Presence Sensing Safety Devices

2-Selection Criteria

Is the hazardous area stationary or mobile? ①

Stationary | Mobile

Stop initiated by contact?

Yes → Safety Edge

No → Laser Scanner

How often do you need access to the hazardous area?

Rarely → **Are there any blind spots where you can not see a person in the hazardous area?** ③

Yes → Gate with Safety Mats or Laser Scanner

No → Gate with Interlock Switches

Frequently → **Do you need to detect full or partial body access?** ②

Partial → POC Light Curtain

Full → **Can a light curtain or mirrors be mounted around the area?**

Yes → **Are there any blind spots where you can not see a person in the hazardous area?** ③

No → **Is the shape of the hazard square/rectangular?** ④

No → Laser Scanner

No → Laser Scanner or Safety Mats

Yes → Laser Scanner or Safety Mats

Yes → PAC Light Curtain or Safety Mats

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Allen-Bradley

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Selection Tips

① Is the hazardous area stationary or mobile?

A stationary hazard refers to a fixed machine or work cell where one or more mechanical hazards exist. A mobile hazard is generally a fixed-rail linear transfer mechanism (e.g., a transfer cart or conveyor) or an Automatic Guided Vehicle (AGV). Use of a safety device on a mobile hazard generally relates to collision avoidance with personnel or surrounding machinery.

In the instance that the hazard moves toward the operator (such as with powered doors) as opposed to the operator moving toward the hazard, a pressure-sensitive safety edge can be mounted to the leading edge of the door. Any contact between the door and personnel will stop the machine before injury can occur.

② What do we mean by full- versus partial-body access?

Full-body access generally refers to the requirement for a person to be standing or walking in (or have access to) the hazardous area around a machine that does not require frequent interaction between personnel and the hazard during regular operation; generally this is for maintenance and troubleshooting. Full-body perimeter or area access control (PAC or AAC, respectively) is achieved through the use of a vertical or horizontal safety field, either opto-electronic (i.e., a light curtain or scanner) or by contact (safety edges and mats).

Partial-body access, on the other hand, is required for applications where an operator must regularly reach into a machine hazard as part of the process at the point of operation (known as POC or Point of Operation Control). In the case of opto-electronic safety devices such as light curtains and area scanners, full- or partial-body detection is directly related to the resolution of the safety device. Below is the relationship of sensing field resolution to the type of detection:

Object to be Detected/Protected	Resolution
Finger (vertical field)	14 mm
Hand (vertical field)	30 mm
Limb (horizontal field for leg detection)	50 mm, 70 mm
Full Body (horizontal fields)	150 mm

2-Selection Criteria

③ Blind Spots

In some cases it may be possible for a person to enter the guarded area and be lost from view, potentially allowing the guard door to be shut and the machine started by another person. Often used in conjunction with hard guarding and a gate outfitted with an interlock switch, presence sensing safety devices such as pressure-sensitive safety mats, and laser scanners can be used to check for the presence of a person anywhere within the enclosed safety area.

④ Is the shape of the hazardous area rectangular?

When the hazardous area to be monitored is a rectangle (or a shape consisting of contiguous rectangles), access to the area can be easily—and cost-effectively—controlled with a standard safety mat. When the hazardous area is irregularly shaped, a custom mat is a viable option, but not necessarily the most cost-effective or readily available. In such a case, a safety scanner is the best option because its scanning field can be easily programmed to scan irregular areas and ignore obstacles (walls, columns) while detecting moving objects (people, AGVs, etc.) as required.

Other Application Considerations

		Safety Mats	Safety Scanner	Point of Operation Control	Perimeter Access Control
Partial Body Detection	Finger Detection			14 mm	
	Hand Detection		30 mm	30 mm	
	Limb Detection		50/70 mm		
Full Body Detection		✓	✓		✓
Uneven Floor			✓	Horizontally Mounted	
Corrosive Chemicals			✓	✓	✓
High-Pressure Washdowns		✓		IP67/IP69K Enclosure	IP67 Enclosure
Steam, Dust Environment		✓			
Reflections, Bright Ambient Light		✓			

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Safety Light Curtains

Selection Navigator

GuardShield Light Curtain	Profile Size [mm]	Type According to IEC 61496	Finger (14 mm)	Hand (30 mm)	Full Body	Protective Height [mm]	Range	Response Time	IP Rating	Integrated Laser Alignment
Standard	40 x 50	Type 4	Yes	Yes	NA	160…1760	14 mm…7 m 30 mm…16 m	20…30 ms	IP65 (IP67)	Optional/Yes
Safe 4	30 x 40					120…1920	14 mm…9 m 30 mm…18 m	14 mm: 11…90 ms 30 mm: 8…48 ms	IP65	Yes
Micro 400	15 x 20					150…1200	5 m	14 mm: 15…42 ms 30 mm: 13…24 ms	Micro 400 IP54 (IP69K) MSR4x IP20	NA
PAC	40 x 50		NA	NA	2 and 3 beams	2 beams: 520 3 beams: 820	16 m	20 ms	IP65	Optional/Yes
Safe 4 PAC	30 x 40					2 beams: 600 3 beams: 840	5…30 m	2 beams: 11 ms 3 beams: 14 ms		Yes
Type 2	40 x 50	Type 2	NA	Yes	NA	160…1760	16 m	20 ms		NA
Safe 2	30 x 40					120…1920	18 m	14 mm: 11…90 ms 30 mm: 8…48 ms		Yes

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Integrated Controller	Operating Temperature [C (F)]	Beam Coding	Blanking	EDM	Aux. Output	Cascadable	Muting	Configuration	PL/SIL CL	GuardShield Light Curtain
Yes	-10…55° (14…131°)	Yes	Yes	Yes	1 PNP 0.5 A max.	Yes	Yes with MSR42 or MSR22LM	DIP Switch		Standard
	0…55° (32…131°)	NA	NA	NA	NA	NA		NA		Safe 4
Requires MSR41 or MSR42			Yes with MSR42	Yes with MSR42	MSR41: 2 PNP 0.1 A max. MSR42: 2 PNP config.	Yes	Yes with MSR42	MSR42 Wiring or Software	PLe/SIL CL3	Micro 400
Yes	-10…55° (14…131°)	Yes		Yes	1 PNP 0.5 A max.		Yes with MSR42 or MSR22LM	DIP Switch		PAC
	0…55° (32…131°)	NA	NA	NA	NA			NA		Safe 4 PAC
	-10…55° (14…131°)	NA		Factory Option	1 PNP 0.5 A max.	NA		Factory	Pld/SIL CL2	Type 2
	0…55° (32…131°)			NA	NA			NA		Safe 2

2-Selection Criteria

Safedge™ Pressure-Sensitive Safety Edges

Features/Benefits

Pressure-sensitive safety edges are flexible strips that can be mounted to the edge of a moving part—such as a machine table or powered door—that poses a crushing or shearing risk. Contact of the edge with an object or personnel switches off the machine hazard. Safety edges are a cost-effective solution for constant safety monitoring in smaller areas, especially those applications requiring physical flexibility and a tight turn radius. Rated to Category 3, safety edges do not develop 'dead spots' like some other pressure-sensitive safety offerings. They are also easy to install and maintain, and can withstand high-pressure washdowns, making them suitable for a wide range of applications and environments. Multiple profile sizes and the availability of custom edge systems also lend to a high degree of application flexibility. It is important to note that Safedge requires a dedicated safety relay for monitoring and control, which can be connected to other safety systems.

Applications

• Sliding doors
• Garage doors
• Pinch points

Common Misapplications

• Submersible applications
• Exposure to volatile chemicals (that can damage the rubber profile)
• Applications where physical contact can injure personnel

MatGuard™ Pressure-Sensitive Safety Mats
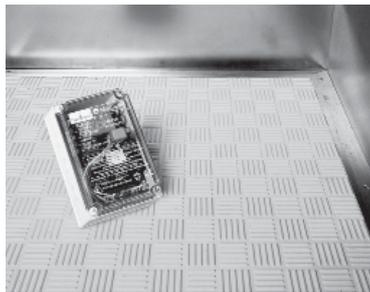
Features/Benefits

Pressure-sensitive safety mats provide constant guarding and monitoring of a floor area around a machine; 66 lbs. or more of pressure on the mat (e.g., an operator's footstep) causes the mat controller unit to switch off power to the hazard. Like safety edges, MatGuard safety mats are easy to apply and maintain, can withstand high pressure washdowns and are not susceptible to dead spots. An ideal solution for relatively small areas, MatGuard products also offer a high degree of application flexibility, offering reversible mats, direct micro quick connectivity to controllers, simple connection to standard and DeviceNet Safety I/O blocks, custom system configurations, and quick-delivery standard sizes. However, mats can be damaged by dropped objects, such as tool dies, and pose a potential trip hazard if trim is not used.

Applications

• Work cells
• Area detection

Common Misapplications

• Uneven floors
• Lack or improper use of uniting trim
• Presence of volatile chemicals

SafeZone™ Safety Laser Scanners

Features/Benefits

The SafeZone safety laser scanners are opto-electronic devices that create a user-configurable scanning field with one or more safety zones. If a person or object enters the warning field, the SafeZone scanner switches a single output that can be used to initiate a warning signal, such as an optical or acoustic alarm. If the inner safety field is breached, the scanner switches two independent safety outputs initiating a machine stop signal to halt dangerous machine motion. Offering warning fields up to 49 meters, the SafeZone is easy to install—either horizontally or vertically—and requires no dedicated controller for operation. Suited for Category 3, SIL2 PLd applications, the scanner is easily interfaced with other safety systems and the easy-to-use configuration software allows customization of the field shape.

Applications

• Work Cells
• Robot Cells
• Stationary or mobile application
• Rotary and index tables
• Moving automated vehicles (AGVs)
• Infeed machinery
• Overhead cranes

Common Misapplications

• Oil, mist, dust, or steam environments
• Outdoor applications
• Extreme temperatures

Point of Operation Control (POC) Light Curtains

GuardShield

GuardShield Safe 4

GuardShield Micro 400

Features/Benefits

POC light curtains are placed close to the hazard, at the point of operation where personnel may frequently interact with the machine as part of a process. POC light curtains are designed for partial-body detection—finger, hand, and arm detection—and are offered in multiple resolutions and protective heights. An easy-to-install Category 4 SIL 3, PLe solution, these light curtains are easily connected to other safety systems, but usually do not require a separate controller and can therefore be operated as standalone units (i.e., without a safety relay). Since they are located at the machine's point of operation, POC light curtains eliminate the need for gates, allowing frequent and easy access to the hazardous area, and can be used as an ergonomic workstation control that increases safety while enhancing productivity. These light curtains can be mounted vertically or horizontally. However, it is important to note that these light curtains do not detect people or objects once they have passed through the light curtain.

POC light curtains are also suitable for use in washdown applications when used in conjunction with the IP67 or IP69K light curtain enclosures.

Applications
• Conveyors
• Electronic fences
• Forming operations
• Robot Cells
• Presses
• Workstations
• Washdown applications (use IP 67 tube accessory)

Common Misapplications
• Used on full revolution machinery
• Mounted too close to hazard

Perimeter Access Control (PAC) Light Curtains

GuardShield PAC

GuardShield Safe 4 PAC

Features/Benefits

PAC light curtains are an easy-to-install, Category 4 solution for full-body access detection. Designed to create a safety perimeter around a machine that does not require frequent interaction between personnel and the hazard during regular operation, PAC light curtains provide large object pass-through sensing with detection ranges up to 30 meters. PAC light curtains can be easily interfaced with other safety systems or used as standalone units without a dedicated control unit/safety relay. However, it is important to note that these light curtains do not detect people or objects once they have passed through the light curtain.

Applications
• Conveyor Systems with muting
• Robot cells
• Opto-electronic fence
• Washdown with IP 67 tube

Common Misapplications
• Used as POC device
• Used on machine that does not stop until completing a full revolution
• Horizontal installation

GuardShield™

Introduction

The Allen-Bradley Guardmaster GuardShield is offered as a Type 2 and a Type 4 POC safety light curtain as well as a Type 4 PAC safety light curtain. The Type 4 POC GuardShield is offered in both 14 mm and 30 mm resolutions while the Type 2 is offered in 30 mm resolution only. The GuardShield PAC is offered with multiple beam configurations with varying beam spacings. All GuardShield family safety light curtains meet the requirements of IEC/EN 61496.

POC safety light curtains are designed to detect the presence of an opaque object of a minimum resolution. These devices are usually positioned in front of the point of operation hazard, however, they may also be used for perimeter guarding applications.

PAC safety light curtains are typically used as opto-electronic fences or as whole body detection devices to detect personnel or large objects when they pass through the sensing field. These PAC safety light curtains are typically positioned around an area or in front of a process entry or exit area.

The Allen-Bradley Guardmaster GuardShield is a two-box safety light curtain, consisting of a nonmatched transmitter and receiver pair. Any GuardShield transmitter of the same family (POC, PAC) and same resolution will work with any receiver of the same family and resolution. The synchronization between transmitter and receiver is achieved optically. The first beam adjacent to the receiver LEDs is the synchronization channel. This synchronization beam cannot be blocked in a fixed or floating blanking application.

The GuardShield safety light curtain has two transistor type PNP safety outputs, referred to as OSSDs (Output signal switching devices). These outputs may be connected to a safety relay module or directly to the primary control element of a machine if the EDM connection within the GuardShield receiver is also connected and configured.

The standard GuardShield receiver also has an auxiliary nonsafety output which can be connected to a PLC for status of the OSSDs, to a stack light for signaling or to control an in-feed motor, etc.

The standard GuardShield requires separate transmitter and receiver cables. The transmitter cable utilizes a 4-pin micro quick-disconnect (M12) connector and is offered in lengths from 2 meters to 30 meters. The receiver cable has an 8-pin micro quick-disconnect (M12) connector and is also offered in lengths from 2 meters to 30 meters.

Typical System Configuration

Components required for a "Guard only" system:

1. Optic heads (operate on 24V DC—ordered as a pair (transmitter/receiver)
2. Cable—two required per pair—specify transmitter cable and receiver cable
3. Mounting brackets—included
4. Safety Relay Module—optional (**Note:** A Category 3 system may be possible by connecting the GuardShield OSSDs directly to two safety contactors and connecting and configuring the EDM mode of operation in the GuardShield receiver.)
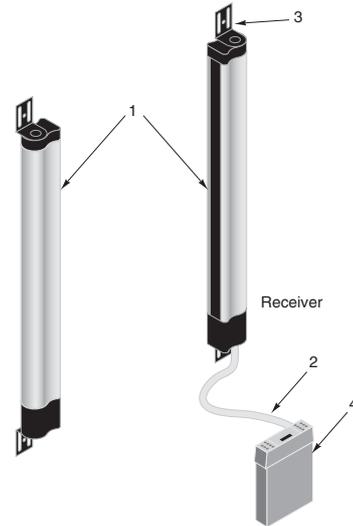
The Allen-Bradley Guardmaster GuardShield Type 4 is a two-box light curtain with DIP switch selectable operating modes.
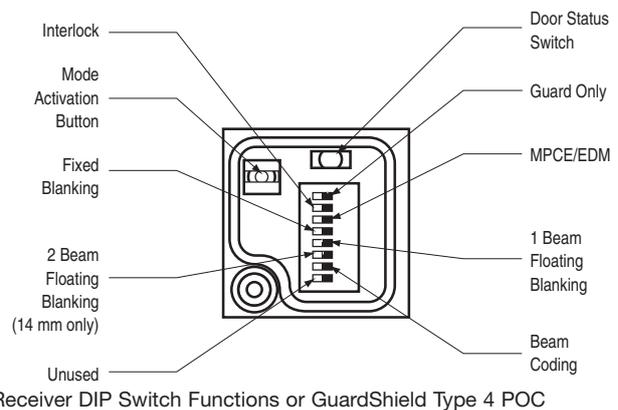
Receiver DIP Switch Functions or GuardShield Type 4 POC

2-Opto-electronics

The standard GuardShield safety light curtain has DIP-switches located in both the transmitter and receiver endcaps. The DIP-switches are accessible through a hinged door that is secured to the endcap with a security screw.

The transmitter DIP-switches provide for the configuration and activation of Beam Coding and Machine Test Signal.

The receiver DIP-switches provide for configuration of all of the GuardShield safety light curtain's modes of operation.

GuardShield Safe 4

The GuardShield Safe 4 is a Type 4 safety light curtain offered in POC and PAC versions with basic ON/OFF functionality. The Safe 4 POC is offered in both 14 mm and 30 mm resolutions in protective heights ranging from 120 mm up to 1920 mm in increments of 120 mm.

The GuardShield Safe 4 PAC (Perimeter Access) is offered with two 120 mm modules providing 500 mm spacing and with three 120 mm modules providing 400 mm spacing. Both the two- and three-beam Safe 4 PAC versions have an operating range from 5 meters up to 30 meters.

The GuardShield Safe 4 POC and Safe 4 PAC are economical Type 4 safety light curtains with ON/OFF functionality and an integrated laser alignment system. The integrated laser alignment system consists of a constantly powered Class 2 visible laser located on the top of the transmitter and on the bottom of the receiver. The constantly powered integrated laser alignment systems allows a low level of laser light to be emitted. Simply touching a finger to the laser beneath the finger symbol reflects the low level of laser light back to a photo sensor which causes the laser light intensity to increase for five minutes or until a finger covers the laser reflecting the laser back to the photo sensor which signals a reduction of the intensity of the emitted laser light. This system assures that both the top and bottom of the Safe 4 pair are quickly and easily aligned or realigned if a light curtain or corner mirror is inadvertently moved during operation.

GuardShield Safe 4

GuardShield Safe 2

The GuardShield Safe 2 is a Type 2, SIL 2, PLd, safety light curtain offered with a 30 mm resolution in protected heights ranging from 120 to 1920 mm in 120 mm increments. The GuardShield Safe 2 is an economical, two-box safety light curtain with ON/OFF functionality and an integrated laser alignment system. The integrated laser alignment system consists of a Class 2 visible laser located at the top of the transmitter and the bottom of the receiver. Each laser has a target located opposite the laser on the transmitter and receiver. This integrated laser alignment system facilitates alignment at installation and during the course of usage if the Safe 2 pair is knocked out of alignment.

GuardShield Micro 400

The GuardShield Micro 400 is an economical three-box (transmitter, receiver and controller) Type 4 safety light curtain offered in a small profile (15 mm X 20 mm) housing. Designed for use in benign industrial environments (IP54), this medium/light duty safety light curtain system is targeted to the semi-conductor, microelectronic and small assembly machine markets.

The compact housing size allows the GuardShield Micro 400 to be mounted in areas where standard safety light curtains may not be able to be mounted due to space constraints.

The GuardShield Micro 400 requires a dedicated controller, either an MSR42 or MSR41. The MSR41 is a basic controller for simple ON/OFF functionality and the MSR42, in addition to providing operating functionality for the Micro 400, can be used as a multi-function safety module. This multi-functional safety module allows the connection of additional safety light curtains, safety laser scanner or a safety device with PNP type outputs as well as E-stops or override switches. The MSR42 can have limited functionality activated by wiring but requires configuration software for any advanced functionality.

The Micro 400 transmitter and receiver are offered with eight-pin M12 connectors at the end of 500 mm (19.8 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are the same cat. no. and are offered in various lengths. These patchcords are configured on one end with M12 connectors that mate to the integrated pigtail connectors and RJ45 connectors on the opposite end, that plug into the MSR41 or MSR42 controller.

The Micro 400 is also offered in cascadable configurations. GuardShield Cascadable Micro 400 safety light curtains allow the interconnection of multiple segments of the Micro 400 safety light curtain with a common pair of safety outputs. This cascadable configurability of the GuardShield Micro 400 reduces overall system wiring and allows the GuardShield Micro 400 to be fitted into a variety of applications where the safety distances for mounting the light curtain may allow personnel to stand between the light curtain's sensing field and the hazard or where multiple-sided guarding is required and the use of corner mirrors is not possible.

GuardShield Micro 400

Micro 400 Cascading

Micro 400 Cascaded

2-Opto-electronics

Safety Light Curtains

Overview

Typical System Configurations

The Allen-Bradley Guardmaster GuardShield and GuardShield Safe 4 safety light curtains are two-box designs. This means the safety light curtain does not need a separate controller to operate. Therefore, the safety outputs of the light curtain (OSSDs) can be connected directly to any safety relay that will accept two PNP inputs.

The following are some common configurations of light curtain systems. The numbers on the drawing indicate the ordering steps to follow to ensure that a complete system is specified.

Components required for a "Guard only" system:

1. Optic heads (operate on 24V DC)—ordered as a pair (transmitter/receiver)
2. Cables—two required per pair—specify length

Optional components (customer or Allen-Bradley Guardmaster supplied):

3. Safety Relays
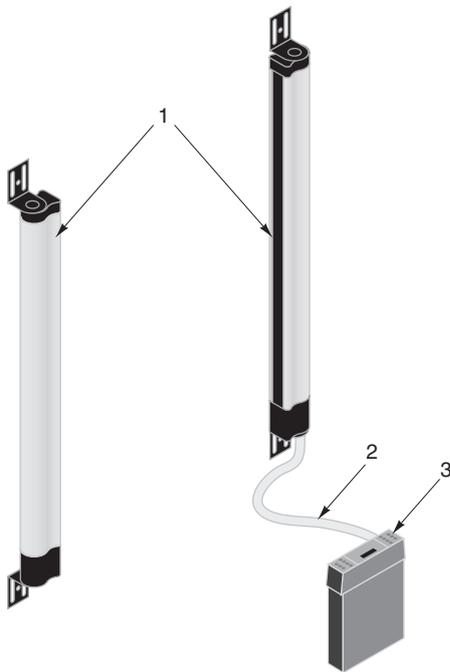
Perimeter Access Control (PAC)

Allen-Bradley Guardmaster PAC safety light curtains consist of two families, the GuardShield PAC family and the Safe 4 PAC family. The GuardShield PAC family is offered with multiple beams with various beam spacings for short range applications (16 meters or less). The Safe 4 PAC family is offered with multiple beams (2 or 3) with various beam spacings for long range (5…30 meters).

PAC safety light curtains are opto-electronic through-beam devices typically used to detect personnel around hazardous equipment or machinery. PAC safety light curtains are usually used as an opto-electronic fence and when used with corner mirrors, can provide two- or three-sided detection around the perimeter of hazardous machinery.
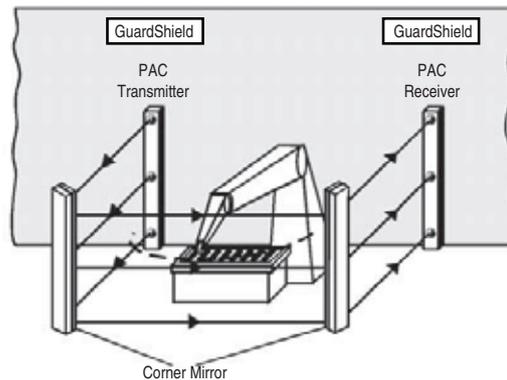
PAC safety light curtains are generally of resolutions that provide detection of limbs and bodies of personnel, i.e., 50 mm, 70 mm, 90 mm and up. It is also common for PAC safety light curtains to be offered with a limited number of infrared beams spaced at consistent distances from one another, such as 3 beams with 400 mm spacing between beams, or 2 beams with 500 mm beam spacing.
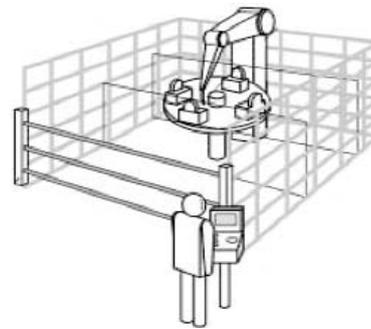

Muting

PAC safety light curtains are also used in conveyorized processes and very often are used in conjunction with a muting module. Muting is the temporary automatic suspension of the protective function of the safety light curtain.

Muting modules can be integrated into the light curtain's receiver or external to the light curtains. Rockwell currently offers external muting modules.

This muting function allows material to move through the safety light curtain's sensing field without stopping the machine, however, if a person attempts to pass through the safety light curtain, they will be detected and the machine will stop. The differentiation between material and personnel is determined by the use of muting sensors. These muting sensors create a particular switching sequence together with the safety light curtain as the material passes through the process.
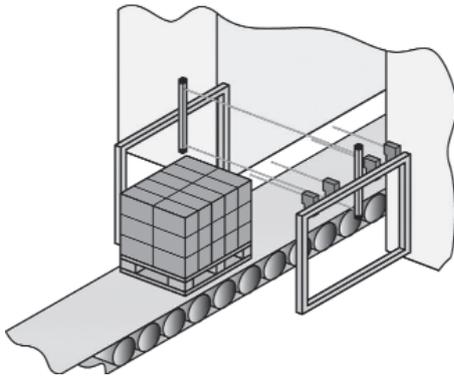
Conveyorized muting

Muting sensors are typically used in pairs and depending upon the sensor configuration and muting module, allow either uni-directional or bi-directional travel of material through the safety light curtain.
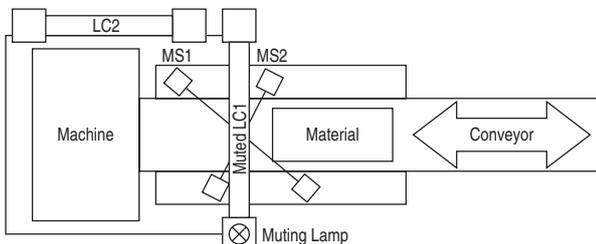

Figure 1: Two-sensor bi-directional muting
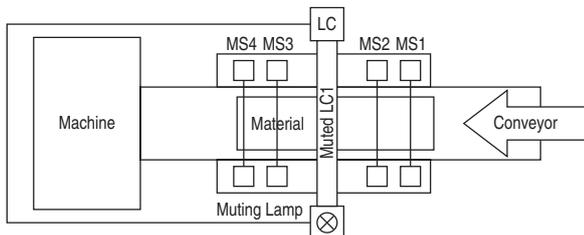
Figure 2: Four-sensor uni-directional muting
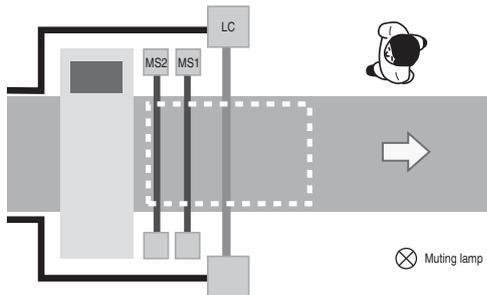
Figure 3: Two-sensor L-type with MSR42
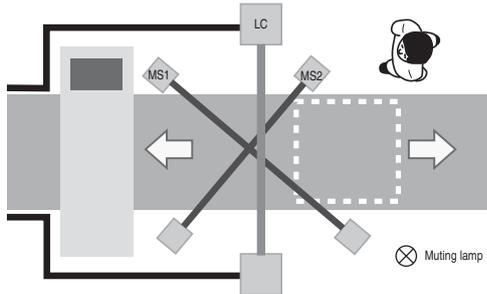
Figure 4: Two-sensor T-type with MSR42

Four-sensor muting for this particular muting module in Figure 2 allows a single direction of travel. A particular sequence is also required in this configuration; muting sensor 1 must be interrupted first followed by muting sensor 2 and then the safety light curtain, then muting sensor 3 and finally muting sensor 4. It is necessary with this particular muting module to have the light curtain's sensing field interrupted within 3 seconds of muting sensor two being interrupted. Also, the material must block muting sensor 3 and muting sensor 4 before clearing muting sensors 1 and 2 or the muting function is overridden and the safety light curtain would become active causing a nuisance shutdown of the machine if the material is within the light curtain sensing field.

An interruption of the safety light curtain sensing field would cause the machine or the hazardous motion to be turned off. The muting cycle is completed when the material clears muting sensor 4.

The muting sensors must be spaced appropriately from the safety light curtain and each other in order to ensure that the sensors cannot be interrupted by personnel, causing the activation of the muting function.

A requirement of muting in machine applications is for indication that the muting function is activated. This is typically accomplished by the use of a muting lamp. The various muting modules offered by Rockwell Automation have an output for the connection of a muting lamp.

GuardShield Perimeter Access Control (PAC)

The Allen-Bradley Guardmaster GuardShield PAC safety light curtain system is a two-box design. This means the safety light curtain does not need a separate controller to operate in a guard-only mode with manual reset. Therefore, the safety outputs of the light curtain (OSSDs) can be connected directly to any safety relay that will accept PNP inputs.

The following are some common configurations of light curtain systems. The numbers on the drawing indicate the ordering steps to follow to ensure that a complete system is specified.

Components required for a multiple-beam PAC system, see Figure 3:

• Optic heads (operate on 24V DC)—ordered as a pair (transmitter/receiver) mounting brackets included
• Cables—separate 4-pin transmitter and 8-pin receiver
• Safety relay if EDM is not used
• Corner mirrors (for multiple side protection)
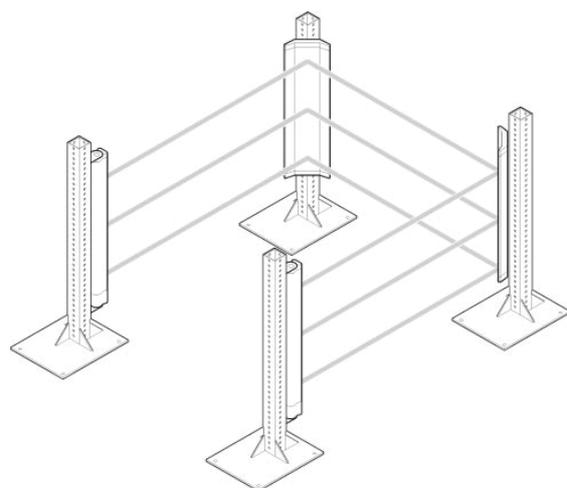
Figure 4

2-Opto-electronics

Safety Light Curtains

Overview

Components Required for PAC with Muting, see Figure 4:

1. Optic heads (operate on 24V DC) with muting module—ordered as a pair (transmitter/receiver)
2. It is also possible to use other Allen-Bradley Guardmaster muting modules such as the MSR42 or the MSR22LM muting module
3. Power supply
4. Cables for light curtains
5. Muting indication
6. Sensors for muting
7. Sensor accessories
8. Sensor cordsets
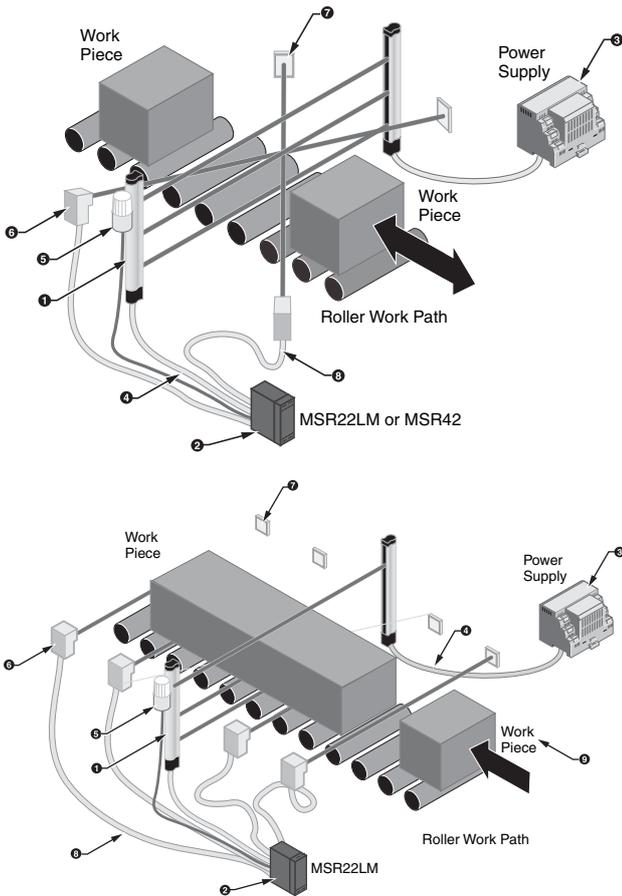
Perimeter Access Control Overview

Typical System Configurations

The Allen-Bradley Guardmaster Safe 4 PAC safety light curtain system is a two box design. This means the safety light curtain does not need a separate controller to operate in a guard-only mode. Therefore, the safety outputs of the light curtain (OSSDs) can be connected directly to any safety relay that will accept PNP inputs.

The following are some common configurations of light curtain systems. The numbers on the drawing indicate the ordering steps to follow to ensure that a complete system is specified.

Components required for a multiple-beam Safe 4 PAC, see Figure 5:

1. Optic heads (operate on 24V DC)—ordered as a pair (transmitter/receiver)
2. Cables—5-pin cables for transmitter and receiver
3. Safety relay
4. Power supply—120V AC to 24V DC
5. Mounting brackets—minimum of 4 per optic head pair
6. Corner mirror columns (for multiple side protection)
7. Mounting stand if required

Figure 5

2-Opto-electronics
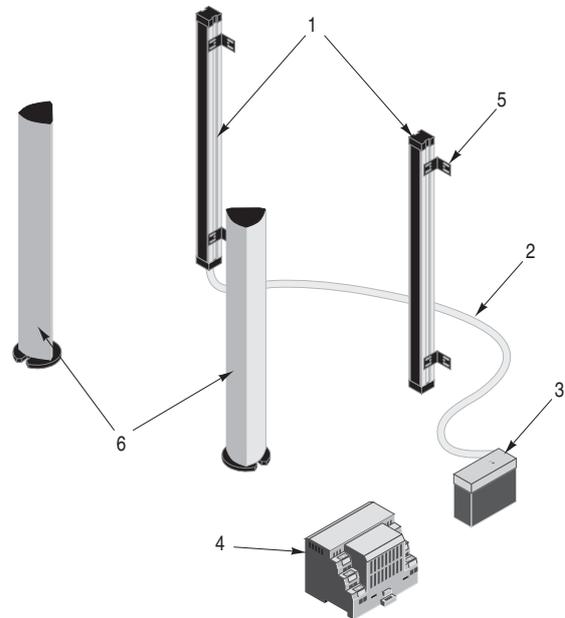
Allen-Bradley
Guardmaster®

Description

Standard GuardShield

The Allen-Bradley Guardmaster GuardShield safety light curtain is an economical, fully featured, Type 4 safety light curtain in a uniquely styled housing. GuardShield safety light curtains are general-purpose presence sensing devices designed for use on hazardous machinery providing point of operation, as well as perimeter and access guarding. This self-contained, two-box, safety light curtain has DIP-switch selectable operating modes and is available in both 14 mm and 30 mm resolutions.

Modes of operation such as fixed and floating blanking, beam coding, start/restart interlock, external device monitoring (EDM), and machine test signal, are selected by DIP-switch settings. These DIP-switches are located beneath a security door, which are conveniently located on both the transmitter and receiver end caps.

The GuardShield's torsionally rigid, extruded aluminium, polyurethane powder-coated housing, combined with an environmental rating of IP65, allows the GuardShield to be used in guarding applications across a broad range of industries.

Remote Teach GuardShield

The GuardShield Remote Teach system provides a remote means of changing a fixed blanking configuration within the GuardShield safety light curtain. This keyswitch box eliminates the need to open the GuardShield receiver door and perform the Teach function.

The three-position key switch simulates the opening of the GuardShield receiver door, teaching the GuardShield light curtain the new fixed blanking area, closing the door and returning to the run mode of operation.

The IP65 rated key switch box is provided with a steel mounting back plate to facilitate mounting of the box in proximity to the GuardShield receiver. It is necessary to see the receiver LEDs when performing the teach function.

Cascadable GuardShield System

A cascadable GuardShield safety light curtain is a standard GuardShield safety light curtain in 14 and 30 mm resolutions with additional M12 connectors located on top of each safety light curtain. The connector on the top of the safety light curtains allow the interconnection of up to a total of three pair of GuardShield safety light curtains with a common pair of OSSDs. The ability to interconnect GuardShield pairs reduces overall system wiring and simplifies the safety circuit resulting in a lower overall cost of a multiple safety light curtain system. This product configurability also allows a GuardShield safety light curtain system to protect multiple sides of a machine or simply adds flexibility when positioning GuardShield in various applications.

The complete cascading GuardShield system has the full functionality of a standard GuardShield (beam coding, EDM, start/restart interlock, fixed and floating blanking). There are a couple of operating modes which can not be configured in the middle and end segments (EDM and Start/Restart Interlock) and must only be configured in the host (first) pair. The system will still have these operating modes active if configured in the host or first GuardShield pair. This host or first pair is the pair of cascading GuardShield light curtains, which have the output cordsets connected and wired to the safety relay, safety PLC or FSDs. Configuring of the EDM operating mode in the end and middle segments will cause the system to go to a lock-out condition after the first interruption of the sensing field. Configuration of the start/restart interlock operating mode in the end and middle segments will cause the system to stay in a red condition awaiting reset after the interruption of the sensing field.

The cascading GuardShield safety light curtains are ordered as pairs (transmitter and receiver) and are shipped under one cat. no. After selecting the appropriate pair of cat. nos. for a cascading GuardShield system, select the interconnecting transmitter and receiver patchcord cat. nos. to connect the GuardShield pairs. The transmitter patchcord is a 4-pin M12 patchcord offered in lengths of 1/3 meter, 1 meter and 2 meters. The receiver patchcord is an 8-pin M12 patchcord offered in lengths of 1/3 meter, 1 meter, and 2 meters.

If the end pair of a cascading system is a cascading pair of GuardShield light curtains, it is necessary to attach a termination adaptor to the top M12 connector located on the receiver. Be sure to order all other required interfaces and accessories.

Patchcord
(2 meter max. length)

Last segment pair can be cascading or standard GuardShield pair
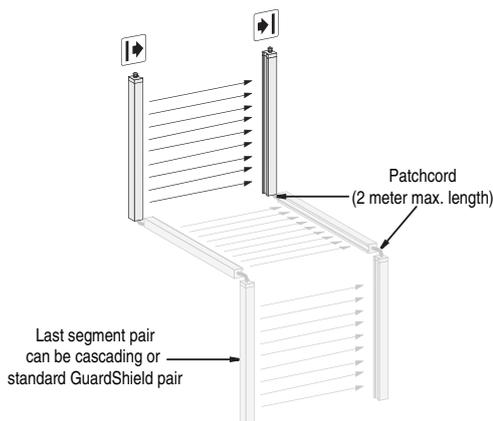
Up to three GuardShield POC segments can be interconnected.

The upper and lower limit of the protective field is shown by markings on the housings.

The width of the protective field is derived from the length of the light path between transmitter and receiver and must not exceed the maximum rated width of the protective field: 7 m for 14 mm (22.9 ft for 0.55 in.), 18 m for 30 mm (59.0 ft for 1.18 in.).

Cascading segments are offered in protective heights from 320…1760 mm in both 14 mm and 30 mm resolutions. Cascading segments of 160 mm are not offered, however; a 160 mm GuardShield can be used as the last segment in a cascading system.

A maximum of three GuardShield light curtains can be interconnected with a common pair of OSSDs. The maximum number of beams allowed in a cascading system is 528 beams, which equates to three 1760 mm cascading GuardShields in 14 mm resolution. The individual segments can have mixed resolutions, e.g., 14 mm and 30 mm as long as the pairs have the same protective heights and resolutions.

The response time of a cascading GuardShield system is the longest response time of any pair in the cascading system. For example, if the response time of each pair in the cascading system is 20 ms, then the cascading system's response time is 20 ms.

Cascading segments can be used as standalone light curtain pairs or can have up to three segments interconnected. These cascading segments all function as independent light curtains.

IMPORTANT	When cascading segments are used as standalone pairs or as the last segment in a cascading system, it is necessary to use a termination plug on the top connector of the GuardShield cascading receiver. It is also possible to use a standard GuardShield Type 4 POC pair as the last segment in a cascading system.

GuardShield with Integrated Laser Alignment System

The GuardShield POC and GuardShield POC cascadable light curtains are offered with an integrated laser alignment system consisting of a Class 1, eye safe, constantly powered laser located in the top of the GuardShield transmitter and at the bottom of the GuardShield receiver. There are targets located across from each laser that help facilitate alignment of the light curtain when the laser is emitting visible light.

Each laser emits a low level of visible light. Simply placing a finger or opaque object in front of the laser reflects the laser light back to a photo sensor. This photo sensor causes the laser to switch state from a barely visible low level of emission to a higher level of emission of visible light. Interrupting the visible light below the finger symbol will cause the laser to change state back to a low level of light emission. The visible light will also change to a low level after five minutes.

The Integrated Laser Alignment system also quickly helps with the re-alignment of pairs when units are knocked out of alignment during the course of the work process or when corner mirrors are used.

The GuardShield and Cascadable GuardShield are offered in 14 and 30 mm resolutions in protective heights from 320 to 1600 mm. The 160 and 1760 mm protective heights are not offered with the integrated laser alignment systems.

ArmorBlock Guard I/O Connectivity

The GuardShield POC and GuardShield Cascadable light curtains are also offered with the Class 1, eye safe, integrated laser alignment system and connectivity to ArmorBlock Guard I/O. The receiver of these light curtains has a five-pin M12 quick-disconnect connector wired to connect to the 1732DS ArmorBlock I/O module, allowing the GuardShield's OSSDs to operate over a DeviceNet Safe network.

This version of the GuardShield has limited configurability, i.e., only beam coding, fixed and floating blanking can be configured by setting the appropriate DIP switches and performing the teach function. EDM, Start/Restart interlock, and the auxiliary output are not available in these models.

You can use the ArmorBlock Guard I/O with any safety controller that communicates on DeviceNet using CIP Safety for the control and monitoring of safety circuits. ArmorBlock Guard I/O detects circuit failures at each I/O point while providing detailed diagnostics directly to the controller. With CIP Safety, you can easily integrate safety and standard control systems by using safety and standard messages on the same wire.

The 1732DS ArmorBlock Guard I/O family consists of 24V DC digital I/O modules that communicate on DeviceNet networks.

2-Opto-electronics

Features

Standard GuardShield

- Fixed blanking—teachable
- Floating blanking
  - One-beam floating blanking on 30 mm resolution
  - Two-beam floating blanking on 14 mm resolution
- Beam coding
- External Device Monitoring (EDM)
- Start/restart interlock
- M12 quick-disconnect connectors
- 160 to 1760 mm in 160 mm increments
- Standard GuardShield can be used as last segment pair in a cascading system

Standard GuardShield with Integrated Laser Alignment

- Fixed blanking—teachable
- Floating blanking
- Beam coding
- M12 quick-disconnect connectors
- Ease of alignment at installation with visible laser alignment
- 320…1600 mm in 160 mm increments
- 14 and 30 mm resolutions

Remote Teach GuardShield

- Three-position momentary key switch
- IP65 rated key switch box
- Y connector for quick-disconnect connections
- Standard GuardShield cables
- Allows quick and efficient reteaching of fixed blanked areas
- 160 to 1760 mm in 160 mm increments

Cascadable GuardShield System

- Easy to interconnect light curtains up to three 1760 mm segment pairs
- No increase in system response time

ArmorBlock Guard I/O GuardShield

- Fixed blanking—teachable
- Floating blanking
- Up to three cascading pairs can connect to ArmorBlock Guard I/O
- Beam coding
- M12 quick-disconnect connectors
- DeviceNet safe network connectivity
- 320…1600 mm in 160 mm increments

Specifications

Safety Ratings	
Standards	IEC/EN 61496 Parts 1 & 2, UL 61496 Parts 1 & 2, UL 1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849
Certifications	cULus, UL 61496, UL 1998, TÜV, and CE Marked for all applicable directives
Power Supply	
Input Power, Max.	24V DC ±20%
Maximum Residual Ripple	0.05 Vss
Power Consumption	0.4 A max (no load)
Outputs	
Safety Outputs	2 OSSD, 0.5 A, short-circuit protected
Non-Safety Outputs	Auxiliary output, 0.5 A max.
Output Voltage, Min.	(Uv) - 2V
Switching Current @ Voltage, Min.	500 mA @ 24V DC
Operating Characteristics	
Response Time	14 mm; 160 mm…1440 mm 20 ms, 1600 mm and 1760 mm, 25 ms. 30 mm; 20 ms. Add 10 ms when beam coding activated.
Status Indicators	ON State, OFF State, Blanking, Alignment, Interlock
Protected Height [mm (in.)]	See Product Selection tables.
Resolution [mm (in.)]	14 (0.55) or 30 (1.18)
Scanning Range/Resolution	0.3…7 m / 14 mm (0.98…22.9 ft / 0.55 in.) 0.3…16 m / 30 mm (0.98…52 ft / 1.18 in.)
Synchronization	Optical, first beam adjacent to LEDs.
Wavelength	870 nm
Environmental	
Enclosure Type Rating	IP65
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	-10…55° (14…131°)
Vibration	IEC60068-2-6: Frequency 10…55 Hz; Amplitude: 0.35 mm (0.01 in.)
Shock	IEC60068-2-29: Acceleration 10 g, pulse duration 16 ms 10…55 Hz
Physical Characteristics	
Mounting	End-cap brackets supplied
Weight	Varies by protective height
Housing Cross Section	40 mm x 50 mm (1.57 in. x 1.96 in.)
Connection Type	Transmitter: 4-pin M12 micro QD; Receiver: 8-pin M12 micro QD
Cable Length	30 m (100 ft) max.

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Allen-Bradley
Guardmaster®

POC Type 4 Safety Light Curtains
GuardShield

Product Selection

Standard System

The Allen-Bradley Guardmaster GuardShield safety light curtains are ordered as pairs—transmitter and receiver—and shipped under one cat. no. After selecting the appropriate light curtain pair, ensure that required interfaces and accessories are ordered.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
160 (6.3)	14 (0.55)	16	440L-P4J0160YD	160 (6.3)	30 (1.18)	8	440L-P4K0160YD
320 (12.6)	14 (0.55)	32	**440L-P4J0320YD**	320 (12.6)	30 (1.18)	16	**440L-P4K0320YD**
480 (18.9)	14 (0.55)	48	440L-P4J0480YD	480 (18.9)	30 (1.18)	24	**440L-P4K0480YD**
640 (25.2)	14 (0.55)	64	**440L-P4J0640YD**	640 (25.2)	30 (1.18)	32	**440L-P4K0640YD**
800 (31.5)	14 (0.55)	80	**440L-P4J0800YD**	800 (31.5)	30 (1.18)	40	**440L-P4K0800YD**
960 (37.8)	14 (0.55)	96	440L-P4J0960YD	960 (37.8)	30 (1.18)	48	**440L-P4K0960YD**
1120 (44.1)	14 (0.55)	112	440L-P4J1120YD	1120 (44.1)	30 (1.18)	56	**440L-P4K1120YD**
1280 (50.4)	14 (0.55)	128	440L-P4J1280YD	1280 (50.4)	30 (1.18)	64	**440L-P4K1280YD**
1440 (56.7)	14 (0.55)	144	440L-P4J1440YD	1440 (56.7)	30 (1.18)	72	440L-P4K1440YD
1600 (63.0)	14 (0.55)	160	440L-P4J1600YD	1600 (63.0)	30 (1.18)	80	440L-P4K1600YD
1760 (69.1)	14 (0.55)	176	440L-P4J1760YD	1760 (69.1)	30 (1.18)	88	440L-P4K1760YD

Note: The GuardShield transmitter requires a 4-pin cable and the receiver requires an 8-pin cable.
Note: To select just a transmitter or receiver, replace the "P" in the above cat. nos. with a "T" for transmitter and an "R" for receiver.

Remote Teach System

The Allen-Bradley Guardmaster GuardShield remote teach system is ordered as a system. The system consists of a standard GuardShield transmitter in either 14 mm or 30 mm resolutions with mounting hardware, a GuardShield receiver with a 10 inch Y-connector cable, a metal key switch box, and a 4-pin 2 meter patchcord which connects between the key switch box and the Y-connector.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
160 (6.3)	14 (0.55)	16	440L-S4J0160YR	160 (6.3)	30 (1.18)	8	440L-S4K0160YR
320 (12.6)	14 (0.55)	32	440L-S4J0320YR	320 (12.6)	30 (1.18)	16	440L-S4K0320YR
480 (18.9)	14 (0.55)	48	440L-S4J0480YR	480 (18.9)	30 (1.18)	24	440L-S4K0480YR
640 (25.2)	14 (0.55)	64	440L-S4J0640YR	640 (25.2)	30 (1.18)	32	440L-S4K0640YR
800 (31.5)	14 (0.55)	80	440L-S4J0800YR	800 (31.5)	30 (1.18)	40	440L-S4K0800YR
960 (37.8)	14 (0.55)	96	440L-S4J0960YR	960 (37.8)	30 (1.18)	48	440L-S4K0960YR
1120 (44.1)	14 (0.55)	112	440L-S4J1120YR	1120 (44.1)	30 (1.18)	56	440L-S4K1120YR
1280 (50.4)	14 (0.55)	128	440L-S4J1280YR	1280 (50.4)	30 (1.18)	64	440L-S4K1280YR
1440 (56.7)	14 (0.55)	144	440L-S4J1440YR	1440 (56.7)	30 (1.18)	72	440L-S4K1440YR
1600 (63.0)	14 (0.55)	160	440L-S4J1600YR	1600 (63.0)	30 (1.18)	80	440L-S4K1600YR
1760 (69.1)	14 (0.55)	176	440L-S4J1760YR	1760 (69.1)	30 (1.18)	88	440L-S4K1760YR
Remote Teach Keyswitch Box Assembly∗			440L-M8600	DC Micro Style Quick-Disconnect Patchcord, 4-Pin∗			889D-F4ACDM-2

Note: The GuardShield transmitter requires a 4-pin cable and the receiver requires an 8-pin cable.
Note: The GuardShield remote teach system light curtains can be ordered as pairs by replacing the "S" in the cat. no. a with "P."
∗ Included with each system cat. no.; can be ordered as a replacement part.

Allen-Bradley
Guardmaster®

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Cascadable Standard System

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
320 (12.6)	14 (0.55)	32	440L-C4J0320YD	320 (12.6)	30 (1.18)	16	440L-C4K0320YD
480 (18.9)	14 (0.55)	48	440L-C4J0480YD	480 (18.9)	30 (1.18)	24	440L-C4K0480YD
640 (25.2)	14 (0.55)	64	440L-C4J0640YD	640 (25.2)	30 (1.18)	32	440L-C4K0640YD
800 (31.5)	14 (0.55)	80	440L-C4J0800YD	800 (31.5)	30 (1.18)	40	440L-C4K0800YD
960 (37.8)	14 (0.55)	96	440L-C4J0960YD	960 (37.8)	30 (1.18)	48	440L-C4K0960YD
1120 (44.1)	14 (0.55)	112	440L-C4J1120YD	1120 (44.1)	30 (1.18)	56	440L-C4K1120YD
1280 (50.4)	14 (0.55)	128	440L-C4J1280YD	1280 (50.4)	30 (1.18)	64	440L-C4K1280YD
1440 (56.7)	14 (0.55)	144	440L-C4J1440YD	1440 (56.7)	30 (1.18)	72	440L-C4K1440YD
1660 (63.0)	14 (0.55)	160	440L-C4J1600YD	1600 (63.0)	30 (1.18)	80	440L-C4K1600YD
1760 (69.3)	14 (0.55)	176	440L-C4J1760YD	1760 (69.3)	30 (1.18)	88	440L-C4K1760YD

Note: Cascadable systems are sold in pairs represented by the "C" in the cat. no. To order the cascadable transmitter or receiver, replace the "C" with a "G" for the transmitter or "F" for the receiver.

## GuardShield with Integrated Laser Alignment

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
320 (12.6)	14 (0.55)	32	440L-P4JL0320YD	320 (12.6)	30 (1.18)	16	440L-P4KL0320YD
480 (18.9)	14 (0.55)	48	440L-P4JL0480YD	480 (18.9)	30 (1.18)	24	440L-P4KL0480YD
640 (25.2)	14 (0.55)	64	440L-P4JL0640YD	640 (25.2)	30 (1.18)	32	440L-P4KL0640YD
800 (31.5)	14 (0.55)	80	440L-P4JL0800YD	800 (31.5)	30 (1.18)	40	440L-P4KL0800YD
960 (37.8)	14 (0.55)	96	440L-P4JL0960YD	960 (37.8)	30 (1.18)	48	440L-P4KL0960YD
1120 (44.1)	14 (0.55)	112	440L-P4JL1120YD	1120 (44.1)	30 (1.18)	56	440L-P4KL1120YD
1280 (50.4)	14 (0.55)	128	440L-P4JL1280YD	1280 (50.4)	30 (1.18)	64	440L-P4KL1280YD
1440 (56.7)	14 (0.55)	144	440L-P4JL1440YD	1440 (56.7)	30 (1.18)	72	440L-P4KL1440YD
1600 (63.0)	14 (0.55)	160	440L-P4JL1600YD	1600 (63.0)	30 (1.18)	80	440L-P4KL1600YD

Note: GuardShields are sold in pairs. To select a transmitter or receiver, replace the "P" in the cat. no. with a "T" for transmitter and an "R" for receiver.

Cascadable GuardShield with Integrated Laser Alignment

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
320 (12.6)	14 (0.55)	32	440L-C4JL0320YD	320 (12.6)	30 (1.18)	16	440L-C4KL0320YD
480 (18.9)	14 (0.55)	48	440L-C4JL0480YD	480 (18.9)	30 (1.18)	24	440L-C4KL0480YD
640 (25.2)	14 (0.55)	64	440L-C4JL0640YD	640 (25.2)	30 (1.18)	32	440L-C4KL0640YD
800 (31.5)	14 (0.55)	80	440L-C4JL0800YD	800 (31.5)	30 (1.18)	40	440L-C4KL0800YD
960 (37.8)	14 (0.55)	96	440L-C4JL0960YD	960 (37.8)	30 (1.18)	48	440L-C4KL0960YD
1120 (44.1)	14 (0.55)	112	440L-C4JL1120YD	1120 (44.1)	30 (1.18)	56	440L-C4KL1120YD
1280 (50.4)	14 (0.55)	128	440L-C4JL1280YD	1280 (50.4)	30 (1.18)	64	440L-C4KL1280YD
1440 (56.7)	14 (0.55)	144	440L-C4JL1440YD	1440 (56.7)	30 (1.18)	72	440L-C4KL1440YD
1600 (63.0)	14 (0.55)	160	440L-C4JL1600YD	1600 (63.0)	30 (1.18)	80	440L-C4KL1600YD

Note: Cascadable GuardShields are sold in pairs. To select a transmitter or receiver, replace the "C" with a "G" for cascadable transmitter and an "F" for a cascadable receiver.

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POC Type 4 Safety Light Curtains
GuardShield

GuardShield with Integrated Laser Alignment and ArmorBlock Guard I/O Connectivity

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
320 (12.6)	14 (0.55)	32	440L-P4JL0320YA	320 (12.6)	30 (1.18)	16	440L-P4KL0320YA
480 (18.9)	14 (0.55)	48	440L-P4JL0480YA	480 (18.9)	30 (1.18)	24	440L-P4KL0480YA
640 (25.2)	14 (0.55)	64	440L-P4JL0640YA	640 (25.2)	30 (1.18)	32	440L-P4KL0640YA
800 (31.5)	14 (0.55)	80	440L-P4JL0800YA	800 (31.5)	30 (1.18)	40	440L-P4KL0800YA
960 (37.8)	14 (0.55)	96	440L-P4JL0960YA	960 (37.8)	30 (1.18)	48	440L-P4KL0960YA
1120 (44.1)	14 (0.55)	112	440L-P4JL1120YA	1120 (44.1)	30 (1.18)	56	440L-P4KL1120YA
1280 (50.4)	14 (0.55)	128	440L-P4JL1280YA	1280 (50.4)	30 (1.18)	64	440L-P4KL1280YA
1440 (56.7)	14 (0.55)	144	440L-P4JL1440YA	1440 (56.7)	30 (1.18)	72	440L-P4KL1440YA
1600 (63.0)	14 (0.55)	160	440L-P4JL1600YA	1600 (63.0)	30 (1.18)	80	440L-P4KL1600YA

Note: GuardShields are sold in pairs. To select a transmitter or receiver, replace the "P" in the cat. no. with an "R" for a receiver. The GuardShield standard transmitter is used in the pair. To order a transmitter, replace the "P" with a "T" and the "A" with a "D."

Cascadable GuardShield with Integrated Laser Alignment and ArmorBlock Guard I/O Connectivity

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
320 (12.6)	14 (0.55)	32	440L-C4JL0320YA	320 (12.6)	30 (1.18)	16	440L-C4KL0320YA
480 (18.9)	14 (0.55)	48	440L-C4JL0480YA	480 (18.9)	30 (1.18)	24	440L-P4KL0480YA
640 (25.2)	14 (0.55)	64	440L-C4JL0640YA	640 (25.2)	30 (1.18)	32	440L-C4KL0640YA
800 (31.5)	14 (0.55)	80	440L-C4JL0800YA	800 (31.5)	30 (1.18)	40	440L-C4KL0800YA
960 (37.8)	14 (0.55)	96	440L-C4JL0960YA	960 (37.8)	30 (1.18)	48	440L-C4KL0960YA
1120 (44.1)	14 (0.55)	112	440L-C4JL1120YA	1120 (44.1)	30 (1.18)	56	440L-C4KL1120YA
1280 (50.4)	14 (0.55)	128	440L-C4JL1280YA	1280 (50.4)	30 (1.18)	64	440L-C4KL1280YA
1440 (56.7)	14 (0.55)	144	440L-C4JL1440YA	1440 (56.7)	30 (1.18)	72	440L-C4KL1440YA
1600 (63.0)	14 (0.55)	160	440L-C4JL1600YA	1600 (63.0)	30 (1.18)	80	440L-C4KL1600YA

Note: Cascadable GuardShields are sold in pairs. To select a transmitter or receiver replace the "C" with an "F" for a cascadable receiver. The cascadable GuardShield standard transmitter is used in these pairs. To order a cascadable transmitter, replace the "C" with a "G" and the "A" with a "D" to specify the appropriate transmitter cat. no.

Recommended Logic Interfaces

| Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR211	2 N.O.	1 N.C.	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-84	440R-H23177
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Standard and Remote Teach Cordsets—Two Required (one for transmitter and one for receiver)

Female Connector (Sensor End)		Cable			
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]	Cat. No.
Transmitter					
	Straight Female	1 Brown 2 White 3 Blue 4 Black	22 AWG 300V 4 A	2 (6.56)	889D-F4AC-2
				5 (16.4)	889D-F4AC-5
				10 (32.8)	889D-F4AC-10
				15 (49.2)	889D-F4AC-15
				20 (65.6)	889D-F4AC-20
				30 (98.4)	889D-F4AC-30
Receiver					
	Straight Female	1 White 2 Brown 3 Green 4 Yellow 5 Grey 6 Pink 7 Blue 8 Red	24 AWG 30V AC/36V DC 1.5 A	2 (6.56)	889D-F8AB-2
				5 (16.4)	889D-F8AB-5
				10 (32.8)	889D-F8AB-10
				15 (49.2)	889D-F8AB-15
				20 (65.6)	889D-F8AB-20
				30 (98.4)	889D-F8AB-30

Cascadable System Patchcords—to connect cascadable GuardShield system

The GuardShield transmitter host patchcord has 4-pin DC micro over-molded quick-disconnect connectors offered in lengths of 1/3 m, 1 m, and 2 m. The GuardShield receiver host patchcord has 8-pin DC micro over-molded quick-disconnect connectors offered in lengths of 1/3 m, 1 m, and 2 m.

Face View of Female	Description	Cat. No.
Transmitter Patchcord		
	4-pin M12 patchcord, 0.3 m (12 in.)	889D-F4ACDM-0M3
	4-pin M12 patchcord, 1 m (39.37 in.)	889D-F4ACDM-1
	4-pin M12 patchcord, 2 m (78.74 in.)	889D-F4ACDM-2
Receiver Patchcord		
	8-pin M12 patchcord, 0.3 m (12 in.)	889D-F8ABDM-0M3
	8-pin M12 patchcord, 1 m (39.37 in.)	889D-F8ABDM-1
	8-pin M12 patchcord, 2 m (78.74 in.)	889D-F8ABDM-2
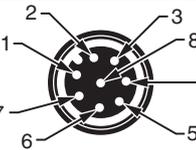
Face View of Female	Description	Cat. No.
Receiver Termination Plug		
	Termination plug 8-pin M12 quick disconnect Required for connection to top connector of cascadable receiver if cascade light curtain is used as a standalone system or as the last segment pair in a cascaded system.	898D-81CU-DM

Note: A termination plug is not necessary for the cascadable transmitter.

Cordsets Approximate Dimensions [mm (in.)]
Dimensions are not intended to be used for installation purposes.
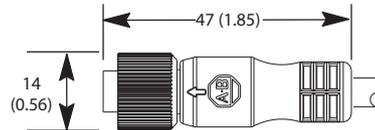
Straight Female M12 Quick Disconnect

ArmorBlock Guard I/O

Top View	Color	No. of Pins	Signal Receiver
	Brown	1	+24V
	White	2	OSSD 2
	Blue	3	0V
	Black	4	OSSD 1
	Grey	5	NC
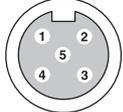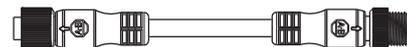
Interconnecting Patchcords—ArmorBlock I/O Connection

Cat. No.	Description
889D-F5ACDM-0M3	Five-pin M12 patchcord, 0.3 m (12 in.)
889D-F5ACDM-1	Five-pin M12 patchcord, 1 m (39.37 in.)
889D-F5ACDM-2	Five-pin M12 patchcord, 2 m (78.74 in.)
889D-F5ACDM-5	Five-pin M12 patchcord, 5 m (196.85 in.)
889D-F5ACDM-10	Five-pin M12 patchcord, 10 m (393.7 in.)

Note: The GuardShield pairs with ArmorBlock Guard I/O Connectivity have a 5-pin M12 quick-disconnect connector on the receiver wired to allow connection to the ArmorBlock 5-pin connector. The transmitter in that GuardShield pair is a standard GuardShield transmitter with integrated laser alignment system offered with a 4-pin M12 quick-disconnect connector. It is possible to connect either a standard 4-pin M12 cordset or the 5-pin M12 quick-disconnect connector cordset or patchcord to this transmitter.

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POC Type 4 Safety Light Curtains

GuardShield

Termination Connector for Cascadable GuardShield Receiver (if it's a standalone pair) with ArmorBlock Guard I/O Connectivity
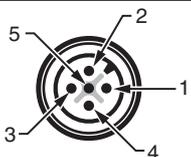
Face View of Female	Description	Cat. No.
5 2 1 3 4	5-pin M12 Termination Adaptor	898D-418U-DM

Note: The cascadable GuardShield with ArmorBlock Guard I/O connectivity can be used as a standalone pair if the top connector on the receiver has a termination adaptor connected. The cascadable transmitter does not require a termination adaptor.

Optional Accessories

Description	Cat. No.
Steel L-shaped end cap mounting bracket (4 per package) **Note:** 4 brackets supplied with each GuardShield pair.	440L-AF6101
Aluminum middle mounting bracket for vibratory applications	**440L-AF6108**
Power supply: Output—24V DC, 3 Amps, 72 W	1606-XLP72E
Laser alignment tool	**440L-ALAT**
GuardShield laser alignment tool bracket	**440L-AF6109**
Mounting stand	**440L-AMSTD**
Vertical shock mount kit	**440L-AF6120**
Horizontal shock mount kit	440L-AF6121
Middle vertical mount kit	440L-AF6122
Middle horizontal mount kit	440L-AF6123
GuardShield weld shield (cat. no. is for a pair of light curtains)	440L-AGWS0160
	440L-AGWS0320
	440L-AGWS0480
	440L-AGWS0640
	440L-AGWS0800
	440L-AGWS0960
	440L-AGWS1120
	440L-AGWS1280
	440L-AGWS1440
	440L-AGWS1600
	440L-AGWS1760
GuardShield Washdown Enclosure Kit **Note**: Only for use with standard GuardShield light curtain.	440L-AGST320
	440L-AGST480
	440L-AGST640
	440L-AGST800
	440L-AGST960
8-pin M12 Receiver Termination Plug (Required for top receiver connector if a cascaded pair is used as a standalone or if it is the last pair in a cascaded system.)	898D-81CU-DM

2-Opto-electronics

Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

Note: Each mirror reduces maximum scan range by up to 15% per mirror. Each corner mirror suppled with two endcap mounting brackets.

GuardShield Light Curtain Cat. No.	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
440L-P4∗0160Y❋ 440L-P2K‡0160YD		440L-AM0750300		440L-AM1250300
440L-P4∗0320Y❋ 440L-P2K‡0320YD		440L-AM0750450		440L-AM1250450
440L-P4∗0480Y❋ 440L-P2K‡0480YD 440L-P4A2500YD		440L-AM0750600		440L-AM1250600
440L-P4∗0640Y❋ 440L-P2K‡0640YD		440L-AM0750750		440L-AM1250750
440L-P4∗0800Y❋ 440L-P2K‡0800YD		440L-AM0750900		440L-AM1250900
440L-P4∗0960Y❋ 440L-P2K‡0960YD 440L-P4A3400YD		440L-AM0751050		440L-AM1251050
440L-P4∗1120Y❋ 440L-P2K‡1120YD		440L-AM0751200		**440L-AM1251200**
440L-P4∗1280Y❋ 440L-P2K‡1280YD		440L-AM0751350		440L-AM1251350
440L-P4∗1440Y❋ 440L-P2K‡1440YD		440L-AM0751500		440L-AM1251500
440L-P4∗1600Y❋ 440L-P2K‡1600YD		440L-AM0751650		440L-AM1251650
440L-P4∗1760Y❋ 440L-P2K‡1760YD		440L-AM0751800		440L-AM1251800

∗ = J or K;
❋ = D or R;
‡ = A or D

2-Opto-electronics

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Standard GuardShield

Remote Teach GuardShield

11
(0.43)

>80
(3.14)

52
(2.05)

40
(1.57)

42
(1.65)

20
(0.79)

75
(2.95)

A

B

C

254 (10)

Cascadable GuardShield

11
(0.43)

80
(3.14) min.

80
(3.14) min.

42
(1.65)

52
(2.05)

32
(1.25)
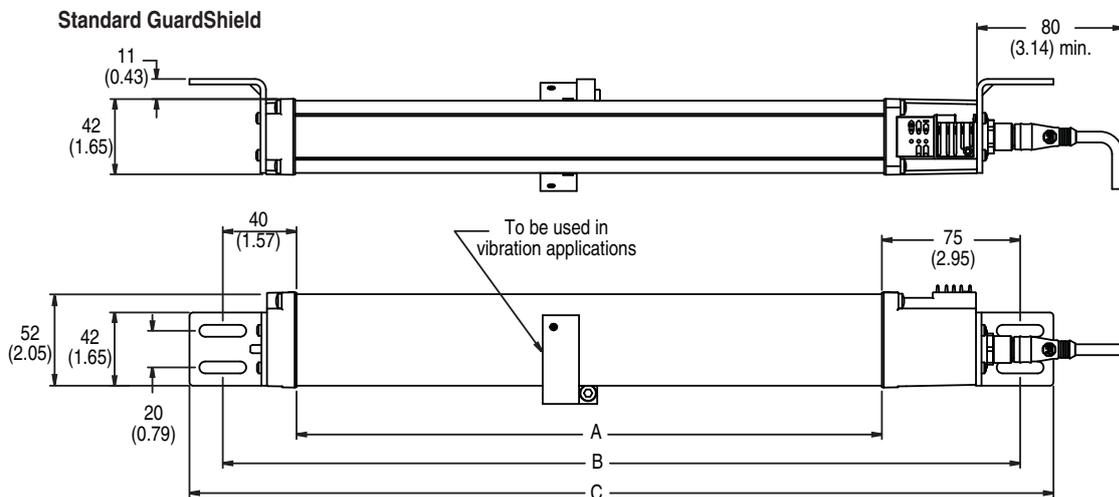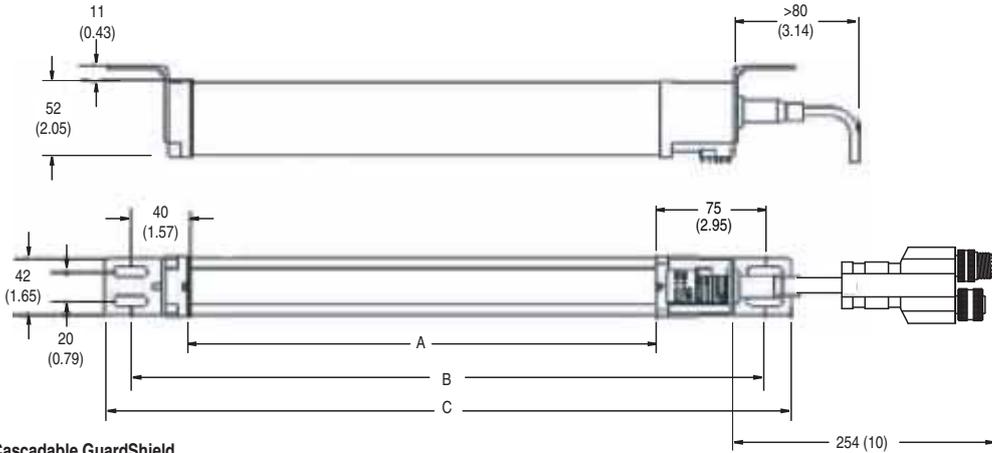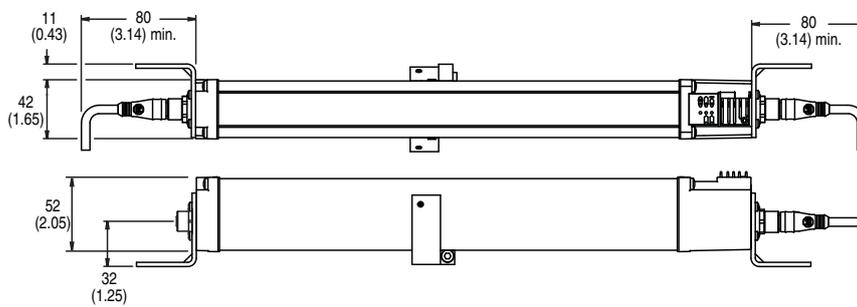
Note: Middle mounting bracket should be used in vibration applications on GuardShield light curtain protective heights of 1120 mm and larger.

Type	A Protective Height [mm]	B Mounting Value [mm]	C Total Length [mm]
440L-∗4‡0160YD	160 ±0.5§	276	312 ±1.5
440L-❊4‡0320YD	320 ±0.5	436	472 ±1.5
440L-❊4‡0480YD	480 ±0.5	596	632 ±1.5
440L-❊4‡0640YD	640 ±0.5	756	792 ±1.5
440L-❊4‡0800YD	800 ±0.6	916	952 ±1.5
440L-❊4‡0960YD	960 ±0.6	1076	1112 ±1.5
440L-❊4‡1120YD	1120 ±0.6	1236	1272 ±1.8
440L-❊4‡1280YD	1280 ±0.7	1396	1432 ±1.8
440L-❊4‡1440YD	1440 ±0.7	1556	1592 ±1.8
440L-❊4‡1600YD	1600 ±0.8	1716	1752 ±2.0
440L-❊4‡1760YD	1760 ±0.8	1876	1912 ±2.0

∗ P = Pair, T = Transmitter, R = Receiver
❊ P = Pair, T = Transmitter, R = Receiver, C = Host Pair, G = Host Transmitter, F = Host Receiver
‡ J = 14 mm resolution or K = 30 mm resolution
§ 160 mm is not available for cascading GuardShield light curtains.

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Standard GuardShield Receiver with Integrated Laser Alignment

11 (0.43)
42 (1.65)
80 min (3.14)
440L-R4JL0320YD shown receiver

A

40 (1.57)
52 (2.05)
Middle Mounting Bracket To Be Used in Vibration Applications
75 (2.95)
20 (0.79)
40 (1.575)
B
C
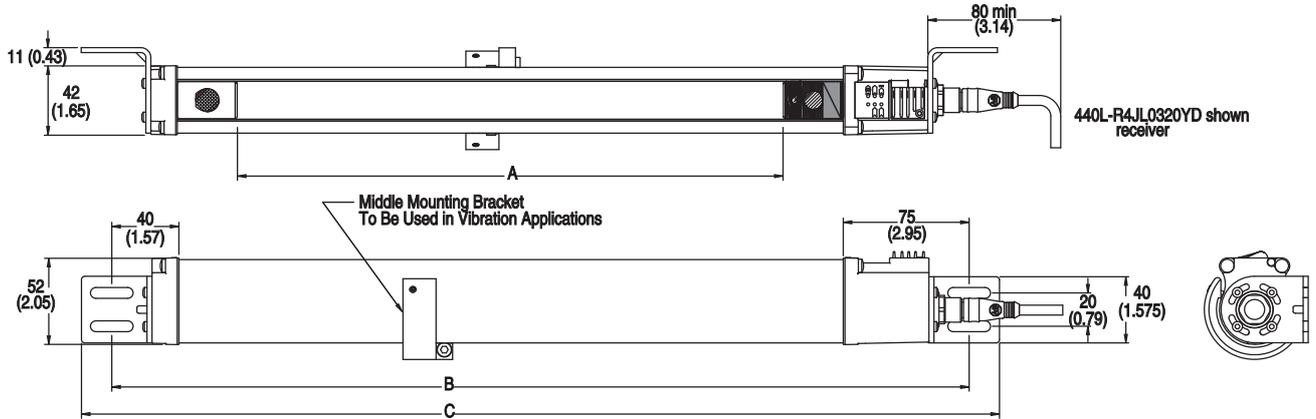
Standard GuardShield Transmitter with Integrated Laser Alignment
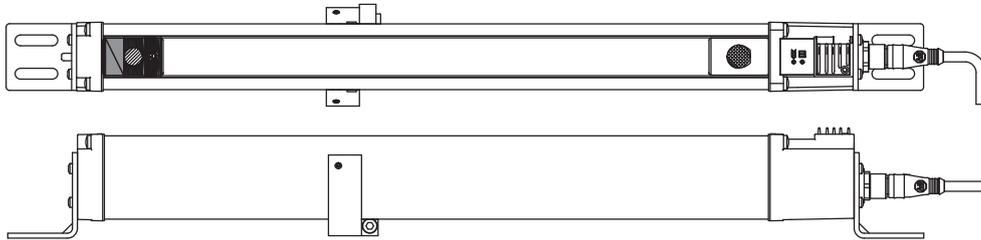
Type	A Protective Height	B Mounting	C Total Length	D Mounting
440L-P4*L0320YD	320±0.5	516	552±1.5	426
440L-P4*L0480YD	480±0.5	676	712±1.5	586
440L-P4*L0640YD	640±0.5	836	872±1.5	746
440L-P4*L0800YD	800±0.5	996	1032±1.5	906
440L-P4*L0960YD	960±0.5	1156	1192±1.5	1066
440L-P4*L1120YD	1120±0.5	1316	1352±1.5	1226
440L-P4*L1280YD	1280±0.5	1476	1512±1.5	1386
440L-P4*L1440YD	1440±0.5	1636	1672±1.5	1546
440L-P4*L1600YD	1600±0.5	1796	1832±1.5	1706

J = 14 mm resolution, K = 30 mm resolution

POC Type 4 Safety Light Curtains

GuardShield

Cascadable GuardShield Receiver with Integrated Laser Alignment
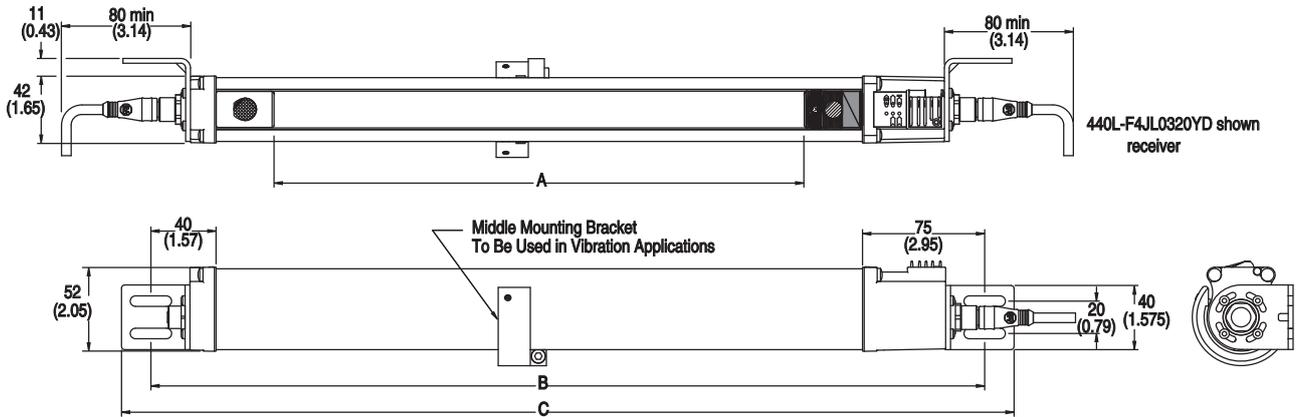
440L-F4JL0320YD shown
receiver

Middle Mounting Bracket
To Be Used in Vibration Applications

Cascadable GuardShield Transmitter with Integrated Laser Alignment

440L-G4JL0320YD shown
transmitter

440L-C4JL0320YD shown
* K = 30 mm resolution
* J = 14 mm resolution
* L = Laser
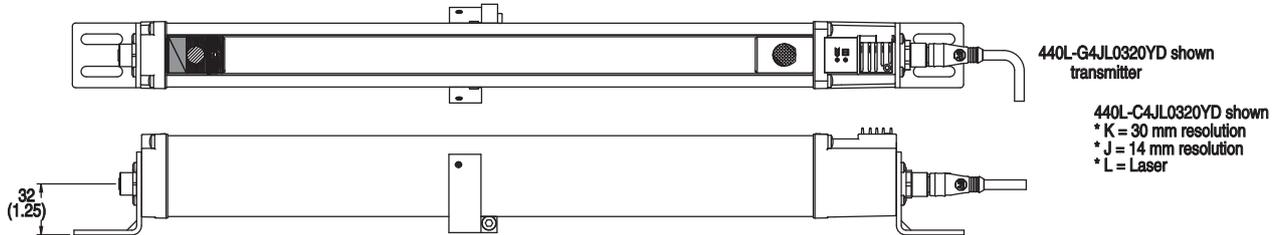
Type	A Protective Height	B Mounting	C Total Length	D Mounting
440L-C4*L0320YD	320±0.5	516	552±1.5	426
440L-C4*L0480YD	480±0.5	676	712±1.5	586
440L-C4*L0640YD	640±0.5	836	872±1.5	746
440L-C4*L0800YD	800±0.5	996	1032±1.5	906
440L-C4*L0960YD	960±0.5	1156	1192±1.5	1066
440L-C4*L1120YD	1120±0.5	1316	1352±1.5	1226
440L-C4*L1280YD	1280±0.5	1476	1512±1.5	1386
440L-C4*L1440YD	1440±0.5	1636	1672±1.5	1546
440L-C4*L1600YD	1600±0.5	1796	1832±1.5	1706

J = 14 mm resolution, K = 30 mm resolution

Wiring Diagram for Connection of OSSDs Directly to Contactors (FSDs) with Restart Interlock

Wiring diagram is not intended to be used for installation purposes.

✻ Auxiliary output is nonsafety. Can be connected to a lamp, motor or status to a PLC.

K1, K2	Safety relay or safety contactor for OSSD 1 and OSSD 2 connection
S1	Switch for external system test (optional)
S2	Switch for reset of light curtain from start/restart interlock

Wiring Diagram for Connection of OSSDs Directly to a Safety Relay Module

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2-25

GuardShield Light Curtain Connected to MSR22LM with Two Sensor Muting

GuardShield Light Curtain Connected to MSR22LM with Four Sensor Muting

NOTES:

1. MUTING SENSORS ARE N.C. PNP TYPE

2. WIRE RESET SWITCH TO S43 & S44 WHEN EXTERNAL MONITORING IS NOT REQUIRED. TERMINAL X44 IS NOT USED.

3. MUTING LAMP MUST MEET THE FOLLOWING CURRENT SPECS:
MINIMUM CURRENT = 25mA
MAXIMUM CURRENT = 100mA
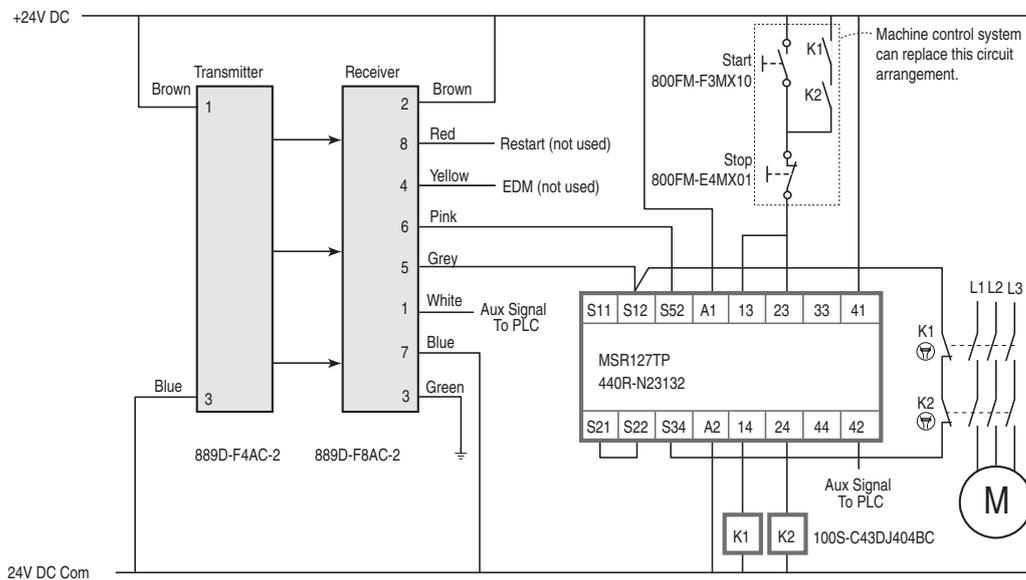
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Description

The Allen Bradley Guardmaster GuardShield Safe 4 is an economical two box, Type 4 safety light curtain with ON/OFF functionality. This basic, guard-only operating mode, safety light curtain has an Integrated Laser Alignment system that simplifies the alignment of each pair of light curtains. Visible laser beams are activated by touching the laser at the finger symbol on front face of the light curtains. Positioning of the transmitter and receiver laser beams to their respective targets facilitates optimal alignment of each Safe 4 pair. The Integrated Laser Alignment system also quickly helps with the re-alignment of pairs when units are knocked out of alignment during the course of the work process or when corner mirrors are used.

The GuardShield Safe 4 is designed to be used in a variety of applications across a broad range of industries in medium to heavy industrial environments. Offered with shock isolator kits for shock and vibration applications and protective heights from 120…1920 mm in 120 mm increments assures that the correct size of safety light curtain is available to suit the application requirement.

The GuardShield Safe 4, with an environmental rating of IP65, meets all applicable global standards and can be used on or around industrial machinery and equipment anywhere in the world.

Features

- M12 connectors
- Optically synchronized
- Integrated laser alignment system
- IP65 enclosure rating
- Simple installation
- cULus Listed and CE Marked for all applicable directives

Applications

- Metal working
- Shears
- Punch presses
- Robot cells
- Automated processes

Specifications

Safety Ratings	
Standards	EN/IEC 61496 Parts 1 and 2, UL 61496 Parts 1 and 2, UL1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849, EN/IEC 61496-1, -2, UL 61496-1, -2, UL 1998
Certifications	cULus Listed and CE Marked for all applicable directives

Power Supply	
Input Power, Max.	24V DC ± 20%
Maximum Residual Ripple	< 10% of U_{sp}
Power Consumption	<500 mA (no load)

Outputs	
Safety Outputs	2 PNP OSSD. 0.3 A, short-circuit protected
Output Voltage	>U_{sp} (at load = 0.1 A)
Switching Current @ Voltage, Min.	300 mA @ 24V DC

Operating Characteristics	
Response Time	Varies by protective height, see Installation Manual
Indicator LEDs	ON -State, OFF-State, internal error
Protected Height [mm (in.)]	120…1920 mm (4.7…75.6 in.) in 120 mm (4.7 in.) increments
Resolution [mm (in.)]	14 mm (0.55 in.) 30 mm (1.18 in.)
Scanning Range	14 mm: 0…9 m (0…29.7 ft) 30 mm: 0…18 m (0…59 ft)
Synchronization	Optical, first beam adjacent to LEDs
Wavelength	950 nm

Environmental	
Enclosure Type Rating	IP65
Relative humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	0…55° (0…131°)
Vibration	IEC 60068-2-6 frequency 10…55 Hz; amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; acceleration 10 g, pulse duration 16 ms 10…55 Hz; amplitude 0.35 mm (0.01 in.)

Physical Characteristics	
Mounting	Rear mounting, standard and adjustable (180°)
Weight	Varies by protective height, see Installation Manual
Housing Cross Section	30 x 40 mm (1.18 x 1.57 in.)
Connection Type	Transmitter: 5-pin M12 micro QD Receiver: 5-pin M12 micro QD
Cable Length	30 m (98.4 ft) max.
ILAS Laser Class	Class 2, IEC 60825-1

2-Opto-electronics

POC Type 4 Safety Light Curtains

GuardShield Safe 4

Product Selection

Standard System

The Allen-Bradley Guardmaster GuardShield Safe 4 safety light curtains are offered in 14 mm and 30 mm resolutions, are ordered as pairs—transmitter and receiver—and are shipped under one cat. no. Each GuardShield Safe 4 pair is shipped with standard mounting brackets. After selecting the appropriate Safe 4 protected height and resolution, ensure that the appropriate cordsets, interfaces, and accessories are ordered.

Protected Height [mm (in.)]	14 mm (0.55 in.) Number of Beams	30 mm (1.18 in.) Number of Beams	Pair Weight [kg (lbs)]	Cat. No. 14 mm (0.55 in.)	Cat. No. 30 mm (1.18 in.)
120 (4.7)	16	8	1.0 (2.2)	445L-P4L0120YD	445L-P4S0120YD
240 (9.4)	32	16	1.4 (3.1)	**445L-P4L0240YD**	445L-P4S0240YD
360 (14.2)	48	94	1.8 (4.0)	445L-P4L0360YD	445L-P4S0360YD
480 (19.9)	64	94	2.2 (4.9)	445L-P4L0480YD	445L-P4S0480YD
600 (23.6)	80	94	2.6 (5.7)	445L-P4L0600YD	**445L-P4S0600YD**
720 (28.3)	96	94	3.0 (6.6)	445L-P4L0720YD	445L-P4S0720YD
840 (33.1)	112	94	3.5 (7.7)	445L-P4L0840YD	445L-P4S0840YD
960 (37.8)	128	94	4.0 (8.8)	445L-P4L0960YD	**445L-P4S0960YD**
1080 (42.5)	144	94	4.0 (8.8)	445L-P4L1080YD	445L-P4S1080YD
1200 (47.2)	160	94	4.5 (9.9)	445L-P4L1200YD	**445L-P4S1200YD**
1320 (52.0)	176	94	5.0 (11.0)	445L-P4L1320YD	445L-P4S1320YD
1440 (56.7)	172	94	5.5 (12.1)	445L-P4L1440YD	445L-P4S1440YD
1560 (61.4)	188	102	6.0 (13.2)	445L-P4L1560YD	445L-P4S1560YD
1680 (66.1)	204	102	6.5 (14.3)	445L-P4L1680YD	445L-P4S1680YD
1800(70.9)	220	110	7.0 (15.4)	445L-P4L1800YD	445L-P4S1800YD
1920 (75.6)	236	118	7.5 (16.5)	445L-P4L1920YD	445L-P4S1920YD

Note: The cat. nos. listed above are pair cat. nos., to specify a transmitter or receiver only, replace the "P" in the cat. no. with a "T" for transmitter or an "R" for receiver.

Required Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150)	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

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Cordsets—Transmitters and receivers both use 5-pin M12 cordsets

Note: Unshielded cordsets are most commonly used for safety light curtains, however, shielded cordsets are also offered to increase immunity to electrical interference.

Female Connector (Sensor End)		Cable			
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]	Cat. No.
	Straight Female Nonshielded	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 250V 4 A	2 (6.56)	889D-F5AC-2
				5 (16.4)	889D-F5AC-5
				10 (32.8)	889D-F5AC-10
				15 (49.2)	889D-F5AC-15
				20 (65.6)	889D-F5AC-20
				30 (98.4)	889D-F5AC-30
	Straight Female Shielded	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 22 AWG 300V 4 A	2 (6.56)	889D-F5EC-2
				5 (16.4)	889D-F5EC-5
				10 (32.8)	889D-F5EC-10
				15 (49.2)	889D-F5EC-15
				20 (65.6)	889D-F5EC-20
				30 (98.4)	889D-F5EC-30

Cordsets Approximate Dimensions [mm (in.)]

Dimensions are not intended to be used for installation purposes.

Straight Female

2-Opto-electronics

Optional Accessories

Description	Cat. No.
Standard kit (4 pieces — supplied with each pair)	445L-AF6140
180° Adjustable kit (two kits required per pair)	**445L-AF6141**
Shock Mount Kit (2 kits required per pair of light curtains)	445L-AF6142
Vertical mounting kit (two kits required per pair)	445L-AF6144
MSR42 Multifunction Module (requires Cat. No. 440L-AF6150 to program)	**440R-P226AGS-NNR**
MSR45E — Safety relay expansion module for MSR42	**440R-P4NANS**
USB optical interface software configuration tool used to configure the MSR42 (Used to configure the MSR42 module or get diagnostic information from the Safe 4.)	**445L-AF6150**
Ribbon cable — to connect one MSR45E to an MSR42	**440R-ACABL1**
Ribbon cable — to connect two MSR45Es to an MSR42	440R-ACABL2
Ribbon cable — to connect three MSR45Es to an MSR42	440R-ACABL3
Mounting stand (Comes with hardware to level base and two GuardShield mounting brackets.)	**440L-AMSTD**

Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

Note: Each mirror reduces maximum scan range by approximately 15% per mirror.

GuardShield Safe 2/Safe 4 Protected Height [mm (in.)]	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
120/240 (4.7/9.4)		440L-AM0750300		440L-AM1250300
360 (14.2)		440L-AM0750450		440L-AM1250450
480 (19)		440L-AM0750600		440L-AM1250600
600 (24)		440L-AM0750750		440L-AM1250750
720/840 (28/33)		440L-AM0750900		440L-AM1250900
960 (38)		440L-AM0751050		440L-AM1251050
1080 (43)		440L-AM0751200		**440L-AM1251200**
1200 (47)		440L-AM0751350		440L-AM1251350
1320/1440 (52/57)		440L-AM0751500		440L-AM1251500
1560 (61)		440L-AM0751650		440L-AM1251650
1680 (66)		440L-AM0751800		440L-AM1251800
1800/1920 (70.9/75.6)		Not available		Not available

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Safe 4
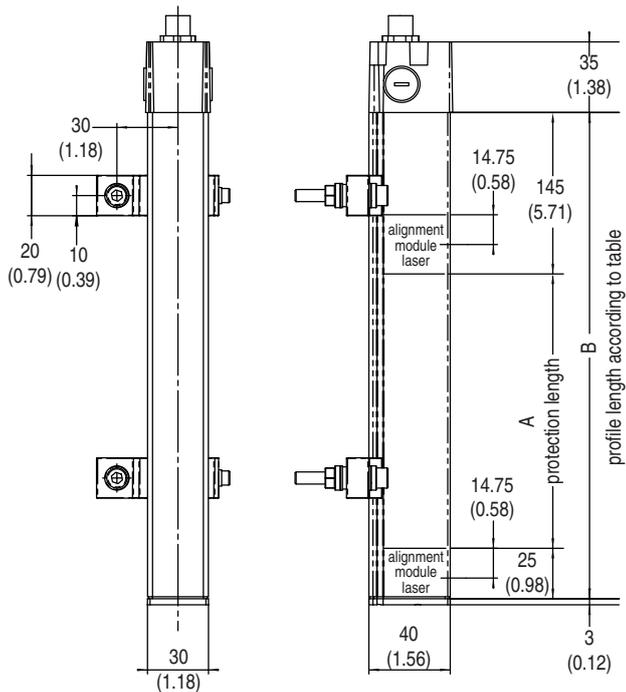
Type	A Protective Height [mm (in.)]	B Profile Length [mm (in.)]
445L-P4*0120YD	120 (4.7)	290 (11.4)
445L-P4*0240YD	240 (9.4)	410 (16.1)
445L-P4*0360YD	360 (14.2)	530 (20.9)
445L-P4*0480YD	480 (18.9)	650 (25.6)
445L-P4*0600YD	600 (23.6)	771 (30.4)
445L-P4*0720YD	720 (28.3)	891 (35.1)
445L-P4*0840YD	840 (33.1)	1011 (39.8)
445L-P4*0960YD	960 (37.8)	1131 (44.5)
445L-P4*1080YD	1080 (42.5)	1252 (49.3)
445L-P4*1200YD	1200 (47.2)	1372 (54.0)
445L-P4*1320YD	1320 (51.9)	1492 (58.7)
445L-P4*1440YD	1440 (56.7)	1612 (63.5)
445L-P4*1560YD	1560 (61.4)	1733 (68.2)
445L-P4*1680YD	1680 (66.1)	1853 (72.9)
445L-P4*1800YD	1800 (70.8)	1973 (77.7)
445L-P4*1920YD	1920 (75.6)	2093 (82.4)

* For 14 mm resolution replace with an "L." For 30 mm resolution replace with an "S." Example: **Cat. No. 445L-P4S0480YD** (for 30 mm resolution).

2-Opto-electronics

Wiring Diagram for Connection to MSR126

Wiring diagram is not intended to be used for installation purposes.
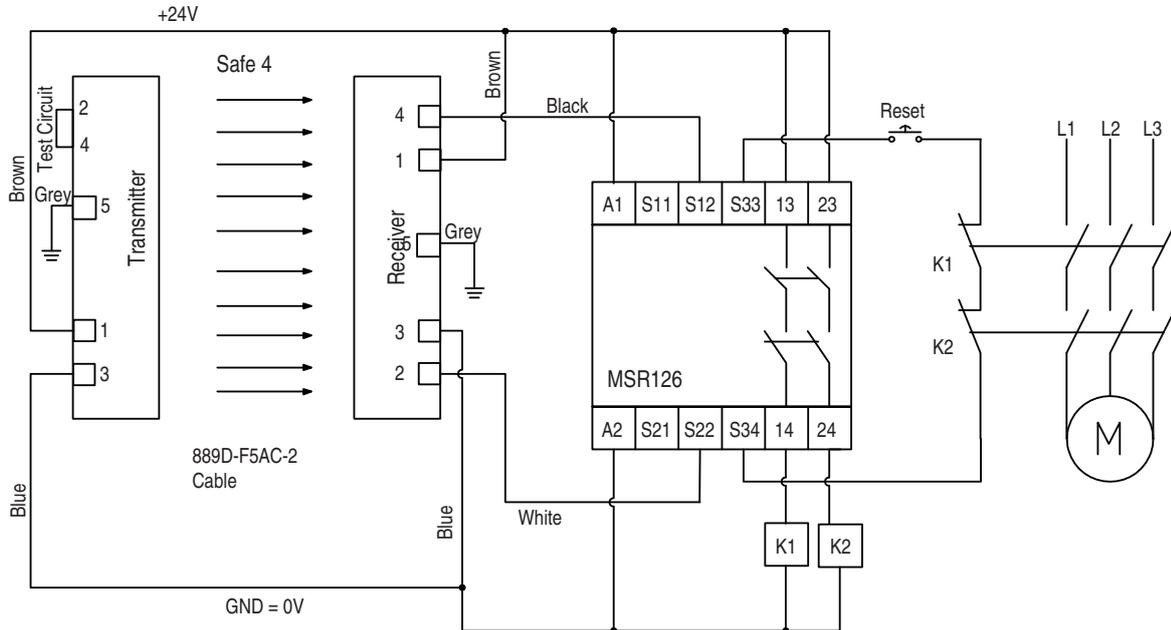
Wiring Diagram for Connection to MSR127
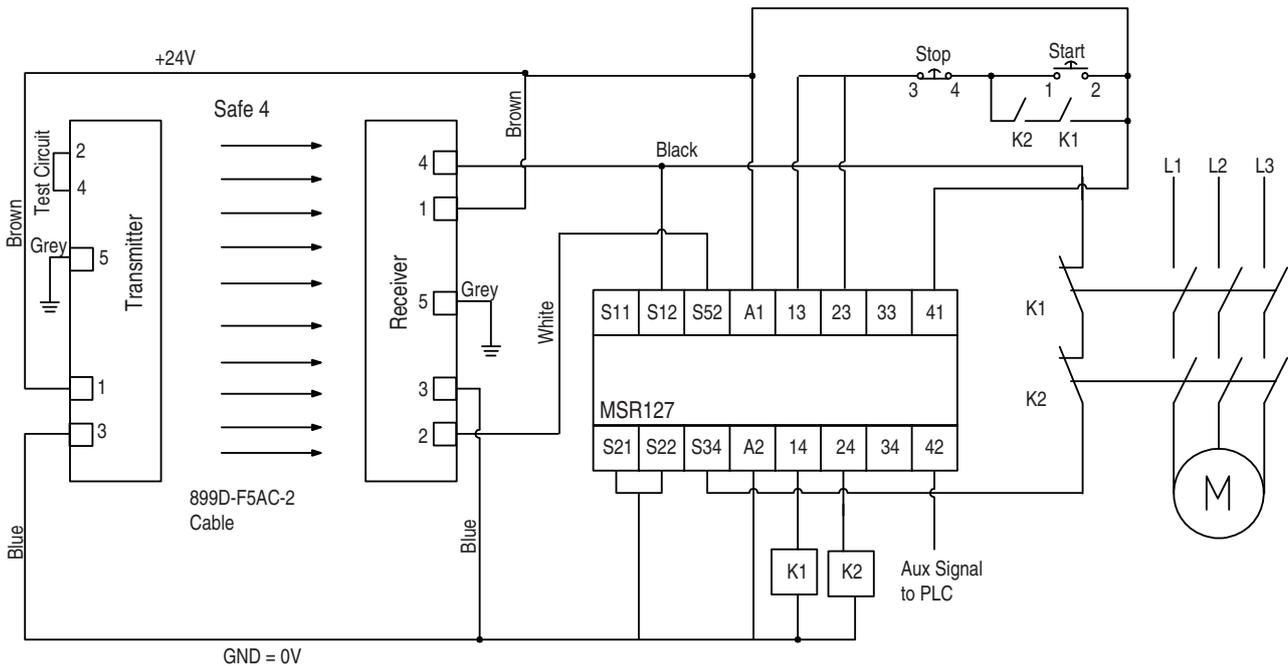
Description

The GuardShield Micro 400 is an economical three-box (transmitter, receiver and controller) Type 4 safety light curtain offered in a small profile (15 x 20 mm (0.59 x 0.79 in.)) housing. Designed for use in benign industrial environments (IP54), this light-duty safety light curtain system is targeted to the semi-conductor, micro electronic and small assembly machine markets.

Protective heights are offered from 150...1200 mm (5.91...47.2 in.) in 150 mm (5.91 in.) increments. The compact housing size allows the GuardShield Micro 400 to be mounted in areas where standard safety light curtains may not be able to be mounted due to space constraints. It is also possible to recess the GuardShield Micro 400 transmitter and receiver into machine frames.

The Micro 400 requires a dedicated controller. The MSR41 controller is used for on/off application and the MSR42 can also be used as a multi-function safety module, allowing the connection of additional safety light curtains, safety laser scanner, or any safety device with two Output Signal Switch Devices (OSSD) outputs, or two contacts, such as E-stops and enabling switches.

There are a number of operating modes that can be configured with the MSR42 controller. EDM, START/Restart interlock, fixed and floating blanking and muting are possible.

The Micro 400 transmitter and receiver are offered with 8-pin M12 connectors at the end of 500 mm (19.8 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are the same and are offered in 3, 5, and 8 m (9.8, 16.4, and 26.2 ft) lengths. These patchcords are configured on one end with M12 connectors (which mate to the integrated pigtail connectors) and RJ45 connectors on the opposite end (which plug into the MSR42 controller).

Cascadable System

The GuardShield Micro 400 is also offered in a cascadable configuration. GuardShield Cascadable Micro 400 safety light curtains allow the interconnection of multiple segments of the Micro 400 safety light curtain with a common pair of safety outputs. This cascadable configurability of the GuardShield Micro 400 reduces overall system wiring and allows the GuardShield Micro 400 to be fitted into a variety of applications where the safety distances for mounting the light curtain may allow personnel to stand between the sensing field of the light curtain and the hazard or where multiple sided guarding is required and the use of corner mirrors is not possible.

A GuardShield Cascadable Micro 400 safety light curtain system is comprised of one or two pair of Cascadable Micro 400 light curtains as well as a standard Micro 400 pair as the last segment pair in the cascaded system.

GuardShield Micro 400 cascaded pairs are offered in both 14 mm and 30 mm resolutions in limited protected heights which are listed in the table below. It is possible to mix 14 mm and 30 mm resolution pairs in a cascaded Micro 400 system.

IMPORTANT	The standard GuardShield Micro 400 must always be the last segment in a cascaded Micro 400 system.

The cascadable Micro 400 safety light curtains are ordered as pairs (transmitter and receiver) and are shipped under one cat. no. After selecting the appropriate light curtain cat. nos. for a cascaded Micro 400 system, select the standard Micro 400 pair as the last segment in the cascaded system and also select interconnecting patchcords.

A cascadable pair of GuardShield Micro 400 light curtains has a 500 mm (19.8 in.) pigtail with a female M12 QD on the bottom of the Micro 400 light curtain and a 500 mm (19.8 in.) pigtail with a male M12 QD attached to the top of the Micro 400 transmitter and receiver.

The GuardShield Cascadable Micro 400 system operates as a single light curtain pair with a common set of OSSDs. Each segment pair is connected in series making the response time of the complete system the sum of each segment pair, plus the response time of the MSR41 or MSR42 and other safety devices in the stop circuit.

When connecting two cascadable segments together, the resultant cable length between segments is 1000 mm (39.6 in.).

If an additional length between segment pairs is required, Rockwell Automation offers an M12-to-M12 patchcord in 1 m (39.37 in.) and 3 m (118.1 in.) lengths (Cat. Nos. 445L-AC8PC1 or 445L-AC8PC3).

IMPORTANT	The maximum cascaded Micro 400 system length can not exceed 10 m as measured between the RJ45 connection at the MSR42 controller to the last beam in the standard Micro 400, including all cable lengths. The maximum number of beams in a cascaded Micro 400 system can not exceed 255 beams.

Features

- Very small profile 15 x 20 mm (0.59 x 0.79 in.)
- M12 connector on 20 inch pigtails
- Minimal dead space of optic heads

Applications

- Light assembly machines/equipment
- Semi-conductor
- Micro-electronics
- Pharmaceutical

2-Opto-electronics

2-Opto-electronics

Specifications

Safety Ratings

Standards	IEC/EN61496 Parts 1 and 2. UL61496 Parts 1 and 2, UL1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849
Certifications	cULus Listed, TÜV, CE Marked for all applicable directives
Power Supply	Input power from MSR41 or MSR42 controller
Input Power, Max.	24V DC ±15%
Maximum Residual Ripple	5% of Vss
Power Consumption	0.07 A max. (no load)

Outputs

Micro 400 Outputs	Data output to controller (MSR41 or MSR42)
MSR41/MSR42 Outputs	Two 400 mA OSSD
Non-Safety Outputs	Auxiliary outputs from MSR41 or MSR42 controller—2 configurable 100 mA, outputs
Switching Current @ Voltage, Max.	400 mA @ 24V DC

Operating Characteristics

Response Time	14 mm: 14…42 ms; 30 mm; 12…23 ms, varies by protective height and resolution
Indicator LEDs—light curtains	ON -State, OFF-State, Intensity
Protected Height [mm (in.)]	150…1200 mm (5.91…47.24 in.) in 150 mm increments
Resolution [mm (in.)]	14 (0.55), 30 (1.18)
Scanning Range/Resolution	14 mm (0.55 in.) resolution: 0…5 m (16.4 ft) 30 mm (1.18 in.) resolution: 0…5 m (16.4 ft)
Synchronization	Electrical through MSR41 or MSR42
Wavelength	940 nm

Environmental

Enclosure Type Rating	Micro 400 is IP54; MSR41 and MSR42 are IP20
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	0…55 ° (14…131 °)
Vibration	IEC 60068-2-6; Frequency 10…55 Hz; Amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; Acceleration 10 g, pulse duration 16 ms 10…55 Hz; Amplitude 0.35 mm (0.01 in.)

Physical Characteristics

Mounting	180° adjustable mounting brackets supplied
Weight	Varies by protective height
Housing Cross Section	15 mm x 20 mm (0.59…0.79 in.)
Connection Type	Transmitter/receiver: 8-pin M12 micro QD
Cable Length	For MSR41 and MSR42: 3, 5, and 8 m (9.8, 16.4, and 26.2 ft), max. Total system length can not exceed 10 m (32.8 ft).
Cascadable Patchcords	1 and 3 m (39.37 and 118.1 in.) M12 to M12 patchcords. Total system length cannot exceed 10 m (32.8 ft) including protective height of Micro 400 (500 mm (19.8 in.)), integrated cables and patchcords from M12 connector to MSR41 or MSR42.

Allen-Bradley
Guardmaster®

Product Selection

IMPORTANT	The maximum length of a GuardShield Micro 400 system is limited to 10 m. This total length includes the length from the last beam in the light curtain housing plus the length of the pigtail cable and the patchcord length.

Standard System

The Allen-Bradley Guardmaster GuardShield Micro 400 safety light curtains are offered in 14 and 30 mm resolution, are ordered as pairs (transmitter and receiver) and are shipped under one cat. no. Each GuardShield Micro 400 pair is shipped with 180° adjustable mounting brackets. After selecting the appropriate pair by cat. no., ensure that the dedicated safety controller (MSR42), required cables, interfaces and accessories are ordered as needed.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
150 (5.9)	14 (0.55)	15	445L-P4C0150FP	150 (5.9)	30 (1.18)	6	445L-P4E0150FP
300 (11.8)	14 (0.55)	30	445L-P4C0300FP	300 (11.8)	30 (1.18)	12	445L-P4E0300FP
450 (17.7)	14 (0.55)	45	445L-P4C0450FP	450 (17.7)	30 (1.18)	18	445L-P4E0450FP
600 (23.6)	14 (0.55)	60	445L-P4C0600FP	600 (23.6)	30 (1.18)	24	445L-P4E0600FP
750 (29.5)	14 (0.55)	75	445L-P4C0750FP	750 (29.5)	30 (1.18)	30	445L-P4E0750FP
900 (35.4)	14 (0.55)	90	445L-P4C0900FP	900 (35.4)	30 (1.18)	36	445L-P4E0900FP
1050 (41.3)	14 (0.55)	105	445L-P4C1050FP	1050 (41.3)	30 (1.18)	42	445L-P4E1050FP
1200 (47.2)	14 (0.55)	120	445L-P4C1200FP	1200 (47.2)	30 (1.18)	48	445L-P4E1200FP

IMPORTANT	The GuardShield Micro 400 requires a dedicated controller (MSR41 or MSR42) as well as transmitter and receiver patchcords.

Cascadable System

The Allen Bradley Guardmaster GuardShield Cascadable Micro 400 safety light curtains are offered in limited protective heights in 14 mm and 30 mm resolutions.They are most commonly ordered as pairs (cascadable transmitter and cascadable receiver) and are shipped under one part number. Each GuardShield Cascadable Micro 400 pair is shipped with mounting brackets. After selecting the appropiate cascadable pair cat. no., ensure that the dedicated safety controller (MSR41 or MSR42), appropiate cables, interfaces and accessories are ordered as well.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
150 (5.9)	14 (0.55)	15	445L-C4C0150FP	150 (5.9)	30 (1.18)	6	445L-C4E0150FP
300 (11.8)	14 (0.55)	30	445L-C4C0300FP	300 (11.8)	30 (1.18)	12	445L-C4E0300FP
450 (17.7)	14 (0.55)	45	445L-C4C0450FP	600 (23.6)	30 (1.18)	24	445L-C4E0600FP
600 (23.6)	14 (0.55)	60	445L-C4C0600FP	900 (35.4)	30 (1.18)	36	445L-C4E0900FP
900 (35.4)	14 (0.55)	90	445L-C4C0900FP	1200 (47.2)	30 (1.18)	48	445L-C4E1200FP
1200 (47.2)	14 (0.55)	120	445L-C4C1200FP	—			

Micro 400 Patchcord for Interconnecting Cascaded Segments (if required)
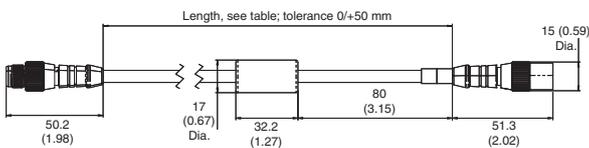
Cascadable Patchcords

Description	Cat. No.
1 m (39.37 in.) patchcord	445L-AC8PC1
3 m (118.11 in.) patchcord	445L-AC8PC3
5 m (196.85 in.) patchcord	445L-AC8PC5

POC Type 4 Safety Light Curtains

GuardShield Micro 400

Micro 400 IP69K Light Curtains

The GuardShield Micro 400 is offered with the transmitter and receiver sealed in clear acrylic tubes with an environmental rating of IP69K. These IP69K Micro 400 light curtains are factory sealed and are ordered as pairs. They are offered in a 14 mm resolution in protected heights of 300 mm (11.8 in.), 600 mm (23.6 in.), 900 mm (35.4 in.) and 1200 mm (47.2 in.) with an operating range of five meters.

The required MSR 41 or MSR42 controllers maintain the IP20 rating and must be mounted in a suitable enclosure.

The Micro 400 IP69K transmitter and receiver are both offered with eight pin M12 connectors at the end of 500 mm (19.8 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are the same cat. no. and are offered in 3 m (9.8 ft), 5 m (16.4 ft), and 8 m (26.2 ft) lengths.

These patchcords are configured on one end with M12 connectors, which mate to the integrated pigtail connectors and RJ45 connectors on the opposite end. These connectors plug into the MSR41 or MSR42 controller.

Areas of Use

- Light assembly machines/equipment
- Semi-conductor
- Micro-electronics
- Pharmaceutical
- Filling systems
- Clean rooms
- Food processing

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
300 (11.8)	14 (0.55)	30	445L-P4C0300KD
600 (23.6)	14 (0.55)	60	445L-P4C0600KD
900 (35.4)	14 (0.55)	90	445L-P4C0900KD
1200 (47.2)	14 (0.55)	120	445L-P4C1200KD

Required Micro 400 Controller—Select One

	Mounting	Size	Cat. No.
MSR41—ON/OFF	35 mm DIN Rail	22.5 mm	**440R-P221AGS**
MSR42—Multi-functional module	35 mm DIN Rail	22.5 mm	**440R-P226AGS-NNR**

Optional Safety Relay Interfaces

Relay	Input Voltage	Reset	Outputs	Cat. No.
MSR45E Safety Relay Expansion Model	Supplied by MSR41 or MSR42	Determined by MSR41 or MSR42	2 N.O.	**440R-P4NANS**

Possible Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**

Standard Micro 400 Patchcords—Required (Transmitters and receivers both use 8-pin M12 to RJ45 patchcords)

Face View M12 Connector	Face View RJ45 Connector	Description	Cat. No.
		1 m patchcord, PVC jacket	445L-AC8RJ1
		2 m patchcord, PVC jacket	445L-AC8RJ2
		3 m patchcord, PVC jacket	445L-AC8RJ3
		5 m patchcord, PVC jacket	445L-AC8RJ5
		8 m patchcord, PVC jacket	445L-AC8RJ8

Pinning table:

1: blue
2: grey
3: green
4: white
5: black
6: pink
7: brown
8: yellow

Shield: Braid wires

Pinning table:

1: blue
2: grey
3: green
4: white
5: black
6: pink
7: brown
8: yellow

Shield: Braid wires

Patchcord [mm (in.)]

6.3 (0.25) dia.
17 (0.67)
Cable
Ferrite
150 (5.91)
32.5 (1.28)

Optional Safety Relay Interface (accessories for MSR41 or MSR42 Controllers)

The MSR41 or MSR42 can have up to three MSR45E safety relays inter-connected. Each module requires a ribbon cable connector to make the interconnection. The table shows the cat. no. for each ribbon cable connector as well as the optical interface for the programming of the MSR42. Programming of the MSR42 is only necessary for advanced operating modes or connection of additional devices.

Description		Cat. No.
	Ribbon cable—for one MSR45E	**440R-ACABL1**
	Ribbon cable—for two MSR45Es	440R-ACABL2
	Ribbon cable—for three MSR45Es	440R-ACABL3
	USB optical interface software configuration tool used to configure the MSR42	**445L-AF6150**

Note: The configuration software can be downloaded at *www.ab.com/safety*.

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Optional Accessories

Description		Cat. No.
	Adjustable 180° bracket kit (two per kit) supplied with each pair Two kits required per pair	445L-AF6143
	Flat bracket kit (two per kit) Two kits per pair	445L-AF6145
	Adjustable flat bracket (two per kit) Two kits required per pair	445L-AF6149
	IP69K mounting bracket kit (two kits per pair supplied with each pair)	445L-AF6160

Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

IMPORTANT Each mirror reduces maximum scan range by 10% per mirror.

GuardShield Micro 400 Protected Height [mm (in.)]	Narrow Mirror Short-Range 0…4 m	Cat. No.
150 (5.9)/300 (11.8)		440L-AM0750300
450 (17.7)		440L-AM0750450
600 (23.6)		440L-AM0750600
750 (29.5)		440L-AM0750750
900 (35.4)		440L-AM0750900
1050 (41.3)		440L-AM0751050
1200 (47.2)		440L-AM0751200

2-Opto-electronics

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Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Safety Light Curtains—Standard
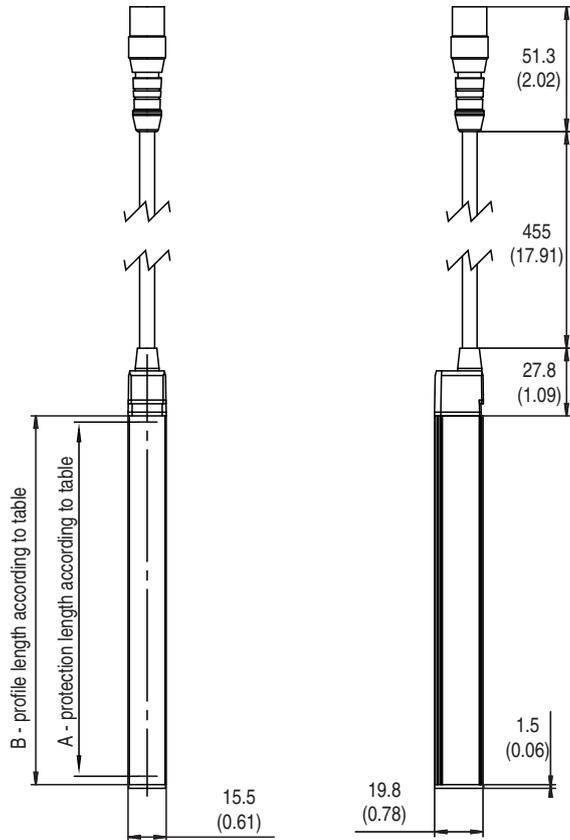
Safety Light Curtains—Cascadable
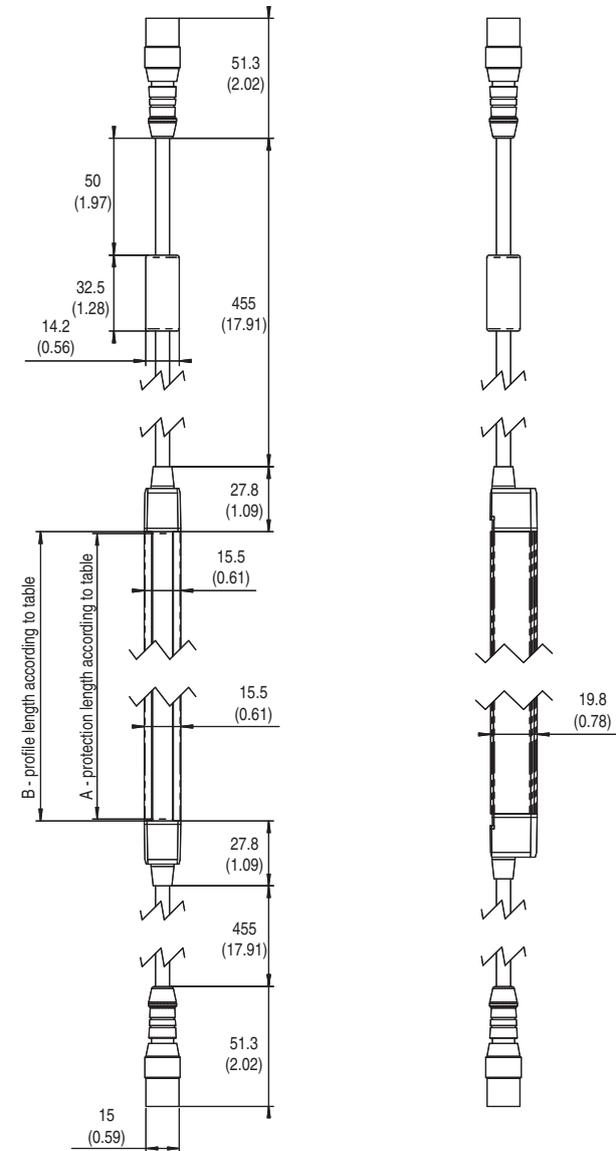
Type	A Protective Height [mm]	B Profile Length [mm]
445L-✳4‡0150FB	150	151.5 ±0.3
445L-✳4‡0300FB	300	301 ±0.3
445L-✳4‡0450FB	450	451 ±0.3
445L-✳4‡0600FB	600	601 ±0.3
445L-✳4‡0750FB	750	751 ±0.3
445L-✳4‡0900FB	900	901 ±0.3
445L-✳4‡1050FB	1050	1051 ±0.3
445L-✳4‡1200FB	1200	1201 ±0.3

✳ P = Standard pair, C = Cascadable pair
‡ C = 14 mm, E = 30 mm

2-Opto-electronics

IP69K Micro 400

18
(0.71)

500
(19.7)

28.4 (1.12) Dia.

System length B

System length B - 38 (1.5)

17.5
(0.69)

Protection High A

29.5
(1.16)
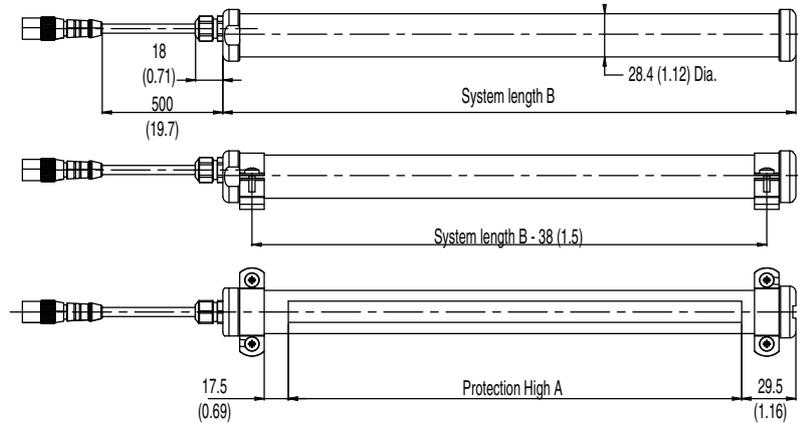
Wiring Diagram for Connection to MSR126 Relay

Wiring diagram is not intended to be used for installation purposes.
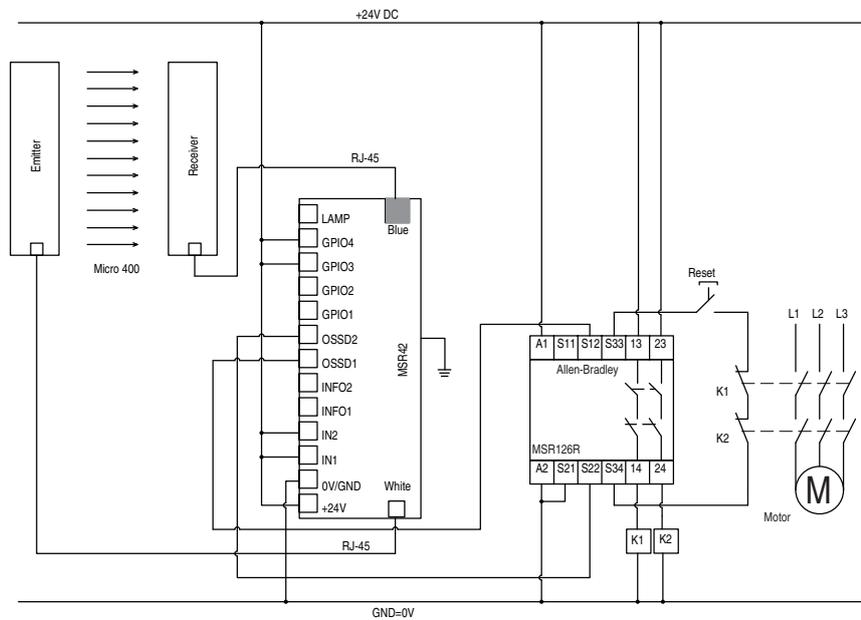
Micro 400 with MSR42 and MSR126R for Monitored Manual Reset with Monitored Output

Wiring Diagram for Connection to MSR45E Expansion Module
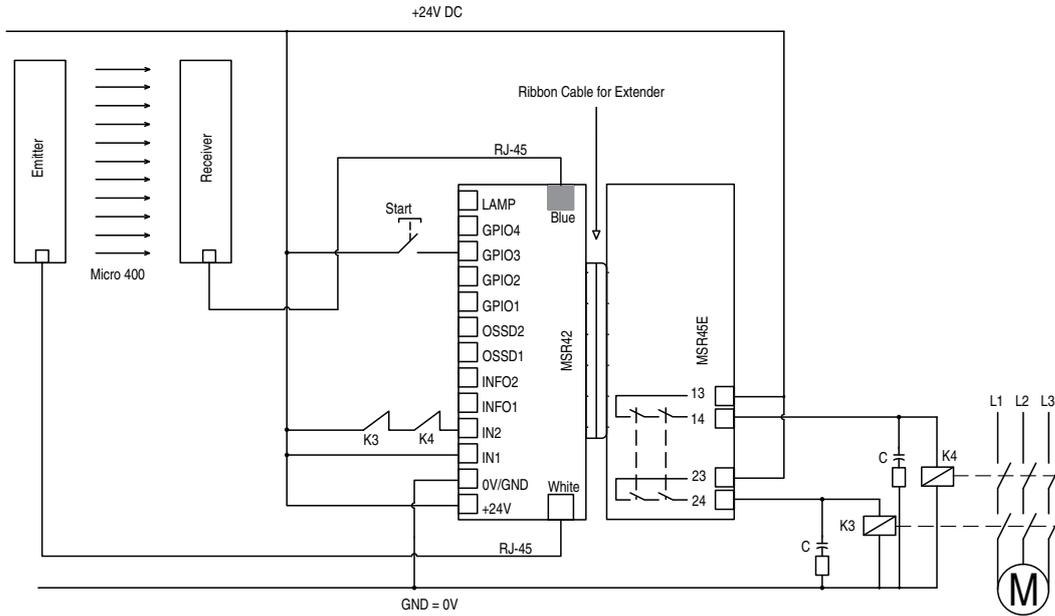
Micro 400 with MSR42 Add-on MSR45E for Manual Reset with Start Release

Wiring Diagram for Connection of MSR42 to Contactor if EDM Is Activated
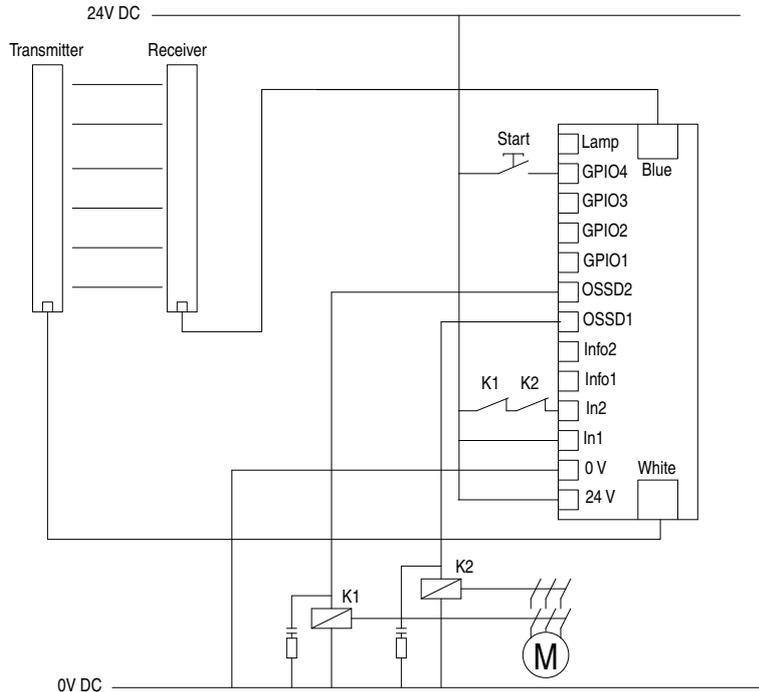
2-Opto-electronics

POC Type 2 Safety Light Curtains

GuardShield Type 2

Overview

The Allen-Bradley Guardmaster GuardShield Type 2 safety light curtain is a new addition to the ABGM portfolio of Opto-Electronic safety devices. The "Type 2" designation means that this particular safety light curtain meets a lesser requirement for performance under fault conditions than the GuardShield Type 4. As a result, the GuardShield Type 2 safety light curtain can only be applied in applications where a formal risk assessment has determined that a Type 2 device is sufficient to meet the level of risk posed by the hazard.

There are a number of regulations that discuss risk assessment. The US based methods of conducting risk assessments which provide guidance for the determination of the level of risk to personnel can be found as follows:

• ANSI TR3—for machinery
• ANSI/RIA 15.05—for the Robotics industry
• ANSI/ISO 12100-1 Safety of Machinery

Typically in North America the use of Type 2 light curtains is not allowed for machinery or equipment covered by ANSI/OSHA regulations and standards whose requirement for performance under fault conditions is "control reliability." Type 2 light curtains do not meet the requirements of "control reliability."

The European Union requires the Risk Assessment be performed per EN ISO 14121 "Principles for Risk Assessment."

Safeguarding of the machine must be appropriate to the foreseeable risks and identified hazards. The level(s) of risk determined from the completion of a formal risk assessment indicate the level of the safety device required. In many instances it is necessary to use a combination of safety devices for adequate protection of personnel from hazards based on the risk assessment.

What Is "Type 2" and "Type 4"

Three types of safety ESPEs (Electro-Sensitive Protective Equipment) are defined within International and European standard IEC/EN 61496 Parts 1 and 2. This standard specifies the requirements for the design, construction, testing and performance of ESPEs—designed specifically to detect persons as part of a safety related system. The three types differ in their performance in the presence of faults and under influences from environmental conditions.

A Type 2 safety light curtain requires:

• A single fault resulting in the loss of detection capability,
• Failure of the OSSDs to go to the OFF state,
• Shall cause the light curtain to lock out as a result of the cycling of power, the next periodic test, or the interruption of the sensing function.

A Type 2 device requires the need for a periodic test of the system prior to a demand on the system, i.e., interruption of the light curtain's sensing field. This periodic test may be initiated by a simple manually operated switch (e.g., pushbutton) or by a more complex automatically controlled PLC.

Ideally the periodic test will be twice the operator interface frequency of exposure to the hazard.

The Type 4 device is required to detect a fault in its safety circuitry and immediately switch to a lock-out condition when the fault occurs. The fault detection is assured through diverse redundancy and cross monitoring of the internal circuit. A Type 4 device will fail to a safe state in the presence of an accumulation of undetected faults.

IMPORTANT	Type 2 safety light curtains do not meet OSHA regulations nor ANSI published standards, which define the requirements of "Control Reliability," therefore it is not allowable to use a Type 2 safety light curtain device on equipment or machinery that requires "Control Reliability."

Description

The Allen-Bradley Guardmaster GuardShield Type 2 safety light curtain is a self contained "two box," Type 2 safety light curtain. Designed for use on or around machinery in which a formal risk assessment has determined that a Type 2 safety device is of a sufficient level of safety to meet the guarding application, the GuardShield Type 2 is the ideal solution. GuardShield Type 2 is offered in either a "Guard Only" operating mode or in a factory configured operating mode of restart interlock with external device monitoring. In either operating mode, the GuardShield Type 2 safety light curtain will provide the appropriate level of protection to personnel.

The GuardShield Type 2 is designed to protect personnel from equipment or machinery hazards where the risk of injury are low. A formal risk assessment should be performed prior to selecting the proper safeguarding device. In many instances it is necessary to use a combination of safety devices to assure complete protection of personnel from hazards.

ATTENTION ⚠️	Safety light curtains of a Type 2 level of safety typically do not meet OSHA or ANSI requirements of "Control Reliability," therefore it is not allowable to use a safety device of a Type 2 level on or around equipment or machinery that requires "Control Reliability."

Applications

- Conveyors
- Packaging machinery (excluding palletizers)
- Textile machinery
- Automated assembly lines
- Automatic storage and retrieval machinery

Specifications

Safety Ratings	
Standards	IEC/EN 61496 Parts 1 & 2, UL 61496 Parts 1 & 2, UL 1998
Safety Classification	Type 2 per IEC/EN61496. Category 2 device per EN 954-1, SIL 2 per IEC 61508, PLd per EN/ISO 13849
Certifications	CE Marked for all applicable directives, UL 1998 Listed, cULus Listed, and TÜV
Power Supply	
Input Power, Max.	24V DC ±20%
Maximum Residual Ripple	0.05 Vss
Power Consumption	400 mA max (no load)
Outputs	
Safety Outputs	2 OSSDs, 0.5 A, short-circuit protected
Non-Safety Outputs	1 auxiliary output, 0.5 A max.
Output Voltage, Min.	U_v - 2V
Switching Current @ Voltage, Min.	500 mA @ 24V DC
Operating Characteristics	
Response Time	20 ms
Status Indicators	On state, off state, alignment, interlock
Protected Height—mm (in)	160…1760 (6.3…69.36) in 160 (6.3) increments
Resolution [mm (in.)]	30 (1.18)
Scanning Range	16 m (52.5 ft)
Synchronization	Optical, without separate synchronization channel
Wavelength	870 nm
Environmental	
Enclosure Type Rating	IP65
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	-10…55° (14…131°)
Vibration	IEC 60068-2-6, frequency, 10…55 Hz Amplitude: 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29 acceleration 10 g, pulse duration 16 ms
Physical Characteristics	
Mounting	End-cap mounting brackets
Weight	Varies by protective height
Housing Cross Section	40 x 50 mm (1.57 x 1.96 in.)
Connection Type	Transmitter: 4-pin micro QD Receiver: 8-pin micro QD
Cable Length	30 m (100 ft) max.

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POC Type 2 Safety Light Curtains

GuardShield Type 2

Product Selection

Standard System

The Allen-Bradley Guardmaster GuardShield safety light curtains are ordered as pairs—transmitter and receiver—and are shipped under one part number. Each GuardShield Type 2 transmitter and receiver is packaged with two right angle mounting brackets. After selecting the appropriate light curtain pair, ensure that required interfaces and accessories are ordered.

Resolution [mm (in.)]	Number of Beams	Protective Height—mm (in)	Pair Weight [kg (lb)]	Cat. No. Guard Only	Cat. No. Restart Interlock with EDM
30 (1.18)	8	160 (6.3)	0.9 (1.9)	440L-P2KA0160YD	440L-P2KD0160YD
30 (1.18)	16	320 (12.6)	1.1 (2.4)	440L-P2KA0320YD	440L-P2KD0320YD
30 (1.18)	24	480 (18.9)	1.6 (3.5)	**440L-P2KA0480YD**	440L-P2KD0480YD
30 (1.18)	32	640 (25.2)	2.0 (4.4)	**440L-P2KA0640YD**	440L-P2KD0640YD
30 (1.18)	40	800 (31.5)	2.5 (5.5)	440L-P2KA0800YD	440L-P2KD0800YD
30 (1.18)	48	960 (37.8)	2.9 (6.4)	440L-P2KA0960YD	440L-P2KD0960YD
30 (1.18)	56	1120 (44.1)	3.4 (7.5)	440L-P2KA1120YD	440L-P2KD1120YD
30 (1.18)	64	1280 (50.4)	3.8 (8.4)	440L-P2KA1280YD	440L-P2KD1280YD
30 (1.18)	72	1440 (56.7)	4.3 (9.5)	440L-P2KA1440YD	440L-P2KD1440YD
30 (1.18)	80	1600 (63.0)	4.7 (10.4)	440L-P2KA1600YD	440L-P2KD1600YD
30 (1.18)	88	1760 (69.1)	5.2 (11.5)	440L-P2KA1760YD	440L-P2KD1760YD

Note: The GuardShield transmitter requires a 4-pin cable and the receiver requires an 8-pin cable.

Recommended Logic Interfaces

| Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Note: The use of a category 4 safety relay module does not improve the category rating of the safety system beyond the category 2 rating of the Type 2 GuardShield light curtain.

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Cordsets—Two Required (one for transmitter and one for receiver)

Female Connector (Sensor End)		Cable			Cat. No.
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]	
Transmitter					
	Straight Female	1 Brown 2 White 3 Blue 4 Black	22 AWG 300V 4 A	2 (6.56)	889D-F4AC-2
				5 (16.4)	889D-F4AC-5
				10 (32.8)	889D-F4AC-10
				15 (49.2)	889D-F4AC-15
				20 (65.6)	889D-F4AC-20
				30 (98.4)	889D-F4AC-30
Receiver					
	Straight Female	1 White 2 Brown 3 Green 4 Yellow 5 Grey 6 Pink 7 Blue 8 Red	24 AWG 30V AC/36V DC 1.5 A	2 (6.56)	889D-F8AB-2
				5 (16.4)	889D-F8AB-5
				10 (32.8)	889D-F8AB-10
				15 (49.2)	889D-F8AB-15
				20 (65.6)	889D-F8AB-20
				30 (98.4)	889D-F8AB-30

Cordsets Approximate Dimensions [mm (in.)]
Dimensions are not intended to be used for installation purposes.

Straight Female

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Optional Accessories

Description		Cat. No.
	Steel L-shaped end cap mounting bracket (4 per package) **Note:** 4 brackets supplied with each GuardShield pair.	440L-AF6101 (1 package per system)
	Aluminum middle mounting bracket for vibratory applications	**440L-AF6108** (1 package per system)
	Power Supply: Output 24V DC, 3 Amps, 72 W	1606-XLP72E
	Laser alignment tool	**440L-ALAT**
	GuardShield laser alignment tool bracket	**440L-AF6109**
	Mounting stand	**440L-AMSTD**
	GuardShield weld shield (cat. no. is for a pair of light curtains)	440L-AGWS0160
		440L-AGWS0320
		440L-AGWS0480
		440L-AGWS0640
		440L-AGWS0800
		440L-AGWS0960
		440L-AGWS1120
		440L-AGWS1280
		440L-AGWS1440
		440L-AGWS1600
		440L-AGWS1760
	Vertical shock mount kit	**440L-AF6120**
	Horizontal shock mount kit	440L-AF6121
	Middle vertical mount kit	440L-AF6122
	Middle horizontal mount kit	440L-AF6123

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Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

Note: Each mirror reduces maximum scan range by approximately 15% per mirror.

GuardShield Light Curtain Cat. No.	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
440L-P2K‡0160YD		440L-AM0750300		440L-AM1250300
440L-P2K‡0320YD		440L-AM0750450		440L-AM1250450
440L-P2K‡0480YD		440L-AM0750600		440L-AM1250600
440L-P2K‡0640YD		440L-AM0750750		440L-AM1250750
440L-P2K‡0800YD		440L-AM0750900		440L-AM1250900
440L-P2K‡0960YD		440L-AM0751050		440L-AM1251050
440L-P2K‡1120YD		440L-AM0751200		**440L-AM1251200**
440L-P2K‡1280YD		440L-AM0751350		440L-AM1251350
440L-P2K‡1440YD		440L-AM0751500		440L-AM1251500
440L-P2K‡1600YD		440L-AM0751650		440L-AM1251650
440L-P2K‡1760YD		440L-AM0751800		440L-AM1251800

‡ = A or D

Weld Shields

The GuardShield weld shields are sold as pairs in the same lengths as the protective heights of the GuardShield safety light curtain.

These polycarbonate weld shields are designed as disposable devices whose purpose is to protect the front window of the GuardShield from damage.
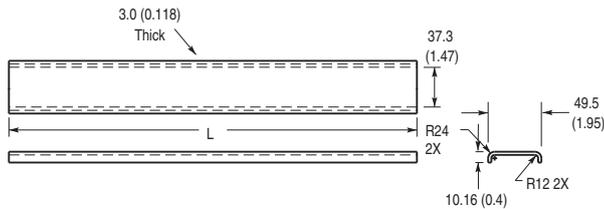
Dimensions "L"—mm (in)	Cat. No.
175.3 (6.9)	440L-AGWS0160
335.3 (13.2)	440L-AGWS0320
495.3 (19.5)	440L-AGWS0480
655.3 (25.8)	440L-AGWS0640
815.3 (32.1)	440L-AGWS0800
975.4 (38.4)	440L-AGWS0960
1135.4 (44.7)	440L-AGWS1120
1295.4 (51.0)	440L-AGWS1280
1455.4 (57.3)	440L-AGWS1440
1615.4 (63.6)	440L-AGWS1600
1778 (70.0)	440L-AGWS1760

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POC Type 2 Safety Light Curtains

GuardShield Type 2

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Safety Light Curtain
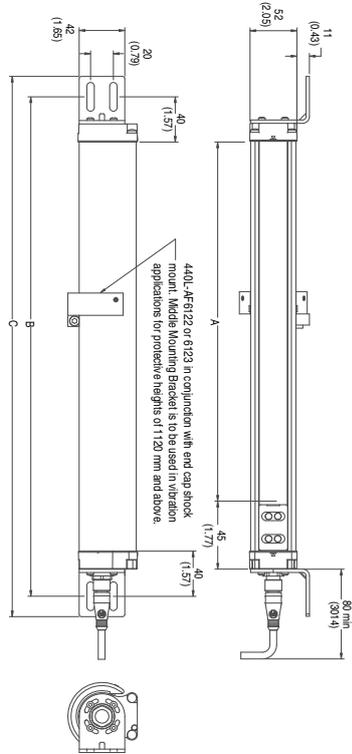
Type	A Protective Height [mm]	B Mounting Value [mm]	C Total Length [mm]
440L-P2K∗0160YD	160 ±0.5	285	321 ±1.5
440L-P2K∗0320YD	320 ±0.5	445	481 ±1.5
440L-P2K∗0480YD	480 ±0.5	605	641 ±1.5
440L-P2K∗0640YD	640 ±0.5	765	801 ±1.5
440L-P2K∗0800YD	800 ±0.5	925	961 ±1.5
440L-P2K∗0960YD	960 ±0.5	1085	1121 ±1.5
440L-P2K∗1120YD	1120 ±0.5	1245	1281 ±1.8
440L-P2K∗1280YD	1280 ±0.5	1405	1441 ±1.8
440L-P2K∗1440YD	1440 ±0.5	1565	1601 ±1.8
440L-P2K∗1600YD	1600 ±0.5	1725	1636 ±2.0
440L-P2K∗1760YD	1760 ±0.5	1885	1112 ±1.5

∗ A for Guard Only or D for Restart Interlock with EDM.

Wiring Diagram for Connection of OSSDs Directly to Contactors (FSDs) fpr GuardShield Type with EDM and Restart Interlock

Wiring diagram is not intended to be used for installation purposes.

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∗ Auxiliary output is nonsafety. Can be connected to a lamp, motor or status to a PLC.

K1, K2	Safety relay or safety contactor for OSSD 1 and OSSD 2 connection
S1	Switch for external system test (optional)
S2	Switch for reset of light curtain from start/restart interlock

Wiring Diagram for Connection of OSSDs Directly to a Safety Relay Module

POC Type 2 Safety Light Curtains

GuardShield Safe 2

Specifications

Safety Ratings

Standards	IEC/EN61496 Parts 1 and 2, UL61496 Parts 1 and 2, UL1998
Safety Classification	Type 2 per IEC/EN61496. Category 2 device per EN 954-1, SIL 2 per IEC 61508, PLd per EN/ISO 13849
Certifications	cULus Listed, TÜV, and CE Marked for all applicable directives

Power Supply

Input Power, Max.	24V DC ± 20% (U_{sp})
Maximum Residual Ripple	< 10% of U_{sp}
Power Consumption	<500 mA (no load)

Outputs

Safety Outputs	2 PNP OSSD. 0.3 A, short-circuit protected
Output Voltage, Min.	U_{sp} -1
Switching Current @ Voltage, Min.	300 mA @ 24V DC

Operating Characteristics

Response Time	Varies by protective height
Indicator LEDs	ON -State, OFF-State, internal error
Protected Height [mm (in.)]	120…1920 mm (4.7…75.6 in.) in 120 mm (4.7 in.) increments
Resolution [mm (in.)]	30 mm (1.18 in.)
Scanning Range	0…18 m (0…59 ft)
Synchronization	Optical, first beam adjacent to LEDs
Wavelength	950 nm

Environmental

Enclosure Type Rating	IP65
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	0…55 ° (0…131 °)
Vibration	IEC 60068-2-6 frequency 10…55 Hz; amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; acceleration 10 g, pulse duration 16 ms 10…55 Hz; amplitude 0.35 mm (0.01 in.)

Physical Characteristics

Mounting	Rear mounting, standard and adjustable (180°)
Weight	Varies by protective height
Housing Cross Section	30 x 40 mm (1.18 x 1.57 in.)
Connection Type	Transmitter: 5-pin M12 micro QD Receiver: 5-pin M12 micro QD
Cable Length	30 m (98.4 ft) max.
ILAS Laser Class	Class 2, IEC 60825-1

Description

The Allen-Bradley Guardmaster GuardShield Safe 2 safety light curtain is a new addition to the Allen-Bradley Guardmaster portfolio of opto-electronic safety devices. The "Type 2" designation means that this particular safety light curtain meets a lesser requirement for performance under fault conditions than the GuardShield Type 4 safety light curtains. As a result, the GuardShield Type 2 safety light curtain can only be applied in applications where a formal risk assessment has determined that a Type 2 device is sufficient to meet the level of risk posed by the hazard.

The GuardShield Safe 2 safety light curtain is a self-contained two-box, safety light curtain in a robust housing with an integrated laser alignment system. The integrated laser alignment system generates two visible beams of light which simplifies alignment of the light curtain pair.

This economical opto-electronic Type 2 safety light curtain is offered in a guard-only mode of operation and is designed for use on or around machinery or equipment where a formal risk assessment has determined that a Type 2 safety device is of a sufficient level of safety to meet the guarding application.

ATTENTION ⚠ Safety light curtains of a Type 2 level of safety typically do not meet OSHA or ANSI requirements of "Control Reliability," therefore it is not allowable to use a safety device of a Type 2 level on or around equipment or machinery that requires "Control Reliability."

Features

- M12 connectors
- Optically synchronized
- Integrated laser alignment system
- IP65 enclosure rating
- Simple Installation
- cULus Listed and CE Marked for all applicable directives

Applications

- Conveyors
- Textile machinery
- Automatic storage and retrieval machinery
- Automated assembly lines

2-Opto-electronics

Product Selection
Standard System Safety Light Curtain

The Allen-Bradley Guardmaster GuardShield Safe 2 safety light curtains are offered in 30 mm resolution, are ordered as pairs—transmitter and receiver—and are shipped under one cat. no. Each GuardShield Safe 2 pair are shipped with 180° mounting brackets. After selecting the appropriate light curtain pair, ensure that the appropriate cables, interfaces, and accessories are ordered.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Pair Weight [kg (lbs)]	Cat. No.
120 (4.7)	30 (1.18)	8	1.0 (2.2)	445L-P2S0120YD
240 (9.4)	30 (1.18)	16	1.4 (3.09)	445L-P2S0240YD
360 (14.2)	30 (1.18)	24	1.8 (3.97)	445L-P2S0360YD
480 (19.9)	30 (1.18)	32	2.2 (4.85)	445L-P2S0480YD
600 (23.6)	30 (1.18)	40	2.6 (5.73)	445L-P2S0600YD
720 (28.3)	30 (1.18)	48	3.0 (6.61)	445L-P2S0720YD
840 (33.1)	30 (1.18)	56	3.5 (7.72)	445L-P2S0840YD
960 (37.8)	30 (1.18)	64	4.0 (8.82)	445L-P2S0960YD
1080 (42.5)	30 (1.18)	72	4.0 (8.82)	445L-P2S1080YD
1200 (47.2)	30 (1.18)	80	4.5 (9.92)	445L-P2S1200YD
1320 (52.0)	30 (1.18)	88	5.0 (11.02)	445L-P2S1320YD
1440 (56.7)	30 (1.18)	86	5.5 (12.13)	445L-P2S1440YD
1560 (61.4)	30 (1.18)	94	6.0 (13.23)	445L-P2S1560YD
1680 (66.1)	30 (1.18)	102	6.5 (14.33)	445L-P2S1680YD
1800 (70.9)	30 (1.18)	110	7.0 (15.43)	445L-P2S1800YD
1920 (75.6)	30 (1.18)	118	7.5 (16.53)	445L-P2S1920YD

Note: The cat. nos. listed above are pair cat. nos., to specify a transmitter or receiver only, replace the "P" in the cat. no. with a "T" for transmitter or an "R" for receiver.

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Note: The use of a category 4 safety relay module does not improve the category rating of the safety system beyond the Category 2 rating of the Type 2 light curtain in use.

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2-Opto-electronics

# POC Type 2 Safety Light Curtains
GuardShield Safe 2

Cordsets—Transmitters and receivers both use 5-pin M12 cordsets

Note: Unshielded cordsets are most commonly used for safety light curtains, however, shielded cordsets are also offered to increase immunity to electrical interference.

Female Connector (Sensor End)		Cable			
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]	Cat. No.
	Straight Female Nonshielded	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 250V 4 A	2 (6.56)	889D-F5AC-2
				5 (16.4)	889D-F5AC-5
				10 (32.8)	889D-F5AC-10
				15 (49.2)	889D-F5AC-15
				20 (65.6)	889D-F5AC-20
				30 (98.4)	889D-F5AC-30
	Straight Female Shielded	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 22 AWG 300V 4 A	2 (6.56)	889D-F5EC-2
				5 (16.4)	889D-F5EC-5
				10 (32.8)	889D-F5EC-10
				15 (49.2)	889D-F5EC-15
				20 (65.6)	889D-F5EC-20
				30 (98.4)	889D-F5EC-30

Cordsets Approximate Dimensions [mm (in.)]

Dimensions are not intended to be used for installation purposes.

Straight Female

Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

Note: Each mirror reduces maximum scan range by approximately 15% per mirror.

GuardShield Safe 2/Safe 4 Protected Height [mm (in.)]	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
120/140 (4.7/9.4)		440L-AM0750300		440L-AM1250300
360 (14.2)		440L-AM0750450		440L-AM1250450
480 (19)		440L-AM0750600		440L-AM1250600
600 (24)		440L-AM0750750		440L-AM1250750
720/840 (28/33)		440L-AM0750900		440L-AM1250900
960 (38)		440L-AM0751050		440L-AM1251050
1080 (43)		440L-AM0751200		**440L-AM1251200**
1200 (47)		440L-AM0751350		440L-AM1251350
1320/1440 (52/57)		440L-AM0751500		440L-AM1251500
1560 (61)		440L-AM0751650		440L-AM1251650
1680 (66)		440L-AM0751800		440L-AM1251800
1800/1920 (70.9/75.6)		Not available		Not available

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Optional Accessories

Description	Cat. No.
Standard kit (4 pieces — supplied with each pair)	445L-AF6140
180° Adjustable kit (two kits required per pair)	**445L-AF6141**
Shock Mount Kit (2 kits required per pair of light curtains)	445L-AF6142
Vertical mounting kit (two kits required per pair)	445L-AF6144
MSR42 Multifunction Module (requires Cat. No. 440L-AF6150 to program)	**440R-P226AGS-NNR**
MSR45E—Safety Relay for MSR41 or MSR42 (requires ribbon cable connection)	**440R-P4NANS**
USB optical interface software configuration tool used to configure the MSR42	**445L-AF6150**
Ribbon cable—for one MSR45E	**440R-ACABL1**
Ribbon cable—for two MSR45Es	440R-ACABL2
Ribbon cable—for three MSR45Es	440R-ACABL3
Mounting stand	**440L-AMSTD**

Note: MSR42 operating software may be downloaded at *www.ab.com/safety*.

2-Opto-electronics

POC Type 2 Safety Light Curtains

GuardShield Safe 2

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Safety Light Curtain
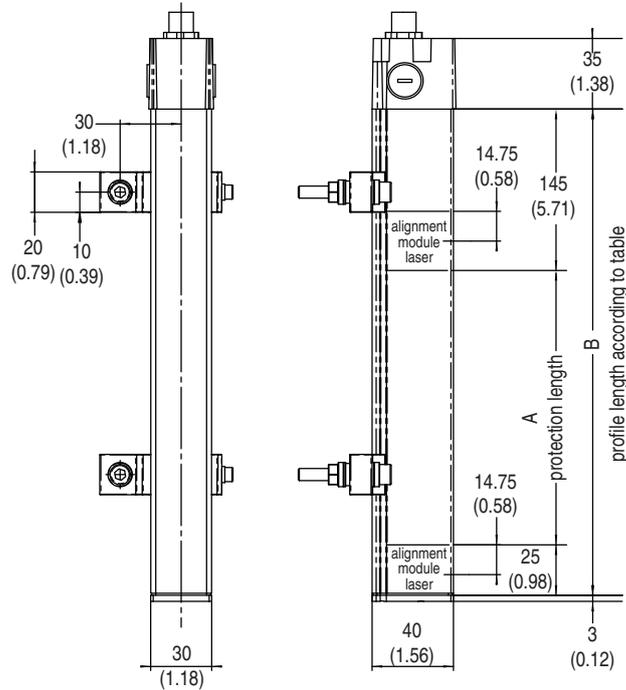
Type	A Protective Height [mm (in.)]	B Profile Length [mm (in.)]
445L-P2S0120YD	120 (4.7)	290 (11.4)
445L-P2S0240YD	240 (9.4)	410 (16.1)
445L-P2S0360YD	360 (14.2)	530 (20.9)
445L-P2S0480YD	480 (18.9)	650 (25.6)
445L-P2S0600YD	600 (23.6)	771 (30.4)
445L-P2S0720YD	720 (28.3)	891 (35.1)
445L-P2S0840YD	840 (33.1)	1011 (39.8)
445L-P2S0960YD	960 (37.8)	1131 (44.5)
445L-P2S1080YD	1080 (42.5)	1252 (49.3)
445L-P2S1200YD	1200 (47.2)	1372 (54.0)
445L-P2S1320YD	1320 (51.9)	1492 (58.7)
445L-P2S1440YD	1440 (56.7)	1612 (63.5)
445L-P2S1560YD	1560 (61.4)	1733 (68.2)
445L-P2S1680YD	1680 (66.1)	1853 (72.9)
445L-P2S1800YD	1800 (70.8)	1973 (77.7)
445L-P2S1920YD	1920 (75.6)	2093 (82.4)

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Wiring Diagram for Connection to MSR126

Wiring diagram is not intended to be used for installation purposes.
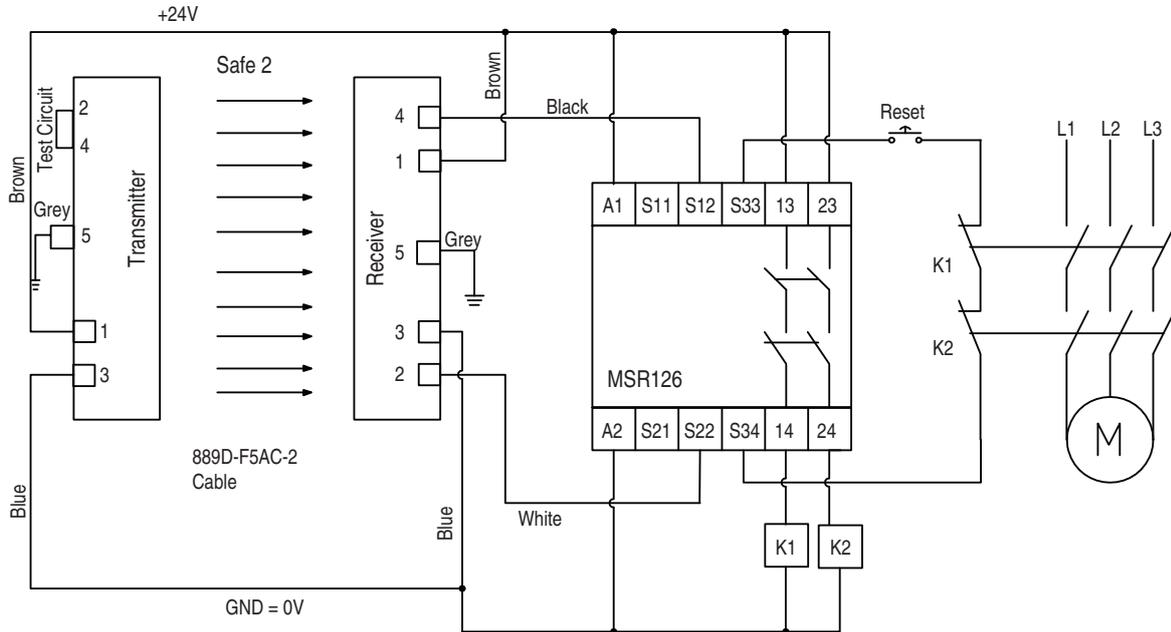
Wiring Diagram for Connection to MSR127

2-Opto-electronics
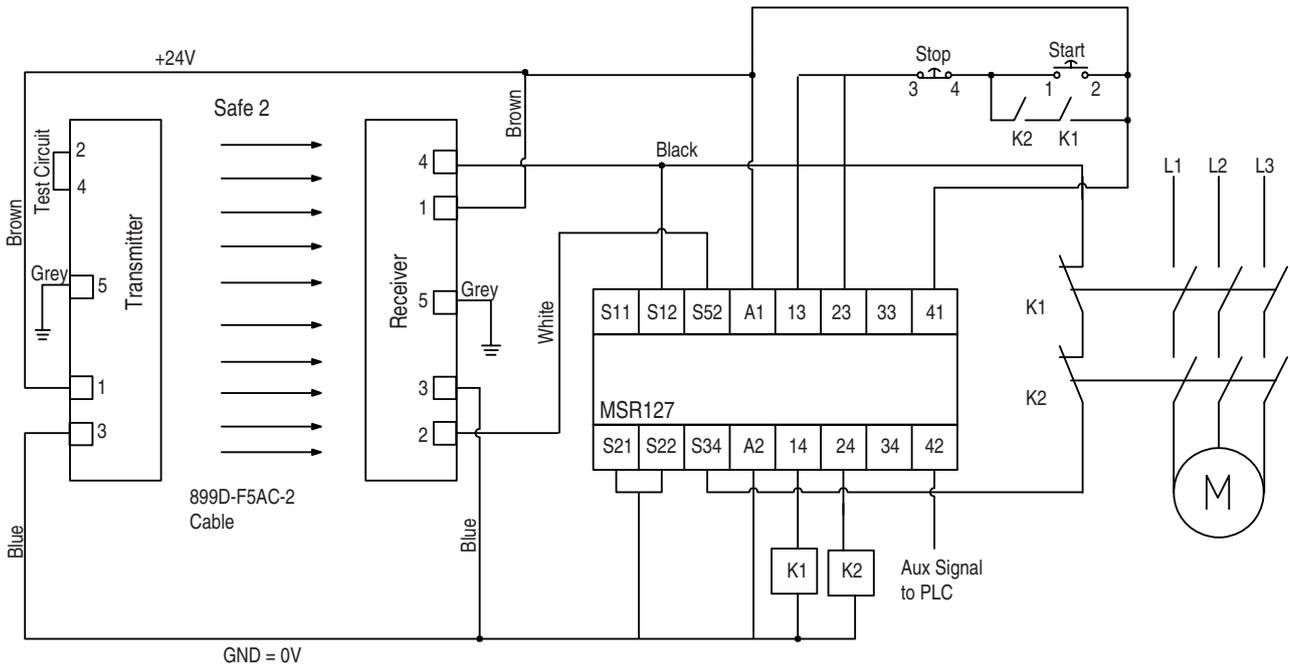
PAC Type 4 Safety Light Curtains

GuardShield PAC

Description

Standard GuardShield PAC

The Allen-Bradley Guardmaster GuardShield Perimeter Access Control (PAC) safety light curtain is a multiple beam, short range (0.3…16 m), Type 4 safety light curtain typically used to provide access detection at machine entry points. It is also possible to use the GuardShield PAC in perimeter guarding applications as an optoelectronic fence as long as the perimeter distance does not exceed the maximum range of 16 meters. Note that when using the GuardShield PAC with corner mirrors for multiple sided guarding, each mirror reduces the maximum scan range of 16 meters by approximately 15%.
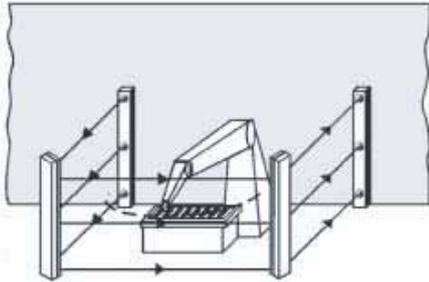
The GuardShield PAC safety light curtain is designed for whole body detection and is currently offered in two configurations: two beams at 500 mm spacing and three beams at 400 mm spacing.

GuardShield PAC with Integrated Laser Alignment System

The GuardShield PAC light curtains are offered with an integrated laser alignment system consisting of a Class 1, eye safe, constantly powered laser located in the top of the GuardShield PAC transmitter and at the bottom of the GuardShield PAC receiver. There are targets located across from each laser which help facilitate alignment of the light curtain when the laser is emitting visible light.

Each laser emits a low level of visible light. Simply placing a finger or opaque object in front of the laser reflects the laser light back to a photo sensor. This photo sensor causes the laser to switch state from a barely visible low level of emission to a higher level of emission of visible light. Interrupting the visible light below the finger symbol will cause the laser to change state back to a low level of light emission. The visible light will also change to a low level after five minutes.

The Integrated Laser Alignment system also quickly helps with the re-alignment of pairs when units are knocked out of alignment during the course of the work process or when corner mirrors are used.

ArmorBlock Guard I/O Connectivity

The GuardShield PAC light curtains are also offered with the integrated laser alignment system and connectivity to ArmorBlock Guard I/O. The receiver of these light curtains has a five-pin M12 quick disconnect connector wired to allow connection to the 1732DS ArmorBlock I/O module. This connectivity of the GuardShield PAC receiver allows the GuardShield's OSSDs to operate over a DeviceNet Safe network.

This version of the GuardShield has limited configurability, i.e., only beam coding can be configured by setting the appropriate DIP switches and performing the teach function. EDM, Start/Restart interlock as well as the auxiliary output are not available in these GuardShield PAC models.

The ArmorBlock Guard I/O can be used with any safety controller that communicates on DeviceNet using CIP Safety for the control and monitoring of safety circuits. ArmorBlock Guard I/O detects circuit failures at each I/O point while providing detailed diagnostics directly to the controller. With CIP Safety, you can easily integrate safety and standard control systems by using safety and standard messages on the same wire.

The 1732DS ArmorBlock Guard I/O family consists of 24V DC digital I/O modules that communicate on DeviceNet networks.

Features
- Beam coding
- External device monitoring (EDM)
- Machine test signal
- Start/restart interlock

Industries
- Material handling
- Packaging equipment
- Automotive
- Robot cells

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Specifications

Safety Ratings

Standards	IEC/EN 61496 Parts 1 & 2, UL 61496 Parts 1 & 2, UL 1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849
Certifications	UL 61496, UL 1998, cULus Listed, TÜV and CE marked for all applicable directives

Power Supply

Input Power, Max.	24V DC ±20%
Maximum Residual Ripple	0.05 Vss
Power Consumption	400 mA (no load)

Outputs

Safety Outputs	2 x PNP, 0.5 A, short circuit protected
Non-Safety Outputs	1 x PNP 0.5 A max.
Output Voltage, Min.	U_v - 2V
Switching Current @ Voltage, Min.	500 mA @ 24V DC

Operating Characteristics

Response Time	20 ms, 30 ms with beam coding activated
Status Indicators	On-state, off-state, alignment, interlock
Protected Height—mm (in)	3 beam = 820 (32.3); 2 beam = 520 (20.4)
Scanning Range	16 m (52.5 ft)
Synchronization	Optical, without separate synchronization channel. First beam adjacent to LEDs.
Wavelength	870 nm

Environmental

Enclosure Type Rating	IP65
Relative Humidity	15%...95% (noncondensing)
Operating Temperature [C (F)]	-10…55° (14…131°)
Vibration	IEC60068-2-6, frequency 10…55 Hz Amplitude: 0.35 mm (0.01 in)
Shock	IEC60068-2-29 acceleration 10 g, pulse duration 16 ms

Physical Characteristics

Mounting	End-cap mounting brackets
Weight	Varies by Cat. No.
Housing Cross Section	40 mm x 50 mm (1.57 in x 1.96 in)
Connection Type	Transmitter: 4-pin micro QD (M12) Receiver: 8-pin micro QD (M12)
Cable Length	30 m (100 ft) max.

2-Opto-electronics

PAC Type 4 Safety Light Curtains

GuardShield PAC

Product Selection

PAC Safety Light Curtains—Standard

The Allen-Bradley Guardmaster GuardShield PAC safety light curtains are ordered as a pair—transmitter and receiver—and are shipped under one Cat. No. After selecting the appropriate Cat. No. ensure that the required interfaces and accessories are ordered as well.

Protected Height [mm (in.)]	Beam Spacing	Number of Beams	Cat. No.
520 (20.4)	500 mm (19.7 in.)	2	440L-P4A2500YD
820 (32.3)	400 mm (15.7 in.)	3	**440L-P4A3400YD**

Note: The GuardShield transmitter requires a 4-pin cable and the receiver requires an 8-pin cable.
Note: To select a transmitter or receiver substitute the "P" in the above cat. nos. with a "T" for a transmitter or an "R" for a receiver.

GuardShield PAC with Integrated Laser Alignment

Protected Height [mm (in.)]	Beam Spacing	Number of Beams	Cat. No.
520 (20.4)	500 mm (19.7 in.)	2	440L-P4AL2500YD
820 (32.3)	400 mm (15.7 in.)	3	440L-P4AL3400YD

Note: The GuardShield transmitter requires a 4-pin cable and the receiver requires an 8-pin cable.
Note: GuardShields are sold in pairs. To select a transmitter or receiver, replace the "P" in the cat. no. with a "T" for a transmitter or an "R" for a receiver.

GuardShield PAC with Integrated Laser Alignment and I/O Connectivity

Protected Height [mm (in.)]	Beam Spacing	Number of Beams	Cat. No.
520 (20.4)	500 mm (19.7 in.)	2	440L-P4AL2500YA
820 (32.3)	400 mm (15.7 in.)	3	440L-P4AL3400YA

Note: GuardShields are sold in pairs. To select a transmitter or receiver, replace the "P" in the cat. no. with an "R" for a receiver. PAC with integrated laser alignment and I/O connectivity uses a standard transmitter. To order a transmitter, replace the "P" with a "T" and the last "A" with a "D" (example: 440L-T2500YD).

Recommended Logic Interfaces

| Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Note: The use of a category 4 safety relay module does not improve the category rating of the safety system beyond the Category 2 rating of the Type 2 light curtain in use.

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Cordsets—Two Required (one for transmitter and one for receiver)

Female Connector (Sensor End)		Cable			
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]	Cat. No.
Transmitter					
	Straight Female	1 Brown 2 White 3 Blue 4 Black	22 AWG 300V 4 A	2 (6.56)	889D-F4AC-2
				5 (16.4)	889D-F4AC-5
				10 (32.8)	889D-F4AC-10
				15 (49.2)	889D-F4AC-15
				20 (65.6)	889D-F4AC-20
				30 (98.4)	889D-F4AC-30
Receiver					
	Straight Female	1 White 2 Brown 3 Green 4 Yellow 5 Grey 6 Pink 7 Blue 8 Red	24 AWG 30V AC/36V DC 1.5 A	2 (6.56)	889D-F8AB-2
				5 (16.4)	889D-F8AB-5
				10 (32.8)	889D-F8AB-10
				15 (49.2)	889D-F8AB-15
				20 (65.6)	889D-F8AB-20
				30 (98.4)	889D-F8AB-30

Cordsets Approximate Dimensions [mm (in.)]

Dimensions are not intended to be used for installation purposes.

Straight Female

Accessories

Muting Sensors

Sensor Type	Connection Location	Type	Cat. No.
Retroreflective	Connected directly to muting module	Dark Switching	42GRU-9000-QD
Transmitted Beam	Receiver (connected directly to the muting module)		42GRR-9000-QD✱
Retroreflective	Connected directly to muting module		42GRU-9000-QD✱
Polarized Retroreflective	Three inch standard reflector		92-39
Polarized Retroreflective	Connected directly to muting module		42GRU-9200-QD✱
Polarized Retroreflective	Three inch standard reflector		92-39
Mechanical Limit Switch	Connected directly to muting module (operating lever must be selected separately)		802M-NX10✱
Muting lamp		Two cat. nos. make this assembly.	855E-24TL7
			855E-BVMC
✱Use with 4-pin, DC Micro cordset when connecting to muting module (5 m length shown). 1 m, 2 m, 3 m, and 5 m lengths available.			889D-F4AC-5

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Publication S117-CA001A-EN-P

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2-Opto-electronics

PAC Type 4 Safety Light Curtains
GuardShield PAC

Accessories—Optional

	Description	Cat. No.
	Steel L-shaped end cap mounting bracket (4 per package) **Note:** 4 brackets supplied with each GuardShield pair.	440L-AF6101 (1 package per system)
	Power Supply: Output 24V DC, 3 A, 72 W	1606-XLP72E
	Laser alignment tool	**440L-ALAT**
	GuardShield laser alignment tool bracket	**440L-AF6109**
	Mounting stand	**440L-AMSTD**
	GuardShield weld shield pair—3 beam	440L-AGWS0960
	GuardShield weld shield pair—2 beam	440L-AGWS0640
	Vertical shock mount kit	**440L-AF6120**
	GuardShield washdown enclosure kit—2 beam PAC	440L-AGST640
	GuardShield washdown enclosure kit—3 beam PAC	440L-AGST960

Note: The GuardShield washdown enclosure kits will not accommodate the GuardShield with Integrated Laser and with Inegrated Laser and ArmorBlock Guard I/O connectivity.

Corner Mirror for Multi-Sided Guarding

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications.

Note: Each mirror reduces maximum scan range by 10% per mirror.

GuardShield Light Curtain Cat. No.	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
440L-P4A2500YD		440L-AM0750750		440L-AM1250750
440L-P4A3400YD		440L-AM0751050		440L-AM1251050

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# PAC Type 4 Safety Light Curtains

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Safety Light Curtain

440L-P4A3400YD
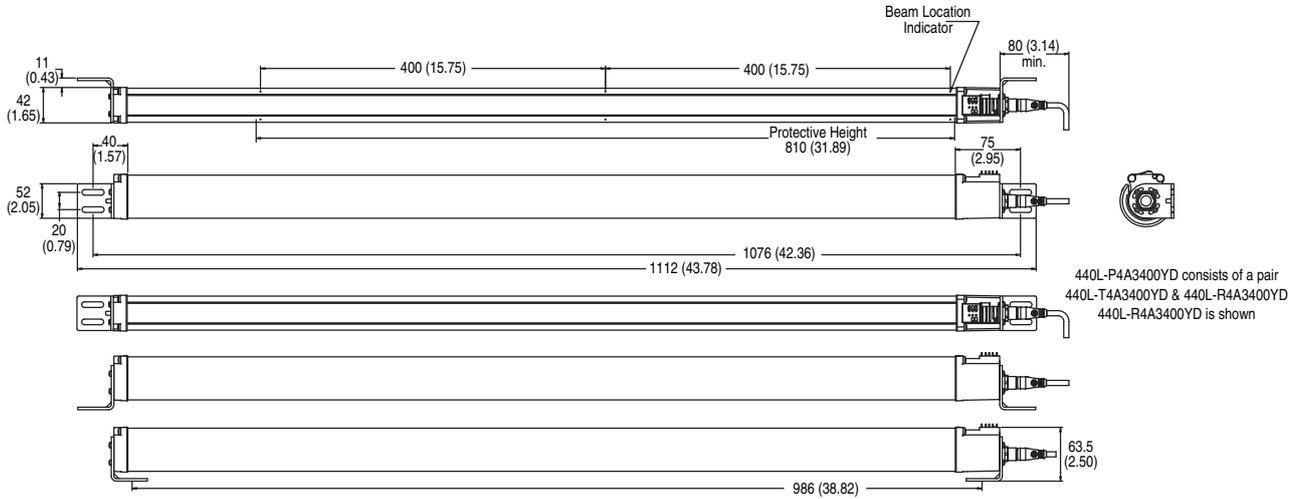
440L-P4A3400YD consists of a pair
440L-T4A3400YD & 440L-R4A3400YD
440L-R4A3400YD is shown
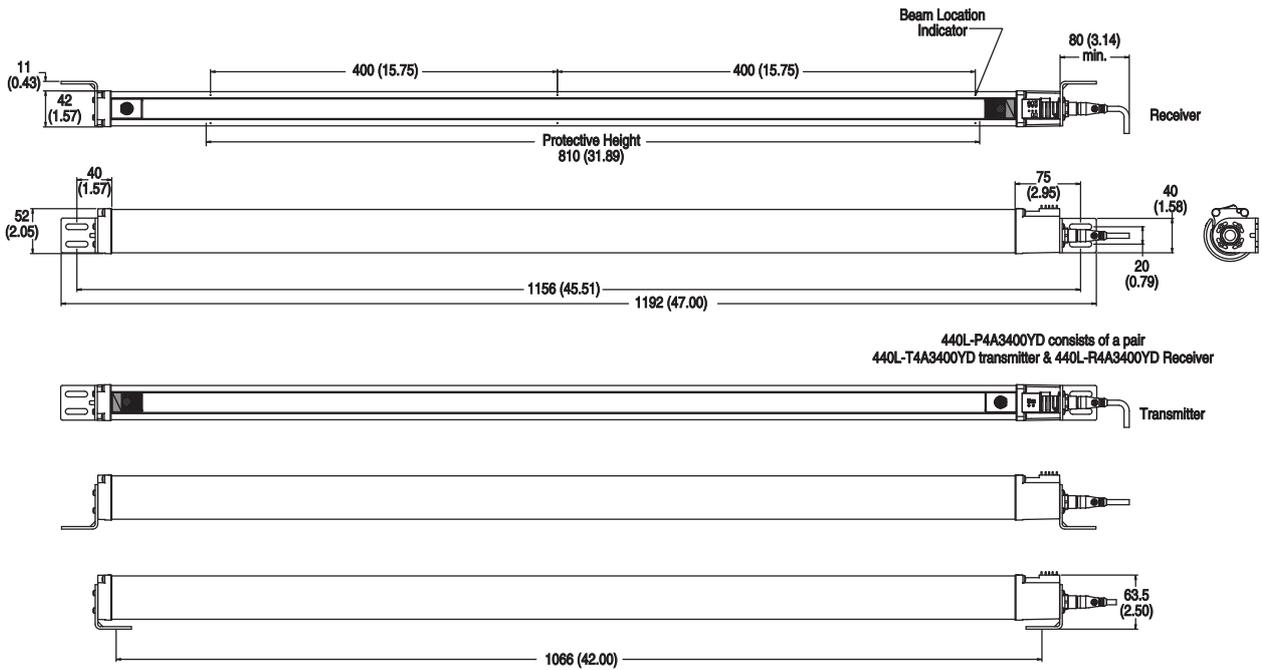
440L-P4AL3400YD

440L-P4A3400YD consists of a pair
440L-T4A3400YD transmitter & 440L-R4A3400YD Receiver

2-Opto-electronics

PAC Type 4 Safety Light Curtains
GuardShield PAC

440L-P4A2500YD

Beam Location Indicator

500 (19.69)

80 (3.14) min.

11 (0.43)

42 (1.65)

Protective Height 520 (20.47)

40 (1.57)

75 (2.95)

52 (2.05)

20 (0.79)

756 (29.8)

792 (31.2)

440L-P4A2500YD CONSISTS OF A PAIR
440L-T4A2500YD & 440L-R4A2500YD
440L-R4A2500YD IS SHOWN

63.5 (2.50)

666 (26.22)

440L-P4AL2500YD

Beam Location Indicator

500 (19.69)

80 (3.14) min.

11 (0.43)

42 (1.65)

Receiver

Protective Height 520 (20.47)

40 (1.57)

75 (2.95)

40 (1.58)

52 (2.05)

836 (33.00)

20 (0.79)

872 (34.33)

440L-P4A2500YD consists of a pair
440L-T4A2500YD transmitter & 440L-R4A2500YD receiver

Transmitter

63.5 (2.50)

746 (29.37)

Cat. No.	A Protective Height [mm]	B Mounting Value [mm]	C Total Length [mm]
440L-P4A3400YD	820 ±0.5	1076	1112 ±1.5
440L-P4A2500YD	520 ±0.5	756	792 ±1.5
440L-P4AL3400Y✶	820 ±0.5	—	—
440L-P4AL2500Y✶	520 ±0.5	—	—

✶ Replace with "D" for standard 8-pin M12 or "A" for 5-pin M12 for ArmorBlock Guard I/O connectivity.

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2-Opto-electronics

Wiring Diagram for Connection of OSSDs Directly to Contactors (FSDs)

Wiring diagram is not intended to be used for installation purposes.
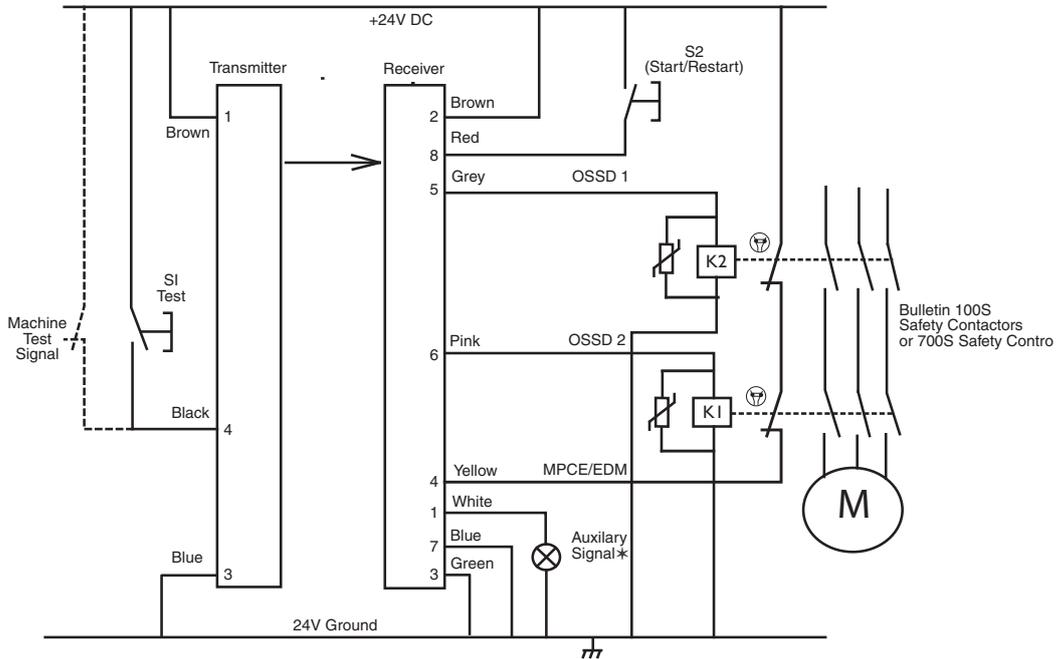
* Auxiliary output is nonsafety. Can be connected to a lamp, motor or status to a PLC.

K1, K2	Safety relay or safety contactor for OSSD 1 and OSSD 2 connection
S1	Switch for external system test (optional)
S2	Switch for reset of light curtain from start/restart interlock

Wiring Diagram for Connection of OSSDs Directly to a Safety Relay Module

2-Opto-electronics

2-63

PAC Type 4 Safety Light Curtains

GuardShield Safe 4 PAC

Description

The Allen Bradley Guardmaster GuardShield Safe 4 PAC is an economical two box, Type 4 safety light curtain with ON/OFF functionality. This basic, guard-only operating mode, perimeter access safety light curtain has an integrated laser alignment system that simplifies the alignment of each pair of light curtains. Visible laser beams are activated by touching the finger symbol on front face of the light curtains. Positioning of the transmitter and receiver laser beams to their respective targets facilitates optimal alignment of each Safe 4 PAC pair. The integrated laser alignment system also helps with the re-alignment of pairs if units are knocked out of alignment during the course of the work process or when corner mirrors are used.

The GuardShield Safe 4 PAC is offered with two 120 mm long, 30 mm resolution optic modules spaced at 500 mm and three 120 mm long, 30 mm resolution optic modules spaced at 400 mm providing whole body detection. Designed for perimeter guarding applications, both configurations of the Safe 4 PAC have operating ranges from 5 to 30 meters which allows them to be used as opto-electronic fences. The use of corner mirrors with the Safe 4 PAC allows multiple-sided guarding in large perimeter applications. The GuardShield Safe 4 PAC is also a low cost solution for entry or exit guarding of a machine process when paired with the MSR42 muting module. The MSR42 can be configured for two-sensor muting with the Safe 4 PAC. The muting function allows material to pass through the sensing field of the Safe 4 PAC when the muting sensors are properly activated by the flow of material.

The GuardShield Safe 4 PAC, with an environmental rating of IP65, is designed to be used in a variety of applications across a broad range of industries in medium to heavy industrial environments. Offered with shock isolator kits for shock and vibration applications, the Safe 4 PAC is suited to medium- and heavy-duty applications.

Features

- M12 connectors
- Optically synchronized
- Integrated laser alignment system
- IP65 enclosure rating
- Simple installation
- cULus Listed and CE Marked for all applicable directives

Applications

- Palletizers
- Material handling systems
- Packaging equipment
- Robot cells
- Automated processes

Specifications

Safety Ratings	
Standards	EN/IEC 61496 Parts 1 and 2, UL 61496 Parts 1 and 2, UL1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849
Certifications	cULus Listed and CE Marked for all applicable directives

Power Supply	
Input Power, Max.	24V DC ± 20%
Maximum Residual Ripple	< 10% of U_{sp}
Power Consumption	<500 mA (no load)

Outputs	
Safety Outputs	2 PNP OSSD. 0.3 A, short-circuit protected
Output Voltage, Min.	U_{sp} -1
Switching Current @ Voltage, Min.	300 mA @ 24V DC

Operating Characteristics	
Indicator LEDs	ON -State, OFF-State, internal error
Protected Height [mm (in.)]	3 beam = 840 mm (33.0 in.) 2 beam = 600 mm (23.6 in,)
Scanning Range	5…30 m (16.4…98.4 ft)
Synchronization	Optical, first beam adjacent to LEDs
Wavelength	950 nm

Environmental	
Enclosure Type Rating	IP65
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	0…55° (0…131°)
Vibration	IEC 60068-2-6 frequency 10…55 Hz; amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; acceleration 10 g, pulse duration 16 ms 10…55 Hz; amplitude 0.35 mm (0.01 in.)

Physical Characteristics	
Mounting	Rear mounting, standard and adjustable (180°)
Weight	Varies by by cat. no., see Installation Manual
Housing Cross Section	30 x 40 mm (1.18 x 1.57 in.)
Connection Type	Transmitter: 5-pin M12 micro QD Receiver: 5-pin M12 micro QD
Cable Length	30 m (98.4 ft) max.
ILAS Laser Class	Class 2, IEC 60825-1

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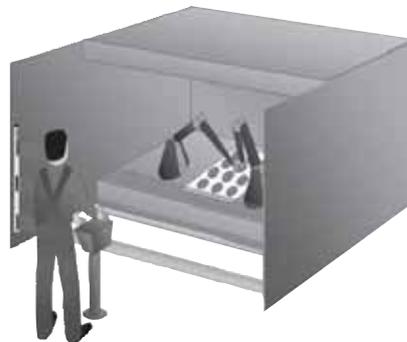
Guardmaster®

Product Selection

Safety Light Curtain—Standard PAC System

The Allen-Bradley Guardmaster GuardShield Safe 4 PAC safety light curtains are offered with two or three modules with various spacing for whole body detection. These are ordered as pairs (transmitter and receiver) and are shipped under one catalog number. Each GuardShield Safe 4 PAC pair is shipped with mounting brackets. After selecting the appropriate Safe 4 PAC, ensure that the appropriate cordsets, interfaces and accessories are ordered.

Protected Height [mm (in.)]	Number of Beams	Beam Spacing	Pair Weight [kg (lbs)]	Cat. No.
600 (23.6)	2	500 mm	4.0 (8.8)	445L-P4S2500YD
840 (33.0)	3	400 mm	4.5 (9.9)	445L-P4S3400YD

Note: The cat. nos. listed above are pair cat. nos. designated by the "P" in the cat. no. To specify a transmitter or receiver, replace the "P" with a "T" for transmitter and "R" for a receiver. The GuardShield Safe 4 PAC requires a 5-pin M12 cordset for the transmitter and the receiver.

Required Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Note: The use of a category 4 safety relay module does not improve the category rating of the safety system beyond the Category 2 rating of the Type 2 light curtain in use.

2-Opto-electronics

PAC Type 4 Safety Light Curtains

GuardShield Safe 4 PAC

Cordsets—Transmitters and receivers both use 5-pin M12 cordsets

Note: Unshielded cordsets are most commonly used for safety light curtains, however, shielded cordsets are also offered to increase immunity to electrical interference.

Female Connector (Sensor End)			Cable			
Face View of Female	Connector Style	Pin/Wire Color	Wire Rating	Length [m (ft)]		Cat. No.
	Straight Female	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 250V 4 A	2 (6.56)		889D-F5AC-2
				5 (16.4)		889D-F5AC-5
				10 (32.8)		889D-F5AC-10
				15 (49.2)		889D-F5AC-15
				20 (65.6)		889D-F5AC-20
				30 (98.4)		889D-F5AC-30
	Shielded Straight Female	1 Brown 2 White 3 Blue 4 Black 5 Grey	22 AWG 22 AWG 300V 4 A	2 (6.56)		889D-F5EC-2
				5 (16.4)		889D-F5EC-5
				10 (32.8)		889D-F5EC-10
				15 (49.2)		889D-F5EC-15
				20 (65.6)		889D-F5EC-20
				30 (98.4)		889D-F5EC-30

Cordsets Approximate Dimensions [mm (in.)]

Dimensions are not intended to be used for installation purposes.

47 (1.85)

14 (0.56)

Straight Female

Accessories

Muting Sensors

Sensor Type	Connection Location	Type	Cat. No.
Retroreflective	Connected directly to muting module	Dark Switching	42GRU-9000-QD
Transmitted Beam	Receiver (connected directly to the muting module)		42GRR-9000-QD∗
Retroreflective	Connected directly to muting module		42GRU-9000-QD∗
Polarized Retroreflective	Three inch standard reflector		92-39
Polarized Retroreflective	Connected directly to muting module		42GRU-9200-QD∗
Polarized Retroreflective	Three inch standard reflector		92-39
Mechanical Limit Switch	Connected directly to muting module (operating lever must be selected separately)		802M-NX10∗
Muting lamp		Two cat. nos. make this assembly.	855E-24TL7
			855E-BVMC
∗Use with 4-pin, DC Micro patchcord when connecting to muting module (5 m length shown). 1 m, 2 m, 3 m, and 5 m lengths available.			889D-F4AC-5

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Optional Accessories

	Description	Cat. No.
	Standard kit (4 pieces — supplied with each pair)	445L-AF6140
	180° Adjustable kit (two kits required per pair)	**445L-AF6141**
	Shock Mount Kit (2 kits required per pair of light curtains)	445L-AF6142
	Vertical mounting kit (two kits required per pair)	445L-AF6144
	MSR42 Multifunction Module (requires 440L-AF6150 to program)	**440R-P226AGS-NNR**
	MSR45E — Safety relay expansion module for MSR42	**440R-P4NANS**
	USB optical interface software configuration tool used to configure the MSR42 (Used to configure the MSR42 module or get diagnostic information from the Safe 4.)	**445L-AF6150**
	Ribbon cable — to connect one MSR45E to an MSR42	**440R-ACABL1**
	Ribbon cable — to connect two MSR45Es to an MSR42	440R-ACABL2
	Ribbon cable — to connect three MSR45Es to an MSR42	440R-ACABL3
	Mounting stand (Comes with hardware to level base and two GuardShield mounting brackets.)	**440L-AMSTD**

2-Opto-electronics

PAC Type 4 Safety Light Curtains

GuardShield Safe 4 PAC

Corner Mirror for Multi-Sided Guarding

GuardShield Safe 4	Narrow Mirror Short-Range 0…4 m	Cat. No.	Wide Mirror Long-Range 4…15 m	Cat. No.
445L-P4S2500YD		440L-AM0750900		440L-AM1250900
445L-P4S3400YD		440L-AM0751200		**440L-AM1251200**

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

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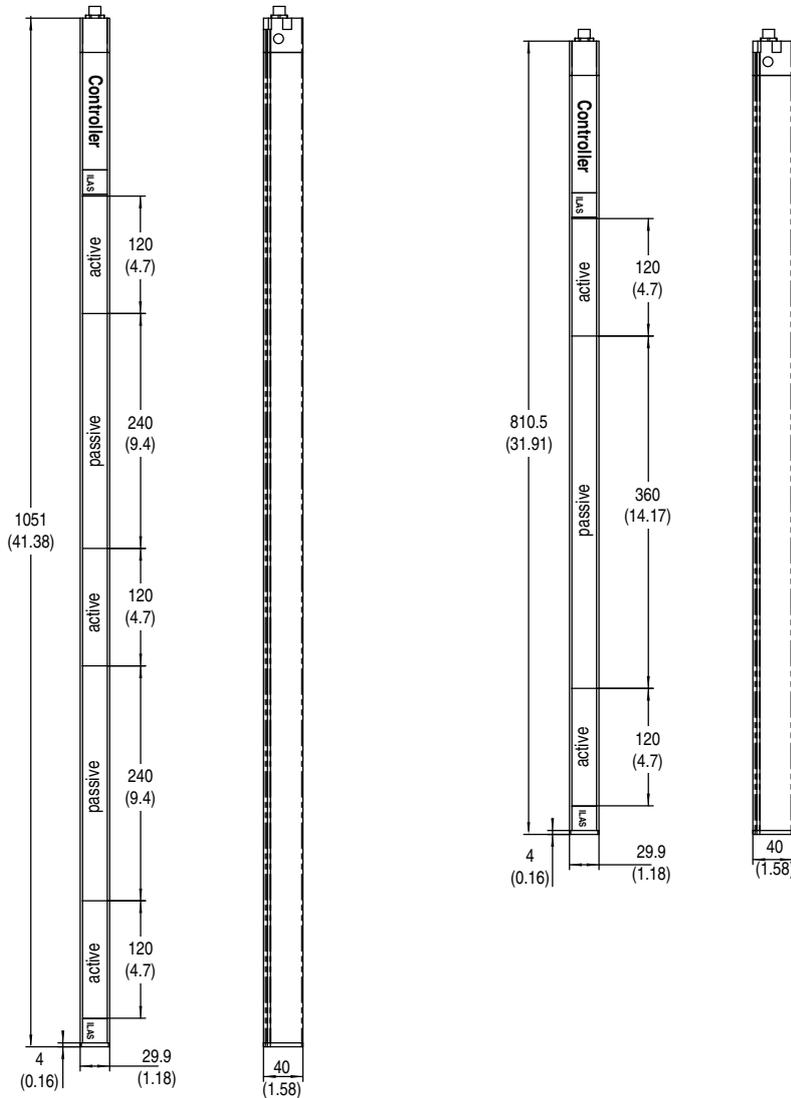
Wiring Diagram for Connection to MSR126

Wiring diagram is not intended to be used for installation purposes.
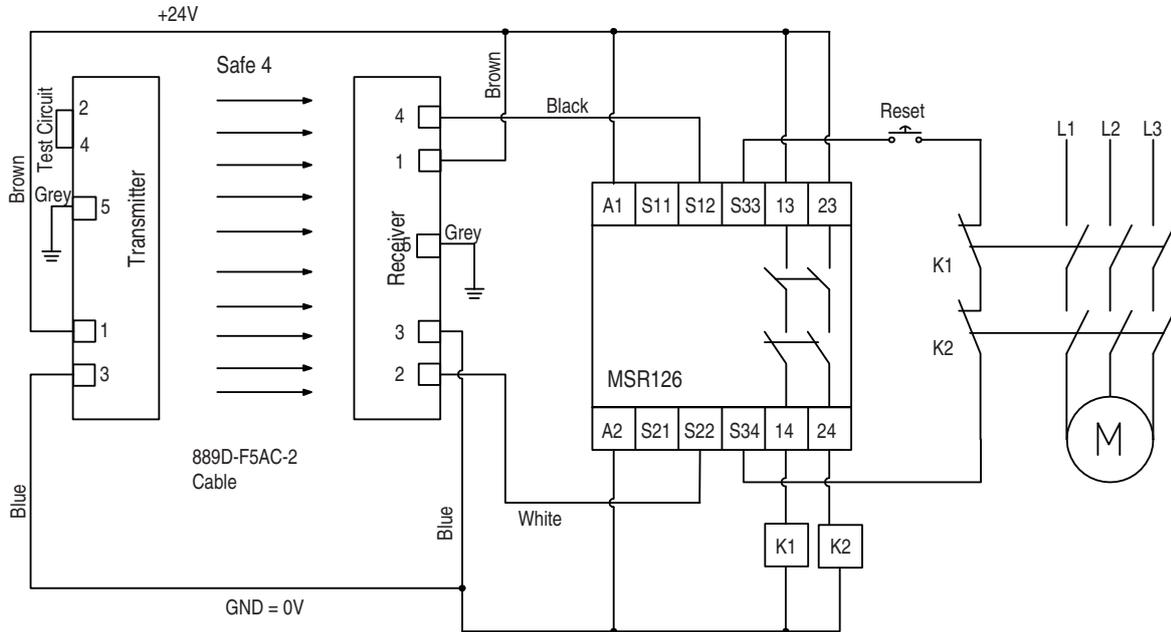
Wiring Diagram for Connection to MSR127
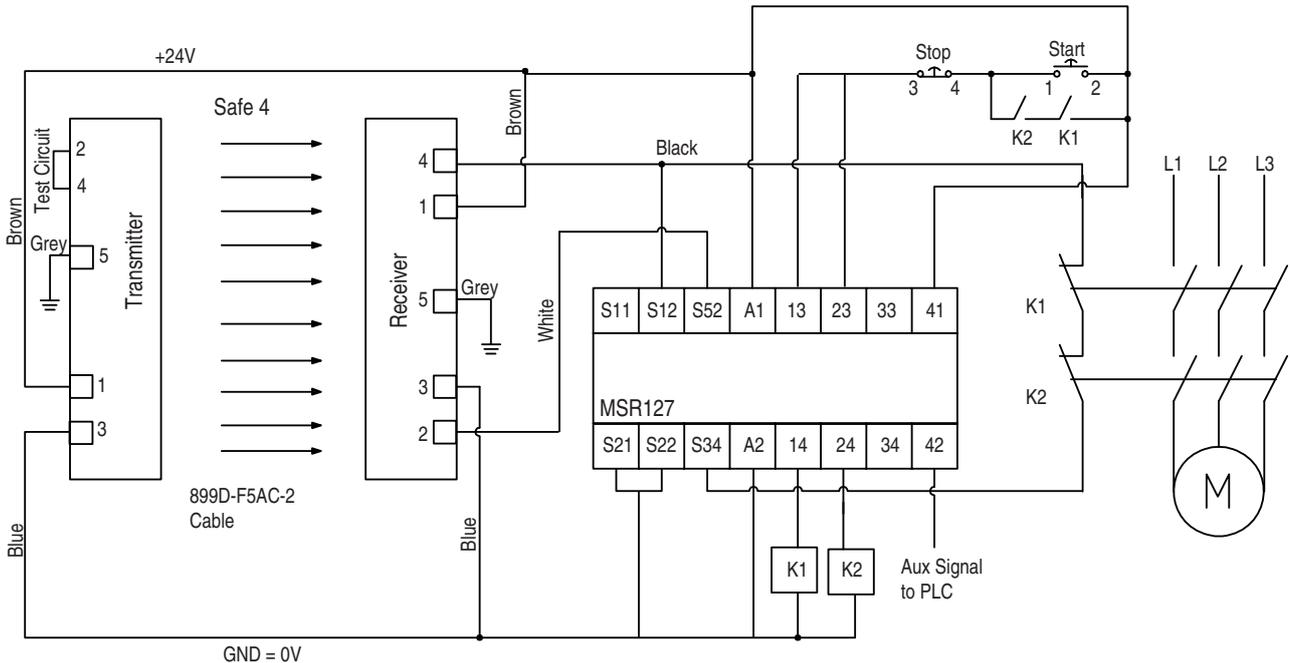
Safety Single Beam

Area Access Control

Description

The Area Access Control (AAC) safety single-beam is a 24V DC through-beam opto-electronic safety switch offered with two operating ranges (a short range (0.5…20 m (1.64…65.5 ft) or a long range (15…70 m (49.2…300 ft)) system. The AAC system uses the same transmitter for both ranges and one of two receivers for a short-range or long-range system. This unique system configuration minimizes the number of cat. nos. necessary for specifying the AAC single-beam system.

The AAC safety single-beam is used as a whole-body detection device. The light beam produced between the AAC transmitter and receiver provides whole-body access detection for hazardous areas such as:

• Robotic work cells
• Processing machines
• Machining centers
• Palletizers
• Transfer lines
• High bay warehouses

Features

• Long scan range (up to 70 m (300 ft))
• Easy installation
• Die cast aluminium housing
• Heated front lens, allowing use even in outdoor applications
• Relay outputs

Specifications

Safety Ratings	
Standards	IEC 61496, Parts 1 & 2
Safety Classification	Type 4, IEC 61496; SIL 3 (IEC 61508); SIL CL3 (IEC 62061); Category 4 (EN ISO 13849); PLe (EN ISO 13849); B_{10d} parameter: 1×10^6 switching cycles (@ DC-13, 24V, 0.6 A); 2×10^5 switching cycles (@ DC-13, 24V, 1.5 A) PFH_d: 4.0×10^{-9}; Mission time: 20 years
Certifications	CE Marked for all applicable directives and BG
Power Supply	
Input Power, Max.	24V DC ±20%
Maximum Residual Ripple	5% of U_v, max.
Power Consumption	24V DC 8 W max.
Outputs	
Safety Outputs	2 N.O. Relays
Switching Current @ Voltage, Min.	0.02 A to 2 A
Operating Characteristics	
Response Time	< 22 ms
Status Indicators	On state, Off state, alignment
Beam Diameter	23 mm (0.91 in.)
Scanning Range	0.5…20 m (1.64…65.5) or 15…70 m (49.2…300 ft)
Synchronization	Optical
Wavelength	950 nm
Environmental	
Enclosure Type Rating	IP67 (EN 60529)
Relative Humidity	15…95%, noncondensing
Operating Temperature [C (F)]	-25…55° (-13…131°)
Vibration	5 g, 10…55 Hz per IEC 60068-2.6
Shock	10 g, 16 ms per IEC 60068-2.29
Physical Characteristics	
Front Window	Heated
Weight	Transmitter unit: approx. 0.9…1.3 kg Receiver unit: approx. 1…1.4
Housing Cross Section	50 x 156 x 116 mm (1.96 x 6.14 x 4.56 in.)
Connection Type	Terminal chamber with cable gland (PG13.5 thread)
Cable Length	50 m (164 ft) max.

Note: The external power supply must be capable of buffering brief power failures of 20 ms as specified in IEC 60204-1.

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Product Selection

Selection Guide for Receiver

Operating Range	Connection Type	Cat. No.
0.5…20 m (1.64…65.5)	Terminal chamber with cable gland (PG13.5 thread)	**440L-R4F0020Q**
15…70 m (49.2…300 ft)		**440L-R4F1570Q**

Selection Guide for Transmitter

Operating Range	Connection Type	Cat. No.
0…70 m (0…300 ft)	Terminal chamber with cable gland (PG13.5 thread)	**440L-T4F2070Q**

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Note: The use of a category 4 safety relay module does not improve the category rating of the safety system beyond the Category 2 rating of the Type 2 light curtain in use.

Accessories

	Description	Cat. No.
	Laser alignment tool	**440L-ALAT**
	Adaptor for alignment aid on AAC	440L-ALBRK1
	Mounting bracket for AAC	**440L-AMBRK4**
	Corner mirror for scanning range 0…30 m	440L-AMIRR1
	Mounting kit for 440L-AMIRR1	440L-AMKIT
	Mounting bracket for mirror 440L-AMIRR1	440L-AMBRK1
	Glass corner mirror, 45° angle 0…30 m	**440L-AMIRR2**

2-Opto-electronics

# Safety Single Beam
Area Access Control

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.
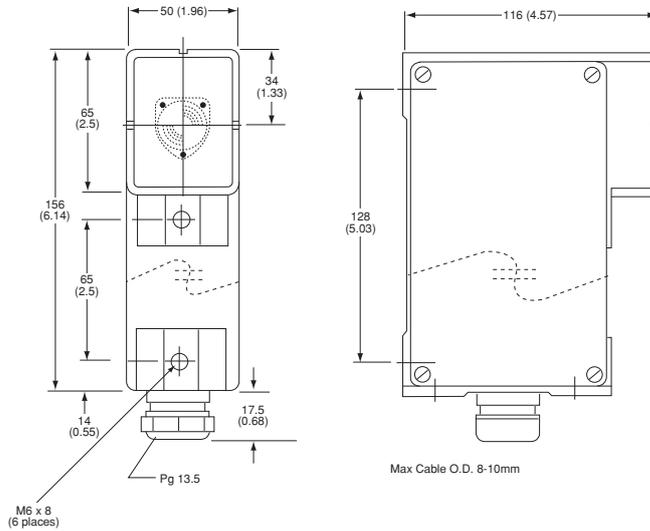

Typical Wiring Diagrams

*Wiring diagram is not intended to be used for installation purposes.*
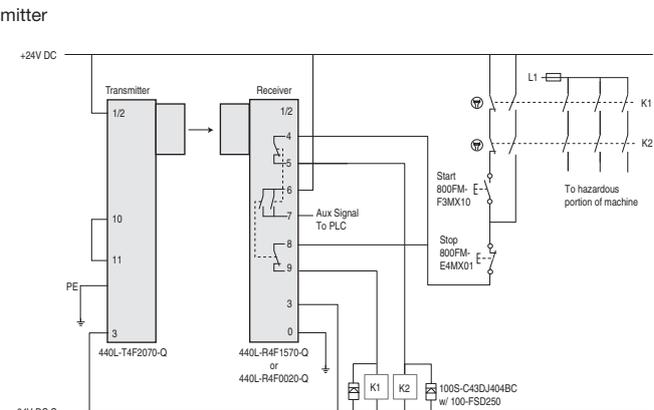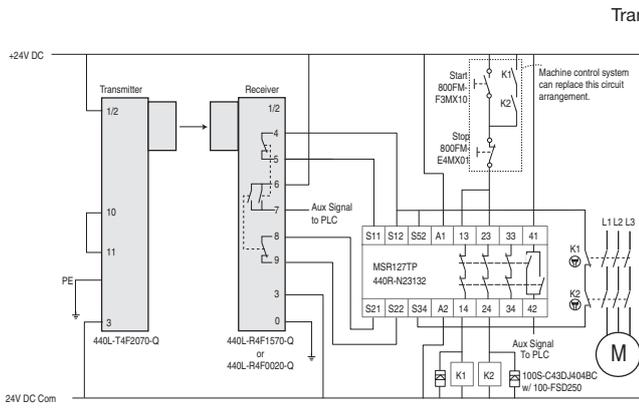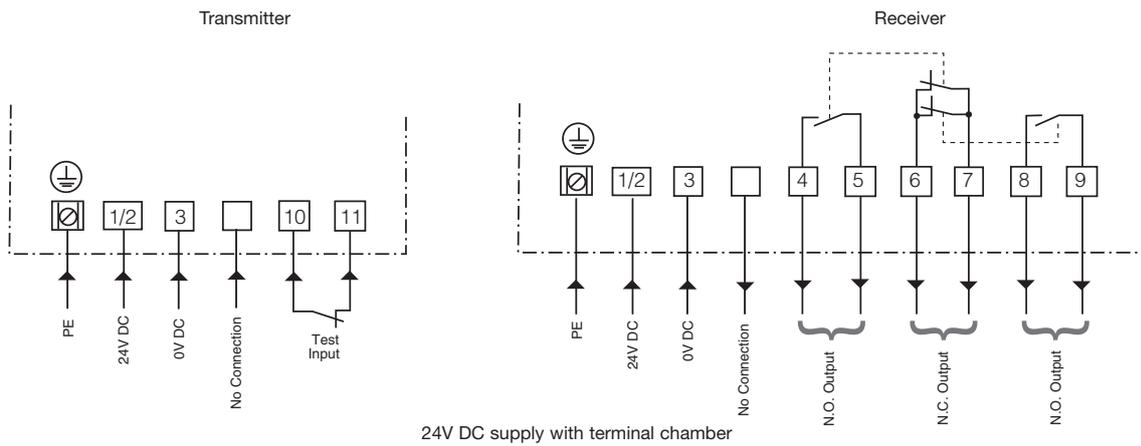
24V DC supply with terminal chamber

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Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

**AAC Mounting Bracket 440L-AMBRK4**
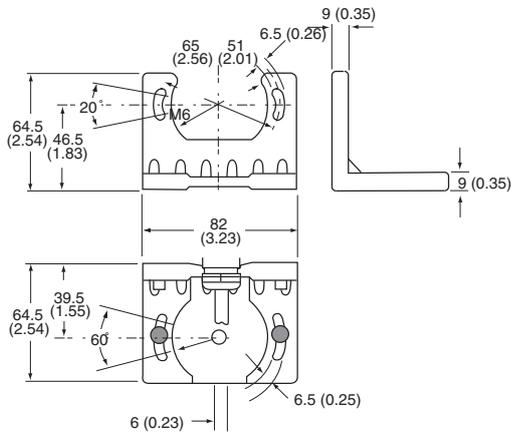
Mounting Bracket 440L-AMBRK1
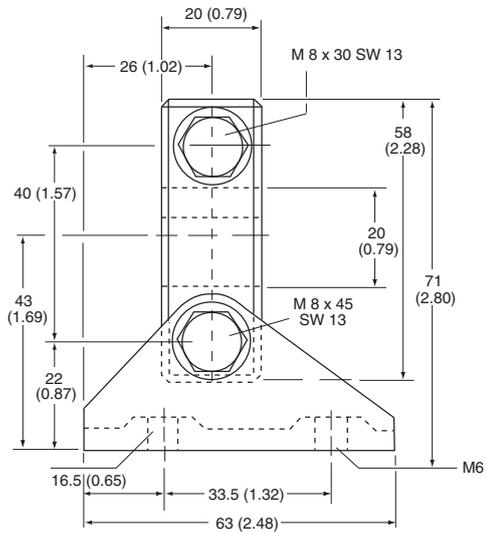
Mounting Bracket 440L-AMBRK1 Mounted to Mirror 440L-AMIRR1
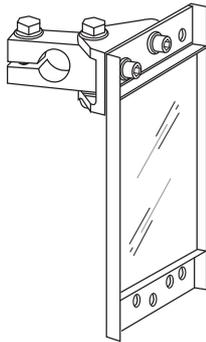
Shown with bracket 440L-AMBRK1
Mounted to mirror 440L-AMIRR1

Mirror 440L-AMIRR1
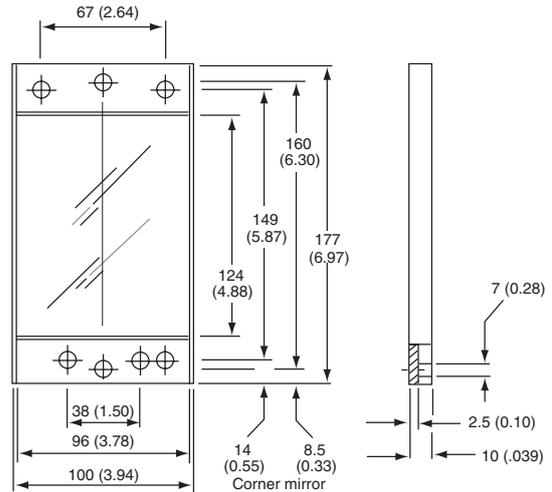
2-Opto-electronics

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Mirror 440L-AMIRR2
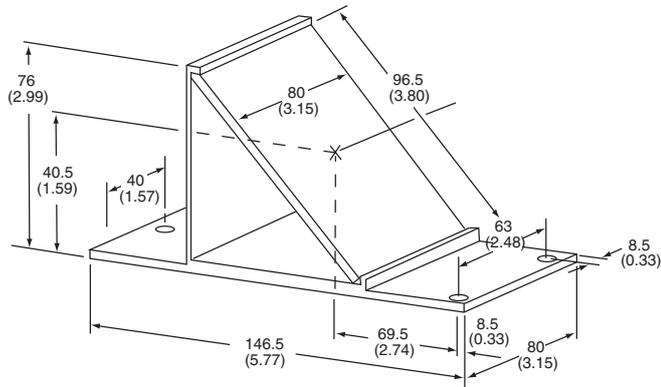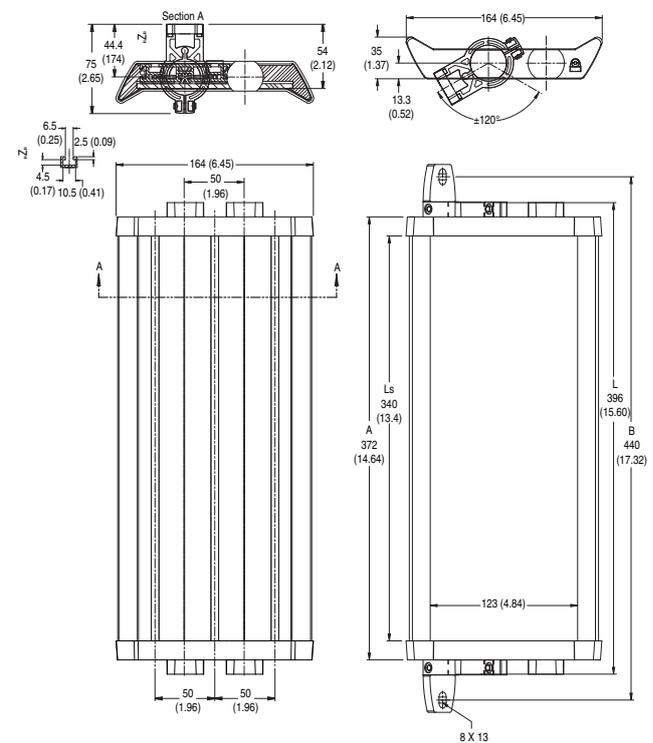
Mirror 440L-AM075


Mirror 440L-AM125
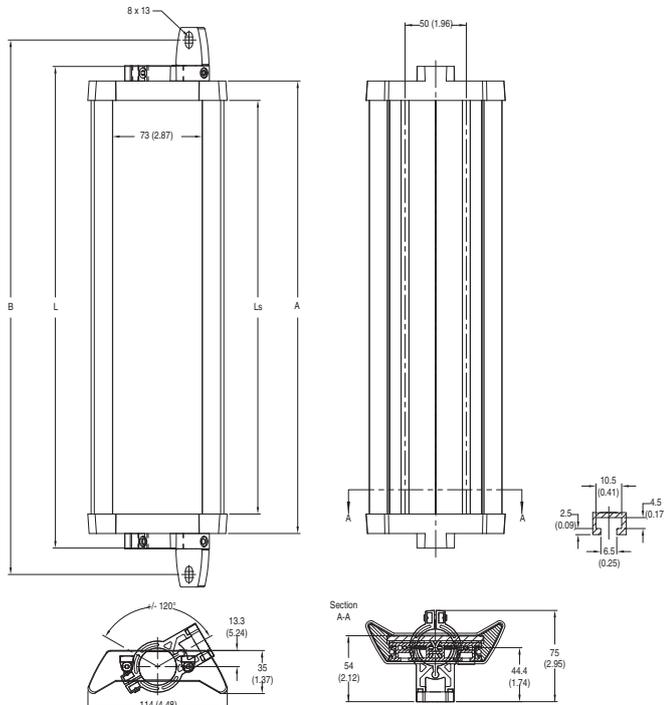
MODEL NO.	SERIES	DESCRIPTION	L	L$_S$	A	B
440L-AM1250300	A	Mirror, 300 mm, 15 m	396	340	372	440
440L-AM1250450	A	Mirror, 450 mm, 15 m	546	490	522	590
440L-AM1250600	A	Mirror, 600 mm, 15 m	696	640	672	740
440L-AM1250750	A	Mirror, 750 mm, 15 m	846	790	822	890
440L-AM1250900	A	Mirror, 900 mm, 15 m	996	940	972	1040
440L-AM1251050	A	Mirror, 1050 mm, 15 m	1146	1090	1122	1190
440L-AM1251200	A	Mirror, 1200 mm, 15 m	1296	1240	1272	1340
440L-AM1251350	A	Mirror, 1350 mm, 15 m	1446	1390	1422	1490
440L-AM1251500	A	Mirror, 1500 mm, 15 m	1596	1540	1572	1640
440L-AM1251650	A	Mirror, 1650 mm, 15 m	1746	1690	1722	1790
440L-AM1251800	A	Mirror, 1800 mm, 15 m	1896	1840	1872	1940

Note: The 1800 mm corner mirror can not be mounted to the floor stand (440L-AMSTD) with end cap brackets. This requires the t-nut kit (440L-AF6115) for rear mounting.

| MODEL NO.	SERIES	DESCRIPTION	L	L$_S$	A	B
440L-AM0750300	A	Mirror, 300 mm, 4 m	396	340	372	440
440L-AM0750450	A	Mirror, 450 mm, 4 m	546	490	522	590
440L-AM0750600	A	Mirror, 600 mm, 4 m	696	640	672	740
440L-AM0750750	A	Mirror, 750 mm, 4 m	846	790	822	890
440L-AM0750900	A	Mirror, 900 mm, 4 m	996	940	972	1040
440L-AM0751050	A	Mirror, 1050 mm, 4 m	1146	1090	1122	1190
440L-AM0751200	A	Mirror, 1200 mm, 4 m	1296	1240	1272	1340
440L-AM0751350	A	Mirror, 1350 mm, 4 m	1446	1390	1422	1490
440L-AM0751500	A	Mirror, 1500 mm, 4 m	1596	1540	1572	1640
440L-AM0751650	A	Mirror, 1650 mm, 4 m	1746	1690	1722	1790
440L-AM0751800	A	Mirror, 1800 mm, 4 m	1896	1840	1872	1940

Note: The 1800 mm corner mirror can not be mounted to the floor stand (440L-AMSTD) with end cap brackets. This requires the t-nut kit (440L-AF6115) for rear mounting.

2-Opto-electronics

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Mounting Stand—440L-AMSTD

25.4 (1.0)
63.5 (2.5)
1828.8 (72.0)
11.1 [7/16] (0.44) Dia.
M10 x 1.5 mm
12.7 [1/2] (0.5) Dia.
19.05 (0.75)
6.35 (0.25)
76.2 (3.0)
7.62 (3.0)
25.4 (1.0) Dia.
6.35 (2.5)
381.0 (15.0)
304.8 (12)
6.35 (0.25)
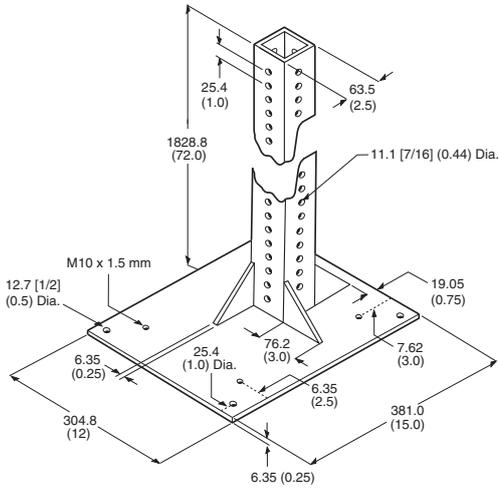
Two of each bracket included with **440L-AMSTD** to mount GuardShield light curtains to mounting stand.

Laser Alignment Tool—440L-ALAT

66.8 (2.63)
12.19 (0.48)
19.05 (0.75)
62.48 (2.46)
4.0 (0.15)

440L-M8600—GuardShield Remote Teach Box

127 (5.0)
101.6 (4.0)
21.59 (0.85)
63.5 (2.50)
127 (5.0)
CONFIG
RUN TEACH
10.16 (0.4)
101.6 (4.0)
13.33 (0.525)
99.31 (3.91)
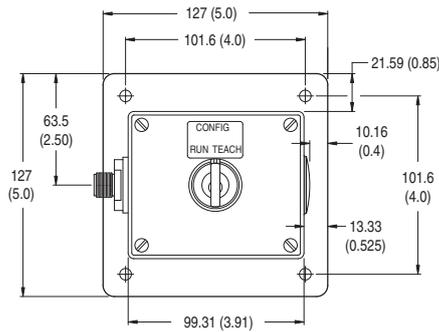
**Swivel Mounting Bracket 442L-AF6106**

Used for end mounting of corner mirrors. Two supplied with each corner mirror.
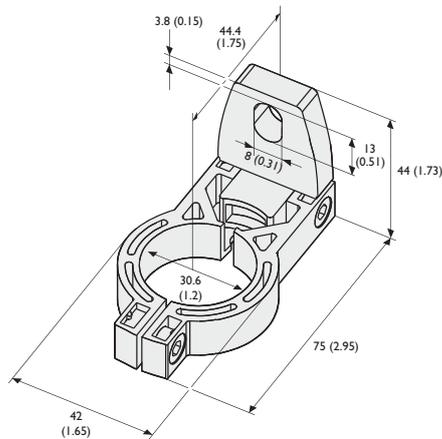
3.8 (0.15)
44.4 (1.75)
8 (0.31)
13 (0.51)
44 (1.73)
30.6 (1.2)
75 (2.95)
42 (1.65)

440L-AF6109—used to mount the 440L-ALAT laser alignment tool to Guard Shield light curtains

4.29 (0.169) hole dia.
81° x 2.66 (0.105) Countersink
17.78 (0.70)
35.56 (1.4)
44.45 (1.75)

2-Opto-electronics

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Weld Shields

The GuardShield weld shields are sold as pairs in the same lengths as the protective heights of the GuardShield safety light curtain.

These polycarbonate weld shields are designed as disposable devices whose purpose is to protect the front window of the GuardShield safety light curtain from damage.
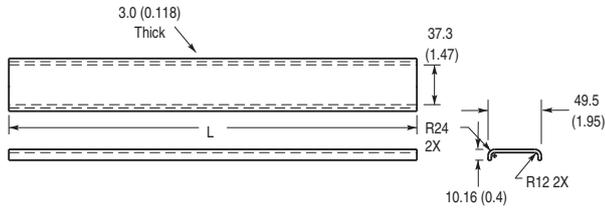
Dimension "L" [mm (in.)]	Cat. No.	Dimension "L" [mm (in.)]	Cat. No.
175.3 (6.9)	440L-AGWS0160	1135.4 (44.70)	440L-AGWS1120
335.3 (13.20)	440L-AGWS0320	1295.4 (51.00)	440L-AGWS1280
495.3 (19.50)	440L-AGWS0480	1455.4 (57.30)	440L-AGWS1440
655.3 (25.80)	440L-AGWS0640	1615.4 (63.60)	440L-AGWS1600
815.3 (32.10)	440L-AGWS0800	1778 (70.00)	440L-AGWS1760
975.4 (38.40)	440L-AGWS0960		

Torque Requirements by Mounting Kit

Cat. No.	Description	Max. Load per Isolator (shear)	Tightening Torque	Spring Rate (shear)
440L-AF6120	Vertical shock mount kit	5 lbs	40 inch lbs	55 lbs/inch
440L-AF6121	Horizontal shock mount kit	22 lbs	40 inch lbs	200 lbs/inch
440L-AF6122	Middle vertical mount kit	5 lbs	40 inch lbs	55 lbs/inch
440L-AF6123	Middle horizontal mount kit	22 lbs	40 inch lbs	200 lbs/inch

Vertical Application

Shock Mounts

Shock mount kits are used for attenuating excessive shock and vibration for both vertical and horizontal applications of the GuardShield family of safety light curtains. These kits are designed to protect the internal optical and electronic components of the GuardShield light curtains and are used mostly in press applications.

Horizontal Application

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GuardShield Washdown Enclosures

The GuardShield washdown enclosure is designed to provide an environmentally protective enclosure for the GuardShield Type 4 and GuardShield PAC safety light curtains when they are applied in washdown applications. There is a range loss of approximately 10% when GuardShield light curtains are mounted inside of the IP67 washdown enclosures.

Approximate Dimensions
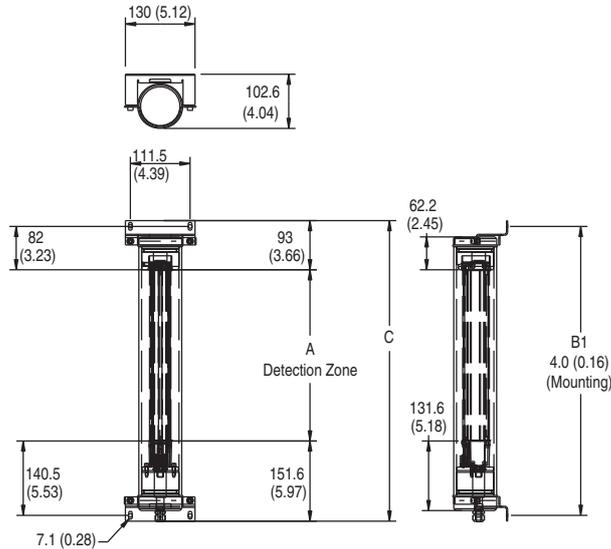
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.


Cat. No.	Use with Light Curtain Cat. No.	A Protective Height [mm (in.)]	B1 Mounting Value [mm (in.)]	C Total Length [mm (in.)]
440L-AGST320	440L-P4►0320YD	320 ±0.5 (12.6 ±0.02)	542.58 (21.36)	564.58 (22.23)
440L-AGST480	440L-P4►0480YD	480 ±0.5 (18.9 ±0.02)	702.58 (27.66)	724.58 (27.66)
440L-AGST640	440L-P4►0640YD	640 ±0.5 (25.2 ±0.02)	862.58 (33.96)	884.58 (34.83)
440L-AGST800	440L-P4►0800YD	800 ±0.5 (31.5 ±0.02)	1022.58 (40.26)	1044.58 (41.13)
440L-AGST960	440L-P4►0960YD	960 ±0.5 (37.8 ±0.02)	1182.58 (46.56)	1204.58 (47.42)

► Replace with J for 14 mm or K for 30 mm.

GuardShield PAC

Cat. No.	Use with Light Curtain Cat. No.	A Protective Height [mm (in.)]	B1 Mounting Value [mm (in.)]	C Total Length [mm (in.)]
440L-AGST960	440L-P4A3400YD	810 ±0.5 (31.8 ±0.02)	1182.58 (46.56)	1204.58 (47.42)
440L-AGST640	440L-P4A2500YD	810 ±0.5 (31.8 ±0.02)	1182.58 (46.56)	884.58 (34.83)

2-Opto-electronics

GuardShield Mounting Brackets:
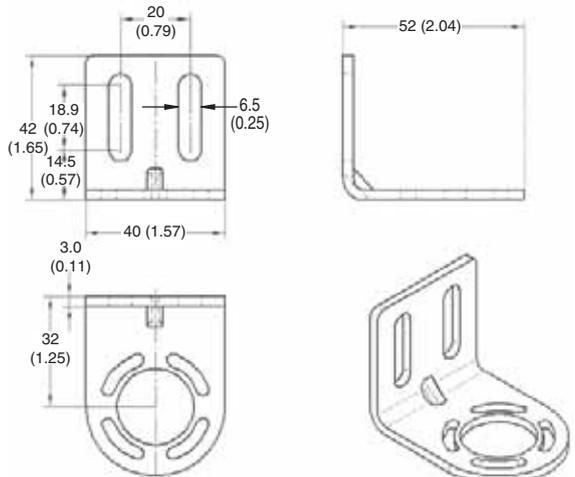
Supplied with each GuardShield safety light curtains.

GuardShield Remote Teach Receiver Bracket
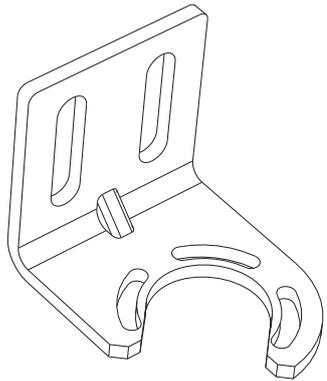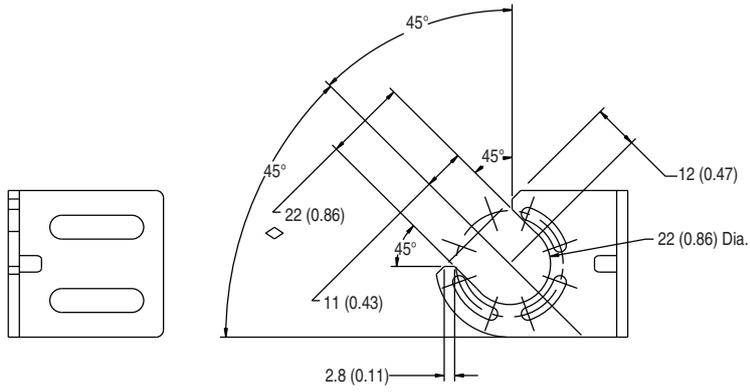
One supplied with each Remote Teach receiver.

GuardShield 440L-AMSTD mounting column brackets
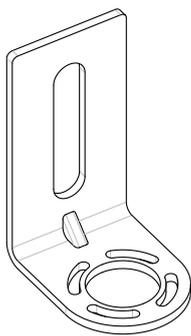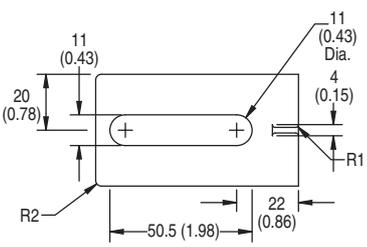
Two supplied with each stand.

Safety Light Curtain Interfaces
120V AC Power Supply and Safety Relay

Description

The Allen-Bradley Guardmaster 120V AC interface box consists of a NEMA 4 rated lockable metal enclosure, a DIN mount 3 A, 24V DC power supply and either a single or dual 22.5 mm safety relay(s).

The single safety relay module provides three N.O. safety and one N.C. auxiliary (nonsafety) "potential free" relay outputs. The dual safety relay configuration allows two pairs of safety light curtains to independently control one or two machines.

The safety relay(s) can be configured for manual reset or automatic reset. The resetting function can be through the key switch mounted on the front cover of the interface box.

Pre-punched holes located on the bottom of the enclosure allow for easy wiring of the system.

Product Selection

Safety Outputs	Auxiliary Outputs	Power Supply Output	Cat. No.
2 N.O.	1 N.C. nonsafety	120V AC/230V DC	440L-M8400
4 N.O.	2 N.C. nonsafety	120V AC/230V DC	440L-M8500

Specifications

Safety Ratings	
Safety Classification	Nonsafety Rated
Power Supply	
Input Power, Max.	120/230V AC
Power Consumption	2 W/4 W
Outputs	
Safety Outputs	2 N.O. or 4 N.O.
Auxiliary Outputs	1 N.C. or 2 N.C. Nonsafety
Switching Current @ Voltage, Min.	10 mA @ 10V
Operating Characteristics	
Response Time	15 ms
Status Indicators	Power = Green K1 = Green if Closed. K2 = Green if Closed.
Recovery Time	100 ms
Electrical Life	222V AC/4 A/880V A cosφ = 0.35 - 100,000 operations
Mechanical Life	2,000,000 operations
Operating Frequency	1200 cycles/hour, max.
Environmental	
Enclosure Type Rating	IP65 (NEMA 4)
Relative Humidity	90%
Operating Temperature [C (F)]	-5…55° (23…131°)
Vibration	0.35 mm, 10…55 Hz
Shock	10 g, 16 ms, 100 shocks
Physical Characteristics	
Weight [kg (lb)]	440L-M8400: 4.87 (10.75) 440L-M8500: /5.1 (11.25)

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.
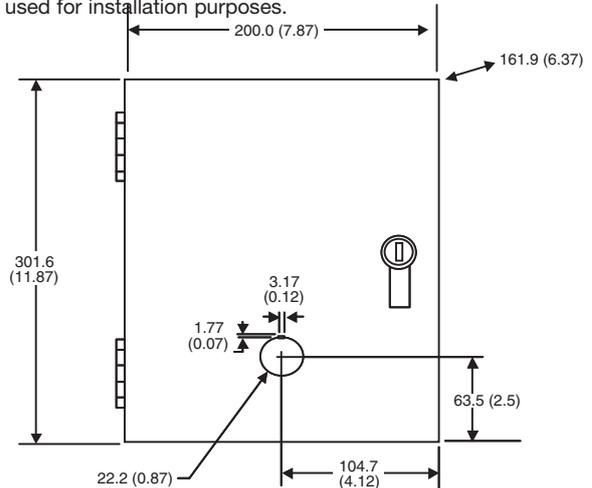
2-Opto-electronics

Safety Light Curtain Interfaces

120V AC Power Supply and Safety Relay

Typical Wiring Diagram

M8400 Single Relay

*Wiring diagram is not intended to be used for installation purposes.*

2-Opto-electronics

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Typical Wiring Diagram
M8500 Dual Relay
*Wiring diagram is not intended to be used for installation purposes.*
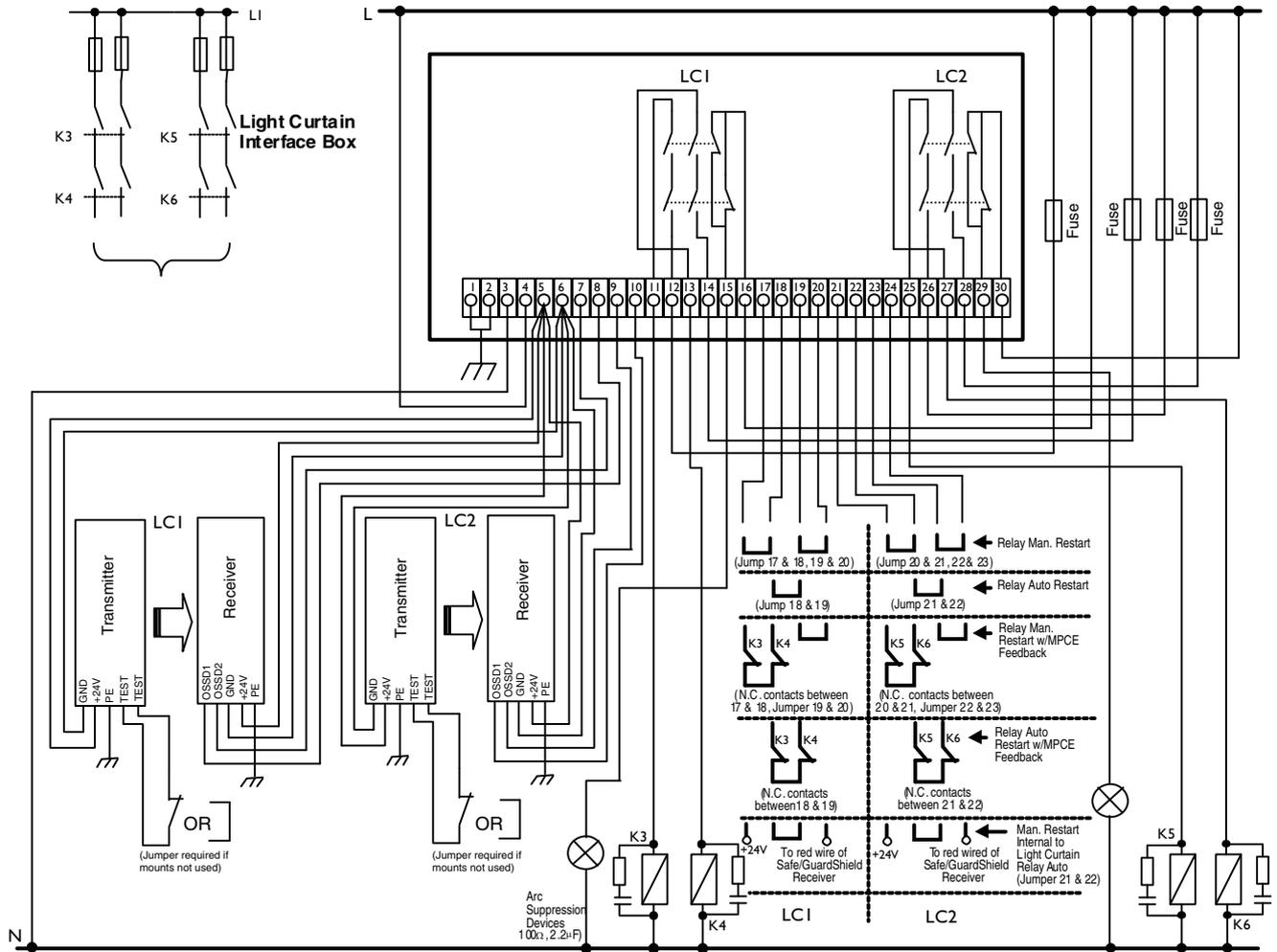
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Principles of Operation

The SafeZone™ safety laser scanner operates on the principle of diffuse reflection and the time flight of light. Pulses of Infrared light are reflected off of a rotating mirror and are emitted over a 190° arc. The diffuse reflection of light is received from an intrusion in the preconfigured sensing field and processed to determine the location and distance of the object from the SafeZone scanner.

At the time of the emission of Infrared light, an electronic stop watch begins. The reflected light is then seen by the SafeZone scanner and processed to determine the distance of the object from the scanner.
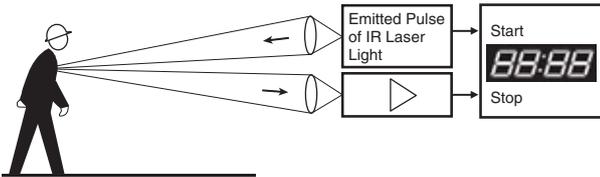

Configuration of the SafeZone's warning and safety fields are accomplished using the Safety Configuration and Diagnostic (SCD) software supplied with each scanner. This Windows®-based software allows easy configuration of irregularly shaped fields by simply clicking and dragging points along the perimeter of the particular zone to shape the contour of the perimeter of the warning or safety field.
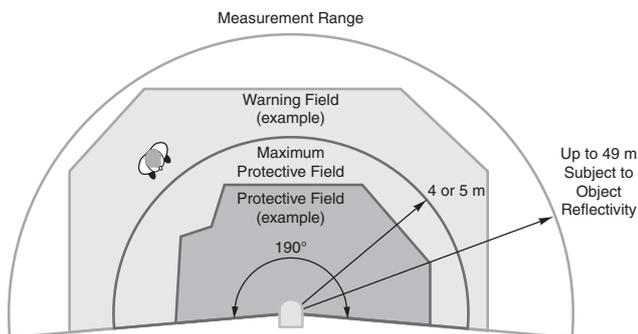
The SafeZone safety laser scanner is well suited to industrial applications and can be used in either vertical or horizontal applications to detect the intrusion of personnel or objects into the configured sensing field(s). This detection can result in an audible alarm or warning light being activated to warn of the intrusion or if the intrusion is in the safety field, the hazardous motion of machinery can be stopped.

Stationary Horizontal Guarding—Single Field Set

It is possible to configure a warning field and a safety field in front of machinery or equipment to protect personnel from accessing the area where hazardous motion takes place. The SafeZone safety laser scanner is required to be mounted at a particular height from the floor. Irregular shapes are easily configured using the Windows-based SCD software.
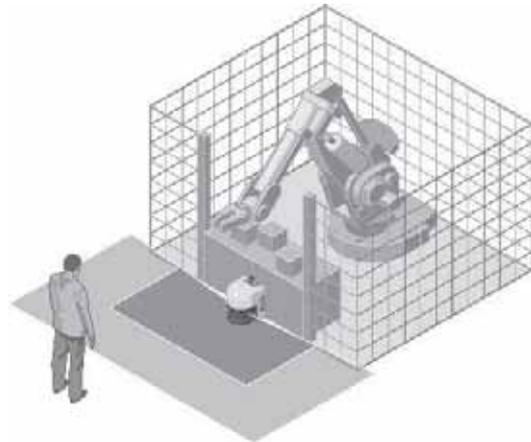
Stationary Vertical Guarding

It is possible to mount the SafeZone safety laser scanner to create a vertical safety field that provides access detection to a hazardous area. It is necessary to configure "contour as a reference," which monitors specific areas at the perimeter of the safety field. Contour as a reference must be configured for vertical applications as this configured feature prevents the manipulation of the scanner.
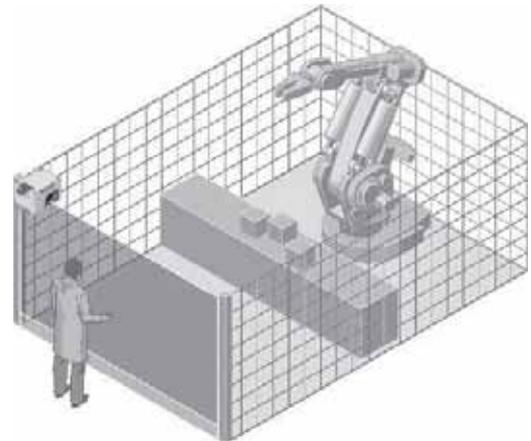
Note: Both the SafeZone singlezone and multizone can be used in stationary horizontal or vertical guarding applications. The SafeZone multizone has a safety field range of 5 m (16.4 ft) and up to four configurable and switchable field sets. The SafeZone singlezone has a safety field range of 4 m (13 ft) and a single configurable field set.

Stationary Horizontal Guarding—Up to Four Safety Zones

The SafeZone multizone safety laser scanner can be configured with up to four field sets; each set may consist of a warning zone and a safety zone. If the application warrants, it may only be necessary to configure the safety zone(s).
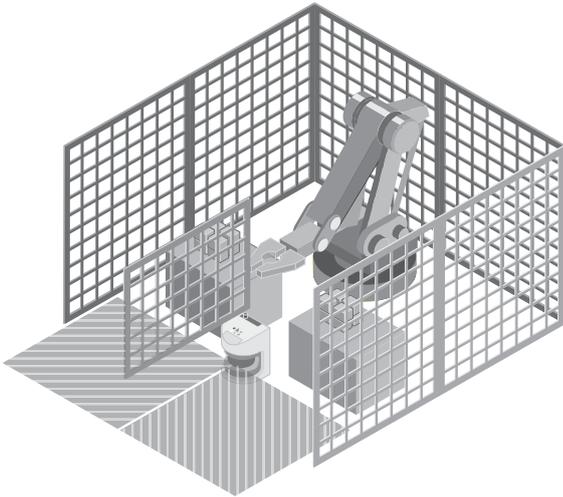

Stationary Vertical Guarding—Two or More Safety Zones

The SafeZone multizone safety laser scanner can be mounted to create up to four vertical detection areas in the same plane. Contour as a reference should be configured to prevent manipulation of the scanner. A static control input switches between the configured fields.
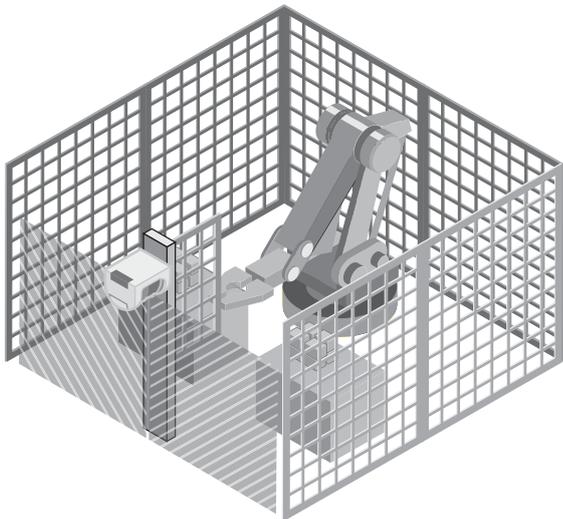
Automatic Guided Vehicles (AGVs)

The SafeZone safety laser scanner is designed to detect fixed objects (walls, columns), as well as moving objects (people, AGVs). The SafeZone safety laser scanner is typically mounted on the front of a mobile vehicle or for AGVs capable of bi-directional travel, in each direction of travel. Any object in the path of the moving vehicle, of sufficient resolution, is detected. When an object or person is detected in the configured warning field, a signal can be used to decrease the speed of the AGV. Intrusion into the safety field will send a signal to the AGV to stop. It is also possible to configure a predetermined time delay where the SafeZone safety laser scanner will monitor the safety field. If the safety field becomes clear, the SafeZone's Output Signal Switching Device (OSSD) will change to a green state and allow the AGV to continue traveling.
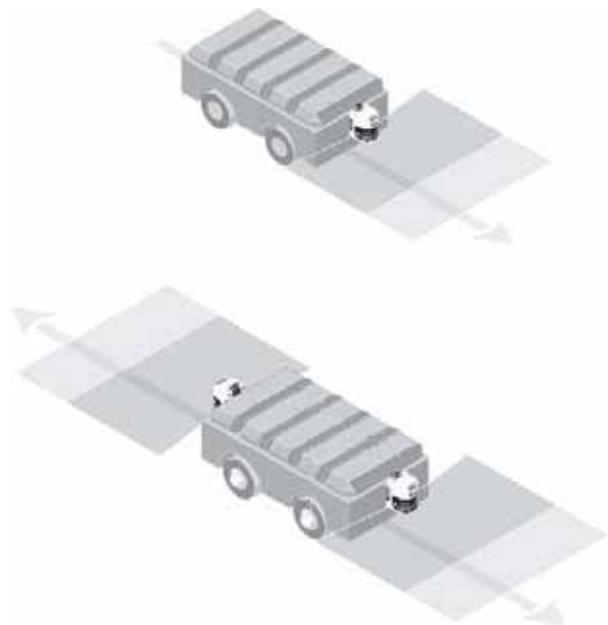
Note: Both the SafeZone singlezone and multizone can be used in mobile applications, depending upon safety field range requirements and the required number of switchable pre-configured field sets.

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2-Opto-electronics

Safety Laser Scanner

SafeZone™ Singlezone/Multizone

Description

The Allen-Bradley Guardmaster SafeZone safety laser scanners are Type 3 opto-electronic devices, which use the diffuse reflection of emitted infrared laser light to determine the intrusion of a person or object within a defined area. A rotating deflection mirror periodically emits Class 1 (eye safe) infrared laser pulses over a 190° angular area to create a two dimensional detection field.

The reflected light is processed by the SafeZone, which sends a stop signal by switching the state of its OSSD, if it is determined that an object is within the preconfigured sensing field(s).

The SafeZone laser scanners are versatile, rugged, opto-electronic devices in an IP65 housing and are ideally suited for a wide range of industrial applications.

Singlezone

The single field set (warning and safety) can be configured within the maximum scanning range of the device. The Safety Configuration and Diagnostic (SCD) Windows-based software, supplied with each scanner, makes programming the SafeZone singlezone simple. A configuration wizard is available to guide the programmer through simple or complex system configurations.

Multizone

Four switchable zone sets (warning and safety) can be configured within the maximum scanning range of the device. The SCD Windows-based software, supplied with each scanner, simplifies the programming of the SafeZone multizone scanners. A configuration wizard is available to guide the programmer through simple or complex system configurations.

Features

- 190° scanning angle
- Seven-segment diagnostic display
- Configurable resolutions 30, 40, 50, 70, and 150 mm
- Integrated EDM
- Horizontal or vertical mounting
- Four or five meter safety field range

Specifications

Safety Ratings	
Standards	IEC 61496-3, UL 61496, IEC 61508
Safety Classification	Type 3, IEC 61496; SIL CL 2, IEC 61508, IEC 62061; Category 3, PLd EN ISO 13849:2009
Certifications	CE Marked for all applicable directives, TÜV, cULus, Type 3 AOPDDR per IEC 61496, SIL 2 per IEC 61508

Power Supply	
Input Power, Max.	24V DC +20%/-30%
Maximum Residual Ripple	5%
Power Consumption	55 W with max. output load, 19 W without output load

Outputs	
Safety Outputs	2 PNP OSSDs 500 mA short-circuit protection
Auxiliary Outputs	1 PNP OSSD, 500 mA nonsafety
Switching Current @ Voltage, Min.	2 A

Operating Characteristics	
Response Time	60 ms or 120 ms
Status Indicators	OSSDs on, reset required, warning field interruption, front screen contaminated, OSSDs off
Scanning Angle	190° max.
Safety Field Range	4 m (13 ft) for Singlezone 5 m (16.4 ft) for Multizone
Resolution [mm (in.)]	30 (1.18), 40 (1.57), 50 (1.96), 70 (2.75), 150 (5.90)
Angular Resolution	0.25…0.50°
Wavelength	905 nm
Power-Up Delay	9…20 s

Environmental	
Enclosure Type Rating	IP65
Operating Temperature [C (F)]	-5…55° (23…131°)
Storage Temperature [C (F)]	-25…70° (-13…+158°)
Vibration	10…150 Hz, 0.35 mm or 5 g per IEC 61496
Shock	Single: 15 g, 11 ms per EN 60068-2-27 Continuous: 10 g, 16 ms per IEC 61496

Physical Characteristics	
Weight [kg (lb)]	3.3 (7.28)
Material	Die-cast aluminum
Display Window	Polycarbonate
Cable Length	10 m or 20 m (32.8 ft or 65.6 ft)

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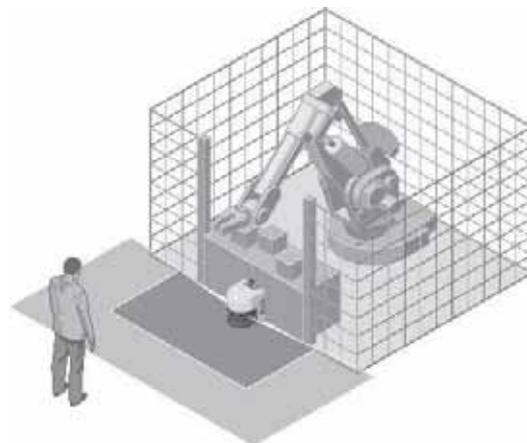
Product Selection

Singlezone Safety Laser Scanner System Components

Item		Description	Cat. No.
1		Scan head and I/O module assembly	**442L-SFZNSZ**
2		Prewired 13 conductor cable with memory module (10 or 20 m (32.8 or 65.6 ft) required)	**442L-CSFZNMZ-10**
			442L-CSFZNMZ-20
3		2 m (6.56 ft) RS232 program cable (required) or	**442L-ACRS232**
		10 m (32.8 ft) RS232 program cable	442L-ACRS232-8

Multizone Safety Laser Scanner System Components

Item		Description	Cat. No.
1		Scan head and I/O Module (required)	**442L-SFZNMZ**
2		Prewired 13 conductor cable with memory module (10 or 20 m (32.8 or 65.6 ft) required)	**442L-CSFZNMZ-10**
			442L-CSFZNMZ-20
3		2 m (6.56 ft) RS232 program cable (required)	**442L-ACRS232**
		10 m (32.8 ft) RS232 program cable	442L-ACRS232-8

Note: A SafeZone safety laser scanner system requires the scan head and I/O module assembly (1) with either a 10 or 20 meter prewired memory module (2) and a programming cable (3).

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
Modular Safety Relays							
MSR211P Base 2 N.C. only	2 N.O.	1 N.C.	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-84	440R-H23177
MSR221P Input Module	—	—	Removable	—	24V DC from the base unit	5-88	440R-H23179
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218
Muting Modules							
MSR22LM	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	5-48	**440R-P23071**
MSR42 (requires optical interface to configure 445L-AF6150	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	5-52	**440R-P226AGS-NNR**

Safety Laser Scanner

SafeZone™ Singlezone/Multizone

Accessories—Optional

Description		Cat. No.
	Mounting Kit 1: Mounting bracket for direct mounting at the rear on wall or machine. No adjustment facility.	**442L-AMBSFZNMZ1**
	Mounting Kit 2: Bracket only in conjunction with mounting kit 1. Mounting at the rear on wall or machine. Longitudinal and cross-wise adjustment possible.	442L-AMBSFZNMZ2
	Mounting Kit 3: Bracket only in conjunction with mounting kit 1 and 2. Mounting at the rear or below on wall, floor or machine. Longitudinal and cross-wise adjustment possible.	442L-AMBSFZNMZ3
	3.0 A power supply	1606-XLP72E
	USB to serial port adaptor cable	9300USBS
	100 m cable spool 13 conductor	442L-C13GD-S100
	Replacement window kit	442L-SFZNMZW
	Replacement part—Singlezone scan head, 4 m	442L-SFZNSZ-SM
	Replacement part—Multizone scan head, 5 m	442L-SFZNMZ-SM
	Replacement part—Singlezone I/O module, 1 field set	442L-SFZNSZ-FM
	Replacement part—Multizone I/O module, 4 field sets	442L-SFZNMZ-FM
	Replacement part—unwired memory module	442L-SFZNMZ-MEM

Note: All SafeZone accessories work with either the multizone or singlezone.

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Safety Laser Scanner
SafeZone™ Singlezone/Multizone

Typical Wiring Diagram

Wiring diagram is not intended to be used for installation purposes.

H2 = indication for error/contamination
H3 = indication for restart
H8 = indication for warning field interruption
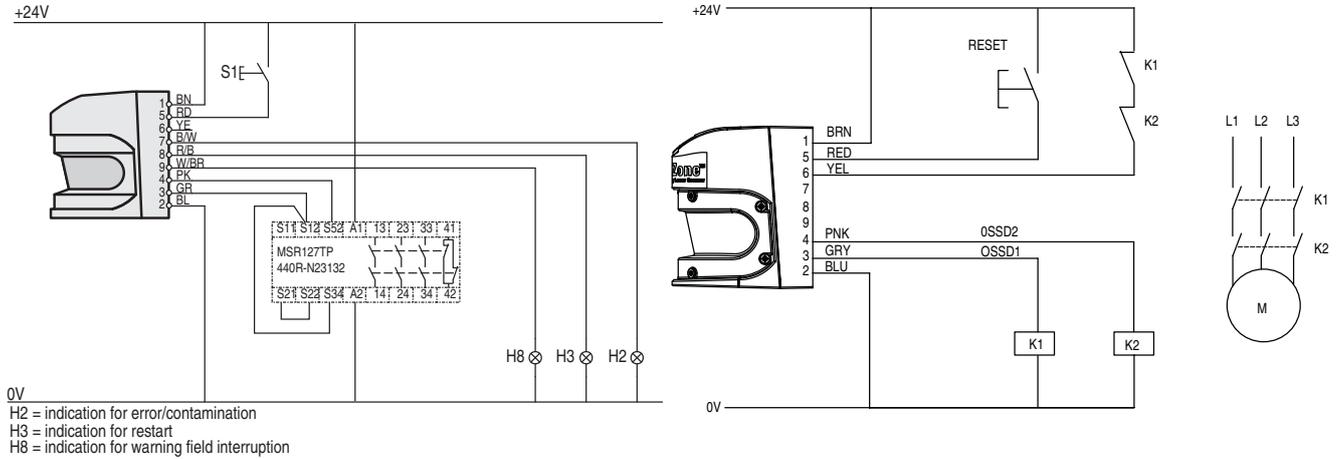
SafeZone with Restart Interlock to MSR127

SafeZone with EDM and Restart Interlock
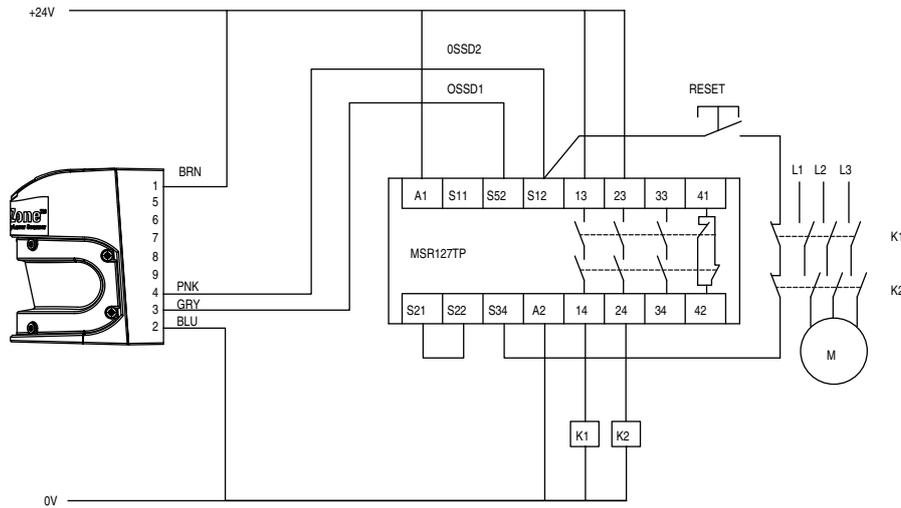
SafeZone to MSR127

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2-Opto-electronics

Safety Laser Scanner

SafeZone™ Singlezone/Multizone

Wiring diagram is not intended to be used for installation purposes.
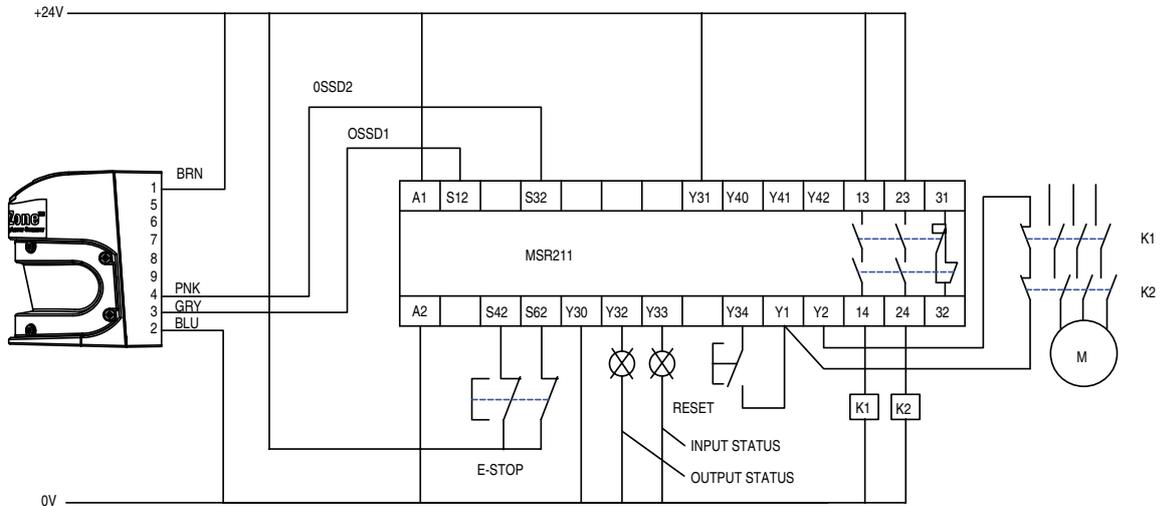
SafeZone to MSR211
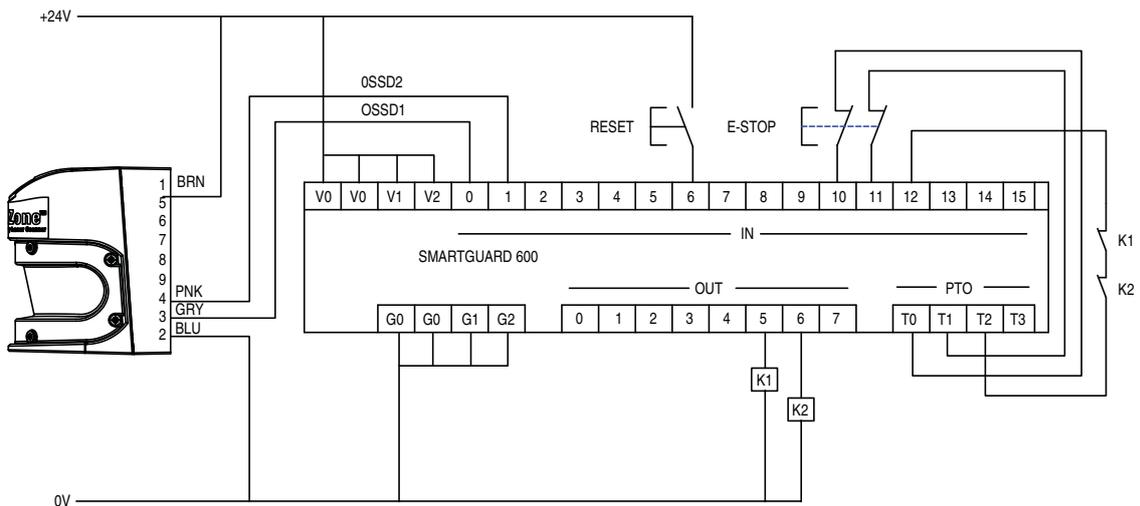
SafeZone to SmartGuard 600

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Bracket Assembly

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Bracket shown assembled
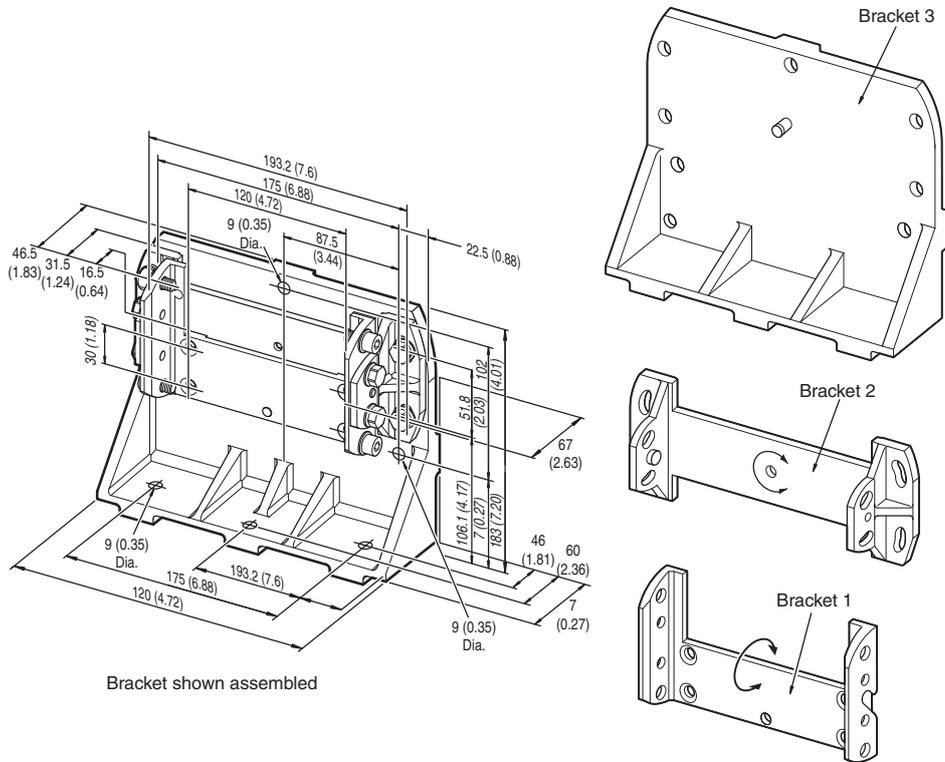
Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

2-Opto-electronics

MatGuard™ Mats

Overview

Chemical Resistance of Sensor Mat Vinyl Covering

Substance	Resistance of Mat Covering
Water	Excellent
Ethyl Alcohol	Excellent
Sodium Chloride	Excellent
Bleach	Excellent
Hydrochloric Acid	Fair to Excellent
Sulphuric Acid	Fair to Excellent
Nitric Acid	Fair to Excellent
Acetic Acid	Fair
Petrol (Gasoline)	Fair
Trichlorethylene	Poor to Fair
Benzene	Poor
Acetone	Poor
Water (Sea)	Excellent
Lubricating Oil	Fair to Excellent
Cutting Fluids	Fair to Excellent
Oil (Auto)	Fair to Excellent
Brake Fluids	Poor to Fair
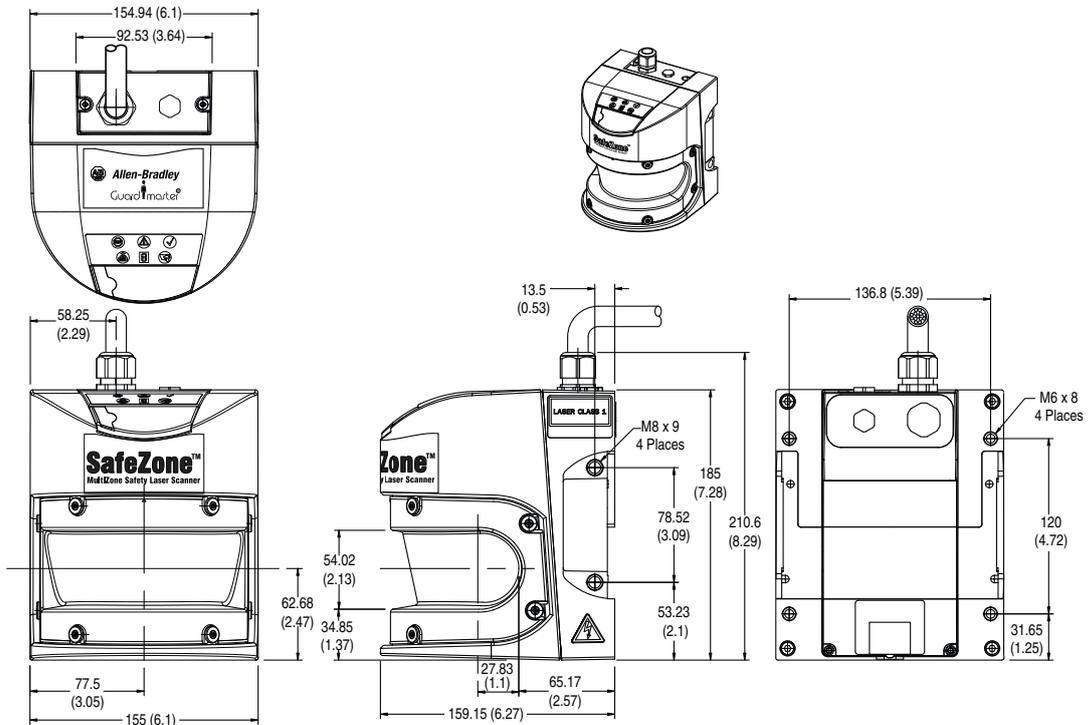
Description

MatGuard consists of a number of interconnecting pressure-sensitive safety mats and a monitoring control unit that provide a system for area detection. The mat has been designed from the "ground up" to meet the arduous conditions found on the factory floor, and uses well-tried components and techniques to be consistent with Category B and Category 1 requirements.

The mats are available in a wide range of standard sizes to meet most requirements. Special sizes and shapes are available. Each mat has two conductive plates that are held apart by non-conductive compressible separators. Each four-wire mat, operating on only 24V DC, is pre-wired and connected in series with other mats, forming a complete floor-level guarding system for hazardous areas. The circuit through the mat must be monitored by a safety-rated control unit, which may be a Minotaur™ Safety Relay, MatGuard control unit, or MatGuard Mat Manager. When the mat is clear, the control unit provides a signal to the machine control circuit.

When a mat is stepped on, the conductive plates touch and the resistance in the circuit falls to zero. This is monitored by the control unit, which sends a stop command to the machine control system.

The unique molding process allows for the long life and reliability of the mat. Being completely sealed (IP67), water, liquids and coolants present no problem. In addition the tough vinyl will resist bleaches, acids, salts, and all but the most aggressive of industrial chemicals.

A range of control units is available including the Mat Manager, which monitors the status of each mat or area of mats individually. This enables quick fault detection/repair and identification of actuated area.

In general, the covering has excellent resistance to acids, alkalis and salts. Hot acids and alkalis, as well as concentrated and organic acids, have a deleterious effect on prolonged exposure. The covering has fair resistance to aliphatic solvents, fair to poor resistance to aromatic and chlorinated solvents, and poor resistance to ketones and most esters.

Note: Combinations of chemicals can have unpredictable effects. Testing is recommended in such cases. Small pieces of the vinyl material are available if testing is required.

Features

- EC type certification
- Third party certification to EN 1760-1
- Also meets EN954-1 (ISO 13849-1) category 3 system and IEC/EN 60204-1, AS 4024.5, ANSI B11.19, ANSI RIA R15.06
- Overall sensitivity including uniting strip
- Mat manager monitors the status of each mat individually
- Rugged construction will take the pressure of 4500 psi (does not include the active uniting trim)
- Vinyl construction resistant to most oils
- Sealed to IP67
- 5-year warranty on mats

Application Types

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2-Safety Mats

Anatomy of a Mat System

The controller detects a presence on the mat, a short circuit, or an open circuit. Under each of these conditions, the safety output relays turn off. When interfaced properly, the machine or hazardous motion will receive a stop signal, and an auxiliary output relay turns ON.

Different ribbed pattern on reverse side (as illustrated)

Wire location STD. 4.5 m

Wire location

Checker pattern (side 1) (for maximum anti-slip)

Straight rib pattern (side 2) (for ease of cleaning in 'hygiene' applications)

Active uniting trim maintains active sensing area at mat junctions

Heavy Duty Ribbed Vinyl

Upper Conductive Plate

Non conductive Compressible Separator

Lower Conductive Plate

Heavy Duty Ribbed Vinyl

Flexible Sealing Bead

Mat at rest

Mat Activated

When the mat is activated the non conductive compressible separators (shown red) compress into their recess allowing the two plates to make contact giving all over sensitivity.

Perimeter trim secures mats to floor

Cable underneath trim

2-Safety Mats

Standards

The MatGuard mat system has been designed to conform with the latest European Standard EN 1760-1 "Safety of machinery— Pressure sensitive devices; mats and floors."

This standard contains requirements for all aspects of design. Some of the most important points are as follows: **(From 4.2.2)** Where an effective sensing area is built up from more than one sensor (mat) it shall have no dead zone.

The standard gives details of the size, force and positioning of test pieces for testing the mat sensitivity.

(From 4.5.1) A single sensor (mat) shall still perform its function after one million actuations by a mass of 75 kg.

(From 4.7) When the actuating force is applied the output signal switching device(s) shall change from an ON state to an OFF state. It shall remain in the OFF state for at least as long as the actuating force is applied.

(From 4.7.1) Device with reset – b) After the actuating force has been removed, the output signal switching device(s) shall only change to the ON state after the application of a reset signal.

(From 4.7.2) Device without reset—For a pressure sensitive mat without reset the output signal switching device(s) shall change to an ON state at power ON and after the actuating force has been removed.

(From 4.15) The pressure sensitive mats shall meet the requirements of the category for which they are specified...

Note: The MatGuard mat system features an "active" mat and a dual channel monitoring control unit. This means that a single electrical fault in the mat, wiring or control unit will be detected and the control unit will go to a safe (OFF) condition.

(From informative annex B.1.1) The top (mat) surface should be of a material which will withstand the operating duty.....The top surface should not present a risk through becoming slippery due to wear or the effects of liquids....

(From informative annex B.1.7) In some situations, heavy loads (such as fork lift trucks) can be applied to the sensor (mat)..... If this is required the user should identify the need to the mat manufacturer.

Note: The standard MatGuard mat can be successfully used with fork lift trucks. The MatGuard Mat System should be installed in accordance with the requirements of EN 999, "The positioning of protective equipment in respect of approach speeds of parts of the human body."

The MatGuard Safety Mat system is also designed to meet the U.S. standards ANSI/RIA R15.06-1999 Safety Requirements for Industrial Robots and Robot Systems and ANSI B11.19 Performance Criteria for Safeguarding.

These two U.S. standards have many similar requirements and provide performance criteria for design, installation and use. Excerpts from these standards include:

From RIA R15.06

(From 11.7) Safety mat systems shall be designed, constructed, and applied such that any single component failure shall not prevent the stopping action of the robot.

(From 5.3.4) Safety mats shall have a minimum object sensitivity which detects 30 kg (66 lb,) weight of an 80 mm (3.125 in.) diameter circular disk anywhere on the mat sensing surface; provide a means to retain minimum object sensitivity at the area where mats joined together.

From ANSI B11.19

(From 11.1.1.4) The safety mat device shall have a maximum response time that is not affected by object sensitivity adjustments or environmental changes.

(From 11.1.1.5) When a component, module, device or system failure occurs, the safety related function shall prevent initiation of the hazardous machine motion, initiate an immediate stop command and prevent re-initiation of the hazardous machine motion.

From AS 4024.5

The MatGuard Safety Mat system is designed to meet the Australian Standard AS 4024.5, which has many similarities to the European Standard EN1760-1. Excerpts from this standard include:

(From 3.2.2) Where an effective sensing area is built up of more than one sensor, it shall have no dead zone.

(From 3.7) When the actuating force is applied the output signal switching device (s) shall change from an 'on' state to an 'off' state. It shall remain in the 'off' state for at least as long as the actuating force is applied.

(From 3.8) The sensor shall be provided with a means for fixed permanent location.

(From 3.10) Provisions shall be made on the top surface of the sensor to minimize slipping under the expected operating conditions.

Application Details

Safety Distance Calculations ANSI/RIA R15.06

The minimum distance calculated is the minimum horizontal distance from the outer edge of the MatGuard sensor mat detection zone to the nearest part of the hazard. The formula for floor mounted safety mats is:

$Ds = [K \times (Ts + Tc + Tr)] + Dpf$

- **Ds** is the minimum safety distance.
- **K** is a minimum speed constant based on the movement of the hand/arm only and the body being stationary.
  K=1600 mm/s (63 in./s)
- **Ts** is the worst stopping time of the machine/equipment.
- **Tc** is the worst stopping time of the control system.
- **Tr** is the response time of the safeguarding device.
- **Dpf** is the depth penetration factor which is the maximum travel towards the hazard within the safety mat area that may occur before a stop is signalled.
  Dpf=1200 mm (48 in.)

The response time of the machine and control system used in the calculation must be the worst case. Some machines have inconsistent response times that are dependent upon mode of operation, nature of the work piece and point in the operating cycle at which stopping is initiated. An allowance should be made for wear in brakes, temperature, aging of components, etc., if this can affect the response time. An allowance for further delays in the machine control system may be required in some circumstances.

Calculation Example

In this example, the MatGuard system is being used with a machine and control system with a worst-case response time measured at 0.485 seconds. The system is on a flat surface, it is not on a raised platform. Using the formula above.

$$T = Ts + Tc + Tr$$
$$0.035 + 0.485$$
$$0.520 \text{ s}$$
$$S = (63 \times 0.520) + 48$$
$$80.76 \text{ in.}$$

Sensor mats will be required from 2032 mm right up to the edge of the machine base plate.

Safety Distance Calculations EN999

The minimum distance calculated is the minimum horizontal distance from the outer edge of the MatGuard sensor mat detection zone to the nearest part of the hazard. The formula for floor mounted safety mats is:

$S = [1600 \times (t1 + t2)] + (1200 - 0,4H)$

- **S** is the minimum safety distance in mm in a horizontal plane from the danger zone to the detecting edge of the device furthest from the danger zone.
- **1600** is a minimum speed constant based on the movement of the hand/arm only and the body being stationary.
  1600 mm/s = 63 in./s
- **t_1** is the maximum time between the actuation of the sensing function and the output signal switching devices being in the off state.
- **t_2** is the maximum response time of the machine, i.e., the time required to stop the machine or remove the risks after receiving the output signal from the protective equipment.
- **1200** is the depth penetration factor which is the maximum travel towards the hazard within the safety mat area that may occur before a stop is signalled.
  1200 mm = 48 in.
- **H** is the distance above the reference plane, e.g., floor, in millimeters.

The response time of the machine and control system used in the calculation must be the worst case time. Some machines have inconsistent response times that are dependent upon mode of operation, nature of the work piece and point in the operating cycle at which stopping is initiated. An allowance should be made for wear in brakes, temperature, aging of components, etc., if this can affect the response time. An allowance for further delays in the machine control system may be required in some circumstances.

Calculation Example

In this example, the MatGuard system is being used with a machine and control system whose worst case response time has been measured as 0.485 seconds. The system is on a flat surface, it is not on a raised platform. Using the formula above,

$$T \quad = \quad t_1 + t_2$$
$$0.035 + 0.485$$
$$0.520 \text{ s}$$
$$S \quad = \quad (1600 \times 0.520) + 1200$$
$$832 + 1200$$
$$2032 \text{ mm}$$

Sensor mats will be required from 2032 mm right up to the edge of the machine base plate.

2-Safety Mats

MatGuard™ Mats
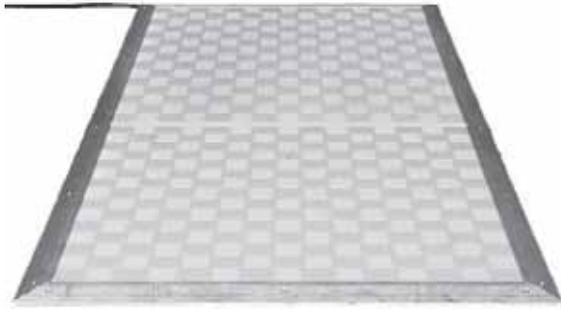
Description

The MatGuard safety mat is a pressure-sensitive safeguarding product that is designed to detect the presence of people on its sensing surface.

The MatGuard safety mat has two conductive hardened steel plates that are held apart by non-conductive compressible separators. Each four-wire mat, operating on only 24V DC, is pre-wired and connected in series with other mats to form a floor level guarding system for hazardous areas. The circuit through the mat must be monitored by a safety-rated control unit, which may be a Minotaur Safety Relay, MatGuard control unit, or MatGuard Mat Manager. When the mat is clear, the control unit provides a signal to the machine control circuit.

When a mat is stepped on, the conductive plates touch and the resistance in the circuit falls to zero. This is monitored by the control unit, which sends a shutdown signal to the machine.

Since the MatGuard safety mat is completely sealed (IP67), water, liquids and coolants present no problem. In addition, the tough vinyl will resist bleaches, acids, salts and many industrial chemicals.

The unique molding process allows the long life and reliability of the mat.

Features

- Hardened steel plate construction
- No dead spots
- 4-wire system to detect opens and shorts
- Can withstand a static pressure of 4500 psi
- IP67 rated

Specifications

Standards	EN1760-1, EN954-1, ISO 13849-1, IEC/EN60204-1, ANSI RIA R15.06, ANSI/B11.19, AS4024.5
Category	Cat. 1 device per EN954-1, suitable for Cat. 3 systems
Certifications	CE Marked for all applicable directives, cULus Listed, CSA Z432-04, and TÜV
Power Supply	24V DC, -20% +10%, provided by the control unit
Connection Wire Length, Max.	200 m (656 ft)
Cable Length	4.5 m (15 ft) standard (see Product Selection)
Detection Weight	30 kg (66 lbs) minimum on an 80 mm (3.125 in.) diameter circular disk
Maximum Pressure Applied to Mat	31,034 kPa (4500 psi)
Zone Size	100 m² (1076 ft²), maximum
Mechanical Life	10,000,000 operations
Operating Temperature [C (F)]	-25…55° (-14…131°)
Relative Humidity	100%
Enclosure Type Rating	IP67 (NEMA 6P)
Vibration	5 g, 10…200 Hz
Shock	11 ms 10 g/16 ms 10 g
Terminal Protection	IP 20 DIN 0470
Wire Size	0.75 mm² (18 AWG), 2 wire; 3.8 mm x 7.4 mm (0.15 in. x 0.29 in.) jacket OD
Weight	10.9 kg/m² (2.2lbs/ft²)
Material	Plastisol Vinyl
Color	Yellow or Black
Trim Material	6063 Aluminum
Mounting	Flat surface
Thickness	16 mm (0.63 in.)

Product Selection—Standard Mats

| Mat Size [mm (in.)]	Cat. No.	
	Standard Perimeter Trim Kit	Safety Mat
500 x 500 (19.7 x 19.7)	440F-T1010	**440F-M1010BYNN**
500 x 1500 (19.7 x 59.1)	440F-T1030	**440F-M1030BYNN**
500 x 750 (19.7 x 29.5)	440F-T1015	440F-M1015BYNN
750 x 750 (29.5 x 29.5)	440F-T1515	440F-M1515BYNN
750 x 1500 (29.5 x 59.1)	440F-T1530	**440F-M1530BYNN**
500 X 1000 (19.7 X 39.4)	440F-T1020	**440F-M1020BYNN**
750 X 1000 (29.5 X 39.4)	440F-T1520	440F-M1520BYNN
1000 x 1000 (39.4 x 39.4)	440F-T2020	**440F-M2020BYNN**
1000 x 1250 (39.4 x 49.2)	440F-T2025	**440F-M2025BYNN**
1000 x 1500 (39.4 x 59.1)	440F-T2030	**440F-M2030BYNN**
1000 x 1800 (39.4 x 70.9)	440F-T2036	440F-M2036BYNN
Recommended control unit. For other control units, see page 5-69.		**440R-C23139**

Examples of Standard System Configurations

Bill of Materials		
Description	Quantity	Cat. No.
Mat	1	**440F-M2030BYNN**
	2	**440F-M1010BYNN**
Mat	1	**440F-M1030BYNN**
Perimeter Trim∗	2	440F-T3210
Perimeter Trim∗	1	440F-T3310
Active Uniting Trim Used to join two mats to ensure no dead spots	1	440F-T3220
MatGuard Controllers	1	440F-C4000S
Corner Trim	4	440F-T3012

Bill of Materials		
Description	Quantity	Cat. No.
MatGuard Safety Mats	1	**440F-M2025BYNN**
	1	**440F-M1010BYNN**
	1	440F-M1015BYNN
Perimeter Trim∗	1	440F-T3310
Corner Trim	1	440F-T3012
Uniting Trim	2	440F-T3020
MatGuard Controllers	1	440F-C4000P

∗ Customer must cut trim to proper length.

2-Safety Mats

Product Selection—Configurable Mats

MatGuard safety mat and trim kit cat. nos. can be configured by selecting the appropriate codes from the tables below.
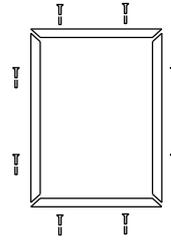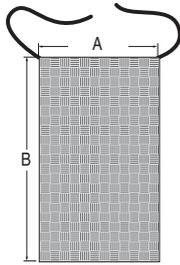
Mats:	440F	M	**13**	**23**	**A**	**Y**	NN
			a	*b*	*c*	*d*	

Trim Kit:	440F	**T**	**13**	**23**
		e	*a*	*b*

2-Safety Mats

a

"A" Dimension [mm (in.)]	
Code	Description
2 digit number	Length of the mat in millimetres/50 Must be in 50 (1.97) increments Min. allowed 150 (03); Max. allowed 1000 (20) The length of A must be equal to or shorter than B.

b

"B" Dimensions [mm (in.)]	
Code	Description
2 digit number	Length of the mat in millimetres/50 Must be in 50 (1.97) increments Min. allowed 200 (04); Max. allowed 1800 (36) The length of A must be equal to or shorter than B.

c

| Cable Exit	
Code	Description
A	Two 4.5 m (15 ft) 2-wire cables—exit out the A corners
B	Two 4.5 m (15 ft) 2-wire cables—exit out the B corners
C	One 9.1 m (30 ft) 4-wire cable with M12 male connector exits out of upper left corner
D	One 9.1 m (30 ft) 4-wire cable without connector exits out of upper left corner
F	One 0.76 m (2.5 ft) 4-wire cable with M12 male connector exits out of upper right corner
G	One 9.1 m (30 ft) 4-wire cable with M12 male connector exits out of upper left corner for use with 898D Distribution Box
H	One 9.1 m (30 ft) 5-wire cable with M12 male connector exits out of upper left corner for use with ArmorBlock Guard I/O

d

Color	
Code	Description
B	Black
Y	Yellow

e

Trim Options	
Code	Description
K	Cable Channel Trim
T	Standard Trim

**Note:** Order controller separately, see page 5-68 for selection details.

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Product Selection, Trim Options

Type	Description	Length	Cat. No.
	Standard perimeter trim (aluminum) for use with up to 3 cables running through channel.	2 m, square ends	440F-T3210
	Aluminum standard perimeter trim. For use with up to 3 cables running through channel.	3 m, square ends	440F-T3310
	Aluminum external corner standard perimeter trim	See page 2-99	440F-T3012
	Aluminum internal corner standard perimeter trim		440F-T3013
	Aluminum perimeter trim with cable channel. Used when up to 8 cables need to be fed through channel.	2 m, square ends	440F-T3211
		3 m, square ends	440F-T3311
		4 m, square ends	440F-T3411
	Aluminium external corner perimeter trim with cable channel	See page 2-99	440F-T3014
	Internal corner perimeter trim with cable channel		440F-T3015

2-Safety Mats

Accessories

Type	Description	Dimensions—mm (in)	Cat. No.
	Aluminum right angle perimeter trim	13 x 25 mm, 2 m length (½ x 1 in., 6.6 ft length)	440F-T3216
		13 x 25 mm, 3 m length (½ x 1 in., 9.8 ft length)	440F-T3316
	Stainless steel angle clip perimeter trim (5 per package)		440F-T102933
	Stainless steel z-clip perimeter trim (5 per package)		440F-T102935
	Active uniting trim (used to join two mats to ensure no dead spots)	1 m (3.28 ft) length, square ends	440F-T3120
		1.5 m (4.9 ft) length, square ends	440F-T3020
		2 m (6.5 ft) length, square ends	440F-T3220
		3 m (9.8 ft) length, square ends	440F-T3320
	Vinyl wire guide	63.5 mm (2.5 in.) width, 2 m (6.6 ft) length	440F-T3230
	Accessories kit for 440F-C4000S and 440F-C4000P. 4 butt splices, 2 500 mA fuses, 4 wire terminations	N/A	440F-A108433
	12 Philips flat head, stainless steel screws for 440FA-3211 and 440FT3411 channel trim. Secures top to the bottom.	#6 x 9.5 (3/8)	440F-A17143
	12 Philips flat head, stainless steel screws with anchors for 440F-T3210, 440F-T3310, and 440F-T3510 trim	#10 x 38 (1.5)	440F-A17141
	12 flat head, stainless steel screws with anchors for 440F-T3211 and 440F-T3411 channel trim	#10 x 32 (1.25)	440F-A17142
	DC Micro QD Cordset, 4-pin 1 Brown 2 White 3 Blue 4 Black	2 m (6.5 ft)	889D-F4AC-2
		5 m (16.4 ft)	889D-F4AC-5
		10 m (32.8 ft)	889D-F4AC-10
		15 m (49.2 ft)	889D-F4AC-15
		20 m (65.6 ft)	889D-F4AC-20
		30 m (98.4 ft)	889D-F4AC-30
Reset push button for Mat Manager controllers			800FP-FOPN3YX11
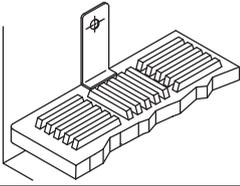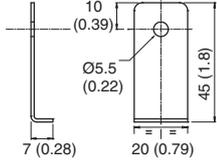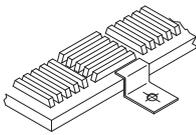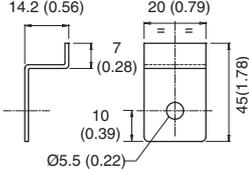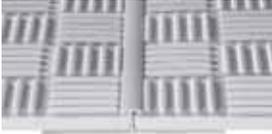
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2-Safety Mats

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Mat System

When more than one mat is needed to protect an area, use the dimensions below to determine how large of an area is covered.

PLEASE SUPPLY A SKETCH LAYOUT FOR MULTIPLE MATS
When calculating the overall area of layout add 'X', 'Y' & 'Z' to allow for Perimeter trim and joints.

Active Uniting Trim
When pressure is applied, the uniting trim causes the mat to deflect and change state, therefore giving all over sensitivity even on the joints.

(Y) - Add 10 mm (0.4 in) for joint

(Z) - Add 53.5 mm (2.1 in) for Standard Perimeter Trim or 99.5 mm (3.9 in) for channel trim.

(X) Dim A or B

(X) Dim A or B

(Z) - Add 52 mm (2.0 in) for Standard Perimeter Trim or 99.5 mm (3.9 in) for channel trim.

Overall size

IMPORTANT   Use the Distance Calculation on page 2-92 to ensure adequate coverage around the hazard.

Standard Perimeter Trim

Internal and External Corners

43 (1.7)   53.5 (2.1)
43 (1.7)
53.5 (2.1)
96 (3.8)
96 (3.8)

Channel Dimensions

14 (0.55)   11 (0.43)
6
14 (0.55)
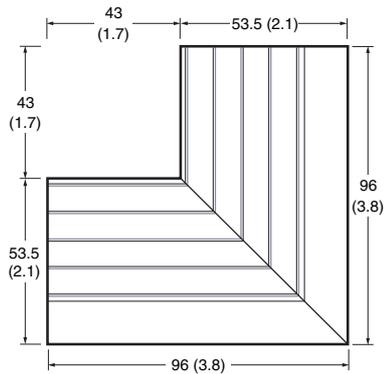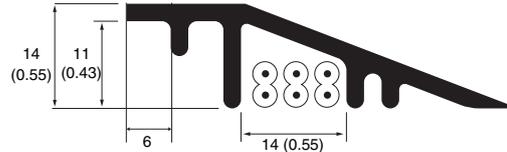
Standard perimeter trim holds three standard 2-wire mat cables or 2 4-wire cables. The equivalent of two cables are needed when connecting two mats in series.

Perimeter Trim with Cable Channel

Internal and External Corners

44.5 (1.8)   99.5 (3.9)
44.5 (1.8)
99.5 (3.9)
144 (5.7)
144 (5.7)

Channel Dimensions

14 (0.55)   9.2 (0.36)
42.2 (1.66)
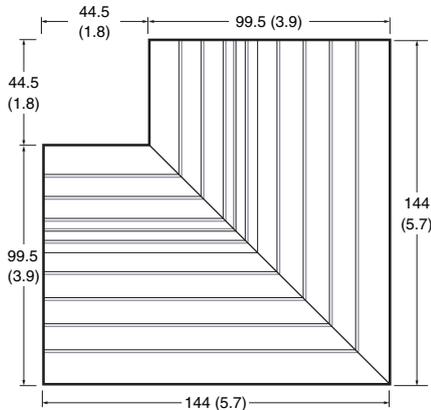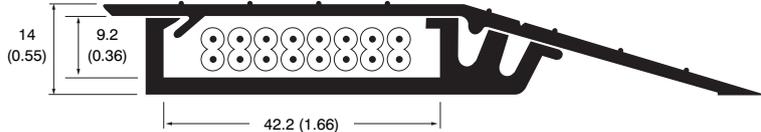
Cable channel trim holds up to 8 standard 2-wire mats cables or 7 4-wire cables even when going around corners.

2-Safety Mats

MatGuard™ Mats

Connectivity

Two-Wire Cable Option

Black Insulation

Checker Pattern

Black Insulation

White Insulation

Straight Pattern

White Insulation
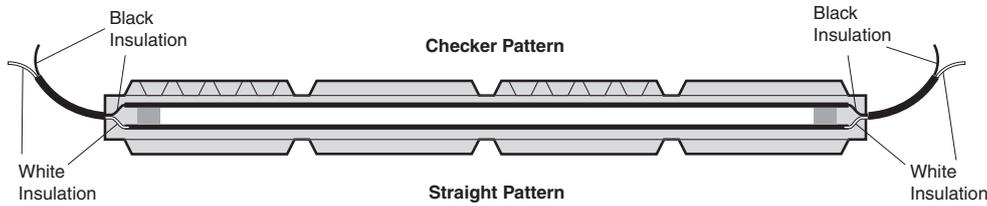
Note: Flat cable O.D. 6.5 mm x 3.5 mm

4-Pin Micro M12 Connector Option [mm (in.)]

42 (1.7)

15 (0.57)
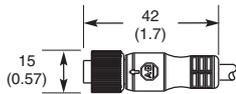
Straight Male

Checkered Rib Side of Mat

Straight Rib Side of Mat

Connection Cables

| Cable Exit Configuration Code	Description	Compatibility	Connector	Wire Color	Circuit
A	Two 4.5 m (15 ft) 2-wire cables—exit out the A corners	Safety Relays		Black Black	N.C.
B	Two 4.5 m (15 ft) 2-wire cables—exit out the B corners	Safety Relays		White White	N.C.
C	One 9.1 m (30 ft) 4-wire cable with M12 male connector exits out of upper left corner	Mat Managers		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
D	One 9.1 m (30 ft) 4-wire cable without connector exits out of upper left corner	Safety Relays		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
F	One 0.76 m (2.5 ft) 4-wire cable with M12 male connector exits out of upper left corner	Mat Managers		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
G	One 9.1 m (30 ft) 4-wire cable with M12 male connector exits out of upper left corner	Distribution Block (2 N.C.) 898D-4*LT-DM4		1 Brown 3 Blue	N.C.
				2 White 4 Black	N.C.
H	One 9.1 m (30 ft) 5-wire cable with M12 male connector exits out of upper left corner	ArmorBlock Guard I/O		1 Brown 2 White	N.C.
				4 Black 5 Grey	N.C.

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Connection to Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR131RTP	3 N.O.	2 N.C., 2 PNP Solid State	Removable (Screw)	Auto./Manual or Monitored Manual	24V AC/DC	5-28	440R-C23139
MSR30RT	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Specialty Safety Relays							
MSR23M	2 N.O.	1 N.C.	Fixed	Automatic/Manual Monitored Manual	24V AC/DC	5-66	**440R-P23073**
Mat Controller	2 N.O.	1 N.C.	Fixed	Automatic/Manual Monitored Manual	24V AC/DC or 115/230V AC	5-68	**440F-C4000S**
Mat Manager	2 N.O.	1 N.C.	Fixed	Auto./Manual Monitored Manual	24V DC	5-70	**440F-C28011**
Modular Safety Relays							
MSR210P Base (2 N.C.)	2 N.O.	1 N.C. and 2 PNP Solid State and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module (all)	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR320P Input Module (all)	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see the Logic section of this catalog.
For additional Safety I/O connectivity, see the Safety I/O section of this catalog.
For Application and wiring diagrams, see the Applications section of this catalog.

Connection Systems

Connection	4-Pin	5-Pin
Cordset	889D-F4AC-∗	889D-F5AC-∗
Patchcord	889D-F4ACDM-✳	889D-F5ACDM-✳
Distribution Box	898D-4‡LT-DM4	NA
Shorting Plug	898D-41LU-DM	NA
T-Port	898D-43LY-D4	NA

∗ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
✳ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
‡ Replace symbol with 4 or 8 for number of ports.

2-Safety Mats

Typical Wiring Diagrams
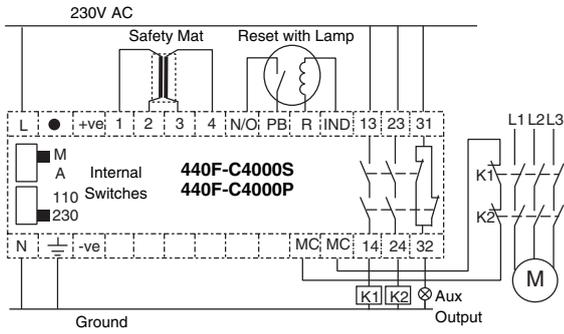
Safety Mat, Monitored Manual Reset,
Dual Channel Output, Monitored Output
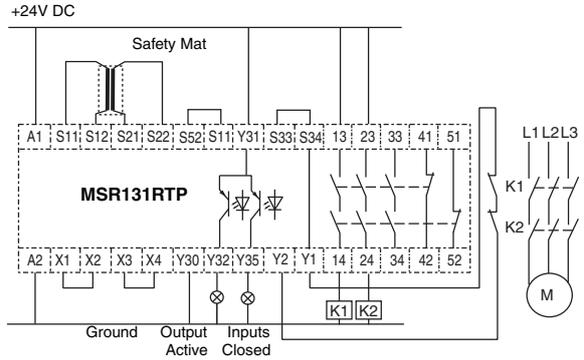
Safety Mat, Automatic Reset, No Output Monitoring
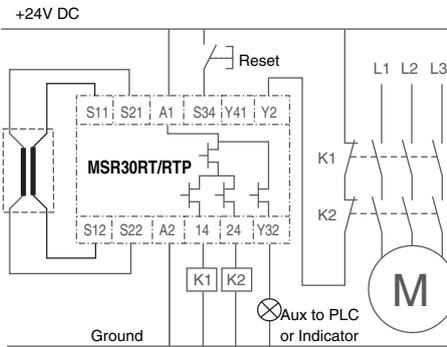
Safety Mat, Dual Channel Output Monitored,
Manual Reset, Output Monitoring
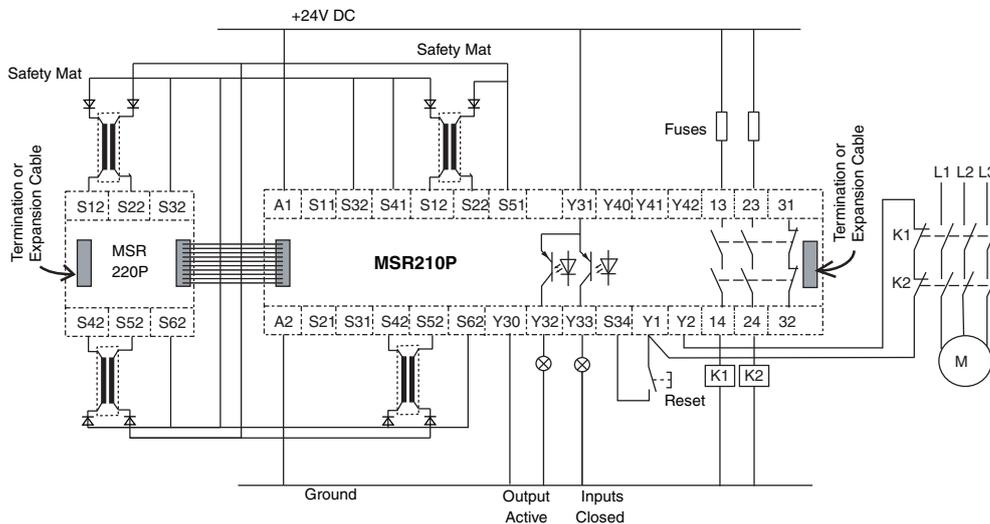
Four Individually Monitored Safety Mats,
Monitored Manual Reset, Dual Output, Output Monitoring

Note: The diodes shown can be terminal blocks with built-in diodes (1492-JD3DF or 1492-JD3DR).
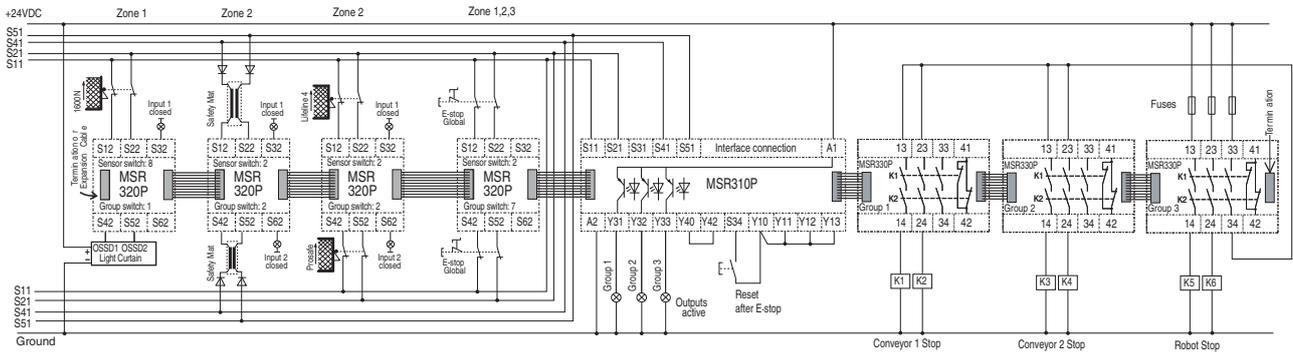
2-Safety Mats

Note: The diodes shown can be terminal blocks with built-in diodes (1492-JD3DF or 1492-JD3DR).
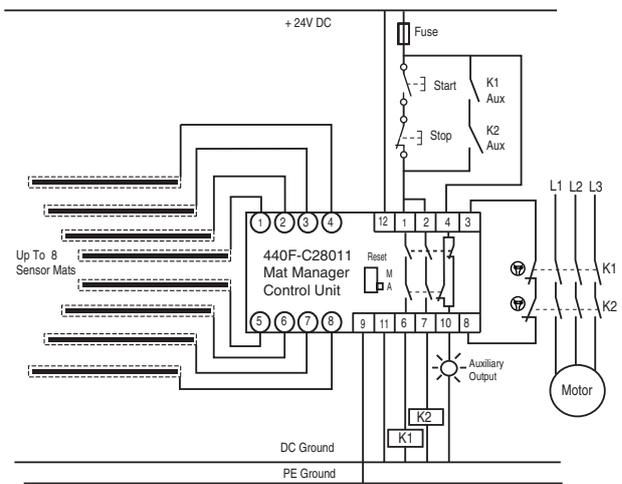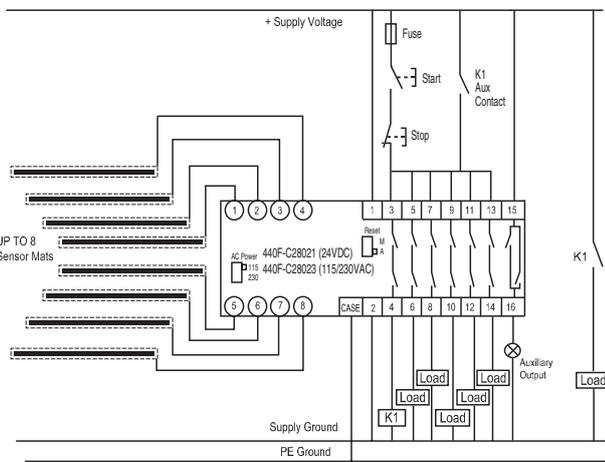
2-Safety Mats
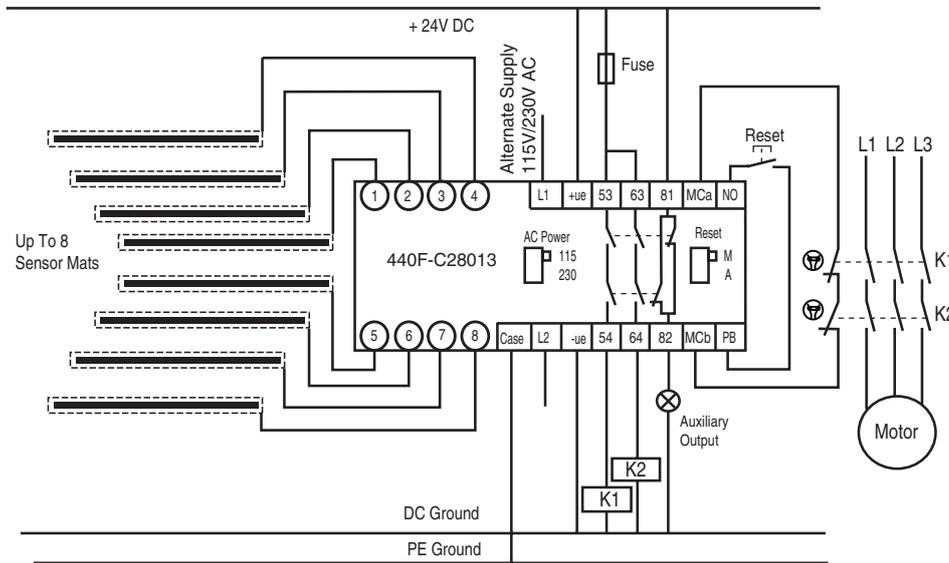
System Components

The Safedge sensitive edge systems are used in a variety of applications where the edge of an object must be detected by contact. The Safedge system consists of three parts: 1) a C-rail, which is used to mount the profile; 2) a profile, which contains the sensing surface; and 3) a control unit, which checks the operation of the profile and interfaces with the control system. A typical system is shown below.

C-Rail

+

Profile

+

Control Unit

Operating Principle

The profile works on the principle of a two-wire design with conductive rubber. Two wires run the length of the profile. The wires are terminated with a known resistor. When the profile is deformed, the conductive rubber comes in contact with each other and causes the overall resistance to drop.

Pressure required is 10 N (2.25 lb) when applied in this direction

Conductive Rubber

Flexible Wire Cores

Non-conductive Rubber
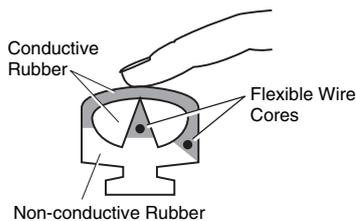
The control unit provides a voltage source to the wires in the profile. It continuously checks the continuity of the wires for shorts, opens and changes in resistance. If the circuit opens, becomes shorted, or the resistance changes, the output of the control unit turns off.

The control unit can also be used to monitor the performance of the output switching devices.

Sensing Surface

The profile is best actuated along its sensing surface. The sensing surface of the Safedge system is active along almost the full length of the edge. The 10 mm at the beginning and end are not active.

Sensing Surface

Control Unit

Sensing Angle

Sensing Length

One distinct advantage of the Safedge system is the active corners. Pressure applied to the corners is detected by the control unit.

Active Corners

2-Safety Edges

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Force Travel Relationship

Since the Safedge system is a contact device, a force is required to operate the device. This force is dependent on the shape of the object applying the force, the speed of the object and deformation distance on the profile. To help understand the force requirements, the European standard EN1760-2 2001 provides three test objects travelling at two speeds. Shown in the graph below is the force that is applied over the deformation distance on the surface of the profile. Note that the force required to operate the corners is greater than the force required along the straight section of the profile. This force must be used as a guideline, as the inanimate object can not be harmed.

Force vs. Distance

V_P = 10 mm/s

Force vs. Distance

V_P = 100 mm/s
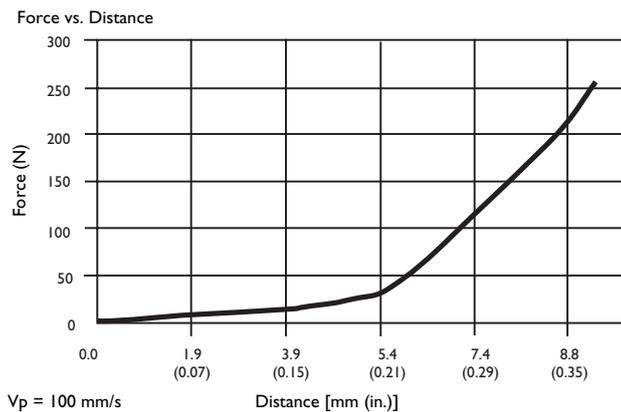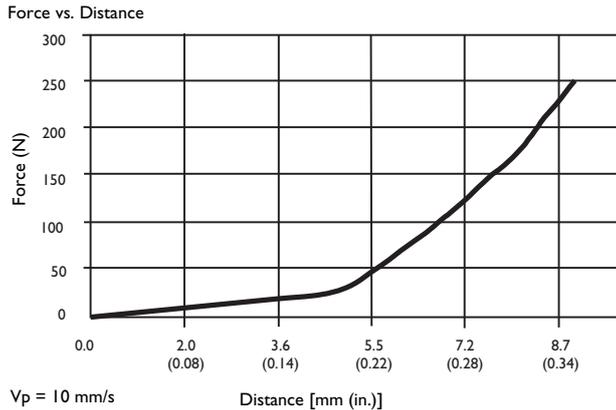
Risk Assessment

A risk assessment must be performed to determine the proper use of the edge system. Additional protective measures must be used when an individual can reach around or over the edge system and gain access to a hazard. The edge system is designed to be a contact type of system. Therefore "cushion factor" is an important consideration.

Selecting the Cushion Factor

One of the important characteristics of edge systems is called cushion factor. The cushion factor is the distance the profile can be depressed after the signal is generated. This is important when the profile is mounted on automated doors.

Automated doors will continue to close for some finite time after the profile sends the initial stop signal. This is known as the system response time. The system response time is the sum of the Safedge control unit response time, the control system response time, and the mechanical stopping time. Systems with longer response time should utilize larger cushion factors. Users must validate that injury does not occur if parts of the body get jammed, for example between the sensing edge and the fixed part of a machine.

Users might also consider a reversing option. When the profile is depressed, the Safedge control unit sends a signal to a reversing relay. Since the reversing relay is not a safety rated device, the user must still confirm that injury does not occur if parts of the body get jammed.

Typical Applications

Typical applications for sensitive edge systems are:
• Sliding doors
• Sliding gates
• Automated guided vehicles
• X-Y tables
• Fence tops
• Scissor jacks
• Loading platforms

The profile is mounted on the leading edge of the moving object. As the profile comes in contact with an object, the sensing surface of the profile deforms. The deformation causes the conductive rubber parts to make contact and reduce the circuit resistance. The control makes contact.

Typically, the edge of the object is leading edge and is moving, like a sliding door or gate. Edge systems have also been used on the leading edges of X-Y tables and automated guided vehicles.

In some applications, a drip edge or seal is needed to reduce wind and rain leaking into a door. The Safedge system accommodates both types of applications. Safedge has three profiles that include a sealing lip.

2-Safety Edges
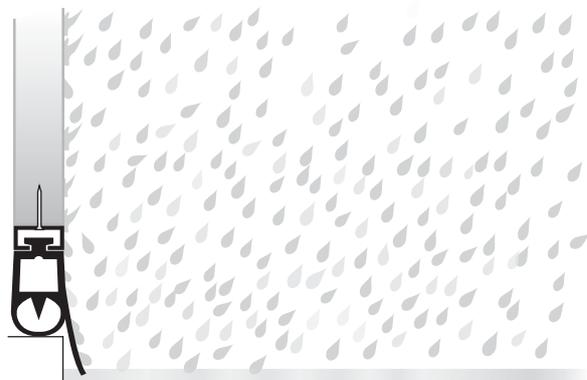
Safedge™ Profiles

Overview

Safedge can also be ordered with a rubber cover as shown below. This allows compression of the rubber boot without deforming the profile.

C-Rail   Sensing   Rubber Boot
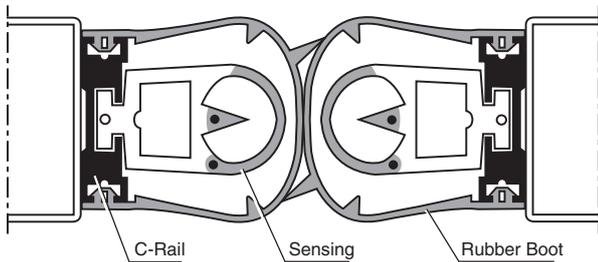
Cable Termination

The cable can be terminated in one of four ways providing flexibility in design and installation of cable routing. Specify the LHT or RHT from the point of view of looking directly at the end of the profiles as shown below.

SET—Straight

UNDER—Under

LHT—Left-hand

RHT—Right-hand

Connection Methods

The profiles can be connected in one of two ways: series or parallel. Either method provides the same performance. Selection of the method is determined by ease of installation. The more popular method is series.

Series Connection

Connection in series
If more than one profile is to be used, they are normally connected in series as shown.

Wire terminal connections

Uses 6K resistor (yellow)
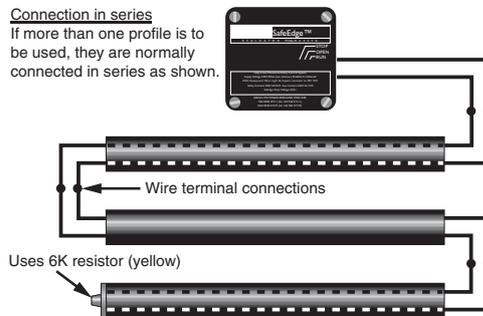
Parallel Connection

Uses 15K resistor (blue)
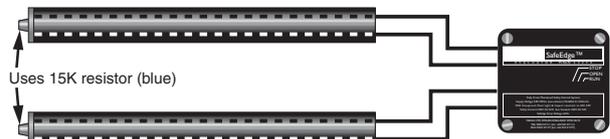
A maximum of two profiles can be connected in parallel.

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Guard master®

2-Safety Edges

Description

The ability of the Safedge profile to out perform competition lies in its innovative design. It uses a combination of non-conductive rubber and flexible wire-cored conductive rubber bonded together so it keeps bouncing back into shape even after repeated compressions.

The Safedge profiles come in three different cushions factors: 5 mm (0.2 in.), 19 mm (0.75 in.), and 41 mm (1.6 in.). Cushion factor is the distance the profile can be depressed after a signal has been generated. The profiles are also offered with a sealing lip which is designed to reduce drafts between the profile and opposing surface.

The profiles come in two different materials. Use the EPDM material in the presence of conductive fluids. The NBR/CR material performs better in the presence of oils. Review the chemical resistance chart to help make the best choice of material. If in doubt, a small sample of the profile should be tested for chemical resistance before a final selection is made.

The Safedge profile has no rigid internal parts which can "break through" or cause fatigue failures after prolonged use. The multi-stranded copper wire core throughout the length of the strip reduces the risk of resistance build up on long lengths.

Features

• Various profiles
• Conductive rubber technology
• Up to 50 m lengths
• Aluminum, plastic or zinc-coated steel mounting rails
• Rubber boot optional
• Active corners
• Sealing lip available

Specifications

Standards	EN1760-2, EN 954-1, ISO13849-1, IEC/EN60204-1, ANSI B11.19, AS 4024.5
Certifications	CE Marked for all applicable directives and TÜV. C-Tick not required.
Power Supply	Operates on 4V DC supplied from control unit.
Operating Temperature [C (F)]	EPDM material: -5…55° (23…131°) NBR/CR material: 0…55° (32…131°)
Relative Humidity	90%
Enclosure Type Rating	IP65 (NEMA 6P)
Wire Size	18 AWG
Material	EPDM: Ethylene Propylene Diene Modified Rubber NBR/CR: Acrylonitrile (34% nitrile) Butadiene Rubber/Chloropriene Rubber
Bend Radius, Min.	500 mm (19.6 in.)

Chemical Resistance of Safedge Profile

Substance	Resistance—"S" Profile EPDM	Resistance—"N" Profile NBR/CR
Acetic Acid (10%)	Good	Good
Acetone	Good	Fair
Ammonium Hydroxide (35%)	Good	Good
Benzene	Poor	Poor
Diesel Oil	Poor	Good
Ethyl Alcohol (Ethanol)	Good	Good
Hydrochloric Acid (10%)	Good	Good
Lubricating Oil	Poor	Good
Nitric Acid (10%)	Good	Fair
Petrol (Gasoline)	Poor	Fair
Silicone Fluids	Good	Good
Sodium Chloride (25%)	Good	Good
Trichlorethylene	Good	Poor
Vegetable Oils (general)	Good	Good
Water (distilled)	Good	Good
Water (sea)	Good	Good
Latex Paint	Good	Good
Oil Base Paint	Good (easy to clean)	

2-Safety Edges

Product Selection—Profiles

Code (See page 2-112)	Approx. Dimensions [mm (in.)]	Safedge Profile	Description	Cushion Factor	Length [m (ft)]	Cat. No.
A	28.5 (1.12), 4.2 (0.17), 24.5 (0.96), 3.2 (0.13)	0110S	Black, EPDM, Weight: 463 g/m (0.33 lbs/ft)	5 mm (0.20 in.)	5 (16.4)	440F-E0110S05
					10 (32.8)	440F-E0110S10
					20 (65.6)	440F-E0110S20
C	28.5 (1.12), 4.2 (0.17), 24.5 (0.96), 3.2 (0.13)	0110N	Black, NBR/CR, Weight: 460 g/m (0.31 lbs/ft)	5 mm (0.20 in.)	5 (16.4)	440F-E0110N05
					10 (32.8)	440F-E0110N10
					20 (65.6)	440F-E0110N20
B	28.5 (1.12), 4.2 (0.17), 24.5 (0.96), 3.2 (0.13)	0110R	Red, EPDM, Weight: 502 g/m (0.34 lbs/ft)	5 mm (0.20 in.)	5 (16.4)	440F-E0110R05
					10 (32.8)	440F-E0110R10
					20 (65.6)	440F-E0110R20
E	28.5 (1.12), 43 (1.69), 14 (0.55)	1610S	Black, EPDM, Weight: 843 g/m (0.57 lbs/ft)	19 mm (0.75 in.)	5 (16.4)	440F-E1610S05
					10 (32.8)	440F-E1610S10
					20 (65.6)	440F-E1610S20
F	28.5 (1.12), 43 (1.69), 14 (0.55)	1610N	Black, NBR/CR, Weight: 837 g/m (0.56 lbs/ft)	19 mm (0.75 in.)	5 (16.4)	440F-E1610N05
					10 (32.8)	440F-E1610N10
					20 (65.6)	440F-E1610N20
H	30 (1.18), 68 (2.68), 36 (1.42)	0310S	Black, EPDM, Weight: 1209 g/m (0.81 lbs/ft)	41 mm (1.61 in.)	5 (16.4)	440F-E0310S05
					10 (32.8)	440F-E0310S10
					20 (65.6)	440F-E0310S20
D, J	28.5 (1.12), 24.5 (0.96), 28-30 (1.10-1.18)	0510S	Black, EPDM, with Sealing Lip, Weight: 545 g/m (0.37 lbs/ft)	5 mm (0.20 in.)	5 (16.4)	440F-E0510S05
					10 (32.8)	440F-E0510S10
					20 (65.6)	440F-E0510S20
G, K	25 (0.98), 43 (1.69), 14 (0.55), 17 (0.67)	0804S	Black, EPDM, with Sealing Lip, Weight: 1013 g/m (0.68 lbs/ft)	19 mm (0.75 in.)	5 (16.4)	440F-E0804S05
					10 (32.8)	440F-E0804S10
					20 (65.6)	440F-E0804S20

Note: Maximum roll size before axial connector needed is 20 m (65.6 ft).

2-Safety Edges

Code (See page 2-112)	Approx. Dimensions [mm (in.)]	Safedge Profile	Description	Cushion Factor	Length [m (ft)]	Cat. No.
I, L	30 (1.18) / 68 (2.68) / 36 (1.42) / 29 (1.14)	0210S	Black, EPDM, with Sealing Lip, Weight: 1291 g/m (0.87 lbs/ft)	41 mm (1.61 in.)	5 (16.4)	440F-E0210S05
					10 (32.8)	440F-E0210S10
					20 (65.6)	440F-E0210S20
M	16 (0.63) / 18 (0.71)	0118S	Black, EPDM, Weight: 242 g/m (0.163 lbs/ft) (mini profile)	3.75 mm (0.15 in.)	5 (16.4)	440F-E0118S05
					10 (32.8)	440F-E0118S10
					20 (65.6)	440F-E0118S20
N, O	50 (1.97) / 67 (2.64)	1111S	Black, EPDM, Weight: 680 g/m (0.457 lbs/ft)	NA	5 (16.4)	440F-E1111S05
					10 (32.8)	440F-E1111S10
					20 (65.6)	440F-E1111S20

Note: Maximum roll size before axial connector needed is 20 m (65.6 ft).

Product Selection—C-Rails

Code	Approx. Dimension [mm (in.)]	Description	Cat. No.
A	10 (0.39) / 25 (0.98)	Aluminium type, Type C112/A. Suitable for all profiles. Length: 3 m (9.8 ft) Weight: 258 g/m (0.17 lbs/ft)	440F-R1212
B	10 (0.39) / 25 (0.98)	Zinc-Coated Steel; Type C112/S. Suitable for all profiles. Length: 2 m (6.5 ft) Weight: 663 g/m (0.45 lbs/ft)	440F-R1112
C	10 (0.39) / 25 (0.98)	PVC Black; Type C112/PB. Suitable for all profiles. Length: 3 m (9.8 ft) Weight: 111 g/m (0.07 lbs/ft)	440F-R1212PB
D	10 (0.39) / 25 (0.98)	PVC Red; Type C112/PR. Suitable for all profiles. Length: 3 m (9.8 ft) Weight: 111 g/m (0.07 lbs/ft)	440F-R1212PR
E	10 (0.39) / 25 (0.98)	PVC Yellow; Type C112/PY. Suitable for all profiles. Length: 3 m (9.8 ft) Weight: 111 g/m (0.07 lbs/ft)	440F-R1212PY
F	25 (0.98) / 10 (0.39) / 20 (0.79)	Aluminium Vertical Lip; Type C112/A2. Suitable for all profiles. Length: 2 m (6.5 ft) Weight: 368 g/m (0.25 lbs/ft)	440F-R1214
G	10 (0.39) / 25 (0.98) / 25 (0.98)	Aluminium Horizontal Lip; Type C112/A3. Suitable for all profiles. Length: 2 m (6.5 ft) Weight: 388 g/m (0.26 lbs/ft)	440F-R1215
H	18 (0.71) / 25 (0.98)	Aluminium Deep Channel; Type C112/A4. Suitable for all profiles. Length: 2 m (6.5 ft) Weight: 345 g/m (0.23 lbs/ft)	440F-R1216
I	8.5 (0.33) / 18 (0.71)	Aluminium; Suitable for Mini Profile Only. Length: 2 m (6.5 ft) Weight: 150 g/m (0.10 lbs/ft)	440F-R1219

2-Safety Edges

Safedge™ Profiles

Code	Approx. Dimension [mm (in.)]	Description	Cat. No.
J	45 (1.77) / 13 (0.51)	Aluminium; Suitable for Rubber Boot Only. Length: 2 m (6.5 ft) Weight: 667 g/m (0.448 lbs/ft)	440F-R2151
NA	45 (1.77) / 10 (0.4)	Aluminium End Plate for C-Rail Option J; 2 Plates; 4 Screws, flat head Philips, 10mm, #6 Weight: 7g (0.01 lbs)	440F-R2152
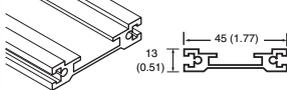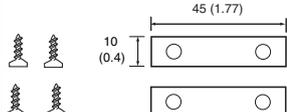
Product Selection—Component Parts
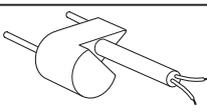
Description		Product Selection Criteria	Cat. No.
	Connector and Cable (diameter = 5 mm (0.20 in.)	1 m (3.2 ft)	440F-A1301
		2 m (6.56 ft)	440F-A1302
		5 m (16.4 ft)	440F-A1305
		10 m (32.8 ft)	440F-A1306
		15 m (49.2 ft)	440F-A1307
	Terminator	6 kΩ (yellow) resistor for series termination	440F-A1308
		15 kΩ (blue) for parallel termination	440F-A1309
	Closing Cap for profile codes (A, B, C, D, J)	Closing Cap material: EPDM	440F-A1302S
		Closing Cap material: NRB	440F-A1302N
	Closing Cap for profile codes (E, F, G, H, K)	Used to close profiles 440F-E0310S and 440F-E1610S.	440F-A1303S
		Used to close profile 440F-E1610N.	440F-A1303N
	Axial Connector	With this connector you can directly connect two profiles. Suitable for 440F-E0110S profiles.	440F-A0061S
		With this connector you can directly connect two profiles. Suitable for 440F-E0110R profiles.	440F-A0061N
	Straight Pin Connector	Kit contains one pair of pins suitable for one joint.	440F-A0004
	90° Corner Connector	For use with profile 440F-E0110S	440F-A0071S
		For use with profile 440F-E0110R	440F-A007IS
		For use with profile 440F-E0110N	440F-A007IN
		For use with profile 440F-E0310S	440F-A0073S
		For use with profile 440F-E1610S	440F-A0074S
		For use with profile 440F-E1610N	440F-A0074N
	90° Corner Connector (vertical)	For use with profile 440F-E0110N	440F-A0072N
		For use with profile 440F-E0110S or 440F-E0110R	440F-A0072S
		For use with profile 440F-E1610N	440F-A0075N
		For use with profile 440F-E1610S	440F-A0075S
		For use with profile 440F-E0310S	440F-A0076S
	45° Corner Connector	For use with profile 440F-E0110N	440F-A0071N45 ∗
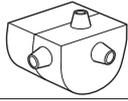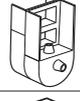
∗ Includes two rubber strips (440F-A0005) when using profile 440F-E0110N.

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Description		Product Selection Criteria	Cat. No.
	60° Corner Connector	When using profile 440F-E0110N	440F-A0071N60 ∗
	30° Corner Connector	When using profile 440F-E0110N	440F-A24007130 ∗
	Connector and Cable	Use only on Mini Profile—1 m (3.3 ft)	440F-A1181
		Use only on Mini Profile—3 m (9.8 ft)	440F-A1183
		Use only on Mini Profile—5 m (16 ft)	440F-A1185
	Terminator	Use only on Mini Profile—8 kΩ (yellow) resistor for series termination	440F-A1186
	Closing Cap	Use only on Mini Profile—Closing Cap material: EPDM	440F-A1318
	Cyanocrylate Adhesive	Use Loctite 401 for dry applications. Use Loctite 380E for wet applications.	NA
	Shears	Use to cut profiles.	440F-A3084
	Connection Box	Polycarbonate housing 53 x 53 x 35 mm (2.09 x 2.09 x 1.38 in.) complete with two pole terminal and trumpet type screw on connector with strain and relief clamp. For use with coiled cable.	440F-A0116
	Coiled Connection Cable	2.5 m (8.2 ft) (extended) of flexible coiled cable. Shelf length is 889 mm (35 in.) long. OD of coil is 22 mm (0.86 in.) and OD of cable is 5 mm (0.20 in.).	440F-A2450
		3.5 m (11.5 ft) (extended) of flexible coiled cable. Shelf length is 1270 mm (50 in.) long. OD of coil is 22 mm (0.86 in.) and OD of cable is 5 mm (0.20 in.).	440F-A2700
	Two rubber strips	When using profile 440F-E0110N shelf length is 175 x 10 x 0.7 mm (6.89 x 0.39 x 0.03 in.).	440F-A0005
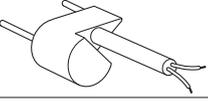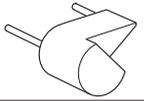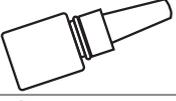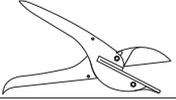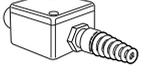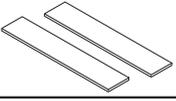
∗ Includes two rubber strips (440F-A0005) when using profile 440F-E0110N.

2-Safety Edges
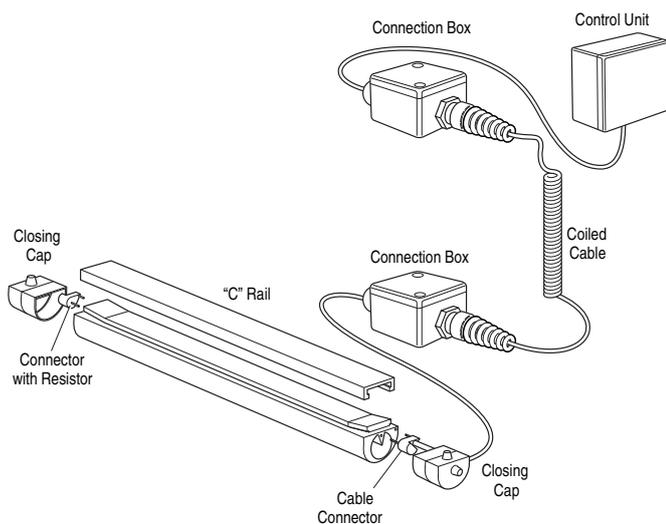
Example application of profile using coiled cable. The coiled cable can not be directly connected to the profile due to the weight of the cable. The proper use of the coiled cable is to connect the coiled cable to the profile through the connection box. The coiled cable should be secured to both the moving and stationary objects so as to prevent straining of the terminal connections.

Connection Box   Control Unit

Closing Cap

"C" Rail

Connector with Resistor

Connection Box

Coiled Cable

Cable Connector

Closing Cap

2-Safety Edges

Factory Assembled Product Selection (standard profile)

440F	-	E*	C	A	M	V	01270
		a	*b*	*c*	*d*		*e*

a

Profile	
Code	Description
A	0110S
B	0110R
C	0110N
D	0510S with Sealing Lip on Right Side
E	1610S
F	1610N
G	0804S with Sealing Lip on Right Side
H	0310S
I	0210S with Sealing Lip on Right Side
J	0510S with Sealing Lip on Left Side
K	0804S with Sealing Lip on Left Side
L	0210S with Sealing Lip on Left Side
N	Rubber Boot over 0110S
O	Rubber Boot over 1610S
P	No Profile

b

C-Rail	
Code	Description
A	1212 aluminium for profile codes A-L
B	1112 zinc coated steel for profile codes A-L
C	1212PB PVC black for profile codes A-L
D	1212PR PVC red for profile codes A-L
E	1212PY PVC yellow for profile codes A-L
F	1214 aluminium with vertical lip for profile codes A-L
G	1215 aluminium with horizontal lip for profile codes A-L
H	1216 aluminium deep rail for profile codes A-L
J	2151 aluminium for profile codes N and O
N	No C-Rail (not needed)

c

Cable Entrance	
Code	Description
A	LHT left entrance with 1 m cable
B	LHT left entrance with 2 m cable
C	LHT left entrance with 3 m cable
D	LHT left entrance with 5 m cable
E	LHT left entrance with 10 m cable
F	RHT right entrance with 1 m cable
G	RHT right entrance with 2 m cable
H	RHT right entrance with 3 m cable
I	RHT right entrance with 5 m cable
J	RHT right entrance with 10 m cable
K	SET straight entrance with 1 m cable
L	SET straight entrance with 2 m cable
M	SET straight entrance with 3 m cable
N	SET straight entrance with 5 m cable
O	SET straight entrance with 10 m cable
P	UNDER entrance with 1 m cable
Q	UNDER entrance with 2 m cable
R	UNDER entrance with 3 m cable
S	UNDER entrance with 5 m cable
T	UNDER entrance with 10 m cable
U	No entrance components

d

Termination	
Code	Description
A	LHT left exit with 1 m cable
B	LHT left exit with 2 m cable
C	LHT left exit with 3 m cable
D	LHT left exit with 5 m cable
E	LHT left exit with 10 m cable
F	RHT right exit with 1 m cable
G	RHT right exit with 2 m cable
H	RHT right exit with 3 m cable
I	RHT right exit with 5 m cable
J	RHT right exit with 10 m cable
K	SET straight exit with 1 m cable
L	SET straight exit with 2 m cable
M	SET straight exit with 3 m cable
N	SET straight exit with 5 m cable
O	SET straight exit with 10 m cable
P	UNDER exit with 1 m cable
Q	UNDER exit with 2 m cable
R	UNDER exit with 3 m cable
S	UNDER exit with 5 m cable
T	UNDER exit with 10 m cable
U	Parallel Termination—15 kΩ
V	Series Termination—6 kΩ
W	No exit components

e

Length of Edge	
Code	Description
5 digit number	Enter length of edge in mm; for example: 50 m = 50000, 500 mm = 00500; 300 mm minimum; ± 2.5 mm tolerance

* Order Controller separately. Refer to SafeEdge Controllers product selection on page 2-115.

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Factory Assembled Product Selection (mini-profile)

440F	-	E*	M	I	M	V	01270
		a	b	c	d		e

a

Profile	
Code	Description
M	0118S 3.75 mm (0.15 in.) Cushion Factor Black, Mini Profile
P	No Profile

b

C-Rail	
Code	Description
I	1219 aluminium for "Profile" code M
N	No C-Rail (not needed)

c

Cable Entrance	
Code	Description
K	SET straight entrance 1 m cable
M	SET straight entrance 3 m cable
N	SET straight entrance 5 m cable
P	UNDER entrance 1 m cable
R	UNDER entrance 3 m cable
S	UNDER entrance 5 m cable
U	No entrance components

d

Termination	
Code	Description
K	SET straight entrance 1 m cable
M	SET straight entrance 3 m cable
N	SET straight entrance 5 m cable
P	UNDER entrance 1 m cable
R	UNDER entrance 3 m cable
S	UNDER entrance 5 m cable
V	Series Termination—8 kΩ
W	No Termination

e

| Length of Edge	
Code	Description
5 digit number	Enter length of edge in mm; for example: 50 m = 50000, 500 mm = 00500; 300 mm minimum; ± 2.58 mm tolerance

* Order Controller separately. Refer to SafeEdge Controllers product selection.

2-Safety Edges

Factory Assembled Examples

440F-ECAKV01250
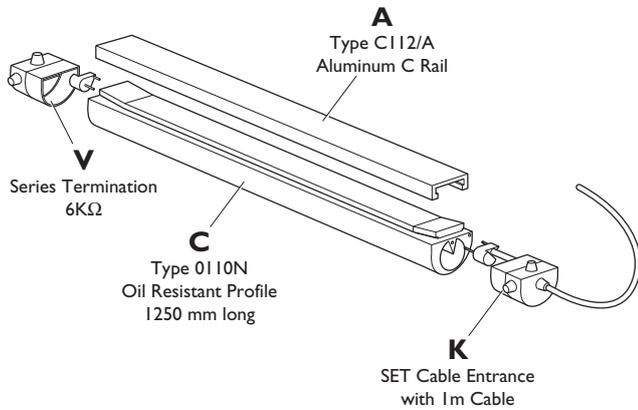
A
Type C112/A
Aluminum C Rail

V
Series Termination
6KΩ

C
Type 0110N
Oil Resistant Profile
1250 mm long

K
SET Cable Entrance
with 1m Cable

This is a single oil resistant profile which is 1250 mm (49.2 in.) long. The edge is terminated with a Series Termination. A 1 m (3.2 ft) cable enters straight into the closing cap. The profile is mounted on a standard aluminum C-rail.

440F-ECFGD01250
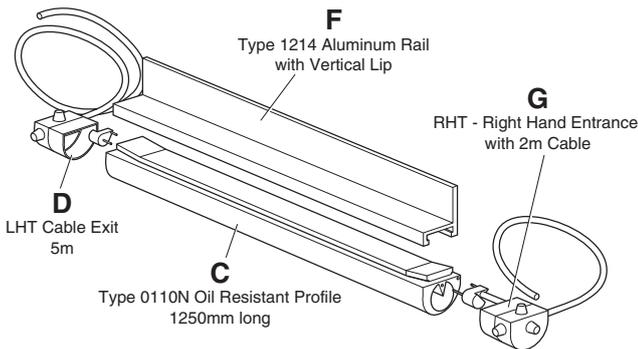
F
Type 1214 Aluminum Rail
with Vertical Lip

G
RHT - Right Hand Entrance
with 2m Cable

D
LHT Cable Exit
5m

C
Type 0110N Oil Resistant Profile
1250mm long

This is a single oil resistant profile which is 1250 mm (49.2 in.) long. The edge is terminated with a 1 m (3.2 ft) cable. A 1 m cable enters straight into the closing cap. The profile is mounted on an aluminum C-rail with a vertical mounting lip. A control unit is not included. This edge is intended to be used in series with another length of edge which has a terminating resistor.

440F-EDFHV00490

V
Series Termination
6KΩ

F
Type 1214 Aluminum Rail
with Vertical Lip

H
RHT- Right-Hand
Entrance
with 3m Cable

D
Type 0510S Profile
with Sealing Lip
490mm long

Note orientation of sealing
lip to cable entrance
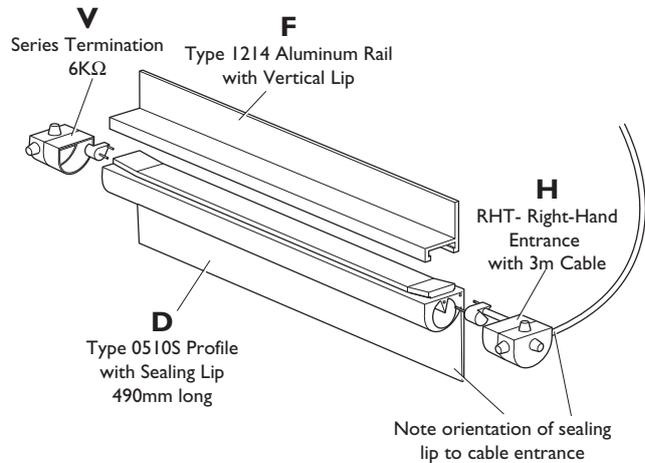
This single profile has a sealing lip and is 490 mm (19.2 in.) long. The profile is terminated with a Series Termination. A 3 m (9.8 ft) cable enters into the right hand side of the closing cap from a plastic surface mounted controller. The profile is mounted on an aluminum rail with a vertical lip for ease of mounting. The orientation of the sealing lip to the vertical lip can be reversed by the user by sliding the profile out of the C-rail, rotating the C-rail 180° and then re-inserting the profile back into the C-rail.

440F-EBGCU03560

G
Type 1215 Aluminum Rail
with Horizontal Lip

U
Parallel
Termination
15KW

B
Type 0110R Profile
3560mm long

C
LHT - Entrance
with 3m Cable
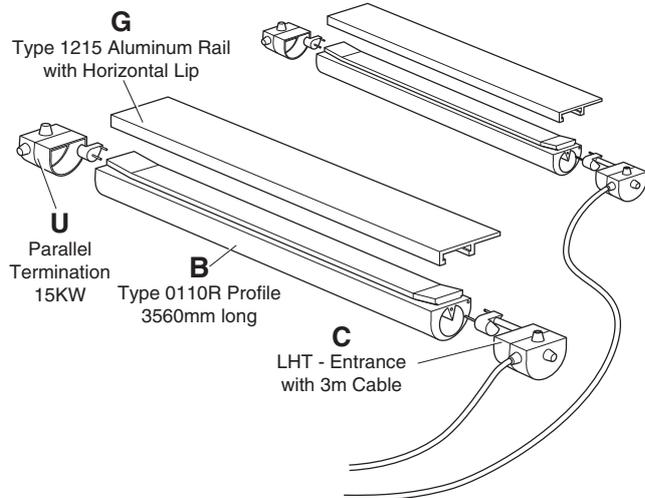
This is a red-colored single profile which is 3560 mm (140.15 in.) long. This profile is part of a parallel profile system, for ease of mounting, as it is terminated with a Parallel Termination. A 3 m (9.8 ft) cable enters into the left side of the closing cap. The profile is mounted on an aluminum C-rail with a horizontal lip for ease of mounting. The horizontal lip can be reversed by the user by sliding the profile out of the C-rail, rotating the C-rail and then re-inserting the profile back into the C-rail. A separate Cat. No. must be entered for the other profile.

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Product Selection—Relays

Single Function Safety Relays	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
	2 N.O.		Fixed		24V AC/DC or 115/230V AC		440F-C251D
	1 N.O.	1 N.C.	Removable	Automatic/Manual	24V AC/DC	5-72	440F-C252D
	2 N.O.		Fixed		24V AC/DC or 115/230V AC		440F-C251P

Typical Wiring Diagrams

Series Terminated, Safedge Input, Manual Reset, Dual Channel Output, Monitored Output

Series Terminated, Cascaded, Safedge Input, Automatic Reset, Dual Channel Output, No Output Monitored

Parallel Terminated, Safedge Input, Manual Reset, Dual Channel Output, Monitored Output

Series Terminated, Safedge Input, Automatic Reset, Single Channel Output, No Output Monitored

2-Safety Edges

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2-Notes

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