Installation Instructions

Original Instructions

GuardShield PAC Type 4 (Perimeter Access Control) Safety Light Curtain

Catalog Numbers 440L-P4Ax, 440L-T4Ax, 440L-R4Ax

ATTENTION:
- Do not use the GuardShield™ PAC safety light curtain with machines that cannot stop electrically in an emergency.
- Always maintain the safety distance between the GuardShield safety light curtain and a dangerous machine movement.
- Install additional mechanical protective devices so you cannot reach the hazardous machine elements without passing through the protective field.
- Install the GuardShield safety light curtain so you can only access the hazard through the sensing field.
- Improper installation can result in serious injury.
- Never connect the outputs to +24V DC. If the outputs connect to +24V DC, they are in the on-state and cannot stop hazardous spots at the machine/application.
- Never expose the GuardShield safety light curtain to flammable or explosive gases.
- Regular safety inspections are imperative (see Inspection on page 4).
- Do not repair or modify the GuardShield safety light curtain. The GuardShield safety light curtain is not field repairable and can only be repaired at the factory. Removal of either of the GuardShield endcaps void the warranty terms of this product.

Only use the GuardShield PAC safety light curtain as defined in these instructions and publications that are listed in Additional Resources on page 8. Only qualified personnel can install, commission, service, and use this safety light curtain, and only on the machine that the device was intended.

If the device is used for any other purposes or modified in any way, warranty claims against Allen-Bradley/Guardmaster become null and void.

IMPORTANT Observe the following items to maintain the 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 98/37/EEC
- Equipment Usage Directive 89/655/EEC
- The work safety regulations/safety rules
- Other relevant health and safety regulations

Manufacturers and users of the machine that uses the safety light curtain are responsible for obtaining and observing all applicable safety regulations and rules.

Specifications

Table 1 - Technical Specifications

Attribute	Value
Light beams	• 440L-P4A3400YD: 3/400 mm spacing • 440L-P4A2500YD: 2/500 mm spacing
Protective field	• 3-beam: 820 mm (31.8 in.) • 2-beam: 820 mm (31.8 in.)
Range	16 m (52.5 ft)
Response time	OSSD – on to off (reaction times) • 20 ms uncoded • 30 ms coded
Power supply	24V DC +/-20% Power supply must meet the requirements of IEC 60204-1 and IEC 61496-1
Power consumption	400 mA max (unloaded)
IR transmitter	Infrared LED (wave length 870 nm)
Aperture angle	Within ± 2.5° for transmitter and receiver
Operating condition	IR transmitter on
Functions	• Guard only: On/off operation with clear/obstructed detection area • Start interlock: Interlock at startup - reset by actuation of momentary N.O. push-button switch (or interruption/restoration of the safety light curtain) • Restart interlock: Interlock at interruption of sensing field - reset by actuation of momentary N.O. push-button switch • Relay monitoring: Monitoring a switch contact of the installation • Beam coding: Can be necessary for multiplex alignment • Test function: Triggering of system test via external switch
Inputs transmitter	Machine test signal • Minimum duration 100 ms • Voltage level for Logic 0: 0...5V DC • Voltage level for Logic Hi 1: > 16V DC
Inputs receiver	Start/restart interlock • Logic Lo • Minimum duration 100 ms • Maximum duration 900 ms • Voltage level for Logic Lo 0: 0...5V DC • Voltage level for Logic Hi 1: > 16V DC
	MPCE • 300 ms after activation of OSSD: • Voltage level for Logic 0:0...5V DC • Voltage level for Logic Hi 1: > 16V DC
Outputs	• Safety outputs (OSSDs): Two solid-state outputs, max switching capacity 500 mA, short circuit protection, max residual voltage 2V (excl. voltage drop through cables) • Auxiliary output: Solid-state output, max power consumption 500 mA, max residual voltage 2V - non-safety output. Max off-state leakage current: 1 mA Max capacitive load: 0.18 uF
Status indicators receiver	• On-state: Constant on when system is in on-state (green status indicator) • Off-state: Constant on when system is in off-state (red status indicator) Lights up at interruption of protective field or if fault occurs • Alignment: Lights up, if input signal is too weak (amber status indicator) • Interlock: Lights up when safety light curtain is in Start or Restart Interlock mode (yellow status indicator)
Status indicators sender	• Power on: Lights up when voltage is on (amber status indicator) • Emitting: Constant on when transmitter is active (yellow status indicator)
QD connectors	• Transmitter: M12 4-pin plug • Receiver: M12 8-pin plug for GuardShield PAC standard safety light curtain or with integrated laser alignment system M12 5-pin plug GuardShield PAC safety light curtain with ArmorBlock® Guard I/O™
Cable length	• Maximum 30 m (100 ft) • Maximum resistance: 5 Ω
Ambient temperature	• Operation: –10...+55 °C (14...131 °F) • Storage: –25...+75 °C (-13...+167 °F)
Relative humidity	Up to 95% (without condensation) 20...55 °C (68...131 °F)
Enclosure rating	IP65

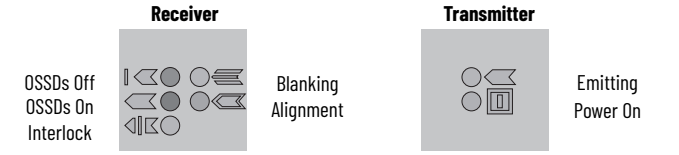
Table 1 - Technical Specifications (Continued)

Attribute	Value
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, duration 16 ms
Material	• Housing: Aluminum • Cover: PMMA (acrylic)
Approvals	IEC 61496 Parts 1 and 2, UL 61496 Parts 1 and 2, UL 1998
Safety classification	• Type 4 per EN/IEC 61496, category 4 EN/ISO 13849 • SIL 3, IEC 61508, SIL CL 3 EN 62061, PLe, EN/ISO 13849
Probability of a dangerous failure per hour PFH	• Standalone system: 9.51 x 10^{-9} • Cascading system (host/guest): 1.95 x 10^{-8} • Cascading system (host/guest/guest): 2.75 x 10^{-8}
T_M (mission time)	20 years (EN ISO 13849)
Transmitter wave length	870 nm

Status Indicators

The standard GuardShield PAC safety light curtain has a status indicator in the receiver, for use as an alignment aid, which flashes when the receiver sees the infrared light from the transmitter. This status indicator turns off when you attain optimal alignment.

Table 2 - System Status Indicators



Condition No.(1)	Receiver Status Indicators					Transmitter Status Indicators	
	OSSDs Off Red	OSSDs On Green	Yellow	Alignment Amber	Interlock Yellow	Power On Amber	Emitting Yellow
1	Off	On	Off	Off	Off	On	On
2	On	Off	Off	Off	Off	On	On
3	On	Off	Off	On	Off	On	On
4	On	Off	Off	Off	On	On	On
5	On	Off	Off	Off	Off	On	Off
6	Flash (2)	Off	Off	Off	Off	On	On
7	On	Off	Off	Off	Off	Flash (2)	On
8	Flash (2)	Off	Off	On	Off	On	On
9	Flash (2)	Off	Off	Off	On	On	On
10	Flash (2)	Off	Data Trans (3)	Off	Off	On	On
11	Flash (2)	Off	Off	Off	Off	Flash (2)	Data Trans (3)

(1) Conditions No. 6...11 are fault conditions.
(2) Flash rate is approximately 2 Hz (two times per second).
(3) Data transmission (factory configuration interface), not available for use outside factory.

Table 3 - Conditions

Condition No. (1)	Description
1	Guard Only mode, safety light curtain unobstructed (aligned, not in interlock)
2	Guard Only mode, safety light curtain interrupted (aligned, not in interlock)
3	Guard Only mode, misaligned (not in interlock)
4	In start or restart interlock (aligned)
5	Transmitter test input active (pin 4)
6	Internal fault, receiver
7	Internal fault, transmitter
8	External fault (OSSD short to ground, +V, or cross connection)
9	External fault (MPCE/EDM error)
10	Configuration mode (receiver access door open)
11	Configuration mode (transmitter access door open)

(1) For fault conditions 6...11, see Troubleshooting on page 4.

Installation

The GuardShield PAC safety light curtain is suitable for most operating environments (IP65 environmental rating). You must observe the proper safety distance.

IMPORTANT The installation of the GuardShield PAC safety light curtain must adhere to the ANSI standard B11.19/E4.2.3.3.6, which requires that a presence sensing device helps prevent the operator or others from reasonably reaching over, around, or under the sensing field into the hazardous area. To meet this requirement, auxiliary safeguards can be required with the GuardShield PAC safety light curtain.

Determine if the machinery on which the GuardShield PAC safety light curtain mounts meets the requirements as specified in the beginning of this publication. The machinery must be able to stop anywhere in its stroke or cycle, consistently and repeatedly.

Mount the GuardShield PAC safety light curtain the proper distance from the point of operation hazard. This distance is referred to as the Safety Distance. See publication 440L-UM001.

ANSI/RIA 15.06 requires that the first beam of the GuardShield PAC safety light curtain is mounted at 300 mm (12 in.) off the floor in vertical applications. The protective height of the GuardShield PAC safety light curtain three-beam is 820 mm (32.28 in). The combination of 300 mm (12 in.) and 820 mm (32.28 in) equals 1120 mm (44.09 in.), which meets the ANSI/RIA 15.06 requirements of a reach-over application. This requirement dictates that the depth penetration factor (D_{pf}) is 1219 mm (48 in.) when performing the safety distance calculation.

Alignment

Standard GuardShield PAC Safety Light Curtain

1. Mount and connect both the transmitter and receiver so they are parallel to each other and positioned at the same height.
2. Turn on power to GuardShield PAC safety light curtain system.
3. Rotate the transmitter while watching the amber status indicator on the receiver to find the point where the indicator for the on state (green status indicator) illuminates and the amber status indicator turns off.
4. Determine the maximum left and right turning angles and position the unit in the center. Tighten all hardware, confirming that the alignment indicator is not illuminated.
5. Cycle power to confirm that the system powers up and goes to the on state (alignment indicator is off).

The GuardShield PAC safety light curtain meets the requirements of IEC 61496, which requires that the optics of the transmitter and receiver emit and receive infrared light at a maximum of ±2.5°. This requirement creates a tight optical path of infrared light and can make the GuardShield PAC safety light curtain difficult to align at maximum range, or when corner mirrors are used in the application to provide two or three sided perimeter guarding.

GuardShield PAC Safety Light Curtain with Integrated Laser Alignment

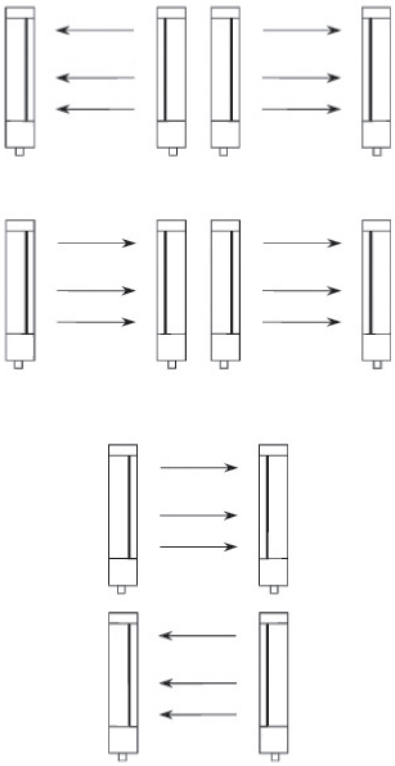
1. Properly locate the GuardShield PAC safety light curtain pair from the point of operation hazard after you perform the safety distance calculation.
2. Use the GuardShield PAC safety light curtain mounting brackets to mount the transmitter and receiver so that they face one another and are positioned in the same direction. The status indicators are opposite one another.
3. To turn on each laser, place a finger or hand in front of each laser.
4. Adjust the transmitter and receiver so that both visible laser beams reach the laser targets opposite each laser. A small deviation from the center of the target is allowable.

Multiple GuardShield PAC Safety Light Curtains

When two or more GuardShield PAC safety light curtains are mounted near one another, the receiver of one GuardShield PAC safety light curtain system can possibly see the infrared light of the transmitter of another GuardShield PAC safety light curtain pair. This optical interference can be over come by the beam code feature of the GuardShield PAC safety light curtain (see publication 440L-UM001). Beam coding changes the pulse pattern of infrared light that the GuardShield PAC safety light curtain transmitter emits.

When two or more GuardShield PAC safety light curtains mount near one another, the receiver of one GuardShield PAC safety light curtain pair can receive infrared light from the transmitter of another pair. Use the beam code feature of the GuardShield PAC safety light curtain (see publication 440L-UM001) to over this optical interference. Beam coding changes the pulse pattern of infrared light that the GuardShield PAC safety light curtain transmitter emits.

Figure 1 - Alignment Options



Transmitters emit in opposite directions. Each receiver receives only the beams of the appropriate transmitter.

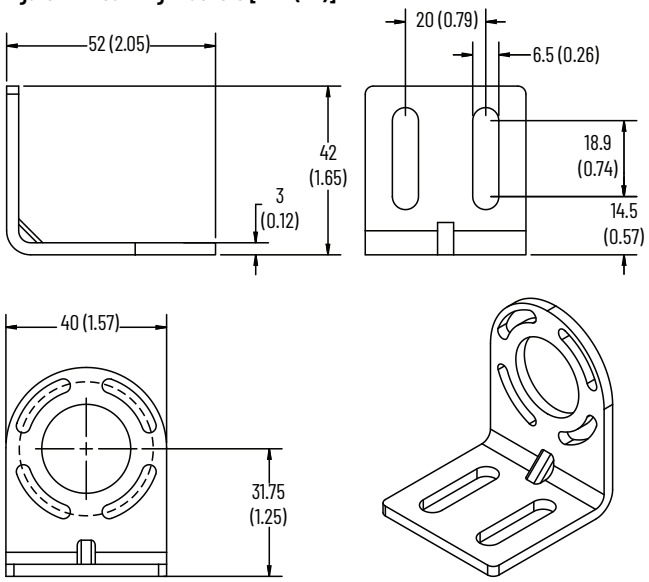
Transmitters emit in the same direction:
→ Coding necessary

Positioning of the light curtain: Transmitters emit in opposite directions.

Mounting Brackets

The GuardShield PAC safety light curtain mounts with right angle brackets that attach to the end caps of both transmitter and receiver. Each GuardShield PAC safety light curtain is supplied with standard right angle mounting brackets and self-threading screws. If necessary, use additional brackets to mount the GuardShield PAC safety light curtain at a proper safety distance from the machinery hazard. See publication 440L-UM001.

Figure 2 - Mounting Brackets [mm (in.)]



Wiring

The external voltage supply (+24V DC) must meet the requirements of IEC 61496-1. In addition, the power supply must meet the following requirements:

- The power supply bridges short-term power failures of 20 ms.
- The power supply has double insulation between the primary and the secondary side.
- The power supply is protected against overload.
- The power supply corresponds to the guidelines of the EWG (industrial environment).
- The power supply corresponds to the Low Voltage Directives.
- The grounded conductor of the power supply device must connect to a grounded conductor PE.
- The maximum deviation of the voltage levels is 24V DC ±20%.

Table 4 - GuardShield PAC ArmorBlock Connectivity

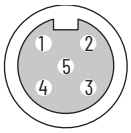
Top View	Color	Pin	Signal
			Receiver
	Brown	1	+24V
	White	2	OSSD 2
	Blue	3	0V
	Black	4	OSSD 1
	Gray	5	NC

Table 5 - Standard Receiver Connectivity

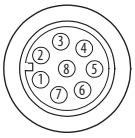
Top View of Concave DC Micro	Color	Pin	Signal
			Receiver
	White	1	Auxiliary output
	Brown	2	+24V DC
	Green	3	Ground
	Yellow	4	EDM
	Gray	5	OSSD 1
	Pink	6	OSSD 2
	Blue	7	OV DC
	Red	8	Start/restart

Table 6 - Receiver Connector for ArmorBlock Guard I/O Connectivity

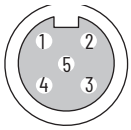
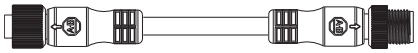
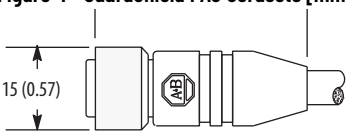
Top View	Color	Pin	Signal
			Receiver
	Brown	1	+24V
	White	2	OSSD 2
	Blue	3	OV
	Black	4	OSSD 1
	Gray	5	NC

Figure 3 - Example of Patchcord



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

Figure 4 - GuardShield PAC Cordsets [mm (in.)]



For circuit diagrams, see publication 440L-UM001.

Initiate the Unit

Before the initiation of the GuardShield PAC safety light curtain, you must complete the following checklist.

Cable check before initiation:

- The power supply solely connects to the GuardShield PAC safety light curtain.
- The power supply is a 24V DC device, which must comply with all applicable standards of the Machinery Directive 2006/42/EC, and the product standard (IEC 61496).
- The power supply at the GuardShield PAC safety light curtain has proper polarity.
- The transmitter connection cable properly connects to the transmitter, the receiver connection cable properly connects to the receiver.
- Confirm the double insulation between the safety light curtain output and an external potential.
- The OSSD outputs do not connect to +24V DC.
- The connected switching elements (load) do not connect to 24V DC.
- There is no connection to a conventional power supply.
- If two or more GuardShield PAC safety light curtains are used, confirm that each system is properly installed to avoid optical interference.

Switch on the GuardShield PAC safety light curtain and observe the following to check its function:

- If the protective field is free of obstructions, 2 seconds after switching on, the system starts to work properly.

Troubleshooting

The safety light curtain conducts an internal self-test after startup. If an error occurs, an appropriate signal combination is sent through the status indicators to the transmitter and receiver.

Table 7 - Errors

Condition No.	Error Description	Action
6	Internal fault, receiver	• Check the configuration of the transmitter and receiver • Replace the receiver
7	Internal fault, transmitter	• Check the configuration of the transmitter and receiver • Check the protective field of the transmitter/receiver • Check the connections of the transmitter/receiver • Exchange the transmitter
8	External fault	• Check the connections of OSSD outputs for a short circuit against +24V DC and GND (cable, connected devices) • Exchange the receiver
9	External fault (MPCE error) The function relay monitoring is activated and after clearing the OSSD, the input relay monitoring does not recognize a change of state.	• Check the connection to relay monitoring • Check the connected relay for closed contact – If OSSD on: The input relay monitoring must have GND level – If OSSD off: The input relay monitoring must have +24V • Switch on only after power off/on
10	Configuration mode (receiver)	• The cover for the DIP switch setting at the receiver is open
11	Configuration mode (transmitter)	• The cover for the DIP switch setting at the transmitter is open

Inspection

ATTENTION: Never operate the GuardShield PAC safety light curtain before you conduct the following inspection. Improper inspection can lead to operator injury.

Specialist personnel or specially qualified and authorized personnel must conduct, record, and document the tests so the tests can be reconstructed and retraced at any time.

Only conduct an inspection if you clearly understand the functioning of the GuardShield PAC safety light curtain, and of the machine, and you have sufficient information available to conduct the inspection.

For the inspection, confirm:

- Approach to hazardous machine parts must only be possible through the protective field of the GuardShield Micro 400 safety light curtain.
- Operators cannot step through the sensing area while working on dangerous machine parts.
- The safety distance of the application is bigger than the calculated value.
- The optic front cover is not scratched or dirty.

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

- The protective field is interrupted.
- Hazardous machine movement stops immediately when the test interrupts the protective field:
  - Directly in front of the transmitter
  - Directly in front of the receiver
  - In the middle between transmitter and receiver
- No hazardous machine movement while the test rod is anywhere within the protective field.
- If the blanking function is active, check all sections of the protective field with the appropriate test piece.

IMPORTANT If any of the previously listed conditions do not stop the hazardous motion of the machine, do not allow the machine to operate.

For the detailed inspection, confirm:

- The machine stops or does not obstruct any safety function.
- The latest machine or connection modifications have no effect on the control system.
- The outputs of the controller of the GuardShield Micro 400 safety light curtain properly connect to the machine.
- The total response time of the machine is shorter than the calculated value.
- Cables and plugs of the GuardShield Micro 400 safety light curtain are in good condition.
- Mounting brackets, caps and cables are properly secured.

Approximate Dimensions

Figure 5 - GuardShield PAC Standard Safety Light Curtain 440L-P4A2500YD [mm (in.)]

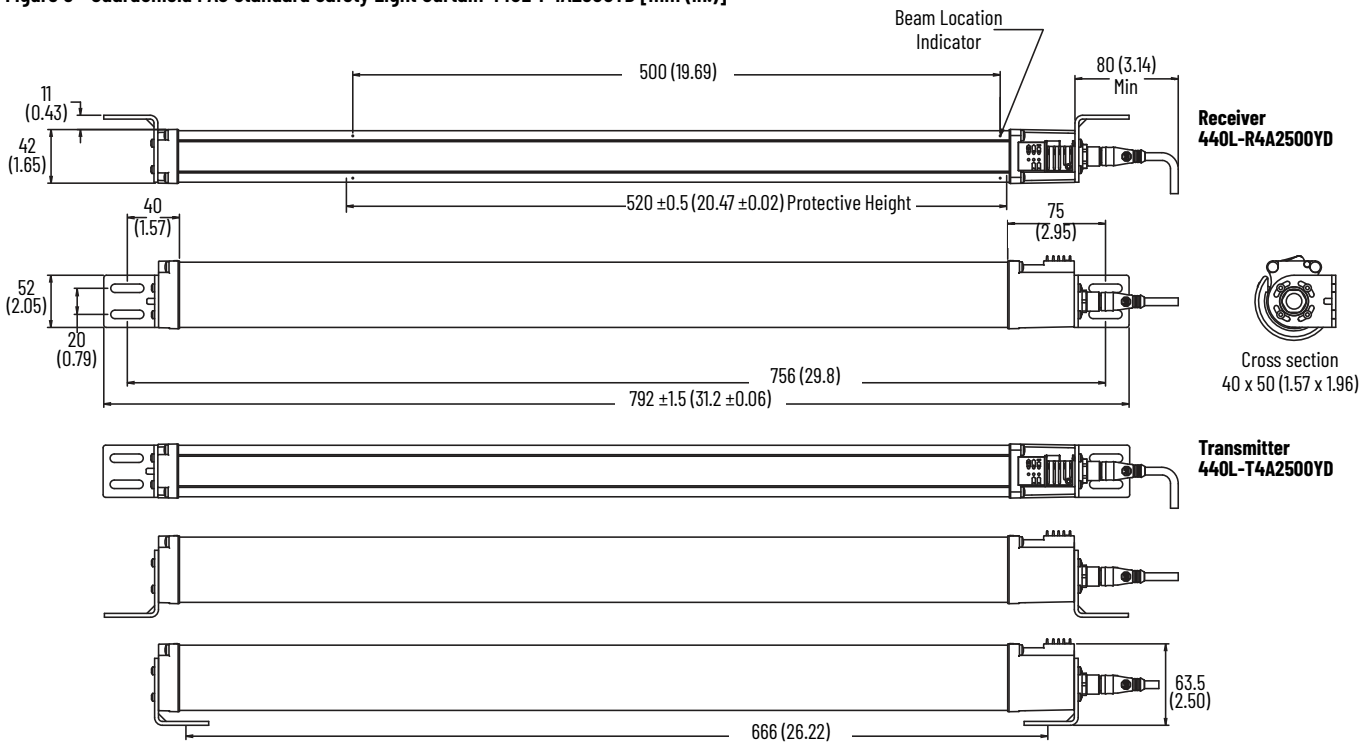


Figure 6 - GuardShield PAC Safety Light Curtain with Integrated Laser Alignment 440L-P4AL2500YD [mm (in.)]

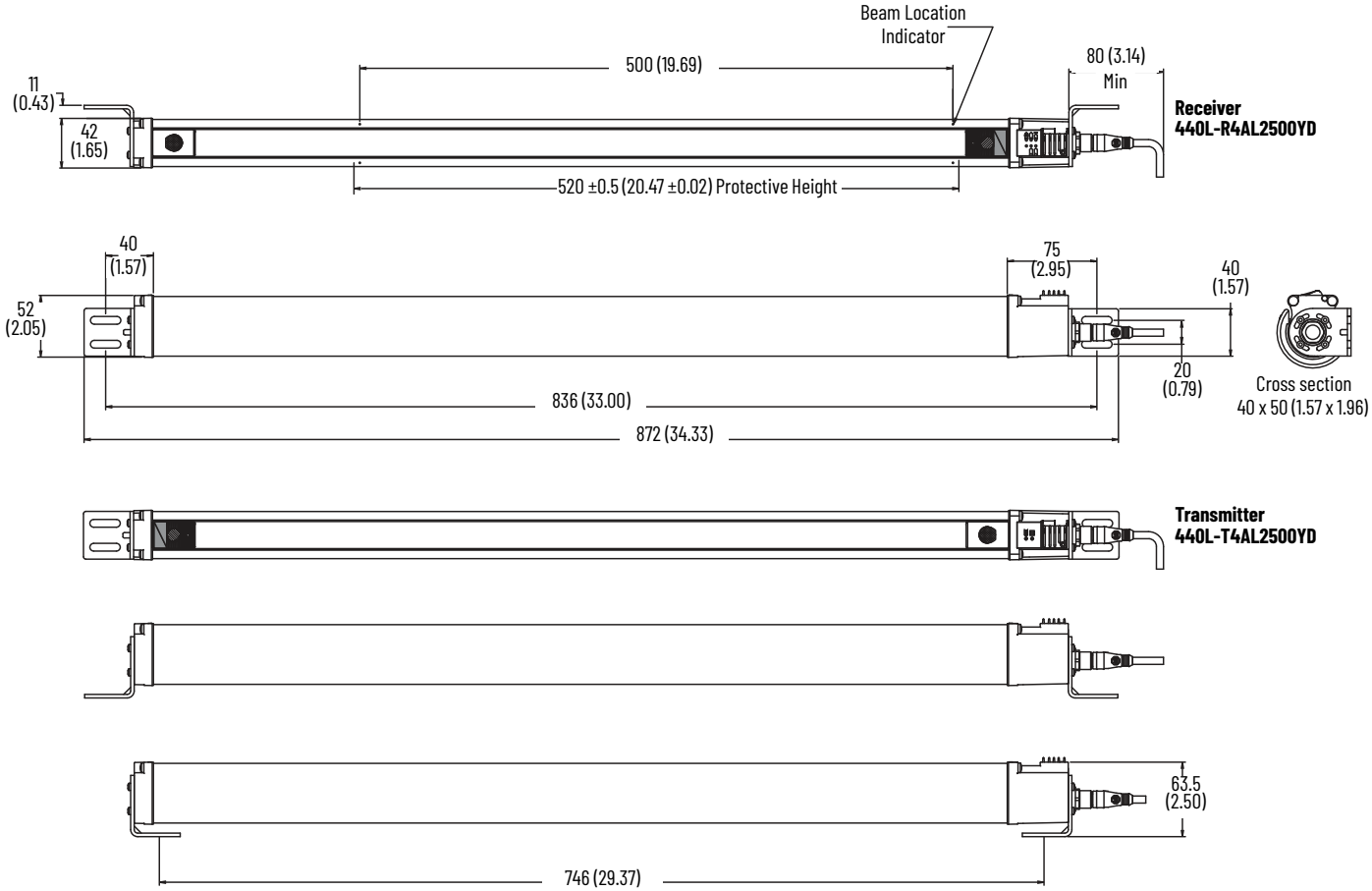


Figure 7 - GuardShield PAC Standard Safety Light Curtains 440L-P4A3400YD [mm (in.)]

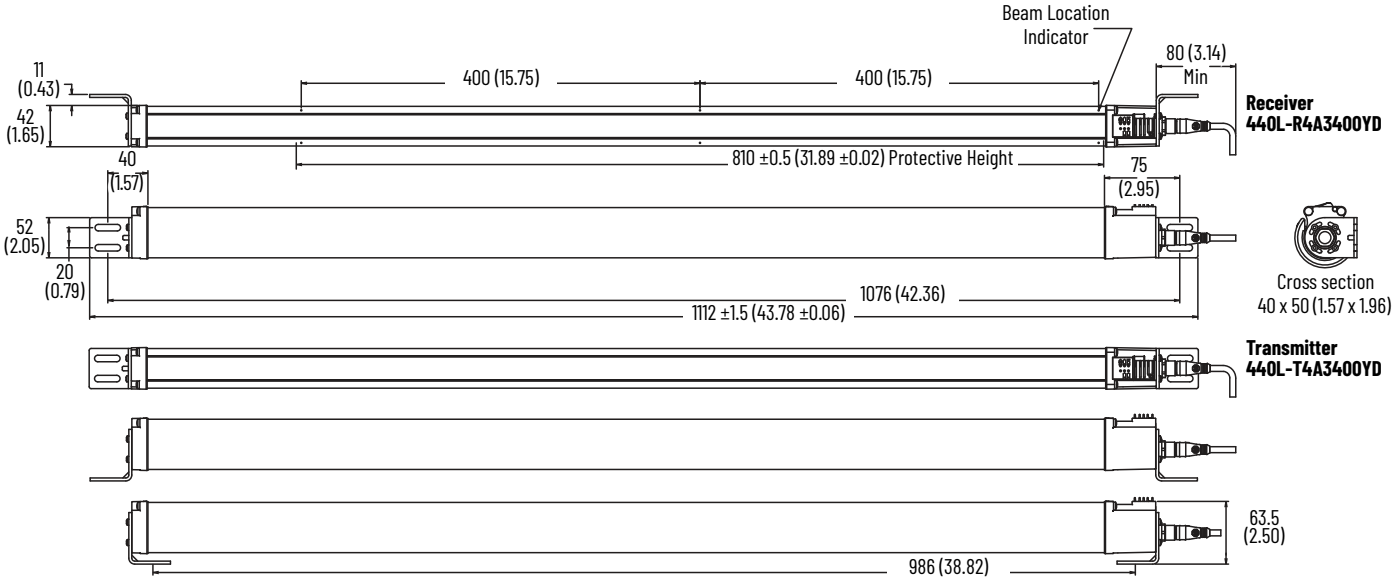
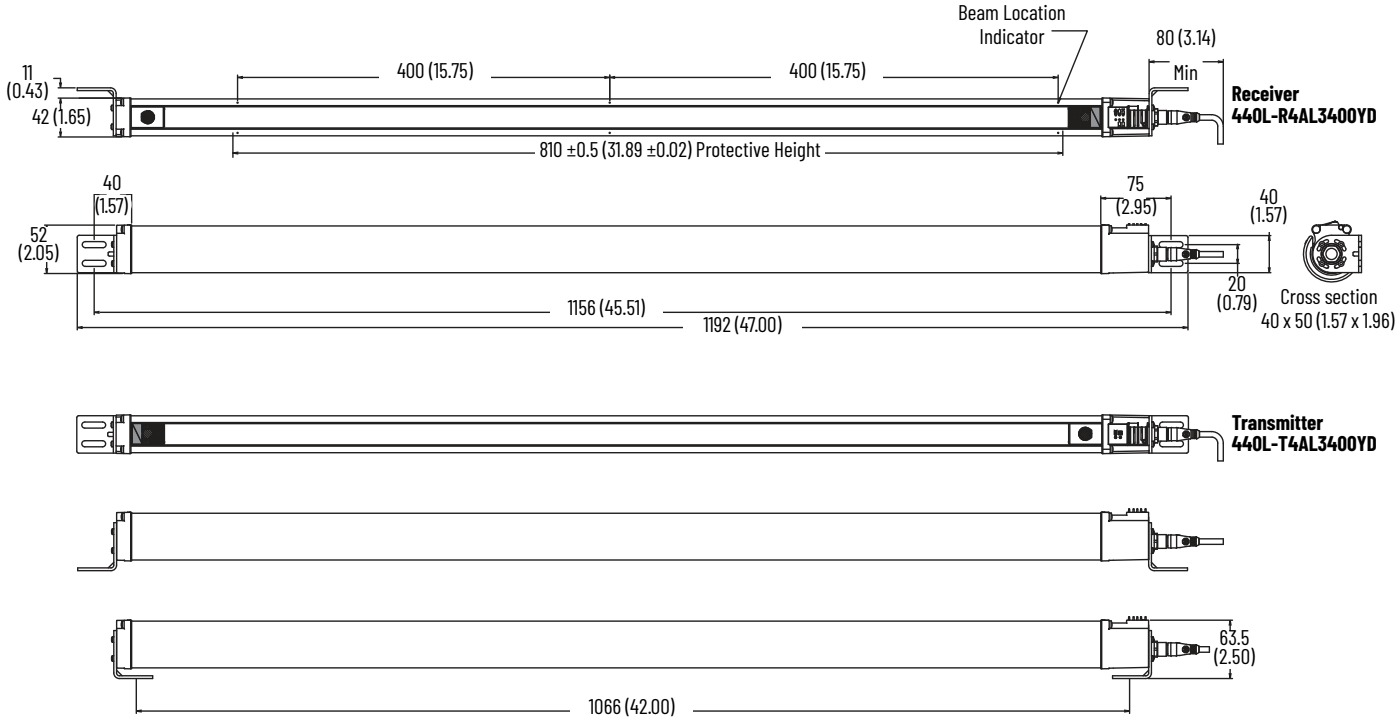


Figure 8 - GuardShield PAC Safety Light Curtain with Integrated Laser Alignment 440L-P4AL3400YD [mm (in.)]



Declaration of Conformity

CE Conformity

Rockwell Automation declares that the products that are shown in this document conform with the Essential Health and Safety Requirements (EHSRs) of the European Machinery Directive (2006/42/EC) and the EMC Directive (2014/30/EU). These products also conform to:

- EN 55022:1998 +A1:2000 +A2:2003- Information technology equipment – Radio disturbance characteristics -Limits and methods of measurement
- EN 61496-1:2004 + A1:2008 - Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests
- CLC/TS 61496-2:2006 IEC 61496-2:2006 - Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)
- EN 61508:2001 - Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN 62061:2005 - Safety of machinery – Functional safety of safety-related electrical, electronic, and programmable control systems
- EN ISO 13849-1:2008 / AC:2009 - Safety of machinery – Safety related parts of control systems – Part 1: General principles for design

For a comprehensive CE certificate visit: rok.auto/certifications.

UKCA Conformity

Rockwell Automation declares that the products that are shown in this document are in compliance with Supply of Machinery (Safety) Regulations (2008 No. 1597) and the Electromagnetic Compatibility Regulations (2016 No. 1091). These products also conform to:

- EN 55022:1998 +A1:2000 +A2:2003- Information technology equipment – Radio disturbance characteristics -Limits and methods of measurement
- EN 61496-1:2004 + A1:2008 - Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests
- CLC/TS 61496-2:2006 IEC 61496-2:2006 - Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)
- EN 61508:2001 - Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN 62061:2005 - Safety of machinery – Functional safety of safety-related electrical, electronic, and programmable control systems
- EN ISO 13849-1:2008 / AC:2009 - Safety of machinery – Safety related parts of control systems – Part 1: General principles for design

For a comprehensive UKCA certificate visit: rok.auto/certifications.

Additional Resources

Resource	Description
GuardShield PAC Type 4 (Perimeter Access Control) Safety Light Curtain User Manual, publication 440L-UM001	Provides operation and installation instructions for the Standard GuardShield PAC safety light curtain, GuardShield PAC safety light curtain with Integrated Laser Alignment system, GuardShield PAC safety light curtain with Integrated Laser Alignment, and ArmorBlock Guard I/O connectivity.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.
For technical support, visit rok.auto/support.

Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752, İçerenköy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

Connect with us.

rockwellautomation.com — expanding **human possibility**®

AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2663 0600, Fax: (32) 2 663 0640
ASIA PACIFIC: Rockwell Automation SEA Pte Ltd, 2 Corporation Road, #04-05, Main Lobby, Corporation Place, Singapore 618494, Tel: (65) 6510 6608, FAX: (65) 6510 6699
UNITED KINGDOM: Rockwell Automation Ltd., Pitfield, Kiln Farm, Milton Keynes, MK11 3DR, United Kingdom, Tel: (44)(1908) 838-800, Fax: (44)(1908) 261-917

Publication 440L-IN015A-EN-P - June 2023
PN-72742
10000100941 Ver 03