INSTALLATION MANUAL FOR
PSD-400 Control Box and LBP-400 Series, LBP-500 Series, LBP-600 Series, or LBP-800 Series Light Bar Pairs

IMPORTANT: PLEASE REVIEW THIS ENTIRE PUBLICATION BEFORE INSTALLING, OPERATING OR MAINTAINING THE PHOTO-ELECTRIC PRESENCE SENSING DEVICE.

Please reference the following pages for information on the light bar pairs shipped with this PSD-400 Control Box:

Specifications for all Light Bar Pairs are on page 21.

- LBP-400 Series (Page 21)
- LBP-500 Series (Page 22)
- LBP-600 Series (Page 23)
- LBP-800 Series (Page 22)
SECTION 1—IN GENERAL
PSD-400 Series Light Curtain System

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SECTION 1—IN GENERAL
PSD-400 Series Light Curtain System

Safety Precautions

Danger is used to indicate the presence of a hazard which WILL cause SEVERE personal injury if the warning is ignored.

THIS SAFETY ALERT SYMBOL IDENTIFIES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL ☢️, BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY, AND CAREFULLY READ THE MESSAGE THAT Follows.

Efficient and safe machine operation depends on the development, implementation and enforcement of a safety program. This program requires, among other things, the proper selection of point-of-operation guards and safety devices for each particular job or operation and a thorough safety training program for all machine personnel. This program should include instruction on the proper operation of the machine, instruction on the point-of-operation guards and safety devices on the machine, and a regularly scheduled inspection and maintenance program.

Rules and procedures covering each aspect of your safety program should be developed and published both in an operator’s safety manual, as well as in prominent places throughout the plant and on each machine. Some rules or instructions which must be conveyed to your personnel and incorporated into your program include:

🔌 **DANGER** Never place your hands or any part of your body in this machine.

🔌 **DANGER** Never operate this machine without proper eye, face and body protection.

🔌 Never operate this machine unless you are fully trained and instructed and unless you have read the instruction manual.

🔌 Never operate this machine if it is not working properly—stop operating and advise your supervisor immediately.

🔌 Never use a foot switch to operate this machine unless a point-of-operation guard or device is provided and properly maintained.

🔌 Never operate this machine unless two-hand trip, two-hand control or presence sensing device is installed at the proper safety distance. Consult your supervisor should you have any questions regarding the proper safety distance.

🔌 Never tamper with, rewire or bypass any control or component on this machine.

A company’s safety program must involve everyone in the company, from top management to operators, since only as a group can any operational problems be identified and resolved. It is everyone’s responsibility to implement and communicate the information and material contained in catalogs and instruction manuals to all persons involved in machine operation. If a language barrier or insufficient education would prevent a person from reading and understanding various literature available, it should be translated, read or interpreted to the person, with assurance that it is understood.

🔌 FOR MAINTENANCE AND INSPECTION ALWAYS REFER TO THE OEM’s (ORIGINAL EQUIPMENT MANUFACTURER’S) MAINTENANCE MANUAL OR OWNER’S MANUAL. If you do not have an owner’s manual, please contact the original equipment manufacturer.

Rockford Systems LLC
Call: 1-800-922-7533
SECTION 1—IN GENERAL

PSD-400 Series Light Curtain System

Safety References

OSHA'S ACT AND FEDERAL REGULATIONS

Since the enclosed equipment can never overcome a mechanical deficiency, defect or malfunction in the machine itself, OSHA (Occupational Safety and Health Administration) has established certain safety regulations that the employers (users) must comply with so that the machines used in their plants, factories or facilities are thoroughly inspected and are in first-class operating condition before any of the enclosed equipment is installed.


Duties:

Sec. 5. (a) Each employer —

(1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

(2) shall comply with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct.

2. OSHA’s Code of Federal Regulations, Subpart O, that an employer (user) must comply with include:

Section 1910.211 Definitions
Section 1910.212 (a) General Requirements for all Machines
Section 1910.217 Mechanical Power Presses
Section 1910.219 (b)(1) Mechanical Power-Transmission Apparatus (Flywheel and Gear Covers)

3. OSHA’s 29 Code of Federal Regulations, Subpart J 1910.147

The Control of Hazardous Energy (Lockout / Tagout)

4. OSHA’s Publications


These publications can be obtained by contacting:

Superintendent of Documents
US Government Printing Office
P.O. Box 371954
Pittsburgh,PA 15250-7954
Phone: (202) 512-1800
Fax: (202) 512-2250
www.gpo.gov

ANSI SAFETY STANDARDS FOR MACHINES

The most complete safety standards for machine tools are published in the ANSI (American National Standards Institute) B11 series. The following is a list of each ANSI B11 Standard available at the printing of this publication.

B11.1 Mechanical Power Presses
B11.2 Hydraulic Presses
B11.3 Power Press Brakes
B11.4 Shears
B11.5 Iron Workers
B11.6 Lathes
B11.7 Cold Headers and Cold Formers
B11.8 Drilling, Milling and Boring
B11.9 Grinding Machines
B11.10 Sawing Machines
B11.11 Gear Cutting Machines
B11.12 Roll Forming and Roll Bending
B11.13 Automatic Screw/Bar and Chucking
B11.14 Coil Slitting Machines
B11.15 Pipe, Tube and Shape Bending
B11.16 Metal Powder Compacting Presses
B11.17 Horizontal Hydraulic Extrusion Presses
B11.18 Coil Processing Systems
B11.20 Safety Requirements for Manufacturing Systems/Cells
B11.21 Lasers
B11.22 CNC Turning Machines
B11.23 Machining Centers
B11/TR1 Ergonomic Considerations for the Design, Installation and Use of Machine Tools
B11/TR2 Mist Control
B11/TR3 Hazard ID and Control
B11/TR4 Control Reliability
R15.06 Robotic Safeguarding

These standards can be purchased by contacting:

American National Standards Institute, Inc.
11 West 42nd Street
New York, New York 10036
Phone: (212) 642-4900
Fax: (212) 302-1286
www.ansi.org

OR

Association of Manufacturing Technology (AMT)
7901 Westpark Drive
McLean, Virginia 22102
Phone: (703) 827-5211
Fax: (703) 893-1151
www.mfgtech.org

(Continued on next page.)
SECTION 1—IN GENERAL

PSD-400 Series Light Curtain System

NATIONAL SAFETY COUNCIL SAFETY MANUALS AND DATA SHEETS

Other good references for safety on machine tools are the National Safety Council’s Safety Manuals and Data Sheets. These manuals and data sheets are written by various committees including the Power Press, Forging and Fabricating Executive Committee. Copies of the following publications are available from their library:

- Safeguarding Concept Illustrations - 6th Edition
- Forging Safety Manual

These manuals can be obtained by contacting:
National Safety Council
1121 Spring Lake Drive
Itasca, IL 60143-3201
1-800-621-7619 ext. 2199
Fax: (630) 285-0797
www.nsc.org

OTHER SAFETY SOURCES

National Institute of Occupational Safety and Health (NIOSH)
4676 Columbia Parkway
Cincinnati, OH 45226
Phone: (513) 533-8236
www.NIOSH.cdc.gov

Robotic Industries Association (RIA)
P.O. Box 3724
Ann Arbor, MI 48106
Phone: (734) 994-6088
www.robotics.org

NEMA (National Electrical Manufacturers)
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209
Phone: (703) 841-3200
NFPA 79 Electrical Standard for Industrial Machinery

For additional safety information and assistance in devising, implementing or revising your safety program, please contact the machine manufacturer, your state and local safety councils, insurance carriers, national trade associations and your state’s occupational safety and health administration.

Warranty, Disclaimer and Limitation of Liability

WARRANTY

Rockford Systems, LLC warrants that this product will be free from defects in material and workmanship for a period of 12 months from the date of shipment thereof. ROCKFORD SYSTEMS LLC’S OBLIGATION UNDER THIS WARRANTY IS EXPRESSLY AND EXCLUSIVELY LIMITED to repairing or replacing such products which are returned to it within the warranty period with shipping charges prepaid and which will be disclosed as defective upon examination by Rockford Systems, LLC. This warranty will not apply to any product which will have been subject to misuse, negligence, accident, restriction and use not in accordance with Rockford Systems, LLC’s instructions or which will have been altered or repaired by persons other than the authorized agent or employees of Rockford Systems, LLC. Rockford Systems, LLC’s warranties as to any component part is expressly limited to that of the manufacturer of the component part.

DISCLAIMER

The foregoing Warranty is made in lieu of all other warranties, expressed or implied, and of all other liabilities and obligations on the part of Rockford Systems, LLC, including any liability for negligence, strict liability, or otherwise, and any implied warranty of merchantability or fitness for a particular purpose is expressly disclaimer.

LIMITATION OF LIABILITY

Under no circumstances, including any claim of negligence, strict liability, or otherwise, shall Rockford Systems, LLC be liable for any incidental or consequential damages, or any loss or damage resulting from a defect in the product of Rockford Systems, LLC.
SECTION 1—IN GENERAL
PSD-400 Series Light Curtain System

Danger and Warning Labels Provided on Control Box and Light Curtain Enclosures as Indicated

The labels shown on this page are furnished on light curtain units (transmitter, receiver, and control box). All personnel operating or working around the machines that have light curtain units with these labels must be required to read, understand and adhere to all dangers and warnings. If any of these labels become destroyed or unreadable, they MUST be replaced. For replacement labels, please contact factory immediately and do not operate machine until danger and warning labels are all in place.

For Replacement Signs Contact Factory or Use Order Form on Back Cover.
Rockford Systems, LLC
5795 Logistics Parkway
Rockford, IL 61109
Toll Free: 1-800-922-7533 (USA only)
Phone: (815) 874-7891
Fax: (815) 874-6144
Web Site www.rockfordsystems.com
E-Mail customerservice@rockfordsystems.com

Photo 1.1
Two Sets of Light Bar Pairs with Labels

Label No. KST-246

Label No. KST-245

Label No. KST-240

Label No. KST-203
“Mechanical Power Press Safety” Booklet

This booklet can also be used as a compliance guide on press brakes. Also see ANSI B11.3.

A copy of Booklet No. MPPS “Mechanical Power Press Safety” is available upon request. This booklet is copied verbatim from the Federal Register and contains all pertinent sections of the OSHA Regulations concerning power presses with which an employer (user) must comply. The enclosed light curtain must be mounted far enough from the point of operation to meet the required “Minimum Safety Distance” as described in the OSHA Regulations for operator protection as a “Point-of-Operation Safeguarding Device.” Specifically, any time a foot switch is used, a suitable point-of-operation guard or device must be used to prevent bodily injury. Moreover, every press must be provided with point-of-operation safeguarding! If you are unfamiliar with these detailed safety regulations that include proper safeguarding of the point of operation or how to calculate the safety distance for light curtains, you may want to attend our regularly scheduled monthly seminars. To obtain additional detailed information about these training seminars, please call, fax, e-mail, or write. Our address, e-mail address, telephone and fax numbers are on the front cover of this manual.

OSHA Regulations and ANSI Standards

Since the enclosed equipment can never overcome a mechanical deficiency, defect or malfunction in the machine itself, OSHA (Occupational Safety and Health Administration) has established certain regulations on employers (users) to ensure that the machines used in their plants, factories or facilities are thoroughly inspected, and are in first-class operating condition before any of the enclosed equipment is installed.

Before installing the enclosed light curtain, be sure that the applicable OSHA Regulations and the ANSI (American National Standards Institute) standards have been read and understood. For example, if the light curtain supplied is going on a mechanical power press (punch press) with a part revolution clutch, the following are the requirements from OSHA:

SUBPART 0, 1910.217, (c)(3)(iii) PRESENCE SENSING DEVICES

(iii) A presence sensing point of operation device shall protect the operator as provided in paragraph (c)(3)(i)(a) of this section, and shall be interlocked into the control circuit to prevent or stop slide motion if the operator’s hand or other part of his body is within the sensing field of the device during the downstroke of the press slide.

(a) The devices may not be used on machines using full revolution clutches.

(b) The devices may not be used as a tripping means to initiate slide motion, except when used in total conformance with paragraph (h).

(c) The device 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 the initiation of a successive stroke until the failure is corrected. The failure shall be indicated by the system.

(d) Muting (bypassing of the protective function) of such device during the upstroke of the press slide, is permitted for the purpose of parts ejection, circuit checking, and feeding.

(e) The safety distance ($D_s$) from the sensing field to the point of operation shall be greater than the distance determined by the following formula:

$$D_s = 63 \text{ inches/second} \times T_s$$

Where: $D_s =$ minimum safety distance (inches);

63 inches/second = hand speed constant;

and $T_s =$ stopping time of the press measured at approximately

90° position of crankshaft rotation (seconds). (See chart on next page.)

Note: Please add the response time of the light curtain to the above formula. (See light curtain specification label.)

(f) Guards shall be used to protect all areas of entry to the point of operation not protected by the presence sensing device.
OSHA Regulations and ANSI Standards (CONTINUED)

SAFETY DISTANCE CHART FOR OSHA FORMULA ONLY

For quick, easy reference for the safety distance, refer to the chart below. Before the presence sensing device (light curtain) mounting location can be determined, the stopping time ($T_s$) of the machine must be obtained. We suggest that this time be measured with a Stop-Time Measurement Unit. Consult factory for information on portable stop-time units or for stop-time devices that can be built into the control.

$$T_s = \text{Stopping Time (seconds)}; \quad D_s = \text{Safety Distance (inches)}.$$  

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<thead>
<tr>
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*Based on the 63 inches/second hand speed constant.

According to the ANSI (American National Standards Institute) B11.1-1988, the total stopping time of the press (for presence sensing devices) should include the total response time of the presence sensing device, as stated by the manufacturer, the response time of the interface, the response time of the control system, the time it takes the press to cease slide motion, and the added time for brake monitoring ($T_{bm}$). The following formula should be used when calculating the safety distance to meet the ANSI Safety Standard:

$$D_s = K (T_s + T_c + T_r + T_{bm}) + D_{pf}$$

where:

- $K = \text{the hand speed constant} = 63 \text{ inches/second}$.
- $T_s = \text{the stop time of the press measured from the final deenergized control element, usually the air valve.}$
- $T_c = \text{the response time of the control.}$
- $T_r = \text{the response time of the presence sensing device and its interface, if any, as stated by the manufacturer or}$
- $T_{bm} = \text{the additional time allowed by the brake monitor before it detects stop-time deterioration.}$
- $D_{pf} = \text{the added distance due to the penetration factor. The minimum object sensitivity is stated by the manufacturer. If beam blankouts or floating window features are used, these figures should be added to the object sensitivity figure. No increase in safety distance is required for fixed-channel blanking applications if the blanked area is entirely occupied by the material or fixtures.}$
OSHA Regulations and ANSI Standards (CONTINUED)

On part revolution clutch presses, the clutch/brake control must have control reliability and brake monitoring (stop-performance monitor). The following are the requirements of OSHA:

(b)(13) Control reliability—When required by paragraph (c)(5), 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. This requirement does not apply to those elements of the control system which have no effect on the protection against point of operation injuries.

(b)(14) Brake monitoring—When required, the brake monitor shall meet the following requirements:

(i) Be so constructed as to automatically prevent the activation of a successive stroke if the stopping time or braking distance deteriorates to a point where the safety distance being utilized does not meet the requirements set forth in paragraph (c)(3)(iii)(e) or (c)(3)(vii)(c) of this section. The brake monitor when used with the Type “B” gate or movable barrier must detect slide top-stop overrun beyond the normal limit reasonably established by the employer.

(ii) Be installed on a press so that it indicates when the performance of the braking system has

(deteriorated to the extent described in paragraph b)(14)(i) of this section; and

(iii) Be constructed and installed in a manner to monitor brake system performance on each stroke.

Light Curtains Applied to Other Machines

The light curtain presence sensing device, that this manual covers, can be applied to many other types of machines or equipment to safeguard personnel from hazards. The prime source of power for machines or equipment may be mechanical, pneumatic, hydraulic, motor, etc. The main consideration, when applying a light curtain, must be the ability to stop the machine’s hazardous motion before any personnel can get their hands or any part of their body into the hazard. Properly interfacing this light curtain to the existing machine control is very important in order to establish control reliability. This reliability has to be established to assure that an output signal is given to stop the hazardous motion. The mechanical condition of a machine or equipment must be kept in first-class condition according to the original equipment manufacturer’s requirements. Again, this must be done so the hazardous motion will stop when the signal is given.

It is also very important to establish a safety distance based on the machine stopping time as discussed earlier in this manual. Areas of the point of operation that are not safeguarded by this light curtain must also be guarded.

Important Information and Warnings

The products covered in this manual perform at least within the regulated Federal, State, local and other laws and regulations, including the OSHA (Occupational Safety and Health Act). It is the employer’s (user’s) responsibility to ensure that applications, installations, wiring, operation and maintenance of these products meet all applicable OSHA and other regulatory requirements. Other organizations provide informational material on the use of presence sensing devices, including ANSI (American National Standards Institute), PMA (Precision Metalworking Association), the National Safety Council and RIA (Robotics Institute of America).

Any questions regarding the application or use of the products should be directed to your company’s safety engineer or safety department, or to a qualified safety person. Remember, these systems will help safeguard against injury only if they are properly installed and integrated into the machine control, and properly operated and maintained. It is the responsibility of the purchaser/user/employer to conduct a hazard analysis of the area, machines, and/or apparatus to be safeguarded prior to the selection and installation of any safeguarding system. Before installing any system, read and understand the General Requirements, Mounting, Electrical Installation, and Initial Power-up sections of this installation manual.
SECTION 2—INTRODUCTION

PSD-400 Series Light Curtain System

Important Information and Warnings (CONTINUED)

When a safety control system is used to protect an operator and other employees from a machine hazard, all of the following conditions must be followed:

1. The machine(s) where the light curtain(s) is applied must have the capability to stop anywhere in its cycle.

2. The entire electrical, pneumatic, mechanical and hydraulic control system must not be able to fail in an unsafe manner. As a minimum, loss of 110 Volt AC control power or loss of the air or hydraulic or hydraulic supply would, in itself, stop the machine. As a rule, the light curtain’s normally closed (closed in safe mode) output contacts are used to allow the machine to operate as normal; when the light curtain is interrupted they are used to stop the machine.

3. The light curtain’s output contacts must not be altered or bypassed once the light curtain is installed.

4. Do not modify or alter the light curtain system in any way.

5. Do not replace components other than approved parts. See Component Removal and Replacement paragraphs in this installation manual.

6. Do not operate this unit without following the appropriate procedures.

7. Your unit has blanking capability. Please do not blank channels without reading the Blanking Section of this installation manual. See later pages of this manual for discussion of the channel blanking system.

8. The key allowing access to the programming features is the responsibility of management. It is also management’s responsibility to determine which (if any) channels can be safely blanked. The key should not be left in the selector switch.

Light Curtains and Other Light Safeguarding Devices

A broad variety of presence sensing safety devices for numerous industrial safeguarding applications are available. Please consult factory for further information.

Each machine safeguarding application can be placed in one of the following categories:

- **Point of operation**—protects the operator from machine pinch-point hazards where work is being done.
- **Area safeguarding**—protects a defined area that is usually horizontal space.
- **Perimeter safeguarding**—detects entry into an area where hazardous machine or equipment motion can occur.

PSD-400 System Features

The PSD-400 Series Light Curtain is a presence sensing device designed to meet important criteria for protecting operating personnel from machine hazards. It is a modulated, infrared “curtain-of-light” that brings the latest electronic and optical technology to the factory floor. Each system is made up of a control box, a transmitter (also known as an emitter or sender) unit, a receiver (detector) unit, interconnecting cables and mounting hardware. The receiver and transmitter interface into the control box using 20’ cables. No other electrical connection is required between the transmitter and receiver. The transmitter unit consists of a series of synchronized LEDs (light emitting diodes) which transmit modulated infrared light (i.e., invisible light) to the receiver unit. The receiver unit consists of a corresponding array of photodiodes that are synchronized with the transmitter LEDs. The control box contains a power supply, main logic processing boards, and all output terminals. The transmitter unit has three indicator lights to denote the system status. Eight additional indicator lights are located inside the control box. Channel indicators are also provided to help with alignment of the units and to indicate when a cell is interrupted.

Using modulated, light-emitting-diode techniques and vibration-analyzed packaging design, this light curtain provides dependable operator protection in environmentally hostile applications such as power presses, press brakes, injection and compression molding machines, and robotic systems. This concept has been tested, evaluated and field proven by tens of thousands of similar systems currently in operation.

When the blanking feature is not used, any interruption of a light beam by an object larger than 1” (MOS), initiates an output signal to the machine control system. This output causes the machine to stop or not allow a cycle until the blockage is removed.

Each receiver and transmitter bar includes mounting brackets and a set of elastomeric shock absorbers. Any receiver unit and transmitter unit of equal length can be used together; matched pairs are not required.
SECTION 2—INTRODUCTION
PSD-400 Series Light Curtain System

Figure 2.1
PSD-400 Light Curtain System

LIGHT CURTAIN SYSTEM FEATURES

- Meets OSHA and ANSI industry safety standards
- Self-checking circuitry (light curtain condition only)
- Individual optical grade lensing on each channel
- Captive-contact output relays
- 20ms response time on the 12” unit
- Detects objects 1” or larger
- Strobe-light and weld-flash immunity without increasing response time
- 100 ft. range between transmitter and receiver
- Channel blanking (fixed or floating)
- Available in 110VAC (230VAC or 24VDC optional)
- High stability and noise immunity
SECTION 2—INTRODUCTION
PSD-400 Series Light Curtain System

Control Box Specifications

Power Requirements
- Standard: 115 VAC ± 15%, 50/60 Hz
- Optional: 230 VAC ± 15%, 50/60 Hz
- Optional: 24 VDC ± 15%

Control Output: Two relays with forced-guided contacts providing two N/O, two NC control contacts, one NO, one NC monitor contacts

Contact Ratings: 6 amps, 250 VAC

Operating Temperature: 32° to 131°F (0° to 55°C)

Enclosure: Meets NEMA 4, 12; IP65

Construction: Enclosure is polyurethane painted steel

Cable Length: 20' (6 m) (Standard)

<table>
<thead>
<tr>
<th>Light Bar Pairs</th>
<th>Response Time</th>
<th>Field of Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP-404</td>
<td>20 ms</td>
<td>4&quot;</td>
</tr>
<tr>
<td>LBP-408</td>
<td>20 ms</td>
<td>8&quot;</td>
</tr>
<tr>
<td>LBP-412</td>
<td>20 ms</td>
<td>12&quot;</td>
</tr>
<tr>
<td>LBP-416</td>
<td>25 ms</td>
<td>16&quot;</td>
</tr>
<tr>
<td>LBP-420</td>
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<td>20&quot;</td>
</tr>
<tr>
<td>LBP-424</td>
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<tr>
<td>LBP-428</td>
<td>30 ms</td>
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</tr>
<tr>
<td>LBP-432</td>
<td>30 ms</td>
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<tr>
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</tr>
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<td>LBP-440</td>
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<td>40&quot;</td>
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<tr>
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<td>35 ms</td>
<td>44&quot;</td>
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<tr>
<td>LBP-448</td>
<td>35 ms</td>
<td>48&quot;</td>
</tr>
<tr>
<td>LBP-452</td>
<td>40 ms</td>
<td>52&quot;</td>
</tr>
<tr>
<td>LBP-456</td>
<td>40 ms</td>
<td>56&quot;</td>
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<tr>
<td>LBP-460</td>
<td>40 ms</td>
<td>60&quot;</td>
</tr>
<tr>
<td>LBP-464</td>
<td>42 ms</td>
<td>64&quot;</td>
</tr>
</tbody>
</table>

Theory of Operation

ELECTRONIC OVERVIEW
The light curtain is an opposed transmitter-receiver curtain-of-light that modulates each of its LED light sources in a special coded manner; the light modulation virtually eliminates ambient light interference. The light curtain electronically sequences its individual LED transmitters and phototransistor receivers at a fast rate that prevents any light interference between individual transmitter-receiver sections.

OPTICAL OVERVIEW
A properly designed and engineered optical system that uses lenses is essential for safe and effective presence sensing safety devices. The light curtain uses high quality individual optical lenses on every transmitter and receiver channel. This individual channel lensing allows the power of the LEDs to be transmitted to the appropriate receiver channel, assuring the optimal signal to noise ratio, and allowing operation in harsh, oily and dirty environments. Individual channel lensing creates a column of light between each of the active transmitter and receiver channels. The creation of a column of light between transmitter and receiver channels is called light collimation. Light collimation is necessary to ensure the infrared light moves from the transmitter to the receiver in a controlled cone that maximizes its efficiency. Additionally, the lens on each receiver channel minimizes the possibility of the infrared light bouncing off shiny objects and fooling the receiver.

(Continued on next page.)
SECTION 2—INTRODUCTION

PSD-400 Series Light Curtain System

DETECTION OF OBJECTS

This light curtain will detect any solid opaque object larger than the MOS (minimum object sensitivity) size that is within its sensing field. Objects larger than the MOS will prevent the infrared light from passing unobstructed from the transmitter to the receiver, causing the system to sense an interruption of one or more channels and send a signal to the machine control. MOS is the smallest object that the light curtain will detect anywhere in the sensing field, regardless of the object’s location in the sensing field, operating range, unit alignment or environmental conditions (dirt, grime, dust, etc.). Conversely, an object that is smaller than the light curtain’s MOS could pass through the protected field without detection if it passes between the light beams of two adjacent channels. An object less than the MOS of the light bar pair may not be detected in the sensing field.

SYSTEM OUTPUT

The light curtain’s output circuit, located in the control box, is also fully checked using self-checking and redundant circuitry. The state of the output-relays is indicated by green (safe operation-machine enabled) and red (unsafe operation-machine disabled) status indicator lights located on the transmitter enclosure. The yellow and green status indicators are illuminated when fixed blanking is turned on. The green indicator flashes when float blanking is turned on.

Two relays with forced-guided contacts provide two normally open (N/O), two normally closed (N/C) control contacts, one normally open (N/O), and one normally closed (N/C) monitor contacts. (See Table 2.2 for output-relay contacts.) Redundant electronic self-checking circuitry constantly monitors the state of the relays. As additional features, an output monitor circuit disables the output relays in the event of relay coil or relay contact failure or other circuit failure. Consequently, in the event of any output circuit component failure or relay circuitry component failure, the system should fail to a safe condition.

CONTROL RELIABILITY

This light curtain is designed to meet certain criteria for safety established by U.S. and international standards. These criteria assure that presence sensing devices meet determined levels of safety performance. The relevant design criteria have been established by industry groups and regulatory bodies specifically for presence sensing safety devices.

As a scanning device, this light curtain is part of a machine control system and must comply with the higher levels of design criteria applicable to safety related machine control components. It is important for the employer/user to recognize that other elements of the machine control system, such as the control circuits and machine control components and other equipment must also be designed so that safety is established and maintained when the system is properly operating as well as when a component fails.

Table 2.2

<table>
<thead>
<tr>
<th>Output-Relay Contacts</th>
<th>Power Applied</th>
<th>Obstruction</th>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NO</td>
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<tr>
<td></td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
SECTION 3—INSTALLATION

PSD-400 Series Light Curtain System

General Requirements

Certain requirements must be satisfied when this light curtain is used to protect an operator and other employees from machine hazards.

Machine Stop—The machine on which the light curtain is applied must have the capability to stop anywhere in its cycle. An example of a machine that cannot be stopped immediately and where the light curtain cannot be applied is on a full-revolution clutch mechanical power press. (See OSHA 1910.217 (c)(3)(iii)(a) on page 7.)

Machine Reliability—The light curtain may not be used on any machine with inconsistent or inadequate stopping performance and/or response time.

Machine Control—The machine control system, either electrical, pneumatic, mechanical, or hydraulic control, must have control reliability and be capable of failing to a safe condition.

Presence Sensing Device Initiation (PSDI)—The use of the light curtain as a tripping device on a mechanical power press is regulated by OSHA.

Output Contacts—The light curtain’s output contacts must not be altered or bypassed once the light curtain is installed. On mechanical power presses, press brakes and similar machines that use a reciprocating ram or slide, it is permissible to incorporate a circuit in the control system that mutes the light curtain’s output when the pinch point is less than 1/4” opening above the material. (See OSHA 1910.217 (c)(3)(iii)(d) on page 7.)

 Mechanical (“Hard”) Guarding—Regulations state that a machine operator or other personnel must not be able to reach over, under, around or through the light curtain’s sensing field and access the point of operation or other hazardous points, or stand between the sensing field and the point of operation. “All areas of entry to the point of operation not protected by the presence sensing device shall be otherwise safeguarded.” See ANSI B11.1 - 1988, E6.3.2 (14). Supplemental mechanical barriers (i.e. “hard guards”) or additional presence sensing devices must be installed to meet this requirement.

Minimum Safety or Separation Distance—This is defined as the minimum distance from the light curtain’s sensing field to the closest hazard or danger point that would prevent the operator from reaching the hazard before the machine’s motion stops. The minimum safety distance is a function of several factors, as described on pages 7 and 8 of this manual.

Preliminary Steps Before Installation

Before proceeding with the installation of the enclosed equipment, you should undertake the following preliminary steps.

1. Read and make sure you understand this entire Installation Manual.
2. Refer to the various photos and line drawings, then make a rough sketch of your installation to plan the location of the enclosed equipment on the machine.
3. If a complete control package is going to be installed, this may be an opportunity to strip down the entire machine by removing all components, piping, wire, etc. Clean, paint and check the entire mechanical condition of the machine, including the clutch and brake, for proper adjustment and required replacement parts before proceeding with the installation of the furnished equipment. Also check the electrical, pneumatic, hydraulic, and mechanical systems of the machine.
4. Make sure the machine is in first-class condition. Before starting any installation, thoroughly inspect the machine or robot. Make sure that all mechanical components and all collateral equipment are in first-class operating condition. Your inspection should be made according to the machine manufacturer’s installation and maintenance instruction manual. Special attention must be given to the machine clutch and brake. The clutch and brake must be maintained in an operating condition which is within the specifications set by the machine manufacturer. This light curtain device is not to be installed on any press brake that has a band brake. For a replacement brake, please contact the original equipment manufacturer. If you have any doubts or questions concerning the condition of the machine or equipment, contact the machine manufacturer for assistance. Repair or replace all parts not operating properly before proceeding.

Inspection and maintenance programs must be established and implemented to keep machines in first-class condition.

Programs must include thorough inspections of each machine on a weekly basis and records kept of these inspections. Any part of the machine that is worn, damaged or is not operating properly must immediately be replaced or repaired before the machine is used.
Preliminary Steps Before Installation

(Continued)

5. After verifying the machine is in first-class condition and operating properly, shut off all power to the machine. Padlock the disconnecting means in the “off” position and do not operate the machine again until the installation of all components has been completed. Lockout/tagout energy isolation procedures must also be practiced and enforced.

Mounting Considerations

Several important safety points mentioned in other sections of this manual are worth repeating again.

After mechanical installation:

- Machine operators or other personnel must not be able to reach over, under, or around the sensing field to reach the point of operation or other danger points.

- The point-of-operation hazard must be accessible only through the sensing field. Supplemental mechanical barrier guards or additional presence sensing devices may be necessary to meet this requirement.

- The correct model must be selected to furnish the necessary protected size and sensing range for the specific application or machine.

- The light curtain must be installed so that the Minimum Safety Distance requirements are complied with (see pages 7 and 8).

The light curtain control is enclosed in a rugged steel enclosure to withstand some of the toughest factory environments.

Electrical connections are all made inside the control box. For this reason, a possible first choice for mounting the control would be near the machine controls. Remember, the light curtain control box has user adjustments as well as the controls for blanking. Therefore, mount it where it is accessible. A clear area (20”) in front of the enclosure is required for access to these features.

Make sure the light bar pairs, control box, and cabling are out of the way of feeding equipment, material, parts, tool and die changing equipment, fork lifts, etc.

As long as the transmitter and receiver segments are mounted with their cable connectors in the same orientation, they can be mounted either horizontally or vertically.

In most cases, mounting the receiver and transmitter segments directly opposite each other will, with minimal adjustment, bring the system into alignment. The powerful LEDs on the light bar pairs, combined with optical grade lenses and channel indicators for each channel, allow for easy alignment.

Use caution when installing any light curtain where the perimeter of the sensing field is adjacent to a reflective surface. Failure to correct this condition can result in serious physical injury or death to personnel. Perform the Test Procedure to test for this condition.

Mounting Control Box Isolators

1. Secure No.1/4-20 isolator rubber mount to the machine or bracket surface.

2. Install control box to isolator and fasten with washer, lock washer, and No. 1/4-20 nut.

(Continued on next page.)
HORIZONTAL LIGHT CURTAIN INSTALLATION

Certain applications may use horizontal mounting of the light curtain to detect intrusion into a hazardous area. For the explanation purposes in this section, the formula used for horizontal mounting assumes that the angle of approach by an object through the sensing field is less than 30°, as shown in Figure 3.2. Applications where the angle of approach is 30° or greater to the sensing field should use the ANSI formula on page 8.

The following discussion is based on the European Standard prEN999 regarding the positioning of safeguarding equipment. In this standard, the safe mounting distance is measured from the point of operation to the sensing field beam farthest away, as shown in Figure 3.2.

To calculate $D_s$, use the ANSI Safe Distance Formula, but use $D_H$ in place of $D_{pf}$ (Depth Penetration Factor), where:

$$D_H = 48 - (0.4 \times H); \text{ but } DH \text{ is never less than } 34\text{"}$$

$H = \text{Height of the light curtain sensing zone above the floor in inches, measured from the lowest beam of the sensing field.}$

The complete formula for horizontal mounting is:

$$D_s = K \times (T_s + T_c + T_r + T_{bm}) + D_H$$

EXAMPLE OF HORIZONTAL LIGHT CURTAIN INSTALLATION:

An automated machine has a stop time (as specified by the manufacturer) of 125 ms. A PSD-400 Control Box with an LBP-400 transmitter and receiver with a response time of 45 ms is mounted horizontally in front of the operator load station. The mounting height of the lowest light curtain beam above the floor is 30 inches. The hand speed constant $K$ is selected as 63 in/sec.

$$D_s = K \times (T_s + T_c + T_r + T_{bm}) + D_H$$

First, calculate $D_H$ to make sure it is not less than 34".

$$D_H = 48 - (0.4 \times H) = 48 - (0.4 \times 30)$$

$D_H = 36$ inches (If $D_H$ was calculated to be less than 34”, then use 34”).

Now, that $D_H$ is known, calculate the remaining portion of the distance formula.

Note that $T_s + T_c = 0.125$ second.

$$D_s = 63 \times (0.125 + 0.045 + 0) + 36$$

$= 63 \times (0.170) + 36$

$= 10.7 + 36$

$D_s = 46.7$ inches (1186 mm)

REFLECTIVE SURFACE INTERFERENCE

A reflective surface adjacent to the sensing field can deflect the optical beam and may cause an obstruction in the sensing field to not be detected. (See Figure 3.3.) Reflective surfaces may be part of the machine, mechanical guard or workpiece. Some examples of reflective surfaces may include shiny metal, glossy paint, foil, plastic, or other similar material. The Test Procedure must be used to test for this condition.

Poor alignment between the transmitter and receiver light bar pairs and/or improper Range Adjustment setting may aggravate reflective surface interference. Correction of this condition consists of relocating the sensing field further away from the reflecting surface (increase ‘a’ in Figure 3.3), reducing the reflectivity of the surface by painting, masking or substituting materials, realigning the light curtain or readjusting the Range Adjustment. After correcting, repeat the Test Procedure. (See the section in this manual on Power On and Alignment.)

The calculation provides the installer with a means of anticipating reflective surface interference. The light curtain must be installed so that no reflective surfaces are inside the beam angle of the transmitter and receiver.
REFLECTIVE SURFACE INTERFERENCE (CONTINUED)

The minimum distance from the sensing field to the reflective surface, \( d \), may be calculated from the formula given below. This assumes a worst case condition where the transmitter and receiver are not in true alignment, as indicated in Figure 3.3c. The formula also requires the Distance Switch Adjustment potentiometer be properly set according to the procedure on page 29.

The worst case distance, \( d \), is calculated from the formula:

\[
d = \frac{R}{2} \tan 2\alpha
\]

where \( \alpha = 2^\circ \) and \( R \) is the operating range of the light curtain.

For example, a PSD-400 Series Light Curtain System is installed on a machine and the distance between the transmitters and receivers is 6 ft (1.8 m);

\[
d = \frac{6}{2} \tan (2 \times 2^\circ)
\]

\[
= 3 \tan 4^\circ
\]

\[
= 3 (0.0699)
\]

\[
= 0.21 \text{ ft or } 2.5 \text{ in (63.5 mm)}
\]

Thus, the center of the transmitter/receiver beam line must be placed greater than 2.5 in (63.5 mm) from a reflective surface.

<table>
<thead>
<tr>
<th>Light Curtain</th>
<th>( \alpha ) value*</th>
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</thead>
<tbody>
<tr>
<td>PSD-400</td>
<td>2.5°</td>
</tr>
<tr>
<td>PSD-500</td>
<td>3.5°</td>
</tr>
<tr>
<td>PSD-800</td>
<td>3.5°</td>
</tr>
<tr>
<td>PSD-600</td>
<td>2.5°</td>
</tr>
</tbody>
</table>

*With transmitter/receiver properly aligned and adjusted.

For example, a PSD-400 Series Light Curtain System is installed on a machine and the distance between the transmitters and receivers is 6 ft (1.8 m);

\[
d = \frac{R}{2} \tan 2\alpha
\]

\[
= \frac{6}{2} \tan (2 \times 2^\circ)
\]

\[
= 3 \tan 4^\circ
\]

\[
= 3 (0.0699)
\]

\[
= 0.21 \text{ ft or } 2.5 \text{ in (63.5 mm)}
\]

Thus, the center of the transmitter/receiver beam line must be placed greater than 2.5 in (63.5 mm) from a reflective surface.
Mounting Considerations (CONTINUED)

MOUNTING POSITION OF TRANSMITTER AND RECEIVER LIGHT BAR PAIRS ON THE MACHINE

When mounting a single light bar pair, the transmitter and receiver can be mounted on either side of the machine. See below. When mounting the light bar pairs vertically with the transmitter on the left and the receiver on the right, the labels will be facing forward. If the light bar pairs are to be installed any other way, please consult factory for an additional set of adhesive labels.

Figure 3.4
Mounting Positions of Transmitter and Receiver When Using Multiple Sets of Light Curtains in a Side-by-Side Installation

This is the recommended arrangement for multiple light curtain installation.

This arrangement is **not** recommended for multiple light curtain installation because there could be interference between the two light curtains.

OTHER WAYS TO MOUNT THE LIGHT CURTAIN SYSTEM

Note: Always make sure the hazard areas, not protected by the light curtain, are safeguarded by barrier guards, additional light presence sensing devices, etc. Examples of hazard areas are the sides and back of the machine or equipment.

(Continued on next page.)
Mounting Considerations (CONTINUED)

MOUNTING POSITION OF TRANSMITTER AND RECEIVER LIGHT BAR PAIRS ON THE MACHINE

Figure 3.6 shows some examples of correct light bar pair installations. Figure 3.7 shows incorrect mounting positions of the light bar pairs. These examples are of GAP or “C” frame constructed machines.

Figure 3.6
Correct Mounting Positions of Light Curtains

Vertically mounted light curtain

Pass-through area safeguarded with horizontally mounted light curtain

Horizontally mounted light curtain

Angle-mounted light curtain

Angle-mounted light curtain

Light curtain and two mirrors providing three-sided protection

Note: Additional supplemental guarding is required where unprotected entry to the hazard zone is accessible, such as along the sides and rear of the machine. A mechanical barrier should be used to prevent personnel from standing between the light curtain and the machine. These drawings are for illustrative purposes only. Your installation may differ from these examples.

Figure 3.7
Incorrect Mounting Positions of Light Curtains

“Pass-through” area without proper safeguarding

Light curtain mounted too low

Light curtain mounted too high

(Continued on next page.)
SECTION 3—INSTALLATION
PSD-400 Series Light Curtain System

Mounting Considerations
(Continued)

TRANSMITTER/RECEIVER MOUNTING ASSEMBLY
1. The light bar pairs are shipped with the mounting brackets (Item 1) and plates (Item 2) preassembled. See Figure 3.8.

2. The mounting brackets are adjustable ±30°. To adjust these brackets, loosen the nuts (Item 3) and turn to the desired position. Tighten nuts. The mounting bracket can also be rotated 90°. To do this, loosen and remove the nuts and mounting bracket (Items 1 and 3). Turn the bracket 90°, replace the nuts. Tighten them. The new position also provides ±30° adjustability.

3. Install vibration isolator (Item 4), if required, and secure with hardware (Items 5, 6, and 7). See Figure 3.8.

Note: Shock mounts should only be used in high-shock applications (typically power press applications).

Figure 3.8 Hardware Installation

Mounting to Special Brackets or Stands
(Continued)

Mount the transmitters and receivers with the cables and connectors at the bottom as shown in Figure 2.1 on page 11.

Once the minimum safety distance has been determined, a mounting location has been selected, any special considerations (i.e., horizontal mounting or reflective surface interference) have been taken care of, special brackets fabricated, and no obstructions are in the sensing field, perform the following steps:

1. Place the mounts in their approximate final position.

2. Using a plumb bob or machine reference points, ensure that the outside bolt holes in each mount are vertical.

3. Measuring from the floor or other horizontal reference line, locate a point at each side which is aligned with the bottom bolt holes of the enclosures.

4. Stretch a carpenter’s chalk line or a cable past the two mounting points determined in the previous step.

5. Adjust the mounts so that all four bottom bolt holes are parallel to the chalk line in the horizontal plane.

6. Rotate the mounts so, that when viewed from the top, all four bolt holes are equal distance from the chalk line.

7. Once the transmitter and receiver units are mounted, mount the control box at the desired location. Take into account cable lengths to both the transmitters and receivers (standard length is 20 feet).

MOUNTING TO SPECIAL BRACKETS OR STANDS
Consult appropriate pages in this manual to determine the dimensions of the light curtain transmitters and receivers used for your application and specific installation details.
## Specifications of Light Bars

<table>
<thead>
<tr>
<th></th>
<th>LBP-400</th>
<th>LBP-500</th>
<th>LBP-600</th>
<th>LBP-800</th>
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</thead>
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<tr>
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<td>LBP-636 - 16 in</td>
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</tr>
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<td></td>
<td></td>
<td>LBP-640 - 12 in</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>LBP-652 - 12 in</td>
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<td></td>
<td>LBP-664 - 12 in</td>
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</tr>
<tr>
<td><strong>Minimum Object Resolution</strong></td>
<td>1.00 in</td>
<td>1.25 in</td>
<td>LBP-624 - 18 in</td>
<td>2.00 in</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>LBP-636 - 14 in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LBP-640 - 10 in</td>
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</tr>
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<td></td>
<td></td>
<td>LBP-652 - 10 in</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>LBP-664 - 10 in</td>
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</tr>
<tr>
<td><strong>Protection Length</strong></td>
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<td>12-96 in</td>
<td>24, 36, 40, 52, 64 in</td>
<td>6-96 in</td>
</tr>
<tr>
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<td>100 ft</td>
<td>100 ft</td>
<td>100 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td><strong>Alignment</strong></td>
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<td>+3.5°</td>
<td>+2.5°</td>
<td>+3.5°</td>
</tr>
<tr>
<td><strong>Light Source</strong></td>
<td>LaAIAs Light Emitting Diode, 880 nm</td>
<td>Circular, weather-tight disconnect of high strength, glass-filled nylon.</td>
<td>Transmitter and receiver are polyester powder painted aluminum.</td>
<td>32°F to 131°F (0°C to 55°C)</td>
</tr>
</tbody>
</table>

### Table 3.3 - LBP-400 Dimensions

![Figure 3.9 - LBP-400 Series STANDARD Light Bar Pair Housings (See Table 3.3)]

Note: The marks indicated by "A" identify the center of the top and bottom infrared beams.

<table>
<thead>
<tr>
<th>Field of Coverage</th>
<th>&quot;A&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>4 (102)</td>
<td>8.54 (217)</td>
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<td>8 (203)</td>
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<td>13.64 (346)</td>
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<td>17.64 (448)</td>
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<td>20 (508)</td>
<td>24.54 (623)</td>
<td>25.64 (651)</td>
</tr>
<tr>
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<td>28.54 (725)</td>
<td>29.64 (753)</td>
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<tr>
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<td>28 (711)</td>
<td>32.54 (827)</td>
<td>33.64 (854)</td>
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<tr>
<td>32&quot;</td>
<td>32 (813)</td>
<td>36.54 (928)</td>
<td>37.64 (956)</td>
</tr>
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<td>36&quot;</td>
<td>36 (914)</td>
<td>40.54 (1030)</td>
<td>41.64 (1058)</td>
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<td>40&quot;</td>
<td>40 (1016)</td>
<td>44.54 (1131)</td>
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<td>57.64 (1464)</td>
</tr>
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<td>60.54 (1538)</td>
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<td>64.54 (1639)</td>
<td>65.64 (1667)</td>
</tr>
<tr>
<td>64&quot;</td>
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<td>68.54 (1741)</td>
<td>69.64 (1769)</td>
</tr>
</tbody>
</table>
**SECTION 3—INSTALLATION**

PSD-400 Series Light Curtain System

Dimensions of Light Bar Pairs (CONTINUED)

Figure 3.10 - LBP-500 Series WIDE Light Bar Pair Housings (See Table 3.4)

Table 3.4 - LBP-500 Dimensions

<table>
<thead>
<tr>
<th>Field of Coverage</th>
<th>&quot;A&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>6 (152)</td>
<td>9.28 (236)</td>
<td>10.38 (264)</td>
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<tr>
<td>12&quot;</td>
<td>12 (305)</td>
<td>15.28 (388)</td>
<td>16.38 (416)</td>
</tr>
<tr>
<td>18&quot;</td>
<td>18 (457)</td>
<td>21.28 (541)</td>
<td>22.38 (568)</td>
</tr>
<tr>
<td>24&quot;</td>
<td>24 (610)</td>
<td>27.28 (693)</td>
<td>28.38 (721)</td>
</tr>
<tr>
<td>30&quot;</td>
<td>30 (762)</td>
<td>33.28 (845)</td>
<td>34.38 (873)</td>
</tr>
<tr>
<td>36&quot;</td>
<td>36 (914)</td>
<td>39.28 (998)</td>
<td>40.38 (1026)</td>
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<tr>
<td>42&quot;</td>
<td>42 (1067)</td>
<td>45.28 (1150)</td>
<td>46.38 (1178)</td>
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<tr>
<td>48&quot;</td>
<td>48 (1219)</td>
<td>51.28 (1303)</td>
<td>52.38 (1330)</td>
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<tr>
<td>60&quot;</td>
<td>60 (1524)</td>
<td>63.28 (1607)</td>
<td>64.38 (1635)</td>
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<tr>
<td>72&quot;</td>
<td>72 (1829)</td>
<td>75.28 (1912)</td>
<td>76.38 (1940)</td>
</tr>
<tr>
<td>84&quot;</td>
<td>84 (2134)</td>
<td>87.28 (2217)</td>
<td>88.38 (2245)</td>
</tr>
<tr>
<td>96&quot;</td>
<td>96 (2438)</td>
<td>99.28 (2522)</td>
<td>100.38 (2550)</td>
</tr>
</tbody>
</table>

UNIT CONFIGURATION [Inches (mm)]

Note: The marks indicated by "A" identify the center of the top and bottom infrared beams.

The LBP-800 Series is for Perimeter Safeguarding ONLY
DO NOT USE for Point-of-Operation Safeguarding

Figure 3.11 - LBP-800 Series WIDE Light Bar Pair Housings (See Table 3.5)

Table 3.5 - LBP-800 Dimensions

<table>
<thead>
<tr>
<th>Field of Coverage</th>
<th>&quot;A&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>12 (305)</td>
<td>15.28 (388)</td>
<td>16.38 (416)</td>
</tr>
<tr>
<td>24&quot;</td>
<td>24 (610)</td>
<td>27.28 (693)</td>
<td>28.38 (721)</td>
</tr>
<tr>
<td>36&quot;</td>
<td>36 (914)</td>
<td>39.28 (998)</td>
<td>40.38 (1026)</td>
</tr>
<tr>
<td>48&quot;</td>
<td>48 (1219)</td>
<td>51.28 (1303)</td>
<td>52.38 (1330)</td>
</tr>
<tr>
<td>60&quot;</td>
<td>60 (1524)</td>
<td>63.28 (1607)</td>
<td>64.38 (1635)</td>
</tr>
<tr>
<td>72&quot;</td>
<td>72 (1829)</td>
<td>75.28 (1912)</td>
<td>76.38 (1940)</td>
</tr>
<tr>
<td>84&quot;</td>
<td>84 (2134)</td>
<td>87.28 (2217)</td>
<td>88.38 (2245)</td>
</tr>
<tr>
<td>96&quot;</td>
<td>96 (2438)</td>
<td>99.28 (2522)</td>
<td>100.38 (2550)</td>
</tr>
</tbody>
</table>

UNIT CONFIGURATION [Inches (mm)]

Note: The marks indicated by "A" identify the center of the top and bottom infrared beams.

(Continued on next page.)
Dimensions of Light Bar Pairs (CONTINUED)

The LBP-600 Series is for Perimeter Safeguarding ONLY
DO NOT USE for Point-of-Operation Safeguarding

Table 3.6 - LBP-600 Dimensions

<table>
<thead>
<tr>
<th>Field of Coverage</th>
<th>&quot;A&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>23 (584)</td>
<td>28.55 (725)</td>
<td>29.65 (753)</td>
</tr>
<tr>
<td>36&quot;</td>
<td>35 (889)</td>
<td>40.55 (1030)</td>
<td>41.65 (1058)</td>
</tr>
<tr>
<td>40&quot;</td>
<td>39 (991)</td>
<td>44.55 (1132)</td>
<td>45.65 (1160)</td>
</tr>
<tr>
<td>52&quot;</td>
<td>51 (1295)</td>
<td>56.55 (1436)</td>
<td>57.65 (1464)</td>
</tr>
<tr>
<td>64&quot;</td>
<td>63 (1600)</td>
<td>68.55 (1741)</td>
<td>69.65 (1769)</td>
</tr>
</tbody>
</table>

Figure 3.12 - LBP-600 Series STANDARD Light Bar Pair Housings

(Continued on next page.)
Electrical Installation (Wiring and Hook-Up)

The following additional installation materials and equipment will be required:

1. **Wire**: Size and type depend on appropriate ordinance. Number 14 stranded wire with an approved insulation is recommended for control circuits. Do not use solid wire.

2. **Conduit**: Rigid or flexible as required by appropriate ordinance. The use of “oil-tight” and “dust-tight” wiring components is strongly recommended for the harsh atmospheric conditions often found in industrial plants.

3. **Miscellaneous wire connectors, electrical tape, etc.**

   **Warning! Use extreme caution to avoid electrical shock during installation or servicing. Be sure that all energy is locked out during installation and maintenance of this light curtain.**

We recommend that National Electrical Code practices be followed for wiring, especially color coding and the use of numbered wire markers on both ends of every wire. Color coding is Black for power circuits, Red for 120 VAC control circuits, White for current carrying ground (frequently referred to as the “neutral or common”), Green for any equipment grounding conductor, and Blue for any low voltage DC control circuits.

Disconnect all power from the machine and light curtain before performing any electrical wire connections or replacing any field replaceable component. Electrical connections must be made by a qualified electrician and must fully comply with the National Electrical Code and any local electrical codes or standards.

The wiring cables to the machine control do not require special shielding. The wiring terminals are designed to quickly and easily accept the incoming power and relay output connections.

All wiring terminals are located inside the control box enclosure. These terminals are accessible only by opening the cover on the control box. See Photo 3.2 on the next page for the locations of the wiring terminals in the control box. The control box enclosure has one knockout combination 0.875”/1.13” hole in the bottom for insertion of conduit and wires. This conduit entrance is for 1/2” or 3/4” hardware. Please remember that the employer/user is responsible for maintaining the enclosure’s NEMA rating by properly sealing all cable entries in the control box enclosure.

Be certain the incoming line power matches the power rating of the light curtain being connected. The light curtain is available in standard 120 VAC. A proper earth ground is required for reliable system operation.

**CONNECTING THE FIRST LIGHT BAR SEGMENTS TO THE CONTROL BOX**

The light curtain’s transmitter and receiver segments are easily connected to the control box using the factory supplied quick-connect cables. The cables on the control box are factory installed.

To connect the receiver segment to the control box cable, mate the cable with the RED connector to the receiver unit.

To connect the transmitter segment to the control box cable, mate the cable with the BLACK connector to the transmitter segment.

**CONNECTING THE CONTROL BOX**

The control box requires electrical connections for power and provides points for connection to the machine interface.

1. **Power Connections**

For AC line voltage units, bring line (black), neutral (white), and ground wiring to the control box. The line and neutral are connected to the terminal block labeled TB2 at the positions indicated. The ground wire is connected to the ground lug inside the enclosure. See Photo 3.2.

Make sure the electrical ground is properly connected first. Again, ensure the incoming line power matches the power rating of the light curtain model being connected.

2. **Machine Interface**

Insert the machine control conduit and wire into the hole at the bottom of the enclosure. Wire it to the relay board terminal block. Normally open and normally closed contacts are labeled below the terminal block. Please refer to the machine control schematic and connection diagrams.

Connect the TB1-MTS (Machine Test Signal) terminals as shown on the machine control schematic and connection diagrams (Photo 3.2).

If the MTS function is not needed, these terminals must be jumpered.

(Continued on next page.)
SECTION 3—INSTALLATION
PSD-400 Series Light Curtain System

Photo 3.2 - Inside View of Control Box

Transmitter
Receiver
Black
Red
Ground Lug
Enclosure

(Continued on next page.)
**SECTION 3—INSTALLATION**

**PSD-400 Series Light Curtain System**

**WIRING LIGHT CURTAIN TO A PLC (PROGRAMMABLE LOGIC CONTROLLER) ON A MECHANICAL POWER PRESS**

These guidelines are provided to alert the employer of the importance of proper installation when connecting the light curtain to PLCs.

To provide maximum operator protection:
- two separate signals from the light curtain must be properly wired to the PLC.
- the PLC must be properly programmed and must be self-checking.
- the Appendix B in the B11.1 ANSI Standard must be followed.

The actual details of wiring, installation and programming the PLC control system are the sole responsibility of the employer. This section only provides general guidelines for connecting the light curtain to a PLC.

Step-by-step instructions are not supplied because of the availability of many different PLCs and a variety of PLC programming methods. If you are interfacing this light curtain with a PLC, please refer to the appropriate ANSI (American National Standards Institute) Standards including B11.1 and B11.19. Also consult with the OEM, Safeguard and PLC manufacturer for their suggestions on wiring a PLC as part of the operator safety control system. Using two separate PLCs is suggested by certain PLC manufacturers for safety related applications.

When wiring the light curtain to a PLC or other microprocessor-based control, two or more independent logic systems must be used to control the machine’s stop circuit. This is necessary to ensure that the light curtain’s control reliability capability is properly transferred by the PLC to the machine’s stop circuit. Since PLCs have different scan times, these figures should be determined and added to the safety distance formula.

**Internal Control Box Features**

**DISTANCE SWITCH**

A “distance switch” is located in the upper right corner of the control panel. This switch is factory set to the short distance position. If the light bar pair is installed less than 16 feet (5 m) apart, this range setting is proper. This setting provides better immunity to harsh lighting environments such as sunlight or nearby welding equipment.

If the light bar pairs are installed over 16 feet apart, switch this setting to the long range position. This setting reduces the risk of interference between one Light Curtain System and another which may be located nearby.

**INDICATORS INSIDE CONTROL BOX**

Indicators inside the control box provide a visual indication of overall system status. These LEDs are visible only when the control box door is open (see Photo 3.2).

**Clear (Green)**

The sensing field is clear of any obstruction and the units are properly aligned.

**Blocked (Red)**

1. The sensing field is blocked or obstructed by an object larger than the unit’s minimum object sensitivity.
2. Receiver and transmitter are misaligned.
3. An internal component, which compromises the integrity of the unit, has failed.
4. An output-relay contact has welded. Replace output relay board immediately.
5. Fault in control box link cable (see Troubleshooting Section).

**Fix Blank (Amber)**

Indicates the unit has the fixed blanking option turned “on.”

**Fault Indicators**

Five indicators labeled MTS, XMTR, RCVR, CNTRLR, and ALIGN provide diagnostic information to help in troubleshooting.

1. **MTS (Amber)** is the indicator for the Machine Test Signal feature. When the MTS is open, the control sends a stop signal to the connected machine and illuminates the red and yellow indicators on the transmitter unit. When the MTS is closed, with no planned obstruction in the sensing field, a run signal is sent to the machine control. TB1-MTS terminals must be connected to each other if they are not used.
2. **XMTR (Red)** is the indicator for the Transmitter and will illuminate if there is a problem with the transmitter.
3. **RCVR (Red)** is the indicator for the Receiver and will illuminate if there is a problem with the receiver.
4. **CNTRLR (Red)** is the control box indicator. It illuminates, for example, if the relay checking circuitry detects a problem with the control relays, (i.e. a coil or contact failure). A fault condition sends a stop signal to the safeguarded machine.
5. **ALIGN (Amber)** is the alignment indicator. When it is illuminated or flashing, it warns of a possible misalignment condition of the light bars. The purpose of the indicator is to provide some visual feedback with the installation and alignment of the light curtain. On a properly installed light curtain, the indicator should be off. The following conditions may cause the indicator to flash intermittently or illuminate:
   a. The light curtain is exposed to a bright light, such as a strobe. The operation of the light curtain is not affected, although the indicator may flash.
   b. If an object is blocking the sensing field, the Alignment indicator will be on. This is normal.
   c. If blanking is turned on and an object is interrupting the sensing field, it is normal for the indicator to be on.

(Continued on next page.)

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GAIN ADJUSTMENT TRIM POTENTIOMETER

This potentiometer increases or decreases output power to the transmitter. This enables the user to adjust the light curtain for optimal performance anywhere within its operating range. Rotating this potentiometer clockwise increases the power level. This, in turn, increases the amount of infrared light emitted by the transmitter’s LED. The potentiometer is located in the center of the control panel (Photo 3.2).

Misalignment, improper gain adjustment or range settings, may increase reflective surface interference. Both physical alignment of transmitter and receiver units and the power settings of the control system electronics should be performed carefully upon installation, and checked periodically thereafter.

To adjust the potentiometer, make sure the sensing field is not obstructed. Rotate the potentiometer fully counterclockwise to minimize the power setting. Apply power to the machine.

Turn the potentiometer clockwise until the green Beam Clear indicator is illuminated on the control panel and on the transmitter bar unit. The red Beam Blocked and the amber Alignment indicators on the inside control panel will go out at the same time. If the transmitter and receiver units are properly oriented to each other and are even roughly aligned, this condition should be easily achieved.

Turn the potentiometer counterclockwise until the green Beam Clear indicator just goes out and the red Beam Blocked indicator is on. Physically adjust the positioning (vertically, horizontally, and rotationally) of the transmitter and receiver light bars until the green Beam Clear indicator turns on again. This is fine tuning the alignment of the units. If slight physical adjustments of the sensing heads do not produce a green Beam Clear indication, then your initial position was good. Secure the head mounting bolts.

To complete the electrical alignment, reduce the adjustment level until the green Beam Clear indicator goes out and the red Beam Blocked indicator illuminates. Adjust the potentiometer clockwise until the green clear indicator is just lit. Next, turn the control two (2) more turns clockwise (to prolong the life of the light curtain). This completes the alignment and adjustment procedure.

Before operating machinery equipped with a light curtain, always perform the Test Procedure. This must be done each time any setup, maintenance, modification, or adjustment to the light curtain or machine system is made, including the range adjustment. Testing is critical to verify the safe installation of the light curtain. Failure to properly test may result in serious physical injury or death to personnel.

OPERATING STATUS INDICATOR LIGHTS

The transmitter light bar has three long-life LED (Light Emitting Diode) indicator lights on the inside of the enclosure (see Figure 3.13). They are green, red and amber lights. Three LED indicators, with the same colors, are also located on the control panel inside the control box enclosure. They are visible only when the enclosure door is open. They indicate the same conditions as the light bar indicators.
TRANSMITTER STATUS INDICATOR LIGHTS

The transmitter light bar LEDs illuminate to indicate the following conditions:

Green (Clear)

1. **Green, steady**
   Indicates the sensing field is clear of any obstruction and the light bars are properly aligned. The machine should function normally when this light is on.

2. **Green, flashing**
   Indicates the unit has the float blanking option turned "on."

3. **Green, steady, Red steady**
   Indicates an alarm condition. See the Troubleshooting Procedures.

Red (Blocked)

1. **Red**
   The sensing field is blocked or obstructed, by an object larger than the unit’s minimum object sensitivity.

2. **Receiver and transmitter are misaligned.**

3. **An internal component, which compromises the integrity of the unit, has failed.**

4. **An output-relay contact has welded.** Replace relay output board immediately.

Amber (Blanking)

Indicates the unit has the fixed blanking option turned “on.” When the amber light is on, either the red or green light is also on to indicate the following conditions:

1. **Amber, steady and Green, flashing**
   Indicates that fixed and float blanking are on. The blanked channels are properly blocked and the remaining channels are clear of obstructions.

2. **Amber, steady and Green, steady**
   Indicates that fixed blanking is on. The fixed blanked channels are properly blocked.

3. **Amber, steady and Red, steady**
   Indicates that fixed blanking is active. The blanked channels are not properly blocked or the remaining channels are obstructed.

4. **Amber, steady, Red, steady and Green, steady**
   Indicates the top channel was fixed blanked. This channel cannot be blanked. Please clear this fixed blanked channel. See pages 31 - 33 for instructions.

No Lights On
See Troubleshooting Procedures.

CHANNEL INDICATOR LIGHTS

The receiver light bar is equipped with individual Channel Indicator Lights. Each infrared channel has its own visible, red indicator located near each phototransistor. The Channel Indicator Lights are helpful during alignment, and when using the fixed blanking feature. These indicator lights show when a channel is interrupted, out of alignment or blanked. See Figure 3.14. If the light curtain has a channel blocked by an object or it is not in alignment, the Channel Indicator Light, for each channel that is affected, will be on.

The blanking feature changes the function of the indicators. See Section on Blanking Procedures.

The Channel Indicator Lights are used as a visible alignment aid. They are not considered a critical component of the safety circuit. An indicator failure by itself will not cause an alarm fault and the light curtain will continue to function.

**Figure 3.14**
Channel Indicator Lights for PSD-400 Series
DISTANCE SWITCH PROCEDURE AND ALIGNMENT

At this point of the installation, the transmitter and receiver light bar segments have been installed and are approximately aligned. The control box has been mounted. All wiring to the light bar pair segments, to the primary power, and to the machine control system has been completed. Power to both the light curtain system and to the machine is off.

The distance switch is located below J2 and J3 (Photo 3.2). Make sure this switch is set to the short distance position if the light bar segments are installed less than 16 feet. If the light bar segments are installed over 16 feet apart, switch this setting to the long range position. This setting reduces the risk of interference between one Light Curtain System and another which may be located nearby.

Misalignment, improper range adjustment or range switch settings, may increase reflective surface interference. Both physical alignment of transmitter and receiver units and the power settings of the control system electronics should be performed carefully upon installation, and checked periodically thereafter.

Before operating machinery equipped with a light curtain, always perform the Test Procedure. This must be done each time any setup, maintenance, modification, or adjustment to the light curtain or machine system is made, including the range adjustment. Testing is critical to verify the safe installation of the light curtain. Failure to properly test may result in serious physical injury or death to personnel.

INITIAL POWER-UP AND CHECKOUT

The initial power-up and checkout sequence described here must be performed before the light curtain is released for production. This checkout sequence must also be followed whenever any setup or maintenance is performed on the light curtain system or the machine it is controlling, or when any modification occurs to the machine to which the light curtain has been interfaced. After completing all instructions in the Mounting and Electrical Installation Sections, the light curtain should be mounted, configured, aligned, and connected to your machinery. The machine power is off. Now perform the steps listed in the next column.

1. Verify the mounting distance of the light bar pairs is equal to or greater than the minimum safe distance from the point-of-operation hazards. See pages 7 and 8.
2. Make sure that all entries to the point-of-operation hazard that are not protected by the light curtain are safeguarded by other means, such as barrier guards, electrical interlock switches, or additional presence sensing devices. Verify that all additional safeguarding devices are installed and operating properly.
3. Make sure the operator is not able to stand between the light curtain’s sensing field and the point-of-operation hazard on the machine. This is often referred to as “pass through.”
4. Open the enclosure door of the light curtain control box. Inspect the electrical connections between the safeguarded machine’s control circuitry and the light curtain. Verify that they are properly connected to the machine so that a stop signal from the light curtain results in an immediate stop during any point in the machine’s cycle.
5. Check all the Channel Indicator Lights and make sure they are functioning properly. Either turn the receiver away from the transmitter or block each beam near the receiver. Make sure each indicator illuminates. If any indicator does not work, the receiver unit should be returned to the factory for repair.
6. Make sure the transmitter and receiver light bars are aligned before continuing.
7. To test the MTS (Machine Test Signal) feature, turn the machine power on. While cycling the machine, verify that the MTS only functions during the nonhazardous portion of the machine cycle. Without interrupting the sensing field, observe the Red indicator on the transmitter light bar illuminates and the output relays deenergize when the MTS circuit is open.

TEST PROCEDURE

When completing this test procedure, make sure these steps are followed for each light bar segment.

1. Be sure fixed or float channel blanking is not turned on.
2. Make sure there are no obstructions between the transmitter and receiver light bar lenses.
3. Apply correct power to the control box (usually 115V). If the receiver and transmitter are properly aligned, the green status LED indicator light on the transmitter should illuminate (see Figure 3.13 on page 27).
4. Break the sensing field once to cause the out-put relays to change state and the red status indicator light to illuminate.
5. Slowly block each channel successively with the proper size test rod (LBP-400 Series uses 1/2” diameter test rod). Verify the red and green status indicators flash alternately and the output relays change state or “trip” each time the object blocks each channel as it is moved through the plane of light (Figure 4.1).

(Continued on next page.)
Test Procedure (CONTINUED)

6. Insert the proper size test rod (LBP-400 Series uses 1" diameter test rod) to interrupt the plane of light (Figure 4.2). Slowly move it through the full sensing field along the center, bottom, sides, and top of the sensing field (Figure 4.3). Ensure that the transmitter’s red status indicator light remains illuminated during this test and all equipment motion is stopped. Verify that each channel indicator light is on at the test rod position while in the sensing field.

If all these system checks are positive, then proceed to the next section. If the light curtain fails any of the checks, do not proceed any further. Do not try to use the light curtain or the machine until the problem has been identified and corrected.

System Check (Function Testing)

Authorized personnel must perform the previous operational check and test procedure at the beginning of each work shift or change in setup. This checkout must be performed at least once every 24 hours. If a malfunction occurs at any step, the power should be removed from the machine. The operator should then notify their supervisor of the malfunction. Machine operation should be terminated until the cause of failure is located and corrected.

Verify the following as instructed in Section 3, General Requirements on pages 13 and 14 of this manual, before running any safeguarded equipment:

- Access to the hazards of the safeguarded machine is not possible either over, under, around, or through the light curtain or supplemental safeguarding.
- The minimum safety distance is not less than the calculated distance.
- The receiver and transmitter light bars are properly connected to the control box.
- The control box is properly closed and locked with the key removed.

If using channel blanking, please refer to the Test Procedure. If using the standard mode (no blanking), please check the following:

1. Apply power to the light curtain control box and light bars.
2. Verify the green status indicators, on the transmitters, are on.
3. Check the entire light curtain system by inserting the proper size test rod (LBP-400 Series uses 1/2" diameter test rod) at either the top or bottom of the sensing field. As the test rod slowly moves through the plane of light, verify the relays change state to the deenergized condition and the red status indicator on the transmitter and the red “system status” indicator inside the control box turns on and off. Move the test rod to the opposite end of the sensing field and repeat this test. It is extremely important that fixed blanking is not active during this procedure.
4. Select a production mode of operation. Cycle the machine in single stroke operation and insert the proper size test rod (LBP-400 Series uses 1" diameter test rod) to interrupt the plane of light (Figure 4.2). Verify that introducing the test rod anywhere in the sensing field, during the hazardous portion of the cycle, stops machine motion immediately. When doing this, never insert the test rod or your hand into the hazardous portion of the machine.

Note: Some machines use muting, which bypasses the light curtain during the nonhazardous portion of the machine cycle. Interrupting the sensing field during this time will not stop the machine.
5. With the machine stopped in the hazardous portion of the cycle, interrupt the sensing field with the proper size test rod (LBP-400 Series uses 1” diameter test rod) anywhere in the plane of light. Verify that the machine will not start with the test rod in the sensing field.

6. Make sure the braking or stopping system of the machine is working properly. If the machine does not stop fast enough, adjust this system or increase the safety distance of the light curtain.

7. If the light curtain safeguarding device or the machine fails any of these tests, do not run the machine. Immediately lockout the machine to prevent its use and notify the supervisor.

Once the checkout procedure is successfully completed, continue with normal operation. Make sure a lock or other means of supervisory control is put on the light curtain control box enclosure. If Fixed or Float Blanking is required, proceed to the Blanking Procedures.

**FIXED BLANKING PROCEDURES**

**Blanking Precautions**

Fixed blanking should be avoided. It should only be used as a last resort. Never blank an excessive number of channels in succession so that someone can reach their hand, arm, or any body part into the hazardous point-of-operation area. When blanking, only one or two channels maximum should be blanked for convenience of piecepart feeding. The safety distance increases when using the blanking feature.

When a light curtain is put into a production situation, avoid blanking any channels. When blanking one channel, a 1/2” blanked area has been created in the plane of light, where an operator can put their hand through. For each additional adjacent channel that is blanked, an additional 1/2” blanked area has been created.

When one channel is blanked, the minimum safety distance increases 4.2”. (See Table 4.1.) For each additional adjacent channel that is blanked, 1.7” is added to the safety distance.

**CHANNEL INDICATOR LIGHTS**

The function of the Channel Indicator Lights (on the receiver) changes when using the blanking function. The channel indicator lights, when not blanking, illuminate if a channel (beam) is interrupted by an object or when the light bars are out of alignment. When fixed (channel) blanking is used, the channel indicator lights will be off when the channel is blocked by an object. If the object is removed from the channel(s) that is programmed to be blanked, the channel indicator light(s) will illuminate.

---

**FIXED BLANKING SETUP**

With supervision, the light curtain can be quickly and easily blanked. When this feature is used, it disables selective, fixed areas in the light curtain’s sensing field. This means it can ignore a partial blockage within its sensing field. This is done by programming and covering various channels at fixed locations. When a channel is blanked (turned off), it is programmed to ignore any object that permanently blocks a blanked channel(s).

### Table 4.1

<table>
<thead>
<tr>
<th>No. of Blanked Channels</th>
<th>Minimum Object Sensitivity</th>
<th>Depth Penetration Factor (additional safety distance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1” (25 mm)</td>
<td>2.5” (63 mm)</td>
</tr>
<tr>
<td>1</td>
<td>1.5” (38 mm)</td>
<td>4.2” (106 mm)</td>
</tr>
<tr>
<td>2</td>
<td>2” (51 mm)</td>
<td>5.9” (149 mm)</td>
</tr>
<tr>
<td>3</td>
<td>2.5” (64 mm)</td>
<td>7.6” (192 mm)</td>
</tr>
<tr>
<td>4</td>
<td>3” (76 mm)</td>
<td>9.3” (235 mm)</td>
</tr>
<tr>
<td>5</td>
<td>3.5” (89 mm)</td>
<td>11” (278 mm)</td>
</tr>
</tbody>
</table>

These objects can include tooling, dies, fixtures, work tables, clamps, brackets, pieceparts, and other workholding devices. Included with the light curtain is one “blanker” (Part No. KYM-280) which can be used to block one channel (7/8” - First Blanker), and one additional blanker (Part No. KYM-281) for adjacent channels (1/2” - Additional Blanker). The stickers on the front of the blankers are bright orange so they can be easily identified by supervisory personnel. This also minimizes misuse of the blanking feature. The blankers are made of flexible -shaped plastic and can easily slip onto the receiver when blanking is required. See Figure 4.4.

**Note:** The blanker should only be attached to the receiver.

The top channel (furthest from the cable connector) on the light bars cannot be fixed or float blanked.

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Figure 4.4
**SECTION 4—CHECKOUT AND OPERATION**

**PSD-400 Series Light Curtain System**

**FIXED BLANKING SETUP (CONTINUED)**

If this system does not react exactly as described, remove power from the light curtain and the machine. Notify supervisory personnel immediately. The machine should not be operated until the malfunction is diagnosed and corrected.

Once channels have been blanked (using the fixed blanking procedure described), the light curtain “remembers” the blanked channels, even when power is removed, until this setup procedure is disabled or the blanking feature is turned off.

As an additional safety feature, the light curtain is designed to constantly monitor each blanked channel to make sure that the blockage is present. If the blanked channels are not blocked, then it will indicate an unsafe (red) condition; the machine will not operate until the blanked channels are blocked, or the programmable blanking switch is reset and blanking is turned off.

**Note:** When using fixed blanking, once a channel is blanked, it must remain blocked or obstructed in order for the light curtain to allow the machine to operate in a normal manner.

**SETUP PROCEDURE FOR FIXED BLANKING (CHANNEL SELECT)**

1. Verify the machine is clear of obstructions and the light curtains are aligned by looking at the individual channel indicator lights on the receiver. All channel indicator lights should be off and the green status indicator light should be on.

2. Select which channels are to be blanked by inserting tool, die, orange blanker or other object in the plane of light. These do not need to be consecutive channels. **Remember, the top channel cannot be blanked.** The green status indicator light goes out and the red status indicator (on the transmitter) should light up, indicating an obstruction in the sensing field. If the red status indicator does not light up or the relays do not deenergize, stop and refer to the Troubleshooting Section.

3. To activate and program the blanked channels, turn the spring-return “Blanking Selector Keyswitch” to the “Program” position. Allow it to return to the “Run” position. This switch is located on the enclosure cover of the control box. The red status indicator light remains on and the green and amber status indicator lights on the transmitter illuminate.

4. Turn this selector switch to the “Reset” position. Allow it to return to the “Run” position. These channels are now stored in memory as blanked channels. The red status indicator light on the transmitter goes out. The green and amber status indicator lights remain on.

5. Perform the 6-step Blanking Test Procedure, below, to verify that only the chosen channels are blanked.

6. If the blanked channels are incorrect, repeat steps 1 through 5.

**FIXED BLANKING TEST PROCEDURE**

1. Check the operation of the channels that were not blanked by inserting the proper size test rod (LBP-400 Series uses 1/2” diameter test rod) from the top to the bottom of the sensing field, near the transmitter, blocking each channel successively. Verify the red and green status indicator lights flash alternately, each channel indicator light is on at the test rod position, and the output relays change state as the test rod is slowly moved through the plane of light.

2. Remove the test rod and the obstruction(s) (tool, fixture, blanker, etc.), from the blanked area(s) of the sensing field, placed in step 2 under Setup Procedure. Verify that the green status indicator light goes out, the yellow status indicator light remains on, and the red status indicator light and channel indicator lights on the blanked channel(s) illuminate, indicating removal of an obstruction from the blanked area. Verify that output relays change state accordingly.

3. Replace the obstruction(s) at the exact former position. Make sure the channel indicator light(s) go off. Verify the red status indicator light goes out, the green status indicator light goes on, and the relays change state.

**Note:** Channels that are blanked must always be obstructed for the machine to run. If they are obstructed, the Channel Indicator Lights are off. If the blanked channel(s) are unobstructed, the Channel Indicator Lights will be on.

4. Select a production mode of operation.

5. Check the entire light curtain system by cycling the equipment in single stroke operation and inserting the proper size test rod (LBP-400 Series uses 1” diameter test rod) into the sensing field where channels were not blanked. Verify that introducing the rod anywhere in the nonblanked channels of the sensing field, during the hazardous portion of the cycle, stops machine motion.

6. With the machine stopped, interrupt the sensing field with the proper size test rod (LBP-400 Series uses 1” diameter test rod) anywhere in the nonblanked channels of the sensing field during the hazardous portion of the cycle. Verify that the machine will not start with the test rod in the sensing field. Once these procedures are successfully completed, proceed with normal operation.

(Continued on next page.)
SECTION 4—CHECKOUT AND OPERATION

PSD-400 Series Light Curtain System

TURNING OFF FIXED BLANK (CHANNEL SELECT) CHANNELS

1. Verify the machine is clear of obstructions and the point of operation is properly safeguarded.

2. Remove the tool, die, orange blanker or object(s) previously inserted in the sensing field. The red status indicator light goes on, the amber status indicator light remains on, and the relays should deenergize. This indicates the removal of an obstruction from the blanked area.

3. Turn the spring-return “Blanking Selector Keyswitch” to the “Program” position. Allow it to return to the “Run” position. The channels that were blanked are now active, nonblanked channels. The amber status indicator light will go off.

4. Turn the spring-return “Blanking Selector Keyswitch” to the “Reset” position. Allow it to return to the “Run” position. The green status indicator light will go on.

5. Check the operation of the channels by inserting the proper size test rod (LBP-400 Series uses 1/2” diameter test rod) from the top to the bottom of the sensing field, near the transmitter, blocking each channel successively. Verify the red and green status indicator lights flash alternately and the output relays change state as the test rod is slowly moved through the plane of light.

6. Make sure there is power to the machine and check the entire light curtain system by cycling the equipment in single stroke operation and inserting the proper size test rod into the sensing field (LBP-400 Series uses 1” diameter test rod). Verify that introducing the rod anywhere in the sensing field, during the hazardous portion of the cycle, either stops equipment or prevents motion.

All situations that may occur to the sensing field must be carefully considered prior to using blanking. This feature may cause the light curtain to be less sensitive to objects in the sensing field. The minimum safe distance must be increased when blanking channels; failure to do so may cause serious physical injury or death.

FLOAT BLANKING PROCEDURE

Up to two (2) channels can be programmed for float blanking. This means up to two channels can be blocked anywhere in the sensing field without the control box sending a stop signal to the protected machine.

Once float blanking has been programmed, the number of blanked channels, or less, can be blocked anywhere along the entire length of view, except for the top channel furthest from the cable connectors.

Both fixed and float blanking can also be used together for added flexibility in your machine safeguarding needs. Be sure to follow the instructions in the Section: Using Fixed Blanking with Float Blanking if these features will be programmed together.

Float blanking does not change the operation of the Channel Indicator Lights. The indicators will show the position of the object when it is inserted into the plane of light.

SETUP PROCEDURE FOR FLOAT BLANKING

1. Verify the machine is clear of obstructions and the light bar pairs are aligned by looking at the channel indicator lights on the receiver. No channel indicator lights should be on. The green status indicator light should be on.

2. Turn the “Float Blanking Switch” from the “Off” position to Position “1” or “2.” “1” is for one channel float and “2” is for two channel float. The red status indicator light will illuminate. If the red status indicator light does not light up, stop and refer to the Troubleshooting Section.

3. To activate the “floating” channel(s), turn the spring-return “Blanking Selector Keyswitch” to the “Reset” position. Allow it to return to the “Run” position. The green status indicator light on the transmitter will flash. The relays should energize. As long as the number of obstructed channels does not exceed what is programmed, the system will continue to operate normally.

4. Perform the Blanking Test Procedure to verify that only the chosen channels are blanked.

5. If the blanked channels are incorrect, repeat steps 1 through 4.

FLOAT BLANKING TEST PROCEDURE

1. Check the operation of the channels by inserting the proper size test object into the plane of light. This test object size is based on if one or two channels are being float blanked (see Table 4.1 on page 31). Insert the test object from the top to the bottom of the sensing field, near the transmitter, blocking each channel successively. Verify the green status indicator light remains on and the red status indicator light does not come on.

2. Remove the test object placed in step 1. Place a larger test object anywhere in the sensing field. Verify that the red status indicator light goes on. The green status indicator light remains on, and the relays should change state accordingly.

3. Remove the obstruction in the sensing field. Verify the red status indicator light goes out, the green status indicator light flashes, and the relays change state.

4. Select a production mode of operation.

5. Check the entire light curtain system by cycling the machine in single stroke operation and inserting a larger object anywhere in the sensing field. Verify that introducing the object anywhere in the sensing field either prevents the machine from operating or stops motion.

6. With the machine stopped, interrupt the sensing field with the proper size test object anywhere in the sensing field. Verify that the machine will not start with the test object in the sensing field.

Once these procedures are successfully completed, proceed with normal operation.

(Continued on next page.)
TURNING OFF FLOAT BLANKING

1. Verify the machine is clear of obstructions and the point of operation is properly safeguarded.

2. Turn the “Float Blanking Switch” from the “1” or “2” position to the “Off” position. The green status indicator light will go off and the red status indicator light will illuminate.

3. Turn the spring-return “Blanking Selector Keyswitch” to the “Reset” position. Allow it to return to the “Run” position. The red status indicator light will go out; the green status indicator light should turn on and the relays should energize.

4. Check the operation of the channels by inserting the proper size test rod from the top to the bottom of the sensing field, near the transmitter, blocking each channel successively. Verify the red and green status indicator lights flash alternately and the output relays change state as the test rod is moved through the plane of light.

5. Make sure there is power to the machine and check the entire light curtain system by cycling the machine in single stroke operation and inserting the larger test rod into the sensing field. Verify that introducing the rod anywhere in the sensing field, during the hazardous portion of the cycle, either stops the machine or prevents motion.

Once these procedures are successfully completed, proceed with normal operation.

USING FIXED BLANKING WITH FLOAT BLANKING

As mentioned previously, float blanking can be used with fixed blanking to allow additional flexibility with your safeguarding requirements.

Float Blanking alters the function of Fixed Blanking when both are active. The following are certain points to remember if using both blanking features.

If Fixed and Float Blanking are off, an interruption of any beam in the sensing field causes the output relays to turn off. This sends a stop signal to the safeguarded machine.

If one channel Float Blanking is programmed, and one beam is blocked, Float Blanking takes precedence and allows a machine run condition to continue. Another way of looking at this is that one beam Float Blanking allows one exception; two beam Float Blanking allows two exceptions. This means a beam which is supposed to be clear and is actually blocked is considered an exception by Float Blanking.

Next, consider a situation where two channels have been programmed for fixed blanking. One beam Float Blanking is also active. Fixed Blanking requires that the beams programmed to be blocked are actually blocked. Float Blanking modifies this requirement by again allowing an exception. In this case, if one beam of the two that are programmed for Fixed Blanking is unblocked, one beam Float Blanking interprets this as one exception and allows a machine run condition to continue. Now, cause a situation that requires two exceptions, by either unblocking another Fix Blanked channel, or interrupting a channel which is supposed to be clear. In this situation, two exceptions have occurred, one beam Float Blanking can only allow one exception; therefore, a stop signal is sent to the machine.

To summarize this feature, a beam which has been programmed to be unblocked and is actually blocked is counted as one beam floating. Likewise, a beam programmed to be blocked and is actually unblocked is also considered as one beam floating.

If this feature is used, remember the safety distance must be increased because the minimum object sensitivity increases. See Table 1.2 on page 8 and Table 4.1 on page 31. If additional information is required, please consult factory.

If using this feature, all situations that may occur to the sensing field must be carefully considered before using it. Again, this feature may cause the light curtain to be less sensitive to objects in the sensing field. The minimum safe distance must be increased; failure to do so may cause serious physical injury or death.
MUTING THE LIGHT CURTAIN

The light curtains in this manual can be muted during the nonhazardous portion of the stroke or cycle of the machine or equipment. On machines that stroke (presses and press brakes), the muting can start at a point in the hazardous motion where the opening is 1/4” or less, or at a point in the stroke where the hazard is eliminated by the time someone can reach into it. This muting can be applied to machines that are down-, up-, or horizontal-acting.

On a mechanically powered machine, the mute signal usually comes from a timing device such as a rotary cam limit switch assembly or a rotary resolver that uses the rotary motion of the crankshaft. See Figure 4.6.

On a hydraulically or pneumatically powered machine, the mute signal usually comes from a timing device such as a linear cam switch assembly or a linear resolver that uses the linear motion of the slide, ram, platen, etc. See Figure 4.7.

See the machine’s electrical schematics for applying the mute feature to the machine utilizing the timing functions, or contact factory for assistance.

TROUBLESHOOTING

The most effective troubleshooting begins with accurate observation of system operating behavior. This often leads directly to the cause of the problem. Please note that the only user-replaceable components in this light curtain system are the fuse and output relays in the control box. Do not open the transmitter or receiver housing. They contain no user serviceable parts and doing so will void the warranty.

Before troubleshooting the light curtain, make sure there are no obstructions in the plane of light and all blanking has been turned off. See Section 5 for lens cleaning instructions. Use Table 4.2 to identify symptoms and to determine possible causes. After determining the problem may be caused by a specific malfunctioning component, the next step is to replace that component.

Please use the appropriate component replacement procedure found later in this manual when doing this. If nothing can be found or it still does not operate properly, return the unit to factory for repair. When returning the light curtain, provide as much information about the symptoms as possible. See later page for RMA Request Form.

<table>
<thead>
<tr>
<th>Transmitter Bar Indicators</th>
<th>Internal Indicators (Control)</th>
<th>POSSIBLE PROBLEM AND ACTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Green</td>
<td>Amber</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Off</td>
<td>Off</td>
<td>Off</td>
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<tr>
<td>Off</td>
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</tr>
<tr>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>

Table 4.2
SECTION 5—MAINTENANCE
PSD-400 Series Light Curtain System

LENSES
Periodically check and clean excess buildup of oil, grease, dust, or other foreign debris on the lens filter covers of the transmitter and receiver light bars. This debris can affect the operation of the light curtain. Recommended cleaning procedure is to wash the filter and bezel using a soft, lint-free cloth and isopropyl alcohol, commercial glass cleaner, or soap and water. Do not use solvents that might effect the lens cover.

The control relays were selected to work with the relay checking circuitry. Never substitute another manufacturer’s part. Only use factory supplied replacement relays or the operation of the light curtain may be impaired, possibly resulting in a severe hazard to the operator.

The painted surface of the light curtain may be cleaned with a mild degreasing cleaner, detergent, or isopropyl alcohol.

COMPONENT REMOVAL AND REPLACEMENT
This section has instructions for the removal and replacement of specific components. Again, the only field replaceable components are the relays and the fuses in the control box. If other parts need replacement, please contact our sales/service department for an RMA number. See last page in this manual for the Return Materials Authorization Request Form.

After replacement of any component or unit, make sure the Power-up and Checkout Procedure is completed. Make sure all power is disconnected before starting any procedures.

RELAY REPLACEMENT PROCEDURE
Any sign of relay wear would warrant relay replacement. If relay K1 or K2 requires replacement, the complete relay board must be replaced.

RELAY BOARD REMOVAL PROCEDURE
1. Remove power from the machine and the light curtain.
2. Unlock the control box enclosure and open the cover.
3. Locate the output relay board (see Photo 3.2 on page 25). K1 and K2 are the output relays.
4. Remove the four screws holding the output relay board in place and any wiring. Remove the J7 connector. Remove the output relay board from the box.
5. Check relay continuity with an ohmmeter. If one relay is bad, replace the output relay board. Verify the replacement output relay board matches the removed board.

(Continued on next page.)

REPLACING FUSE F1 AND F2
1. Remove power from the machine and the light curtain.
2. Unlock the control box enclosure and open the cover.
3. Pull fuse F1 or F2 from the socket. Check the fuse. If a new fuse is required, use only an exact replacement. Use Part No. RTY-021 for F1 and Part No. RTY-022 for F2.

LIGHT BAR REMOVAL AND REPLACEMENT
1. Remove power from the machine and the light curtain.
2. Disconnect the cable at the transmitter or receiver connector.
3. Remove the transmitter/receiver from the mounting bracket.
4. Verify that the replacement transmitter/receiver is the same length as the removed unit. Mount the replacement transmitter/receiver to the mounting bracket and make sure both light bar pairs are aligned.
5. Connect the control box cables to the transmitter/receiver connectors.
6. Apply power to the light curtain. Do the Checkout Procedure on the repaired system.
STANDARDS

The light curtain meets or exceeds applicable OSHA, ANSI and RIA Standards. Additionally, the light curtain is designed to meet UL, CSA, BSI and other evolving world standards.

ANSI (American National Standards Institute): ANSI is an association of industry representatives who develop technical standards that include safety standards. ANSI Standards exist for mechanical power presses (ANSI B11.1), hydraulic presses (ANSI B11.2), industrial robots and robot systems (ANSI/RIA R15.06), and many other machine tools. ANSI Standards represent a consensus of opinions from numerous industries on best safety practices and design.

Barrier Guards: Mechanical barriers that prevent an operator or other personnel from reaching over, under, around, or through the defined area of an installed light curtain and into the point of operation of the safeguarded machine. Barrier guards include bars, screens, expanded metal, channel, rod and other mechanical barriers.

Captive-Contact Safety Relays: A type of relay contact configuration where the contacts are locked together such that if one set of contacts weld, the other contacts cannot change state. They are also called safety relays, forced contacts, or locked contacts.

Channel Blanking: Selecting specific channels to ignore a specific obstruction within the sensing field. These objects could include die fixtures, brackets and other workholding tools.

Channel Indicators: Indicators on the light bar receiver to help with alignment of the light bar pairs.


Control Reliability: The following is extracted from the sources referenced at the conclusion of each citing:

"...control circuits shall incorporate features to minimize the possibility of an unintended stroke in the event of the failure of a control component to function properly, including relays, limit switches, and static output circuits." (OSHA CFR 1910.217 (b)(8)(v))

"...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." (OSHA CFR 1910.217 Mechanical Power Presses)

"...control circuits shall be designed and constructed so that a single failure or fault within the system does not prevent the normal stopping action from being applied to the press when required, or does not create an unintended stroking action, but does prevent initiation of a successive stroke until the failure is corrected." (ANSI B11.1-1988—Mechanical Power Presses)

"...control shall be designed to prevent initiation of a stroke signal in the event that a failure occurs within the press control." (ANSI B11.2-1982—Hydraulic Presses)

“Robots shall be designed and constructed so that any single, reasonably foreseeable failure will not cause hazardous motion of the robot.” (ANSI/RIA R15.06-1986)

Defined Area: The curtain or plane of light that is created between the receiver and transmitter. When the defined area is interrupted by an opaque object of a specified cross-section, a signal is given.

Machine Response Time: The time between the interruption by the Final Switching Devices (FSDs) of the electrical supply to the Machine Primary Control Element(s) (MPCEs) and the instant when the dangerous parts of the machine are stopped.

Minimum Object Sensitivity (MOS): The minimum object size that a light curtain will reliably detect at any point in the sensing field. Objects equal to or greater than the MOS will be detected anywhere in the sensing field. Objects less than the MOS may pass undetected through the sensing field if they pass exactly midway between two adjacent light beams.

OSHA (Occupational Safety and Health Administration): A U.S. Federal agency, Division of the U.S. Department of Labor, responsible for regulating workplace safety. OSHA Regulations often reference ANSI Standards, including mechanical power press requirements (OSHA CFR 1910.217).

OSHA Approved or Recognized: OSHA does not establish and/or recognize, approve or recommend any manufacturers’ device, component, or machine. OSHA is authorized to establish and enforce regulations on workplace safety. It is the responsibility of the buyer/user/employer to determine that a light curtain meets OSHA Regulations or ANSI Standards. These requirements are very specific, such as requiring that a safety light curtain incorporate “control reliability” in its design.

Output Relays: With a safeguarding device, such as a light curtain, the output relays are the devices used to initiate an output signal to stop the machine. Output relays must be checked for coil shorts, welded contacts, and an open circuit in the coil in order to be in compliance with OSHA (1910.217). Advanced designs utilize captive-contact safety relays in order to realize the necessary level of safety required of a light curtain.

Penetration Depth Factor: Under OSHA and ANSI, a presence sensing device must have a minimum object sensitivity (MOS) to detect a hand or finger as they may penetrate the sensing field. When channels are blanked, the hands or fingers can penetrate further before detection. To maintain the minimum safety distance when channels are blanked, the light curtain must be located further away from the point-of-operation hazard by the distance referred to as the penetration depth factor. See page 8.

Perimeter Safeguarding: A work envelope that is safeguarded so that a person entering is detected. The sensing field consists of the perimeter only.

(Continued on next page.)
SECTION 6—GLOSSARY

PSD-400 Series Light Curtain System

**Pinch Point (See also Point of Operation):** Any point of operation where it is possible for part of the body to be caught between the moving parts of a machine or auxiliary equipment, or between moving and stationary parts of a machine or auxiliary equipment, or between the material and moving part or parts of the machine or auxiliary equipment.

**Point of Operation:** The area of the machine where material is positioned and work is being performed during any process such as shearing, punching, forming, welding, or assembling. (ANSI B11.1)

**Presence Sensing Safety Device:** A device that may be referred to as light curtains or light screens. It is designed, constructed and arranged to create a sensing field, area, or plane that will detect the presence of a body part or other object. (ANSI B11.1)

**PSDI (Presence Sensing Device Initiation):** A term used in an industrial machine control application where a presence sensing device is used to start the cycle of the machine. The presence sensing device also has to safeguard the machine.

**Receiver:** The unit that receives light from the transmitter, and is composed of a row of synchronized photo-transistors. The receiver detects a curtain or screen of light called the defined area when it is placed opposite the transmitter. The receiver is also referred to as the detector.

**Resolution:** The minimum object size that a safety light curtain can detect anywhere within its sensing field. The minimum object sensitivity is increased (less sensitive) and the minimum safety distance would become greater when channels are blanked.

**Response Time:** The length of time that elapses between the interruption of the light beam and the output signal from the light curtain. Response time must always include the reaction time of the output device(s) (i.e. relays) specified in milliseconds.

**Safeguarded Machine:** The machine whose point of operation hazard is protected.

**Safety Distance:** Distance between the nearest pinch point in the point of operation and the light curtain sensing field; arranged so that the operator cannot reach the pinch point before the machine comes to a full stop. There is a direct relationship between the response time of a light curtain and the proximity to the machine: the quicker the total response time, of the machine and light curtain, the closer the curtain can be installed to the point of operation.

**Self-Checking:** The ability to electronically verify that all critical internal components, and their redundant counterparts, are working properly.

**Single Component Failure:** ANSI B11.1 specifies that safety devices shall not allow a single component failure which could result in an unsafe condition. Redundancy and cross- or self-checking are required so that a single component failure does not create an unsafe condition in the light curtain’s response.

**Through-Beam:** A system consisting of a transmitter and receiver in separate enclosures facing one another. The light beams are transmitted from an array of LEDs in the transmitter to an array of photo-detectors in the receiver.

**Transmitter:** The light-emitting unit consisting of a row of synchronized modulated infrared LEDs. The transmitter emits and the receiver detects infrared light (when placed opposite) creating a curtain or screen of light called the defined area.
PRESS BRAKE TABLES

To install these tables, select the mounting location and drill holes for the mounting brackets on the bed of the machine. Fasten the mounting bracket to the machine using the fasteners provided. Next insert the table into the mounting bracket and adjust it to the desired position.

After installation of the table on a press brake, a physical line can be scribed or painted on the table surface to indicate the light curtain’s plane of light. This line would indicate how far forward the operator can reach before being detected. These tables can also be used to support the piecepart and provide a reference point for blanking the light curtain, if required.

Table 7.1

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFS-089</td>
<td>Adjustable Table for 4' Press Brake</td>
<td>10”</td>
</tr>
<tr>
<td>FFS-090</td>
<td>Adjustable Table for 6' Press Brake</td>
<td>14”</td>
</tr>
<tr>
<td>FFS-091</td>
<td>Adjustable Table for 8' Press Brake</td>
<td>14”</td>
</tr>
<tr>
<td>FFS-092</td>
<td>Adjustable Table for 10' Press Brake</td>
<td>16”</td>
</tr>
<tr>
<td>FFS-093</td>
<td>Adjustable Table for 12' Press Brake</td>
<td>16”</td>
</tr>
</tbody>
</table>

For tables over 12’ please consult factory.

“NO-GO” INDICATOR LIGHT

The red “No-Go” indicator provides feedback so the operators can hold the piecepart in the correct position. At the same time, the indicator will let them know if their hand or piecepart is being detected by the light curtain. The red “No-Go” indicator light can be wired into new or existing light curtain installations.

Drill a hole on the side of the box for a conduit connection. To maintain the sealing, the conduit connection should be carefully made. Because the connection must be securely tightened, angled connectors should not be used.

The use of Sealtite is strongly recommended when installing the unit on moving parts of the machine such as the ram. When installed in this fashion, provide enough extra Sealtite to allow for the moving part to go through the full range of ram adjustment and motion without putting strain on the connection. Too much Sealtite can cause rubbing on other stationary machine parts.

The “No-Go” indicator should be mounted in the peripheral sight of the operator, on the ram or upper frame of the press brake, using four 1/4-20 screws and the four mounting holes provided on the box mounting tabs. To disassemble the front cover from the box, loosen the four screws from the front cover until they are completely free from the box, but not removed from the cover. Pull the cover off the mounting box. The connections to the indicator can be made on the saddle clamp terminals provided on the bottom of the indicator base. The voltage for the transformer style lamp is 120VAC 50/60 Hz. Wire sizes AWG 18-14 are recommended and AWG 12 could be used if only a few wires are required. Wire should be stripped 5/16”. The use of spade or ring terminals is not recommended.
SECTION 7—INSTALLATION OF ACCESSORIES

PSD-400 Series Light Curtain System

“NO-GO” INDICATOR LIGHT (CONTINUED)

Wires must be positioned so they are below the receptacle gasket sealing surface. The screws used to assemble the front cover to the box should be tightened for proper sealing after the wiring connections are made.

Connections to the light curtain can be made in several ways depending on the light curtain being used and the control it is connected to. See Figure 7.1 for general connection instructions.

The light curtain has a spare N/C (Normally Closed) monitor relay output contact capable of switching 120 VAC. It is used to signal the indicator. This N/C contact will be open when the light curtain is powered up and the light beams are clear from obstructions. It will close when the light curtain is interrupted by an obstruction.

MOUNTING BRACKET INSTALLATION

These stationary, non-swing-away light-curtain mounting brackets are heavy-duty and versatile. Their design allows them to be tailored to each individual machine. They are available in two-, three-, or five-section assemblies and are custom-built. Two of these brackets can also be furnished with integral guarding material. See measurement forms on pages 44 and 45 when ordering.

SWING-AWAY MOUNTING

BRACKETS (SAB-A AND SAB-NA)

These mounting brackets are ideal for presses and press brakes when the light curtain must be swung out of the way for die changes or maintenance. The transmitter and receiver are easily aligned when swung back into the operating position. The 2” square extruded aluminum brackets include side barrier guards as shown. The nonadjustable section of these guards are constructed of black or yellow (1/2” sq.) mesh, or polycarbonate. The lower portion of the guard can be constructed of adjustable steel hairpins.

Swing-away brackets and barriers guards are built to specifications. See measurement forms on pages 45-47.
SECTION 7—INSTALLATION OF ACCESSORIES
PSD-400 Series Light Curtain System

MOUNTING LIGHT CURTAINS TO PRESS BRAKES

This illustration shows the top view of a press brake with the swing-away mounting brackets. The light curtain can be swung out of the way for changing dies or for maintenance.

Be sure that the area not protected by the light curtain is safeguarded by some other means, such as barriers.

INSTALLATION OF FLOOR STANDS

When light curtains (transmitter or receiver) cannot be conveniently mounted to the machine in a point-of-operation safeguarding application, a floor stand can be furnished. Floor stands can also be used when safeguarding large work envelope or perimeter areas. Mirrors or single beam devices can be attached to the floor stand when the application requires multiple-sided safeguarding. Light curtains, single beam devices, or mirrors can easily be adjusted up or down on any side of the extruded aluminum floor stand.

This floor stand assembly consists of a 6’ length of 2” square extruded aluminum, one base, and two right angle brackets with fasteners. The base has four holes for permanent attachment to the floor with bolts (not furnished). Other floor stand sizes are available. Please consult factory.

Part No. KTR-077
6 foot floor stand assembly (one)
MIRRORS FOR LIGHT CURTAINS

Mirrors can be used with the light curtains to protect more than one side of the point of operation or work envelope. They can help protect two, three and even four sides of the point of operation or perimeter area.

The mirrors are usually mounted on a 45° angle at each corner of the area to be safeguarded. Convenient mounting brackets are provided along with a set of shock and vibration isolation mounting fasteners.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description of Mirror</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Mount</td>
<td></td>
</tr>
<tr>
<td>KTR-026</td>
<td>7” Field of Coverage</td>
</tr>
<tr>
<td>KTR-034</td>
<td>12” Field of Coverage</td>
</tr>
<tr>
<td>KTR-003</td>
<td>16” Field of Coverage</td>
</tr>
<tr>
<td>KTR-036</td>
<td>18” Field of Coverage</td>
</tr>
<tr>
<td>KTR-028</td>
<td>21” Field of Coverage</td>
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<tr>
<td>KTR-061</td>
<td>24” Field of Coverage</td>
</tr>
<tr>
<td>KTR-030</td>
<td>28” Field of Coverage</td>
</tr>
<tr>
<td>KTR-032</td>
<td>35” Field of Coverage</td>
</tr>
<tr>
<td>KTR-043</td>
<td>42” Field of Coverage</td>
</tr>
<tr>
<td>KTR-062</td>
<td>50” Field of Coverage</td>
</tr>
<tr>
<td>KTR-064</td>
<td>64” Field of Coverage</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description of Mirror</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Stand Mount</td>
<td></td>
</tr>
<tr>
<td>KTR-027</td>
<td>7” Field of Coverage</td>
</tr>
<tr>
<td>KTR-035</td>
<td>12” Field of Coverage</td>
</tr>
<tr>
<td>KTR-005</td>
<td>16” Field of Coverage</td>
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<tr>
<td>KTR-037</td>
<td>18” Field of Coverage</td>
</tr>
<tr>
<td>KTR-029</td>
<td>21” Field of Coverage</td>
</tr>
<tr>
<td>KTR-069</td>
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</tr>
<tr>
<td>KTR-031</td>
<td>28” Field of Coverage</td>
</tr>
<tr>
<td>KTR-033</td>
<td>35” Field of Coverage</td>
</tr>
<tr>
<td>KTR-044</td>
<td>42” Field of Coverage</td>
</tr>
<tr>
<td>KTR-045</td>
<td>48” Field of Coverage</td>
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<tr>
<td>KTR-070</td>
<td>56” Field of Coverage</td>
</tr>
<tr>
<td>KTR-071</td>
<td>64” Field of Coverage</td>
</tr>
</tbody>
</table>

BARRIER GUARDS

LEFT AND RIGHT OF BOLSTER ON MECHANICAL POWER PRESSES

“AP1” Adjustable panel in lower section of panel

AP1 panels are typically furnished for power presses when barrier guards are required to protect the hazard area not protected by the light curtain. Please see page 46 for measurement form. 1/2” square black or yellow mesh is fastened into the aluminum frames for permanent assembly, while adjustable steel hairpins are located in the lower section of the panel.

When applying this type of panel, be sure the feed-line height is considered for hairpin adjustment. Typically hairpin adjustment is approximately half the panel height unless specified differently. Roof sections may also be needed on each panel. Mounts for these panels are found on page 43.

LEFT AND RIGHT OF RAM ON PRESS BRAKES

Nonadjustable panels

Nonadjustable panels are typically furnished for press brakes when barriers are required to protect the hazard area not protected by light curtains. Please see page 47 for measurement form. 1/2” square black or yellow mesh is fastened into the aluminum frames for permanent assembly.
SECTION 7—INSTALLATION OF ACCESSORIES
PSD-400 Series Light Curtain System

MOUNTS
These standard mounts are designed to attach guards to the frame of the machine. They are furnished complete with all mounting hardware, fasteners and panel connectors necessary to install the guard.

| SFM | SFM-7 |
| SFM-24 | FFM |

OTHER PANEL FRAME CONSTRUCTIONS AVAILABLE
AP2 - Lower Section - 5/8 Frame
AP3 - Lower Section - 3/4 Frame
AP4 - Interior Section - Full Frame
AP5 - Lower Section - Full Frame
API - Lower Section - Inclined

NONADJUSTABLE AREA
CONSTRUCTION
1. H"or 1"Square
   Black Mesh
2. H"or 1"Square
   Yellow Mesh
3. Polycarbonate

PANEL SEGMENT TYPE
1. Feeding (FS)
2. Adjustable (AS)
3. Polycarbonate (PCS)
4. Empty (ES)
If more than one machine is to be measured, please make copies of this page.

Check the required stationary bracket. If the standard dimensions specified here do not fit your application, indicate the dimensions required. “A” dimension for all brackets should be a minimum of 8” more than the light curtain “field of coverage” height.

### SB-2

- **2-Section Mounting Bracket (2 Dimensional)**
  - **A**:
    - Std: 32”
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 

### SB-3 OBI

- **3-Section Mounting Bracket (3 Dimensional)**
  - **A**:
    - Std: 32”
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 24”
  - **C**:
    - Std: 
    - Req’d: 12” (3” Min.)

### SB-3 SS

- **3-Section Mounting Bracket (2 Dimensional)**
  - **A**:
    - Std: 
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 12”

### SB-3 SSG

- **3-Section Mounting Bracket (2 Dimensional) With Guards**
  - **A**:
    - Std: 44”
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 12”
  - **Guard Mat’l**:
    - Std: 
    - Req’d: Blk

### SB-5

- **5-Section Mounting Bracket (3 Dimensional)**
  - **A**:
    - Std: 36”
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 24”
  - **C**:
    - Std: 
    - Req’d: 12” (3” Min.)

### SB-5 G

- **5-Section Mounting Bracket (2 Dimensional) With Guards**
  - **A**:
    - Std: 36”
    - Req’d: 
  - **B**:
    - Std: 
    - Req’d: 24”
  - **C**:
    - Std: 
    - Req’d: 12” (3” Min.)
  - **Guard Mat’l**:
    - Std: 
    - Req’d: Blk

*B dimension must include safety distance. Stopping time of the machine must be determined to establish the safety distance. Please consult factory if assistance is needed.

**CHOICES OF GUARDING MATERIAL:** 1/2” square Black (Blk) or Yellow (Y) mesh, or Polycarbonate (PC). Black mesh is furnished as standard guarding material unless otherwise specified.
SPECIFICATIONS FOR SWING-AWAY LIGHT CURTAIN MOUNTING BRACKETS

**SAB-A**
SWING-AWAY BRACKETS WITH ADJUSTABLE GUARDS

**SAB-NA**
SWING-AWAY BRACKETS WITH NONADJUSTABLE GUARDS

Note: B + C dimension includes safety distance. Stopping time of the machine must be determined to establish the safety distance. Please consult factory if assistance is needed.

Select the appropriate SAB (Swing-Away Bracket) for your application. If adjustability is required in the barrier guard section, select the mounting bracket SAB-A. If adjustability is not required, select the mounting bracket SAB-NA.

Please complete the measurement form on pages 25 or 26 when ordering these brackets. The “A,” “B,” “C,” “D,” and “E” dimensions will be determined from the measurements supplied. Check the material type for the sides and rear panels below.

### SAB-A

<table>
<thead>
<tr>
<th>LEFT SIDE OF MACHINE</th>
<th>RIGHT SIDE OF MACHINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side Panel Material Type</td>
<td>Side Panel Material Type</td>
</tr>
<tr>
<td>Black Mesh</td>
<td>Black Mesh</td>
</tr>
<tr>
<td>Yellow Mesh</td>
<td>Yellow Mesh</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>Polycarbonate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rear Panel Material Type</th>
<th>Rear Panel Material Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Mesh</td>
<td>Black Mesh</td>
</tr>
<tr>
<td>Yellow Mesh</td>
<td>Yellow Mesh</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>Polycarbonate</td>
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</table>

### SAB-NA

<table>
<thead>
<tr>
<th>LEFT SIDE OF MACHINE</th>
<th>RIGHT SIDE OF MACHINE</th>
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</thead>
<tbody>
<tr>
<td>Side Panel Material Type</td>
<td>Side Panel Material Type</td>
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<tr>
<td>Yellow Mesh</td>
<td>Yellow Mesh</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>Polycarbonate</td>
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</table>

<table>
<thead>
<tr>
<th>Rear Panel Material Type</th>
<th>Rear Panel Material Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Mesh</td>
<td>Black Mesh</td>
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<tr>
<td>Yellow Mesh</td>
<td>Yellow Mesh</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>Polycarbonate</td>
</tr>
</tbody>
</table>
Determine which mounting brackets are required; SAB-A (with adjustable barrier guards) or SAB-NA (with nonadjustable barrier guards). Check the bracket type required and complete measurements for the machine where brackets will be applied.

- SAB-A
- SAB-NA

**PRESS APPLICATION**

A: Enter dimensions from mounting point on press frame to inside of swing-away mounting bracket. (Be sure bracket extending forward will clear bolster and any obstruction on the side of the press frame.)

B: Enter dimension from front side of machine frame mounting bracket to front edge of bolster plate (assuming nearest pinch point to operator is at the front edge of bolster).

C: Enter the minimum safety distance determined by the safety distance formula. Stopping time of the press must be determined to establish safety distance.

D: Enter the panel height for the guard on the left and right side of machine.

   ________" Left   ________" Right

Note: The light curtain mounting extrusion will be a minimum of 8" longer than the light curtain “field of coverage.”

E: If roof section(s) are required, enter “E” dimension(s) (height) and provide length of roof section(s):

   Left_________"   Right_________"

F: If floor section(s) are required, enter “F” dimension(s) (height) and provide length of floor section(s):

   Left_________" Front_________" Right_________"

G: If hairpins are required on side panel extending upward, enter “G” dimension (height) above the guard to the flywheel cover and provide length ________".

H: Height from floor to top of bolster.

I: Minimum feedline height.

J: Maximum feedline height.

**Precautions should be taken when applying light curtains for point-of-operation safeguarding. Be sure that someone cannot “pass through” or stand undetected between the plane of light and the hazard when a light curtain is mounted in a vertical position. If a light curtain must be mounted in this manner due to the “safety distance” requirements or configuration of the machine, be sure that supplemental safeguarding is provided to safeguard this “pass-through” area. Examples of supplemental safeguarding include a horizontally-mounted light curtain, single beam lights, guards or pressure sensitive safety mats on the floor.**
**SECTION 8—MEASUREMENT FORMS**

**PSD-400 Series Light Curtain System**

---

**SWING-AWAY LIGHT CURTAIN MOUNTING BRACKETS (PRESS BRAKE APPLICATIONS)**

**MEASUREMENT FORM FOR MODELS SAB-A (WITH ADJUSTABLE BARRIER GUARDS) AND SAB-NA (WITH NONADJUSTABLE BARRIER GUARDS)**

Determine which mounting brackets are required; SAB-A (with adjustable barrier guards) or SAB-NA (with nonadjustable barrier guards). Check the bracket type required and complete measurements for the machine where brackets will be applied.

- **SAB-A**
- **SAB-NA**

**PRESS BRAKE APPLICATION**

---

**MEASURING INSTRUCTIONS**

Check type of press brake:
- Mechanical-Friction Clutch
- Air Clutch
- Single Speed
- Two Speed
- Hydraulic (Down-Acting Slide)
- Hydraulic (Up-Acting Slide)
- Hydra-Mechanical

Size of light curtain: ___________”

A: Enter dimensions from mounting point on machine frame to inside of swing-away bracket. (Be sure bracket extending forward will clear slide.)

Note: Left and right side dimensions may be different due to an extension on one end of the slide.

B: Enter dimension from front side of machine frame mounting bracket to front of slide or bed.

Note: Left and right side dimensions may be different due to available mounting surfaces on side of machine.

C: Enter the minimum safety distance determined by the safety distance formula. Stopping time of the machine must be determined to establish safety distance.

D: Enter the panel height for the guards on the left and right end of the machine.

Note: The light curtain mounting extrusion will be a minimum of 8” longer than the light curtain “field of coverage.”

E: Enter inside frame dimension at the rear of machine.

F: Enter height from floor to feedline.

G: Enter dimension from back of the slide to rear of machine.

If floor/roof sections are required, please read the instructions (E & F) on page 25 and provide dimensions in the Notes Section above.

---

**Notes:**

Precautions should be taken when applying light curtains for point-of-operation safeguarding. Be sure that someone cannot “pass through” or stand undetected between the plane of light and the hazard when a light curtain is mounted in a vertical position. If a light curtain must be mounted in this manner due to the “safety distance” requirements or configuration of the machine, be sure that supplemental safeguarding is provided to safeguard this “pass-through” area. Examples of supplemental safeguarding include a horizontally-mounted light curtain, single beam lights, guards or pressure sensitive safety mats on the floor.
SECTION 9 AND 10—ORDER AND RMA FORMS

PSD-400 Series Light Curtain System

ORDER FORM FOR SIGNS AND LITERATURE

Company ____________________________________________

Address ____________________________________________

City ___________________________ State ________________ Zip _____________

Phone __________________________ Fax __________________

Name ___________________________ Purchase Order No. _______________ Date ____________

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Quantity Required</th>
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</thead>
<tbody>
<tr>
<td>KSL-209</td>
<td>Installation Manual for Light Curtains</td>
<td></td>
</tr>
<tr>
<td>KST-245</td>
<td>Specifications Label</td>
<td></td>
</tr>
<tr>
<td>KST-246</td>
<td>Danger Label 4&quot; x 2&quot;</td>
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<tr>
<td>KST-203</td>
<td>Warning Label (Blanking and Muting)</td>
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<tr>
<td>KST-242</td>
<td>Control Box Label</td>
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<tr>
<td>KSC-054</td>
<td>Danger Sign - 5&quot; x 6&quot; (English)</td>
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<tr>
<td>KSC-054S</td>
<td>Danger Sign - 5&quot; x 6&quot; (Spanish)</td>
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<tr>
<td>KSC-054F</td>
<td>Danger Sign - 5&quot; x 6&quot; (French)</td>
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<td>KSC-055</td>
<td>Danger Sign (Foot Switch) 5&quot; x 6&quot; (English)</td>
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<tr>
<td>KSC-055S</td>
<td>Danger Sign (Foot Switch) 5&quot; x 6&quot; (Spanish)</td>
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</tr>
<tr>
<td>KSC-055F</td>
<td>Danger Sign (Foot Switch) 5&quot; x 6&quot; (French)</td>
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<td>KSC-000</td>
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<td>Booklet - &quot;Mechanical Power Press Safety&quot; (MPPS)</td>
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<tr>
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<tr>
<td>SFM</td>
<td>Catalog - &quot;Shields For Machinery&quot;</td>
<td></td>
</tr>
</tbody>
</table>

For prices and delivery, please use address, phone or fax number listed on the front cover of this manual.

Your Signature ___________________________ Date ____________

RETURN MATERIALS AUTHORIZATION REQUEST FORM

To return material for any reason contact the sales department in our organization at 1-800-922-7533 for an R.M.A. Number. All returned materials shipments must be prepaid and sent to 5795 Logistics Parkway, Rockford, IL 61109. Complete this form and send with material. Make sure the R.M.A. Number is plainly identified on the outside of the shipping container.

Company ____________________________

Address ____________________________________________

City ___________________________ State ________________ Zip _____________

Phone __________________________ Fax __________________

Contact Name ___________________________ Representative __________________

Service Requested  ☐ Full Credit  ☐ 25% Restocking  ☐ Repair & Return  ☐ Warranty Replacement

Reason for return (describe in detail):

__________________________________________________________________________

__________________________________________________________________________

Original Invoice No. ______________ Date ______________ Replacement Invoice No. ______________ Date ______________

Return Materials Authorized By _____________________________________________ Date ______________