

GuardShield Safety Light Curtain

Catalog Numbers 450L-B4FNxYD, 450L-B4HNxYD



Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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Read this preface to become familiar with the rest of the manual. It provides information concerning the following:

- Who would use this manual
- Purpose of this manual
- Related documentation
- Conventions that are used in this manual

Who Should Use This Manual

Use this manual if you design, install, program, or troubleshoot systems that use the 450L-B GuardShield™ safety light curtain.

You must have a basic understanding of electrical circuitry and familiarity with safety-related systems. If you do not, obtain the proper training before using this product.

All inspections must be implemented by a qualified person. A qualified person has done the following:

- Undergone the appropriate technical training
- Instructed by the responsible machine operator in the operation of the machine and the currently valid safety guidelines
- Read and have on-going access to these user manuals.

The light curtain must be used only on the machine it has been installed on and initialized by qualified personnel.

Purpose of This Manual

This manual is a reference guide for the 450L-B GuardShield safety light curtain. It describes the procedures to install, wire, and troubleshoot the safety light curtain.

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide steps or hierarchical information.

Terminology

Abbreviation	Definition
DoC	Declaration of conformity
EDM	External device monitoring
ESPE	Electro-sensitive protective equipment
FSD	Final switching device
NC	Not connected
OID	Optical Interface Device
OSSD	Output Signal Switching Device. Typically designates a pair of solid-state signals pulled up to the DC source supply. The signals are tested for short circuits to the DC power supply, short circuits to the DC common, and short circuits between the two signals
PL	Performance Level
POC	Point of Operation Control
QD	Quick disconnect
RB	Restart button
Rx	Receiver
SIL	Safety integrity level
Tx	Transmitter

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
GuardShield 450L-B Safety Light Curtain Product Information, publication 450L-PC001	Provides a short description for installation for replacement of 450L-B units.
GuardShield 450L Side Mounting Kit, publication 450L-IN002	Provides a short description for installation of the side mount brackets.
GuardShield 450L Weld Shield Kit, publication 450L-IN001A	Provides a short description for installing the weld shield kit.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.
Safety Book 4 - Safety-related control systems for machinery, publication http://literature.rockwellautomation.com/idc/groups/literature/documents/rm/safebk-rm002_-en-p.pdf	Provides principles, standards, and implementation of Safety-related control systems for machinery.

You can view or download publications at <http://www.rockwellautomation.com/global/literature-library/overview.page>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

General Description

450L-B GuardShield Safety Light Curtain Overview

The 450L-B GuardShield™ safety light curtain family are general-purpose presence sensing devices that are designed for use on hazardous machinery for point of operation control (POC). The product family is certified as Type 4 electro-sensitive protective equipment (ESPE) (as defined by EN 61496-1 and IEC 61496-2). This certification allows this product to be used in applications that require PLe/Category 4 according to EN ISO 13849-1.

The 450L-B safety light curtains are offered in multiple lengths from 150...1950 mm (5.9...76.77 in.) in increments of 150 mm (5.9 in.). Each length is available in finger (14 mm [0.55 in.]) or hand (30 mm [1.18 in.]) resolution with a basic set of sensing functions.

What makes the 450L GuardShield light curtain system unique from other solutions is that it consists of two identical transceiver sticks. These safety light curtains are not designated as transmitter or receiver right out-of-the-box. The configuration of a stick as a transmitter or a receiver is done by inserting either:

- a. A dedicated transmitter or receiver plug-in into the transceiver sticks or
- b. A universal plug-in module in each transceiver stick, which allows a selection for the transmitter or the receiver function by wiring.

The 450L-B GuardShield contains an intensity display, which allows for quick, easy installation, optimal alignment, and clear indication of the light reserve. The status indicators of both sticks display the operating status.

The product line is designed as a two box system, which has no inactive sensing area or dead or blind zones at the top and bottom of each stick. This design allows a perfect and easy integration in individual machine designs.

Selectable function depends on the installed receiver plug-in, which can be inserted in a 450L-B GuardShield safety light curtain transceiver stick. Different operation modes can be selected via the DIP switch on the receiver plug-ins.

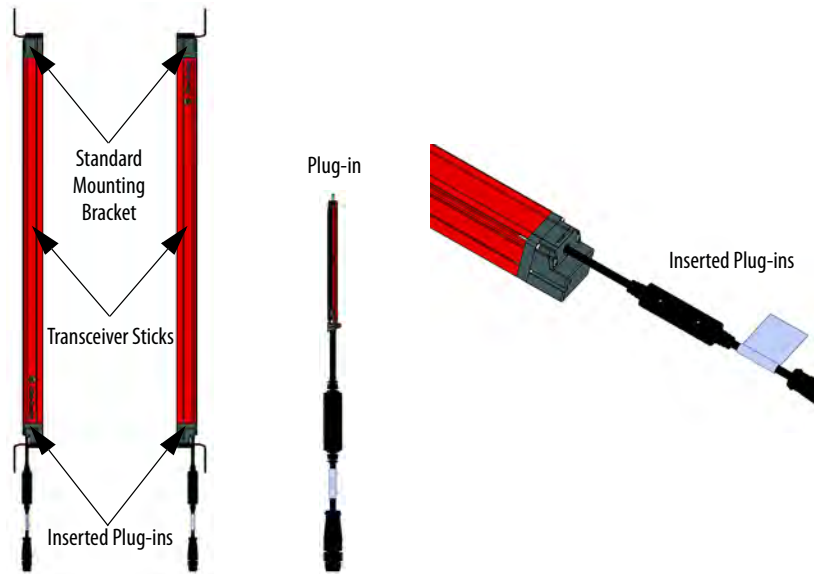
Depending on the type of plug-in that is installed in a 450L-B GuardShield stick, the system offers;

- Connectivity to ArmorBlock® Guard I/O™ (5-pin M12 QD) for network connectivity providing CIP Safety™ over DeviceNet™ or EtherNet/IP™.
- Auto or manual start modes
- External device monitoring (EDM)

Recognized technical regulations and ISO 9000 quality assurance procedures are carefully applied during the development and production of Allen-Bradley® GuardShield products.

Assembly Overview

Figure 1 - Assembly Overview for a 450L-B GuardShield Safety Light Curtain System



Packaged Contents

A 450L-B GuardShield safety light curtain is normally shipped as an individual component (single transceiver). A complete functional system includes four individual boxes.

Table 1 - List for a Complete System

Position	Required Quantity	Description	Remark
1	2	450L-B GuardShield transceiver stick	Each box contains: A. One stick B. Mounting kit (top and bottom) C. Test rod and D. Short instruction manual
2	1	Transmitter Plug-In	150 mm (5.9 in.) pigtail with M12 QD connector (male)
3	1	Receiver Plug-In	150 mm (5.9 in.) pigtail with M12 QD connector (male)

Figure 2 - Content of 450L-B GuardShield Transceiver Stick Box

See [Principle of Operation on page 15](#) to identify these options.

- Limits of the detection zone
- The beam center lines
- Indication of the plane of detection
- Axis of detection zone

Figure 3 - Transmitter Bottom Plug-in, No DIP Switches, 5-pin, or 8-pin M12 QD**Figure 4 - Receiver Bottom Plug-in, with DIP Switches, 5-pin, or 8-pin M12 QD**

The number of DIP switches and the number of pins (five or eight) of the M12 QD plug depends on plug-in type.

Depending on the cat. no., pre-assembled sticks are available (plug-in already inserted in stick). For more details, see [Catalog Numbers on page 79](#). For availability, check with your nearest Allen-Bradley distributor or Rockwell Automation sales office.

Safety Concepts

This section describes the safety Performance Level concept and explains how the 450L-B GuardShield™ safety light curtains meet the requirements for SIL 3 and PLe for Category 4 architectures.

Safety Standards Applied to 450L-B GuardShield

The 450L-B GuardShield safety light curtain satisfies applicable requirements in the following standards that are related to functional and machinery assembly:

- IEC 61496-1/-2 (Type 4)
- IEC 61508 (SIL 3)
- IEC 62061 (SILcl 3)
- EN/ISO 13849-1 (Performance Level e (PLe), Category 4)
- UL 508

Published dates of the individual standards are given in the Declaration of Conformity (see www.rockwellautomation.com/global/certification/overview.page).

Safety Certification

Each 450L-B GuardShield safety light curtain is a Type 4 ESPE as defined by IEC 61496-1 and CLC/TS 61496-2. The safety light curtains are allowed for use with controls in compliance with these certifications.

- PLe (in a Category 4 architecture) in compliance with EN ISO 13849
- SIL CL3 in accordance with EN 62061
- SIL 3 in accordance with IEC 61508

Safety requirements are based on the standards applicable at the time of certification with a proof test interval of 20 years.

The device is suitable for the following:

- Point of operation control (POC) finger- and hand-detection
- Hazardous area protection
- Access protection

Access to the hazardous point must be allowed only through the protective field. The machine/system is not allowed to start as long as personnel are within the hazardous area (see [Correct Installation on page 40](#)).

Depending on the application, mechanical protective devices are potentially required on the safety light curtain.

TÜV Rheinland has approved the 450L-B GuardShield safety light curtains for use in safety-related applications where Performance Level (PL) up to “e” and Safety Integrity Level up to “3” are required.

IMPORTANT Observe the following directives, rules, and regulations to help conform to proper and safe use of the GuardShield safety light curtain:

The national/international rules and regulations apply to the installation, use, and periodic technical inspections of the safety light curtain, in particular:

- Machine Directive
- Low Voltage Directive
- Equipment Usage Directive
- Work safety regulations/safety rules
- Other relevant health and safety regulations

Published dates of the individual standards are given in the Declaration of Conformity (see www.rockwellautomation.com/global/certification/overview.page).

Manufacturers and users of the machine with which the safety light curtain is used are responsible for obtaining and observing all applicable safety regulations and rules:

- The notices, in particular the test regulations of this user manual (for example, on use, mounting, installation, or integration into the existing machine controller) must be observed.
- Specialist personnel or specially qualified and authorized personnel implement the tests and must record and document that the tests can be reconstructed and retraced at any time.
- This user manual must be made available to the user of the machine where the GuardShield safety light curtain is installed. The machine operator is instructed in the use of the device by specialist personnel.

Installation Requirements

The 450L-B GuardShield safety light curtains must be installed in accordance with the applicable regulations and standards.

While the 450L-B GuardShield safety light curtains can be used for SIL 3, PLe and Category 4 applications, the installer must comply with the minimum (safe) distance requirements. For example, according to EN ISO 13855, if installed in the European Union.

The installed system, including the safety control system and the means by which the machine stops, must achieve the needed safety Performance Level. The 450L-B GuardShield safety light curtains are only one element in the safety system. Additional guidance can be found in Safe Book 4 (publication number [SAFE-RM002](#)).

Possible Misuse

GuardShield 450L-B safety light curtains are designed to be used as electrosensitive protective equipment in the sense of the machinery directive. These devices are only used in applications as

- Point of operation control device
- Access control device
- Hazardous area control device



WARNING: The following applications and/or environmental conditions can lead to misuse and potentially cause severe injuries or death (for more information see IEC 62046):

- Machines which eject materials, swarf, or component parts
- Risk of injury from thermal or other radiation
- Unacceptable noise levels
- Transparent objects need to be detected
- An environment which exceeds the specification limits provided in [Specifications on page 73](#).

Some but not all possible limits are electrostatic discharge, radio frequency interference, vibration/shock, ambient light, pollution, temperature, humidity.

Without additional measures (IEC 62998), GuardShield 450L-B safety light curtains are not designed to be used for the following applications:

- Outdoors
 - Under water
 - Explosive atmospheres
 - Altitudes over 3000 m (1.86 miles) above sea level
 - With enhanced ionizing or radar radiation
-

Notes:

Description of Operation

This chapter provides information on the special features and properties of the 450L-B safety light curtain. It also describes the structure and functions of the unit, particularly the different operating modes.

Principle of Operation

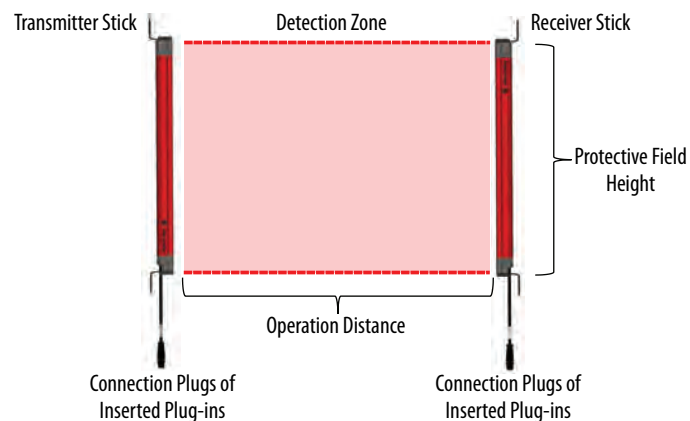
A functional 450L-B GuardShield™ safety light curtain system consists of the following:

- Two transceiver sticks (same length and resolution)
- A transmitter plug-in
- A receiver plug-in

The type of plug-in defines which way a transceiver stick performs: as a transmitter stick or as a receiver stick. The maximum distance between transmitter and receiver sticks is referred to as the operation distance or operating range (see [Figure 5](#) and [Specifications on page 73](#)). The 450L-B GuardShield systems also require a minimum operating distance. If a system is installed below this distance, the safety outputs do not switch to on. The scanning range is reduced by using deflector mirrors and/or weld shields (see deflector mirror in [Optional Accessories on page 81](#) and [Weld Shields on page 87](#)).

The protective field height of a 450L-B GuardShield safety light curtain is equal to the total length of a stick ([Dimensions on page 78](#)).

Figure 5 - Principle Operation of a 450L-B GuardShield System



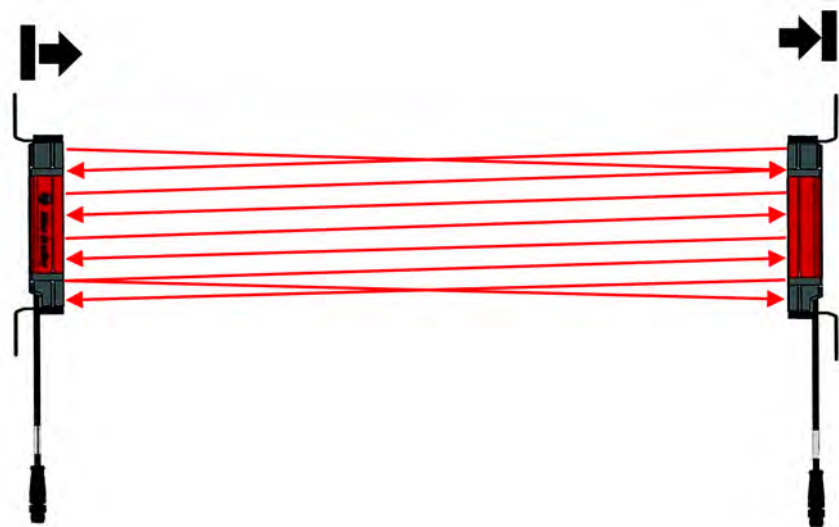
A short time after powerup (see [Table 25 on page 73](#)) and alignment of a system, nonvisible infrared light beams build up a plane of detection (protective field) between the two sticks. The axis of the detection zone is vertical to the front window of the transparent front window.

Sequential pulses of infrared light are sent between the two sticks. The beam status analysis and the processing are done by the receiver. When one or more beams are interrupted, the two output signal switching devices (OSSDs) turn off. A safety control, safety relay, or safety contactor evaluates the signal to stop the dangerous state of the machine.

The first or last beam near the end of the sticks optically synchronizes the timing of the emission and reception of infrared light pulses. These beams are referred to as the synchronization beams. Because the 450L-B GuardShield systems are optically synchronized, no electrical connection is required between the transmitter and receiver sticks.

Caused by the unique transceiver architecture of the GuardShield 450L-B sticks, every 450L-B stick transmits and receives infrared light. In contrast to the classical architecture of common pure transmitter and receiver light curtain systems, GuardShield 450L-B transceiver sticks exchange protective field information via the infrared light. So infrared light is not only sent from a 450L-B transceiver working as a transmitter to a receiver. As indicated in [Figure 7 on page 17](#), a 450L-B transceiver stick also works as a receiver transmits some infrared light to the transmitter.

Figure 6 - Schematic Display of Beam Center Lines



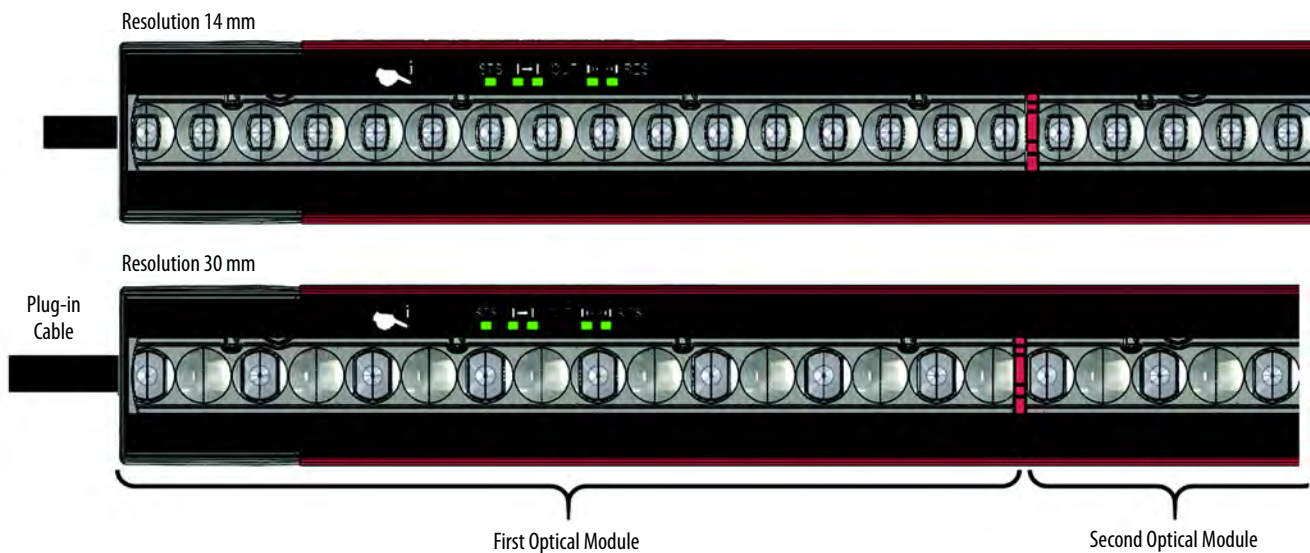
A GuardShield 450L-B transceiver, which acts as a receiver, has two safety outputs: Output Signal Switching Devices (OSSDs) and depending on the plug-in that is used, one additional non-safety auxiliary output. When the GuardShield transmitter and receiver are properly powered, aligned, not obstructed and the start/restart mode has been correctly initiated, all OSSDs are ON (output voltage = +24V DC). The two safety OSSDs are cross-fault monitored and short-circuit protected (see [OSSD Output on page 56](#)).

Interruption of the sensing field causes the receiver OSSD to switch OFF (sourced current 0V DC).

For automatic restart: no obstruction of the GuardShield sensing field causes the two safety outputs (OSSD) to switch to the active high (On) state (+24V DC).

With the appropriate resolution, the 450L-B GuardShield safety light curtain system provides finger or hand protection. The resolution corresponds to the diameter of the test rod belonging to the safety light curtain, which is reliably detected when positioned in the protective field. The resolution of a 450L-B GuardShield stick is printed on the product label (see [Product Labels on page 72](#)).

Figure 7 - Active Lenses for Different Resolutions



Resolution [mm (in.)]	Lens Number Per Module															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14 (0.55)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
30 (1.18)	X		X		X		X		X		X		X		X	

IMPORTANT The gap (approximately 1.5 mm (0.05 in.) between adjacent modules, which are red (indicated in [Figure 7](#) for hand and finger resolution), has no impact on resolution.

Range of Use

Typical applications for range of use are shown on [page 89](#). The GuardShield safety light curtain operates as a proper protective device only if the following conditions are met:

- The control of the machine must be electrical.
- The controlled machine must be able to be stopped anywhere in its stroke or cycle.
- The 450L-B GuardShield system must be mounted such that access to the hazard is only through the light curtain protective field (after the machine is stopped).
- The 450L-B GuardShield system must be mounted such that the safety distance fulfills all local regulations in any operation mode of the machine.
- The statutory and local rules and regulations must be observed when installing and using the device.

IMPORTANT Additional measures can be necessary so that the safety light curtain system does not fault when other forms of light radiation are present in a particular application. For example, reduction of cable control devices on cranes, radiation from weld spatter, effects from other infrared status indicators, or effects from strobe lights.

Safety Functions

The GuardShield™ safety light curtain offers a range of functions that are integral to the system.

The 450L-B GuardShield system functions (operating modes) are selected through DIP switch settings on the receiver plug-in. A confirmation of the configuration is only required after powerup of the receiver stick if before powerup the receiver stick was operated with another DIP switch setting (see [Confirmation of a New System Configuration on page 26](#)).



ATTENTION: The protective system must be tested for proper operation after each change to the configuration.

Start Modes

IMPORTANT The start button can also be used to power cycle a receiver stick if there is a lockout. A receiver stick performs the power off/on cycle if the input of the start button is activated for a minimum of 10 seconds, but not longer than 20 seconds. This function is also available if automatic start is configured.

Automatic (Re) Start

When in the automatic start mode of operation (also known as “Guard only” mode), the light curtain operates as an on/off device. The OSSD outputs switch off, according to an interruption of the sensing field, and automatically switch on when the protective field is cleared. The 450L-B GuardShield pairs that are equipped with bottom plug-ins and factory-default DIP switch settings work in Automatic Start mode.

Manual (Re) Start

The manual start mode of operation (also known as “restart interlock”) helps prevent the OSSD outputs from switching ON automatically after interruption and clearance of the protective field or powerup. A manual start of the GuardShield system is required. Start up of the system is accomplished through a momentary N.O. push button or key switch. An orange status indicator (RES) on the 450L-B GuardShield receiver indicates to the user that the system is ready for manual restart.

Manual start is not available in 450L-B GuardShield light curtains with ArmorBlock® Guard I/O™ connectivity (five-pin bottom plug-in).

The start button must be pressed a minimum 50 ms. The maximum time for accepting the start is five seconds. If the pulse width is too short or too long, the start function is not executed. The start reacts on the falling edge of the start pulse (for wiring see [Figure 35 on page 55](#)).

Manual Cold Start

The manual cold start (also known as “start interlock”) helps prevent the OSSD outputs from switching ON after power-up of the system, even when the protective field is unobstructed. After each power-up, a one-time manual start of the system is required for the 450L-B GuardShield system OSSD outputs to enter the ON state. The start will occur after actuation and release of a momentary N.O. push button (minimum actuation time: 50 ms; maximum actuation time five seconds).

After the initial power-up and manual start has taken place, the light curtain system will operate in the automatic start mode (see [Automatic \(Re\) Start on page 19](#)). Activation of this mode of operation and selection of the starting method is through DIP switch settings. An orange status indicator (RES) on the 450L-B GuardShield receiver indicates to the user that the system is ready to be manually started (for wiring see [Figure 35 on page 55](#)).

Manual cold start is not available in GuardShield light curtains with ArmorBlock® Guard I/O™ connectivity (five-pin bottom plug-in).

Manual (Re) Start with Off Function

This start mode allows the OSSD outputs to be switched on manually (if the protection field is unobstructed) and switch off manually. The OSSD outputs can be manually turned OFF by use of the same momentary N.O. push button or key switch that is used for manual start. Configuration and activation of this mode of operation is through DIP switch settings. An orange status indicator (RES) on the 450L-B GuardShield receiver indicates to the user that the system is ready to be manually started (for wiring see [Figure 35 on page 55](#)).

Relay Monitoring (EDM)

The relay monitor function (EDM= external device monitor function) is an input signal to the GuardShield receiver. It is used to monitor the state of the primary control contactors of the protected machinery or other final switching devices (FSD). The EDM input is looking for a change of state of the contactors/FSD within a time period of maximum 300 ms before the system faults. A fault causes the 450L-B GuardShield to enter a lockout condition (OSSDs OFF and error indication). One reason to select the EDM function can be the detection of an unsafe condition such as welded contacts in one of the FSD. Activation of this mode of operation is through the DIP switch setting on the 450L-B GuardShield receiver plug-in (for wiring see [Figure 34 on page 54](#)).

Relay monitoring is not available in 450L-B GuardShield safety light curtains with ArmorBlock® Guard I/O™ connectivity (M12 five-pin QD plug-in).

Low Operation Range

The operation range of a 450L-B GuardShield pair (the maximum distance between the two sticks) can be reduced to minimize the influence of neighboring optical sensors on light curtain performance ([Multiple 450L-B GuardShield on page 42](#)).

The limits of the default operating range and the limits of the reduced operating range (set by DIP switch) are list in [Table 25 on page 73](#)

The status indicators at transmitter and receiver indicate the activation of the low range function (see [Status Indicators on page 61](#)).

Response Time

The maximum response time (T_r) of the individual 450L-B GuardShield safety light curtain lengths are listed in [Table 2 on page 22](#). These response times are independent of the inserted plug-in.

Table 2 - Response Times (T_r) for 14 mm and 30 mm Resolution
(xxxx= Protective Height in mm)

Protective Field Height [mm (in.)]	Response Time (T_r) 14 mm Resolution (Cat. No.: 450L-B4FNxxxxYD) [ms]	Response Time (T_r) 30 mm Resolution (Cat. No.: 450L-B4HNxxxxYD) [ms]
150 (5.91)	< 15	< 13
300 (11.81)	< 15	< 13
450 (17.72)	< 15	< 13
600 (23.62)	< 15	< 13
750 (29.53)	< 15	< 13
900 (35.43)	< 15	< 13
1050 (41.34)	< 16	< 13
1200 (47.24)	< 17	< 13
1350 (53.15)	< 19	< 13
1500 (59.06)	< 20	< 13
1650 (64.96)	< 22	< 13
1800 (70.87)	< 23	< 14
1950 (76.77)	< 25	< 15

IMPORTANT Determining Stop Time: The stopping time calculation must include the response times of all devices in the stop circuit (see [Determining the Safety Distance on page 30](#)). Not including all device and control system elements when calculating the stopping time results in an inaccurate safety distance calculation.

The 450L-B GuardShield response time (T_r) is also printed on the product label.

System Configuration

System configuration can be performed by setting the DIP switches at the receiver plug-in. First set the DIP switches and then mount the light curtain and perform the electrical connections.

[Table 3](#) shows the following:

- Which plug-ins are available
- Which functionality can be selected with the receiver plug-in

Table 3 - Plug-ins Available for 450L-B GuardShield

Description/ Cat. No.	Transmitter Plug-in		Receiver Plug-in		Universal Plug-in
	5-pin/ 450L-APT-PW5	8-pin ¹ / 450L-APT-PW8	ON/OFF 5-pin/ 450L-APR-ON-5	EDM 8-pin/ 450L-APR-ED-8	8-pin/ 450L-APU-UN-8
Number of connection pins	5	5	5	8	8
Number of DIP switches	0	0	4	8	12
Low range activation (see “Low Operation Range” section on page 21)	N/A	N/A	X	X	X
Start Mode selection (see Start Modes section on page 19)	N/A	N/A	N/A	X	X
EDM (see “Relay Monitoring” on page 21)	N/A	N/A	N/A	X	X
Transmitter and receiver functionality	N/A	N/A	N/A	N/A	X

1 The eight-pin M12 for the transmitter is simply for the convenience of specifying two eight-conductor cordsets for the system.

The universal plug-in can be set to perform as an emitter or receiver. If pins four and eight of the connectors are short circuited at power-up, the stick behaves like a transmitter. In this case, the DIP switches have no functionality. If pin four and pin eight of the plug-in are not short circuited at power-up, the corresponding stick behaves like a receiver. In this case, the DIP switches have the same functionality as the 450L-APR-ED-8 receiver plug-in.

Transmitter Plug-in DIP Switch Settings

The transmitter plug-ins have no DIP switch setting possibilities.

Receiver Plug-in DIP Switch Settings

Identify and set the appropriate DIP switches for the configuration desired. DIP switch identification (Figure 8) and function are explained in Table 4 and Table 5 on page 24.

**Figure 8 - DIP Switch Location at Receiver Plug-in
(Number of DIP Switches Varies Depending on Plug-in Type)**



When delivered from the factory, the following default settings are configured in the receiver plug-ins.

IMPORTANT DIP switches must be switched to OFF if no “Switch Function” is defined. Otherwise, a lockout condition occurs.

Table 4 - Function and Default Settings for the M12 Five-pin On/Off Receiver (450L-APR-ON-5) Plug-in

Switch Number	Switch Function	Default	Description
1	—	OFF	—
2	Low Range activation	OFF	OFF: Disabled ON: Enabled
3	—	OFF	—
4	—	OFF	—

Table 5 - Function and Default Settings for the M12 Eight-pin EDM Receiver Plug-in (450L-APR-ED-8)

Switch Number	Switch Function	Default	Description
1	—	OFF	—
2	Low range activation	OFF	OFF: Disabled ON: Enabled
3	—	OFF	—
4	—	OFF	—
5	Combination activates of the following start modes: Automatic start Manual (re) start Manual cold start Manual start with off function	OFF	DIP 5: OFF, DIP 6 OFF: Automatic start (Default)
6		OFF	DIP 5: ON, DIP 6 OFF: Manual (re) start DIP 5: OFF, DIP 6 ON: Manual cold start DIP 5: ON, DIP 6 ON: Manual start with off function
7	External Device Monitoring	OFF	OFF: Disabled ON: Enabled
8	—	OFF	—

Universal Plug-in DIP Switch Settings

Table 6 - Function and Default Settings for the M12 Eight-pin UNIV Plug-in (450L-APR-UN-8) Without Pin Four and Pin Eight Short Circuited (Receiver-mode)

Switch Number	Switch Function	Default	Description
1	—	OFF	—
2	Low range activation	OFF	OFF: Disabled ON: Enabled
3	—	OFF	—
4	—	OFF	—
5	Combination activates one of the following start modes: Automatic start Manual (re) start Manual cold start Manual start with off function	OFF	DIP 5: OFF, DIP 6 OFF: Automatic start (Default) DIP 5: ON, DIP 6 OFF: Manual (re) start
6		OFF	DIP 5: OFF, DIP 6 ON: Manual cold start DIP 5: ON, DIP 6 ON: Manual start with off function
7	External device monitoring	OFF	OFF: Disabled ON: Enabled
8	—	OFF	—
9	—	OFF	—
10	—	OFF	—
11	—	OFF	—
12	—	OFF	—

For the UNIV plug-in, if pin four and pin eight are short circuited (transmitter mode), the DIP switch settings have no impact on the transmitter functionality.

After installing the plug-in on the 450L-B GuardShield transmitter stick and power-up, a configuration confirmation can be performed (signaled by the red/green blinking of the STS status indicator). The confirmation of the configuration can be performed without receiver and transmitter aligned.

IMPORTANT After each reconfiguration of a 450L-B GuardShield, test the system for proper configuration and operation before placing the guarded machine in operation.



ATTENTION: Every modification of the DIP switches must be confirmed with a configuration confirmation procedure after the first powerup (see [Confirmation of a New System Configuration on page 26](#)).

Confirmation of a New System Configuration

IMPORTANT The confirmation procedure isn't required when the receiver stick is operated the first time (brand new receiver). The STS status indicator flashes red/green when a confirmation is required.

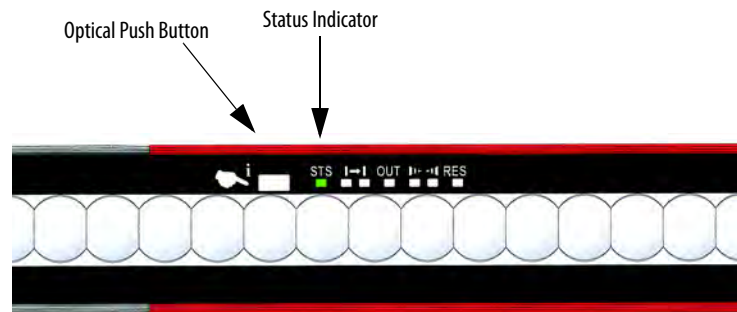
Confirmation of a system configuration needs only be performed when the receiver stick was previously operated with another configuration or when the receiver stick was previously operated with another transmitter.

If the receiver plug-in is exchanged with a new plug-in with the same plug-in type and DIP switch settings as the original one, no confirmation procedure is required. Also, no configuration confirmation procedure is required for GuardShield 450L-B transceiver sticks out-of-the-box.

Perform a confirmation procedure of a new configuration when you reinsert the plug-in to the light curtain stick with a changed DIP switch setting. The request for such a confirmation is displayed via a 1 Hz red/green blinking STS status indicator (Figure 9).

This process has to be performed only once, after the first powerup of a plug-in with new settings. It is not required at any following powerup (only when DIP switches are changed again).

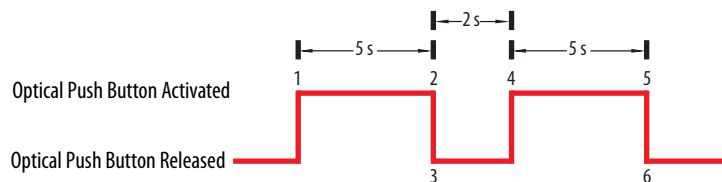
Figure 9 - Position of Optical Push Button and Status Indicator



Confirmation Procedure

The optical push button (Figure 9) has to be activated two times for five seconds (Figure 10). Between the two activations, a break of a maximum of two seconds is allowed.

Figure 10 - Configuration Process



Description 1:

Time borders 1...6 are indicated with changed blink frequency or changed blinking color of the status indicator (STS). By pressing a finger on the optical push button (first activation), the STS-indicator changes the green/red blinking frequency from 1...10 Hz (1). The button must now be pressed a minimum of five seconds. A color change: green/red to green/off (2) indicates the end of five seconds. Now the optical push button has to be released. A changed frequency (3) indicates the release. The optical push button has to be actuated again within two seconds. The second actuation has to be for approximately five seconds again (the status indicator STS indicates the actuation with 10 Hz green/red (4). The actuation must be at least five seconds. After approximately five seconds, the teach-in must be released within two seconds. The end of the five seconds is indicated with a changed color (5). As soon as the optical push button is deactivated, the status indicator STS shines continuously (6).

Description 2:

1. The status indicator STS blinks green/red (1 Hz, one time red, and one time green per second, 50:50 duty cycle) which indicates that the stick is in the configuration mode.
2. Actuate optical push button for five seconds ([Figure 10 on page 26](#)).
3. STS blinks green/red to indicate actuation with a frequency of 10 Hz and 50:50 duty cycle.
4. As soon as status indicator STS changes from green/red to green/off, release the optical push button.
5. Release is indicated with a change of frequency of 10...1 Hz (status indicator STS green/off and a 50:50 duty cycle).
6. Within two seconds, actuate the optical push button.
7. Status indicator STS indicates the activation by a new green/red frequency of 10 Hz and a 50% duty cycle.
8. Actuate the optical push button for five seconds.
9. As soon as the status indicator changes from green/red blinking to green/off blinking, release.
10. After releasing, the status indicator STS will be solid green.

If any error occurs in this procedure, a new configuration is not stored and the STS-indicator starts blinking again (1 Hz, green/red, and 50:50 duty cycle). For example:

- If the actuator is released before the five seconds
- Or it's not actuated within the two seconds thereafter

IMPORTANT If the configuration confirmation procedure is not properly completed, the unit remains in the configuration confirmation request mode (1 Hz blinks red/green for STS status indicator).

Once the configuration confirmation procedure is completed, verify that the operating mode has changed to the intended configuration.

Installation and Wiring



ATTENTION: The 450L-B GuardShield™ light curtain must not be used with machines that cannot be stopped electrically in an emergency.

The required safety distance (see [Determining the Safety Distance on page 30](#)) between the 450L-B GuardShield light curtain and a dangerous machine movement always has to be maintained.

Additional mechanical protective devices have to be installed if hazardous machine elements can be reached without passing through the protective field. Improper installation can result in serious injury.

Never connect the safety outputs (OSSDs) to +24V DC. If the safety outputs are connected to +24V DC, they are in the ON-state and cannot stop hazardous machine/application movements.

Never expose the 450L-B GuardShield to flammable or explosive gases. Do not install 450L GuardShield light curtain for outdoor or underwater applications without additional measures.

Regular safety inspections are imperative (see maintenance).

Do not open or attempt to repair or modify the 450L-B GuardShield. Removal of either of the gray GuardShield end caps or the transparent front window voids the warranty terms of this product.

IMPORTANT Do not insert or remove plug-ins when power is applied to the plug-in.

The GuardShield safety light curtain must be used only as defined in the [Range of Use on page 18](#).

If the device is used for any other purposes or modified in any way, warranty claims against Rockwell Automation® become null and void.

Installation must be in accordance with the present manual and implemented by qualified personnel exclusively.

A 450L-B GuardShield safety light curtain system is intended to be part of the safety-related control system of a machine. Before installation, a thorough risk assessment has to be performed to determine whether the specifications of this device are suitable for all foreseeable operational and environmental characteristics of the application.

See [page 73](#) for certification information and ratings. The requirements that are defined in this appendix, for example, power supply, cables, and ambient conditions, must be observed and maintained to allow the safety function.

Use appropriate screws, bolts, and/or nuts to mount the sticks and plug-ins to avoid damage.

Do not over-torque the mounting hardware:

- The required screwdriver type for installation of the plug-ins is a Phillips tip screwdriver for M2 x 8 Phillips screw. For maximum torque: 0.38 N•m (3.36 lb•in).
- The required screwdriver type for installation of the standard top/bottom mounting kit is a Phillips tip screwdriver for M3 x 10 Phillips DIN 965 A screw. For maximum torque: 0.7 N•m (6.19 lb•in).



ATTENTION: Overtightening damages the light curtain.

IMPORTANT The plug-in mounting screws are captive.

Only use the designated mounting holes of the mounting bracket.

Use only fixed, stable, and sturdy mounting posts or frames to mount a 450L-B GuardShield safety light curtain system.

Determining the Safety Distance

The light curtain must be mounted with proper safety distance:

- From the point of danger
- From reflective surfaces

To help prevent a person from reaching through the protective field to a dangerous area (while the machine is still moving), both points must be considered in an installation.

The calculation of point one varies depending on the region (country) where it is finally operated.

US Safety Distance Formula

This distance, referred to as the safety distance, must be properly calculated before determining the safety light-curtain protective height and mounting the light curtains on the machine. Failure to calculate this safety distance properly can result in operator injury.



ATTENTION: The GuardShield safety light curtains must be mounted at a sufficient distance from the pinch point or point of operation hazard. This distance helps ensure that the machine stops before a finger, hand, arms, or body reach the hazard.

Regardless of the calculated safety distance, the protective field of a GuardShield safety light curtain is never mounted closer than six inches from the point of operation to the pinch point hazard.

In the United States, two formulas are commonly used to calculate the safety distance.

- The OSHA formula is the minimum requirement for the calculation of the safety distance.
- The ANSI formula, the formula we recommend, incorporates additional factors to be considered when calculating the safety distance.

OSHA Safety Distance Calculation Formula

The OSHA safety distance formula as specified in CFR29 Subpart O1910.217 is as follows:

$$D_s = 63 \times T$$

D_s Safety Distance in inches (1 in. = 25.4 mm)

63 Is the OSHA recommended hand in speed constant inches per second (63 in./sec = 1600 mm/sec)

T Is the total stop time of all devices in the safety circuit, which is measured in seconds. This value must include all components that are involved to stop the hazardous motion of the machinery. For a mechanical power press, it is the stopping time that is measured at approximately the 90° position of the crankshaft rotation.

IMPORTANT The T number must include the response times of all devices, including the response time of the safety light curtain, the safety light curtain controller (if used), the machine control circuit, and any other devices that react to stop the hazardous motion of the machinery. Not including the response time of a device or devices in the stop time calculation results in insufficient safety distance for the application, which results in operator injury.

The ANSI Safety Distance Formula

The ANSI B11.19 safety distance formula, which is the Rockwell Automation® recommended formula for USA, is as follows:

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

D_s Minimum safety distance between the safe guarding device and the nearest point of operation hazard (in inches).

K Hand-speed constant in inches per second. The ANSI standard value is 63 inches per second when the operator begins reaching toward the point of operation hazard from rest.

IMPORTANT ANSI B11.19 1990 E4.2.3.3.5 states “The value of the hand-speed constant, K , is determined in various studies. Although these studies indicate speeds of 63 inches/second to over 100 inches/second, they are not conclusive. The employer can consider all factors, including the physical ability of the operator, when determining the value of K to be used.”

T_s Stop time of the machine tool that is measured at the final control element.

T_c Response time of the control system

T_r Response time of the presence sensing device (safety light curtain) and its interface, if any. The device manufacturer states this value or you can measure it.

IMPORTANT A stop time device is used to measure “ $T_s + T_c + T_r$.”

T_{bm} Additional time that is allowed for the brake monitor to compensate for variations in normal stop time.

D_{pf} Depth penetration factor. It is an added distance to allow for how far into the protective field an object, such as a finger or hand, can travel before being detected. D_{pf} is related to the safety light-curtain object sensitivity. Object sensitivity is the smallest diameter object that is detected anywhere in the sensing field (commonly also known as resolution).

Example for D_{pf} :

The D_{pf} can be approximated in a perpendicular safety-light curtain application with object sensitivity (effective resolution) less than 63.5 mm (2.5 in.):

$$D_{pf} \text{ (inches)} = 3.4 \times (\text{Object Sensitivity [inch]} - 0.276 \text{ [inch]}), \text{ but Not less than 0.}$$

Table 7 - Depth of Penetration Factor

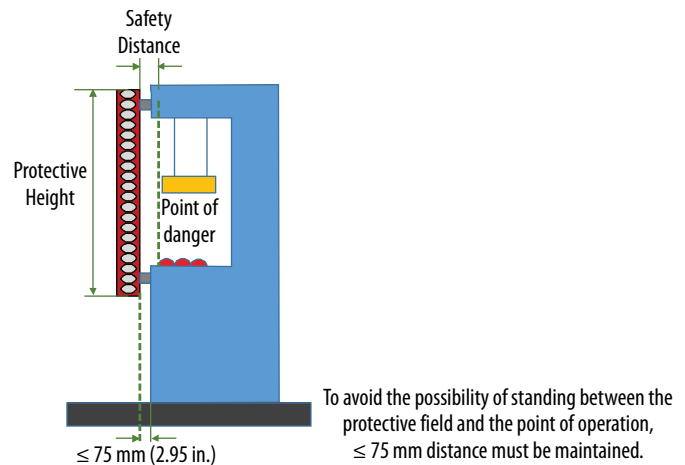
Description	Depth Penetration Factor
Finger resolution (14 mm = 0.551 in.)	23.7 mm (0.935 in.)
Hand resolution (30 mm = 1.181 in.)	78.1 mm (3.077 in.)

European Safety Distance Formula

A safety distance must be maintained between the light curtain and the point of danger (Figure 11), as described in IEC/TS 62046. This safety distance helps ensure that the point of danger can only be reached after the dangerous state of the machine has been removed.

The safety distance as defined in EN ISO 13855 and EN ISO 13857 depends on:

- Machine stop time
- Response time of the protective device (safety light curtain + control circuit)
- Resolution of the safety light curtain
- Approach speed to the danger point
- Position of the AOPD

Figure 11 - Safety Distance from the Point of Danger to the Light Curtain

How to calculate the Safety Distance (S) according to EN ISO 13855 and EN ISO 13857:

- First, calculate S use the following formula:

$$S = 2 \text{ [mm/ms]} \times T + 8 \times (d - 14) \text{ [mm]}$$

Where:

T = Stopping/run-down time of the machine [ms] + response time of the safety light curtain [ms] + response time of the control circuit [ms]

d = Resolution of the light curtain [mm]

S = Safety distance [mm]

The reach/approach speed is already included in the formula.

- If the result S is ≤ 500 mm (19.6 in.), then use the determined value as the safety distance.
- If the result S is > 500 mm (19.6 in.), then recalculate S as follows:

$$S = 1600 \times T + 8 \times (d - 14) \text{ [mm]}$$

- If the new value S is > 500 mm (19.6 in.), then use the newly determined value as the minimum safety distance.
- If the new value S is ≤ 500 mm (19.6 in.), then use 500 mm (19.6 in.) as the safety distance.

Example:

Stopping/run-down time of the machine = 290 ms

Response time safety-light curtain = 20 ms

Response time of the control circuit = 10 [ms]

$$T = 290 \text{ [ms]} + 20 \text{ [ms]} + 10 \text{ [ms]} = 320 \text{ [ms]}$$

Resolution of the light curtain = 14 mm (0.55 in.)

$$S = 2 \times 320 + 8 \times (14 - 14) = 640 \text{ mm (25.1 in.) } S > 500 \text{ mm, therefore:}$$

$$S = 1.6 \times 320 + 8 \times (14 - 14) = 512 \text{ mm (20.1 in.)}$$

[Figure 11 on page 33](#) also indicates the distance to avoid standing behind the safety light curtain. If the light curtain is installed more than 75 mm (2.95 in.) from the machine:

- With auto restart
- Where the dangerous area is not visible from the reset button more protective measures must be considered (for example, an additional horizontal installed light curtain).

Minimum Distance from Reflective Surfaces

The infrared light that is transmitted from the two transceivers can be reflected off shiny surfaces. If this condition occurs, it can result in an object not being detected when it enters the GuardShield sensing field.

All reflecting surfaces and objects (for example, material bins) must therefore be at a minimum distance “A” from the protective sensing field of the system. The minimum distance “A” depends on the distance “D” between the two transceivers.

Figure 12 - Minimum Distance “A” from Reflective Surfaces (Top View)

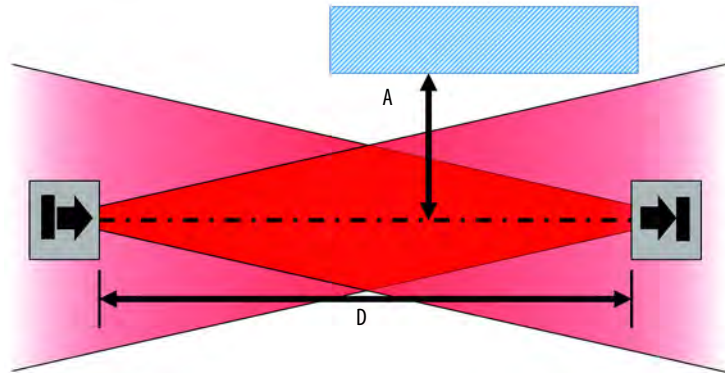
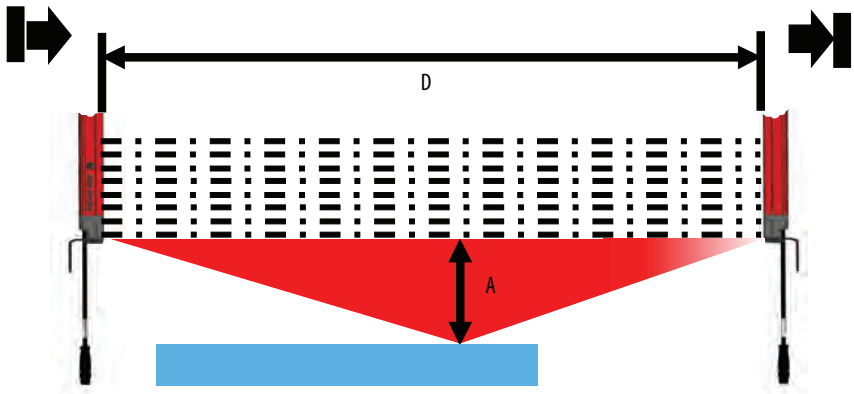


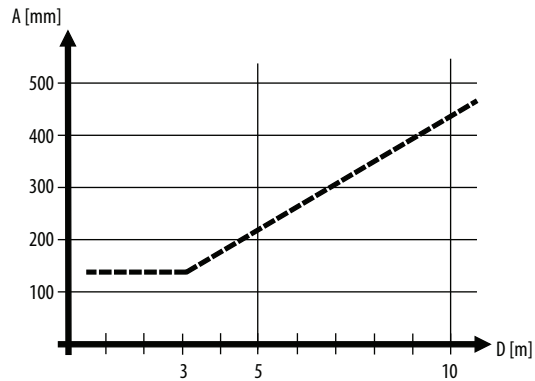
Figure 13 - Minimum Distance “A” from Reflective Surfaces (Side View)



The minimum distance from the reflective surfaces can be determined as follows:

- Determine the distance “D” [m] between transmitter and receiver
- Read the minimum distance “A” [mm] from the graph:

Figure 14 - Graph, Minimum Distance "A" from Reflective Surfaces (D= Distance Between Receiver and Transmitter)



The effective aperture angle for the 450L-B GuardShield system is $\pm 2.5^\circ$ at a mounting distance of ≥ 3.0 m (9.8 ft). Calculate the minimum distance to reflective surfaces depending on the distance between the transmitter and the receiver, with an aperture angle of 2.5°

Note: Formula: $A \text{ [mm]} = \tan 2.5^\circ \times D = 43.7 \times D \text{ [m]}$

A = Minimum distance to reflective surfaces

D = Distance between transmitter and receiver

Or take the appropriate value from Table 10.

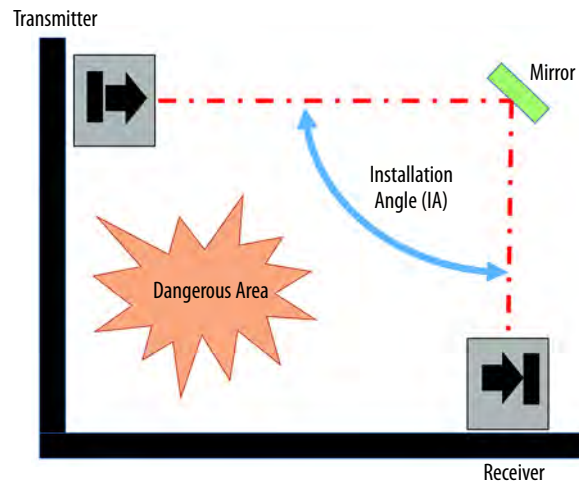
Table 8 - Minimum Distance "A" for Various Distances "D" Between Transmitter and Receiver

Distance between Transmitter and Receiver [m (ft)](Range D) [m (ft)]	Minimum Distance "A" [mm (in.)]
0.3...3.0 (0.98...9.8)	135 (5.31)
4.0 (13.1)	175 (6.88)
5.0 (16.4)	220 (8.66)
6.0 (19.6)	265 (10.43)
7.0 (22.9)	310 (12.2)
10.0 (32.8)	440 (17.32)

Mirrors

The 450L-B GuardShield safety light curtains can be used with corner mirrors (see [Corner Mirror for Multi-sided Guarding on page 82](#)). Mirrors are only allowed for applications without undetected access into the protected area.

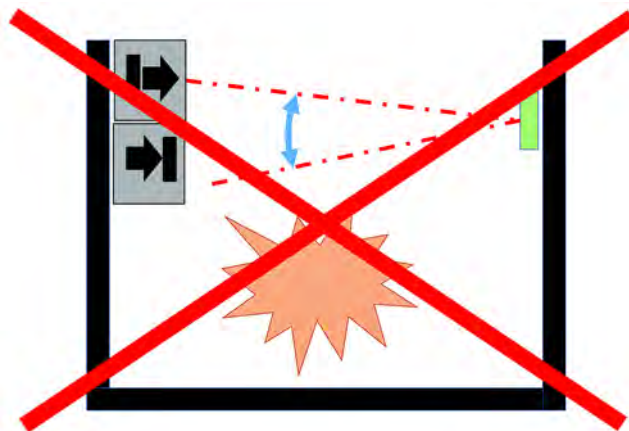
Figure 15 - Installation Angle for Mirrors (View from the Top)



ATTENTION: When using mirrors, all sides of the protective field have to fulfill the requirements for minimum safety distance and minimum distance from the reflective surfaces.

The installation angle (IA) must be between $70^\circ < IA < 110^\circ$ otherwise serious injury or death could result.

Figure 16 - Possible Misuse of a Mirror

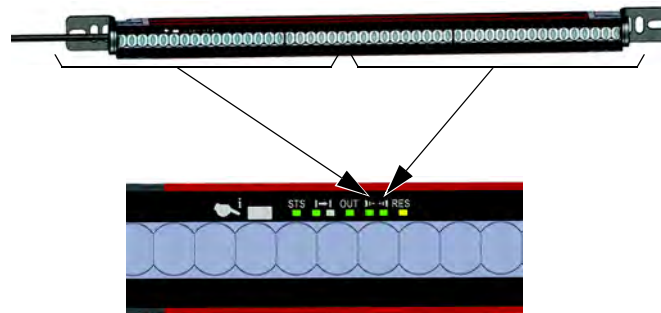


Installation and Mounting

This section describes the preparation, selection, and installation of the 450L-B GuardShield safety light curtain system.

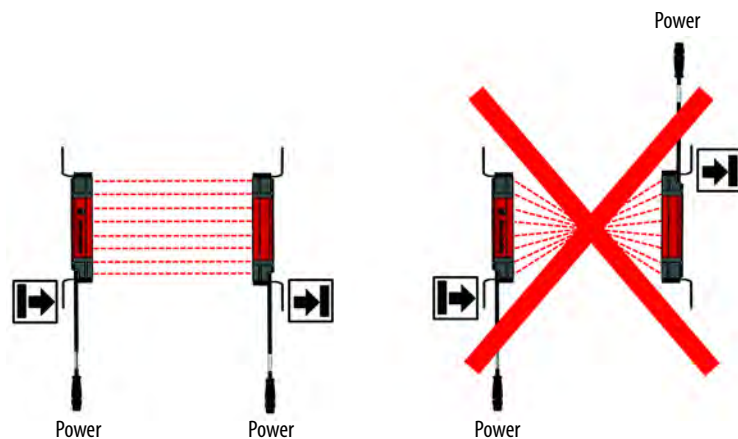
- A 450L-B GuardShield safety light curtain system can be used in all mounting orientations.
- The 450L-B GuardShield has two status indicators in each stick for display intensity ([Figure 17](#)). One status indicator refers to the first half of the protective field, the other status indicator to the second half of the protective field. These status indicators begin to flash green when the infrared light from the transmitter is “seen” by the receiver. The status indicators turn solid green when optimal alignment is attained. These two status indicators can be used as an alignment aid.

Figure 17 - Status Indicators to Display Intensity



- Mount both sticks properly located from the point of operation hazard after performing the safety distance calculation (see [Determining the Safety Distance on page 30](#)).
- Mount both sticks properly located from any reflective surfaces (see [Minimum Distance from Reflective Surfaces on page 35](#)).
- They must be parallel to each other and be positioned at the same height. The transmitter and receiver connection plug-in locations must point in the same direction ([Figure 18](#)).

Figure 18 - Correct Positioning and Incorrect Positioning of Transmitter and Receiver Sticks



- The optical lens system of transmitter and receiver stick must be located in exact opposition to each other.
- Take suitable measures to attenuate vibration.
- The safety light curtain must be mounted such that the hazardous point cannot be reached from below, above, or behind the safety light curtain and that the light curtain cannot be repositioned (see [Correct Installation on page 40](#) and [Incorrect Installation on page 41](#)).
- Connect both sticks.
- Turn on power to the 450L-B GuardShield system.
- If the STS status indicator at the receiver stick displays a configuration change, confirmation is required to proceed with [Confirmation of a New System Configuration on page 26](#).
- Rotate the transmitter and receiver sticks while watching the two status indicators on the sticks. Find the point where the two indicators for the intensity state illuminate to a solid green condition.
- Determine the maximum left and right adjustment angles and position each unit in the center. Tighten all hardware until the alignment (intensity) indicators are not blinking.
- Cycle power to assure that the system powers up, goes to the ON state (STS status indicator solid green) and the intensity status indicators indicate solid green.

An external laser alignment tool (440L-ALAT) and a dedicated mounting bracket (450L-ALAT-C) are offered as accessories (see [Alignment Tool and Bracket on page 86](#)). Use these items for aligning the 450L-B GuardShield for larger operation distances or when corner mirrors are used in the application.

IMPORTANT If EDM or manual start functions are configured through DIP switch settings, assure that the proper receiver wire connections are made.

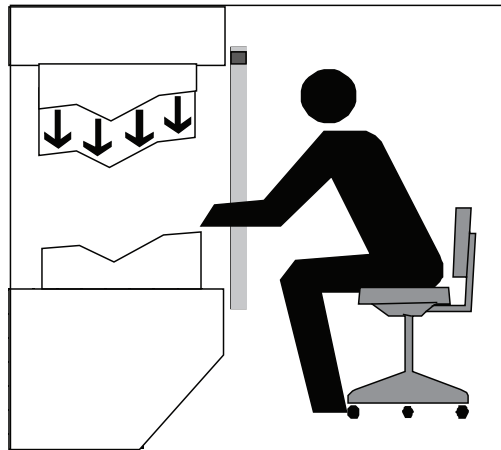
The minimum operating distance must always be followed (see [Table 23 on page 65](#)). Stable operation cannot be guaranteed when operating under this specified value. When the transmitter and the receiver stick are positioned closer than specified, it results in an interruption of the protective field and switches off the two OSSDs.

IMPORTANT Rockwell Automation recommends that you only use the mounting brackets that we offer.

Take appropriate measures to dampen vibration if the vibration and shock requirements are above the values and test conditions that are specified in the attachment.

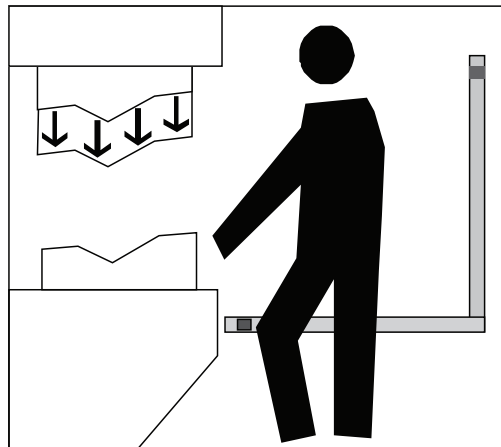
Correct Installation

Figure 19 - Operators Cannot Reach Hazardous Machine Parts without Passing Through the Protective Field



ATTENTION: The installation of the GuardShield safety light curtain must be such that access to the hazard is only possible through the sensing field of the GuardShield. Auxiliary safe guarding can be required with the GuardShield to meet this requirement.

Figure 20 - Operators Must Not Step between Protective Field and Hazardous Machine Parts (Pass Through Prevention)



Incorrect Installation

Figure 21 - Operators Can Reach Hazardous Machine Parts without Passing Through the Protective Field

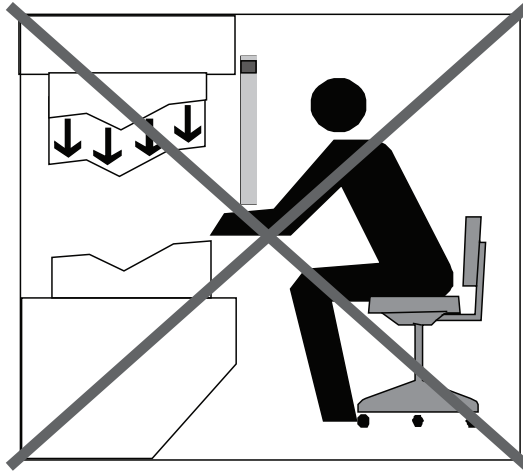
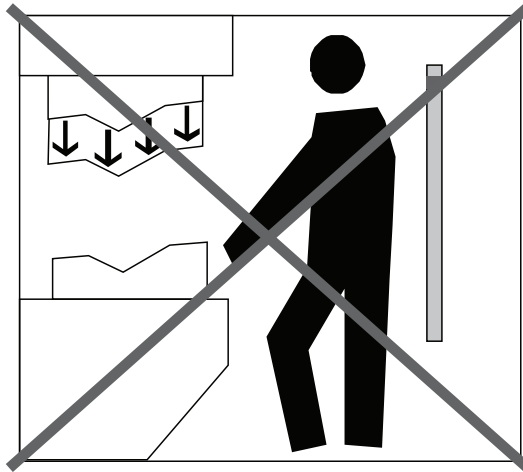
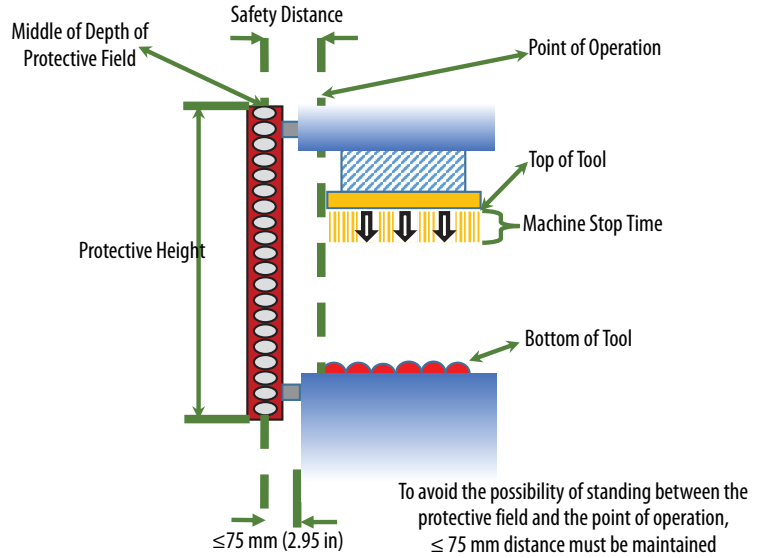


Figure 22 - Operators Can Step between Protective Field and Hazardous Machine Parts



The 450L-B GuardShield must be mounted at the proper distance from the point of operation hazard. This distance is referred to as the safety distance. If the safety distance calculation is such that a person can step between a vertically mounted safety light curtain and the machine hazard, more protective measures are required.

Figure 23 - Terms to Help Define Safety Distance to Avoid the Possibility of Standing between the Protective Field and the Point of Operation a Distance of ≤ 75 mm Must Be Maintained

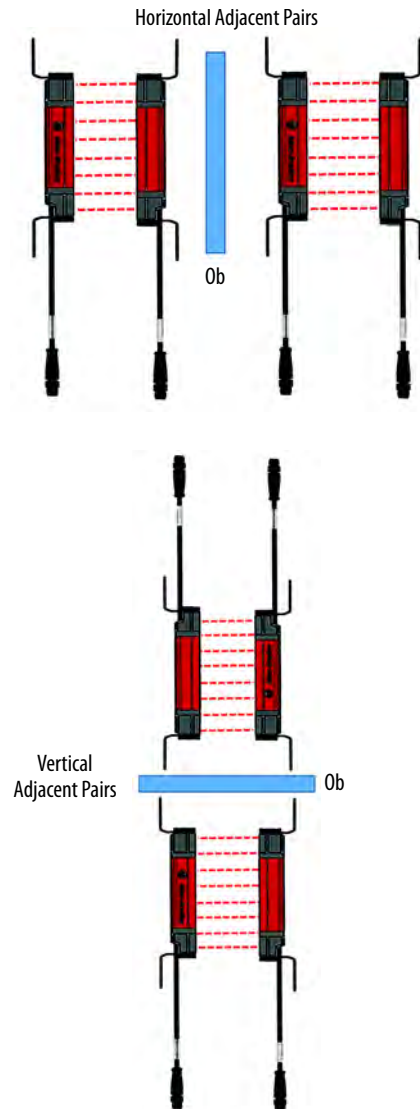


Multiple 450L-B GuardShield

When two or more 450L-B GuardShield pairs are mounted closely, it is possible for the receiver of one pair to “see” infrared light from the transmitter of another pair. Optical interference between neighbored 450L-B GuardShield systems can affect the reliability.

- Check if the maximum operation range can be reduced (see [Low Operation Range on page 21](#)).
- Install mechanical barriers to help prevent this type of optical interference ([Figure 23 on page 42](#)).

**Figure 24 - Optical Barriers (ob) Are Required for Adjacent Light Curtains
450L-B GuardShield Installations**



The transceiver architecture of 450L-B safety light curtains does not allow a "back-to-back" installation of adjacent transmitters as is common with safety light curtain systems with a pure transmitter and receiver architecture. Depending on the installed distance, the reduced operating functionality (see [Low Operation Range on page 21](#)) instead of an optical barrier can be used to prevent optical interference of adjacent 450L-B systems.

Mounting Brackets

Standard Top/Bottom Mounting Kit

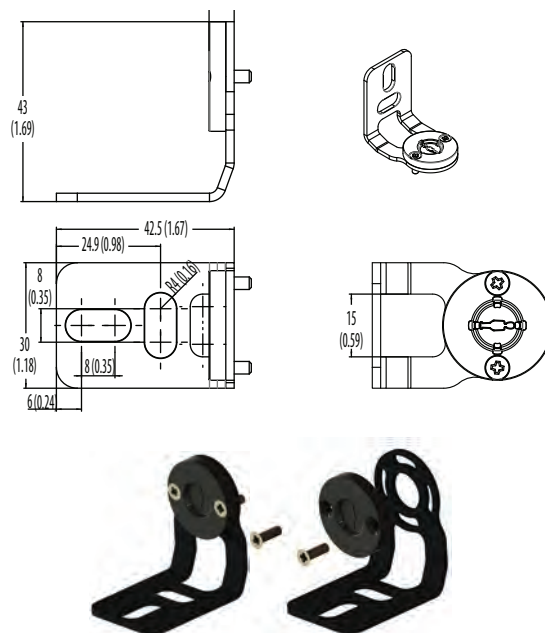
The 450L-B GuardShield can be mounted using right angle brackets that are attached to the end caps of both the transmitter and receiver sticks. A pair of end cap mounting brackets are supplied with each stick.

The required screwdriver type for installation of the standard top/bottom mounting kit is a Phillips screwdriver for M3 x 10 Phillips DIN 965 A screw. The maximum torque cannot be above 0.7 Nm otherwise the light curtain could become damaged.

The top/bottom mounting kit allows a rotation of $\pm 20\%$ of the 450L-B GuardShield aluminum profile.

The length of the transceiver stick and the vibration and shock conditions of the application often require use of additional side mounting brackets.

Figure 25 - Standard Mounting Bracket Kit, Which Is Supplied with Each Stick (Cat. No. 450L-AM-TBM: Contains Two Brackets for One Stick)



Two M6 DIN 912 screws (not provided) are required for proper mounting of each stick.

Photos that are shown in [Figure 26](#) present different cable guide options. The bending radius of the cable is small enough so that the cable can be guided in a 90° angle. The minimum bending radius is specified in [Specifications on page 73](#).

Figure 26 - Connection Cable Guide Options

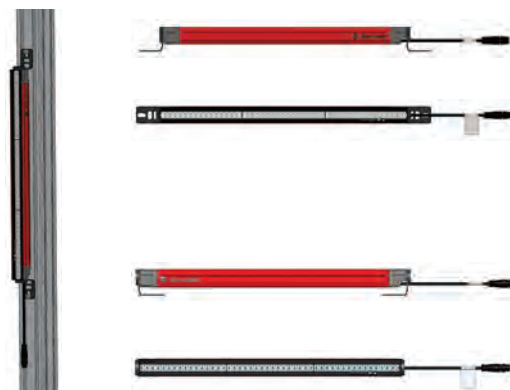


[Figure 27](#) and [Figure 28](#) show possible mounting when attaching to extruded aluminum profiles.

Figure 27 - 450L-B GuardShield Mounted Sideways on an Extruded Aluminum Profile Using the Standard Top/Bottom Mounting Bracket



Figure 28 - 450L-B GuardShield Mounted Backwards on an Extruded Aluminum Profile Using the Standard Top/Bottom Mounting Bracket



Side Mounting Bracket

The side mounting clamp allows a rotation of the snapped in 450L-B GuardShield profile of $\pm 5^\circ$.

Figure 29 - Dimensions of the Side Mounting Bracket 450L-AM-SM (Contains Two Brackets)

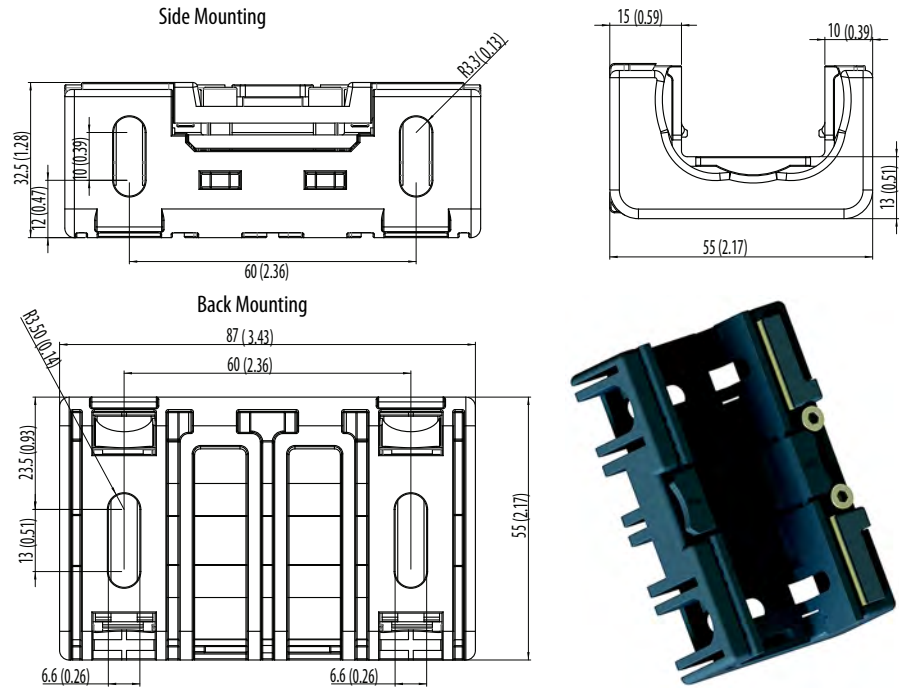
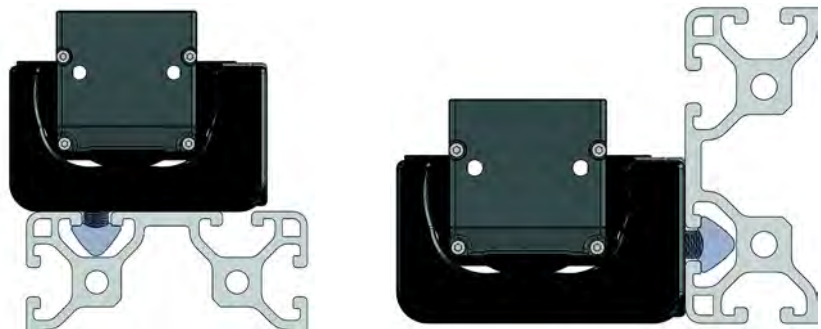


Figure 30 - 450L-B GuardShield Snapped in a Side Mounting Kit



Figure 31 - 450L-B GuardShield Mounted on an Extruded Aluminum Profile Using Side-mounting Bracket Kit (450L-AM-SM: Contains Two Brackets)



Two M6 DIN 912 screws (not provided) are required (minimum) for proper mounting of each clamp.

IMPORTANT Use side mounting brackets and, or instead of, the top/bottom mounting kits in vibration applications.

Use additional side mounting brackets in vibration applications for protective heights of 1050 mm (41.3 in.) and larger.

Table 9 - Number of Side Mounting Brackets without Top/Bottom Brackets

Stick Length	Number of Side Mounting Brackets Per Stick
150 mm (5.9 in.)	1
300...900 mm (11.8...35.43 in.)	2
1050...1950 mm (41.34...76.77 in.)	2 (3 for vibration applications)

Table 10 - Number of Side Mounting Brackets and Top/Bottom Brackets

Stick Length	Number of Side Mounting Brackets Per Stick
150...900 mm (5.9...35.43 in.)	0
1050...1950 mm (41.34...76.77 in.)	1 for vibration applications

The required screwdriver type for installation of the side mounting kit is a hex tip screwdriver for M6 screws.



WARNING: The light curtain can be damaged if the maximum torque is above 11 N•m.

Do not clamp the gray plastic end cap ([Figure 32](#)).

Figure 32 - Correct and Incorrect Positioning of the Side Mounting Bracket

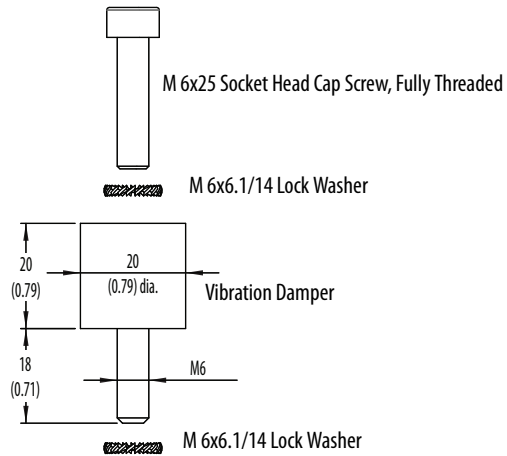


The side mounting brackets should be positioned close to the gray end cap. Additional brackets should be positioned so that the distance between each bracket is equal (symmetric). The optical interface device 450L-AD-OID (see [Optical Interface Device \(OID\) on page 66](#)) can also be installed in combination with the side mounting brackets.

Shock Mounting Kit

Special shock mount brackets are offered for applications that exhibit shock and vibration. For vertical installations, the vibration damper (445L-AF6142) can be used in combination with the standard L-shaped top/bottom mounting bracket and side mounting.

Figure 33 - Shock Mount Brackets 445L-AF6142



Electrical Installation



ATTENTION: Remove power from the entire machine/system line.

The machine system could inadvertently start up while you are connecting the devices.



ATTENTION: Make sure the entire system is disconnected during the electrical installation.

Plug-ins

To assemble a 450L-B GuardShield safety light curtain system two 450L-B GuardShield sticks—one transmitter and one receiver plug-in—are required. Instead of one transmitter and one receiver plug-in, two universal plug-ins can be used. Unpack the plug-ins and set the DIP switches according to the required functional settings. Remove the red slot cover from the 450L-B GuardShield stick and insert plug-in.

IMPORTANT Maximum number of mating cycles: 50. Do not insert a plug-in more than 100 times in a 450L-B GuardShield stick.



ATTENTION: To avoid pollution or contamination, the installation of a plug-in into a stick must be implemented in a dry and clean area. Make sure that the rubber seal at the plug-in does not get out of place when the plug-in is inserted in the light curtain.

**Table 11 - Pin Assignment of the Transmitter 5-pin Plug-in (Male M12 5-pin),
Cat. No.: 450L-APT-PW-5**

Transmitter Bottom Plug-in Face View of Male M12 5-pin (DC Micro)	View	Pin Number	Signal Transmitter
		1	24V DC
		2	Do not connect
		3	0V (Ground)
		4	Do not connect
		5	Earth PE

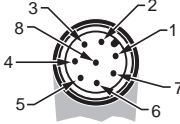

**Table 12 - Pin Assignment of the Transmitter 8-pin Plug-in (Male M12 8-pin),
Cat. No.: 450L-APT-PW-8**

Transmitter Bottom Plug-in Face View of Male M12 8-pin (DC Micro)	View	Pin Number	Signal Transmitter
		1	Do not connect
		2	+24V DC
		3	Earth PE
		4	Do not connect
		5	Do not connect
		6	Auxiliary output (lockout stick)
		7	0V (GND)
		8	Do not connect

**Table 13 - Pin Assignment of the Receiver 5-pin Plug-in (Male M12 5-pin),
Cat. No.: 450L-APR-ON-5**

Receiver Bottom Plug-in Face View of Male M12 5-pin (DC Micro)	View	Pin Number	Signal Receiver
		1	+24V DC
		2	OSSD1
		3	0V (GND)
		4	OSSD2
		5	Earth PE

**Table 14 - Pin Assignment of the Receiver 8-pin Plug-in (Male M12 8-pin),
Cat. No.: 450L-APR-EDM-8**

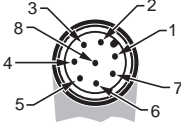
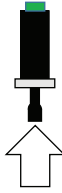
Receiver Bottom Plug-in Face View of Male M12 8-pin (DC Micro)	View	Pin Number	Signal Receiver
		1	Auxiliary output (OSSD emulation)
		2	+24V DC
		3	Earth PE
		4	EDM (Input) ¹
		5	OSSD1
		6	OSSD2
		7	0V (GND)
		8	Start ¹

¹ If set with DIP switches



ATTENTION: The Auxiliary output is only a status output for diagnosis purposes to connect, for example, an indicator lamp. Do not connect this output to fulfill safety functions.

**Table 15 - Pin Assignment of the Universal 8-pin Plug-in (Male M12 8-pin),
(Cat. No. 450L-APU-UN-8)**

Receiver Bottom Plug-in Face View of Male M12 8-pin (DC Micro)	View	Pin Number	Signal Transmitter	Signal Receiver
		1	Do not connect	Auxiliary output (OSSD emulation)
		2	+24V DC	+24V DC
		3	Earth PE	Earth PE
		4	²	EDM input ¹
		5	Do not connect	OSSD1
		6	Auxiliary output (Lockout)	OSSD2
		7	0V (GND)	0V (GND)
		8	²	Start ¹

¹ If set with DIP switches

² Pin 4 connected to pin 8 (short circuited)

IMPORTANT If pin four is connected to pin eight, the corresponding 450L-B GuardShield stick acts like a transmitter.



ATTENTION: The Auxiliary output is only a status output for diagnosis purposes to connect, for example, an indicator lamp. Do not connect this output to fulfill safety functions.

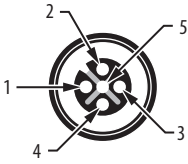
Connection Cables

Transmitter Cable Connection

Depending on the selected plug-in, the GuardShield transmitter plug-in has either a five-pin or eight-pin M12 (DC micro) male connector. Connection cable accessories are offered from 2...30 m (6.6...98 ft) lengths.

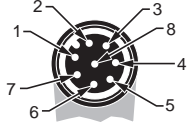
Only the 450L-B GuardShield transmitter with five-pin M12 QD plug-in can be used with ArmorBlock® Guard I/O™ Connectivity.

Table 16 - Pin Assignment of the Cable If Connected to a M12 Five-pin Transmitter Bottom Plug-in (Cat. No. 450L-APT-PW-5)

Transmitter Connection Cable Face View of Female M12 5-pin (DC Micro)	Color (Cable Cat. No.: 889D-F5BC-x) ¹	Pin Number	Signal Transmitter
	Brown	1	24V DC
	White	2	Do not connect
	Blue	3	0V (Ground)
	Black	4	Do not connect
	Gray	5	Earth PE

IMPORTANT The transmitter is not expected to be connected to the ArmorBlock Guard I/O module.

Table 17 - Pin Assignment of the Cable If Connected to a M12 Eight-pin Transmitter Bottom Plug-in (Cat. No. 450L-APT-PW-8)

Transmitter Connection Cable Face View of Female M12 8-pin (DC Micro)	Color (Cable Cat. No.: 889D-F8AB-x) ¹	Pin Number	Signal Transmitter
	White	1	Do not connect
	Brown	2	+24V DC
	Green	3	Earth PE
	Yellow	4	Do not connect
	Gray	5	Do not connect
	Pink	6	Auxiliary output (lockout stick) (24V = normal operation, 0V = lockout stick)
	Blue	7	0V (GND)
	Red	8	Do not connect

¹ Replace x with 2, 5, 10, 15, 20, or 30 for available lengths in meters.

Receiver Cable Connection

Depending on the selected plug-in, the GuardShield receiver plug-in has either a five-pin or eight-pin M12 (DC micro) connector (male). Connection cable accessories are offered from 2 m (6.6 ft) to 30 m (98 ft) lengths.

Table 18 - Pin Assignment of the Cable If Connected to a M12 Five-pin Receiver Plug-in (Cat. No. 450L-APR-ON-5)

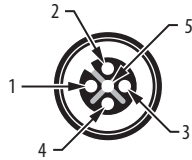
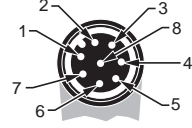
Receiver Connection Cable Face View of Female M12 5-pin (DC Micro)	Color (Cable Cat. No.: 889D-F5BC-x) ¹	Pin Number	Signal Transmitter
	Brown	1	+24V DC
	White	2	OSSD1
	Blue	3	0V (GND)
	Black	4	OSSD2
	Gray	5	Earth PE

Table 19 - Pin Assignment of the Cable If Connected to a M12 Eight-pin Receiver Plug-in (Cat. No. 450L-APR-ED-8)

Receiver Connection Cable Face View of Female M12 8-pin (DC Micro)	Color (Cable Cat. No.: 889D-F8AB-x) ¹	Pin Number	Signal Receiver
	White	1	Auxiliary output (OSSD high = 24V)
	Brown	2	24V DC
	Green	3	Earth PE
	Yellow	4	EDM (Input) ²
	Gray	5	OSSD1
	Pink	6	OSSD2
	Blue	7	0V (GND)
	Red	8	Start ²

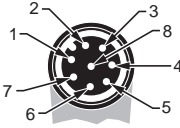
¹ Replace **x** with 2, 5, 10, 15, 20, or 30 for available lengths in meters.

² If set with DIP switches



ATTENTION: The Auxiliary output is only a status output for diagnosis purposes to connect, for example, an indicator lamp. Do not connect this output to fulfill safety functions.

Table 20 - Pin Assignment of the Cable If Connected to a M12 Eight-pin Universal Plug-in; (Depending on Wiring Can Either Be a Transmitter or a Receiver) (Cat. No. 450L-APU-UN-8)

Connection Cable Face View of Female M12 8-pin (DC Micro)	Color (Cable Cat. No.: 889D-F8AB-x) ¹	Pin No.	Signal Transmitter	Signal Receiver
	White	1		Auxiliary output (OSSD high = 24V)
	Brown	2	+24V DC	24V DC
	Green	3	Earth	Earth
	Yellow	4	²	EDM (Input) ³
	Gray	5	Do not connect	OSSD1
	Pink	6	Auxiliary output (lockout stick) (24V = normal operation, 0V = lockout stick)	OSSD2
	Blue	7	0V (GND)	0V (GND)
	Red	8	²	Start ³

¹ Replace x with 2, 5, 10, 15, 20, or 30 for available lengths in meters.

² Pin 4 connected to pin 8 (short circuit).

³ If set with DIP switch.

Power Supply

The external voltage supply (+24V DC) must meet the requirements of IEC 61496-1. Give special attention to the following requirements:

- The power supply must bridge a short-term power failure of 20 ms (according to IEC 60204-1)
- The maximum deviation of the voltage levels is 24V DC \pm 15%.
- The power supply is protected against overload (fuse with 3A in the 24V DC circuit)
- The power supply corresponds to the Low Voltage Directives.
- The 450L-B devices must be provided with a 24V DC PELV or SELV power supply that conforms to the requirements of 414-3 or IEC 60364-4-41. These provisions have been taken to help ensure that, even if an internal fault occurs, the voltage at the outgoing terminals cannot exceed 60V DC.

To comply with UL restrictions, 450L-B GuardShield sticks are powered by DC sources whose secondary circuits are isolated from the primary circuit by double insulation or reinforced insulation. The DC power supply must satisfy the requirements for Class 2.

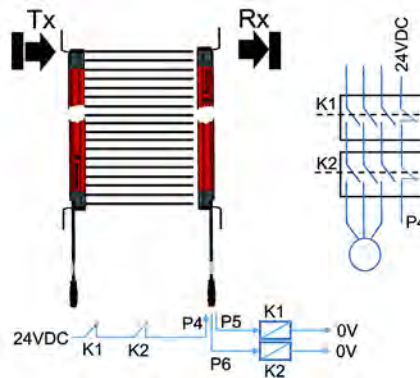
Rockwell Automation® power supplies are SELV and PELV compliant. They also meet the isolation and output hold-off time requirements of two 450L-B GuardShield transceiver sticks (450L-B GuardShield outputs not loaded):

- 2080-PS120-240V AC
- 1606-XLP15E
- 1606-XLP30E
- 1606-XLP50E
- 1606-XLP50EZ
- 1606-XLP72E
- 1606-XLP95E
- 1606-XLDNET4
- 1606-XLSDNET4

External Device Monitoring (EDM) Connection

The [Relay Monitoring \(EDM\) on page 21](#) describes the EDM feature. The EDM function can be performed with the receiver plug-ins: 450L-APR-ED-8 or 450L-APU-UN-8.

Figure 34 - Connecting the Contact Elements to the EDM Input



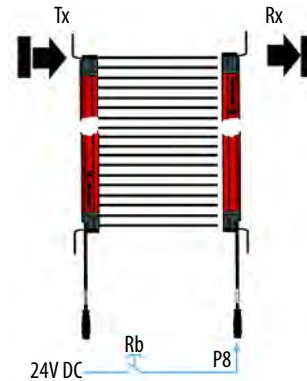
IMPORTANT EDM function is not available for GuardShield with receiver M12 5-pin plug-in (ArmorBlock Guard I/O connectivity).

IMPORTANT Surge suppression elements are often required for the contactors depending on the contactor.

Restart Button

[Start Modes on page 19](#) describes the options for the individual start modes.

Figure 35 - Connecting the Restart Button to Pin 8



The start button must be pressed a minimum of 50 ms. The maximum time for accepting the start is five seconds. The start reacts on the falling edge of the start pulse.

If there is a manual start, the start button must be located outside the hazardous area such that a person working inside the hazardous area cannot operate it. Manual start is not available in GuardShield light curtains with five-pin M12 QD connection plug-ins (ArmorBlock Guard I/O connectivity).

IMPORTANT Start is not available for GuardShield with M12 five-pin plug-in (ArmorBlock, Guard I/O connectivity).

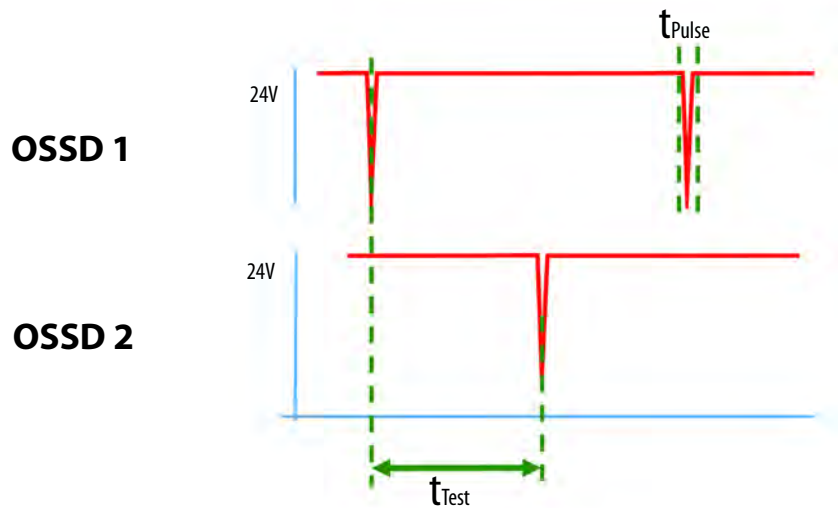
The start button can also be used to reset the system if there is a lockout. The stick performs a manual start if the button is pressed a minimum of 10 seconds and not longer than 20 seconds.

OSSD Output

Test Pulses

The safety outputs of a 450L-B GuardShield safety light curtain system use test pulses to check for OSSD output faults. This process is illustrated graphically as follows.

Figure 36 - OSSD Safety Output Test Pulse Characteristic



T_{test} depends on stick length and resolution (150 mm [5.90 in.]...67 ms; 1950 mm [76.77 in.]...112 ms)

T_{Pulse} depends on load. 0.05 ms is typical for resistive load and longer if a capacitive load is used.

The theoretical maximum time for switching off OSSDs with a capacitive load of 0.5 μF is determined to be 0.37 ms, though in practice it is much shorter.

The test pulses can lead to the connected device being switched off sporadically if the device doesn't filter the test pulses correctly.

OSSD Signal Processing

The dangerous movement of the machine must reach a safe state at any time if at least one of the two OSSDs switches off (0V).

In the application, the signals of both OSSDs must be processed separately. Both signals must always be connected to either a safety controller, safety relay or safety contactors. When safety contactors are used (positively guided contactors), verification of the status of each must be implemented (see [External Device Monitoring \(EDM\) Connection on page 54](#) and [Relay Monitoring \(EDM\) on page 21](#)).

OSSD Restart Time (from off to on)

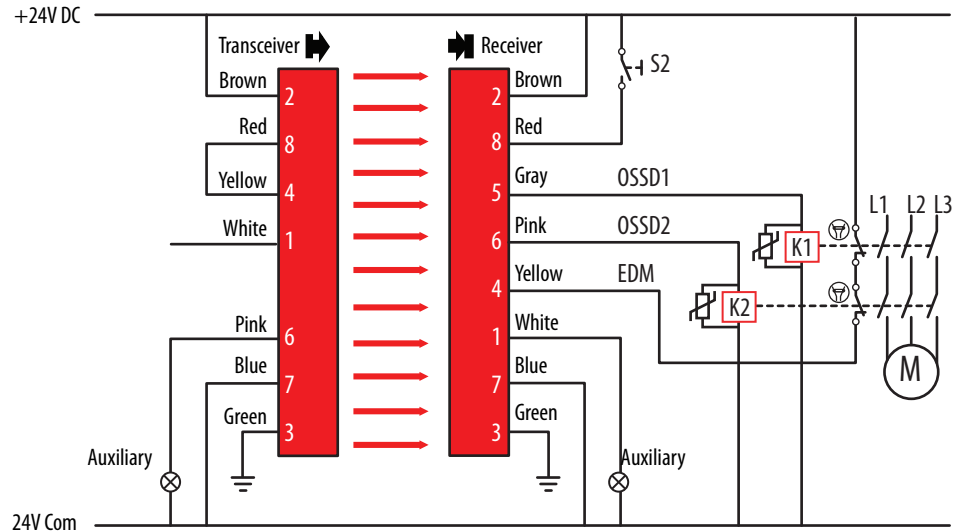
The times that are necessary to switch on the OSSDs after clearance of an interruption of the protective field if automatic reset is as follows.

- Both synchronization beams interrupted before clearance is <210 ms
- Zero or one synchronization beams interrupted before clearance is <33 ms.

Each GuardShield 450L-B system has two synchronization beams: one beam is at the bottom and one beam is at the top of the protective field.

Typical Wiring Diagram**Direct to Contactors**

Figure 37 - Example of Connecting to External Contactors with a 450L-APR-ED-8 Plug-in for the Receiver and a 450L-APT-PW-8 Plug-in for the Transmitter



S2=manual restart; K1/K2 = safety contactors (Rockwell Automation® Bulletin 100S-C contactors with electronic coils). For nonmotor loads, K1/K2 can be Rockwell Automation Bulletin 700S-CF control relays with electronic coils).

IMPORTANT EDM must be activated in the 450L-B GuardShield and the application requires safety contactors (K1 & K2). EDM feedback is only available on eight-pin plug-ins.

The use of some type of surge suppression to help protect and extend the operating life of the OSSD outputs is required. The potentially high current surges that are created when switching inductive load devices, such as motor starters and solenoids, requires this extra protection. By adding a suppression device directly across the coil of an inductive device, you prolong the life of the outputs. You also reduce the effects of voltage transients and electrical noise from radiating into adjacent systems.

Figure 37 on page 57 shows an output with a suppression device. We recommend that you locate the suppression device as close as possible to the load device. Since the outputs are 24V DC, we recommend 1N4001 (50V reverse voltage) to 1N4007 (1000V reverse voltage) diodes for surge suppression for the OSSD safety outputs. The diode is connected as close as possible to the load coil.



ATTENTION: The response time of the safety contactors often increases drastically, when surge suppression diodes are used.

Never install suppressors directly across:

- The OSSD outputs or
- Contacts of the safety device or module.

A short circuit fail of a surge suppressor element leads to an unsafe condition and causes serious injury or death.

GSR SI Safety Relay Module

Figure 38 - Example of Connecting to a 450L-B GuardShield System with a 5-pin Transmitter and 5-pin Receiver Plug in to a GSR SI (Cat. No.: 440R-S12R2) Safety Relay

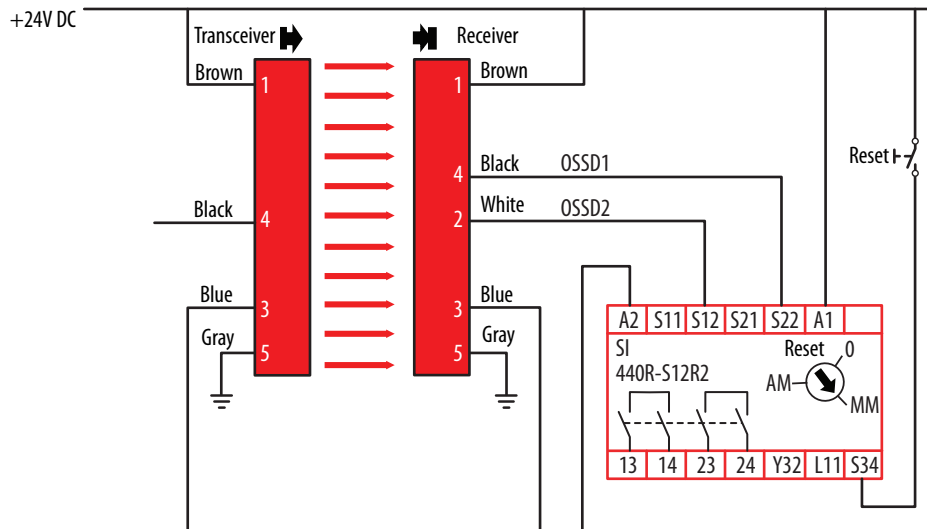
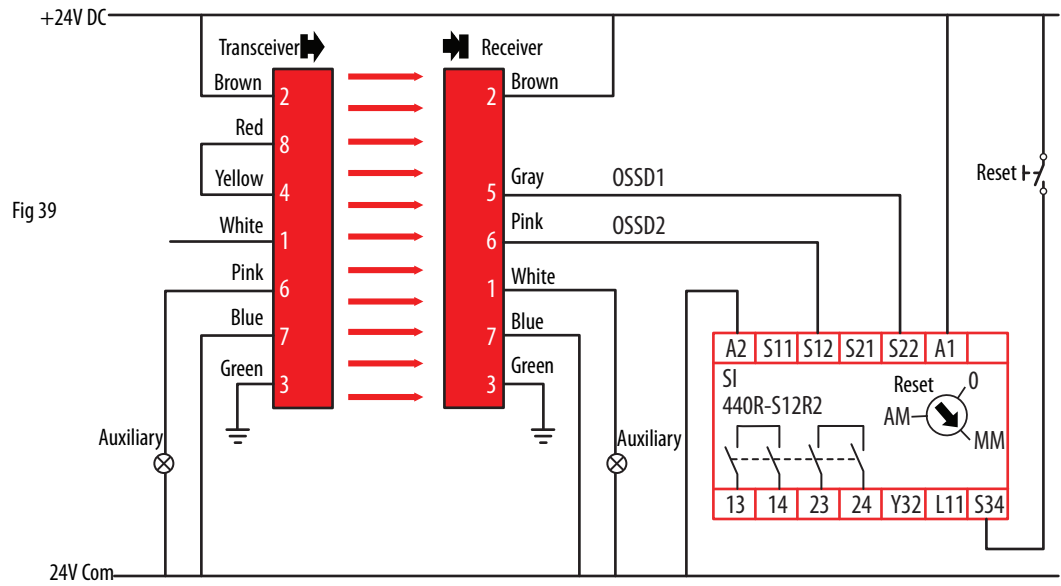


Figure 39 - Example of Connecting to a 450L-B GuardShield with Two Universal Plug-ins (Cat. No.: 450L-APU-UN-8) to a GSR SI (Cat. No.: 440R-S12R2) Safety Relay





Notes:

Status Indicators and Troubleshooting

Status Indicators

The light curtain conducts an internal self-test after startup. If an error occurs, an appropriate signal combination displays the indicator status. If a 450L-B GuardShield™ light curtain acts like a transmitter or as a receiver, it is also shown as an inverse print mark on the plug-in label (see [Figure 44 on page 72](#)).

Transmitter: 

Receiver: 

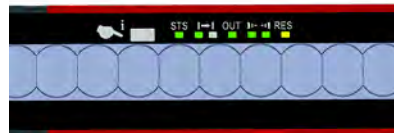
IMPORTANT If you use a universal plug-in, only the status indicators or the wiring can give the information if a light curtain is a transmitter or a receiver.

A quick categorization of an error can be done by checking the status indicator “STS.” See [Table 21 on page 62](#).

System Status Indicators

In the area closest to the connection plug-in, there are seven different status indicator lights. The “STS” and “OUT” status indicators are bicolor. Their functions and colors are defined in [Table 21 on page 62](#):

Figure 40 - Status Indicators of a 450L-B GuardShield Light Curtain




The transceiver architecture causes both sticks to exhibit the same status indicators.

Status Indicator Normal Operation

For normal operation, the status indicators give the following information.

Table 21 - Status Indicators on a 450L-B GuardShield Light Curtain (Colors and Functions) for Normal Operation

No	Marking	Status Indicator Name	Color	Behavior	Description	System Status	
1	STS	Status indicator	Green		On	Power on and system is OK	No
			Green	Red	Blinking	Configuration that is changed or receiver was operated previously with another transmitter (see See Confirmation of a New System Configuration on page 26)	No
			Green	Off	Blinking	See Troubleshooting on page 63	No
			Off	Red	Blinking		No
			Off	Red	On		No
2		Transmitter	Green		On	Plug-in identifies stick as a transmitter	No
					Blinking 1 Hz (50:50)	See Troubleshooting on page 63	No
					Blinking 1 Hz (98:2)	Reduced range is activated	No
					Off	Stick is receiver	No
3		Receiver	Green		On	Plug-in identifies the stick as a receiver	No
					Blinking 1 Hz (98:2)	Reduced range is activated	No
					Off	Stick is transmitter	No
4	OUT	Safety outputs	Green	On	Safety outputs are on (receiver)	No	
			Red	On	Safety outputs are off (receiver)	No	
				Off	Transmitter	No	
5		Regional light intensity level 1	Green		On	Bottom half zone is not interrupted and intensity is OK	Yes
					Blinking 1 Hz (50:50)	Bottom half zone intensity is at the limit	Yes
					Off	Bottom half zone interrupted	Yes
6		Regional light intensity level 2	Green		On	Top half zone is not interrupted and intensity is OK	Yes
					Blinking 1 Hz (50:50)	Top half zone intensity is at the limit	Yes
					Off	Top half zone interrupted	Yes
7	RES	Start	Amber	On	Start required (receiver)	No	
				Off	No start is required (receiver)	No	

The last column in [Table 21](#) describes if the signal is displayed simultaneously at both sticks:

- “No” means that the status indicator shows the status of the individual stick only
- “Yes” means that the status indicator shows the status of the complete system

Optical Push Button

The optical push button is positioned at the front window next to the status indicators. For activation, place your finger on the square (Figure 41). It is operated with infrared light and can be used to:

- Confirm a new configuration (see [Confirmation of a New System Configuration on page 26](#)) or
- Start power off/on cycle if there is a lockout. For recycling, the optical push button has to be pressed between 10...20 seconds. Otherwise, the recycle command is ignored.

Figure 41 - Optical Push Button



Troubleshooting

Status Indicator Error Display

If the STS status indicator is red, blinks red on/off, or blinks green an error occurred which prevents the system from working in normal operation.



Errors can be caused externally (STS = green blinking) and internally (STS = red blinking or red on). Examples of external recoverable errors include: ambient light and/or start button fault.

If there's an error, the second status indicator provides more information about the root cause ([Table 21 on page 62](#)).



ATTENTION: To indicate if a system is in the configuration mode, the STS status indicator blinks alternately red/green (50:50; 1 Hz). The configuration mode is "not" an error. It just indicates that the DIP switch configuration and/or plug-in was changed and it must be confirmed. For normal operation, the configuration must be confirmed first. This procedure is described in [Confirmation of a New System Configuration on page 26](#).

The timing of the status indicator blinking defines a frequency and a duty cycle. The frequency defines one sequence of on and off, as a default frequency 1 Hz is used if not otherwise mentioned. The duty cycle defines the ratio of the on duration and the off duration of the status indicator. If not otherwise mentioned, the default value for the duty cycle is 50:50, meaning 50% on, 50% off. The interpretation is first value on time, second value off time, for example, 10:90 means 10% on, 90% off.

Table 22 - Status Indicators for External Errors and System Errors

No	Error Short Description	First Status Indicator				Second Status Indicator			
		Marking (Name)	Color	Blink Frequency	Duty Cycle (On/Off)	Marking (Name)	Color	Blink Frequency	Duty Cycle
0	Configuration changed ¹	STS	Red/ Green	1 Hz	50:50	—	—	—	—
1	Internal lockout ²	STS	Red	ON	100:0	—	—	—	—
2	EDM error ²	STS	Red	1 Hz	50:50	RES	Amber	1 Hz	10/90
3	Start error ¹	STS	Red	1 Hz	50:50	RES	Amber	1 Hz	90/10
4	Ambient light or EMC disturbances	STS	Red	1 Hz	50:50	—	—	—	—
5	Short circuit between OSSDs to 24V DC (lockout) ²	STS	Red	1 Hz	50:50	OUT	Red	1 Hz	50/50
6	Error supply voltage ¹	STS	Red	1 Hz	50:50	Stick type (transmitter or receiver)	Green	1 Hz	50/50
7	24V DC connected to transmitter plug-in input ¹	STS (Tx)	Green	ON	100:0	Stick type transmitter	Green	1 Hz	50/50

¹ Error: If there's an error, remove the error source. For manual restart, activate the restart button.

² If there's a lockout, remove the lockout source. Lockout requires power recycling or adequate action (see [Table 23 on page 65](#)), [Restart Button on page 55](#) and [Optical Push Button on page 63](#).



ATTENTION: If automatic restart is used, the system starts immediately.

For fault conditions 0...7 and corrective actions, see [Table 23 on page 65](#).

Table 23 - Errors, Lockouts, and Corrections

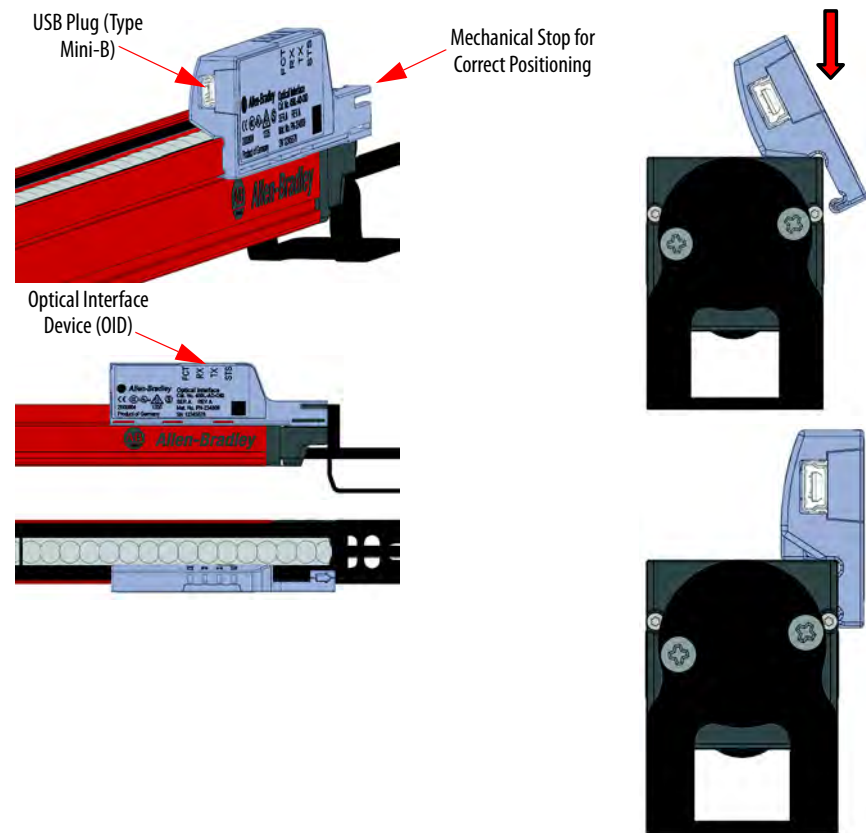
Condition Number	Error Description	Action
0	Confirmation changed	See Confirmation of a New System Configuration on page 26
1	Internal lockout	<p>Make sure that the correct plug-in is inserted and that the DIP switch settings of the plug-in are in correct position.</p> <p>One of the following methods clear the lockout mode of a 450L transmitter stick:</p> <ol style="list-style-type: none"> 1. Power down, then power up. If the fault is still present, the module lockout occurs again. 2. A start signal longer than 10 seconds and less than 20 seconds acts like a power-up. 3. Press your finger on the optical push button longer than 10 seconds and less than 20 seconds (Figure 9 on page 26) <p>If the fault persists, replace the 450L-B GuardShield transceiver stick.</p> <p>Further diagnosis options are possible with the software Connected Component Workbench in combination with the USB/optical interface device (OID; Cat. No.: 450L-AD-OID). If the 450L-B GuardShield unit has a lockout, the exact fault description can be determined with these tools.</p>
2	EDM feedback signal at receiver plug-in not okay (external error)	<p>Short circuit between or to ground or over current at OSSDs</p> <ol style="list-style-type: none"> 1. Check wiring and function of external contactor 2. Check connected relay for closed contact (if OSSD ON-input "Relay monitoring" must have GND level, if OSSD OFF-input "Relay monitoring" must have +24V) 3. Repower the system or use adequate action after the lock out source is removed.
3	Start signal not okay	Check signal status and signal timing at receiver plug-in for the manual start
4	Ambient light can lead to short sporadic switch off the OSSD.	<p>Check system set-up and remove foreign ambient light source. Ambient light sources can be:</p> <ul style="list-style-type: none"> • Strong flashing beacon • Infrared remote controls • Laser pointers • Infrared light sensors
5	Short circuit between or to ground or over current at OSSDs	Check wiring and connected components at the two OSSDs
6	Error supply voltage	Check 24V DC power that is supplied to the stick
7	Voltage that is connected to transmitter plug-in input	Make sure DIP switch 4 is set to the default position (off). Make sure that the 24V DC voltage is not supplied to pin 4 of the 450L-APT-PW-5 part or voltage supply to pin 1 of the 450L-APT-PW-8 plug-in connector.
8	System cannot be aligned	<p>Make sure that both edges are parallel and installed at the same level.</p> <p>Make sure that the transparent front cover is clean, no dust and is not scratched.</p> <p>Make sure that the distance between transmitter and receiver is above the minimum distance.</p> <p>Make sure that the distance between transmitter and receiver is below maximum distance.</p> <p>Make sure that "low operation range" is not activated if operated above maximum range of the "low operation range" function</p>
9	OSSD outputs switch off sporadically	<p>Check all hints of row 7 first</p> <p>Check that no ambient light from other sensors or sun can have an impact on the performance of a 450L-B GuardShield system.</p> <p>Make sure that the power supply is adequate and the devices that are connected to the OSSD outputs are within the limits.</p> <p>Make sure that the 450L-B GuardShield connection cables are not guided parallel to high-power supply cables of the application</p>

IMPORTANT Conditions 0...7 of [Table 22 on page 64](#) show the status indicator for condition numbers 0...7 in [Table 23 on page 65](#).

Optical Interface Device (OID)

More service information is available by using the optical interface device (450L-AD-OID) and the Rockwell Automation® Connected Components Workbench™ software package. This device can be snapped on a stick and used to visualize (for example) the protective field status if connected to a computer via a USB interface. The required Rockwell Automation® Connected Components Workbench™ software is available on <http://www.rockwellautomation.com/global/support/connected-components/workbench.page>.

Figure 42 - Optical Interface Device That Is Snapped on a 450L-B GuardShield



The Optical Interface Device (OID) has a USB interface for connection to a personal computer for diagnostic purposes. Use a standard USB A Male to USB Mini-B Male cable for connecting to the OID. The OID is delivered including a USB (Type A <-> Type Mini-B) 1 m (3.28 ft) long connection cable (Cat. No.: 2711C-CBL-UU02). The device must be positioned correctly at the end of the protective field (2) above the status indicators to allow a communication. First move the latch of the interface close to the bottom end cap so that it touches the end cap and then turn it so that it snaps in.

The OID can be used when the light curtain is mounted with the top/bottom and/or the side mounting kit. If there is a weld shield, the weld shield has to be removed before the OID can be installed.

Troubleshooting with Connected Component Workbench

When connected to the 450L-B GuardShield light curtain through the USB port with the Optical Interface Device, the Connected Component Workbench diagnosis function displays the status of the connected stick. If there's an error, detailed diagnostic information of the corresponding stick is provided.

Notes:

Safety Instructions

Maintenance



ATTENTION: Never operate the GuardShield™ light curtain before conducting the Daily Inspection. Improper inspection can lead to serious, or even deadly, injury.



ATTENTION: Assure that all power to the machine and safety system is disconnected during electrical installation.



ATTENTION: Before powering up the GuardShield system, the responsible person reviews the checklist:

- For safety reasons, all inspection results are recorded.
 - Only people who clearly understand the function of the 450L-B GuardShield and the machine, can inspect them.
 - If the installer, engineer, and operator are different people, they must all have sufficient information available for the inspection.
-

Daily Inspection

1. Approach to hazardous machine parts must only be possible by passage through the GuardShield protective field.
2. Operators cannot step through the sensing area while working on dangerous machine parts.
3. The safety distance of the application is bigger than the calculated value.
4. The optic front cover is not scratched or dirty.

The inspection interval for 1...4 are:

- Daily or whenever the machine setting is changed (electrical or mechanical)
- Whenever a 450L light curtain component (stick and/or plug-in) is replaced
- According to the requirements of local regulation or an application-specific standard
- According to the inspection instruction of the application

Operate the machine and check if the hazardous movement stops under the following circumstances:

1. The protective field is interrupted.
2. If the test rod directly in front of the transmitter or receiver or between the transmitter and receiver, interrupts the protective field, the hazardous machine movement stops immediately ([Figure 43 on page 71](#)).
3. There is no hazardous machine movement while the test rod is anywhere within the protective field.
4. Make sure that there are no reflective surfaces within the calculated distance (see [Minimum Distance from Reflective Surfaces on page 35](#)).

Before introducing the test rod, verify that the protective field is free. Both intensity indicators are green at the 450L-B stick, which acts as the receiver (see [Figure 15 on page 37](#)). If the two intensity indicators are not green, then you change this state first. Move the test rod through the protective field as indicated in [Figure 43 on page 71](#). Use test rod 450L-AT-14 for 450L with finger resolution (14 mm [0.55 in.]) and test rod 450L-AT-30 for 450L with hand resolution (30 mm [1.18 in.]). The protective field must be interrupted all the time:

- If the test rod is placed at any angle anywhere within the protective field (static)
- If the test rod is moved (according to [Figure 41 on page 63](#)) with the axis of the test rod normal to the plane of the detection zone, at any speed between 0 m/s and 0.3 m/s (dynamic).

The interruption of the protective field is displayed at the indicator diodes. Verify that the minimum of one intensity indicator ([Figure 15 on page 37](#)) is off as long as the test rod is in the protective field. If both intensity indicators are simultaneously green or blinking green during the static and dynamic testing, the resolution to operate the application is not fulfilled.



WARNING: If any of the previous conditions don't stop the hazardous motion of the machine or simultaneously lead to two green intensity indicators (see [Figure 15 on page 37](#)), then do not allow the machine to be placed into operation.

Figure 43 - Proper Testing of Protective Field Using Test Rod

IMPORTANT If one or more mirrors are used (see [Mirrors on page 37](#)), inspect each protective field separately. The movement of the test rod is also performed directly in front of the mirrors.

Six-month Inspection

Check the following items:

- Every six months or
 - Whenever a machine setting is changed or
 - The local regulation or an application-specific standard requires an inspection
1. Machine stops or does not obstruct any safety function.
 2. The latest machine or connection modifications have no effect on the control system.
 3. The outputs of the 450L-B GuardShield are properly connected to the machine.
 4. The total response time of the machine is shorter than the calculated value.
 5. Cables and plugs of the 450L-B GuardShield are in flawless condition.
 6. Mounting brackets, caps and cables are tightly secured.
 7. Optical windows and components (mirrors or weld shields) are clean.

IMPORTANT Document the test results, signature, and file them appropriately.

Cleaning

The effectiveness and the reliability of the safety light curtain system is reduced if the optic front window of the 450L-B GuardShield light curtain is dirty. Regularly clean with a soft cloth and rub without pressure. Do not apply aggressive or abrasive agents, which can attack the surface.

Disposal

The 450L-B GuardShield safety light curtain has been designed according to the main environmental protection directives (for example, RoHS). Always dispose of unserviceable devices in compliance with local/national rules and regulations.

Product Labels

The address that is printed on the stick and on the plug-in product and packaging labels refers to the Rockwell Automation global address. For the regional office addresses, see the listing on the back cover of this publication.

Stick Label

Figure 44 - Explanation of Date Code on a Stick [1335: Year 2013, Week: 35; Serial Number Is 1068700055]



Plug-in Label

Figure 45 - Explanation of Date Code at a 450L Plug-in [1337: Year 2013, Week: 37; Serial Number Is 123456]



A black square with a gray letter quickly indicates the principle type of plug-in (Figure 45).

IMPORTANT The cat. no. is also printed on the plug-in housing, which is inside the transmitter stick.

Specifications

This appendix provides the specifications for the 445L-B GuardShield™ safety light curtain.

Table 24 - Safety Ratings

Attribute	Value
Standards	IEC 61508, EN/ISO 13849-1, IEC 62061, UL 508 (for more details, see the Product Certification link at http://www.rockwellautomation.com/global/certification/overview.page for Declaration of Conformity)
Safety classification	Type 4 according to IEC 61496-1/-2 Up to PLe (Category 4) per ISO 13849-1, SIL 3 per IEC 61508 and SILcl 3 per IEC 62061
Functional safety data	PFHD: $12.7 \cdot 10^{-9}$ Mission time/PTI: 20 (twenty) years Mode of operation: High demand mode

Table 25 - Operating Characteristics

Attribute	Value
Switch function	OSSDs enable (on, high, 24V DC) when protective field not interrupted
Protective field length	150...1950 mm (5.91...76.77 in.) in 150 mm (5.91 in.) increments
Resolution	Finger: 14 mm (0.55 in.); Hand: 30 mm (1.18 in.)
Number of active lenses (see Figure 7 on page 17)	Finger: 16 per 150 mm (5.91 in.) increment; Hand: 8 per 150 mm (5.91 in.) increment
Operating range	Resolution 14 mm (0.55 in.): 0.5...4 m (1.64...13.12 ft) Resolution 30 mm (1.18 in.): 0.9...6.5 m (2.95...21.3 ft) Reduced (selected with DIP switch): Resolution 14 mm (0.55 in.): 0.9...2 m (2.95...6.56 ft) Resolution 30 mm (1.18 in.): 1.2...3.5 m (3.94...11.48 ft)
Response time	OSSD – ON to OFF Finger resolution <25 ms Hand resolution < 15 ms (for details see Response Time on page 22)
Power up time	Maximum 5 seconds
OSSD restart time after clearance of the protective field if automatic reset	210 ms (See Safety outputs (OSSDs) on page 74)
Power Supply	24V DC $\pm 15\%$; Power supply must meet the requirements of IEC 60204-1 and IEC 61496-1. Reverse connection protection integrated.
Protection class (EN50178)	II (safety extra-low voltage SELV/PELV)

Table 25 - Operating Characteristics

Attribute	Value
Power consumption (system = two sticks)	Protective height: 150 mm (5.91 in.): 120 mA maximum 1950 mm (76.77 in.): 600 mA (outputs not loaded)
Peak current during power-up cycle	800 mA maximum (outputs not loaded)
Duration of peak current during power-up cycle	100 ms
Power down time	3000 ms
Transmitted infrared wave length	Infrared (wave length 855 nm)
Aperture angle	Within $\pm 2.5^\circ$ @ 3 m (9.8 ft)
Synchronization	Optical
DIP switch selectable functions	Depends on inserted plug-in: start mode; external device monitoring (EDM); maximum operating range
Ambient light	Incandescent lamp: 3000 lux or less Sunlight: 100,000 lux or less

Table 26 - Inputs

Attribute	Value
Input receiver plug-in Manual start	Minimum duration 50 ms; maximum duration 5 seconds Voltage level for Logic Low/0: 0...5V DC Voltage level for Logic Hi/1: > 16V DC Current: 7 mA typical
Input receiver plug-in EDM	300 ms after activation of OSSD Voltage level for Logic Low/0: 0...5V DC Voltage level for Logic Hi/1: > 16V DC Current: 7 mA typical

Table 27 - Safety Outputs

Attribute	Value
Safety outputs (OSSDs)	2 solid-state outputs
Switching capacity	500 mA each, maximum
Residual voltage (drop from power supply)	2V (excl. voltage drop through cables), maximum
Connection cable length	100 m (330 ft) maximum with 22AWG; Condition: power supply 24V and maximum load on outputs 50 mA total
Switching voltage to HIGH (Ueff)	11...30 V
Switching voltage to LOW	-3...2V
Load capacity	0.5 μ F maximum
Short circuit protection	Yes
Test pulse data	See OSSD Output on page 56
Short-circuit detection	Yes
Galvanic isolation: I/O from Logic	No

Table 28 - Status Outputs

Attribute	Value
Number of status outputs	Up to 1 nonsafety solid-state output (depends on plug-in)
Switching capacity	200 mA each, maximum
Residual voltage (drop from power supply)	2V (excl. voltage drop through cables), maximum
Short circuit protection	Yes
Galvanic isolation: I/O from Logic	No

Table 29 - Environmental and General Protection

Attribute	Value
Operating temperature	-10...55°C (14...131°F)
Storage temperature	-25...75°C (-13...167°F)
Operating humidity	5...95% (without condensation)
Enclosure rating	IP65
Vibration Resistance	Per IEC 61496-1, IEC 60068-2-6 Frequency 10...55 Hz Amplitude 0.35 mm (0.01 in.)
Shock	Per IEC 61496-1, IEC 60068-2-29 Acceleration 10 g (0.35 oz), Duration 16 ms
Pollution level	2

Table 30 - Electrical Protection

Attribute	Value
Short-circuit protection	Incorporated
Current limitation	Incorporated
Overload protection	Incorporated
Reverse polarity protection	Incorporated
Overvoltage protection	Incorporated (up to 60V max.)
Thermal shutdown/restart	Incorporated

Table 31 - General

Attribute	Value
Materials	<p>Transceiver stick (450L-B...):</p> <p>Profile: Extruded aluminum, powder coated</p> <p>End caps: Polyamide</p> <p>Front window: Polycarbonate</p> <p>Screws: Steel</p> <p>Plug-in (450L-AP...):</p> <p>Pig tail cable: Polyurethane</p> <p>M12 Connector: Bare cooper, SR-PVC, PUR</p> <p>Body: Polyamide</p> <p>Mounting brackets:</p> <p>Top/Bottom 450L-AM-TBM: Steel, powder coated</p> <p>Bracket: Steel</p> <p>Screws: Steel</p> <p>Side mounting 450L-AM-SM:</p> <p>Body: Polyamide</p> <p>Screws: Steel</p> <p>Laser alignment tool bracket 450L-ALAT-C: Polyamide</p> <p>Test rod: Aluminum</p> <p>Optical Interface Device 450L-AD-OID: Polyamide</p>
Stick dimensions Cross section Length	<p>30 x 30 mm (1.18 x 1.18 in.)</p> <p>N x 150 mm (N x 5.9 in.) [N = 1 ... 13]</p>
Screw type and maximum torque of top/bottom mounting bracket	<p>M3 x 10; Phillips screw</p> <p>0.7 Nm max.</p>
Screw type and maximum torque for M2 screws of plug-in	<p>M2 x 8; Phillips screw</p> <p>0.38 Nm max.</p>
Maximum torque for screws of side mounting bracket	<p>Screws:</p> <p>M6: maximum 11 Nm</p> <p>M4: Maximum 2.8 Nm</p>
Status indicators stick	<p>Color and coding according to IEC 60204-1</p> <p>Transceiver type (Rx or Tx)</p> <p>Status</p> <p>Intensity (for two regions)</p> <p>Start/Restart</p> <p>Output</p>
Connection plug	<p>Depending on installed plug-in:</p> <p>M12 5-pin (male) or M12 8-pin (male) fixed at pigtail with cable length: 0.15m (11.81 in.); minimum outer bending radius of pigtail: > 3xD:</p> <p>5 pin: D = 4.4 mm (0.17 in.)</p> <p>8 pin: D = 5.5 mm (0.22 in.)</p>
Connection cable length	<p>Maximum 100 m (330 ft) with wire section AWG 22 (Condition: Power supply 24V and maximum load on outputs 50 mA total)</p>
Accessories included	<p>Test rod, top/bottom mounting brackets and installation instruction</p>
Silicon	<p>The unit does not release any silicone or other LABS-critical substances and is suitable for use in paint shops.</p>

Certifications

See the Product Certification link at <http://www.rockwellautomation.com/global/certification/overview.page> for Declaration of Conformity, Certificates, and other certification details.

- cULus Listed Industrial Control Equipment, which is certified for US and Canada
- CE Marked for all applicable directives (see “Compliance to European Union Directives”)
- RCM marked (Australia)
- TÜV Rheinland Certified for Functional Safety up to SIL 3 Category 4 for use in safety applications up to and including SIL 3, in accordance with IEC 61508 and EN 62061, Performance Level e and Category 4 in accordance with ISO 13849-1, ESPE type 4 safety light curtain according to EN IEC 61496.

Compliance to European Union Directives

Rockwell Automation B.V. (address: Rivium Promenade 160, 2909 LM Capelle aan den IJssel, The Netherlands) declares that this product is in conformity with the provisions of the following EC directives (including all applicable amendments):

- 2014/30/EU Electromagnetic Compatibility Directive (EMC)
- 2006/42/EC Machinery Directive (MD)

And that the respective standards and/or technical specifications have been applied. It is approved for installation within the European Union and EEA regions. All relevant directives and standards are listed in the declaration of conformity, which is available on <http://www.rockwellautomation.com/global/certification/overview.page>.

Dimensions

Figure 46 - 450L Stick Dimensions [mm (in.)]

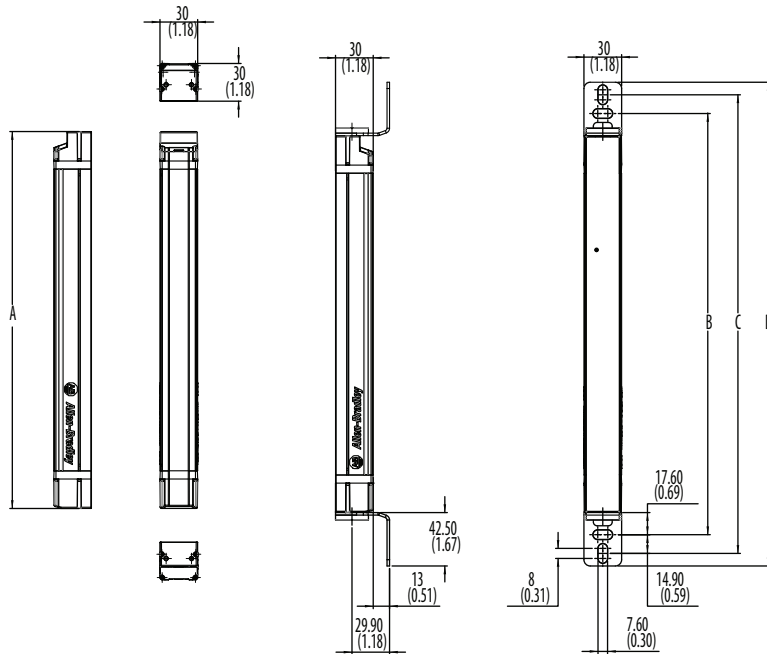


Table 32 - 450L Stick Dimensions [mm (in.)]

Catalog Number	A Protective Height	B Mounting Value	C Mounting Value	D Total Length
450L-B4xN0150YD	150 (5.91)	185.5 (7.3)	215 (8.46)	235 (9.25)
450L-B4xN0300YD	300 (11.81)	335.5 (13.21)	365 (14.37)	385 (15.16)
450L-B4xN0450YD	450 (17.72)	485.5 (19.11)	515 (20.28)	535 (21.06)
450L-B4xN0600YD	600 (23.62)	635.5 (25.02)	665 (26.18)	685 (26.97)
450L-B4xN0750YD	750 (29.53)	785.5 (30.93)	815 (32.09)	835 (32.87)
450L-B4xN0900YD	900 (35.43)	935.5 (36.83)	965 (37.99)	985 (38.78)
450L-B4xN1050YD	1050 (41.34)	1085.5 (42.74)	1115 (43.9)	1135 (44.68)
450L-B4xN1200YD	1200 (47.24)	1235.5 (48.64)	1265 (49.8)	1285 (50.59)
450L-B4xN0350YD	1350 (53.15)	1385.5 (54.55)	1415 (55.71)	1435 (56.5)
450L-B4xN1500YD	1500 (59.06)	1535.5 (60.45)	1565 (61.61)	1585 (62.4)
450L-B4xN1650YD	1650 (64.96)	1685.5 (66.36)	1715 (67.52)	1735 (68.31)
450L-B4xN1800YD	1800 (70.87)	1835.5 (72.26)	1865 (73.43)	1885 (74.21)
450L-B4xN1950YD	1950 (76.77)	1985.5 (78.17)	2015 (79.33)	2035 (80.12)

Catalog Numbers

Sticks

The catalog number refers to a stick, including top/bottom mounting kit and test rod.

Table 33 - Transceiver Stick Catalog Number Setup

450L	-	B	4	H	N	-	0750	-	Y	D
1		2	3	4	5		6		7	8

Table 34 - Description 450L-B Sticks Cat. Nos.

#	Description
1	Bulletin number
2	Family B
3	Type according to IEC61496
4	Resolution H: hand F: finger
5	Laser alignment help N: not integrated
6	Protective field length in mm [0750 = 750 mm (29.53 in.)]
7	IP rating Y: IP65
8	D: <i>not used</i>

Table 35 - 450L-B Transceiver Stick Cat. No., Weight, and Shipping Dimensions [mm (in.)]

Protective Field Length	Cat. No.		Approximate Shipping Weight (Including Packaging) [kg (lb)]	Shipping Dimensions
	Resolution 14 (0.55)	Resolution 30 (1.18)		
150 (5.90)	450L-B4FN0150YD	450L-B4HN0150YD	0.59 (1.3)	860 x 111 x 68 (33.86 x 4.37 x 2.68)
300 (11.81)	450L-B4FN0300YD	450L-B4HN0300YD	0.72 (1.59)	860 x 111 x 68 (33.86 x 4.37 x 2.68)
450 (17.72)	450L-B4FN0450YD	450L-B4HN0450YD	0.85 (1.87)	860 x 111 x 68 (33.86 x 4.37 x 2.68)
600 (32.62)	450L-B4FN0600YD	450L-B4HN0600YD	0.98 (2.16)	1310 x 111 x 68 (51.57 x 4.37 x 2.68)
750 (29.53)	450L-B4FN0750YD	450L-B4HN0750YD	1.11 (2.45)	1310 x 111 x 68 (51.57 x 4.37 x 2.68)
900 (35.43)	450L-B4FN0900YD	450L-B4HN0900YD	1.24 (2.73)	1310 x 111 x 68 (51.57 x 4.37 x 2.68)
1050 (41.34)	450L-B4FN1050YD	450L-B4HN1050YD	1.37 (3.02)	1760 x 111 x 68 (69.29 x 4.37 x 2.68)
1200 (47.24)	450L-B4FN1200YD	450L-B4HN1200YD	1.5 (3.3)	1760 x 111 x 68 (69.29 x 4.37 x 2.68)
1350 (53.15)	450L-B4FN1350YD	450L-B4HN1350YD	1.63 (3.59)	1760 x 111 x 68 (69.29 x 4.37 x 2.68)

Table 35 - 450L-B Transceiver Stick Cat. No., Weight, and Shipping Dimensions [mm (in.)]

Protective Field Length	Cat. No.		Approximate Shipping Weight (Including Packaging) [kg (lb)]	Shipping Dimensions
	Resolution 14 (0.55)	Resolution 30 (1.18)		
1500 (59.05)	450L-B4FN1500YD	450L-B4HN1500YD	1.77 (3.90)	2360 x 111 x 68 (92.91 x 4.37 x 2.68)
1650 (64.96)	450L-B4FN1650YD	450L-B4HN1650YD	1.91 (4.21)	2360 x 111 x 68 (92.91 x 4.37 x 2.68)
1800 (70.86)	450L-B4FN1800YD	450L-B4HN1800YD	2.05 (4.52)	2360 x 111 x 68 (92.91 x 4.37 x 2.68)
1950 (76.77)	450L-B4FN1950YD	450L-B4HN1950YD	2.18 (4.81)	2360 x 111 x 68 (92.91 x 4.37 x 2.68)

Plug-ins

Table 36 - Plug-in Cat. No. Set-up

450L	-	APR	-	ON	-	5
1		2		3		4

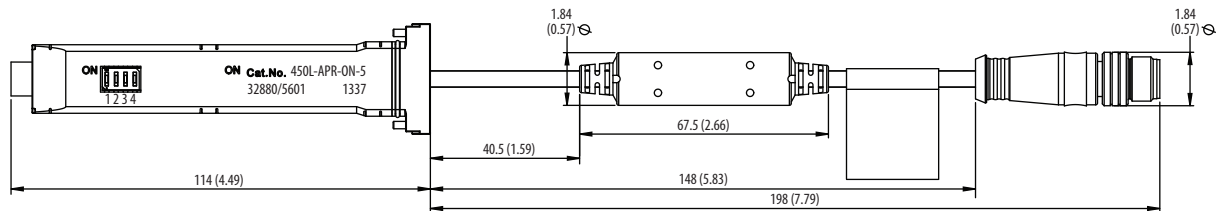
Table 37 - 450L Plug-in Cat. No.

#	Description
1	Bulletin number
2	Type: APR: Accessory Plug-in Receiver APT: Accessory Plug-in Transmitter APU: Accessory Plug-in Universal
3	Function: PW: Power ON: On/Off ED: EDM UN: Universal
4	Number of pins 5: 5-pin 8: 8-pin

Table 38 - 450L Plug-ins

Description	Cat. No.
450L Plug-in Tx 5-pin	450L-APT-PW-5
450L Plug-in Tx 8-pin	450L-APT-PW-8
450L Plug-in Rx ON/OFF 5-pin	450L-APR-ON-5
450L Plug-in Rx EDM 8-pin	450L-APR-ED-8
450L Plug-in Universal 8-pin	450L-APU-UN-8

Figure 47 - 450L Plug-in Dimensions [mm (in.)]



Optional Accessories

Table 39 - Accessories

Description	Cat. No.
L-shaped end-cap mounting bracket kit (two per package), shipped with each stick (see Standard Top/Bottom Mounting Kit on page 44)	450L-AM-TBM
Side mounting bracket (2 per package) (see Side Mounting Bracket on page 46)	450L-AM-SM
445L bracket (2 per package)	445L-AF6140
445L bracket (180°) (2 per package)	445L-AF6141
445L bracket (back side) (2 per package)	445L-AF6144
Power supply Output—24V DC, 3 amps, 72 W	1606-XLP72E
Laser alignment tool (see Alignment Tool and Bracket on page 86)	440L-ALAT
450L-B laser alignment tool bracket (see Alignment Tool and Bracket on page 86)	450L-ALAT-C
Optical Interface Device (including USB cable) (see Optical Interface Device (OID) on page 66)	450L-AD-OID
450L stick slot cover (plug-in slot, one red slot cover shipped with each 450L-B stick)	450L-AS-1
Shock mount kit (one kit is required per stick) (see Shock Mounting Kit on page 48)	445L-AF6142
Mounting stand (column) (see Mounting Columns on page 84)	440L-AMSTD
Mounting stand (column) (see http://literature.rockwellautomation.com/idc/groups/literature/documents/um/445l-um004_-en-p.pdf)	445L-AMSTD2M
Corner mirror (xxxx = 0300...1800 mm [11.8...70.86 in.] in 150 mm [5.9 in.] increments) (see Mirrors on page 37)	440L-AM075xxxx
Corner mirror (xxxx = 0300...1800 mm [11.8...70.86 in.] in 150 mm [5.9 in.] increments) (see Mirrors on page 37)	440L-AM125xxxx
Mirror mounting bracket (see Corner Mirror for Multi-sided Guarding on page 82)	442L-AF6106
Weld shield (xxxx = 0150...1950 mm [5.9...76.77 in.] in 150 mm [5.9 in.] increments) (see Weld Shields on page 87)	450L-AW-xxxx
Safety Relay GSR SI GSR CI GSR D GSR DIS	440R-S12R2 440R-S13R2 440R-D22R2 440R-D22S2
Safety Relay Muting Box	445L-AMUTBOX1
Configurable Safety Relay CR-30	440C-CR30
External contactor	100S: 100S-C09QJ14BC, 100S-C43QJ22BC 700S: 700S-CF53QDJBC (or minor variations)
Test rod 14 mm (shipped with each stick that has finger resolution) (see Daily Inspection on page 69)	450L-AT-14
Test rod 30 mm (shipped with each stick that has hand resolution) (see Daily Inspection on page 69)	450L-AT-30

Corner Mirror for Multi-sided Guarding

Specially constructed glass mirrors for two-sided and three-sided safeguard applications (see [Mirrors on page 37](#) for installation).

IMPORTANT Each mirror reduces maximum scan range by 10%. Each corner mirror is supplied with two end-cap mounting brackets (442L-AF6106).

Figure 48 - Dimensions of the Mirror (440L-AM075) (Width 75 mm (2.95 in.))

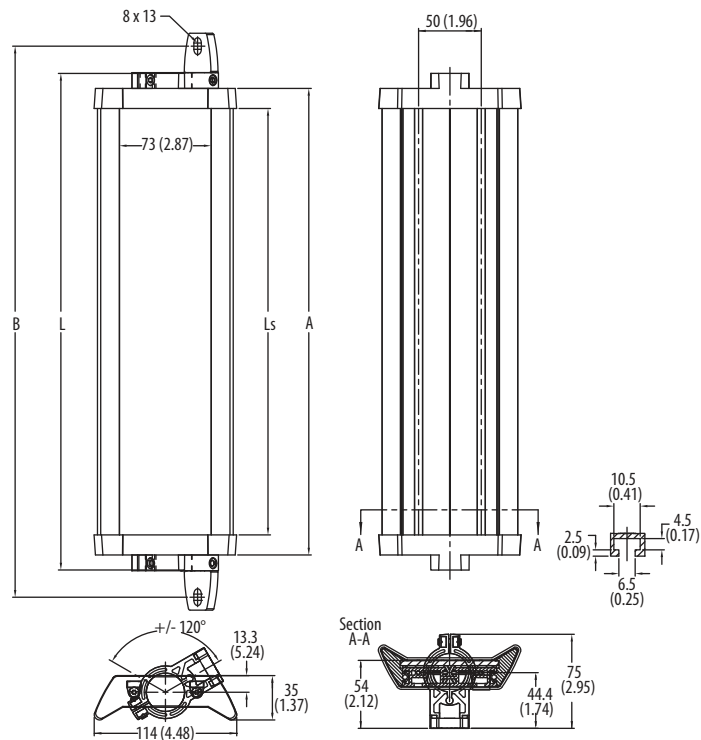


Table 40 - Mirror (75 mm (2.95 in.) Width

Model Number	Series	Description	L	L ₅	A	B
440L-AM0750300	A	Mirror, 300 mm (11.81 in.), 4 m (13.12 ft)	396	340	372	440
440L-AM0750450	A	Mirror, 450 mm (17.72 in.), 4 m (13.12 ft)	546	490	522	590
440L-AM0750600	A	Mirror, 600 mm (23.62 in.), 4 m (13.12 ft)	696	640	672	740
440L-AM0750750	A	Mirror, 750 mm (29.53 in.), 4 m (13.12 ft)	846	790	822	890
440L-AM0750900	A	Mirror, 900 mm (35.43 in.), 4 m (13.12 ft)	996	940	972	1040
440L-AM07501050	A	Mirror, 1050 mm (41.34 in.), 4 m (13.12 ft)	1146	1090	1122	1190
440L-AM07501200	A	Mirror, 1200 mm (47.24 in.), 4 m (13.12 ft)	1296	1240	1272	1340
440L-AM07501350	A	Mirror, 1350 mm (53.15 in.), 4 m (13.12 ft)	1446	1390	1422	1490
440L-AM07501500	A	Mirror, 1500 mm (59.05 in.), 4 m (13.12 ft)	1596	1540	1572	1640
440L-AM07501650	A	Mirror, 1650 mm (64.96 in.), 4 m (13.12 ft)	1746	1690	1722	1790
440L-AM07501800	A	Mirror, 1800 mm (70.86 in.), 4 m (13.12 ft)	1896	1840	1872	1940

Figure 49 - Dimensions of the Mirror (440L-AM125) (Width 125 mm (4.92 in.))

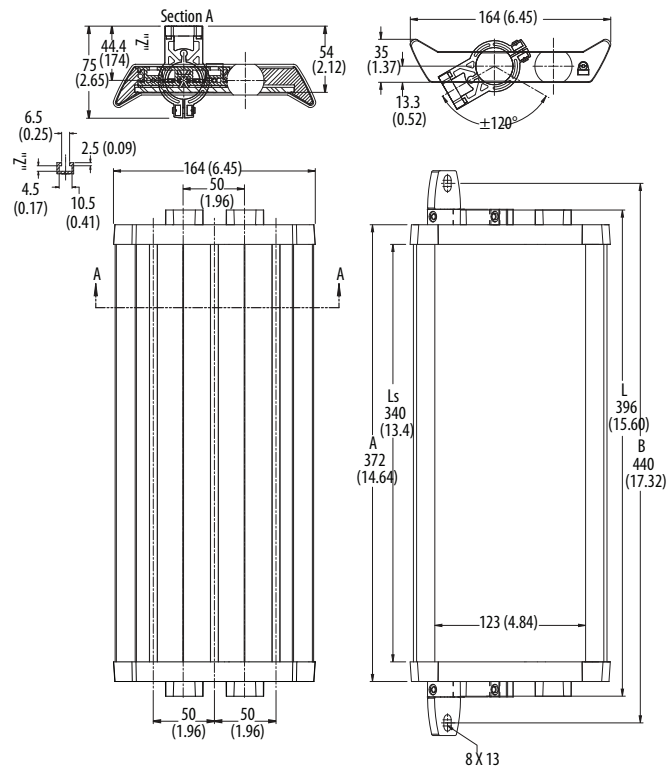
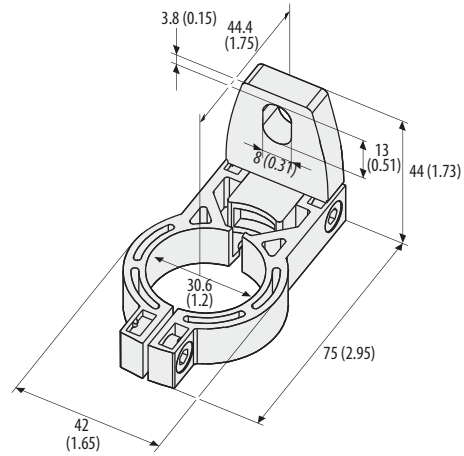


Table 41 - Mirror (Width: 125 mm (4.92 in.))

Series	Description	L	L ₅	A	B	Cat. No.
A	Mirror, 300 mm (11.81 in.), 4 m (13.12 ft)	396	340	372	440	440L-AM1250300
A	Mirror, 450 mm (17.72 in.), 4 m (13.12 ft)	546	490	522	590	440L-AM1250450
A	Mirror, 600 mm (23.62 in.), 4 m (13.12 ft)	696	640	672	740	440L-AM1250600
A	Mirror, 750 mm (29.53 in.), 4 m (13.12 ft)	846	790	822	890	440L-AM1250750
A	Mirror, 900 mm (35.43 in.), 4 m (13.12 ft)	996	940	972	1040	440L-AM1250900
A	Mirror, 1050 mm (41.34 in.), 4 m (13.12 ft)	1146	1090	1122	1190	440L-AM12501050
A	Mirror, 1200 mm (47.24 in.), 4 m (13.12 ft)	1296	1240	1272	1340	440L-AM12501200
A	Mirror, 1350 mm (53.15 in.), 4 m (13.12 ft)	1446	1390	1422	1490	440L-AM12501350
A	Mirror, 1500 mm (59.05 in.), 4 m (13.12 ft)	1596	1540	1572	1640	440L-AM12501500
A	Mirror, 1650 mm (64.96 in.), 4 m (13.12 ft)	1746	1690	1722	1790	440L-AM12501650
A	Mirror, 1800 mm (70.86 in.), 4 m (13.12 ft)	1896	1840	1872	1940	440L-AM12501800

Swivel Mounting Bracket 442L-AF6106



Mounting Columns

Two stands are available to mount sticks or mirrors.

Figure 50 - 440L-AMSTD

To mount the 450L-B transceiver stick at any height of the 440L-AMSTD use side mounting kit 450L-AM-SM.

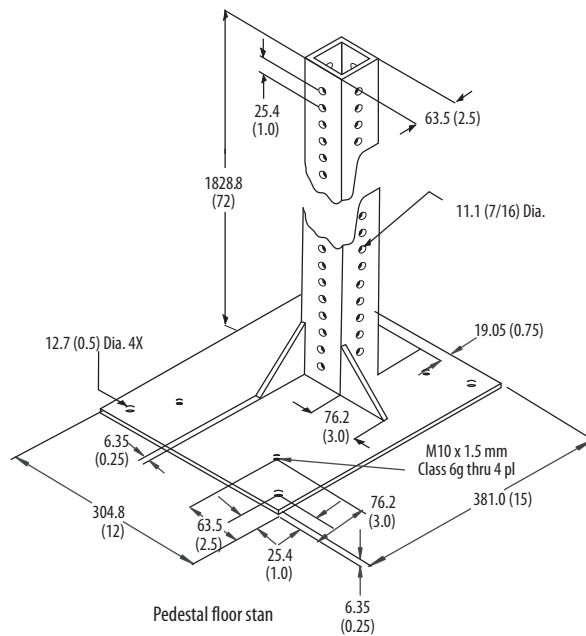
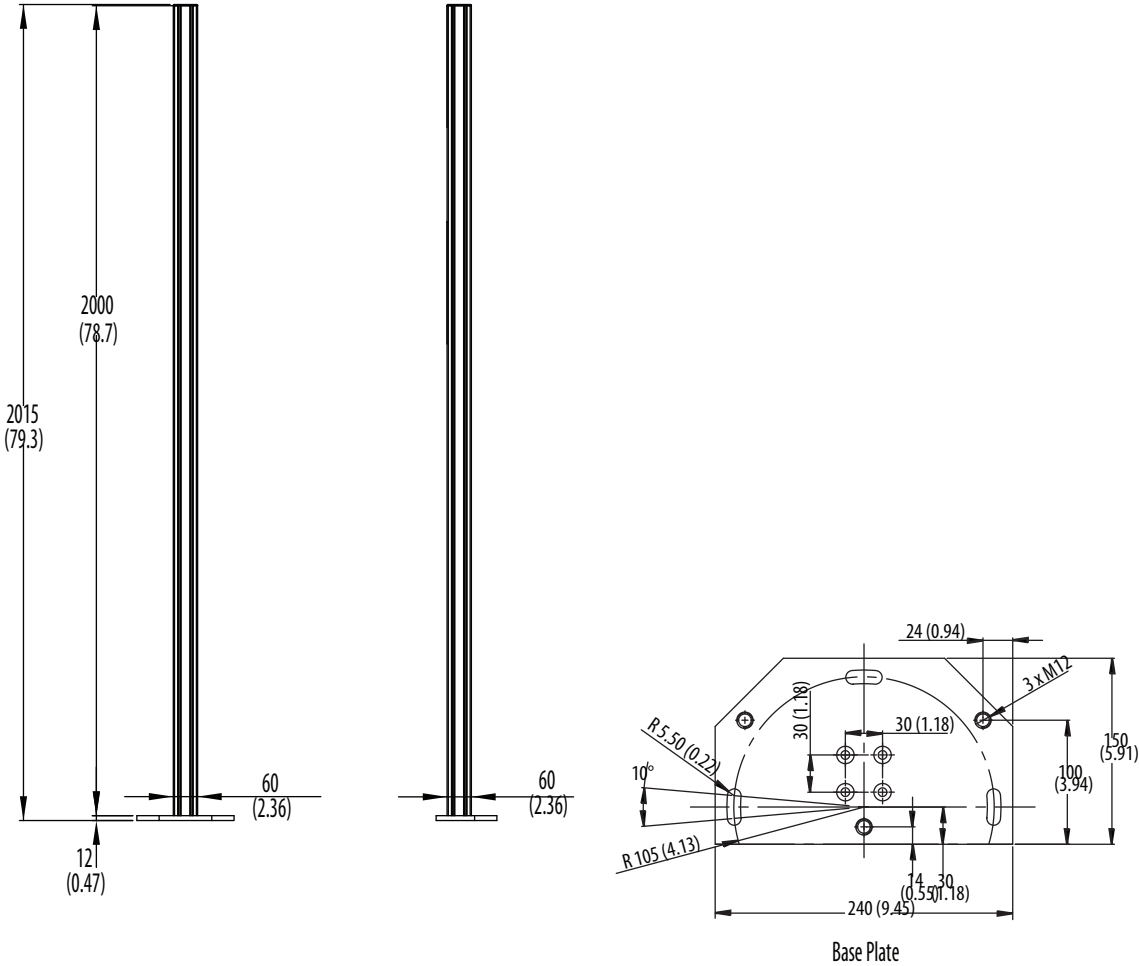


Figure 51 - 440L-AMSTD2M



Alignment Tool and Bracket

Optional laser-alignment tool 440L-ALAT (laser class 2) and bracket (450L-ALAT-C) to mount laser alignment tool

Figure 52 - Laser Alignment Tool (440L-ALAT)

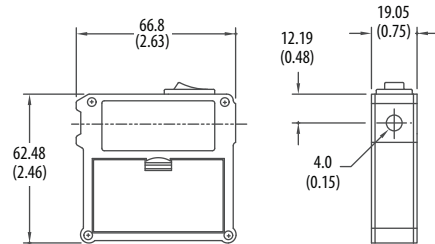
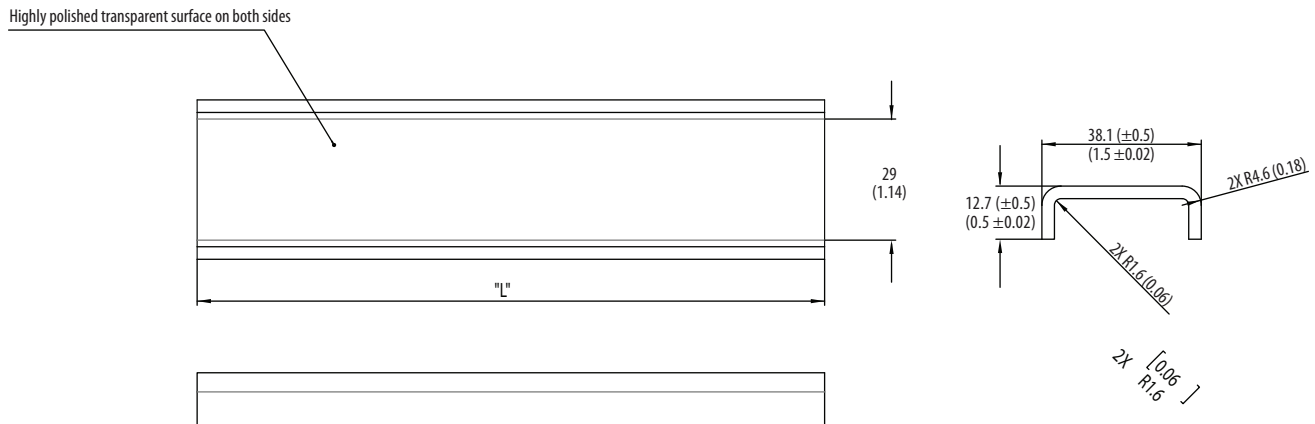


Figure 53 - Alignment Tool Bracket (450L-ALAT-C)



Weld Shields

Figure 54 - Weld Shield Dimensions



The GuardShield weld shields are sold in the same lengths as the protective field heights of the 450L-B GuardShield Safety Light Curtains. These polycarbonate weld shields are designed as disposable devices whose purpose is to help protect the front window of the 450L-B GuardShield from damage. One weld shield reduces the operation range by approximately 10%. For a 450L-B with finger resolution and a weld shield that is installed on each stick, the maximum range of operation reduces to: 6.3 m (20.67 ft) x 90% x 90% = 5.1 m (16.73 ft). The installation of the weld shields does not affect the minimum operation range.

Table 42 - Weld Shields

Description	Cat. No.
Weld Shield Kit, two pieces per kit 450L Safety Light Curtain, Length xxxx mm [xxxx: 0150...1950 mm (5.9...76.77 in.) in 0150 mm (5.9 in.) increments]	450L-AW-xxxx

The weld shield is supplied with precut Velcro® tape strips. Position the strips on the front window and attach the weld shields. Additional information about the weld shields is provided in the 450L GuardShield Light-curtain Weld-shield Installation Instructions ([450L-IN001](#)).

Cables

Depending on the plug-in, an M12 5-pin or a M12 8-pin connection cable is required to connect a 450L-B transceiver stick. Connection cables (also commonly referred to as cordsets) have an M12 plug (female) at one end and the other end is free wires. Extension cables (also commonly referred to as patchcord cables) have one M12 plug at each end. They can be used to extend the length of the connection cables. Only the M12 five-pin patchcords can be used to connect a 450L-B directly to a GuardShield ArmorBlock.

Table 43 on page 88 lists cables that are required for connecting a 450L-B stick (cable color black). Check <http://ab.rockwellautomation.com/Connection-Devices/DC-Micro-Cordsets-and-Patchcords> for additional lengths and/or cable jacket colors like yellow or red.

Table 43 - Connection Cables (Cordsets and Patchcords); Unshielded; Color: Black

Description	Cat. No.	
	Female M12 5-pin ¹	Female M12 8-pin ¹
No connector (cordset)	889D-F5BC-x	889D-F8AB-x
Male M12 connector (patchcord)	889D-F5BCDM-x	889D-F8ABDM-x

¹ Replace the "x" with 2 (2 m (6.6 ft)), 5 (5 m (16.4 ft)), 10 (10 m (32.8 ft)), 15 (15 m (49.2 ft)), 20 (20 m (65.6 ft)), or 30 (30 m (98.4 ft)) for length.

IMPORTANT For environments with high EMC (electromagnetic disturbances) influences, shielded cables are highly recommended.

Figure 55 - Patchcord Cable

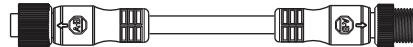
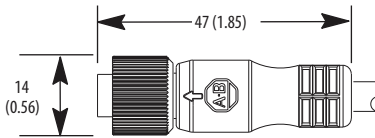


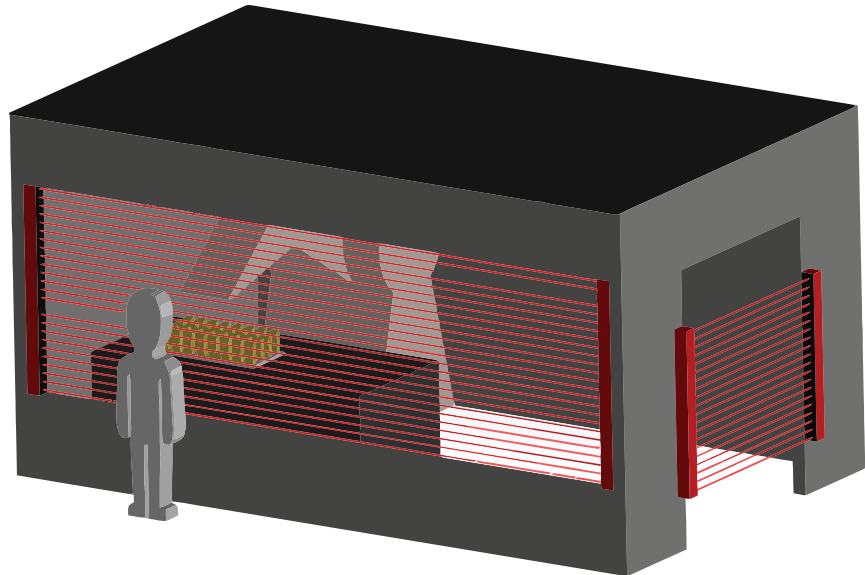
Figure 56 - Dimensions M12 Five-pin Plug



Typical Installations

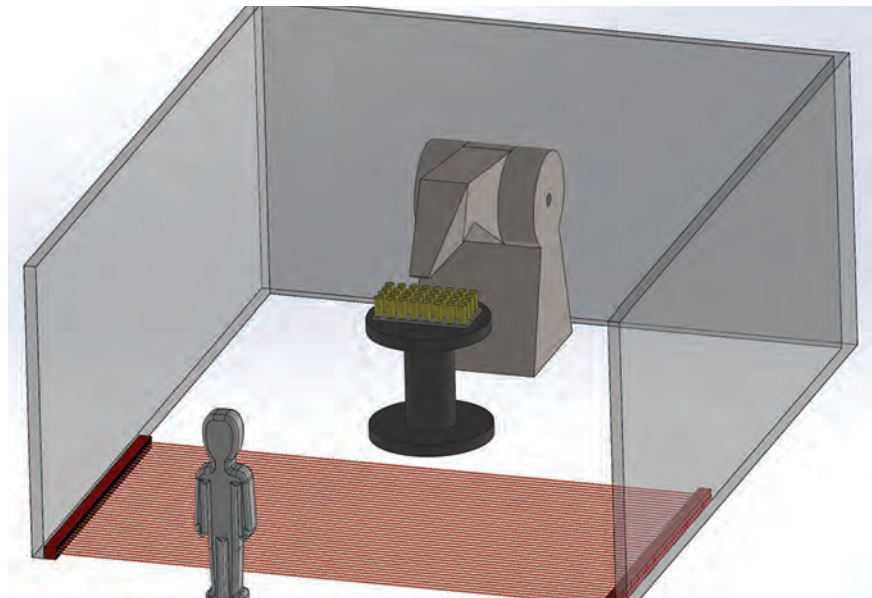
Safety Light Curtain Mounted Vertically

Figure 57 - Point of Operation Control (POC) and Access Control (AC)



Safety Light Curtain Mounted Horizontally

Figure 58 - Hazardous Zone Safe Guarding (Area Protection)



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Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

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