Installation Instructions

Original Instructions

GuardShield Micro 400 Safety Light Curtains

Catalog Numbers 445L-P4*xyyyy*FP, 445L-C4*xyyyy*FP, 445L-P4*xyyyy*KP

Topic	Page
Summary of Changes	1
About This Manual	1
Introduction	1
Important Requirements	3
Safety Precautions — Principles for Safe Use and Symbols Used	3
Specialist Personnel	3
Range of Uses of the Device	3
Product Description	4
Special Features	4
Principle of Operation	4
The GuardShield Light Curtain	4
Cascading	5
Examples of Range of Use	5
Safety Functions	5
Response Time	5
Determining the Safety Distance	7
Installation and Mounting	9
Installation and Alignment Procedure	9
Micro 400 IP69K	11
Mounting Brackets	12
Electrical Installation — Connections	12
Checklist	14
Troubleshooting	15
Safety Instructions—Maintenance	15
Product Label	17
Dimensions [mm (in.)]	21
Accessories	22
GuardShield Micro 400 Special Safety Light Curtain Systems	24
Certifications	32

Summary of Changes

- Updated Figure 23 on page 24.
- Updated Table 21 on page 25.

About This Manual

This manual covers the operation and installation of the:

- GuardShield™ Micro 400 POC, see POC on page 3
- GuardShield Micro 400 PAC, see Perimeter Systems (PAC) on page 25
- GuardShield Micro 400 PAC IP69K systems, see Micro 400 IP69K Option on page 3
- GuardShield Micro 400 Specials on page 2

IMPORTANT Save these instructions for use at a future time.

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

This technical description must be followed when installing and commissioning the GuardShield Micro 400. A qualified person must conduct the inspection and commissioning.

Rockwell Automation reserves the right to make changes or revisions to the material contained in this publication. Rockwell Automation cannot be held liable for incidental or consequential damages that result from the furnishing, performance, or use of this material.

Introduction

The GuardShield Micro 400 is an economical three box (transmitter, receiver, and controller) Type 4 safety light curtain offered in a small profile (15 x 20 mm (0.59 x 0.79 in.)) housing.

The protective heights are offered from 50...1200 mm (1.97...47.24 in.) in 50 mm (1.97 in.) increments. The compact housing size allows the GuardShield Micro 400 to be mounted in areas where standard safety light curtains must not be able to be mounted due to space constraints. It is also possible to recess the GuardShield Micro 400 transmitter and receiver into machine frames.

Allen Bradley 445L-P4C0450FP | gesrepair.com

Micro 400 System

The Micro 400 requires a dedicated controller, either an MSR41, which has ON/OFF functionality or an MSR42, which offers advanced functionality of fixed and floating blanking, manual restart and muting. The MSR42 can also be used as a multifunction safety module, which allows the connection of additional safety light curtains, safety laser scanner — any safety device with PNP type outputs.

The Micro 400 transmitter and receiver are offered with 8-pin M12 connectors at the end of 500 mm (20 in.) pigtail cables. The two patchcords to connect the transmitter and receiver to the controller are the same part number and are offered in various lengths. These patchcords are configured on one end with M12 connectors, which mate to the integrated pigtail connectors of the light curtain. The RJ45 connectors on the opposite end are plugged into to the MSR 41 or MSR42 controllers.

Micro 400 Cascading

The GuardShield Micro 400 is also offered in a cascadable configuration. GuardShield Cascadable Micro 400 safety light curtains allow the interconnection of multiple segments of the Micro 400 safety light curtain with a common pair of safety outputs. The cascadable configurability of the GuardShield Micro 400 reduces overall system wiring. It allows the series connection of multiple protective fields, for example, the front and the backside of an application or a combined horizontal and vertical protection area.

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

GuardShield Micro 400 cascaded pairs are offered in both 14 mm (0.55 in.) and 30 mm (1.18 in.) resolutions in limited protected heights. It is possible to mix 14 mm (0.55 in.) and 30 mm (1.18 in.) resolution pairs in a Cascaded Micro 400 system.

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

A cascadable pair of GuardShield Micro 400 light curtains has two 500 mm (20 in.) pigtails at each stick with a female (bottom) and a male (top) M12 quick disconnect.

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

When connecting two cascadable segments together, the resultant cable length between segments is 1000 mm (40 in.).

If an additional length between segment pairs is required, M12 patchcords in 1 m, 3 m, and 5 m (3.3 ft, 9.8 ft, and 16.4 ft) lengths (445L-AC8PC1 or 445L-AC8PC3) are offered.

IMPORTANT The maximum Cascaded Micro 400 system length cannot exceed 10 m (32.8 ft). This distance is measured between the RJ45 connection at the MSR 41 or MSR 42 Controller to the last beam in the standard Micro 400 (including all cable lengths). The maximum number of beams in a cascaded Micro 400 system cannot exceed 255 beams.

Micro 400 Washdown Option

The GuardShield Micro 400 is offered with the transmitter and receiver that is sealed in clear polycarbonate tubes with an environmental rating of IP69K. These IP69K Micro 400 light curtains are factory sealed and are ordered as pairs. They are offered in a 14 mm (0.55 in.) resolution in protected heights from 150...1200 mm (5.9...47.2 in.).

The required MSR41 or MSR42 controllers maintain the IP20 rating and must be mounted in a suitable enclosure.

The Micro 400 IP69K transmitter and receiver are both offered with 8-pin M12 connectors at the end of 500 mm (20 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are offered in 1 m, 2 m, 3 m, 5 m, and 8 m (3.3 ft, 6.6 ft, 9.8 ft, 16.4 ft, and 26.2 ft) lengths.

These patchcords are configured on one end with M12 connectors for the light curtain pigtail and RJ45 connectors on the opposite end for the MSR42 or MSR41 controller.

Micro 400 Specials

In addition to the standard GuardShield Micro 400 configurations, the GuardShield Micro 400 is also offered in special configurations as described in the Appendix.

The GuardShield Micro 400 safety light curtains are general-purpose presence sensing devices, providing point of operation (POC) and perimeter (PAC) detection.

IMPORTANT These installation instructions are designed to address the technical personnel of the machine manufacturer and or the installer of the safety system. These instructions describe the proper mounting, configuration, electrical installation, commissioning, operation, and maintenance of the GuardShield Micro 400 safety light curtain. These installation instructions do not provide instruction for the operation of machinery to which the GuardShield Micro 400 safety light curtain is integrated. Only qualified personnel can install this equipment.

Important Requirements

The GuardShield Micro 400 requires a dedicated controller. The MSR41 controller is used for on/off applications. The MSR42 controller can also be used as a multi-functional safety module, The MSR42 allows these connections:

- Additional safety light curtains,
- Safety laser scanner,
- Safety devices with two Output Signal Switch Devices (OSSD) outputs,
- Safety switch with two contacts (E-stops and enabling switches).

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

Safety Precautions — Principles for Safe Use and Symbols Used

The following instructions are preventive warnings to confirm the safe and proper operation of the GuardShield Micro 400 light curtains. These instructions are an essential part of the safety precautions and therefore have to be observed at any time.

Throughout this manual, we use the labels ATTENTION and IMPORTANT to alert you to the following:



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.

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



ATTENTION: The GuardShield Micro 400 must not be used with machines that cannot be stopped electrically in an emergency.

The safety distance between the GuardShield Micro 400 and a dangerous machine movement has to be maintained always.

Additional mechanical protective devices have to be installed in a way that hazardous machine elements cannot be reached without passing through the protective field.

The GuardShield Micro 400 has to be installed in a way that operators can only access the hazard through the sensing field of the Micro 400.

Improper installation can result in serious injury.

Never connect the outputs to +24V DC. If the outputs are connected to +24V DC, they are in ON-state and cannot stop hazardous spots at the machine/application.

Never expose the GuardShield Micro 400 to flammable or explosive gases.

Regular safety inspections are imperative (Safety Instructions—Maintenance on page 15).

Specialist Personnel

A qualified person must install, commission, and service the GuardShield Micro 400 safety light curtain. A qualified person is defined as a person who:

- Has undergone the appropriate technical training
- The machine operator has been instructed in the operation of the machine and the currently valid safety guidelines
- Has read and has ongoing access to these installation instructions

Range of Uses of the Device

The GuardShield Micro 400 safety light curtain is classified as electro-sensitive protective equipment (ESPE). It fulfills the requirements of a Type 4 ESPE defined by IEC 61496-1 and CLC/TS 61496-2 and is, therefore, allowed for use with controls in safety category Type 4 in compliance with EN ISO 13849, SIL CL3 in accordance with EN62061 or up to PLe in accordance with EN ISO 13849.

These devices are suitable for:

- Point of operation protection (finger and hand protection)
- Hazardous area protection

Access to the hazardous point must be allowed only through the protective field. The machine/system is not allowed to start as long as personnel are within the hazardous area. See the Examples of Range of Use on page 5 for an illustration of the protective modes.

Depending on the application, mechanical protection devices can be required and the safety light curtain.

POC

The GuardShield Micro 400 POC is available in the following physical resolutions:

- 14 mm (0.55 in.)
- 30 mm (1.18 in.).

The protective field height of standard GuardShield Micro 400 is between 50 mm (1.97 in.) and 1200 mm (47.2 in.).

The maximum protective field width is 0...5 m (16.4 ft).

Cascadable Micro 400

The cascadable GuardShield Micro 400 POC is available in the following physical resolutions:

- 14 mm (0.55 in.)
- 30 mm (1.18 in.).

The protective field height of cascadable GuardShield Micro 400 is between 300 mm (11.82 in.) and 1200 mm (47.2 in.). The maximum protective field width is 0...5 m (16.4 ft).

Micro 400 IP69K Option

The physical resolution of the GuardShield Micro 400 IP69K is 14 mm (0.55 in.). The protective field height of GuardShield Micro 400 IP69K is 300...1200 mm (11.8...47.2 in.). The maximum protective field width is 0...5 m (16.4 ft).

The Micro 400 IP69K option has the Micro 400 light curtains factory sealed in polycarbonate enclosures.

The GuardShield Micro 400 requires a controller to operate with one of the following safety controllers

- MSR41 ON/OFF functionality
- MSR42 multifunction module

Proper Use

The GuardShield Micro 400 safety light curtain must be used only as defined in the Range of Uses of the Device on page 3. Only qualified personnel can use this light curtain and it can only be used on the machine that it has been installed on and initialized by qualified personnel.

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

General Protective Notes and Protective Measures

IMPORTANT Observe the following items to maintain the proper and safe use of the GuardShield Micro 400 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 2006/42/EC
- Low Voltage Directive 2006/95/EC
- Use of Work Directive (2009/104/EC)
- The work safety regulations/safety rules
- Other relevant health and safety regulations

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

The notices, in particular the test regulations of these installation instructions (for example, on use, mounting, installation, or integration into the existing machine controller) must be observed.

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

The installation instructions must be made available to the user of the machine where the GuardShield Micro 400 safety light curtain is installed. The machine operator is to be instructed in the use of the device by specialist personnel and must be instructed to read the installation instructions.

Product Description

This section provides information on the special features and properties of the safety light curtain. It describes the structure and functions of the unit, in particular the different operating modes.

Read this section before you mount, install, and commission the unit.

Special Features

- Slim design 15 x 20 mm (0.59 x 0.79 in.)
- Built in diagnostic LEDs
- HW configurable with MSR41
- HW and SW configurable with MSR42
- M12 connector on 508 mm (20 in.) pigtails
- Low maintenance and cost-effective

Principle of Operation

The GuardShield Micro 400 safety light curtain consists of a non-matched pair of optic units, for example, transmitter and receiver with the same protected height and resolution. The controller functionality of the Micro 400 light curtains is through a separate control module.

- MSR41 ON/OFF functionality
- MSR42 multifunction module

The maximum distance between transmitter and receiver is referred to as the protective field width or range. The protective field height is the distance between the first and last beam in the device.

The transmitter emits sequential pulses of infrared light, which the GuardShield Micro 400 receives and processes by the connected controller. The connected MSR controller synchronizes the timing of the emission and reception of the infrared light pulses.

The connected controller has safety outputs [Output Signal Switching Devices (OSSDs)] and nonsafety auxiliary outputs. When the GuardShield Micro 400 transmitter and receiver are properly connected and aligned, the OSSDs of the connected controller are current sourcing +24V DC. Interruption of the sensing field causes the controller to switch the sourced current OFF (0V DC).

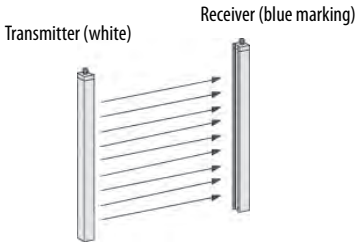
When you restore the GuardShield Micro 400 sensing field (in Guard only configuration), it causes safety outputs (OSSDs) of the controller to switch to the active high state (resume current sourcing +24V DC).

IMPORTANT Operating mode as manual or automatic restart (reset), EDM (external device monitoring), blanked beams, or overriding of the GuardShield Micro 400 are controlled from the connected safety controller (for example, MSR42). For details, see the user manual of the connected safety controller.

The GuardShield Light Curtain

The GuardShield Micro 400 safety light curtain consists of a transmitter and a receiver.

Figure 1 - Components of the GuardShield Micro 400



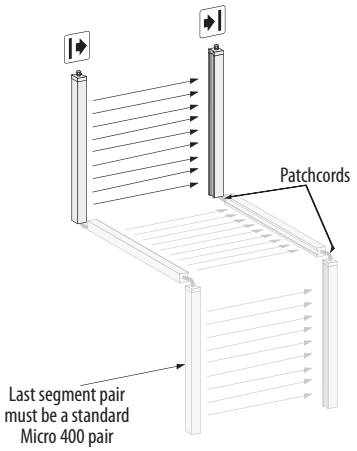
The protective field is between the bottom of the top end cap and the area above the status LEDs.

The width of the protective field is derived from the distance between transmitter and receiver. The distance must not exceed the maximum rated width of the protective field 0...5 m (0...16.4 ft).

Cascading

The GuardShield, Micro 400 POC is also available in cascading segments which allow a number of GuardShield Micro 400 transmitters and receivers to be interconnected. This product configurability allows the GuardShield Micro 400 to help protect multiple sides of a machine or simply adds flexibility when positioning the GuardShield Micro 400 in various applications.

Figure 2 - Up to Three GuardShield Micro 400 Segments Can Be Interconnected. See the Following Text for Limitations.



Standard GuardShield Micro 400 cascading segments are offered in protective heights from 150...1200 mm (5.91...47.2 in.) in both 14 mm (0.55 in.) and 30 mm (1.18 in.) resolutions.

A maximum of three GuardShield Micro 400 light curtains can be interconnected (maximum two cascades plus one standard GuardShield Micro 400). The maximum number of beams in a cascading system is 255 beams. The individual segments can have mixed resolutions as long as the pairs have the same protective heights and resolutions. The maximum cable length from the control unit to the last beam can be 10 m (32.8 ft).

Cascading segments cannot be used as standalone light curtain pairs.

However, if using multiple cascaded pairs or only one, the last pair in the cascaded system must be a standard GuardShield Micro 400 light curtain.

Consider the following limitations:

- A maximum of 255 light beams per controller
- 10 m (32.8 ft) maximum total length for light curtains, extension modules, and connection cable combined (Figure 2)
- Only a Rockwell Automation® patchcord (445L-AC8xxx) can be used between the light curtains and the controller. A patchcord is required to connect the M12 connector of the Micro 400 to either the MSR41 or MSR42 controller. The patchcord has an 8-pin M12 on one end and an RJ45 connector on opposite end.

Examples of Range of Use

The GuardShield Micro 400 safety light curtain operates as a proper protective device only if the following conditions are met:

- The control of the machine must be electrical.
- The controlled machine must be able to be stopped anywhere in the machines stroke or cycle.
- The transmitter and receiver must be mounted such that access to the hazard is only through the light curtain protective field.
- If used as an access device, the restart button must be located outside the hazardous area. This location helps to prevent the start-up of machinery while personnel are inside the hazardous area.
- The statutory and local rules and regulations must be observed when installing and using the device.

IMPORTANT Additional measures can be necessary to confirm that the ESPE does not fail to danger when other forms of light radiation are present in a particular application (for example, use of cableless control devices on cranes, radiation from weld spatter or effects from strobe lights).

Safety Functions

The GuardShield Micro 400 safety light curtain offers various functions, which are integral to the system.

Operating modes, functions, and features of the GuardShield system are activated through hardware or software of the corresponding connected MSR41 or MSR42 controller. For details, see the manual of the attached controller.

IMPORTANT The protective system must be tested for proper operation after every change to the configuration.

Response Time

The standard response time of the light curtain (see MSR42) is dependent on the physical resolution and the protective height and is shown on the product label. The actual response time depends on the connected control unit and its configuration. The response time can be faster and can be taken from the corresponding configuration control document, created from the configuration software of the corresponding safety controller (for example, MSR42).

The total light-curtain system response time for a cascaded system is the sum of the response times of each cascade plus the response time of the standard light curtain. The declared response times are worst case values.

A worst case response time is printed on the product label or in the GuardShield Micro 400 Products section:

t_{LC}	Response time of the standard Micro 400 light curtain
t_C	Response time of the control unit (for example, MSR42) including any connected MSR45 relay modules
t_{Nx}	Sum of response times t_{Nx} of all additional connected GuardShield Micro 400 light curtain cascades (x = 1 or 2)

Figure 1 shows an example of the total response time of a cascaded light curtain.

Table 1 - Total Response Time

Description	Length/Resolution [mm (in.)]	Response Time
Cascade 1 (t_{N1})	1200/14 (47.24/0.55)	41.9 ms
Cascade 2 (t_{N2})	300/14 (11.8/0.55)	18.5 ms
Standard (t_{LC})	600/14 (23.62/0.55)	26.3 ms
System ($t_{LC} + t_C + t_N$)	1200/14-300/14-600/14 (47.24/0.55-11.8/0.55-23.62/0.55)	86.7 ms + t_C

The response time printed on the product label reflects the double scan mode of the MSR41 and MSR42 controller.

IMPORTANT The response time of the GuardShield Micro 400 light curtain system is dependent on the operating mode of the connected safety controller. With the help of an optical interface (445L-AF6150) it is also possible, to delay the response time of the connected safety light curtain system, when the GuardShield Micro 400 is connected to the MSR42 controller.

If a controller unit is reconfigured, a new configuration control document must be printed and has to be kept close to the controller. Also the corresponding control unit has to be marked with the provided label.

A detailed explanation, including the corresponding safety information, for configuring an MSR42 controller module can be found in publication Safety-UM001.

Parameters, which can lead to an increased response time:

- Stop delay time
- Blanking
- Muting
- Using an MSR45E relay expansion module

IMPORTANT When changes are made to the configuration of the GuardShield Micro 400 system, it is necessary to recalculate the safety distance and potentially relocate the GuardShield Micro 400 light curtains at the proper distance from the hazard.

Blanking

There are some industrial applications where material must be fed through the protective field (for example, textile machines or small assembly machines). This movement of material through the GuardShield Micro 400 sensing field in the standard safety mode would result in an interruption and therefore bring the machine to an unwanted stop. To avoid stoppage, it is possible to blank out certain beams. This operating mode is known as Fixed Blanking. Blanking functionality is available with the MSR42 controller and requires the optical interface module to program this functionality.

IMPORTANT The device can be operated in a fixed and/or floating blanking mode if an MSR42 controller is used. The resolution increases according to configuration control document. The light curtain stick has to be clearly labeled with the configured resolution.

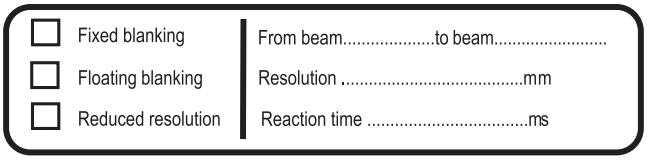
With an MSR42 safety controller and an Optical Interface (445L-AF6150) it is possible for authorized personnel to activate different blanking modes. Blanking modes are broken down into the following categories:

- Fixed blanking
- Floating blanking

IMPORTANT With the blanking function, the resolution and the response time of the GuardShield Micro 400 light curtain system is changed. If the Blanking function is activated, a new, longer response time, and a new, larger resolution is present, which must be applied to the calculation of the safety distance. The minimal safety distance of the light curtain must always be adapted to the actual operating mode. The corresponding reaction time of a light curtain without blanking is stated on the label of each system. If blanking is configured, the new reaction time, and the new resolution, according to the configuration control document must be entered in the appropriate spaces on the supplied label, and attached to the GuardShield Micro 400 light curtain (see Table 3). The labels are provided with the GuardShield Micro 400 mounting kit.

After configuring blanking, the label must be attached and clearly visible on the receiver portion of the light curtain.

Figure 3 - Additional Label for Blanking



IMPORTANT Further information on Blanking can be found in publication Safety-UM001.

Determining the Safety Distance

The light curtain must be mounted with proper safety distance

- From the point of danger
- From reflecting surfaces

US Safety Distance Formula

IMPORTANT The GuardShield Micro 400 safety light curtains must be mounted at a sufficient distance from the pinch point or point of operation hazard. The machine has to stop before a finger, hand, arm, or body reaches the hazard.

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

IMPORTANT Regardless of the calculated safety distance, GuardShield Micro 400 safety light curtains are never be mounted closer than 152.4 mm (6 in.) from the point of operation or pinch point hazard.

In the United States, there are two formulas that are used to calculate the safety distance. The first, the OSHA formula, is the minimum requirement for the calculation of the safety distance. The second formula, the one recommended by Rockwell Automation, is the ANSI formula, which incorporates additional factors to be considered when calculating the safety distance.

OSHA Safety Distance Calculation Formula

The OSHA safety distance formula as specified in CFR Subpart O 1910.217 is as follows:

$D_s = 63 \times T_S$

D_s Safety Distance in inches

63 Is the OSHA recommended hand speed constant in inches per second

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

The T_S number must include the response times of all devices. For example:

- Safety light curtain,
- Safety light curtain controller (if used),
- Machine control circuit,
- Any other devices that react to stop the hazardous motion of the machinery.

Not including the response time of a device or devices in the stop time calculation results in insufficient safety distance for the application. This insufficient distance can result in operator injury.

IMPORTANT Determining Stop Time: The measurement of stopping time (Ts) must include the stopping times of all devices in the stop circuit. Not including all device and control system elements when you calculate Ts results in an inaccurate safety distance calculation.

The ANSI Safety Distance Formula

The ANSI safety distance formula, which is the Rockwell Automation recommended formula, is as follows:

$$D_S = K \times (T_S + T_{CS} + T_r + T_{bm}) + D_{pf}$$

D_s Minimum safety distance between the safeguarding device and the nearest point of operation hazard, in inches.

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

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

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

T_{cs} Response time of the control system.

A stop time device measures T_s and T_{cs}.

T_r Response time of the presence sensing device (safety light curtain) and its interface (MSR4x and MSR45E). The device manufacturer states this value or you can measure it.

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

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

Example:

In safeguarding, such as a perpendicular safety light-curtain application with object sensitivity (effective resolution) less than 63.5 mm (2.5 in.), the D_{pf} can be approximated based on the following formula:

D_{pf} (inches) = 3.4 × (Object Sensitivity – 0.276), but not less than 0.

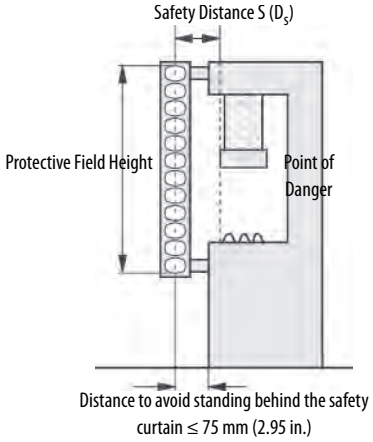
European Safety Distance Formula

A safety distance must be maintained between the light curtain and the point of danger. This safety distance confirms that the point of danger can only be reached after the dangerous state of the machine has been removed.

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

- Stopping/run-down time of the machine or system. (The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- Response time of the protective device, for example, GuardShield Micro 400 (see Response Time on page 5).
- Reach or approach speed.
- Resolution of the light curtain and/or beam separation.

Figure 4 - Safety Distance from the Point of Danger



How to Calculate the Safety Distance S According to EN ISO 13855 and EN ISO 13857:

First, calculate S using the following formula:

S = 2000 × T + 8 × (d – 14) [mm]

Where...

T = stopping/run-down time of the machine + response time of the protective device [s]
d = resolution of the light curtain [mm]
S = safety distance [mm]
The reach/approach speed is already included in the formula.

If the result S is <= 500 mm (19.6 in.), then use the determined value as the safety distance.

If the result S is > 500 mm (19.6 in.), then recalculate S as follows:
S = 1600 × T + 8 × (d – 14) [mm]

Example:

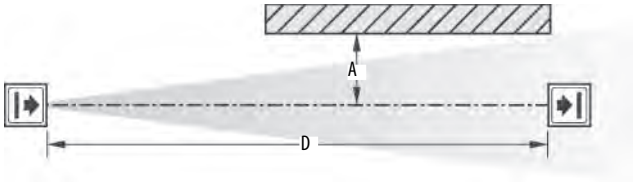
Stopping/run-down time of the machine = 290 ms
Response time = 30 ms
Resolution of the light curtain = 14 mm (0.55 in.)
T = 290 ms + 30 ms = 320 ms = 0.32 s
S = 2000 × 0.32 + 8 × (14 – 14) = 640 mm (25.1 in.)
S > 500 mm (19.6 in.) therefore:
S = 1600 × 0.32 + 8 × (14 – 14) = 512 mm (20.1 in.)

Minimum Distance from Reflecting Surfaces

The infrared light from the transmitter can be reflected off shiny surfaces and received by the system receiver. If this condition occurs, it can result in an object not being detected when it enters the GuardShield Micro 400 sensing field.

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

Figure 5 - Minimum Distance from Reflecting Surfaces

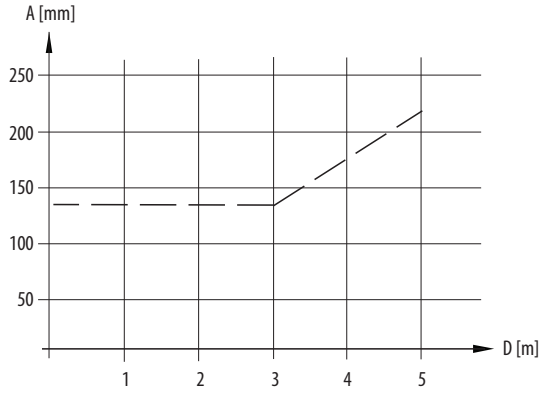


How to Determine the Minimum Distance from the Reflecting Surfaces:

-> Determine the distance D [m] transmitter-receiver

-> Read the minimum distance A [mm] from the graph:

Figure 6 - Minimum Distance from Reflecting Surfaces



The effective aperture angle for the GuardShield Micro 400 system is ± 2.5° at a mounting distance of > 3.0 m (9.8 ft). Calculate the minimum distance to reflective surfaces depending on the distance between the transmitter and the receiver. Use an aperture angle of ± 2.5° or take the appropriate value from the following table:

Distance between Transmitter and Receiver (Range D) [m (ft)]	Minimum Distance a [mm (in.)]
0…3.0 m (0…9.8 ft)	135 (5.31)
4.0 m (13.1 ft)	175 (6.88)
5.0 m (16.4 ft)	220 (8.66)

Formula: a = tan 2.5° x D [mm]

a = minimum distance to reflective surfaces
D = distance between transmitter and receiver

Installation and Mounting

This section describes the installation of the GuardShield Micro 400 safety light curtain.

A rigid and flat base, which is isolated against shock and vibration is selected to mount the GuardShield Micro 400 light curtain. This selection in combination with the standard mounting bracket set keeps the initial alignment during operation even in harsh industrial environments.

The GuardShield Micro 400 safety light curtain is suitable for most benign operating environments (IP54). Proper safety distance and adequate protective height must be observed. For the installation height and safety distance, refer to Determining the Safety Distance on page 7 and Figure 9.

IMPORTANT The installation of the GuardShield Micro 400 safety light curtain must be such that access to the hazard is only possible through the sensing field of the GuardShield (see Figure 7). Auxiliary safeguarding can be required with the GuardShield Micro 400 to meet this requirement.

Determine if the machinery, on which the GuardShield Micro 400 is to be mounted, meets the requirements as specified in the beginning of this manual. For example, machinery must be able to be stopped anywhere in its stroke or cycle, consistently and repeatedly.

Figure 7 - Correct Installation



Operators cannot reach hazardous machine parts without passing through the protective field.

Operators must not step between the protective field and hazardous machine parts (bypass prevention).

Figure 8 - Incorrect Installation

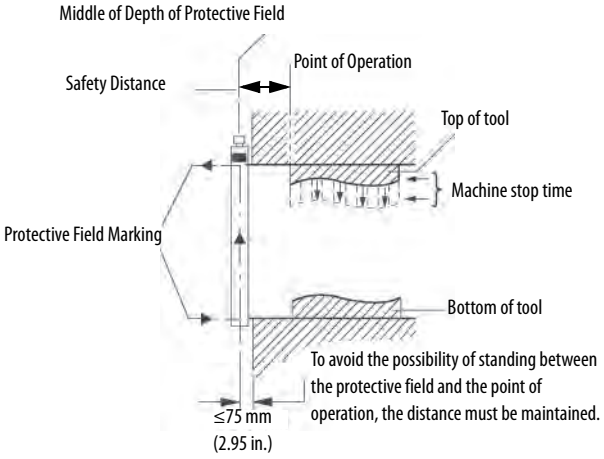


Operators can reach hazardous machine parts without passing through the protective field.

Operators can step between the protective field and hazardous machine parts.

The GuardShield Micro 400 must be mounted at the proper distance from the point of operation hazard. This distance is referred to as the Safety Distance.

Figure 9 - Determining Machine Stopping Time and Safety Distance



Installation and Alignment Procedure

The alignment procedure for the standard GuardShield Micro 400 can be made easier with the use of integrated indicator LEDs, see Table 6 on page 15.

Mount the transmitter and receiver with the brackets (Figure 11 on page 10). Make sure that the longitudinal axes of both are oriented parallel to each other. A vertical or horizontal mounting level can help to find the correct position.

Take care that the receiver and transmitter are oriented in the same direction. In other words, both connection ends must be at the same end of the protective field. A reference would be that the indicator LEDs are opposite one another. It is not allowed to mount the GuardShield Micro 400 systems rotated at 180° (see Figure 10 on page 10).

Connect the transmitter and receiver to the controller and power up. Align according to the description in the following section. The indicators help for alignment.

After aligning the longitudinal axis of the transmitter and receiver, rotate the receiver along the longitudinal axis to find the receiving angle. During rotation, the green LED indicates a free protective field. If this green LED

is blinking, the amount of light is not sufficient for stable operation. After realigning the light curtain, the protective field must be briefly interrupted. After removing the object from the protective field, a green LED indicates a sufficient intensity level.

Adjust and mount the receiver at the center of this operating angle.

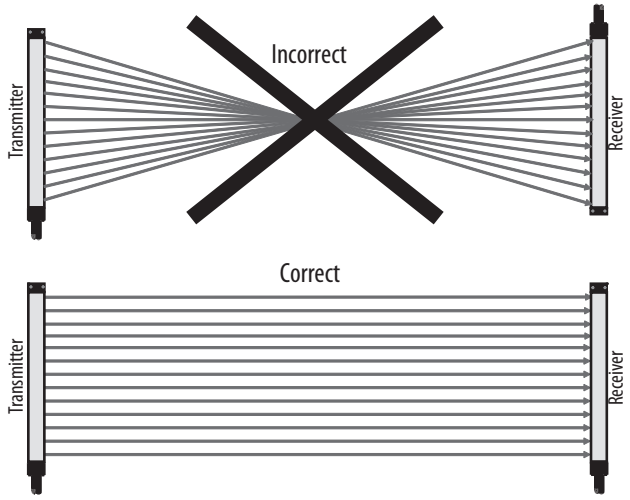
After aligning the receiver, rotate the transmitter to find the transmitting angle. During rotation, the green LED indicates the transmitting angle of the GuardShield Micro 400 light curtain.

Adjust and mount the transmitter at the center of this operating angle.

Test the protective function of the GuardShield Micro 400 light curtain by using the test rod, according to Figure 19 on page 16. The insertion of this rod into the protective field at any position has to lead to a protective field interruption (illumination of the red LED in the GuardShield Micro 400).

Cycle power to confirm that the system powers up and goes to the ON state.

Figure 10 - Layout of the Transmitter/Receiver

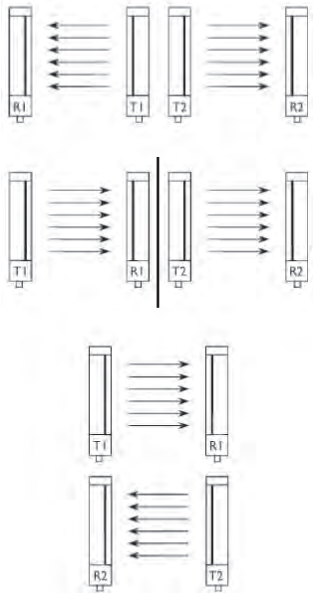


Multiple GuardShield Micro 400 Light Curtains

When two or more GuardShield Micro 400 light curtains are mounted close to one another, it can be possible for the receiver of one GuardShield Micro 400 pair to receive infrared light from the transmitter of another GuardShield Micro 400 pair.

There are various techniques to help prevent or reduce the possibility of optical interference from light curtains that are mounted in the same plane. The simplest method is to alternate transmitter and receiver pairs so that the receiver from a second pair is facing away from the transmitter of another light curtain pair nearby. It is also possible to place a physical barrier between pairs to help prevent the infrared light from reaching another light curtain pair.

Figure 11 - Multiple GuardShield Micro 400 Alignment Options



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

Transmitters emit in same direction: Optical (physical) barrier necessary

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

Cascaded GuardShield Micro 400

Configuration of Operating Modes in Cascading Systems

The operating modes of a cascaded GuardShield Micro 400 can be configured at the MSR42 control unit.

Two Segment Cascading GuardShield Systems

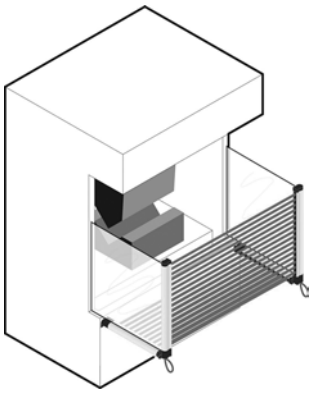
Operators must not step between the protective field and hazardous machine parts (bypass prevention), see Figure 7 on page 9.

There are a few methods of detecting the presence of a person who could be standing in front of the machine hazard but inside of the light curtain. The most cost-effective solution is to interconnect an additional light curtain in series to the vertical pair (see Figure 12). This solution is accomplished with a cascading pair of GuardShield Micro 400 safety light curtains with a protective height and resolution, which are based on the risk assessment. It is then necessary to select the horizontal protected height of the pair of GuardShield Micro 400 light curtains. This pair provides detection from the vertical pair to the front of the machine hazard. In most cases, this horizontal pair of GuardShield Micro 400 can be 30 mm (1.18 in.) resolution as their purpose is to detect the presence of a person, not fingers.

The next step is to select the interconnect patchcords for the transmitter and receiver. These patchcords are offered in various lengths (see Table 5 on page 12). The final cascading segment, which is not connected to another pair of GuardShield Micro 400 light curtains is a standard GuardShield Micro 400 light curtain.

“L-shaped” two segment GuardShield Micro 400 cascading systems offer protection when it is possible to stand between the vertical light curtain and the machine hazard (see Figure 7 on page 9 and Figure 12 on page 11).

Figure 12 - Two Segment, L-shaped Cascaded System

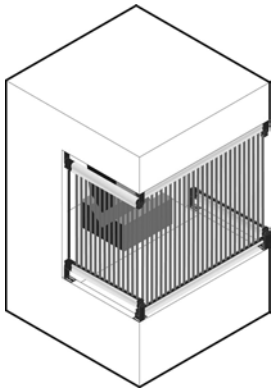


Three Segment GuardShield Cascading Systems

When the use of corner mirrors is not practical or possible, three-sided guarding of a machine hazard is possible using cascading GuardShield Micro 400 light curtains.

Figure 13 shows the top and bottom mounting of three GuardShield Micro 400 segments is possible, which provides three-sided machine guarding without the use of corner mirrors.

Figure 13 - Three Segment, U-shaped Cascaded System



Mounting and Alignment of Cascading GuardShield

IMPORTANT It helps to align the cascading segments in a particular order. First connect the last segment (segment with one connector) closest to the control unit. Once the LED in the edge is green; secure mounting brackets of that pair. Next connect middle segment to the last segment and connect to the controller. When middle segment receiver LED is green, secure those brackets. Finally connect the closest segment to the other segments and connect all together to the controller.

Only the diagnosis LED of the first segment displays the protective field status. The LEDs of other segments stay off.

For aligning a cascaded system, the optical interface module (see Accessories on page 22) can be a valuable alignment aid.

In a cascading system, only the LEDs of the segment closest to the controller are working. LEDs of other segments don't work.

Micro 400 IP69K

The GuardShield Micro 400 IP69K meets the requirements of Protection Classes IP65, IP66, IP67, IP68, and IP69K to IEC 60529 standards.

The tubes around the GuardShield Micro 400 have no influence on either operation range or safety class as per IEC/EN 61496-1.

Mounting kits are provided which attach to the connection and end module of the tube. The Micro 400 IP69K is supplied with the two mounting brackets. Do not rotate end or connection cap (danger of bending the light curtain).

The polycarbonate enclosure must be cleaned regularly and when dirty.

1. Do not use any powerful cleansing materials.
2. Do not use any abrasive cleansing materials.
3. Due to static charge, dust particles remain attached to the polycarbonate enclosure. You can alleviate this effect by using an anti-static plastic cleansing agent that is applied with an anti-static cloth for cleaning.
4. Clean polycarbonate enclosure as follows:
   - Remove dirt on the enclosure using ample quantities of water. In that way, you avoid scratching the surface.
   - Then wipe off with a clean, slightly damp cloth.
   - Finally, dry the plastic tube with a clean cloth.
5. Short time (max 2 min) with 80 °C (176 °F) warm water washable.

After every cleaning process, note the following:

- Remove water residues on the enclosure.
- Wipe the tubes with a clean cloth.
- Check position of transmitter and receiver to confirm that excessively loose or excessively tight grip or movement to the back by the safety device is not possible.
- Check safety function of the protective device

The connection plug has to be mounted away from high-pressure water.

Table 2 - Material Specifications

Attribute	Value
Protection Class (IEC 60529) Tube: Plug:	 IP65, IP66, IP67, IP68, IP69K IP65
Material:Connector and closure caps	POM (Polyoxymethylene)
Plastic tube	Polycarbonate
Cable screw fitting	PA6 (Polyamide 6)
O-rings (seals)	NBR (Nitril-Butadien-Rubber)
Mounting brackets	V2A [1.4301 (X5CrNi18-10)]
Pigtail cable	PVC
M12 Plug	Nickel-plated brass copper

IMPORTANT Do not rotate end or connection cap as there's a danger of bending the light curtain.

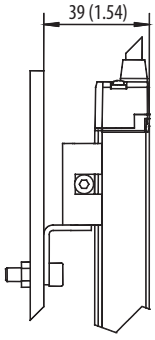
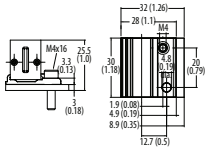
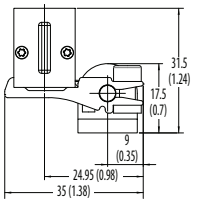
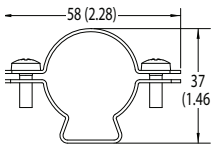
Do not mount brackets on transparent tube. Excessive force can damage the tube. When using cleaning solutions, consider the materials that are listed in Table 2.

Mounting Brackets

The GuardShield Micro 400 is mounted using brackets, which attach to the side of both transmitter and receiver. It can be necessary to use additional brackets to mount the GuardShield Micro 400 at a proper safety distance from the machinery hazard. The backside of the light curtain profile has continuous grooves to fix the mounting brackets at any position along the light curtain housing.

Further brackets can be obtained as an option, to offer the possibility of mounting on the side or in the center:

Table 3 - Brackets

Bracket	Dimensions	Description
		445L-AF6143 Adjustable 180° bracket kit (two per kit) supplied with each pair
		445L-AF6145 Flat bracket kit (two per kit). Two kits are required per pair
		445L-AF6149 Adjustable flat bracket (two per kit). Two kits are required per pair
		445L-AF6160 IP69K mounting bracket kit (two kits per pair supplied with each pair)

Electrical Installation — Connections

The connection of a GuardShield Micro 400 to a machine controller must occur using an MSR41 or MSR42 Series safety controller module. Only prefabricated cable (445L-AC8xxx) provided by Rockwell Automation can be used between the light curtain and controller (see Table 4 and Table 5).

The Micro 400 requires two patchcords, one for the transmitter and one for the receiver. The M12 8-pin connector is used for connecting to the light curtain, while the RJ45 connector is plugged to the controller. M12 to M12 patchcords are used for extending the cable, especially between cascades of the Micro 400 light curtain.

The connection cables are offered with color coded rings that are attached to each cable. Remove one color ring from the cable as necessary. The following color code is defined:

- White – Transmitter (Tx)
- Blue – Receiver (Rx)

Table 4 - Connection Cables

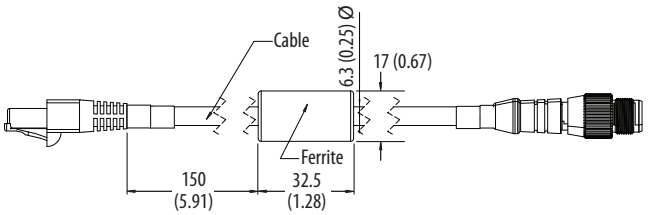
Description [m (ft)]	Cat. No.
Patchcord, PVC jacket, 1 (3.3) M12 to RJ45	445L-AC8RJ1
Patchcord, PVC jacket, 2 (6.6) M12 to RJ45	445L-AC8RJ2
Patchcord, PVC jacket, 3 (9.8) M12 to RJ45	445L-AC8RJ3
Patchcord, PVC jacket, 5 (16.8) M12 to RJ45	445L-AC8RJ5
Patchcord, PVC jacket, 8 (26.2) M12 to RJ45	445L-AC8RJ8

Table 5 - Extension Cables

Description [m (ft)]	Cat. No.
Patchcord, PVC jacket, 1 (3.3) M12 to M12	445L-AC8PC1
Patchcord, PVC jacket, 3 (9.8) M12 to M12	445L-AC8PC3
Patchcord, PVC jacket, 5 (16.8) M12 to M12	445L-AC8PC5

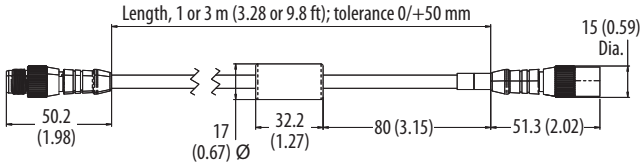
The RJ45 connector/M12 8-pin connector male [shielded cable], connection cable from MSR41 or MSR42 control unit to the light curtain are shown in Figure 14.

Figure 14 - GuardShield Micro 400 Connection Cable Dimensions [mm (in.)]



The M12 connector (male)/M12 8-pin connector (female) [shielded cable], extension connection cable or to use between light curtain cascades are shown in Figure 15.

Figure 15 - GuardShield Micro 400 Extension Patchcord Cable Dimensions [mm (in.)]



Power supply, inputs, safety outputs, and status outputs are connected to the terminal block of the MSR41, MSR42 controller, or a MSR45E (see Figure 16 and Figure 17 on page 14).

The interfacing of the light curtain with the machine control has to be control reliable. For example, a correct interface with a safety PLC or safety relays with positive guided relay contacts.

IMPORTANT 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 interface of a safety light curtain to a machine control that does not meet the necessary safety integrity level, can result in injury to personnel. For instance, use of general-purpose PLCs or relays can cause injury to personnel.

Figure 16 - Wiring Diagram for Connection of MSR42 to Contactors

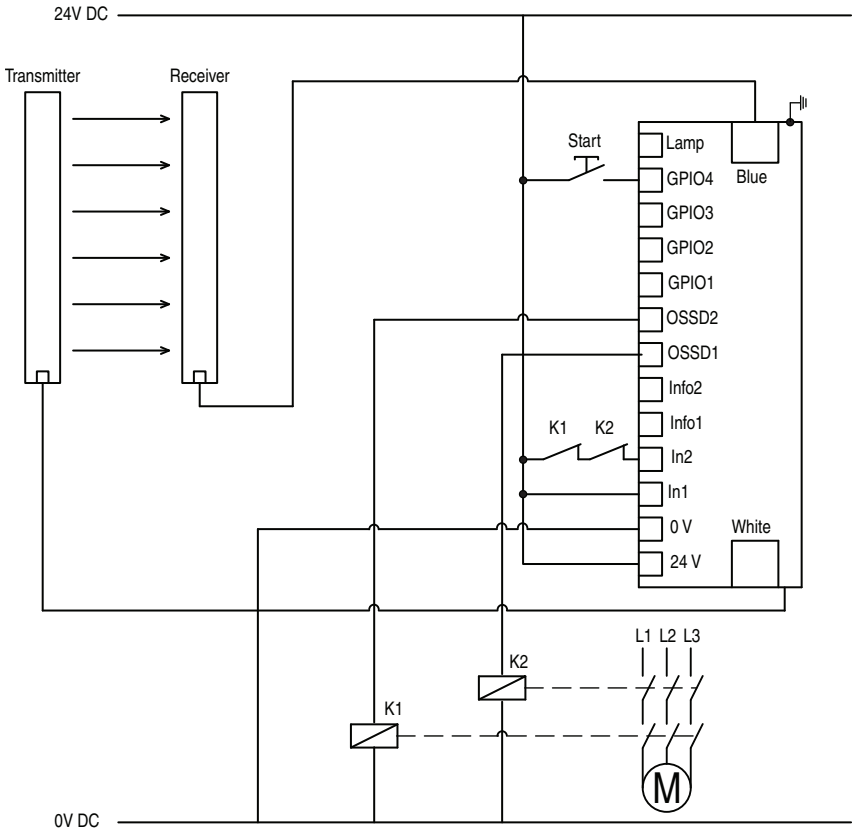
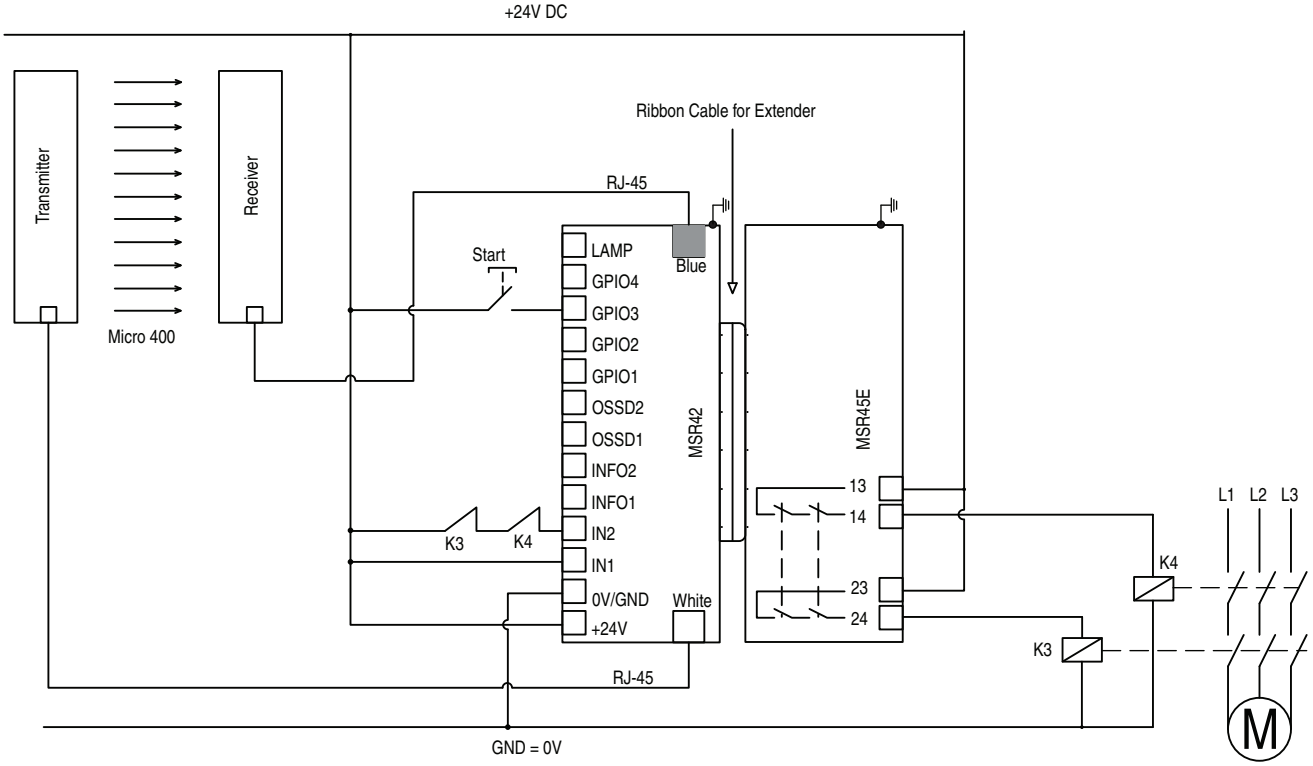


Figure 17 - Wiring Diagram for Connection to MSR45E Expansion Module and External Contactor Using Start Release



External Test Signal

In case the risk analysis of the application requires an external test signal (according to EN 13849-1), refer to the MSR42 Control Unit User Manual.

Power Supply

The power supply and the evaluation of the protective field of a GuardShield Micro 400 light curtain can only be conducted through an MSR41 or MSR42 Series control unit.

Bringing Into Operation

The transmitter and receiver units must be connected to an MSR41 or MSR42 safety control unit. Then the supply voltage can be connected to the control unit. After power-up, there is an automatic self-test (duration < 5 s) of all system components.

If the protective field is free and the transmitter and receiver are correctly aligned, the green LEDs on the GuardShield Micro 400 light curtains illuminate.

If after a successful power-up the light curtain detects an interruption of the protection field, the red LEDs on the GuardShield Micro 400 light curtains illuminate.

Outputs

A GuardShield Micro 400 safety light curtain pair is always connected to a safety controller. Every connection to a machine controller or a safety circuit is done through an MSR41 or MSR42 safety controller. Each controller provides two redundant semiconductor OSSD (Output Signal Switching Device) safety outputs. One or more MSR45E safety relay expansion modules can be connected to the MSR41 or MSR42 controller.

Each MSR41 or MSR42 safety controller also provides two status outputs (Info1 and Info2). These controller outputs can only be connected to the machine controller for information purposes.

ATTENTION: The status outputs (Info1 and Info2) of the MSR41 or MSR42 safety control units are not safety related. They cannot be used within the safety circuit of the machine.

Before first powering up or after a changed machine setting, the responsible person must review the following checklist.

Checklist

Before the initiation of the GuardShield Micro 400 the responsible person must work through the following checklist.

Check before first initiation or after a changed machine setting (for example, a rewiring):

1. The power supply is a 24V DC device that must comply to all applicable standards of the Machinery Directive 2006/42/EC, and the product standard (IEC61496), for example 1606-XLP-series. No connection to a conventional power supply.
2. Proper polarity of the power supply at the controller of the GuardShield Micro 400.
3. The transmitter connection cable is properly connected to the transmitter, the receiver connection cable is properly connected to the receiver. All plugs are connected.

4. The OSSD outputs are not connected to +24V DC.
5. The connected switching elements (load) are not connected to 24V DC.
6. If two or more GuardShield Micro 400 light curtains are to be used, make sure that each system is properly installed, to avoid optical interference.

Switch on the GuardShield Micro 400 and check its function by observing the following: 2 seconds after switching on, the system starts to work properly if the protection field is free of obstructions

Troubleshooting

With the help of two LEDs, system conditions and faults of the GuardShield Micro 400 systems are indicated.

A red and a green LED are integrated in the end-cap connection module of each profile (near the cable), which clearly signals the status of the protective field. With the help of the LED display, system conditions and faults of the GuardShield Micro 400 systems are indicated.

Figure 18 - Indicators



Table 6 - LED Meanings

LED	Color	Meaning
Green	On	Protective field is free.
	Flashing	Intensity is inadequate.
Red	Off	Protective field is free.
	On	Protective field is interrupted.
	Flashing	Error (lock out condition)

The conditions signaled by the LEDs can also be obtained from the status outputs of the connected MSR41 or MSR42 control module (see MSR41 Safety Module User Manual and MSR42 Control Module User Manual of the corresponding control unit).

Continuous red LED: Check the alignment if the LED of the GuardShield Micro 400 is continuously red. With the help of the optical interface (445L-AF6150), it is possible to display individual beam status on a laptop using a USB interface.

Red LED blinking (lockout condition): If the red LED of the GuardShield Micro 400 is blinking, the following conditions can cause the fault:

1. Inadequate supply voltage to the MSR41 or MSR42 safety controller.
2. Transmitter and/or receiver cables not correctly plugged into the MSR41 or MSR42 controller.
3. Transmitter and receiver light curtains are connected to the incorrect locations in the controller (transmitter plugged into receiver connection).
4. Incorrect assembly of cascaded systems (transmitter and receiver mixed).
5. Cable connector makes poor contact.
6. Error in the EDM feedback channel at the safety control (only if EDM).
7. Short circuit at the OSSD outputs.
8. Foreign light source affects the receiving unit.
9. Blanking configured and wrong light curtain length or resolution connected (only if blanking).

Corrective Steps

1. Examine connections, cables, and plugs of transmitter and receiver.
2. Turn the supply voltage off and on again.

With the help of the optical interface, it is possible to display the lock out information on a laptop using a USB interface.

If the LED of the safety light curtain is still blinking red, contact Rockwell Automation technical support.

IMPORTANT In cascaded systems only the LED in the first safety light curtain illuminates (closest to the safety controller).

Safety Instructions—Maintenance

ATTENTION: Never operate the GuardShield Micro 400 before conducting the following inspection. Improper inspection can lead to operator injury.

For safety reasons, all inspection results must be recorded.

Only persons, who clearly understand the functioning of the GuardShield Micro 400 and of the machine, can conduct an inspection.

If the installer, planning engineer and operator are different people, make sure that they have sufficient information available to conduct the inspection.

Regular Inspection

The following inspections must be done regularly. For example, the frequency of the inspection must be daily or according to the risk assessment.

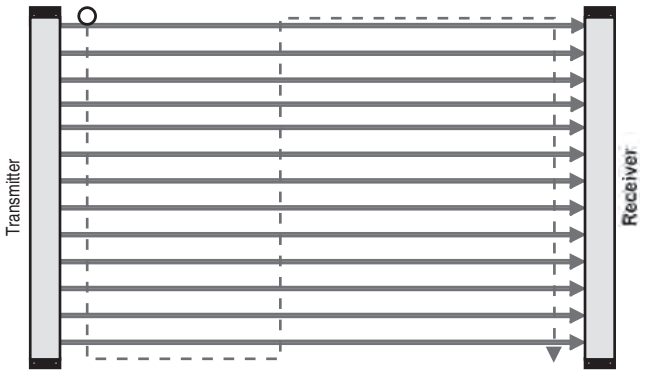
1. Approach to hazardous machine parts must only be possible through the protective field of GuardShield Micro 400.
2. Operators cannot step through the sensing area while working on dangerous machine parts.
3. The safety distance of the application is bigger than the calculated value.
4. The optic front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

   The inspection interval for 1...4 is:
   - Daily
   - According to the risk assessment
   - Whenever the machine setting is changed (electrical or mechanical)
   - Whenever a light curtain component (stick and/or plug-in) is replaced
   - According to the requirements of local regulation or an application-specific standard
   - According to the inspection instruction and the risk assessment of the application

   Operate the machine and check if the hazardous movement stops under the following circumstances.
5. The protective field is interrupted.
6. Hazardous machine movement stops immediately if 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
7. No hazardous machine movement while the test rod is anywhere within the protective field.
8. If the blanking function is activated, check all sections of the protective field with the appropriate test piece.

IMPORTANT If any of the previously listed conditions do not stop hazardous motion of the machine, do not allow the machine to be placed in operation.

Figure 19 - Proper Testing of Protective Field Using Test Rod

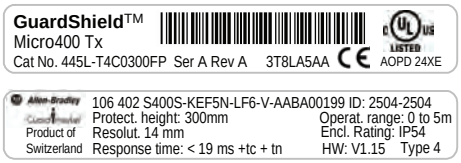


   Additionally, a more detailed inspection has to be carried out.
   - Whenever a machine setting is changed
   - The local regulation or an application-specific standard requires an inspection
   - According to the inspection instruction and the risk assessment of the application
   - Frequently, for example, every six months.
9. Machine stops or does not obstruct any safety function.
10. The latest machine or connection modifications have no effect on the control system.
11. The outputs of the controller of the GuardShield Micro 400 are properly connected to the machine.
12. The total response time of the machine is shorter than the calculated value.
13. Cables and plugs of the GuardShield Micro 400 are in good condition.
14. Mounting brackets, caps and cables are properly secured.

Cleaning

If the optic front cover of the GuardShield Micro 400 is dirty or scratched, the outputs turn off. Take a clean, soft cloth and rub without pressure. Do not apply aggressive or abrasive agents, which attack the surface.

Product Label



Date Code

AABCCDEE

AA= Production place (AL=Mexico, 3T= Switzerland)

B = Year

CC= Day (LA = 001, LB = 002, ...)

D = Internal RA product code

4 = GS Micro 400 System

5 = GS Micro 400 Tx

6 = GS Micro 400 Rx

EE= Counter (AA=001, AB=002, ...)

Example: 3T8LA5AA:

AA= 3T = Produced in Switzerland

B = 8 = Year 2008

CC= LA = Day 001

D = 5 = Transmitter

EE= AA =001

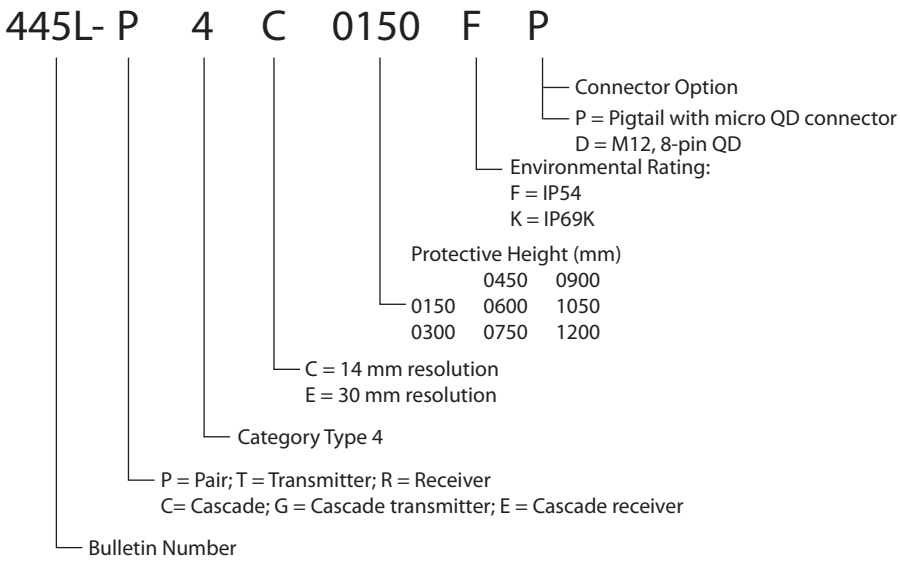
Table 7 - Explanation of Terminology

Abbreviations/ Terminology	Definition
Rx	Receiver
Tx	Transmitter
Cat No	Catalog number
Ser	Series number
Rev	Revision number
HW	Hardware version
AOPD type	Active opto-electronic protective equipment type 4 based on IEC 61496-1, -2
Type 4	Type 4 based on IEC 61496-1, -2
3T8LA5AA	Date Code
Operating range	Maximum operating range
Protective height	Protective height
Resolution	Resolution for the protective device ("without blanking")
Enclosure rating	IP – enclosure rating
Response time (no blanking)	Response time (see MSR42) for the protective device, see Response Time on page 5. 19 ms Response time t_{LC} of the light curtain cascade t_c Response time of the control unit including any connected relay modules t_N Sum of response times t_{LC} of all additional connected GuardShield Micro 400 light curtain cascades

Technical Specifications

Attribute	Value
Safety Ratings	
Standards	IEC/EN61496 Parts 1 and 2, UL61496 Parts 1 and 2, UL1998
Safety classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849-1
Probability of a dangerous failure per hour PFH	6.0 E-9 1/h MSR42 or MSR41 and MSR45E 4.0 E-9 1/h Micro 400
Certifications	c-UL-us Listed, TÜV, and CE Marked for all applicable directives
Outputs	
Micro 400 outputs	Data output to controller (MSR41 or MSR42)
MSR41/MSR42 outputs	Two 400 mA OSSD
Non-safety outputs	Auxiliary outputs from MSR41 or MSR42 controller—2 configurable 100 mA, outputs
Switching current @ voltage, max	400 mA @ 24V DC
Operating Characteristics	
Response time	14 mm (0.55 in.): 12…42 ms, varies by protective height and resolution, protective height 150…1200 mm (5.95…47.24 in.) 30 mm (1.18 in.); 11…23 ms, varies by protective height and resolution, protective height 150…1200 mm (5.95…47.24 in.)
Indicator LEDs	ON -State, OFF-State, Intensity, lockout
Protected height	Standard slim profile: 50…1200 mm (1.97…47.2 in.) in 50 mm (1.97 in.) increments Re-inforced profile: Up to 2200 mm (86.6 in.)
Resolution	14 mm (0.55 in.), 30 mm (1.18 in.), or PAC (Perimeter)
Scanning Range/resolution	14 mm (0.55 in.) resolution: 0…5 m (16.4 ft) 30 mm (1.18 in.) resolution: 0…5 m (16.4 ft)
Synchronization	Electrical through MSR41 or MSR42
Wave length	940 nm
Time for self check when switching on U_{sp}	< 5 s
Environmental	
Enclosure type rating	Micro 400 is IP54; Micro 400 IP69K is IP65, IP66, IP67, IP68, IP69K, Plug: IP65
Relative humidity	15…95% (noncondensing)
Operating temperature	0…55 °C (14…131 °F)
Storage temperature	-20…+70 °C (4…158 °F)
Vibration	IEC 60068-2-6; Frequency 10…55 Hz; Amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; Acceleration 10 g, pulse duration 16 ms 10…55 Hz; Amplitude 0.35 mm (0.01 in.)
Power supply	Input power from MSR41 or MSR42 controller
Input power, max	24V DC ±15% (MSR41 or MSR42 controller)
Maximum residual ripple	5% of Vss
Power consumption	0.07 A max (no load)
Equipment class	III (VDE 0106 part 100)
EMC	IEC 61496 part 1
Physical Characteristics	
Number of beams, max	255
Standard mounting	180° adjustable mounting brackets supplied (two sets 445L-AF6143)
Weight	Varies by protective height
Housing cross section	Slim profile (standard): 15 mm x 20 mm (0.59 x 0.79 in.) Re-inforced profile (special): 30 mm x 40 mm (1.18 x 1.57 in.)
Optical window	Polycarbonate
Enclosure and enclosure treatment	Aluminum, polyester powder coated, silicon free
Connection type	Transmitter/receiver: 8-pin M12 micro QD
Cable length	1, 2, 3, 5, and 8 m (3.3, 6.6, 9.8, 16.4, and 26.2 ft) cable M12 to RJ45 for MSR41 or MSR42. Max total system length cannot exceed 10 m (32.8 ft).
Patchcords	1 m, 3 m, and 5 m (3.3 ft, 9.8 ft, and 16.4 ft) M12 to M12 patchcords. Total system length cannot exceed 10 m (32.8 ft) including protective height of Micro 400, integrated cables and patchcords from M12 connector to MSR41 or MSR42.

Catalog Number Configurator



GuardShield Micro 400 Products

The response times in Table 8 are maximum values with no blanking configured. If blanking is configured in the Micro 400 controller, the response time values could be higher. The times depend on the controller type and the configuration. The real response time can be faster. Go to the Download section of the Product Compatibility and Download Center (PCDC) and search for MSR42.

IMPORTANT Since 2017 GuardShield Micro 400 products are only sold as pairs. Just for reference, the following tables provide the previous catalog numbers for a single transmitter and a single receiver. However, these numbers are not available as single sticks anymore (for example, for replacement purposes). In case of a replacement, a complete sensor pair must be ordered.

The following lists provide an extract of the Rockwell Automation offering. A complete list of all lengths and resolutions are available in the Rockwell Automation order tool Proposal Works. The response time of each pair can be evaluated in the Configuration Tool software or is provided on the product label.

Table 8 - GuardShield Micro 400, Standard, Profile 20 x 15 mm, Resolution 14 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Ind. Packaging]
445L-P4C0150FP	445L-T4C0150FP	445L-R4C0150FP	14 (0.55)	150 (5.91)	14.6	0.8 kg (28.2 oz)
445L-P4C0300FP	445L-T4C0300FP	445L-R4C0300FP	14 (0.55)	300 (11.81)	18.5	0.9 kg (31.7 oz)
445L-P4C0450FP	445L-T4C0450FP	445L-R4C0450FP	14 (0.55)	450 (17.71)	22.4	0.9 kg (31.7 oz)
445L-P4C0600FP	445L-T4C0600FP	445L-R4C0600FP	14 (0.55)	600 (23.62)	26.3	1.0 kg (35.27 oz)
445L-P4C0750FP	445L-T4C0750FP	445L-R4C0750FP	14 (0.55)	750 (29.52)	30.2	1.1 kg (38.8 oz)
445L-P4C0900FP	445L-T4C0900FP	445L-R4C0900FP	14 (0.55)	900 (35.43)	34.1	1.3 kg (45.86 oz)
445L-P4C1050FP	445L-T4C1050FP	445L-R4C1050FP	14 (0.55)	1050 (41.33)	38.0	1.3 kg (45.86 oz)
445L-P4C1200FP	445L-T4C1200FP	445L-R4C1200FP	14 (0.55)	1200 (47.24)	41.9	1.3 kg (45.86 oz)

Table 9 - GuardShield Micro 400, Standard, Profile 20 x 15 mm, Resolution 30 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Ind. Packaging]
445L-P4E0150FP	445L-T4E0150FP	445L-R4E0150FP	30 (1.18)	150 (5.91)	12.4	0.8 kg (28.2 oz)
445L-P4E0300FP	445L-T4E0300FP	445L-R4E0300FP	30 (1.18)	300 (11.81)	13.9	0.9 kg (31.7 oz)
445L-P4E0450FP	445L-T4E0450FP	445L-R4E0450FP	30 (1.18)	450 (17.71)	15.5	0.9 kg (31.7 oz)
445L-P4E0600FP	445L-T4E0600FP	445L-R4E0600FP	30 (1.18)	600 (23.62)	17.0	1.0 kg (35.27 oz)
445L-P4E0750FP	445L-T4E0750FP	445L-R4E0750FP	30 (1.18)	750 (29.52)	18.5	1.1 kg (38.8 oz)
445L-P4E0900FP	445L-T4E0900FP	445L-R4E0900FP	30 (1.18)	900 (35.43)	20.2	1.2 kg (42.33 oz)
445L-P4E1050FP	445L-T4E1050FP	445L-R4E1050FP	30 (1.18)	1050 (41.33)	21.7	1.3 kg (45.86 oz)
445L-P4E1200FP	445L-T4E1200FP	445L-R4E1200FP	30 (1.18)	1200 (47.24)	23.3	1.3 kg (45.86 oz)

Table 10 - GuardShield Micro 400, Cascaded, Profile 20 x 15 mm, Resolution 14 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Protection Height A [mm (in.)]	Weight Per Pair [Ind. Packaging]
445L-C4C0150FP	445L-G4C0150FP	445L-F4C0150FP	14 (0.55)	150 (5.91)	0.8 kg (28.2 oz)
445L-C4C0300FP	445L-G4C0300FP	445L-F4C0300FP	14 (0.55)	300 (11.81)	0.9 kg (31.7 oz)
445L-C4C0450FP	445L-G4C0450FP	445L-F4C0450FP	14 (0.55)	450 (17.71)	0.9 kg (31.7 oz)
445L-C4C0600FP	445L-G4C0600FP	445L-F4C0600FP	14 (0.55)	600 (23.62)	1.0 kg (35.27 oz)
445L-C4C0900FP	445L-G4C0900FP	445L-F4C0900FP	14 (0.55)	900 (35.43)	1.2 kg (42.33 oz)
445L-C4C1200FP	445L-G4C1200FP	445L-F4C1200FP	14 (0.55)	1200 (47.24)	1.3 kg (45.86 oz)

Table 11 - GuardShield Micro 400, Cascaded, Profile 20 x 15 mm, Resolution 30 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Protection Height A [mm (in.)]	Weight Per Pair [Ind. Packaging]
445L-C4E0150FP	445L-G4E0150FP	445L-F4E0150FP	30 (1.18)	150 (5.91)	0.8 kg (28.2 oz)
445L-C4E0300FP	445L-G4E0300FP	445L-F4E0300FP	30 (1.18)	300 (11.81)	0.9 kg (31.7 oz)
445L-C4E0600FP	445L-G4E0600FP	445L-F4E0600FP	30 (1.18)	600 (23.62)	1.0 kg (35.27 oz)
445L-C4E0750FP	445L-G4E0750FP	445L-F4E0750FP	30 (1.18)	750 (29.52)	1.1 kg (38.8 oz)
445L-C4E0900FP	445L-G4E0900FP	445L-F4E0900FP	30 (1.18)	900 (35.43)	1.2 kg (42.33 oz)
445L-C4E1200FP	445L-G4E1200FP	445L-F4E1200FP	30 (1.18)	1200 (47.24)	1.3 kg (45.86 oz)

Table 12 - GuardShield Micro 400, IP69K, Tube, Resolution 14 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Ind. Packaging]
445L-P4C0150KD	445L-T4C0150KD	445L-R4C0150KD	14 (0.55)	150 (5.91)	14.6	1.45 kg (51.15 oz)
445L-P4C0300KD	445L-T4C0300KD	445L-R4C0300KD	14 (0.55)	300 (11.81)	18.5	1.5 kg (52.9 oz
445L-P4C0600KD	445L-T4C0600KD	445L-R4C0600KD	14 (0.55)	600 (23.62)	26.3	1.7 kg (59.96 oz
445L-P4C0900KD	445L-T4C0900KD	445L-R4C0900KD	14 (0.55)	900 (35.43)	34.1	2.3 kg (81.13 oz
445L-P4C1200KD	445L-T4C1200KD	445L-R4C1200KD	14 (0.55)	1200 (47.24)	41.9	2.4 kg (84.66 oz

Dimensions [mm (in.)]

Figure 20 - GuardShield Micro 400 Standard

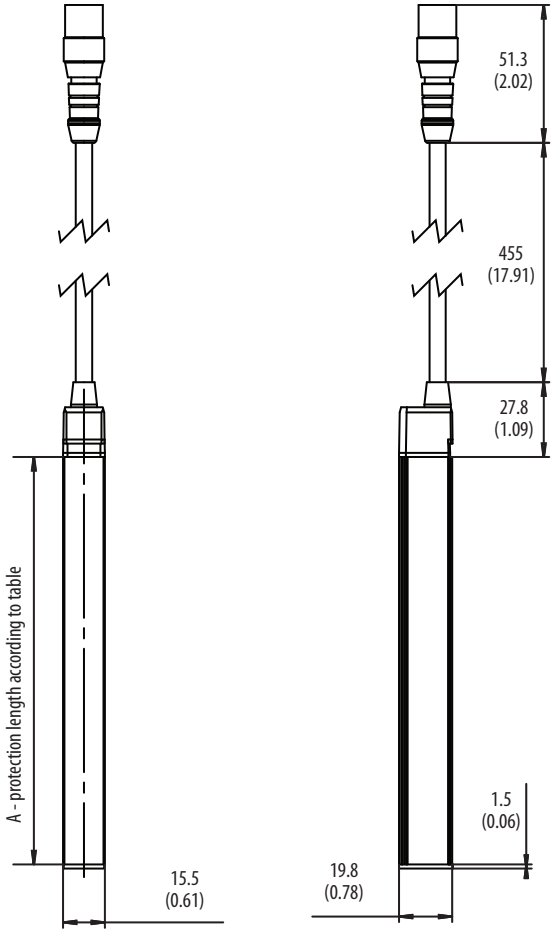


Figure 21 - GuardShield Micro 400 IP69K

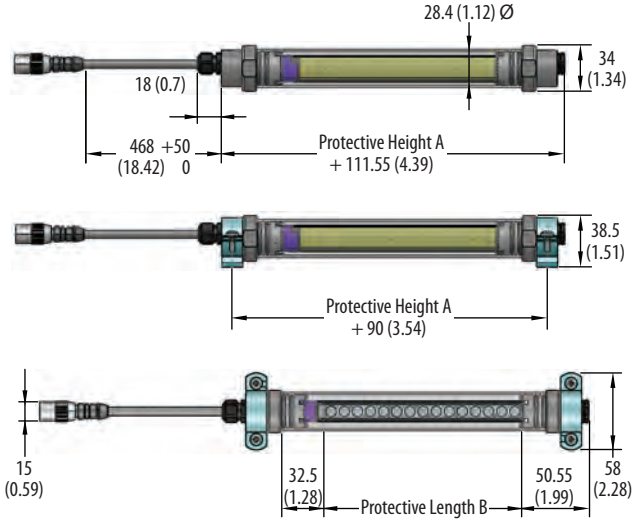


Figure 22 - GuardShield Micro 400 Cascades

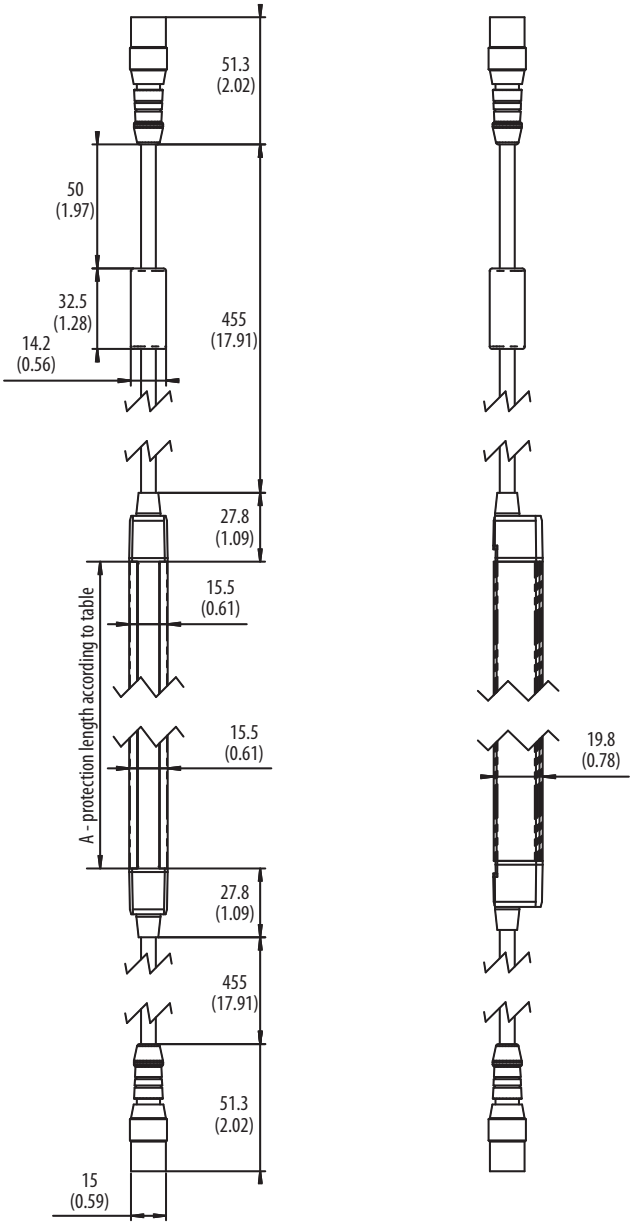


Table 13 - GuardShield Micro 400 IP69K (Washdown)

System Cat. No. (Mounting Kit Included)	Protection Zone Height A [mm (in.)]	System Length (No Cable) [mm (in.)]
445L-P4C0150KD	150 (5.9)	280 (11.0)
445L-P4C0300KD	300 (11.8)	430 (16.9)
445L-P4C0600KD	600 (23.6)	730 (28.7)
445L-P4C0900KD	900 (35.4)	1030 (40.5)
445L-P4C1200KD	1200 (47.2)	1330 (52.3)

Accessories

Table 14 - Required Safety Controller — Select One [mm (in.)]

Description	Mounting	Size	Catalog Number
 MSR41 ON/OFF	35 mm DIN Rail	22.5 (0.89)	440R-P221AGS
 MSR42 Multi-functional Module	35 mm DIN Rail	22.5 (0.89)	440R-P226AGS-NNR

Table 15 - Optional Safety Relay Expansion Module

Relay	Input Voltage	Reset	Outputs	Catalog Number
 MSR45E Safety Relay expansion module	Supplied by MSR41 or MSR42	Determined by MSR41 or MSR42	2 N.O.	440R-P4NANS

The MSR41 or MSR42 can have up to three MSR45E safety relays interconnected. Each module requires a ribbon cable connector to make the interconnection. The table shows the cat. no. for each ribbon cable connector.

Table 16 - Safety Relay Interface Accessories for MSR41 or MSR42 Controllers

Description		Catalog Number
	Ribbon cable – for one MSR45E	440R-ACABL1
	Ribbon cable – for two MSR45Es	440R-ACABL2
	Ribbon cable – for three MSR45Es	440R-ACABL3

Operation mode and parameters of the MSR42 controller can be changed using the configuration software, which is available on[Product Compatibility and Download Center (PCDC)] and with the optical interface 445L-AF6150. Programming of the MSR42 is only necessary for advanced operating modes (for example, blanking, muting) or for connection of additional devices (for example, enabling switch, emergency stop button).

Table 17 - Optical Interface

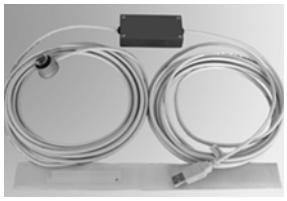
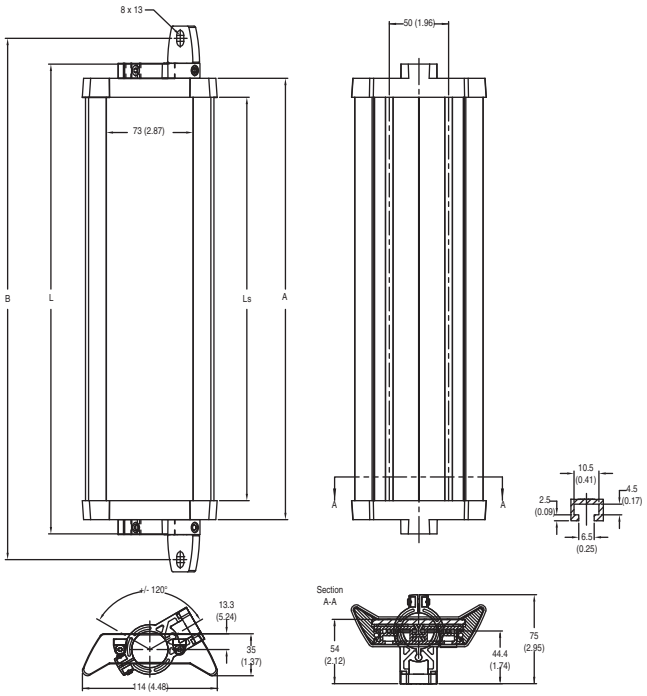
Description		Catalog Number
	USB optical interface software configuration tool that is used to configure the MSR42	445L-AF6150

Table 18 - Optional Accessories

Description		Catalog Number
	Adjustable 180° bracket kit (two per kit). Two kits are supplied with each pair	445L-AF6143
	Flat bracket kit (two per kit) Two kits are required per pair	445L-AF6145
	Adjustable flat bracket (two per kit) Two kits are required per pair	445L-AF6149
	IP69K mounting bracket kit (two per kit). Two kits are supplied with each IP69K pair.	445L-AF6160

Table 19 - Mirror 440L-AM075



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

Specially constructed glass mirrors for 2- and 3-sided safeguarding applications. Each mirror reduces maximum scan range by 10% per mirror. Each corner mirror is supplied with two end-cap mounting brackets.

Table 20 - Corner Mirror for Multi-sided Guarding

Protected Height [mm (in.)]	Narrow Mirror Short-range 0…4 m (0…13.1 ft)	Mirror Height [(mm (in.)]	Catalog Number
150 (5.91) / 300 (11.8)		300 (11.8)	440L-AM0750300
450 (17.7)		450 (17.7)	440L-AM0750450
600 (23.6)		600 (23.6)	440L-AM0750600
750 (29.5)		750 (29.5)	440L-AM0750750
900 (35.4)		900 (35.4)	440L-AM0750900
1050 (41.3)		1050 (41.3)	440L-AM0751050
1200 (47.2)		1200 (47.2)	440L-AM0751200

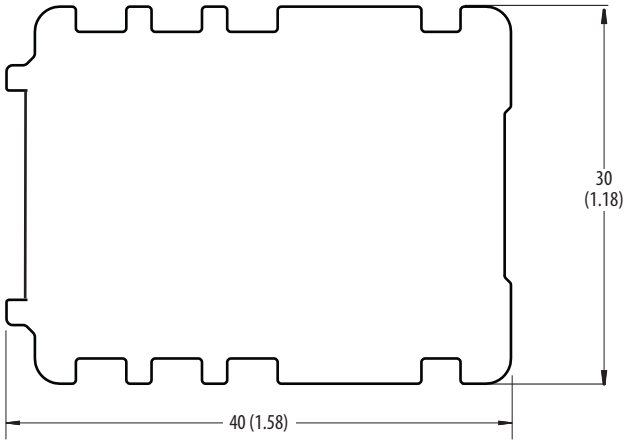
GuardShield Micro 400 Special Safety Light Curtain Systems

In addition to the GuardShield Micro 400 manual, this appendix gives some additional information for some GuardShield Micro 400 special systems.

Systems with Re-inforced Profiles

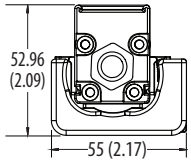
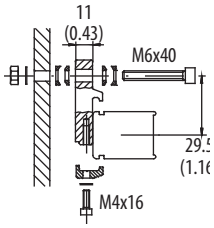
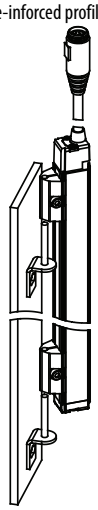
The GuardShield Micro 400 standard safety light curtains are offered in the slim profile with dimensions of 20 x 15 mm (0.79 x 0.59 in.). The maximum length is limited to 1200 mm (47.2 in.) to help prevent damage by twisting or bending. For longer lengths up to 2200 mm (86.61 in.), the systems are offered in a red re-inforced profile. Standard and cascaded systems are available based on the re-inforced profile.

Figure 23 - Cross Section of the Robust (Re-inforced) Profile [mm (in.)]



The default mounting kit that is shipped with a GuardShield Micro 400 in a re-inforced profile is catalog number 450L-AM-SM. Drawings of this mounting kit are provided in publication 450L-IN002. Optional mounting kits (catalog number 445L-AF6140 or 445L-AF6141) are also available (for details, see publication 445L-UM001).

Table 21 - Mounting Accessories for Re-inforced Profile

Accessory	Catalog Number
Side mounting bracket kit for re-inforce profile (two per kit) supplied with each pair. 	450L-AM-SM
Optional flat bracket kit for re-inforce profile (two per kit).  Two kits required per pair.	445L-AF6140
Optional adjustable 180° bracket kit (two per kit) for re-inforced profile.  Two kits required per pair.	445L-AF6141

Perimeter Systems (PAC)

Perimeter systems are produced with several single-beam light barriers. But the flexibility of the GuardShield Micro 400 system also allows the production of vertical entry safeguarding according to the standard EN ISO 13855 [2010]. Such systems are composed of active and passive elements in one compact profile (see Table 30 and Table 31 on page 30. The element length of each is 50 mm (1.97 in.).

The significant advantage of GuardShield Micro 400 perimeter systems is the easier way of mounting and the uncomplicated way of starting up the operation. The time that is required to connect and align the optics is reduced in comparison to standard perimeter systems consisting of single beam light barriers and mirrors.

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

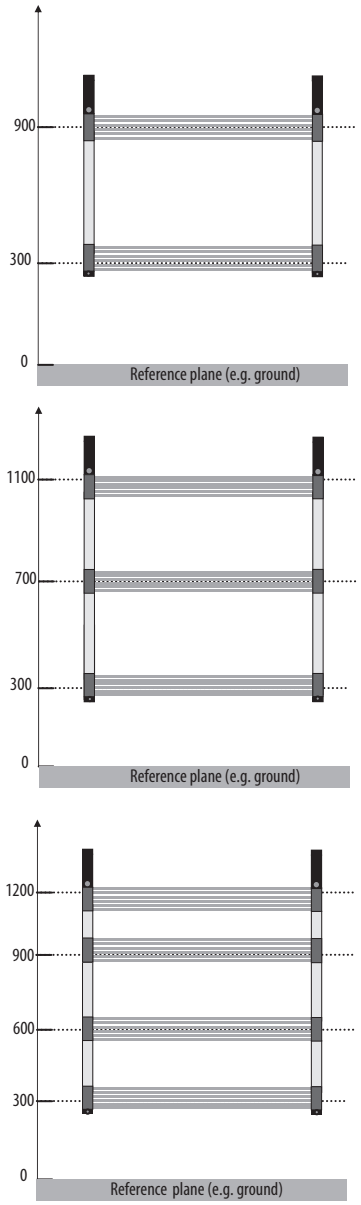
How to Calculate the Safety Distance S for GuardShield Micro 400 PAC Systems

For vertical mounted perimeter systems or light curtains with horizontal approach and a resolution larger than >40 mm (1.57 in.), the safety distance is calculated according to the formula:

S = 1.6 mm (0.06 in.)/ms x T + 850 mm (33.46 in.)

More detailed information regarding safety distance and safety heights can be found in standard EN 13855 (2010).

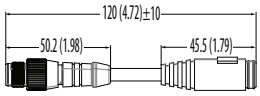
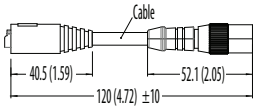
Figure 24 - Perimeter Systems (2-, 3-, and 4-beams), Installation According to EN ISO 13855 [2010]



Special Patchcords

All GuardShield Micro 400 light curtains have actually M12/8-pin connector. Special patchcords can be necessary to replace older connector versions:

Table 22 - Cordset Dimensions

Cordset [mm (in.)]	Catalog Number	Description
	445L-ACDN9M12	Patchcord, 8-pin, Din9/ female to M12/male
	445L-109296	Patchcord, 8-pin, Din9/ male to M12/female

Special Systems

Besides the standard lengths that are given in Technical Specifications on page 18, Rockwell Automation also offers some special lengths and configurations. For those systems, longer lead time can be expected.

The mentioned response times in Table 23 on page 27 are maximum values. The times depend on the controller type and the configuration. The real response time can be faster. Obtain the exact response time from the MSR42 configuration software. To download the configuration software, go the Download section of the Product Compatibility and Download Center (PCDC) and search for MSR42.

Table 23 - GuardShield Micro 400, Nonstandard Lengths, Profile 20 x 15 mm (0.79 x 0.59 in.), Resolution 14 mm (0.55 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-P4C0050FP	445L-T4C0050FP	445L-R4C0050FP	14 (0.55)	20 x 15	50 (1.97)	12.0	0.6 kg (21.16 oz)
445L-P4C0100FP	445L-T4C0100FP	445L-R4C0100FP	14 (0.55)	20 x 15	100 (3.94)	13.3	0.7 kg (24.69 oz)
445L-P4C0200FP	445L-T4C0200FP	445L-R4C0200FP	14 (0.55)	20 x 15	200 (7.87)	15.9	0.8 kg (28.2 oz)
445L-P4C0250FP	445L-T4C0250FP	445L-R4C0250FP	14 (0.55)	20 x 15	250 (9.84)	17.2	0.8 kg (28.2 oz)
445L-P4C0350FP	445L-T4C0350FP	445L-R4C0350FP	14 (0.55)	20 x 15	350 (13.78)	19.8	0.9 kg (31.7 oz)
445L-P4C0400FP	445L-T4C0400FP	445L-R4C0400FP	14 (0.55)	20 x 15	400 (15.75)	21.1	0.9 kg (31.7 oz)
445L-P4C0500FP	445L-T4C0500FP	445L-R4C0500FP	14 (0.55)	20 x 15	500 (19.69)	23.7	0.9 kg (31.7 oz)
445L-P4C0550FP	445L-T4C0550FP	445L-R4C0550FP	14 (0.55)	20 x 15	550 (21.65)	25.0	1.0 kg (35.27 oz)
445L-P4C0650FP	445L-T4C0650FP	445L-R4C0650FP	14 (0.55)	20 x 15	650 (25.59)	27.6	1.0 kg (35.27 oz)
445L-P4C0700FP	445L-T4C0700FP	445L-R4C0700FP	14 (0.55)	20 x 15	700 (27.56)	28.9	1.1 kg (38.8 oz)
445L-P4C0800FP	445L-T4C0800FP	445L-R4C0800FP	14 (0.55)	20 x 15	800 (31.50)	31.5	1.2 kg (42.33 oz)
445L-P4C0850FP	445L-T4C0850FP	445L-R4C0850FP	14 (0.55)	20 x 15	850 (33.46)	32.8	1.2 kg (42.33 oz)
445L-P4C0950FP	445L-T4C0950FP	445L-R4-C0950FP	14 (0.55)	20 x 15	950 (37.4)	35.4	1.3 kg (45.86 oz)
445L-P4C1000FP	445L-T4C1000FP	445L-R4C1000FP	14 (0.55)	20 x 15	1000 (39.37)	36.7	1.3 kg (45.86 oz)
445L-P4C1100FP	445L-T4C1100FP	445L-R4C1100FP	14 (0.55)	20 x 15	1100 (43.31)	39.3	1.3 kg (45.86 oz)

Table 24 - GuardShield Micro 400, Nonstandard Lengths, Profile 20 x 15 mm (0.79 x 0.59 in.), Resolution 30 mm (1.18 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-P4E0050FP	445L-T4E0050FP	445L-R4E0050FP	30 (1.18)	20x15	50 (1.97)	11.3	0.6 kg (21.16 oz)
445L-P4E0100FP	445L-T4E0100FP	445L-R4E0100FP	30 (1.18)	20x15	100 (3.94)	11.8	0.6 kg (21.16 oz)
445L-P4E0200FP	445L-T4E0200FP	445L-R4E0200FP	30 (1.18)	20x15	200 (7.87)	12.9	0.7 kg (24.69 oz)
445L-P4E0250FP	445L-T4E0250FP	445L-R4E0250FP	30 (1.18)	20x15	250 (9.84)	13.3	0.7 kg (24.69 oz)
445L-P4E0350FP	445L-T4E0350FP	445L-R4E0350FP	30 (1.18)	20x15	350 (13.78)	14.4	0.8 kg (28.2 oz)
445L-P4E0400FP	445L-T4E0400FP	445L-R4E0400FP	30 (1.18)	20x15	400 (15.75)	15.0	0.8 kg (28.2 oz)
445L-P4E0500FP	445L-T4E0500FP	445L-R4E0500FP	30 (1.18)	20x15	500 (19.69)	15.9	0.9 kg (31.7 oz)
445L-P4E0550FP	445L-T4E0550FP	445L-R4E0550FP	30 (1.18)	20x15	550 (21.65)	16.5	1.0 kg (35.27 oz)
445L-P4E0650FP	445L-T4E0650FP	445L-R4E0650FP	30 (1.18)	20x15	650 (25.59)	17.6	1.1 kg (38.8 oz)
445L-P4E0700FP	445L-T4E0700FP	445L-R4E0700FP	30 (1.18)	20x15	700 (27.56)	18.1	1.2 kg (42.33 oz)
445L-P4E0800FP	445L-T4E0800FP	445L-R4E0800FP	30 (1.18)	20x15	800 (31.5)	19.1	1.3 kg (45.86 oz)
445L-P4E0850FP	445L-T4E0850FP	445L-R4E0850FP	30 (1.18)	20x15	850 (33.46)	19.6	1.3 kg (45.86 oz)
445L-P4E0950FP	445L-T4E0950FP	445L-R4E0950FP	30 (1.18)	20x15	950 (37.4)	20.7	1.4 kg (49.38 oz)
445L-P4E1000FP	445L-T4E1000FP	445L-R4E1000FP	30 (1.18)	20x15	1000 (39.37)	21.1	1.4 kg (49.38 oz)
445L-P4E1100FP	445L-T4E1100FP	445L-R4E1100FP	30 (1.18)	20x15	1100 (43.31)	22.2	1.5 kg (52.9 oz)

Table 25 - GuardShield Micro 400, Nonstandard Lengths, Cascaded, Profile 20 x 15 mm (0.79 x 0.59 in.), Resolution 14 mm (0.55 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-C4C0050FP	445L-G4C0050FP	445L-F4C0050FP	14 (0.55)	20x15	50 (1.97)	12.0	0.6 kg (21.16 oz)
445L-C4C0100FP	445L-G4C0100FP	445L-F4C0100FP	14 (0.55)	20x15	100 (3.94)	13.3	0.6 kg (21.16 oz)
445L-C4C0200FP	445L-G4C0200FP	445L-F4C0200FP	14 (0.55)	20x15	200 (7.87)	15.9	0.8 kg (28.2 oz)
445L-C4C0250FP	445L-G4C0250FP	445L-F4C0250FP	14 (0.55)	20x15	250 (9.84)	17.2	0.9 kg (31.7 oz)
445L-C4C0350FP	445L-G4C0350FP	445L-F4C0350FP	14 (0.55)	20x15	350 (13.78)	19.8	0.9 kg (31.7 oz)
445L-C4C0400FP	445L-G4C0400FP	445L-F4C0400FP	14 (0.55)	20x15	400 (15.75)	21.1	0.9 kg (31.7 oz)
445L-C4C0500FP	445L-G4C0500FP	445L-F4C0500FP	14 (0.55)	20x15	500 (19.69)	23.7	0.9 kg (31.7 oz)
445L-C4C0550FP	445L-G4C0550FP	445L-F4C0550FP	14 (0.55)	20x15	550 (21.65)	25.0	1 kg (35.27 oz)
445L-C4C0650FP	445L-G4C0650FP	445L-F4C0650FP	14 (0.55)	20x15	650 (25.59)	27.6	1 kg (35.27 oz)
445L-C4C0700FP	445L-G4C0700FP	445L-F4C0700FP	14 (0.55)	20x15	700 (27.56)	28.9	1 kg (35.27 oz)
445L-C4C0800FP	445L-G4C0800FP	445L-F4C0800FP	14 (0.55)	20x15	800 (31.5)	31.5	1.1 kg (38.8 oz)
445L-C4C0850FP	445L-G4C0850FP	445L-F4C0850FP	14 (0.55)	20x15	850 (33.46)	32.8	1.1 kg (38.8 oz)
445L-C4C0950FP	445L-G4C0950FP	445L-F4C0950FP	14 (0.55)	20x15	950 (37.4)	35.4	1.1 kg (38.8 oz)
445L-C4C1000FP	445L-G4C1000FP	445L-F4C1000FP	14 (0.55)	20x15	1000 (39.37)	36.7	1.3 kg (45.86 oz)
445L-C4C1100FP	445L-G4C1100FP	445L-F4C1100FP	14 (0.55)	20x15	1100 (43.31)	39.3	1.3 kg (45.86 oz)

Table 26 - GuardShield Micro 400, Nonstandard Lengths, Cascaded, Profile 20 x 15 mm (0.79 x 0.59 in.), Resolution 30 mm (1.18 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-C4E0050FP	445L-G4E0050FP	445L-F4E0050FP	30 (1.18)	20x15	50 (1.97)	11.3	0.1 kg (3.53 oz)
445L-C4E0150FP	445L-G4E0150FP	445L-F4E0150FP	30 (1.18)	20x15	150 (5.91)	12.4	0.2 kg (7.05 oz)
445L-C4E0300FP	445L-G4E0300FP	445L-F4E0300FP	30 (1.18)	20x15	300 (11.81)	13.9	0.3 kg (10.58 oz)
445L-C4E0350FP	445L-G4E0350FP	445L-F4E0350FP	30 (1.18)	20x15	350 (13.78)	14.4	0.4 kg (14.11 oz)
445L-C4E0400FP	445L-G4E0400FP	445L-F4E0400FP	30 (1.18)	20x15	400 (15.75)	15.0	0.4 kg (14.11 oz)
445L-C4E0450FP	445L-G4E0450FP	445L-F4E0450FP	30 (1.18)	20x15	450 (17.72)	15.5	0.4 kg (14.11 oz)
445L-C4E0600FP	445L-G4E0600FP	445L-F4E0600FP	30 (1.18)	20x15	600 (23.62)	17.0	0.5 kg (17.64 oz)
445L-C4E0750FP	445L-G4E0750FP	445L-F4E0750FP	30 (1.18)	20x15	750 (29.52)	18.5	0.6 kg (21.16 oz)
445L-C4E0900FP	445L-G4E0900FP	445L-F4E0900FP	30 (1.18)	20x15	900 (35.43)	20.2	0.7 kg (24.69 oz)
445L-C4E1200FP	445L-G4E1200FP	445L-F4E1200FP	30 (1.18)	20x15	1200 (47.24)	23.3	0.9 kg (31.7 oz)

Table 27 - GuardShield Micro 400, Special Systems, Profile Re-inforced, Resolution 14 mm (0.55 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-110490-0001	445L-110119	445L-110118	14 (0.55)	40x30	150 (5.91)	14.6	1.1 kg (38.8 oz)
445L-110490-0002	445L-110121	445L-110120	14 (0.55)	40x30	300 (11.81)	18.5	1.3 kg (45.86 oz)
445L-110490-0003	445L-110123	445L-110122	14 (0.55)	40x30	400 (15.75)	21.1	1.5 kg (52.9 oz)
445L-110490-0004	445L-110125	445L-110124	14 (0.55)	40x30	450 (17.72)	22.4	1.6 kg (56.44 oz)
445L-110490-0024	445L-111391	445L-111390	14 (0.55)	40x30	500 (19.69)	23.7	1.3 kg (45.86 oz)
445L-110490-0006	445L-110129	445L-110128	14 (0.55)	40x30	600 (23.62)	26.3	1.9 kg (67.02 oz)
445L-110490-0008	445L-110133	445L-110132	14 (0.55)	40x30	750 (29.53)	30.2	2.2 kg (77.6 oz)
445L-110490-0028	445L-112858	445L-112857	14 (0.55)	40x30	800 (31.5)	31.5	2.3 kg (81.13 oz)
445L-110490-0009	445L-110135	445L-110134	14 (0.55)	40x30	900 (35.43)	34.1	2.5 kg (88.18 oz)
445L-110490-0010	445L-110137	445L-110136	14 (0.55)	40x30	1000 (39.37)	36.7	2.8 kg (98.77 oz)
445L-110490-0029	445L-112862	445L-112861	14 (0.55)	40x30	1050 (41.34)	38.0	2.9 kg (102.29 oz)
445L-110490-0025	445L-111394	445L-111395	14 (0.55)	40x30	1100 (43.31)	39.3	3.0 kg (105.82 oz)
445L-110490-0011	445L-110139	445L-110138	14 (0.55)	40x30	1200 (47.24)	41.9	3.1 kg (109.35 oz)
445L-110490-0013	445L-110143	445L-110142	14 (0.55)	40x30	1350 (53.15)	45.8	3.4 kg (119.93 oz)
445L-110490-0014	445L-110145	445L-110144	14 (0.55)	40x30	1500 (59.06)	49.7	3.7 kg (130.51 oz)
445L-110490-0015	445L-110147	445L-110146	14 (0.55)	40x30	1600 (62.99)	52.3	4.1 kg (144.62 oz)
445L-110490-0017	445L-110151	445L-110150	14 (0.55)	40x30	1650 (64.96)	53.6	4.1 kg (144.62 oz)
445L-110490-0030	445L-112866	445L-112865	14 (0.55)	40x30	1700 (66.93)	54.9	4.2 kg (148.15 oz)
445L-110490-0018	445L-110153	445L-110152	14 (0.55)	40x30	1800 (70.87)	57.5	4.3 kg (151.68 oz)
445L-110490-0019	445L-110155	445L-110154	14 (0.55)	40x30	2000 (78.74)	62.7	4.3 kg (151.68 oz)
445L-110490-0027	445L-111378	445L-111377	14 (0.55)	40x30	2100 (82.68)	65.3	4.4 kg (155.20 oz)
445L-110490-0020	445L-110157	445L-110156	14 (0.55)	40x30	2200 (86.61)	67.9	4.6 kg (162.26 oz)

Table 28 - GuardShield Micro 400, Special Systems, Profile Re-inforced, Resolution 30 mm (1.18 in.)

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-110490-0005	445L-110127	445L-110126	30 (1.18)	40x30	500 (19.69)	15.9	1.7 kg (59.96 oz)
445L-110490-0012	445L-110141	445L-110140	30 (1.18)	40x30	1300 (51.18)	24.3	3.3 kg (116.4 oz)
445L-110490-0016	445L-110149	445L-110148	30 (1.18)	40x30	1600 (62.99)	27.4	4.1 kg (144.62 oz)

Table 29 - GuardShield Micro 400, Special Systems, Cascaded, Profile Re-inforced, Resolution 14 mm

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-110491-0001	445L-110171	445L-110170	14 (0.55)	40x30	600 (23.62)	26.3	1.9 kg (67.02 oz)
445L-110491-0002	445L-110173	445L-110172	14 (0.55)	40x30	750 (29.53)	30.2	2.2 kg (77.6 oz)
445L-110491-0003	445L-110175	445L-110174	14 (0.55)	40x30	900 (35.43)	34.1	2.5 kg (88.18 oz)
445L-110491-0004	445L-110177	445L-110176	14 (0.55)	40x30	1000 (39.37)	36.7	2.8 kg (98.77 oz)
445L-110491-0015	445L-111399	445L-111398	14 (0.55)	40x30	1050 (41.34)	38.0	2.9 kg (102.29 oz)
445L-110491-0005	445L-110179	445L-110178	14 (0.55)	40x30	1100 (43.31)	39.3	2.9 kg (102.29 oz)
445L-110491-0006	445L-110181	445L-110180	14 (0.55)	40x30	1200 (47.24)	41.9	3.1 kg (109.35 oz)
445L-110491-0007	445L-110183	445L-110182	14 (0.55)	40x30	1350 (53.15)	45.8	3.4 kg (119.93 oz)
445L-110491-0008	445L-110185	445L-110184	14 (0.55)	40x30	1500 (59.06)	49.7	3.7 kg (130.51 oz)
445L-110491-0009	445L-110187	445L-110186	14 (0.55)	40x30	1650 (64.96)	53.6	4.1 kg (144.62 oz)
445L-110491-0010	445L-110189	445L-110188	14 (0.55)	40x30	1800 (70.87)	57.5	4.3 kg (151.68 oz)

Table 30 - GuardShield Micro 400, Special Systems, Profile Slim, PAC

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Included]
445L-110492-0002	445L-110161	445L-110160	2 Beam, 500 (19.68)	20x15	550 (21.65)	11.8	1.0 kg (35.27 oz)
445L-110492-0004	445L-110165	445L-110164	3 Beam, 400 (15.75)	20x15	850 (33.46)	12.4	1.2 kg (42.33 oz)
445L-110492-0006	445L-110169	445L-110168	4 Beam, 300 (11.81)	20x15	950 (37.40)	12.9	1.3 kg (45.86 oz)

Table 31 - GuardShield Micro 400, Special Systems, Profile Re-inforced, PAC

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per pair [Packaging Included]
445L-110492-0001	445L-110159	445L-110158	2 Beam, 500 (19.68)	40x30	550 (21.65)	11.8	1.8 kg (63.49 oz)
445L-110492-0003	445L-110163	445L-110162	3 Beam, 400 (15.75)	40x30	850 (33.46)	12.4	2.4 kg (84.66 oz)
445L-110492-0005	445L-110167	445L-110166	4 Beam, 300 (11.81)	40x30	950 (37.40)	12.9	3.1 kg (109.35 oz)

Table 32 - Special GuardShield Micro 400, Special Systems

Sensor Pair	Transmitter	Receiver	Resolution [mm (in.)]	Profile Dimensions [mm x mm]	Protection Height A [mm (in.)]	Response Time, Max t_{LC} [ms]	Weight Per Pair [Packaging Induded]
445L-103567-0055	—	—	14 (0.55)	20 x 15	150…150 (5.91…5.91)	18.5	1.9 kg (67.02 oz)
445L-109316	—	—	14 (0.55)	20 x 15	150 (5.91) cascaded	14.6	0.6 kg (21.16 oz)
445L-109317	—	—	14 (0.55)	20 x 15	150 (5.91)	14. 6	0.6 kg (21.16 oz)
445L-103567-0018	—	—	14 (0.55)	20 x 15	50…450 (1.97…17.72)	23.7	1.2 kg (42.33 oz)
445L-103567-0065	—	—	14 (0.55)	20 x 15	50…400 (1.97…15.75)	22.4	1.1 kg (38.8 oz)
445L-110490-0007	445L-110131	445L-110130	30 (1.18)	20 x 15	650 (25.59)	17.6	1.0 kg (35.27 oz)
445L-108582-0002	445L-108578	445L-108579	30 (1.18)	20 x 15	900 (35.43)	20.2	1.3 kg (45.86 oz)
—	445L-108670	445L-108671	30 (1.18)	20 x 15	800 (31.5)	19.1	1.2 kg (42.33 oz)
445L-108582-0003			30 (1.18)	20 x 15	600 (23.62)	<17.0	
445L-108582-0001			30 (1.18)	20 x 15	650 (25.6)	<18.0	
445L-108582-0004			30 (1.18)	20 x 15	800 (31.5)	<20.0	
445L-108582-0002			30 (1.18)	20 x 15	900 (35.4)	<21.0	
445L-103663-0013			30 (1.18)	20 x 15	1300 (51.18)	<25.0	
445L-103663-0007			30 (1.18)	20 x 15	1550 (61.02)	<27.0	
445L-103663-0020			30 (1.18)	20 x 15	1800 (70.86)	<30.0	
445L-106317			14 (0.55)	20 x 15	700 (27.56)	<29.0	
445L-106316			14 (0.55)	20 x 15	700 (27.56)	<29.0	
445L-110130			30 (1.18)	20 x 15	650 (25.59)	<17.5	
445L-108671			30 (1.18)	20 x 15	800 (31.5)	<19.1	
445L-110131			30 (1.18)	20 x 15	650 (25.6)	<17.5	
445L-108670			30 (1.18)	20 x 15	800 (31.5)	<19.1	

Certifications

See Declaration of Conformity and other Certificates at Rockwell Automation Literature Library.

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

Compliance to European Union Directives

Rockwell Automation B.V. (address: Rivium Promenade 160, 2909 LM Capelle aan den Ijssel, The Netherlands) declares that this product is in conformity with the provisions of the following EC directives (including all applicable amendments): 2014/30/EU Electromagnetic Compatibility Directive (EMC) and 2006/42/EC Machinery Directive (MD) and that the respective standards and/or technical specifications have been applied. It is approved for installation within the European Union and EEA regions.

Waste Electrical and Electronic Equipment (WEEE)



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

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

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

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

Allen-Bradley, Guardmaster, GuardShield, Rockwell Automation, and Rockwell Software are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

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

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

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) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 445L-IN005A-EN-P - May 2018
Supersedes Publication 445L-UM003A-EN-P - March 2016

PN-107934
10000167493 Ver 05 - CSA: 107 123

Copyright © 2018 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.