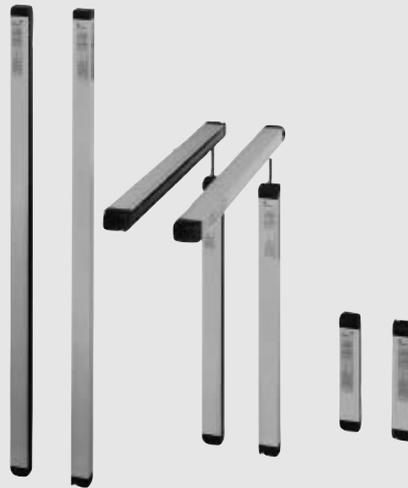


Safety Light Curtain

**F3S-B**

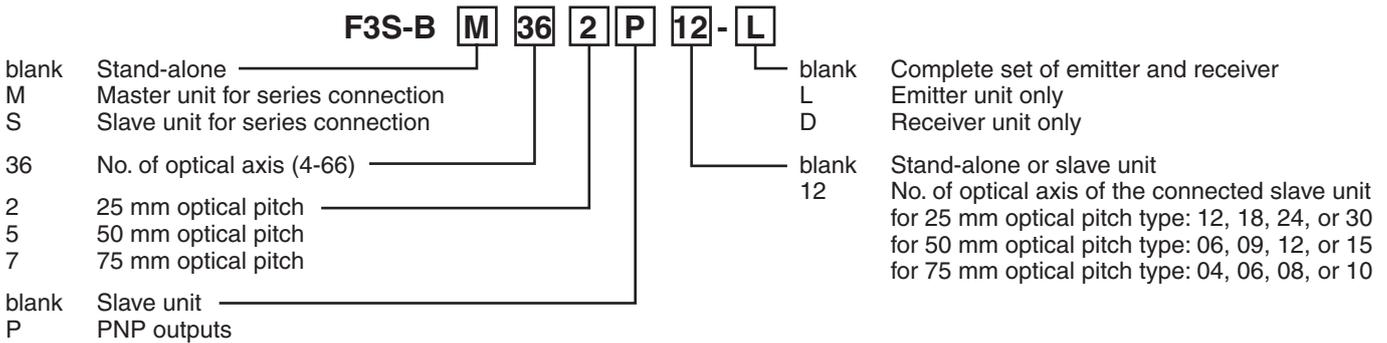
*Suitable for  
Detecting Human  
Bodies in a  
Dangerous Area*

*Safety Design for Category 2.*

**Features**

- The F3S-B is a type 2 Safety Light curtain intended to be used as or with the safety related parts of the control system of a machine to category 2, 1 or B as defined in the European standard EN954-1.
- Compliance with IEC 61496-2, EN 61496-1 standards and machine and EMC directive.
- Received certificates from Notified Bodies as Type 2 ESPE (Electro-Sensitive-Protective-Equipment).
- UL/CSA approved.
- Pursuing safety with high level of safety design and FMEA.
- Series configuration of two units is possible.
- Units available with an axis pitch of 25 mm (hand protection), 50 mm (arm protection) or 75 mm (body protection) in protective height ranging from 300 mm to 1650 mm.
- Human body detection system without a dedicated control box.
- M12 Connector

Ordering Information



Stand-alone	Master unit	Slave unit	Optical resolution	No. of optical axes	Protective height	Weight (without accessories)
F3S-B122P	F3S-BM122P□□	F3S-BS122	30 mm	12	300 mm	0.9 kg
F3S-B182P	F3S-BM182P□□	F3S-BS182		18	450 mm	1.2 kg
F3S-B242P	F3S-BM242P□□	F3S-BS242		24	600 mm	1.5 kg
F3S-B302P	F3S-BM302P□□	F3S-BS302		30	750 mm	1.8 kg
F3S-B362P	F3S-BM362P□□	-		36	900 mm	2.1 kg
F3S-B422P	F3S-BM422P□□	-		42	1,050 mm	2.5 kg
F3S-B482P	F3S-BM482P□□	-		48	1,200 mm	2.8 kg
F3S-B542P	F3S-BM542P□□	-		54	1,350 mm	3.1 kg
F3S-B602P	F3S-BM602P□□	-		60	1,500 mm	3.4 kg
F3S-B662P	F3S-BM662P□□	-		66	1,650 mm	3.7 kg
F3S-B065P	F3S-BM065P□□	F3S-BS065		55 mm	6	300 mm
F3S-B095P	F3S-BM095P□□	F3S-BS095	9		450 mm	1.2 kg
F3S-B125P	F3S-BM125P□□	F3S-BS125	12		600 mm	1.5 kg
F3S-B155P	F3S-BM155P□□	F3S-BS155	15		750 mm	1.8 kg
F3S-B185P	F3S-BM185P□□	-	18		900 mm	2.1 kg
F3S-B215P	F3S-BM215P□□	-	21		1,050 mm	2.5 kg
F3S-B245P	F3S-BM245P□□	-	24		1,200 mm	2.8 kg
F3S-B275P	F3S-BM275P□□	-	27		1,350 mm	3.1 kg
F3S-B305P	F3S-BM305P□□	-	30		1,500 mm	3.4 kg
F3S-B335P	F3S-BM335P□□	-	33		1,650 mm	3.7 kg
F3S-B047P	F3S-BM047P□□	F3S-BS047	80 mm		4	300 mm
F3S-B067P	F3S-BM067P□□	F3S-BS067		6	450 mm	1.2 kg
F3S-B087P	F3S-BM087P□□	F3S-BS087		8	600 mm	1.5 kg
F3S-B107P	F3S-BM107P□□	F3S-BS107		10	750 mm	1.8 kg
F3S-B127P	F3S-BM127P□□	-		12	900 mm	2.1 kg
F3S-B147P	F3S-BM147P□□	-		14	1,050 mm	2.5 kg
F3S-B167P	F3S-BM167P□□	-		16	1,200 mm	2.8 kg
F3S-B187P	F3S-BM187P□□	-		18	1,350 mm	3.1 kg
F3S-B207P	F3S-BM207P□□	-		20	1,500 mm	3.4 kg
F3S-B227P	F3S-BM227P□□	-		22	1,650 mm	3.7 kg

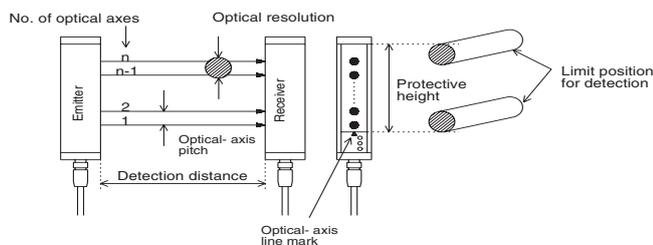
## Nomenclature

### Protective height

The F3S-B can detect in the area indicated by "Protective height" in the figure below. The protective height is from "the Optical-axis line mark above the indicator area" to "the end of the yellow metal case".

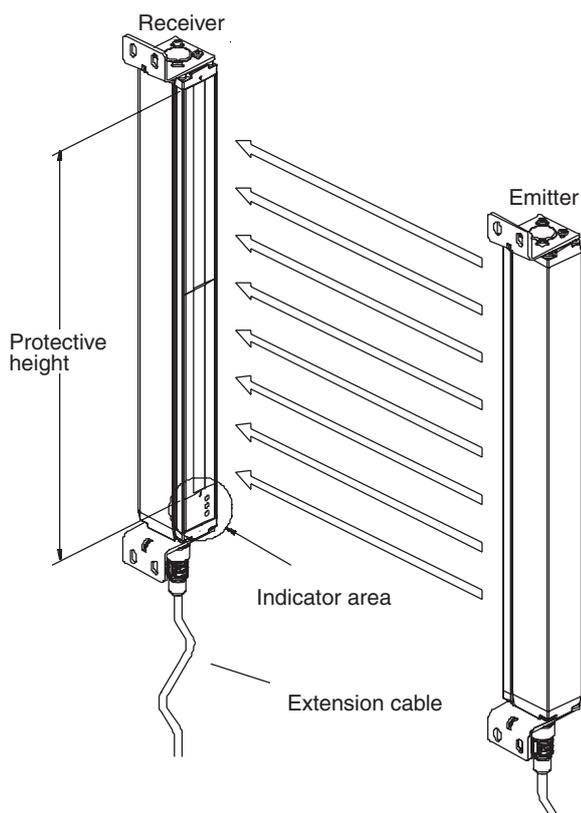
### Optical-axis line mark

The center line for optical axes is indicated by the triangle mark. This position is a reference line for measuring safety distance.



### Stand-alone type

This is the most common configuration, and it is used to protect a hazardous part of a machine when approached from one direction only.

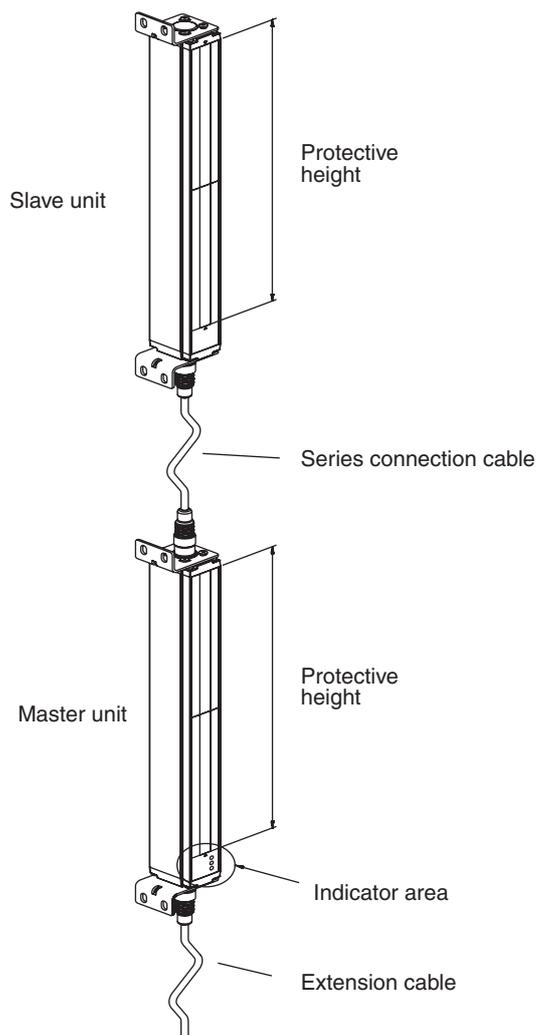


### Series connection types

When your application requires an additional protective zone, for example, to prevent someone from staying behind a primary detection zone, the F3S-B may be connected in series. The system consists of a master unit, a slave unit, and a series connection cable, type F39-JB1B.

The series connection allows up to 96 axes and 2.4 m of protective height in total.

Series connection types have the same characteristics as a stand-alone types. When the detection zone of the master unit or that of the slave unit is interrupted, the outputs of the master unit go to the OFF-state.



Note: Slave unit does not have indicators.  
Master unit and slave unit need to be ordered separately.

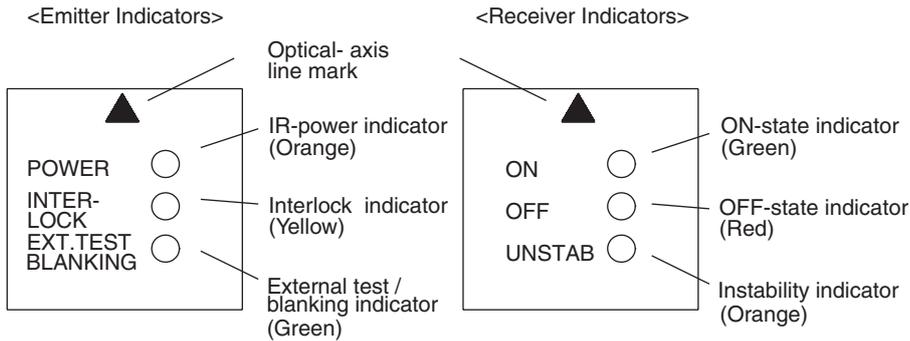
Rating and Performance

Type	F3S-B□□□P <sup>*1</sup> Stand-alone			F3S-BM□□□P□□ <sup>*1</sup> Master unit for series connection			F3S-BS□□□ <sup>*1</sup> Slave unit for series connection		
	No. of optical axes	12 to 66	6 to 33	4 to 22	12 to 66	6 to 33	4 to 22	12 to 30	6 to 15
Optical-axis pitch	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm
Optical resolution (Detection capability)	Non-transparent: in diameter								
	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm
Protective height	300 / 450 / 600 / 750 / 900 / 1,050 / 1,200 / 1,350 / 1,500 / 1,650 mm						300 / 450 / 600 / 750 mm		
Detection distance	0.3 to 5.0 m, up to 8 m on request								
Response time	ON to OFF: See table "Response Time" OFF to ON <sup>*2</sup> : Default 100 ms (selectable with F39-U1E, 80 to 400 ms)								
Startup waiting time	2 s max.								
Supply voltage: Vs	24 VDC ± 20% (including 5 Vp-p ripple)								
Current consumption	400 mA max. (under no-load conditions)								
Light source	Infrared LED (880 nm wavelength). Lifetime: 50,000 hrs. at 25 °C.								
Effective aperture angle	Within ± 5° for the emitter and receiver at a detection distance of at least 3 m according to IEC 61496-2								
Operating mode	Light ON								
Control output	Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Instability output	PNP transistor output (not safety-related control output), activated during an insufficient light detection, failure detection and connection with F39-E1, load current 100 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Protection circuit	Output short-circuit protection, power supply reverse connection protection								
Start/restart interlock function	Mode selection before power ON by connecting "Interlock selection input" line to: Active: No connection or 0 to 2.5 VDC, 3 mA max. Inactive: Instability output line Reset of start/restart interlock by connecting "Interlock selection input" line to: Interlock reset: 17 VDC to Vs, 20 mA max. Duration time 15 to 2,500 ms								
External test function	Mode selection by connecting "External test input" line to: Active: 17 VDC to Vs, 10 mA max. Duration time at least 15 ms Inactive: No connection or 0 to 2.5 VDC, 2 mA max.								
Relay monitoring function (optional)	Default inactive, selectable with F39-U1E Relay monitoring input line with NC contact connected, Available level: 17 VDC to Vs, 10 mA max. Allowed relay delay time <sup>*3</sup> : Selectable between 20 and 300 ms Termination when not selected: No connection or 0 to 2.5 VDC, 2 mA max.								
Start interlock function (optional)	Default inactive, selectable with F39-U1E								
Blanking function (optional)	Default inactive, selectable with F39-U1E								
Indicator	See "Indicators"						No indicators		
Connection method	For Extension cable: 8 pins, M12 connector For Series connection cable: 6 pins, M12 connector								
Ambient temperature	During operation: -10 to 55 °C (with no freezing) During storage: -25 to 70 °C								
Ambient humidity	During operation: 35 to 85 %RH (with no condensation) During storage: 35 to 95 %RH								
Insulation resistance	20 MΩ min. (at 500 VDC)								
Dielectric strength voltage	1,000 VAC 50/60 Hz for 1 min								
Degree of protection	IEC60529 IP65								
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.7mm, X, Y and Z directions 20 sweeps								
Shock resistance	Normal operation: 100 m/s <sup>2</sup> [10 G], X, Y and Z directions: 1000 times								
Materials	Case: Aluminum Front cover: PMMA (acrylic resin) End caps: PA6								
Size (cross section)	30 x 40 mm								

Type	F3S-B□□□P <sup>*1</sup> Stand-alone	F3S-BM□□□P□□ <sup>*1</sup> Master unit for series connection	F3S-BS□□□ <sup>*1</sup> Slave unit for series connection
Accessories	Test rod <sup>*3</sup> , mounting brackets (top and bottom), mounting brackets (intermediate) <sup>*4</sup> , mounting plates <sup>*5</sup> , Instruction manual <sup>*5</sup>		
Applicable standard	IEC(EN)61496-1 TYPE 2 ESPE (Electro-Sensitive Protective Equipment) IEC 61496-2 TYPE 2 AOPD (Active Opto-electronic Protective Devices)		

Note: 1. For detailed type names and optical specifications, see „Type Naming Rule“  
 2. Nominal value (set time). The accuracy is -0 ... +70% of the ON to OFF response time.  
 3. Only with F3S-B□□□2P and BM□□□2P□□.  
 4. For the 1,050 mm protective height and longer types.  
 5. Only with F3S-B□□□P□ and BM□□□2P□□.

Indicators



Emitter	IR-power indicator: Interlock indicator: External test/ blanking indicator:	Lit when emitting. Lit during start/restart interlock or start interlock. Lit during external test. / Flashing when using blanking function.
Receiver	ON-state indicator: OFF-state indicator: Instability indicator:	Lit when receiving light. Lit with interrupted light. Flashing during connection with F39-E1 or with failure. Lit with an insufficient light reception or failure. Flashing during connection with F39-E1.

## Table of Response Time

### Stand-alone type

	Response time [ms ]		Response time [ms ]		Response time [ms ]
F3S-B122P	20	F3S-B065P	20	F3S-B047P	20
F3S-B182P	20	F3S-B095P	20	F3S-B067P	20
F3S-B242P	20	F3S-B125P	20	F3S-B087P	20
F3S-B302P	23	F3S-B155P	20	F3S-B107P	20
F3S-B362P	27	F3S-B185P	20	F3S-B127P	20
F3S-B422P	30	F3S-B215P	21	F3S-B147P	20
F3S-B482P	34	F3S-B245P	22	F3S-B167P	20
F3S-B542P	37	F3S-B275P	24	F3S-B187P	20
F3S-B602P	41	F3S-B305P	26	F3S-B207P	20
F3S-B662P	45	F3S-B335P	28	F3S-B227P	21

### Series connection types

The following chart shows the response time of combinations of a master unit and a slave unit connected in series. For example, the response time of the combination of F3S-BM122P30 and F3S-BS302 is 30 ms.

Slave unit F3S- Master unit	Response time [ms]			
	BS122	BS182	BS242	BS302
F3S-BM122P□□	20	23	27	30
F3S-BM182P□□	23	27	30	34
F3S-BM242P□□	27	30	34	37
F3S-BM302P□□	30	34	37	41
F3S-BM362P□□	34	37	41	45
F3S-BM422P□□	37	41	45	49
F3S-BM482P□□	41	45	49	54
F3S-BM542P□□	45	49	54	57
F3S-BM602P□□	49	54	57	61
F3S-BM662P□□	54	57	61	65

Slave unit F3S- Master unit	Response time [ms]			
	BS047	BS067	BS087	BS107
F3S-BM047P□□	20	20	20	20
F3S-BM067P□□	20	20	20	20
F3S-BM087P□□	20	20	20	20
F3S-BM107P□□	20	20	20	20
F3S-BM127P□□	20	20	20	21
F3S-BM147P□□	20	20	21	23
F3S-BM167P□□	20	21	23	24
F3S-BM187P□□	21	23	24	25
F3S-BM207P□□	23	24	25	26
F3S-BM227P□□	24	25	26	27

Slave unit F3S- Master unit	Response time [ms]			
	BS065	BS095	BS125	BS155
F3S-BM065P□□	20	20	20	21
F3S-BM095P□□	20	20	21	22
F3S-BM125P□□	20	21	22	24
F3S-BM155P□□	21	22	24	26
F3S-BM185P□□	22	24	26	28
F3S-BM215P□□	24	26	28	30
F3S-BM245P□□	26	28	30	32
F3S-BM275P□□	28	30	32	34
F3S-BM305P□□	30	32	34	35
F3S-BM335P□□	32	34	35	37

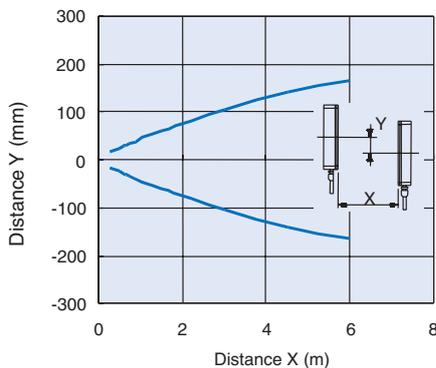
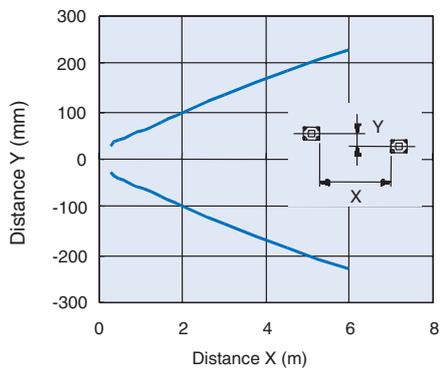
## Characteristic data

### Operating Range

#### F3S-B122P

Parapendicular to Center Line of Lenses

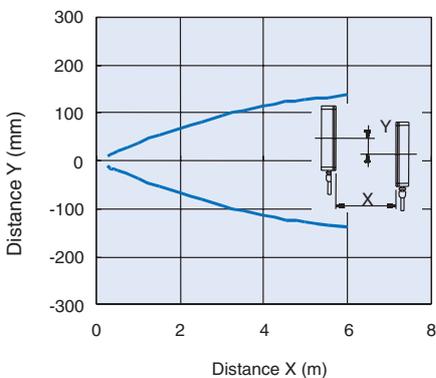
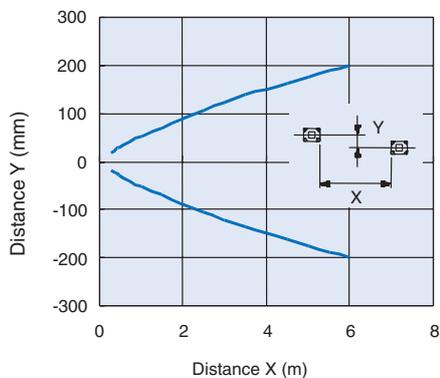
Parallel to Center Line of Lenses



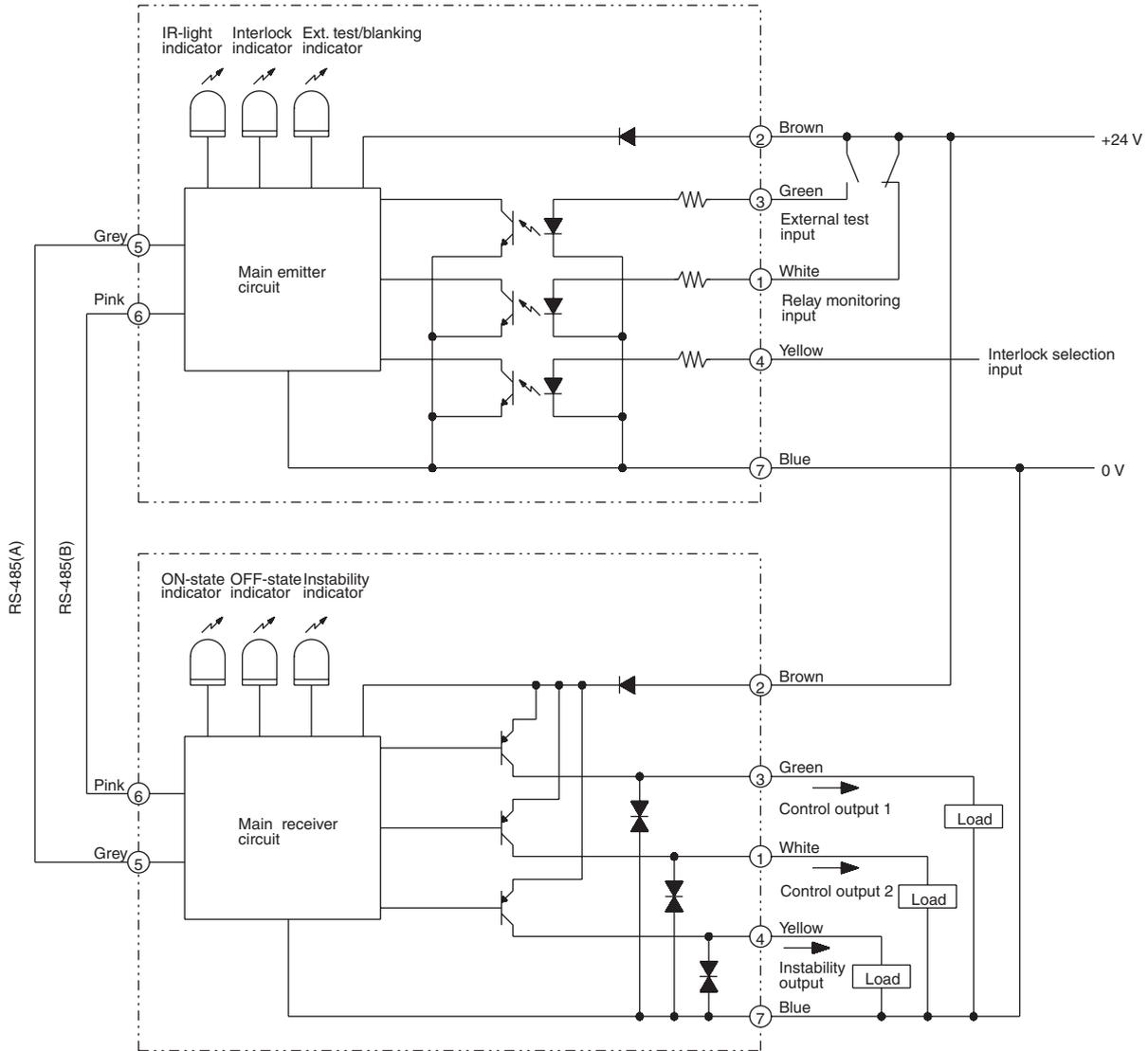
#### F3S-B662P

Parapendicular to Center Line of Lenses

Parallel to Center Line of Lenses



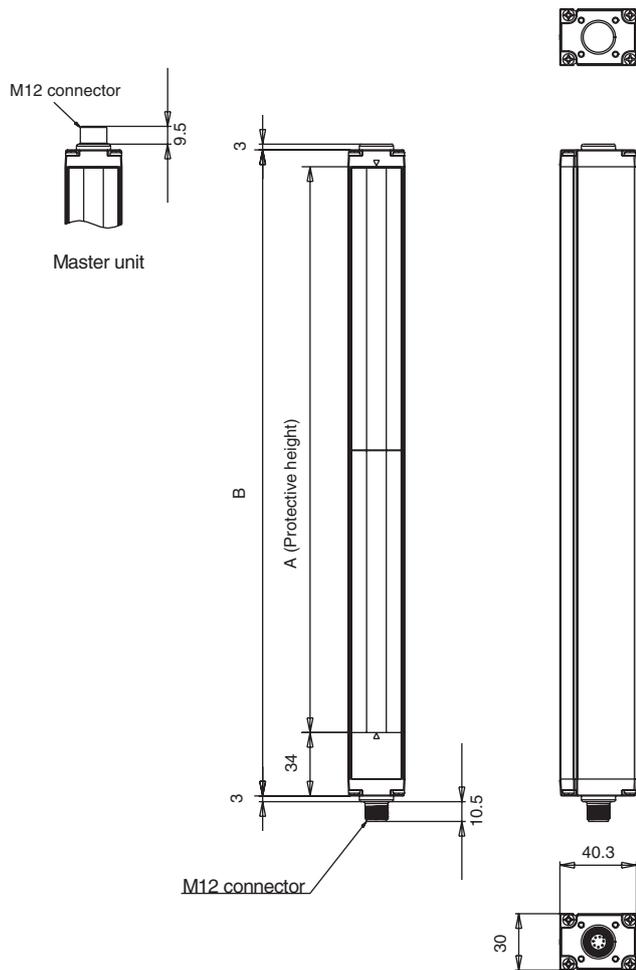
I/O Circuit Diagram



Dimensions

Safety Light Curtain

F3S-B

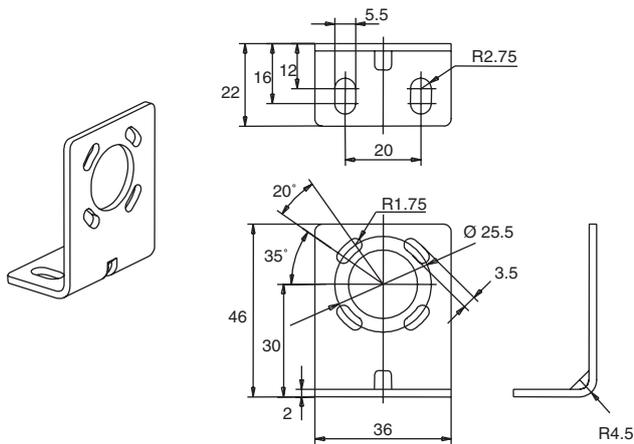


Type	A Protective height	B Full length
F3S-B122, -B065, -B047	300	343
F3S-B182, -B095, -B067	450	493
F3S-B242, -B125, -B087	600	643
F3S-B302, -B155, -B107	750	793
F3S-B362, -B185, -B127	900	943
F3S-B422, -B215, -B147	1050	1093
F3S-B482, -B245, -B167	1200	1243
F3S-B542, -B275, -B187	1350	1393
F3S-B602, -B305, -B207	1500	1543
F3S-B662, -B335, -B227	1650	1693

Note: All units are in Millimeters unless otherwise indicated.

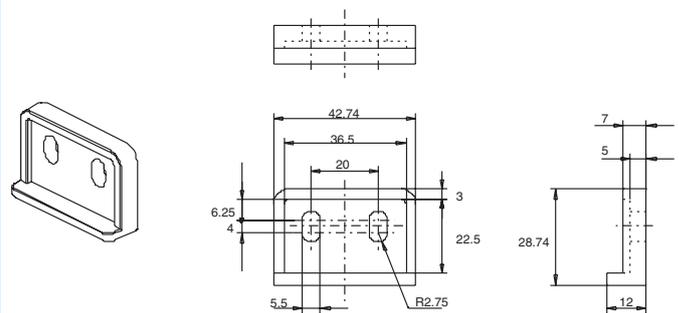
Accessoires

Mounting Bracket (Top and Bottom)



Mounting Plate

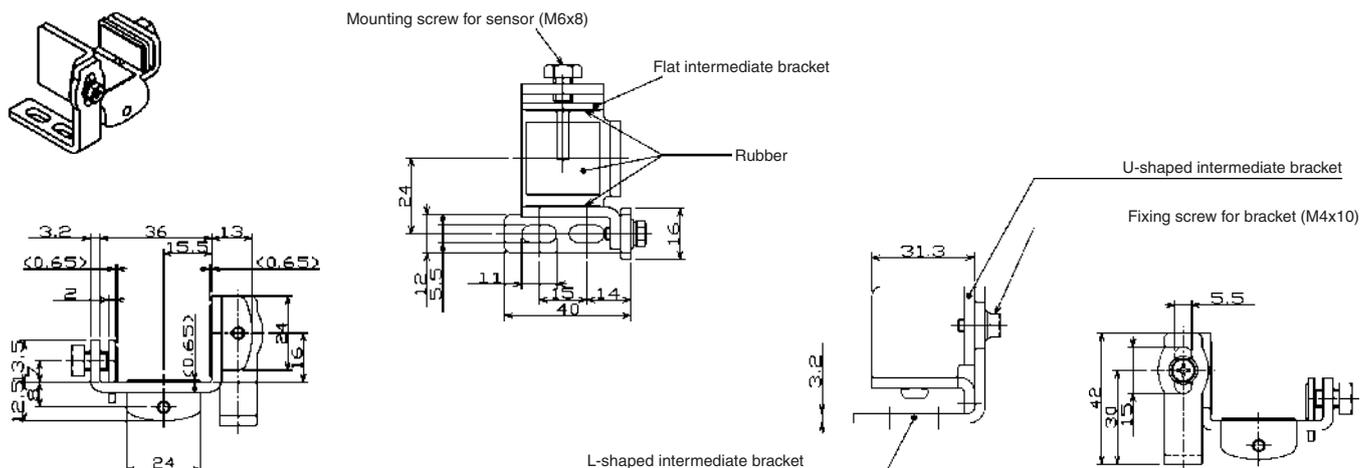
Only supplied with types which have a protective height of 1050 mm or longer (Including intermediate brackets). Only needed for rear mounting



F3S-B

### Intermediate Mounting Bracket

Only needed for types which have a protective height of 1050 mm or longer



### Options (Order Separately)

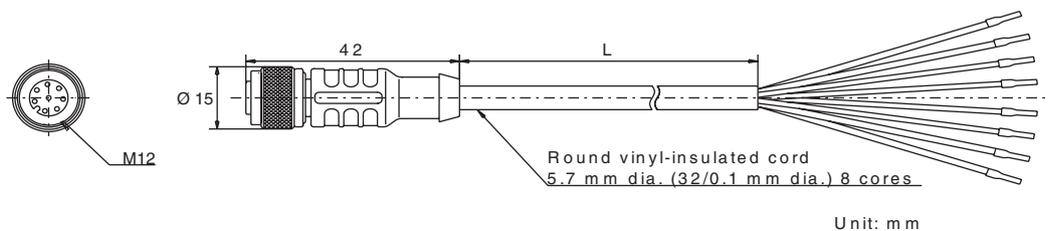
#### Extension Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1A (L = 3 m)

F39-JB2A (L = 7 m)

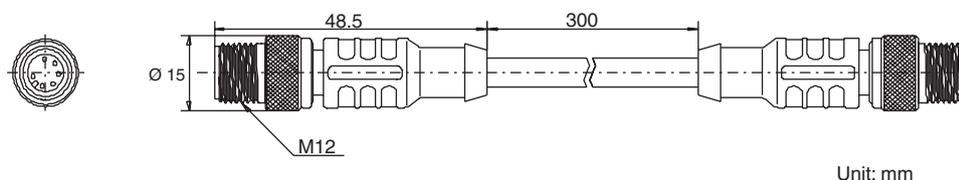
F39-JB3A (L = 10 m)



#### Series Connection Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1B



#### Optional Function Kit

F39-EU1E

This set includes the following items:

- F39-U1E OptionalFunction Software
- F39-E1 Interface Unit
- F39-JB1C Interface Cable

The F39-U1E Optional Function Software is the WINDOWS®-based software for use with the F39-E1 Interface Unit to program the F3S-B Safety Light Curtain, and provided with one 3.5 inch floppy disk. This software has the following features:

- Set the following functions to the F3S-B
  - Start interlock function
  - Relay monitoring function
  - Blanking function
- Display each axis and each input line condition of the F3S-B
- Change the ON delay time

Note: The F3S-B is not in normal operation during connection with the F39-E1. The control outputs are held in their OFF-state. For detailed information please refer to "Details of F39-EU1E" in this data sheet.

#### ⚠ WARNING

After setting the blanking function, check that the F3S-B detects a test rod at any position in the F3S-B detection zone through which a person reaches the hazardous part of the machine. If any positions are found by check above, install protective structures to there to prevent intrusion which F3S-B can not detect. Failure to do so may result in serious injury.

Perform the installation check and the periodical inspection described in the F3S-B manual.

Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury.

Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %. Do not connect the F39-E1 to an AC power supply.

## Installation

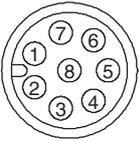
### Wiring

Disconnect all sources of power before wiring the F3S-B to a machine.

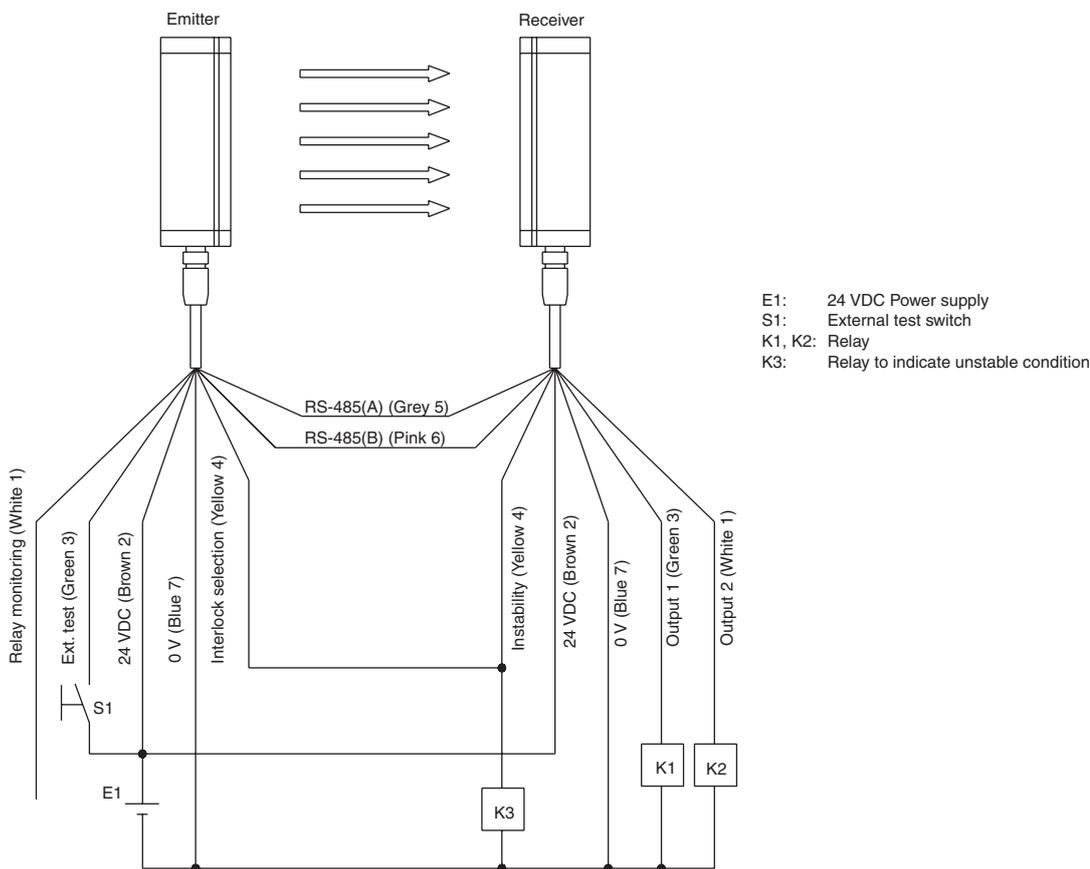
- Connect the emitter extension cable (F39-JBxA-L optional, gray color outer jacket) to the emitter. (The emitter uses gray color plastic caps.)

- Connect the receiver extension cable (F39-JBxA-D optional, black color outer jacket) to the receiver. (The receiver unit uses black color plastic caps.)
- Connect the 0 V line of the power supply directly to protective earth (PE).

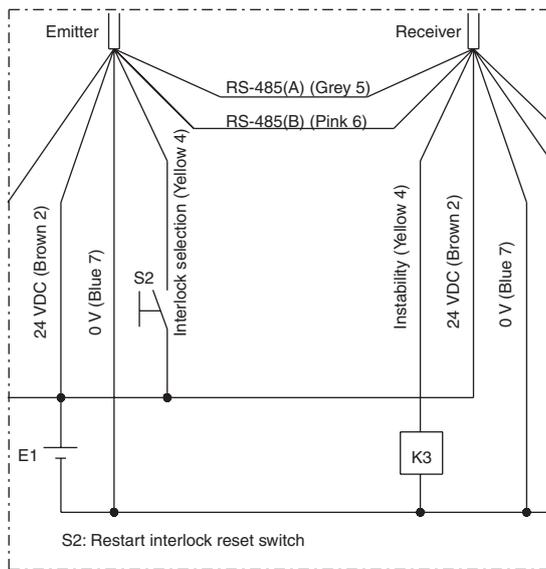
Note: Be sure to wire correctly. Failure to do so may damage the F3S-B.

Front View	Pin No.	Signal Name		Wire Color of Extension Cable
		Receiver	Emitter	
	1	Control output 2	Relay monitoring input	White
	2	24 VDC	24 VDC	Brown
	3	Control output 1	External test input	Green
	4	Instability output	Interlock selection input	Yellow
	5	RS-485 (A)	RS-485 (A)	Grey
	6	RS-485 (B)	RS-485 (B)	Pink
	7	0 V	0 V	Blue
	8	N.C. / reserved*1	N.C. / reserved	Red

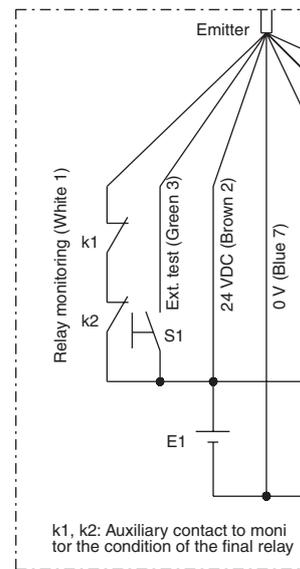
\*1. N.C. / reserved: do not connect



**When using START/RESTART FUNCTION**



**When using optional RELAY MONITORING FUNCTION**



**Details of F39-EU1E Optional Function Kit**

**1. Installation**

**1.1 Preparation**



Perform the installation check and the periodical inspection described in the F3S-B manual.

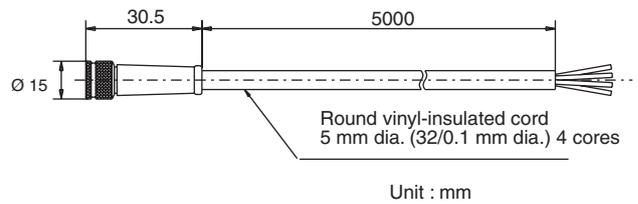
Do not disassemble, repair or modify the F39-E1.

Do not use the F39-E1 in flammable or explosive environments.

To use the F39-U1E software, the following items are necessary.

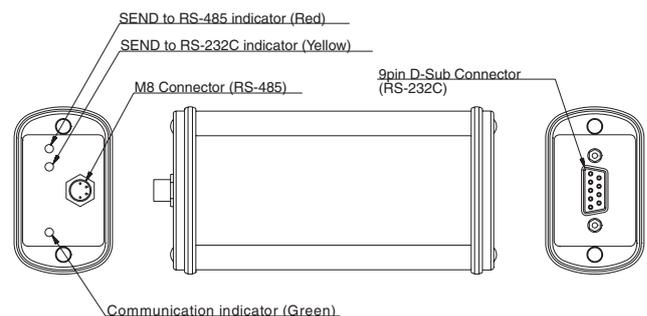
- Personal Computer (not included)
  - Windows® 95, Windows® 98, or Windows NT®
  - 133MHz Pentium® processor or better
  - 32MB RAM or higher for Windows® 95 and Windows® 98
  - 64MB RAM or higher for Windows NT®
  - A 115kBd RS-232 serial interface port or better
- F39-E1 Interface Unit

- F39-JB1C Interface cable 5 m cable length, M8 connector (4 pins)



- RS-232C cable (not included)

**1.2 Component Names and Functions of the F39-E1 Interface Unit**



**SEND to RS-485 Indicator (Red)**

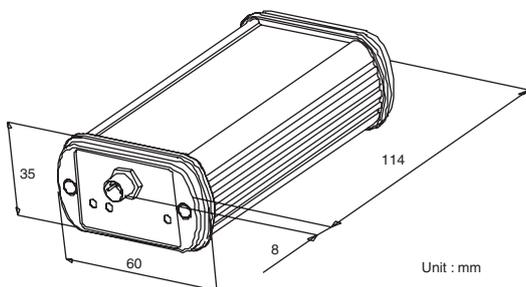
Lit when the F39-E1 sends data to the F3S-B via RS-485.

**SEND to RS-232C Indicator (Yellow)**

Lit when the F39-E1 sends data to the PC via RS-232C.

**COMMUNICATION Indicator (Green)**

Flashing during communication between the F3S-B and the F39-E1.

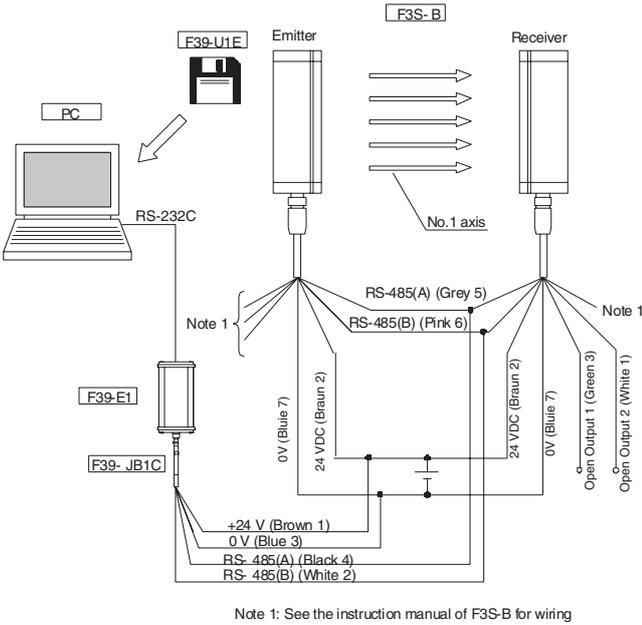


1.3 Hardware Connection

**⚠ WARNING**

Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury. Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %. Do not connect the F39-E1 to an AC power supply.

1.3.1 Wiring Diagram



1.3.2 Wiring Procedure

1. Connect the F3S-B (see the instruction manual of the F3S-B for wiring.)
2. Connect the Interface cable (F39-JB1C) to the Interface unit (F39-E1).
3. Connect the 4 wires of the Interface cable to each appropriate line of the F3S-B.
4. Connect an RS-232C cable to the PC and the Interface unit.

1.4 Software-Installation

Copy the file „F39-U1E\_ver#.#.exe“ and F39-U1E\_ver#.#.dat from the enclosed 3.5-inch floppy disk onto the hard disk of the PC.

2. Function Description

2.1 Start Interlock

When the Start interlock function is used, the F3S-B does not go to the ON-state automatically after power ON. Interrupting one or more axes resets the start interlock condition of the F3S-B then starts normal operation. The duration of the interruption must be equal or shorter as defined in the „Max. interruption time (sec)“.

Max. Interruption Time

The max interruption time can be set between 0.3 and 2 s.

Note: In the case both the Start interlock and the Start/restart interlock are selected, only the Start/restart interlock will be activate.

Start/Restart interlock is a function which is selected by wiring. Refer to the instruction manual of the F3S-B for more detailed information.

2.2 Relay Monitoring

MPCEs (Machine Primary Control Elements) are usually relays or contactors used to control hazardous movement directly. The state of the MPCEs can be checked with the Relay monitoring function.

A voltage of 17 VDC to Vs (Supplied voltage to F3S-B) has to be applied to the Relay monitoring input through the NC contacts of the MPCEs when the F3S-B control outputs are in the OFF-state (see the F3S-B manual for wiring information). To ensure this logic relation, the MPCEs must be safety approved types, with forcibly guided contacts.

Allowed Relay Delay Time

The allowed relay delay time can be set between 20 and 300 ms. This delay time has to be set at least 20 milliseconds shorter than the Outputs ON delay time.

2.3 Outputs ON Delay

You can set the ON delay time of control outputs between 80 and 400 ms. This corresponds to the time which the control outputs go to ON-state after the detection zone is not interrupted.

Note: 1. When the Relay monitoring function is also used, the ON delay time must meet the formula below.

2. ON delay time = Allowed relay delay time + 20 ms After the Relay monitoring function is set, if the ON delay time does not meet the above formula, the ON delay time will be changed automatically into "Allowed relay delay time" + 20 ms.

2.4 Blanking

With the Blanking function, one or more axes can be disabled. This function is useful in an application where a part of the F3S-B detection zone is always interrupted. The Manual-setting and the Teaching-setting are available to select the blanked axes.

Note: 1. In the case the blanked zone is not filled with structure completely and remains some opening, the opening must be filled with the protective structure.

2. All axes can not be disabled. At least one axis needs to be active.

3. Ratings and Performance

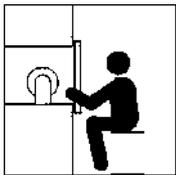
Type	F39-E1 Interface unit
Supply voltage	24 VDC ± 20% (including 5 Vp-p ripple)
Current Consumption	120 mA max.
Interface	RS-232C interface, RS-485 interface
Indicator	See 1-2
Connection method	RS-485: 4pins, M 8 connector RS-232C: D-SUB connector, 9 pins
Protection circuit	RS 485 protection against wrong wiring
Ambient Temperature	During operation: -10 to 55° C (with no freezing) During storage: -25 to 70° C
Ambient Humidity	During operation : 35 to 85% RH (with no condensation)
Ambient Humidity	During storage: 35 to 95% RH
Insulation Resistance	20 MΩ min. (at 500 VDC)
Dielectric strength voltage	500 VAC 50/60 Hz for 1 min.
Degree of Protection	IEC60529 IP20
Shock resistance	Normal operation: 150 m/s <sup>2</sup> [15 G], ±X, ±Y and ±Z directions: 3 times
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.3mm, X, Y and Z directions: 10 sweeps
Cable length	RS-485 cable: 5 m (4 pin 0.25 mm <sup>2</sup> ) RS-232C cable: Standard
Materials	Case: Aluminum
Size	122 x 60 x 35 mm
Conformity	EMC Directive

Precautions

⚠ WARNING

1. Do not use the F3S-B on machines that can not be stopped by electrical control in case of an emergency.
2. Do not use the F3S-B in flammable or explosive environments
3. Always maintain the safety distance between F3S-B and a hazardous part of the machine. Serious injury may result if the machine does not stop before someone reaches the hazardous part.
4. Install protective structures around a machine so that you must pass through the detection zone to reach a hazardous part of the machine.
5. Install F3S-B so that some parts of the operator's body remain in the detection zone at all times when the operator works in the hazardous area.
6. Failure to do so may result in serious injury.

Correct installation



A hazardous part of a machine can be reached only by passing through the sensor detection zone.

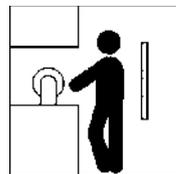


Some part of the operator's body remains in the detection zone while they are working.

Incorrect installation



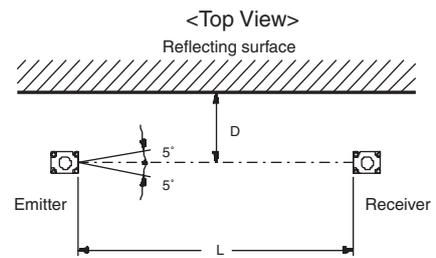
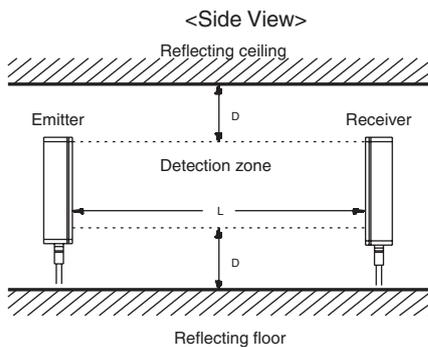
A hazardous part of the machine can be reached without passing through the sensor detected zone.



A worker is between the sensor detection zone and a hazardous part of a machine.

⚠ WARNING

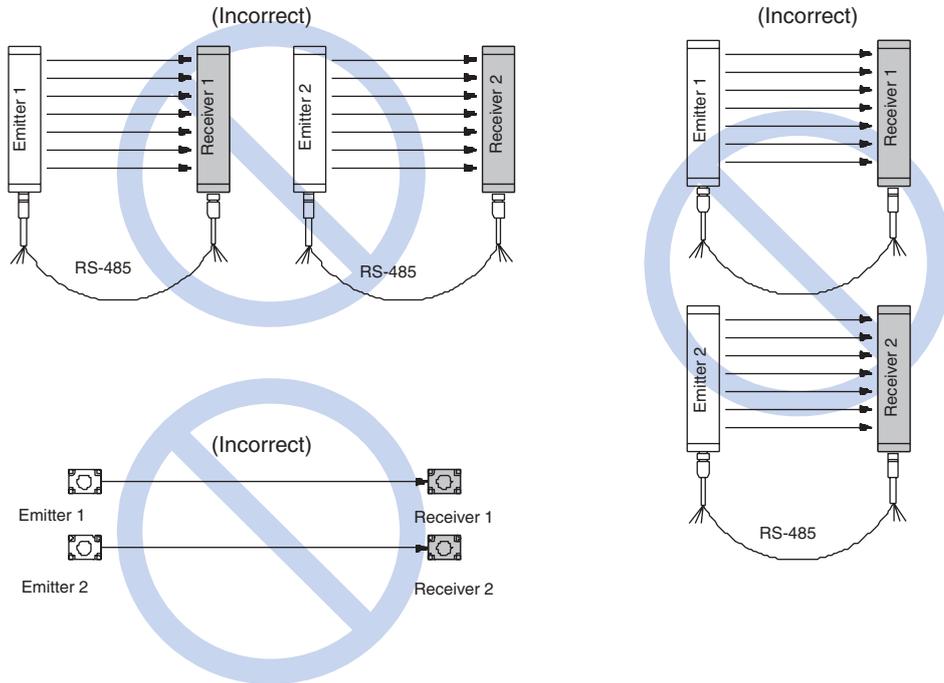
1. Be sure to install the F3S-B to minimize the effects of reflections from reflective surfaces. Failures to do so will create an inability to detect and may result in serious injury
2. Install the F3S-B with a minimum distance D as shown below form the reflective surface (highly reflective surfaces) like metal walls, floors, ceilings, and work pieces.



Distance between emitter and receiver (detection distance L)	Minimum installation distance D
0.3 to 3 m	0.26 m
3 to 5 m	$L \times \tan 5^\circ = L \times 0.088$ (m)

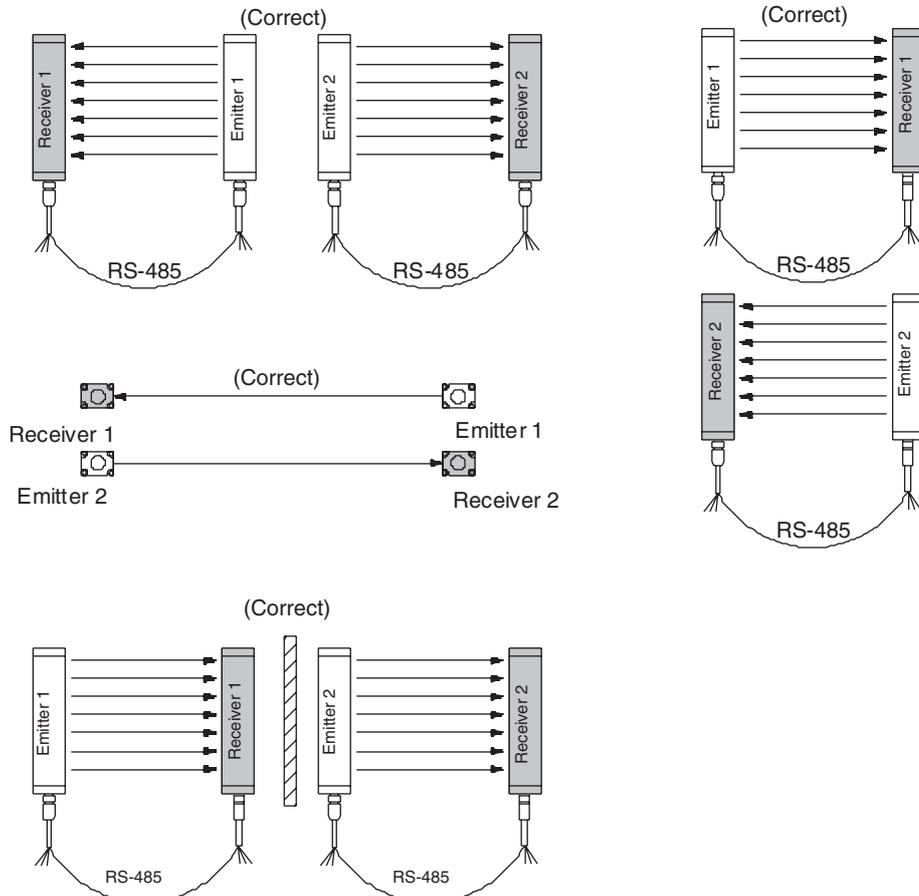
**⚠ WARNING**

When using multiple sets of the F3S-B, install them so that mutual interference is not incurred.



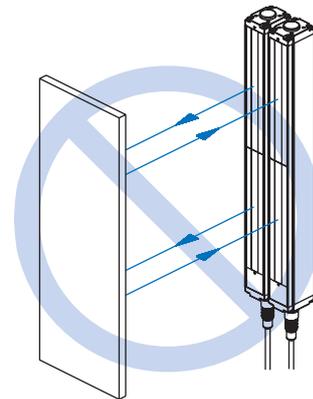
**Alternate emitters and receivers**

Correct installations are shown below to prevent mutual interference.



⚠ WARNING

1. The F3S-B is a TYPE 2 Electro-sensitive protective equipment, intended to be used as or with the safety related part of control system to category 2, 1 or B as defined in the European standard EN954-1.  
Do not use the F3S-B in category 3 or 4 systems.
2. A qualified person, as determined by local regulations, must confirm that installation, inspection and maintenance are implemented correctly.
3. Do not short the output lines to the +24 V line. Doing so will cause the output to be always ON, creating a hazardous situation.
4. Do not connect the F3S-B to a power supply with voltage higher than 24 VDC + 20%. Do not connect the F3S-B to an AC power supply.
5. Be sure to conduct inspections regularly.
6. The F3S-B cannot be used in applications where hazardous projectiles may exit the protected zone.
7. Do not disassemble, repair or modify the F3S-B.
8. DC power supply units must satisfy all of the conditions below so that the F3S-B can comply with the applicable standards IEC 61496-1 and UL 508.
  - (1.) The power supply voltage must be within rating (24 VDC  $\pm$  20%).
  - (2.) The power supply is connected only to the F3S-B and to the electro-sensitive protective function of the F3S-B, such as a safety controller and muting sensors, and it has enough rated current for all the devices.
  - (3.) The power supply uses double or reinforced insulation between the primary and secondary circuits.
- (4.) The power supply automatically resets overcurrent protection characteristics (voltage drop).
- (5.) The power supply maintains an output holding time of at least 20 ms.
- (6.) FG (frame ground terminal) must be connected to PE (protective earth) when using a commercially available switching regulator.
- (7.) The power supply must have output characteristics required for the power source for Class 2 Circuit or Limited Voltage / Current Circuit as defined in UL508.
- (8.) The power supply must conform to regulatory requirements and standards, regarding EMC and electrical equipment safety, of the country where the F3S-B is installed and where machinery will be operated, for example: The EMC Directive (industrial environment) and the Low Voltage Directive in EU.
9. Do not use the F3S-B in a direct retroreflective configuration. Otherwise detection may fail.



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety sensor for Palletisers

# F3S-TGR-SB□C series



## Features

### For Palletiser

F3S-TGR-SB□C series has been developed especially for Palletisers and wrapping machine access protection applications.

### Active - Passive system and Plug and play

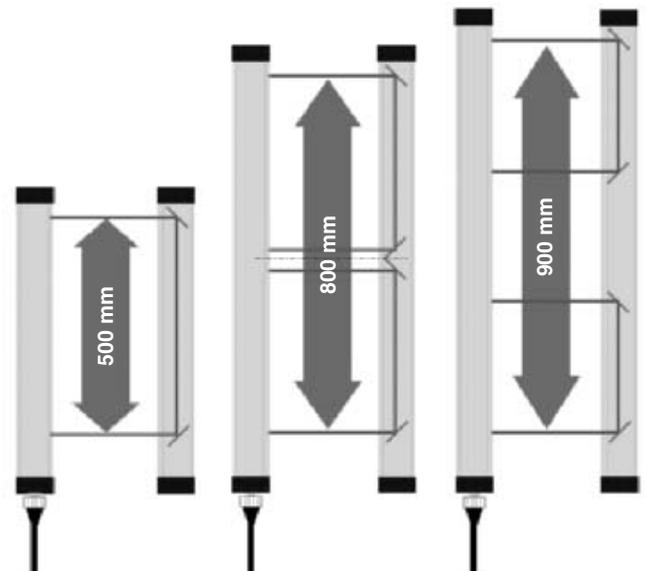
By using a mirror system we can achieve an active - passive multi beam system. This active passive system will improve installation time and reduce costs.



### 3 Different types available

We provide 3 different Types as following:

- 2 beam Type (beam pitch 500 mm)
- 3 beam Type (beam pitch 400 mm)
- 4 beam Type (beam pitch 300 mm)



### Muting functions are integrated

Following Muting functions are integrated:

- Muting sensor inputs
- Muting Lamp output
- Override input (120 second max)
- Test / Reset input
- Interlock function and Test Reset input

F3S-TGR

### Decentralized Muting connection Box

Furthermore, using a F39-TGR-SB-CMB1, it's possible to reduce the wiring time and wiring material for the muting Sensors and Muting Lamp etc.



Ex. 1

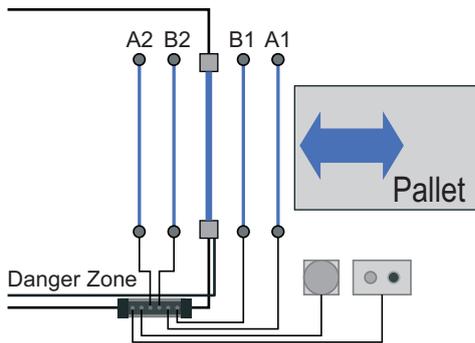
Ex. 2

In the conventional solution all wires from the light curtain, mute sensors, lamp, reset are wired back to the mute controller in the control cabinet (See Ex. 1)  
As you can see this solution need JUST ONE WIRE to the cabinet (See Ex. 2)

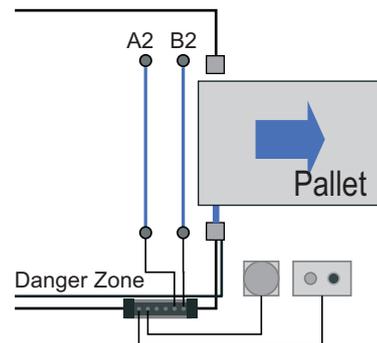


Multiple mute connections are possible

#### 1. PARALLEL MUTING and TWO WAY direction

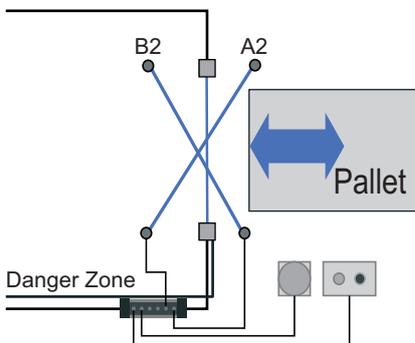


#### 2. PARALLEL MUTING and ONE WAY direction

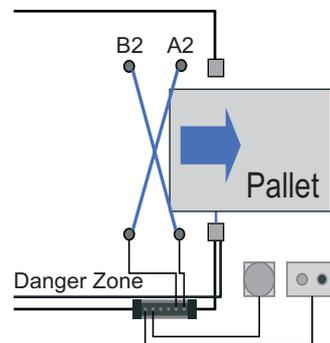


Please add MTL\*. Ex. F3S-TGR-SB4-K1CMTL

#### 3. CROSS MUTING and TWO WAY direction



#### 4. CROSS MUTING and ONE WAY direction



Please add MTL\*. Ex. F3S-TGR-SB4-K1CMTL

#### Reference

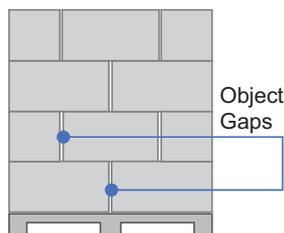
- Muting Lamp
  - Override and Test Switch
  - F3S-TGR-SB□-K□C
  - Muting sensor
  - F3S-TGR-SB-CMB□
  - Mechanical Guard
- \*MTL has a special software inside of F3S-TGR-SB□C which works to finalize a Muting function.

### Muting Sensors Recommendation

It is recommended to use the E3Z or E3G as muting sensor. Please refer to the E3Z datasheet *Cat.No. E701-E2-Cat04-01* and the E3G datasheet *Cat.No. E278-E2-Cat04-03*.

#### SOLUTION 1: Object Gaps

In many palletiser applications there is a gap between objects on the pallet. The Muting function may not work correctly because of this gap. To avoid the mutual interruption, we recommend to use E3G□□□□T as muting sensor. E3G-□□□□T has ON delay timer internally (0 to 5 seconds)



#### SOLUTION 2: Misalignment of pallets

When using a CROSS MUTING system, It may cause that unexpected behavior when the pallets get out of alignment then E3G□□□□T also solves the problem by OFF delay timer (0 to 5 seconds).



List of Models

Safety Multi beam Sensors

F3S-TGR-SB2-K□C Mirror Reflection Type (Type 2)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	<input type="text"/> 0.5 to 6 m	500	F3S-TGR-SB2-K2C-500(MTL)*
	3	<input type="text"/> 0.5 to 5 m	400	F3S-TGR-SB2-K3C-800(MTL)*
	4		300	F3S-TGR-SB2-K4C-900(MTL)*

\*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

F3S-TGR-SB4-K□C Mirror Reflection Type (Type 4)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	<input type="text"/> 0.5 to 6 m	500	F3S-TGR-SB4-K2C-500(MTL)*
	3	<input type="text"/> 0.5 to 5 m	400	F3S-TGR-SB4-K3C-800(MTL)*
	4		300	F3S-TGR-SB4-K4C-900(MTL)*

\*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

Muting Connecting Box (Order Separately)

Flexible Connecting Box

Appearance	SLC Connection Type	Other connection	Model
	M12 8pin connector without cable	4 x Muting sensor connection (4pin) 1 x Muting Lamp M12 (4pin) 1 x Override/Test input M12 (4pin) 1 x cabinet connection M12 (8pin)	F39-TGR-SB-CMB1
	M12 8pin connector with 100 mm cable		F39-TGR-SB-CMB2

Accessories (Order Separately)

Connector Cable

Appearance	Cable length	Specification	Model
	2 m	M12 connector (8pin Socket) For cabinet connection (From F3S-TGR-SB□-K□C or F3S-TGR-SB-CMB□)	F39-TGR-SB4-CVLB2R
	5 m		F39-TGR-SB4-CVLB5R
	10 m		F39-TGR-SB4-CVLB10R
	2 m	M12 connector (4pin Plug) For Muting sensor, Muting Lamp connection and Override/Test connection	F39-TGR-SB4-CVLB2MC

Connector Plug Assemblies, Screw-on Type

Appearance	Cable connection direction	Specification	Connection method	Applicable cable diameter	Model
	Straight	DC only 4pin Plug	Screw-on	3 dia. (3 to 4 dia.)	XS2G-D4S5
	Right angle				XS2G-D4S6

Muting Lamp

Appearance	Specification	Model
	24 V DC	F39-A11

Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

Laser alignment Kit

Appearance	Model
	F39-LKK2-SB

## Rating and Performance

### Safety sensors

#### F3S-TGR-SB□-K□C

Item	Model	
	F3S-TGR-SB4-K□C-□□□(MTL)*	F3S-TGR-SB2-K□C-□□□(MTL)*
Sensor type	Type 4	Type 2
Applicable safety category	4, 3, 2, 1, B	2, 1, B
Operating range	F3S-TGR-SB□-K2C F3S-TGR-SB□-K3C/K4C	0.5 - 6 m 0.5 - 6 m
Beam pitch and Number of beam	F3S-TGR-SB□-K2C F3S-TGR-SB□-K3C F3S-TGR-SB□-K4C	500 mm 2 beam with mirror 400 mm 3 beam with mirror 300 mm 4 beam with mirror
Outermost beam gap	F3S-TGR-SB□-K2C F3S-TGR-SB□-K3C F3S-TGR-SB□-K4C	500 mm 800 mm 900 mm
Effective aperture angle (EAA)	Within ±2.5°	Within ±5°
Light source	Infrared LED (880 nm)	
Power supply	24 VDC ± 20%	
Current Consumption	420 mA	
OSSD	Two PNP transistor outputs, 250 mA each. (500 mA sum)	
Output operation mode	Light - ON	
Test functions	Self-test (after power ON and during operation, one cycle during response time)	
Protection	Output short-circuit protection, Reverse Polarity protection	
Response time	ON to OFF 16ms max OFF to ON 300 ms (Maximum Power-ON time is 900 ms)	
Ambient temperature	Operating: -10 to +55 °C (with no dew condensation)	
Ambient humidity	15% to 95% (non condensing)	
Metal housing (Al) painted	Yellow (RAL 1303 F14)	
Degree of protection	IP65	
Accessories	M6 T-Bolt x 8, M6 Nut x 8 Mounting fixture x 4	
Applicable standards	EN61496-1; 1997 prEN61496-2; 1997	

\*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

### Muting Connecting Box

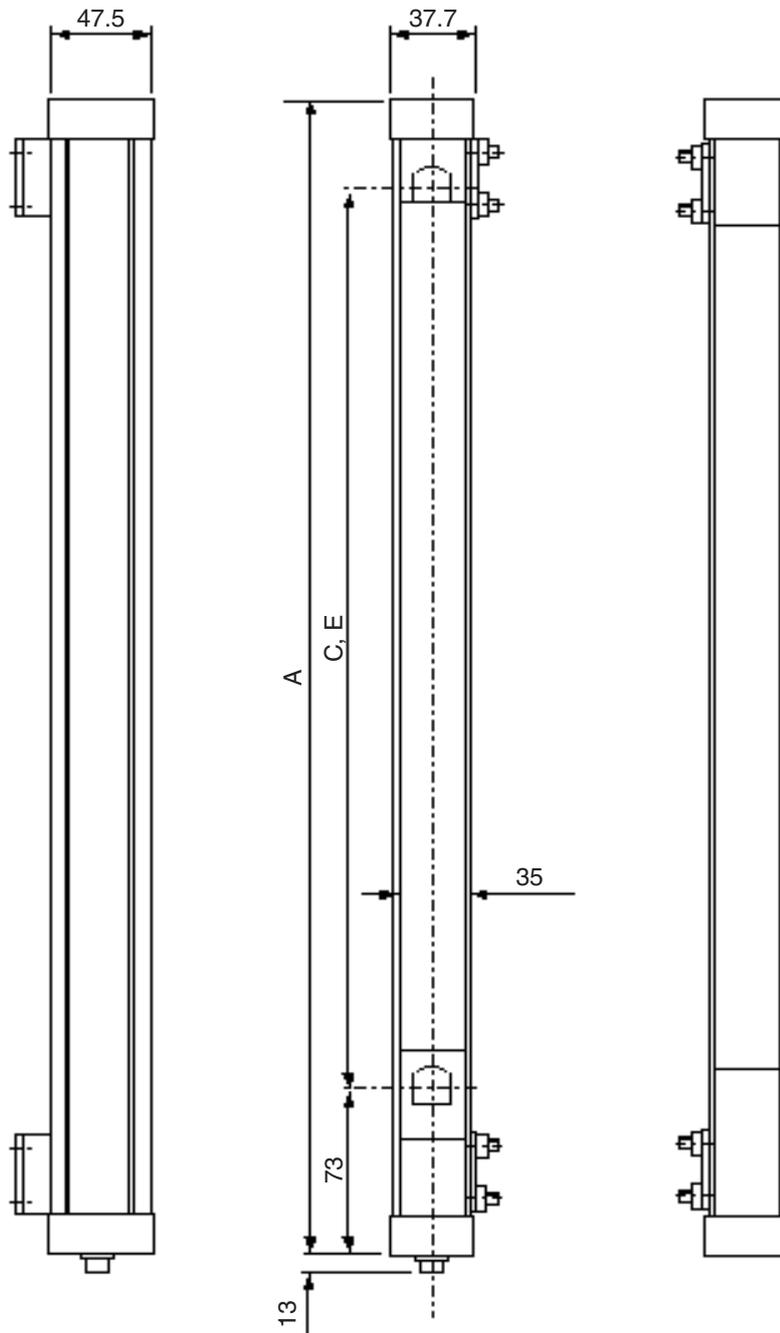
#### F3S-TGR-SB-CMB□

Item	Model	F39-TGR-SB-CMB□
Power supply	24 VDC ± 20%	
Consumption	10 W max	
Ambient temperature	During operation: -10 to +55 °C (with no dex condensation)	
Ambient humidity	15% to 95% (non condensing)	
RX connector	M12 8 pins female	
Cabinet connector	M12 8 pins male	
Sensor connector	4 x M12 4 pins female	
Muting indicator	M12 4 pins female	
Test / Override connectors	M12 4 pins female	
Metal housing (Al) painted	Yellow (RAL 1303 F14)	
Degree of protection	IP65	
Material	Case	Aluminium
	Connector	Brass with nickel plate
	Front Cover	Aluminium
Weight	0.5 kg	
Accessories	M6 T-Bolt x 4, M6 Nut x 4 Mounting fixture x 2, Connector cover x 2	

Item	Model	F39-TGR-SB-CMB□
Applicable standards	93/68/EEC DIN V VDE 0801:1990 and am.A1:1994 EN 50081-2:1993 EN 55022:1998	

Dimensions

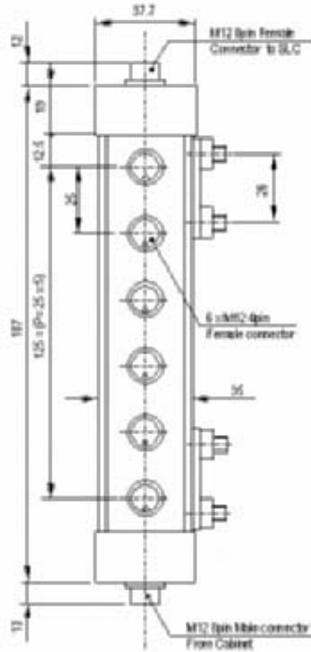
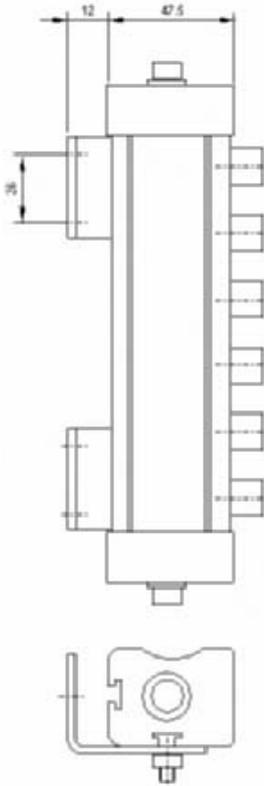
F3S-TGR-SB-K□C-□□□ with Mounting Brackets



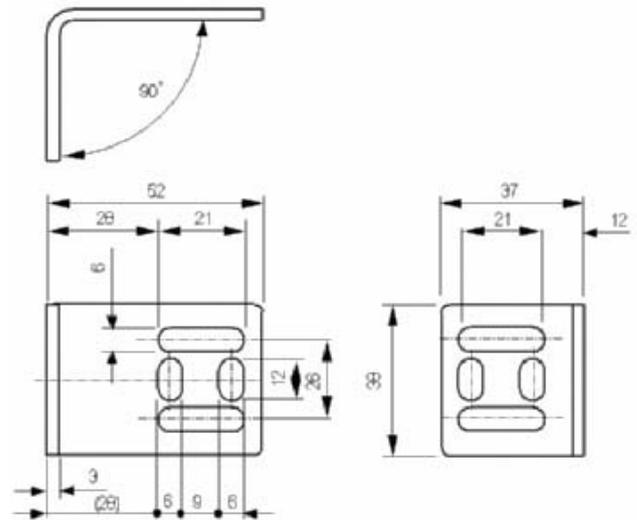
Model	A	C	E
F3S-TGR-SB□-K2C500	614 mm	500 mm	500 mm
F3S-TGR-SB□-K3C800	914 mm	800 mm	400 mm
F3S-TGR-SB□-K4C900	1,014 mm	900 mm	300 mm

F39-TGR-SB-CMB1

Muting connection box

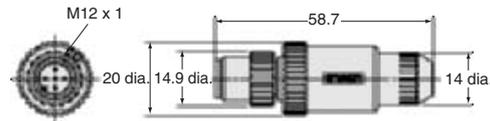


Mounting bracket (Common bracket for F3S-TGR-SB□-K□C and F39-TGR-SB-CMB□)

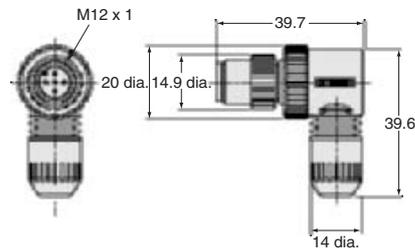


Connector Plug Assemblies, Screw-on Type

XS2G-D4S5



XS2G-D4S6

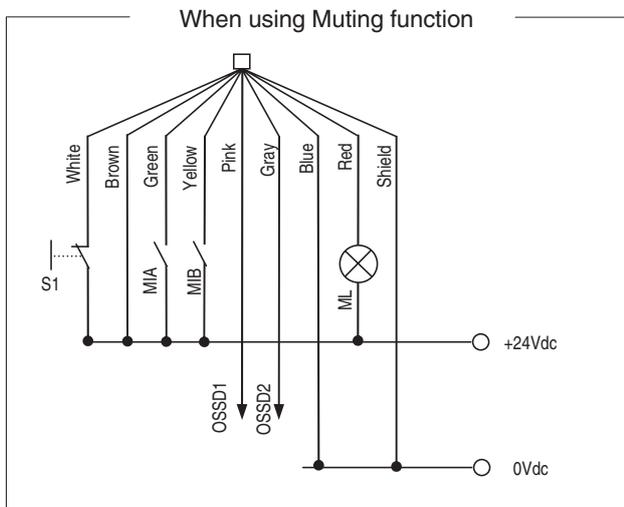
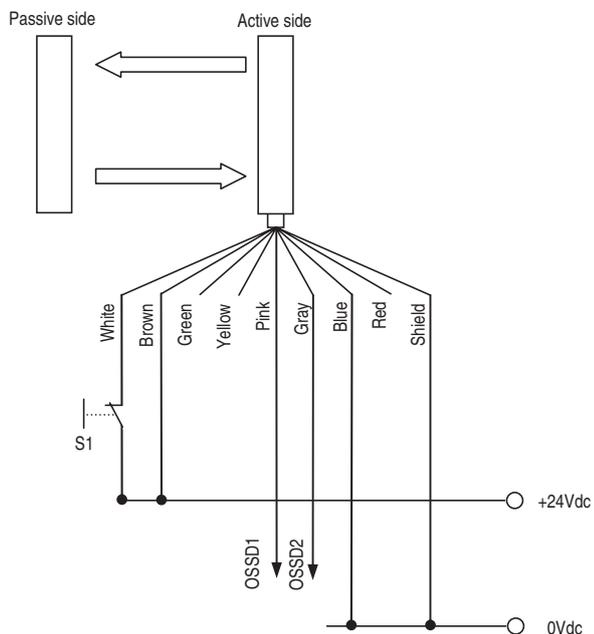


F3S-TGR

Connection

F3S-TGR-SB□-K□C

Connection example



S1: External Test / Interlock reset Switch

MIA : Muting input A

MIB : Muting input B

ML : Muting Lamp

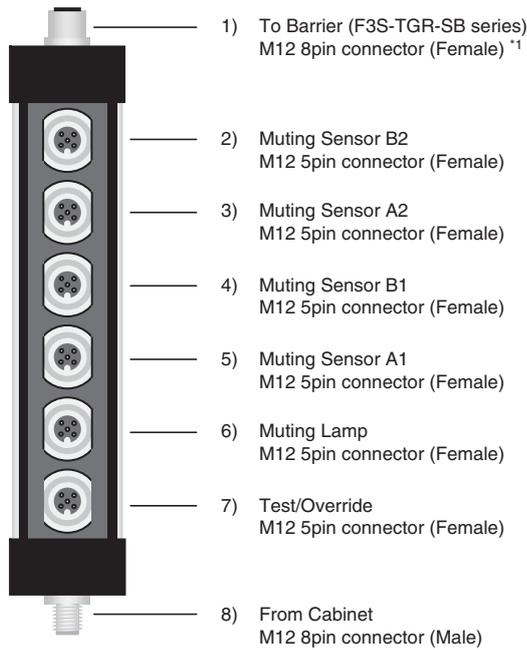
In case of Cat 4 (EN954-1), OSSD1/2 must be connected Safety Relay Unit (G9SA, G9SB-301B etc.) with feedback monitor

Pin reference

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

F3S-TGR-SB-CMB□

Pin and Plug reference



\*1 In case of F3S-TGR-SB-CMB2, M12 8pin connector with 100 mm cable

1) To F3S-TGR-SB Series

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

2), 3) 4), 5) Wiring of Muting Sensor connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	0 V	Blue
	4	PNP Input	Black

6) Wiring of Muting Lamp connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	No connect	Blue
	4	0 V	Black

7) Test/Override connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	Test input	White
	3	No connect	Blue
	4	Override input	Black

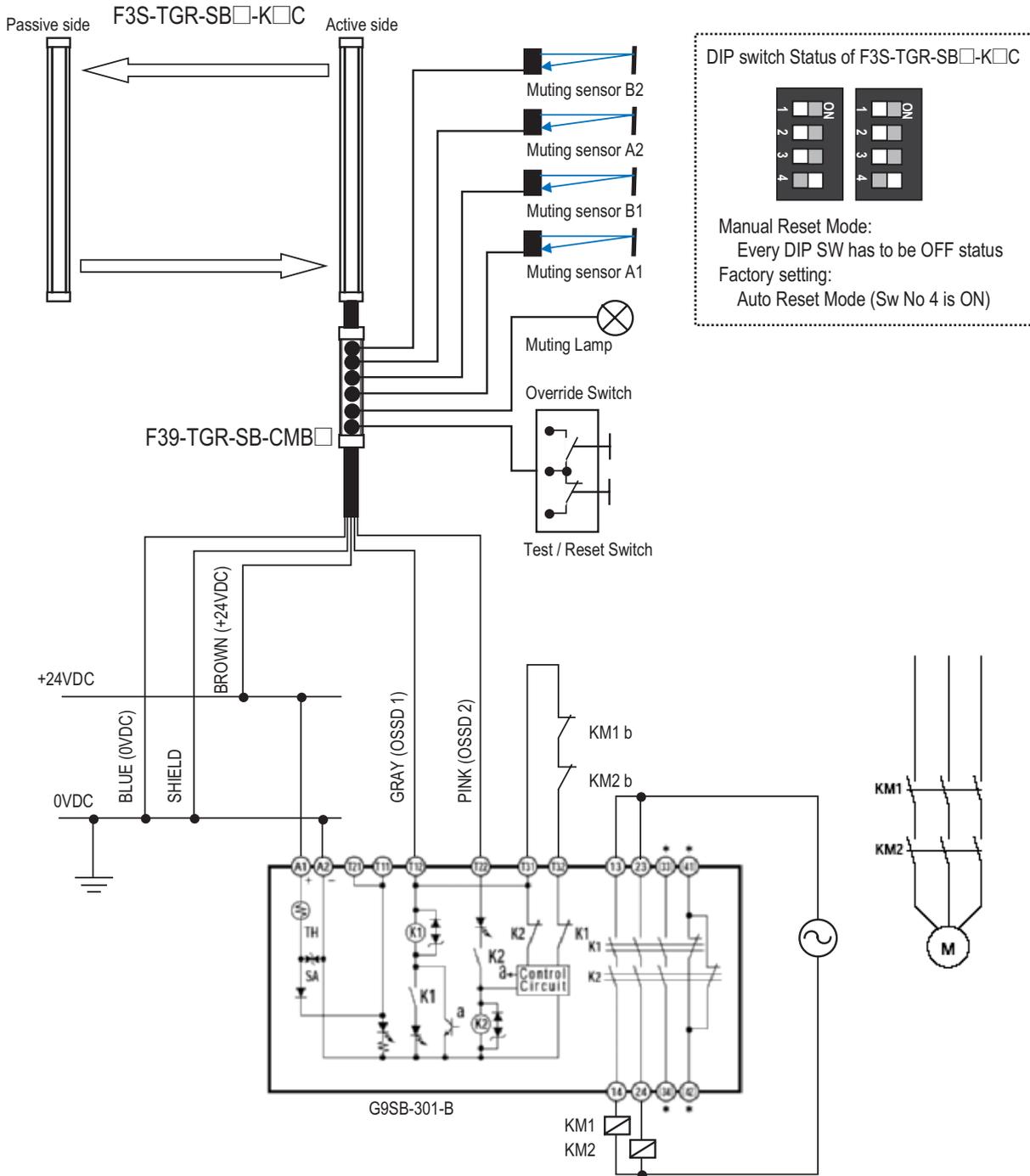
8) From Cabinet

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

Application

Manual Reset Mode (by Safety barrier)

F3S-TGR-SB4-K2C / F39-TGR-SB-CMB□ / G9SB-200-B or 301-B



DIP switch Status of F3S-TGR-SB□-K□C

1	ON	1	ON
2	OFF	2	OFF
3	OFF	3	OFF
4	OFF	4	ON

Manual Reset Mode:  
Every DIP SW has to be OFF status  
Factory setting:  
Auto Reset Mode (Sw No 4 is ON)

F39-TGR-SB-CMB□ Plug reference

Muting Sensor (B2/A2/B1/A1)

Muting Lamp

Test and Override inputs

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.  
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety light curtain for long distance detection

# F3SL

*20-m long-distance detection. Safety light curtain (Type 4) is ideal for detection of intrusion of human bodies in large machines and conveyor lines.*



## Features

- Complies with IEC standards, EN standards, and North American standards. EC-based certification from TÜV for EU machine directives. Can be used as a safety guard for satisfaction of OSHA requirements for on-site labor safety in North America.
- Special controller not needed. Detection of human body intrusion is possible using just the sensor unit.
- Includes "Start/restart interlock function" to prevent automatic reset of output.
- Includes floating blanking function (disables 1 or 2 non specific beams) and Fixed Blanking (disables specific beams)
- Built-in EDM (External Device Monitor). Feedback check is possible without a controller

## Ordering Information

### Sensors

 Infrared ray

Sensor type	Shape	Sensing distance			Operating mode	Detection width (mm)	Model	
Through-beam			0.3 to 20m			Light ON	351	F3SL-A0351P30
			523	F3SL-A0523P30				
			700	F3SL-A0700P30				
			871	F3SL-A0871P30				
			1,046	F3SL-A1046P30				
			1,219	F3SL-A1219P30				
			1,394	F3SL-A1394P30				
			1,570	F3SL-A1570P30				
			1,746	F3SL-A1746P30				
			1,920	F3SL-A1920P30				
			2,095	F3SL-A2095P30				

### Accessories (Order Separately)

Special cable (please order one each for the emitter and the receiver)

Cable length	Specifications	Model	
		For emitter	For receiver
10 m	Connector	F39-JL10A-L	F39-JL10A-D
15 m		F39-JL15A-L	F39-JL15A-D
30 m		F39-JL30A-L	F39-JL30A-D

Reflection mirror (15% sensing distance attenuation)

Mirror material	Width (mm)	Thickness (mm)	Length (mm)	Model
Glass mirror	125	31	460	F39-MDG460
			607	F39-MDG0607
			750	F39-MDG0750
			907	F39-MDG0907
			1,057	F39-MDG1057
			1,357	F39-MDG1357
			1,500	F39-MDG1500
			1,657	F39-MDG1657
			1,807	F39-MDG1807

Note: Other sizes are available upon request.

### Safety Relay Unit

For controlling the outputs we recommend to use safety relay units G9SA or G9SB

Appearance	Output	Model
	Expandable relay unit series with up to 8 safety relay outputs. Time delay for stop category 1 can be realized. (Please refer to page G-109)	G9SA series
	Small size safety relay unit with 17.5 mm and 22.5 mm size. Up to 3 safety relay outputs are available. (Please refer to page G-123)	G9SB series
	Fletible and expandable safety unit with solid state outputs	G9SX series

## Rating/performance

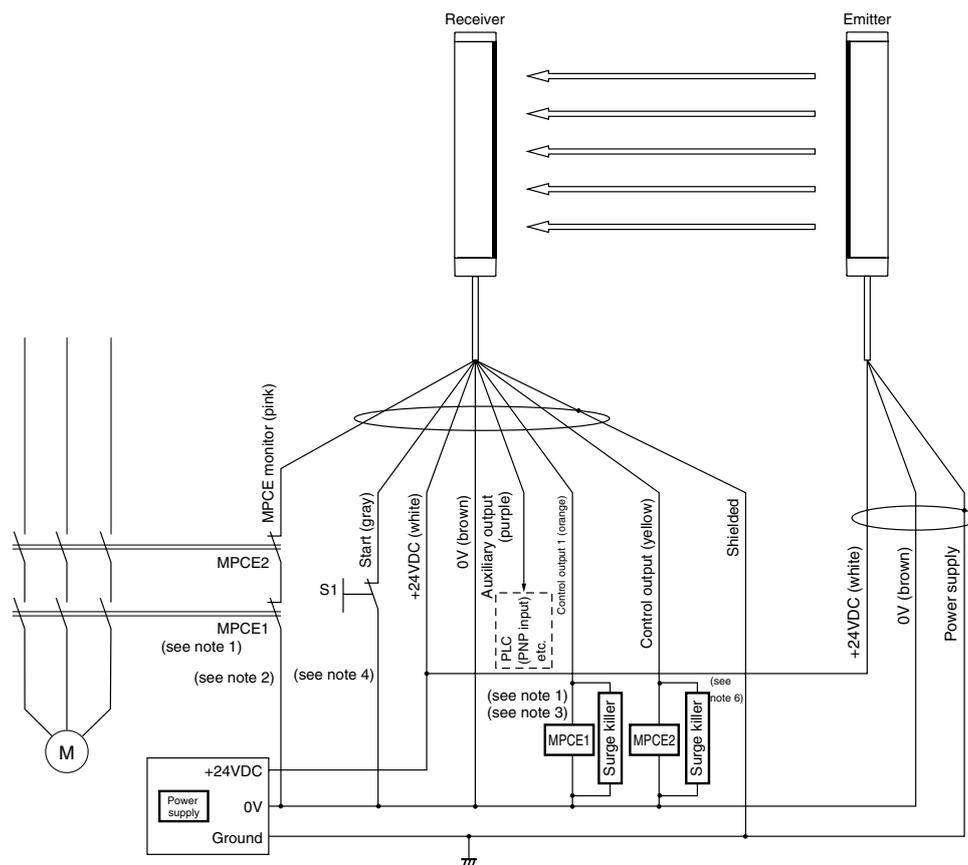
Item	Model	F3SL-A0351 P30	F3SL-A0523 P30	F3SL-A0700 P30	F3SL-A0871 P30	F3SL-A1046 P30	F3SL-A1219 P30	F3SL-A1394 P30	F3SL-A1570 P30	F3SL-A1746 P30	F3SL-A1920 P30	F3SL-A2095P30
Sensing distance	0.3 to 20 m											
Optical axis pitch	22 mm											
Number of optical axes	16	24	32	40	48	56	64	72	80	88	96	
Protective height	351 mm	523 mm	700 mm	871 mm	1,046mm	1,219mm	1,394mm	1,570mm	1,746mm	1,920mm	2,095mm	
Min. sensing object	Opaque object, 30-mm dia. or greater (52-mm or 74-mm dia. when using floating blanking)											
Effective Aperture angle	Emitter/receiver: ±2.5° or less each (based on IEC61496-2 at detection distance of 3 m or greater)											
Light source (wave length)	Infrared LED (850 nm)											
Power supply voltage	24 V DC ±20% including 5% ripple (p-p)											
Startup time after turning on power	3 s max.											
Current consumption	Emitter: 285 mA or less, receiver: 1.4 A or less (including load output current)											
Control output	PNP transistor outputs x 2, load current 500 mA or less (residual voltage 2 V or less) (excluding voltage drop due to cable extension), Light ON											
Auxiliary output	Same signal as control output: PNP transistor outputs x 1 output (non-safety output), load current 100 mA or less (residual voltage 1 V or less) (excluding voltage drop due to cable extension)											
Protective circuits	Output load short circuit protection, reverse power connection protection											
Safety functions	Start/restart interlock function (select enable/disable with DIP switch) <ul style="list-style-type: none"> <li>Blanking functions ① Channel select (fixed blanking) ② Floating blanking ③ No blanking (initial setting)</li> </ul> Select ①, ②, or ③ with DIP switch. The optical axes for ① fixed blanking are set by a teach button.											
Diagnosis functions	<ul style="list-style-type: none"> <li>Self diagnosis functions when the power is turned on</li> <li>External relay (MPCE) monitor function (connect external relay monitor input wire to contact b of external relay, 50 mA 24 V DC)</li> </ul>											
Response time ON→OFF	20 ms max.					25 ms max.			30 ms max.		35 ms max.	
Ambient temperature	Operating/Storage: 0°C to 55°C (with no icing or condensation)											
Ambient humidity	Operating./Storage: 35% to 95% RH (no condensation)											
Vibration resistance	Malfunction / durability: 10 to 50 Hz, amplitude 0.7 mm, 20 sweeps each in X, Y, and Z directions											
Shock resistance	Wrong operation / durability: 100 m/s <sup>2</sup> , 1,000 times each in X, Y, and Z directions											
Protective Degree	IEC Standard IP65											
Connection method	M12 Connector											
Weight (Packed state)	11kg max.											
Material	Case	Aluminum										
Accessories	Test rod, mounting brackets (upper/lower), operation manual, special hex wrench for program button access, test load resistors (1 kΩ, 2 resistors), surge protector (2)											
Applicable standards	IEC (EN) 61496-1 TYPE4 ESPE *1 IEC61496-2 TYPE4 AOPD *2											

\*1) ESPE (Electro-Sensitive Protective Equipment)

\*2) AOPD (Active Opto-electronic Protective Devices)

## Connection

Wire the F3SL only after all power has been turned off.



M: Mechanical drive unit including 3-phase motor  
 S1: Start switch for interlock reset (NC contact)  
 MPCE1, MPCE2: Contactor or safety relay with compulsory guide mechanism (G7SA is recommended)

- Note: 1. Please use a safety relay with forcibly guided contacts (such as the G7SA) for MPCE1 and MPCE2, which are relays that perform ultimate control of the machine.  
 2. If you do not intend to use the MPCE monitor function, short the MPCE monitor line (pink) to power supply 0 V.  
 3. If a load is not connected to control output 1 and control output 2, an error will result and normal operation will not take place. For testing purposes during installation or at other times, connect the 10 kΩ resistors included with the operation manual to the MPCE1 and MPCE2 positions.  
 4. If you intend to use auto start mode, short the start line (gray) to power supply 0 V.  
 5. Take care when wiring not to make any mistakes regarding the cable colors. In particular, the wire colors of the power supply line (+ 24 V DC: white, 0 V: brown) are different from the regular sensor wires.  
 6. Connect the provided surge protector in parallel with MPCE1 and MPCE2.

## Wiring method

### Receiver unit connector

Front view diagram	Pin No.	Signal name	Wire color of special cable
		Receiver	
	1	Control output 1 (OSSD1)	Orange
	2	0V	Brown
	3	Shielded	---
	4	+DC24V	White
	5	Auxiliary output (AUXIL-	Purple
	6	MPCE monitor	Pink
	7	Start	Gray
	8	Control output 2 (OSSD2)	Yellow

### Emitter unit connector

Front view diagram	Pin No.	Signal name	Wire color of special cable
		Emitter	
	10	Shielded	---
	11	+DC24V	White
	12	0V	Brown

### Special cable (purchased separately)

For emitter (3-pin)		For receiver (8-pin)		Cable length
F39-JL10A-L	Black connector	F39-JL10A-D	Red connector	
F39-JL15A-L		F39-JL15A-D		15 m
F39-JL30A-L		F39-JL30A-D		30 m

Note: Please order one each for the emitter and the receiver.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.  
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety Single Beam Sensor & Controller

**E3FS series with  
F3SP-U3P-TGR and F3SP-U5P-TGR**



**Features**

The E3FS is a type 2 Safety Single beam sensor intended to be used with the control units F3SP-U3P -TGR and F3SP-U5P-TGR.

- Safety Single Beam (E3FS)
  - 1) Up to Category 2 (EN954-1)  
Type2 ESPE and Type2 AOPD.  
Approved by TÜV Product Service
- Muting Controller for Safety single beam sensor (F3SP-U3P-TGR and F3SP-U5P-TGR)
  - 1) Muting functions are integrated  
Muting inputs  
Override function  
Muting Lamp output  
Interlock function and Test Reset input
  - 2) 2 different model available  
2 beam unit (F3SP-U3P-TGR)  
4 beam unit (F3SP-U5P-TGR)
  - 3) Small Controller  
2 beam unit W=22.5 mm  
4 beam unit W=45.0 mm



- 2) High protection against water  
IP67 (IEC60529)
- 3) Small Sensor  
M18 x 65 mm
- 4) 4 different model available  
Plastic case (with cable type and connector type)  
Brass case (with cable type and connector type)

E3FS

## Ordering Information

### Safety Single beam Sensors (Type 2)

#### E3FS-10B4 series

Appearance	Case material	Operation distance	Model	
	Plastic	 0 to 10 m	Cable Type	E3FS-10B4
			Plug Type	E3FS-10B4-P1
	Nickel Brass		Cable Type	E3FS-10B4-M
			Plug Type	E3FS-10B4-M1-M

### Controller for Safety Single beam Sensors

#### F3SP-UxP series

Appearance	Sensors	Output contacts	Width	Model
	1 to 2 Safety Single beam sensors	2 NO 2.5 A	22.5 mm	F3SP-U3P-TGR
	1 to 4 Safety Single beam sensors		45 mm	F3SP-U5P-TGR

### Accessories

#### Muting Lamp

Appearance	Model
	F39-A11

#### Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

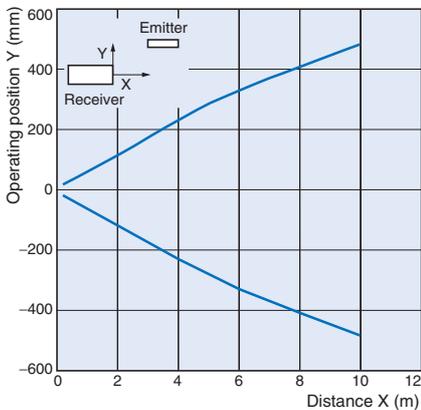
Rating and Performance

Sensors

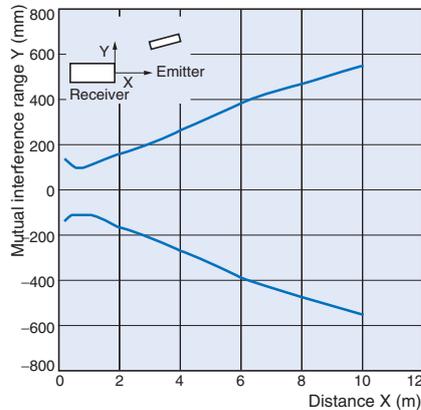
E3FS-10B4 series

Sensing method	Through-beam	
Controller	F3SP-U3P-TGR, F3SP-U5P-TGR	
Supply voltage	24 VDC $\pm$ 10% (ripple p-p 10% max.)	
Effective aperture angle (EAA)	$\pm 5^\circ$ (at 3 m)	
Current consumption	Emitter:50 mA max. Receiver:25 mA max.	
Sensing distance	10 m	
Standard sensing object	Opaque object: 11 mm min. in diameter	
Response time	2.0 ms (E3FS only) Response time of controller = Response time of the system	
Control output	PNP transistor output, load current: 100 mA max., residual voltage: 2 V max. (Except for voltage drop due to cable extension)	
Test input (Emitter)	21.5 to 24 VDC: Emitter OFF (source current: 3 mA max.) Open or 0 to 2.5 V: Emitter ON (leakage current: 0.1 mA max.)	
Power supply reset time	100 ms	
Ambient light intensity	Incandescent lamp: 3,000 lx max. (light intensity on the receiver surface) Sunlight: 10,000 lx max. (light intensity on the receiver surface)	
Ambient temperature	Operating: -10 to 55°C, storage: -30 to 70°C (with no icing or condensation)	
Ambient humidity	Operating: 35% to 85%, storage: 35% to 95% (with no icing or condensation)	
Insulation resistance	20 M $\Omega$ min. (at 500 VDC)	
Dielectric strength	1,000 VAC 50/60 Hz 1 min	
Vibration resistance	Malfunction	10 to 55 Hz, double amplitude: 1.5 mm, 2 h each in the X, Y, and Z directions
	Operating limit	10 to 55 Hz, double amplitude: 0.7 mm, 50 min each in the X, Y, and Z directions
Shock resistance	Malfunction	500 m/s <sup>2</sup> (approx. 50 G), 3 times each in the X, Y, and Z directions
	Operating limit	100 m/s <sup>2</sup> (approx. 10 G), 1,000 times in the X, Y, and Z directions
Degree of protection	IP67 (IEC standard)	
Light source	Infrared LED	
Operation indicators	Emitter: Emitting (orange) Receiver: Output ON (green), Output OFF (red)	
Protection	Output short-circuit protection, reverse polarity protection	
Weight (in packaging)	E3FS-10B4 2M (ABS resin case): approx. 150 g for 1 set (weight without cable: approx. 55 g) E3FS-10B4-M1-M (metal case): approx. 125 g for 1 set	
Applicable standard	IEC61496-1, EN61496-1 Type 2 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2, prEN61496-2 Type 2 AOPD (Active Opto-electronic Protective Devices)	
Accessories	Emitter, Receiver, four nuts for mounting, and an instruction manual	

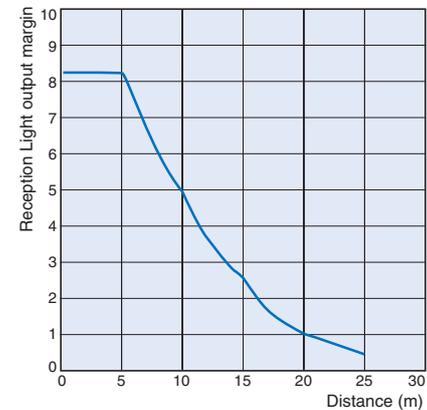
Parallel Operating Range



Mutual interference Range



Excess Gain Ratio



E3FS

Controllers  
F3SP-U series

	F3SP-U3P	F3SP-U5P
Number of sensors	1 to 2 Safety Single beam sensor	1 to 4 Safety Single beam Sensor
Width	22.5 mm	45 mm
Muting Input	2 Inputs	4 Inputs
Safety related function	Override function Muting Lamp Connection Interlock System (Automatic and manual reset)	
Power supply voltage	24 VDC $\pm 10\%$	
Power consumption	420 mA max.	
Output contacts	2 NO 2.5 A (protected by fuse), 115 V AC max.	2 NO 2.5 A (protected by fuse), 250 V AC max.
Indicators	6 LED for status and diagnostics	
Enclosure rating	IP20	
Terminal	16 screw terminals, Detachable blocks with '4pin'	32 screw terminals, Detachable blocks with '4pin'
Response time	$\leq 30$ ms	
Ambient temperature	Operation: $-10^{\circ}\text{C}$ $+55^{\circ}\text{C}$	
Housing material	Plastic; DIN rail mounting	
Weight	0.3 kg	

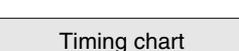
Operating Instructions

Output Circuit

Model	Connection method	Output transistor	Output circuit
E3FS-10DB4 2M E3FS-10DB4-P1 E3FS-10DB4-M 2M E3FS-10DB4-M1-M	Connect the pink and brown wire	ON when light is incident (Light-ON)	
Receiver circuit	Connect the pink and blue wire	ON when light is interrupted (Dark-ON)	
E3FS-10LB 2M E3FS-10LB-P1 E3FS-10LB-M 2M E3FS-10LB-M1-M		Emitter circuit	

## Timing Chart

### Output mode and timing chart

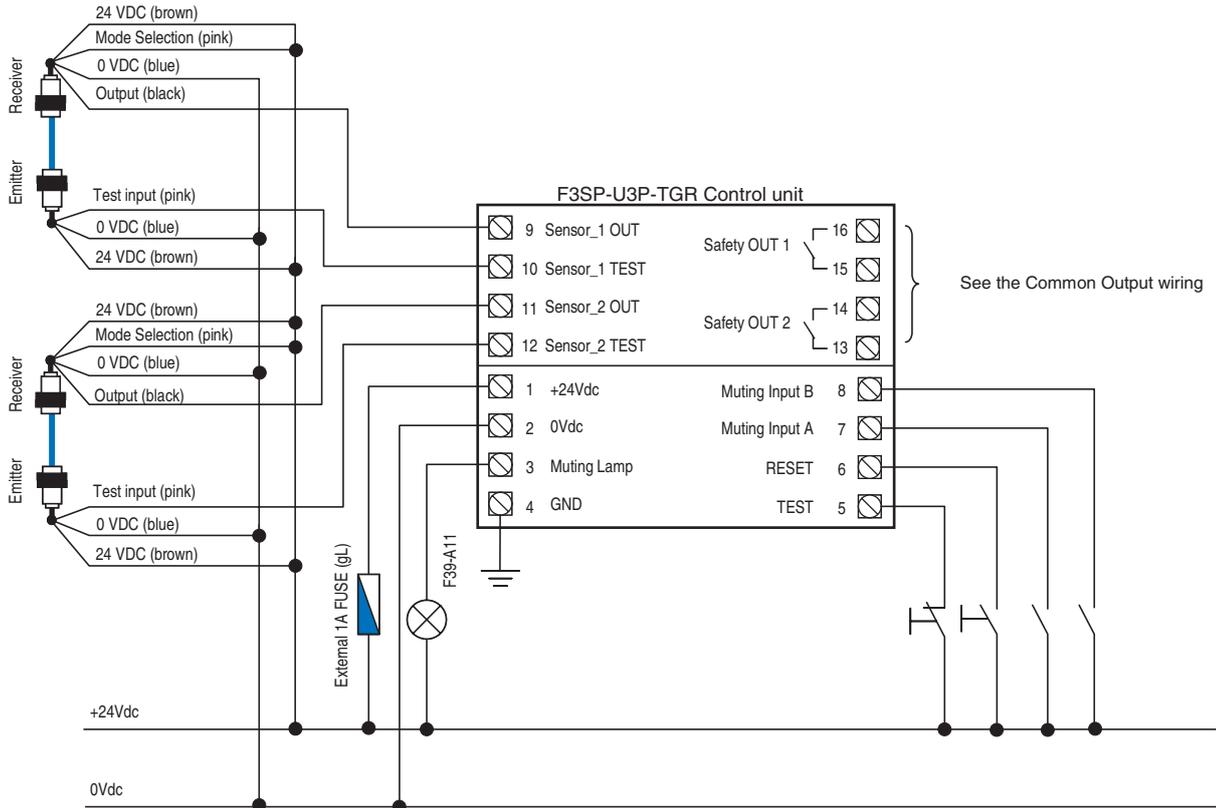
Receiver connection		Connect Pink (2) to Brown(1)	Connect Pink (2) to Blue (3)
Mode of output		ON when Incident (Light ON)	ON when interrupted (Dark ON)
Light Incident			
Light interrupted			
Indicator	Green		
	Red		
Control output	ON		
	OFF		
Load (Relay)	ON		
	OFF		

### Emitting timing chart

		Timing chart
Test input	ON	
	OFF	
Light emission	ON	
	OFF	
Indicator	ON	
	OFF	

Connection

F3SP-U3P Manual Reset (Cat2)



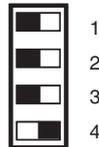
**WARNING:** Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

**WARNING:** The power supply of Safety sensors must be taken from the same supply of F3S-U3P-TGR unit.

Dip Switch setting

	Function	ON	OFF
4	Not used	-----	-----
3	Muting Activate	It will be muting Sensor_1 only	<u>It will be muting both Sensor</u>
2	Muting Duration	Infinite	<u>60 Second</u>
1	Reset mode	<u>Auto Reset</u>	Manual Reset

ON OFF

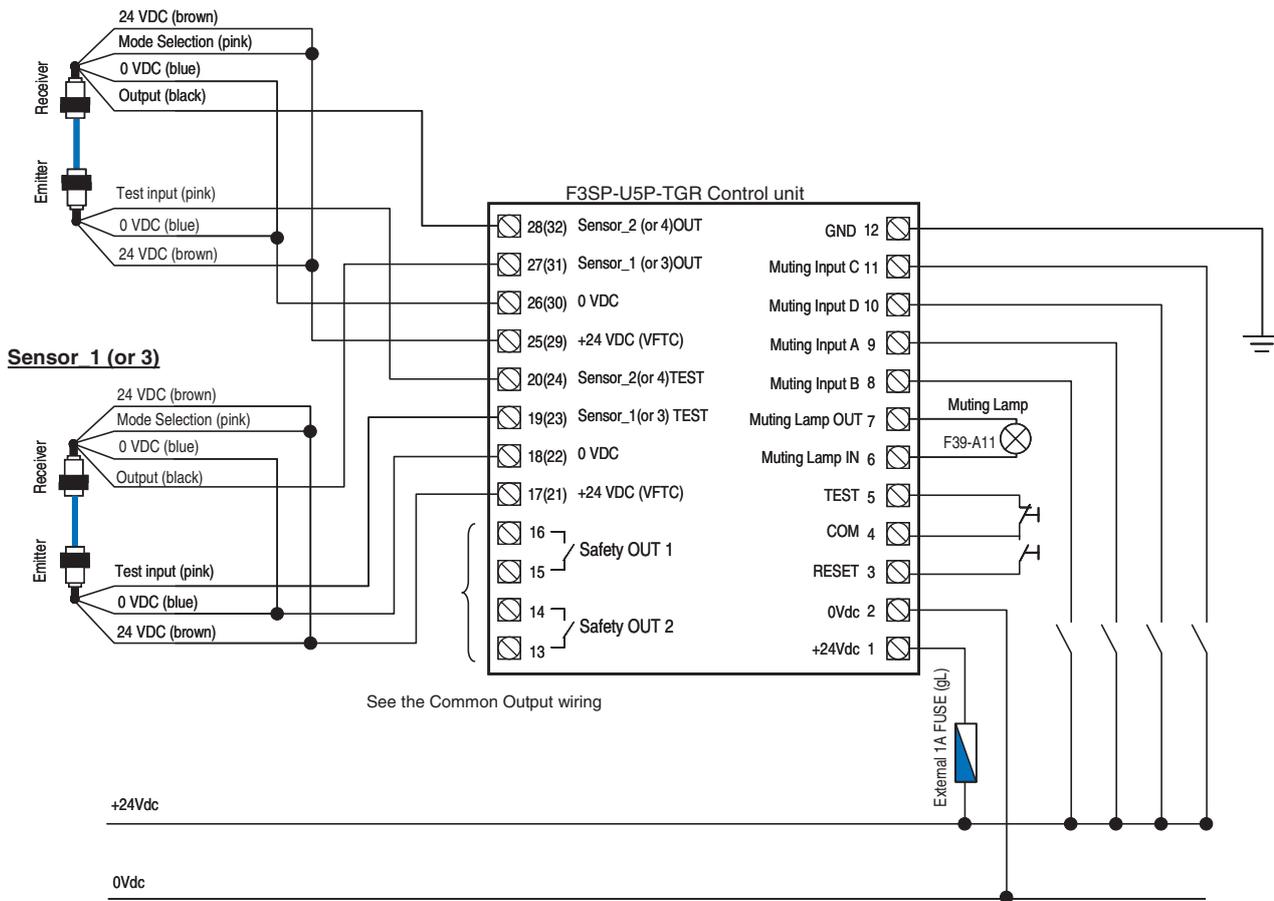


Factory setting

The underlines are initial setting (Factory setting)

## F3SP-U5P Manual Reset (Cat 2)

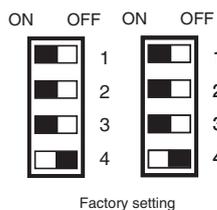
### Sensor 2 (or 4)



**WARNING:** Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

### Dip Switch setting

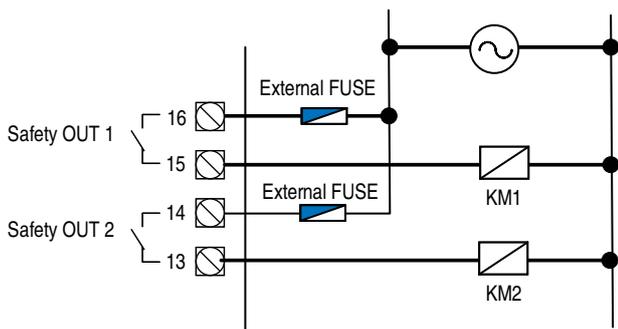
	Function	ON	OFF
4	Not used	-----	-----
3	Muting Activate	Muting inputs A-B act on the sensor_1. Muting inputs C-D act on the sensor_2. Other sensor 3-4 continue to work	<u>Muting inputs A-B act on the sensor 1 and 2.</u> <u>Muting inputs C-D act on the sensor 3 and 4.</u>
2	Muting Duration	Infinite	<u>60 Second</u>
1	Reset mode	<u>Auto Reset</u>	Manual Reset



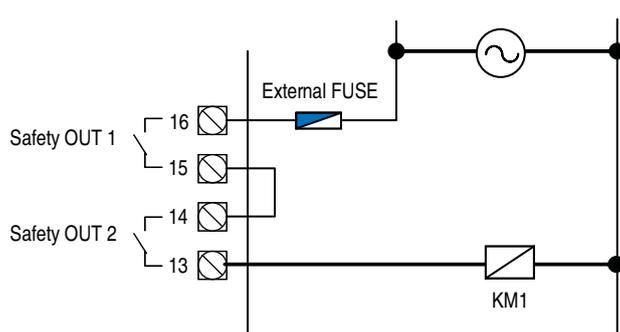
The underlines mean initial setting (Factory setting)

### Common Output wiring

#### In case of 2 load



#### In case of 1 load



## Precautions for Correct Use

### Warning

OMRON's Single-beam Safety Sensor input Module (B1 Module) from the F3SX Series is the only controller that can be used for the E3FS-10B4□□□□ (type 2). Normal operation may not be possible if another Single-beam Sensor Controller is used.



The Sensor cannot be used as part of a safety system when the mode selection input of the Single-beam Safety Sensor Receiver is connected to 0 V because the Sensor will turn ON when light is interrupted (Dark ON). Be sure to connect the mode selection input to 24 VDC if you want the Sensor to turn ON when light is incident (Light ON).



### Safety Distance

The safety distance is the minimum distance that must be maintained between the Sensor and a hazardous part of the machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of the Sensor.

Safety distance (S) = Intrusion speed into the detection zone (K) x Total response time for the machine and Sensor + Additional distance calculated based on the detection capability of the Sensor (C)

The safety distance varies with the national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the Sensor. Be sure to refer to the related standards.

Here T = T1 + T2 + T3, where

T1 = Maximum machine stop time (s)

T2 = Sensor response time (s)  
(From ON to OFF: 2.0 ms for the E3FS)

T3 = F3SP response time (s)  
(From ON to OFF: Refer to Response Time.)

The maximum stop time for a machine is the time it takes to actually stop dangerous parts after the machine receives a stop signal from the F3SP.

### Warning

Measure the actual maximum stop time for the machine and the periodical check it to see if the time changes.



Reference: Method for Calculating Safety Distance as Defined in the European Standard EN999 (with Intrusion Perpendicular to the Detection Zone)

K and C are as follows for the Single-beam Safety Sensors.

1) When a Single-beam Safety Sensor is used alone (when the risk assessment indicates that a single beam is sufficient)

K = 1600 mm/s

C = 1200 mm

Height of the beam from the ground or from a reference surface: 750 mm (EN999 recommendation)

2) When multiple Single-beam Safety Sensors are installed at different heights.

K = 1600 mm/s

C = 850 mm

The beam heights in the following table are the EN999 recommendations.

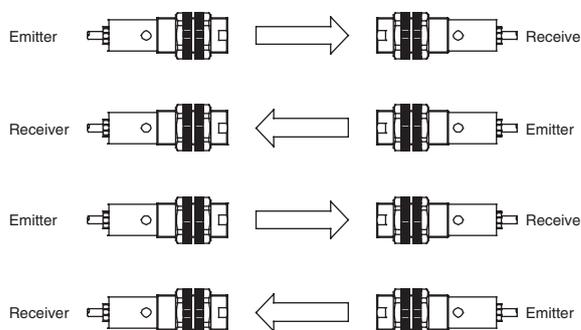
No. of beams	Height from the reference surface (example: the floor)
2	400 mm, 900 mm
3	300 mm, 700 mm, 1,100 mm
4	300 mm, 600 mm, 900 mm, 1,200 mm

Note: Refer to the F3SN/F3SH instruction manuals for details on Safety Light curtains and Multi-beam Safety Sensor.

### Preventing Mutual Interference

Observe the following items during installation to prevent Single-beam Safety Sensors from interfering with each other or with Safety Light Curtains.

- Leave adequate space between the Sensors during installation. (Refer to the instruction manuals for the E3FS.)
- Use baffle plates to separate Sensors.
- Alternate Emitters and Receivers during installation. (See the figure below.)



Check for mutual interference between Single-beam Safety Sensors or Safety Light Curtains connected to the same or different Control Units before finalizing placement and starting normal operation.

### Warning

When installing multiple Safety Light Curtains, Multi-beam Safety Sensors, and Single-beam Safety Sensors, take necessary steps to prevent mutual interference. Otherwise detection may fail and serious injury may result.



## Dimensions

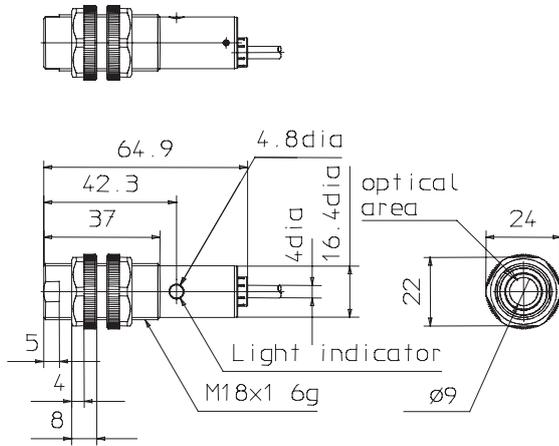
Note: All units are in millimeters unless otherwise indicated

### Plastic housing

Cable type:

E3FS-10LB

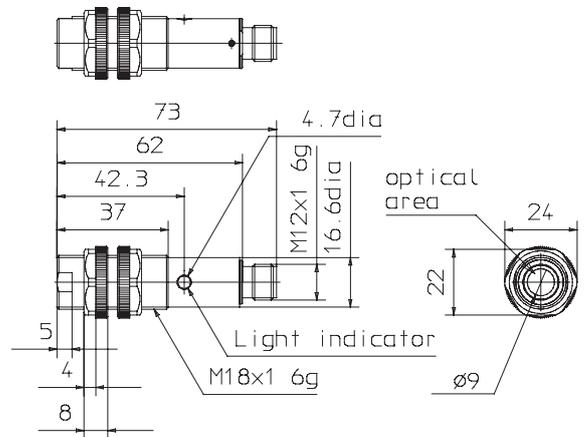
E3FS-10DB4



Connector type:

E3FS-10LB-P1

E3FS-10DB4-P1

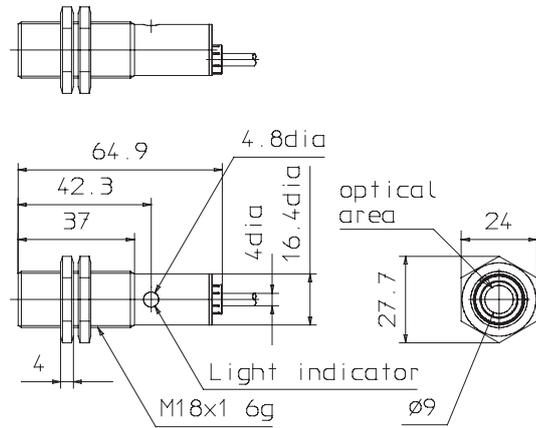


### Metallic housing

Cable type:

E3FS-10LB-M

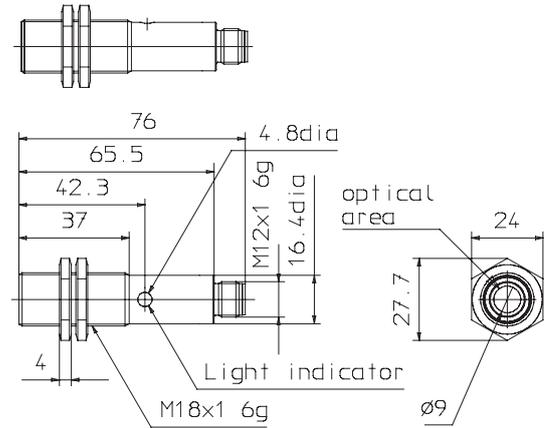
E3FS-10DB4-M



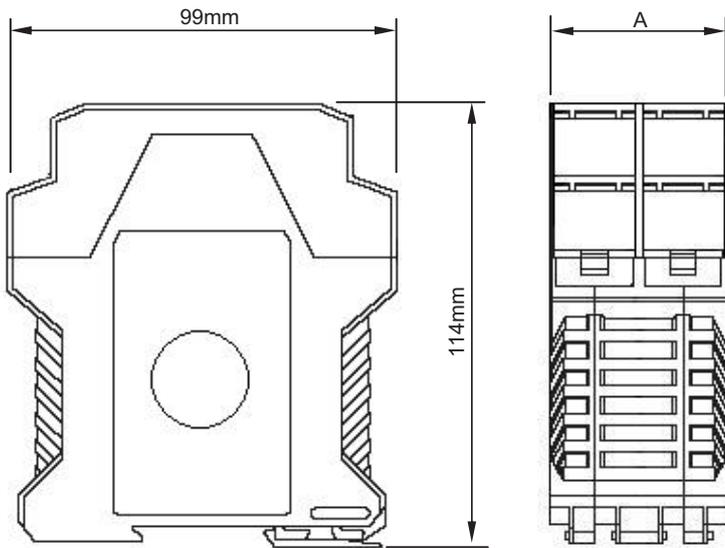
Connector type:

E3FS-10LB-M1-M

E3FS-10DB4-M1-M



Controller  
 F3SP-U3P and F3SP-U5P



Model	A
F3SP-U3P-TGR	22.5 mm
F3SP-U5P-TGR	45 mm

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.  
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.