

Safety Design for Category 2. Suitable for Detecting Human Bodies in a Dangerous Area.

- 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 (1997) (Type 2 AOPD), EN 61496-1 (06/98) (Type 2 ESPE) standards and EMC Directive: No. 98/336/EEC, No. 98/37/EC.
- Received certificates from Notified Bodies as Type 2 ESPE (Electro-Sensitive-Protective-Equipment).
- 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

F3S-B M 36 2 P 12 - L

blank	Stand-alone
M	Master unit for series connection
S	Slave unit for series connection
36	No. of optical axis (4–66)
2	25mm optical pitch
5	50mm optical pitch
7	75mm optical pitch
blank	Slave unit
P	PNP outputs
blank	Stand-alone or slave unit
12	No. of optical axis of the connected slave unit for 25mm optical pitch type: 12, 18, 24, or 30 for 50mm optical pitch type: 06, 09, 12, or 15 for 75mm optical pitch type: 04, 06, 08, or 10
blank	Complete set of emitter and receiver
L	Emitter unit only
D	Receiver unit only

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	0.9 kg
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	0.9 kg
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

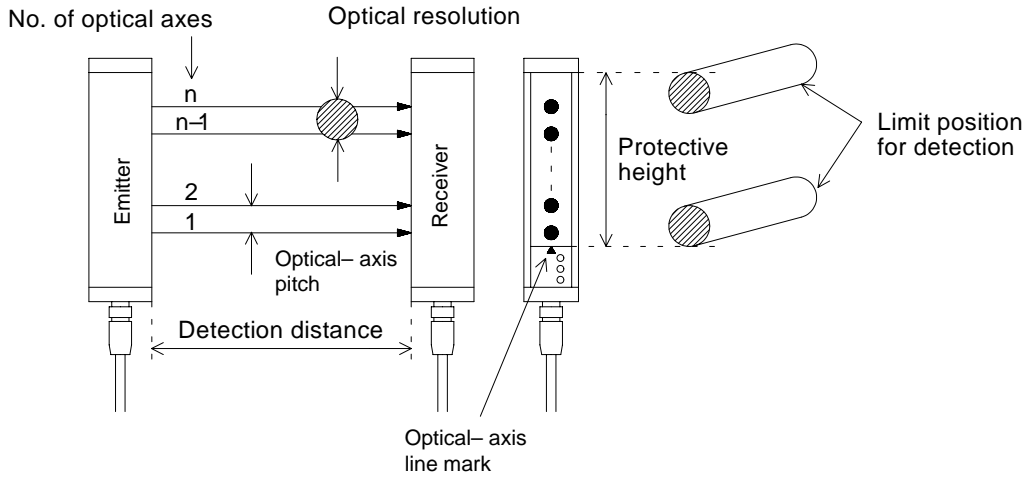
Nomenclature

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".

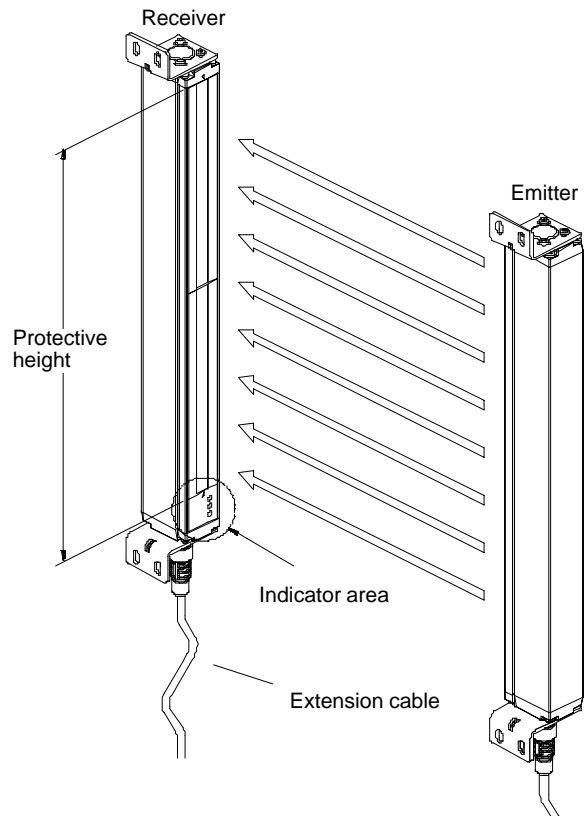
Optical-axis line mark

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.



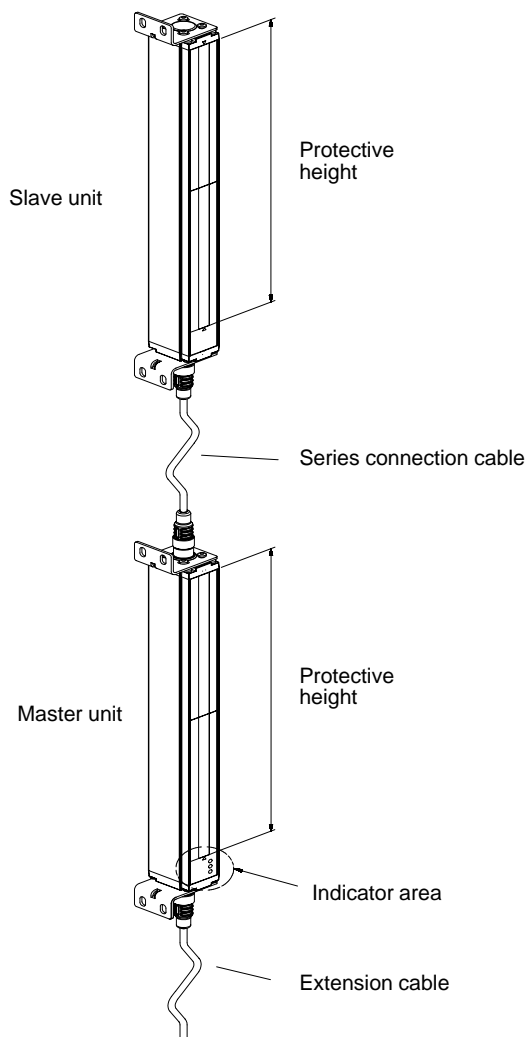
Series connection types

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.



Specifications

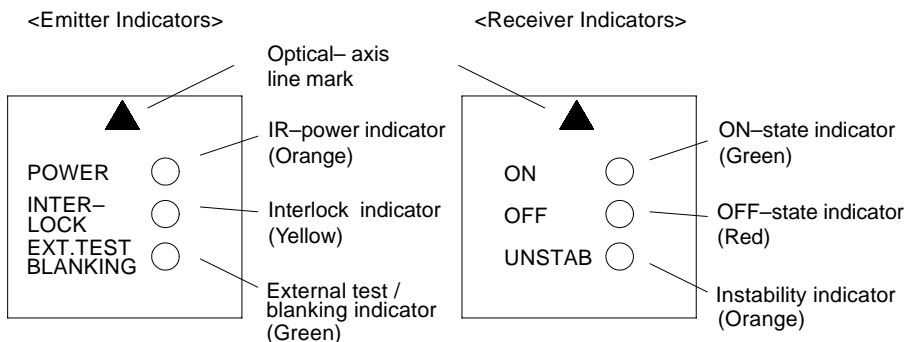
■ Rating and Performance

Type	F3S-B□□□P ¹ Stand-alone			F3S-BM□□□P□□ ¹ Master unit for series connection			F3S-BS□□□ ¹ 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	4 to 10
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								
Response time	ON to OFF: See table "Response Time" OFF to ON ² : 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)								

Type	F3S-B□□□P ¹ Stand-alone	F3S-BM□□□P□□ ¹ Master unit for series connection	F3S-BS□□□ ¹ Slave unit for series connection
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 ² : 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 ² [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		
Accessories	Test rod ³ , mounting brackets (top and bottom), mounting brackets (intermediate) ⁴ , mounting plates ⁴ , Instruction manual ⁵		
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

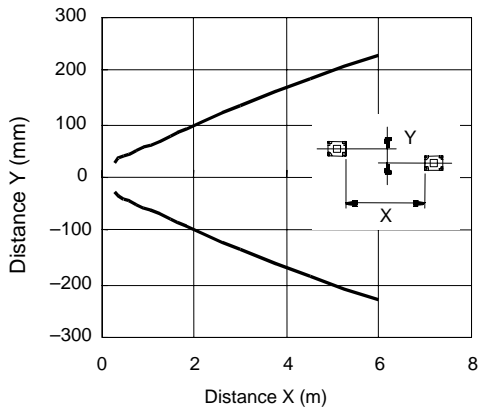
Slave unit F3S- Master unit	Response time [ms]			
	BS065	BS095	BS125	BS155
F3S-BM065P□□	20	20	20	21
F3S-BM095P□□	20	20	21	22
F3S-BM125P□□	20	21	22	24
F3S-BM155P□□	21	22	24	26
F3S-BM185P□□	22	24	26	28
F3S-BM215P□□	24	26	28	30
F3S-BM245P□□	26	28	30	32
F3S-BM275P□□	28	30	32	34
F3S-BM305P□□	30	32	34	35
F3S-BM335P□□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

Engineering Data

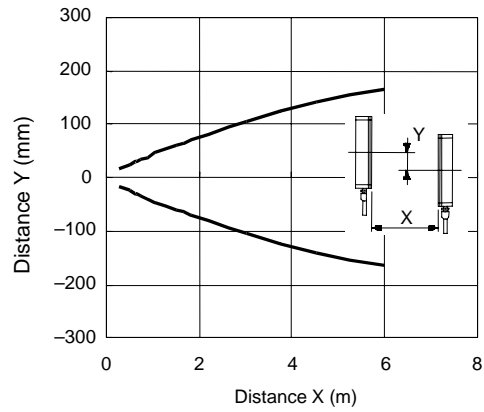
■ Operating Range

F3S-B122P

(Parapendicular to Center Line of Lenses)

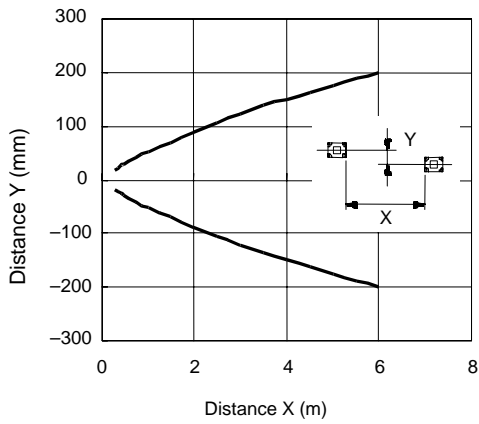


(Parallel to Center Line of Lenses)

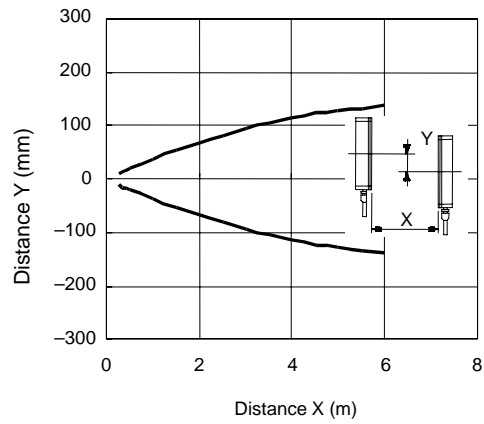


F3S-B662P

(Parapendicular to Center Line of Lenses)



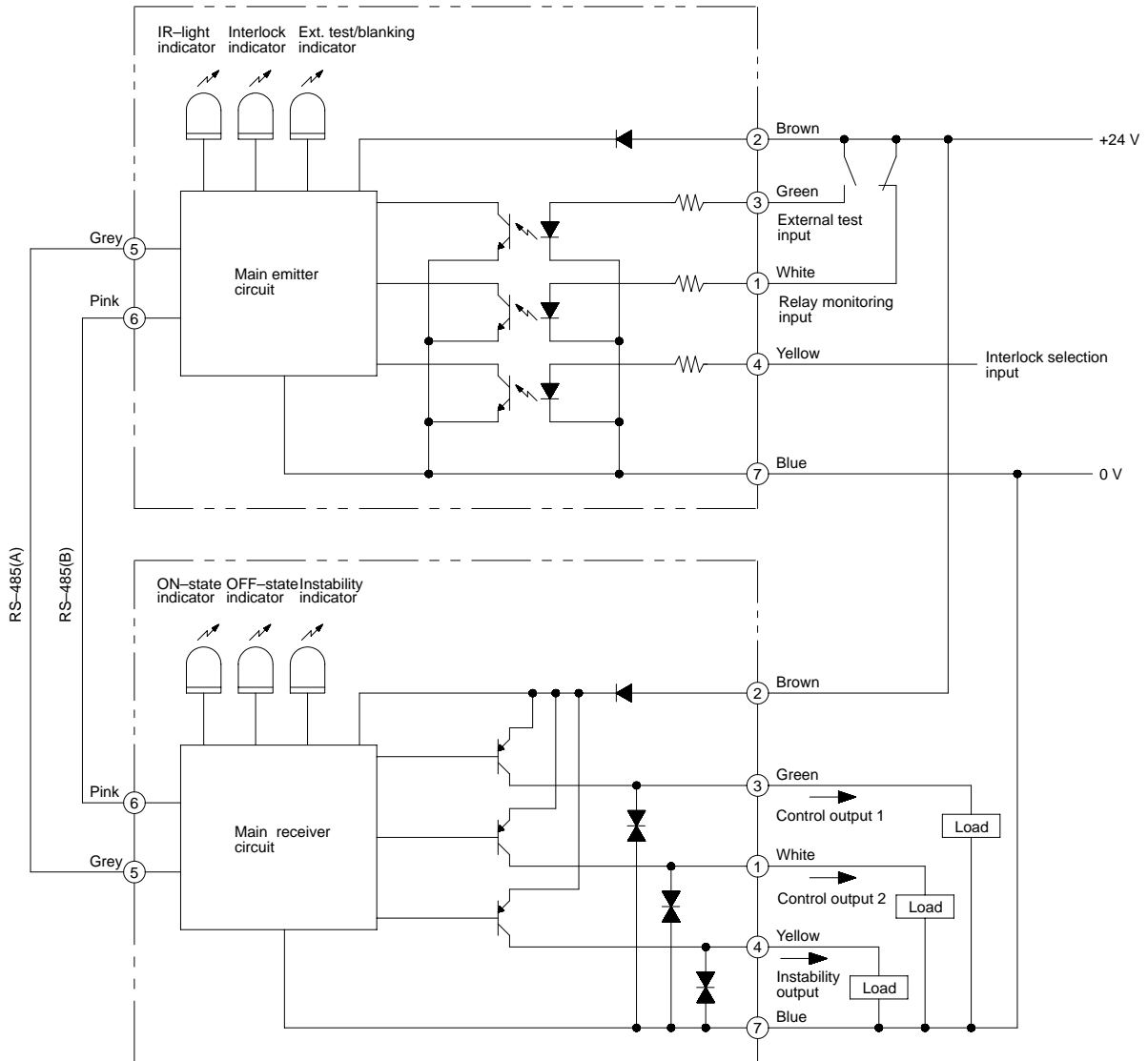
(Parallel to Center Line of Lenses)



Operation

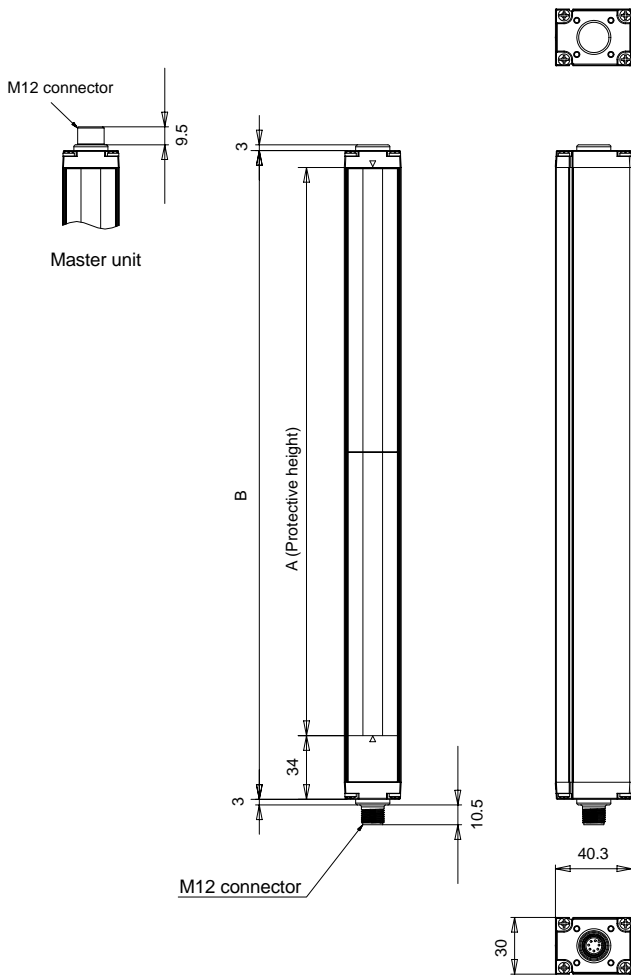
I/O Circuit

Circuit Diagram



Dimensions

■ F3S-B

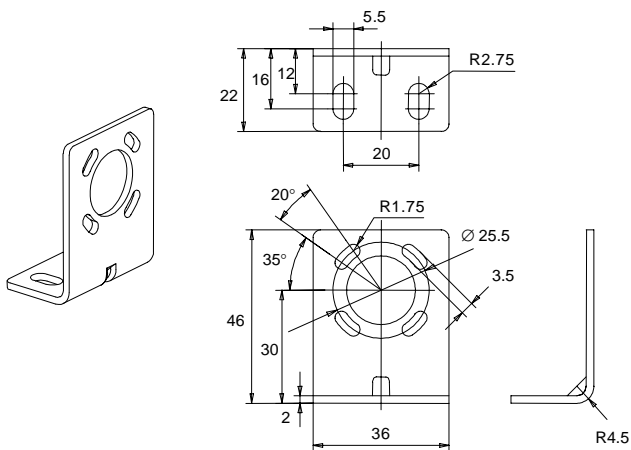


Type	A Protective height	B Full length
F3S-B122, -B065, -B047	300	343
F3S-B182, -B095, -B067	450	493
F3S-B242, -B125, -B087	600	643
F3S-B302, -B155, -B107	750	793
F3S-B362, -B185, -B127	900	943
F3S-B422, -B215, -B147	1050	1093
F3S-B482, -B245, -B167	1200	1243
F3S-B542, -B275, -B187	1350	1393
F3S-B602,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

Note: All units are in Millimeters unless otherwise indicated.

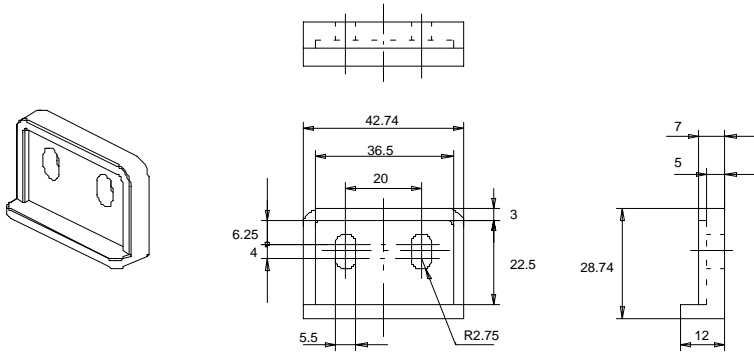
Accessories

■ Mounting Bracket (Top and Bottom)



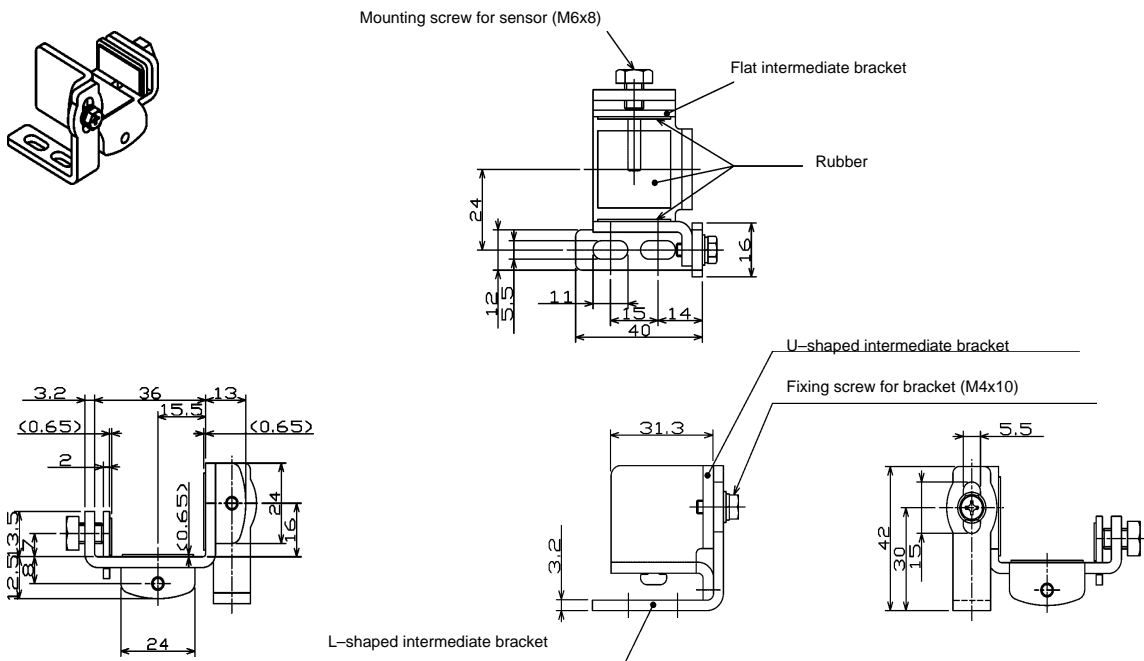
■ Mounting Plate

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



■ Intermediate Mounting Bracket

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



Options (Order Separately)

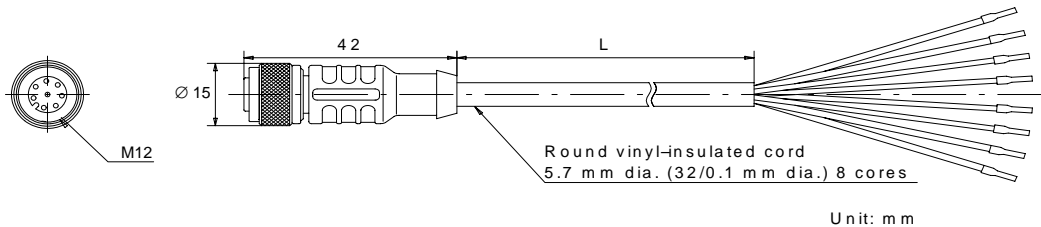
■ Extension Cable

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

F39-JB1A (L = 3 m)

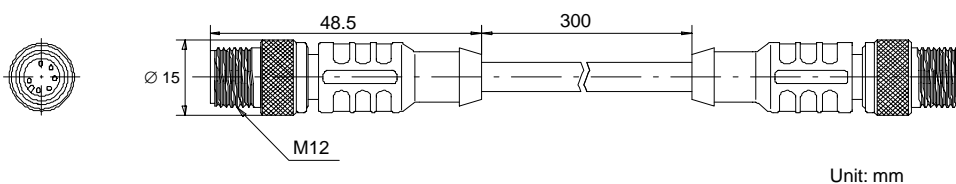
F39-JB2A (L = 7 m)

F39-JB3A (L = 10m)



■ F39-JB1B Series Connection Cable

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



■ F39-EU1E Optional Function Kit

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 E39-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 the 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

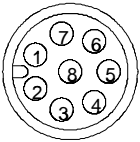
Disconnect all sources of power before wiring the F3S-B to a machine.

- Connect the emitter extension cable (F39-JB□A-L optional, **gray color outer jacket**) to the emitter. (The emitter uses gray color plastic caps.)
- Connect the receiver extension cable (F39-JB□A-D optional, **black color outer jacket**) to the receiver. (The receiver unit uses black color plastic caps.)

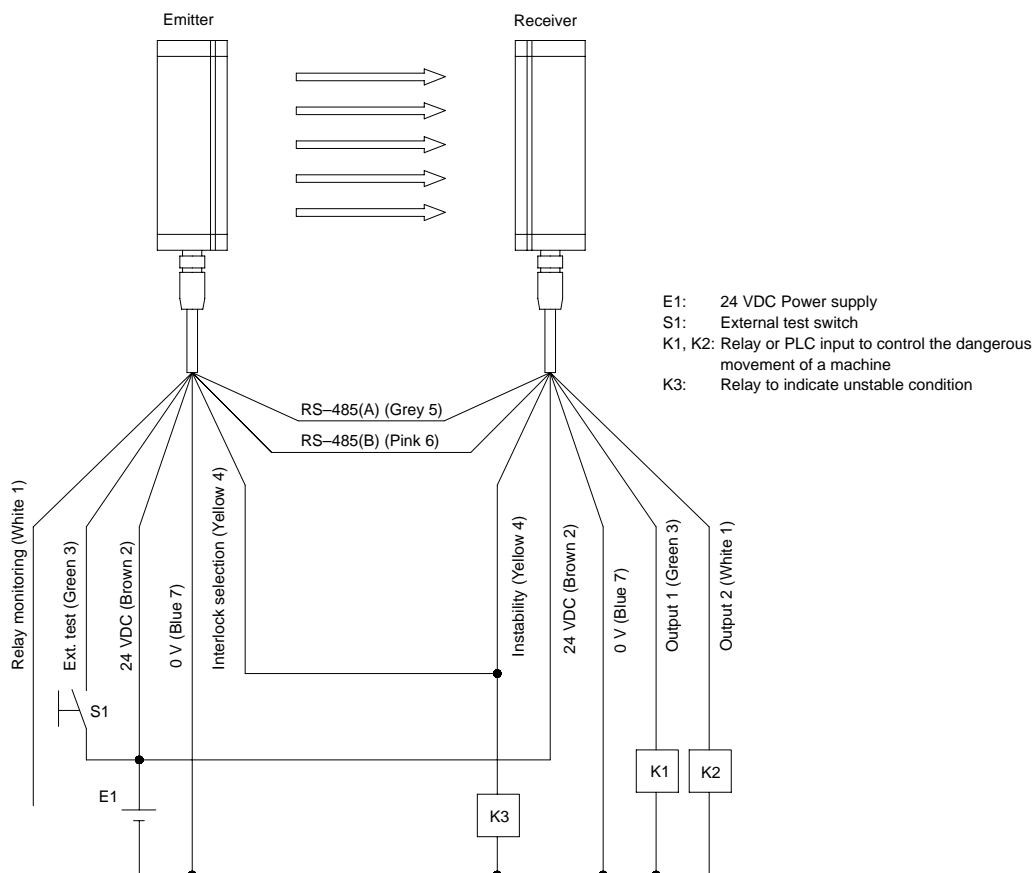
- Connect the 0 V line of the power supply directly to protective earth (PE).

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

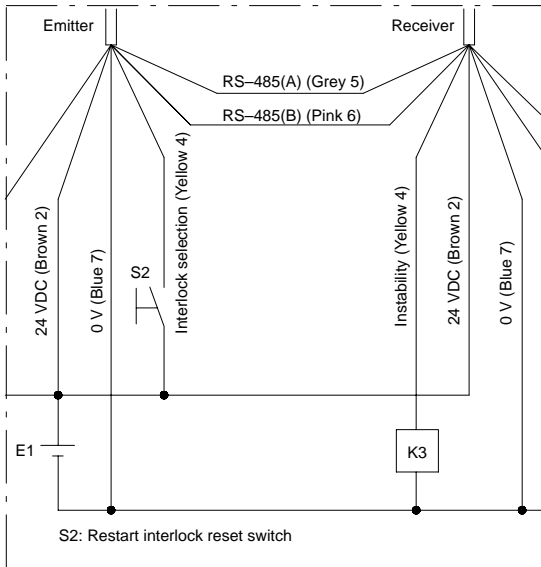
Connector (Main Unit End)

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	N.C. / reserved	Red

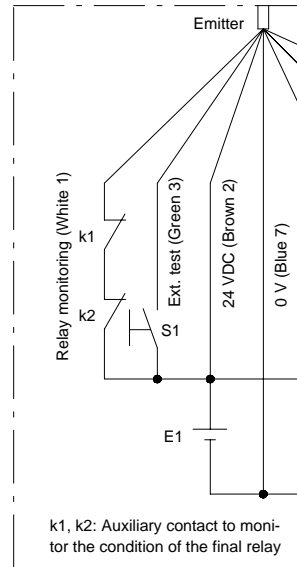
Note: N.C. / reserved: do not connect



When using START/RESTART FUNCTION



When using optional RELAY MONITORING FUNCTION



■ Details of F39-EU1E Optional Function Kit

1. Installation

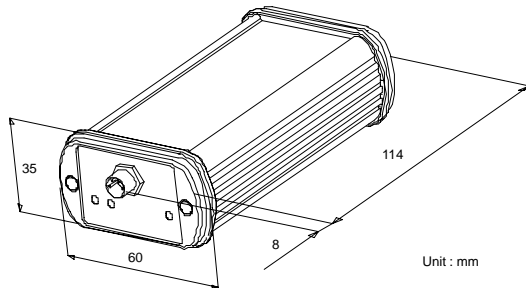
1.1 Preparation

Caution

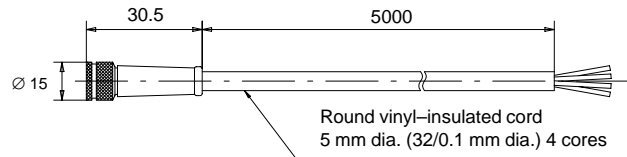
Perform the installation check and the periodical inspection described in the F3S-B manual.
 Do not disassemble, repair or modify the F39-E1.
 Do not use the F39-E1 in flammable or explosive environments.

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



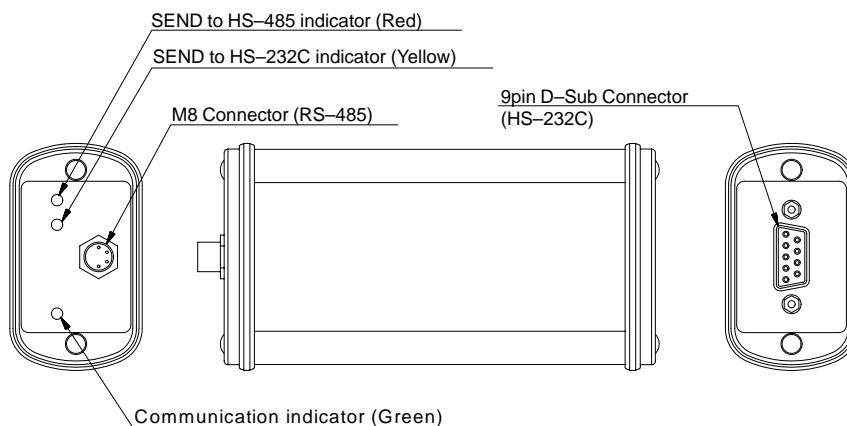
- F39-JB1C Interface cable 5 m cable length, M8 connector (4 pins)



Unit : mm

- 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



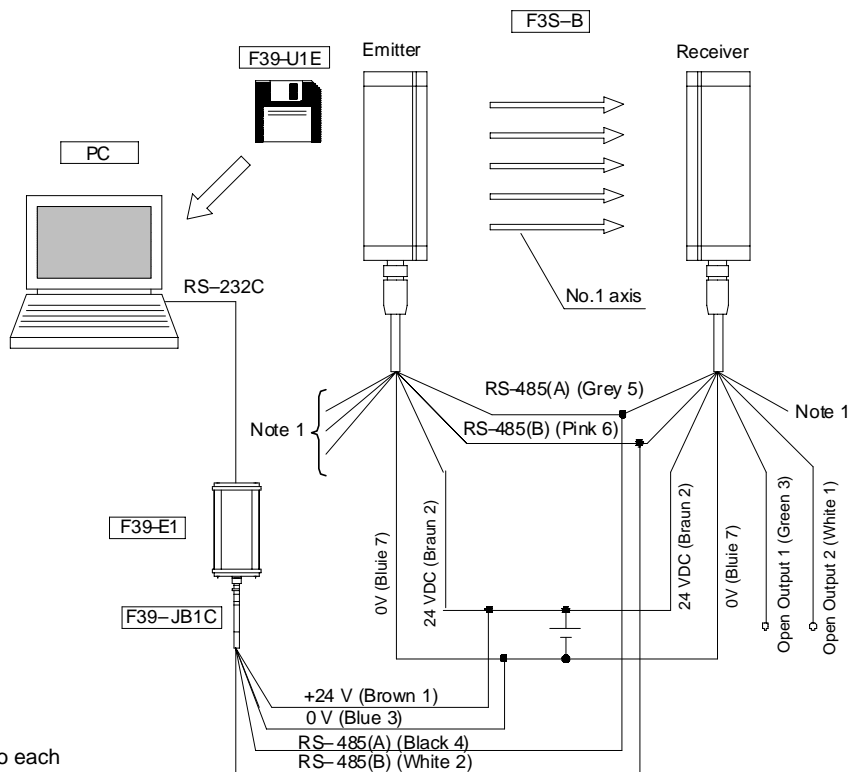
WARNING

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.

Note 1: See the instruction manual of F3S-B for wiring

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 V_s (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 \geq 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.

2. Ratings and Performance

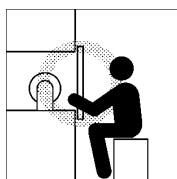
Type	F39-E1 Interface unit
Supply voltage	24 VDC \pm 20% (including 5 Vp-p ripple)
Current Consumption	120 mA max.
Interface	RS-232C interface, RS-485 interface
Indicator	See 1-2
Connection method	RS-485: 4pins, M 8 connector RS-232C: D-SUB connector, 9 pins
Protection circuit	RS 485 protection against 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 M Ω 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 ² [15 G], \pm X, \pm Y and \pm 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 ²) 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 that hazardous area.
6. Failure to do so may result in serious injury.

Correct installation

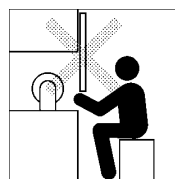


A hazardous part of a machine can be reached only by passing through the sensor detection zone.

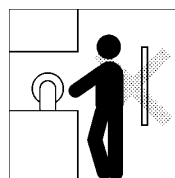


Some part of the operator's body remains in the detection zone while they are working.

Incorrect installation



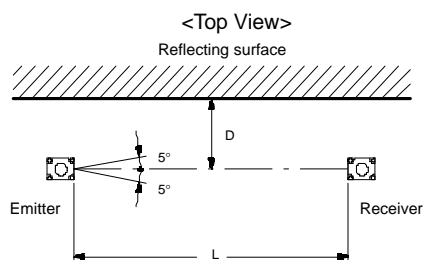
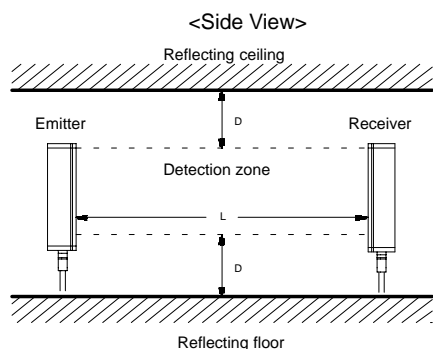
A hazardous part of the machine can be reached without passing through the sensor detected zone.



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

! WARNING

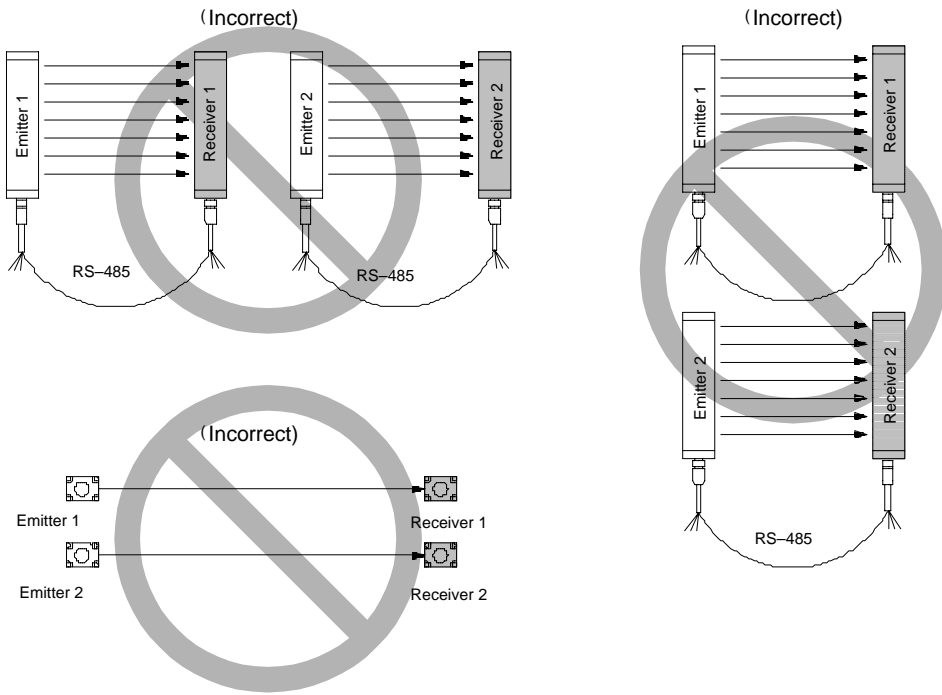
1. Be sure to install the F3S-B to minimize the effects of reflections from reflective surfaces. Failures to do so will create an inability to detect and may result in serious injury.
2. Install the F3S-B with a minimum distance D as shown below from the reflective surface (highly reflective surfaces) 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	0.27 m
3 to 5 m	$L \times \tan 5^\circ = L \times 0.087 \text{ (m)}$

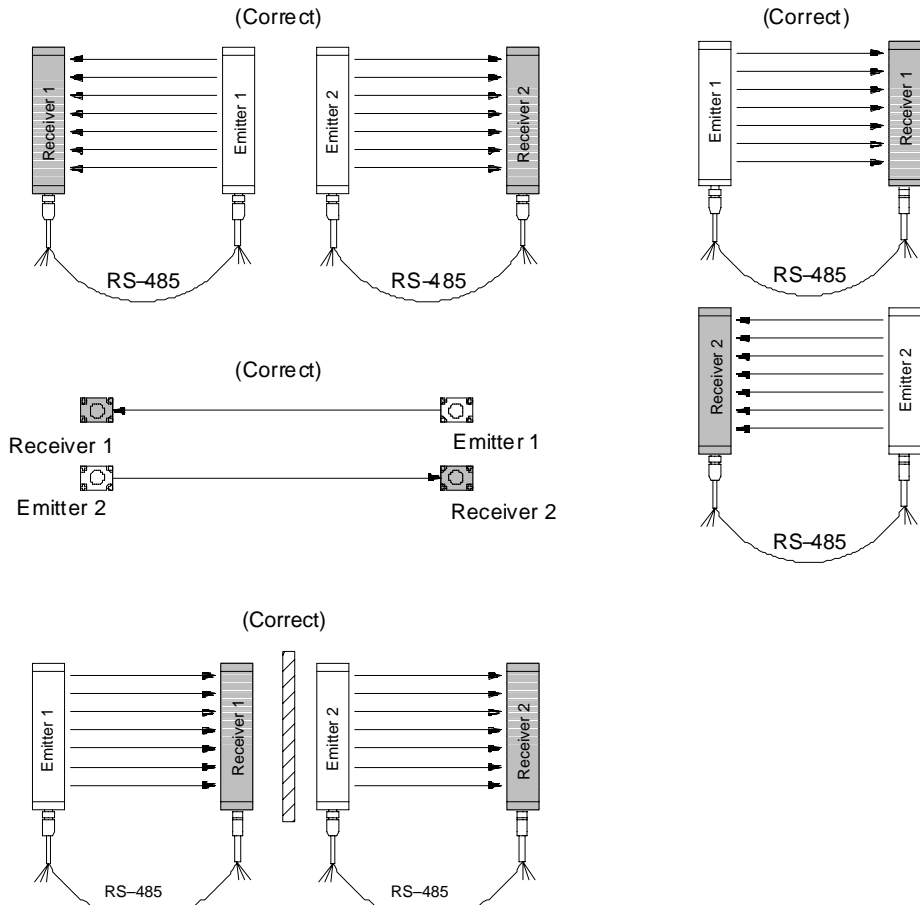
! WARNING

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



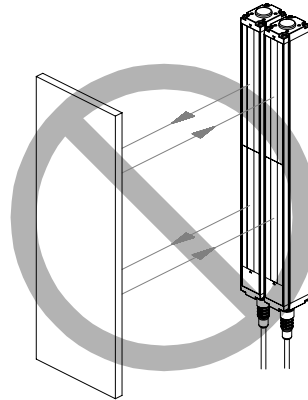
Alternate emitters and receivers

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 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.

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