Honeywell

Safety Light Curtain Installation Manual

FF-SB12, FF-SB14, FF-SB15 Series
Safety Light Curtains

107062-12 EN FR26 GLO 501 Printed in France

Honeywell

Revision History

Reference	Circulation	Description	Languages
107062-10			EN
107062-11	April 2001	Removal of FF-SBCE Addition of filtered version Update of the rating plate	EN
107062-12	May 2001	Removal of FF-SB30 models	EN

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Order : PK107062-12

Table of content

Introduction

Overview

This manual contains description, operation, installation, electrical connections, maintenance and troubleshooting information related to the FF-SB Series safety light curtains.

Important Highlighted Information

Important danger, warning, caution and notices are highlighted throughout the manual as follows:

⚠ DANGER

A DANGER symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

A WARNING symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

A CAUTION symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

A NOTICE symbol indicates important information that must be remembered and aids in job performance.

Organization of Installation Manual

This installation manual consists of the following:

Introduction contains a table of contents and explains the manual's organization.

Description and Operation discusses the terms and concepts related to operation as well as specifications and order guide information. This section also discusses the importance of the installer's role in set-up and installation of the machine guarding system.

Organization of Installation Manual (cont'd)

Installation contains mounting and positioning information. This section explains safety distance and how it is calculated. How to mount light curtains and mirrors is also discussed.

Electrical Connections covers electrical installation and wiring diagram information.

Maintenance and Troubleshooting contains inspection, cleaning, maintenance and troubleshooting informations.

Index contains keywords and their associated pages related to topics found throughout this manual.

Warranty And Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Commencing with date of shipment, Honeywell's warranty runs for 18 months. If warranted goods are returned to Honeywell during that period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is the Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose.**

While we provide application assistance, personally and through our literature, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

Sales And Service

Honeywell's Sensing & Control Division serves its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or the name of the nearest distributor, contact a nearby sales office or call:

TELEPHONE

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+ 33 (0) 1 60 19 82 68	France
+ 49 (0) 69 8064 444	Germany
+ 34 91 313 61 00	Spain
+ 1-815-235-6847	International
+ 44 (0) 118 906 2600	UK
+ 1-800-537-6945	USA

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+ 61 (0) 2 9370 4525	Australia
+ 1-800-565-4130	Canada
+ 33 (0) 1 60 19 81 73	France
+ 49 (0) 69 8064 442	Germany
+ 34 91 313 61 29	Spain
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INTERNET

http://www.honeywell.com/sensing/
info.sc@honeywell.com

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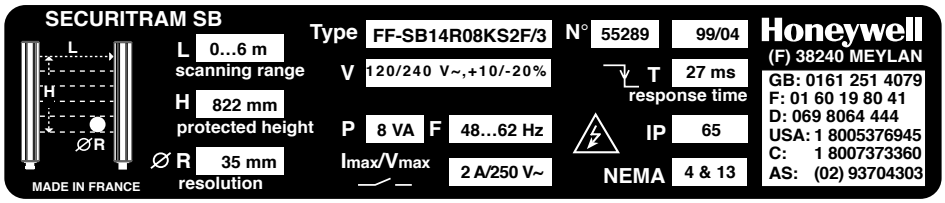
Light Curtain Identification

Each emitter and receiver has two plates, an identification plate and an approval plate.

The identification plate contains the following:
- Catalog listing (type)
- Serial number
- Date code
- Power consumption (P)
- Supply voltage

The approval plate certifies that the product conforms to the technical examination endorsement issued by the approval institutes of different countries.

Identification Plate



Approval Plate

Jumper Links for Selection Mode on Receiver Power Board	
Catalog Listing	**Serial Number**
FF-SB14E/RxxK-S2	51730 TO ....
FF-SB14E/Rxx4-S2	21439 TO ...
FF-SB15...	1025 TO ...

Power Consumption
- 8 VA for ac version
- 8 W for dc version

Description and Operation

Overview

This chapter contains terms and concepts related to safety and the application of the FF-SB Series light curtain. The importance of the installer's role in the set-up and installation of the machine guarding systems is discussed. The section also contains specification and order guide information.

Machine Guarding and Perimeter Protection

FF-SB12, FF-SB14 and FF-SB30 Series thru-scan light curtains are non-contact machine guarding devices designed to increase the protection of operators of power driven machinery (see figure 1-1). The FF-SB15 Series light curtain is designed for perimeter guarding of dangerous areas.

⚠ WARNING

IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

- Install FF-SB light curtains in accordance with this installation manual and applicable local safety regulations (OSHA, ANSI, European standards).
- Allow entry into protected area by interruption of sensing field or other safeguarding device only.
- Consult local safety agency before installing FF-SB Safety light curtains.

Failure to comply with these instructions could result in death or serious injury.

FF-SB Series light curtains generate a stop signal if the sensing field is interrupted. Further operation is prevented until the sensing field is cleared. The FF-SB Series light curtain monitors itself continuously for component failures, misalignments, and dirt accumulations. Small misalignments or dirt accumulation are indicated by a flashing LED. If misalignment or dirt accumulations become too great or a component fails, a stop signal is generated. Operation is prevented until the condition is corrected.

⚠ WARNING

IMPROPER SYSTEM PERFORMANCE

- Consult local safety agency before designing a machine control system.
- Comply with local safety requirements when designing machine control link, interface and all control elements that affect safety.
- Install two independent safety relay contacts into machine control stop circuit controlled by FF-SB Series light curtain.
- Ensure two independent stop circuit relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

FF-SB12, FF-SB14 and FF-SB15 Series light curtains are designed so a malfunction or an interruption of the sensing field will cause the light curtain to generate a stop signal within a maximum of 30 milliseconds. This stop signal will be generated automatically if a malfunction occurs in the light curtain. All other machine control components that affect safety should also be designed to the same high level of operation.

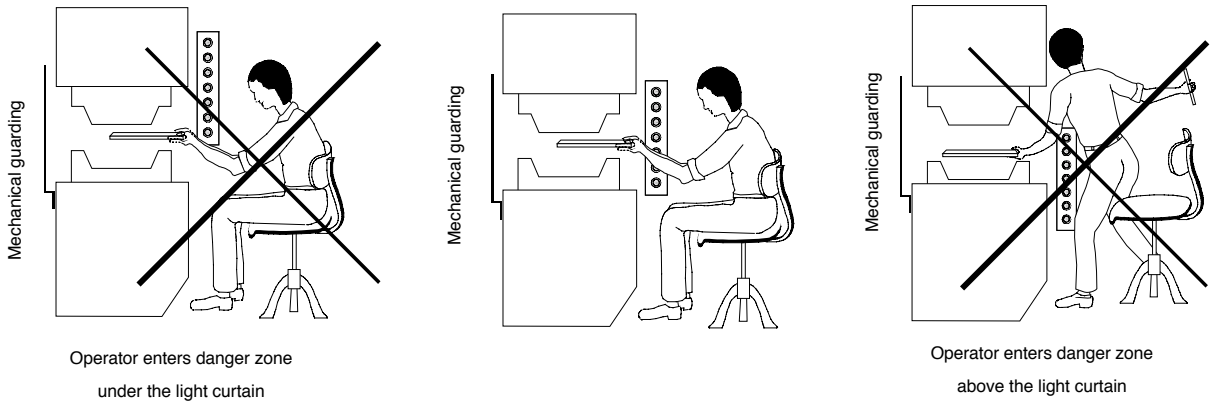
⚠ WARNING

IMPROPER MACHINE REACTION

- Ensure the machine control is capable of stopping the machine at any point in the cycle.
- Ensure that a loss of power does NOT impair stopping action of machine.

Failure to comply with these instructions could result in death or serious injury.

Figure 1-1 Point-of-operation Guarding (use FF-SB12 or FF-SB14 only)



Point-of-operation is defined as that area where a machine performs work (such as cutting, shaping, boring, or forming) on a material.

⚠ DANGER

FULL REVOLUTION MECHANICAL POWER PRESSES CANNOT BE STOPPED IN MID-STROKE (OSHA 29CFR 1910.217). Do NOT use FF-SB Series light curtains on full revolution mechanical power presses.

Failure to comply with these instructions will result in death or serious injury.

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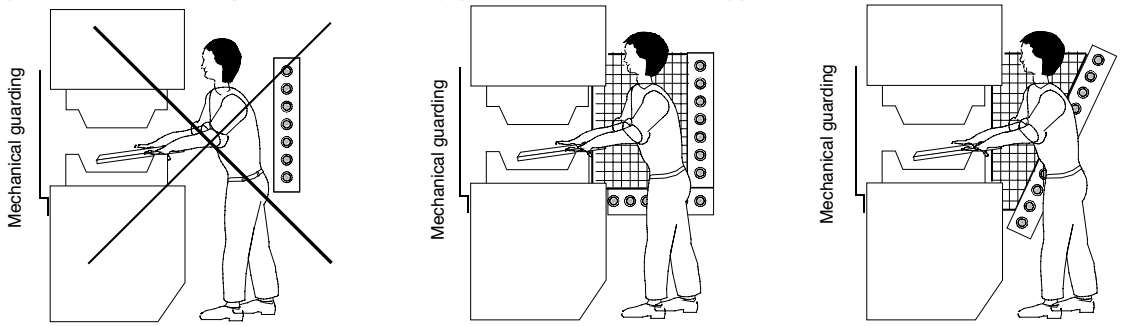
For point-of-operation guarding the light curtain(s) and any mechanical guards should be installed so no one can stand between the light curtain and the danger zone. This may require additional hard guarding, horizontal or angled positioning of the light curtain, or additional light curtains (see figure 1-2).

Figure 1-2 Point-of-operation Guarding (use FF-SB12 or 14 only)



Operator is undetected between the light curtain and dangerous area

Right-angle mounting of two light curtains prevents undetected presence inside dangerous area

Light curtain mounted in an angled position prevents undetected presence inside the dangerous area

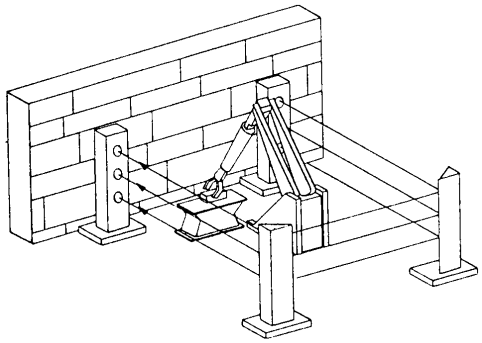
⚠ DANGER

IMPROPER POINT-OF-OPERATION PROTECTION

Do NOT use FF-SB15 Series light curtains in point-of-operation applications.

Failure to comply with these instructions will result in death or serious injury.

Figure 1-3 Perimeter Guarding (use FF-SB12, FF-SB14, or FF-15)



⚠ WARNING

IMPROPER PERIMETER PROTECTION ACTIVATION

- Design control circuit that requires a manual restart before further machine operation can occur.
- Locate manual restart to allow operator a clear view of danger zone.
- Operator must NOT be able to reach manual restart from within danger zone.
- Design control circuit to prevent Programmable Logic Controller from overriding manual restart.

Failure to comply with these instructions could result in death or serious injury.

Approvals

Figure 1-4 Approval Plate

CE	Only the packaging and the documentation of FF-SB Series products carry the CE mark; the CE declaration of conformity is at the back of this manual
cCSAus	The Canadian Standard Association has been accredited as a Nationally Recognized Testing Laboratory (NRTL) by the US Occupational Safety and Health Administration (OSHA). The CSA is able to carry out tests according to the Canadian and UL standards and delivers a single certificate which is valid for both Canada and the United States.
Standard Australia	Australian Standard
BG	German Berufsgenossenschaft E+MIII

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Standards Compliance

Standard	Title
ANSI B11.1	Mechanical Power Presses
ANSI B11.2	Hydraulic Power Presses
ANSI B11.19	Safeguarding when Referenced by the Other B11 Machine Tool Safety Standards
ANSI/RIA R15.06	Safety Requirements for Industrial Robots and Robot Systems
UL 508	Underwriters Laboratory
pr EN 50100-1/2	European Normalisation
EN 292	Safety of Machinery - Basic Concepts, General Principles for Design
EN 60204	Safety of Machinery - Electrical Equipment of Machines
EN 999	Safety of Machinery - Positioning of Protective Equipment Related to Approach Speeds of Parts of the Human Body
EN 294	Safety of Machinery - Safety Distances to Prevent Upper Limbs from Reaching Danger Zones
EN 811	Safety of Machinery - Safety Distances to Prevent Lower Limbs from Reaching Danger Zones

Regulations Compliance

	Title
OSHA 29 CFR 1910.212	General Requirements for (guarding of) All Machines
OSHA 29 CFR 1910.217	(Guarding of) Mechanical Power Presses

Directives Compliance

Machine Directive 98/37/EC
Low Voltage Directive 73/23/EC
Electromagnetic Compatibility Directive 89/336/EC

Control Reliability

"Control Reliability" means that "the device, system or interface shall be designed, constructed and installed such that a single component failure within the device, interface or system shall not prevent normal stopping action from taking place but shall prevent a successive machine cycle." (ANSI B11.19-1990, 5.5)

OSHA 29 CFR 1910.217 states that "the control system shall be constructed so that a failure within the system does not prevent the normal stopping action from being applied to the press when required, but does prevent initiation of a successive stroke until the failure is corrected. The failure shall be detectable by a simple test, or indicated by the control system."

Honeywell has developed new patented self-checking techniques which combine reliability with safety. The FF-SB Series light curtains function with dual channel redundancy and positive self-checking monitoring. This means that a faulty component in our system will make the safety barrier fail in a safe mode.

This design meets the highest requirements (Category 4 Electrosensitive Protective equipment) as described in the IEC 61496 European project norm. Category 4 safety light curtains are designed and manufactured in such a way that a single breakdown or an accumulation of failures does not lead to the loss of the safety function when a dangerous situation arises. **The safety function is maintained on a permanent basis.**

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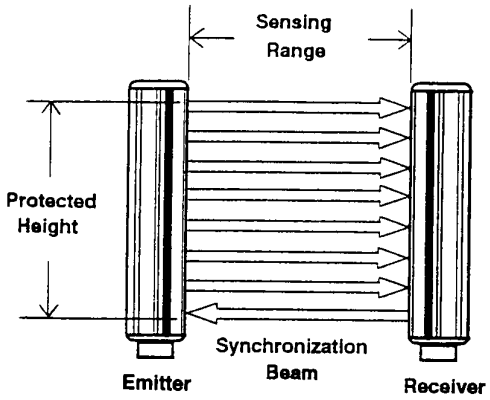
Operation

The FF-SB12 and FF-SB14 Series are thru-scan light curtains. Emitters transmit modulated, infrared light that is detected by photoreceivers in the receiver (see figure 1-5). The number of light beams depends on the protected height and resolution of the light curtain.

Figure 1-5 FF-SB Series Operational Diagram



The FF-SB15 Series is also a thru-scan type light curtain. The emitter transmits two or three groups of eight beams each, plus the synchronization beam.

Resolution

FF-SB Series light curtain resolution (sometimes called object sensitivity) is the minimum object size that will interrupt at least one light beam when it enters the sensing field. Anything entering the sensing field equal to or greater than this minimum size will be detected. Resolution is not affected by scanning distance or dust accumulation. The FF-SB Series does not have a sensitivity adjustment.

Two factors determine the resolution of the light curtain: beam center distance and light beam diameter (see figure 1-6). FF-SB12 has a center distance of 12,7 mm (0.5 inches) and the FF-SB14 has a center distance of 25,4 mm (1 inch).

Beam diameter is the smallest width that will block a single light beam. The FF-SB12 and FF-SB14 have a beam diameter of 9,5 mm (0.37 inch). The combination of the beam diameter and center distance gives the FF-SB12 (see figure 1-6) a resolution of 22 mm (0.87 inch), the FF-SB14 a resolution of 35 mm (1.38 inches).

The FF-SB15 has a 235 mm (8.5 inches) gap between the sets of its beams and is considered suitable for perimeter guarding only.

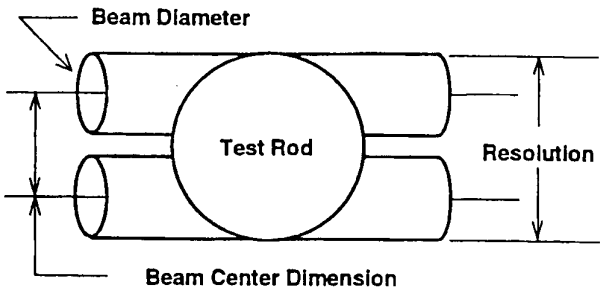
⚠ DANGER

IMPROPER POINT-OF-OPERATION PROTECTION

Do NOT use FF-SB15 Series light curtains in point-of-operation applications.

Failure to comply with these instructions will result in death or serious injury.

Figure 1-6 Light Curtain Resolution



⚠ WARNING

IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

- DO NOT use FF-SB12 or SB14 with FF-SB15 emitters or receivers.

Failure to comply with these instructions could result in death or serious injury.

Protected Height

Protected height is the height from the top of the uppermost light beam to the bottom of the synchronization beam (see figure 1-5). The synchronization beam is part of the protected height.

Synchronization

The FF-SB Series emitter is optically synchronized by an infrared light beam sent from the receiver to the emitter. The beam keeps the emitter and receiver in synchronization. External wiring between the emitter and receiver or through a third control unit is not needed. To simplify maintenance and inventory, the emitter and receiver are not matched.

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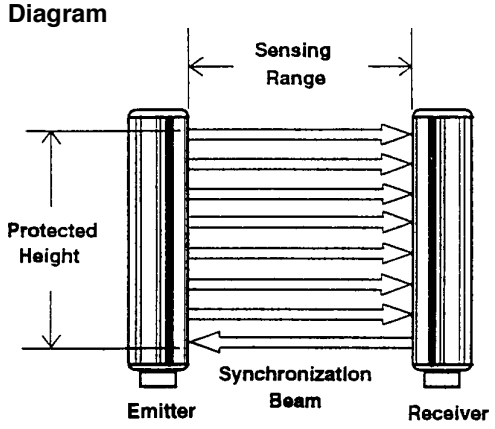
Response Times

The response time of FF-SB Series light curtains is the maximum time it takes the light curtain to generate a stop signal after the sensing field has been interrupted. See the table below for response times for individual light curtains.

Protected Heights (mm/in)	**Response Times** (milliseconds)			
	FF-SB12	**FF-SB14**	**FF-SB15**	**FF-SB14 filter version**
200 (7.87)	25	—	—	—
400 (15.75)	27	25	—	40
600 (23.6)	29	26	25	41
800 (31.5)	—	27	—	42
1000 (39.37)	—	28	26	43
1200 (47.24)	—	29	—	44
1400 (55.12)	—	30	27	45

Scanning Range

Figure 1-7 Scanning Range Diagram



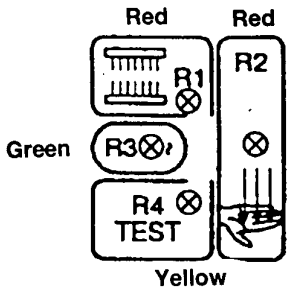
Scanning range is the maximum distance allowed between the emitter and the receiver (see figure 1-7). The FF-SB Series light curtains have the following scan ranges:

Product	**Scan Range**
FF-SB120 m to 10 m (0 ft to 32.8 ft)	
FF-SB14 (filter version for crowded areas or welding applications)	0 m to 6 m (0 ft to 19.7 ft)
FF-SB15	3 m to 24 m (9.84 ft to 78.8 ft)
FF-SB12E/R02E-52	0 m to 6 m (0 ft to 19.7 ft)

Indicators

FF-SB12, FF-SB14 and FF-SB15 Series receivers have four LED indicators (see figure 1-8). The emitters have one LED. These LED indicators provide important information related to light curtain status.

Figure 1-8 Receiver Indicators



Signal Strength Indicator (receiver)

The R1 indicator will flash repeatedly if the received light level is lower than the normal operating level, but is still sufficient for operation. If the received light level drops too low, an alarm state results and the light curtain generates a stop signal. To prevent unnecessary shutdowns, this indicator will signal the need for cleaning and/or alignment.

Operation Indicators (receiver)

There are two LED indicators that provide operation status (see figure 1-8): R2 (red) and R3 (green). R3 indicates the receiver is operating normally and the sensing field is clear. This indicator must be on to ensure the equipment is working properly (red R2 will be off).

R2 indicates that the light curtain is in an alarm state. If the sensing field is interrupted, the FF-SB Series light curtain will immediately generate a stop signal. In this condition, R2 will be on and R3 will be off.

Test Indicator (receiver)

FF-SB Series light curtains provide a connection for testing the state of external contacts. The test contacts allow verification of external safety-related electromechanical components. When any contact in the external test circuit opens, the FF-SB Series light curtains will switch to the alarm state. R4, the test indicator, will turn on and the relay outputs will be de-energized while the test circuit is open.

The customer is responsible for providing the external test circuitry. See figures 3-3, 3-4 and 3-5 for the wiring diagrams of the external test circuitry.

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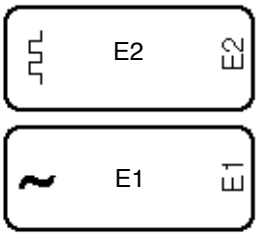
Power Indicator (emitter)

FF-SB Series emitters have a yellow E1 LED that, if illuminated, indicates power is applied to the light curtain (see figure 1-9).

Figure 1-9 Emitter Indicators



Synchronization Beam Reception Indicator (emitter)

FF-SB Series emitters have a yellow E2 LED that, if illuminated, indicates the synchronization beam is established. (see figure 1-9). E2 also illuminates if one beam is interrupted near the emitter.

Mirrors

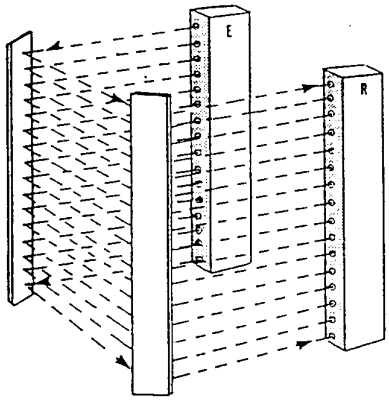
FF-SB Series mirrors provide a means to guard more than one side of a danger zone with one light curtain. One or two mirrors can be used with a emitter and receiver pair. For FF-SB12 and FF-SB14 light curtains, each mirror reduces the scanning range by 10 %. For FF-SB15 light curtains, each mirror reduces the scanning range by 15 %. See the Scanning Range with Mirrors table below.

Scanning Range with Mirrors

FF-SB Series	Scanning Range m (ft)	Scanning Range with Mirrors	
		1 Mirror	2 Mirrors
FF-SB12	10 (32.8)	9 (26.52)	8,1 (23.87)
FF-SB14	10 (32.8)	9 (26.52)	8,1 (23.87)
FF-SB15	24 (78.8)	20,4 (75)	17,3 (63.7)

Figure 1-10 illustrates the combination of an emitter, receiver, and two mirrors guarding three sides of a danger zone.

Figure 1-10 Two Mirrors Used with One FF-SB Light Curtain



The protected height of the light curtain determines which mirrors should be used. Refer to the Mirror Heights table below for the height of individual mirrors and the protected height they are meant to operate with.

Mirror Heights

Part Listing	Use with Protected Height mm (in.)	Overall Mirror Frame Height w/o brackets
FF-SBSMIR02	200 (7.87)	298 (11.73)
FF-SBSMIR04	400 (15.75)	501 (19.72)
FF-SBSMIR06	600 (23.6)	704 (27.72)
FF-SBSMIR08	800 (31.5)	909 (35.79)
FF-SBSMIR10	1000 (39.37)	1112 (43.78)
FF-SBSMIR12	1200 (47.24)	1315 (51.77)
FF-SBSMIR14	1400 (55.12)	1520 (59.84

Mirrors are shipped with all the necessary mounting hardware and rotatable brackets (see page 35).

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Specifications

OPERATING CHARACTERISTICS		
Scanning Range	FF-SB12	0 m to 10 m (0 ft to 32.8 ft.) for -S2 version 0 m to 6 m (0 ft to 19.7 ft.) for -S2F version and FF-SB12E1R02E-S2
	FF-SB14	0 m to 10 m (0 ft to 32.8 ft)
	FF-SB15	3 m to 24 m (9.84 ft to 78.8 ft)
Object Detection Size	FF-SB12	22 mm (0.87 in) minimum
	FF-SB14	35 mm (1.38 in) minimum
	FF-SB15	235 mm (9.25 in) minimum (body detection)
Angle of Divergence		± 2°
Emitting Light Source		Infrared, pulsed, 880 nm
Immunity to Ambient Light	sunlight	20,000 Lux
	lamplight	15,000 Lux
ELECTRICAL CHARACTERISTICS		
Supply Voltage (emitter or receiver)		120/240 Vac (+10 %, -20 %), 48 Hz to 62 Hz 24 Vdc to 48 Vdc*, ± 15 %,
Power Consumption (emitter or receiver)		8 Vac / 8 W dc
Output Type		Mechanically-linked relay contacts
Output Switching Capability		50 mA min., 2 Amps at 250 Vac 1 Amp at 48 Vdc Max.
Test Input		External dry contact required
Response Times	FF-SB12	≤ 29 msec
	FF-SB14	≤ 30 msec
	FF-SB15	≤ 27 msec
Immunity to Electrical Noise		IEC 1000-4-4 (Replaces IEC 801-4, Norm)
ENVIRONMENTAL/PHYSICAL CHARACTERISTICS		
Operating Temperature Range		0 °C to 55 °C (32 °F to 131 °F)
Sealing		NEMA 4, 13, and IP 65
Housing Dimension	FF-SB12/FF-SB14	Width, 56 mm (2.2 in); Depth, 116 mm (4.6 in); Height**
	FF-SB15	Width, 56 mm (2.2 in); Depth, 116 mm (4.6 in) Height 4 beam group, 1569 mm (61.77 in) Height 3 beam group, 1169 mm (46.02 in) Height 2 beam group, 769 mm (30.28 in)
Material	Housing	Aluminum Alloy
SB12, FF-SB14)		
		Polymethylmethacrylate (PMMA) (FF-SB15)

*The dc version is featured with a galvanic insulation (dc to dc converter) that provides the same level of immunity to external disturbances as ac versions; this is essential to guarantee the safety integrity of the light curtain.

**Refer to the Unit Height Table for individual unit heights.

Light Curtain Order Guide

Catalog listings for the FF-SB Series light curtains include: one emitter, one receiver, two mating plugs for the metal quick-disconnect connectors, two arc suppressors, one test rod, and this installation manual.

The three safety relays R1, R2, and R3, the cycle start push-button, and the test contacts (shown in the wiring diagram in Chapter 3) must be supplied by the customer. Mounting brackets, accessories, and mirrors must be ordered separately.

Each set of mounting brackets includes the following hardware: bolts, nuts, washers, and vibration dampeners. For a typical light curtain installation, two sets of mounting brackets are necessary; one for the emitter and one for the receiver. An emitter or receiver may require different types of mounting brackets in certain applications.

If the light curtains are mounted directly to a machine, order the mounting accessories set (FF-SBZS8000). Mirrors are supplied with mounting brackets and accessories.

FF-SB12 Series

Resolution: 22 mm (0.86 in)

FF- SB12E/R □ □ □ - S2

- G = 240 Vac only (unit size = 200 mm)
- K = 120/240 Vac[1] (unit size > 200 mm)
- E = 120 Vac only (unit size = 200 mm)
- 4 = 24-48 Vdc

Nominal protected height
- 02 = 200 mm (7.87 in)
- 04 = 400 mm (15.75 in)
- 06 = 600 mm (23.62 in)

Example: FF-SB12E/R04K-S2

[1]The unit automatically switches to the applied ac voltage level.

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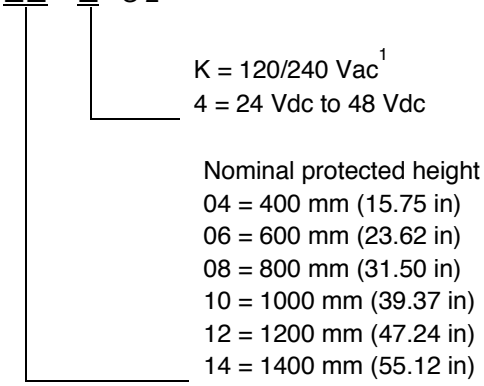
FF-SB14 Series

Resolution: 35 mm (1.38 in)

FF- SB14E/R □□ □ - S 2

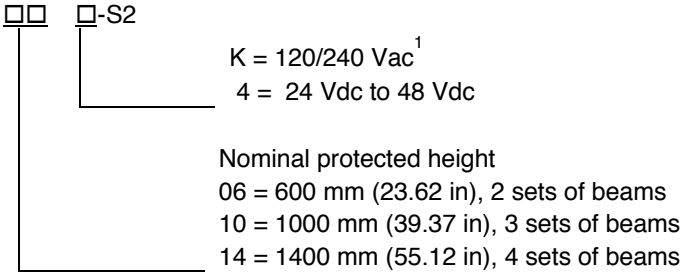


Example: FF-SB14E/R08K-S2

FF-SB15 Series

Resolution: Perimeter Guarding (Body Detection) ONLY

FF- SB15E/R □□ □-S2



Example: FF-SB15E/R10K-S2

[1]The unit automatically switches to the applied ac voltage level.

Mirror and Mounting Bracket Order Guide

Mounting Bracket Kit (one kit is required for emitter, one kit is required for receiver)

Part Listings	Description
FF-SBZS5000	Two omega shaped brackets with vibration dampeners and mounting accessories
FF-SBZS6000	Two "L" shaped brackets with vibration dampeners and mounting accessories
FF-SBZS7000A	Two rotatable brackets with vibration dampeners and mounting accessories
FF-SBZS8000	Set of vibration dampeners and mounting accessories (includes 8 screws + 8 nuts + 8 washers + 8 antivibration inserts)
FF-MPZS9018	Floor mounting post for mirror
FF-SBZS9010	Floor mounting column for FF-SB Series with protected height at 1000 mm or less, this listing includes a FF-SBZS8000 set.

Mirrors

Part Listings	Description
FF-SBSMIR02	One deflection mirror for use with the 200 mm protection height light curtain
FF-SBSMIR04	One deflection mirror for use with the 400 mm protection height light curtain
FF-SBSMIR06	One deflection mirror for use with the 600 mm protection height light curtain
FF-SBSMIR08	One deflection mirror for use with the 800 mm protection height light curtain
FF-SBSMIR10	One deflection mirror for use with the 1000 mm protection height light curtain
FF-SBSMIR12	One deflection mirror for use with the 1200 mm protection height light curtain
FF-SBSMIR14	One deflection mirror for use with the 1400 mm protection height light curtain

Replacement Part Order Guide

There are two versions of the FF-SB Series light curtains: the Original version and the CE version. Refer to the appropriate replacement part table when ordering.

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FF-SB Light Curtains

Catalog Listing	Serial Number
FF-SB12E/R . . .	5001→....
FF-SB14E/RxxK-S2	50001→....
FF-SB14E/Rxx4-S2	21001→....
FF-SB15 . . .	1001→....

FF-SB Replacement Parts

Part Listings	Description	
Relays		
FF-SBZ132001	Removable 3 relay board for FF-SB Series except FF-SB12 200 mm	
FF-SBZ132003	FF-SB CE removable 3 relay board filtered	
FF-SBZ0110020	Two safety relays for FF-SB12E/R02E-S2	
Fuses		
FF-SBZ109001	Box of 10 fuses 0,25 A / Time delay for SB12E/R02❑-S2❑	
FF-SBZ109002	Box of 10 fuses 0,5 A time delay for FF-SB	
Plugs		
FF-SBZ1721201	Female supply plug for emitter or receiver	
FF-SBZ1721136	Female signal plug for receiver	
FF-SBZ1721137	Plug-female supply metal plug emitter FF-SB/K-S	
FF-SBZ1721202	Plug-female supply metal plug receiver FF-SB/K-S	
Other Spare Parts		
FF-SBZ0130010	Set of 8 Torx screws for FF-SB	
FF-SBZ172115	Kit of 100 female crimping contacts for DIN 43652 metal connector	
FF-SBZ666144*	Kit of reducer and câble glands for a complete set FF-SB*	
FF-SBZROD22	ø22 mm test rod for FF-SB12 Series	
FF-SBZROD35	ø35 mm test rod for FF-SB14 and FF-SB15 series	
FF-SBZ0140010	Torx screw driver ac x 20	
FF-SBZCRIMP	Crimping tool for FF-SB connectors	
FF-SBZREMOV	Removal tool for FF-SB connectors	
FF-SBZSERV1	1st level maintenance kit for FF-SB series	
Transparent front plates		
FF-SBZ0100050	2 transparent front plates for emitter and receiver for FF-SB12 series	H = 200 mm
FF-SBZ0100010	2 transparent front plates for emitter and receiver for FF-SB12/14 series	H = 400 mm
FF-SBZ0100020	2 transparent front plates for emitter and receiver for FF-SB12/14 series	H = 600 mm
FF-SBZ0100030	2 transparent front plates for emitter and receiver for FFSB14 series	H = 800 mm
FF-SBZ0100040	2 transparent front plates for emitter and receiver for FF-SB14 series	H = 1000 mm
FF-SBZ0100060	2 transparent front plates for emitter and receiver for FF-SB14 series	H = 1200 mm
FF-SBZ0100070	2 transparent front plates for emitter and receiver for FF-SB14 series	H = 1400 mm
FF-SBZ01506	2 front plates for one FF-SB15E/R06❑-S2 set	
FF-SBZ01510	2 front plates for one FF-SB15E/R10❑-S2 set	
FF-SBZ01514	2 front plates for one FF-SB15E/R14	
Special front plates		
FF-SBZFL40❑❑	1 special optical filter (shock-proof, improve immunity to light interference. Reduces scanning ranges by 40 %. For receiver only) Nominal protected height (ex: FF-SBZFL4006 to be fixed on a receiver unit)	
FF-SBZFL00❑❑	1 shock-proof transparent front plate (order 2 for a complete set emitter and receiver) Nominal protected height (ex: FF-SBZFL0006 plates)	

*The kit FF-SBZ666144 includes:

- For the emitter plug: PG9: allowed cable diameters: 5 mm to 8,7 mm / 0,2 in to 0.34 in
- For the receiver plug: PG13: allowed cable diameters : 8,5 mm to 13,5 mm / 0.33 in to 0.53 in
  PG21: allowed cable diameters: 11 mm to 19 mm / 0.44 in to 0.74 in
  Reducer PG21/PG13
  Reducer PG21/PG9

Part Listings	Description
Power supply board	
FF-SBZE131X	Extension Module for Emitter FF-SB14 std range
FF-SBZR131X	Extension Module for Receiver FF-SB14 std range
FF-SBZE108X	Extension Module for Emitter FF-SB14 long range or FF-SB15
FF-SBZR108X	Extension Module for Receiver FF-SB14 long range or FF-SB15
FF-SBZE131M	Master Module for Emitter FF-SB14 std range
FF-SBZR131M	Master Module for Receiver FF-SB14 std range
FF-SBZE108M	Master Module for Emitter FF-SB14 long range or FF-SB15
FF-SBZR108M	Master Module for Receiver FF-SB14 long range or FF-SB15
FF-SBZE130K	Supply Module 120/240 Vac for FF-SB12/14/15 Emitter with metal plugs
FF-SBZR130K	Supply Module 120/240 Vac for FF-SB12/14/15 Receiver with metal plugs
FF-SBZR1302K	115/230 V Mod Rece FF-SB-KS2 CE filtered
FF-SBZE090E	Supply Module 120 Vac for FF-SB12/14 200 mm Emitter with metal plugs
FF-SBZR090E	Supply Module 120 Vac for FF-SB12/14 200 mm Receiver with metal plugs
FF-SBZE090G	Supply module 240 Vac for FF-SB12 emitter
FF-SBZR090G	Supply module 240 Vac for FF-SB12 receiver
FF-SBZE147K	Supply module 120/240 Vac FF-SB14 emitter with plastic plugs
FF-SBZR147K	Supply module 120/240 Vac FF-SB14 receiver with plastic plugs
FF-SBZE1384	Supply Module 24 to 48 Vdc for FF-SB12/14/15 Emitter with metal plugs
FF-SBZR1384	Supply Module 24 to 48 Vdc for FF-SB12/14/15 Receiver with metal plugs
FF-SBZR13824	24/48 Vdc Mod Rece FF-SB14S2 CE filtered

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Installation

Overview

This chapter contains information about calculating the safety distance and properly mounting a safety light curtain. Mirror information is also provided.

⚠ WARNING

IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

- Install FF-SB Light Curtains in accordance with this installation manual and applicable local safety regulations (OSHA, ANSI, European standards).
- Allow entry into protected area by interruption of sensing field or other safeguarding device only.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

IMPROPER SYSTEM PERFORMANCE

- Comply with local safety requirements when designing machine control link, interface and all control elements that affect safety.
- Install two independent relay contacts into machine control stop circuit controlled by FF-SB Series Light Curtain.
- Ensure two independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

IMPROPER MACHINE REACTION

- Ensure the machine control is capable of stopping the machine at any point in the cycle.
- Ensure that a loss of power does NOT impair stopping action of machine.

Failure to comply with these instructions could result in death or serious injury.

How to Calculate Safety Distance

⚠ WARNING

IMPROPER SAFETY DISTANCE

- Calculate safety distance using formula $D_S > V(t_1+t_2)+C$ where,
  - D_S is the safety distance OSHA 29 CFR 1910.217 (c) (3) (iii) (e)
  - V is the hand speed constant of 63 inches per second
  - t_1 is the response time of the FF-SB light curtain
  - t_2 is the stopping time of the machine including interconnecting components such as relays, solenoids, and brakes, and C is additional safety distance.
- Obtain C, the additional safety distance from local safety agency.

Failure to comply with these instructions could result in death or serious injury.

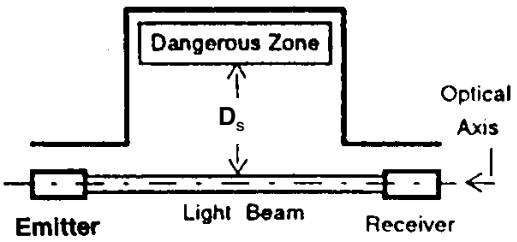
The safety distance is the minimum distance between the sensing field and the danger zone. This distance ensures that the danger zone cannot be reached until the machine motion has been stopped.

Calculate the safety distance (see figure 2-1) using the following formula:

$$D_S \geq V(t_1+t_2)+C \text{ where,}$$

- D_S is the safety distance from the light curtain sensing field to the danger zone.
- V is the velocity of movement into the danger zone; the OSHA hand speed constant is 63 inches per second; see local health and safety regulations for current value.
- t_1 is the response time of the FF-SB light curtain.
- t_2 is the stopping time of the equipment guarded by the light curtain including interconnecting components such as all mechanical, electromechanical, and electronic parts such as relays, solenoids, and brakes.
- C is additional safety distance. See local health and safety regulations for this value.

Figure 2-1 Light Curtain Safety Distance Diagram



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⚠ DANGER

IMPROPER POINT-OF-OPERATION PROTECTION

Install the FF-SB Light Curtains and mechanical guards so that NO person can stand between the light curtain and the danger zone without being detected.

Failure to comply with these instructions will result in death or serious injury.

Point-of-operation is defined as that area where a machine performs work (such as cutting, shaping, boring, or forming) on a material.

Sample Calculation (Point-of-operation guarding)

Country: USA
Application: Mechanical or hydraulic power press
Protection: Point-of-operation guarding
Formula: $D_S \geq V(t_1+t_2)+C$

- V = 63 in/sec.
- t_1 = 30 ms (FF-SB14E/R14K-S2)
- t_2 = 200 ms (machine stop time; including response time of all interconnecting components, such as relays, solenoids, brakes, etc.)
- C = 3.8 in. (ANSI B11.1 and ANSI B11.2) [FF-SB14]
- D_S = 63 (0.030 + 0.200) + 3.8 in. = 18.29 in.

⚠ WARNING

IMPROPER PERIMETER PROTECTION

- Design control circuit to require a manual restart before further machine operation can occur.
- Locate manual restart to allow operator a clear view of danger zone.
- Operator should NOT be able to reach manual restart from within danger zone.
- Design control circuit to prevent Programmable Logic Controller from overriding manual restart.

Failure to comply with these instructions could result in death or serious injury.

Sample Calculation (Perimeter guarding)

Country: USA
Application: Robotics
Protection: Perimeter guarding
Formula: $D_S \geq V(t_1+t_2)+C$

- V = 63 in./sec.
- t_1 = 26 ms (FF-SB15E/R10K-S2)
- t_2 = 200 ms (robotics stop time, including response time of all interconnecting components, such as relays, solenoids, brakes, etc.)
- C = 33.5 in. (USA)
- D_S = 63 (0.026 + 0.200) + 33.5 = 47.74 in.

How to Calculate Safety Distance (Reflective Surfaces Considered)

⚠ WARNING

REFLECTIVE SURFACES

- To prevent two optical paths to the receiver, install FF-SB light curtains so there are no reflective surfaces within the beam angles of the emitter and receiver.
- Calculate reflective safety distance using formula D = L (tan 2,5°), where

– D is the minimum distance to reflective surface (always greater than 131 mm or 5.16 in)
– L is the installed scanning range

Failure to comply with these instructions could result in death or serious injury.

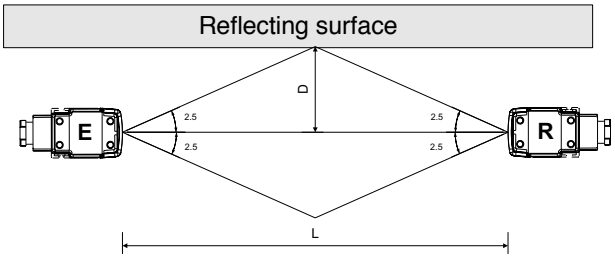
Reflective surfaces near the sensing field can cause reflection of the sensing beams and result in two optical paths to the receiver. The light curtain must be installed so there are no reflective surfaces within the beam angles of the emitter and receiver. Figure 2-2 illustrates the beam angles.

Calculate the reflective minimum safety distance using the following formula:

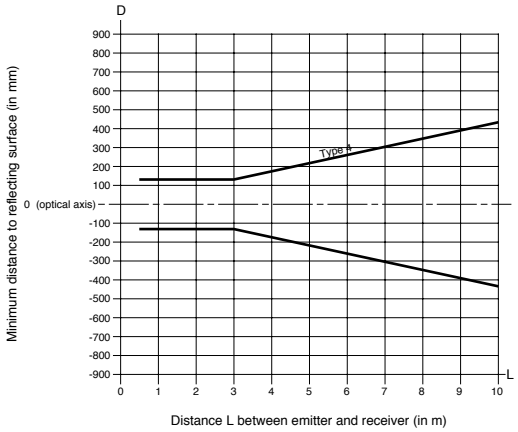
D = 131 mm, for scanning distances between 0 and 3 m
D = L x tan 2.5° for scanning distances greater than 3 m
D = Minimum distance to reflective surface (always greater than 131 mm or 5.16 in.)
L = Installed scanning range

The emitter and receiver must have the same protected height and resolution. The emitter and receiver must be mounted at the same height and aligned with each other (see figure 2-2).

Figure 2-2
Distance from Reflective Surfaces (1)



Distance from Reflective Surfaces



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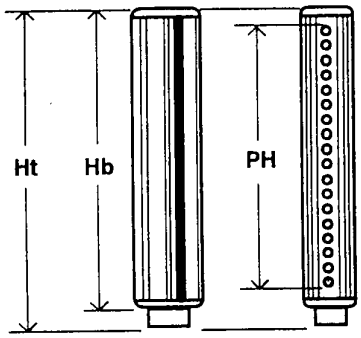
Emitter and Receiver Dimensions

Different protection heights are available in the FF-SB Series light curtain product line. Refer to figure 2-3 and the emitter and receiver heights table below.

Figure 2-3 Emitter and Receiver Height Diagram



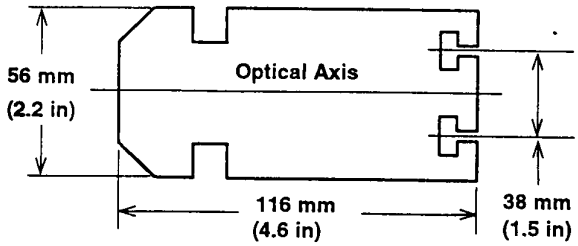
Emitter and Receiver Heights mm (in) - for reference only

Model	Nominal Protected Height	PH	Hb	Ht
FF-SB12	200 (7.87)	212,7 (8.4)	274,6 (10.8)	366,6 (14.4)
FF-SB12		415,9 (16.4)	477,8 (18.8)	569,8 (22.4)
FF-SB14	400 (15.75)	415,9 (16.4)	477,8 (18.8)	569,8 (22.4)
FF-SB12		619,1 (24.4)	681 (26.8)	773 (30.4)
FF-SB14	600 (23.6)	619,1 (24.4)	681 (26.8)	773 (30.4)
FF-SB15		619 (24.4)	689 (27.1)	769 (30.3)
FF-SB14	800 (31.5)	822,3 (32.4)	884,2 (34.8)	976,2 (38.4)
FF-SB14		1025,5 (40.4)	1087,4 (42.8)	1179,4 (46.4)
FF-SB15	1000 (39.37)	1025 (40.4)	1089 (42.9)	1169 (46.0)
FF-SB14	1200 (47.24)	1228,7 (48.4)	1291 (50.8)	1382,6 (54.4)
FF-SB14		1431,9 (56.4)	1493,8 (58.8)	1585,8 (62.4)
FF-SB15	1400 (55.12)	1432 (56.4)	1489 (58.6)	1569 (61.8)

PH = Protection Height; Hb = Unit Height; Ht = Unit Height with Female Plug Connector

All emitter and receiver units have the same cross-sectional size. Figure 2-4 illustrates the cross-sectional dimensions of the light curtain series.

Figure 2-4 Emitter and Receiver cross-sectional Dimensions



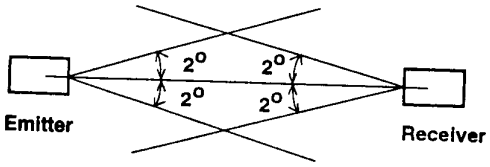
Mounting Considerations

This section discusses optical alignment and mounting considerations. There are several different ways to mount the FF-SB Series light curtains (singularly, in groups, and in several different orientations).

Optical Alignment

Proper optical alignment of the FF-SB Series light curtains ensures optimum operation. The emitter and receiver units must be mounted in parallel, at the same height, and with an angular displacement of no more than $\pm 2^{\circ}$. See figure 2-5 for proper alignment.

Figure 2-5 Emitter and Receiver Optical Alignment



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Vertical Mounting

⚠ WARNING

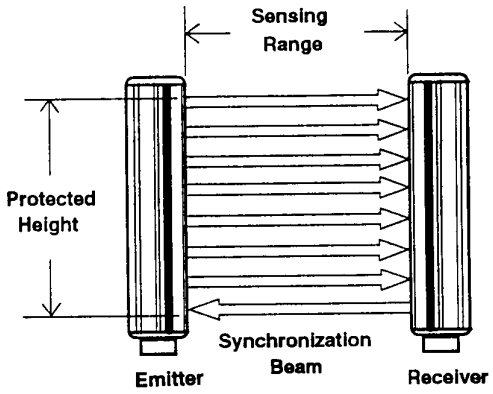
IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

- Mount FF-SB Series light curtains so that any entry into protected area must interrupt sensing field or other safeguarding devices.
- Install mechanical guards or additional FF-SB light curtains to prevent operating personnel from reaching around, under, or over sensing field.

Failure to comply with these instructions could result in death or serious injury.

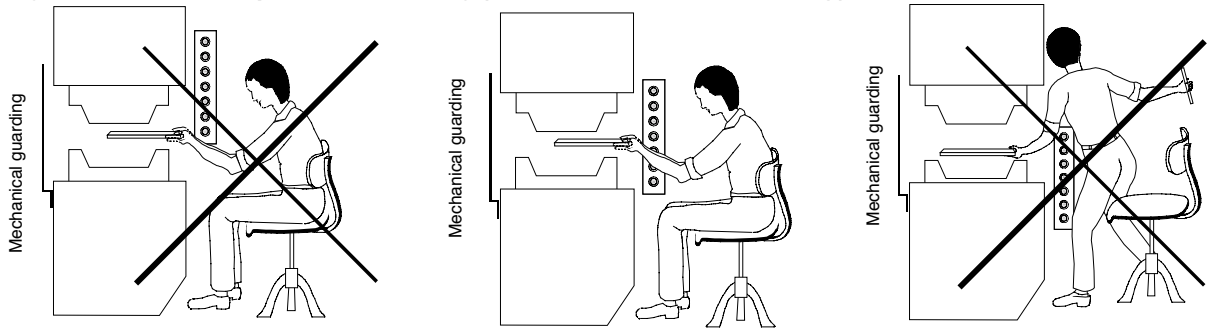
Vertical mounting may require the installation of mechanical guards or additional light curtains to prevent operating personnel from reaching around, under, or over the sensing field (see figure 2-6).

Figure 2-6 Vertical Mounting



For point-of-operation guarding, the light curtain(s) and any mechanical guards must be installed to detect or prevent operating personnel from standing between the light curtain and the danger zone (see figures 2-7 and 2-8).

Figure 2-7 Point-of-operation Guarding (use FF-SB12 or FF-SB14 only)



Operator enters danger zone under the light curtain

Operator enters danger zone above the light curtain

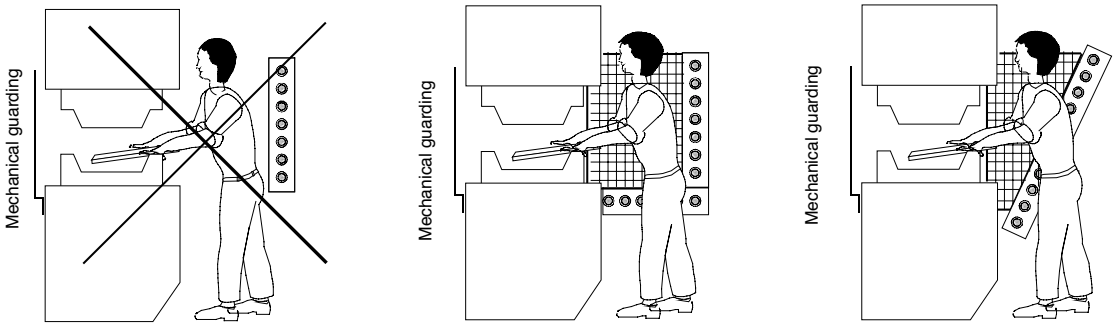
⚠ DANGER

IMPROPER POINT-OF-OPERATION PROTECTION

Install FF-SB Light Curtains and mechanical guards so NO person can stand between light curtain and danger zone without being detected.

Failure to comply with these instructions will result in death or serious injury.

Figure 2-8 Point-of-operation Guarding (use FF-SB12 or FF-SB14 only)



Operator is undetected between the light curtain and dangerous area

Right-angle mounting of two light curtains prevents undetected presence

Light curtain mounted in an angled position prevents undetected presence inside the dangerous area

area

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FF-SB15 Mounting

⚠ DANGER

IMPROPER POINT-OF-OPERATION PROTECTION

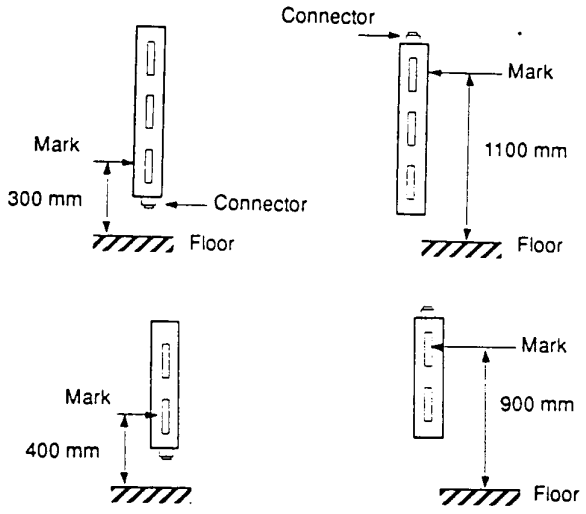
Do NOT use FF-SB15 Series light curtains for point-of-operation applications.

Failure to comply with these instructions will result in death or serious injury.

Using the alignment mark located near the connector of each FF-SB15 emitter and receiver unit, (see figure 2-9) mount the three beam units so that the mark is 300 mm (11.8 in.) above the ground with connector down or 1100 mm (43.3 in.) above the ground with the connector up.

Mount the two-beam-group FF-SB15 light curtain units so the alignment mark is 400 mm (15.75 in.) or 900 mm (35.4 in.) above the floor. Note the orientation of the connector (see figure 2-9).

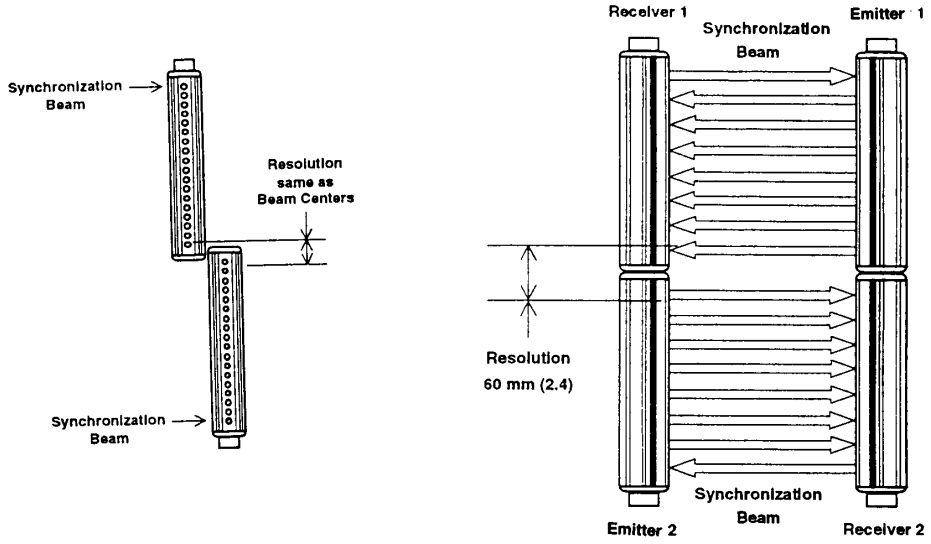
Figure 2-9 FF-SB15 Emitter and Receiver Vertical Mounting



FF-SB12 and FF-SB14 Mounting

Two emitter/receiver units may be mounted together to obtain a greater protected height (see figure 2-10). Mount the units head-to-head so the synchronization beams are as far apart as possible. Mount the emitter/receiver units in a reverse transmitting position to prevent mutual interference or cross-talk. The units may be mounted with the over-lapping heads to maintain the resolution throughout the protected height.

Figure 2-10 Two Emitter/Receiver Units Mounted Vertically



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Side by Side Installation

NOTICE

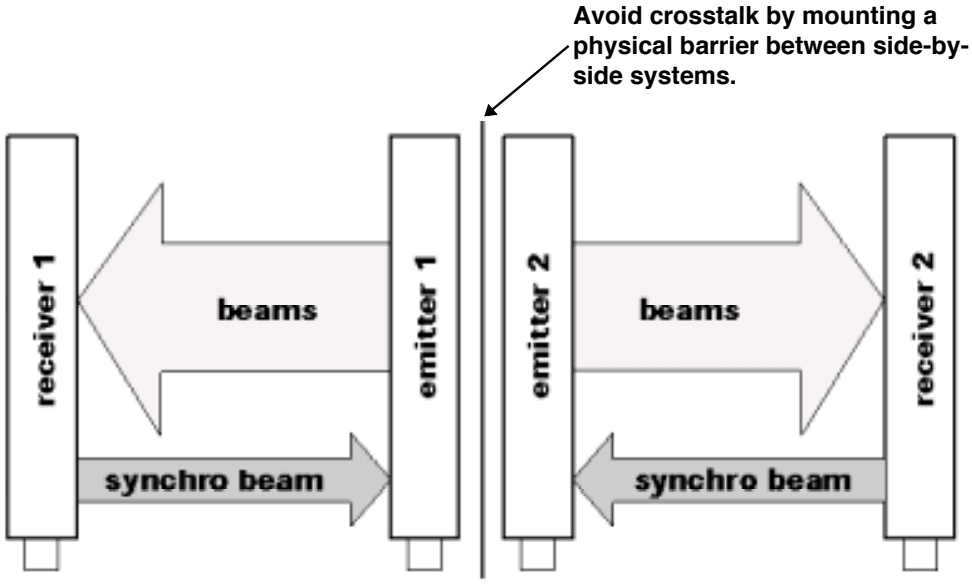
MUTUAL INTERFERENCE OR CROSS-TALK

A physical barrier or filter may be necessary in side-by-side system installations for proper operation.

When two or more light curtain systems are installed on adjacent machines, optical interference may occur if two units are within the field of view. A physical barrier may be required to eliminate the interfering light path (see figure 2-11).

Interference or crosstalk may also be prevented by installing an additional front plate filter or using a filter version of the FF-SB14 Series. The scanning range of these units is up to 6 meters (19.68 feet).

Figure 2-11 Physical Barrier

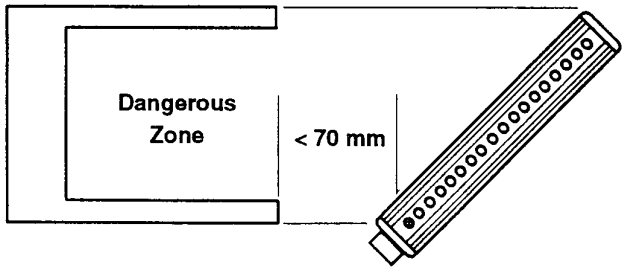


Diagonal and Right-Angle Mounting

⚠ WARNING
IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN
To prevent operating personnel from access to danger zone, install hard guard or right-angle mounting if distance between danger zone and closest light beam is greater than 70 millimeters (2.8 in.).
Failure to comply with these instructions could result in death or serious injury.

For point-of-operation guarding, the safety light curtain(s) and any hard guarding must be installed so that no person can stand between the light curtain and the danger zone without being detected. Installation may require additional hard guarding, horizontal or diagonal mounting of the light curtain (see figure 2-12), or additional light curtains mounted at right angles to each other (see figure 2-13).

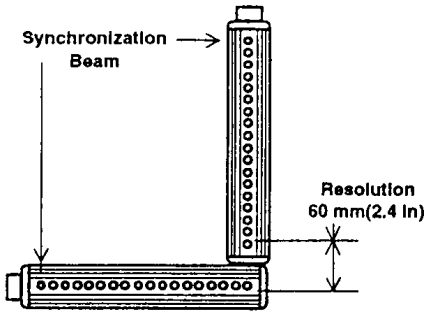
Figure 2-12 Diagonal Mounting



Elevation View

A right-angle mounting arrangement may be used if the altered resolution at the joint is acceptable to the local regulatory agency. If right-angle mounting is used, the units must be mounted so the synchronization beams are as far apart as possible (see figure 2-13). The emitters and receivers units should be mounted with opposite orientations to prevent mutual interference or cross-talk.

Figure 2-13 Right-Angle Mounting



Mounting Hardware

FF-SB Series light curtains are designed with an easy to use T-slot mounting system. Three styles of mounting brackets are available. Each style bracket includes the necessary mounting accessories (bolts, nuts, washers, and vibration dampeners) to mount one emitter or one receiver unit.

⚠ WARNING
ELECTRICAL SHOCK
Properly ground FF-SB Series light curtain housing by connecting earth ground through the connector. Vibration dampeners electrically isolate FF-SB light curtain housing from mounting surface.
Failure to comply with these instructions could result in death or serious injury.

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CAUTION

LIGHT CURTAIN DAMAGE

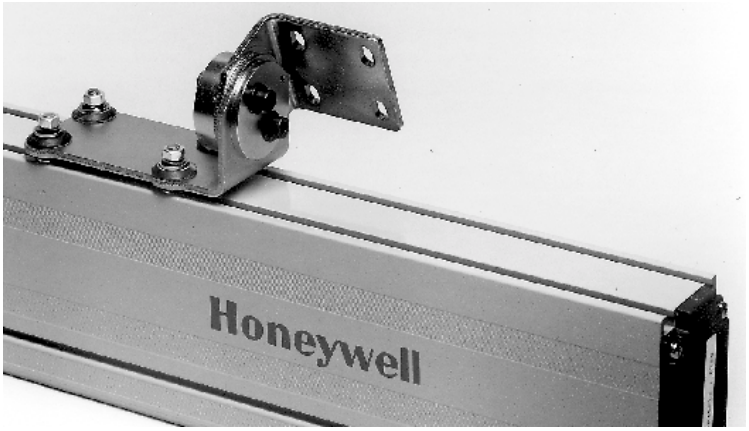
Mount FF-SB Series light curtains with vibration dampening to prevent damage to emitter and receiver units.
Failure to comply with these instructions may result in product damage.

To mount one complete light curtain system, use two mounting bracket sets, one for the emitter and another for the receiver. The emitter and receiver units may require different types of mounting brackets based on application requirements. Order mounting accessories (FF-SBZS8000) if the light curtain system is mounted directly to the machine, custom brackets are used, or replacement mounting accessories are needed.

T-slot Mounting System

The FF-SB Series T-slot mounting design allows bracket placement anywhere along the back of the light curtain housing (see figure 2-14). The two parallel T-slots are designed to fit the head of an M6-25 bolt.

Figure 2-14 T-slots with Rotatable Mounting Bracket



Mounting Accessory Set

The mounting accessory set (FF-SBZS8000) may be used with custom brackets. The accessory set contains the following hardware:

Mounting Accessory Set FF-SBZS8000

Mounting Hardware	Quantity
M6.U Washer	8
H.M6 Nut	8
H.M6-25 Bolt	8
Onduflex ø6 Washer	8
Rubber Vibration Damper (603 155.002)	8
Metal Hub (604 649.001)	8

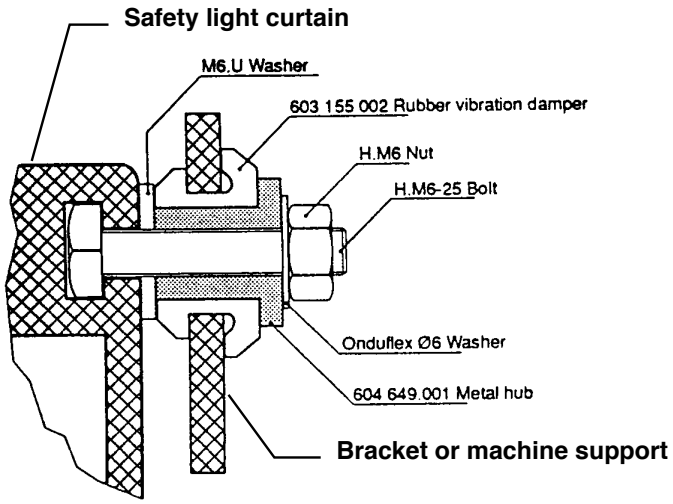
Figure 2-15 illustrates how the mounting accessories are assembled for direct mounting or mounting with brackets.

CAUTION

LIGHT CURTAIN/MOUNTING HARDWARE DAMAGE

Carefully install mounting hardware (especially washers, rubber vibration damper and metal hub) to ensure correct orientation and installation.
Failure to comply with these instructions may result in product damage.

Figure 2-15 Mounting Accessory Set Assembly



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Mounting Brackets

Three types of mounting brackets are available:
- Omega bracket (see figure 2-16)
- "L" bracket (see figure 2-17)
- Rotatable bracket (see figure 2-18)

Each mounting accessories set includes two brackets and mounting hardware. Two sets are required for one light curtain system (one for the emitter and one for the receiver). See figure 2-15 for assembly.

Figure 2-16 Omega Bracket Dimensions

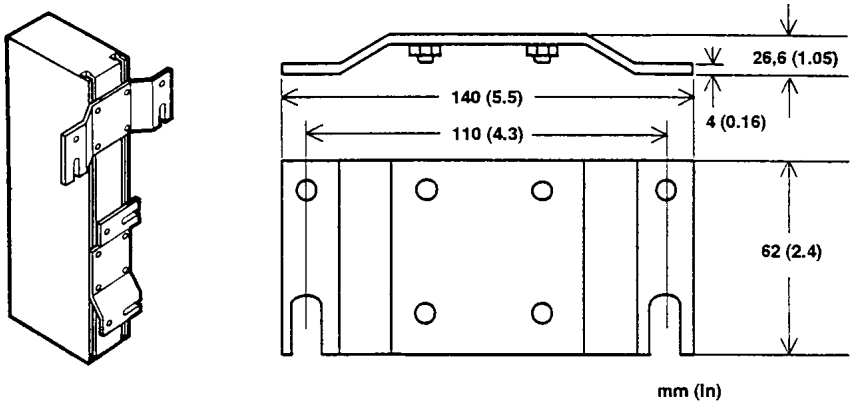


Figure 2-17 "L" Bracket Dimensions

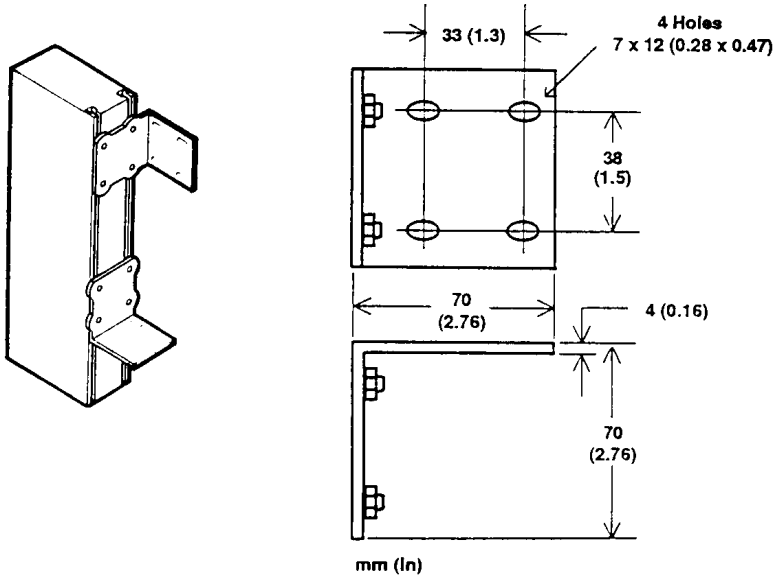
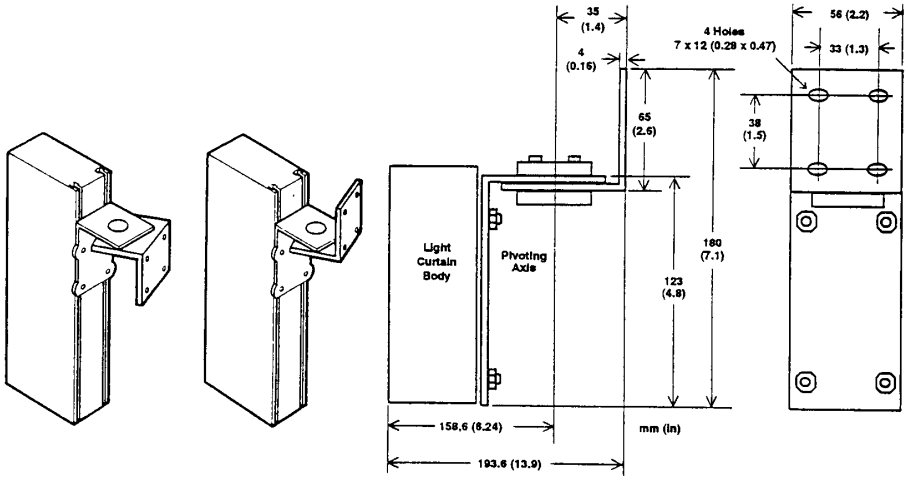


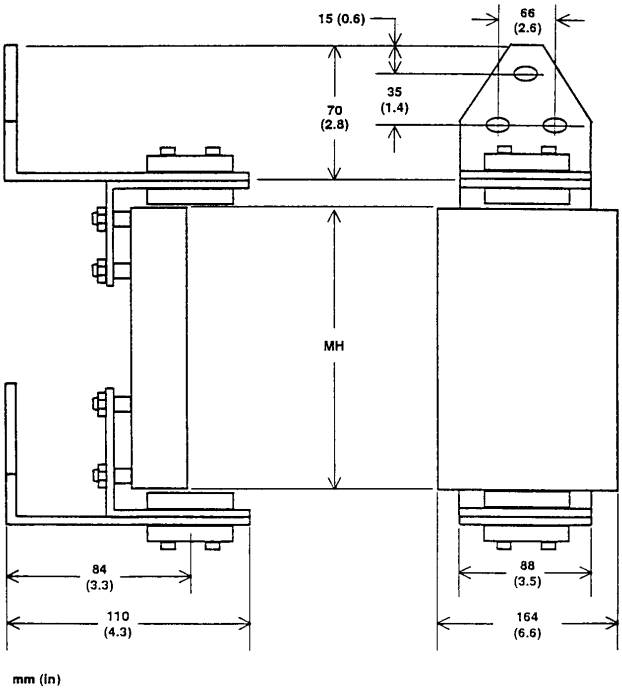
Figure 2-18 Rotatable Bracket Dimensions



Mounting the Mirrors

FF-SB Series mirrors include all mounting brackets and hardware necessary for installation. The mounting brackets allow rotation of the mirrors to the desired angle. See figure 2-19 for mounting dimensions. Rotatable brackets are recommended if the emitter and receiver devices are mounted more than 1/2 the maximum scanning distance of the product (and/or using mirrors). Figures 2-20 and 2-21 illustrate floor mounting posts that are available.

Figure 2-19 Mirror Mounting Dimensions



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Mirror Heights

Catalog Listing*	Protected Height	MH Mirror Heights
FF-SBSMIR02	200 (7.87)	298 (11.73)
FF-SBSMIR04	400 (15.75)	501 (19.72)
FF-SBSMIR06	600 (23.6)	704 (27.72)
FF-SBSMIR08	800 (31.5)	909 (35.79)
FF-SBSMIR10	1000 (39.37)	1112 (43.78)
FF-SBSMIR12	1200 (47.24)	1315 (51.77)
FF-SBSMIR14	1400 (55.12)	1520 (59.84)

*Rotatable brackets are included with mirrors.

Figure 2-20 Floor Mounting Post FF-MPZS9018 (mm)

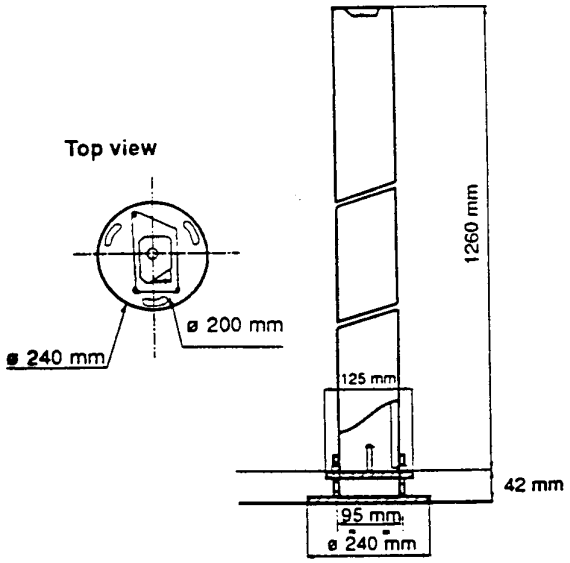
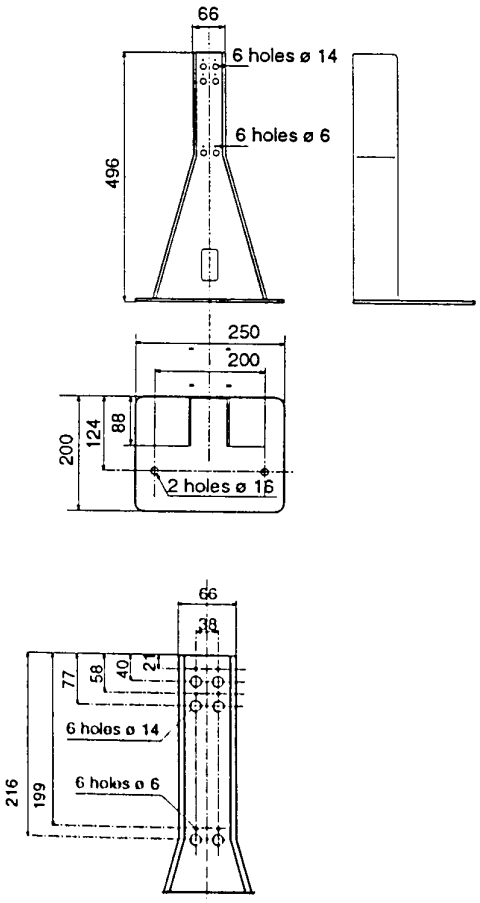


Figure 2-21 Floor Mounting Post FF-SBZS9010 (mm) - light curtain used for 1000 mm (39.37 in) height or less)



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Electrical Connections

Overview

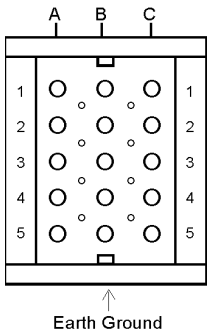
This chapter contains information about electrical installation and wiring.

> **⚠ WARNING**
> **IMPROPER INSTALLATION**
> Strictly adhere to all electrical connection instructions.
> **Failure to comply with these instructions could result in death or serious injury.**

Connector Wiring

All FF-SB Series light curtains have a metal quick-disconnect connector (supplied). Emitter units use connector FF-SBZ1721137 and the receiver units use connector FF-SBZ1721202.
Figure 3-1 illustrates a rear view of the connector (pins inserted this side). Both connectors use the same type of crimped pins.

Figure 3-1 Rear View of Quick-Disconnect Connector



- connections are made through quick disconnect metal DIN 43652 plugs delivered with the light curtain.
- cross sectional area of stranded wires to be crimped (metal DIN 43652 plugs only) : 0,5 mm2 (AWG20) as a minimum, 1,5 mm2 (AWG16) as a maximum.
- packing glands and allowed cable diameters to guarantee the IP 65 / NEMA 4, 13 sealing (metal DIN 43652 plugs only) :

Emitter plug: PG9 allowed cable diameters: 5 mm to 8,7 mm / 0.22 in to 0.34 in
Receiver plug: PG21 allowed cable diameters: 11 mm to 19 mm / 0.44 in to 0.74 in
PG13: allowed cable diameters: 8,5 mm to 13,5 mm / 0.33 in to 0.53 in

Ensure the following tools are available when wiring the quick-disconnect connector:
- A set of wire strippers.
- A medium sized flat-head screwdriver.
- An FF-SBZCRIMP (Honeywell part number FF-SBZCRIMP) crimping tool or equivalent.

Install pin into connector as follows:

1. Strip about 8 mm (0.3 inch) of insulation from the wire end.
2. Using a crimping tool, crimp the pin onto the wire.
3. Push the pin into the correct slot in the connector. Tabs on the sides of the pin will expand into slots and hold the pin in place when properly seated.

Remove a pin from the connector as follows:

1. Remove the gray plastic receptacle from the plug.
2. Remove the ground screw.
3. Using a screwdriver, pry up the edges of the plastic retainer piece on each side of the receptacle.
4. Slide the plastic retainer up and remove it.
5. Slide the metal part on each side down, and remove it.
6. Using a screw driver in the side slots, push the top part off.
7. Using the removal tool equivalent to FF-SBZREMOV (Honeywell part number FF-SBZREMOV), slide over pin and push until the spring releases the pin; remove pin.

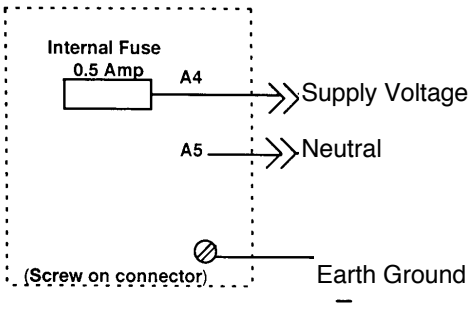
Power Wiring

FF-SB Series light curtains operate on either 120 or 240 volts ac. The emitter and receiver units automatically switch to the ac voltage applied with the exception of FF-SB12E/R02E-S2 which operates on 120 Vac only.

A low voltage version (24-48 Vdc) is available for the FF-SB14 and FF-SB15 Series.

All of the FF-SB Series light curtains have the same connections for power. Figure 3-2 shows the power connections. Figure 3-3 illustrates the receiver connections.

Figure 3-2 Emitter and Receiver Power Connections



Note : For Vdc versions, the supply connection is the following :

Terminal A4 : **+**

Terminal A5 : **-**

However, the FF-SB14 and FF-SB15 low voltage light curtains are polarity independent.

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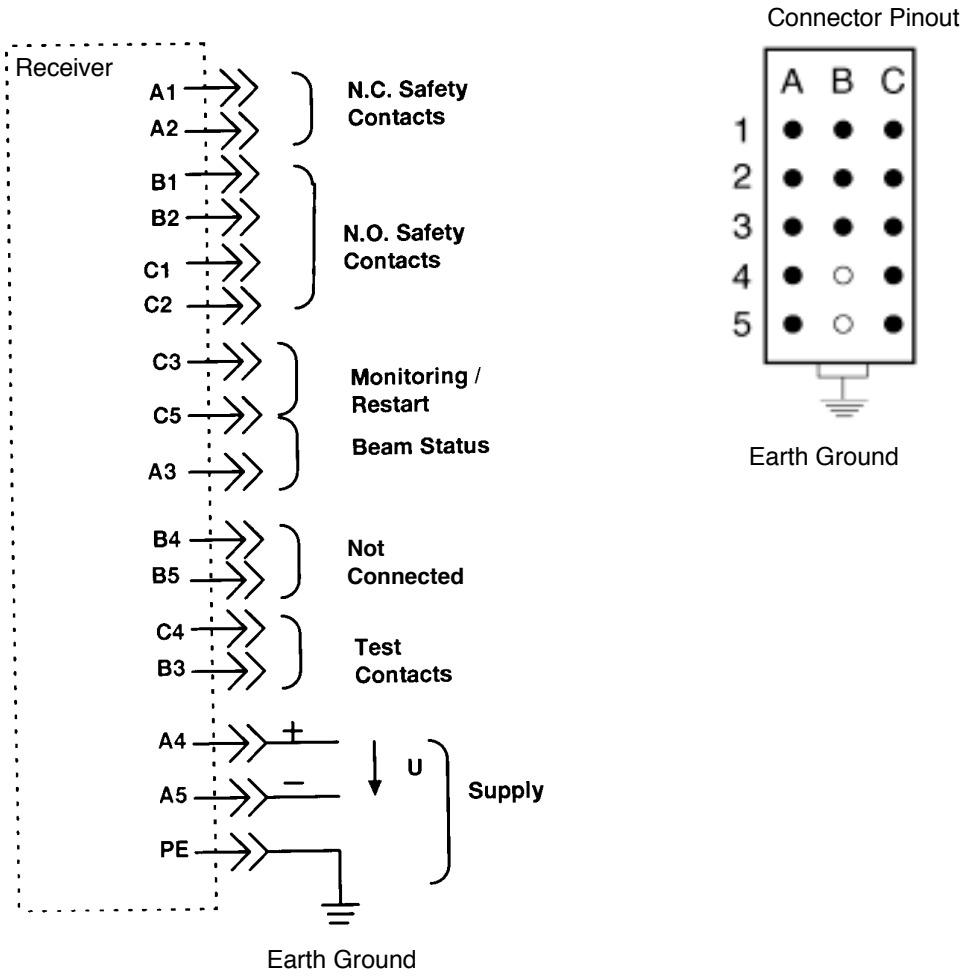
The wire gauge of the ground connection should be equal to the power supply wire gauge. The length of the ground connection wire should be as short as possible. To minimize noise interference, the ground terminal of the light curtain **must** be connected to the main ground of the machine.

Figure 3-3 Connections for Receivers



A1, A2: 1 Normally Closed (NC) safety contact
B1, B2 and **C1, C2:** 2 Normally Open (NO) safety contacts
A3, C5: Beam status, A3 is internally connected to the 0 V when the beams are unobstructed (NPN output), I = 5 mA to 20 mA, 30 Vdc max.
C3, C5: Restarts the safety light curtain and monitors the external relays.

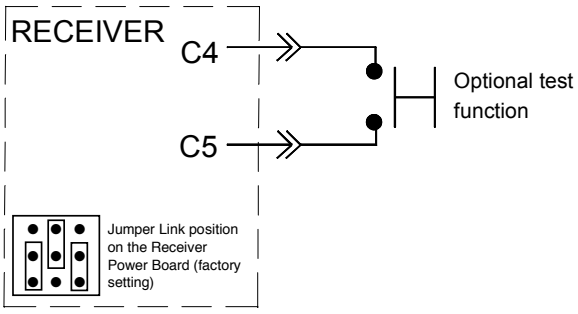
Test Contacts

Test contacts may be used for additional external relay checking. When the link between the two contacts is open, the light curtain is in the red condition and R2 and R4 (LEDs on receiver) are illuminated. To return to the green condition, the link between the contacts must be reestablished.

C4, C5: For FF-SB Original Series or FF-SB CE in factory setting (see figure 3-4).
C4, B3: For FF-SB CE Series in cycle start mode (see figure 3-5).

Factory Settings (receivers only)

Figure 3-4 Replacing FF-SB Original Series with CE Version (factory setting)

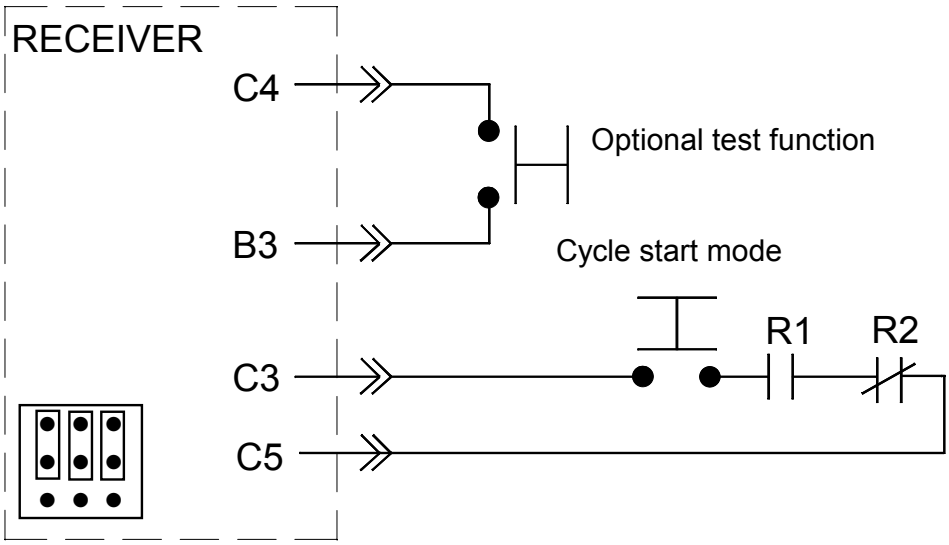


NOTICE: Points C4 and C5 are jumpered if the optional test function is not used (no voltage is applied).

Cycle Start Mode

During the cycle start mode, the R4 LED on the receiver flickers and the cycle start mode push-button on the external relay monitoring loop (C3-C5) requires actuation. Once actuated, the light curtain changes to a green condition (R3 LED is illuminated, R2 LED is not illuminated) and allows the machinery to operate.

Figure 3-5 FF-SB Series CE Version (cycle start mode) with external relay monitoring by the FF-SB



Jumper links on the receiver power board provide access to this mode

NOTICE: Points C4 and B3 are jumpered if the optional test function is not used (no voltage is applied).

Wiring Diagrams

⚠ WARNING
IMPROPER SYSTEM PERFORMANCE
Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.
Failure to comply with these instructions could result in death or serious injury.

The following wiring diagrams illustrate the electrical connections for the FF-SB Series light curtains. The customer must supply the three safety relays, R1, R2 and R3, the cycle start push-button and the test circuit.

Mechanically linked contact relays are sometimes called captive contact, anti-weld, or guided contact relays.

⚠ WARNING

IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

Use figure 3-6 wiring diagram to ensure external relay monitoring by the interface.

Failure to comply with these instructions could result in death or serious injury.

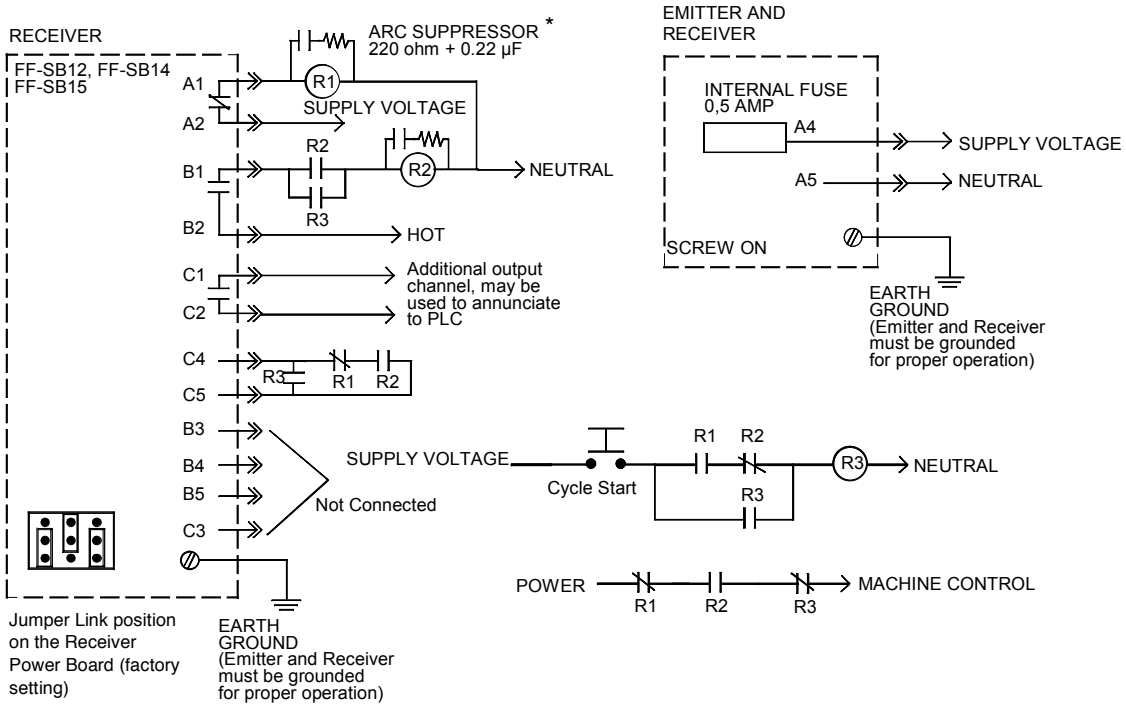
⚠ WARNING

IMPROPER SYSTEM PERFORMANCE

Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

Figure 3-6 Wiring Diagram to replace Original Version FF-SB Series configuration with CE Version of FF-SB Series configuration (except FF-SB12R02)



*Two arc suppressors are provided with the light curtain.

NOTICE

The cycle-start push-button is the normal push-button used to start the machine cycle and not an additional button for the operator.

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⚠ WARNING

IMPROPER SYSTEM PERFORMANCE

Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

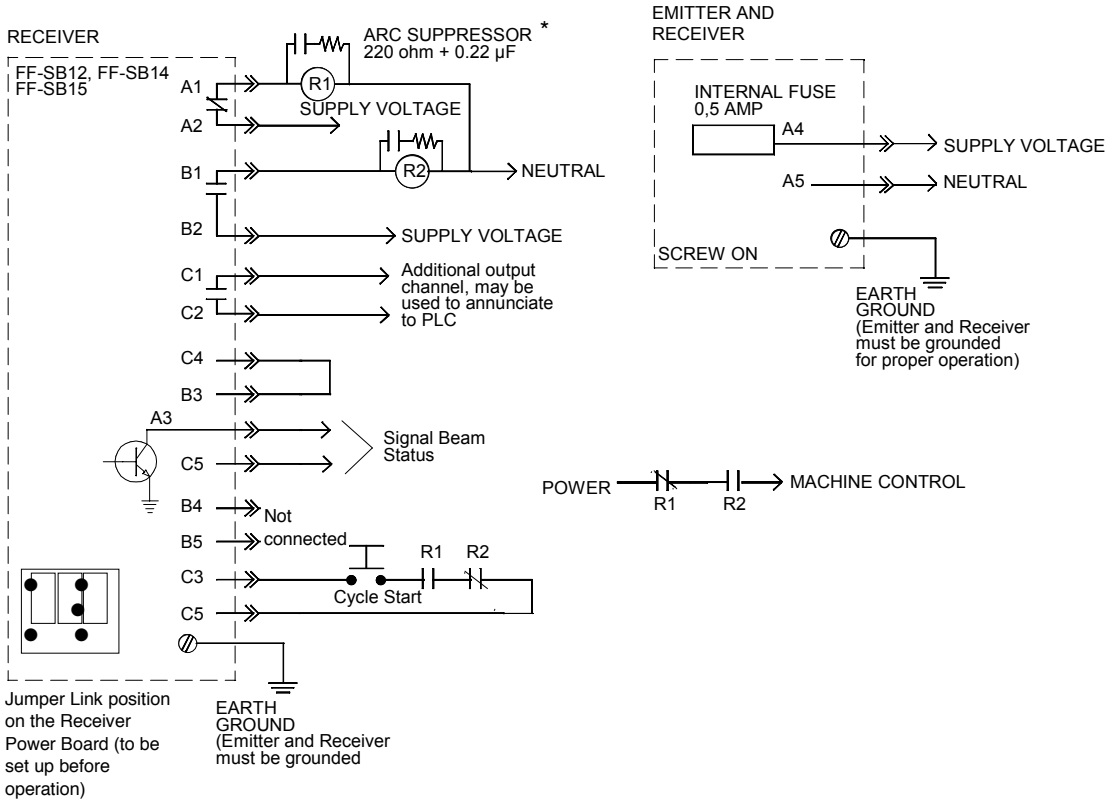
⚠ WARNING

IMPROPER INSTALLATION OF FF-SB SERIES LIGHT CURTAIN

Use Figure 3-7 wiring diagram to ensure external relay monitoring of the FF-SB Series Light Curtain.

Failure to comply with these instructions could result in death or serious injury.

Figure 3-7 Wiring Diagram for FF-SB Series configuration (except FF-SB12R02)



*Two arc suppressors are provided with the light curtain.

⚠ WARNING

IMPROPER SYSTEM PERFORMANCE

Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

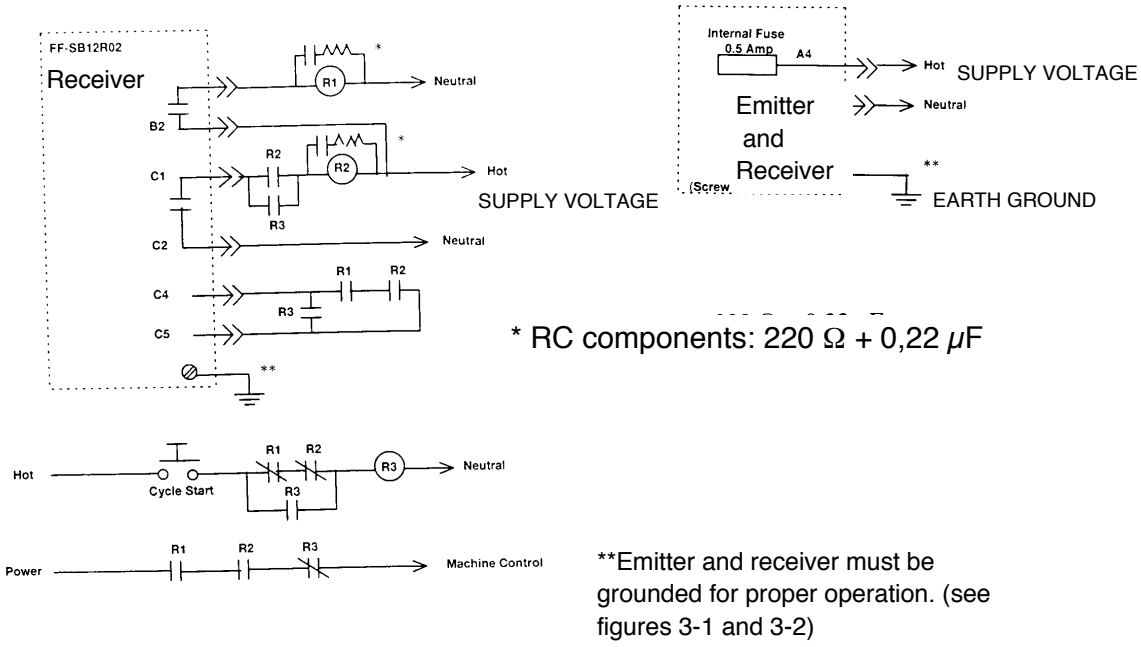
⚠ WARNING

IMPROPER INSTALLATION OF FF-SB12E/R02 SERIES LIGHT CURTAIN

For FF-SB12R02 Series light curtains, use figure 3-8 wiring diagram ONLY.

Failure to comply with these instructions could result in death or serious injury.

Figure 3-8 Wiring Diagram of FF-SB12R02



NOTICE

The cycle-start push-button is the normal push-button used to start the machine cycle and not an additional button for the operator.

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⚠ WARNING

IMPROPER PERIMETER PROTECTION

- Design control circuit to allow a manual restart before further machine operation can occur.
- Locate manual restart to allow operator a clear view of danger zone.
- Operator should NOT be able to reach manual restart from within danger zone.
- Design control circuit to prevent Programmable Logic Controller from overriding manual restart.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

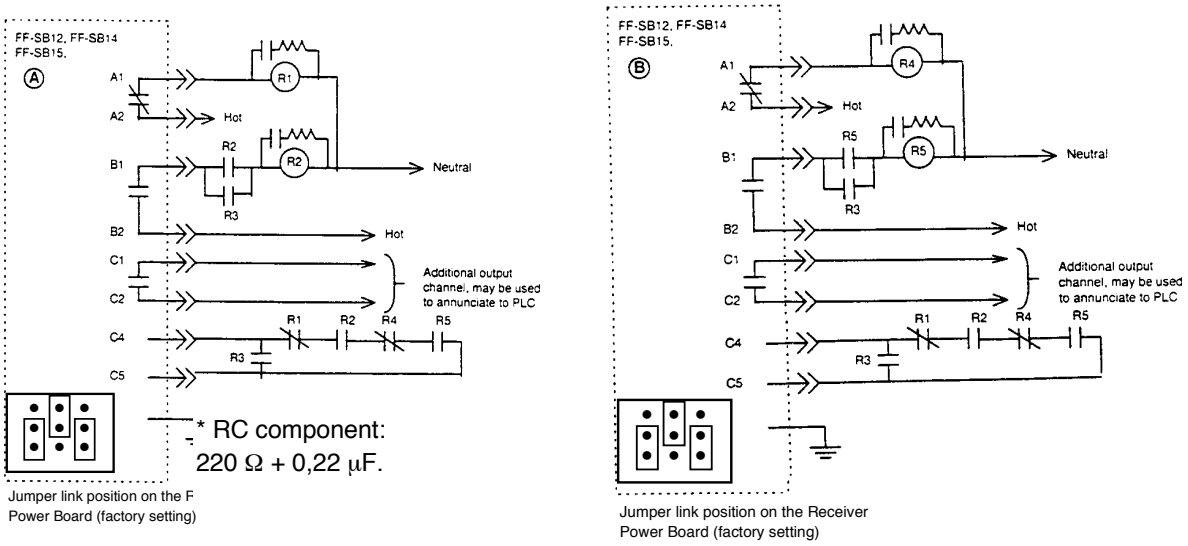
IMPROPER SYSTEM PERFORMANCE

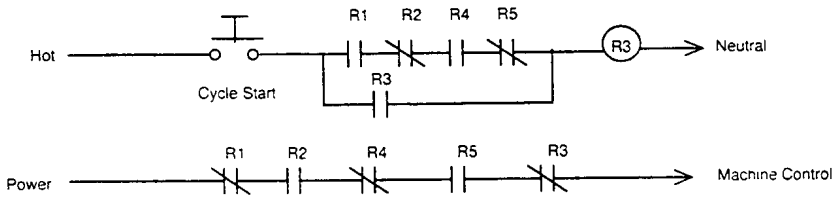
Ensure independent stop circuit safety relays have mechanically linked contacts that prevent contact overlapping in the event of a welded contact.

Failure to comply with these instructions could result in death or serious injury.

Figure 3-9 Connection of Two Safety Light Curtains (new installation)

Five relays, R1, R2, R3, R4 and R5 are used as follows:





NOTICE

If the sensing field of one safety light curtain is interrupted, the other goes immediately into the RED condition.

Maintenance and Troubleshooting

Overview

This chapter contains operational test procedures, troubleshooting, cleaning, maintenance, and repair instructions.

⚠ WARNING

IMPROPER MAINTENANCE

Strictly adhere to all maintenance and troubleshooting instructions.

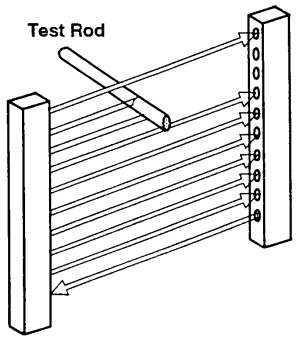
Failure to comply with these instructions could result in death or serious injury.

Operational Test

To ensure operational readiness, perform the operational test at least once a day and every time the light curtain is repaired or powered up. The operational test consists of passing a test rod (included with unit) through the sensing field to ensure the light curtain will detect it (see figure 4-1). The included test rod will have a diameter equal to the resolution of the light curtain. The resolutions of the FF-SB Series light curtains are as follows:

Light Curtain	Resolution
FB-SB12	22 mm (0.87 in)
FB-SB14 and FF-SB15	35 mm (1.38 in)

Figure 4-1 Operational Test with the Test Rod



Troubleshooting Procedures

When the FF-SB Series safety light curtains are working properly and the sensing field is not interrupted, the emitter LEDs E1 and E2 (yellow) are both illuminated, the receiver LED R3 (green) is illuminated, and all other LEDs are NOT illuminated. If this condition is not met, refer to the following troubleshooting chart, flow diagram (see figure 4-3) and corresponding repair procedures.

Troubleshooting Chart (see figure 4-2 for indicator information)

Symptom	Probable Cause	Corrective Action
E1: ON / E2: ON R1: ON / R2: ON R3: ON / R4: flickers.	Relay contact stuck in the closed condition.	Immediately, exchange the relay board (see chapter 8.4).
All light emitting diode (LED) indicators are NOT illuminated.	No power.	Ensure fuse is not blown (see Fuse Replacement procedure). Ensure supply voltage is correct; as specified (see Specifications). Ensure electrical power connections are secure and correct (see Electrical Connections chapter).
LED E1, E2, R1, R2 and R4 are illuminated.	Test input is open.	Ensure the external circuit wiring connection between pins C4 and B3 on the receiver connector is secure (see Electrical Connections chapter).
LED E1 and R2 are illuminated, R4 and E2 are NOT illuminated.	Sensing field may be obstructed. Emitter and/or receiver units need to be cleaned. Emitter and/or receiver units need to be aligned. Emitter and/or receiver unit internal error.	Remove obstacles interrupting sensing field. Clean emitter lens, receiver lens and mirrors (see Emitter and Receiver Cleaning). Align emitters, receiver and mirrors. Replace emitter and/or receiver unit.
LED E1, E2 and R2 are illuminated, R4 is flickering.	Light curtain is in cycle start mode.	Ensure monitoring loop connections between pins C3 and C5 are secure. (see Electrical Connections chapter). Press cycle-start push-button.
LED E1, E2 and R3 are illuminated, R1 is flickering.	Emitter and/or receiver units is contaminated. Emitter and/or receiver units is misaligned.	Clean emitter lens, receiver lens and mirrors (see Emitter and Receiver Unit Cleaning section). Align emitters, receiver and mirrors.
Random alarms without apparent cause (i.e., erratic outputs, flickering LEDs).	Line voltage transients greater than IEC 801-4 Norm standard. Unacceptable ambient	Ensure the correct supply voltage is provided (see Electrical Connections chapter). Ensure RC elements on the inductive loads are present (see Electrical Connections chapter).
rnal circuit connection to pins C4 and C5 on the receiver		connector are secure (see Electrical Connections chapter). Ensure ground connection on emitter and receiver are secure (see Electrical Connections chapter). Use a special optical filter (see Order Guide).
LEDs E1, E2 and R3 are NOT illuminated, or other LEDs are illuminated.	External relays may not be working.	Refer to system wiring diagram and ensure the external relays connected to or linked with the safety light curtain are operating properly (see Electrical Connections chapter).

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⚠ DANGER

IMPROPER RELAY OUTPUT BOARD MAINTENANCE

After a period of extended operation, it is possible that a switching relay can malfunction such that it remains stuck of fused in the **closed** position following a breach of the light curtain's protection field and the shutdown of the machine.

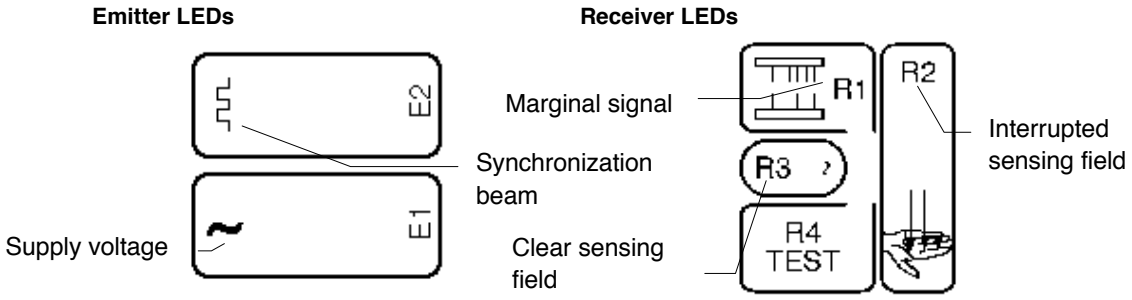
In the case of such a relay malfunction, the machine will not restart following the clearing of the protection field (and pressing of the restart button when in manual restart mode) and the following warning diagnostic LED condition will be seen on the light curtain receiver unit:

R2 (red) ON R1 (red) OFF R4 (yellow) FLASHING

It is essential to **immediately replace** the relay board upon the first occurrence of a stuck or fused relay and the activation of the receiver operation status LED R2.

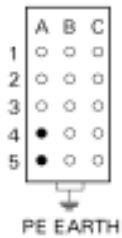
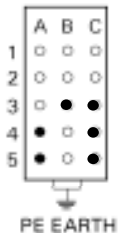
Failure to comply with these instructions will result in death or serious injury.

Figure 4-2 Emitter and Receiver LEDs



LED	Location	Color	Function
E1	Emitter	Yellow	Supply voltage on
E2	Emitter	Yellow	Synchronization beam detection
R1	Receiver	Red	Marginal signal detection
R2	Receiver	Red	Interrupted sensing field
R3	Receiver	Green	Clear sensing field
R4	Receiver	Yellow	Illuminated = test, Flickering = restart required

Test Plug Construction (see troubleshooting flow diagram, sheet 1 of 2)

Emitter Female Plug Connector FF-SBZ1721137	Receiver Female Plug Connector FF-SBZ1721202
Using Female Plug Connector FF-SBZ1721137, connect pins A4 and A5 to supply voltage and the ground pin to earth ground. Assemble the following 	Using a Female Plug Connector FF-SBZ1721202, connect pins A4 and A5 to supply voltage and the pins: C4, C5, B3 and C3. 

Emitter Board Visual Test (see troubleshooting flow diagram, sheet 2 of 2)

1. Clean the front lens window of the emitter.
2. Place your eye against the emitter front lens window and observe the presence of a low energy red light (a spot) in the middle of each beam (except synchronization).
3. If you can observe the presence of this red light, the emitter is working correctly. If you cannot, replace the faulty emitter board.

Figure 4-3 Troubleshooting Flow Diagram (Sheet 1 of 2)

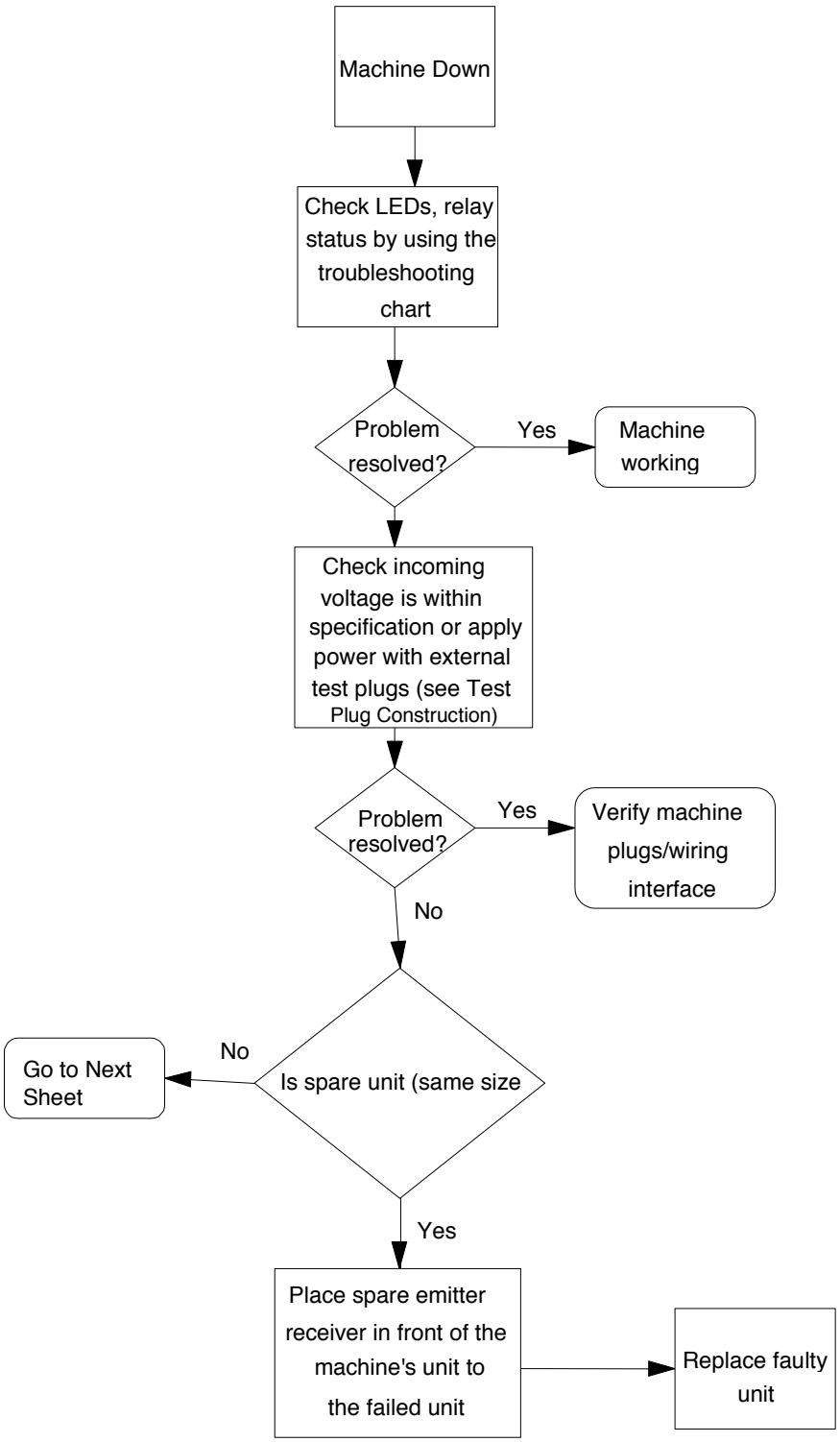
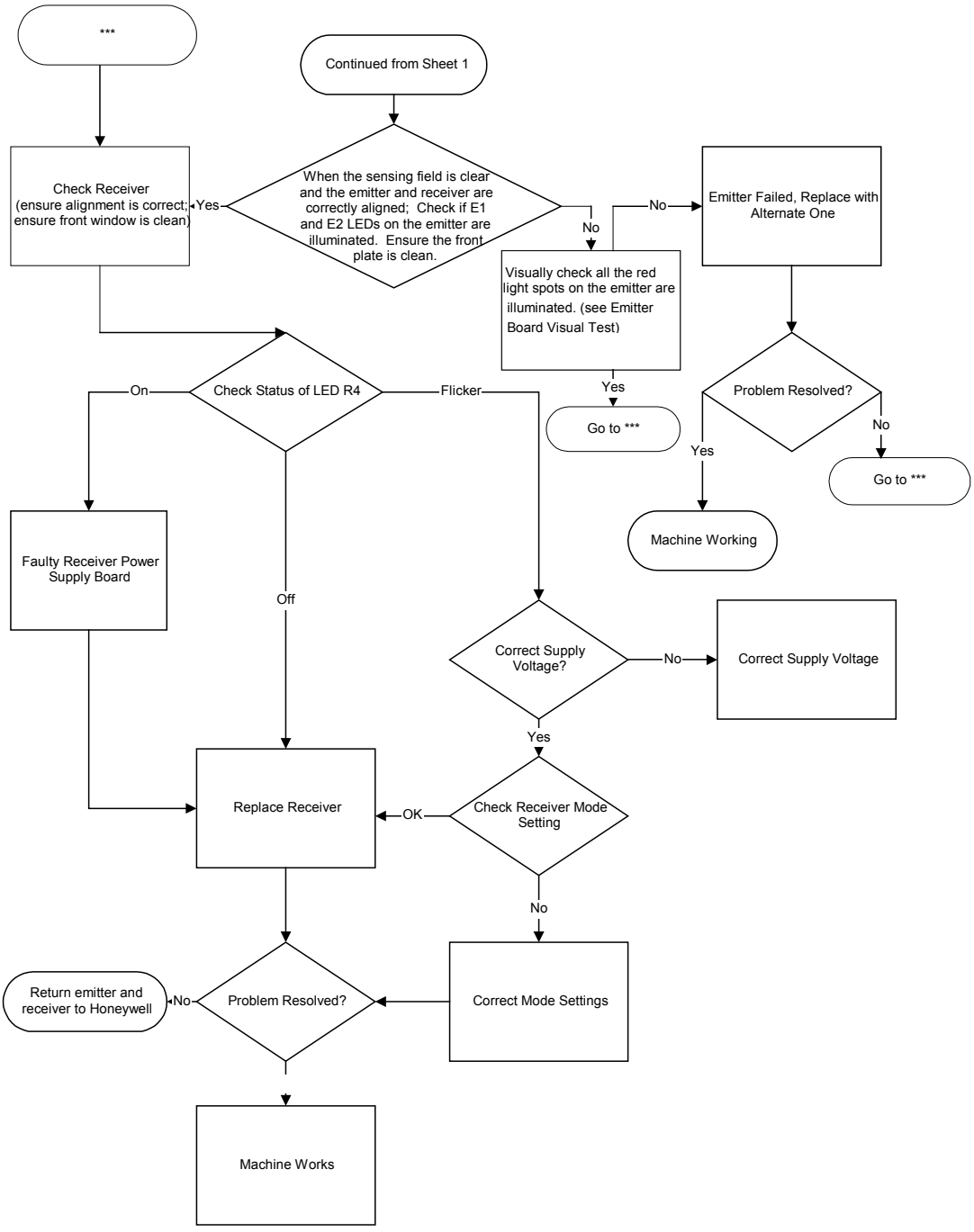


Figure 4-3 Troubleshooting Flow Diagram (Sheet 2 of 2)



Cleaning

The FB-SB Series light curtains and mirrors are designed to operate in harsh industrial environments. Exposure to dirt, dust, grease, and oil are unavoidable in these harsh environments. Periodically clean the emitter/receiver units and mirrors. This section provides specific, step by step, instructions on the proper cleaning techniques for the FB-SB Series emitters, receivers, and mirrors.

Using a Dry Cloth

Clean dust or loose, dry dirt from the emitter and receiver units using a soft, clean, non-abrasive cloth.

⚠ WARNING
POWER APPLIED TO MACHINE CONTROL SYSTEM
Turn off and disconnect power from FF-SB Series light curtain and machine.
Failure to comply with these instructions could result in death or serious injury.

1. Turn off and disconnect power to both the light curtain and the machine.

CAUTION
FF-SB SERIES LIGHT CURTAIN FRONT PLATE AND FINISH DAMAGE
Gently wipe soiled areas with soft, clean, non-abrasive cloth. To prevent scratching clear plastic front plate or finish, do NOT rub hard.
Failure to comply with these instructions may result in product damage.

2. Gently wipe the soiled areas with a soft, clean, non-abrasive cloth. Do not rub hard to prevent scratching the clear plastic front plate or finish. If the dirt will not wipe off with a dry cloth, clean units with a soap and water solution. See Cleaning with Soap and Water below.

3. Connect power to the machine and light curtain.

4. Perform the operational test to ensure proper functional readiness.

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Using Soap and Water

⚠ WARNING
POWER APPLIED TO MACHINE CONTROL SYSTEM
Turn off and disconnect power from FF-SB Series light curtain and machine.
Failure to comply with these instructions could result in death or serious injury.

CAUTION
FF-SB SERIES LIGHT CURTAIN FRONT PLATE AND FINISH DAMAGE
Do NOT use solvents to clean emitter or receiver to prevent damage to clear plastic front plate and paint finish.
Failure to comply with these instructions may result in product damage.

1. Turn off and disconnect power to the light curtain and machine.
2. Dampen a soft, clean, non-abrasive cloth in the solution of mild soap and water. Squeeze excess solution from the cloth.
3. Wipe the soiled areas gently with the damp cloth. Do not rub hard to prevent scratching the clear plastic front plate or paint finish.
4. Rinse the cloth in clean water and gently wipe off any excess soap.
5. Dry the emitter and receiver with a soft, dry, non-abrasive cloth. Ensure there is no moisture left on the emitter and receiver units before power is applied.
6. Connect power to the machine and light curtain.
7. Perform the operational test to ensure proper functional readiness.

Cleaning the Mirrors

CAUTION
FF-SBMIR SERIES MIRROR DAMAGE
Use soft, clean, non-abrasive cloth to clean dust or dirt from mirror to prevent scratching surface.
Failure to comply with these instructions may result in product damage.

1. Dampen a soft, clean, non-abrasive cloth with 90 % alcohol or white spirit.
2. Wipe the face of the mirror gently with the damp cloth. Do not rub hard to prevent scratching the finish.
3. Dry the mirror with a soft, dry, non-abrasive cloth. Ensure there is no moisture or lint left on the mirrors.
4. Perform the operational test to ensure proper functional readiness.

Repair and Maintenance

This section provides step-by-step instructions related to repair and maintenance..
The tools required include a Philips head screw driver and a #20 Torx driver.

⚠ WARNING
WARRANTY CONDITIONS
Repair and maintenance are limited only to : power supply module replacement, optical controller module replacement, and fuse replacement.
Please send back the board to Honeywell for repair.
Failure to comply with these instructions could result in death or serious injury.

Interchangeability

Emitter and receiver units are not matched. An emitter unit from one FF-SB system may be used with the receiver unit from another if the catalog listings of the units are the same. If a replacement for one part of a FF-SB system is required, maintenance time is greatly reduced.

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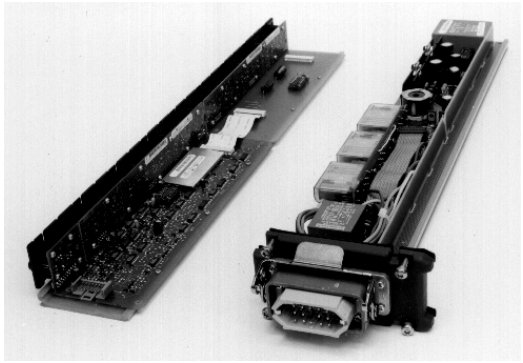
Emitter and Receiver Module Assemblies

Two module assemblies are located inside each emitter and receiver unit; the power supply module and the optical controller module (see figure 4-4)

Figure 4-4 Emitter and Receiver Module Assemblies



The power supply module in the receiver unit has three mechanically linked relays. The power supply module in the emitter unit has no relays. A fuse is located on the power supply module of the emitter and receiver.

The optical controller module has a master module that controls the LEDs in the emitter unit and the photoreceivers in the receiver unit. Some units may have one or more optical extension modules connected to the master module (and any other extension modules) via a flat ribbon cable.

Power Supply Module Removal

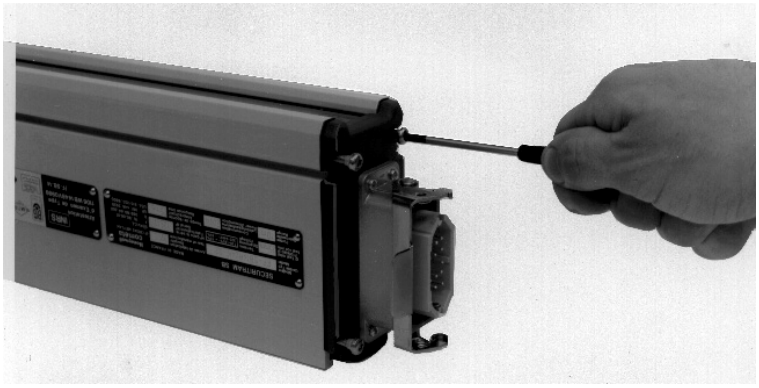
⚠ WARNING
POWER APPLIED TO MACHINE CONTROL SYSTEM
Turn off and disconnect power from FF-SB Series light curtain and machine.
Failure to comply with these instructions could result in death or serious injury.

1. Turn off and disconnect power to the light curtain and machine.

2. Remove the light curtain from the machine and place it on a clean, level work surface.

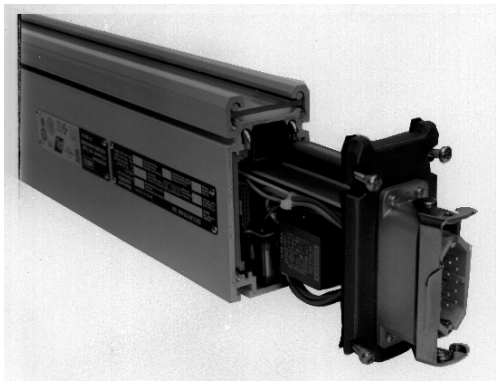
3. Using a #20 Torx driver, loosen the four captive screws in the end-plate with the terminal block connector (see figure 4-5). The screws do not need to be removed from the end-plate. Pull the end-plate away from the housing.

Figure 4-5 End-plate



4. Remove the terminal block connector and circuit board by sliding the module out (see figure 4-6) of the housing.

Figure 4-6 Terminal Block Connector



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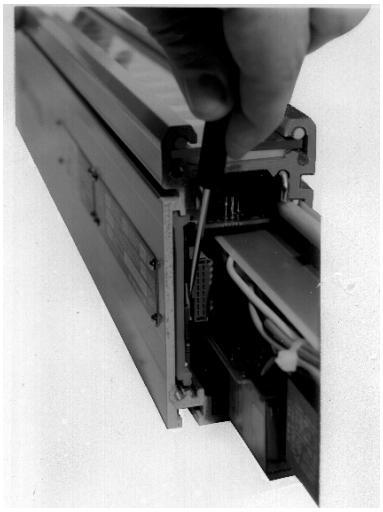
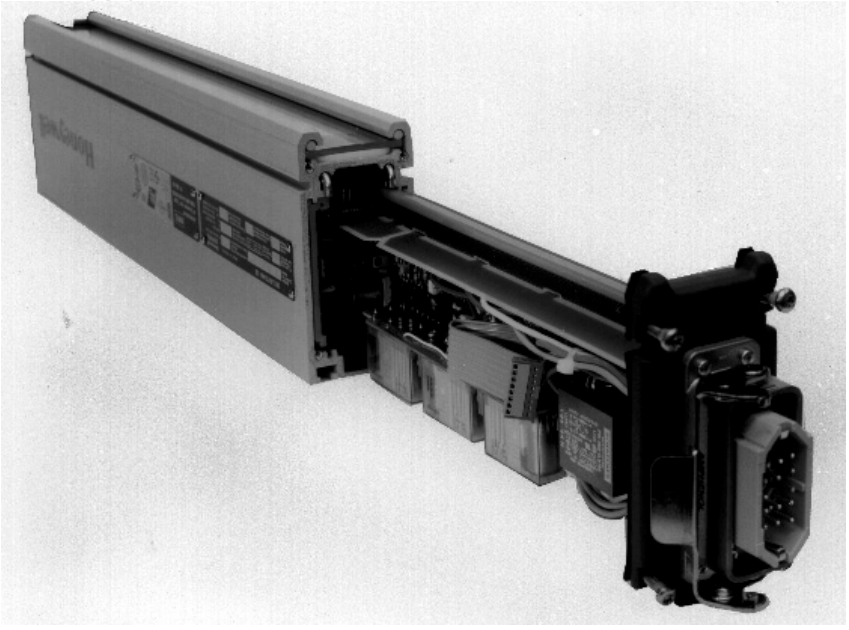
5. Disconnect the flat cable connector by pushing the tab that holds the connector to the left (see figure 4-7). Pull the connector straight out.

Figure 4-7 Flat Cable Connector



6. Remove the power supply module from the housing (see figure 4-8).

Figure 4-8 Power Supply Module

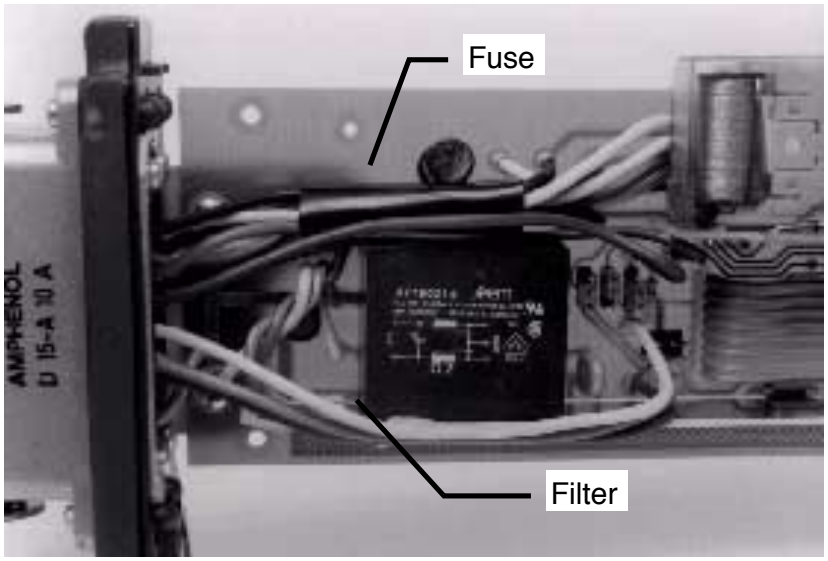


Fuse Replacement

The fuse is located near the relays above the electrical noise filter on the receiver unit (see figure 4-9). The fuse is in the same location on the emitter power board.

1. Remove the power supply module as directed in the previous section.

Figure 4-9 Fuse



2. Replace the fuse with a 0,5 amp, (120/240 Vac versions) or a 1 amp slow blow fuse (low voltage version).

3. Replace the power supply module.

4. Perform the operational test to ensure proper functional readiness.

Output Relay Replacement (on receiver)

1. Remove the receiver power supply module as directed in the Power Supply Module Removal section.

2. Remove the screws holding the output relay board to the power supply module. Two holes in the orange rail ease access to the screws. (see figure 4-10).

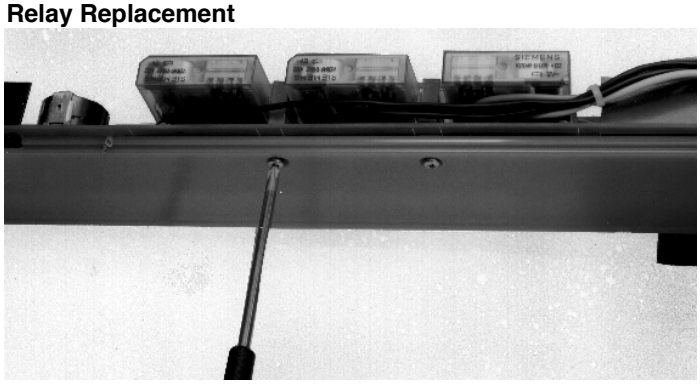
3. Carefully disconnect and remove the output relay board.

CAUTION

CONNECTOR PIN DAMAGE
Replace 3-output relay board with care to avoid damaging pins.
Failure to comply with these instructions may result in product damage.

4. Positioning the connectors like the first output relay board, install a new output relay board (same part number).

Figure 4-10 Output Relay Replacement



5. Perform the operational test to ensure proper functional readiness.

Changing Internal Jumper Link Positions (receiver only)

1. Remove the receiver power supply module from the light curtain housing.
2. Observe and note the position of the jumper links (see Electrical Connections chapter).
3. To reconfigure the factory settings of a new FF-SB Series light curtain to the cycle start mode, carefully remove the jumper links and plug them in the positions illustrated in figure 4-13.
4. Perform an operational test to ensure proper functional readiness.

Figure 4-11 Factory Setting Jumper Link Positions on Receiver Power Supply Board

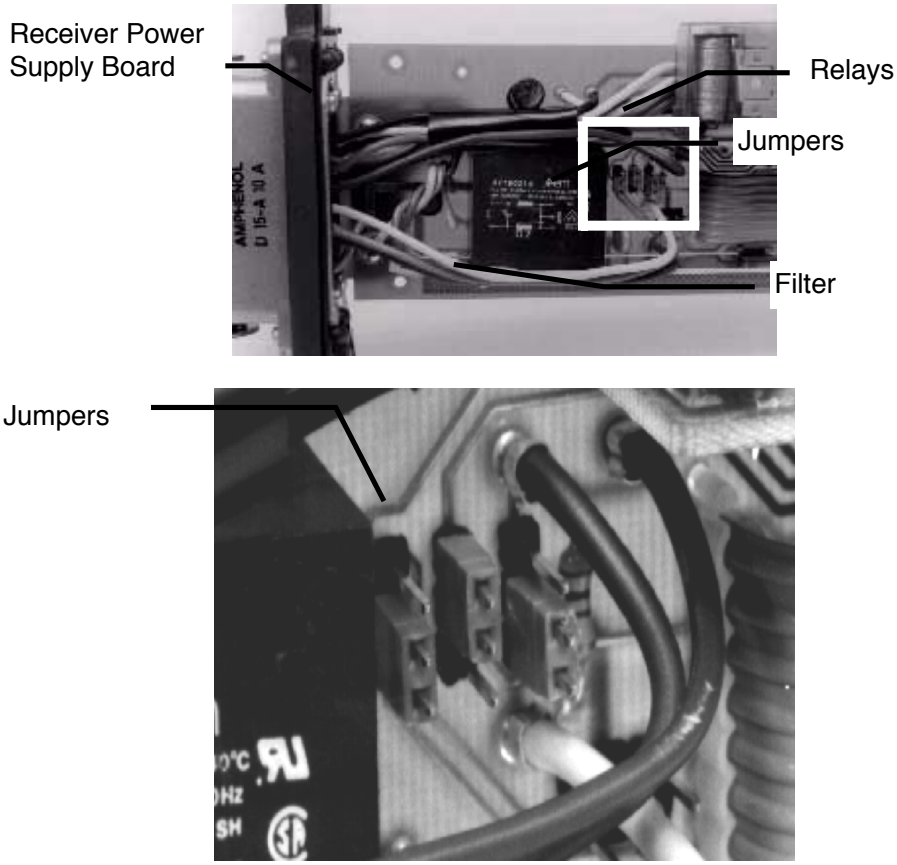


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Figure 4-12 Factory Setting Jumper Positions

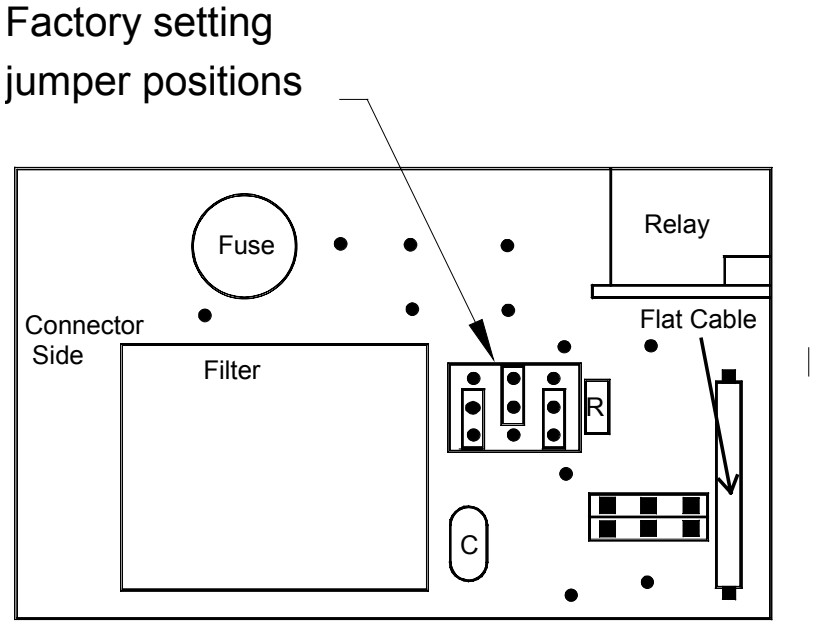
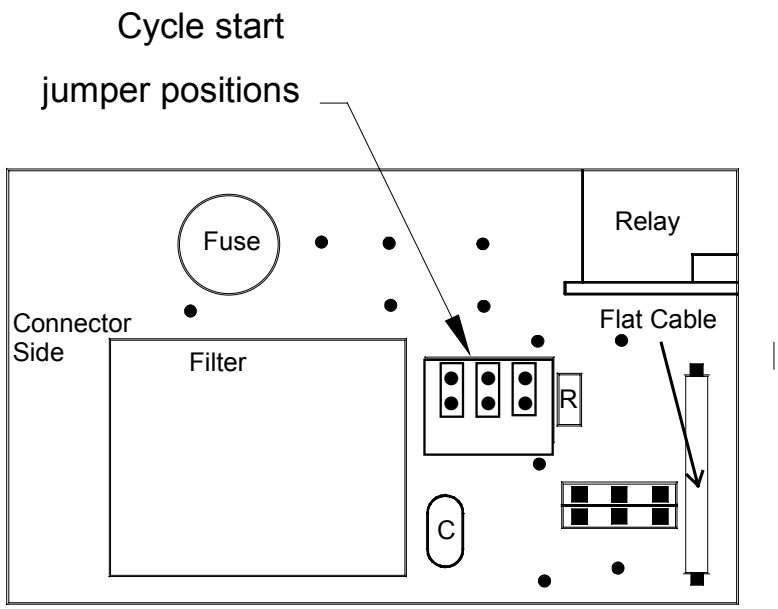


Figure 4-13 Cycle Start Mode Jumper Positions



Front Window Plate Replacement

NOTICE

1200 and 1400 mm protected height FF-SB Series Light Curtain emitters and receivers have a black part located in the middle of the transparent front plate that must be removed during front plate removal.

1. Ensure you have the following tools and spare parts: 1 #20 Torx driver, 2 to 4 joiner clamps (2 for
2. FF-SB14 400 mm, 4 for FB-SB14 1400 mm), 2 wooden battens (30 mm x 30 mm for example), spare front plates with gaskets.
3. Remove the power supply and optical controller modules as described in the previous sections.
4. Remove the end cover and pull off the two plastic caps on each end of this piece.
5. Depress both sides of the plate and remove the black piece by pushing it to one side.
6. Depress the transparent front window plate with the clamp, inserting wooden battens between clamps and the safety light curtain.
7. Remove the two pressing rods by pushing them (for 1200 and 1400 mm, pull the rods with a screw).
8. Remove front window plate and gasket.
9. Install the new gasket. Glue point of the gasket in the middle of the height of the light curtains (ease tension on gasket).
10. Hold gasket and allow the new front window plate to slide in the housing (sticker inside).
11. Press the front window plate with the clamps and replace the pressing rods.
12. Replace end cover and the electronic boards.
13. Perform an operational test to ensure proper functional readiness.

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CE Declaration of conformity

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HONEYWELL GRENOBLE
QUALITY ASSURANCE DEPARTMENT

CE declaration of conformity

We: Honeywell
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Declare: under our sole responsibility that the Protective Equipment catalogued:

Safety light curtain FF-SB series

To which this declaration relates is in conformity with the techical requirements of the standards and the provisions of the essential requirements of the Directives detailed below.
We implement a quality insurance system in accordance with the ISO 9001 standard certified by the French organisation AFAQ under the number QUAL/1994/2213a.

Directives:
- **Machine Directive 98/37/EC**, to which the EC-type examination certificate delivered by the Institut National de Recherche et de Sécurité (INRS) relates.
- **Low Voltage Directive 73/23/EC**
- **Electromagnetic Compatibility Directive 89/336/EC**

Standards:
- **pr EN 50100 :** Part 1(1) : Safety of machinery – Electrosensitive Protective Equipment – General Requirements and tests.
- **pr EN 50100 :** Part 2(1)**:** Safety of machinery – Electrosensitive Protective Equipment – Active Optoelectronic Protective Devices.

Safety Category: Category 4 as per pr EN 50100 1/2

The conformity to the European directives of the type model from the series listed above has been certified by:

Notified body: Institut National de Recherche et de Sécurité (INRS)
Avenue de Bourgogne – B.P. 27
54501 Vandœuvre Cedex – France

Certificate number: 1106 WB 1448 V 09 89 Date of certificate : 11/01/1990

Legal Representative In Europe :
Place of issue : Meylan
Quality Manager :
Patrick Goud
Signature :

Date : 10.04.2001
General Manager :
Richard Gibbs
Signature :

(1) : The IEC is adopting the European project norm. Finally, it will be codified EN 61496- parts 1 & 2.

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AFAQ N°1994/2213

Characteristics and dimensions of equipment listed in this manual are for reference only and are subject to change without prior notice.

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