Non-Contact Switches

SensaGuard™

Description

When it comes to machine safety, Rockwell Automation knows that protection of personnel and equipment is your main concern. At the same time, flexibility and productivity are points that must also be considered as you design your safety system. Optimize all of these with the new Allen-Bradley SensaGuard family of non-contact switches.

Featuring the latest generation of RFID technology for coding and inductive technology for sensing, SensaGuard's large sensing range and tolerance to misalignment is a cost-effective solution that is ideally suited for a wide range of industrial safety applications.

The SensaGuard product line is a Category 4/SIL 3 rated switch per EN954-1, TÜV functional safety approved to IEC 61508.

Features

- Switches can be connect to a standard safety relay, for example, the MSR126, MSR127, MSR200/300 Family, SmartGuard™ and Safety I/O Blocks
- Multiple actuator sizes for large sensing distance
- IP69K environmental rating
- Short-circuit and over-voltage protection
- LED located on the switch for door status and troubleshooting
- Unique coded version
  - Automatic learn process at unit power up
  - During commissioning you have the option to select if the sensor can learn a new actuator up to eight times or lock the unit so it can not learn another actuator
- Integrated latch version
  - Adjustable magnetic latch force 20…60N
  - Designed for easy mounting on aluminum profile

Benefits

- No dedicated controller required
- Cat 4/SIL 3 rating maintained even with multiple units connected in series
- Switches can be connected in series with other devices (light curtain, E-stops, key interlock switches)
- Extended diagnostics for easy troubleshooting
- Large sensing distances
- Tolerance to misalignment
- Multiple sensing directions
- Stainless steel version suitable for use in harsh environments
- Use standard proximity brackets

Specifications

Safety Ratings		
Standards	IEC 60947-5-3, IEC 61508, EN 954	
Safety Classification	Cat. 4/SIL3	
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	PFH_D: > 1.12 x 10^{-9} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics	
Certifications	CE Marked for all applicable directives, cULus (UL 508), and TÜV	
Outputs (Guard Door Closed, Actuator in Place)		
Safety Outputs	2 x PNP, 0.2 A, max.; Status: ON (+24V DC)	
Auxiliary Outputs	1 x PNP, 0.2 A max.; Status: OFF (0V DC)	
Operating Characteristics		
Sensing Distance (Assure)	18 mm Plastic Barrel/18 mm Target	15 mm (0.59 in.)
	18 mm Plastic Barrel/30 mm Target	25 mm (0.98 in.)
	18 mm Stainless Steel Barrel/Standard Target	10 mm (0.39 in.)
	Large Rectangular Flat Pack with Standard Target	15 mm (0.59 in.)
Misalignment Tolerance, Min	See misalignment curve	
Repeat Accuracy	10% of Sensing Range	
Output Current, Max.	200 mA (all outputs)	
Operating Voltage	24V DC, +10%/-15% Class 2	
Current Consumption	50 mA	
Frequency of Operating Cycle	1 Hz	
Response Time (Off)	54 ms	
Environmental		
Enclosure Type Rating	NEMA 3, 4X, 12, 13, IP69K	
Operating Temperature [C (F)]	-10…+55° (+14…+131°)	
Relative Humidity	5…95%	
Shock	IEC 68-2-27, 30 g, 11 ms	
Vibration	IEC 68-2-6 10…55 Hz	
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6	
Physical Characteristics		
Housing Material	VALOX® DR 48	
Actuator Material	VALOX® DR 48	
Color	Red	

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 30 years

Product Selection

Type	Assured Sensing Distance	LED Door Indication/ Diagnostic	Margin Indication	Magnetic Hold	Actuator Code Type	Cat. No.		
						Cable		Connector
						3 m	10 m	6 inch Pigtail, 8-pin Micro (M12)
18 mm plastic barrel/18 mm actuator	15 mm (0.59 in.)	Yes	—	—	Standard	440N-Z21S16A	440N-Z21S16B	**440N-Z21S16H**
					Unique	440N-Z21U16A	440N-Z21U16B	440N-Z21U16H
18 mm plastic barrel/30 mm actuator	25 mm (0.98 in.)	Yes	—	—	Standard	440N-Z21S26A	440N-Z21S26B	**440N-Z21S26H**
					Unique	440N-Z21U26A	440N-Z21U26B	440N-Z21U26H
18 mm stainless steel barrel/18 mm actuator	10 mm (0.39 in.)	Yes	—	—	Standard	440N-Z21S17A	440N-Z21S17B	**440N-Z21S17H**
					Unique	440N-Z21U17A	440N-Z21U17B	440N-Z21U17H
Plastic rectangular/ rectangular actuator	18 mm (0.71 in.)	Yes	—	—	Standard	440N-Z21SS2A	440N-Z21SS2B	**440N-Z21SS2H**
					Unique	440N-Z21US2A	440N-Z21US2B	440N-Z21US2H
			Yes	—	Standard	440N-Z21SS2AN	440N-Z21SS2BN	**440N-Z21SS2HN**
					Unique	440N-Z21US2AN	440N-Z21US2BN	440N-Z21US2HN
			Yes	Yes (9 N)	Standard	440N-Z21SS2AN9	440N-Z21SS2BN9	440N-Z21SS2HN9
					Unique	440N-Z21US2AN9	440N-Z21US2BN9	440N-Z21US2HN9
Plastic housing with integrated latch	Contact/ latched	Yes	—	Adjustable 20…60 N	Standard	440N-Z21SS3PA	440N-Z21SS3PB	440N-Z21SS3PH
					Unique	440N-Z21US3PA	440N-Z21US3PB	440N-Z21US3PH

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP				Auto./Manual		5-26	**440R-N23132**
Modular Safety Relays							
MSR211P Base 2 N.C. only	2 N.O.	1 N.C.	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-84	440R-H23177
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Connection Systems

Description	Cat. No.
Cordset	889D-F8AB-✶
Patchcord	889D-F8ABDM-❄
Safety Wired T-Port	898D-438Y-D8
Safety Wired Shorting Plug	898D-418U-DM

✶ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard lengths.
Note: For additional information, see page 7-1.

Non-Contact Switches

SensaGuard™

Accessories

	Description	To Be Used With	Cat. No.
	18 mm plastic actuator	Standard coded models only	440N-Z18PT
		Unique coded models only	440N-Z18UPT
	30 mm plastic actuator	Standard coded models only	440N-Z30PT
		Unique coded models only	440N-Z30UPT
	18 mm stainless steel actuator	Standard coded models only	440N-Z18SST
		Unique coded models only	440N-Z18USST
	Rectangular plastic actuator	Standard coded models only	440N-ZPREC
		Unique coded models only	440N-ZUPREC
		Standard coded margin/magnetic hold models only	440N-ZPRECM
		Unique coded margin/magnetic hold models only	440N-ZUPRECM
	Integrated latch actuator	Standard coded models only	440N-ZLPREC
		Unique coded models only	440N-ZULPREC
	Mountingbracket for tubular proximity sensors—right angle style	18 mm barrel models	871A-BRS18
	Mounting bracket for tubular sensors—clamp style		871A-BP18
	Snap clamp mounting bracket		871A-SCBP18
	Swivel/tilt bracket allows ±10° vertical and 360° rotation adjustment		60-2649
	Mounting plate for vertically hinged doors	Integrated latch version only	440N-AHDB
	Mounting plate for slide and gull wing doors		440N-ASDB

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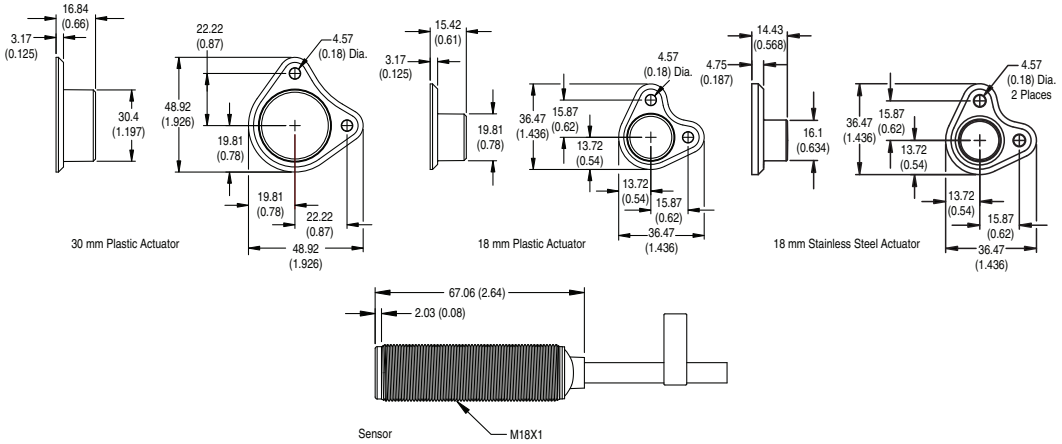
Publication S117-CA001A-EN-P

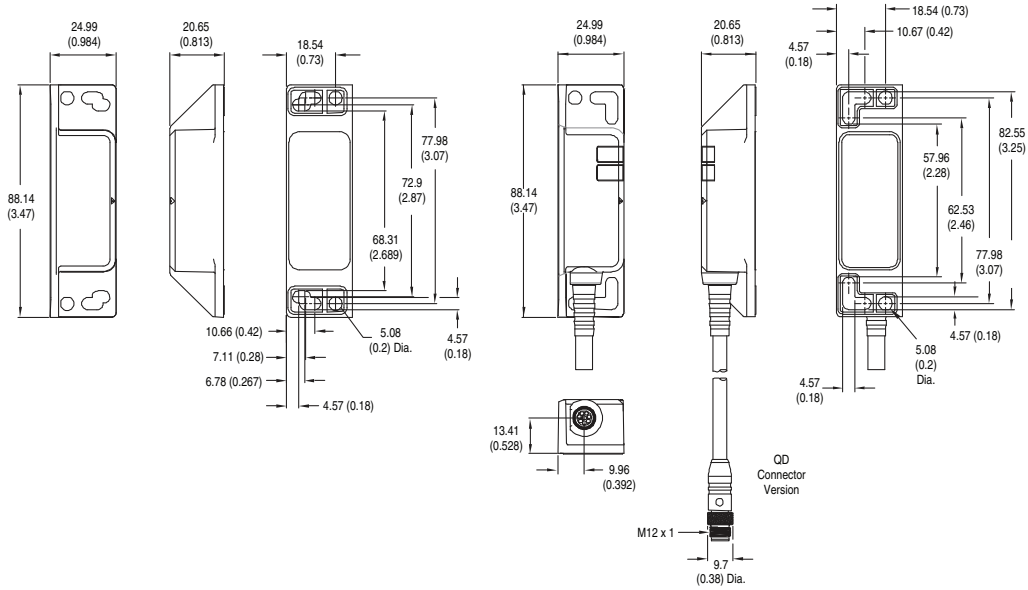
Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

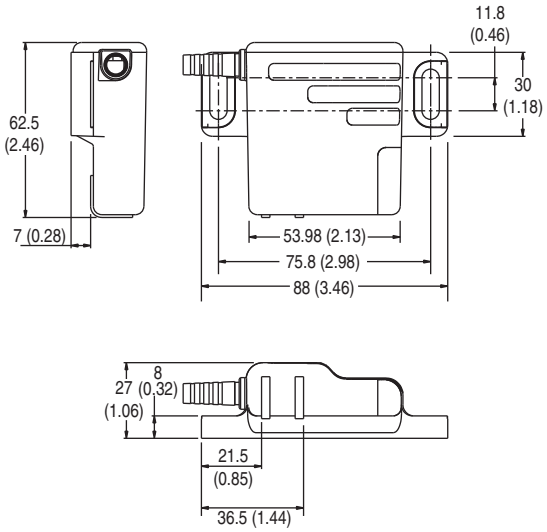
18 mm Barrel



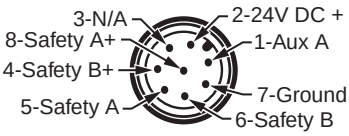
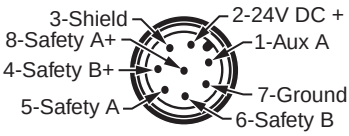
Large Rectangular Flat Pack



Integrated Latch



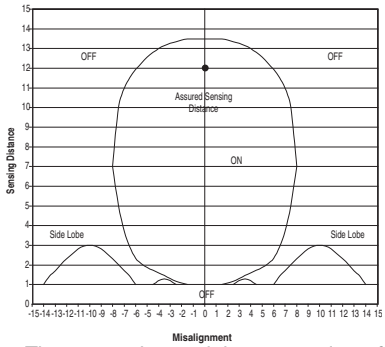
Typical Wiring Diagrams

Description		Plastic	Stainless Steel
8-Pin Micro (M12)			
8-Pin Cordset 889D-F8AB-∗ or cable version	Grey	Safety A	Safety A
	Red	Safety A+	Safety A+
	Pink	Safety B	Safety B
	Yellow	Safety B+	Safety B+
	White	Aux A	Aux A
	Brown	24V DC +	24V DC +
	Blue	Gnd	Gnd
	Green	NA	Shield

∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.

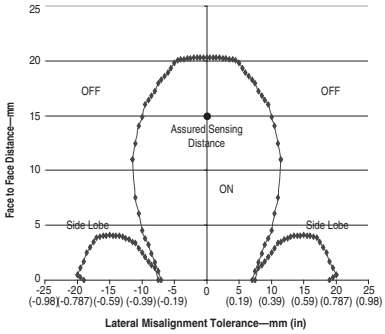
Misalignment Curves

18 mm Stainless Steel Barrel



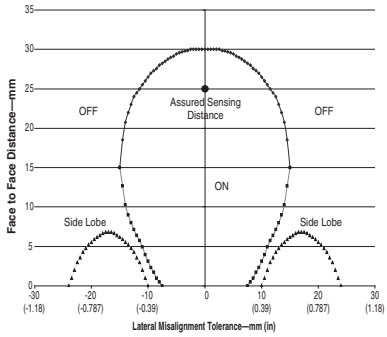
Note: There must be a minimum spacing of 4 mm (0.157 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

18 mm Plastic Barrel



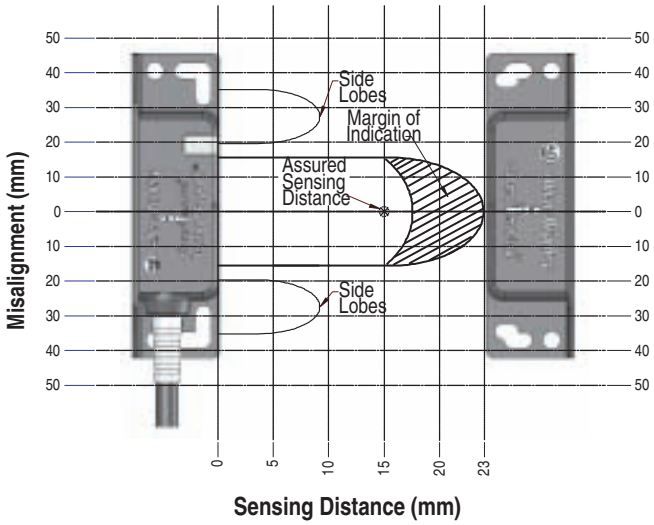
Note: There must be a minimum spacing of 4 mm (0.157 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

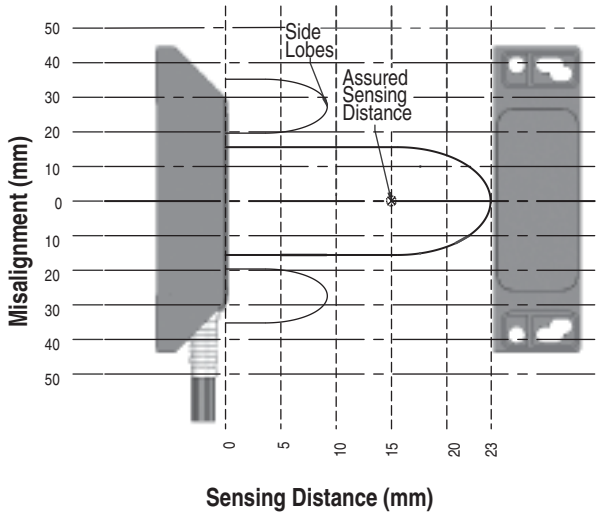
30 mm Plastic Barrel



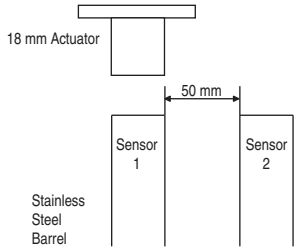
Note: There must be a minimum spacing of 7 mm (0.275 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

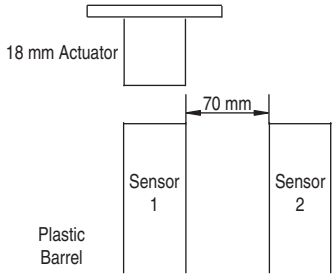
Large Rectangular Flat Pack

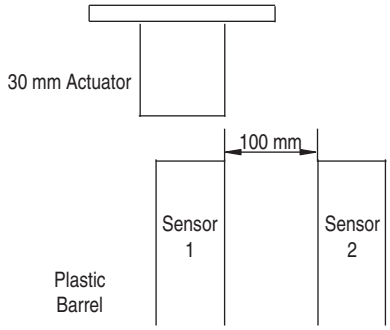


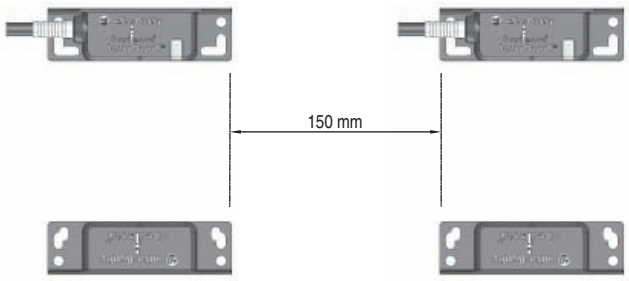


Minimum Distance Between Sensors

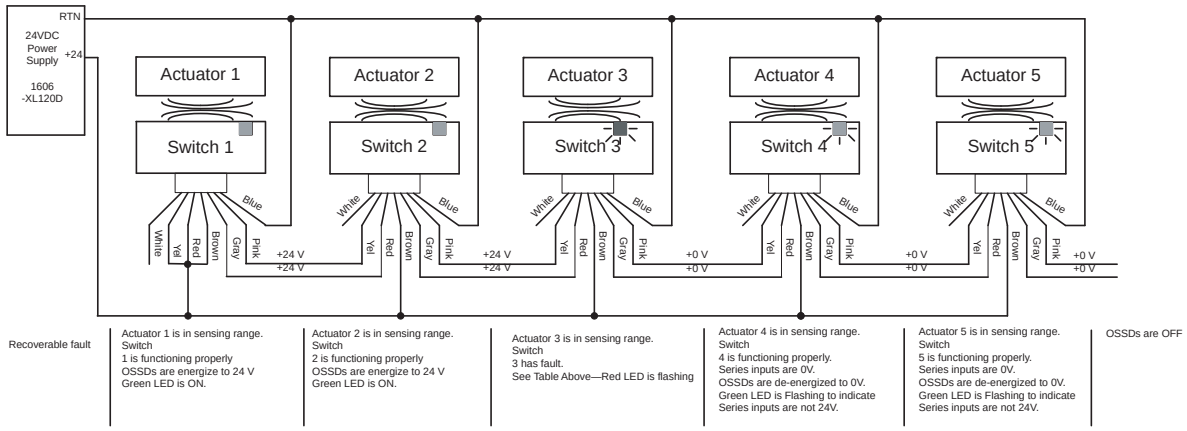








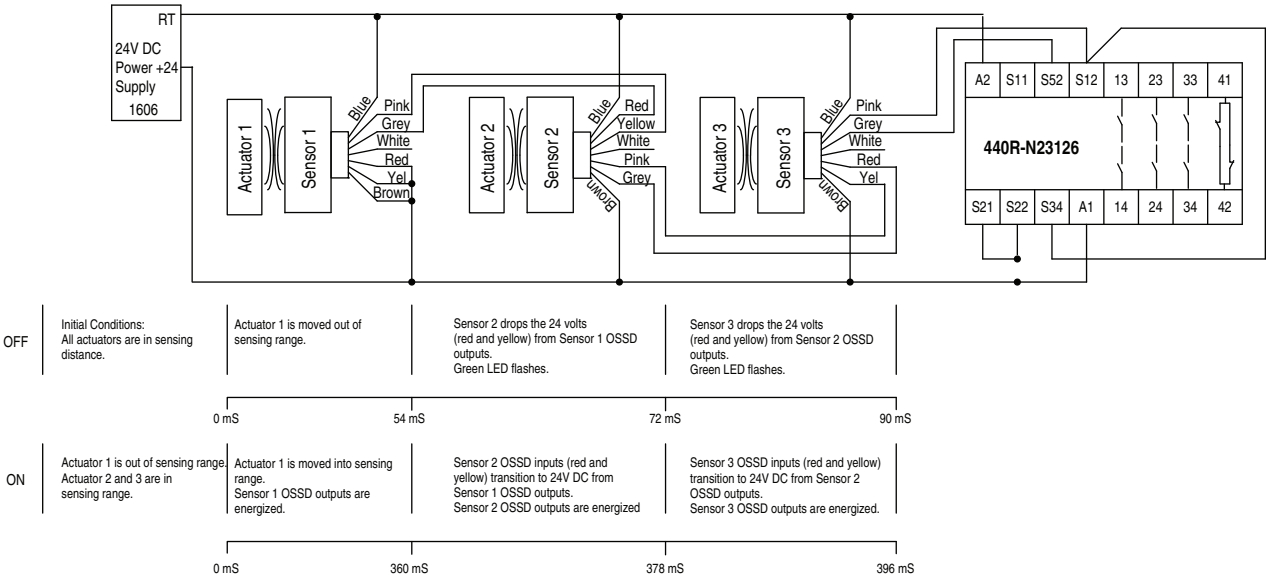
Diagnostic



Unit Indicators (per IEC 60073)

	State	Status	Troubleshooting
Device Output LED	Off	Not Powered	NA
	Red	Not Safe, Output Off	NA
	Green	Safe, Output On	NA
	Green Flash	Power Up Test	Check 24V DC on Safety + Outputs (yellow and red wire)
	Red Flash	1 Hz Flash Recoverable Fault 4 Hz Flash Nonrecoverable Fault	Recoverable Fault: Check Safety Outputs Are Not Shorted to GND, 24V DC or Each Other. Cycle Power.
	Amber Flash	Safe, Output On, Sensor Is Reaching Max. Sensing Distance	Re-adjust Distance Between Actuator and Sensor until Output LED Is Green

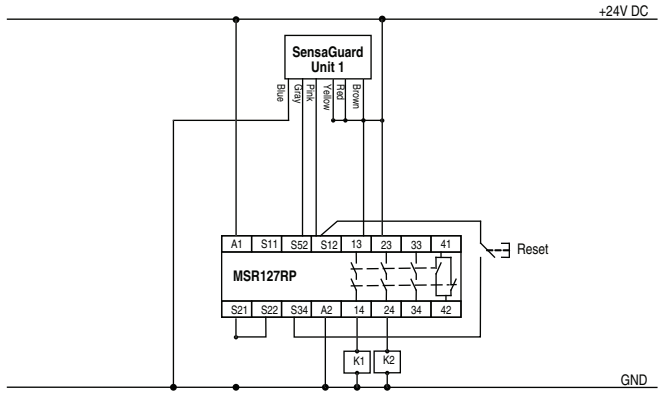
Unit Response Time



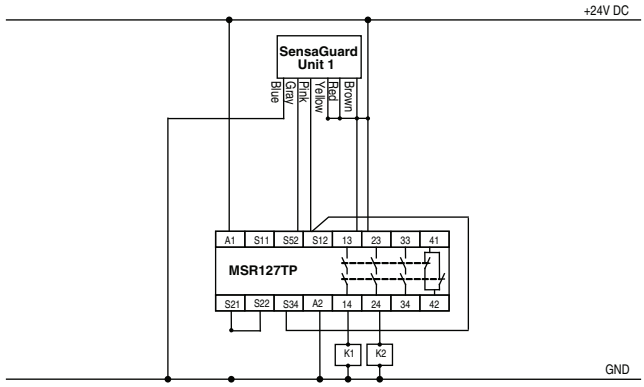
Application Wiring Examples

MSR127RP with One Sensor

Monitored Reset

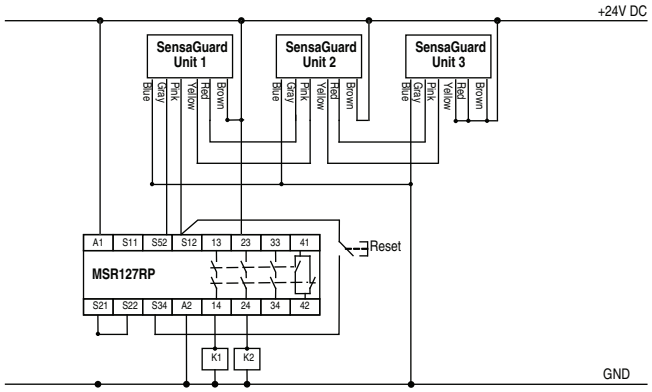


Automatic Reset

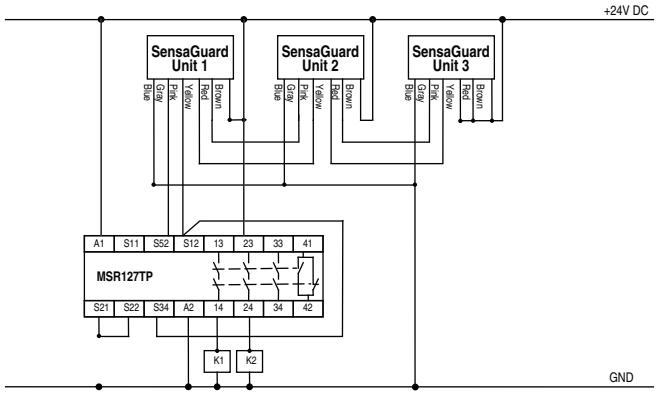


MSR127RP with Three Sensors

Monitored Reset

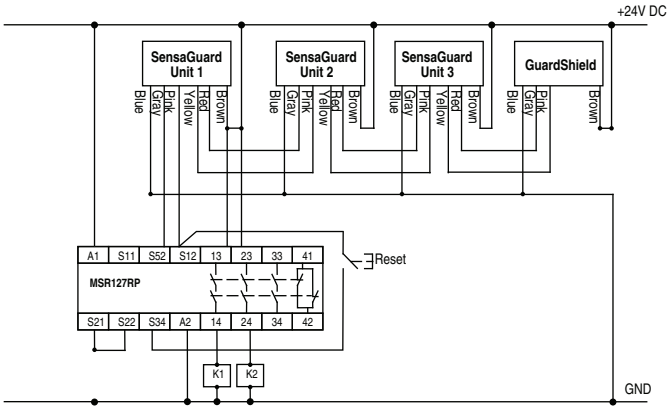


Automatic Reset



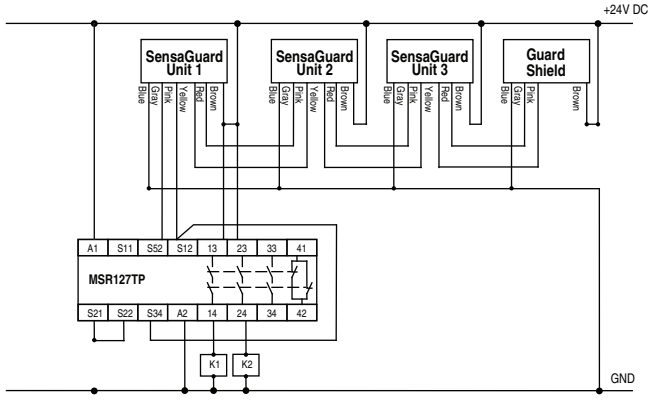
MSR127RP with Two Sensors and One Light Curtain

Monitored Reset



Note: Light curtain must be last (farthest from MSR127).

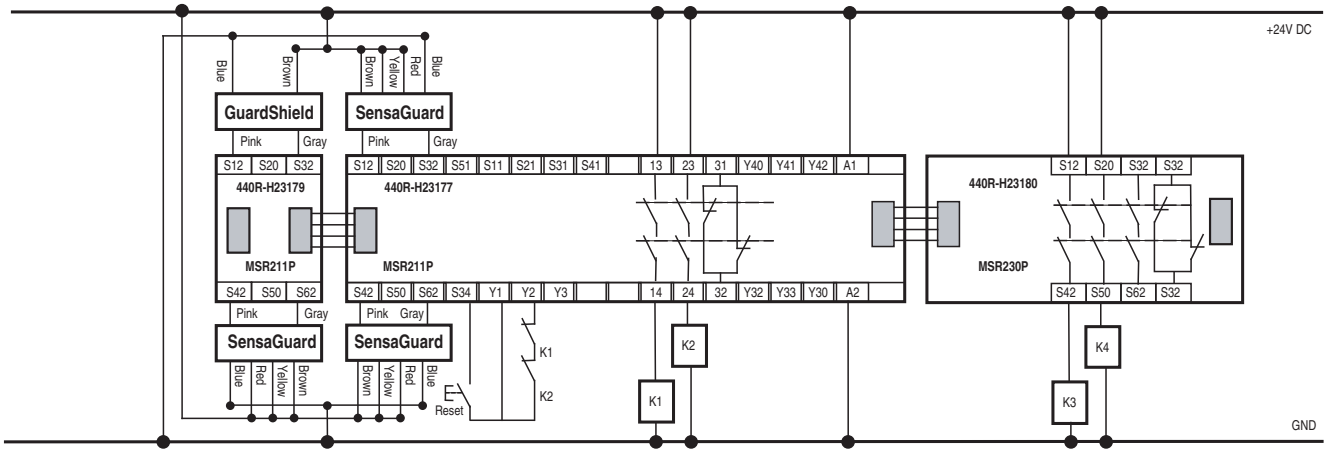
Automatic Reset



Note: Light curtain must be last (farthest from MSR127).

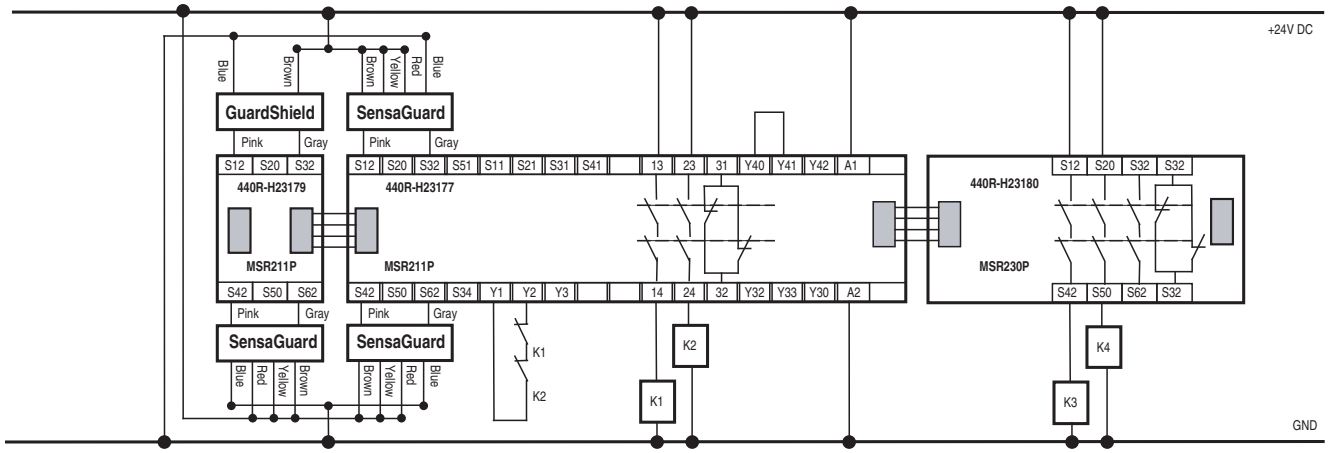
MSR200 Series with Three Sensors and One Light Curtain

Manual Reset



Note: Light curtain can be attached to any input.

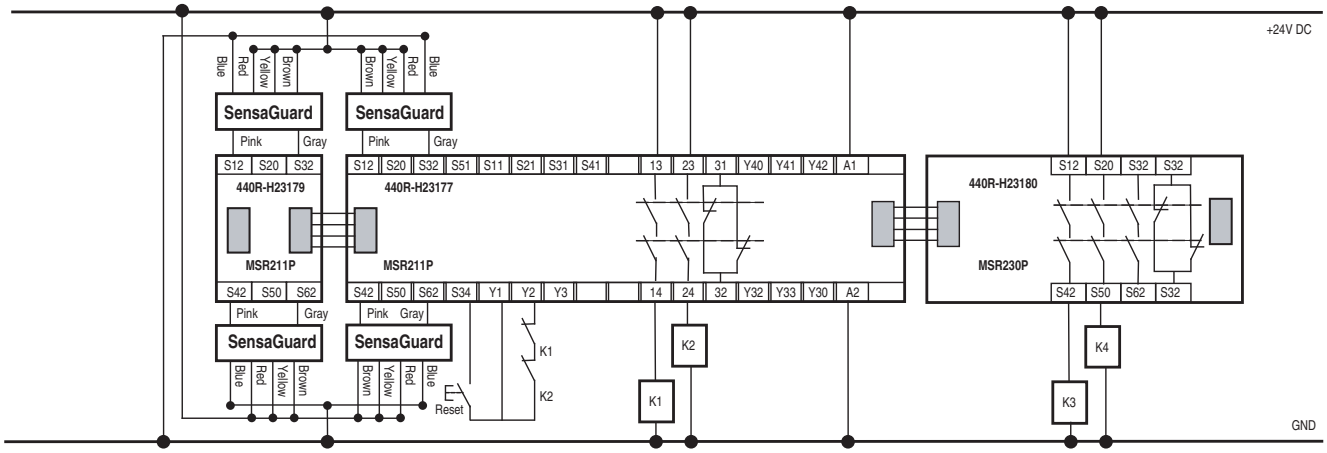
Automatic Reset



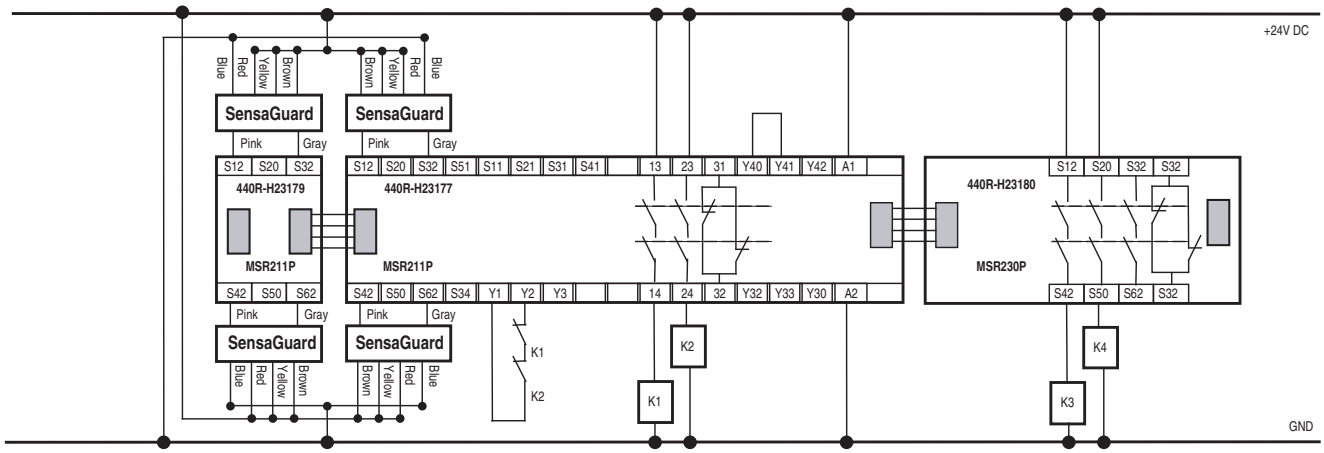
Note: Light curtain can be attached to any input

MSR200 Series with Four Sensors

Manual Reset



Automatic Reset



Non-Contact Switches

Magnetically Coded

Description

With the increasing speed and complexity of applications a simple magnetic switch may be insufficient to meet the increased risks, therefore the design incorporates several magnetically sensitive elements which must be triggered in a particular sequence to operate correctly.

The sensor with its molded-in brackets and diminutive size, is extremely versatile and simple to install. For high-risk applications the control unit is used with a single sensor to give a high-integrity system. For other applications, multiple sensors (including mechanical switches) can be connected.

Features

- Non-contact actuation
- Magnetic coded sensing
- High tolerance to misalignment
- Designed for use with specified controllers

Specifications

	MC1	MC2
Safety Ratings		
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, IEC60947-5-1, IEC/EN60947-5-3, ANSI B11.19, AS4024.1	
Safety Classification	Cat. 1 Device per EN 954-1; Dual channel interlocks suitable for Cat. 3 or 4 systems	
Functional Safety Data ✶ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics	
Certifications	CE Marked for all applicable directives, cULus, and TÜV	
Outputs (Guard Door Closed, Actuator in Place)		
Safety Outputs	2 N.C. REEDS	2 N.C. Solid-State Relays
Auxiliary Outputs	—	1 x PNP, 0.2 A max.; Status: OFF (0V DC)
Operating Characteristics		
Operating Distance, Make [mm (in.)]	8 (0.3)	10 (0.39)
Operating Distance, Break [mm (in.)]	15 (0.59)	25 (0.98)
Misalignment Tolerance, Min	See Misalignment Wire	
Repeat Accuracy	10% of Sensing Range	
Output Current, Max.	200 mA	200 mA
Switching Current @ Voltage, Max.	24V DC @ 200 mA	24V DC @ 200 mA +10%/-15%
Operating Voltage/Power Supply	—	24V DC, +10%/-15%/50 mA max./Class 2 SELV
Frequency of Operating Cycle	1 Hz	1 Hz
Environmental		
Enclosure Type Rating	IP67 (NEMA 6P)	IP 69K
Operating Temperature [C (F)]	-10…+55° (+14…+131°)	
Relative Humidity	5…95%	
Shock	IEC 68-2, 27, 30 g, 11 ms	
Vibration	IEC 68-2-6, 10…55 Hz	
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6	
Physical Characteristics		
Housing Material	Molded ABS	Ultrador
Actuator Material	Molded ABS	Ultrador
Color	Red	

✶ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Type	Operating Voltage/Input Current	Safety Outputs	Auxiliary Outputs	Status Indicator	Connection	Cat. No.
MC1	—	2 N.C. REEDS	—	No	—	**440N-Z2NRS1C**
					—	**440N-Z2NRS1A**
					10 m Cable	440N-Z2NRS1B
MC2	24V DC, +10%/-15%/50 mA max.	2 N.C. Solid-State Relays	1 x PNP, 0.2 A max.; Status: OFF (0V DC)	Yes	8-Pin Micro (M12)	440N-Z21W1PH
					—	440N-Z21W1PA
					—	440N-Z21W1PB

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Connection Systems

Description	Connection to Distribution Box 4-Pin Micro (M12)	8-Pin Micro (M12)
	2 N.C.	2 N.C. & 1 N.O.
Cordset	889D-F4AC-✶	889D-F8AB-✶
Patchcord	889D-F4ACDM-❄	889D-F8ABDM-❄
Distribution Box	898D-4‡LT-DM4	—
Shorting Plug	898D-41LU-DM	—
T-Port	898D-43LY-D4	—

✶ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
‡ Replace symbol with 4 or 8 for number of ports.
Note: For additional information, see the page 7-1.

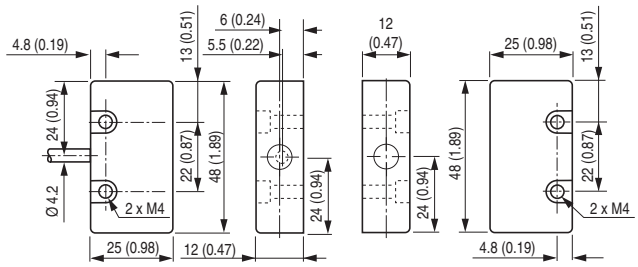
Accessories

Description	Cat. No.
MC1 Spare Actuator	440N-A17233
MC2 Spare Actuator	440N-A32114

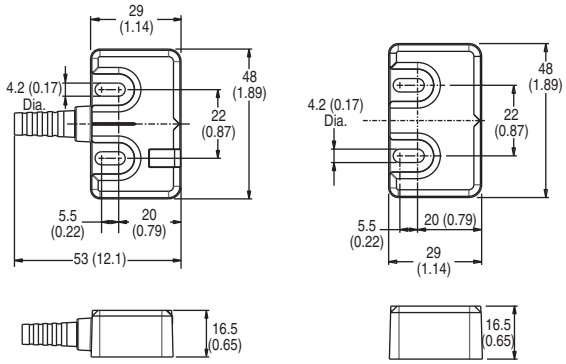
Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

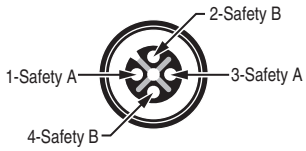
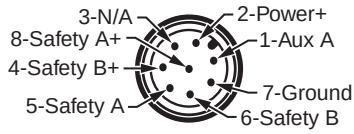
MC1



MC2



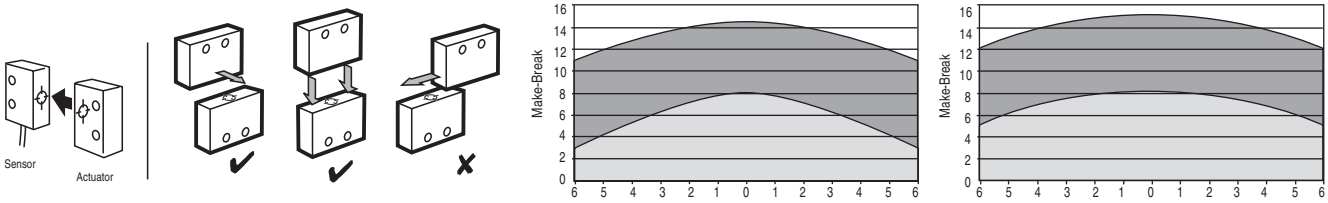
Typical Wiring Diagrams

Description		MC1 2 N.C.	MC2 2 N.C. + 1 N.O.
4-Pin Micro (M12)			—
8-Pin Micro (M12)		—	
Cordset 889D-F4AC-∗ or Cable Version	Brown	Safety A	—
	Blue		
	White	Safety B	—
	Black		
8-Pin Cordset 889D-F8AB-∗ or Cable Version	Grey	—	Safety A
	Red		Safety A
	Pink		Safety B
	Yellow		Safety B
	White		Aux
	Brown		24V DC +
	Blue		Gnd
	Green		NA

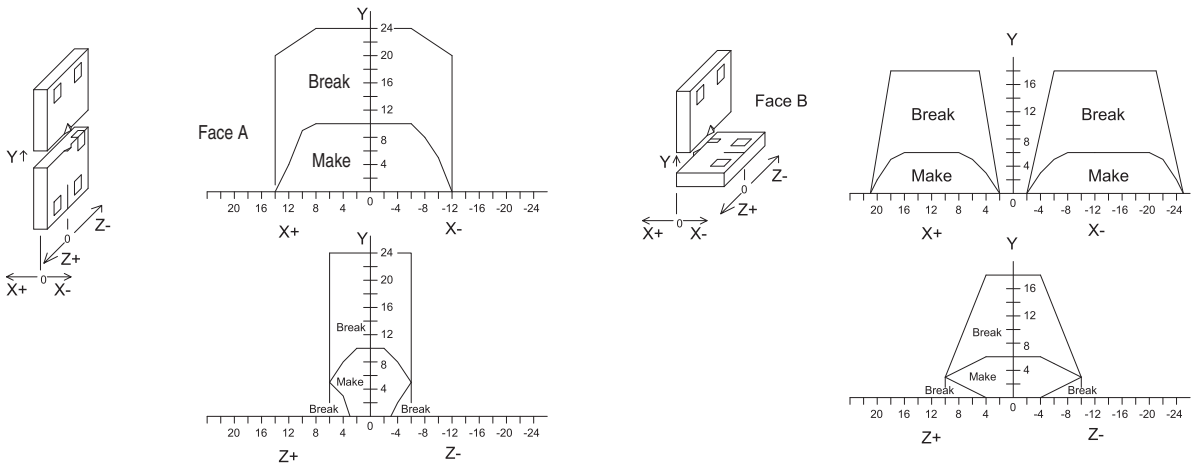
∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.

Sensing & Misalignment Curve

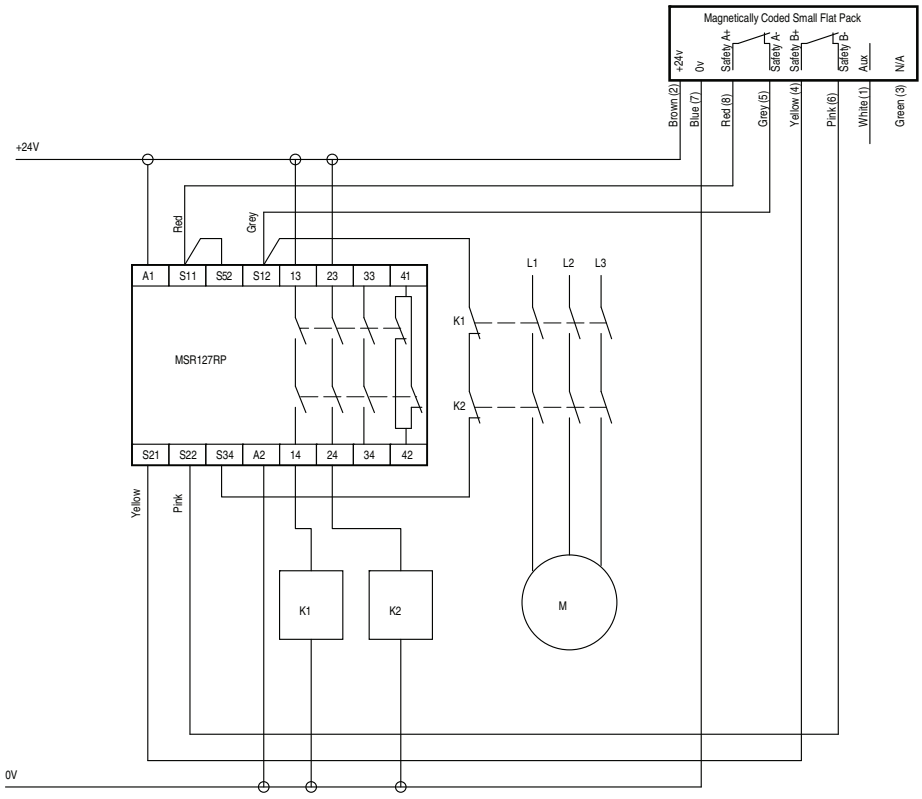
MC1



MC2



MC2 Application Wiring Example



Non-Contact Switches

Ferrogard™ 1, 2, 20 & 21

Description

The Ferrogard range of magnetically actuated safety switches offers non-contact reliability together with tolerance to misalignment. They are designed to be installed so that when a guard door is opened, the action of the magnetic actuator being removed from the switch opens the N.C. safety contacts which are intended for the isolation of control power to a machine primary control element.

The FRS1, FRS2, FRS20, FRS21 are rectangular housings. Sealed to IP67 (NEMA 6P), these Ferrogards are ideal for wet environments.

Unlike some magnetic switches the Ferrogards have protected safety contacts to help ensure that they do not fail to danger. In addition, some versions have independent auxiliary signal contacts to indicate the guard condition.

All Ferrogards have internal non-resettable overload protection on the safety contact. They should be protected by an external fuse rated as shown in the Specifications table.

Features

- Non-contact actuation
- High tolerance to misalignment
- High switching current (up to 2 A AC, 1 A DC)
- Plastic rectangular housing (IP67)
- Cable or quick-disconnect (QD) connections

Specifications

Safety Ratings	
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, ANSI B11.19, AS4024.1
Safety Classification	Cat. 1 Device per EN954-1 Dual channel interlocks suitable for Cat. 3 or 4 systems
Functional Safety Data **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics
Certifications	CE Marked for all applicable directives and cULus
Outputs (Guard Door Closed, Actuator in Place)	
Safety Outputs	FRS1: 1 N.C., FRS2: 1 N.C., FRS20: 2 N.C., FRS21: 2 N.C.
Auxiliary Outputs	FRS1: None, FRS2: 1 N.O., FRS20: None, FRS21: 1 N.O.
Operating Characteristics	
Operating Distance, Make [mm (in.)]	Safety: 12 (0.47); Auxiliary: 15 (0.59)
Operating Distance, Break [mm (in.)]	Safety: 23 (0.91); Auxiliary: 26 (1.02)
Fuses, External	FRS1, 2 & 21: 1.6 A (Bussmann BK/60 A-1.6 A) max. FRS20: 0.4 A (Bussmann BK/60 A-400 mA) max.
Environmental	
Enclosure Type Rating	IP67 (NEMA 6P)
Operating Temperature [C (F)]	-10…+55° (+14…+131°)
Relative Humidity	5…95%
Shock	50 g
Vibration	7 g; 50…200 Hz
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6
Physical Characteristics	
Actuator/Housing Material	Molded ABS plastic
Weight [g (lbs)]	FRS 1—Sensor: 35 (0.08)/Actuator: 85 (0.19) FRS 2—Sensor: 40 (0.09)/Actuator: 85 (0.19) FRS 20—Sensor: 43 (0.09)/Actuator: 85 (0.19) FRS 21—Sensor: 43 (0.09)/Actuator: 85 (0.19)
Color	Red

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Safety Contact Switching Capability	Safety Contacts	Auxiliary Contacts	Connection	Type	Cat. No.
250V AC, 2 A max	1 N.C.	—	2 m Cable	FRS 1	440N-G02001
			4 m Cable		440N-G02004
			6 m Cable		440N-G02022
			8 m Cable		440N-G02041
			10 m Cable		440N-G02015
		1 N.O.	2 m Cable	FRS 2	440N-G02002
			4 m Cable		440N-G02014
			6 m Cable		440N-G02038
			8 m Cable		440N-G02033
			10 m Cable		440N-G02019
			15 m Cable		440N-G02043
			20 m Cable		440N-G02040
			4-Pin Micro QD		440N-G02093
	2 N.C.	—	4-Pin Micro QD	FRS 20	440N-G02097
	2 N.C.	1 N.O.	2 m Cable	FRS 21	440N-G02055
			4 m Cable		440N-G02061
			6 m Cable		440N-G02060
			10 m Cable		440N-G02059
			6-Pin AC Micro QD§		440N-G02098
24V DC, 1 A	1 N.C.	1 N.O.	2 m Cable	FRS 2	440N-G02092
			4-Pin Micro QD		**440N-G02094**
	2 N.C.	—	4 m Cable	FRS 20	440N-G02085
			4-Pin Micro QD		**440N-G02090**
		1 N.O.	2 m Cable	FRS 21	440N-G02058
			4 m Cable		440N-G02077
			6 m Cable		440N-G02083
			6-Pin Micro QD		**440N-G02099**

Note: Contacts are described with the guard door closed, that is, actuator in place. Switch is shipped complete with actuator.
§ For connector ratings see 3-9.

Non-Contact Switches

Ferrogard™ 1, 2, 20 & 21

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR30T	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Single-Function Safety Relays for 1 N.C. & 1 N.O. Contact Switch							
MSR9T	2 N.O.	1 N.C.	Fixed	Auto./Manual	24V AC/DC	5-14	440R-F23027
MSR33RT	2 N.O. Solid State	1 N.O.	Removable	Auto. or Monitored Manual	24V DC SELV	5-18	440R-F23200
Modular Safety Relays							
MSR211P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-84	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Connection Systems

Description	Connection to Distribution Box 4-Pin Micro (M12) 1 N.C. & 1 N. O.	6-Pin Micro (M12) 2 N.C. & 1 N.O.
Cordset	889D-F4AC-∗	889R-F6ECA-∗
Patchcord	889D-F4ACDM-❄	889R-F6ECRM-❄
Distribution Box	898D-P4‡KT-DM4	898R-F68MT-A5
Shorting Plug	898D-41KU-DM	898R-P61MU-RM
T-Port	898D-43KY-D4	—

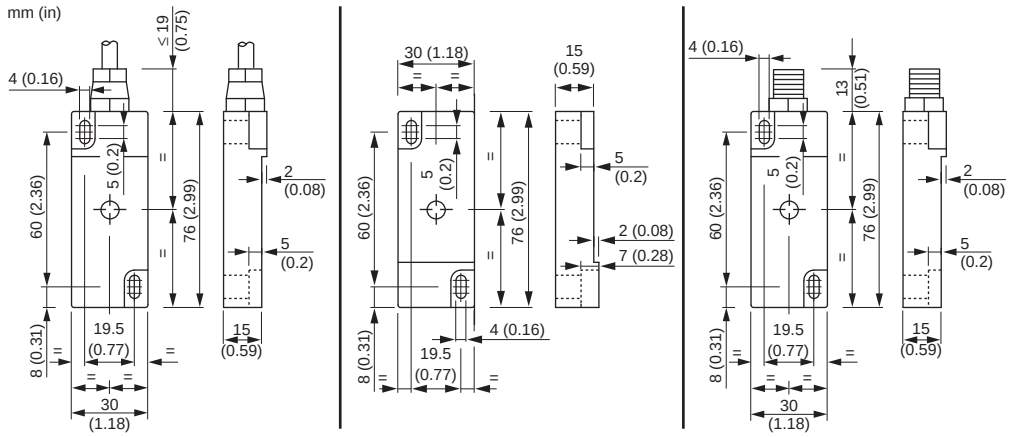
∗ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
‡ Replace symbol with 4 or 8 for number of ports.
Note: For additional information, see the Safety Connection System section (page 7-1) of this catalog.

Accessories

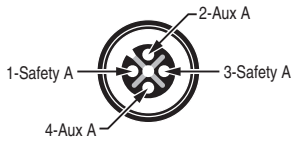
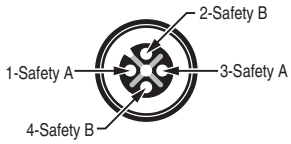
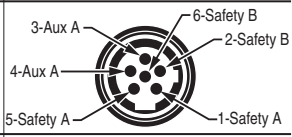
Description	Cat. No.
Replacement Actuator	440N-A02005

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



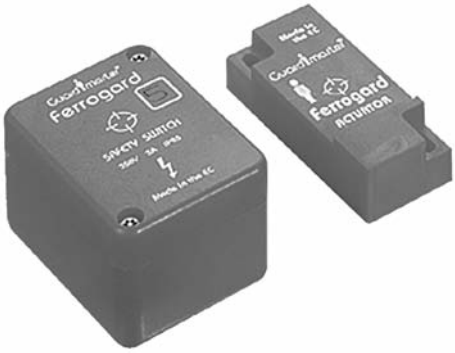
Typical Wiring Diagrams

		FRS1	FRS2	FRS20	FRS21
		1 N.C.	1 N.C. + 1 N.O.	2 N.C.	2 N.C. + 1 N.O.
4-Pin Micro (M12)		—			—
6-Pin Micro (M12)		—	—	—	
Cordset 889D-F4AC-∗ or Cable Versions	Brown	—	Safety A	Safety A	—
	Blue				
	Black	—	Aux A	Safety B	—
	White				
Cordset 889R-F6ECA-∗	Red/White	—	—	—	Safety A
	Red/Black				
	Red				Safety B
	Red/Blue				
	Green				Aux A
	Red/Yellow				
Cable Versions	Safety A	Brown	Blue	Brown	Black
		Blue	White	Blue	White
	Safety B	—	Yellow	Black	Red
			Green	White	Blue
	Aux A	—	—	—	Yellow
					Green

∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.

Non-Contact Switches

Ferrogard™ 3, 4 & 5



Description

The Ferrogard range of magnetically actuated switches offers non-contact reliability together with tolerance to misalignment. They are designed to be installed so that when a guard door is opened, the action of the magnetic actuator being removed from the switches opens the N.C. safety contacts which are intended for the isolation of control power to a machine primary control element.

The FRS 3, 4 and 5 have terminal connections. The user must drill a hole in the housing at a convenient location to allow the wiring to enter the housing. The cover is secured with anti-tamper security screws.

Unlike some magnetic switches the Ferrogards have protected safety contacts to help ensure that they do not fail to danger. In addition, some versions have independent auxiliary signal contacts to indicate the guard condition.

All Ferrogards have internal non-resettable overload protection on the safety contact. They should be protected by an external fuse rated as shown in the Specifications table.

Features

- Non-contact actuation
- High tolerance to misalignment
- High switching current (up to 2 A)
- Various contact arrangements
- Terminal connections

Specifications

Safety Ratings	
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, ANSI B11.19, AS4024.1
Safety Classification	Cat. 1 Device per EN954-1 Dual channel interlocks suitable for Cat. 3 or 4 systems
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics
Certifications	CE Marked for all applicable directives and cULus
Outputs (Guard Door Closed, Actuator in Place)	
Safety Outputs	FRS3: 1 N.C., FRS4: 1 N.C., FRS5: 1 N.C.
Auxiliary Outputs	FRS3: 1 N.C., FRS4: 1 N.O., FRS5: None
Operating Characteristics	
Operating Distance, Make [mm (in.)]	Safety/Auxiliary: FRS 3—12 (0.47); FRS 4—12 (0.47); FRS 5—12 (0.47)
Operating Distance, Break [mm (in.)]	Safety/Auxiliary: FRS 3—24 (0.94); FRS 4—10 (0.39); FRS 5—12 (0.47)
Auxiliary Contact Switching Capability, Min	300V DC, 250V AC 0.5 A including inrush
Safety Contact External Fusing	≤1.6 A quick blow
Environmental	
Enclosure Type Rating	IP65 (NEMA 13)
Operating Temperature [C (F)]	-10…+65° (+14…+149°)
Relative Humidity	5…95%
Shock	IEC 68-2-27, 30 g, 11 ms
Vibration	IEC 68-2-6, 10…200 Hz
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6
Physical Characteristics	
Housing Material	Molded ABS plastic
Actuator Material	Molded ABS plastic
Color	Red

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Safety Contact Switching Capability	Connection Type	Housing Material	Safety Contacts	Auxiliary Contacts	Type	Cat. No.
250V AC 2 A max	Terminals	Red Molded ABS Plastic	1 N.C.	1 N.C.	FRS 3	440N-G02003
				1 N.O.	FRS 4	440N-G02008
				—	FRS 5	440N-G02009

Note: Contacts are described with the guard door closed, that is, actuator in place.

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126T	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
MSR30T	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

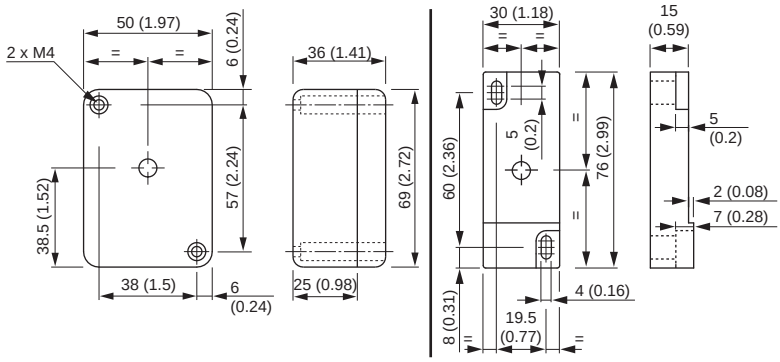
Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Accessories

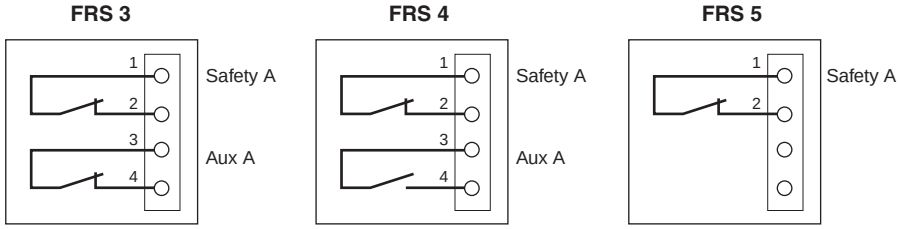
Description	Cat. No.
Replacement Actuator	440N-A02005

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



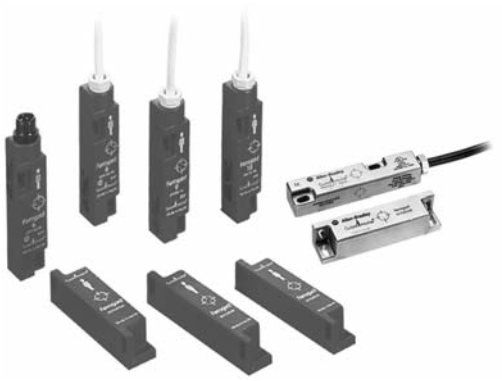
Typical Wiring Diagrams



3-Interlock Switches

Non-Contact Switches

Ferrogard™ 6, 9,10, 13 & 14



Description

The Ferrogard range of magnetically actuated safety switches offers non-contact reliability together with tolerance to misalignment. They are designed to be installed so that when a guard door is opened, the action of the magnetic actuator being removed from the switch opens the N.C. safety contact which is intended for the isolation of control power to a machine primary control element.

The FRS 6, 9, 10, 13, and 14 sensors and actuators incorporate slim housings to accommodate narrow mounting areas. They are environmentally sealed to IP67 (NEMA 6P), which makes them ideal for wet environments. These Ferrogard switches have two active sensing faces allowing more flexible mounting options.

Unlike some magnetic switches the Ferrogards have protected safety contacts to help ensure that they do not fail to danger.

All Ferrogards have internal non-resettable overload protection on the safety contact. They should be protected by an external fuse rated as shown in the Specifications table.

Features

- Non-contact actuation
- High tolerance to misalignment
- High switching current (up to 3 A)
- Two sensing faces
- IP67 (NEMA 6P) Rating
- Slim housings
- Stainless steel models available

Specifications

Safety Ratings		
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, ANSI B11.19, AS4024.1	
Safety Classification	Cat. 1 Device per EN954-1 Dual channel interlocks suitable for Cat. 3 or 4 systems	
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics	
Certifications	CE Marked for all applicable directives and cULus	
Outputs (Guard Door Closed, Actuator in Place)		
Safety Outputs	1 N.C.	1 N.C.
Auxiliary Outputs	—	1 N.C.
Operating Characteristics		
Operating Distance, Make [mm (in.)]	12 (0.47)	
Operating Distance, Break [mm (in.)]	23 (0.91)	
Environmental		
Enclosure Type Rating	IP67 (NEMA 6P)	
Operating Temperature [C (F)]	-10…+65° (+14…+149°)	
Relative Humidity	5…95%	
Shock	IEC 68-2-27, 30 g, 11 ms	
Vibration	IEC 68-2-6, 10…55 Hz	
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6	
Physical Characteristics		
Actuator/Housing Material	Molded ABS plastic	
Weight [g (lb)]	Sensor/Actuator FRS 6—28 (0.06)/70 (0.15) FRS 9—28 (0.06)/70 (0.15) FRS 10—28 (0.06)/70 (0.15)	
Color	Red	

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Safety Contact Switching Capability	Safety Contacts	Auxiliary Contacts	Housing Material	Type	Connection	Cat. No.
250V AC, 2 A	1 N.C.	—	Red Molded ABS Plastic	FRS 6	2 m Cable	**440N-G02023**
					4 m Cable	440N-G02028
					6 m Cable	440N-G02032
					10 m Cable	440N-G02013
					4-Pin Micro QD	440N-G02095
24V DC, 1 A				FRS 9	2 m Cable	**440N-G02044**
					4 m Cable	440N-G02075
					6 m Cable	440N-G02082
					10 m Cable	440N-G02089
					4-Pin Micro QD	440N-G02096
110V AC, 3 A				FRS 10	2 m Cable	440N-G02045
					4 m Cable	440N-G02088
250V AC, 2 A		1 N.C.	Stainless Steel	FRS 13	2 m Cable	440N-G02154
					4 m Cable	440N-G02155
					4-Pin Micro QD	440N-G02160
24V DC, 1 A				FRS 14	2 m Cable	440N-G02156
					4 m Cable	440N-G02157
					4-Pin Micro QD	440N-G02161

Note: Contacts are described with the guard door closed, that is, actuator in place.

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126T	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
MSR30T	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Connection Systems

Description	4-Pin Micro (M12)
Cordset	889D-F4AC-∗
Patchcord	889D-F4ACDM-❄

∗ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
Note: For additional information, see page 7-1.

Accessories

Description	Cat. No.
FRS 6, 9, 10 Plastic Replacement Actuator	440N-A02025
FRS 13, 14 Stainless Steel Replacement Actuator	440N-A02165

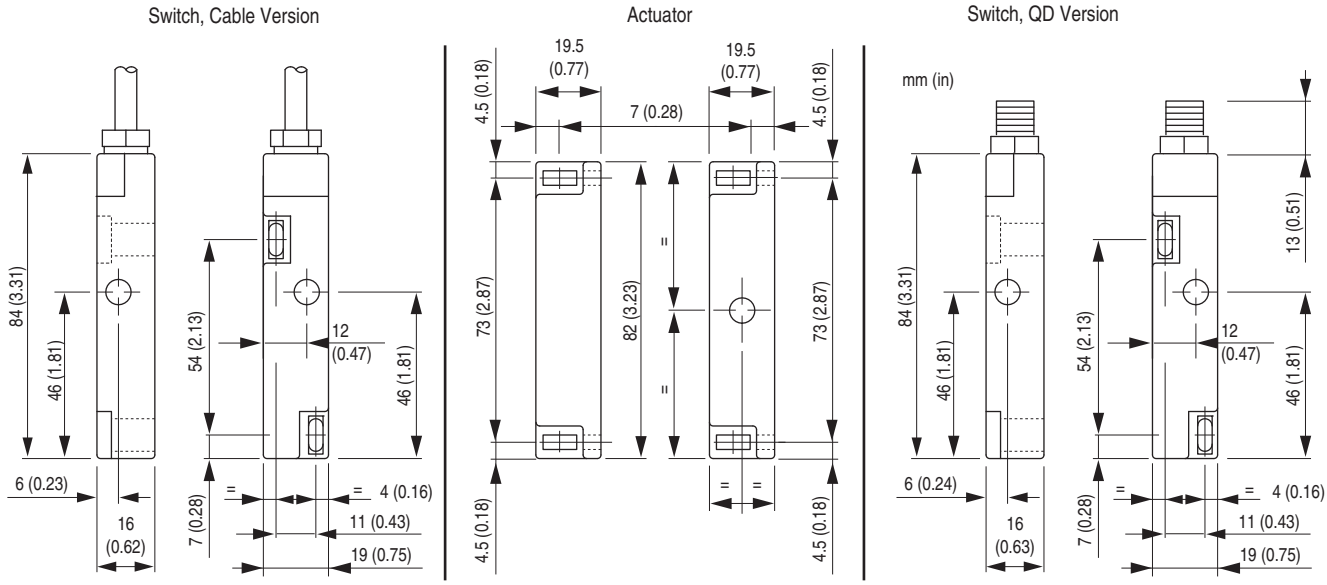
Non-Contact Switches

Ferrogard™ 6, 9,10, 13 & 14

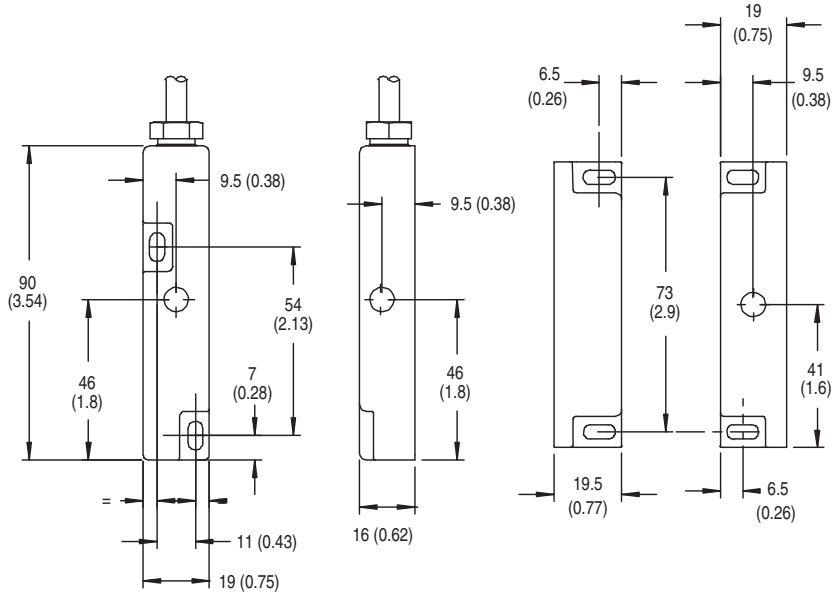
Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

FRS 6, 9, 10



FRS 13, 14



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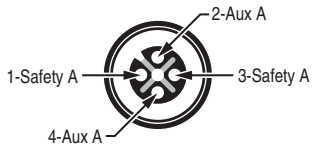
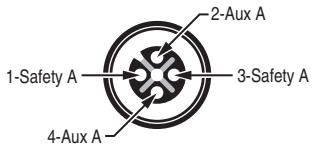
Publication S117-CA001A-EN-P

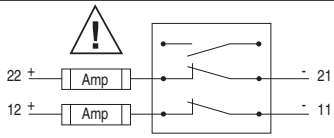
Typical Wiring Diagrams

		FRS 6, 9, 10	FRS 13, 14
		1 N.C.	1 N.C. + 1 N.O.
4-Pin Micro (M12)			
Cordset 889D-F4AC-∗	Brown	Safety A	Safety A
	Blue		
	White	—	Aux A
	Black		
Cable Version	Safety A	Brown	Brown
		Blue	Blue
	Aux A	—	Black
			Grey

∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.

External Fuse Safety Contacts

WARNING: All safety contacts fitted with internal non-resettable fuse and must be fused externally as detailed.



	Recommended: *Bussman BK/GDA-1.6 A ** Bussman BK/GDA-400 mA ***Bussman BK/GDA-2.5 A
FRS 1, 2, 3, 4, 5, 6, 13, 21 AC	AC ≤ 1.6 A* (F) IEC 60127-2
FRS 9, 14, 2 DC, 20 DC, 21 DC	DC ≤ 0.4 A** (F) IEC 60127-2
FRS 10	AC ≤ 2.5 A*** (F) IEC 60127-2

Non-Contact Switches

Ferrogard™ GD2

Description

The Ferrogard range of magnetically actuated safety switches offers non-contact reliability together with tolerance to misalignment. They are designed to be installed so that when a guard door is opened, the action of the magnetic actuator being removed from the switch opens the N.C. safety contacts which are intended for the isolation of control power to a machine primary control element.

The GD2 version has a stainless steel housing for added protection against inadvertent impacts to the housing. The contacts are completely sealed to meet IP68 (NEMA 6P) requirements, making them ideal for wet environments. The GD2 also has a wider temperature range than the plastic Ferrogard switches, making them useful in a wider range of applications.

Unlike some magnetic switches, the Ferrogards have protected safety contacts to help ensure that they do not fail to danger. In addition, some versions have independent auxiliary signal contacts to indicate the machine and guard condition.

All Ferrogards have internal non-resettable overload protection on the safety contact. They should be protected by an external fuse rated as shown in the Specifications table.

Features

- Non-contact actuation
- High tolerance to misalignment
- High switching current (up to 2 A AC, 1 A DC)
- Wide temperature range (-25…+125°C (-13…+257°F))
- Stainless steel housing
- Various contact arrangements

Specifications

Safety Ratings			
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, ANSI B11.19, AS4024.1		
Safety Classification	Cat. 1 Device per EN954-1 Dual channel interlocks suitable for Cat. 3 or 4 systems		
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics		
Certifications	CE Marked for all applicable directives and cULus		
Outputs (Guard Door Closed, Actuator in Place)			
Safety Outputs	1 N.C.	2 N.C.	2 N.C.
Auxiliary Outputs	1 N.O.	—	1 N.O.
Operating Characteristics			
Operating Distance, Make [mm (in.)]	Safety: 12 (0.47); Auxiliary: 15 (0.59)		
Operating Distance, Break [mm (in.)]	Safety: 23 (0.91); Auxiliary: 26 (1.02)		
Environmental			
Enclosure Type Rating	IP68 (NEMA 6P)		
Operating Temperature [C (F)]	-25…+125° (-13…+257°)		
Relative Humidity	5…95%		
Shock	IEC 68-2-27, 30 g, 11 ms		
Vibration	IEC 68-2-6, 10…200 Hz		
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6		
Physical Characteristics			
Housing Material	Stainless Steel; BS3146 ANC4B (316L)		
Actuator Material	Stainless Steel; BS3146 ANC4B (316L)		
Weight [g (lbs)]	Sensor: 156 (0.34); Actuator: 168 (0.37)		

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Safety Contact Switching Capability	Safety Contacts	Auxiliary Contacts	Connection	Type	Cat. No.
250V AC, 2 A max.	2 N.C.	—	3 m Cable	FRS 20 GD2	440N-G02113
	1 N.C.	1 N.O.	3 m Cable	FRS 2 GD2	440N-G02112
	2 N.C.		3 m Cable	FRS 21 GD2	440N-G02117
24V DC, 1 A max.	1 N.C.	1 N.O.	3 m Cable	FRS 2 GD2	440N-G02118
			10 m Cable	FRS 2 GD2	440N-G02147
	2 N.C.	—	3 m Cable	FRS 20 GD2	440N-G02119
	2 N.C.	1 N.O.	3 m Cable	FRS 21 GD2	**440N-G02123**
			6 m Cable	FRS 21 GD2	440N-G02143
			10 m Cable	FRS 21 GD2	440N-G02137
			8-Pin Micro (M12)	FRS 21 GD2	**440N-G02149**

Note: Contacts are described with the guard door closed, that is, actuator in place. Switch is shipped with complete actuator.

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126T	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
MSR30T	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Connection Systems

Description	8-Pin Micro (M12)
Cordset	889D-F8AB-✶
Patchcord	889D-F8ABDM-❄

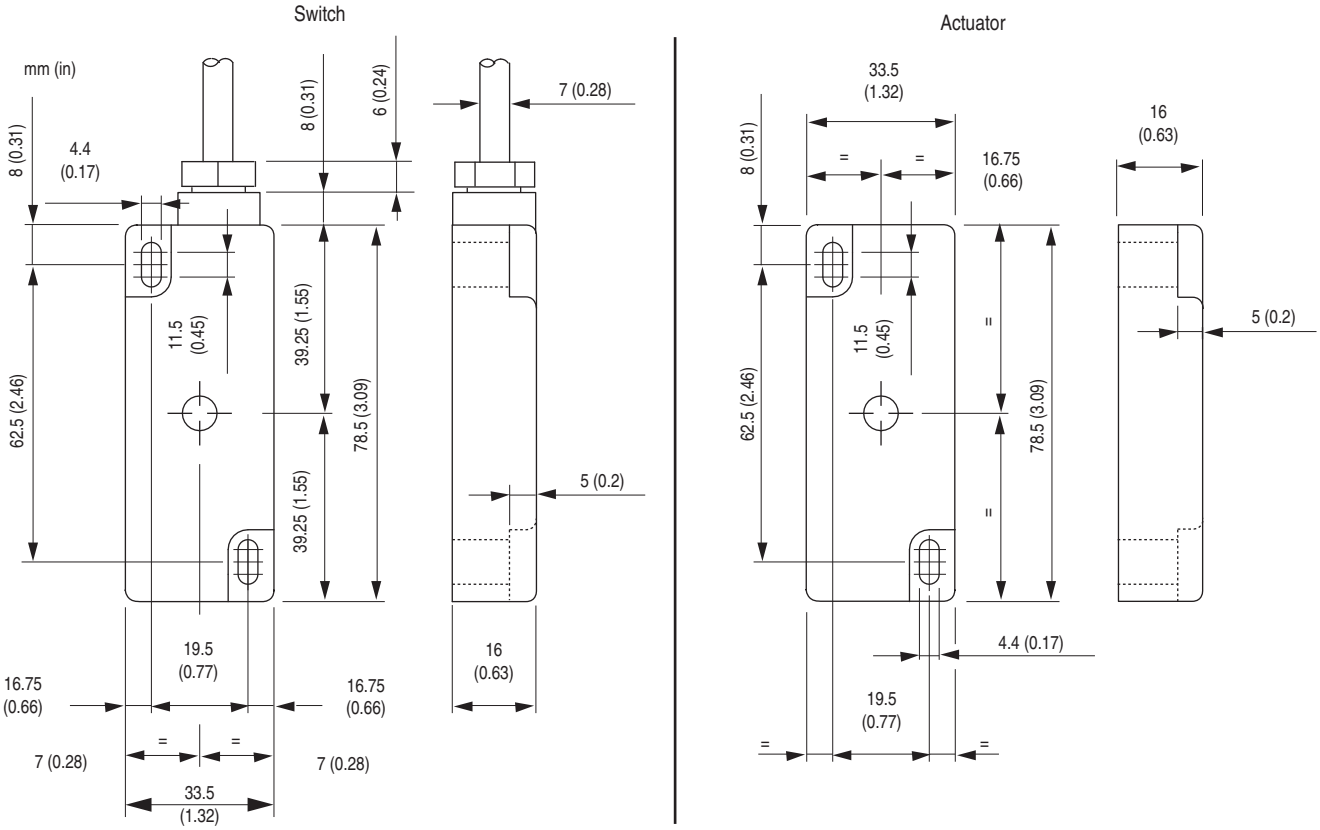
Accessories

Description	Cat. No.
Actuator	440N-A02128

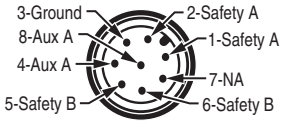
✶ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
Note: For additional information, see page 7-1.

Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



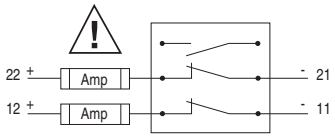
Typical Wiring Diagrams

Description		FRS21 2 N.C. + 1 N.O.	FRS2 1 N.C. + 1 N.O.	FRS20 2 N.C.
Cable Versions	Safety A	Black	Blue	Brown
		White	Red	Blue
	Safety B	Red	—	Black
		Blue		White
	Aux A	Yellow	Yellow	—
		Green	Green	
	Shield Gnd	—	Green/Yellow	Green/Yellow
8-Pin Micro (M12)			—	—
Cordset 889D-F8AB-∗	Brown White	Safety A	—	—
	Grey Pink	Safety B	—	—
	Yellow Red	Safety B	—	—
	Green Blue	NA	—	—

∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.

External Fuse Safety Contacts

WARNING: All safety contacts fitted with internal non-resettable fuse and must be fused externally as detailed.

	FRS 2 GD2 FRS20 GD2 FRS21 GD2	AC ≤ 1.6 A* (F) IEC 60127-2
	FRS 2 GD2 FRS 20 GD2 FRS21 GD2	DC ≤ 0.4 A** (F) IEC 60127-2

Recommended:
*Bussman BK/GDA-1.6 A
** Bussman BK/GDA-400 mA

Non-Contact Switches

Ferrogard™ GS1 & GS2

Description

The Ferrogard range of magnetically actuated safety switches offers non-contact reliability together with tolerance to misalignment. They are designed to be installed so that when a guard door is opened, the action of the magnetic actuator being removed from the switch opens the N.C. safety contacts which are intended for the isolation of control power to a machine primary control element.

The GS1 and GS2 are designed for heavy duty applications. The GS1 is housed in a stainless steel or brass housing. The GS2 offers the same characteristic as the GS1, but in an Ex Range housing for hazardous locations.

Unlike some magnetic switches the Ferrogards have protected safety contacts to help ensure that they do not fail to danger.

All Ferrogards have internal non-resettable overload protection on the safety contact. They should be protected by an external fuse rated as shown in the Specifications table.

See **Other Safety Products** section on page **9-1** for more information on the Ex Range version of the Ferrogard GS2.

Features

- Non-contact actuation
- High tolerance to misalignment
- High switching current (2 A AC)
- Metal housings (IP68)
- Ex Range version available

Specifications

Safety Ratings	
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, ANSI B11.19, AS4024.1
Safety Classification	Cat. 1 Device per EN954-1 Dual channel interlocks suitable for Cat. 3 or 4 systems
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics
Certifications	GS1 & GS2 - CE Marked for all applicable directives and cULus GS2 Ex - EExd IIC T6 Baseefa
Outputs (Guard Door Closed, Actuator in Place)	
Safety Outputs	1 N.C.
Auxiliary Outputs	—
Operating Characteristics	
Operating Distance, Make [mm (in.)]	GS1: 12 (0.47); GS2: 15 (0.59)
Operating Distance, Break [mm (in.)]	GS1: 23 (0.91); GS2: 26 (1.02)
Environmental	
Enclosure Type Rating	IP68 (NEMA 6P)
Operating Temperature [C (F)]	GS1: -25…+125° (-13…+257°) GS2: -40…+60° (-40…146°)
Relative Humidity	5…95%
Shock	IEC 68-2-27, 30 g, 11 ms
Vibration	IEC 68-2-6, 10…55 Hz
Radio Frequency	IEC 61000-4-3, IEC 61000-4-6
Physical Characteristics	
Housing Material	Stainless Steel or Brass
Weight [g (lbs)]	GS1 Brass: 381 (0.84) GS1 Steel: 388 (0.86) Actuator: 116 (0.26)

∗ Usable for ISO 13849-1:2006 and IEC 62061. Data other than B10d is based on:
- Usage rate of 1op/10 mins., 24 hrs/day, 360 days/year, representing 51840 operations per year
- Mission time/Proof test interval of 38 years

Product Selection

Safety Contact Switching Capability	Safety Contacts	Auxiliary Contacts	Connection	Housing Material	Type	Cat. No.
250V AC, 2 A	1 N.C.	None	2 m Cable	Brass	GS 1	440N-G02048
				Stainless Steel		440N-G02049
			3 m Cable	Brass	GS2-Ex (brass)	440N-H02046
				Stainless Steel	GS2-Ex (stainless steel)	440N-H02047

Note: Contacts are described with the guard door closed, that is, actuator in place. Switch is shipped with complete actuator.

Recommended Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126T	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**
MSR30T	2 N.O. Solid State	1 N.O. Solid State	Removable	Auto./Manual or Monitored Manual	24V DC	5-16	440R-N23198
Modular Safety Relays							
MSR210P Base 2 N.C. only	2 N.O.	1 N.C. and 2 PNP Solid State	Removable	Auto./Manual or Monitored Manual	24V DC from the base unit	5-82	440R-H23176
MSR220P Input Module	—	—	Removable	—	24V DC	5-86	440R-H23178
MSR310P Base	MSR300 Series Output Modules	3 PNP Solid State	Removable	Auto./Manual Monitored Manual	24V DC	5-102	440R-W23219
MSR320P Input Module	—	2 PNP Solid State	Removable	—	24V DC from the base unit	5-106	440R-W23218

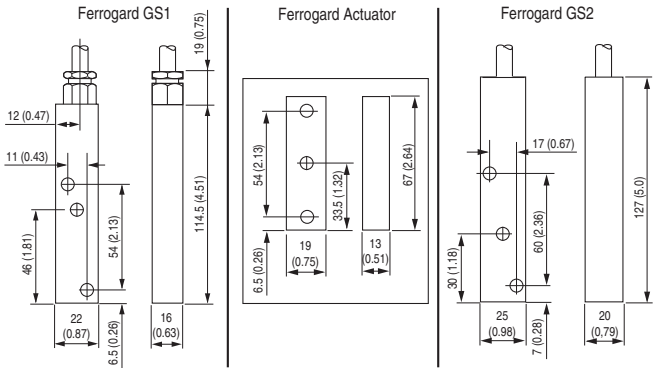
Note: For additional Safety Relays connectivity, see page 5-12.
For additional Safety I/O and Safety PLC connectivity, see page 5-116.
For application and wiring diagrams, see page 10-1.

Accessories

Description	Used with	Cat. No.
Actuator, Alnico	Brass Switch	440N-A02056
Actuator, Epoxy-painted	Stainless Steel	440N-A02057

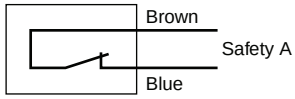
Approximate Dimensions

Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Typical Wiring Diagrams

Cable



External Fuse Safety Contacts

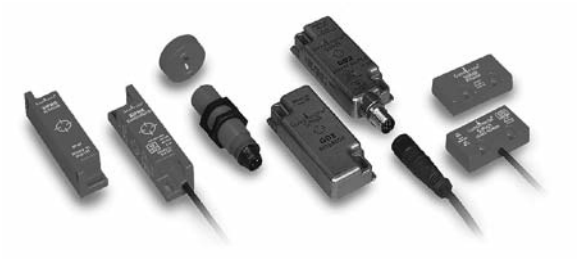
WARNING: All safety contacts fitted with internal non-resettable fuse and must be fused externally as detailed.

GS1 GS2	AC ≤ 1.6 A* (F) IEC 60127-2

Recommended:
*Bussman BK/GDA-1.6 A

Non-Contact Switches

Sipha™ Sensors



Description

With the increasing speed and complexity of applications a simple magnetic switch may be insufficient to meet the increased risks, therefore Sipha's design incorporates several magnetically sensitive elements which must be triggered in a particular sequence to operate correctly. The Sipha sensor, designed to operate with its own actuator, helps prevent defeatability by a simple magnet.

The Sipha with its molded-in brackets and diminutive size, is extremely versatile and simple to install. The Sipha sensor must be connected to the Sipha control unit giving a monitored circuit. For high-risk applications the control unit is used with a single sensor to give a high-integrity system. For other applications, multiple sensors (including mechanical switches) can be connected to one Sipha control unit. Sipha has facilities for connecting a manual reset button and for monitoring external devices such as contactors.

Four types of sensors and actuators are available incorporating different operating distances and physical sizes.

Features

- Non-contact actuation
- Magnetic coded sensing
- Four housing styles
- Must be operated with its own safety control unit

Specifications

Safety Ratings	
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, IEC60947-5-1, IEC/EN60947-5-3, ANSI B11.19, AS4024.1
Safety Classification	Rating dependent on control unit and application.
Functional Safety Data **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	B10d: > 2 x 10^6 operations at min. PFH_D: > 3 x 10^{-7} MTTFd: > 385 years Dual channel interlock may be suitable for performance levels PLe or PLd (according to ISO 13849-1:2006) and for use in SIL2 or SIL3 systems (according to IEC 62061) depending on application characteristics
Certifications	CE Marked for all applicable directives, cULus, and TÜV
Outputs (Guard Door Closed, Actuator in Place)	
Auxiliary Output Switching	300V DC, 250V AC, 0.5 A including inrush. 15V A/10 W suitable for AC/DC circuits
Operating Characteristics	
Sensing Distance, Make [mm (in.)]	Style S1: 5 (0.20) Style S2: 9 (0.35) Style S3: 5 (0.20) Style S4: 10 (0.39)
Sensing Distance, Break [mm (in.)]	Style S1: 11 (0.43) Style S2: 12 (0.47) Style S3: 12 (0.47) Style S4: 13 (0.51)
Environmental	
Enclosure Type Rating	IP67 (NEMA 6P)
Operating Temperature [C (F)]	S1, S2, S3: -10…+55° (+14…+131°) S4 (GD2): -25…+125° (-13…+257°)
Vibration	1 mm, 10…55 Hz
Shock	30 g, 11 ms half-sine
Physical Characteristics	
Cable Size	0.54 mm^2 (20 AWG) 4-wire PVC Jacket OD—4 mm (0.16 in.)
Material	S1, S2: Molded ABS S30 (Actuator): Polyester S31 (Sensor): Nylon (Trogamid) S4 (GD2): Stainless Steel
Mounting	Any position
Weight [g (lbs)]	S1: Sensor: 18 (0.04); Actuator: 15 (0.03) S2: Sensor: 20 (0.04); Actuator: 30 (0.07) S3: Sensor: 18 (0.04) Actuator: 6 (0.01) S4: Sensor: 150 (0.33); Actuator: 170 (0.37)

Product Selection

Housing Style	Housing Material	Safety Contacts	Auxiliary Contacts	Type	Connection	Cat. No.
 S1	ABS plastic	1 N.C. & 1 N.O.	None	S11	3 m Cable	**440N-S32014**
					10 m Cable	440N-S32016
			1 N.C.	S12	3 m Cable	440N-S32022
					10 m Cable	440N-S32032
			1 N.O.	S13	3 m Cable	440N-S32037
					10 m Cable	440N-S32036
 S2			None	S21	3 m Cable	440N-S32015
					10 m Cable	440N-S32017
			1 N.C.	S22	3 m Cable	440N-S32023
					10 m Cable	440N-S32033
			1 N.O.	S23	3 m Cable	440N-S32038
					10 m Cable	440N-S32039
 S3	Actuator: Polyester Sensor: Nylon [Trogamid]		None	S31	3 m Cable	440N-S32101
					4-Pin Micro (M12)	440N-S32024
 S4	Stainless Steel		1 N.C.	S42	8-Pin Micro (M12)	**440N-S32047**
					3 m Cable	440N-S32055
					10 m Cable	440N-S32056
			1 N.O.	S43	8-Pin Micro (M12)	440N-S32046
					3 m Cable	440N-S32053
					10 m Cable	440N-S32054

Recommended Logic Interfaces

Housing	Supply Voltage	Safety Contacts	Auxiliary Contacts	Housing Width	Type	Cat. Page No.	Cat. No.
	24V AC/DC	1 N.O.	1 N.C. Solid State	22.5 mm	Control Unit 1	5-74	440N-S32013
	24V AC/DC; 115/230V AC	2 N.O.	1 N.C.	45 mm	Control Unit 2		440N-S32021
	24V AC/DC; 115/230V AC	2 N.O. + 1 N.O. delayed	1 N.C.	90 mm	Sipha 6		440N-S32052

Connection Systems

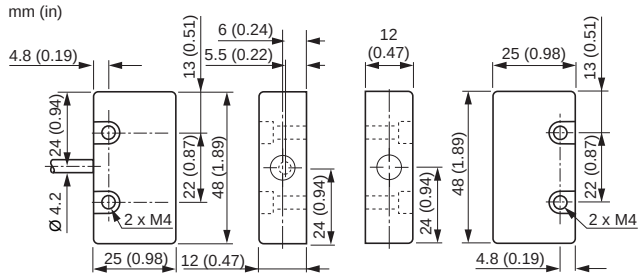
Description	4-Pin Micro (M12)	8-Pin Micro (M12)
Cordset	889D-F4ECA-✶	889D-F8AB-✶
Patchcord	889D-F4ECRM-❄	889D-F8ABDM-❄

✶ Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
❄ Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
Note: For additional information, see page 7-1.

Approximate Dimensions

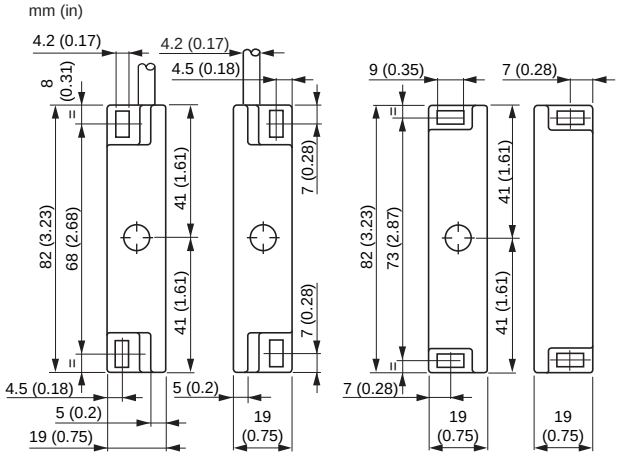
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.

Sipha S1



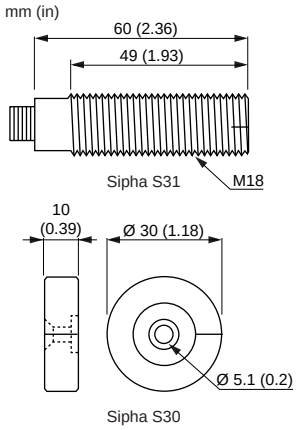
Sipha S11, S12, S13 Sipha S10

Sipha S2



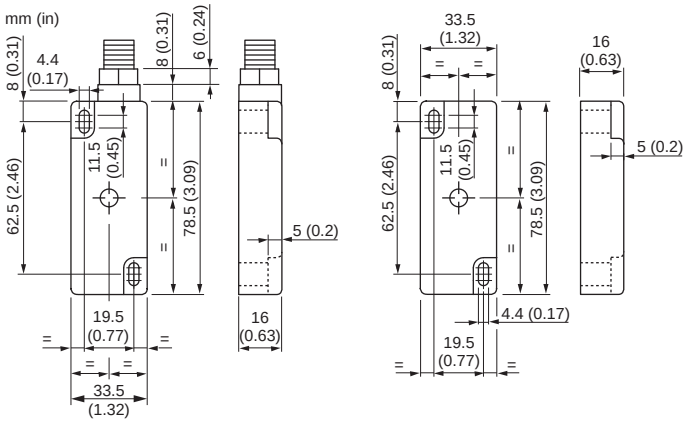
Sipha S21, S22, S23 Sipha S20

Sipha S3



Sipha S31 Sipha S30

Sipha S4



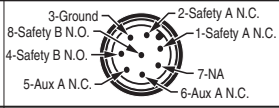
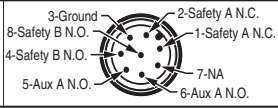
Sipha S42, S43 Sipha S40

Accessories

Description	Cat. No.
Actuator S10	440N-A32019
Actuator S20	440N-A32020
Actuator S30	440N-A32025
Actuator S40 (GD2)	440N-A32041
Bag of 40 washers for S2 models	440N-A17127

Typical Wiring Diagrams

Description		S11, S21 1 N.O. + 1 N.C.	S42, S12, S22 2 N.C. + 1 N.O.	S43, S13, S23 1 N.C. + 2 N.O.
Cable Versions	Red	Safety A_N.C.	Safety A_N.C.	Safety A_N.C.
	Blue			
	Yellow	Safety B_N.O.	Safety B_N.O.	Safety B_N.O.
	Green			
	Black	—	Aux A_N.C.	Aux A_N.O.
	White			
	Green/Yellow	—	External Ground	External Ground

Description		S31	S42	S43
4-Pin Micro (M12)			—	—
8-Pin Micro (M12)		—		
4-Pin Cordset 889D-F4AC-∗	Brown	Safety A_N.C.	—	—
	Blue			
	White	Safety B_N.O.	—	—
	Black			
8-Pin Cordset 889D-F8AB-∗	White Brown	Safety A	Safety A_N.C.	Safety A_N.C.
	Red Yellow	Safety B	Safety B_N.O.	Safety B_N.O.
	Grey Pink	Aux A	Aux A_N.C.	Aux A_N.O.
	Green Blue	NA	Gnd	Gnd

∗ Replace symbol with 2 (2 m), 5 (5 m) or 10 (10 m) for standard cable lengths.