GuardShield™ Safe 2

Safety Light Curtain
Important User Information

Solid state equipment has operational characteristics different from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (Publication 50-1-1) available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of these differences, and because of the wide variety of uses for solid state equipment, all persons responsible for applying and installing this equipment must satisfy themselves at each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible 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 application, Rockwell Automation, Inc. cannot assume responsibility or liability for actual work done on the examples and diagrams. No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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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.

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

**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 consequences.

**SHOCK HAZARD**
- Labels may be on or inside the equipment (for example, drive or motor) to alert people that hazardous voltage may be present.

**HEAT HAZARD**
- Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

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**Conditions required for proper use of the GuardShield Type 2 Safety Light Curtain**

**IMPORTANT:** GuardShield Type 2 devices do not meet the requirements of OSHA 1920.217, ANSI/RIA 15.06, ANSI B11.1, B11.2, B11.19 or B11.20.

Please make sure you read and understand these requirements before you select and install the GuardShield Type 2 safety light curtain. GuardShield Type 2 safety light curtains can only be used on equipment where a formal risk assessment determines that a Type 2 level of safety device is permissible.

The GuardShield Type 2 family of safety light curtains are general purpose presence sensing devices which are designed to help protect personnel working on or near machinery.

The installation of the GuardShield Type 2 safety light curtain must comply with all applicable federal, state and local rules, regulations and codes.

It is the responsibility of the employer to properly install, operate and maintain the product as well as the machinery on which the GuardShield Type 2 presence sensing device is installed. GuardShield Type 2 safety light curtains must be properly installed by qualified personnel.

GuardShield Type 2 safety light curtains are presence sensing devices and will not protect personnel from heat, chemicals or flying parts. They are intended to signal a stop of machine motion when the sensing field is broken.

GuardShield Type 2 safety light curtains can only be used on equipment which can be stopped anywhere in its stroke or cycle, consistently and repeatably.

GuardShield Type 2 safety light curtains should never be used on full revolution clutching machinery.

The effectiveness of the GuardShield Type 2 safety light curtains depend upon the integrity of the machine control circuit. The machinery that the GuardShield Type 2 presence sensing device is installed on should have control circuitry that is of a level of safety integrity equal to or better than a category Type 2 design.

All stopping mechanisms for the machinery should be inspected regularly to provide proper operation. The protected machinery must have a consistent reliable and repeatable stopping time.

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**ATTENTION!** Failure to read and follow these instructions can lead to misapplication or misuse of the GuardShield safety light curtains, resulting in personal injury and damage to equipment.
1. Approvals and Conformity

TÜV Rheinland Product Safety GmbH, performed the CE - type examination according to the machinery directive EC/98/37, appendix VI and the respective standards ICE 61496.

The CE - conformity declaration and the product approval certification (TÜV) is available on the homepage www.Rockwell Automation.com.

All ROCKWELL AUTOMATION products are developed and manufactured following generally accepted rules in industry and in compliance with a total quality management system ISO 9001: 2000.

GuardShield Safe 2 is a type 4 optoelectronic protective equipment (AOPE) type 2 for any application in explosive EX or radioactive areas.

GuardShield Safe 2 is not designed and approved for any application in explosive EX or radioactive areas.

GuardShield Safe 2 does not comply with the optical requirements of a type 4 light curtain according the international standard IEC 61496.

2. Introduction

GuardShield Safe 2 safety light curtains are active optoelectronic protective equipment (AOPE) type 2 and comply to annex IV of the European Machinery Directive EC/98/37 and IEC 61496 as a safety component.

The GuardShield Safe 2 is offered with a 30mm resolution in Guard Only mode.

2.1. System design

GuardShield Safe 2 safety light curtains consist of a transmitter and a receiver, each having a standard built-in intelligent laser alignment system ILAS. (Figure 1).

This allows a much easier adjustment during installation and system testing compared to conventional safety light curtains.

3. Applications

3.1. Typical applications

Depending on the risk analysis GuardShield Safe 2 systems are used for (Figure 2):

- Entry / exit safeguarding
- Point-of-operation safeguarding
- Hazards area safeguarding
- Combination of entry and area safeguarding
- Combination of entry, area and point-of-operation safeguarding

Typical areas of applications are:

- Processing machinery
- Conveyor machines
- Automated paint shops

Typical markets are:

- Semi conductor industry
- Paper processing
- Wood processing
- Glass manufacturing
- Textile industry

3.2. Applications restrictions

GuardShield Safe 2 is not designed and approved for any application in explosive EX or radioactive areas.
3. Application Conditions

The safe application of the light curtain systems GuardShield Safe 2 needs certain precautions:

1. The control unit of the machine or system must be able to be electrically stopped and the stop time must be known.
2. The hazardous moving parts of the machine must always be stoppable and must achieve a safe position or complete standstill within the specified stop time of the machine.
3. When installing GuardShield Safe 2, the only way to access the hazard must be through the sensing field of the GuardShield Safe 2.

4. Principles of Operation

The transmitter sends coded infrared light pulses to the receiver, which evaluates them. If an object e.g. a hand (30 mm) penetrates the protective field, the redundant solid state Output Signal Switching Devices (OSSD) of the receiver switch off to stop the machine. As soon as the protective field is cleared, both outputs switch on again (automatic restart).

4.1. Mode of operation

GuardShield Safe 2 operates in the guard only mode with automatic restart.

4.2. Intelligent Laser Alignment System ILAS

The ILAS is a most convenient feature to make alignment a pleasure. The ILAS can be activated at any time during installation or operation. It provides the possibility to check if the light curtain is still perfectly aligned.

4.3. Perimeter systems

Perimeter systems are usually produced by means of several single beam light barriers. But the flexibility of the GuardShield Safe 2 system allows also the production of vertical entry safeguarding according to the standard EN 999. Such systems are composed of active and passive elements in one compact profile. The element length of each is 120 mm.

The big advantage of GuardShield Safe 2 Perimeter systems is the easy way of mounting and the uncomplicated way of starting up the operation. The time needed to connect the wires and aligning the optics is drastically reduced in comparison to standard Perimeter systems consisting of single beam light barriers, where often mirrors are also included which can only be positioned with difficulties.

The protective field and the active elements respectively, are clearly recognized as black surfaces with the integrated optical lenses. The not monitored areas (passive elements) are also clearly indicated as yellow surfaces.
5.1. Regulations and standards

The compliance with the fundamental health & safety requirements as detailed in the EU Machinery Directive EC/98/27 has to be achieved with the correct implementation of safety components. With the help of a hazard analysis as laid out in EN 292 and EN 1050, a comprehensive safety evaluation has to be made when designing and planning machinery and machinery control equipment. If Active Optoelectronic Protective Devices (AOPD) is used, the required safety distances, sufficient protective height and all application conditions must be considered during the planning phase.

5.1.1. Safety distance to danger point

According to the standards, the GuardShield Safe 2 light curtain and the point of danger must be separated by a defined safety distance. This minimum distance safeguards that the danger point may only be reached after the hazardous motion has stopped. The safety distance (see also standards EN 294, EN 775, EN 811, EN 999) depends on:

- Machine stop time
- Response time of the protective device (light curtain + safety relays)
- Resolution of the protective device
- Approaching speed to the danger point
- Position of the AOPD
- Protective field
- Height of protective field
- Approach angle
- Position of the AOPD
- Any additional components

The safety distance $S$ can be calculated using the formula:

\[ S = 1.6 \frac{mm}{ms} \times T + 850 \ [mm] \]

In cases of ‘vertical’ installation of the light curtains within an industrial environment and a resolution of the light curtain system $d$, where $14 \text{ mm} \leq d \leq 40 \text{ mm}$, the safety distance $S$ to the point of danger is calculated according to the formula:

\[ S = \frac{S - 1.6 \frac{mm}{ms} \times T + 850 \ [mm]}{d} \]

5.1.2. Height of protective field

The protective field is clearly visible as the black area with the optical lenses on the transmitter and receiver. In addition the height of the protective field $A$ is found on the label of each system and in the selection tables, described in chapter 8.2 (resolution 30 mm).

**Warning:**

The laser beams of the ILAS are not part of protective field. Use only the protective field as mentioned on the product label. Otherwise serious injury or death may occur.

5.1.3. Response time – light curtain

The response time $t_R$ is found on the product label, Configuration Tool or from the selection tables 8.2.

5.1.4. Distance to reflective surfaces

Reflective surfaces may cause reflections within the transmitter and receiver aperture angle, i.e. an interruption of the protective field would not be recognized (Figure 7).

\[ \text{Figure 7: Distance to reflective surfaces} \]

Should reflective surfaces arise, i.e. aluminium container passing near the light curtain or if the danger point itself is reflective, i.e. a steel blade, the safety distance $S_R$ must be increased, such that no reflective surface lies within the distance $S_R$. The increase of the safety distance is dependant of the actual operation range $R$ according to IEC 61496 and may be calculated as follows:

GuardShield Safe 2:

\[ S_2 = 0.0437 \times R \]

\[ S_2 = 131 \text{ mm} \]

For $R < 3 \text{ m}$

For $R \geq 3 \text{ m}$

5.1.6. Mounting brackets

The backside of the light curtain profile has continuous grooves to fix the mounting brackets at any position along the light curtain housing (Figure 10).

Each system is delivered with four mounting brackets.

Available mounting brackets (Figure 9):

- Vertical mounting brackets for mounting the light curtain in the vertical axis of the light curtain. ($\pm 4^\circ$ adjustable)
- POC AND SICK FGS mounting profiles (not adjustable)

\[ \text{Figure 8: Multiple light curtain arrangement} \]

\[ \text{Figure 9: Multiple light curtain arrangement} \]
GuardShield Safe 2 Operation Manual

5.1.7. Intelligent Laser Alignment System ILAS

- For side mounting
- Adjustable by ± 4°

Vertical mounting brackets (optional)
- For mounting in the vertical axis of the light curtain
- Adjustable by ± 4°

POC AND SICK FGS mounting profile (optional)
- A special profile which is compatible with existing POC AND SICK FGS-mountings.
- Adjustments have to be made with the POC AND SICK FGS-mountings, if available.

180° Mounting, rotation ± 90°, for applications where the mounting angle is not set using the mounting frame.

To switch on ILAS:
- Touch the hand symbol \( \text{ILAS} \)

Operation: Laser beam is blinking

To switch off ILAS:
- Touch the hand symbol \( \text{ILAS} \) again
- Automatically after 5 minutes

Figure 9: Different mounting brackets for a GuardShield Safe 2 / Safe4

The mounting brackets contain all necessary mounting parts and a separate instruction sheet to ensure that the parts are assembled properly.

WARNING: Class 2 Laser
Do not expose your eyes to the laser beam to prevent exposure to dangerous radiation!
Turn ILAS off if not used!

Figure 10: Layout of the transmitter / receiver

1. Mount the transmitter and the receiver with the adjustable mounting brackets. Make sure that the longitudinal axis of both are oriented parallel. A spirit level might help to find the correct position.
2. Take care that the receiver and transmitter are oriented in the same direction. This means, the controllers of the transmitter and receiver have to be at the same end of the protective field. It is not allowed to mount GuardShield Safe 2 systems turned by 180° (Figure 10).
3. The ILAS is activated by touching the hand symbol at the transmitter resp. at the receiver.
4. Adjust the transmitter and receiver in a way that both laser points hit the laser target on the opposite unit. Small deviations are harmless as long as they are within the aperture angle.
5. Tighten all screws firmly.
6. Switch the ILAS off when aligned.
7. Control the operation of the light curtain by using the test rod (Figure 12). Introducing the test rod into the protective field at any position must lead to a protective field interruption (shining of the red LED on the receiver).

To switch on ILAS:
- Touch the hand symbol \( \text{ILAS} \)

Operation: Laser beam is blinking

To switch off ILAS:
- Touch the hand symbol \( \text{ILAS} \) again
- Automatically after 5 minutes

5.1.8. Adjustment Procedure without ILAS

1. Mount the transmitter and the receiver with the adjustable mounting brackets. Make sure that the longitudinal axis of both are oriented parallel. Take care that receiver and transmitter are oriented in the same direction. This means, the controllers of transmitter and receiver have to be at the same end of the protective field. It is not allowed to mount GuardShield Safe 2 systems turned by 180° (Figure 10).
2. After aligning the longitudinal axis of transmitter and receiver, rotate the receiver around the longitudinal axis to find the receiving angle. During rotation, the receiving angle is shown when the green LED of the receiver controller is on. Adjust the receiver to the centre point of the operating angle, and tighten.
3. After aligning the receiver rotate the transmitter to find the emitting angle. During rotation, the emitting angle is shown when the green LED of the transmitter controller is on. Adjust the receiver to the centre point of the operating angle, and tighten.
4. When mounting Perimeter Systems adjust the heights according to the recommendations in the standard EN 999.

5.1.9. Adjustment Procedure with ILAS

1. Mount the transmitter and the receiver with the adjustable mounting brackets. Look for that the longitudinal axis of both are oriented parallel. Take care that receiver and transmitter are oriented in the same direction. This means, the controllers of transmitter and receiver have to be at the same end of the protective field. It is not allowed to mount GuardShield Safe 2 systems turned by 180° (Figure 10).
2. The ILAS is activated by touching the hand symbol at the transmitter resp. at the receiver.
3. Adjust the transmitter and receiver in a way that both laser points hit the laser target on the opposite unit. Small deviations are harmless as long as they are within the aperture angle.
4. Tighten all screws firmly.
5. Switch the ILAS off when aligned.
6. Control the operation of the light curtain by using the test rod (Figure 12). Introducing the test rod into the protective field at any position must lead to a protective field interruption (shining of the red LED on the receiver).

5.1.10. Remarks to ILAS

Due to dimensional tolerances the red ILAS light spot deflects from the target center when the light curtain is aligned optimal in the center of the operating range. The optional operating point can be found after alignment with ILAS (chapter 5.1.9) when moving the axis in X- (left, right) and Z- (up, down) direction. The optimal operating point is in the middle of the two end points, where the receiver output switches from active to inactive condition.

On optimal alignment of the light curtain the ILAS light point can deflect from the ILAS target point. The maximum deflection adds up to the following value due the operating distance:
- 2 m \( R = 7 \text{ mm} \) \( D = 7 \text{ mm} \)
- 6 m \( R = 20 \text{ mm} \) \( D = 21 \text{ mm} \)
- 9 m \( R = 30 \text{ mm} \) \( D = 32 \text{ mm} \)
- 18 m \( R = 60 \text{ mm} \) \( D = 63 \text{ mm} \)
- 30 m \( R = 90 \text{ mm} \) \( D = 105 \text{ mm} \)

5.1.11. Testing the protection field

After Installation and Alignment of the GuardShield Safe 2 safety light curtain, the protection field has to be tested with the test rod for the corresponding resolution (30 mm) according Figure 12.

When mounting Perimeter Systems adjust the heights according to the recommendations in the standard EN 999, RIA 15.06 or according to the prevailing local regulation.
GuardShield Safe 2

Operation Manual

5.2. Electrical Installation

5.2.1. Connection diagram

The transmitter and receiver are connected to the machine control using a 5-wire cable. For the transmitter and the receiver two M12 (for cable - Ø 3 ... 6.5 mm)

Figure 12: Correct testing of the protective field using a test rod

5.2.2. Test input to transmitter

Normally the test input at the transmitter is installed with a short circuit jumper to activate the transmitter. If an external test is desired, a contact can be connected to the test input (Figure 13).

Figure 13: Terminal block connection (see also Figure 18)

Figure 14: M12/5 Pin connector

Figure 15: Wiring of the connecting cables of the M12/5 Pin connector

Transmitter and receiver are supplied with M12/5 pin connectors. The wiring is given in Figure 14 and Figure 15.

5.2.3. Power supply

GuardShield Safe 2 safety light curtains are devices of electrical safety level III (extra low voltage). 24 VDC ± 20 % has to be supplied by a power supply that complies with IEC / EN 60204 and IEC / EN 60742. Such a power supply meets the electrical safety requirements and maintains the minimum power of 18 VDC during 20 ms even in the event of voltage dips.

5.2.4. Bringing into operation

After the power supply has been applied to the GuardShield Safe 2 and the automatic power-up test is successfully completed (power up test time < 3 s) the green LED on the receiver and transmitter will light on. The system is now ready to operate.

The following points have to be considered:

- In case of operation in the modus "self monitoring" both OSSD outputs have to be connected separately to the safety switching of the machine.

GuardShield Safe 2:

- In case of connecting an external test it could be that, depending on the test type, only one OSSD output (OSSD1 or OSSD2) has to be considered.

The timing of test input is as follows (Figure 16):

<table>
<thead>
<tr>
<th>Test input</th>
<th>Time to test t</th>
<th>Restart time after test t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test input open or short circuited</td>
<td>t2 &gt; t1</td>
<td>t3 ≤ 800</td>
</tr>
<tr>
<td>Test input closed</td>
<td>t2 ≥ t1</td>
<td>t3 ≤ 800</td>
</tr>
</tbody>
</table>

Time t1 means the response time of the respective GuardShield Safe 2 type (see product label).

Important information:

Safety devices for connection of GuardShield Safe 2 must be built with PNP logic. The outputs will be periodically controlled for short-circuit and cross-fault detection.

The output voltage at the solid-state outputs is dependant on the power supply and the output load (see chapter 11 Technical Data).

5.2.5. Outputs

The two redundant Output Signal Switching Devices (OSSD) are fully monitored. Any short circuits are detected. The maximum load is 0.4 A, higher currents are limited through short circuit protection. Increased output loads may be realized using external safety interfaces.

5.2.6. Trouble shooting

Possible errors and operation status are indicated with the LED indicators on the transmitter and receiver. Also the Optical Interface has an option that can be used for the diagnostics.

Following combinations are relevant:

| Table 1: Transmitter |
|----------------------|------------------|------------------|
| Internal test        | Transmitter      | Test LED Transmitter |
| Short circuited (closed) | Active | Green |
| Open                 | Inactive         | Red |

GuardShield Safe 2: 2

The automatic power-up test will only be successful, if the transmitter and receiver are properly aligned, correctly connected and the protective field is not interrupted.

Any intrusion of an object into the protective field will switch the OSSD off within the specified response time and the LED at the receiver toggles from green to red.
Table 2: Receiver

<table>
<thead>
<tr>
<th>Status</th>
<th>Orange (Power)</th>
<th>Green (Protective field not interrupted)</th>
<th>Red (Protective field interrupted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No power supply (external)</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>No sufficient power (external)</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>OSSD on (on-load operation, protective field not interrupted, normal)</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>OSSD off (off-load operation, protective field interrupted or insufficient alignment of the system)</td>
<td>flashing</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>OSSD error (external, short circuit between OSSD 1 and OSSD 2, towards 0 V and off 24 VDC)</td>
<td>all 3s short time</td>
<td>off</td>
<td>flashing</td>
</tr>
<tr>
<td>Controller error (internal)</td>
<td>irregular flashing</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>Protective field error (internal)</td>
<td>off</td>
<td>flashing</td>
<td>on</td>
</tr>
</tbody>
</table>

**External error:** An external interface error can be resolved by correcting the installation, due to
1. Receiver: short circuit of both OSSDs, of OSSD to U_{in}, of OSSD to GND
2. Transmitter: Test input open
3. No or too low power supply

**Internal error** (orange LED is irregularly flashing): Please contact the nearest ROCKWELL AUTOMATION representative.

**Normal operation**

<table>
<thead>
<tr>
<th>Transmitter Operation status</th>
<th>Receiver Protective field status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test input closed OSSD on</td>
<td>Protective field free</td>
</tr>
<tr>
<td>Test input closed OSSD off</td>
<td>Protective field interrupted</td>
</tr>
<tr>
<td>Test input open OSSD off</td>
<td>Test active</td>
</tr>
</tbody>
</table>

5.2.7. **Optical Interface**

As an accessory Rockwell Automation offers an Optical Interface including a software package for extended diagnostic purposes.

The adapter may be snapped on the controller during normal operation and may be connected via the interface to a MS-Windows personal computer for diagnoses purposes. A detailed description about extended diagnostic features is shipped with the diagnostic package.

The Optical Interface offers apart from the diagnosis of operating conditions, the possibility to select and analyse the length of the interrupted protective field.

6. **Interfacing to safety devices**

The interfacing of the light curtain with the machine control has to be control reliability, i.e. a correct interface with a safety PLC or safety relays with positive guided relay contacts. **Figure 18 - Diagram for automatic reset mode** - shows a diagram of a typical emergency stop relay component.

Other applications are mentioned in the application note “Safety Interfaces with GuardShield Safe 2”, on the ROCKWELL AUTOMATION homepage.

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**Danger**

The safety devices and the interconnection to the machinery have to comply with the basic safety requirements as mentioned in the current regulations and standards.

Direct interfacing of a safety light curtain to machine control that does not meet the necessary safety integrity level, i.e. use of general purpose PLCs or general purpose relays can cause serious injury or death of persons.

**Consult a professional safety engineer!**

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**Figure 17: Optical Interface**

**Figure 18: Diagram for automatic reset mode with ROCKWELL AUTOMATION MSR 42**
7. Dimensional drawings

8. Selection of a safety light curtain

8.1. Check list

In consideration of following points the selection of a proper GuardShield Safe 2 safety light curtain will be simplified:

1. Regulations

   Look up carefully the actual regulations and codes applicable to the particular application in your country. Local authorities and professional organisations as well as ROCKWELL AUTOMATION representatives will provide necessary assistance.

   USA: Occupation Safety and Health Administration OSHA, others like ANSI, RIA and further professional organisations

   GB: Health and Safety Executive HSE, safety consultants and professional organisations

2. Protective field

   Determination of
   • required operating range,
   • protective height (available in increments of 120 mm),
   • resolution (object detection capability: 30 mm)
   • and configuration of light curtain (special configuration with extension modules)

3. Response time

   The response time $t_{R-BWS}$ of GuardShield Safe 2 can be found on the product label and in the selection table (next section). The response time can also be calculated with the Optical Configuration Tool.

4. Corner mirrors

   Using corner mirrors allow safeguarding two or three protective fields with one light curtain. Each corner mirror reduces the operating range by approximately 15 % per mirror.

8.2. Selection table

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Protective height A (mm)</th>
<th>Total length B (mm)</th>
<th>Response time $t_{R}$ (ms)</th>
<th>Max. range (m)</th>
<th>Resolution (mm)</th>
<th>Weight per pair (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>445L-P2S0120YD</td>
<td>120</td>
<td>290</td>
<td>7.8</td>
<td>6</td>
<td>30</td>
<td>1.0</td>
</tr>
<tr>
<td>445L-P2S0240YD</td>
<td>240</td>
<td>410</td>
<td>10.5</td>
<td>6</td>
<td>30</td>
<td>1.4</td>
</tr>
<tr>
<td>445L-P2S0360YD</td>
<td>360</td>
<td>530</td>
<td>13.1</td>
<td>6</td>
<td>30</td>
<td>1.8</td>
</tr>
<tr>
<td>445L-P2S0480YD</td>
<td>480</td>
<td>650</td>
<td>15.8</td>
<td>6</td>
<td>30</td>
<td>2.2</td>
</tr>
<tr>
<td>445L-P2S0600YD</td>
<td>600</td>
<td>771</td>
<td>18.4</td>
<td>6</td>
<td>30</td>
<td>2.6</td>
</tr>
<tr>
<td>445L-P2S0720YD</td>
<td>720</td>
<td>891</td>
<td>21.1</td>
<td>6</td>
<td>30</td>
<td>3.0</td>
</tr>
<tr>
<td>445L-P2S0840YD</td>
<td>840</td>
<td>1011</td>
<td>23.7</td>
<td>6</td>
<td>30</td>
<td>3.5</td>
</tr>
<tr>
<td>445L-P2S0960YD</td>
<td>960</td>
<td>1131</td>
<td>26.3</td>
<td>6</td>
<td>30</td>
<td>4.0</td>
</tr>
<tr>
<td>445L-P2S1080YD</td>
<td>1'080</td>
<td>1'252</td>
<td>29.9</td>
<td>6</td>
<td>30</td>
<td>4.0</td>
</tr>
<tr>
<td>445L-P2S1200YD</td>
<td>1'200</td>
<td>1'372</td>
<td>31.6</td>
<td>6</td>
<td>30</td>
<td>4.5</td>
</tr>
<tr>
<td>445L-P2S1320YD</td>
<td>1'320</td>
<td>1'492</td>
<td>34.3</td>
<td>6</td>
<td>30</td>
<td>5.0</td>
</tr>
<tr>
<td>445L-P2S1440YD</td>
<td>1'440</td>
<td>1'612</td>
<td>36.9</td>
<td>6</td>
<td>30</td>
<td>5.5</td>
</tr>
<tr>
<td>445L-P2S1560YD</td>
<td>1'560</td>
<td>1'733</td>
<td>39.6</td>
<td>6</td>
<td>30</td>
<td>6.0</td>
</tr>
<tr>
<td>445L-P2S1680YD</td>
<td>1'680</td>
<td>1'853</td>
<td>42.2</td>
<td>6</td>
<td>30</td>
<td>6.5</td>
</tr>
<tr>
<td>445L-P2S1800YD</td>
<td>1'800</td>
<td>1'973</td>
<td>44.9</td>
<td>6</td>
<td>30</td>
<td>7.0</td>
</tr>
<tr>
<td>445L-P2S1920YD</td>
<td>1'920</td>
<td>2'093</td>
<td>47.6</td>
<td>6</td>
<td>30</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Figure 19: Dimensional drawing, cross Section
8.3. Accessories / Components

Table 4

<table>
<thead>
<tr>
<th>ROCKWELL AUTOMATION Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>445L-AC5SH-5</td>
<td>5 m PVC shielded cable with M 12 / 5 pin connector, Figure 13</td>
</tr>
<tr>
<td>445L-AF6140</td>
<td>Standard mounting kit (4 pieces)</td>
</tr>
<tr>
<td>445L-AF6141</td>
<td>Adjustable mounting kit</td>
</tr>
<tr>
<td>445L-AF6142</td>
<td>Shock mount kit</td>
</tr>
<tr>
<td>445L-AF6144</td>
<td>Mounting kit for POC AND SICK FGS adapter (4 pieces)</td>
</tr>
<tr>
<td>445L-AF6150</td>
<td>Optical Interface (incl. software)</td>
</tr>
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</table>

Table 5 - Corner Mirror

<table>
<thead>
<tr>
<th>GuardShield Safe 2 / Safe 4 Protective Height (mm)</th>
<th>GuardShield Safe 2 / Safe 4 Narrow Corner Mirror, short range 0..4M</th>
<th>Catalog Number</th>
<th>Wide Corner Mirror, Long range 4..15M</th>
<th>Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 / 240</td>
<td>440L-AM0750300</td>
<td>440L-AM1250300</td>
<td></td>
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<tr>
<td>360</td>
<td>440L-AM0750450</td>
<td>440L-AM1250450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>480 / 600</td>
<td>440L-AM0750600</td>
<td>440L-AM1250600</td>
<td></td>
<td></td>
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<tr>
<td>720</td>
<td>440L-AM0750750</td>
<td>440L-AM1250750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>840</td>
<td>440L-AM0750900</td>
<td>440L-AM1250900</td>
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</tr>
<tr>
<td>960</td>
<td>440L-AM0751050</td>
<td>440L-AM1251050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1080 / 1200</td>
<td>440L-AM0751200</td>
<td>440L-AM1251200</td>
<td></td>
<td></td>
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<tr>
<td>1320</td>
<td>440L-AM0751350</td>
<td>440L-AM1251350</td>
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<td>1440</td>
<td>440L-AM0751500</td>
<td>440L-AM1251500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1560</td>
<td>440L-AM0751650</td>
<td>440L-AM1251650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1680 / 1800</td>
<td>440L-AM0751800</td>
<td>440L-AM1251800</td>
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<tr>
<td>1800</td>
<td>None Available</td>
<td>None Available</td>
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</tr>
</tbody>
</table>

9. Inspection and service

All light curtains contain only electronics and therefore need limited maintenance.

9.1. Cleaning

The optical windows are to be cleaned with non-aggressive materials only. The interval between cleaning is dependant on the air pollution at the installation.

⚠️ Do not use aggressive solvents or abrasive substances. Otherwise range reduction and false switching could arise.

9.2. Inspections

The light curtain must, depending on the valid regulations, be periodically tested by qualified and trained persons.

The function of the light curtain can be tested with the supplied test rod, which has a diameter corresponding to the resolution of the light curtain. The status is indicated through the LED display in the ROCKWELL AUTOMATION GuardShield Safe 2 light curtain.

**Functional Test**

The function of the light curtain can be tested using the test rod, (Figure 12), which has a diameter corresponding to the resolution of the light curtain. The status is displayed at the LED on the transmitter or receiver. The status can be easily read from the trouble shooting labels “Transmitter Status” and “Receiver Status” (table 1 and 2, page 13).

9.3. Decommissioning

The safety light curtain may only be removed, if the machinery or assembly line will be closed definitively. This has to be done by removing the main supply from the machinery. It must be impossible to bring the machinery into operation without using tools.

The light curtain can be reused provided the current regulations are taken into consideration.

If the light curtain has to be disposed, it can easily be disassembled and recycled using state of the art recycling technology and following current disposal regulation. It does not contain harmful materials except small quantities of materials used in electronic PCBs.
## 10. Technical Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Profile length</td>
<td>120 ... 1920</td>
<td>120mm increments</td>
</tr>
<tr>
<td>Operating range</td>
<td>0 ... 6 m</td>
<td></td>
</tr>
<tr>
<td>Object detection capability (Resolution)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply $U_{sp}$</td>
<td>24 VDC ± 20 %</td>
<td>PELV, IEC 60 204-1</td>
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<tr>
<td>Power supply ripple</td>
<td>&lt; 10 % of $U_{sp}$</td>
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</tr>
<tr>
<td>Equipment Class</td>
<td>III</td>
<td>VDE 0106 part 100</td>
</tr>
<tr>
<td>Time for self check when switching on $U_{sp}$</td>
<td>&lt; 3 s</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>&lt; 500 mA</td>
<td>No-load operation</td>
</tr>
<tr>
<td>Outputs, short circuit proof</td>
<td>2 x PNP, 0.3 A</td>
<td>Max. capacitive load 0.5 µF</td>
</tr>
<tr>
<td>Output voltage</td>
<td>&gt; $U_{sp}$ - 1</td>
<td>Load 0.1 A</td>
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<tr>
<td>Response time $t_{R(BWS)}$</td>
<td>Selection table</td>
<td></td>
</tr>
<tr>
<td>Connector</td>
<td>M 12, 5-Pin</td>
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<tr>
<td>Connection cable</td>
<td>Max length 5M</td>
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<tr>
<td>Cross section max.</td>
<td>1.5 mm$^2$</td>
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<tr>
<td>Outside diameter of cable</td>
<td>3 ... 6.5 mm</td>
<td>for M12</td>
</tr>
<tr>
<td>Mode of operation</td>
<td>Guard only with automatic restart</td>
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</tr>
<tr>
<td>Safety category</td>
<td>Type 2</td>
<td>IEC 61496</td>
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<tr>
<td>Standards</td>
<td>IEC 61496 part 1+2</td>
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<tr>
<td>Electromagnetic compatibility (EMC)</td>
<td>IEC 61 496 part 1</td>
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<tr>
<td>Enclosure rating</td>
<td>IP65</td>
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<tr>
<td>Temperature range</td>
<td>0 ... +55°C</td>
<td>Operation with ILAS</td>
</tr>
<tr>
<td>Relative air humidity</td>
<td>15 ... 95 %</td>
<td>Not condensing</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Aluminum profile 30 x 40 mm</td>
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</tr>
<tr>
<td>Optical window</td>
<td>Polycarbonate, bonded</td>
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<tr>
<td>Enclosure treatment</td>
<td>Polyester powder coated</td>
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<tr>
<td>ILAS</td>
<td>Laser class 2</td>
<td>EN 60 825</td>
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<td>Dimensions</td>
<td>Dimensions and selection tables</td>
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<tr>
<td>Weight</td>
<td>Selection tables</td>
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</tbody>
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