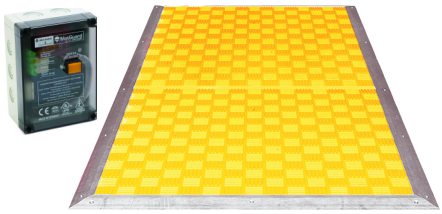
Technical Data

Original Instructions

Safety Mats and Edges Specifications

Bulletin 440F

MatGuard Pressure-sensitive Safety Mats



Pressure-sensitive safety mats provide constant guarding and monitoring of a floor area around a machine. 30 kg (66 lb) or more of pressure on the safety mat (for example, an operator's footstep) causes the safety mat controller unit to switch off power to the hazard. Like safety edges, MatGuard™ safety mats are easy to apply and maintain, can withstand high-pressure washdowns and are not susceptible to dead spots. An ideal solution for relatively small areas, MatGuard products also offer a high degree of application flexibility. We offer reversible safety mats, direct micro quick connectivity to controllers, simple connection to standard and DeviceNet® Safety I/O blocks, custom system configurations, and quick-delivery standard sizes. However, dropped objects, such as tool dies can damage safety mats. Also, safety mats can pose a potential trip hazard if trim is not used

For more information, see MatGuard Safety Mats on page 5.

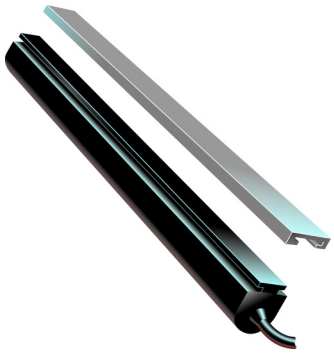
Applications

- Work cells
- Area detection

Common Misapplications

- Uneven floors
- Lack or improper use of uniting trim
- Presence of volatile chemicals

Safedge Pressure-sensitive Safety Edges



Safedge™ pressure-sensitive safety edges are flexible strips that can be mounted to the edge of a moving part-such as a machine table or powered door-that poses a risk from crushing or shearing. Contact of the edge with an object or personnel switches off the machine hazard. Safety edges are a cost-effective solution for constant safety monitoring in smaller areas, especially in applications that require physical flexibility and a tight turn radius.

Rated to Category 3, safety edges do not develop dead spots like some other pressure-sensitive safety offerings. They are also easy to install and maintain, and can withstand high-pressure washdowns, which makes them suitable for a wide range of applications and environments. Multiple profile sizes and the availability of custom edge systems also lend to a high degree of application flexibility. It is important to note that Safedge requires a dedicated safety relay for monitoring and control, which can be connected to other safety systems.

For more information, see Safedge Safety Edges on page 21.

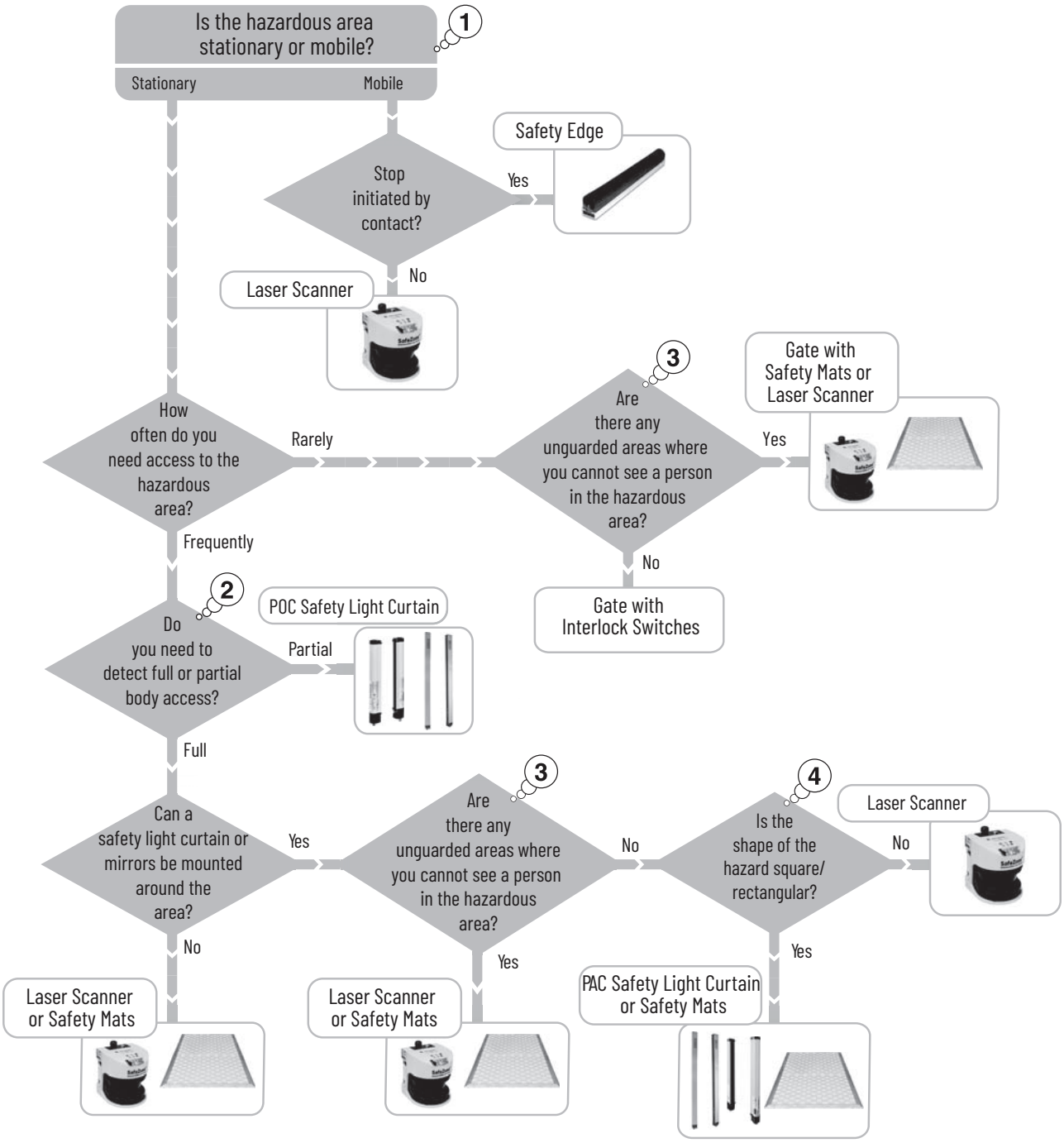
Applications

- Sliding doors
- Garage doors
- Pinch points

Common Misapplications

- Submersible applications
- Exposure to volatile chemicals (that can damage the rubber profile)
- Applications where physical contact can injure personnel

Selection Flowchart



1 Stationary/mobile Hazardous Area

A stationary hazard refers to a fixed machine or work cell where one or more mechanical hazards exist. A mobile hazard is generally a fixed rail linear transfer mechanism (for example, a transfer cart or conveyor) or an Automatic Guided Vehicle (AGV). Use of a safety device on a mobile hazard generally relates to collision avoidance with personnel or surrounding machinery.

In the instance that the hazard moves toward the operator (such as with powered doors) as opposed to the operator moving toward the hazard, a pressure-sensitive safety edge can be mounted to the leading edge of the door. Any contact between the door and personnel stops the machine before injury can occur.

2 Full-body Versus Partial-body Access

Full-body access refers to the requirement for a person to be standing or walking in (or have access to) the hazardous area around a machine that does not require frequent interaction between personnel and the hazard during regular operation; generally this access is for maintenance and troubleshooting. Full-body perimeter or area access control (PAC or AAC, respectively) is achieved by using a vertical or horizontal safety field, either opto-electronic (that is, a light curtain or scanner) or by contact (safety edges and mats).

Partial-body access, on the other hand, is required for applications where an operator must regularly reach into a machine hazard as part of the process at the point of operation (known as POC or Point of Operation Control). If opto-electronic safety devices such as light curtains and area scanners are used, full- or partial-body detection is directly related to the resolution of the safety device. The following table shows the relationship of sensing field resolution to the type of detection.

Object to be Detected/Protected	Resolution [mm (in.)]
Finger	14 (0.55)
Hand	30 (1.18)
Arm	40 (1.57)
Leg	70 (2.76)

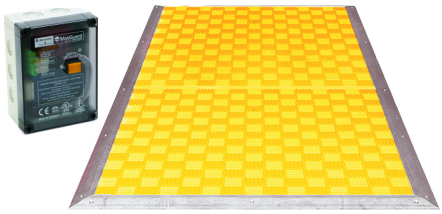
3 Unguarded Areas

In some cases, it is possible for a person to enter the guarded area and be lost from view, potentially allowing another person to close the guard door and start the machine. Often used with hard guarding and a gate that is outfitted with an interlock switch, presence sensing safety devices such as pressure-sensitive safety mats and laser scanners can be used to check for the presence of a person anywhere within the enclosed safety area.

4 Hazardous Area Shape

When the hazardous area to be monitored is a rectangle (or a shape consisting of contiguous rectangles), access to the area can be easily- and cost-effectively-controlled with a standard safety mat. When the hazardous area is irregularly shaped, a custom safety mat is a viable option, but not necessarily the most cost-effective or readily available. In such a case, a safety scanner is the best option because its scanning field can be easily programmed to scan irregular areas and ignore obstacles (walls, columns) while detecting moving objects (people, AGVs, and so on) as required.

System Overview



The MatGuard area detection system consists of a number of interconnecting pressure-sensitive safety mats and a monitoring control unit. The safety mat meets the arduous conditions that are found on the factory floor, and uses well-tried components and techniques, consistent with Category B and Category 1 requirements.

The safety mats are available in a wide range of standard sizes to meet most requirements. Special sizes and shapes are available. Each safety mat has two conductive plates that nonconductive compressible separators hold apart. Each four-wire safety mat operates on 24V DC and is prewired and connected in series with other safety mats, which forms a complete floor-level guarding system for hazardous areas. A safety-rated control unit such as a Minotaur™ safety relay, MatGuard control unit, or MatGuard Mat Manager monitors the circuit through the safety mat. When the safety mat is clear, the control unit sends a signal to the machine control circuit.

When you step on a safety mat, the conductive plates touch and the resistance in the circuit falls to zero. The control unit monitors this activity, and sends a stop command to the machine control system.

The unique molding process allows for long life and reliability of the safety mat. The safety mat is sealed (IP67) so water, liquids, and coolants do not cause problems with the unit. In addition, the tough vinyl resists bleaches, acids, salt, and all but the most aggressive of industrial chemicals.

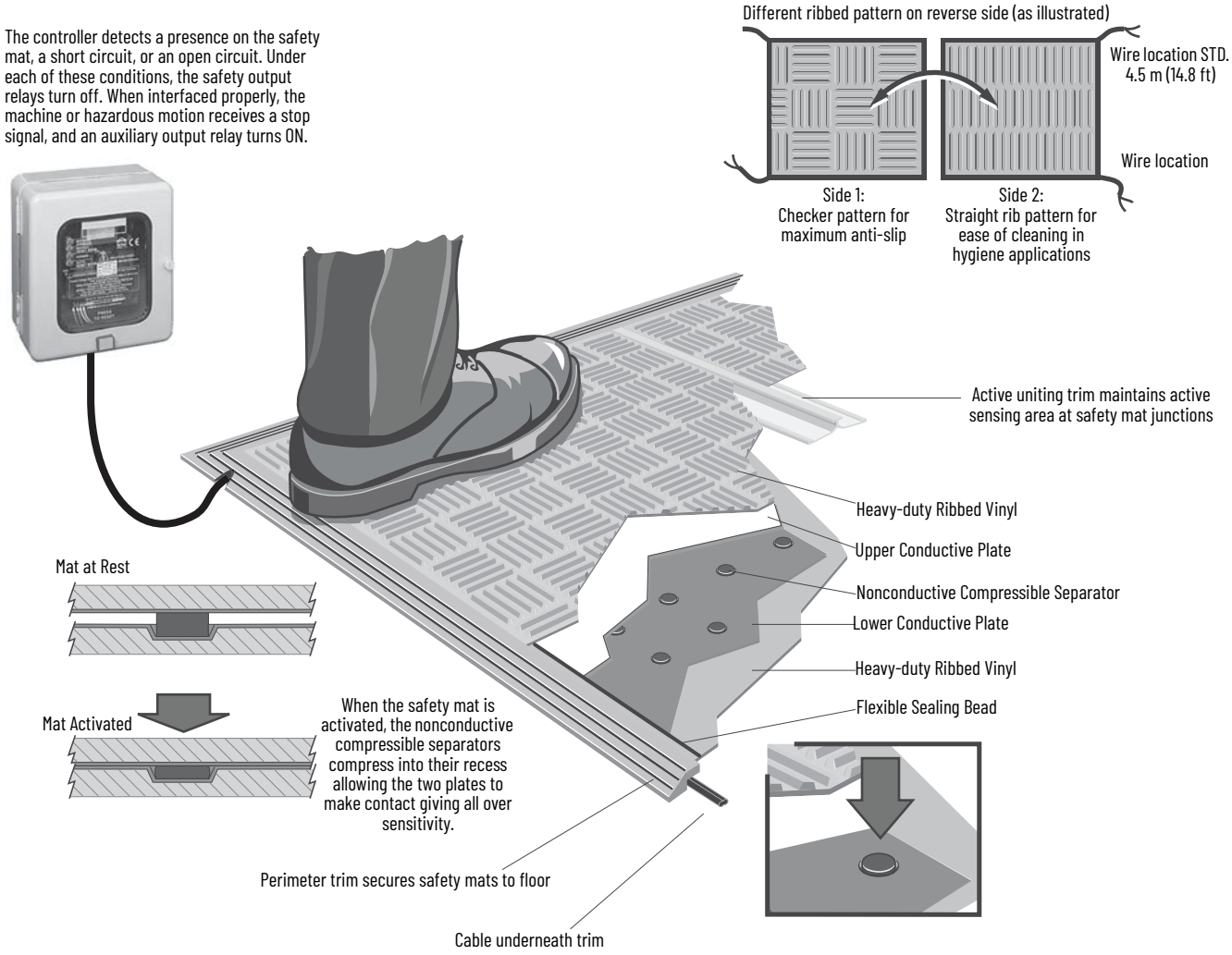
A range of control units is available including the mat manager, which monitors the status of each safety mat or area of safety mats individually. This monitoring enables quick fault detection/repair and identification of the actuated area.

For more information, see the publications in Additional Resources on page 33.

Features

- EC type certification
- Third-party certification to EN 1760-1
- Also meets EN954-1 (ISO 13849-1) Category 3 system and IEC/EN60204-1, AS 4024.5, ANSI B11.19, ANSI RIA R15.06
- Overall sensitivity including the uniting strip
- Mat manager monitors the status of each safety mat individually
- Rugged construction takes the pressure of 4500 psi (excludes the active uniting trim)
- Vinyl construction is resistant to most oils
- Sealed to IP67

Figure 1 - Safety Mat System Anatomy



Standards

The MatGuard safety mat system conforms with the latest European Standard BS EN 13856-1:2013 "Safety of machinery-Pressure sensitive protective devices; General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors."

This standard contains requirements for all aspects of design. Some of the most important points are as follows:

- (From 4.2.2) Where an effective sensing area is built up of more than one sensor (mat), joints and junctions shall respond to the actuating force in accordance to the standard. The standard gives details on the size, force, and positioning of test pieces for testing the safety mat sensitivity.
- (From 4.5.1) A pressure-sensitive mat shall perform its function for the number of operations typically expected. The expected number of operations for the pressure-sensitive mat shall be not less than 100,000 operations in each of five locations (500,000 operations in total). If the effective sensing area consists of a combination of sensors, this requirement shall apply to the combination of sensors. In addition, the expected number of operations for the sensor alone is a further one million operations in one other location.
- (From 4.7.1) When any actuating force is applied to the effective sensing area the output signal switching device(s) shall change from an ON state to an OFF state. Similarly, the OFF state shall also be generated when an actuating force is already present on the effective sensing area when power is put ON. The output signal switching device shall remain in the OFF state for at least as long as the actuating force is present on the effective sensing area.
- (From 4.7.2) Device with reset - For a pressure-sensitive mat or pressure-sensitive floor with reset, the reset signal shall be manually applied either directly to the control unit of the safeguard or, alternatively, via the machine control system.
- (From 4.7.3) Device without reset-For a pressure sensitive mat without reset, the output signal of the output signal switching device(s) shall change to an ON state at power ON and after the actuating force has been removed. If a device without reset is used, then the reset function should be provided in the machine control system.

- (From 4.15.2) The pressure sensitive mats shall meet the requirements of the performance level (PL) and category for which they are specified and marked. The PLs and categories are specified in ISO 13849-1.

IMPORTANT	The MatGuard safety mat system features an active safety mat and a dual-channel monitoring control unit. When an electrical fault in the safety mat, wiring, or control unit is detected, the control unit goes to a safe (OFF) condition.

- (From informative annex C.2.4) In some situations, heavy loads (such as fork lift trucks) can be applied to the sensor (mat). If this is required, the user should identify the need to the safety mat manufacturer.

The MatGuard safety mat system also meets the U.S. standards ANSI/RIA R15.06-1999 Safety Requirements for Industrial Robots and Robot Systems and ANSI B11.19 Performance Criteria for Safeguarding.

These two U.S. standards have many similar requirements and provide performance criteria for design, installation and use.

Excerpts from these standards include:

- From RIA R15.06
  - (From 5.4.2) A single fault in any of these parts does not lead to the loss of the safety function.
  - (From 5.3.4) Safety mats shall have a minimum object sensitivity which detects 30 kg (66 lb) weight of an 80 mm (3.125 in.) diameter circular disk anywhere on the mat sensing surface; provide a means to retain minimum object sensitivity at the area where mats joined together.
- From ANSI B11.19
  - (From 11.1.1.4) The safety mat device shall have a maximum response time that is not affected by object sensitivity adjustments or environmental changes.
  - (From 11.1.1.5) When a component, module, device, or system failure occurs, the safety-related function shall prevent initiation of the hazardous machine motion, initiate an immediate stop command, and prevent reinitiation of the hazardous machine motion.
- From AS 4024.5

  The MatGuard safety mat system is designed to meet the Australian Standard AS 4024.5, which has many similarities to the European Standard EN1760-1. Excerpts from this standard include:
  - (From 3.2.2) Where an effective sensing area is built up of more than one sensor, it shall have no dead zone.
  - (From 3.7) When the actuating force is applied the output signal switching device (s) shall change from an 'on' state to an 'off' state.

  It shall remain in the 'off' state for at least as long as the actuating force is applied.
  - (From 3.8) The sensor shall be provided with a means for fixed permanent location.
  - (From 3.10) Provisions shall be made on the top surface of the sensor to minimize slipping under the expected operating conditions.

Application Details

Safety Distance Calculations ISO 13855:2010

The calculated minimum distance is the minimum horizontal distance from the outer edge of the MatGuard safety mat detection zone to the nearest part of the hazard. The formula for floor-mounted safety mats is:

$S = (K*T) + C$

- S is the minimum safety distance.
- K is the approach speed parameter, in millimeters per second, derived from data on approach speeds of the body or parts of the body
- K=1600 mm/s (63 in./s) for Safety Mats
- T is the overall system stopping performance, the interval between the actuation of the sensing function and the termination of the hazardous machine function T = T1 + T2

  Where t1 is the maximum time between actuation of the sensing function and the output signal switching device being in the OFF state. For the MatGuard safety mat system, t1 = 35 ms

  And t2 is the response time of the machine, that is, the time that is required to stop the machine or remove the risks after receiving the output from the MatGuard safety mat system.
- C is the intrusion distance, or the distance that a part of the body can move past the safeguard towards the hazard zone before actuation of the safeguard

  C = 1200 mm (48 in.) for Safety Mats

The response time of the machine and control system that is used in the calculation must be worst case. Some machines have inconsistent response times that depend on the mode of operation, nature of the work piece, and the point in the operating cycle at which stopping is initiated. Allow for wear in brakes, temperature, age of components, and so on, if these factors can affect the response time. Some circumstances can require an allowance for further delays in the machine control system.

Calculation Example:

In this example, the MatGuard system is used with a machine and control system with a worst-case response time of 0.485 seconds. The system is on a flat surface and is not on a raised platform.

T = t1 + t2
= 0.035 s + 0.485 s
= 0.520 s
S = (1600 * 0.520) + 1200 mm
= 832 + 1200 mm
= 2032 mm (80.76 in.)

This example requires safety mats from 2032 mm (80 in.) to the edge of the machine base plate.

Specifications

Table 1 - General Specifications

Attribute	Value
Standards	EN1760-1, EN954-1, ISO 13849-1, IEC/EN60204-1, ANSI RIA R15.06, ANSI/B11.19, AS4024.5
Category	Cat. 1 device per EN954-1, suitable for Cat. 3 systems
Certifications	CE and UKCA Marked, cULus Listed, CSA Z432-04, and TÜV Certified
Power supply	24V DC, -20% +10%, provided by the control unit
Connection wire length, max	200 m (656 ft)
Cable length	4.5 m (15 ft) standard (see Product Selection)
Detection weight	30 kg (66 lb) minimum on an 80 mm (3.125 in.) diameter circular disk
Pressure applied to mat, max	31,034 kPa (4500 psi)
Zone size, max	100 m^2 (1076 ft^2)
Mechanical life	10,000,000 operations
Operating temperature	-25...+55 °C (-14...+131 °F)
Relative humidity	100%
Enclosure type rating	IP67 (NEMA 6P)
Vibration	5 g, 10...200 Hz
Shock	11 ms 10 g/16 ms 10 g
Terminal protection	IP20 DIN 0470
Wire size	• 2-wire: 0.75 mm^2 (18 AWG) • Jacket OD: 3.8 x 7.4 mm (0.15 x 0.29 in.)
Weight	10.9 kg/m^2 (2.2 lb/ft^2)
Material	• Safety mat: Plastisol vinyl • Trim: 6063 aluminum
Color	Yellow or black
Mounting	Flat surface
Thickness	16 mm (0.63 in.)

Table 2 - Chemical Resistance of Safety Mat Vinyl Covering

Substance	Resistance of Safety Mat Covering
Water	Excellent
Ethyl alcohol	Excellent
Sodium chloride	Excellent
Bleach	Excellent
Water (sea)	Excellent
Hydrochloric acid	Fair to excellent
Sulphuric acid	Fair to excellent
Nitric acid	Fair to excellent
Lubricating oil	Fair to excellent
Cutting fluids	Fair to excellent
Oil (auto)	Fair to excellent
Acetic acid	Fair
Petrol (gasoline)	Fair
Trichloroethylene	Fair to poor
Brake fluids	Poor to fair
Benzene	Poor
Acetone	Poor

In general, the covering has excellent resistance to acids, alkalis, and salt. Hot acids, alkalis, and concentrated/organic acids, have a deleterious effect on prolonged exposure. The covering has fair resistance to aliphatic solvents, fair to poor resistance to aromatic and chlorinated solvents, and poor resistance to ketones and most esters.

IMPORTANT Combinations of chemicals can have unpredictable effects. We recommend testing in such cases. Small pieces of the vinyl material are available if you require testing.

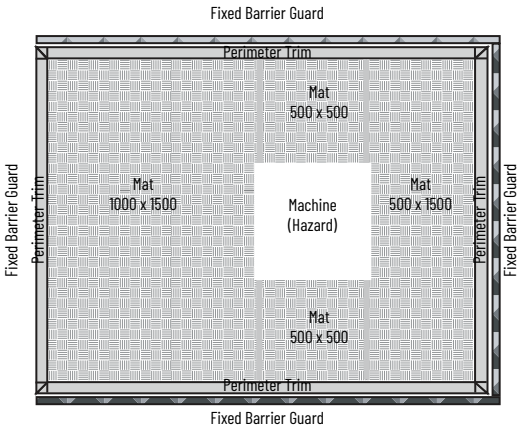
Product Selection

Table 3 - Standard Safety Mats

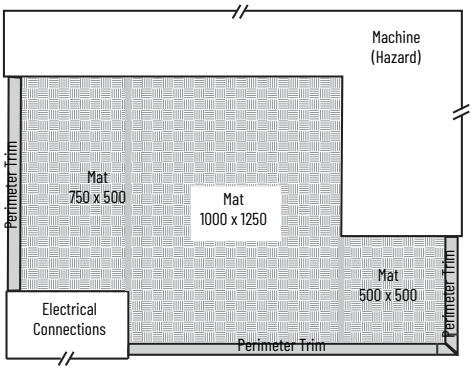
Mat Size [mm (in.)]	Cat. No.	
	Standard Perimeter Trim Kit	Safety Mat
500 x 500 (19.7 x 19.7)	440F-T1010	440F-M1010BYNN
500 x 1500 (19.7 x 59.1)	440F-T1030	440F-M1030BYNN
500 x 750 (19.7 x 29.5)	440F-T1015	440F-M1015BYNN
750 x 750 (29.5 x 29.5)	440F-T1515	440F-M1515BYNN
750 x 1500 (29.5 x 59.1)	440F-T1530	440F-M1530BYNN
500 X 1000 (19.7 X 39.4)	440F-T1020	440F-M1020BYNN
750 X 1000 (29.5 X 39.4)	440F-T1520	440F-M1520BYNN
1000 x 1000 (39.4 x 39.4)	440F-T2020	440F-M2020BYNN
1000 x 1250 (39.4 x 49.2)	440F-T2025	440F-M2025BYNN
1000 x 1500 (39.4 x 59.1)	440F-T2030	440F-M2030BYNN
1000 x 1800 (39.4 x 70.9)	440F-T2036	440F-M2036BYNN
Recommended control unit (1)		440R-C23139

(1) For other control units, contact you local Allen-Bradley distributor or Rockwell Automation sales office.

Examples of Standard System Configurations

System Layout	Bill of Materials		
	Description	Quantity	Cat. No.
	Mat	1	440F-M2030BYNN
		2	440F-M1010BYNN
	Mat	1	440F-M1030BYNN
	Perimeter trim (1)	2	440F-T3210
	Perimeter trim (1)	1	440F-T3310
	Active uniting trim (used to join two safety mats to achieve no dead spots)	1	440F-T3220
	MatGuard controllers	1	440F-C4000S
	Corner trim	4	440F-T3012

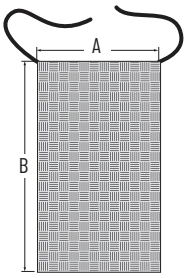
(1) Cut trim to proper length.

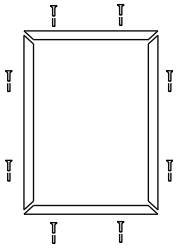
System Layout	Bill of Materials		
	Description	Quantity	Cat. No.
	MatGuard safety mats	1	440F-M2025BYNN
		1	440F-M1010BYNN
		1	440F-M1015BYNN
	Perimeter trim (1)	1	440F-T3310
	Corner trim	1	440F-T3012
	Uniting trim	2	440F-T3020
	MatGuard controllers	1	440F-C4000P

(1) Cut trim to proper length.

Configurable Safety Mats

Use codes from the following tables to configure MatGuard safety mat and trim kit catalog numbers.





Mats:	**440F**	**-**	**M**	**13**	**23**	**A**	**Y**	**NN**
				a	b	c	d	
Trim Kit:	**440F**	**-**	**T**	**13**	**23**			
			e	a	b			

a	
Dimension A [mm (in.)]	
Code	**Description**
2-digit number	Length of the safety mat in millimeters/50 Must be in 50 (1.97) increments Minimum allowed 150 (03); Maximum allowed 1000 (20) The length of A must be equal to or shorter than B.

b	
Dimension B [mm (in.)]	
Code	**Description**
2-digit number	Length of the safety mat in millimeters/50 Must be in 50 (1.97) increments Minimum allowed 200 (04); maximum allowed 1800 (36) The length of A must be equal to or shorter than B.

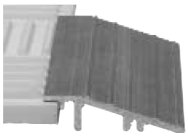
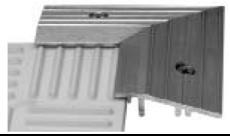
c	
Cable Exit	
Code	**Description**
A	Two 4.5 m (15 ft) 2-wire cables—exit the A corners
B	Two 4.5 m (15 ft) 2-wire cables—exit the B corners
C	One 9.1 m (30 ft) 4-wire cable with M12 plug connector exits the upper-left corner
D	One 9.1 m (30 ft) 4-wire cable without connector exits the upper-left corner
F	One 0.76 m (2.5 ft) 4-wire cable with M12 plug connector exits the upper-right corner
G	One 9.1 m (30 ft) 4-wire cable with M12 plug connector exits the upper-left corner for use with 898D distribution box
H	One 9.1 m (30 ft) 5-wire cable with M12 plug connector exits the upper-left corner for use with ArmorBlock® Guard I/O™ module

d	
Color	
Code	**Description**
B	Black
Y	Yellow

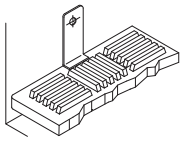
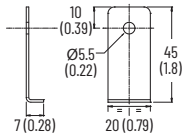
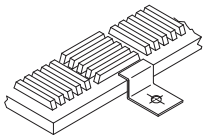
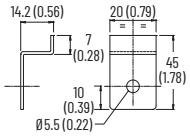
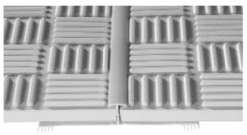
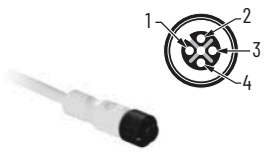
e	
Trim Options	
Code	**Description**
K	Cable channel trim
T	Standard trim

IMPORTANT Order controller separately, see Control Relays on page 31 for selection details.

Table 4 - Trim Options

Type	Description	Length	Cat. No.
	Standard perimeter trim (aluminum) for use with up to three cables that run through the channel.	2 m (6.6 ft), square ends	440F-T3210
	Aluminum standard perimeter trim. For use with up to three cables that run through the channel.	3 m (9.8 ft), square ends	440F-T3310
	Aluminum external corner standard perimeter trim	See Approximate Dimensions on page 13.	440F-T3012
	Aluminum internal corner standard perimeter trim		440F-T3013
	Aluminum perimeter trim with cable channel. Use to feed up to eight cables through the channel.	2 m (6.6 ft), square ends	440F-T3211
		3 m (9.8 ft), square ends	440F-T3311
		4 m (13.1 ft), square ends	440F-T3411
	Aluminum external corner perimeter trim with cable channel	See Approximate Dimensions on page 13.	440F-T3014
	Internal corner perimeter trim with cable channel		440F-T3015

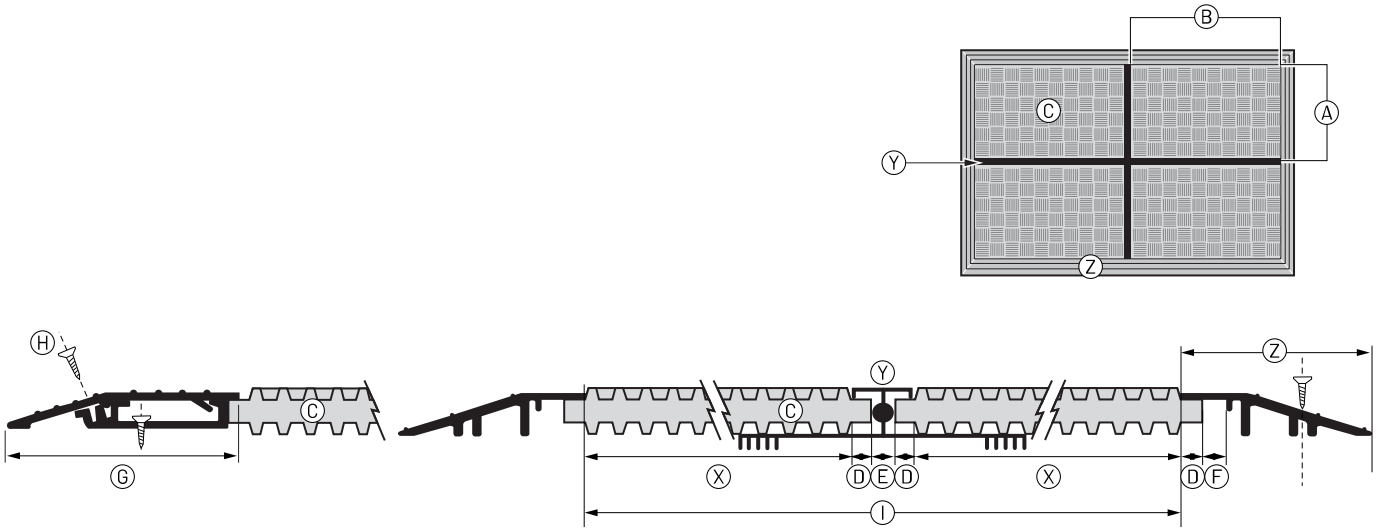
Accessories

Type	Description	Approximate Dimensions	Cat. No.
	Aluminum right angle perimeter trim	13 x 25 mm, 2 m length (0.5 x 1 in., 6.6 ft length)	440F-T3216
		13 x 25 mm, 3 m length (0.5 x 1 in., 9.8 ft length)	440F-T3316
	Stainless-steel angle clip perimeter trim (5 per package)	Dimensions in mm (in.) 	440F-T102933
	Stainless-steel z-clip perimeter trim (5 per package)	Dimensions in mm (in.) 	440F-T102935
	Active uniting trim. Use to join two safety mats with no dead spots.	1 m (3.28 ft) length, square ends	440F-T3120
		1.5 m (4.9 ft) length, square ends	440F-T3020
		2 m (6.5 ft) length, square ends	440F-T3220
		3 m (9.8 ft) length, square ends	440F-T3320
	Vinyl wire guide	63.5 mm (2.5 in.) width, 2 m (6.6 ft) length	440F-T3230
	Accessories kit for 440F-C4000S and 440F-C4000P. Four butt splices, two 500 mA fuses, four wire terminations	—	440F-A108433
	12 Philips flat head, stainless-steel screws for 440F-A3211 and 440F-T3411 channel trim. Secures the top to the bottom.	#6 x 9.5 (3/8)	440F-A17143
	12 Philips flat head, stainless-steel screws with anchors for 440F-T3210, 440F-T3310, and 440F-T3510 trim	#10 x 38 (1.5)	440F-A17141
	12 flat head, stainless-steel screws with anchors for 440F-T3211 and 440F-T3411 channel trim	#10 x 32 (1.25)	440F-A17142
	DC micro QD cordset, 4-pin 1 Brown 2 White 3 Blue 4 Black	2 m (6.5 ft)	889D-F4AC-2
		5 m (16.4 ft)	889D-F4AC-5
		10 m (32.8 ft)	889D-F4AC-10
		15 m (49.2 ft)	889D-F4AC-15
		20 m (65.6 ft)	889D-F4AC-20
		30 m (98.4 ft)	889D-F4AC-30
Reset push button for mat manager controllers			800FP-F0PN3YX11

Approximate Dimensions

Use perimeter trim to secure safety mats in place during installation. Active uniting trim is required between safety mats when using multiple units to cover an area. Proper use of perimeter and/or active uniting trim must be considered when calculating the total area covered by safety mats. The following image shows the additional distances to add to the nominal safety mat sizes when calculating the total area. For example, a system with four 1500 x 1000 mm (59.1 x 39.4 in.) safety mats with 440F-T3x10 perimeter trim and active uniting trim occupies an area of 3114 x 2114 mm (122.6 x 83.2 in.).

Figure 2 - Safety Mat System Dimensions

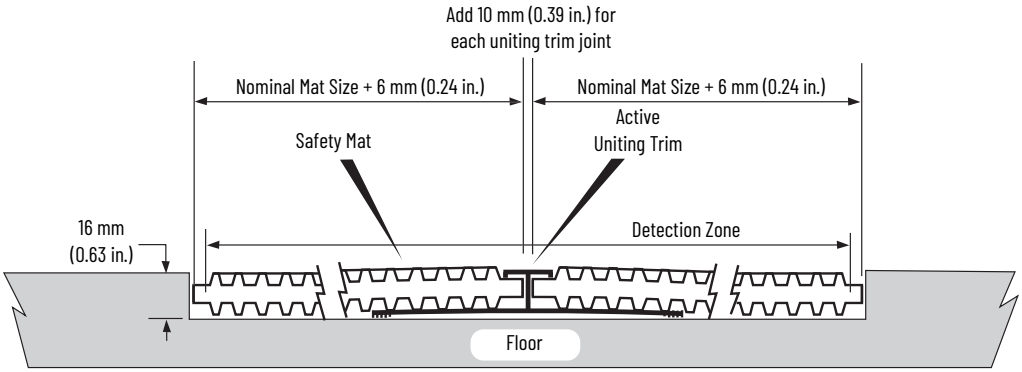


Item	Description
A	Width of safety mat (see Product Selection on page 9)
B	Length of safety mat (see Product Selection on page 9)
C	Safety mat
D	3 mm (0.12 in.) overlap
E	Uniting trim - Add 4 mm (0.16 in.) for each in a multi safety mat system.
F	3 mm (0.12 in.)
G	Channel perimeter trim - Add 95 mm (3.74 in.) for each
H	Self-tapping screw - No. 6 x 9.5 mm (3/8 in.) (not supplied)
I	Detection zone
X	Dimension A or B
Y	Active uniting trim - When pressure is applied to the active uniting trim, the uniting trim causes the safety mat to deflect and change state, which provides all-over sensitivity, even on the joints. Add 10 mm (0.4 in.) for each joint [(A) overlap + (A) overlap + (B) for uniting trim]
Z	Perimeter trim - Add 53.5 mm (2.1 in) for each standard perimeter trim or 99.5 mm (3.9 in.) for each channel trim

IMPORTANT Use Safety Distance Calculations ISO 13855:2010 on page 7 to confirm adequate coverage around the hazard.

For applications where the safety mat is installed below floor level, an additional 6 mm (0.24 in.) must be added to the nominal dimension of each safety mat, as shown in the following image.

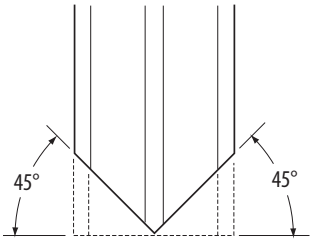
Figure 3 - Below Floor Level Installation



Active Uniting Trim Fixing

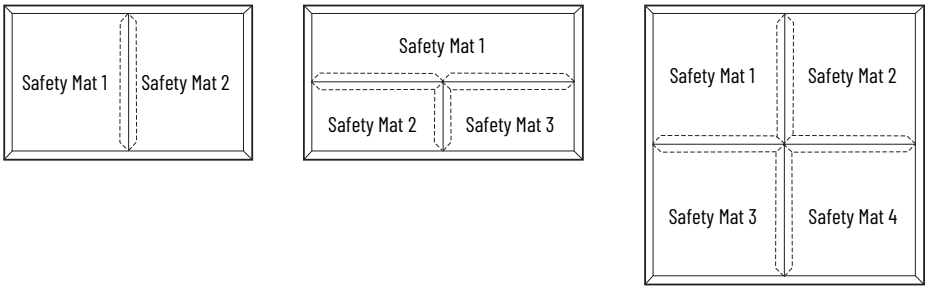
All active uniting trim sections that are used in installation must be blunt mitered to 45º, as shown in the following image, to help with installation and to retain the overall sensitivity of the sensing area.

Figure 4 - 45° Miter



The following image shows junctions of typical multiple safety mat configurations.

Figure 5 - Multiple Safety Mat Configurations

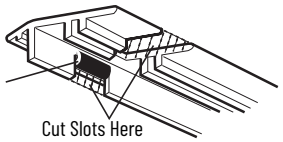


Perimeter Trim Fixing

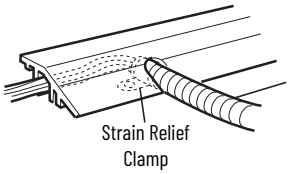
Where the wiring to the mat manager is not buried, notch the perimeter trim at the wire entry and exit positions, and cut the trim slope to suit the conduit system. The following image shows conduit system options. Notch the trim thoroughly so that the wiring is not trapped when the perimeter trim flexes. Verify that there are no sharp edges or burrs, which can damage the wires.

Figure 6 - Perimeter Trim Fixings

440F-T3210
440F-T3310
440F-T3510
Use edge grommets over sharp edges.

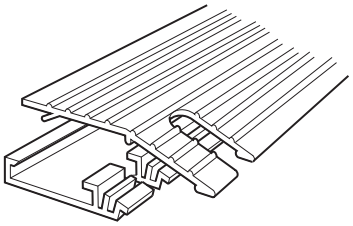


440F-T3210
440F-T3310
440F-T3510

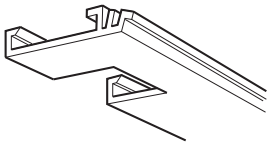


Use a strain relief clamp with flexible conduit.

440F-T3211
440F-T3411
Suggested cutout for flexible conduit entry.

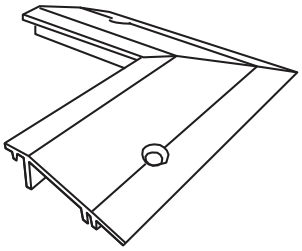


Suggested cut-out for safety mat wires that enter the cable trunk (base of perimeter trim).

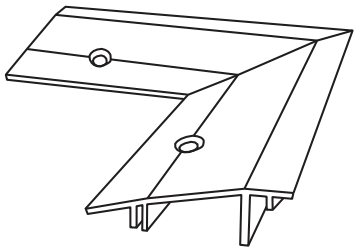


For external corner trim, use 440F-T3014. For internal corner trim, use 440F-T3015.

440F-T3012
Aluminum external corner perimeter trim. (Use with 440F-T3510, 440F-T3310, and 440F-T3210)



440F-T3013
Aluminum internal corner perimeter trim. (Use with 440F-T3510, 440F-T3310, and 440F-T3210)

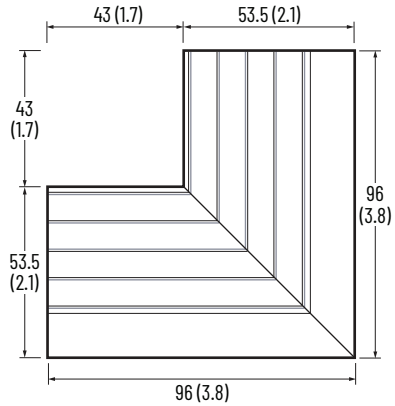


Mark out the edge trim fixing positions on the floor, allowing the trim to overlap the safety mat. Use the holes in the trim as a guide to mark out and drill the floor (fit plugs, if necessary). Clean off the floor and fix the safety mats and edge trim in place with countersunk screws to suit the application.

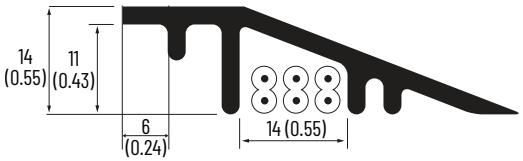
As you fix the perimeter trim, verify that none of the wiring is trapped or crushed between the trim and the floor or the top and bottom sections (depending on trim type). If it is possible to catch or pull the wires, you must use a strain relief clamp where the wiring exits the perimeter trim. All wiring must be protected in suitable conduit. If possible, the wiring or conduit must not cross a floor area where it is a tripping hazard. If crossing the floor cannot be avoided, the wiring/conduit must be enclosed within a protective wire guide (catalog number 440F-A3230).

Standard Perimeter Trim

Internal and External Corners



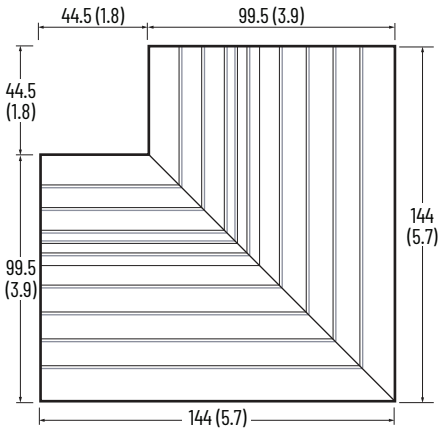
Channel Dimensions



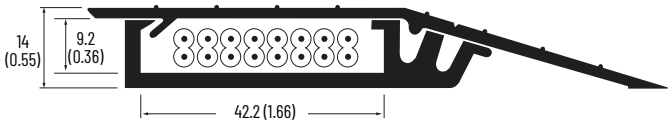
Standard perimeter trim holds three standard 2-wire safety mat cables or two 4-wire cables. The equivalent of two cables is needed when connecting two safety mats in series.

Perimeter Trim with Cable Channel

Internal and External Corners



Channel Dimensions



Cable channel trim holds up to eight standard 2-wire safety mats cables or seven 4-wire cables even when going around corners.

Connectivity

Figure 7 - Two-wire Cable Option

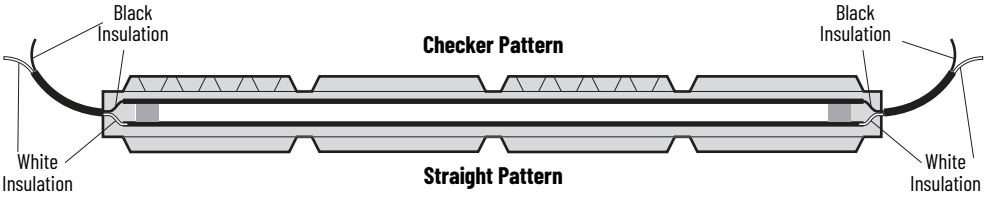
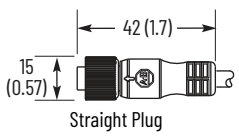
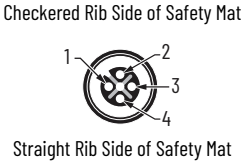
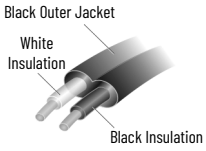
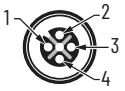
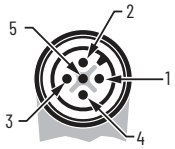


Figure 8 - 4-pin Micro M12 Connector Option [mm (in.)]





Cable Connections

Cable Exit Configuration Code	Description	Compatibility	Connector	Wire Color	Circuit
A	Two 4.5 m (15 ft) 2-wire cables exit the A corners	Safety Relays		Black Black	N.C.
B	Two 4.5 m (15 ft) 2-wire cables exit the B corners	Safety Relays		White White	N.C.
C	One 9.1 m (30 ft) 4-wire cable with M12 plug connector exits the upper-left corner	Mat Managers		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
D	One 9.1 m (30 ft) 4-wire cable without connector exits the upper-left corner	Safety Relays		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
F	One 0.76 m (2.5 ft) 4-wire cable with M12 plug connector exits the upper-left corner	Mat Managers		1 Brown 2 White	N.C.
				3 Blue 4 Black	N.C.
G	One 9.1 m (30 ft) 4-wire cable with M12 plug connector exits the upper-left corner	Distribution Block (2 N.C.) 898D-4xLT-DM4		1 Brown 3 Blue	N.C.
				2 White 4 Black	N.C.
H	One 9.1 m (30 ft) 5-wire cable with M12 plug connector exits out of upper-left corner	ArmorBlock Guard I/O		1 Brown 2 White	N.C.
				4 Black 5 Gray	N.C.

Connection to Logic Interfaces

Table 5 - Specialty Safety Relays

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
Mat controller	2 N.O.	1 N.C.	Fixed	Automatic/manual Monitored manual	24V AC/DC or 115/230V AC	440F-C4000P
Mat manager	2 N.O.	1 N.C.	Fixed	Automatic/manual Monitored manual	24V DC	440F-C28011

Table 6 - Other Logic Interfaces

Description	Power Supply	Mat Area, Max (1)	Cat. No.
ArmorBlock module	24V DC	90 m^2	1732ES-IB8X0BV4
CompactBlock™ I/O module		111.4 m^2	1791ES-IB8X0BV4
Compact GuardLogix® module		170 m^2	5069-IB8S
Guardmaster® CI safety relay		26 m^2	440R-S13R2
Guardmaster DI safety relay		40 m^2	440R-D22R2
Guardmaster CR30 safety relay		25.3 m^2	440C-CR30-22BBB

(1) Determined by capacitance testing.

Connection Systems

Connection	4-pin Cat. No. (1)	5-pin Cat. No. (1)
Cordset	889D-F4AC-*x*	889D-F5AC-*x*
Patchcord	889D-F4ACDM-*y*	889D-F5ACDM-*y*
Distribution box	898D-4zLT-DM4	—
Shorting plug	898D-41LU-DM	—
T-port	898D-43LY-D4	—

(1) x = 2 (2 m [6.6 ft]), 5 (5 m [16.4 ft]), or 10 (10 m [32.8 ft]) for standard cable lengths.
y = 1 (1 m [3.3 ft]), 2 (2 m [6.6 ft]), 3 (3 m [9.8 ft]), 5 (5 m [16.4 ft]), or 10 (10 m [32.8 ft]) for standard cable lengths.
z = 4 or 8 for the number of ports.

Typical Wiring Diagrams

IMPORTANT The diodes that are shown can be terminal blocks with built-in diodes (1492-JD3DF or 1492-JD3DR).

Figure 9 - Safety Mat, Monitored Manual Reset, Dual Channel Output, Monitored Output

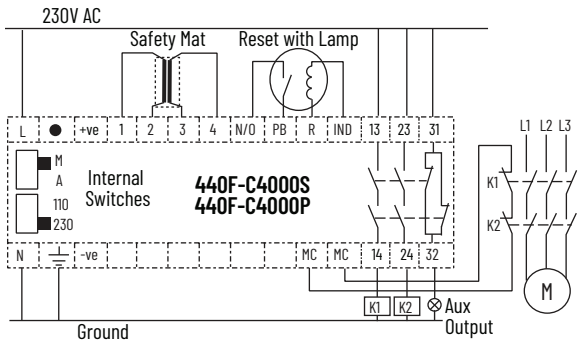


Figure 10 - Mat Manager (Cat. No. 440F-C28021)

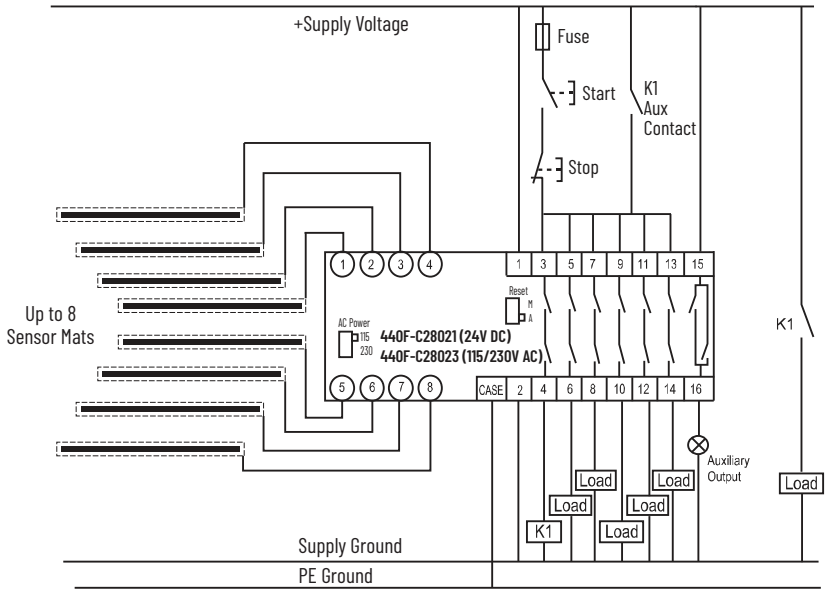


Figure 11 - Mat Manager (Cat. No. 440F-C28011)

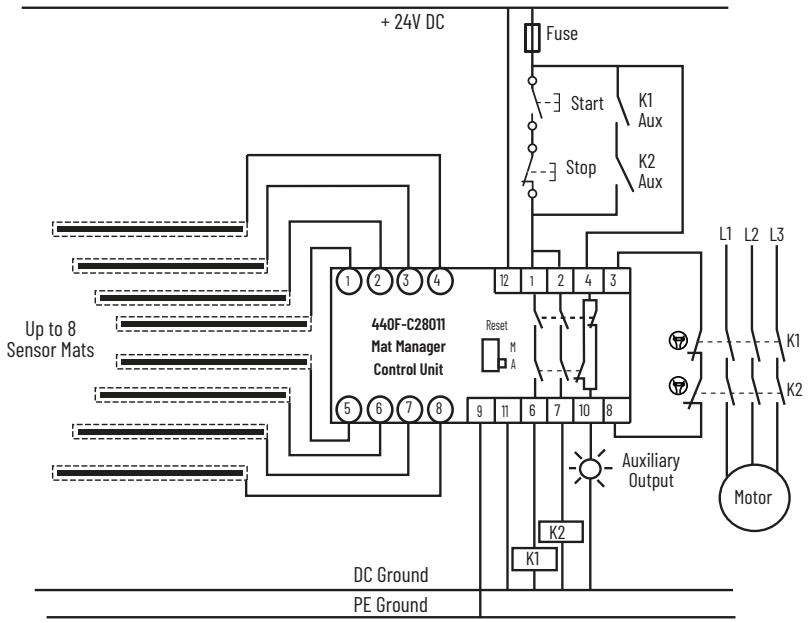
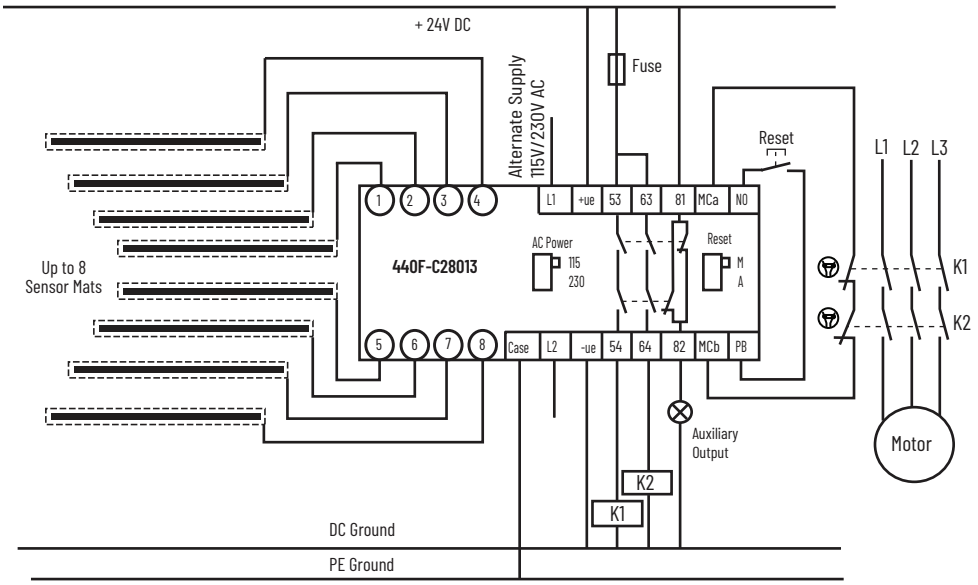
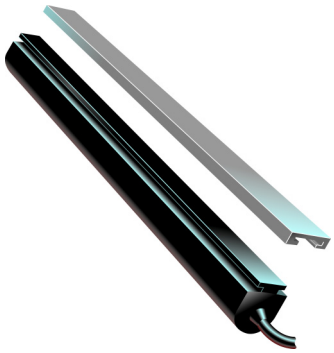


Figure 12 - Mat Manager (Cat. No. 440F-C28013)



System Overview



Innovative design allows the Safedge profile to outperform the competition. The profile uses a bonded combination of non-conductive rubber and flexible wire-cored conductive rubber to bounce back into shape even after repeated compressions.

The Safedge profiles come in three different cushion factors: 5 mm (0.2 in.), 19 mm (0.75 in.), and 41 mm (1.6 in.). Cushion factor is the distance that the profile can compress after a signal is generated. We also offer the profiles with a sealing lip to reduce drafts and leakage between the profile and opposing surface.

The profiles come in two different materials: EPDM (for use in the presence of conductive fluids), and NBR/CR (for use in the presence of oils). Review the chemical resistance chart to choose the best material. If in doubt, test a small sample of the profile for chemical resistance before your final selection.

The Safedge profile has no rigid internal parts that can break through or cause fatigue failures after prolonged use. The multi-stranded copper wire core throughout the length of the strip reduces the risk of resistance buildup on long lengths.

Features

- Various profiles
- Conductive rubber technology
- Up to 50 m (164 ft) lengths
- Aluminum, plastic, or zinc-coated steel mounting rails
- Rubber boot optional
- Active corners
- Sealing lip available

System Components

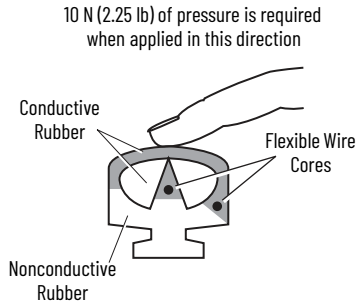
Use the Safedge sensitive edge systems in various applications where the edge of an object must be detectable by contact. The Safedge system consists of three parts.

- C-rail: Used to mount the profile.
- Profile: Contains the sensing surface.
- Control unit: Checks the operation of the profile and interfaces with the control system.

Figure 13 - System Components

Operating Principle

The profile works on the principle of a two-wire design with conductive rubber. Two wires run the length of the profile. The wires end with a known resistor. When the profile deforms, the conductive rubber comes in contact with itself and causes the overall resistance to drop.

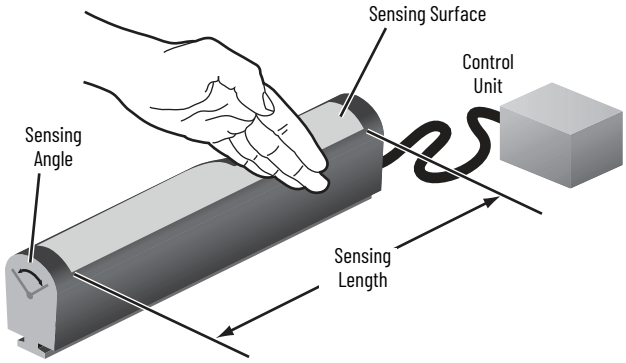


The control unit provides a voltage source to the wires in the profile. The control unit continuously checks the continuity of the wires for shorts, opens, and changes in resistance. If the circuit opens, shorts, or the resistance changes, the output of the control unit turns off.

You can also use the control unit to monitor the performance of the output switching devices.

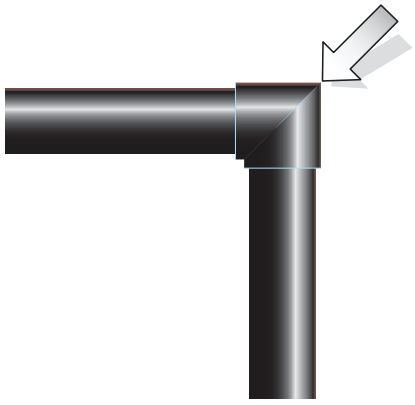
Sensing Surface

The profile is best actuated along the sensing surface. The sensing surface of the Safedge system is active along almost the full length of the edge. The 10 mm (0.4 in.) at the beginning and end are not active.



One distinct advantage of the Safedge system is that the control unit detects pressure that is applied to the corners.

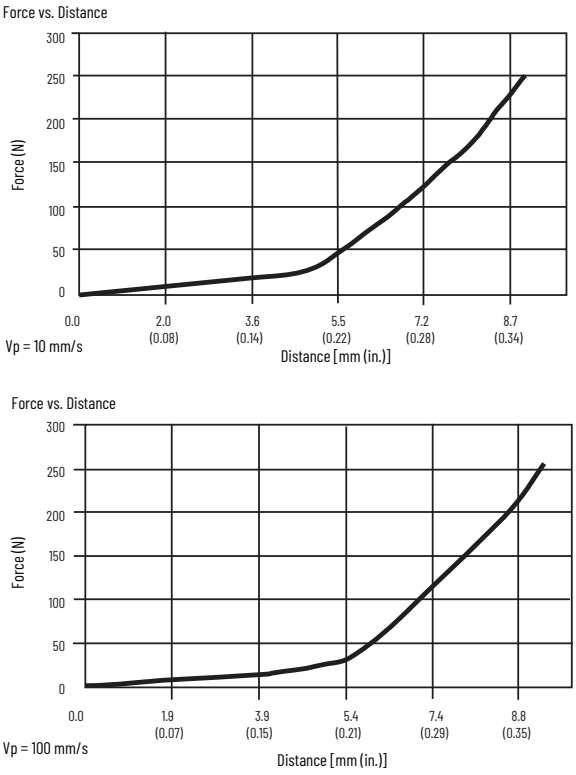
Figure 14 - Active Corners



Force Travel Relationship

Since the Safedge system is a contact device, a force is required to operate the device. This force depends on the shape of the object that applies the force, the speed of the object, and the deformation distance on the profile. To help understand the force requirements, the European standard EN1760-2 2001 provides three test objects that travel at two speeds. Figure 15 on page 22 shows the force that is applied over the deformation distance on the surface of the profile. The force required to operate the corners is greater than the force required along the straight section of the profile. Use this force as a guideline, as the inanimate object cannot be harmed.

Figure 15 - Force Applied to Profile



Risk Assessment

Perform a risk assessment to determine the proper use of the edge system. Use additional protective measures when an individual can reach around or over the edge system and gain access to a hazard. The edge system is a contact type of system. Therefore, cushion factor is an important consideration.

Select the Cushion Factor

An important characteristic of edge systems is called cushion factor. The cushion factor is the distance that the profile can be pressed after the signal is generated. This factor is important when you mount the profile on automated doors.

Automated doors continue to close for some finite time after the profile sends the initial stop signal. This time is known as the system response time. The system response time is the sum of the Safedge control unit response time, the control system response time, and the mechanical stopping time. Systems with a longer response time require larger cushion factors. You must validate that injury does not occur if parts of the body become jammed, for example, between the sensing edge and the fixed part of a machine.

You might also consider a reversing option. When the profile is pressed, the Safedge control unit sends a signal to a reversing relay. Since the reversing relay is not a safety-rated device, you must still confirm that injury does not occur if parts of the body become jammed.

Typical Applications

Typical applications for sensitive edge systems are:

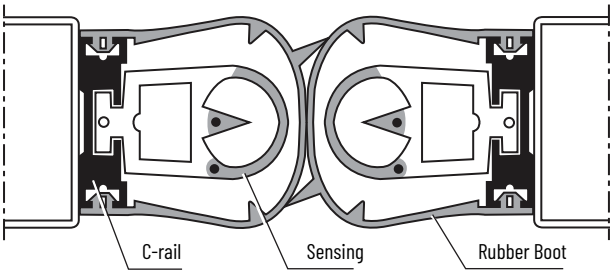
- Sliding doors
- Sliding gates
- Automated guided vehicles
- X-Y tables
- Fence tops
- Scissor jacks
- Loading platforms

The profile mounts on the leading edge of the moving object. As the profile comes in contact with an object, the sensing surface of the profile deforms. The deformation causes the conductive rubber parts to make contact and reduce the circuit resistance. The control makes contact.

Typically, the edge of the object is the leading edge and is moving, like a sliding door or gate. Edge systems are also used on the leading edges of X-Y tables and automated guided vehicles.

Some applications require a drip edge or seal to reduce wind and rain leakage into a door. The Safedge system accommodates both types of applications. The Safedge system has three profiles that include a sealing lip.

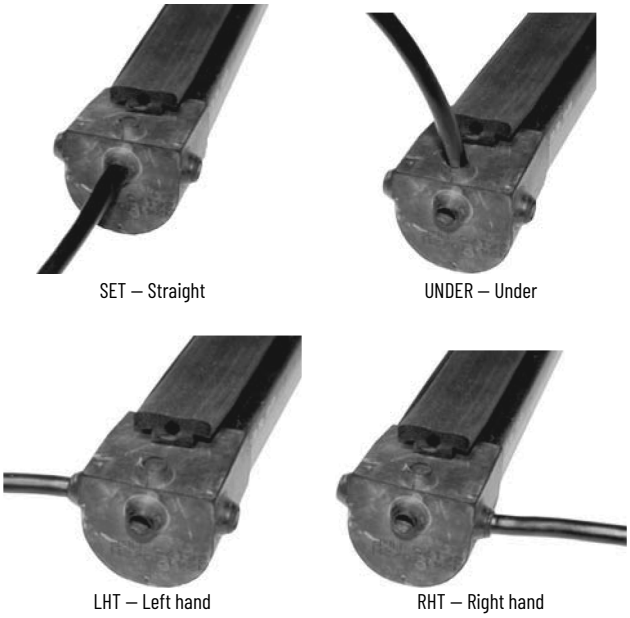
You can also order safety edges with a rubber cover. The cover allows compression of the rubber boot without deforming the profile.



Cable End

You can end the cable in one of four ways providing flexibility in the design and installation of cable routing. Specify the LHT or RHT from the point of view of looking directly at the end of the profiles as shown in the following image.

Figure 16 - Cable Ends



Connection Methods

The profiles can connect in one of two ways: Series or parallel. Either method provides the same performance. The ease of installation determines which method to choose. The more popular method is series.

Figure 17 - Series Connection

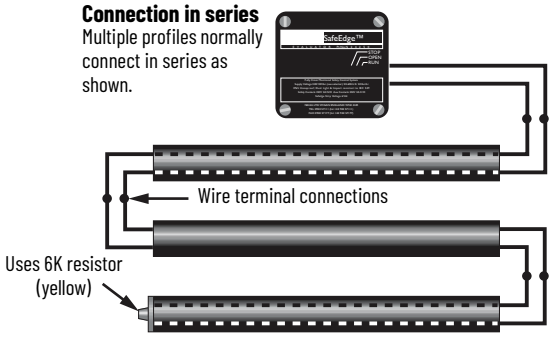
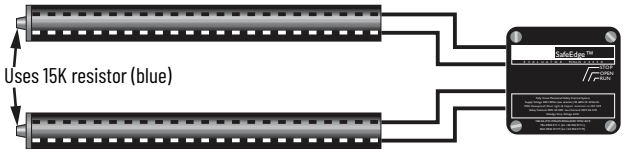


Figure 18 - Parallel Connection



IMPORTANT You can connect a maximum of two profiles in parallel.

Specifications

Attribute	Value
Standards	EN1760-2, EN 954-1, ISO13849-1, IEC/EN60204-1, ANSI B11.19, AS 4024.5
Certifications	CE and UKCA Marked and TÜV Certified. C-Tick not required.
Power supply	Operates on 4V DC supplied from control unit.
Operating temperature	• EPDM material: -5…+55 °C (23…131 °F) • NBR/CR material: 0…55 °C (32…131 °F)
Relative humidity	90%
Enclosure type rating	IP65 (NEMA 6P)
Wire size	18 AWG
Material	• EPDM: Ethylene propylene diene modified rubber • NBR/CR: Acrylonitrile (34% nitrile) butadiene rubber/ chloroprene rubber
Bend radius, min	500 mm (19.6 in.)

Chemical Resistance of Safedge Profile

Substance	Resistance	
	S Profile EPDM	N Profile NBR/CR
Acetic acid (10%)	Good	Good
Acetone	Good	Fair
Ammonium hydroxide (35%)	Good	Good
Benzene	Poor	Poor
Diesel oil	Poor	Good
Ethyl alcohol (ethanol)	Good	Good
Hydrochloric acid (10%)	Good	Good
Lubricating oil	Poor	Good
Nitric acid (10%)	Good	Fair
Petrol (gasoline)	Poor	Fair
Silicone fluids	Good	Good
Sodium chloride (25%)	Good	Good
Trichloroethylene	Good	Poor
Vegetable oils (general)	Good	Good
Water (distilled)	Good	Good
Water (sea)	Good	Good
Latex paint	Good	Good
Oil base paint	Good (easy to clean)	—

Product Selection

IMPORTANT
- Maximum roll size before axial connector needed is 20 m (65.6 ft).
- See page 29 for Code explanations.

Table 7 - Profiles

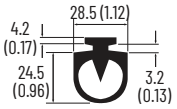
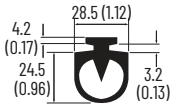
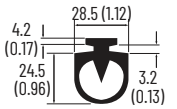
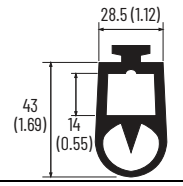
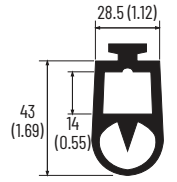
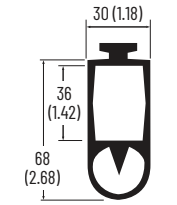
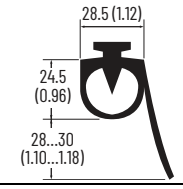
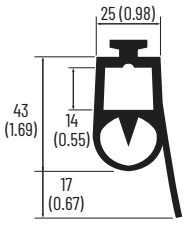
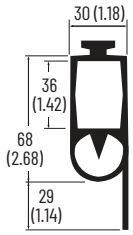
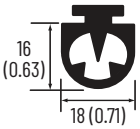
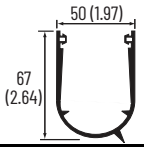
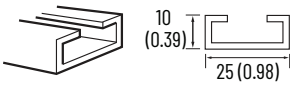
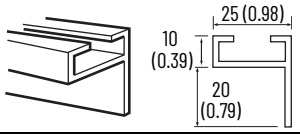
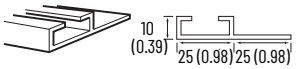
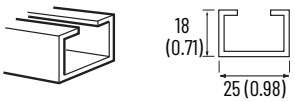
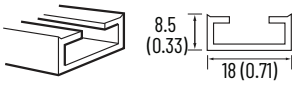
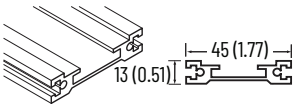
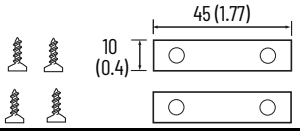
Code	Approximate Dimensions [mm (in.)]	Safedge Profile	Description	Cushion Factor [mm (in.)]	Length [m (ft)]	Cat. No.
A		0110S	Black, EPDM, weight: 463 g/m (0.33 lb/ft)	5 (0.20)	5 (16.4)	440F-E0110S05
					10 (32.8)	440F-E0110S10
					20 (65.6)	440F-E0110S20
C		0110N	Black, NBR/CR, weight: 460 g/m (0.31 lb/ft)	5 (0.20)	5 (16.4)	440F-E0110N05
					10 (32.8)	440F-E0110N10
					20 (65.6)	440F-E0110N20
B		0110R	Red, EPDM, weight: 502 g/m (0.34 lb/ft)	5 (0.20)	5 (16.4)	440F-E0110R05
					10 (32.8)	440F-E0110R10
					20 (65.6)	440F-E0110R20
E		1610S	Black, EPDM, weight: 843 g/m (0.57 lb/ft)	19 (0.75)	5 (16.4)	440F-E1610S05
					10 (32.8)	440F-E1610S10
					20 (65.6)	440F-E1610S20
F		1610N	Black, NBR/CR, weight: 837 g/m (0.56 lb/ft)	19 (0.75)	5 (16.4)	440F-E1610N05
					10 (32.8)	440F-E1610N10
					20 (65.6)	440F-E1610N20
H		0310S	Black, EPDM, weight: 1209 g/m (0.81 lb/ft)	41 (1.61)	5 (16.4)	440F-E0310S05
					10 (32.8)	440F-E0310S10
					20 (65.6)	440F-E0310S20
D, J		0510S	Black, EPDM, with sealing lip, weight: 545 g/m (0.37 lb/ft)	5 (0.20)	5 (16.4)	440F-E0510S05
					10 (32.8)	440F-E0510S10
					20 (65.6)	440F-E0510S20
G, K		0804S	Black, EPDM, with sealing lip, weight: 1013 g/m (0.68 lb/ft)	19 (0.75)	5 (16.4)	440F-E0804S05
					10 (32.8)	440F-E0804S10
					20 (65.6)	440F-E0804S20

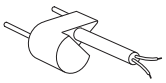
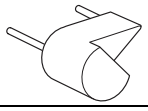
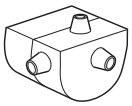
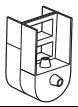
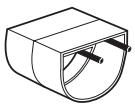
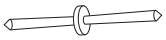
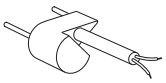
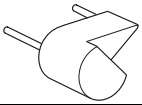
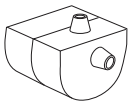
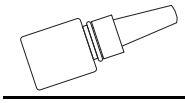
Table 7 - Profiles (Continued)

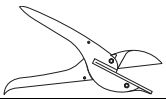
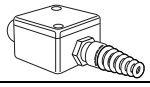
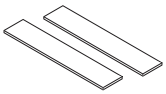
Code	Approximate Dimensions [mm (in.)]	Safedge Profile	Description	Cushion Factor [mm (in.)]	Length [m (ft)]	Cat. No.
I, L		0210S	Black, EPDM, with sealing lip, weight: 1291 g/m (0.87 lbs/ft)	41 mm (1.61 in.)	5 (16.4)	440F-E0210S05
					10 (32.8)	440F-E0210S10
					20 (65.6)	440F-E0210S20
M		0118S	Black, EPDM, weight: 242 g/m (0.163 lbs/ft) (mini profile)	3.75 mm (0.15 in.)	5 (16.4)	440F-E0118S05
					10 (32.8)	440F-E0118S10
					20 (65.6)	440F-E0118S20
N, O		1111S	Black, EPDM, weight: 680 g/m (0.457 lbs/ft)	—	5 (16.4)	440F-E1111S05
					10 (32.8)	440F-E1111S10
					20 (65.6)	440F-E1111S20

C-rails

Code	Approximate Dimension [mm (in.)]	Description	Cat. No.
A		Aluminum type, Type C112/A. Suitable for all profiles. Length: 3 m (9.8 ft); weight: 258 g/m (0.17 lb/ft)	440F-R1212
B		Zinc-coated steel; Type C112/S. Suitable for all profiles. Length: 2 m (6.5 ft); weight: 663 g/m (0.45 lb/ft)	440F-R1112
C		PVC black; Type C112/PB. Suitable for all profiles. Length: 3 m (9.8 ft); weight: 111 g/m (0.07 lb/ft)	440F-R1212PB
D		PVC red; Type C112/PR. Suitable for all profiles. Length: 3 m (9.8 ft); weight: 111 g/m (0.07 lb/ft)	440F-R1212PR
E		PVC yellow; Type C112/PY. Suitable for all profiles. Length: 3 m (9.8 ft); weight: 111 g/m (0.07 lb/ft)	440F-R1212PY
F		Aluminum vertical lip; Type C112/A2. Suitable for all profiles. Length: 2 m (6.5 ft); weight: 368 g/m (0.25 lb/ft)	440F-R1214
G		Aluminum horizontal lip; Type C112/A3. Suitable for all profiles. Length: 2 m (6.5 ft); weight: 388 g/m (0.26 lb/ft)	440F-R1215
H		Aluminum deep channel; Type C112/A4. Suitable for all profiles. Length: 2 m (6.5 ft); weight: 345 g/m (0.23 lb/ft)	440F-R1216
I		Aluminum; suitable for mini profile only. Length: 2 m (6.5 ft); weight: 150 g/m (0.10 lb/ft)	440F-R1219
J		Aluminum; suitable for rubber boot only. Length: 2 m (6.5 ft); weight: 667 g/m (0.448 lb/ft)	440F-R2151
—		Aluminum end plate for c-rail option J; 2 plates; 4 screws, flat head Philips, 10 mm (0.4 in.), #6; weight: 7 g (0.01 lb)	440F-R2152

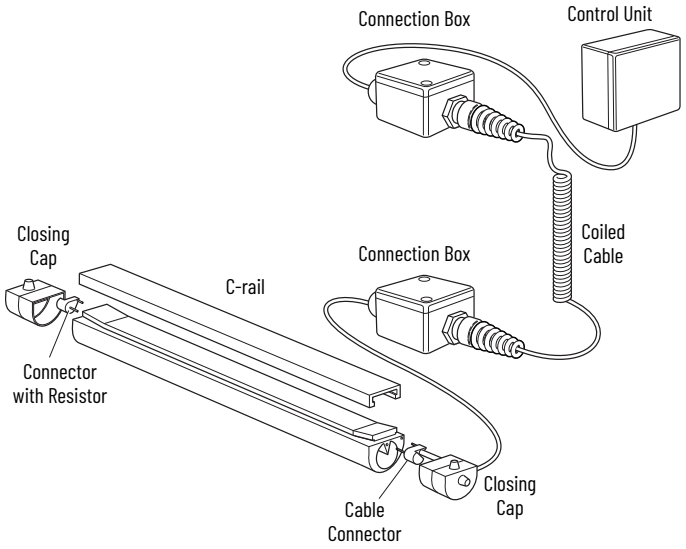
Component Parts

Description		Product Selection Criteria	Cat. No.
	Connector and cable [Ø5 mm (0.20 in.)]	1 m (3.2 ft)	440F-A1301
		2 m (6.56 ft)	440F-A1302
		5 m (16.4 ft)	440F-A1305
		10 m (32.8 ft)	440F-A1306
		15 m (49.2 ft)	440F-A1307
	Terminator	6 kΩ (yellow) resistor for series termination	440F-A1308
		15 kΩ (blue) for parallel termination	440F-A1309
	Closing cap for profile codes (A, B, C, D, J)	Closing cap material: EPDM	440F-A1302S
		Closing cap material: NRB	440F-A1302N
	Closing cap for profile codes (E, F, G, H, K)	Used to close profiles 440F-E0310S and 440F-E1610S.	440F-A1303S
		Used to close profile 440F-E1610N.	440F-A1303N
	Axial connector	With this connector, you can directly connect two profiles. Suitable for 440F-E0110S profiles.	440F-A0061S
		With this connector, you can directly connect two profiles. Suitable for 440F-E0110R profiles.	440F-A0061N
	Straight pin connector	Kit contains one pair of pins suitable for one joint.	440F-A0004
	90° corner connector	For use with profile 440F-E0110S	440F-A0071S
		For use with profile 440F-E0110R	440F-A0071S
		For use with profile 440F-E0110N	440F-A0071N
		For use with profile 440F-E0310S	440F-A0073S
		For use with profile 440F-E1610S	440F-A0074S
		For use with profile 440F-E1610N	440F-A0074N
	90° corner connector (vertical)	For use with profile 440F-E0110N	440F-A0072N
		For use with profile 440F-E0110S or 440FE0110R	440F-A0072S
		For use with profile 440F-E1610N	440F-A0075N
		For use with profile 440F-E1610S	440F-A0075S
		For use with profile 440F-E0310S	440F-A0076S
	45° corner connector	Includes two rubber strips (440F-A0005) when using profile 440F-E0110N	440F-A0071N45
	60° corner connector	Includes two rubber strips (440F-A0005) when using profile 440F-E0110N	440F-A0071N60
	30° corner connector	Includes two rubber strips (440F-A0005) when using profile 440F-E0110N	440F-A24007130
	Connector and cable	Use only on Mini Profile—1 m (3.3 ft)	440F-A1181
		Use only on Mini Profile—3 m (9.8 ft)	440F-A1183
		Use only on Mini Profile—5 m (16 ft)	440F-A1185
	Terminator	Use only on Mini Profile; 8 kΩ (yellow) resistor for series termination	440F-A1186
	Closing cap	Use only on Mini Profile; material: EPDM	440F-A1318
	Cyanoacrylate adhesive	Use Loctite 401 for dry applications. Use Loctite 380E for wet applications.	–

Description		Product Selection Criteria	Cat. No.
	Shears	Use to cut profiles.	440F-A3084
	Connection box	Polycarbonate housing 53 x 53 x 35 mm (2.09 x 2.09 x 1.38 in.) complete with two pole terminal and trumpet type screw on connector with strain and relief clamp. For use with coiled cable.	440F-A0116
	Coiled Connection Cable	2.5 m (8.2 ft) (extended) of flexible coiled cable. Shelf length is 889 mm (35 in.) long. OD of coil is 22 mm (0.86 in.) and OD of cable is 5 mm (0.20 in.).	440F-A2450
		3.5 m (11.5 ft) (extended) of flexible coiled cable. Shelf length is 1270 mm (50 in.) long. OD of coil is 22 mm (0.86 in.) and OD of cable is 5 mm (0.20 in.).	440F-A2700
	Two rubber strips	When using profile 440F-E0110N, shelf length is 175 x 10 x 0.7 mm (6.89 x 0.39 x 0.03 in.).	440F-A0005

Application Example

Example application of a profile that uses a coiled cable. The coiled cable cannot connect directly to the profile due to the weight of the cable. The proper use of the coiled cable is to connect the coiled cable to the profile through the connection box. Secure the coiled cable to both the moving and stationary objects to help prevent straining of the terminal connections.



Factory Assembled Product Selection (Standard Profile)

IMPORTANT Order controller separately. See Control Relays on page 31.

440F - E	C	A	M	V	01270
	a	b	c	d	e

a	
Profile	
Code	**Description**
A	0110S
B	0110R
C	0110N
D	0510S with sealing lip on right side
E	1610S
F	1610N
G	0804S with sealing lip on right side
H	0310S
I	0210S with sealing lip on right side
J	0510S with sealing lip on left side
K	0804S with sealing lip on left side
L	0210S with sealing lip on left side
N	Rubber boot over 0110S
O	Rubber boot over 1610S
P	No profile

b	
C-rail	
Code	**Description**
A	1212 aluminum for profile codes A...L
B	1112 zinc-coated steel for profile codes A...L
C	1212PB PVC black for profile codes A...L
D	1212PR PVC red for profile codes A...L
F	1214 aluminum with vertical lip for profile codes A...L
G	1215 aluminum with horizontal lip for profile codes A...L
H	1216 aluminum deep rail for profile codes A...L
I	1219 aluminum for profile code M only
J	2151 aluminum for profile codes N and O
N	No C-rail (not needed)

c	
Cable Entrance	
Code	**Description**
C	LHT left entrance with 3 m (9.8 ft) cable
E	LHT left entrance with 10 m (32.8 ft) cable
H	RHT right entrance with 3 m (9.8 ft) cable
J	RHT right entrance with 10 m (32.8 ft) cable
M	SET straight entrance with 3 m (9.8 ft) cable
O	SET straight entrance with 10 m (32.8 ft) cable
R	UNDER entrance with 3 m (9.8 ft) cable
T	UNDER entrance with 10 m (32.8 ft) cable
U	No entrance components

d	
Termination	
Code	**Description**
C	LHT left exit with 3 m (9.8 ft) cable
E	LHT left exit with 10 m (32.8 ft) cable
H	RHT right exit with 3 m (9.8 ft) cable
J	RHT right exit with 10 m (32.8 ft) cable
M	SET straight exit with 3 m (9.8 ft) cable
O	SET straight exit with 10 m (32.8 ft) cable
R	UNDER exit with 3 m (9.8 ft) cable
T	UNDER exit with 10 m (32.8 ft) cable
U	Parallel termination (15 kΩ)
V	Series termination (6 kΩ)
W	No exit components

e	
Length of Edge	
Code	**Description**
5-digit number	Enter length of edge in mm; for example: 50 m = 50000, 500 mm = 00500; 300 mm minimum; ±2.5 mm tolerance

Factory Assembled Product Selection (Mini-profile)

IMPORTANT Order controller separately. See Control Relays on page 31.

440F - E	M	I	M	V	01270
	a	b	c	d	e

a	
Profile	
Code	**Description**
M	0118S 3.75 mm (0.15 in.) cushion factor black, mini profile
P	No profile

b	
C-rail	
Code	**Description**
I	1219 aluminum for Profile code M
N	No C-rail (not needed)

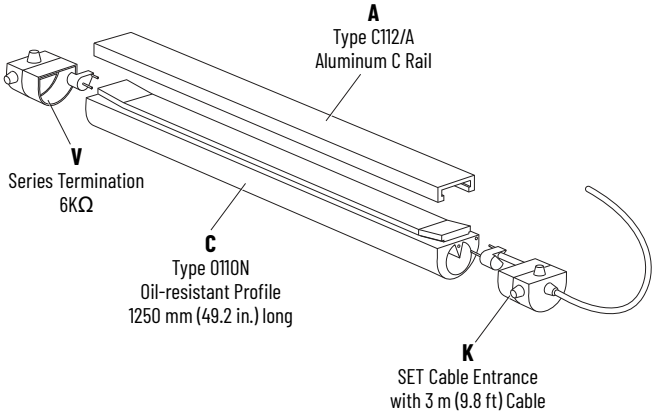
c	
Cable Entrance	
Code	**Description**
M	SET straight entrance 3 m (9.8 ft) cable
R	UNDER entrance 3 m (9.8 ft) cable
U	No entrance components

d	
Termination	
Code	**Description**
M	SET straight entrance 3 m (9.8 ft) cable
R	UNDER entrance 3 m (9.8 ft) cable
V	Series termination-8 kΩ
W	No termination

e	
Length of Edge	
Code	**Description**
5-digit number	Enter length of edge in mm; for example: 50 m = 50000, 500 mm = 00500; 300 mm minimum; ±2.58 mm tolerance

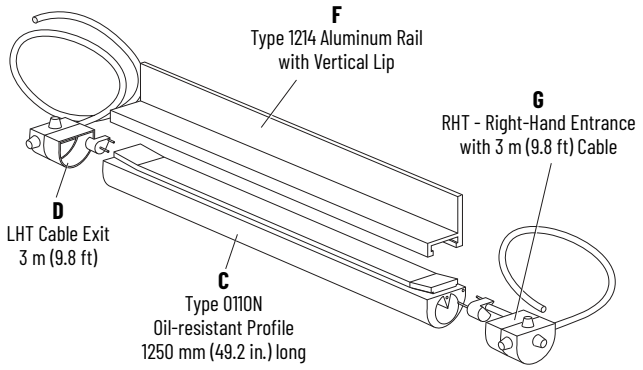
Factory Assembled Examples

Figure 19 - Catalog Number 440F-ECAMM01250



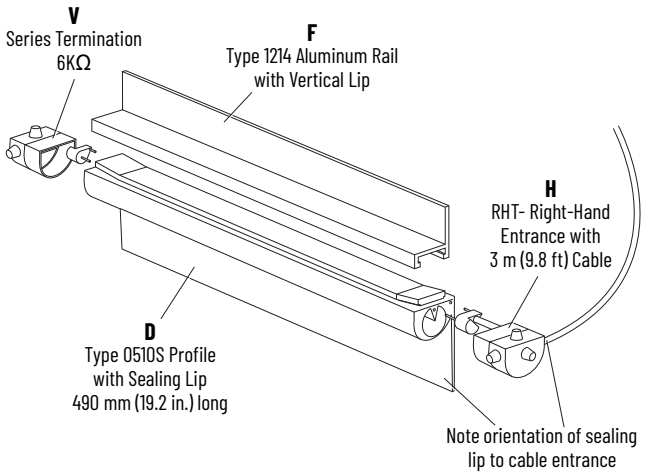
This example shows one oil-resistant profile that is 1250 mm (49.2 in.) long. The edge ends with a series termination. A 3 m (9.8 ft) cable enters straight into the closing cap. The profile mounts on a standard aluminum C-rail.

Figure 20 - Catalog Number 440F-ECFHC01250



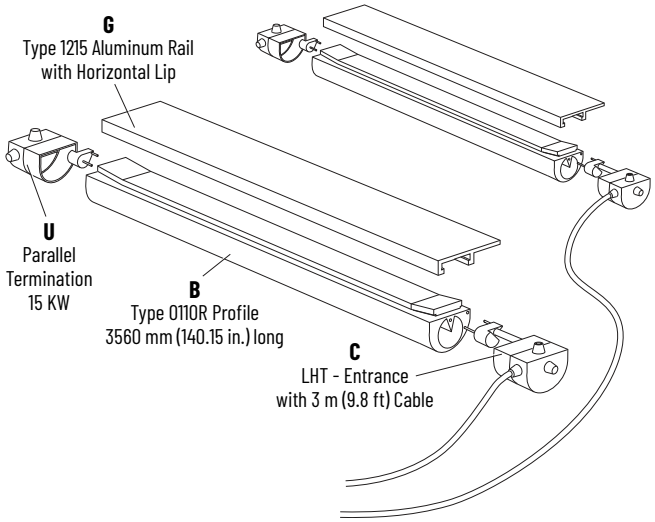
This example shows one oil-resistant profile that is 1250 mm (49.2 in.) long. The edge ends with a 3 m (9.8 ft) cable. A 3 m cable enters straight into the closing cap. The profile mounts on an aluminum C- rail with a vertical mounting lip. A control unit is not included. This edge is intended for use in series with another length of edge that has a terminating resistor.

Figure 21 - Catalog Number 440F-EDFHV00490



This single profile has a sealing lip and is 490 mm (19.2 in.) long. The profile ends with a series termination. A 3 m (9.8 ft) cable enters into the right-hand side of the closing cap from a surface-mounted controller. The profile mounts on an aluminum rail with a vertical lip for ease of mounting. You can reverse the orientation of the sealing lip to the vertical lip by sliding the profile out of the C-rail, rotating the C-rail 180°, and reinserting the profile into the C-rail.

Figure 22 - Catalog Number 440F-EBGCU03560



This example shows a red-colored single profile that is 3560 mm (140.15 in.) long. This profile is part of a parallel profile system, for ease of mounting, as it ends with a parallel termination. A 3 m (9.8 ft) cable enters into the left side of the closing cap. The profile mounts on an aluminum C-rail with a horizontal lip for ease of mounting. You can reverse the horizontal lip by sliding the profile out of the C-rail, rotating the C-rail, and reinserting the profile into the C-rail. You must enter a separate catalog number for the other profile.

Control Relays

Single-function Safety Relays	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
	2 N.O.	1 N.C.	Fixed	Automatic/manual	24V AC/DC or 115/230V AC	440F-C251D
	1 N.O.		Removable		24V AC/DC	440F-C252D
	2 N.O.		Fixed		24V AC/DC or 115/230V AC	440F-C251P

Typical Wiring Diagrams

Figure 23 - Series Ended, Safedge Input, Manual Reset, Dual-channel Output, Monitored Output

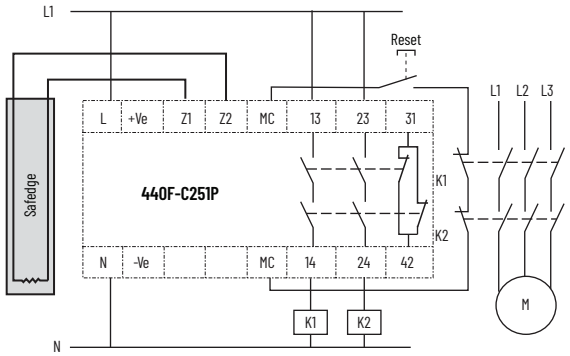


Figure 24 - Parallel Ended, Safedge Input, Manual Reset, Dual-channel Output, Monitored Output

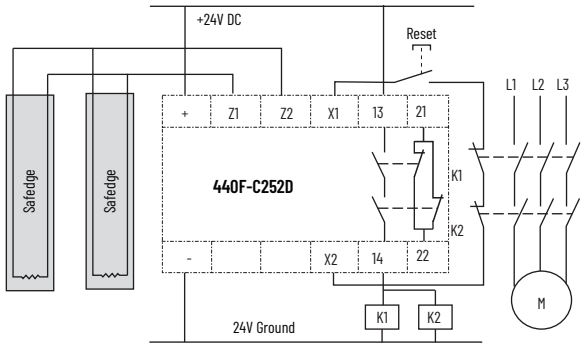


Figure 25 - Series Ended, Cascaded, Safedge Input, Automatic Reset, Dual-channel Output, No Output Monitored

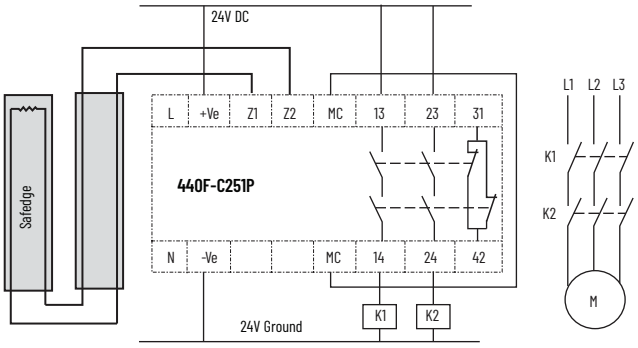
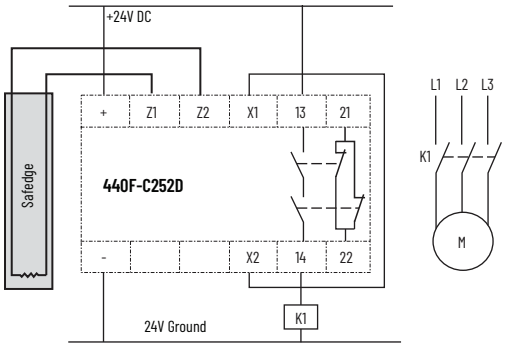


Figure 26 - Series Ended, Safedge Input, Automatic Reset, Single-channel Output, No Output Monitored



Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
MatGuard Mat Manager User Manual, publication 440F-UM001	Provides instructions to install, wire, commission, and maintain your MatGuard Mat Manager.
MatGuard Control Unit with MatGuard Pressure Sensitive Safety Mat System, publication 440F-UM003	Provides instructions to install, wire, commission, and maintain your MatGuard control unit.
Guardmaster Safedge Pressure Sensitive Safety Edge System Installation and User Manual, publication 440F-UM002	Provides instructions to install, wire, commission, and maintain your safety edge system.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
ProposalWorks™ configuration software, rok.auto/systemtools	Helps configure complete, valid catalog numbers and build complete quotes based on detailed product information.
Advisor configuration software, advisor.rockwellautomation.com	Advisor is the future state for ProposalWorks, and will also help configure complete, valid catalog numbers and build complete quotes based on detailed product information.
Rockwell Automation Global SCCR tool, rok.auto/sccr	Provides coordinated high-fault branch circuit solutions for motor starters, soft starters, and component drives.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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