



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 * | PFH _D : > 1.12 x 10 ⁻⁹ MTTF _D : > 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 | |
| Note: | For up-to-date information, visit http://www.ab.com/Safety/ | |
| 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 6 inch Pigtail, 8-pin Micro (M12) |
| | | | | | | 3 m | 10 m | |
| 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.

Safety Switches
Non-Contact Switches
 SensaGuard™

Accessories

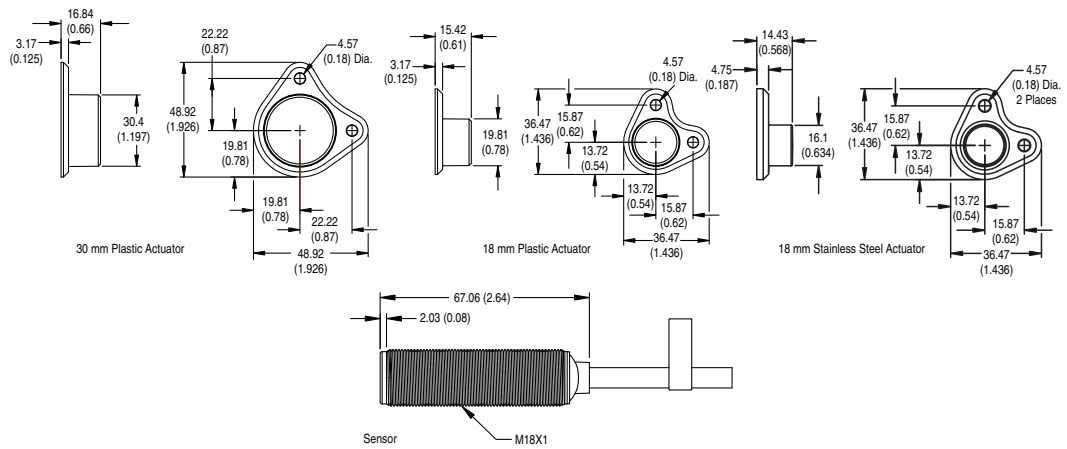
| | Description | To Be Used With | Cat. No. |
|---|---|---|--------------|
|  | 18 mm plastic actuator | Standard coded models only | 440N-Z18PT |
| | | Unique coded models only | 440N-Z18UPT |
|  | 30 mm plastic actuator | Standard coded models only | 440N-Z30PT |
| | | Unique coded models only | 440N-Z30UPT |
|  | 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 |
|  | Mounting bracket 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 |

3-Interlock
Switches

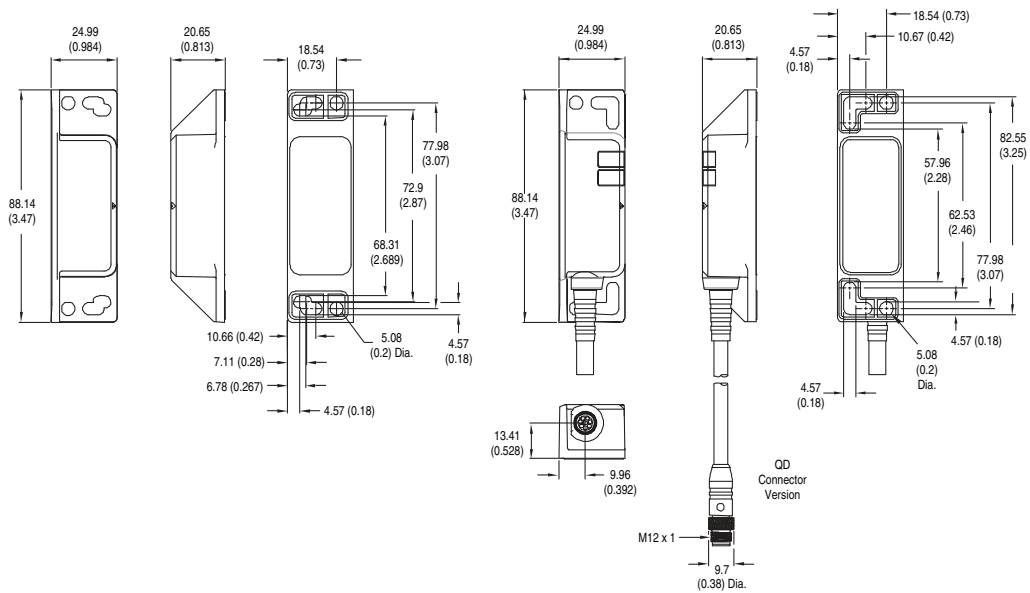
Approximate Dimensions

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

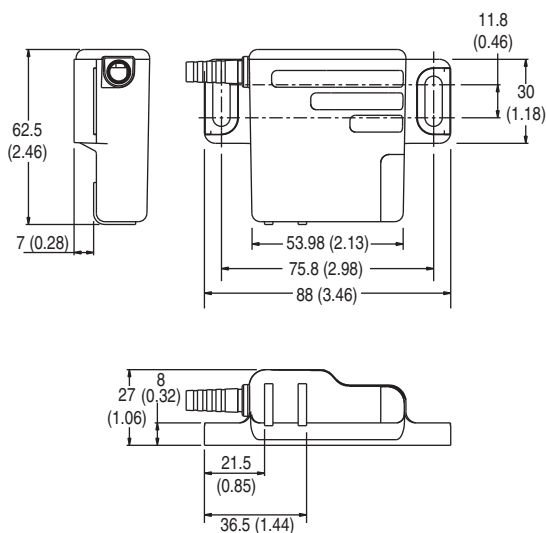
18 mm Barrel



Large Rectangular Flat Pack



Integrated Latch



3-Interlock Switches

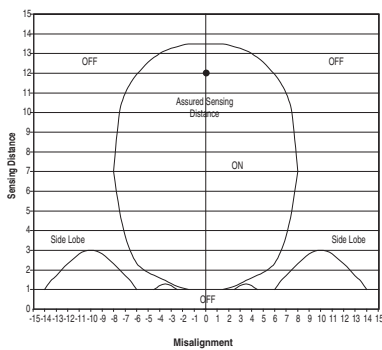
Typical Wiring Diagrams

| Description | | Plastic | Stainless Steel |
|--|--------|-----------|-----------------|
| 8-Pin Micro (M12) | | | |
| 8-Pin Cordset 889D-F8AB- <i>*</i> 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.

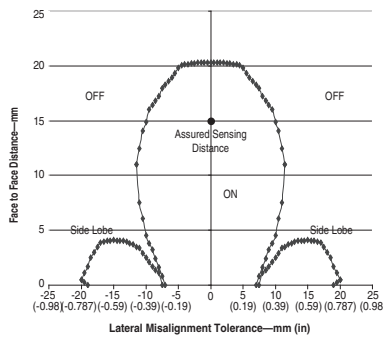
Misalignment Curves

18 mm Stainless Steel Barrel



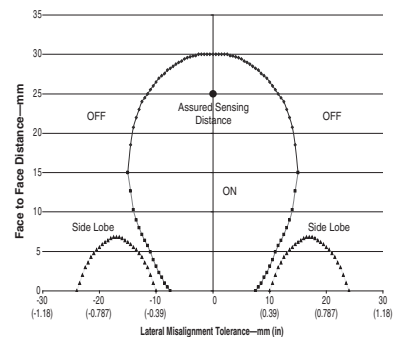
Note: There must be a minimum spacing of 4 mm (0.157 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

18 mm Plastic Barrel



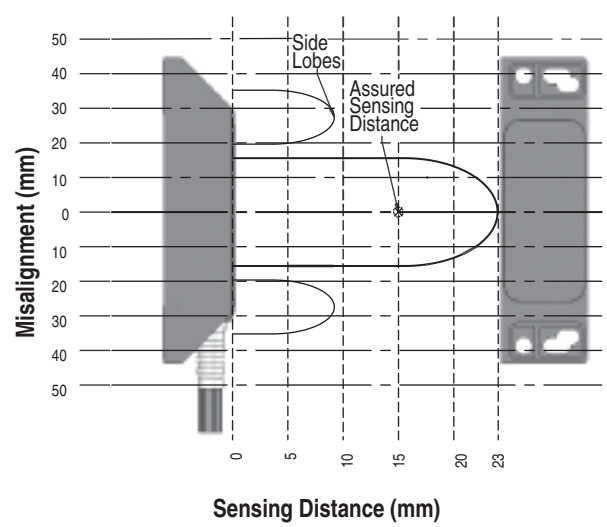
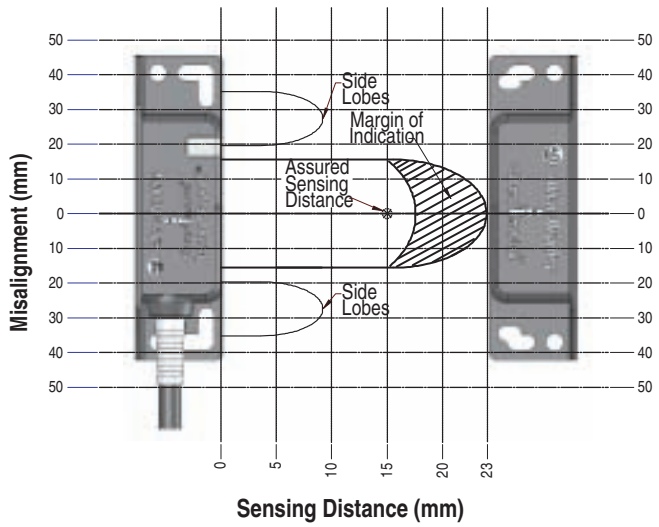
Note: There must be a minimum spacing of 4 mm (0.157 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

30 mm Plastic Barrel

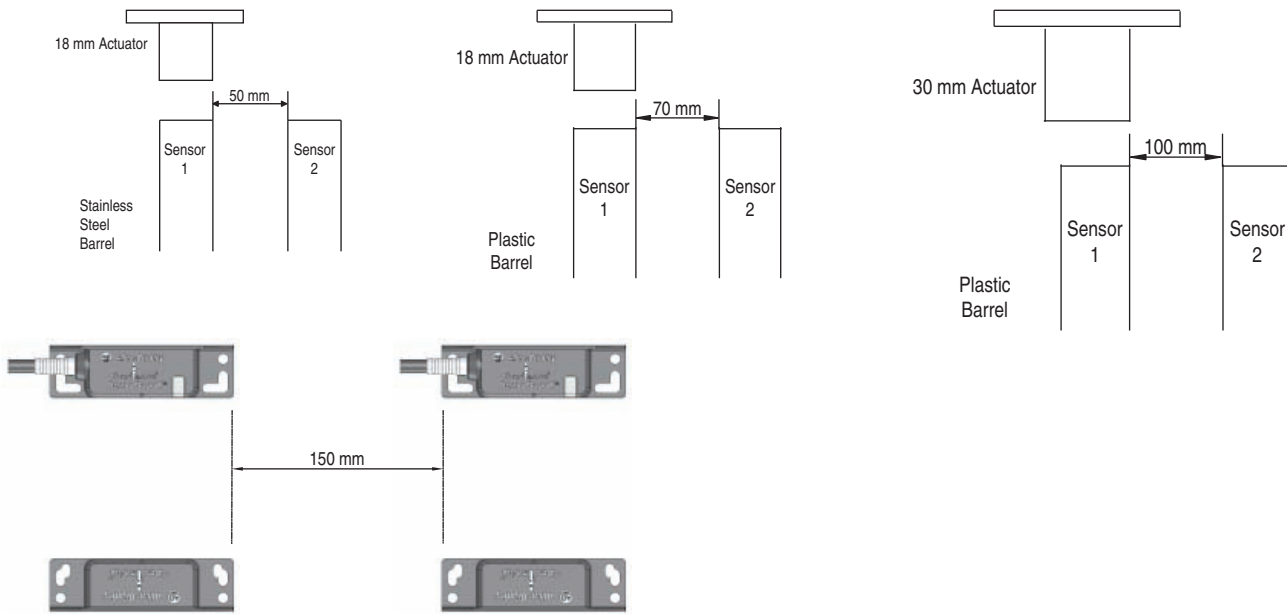


Note: There must be a minimum spacing of 7 mm (0.275 in.) if actuator and sensor face approaches laterally. This will prevent false triggering due to the side lobe areas.

Large Rectangular Flat Pack

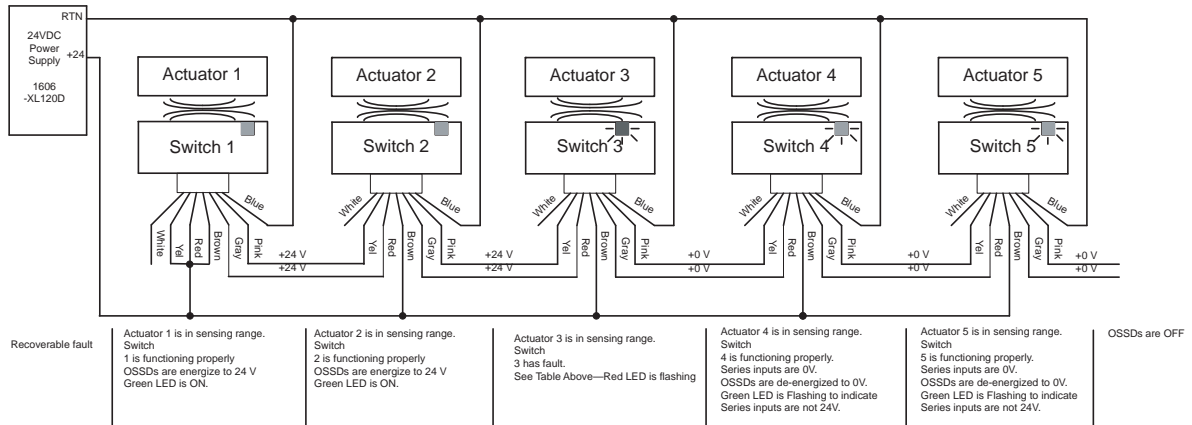


Minimum Distance Between Sensors



3-Interlock
Switches

Diagnostic

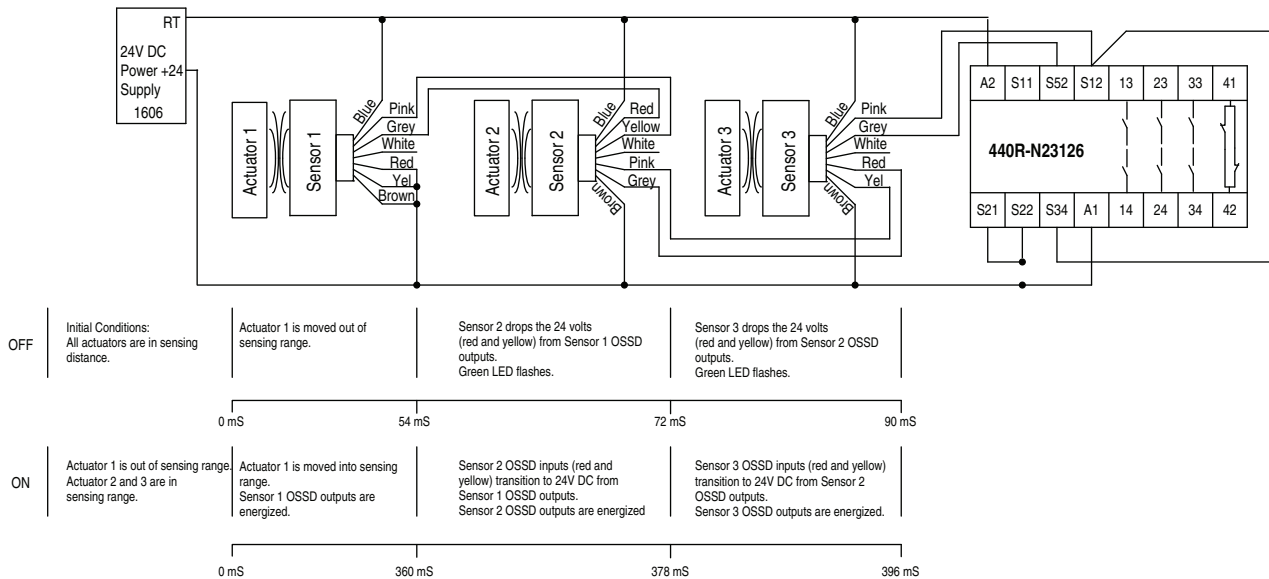


Unit Indicators (per IEC 60073)

| | 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 |

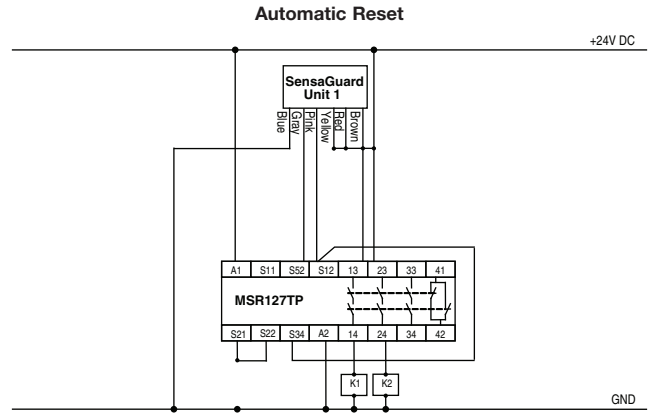
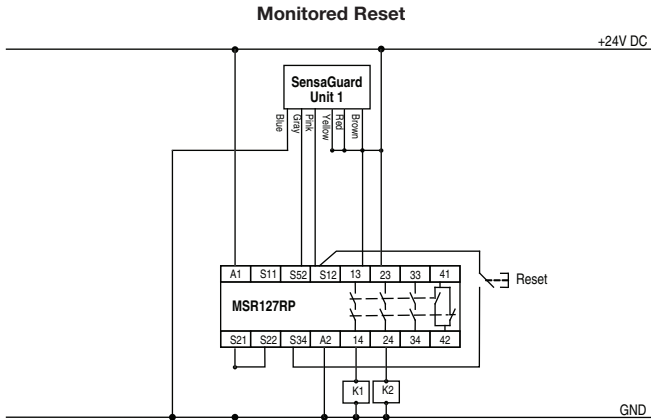
3-Interlock Switches

Unit Response Time

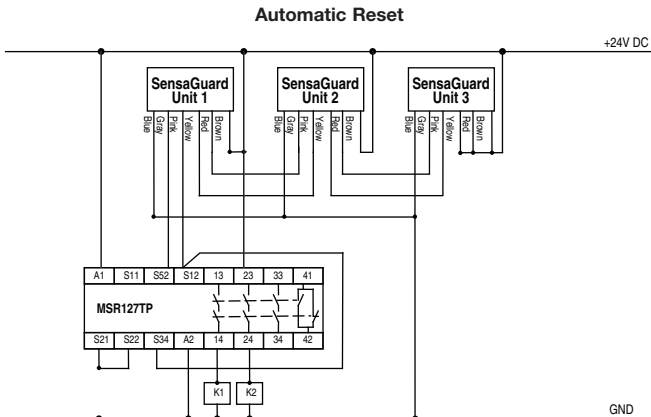
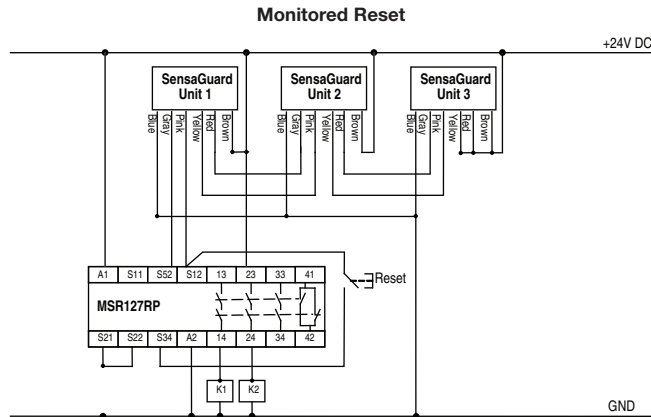


Application Wiring Examples

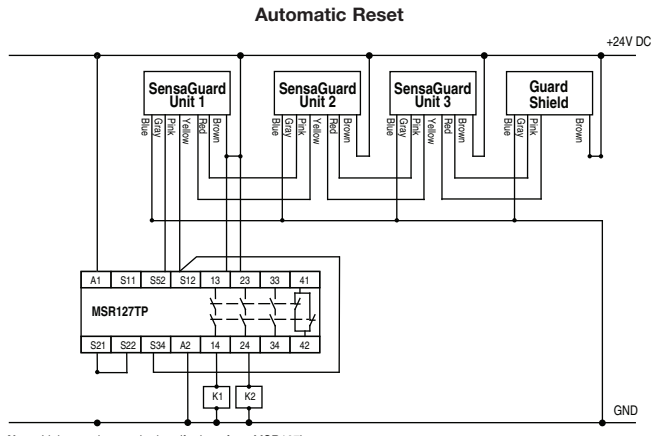
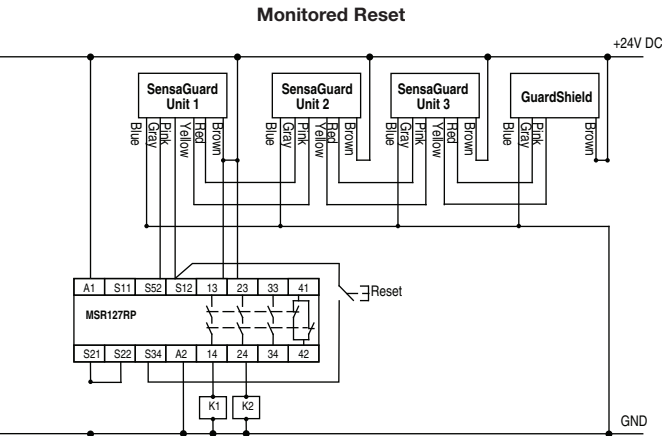
MSR127RP with One Sensor



MSR127RP with Three Sensors



MSR127RP with Two Sensors and One Light Curtain



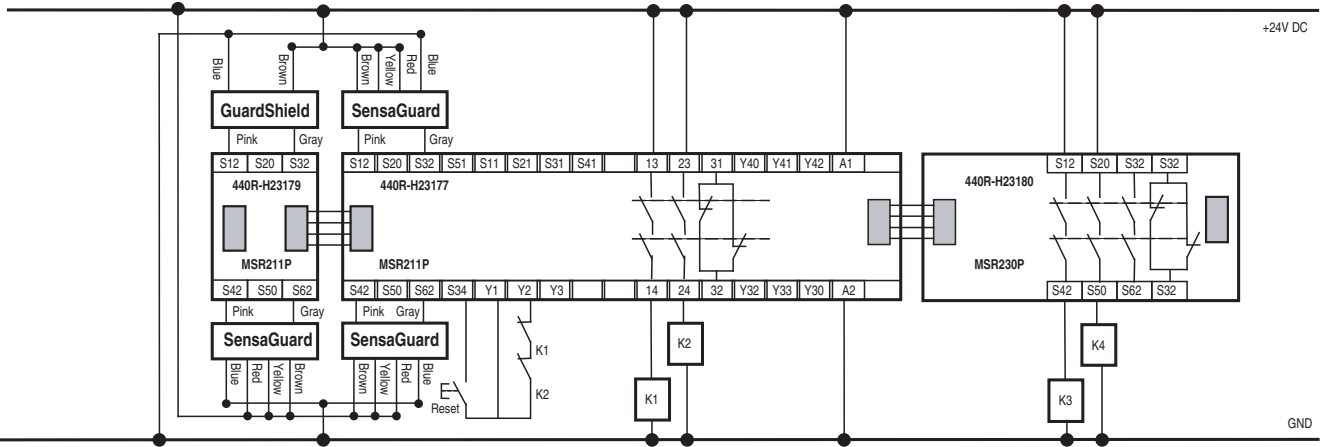
Note: Light curtain must be last (farthest from MSR127).

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

3-Interlock
Switches

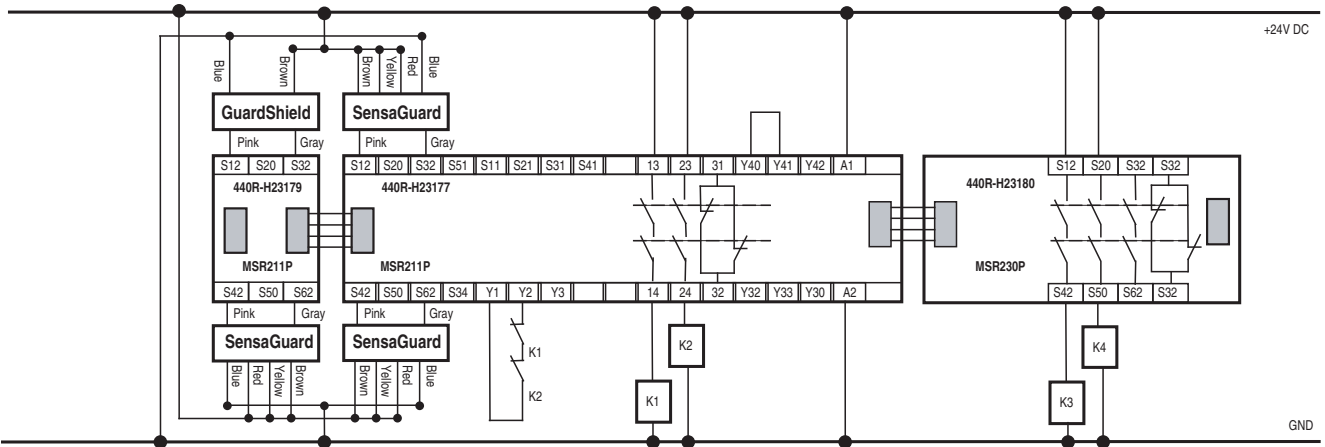
MSR200 Series with Three Sensors and One Light Curtain

Manual Reset



Note: Light curtain can be attached to any input.

Automatic Reset



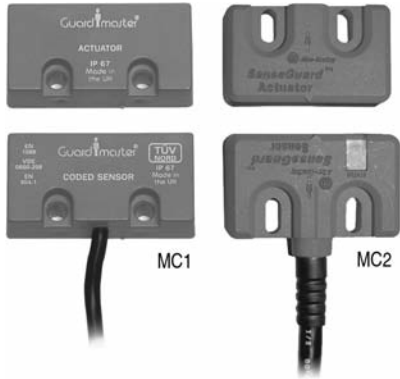
Note: Light curtain can be attached to any input

3-Interlock
Switches

Safety Switches

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 * | 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 | 898D-F4AC-* | 898D-F8AB-* |
| Patchcord | 898D-F4ACDM-* | 898D-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.

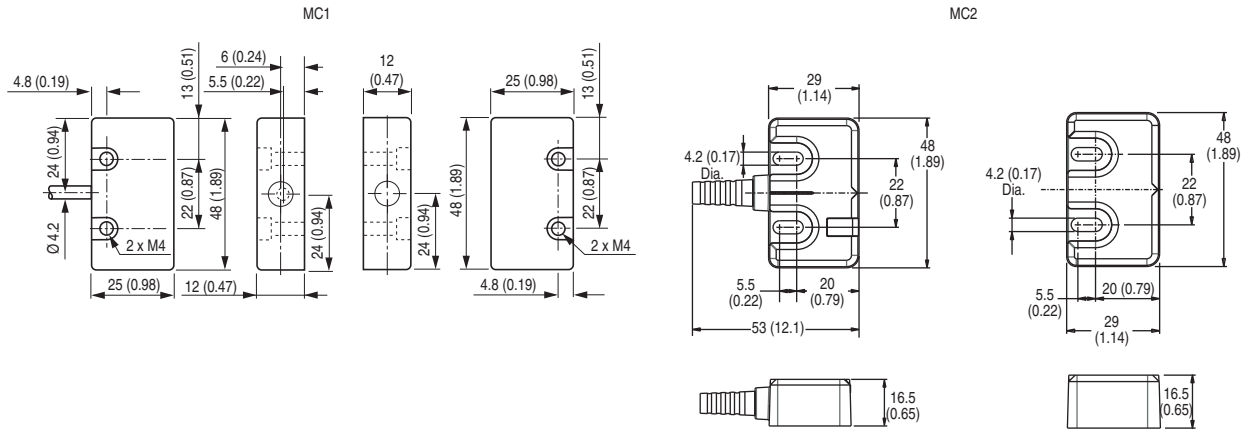
Accessories

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

Safety Switches
Non-Contact Switches
 Magnetically Coded

Approximate Dimensions

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



Typical Wiring Diagrams

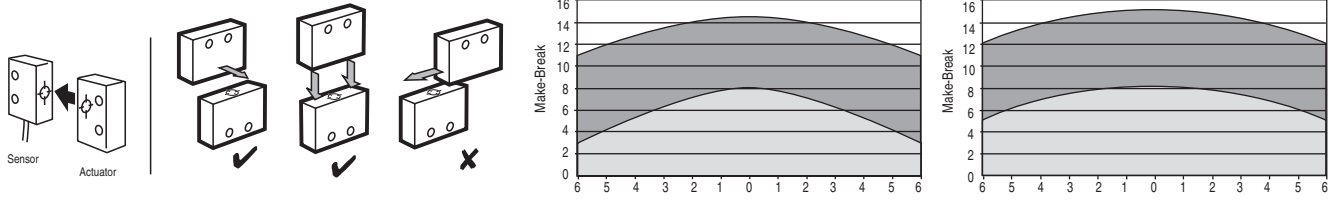
| Description | | MC1 | MC2 |
|--|--------|----------|-----------------|
| | | 2 N.C. | 2 N.C. + 1 N.O. |
| 4-Pin Micro (M12) | | | — |
| | | — | |
| Cordset 889D-F4AC-* or Cable Version | Brown | Safety A | — |
| | Blue | | — |
| | White | Safety B | — |
| | Black | | — |
| 8-Pin Cordset 889D-F8AB-* 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.

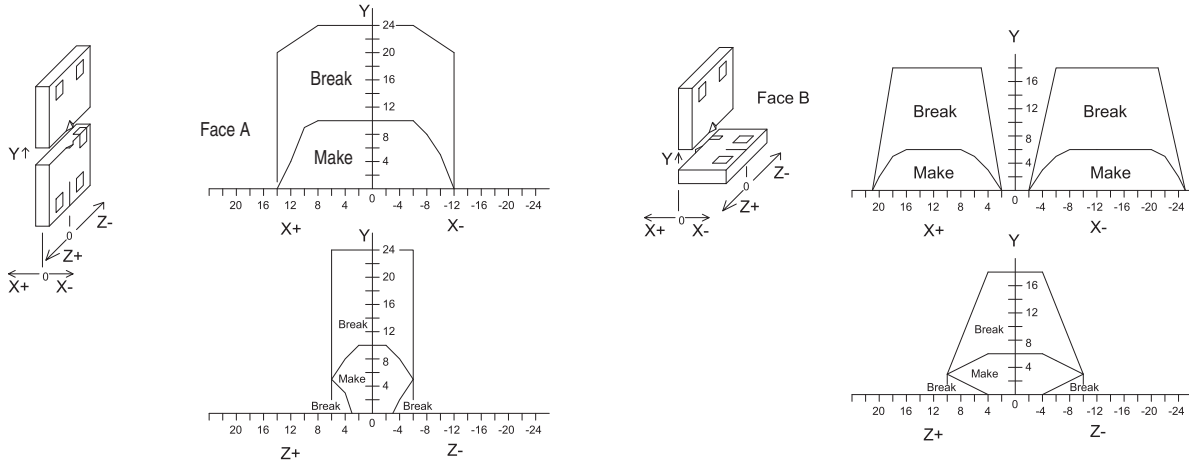
3-Interlock
Switches

Sensing & Misalignment Curve

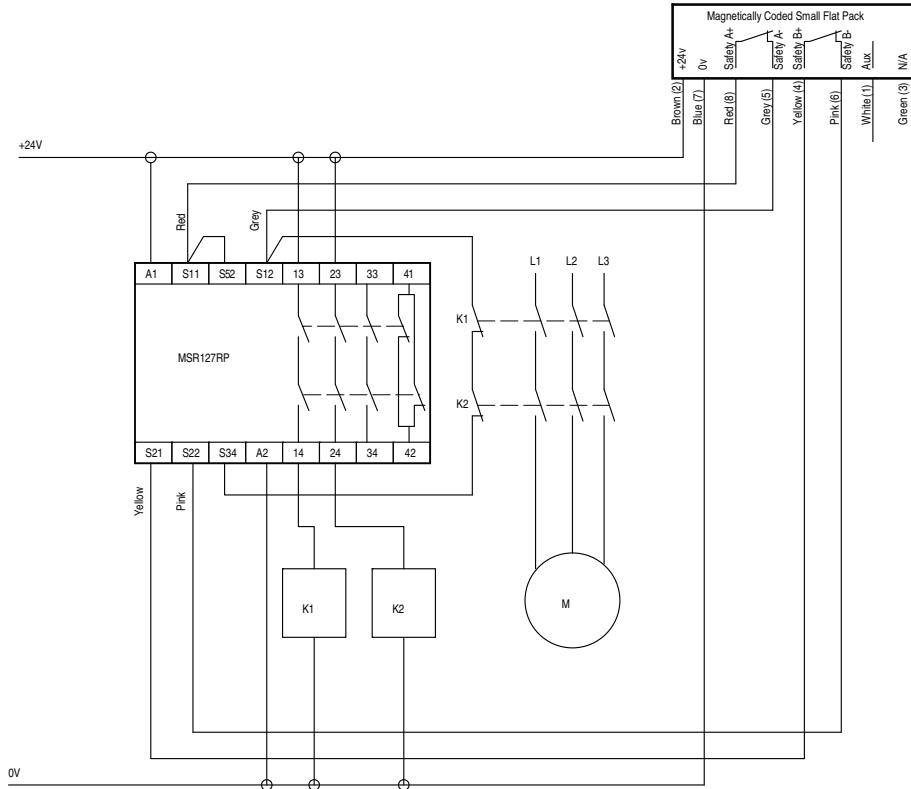
MC1



MC2



MC2 Application Wiring Example



3-Interlock Switches

Safety Switches

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 | B10d: > 2 x 10 ⁶ operations at min. PFH _D : > 3 x 10 ⁻⁷ MTTFd: > 385 years |
| Note: For up-to-date information, visit http://www.ab.com/Safety/ | 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 |
| | 2 N.C. | — | 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.

Safety Switches
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 | 6-Pin Micro (M12) |
|------------------|--------------------------------|-------------------|
| | 4-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 | — |

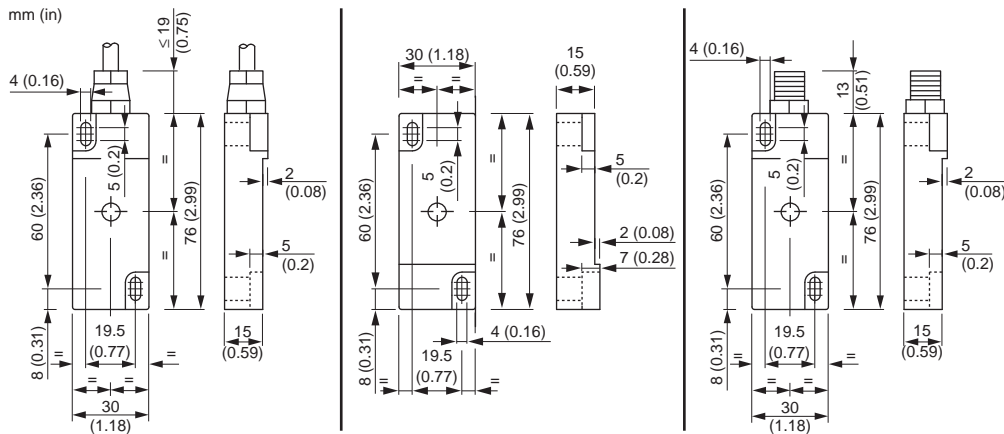
Accessories

| Description | Cat. No. |
|----------------------|-------------|
| Replacement Actuator | 440N-A02005 |

* 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.

Approximate Dimensions

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



Typical Wiring Diagrams

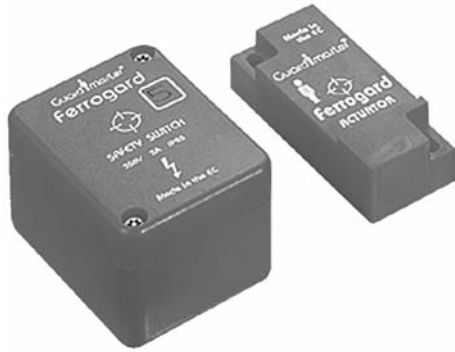
| | | FRS1 | FRS2 | FRS20 | FRS21 |
|---|------------|--------|-----------------|----------|-----------------|
| | | 1 N.C. | 1 N.C. + 1 N.O. | 2 N.C. | 2 N.C. + 1 N.O. |
| 4-Pin Micro (M12) | | — | | | — |
| 6-Pin Micro (M12) | | — | — | — | |
| Cordset 889D-F4AC- <i>*</i> or Cable Versions | Brown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

Safety Switches

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 * | B10d: > 2 x 10 ⁶ operations at min. PFH _D : > 3 x 10 ⁻⁷ MTTFd: > 385 years |
| Note: For up-to-date information, visit http://www.ab.com/Safety/ | 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 |

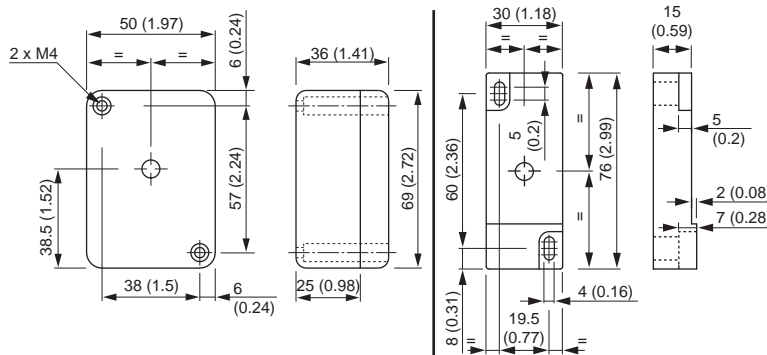
Note: For additional Safety Relays connectivity, see page 5-12.
 For additional Safety I/O and Safety PLC connectivity, see page 5-116.
 For application and wiring diagrams, see page 10-1.

Accessories

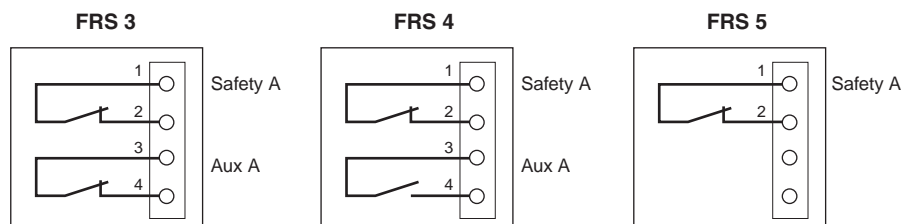
| Description | Cat. No. |
|----------------------|-------------|
| Replacement Actuator | 440N-A02005 |

Approximate Dimensions

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

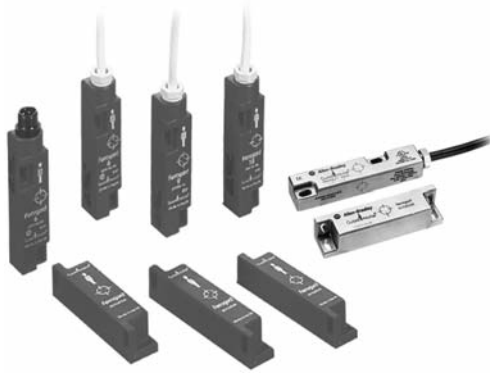


Typical Wiring Diagrams



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 * | 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 |
| Note: | For up-to-date information, visit http://www.ab.com/Safety/ |
| 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

3-Interlock Switches

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 | | | | | | |
| FRS 9 | | | | 2 m Cable | 440N-G02044 | | | | | |
| | | | | 4 m Cable | 440N-G02075 | | | | | |
| | | | | 6 m Cable | 440N-G02082 | | | | | |
| | | | 10 m Cable | 440N-G02089 | | | | | | |
| FRS 10 | | | 4-Pin Micro QD | 440N-G02096 | | | | | | |
| | 2 m Cable | 440N-G02045 | | | | | | | | |
| 4 m Cable | 440N-G02088 | | | | | | | | | |
| 110V AC, 3 A | 1 N.C. | — | Red Molded ABS Plastic | FRS 13 | 2 m Cable | 440N-G02154 | | | | |
| | | | | | 4 m Cable | 440N-G02155 | | | | |
| | | | | | 4-Pin Micro QD | 440N-G02160 | | | | |
| FRS 14 | | | | | 2 m Cable | 440N-G02156 | | | | |
| | | | | 4 m Cable | 440N-G02157 | | | | | |
| 250V AC, 2 A | | | | 1 N.C. | — | Stainless Steel | FRS 13 | 4 m Cable | 440N-G02161 | |
| | | | | | | | | FRS 14 | 2 m Cable | 440N-G02156 |
| | | | | | | | | | 4 m Cable | 440N-G02157 |
| FRS 10 | | | 2 m Cable | | | | | 440N-G02045 | | |
| | | | 4 m Cable | | | | 440N-G02088 | | | |
| 24V DC, 1 A | 1 N.C. | — | Stainless Steel | | | | FRS 13 | 4-Pin Micro QD | 440N-G02160 | |
| | | | | | | | | FRS 14 | 2 m Cable | 440N-G02156 |
| 4 m Cable | | | | | | | | | 440N-G02157 | |
| FRS 10 | | | | | | 2 m Cable | | 440N-G02045 | | |
| | | | | | | 4 m Cable | 440N-G02088 | | | |

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

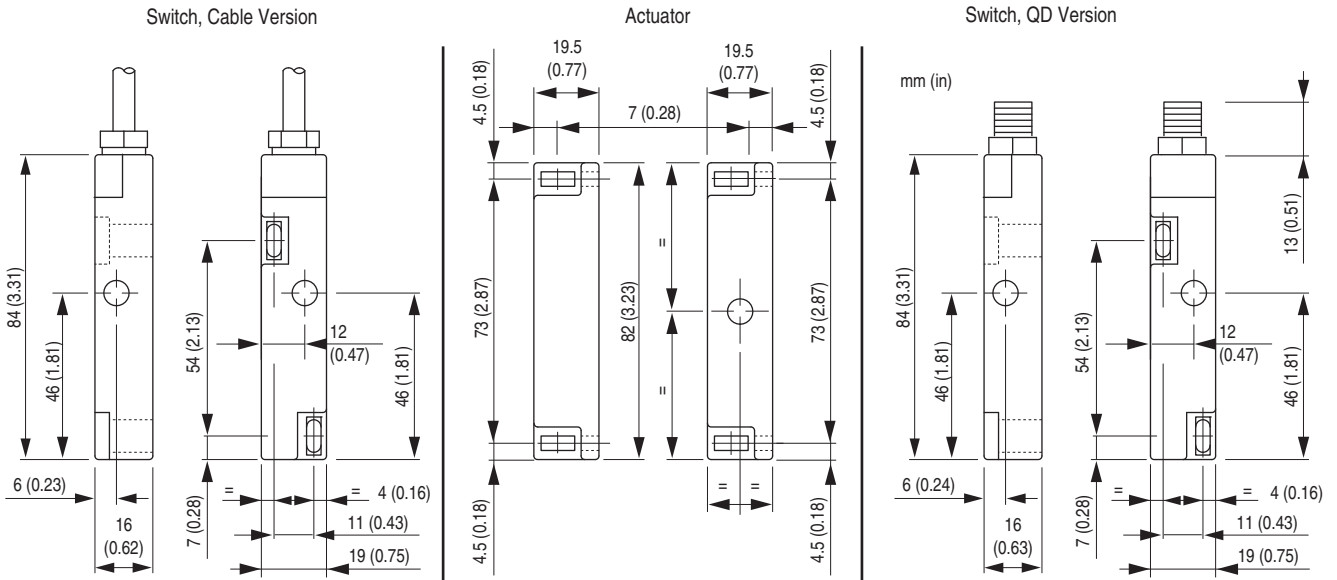
| Description | Cat. No. |
|---|-------------|
| FRS 6, 9, 10 Plastic Replacement Actuator | 440N-A02025 |
| FRS 13, 14 Stainless Steel Replacement Actuator | 440N-A02165 |

Safety Switches
Non-Contact Switches
 Ferrogard™ 6, 9,10, 13 & 14

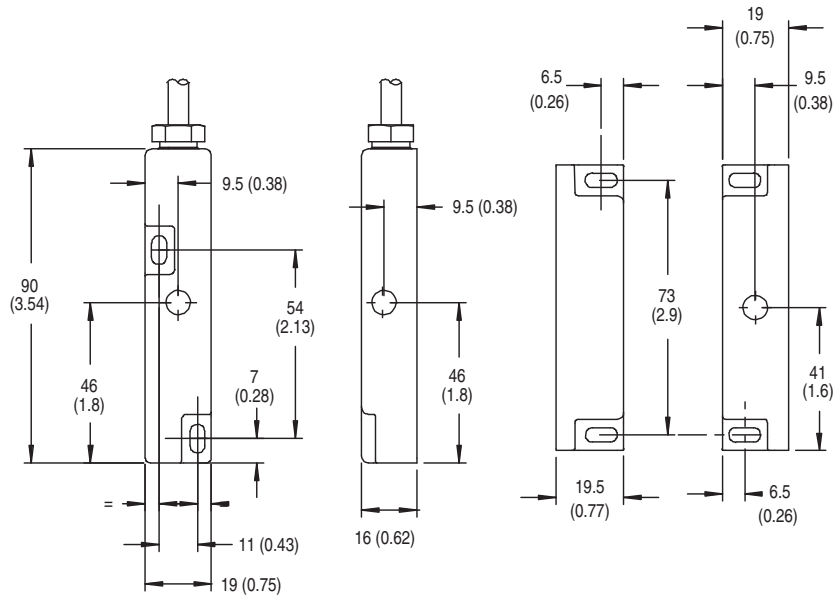
Approximate Dimensions

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

FRS 6, 9, 10



FRS 13, 14



3-Interlock
Switches

Typical Wiring Diagrams

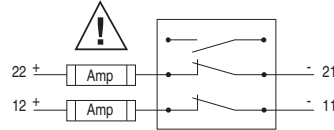
| | | FRS 6, 9, 10 | FRS 13, 14 |
|------------------------|----------|--------------|-----------------|
| | | 1 N.C. | 1 N.C. + 1 N.O. |
| 4-Pin Micro (M12) | | | |
| Cordset 889D-F4AC-* | Brown | Safety A | Safety A |
| | Blue | — | Aux A |
| | White | — | — |
| | Black | — | — |
| Cable Version |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

Safety Switches

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 * | 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 | | |
| Note: | For up-to-date information, visit http://www.ab.com/Safety/ | | |
| 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-* |

* 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.

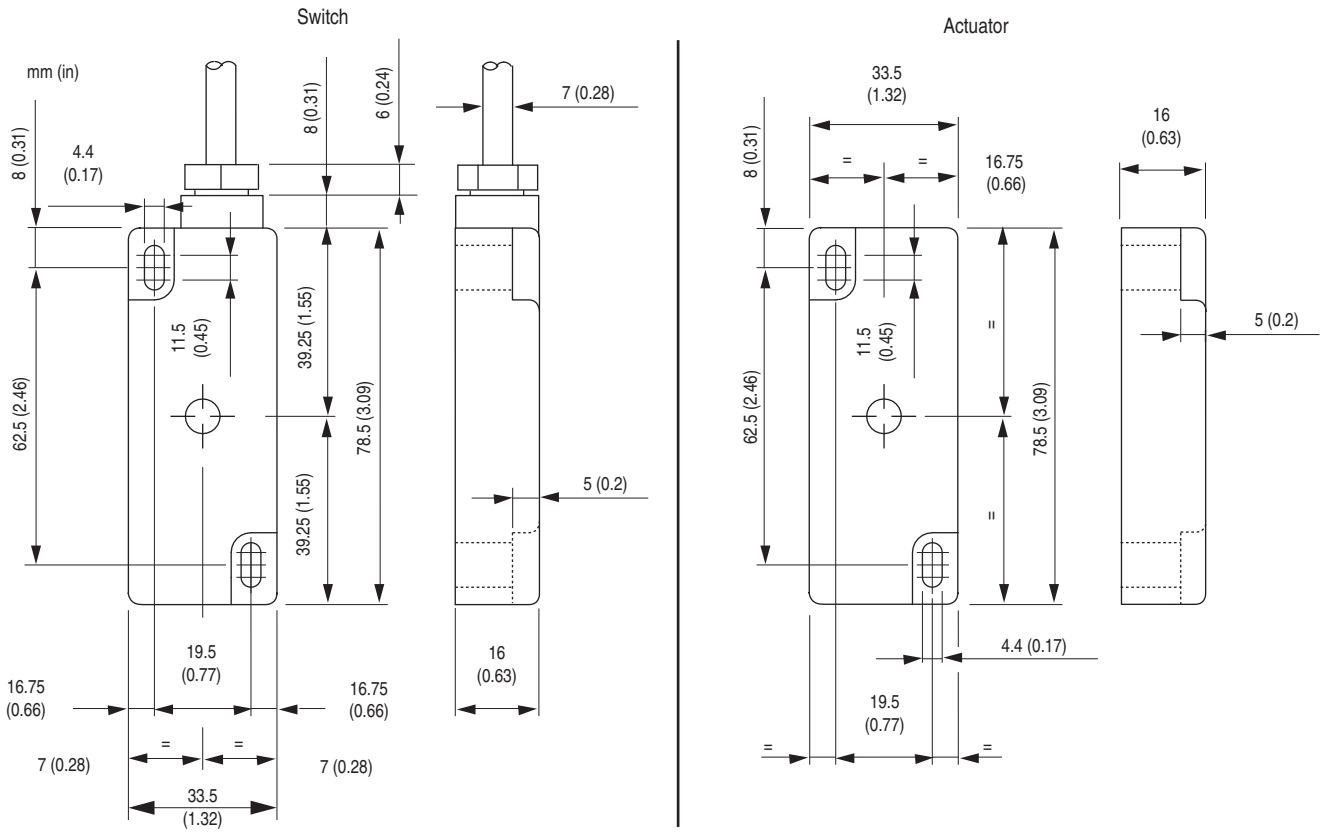
Accessories

| Description | Cat. No. |
|-------------|-------------|
| Actuator | 440N-A02128 |

Safety Switches
Non-Contact Switches
 Ferrogard™ GD2

Approximate Dimensions

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



3-Interlock
Switches

Typical Wiring Diagrams

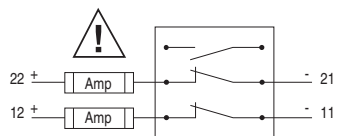
| Description | | FRS21 | FRS2 | FRS20 |
|-----------------------|----------------|-----------------|-----------------|--------|
| | | 2 N.C. + 1 N.O. | 1 N.C. + 1 N.O. | 2 N.C. |
| Cable Versions | Safety A | Black | Blue | Brown |
| | | White | Red | Blue |
| | Safety B | Red | — | Black |
| | | Blue | — | 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

FRS 2 GD2
 FRS 20 GD2
 FRS21 GD2

AC ≤ 1.6 A* (F) IEC 60127-2

DC ≤ 0.4 A** (F) IEC 60127-2

Recommended:

*Bussman BK/GDA-1.6 A

** Bussman BK/GDA-400 mA

Safety Switches

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 * | 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 |
| Note: | For up-to-date information, visit http://www.ab.com/Safety/ |
| 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 |

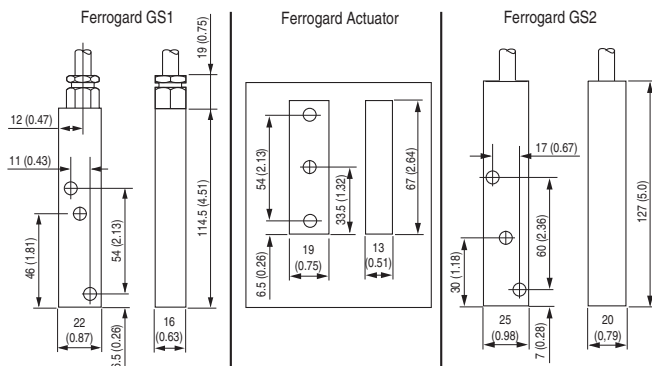
Note: For additional Safety Relays connectivity, see page 5-12.
 For additional Safety I/O and Safety PLC connectivity, see page 5-116.
 For application and wiring diagrams, see page 10-1.

Accessories

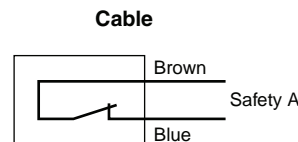
| Description | Used with | Cat. No. |
|-------------------------|-----------------|-------------|
| Actuator, Alnico | Brass Switch | 440N-A02056 |
| Actuator, Epoxy-painted | Stainless Steel | 440N-A02057 |

Approximate Dimensions

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



Typical Wiring Diagrams



External Fuse Safety Contacts



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

| | |
|-----|-----------------------------|
| GS1 | AC ≤ 1.6 A* (F) IEC 60127-2 |
| GS2 | |

Recommended:
 *Bussman BK/GDA-1.6 A

Safety Switches

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 | B10d: > 2 x 10 ⁶ operations at min. PFH _D : > 3 x 10 ⁻⁷ MTTFd: > 385 years |
| Note: For up-to-date information, visit http://www.ab.com/Safety/ | 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 | ABS plastic | | 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] | 1 N.C. & 1 N.O. | None | S31 | 3 m Cable | 440N-S32101 |
|  S4 | Stainless Steel | | 4-Pin Micro (M12) | | 440N-S32024 | |
| | | | 8-Pin Micro (M12) | | 440N-S32047 | |
| | | | 3 m Cable | S42 | 440N-S32055 | |
| | | | 10 m Cable | | 440N-S32056 | |
| | | | 8-Pin Micro (M12) | S43 | 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 | Sipa 6 | | 440N-S32052 |

Connection Systems

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

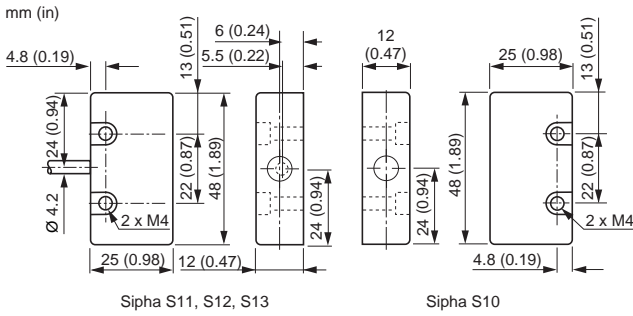
* Replace symbol with 2 (2 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
 * Replace symbol with 1 (1 m), 2 (2 m), 3 (3 m), 5 (5 m), or 10 (10 m) for standard cable lengths.
Note: For additional information, see page 7-1.

Safety Switches
Non-Contact Switches
 Sipa™ Sensors

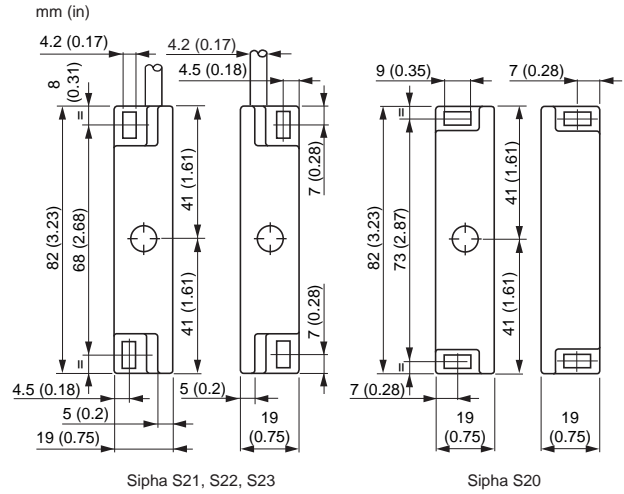
Approximate Dimensions

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

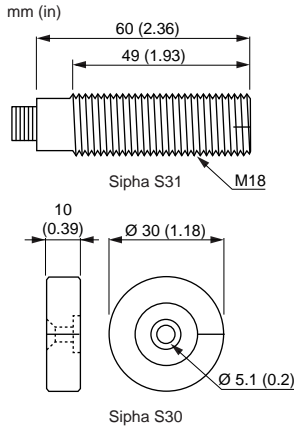
Sipa S1



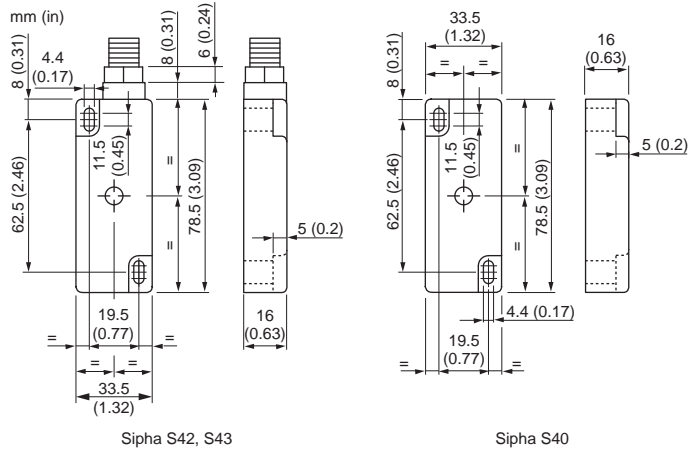
Sipa S2



Sipa S3



Sipa S4



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 |

3-Interlock
Switches

Typical Wiring Diagrams

| Description | | S11, S21 | S42, S12, S22 | S43, S13, S23 |
|----------------|--------|-----------------|-----------------|-----------------|
| | | 1 N.O. + 1 N.C. | 2 N.C. + 1 N.O. | 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 | — | External Ground | External Ground |
| 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.