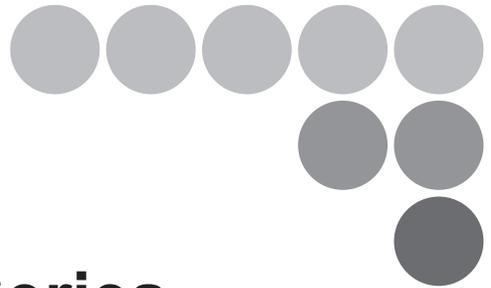


OMRON



Safety Light Curtain

F3SR-430B□□□□ Series

User's Manual



No. SCHG-727F

Original instructions

Introduction

Thank you for purchasing the F3SR-B Series Safety Light Curtain (hereinafter referred to as the "F3SR-B"). This is the instruction Manual describing the use of F3SR-B. Always heed the following points when using the F3SR-B:

- Be sure to have F3SR-B 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 F3SR-B 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. An F3SR-B does not receive type approval provided by Article 44-2 of the Labour Safety and Health Law of Japan. Therefore, the F3SR-B cannot be used as a "safety system for pressing or shearing machines" prescribed in Article 42 of that law.
2. The F3SR-B is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Index Annex V, Item 2.
3. EC Declaration of Conformity
OMRON declares that F3SR-B is in conformity with the requirements of the following EC Directives:
 - Machinery Directive 2006/42/EC
 - EMC Directive 2004/108/EC
4. F3SR-B is in conformity with the following standards:
 - (1) European standards
EN 61496-1 (Type 4 ESPE), CLC/TS 61496-2 (Type 4 AOPD), EN 61508-1 through -3 (SIL 3), EN 61000-6-4
 - (2) International standards
IEC 61496-1 (Type 4 ESPE), IEC 61496-2 (Type 4 AOPD), IEC 61508-1 through -3 (SIL 3), ISO 13849-1:2006 (Category 4, PL e)
 - (3) JIS standards
JIS B 9704-1 (Type 4 ESPE), JIS B 9704-2 (Type 4 AOPD)
 - (4) North American Standards:
UL 61496-1 (Type 4 ESPE), UL 61496-2 (Type 4 AOPD), UL 508, UL 1998, CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8
5. The F3SR-B received the approvals of EC Type-Examination in accordance with the EU Machinery Directive, Type 4 ESPE and Type 4 AOPD from the EU accredited body, TÜV SÜD Product Service GmbH.
6. The F3SR-B received the certificates of UL listing for US and Canadian safety standards from the Third Party Assessment Body UL, Type 4 ESPE and Type 4 AOPD.
7. The F3SR-B is designed according to the standards listed below. To make sure that the final system complies with the following standards and regulations, you are asked to design and use it in accordance with all other related standards, laws, and regulations. If you have any questions, consult with specialized organizations such as the body responsible for prescribing and/or enforcing machinery safety regulations in the location where the equipment is to be used.
 - European Standards: EN 415-4, EN 692, EN 693
 - 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.0731001 dated July 31, 2007.

* For date of effect for these standards, see Related Standards.



Related Standards p.64

Terms and Conditions Agreement

Read and understand this catalog.

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

Warranties.

- (a) Exclusive Warranty. Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.
- (b) Limitations. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

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Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

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Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases. NEVER USE THE PRODUCT 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(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products.

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Performance Data.

Data presented in Omron Company websites, catalogs and other materials 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 user must correlate it to actual application requirements. Actual performance is subject to the Omron's 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 part 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 part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions.

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Precautions on Safety

Regarding the alert symbols and meanings used for the safe uses

In order to use the F3SR-B safely, the precautions listed in this manual indicated by alert symbols and descriptions must be followed. Failure to follow all precautions and alerts may result in an unsafe use or operation.

The following indications 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.

Meanings of Alert Symbols

	Indicates prohibited actions.
	Indicates mandatory actions.
	Indicates the risk of electric shock.

Alert Statements in this Manual

For users



WARNING

The F3SR-B 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.



For installation

WARNING

Make sure to test the operation of the F3SR-B after installation to verify that the F3SR-B 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 install the F3SR-B at the safe distance from the hazardous part of the equipment. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.



Install a protective structure so that the hazardous part of a machine can only be reached by a person that passes through the sensor's detection zone. Install the sensors so that part of the person is always present in the detection zone when working in a machine's hazardous zones. If a person is able step into the hazardous zone of a machine and remain behind the F3SR-B's detection zone, configure the system with an interlock function that prevents the machine from being restarted. Failure to do so may result in serious injury.



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



The F3SR-B cannot protect a person from a projectile exiting the hazardous zone. Install protective cover(s) or fence(s).



Install the sensor system so that it is not affected by the reflective surface of the F3SR-B.



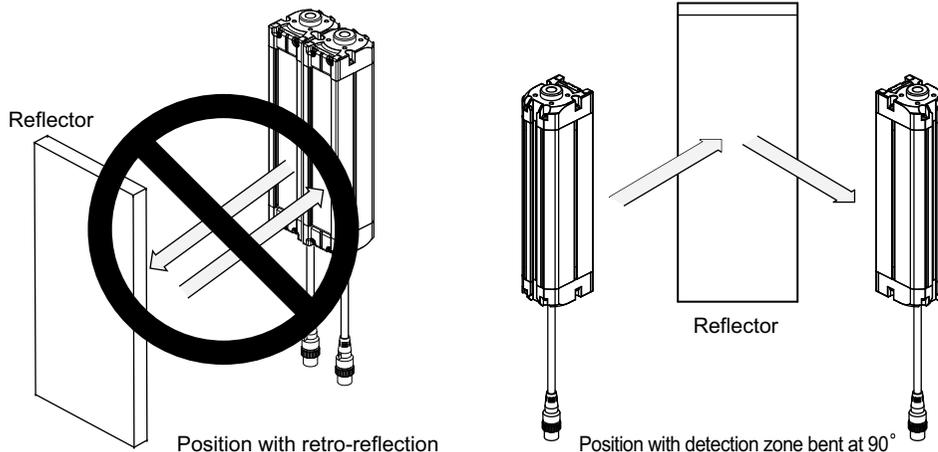
When using more than 1 set of F3SR-B, install them so that mutual interference does not occur, such as by configuring series connections or using physical barriers between adjacent sets.



Make sure that the F3SR-B is securely mounted and its cables and connectors are properly secured.



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.



Perform an inspection for all F3SR-B as described in "Chapter 5 Checklists".



For wiring

WARNING

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



Do not short-circuit the output line to the +24 V line. Otherwise, the output is always ON. Also, the 0 V 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 F3SR-B to a DC power supply of more than 24 V DC + 20 %. Also, do not connect to an AC power supply. Failure to do so may result in electric shock or breakdown of the device.



For the F3SR-B 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 (24 V DC \pm 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 20 ms or longer
- Must satisfy output characteristic requirements for class 2 circuit or limited voltage current circuit defined by UL 508. Refer to p.46 for details.
- Must comply with laws and regulations, regarding EMC and electrical equipment safety, of the country or region where the F3SR-B is used (e.g., 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.



Others

WARNING

To use the F3SR-B in PSDI mode (Reinitiation of cyclic operation by the protective equipment), you must configure an appropriate circuit between the F3SR-B and the machine. For details about PSDI, refer to OSHA 1910.217, IEC 61496-1, and other relevant standards and regulations.



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



Do not use the F3SR-B in environments where flammable or explosive gases are present. Doing so may result in explosion.



Perform daily and 6-month inspections for the F3SR-B. 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 F3SR-B 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
- This is a class A product. In residential areas it may cause radio interference, in which case the Responsible Person may be required to take adequate measures to reduce interference.
- In environments where foreign material such as spatter adheres to the F3SR-B, attach a cover to protect the F3SR-B from the spatter.
- Do not use radio equipment such as cellular phones, walkie-talkies, or transceivers near the F3SR-B.
- F3SR-B can be used at altitudes up to 2,000 meters.

■ Wiring and installation

- Make sure to perform wiring while the power supply is OFF. Otherwise, the F3SR-B may fail to operate due to the diagnosis function.
- Do not short-circuit output lines to +24 V line. Otherwise a fault of F3SR-B may occur.

- When extending the communication line with a cable (twisted-pair wire) other than the dedicated cable (F39-JD□□), use a cable with the same or superior specifications. Connect the shield to the 0V line.



Cable specification (extension cable) p.6

- When replacing the cable connectors with other types of connectors, use connectors that provide a protection grade of IP65, IP67 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 seconds or more in case of series connection) after turning ON the power of the F3SR-B.
- Be sure to route the F3SR-B 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.
- If the protective height is 1000 mm or more, use intermediate brackets of specified quantities and locations according to the dimensions.
If the brackets described above are not used, ratings and performance cannot be met.

■ 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 F3SR-B cannot detect transparent and/or translucent objects.



Contents

Legislation and Standards	i
Terms and Conditions Agreement	iii
Precautions on Safety	v
Precautions for Safe Use	ix
Precautions for Correct Use	ix
Chapter 1 Overview and Specifications	1
Basic Configuration and Names	1
Features	2
Easy Beam Alignment	2
Immediate Check on Error Cause with LED Indicators	2
Compliance to IP65 and IP67	2
Additional Safety Functions	2
Enhanced Mutual Interference Prevention	2
Long Range Detection	2
Robust Body	2
Indicator Display Patterns	3
Ratings/Specifications	5
List of Model Name/Current Consumption	7
Chapter 2 System Configuration and Functions	8
Wiring Diagrams	8
Interlock Function	9
External Test Function	10
Self-Test Function	10
Lockout Reset Function	12
External Device Monitoring Function	12
Operating Range Select Function	13
Availability of Functions Based on Input Line Status	14
Chapter 3 Wiring/Installation	15
Installation Conditions	15
Detection Zone and Approach	15
Safety Distance	16
Distance from Reflective Surfaces	19
Mutual Interference Prevention	20
Dimensions	22

When Using Top/Bottom Mounting Brackets	22
When Using Free-location Mounting Brackets	26
Mounting a Spatter Protection Cover	30
Mounting	31
Part Configuration of F39-LR1 Top/Bottom Mounting Brackets	31
Part Configuration of F39-LR2 Intermediate Mounting Brackets	31
Part Configuration of F39-LR3 Free-location Mounting Brackets	32
The number of brackets required	33
Mounting Procedure	33
Wiring	45
Wiring Precautions	45
Power Supply Unit	46
Wiring Procedure	46
Chapter 4 Input/Output Circuit and Applications	50
Input/Output Circuit	50
Wiring Examples	51
Using only F3SR-B	51
Connecting to a controller F3SP-B1P	52
Chapter 5 Checklists	53
Pre-Operation Checklists	53
Checklists	53
Maintenance Checklists	55
Checklists	55
Chapter 6 Appendix	57
Troubleshooting	57
Lockout State	57
Troubleshooting	58
Accessories (Sold Separately)	61
Related Standards	64
International Standards	64
European Standards	64
U.S. Federal Regulations	64
U.S. Standards	65
Canadian Standards	65
SEMI Standards	66
JIS Standards	66

Features

■ Easy Beam Alignment

Top/bottom-beam incident light state can be checked with the white LED TOP/BTM indicators. These indicators provide easy alignment.

In addition, stable-beam incident light level can be checked with the stable-state indicators (STB).



Indicator Display Patterns p.3

■ Immediate Check on Error Cause with LED Indicators

When an error occurs, an LED indicator according to an error cause blinks so that the user can immediately check the content of the error.



Indicator Display Patterns p.4

■ Compliance to IP65 and IP67

F3SR-B complies with IP65 and IP67 degree of protection.

· IP65

Dust-protected. Water splashed against the enclosure from any direction for one minute per one squaremeter and for at least three minutes in total shall have no harmful effects.

· IP67

Dust-protected. Submerged one meter underwater for 30 minutes shall have no harmful effects.

■ Additional Safety Functions

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

■ Enhanced Mutual Interference Prevention

The interference light detection and cycle shift algorithm prevents mutual interference in up to 3 sets.

■ Long Range Detection

A 20 m long range detection allows a wide variety of applications.

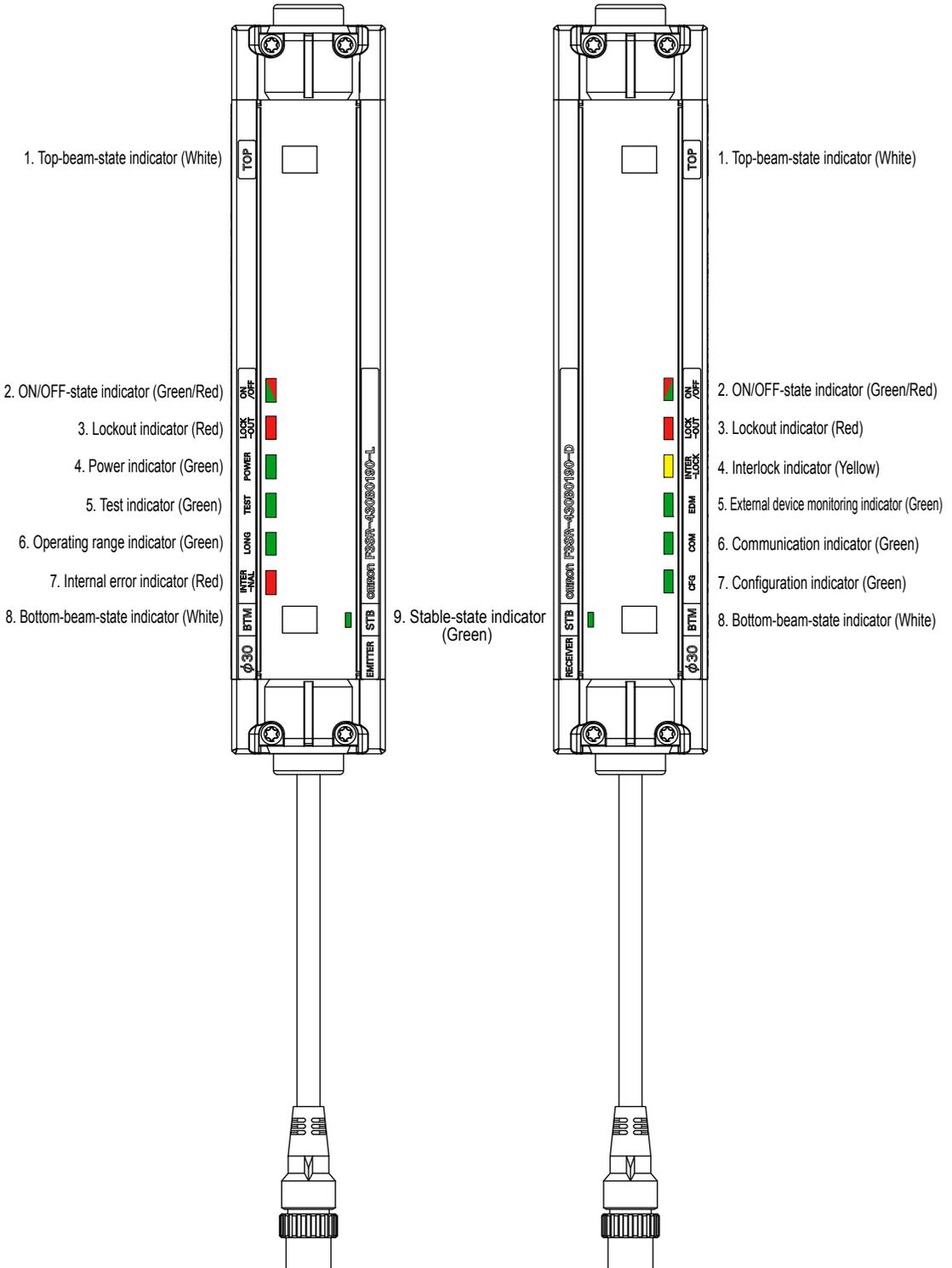
■ Robust Body

The F3SR has robust body resistant to harsh environments.

Indicator Display Patterns

Emitter

Receiver



Emitter

No.	Indicators	Labels	ON	Blinking
1	Top-beam-state indicator	TOP	Turns ON when the top beam is receiving light.	--
2	ON/OFF-state indicator	ON/OFF	Green indicator turns ON when safety output is ON. Red indicator turns ON when safety output is OFF.	Red indicator blinks when the F3SR-B enters a lockout due to a safety output error.
3	Lockout indicator	LOCK OUT	Turns ON when the F3SR-B enters lockout due to an error on the receiver.	Blinks when the F3SR-B enters lockout due to an error on the emitter.
4	Power indicator	POWER	Turns ON while the emitter is ON.	Blinks when the F3SR-B enters lockout due to power voltage/noise.
5	Test indicator	TEST	Turns ON while light emission stops.	--
6	Operating range indicator	LONG	Turns ON when operating mode of operating range is LONG by the operating range select input.	Blinks when the F3SR-B enters lockout due to an operating range select input error.
7	Internal error indicator	INTERNAL	--	Blinks when the F3SR-B enters lockout due to an internal error.
8	Bottom-beam-state indicator	BTM	Turns ON when the bottom beam is receiving light.	--
9	Stable-state indicator	STB	This indicator turns on when the unit is in a stable operation (when each receiver beam is detecting at least 170% of the ON-threshold light level). We recommend using the indicator for installing the unit to ensure stable operation.	Blinks when safety output turns OFF due to ambient light or vibration.

Receiver

No	Indicators	Labels	ON	Blinking
1	Top-beam-state indicator	TOP	Turns ON when the top beam is receiving light.	--
2	ON/OFF-state indicator	ON/OFF	Green indicator turns ON when safety output is ON. Red indicator turns ON when safety output is OFF.	Red indicator blinks when the F3SR-B enters a lockout due to a safety output error.
3	Lockout indicator	LOCK OUT	Turns ON when the F3SR-B enters lockout due to an error on the emitter.	Blinks when the F3SR-B enters lockout due to an error on the receiver.
4	Interlock indicator	INTERLOCK	Turns ON when the receiver enters interlock.	Blinks when the F3SR-B enters lockout due to a wiring error of reset, function select, or external device monitoring inputs.
5	External device monitoring indicator	EDM	Turns ON when an input is given to external device monitoring input.	Blinks when the F3SR-B enters lockout due to an external device monitoring error.
6	Communication indicator	COM	Turns ON when communication between emitter and receiver is established.	Blinks when the F3SR-B enters lockout due to a communication error between receiver and emitter.
7	Configuration indicator	CFG	--	Blinks when the emitter enters lockout due to a model difference error between emitter and receiver.
8	Bottom-beam-state indicator	BTM	Turns ON when the bottom beam is receiving light.	--
9	Stable-state indicator	STB	This indicator turns on when the unit is in a stable operation (when each receiver beam is detecting at least 170% of the ON-threshold light level). We recommend using the indicator for installing the unit to ensure stable operation.	Blinks when safety output turns OFF due to ambient light or vibration.

Ratings/Specifications

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

	F3SR-430B□□□□
Detection capability	Opaque objects
	Diameter 30 mm
Beam gap	20 mm
Number of beams	8 to 112
Protective height	190 to 2270 mm
Lens diameter	7 mm x 12 mm
Operating range	5 to 20 m (for long wiring), 0.3 to 7 m (for short wiring)
Response time	ON to OFF: 15 ms max, OFF to ON: 60 ms max.
Startup waiting time	2 s max.
Power supply voltage (Vs)	SELV/PELV 24 VDC±20% (ripple p-p 10% max.)
Current consumption (no load)	 List of Model Name/Current Consumption p.7
Light source	Infrared LED (870 nm wavelength)
Effective aperture angle (EAA)	Within ±2.5° for both emitter and receiver at operating range 3 meters or more per IEC 61496-2.
Safety output (OSSD)	Two PNP transistor outputs, Load current: 500 mA max., Residual voltage: 2 V max. (except for voltage drop due to cable extension), Leakage current 1 mA max., load inductance 2.2H max *1 Maximum capacitive load differs according to the total cable length as shown below. *2 100 m max: 0.05μF max, 70 m max: 0.5μF max, 50 m max: 1.0μF max
Output operation mode	Safety outputs are ON when the beams are clear.
Input voltage	Test input, reset input, external device monitoring input, and function select input: ON voltage: 11 to 24 V OFF voltage: 0 to 5 V , or open Operating range select input: ON voltage: 11 to 24 V OFF voltage: 0 to 5 V
Input current	Test input, reset input, function select input: 1.5 to 3 mA Operating range select input: 1.5 to 4 mA External device monitoring input: 10 to 20 mA
Indicator	 Indicator Display Patterns p.3
Mutual interference prevention function	Interference light detection and cycle shift algorithm prevents mutual interference in up to 3 sets.
Test functions	- Self test (after power ON, and during operation) - External test (light emission stop function by test input)

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

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

	F3SR-430B□□□□
Safety-related functions	- External device monitoring - Start interlock, restart interlock
Wiring connections	M12 connectors, 8-pin
Protection circuit	Output short-circuit protection, and power supply reverse polarity protection
Ambient temperature	During operation: -10 to 55°C (non-freezing), During storage: -25 to 70°C
Ambient humidity	During operation: 35 to 85%RH (non-condensing), During storage: 35 to 95%RH
Operating ambient light intensity	Incandescent lamp: 3,000 lx max. on receiving surface. Sunlight: 10,000 lx max. on receiving surface.
Insulation resistance	20 MΩ or higher (500 VDC)
Withstand voltage	1,000 VAC, 50/60 Hz, 1 min
Degree of protection	IP65 and IP67 (IEC 60529)
Vibration resistance	Malfunction: 10 to 55 Hz, Multiple amplitude of 0.7 mm, 20 sweeps in X, Y, and Z directions
Shock resistance	Malfunction: 100 m/s ² , 1,000 times each in X, Y, and Z directions
Pollution degree	Pollution degree 3
Connection cable	Dia. 6 mm, minimum bend radius of 5 mm
Extension cable	Dia. 6.6 mm, 8-wire (0.3 mm ² : 4 pairs, conductor resistance 0.058 Ω /m), with braided shield, minimum bend radius: 36 mm  For details about twisted pair wires (single-ended cable) p.47, (double-ended cable)p.48  For details about total extension cable length p.48
Material	Casing: Aluminum, zinc die-cast Optical cover: PMMA resin (acrylic), Cable: Oil resistant PVC
Weight	Model: F3SR-430B□□□□ (The □□□□ contain the 4-digit number indicating the protective height (mm).) Formula: Weight (g) = (protective height) x 4 + α The values for α are as follows: When protective height is 190 mm, α=1100 When protective height is between 270 and 510 mm, α=1500 When protective height is between 590 and 1070 mm, α=2000 When protective height is between 1150 and 2270 mm, α=2500
Accessories	Users Manual
Applicable standards	 Legislation and Standards p.i
Safety-related characteristic data (EN 61508:2010)	See http://www.fa.omron.co.jp/safety_6en/

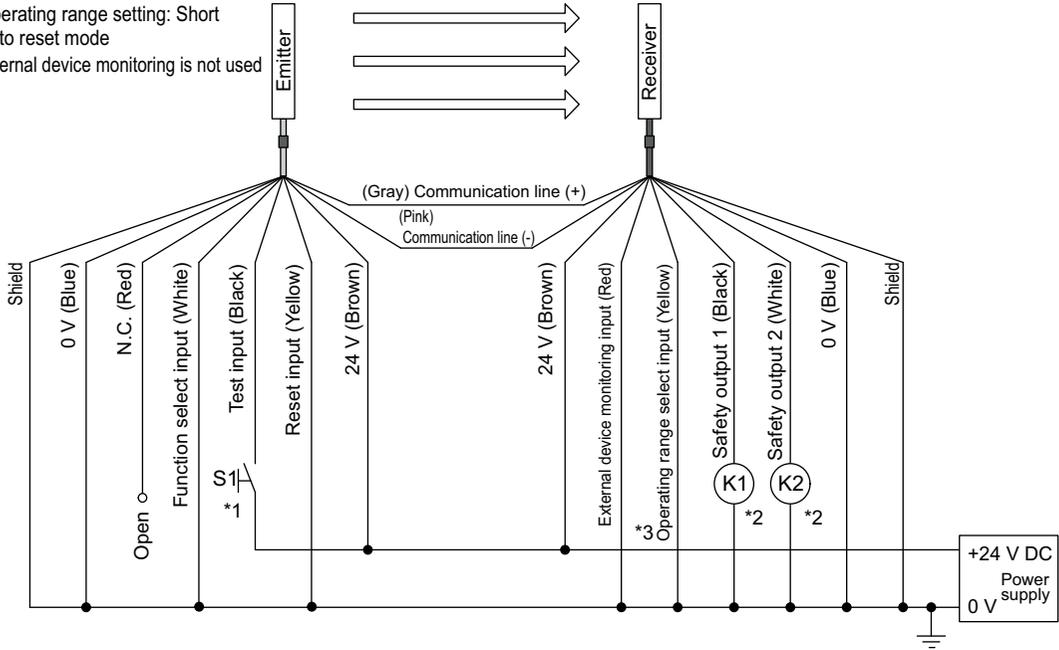
List of Model Name/Current Consumption

Model	Number of beams	Protective height [mm]	Current consumption			
			Emitter		Receiver (no load)	
			Operating range setting: Short	Operating range setting: Long	Operating range setting: Short	Operating range setting: Long
F3SR-430B0190	8	190	38 mA	44 mA	57 mA	64 mA
F3SR-430B0270	12	270	40 mA	47 mA	59 mA	66 mA
F3SR-430B0350	16	350	42 mA	50 mA	60 mA	67 mA
F3SR-430B0430	20	430	43 mA	53 mA	62 mA	69 mA
F3SR-430B0510	24	510	45 mA	57 mA	63 mA	70 mA
F3SR-430B0590	28	590	47 mA	60 mA	65 mA	72 mA
F3SR-430B0670	32	670	48 mA	63 mA	66 mA	73 mA
F3SR-430B0750	36	750	50 mA	66 mA	68 mA	75 mA
F3SR-430B0830	40	830	52 mA	69 mA	69 mA	76 mA
F3SR-430B0910	44	910	53 mA	73 mA	71 mA	78 mA
F3SR-430B0990	48	990	55 mA	76 mA	72 mA	79 mA
F3SR-430B1150	56	1150	58 mA	82 mA	75 mA	82 mA
F3SR-430B1310	64	1310	61 mA	89 mA	78 mA	85 mA
F3SR-430B1470	72	1470	65 mA	95 mA	81 mA	88 mA
F3SR-430B1630	80	1630	68 mA	102 mA	84 mA	91 mA
F3SR-430B1790	88	1790	71 mA	108 mA	87 mA	94 mA
F3SR-430B1950	96	1950	74 mA	114 mA	91 mA	98 mA
F3SR-430B2110	104	2110	78 mA	121 mA	94 mA	101 mA
F3SR-430B2270	112	2270	81 mA	127 mA	97 mA	104 mA

Chapter 2 System Configuration and Functions

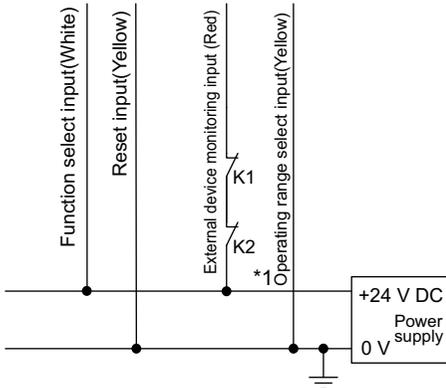
Wiring Diagrams

- Operating range setting: Short
- Auto reset mode
- External device monitoring is not used

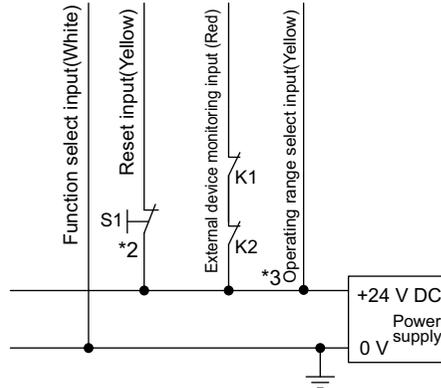


- S1 : External test / lockout reset switch (connect to 0V if a switch is not required)
 K1, K2 : Relay or other device that controls hazardous parts of the machine
 *1 Use a switch for micro loads (Input specifications: 24 V, 2.5 mA).
 *2 F3SR-B can operate even if K1 and K2 are not connected.
 *3 To change the operating range setting to Long, connect the operating range select input line to 24 V.

- Operating range setting: Short
- Auto reset mode
- External device monitoring is used



- Operating range setting: Long
- Manual reset mode
- External device monitoring is used



- K1, K2: Relay or other device that controls hazardous parts of the machine
 S1 : Interlock reset switch
 *1 To change the operating range setting to Long, connect the operating range select input line to 24 V.
 *2 Use a switch for micro loads (Input specifications: 24 V, 2.5 mA).
 *3 To change the operating range setting to Short, connect the operating range select input line to 0 V.

Interlock Function

The F3SR-B turns the safety output OFF when its power is turned ON or its beam is blocked, 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 and manual reset.

Auto Reset

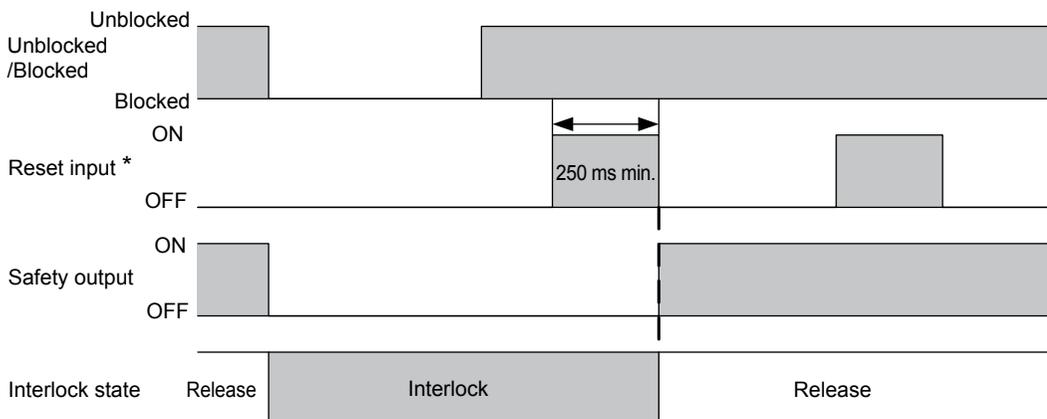
When the blocking object is removed from the detection zone, the safety outputs automatically turn ON. Auto reset is convenient when applying an interlock with another device within the same system.



Wiring for auto reset mode p.8

Manual Reset

Even when an blocking object has been removed in a detection zone, the safety outputs keep OFF state until the reset signal is input. This allows the machine to be manually reset using a reset switch after ensuring safety, preventing unexpected startup (EN 1037).



* Reset input: ON = 0 V or open, OFF = 24 V

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.
- F3SR-B is blocked (restart interlock). After the F3SR-B is blocked and the machine stops, the machine can be restarted after safety is ensured.



Wiring for manual reset mode p.8

The procedure for manual reset is shown below.

1. Short-circuit the reset input line (Yellow) to 24 V.
2. Open the reset input line (Yellow), or short-circuit it to 0 V. (250 ms or longer)
3. Short-circuit the reset input line (Yellow) to 24 V.



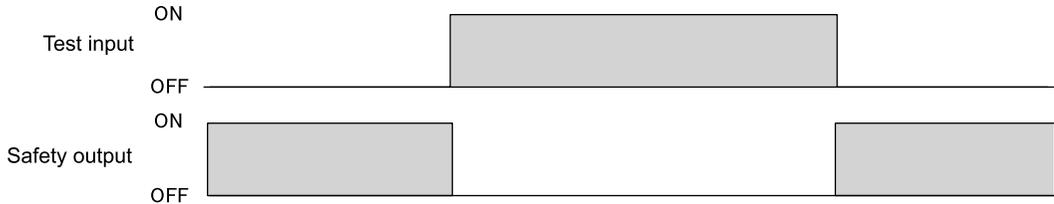
CHECK!

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

External Test Function

This function stops emission by test input. It creates a state in which the F3SR-B is blocked using external signals so that whether or not the safety system stops properly can be verified.

To stop the emission, apply voltage of 24 V to the emitter's test input line.

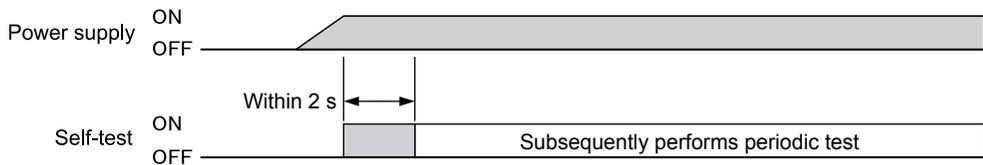


Status of Indicators When External Test Function is Performed

Test indicator turns ON when voltage is applied to the test input.

Self-Test Function

The F3SR-B performs the self-test when power is turned ON (within 2 seconds) 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 F3SR-B enters lockout state, keeps the safety outputs in the OFF state, and indicates the error at the same time.

Self-Test Details

The self-test detects the types of errors described below.

Emitter

- Failure of emitter element or circuit
- MPU failure
- Broken or short-circuited cable

Receiver

- Abnormal external power supply voltage
- Failure of internal power supply circuit
- Failure of receiver element or detection circuit
- MPU failure
- Memory failure

- Ambient light
- Failure of safety output circuit
- Broken or short-circuited cable



Error indication patterns and causes of errors p.57



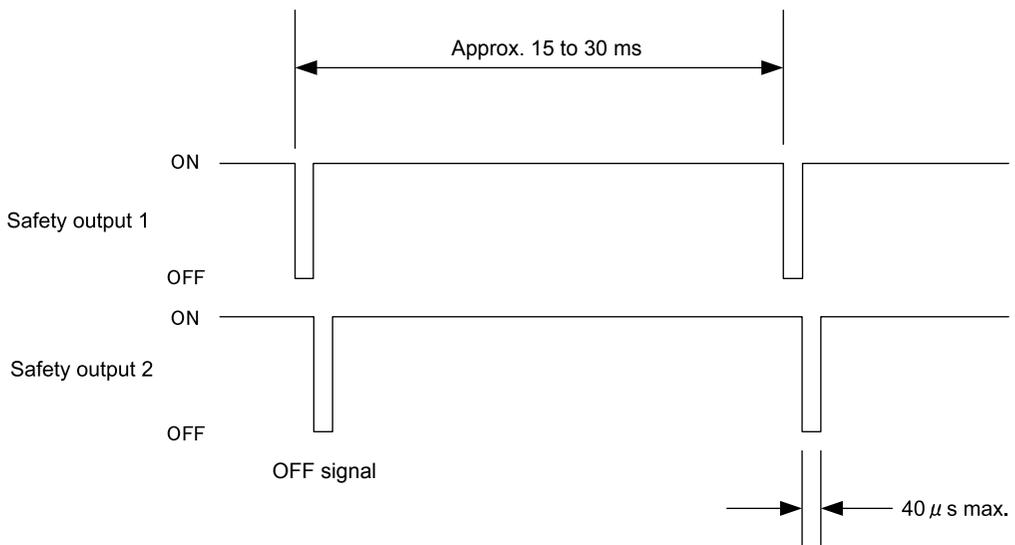
How to reset lockout: See p.12



For information about lockout, see p.57

■ Waveform of Safety Outputs

When the F3SR-B is in the beam-clear state, 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 the output circuit or wiring as a failure, and it enters lockout state. (See the table below.)



Lockout Reset Function

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

- Cycle the power back ON
- Lockout reset by test input

Lockout can be reset by the test input when the sensor is in lockout state.

The procedure for lockout reset is shown below.

1. Open the test input line (Black), or short-circuit it to 0 V. (1 s or longer)
2. Short-circuit the test input line (Black) to 24 V. (1 s or longer)
3. Open the test input line (Black), or short-circuit it to 0 V.

External Device Monitoring Function

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

This function constantly monitors feedback signals from a relay, which are input to the receiver's external device monitoring input line, and brings the F3SR-B into a lockout state when an error occurs. The relay's operational delay can be up to 0.3 s without being evaluated as an error.

For example, if the signal from the relay does not change within 0.3 s after the safety outputs turn from ON to OFF and, 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 24 V is applied to the external device monitoring line via the external relay's normally closed (N.C.) contact.

For wiring when using or not using external device monitoring, see wiring diagram on page 8 to select "used" or "not used" of the function.

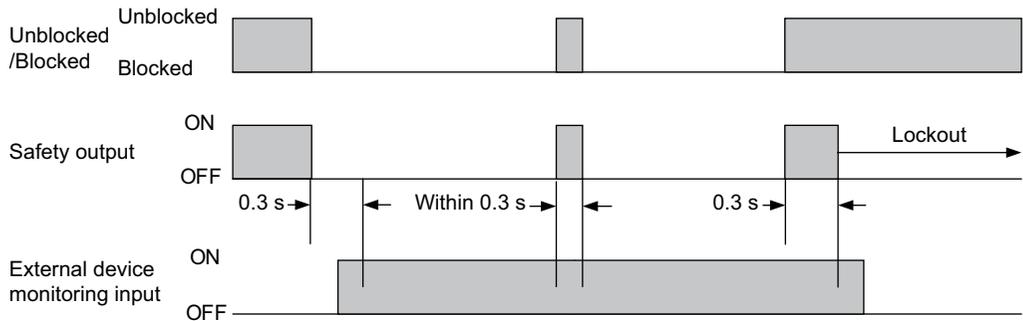


Wiring when external device monitoring function is used or not used p.8

Timing Chart

The F3SR-B checks the status of the external device monitoring input 0.5 s or later after the power of the F3SR-B is turned ON. If the status of the safety outputs is switched again within 0.3 s as the following timing chart, the F3SR-B will not enter the lockout state even if the status of the external device monitoring input does not change.

When the external device monitoring input does not change within 0.3 s after the safety outputs turn from ON to OFF or OFF to ON, it is evaluated as an error and the F3SR-B enters lockout.



■ Status of Indicators When External Device Monitoring Function is Performed

When an input is applied to the external device monitoring input, the receiver's external device monitoring indicator (EDM) turns ON.

■ Operating Range Select Function

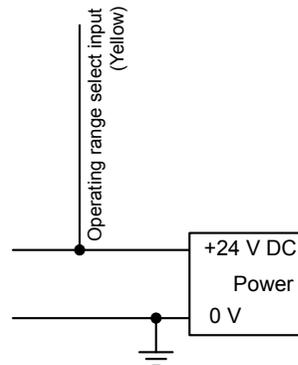
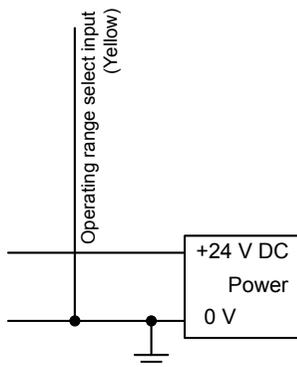
This function allows you to select operating range by wiring at startup.

The F3SR-B enters lockout when wiring at startup is open or wiring is switched during operation.

Operating range can be selected from Short (0.3 to 7 m) or Long (5 to 20 m).

Short: Operating ranges 0.3 to 7 m

Long: Operating ranges 5 to 20 m



- Be sure to connect the operating range select input line to either 24 V or 0 V according to the range used. When the line is not connected to 24 V or 0 V, it will result in a wiring error and the F3SR-B enters a lockout state.

- When you use the operating range of 0.3 to 5m, make sure to connect the operating range select input line to a 0V with the Short setting.

When you use the operating range of 5 to 7m, we recommend that you connect the operating range select input line to a 0V with the Short setting.

■ Availability of Functions Based on Input Line Status

The F3SR-B determines operation mode of the external device monitoring and interlock functions (manual reset and auto reset) based on the wiring status of the three input lines at startup (reset input/external device monitoring input/function select input). Any combinations other than the table below will result in wiring errors leading to lockout state.

■ Using the F3SR-B with external device monitoring disabled and auto reset

Input line	Wiring status
Reset input	0 V or open
External device monitoring input	
Function select input	

■ Using the F3SR-B with external device monitoring enabled and auto reset

Input line	Wiring status
Reset input	0 V or open
External device monitoring input	24 V *1
Function select input	24 V

■ Using the F3SR-B with external device monitoring enabled and manual reset

Input line	Wiring status
Reset input	24 V
External device monitoring input	24 V *1
Function select input	0 V or open

*1 Apply voltage of 24 V via normally closed (N.C.) contact of the external relay (or contactor) that controls hazardous parts of machines.

Chapter 3 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 zones.



If a person is able to step into the hazardous zone of a machine and remain behind the F3SR-B'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 F3SR-B in PSDI mode (Reinitiation of cyclic operation by the protective equipment), you must configure an appropriate circuit between the F3SR-B and the machine. For details about PSDI, refer to OSHA 1910.217, IEC 61496-1, and other relevant standards and regulations.



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



Do not use the F3SR-B in environments where flammable or explosive gases are present. Doing so may cause an explosion.



The F3SR-B cannot protect a person from an object flying from a hazardous zone. Install protective cover(s) or fence(s).

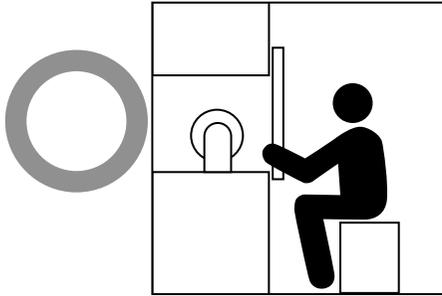


Make sure that the F3SR-B is securely mounted and its cables and connectors are properly connected.

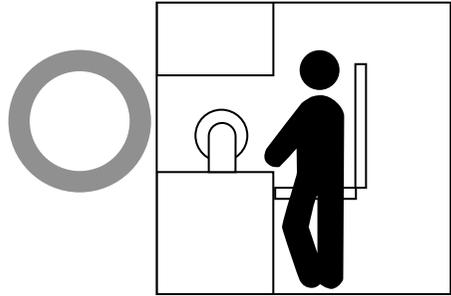


Correct installation

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

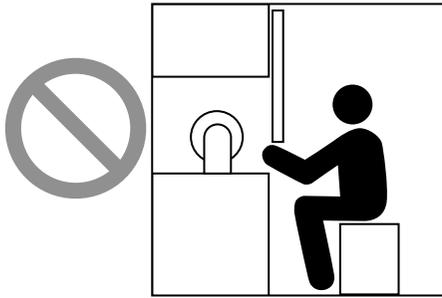


While working, a person is inside the sensor's detection zone.

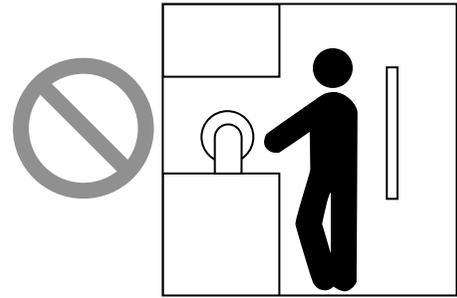


Incorrect installation

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



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



Safety Distance

The safety distance is the minimum distance that must be set between the F3SR-B 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. Always refer to the relevant standards and specifications.

WARNING

Make sure to secure the safety distance (S) between the F3SR-B and the hazardous part. Otherwise, the machine may not stop before a person reaches the hazardous part, resulting in serious injury.



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

■ How to calculate the safety distance specified by International Standard ISO 13855 (European standard EN 999) (Reference)

In case of perpendicular approach of a human body to F3SR-B's detection zone

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

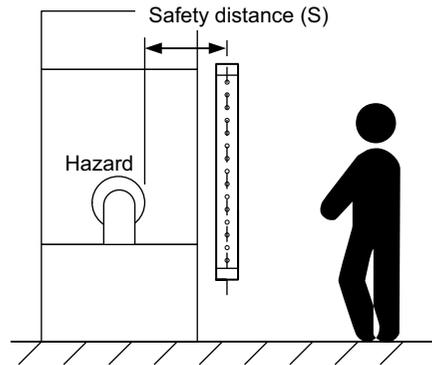
- S: Safety distance
- K: Approach speed to the detection zone
- T: Total response time of the machine and F3SR-B
- C: Additional distance calculated by the detection capability of the F3SR-B

<System that has detection capability of 30 mm or less>

Use $K = 2,000 \text{ mm/s}$ and $C = 8 \times (d - 14 \text{ mm})$ in formula (1) for the calculation.

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

- S = Safety distance (mm)
- T_m = Machine's response time (s)
- T_s = Response time of the F3SR-B from ON to OFF (s)
- d = Detection capability of the F3SR-B (mm)



[Calculation example]

When $T_m = 0.05 \text{ s}$, $T_s = 0.015 \text{ s}$, and $d = 30 \text{ mm}$:

$S = 2,000 \text{ mm/s} \times (0.05 \text{ s} + 0.015 \text{ s}) + 8 \times (30 \text{ mm} - 14 \text{ mm})$
 $= 258 \text{ mm}$

If the result $< 100 \text{ mm}$, use $S = 100 \text{ mm}$.

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

$S = 1,600 \text{ mm/s} \times (T_m + T_s) + 8 \times (d - 14 \text{ mm})$. . . formula (2)

If the result of this formula (2) $< 500 \text{ mm}$, use $S = 500 \text{ mm}$.

In case of horizontal approach of a human body to F3SR-B's detection zone

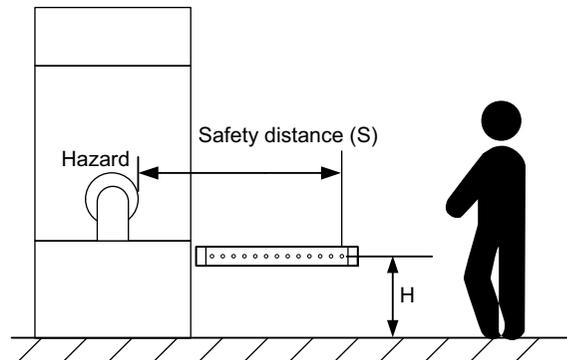
Use $K = 1,600 \text{ mm/s}$ and $C = (1200 - 0.4 \times H)$ in formula (1) for calculation. Note that C must not be less than 850 mm.

$$S = 1,600 \text{ mm/s} \times (T_m + T_s) + 1200 - 0.4 \times H$$

- S = Safety distance (mm)
- T_m = Machine's response time (s)
- T_s = Response time of F3SR-B from ON to OFF (s)
- H = Installation height (mm)

Note that H must satisfy:

$$1000 \geq H \geq 15 \text{ (d - 50 mm)}$$



Also, you must include a hazardous condition under which a person may go through under a detection zone carelessly if the installation height exceeds 300 mm (200 mm for other purpose than industrial use) into risk assessment.

[Calculation example]

When $T_m = 0.05 \text{ s}$, $T_s = 0.015 \text{ s}$, $d = 30 \text{ mm}$, and $H = 500 \text{ mm}$:

$$\begin{aligned} S &= 1,600 \text{ mm/s} \times (0.05 \text{ s} + 0.015 \text{ s}) + 1200 - 0.4 \times 500 \text{ mm} \\ &= 1104 \text{ mm} \end{aligned}$$

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

If a person approaches the detection zone of the F3SR-B perpendicularly, calculate the safety distance as shown below.

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

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

Approach speed K is not specified in the ANSI B.11.19 standard. To determine the value of K to apply, consider all factors, including the operator's physical ability.

- T_s = Machine's stopping time (s)
- T_r = Response time of the F3SR-B from ON to OFF (s)
- T_c = Machine control circuit's maximum response time required to activate its brake (s)
- T_{bm} = Additional time (s)

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

• Dpf = Additional distance

According to ANSI's formula, Dpf is calculated as shown below:

$D_{pf} = 3.4 \times (d - 7.0)$: Where d is the detection capability of the F3SR-B (unit: mm)

[Calculation example]

When $K = 1,600 \text{ mm/s}$, $T_s + T_c = 0.06 \text{ s}$, brake monitor setting time = 0.1 s ,

$T_r = 0.015 \text{ s}$, and $d = 30 \text{ mm}$:

$T_{bm} = 0.1 - 0.06 = 0.04 \text{ s}$

$D_{pf} = 3.4 \times (30 - 7.0) = 78.2 \text{ mm}$

$S = 1,600 \text{ mm/s} \times (0.06 \text{ s} + 0.015 \text{ s} + 0.04 \text{ s}) + 78.2 \text{ mm} = 262.2 \text{ mm}$

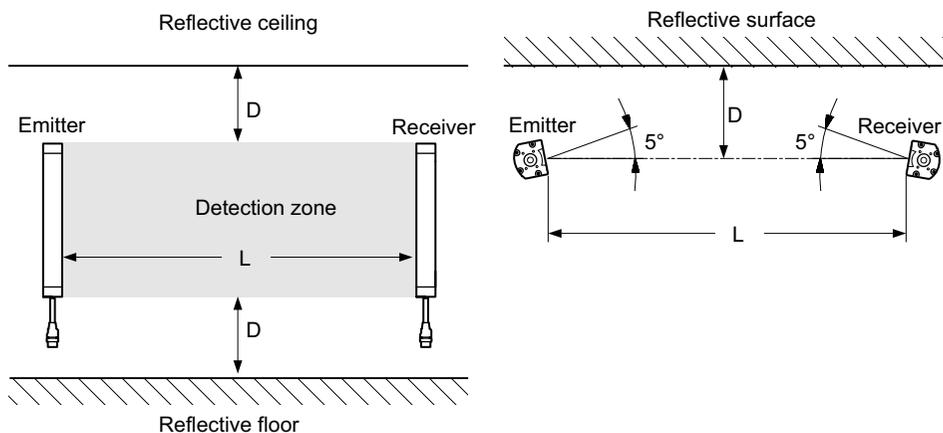
Distance from Reflective Surfaces

⚠ 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.

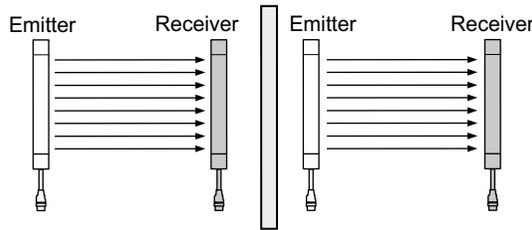


Distance between an emitter and a receiver (operating range L)	Minimum installation distance D
0.3 m to less than 3 m	0.13 m
3 m or greater	$L/2 \times \tan 5^\circ = L \times 0.044 \text{ (m)}$

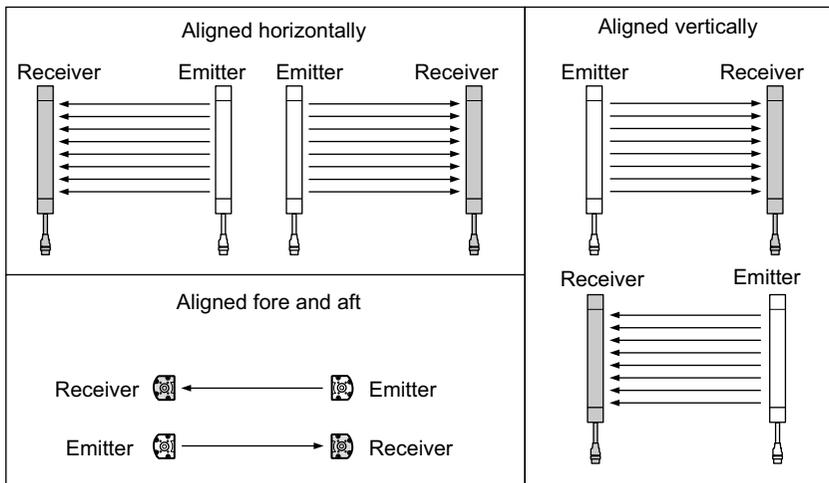
Mutual Interference Prevention

Mutual interference is prevented in up to 3 sets, using interference light detection and cycle shift algorithm. If 4 or more sets of F3SR-B are installed, arrange them so that mutual interference does not occur. If 2 sets are installed near each other, reflection from the surface of the F3SR-B may cause mutual interference. When mutual interference occurs, the safety outputs are turned OFF in a moment or the F3SR-B enters lockout. Combining countermeasures 1 to 3 shown below is effective.

1. Install a physical barrier between 2 sets

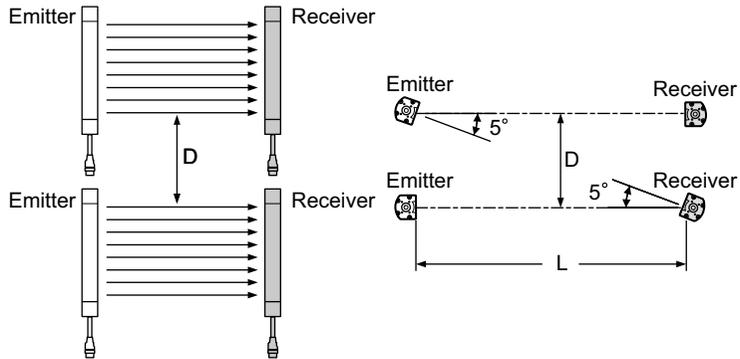


2. Alternate the direction of emission between 2 sets (alternation)



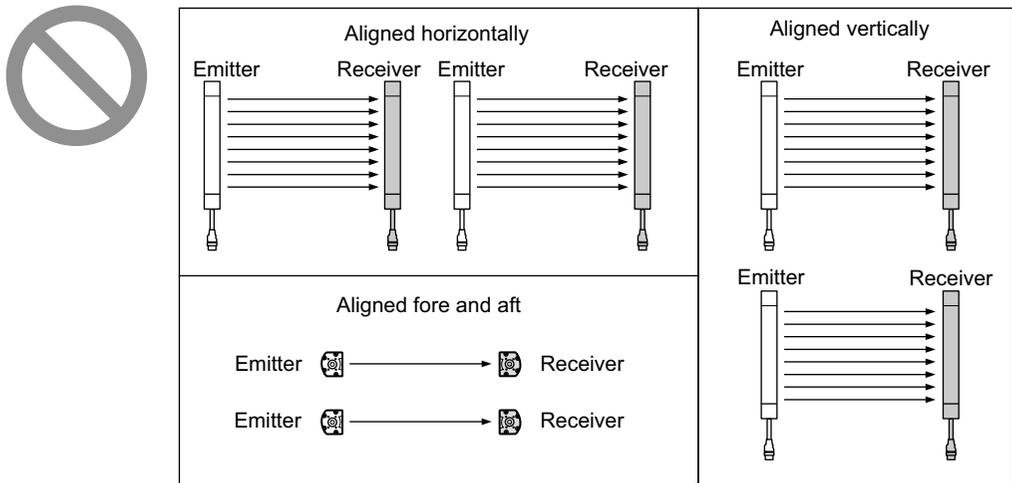
If 2 sets are installed near each other, reflection from the surfaces may cause mutual interference.

3. Keep sufficient distance between the F3SR-Bs so that mutual interference does not occur



Distance between emitter and receiver (operating range L)	Minimum installation distance D
0.3 m to less than 3 m	0.26 m
3 m or greater	$L \times \tan 5^\circ = L \times 0.088$ (m)

When using 4 or more sets, the installations shown below may cause mutual interference. When mutual interference occurs, the safety outputs are turned OFF in a moment or the F3SR-B enters lockout.



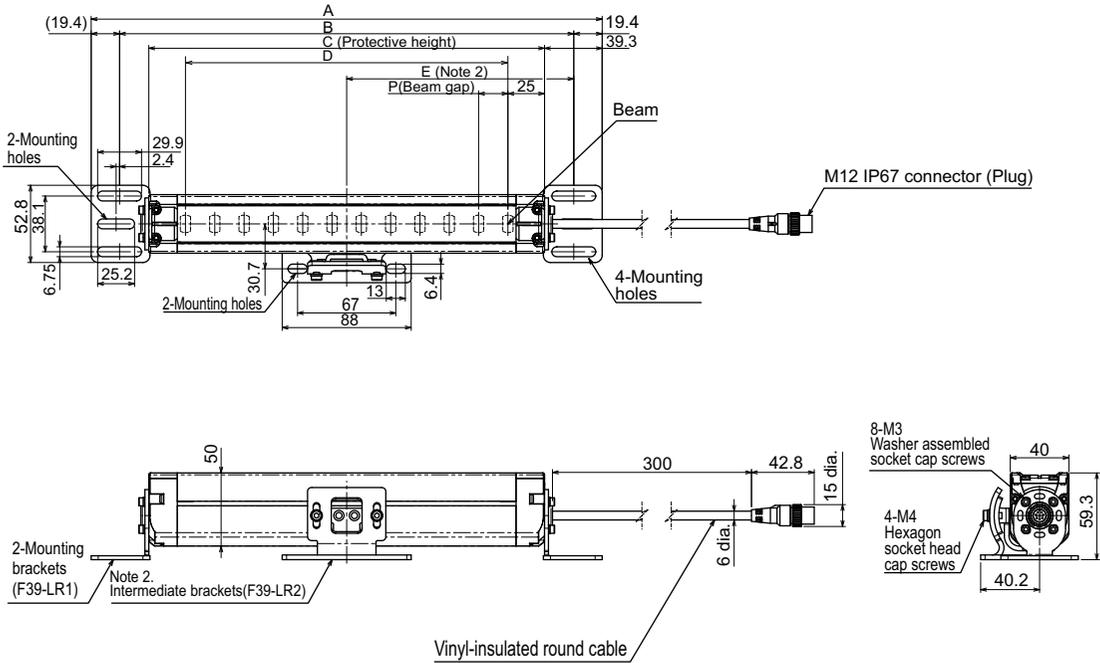
When you use the operating range of 0.3 to 5m, make sure to connect the operating range select input line to a 0V with the Short setting.

When you use the operating range of 5 to 7m, we recommend that you connect the operating range select input line to a 0V with the Short setting.

Dimensions

When Using Top/Bottom Mounting Brackets

Backside Mounting



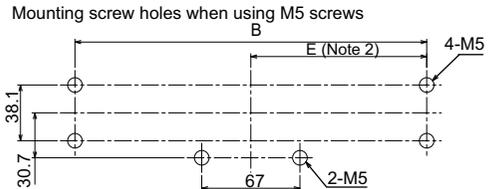
Note 1. The difference in dimension for models is according to the following calculation.

F3SR-430B□□□□ : 0190 to 2270 = C (Protective height)

- Dimension A = C + 78.6
- Dimension B = C + 39.8
- Dimension D = C - 50
- Dimension E (Refer to Note 2.)
- Dimension P (Beam gap) = 20

Note 2. The applicable protective height of intermediate bracket and mounting holes for intermediate bracket are the following.

Protective height	Number of intermediate mounting brackets	Dimensions E *
0190 to 0990	0	-
1070 to 1950	1	B/2
2030 to 2270	2	B/3



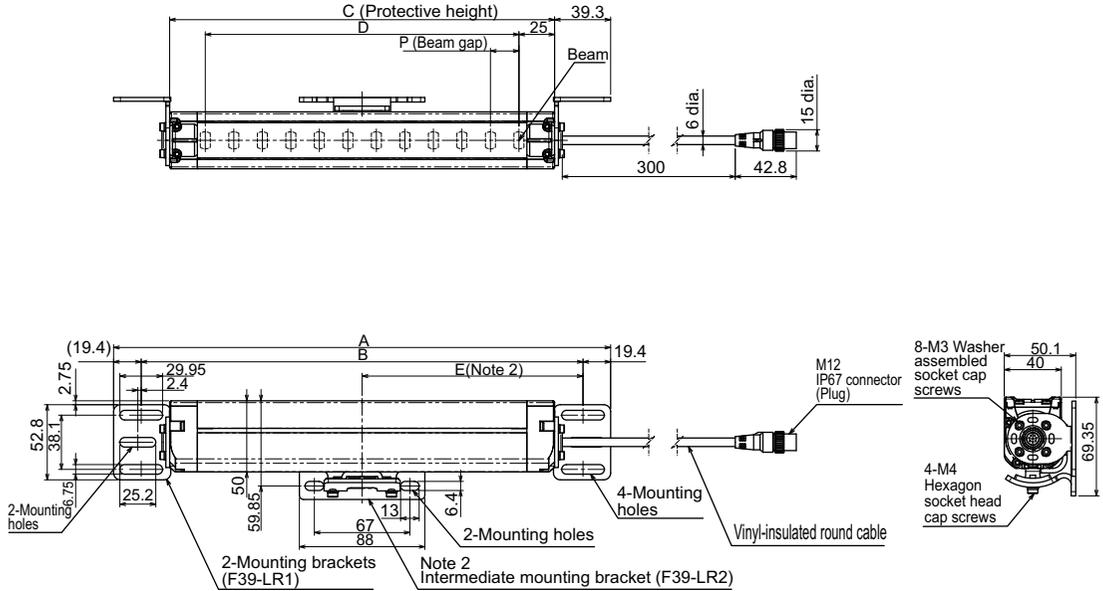
* If the value obtained by above calculation is not used, give dimension E as 1000 mm or less.

[Unit: mm]



Bracket mounting procedure (Mounting) p.31

■ Side Mounting



Note 1. The difference in dimension for models is according to the following calculation

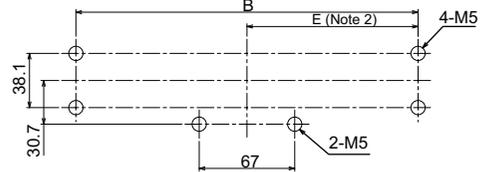
Example
 F3SR-430B □□□□ : 0190 to 2270 = C (Protective height)
 C

- Dimension A = C + 78.6
- Dimension B = C + 39.8
- Dimension D = C - 50
- Dimension E (Refer to Note 2.)
- Dimension P (Beam gap) = 20

Note 2. The applicable protective height of intermediate bracket and mounting holes for intermediate bracket are the following.

Protective height	Number of intermediate mounting brackets	Dimensions E *
0190 to 0990	0	-
1070 to 1950	1	B/2
2030 to 2270	2	B/3

Mounting screw holes when using M5 screws



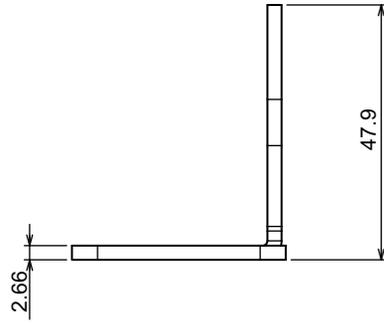
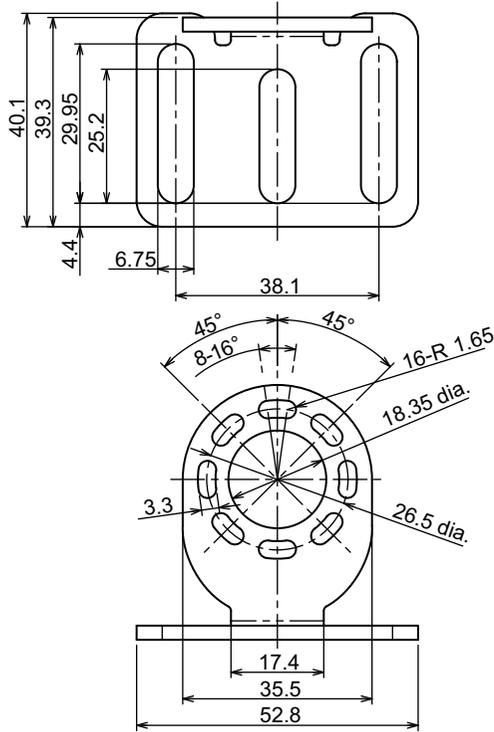
* If the value obtained by above calculation is not used, give dimension E as 1000 mm or less.

[Unit: mm]



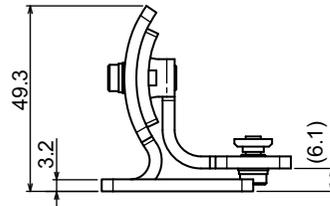
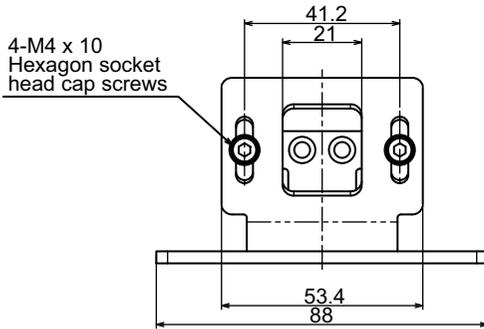
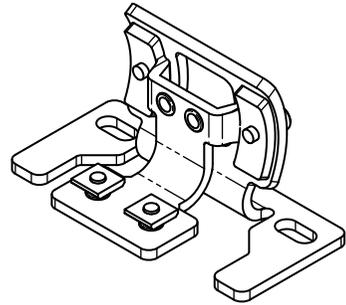
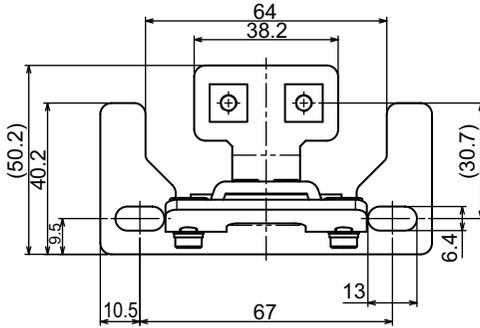
Bracket mounting procedure (Mounting) p.31

■ Dimensions of Top/Bottom Mounting Brackets



Bracket material: Stainless steel (SUS304)
[Unit: mm]

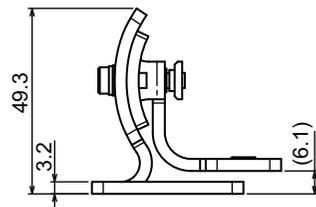
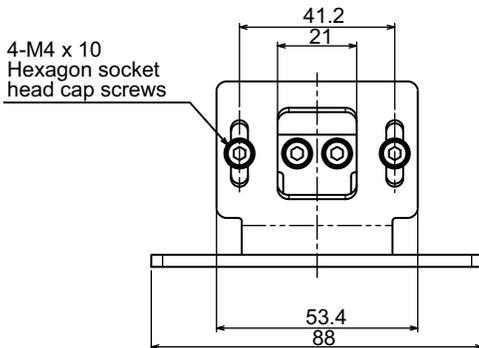
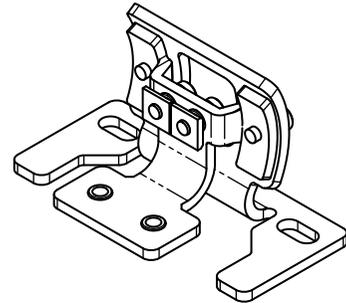
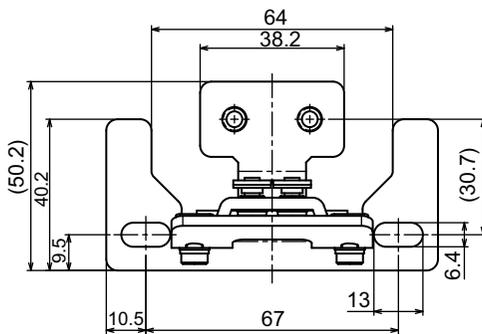
■ Dimensions of Intermediate Mounting Brackets (Backside Mounting)



Bracket material: Stainless steel (SUS304)

[Unit: mm]

■ Dimensions of Intermediate Mounting Brackets (Side Mounting)

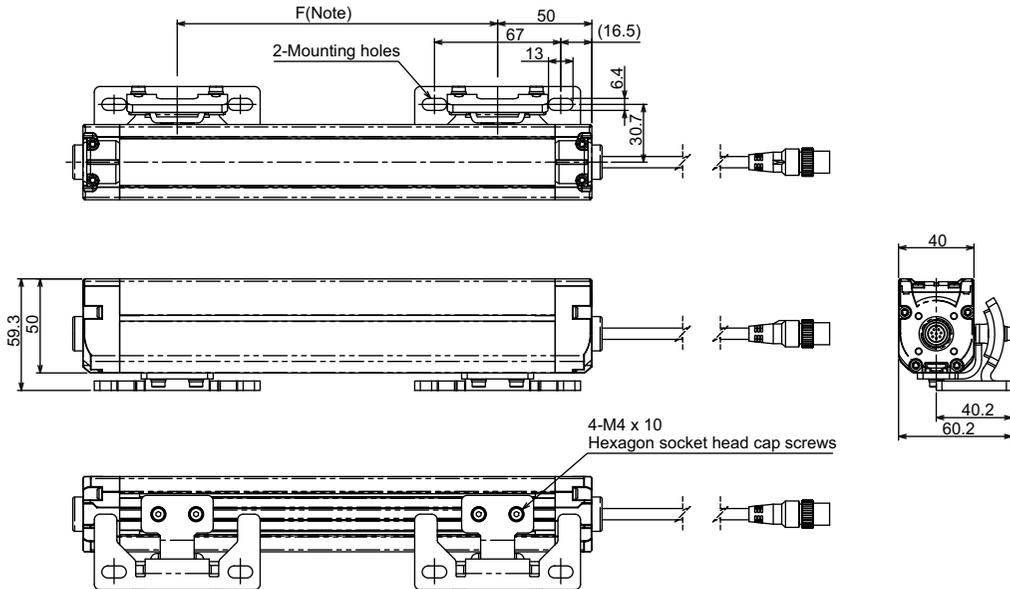


Bracket material: Stainless steel (SUS304)

[Unit: mm]

When Using Free-location Mounting Brackets

Backside Mounting



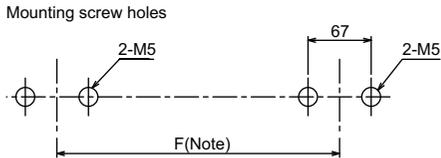
Note. The difference in dimension for models is according to the following calculation.

Type

F3SR-430B $\square\square\square\square$: 0190 to 2270=C(Protective height)
C

Protective height	Number of intermediate mounting brackets	Dimensions F *
0190 to 0750	2	$F=C-100$
0830 to 1470	3	$F=(C-100)/2$
1630 to 2110	4	$F=(C-100)/3$
2270	5	$F=(C-100)/4$

* If the value obtained by above calculation is not used, give dimension F as 700 mm or less.

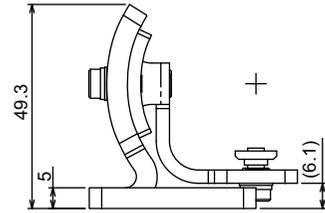
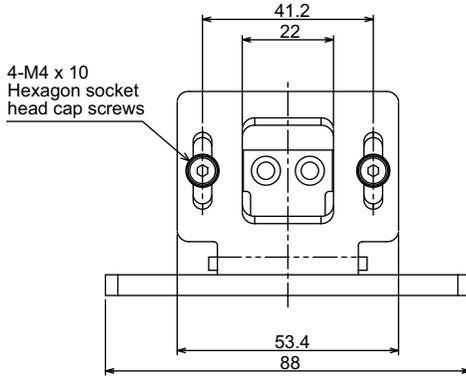
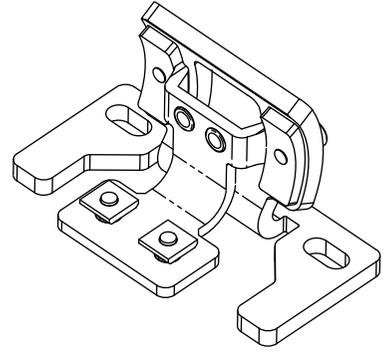
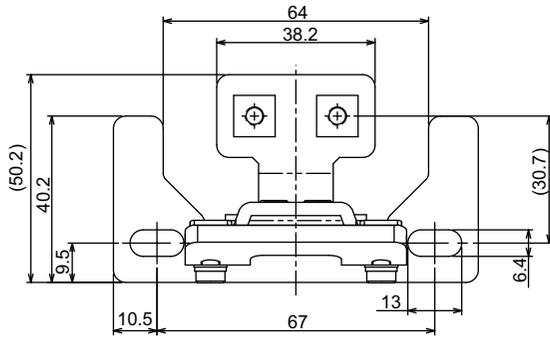


[Unit: mm]



Bracket mounting procedure (Mounting) p.31

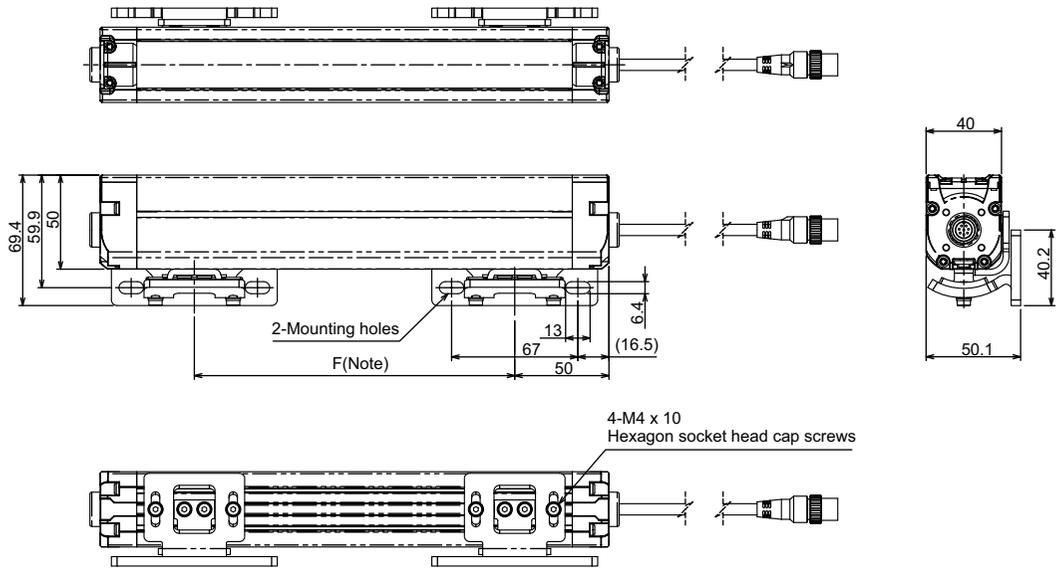
■ Dimensions of Free-location Mounting Brackets (Backside Mounting)



Bracket material: Stainless steel (SUS304)

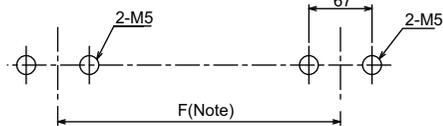
[Unit: mm]

■ Side Mounting



Note. The difference in dimension for models is according to the following calculation.

Mounting screw holes



Type
 F3SR-430B □□□□ : 0190 to 2270=C(Protective height)
 C

Protective height	Number of intermediate mounting brackets	Dimensions F *
0190 to 0750	2	F=C-100
0830 to 1470	3	F=(C-100)/2
1630 to 2110	4	F=(C-100)/3
2270	5	F=(C-100)/4

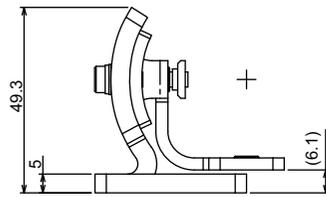
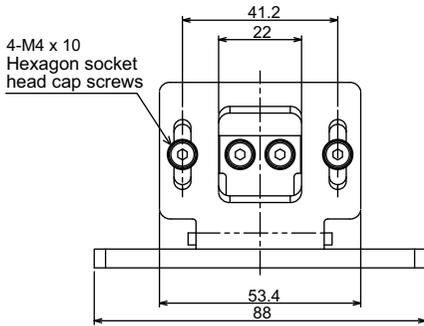
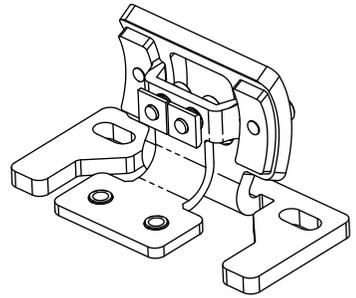
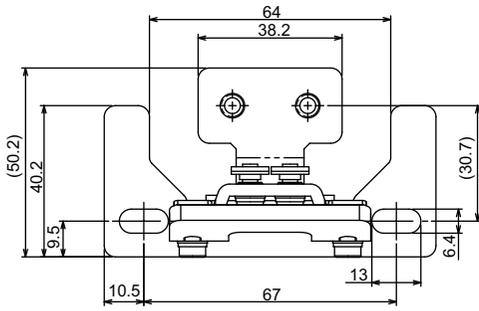
* If the value obtained by above calculation is not used, give dimension F as 700 mm or less.

[Unit: mm]



Bracket mounting procedure (Mounting) p.31

■ Dimensions of Free-location Mounting Brackets (Side Mounting)



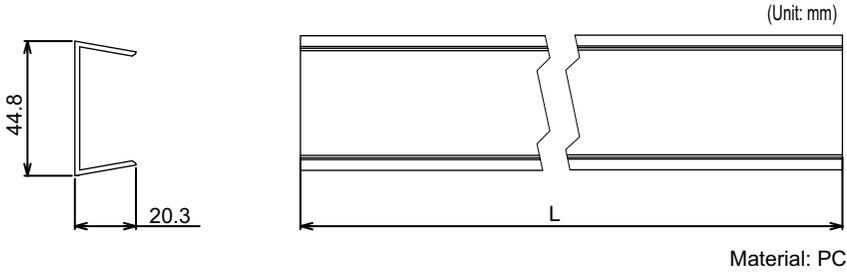
Bracket material: Stainless steel (SUS304)

[Unit: mm]

Mounting a Spatter Protection Cover

Dimensions of F39-HRB□□□□ Spatter Protection Cover

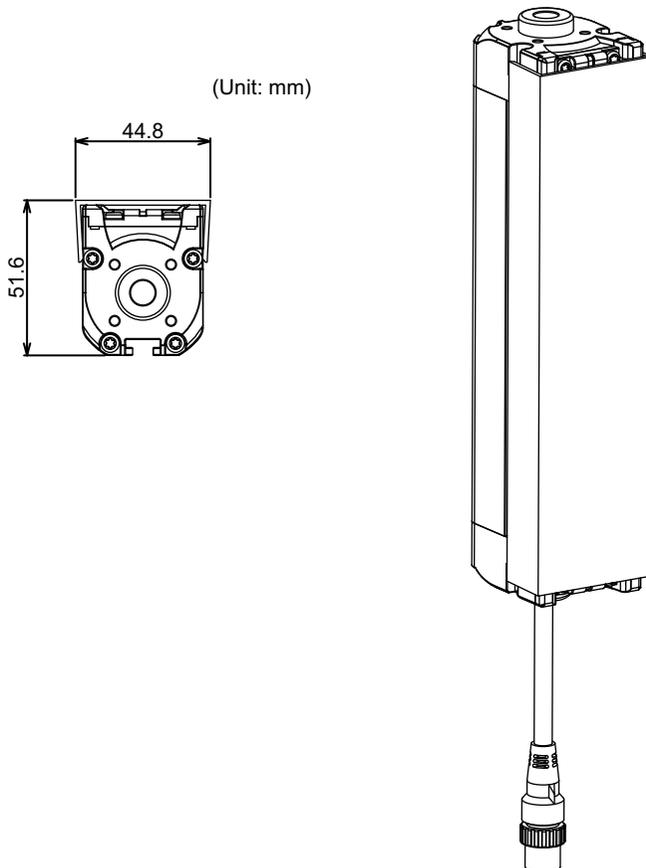
(The boxes □□□□ indicate 4-digit numbers that is the same as the sensor's protective height.)



When protective height is 0190 to 1790 mm: L = □□□□ - 20 mm

When protective height is 1870 to 2270 mm: L = □□□□ - 10 mm

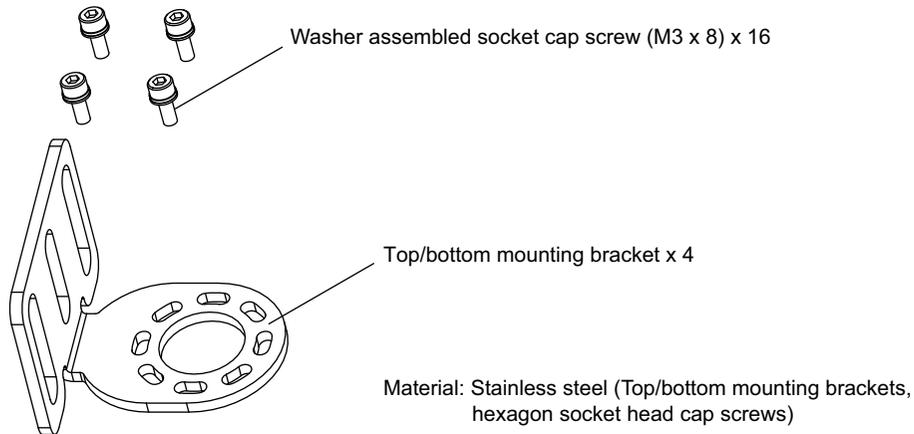
Assembly dimensions



For the F3SR of the model numbers □□□□ of 1870 or greater, use two spatter covers in combination.

Mounting

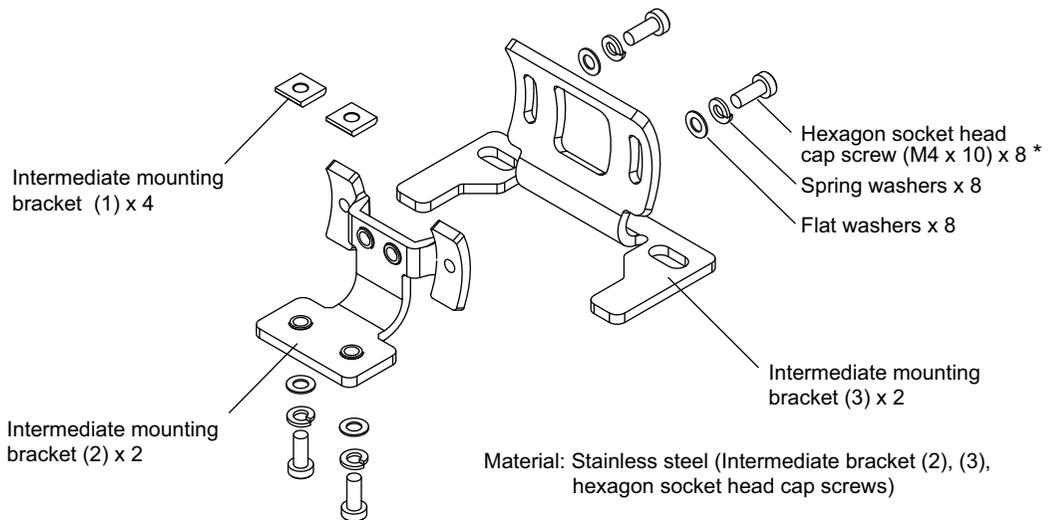
Part Configuration of F39-LR1 Top/Bottom Mounting Brackets



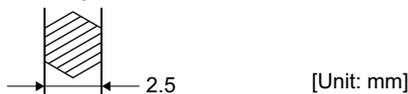
 Screws to mount top/bottom mounting brackets to the wall are not included. Customers are requested to prepare them by themselves.

CHECK!

Part Configuration of F39-LR2 Intermediate Mounting Brackets



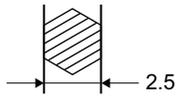
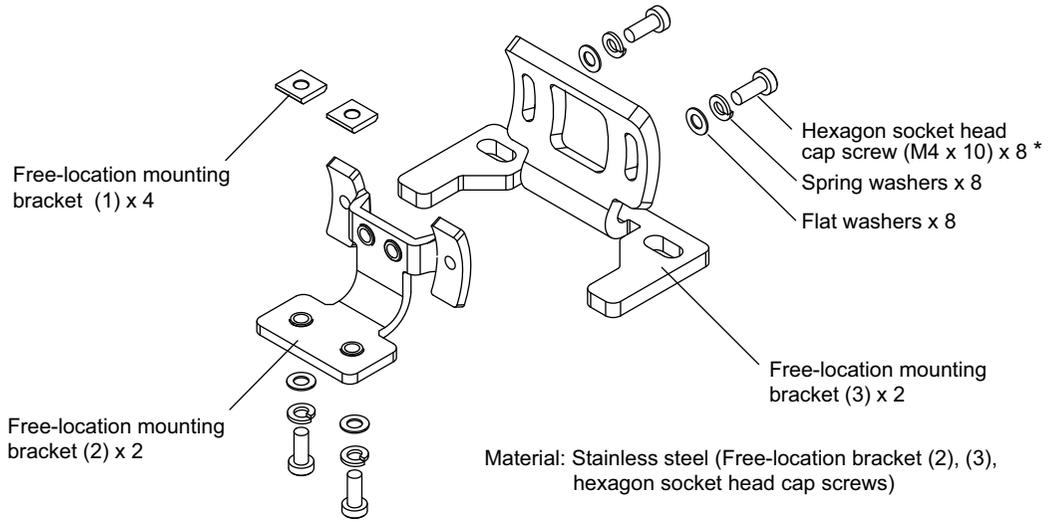
* The opposite side of the hexagon socket is 2.5 mm.



 Screws to mount intermediate mounting brackets to the wall are not included. Customers are requested to prepare them by themselves.

CHECK!

Part Configuration of F39-LR3 Free-location Mounting Brackets



[Unit: mm]



Screws to mount free-location mounting brackets to the wall are not included. Customers are requested to prepare them by themselves.

The number of brackets required

The numbers of brackets required by the protective heights are as follows:

- To use top/bottom mounting brackets only, see p.33.
- To use top/bottom and intermediate mounting brackets, see p.35.

Protective height	Top/bottom mounting bracket	Intermediate mounting bracket
0190 to 0990	2	0
1070 to 1950	2	1
2030 to 2270	2	2

- To use free-location mounting brackets, see p.41.

Protective height	Free-location mounting bracket
0190 to 0750	2
0830 to 1470	3
1630 to 2110	4
2270	5

Mounting Procedure

When Attaching the Top/Bottom Mounting Brackets Only

1. Attach top/bottom mounting brackets and fasten them lightly using the included hexagon socket head cap screws (M3x8). (Figure 1)

Tighten the lower side of the sensor lightly after drawing a power cable to the center of the top/bottom mounting brackets.

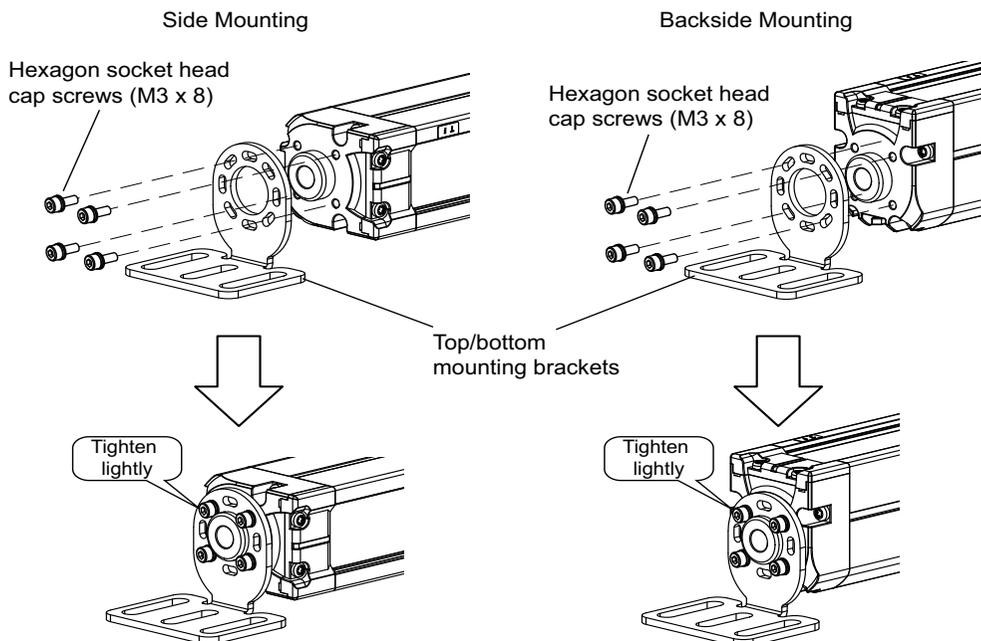


Figure 1

- Adjust the positions of top/bottom mounting brackets to the mounting place on the wall and tighten the screws. (Figure 2)



Screws to mount the brackets to the wall are not included.

CHECK!

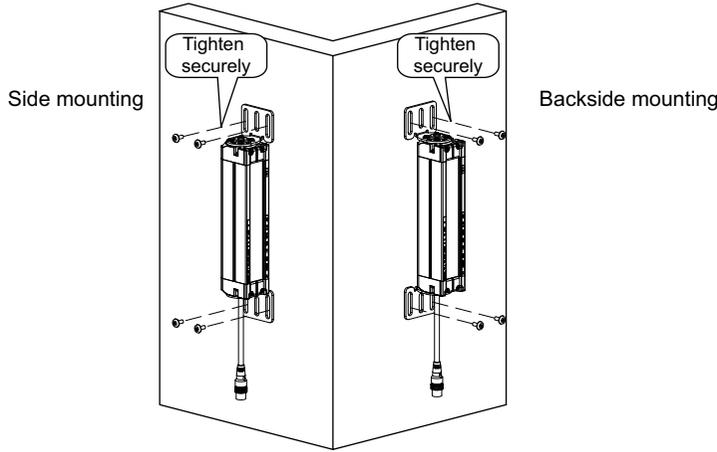


Figure 2

- Turn ON the power supply to the sensor.

Move the emitter (Figure 3) from side to side to align it to a center position where the stable-state indicator (STB) is turned ON while checking the top beam state and bottom beam state with the top-beam-state indicators (TOP) and bottom-beam-state indicators (BTM). (Figure 4)

Then, move the receiver from side to side (Figure 3) to align it to a center position where the stable-state indicators (STB) are turned ON. (Figure 4)

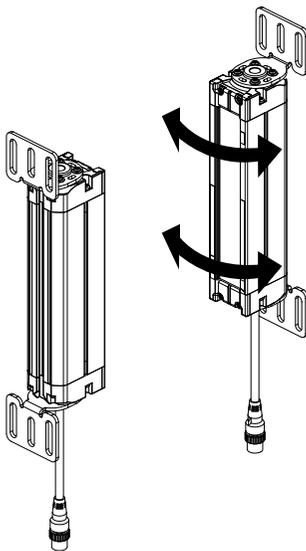


Figure 3

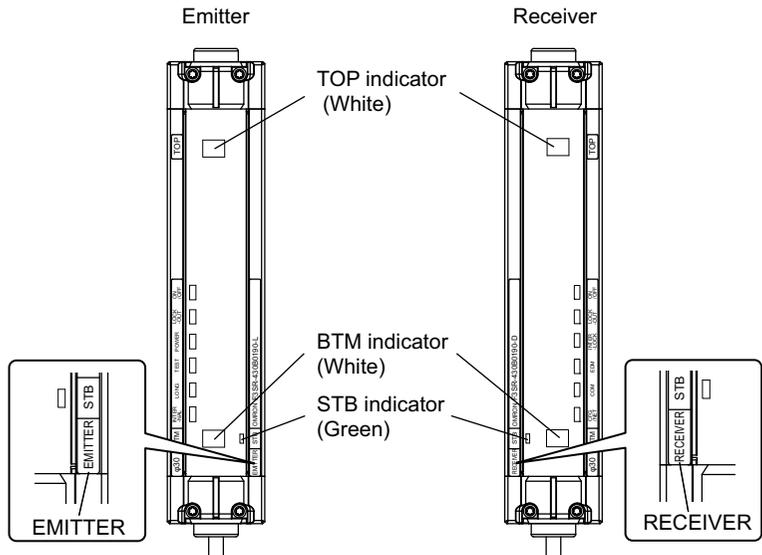


Figure 4



CHECK!

- Confirm that there is no interrupting object in the detection zone, before adjusting beams.
- If the stable-state indicator (STB) does not turn ON despite of alignment, check the parallelism of surfaces to mount the emitter and the receiver, and installation heights of the emitter and the receiver.

4. Tighten the lightly fastened hexagon socket head cap screws (M3 x 8) of the top/bottom mounting brackets. (Figure 5) Tighten the hexagon socket head cap screws (M3 x 8) with the specified torque at 0.54 N·m.



- Tighten all screws evenly.
- Uneven screw tightness will decrease fixing power of F3SR-B.
- Tightening screws with a torque other than specified may cause failure.

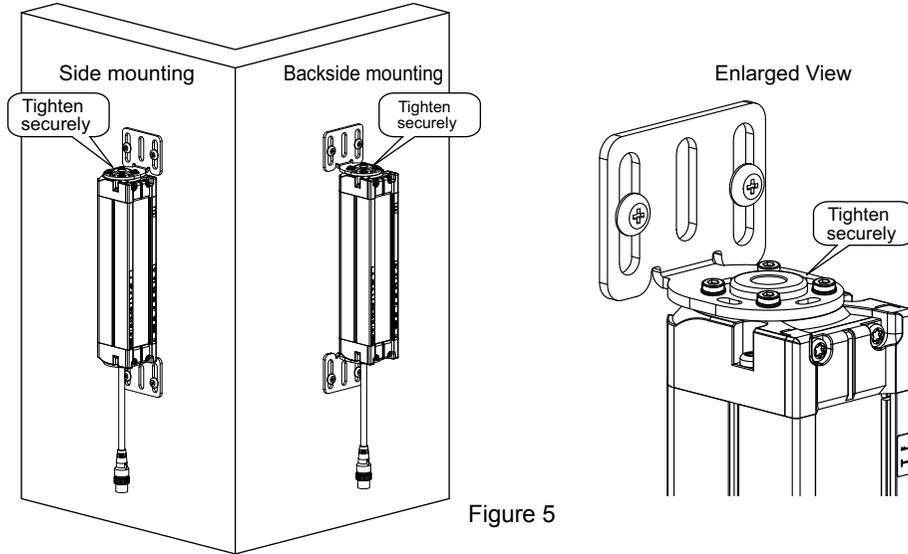


Figure 5

Mounting is completed.

■ When Attaching the Top/Bottom and Intermediate Mounting Brackets

1. Insert the intermediate mounting brackets to the T-slot in the back side of the sensor, placing the protrusion of the intermediate mounting bracket (1) to the outside of the slot. (Figure 6)

As external dimensions of the intermediate mounting bracket is same in length and width, inserting either direction is available.

Make sure to insert two intermediate mounting brackets (1) for mounting each intermediate mounting bracket.

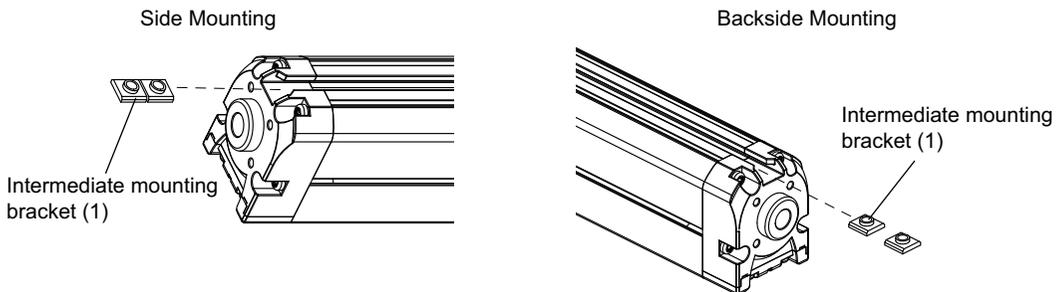


Figure 6

- Align the screw holes of intermediate mountings (1) inserted into the T-slot with the intermediate mounting (2), and fasten them lightly using two attached hexagon socket head cap screws (M4 x 10). (Figure 7)

Fasten the brackets lightly so that the intermediate mounting (2) can slide in the slot.

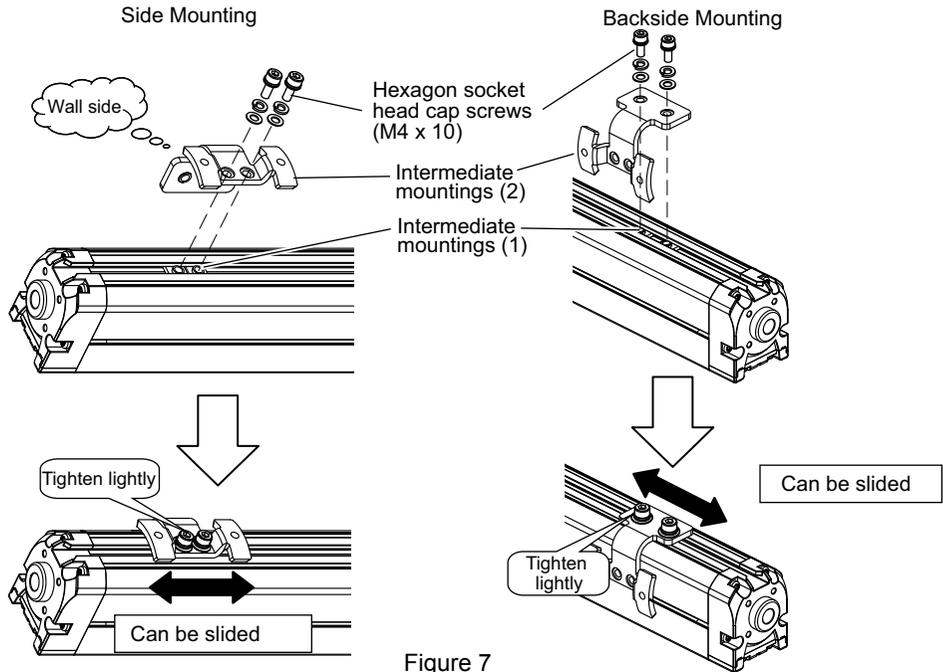


Figure 7

- Fasten the intermediate mounting bracket (2) and intermediate mounting bracket (3) lightly using two attached hexagon socket head cap screws (M4 x 10). (Figure 8)
Fasten the screws lightly so that the intermediate mounting bracket (3) can move.

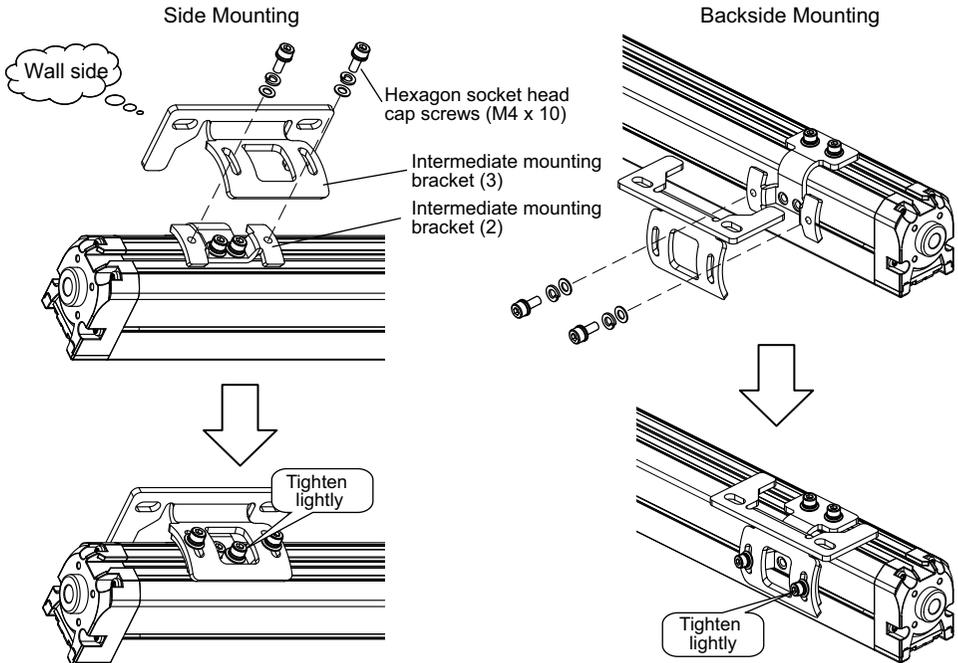


Figure 8

- Attach the top/bottom mounting brackets to the top/bottom screw holes and fasten them lightly using the attached hexagon socket head cap screws (M3 x 8). (Figure 9)
Fasten the brackets lightly so that the sensor can rotate.

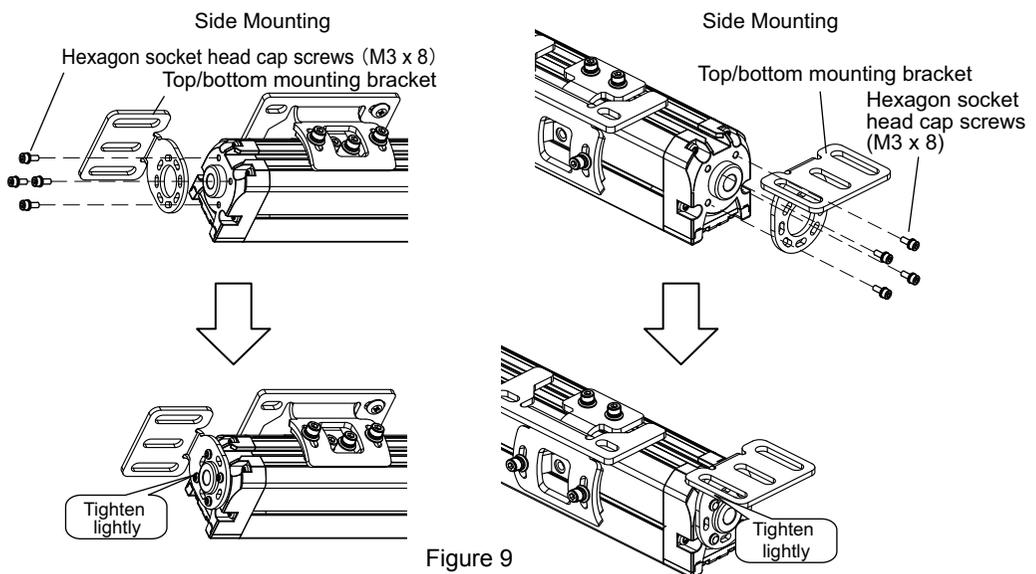
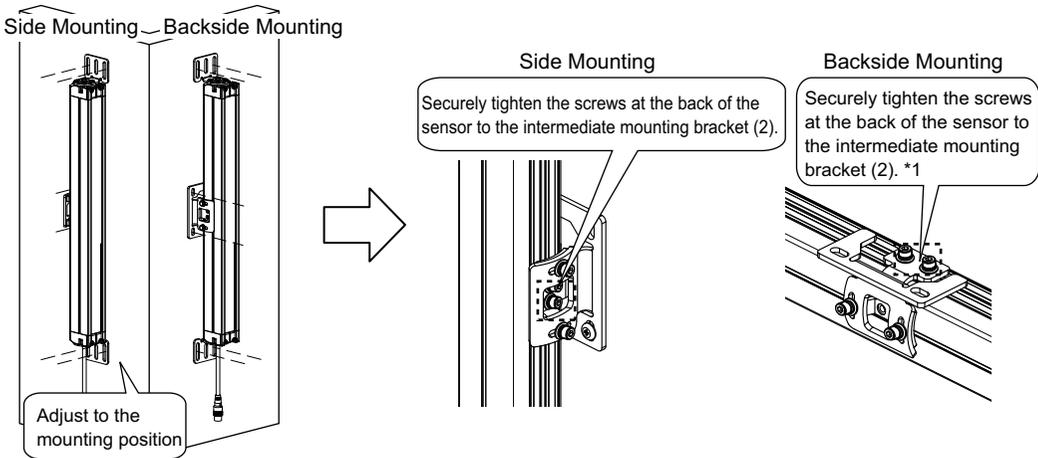


Figure 9

- Position the top/bottom mounting brackets and the intermediate mounting bracket (3) to the mounting places on the wall and tighten the two hexagon socket head cap screws in the back side of the sensor. (Figure 10).



Screws to mount brackets to the wall are not included.



*1 When you do backside mounting, position the F3SR to the mounting place on the wall. Then remove it from the wall. Securely tighten the intermediate mountings (2) with the screws in the back side of the sensor.

Figure 10

- Tighten the screws to mount to the wall by the order of top/bottom and intermediate mounting bracket (3). (Figure 11)



Screws to mount brackets to the wall are not included.

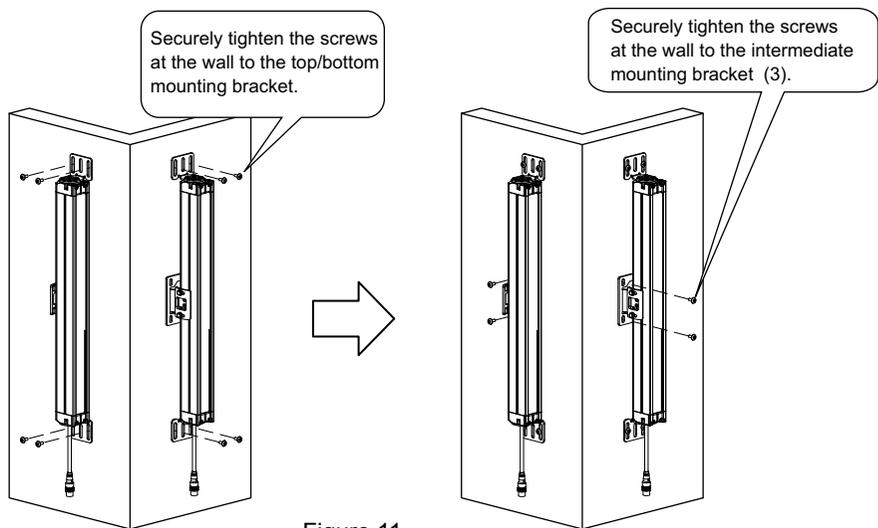


Figure 11

7. Turn ON the power supply to the sensor.

Move the emitter (Figure 12) from side to side to align it to a center position where the stable-state indicators (STB) are turned ON while checking the top beam state and bottom beam state with the top-beam-state indicators (TOP) and bottom-beam-state indicators (BTM). (Figure 13)

Then, move the receiver from side to side (Figure 12) to align it to a center position where the stable-state indicators (STB) are turned ON. (Figure 13)

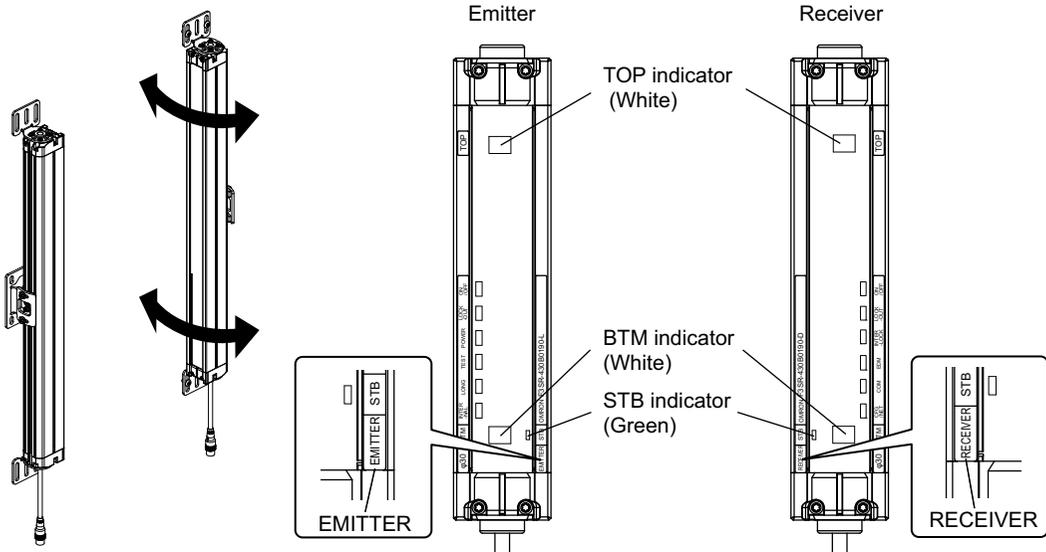


Figure 12

Figure 13



- Confirm that there is no blocking object in the detection zone, before adjusting beams.
- If the stable-state indicator (STB) does not turn ON after alignment, check the parallelism of surfaces for the emitter and the receiver, and installation heights of the emitter and the receiver.

8. Tighten the lightly fastened hexagon socket head cap screws (M3 x 8) of the top/bottom mounting brackets. (Figure 14)

Tighten the screws (M3 x 8) with the specified torque at 0.54 N·m.



- Tighten all screws evenly.
- Uneven screw tightness will decrease fixing power of F3SR-B.
- Tightening screws with a torque other than specified may cause failure.

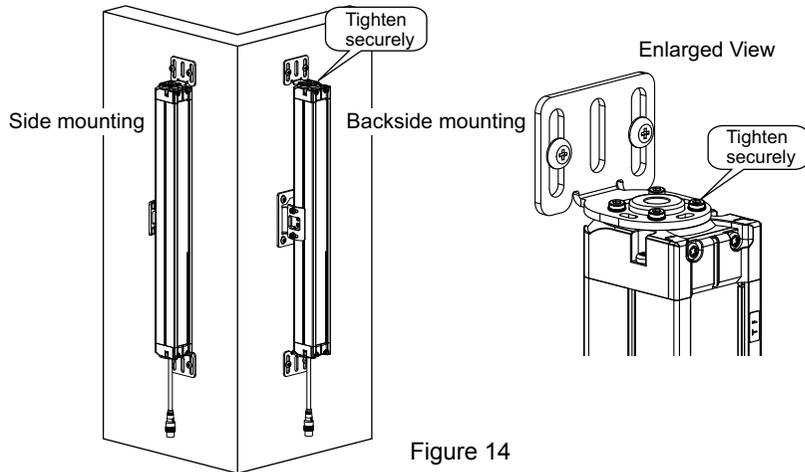


Figure 14

9. Tighten the lightly fastened two hexagon socket head cap screws (M4 x 10) of the intermediate mounting bracket (2) and intermediate mounting bracket (3). (Figure 15)

If there are more than two intermediate mounting brackets, tighten the screws from the order of top → bottom → middle brackets.

Tighten the screws (M4 x 10) with the specified torque at 1.2 N·m.



- Tightening screws with a torque other than specified may cause failure.

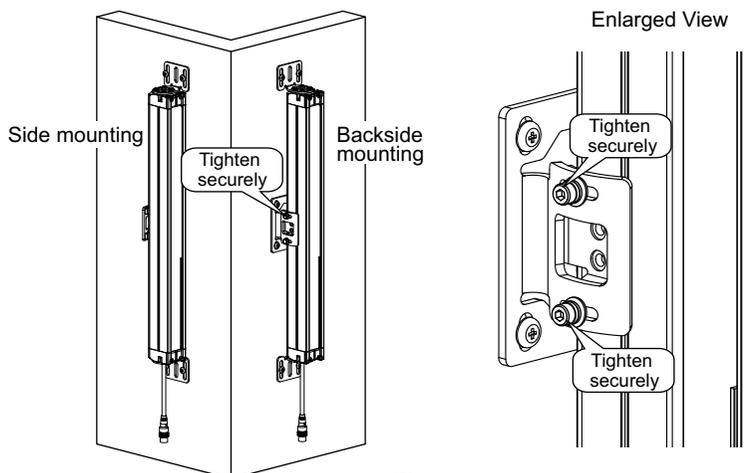


Figure 15

Mounting is completed.

■ When Attaching the Free-location Mounting Brackets

1. Insert the free-location mounting brackets to the T-slot in the back side of the sensor, placing the protrusion of the free-location mounting bracket (1) to the outside of the slot. (Figure 16)

As external dimensions of the free-location mounting bracket is same in length and width, inserting either direction is available.

Make sure to insert two free-location mounting brackets (1) for mounting each free-location mounting bracket.

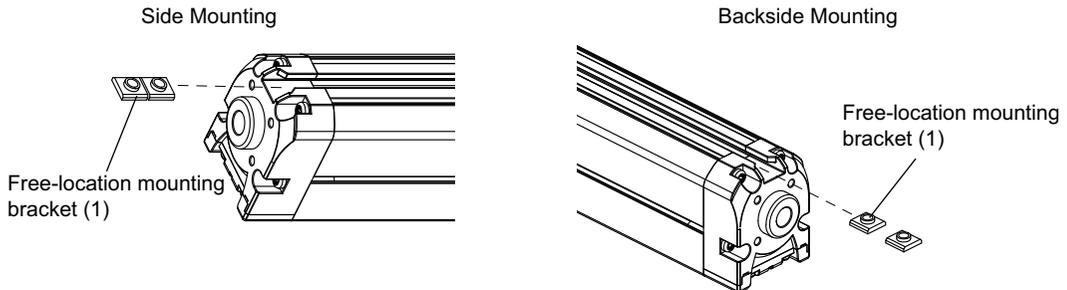


Figure 16

2. Align the screw holes of free-location mountings (1) inserted into the T-slot with the free-location mounting (2), and fasten them lightly using two attached hexagon socket head cap screws (M4 x 10). (Figure 17)

Fasten the brackets lightly so that the free-location mounting (2) can slide in the slot.

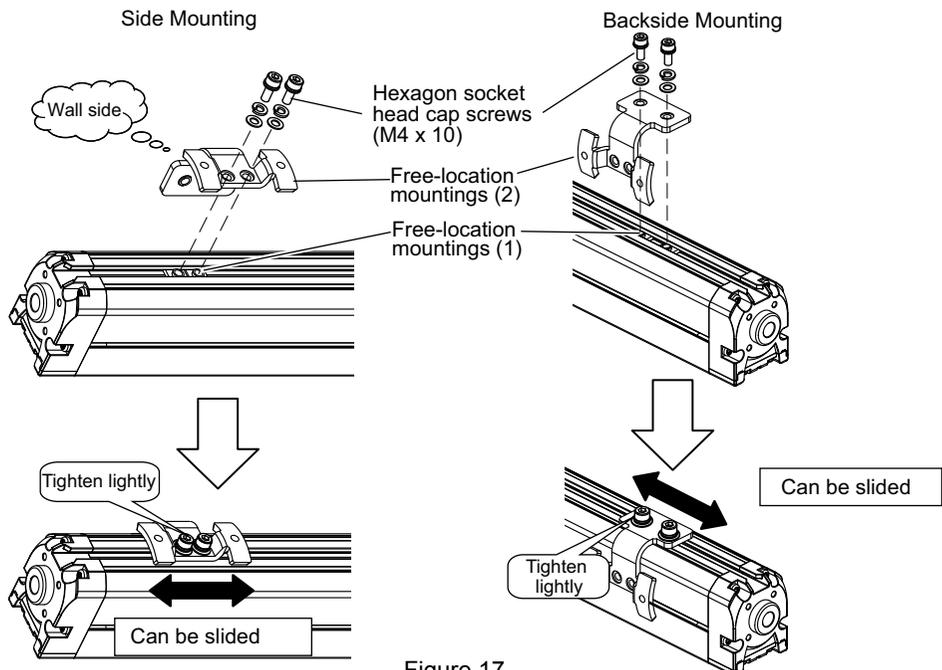


Figure 17

- Fasten the free-location mounting bracket (2) and free-location mounting bracket (3) lightly using two attached hexagon socket head cap screws (M4 x 10). (Figure 18)
Fasten the screws lightly so that the free-location mounting bracket (3) can move.

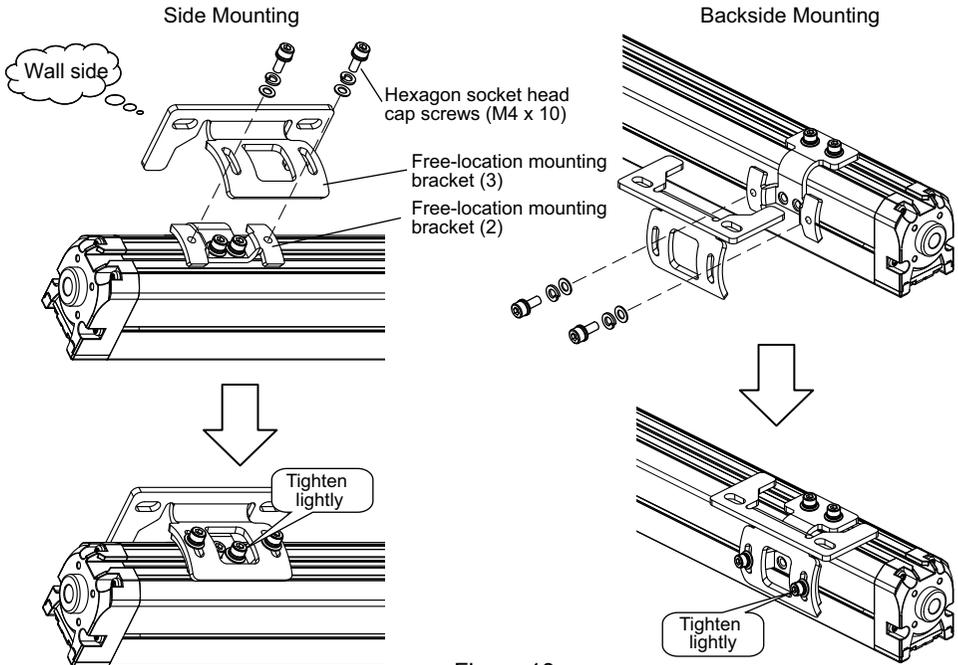


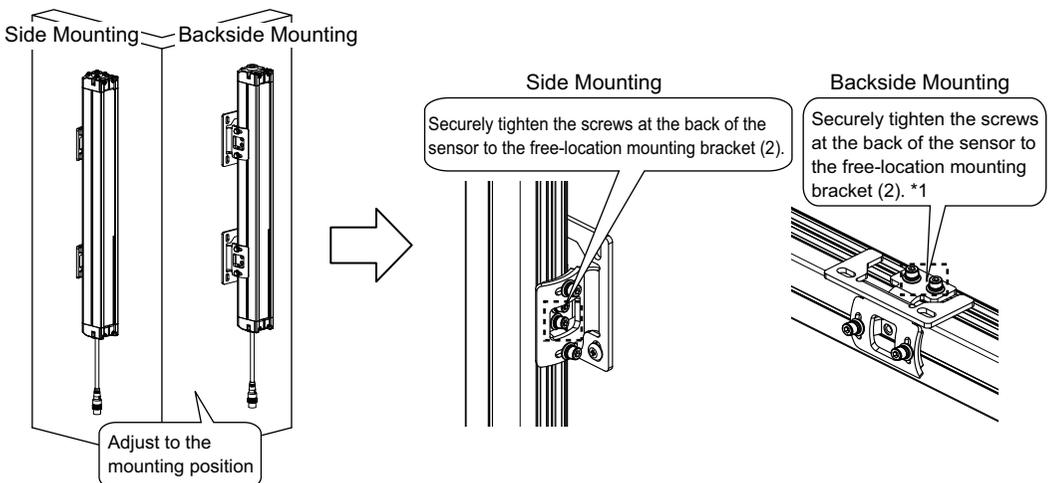
Figure 18

- Position the free-location mounting bracket (3) to the mounting places on the wall and tighten the two hexagon socket head cap screws in the back side of the sensor. (Figure 19).



Screws to mount brackets to the wall are not included.

CHECK!



*1 When you do backside mounting, position the F3SR to the mounting place on the wall. Then remove it from the wall. Securely tighten the free-location mountings (2) with the screws in the back side of the sensor.

Figure 19

- Securely tighten the screws at the wall to the free-location mounting bracket (3). (Figure 20)



Screws to mount brackets to the wall are not included.

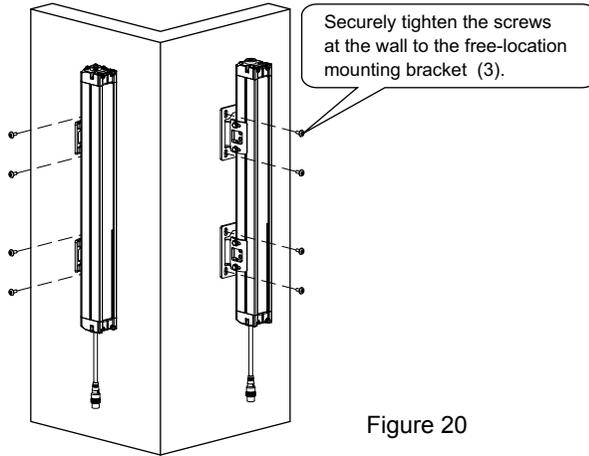


Figure 20

- Turn ON the power supply to the sensor.
 Move the emitter (Figure 21) from side to side to align it to a center position where the stable-state indicators (STB) are turned ON while checking the top beam state and bottom beam state with the top-beam-state indicators (TOP) and bottom-beam-state indicators (BTM). (Figure 22)
 Then, move the receiver from side to side (Figure 21) to align it to a center position where the stable-state indicators (STB) are turned ON. (Figure 22)

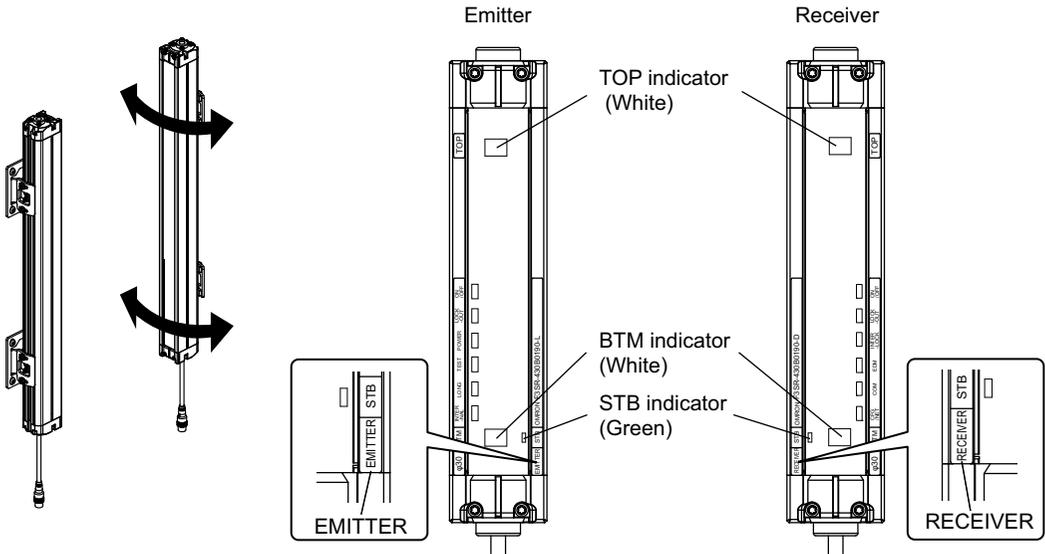


Figure 21

Figure 22



- Confirm that there is no blocking object in the detection zone, before adjusting beams.
- If the stable-state indicator (STB) does not turn ON after alignment, check the parallelism of surfaces for the emitter and the receiver, and installation heights of the emitter and the receiver.

7. Tighten the lightly fastened two hexagon socket head cap screws (M4 x 10) of the free-location mounting bracket (2) and free-location mounting bracket (3). (Figure 23)

If there are more than two free-location mounting brackets, tighten the screws from the order of top → bottom → middle brackets.

Tighten the screws (M4 x 10) with the specified torque at 1.2 N·m.



Tightening screws with a torque other than specified may cause failure.

CHECK!

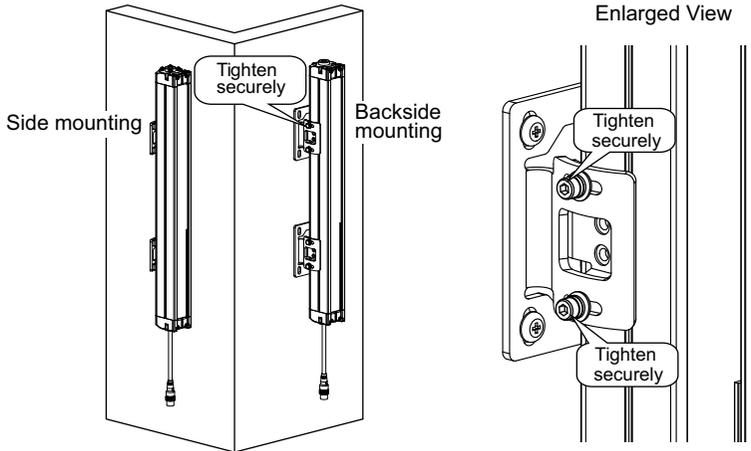


Figure 23

Mounting is completed.

Wiring

Wiring Precautions

WARNING

Double or reinforced insulation from hazardous voltage must be applied to all input lines.

Failure to do so may result in electric shock.



Connect the load between the output and 0 V line (PNP output)

Connecting between the output and +24 V line is dangerous because the operation mode is reversed to "ON when blocked."



Do not short-circuit the output line to the +24 V line.

By doing so, the output is always ON. Also the 0 V of the power supply must be grounded so that output does not turn ON due to grounding of the output line.

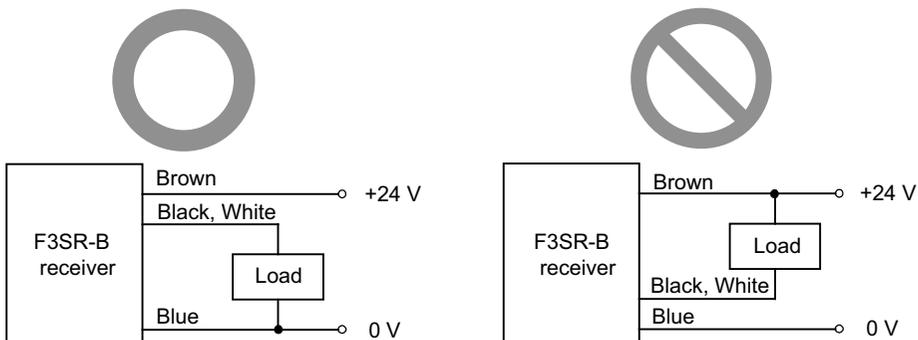


Configure the system by using the optimal number of safety outputs that satisfy the requirements of the necessary safety category.



Do not connect each line of F3SR-B to a DC power supply higher than 24 V + 20 %. Also do not connect to an AC power supply.

Failure to do so may result in electric shock or breakdown of the device.



Power Supply Unit

WARNING

For the F3SR-B 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 (24 V DC \pm 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
- Output holding time must be 20 ms or longer
- Must satisfy output characteristics requirements for class 2 circuit or limited voltage current circuit defined by UL 508 (Refer to remarks)
- Must comply with laws and regulations, regarding EMC and electrical equipment safety, of the country or region where the F3SR-B is used (e.g., 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 wiring of isolation transformer, there must be a limited current voltage circuit to which isolated power supply provides power, and the “current is limited to 8 A max. (including short-circuit)” or “circuit protection such as a fuse is used to limit the current, which as a rating of 4.2 A max.” (24 V DC power supply).

Recommended power supply: OMRON S82K (15 W, 30 W, 50 W, or 90 W), S8VS (60 W) S82J (10 W, 25 W, or 50W)

These products are approved by UL listing (UL 508, 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-JD□□-L, gray, sold separately) to the emitter's connection cable (gray).
2. Connect a receiver cable (F39-JD□□-D, black, sold separately) to the receiver's connection cable (black).

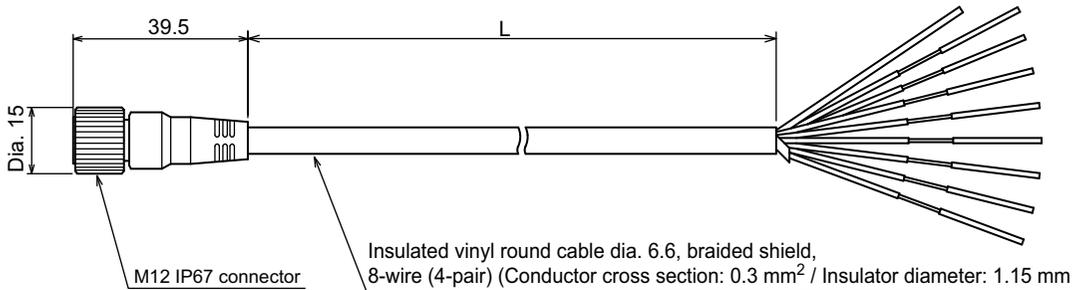
3. Connect the 0 V line of the power supply directly to the protective earth (PE).



To ensure proper wiring, check that the color of the cable match (emitter: gray, receiver: black). Failure to do so may result in damage to the F3SR-B. Incorrect wiring can be prevented by matching the colors.

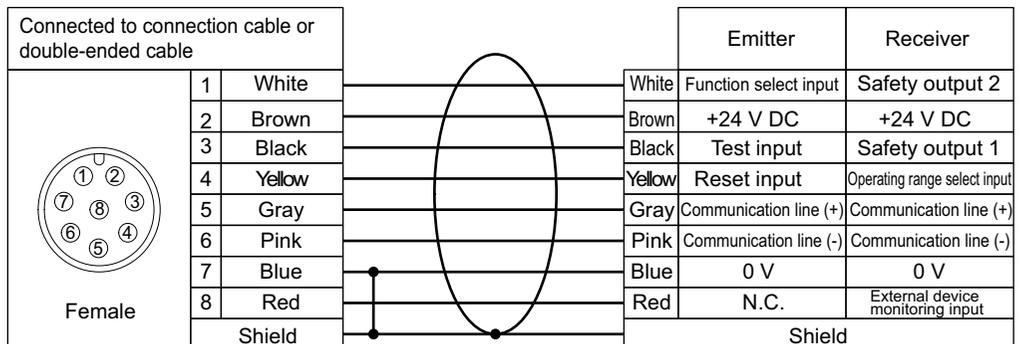
■ Single-ended Cable (F39-JD□A-L, F39-JD□A-D)

(Unit: mm)



Set model name	For emitter		For receiver		L (mm)
F39-JD3A	F39-JD3A-L	Gray cable	F39-JD3A-D	Black cable	3000
F39-JD7A	F39-JD7A-L		F39-JD7A-D		7000
F39-JD10A	F39-JD10A-L		F39-JD10A-D		10000
F39-JD15A	F39-JD15A-L		F39-JD15A-D		15000
F39-JD20A	F39-JD20A-L		F39-JD20A-D		20000

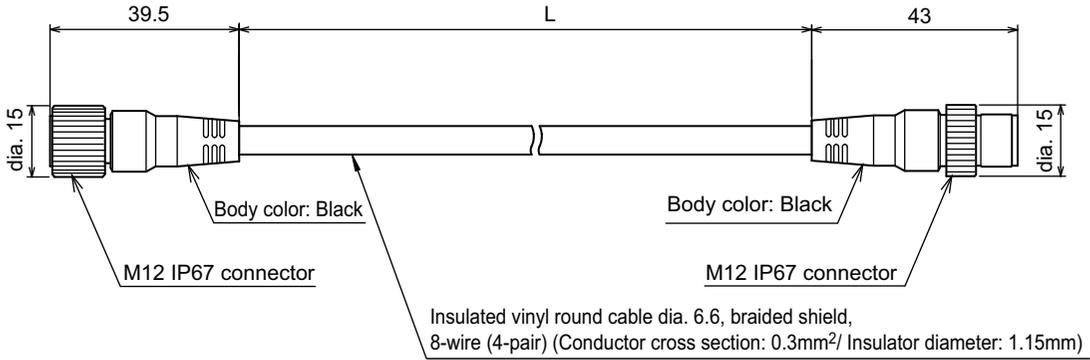
Internal wiring diagram (F39-JD□A-L, F39-JD□A-D)



Twisted pair wires are white and red, brown and blue, black and yellow, and gray and pink

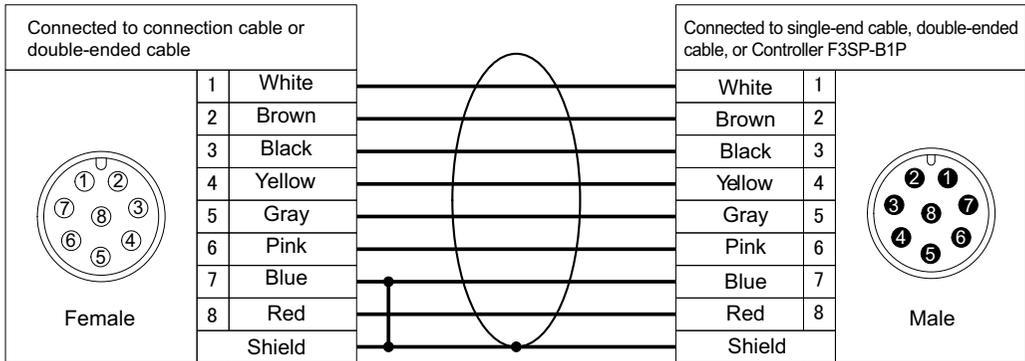
■ Double-ended Cable: For extension or connection with F3SP-B1P (F39-JD□B, sold separately)

(Unit: mm)



Set model name	For emitter		For receiver		L (mm)
F39-JDR5B	F39-JDR5B-L	Gray cable	F39-JDR5B-D	Black cable	500
F39-JD1B	F39-JD1B-L		F39-JD1B-D		1000
F39-JD3B	F39-JD3B-L		F39-JD3B-D		3000
F39-JD5B	F39-JD5B-L		F39-JD5B-D		5000
F39-JD7B	F39-JD7B-L		F39-JD7B-D		7000
F39-JD10B	F39-JD10B-L		F39-JD10B-D		10000
F39-JD15B	F39-JD15B-L		F39-JD15B-D		15000
F39-JD20B	F39-JD20B-L		F39-JD20B-D		20000

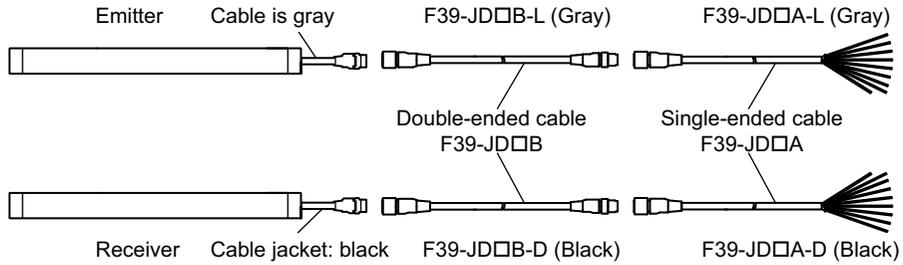
Internal wiring diagram (F39-JD□B-L, F39-JD□B-D)



Twisted pair wires are white and red, brown and blue, black and yellow, and gray and pink

If the length of the single-ended cable F39-JD□A is insufficient, use one or more double-ended cable F39-JD□B to extend the length as required. Limit the total length of the cable to not more than 100 m.

Connection example



In the case of using cables other than designated cable by OMRON, cables must satisfy the following specifications:

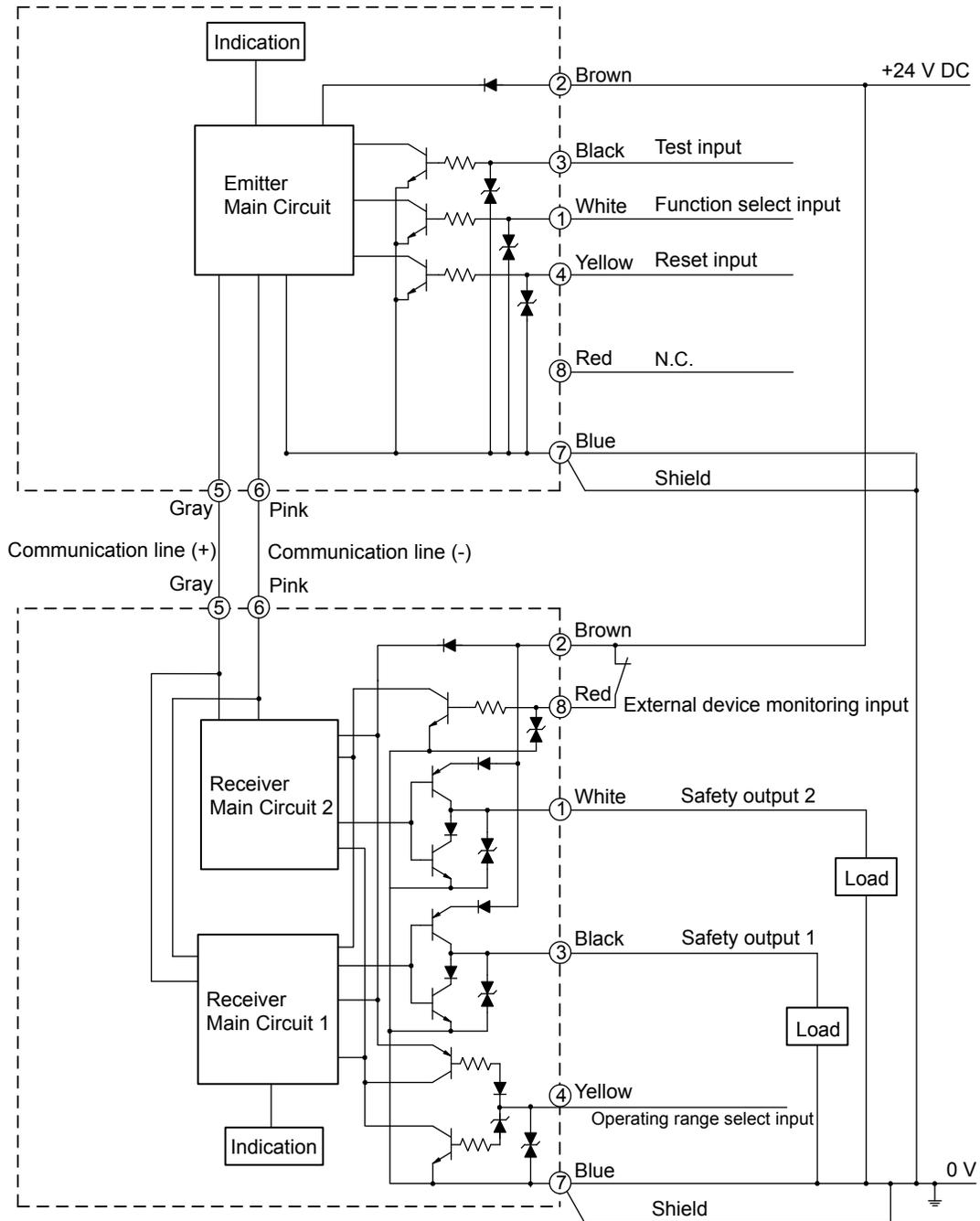
[Extension cable]

1. 8-conductor cable (0.3 mm² min x 4 pairs, conductor resistance at 0.058 Ω/m max)
2. With braided shield
3. Connect Pin 7 with Shield.
4. Use twisted pairs for communication lines (+) and (-), and 24 V and 0 V.

Chapter 4 Input/Output Circuit and Applications

Input/Output Circuit

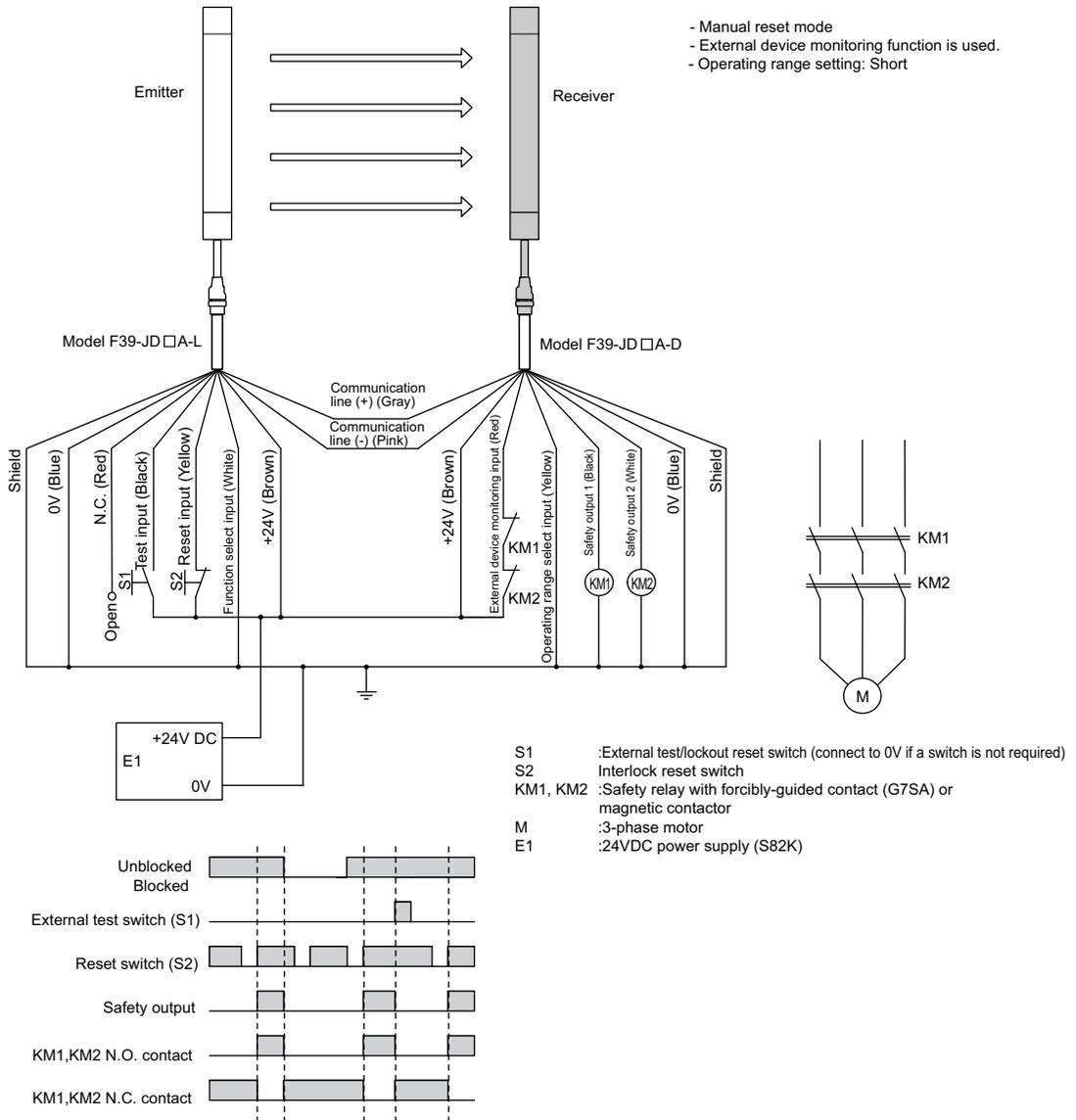
The numbers in white circles indicate the connector's pin numbers.



Wiring Examples

Using only F3SR-B

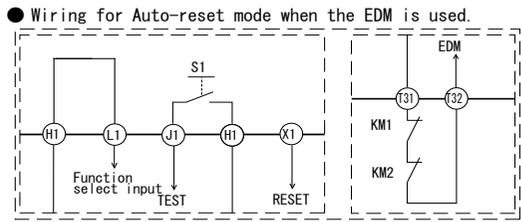
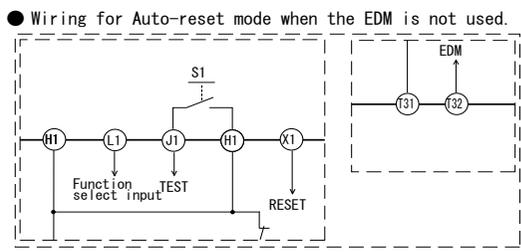
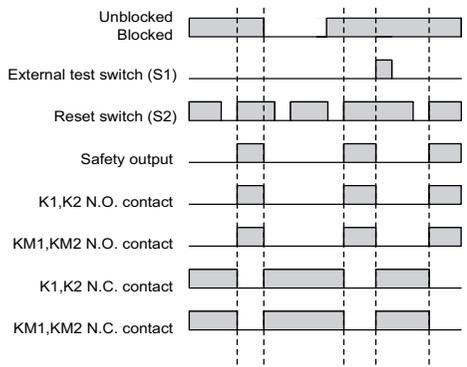
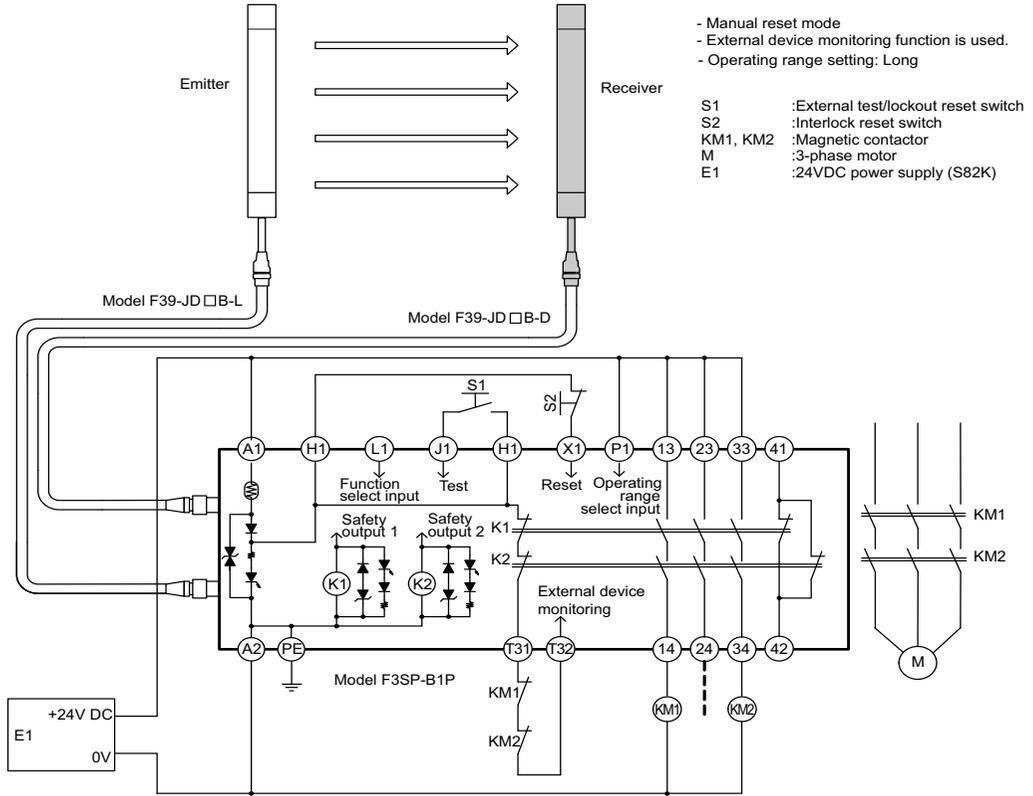
- Use of relay contact welding detection and interlock is possible without a controller or relay unit



- Wiring for auto reset mode p.8
- Wiring when external device monitoring function is not used p.8

Connecting to a controller F3SP-B1P

- Reduced wiring using connectors
- Safety relay included



Chapter 5 Checklists

Pre-Operation Checklists

WARNING

Make sure to test the operation of the F3SR-B after installation to verify that the F3SR-B 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 chief responsible person must use the following checklist to verify the operation, placing a check mark in each of the boxes.

Checklists

■ Installation Condition Check

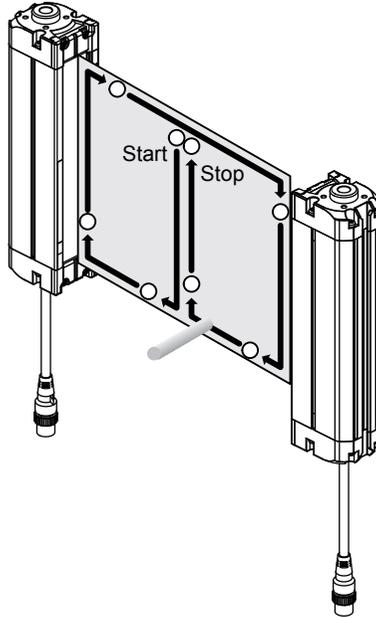
- The machine itself does not prevent the operation of safety functions such as stopping.
- The hazardous part of a machine cannot be reached without passing through the detection zone of the F3SR-B.
- The system is configured so that the F3SR-B can always detect an operator who is working in the hazardous zone.
- The interlock reset switch is installed in a location that provides a clear view of the entire hazardous zone and it cannot be activated from within the hazardous zone.
- Safety distance has been calculated. Calculated distance: $S = (\quad)$ mm
- The actual distance is equal to or greater than the calculated distance. Actual distance = (\quad) mm
- Reflective surfaces are not installed in prohibited zones.
- Not installed in a reflective configuration.
- It is not used in flammable or explosive atmosphere.

■ Wiring Check Before Power Is Turned ON

- Power supply unit must be dedicated to electro-sensitive protective equipment such as F3SR-B and safety controller, and must not be connected to other devices. It must have tolerance against total rated current of devices if it is connected to multiple devices.
- 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 +24 V line.
- Loads are not connected to the +24 V line.
- All lines are not connected to commercial power source.
- Model of emitter and receiver must be the same.
- When 2 or more sets of F3SR-B are used, mutual interference prevention measures are taken.
- Neither connector, cap, or bracket must be loose.

- Power supply's 0 V line must be grounded.
- Wiring must not be bent, cracked, nor damaged.
- **Operation Check While the Machine Is Stopped**

- The test rod is not deformed.
 - Use a test rod with an appropriate diameter for inspection.
- 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, the stable-state indicators (STB) turn off and the ON/OFF-state indicators turn red.



- When the external test function is used:
 - ON/OFF-state indicators turn red when the test input line is short-circuited to 24V.
- When the external device monitoring function is used:
 - When the F3SR-B is blocked and the external device monitoring input line is open, it enters a lockout state.
- When the manual reset function is used:
 - After the F3SR-B is turned ON, the ON/OFF-state indicators must remain red, even if the F3SR-B is not blocked. The reset input must turn the ON/OFF-state indicators to green.
 - After that, when the F3SR-B is blocked and returned to unblocked state when the ON/OFF-state indicators are green, the ON/OFF-state indicators remain red. The reset input must turn the ON/OFF-state indicators to green.
- **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 any of the three 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 F3SR-B 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 F3SR-B. 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.

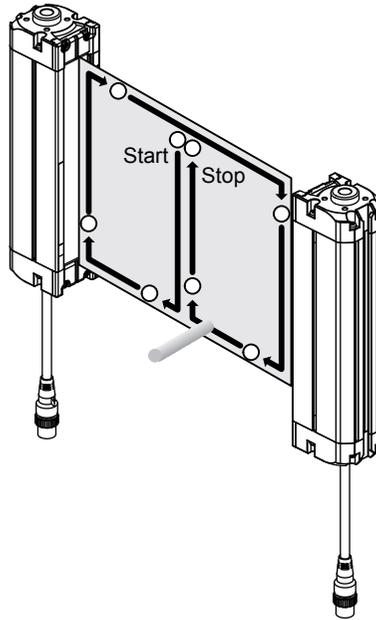
When the user is a different person from those who installed or designed the system, he/she must be properly trained for maintenance.

Checklists

■ Inspection at Startup and When Changing Operators

- There is no approach route other than through the detection zone of the F3SR-B.
- Part of the operator's body always remains in the detection zone of the F3SR-B when working around the machine's hazardous part.
- The actual safety distance is equal to or greater than the calculated value.
- There must be no dirt on or damage to the optical surface or spatter protection cover (F39-HRB□□□□, sold separately) of the F3SR-B.
- ON/OFF-state indicators turn red when the test input line is short-circuited to 24V.
- The test rod is not deformed.
- When the manual reset function is used:
 - After the F3SR-B is turned ON, the ON/OFF-state indicators must remain red, even if the F3SR-B is unblocked. The reset input must turn the ON/OFF-state indicators to green.
 - After that, when the F3SR-B is blocked and returned to unblocked state when ON/OFF-state indicators are green, the ON/OFF-state indicators remain red. The reset input must turn the ON/OFF-state indicators to green.
- When the power of the F3SR is turned ON while nothing is in the detection zone, it must operate as follows:
 - When auto manual reset is not used: After the F3SR-B is turned ON, the power indicator and ON/OFF-state indicators turn green within 2 seconds.
 - When manual reset is used: After the F3SR-B is turned ON, the power indicator turns green and the ON/OFF-state indicators turn to red within 2 seconds.
- Nothing should exist in the detection zone and the stable-state indicators must turn green at power ON.

- 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, the stable-state indicators (STB) turn OFF and the ON/OFF-state indicators turn to red.



Confirm that hazardous parts should stop while the machine is operating, as shown below.

- Neither connector, cap, or bracket must be loose.
- **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 any of the three 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 F3SR-B is turned OFF while nothing is in the detection zone.
- **Items to Inspect Every 6 Months or When Machine Settings Are Changed**

In addition to inspection item at operation start, following items must also be verified.

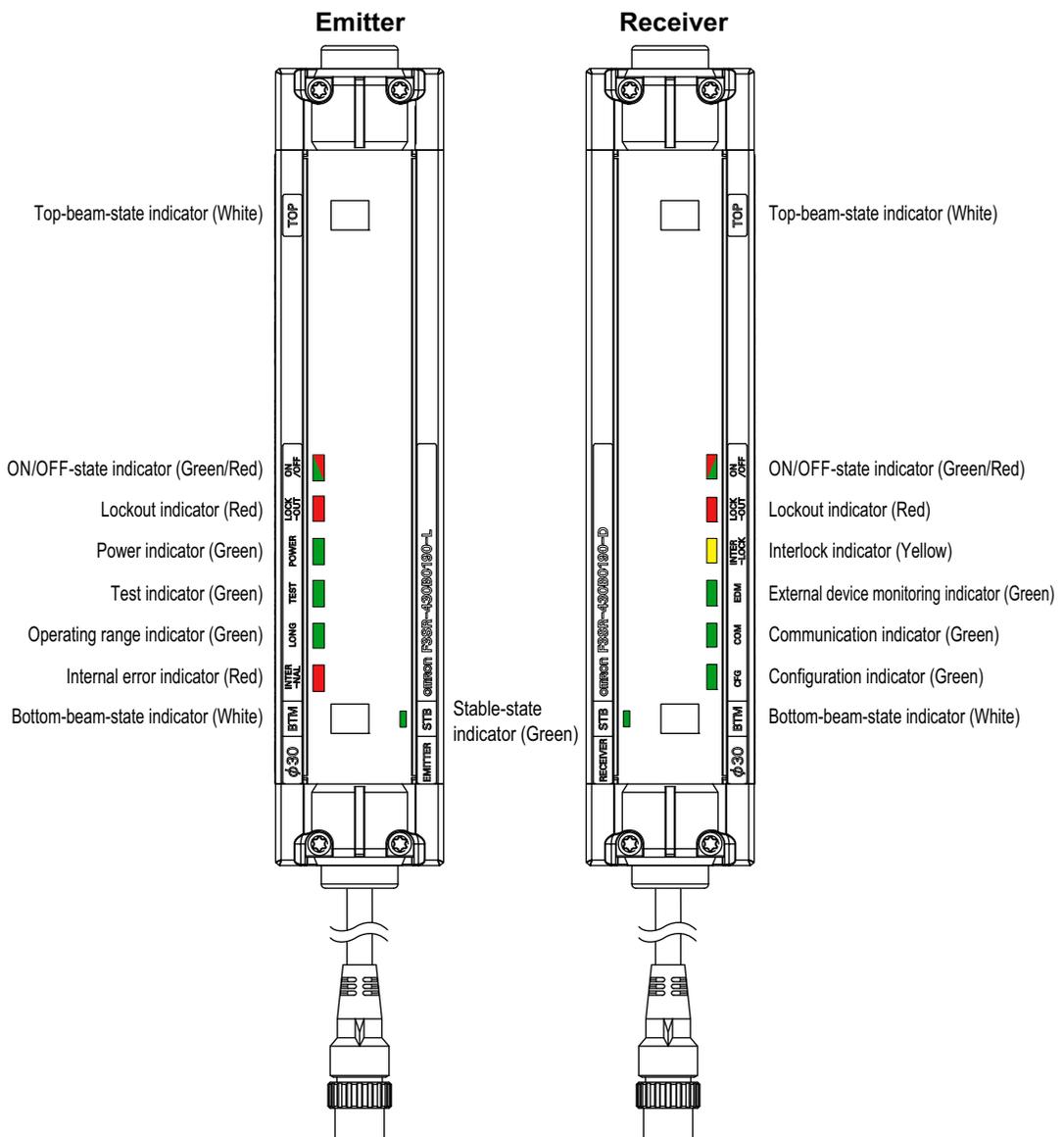
 - The outputs of the F3SR-B and the machine are properly wired.
 - The total number of times that the control relays/contactors have switched is significantly lower than their design lives.
 - There is no ambient light.
 - Power supply's 0 V line must be grounded.
 - Wiring must not be bent, cracked, nor damaged.

Troubleshooting

Lockout State

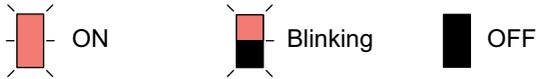
If F3SR-B detects any failure, it keeps safety output OFF and transitions to lockout state. Under lockout state, the F3SR-B blinks or turns ON the lockout indicator, and also blinks other indicators according to its error. Solve the problems based on the table on the following pages.

After solving the problem, turn the power ON again or provide the lockout reset by test input to restart the F3SR-B.



Troubleshooting

Check the cause of errors in accordance with the display combination at the time of an error as shown below, and take measures according to the following troubleshooting tables.



Combination of Error Indicators and Error Description

[Error description]

<p>CHECK! Lockout indicators turn ON or blink by the following combinations. Emitter: ON/Receiver: Blinking or Emitter: Blinking/Receiver: ON</p>	POWER	ON/OFF	➔ Safety output error
		INTERLOCK	➔ Input wiring error
		EDM	➔ External device monitoring error
		COM	➔ Communication error
		LONG	➔ Operating range wiring error
		INTERNAL	➔ Internal error
		CFG	➔ Combination configuration error between emitter and receiver
	STB	➔ Ambient light error	
	POWER	ON/OFF	➔ Error due to power supply voltage or noise
		COM	➔ Communication error due to power supply voltage or noise
POWER	INTERNAL	➔ Internal error due to power supply voltage or noise	
	STB	➔ Malfunction due to ambient light or vibration	

Description	Cause and measures
Safety output error	<p>Safety output lines may be short-circuited to each other or another signal line may be short-circuited to the safety output line. Wire the safety output lines properly.</p> <p> p.8</p>
Error due to power supply voltage or noise	<p>The power supply voltage may have dropped temporarily when the F3SR is in operation. Check for temporary power supply voltage drop (by about 12 VDC) by the influence of the induction load etc. If the exclusive power supply is not used, check the power consumption of other connected devices for enough capacity.</p>
	<p>Effect of noise may be excessive.</p> <p>If other devices using the same power supply generate noise, do not share the same power supply with other devices and use it as that exclusive for the safety component.</p>
	<p>The inductive noise tends to be induced especially if the power line and the power supply line are arranged in parallel. Arrange the exclusive power supply near the light curtain or lay the power line away from the power line.</p>
	<p>If the power supply for operation is located near the power supply and it uses the same ground, it is subject to the influence of common mode noise from the ground. Separate the grounding point or use it as the exclusive ground.</p>
	<p>Power supply voltage may be outside the rated range. Connect to a 24 VDC \pm 20% power supply voltage.</p>
	<p>Voltage fluctuation may have occurred due to insufficient power supply capacity. Replace the power supply with one that has a larger capacity.</p> <p>Instantaneous break or instantaneous stop may have occurred 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 electrical-detection protective functions, such as the F3SR-B, safety controller, muting sensor, etc.</p>
Operating range wiring error	<p>Operating range select input line may be open. Connect to a 0 V or 24 V according to the desired operating range.</p> <p> p.13</p>
	<p>Wiring of the operating range select input line may have been switched after starting up the sensor. Connect to a 0 V or 24 V according to the desired operating range, and then restart the sensor.</p> <p> p.13</p>
Internal error	<p>An error may have occurred in the internal circuit. Replace the F3SR-B.</p>
Ambient light error	<p>The receiver may be receiving light emitted from another photoelectric switch or F3SR-B. Check the operating range select input line for correct wiring corresponding to the installation distance.</p> <p> p.13</p> <p>If it is correctly wired, take necessary measures against mutual interference according to "Mutual Interference Prevention" in Chapter 3.</p> <p> p.20</p>

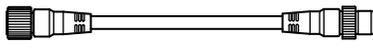
Description	Cause and measures
Input wiring error	Combinations of function select input line, external device monitoring input line, and reset input line may be wrong. Perform correct wiring.  p.8
External device monitoring error	Combinations of function select input line, external device monitoring input line, and reset input line may be wrong. Perform correct wiring.  p.8
	Relay may be welded. Replace the relay.
	The relay and external device monitoring input line may not be properly wired. Check the wiring with the relay  p.8
	The relay response time may be exceeding the allowable delay time (0.3 s). Replace the relay with the one that has an appropriate response time.  p.12
Communication error	The communication line or other wiring may be broken or short-circuited. Check the wiring and cables.
	A power cable may be detached. Check connectors of power cable.
	If the wiring is extended without using the dedicated cable, the cable used for extension may not have performance equivalent or greater than the dedicated cable. Use a cable with the same performance or more than the dedicated cable. Otherwise connect the shield to the 0 V line.  p.49
Communication error due to power supply voltage or noise	Communication error may have occurred due to noise. Check the noise level in the environment around the communication line.
	The power supply voltage may have dropped temporarily when the F3SR is in operation. Check for temporary power supply voltage drop (by about 12 VDC) by the influence of the induction load etc. If the exclusive power supply is not used, check the power consumption of other connected devices for enough capacity.
Internal error due to power supply voltage or noise	The internal circuitry may be defective due to power supply voltage or noise. Check the ambient noise environment. Make sure that the power supply voltage is 24VDC \pm 20% and replace the F3SR-B.
Combination configuration error between emitter and receiver	A model between emitter and receiver may be wrong. Confirm emitter and receiver are a same model.
Malfunction due to ambient light or vibration	An instantaneous beam shift may have occurred due to vibration or ambient light. Check the installation condition. Check the operating range select input line for correct wiring corresponding to the installation distance.  p.13 If it is correctly wired, take necessary measures against mutual interference according to "Mutual Interference Prevention" in Chapter 3.  p.20

Accessories (Sold Separately)

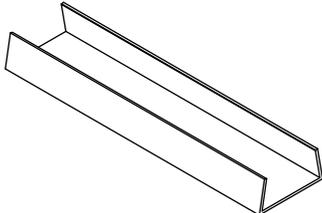
Single-ended Cable (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JD3A	3 m	M12 connector (8-pin) - 8 wires + Shield
	F39-JD7A	7 m	
	F39-JD10A	10 m	
	F39-JD15A	15 m	
	F39-JD20A	20 m	

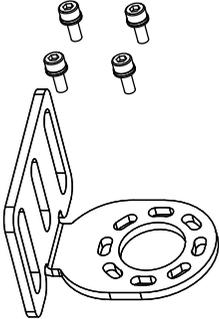
Double-ended Cable: For connection with F3SP-B1P or cable extension (2 cables per set, for emitter and receiver)

Appearance	Model name	Cable length	Specifications
	F39-JDR5B	0.5 m	M12 connector (8-pin) - M12 connector (8-pin)
	F39-JD1B	1 m	
	F39-JD3B	3 m	
	F39-JD5B	5 m	
	F39-JD7B	7 m	
	F39-JD10B	10 m	
	F39-JD15B	15 m	
	F39-JD20B	20 m	

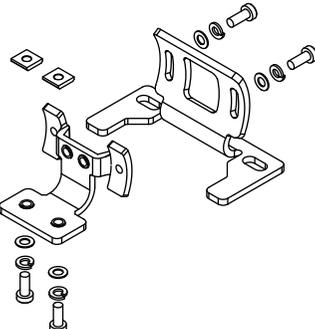
Spatter protection cover (2 cables per set, common for emitter/receiver)

Appearance	Model name	Note
	F39-HRB□□□□	In this table, the □□□□ in the model indicates the same 4-digit number as the protective height (□□□□ in the model) of the F3SR-B. When a spatter protection cover is attached, operating range of F3SR-B is reduced by about 10%. For the F3SR of the model numbers □□□□ of 1870 or greater, use two spatter covers in combination.

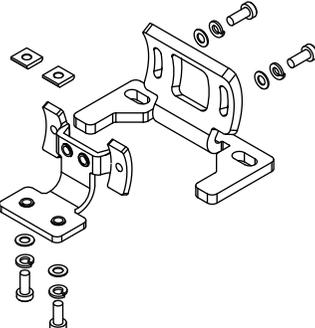
Top/bottom mounting bracket

Appearance	Model name	Application	Note
	F39-LR1	Top/bottom mounting bracket for F3SR-B.	4 brackets per set (2 brackets for emitter, 2 brackets for receiver) Side mounting and backside mounting are possible.

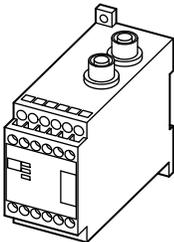
Intermediate mounting bracket

Appearance	Model name	Application	Note
	F39-LR2	Used with top/bottom mounting brackets.	2 brackets per set Side mounting and backside mounting are possible.

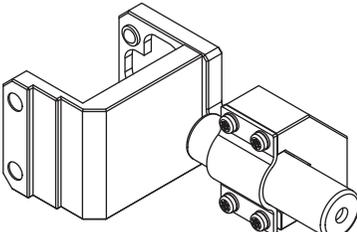
Free-location mounting bracket

Appearance	Model name	Application	Note
	F39-LR3	Used with free-location mounting brackets.	2 brackets per set Side mounting and backside mounting are possible.

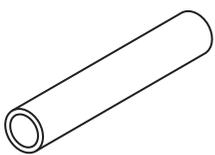
Control unit

Appearance	Model name	Output	Note
	F3SP-B1P	Relay, 3a+1b contact	For connection with F3SR-B, use an F39-JD□B double-end connector cable.

Laser alignment kit

Appearance	Model name	Application	Specifications
	F39-PTR	Beam Alignment for F3SR-B	Infrared laser diode (650nm wavelength, 1mW max, JIS CLASS2, IEC CLASS2, FDA CLASS II)

Test Rod

Appearance	Model name	Diameter
	F39-TRD30	30 mm dia.



To check operation before use, purchase and use the test rod.

Related Standards

International Standards

- IEC 61496-1:2008 Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests
- IEC 61496-2:2006 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices
- IEC 61508-1 through -3: 2010 Functional safety of electrical/electronic/programmable electronic safety-related systems
- IEC 62061:2005 Safety of machinery - Safety-related electrical, electronic and programmable electronic control systems
- ISO 13849-1:2006 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- ISO 13855:2002 Safety of machinery - Positioning of protective equipment with respect to the approach speeds of parts of the human body

European Standards

- EN 61496-1:2004+A1:2008 Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests
- CLC/TS 61496-2:2006 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices
- EN 61508-1 through -3:2010 Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN 415-4:1997 Palletisers and depalletisers
- EN 692:2005 Mechanical presses
- EN 693:2001 Hydraulic presses
- EN 999:1998 Safety of machinery - Positioning of protective equipment with respect to the approach speeds of parts of the human body
- EN 1037:1995 Safety of machinery : Prevention of unexpected start-up
- EN 61000-6-4:2007/A1:2011 Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
- EN 62061:2005 Safety of machinery - Safety-related electrical, electronic and programmable electronic control systems

U.S. Federal Regulations

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

U.S. Standards

- ANSI B11.1:2001 Mechanical power presses
- ANSI B11.2:1995 (R2005) Hydraulic power presses
- ANSI B11.3:2002 Power press brakes
- ANSI B11.4:2003 Metal shears
- ANSI B11.5:1988 (R2002) Iron workers
- ANSI B11.6:2001 Lathes
- ANSI B11.7:1995 (R2005) Cold headers and cold formers
- ANSI B11.8:2001 Drilling, milling, and boring machines
- ANSI B11.9:1975 (R2005) Grinding machines
- ANSI B11.10:2003 Metal sawing machines
- ANSI B11.11:2001 Gear cutting machines
- ANSI B11.12:2005 Roll forming and roll bending machines
- ANSI B11.13:1992 (R1998) Single- and multiple-spindle automatic bar and chucking machines
- ANSI B11.14:1996 Coil slitting machines/systems
- ANSI B11.15:2001 Pipe, tube, and shape bending machines
- ANSI B11.16:2003 Metal powder compacting presses
- ANSI B11.17:2004 Horizontal hydraulic extrusion presses
- ANSI B11.18:2006 Machines and machinery systems for processing strip, sheet or plate from coiled configuration
- ANSI B11.19:2003 Performance criteria for the design, construction, care, and operation of safeguarding when referenced by the other B11 machine tool safety standards
- ANSI/RIA 15.06:1999 Industrial robots & robot systems safety requirements
- UL 1998:1998 Safety-related software
- UL 508:1999 Industrial control equipment
- UL 61496-1:2002 Electro-sensitive protective equipment - Part 1: General requirements and tests
- UL 61496-2:2002 Electro-sensitive protective equipment - Part 2: Particular requirements for active opto-electronic protective devices

Canadian Standards

- CAN/CSA C22.2 No.14-05 Industrial control equipment
- CAN/CSA C22.2 No.08-M1986 (R2008) Electronics integrated safety functions
- CSA Z142-02 Code for power press operation: Health, safety, and guarding requirements
- CSA Z432-04 Safeguarding of machinery
- CCSA Z434-03 Industrial robots and robot systems : General safety requirements

■ SEMI Standards

- SEMI S2-0706 Environmental, health, and safety guideline for semiconductor manufacturing equipment

■ JIS Standards

- JIS B 9704-1:2006 Safety of machinery - Electro-sensitive protective equipment - Part 1 : General requirements and tests
- JIS B 9704-2:2008 Safety of machinery - Electro-sensitive protective equipment - Part 2 : Particular requirements for equipment using active opto-electronic protective devices

Revision History

A manual revision code appears as a suffix to the product number at the bottom of the front and back covers of this manual.

No. SCHG-727:F

↑
Revision No.

Revision symbol	Revision date	Revisions
A	August, 2009	First edition
C	August, 2009	<ul style="list-style-type: none">• Added the contents about UL standards• Minor correction
D	February, 2010	<ul style="list-style-type: none">• Added the contents about new Machinery Directives• Added the contents about Free-location mounting• Minor correction
E	November, 2012	<ul style="list-style-type: none">• Added and corrected dimensions and notes.• Corrected the contents about EN 61508• Correction of errors
F	July, 2014	<ul style="list-style-type: none">• Updated the dates of effect for standards.• Changed the content of "Terms and Conditions Agreement".• Changed the test rod as an optional accessory.• Minor correction

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