

■ Description

The MiniProtect MP2100 protective light curtain provides reliable cost effective guarding. It is ideal for use on equipment where low risk has been assessed. The system consists of a transmitter, receiver and cables. The control circuitry is contained within the transmitter and receiver; a third control box is not required.

The MP2100's slim, compact design and adjustable mounting brackets allow for mounting in locations where space is at a premium.

Two solid-state safety outputs provide 500 mA at 24 VDC.

Two operating modes are available: Automatic Start for point of operation guarding and Start/Restart Interlock for perimeter guarding. (These modes are selected at time of order.)

The status indicators are a valuable tool for making installation a "snap". Two LEDs indicate top end and bottom end alignment while two other LEDs report the machine status.

High immunity to strobe or ambient light interference is assured through precise optics and its sophisticated electronics.

MiniProtect



MP2100

- Resolution: 30 mm (1.18 in.)
- Range: 15 m (49 ft.)
- Protective heights: 147 to 1470 mm (5.7 to 57.9 in.)
- Compact size — 31 x 32 mm (1.22 x 1.26 in.)
- Two-box design, no controller or connections between transmitter and receiver required
- LED indicators for status and diagnostics
- Two PNP safety outputs
- Choice of two operating modes: Automatic Start and Start/Re-Start Interlock (factory selectable only)
- Adjustable mounting brackets
- Quick-disconnect cables
- Type 2 ESPE per IEC 61496-1, -2

Options

- Relay outputs through an RM-1 or RM-X
- Muting through an RM-3 module

Type 2 vs. Type 4 Light Curtains

See the article "Type 2 vs. Type 4 Light Curtains" in the Engineering Section of this catalog.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ Specifications for Transmitter and Receiver

Performance
Protective Height: 147 to 1470 mm (5.7 to 57.9 in)
Operating Range: 0.3 to 15 m (1 to 49 ft.)
Minimum Object Resolution: 30 mm (1.18 in)
Response Time: See table at right
Effective Aperture Angle: $\pm 5^\circ$ per the requirements of IEC 61496-1, -2 for a Type 2 ESPE
Input Voltage (V_{in}): 24 VDC \pm 20%
Input Power: 3.4 watts (without load on the outputs)
Safety Output Ratings: Two PNP outputs sourcing 500 mA max @ V_{in} (see note 1). Short circuit protected.
Power Supply: 24 VDC \pm 20%. The rating depends on the current requirements of the loads attached to the outputs (see note 2). The power supply must meet the requirements of IEC 60204-1 and 61496-1. Omron STI part number 42992 or equivalent.
Start/Restart N.C. Input: 20 mA @ 24 VDC
Light Source: GaAIAs Light Emitting Diode, 880 nm
Mechanical
Cable Length Extension Cables: Available in lengths of 3, 10 and 30 m
Construction: Polyurethane powder-painted aluminum
Connections: M12 4-pole connector for transmitter; M12 5-pole connector for receiver
Environmental
Temperature 0 to 55°C (32 to 131°F)
Relative Humidity: 95% maximum, non-condensing
Enclosure Rating: IP65
Indicator Lights: Transmitter – Power applied, interlock; Receiver – Machine run, machine stop, top align, bottom align
Vibration: 10 to 55 Hz on all three axes
Shock: 10 g for 0.16 second; 1,000 shocks for each axis
Approvals
The MP2100 series has been EC type examined to the requirements of IEC 61496-1, -2 for a Type 2 ESPE. TUV, CSA and UL listed.

Specifications are subject to change without notice.

Note 1: Voltage available at the outputs is equal to $V_{in} - 1.0$ VDC.

Note 2: Total system current requirement is the sum of the transmitter 50 mA and receiver 1.09 A max. (Receiver 90 mA + OSSD1 load + OSSD2 load)

Model	Response Time
MP21Y-30-150	14 ms
MP21Y-30-300	15 ms
MP21Y-30-450	16 ms
MP21Y-30-600	17 ms
MP21Y-30-750	18 ms
MP21Y-30-900	19 ms
MP21Y-30-1050	20 ms
MP21Y-30-1200	22 ms
MP21Y-30-1350	23 ms
MP21Y-30-1500	24 ms

▲ WARNING!

DO NOT use this Protective Light Curtain where a risk assessment has determined that *control reliability* is required, such as for hazardous machinery. Use only for equipment where the *worst-case* injury from an accident can be remedied by simple first aid, as determined by a thorough risk assessment.

DO NOT use unless the device is installed, tested, and inspected according to Omron STI's Installation Manual

This protective device meets the Type 2 requirements of IEC 61496. It DOES NOT meet U.S. OSHA 1910.217, ANSI B11, or ANSI/RIA R15.06 requirements.

If you are unsure of which model of light curtain to choose, contact Omron STI (1-888-510-4357, or www.sti.com). Failure to comply with this warning could result in serious injury or death.

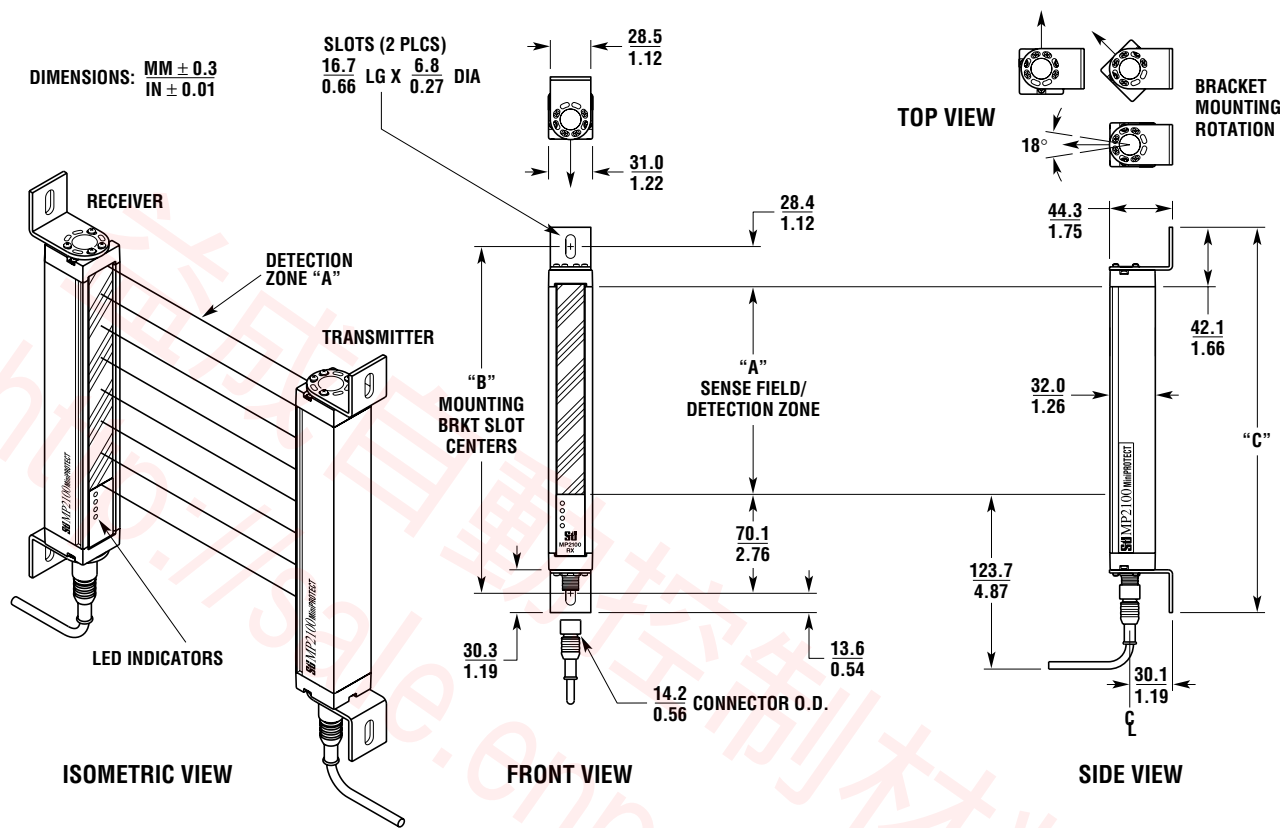
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■ Dimensions—mm/in.

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Mini Protect MP2100 Dimensions

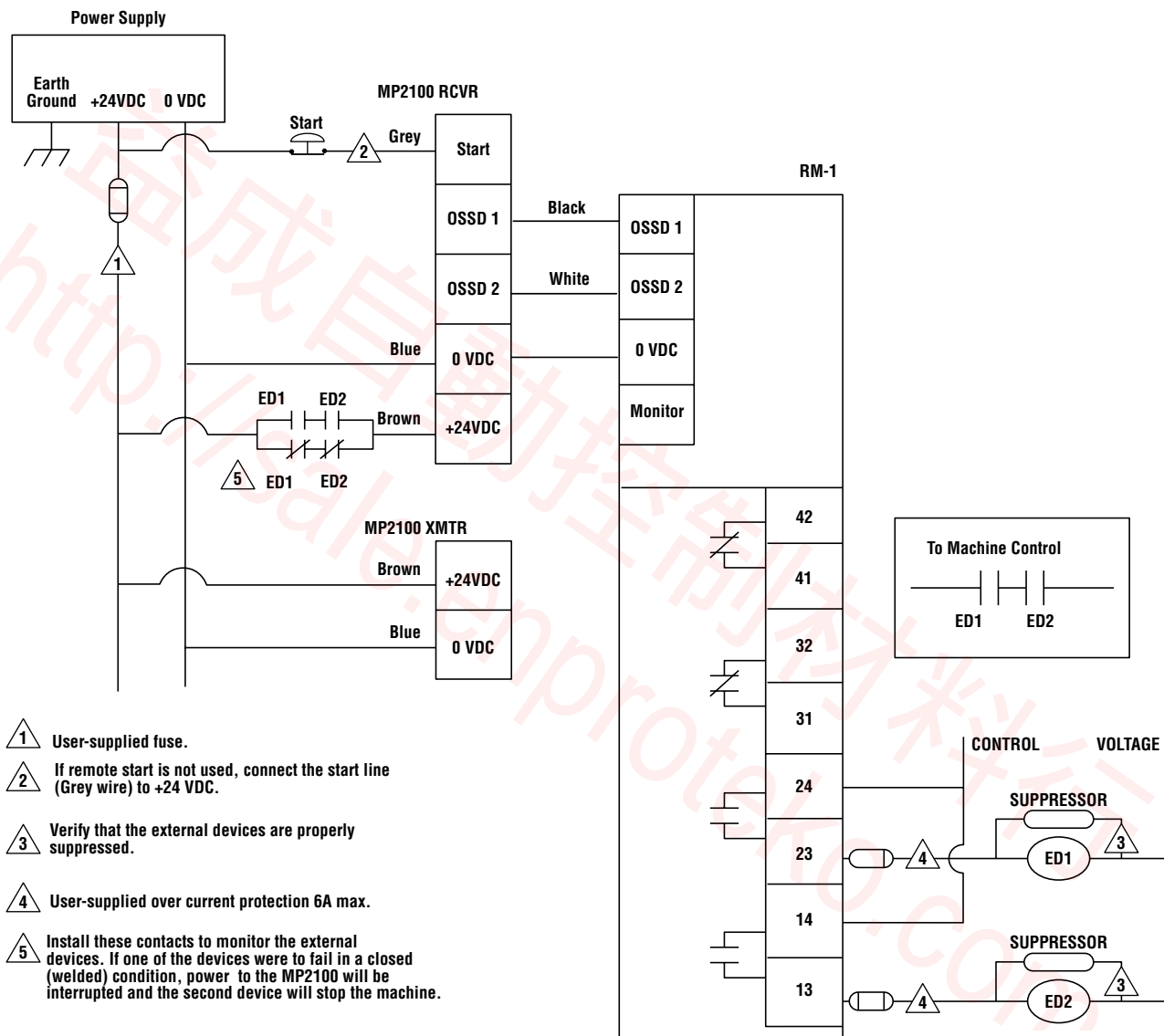
	150 mm	300 mm	450 mm	600 mm	750 mm
A mm/in.	147/5.8	294/11.6	441/17.4	588/23.2	735/28.9
B mm/in.	245/9.7	392/15.5	540/21.2	687/27.0	833/32.8
C mm/in.	272/10.8	419/16.5	566/22.3	713/28.1	860/33.9
System Shipping Weight					
kg/lb.	2.7/6.0	2.9/6.5	3.2/7.0	3.4/7.5	3.6/8.0

	900 mm	1050 mm	1200 mm	1350 mm	1500 mm
A mm/in.	882/34.7	1029/40.5	1176/46.3	1323/52.1	1470/57.9
B mm/in.	981/38.6	1128/44.4	1274/50.2	1421/56.0	1569/61.8
C mm/in.	1007/39.7	1154/45.5	1301/51.3	1448/57.1	1595/62.8
System Shipping Weight					
kg/lb.	3.9/8.5	4.1/9.0	4.3/9.5	4.5/10.0	4.8/10.5

A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ **Wiring**

Connecting to Machine Control System Via RM-1 Module



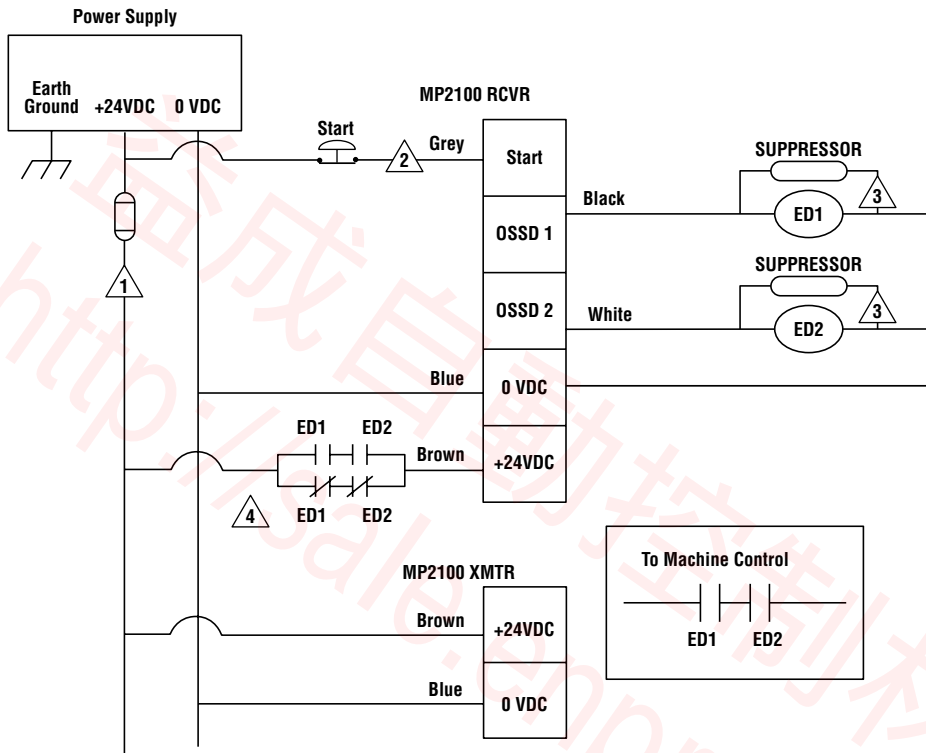
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■ Wiring (continued)

Connecting to Machine Control System Via Two Force-Guided Relays

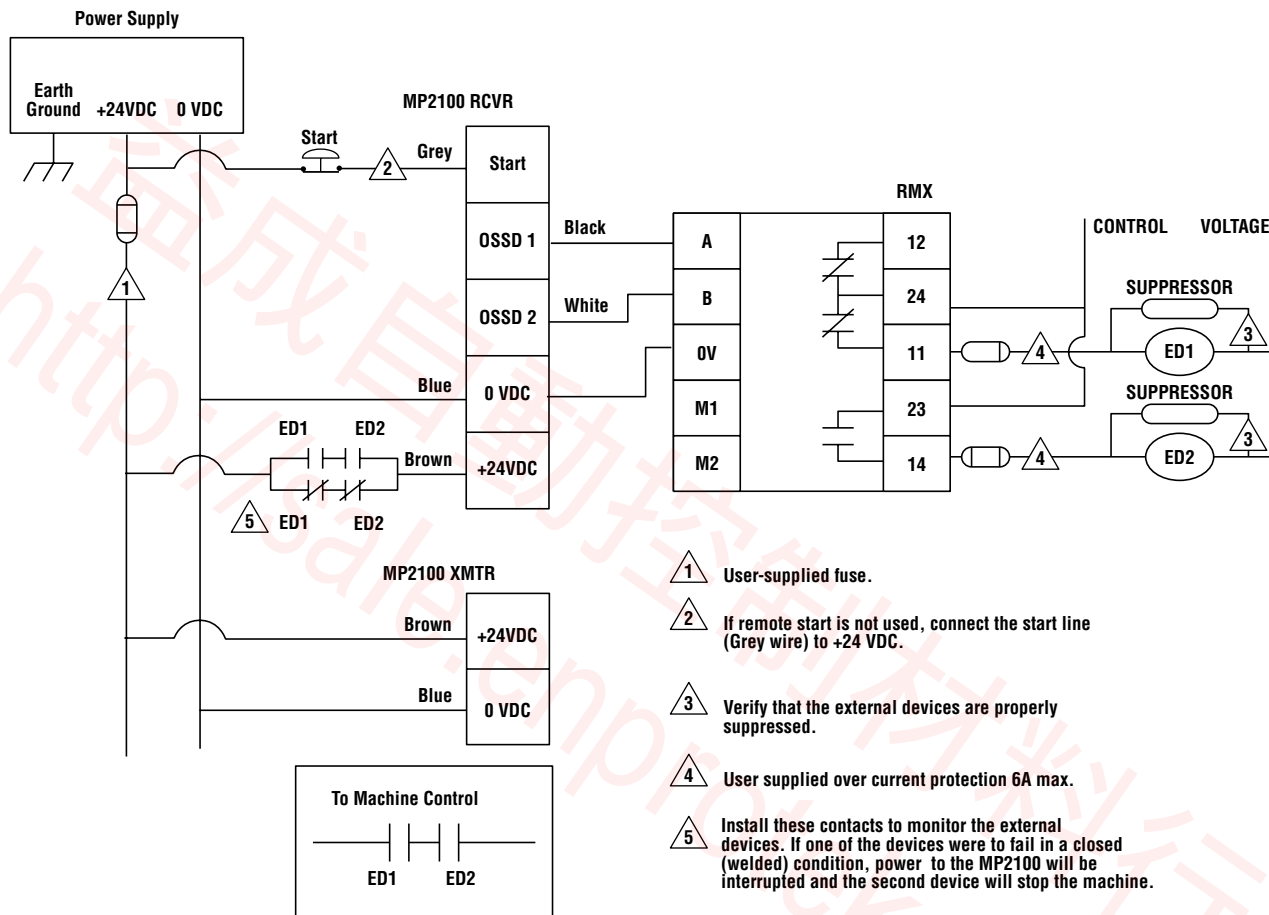
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- 1 User-supplied fuse.
- 2 If remote start is not used, connect the start line (Grey wire) to +24 VDC.
- 3 The external devices must be suppressed with the components provided in the Documentation Kit.
- 4 Install these contacts to monitor the external devices. If one of the devices were to fail in a closed (welded) condition, power to the MP2100 will be interrupted and the second device will stop the machine.

A Go to the Engineering Guide
For in-depth information on
safety standards and use.

Connecting to Machine Control System Via RM-X Module



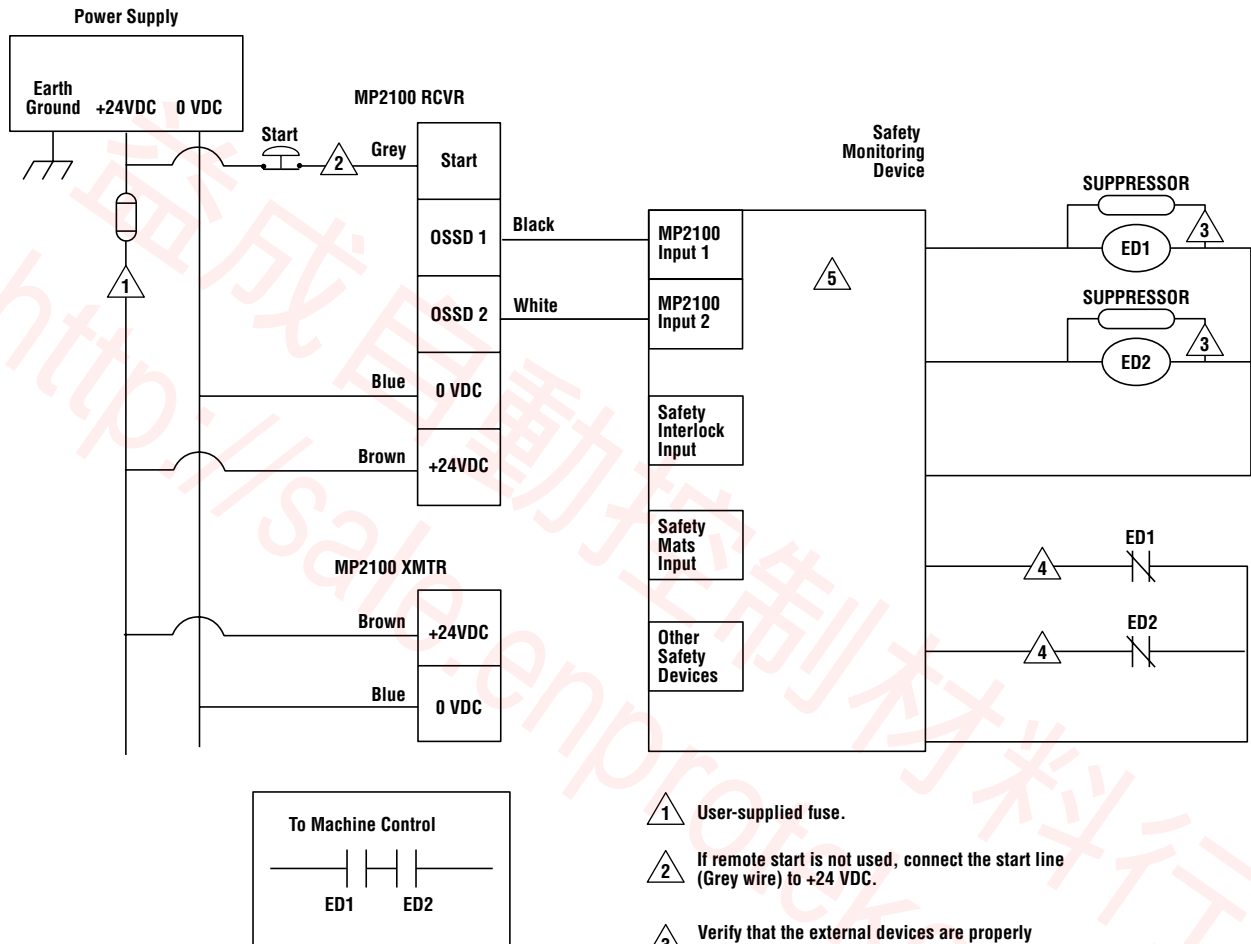
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■ **Wiring (continued)**

Connecting to Machine Control System Via Safety Monitoring Device

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- 1 User-supplied fuse.
- 2 If remote start is not used, connect the start line (Grey wire) to +24 VDC.
- 3 Verify that the external devices are properly suppressed.
- 4 The Safety Monitoring Device can be configured to monitor the external devices Normally Closed Contacts.
- 5 The use of a Safety Monitoring Device does NOT increase the safety level of the MP2100. The MP2100 is a Type 2 ESPE per IEC 61496-1, -2.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ Ordering

To order a MiniProtect MP2100 system, simply fill in the fields in the model number sequence given below.

____ - 30 - ____ - ____
 ① ② ③

Example: MP21Y-30-300-AS

This MP2100 standard system has a 30 mm (1.18 in.) minimum object resolution, a 294 mm (11.6 in.) coverage height, and an automatic start operating mode. The transmitter and receiver cables are sold separately (see below).

① Information required. Represents the system type.

Designator	Description
MP21Y	Standard system

② Information required. Represents the coverage height of the detection zone.

Designator	Coverage Height
150	147 mm (5.8 in.)
300	294 mm (11.6 in.)
450	441 mm (17.4 in.)
600	588 mm (23.2 in.)
750	735 mm (28.9 in.)
900	882 mm (34.7 in.)
1050	1029 mm (40.5 in.)
1200	1176 mm (46.3 in.)
1350	1323 mm (52.1 in.)
1500	1470 mm (57.9 in.)

③ Information required. Represents the operating mode

Designator	Description
AS	Automatic Start
RS	Start/Restart Interlock

Note: This feature is only factory configured.

Accessories (Order Separately)

Transmitter Cables	Part Number
3 m (9.8 ft.)	60660-0030
10 m (32.8 ft.)	60660-0100
30 m (98.5 ft.)	60660-0300

Receiver Cables	Part Number
3 m (9.8 ft.)	60661-0030
10 m (32.8 ft.)	60661-0100
30 m (98.5 ft.)	60661-0300

Resource Modules and Force-Guided Relays

The MP2100 is compatible with the following products: the RM-1, RM-3, and RM-X resource modules, and the FGR Series relays



For information on safety light curtain accessories, see page D184



For information on Resource Modules, see page D138



For information on Force-Guided Relays, see pages D5

Safety Standards and Precautions

DO NOT use this Protective Light Curtain where a risk assessment has determined that control reliability is required, such as for hazardous machinery. Use only for equipment where the worst-case injury from an accident can be remedied by simple first aid, as determined by a thorough risk assessment.

DO NOT use unless the device is installed, tested, and inspected according to Omron STI's Installation Manual

This protective device meets the Type 2 requirements of IEC 61496. It DOES NOT meet U.S. OSHA 1910.217, ANSI B11, or ANSI/RIA R15.06 requirements.

If you are unsure of which model of light curtain to choose, contact Omron STI (1-888-510-4357, or www.sti.com). Failure to comply with this warning could result in serious injury or death.

The MiniProtect MP2100 should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MiniProtect MP2100 on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

MC4700, MCF4700 and MCJ4700

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safety light curtains**MCF4700 Series**

- Segmented lengths from 100 to 1800 mm (3.9 to 70.9 in.). Segments are connected by interconnect cables.

MCJ4700 Series

- Segmented lengths from 75 mm (3.0 in.) to 1800 mm (71.0 in.). **Electro/mechanical joints** link the segments at a 90° angle.

Options

- DeviceNet™ Interface
- Low ESD models. Consult factory.
- Muting through RM-3 module

Description

The MicroSafe 4700 series is unique due to superior response time – as fast as 6.69 msec – and excellent resolution of 12 mm. This combination of speed and resolution allow this ultra-compact light curtain to be mounted closer to the point of hazardous operation.

The MicroSafe MC4700 series consists of an identical length transmitter and receiver, combined with an LCM series controller and appropriate cables. The ultra-compact transmitter and receiver dimensions allow the MicroSafe to be mounted on small automatic assembly machines and in other applications where space is at a premium. The in-line connector cables allow the mounting of the transmitter and receiver in crowded locations where a standard connector would not fit. The controller end of the cable is

MicroSafe®

MC4700, MCF4700 and MCJ4700

- Ultra-compact 26 x 28 mm (1.0 x 1.1 in.) transmitter and receiver;
- Excellent resolutions of 12, 14, 20 and 30 mm
- Protected heights from 100 to 1800 mm (3.9 to 70.9 in.)
- Two-digit diagnostics display visible on controller
- Choice of operating modes
 - Automatic Start
 - Restart Interlock
 - Start/Restart Interlock
- Available enclosures:
 - 100 mm DIN enclosure with removable terminal blocks
 - IP65-rated lockable metal enclosure
- Available outputs:
 - 2 PNP safety outputs
 - 1 N.O. and 1 N.O./N.C. safety relay output
 - 2 auxiliary outputs (1 NPN, 1 PNP), follow or alarm mode
- Individual Beam Indicators
- Exact channel select and floating blanking
- MPCE monitoring
- In-line connector cables
- Adjustable mounting brackets

not terminated, which allows the length to be easily shortened in the field.

The MCF4700 consists of at least two transmitter and receiver segments, combined with an LCM series controller and appropriate interconnecting cables.

The MicroSafe MCJ4700 also consists of at least two transmitter and receiver segments, mechanically linked at a 90° angle. Interconnect cables are not required.

For easy alignment, the MicroSafe series features Omron STI's patented Individual Beam Indicator lights.

DeviceNet Option

The LCM series controller is available with an optional DeviceNet™ interface. DeviceNet™ allows the LCM series controller to communicate non-safety-related data across this popular fieldbus. As the de facto standard for factory fieldbus communications, DeviceNet™ is widely employed in the automotive, semiconductor and other industries.

Monitoring of a DeviceNet™ equipped light curtain provides the process control system with the following *non-safety* information: manufacturer, product name, operating mode, detection zone status, safety output status, MPCE monitoring enabled/disabled, floating blanking active/inactive, exact channel select active/inactive, transmitter, receiver, controller, and relay faults, error codes and descriptions.

DeviceNet™ and the LCM series controller provide a powerful automation solution.

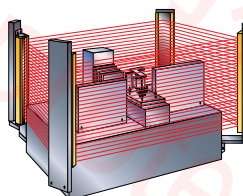
■ Applicable Controllers

The LCM controller includes virtually every desirable safety light curtain feature. There are two options available: DeviceNet™ interface, and a multi-channel select (not CE marked) version capable of storing up to eight selected patterns.

■ Applications

MC4700 Application

Due to its small dimensions, the MicroSafe can be elegantly integrated into table-top automated production equipment. Its in-line connector cables allow it to be mounted in tight, confined spaces. Since cable length can be shortened in the field, it is easy for OEM equipment builders to achieve a custom, built-in look.

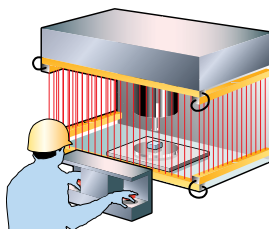


MCF4700 Application

Here, a three-segment MicroSafe Flexible series system forms a "U-shaped" guard zone to protect all unguarded sides of a small machine. Without the MicroSafe Flexible,

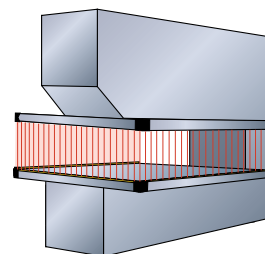


safety light curtains would have to be used.



MCJ4700 Application

In this application the light curtain is not visible. With the creation of a jointed-segmented MCJ4700, an OEM has the ability to truly build the light curtain into their product. The OEM or integrator is able to apply a CE marked safety solution that meets world-wide standards. With a small size housing of 26 mm x 28 mm (1.0 x 1.1 in.), the ability to mount on a single plane, and segment increments as small as 75 mm (2.95 in.), the MCJ4700 provides the cleanest, most elegant safety solution.



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MC4700, MCF4700 and MCJ4700

■ Specifications for Transmitter and Receiver

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Performance	
Protected Height:	12 mm — 100 to 1200 mm (3.9 to 62.9 in.) in 100 mm increments 14 mm — 150 to 1800 mm (5.9 to 71.2 in.) in 75 mm increments 20 mm — 150 to 1800 mm (5.9 to 71.2 in.) in 75 mm increments 30 mm — 150 to 1800 mm (5.9 to 71.2 in.) in 150 mm increments
Operating Range:	MC47SR and MC47SRS; MCF47 and MCF47S; MCJ47 and MCJ47S 12 mm — 0.2 to 3 m (0.7 to 10 ft.) 14 mm — 0.3 to 5 m (1 to 17 ft.) for MC4700 and MCJ4700; 14 mm — 0.3 to 3 m (1 to 10 ft.) for MCF4700 20 mm — 0.3 to 7 m (1 to 23 ft.) 30 mm — 0.3 to 7 m (1 to 23 ft.) MC47LR and MC47LRS 12 mm — 0.2 to 5 m (0.7 to 17 ft.) 20 mm — 0.3 to 12 m (1 to 39 ft.) 30 mm — 0.3 to 12 m (1 to 39 ft.)
Resolution:	12 mm — 0.47 in.* 14 mm — 0.55 in.* 20 mm — 0.79 in.* 30 mm — 1.2 in.* * Use of exact channel select and/or floating blanking may increase this value.
Effective Aperture Angle:	±2.5° transmitter and receiver
Light Source:	850 nm LED
Light Source Life:	100,000 hours
Indicators:	Channel Select or Floating blanking – amber; Interlock or Fault – yellow; Machine Stop – red, Individual Beam Indicators – red; Machine Run – green.
Mechanical	
Enclosure:	IP65 transmitter and receiver enclosure. Polyurethane powder-painted aluminum yellow.
Cable Length:	Transmitter – maximum 30 m (100 ft.); standard 3 m (10 ft.) Receiver – maximum 30 m (100 ft.); standard 3 m (10 ft.) *For MCF4700 Series: Interconnect cables are available from 0.3 m (12 in.) to 10 m (33 ft.). Maximum total length of a system is 15 m (49 ft.). Consult factory for longer lengths.
Cable Connections:	Circular style, 5-conductor for transmitter, 8-conductor for receiver
Environmental	
Protection Rating:	Transmitter and receiver – IP65; Available controllers: 35 mm DIN mount - IP20, Metal Chassis - IP65 (for more information see the LCM Series section)
Operating Temperature:	0 to 55°C (32 to 133°F)
Storage Temperature:	-25 to 75°C (-13 to 167°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	5–60 Hz maximum on all 3 axes
Shock:	10 g for 0.016 seconds; 1,000 shocks for each axis on two axis
Conformity Tested To/Approvals	
Approvals:	IEC61496, CE Mark
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.27(c), OSHA 1910.212
Other Approvals:	All MC4700 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. TUV Registration Number: BB201132801, BB211167401, BB221006201. CSA Certificate 1289466. UL listed.

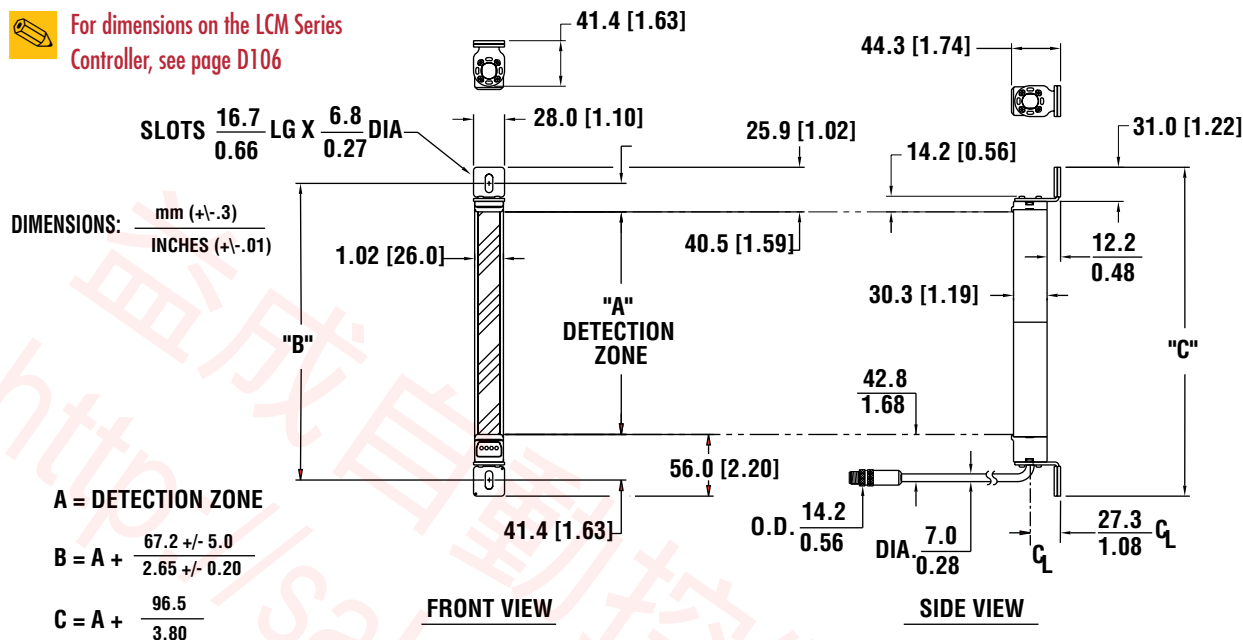
Specifications are subject to change without notice.

MC4700, MCF4700 and MCJ4700

■ Dimensions for MC4700 Series—mm/in.



For dimensions on the LCM Series Controller, see page D106



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MicroSafe MC4700 Dimensions

MC4700-12		
A mm/in.	B mm/in.	C mm/in.
102/4.0	169/6.7	198/7.8
202/8.0	269/10.6	298/11.7
302/11.9	369/14.5	398/15.7
402/15.8	469/18.5	498/19.6
502/19.8	569/22.4	598/23.5
602/23.7	669/26.3	698/27.5
702/27.6	769/30.3	798/31.4
802/31.6	869/34.2	898/35.4
902/35.5	969/38.1	998/39.3
1002/39.5	1069/42.1	1098/43.2
1102/43.4	1169/46.0	1198/47.2
1202/47.3	1269/50.0	1298/51.1

MC4700-14 and MC4700-20		
A mm/in.	B mm/in.	C mm/in.
159/6.3	226/8.9	255/10.0
235/9.3	302/11.9	331/13.0
309/12.2	376/14.8	405/15.9
385/15.2	452/17.8	481/18.9
459/18.1	526/20.7	555/21.9
535/21.1	602/23.7	631/24.8
609/24.0	676/26.6	705/27.8
685/27.0	752/29.6	781/30.7
759/29.9	826/32.5	855/33.6
835/32.9	902/35.5	931/36.7
909/35.8	976/38.4	1005/39.6
985/38.9	1052/41.4	1081/42.6
1059/41.7	1126/44.3	1155/45.5
1135/44.7	1202/47.3	1231/48.5
1209/47.6	1276/50.2	1305/51.4
1285/50.6	1352/53.2	1381/54.4
1359/53.5	1426/56.1	1455/57.3
1435/56.5	1502/59.1	1531/60.3
1509/59.4	1576/62.0	1605/63.2
1585/62.4	1652/65.0	1681/66.2
1659/65.3	1726/68.0	1755/69.1
1735/68.3	1802/70.9	1831/72.1
1809/71.2	1876/73.9	1905/75.0

MC4700-30		
A mm/in.	B mm/in.	C mm/in.
159/6.3	226/8.9	255/10.0
309/12.2	376/14.8	405/15.9
459/18.0	526/20.7	555/21.9
609/24.0	676/26.6	705/27.8
759/29.9	826/32.5	855/33.7
909/35.8	976/38.4	1005/39.6
1059/41.7	1126/44.3	1155/45.5
1209/47.6	1276/50.2	1305/51.4
1359/53.5	1426/56.1	1455/57.3
1509/59.4	1576/62.0	1605/63.2
1659/65.3	1726/68.0	1755/69.1
1809/71.2	1876/73.9	1905/75.0



MC4700, MCF4700 and MCJ4700

■ Ordering for MC4700 Series

To order a MicroSafe MC4700 system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

 For specifications and dimensions on the LCM Series Controller, see page D106



Example: MC47SR-12-300-LCM1-10X-10R-RM1

This MicroSafe system is short range has 12 mm (0.47 in.) minimum object resolution, a 300 mm (11.8 in.) protection height, an LCM1 controller, 10 m (33 ft.) transmitter and receiver cables, and an RM-1 relay output module.

① Information required. Indicates operating range of the light curtain and if the MicroSafe system is manufactured to low ESD requirements. ESD systems are used where the build-up of an electrostatic charge on the light curtain and its subsequent discharge may harm the product being produced by the guarded machine (i.e. integrated circuits, disk drives, electronic components, etc.).

Designator	Description
MC47SR	Range based on minimum object resolution of the system. 12 mm—0.2 to 3 m (0.7 to 10 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart.</i> 14 mm—0.3 to 5 m (1 to 17 ft.). 20 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i> 30 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i>

MC47LR	Range based on minimum object resolution of the system. 12 mm—0.2 to 5 m (0.7 to 17 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart, please select the SR version above.</i> 20 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SR version above.</i> 30 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SR version above.</i>
MC47SRS	Low ESD MicroSafe System. Range based on minimum object resolution of the system. 12 mm—0.2 to 3 m (0.7 to 10 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart.</i> 14 mm—0.3 to 5 m (1 to 17 ft.). 20 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i> 30 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i>
MC47LRS	Low ESD MicroSafe System. Range based on minimum object resolution of the system. 12 mm—0.2 to 5 m (0.7 to 17 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart, please select the SRS version above.</i> 20 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SRS version above.</i> 30 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SRS version above.</i>

② Information required. Represents the minimum object resolution of the light curtain in millimeters. Designators are described below.

Designator	Minimum Object Resolution
12	12 mm (0.47 in.)
14	14 mm (0.55 in.)
20	20 mm (0.79 in.)
30	30 mm (1.18 in.)

③ Information required.

Represents protective heights of the light curtain in millimeters. Protection heights available are a function of minimum object resolution. Designators are described below and divided into three sections, those for 12 mm resolutions, those for 14/20 mm and those for 30 mm resolutions.

12 mm Minimum Object Resolution Systems

Designator	# Beams	Protection Height
100	16	102 mm (4.0 in.)
200	32	202 mm (8.0 in.)
300	48	302 mm (11.9 in.)
400	64	402 mm (15.8 in.)
500	80	502 mm (19.8 in.)
600	96	602 mm (23.7 in.)
700	112	702 mm (27.6 in.)
800	128	802 mm (31.6 in.)
900	144	902 mm (35.5 in.)
1000	160	1002 mm (39.5 in.)
1100	176	1102 mm (43.4 in.)
1200	192	1202 mm (47.3 in.)

14 mm and 20 mm

Minimum Object Resolution Systems

Designator	# Beams	Protection Height
150	14	159 mm (6.3 in.)
225	21	235 mm (9.3 in.)
300	28	309 mm (12.2 in.)
375	35	385 mm (15.2 in.)
450	42	459 mm (18.1 in.)
525	49	535 mm (21.1 in.)
600	56	609 mm (24.0 in.)
675	63	685 mm (27.0 in.)
750	70	759 mm (29.9 in.)
825	77	835 mm (32.9 in.)
900	84	909 mm (35.8 in.)
975	91	985 mm (38.8 in.)
1050	98	1059 mm (41.7 in.)
1125	105	1135 mm (44.7 in.)
1200	112	1209 mm (47.6 in.)
1275	119	1285 mm (50.6 in.)
1350	126	1359 mm (53.3 in.)
1425	133	1435 mm (56.5 in.)
1500	140	1509 mm (59.4 in.)
1575	147	1585 mm (62.4 in.)
1650	154	1659 mm (65.3 in.)
1725	161	1735 mm (68.3 in.)
1800	168	1809 mm (71.2 in.)

30 mm Minimum Object Resolution Systems

Designator	# Beams	Protection Height
150	7	159 mm (6.3 in.)
300	14	309 mm (12.2 in.)
450	21	459 mm (18.1 in.)
600	28	609 mm (24.0 in.)
750	35	759 mm (29.9 in.)
900	42	909 mm (35.8 in.)
1050	49	1059 mm (41.7 in.)
1200	56	1209 mm (47.6 in.)
1350	63	1359 mm (53.3 in.)
1500	70	1509 mm (59.4 in.)
1650	77	1659 mm (65.3 in.)
1800	84	1809 mm (71.2 in.)

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safety light curtains

④ Information required. Represents controller version. Designators and descriptions are given below.

Designator	Description
LCM1	DIN-mount, IP20, solid-state safety output, 24 VDC
LCM2	DIN-mount, IP20, solid-state safety output, 24 VDC, DeviceNet interface
LCM3	DIN-mount, IP20, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM100	Metal enclosure, IP65, relay safety output, 100-230 VAC
LCM200	Metal enclosure, IP65, relay safety output, 100-230 VAC, DeviceNet interface
LCM300	Metal enclosure, IP65, relay safety output, 100-230 VAC, non-CE-marked, multiple stored channel select patterns
LCM110	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch
LCM210	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, DeviceNet interface
LCM310	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM120	Metal enclosure, IP65, solid-state safety output, 24 VDC
LCM220	Metal enclosure, IP65, solid-state safety output, 24 VDC, DeviceNet interface

(continued on next page)

MC4700, MCF4700 and MCJ4700

■ Ordering for MC4700 Series (continued)

LCM320	Metal enclosure, IP65, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM130	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch
LCM230	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM330	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM140	Metal enclosure, IP65, relay safety output, 24 VDC
LCM240	Metal enclosure, IP65, relay safety output, 24 VDC, DeviceNet interface
LCM340	Metal enclosure, IP65, relay safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM150	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch
LCM250	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM350	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns

Note: For more configurations with quick-disconnect connectors refer to the LCM controller section.

⑤ Information required. Represents transmitter (X) and receiver (R) cable length. Designators and descriptions are given below.

Designator	Description
3	3 m (10 ft.)
10	10 m (33 ft.)
30	30 m (99 ft.)

⑥ Information optional. Indicate if you would like an Omron STI RM series resource module.

Designator	Description
RM1	Include RM-1 resource module, force-guided relay output
RM3	Include RM-3 resource module, mute module
RM4	Include RM-4 resource module, allow for wiring up to four MC4700 systems
RMX	Include RM-X resource module
(Blank)	No RM series resource module



For information on Resource Modules, see page D138



For information on safety light curtain accessories, see page D184



Go to the Engineering Guide
For in-depth information on safety standards and use.



Safety Standards and Precautions

All models of the MicroSafe meet ANSI/RIA R15.06-1999, ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MicroSafe meets ANSI control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MicroSafe systems employing LCM controllers (except those with the ability to store multiple channel select patterns) have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MicroSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MicroSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

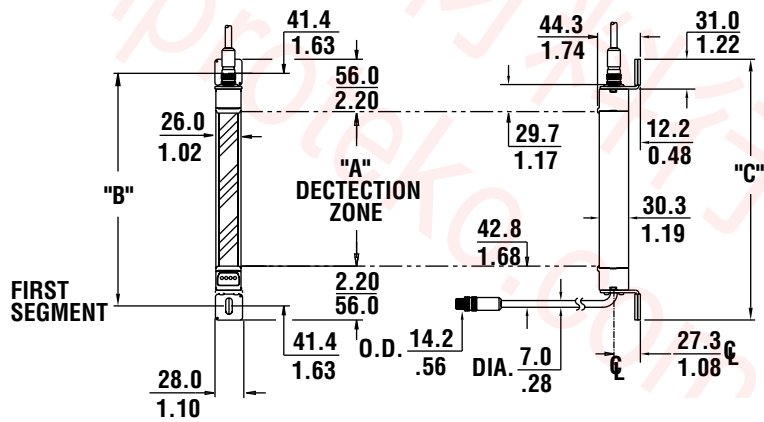
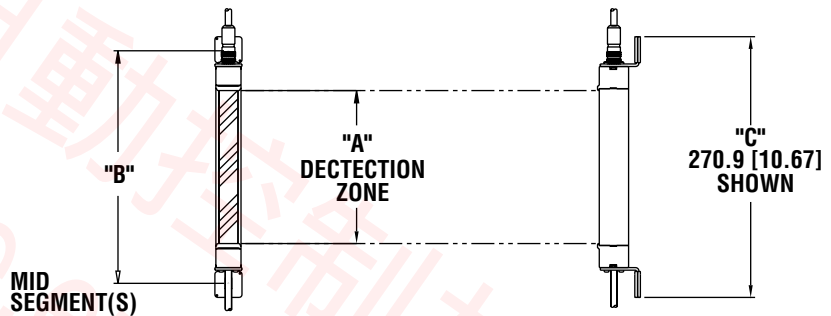
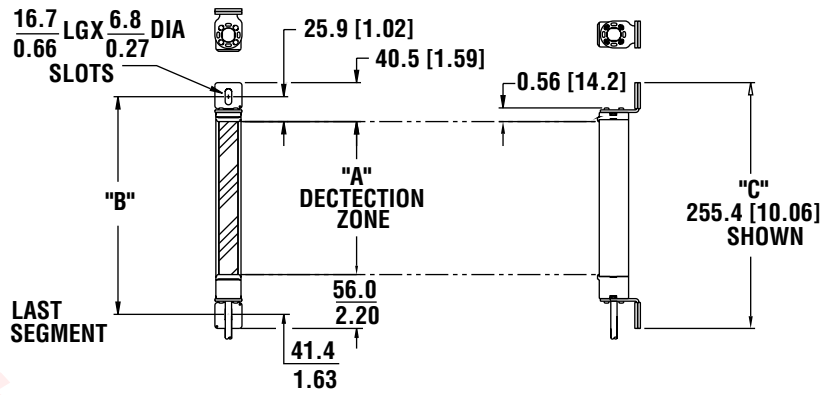
■ Dimensions for MCF4700 Series—mm/in.

D

safety light curtains



For dimensions on the LCM Series Controller, see page D106



FRONT VIEW

SIDE VIEW

A Go to the Engineering Guide
For in-depth information on safety standards and use.

MC4700, MCF4700 and MCJ4700

MicroSafe Flexible MCF4700 Dimensions

MCF4700-12			MCF4700-14, MCF4700-20 and MCF4700-30					
A mm/in.	B mm/in.	C mm/in.	A mm/in.	B mm/in.	C mm/in.	A mm/in.	B mm/in.	C mm/in.
FIRST, MIDDLE SEGMENT			FIRST, MIDDLE SEGMENT			LAST SEGMENT		
102/4.0	185/7.3	214/8.4	159/6.3	242/9.5	271/10.7	159/6.3	226/8.9	255/10.0
202/8.0	285/11.2	314/12.4	*235/9.3	318/12.5	347/13.7	*235/9.3	302/11.9	331/13.0
302/11.9	385/15.2	414/16.3	309/12.2	392/15.4	421/16.6	309/12.2	376/14.8	405/15.9
402/15.8	485/19.1	514/20.2	*385/15.2	468/18.4	497/19.6	*385/15.2	452/17.8	481/18.9
502/19.8	585/23.0	614/24.2	459/18.1	542/21.3	571/22.5	459/18.1	526/20.7	555/21.9
602/23.7	685/27.0	714/28.1	*535/21.1	618/24.3	647/25.5	*535/21.1	602/23.7	631/24.8
702/27.6	785/30.9	814/32.0	609/24.0	692/27.2	721/28.4	609/24.0	676/26.6	705/27.8
802/31.6	885/34.8	914/36.0	*685/27.0	768/30.2	797/31.4	*685/27.0	752/29.6	781/30.7
902/35.5	985/38.8	1014/39.9	759/29.9	842/33.1	871/34.3	759/29.9	826/32.5	855/33.7
1002/39.5	1085/42.7	1114/43.9	*835/32.9	918/36.1	947/37.3	*835/32.9	902/35.5	931/36.7
1102/43.4	1185/46.7	1214/47.8	909/35.8	992/39.1	1021/40.2	909/35.8	976/38.4	1005/39.6
LAST SEGMENT			*985/38.9	1068/42.0	1097/43.2	*985/38.9	1052/41.4	1081/42.6
102/4.0	169/6.7	198/7.8	1059/41.7	1142/45.0	1171/46.1	1059/41.7	1126/44.3	1155/45.5
202/8.0	269/10.6	298/11.7	*1135/44.7	1218/48.0	1247/49.1	*1135/44.7	1202/47.3	1231/48.5
302/11.9	369/14.5	398/15.7	1209/47.6	1292/50.9	1321/52.0	1209/47.6	1276/50.2	1305/51.4
402/15.8	469/18.5	498/19.6	*1285/50.6	1368/53.9	1397/55.0	*1285/50.6	1352/53.2	1381/54.4
502/19.8	569/22.4	598/23.5	1359/53.5	1442/56.8	1471/57.9	1359/53.5	1426/56.1	1455/57.3
602/23.7	669/26.3	698/27.5	*1435/56.5	1518/59.8	1547/60.9	*1435/56.5	1502/59.1	1531/60.3
702/27.6	769/30.3	798/31.4	1509/59.4	1592/62.7	1621/63.8	1509/59.4	1576/62.0	1605/63.2
802/31.6	869/34.2	898/35.4	*1585/62.4	1668/65.7	1697/66.8	*1585/62.4	1652/65.0	1681/66.2
902/35.5	969/38.1	998/39.3	1659/65.3	1742/68.6	1771/69.7	1659/65.3	1726/68.0	1755/69.1
1002/39.5	1069/42.1	1098/43.2	*1735/68.3	1818/71.6	1847/72.7	*1735/68.3	1802/70.9	1831/72.1
1102/43.4	1169/46.0	1198/47.2	1809/71.2	1892/74.5	1921/75.6	1809/71.2	1876/73.9	1905/75.0

* Not available in 30 mm resolution

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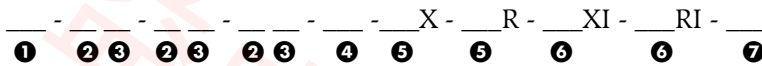
safety light curtains

MC4700, MCF4700 and MCJ4700

Ordering for MCF4700 Series

To order a MicroSafe Flexible system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

 For specifications and dimensions on the LCM Series Controller, see page D106



Example:

MCF47-12300-30900-20300-LCM1-10X-10R-030100XI-030100RI-RM1

This system has a 12 mm minimum object resolution and 302 mm long first segment, 30 mm minimum object resolution and 909 mm long middle segment and a 20 mm minimum object resolution and 309 mm long last segment, an LCM1 controller, 10 m transmitter and receiver cables, a 3 m and a 10 m interconnect transmitter and receiver cables, and an RM-1 relay output module.

1 Information required. Indicates if the MCF4700 is used in ESD sensitive applications may require manufacturing to low ESD requirements. This option is typically required where the build-up of an electrostatic charge on the light curtain and its subsequent discharge could harm the product being produced by the guarded machine (i.e. integrated circuits, disk drives, electronic components, etc.). On low ESD systems, transmitters and receivers are nickel plated and other modifications are incorporated.

Designator	Description
MCF47	MicroSafe Flexible system
MCF47S	Low ESD MicroSafe Flexible system

2 Information required. Represents the minimum object resolution of each transmitter and receiver pair in millimeters. Designators are described below. It is possible to order different object resolutions for each pair of segments.

Designator	Minimum Object Resolution
12	12 mm (0.47 in.)
14	14 mm (0.55 in.)
20	20 mm (0.79 in.)
30	30 mm (1.18 in.)

3 Information required. Represents the protection height of each transmitter and receiver pair in a system. The MCF4700 series must have a minimum of two segments: one first and one end. It is possible to order a different object resolution for each pair of segments. Up to two middle segments can be added.

The total protected height of a system cannot exceed 256 beams or 3450 mm (135.8 in.).

Combine the designators given here to complete fields **2** and **3** in the model sequence.

12 mm Minimum Object Resolution Systems

Designator	# Beams	Protection Height
100	16	102 mm (4.0 in.)
200	32	202 mm (8.0 in.)
300	48	302 mm (11.9 in.)
400	64	402 mm (15.8 in.)
500	80	502 mm (19.8 in.)
600	96	602 mm (23.7 in.)
700	112	702 mm (27.6 in.)
800	128	802 mm (31.6 in.)
900	144	902 mm (35.5 in.)
1000	160	1002 mm (39.5 in.)
1100	176	1102 mm (43.4 in.)

14 mm, 20 mm or 30 mm

Minimum Object Resolution Systems

Designator	# Beams	Protection Height
150	14/7	159 mm (6.3 in.)
225***	21	235 mm (9.3 in.)
300	28/14	309 mm (12.2 in.)
375***	35	385 mm (15.2 in.)
450	42/21	459 mm (18.1 in.)
525***	49	535 mm (21.1 in.)
600	56/28	609 mm (24.0 in.)
675***	63	685 mm (27.0 in.)
750	70/35	759 mm (29.9 in.)
825***	77	835 mm (32.9 in.)
900	84/42	909 mm (35.8 in.)
975***	91	985 mm (38.8 in.)
1050	98/49	1059 mm (41.7 in.)
1125***	105	1135 mm (44.7 in.)
1200	112/56	1209 mm (47.6 in.)
1275***	119	1285 mm (50.6 in.)
1350	126/63	1359 mm (53.3 in.)
1425***	133	1435 mm (56.5 in.)
1500	140/70	1509 mm (59.4 in.)
1575***	147	1585 mm (62.4 in.)
1650	154/77	1659 mm (65.3 in.)
1725***	161	1735 mm (68.3 in.)
1800	168/84	1809 mm (71.2 in.)

*** Not available in 30 mm resolution

safety light curtains

④ Information required. Represents controller version. Designators and descriptions are given below.

Designator	Description
LCM1	DIN-mount, IP20, solid-state safety output, 24 VDC
LCM2	DIN-mount, IP20, solid-state safety output, 24 VDC, DeviceNet interface
LCM3	DIN-mount, IP20, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM100	Metal enclosure, IP65, relay safety output, 100-230 VAC
LCM200	Metal enclosure, IP65, relay safety output, 100-230 VAC, DeviceNet interface
LCM300	Metal enclosure, IP65, relay safety output, 100-230 VAC, non-CE-marked, multiple stored channel select patterns
LCM110	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch
LCM210	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, DeviceNet interface
LCM310	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM120	Metal enclosure, IP65, solid-state safety output, 24 VDC
LCM220	Metal enclosure, IP65, solid-state safety output, 24 VDC, DeviceNet interface
LCM320	Metal enclosure, IP65, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM130	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch
LCM230	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM330	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM140	Metal enclosure, IP65, relay safety output, 24 VDC
LCM240	Metal enclosure, IP65, relay safety output, 24 VDC, DeviceNet interface
LCM340	Metal enclosure, IP65, relay safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM150	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch
LCM250	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM350	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns

Note: For more configurations with quick-disconnect connectors refer to the LCM controller section.

⑤ Information required. Represents transmitter (X) and receiver (R) cable lengths. Designators and descriptions are given below.

Designator	Description
3	3 m (10 ft.)
10	10 m (33 ft.)
30	30 m (99 ft.)

⑥ Information required. Represents transmitter and receiver interconnect cable lengths. The MCF4700 series segments feature an in-line connector cable design. A flexible 150 mm (6 in.) cable is always supplied between each segment. Length of interconnect cables given below are in addition to this standard cable. The maximum cumulative system length, including the cables is 15 m (49 ft.) for the transmitter and 15 m (49 ft.) for the receiver. The transmitter and receiver interconnect cable lengths do not need to match.

Combine the designators listed below to complete both fields numbered ⑥ in the example.

The combination for a three-segment system might look like 030. This means that the system uses only the standard 150 mm (6 in.) cables between two of the segments and a 3 m (10 ft.) interconnect cable between the other segments.

Designator	Interconnect Cable
(Blank)	Standard 150 mm (6 in.)
003	0.3 m (12 in.)
005	0.5 m (20 in.)
010	1 m (3.3 ft.)
020	2 m (6.6 ft.)
030	3 m (10 ft.)
050	5 m (16 ft.)
100	10 m (33 ft.)

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safety light curtains

MC4700, MCF4700 and MCJ4700

■ Ordering for MCF4700 Series (cont.)

⑦ Information optional. Indicate if you would like an Omron STI RM Series resource module.

Designator	Description
RM1	Include RM-1 resource module, force-guided relay output
RM3	Include RM-3 resource module, mute module
RM4	Include RM-4 resource module, allow for wiring up to four MC4700 systems
RMX	Include RM-X resource module
(Blank)	No RM series resource module

 For information on Resource Modules, see page D138

 For information on safety light curtain accessories, see page D184

Safety Standards and Precautions

All models of the MicroSafe meet ANSI/RIA R15.06-1999, ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MicroSafe meets ANSI control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MicroSafe systems employing LCM controllers (except those with the ability to store multiple channel select patterns) have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MicroSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MicroSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

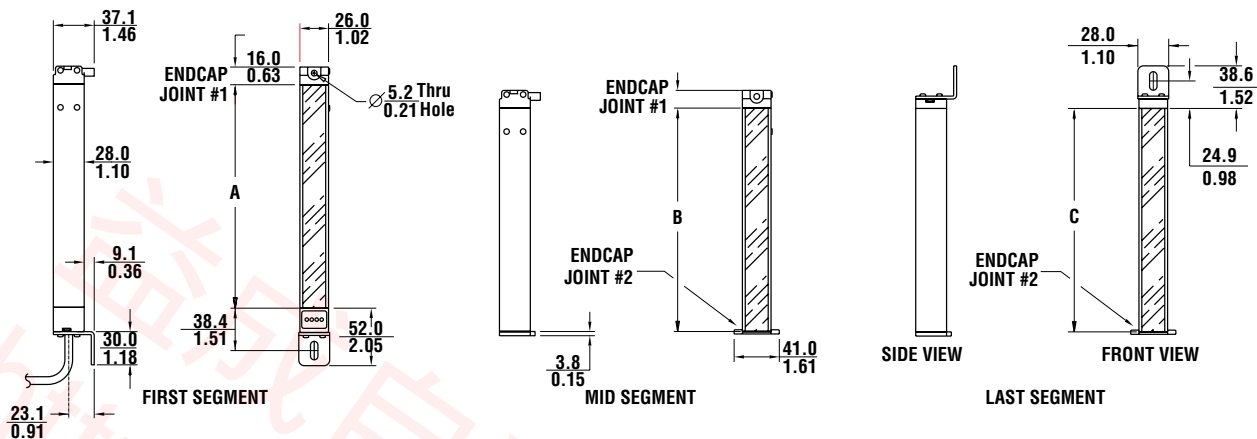
All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

MC4700, MCF4700 and MCJ4700

■ Dimensions for MCJ4700 Series—mm/in.

 For dimensions on the LCM Series Controller, see page D106



MicroSafe Jointed MCJ4700 Dimensions

MCJ4700-12 A, B & C mm/in.
FIRST, MIDDLE & LAST SEGMENTS
102/4.0
202/8.0
302/11.9
402/15.8
502/19.8
602/23.7
702/27.6
802/31.6
902/35.5
1002/39.5
1102/43.4

MCJ4700-14, MCJ4700-20 and MCJ4700-30 A mm/in.
FIRST SEGMENT ONLY
159/6.3
*235/9.3
309/12.2
*385/15.2
459/18.1
*535/21.1
609/24.0
*685/27.0
759/29.9
*835/32.9
909/35.8
*985/38.8
1059/41.7
*1135/44.7
1209/47.6
*1285/50.6
1359/53.5
*1435/56.5
1509/59.4
*1585/62.4
1659/65.3
*1735/68.3
1809/71.2

*Not available in 30 mm resolution.

MCJ4700-14, MCJ4700-20 and MCJ4700-30 B & C mm/in.
MIDDLE AND LAST SEGMENTS
*78/3.0
152/6.0
*228/9.0
302/11.9
*378/14.9
452/17.8
*528/20.8
602/23.7
*678/26.7
752/29.6
*828/32.6
902/35.5
*978/38.5
1052/41.4
*1128/44.4
1202/47.3
*1278/50.3
1352/53.2
*1428.0/56.2
1502/59.1
*1578/62.1
1652/65.0
*1728/68.0
1802/70.9

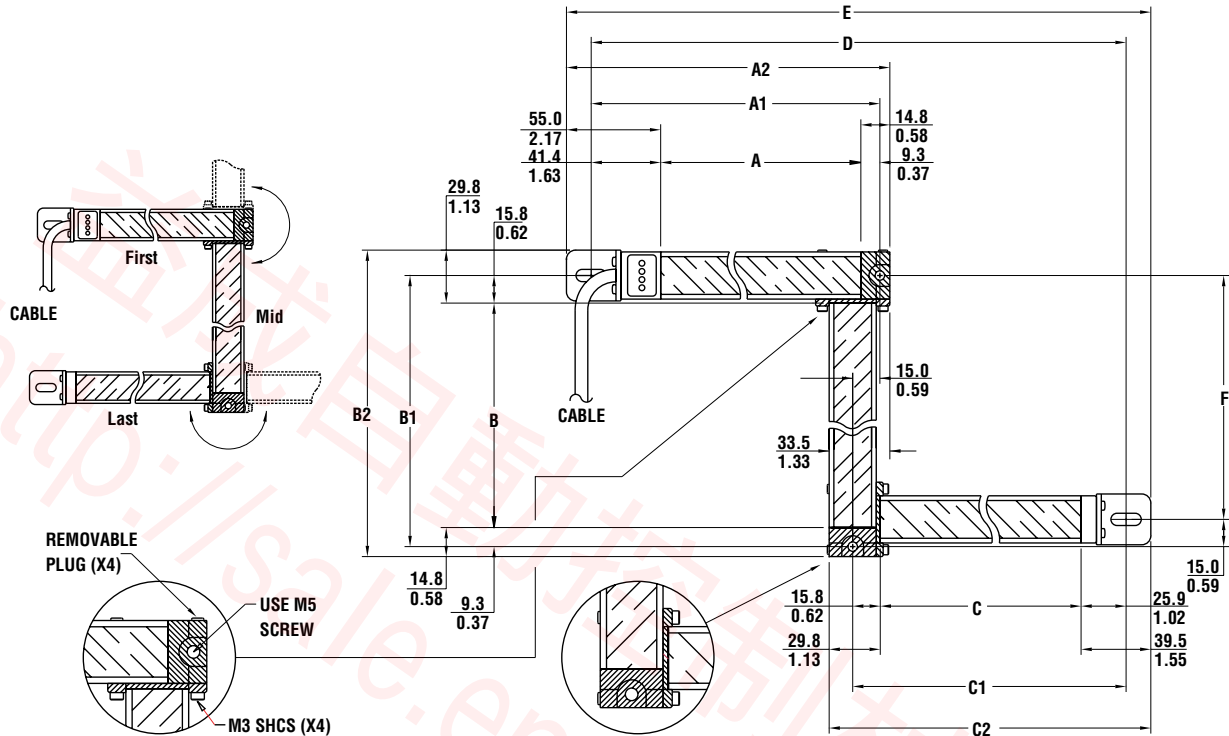
*Not available in 30 mm resolution.

D
safety light curtains

90° Jointed MicroSafe MCJ4700 Dimensions—mm/in.

D

safety light curtains



Mounting dimension formulas based on detection zones A, B, C

- A = Detection Zone (First Segment)
- A1 = A + 50.7 mm (1.99 in.) (mtg holes)
- A2 = A + 69.8 mm (2.75 in.)
- B = Detection Zone (Middle Segment)
- B1 = B + 25.1 mm (0.99 in.) (mtg holes)
- B2 = B + 44.6 mm (1.76 in.)
- C = Detection Zone (Last Segment)
- C1 = C + 41.7 mm (1.64 in.) (mtg holes)
- C2 = C + 68.9 mm (2.72 in.)
- D = A1 + C1 - 15.0 mm (0.59 in.) (mtg holes)
- E = A2 + C2 - 33.5 mm (1.32 in.)
- F = B1 - 15.0 mm (0.59 in.) (mtg holes)

A Go to the Engineering Guide
For in-depth information on
safety standards and use.

■ Ordering for MCJ4700 Series

To order a 90° Jointed MicroSafe system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow. It is possible to order a different object resolution for each pair of segments.



For specifications and dimensions on the LCM Series Controller, see page D106

MCJ47- - - - - - X - R -
 ① ② ③ ② ③ ② ③ ④ ⑤ ⑤ ⑥

Example: MCJ47-12200-20450-301650-LCM1-10X-30R-RM1

This system has a 12 mm minimum object resolution and 202 mm long first segment, a 20 mm minimum object resolution and 459 mm long middle segment, a 30 mm minimum object resolution and 1959 mm long last segment, an LCM1 controller, a 10 m transmitter and 30 m receiver cable and an RM-1 relay output module.

① Information required. Indicates if the MicroSafe system is manufactured to low ESD requirements. This option is typically required where the build-up of an electrostatic charge on the light curtain and its subsequent discharge could harm the product being produced by the guarded machine (i.e. integrated circuits, disk drives, electronic components, etc.). On low ESD systems, transmitters and receivers are nickel plated and other modifications are incorporated. Designators are described below.

Designator	Description
MCJ47	Standard MicroSafe system
MCJ47S	Low ESD MicroSafe system

② Information required. Represents the minimum object resolution of each transmitter and receiver pair. Designators are described below.

Designator	Minimum Object Resolution
12	12 mm (0.47 in.)
14	14 mm (0.55 in.)
20	20 mm (0.79 in.)
30	30 mm (1.18 in.)

③ Information required. Represents the protection height of all transmitter and receiver segments in a system. MicroSafe MCJ4700 Series light curtains must have a minimum of two segments one first and one last.

The total protected height of a system cannot exceed 256 beams or 3450 mm (135.8 in.).

12 mm Minimum Object Resolution Systems

Designator	# Beams	Protection Height
100	16	102 mm (4.0 in.)
200	32	202 mm (8.0 in.)
300	48	302 mm (11.9 in.)
400	64	402 mm (15.8 in.)
500	80	502 mm (19.8 in.)
600	96	602 mm (23.7 in.)
700	112	702 mm (27.6 in.)
800	128	802 mm (31.6 in.)
900	144	902 mm (35.5 in.)
1000	160	1002 mm (39.5 in.)
1100	176	1102 mm (43.4 in.)

First Segment ONLY of 14, 20 or 30 mm

Minimum Object Resolution Systems # Beams

Design. (14&20/30 mm)	# Beams	Protection Height
150	14/7	159 mm (6.3 in.)
225*	21/*	235 mm (9.3 in.)
300	28/14	309 mm (12.2 in.)
375*	35/*	385 mm (15.2 in.)
450	42/21	459 mm (18.1 in.)
525*	49/*	535 mm (21.1 in.)
600	56/28	609 mm (24.0 in.)
675*	63/*	685 mm (27.0 in.)
750	70/35	759 mm (29.9 in.)
825*	77/*	835 mm (32.9 in.)
900	84/42	909 mm (35.8 in.)
975*	91/*	985 mm (38.8 in.)
1050	98/49	1059 mm (41.7 in.)
1125*	105/*	1135 mm (44.7 in.)
1200	112/56	1209 mm (47.6 in.)
1275*	119/*	1285 mm (50.6 in.)
1350	126/63	1359 mm (53.3 in.)
1425*	133/*	1435 mm (56.5 in.)
1500	140/70	1509 mm (59.4 in.)
1575*	147/*	1585 mm (62.4 in.)
1650	154/77	1659 mm (65.3 in.)
1725*	161/*	1735 mm (68.3 in.)
1800	168/84	1809 mm (71.2 in.)

* Not available in 30 mm resolution

D

safety light curtains



MC4700, MCF4700 and MCJ4700

■ Ordering for MCJ4700 Series (continued)

Mid and Last Segment of 14, 20 or 30 mm

Minimum Object Resolution Systems

Beams

Designator (20/30 mm)	# Beams	Protection Height
075*	7/*	78 mm (3.1 in.)
150	14/7	152 mm (6.0 in.)
225*	21/*	228 mm (9.0 in.)
300	28/14	302 mm (11.9 in.)
375*	35/*	378 mm (14.9 in.)
450	42/21	452 mm (17.8 in.)
525*	49/*	528 mm (20.8 in.)
600	56/28	602 mm (23.7 in.)
675*	63/*	678 mm (26.7 in.)
750	70/35	752 mm (29.6 in.)
825*	77/*	828 mm (32.6 in.)
900	84/42	902 mm (35.5 in.)
975*	91/*	978 mm (38.5 in.)
1050	98/49	1052 mm (41.4 in.)
1125*	105/*	1128 mm (44.4 in.)
1200	112/56	1202 mm (47.3 in.)
1275*	119/*	1278 mm (50.3 in.)
1350	126/63	1352 mm (53.2 in.)
1425*	133/*	1428 mm (56.2 in.)
1500	140/70*	1502 mm (59.1 in.)
1575*	147/*	1578 mm (62.1 in.)
1650	154/77*	1652 mm (65.0 in.)
1725*	161/*	1728 mm (68.0 in.)
1800	168/84	1802 mm (70.9 in.)

* Not available in 30 mm resolution

④ Information required. Represents controller version. Designators and descriptions are given below.

Designator	Description
LCM1	DIN-mount, IP20, solid-state safety output, 24 VDC
LCM2	DIN-mount, IP20, solid-state safety output, 24 VDC, DeviceNet interface
LCM3	DIN-mount, IP20, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM100	Metal enclosure, IP65, relay safety output, 100-230 VAC
LCM200	Metal enclosure, IP65, relay safety output, 100-230 VAC, DeviceNet interface
LCM300	Metal enclosure, IP65, relay safety output, 100-230 VAC, non-CE-marked, multiple stored channel select patterns
LCM110	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch
LCM210	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, DeviceNet interface
LCM310	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM120	Metal enclosure, IP65, solid-state safety output, 24 VDC
LCM220	Metal enclosure, IP65, solid-state safety output, 24 VDC, DeviceNet interface
LCM320	Metal enclosure, IP65, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM130	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch
LCM230	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM330	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns
LCM140	Metal enclosure, IP65, relay safety output, 24 VDC
LCM240	Metal enclosure, IP65, relay safety output, 24 VDC, DeviceNet interface
LCM340	Metal enclosure, IP65, relay safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM150	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch
LCM250	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM350	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, non-CE marked, multiple stored channel select patterns

Note: For more configurations with quick-disconnect connectors refer to the LCM controller section.

⑤ Information required. Represents transmitter (X) and receiver (R) cable lengths. Designators and descriptions are given below.

Designator	Description
3	3 m (10 ft.)
10	10 m (33 ft.)
30	30 m (99 ft.)

⑥ Information optional. Indicate if you would like an Omron STI RM Series resource module.

Designator	Description
RM1	Include RM-1 resource module, force-guided relay output
RM3	Include RM-3 resource module, mute module
RM4	Include RM-4 resource module, allow for wiring up to four MC4700 systems
RMX	Include RM-X resource module
(Blank)	No RM series resource module



For information on Resource Modules, see page D138



For information on safety light curtain accessories, see page D184

Safety Standards and Precautions

All models of the MicroSafe meet ANSI/RIA R15.06-1999, ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MicroSafe meets ANSI control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MicroSafe systems employing LCM controllers (except those with the ability to store multiple channel select patterns) have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MicroSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MicroSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.



■ Description

A MegaSafe MG4600 system consists of a transmitter and receiver of equal height. The control reliable circuitry is contained within the receiver and transmitter enclosures, eliminating the need for a separate controller and interconnecting cables.

The MG4600 is available with a complete feature set. Individual Beam Indicators are included to simplify alignment. When an infrared beam is out of alignment, the corresponding Individual Beam Indicator will glow red.

The one NO and one NO/NC safety relay outputs are field replaceable.

The choice of either Automatic Start or Start/Restart Interlock modes means that the MG4600 can be configured for either point-of-operation or perimeter guarding.

Exact Channel Select allows user-selected areas of the MG4600 detection zone to be permanently blocked. This is valuable if tooling or other machine parts must permanently obstruct a portion of the zone. Exact Channel Select programming is as easy as pushing a button.

Floating Blanking is useful when process material or parts must transit through the detection zone. Floating Blanking allows up to two beams to be blocked anywhere in the zone.

MegaSafe®

MG4600

- Individual beam indicators
- Simple two-box design
- Resolutions available: 14 mm (0.55 in.), 19 mm (0.75 in.), 30 mm (1.18 in.) and 53 mm (2.09 in.)
- Range: 7.5 m (25 ft.) range for the 14 mm resolution, 20 m (65 ft.) range for the 19, 30 and 53 mm resolutions
- Protective heights from 435 to 2096 mm (17 to 82.5 in.) depending on minimum object resolution
- Robust size: 98 x 80 mm (3.9 x 3.1 in.)
- 85-135 VAC or 24 VDC input
- Rugged unit designed for automotive environments
- Field-replaceable weld shield
- Mounting via adjustable brackets or T-slots
- Floating Blanking
- Exact Channel Select
- Choice of operating modes
- Field-replaceable safety relay outputs
- Quick-disconnect connections to meet Ford and DaimlerChrysler requirements
- Meets Ford EL4 Standard

Options

- MPCE monitoring
- Machine Test Signal (MTS)
- DeviceNet™ Interface
- Alarm/Follow Mode
- Short Range Version
- External Channel Select and Floating Blanking

A Go to the Engineering Guide
For in-depth information on safety standards and use.

Machine primary control element monitoring is required for control reliability. MPCE monitoring is optional with the MG4600.

Quick-disconnect Brad Harrison-style connectors, adjustable mounting brackets, and T-slots make the installation of the MG4600 fast and easy.

DeviceNet Option

Available as an option, the DeviceNet interface allows communication of nonsafety-related data from the MG4600 to the main machine controller, and other nodes residing on this popular communication bus. DeviceNet is used in many industries including automotive, medical, and semiconductor.

Monitoring of a DeviceNet equipped light curtain provides the process control system with the following non-safety information: manufacturer; product name; operating mode; detection zone status; safety output status; signal strength; number of beams installed; number of beams selected; MPCE monitoring enabled/disabled; floating blanking active/inactive; exact channel select active/inactive; blanking pattern for exact channel select; receiver diagnostic codes; error codes and descriptions.

DeviceNet and the MegaSafe MG4600 provide a powerful automation safeguarding solution.

MTS Option

This optional feature allows the machine control system to check for proper operation of the light curtain's safety outputs. An input from the main machine controller to the light curtain causes a simulated blocked beam state in the transmitter which, in turn, cycles the safety outputs.

Alarm/Follow Mode Option

Also an option, this feature permits configuration of the two non-safety auxiliary outputs in either Alarm or Follow mode.

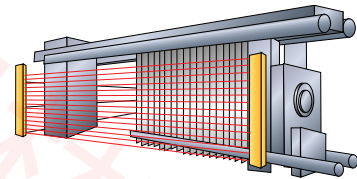
When configured in **Alarm** mode, the auxiliary outputs will be de-energized when the system is behaving normally and energized when the system is in a faulted/interlocked state. The system will remain in this state until the condition is cleared.

When configured for **Follow** mode, the auxiliary outputs mimic the state of the safety outputs. This means that they will be closed when the sensing field is clear and open when the sensing field is broken.

■ Applications

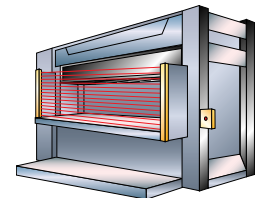
Application ①

The 20 m range of the MegaSafe MG4600-20, -30 or -50 makes this safety light curtain system an ideal choice for guarding the perimeter of a large filter press. In this application, a small minimum object resolution allows the light curtain to be mounted closer to the machine than many perimeter guarding systems. Because there is no separate control box (all control logic is in the transmitter and receiver), and there are no physical connections between the transmitter and receiver, long cable runs are not required.



Application ②

The small minimum object resolution, quick response time, and feature set of the MG4600 make it perfect for guarding metal forming equipment. In this application, floating blanking allows the material to bend up through the detection zone without sending a stop signal to the guarded machine.



MG4600

■ Specifications for Transmitter and Receiver

Performance	
Protected Height:	14 mm or 19 mm —438 to 1394 mm (17.2 to 54.9 in.) 30 mm — 523 to 2096 mm (20.6 to 82.5 in.) 50 mm — 700 to 2096 mm (27.6 to 82.5 in.)
Operating Range	MG46SR: 0.3 to 7.5 m (1 to 25 ft.) for 14 mm resolution 0.3 to 9 m (1 to 30 ft.) for 19, 30 and 50 mm resolutions MG46LR: 0.3 to 20 m (1 to 65 ft.) for 19, 30 and 50 mm resolutions (Not available with 14 mm resolution)
Resolution:	14 mm (0.55 in.), 19 mm (0.75 in.), 30 mm (1.18 in.), or 53 mm (2.09 in.); use of exact channel select and/or floating blanking may increase value.
Safety Output Ratings:	6 A at 115 VAC (mini-connectors), 3 A at 115 VAC (micro-connectors), (System contains 8 A relays. To obtain approvals, the relays are derated)
Auxiliary Output Ratings:	3 A at 115 VAC (micro or mini connector)
Safety Output Contacts:	1 N.O. and 1 N.O./N.C. on a field replaceable assembly
Auxiliary Output Contacts:	1 N.O./N.C. on a field replaceable assembly, available in follow mode or alarm mode
MPCE Monitoring Circuit:	50 mA steady state @ 24 VDC
Start/Restart Circuit:	20 mA @ 24 VDC
Effective Aperture Angle:	±2.5° maximum, transmitter and receiver at operating range greater than 3 m (9.8 ft.).
Light Source:	GaAlAs Light Emitting Diode, 850 nm
Transmitter Indicator:	power indication (yellow)
Receiver Indicators:	machine run (green); machine stop (red); interlock/fault (yellow); exact channel select/floating blanking (amber); individual beam indicators (red)
Electrical	
Transmitter:	85-135 VAC, or 24 VDC input power
Receiver:	85-135 VAC, or 24 VDC input power
Transmitter Current Requirements:	300 mA @ 24 VDC, 7 VA @ 115 VAC
Receiver Current Requirements:	420 mA @ 24 VDC, 10 VA @ 115 VAC
Mechanical	
Enclosure:	Polyurethane powder-painted aluminum, yellow color
Cable Length:	Maximum 75 m (247 ft.)
Cable Connections (see drawing)	
Transmitter:	Power Input 3-pin Quick Disconnect (mini or micro connector), MTS (machine test signal), 2-pin Quick Disconnect Micro Connector Separate Connector
Receiver:	Power Input 3-pin Quick Disconnect (mini or micro connector), Safety Relay Outputs 5-pin Quick Disconnect (mini or micro connector).
	Options: Auxiliary Output 4-pin (micro connector only), MPCE & Remote Start 5-pin (micro connector shielded cable only), and DeviceNet 5-pin (micro connector shielded cable only)
Environmental	
Protection Rating:	NEMA 4, 12; IP65
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Storage Temperature:	-25 to 75°C (-13 to 167°F)
Vibration:	5-60 Hz maximum on all 3 axes
Shock:	10 g of 0.016 seconds; 1,000 shocks for each axes on two axes
Conformity/Approvals	
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c),
Others:	EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. TUV Registration Number: BB211081501. CSA Certificate 1193351.

Response Times for Systems with 14 mm and 20 mm Resolution

Protected Height (mm/in.)	Response Time (seconds)	
	Normally Open (N.O.)	Normally Closed (N.C.)
438/17.2	<0.025	<0.040
523/20.6	<0.030	<0.045
613/24.1	<0.030	<0.045
700/27.6	<0.030	<0.045
785/30.9	<0.035	<0.050
871/34.3	<0.035	<0.050
958/37.7	<0.040	<0.055
1046/41.2	<0.040	<0.055
1133/44.6	<0.040	<0.055
1219/48.0	<0.045	<0.060
1306/51.4	<0.045	<0.060
1394/54.9	<0.045	<0.060

Response Times for Systems with 30 mm Resolution

Protected Height (mm/in.)	Response Time (seconds)	
	Normally Open (N.O.)	Normally Closed (N.C.)
523/20.6	<0.025	<0.040
700/27.6	<0.025	<0.040
871/34.3	<0.025	<0.040
1046/41.2	<0.030	<0.045
1219/48.0	<0.030	<0.045
1394/54.9	<0.030	<0.045
1570/61.8	<0.035	<0.050
1746/68.7	<0.035	<0.050
1920/75.6	<0.040	<0.055
2096/82.5	<0.040	<0.055

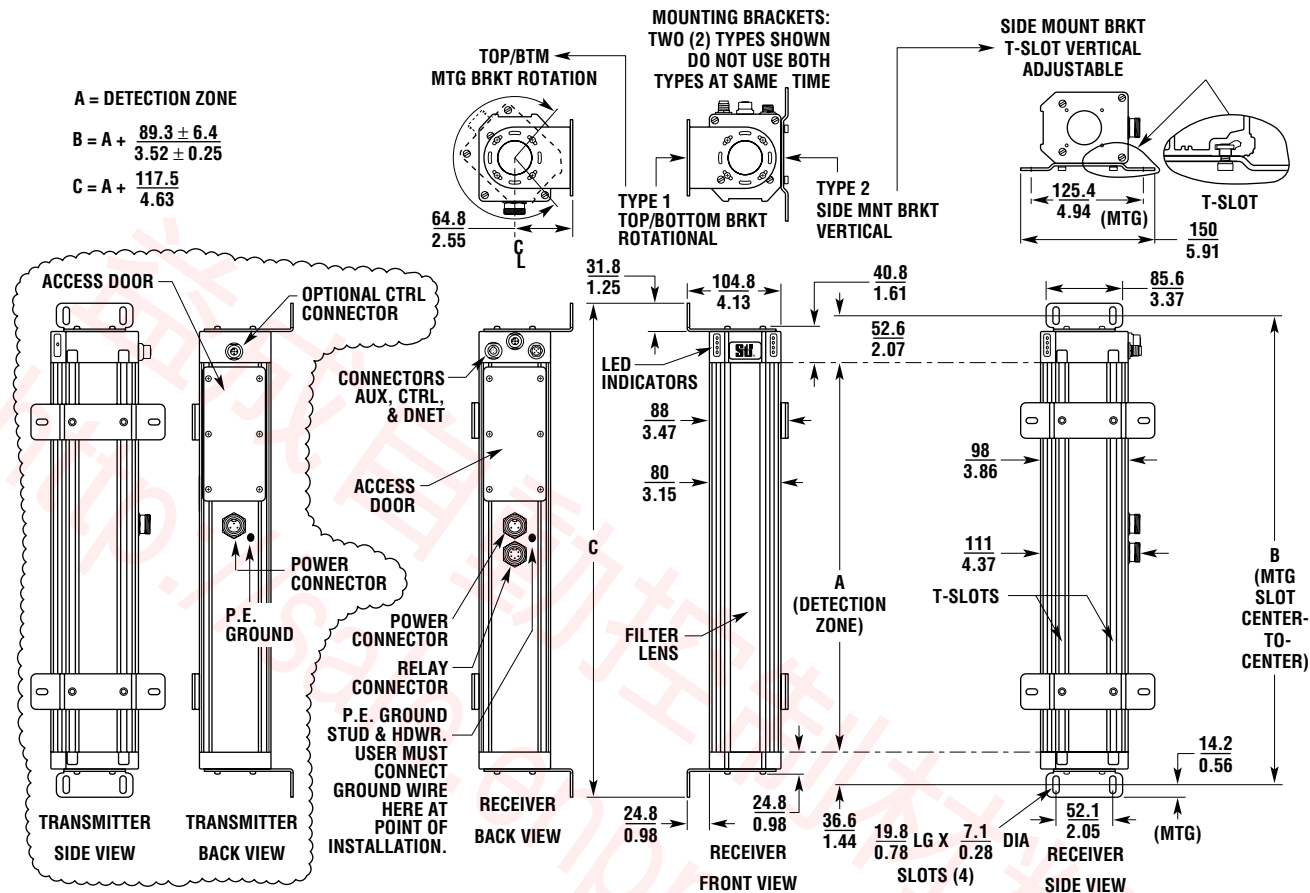
Response Times for Systems with 50 mm Resolution

Protected Height (mm/in.)	Response Time (seconds)	
	Normally Open (N.O.)	Normally Closed (N.C.)
700/27.6	<0.025	<0.040
1046/41.2	<0.025	<0.040
1394/54.9	<0.025	<0.040
1746/68.7	<0.025	<0.040
2096/82.5	<0.025	<0.040

Specifications are subject to change without notice.

This drawing is available in CAD format
at www.sti.com/curtains/MG4600/

■ **Dimensions—mm/in.**



D safety light curtains

MegaSafe MG4600 Dimensions

MG4600-14 and MG4600-20		
A mm/in.	B mm/in.	C mm/in.
438/17.2	527/20.8	556/21.9
523/20.6	612/24.1	641/25.2
613/24.1	702/27.7	731/28.8
700/27.6	789/31.1	818/32.2
785/30.9	874/34.4	903/35.5
871/34.3	960/37.8	989/38.9
958/37.7	1047/41.2	1076/42.4
1046/41.2	1135/44.7	1164/45.8
1133/44.6	1222/48.1	1251/49.2
1219/48.0	1308/51.5	1337/52.6
1306/51.4	1395/54.9	1424/56.1
1394/54.9	1483/58.4	1512/59.5

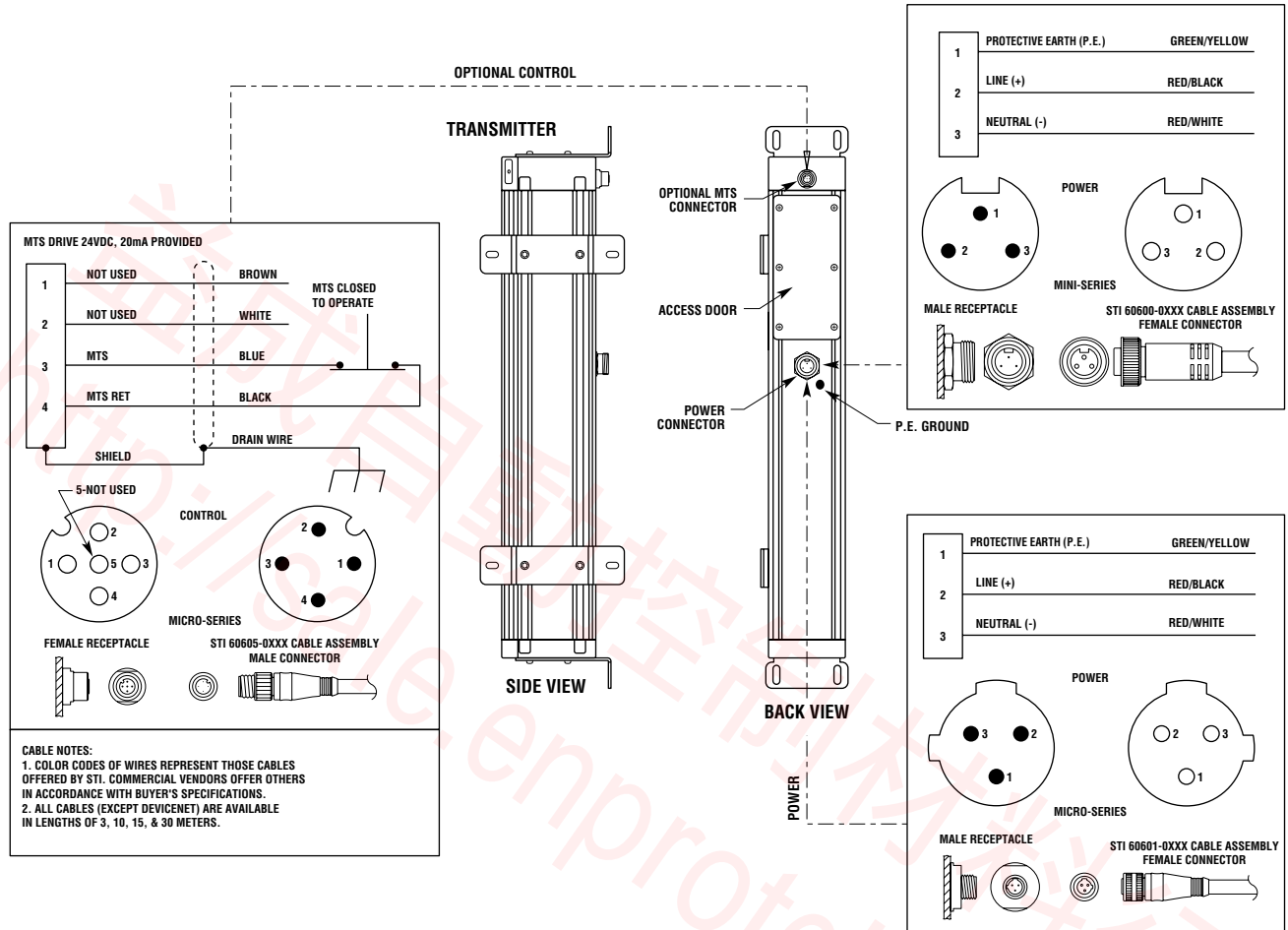
MG4600-30		
A mm/in.	B mm/in.	C mm/in.
523/20.6	612/24.1	641/25.2
700/27.6	789/31.1	818/32.2
871/34.3	960/37.8	989/38.9
1046/41.2	1135/44.7	1164/45.8
1219/48.0	1308/51.5	1337/52.6
1394/54.9	1483/58.4	1512/59.5
1570/61.8	1659/65.3	1688/66.4
1746/68.7	1834/72.2	1863/73.3
1920/75.6	2009/79.1	2038/80.2
2096/82.5	2185/86.0	2214/87.2

MG4600-50		
A mm/in.	B mm/in.	C mm/in.
700/27.6	789/31.1	818/32.2
1046/41.2	1135/44.7	1164/45.8
1394/54.9	1483/58.4	1512/59.5
1746/68.7	1830/72.1	1859/73.2
2096/82.5	2185/86.0	2214/87.2

D

safety light curtains

■ Wiring — Transmitter



A Go to the Engineering Guide
For in-depth information on safety standards and use.

MG4600

■ Ordering

To order a MegaSafe MG4600 system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

D safety light curtains

— — — — — X — R — S — — — — —
 ① ② ③ ④ ⑤ ⑥ ⑥ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

Example: MG46SR-20-435-A2-BK-10X-10R-15S-10A-15C-10M-RV-D

This system is short range, has 20 mm (0.79 in.) minimum object resolution, a 435 mm (17.2 in.) coverage height, 115 VAC operating power with micro connector, external channel select and floating blanking switches, 10 m (33 ft.) transmitter and receiver cables, 15 m (49 ft.) safety output cable, auxiliary outputs configured in the “alarm” mode with 10 m (33 ft.) cable, MPCE and remote start connection with 15 m (49 ft.) cable, MTS connector with 10 m (33 ft.) cable, DeviceNet interface, and 6 m (20 ft.) DeviceNet cable.

① Information required. Represents the system operating range. For applications where the transmitter and receiver will be mounted less than 9 m (29.5 ft.) apart, please select the SR version.

Designator	Description
MG46SR	0.3 to 7.5 m (1 to 25 ft.) for 14 mm resolution 0.3 to 9 m (1 to 30 ft.) for 20, 30 and 50 mm resolutions
MG46LR	0.3 to 20 m (1 to 65 ft.) for 20, 30 and 50 mm resolutions (Not available for 14 mm)

② Information required. Represents the minimum object resolution of the system.

Designator	Description
14	14 mm (0.55 mm)
20	19 mm (0.75 inch)
30	30 mm (1.18 inch)
50	53 mm (2.09 inch)

③ Information required. Represents coverage height, which is a function of minimum object resolution. Designators are divided into three sections.

14 & 20 mm Minimum Object Resolution Systems

Designator	Description
435	438 mm (17.2 in.)
520	523 mm (20.6 in.)
610	613 mm (24.1 in.)
700	700 mm (27.6 in.)
785	785 mm (30.9 in.)
870	871 mm (34.3 in.)
955	958 mm (37.7 in.)
1045	1046 mm (41.2 in.)
1130	1133 mm (44.6 in.)
1215	1219 mm (48.0 in.)
1305	1306 mm (51.4 in.)
1390	1394 mm (54.9 in.)

30 mm Minimum Object Resolution Systems

Designator	Description
520	523 mm (20.6 in.)
700	700 mm (27.6 in.)
870	871 mm (34.3 in.)
1045	1046 mm (41.2 in.)
1215	1219 mm (48.0 in.)
1390	1394 mm (54.9 in.)
1570	1570 mm (61.8 in.)
1745	1746 mm (68.7 in.)
1920	1920 mm (75.6 in.)
2095	2096 mm (82.5 in.)

50 mm Minimum Object Resolution Systems

Designator	Description
700	700 mm (27.6 in.)
1045	1046 mm (41.2 in.)
1390	1394 mm (54.9 in.)
1745	1746 mm (68.7 in.)
2095	2096 mm (82.5 in.)

④ Information required. Represents input power as well as input power and safety output connector type.

Designator	Description
A1	115 VAC, Mini Power Input and Safety Output Connectors
A2	115 VAC, Micro Power Input and Safety Output Connectors
D1	24 VDC, Mini Power Input and Safety Output Connectors
D2	24 VDC, Micro Power Input and Safety Output Connectors

⑤ Information optional. Indicates the addition of External Channel Select and Floating Blanking switches.

Designator	Description
(Blank)	No option
BK	External C.S. and F.B. installed

⑥ Information optional. Represents transmitter (X) and receiver (R) and safety output (S) cable length. Connector style on these cables will match the style specified under ④, input power. Example: If a micro-style connector was ordered for the input power connection (option A2 or D2), the transmitter, receiver and safety output connections will have micro-style connectors.

Designator	Description
(Blank)	No cable
3	3 m (10 ft.)
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)

⑦ Information optional. Indicate if you would like the optional auxiliary outputs, the associated connector, and if you would like to have a cable supplied with them. This cable has a micro-style connector. Designators and descriptions follow.

Designator	Description
(Blank)	No auxiliary output or cable
A	Auxiliary output. Operates in alarm mode. No cable supplied.
3A	Auxiliary output. Operates in alarm mode. 3 m (10 ft.) cable supplied.
10A	Auxiliary output. Operates in alarm mode. 10 m (33 ft.) cable supplied.
15A	Auxiliary output. Operates in alarm mode. 15 m (49 ft.) cable supplied.
30A	Auxiliary output. Operates in alarm mode. 30 m (99 ft.) cable supplied.
F	Auxiliary output. Operates in follow mode. No cable supplied.
3F	Auxiliary output. Operates in follow mode. 3 m (10 ft.) cable supplied.
10F	Auxiliary output. Operates in follow mode. 10 m (33 ft.) cable supplied.
15F	Auxiliary output. Operates in follow mode. 15 m (49 ft.) cable supplied.
30F	Auxiliary output. Operates in follow mode. 30 m (99 ft.) cable supplied.

⑧ Information optional. Indicate if you would like the optional MPCE monitoring and remote start connection, and what length cable you would like to have supplied with it. This cable has a micro-style connector. Designators and descriptions are given below.

Designator	Description
(Blank)	No MPCE/remote start connection or cable.
3C	MPCE/remote start connection. 3 m (10 ft.) cable supplied.
10C	MPCE/remote start connection. 10 m (33 ft.) cable supplied.
15C	MPCE/remote start connection. 15 m (49 ft.) cable supplied.
30C	MPCE/remote start connection. 30 m (99 ft.) cable supplied.

Safety Standards and Precautions

All models of the MegaSafe MG4600 meet ANSI/RIA R15.06-1999 and ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MegaSafe MG4600 series meets ANSI control reliability requirements for point-of-operation presence sensing devices.

MegaSafe MG4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE.

The MegaSafe MG4600 should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MegaSafe MG4600 on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

⑨ Information optional. Indicate if you would like the optional Machine Test Signal (MTS) connection, and what length cable you would like to have supplied with it. This cable has a micro-style connector. Designators and descriptions are given below.

Designator	Description
(Blank)	No MTS connection or cable.
3M	MTS connection. 3 m (10 ft.) cable supplied.
10M	MTS connection, 10 m (32 ft.) cable supplied.
15M	MTS connection, 15 m (49 ft.) cable supplied.
30M	MTS connection, 30 m (99 ft.) cable supplied.

⑩ Information optional. Indicate if you would like the optional DeviceNet interface.

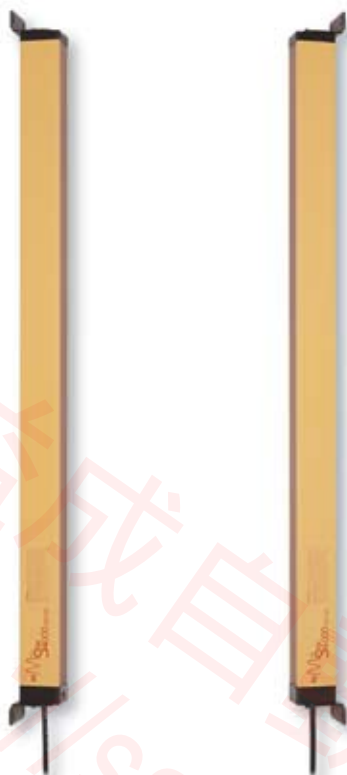
Designator	Description
(Blank)	No DeviceNet
RV	DeviceNet installed

⑪ Information optional. Indicate if you would like the optional DeviceNet cable.

Designator	Description
(Blank)	No DeviceNet
D	6 m (19.7 ft.) cable

 For additional MG4600 cables, see light curtain accessories on page D198

 For information on safety light curtain accessories, see page D184



MiniSafe®

MS4600

- Resolution: 14 mm (0.55 in.), 19 mm (0.75 in.) or 30 mm (1.18 in.) resolution
- Range: 7.5 m (25 ft.) range for the 14 mm resolution
20 m (65 ft.) range for the 19 and 30 mm resolutions
- Protected Heights: 14 mm and 19 mm protected heights from 263 to 1393 mm (10 to 55 in.); or 30 mm protected heights from 351 to 2095 mm (14 to 83 in.)
- Compact size — 35 x 50 mm (1.4 x 2 in.)
- Simple “two-box” design — no separate control box required
- No cable required between transmitter and receiver
- Two PNP safety outputs designed to directly switch machine primary control elements
- Available with one NPN or one PNP auxiliary output
- Individual Beam Indicators
- Exact Channel Select
- Floating Blanking
- Choice of operating modes
- MPCE monitoring
- Choice of in-line cable with QD connector or QD connector only
- Adjustable mounting brackets

Options

- DeviceNet™ Interface
- Machine Test Signal (MTS)
- Auxiliary Outputs Alarm/Follow Mode
- Versions for darkroom applications (940 nm), consult factory
- Muting through RM-3 module



■ Description

A MiniSafe MS4600 system consists of a transmitter and receiver of equal height. Since the control reliable circuitry is contained in the receiver and transmitter, no separate control box is required.

Despite its compact dimensions, the MS4600 comes with a complete feature set. Individual Beam Indicators are included to simplify alignment. When an infrared beam is out of alignment, the corresponding Individual Beam Indicator will glow red.

Two solid-state safety outputs provide 500 mA of current at 24 VDC.

The ability to select Automatic Start and Start/Restart Interlock modes means that the MS4600 can be configured for either point-of-operation or perimeter guarding.

Exact Channel Select allows the MS4600 detection zone to have permanently blocked beams. This is valuable if tooling or other machine parts must permanently obstruct a portion of the zone. Exact Channel Select programming is as easy as pushing a button.

Floating Blanking is useful when process material or parts must transit through the detection zone. Floating Blanking allows up to two beams to be blocked anywhere in the zone.

Machine primary control element monitoring is required for control reliable safety. MPCE

A Go to the Engineering Guide
For in-depth information on safety standards and use.

monitoring is built into the MS4600 rather than being required externally.

In-line connector cables and adjustable mounting brackets allow the MS4600 to fit in space-constrained locations and simplify installation.

DeviceNet Option

This optional interface allows an MS4600 system to communicate non-safety related data across this popular fieldbus. As the de facto standard for fieldbus communications, DeviceNet is widely employed in the automotive, semiconductor and other industries.

Monitoring of a DeviceNet equipped light curtain provides the process control system with the following non-safety information: manufacturer; product name; operating mode; detection zone status; solid-state safety output status; signal strength; number of beams installed; number of beams selected; MPCE monitoring enabled/disabled; floating blanking active/inactive; exact channel select active/inactive; blanking pattern for exact channel select; receiver diagnostic codes; error codes and descriptions.

DeviceNet and the MiniSafe MS4600 provide a powerful automation solution.

MTS Option

Machine Test Signal (MTS) is an optional feature on the MS4600 series light curtain. MTS allows the machine control system to check for the proper operation of the light curtain safety outputs by simulating a beam blocked state on the transmitter.

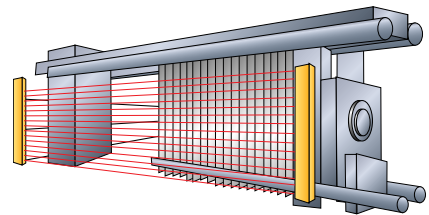
Alarm/Follow Mode Option

The non-safety output can be configured to have either “alarm” or “follow” functionality. “Alarm” mode means that the non-safety outputs will be de-energized if the system is behaving normally and energized if the system is in a faulted/interlocked state and will remain this way until the condition is cleared. “Follow” mode mimics the state of the solid-state safety outputs, meaning they will be active when the system is in the machine run state and inactive when the system is in the machine stopped state.

■ Applications

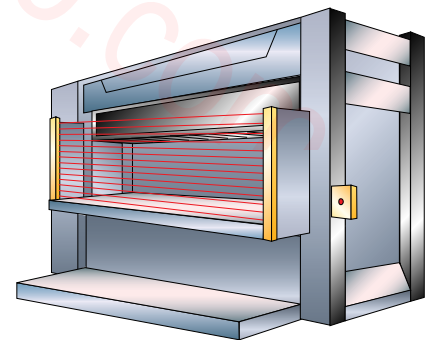
Application ①

With a range of 20 m a MiniSafe MS4600 system could be used to guard the perimeter of a large filter press. In this application the small 19 mm (0.75 in.) minimum object resolution would allow the curtain to be mounted closer than many perimeter guarding systems and since there is no separate control box, long cable runs are not required.



Application ②

The small minimum object resolution, quick response time, and feature set of the MS4600 make it perfect for guarding metal forming equipment. In this application, floating blanking allows the material to bend up through the detection zone without sending a stop signal to the guarded machine.

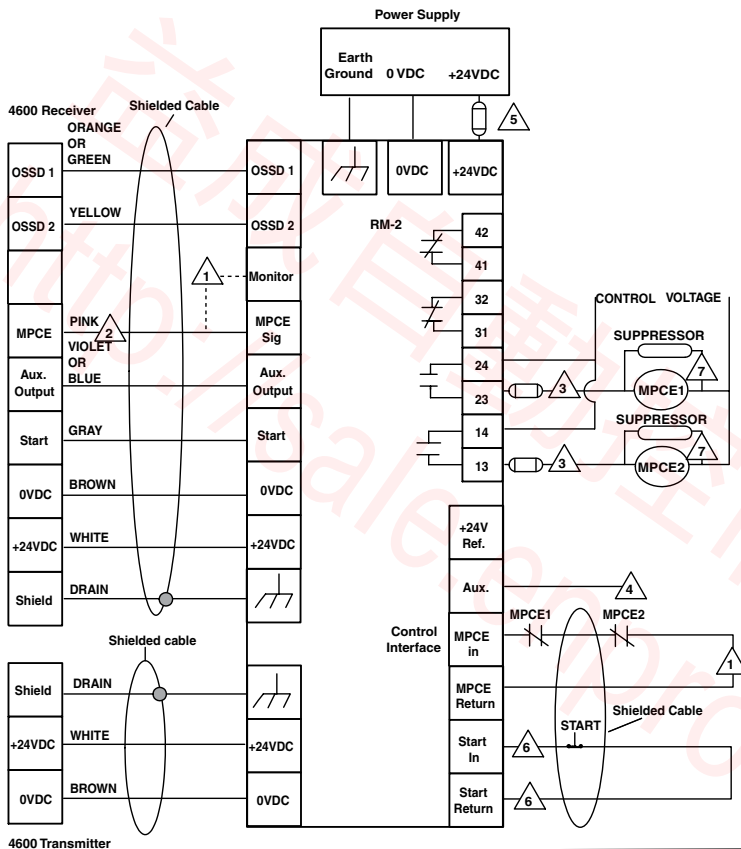


D

safety light curtains

Connecting Via an RM-2 Module

The Omron STI RM-2 module provides force-guided relay outputs for machine control as well as a convenient location to terminate all outputs and inputs from the MS4600.



4600 Transmitter

① MPCE monitoring must be used when using the RM2. If the RM2 is the Final Switching Device connect the Pink wire to the MONITOR terminal of the RM2. If force-guided control relays are used as Final Switching Devices connect the Pink wire to the MPCE Sig. terminal. Then connect a set of N.C. contacts from MPCE1 and MPCE2 to the MPCE in and MPCE return terminals. (Do not connect both.)

For transmitter with MTS option

Blue

Black

- ② For testing prior to installation, the user may select MPCE OFF (default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0 VDC line.
- ③ User-supplied over current protection, 6 A max.
- ④ Auxiliary output-connect to PLC (optional).
- ⑤ User-supplied fuse.
- ⑥ If remote start is not used, install a jumper across the Start connections at the Control Interface terminals.
- ⑦ Verify that the final switching devices are properly suppressed.

D
safety light curtains

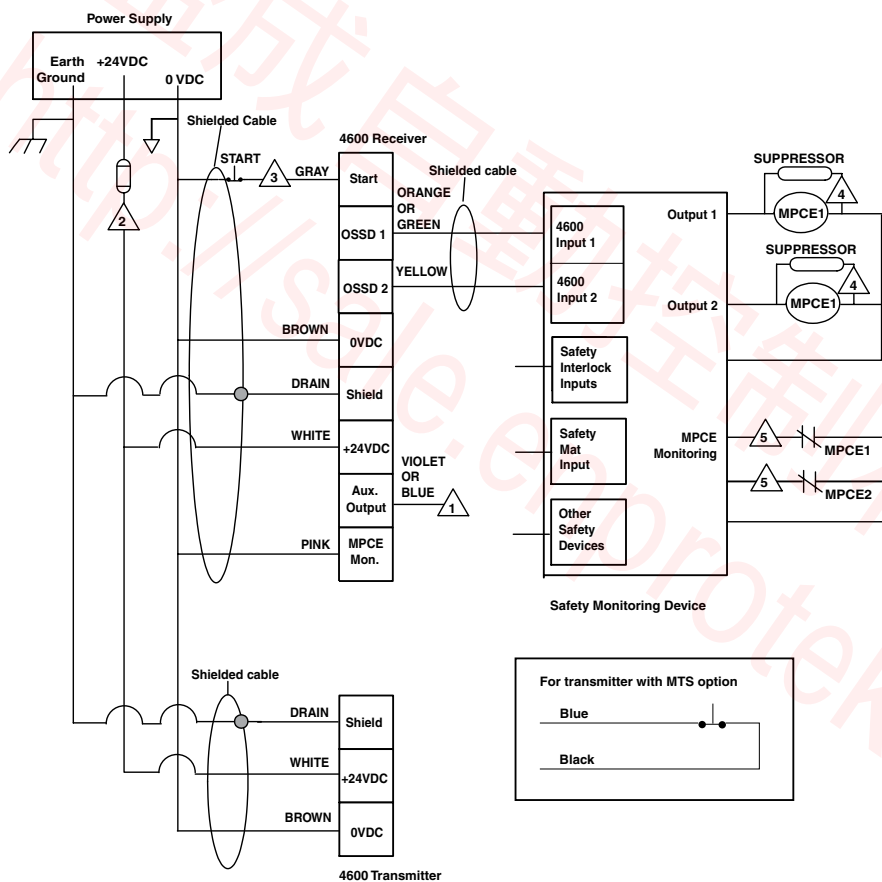
■ Using Solid-state Outputs (continued)

Connecting to a Safety Monitoring Device

The wiring from the MS4600 to the machine control circuit must be control reliable. Safety devices, such as the MS4600 should not depend on a PLC to stop a guarded machine. However, safety related monitoring devices are now available. Note that all safety inputs are directed to the monitoring device which also performs the MPCE monitoring function.

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safety light curtains

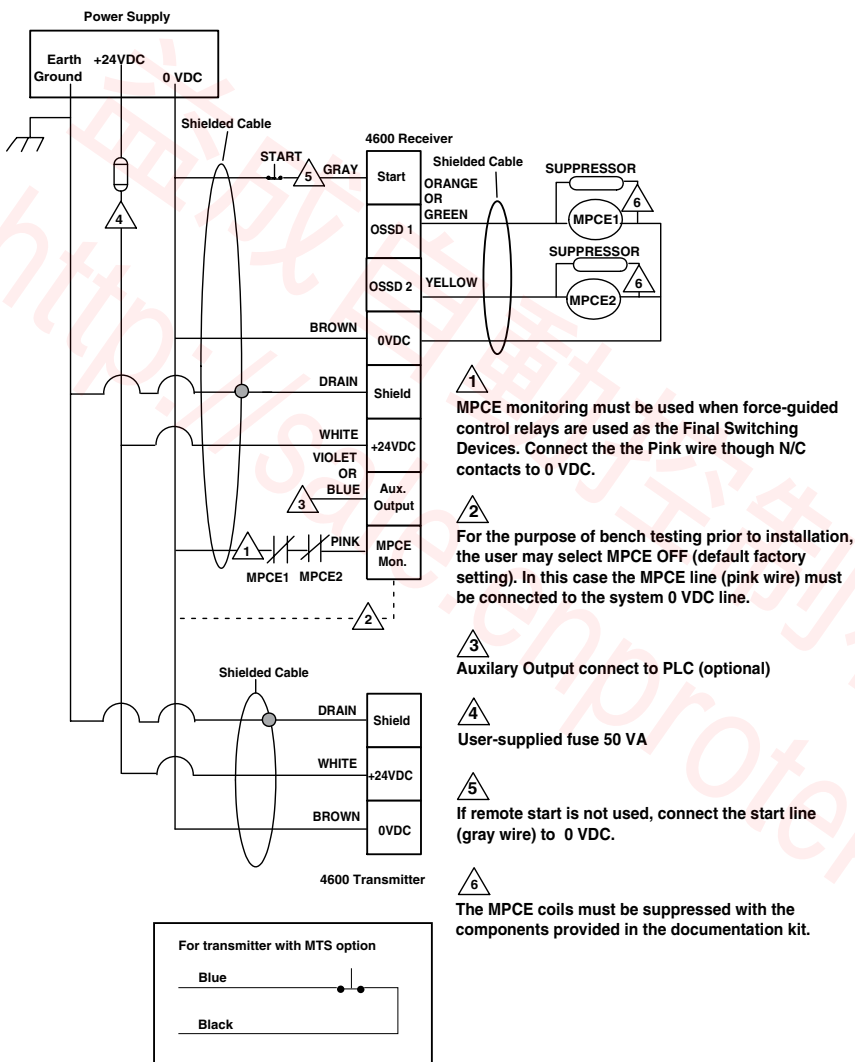


- ⚠️ 1 Auxiliary Output connect to PLC (optional)
- ⚠️ 2 User-supplied fuse.
- ⚠️ 3 If remote start is not used, connect the start line (grey wire) to 0VDC.
- ⚠️ 4 Verify that the final switching devices are properly suppressed.
- ⚠️ 5 The Safety Monitoring Device must monitor the MPCE's Normally Closed Contacts.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

Connecting Via Two Force-Guided Relays

FGR series relays provide force-guided outputs for machine control.



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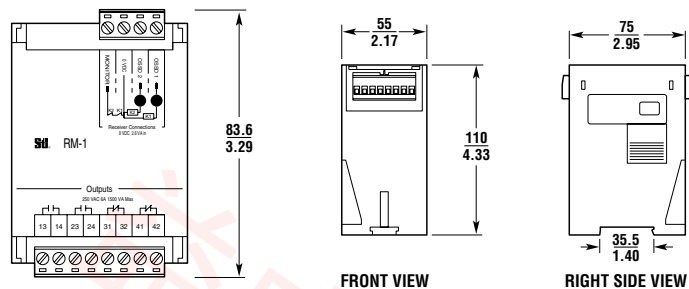
safety light curtains

MS4600

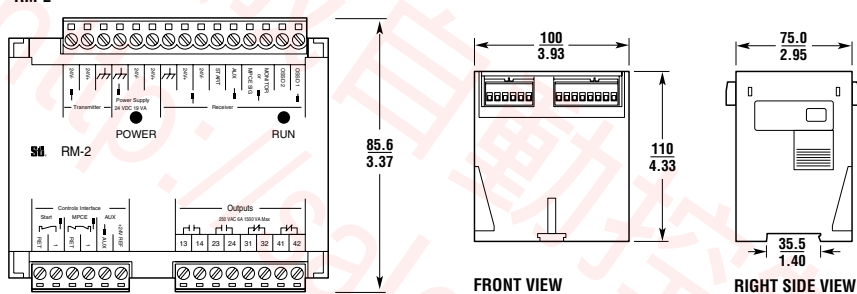
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safety light curtains

■ Module Dimensions—mm/in.

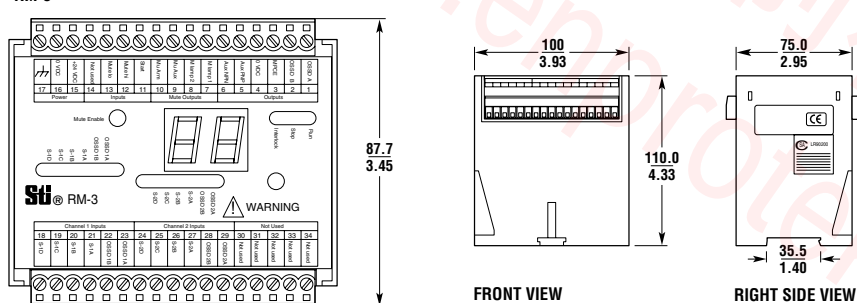
RM-1



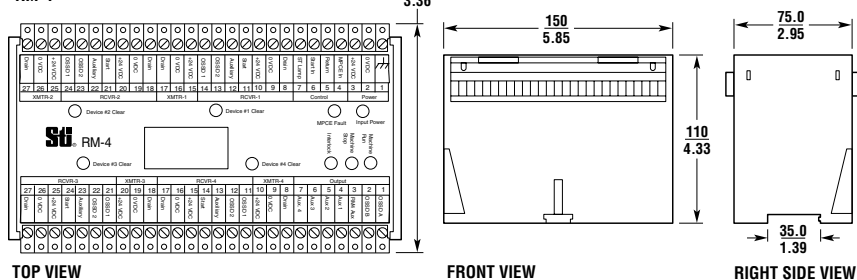
RM-2



RM-3



RM-4



■ Available Modules

The following relay modules are available to extend the function of the MS4600 series:

RM-1: Provides force-guided safety relay outputs using input from MS4600 system. Receives required 24 VDC power direct from MS4600 solid-state safety outputs. DIN rail mount. Removable terminal blocks.

RM-2: Provides a single location to terminate all inputs and outputs to MS4600 system. Also provides force-guided safety relay outputs using input from MS4600 system. Requires external 24 VDC power supply which also provides power to the MS4600. DIN rail mount. Removable terminal blocks.

RM-3: Provides muting, the temporary automatic suspension of the safety function, for up to two safety light curtains. Requires external 24 VDC power supply. It has DIN-rail mount and removable terminal blocks.

RM-4: Up to four MS4600 systems can be connected to the RM-4. It provides two PNP safety outputs and one user selectable NPN or PNP non-safety, auxiliary output. Additionally, connections are provided for the auxiliary output of each safety device. It requires external 24 VDC power supply which also provides power to the MS4600.

In addition to the above modules, the **RM-X**, **RM2-AC** and **RM2-AC-IP** are also compatible with the MS4600.



For information on Resource Modules, see page D138



■ Specifications for Transmitter and Receiver

Performance
Protected Height: 14 and 19 mm — 263 to 1393 mm in 86 mm increments (10.3 to 54.5 inches in 3.4 inch increments) 30 mm — 350 to 2090 mm (13.8 to 82.6 in.)
Operating Range
MS46SR: 0.3 to 7.5 m (1 to 25 ft.) for 14 mm resolution 0.3 to 9 m (1 to 30 ft.) for 19 mm and 30 mm resolutions
MS46LR: 0.3 to 20 m (1 to 65 ft.)/Not available with 14 mm resolution
Resolution: 14 mm (0.55 in.), 19 mm (0.75 in.) or 30 mm (1.18 in.). Use of Exact Channel Select and/or Floating Blanking may increase this value.
Response Time (varies by protected height): See tables at right
Input Voltage (V_{in}): 24 VDC \pm 20%
Input Power: 14 watts (without load on the outputs)
Safety Output Ratings: Two PNP outputs sourcing 500 mA max @ V_{in} (see note 1). Short circuit protected.
Auxiliary (Non-Safety) Output Ratings: One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)
Power Supply: 24 VDC \pm 20%. The rating depends on the current requirements of the loads attached to the outputs (see note 3). The power supply must meet the requirements of IEC 60204-1 and 61496-1. Omron STI part number 42992 or equivalent.
MPCE Monitoring Circuit: 50 mA steady state @ 24 VDC
Start/Restart Input: N.C. or N.O. momentary contact (20 mA consumption)
Effective Aperture Angle: $\pm 2.5^\circ$ maximum, transmitter and receiver at operating range greater than 3 m (9.8 ft.).
Light Source: GaAlAs Light Emitting Diode, 850 nm
Indicators
Transmitter: power applied
Receiver: machine run, machine stop, interlock/fault; channel select/floating blanking, individual beam
Mechanical
Enclosure: Polyurethane powder-painted aluminum
Cable Length: Optional cables are available in 10, 15, 30 and 50 m lengths
Cable Connections
Receiver: 8-pin
Transmitter: 3-pin standard, 5-pin with MTS
Environmental
Protection Rating: NEMA 4, 12; IP65
Operating Temperature: 0 to 55°C (32 to 131°F)
Relative Humidity: 95% maximum, non-condensing
Vibration: 5-60 Hz maximum on all three axes
Shock: 10 g for 0.016 seconds, 1,000 shocks for each axes on two axes
Conformity/Approvals
Conforming to Standards: ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212
Other Approvals: All MS4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. TUV Registration No: BB991007101. UL1998

Response Times for Systems With 14 mm and 20 mm Resolutions

Protected Height (mm/in.)	No. of Beams	Response Time (seconds)
263/10.4	24	<0.016
350/13.8	32	<0.017
437/17.2	40	<0.019
524/20.6	48	<0.021
611/24.1	56	<0.023
698/27.5	64	<0.025
785/30.9	72	<0.027
872/34.3	80	<0.031
959/37.7	88	<0.033
1046/41.2	96	<0.035
1133/44.6	104	<0.035
1220/48.0	112	<0.037
1306/51.4	120	<0.039
1393/54.9	128	<0.040

Response Times for Systems With 30 mm Resolutions

Protected Height (mm/in.)	No. of Beams	Response Time (seconds)
350/13.8	16	<0.014
524/20.6	24	<0.016
698/27.5	32	<0.017
872/34.3	40	<0.019
1046/41.2	48	<0.021
1220/48.0	56	<0.023
1393/54.9	64	<0.025
1570/61.8	72	<0.027
1741/68.6	80	<0.029
1915/75.4	88	<0.031
2090/82.3	96	<0.033

Specifications are subject to change without notice.
Note 1: Voltage available at the outputs is equal to V_{in} - 2.0 VDC.

Note 2: Total current required by the two solid-state outputs and the aux. output should not exceed 1.1 A.

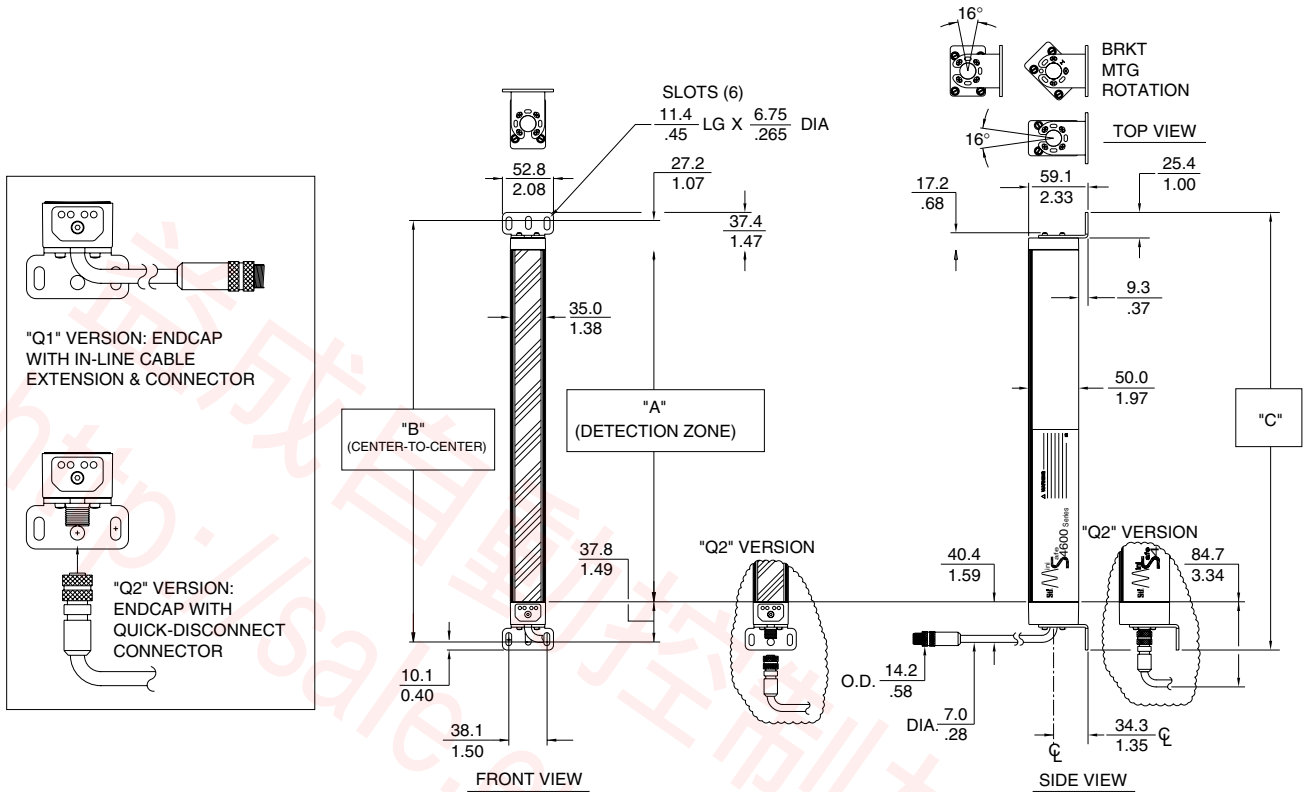
Note 3: Total system current requirement is the sum of the transmitter 285 mA and receiver 1.4 A max. (Receiver 300 mA + OSSD1 load + OSSD2 load + Aux. output load)

D

safety light curtains

■ MS4600-14 and -20 Dimensions—mm/in.

D
safety light curtains



DIMENSIONS: $\frac{\text{mm (+/-).3}}{\text{INCHES (+/-).01}}$

A = DETECTION ZONE

$B = A + \frac{65.0}{2.56}$

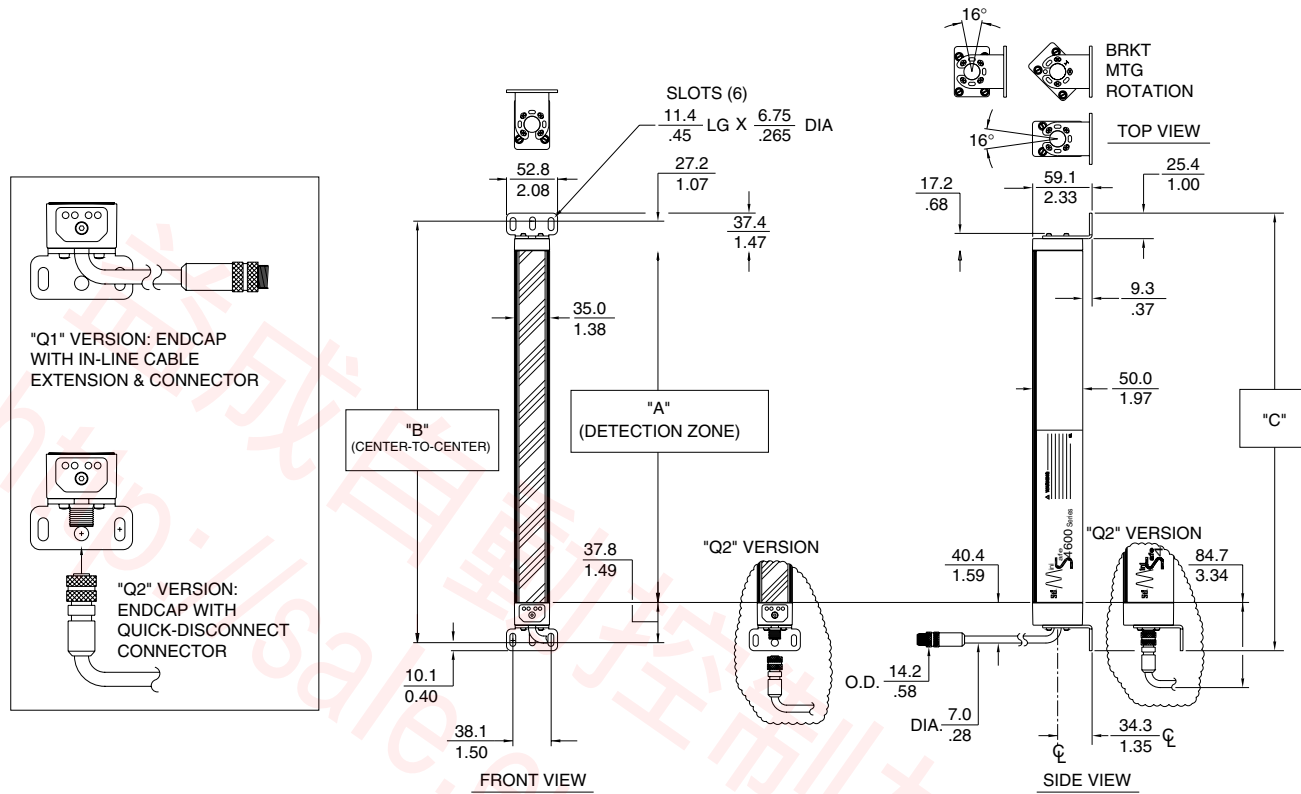
$C = A + \frac{85.4}{3.36}$

MiniSafe MS4600-14 and MS4600-20 Dimensions

	MS46-X-260-14	MS46-X-350-14	MS46-X-435-14	MS46-X-520-14	MS46-X-610-14	MS46-X-700-14	MS46-X-785-14
	MS46-R-260-14	MS46-R-350-14	MS46-R-435-14	MS46-R-520-14	MS46-R-610-14	MS46-R-700-14	MS46-R-785-14
	MS46-X-260-20	MS46-X-350-20	MS46-X-435-20	MS46-X-520-20	MS46-X-610-20	MS46-X-700-20	MS46-X-785-20
	MS46-R-260-20	MS46-R-350-20	MS46-R-435-20	MS46-R-520-20	MS46-R-610-20	MS46-R-700-20	MS46-R-785-20
A mm/in.	263/10.4	350/13.8	437/17.2	524/20.6	611/24.1	698/27.5	785/30.9
B mm/in.	328/12.9	415/16.3	502/19.8	589/23.1	676/26.6	763/30.0	851/33.5
C mm/in.	348/13.7	435/17.1	522/20.6	609/24.0	696/27.4	783/30.8	870/34.3
System Shipping Weight							
kg/lb.	4.5/10	4.8/11	5.2/11	5.6/12	5.9/13	6.2/14	6.6/15

	MS46-X-870-14	MS46-X-955-14	MS46-X-1045-14	MS46-X-1130-14	MS46-X-1215-14	MS46-X-1305-14	MS46-X-1390-14
	MS46-R-870-14	MS46-R-955-14	MS46-R-1045-14	MS46-R-1130-14	MS46-R-1215-14	MS46-R-1305-14	MS46-R-1390-14
	MS46-X-870-20	MS46-X-955-20	MS46-X-1045-20	MS46-X-1130-20	MS46-X-1215-20	MS46-X-1305-20	MS46-X-1390-20
	MS46-R-870-20	MS46-R-955-20	MS46-R-1045-20	MS46-R-1130-20	MS46-R-1215-20	MS46-R-1305-20	MS46-R-1390-20
A mm/in.	872/34.3	959/37.7	1046/41.2	1133/44.6	1220/48.0	1306/51.4	1393/54.9
B mm/in.	937/36.9	1024/40.3	1111/43.7	1198/47.2	1285/50.6	1372/54.0	1459/57.4
C mm/in.	957/37.7	1044/41.1	1131/44.5	1218/48.0	1305/51.4	1392/54.8	1479/58.2
System Shipping Weight							
kg/lb.	6.9/15	7.3/16	8.2/18	8.5/19	8.9/20	9.2/20	9.6/21

■ MS4600-30 Dimensions—mm/in.



D safety light curtains

DIMENSIONS: $\frac{\text{mm (+/-).3}}{\text{INCHES (+/-).01}}$

A = DETECTION ZONE B = A + $\frac{65.0}{2.56}$ C = A + $\frac{85.4}{3.36}$

MiniSafe MS4600-30 Dimensions

	MS46-X-350-30	MS46-X-520-30	MS46-X-700-30	MS46-X-870-30	MS46-X-1045-30	MS46-X-1215-30
	MS46-R-350-30	MS46-R-520-30	MS46-R-700-30	MS46-R-870-30	MS46-R-1045-30	MS46-R-1215-30
A mm/in.	350/13.8	524/20.6	698/27.5	872/34.3	1046/41.2	1220/48.0
B mm/in.	415/16.3	589/23.2	763/30.0	938/36.9	1111/43.7	1285/50.6
C mm/in.	435/17.1	609/24.0	783/30.8	957/37.7	1131/44.5	1305/51.4
System Shipping Weight						
kg/lb.	4.8/11	5.6/12	6.2/14	6.9/15	8.2/18	8.9/20

	MX46-X-1390-30	MS46-X-1570-30	MS46-X-1745-30	MS46-X-1920-30	MS46-X-2095-30
	MX46-R-1390-30	MS46-R-1570-30	MS46-R-1745-30	MS46-R-1920-30	MS46-R-2095-30
A mm/in.	1393/54.9	1570/61.8	1741/68.6	1915/75.4	2090/82.3
B mm/in.	1459/57.4	1635/64.4	1807/71.1	1981/78.0	2155/84.8
C mm/in.	1479/58.2	1655/65.2	1827/71.9	2001/78.8	2175/85.6
System Shipping Weight					
kg/lb.	9.6/21	10.0/22	10.4/23	10.9/24	11.8/26



OMRON SCIENTIFIC TECHNOLOGIES, INC.
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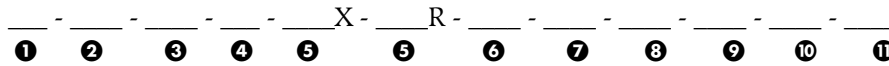
For the Latest Information
On the Internet: www.sti.com or www.omron.ca



MS4600

Ordering

To order a MiniSafe MS4600 system, simply fill in these fields.



D safety light curtains

1 Information required. Represents the system operating range. For applications where the transmitter and receiver will be mounted less than 7.5 m (25 ft.) or 9 m (30 ft.) apart (depending on resolution), please select the SR version.

Designator	Description
MS46SR	0.3 to 7.5 m (1 to 25 ft.) for 14 mm resolutions 0.3 to 9 m (1 to 30 ft.) for 20 and 30 mm resolutions
MS46LR	0.3 to 20 m (1 to 65 ft.) for 20 and 30 mm resolutions (Not available for 14 mm)

2 Information required. Represents the minimum object resolution of the system.

Designator	Minimum Object Resolution
14	14 mm (0.55 in.)
20	19 mm (0.75 in.)
30	30 mm (1.18 in.)

3 Information required. Represents the coverage height of the detection zone.

Designator	Description
260*	263 mm (10.4 in.)
350	351 mm (13.8 in.)
435*	437 mm (17.2 in.)
520	524 mm (20.6 in.)
610*	611 mm (24.1 in.)
700	698 mm (27.5 in.)
785*	785 mm (30.9 in.)
870	872 mm (34.3 in.)
955*	959 mm (37.7 in.)
1045	1046 mm (41.2 in.)
1130*	1133 mm (44.6 in.)
1215	1220 mm (48.0 in.)
1305*	1306 mm (51.4 in.)

1390	1393 mm (54.9 in.)
1570**	1567 mm (61.8 in.)
1745**	1741 mm (68.6 in.)
1920**	1915 mm (75.4 in.)
2095**	2090 mm (82.3 in.)

* Not available in 30 mm resolutions
** Only available in 30 mm resolutions

4 Information required. Represents the connector type for transmitter and receiver.

Designator	Description
Q1	In-line cable with quick disconnect (QD) connector (pig tail)
Q2	QD connector

5 Information required. Represents transmitter (X) and receiver (R) cable length. Cables can be shortened in the field.

Designator	Description
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)
50	50 m (164 ft.)

6 Information required. Represents the start/restart input type.

Designator	Description
NC	Normally closed
NO	Normally open

7 Information required. Indicate the Auxiliary output configuration.

Designator	Description
FN	NPN output follow solid-state safety outputs
FP	PNP output follow solid-state safety outputs
AN	NPN output operate only in Alarm status
AP	PNP output operate only in Alarm status

8 Information optional. Indicate optional MTS on transmitter.

Designator	Description
M	Include MTS
(Blank)	No MTS

9 Information optional. Indicate optional DeviceNet interface.

Designator	Description
RV	DeviceNet Installed
(Blank)	No DeviceNet

10 Information optional. Indicate optional DeviceNet cable.

Designator	Description
D	6 m (20 ft.) Cable
(Blank)	No DeviceNet Cable

11 Information optional. Indicate optional RM relay module.

Designator	Description
RM1	Include RM-1 Resource Module
RM2	Include RM-2 Resource Module
RM2A	Include RM-2AC Resource Module
RM2AP	Include RM-2AC-IP Resource Module, IP65
RM3	Include RM-3 Resource Module
RM4	Include RM-4 Resource Module
RMX	Include RM-X Resource Module
(Blank)	Do not include Resource Module

For information on Resource Modules, see page D138

For information on safety light curtain accessories, see page D184

A Go to the Engineering Guide For in-depth information on safety standards and use.

Safety Standards and Precautions

All models of the MiniSafe MS4600 meet ANSI/RIA R15.06-1999 and ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MiniSafe MS4600 series meets ANSI control reliability requirements for point-of-operation presence sensing devices.

MS4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE.

The MiniSafe MS4600 should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MiniSafe MS4600 on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

D

safety light curtains

MS4600 Three-Box System

D
safety light curtains

■ Description

The MiniSafe MS4600 three-box light curtain system is unique due to its superior response time — as fast as 16 msec. This speed allows the light curtain to be mounted closer to the point of hazardous operation.

The MiniSafe MS4600 series consists of an identical length transmitter and receiver, combined with a controller and appropriate interconnecting cables. The in-line connector cables allow the mounting of the transmitter and receiver in crowded locations where a standard connector would not fit.

For easy alignment, the MiniSafe features Omron STI's patented Individual Beam Indicator lights.

MiniSafe®

MS4600 Three-Box System

- Simple 3-box design
- Rugged transmitter and receiver—35 x 50 mm (1.42 x 2.0 in.)
- Two 6-amp safety relay outputs
- 30 mm (1.2 in.) resolution
- Protected heights from 150 to 1809 mm (6.2 to 71.2 in.)
- Individual Beam Indicator lights
- In-line connector cables
- Mini connectors for power and output
- Adjustable mounting brackets
- Exact channel select
- Floating blanking
- Auxiliary outputs
- Restart interlock
- MPCE monitoring
- Response time as fast as 16 msec
- Two-digit diagnostic display
- IP65-rated lockable metal enclosure

Option

- Remote reset

A Go to the Engineering Guide
For in-depth information on
safety standards and use.

■ **Specifications for Transmitter and Receiver**

Performance
Protected Height: 159 to 1809 mm (6.2 to 71.2 in.)
Operating Range: 0.3 to 12 m (1 to 39 ft.)
Resolution: 30 mm (1.2 in.) Use of exact channel select and/or floating blanking may increase this value.
Effective Aperture Angle: ±2.5° transmitter and receiver
Light Source: 850 nm LED
Light Source Life: 100,000 hours
Indicators: Channel select or float blanking – yellow; Interlock or fault – yellow; Machine stop – red, individual beam indicators – red; machine run – green
Mechanical
Enclosure: Polyurethane powder-painted aluminum
Cable Length:
Transmitter – maximum 30 m (100 ft.)
Receiver – maximum 30 m (100 ft.)
Cable Connections: Circular style, 6-conductor for transmitter, 9-conductor for receiver
Environmental
Protection Rating: IP65; NEMA 4, 12
Operating Temperature: 0 to 55°C (32 to 133°F)
Storage Temperature: -25 to 75°C (-13 to 167°F)
Relative Humidity: 95% maximum, non-condensing
Vibration: 5–60 Hz maximum on all 3 axes
Shock: 10 g for 0.016 seconds; 1,000 shocks on two axes
Conformity/Approvals
Approvals: IEC61496
Conforming to Standards: ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.27(c), OSHA 1910.212
Other Approvals: EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC61496-1 and -2), UL listed

Specifications are subject to change without notice.

■ **Specifications for Controller**

Performance
Indicators: Safety output status, interlock status, exact channel select floating blanking, 2-digit diagnostic display
Electrical
Supply: Autoselecting 100-240 VAC ± 10%, 30 VA
Safety Output, Contact Ratings: 1 N.O. and 1 N.O./N.C. on a field-replaceable assembly. * 6 A at 115 VAC (mini-connectors). System contains 8 A relays. To obtain approvals, the relays are derated.
Auxiliary Output, Mechanical: 1 N.O./N.C. 3 A*
MPCE: 50 mA @ 24 VDC ±20% current source, steady state. Minimum wire size, 22 AWG unshielded. Maximum cable length 50 m (164 ft.)
Remote Start: 20 mA @ 24 VDC ±20% current source, steady state. Minimum wire size, 22 AWG unshielded. Maximum cable length 50 m (164 ft.)
Mechanical/Environmental
Metal Chassis: Lockable metal enclosure, protection rating IP65
Operating Temperature: 0 to 55°C (32 to 131°F)
Relative Humidity: 95% maximum, Non-condensing
Vibration: 5-60 Hz maximum on all three axes
Shock: 10 g for 0.016 seconds; 1,000 shocks for each axes on two axes

Specifications are subject to change without notice.

*Field replaceable relay assembly part number 68070-0010.

■ **Controller Response Times**

Protective Height mm/in.	# of Beams	Response Times–mS	
		Normally Open	Normally Closed
159/6.3	7	16.9	26.9
309/12.2	14	17.7	27.7
459/18.1	21	18.4	28.4
609/24.0	28	19.1	29.1
759/29.9	35	19.8	29.8
909/35.8	42	20.5	30.5
1059/41.7	49	21.3	31.3
1209/47.6	56	22.0	32.0
1359/53.3	63	22.7	32.7
1509/59.4	70	23.4	33.4
1659/65.3	77	24.2	34.2
1809/71.2	84	24.9	34.9

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safety light curtains

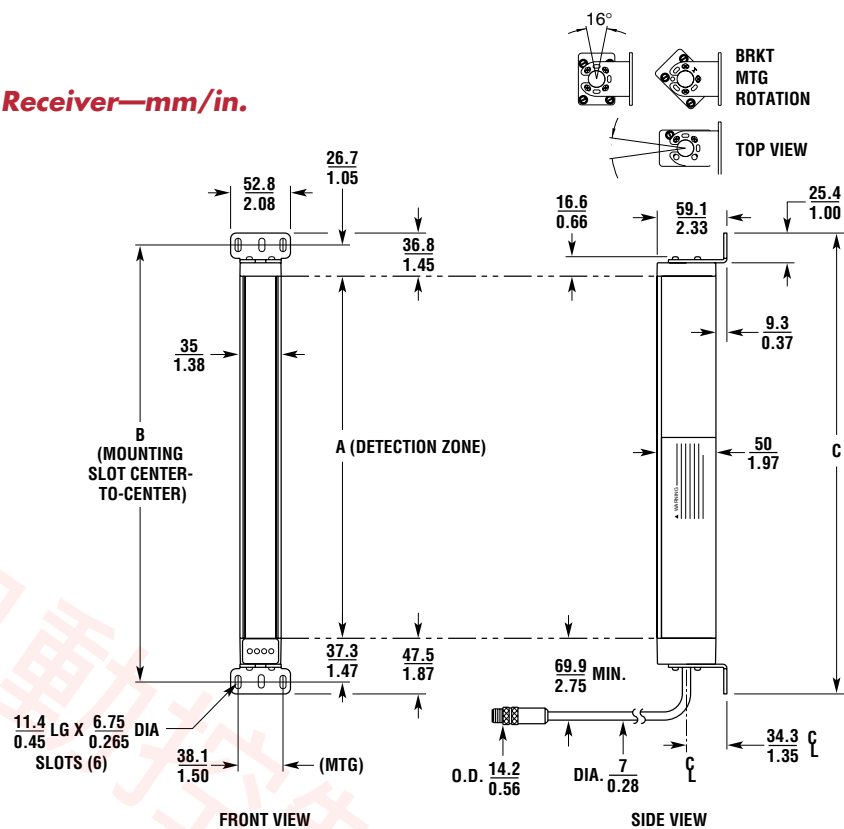
MS4600 Three-Box System

■ Dimensions of Transmitter and Receiver—mm/in.

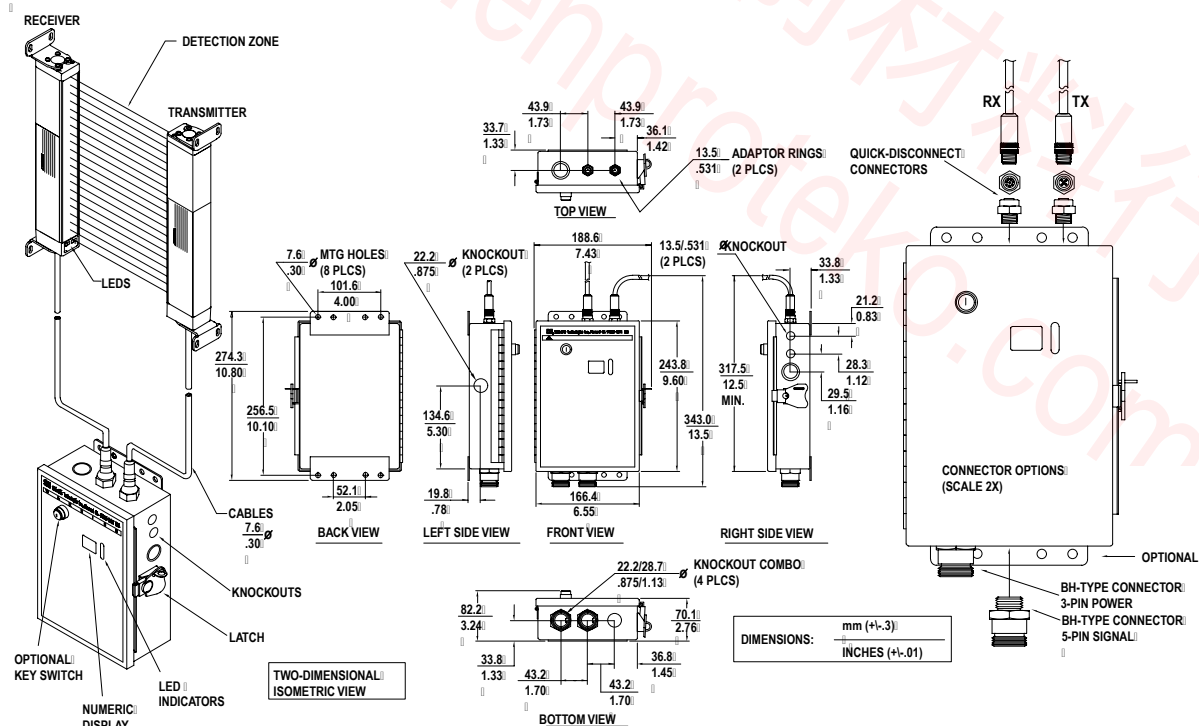
MiniSafe MS4600 Three-Box Series Dimensions

A mm/in.	B mm/in.	C mm/in.
159/6.3	224/8.8	244/9.6
309/12.2	374/14.7	394/15.5
459/18.1	524/20.6	544/21.4
609/24.0	674/26.5	694/27.3
759/29.9	824/32.4	844/33.2
909/35.8	974/38.3	994/39.1
1059/41.7	1124/44.2	1144/45.0
1209/47.6	1274/50.2	1294/50.9
1359/53.5	1424/56.1	1444/56.9
1509/59.4	1574/62.0	1594/62.8
1659/65.3	1724/67.9	1744/68.7
1809/71.2	1874/73.8	1894/74.6

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safety light curtains



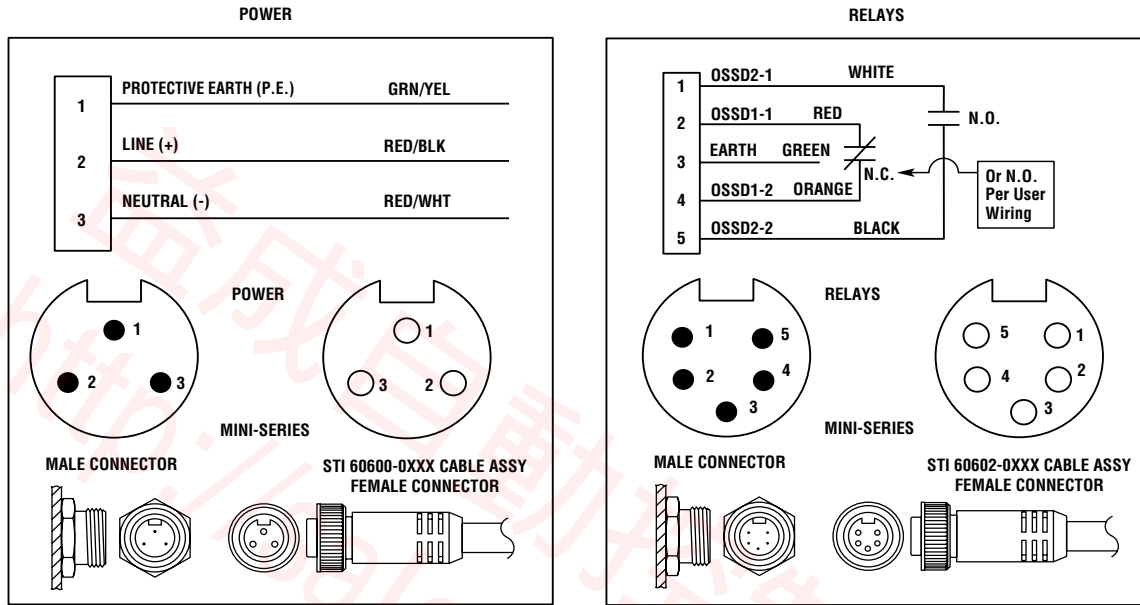
■ Dimensions of Metal Enclosure—mm/in.



A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ **Input Power and Safety Output Connection**

The MS4600-TB comes standard with a mini (3-pin) for power and a mini (5-pin) for safety outputs.



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 safety light curtains

MS4600 Three-Box System

■ Ordering

To order a MiniSafe MS4600 three-box series system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

$\underline{\quad}$ -30 - $\underline{\quad}$ - $\underline{\quad}$ X - $\underline{\quad}$ R
 ① ② ③ ④

Remember that all MS4600 three-box systems include the following components with the features listed below:

- **Controller:** Two force-guided, safety relay outputs; one auxiliary relay output; exact channel select; floating blanking; MPCE monitoring; two-digit diagnostic display; quick disconnect transmitter and receiver cables; quick disconnect connections for power and safety outputs (optional); IP65 metal enclosure with hasp for user supplied lock.
- **Transmitter and Receiver (coverage height specified below):** 1.2 inch (30 mm) resolution; Individual Beam Indicators on receiver; quick-disconnect, in-line cable connections; adjustable mounting brackets.
- **Cables (length specified below):** Quick-disconnect connections on both ends.

① Information required. Indicates presence or absence of a run/start switch or a connector for user to wire a remote run/start switch.

Designator	Description
MS46TB	Run/Start switch not supplied.
MS46TBK	Lid-mounted run/start switch installed.

② Information required. Represents coverage heights of the light curtain in millimeters.

Designator	Coverage Height
150	159 mm (6.3 in.)
300	309 mm (12.2 in.)
450	459 mm (18.1 in.)
600	609 mm (24.0 in.)
750	759 mm (29.9 in.)
900	909 mm (35.8 in.)
1050	1059 mm (41.7 in.)
1200	1209 mm (47.6 in.)
1350	1359 mm (53.3 in.)
1500	1509 mm (59.4 in.)
1650	1659 mm (65.3 in.)
1800	1809 mm (71.2 in.)

③ Information required. Represents transmitter (X) and receiver (R) cable length. Designators and descriptions are given below.

Designator	Description
5	5 m (17 ft.)
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)

Note: Quick disconnect connectors for power and safety outputs are available (optional).



For information on safety light curtain accessories, see page D184

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Go to the Engineering Guide
For in-depth information on safety standards and use.



■ Safety Standards and Precautions

All models of the MiniSafe meet ANSI/RIA R15.06-1999, ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MiniSafe meets ANSI control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MiniSafe systems employing controllers have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MiniSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MiniSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

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safety light curtains



■ Description

Designed for use in explosive environments, an MS4600-EP system consists of a transmitter and receiver of equal height housed in an explosion-proof enclosure. Since the control reliable circuitry is contained in the receiver and transmitter, no separate control box is required.

The MS4600-EP comes with a complete feature set. Individual Beam Indicators are included to simplify alignment.

Two solid-state safety outputs provide 500 mA of current at 24 VDC.

The ability to select Automatic Start and Start/Restart Interlock modes means that the MS4600-EP can be configured for either point-of-operation or perimeter guarding.

Exact Channel Select allows the MS4600-EP detection zone to have permanently blocked beams. This is valuable if tooling or other machine parts must permanently obstruct a portion of the zone.

Floating Blanking is useful when process material or parts must transit through the detection zone. Floating Blanking allows up to two beams to be blocked anywhere in the zone.

Machine primary control element monitoring is required for control reliable safety. MPCE monitoring is built into the MS4600-EP rather than being required externally.

Explosion Proof

MiniSafe® MS4600-EP

- 14 mm (0.55 in.), 19 mm (0.75 in.) or 30 mm (1.18 in.) resolution
- 13.5 m (45 ft.) range
- Protected heights from 263 to 1219 mm (10.4 to 48 in.)
- Simple “two-box” design — no separate control box required
- No cable required between transmitter and receiver
- Two PNP safety outputs designed to directly switch machine primary control elements
- Individual Beam Indicators
- Available with one NPN or one PNP auxiliary output
- Exact Channel Select
- Floating Blanking
- Choice of operating modes
- MPCE monitoring

Options

- DeviceNet™ Interface
- Machine Test Signal (MTS)
- Auxiliary Outputs Alarm/Follow Mode

A Go to the Engineering Guide
For in-depth information on safety standards and use.

DeviceNet Option

This optional interface allows an MS4600-EP system to communicate non-safety related data across this popular fieldbus. As the de facto standard for fieldbus communications, DeviceNet is widely employed in the automotive, semiconductor and other industries.

Monitoring of a DeviceNet equipped light curtain provides the process control system with the following non-safety information: manufacturer; product name; operating mode; detection zone status; solid-state safety output status; signal strength; number of beams installed; number of beams selected; MPCE monitoring enabled/disabled; floating blanking active/inactive; exact channel select active/inactive; blanking pattern for exact channel select; receiver diagnostic codes; error codes and descriptions.

DeviceNet and the MiniSafe MS4600-EP provide a powerful automation solution.

MTS Option

Machine Test Signal (MTS) is an optional feature on the MS4600-EP series light curtain. MTS allows the machine control system to check for the proper operation of the light curtain safety outputs by simulating a beam blocked state on the transmitter.

Alarm/Follow Mode Option

The non-safety output can be configured (at the time of sale) to have either “alarm” or “follow” functionality. “Alarm” mode means that the non-safety outputs will be de-energized if the system is behaving normally and energized if the system is in a faulted/interlocked state and will remain this way until the condition is cleared. “Follow” mode mimics the status of the solid-state safety outputs, meaning they will be active when the system is in the machine run state and inactive when the system is in the machine stopped state.

Enclosure

- Integral cast mounting feet
- Ground-lug package
- Sandblasted natural finish
- Certifications:
 - Europe: ATEX Directive 94/9/EC Certificate Number DEMKO 04 ATEX 0322237U
 - North America: Class I, II & III, Div. 1 & 2
 - Canada: UL (FTRV7); Canadian Electrical Code: Class I, Groups C and D; Class II, Groups E, F & G (Ref. C22.2 No. 30-1991 and C22.2 No. 25-1966)
 - U.S.: UL (FTRV), NFPA 70/NEC: Class I, Groups C & D; Class II, Groups E, F & G; Class II Groups F & G Division II only

Applications

Industries such as chemicals, agriculture, waste water, printing, distilling, pharmaceuticals, and cosmetics have hazardous process locations.

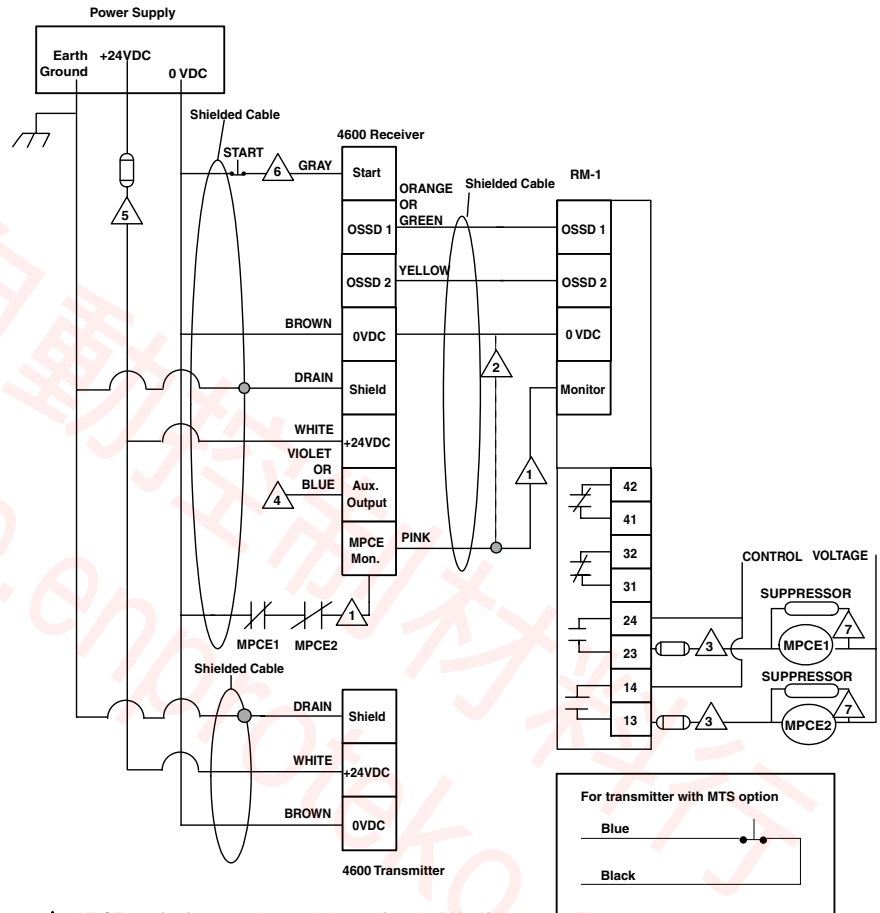


■ Using Solid-state Outputs

Extreme versatility is a feature of the solid-state outputs from the MiniSafe MS4600-EP. These outputs can be connected to an Omron STI RM-series relay module, a safety monitoring and control device, or in many cases, directly to the primary control element of the guarded machine.

Connecting Via an RM-1 Module

The Omron STI RM-1 module provides force-guided relay outputs for machine control. OSSD (safety) outputs 1 and 2 are connected to the RM-1 and provide the power necessary to energize its relays.

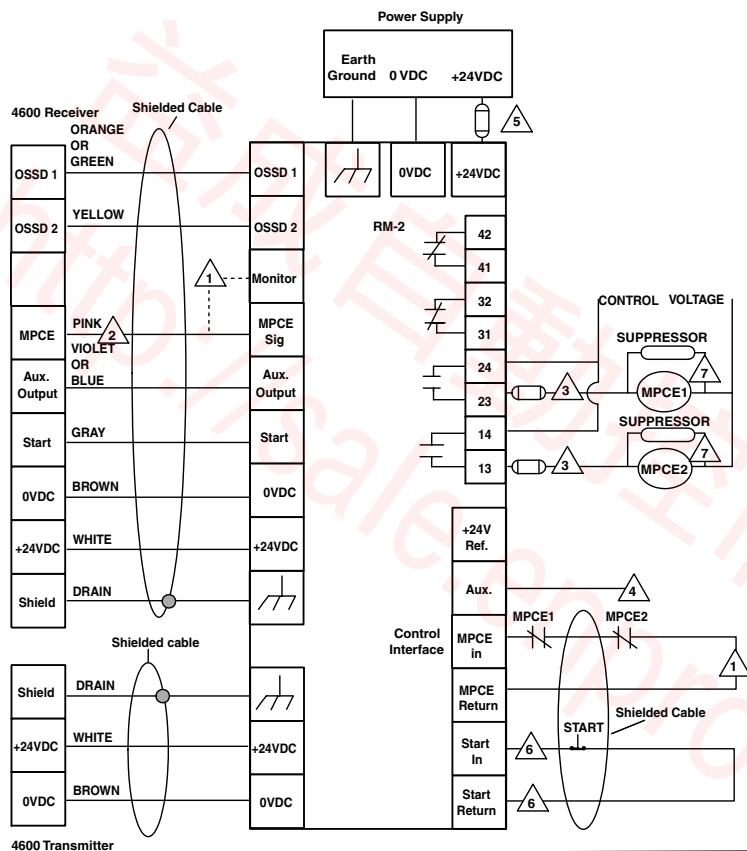


- ⚠ 1 MPCE monitoring must be used when using the RM1. If the RM1 is the Final Switching Device connect the Pink wire to the MONITOR terminal of the RM1. If force-guided control relays are used as Final Switching Devices they must be monitored, connect the Pink wire through N/C contacts to 0 VDC. (Do not connect both.)
- ⚠ 2 For testing prior to installation, the user may select MPCE OFF(default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0VDC line.
- ⚠ 3 User supplied over current protection, 6 A max.
- ⚠ 4 Auxiliary Output connect to PLC (optional)
- ⚠ 5 User-supplied fuse.
- ⚠ 6 If remote start is not used, connect the start line (grey wire) to 0 VDC.
- ⚠ 7 Verify that the final switching devices are properly suppressed.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

Connecting Via an RM-2 Module

The Omron STI RM-2 module provides force-guided relay outputs for machine control as well as a convenient location to terminate all outputs and inputs from the MS4600.



4600 Transmitter

① MPCE monitoring must be used when using the RM2. If the RM2 is the Final Switching Device connect the Pink wire to the MONITOR terminal of the RM2. If force-guided control relays are used as Final Switching Devices connect the Pink wire to the MPCE Sig. terminal. Then connect a set of N.C. contacts from MPCE1 and MPCE2 to the MPCE in and MPCE return terminals. (Do not connect both.)

For transmitter with MTS option

Blue

Black

- ② For testing prior to installation, the user may select MPCE OFF (default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0 VDC line.
- ③ User-supplied over current protection, 6 A max.
- ④ Auxiliary output-connect to PLC (optional).
- ⑤ User-supplied fuse.
- ⑥ If remote start is not used, install a jumper across the Start connections at the Control Interface terminals.
- ⑦ Verify that the final switching devices are properly suppressed.

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safety light curtains

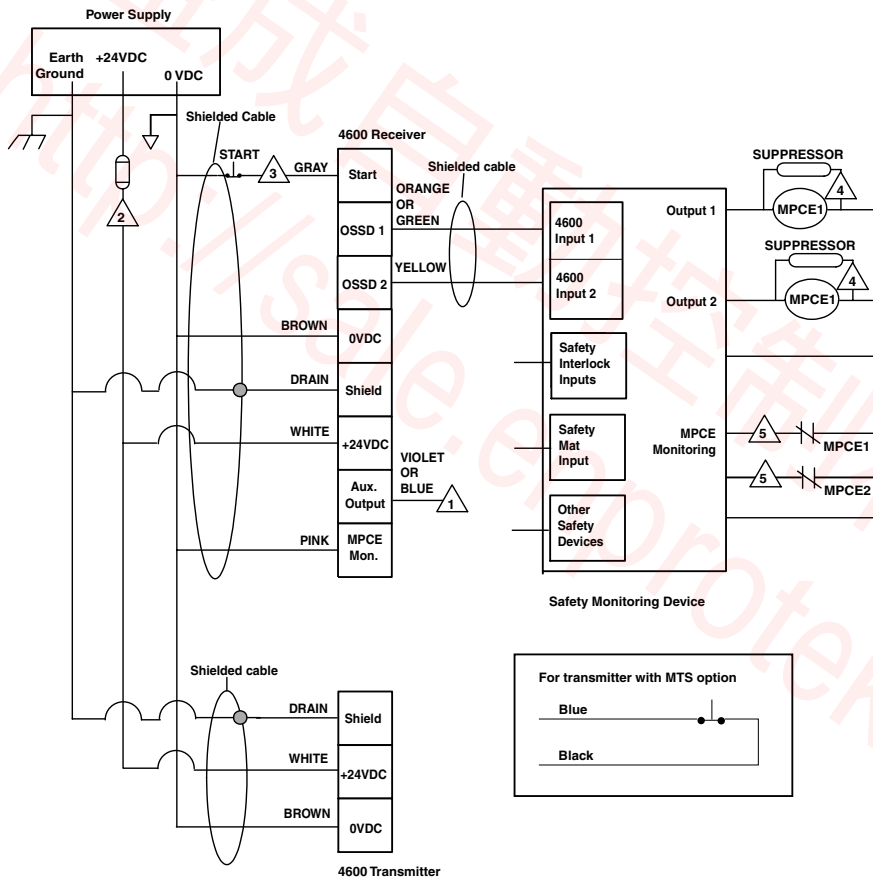
■ Using Solid-state Outputs (continued)

Connecting to a Safety Monitoring Device

The wiring from the MS4600 to the machine control circuit must be control reliable. Safety devices, such as the MS4600-EP should not depend on a PLC to stop a guarded machine. However, safety related monitoring devices are now available. Note that all safety inputs are directed to the monitoring device which also performs the MPCE monitoring function.

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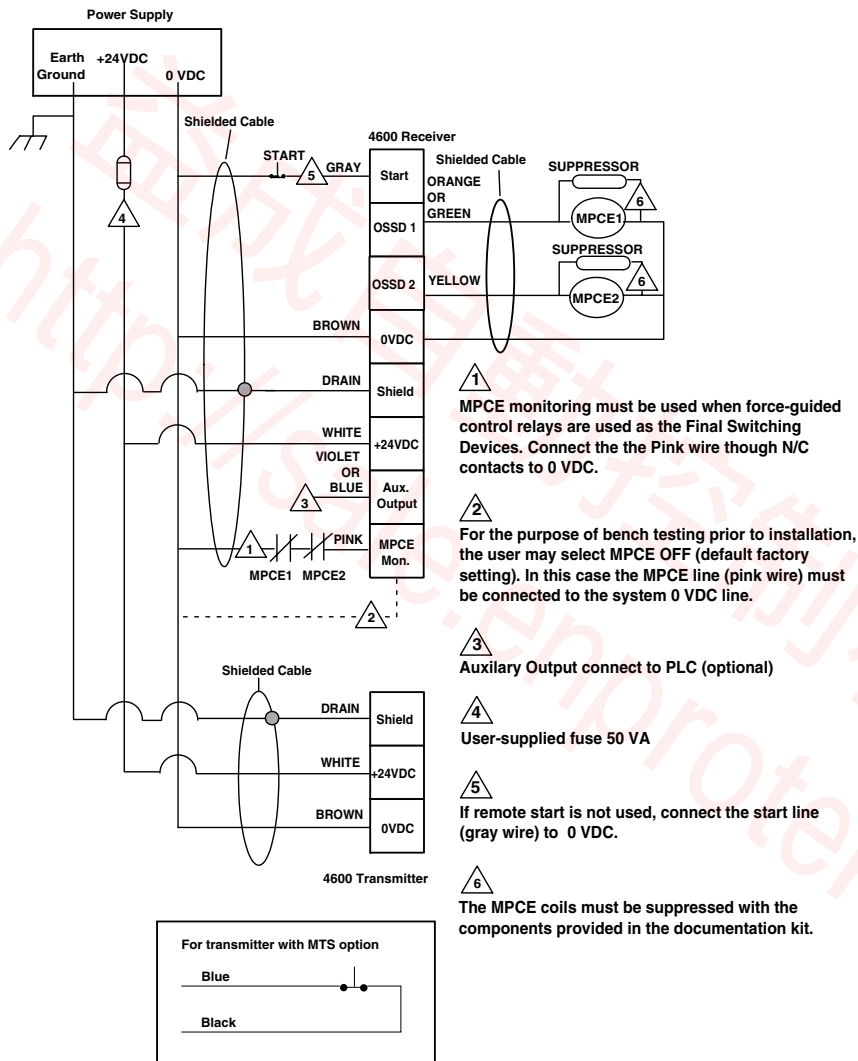


- ⚠️ 1 Auxiliary Output connect to PLC (optional)
- ⚠️ 2 User-supplied fuse.
- ⚠️ 3 If remote start is not used, connect the start line (grey wire) to 0VDC.
- ⚠️ 4 Verify that the final switching devices are properly suppressed.
- ⚠️ 5 The Safety Monitoring Device must monitor the MPCE's Normally Closed Contacts.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

Connecting Via Two Force-Guided Relays

FGR series relays provides force-guided outputs for machine control.



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safety light curtains

■ Specifications for Transmitter and Receiver

Performance	
Protected Height:	350 to 1219 mm (13.8 to 48.0 in.)
Operating Range:	0.3 to 13.5 m (1 to 45 ft.) for 19 mm and 30 mm resolutions (Not available for 14 mm resolution)
Resolution:	14 mm (0.55 in.), 19 mm (0.75 in.) or 30 mm (1.18 in.). Use of Exact Channel Select and/or Floating Blanking may increase this value.
Response Time (varies by protected height):	see tables at right
Input Voltage (V_{in}):	24 VDC \pm 20%
Input Power:	14 watts (without load on the outputs)
Safety Output Ratings:	Two PNP outputs sourcing 500 mA max @ V_{in} (see note 1). Short circuit protected.
Auxiliary (Non-Safety) Output Ratings:	One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)
Power Supply:	24 VDC \pm 20%. The rating depends on the current requirements of the loads attached to the outputs (see note 3). The power supply must meet the requirements of IEC 60204-1 and 61496-1. Omron STI part number 42992 or equivalent.
MPCE Monitoring Circuit:	50 mA steady state @ 24 VDC
Start/Restart Input Circuit:	20 mA @ 24 VDC
Effective Aperture Angle:	$\pm 2.5^\circ$ maximum, transmitter and receiver at operating range greater than 3 m (9.8 ft.).
Light Source:	GaAlAs Light Emitting Diode, 850 nm
Indicator – Transmitter:	power applied; Receiver: machine run, machine stop, interlock/fault; channel select/floating blanking, individual beam
Mechanical	
Enclosure:	Cast aluminum, 357-T6 Al alloy
Cable Length:	Optional cables are available in 10, 15, 30 and 50 m lengths
Cable Connections – Receiver:	8-pin; Transmitter: 3-pin standard, 5-pin with MTS
Environmental	
Protection Rating:	IP66; NEMA 3, 4, 4X, 7, 9 12
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	Tested in accordance with UL991 vibration specifications, Section 20, at 5 G peak vibration level, frequency range 5-60 Hz in 3 axes
Shock:	Tested to withstand shock resulting from a 3 ft. lb. impact detailed in UL991, Section 21
MS4600 Conformity/Approvals	
Conforms to:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212
Other Approvals:	The MS4600 system has been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. TUV Registration No: BB991007101. UL1998
Enclosure Certification	
Europe:	ATEX Directive 94/9/EC, Certificate Number DEMKO 04 ATEX 0322237U
North America:	Class I, II & III, Div. 1 & 2
Canada:	UL (FTRV7); Canadian Electrical Code: Class I, Groups C and D; Class II, Groups E, F & G (Ref. C22.2 No. 30-1991 and C22.2 No. 25-1966). UL listed.
U.S.:	UL (FTRV), NFPA 70/NEC: Class I, Groups C & D; Class II, Groups E, F & G; Class II Groups F & G Division II only. UL listed

Response Times for Systems With 14 mm and 20 mm Resolutions

Protected Height (mm/in.)	Response Time (seconds)
263/10.4	<0.020
350/13.8	<0.020

Response Times for Systems With 30 mm Resolutions

Protected Height (in./mm)	Response Time (seconds)
350/13.8	<0.020
524/20.6	<0.020
872/34.3	<0.020
1220/48.0	<0.025

Specifications are subject to change without notice.

Note 1: Voltage available at the outputs is equal to $V_{in} - 2.0$ VDC.

Note 2: Total current required by the two solid-state outputs and the aux. output should not exceed 1.1 A.

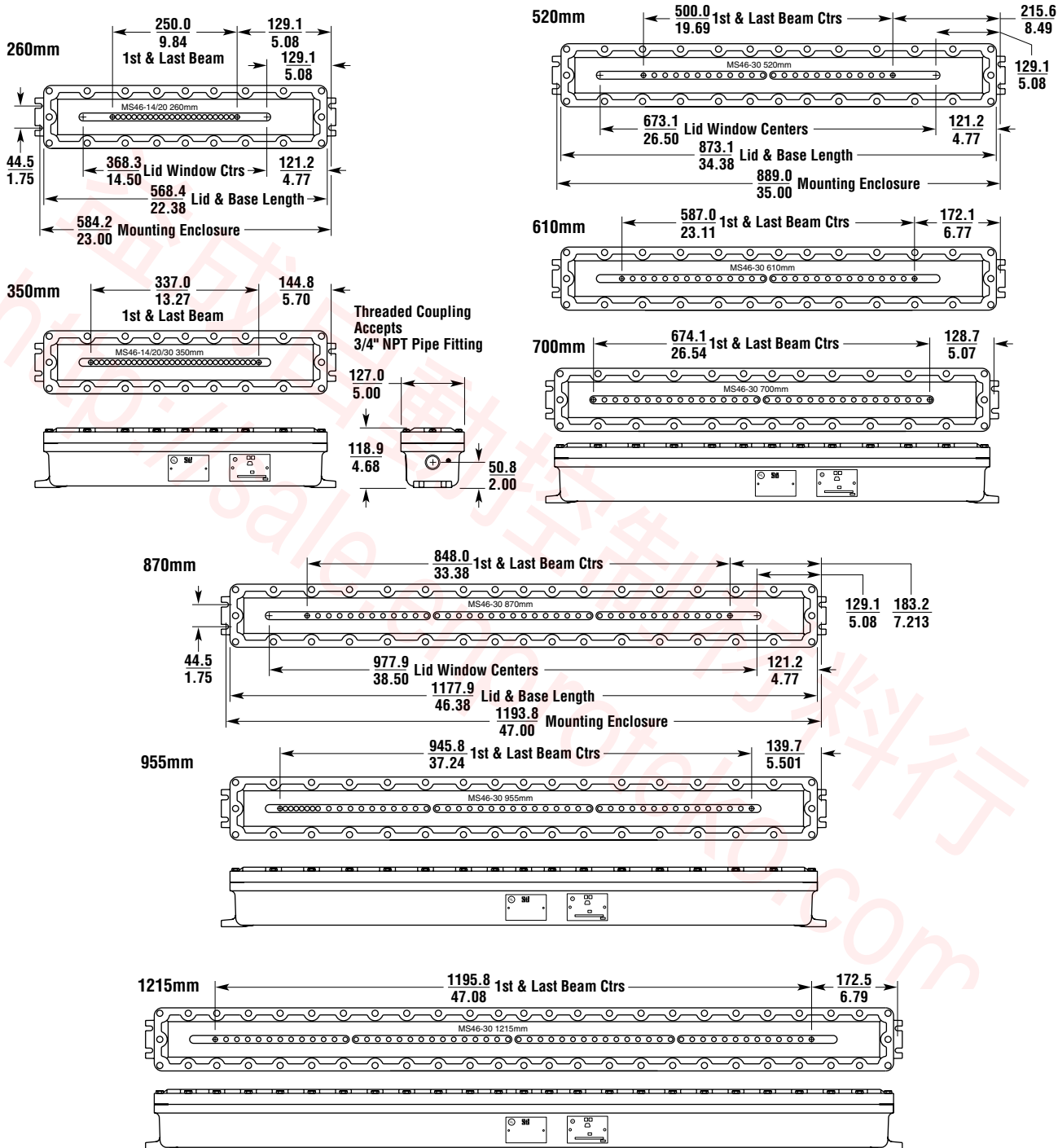
Note 3: Total system current requirement is the sum of the transmitter 285 mA and receiver 1.4 A max. (Receiver 300 mA + OSSD1 load + OSSD2 load + Aux. output load)



Go to the Engineering Guide
For in-depth information on safety standards and use.



■ Dimensions—mm/in.



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safety light curtains

MS4600-EP

Ordering a Complete System

To order an Explosion Proof MS4600-EP system, fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found below.

① - ② - ③ - ④ - ④ X* - ⑤ R* - ⑥ - ⑦ - ⑧ - ⑨ - ⑩

Example: MS46EPLR-30-520-10X-10R-NO-FN-M-RV-D-RM1

① Information required. Represents the system operating range. For applications where the transmitter and receiver will be mounted less than 6.3 m (20 ft.) or 5 m (16.5 ft.) apart (depending on resolution), please select the SR version.

Designator	Description
MS46EPLR	0.3 to 13.5 m (1 to 45 ft.) for 20 and 30 mm resolutions
MS46EPSR	0.3 to 6.3 m (1 to 20.5 ft.) for 20 and 30 mm resolutions; 0.3 to 5 m (1 to 16.5 ft.) for 14 mm resolutions

② Information required. Represents the minimum object resolution of the system.

Designator	Description
14	14 mm (0.55 in.)
20	19 mm (0.75 in.)
30	30 mm (1.18 in.)

③ Information required. Represents the coverage height of the detection zone.

14 & 20 mm Minimum Object Resolution Systems

Designator	Description
260	263 mm (10.4 in.)
350	350 mm (13.8 in.)

30 mm Minimum Object Resolution Systems

Designator	Description
350	350 mm (13.8 in.)
520	524 mm (20.6 in.)
610	611 mm (24.1 in.)
700	698 mm (27.5 in.)
870	872 mm (34.3 in.)
955	959 mm (37.7 in.)
1215	1220 mm (48.0 in.)

④ Information required. Represents transmitter (X) and receiver (R) cable length. Cables can be shortened in the field.

Designator	Description
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)
50	50 m (164 ft.)

⑤ Information required. Represents the start/restart input type.

Designator	Description
NC	Normally closed
NO	Normally open

⑥ Information required. Indicate the Auxiliary output configuration.

Designator	Description
FN	NPN output follow solid-state safety outputs
FP	PNP output follow solid-state safety outputs
AN	NPN output operate only in Alarm status
AP	PNP output operate only in Alarm status

⑦ Information optional. Indicate optional MTS on transmitter.

Designator	Description
M	Include MTS
(Blank)	No MTS

⑧ Information optional. Indicate optional DeviceNet interface.

Designator	Description
RV	DeviceNet Installed
(Blank)	No DeviceNet

⑨ Information optional. Indicate optional DeviceNet cable.

Designator	Description
D	6 m (20 ft.) Cable
(Blank)	No DeviceNet Cable

⑩ Information optional. Indicate optional RM resource module.

Designator	Description
RM1	Include RM-1 Resource Module
RM2	Include RM-2 Resource Module
RM2A	Include RM-2AC Resource Module
RM2AP	Include RM-2AC-IP Resource Module, IP65 metal enclosure
(Blank)	Do not include Resource Module

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safety light curtains

 For information on Resource Modules, see page D138

 For information on safety light curtain accessories, see page D184

 Go to the Engineering Guide For in-depth information on safety standards and use.

Installation Notes

Because explosion-proof housings offer a smaller range of adjustment than standard Omron STI mounting brackets, the installation and alignment of transmitters and receivers is a process requiring attention to detail. The mounting lugs of the enclosures each have two adjustment screws which, when the enclosure is mounted against a hard, flat surface, allow a small amount of rotational adjustment.

Transmitter, Receiver and DeviceNet Cable Warning

Transmitter, receiver and DeviceNet cables supplied for use with MS4600-EP model light curtains are not explosion-proof. It is the responsibility of the purchaser, installer and employer to enclose these cables in appropriate explosion-proof conduit to ensure the integrity of the system.

Hybrid Systems

An application may exist where it is not necessary for the entire light curtain system to be in the hazardous area. In this case, hybrid systems which combine both explosion-proof and standard components are available. Contact Omron STI for details.

*When ordering a hybrid system, specify which component is to be explosion-proof (transmitter or receiver) by adding "EP" after the "X" or "R" in Step 4 of ordering.

EXAMPLE:

MS46EP-20-520-10X-15REP-FN-M-RV-D-RM1

Safety Standards and Precautions

All models of the Explosion-Proof MS4600-EP meet ANSI/RIA R15.06-1999 and ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MS4600-EP series meets ANSI control reliability requirements for point-of-operation presence sensing devices.

MS4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE.

The MS4600-EP should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MS4600-EP on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

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safety light curtains

MS4700 and MSF4700

Rev. 11.07

D
safety light curtains

■ Description

The MiniSafe MS4700 simple three-box light curtain system is unique due to its superior response time – as fast as 8 msec –with excellent resolution of 12 mm. This speed and resolution allow this light curtain to be mounted closer to points of hazardous operation.

The MiniSafe MS4700 and MSF4700 series consists of an identical length transmitter and receiver, combined with an LCM series controller and appropriate interconnecting cables. (Multi-segmented versions are also available. The in-line connector cables allow the mounting of the transmitter and receiver in crowded locations where a standard connector would not fit. The controller end of the cable is not terminated, which allows the length to be easily shortened in the field.

For easy alignment, the MiniSafe features Omron STI's patented Individual Beam Indicator lights.

■ Applicable Controllers

The LCM series controller includes virtually every desirable safety light curtain feature. The only option available is a DeviceNet™ interface.

The MiniSafe MS4700 and MSF4700 series systems have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

- Rugged transmitter and receiver—35 x 50 mm (1.4 x 2.0 in.)
- Excellent resolutions of 12 mm (0.47 in.), 14 mm (0.55 in.), 20 mm (0.79 in.), and 30 mm (1.2 in.)
- Protected heights from 100 to 1800 mm (3.9 to 71.2 in.)
- Compact size: 35 x 50 mm (1.4 x 2 in.)
- Individual Beam Indicators
- In-line connector cables
- Adjustable mounting brackets
- Exact Channel Select and Floating Blanking
- Available outputs:
 - 2 PNP safety outputs
 - 1 N.O. and 1 N.O./N.C. safety relay outputs

- 2 auxiliary outputs (1 NPN, 1 PNP), follow or alarm mode
- Auxiliary relay output (1 N.O. and 1 N.C.) follow or alarm mode

- Choice of operating modes:
 - Automatic start
 - Restart interlock
 - Start/restart interlock
- MPCE monitoring
- Two-digit diagnostic display
- Simple 3-box design

Options

- DeviceNet™ Interface
- Multiple stored channel select patterns (non-CE versions)
- Muting through RM-3

A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ DeviceNet Option

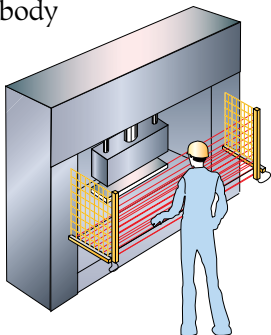
DeviceNet™ allows the LCM series controller to communicate non-safety related data across this popular fieldbus. As the de facto standard for factory fieldbus communications, DeviceNet™ is widely employed in the automotive, semiconductor and other industries.

Monitoring of the DeviceNet™ equipped light curtain provides the process control system with the following *non-safety* information: manufacturer; product name; operating mode; detection zone status; safety output status; MPCE monitoring enabled/disabled; floating blanking active/inactive; exact channel select active/inactive; transmitter, receiver, controller, and relay faults; error codes and descriptions.

DeviceNet™ and the LCM series controller provide a powerful automation solution.

■ Application

In this application, two rugged sets of MiniSafe Flexible series transmitters and receivers form an L-shaped guard zone. Should the machine operator penetrate the vertical segment, a stop signal will be sent to the guarded machine. The horizontal segment guards the operator should he attempt to place his body between the vertical segment and the point of hazardous operation.



■ Specifications for Transmitter and Receiver

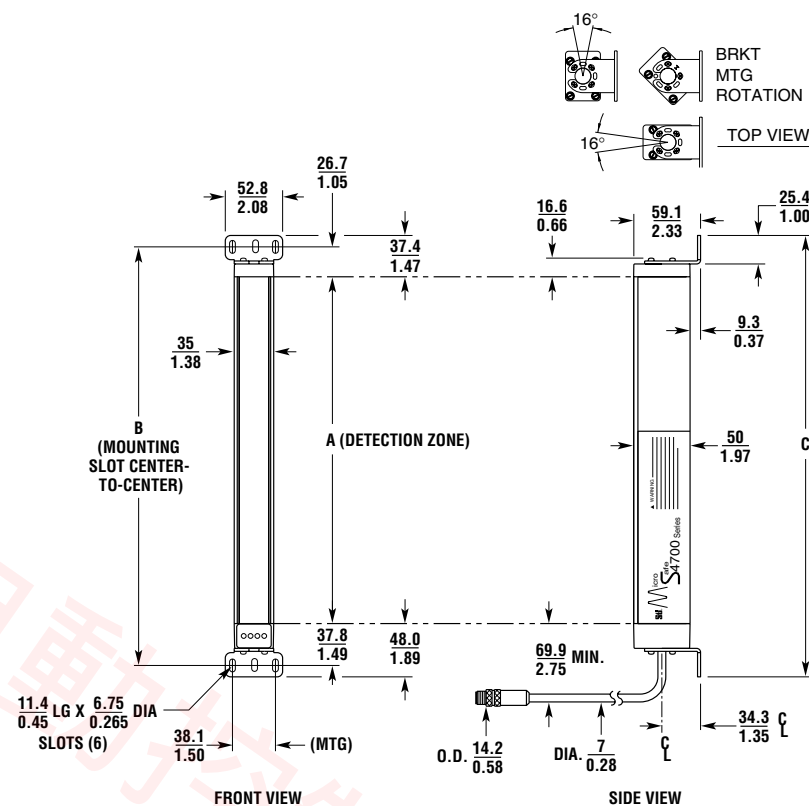
Performance	
Protected Height:	12 mm — 100 to 1600 mm (3.9 to 62.9 in.) 14 mm — 150 to 1809 mm (5.9 to 71.2 in.) 20 mm — 150 to 1809 mm (5.9 to 71.2 in.) 30 mm — 150 to 1809 mm (5.9 to 71.2 in.)
Operating Range:	MS47SR and MSF4700 12 mm — 0.2 to 3 m (0.7 to 10 ft.) (<i>not available on MSF4700</i>) 14 mm — 0.3 to 5 m (1 to 17 ft.) for MS47SR; 0.3 to 3 m (1 to 10 ft) for MSF4700 20 mm — 0.3 to 7 m (1 to 23 ft.) 30 mm — 0.3 to 7 m (1 to 23 ft.) MS47LR 12 mm — 0.2 to 5 m (0.7 to 17 ft.) 20 mm — 0.3 to 12 m (1 to 39 ft.) 30 mm — 0.3 to 12 m (1 to 39 ft.)
Resolution:	12 mm — 0.47 in.* 14 mm — 0.55 in.* 20 mm — 0.79 in.* 30 mm — 1.2 in.*
* Use of exact channel select and or floating blanking may increase this value.	
Effective Aperture Angle:	±2.5° transmitter and receiver
Light Source:	850 nm LED
Light Source Life:	100,000 hours
Indicators:	Channel select or float blanking – yellow; Interlock or fault – yellow; Machine stop – red; Individual beam indicators – red; Machine run – green
Mechanical	
Enclosure:	IP65 transmitter and receiver enclosure only. Polyurethane powder-painted aluminum yellow 3.
Cable Length:	Transmitter – maximum 30 m (100 ft.); standard 3 m (10 ft.) Receiver – maximum 30 m (100 ft.); standard 3 m (10 ft.)
Cable Connections:	Circular style, 6 conductor for transmitter, 9 conductor for receiver
Environmental	
Protection Rating:	IP65; NEMA 4, 12 transmitter and receiver only, IP20 or IP65 controller
Operating Temperature:	0 to 55°C (32 to 133°F)
Storage Temperature:	-25 to 75°C (-13 to 167°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	5–60 Hz maximum on all 3 axes
Shock:	10 g for 0.016 seconds; 1,000 shocks for each axes on two axes
Conformity/Approvals	
Approvals:	IEC61496
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.27(c), OSHA 1910.212
Other Approvals:	EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC61496), UL listed.

Specifications are subject to change without notice.

MS4700 and MSF4700

■ Dimensions—mm/in.

MS4700 Dimensions



D

safety light curtains

This drawing is available in CAD format at www.sti.com/curtains/MS4700/

For dimensions on the LCM Series Controller, see page D106

MiniSafe MS4700 Dimensions

MS4700-12		
A mm/in.	B mm/in.	C mm/in.
102/4.0	167/6.6	187/7.4
202/8.0	267/10.5	287/11.3
302/11.0	367/14.4	387/15.2
402/15.8	467/18.4	487/19.2
502/19.8	567/22.3	587/23.1
602/23.7	667/26.3	687/27.0
702/27.6	767/30.2	787/31.0
802/31.6	867/34.1	887/34.9
902/35.5	967/38.1	987/38.9
1002/39.5	1067/42.0	1087/42.8
1102/43.4	1167/45.9	1187/46.7
1202/47.3	1267/49.9	1287/50.7
1302/51.3	1367/53.8	1387/54.6
1402/55.2	1467/57.8	1487/58.5
1502/59.1	1567/61.7	1587/62.5
1602/63.1	1667/65.6	1687/66.4

MS4700-14 and MS4700-20		
A mm/in.	B mm/in.	C mm/in.
159/6.3	224/8.8	244/9.6
235/9.3	300/11.8	320/12.6
309/12.2	374/14.7	394/15.5
385/15.2	450/17.7	470/18.5
459/18.1	524/20.6	544/21.4
535/21.1	600/23.6	620/24.4
609/24.0	674/26.5	694/27.3
685/27.0	750/29.5	770/30.3
759/29.9	824/32.4	844/33.2
835/32.9	900/35.4	920/36.2
909/35.8	974/38.3	994/39.1
985/38.9	1050/41.3	1070/42.1
1059/41.7	1124/44.3	1144/45.0
1135/44.7	1200/47.2	1220/48.0
1209/47.6	1274/50.2	1294/50.9
1285/50.6	1350/53.1	1370/53.9
1359/53.5	1424/56.1	1444/56.9
1435/56.5	1500/59.1	1520/59.8
1509/59.4	1574/62.0	1594/62.8
1585/62.4	1650/65.0	1670/65.7
1659/65.3	1724/67.9	1744/68.7
1735/68.3	1800/70.9	1820/71.7
1809/71.2	1874/73.8	1894/74.6

MS4700-30		
A mm/in.	B mm/in.	C mm/in.
159/6.3	224/8.8	244/9.6
309/12.2	374/14.7	394/15.5
459/18.1	524/20.6	544/21.4
609/24.0	674/26.5	694/27.3
759/29.9	824/32.4	844/33.2
909/35.8	974/38.3	994/39.1
1059/41.7	1124/44.3	1144/45.0
1209/47.6	1274/50.2	1294/50.9
1359/53.5	1424/56.1	1444/56.9
1509/59.4	1574/62.0	1594/62.8
1659/65.3	1724/67.9	1744/68.7
1809/71.2	1874/73.8	1894/74.6

A Go to the Engineering Guide For in-depth information on safety standards and use.

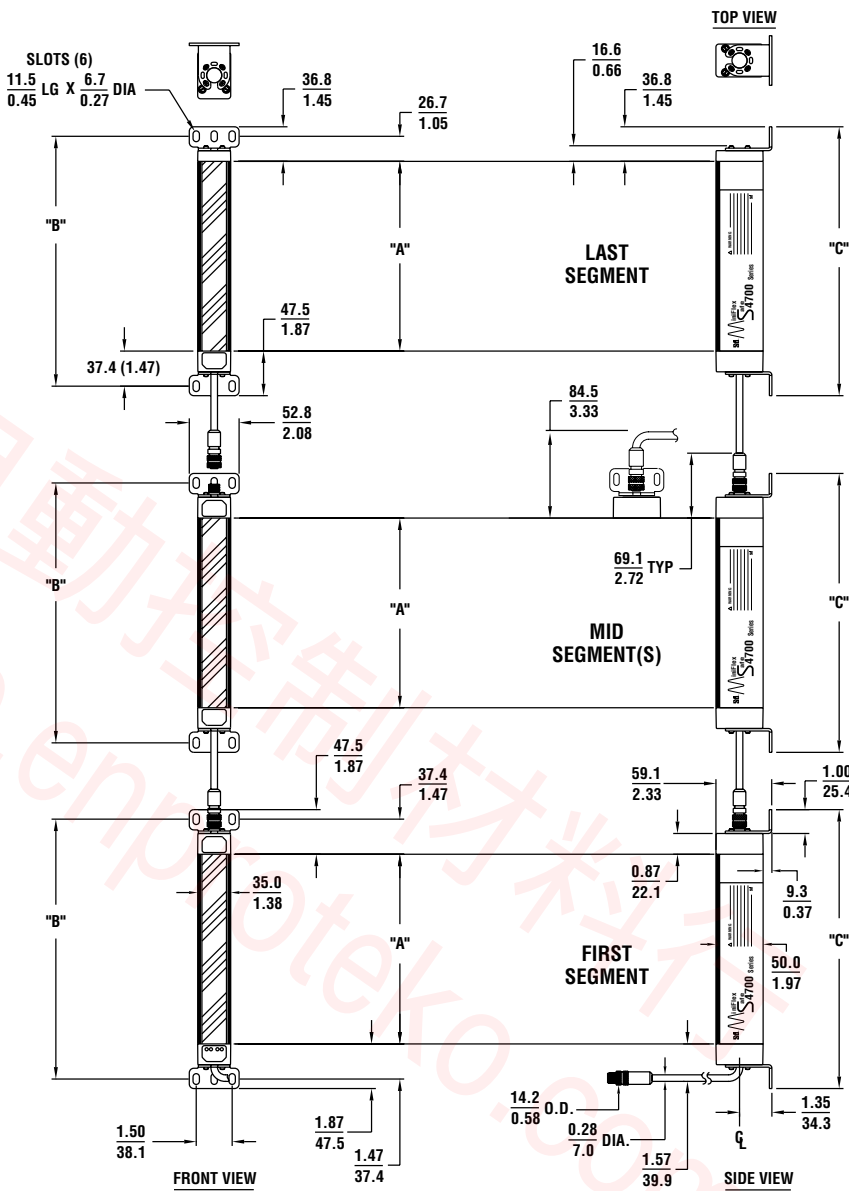
MS4700 and MSF4700

MSF4700 Dimensions

 For dimensions on the LCM Series Controller, see page D106

MiniSafe Flexible MSF4700 Dimensions

MSF4700-14	MSF4700-20	MSF4700-30
A mm/in.	A mm/in.	A mm/in.
159/6.3	159/6.3	159/6.3
235/9.3	309/12.2	309/12.2
309/12.2	459/18.1	459/18.1
385/15.2	609/24.0	609/24.0
459/18.1	759/29.9	759/29.9
535/21.1	909/35.8	909/35.8
609/24.0	1059/41.7	1059/41.7
685/27.0	1209/47.6	1209/47.6
759/29.9	1359/53.5	1359/53.5
835/32.9	1509/59.41	1509/59.41
909/35.8	1659/65.3	1659/65.3
985/38.8	1809/71.2	1809/71.2
1059/41.7		
1135/44.7		
1209/47.6		
1285/50.6		
1359/53.5		
1435/56.5		
1509/59.41		
1585/62.4		
1659/65.3		
1735/68.3		
1809/71.2		



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safety light curtains

DIMENSIONS: $\frac{\text{mm (+/-0.3)}}{\text{INCHES (+/-0.01)}}$

LAST SEGMENT	MID SEGMENT(S)	FIRST SEGMENT
A = DETECTION ZONE	A = DETECTION ZONE	A = DETECTION ZONE
$B = A + \frac{64.1 \pm 5.0}{2.53 \pm 0.20}$	$B = A + \frac{74.8 \pm 5.0}{2.95 \pm 0.20}$	$B = A + \frac{74.8 \pm 5.0}{2.95 \pm 0.20}$
$C = A + \frac{84.3}{3.32}$	$C = A + \frac{95.0}{3.74}$	$C = A + \frac{95.0}{3.74}$



MS4700 and MSF4700

■ Ordering

To order a MiniSafe MS4700 or MSF4700 system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

 For specifications and dimensions on the LCM Series Controller, see page D106

MS4700 Sequence:

$\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ X - $\underline{\quad}$ R - $\underline{\quad}$
 ① ② ③ ④ ⑤ ⑤ ⑦

Example: MS47-12-300-LCM1-10X-10R-RM1

This standard MiniSafe system has 12 mm (0.47 in.) minimum object resolution, a 300 mm (13.78 in.) coverage height, an LCM-1 controller, 10 m transmitter and receiver cables, and an RM-1 relay output module.

MSF4700 Sequence:

$\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ - $\underline{\quad}$ X - $\underline{\quad}$ R - $\underline{\quad}$ XI - $\underline{\quad}$ RI - $\underline{\quad}$
 ① ② ③ ② ③ ② ③ ④ ⑤ ⑤ ⑥ ⑥ ⑦

Example:

MSF47-20300-30900-20300-LCM1-10X-10R-030100XI-030100RI-RM1

This system has a 30 mm minimum object resolution and 309 mm long first segment, 30 mm minimum object resolution and 909 mm long middle segment and a 20 mm minimum object resolution and 309 mm long last segment, an LCM1 controller, 10 m transmitter and receiver cables, a 3 m and a 10 m interconnect transmitter and receiver cables, and an RM-1 relay output module.

D safety light curtains

A Go to the Engineering Guide
For in-depth information on safety standards and use.

① Information required. Represents the system operating range. Operating range is based on the minimum object resolution of the system. Designators are described below.

Designator	Description
MS47SR	Range based on minimum object resolution of the system. 12 mm—0.2 to 3 m (0.7 to 10 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart.</i> 14 mm—0.3 to 5 m (1 to 17 ft.). 20 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i> 30 mm—0.3 to 7 m (1 to 23 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart.</i>
MS47LR	Range based on minimum object resolution of the system. 12 mm—0.2 to 5 m (0.7 to 17 ft.). <i>For applications where the transmitter and receiver will be mounted less than 3 m (9.9 ft.) apart, please select the SR version above.</i> 20 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SR version above.</i> 30 mm—0.3 to 12 m (1 to 39 ft.). <i>For applications where the transmitter and receiver will be mounted less than 7 m (23 ft.) apart, please select the SR version above.</i>
MSF47	Range based on minimum object resolution of the system. Heavy-duty flexible system 14 mm—0.3 to 3 m (1 to 10 ft.). 20 mm or 30 mm—0.3 to 7 m (1 to 23 ft.).

② Information required. Represents the minimum object resolution of the light curtain in millimeters. For the MSF 4700, it is possible to order different object resolutions for each pair of segments. Designators are described below.

Designator	Minimum Object Resolution
12*	12 mm (0.47 in.)
14	14 mm (0.55 in.)
20	20 mm (0.79 in.)
30	30 mm (1.18 in.)

*Not available on MSF4700

③ Information required. Represents coverage heights of the light curtain in millimeters. Coverage

heights available are a function of minimum object resolution. Designators are described below and divided into two sections, those for 12 mm resolutions, those for 14, 20 & 30 mm resolutions.

MSF4700 Information: The MSF4700 series must have a minimum of two segments: one first and one end. It is possible to order a different object resolution for each pair of segments. Up to two middle segments can be added. The total protected height of a system cannot exceed 256 beams or 3450 mm (135.8 in.). Combine the designators given here to complete fields ② and ③ in the model sequence.

12 mm Minimum Object Resolution Systems*

Designator	Coverage Height
100*	102 mm (4.0 in.)
200*	202 mm (8.0 in.)
300*	302 mm (11.9 in.)
400*	402 mm (15.8 in.)
500*	502 mm (19.8 in.)
600*	602 mm (23.7 in.)
700*	702 mm (27.6 in.)
800*	802 mm (31.6 in.)
900*	902 mm (35.5 in.)
1000*	1002 mm (39.5 in.)
1100*	1102 mm (43.4 in.)
1200*	1202 mm (47.3 in.)
1300*	1302 mm (51.3 in.)
1400*	1402 mm (55.2 in.)
1500*	1502 mm (59.1 in.)
1600*	1602 mm (63.1 in.)

*Not available on MSF4700

14 mm, 20 mm and 30 mm Minimum Object Resolution Systems

Designator	# Beams	Coverage Height
150	14	159 mm (6.3 in.)
225**	21	235 mm (9.3 in.)
300	28	309 mm (12.2 in.)
375**	35	385 mm (15.2 in.)
450	42	459 mm (18.1 in.)
525**	49	535 mm (21.1 in.)
600	56	609 mm (24.0 in.)
675**	63	685 mm (27.0 in.)
750	70	759 mm (29.9 in.)
825**	77	835 mm (32.9 in.)
900	84	909 mm (35.8 in.)
975**	91	985 mm (38.8 in.)
1050	98	1059 mm (41.9 in.)
1125**	105	1135 mm (44.9 in.)
1200	112	1209 mm (47.6 in.)
1275**	119	1285 mm (50.6 in.)
1350	126	1359 mm (53.3 in.)
1425**	133	1435 mm (56.5 in.)
1500	140	1509 mm (59.4 in.)
1575**	147	1585 mm (62.4 in.)
1650	154	1659 mm (65.3 in.)
1725**	161	1735 mm (68.3 in.)
1800	168	1809 mm (71.2 in.)

**Not available in 30 mm resolution

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safety light curtains

MS4700 and MSF4700

■ Ordering (continued)

④ Information required. Represents controller version. Designators and descriptions are given below.

Designator	Description
LCM1	DIN-mount, IP20, solid-state safety output, 24 VDC
LCM2	DIN-mount, IP20, solid-state safety output, 24 VDC, DeviceNet interface
LCM3	DIN-mount, IP20, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM100	Metal enclosure, IP65, relay safety output, 100-230 VAC
LCM200	Metal enclosure, IP65, relay safety output, 100-230 VAC, DeviceNet interface
LCM300	Metal enclosure, IP65, relay safety output, 100-230 VAC, non-CE-marked, multiple stored channel select patterns
LCM110	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch
LCM210	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, DeviceNet interface
LCM310	Metal enclosure, IP65, relay safety output, 100-230 VAC, lid-mounted reset switch, non-CE mark, multiple stored channel select patterns
LCM120	Metal enclosure, IP65, solid-state safety output, 24 VDC
LCM220	Metal enclosure, IP65, solid-state safety output, 24 VDC, DeviceNet interface
LCM320	Metal enclosure, IP65, solid-state safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM130	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch
LCM230	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM330	Metal enclosure, IP65, solid-state safety output, 24 VDC, lid-mounted reset switch, non-CE mark, multiple stored channel select patterns
LCM140	Metal enclosure, IP65, relay safety output, 24 VDC
LCM240	Metal enclosure, IP65, relay safety output, 24 VDC, DeviceNet interface
LCM340	Metal enclosure, IP65, relay safety output, 24 VDC, non-CE-marked, multiple stored channel select patterns
LCM150	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch
LCM250	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, DeviceNet interface
LCM350	Metal enclosure, IP65, relay safety output, 24 VDC, lid-mounted reset switch, non-CE mark, multiple stored channel select patterns

Note: For more configurations with quick-disconnect connectors refer to the LCM controller section.

⑤ Information required. Represents transmitter (X) and receiver (R) cable lengths. Designators and descriptions are given below.

Designator	Description
3	3 m (10 ft.)
10	10 m (33 ft.)
30	30 m (99 ft.)

⑥ Information required for MSF4700 only. Represents transmitter and receiver interconnect cable lengths. The MSF4700 Series segments feature an in-line connector cable design. A flexible 150 mm (6 in.) cable is always supplied between each segment. Length of interconnect cables given below are in addition to this standard cable. The maximum cumulative system length, including the cables is 15 m (49 ft.) for the transmitter and 15 m (49 ft.) for the receiver. The transmitter and receiver interconnect cable lengths do not need to match.

Combine the designators listed below to complete both fields numbered ⑥ in the example.

The combination for a three-segment system might look like 030. This means that the system uses only the standard 150 mm (6 in.) cables between two of the segments and a 3 m (10 ft.) interconnect cable between the other segments.

Designator	Interconnect Cable
(Blank)	Standard 150 mm (6 in.)
003	0.3 m (12 in.)
005	0.5 m (20 in.)
010	1 m (3.3 ft.)
020	2 m (6.6 ft.)
030	3 m (10 ft.)
050	5 m (16 ft.)
100	10 m (33 ft.)

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For in-depth information on
safety standards and use.

⑦ Information optional. Indicate if you would like an Omron STI RM Series resource module.

Designator	Description
RM1	Include RM-1 resource module, force-guided relay output
RM3	Include RM-3 resource module, mute module
RM4	Include RM-4 resource module, allow for wiring up to four MC4700 systems
RMX	Include RM-X resource module
(Blank)	No RM series resource module



For information on Resource Modules, see page D138



For information on safety light curtain accessories, see page D184

Safety Standards and Precautions

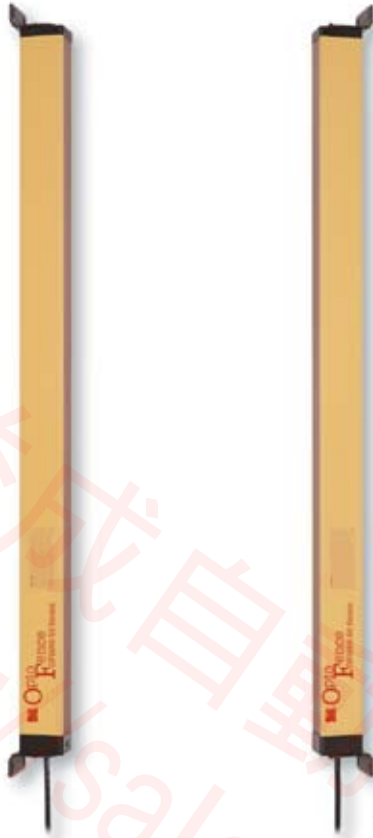
All models of the MiniSafe meet ANSI/RIA R15.06-1999, ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply, as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The MiniSafe meets ANSI control reliability requirements for point-of-operation presence sensing devices. All controllers have CSA-CUS acceptance and are designed to meet UL508.

MiniSafe systems employing LCM-1 controllers (except those with the ability to store multiple channel select patterns) have been EC type examined to the requirements of category 4, EN 954-1 (type 4, IEC 61496).

The MiniSafe should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a MiniSafe on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.



■ Description

An OptoFence OF4600-50 system consists of a transmitter and receiver of equal height. Since the control reliable circuitry is contained in the receiver and transmitter, no separate control box is required.

Despite its compact dimensions, the OF4600-50 comes with a complete feature set. Individual Beam Indicators are included to simplify alignment. When an infrared beam is out of alignment, the corresponding Individual Beam Indicator will glow red.

Two solid-state safety outputs provide 500 mA of current at 24 VDC.

The ability to select the Start/Restart Interlock operating mode means that the OF4600-50 is ideal for perimeter guarding applications.

Exact Channel Select allows the OF4600-50 detection zone to have permanently blocked beams. This is valuable if tooling or other machine parts must permanently obstruct a portion of the zone. Exact Channel Select programming is as easy as pushing a button.

Floating Blanking is useful when process material or parts must transit through the detection zone. Floating Blanking allows up to two beams to be blocked anywhere in the zone.

Machine primary control element monitoring is required for control reliable safety. MPCE

OptoFence®

OF4600-50

- Resolution: 53 mm (2.09 in.)
 - Range: 20 m (65 ft.)
 - Six protected heights available: 700 mm (27 in.), 1046 mm (41 in.), 1394 mm (55 in.), 1741 mm (69 in.), 2090 mm (82 in.), and 2445 mm (96 in.)
 - Compact size — 35 x 50 mm (1.4 x 2 in.)
 - Simple “two-box” design — no separate control box required
 - No cable required between transmitter and receiver
 - Two PNP safety outputs designed to directly switch machine primary control elements
 - Individual Beam Indicators
 - Available with one NPN or one PNP auxiliary output
 - Exact Channel Select
 - Floating Blanking
 - Choice of operating modes
 - MPCE monitoring
 - In-line connector cables
 - Adjustable mounting brackets
- Options**
- DeviceNet™ Interface
 - MTS (Machine Test Signal)
 - Alarm/Follow Mode for auxiliary output
 - Versions available for darkroom applications (940 nm) — consult factory
 - Muting through RM-3 module

A Go to the Engineering Guide
For in-depth information on
safety standards and use.

monitoring is built into the OF4600-50 rather than being required externally.

In-line connector cables and adjustable mounting brackets allow the OF4600-50 to fit in space-constrained locations and simplify installation.

DeviceNet Option

This optional interface allows an OF4600-50 system to communicate non-safety related data across this popular fieldbus. As the de facto standard for fieldbus communications, DeviceNet is widely employed in the automotive, semiconductor and other industries.

Monitoring of a DeviceNet equipped light curtain provides the process control system with the following non-safety information: manufacturer; product name; operating mode; detection zone status; solid state safety status; signal strength; number of beams installed; number of beams selected; MPCE monitoring enabled/disabled; floating blanking active/inactive; exact channel select active/inactive; blanking pattern for exact channel select; receiver diagnostic codes; error codes and descriptions.

DeviceNet and the OptoFence OF4600-50 provide a powerful automation solution.

MTS Option

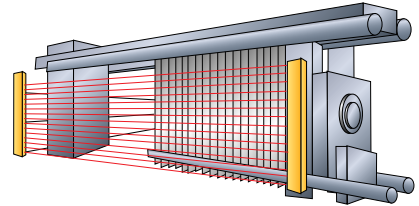
Machine Test Signal (MTS) is an optional feature on the OF4600 series light curtain. MTS allows the machine control system to check for the proper operation of the light curtain safety outputs by simulating a beam blocked state on the transmitter.

Alarm/Follow Mode Option

The non-safety output can be ordered to have either “alarm” or “follow” functionality. “Alarm” mode means that the non-safety output will be de-energized if the system is behaving normally and energized if the system is in a faulted/interlocked state and will remain this way until the condition is cleared. “Follow” mode mimics the state of the safety solid state safety outputs, meaning they will be active when the system is in the machine run state and inactive when the system is in the machine stopped state.

Applications

With a range of 20 m, an OptoFence OF4600-50 system could be used to guard the perimeter of a large filter press. Since there is no separate control box, long cable runs are not required.



D

safety light curtains

■ Understanding the Standards

A typical application for the OptoSafe OF4600-50 is perimeter guarding around a robotic work cell. The standard which covers this use is the recently revised and approved ANSI/RIA R15.06-1999 *American National Standard for Industrial Robots and Robot Systems – Safety Requirements*. This standard allows the use of safety light curtains and provides the following formula for determining the safe mounting distance of a curtain:

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

Where :

D_s = minimum safe distance between safeguarding device and the hazard.

K = speed constant: 63 inches/sec minimum based on the movement being the hand/arm only

and the body being stationary.

NOTE: A greater value may be required in specific applications and when a body in motion must also be considered.

T_s = worst stopping time of the machine/equipment.

T_c = worst stopping time of the control system.

T_r = response time of the safeguarding device including its interface.

D_{pf} = maximum travel towards the hazard within the presence sensing safeguarding device's field that may occur before a stop is signaled. Depth penetration factors will change depending on the type of device and application.

Of the factors defined above, the most important, the depth penetration factor (D_{pf}), is based on the minimum object sensitivity of

the safety light curtain. Curtains with an object sensitivity greater than 2.5 in. are required to use a D_{pf} of 36 inches where a person must reach through the plane of light. The OptoFence OF4600-50 has a minimum object resolution of 2.0 inches and is allowed to use a D_{pf} equal to $3.4 \times (2.0 - 0.275 \text{ in.})$ or 5.87 in. As you can see, if all the other factors are equal, the OF4600-50 can be mounted closer to the hazardous area than similar curtains with a larger minimum object resolution. This saves money and requires less factory space.

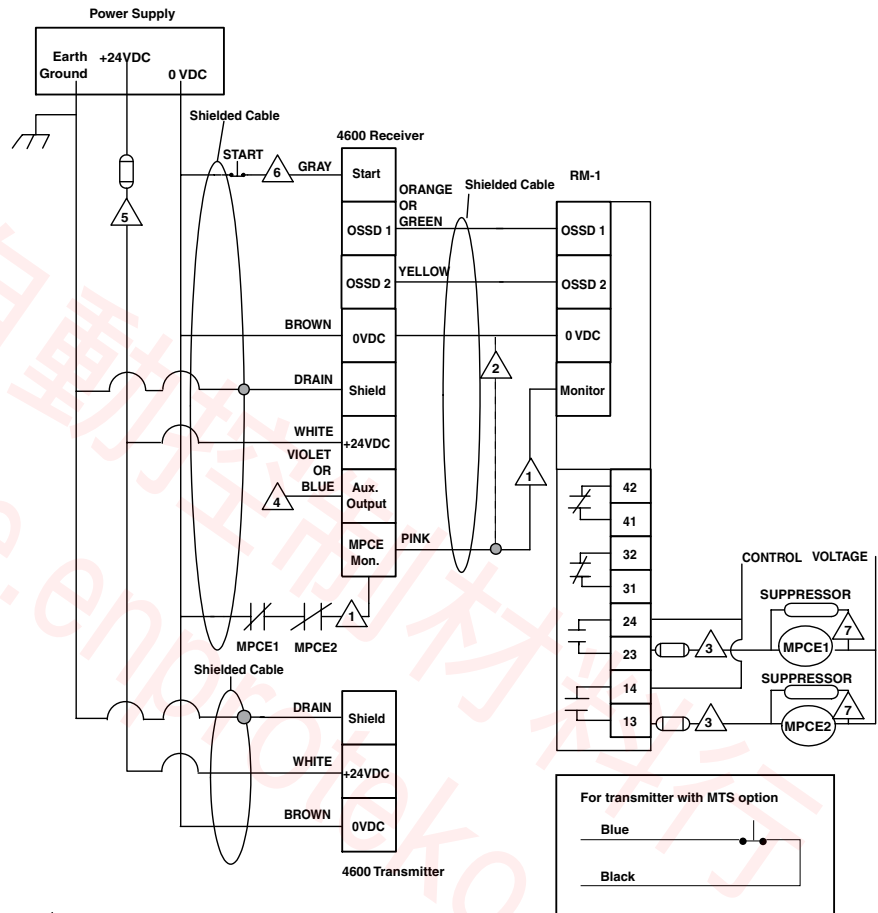
A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ Using Solid-state Outputs

Extreme versatility is a feature of the solid-state outputs from the OptoFence OF4600-50. These outputs can be connected to an Omron STI RM-series relay module, a safety monitoring and control device, or in many cases, directly to the primary control element of the guarded machine.

Connecting Via an RM-1 Module

The Omron STI RM-1 module provides force-guided relay outputs for machine control. OSSD (safety) outputs 1 and 2 are connected to the RM-1 and provide the power necessary to energize its relays.



- ⚠ 1 MPCE monitoring must be used when using the RM1. If the RM1 is the Final Switching Device connect the Pink wire to the MONITOR terminal of the RM1. If force-guided control relays are used as Final Switching Devices they must be monitored, connect the Pink wire through N/C contacts to 0 VDC. (Do not connect both.)
- ⚠ 2 For testing prior to installation, the user may select MPCE OFF (default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0 VDC line.
- ⚠ 3 User supplied over current protection, 6 A max.
- ⚠ 4 Auxiliary Output connect to PLC (optional)
- ⚠ 5 User-supplied fuse.
- ⚠ 6 If remote start is not used, connect the start line (grey wire) to 0 VDC.
- ⚠ 7 Verify that the final switching devices are properly suppressed.

D

safety light curtains

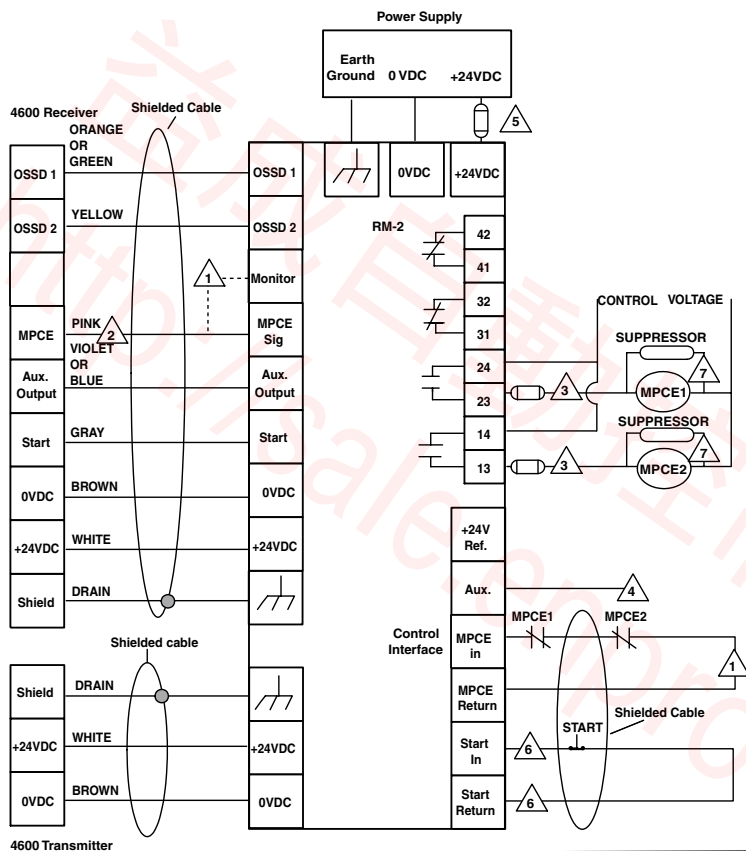
■ Using Solid-state Outputs (continued)

Connecting Via an RM-2 Module

The Omron STI RM-2 module provides force-guided relay outputs for machine control as well as a convenient location to terminate all outputs and inputs from the OF4600-50.

D

safety light curtains



4600 Transmitter

1 MPCE monitoring must be used when using the RM2. If the RM2 is the Final Switching Device connect the Pink wire to the MONITOR terminal of the RM2. If force-guided control relays are used as Final Switching Devices connect the Pink wire to the MPCE Sig. terminal. Then connect a set of N.C. contacts from MPCE1 and MPCE2 to the MPCE in and MPCE return terminals. (Do not connect both.)

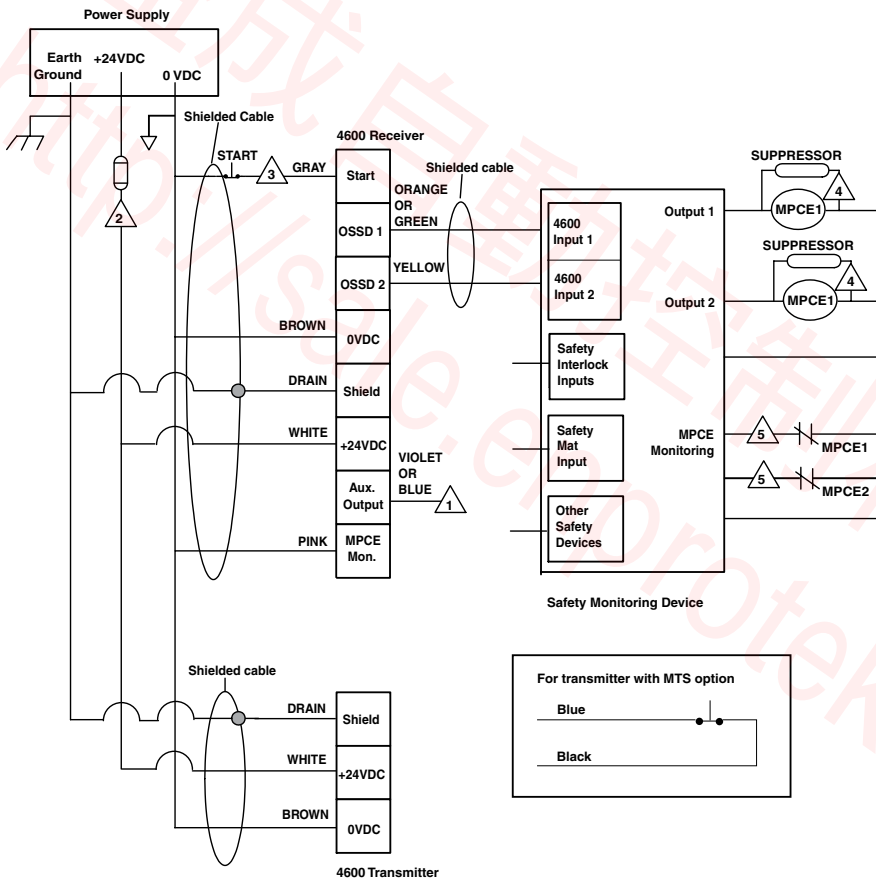
For transmitter with MTS option
Blue
Black

- 2 For testing prior to installation, the user may select MPCE OFF (default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0 VDC line.
- 3 User-supplied over current protection, 6 A max.
- 4 Auxiliary output-connect to PLC (optional).
- 5 User-supplied fuse.
- 6 If remote start is not used, install a jumper across the Start connections at the Control Interface terminals.
- 7 Verify that the final switching devices are properly suppressed.

A Go to the Engineering Guide
For in-depth information on safety standards and use.

Connecting to a Safety Monitoring Device

The wiring from the OF4600-50 to the machine control circuit must be control reliable. Safety devices, such as the OF4600-50 should not depend on a PLC to stop a guarded machine. However, safety related monitoring devices are now available. Note that all safety inputs are directed to the monitoring device which also performs the MPCE monitoring function.



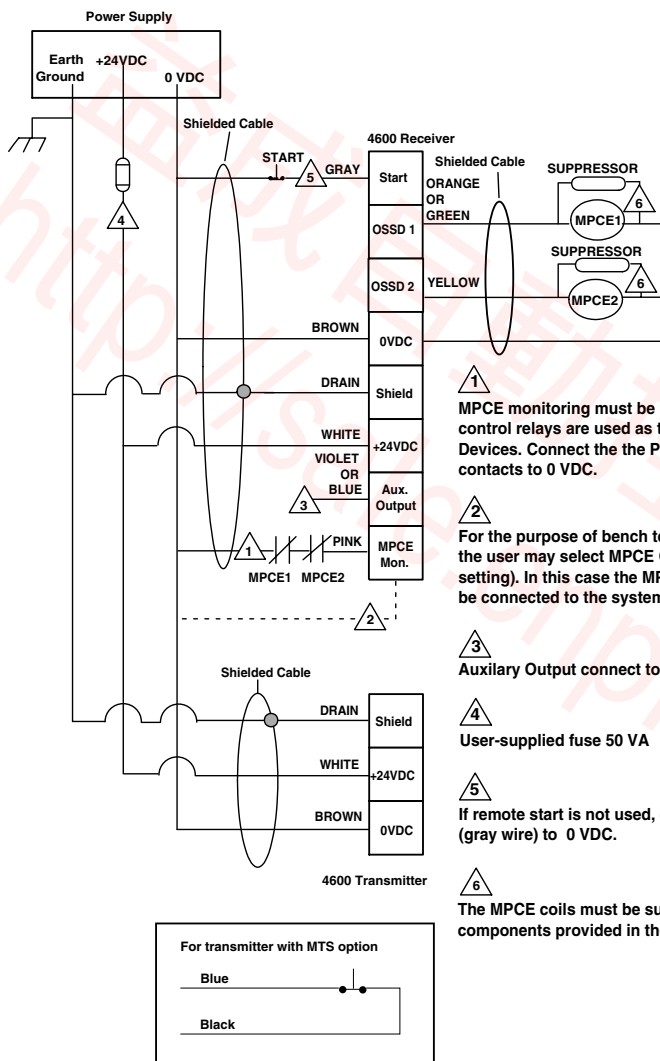
- 1 Auxiliary Output connect to PLC (optional)
- 2 User-supplied fuse.
- 3 If remote start is not used, connect the start line (grey wire) to 0VDC.
- 4 Verify that the final switching devices are properly suppressed.
- 5 The Safety Monitoring Device must monitor the MPCE's Normally Closed Contacts.

■ Using Solid-state Outputs (continued)

Connecting Via Two Force-Guided Relays

FGR series relays provides force-guided outputs for machine control.

D safety light curtains



- 1 MPCE monitoring must be used when force-guided control relays are used as the Final Switching Devices. Connect the the Pink wire though N/C contacts to 0 VDC.
- 2 For the purpose of bench testing prior to installation, the user may select MPCE OFF (default factory setting). In this case the MPCE line (pink wire) must be connected to the system 0 VDC line.
- 3 Auxiliary Output connect to PLC (optional)
- 4 User-supplied fuse 50 VA
- 5 If remote start is not used, connect the start line (gray wire) to 0 VDC.
- 6 The MPCE coils must be suppressed with the components provided in the documentation kit.

A Go to the Engineering Guide For in-depth information on safety standards and use.

■ **Module Dimensions—mm/in.**

■ **Available Modules**

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safety light curtains

The following relay modules are available to extend the function of the OF4600-50 series:

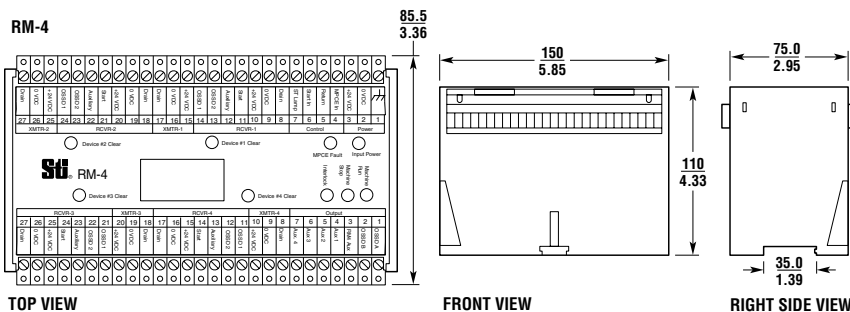
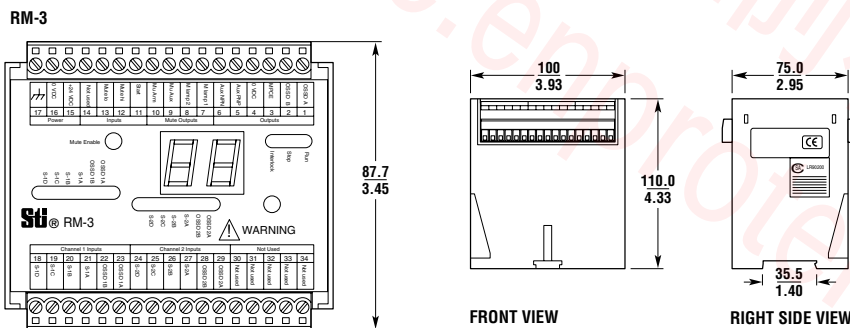
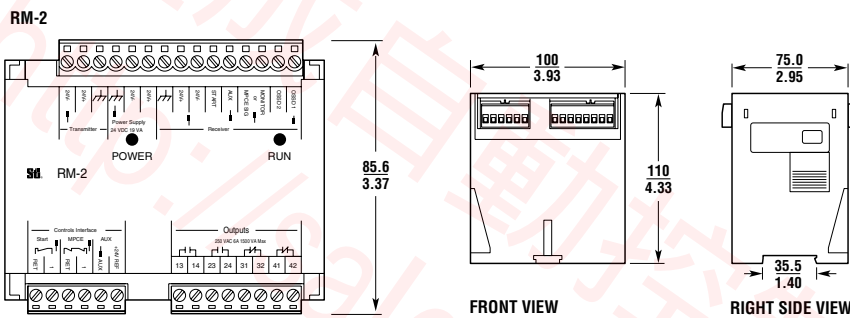
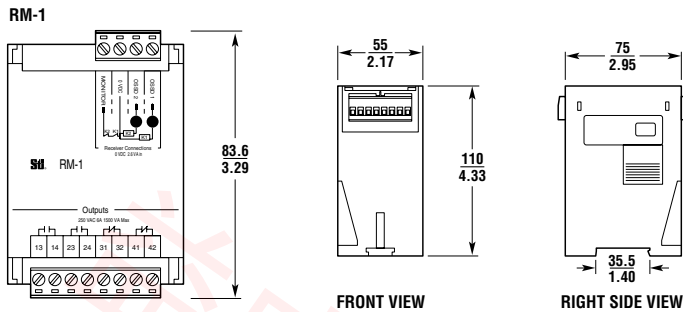
RM-1: Provides force-guided safety relay outputs using input from OF4600-50 system. Receives required 24 VDC power direct from OF4600-50 solid-state safety outputs. DIN rail mount. Removable terminal blocks.

RM-2: Provides a single location to terminate all inputs and outputs to OF4600-50 system. Also provides force-guided safety relay outputs using input from OF4600-50 system. Requires external 24 VDC power supply which also provides power to the OF4600-50. DIN rail mount. Removable terminal blocks.

RM-3: Provides muting, the temporary automatic suspension of the safety function, for up to two safety light curtains. Requires external 24 VDC power supply. It has DIN-rail mount and removable terminal blocks.

RM-4: Up to four OF4600-50 systems can be connected to the RM-4. It provides two PNP safety outputs and one user selectable NPN or PNP non-safety, auxiliary output. Additionally, connections are provided for the auxiliary output of each safety device. It requires external 24 VDC power supply which also provides power to the OF4600-50.

In addition to the above modules, the **RM-X**, **RM2-AC** and **RM2-AC-IP** are also compatible with the OF4600-50.



 For information on Resource Modules, see page D138

■ Specifications for Transmitter and Receiver

Performance	
Protected Heights: 698, 1046, 1393, 1741, 2090 and 2437 mm (27.5, 41.2, 54.9, 68.6, 82.3 and 95.9 in.)	
Operating Range	
OF4600-50SR: 0.3 to 9 m (1 to 30 ft.)	
OF4600-50LR: 0.3 to 20 m (1 to 65 ft.)	
Resolution: 53 mm (2.09 in.). Use of Exact Channel Select and/or Floating Blanking will increase this value.	
Response Time (varies by protected height): see chart at right	
Input Voltage (V_{in}): 24 VDC \pm 20%	
Input Power: 14 watts (without load on the outputs)	
Safety Output Ratings: Two PNP outputs sourcing 500 mA max @ V_{in} (see note 1). Short circuit protected.	
Auxiliary (Non-Safety) Output Ratings: One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)	
Power Supply: 24 VDC \pm 20%. The rating depends on the current requirements of the loads attached to the outputs (see note 3). The power supply must meet the requirements of IEC 60204-1 and 61496-1. Omron STI part number 42992 or equivalent.	
MPCE Monitoring Circuit: 50 mA steady state @ 24 VDC	
Start/Restart Input: N.C. or N.O. momentary contact (20 mA consumption)	
Effective Aperture Angle: $\pm 2.5^\circ$ maximum, transmitter and receiver at operating range greater than 3 m (9.8 ft.).	
Light Source: GaAIAs Light Emitting Diode, 850 nm	
Indicator	
Transmitter: power applied	
Receiver: machine run, machine stop, interlock/fault; channel select/floating blanking, individual beam	
Mechanical	
Enclosure: Polyurethane powder-painted aluminum	
Cable Length: Cables are available in 10, 15, 30 and 50 m lengths	
Cable Connections	
Receiver: 8-pin	
Transmitter: 3-pin standard, 5-pin with MTS	
Environmental	
Protection Rating: IP65; NEMA 4, 12	
Operating Temperature: 0 to 55°C (32 to 131°F)	
Relative Humidity: 95% maximum, non-condensing	
Vibration: 5-60 Hz maximum on all three axes	
Shock: 10 g for 0.016 seconds, 1,000 shocks for each axes on two axes	
Conformity/Approvals	
Conforming to Standards: ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212	
Other Approvals: All OF4600 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE. UL listed.	

Specifications are subject to change without notice.

Response Time

Protected Height (mm/in.)	No. of Beams	Response Time (seconds)
698/27.5	16	<0.014
1046/41.2	24	<0.016
1393/54.9	32	<0.017
1741/68.6	40	<0.021
2090/82.3	48	<0.025
2437/95.9	56	<0.025

Note 1: Voltage available at the outputs is equal to $V_{in} - 2.0$ VDC.

Note 2: Total current required by the two solid-state outputs and the aux. output should not exceed 1.1 A.

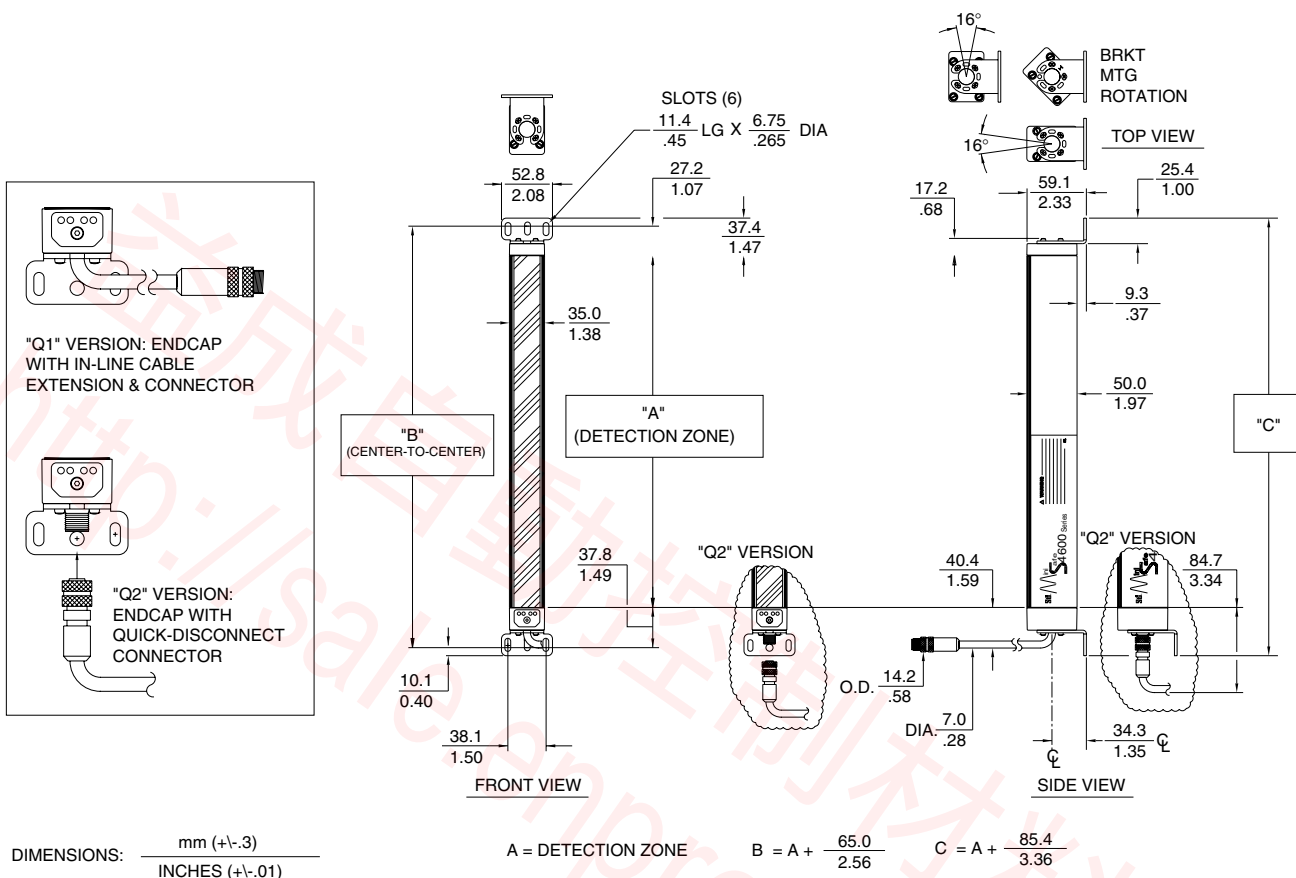
Note 3: Total system current requirement is the sum of the transmitter 285 mA and receiver 1.4 A max. (Receiver 300 mA + OSSD1 load + OSSD2 load + Aux. output load)



Go to the Engineering Guide
For in-depth information on
safety standards and use.



■ OF4600-50 Dimensions—mm/in.



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safety light curtains

OptoFence OF4600-50 Dimensions

	OF46-X-700-50	OF46-X-1045-50	OF46-X-1390-50	OF46-X-1745-50	OF46-X-2095-50	OF46-X-2445-50
	OF46-R-700-50	OF46-R-1045-50	OF46-R-1390-50	OF46-R-1745-50	OF46-R-2095-50	OF46-R-2445-50
A mm/in.	698/27.5	1046/41.2	1393/54.9	1741/68.6	2090/82.3	2437/95.9
B mm/in.	763/30.0	1111/43.7	1460/57.5	1807/71.1	2155/84.8	2507/98.5
C mm/in.	783/30.8	1131/44.5	1479/58.2	1827/71.9	2175/85.6	2423/99.5
System Shipping Weight						
kg/lb.	6.6/14	8.2/18	9.6/21	11.4/25	12.8/28	14.6/32

OF4600-50

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safety light curtains

■ Ordering

To order a OptoFence OF4600-50 system, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow.

① - ② - ③ - ④ X - ④ R - ⑤ - ⑥ - ⑦ - ⑧ - ⑨ - ⑩

① Information required. Represents the system operating range. *For applications where the transmitter and receiver will be mounted less than 9 m (29.5 ft.) apart, please select the SR version.*

Designator	Description
OF46-50SR	0.3 to 9 m (1 to 30 ft.)
OF46-50LR	0.3 to 20 m (1 to 65 ft.)

② Information required. Represents the coverage height of the detection zone. Designators are described below:

Designator	Coverage Height
700	698 mm (27.5 in.)
1045	1046 mm (41.2 in.)
1390	1393 mm (54.9 in.)
1745	1741 mm (68.6 in.)
2095	2090 mm (82.3 in.)
2445	2437 mm (95.9 in.)

③ Information required. Represents the connector type for transmitter and receiver.

Designator	Description
Q1	In-line cable with QD connector (pig tail)
Q2	QD connector

④ Information required. Represents transmitter (X) and receiver (R) cable length. Cables can be shortened in the field.

Designator	Description
10	10 m (33 ft.)
15	15 m (49 ft.)
30	30 m (99 ft.)
50	50 m (164 ft.)

⑤ Information required. Represents the start/restart input type.

Designator	Description
NC	Normally closed
NO	Normally open

⑥ Information required. Represents the Auxiliary output configuration. Designators are described below.

Designator	Description
FN	NPN outputs follow solid-state safety outputs
FP	PNP outputs follow solid-state safety outputs
AN	NPN outputs operate only in Alarm status
AP	PNP outputs operate only in Alarm status

⑦ Information optional. Indicate if you would like the optional MTS (machine test signal) on transmitter.

Designator	Description
M	Include MTS
(Blank)	No MTS

⑧ Information optional. Indicate if you would like the optional DeviceNet interface.

Designator	Description
RV	DeviceNet Installed
(Blank)	No DeviceNet

⑨ Information optional. Indicate if you would like the optional DeviceNet cable.

Designator	Description
D	6 m (19 ft.) DeviceNet Cable
(Blank)	No DeviceNet Cable

⑩ Information optional. Indicate optional RM resource module.

Designator	Description
RM1	Include RM-1 Resource Module
RM2	Include RM-2 Resource Module
RM2A	Include RM-2AC Resource Module
RM2AP	Include RM-2AC-IP Resource Module, IP65
RM3	Include RM-3 Resource Module
RM4	Include RM-4 Resource Module
RMX	Include RM-X Resource Module
(Blank)	Do not include Resource Module

 For information on Resource Modules, see page D138

 For information on safety light curtain accessories, see page D184

A Go to the Engineering Guide For in-depth information on safety standards and use.

Safety Standards and Precautions

All models of the OptoFence OF4600-50 meet ANSI/RIA R15.06-1999 and ANSI B11.19-2003. When used with mechanical power presses, OSHA industrial safety standards apply as stated in 1910.217(c). For other applications, the machine guarding requirements found in section 1910.212 apply. The OptoFence OF4600-50 series meets ANSI control reliability requirements for point-of-operation presence sensing devices.

OptoFence OF4600-50 systems have been EC type examined to the requirements of IEC 61496-1, -2 for a Type 4 ESPE.

The OptoFence OF4600-50 should only be used on machinery that can consistently and immediately stop anywhere in its cycle or stroke. Never use a OptoFence OF4600-50 on a full revolution clutched power press or machine. If the light curtain does not protect all access to the point of operation, the unprotected access must be guarded by other appropriate devices such as mechanical guards.

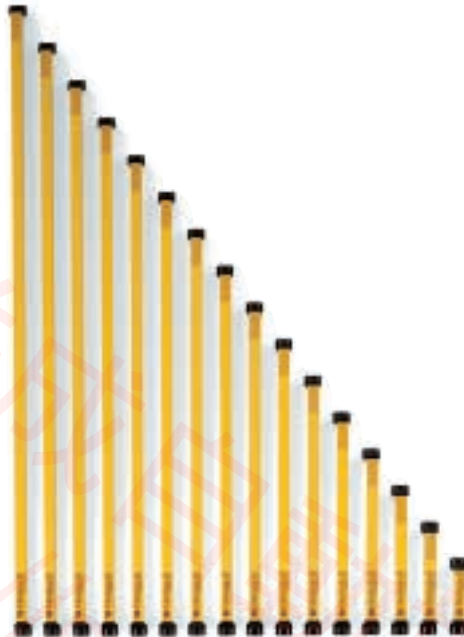
The purchaser, installer and employer have the responsibility to meet all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See the Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

Rev. 1.04



File No. LR90200



MiniSafe®

MS4300

- 19 mm (0.75 in.) resolution
- 9.1 m (30 ft.) range
- Protected heights from 102 to 1626 mm (4 to 64 in.)
- Small size—32 x 32 mm (1.25 x 1.25 in.)
- Status indicator lights
- Quick-disconnect cables
- Adjustable mounting brackets
- Highly immune to electromagnetic interference, strobe or ambient light interference and welding flash
- Versions available for darkroom applications—consult factory

■ Description

A MiniSafe consists of an identical length transmitter and receiver, combined with an STI Universal or DuoSafe Controller and appropriate interconnecting cables.

The compact transmitter and receiver are suited for machinery where space is at a premium.

The slender MiniSafe housings provide a designed-in appearance.

■ Applicable Controllers

MiniSafe MS4300 transmitter and receivers can be used with the Universal controller or combined with other STI safety light curtain components and a DuoSafe controller as part of a system to guard more than one opening or machine.

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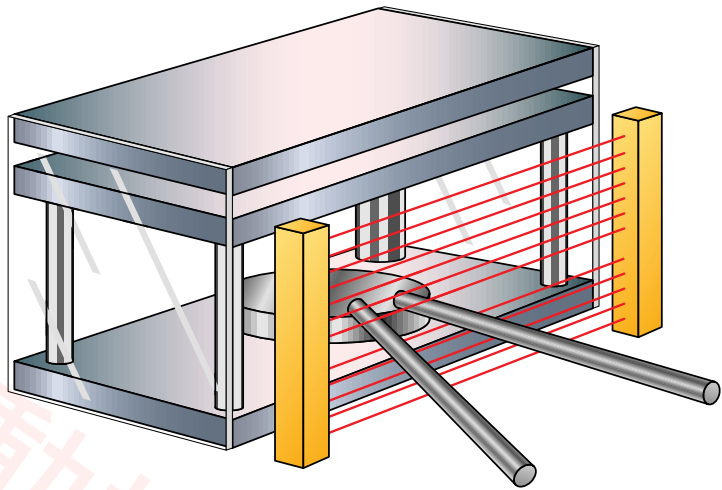
safety light curtains

MiniSafe® MS4300

■ Applications

Automobile Wiper Arm Assembly

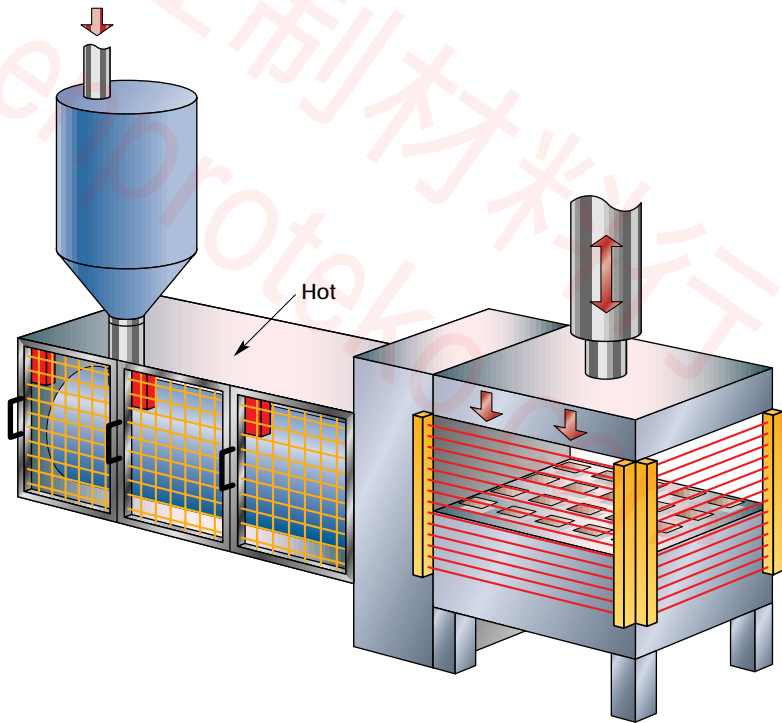
This machine assembles the long tubular pieces that operate car wipers. At the point where the two pieces are riveted together, a hazard is created. The operator places the parts to be joined in a fixture and presses a button to begin the cycle. Using a MiniSafe MS4300 with 1-beam Floating Blanking enabled, the benefits of close mounting can be preserved while allowing for the presence of the parts being assembled.



D
safety light curtains

Plastic Molding Machine

A MiniSafe guards personnel from a pinch-point hazard on this machine. Additionally, workers are protected from a burn hazard by hinged guards held closed by solenoid-locking safety switches.



A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ Specifications for Transmitter and Receiver

Performance	
Protected Height:	102 to 1626 mm (4 to 64 in.) in 102 mm (4 in.) increments
Operating Range:	0.3 to 9.1 m (1 to 30 ft.)
Resolution:	19 mm (0.75 in.) Use of Exact Channel Select and/or Floating Blanking may increase this value.
Effective Aperture Angle:	±6° transmitter and receiver
Light Source:	880 nm LED
Light Source Life:	100,000 hours
Indicators:	Beam blocked, beam clear, interlock
Mechanical	
Enclosure:	Polyurethane powder-painted aluminum
Cable Length:	Transmitter – 4.6 m (15 ft.) standard, 30 m (100 ft.) maximum; 30 m (100 ft.) standard with DIN-style controller Receiver – 1.5 m (5 ft.) standard, 30 m (100 ft.) maximum; 30 m (100 ft.) standard with DIN-style controller
Cable Connections:	Circular, weather-tight disconnects
Environmental	
Protection Rating:	IP65; NEMA 4, 12
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	Tested in accordance with UL991 vibration specification, Section 20, at 5G peak vibration level, frequency range 5–60 Hz in 3 axes
Shock:	Tested to withstand shock resulting from a 3 ft.-lb. impact detailed in UL991, Section 21
Conformity/Approvals (when combined with an STI Universal or DuoSafe controller)	
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212
Other Approvals:	CSA-CUS Certified (file no. LR90200)

Specifications are subject to change without notice.

 For specifications on the Universal Controller, see www.sti.com

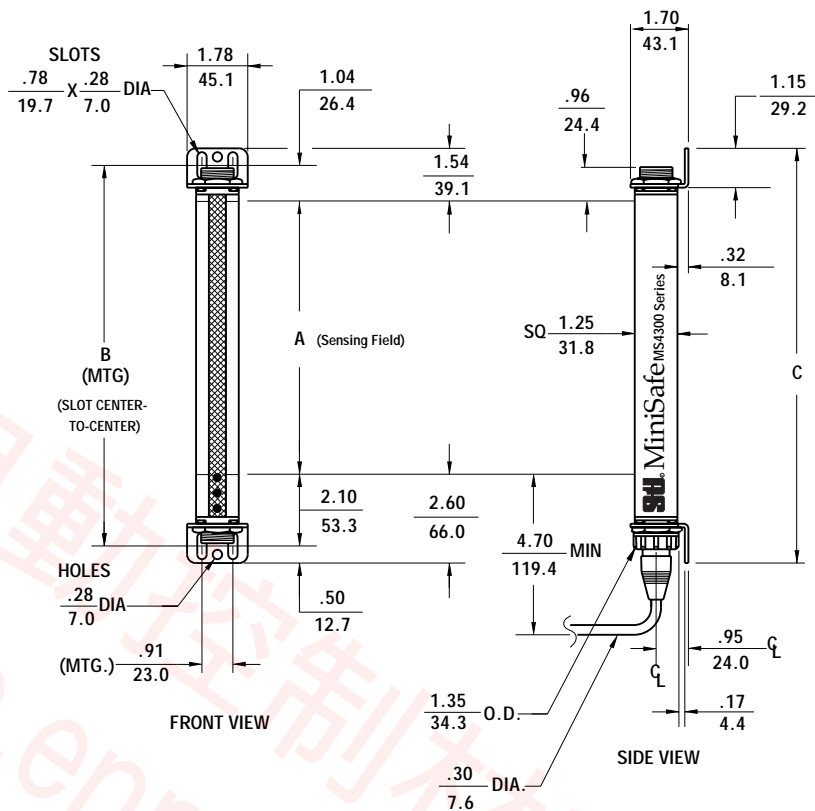
 For specifications on the DuoSafe Controller, see www.sti.com

D

safety light curtains

MiniSafe® MS4300

■ Dimensions—in./mm



This drawing is available in CAD format at www.sti.com/curtains/MS4300/

For dimensions on the Universal Controller, see www.sti.com

For dimensions on the DuoSafe Controller, see www.sti.com

MiniSafe MS4300 Dimensions

DIM	MS4304	MS4308	MS4312	MS4316	MS4320	MS4324	MS4328	MS4332
A in./mm	4/102	8/203	12/305	16/406	20/508	24/607	28/711	32/813
B in./mm	7.14/181	11.14/283	15.14/385	19.14/486	23.14/588	27.14/689	31.14/791	35.14/893
C in./mm	8.14/206	12.14/308	16.14/410	20.14/512	24.14/613	28.14/715	32.14/816	36.14/918
System Shipping Weight								
lb./kg	16/7.3	16/7.3	17/7.7	18/8.2	18/8.2	18/8.2	19/8.6	20/9.1

DIM	MS4336	MS4340	MS4344	MS4348	MS4352	MS4356	MS4360	MS4364
A in./mm	36/914	40/1016	44/1118	48/1219	52/1321	56/1422	60/1524	64/1626
B in./mm	39.14/994	43.14/1096	47.14/1197	51.14/1299	55.14/1401	59.14/1502	63.14/1604	67.14/1705
C in./mm	40.14/1020	44.14/1121	48.14/1223	52.14/1324	56.14/1426	60.14/1528	64.14/1629	68.14/1730
System Shipping Weight								
lb./kg	20/9.1	20/9.1	21/9.5	22/10	22/10	22/10	23/10.4	23/10.4

A Go to the Engineering Guide
For in-depth information on safety standards and use.

■ **Ordering**

To order a MiniSafe MS4300C system with a Universal Controller, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow. Information is required in all fields.



For specifications and dimensions on the Universal Controller, see www.sti.com



To order MS4300 components as part of a DuoSafe system, see www.sti.com

MS43 _____ - _____ X- _____ R
 ① ② ③ ③

Example: MS4324C-AC1-30X-15R

This system has a 610 mm (24 in.) coverage height, standard controller, 115 VAC input power, 9.1 m (30 ft.) transmitter cable and a 4.6 m (15 ft.) receiver cable.

① Information required. Represents the coverage height of the light curtain in inches. Designators are described below:

Designator	Coverage Height
04	102 mm (4 in.)
08	203 mm (8 in.)
12	305 mm (12 in.)
16	406 mm (16 in.)
20	508 mm (20 in.)
24	610 mm (24 in.)
28	711 mm (28 in.)
32	813 mm (32 in.)
36	914 mm (36 in.)
40	1016 mm (40 in.)
44	1118 mm (44 in.)
48	1219 mm (48 in.)
52	1321 mm (52 in.)
56	1422 mm (56 in.)
60	1524 mm (60 in.)
64	1626 mm (64 in.)

② Represents Controller Style and Power Input.

Designator	Description
C-AC1	NEMA 4, 12 enclosure, 115 VAC
C-AC2	NEMA 4, 12 enclosure, 230 VAC
C-DC1	NEMA 4, 12 enclosure, 24 VDC negative ground
C-DC2	NEMA 4, 12 enclosure, 24 VDC positive or negative ground
C-DN-DC1	DIN mount enclosure, 24 VDC negative ground

To specify a controller with lid-mounted Run/Start key switch, begin designator with CK- rather than C-. Available only on NEMA enclosure.



For information on STI safety light curtain accessories, see www.sti.com

③ Represents transmitter (X) and receiver (R) cable length.

The standard cable lengths supplied with a NEMA 4, 12 enclosure controller are a 4.6 m (15 ft.) transmitter and a 1.5 m (5 ft.) receiver. Cables are available in 5-foot increments from 5 to 100 feet (1.5 to 30 meters) for the transmitter and receiver.

The standard cable lengths supplied with a DIN mount enclosure controller are 9.1 m (30 ft.) on both the transmitter and receiver.

For NEMA 4, 12 enclosure:

Designator	Description
05	1.5 m (5 ft.) cable
10	3.0 m (10 ft.) cable
15	4.6 m (15 ft.) cable
20	6.1 m (20 ft.) cable
25	7.6 m (25 ft.) cable
30	9.1 m (30 ft.) cable
35	10.7 m (35 ft.) cable
40	12.2 m (40 ft.) cable
45	13.7 m (45 ft.) cable
50	15.2 m (50 ft.) cable
55	16.8 m (55 ft.) cable
60	18.3 m (60 ft.) cable
65	19.8 m (65 ft.) cable
70	21.3 m (70 ft.) cable
75	22.9 m (ft.) cable
80	24.4 m (80 ft.) cable
85	25.9 m (85 ft.) cable
90	27.4 m (90 ft.) cable
95	29.0 m (95 ft.) cable
100	30.48 m (100 ft.) cable

For DIN-mount enclosure:

Designator	Description
30	9.1 m (30 ft.) cable

* Consult factory for longer cables

Safety Standards and Precautions

The MiniSafe meets ANSI/RIA R15.06-1999, ANSI B11.19-2003 and the following applicable OSHA standards. When used with mechanical power presses, OSHA standard 1910.217(c) applies. For other applications, the requirements of section 1910.212 apply. When combined with an STI Universal or DuoSafe Controller, the MiniSafe meets B11.19-1990 standards, including control reliability requirements for point-of-operation presence sensing devices, and complies with CSA and UL508 standards.

Only use the MiniSafe on machinery that stops consistently and immediately anywhere in its cycle or stroke. Never use a MiniSafe on a full-revolution clutched press or machine. Access to the point of operation or hazardous machine area not protected by the MiniSafe must be guarded by fencing, barriers or other appropriate methods.

The purchaser, installer and employer are responsible for meeting all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.



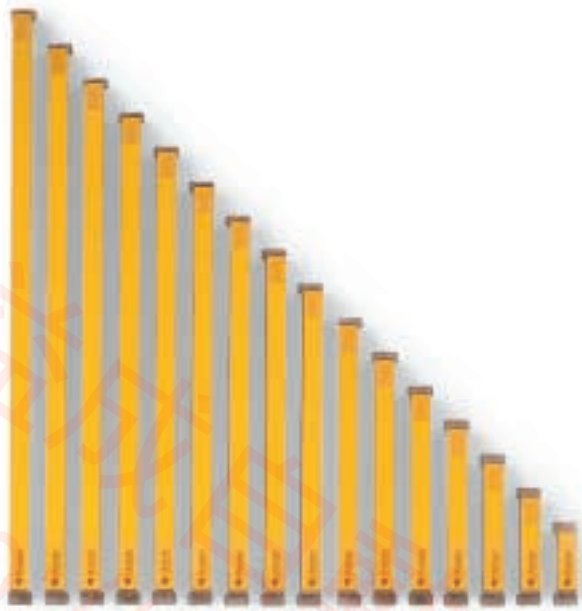
Go to the Engineering Guide

For in-depth information on safety standards and use.

Rev. 1.04



File No. LR90200



MiniSafe®

MS4400

- 25.4 mm (1.0 in.) resolution
- 30.5 m (100 ft.) range
- Protected heights from 102 to 1626 mm (4 to 64 in.)
- Individual Beam Indicator lights covered by U.S. and international patents
- Compact size—57 x 47 mm (2.25 x 1.8 in.)
- Status indicator lights
- Quick-disconnect cables
- Adjustable mounting brackets
- Highly immune to electromagnetic interference, strobe or ambient light interference and welding flash
- Versions available for darkroom applications—consult factory

■ Operation

A MiniSafe® MS4400 system consists of an identical length transmitter and receiver, combined with an STI Universal or DuoSafe Controller and appropriate interconnecting cables.

For easier alignment, MS4400 receivers feature STI's patented Individual Beam Indicator lights which allow the MiniSafe to be used with mirrors on larger machines and for guarding moderate-length perimeters.

■ Applicable Controllers

MiniSafe MS4400 transmitters and receivers can be used with the Universal Controller or combined with other STI safety light curtain components and a DuoSafe controller as part of a system to guard more than one opening or machine.

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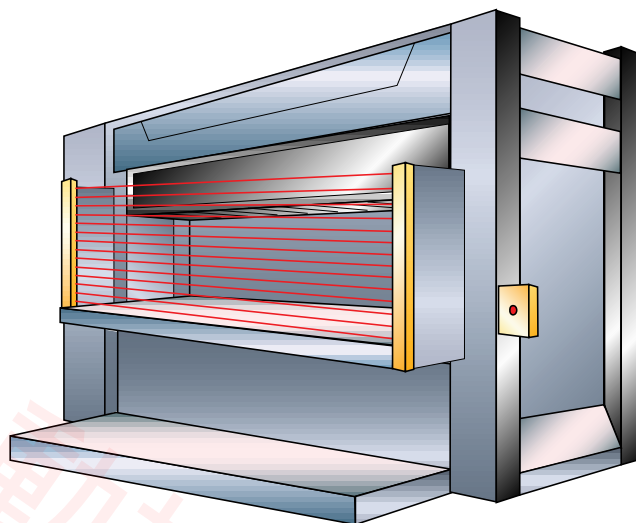
safety light curtains

MiniSafe® MS4400

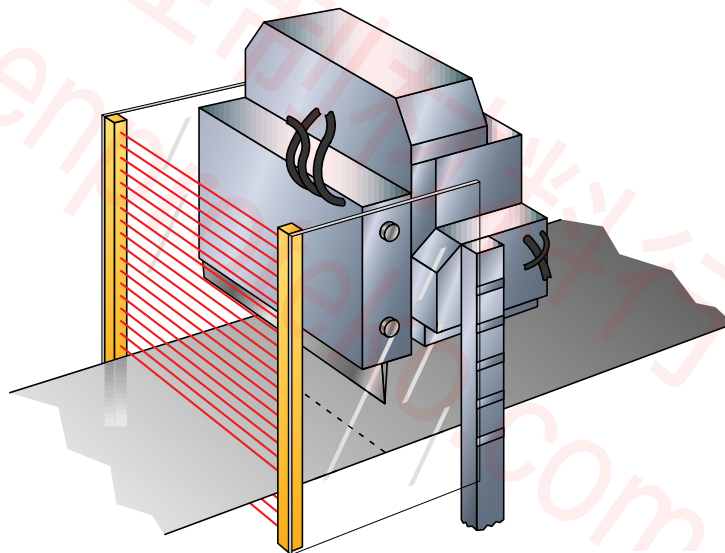
■ Applications

Press Brake

A light curtain must ignore material as piece parts move during the down stroke of a press brake. The MiniSafe MS4400, with the Universal Controller, can be programmed to disregard an object less than 51 mm (2.0 in.) thick anywhere in the sensing area during the non-hazardous motion of the press brake. For large press brakes, such as those used in the ship building industry, a light curtain may also be installed horizontally to accommodate the material.

**Sheet Metal Shear**

MS4400 allows access for material, setup and die changing as well as safety on shears in general i.e. paper, plastic... The use of floating blanking or channel select accommodates the web moving through the light curtain detection zone.



D

safety light curtains

**Go to the Engineering Guide**

For in-depth information on safety standards and use.



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■ Specifications for Transmitter and Receiver

Performance	
Protected Height:	102 to 1626 mm (4 to 64 in.) in 102 mm (4 in.) increments
Operating Range:	0.30 to 30.5 m (1 to 100 ft.)
Resolution:	25.4 mm (1.0 in.) Use of Exact Channel Select and/or Floating Blanking may increase this value.
Effective Aperture Angle:	±2.5° transmitter and receiver
Light Source:	880 nm LED
Light Source Life:	100,000 hours
Indicators:	Beam blocked, beam clear, interlock, individual beam
Mechanical	
Enclosure:	Polyurethane powder-painted aluminum
Cable Length:	Transmitter – 4.6 m (15 ft.) standard, 30.5 m (100 ft.) maximum; 15.2 m (50 ft.) standard width with DIN-style controller Receiver – 1.5 m (5 ft.) standard, 15.2 m (50 ft.) maximum; 15.2 m (50 ft.) standard width with DIN-style controller
Cable Connections:	Circular, weather-tight disconnects
Environmental	
Protection Rating:	IP65; NEMA 4, 12
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	Tested in accordance with UL991 vibration specification, Section 20, at 5 G peak vibration level, frequency range 5–60 Hz in 3 axes
Shock:	Tested to withstand shock resulting from a 3 foot-pound impact detailed in UL991, Section 21
Conformity/Approvals (when combined with an STI Universal or DuoSafe controller)	
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212
Other Approvals:	CSA-CUS Certified (file no. LR90200)

Specifications are subject to change without notice.



For specifications on the
Universal Controller, see www.sti.com



For specifications on the
DuoSafe Controller, see www.sti.com

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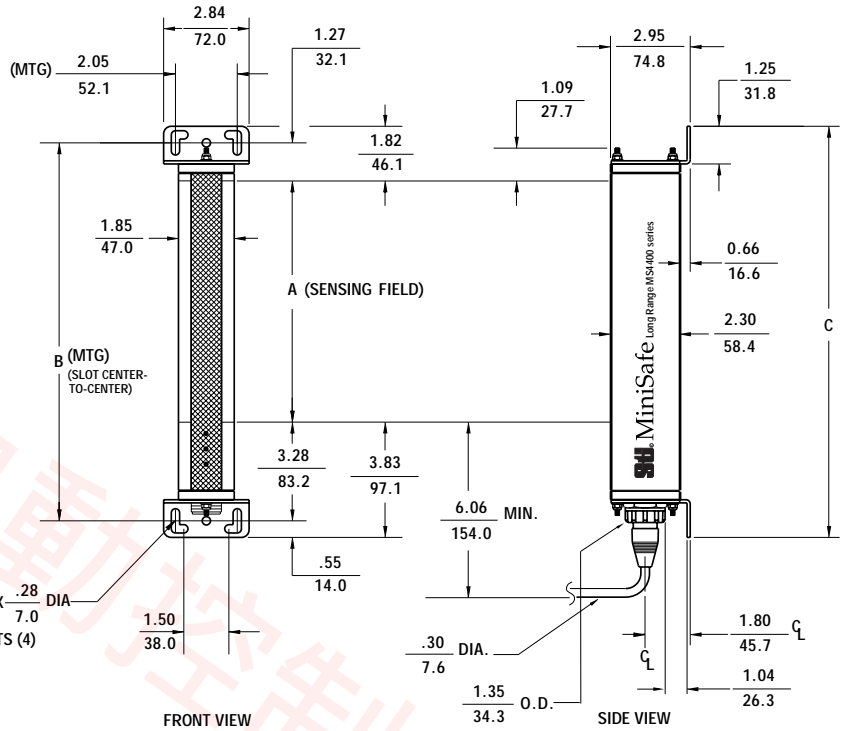
D3

MiniSafe® MS4400

■ Dimensions—in./mm

D

safety light curtains



This drawing is available in CAD format at www.sti.com/curtains/MS4400/

For dimensions on the Universal Controller, see www.sti.com

For dimensions on the DuoSafe Controller, see www.sti.com

MiniSafe MS4400 Dimensions

DIM	MS4404	MS4408	MS4412	MS4416	MS4420	MS4424	MS4428	MS4432
A in./mm	4.0/102	8/203	12/305	16/406	20/508	24/607	28/711	32/813
B in./mm	8.54/217	12.54/319	16.54/420	20.54/522	24.54/623	28.54/725	32.54/827	36.54/928
C in./mm	9.64/245	13.64/346	17.64/448	21.64/550	25.64/651	29.64/753	33.64/854	37.64/956
System Shipping Weight								
lb./kg	21/9.5	22/10	22/10	23/10.4	25/11.3	26/11.8	27/12.2	28/12.7

DIM	MS4436	MS4440	MS4444	MS4448	MS4452	MS4456	MS4460	MS4464
A in./mm	36/914	40/1016	44/1118	48/1219	52/1321	56/1422	60/1524	64/1626
B in./mm	40.54/1030	44.54/1131	48.54/1233	52.54/1335	56.54/1436	60.54/1538	64.54/1639	68.54/1741
C in./mm	41.64/1058	45.64/1159	49.64/1261	53.64/1362	57.64/1464	61.64/1566	65.64/1667	69.64/1769
System Shipping Weight								
lb./kg	29/13.2	31/14	31/14	33/15	35/15.9	35/15.9	37/16.8	39/17.7

A Go to the Engineering Guide
For in-depth information on safety standards and use.



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■ **Ordering**

To order a MiniSafe MS4400C system with a Universal Controller, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow. Information is required in all fields.

 For specifications and dimensions on the Universal Controller, see www.sti.com

 To order a MiniSafe MS4400 as part of a DuoSafe system, see www.sti.com

MS44 - X- R
 ① ② ③ ④

Example: MS4424C-AC1-50X-15R

This system has a 610 mm (24 in.) coverage height, Floating Blank-ing/Guard Mode controller, 115 VAC input power, 16.2 m (50 ft.) transmitter cable and a 4.6 m (15 ft.) receiver cable.

① Represents the coverage height of the light curtain in inches. Designators are described below:

Designator	Coverage Height
04	102 mm (4 in.)
08	203 mm (8 in.)
12	305 mm (12 in.)
16	406 mm (16 in.)
20	508 mm (20 in.)
24	610 mm (24 in.)
28	711 mm (28 in.)
32	813 mm (32 in.)
36	914 mm (36 in.)
40	1016 mm (40 in.)
44	1118 mm (44 in.)
48	1219 mm (48 in.)
52	1321 mm (52 in.)
56	1422 mm (56 in.)
60	1524 mm (60 in.)
64	1626 mm (64 in.)

② Represents Controller Style and Power Input.

Designator	Description
C-AC1	NEMA 4, 12 enclosure, 115 VAC
C-AC2	NEMA 4, 12 enclosure, 230 VAC
C-DC1	NEMA 4, 12 enclosure, 24 VDC negative ground
C-DC2	NEMA 4, 12 enclosure, 24 VDC positive or negative ground
C-DN-DC1	DIN mount enclosure, 24 VDC negative ground

To specify a controller with lid-mounted Run/Start key switch, begin designator with CK- rather than C-. Available only on NEMA enclosure.

③ Represents transmitter (X) and receiver (R) cable length.

The standard cable lengths supplied with a NEMA 4, 12 enclosure controller are a 4.6 m (15 ft.) transmitter and a 1.5 m (5 ft.) receiver. Cables are available in 5-foot increments from 5 to 100 feet (1.5 to 30 meters) for

the transmitter and 5 to 50 feet (1.5 to 15 meters) for the receiver.

The standard cable lengths supplied with a DIN mount enclosure controller are 9.1 m (30 ft.) on both the transmitter and receiver. Cables are available as listed below. The maximum transmitter cable length is 30.5 m (100 ft.). The maximum receiver cable length is 15.2 m (50 ft.).

For NEMA 4, 12; IP65 Enclosure

Designator	Description
05	1.5 m (5 ft.) cable
10	3.0 m (10 ft.) cable
15	4.6 m (15 ft.) cable
20	6.1 m (20 ft.) cable
25	7.6 m (25 ft.) cable
30	9.1 m (30 ft.) cable
35	10.7 m (35 ft.) cable
40	12.2 m (40 ft.) cable
45	13.7 m (45 ft.) cable
50	15.2 m (50 ft.) cable
55	16.8 m (55 ft.) cable
60	18.3 m (60 ft.) cable
65	19.8 m (65 ft.) cable
70	21.3 m (70 ft.) cable
75	22.9 m (75 ft.) cable
80	24.4 m (80 ft.) cable
85	25.9 m (85 ft.) cable
90	27.4 m (90 ft.) cable
95	29.0 m (95 ft.) cable
100	30.5 m (100 ft.) cable

For DIN-Mount Enclosure

Designator	Description
30	9.1 m (30 ft.) cable
75	22.9 m (75 ft.) cable
100	30.5 m (100 ft.) cable

 For information on STI safety light curtain accessories, see www.sti.com

D
safety light curtains

Safety Standards and Precautions

The MiniSafe meets ANSI/RIA R15.06-1999, ANSI B11.19-2003, Ford Motor Company EL-4 and the following applicable OSHA standards. When used with mechanical power presses, OSHA standard 1910.217(c) applies. For other applications, the machine requirements of section 1910.212 apply. When combined with an STI Universal or DuoSafe Controller, the MiniSafe meets B11.19-1990 standards, including control reliability requirements for point-of-operation presence sensing devices, and complies with CSA and UL508 standards.

Only use the MiniSafe on machinery that stops consistently and immediately anywhere in its cycle or stroke. Never use a MiniSafe on a full-revolution clutched press or machine. Access to the point of operation or hazardous machine area not protected by the MiniSafe must be guarded by fencing, barriers or other appropriate methods.

The purchaser, installer and employer are responsible for meeting all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indicated.

Perimeter Guarding Special Requirements

For perimeter guarding installations, the guarded machine or robot controller must be wired so that any stop signal generated by the light curtain will cause an immediate stop of the hazardous motion. The machine or robot must only be restarted by actuation of a manual reset switch. This reset switch must be located outside the area of hazardous motion and positioned so that the hazardous area can be observed by the switch operator. This is intended to prevent a machine from automatically restarting once an obstruction is no longer detected by the sensing field of the light curtain.



Go to the Engineering Guide
For in-depth information on safety standards and use.



Rev. 7.02



■ Description

A FlexSafe system consists of at least two, transmitter and receiver segments, combined with an STI Universal or DuoSafe controller and appropriate interconnecting cables.

The compact transmitter and receiver size is perfect for machinery where space is at a premium. The slender FlexSafe housings provide a designed-in appearance.

All sections in a FlexSafe system must be installed with an equal distance between transmitter and receiver segments.

■ Applicable Controllers

FlexSafe FS4300 transmitters and receivers can be used with the Universal controller or combined with other STI safety light curtain components and a DuoSafe controller as part of a system to guard more than one opening or machine.

FlexSafe®

FS4300

- 19 mm (0.75 in.) resolution
- 9.1 m (30 ft.) range
- Protected heights of combined segments available from 203 to 1626 mm (8 to 64 in.)
- Unique segmented transmitter and receiver; design concept is covered by U.S. and international patents
- Small size—32 x 32 mm (1.25 x 1.25 in.)
- Status indicator lights
- Quick-disconnect cables
- Adjustable mounting brackets
- Highly immune to electromagnetic interference, strobe or ambient light interference and welding flash
- Versions available for darkroom applications (940 nm) — consult factory

D

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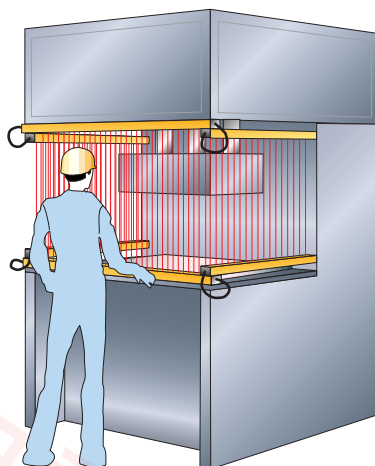


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■ Applications

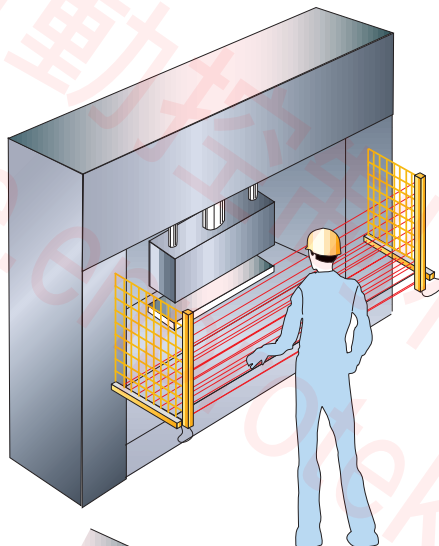
Application ①

Here, a three-segment FlexSafe system forms a “U-shaped” guard zone to protect all unguarded sides of a machine. Without the FlexSafe, mirrors or three conventional safety light curtains would have to be used.



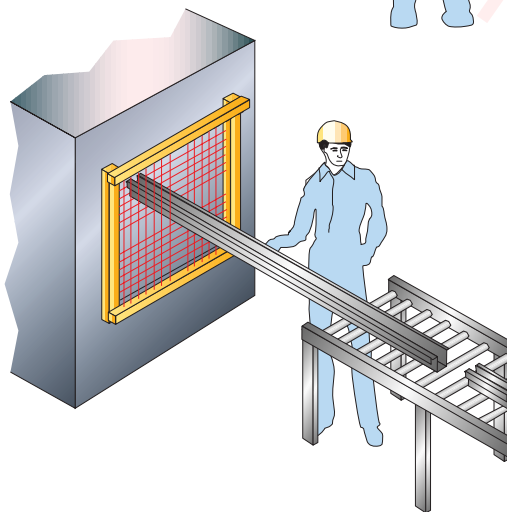
Application ②

In this application, two sets of FlexSafe transmitters and receivers form an L-shaped guard zone. Should the machine operator penetrate the vertical segment of the FlexSafe, a stop signal will be sent to the guarded machinery. The horizontal segment guards the operator should he attempt to place his body between the vertical segment and the point of hazardous operation.



Application ③

The concept behind this application has received U.S. Patent No. 5,281,809. Using a FlexSafe system to form a picture-frame-shaped guard zone, the operator then programs the Exact Channel Select feature to allow the feed stock to enter the machine through the light curtain sensing field. Unlike a conventional single-segment light curtain, the FlexSafe is designed so that it does not cast a “shadow” and create an unprotected area, thus protecting all areas around the area filled by the feed stock.



Go to the Engineering Guide
For in-depth information on safety standards and use.

■ Specifications for Transmitter and Receiver

Performance	
Protected Height:	203 to 1626 mm (8 to 64 in.) in 102 mm (4 in.) increments
Operating Range:	0.30 to 9.1 m (1 to 30 ft.)
Resolution:	19 mm (0.75 in.) Use of Exact Channel Select and/or Floating Blanking may increase this value
Effective Aperture Angle:	±6° transmitter and receiver
Light Source:	880 nm LED
Light Source Life:	100,000 hours
Indicators:	Beam blocked, beam clear, interlock
Mechanical	
Enclosure:	Polyurethane powder-painted aluminum
Cable Length:	Transmitter – 1.5 m (5 ft.) to 30 m (100 ft.) in 1.5 m (5 ft.) increments Receiver – 1.5 m (5 ft.) to 30 m (100 ft.) in 1.5 m (5 ft.) increments Interconnect – Available in lengths from 203 mm (8 in.) to 6096 mm (240 in.). Maximum total length of all interconnect cables is 6096 mm (240 in.)
Cable Connections:	Circular, weather-tight disconnects
Environmental	
Protection Rating:	IP65; NEMA 4, 12
Operating Temperature:	0 to 55°C (32 to 131°F)
Relative Humidity:	95% maximum, non-condensing
Vibration:	Tested in accordance with UL991 vibration specification, Section 20, at 5G peak vibration level, frequency range 5–60 Hz in 3 axes
Shock:	Tested to withstand shock resulting from a 3 foot-pound impact detailed in UL991, Section 21
Conformity/Approvals (when combined with an STI Universal or DuoSafe controller)	
Conforming to Standards:	ANSI/RIA R15.06-1999, ANSI B11.19-2003, OSHA 1910.217(c), OSHA 1910.212
Other Approvals:	CSA-CUS Certified (file no. LR90200)

Specifications are subject to change without notice.



For specifications on the
Universal Controller, see www.sti.com



For specifications on the
DuoSafe Controller, see www.sti.com

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D3

FlexSafe® FS4300

■ Dimensions—in/mm

D
safety light curtains



This drawing is available in CAD format at www.sti.com/curtains/FS4300/

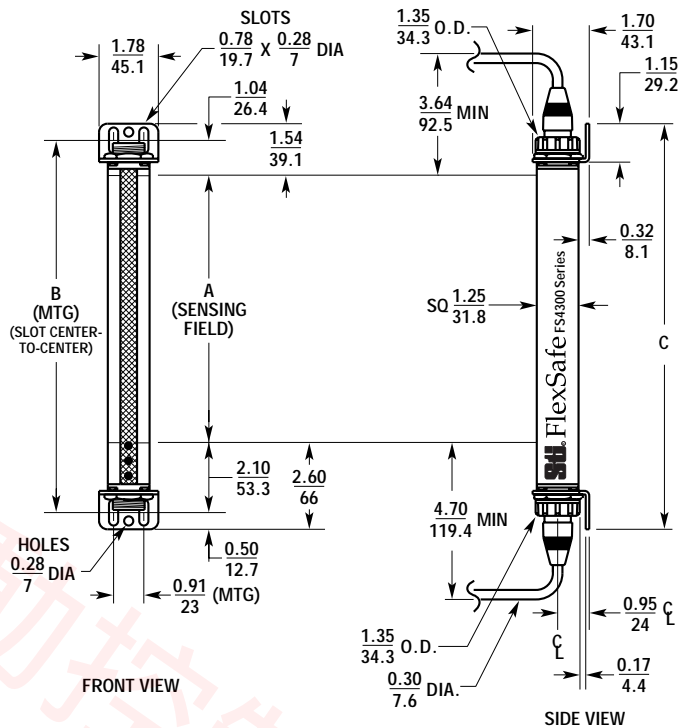


For dimensions on the Universal Controller, see www.sti.com



For dimensions on the DuoSafe Controller, see www.sti.com

Dimensions typical for first, intermediate, and last segments. LED indicators on first segment only.



FlexSafe FS4300 Dimensions

DIM	FS4304X-1	FS4308X-1	FS4312X-1	FS4316X-1	FS4320X-1	FS4324X-1	FS4328X-1	FS4332X-1
	FS4304X-2	FS4308X-2	FS4312X-2	FS4316X-2	FS4320X-2	FS4324X-2	FS4328X-2	FS4332X-2
	FS4304X-3	FS4308X-3	FS4312X-3	FS4316X-3	FS4320X-3	FS4324X-3	FS4328X-3	FS4332X-3
	FS4304R-1	FS4308R-1	FS4312R-1	FS4316R-1	FS4320R-1	FS4324R-1	FS4328R-1	FS4332R-1
	FS4304R-2	FS4308R-2	FS4312R-2	FS4316R-2	FS4320R-2	FS4324R-2	FS4328R-2	FS4332R-2
	FS4304R-3	FS4308R-3	FS4312R-3	FS4316R-3	FS4320R-3	FS4324R-3	FS4328R-3	FS4332R-3
A in./mm	4/102	8/203	12/305	16/406	20/508	24/607	28/711	32/813
B in./mm	7.14/181	11.14/283	15.14/385	19.14/486	23.14/588	27.14/689	31.14/791	35.14/893
C in./mm	8.14/206	12.14/308	16.14/410	20.14/512	24.14/613	28.14/715	32.14/816	36.14/918
System Shipping Weight								
lb./kg	Each system varies, consult factory.							

DIM	FS4336X-1	FS4340X-1	FS4344X-1	FS4348X-1	FS4352X-1	FS4356X-1	FS4360X-1
	FS4336X-2	FS4340X-2	FS4344X-2	FS4348X-2	FS4352X-2	FS4356X-2	FS4360X-2
	FS4336X-3	FS4340X-3	FS4344X-3	FS4348X-3	FS4352X-3	FS4356X-3	FS4360X-3
	FS4336R-1	FS4340R-1	FS4344R-1	FS4348R-1	FS4352R-1	FS4356R-1	FS4360R-1
	FS4336R-2	FS4340R-2	FS4344R-2	FS4348R-2	FS4352R-2	FS4356R-2	FS4360R-2
	FS4336R-3	FS4340R-3	FS4344R-3	FS4348R-3	FS4352R-3	FS4356R-3	FS4360R-3
A in./mm	36/914	40/1016	44/1118	48/1219	52/1321	56/1422	60/1524
B in./mm	39.14/994	43.14/1096	47.14/1197	51.14/1299	55.14/1401	59.14/1502	63.14/1604
C in./mm	40.14/1020	44.14/1121	48.14/1223	52.14/1324	56.14/1426	60.14/1528	64.14/1629
System Shipping Weight							
lb./kg	Each system varies, consult factory.						



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■ **Ordering**

To create a FlexSafe system with a Universal Controller, simply fill in the fields in the model number sequence given below. Each field is numbered and information on completing a specific field can be found in the sections which follow. Information is required in all fields.



For specifications and dimensions on the Universal Controller, see www.sti.com



To order FS4300 components as part of a DuoSafe system, see www.sti.com

FS43 - X- R- - XI- RI
 ① ② ② ③ ④ ④

Example: FS43C-AC1-15X-05R-081612-1208XI-1224RI

This system has a standard controller, 115 VAC input power, 4.6 m (15 ft.) transmitter cable and a 1.5 m (5 ft.) receiver cable. It has an 203 mm (8 in.) first segment, 406 mm (16 in.) middle segment, and a 305 mm (12 in.) end segment. Additionally, on the transmitter side, it has a 305 mm (12 in.) interconnect cable between the first and middle segment and an 203 mm (8 in.) interconnect cable between the middle and end segment. On the receiver side it has a 305 mm (12 in.) interconnect cable between the first and middle segment and a 610 mm (24 in.) interconnect cable between the middle and end segments.

① Represents Controller Style and Input Power

Designator	Description
C-AC1	NEMA 4, 12 enclosure, 115 VAC
C-AC2	NEMA 4, 12 enclosure, 230 VAC
C-DC1	NEMA 4, 12 enclosure, 24 VDC negative ground
C-DC2	NEMA 4, 12 enclosure, 24 VDC positive or negative ground
C-DN-DC1	DIN mount enclosure, 24 VDC negative ground

To specify a controller with lid-mounted Run/Start key switch, begin designator with CK- rather than C-. Available only on NEMA enclosure.

② Represents transmitter (X) and receiver (R) cable length.

The standard cable lengths supplied with a DIN mount enclosure controller are 16.2 m (50 ft.) on both the transmitter and receiver.

For IP65, NEMA 4, 12 enclosure:

Designator	Description
05	1.5 m (5 ft.) cable
10	3.0 m (10 ft.) cable
15	4.6 m (15 ft.) cable
20	6.1 m (20 ft.) cable
25	7.6 m (25 ft.) cable
30	9.1 m (30 ft.) cable
35	10.7 m (35 ft.) cable
40	12.2 m (40 ft.) cable
45	13.7 m (45 ft.) cable
50	15.2 m (50 ft.) cable
55	16.8 m (55 ft.) cable
60	18.3 m (60 ft.) cable
65	19.8 m (65 ft.) cable
70	21.3 m (70 ft.) cable
75	22.9 m (75 ft.) cable
80	24.4 m (80 ft.) cable
85	25.9 m (85 ft.) cable
90	27.4 m (90 ft.) cable
95	29.0 m (95 ft.) cable
100	30.48 m (100 ft.) cable

For DIN-mount enclosure:

Designator	Description
30	9.1 m (30 ft.) cable
50	15.2 m (50 ft.) cable

D

safety light curtains

③ Represents the length of all transmitter and receiver segments in a system.

FlexSafe safety light curtains must have a minimum of two segments—one first and one end. Up to two middle segments may be added. The protected height of a system cannot exceed 1626 mm (64 in.). A 1524 mm (60 in.) middle segment is not available.

Combine the designators given below to complete field ③ in the model number sequence. The combination for a three segment system might look like 081224. This means that the system has an 203 mm (8 in.) first segment, 305 mm (12 in.) middle segment, and a 610 mm (24 in.) end segment.

Designator	Coverage Height
04	102 mm (4 in.)
08	203 mm (8 in.)
12	305 mm (12 in.)
16	406 mm (16 in.)
20	508 mm (20 in.)
24	610 mm (24 in.)
28	711 mm (28 in.)
32	813 mm (32 in.)
36	914 mm (36 in.)
40	1016 mm (40 in.)
44	1118 mm (44 in.)
48	1219 mm (48 in.)
52	1321 mm (52 in.)
56	1422 mm (56 in.)
60	1524 mm (60 in.)

④ Represents transmitter (XI) and receiver (RI) interconnect cable length.

The transmitter segments may have different interconnect cable lengths than the receiver. Combine the designators listed below to complete both fields numbered ④ above.

The combination for a three segment system may look like 1224. This means that the system uses a 305 mm (12 in.) interconnect cable between the first and middle segment and a 610 mm (24 in.) interconnect cable between the middle and end segments.

Designator	Description
08	302 mm (8 in.) interconnect cable
12	305 mm (12 in.) interconnect cable
24	610 mm (24 in.) interconnect cable
36	914 mm (36 in.) interconnect cable
48	1219 mm (48 in.) interconnect cable
60	1524 mm (60 in.) interconnect cable
72	1829 mm (72 in.) interconnect cable
120	3048 mm (120 in.) interconnect cable
144	3658 mm (144 in.) interconnect cable
240	6096 mm (240 in.) interconnect cable



For information on STI safety light curtain accessories, see www.sti.com

Safety Standards and Precautions

The FlexSafe meets ANSI/RIA R15.06-1999, ANSI B11.19-2003 and the following applicable OSHA standards. When used with mechanical power presses, OSHA standard 1910.217(c) applies. For other applications, the requirements of section 1910.212 apply. When combined with an STI Universal or DuoSafe controller, the FlexSafe meets B11.19-1990 standards, including control reliability requirements for point-of-operation presence sensing devices and complies with CSA and UL508 standards.

Only use the FlexSafe on machinery that stops consistently and immediately anywhere in its cycle or stroke. Never use a FlexSafe on a full-revolution clutched press or machine. Access to the point of operation or hazardous machine area not protected by the FlexSafe, including possible corners between FlexSafe segments, must be guarded by fencing, barriers or other appropriate methods.

The purchaser, installer and employer are responsible for meeting all local, state and federal government laws, rules, codes or regulations relating to the proper use, installation, operation and maintenance of this control and the guarded machine. See Installation and Operation Manual for additional information.

All application examples described are for illustration purposes only. Actual installations will differ from those indi-



Go to the Engineering Guide
For in-depth information on safety standards and use.