

Safe 4 and Safe 2 POC Light Curtain Migration

Bulletin 445L



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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Notes:

A number of older Allen-Bradley® GuardShield™ safety light curtains will soon be obsoleted and no longer be available for sale. This publication suggests examples of how to convert these existing light curtain applications to safety light curtains with the latest technologies.

The products that are described in this publication can be used in various ways. Therefore, designers must verify that all steps have been taken to help assure that each application and use of this control equipment meets all performance and safety requirements. Designers must consider applicable laws, regulations, codes, and standards.

The wiring diagrams in this publication are intended as examples. Since many variables and requirements are associated with any particular installation, Rockwell Automation does not assume responsibility or liability for actual use based on these examples.

This publication is intended for machine safeguarding system designers who have been adequately trained in the design and use of safeguarding systems and risk assessments.

Additional Resources

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

| Resource | Description |
|--|--|
| GuardShield™ Safe 4 and Safe 4 PAC Safety Light Curtains User Manual, publication 445L-UM001 | Provides detailed information to install, wire, configure, troubleshoot, and use the GuardShield Safe 4 and Safe 4 PAC safety light curtains. |
| GuardShield Safe 2 and Safe 2 PAC Safety Light Curtains User Manual, publication 445L-UM002 | Provides detailed information to install, wire, configure, troubleshoot, and use the GuardShield Safe 2 and Safe 2 PAC safety light curtains. |
| GuardShield Safety Light Curtain User Manual, publication 450L-UM001 | Provides detailed information to install, wire, configure, troubleshoot, and use the GuardShield 450L safety light curtains. |
| GuardShield Type 4 and GuardShield Remote Teach User Manual, publication 440L-UM003 | Provides detailed information to install, wire, configure, troubleshoot, and use the GuardShield 440L Type 4 safety light curtains. |
| GuardShield Type 2 Safety Light Curtain Installation, publication 440L-IN011 | Provides detailed information to install, wire, configure, troubleshoot, and use the GuardShield Type 2 safety light curtains. |
| System Design for Control of Electrical Noise, publication GMC-RM001 | Provides a thorough review of the installation and grounding of noisy components and what can be done to minimize their potential for injecting noise into the system. |
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation® industrial system. |
| Product Certifications website, rok.auto/certifications | Provides declarations of conformity, certificates, and other certification details. |
| Safety Book 5, Safety-related Control Systems for Machinery, publication SAFEBK-RM002 | 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.

Introduction

Scope

This document provides conversion details from the Safe 4 POC and Safe 2 POC light curtains. POC is an acronym for point of operation control, typically where an operator has direct access to a hazard through the light curtain. POC light curtains have two resolutions: 14 mm (0.55 in.) for finger detection or 30 mm (1.18 in.) for hand protection.

This document excludes the PAC type light curtains. PAC is an acronym for perimeter access control. PAC light curtains are used in applications that require full body detection.

For further assistance in replacing the 445L PAC devices, contact Technical Support.

Benefits

The 450L light curtain provides the following additional benefits

- Single stick transceiver
- Functionality provided by a plug-in module
- Cat 4 PLe and SIL 3 rating
- Full active design (no passive zones at top or bottom of the stick)

Conversion Concerns

Manufacturers, distributors, integrators, and you recognize that product obsolescence is a fact of the industrial business cycle. This document attempts to provide a more cost-effective recommendation for converting the 445L Safe 4 and Safe 2 light curtains to the state-of-the-art 450L light curtain family. Take into consideration the following major concerns.

Range

Range is the distance between the transmitter and receiver. For this migration, the range is the first consideration.

Protective Height/Resolution

Protective height is the length of the field that the light curtain detects. The stick length of the 445L Safe 4 light curtain is longer than the protective field. Therefore, you must confirm that the migration is to an equivalent or larger protective field length or perform a risk assessment if a shorter length is selected.

Resolution is the ability of the light curtain to detect certain size objects. Finger detection is acceptable at 14 mm (0.55 in.) and hand detection at 30 mm (1.18 in.). The migration suggestions in this document maintain the resolutions from 445L Safe 4 to 450L or 440L. Perform a risk assessment before changes are made to the resolution. This assessment can require the light curtains to be relocated depending on the hazard.

Electrical Connections

The 445L Safe 4 light curtains have 5-pin QD connectors. This document shows migration to light curtains that have similar electrical connections, to eliminate, or minimize wiring changes.

Mounting

The 445L Safe 4 and 450L light curtains have similar housing features. These features also allow the 445L Safe 4 mounting brackets to be used by the preferred migration path to the 450L light curtains. This approach simplifies the migration as it minimizes the installation changes.

If you determine that the best migration path is to the 440L light curtain, the mounting brackets must be changed.

Response Time

Response time is the time that is required to perform the safety function. For each conversion, the comparable response time is provided. An increase in the response time can require that you adjust the safety distance. A risk assessment must be performed if the migration is to a longer response time (see [SAFEBOOK-RM002](#) for further information on the safety distance calculation).

Output Load Capability

Output load capability is the ability of the light curtain safety OSSD outputs to switch loads. The 445L Safe 4 light curtain has a limit of 300 mA; which is

less than the 500 mA switching capability of either the 450L or the 440L light curtains.

OSSD Pulse Testing

The 445L Safe 4 and 450L light curtains use pulse testing on the OSSD safety outputs to detect short circuits to 24V, 0V, and to each other. The 440L light curtain does not use pulse testing; instead, short circuits are checked by creating a short delay between the turn on of the OSSD safety outputs.

This section is provided for informational purposes only. Both methods of detecting short circuits on the OSSD safety signals are adequate for their safety ratings and cannot influence the decision to migrate to one light curtain or the other.

Notes:

445L Safe 4 POC Light Curtain

Range

The first criteria for determining the best migration path is the range of the 445L Safe 4. The 445L Safe 4 has 3 ranges of resolution:

- 0...9 m (0...29.5 ft) with 14 mm (0.55 in.) resolution
- 0...18 m (0...59 ft) with 30 mm (1.18 in.) resolution
- 5...30 m (16.4...98.4 ft) with 30 mm (1.18 in.) resolution

[Table 1](#) compares the range of the 445L Safe 4 to the 450L-B, 450L-E, and the 440L Type 4 light curtains. The preferred solution is to migrate to the 450L-B light curtain. The second preference is to migrate to the 450L-E light curtain. The alternative is to migrate to the 440L.

For long range applications where the 30 mm (1.18 in.) 445L Safe 4 light curtain is used at the range of 16...30 m (52...98.42 ft), two sets of light curtains must be used to cover the distance.

For small range applications where a 445L Safe 4 light curtain with hand resolution [30 mm (1.18 in.)] is installed at an operating distance smaller than 0.9 m (2.95 ft), a 450L with finger [14 mm (0.55 in.)] resolution [operating range >0.5m (1.64 ft)] or a 440L with hand [30 mm (1.18 in.)] resolution must be considered.

For small range applications where the 14 mm (0.55 in.) 445L Safe 4 light curtain is installed at a distance smaller than 0.5 m (1.64 ft), a 440L with finger resolution must be considered.

Table 1 - Range Comparison

| Resolution | Range m (ft) | | | |
|------------------|-------------------------|---------------------------|---|--------------------------|
| | 445L Safe 4 | 450L-B | 450L-E | 440L Type 4 |
| 14 mm (0.55 in.) | 0...9 (0...29.5) | 0.5...4 (1.64...13.12) | 0.5...9 (1.64...29.53) | 0.3...7 (0.98...22.9) |
| 30 mm (1.18 in.) | 0...18 (0...59) | 0.9...7 (2.95...23) | 0.9...16.2 (2.95...53.15) | 0.3...16 (0.98...52) |
| | 5...30 (16.4...98.4) | — | Need two light curtains for ranges between 18...30 m (59...98.4) | |

Protective Height

Protective height is that portion of the light curtain that is designed to detect the presence of an object, typically a finger (with 14 mm (0.55 in.) resolution), or a hand (with 30 mm (1.18 in.) resolution).

The 445L Safe 4 light curtain has protective heights from 120...1920 mm (4.72 ...75.6 in.), in increments of 120 mm (4.72 in.). The 450L light curtain has protective heights from 150...1950 mm (5.9...76.77 in.) in increments of 150 mm (5.9 in.). The 440L Type 4 light curtain has protective heights from 160...1760 mm (6.3...69.2 in.) in increments of 160 mm (6.3 in.). In cases where the protective height between the 445L Safe 4 light curtain and the alternative safety light curtain differs, 445L Safe 4 provides all alternatives with a longer protective height (see [Table 2](#)...[Table 4](#)).

Table 2 - 445L Safe 4 Light Curtains to 450-B Light Curtains [mm (in.)]

| Resolution | From 445L Safe 4 Light Curtain | | To 450L-B Light Curtain | |
|------------|--------------------------------|----------------|-------------------------|-----------------|
| | Protective Height | Cat. No. | Protective Height | Cat. No. |
| 14 (0.55) | 120 (4.7) | 445L-P4L0120YD | 150 (5.9) | 450L-B4FN0150YA |
| | 240 (9.4) | 445L-P4L0240YD | 300 (11.8) | 450L-B4FN0300YA |
| | 360 (14.2) | 445L-P4L0360YD | 450 (17.7) | 450L-B4FN0450YA |
| | 480 (19.9) | 445L-P4L0480YD | 600 (23.6) | 450L-B4FN0600YA |
| | 600 (23.6) | 445L-P4L0600YD | 600 (23.6) | 450L-B4FN0600YA |
| | 720 (28.3) | 445L-P4L0720YD | 750 (29.5) | 450L-B4FN0750YA |
| | 840 (33.1) | 445L-P4L0840YD | 900 (35.4) | 450L-B4FN0900YA |
| | 960 (37.8) | 445L-P4L0960YD | 1050 (41.3) | 450L-B4FN1050YA |
| | 1080 (42.5) | 445L-P4L1080YD | 1200 (47.2) | 450L-B4FN1200YA |
| | 1200 (47.2) | 445L-P4L1200YD | 1200 (47.2) | 450L-B4FN1200YA |
| | 1320 (52.0) | 445L-P4L1320YD | 1350 (53.1) | 450L-B4FN1350YA |
| | 1440 (56.7) | 445L-P4L1440YD | 1500 (59.1) | 450L-B4FN1500YA |
| | 1560 (61.4) | 445L-P4L1560YD | 1650 (65.0) | 450L-B4FN1650YA |
| | 1680 (66.1) | 445L-P4L1680YD | 1800 (70.9) | 450L-B4FN1800YA |
| | 1800 (70.9) | 445L-P4L1800YD | 1800 (70.9) | 450L-B4FN1800YA |
| | 1920 (75.6) | 445L-P4L1920YD | 1950 (76.8) | 450L-B4FN1950YA |
| 30 (1.18) | 120 (4.7) | 445L-P4S0120YD | 150 (5.9) | 450L-B4HN0150YA |
| | 240 (9.4) | 445L-P4S0240YD | 300 (11.8) | 450L-B4HN0300YA |
| | 360 (14.2) | 445L-P4S0360YD | 450 (17.7) | 450L-B4HN0450YA |
| | 480 (19.9) | 445L-P4S0480YD | 600 (23.6) | 450L-B4HN0600YA |
| | 600 (23.6) | 445L-P4S0600YD | 600 (23.6) | 450L-B4HN0600YA |
| | 720 (28.3) | 445L-P4S0720YD | 750 (29.5) | 450L-B4HN0750YA |
| | 840 (33.1) | 445L-P4S0840YD | 900 (35.4) | 450L-B4HN0900YA |
| | 960 (37.8) | 445L-P4S0960YD | 1050 (41.3) | 450L-B4HN1050YA |
| | 1080 (42.5) | 445L-P4S1080YD | 1200 (47.2) | 450L-B4HN1200YA |
| | 1200 (47.2) | 445L-P4S1200YD | 1200 (47.2) | 450L-B4HN1200YA |
| | 1320 (52.0) | 445L-P4S1320YD | 1350 (53.1) | 450L-B4HN1350YA |
| | 1440 (56.7) | 445L-P4S1440YD | 1500 (59.1) | 450L-B4HN1500YA |
| | 1560 (61.4) | 445L-P4S1560YD | 1650 (65.0) | 450L-B4HN1650YA |
| | 1680 (66.1) | 445L-P4S1680YD | 1800 (70.9) | 450L-B4HN1800YA |
| | 1800 (70.9) | 445L-P4S1800YD | 1800 (70.9) | 450L-B4HN1800YA |
| | 1920 (75.6) | 445L-P4S1920YD | 1950 (76.8) | 450L-B4HN1950YA |

Table 3 - 445L Safe 4 Light Curtains to 450L-E Light Curtains [mm (in.)]

| Resolution | From 445L Safe 4 | | To 450L-E | |
|------------|-------------------|----------------|-------------------|-----------------|
| | Protective Height | Cat. No. | Protective Height | Cat. No. |
| 14 (0.55) | 120 (4.7) | 445L-P4L0120YD | 150 (5.9) | 450L-E4FL0150YD |
| | 240 (9.4) | 445L-P4L0240YD | 300 (11.8) | 450L-E4FL0300YD |
| | 360 (14.2) | 445L-P4L0360YD | 450 (17.7) | 450L-E4FL0450YD |
| | 480 (19.9) | 445L-P4L0480YD | 600 (23.6) | 450L-E4FL0600YD |
| | 600 (23.6) | 445L-P4L0600YD | 600 (23.6) | 450L-E4FL0600YD |
| | 720 (28.3) | 445L-P4L0720YD | 750 (29.5) | 450L-E4FL0750YD |
| | 840 (33.1) | 445L-P4L0840YD | 900 (35.4) | 450L-E4FL0900YD |
| | 960 (37.8) | 445L-P4L0960YD | 1050 (41.3) | 450L-E4FL1050YD |
| | 1080 (42.5) | 445L-P4L1080YD | 1200 (47.2) | 450L-E4FL1200YD |
| | 1200 (47.2) | 445L-P4L1200YD | 1200 (47.2) | 450L-E4FL1200YD |
| | 1320 (52.0) | 445L-P4L1320YD | 1350 (53.1) | 450L-E4FL1350YD |
| | 1440 (56.7) | 445L-P4L1440YD | 1500 (59.1) | 450L-E4FL1500YD |
| | 1560 (61.4) | 445L-P4L1560YD | 1650 (65.0) | 450L-E4FL1650YD |
| | 1680 (66.1) | 445L-P4L1680YD | 1800 (70.9) | 450L-E4FL1800YD |
| | 1800 (70.9) | 445L-P4L1800YD | 1800 (70.9) | 450L-E4FL1800YD |
| | 1920 (75.6) | 445L-P4L1920YD | 1950 (76.8) | 450L-E4FL1950YD |
| 30 (1.18) | 120 (4.7) | 445L-P4S0120YD | 150 (5.9) | 450L-E4HL0150YD |
| | 240 (9.4) | 445L-P4S0240YD | 300 (11.8) | 450L-E4HL0300YD |
| | 360 (14.2) | 445L-P4S0360YD | 450 (17.7) | 450L-E4HL0450YD |
| | 480 (19.9) | 445L-P4S0480YD | 600 (23.6) | 450L-E4HL0600YD |
| | 600 (23.6) | 445L-P4S0600YD | 600 (23.6) | 450L-E4HL0600YD |
| | 720 (28.3) | 445L-P4S0720YD | 750 (29.5) | 450L-E4HL0750YD |
| | 840 (33.1) | 445L-P4S0840YD | 900 (35.4) | 450L-E4HL0900YD |
| | 960 (37.8) | 445L-P4S0960YD | 1050 (41.3) | 450L-E4HL1050YD |
| | 1080 (42.5) | 445L-P4S1080YD | 1200 (47.2) | 450L-E4HL1200YD |
| | 1200 (47.2) | 445L-P4S1200YD | 1200 (47.2) | 450L-E4HL1200YD |
| | 1320 (52.0) | 445L-P4S1320YD | 1350 (53.1) | 450L-E4HL1350YD |
| | 1440 (56.7) | 445L-P4S1440YD | 1500 (59.1) | 450L-E4HL1500YD |
| | 1560 (61.4) | 445L-P4S1560YD | 1650 (65.0) | 450L-E4HL1650YD |
| | 1680 (66.1) | 445L-P4S1680YD | 1800 (70.9) | 450L-E4HL1800YD |
| | 1800 (70.9) | 445L-P4S1800YD | 1800 (70.9) | 450L-E4HL1800YD |
| | 1920 (75.6) | 445L-P4S1920YD | 1950 (76.8) | 450L-E4HL1950YD |

Table 4 - 445L Safe 4 Light Curtains to 440L Type 4 Light Curtains [mm (in.)]

| Resolution | From Safe 4 (445L) | | To 440L | |
|-------------|--------------------|----------------|-------------------|----------------|
| | Protective Height | Cat. No. | Protective Height | Cat. No. |
| 14 (0.55) | 120 (4.7) | 445L-P4L0120YD | 160 (6.3) | 440L-P4J0160YA |
| | 240 (9.4) | 445L-P4L0240YD | 320 (12.5) | 440L-P4J0320YA |
| | 360 (14.2) | 445L-P4L0360YD | 480 (18.8) | 440L-P4J0480YA |
| | 480 (19.9) | 445L-P4L0480YD | 480 (18.8) | 440L-P4J0480YA |
| | 600 (23.6) | 445L-P4L0600YD | 640 (25.1) | 440L-P4J0640YA |
| | 720 (28.3) | 445L-P4L0720YD | 800 (31.4) | 440L-P4J0800YA |
| | 840 (33.1) | 445L-P4L0840YD | 960 (37.7) | 440L-P4J0960YA |
| | 960 (37.8) | 445L-P4L0960YD | 1120 (44.0) | 440L-P4J1120YA |
| | 1080 (42.5) | 445L-P4L1080YD | 1120 (44.0) | 440L-P4J1120YA |
| | 1200 (47.2) | 445L-P4L1200YD | 1280 (50.3) | 440L-P4J1280YA |
| | 1320 (52.0) | 445L-P4L1320YD | 1440 (56.6) | 440L-P4J1440YA |
| | 1440 (56.7) | 445L-P4L1440YD | 1440 (56.6) | 440L-P4J1440YA |
| | 1560 (61.4) | 445L-P4L1560YD | 1600 (65.0) | 440L-P4J1600YA |
| | 1680 (66.1) | 445L-P4L1680YD | 1760 (69.2) | 440L-P4J1760YA |
| | 1800 (70.9) | 445L-P4L1800YD | — | — |
| 1920 (75.6) | 445L-P4L1920YD | — | — | |
| 30 (1.18) | 120 (4.7) | 445L-P4S0120YD | 160 (6.3) | 440L-P4K0160YA |
| | 240 (9.4) | 445L-P4S0240YD | 320 (12.5) | 440L-P4K0320YA |
| | 360 (14.2) | 445L-P4S0360YD | 480 (18.8) | 440L-P4K0480YA |
| | 480 (19.9) | 445L-P4S0480YD | 480 (18.8) | 440L-P4K0480YA |
| | 600 (23.6) | 445L-P4S0600YD | 640 (25.1) | 440L-P4K0640YA |
| | 720 (28.3) | 445L-P4S0720YD | 800 (31.4) | 440L-P4K0800YA |
| | 840 (33.1) | 445L-P4S0840YD | 960 (37.7) | 440L-P4K0960YA |
| | 960 (37.8) | 445L-P4S0960YD | 1120 (44.0) | 440L-P4K1120YA |
| | 1080 (42.5) | 445L-P4S1080YD | 1120 (44.0) | 440L-P4K1120YA |
| | 1200 (47.2) | 445L-P4S1200YD | 1280 (50.3) | 440L-P4K1280YA |
| | 1320 (52.0) | 445L-P4S1320YD | 1440 (56.6) | 440L-P4K1440YA |
| | 1440 (56.7) | 445L-P4S1440YD | 1440 (56.6) | 440L-P4K1440YA |
| | 1560 (61.4) | 445L-P4S1560YD | 1600 (65.0) | 440L-P4K1600YA |
| | 1680 (66.1) | 445L-P4S1680YD | 1760 (69.2) | 440L-P4K1760YA |
| | 1800 (70.9) | 445L-P4S1800YD | — | — |
| 1920 (75.6) | 445L-P4S1920YD | — | — | |

All light curtains in this document are available with 5-pin QD connectors. These connectors minimize changes to the wiring.

For 440L with an integrated laser alignment, change the listed catalog number in [Table 4](#) from 440L-xP4yzzzzYA to 440L-xP4LyzzzzYA.


Connections

Transmitter Connection

The 450L light curtain uses plug-in modules to determine functionality. To convert from the 445L Safe 4 light curtain to 450L light curtain (B and E versions), the following two plug-in modules are required:

- Transmitter: 450L-APT-PW-5
- Receiver: 450L-APR-ON-5

Table 5 - Transmitter Pinout Descriptions

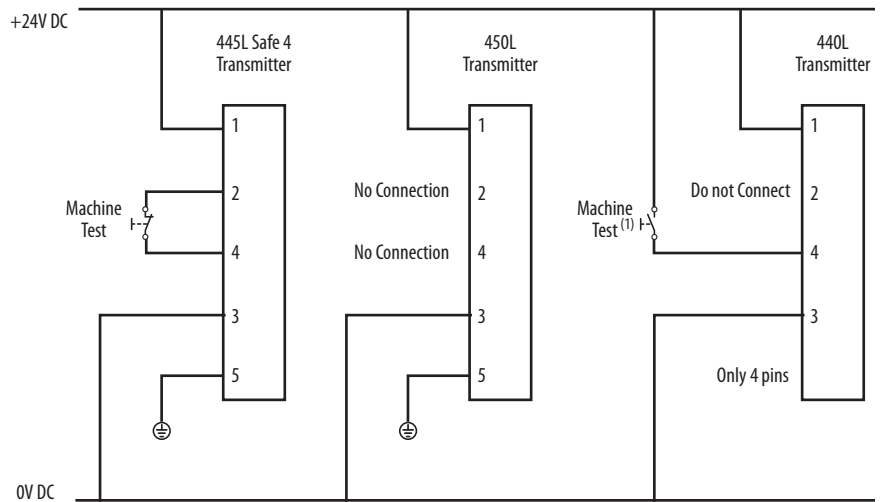
| View | Pin | 445L Safe 4 | 450L-B and 450L-E | 440L Type 4 |
|---|-----|-------------|-------------------|---------------------|
|  | 1 | +24V | +24V | +24V |
| | 2 | Test 2 | No connection | Do not connect |
| | 3 | 0V | 0V | 0V |
| | 4 | Test 1 | No connection | Test ⁽¹⁾ |
| | 5 | Ground (PE) | Ground (PE) | No Pin |

Transmitter Test Function

The transmitter test function allows you to turn off the transmitter at any time. This function is often used to verify that the light curtain is operating properly. If the application requires the use of the test function, then you must consider migration to the 440L light curtain. [Figure 1](#) compares the schematic of the transmitter test functions.

- 445L Safe 4: Short Pin 2 to Pin 4 when test function is not needed.
- 450L: No test function.
- 440L: Pin 4 is left open when test function is not needed. Pin 2 must remain unconnected. If the polarity of the test function requires inversion, the 440L transmitter DIP switch 2 must be set to ON.

Figure 1 - Transmitter Test Schematics ⁽¹⁾



(1) See [Transmitter Test Function](#).

Receiver Connection

The receiver QD connections are interchangeable.

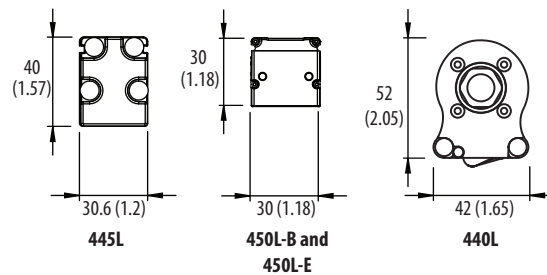
Table 6 - Receiver Pinout Description

| View | Pin | 445L Safe 4 | 450L | 440L |
|---|-----|-------------|-------------|---------------|
|  | 1 | +24V | +24V | +24V |
| | 2 | OSSD 2 | OSSD 2 | OSSD 2 |
| | 3 | 0V | 0V | 0V |
| | 4 | OSSD 1 | OSSD 1 | OSSD 1 |
| | 5 | Ground (PE) | Ground (PE) | No Connection |

Housing

[Figure 2](#) shows the comparison of the housing cross-sections of the light curtains referenced in this document. The 445L Safe 4 and 450L light curtains have similar housing sizes. This size is significant as the mounting brackets for the 445L Safe 4 light curtain can be used with the 450L light curtain as well. Migration to the 440L light curtain requires changes to the mounting brackets.

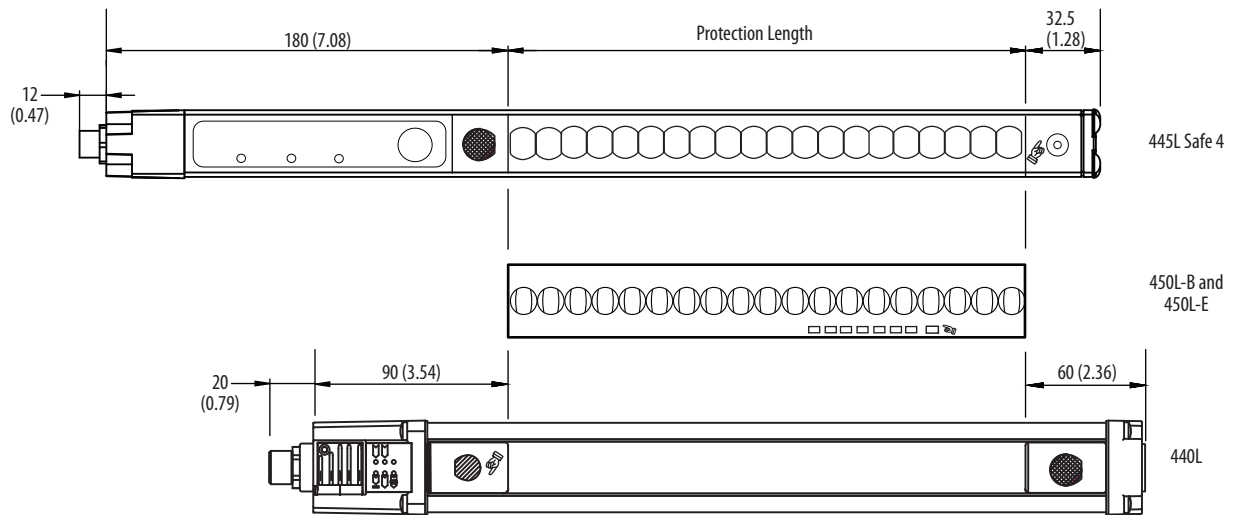
Figure 2 - Cross Section Comparison of Housing



Overall Housing Length

[Figure 3 on page 18](#) shows a comparison of the protective length to the overall housing length. The housing length of the 445L Safe 4 and 440L light curtains is longer than the protective length. The length of the housing of the 450L light curtain is equal to the length of the protective field.



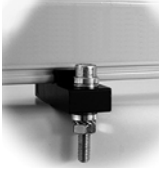






Figure 3 - Protection Length Compared to Housing Length [mm (in.)]



445L Safe 4 Mounting Brackets

The mounting brackets for the 445L Safe 4 light curtain can be used by the 450L light curtains. Depending on the installation, the position of the brackets need to be changed as the 450L has no dead zone, which shortens the distance between the mounting points (see [Figure 3](#)). The mounting brackets for the 440L light curtains are different and require further considerations by you. [Table 7 on page 19](#) shows the various types of mounting brackets for the 445L Safe 4, 450L, and 440L light curtains.

Table 7 - Mounting Bracket Types

| Bracket Type | 445L Safe 4 and 450L | 440L |
|----------------------------|--|---|
| Standard 445L Safe 4 |  <p>450L-AM-SM Shipped with 445L Safe 4 after April 2017. Optional for 450L.</p> |  <p>440L-AF6101 End-cap mounting brackets shipped with all 440L.</p> |
| Old Standard 445L Safe 4 |  <p>445L-AF6140 Shipped with 445L Safe 4 before May 2017. Optional for 450L.</p> | No equivalent for 440L. |
| Vertical |  <p>445L-AF6144 Optional for 445L Safe 4 and 450L.</p> | No equivalent for 440L. |
| Swivel |  <p>445L-AF6141 Optional for 445L Safe 4 and 450L.</p> | The standard end-cap mounting brackets provide swivel adjustments. |
| Shock Mount |  <p>445L-AF6142 Optional for 445L Safe 4 and 450L.</p> |  <p>440L-AF6120 Other kits available. Optional for 440L.</p> |
| Standard 450L-B and 450L-E |  <p>450L-AM-TBM Shipped with every 450L. Cannot be used with 445L Safe 4.</p> |  <p>440L-AF6108</p> |

IMPORTANT The 450L-AM-SM is not shipped with each 450L. The 450L-AM-TBM is shipped with every 450L.

Figure 4 - 450L-AM-TBM Type 4 Mounting Brackets [mm (in.)]

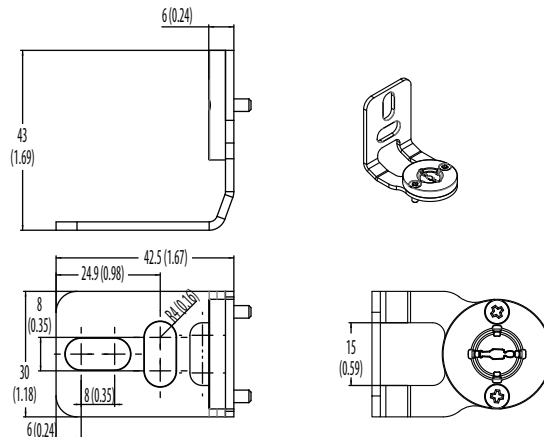
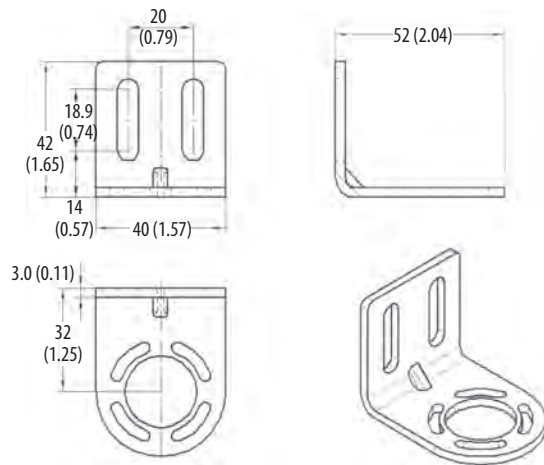


Figure 5 - 440L Type 4 Mounting Brackets [mm (in.)]



Laser Alignment

The 445L Safe 4 light curtain has laser alignment. The 445L Safe 4 light curtain aligns with two points: one at the top of the light curtain and one at the bottom of the light curtain.

The 440L Type 4 is available with integrated laser alignment similar to the 445L Safe 4 (top and bottom).

The 450L-E has integral laser alignment; it creates a linear series of spots that appear along the length of the opposite transceiver.

The 450L-B does not have integrated laser alignment. An external alignment laser, which can be snapped on the 450L-B stick, is optionally available. Use the 440L-ALAT laser with the 450L-ALAT-C snap-on bracket, as shown in [Figure 6](#).

Figure 6 - Laser Alignment Bracket and Laser

Response Time

Response time is dependent on the height of the protective field of the light curtain. [Table 8 on page 22](#) and [Table 9 on page 23](#) compare the response times of the 445L Safe 4 to the 450L and 440L light curtains.

For shorter protection heights, the response time of the 445L Safe 4 light curtain is faster than the response time of the 450L-B or the 440L. In this case, the safety distance must be recalculated. This calculation can require the location of the light curtain to be moved further away from the hazard. The 450L-E response time in Table 8 is for basic ON/OFF applications. See publication [450L-UM001](#), for the response times for advanced applications.

Table 8 - Response Time Comparison for the 450L Light Curtain [mm (in.)]

| Resolution | From 445L Safe 4 | | To 450L | | |
|-------------|-------------------|--------------------|-------------------|---------------------------|---------------------------|
| | Protective Height | Response Time (ms) | Protective Height | 450L-B Response Time (ms) | 450L-E Response Time (ms) |
| 14 (0.55) | 120 (4.7) | 10.5 | 150 (5.9) | 15 | 9 |
| | 240 (9.4) | 15.8 | 300 (11.8) | 15 | 9 |
| | 360 (14.2) | 21.2 | 450 (17.7) | 15 | 9 |
| | 480 (19.9) | 26.3 | 600 (23.6) | 15 | 9 |
| | 600 (23.6) | 34.6 | 600 (23.6) | 15 | 9 |
| | 720 (28.3) | 36.8 | 750 (29.5) | 15 | 9 |
| | 840 (33.1) | 42.2 | 900 (35.4) | 15 | 9 |
| | 960 (37.8) | 47.5 | 1050 (41.3) | 16 | 9 |
| | 1080 (42.5) | 52.8 | 1200 (47.2) | 17 | 9 |
| | 1200 (47.2) | 58.1 | 1200 (47.2) | 17 | 9 |
| | 1320 (52.0) | 63.4 | 1350 (53.1) | 19 | 9 |
| | 1440 (56.7) | 68.7 | 1500 (59.1) | 20 | 9 |
| | 1560 (61.4) | 74 | 1650 (65.0) | 22 | 9 |
| | 1680 (66.1) | 79.3 | 1800 (70.9) | 23 | 9 |
| | 1800 (70.9) | 84.6 | 1800 (70.9) | 23 | 9 |
| 1920 (75.6) | 85.5 | 1950 (76.8) | 25 | 9 | |
| 30 (1.18) | 120 (4.7) | 7.9 | 150 (5.9) | 13 | 9 |
| | 240 (9.4) | 10.5 | 300 (11.8) | 13 | 9 |
| | 360 (14.2) | 13.2 | 450 (17.7) | 13 | 9 |
| | 480 (19.9) | 15.8 | 600 (23.6) | 13 | 9 |
| | 600 (23.6) | 18.5 | 600 (23.6) | 13 | 9 |
| | 720 (28.3) | 21.1 | 750 (29.5) | 13 | 9 |
| | 840 (33.1) | 23.8 | 900 (35.4) | 13 | 9 |
| | 960 (37.8) | 26.3 | 1050 (41.3) | 13 | 9 |
| | 1080 (42.5) | 29.1 | 1200 (47.2) | 13 | 9 |
| | 1200 (47.2) | 31.6 | 1200 (47.2) | 13 | 9 |
| | 1320 (52.0) | 34.3 | 1350 (53.1) | 13 | 9 |
| | 1440 (56.7) | 37 | 1500 (59.1) | 13 | 9 |
| | 1560 (61.4) | 39.6 | 1650 (65.0) | 13 | 9 |
| | 1680 (66.1) | 42.3 | 1800 (70.9) | 14 | 9 |
| | 1800 (70.9) | 44.9 | 1800 (70.9) | 14 | 9 |
| 1920 (75.6) | 47.6 | 1950 (76.8) | 15 | 9 | |

Table 9 - Response Time (with no Beam Coding) for 440L Light Curtain [mm (in.)]

| Resolution | From 445L Safe 4 | | To 440L | |
|-------------|-------------------|---------------|-------------------|---------------|
| | Protective Height | Response Time | Protective Height | Response Time |
| 14 (0.55) | 120 (4.7) | 10.5 | 160 (6.3) | 20 |
| | 240 (9.4) | 15.8 | 320 (12.5) | 20 |
| | 360 (14.2) | 21.2 | 480 (18.8) | 20 |
| | 480 (19.9) | 26.3 | 480 (18.8) | 20 |
| | 600 (23.6) | 34.6 | 640 (25.1) | 20 |
| | 720 (28.3) | 36.8 | 800 (31.4) | 20 |
| | 840 (33.1) | 42.2 | 960 (37.7) | 20 |
| | 960 (37.8) | 47.5 | 1120 (44.0) | 20 |
| | 1080 (42.5) | 52.8 | 1120 (44.0) | 20 |
| | 1200 (47.2) | 58.1 | 1280 (50.3) | 20 |
| | 1320 (52.0) | 63.4 | 1440 (56.6) | 20 |
| | 1440 (56.7) | 68.7 | 1440 (56.6) | 20 |
| | 1560 (61.4) | 74 | 1600 (65.0) | 25 |
| | 1680 (66.1) | 79.3 | 1760 (69.2) | 25 |
| | 1800 (70.9) | 84.6 | --- | --- |
| 1920 (75.6) | 85.5 | --- | --- | |
| 30 (1.18) | 120 (4.7) | 7.9 | 160 (6.3) | 20 |
| | 240 (9.4) | 10.5 | 320 (12.5) | 20 |
| | 360 (14.2) | 13.2 | 480 (18.8) | 20 |
| | 480 (19.9) | 15.8 | 480 (18.8) | 20 |
| | 600 (23.6) | 18.5 | 640 (25.1) | 20 |
| | 720 (28.3) | 21.1 | 800 (31.4) | 20 |
| | 840 (33.1) | 23.8 | 960 (37.7) | 20 |
| | 960 (37.8) | 26.3 | 1120 (44.0) | 20 |
| | 1080 (42.5) | 29.1 | 1120 (44.0) | 20 |
| | 1200 (47.2) | 31.6 | 1280 (50.3) | 20 |
| | 1320 (52.0) | 34.3 | 1440 (56.6) | 20 |
| | 1440 (56.7) | 37 | 1440 (56.6) | 20 |
| | 1560 (61.4) | 39.6 | 1600 (65.0) | 20 |
| | 1680 (66.1) | 42.3 | 1760 (69.2) | 20 |
| | 1800 (70.9) | 44.9 | --- | --- |
| 1920 (75.6) | 47.6 | --- | --- | |

Output Load Capability

The 450L and 440L light curtains have higher output load capability than the 445L Safe 4 light curtain. The output load capability of the two light curtains is shown in [Table 10](#). All three light curtains have output short-circuit protection.

Table 10 - Output Load Capability

| Load Type | 445L Safe 4 POC | 450L | 440L |
|-----------|-----------------|--------|--------|
| DC | 300 mA | 500 mA | 500 mA |

445L Safe 2 POC Light Curtain

The 445L Safe 2 POC has many of the same features as the 445L Safe 4 POC light curtain including:

- Connections
- Housing size
- Standard mounting
- Shock mounting
- Laser alignment
- Response time
- Output load capability

Light Curtain Range

The first criteria for determining the best migration path is the range of the 445L Safe 2 light curtain. The 445L Safe 2 POC light curtain is only available in 30 mm (1.18 in.) resolution.

[Table 11](#) compares the range of the 445L Safe 2 light curtain to the 450L-B light curtain, 450L-E light curtain, and the 440L Type 2 light curtain. The preferred solution is to migrate to the 450L-B; the second preferred migration is to the 450L-E light curtain. The alternative is to migrate to the 440L Type 2 light curtain.

The 445L Safe 2 and 440L Type 2 light curtains meet the light curtain standard IEC61496 for Type 2. The 450L-B and 450L-E meet the light curtain standard IEC61496 for Type 4. Type 4 light curtains have a higher safety rating than Type 2.

Table 11 - Range Comparison

| Resolution | Range m (ft) | | | |
|------------|-----------------|----------------------------|------------------------------|-------------------------|
| | 445L Safe 2 | 450L-B | 450L-E | 440L Type 2 |
| 30 (1.18) | 0...18 (0...59) | 0.9...6.5 (2.95...21.3) | 0.9...16.2 (2.95...53.15) | 0.3...16 (0.98...52) |

Protective Height

Protective height is that portion of the light curtain that is designed to detect the presence of an object, typically a hand.

The 445L Safe 2 has protective heights from 120...1920 mm (4.72...75.59 in.), in increments of 120 mm (4.72 in.). The 450L light curtain has protective heights from 150...1950 mm (5.9...76.77 in.) in increments of 150 mm (5.9 in.). The 440L Type 2 light curtain has protective heights from 160...1760 mm (6.3...69.29 in.) in increments of 160 mm (6.3 in.).

[Table 12](#) through [Table 14](#) show the recommended conversions from the 445L Safe 2 light curtain to either the 450L-B, 450L-E, or 440L Type 2 light curtain.

Table 12 - 445L Safe 2 to 450L-B Light Curtain Conversion [mm (in.)]

| Resolution | From 445L Safe 2 | | To 450L-B | |
|-------------|-------------------|----------------|-------------------|-----------------|
| | Protective Height | Cat. Nos. | Protective Height | Cat. Nos. |
| 30 (1.18) | 120 (4.7) | 445L-P2S0120YD | 150 (5.9) | 450L-B4HN0150YD |
| | 240 (9.4) | 445L-P2S0240YD | 300 (11.8) | 450L-B4HN0300YD |
| | 360 (14.2) | 445L-P2S0360YD | 450 (17.7) | 450L-B4HN0450YD |
| | 480 (19.9) | 445L-P2S0480YD | 600 (23.6) | 450L-B4HN0600YD |
| | 600 (23.6) | 445L-P2S0600YD | 600 (23.6) | 450L-B4HN0600YD |
| | 720 (28.3) | 445L-P2S0720YD | 750 (29.5) | 450L-B4HN0750YD |
| | 840 (33.1) | 445L-P2S0840YD | 900 (35.4) | 450L-B4HN0900YD |
| | 960 (37.8) | 445L-P2S0960YD | 1050 (41.3) | 450L-B4HN1050YD |
| | 1080 (42.5) | 445L-P2S1080YD | 1200 (47.2) | 450L-B4HN1200YD |
| | 1200 (47.2) | 445L-P2S1200YD | 1200 (47.2) | 450L-B4HN1200YD |
| | 1320 (52.0) | 445L-P2S1320YD | 1350 (53.1) | 450L-B4HN1350YD |
| | 1440 (56.7) | 445L-P2S1440YD | 1500 (59.1) | 450L-B4HN1500YD |
| | 1560 (61.4) | 445L-P2S1560YD | 1650 (65.0) | 450L-B4HN1650YD |
| | 1680 (66.1) | 445L-P2S1680YD | 1800 (70.9) | 450L-B4HN1800YD |
| | 1800 (70.9) | 445L-P2S1800YD | 1800 (70.9) | 450L-B4HN1800YD |
| 1920 (75.6) | 445L-P2S1920YD | 1950 (76.8) | 450L-B4HN1950YD | |

Table 13 - 445L Safe 2 to 450L-E Light Curtain Conversion [mm (in.)]

| Resolution | From 445L Safe 2 | | To 450L-E | |
|------------|-------------------|----------------|-------------------|-----------------|
| | Protective Height | Cat. Nos. | Protective Height | Cat. Nos. |
| 30 (1.18) | 120 (4.7) | 445L-P2S0120YD | 150 (5.9) | 450L-E4HL0150YD |
| | 240 (9.4) | 445L-P2S0240YD | 300 (11.8) | 450L-E4HL0300YD |
| | 360 (14.2) | 445L-P2S0360YD | 450 (17.7) | 450L-E4HL0450YD |
| | 480 (19.9) | 445L-P2S0480YD | 600 (23.6) | 450L-E4HL0600YD |
| | 600 (23.6) | 445L-P2S0600YD | 600 (23.6) | 450L-E4HL0600YD |
| | 720 (28.3) | 445L-P2S0720YD | 750 (29.5) | 450L-E4HL0750YD |
| | 840 (33.1) | 445L-P2S0840YD | 900 (35.4) | 450L-E4HL0900YD |
| | 960 (37.8) | 445L-P2S0960YD | 1050 (41.3) | 450L-E4HL1050YD |
| | 1080 (42.5) | 445L-P2S1080YD | 1200 (47.2) | 450L-E4HL1200YD |
| | 1200 (47.2) | 445L-P2S1200YD | 1200 (47.2) | 450L-E4HL1200YD |
| | 1320 (52.0) | 445L-P2S1320YD | 1350 (53.1) | 450L-E4HL1350YD |
| | 1440 (56.7) | 445L-P2S1440YD | 1500 (59.1) | 450L-E4HL1500YD |
| | 1560 (61.4) | 445L-P2S1560YD | 1650 (65.0) | 450L-E4HL1650YD |
| | 1680 (66.1) | 445L-P2S1680YD | 1800 (70.9) | 450L-E4HL1800YD |
| | 1800 (70.9) | 445L-P2S1800YD | 1800 (70.9) | 450L-E4HL1800YD |
| | 1920 (75.6) | 445L-P2S1920YD | 1950 (76.8) | 450L-E4HL1950YD |

Table 14 - 445L Safe 2 to 440L Type 2 Light Curtain Conversion [mm (in.)]

| Resolution | From 445L Safe 2 | | To 440L Type 2 | |
|------------|-------------------|----------------|-------------------|-----------------|
| | Protective Height | Cat. Nos. | Protective Height | Cat. Nos. |
| 30 (1.18) | 120 (4.7) | 445L-P2S0120YD | 160 (6.3) | 440L-P2KA0160YD |
| | 240 (9.4) | 445L-P2S0240YD | 320 (12.5) | 440L-P2KA0320YD |
| | 360 (14.2) | 445L-P2S0360YD | 480 (18.8) | 440L-P2KA0480YD |
| | 480 (19.9) | 445L-P2S0480YD | 480 (18.8) | 440L-P2KA0480YD |
| | 600 (23.6) | 445L-P2S0600YD | 640 (25.1) | 440L-P2KA0640YD |
| | 720 (28.3) | 445L-P2S0720YD | 800 (31.4) | 440L-P2KA0800YD |
| | 840 (33.1) | 445L-P2S0840YD | 960 (37.8) | 440L-P2KA0960YD |
| | 960 (37.8) | 445L-P2S0960YD | 960 (37.8) | 440L-P2KA0960YD |
| | 1080 (42.5) | 445L-P2S1080YD | 1120 (44.0) | 440L-P2KA1120YD |
| | 1200 (47.2) | 445L-P2S1200YD | 1280 (50.3) | 440L-P2KA1280YD |
| | 1320 (52.0) | 445L-P2S1320YD | 1440 (56.6) | 440L-P2KA1440YD |
| | 1440 (56.7) | 445L-P2S1440YD | 1440 (56.6) | 440L-P2KA1440YD |
| | 1560 (61.4) | 445L-P2S1560YD | 1600 (65.0) | 440L-P2KA1600YD |
| | 1680 (66.1) | 445L-P2S1680YD | 1760 (69.2) | 440L-P2KA1760YD |
| | 1800 (70.9) | 445L-P2S1800YD | — | — |
| | 1920 (75.6) | 445L-P2S1920YD | — | — |

IMPORTANT The 440L Type 2 receiver is only available with an 8-pin connector. The user manual [440L-IN011](#) provides details for the connection and response time.

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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Waste Electrical and Electronic Equipment (WEEE)



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Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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