Model CA Cascading Safety Light Curtain

Cascading Safety Light Curtains provide multiple plane guarding (x, y and z).

Emitter

Receiver

Receiver

Emitter

PINNACLE
SYSTEMS, INC.

Safety Sensors and Controls for Industrial Machine Guarding Systems

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The Ultimate in Safety – Quality – Value - Flexibility

Cascading safety light curtains provide the user the ability to connect additional sets of light curtains by daisy chaining multiple emitters and receivers together. The interconnecting cables are factory supplied and the user defines length. The cascading of safety light curtains provides mulitple areas of guarding in any plane (X, Y, Z), while utilizing the control reliable dual safety outputs from the Category 4 safety device for the safety outputs to the machine control. The ability to guard multiple areas on irregular shaped machines by cascading safety light curtains reduces wiring and provides a lower cost yet effective machine guarding solution.

The Model CA Cascading Safety Light Curtain is an infrared safety light curtain that is designed to the IEC 61496 standard. When properly installed, it protects the machine operator by passing an invisible infrared light beam across an area to be guarded and examining whether or not the light beam(s) are blocked. If the light beam(s) are blocked, monitored solid state outputs will open, issuing a "STOP" command to the machines normally closed (N.C.) "STOP" circuit. The Model CA System is composed of transmitting units (EMITTERS), and receiving unit (RECEIVERS). The entire system is control reliable Category 4 (per IEC 61496). A single fault anywhere within the Model CA will not prevent at least one of the solid state outputs from opening up, (allowing a "STOP" command) when either a beam is broken or an internal fault occurs.

Theory of operation.

The Model CA Cascading Safety Light Curtain protects an area by projecting a curtain of infrared light. The infrared emitters and receivers face each other across the field to be protected. Each LED pair is spaced along the length of the pylons at regular intervals from .5" (12mm), up to 8" (203mm) depending on the application. The smaller spacing are for finger guarding, the larger spacing are for body protection. The emitter/receiver pairs are scanned sequentially (one at a time) by a very short pulse of infrared light starting from bottom (cable end), and working up to the end, until every beam pair has been scanned. Two 16 bit computers in the first emitter pylon and two 16 bit computers in the first receiver pylon control the operation, as well as cross check each pylon.

To machine

The System.

The Model CA Cascading Safety Light Curtain employs infrared technology in a small sealed NEMA 4 (IP 67) aluminum housing with an infrared passing (daylight filtering) acrylic lens. This system provides harmless invisible protection and an unobstructed view of the guarded area. There are two parts to the Model CA: An Emitter pylon and a Receiver pylon. The Emitter pylon has no outputs. The Receiver pylon contains two monitored solid state 24vdc outputs. Both pylon sets are synchronized to each other electronically as they are connected together with the interconnect cables to the top and bottom of the next set of pylons.

System Safety.

The Model CA Cascading Safety Light Curtain incorporates redundant, and diverse technology that provides a backup for every system that could cause an unsafe condition.

External Device Monitoring (EDM).

A method in which the Model CA Category 4 cascading safety light curtain logic monitors the state of various external control devices. The control devices are external and not part of the Model CA light curtain pylons. A lockout or stop signal will result if an unsafe state is detected in an external device. The External Device Monitoring (EDM) is an optional function of the Model CA safety light curtain for monitoring the status of external devices such as gate and door switches, safety switches or the main control element of the drive (MPCE). Solid state outputs are turned on separately to be checked and to assure neither output has been shorted, before fully turning on.
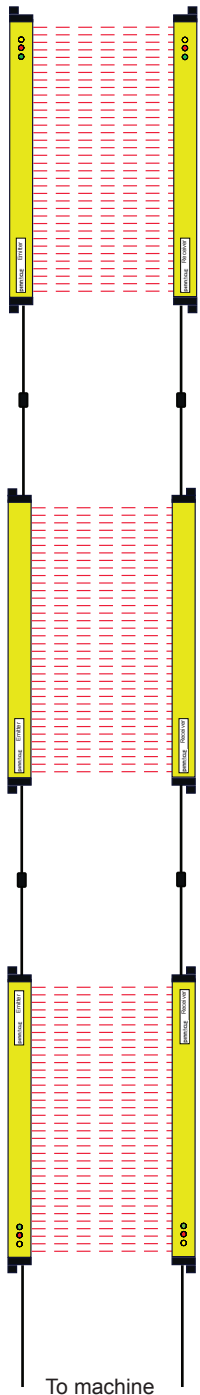
Design Criteria.

Designed to meet IEC 61496-1 & 2, UL 1998, UL subject 491, OSHA, ANSI, CSA, ANSI-RIA R15.06-1999

Microprocessor redundancy for both Emitter and Receiver pylons

Redundant, monitored, 24vdc solid state outputs (PNP)

Watchdogs on CPU's and outputs prevent unintentional output during lockups.

Remote Status Display and Blanking Options

Remote Status Display

The optional Remote Status Display (RSD) may be used in conjunction with the Model CA Cascading Safety Light Curtain. The RSD provides the machine operator and front line supervisor immediate system status and diagnostics when the Model CA is mounted inside the machine control panel. The RSD also controls all blanking options directly from the panel location where it is installed.

Remote Status Display (RSD) Components:

• Red/Green/Yellow indicator lights

• Diagnostic scrolling message display with 5' (1.5m) of connector cable

• Keyed selector switch and yellow blanking active indicator supplied if blanking is used

The RSD components are mounted on a steel plate and are designed to be exterior panel mounted. The RSD option enhances safety and is a time saver at machine set-up and when maintenance diagnostics are required.

Cincinnati Interface

Description: The Cincinnati Interface is provided to allow an external device to determine if the light curtain is still capable of shutting down the safety control circuit. The Cincinnati Interface allows an external device to override the light curtain and initiate a RED condition and open up the standard output relay contacts.

Application: Cincinnati Press, PLC

• Manual Latching Relay Provision

Blanking Options

Floating Blank - (8K) Option

The "Floating Blank" option provides the flexibility necessary to effectively guard all types of equipment that require multiple floating beams. This is quite common in the fabricating industry where the work piece moves.

The "Floating Blank" permits work pieces to be formed vertically or horizontally through the guarded area without shutting down the machine. Entry into the protected area by the operator or passerby will prevent the start or, if the machine is in motion, will provide a signal to stop the machine.

The "Floating Blank" is controlled by a keyed selector switch that will allow a work opening of 2" (51mm) based on 1/2" (13mm) increments. This information is displayed on the message display of the controller. Blanking adjustments required when die heights change are not necessary. The "Floating Blank" light curtain automatically adjusts to the various feed positions providing production with protection.

(Continued at the top of the next column)

The "Floating Blank" (8K) Option includes:

--1/2" (13mm) - Constant scan light curtain

--1" (25mm) - One floating beam

--1 1/2" (38mm) - Two floating beams

--2" (51mm) - Three floating beams

Auto-Blanking - (AB) Option

The advanced "Auto Blank" option is unique because it will automatically blank out only the required number of beams needed to accept an obstruction such as a conveyor, bracket, or fixture. The unit is easily programmed by a supervisory controlled four-position keyed selector switch located on the front panel of the RSD Display. The "Auto Blank" method of blanking is much safer than DIP switch or master/slave blanking systems because only the areas of the obstruction will be blanked. This feature prohibits unsafe oversizing of the blanked area commonly found throughout the industry on manually blanked systems. "Auto Blank" also **eliminates the need** to count beams and to locate where and what beams are to be shut off to obtain the correct beam elevation to accept an obstruction. This information is displayed on the message display of the controller. "Auto Blank" will also watch the obstruction and, if it moves or is removed, will go into a "machine stop mode" to prevent further machine operation. This is an additional safety feature not available on manually blanked units. These features truly enhance production while providing the ultimate in safety.

When the key switch is turned to the "Auto Blank" function, the "External Diagnostic Message Display" will show the number of blocked beams and where the obstruction is in the light curtain, then verify that the obstruction is being monitored. This is required information for the depth penetration factor and for proper installation of any safety light curtain. Learned Auto Blank patterns for the Model CA are stored in non-volatile memory for automatic recall at power-up.

To machine

The versatile "Auto Blank" (AB) blanking series includes:

• Constant scan light curtain

• One beam floating blank built-in plus "Auto Blank" capability

• Two "Auto Blank" modes - up to 4" blanked out (larger sizes available upon request) but need not be sequential
    A. One "Auto Blank" mode with keyed reset when guarded zone is penetrated (latch)
    B. One "Auto Blank" mode with automatic reset when guarded zone is penetrated
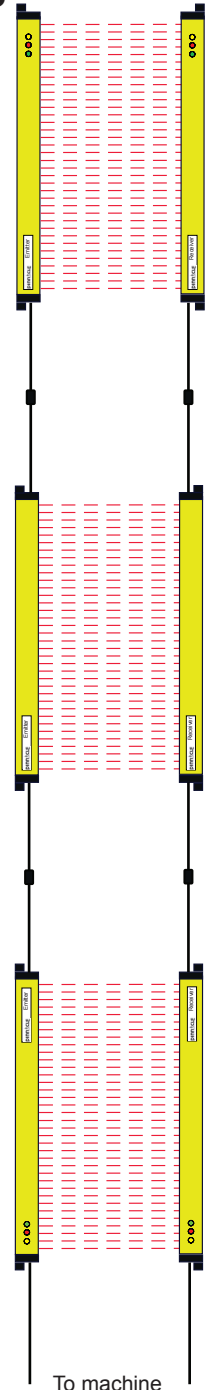
Safety Relay and Socket Assembly
Part # 52-278 (Two Required)
### DIN-Rail or Back Plate Mounting
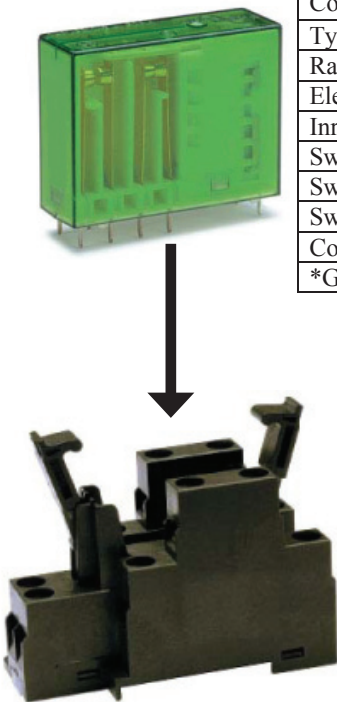
Contact material	AgSn O_{2+} O.2μm Au
Type of contact	Crest contact
Rated switching capacity	250VAC 8A AC1 2'000VA
Electr. Life AC1 (360 cycles/h)	Approx. 100'00
Inrush current max.	20A for 20ms
Switching voltage range	5 to 250 VDC/VAC
Switching current range*	10mA to 8A
Switching capacity range*	0.06VA(W) to 2'000VA
Contact resistance (as delivered)	≤100m Ω/28V/100mA
*Guide values	

- Safety relay with force guided contacts (dry)
- Relay configuration: 2NO/1NC
- Mean coil power 0.75W
- Holding power 0.21W
- EN 50205 type A

| Technical data	
Rate current	6A
Rated voltage	250VAC
Test voltage coil/contacts	2'500Veff
Insulation class (IEC 60664-1)	250VAC
Creepage resistance	CTI 250
Weight	Approx. 65g
Ambient temperature	-25°C to +70°C
Cross sections for connection with	
-wires	2x2.5mm²
-end sleeves for strands	2x1.5mm²
Torque max.	0.8 Nm
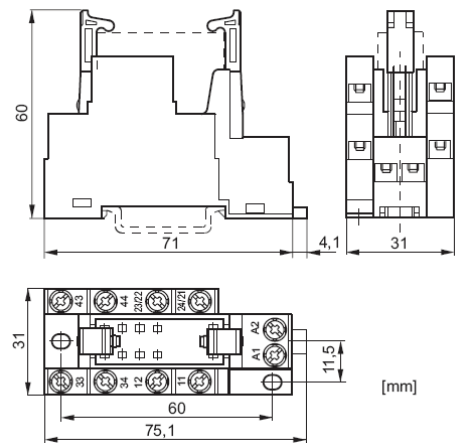
- DIN rail socket
- Integrated retaining/ejector handles
- Screw terminals
- Assembly on DIN rail 35mm or with 2xM3 screws

-OR-

SSSR Safety Relay Interface
Part # SSSR
Allows customer selectable Manual or Auto Reset.
Fits in a smaller space than two 52-278 safety relays.

7/8" Wide
(22.23mm)

4-5/8" Tall
(117.45mm)

4-7/8" Deep
(123.83mm)
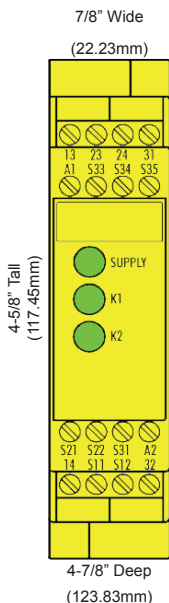
Basic device for Emergency-Stop and Safety Gate Applications
- Basic device to EN 60204-1:2005 and EN ISO 13849:2007 for single or dual E-stop monitoring.
- PL e / category 4 in accordance with EN ISO 13849-1:2007 (previously EN 954:1997 category 4)
- SILCL 3 in accordance with EN 62061:2005
- Stop category 0 acc. EN 60204-1
- Manual or automatic start
- Cross monitoring
- Feedback loop to monitoring external contactors
- 2 Enabling paths, 1 signalling path
- Processing of signals from output switching devices (OSSD) of light curtains acc. EN 61496-1.
- To connect to load side of safety mats acc. EN 1760-1
- Debouncing of inputs
-

Description of Device and Function
SSSR - This device is a two-channel safety switching device for emergency stop applications with self-monitoring on each ON-OFF cycle. It conforms to EN 60204-1 and is equipped with positively driven relays.
Basic function: After supply voltage has been connected to terminals A1/A2 and the safety inputs closed, operating the reset button closes the enabling current paths (manual start). When the safety inputs are opened/de-excited the enabling current paths will open.

Specifications and Dimensions

- **Input Power:** *Emitter pylon:* 24vdc @ .125A
  Receiver pylon: 24vdc @ .125A (solid state outputs are PNP which may draw up to .25A additional)

- **Internal fuses**: *Emiter Pylon:* F1 @ 1A
  Receiver Pylon: F1 @ 1A, F2 @ 1/2A, F3 @ 1/2A

- **Outputs:** *Receiver pylon:* monitored, 2 outputs, solid state PNP (24vdc when GREEN, float when RED/off). Max .25A draw each.

- **Indicators:** *Emitter pylon:* Yellow, Red, Green.
  Receiver pylon: Yellow, Red, Green.

- **Construction:** Painted aluminum extrusion with Acrylic IR lens and Viton Seals providing NEMA 14 (IP 65) protection.

  Optional Polycarbonate tubes (sleeves) over the pylons provides NEMA 4 (IP 65) protection.

  Emitter pylon: Four conductor 24AWG

  Receiver pylon: Six conductor 24AWG

  Pylons: Yellow | Cables: Black

- **Temperature:** 0 to 50c (up to 95% humidity, non-condensing)

- **Safety Software:** 0 to 50c tested to UL1998 and ISO 9001 standards.

- **Pylon Enclosures:** Tested to IEC 60529

- **EMC Testing** to IEC 61000-4 standards.

- **Dimensions**: 1.45" (36.8mm) square X selected length (see tables for lengths)

- **Beam Spacing & Minimum Object Sensitivity (MOS)**
  .5" (12.7mm)   .55" (14mm) MOS
  1" (25.4mm)   1.18" (30mm) MOS

  (special order, 4" active area followed by a 4" or 8" gap)

- **Response Time and Scanning Frequency:**
  < 30 mSec total, 10 khz

- **Shock:** Tested to withstand high vibration (using shock mounts)

- **Self-Checking:** Every 15mSec

- **Scanning distance**
  From 1' to 20' standard (1-6m)
  From 21' to 50' (6-15m) extended range (optional)
  The range is stated as a two digit number within the Model #

- **Specials:** Custom designed light curtains for special applications. Consult factory.

- **Surface Mount Technology**

- **One Year Warranty**

- **Made in USA**

> *Model CA output circuits must be used with either "control reliable" PLC input circuits, or a safety module.*

Pylons with Fixed Mounting Brackets (In/mm)

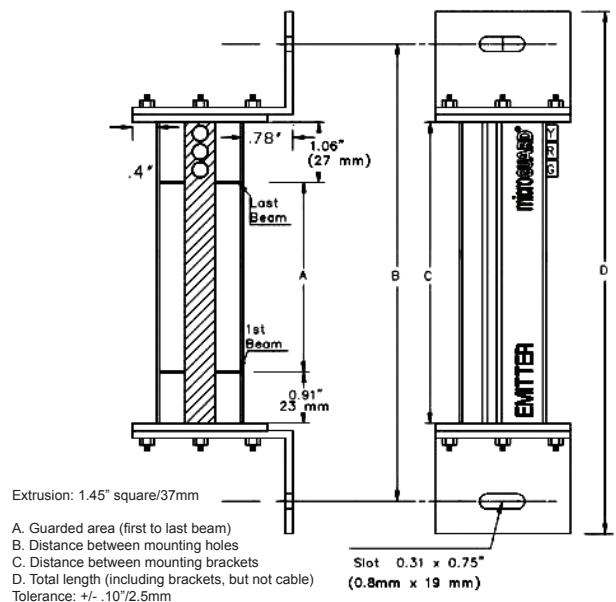| Model	DIM A	DIM B	DIM C	DIM D
CA-04	3.50 / 89	7.20 / 183	5.35 / 136	8.20 / 208
CA-08	7.50 / 190	11.20 / 284	9.35 / 237	12.20 / 310
CA-12	11.50 / 292	15.20 / 386	13.35 / 339	16.20 / 411
CA-16	15.50 / 394	19.20 / 488	17.35 / 441	20.20 / 513
CA-20	19.50 / 495	23.20 / 589	21.35 / 542	24.20 / 615
CA-24	23.50 / 597	27.20 / 691	25.35 / 644	28.20 / 716
CA-28	27.50 / 698	31.20 / 792	29.35 / 745	32.20 / 818
CA-32	31.50 / 800	35.20 / 894	33.35 / 847	36.20 / 919
CA-36	35.50 / 902	39.20 / 996	37.35 / 949	40.20 / 1021
CA-40	39.50 / 1003	43.20 / 1097	41.35 / 1050	44.20 / 1123
CA-44	43.50 / 1105	47.20 / 1199	45.35 / 1152	48.20 / 1224
CA-48	47.50 / 1207	51.20 / 1300	49.35 / 1253	52.20 / 1326
CA-52	51.50 / 1308	55.20 / 1402	53.35 / 1355	56.20 / 1427
CA-56	55.50 / 1410	59.20 / 1504	57.35 / 1457	60.20 / 1529
CA-60	59.50 / 1511	63.20 / 1605	61.35 / 1558	64.20 / 1631
CA-64	63.50 / 1613	67.20 / 1707	65.35 / 1660	68.20 / 1732

(Incremental additives for longer pylons available)
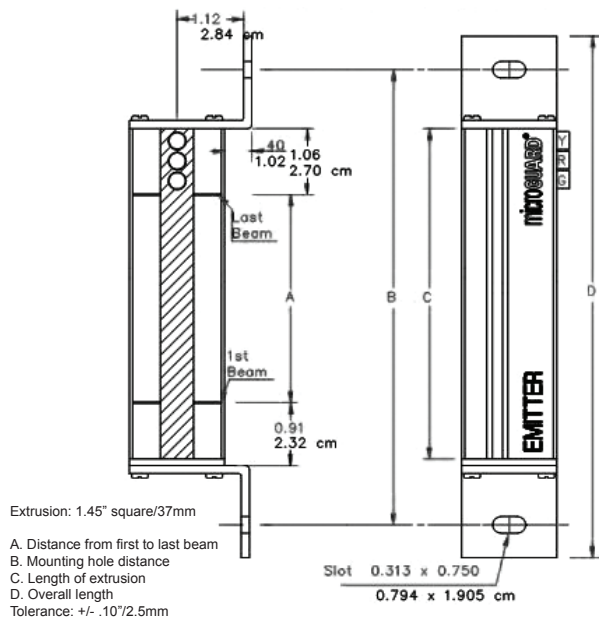
Pylons with Swivel Mounting Brackets (In/mm)

Model	DIM A	DIM B	DIM C	DIM D
CA-04	3.50 / 89	7.93 / 201	5.35 / 136	8.93 / 227
CA-08	7.50 / 190	11.93 / 303	9.35 / 238	12.93 / 328
CA-12	11.50 / 292	15.93 / 405	13.35 / 339	16.93 / 430
CA-16	15.50 / 394	19.93 / 506	17.35 / 441	20.93 / 532
CA-20	19.50 / 495	23.93 / 608	21.35 / 542	24.93 / 633
CA-24	23.50 / 597	27.93 / 709	25.35 / 644	28.93 / 735
CA-28	27.50 / 698	31.93 / 811	29.35 / 745	32.93 / 836
CA-32	31.50 / 800	35.93 / 913	33.35 / 847	36.93 / 938
CA-36	35.50 / 902	39.93 / 1014	37.35 / 949	40.93 / 1040
CA-40	39.50 / 1003	43.93 / 1116	41.35/ 1050	44.93 / 1141
CA-44	43.50 / 1105	47.93 / 1199	45.35 / 1152	48.93 / 1224
CA-48	47.50 / 1206	51.93 / 1319	49.35 / 1253	52.93 / 1344
CA-52	51.50 / 1308	55.93 / 1421	53.35 / 1355	56.93 / 1446
CA-56	55.50 / 1409	59.93 / 1522	57.35 / 1457	60.93 / 1548
CA-60	59.50 / 1511	63.93 / 1624	61.35 / 1558	64.93 / 1649
CA-64	63.50 / 1613	67.93 / 1725	65.35 / 1660	68.93 / 1751

(Incremental additives for longer pylons available)

Extrusion: 1.45" square/37mm

A. Distance from first to last beam
B. Mounting hole distance
C. Length of extrusion
D. Overall length
Tolerance: +/- .10"/2.5mm

Slot 0.313 x 0.750
0.794 x 1.905 cm

Extrusion: 1.45" square/37mm

A. Guarded area (first to last beam)
B. Distance between mounting holes
C. Distance between mounting brackets
D. Total length (including brackets, but not cable)
Tolerance: +/- .10"/2.5mm

Slot 0.31 x 0.75"
(0.8mm x 19 mm)

Ordering/Pricing Procedure

21' (6.3m) input power and safety output cable with connector supplied standard. Max length is 45'. Consult factory for longer lengths.

Set 1

pinnacle Emitter | pinnacle Receiver

Specify interconnect cable length
Set 1 to Set 2
(CAB)

Set 2

pinnacle Emitter | pinnacle Receiver

Specify interconnect cable length
Set 2 to Set 3
(CAB)

Set 3

pinnacle Emitter | pinnacle Receiver

To machine

Ordering/Pricing Procedure for Pylons

CA — ___ - ___ - ___ — ___ - ___ - ___ — ___ ___ — ___

	Set 1	Set 2	Set 3		Set 1	Set 2	Set 3			

Cascading System | **Pylon Guarded Zone in inches** 4"(102mm) to 120" (3,048mm) in 4" (102mm) increments | **Beam Spacing Options** .5" (13mm) 1" (25mm) 4" (100mm) | **Light Curtain Style or Blanking*** OF 1F 8K AB | **Scanning Distance In Feet** 20' (6.1m) standard, 50' (10.7m) maximum

*Light Curtain Style or Blanking Description

OF — - Constant scan - no blanking
1F — - 1 beam floating blank built-in.
8K — - Up to 3 beam floating blank adjustable by the use of a supervisory keyswitch removable in all positions. Capable of constant scan or one, two or three floating beams. (Requires RSD option)
AB — - Includes constant scan light curtain, one beam floating blank and two auto blank modes. (Requires RSD option)

If modifications are needed, please consult factory.

Options

SMB — - **Swivel Mounting Brackets for Pylons**: Replaces the fixed mounting brackets normally supplied. Provides a 360° rotation of pylons.
**PT** — - **Polycarbonate tube** which will encase the pylons for high impact protection.

Ordering/Pricing Procedure for Cables

CAB — **21** — ___ — ___

Cascading System Cables | **21' (6.3m) Supplied Standard** | **Set 1 to Set 2** | **Set 2 to Set 3**

Input power (24VDC) and Safety Output Cable with Connector

200' Maximum Length

Interconnecting Cables with Connector

Max 6' (1.8m) between sets 24' (7.3m) max cumulative interconnect length in system.

Please note that both the Pylons and Cables part numbers must be submitted to complete the order.

• Pylons can be hard wired together with no connectors if required (consult factory).
• Maximum of 128 beams per system (cumulative).
• Consult factory for larger beam systems or additional segments if needed.
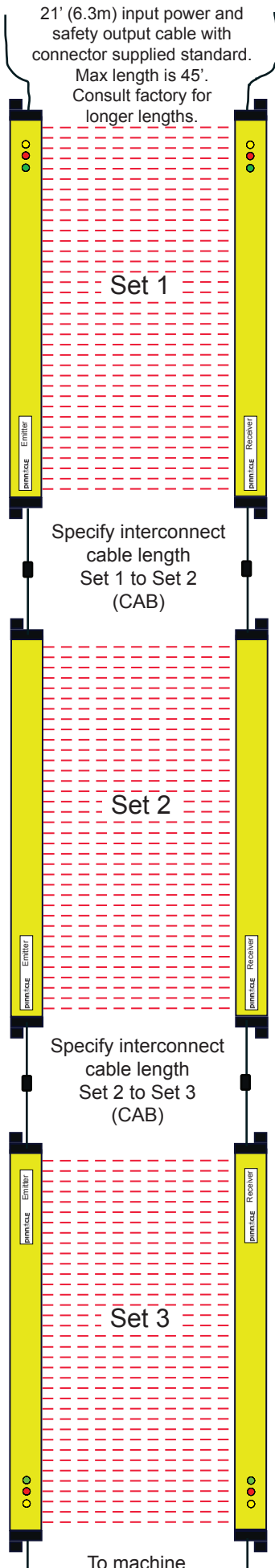
Accessories

Cornering Mirror Dimensions

Through the use of cornering mirrors, multiple sides or work envelopes can be guarded which enhance safety and reduce downtime related to mechanical and electrical interlock systems. Include a 15% reflectivity loss per mirror when calculating the total scanning distance of the light curtain.

Model	Dim A (hole to hole)	Dim B (mirror)	Dim C (total)
MGM-12	19.45" (494mm)	18.25" (464mm)	20.50" (521mm)
MGM-18	25.45" (646mm)	24.25" (616mm)	26.50" (673mm)
MGM-24	31.45" (799mm)	30.25" (768mm)	32.50" (825mm)
MGM-30	37.45" (951mm)	35.25" (895mm)	38.50" (978mm)
MGM-36	43.45" (1104mm)	42.25" (1073mm)	44.50" (1130mm)
MGM-42	49.45" (1256mm)	48.25" (1226mm)	50.50" (1282mm)
MGM-48	55.45" (1408mm)	54.25" (1378mm)	56.50" (1435mm)
MGM-60	67.45" (1713mm)	66.25" (1683mm)	68.50" (1739mm)
MGM-72	79.45" (2018mm)	78.25" (1988mm)	80.50" (2045mm)
MGM-84	91.45" (2323mm)	90.25" (2292mm)	92.50" (2350mm)
MGM-96	103.45" (2628mm)	102.25" (2597mm)	104.50" (2654mm)

Pedestal Dimensions (Model 8000)

The heavy duty, all welded steel pedestal floor mounts can be used for mounting either light curtain pylons or cornering mirrors. Sliding mounts on the pedestal are of universal design and are supplied standard. Unique floating base on pedestal is designed to compensate for uneven floors.

NOTE: Pedestals must be bolted to the floor, they must not be movable (ANSI B11.19-2003).

1. Sliding mounts supplied
2. Standard height is 72" (1829mm) - Model #8000
   Optional 96" (2438mm) - Model #8096
3. Painted OSHA yellow
4. Pedestal is 12 gauge steel
   Base Plate is 1/4" (6.35mm) steel plate

Ordering Procedure
Specify Pedestal Model Number and Quantity

Safety Light Curtains
"A system designed specifically for your machine guarding needs"

	Model MG – Metal Box	Model DR – DIN-rail	Model CE – Solid State
Description	"Thin Profile" with Nema 12 (IP 64) Enclosure and two Quick Disconnect cables	"Thin Profile" with "Intelligent Safety Relay" DIN-rail Controller and 22' (6,705mm) Quick Disconnect cables	"Thin Profile" with Solid State Outputs and two 21' (6,096mm) Quick Disconnect cables with mult-directional pigtails
Controller Enclosure	Metal Box	Gray Polycarbonate (IP 40) UL94 V-1	N/A
Pylon Construction	Aluminum Extrusion NEMA 4 (IP 65)	Aluminum Extrusion NEMA 4 (IP 65)	Aluminum Extrusion NEMA 4 (IP 65)
Input Voltage	120VAC, 24VDC, 220VAC	24VDC	24VDC
Sizes	4" (102mm) – 120" (3,048mm) in 4" (102 mm) increments	4" (102mm) – 120" (3,048mm) in 4" (102 mm) increments	4" (102mm) – 120" (3,048mm) in 4" (102 mm) increments
Beam Spacing	½" (13mm) or 1" (25mm) beam centers	½" (13mm) or 1" (25mm) beam centers	½" (13mm) or 1" (25mm) or 4" (102mm) beam centers
Blanking Style			
Auto Blank	Yes	Yes	Yes
Floating Blank	Yes	Yes	Yes
Scanning Ranges	1' – 50' (.3-16m)	1' – 50' (.3-16m)	1' – 50' (.3-16m)
Warranty	2 Years	2 Years	1 Year

Additional products to achieve your *Total Safety Solution*!!!

- Safety Light Curtains (All Types and Styles)

- Universal Safety Controller HUB / Safety PLC

- Safety Mat Systems and Controls
    - Area Guarding Systems
    - NSD Safety Mat Systems
    - STTS Safety Mat Systems
    - Direction of Travel Mats
    - High-Temp Welding Mats

- Ergonomic Palm Buttons
    - UltraTouch Palm Buttons

- Safety Interlock Switches (including explosion proof)

- Customized "control reliable" controls for dual solenoid activated pneumatic and hydraulic valve applications

- Fencing with Interlocks

- E-Stop Buttons

- Stack Lights

- Energy Isolation and Single Point Lockout Systems

- Plant Surveys, Risk Assessment & Installation Services

- Customized Control Panels; Stainless Steel enclosures available for all products

Punch Press / Metal Stamping Industry

- Resolver or Rotary Cam Based Clutch / Brake Controls - OSHA/ANSI Compliant

- Punch Press Automation Controllers

- Time-Based Brake Monitors

- Programmable Limit Switches

- Die Protection & Tonnage Monitoring Systems

- Servo Feed Interfaces

Press Brake Guarding and Controls

- Press Brake Guarding for Mechanical, Air Clutch and Hydraulic Press Brakes

- Press Brake Control Systems

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S Y S T E M S ,   I N C.

www.pinnaclesystems.com

Sales and Marketing Office

P.O. Box 100088

Pittsburgh, PA 15233

Toll Free: (800) 569-7697
Phone: (412) 262-3950
Fax: (412) 262-4055

sales@pinnaclesystems.com

Manufacturing and Service Center

1510 Hubbard Ave.

Batavia, IL 60510 USA

Phone: 630-443-8542

Fax: 630-443-8601

service@pinnaclesystems.com

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