14

■ Operation of the F3SJ's indicators when external test function is performed

Test indicator blinks when voltage is applied to the test input.

Self-Test Function

The F3SJ performs the self-test when power is turned ON (within 2 second, or 2.2 seconds in case of series connection) to check for errors. Also, it regularly performs the self-test (within the response time) while operating.



If an error is found in the self-test, the F3SJ enters lockout state, keeps the safety outputs in the OFF state, and indicates the error at the same time.

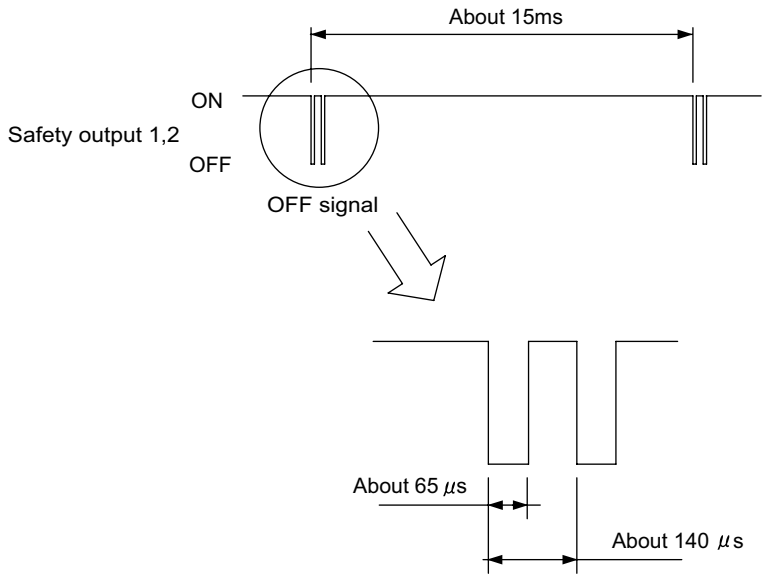
Error indication patterns and causes of errors p.8

How to reset lockout: See p.29 for basic system and p.46 for muting system

For information about lockout, see p.113

■ Waveform of safety outputs

When the F3SJ is receiving light, the safety outputs cyclically turn OFF as shown below to test the output circuit. When this OFF signal is fed back, the output circuit is diagnosed as normal. If the output signal does not include an OFF pulse signal, the receiver diagnoses a failure in the output circuit or wiring, and it enters lockout state. (See the table below.)



Auxiliary Output (Non-Safety Output)

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

⚠ WARNING

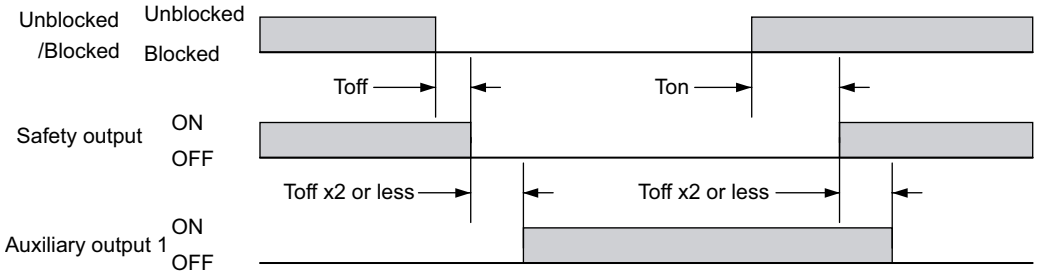
Do not use the auxiliary output or external indicator output for safety applications.
Human body may not be detected when F3SJ fails, resulting in serious injury.

The output operation mode for auxiliary output 1 is as follows:

•Auxiliary output 1: Inverse of safety output signals

CHECK!

Auxiliary output 1 is load current 300mA max.



Ton: Response time of safety output's OFF to ON, Toff: Response time of safety output's ON to OFF

See p.14 for response time

Resetting Lockout

When the cause of the lockout is removed, the lockout condition can be released by using either of the following methods.

•Cycle the power back ON

•Reset input (except for lockout due to a communication error or a wiring error)

For manual reset, apply 9 to 24V to the reset input line for 100ms or longer, and then open the switch to apply a 0 to 1.5V signal or open circuit (pin 4/yellow).

For auto reset, set the reset line open or to 0 to 1.5V for 100ms or longer, and then apply 9 to 24V again (pin 4/yellow).

External Device Monitoring Function (EDM)

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

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

For example, if the (N.C.) contact is not closed and a specified voltage is not applied to the external device monitoring line within 300ms after the safety outputs turn from ON to OFF, it is evaluated as an error and enters a lockout state.

To utilize this function properly, use safety relays and contactors that have forcibly guided or mechanically linked contact structure.

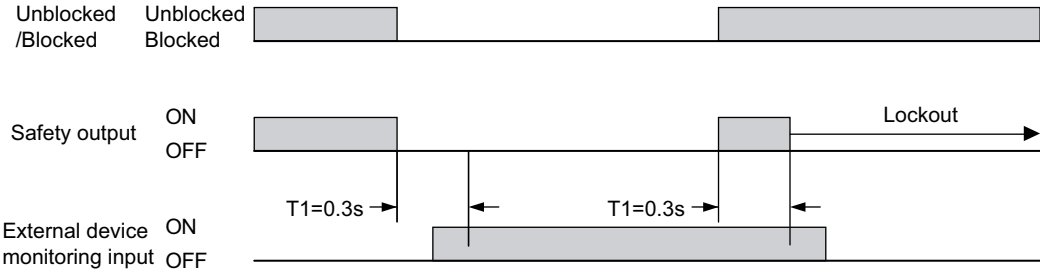
■ Wiring

Perform wiring so that 9 to 24V is applied to the external device monitoring line via the external relay's normally closed (N.C.) contact.

When external device monitoring is not being used, apply auxiliary output 1 to the external device monitoring output.

■ Timing chart

The F3SJ reads out a device monitoring input value 500ms or later after the power of the F3SJ is turned ON. If the status of the safety outputs is changed back to the original status within the allowable delay time, the F3SJ will not enter the lockout state.



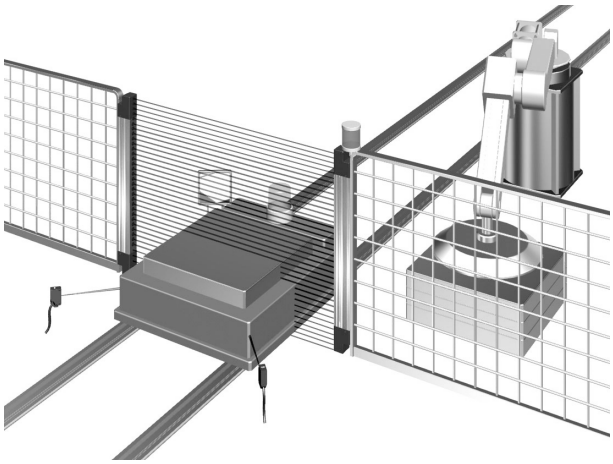
T1: Allowable delay time

■ F3SJ's indicators

- For basic system: When an input is applied to the external device monitoring input, the external device monitoring indicator (muting input 1 indicator) turns ON.
- For muting system: The indicators can not be used to check the input to the external device monitoring input.

Muting System

The muting function temporarily disables the safety function of the F3SJ, keeping the safety outputs ON even if beams are blocked. This makes it possible to install safety light curtains for AGV passage, enabling both safety and productivity. When muting, the muting indicator turns ON to notify people in the surrounding area that the safety functions are disabled.



⚠ WARNING

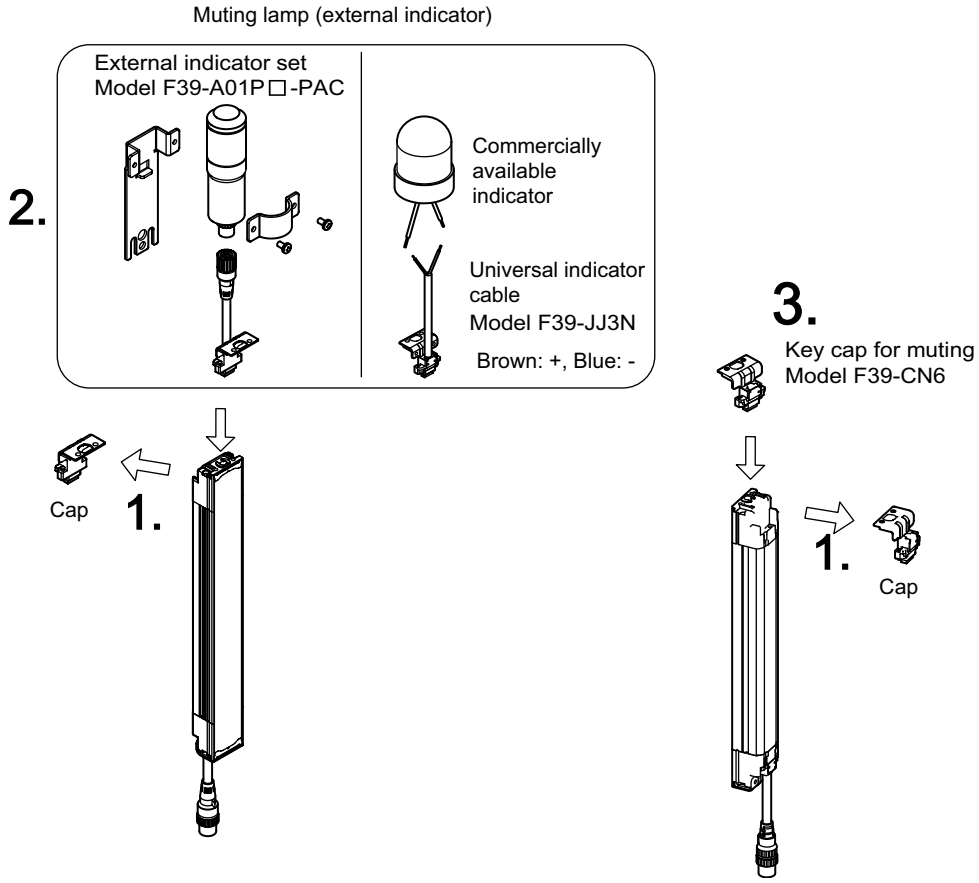
The muting and override functions disable the safety functions of the device. You must ensure safety using other method when these functions are operating.

Muting sensors must be installed 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 detection of a person, it may result in serious injury.

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.

Upgrading F3SJ for Muting System

1. Remove the caps of the emitter and receiver.(driver comes with key cap for muting)
2. Install a muting lamp (external indicator) on either the emitter or the receiver.
3. Attach the key cap for muting to the emitter/receiver on which the muting lamp (external indicator) was not installed.



■ Muting sensor

The muting sensor is the sensor that is the trigger for temporarily disabling the F3SJ's safety functions. Through-beam or retro-reflective photoelectric sensors, proximity sensors, or limit switches can be used as muting sensors. (recommendation: OMRON E3Z series, E2E series, D4N series)Use those with PNP outputs or N.O. type contacts.

CHECK! Use the same power source for a muting sensor as that for the light curtain. If different power supply is used, shutdown of the light curtain power may not be available.

■ Muting lamp (external indicator)

Because it notifies workers that the muting function is operational, the muting lamp (external indicator) must be installed. Use the F39-A01P□-PAC or an F39-JJ3N universal indicator cable and a commercially available external indicator.

Recommended External Indicators p.59

■ F3SJ's indicators

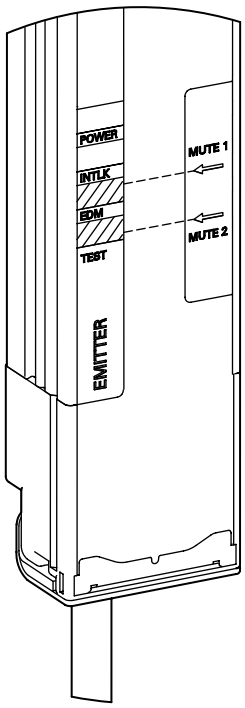
- •Muting input 1 indicator turns ON when an input is applied to muting input 1.
- •Muting input 2 indicator turns ON when an input is applied to muting input 2.
- •Muting error indicator turns ON when a muting error occurs.

Wiring Diagrams p.35

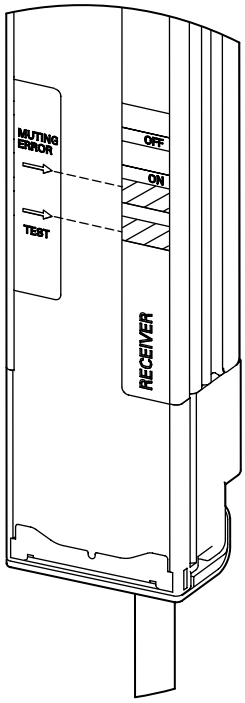
CHECK!

When muting settings are made, align the indicator labels (included with F39-CN6) with the indicator and attach them, as indicated by the shaded areas in the diagram below.

Emitter



Receiver



Muting Timing Diagram

■ Start conditions

If both of the following 2 conditions are present for the F3SJ, muting is activated.

1. No interrupting object is found in the F3SJ's detection zone, and safety outputs are ON.
2. After muting input 1 is turned ON (connected to 9 to 24V), muting input 2 is turned ON (connected to 9 to 24V) within the muting input time limit T1 (0.03 to 3s).

If condition 1 is satisfied but the time requirement of condition 2 is not, a muting error occurs, and the receiver's muting error indicator turns ON.

Muting error can be released by any of following conditions:

•When muting is started by the proper muting sequence.

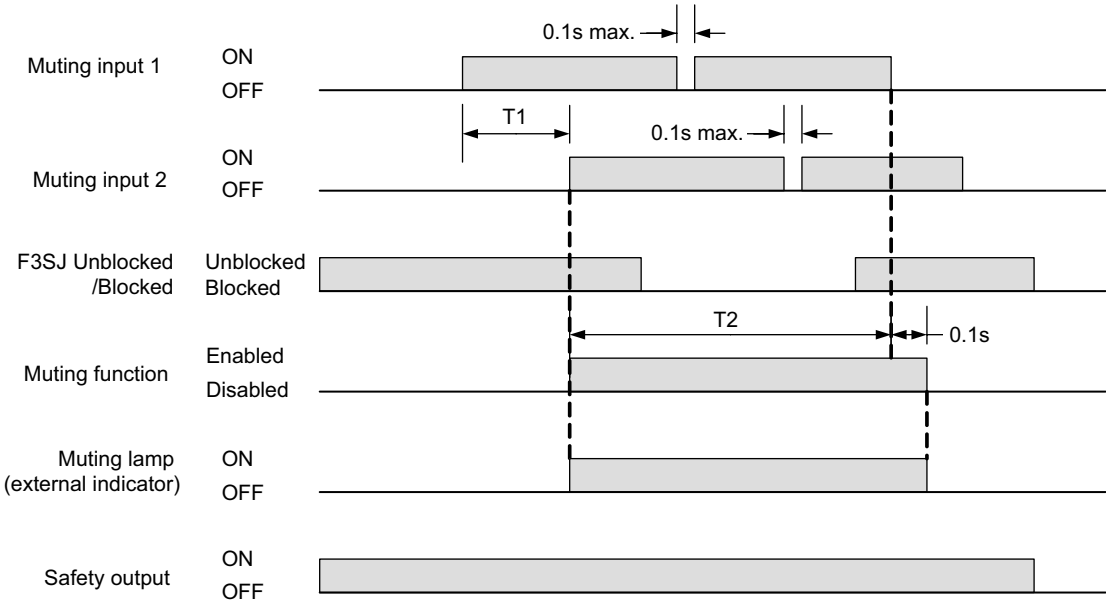
•Power cycle under muting input 1 and 2 OFF state.

■ End conditions

If either of the following conditions are satisfied, the muting state is released.

•Muting input 1 or 2 turns OFF 0.1s or later.

•The muting continuation time exceeds the muting time limit of 60s.



T1: Muting input time limit (0.03 to 3s)

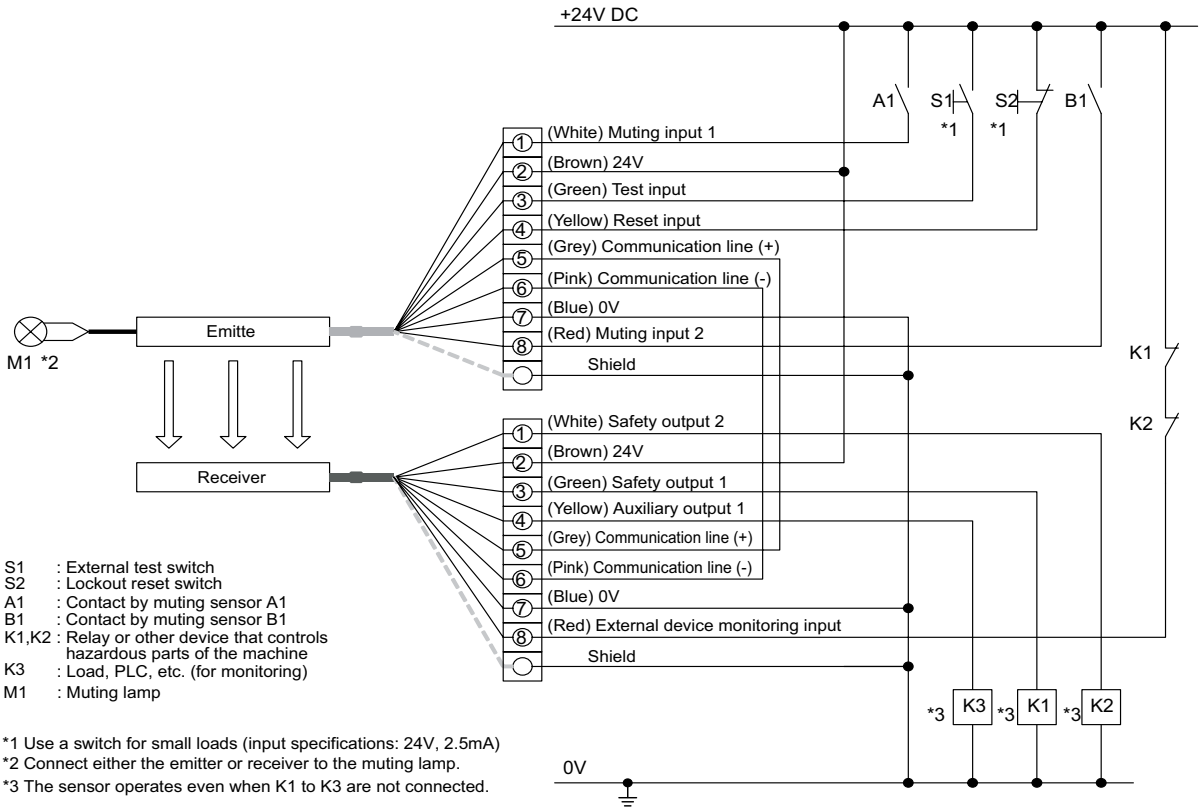
T2: Muting time limit (60s)

CHECK!

Muting state can be released if a sensor transitions to lockout as well.

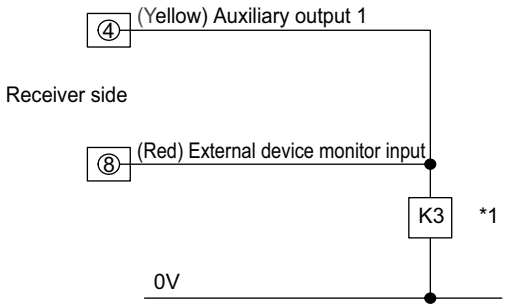
Wiring Diagrams

■ Wiring when using muting and external device monitoring functions



■ Wiring when external device monitoring function is not required

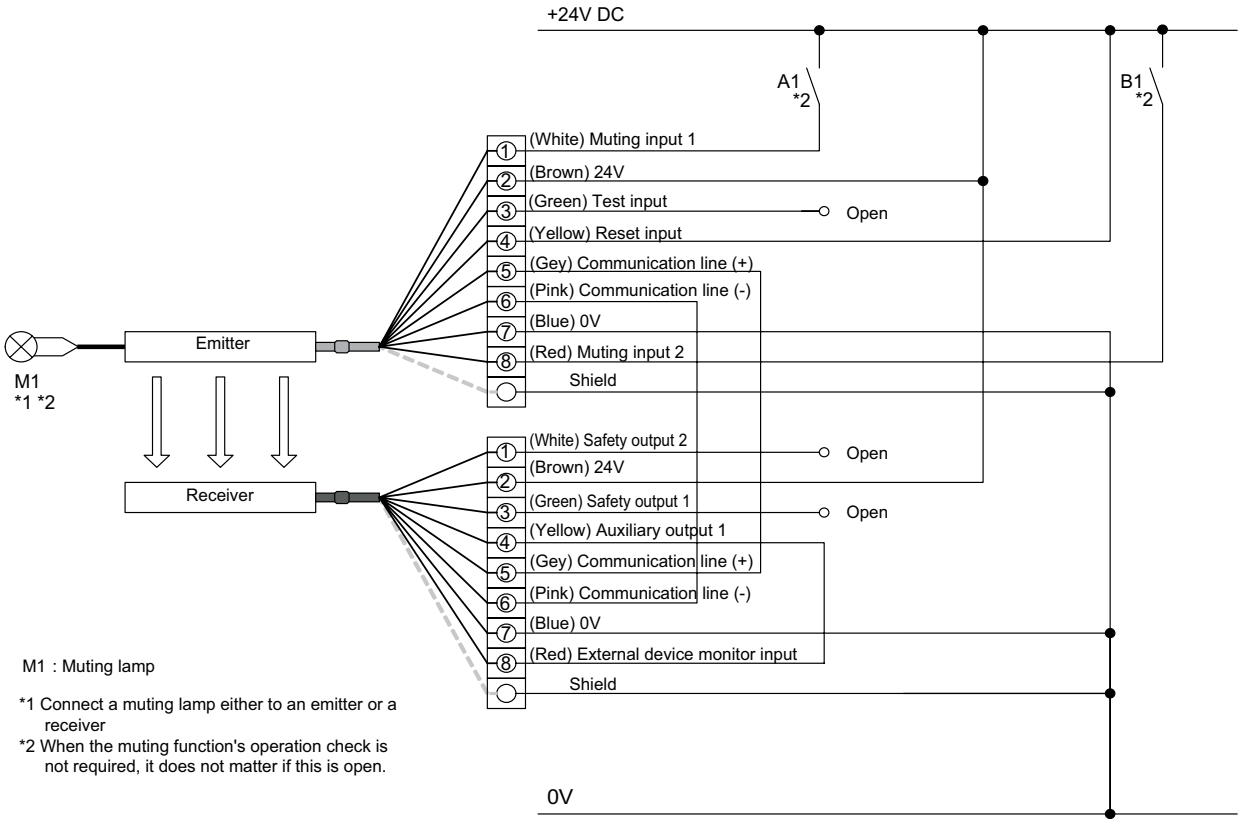
Disable the external device monitoring function by connecting auxiliary output 1 and the external device monitoring input as shown in the diagram below.



*1 If K3 is not required, connect auxiliary output 1 to external relay monitor input only

■ Ref.: Minimum wiring required to check the operation of the F3SJ when using the muting function

(Wiring that does not use the external device monitoring function)



Installation standard for muting sensors

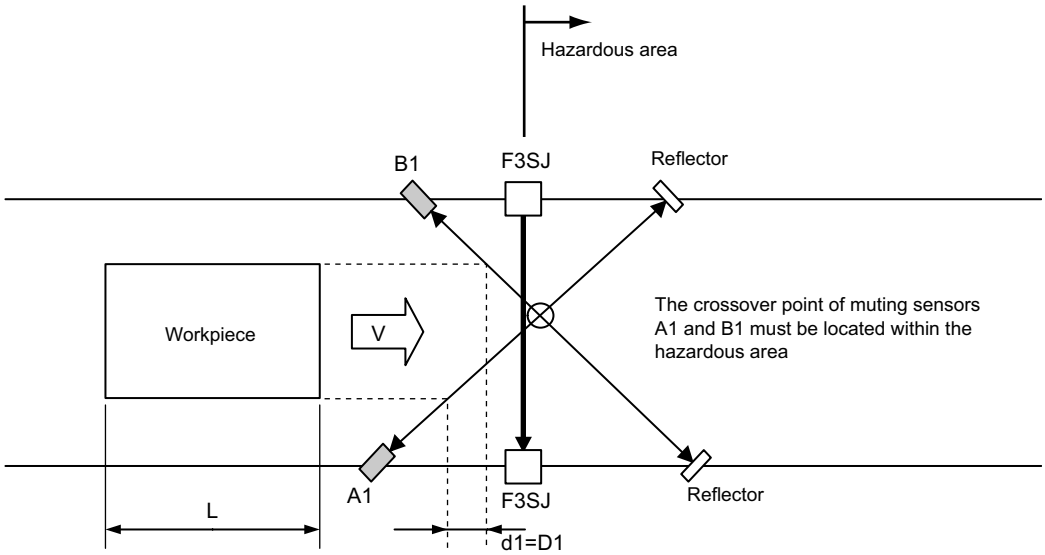
- Set the muting sensors so that they can detect all of the passing detection objects (palettes, automobiles, etc.). Do not install in a position so that only the front or rear end of the detection object is detected.
- Set the muting sensors so that they detect the objects even when they are loaded on palettes or other transport devices.
- Also, install the F3SJ and muting sensors so that each object passes through all muting sensors before the next object arrives at the first muting sensor. Also, install all F3SJ and muting sensors so that no person is able to accidentally enter the hazardous area while the muting function is enabled.

Installation Example of 2 Muting Sensors

This is an example of 2 retro-reflective type photoelectric sensors used as muting sensors installed in a cross pattern.

Use 2 sensors when the length L of the workpieces are not constant or are insufficient.

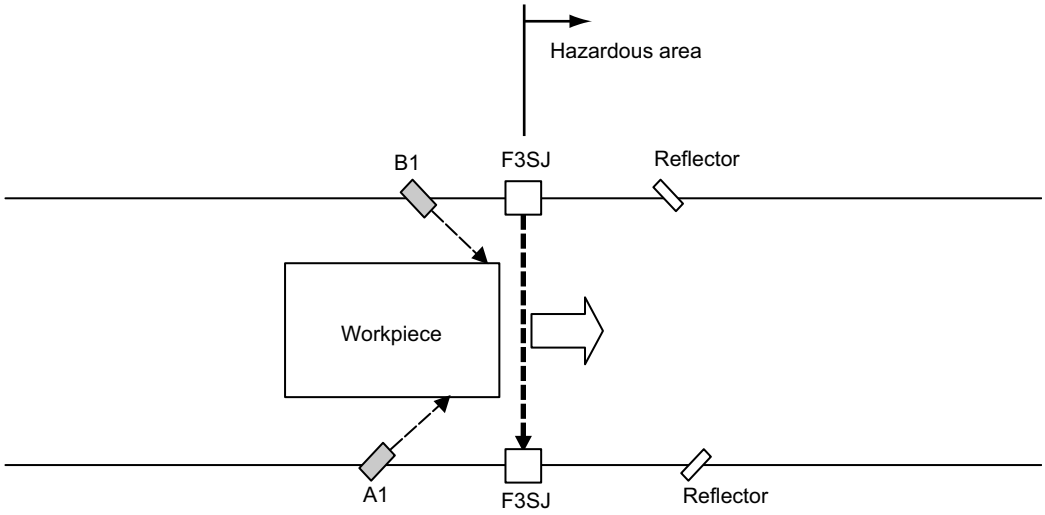
1. Before a workpiece passes through



The output state of muting sensors A1 and B1 are both OFF (contacts A1 and B1 are open due to muting output), and the safety function of the F3SJ is working.

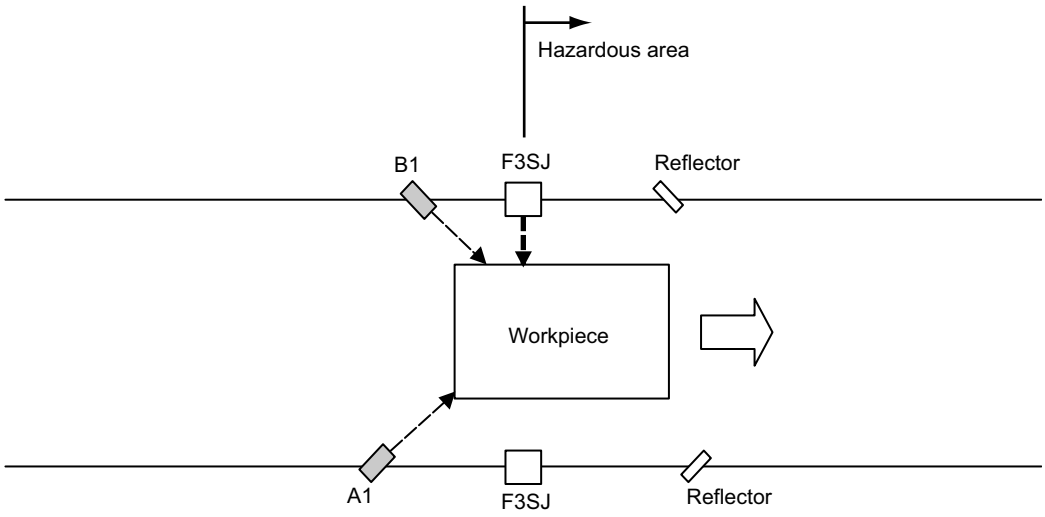
In this example where 2 muting sensors are used, the crossover point of muting sensors A1 and B1 must be located in the hazardous area. This configuration prevents the muting function from being enabled by a person passing through the crossover point.

2. The muting sensor outputs are turned ON (muting inputs are HIGH) and the safety function of the F3SJ is disabled.



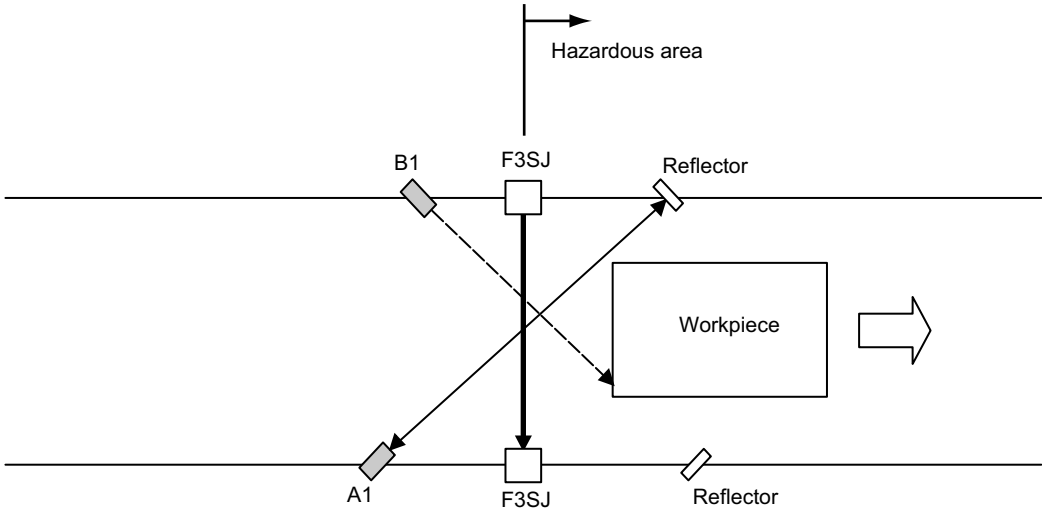
When muting sensors A1 and B1 are turned ON in this order, the muting function is enabled. In this state, the safety function of the F3SJ is disabled.

3. The muting sensor outputs are turned ON (muting inputs are HIGH) and the safety function of the F3SJ is disabled.



The F3SJ is blocked but the safety function is disabled by the muting function, and safety outputs 1 and 2 are turned ON.

4. The muting function is released



Muting sensor A1 is turned OFF, the muting function is released, and the safety function of the F3SJ is enabled.

■ Installation distance

The minimum distance, D1, required for muting sensors to keep the muting function enabled is

$$D1 < L \quad \text{. . . . . Formula (1)}$$

L: Length of a workpiece

The maximum distance, d1, required for muting sensors to keep the muting function enabled is

$$V \times T1min < d1 < V \times T1max \quad \text{. . . . . Formula (2)}$$

V: Approach speed of a workpiece

T1min: Muting input time limit value (minimum). 0.03s.

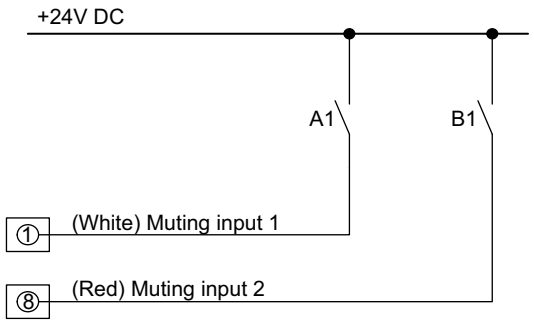
T1max: Muting input time limit value (maximum). 3s.

To enable the muting function, D1 and d1 must satisfy formulas (1) and (2), respectively.

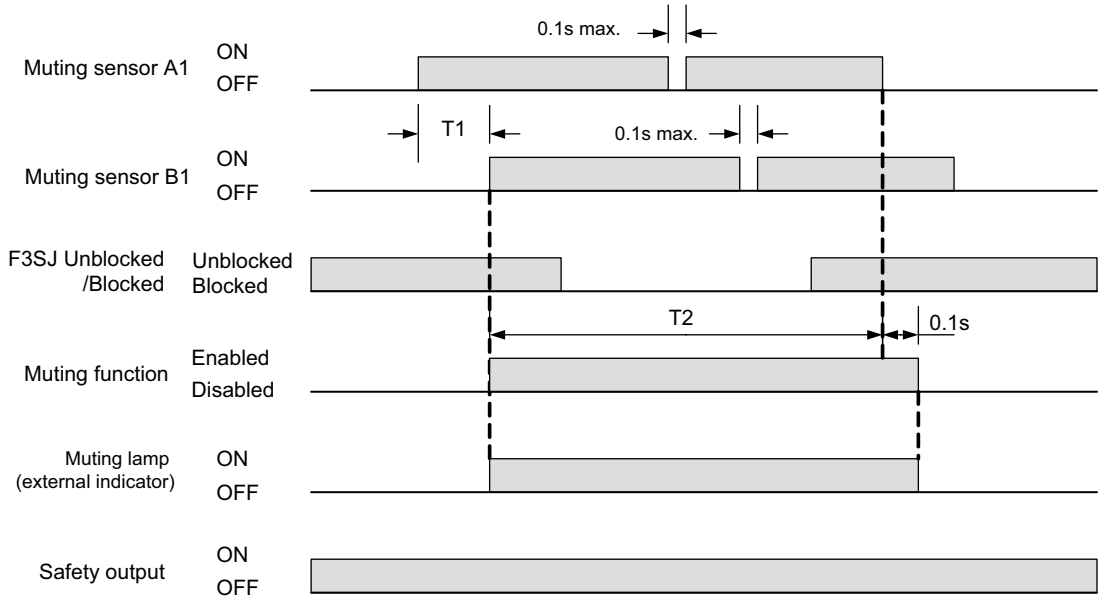
This distance must prevent the muting function from being enabled by a person passing through the muting sensors.

Also, install the F3SJ and muting sensors so that a workpiece passes through all muting sensors before the next workpiece arrives at the muting sensors.

■ Wiring Diagrams



■ Timing chart

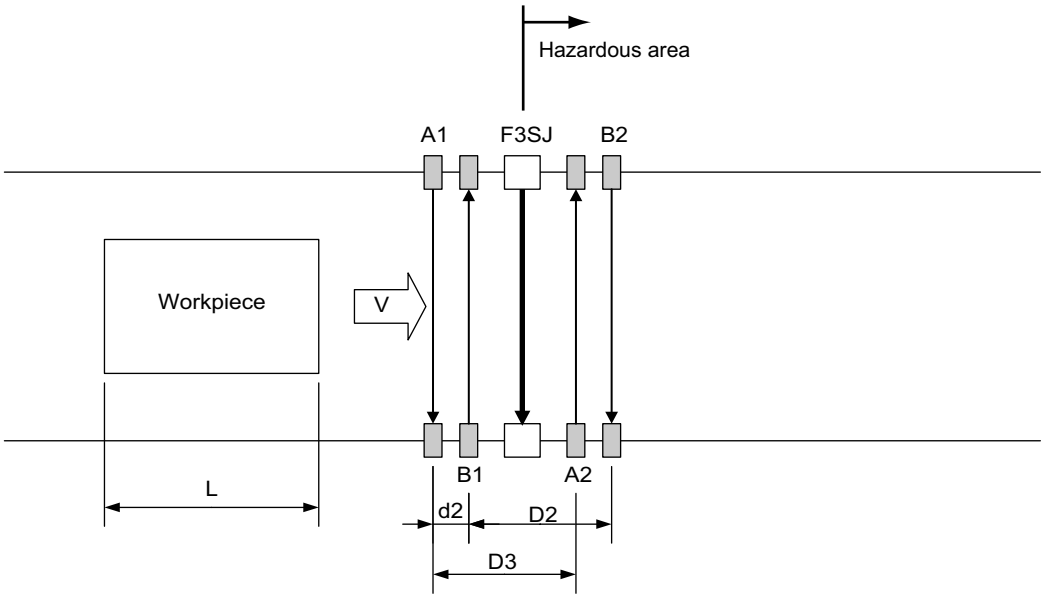


T1: Muting input time limit
T2: Muting time limit

Installation Example of 4 Muting Sensors

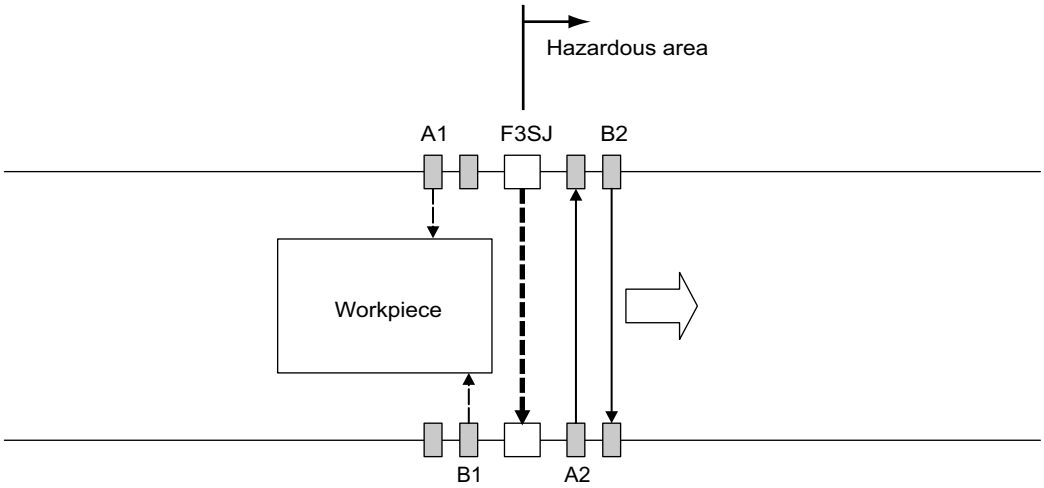
This installation example uses 4 through-beam type photoelectric sensors as muting sensors.
The use of 4 muting sensors is useful when the length of the workpieces (L) is constant or longer.

1. Before a workpiece passes through



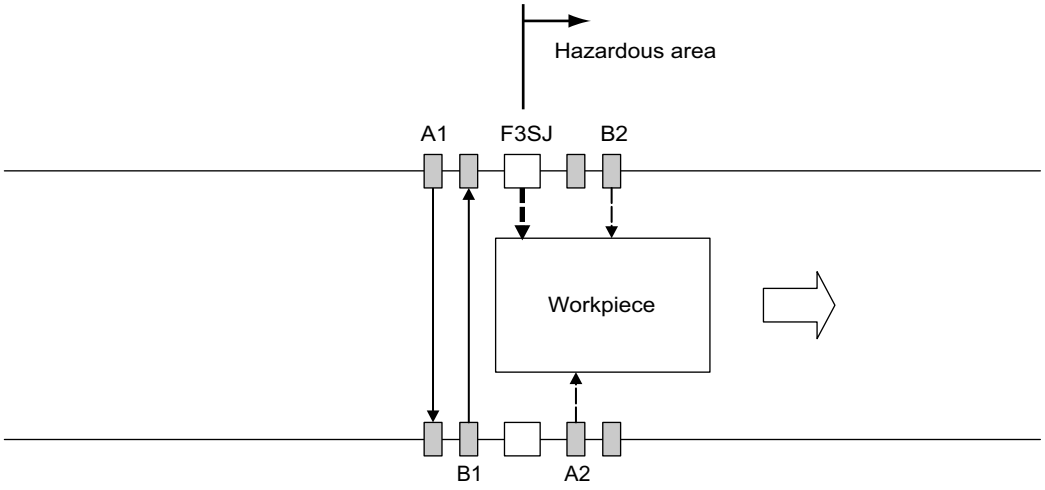
All muting sensors are turned OFF and the safety function of the F3SJ is working.

2. The muting sensors are blocked and the safety function of the F3SJ is disabled



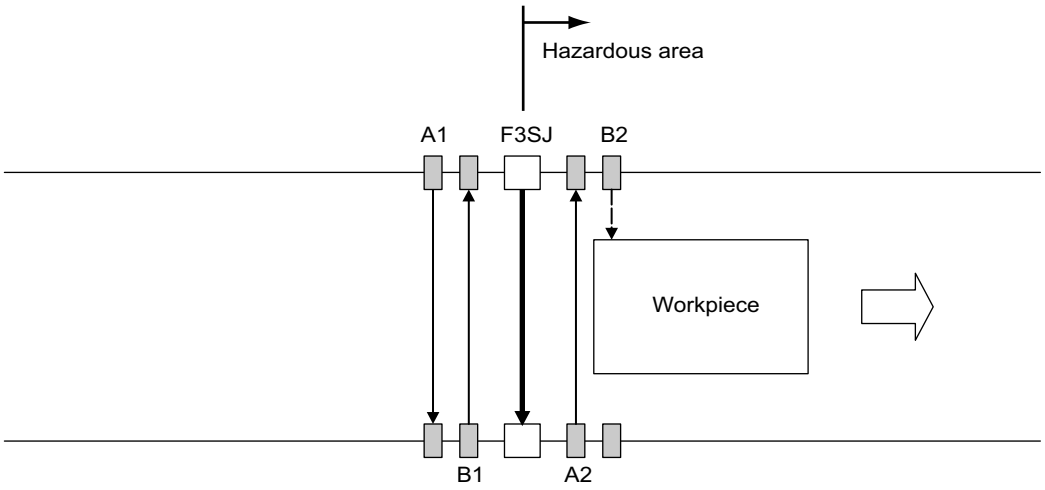
When muting sensors A1 and B1 are turned ON in this order, the muting function is enabled. In this state, the safety function of F3SJ is disabled.

3. The muting sensors are blocked and the safety function of the F3SJ is disabled



Muting sensors A1 and B1 are turned OFF but A2 and B2 are ON, so the muting function is still working. Safety outputs 1 and 2 are turned ON.

4. The muting function is released



Muting sensor A2 is turned OFF and the muting function is released, and the safety function of the F3SJ is working.

■ Installation distance

The minimum distances, D2 and D3, required for the muting sensors to keep the muting function enabled are

D2 < L . . . . . Formula (3)

D3 < L . . . . . Formula (4)

L: Length of a workpiece

The maximum distance, d2, required for muting sensors to keep the muting function enabled is

V x T1min < d2 < V x T1max . . . . . Formula (5)

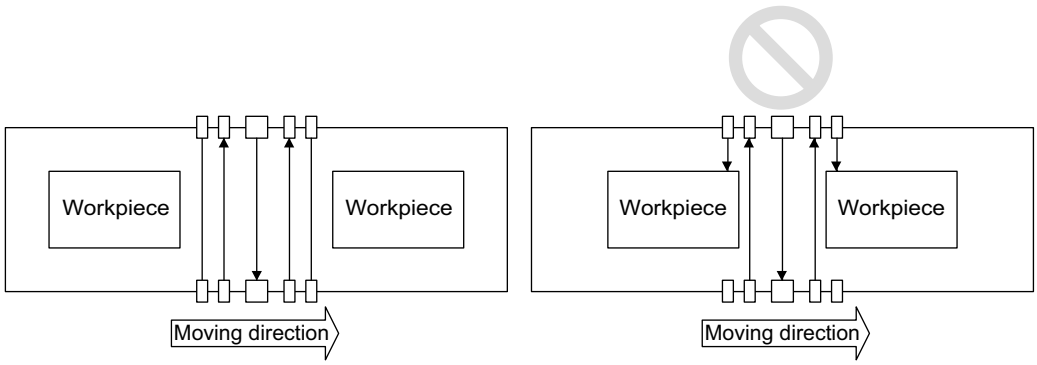
V: Approach speed of a workpiece

T1min: Muting input time limit value (minimum). 0.03s.

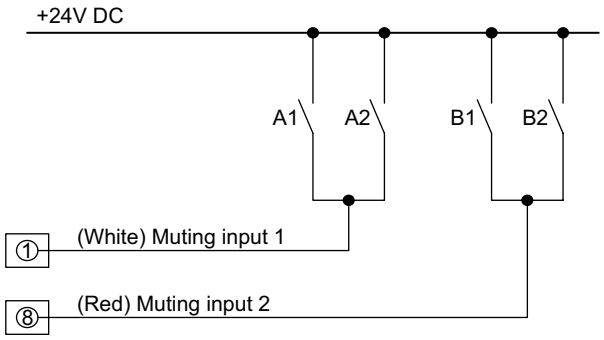
T1max: Muting input time limit value (maximum). 3s.

To enable the muting function, D2, D3, and d2 must satisfy formulas (3), (4), and (5), respectively.

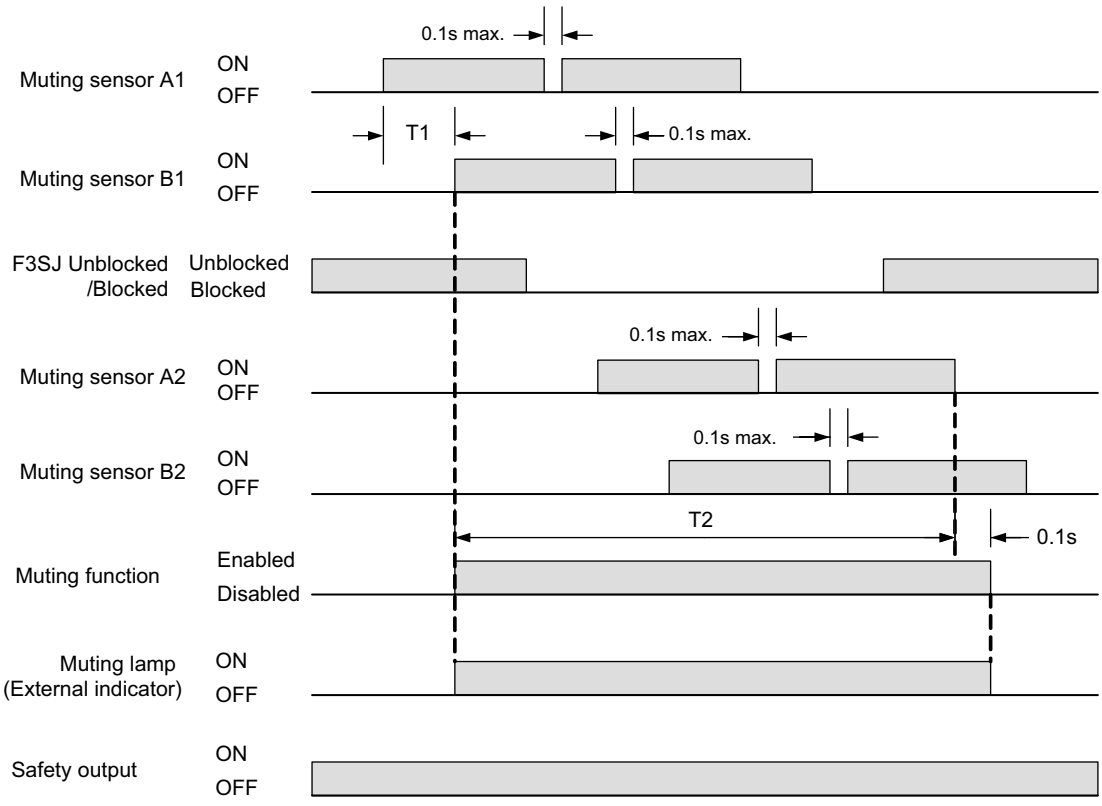
This distance must prevent the muting function from being enabled by a person passing through the muting sensors. Also, install the F3SJ and muting sensors so that a workpiece passes through all muting sensors before the next workpiece arrives at the first muting sensor.



■ Wiring Diagrams



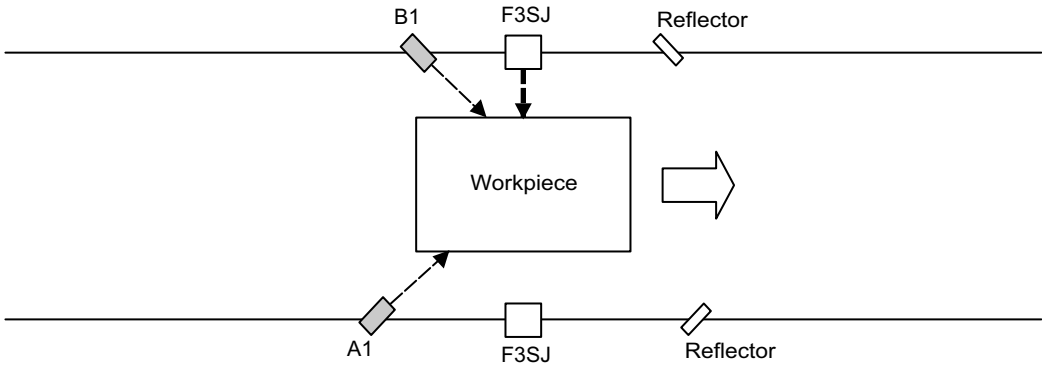
■ Timing chart



T1: Muting input time limit
T2: Muting time limit

Override Function

The override function forcibly turns the safety outputs ON when the muting start condition is not satisfied. If a workpiece stops while passing through the detection zone of 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 zone 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 F3SJ detection zone.



The override function can be enabled for up to 60s.
The muting lamp (external indicator) turns ON while overriding.

⚠ WARNING

The muting and override functions disable the safety functions of the device. You must ensure safety using other method when these functions are operating.

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.

Install the switch that uses hold-to-run device such as a spring-return key switch and is installed in a location that provides a clear view of the entire hazardous area and where it cannot be activated from within the hazardous area. Make sure that nobody is in the hazardous area before activating the override function.

■ Override start conditions

If all of the following conditions are present in the F3SJ, the override function starts.

1. If either muting input 1 or 2 is ON (1 or more muting sensors are turned ON by a workpiece)
2. The F3SJ is blocked and the output is OFF
3. Under the conditions of 1 and 2 shown above, the reset input changes from ON to OFF and the test input changes from OFF to ON at the same time. The changing time of these 2 inputs must be 300ms or less.

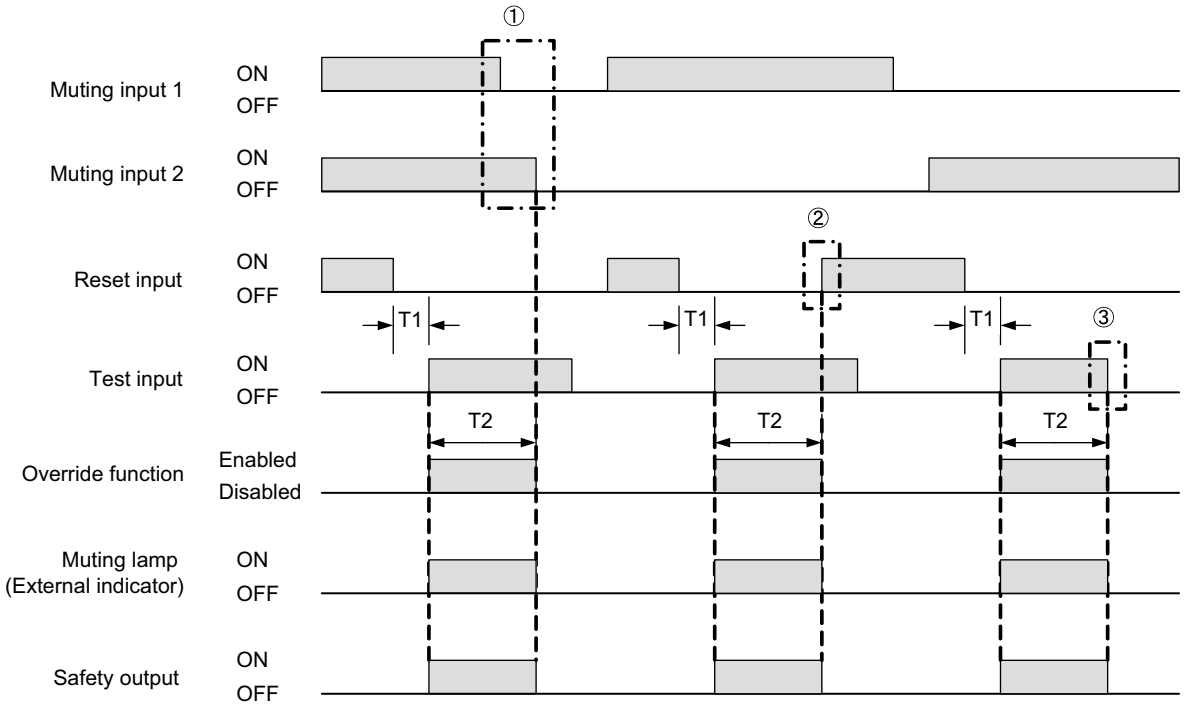
■ Override end conditions

When either of the following conditions is satisfied, the function is released.

- •When 60 seconds has elapsed under the override status
- •All muting sensors are turned OFF
- •When the reset input is turns from OFF to ON and/or the test input turns from ON to OFF

CHECK!

Override state can be released if a sensor transitions to lockout as well.



T1: Muting input time limit (300ms)
T2: Muting time limit

The override function is disabled when T2 exceeds 60 seconds or if a reversal occurs in any of the areas ① to ③ designated by dotted lines.

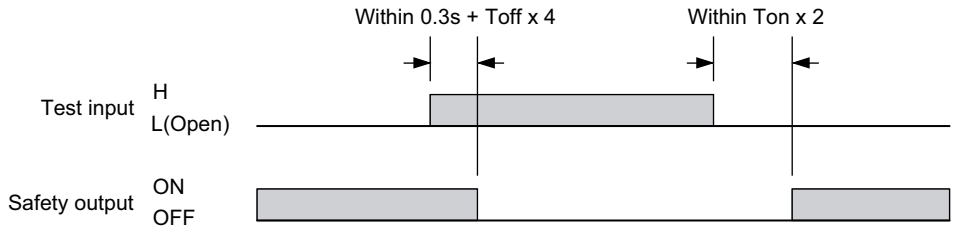
■ F3SJ's indicators

- •Muting input 1 indicator turns ON when an input is applied to muting input 1.
- •Muting input 2 indicator turns ON when an input is applied to muting input 2.
- •The muting error indicator turns ON when a muting error occurs.

External Test Function

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

To stop the emission, apply 9~24V to the emitter's test input line. The voltage must be applied for a period 0.3s plus 4 times of Toff or longer.



Ton: Response time of safety output's OFF to ON, Toff: Response time of safety output's ON to OFF

Response time p.14

■ Operation of the F3SJ's internal indicators when external test function is performed

Test indicator blinks when voltage is applied to the test input.

Self-Test Function

The F3SJ performs the self-test when power is turned ON (within 2 second, or 2.2 seconds in case of series connection) to check for errors. Also, it regularly performs the self-test (within a response time) while operating.

The timing chart is the same as the one for the basic system. For details, see the following the page.

p.27

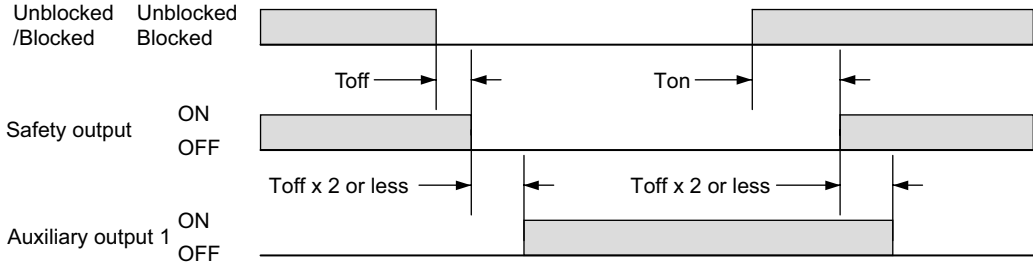
Auxiliary Output (Non-Safety Output)

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

⚠ WARNING

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.

Auxiliary output 1 provides an inverted signal of the safety output.



Ton: Response time of safety output's OFF to ON, Toff: Response time of safety output's ON to OFF

Response time p.14

Resetting Lockout

When the cause of the lockout is removed, the lockout condition can be released by using either of the following methods.

•Cycle the power back ON

•Set the reset input line open or to 0 to 1.5V for 300ms or longer, and then apply 9 to 24V again (except for lockout due to a communication error or a wiring error).

External Device Monitoring Function (EDM)

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

The wiring and timing chart are the same as those for the basic system. For details, see the following page.

p.30

Chapter3 Wiring/Installation

Installation Conditions

Detection Zone and Approach

⚠ 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 areas.
If a person is able to step into the hazardous area 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.

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 a full-rotation clutch. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.

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, IEC61496-1, and other relevant standards and regulations.

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.

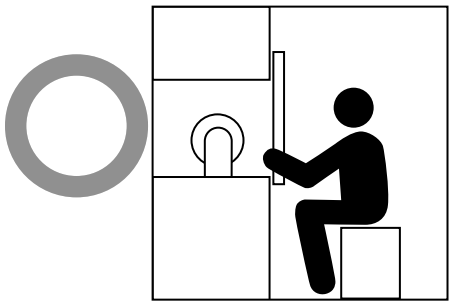
Do not use the F3SJ in environments where flammable or explosive gases are present. Doing so may cause an explosion.

The F3SJ cannot protect a person from an object flying from a hazardous area. Install protective cover(s) or fence(s).

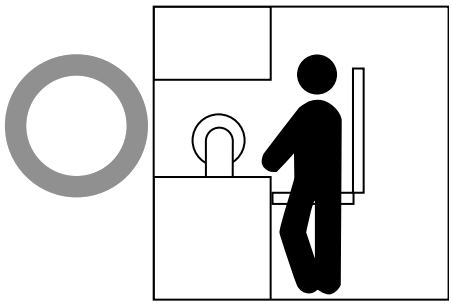
Make sure that the F3SJ is securely mounted and its cables and connectors are properly connected.

Correct installation

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

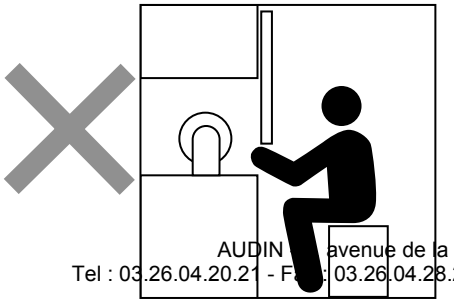


While working, a person is inside the sensor's detection zone.

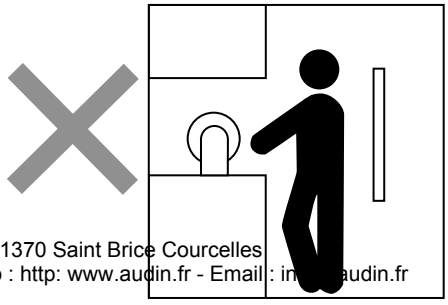


Incorrect installation

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

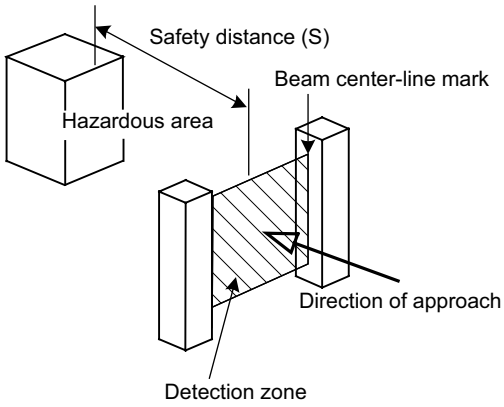


A person is between the sensor's detection zone and the hazardous area of a machine.



Safety Distance

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 the relevant standards.



⚠ WARNING

Make sure to secure the safety distance (S) between the F3SJ and the hazardous part. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.

CHECK!

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 European standard EN999 (reference)

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

S = K x T + C . . . 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 40mm or less

Use K = 2,000mm/s and C = 8 x (d - 14mm) in formula (1) for the calculation.

S = 2,000mm/s x (Tm + Ts) + 8 x (d - 14mm)

- S = Safety distance (mm)
- Tm = Machine's response time (s)
- Ts = Response time of the F3SJ from ON to OFF (s)
- d = Detection capability of the F3SJ (mm)

[Calculation example]

When Tm = 0.05s, Ts = 0.01s, and d = 14mm:

S=2,000mm/s x (0.05s + 0.01s) + 8 x (14mm - 14mm)

= 120mm . . . Formula (2)
If the result < 100mm, use S = 100mm.
If the result exceeds 500mm, use the following expression where K = 1,600mm/s.
S=1,600mm/s x (Tm + Ts) + 8 x (d - 14mm) . . . Formula (3)

If the result of this formula (3) < 500mm, use S = 500mm.

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

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

S = K x (Ts + Tc + Tr + Tbm) + Dpf

- S: Safety distance
- K: Approach speed to the detection zone (the value recommended by OSHA standard is 1,600mm/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.

- Ts = Machine's stopping time (s)
- Tr = Response time of the F3SJ from ON to OFF (s)
- Tc = Machine control circuit's maximum response time required to activate its brake (s)
- Tbm = Additional time (s)

If a machine has a brake monitor, "Tbm= Brake monitor setting time - (Ts + Tc)". If it has no brake monitor, we recommend using 20% or more of (Ts + Tc) as additional time.

- Dpf = Additional distance

According to ANSI's formula, Dpf is calculated as shown below:
Dpf = 3.4 x (d - 7.0): Where d is the detection capability of the F3SJ (unit: mm)

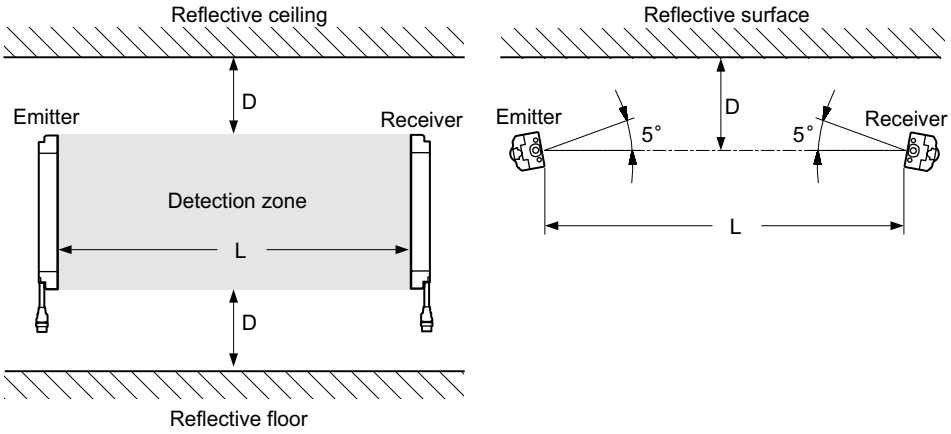
[Calculation example]
When K = 1,600mm/s, Ts + Tc = 0.06s, brake monitor setting time = 0.1s,
Tr = 0.01s, and d = 14mm:
Tbm = 0.1 - 0.06 = 0.04s
Dpf = 3.4 x (14 - 7.0) = 23.8mm
S = 1,600 x (0.06 + 0.01 + 0.04) + 23.8 = 199.8mm

Distance from Reflective Surfaces

⚠ WARNING

Install the sensor system so that it is not affected by reflective surfaces. 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 an emitter and a receiver (operating range L)	Allowable installation distance D
For 0.2 to 3m	0.13m
For 3m or more	L/2 x tan5 ° = L x 0.044 (m)

Mutual Interference Prevention

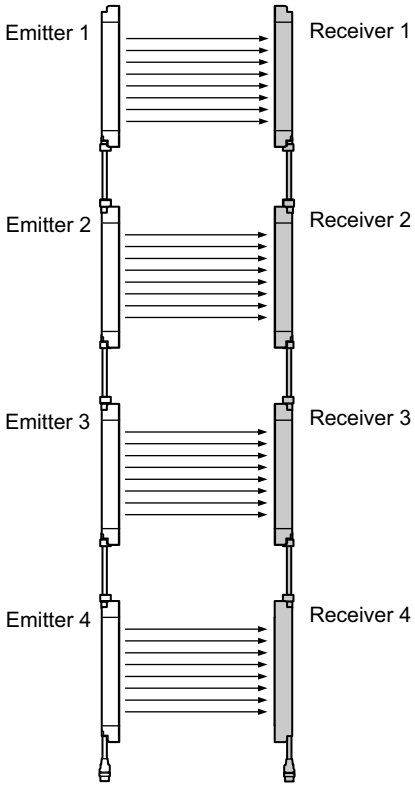
⚠ WARNING

Do not use the sensor system with mirrors in a retro-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.

■ Series connection

Series connection can prevent mutual interference when multiple sensors are used. Up to 4 sets, 400 beams, can be connected. The emission of series-connected F3SJ is time-divided, so mutual interference does not occur and safety is ensured.

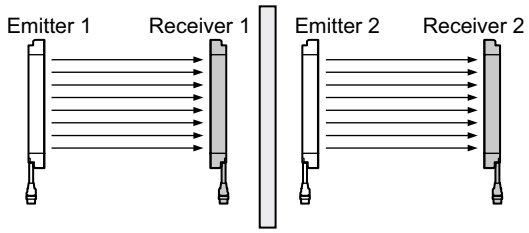


How to perform series connection p.55

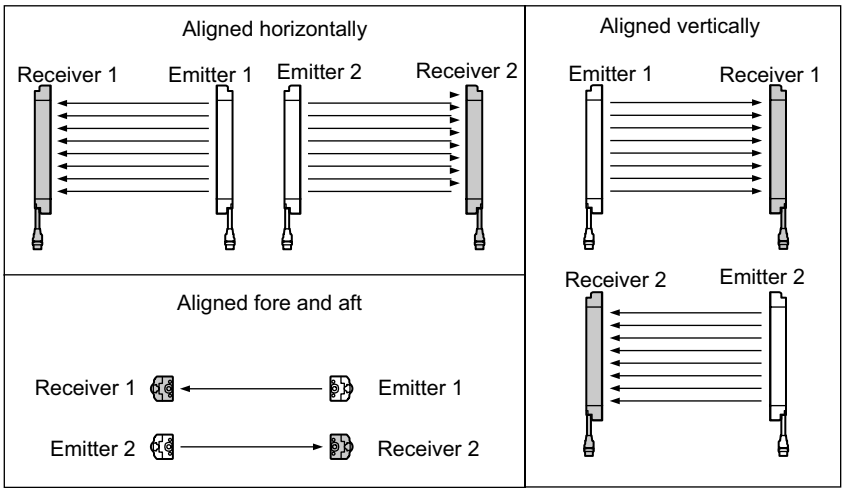
■ No connection

Mutual interference is prevented in up to 3 sets, using interference light avoidance algorithm. If 4 or more sets of F3SJ are installed and are not connected to each other, arrange them so that mutual interference does not occur. If 2 sets are installed near each other, reflection from the surface of the F3SJ may cause mutual interference. When mutual interference occurs, the F3SJ-A enters lockout. Combining countermeasures 1 to 3 shown below is effective.

1. Install a physical barrier between 2 sets

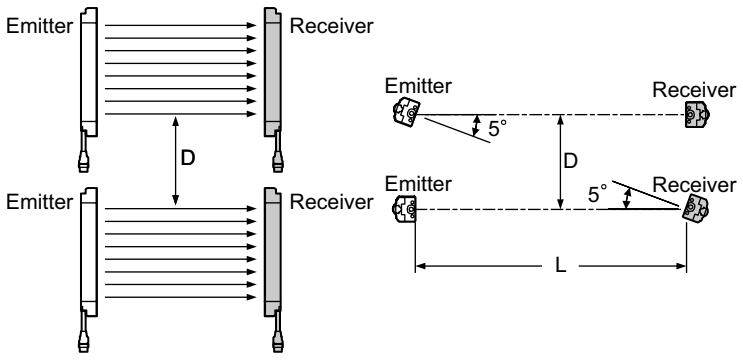


2. Alternate the direction of emission between 2 sets (alternation)



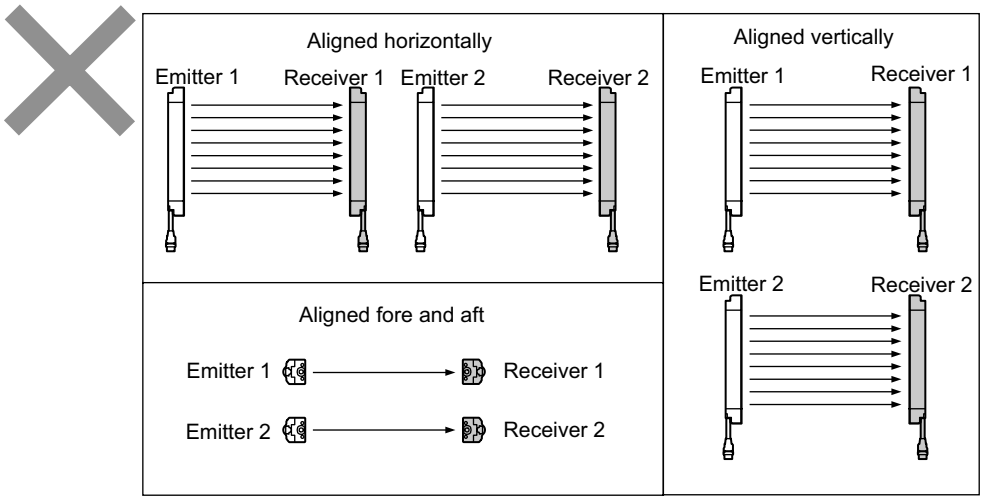
If 2 sets are installed near each other, reflection from the surfaces may cause mutual interference.

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 3m	0.26m
For 3m or more	L x tan5 ° = L x 0.088 (m)

When using 4 or more sets that are not series-connected, the installations shown below may cause mutual interference. When mutual interference occurs, the F3SJ enters lockout.



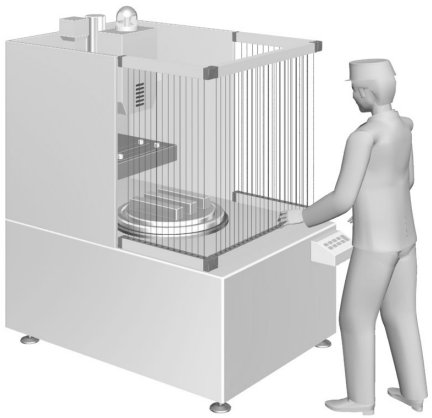
Series Connection

From 2 to 4 sets of F3SJ can be series-connected. Series connection allows them to be used as a a safety light curtain, requiring only 1 set to be wired to a controller and preventing mutual interference.

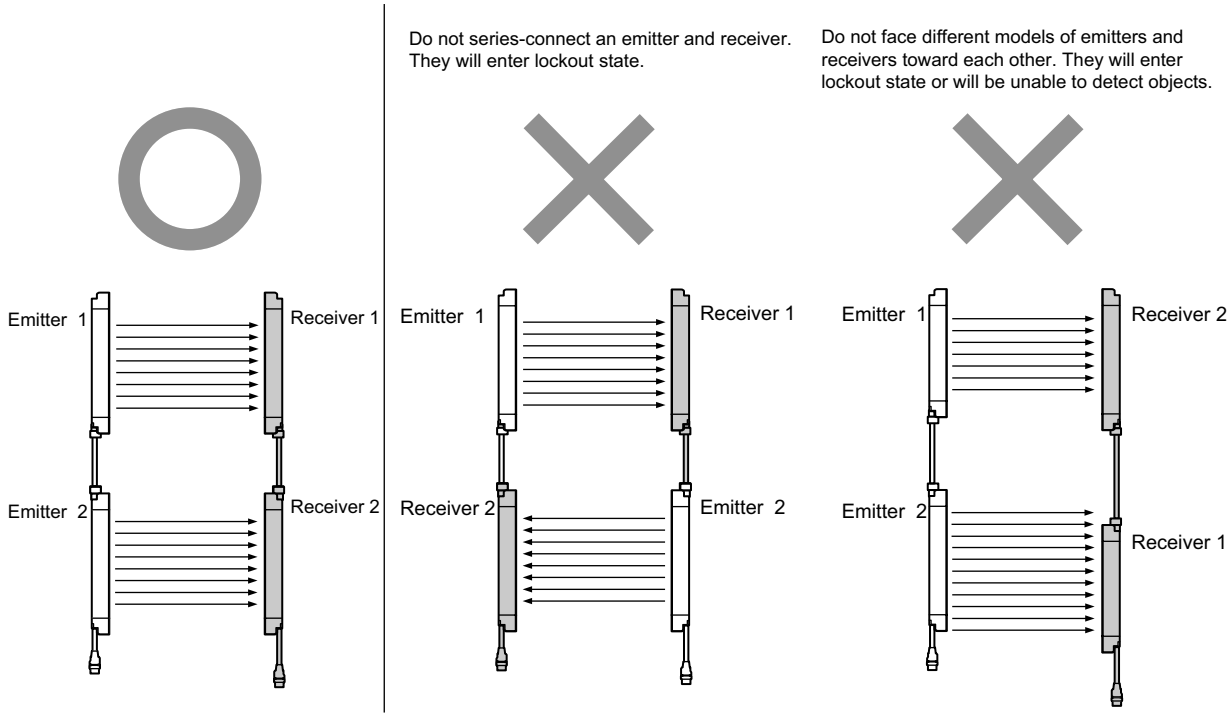
If any 1 set of series-connected F3SJ is blocked, both of the safety outputs turn OFF. The indication LED for each F3SJ turns ON separately.

- Number of connections: Up to 4 sets
- Total number of beams: Up to 400 beams
- Connection cable length between 2 F3SJ in series connection: 15m max.

Ex.: Configuring an L- or U-shaped detection zone



Connect an emitter to another emitter, and a receiver to another receiver, as shown below.



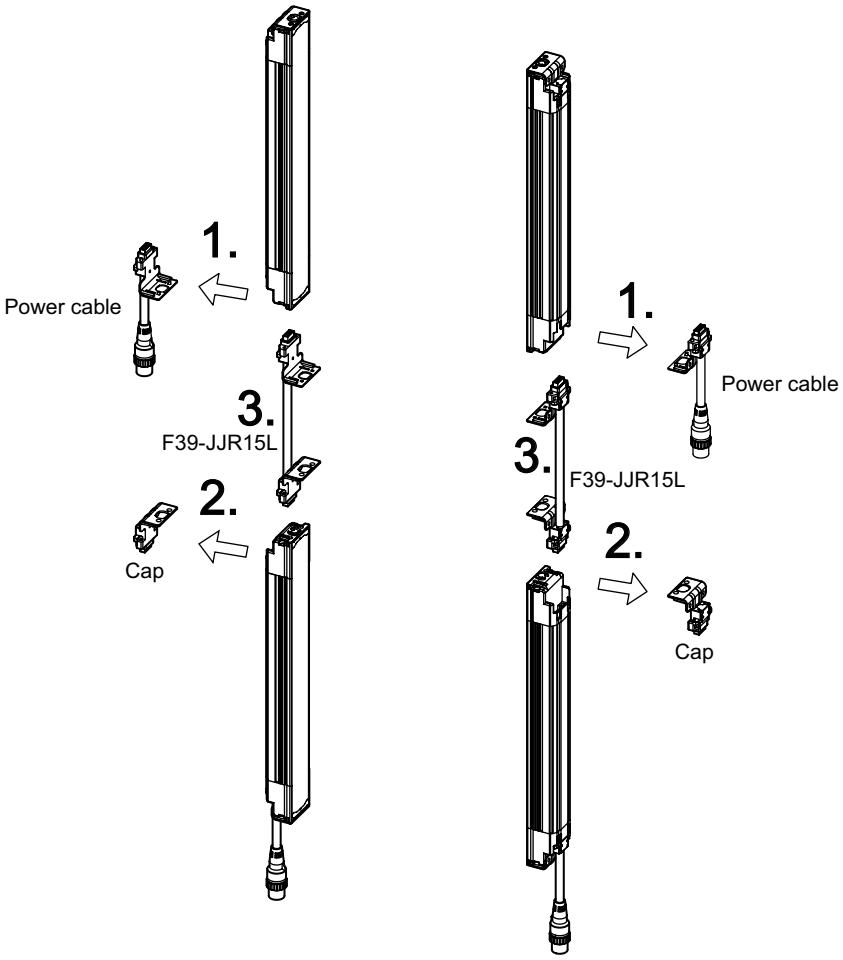
CHECK!

If caps and series connection cables are not connected properly, the F3SJ enters lockout (when power is turned ON).

Connection Procedure

■ When using the F39-JJR15L series connection cable for close contact (sold separately)

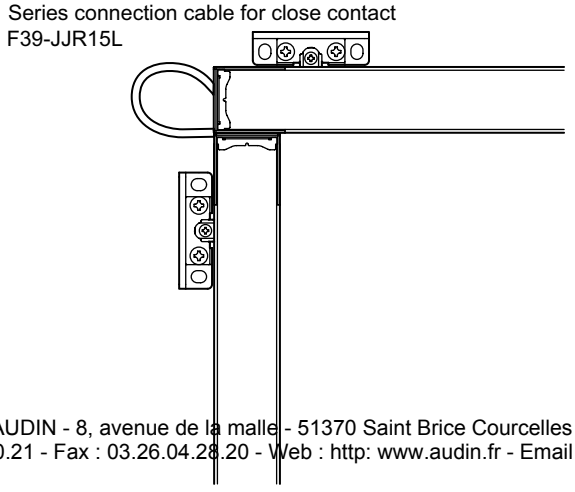
1. Remove the connection cable of the F3SJ. (driver comes with F39-JJR15L)
2. Remove the cap from the other F3SJ.
3. Use the F39-JJR15L series connection cable for close contact to connect them.



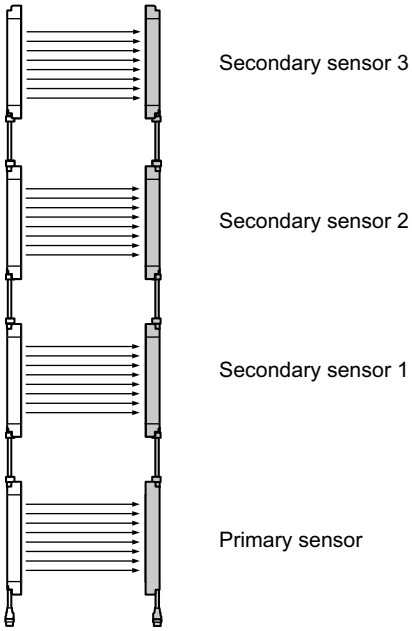
CHECK!

Use the F39-JJR15L series connection cable for close contact when the connection distances between F3SJ are short for a L-shaped configuration, and use the F39-JJR3W (and F39-JC□B) series connection cable for extension when the connection distances are long.

Ex.: L-shaped configuration



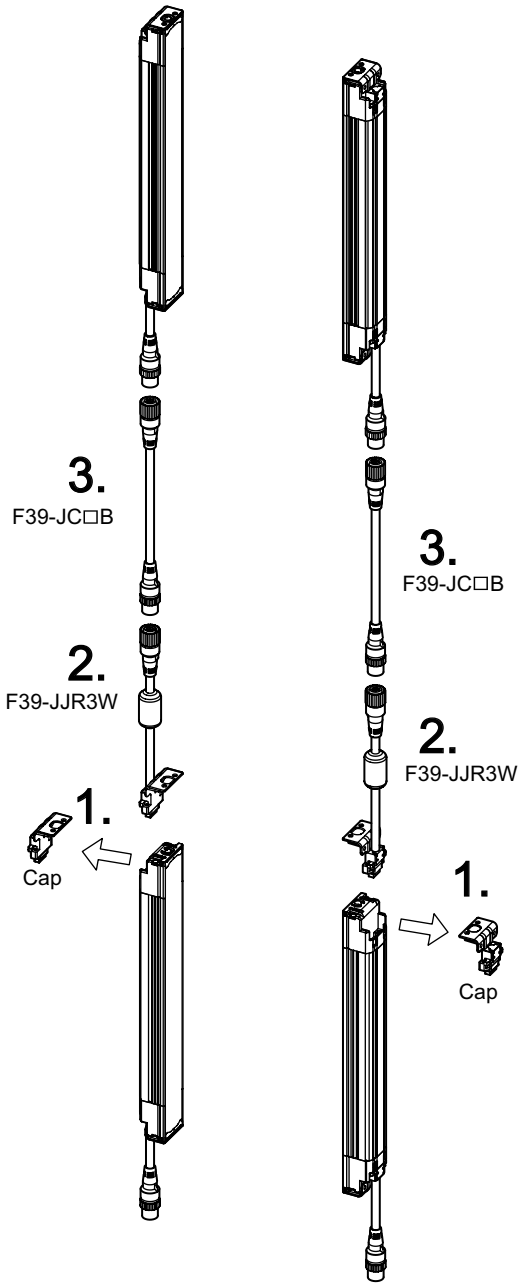
The terms used in this document to describe each F3SJ in a series connection are shown below.



CHECK! When attaching a cable or cap, tightly fasten the screws (M2, in 4 places, recommended torque: 0.15N·m). Failure to do so may cause the cable/cap to come loose, leading to deterioration of the protective functions.

■ When using the F39-JJR3W series connection cable for extension (sold separately)

1. Remove the caps from the primary sensor. (driver comes with key cap for muting)
2. Use the F39-JJR3W series connection cable for extension to connect them.
3. When changing the connection distance between the F3SJ, connect a F39-JC□B Cable with connectors on both ends (sold separately).



CHECK!

When attaching a cable or a cap, tightly fasten the screws (M2, in 4 places, recommended torque: 0.15N·m). Failure to do so may cause the cable/cap to come loose, leading to deterioration of the protective functions.

Attaching External Indicators

An external indicator can be connected and turned ON based on the operation of the F3SJ. Indicators can be attached to emitters and/or receivers.

Example:

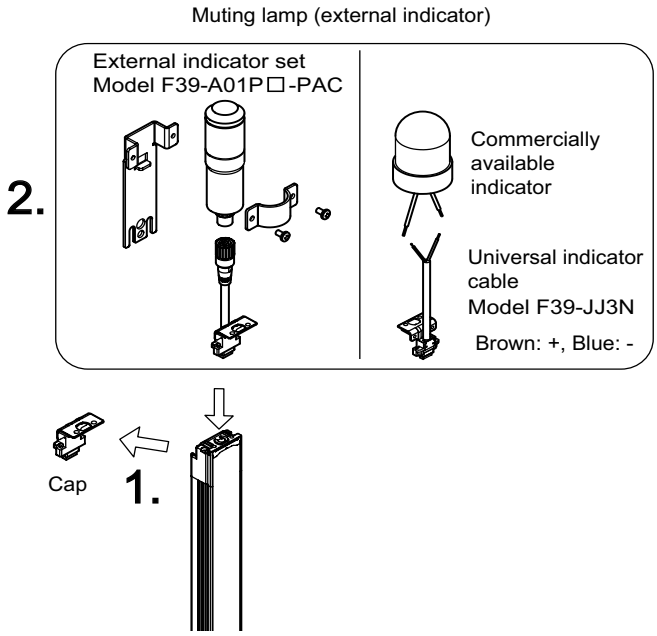
- Indicate that the F3SJ is in lockout
- Indicate that a machine is stopped (safety output is OFF)
- Indicate that the F3SJ is in muting or override

⚠ WARNING

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.

Connection Procedure

1. Remove the cap from the side (emitter or receiver) to which you want to attach the external indicator. (driver comes with F39-A01P□-PAC, F39-JJ3N)
2. Attach the external indicator.



Recommended items

Name	Model name	Description
External indicator set	F39-A01P□-PAC	A set consisting of an LED indicator, connection cable, and mounting brackets. The LED indicator is available in red or green.
Universal indicator cable	F39-JJ3N	Available external indicators - Incandescent lamp: 24VDC, 3 to 7W - LED lamp: Load current 300mA max.

CHECK!

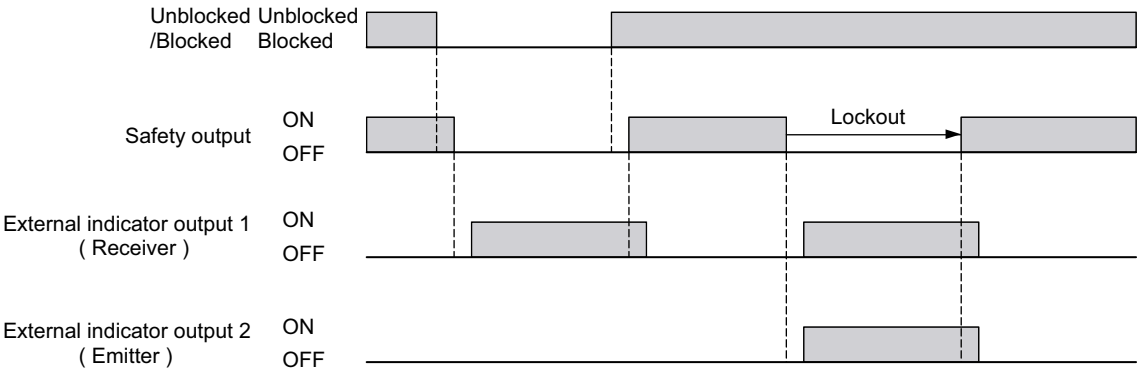
When attaching a cable or cap, tightly fasten the screws (M2, in 4 places, recommended torque: 0.15N·m). Failure to do so may cause the cable/cap to come loose, leading to deterioration of the protective functions.

Output Operation

The external indicator output 1 (on the receiver side) is configured as "safety output reverse output (ON when blocked)", while the external indicator output 2 (on the emitter side) is configured as "lockout output (ON during lockout)".

When the muting function is used, both the emitter and receiver are configured as muting/override output (ON during muting and during override).

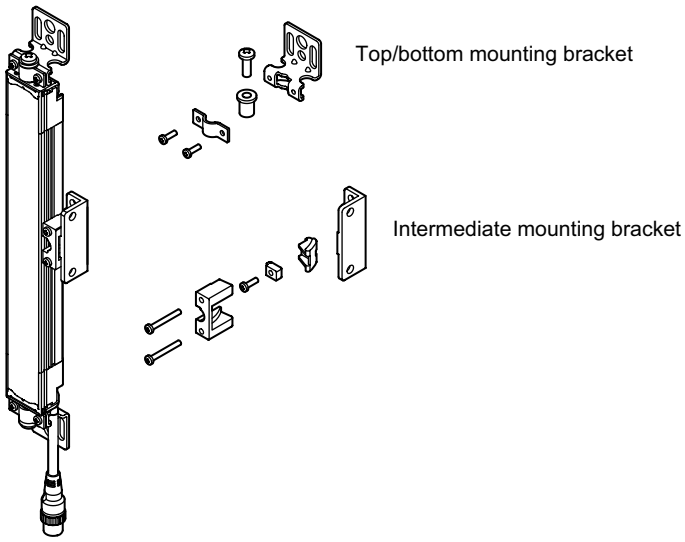
Timing chart of basic system

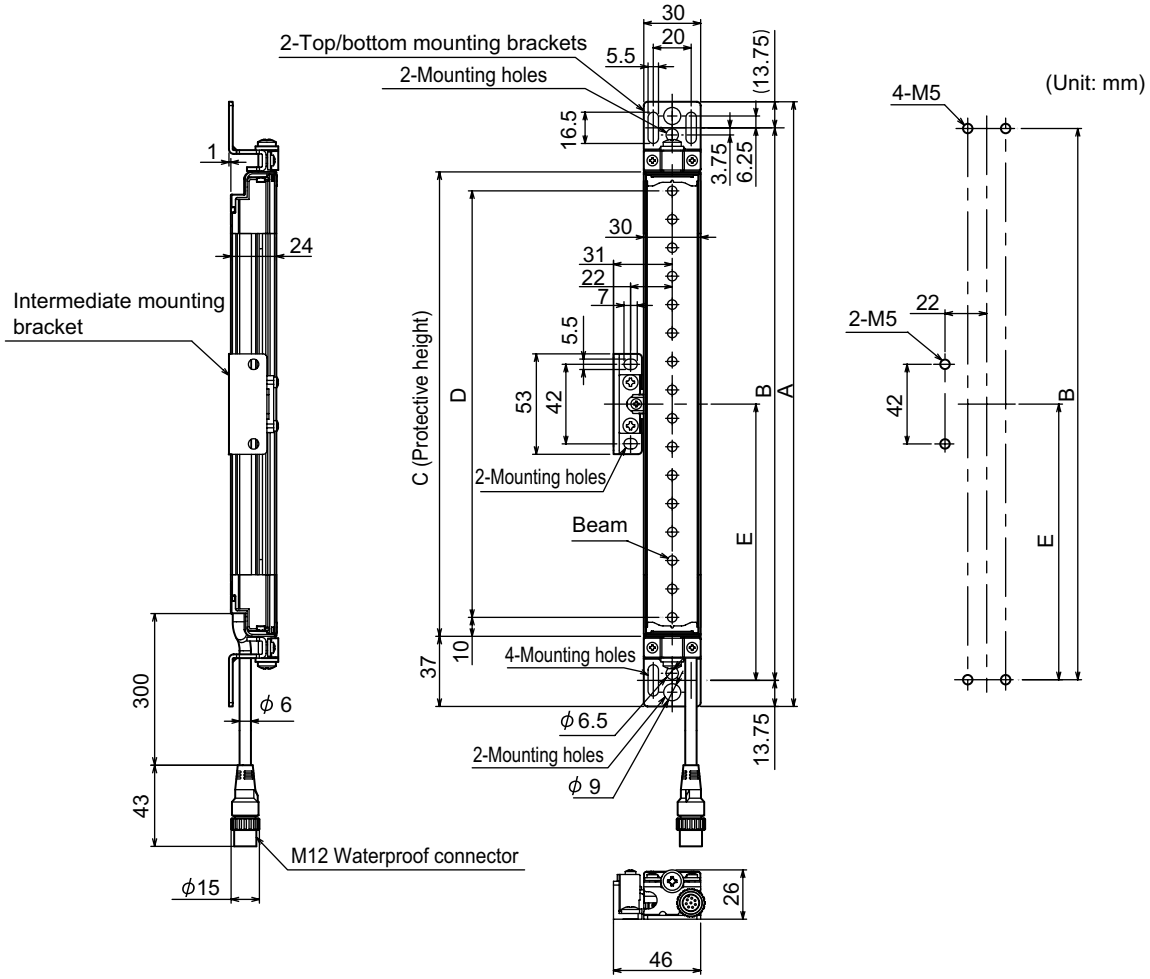


Dimensions

When Using Standard Mounting Brackets

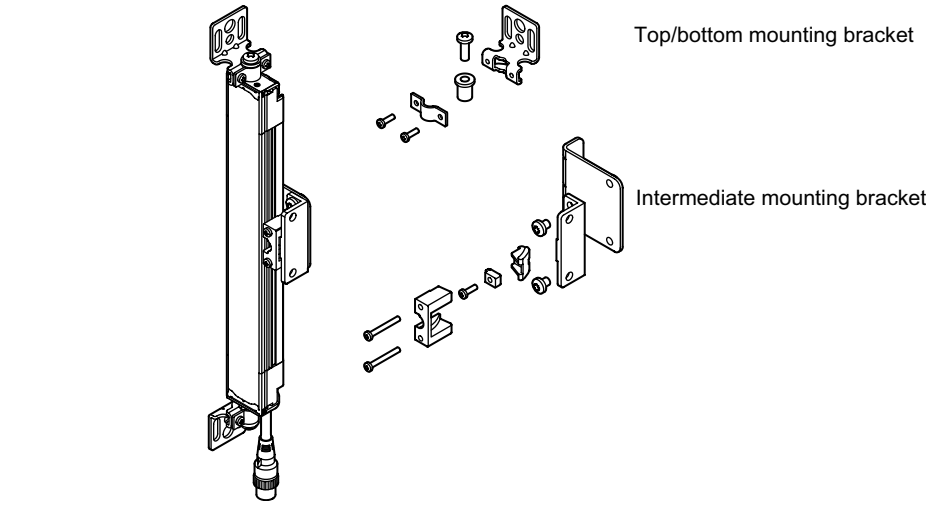
■ Backside mounting

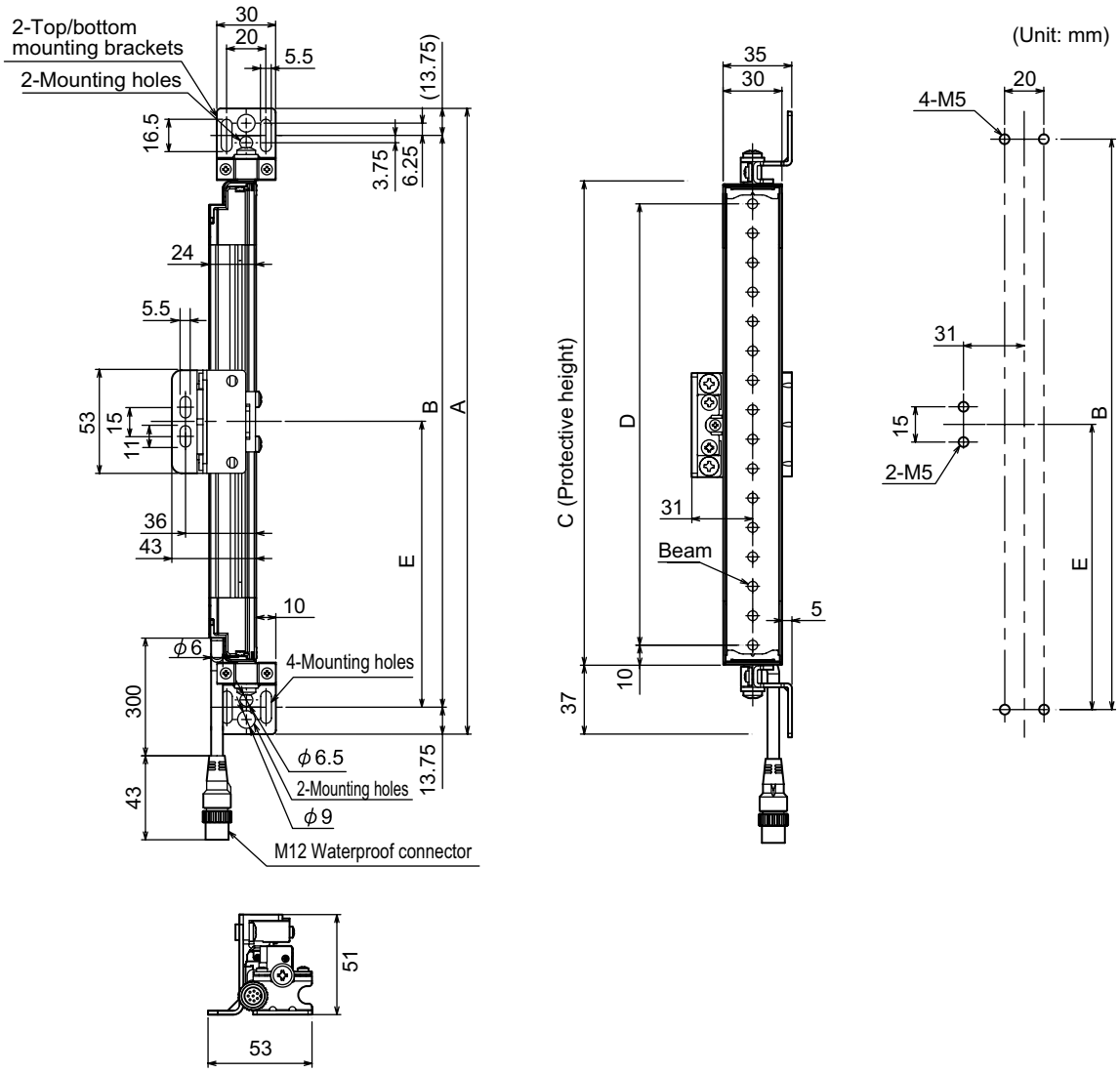




Bracket mounting procedure (Mounting) p.75

■ Side mounting





Bracket mounting procedure (Mounting) p.75

Dimensions A to E

A	C + 74
B	C + 46.5
C	4-digit number of the model name (protective height)
D	C - 20
E	Depends on the protective height. See the table below.

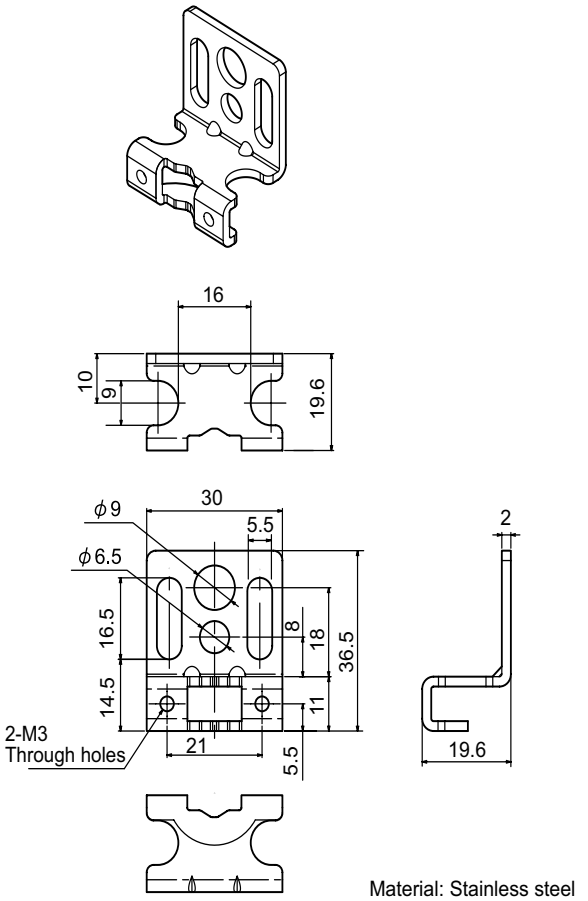
Dimension E

Protective height	Number of intermediate mounting brackets	E*1
0245 to 0596	0	-
0605 to 1130	1	B/2
1136 to 1658	2	B/3
1667 to 2180	3	B/4
2195 to 2495	4	B/5

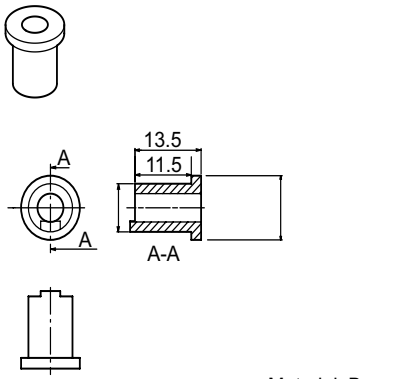
*1. Use E = 530 or less when none of the E values shown above are used.

■ Dimensions of standard brackets (top/bottom mounting brackets)

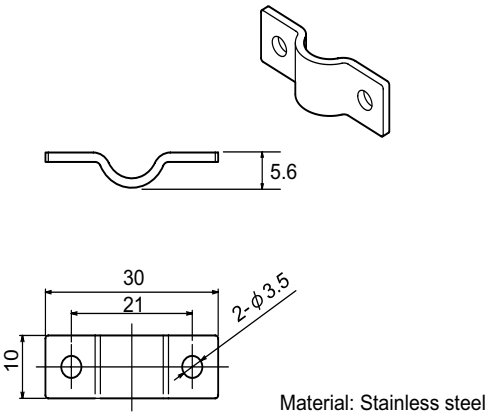
(Unit: mm)



Material: Stainless steel



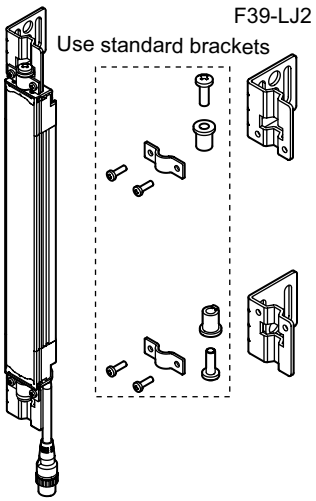
Material: Brass

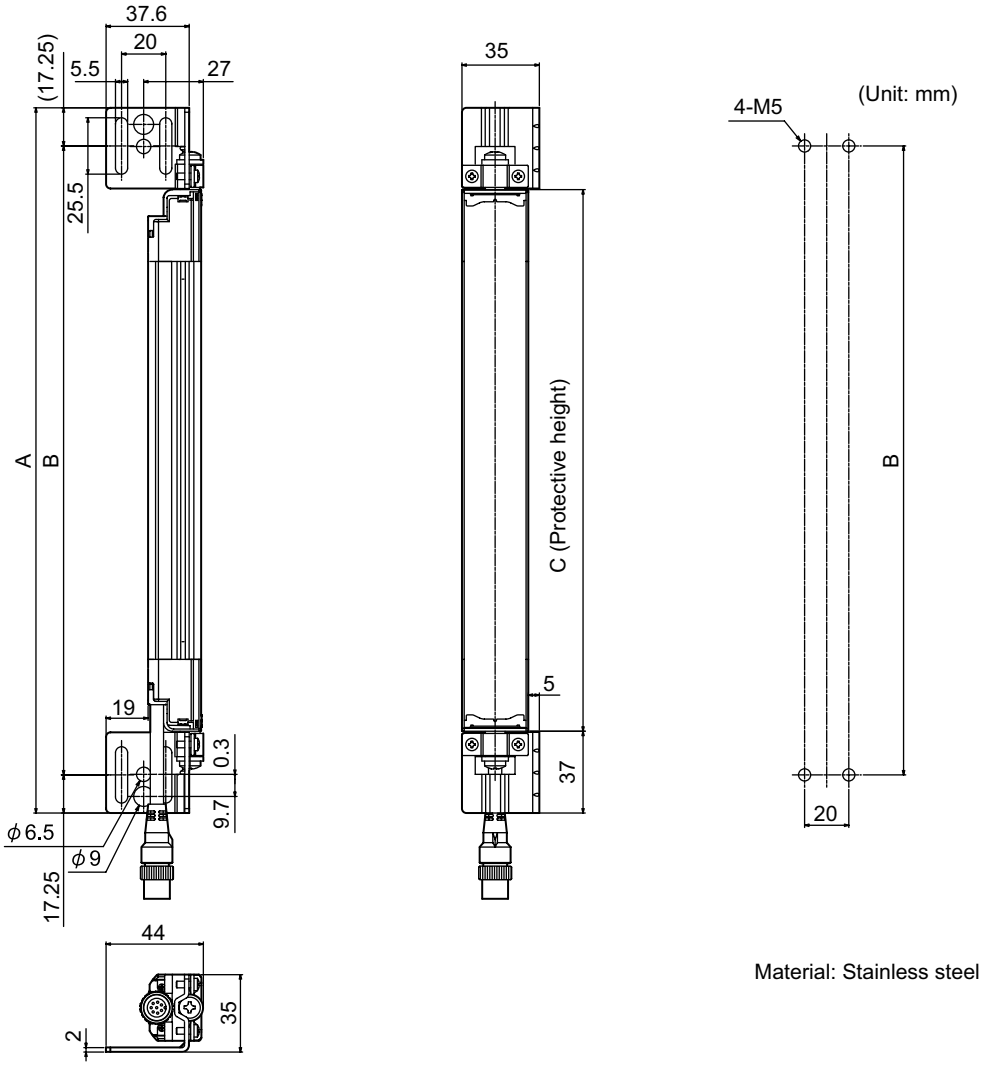


Material: Stainless steel

When Using Optional Mounting Brackets

■ F39-LJ2 side-mounting optional bracket





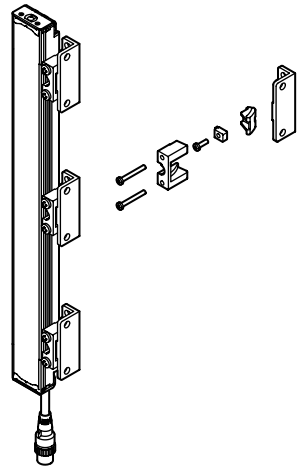
Material: Stainless steel

Dimensions A to C

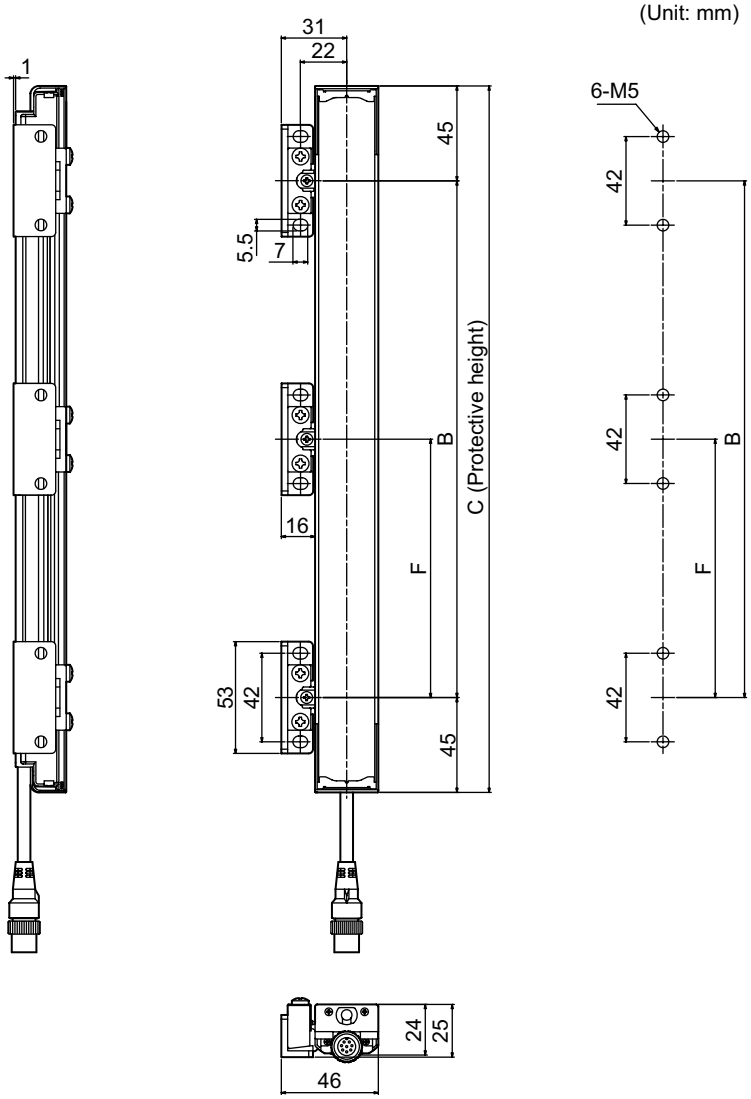
A	C + 74
B	C + 39.5
C	4-digit number of the model name (protective height)

■ F39-LJ3 free-location mounting bracket

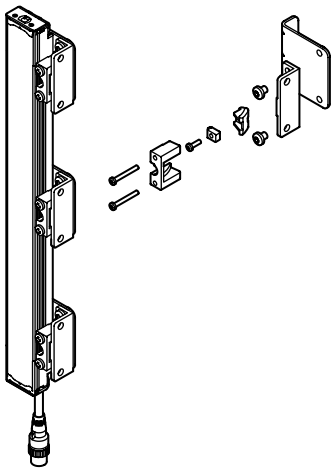
Backside mounting



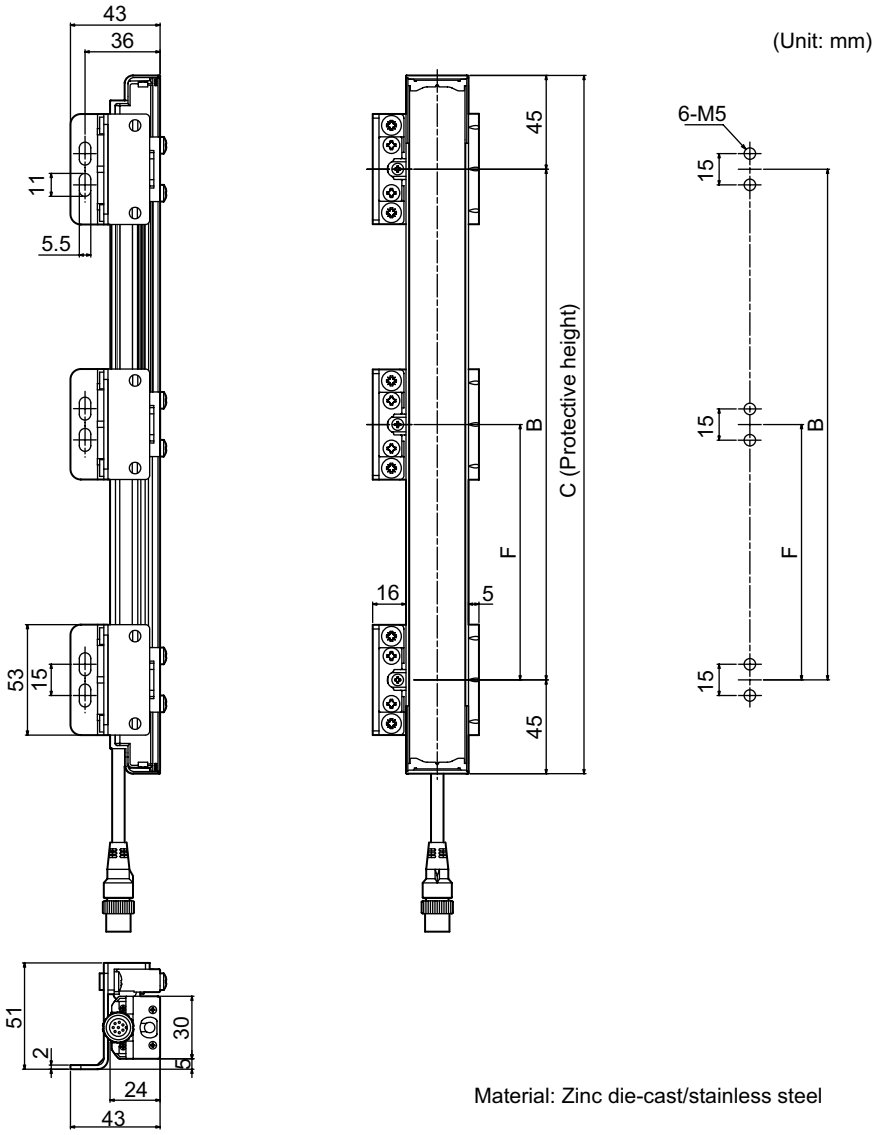
(Unit: mm)



Backside mounting



(Unit: mm)



Material: Zinc die-cast/stainless steel

Dimensions B, C, and F

B	C - 90
C	4-digit number of the model name (protective height)
F	Depends on the protective height. See the table below.

Dimension F

Protective height	Number of intermediate mounting brackets	F*1
245 to 440	2	-
443 to 785	3	B/2
794 to 1136	4	B/3
1145 to 1490	5	B/4
1495 to 1838	6	B/5
1845 to 2180	7	B/6
2195 to 2495	8	B/7

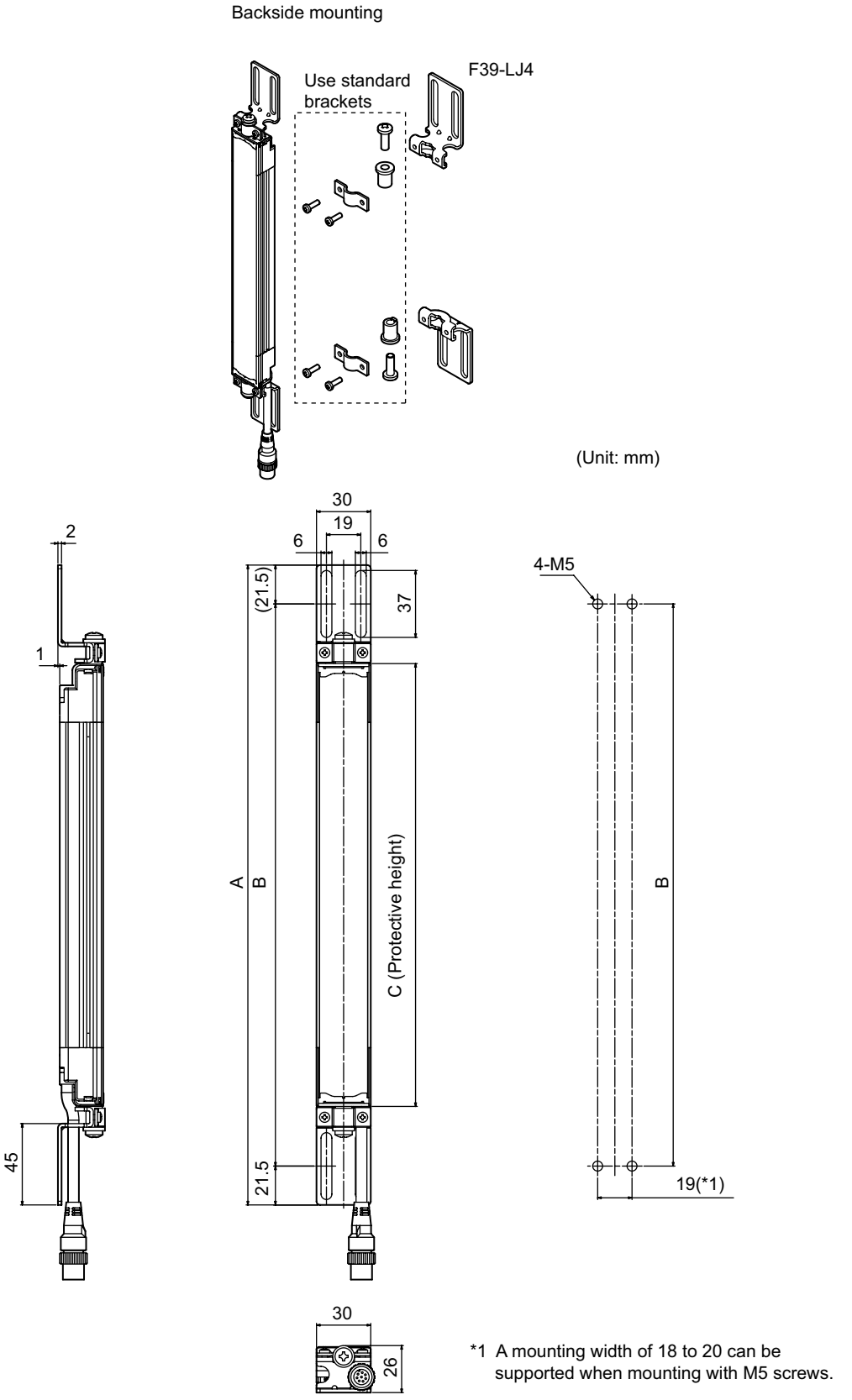
*1. Use F = 350 or less when none of the F values shown above are used.

When only F39-LJ3 free-location mounting brackets are used without standard brackets, allow a space of at least 350mm between the brackets. The number of brackets required varies according to the protective height. For details about the number of required brackets, refer to the table below.
The intermediate mounting brackets shipped with the product are the same as the F39-LJ3 free-location mounting brackets. Purchase brackets as necessary if there are fewer intermediate mounting brackets than required. When intermediate mounting brackets are included, they can be used as free-location mounting brackets.

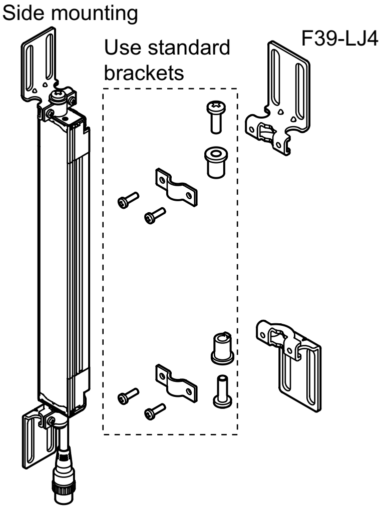
Required number of F39-LJ3 free-location mounting brackets (2 pieces are included with F39-LJ3) for 1 F3SJ set (emitter/receiver)

Protective height	Number of free-location mounting brackets included as intermediate mounting brackets	Number of free-location mounting brackets required for mounting F3SJ	Number of additional free-location mounting brackets that need to be purchased
245 to 440	0	4	2 sets
443 to 596	0	6	3 sets
605 to 785	2	6	2 sets
794 to 1130	2	8	3 sets
1136	4	8	2 sets
1145 to 1490	4	10	3 sets
1495 to 1658	4	12	4 sets
1667 to 1838	6	12	3 sets
1845 to 2180	6	14	4 sets
2195 to 2495	8	16	4 sets

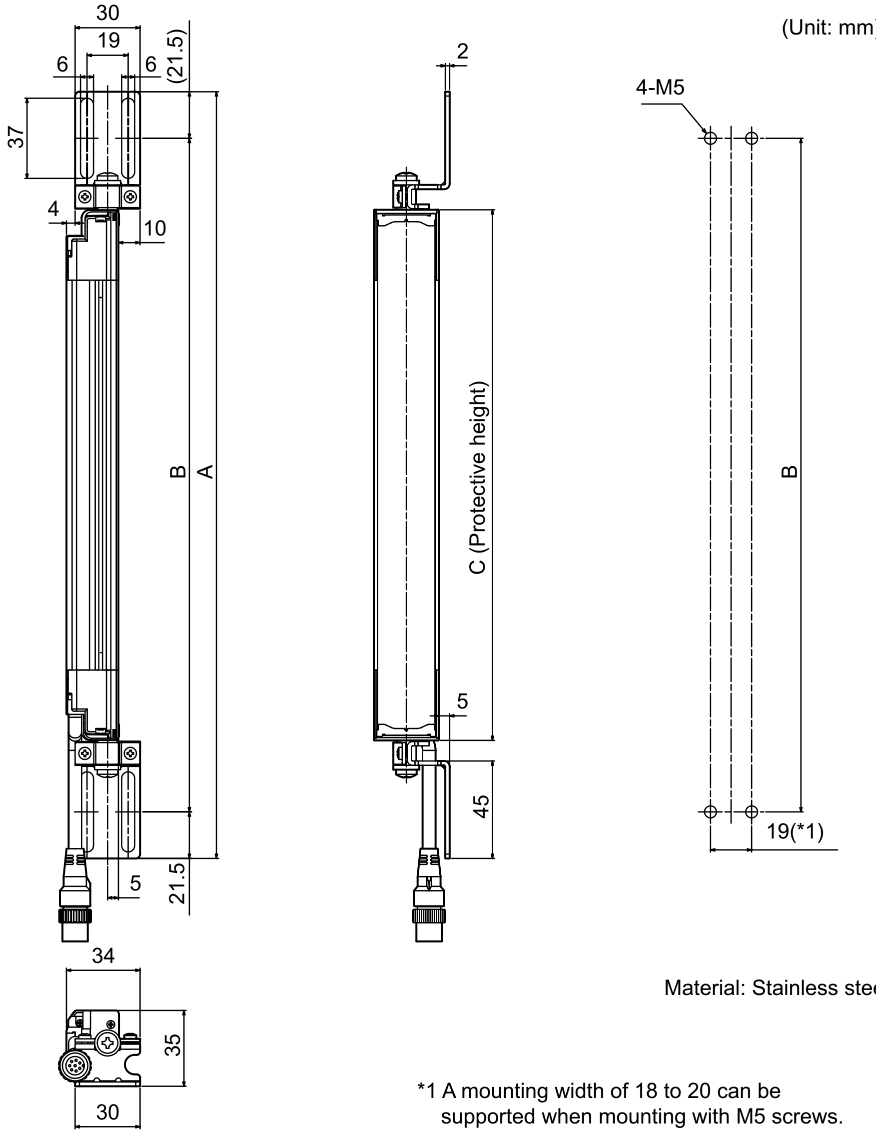
■ F39-LJ4 top/bottom mounting bracket B



*1 A mounting width of 18 to 20 can be supported when mounting with M5 screws.



(Unit: mm)



Material: Stainless steel

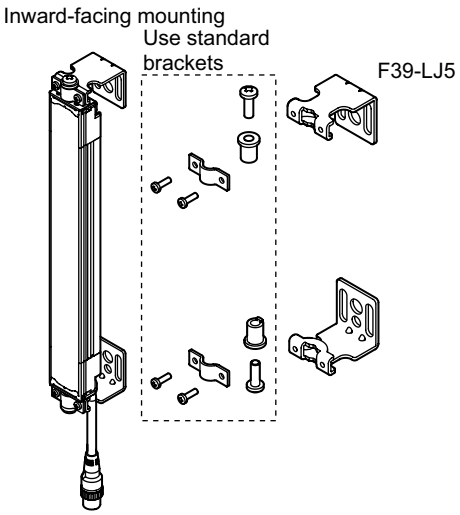
*1 A mounting width of 18 to 20 can be supported when mounting with M5 screws.

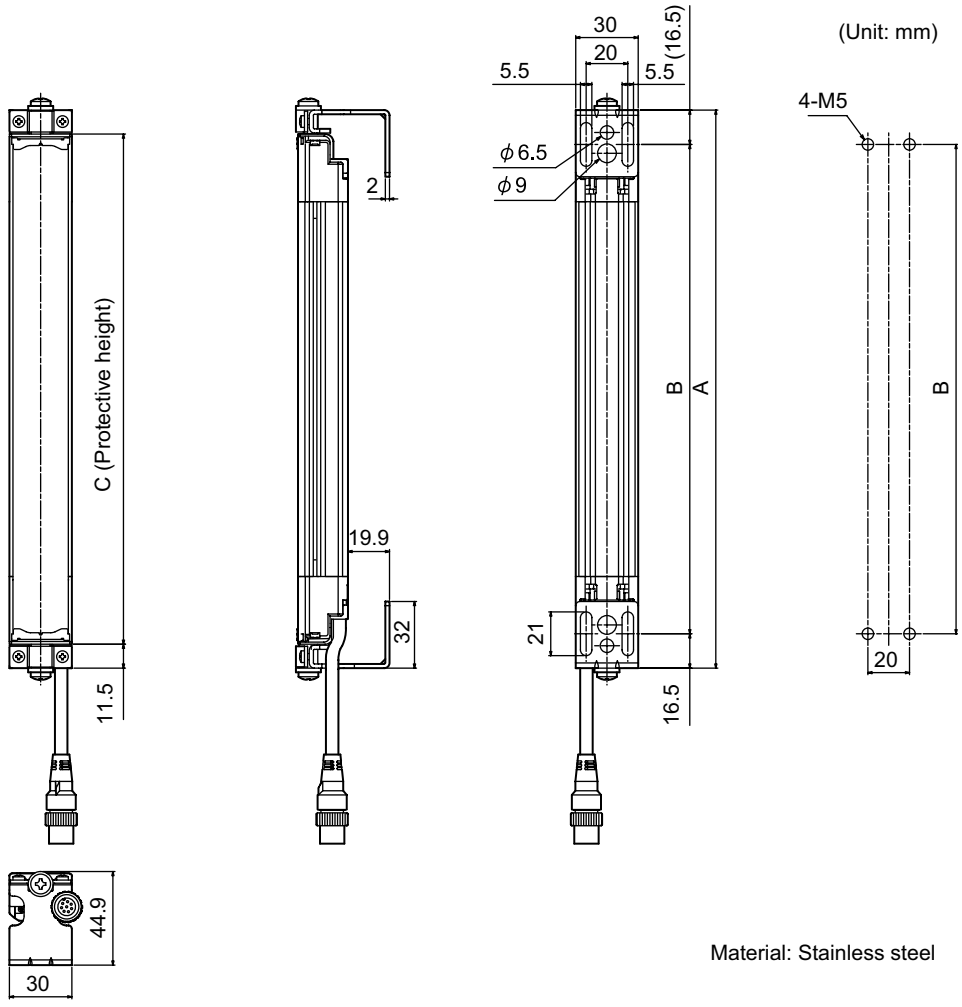
Dimensions A to C

A	C + 109
B	C + 66
C	4-digit number of the model name (protective height)

■ F39-LJ5 replacement bracket for F3SN

Use these replacement brackets for an F3SN with a small protective height.
(These brackets are designed for use with the F3SN's mounting holes.)

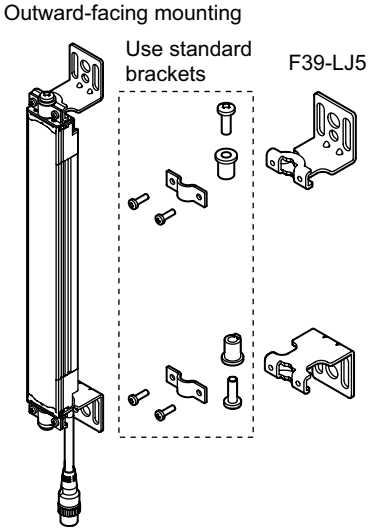


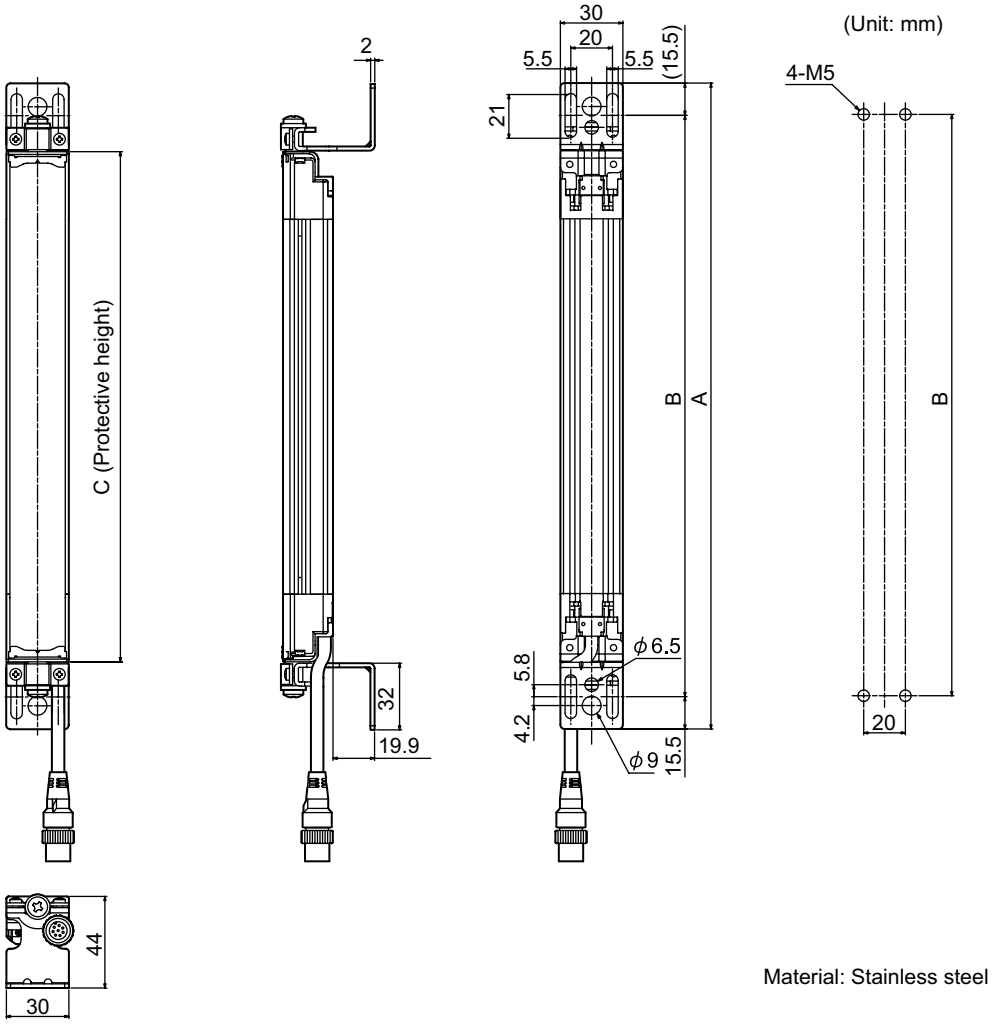


Material: Stainless steel

Dimensions A to C

A	C + 23
B	C - 10
C	4-digit number of the model name (protective height)



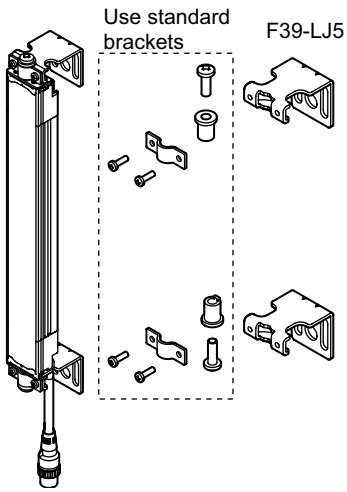


Material: Stainless steel

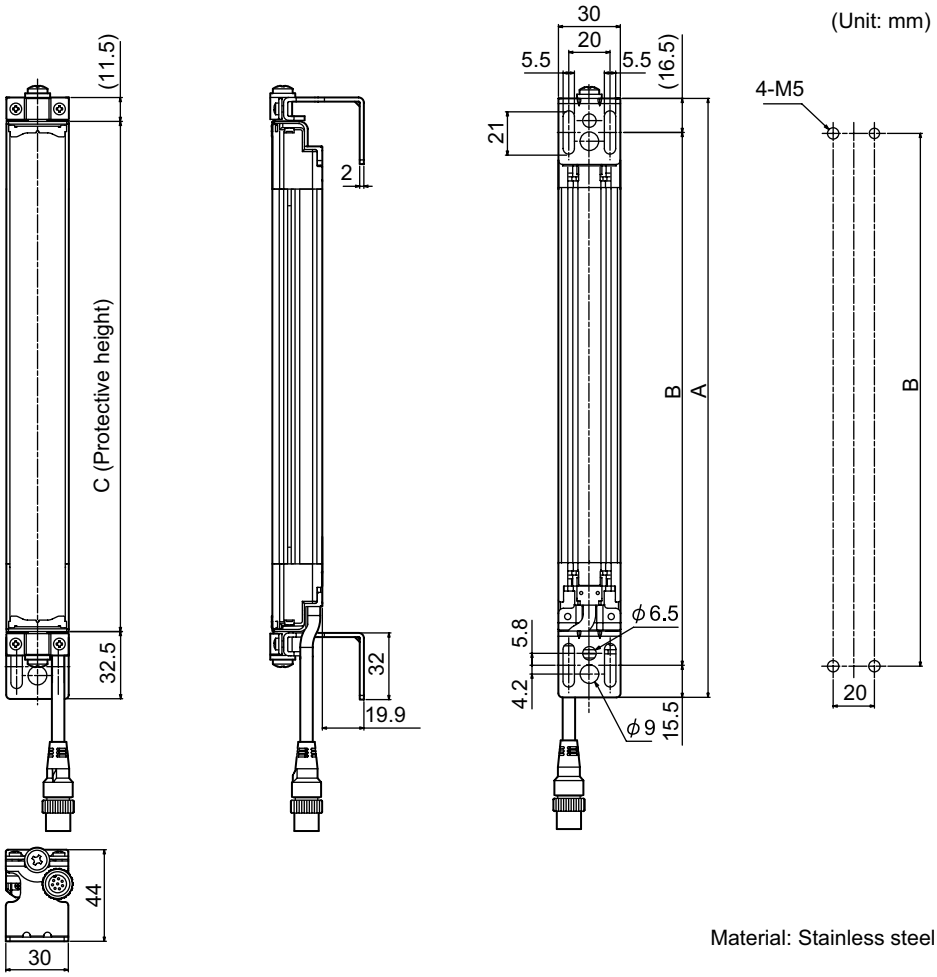
Dimensions A to C

A	C + 65
B	C + 34
C	4-digit number of the model name (protective height)

Inward + outward-facing mounting



(Unit: mm)



Material: Stainless steel

Dimensions A to C

A	C + 44
B	C + 12
C	4-digit number of the model name (protective height)

F3SN replacement correspondence table (F3SN mounting holes can be used without modification)

•When replacing F3SN-□□□□□P14 with F3SJ-A□□□□P14

F3SN		Replacement F3SJ		Replacement method using F39-LJ5
Model name	Protective height	Model name	Protective height	
F3SN-□0153P14	153	-	-	-
F3SN-□0180P14	180	F3SJ-A0245P14	245	Inward-facing mounting
F3SN-□0189P14	189	F3SJ-A0245P14	245	Inward-facing mounting
F3SN-□0198P14	198	F3SJ-A0245P14	245	Inward + outward-facing mounting
F3SN-□0207P14	207	F3SJ-A0245P14	245	Inward + outward-facing mounting
F3SN-□0216P14	216	F3SJ-A0245P14	245	Outward-facing mounting
F3SN-□0225P14	225	F3SJ-A0245P14	245	Outward-facing mounting

For lengths greater than the F3SN-□0234P14:

Add 11 to the F3SN's 4-digit number and apply it as the F3SJ's 4-digit number, and then replace with the standard brackets included with the product.

[Selection example] F3SN-A0315P14 becomes F3SJ-A0326P14 (replace with standard brackets)

CHECK!

- The protective height is 11mm longer.
- Replace with outward-facing mounting of F39-LJ5 when you want to set the detection surface height to be same as the F3SN.

However, the F39-LJ5 and intermediate mounting brackets cannot be mounted simultaneously, so set the protective height to 600mm or less.

•When replacing F3SN-□□□□□P25 with F3SJ-A□□□□P20

F3SN		Replacement F3SJ		Replacement method using F39-LJ5
Model name	Protective height	Model name	Protective height	
F3SN-□0187P25	187	-	-	-
F3SN-□0217P25	217	F3SJ-A0260P20	260	Inward-facing mounting
F3SN-□0232P25	232	F3SJ-A0260P20	260	Inward + outward-facing mounting
F3SN-□0247P25	247	F3SJ-A0245P20	245	Outward-facing mounting

For lengths greater than the F3SN-□0262P25:

Subtract 17 from the F3SN's 4-digit number and apply it as the F3SJ's 4-digit number, and then replace with the standard brackets included with the product.

[Selection example] F3SN-A0322P25 becomes F3SJ-A0305P20 (replace with standard brackets)

CHECK!

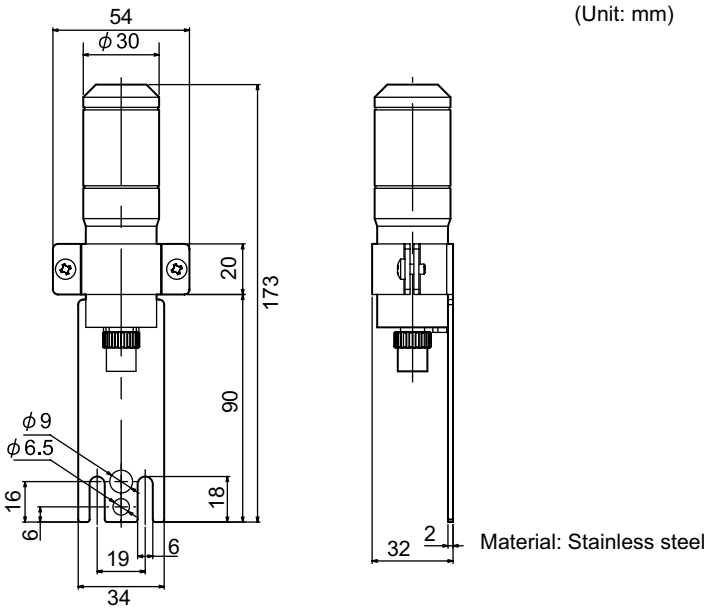
- The protective height becomes 17mm shorter.
- Replace with outward-facing mounting of F39-LJ5 when you want to set the detection surface height to be same as the F3SN.

However, the F39-LJ5 and intermediate mounting brackets cannot be mounted simultaneously, so set the protective height to 600mm or less.

F39-A01P□-PAC External Indicator Set

•F39-A01P□-PAC

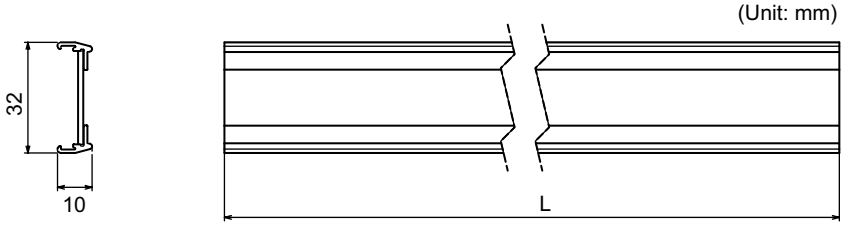
(Unit: mm)



When Using Spatter Protection Covers

■ Dimensions of the spatter protection cover F39-HJ□□□□, F39-HJ□□□□-20, F39-HJ□□□□-30

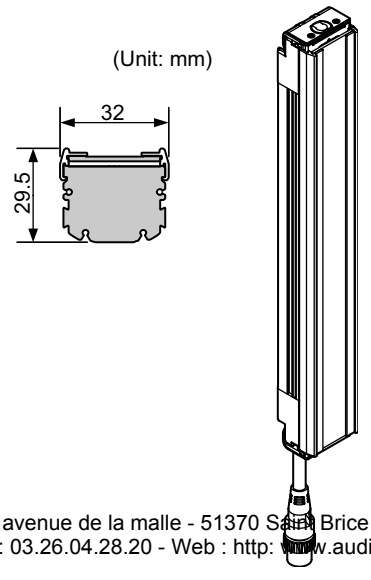
(Unit: mm)



L=□□□□-10 mm Material: PC (protective cover)

■ Assembly dimensions

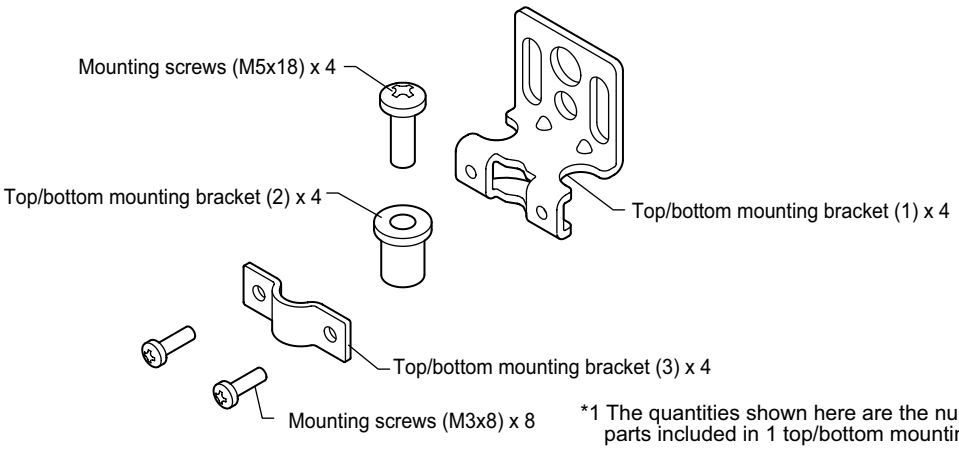
(Unit: mm)



Mounting

The procedures for using standard mounting brackets (included) are explained in this section.

Top/Bottom Mounting Brackets



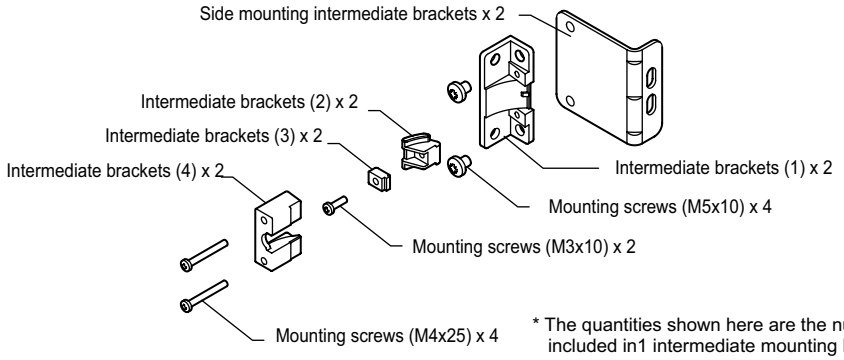
*1 The quantities shown here are the number of parts included in 1 top/bottom mounting bracket set

Material: Stainless steel (top/bottom mounting bracket (1), (3))
Brass (top/bottom mounting bracket (2))
Iron (mounting screws)

Intermediate Mounting Brackets

The number of intermediate mounting brackets included with F3SJ of various protective heights is shown below.

Protective height	Number of intermediate mounting brackets
0245 to 0596	0
0605 to 1130	1
1136 to 1658	2
1667 to 2180	3
2195 to 2495	4

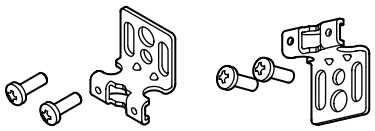


* The quantities shown here are the number of parts included in1 intermediate mounting bracket set

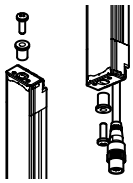
Material: Stainless steel (intermediate mounting bracket)
Zinc die-cast (Intermediate mounting brackets (2), (4))

Mounting Procedure

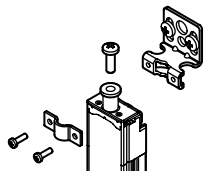
1. Attach the top/bottom mounting bracket (1) to a wall or pillar.



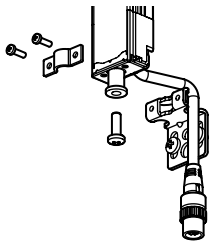
2. Place the top/bottom mounting bracket (2) in the screw hole at the top or bottom of the F3SJ, and tighten it with an included screw (M5x18).



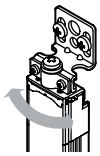
3. Use the top/bottom mounting bracket (3) and (1) to hold the top of the F3SJ, and fasten them lightly with the included screws (M3x8).



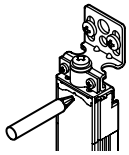
4. Perform the same step for the bottom of the F3SJ and hand tighten.



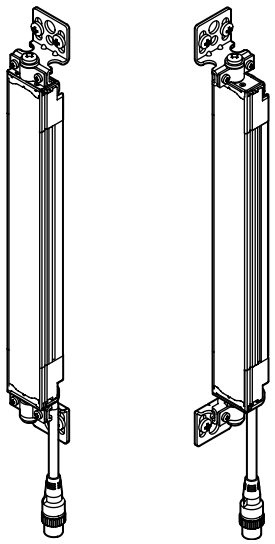
5. Turn the F3SJ right and left to align it to a center position where the 5 lamps of the incident light level indicator are turned ON.



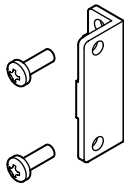
6. Fasten the screws tightly.



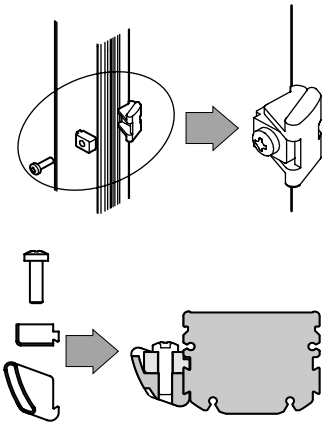
7. Mounting is complete.
   If intermediate brackets are required, proceed to steps 8 to 13.



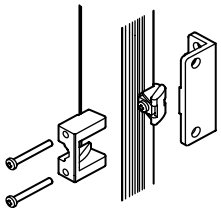
8. For backside mounting, attach the intermediate mounting bracket (1) to a wall or pillar.



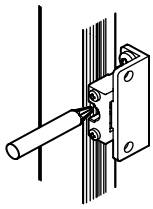
9. Using the included mounting screws (M3x10), lightly fasten the intermediate mounting brackets (2) and (3) so that they are able to slide on the casing.



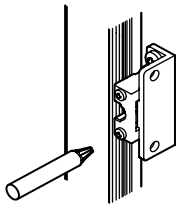
10. Using the included mounting screws (M4x25), lightly fasten the intermediate mounting bracket so that the F3SJ can slide right and left.



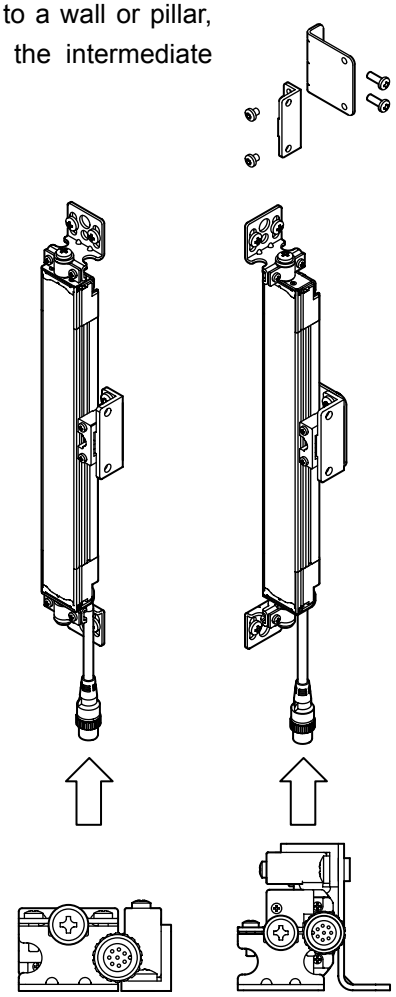
11. Tightly fasten the intermediate mounting brackets (2) and (3) through the opening in the intermediate mounting bracket (4).



12. After performing the adjustment described in Step 5, tightly fasten the intermediate mounting bracket (4).



13. For side mounting, attach the side-mounting intermediate bracket to a wall or pillar, and then use the included mounting screws (M5x10) to fasten the intermediate mounting bracket (1).



Wiring

Wiring Precautions

⚠ WARNING

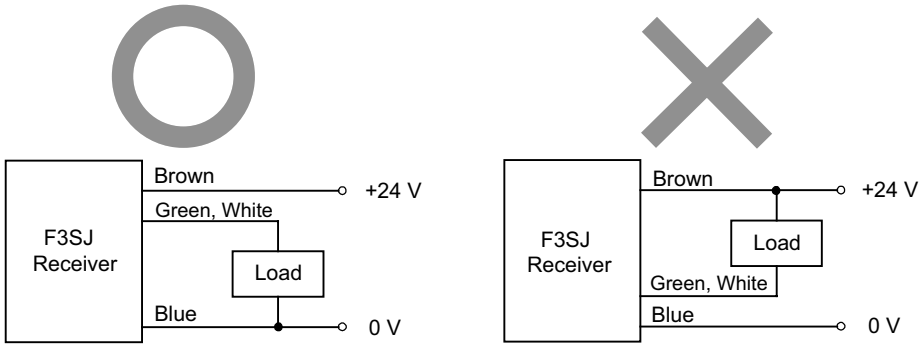
Double or reinforced insulation from hazardous voltage must be applied to all input and output lines. Failure to do so may result in electric shock.

Connect the load between the output and 0V line. (PNP output)
Connecting between the output and +24V line is dangerous because the operation mode is reversed to "ON when blocked".

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

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

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



Power Supply Unit

⚠ WARNING

For the 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 the rated power voltage (24V DC ± 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 reinforced insulation must be applied between the primary and secondary circuits
- •Automatic recovery of overcurrent protection characteristics (reversed L sagging)
- •Output holding time must be 20ms or longer
- •Must satisfy output characteristic requirements for class 2 circuit or limited voltage current circuit defined by UL508 (Refer to remarks)
- •Must comply with laws and regulations, regarding EMC and electrical equipment safety, of the country or region where the F3SJ is used (Ex: In EU, the power supply must comply with the EMC Directive and the Low Voltage Directive.)

(Remarks)

To prevent a fire, the secondary circuit of the power supply must satisfy either of the following conditions in accordance with UL 508:

- • As with secondary winding of isolation transformer, there must be a limited current voltage circuit to which isolated power supply provides power, and the "current is limited to 8A max. (including short-circuit)" or "circuit protection such as a fuse is used to limit the current, which has a rating of 4.2A max." (24VDC power supply).
  Recommended power supply: OMRON S82K (15 W, 30 W, 50 W, 90 W type), S8VS (60 W type), S82J (10 W, 25 W, 50 W type)
  These products are approved by UL listing (UL508, class 2 power supply), CE marking compatible (EMC/Low Voltage Directive).
- • Class 2 power supply unit complying with UL 1310, or a circuit using 2 transformers complying with UL 1585 as a power supply.

Wiring Procedure

1. Connect an emitter cable (F39-JC□□-L, grey, sold separately) to the emitter's connection cable (grey).

2. Connect a receiver cable (F39-JC□□-D, black, sold separately) to the receiver's connection cable (black).

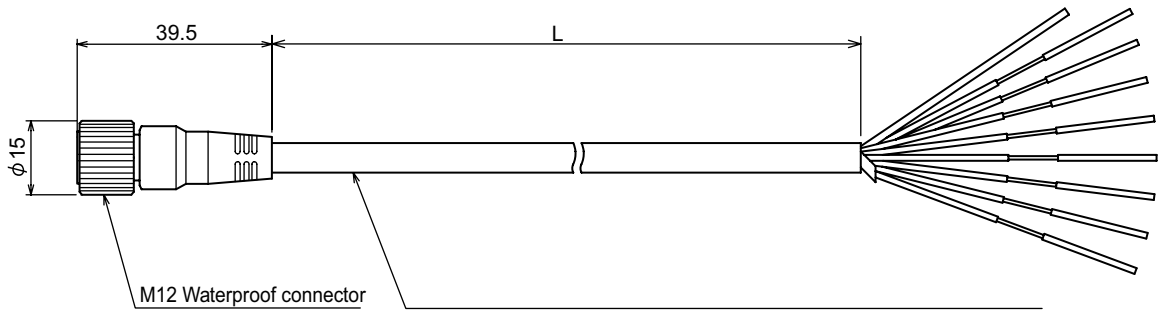
3. Connect the 0V line of the power supply directly to the protective earth (PE).

CHECK!

To ensure proper wiring, check that the color of the cable matches the color of the connector's resin cover (emitter: grey, receiver: black). Failure to do so may result in damage to the F3SJ. Incorrect wiring can be prevented by matching the colors.

■ Cable with connector on one end (F39-JC□A, sold separately)

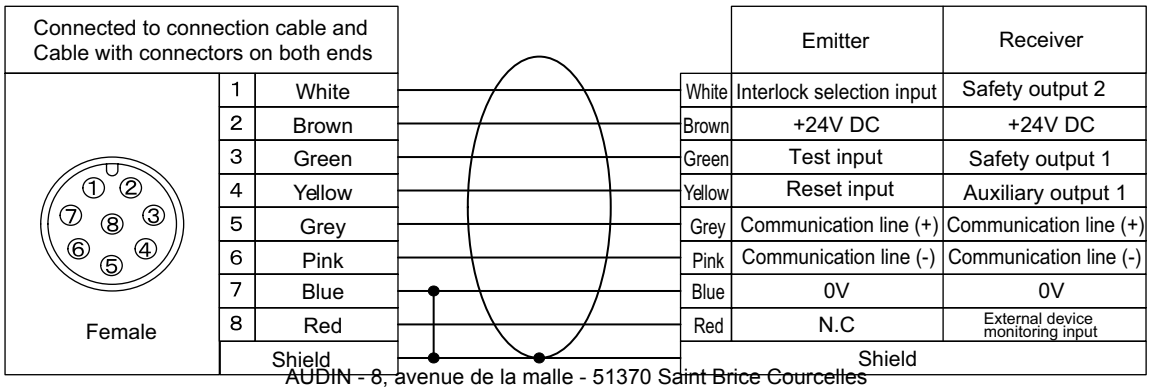
(Unit: mm)



Insulated vinyl round cable ϕ6.6
8-wire (4-pair) (Cross section of conductor: 0.3mm²/insulator diameter: ϕ1.15mm)

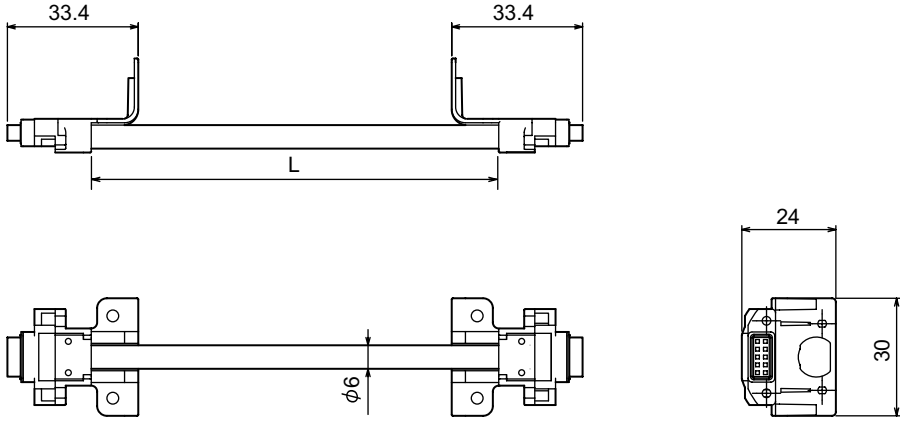
Set model name	For emitter		For receiver		L (mm)
F39-JC3A	F39-JC3A-L	Grey cable	F39-JC3A-D	Black cable	3000
F39-JC7A	F39-JC7A-L		F39-JC7A-D		7000
F39-JC10A	F39-JC10A-L		F39-JC10A-D		10000
F39-JC15A	F39-JC15A-L		F39-JC15A-D		15000
F39-JC20A	F39-JC20A-L		F39-JC20A-D		20000

Internal wiring diagram (F39-JC□A-L, F39-JC□A-D)



■ Series connection cable for close contact(F39-JJR15L, sold separately)

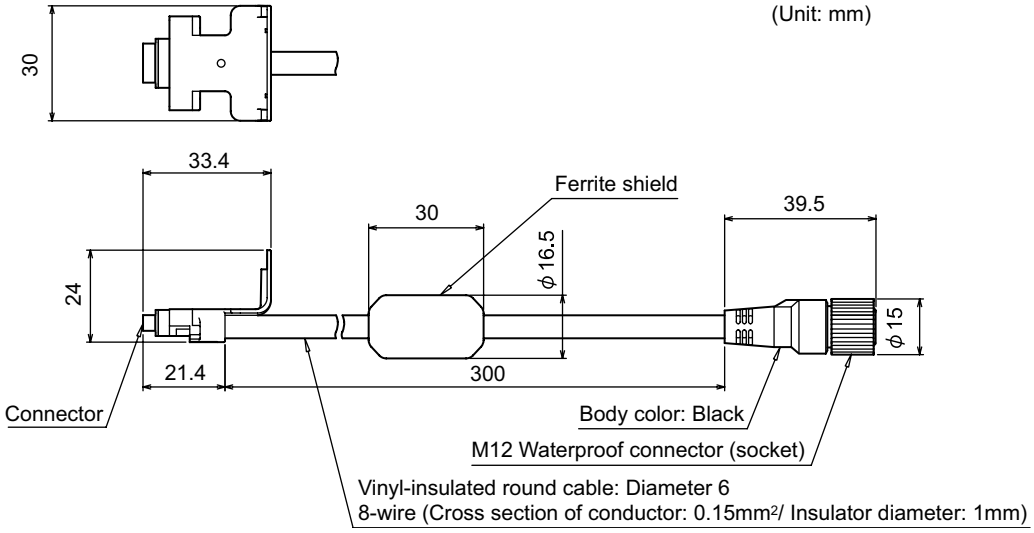
(Unit: mm)



Set model name	For emitter		For receiver		L (mm)
F39-JJR15L	F39-JJR15L-L	Grey cable	F39-JJR15L-D	Black cable	150

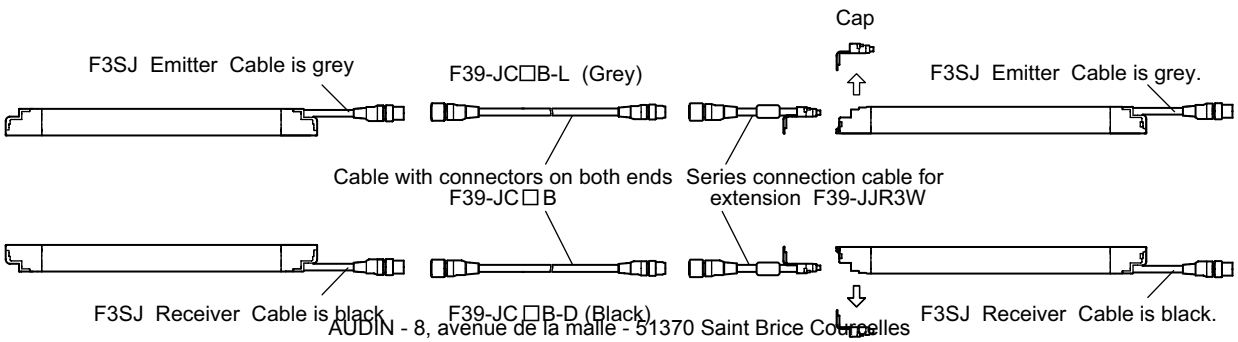
■ Series connection cable for extension (F39-JJR3W, sold separately)

(Unit: mm)



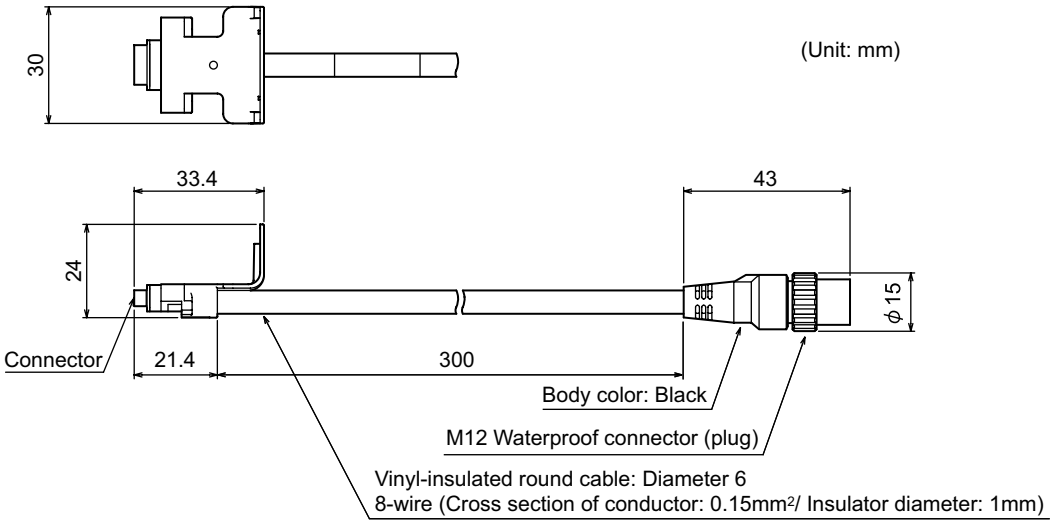
Set model name	For emitter		For receiver	
F39-JJR3W	F39-JJR3W-L	Grey cable	F39-JJR3W-D	Black cable

Use F39-JC□B cable with connectors on both ends to connect between F3SJ. (The maximum length between series connections is 15m.)



■ Connection cable (F39-JJR3K, sold separately)

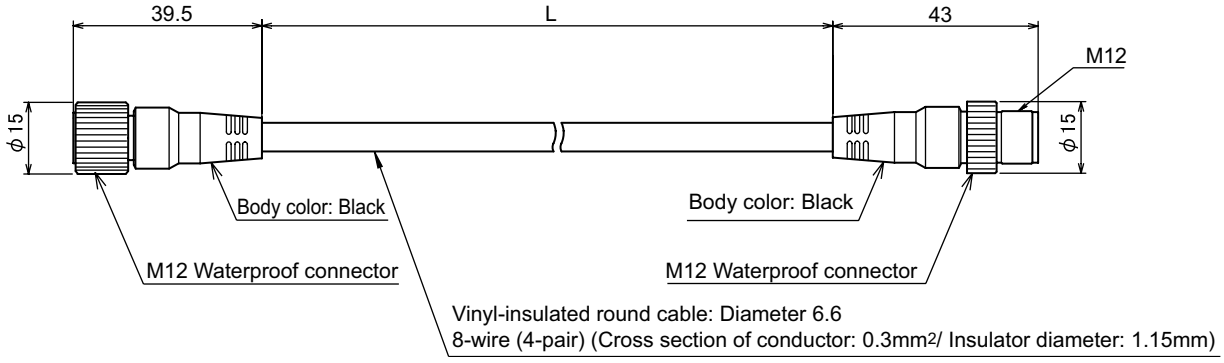
The connection cable is a standard included product. Purchase a replacement when damaged or lost.



Set model name	For emitter		For receiver	
F39-JJR3K	F39-JJR3K-L	Grey cable	F39-JJR3K-D	Black cable

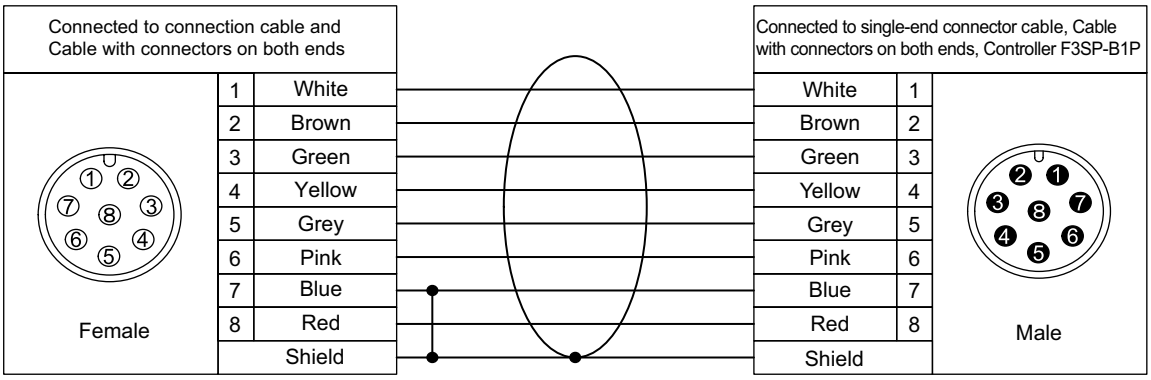
■ Cable with connectors on both ends: Cable for extension and for connection to F3SP-B1P (F39-JC□B, sold separately)

(Unit: mm)



Set model name	For emitter		For receiver		L (mm)
F39-JCR2B	F39-JCR2B-L	Grey cable	F39-JCR2B-D	Black cable	200
F39-JCR5B	F39-JCR5B-L		F39-JCR5B-D		500
F39-JC1B	F39-JC1B-L		F39-JC1B-D		1000
F39-JC3B	F39-JC3B-L		F39-JC3B-D		3000
F39-JC5B	F39-JC5B-L		F39-JC5B-D		5000
F39-JC7B	F39-JC7B-L		F39-JC7B-D		7000
F39-JC10B	F39-JC10B-L		F39-JC10B-D		10000
F39-JC15B	F39-JC15B-L		F39-JC15B-D		15000
F39-JC20B	F39-JC20B-L		F39-JC20B-D		20000

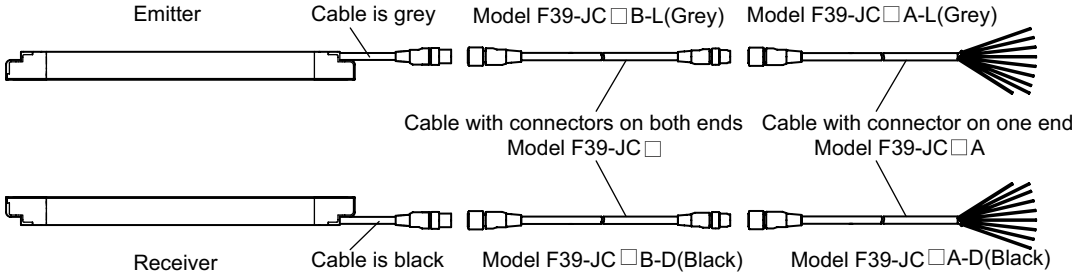
Internal wiring diagram (F39-JC□B-L, F39-JC□B-D)



Twisted pair wires are white and red, brown and blue, green and yellow, and grey and pink

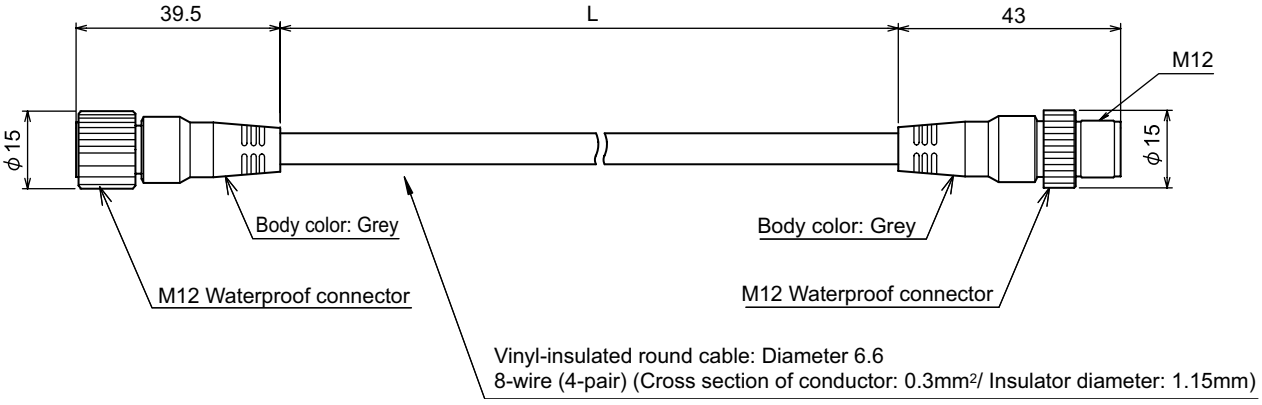
If the length of the F39-JC□A cable with connector on one end is insufficient, use 1 or more F39-JC□B cable with connectors on both ends to extend the length, as required.

Connection example



■ Cable with connectors on both ends: Cable for connection with G9SA-300-SC (F39-JC□C, sold separately)

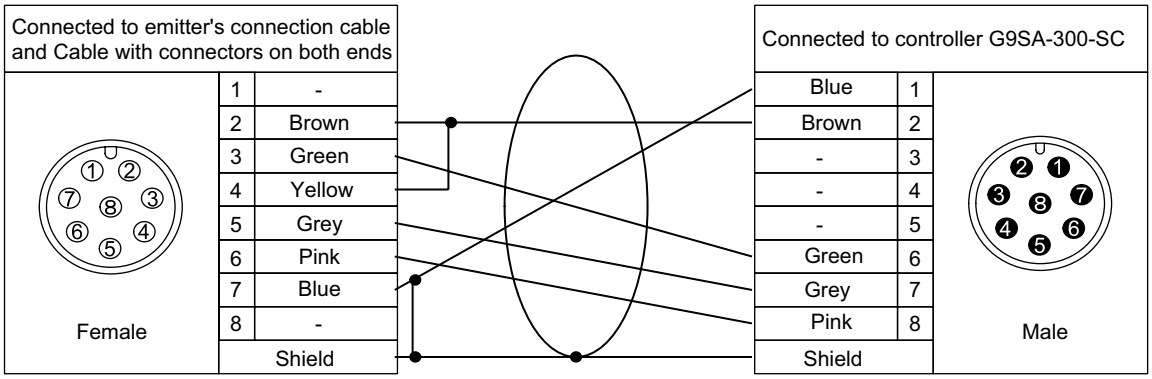
(Unit: mm)



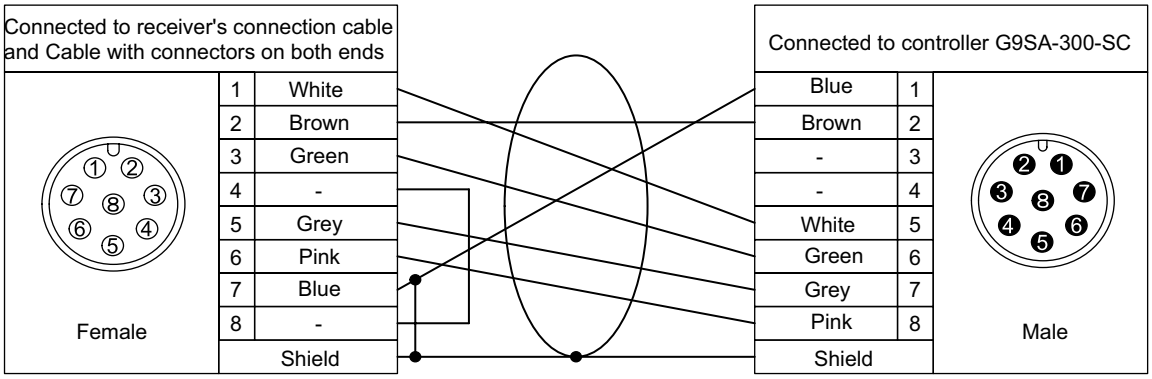
Set model name*1	For emitter		For receiver		L (mm)
F39-JCR2C	F39-JCR2C-L	Grey cable	F39-JCR2C-D	Black cable	200
F39-JC1C	F39-JC1C-L		F39-JC1C-D		1000
F39-JC3C	F39-JC3C-L		F39-JC3C-D		3000
F39-JC7C	F39-JC7C-L		F39-JC7C-D		7000
F39-JC10C	F39-JC10C-L		F39-JC10C-D		10000
F39-JC15C	F39-JC15C-L		F39-JC15C-D		15000

*1. Use only 1 set of F39-JC□C. If the cable length is insufficient, use F39-JC□B for extension.

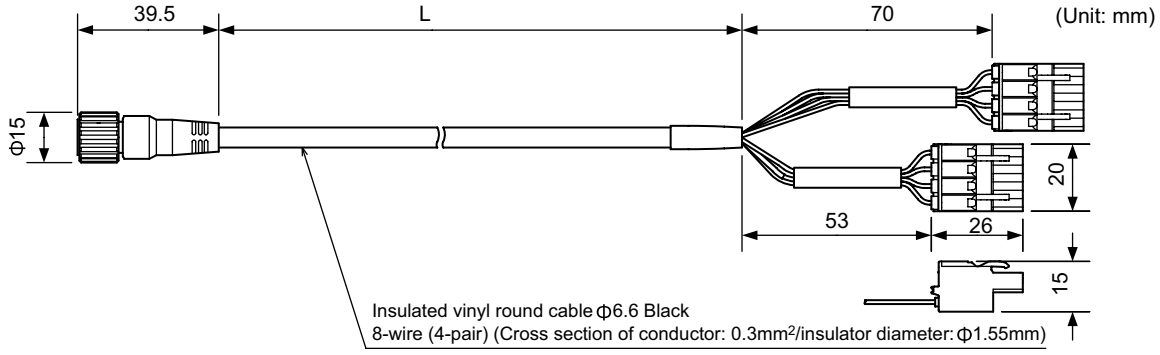
Internal wiring diagram (F39-JC□C-L)



Internal wiring diagram (F39-JC□-D)



■ Cable with connectors on both ends: Cable for connection with F3SX (F39-JC□T, sold separately)



Model name	L (mm)
F39-JC1T	1000
F39-JC3T	3000
F39-JC5T	5000
F39-JC7T	7000
F39-JC10T	10000
F39-JC15T	15000

Adjustment Procedure

1. Check the following points:
   - The optical surface of the emitter and receiver should be clean.
   - There should be no interrupting object in the detection zone of the F3SJ.

2. Adjust the emitter's beams.
   Adjust the angle of the emitter while checking the incident light level indicator, and align the emitter so that it faces the center position where the incident light level indicator turns ON.

3. Adjust the receiver's beams.
   Adjust the angle of the receiver while checking the incident light level indicator, and align the receiver so that it faces the center position where the incident light level indicator turns ON.

4. Make sure that all 5 lamps of the incident light level indicator are turned ON.

5. While taking care not to change the adjustment status of the beams, tightly fasten all the bracket screws and mounting screws.
   The table below shows the tightening torques for the included screws.

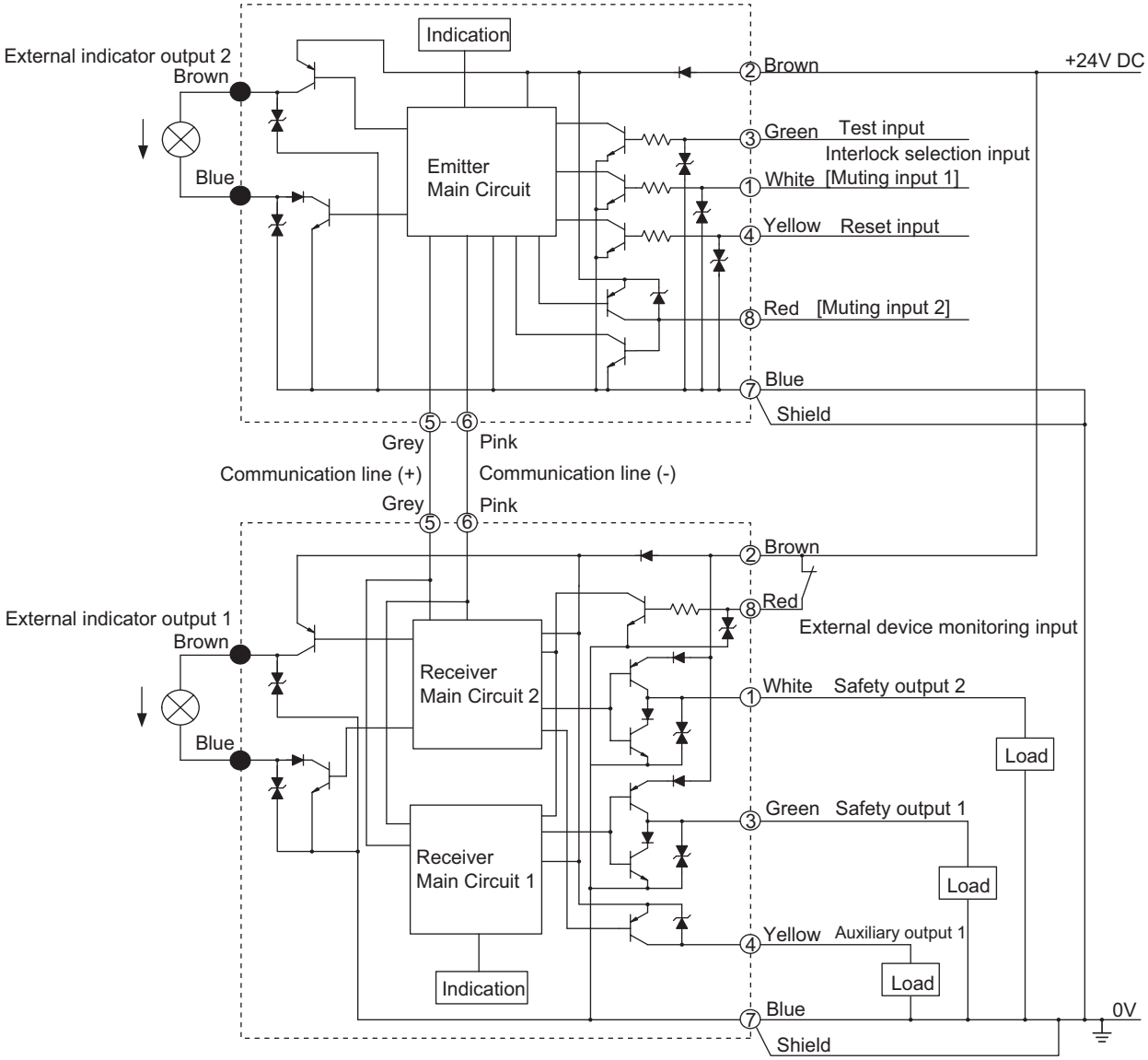
Mounting bracket type	Nominal diameter x length of screw (mm)	Tightening torque
Top/bottom mounting brackets	M3x8	0.54N·m
	M5x18	2.3N·m
Intermediate mounting brackets	M3x10	0.54N·m
	M4x25	1.2N·m
	M5x10	2.3N·m

If some of the 5 lamps of the incident light level indicator are not turned ON even when the receiver angle is adjusted, check whether or not the mounting surfaces of the emitter/receiver are parallel, and whether or not the mounting height of the emitter/receiver is appropriate.

Chapter4 Input/Output Circuit and Applications

Input/Output Circuit

The numbers in white circles indicate the connector's pin numbers.
The black circles indicate connectors for series connection.
The words in brackets [ ] indicate the signal name for muting system.



For details about wiring, see the following sections.

When not using the muting function, see p.23

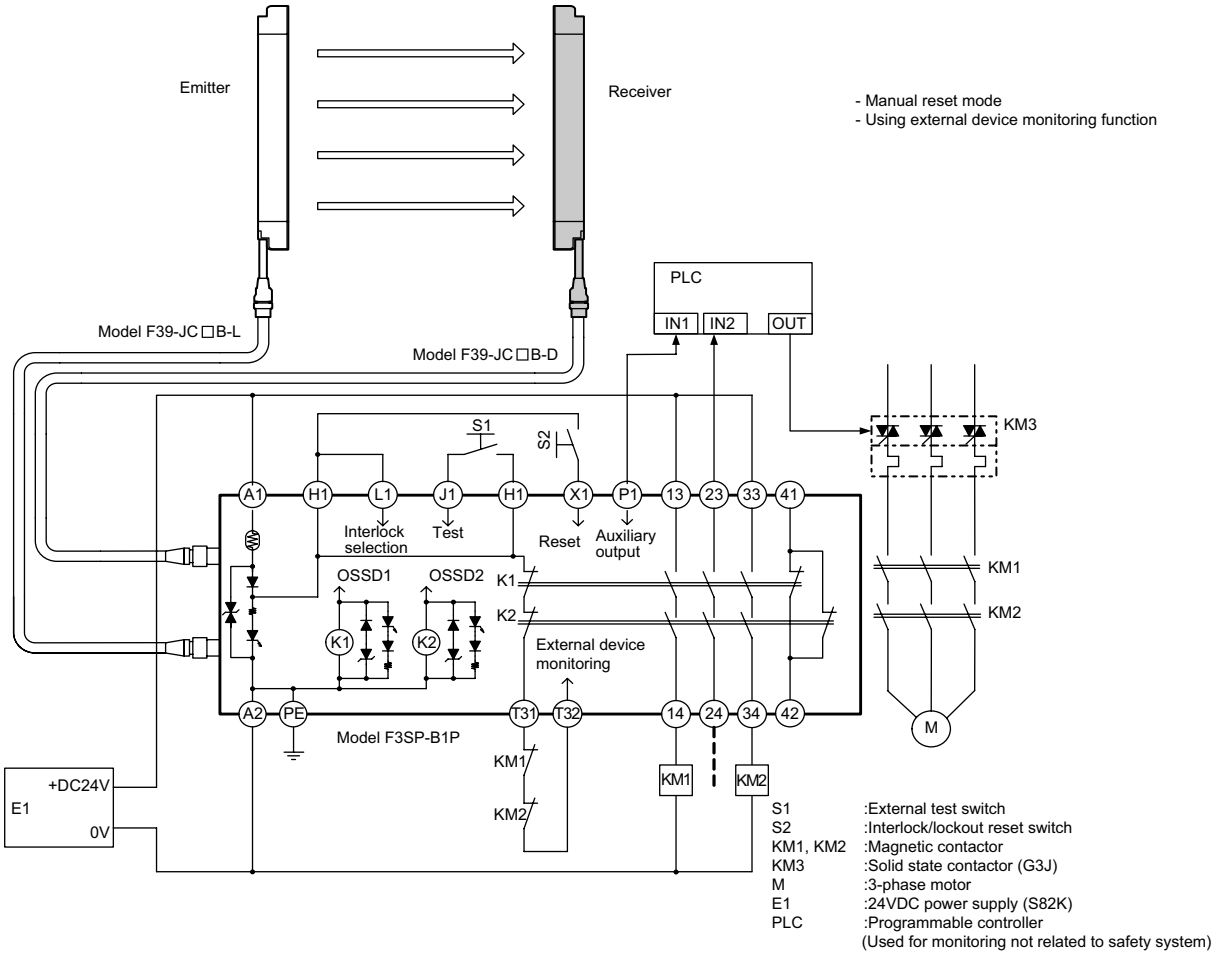
When using muting function, see p.35

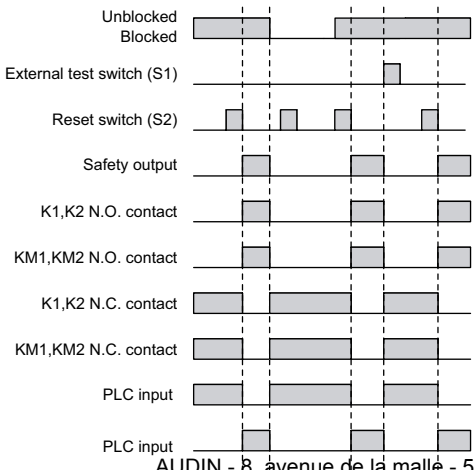
Wiring Examples

Some examples of a motor control system using F3SJ are shown. The category of these systems defined by EN954-1 is 4.

Connecting to an F3SP-B1P

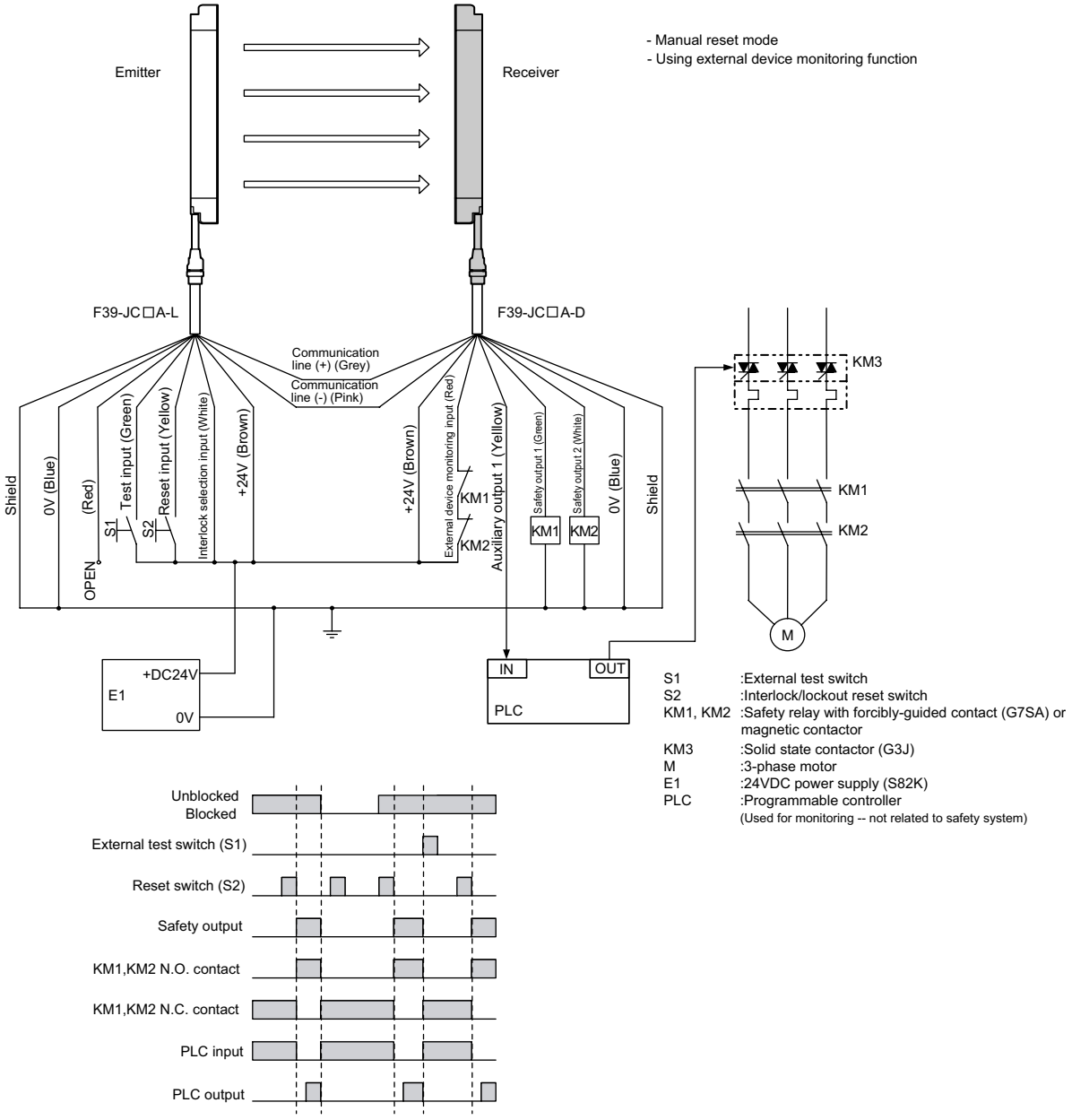
•Reduced wiring due to connector connection
•Safety relay included





Using only F3SJ

•Use of relay contact welding detection and interlock is possible without a controller or relay unit

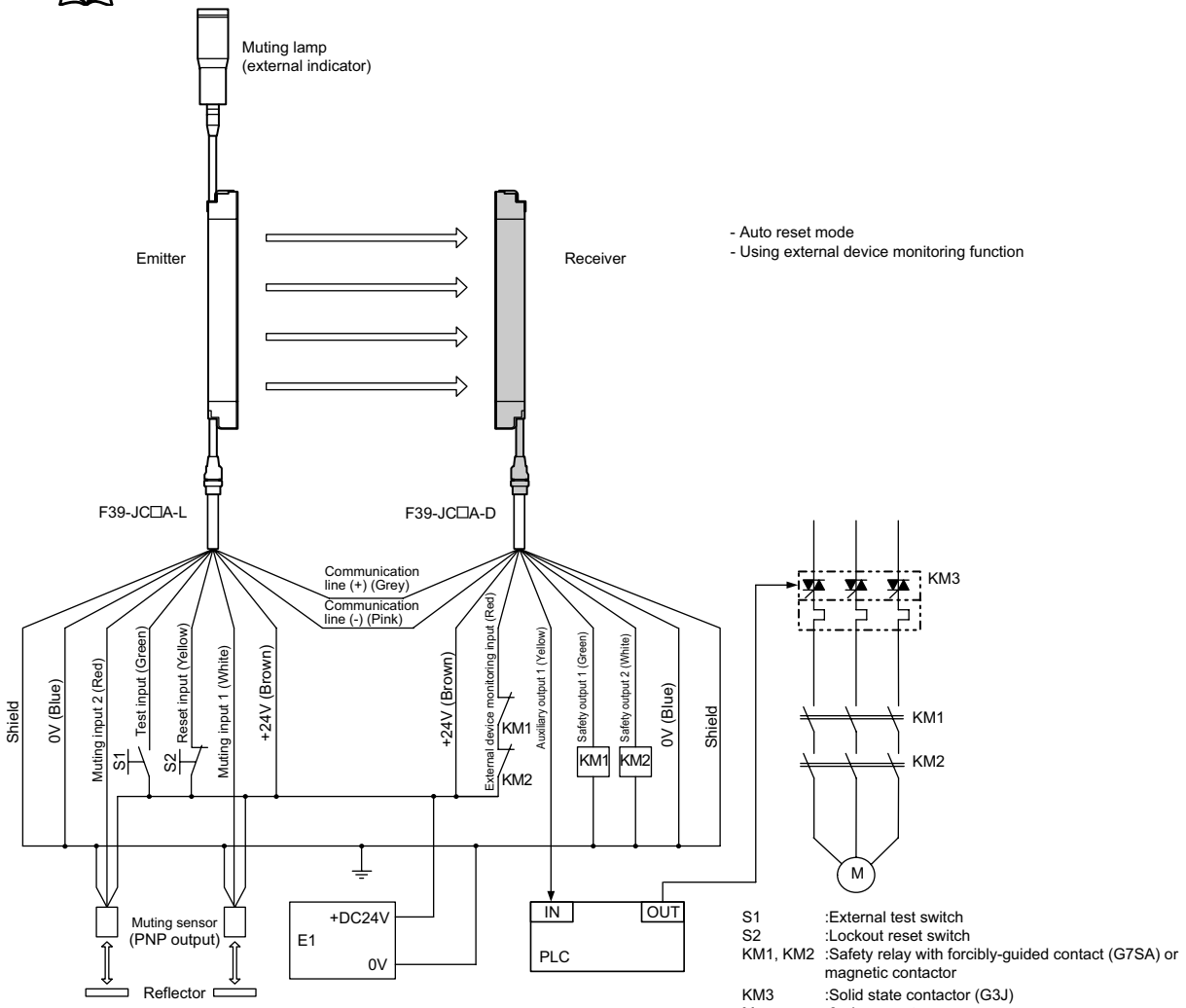


S1 :External test switch
S2 :Interlock/lockout reset switch
KM1, KM2 :Safety relay with forcibly-guided contact (G7SA) or magnetic contactor
KM3 :Solid state contactor (G3J)
M :3-phase motor
E1 :24VDC power supply (S82K)
PLC :Programmable controller
(Used for monitoring -- not related to safety system)

Connecting a muting sensor

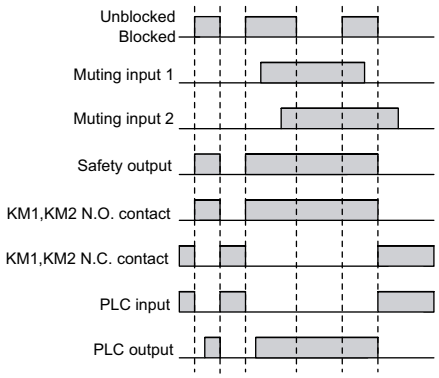
- Attaching a key cap for muting (F39-CN6) enables the muting function to be used

Attaching the key cap for muting (F39-CN6) p.32



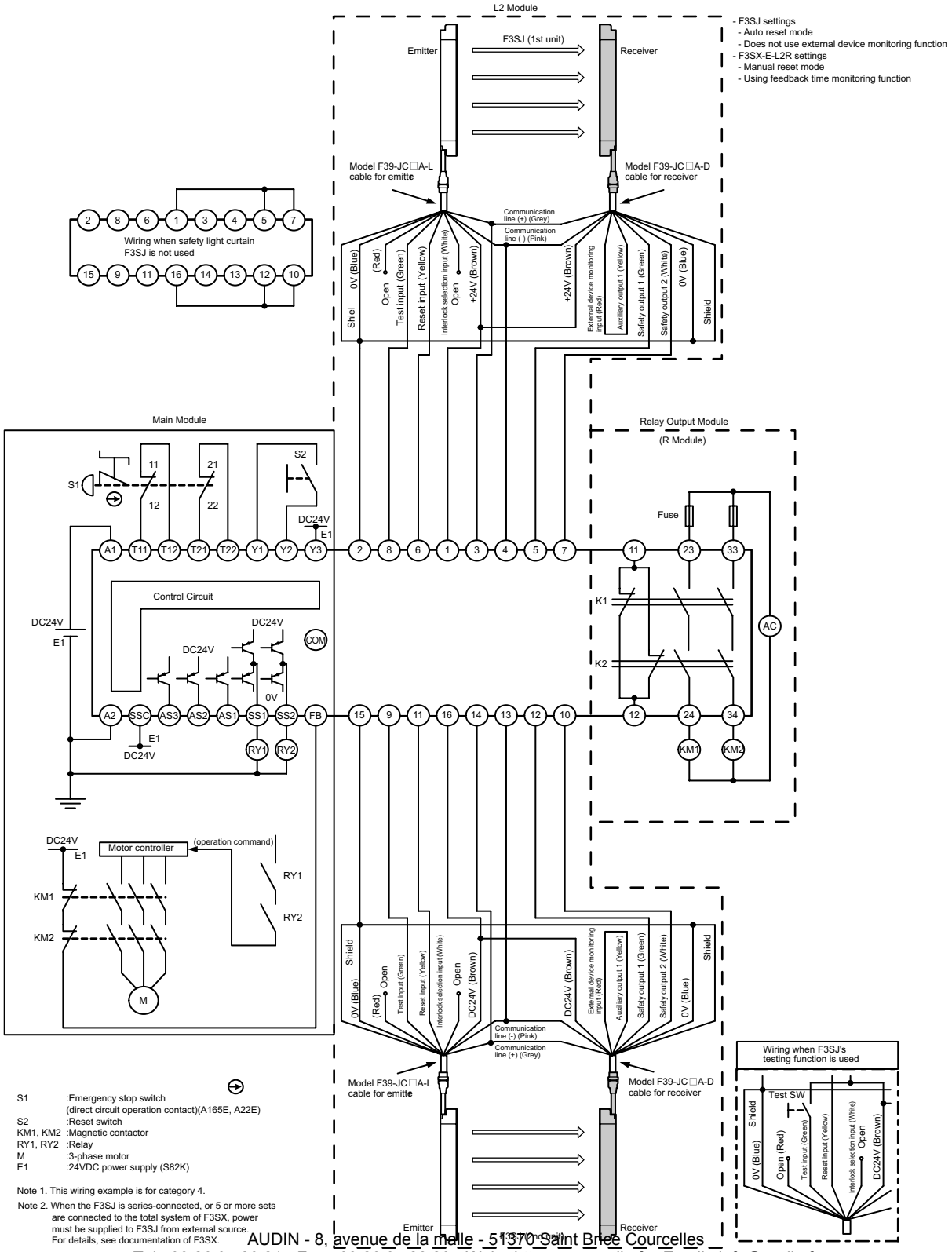
S1 :External test switch
S2 :Lockout reset switch
KM1, KM2 :Safety relay with forcibly-guided contact (G7SA) or magnetic contactor
KM3 :Solid state contactor (G3J)
M :3-phase motor
E1 :24VDC power supply (S82K)
PLC :Programmable controller
(Used for monitoring -- not related to safety system)

Muting sensor: Retro-reflective photoelectric sensor (E3Z-R81)



Connecting to an F3SX-E-L2R

- Emergency stop switch can be connected
- Door switch, two hand control, single beam, or relay unit can be used in combination with F3SX
- Various settings can be changed and input/output terminals can be monitored using the setting support software for F3SX



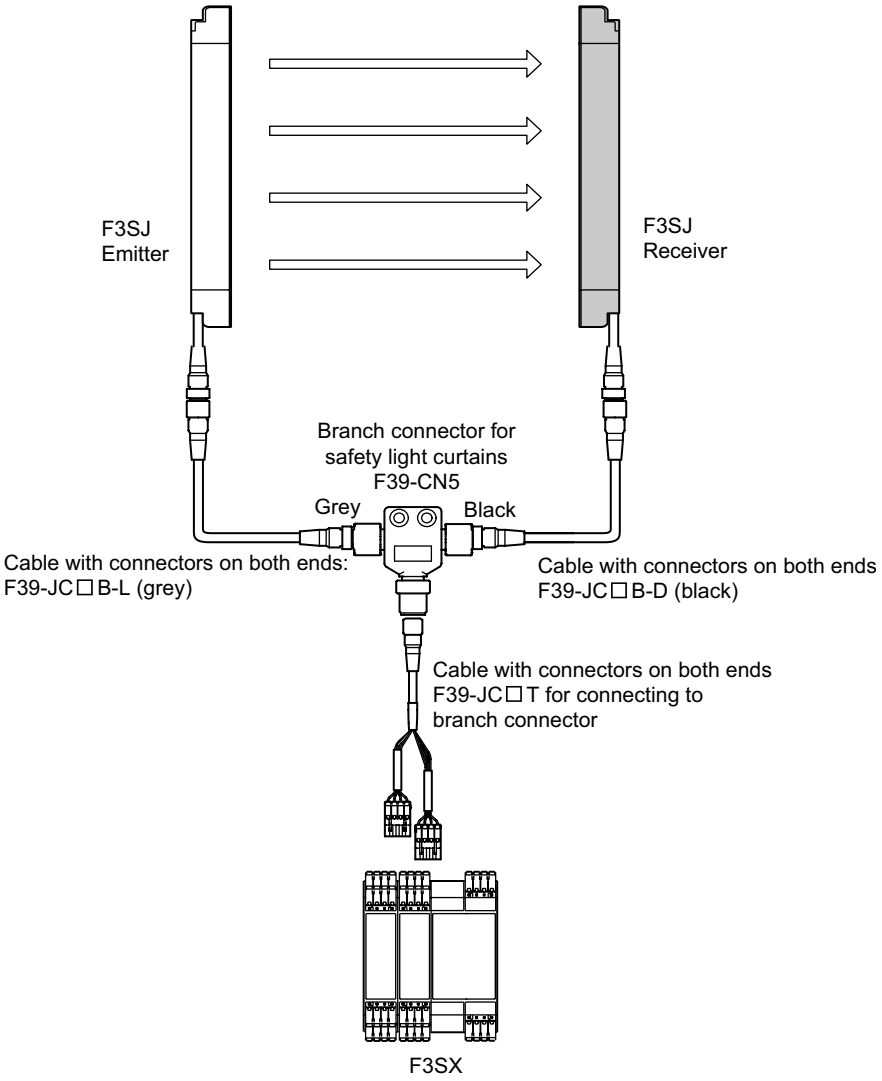
S1 :Emergency stop switch (direct circuit operation contact)(A165E, A22E)
S2 :Reset switch
KM1, KM2 :Magnetic contactor
RY1, RY2 :Relay
M :3-phase motor
E1 :24VDC power supply (S82K)

Note 1. This wiring example is for category 4.

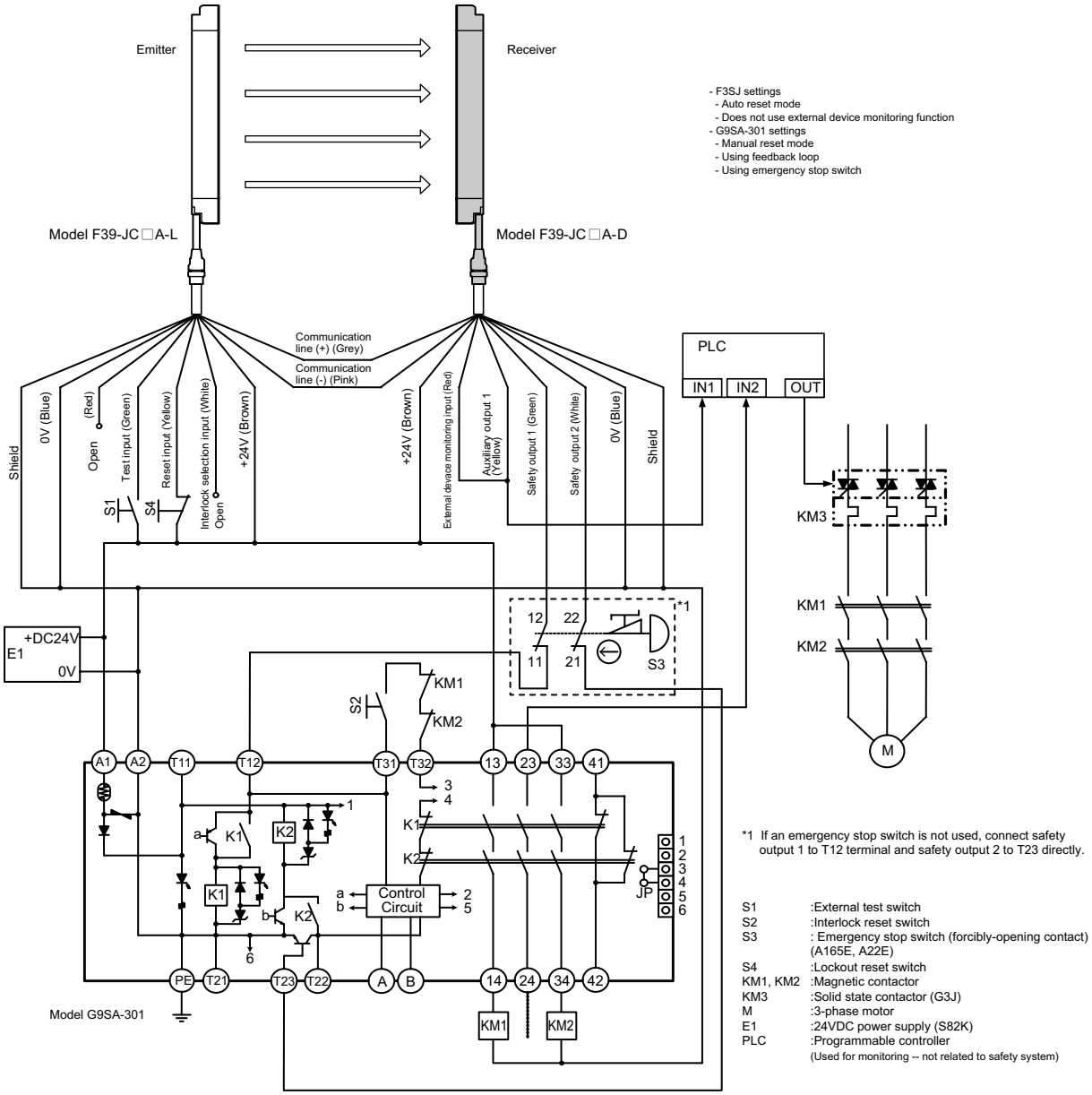
Note 2. When the F3SJ is series-connected, or 5 or more sets are connected to the total system of F3SX, power must be supplied to F3SJ from external source. For details, see documentation of F3SX.

•Using a branch connector

Connector connection is possible using a cable with connectors on both ends and branch connector for safety light curtains.

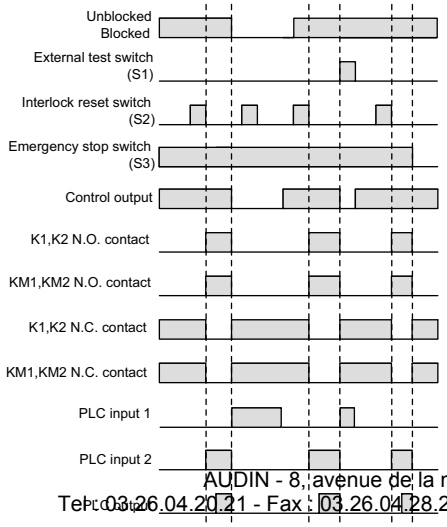


Connecting to a G9SA-301



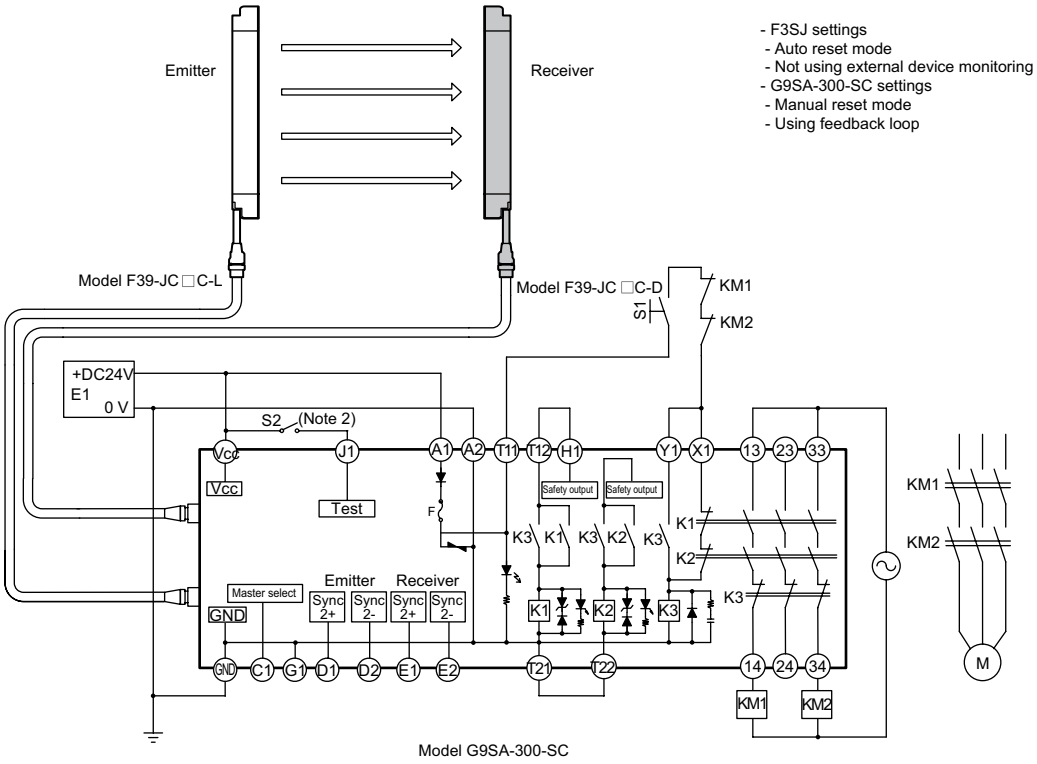
*1 If an emergency stop switch is not used, connect safety output 1 to T12 terminal and safety output 2 to T23 directly.

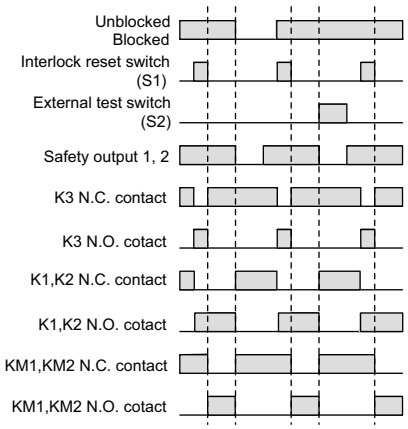
S1	:External test switch
S2	:Interlock reset switch
S3	: Emergency stop switch (forcibly-opening contact) (A165E, A22E)
S4	:Lockout reset switch
KM1, KM2	:Magnetic contactor
KM3	:Solid state contactor (G3J)
M	:3-phase motor
E1	:24VDC power supply (S82K)
PLC	:Programmable controller (Used for monitoring -- not related to safety system)



Connecting to a G9SA-300-SC

•Reduced wiring due to connector connection



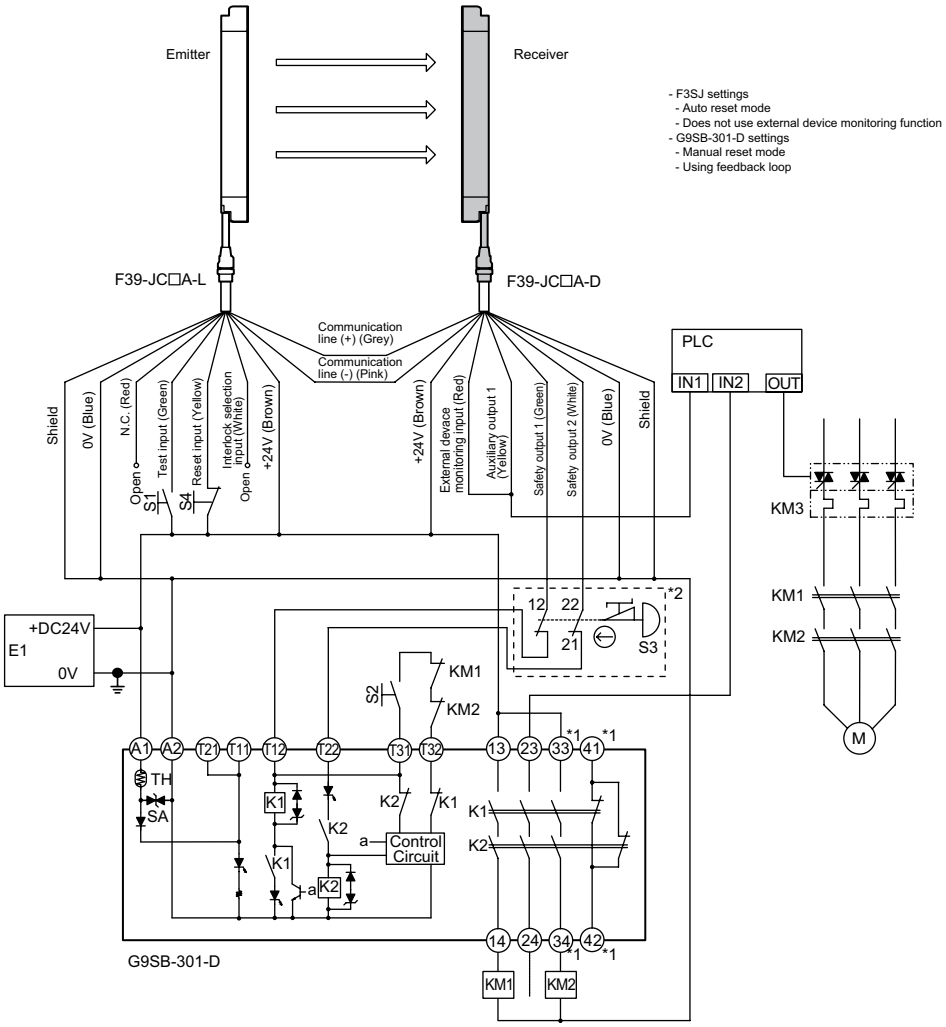


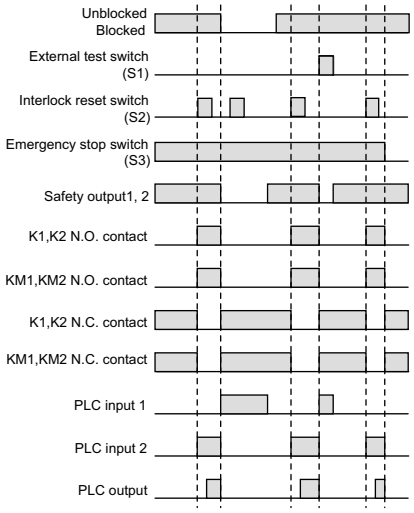
Note 1) F3SJ's external device monitoring and auxiliary output cannot be used.
Note 2) S2 performs normal operation when opened and external test when short-circuited.
Note 3) Do not connect any cable to terminals C1, D1, D2, E1, and E2

S1	:Interlock reset switch
S2	:External test switch (open between Vcc and J1 if a switch is not required)
KM1, KM2	:Magnetic contactor
M	:3-phase motor
E1	:24V DC power supply (S82K)

Connecting to a G9SB-301-D

•Thin (22.5mm thick)



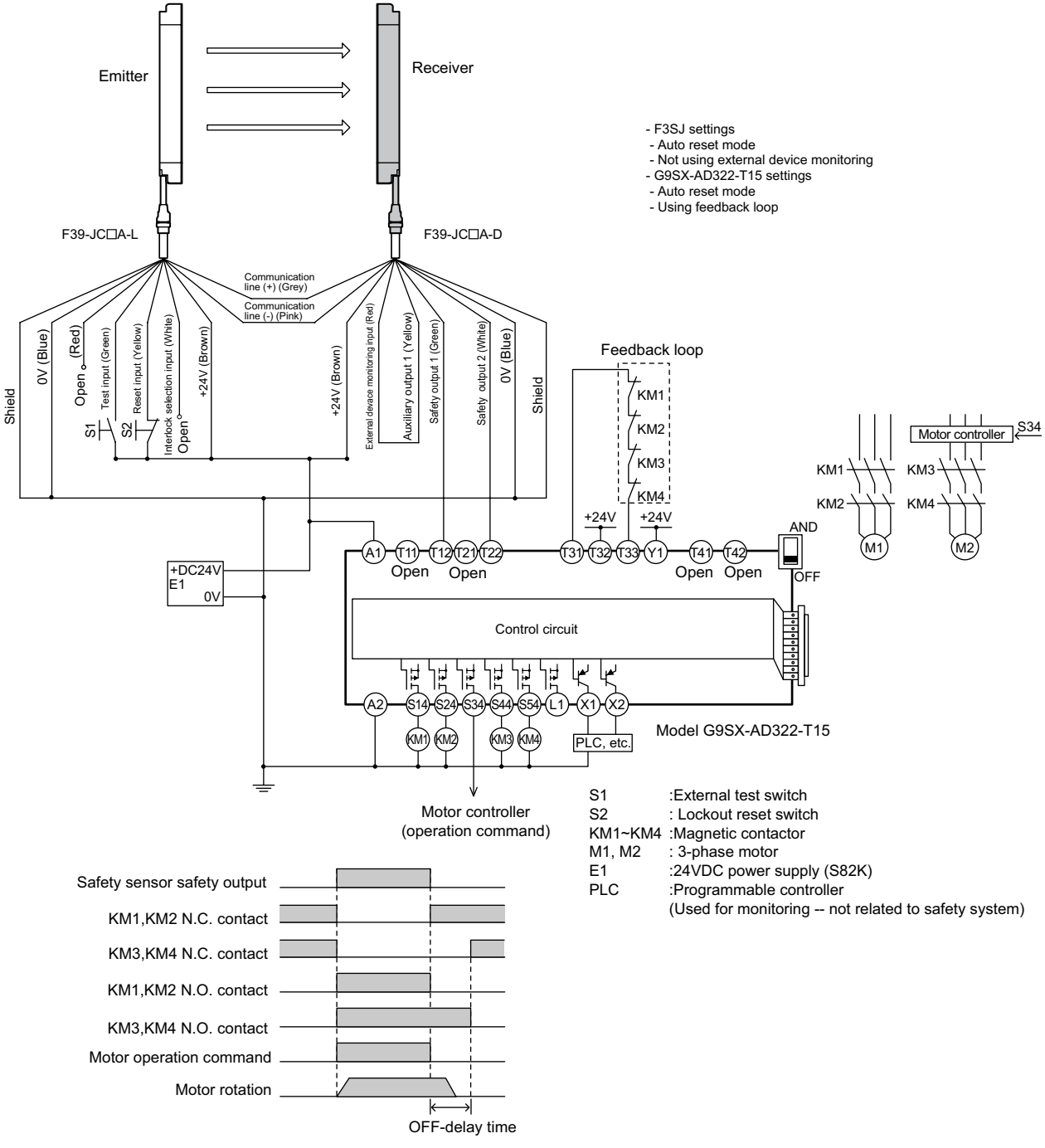


*1 The G9SB-200-D (17.5 mm thick), with no 33-34 and 41-42, is also available.
*2 If an emergency stop switch is not used, connect safety output 1 to T12 terminal and safety output 2 to T22 directly.

S1	:External test switch
S2	:Interlock reset switch
S3	: Emergency stop switch (forcibly-opening contact) (A165E, A22E)
S4	:Lockout reset switch
KM1, KM2	:Magnetic contactor
KM3	:Solid state contactor (G3J)
M	:3-phase motor
E1	:24VDC power supply (S82K)
PLC	:Programmable controller (Used for monitoring -- not related to safety system)

Connecting to a G9SX-AD322-T15

- Can be configured for partial control and total control
- Can be extended to connect a door switch or a relay unit



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Chapter5 Checklists

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Pre-Operation Checklists

⚠ WARNING

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.

After installation, the highest level administrator must use the following checklist to verify the operation, placing a check mark in each of the boxes.

Checklists

■ Installation condition check

- ☐The machine itself does not prevent the operation of safety functions such as stopping.
- ☐The hazardous part of a machine cannot be reached without passing through the detection zone of the F3SJ.
- ☐The system is configured so that the F3SJ can always detect a worker who is working in the hazardous area.
- ☐The interlock reset switch is installed in a location that provides a clear view of the entire hazardous area and it cannot be activated from within the hazardous area.
- ☐Safety distance has been calculated. Calculated distance: S = ( )mm
- ☐The actual distance is equal to or greater than the calculated distance. Actual distance = ( )mm
- ☐Reflective surfaces are not installed in prohibited areas.

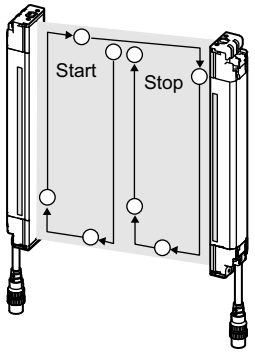
■ Wiring check before power is turned ON

- ☐The power supply unit has tolerance against the total rated current of connected devices including the F3SJ.
- ☐The power supply unit is a 24 VDC unit that conforms to the EMC Directive, Low-voltage Directive, and output holding specifications.
- ☐The power supply polarity is not connected in reverse.
- ☐Emitter/receiver cables are properly connected to the respective emitters/receivers.
- ☐Double insulation is used between I/O lines and the hazard potential (commercial power supplies, etc.).
- ☐Outputs are not short-circuited to +24V line.
- ☐Loads are not connected to the +24V line.
- ☐All lines are not connected to commercial power source.
- ☐When 2 or more sets of F3SJ are used, series connection is made or mutual interference prevention measures are taken.

■ Operation check while the machine is stopped

- ☐The test rod is not deformed.
  The detection capability varies according to the model. Use a test rod with an appropriate diameter for inspection.
- ☐When the power of the F3SJ is turned ON while nothing is in the detection zone, it must operate as follows:
  When auto reset is made: Power indicator and ON output indicator must turn ON within 2 seconds (2.2 seconds in case of series connection).
  When manual reset is made: Power indicator and OFF output indicator must turn ON within 2 seconds (2.2 seconds in case of series connection).
- ☐The sensor can detect a test rod wherever it is in the detection zone. In other words, when a test rod is inserted into the detection zone, all 5 incident light level indicators turn OFF, and the OFF-state indicator turns ON.

To check detection, move the test rod as shown in the diagram below.



☐When the external test function is used:
The OFF-state indicator turns ON when the test input line is short-circuited to 9 to 24V.
☐When the external device monitoring function is used:
When the F3SJ is blocked and the external device monitoring input terminal is open, it enters a lockout state.
☐When the start interlock function is used:
After the F3SJ is turned ON, the OFF-state indicator remains turned ON, even if the F3SJ is receiving light. The reset switch input turns ON the ON-state indicator.
☐When the restart interlock function is used:
While the ON-state indicator is ON, the OFF-state indicator remains turned ON, even when the F3SJ is blocked and then receives light again. The reset switch input turns ON the ON-state indicator.

■ Checking that hazardous parts stop while the machine operates

☐The hazardous parts stop immediately when a test rod is inserted into the detection zone at 3 positions: "directly in front of the emitter", "directly in front of the receiver", and "between the emitter and receiver". (Use the appropriate test rod.)
☐The hazardous parts remain stopped as long as the test rod is in the detection zone.
☐The hazardous parts stop when the power of the F3SJ is turned OFF.
☐The actual response time of the whole machine is equal to or less than the calculated value.

Maintenance Checklists

⚠ WARNING

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

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

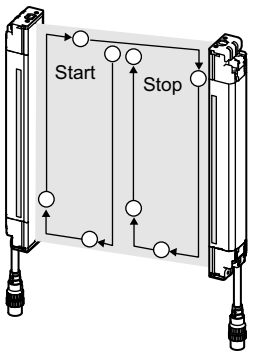
To ensure safety, keep a record of the inspection results.

When the user is a different person from those who installed or designed the system, he/she must be properly trained for maintenance.

Daily Maintenance

■ Inspection at startup and when changing operators

- ☐There is no approach route other than through the detection zone of the F3SJ.
- ☐Part of the operator's body always remains in the detection zone of the F3SJ when working around the machine's hazardous part.
- ☐The actual safety distance is equal to or greater than the calculated value.
- ☐There is no dirt on or damage to the optical surface or spatter protection cover (F39-HJ, sold separately) of the F3SJ.
- ☐The test rod is not deformed.
- ☐When the power of the F3SJ is turned ON while nothing is in the detection zone, it operates as follows:
  At auto reset: After the power is turned ON, the power indicator and the ON-state indicator must turn ON within 2 second (2.2 seconds in case of series connection).
  At manual reset: After the power is turned ON, the power indicator and the OFF-state indicator must turn ON within 2 second (2.2 seconds in case of series connection).
- ☐The test rod is detected when it is moved around in the detection zone as shown in the diagram below.
  In other words, when a test rod is inserted into the detection zone, all 5 incident light level indicators turn OFF, and the OFF output indicator turns ON.
  Use the appropriate test rod for the model name to perform inspection.



■ Checking that hazardous parts stop while the machine operates

- ☐The hazardous parts are movable when nothing is in the detection zone.
- ☐The hazardous parts stop immediately when a test rod is inserted into the detection zone at 3 positions: "directly in front of the emitter", "directly in front of the receiver", and "between the emitter and receiver". (Use the appropriate test rod.)
- ☐The hazardous parts remain stopped as long as the test rod is in the detection zone.
- ☐The hazardous parts stop when the power of the F3SJ is turned OFF while nothing is in the detection zone.

6-Month Inspection

■ Items to inspect every 6 months or when machine settings are changed

- ☐The machine itself does not prevent the operation of safety functions such as stopping.
- ☐No modifications or connection changes have been made to the machine that may have an adverse effect on the machine's control system.
- ☐The outputs of the F3SJ and the machine are properly wired.
- ☐The actual response time of the whole machine is equal to or less than the calculated value.
- ☐The total number of times that the control relays/contactors have switched is significantly lower than their design lives.
- ☐The tightening screws for mounting brackets are not loose.
- ☐There is no disturbance light.

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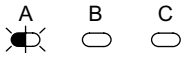
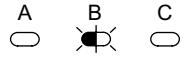
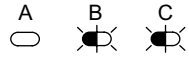
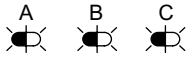
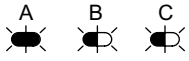
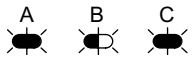
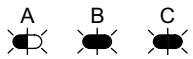
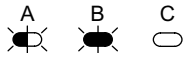
Chapter6 Appendix

Troubleshooting

Lockout State

When a sensor enters lockout, the error mode indicator for the emitter or receiver in which the error occurs turns ON or blinks to indicate the error details.
Solve the problems based on the table below.

Error mode indicator	Description	Cause	Solution
	Interlock wiring error	The reset input line and interlock selection input line are not properly wired.	Check that wiring has been made for auto reset or manual reset.
		The interlock selection input line is broken or short-circuited.	
	External device monitoring error	Relay is welded.	Replace the relay.
		The relay and external device monitoring input line are not properly wired.	Check the wiring for the relay.
		The relay response time exceeds the allowable delay time.	Replace the relay with one that has an appropriate response time.
		If short-circuit is made to an auxiliary output instead of a relay, the auxiliary output line is broken or short-circuited.	Make sure there is no failure in the external device monitoring input and auxiliary output lines.
	Safety output error	The safety output lines are short-circuited to each other.	Wire the output lines properly.
		The safety output line and 24V, 0V, or other input/output line are short-circuited.	
		Failure of safety output circuit.	Replace the receiver.
	Series connection cable error	A series connection cable connector is detached or broken.	Replace the series connection cable.
	Noise or sensor failure	Effect of noise is excessive.	Check the noise level in the surrounding environment.
		Sensor's internal circuit is damaged.	Replace the sensor.
	Model error/ Series connection error	The models of the emitter and receiver in a set are different. (Ex.: Different number of beams)	Connect the appropriate models.
		The number of sensors in series connection does not match. Ex.: Power is turned ON with 2 receivers and 1 emitter)	

Error mode indicator	Description	Cause	Solution
	Power supply capacity error	Power supply voltage is outside the rated range.	Connect to a 24VDC± 20% power supply voltage.
		Voltage fluctuation due to insufficient power supply capacity.	Replace the power supply with one that has a larger capacity.
		Instantaneous break or instantaneous stop due to power sharing with other devices.	Do not share the power supply with other devices, and connect to a power supply that is dedicated to devices for electro-sensitive protective function such as the F3SJ, safety controller, muting sensor, etc.
	Cap error	Cap is not attached.	Attach the cap properly.
		Failure of F3SJ's internal circuit.	Replace the sensor.
	Mutual interference error	Disturbance light is received.	Block the disturbance light.
		The receiver is receiving light emitted from another photoelectric switch or sensor.	
		Light emitted from another F3SJ is being received.	See Chapter 4 "Mutual Interference Prevention".
	Muting wiring error	The muting input 1 and 2, reset input, and test input lines are not wired properly.	Perform the proper wiring.
	Communication error	The communication line is broken or short-circuited with another input/ output line.	Check the wiring of the communication line.
		Communication error due to noise.	Check the noise level in the environment around the communication line.
		Series-connection cable is disconnected.	Check the connector between series-connected sensors.
		Failure of F3SJ's internal circuit.	Replace the sensor.

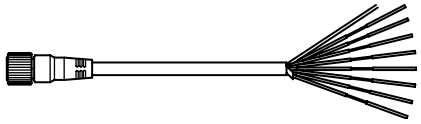
Trouble under other state than lockout

The table below shows how to handle problems in which a sensor doesn't work while interlock indicator and error mode indicator aren't flashing.

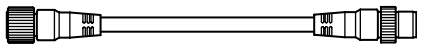
Phenomenon	Cause	Operation
Incident light intensity level indicators aren't turned ON even if the sensor is receiving light.	Communication line is not connected.	Check the communication line and proper wiring.
	Communication line is affected by too much noise.	Check the noise environment around the communication line.

Accessories (Sold Separately)

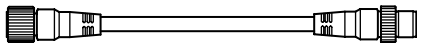
Cable with connector on one end (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JC3A	3m	M12 connector (8-pin) - 8 wires + Shield
	F39-JC7A	7m	
	F39-JC10A	10m	
	F39-JC15A	15m	
	F39-JC20A	20m	

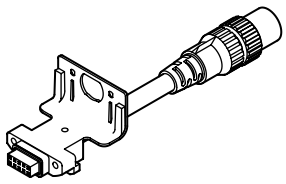
Cable with connectors on both ends: For connection with F3SP-B1P or cable extension (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JCR2B	0.2m	M12 connector (8-pin) - M12 connector (8-pin)
	F39-JCR5B	0.5m	
	F39-JC1B	1m	
	F39-JC3B	3m	
	F39-JC5B	5m	
	F39-JC7B	7m	
	F39-JC10B	10m	
	F39-JC15B	15m	
	F39-JC20B	20m	

Cable with connectors on both ends: For connection with G9SA-300-SC (2 cables per set, for emitter and receiver)

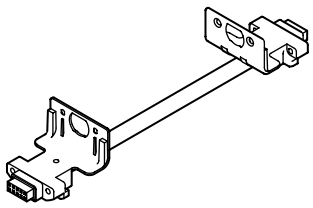
Appearance	Model name	Cable length	Specifications
	F39-JCR2C	0.2m	M12 connector (8-pin) - M12 connector (8-pin)
	F39-JC1C	1m	
	F39-JC3C	3m	
	F39-JC7C	7m	
	F39-JC10C	10m	
	F39-JC15C	15m	

Connection cable (2 cables per set, for emitter and receiver)

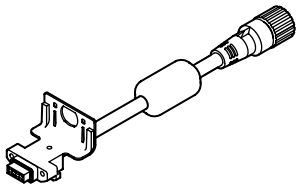
Appearance	Model name	Cable length	Specifications
	F39-JJR3K	0.3m	Cap (10-pin) - M12 connector (8-pin)

* Standard cable included with the F3SJ. Purchase a replacement when damaged or lost.

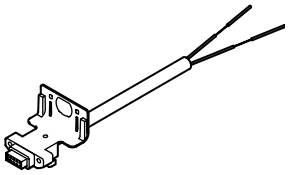
Series connection cable for close contact (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JJR15L	0.15m	Cap (10-pin) - Cap (10-pin)

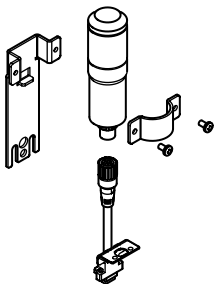
Series connection cable for extension (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JJR3W	0.3m	Cap (10-pin) - M12 connector (8-pin)

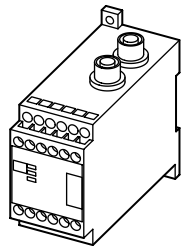
Universal indicator cable

Appearance	Model name	Cable length	Specifications
	F39-JJ3N	3m	Cap (10-pin) - 2 wires

External indicator set

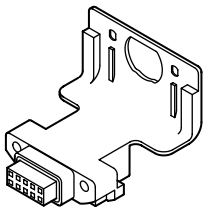
Appearance	Model name	Color	Specifications
	F39-A01PR-PAC	Red	Cap (10-pin) - M12 connector (8-pin) Mounting brackets included Cable length 0.1m
	F39-A01PG-PAC	Green	

Control unit

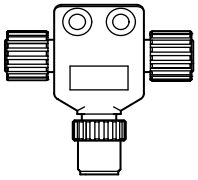
Appearance	Model name	Output
	F3SP-B1P	Relay, 3a+1b

* If the F3SJ is connected to the F3SP-B1P control unit, it cannot be used as a muting system.

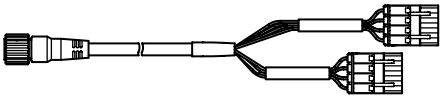
Key cap for muting

Appearance	Model name	Note
	F39-CN6	Case color: Orange Can be used for emitter and receiver

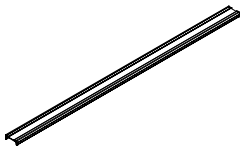
Branch connector for safety light curtains

Appearance	Model name	Note
	F39-CN5	Wire-saving connector for connection with F3SX Use in combination with F39-JC□□T.

Cable with connectors on both ends for use with branch connector

Appearance	Model name	Cable length	Note
	F39-JC1T	1m	Wire-saving cable for connection with F3SX Use in combination with F39-CN5.
	F39-JC3T	3m	
	F39-JC5T	5m	
	F39-JC7T	7m	
	F39-JC10T	10m	
	F39-JC15T	15m	

Spatter protection cover (2 cables per set, common for emitter/receiver)

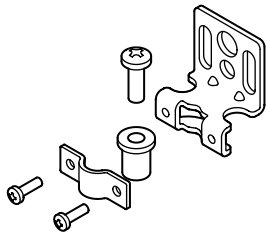
Appearance	Model name *1	Note
	F39-HJ□□□□	To be applied to sensors with protective height up to 1955; F3SJ-A14 series (beam gap of 9mm) F3SJ-A20 series (beam gap of 15mm) F3SJ-A30 series (beam gap of 25mm)
	F39-HJ□□□□-20 *3	To be applied to sensors with protective height of 1970 or more; F3SJ-A20 series (beam gap of 15mm)
	F39-HJ□□□□-30 *3	To be applied to sensors with protective height of 1970 or more; F3SJ-A30 series (beam gap of 25mm)

*1. In this table, the □□□□ in the model name indicates the same 4-digit number as the protective height (□□□□ in the model name) of the F3SJ.

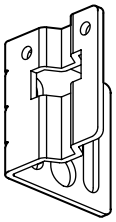
*2. When a spatter protection cover is attached, the operating range of the F3SJ is reduced by about 10%.

*3. Use a combination of 2-divided spatter protection cover.

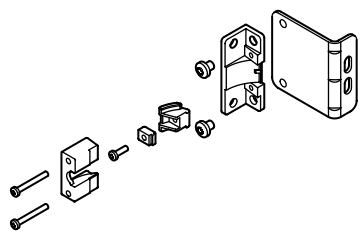
Top/bottom mounting bracket (for top/bottom mounting)

Appearance	Model name	Application	Note
	F39-LJ1	(Standard brackets included with the F3SJ) Purchase replacements when damaged or lost.	2 brackets for emitter, 2 brackets for receiver (4 brackets per set)

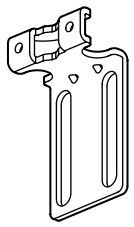
Side flat mounting bracket (4 brackets per set)

Appearance	Model name	Application	Note
	F39-LJ2	Use these small-sized brackets when performing side mounting with top/bottom mounting brackets, so that they do not protrude from the detection surface.	2 brackets for emitter, 2 brackets for receiver (4 brackets per set) (Use in combination with top/bottom mounting brackets)

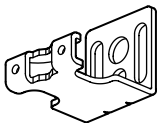
Free-location mounting bracket (also used as standard mounting bracket)

Appearance	Model name	Application	Note
	F39-LJ3	Brackets for mounting in any location without using top/bottom mounting brackets. Side mounting and backside mounting are possible.	2 brackets per set Same as the intermediate mounting brackets included for F3SJ with protective height larger than 595mm.

Top/bottom mounting bracket B

Appearance	Model name	Application	Note
	F39-LJ4	Mounting bracket used when replacing existing area sensors with the F3SJ. Suitable for mounting hole pitch of 18 to 20mm.	2 brackets for emitter, 2 brackets for receiver (4 brackets per set) (Use in combination with top/bottom mounting brackets)

Mounting bracket for F3SN replacement

Appearance	Model name	Application	Note
	F39-LJ5	Mounting bracket used when an F3SN with protective height of 300mm or less is replaced by an F3SJ.	2 brackets for emitter, 2 brackets for receiver (4 brackets per set) (Use in combination with top/bottom mounting brackets)

Glossary

Auto reset	Setting status by which the safety output automatically turns ON when the F3SJ receives light after the power is turned ON and after the F3SJ is blocked.
Auxiliary output 1	Provides an inverted signal of the safety output. This CANNOT be used for safety applications.
Detection capability	Minimum size of an object that can be detected in the protective height of the F3SJ.
Effective aperture angle (EAA)	Range of angles for which the F3SJ can operate.
External device monitoring(EDM)	Function that detects malfunctions, such as welding, in external relays (or contactors) that control the hazardous area of a machine, by monitoring the operation of N.C. contact.
External Indicator Output	Used to turn on muting lamps, etc. This CANNOT be used for safety applications.
External test	Function that stops emission at any time to check that the safety output is being properly turned OFF.
Interlock	Function that holds the safety outputs to OFF until safety is ensured and a reset input is applied.
Key cap for muting	Connector that is attached to the end cap of an emitter or receiver to use muting function.
Lockout	Function that holds safety output OFF when an error is detected by the F3SJ.
Manual reset	Setting status by which the safety outputs is turned ON from the interlock state by applying a reset input while the F3SJ is receiving light.
Muting	Function that temporarily disables the safety function of the F3SJ, keeping the safety output ON even if beams are being blocked.
Muting sensor	Input device, such as photoelectric sensor or proximity sensor, that inputs the timing of the start and end of the muting function.
Override	Function that forcibly turns the safety output ON when the muting function is not working.
Primary sensor	Name of the F3SJ connected nearest the power supply when series-connected.
Reset	Releases the interlock state/lockout state.
Response time from ON to OFF	Time period from when the F3SJ is blocked until the safety output turns from ON to OFF.
Restart interlock	Enters interlock state when the F3SJ is blocked.
Safety output (OSSD)	Outputs +24V when receiving light. Can be used for safety applications.
Secondary sensor	Name used for F3SJ other than the primary sensor, when series-connected.
Start interlock	Enters interlock after power is turned ON.

Related Standards

International Standards

- IEC61496-1 Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests
- IEC61496-2 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices
- IEC61508-1 through -7 Functional safety of electrical/electronic/programmable electronic safety-related systems

European Standards

- EN61496-1 Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests
- prEN61496-2 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices
- EN61508-1 through -7 Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN954-1 Safety of Machinery - Safety-related parts of control systems - Part 1: General principles for design
- EN415-4 Palletisers and depalletisers
- EN692 Mechanical presses
- EN693 Hydraulic presses
- EN1037 Safety of machinery : Preventation of unexpected start-up

U.S. Federal regurations

- OSHA 29 CFR 1910.212 General requirements for all machines
- OSHA 29 CFR 1910.217 Mechanical power presses

U.S. Standards

- ANSI B11.1 Mechanical power presses
- ANSI B11.2 Hydraulic power presses
- ANSI B11.3 Power press brakes
- ANSI B11.4 Metal shears
- ANSI B11.5 Iron workers
- ANSI B11.6 Lathes
- ANSI B11.7 Cold headers and cold formers
- ANSI B11.8 Drilling, milling, and boring machines
- ANSI B11.9 Grinding machines
- ANSI B11.10 Metal sawing machines
- ANSI B11.11 Gear cutting machines
- ANSI B11.12 Roll forming and roll bending machines
- ANSI B11.13 Single- and multiple-spindle automatic bar and chucking machines
- ANSI B11.14 Coil slitting machines/systems
- ANSI B11.15 Pipe, tube, and shape bending machines
- ANSI B11.16 Metal powder compacting presses
- ANSI B11.17 Horizontal hydraulic extrusion presses

- ANSI B11.18 Machines and machinery systems for processing strip, sheet or plate from coiled configuration
- ANSI B11.19 Performance criteria for the design, construction, care, and operation of safeguarding when referenced by the other B11 machine tool safety standards
- ANSI/RIA 15.06 Industrial robots & robot systems safety requirements
- UL1998 Safety-related software
- UL508 Industrial control equipment
- UL61496-1 Electro-sensitive protective equipment - Part 1: General requirements and tests
- UL61496-2 Electro-sensitive protective equipment - Part 2: Particular requirements for active opto-electronic protective devices

Canadian Standards

- CAN/CSA 22.2 No. 14 Industrial control equipment
- CAN/CSA 22.2 No. 0.8 Electronics integrated safety functions
- CSA Z142 Code for power press operation: Health, safety, and guarding requirements
- CSA Z432 Safeguarding of machinery
- CSA Z434 Industrial robots and robot systems : General safety requirements

SEMI Standards

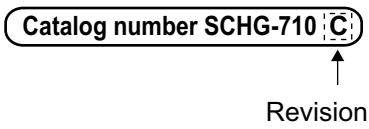
- SEMI S2 Environmental, health, and safety guideline for semiconductor manufacturing equipment

JIS Standards

- JIS B 9704-1 Safety of machinery - Electro-sensitive protective equipment - Part 1 : General requirements and tests
- JIS B 9704-2 Safety of machinery - Electro-sensitive protective equipment - Part 2 : Particular requirements for equipment using active opto-electronic protective devices

Revision History

The revision symbols of the manual are attached to the catalog number in the lower part of the front cover and back cover.



Revision symbol	Revision date	Revisions
A	January, 2005	First edition
A	January, 2005	Minor correction
B	February, 2005	Minor correction
C	February, 2005	Minor correction

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