



Remote Safety Relay Product Manual

Original Instructions

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Chapter 1 About This Document

1.1 Important... Read this before proceeding!

The user is responsible for satisfying all local, state, and national laws, rules, codes, and regulations relating to the use of this product and its application. Banner Engineering Corp. has made every effort to provide complete application, installation, operation, and maintenance instructions. Please contact a Banner Applications Engineer with any questions regarding this product.

The user is responsible for making sure that all machine operators, maintenance personnel, electricians, and supervisors are thoroughly familiar with and understand all instructions regarding the installation, maintenance, and use of this product, and with the machinery it controls. The user and any personnel involved with the installation and use of this product must be thoroughly familiar with all applicable standards, some of which are listed within the specifications. Banner Engineering Corp. makes no claim regarding a specific recommendation of any organization, the accuracy or effectiveness of any information provided, or the appropriateness of the provided information for a specific application.

1.2 Use of Warnings and Cautions

The precautions and statements used throughout this document are indicated by alert symbols and must be followed for the safe use of the Remote Safety Relay. Failure to follow all precautions and alerts may result in unsafe use or operation. The following signal words and alert symbols are defined as follows:

Signal Word and Symbol	Definition
 WARNING:	Warnings refer to potentially hazardous situations which, if not avoided, could result in serious injury or death.
 CAUTION:	Cautions refer to potentially hazardous situations which, if not avoided, could result in minor or moderate injury.

These statements are intended to inform the machine designer and manufacturer, the end user, and maintenance personnel, how to avoid misapplication and effectively apply the Remote Safety Relay to meet the various safeguarding application requirements. These individuals are responsible to read and abide by these statements.

1.3 EU Declaration of Conformity (DoC)

Banner Engineering Corp. herewith declares that these products are in conformity with the provisions of the listed directives and all essential health and safety requirements have been met. For the complete DoC, please go to www.bannerengineering.com.

Product	Directive
Remote Safety Relay	EU: Machinery Directive 2006/42/EC

Representative in EU: Spiros Lachandidis, Managing Director, Banner Engineering BV | Park Lane | Culliganlaan 2F bus 3 | 1831 Diegem, BELGIUM

Chapter 2 Product Overview

For OSSD Operation, Solid-State Input to Relay Output



- Convert low-current OSSD outputs into two 8 A, pulse-free 24 V DC relay outputs for machine shutoff circuits, hydraulic valves, and other machine controls that require relay switching
- Switch higher-current machine shutoff circuits, hydraulic valves, and other machine control points with two 8 A relay outputs
- Mount directly on machines or near actuators with a compact, IP65/IP67-rated housing to reduce the need for cabinet space and long cable runs
- Support safety designs rated up to Category 4 / PL e and SIL 3 when used with solid-state safety devices that include short-circuit detection
- Connect to Banner Remote Safety I/O blocks and other dual-channel OSSD output devices, including safety light curtains, safety laser scanners, RFID safety switches, Emergency Stop buttons, and rope/cable pull switches with OSSD outputs
- Simplify wiring with internal relays that monitor their own switching, eliminating the need for a separate monitoring circuit for the RSr relay itself
- Simplify installation checks and troubleshooting with on-device indicators for power/reset, fault, safety input, and relay output status
- Choose automatic reset models that turn relay outputs ON when safety inputs return ON, or manual reset models that require a reset signal before relay outputs turn ON

WARNING:



- **Not a stand-alone safeguarding device**
- Failure to properly safeguard hazards according to a risk assessment, local regulations, and applicable standards might lead to serious injury or death.
- This Banner Engineering Corp. device is considered complementary equipment that is used to augment safeguarding that limits or eliminates an individual's exposure to a hazard without action by the individual or others.

WARNING:



- **Do not abuse the module after failure**—If an internal fault has occurred and the module will not reset, do not tap, strike, or otherwise attempt to correct the fault with a physical impact to the housing.
- Failure to follow these instructions could result in serious injury or death.
- An internal relay might have failed in such a manner that its replacement is required. If the module is not immediately replaced or repaired, multiple simultaneous failures might accumulate such that the safety function cannot be guaranteed.

2.1 Models

Model	Relay	Inputs	Reset	Output Current	Connection
RSr-L-SIL-8A-Q	L-Code	2 OSSD Safety Inputs	Latched Relay (reset input on aux wire)	Relay Outputs (two 8-amp relay outputs)	5-pin M12 connectors
RSr-L-SIT-8A-Q			Trip (aux output on aux wire)		

2.2 Overview

The Remote Safety Relay (RSr) is used to convert [output signal switching device](#) (OSSD) outputs from low current 24 V DC to high current pulse-free 24 V DC outputs.

The RSr relay is designed to be used with the Remote Safety I/O block or any other OSSD output device. The RSr relay is a hardened device for on-machine use. This relay is suited for packaging, material handling, and automotive applications, as well as any other machine that requires distributed I/O with high-power outputs.

The RSr relay has a compact design with a low profile. Each unit is sealed in an industrial hardened housing and contains relays and internal monitoring circuits. The unit can be mounted directly on a machine (without a control cabinet) allowing OEMs and users to reduce installation and operating costs. It can also be mounted close to the actuators, offering shorter cable runs and reducing wiring costs.

2.2.1 Safety Circuit Integrity and ISO 13849-1 Safety Circuit Principles

Safety circuits involve the safety-related functions of a machine that minimize the level of risk of [harm](#). These safety-related functions can prevent initiation, or they can stop or remove a hazard. The failure of a safety-related function or its associated safety circuit usually results in an increased risk of harm.

The integrity of a safety circuit depends on several factors, including fault tolerance, risk reduction, reliable and well-tried components, well-tried safety principles, and other design considerations.

Depending on the level of [risk](#) associated with the machine or its operation, an appropriate level of safety circuit integrity (performance) must be incorporated into its design. Standards that detail safety performance levels include ANSI B11.19 Performance Criteria for Safeguarding and ISO 13849-1 Safety-Related Parts of a Control System.

2.2.2 Safety Circuit Integrity Levels

Safety circuits in International and European standards have been segmented into Categories and Performance Levels, depending on their ability to maintain their integrity in the event of a failure and the statistical likelihood of that failure. ISO 13849-1 details safety circuit integrity by describing circuit architecture/structure (Categories) and the required performance level (PL) of safety functions under foreseeable conditions.

In the United States, the typical level of safety circuit integrity has been called "[control reliability](#)." Control Reliability typically incorporates redundant control and self-checking circuitry and has been loosely equated to ISO 13849-1 Category 3 or 4 and/or Performance Level "d" or "e" (see ANSI B11.19).

Perform a risk assessment to ensure appropriate application, interfacing/hookup, and risk reduction (see ANSI B11.0 or ISO 12100). The risk assessment must be performed to determine the appropriate safety circuit integrity to ensure that the expected risk reduction is achieved. This risk assessment must take into account all local regulations and relevant standards, such as U.S. Control Reliability or European "C" level standards.

2.2.3 Fault Exclusion

An important concept within the requirements of ISO 13849-1 is the probability of the occurrence of a failure, which can be reduced using a technique termed "fault exclusion." The rationale assumes that the possibility of certain well-defined failure(s) can be reduced via design, installation, or technical improbability to a point where the resulting [fault\(s\)](#) can be, for the most part, disregarded—that is, "excluded" in the evaluation.

Fault exclusion is a tool a designer can use during the development of the safety-related part of the control system and the risk assessment process. Fault exclusion allows the designer to design out the possibility of various failures and justify it through the risk assessment process to meet the requirements of ISO 13849-1/-2.

Requirements vary widely for the level of safety circuit integrity in safety applications (that is, Control Reliability or Category/Performance Level) per ISO 13849-1. Although Banner Engineering Corp. always recommends the highest level of safety in any application, the user is responsible to safely install, operate, and maintain each safety system and comply with all relevant laws and regulations.

WARNING:

- **Determine the safety category**
- The design and installation of the safety devices and the means of interfacing of those devices could greatly affect the level of safety circuit integrity.
- Perform a risk assessment to determine the appropriate safety circuit integrity level or safety category, as described by ISO 13849-1, to ensure that the expected risk reduction is achieved and that all applicable regulations and standards are met.

2.2.4 Monitoring of Safety Devices

Requirements vary widely for the level of safety circuit integrity in safety applications (that is, Control Reliability or Category/Performance Level) per ISO 13849-1. While Banner Engineering always recommends the highest level of safety in any application, it is the responsibility of the user to safely install, operate and maintain each safety system and comply with all relevant laws and regulations.

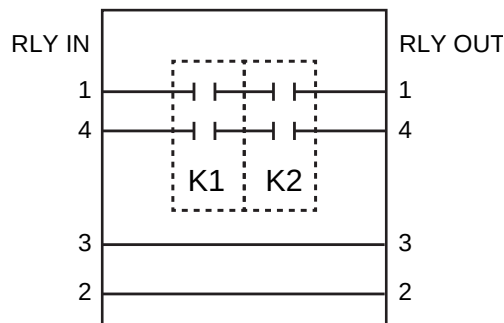
Although only a few applications are listed (see ["Input Device Requirements" on page 12](#)), the Module can monitor a variety of devices as long as the input requirements are complied with (see ["Electrical Installation" on page 18](#) and ["Specifications" on page 14](#)). The RSr does not have 500 ms simultaneity between inputs and thus **cannot be used for monitoring a two-hand control**. In all cases, the safety performance (integrity) must reduce the risk from identified hazards as determined by the machine's risk assessment.

WARNING:

- **Ensure the safety circuit integrity**
- The safety circuit integrity level is affected by the design and installation of the safety devices and the means of interfacing with those devices.
- Perform a risk assessment to determine the appropriate safety circuit integrity level or category to ensure the expected risk reduction is achieved and all applicable regulations and standards are in compliance (see ANSI B11.0 and ANSI B11.19, ISO 12100 and ISO 13849-1 or the applicable standards).

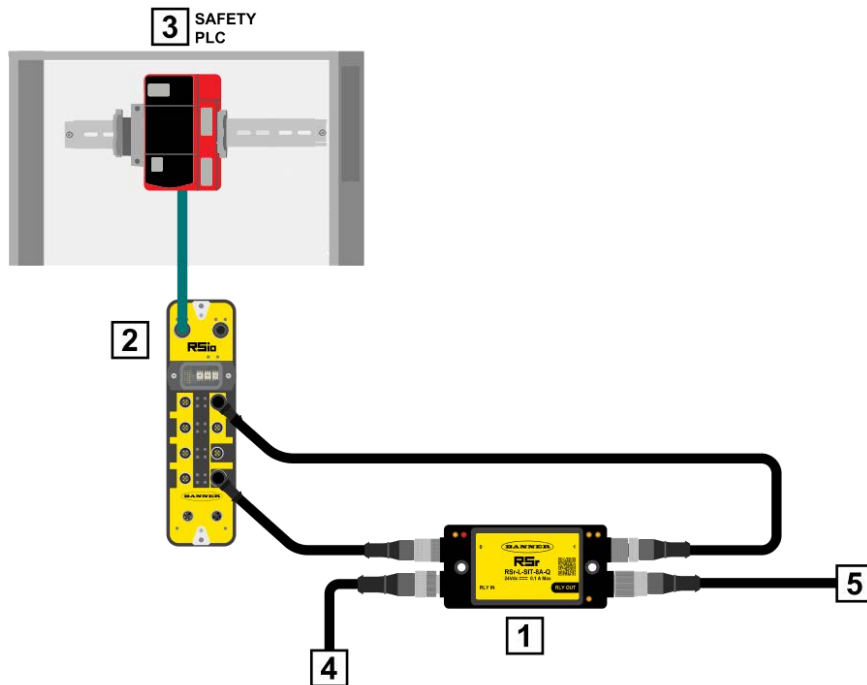
The RSr relay has two internal relays which are controlled by the OSSDs inputs received on the A-code M12 connectors. Both relay outputs of the RSr relay are series-connected through both relays; they are fully redundant outputs. The RSr relay also has the ability to self-monitor these relays to ensure that they are switching properly; no [external device monitoring](#) of the RSr relay is required.

Figure 1. RSr Relay Output Configuration



2.2.5 Application Examples

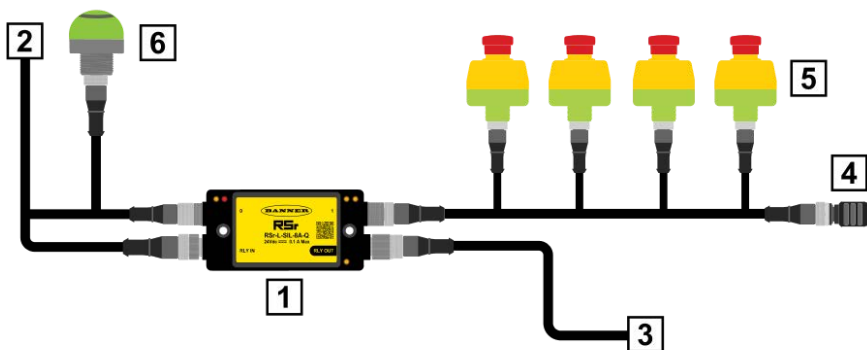
Figure 2. RSr relay with the Remote Safe I/O block for high power relay outputs



1. RSr Relay
2. Remote Safe I/O Block
3. Safety PLC
4. 16 A Power Supply
5. Machine Shutoff

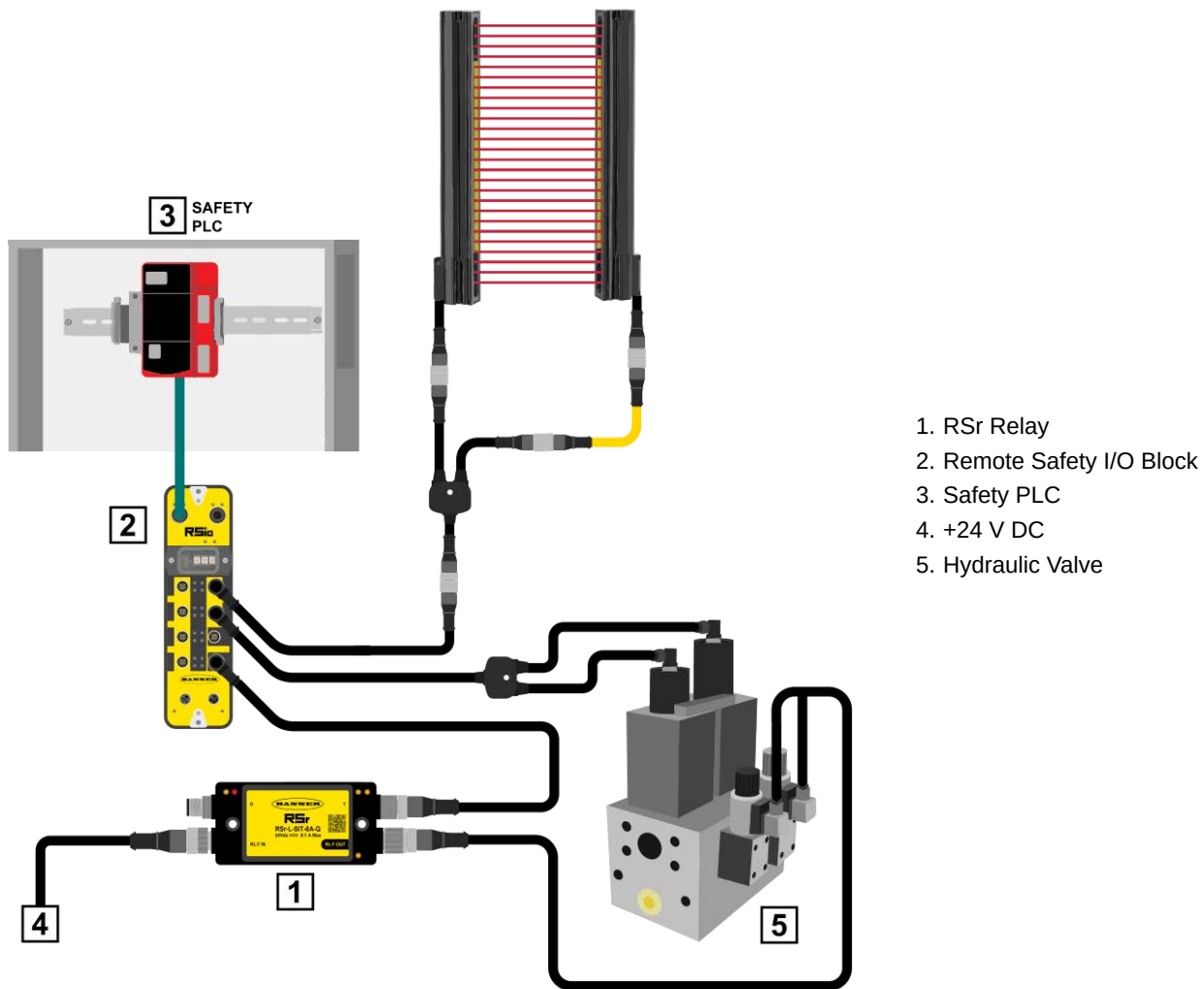
Figure 3. Latch version of RSr relay used with a string of E-stops with OSSD outputs

(Reset on pin 4)



1. RSr Relay
2. Power Supply
3. Machine Power
4. M12 Termination Plug
5. Emergency Stop Buttons
6. Reset Switch

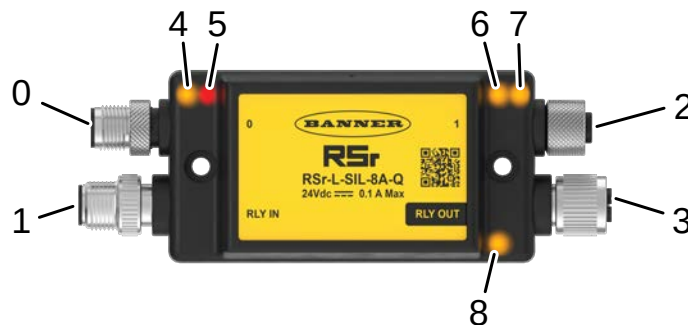
Figure 4. RSr relay used to convert OSSD outputs to contact output for devices that do not like the OSSD test pulses



2.3 Features and Indicators

The RSr relay has indicators for status, fault, safety input status, and relay output status. There are no adjustments or user-serviceable parts on the relay.

Figure 5. Features



0. Male 5-pin M12 A-code connector (Port 0)
1. Male 5-pin M12 L-code connector (Port 1, RLY IN)
2. Female 5-pin M12 A-code connector (Port 2)
3. Female 5-pin M12 L-code connector (Port 3, RLY OUT)
4. Status LED: Power on/reset needed
5. Fault LED: Lockout condition
6. Safety input 1 status LED
7. Safety input 2 status LED
8. Relay output status LED

When power is applied, all LEDs are on for 0.1 second, followed by all LEDs off for 0.1 second. Trip models repeat the sequence two times. Latch models repeat the sequence three times.

Table 1. LED Descriptions

Condition	Status LED (Yellow)	Fault LED (Red)	Input 1 LED (Yellow)	Input 2 LED (Yellow)	Relay LED (Yellow)
Reset (Latch)	Flashing	Off	Solid	Solid	Off
Input Fault	Flashing	Solid	Input ON: Flashing Input OFF: Off	Input ON: Flashing Input OFF: Off	Off
Output Fault	Flashing	Solid	Off	Off	Flashing
Internal Fault	Off	Solid	Off	Off	Off
Environmental Fault	Flashing	Solid	Flashing	Flashing	Flashing
No Fault	Solid	Off	Off	Off	Off
No Fault Inputs ON	Solid	Off	Solid	Solid	Solid
No Fault Inputs OFF	Solid	Off	Off	Off	Off

2.4 Module Port Wiring

The M12 L-code ports are for the high power to the relay contacts and switched power out of the relay contacts.

For both the trip models and latch models, the L-code port pin assignments are the same. RLY IN (port 1) is the input power to be switched by the internal relays. RLY OUT (port 3) is the switched outputs of the relay contacts. Whatever power is supplied to RLY IN will be switched ON and OFF at RLY OUT. The pinout is as follows:

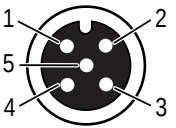
Table 2. 5-Pin L-Code M12 Male and Female Pinouts

Male Pinout	Female Pinout	Pin	Wire Color	Signal Description
		1	Brown	24 V DC (V1)
		2	White	DC Common (V2)
		3	Blue	DC Common (V1)
		4	Black	24 V DC (V2)
		5	Yellow/Green	Functional Earth

The M12 A-code ports are for the controlling signals to the module, pass-through signal (trip version), aux output (trip version) and/or reset signal (latch version).

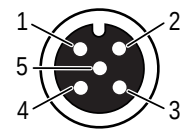
For A-code ports, the wiring is different between the trip models and the latch models. The pinout is as follows:

Table 3. Trip Models: 5-Pin M12 A-Code Male and Female Pinouts

Male Pinout	Female Pinout	Pin	Wire Color	Port 0 and Port 2 Description
		1	Brown	24 V DC
		2	White	OSSD
		3	Blue	DC Common
		4	Black	OSSD
		5	Gray	Aux Output

Inputs at port 0 are passed to port 2 or vice versa.

Table 4. Latch Models: 5-Pin M12 A-Code Male and Female Pinouts

Male Pinout	Female Pinout	Pin	Wire Color	Port 2 Description	Port 0 Description
		1	Brown	24 V DC (up to 4 A)	24 V DC (up to 4 A)
		2	White	OSSD	Open
		3	Blue	DC Common	DC Common
		4	Black	OSSD	Reset
		5	Gray	Reset	Open

The 24 V DC (and common) power should only be supplied on one of the A-code ports. It will be passed on to the other port.

2.5 AUX output (Trip Models)

Pin 5 of the A-code M12 is an auxiliary output. This output follows the state of the relay outputs (ON when relays are ON, OFF when relays are OFF. If a relay is faulted, the aux output should be OFF.)

The AUX output is not a pass-through pin. The RSr AUX are outputs on pin 5 of both the male and female A-code M12 connectors.

Chapter 3

Input Device Requirements

CAUTION:



- **Incomplete installation information**
- Many installation considerations necessary to properly apply these devices are not covered by this document.
- Refer to the appropriate device installation instructions to ensure the safe application of the device.

3.1 Optical Sensors

The safety inputs may be used to monitor optical-based devices that use light as a means of detection. These devices include safety light screens (curtains), safety laser scanners, and multiple/single beam devices (grids/points).

The design and installation of the optical safeguarding device should comply with ANSI B11.19, IEC 61496 (all applicable parts), ISO 13855, and/or other applicable standards. Optical safety devices must be placed at an appropriate [safety distance](#) (separation distance) from the safeguarded hazard. Because these devices vary, it is not practical to list specific calculations here. Refer to the applicable standards and to manufacturer documentation specific to your device for the appropriate calculations and for complete installation information.

3.2 Interlocked Guards (Gates)

The safety inputs can be interfaced with RFID safety switches to monitor the position of an interlock guard or gate. Each switch must provide OSSD outputs on pins 2 and 4 of a 4- or 5-pin M12 connector.

The design and installation of the interlocked guard and the safety switches should comply with ANSI B11.19, ISO 14119, ISO 14120, and/or other applicable standards. See the device manufacturer's installation instructions for complete information.

3.3 Emergency Stop Push Buttons and Rope/Cable Pull Switches

The RSr relay can interface with Emergency Stop or Rope/Cable Pull Switches with OSSD outputs on pins 2 and 4 of a 4- or 5-pin M12 connector.

The switch must provide OSSD outputs for safety which are ON (conducting) when the switch is armed. Once activated, the E-stop switch must turn OFF its OSSD outputs, and must require a deliberate action (such as twisting, pulling, or unlocking) to return to the closed-contact, armed position. The switch must be a "positive-opening" (or direct-opening) type, as described by IEC 60947-5-1.

Standards NFPA 79, ANSI B11.19, IEC/EN 60204-1, and ISO 13850 specify additional emergency stop switch device requirements, including the following:

- Emergency-stop push buttons shall be located at each operator control station and at other operating stations where emergency shutdown is required.
- Stop and emergency-stop push buttons shall be continuously operable and readily accessible from all control and operating stations where located. Do not mute or bypass E-stop buttons or rope/cable pulls.
- Actuators of emergency-stop devices shall be colored red. The background immediately around the device actuator shall be colored yellow (where possible). The actuator of a push-button-operated device shall be of the palm or mushroom-head type.
- The emergency-stop actuator shall be a self-latching type.

In addition, for Rope/Cable Pull Installations Only:

- The wire rope should be easily visible and readily accessible along its entire length. Red markers or flags may be fixed on the rope to increase its visibility.
- The rope or cable pull must provide constant tension and must have the capability to react to a force in any direction.
- Mounting points, including support points, must be rigid.

- The rope should be free of friction at all supports. Pulleys are recommended.
- The switch must have a self-latching function that requires a [manual reset](#) after actuation

Some applications may have additional requirements; comply with all relevant regulations. See the device manufacturer installation instructions for complete information.

WARNING:

- **Do not mute or bypass any emergency stop device**
- Muting or bypassing the safety outputs renders the emergency stop function ineffective.
- ANSI B11.19, NFPA 79 and IEC/EN 60204-1 require that the emergency stop function remains active at all times.

Chapter 4 Specifications

Input Voltage and Current

24 V DC $\pm 20\%$

The power supply must meet the requirements for extra low voltages with protective separation (SELV, PELV)

< 100 mA Nominal

Power Consumption

Approximately 2.0 W / 2.0 VA, Nominal

Supply Protection Circuitry

Protected against reverse polarity and transient voltages

Pollution Degree

2

Output Response Time

20 ms, maximum

Input Requirements: Safety Input Switch

Input ON Current: 5 mA typical at 24 V DC, 40 mA peak contact cleaning current at 24 V DC

Input ON threshold: > 15 V DC (guaranteed on), 30 V DC maximum

Input OFF Threshold: < 5 V DC and < 2 mA, -3 V DC minimum

Input Requirements: Reset Switch

Reset ON threshold: > 15 V DC (guaranteed on), 30 V DC maximum

Input OFF Threshold: < 5 V DC, -0.5 V DC minimum

Reset Duration: 350 ms minimum, 3000 ms maximum

Simultaneity Monitoring Period

3 seconds (going from OFF to ON)

Minimum OFF-State Recovery Time

400 ms maximum

Indicators

Status, Fault, Safety Input status, and Relay Output status

Construction

Coupling Material: Nickel-plated brass

Body: Thermoplastic polyurethane (TPU)

Environmental Rating

For indoor use only

IP65, IP67 (IEC 60529)

Mounting

Two M4 screws, 0.9 Nm (8 in lbs)

Output Configuration

Contacts: AgSnO₂ + 0.2 μ m Au

Each normally open output channel is a series connection of contacts from two forced-guided (mechanically linked) relays, K1-K2.

MTTFd

209 years per EN ISO 13849-1

PFHd

1.38×10^{-9} per IEC 61508

AUX Output Rating

Solid-state output, 24 V at 70 mA

Vibration Resistance

10 Hz to 200 Hz at ≤ 5 g

Mechanical life

> 40×10^6 operations

Switching Frequency

20 switching cycles/s

Proof Test Interval

20 years

Switched Voltage

The power supply must meet the requirements for extra low voltages with protective separation (SELV, PELV)

Switched Current Rating

RSr switching capacity to IEC/EN 60947-5-1

DC1: 24V / 8A

DC13: 24V 2 A

DC13, 0.1Hz: 24V, 4A

Electrical life (switching cycles of the output contacts, resistive load)

350,000 cycles DC13, 24 V; 1,500,000 cycles DC1 24 V

Transient suppression is recommended when switching inductive loads. Install suppressors across load. Never install suppressors across output contacts (see Warning, Arc Suppressors in "Safety Input Device Wiring Options" on page 19).

Operating Conditions

Temperature: -25 °C to +60 °C (-13 °F to +140 °F)

Storage Temperature: -30 °C to +70 °C (-22 °F to +158 °F)

Humidity: 90% at +50 °C maximum relative humidity (non-condensing)

Operating Altitude: 2000 m maximum (6562 ft maximum) per IEC 61010-1

Category / Performance Level (EN ISO13849-1)

Cat. 4 / PL e with solid-state devices with short-circuit detection

SIL / SIL CL (IEC61508 and EN62061)

SIL 3 with Solid-State devices with short-circuit detection

Certifications



Banner Engineering BV
Park Lane, Culliganlaan 2F bus 3
1831 Diegem, BELGIUM



Required Overcurrent Protection



WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

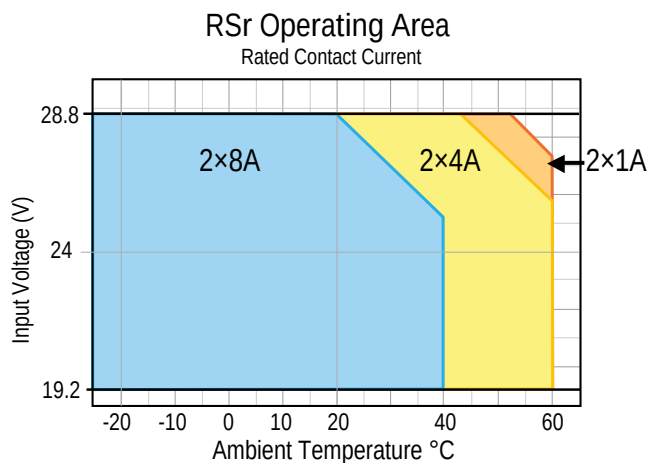
Overcurrent protection may be provided with external fusing.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

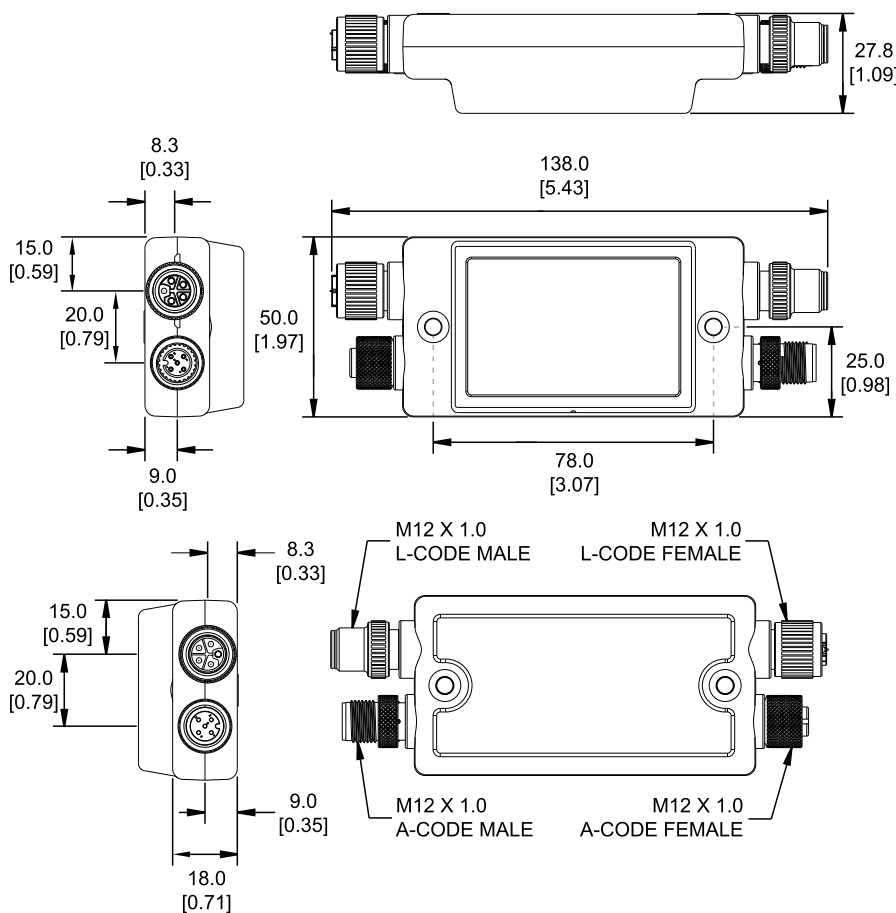
Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Figure 6. Derate Curve



4.1 Dimensions

All measurements are listed in millimeters [inches], unless noted otherwise. The measurements provided are subject to change.



Chapter 5 System Installation

5.1 Appropriate Application

The ability of the RSr to perform its safeguarding function depends on the appropriateness of the application and on its proper mechanical and electrical installation and interfacing to the safety system. If all mounting, installation, interfacing, and checkout procedures are not followed properly, the RSr cannot provide the protection for which it was designed.

5.2 Mounting Considerations

The RSr relay is intended for use in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

The relay is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

The RSr is rated to IP67, but it is recommended to install caps on open connectors in wet environments.

This relay is supplied as enclosed equipment. It should not require additional enclosures when used in locations consistent with the enclosure ratings stated in ["Specifications" on page 14](#).

The relay must be fastened to a flat surface, so that there is no strain on the housing when the relay is tightened down. The mounting distances depend on which plug-in connectors are used and on the bend radius of the cables.

The relay can be mounted in a horizontal or a vertical direction

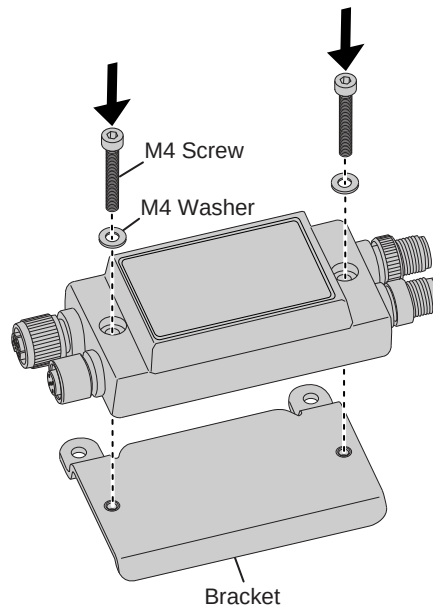
Heat Dissipation Considerations: For reliable operation, ensure that the operating specifications are not exceeded. The environment must provide adequate heat dissipation, so that the air closely surrounding the RSr relay does not exceed the maximum operating temperature stated in the ["Specifications" on page 14](#). Methods to reduce heat build-up include forced airflow (for example, fans) and spacing between relays and other sources of heat.

NOTE: The machine builder (user) is responsible to ensure the wiring/cabling is not easily manipulated by an operator to defeat the safety function(s). For example, the operator cannot remove a device from the system.

5.3 Mount the Relay Using a Bracket

Use the following instructions to mount the Remote Safety Relay using a bracket.

Figure 7. Mount Using a Bracket



1. Mark the drill holes.
2. Pre-drill the marked holes.
3. Mount the RSr relay to the RSr-MBK-01 bracket using the supplied M4 screws and washers.
4. Tighten the screws to the recommended torque: 0.9 Nm (8 in lbs).
5. Insert two user-supplied M4 fixing screws of an appropriate length, with washers, to mount the bracket and RSr relay to the desired surface.



CAUTION: Do not overtighten the RSr relay mounting screw during installation. Overtightening can affect the performance of the RSr relay.

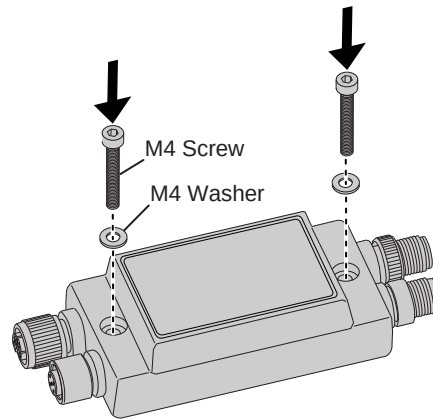
5.4 Mount the Relay Directly

Use the following instructions to mount the Remote Safety Relay directly to a surface. All hardware is user-supplied.

Install the RSr to allow access for functional checks, maintenance, and service or replacement. Do not install the RSr in such a way to allow for intentional defeat.

Fasteners must be of sufficient strength to guard against breakage. Use of permanent fasteners or locking hardware is recommended to prevent the loosening or displacement of the device. The mounting holes in the RSr accept M4 hardware.

Figure 8. Mounting



1. Mark the drill holes.
2. Pre-drill the marked holes.
3. Insert two user-supplied M4 fixing screws of an appropriate length, with washers, to mount the RSr relay to the desired surface.
4. Tighten the screws to the recommended torque: 0.9 Nm (8 in lbs).



CAUTION: Do not overtighten the RSr relay mounting screw during installation. Overtightening can affect the performance of the RSr relay.

5.5 Electrical Installation

WARNING:



- **Risk of electric shock**
- Use extreme caution to avoid electrical shock. Serious injury or death could result.
- Always disconnect power from the safety system (for example, device, module, interfacing, etc.), guarded machine, and/or the machine being controlled before making any connections or replacing any component. Lockout/tagout procedures might be required. Refer to OSHA 29CFR1910.147, ANSI Z244-1, or the applicable standard for controlling hazardous energy.
- Make no more connections to the device or system than are described in this manual. Electrical installation and wiring must be made by a Qualified Person⁽¹⁾ and must comply with the applicable electrical standards and wiring codes, such as the NEC (National Electrical Code), NFPA 79, or IEC 60204-1, and all applicable local standards and codes.

Electrical installation must be made by a Qualified Person⁽²⁾ and must comply with NEC (National Electrical Code), NFPA 79 or IEC/EN 60204-1, and all applicable local standards. It is not possible to give exact wiring instructions for a device that interfaces to a multitude of machine control configurations. The following guidelines are general in nature. Perform a risk assessment to ensure appropriate application, interfacing/ hookup, and risk reduction (see ANSI B11.0 or ISO 12100).

The RSr has no delay function. Its output relay contacts open within 20 milliseconds after the safety inputs open. This classifies the RSr as a functional stop "Category 0" control, as defined by NFPA 79 and IEC/EN 60204-1.

The safety inputs must be connected to OSSD outputs.

⁽¹⁾ A Qualified Person is a person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

⁽²⁾ A person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

NOTE: Properly wire the device.

- The user is responsible for properly wiring the Remote Safety Relay to any particular system. General wiring configurations are provided only to illustrate the importance of proper installation.
- Use proper wiring practices when connecting to the inputs or outputs of the RSr relay. Ensure proper insulation on conductors to avoid shorts between conductors.
- Apply power only after all electrical connections have been established.

5.5.1 Safety Input Device Wiring Options

The operation of all [dual-channel](#) wiring options is concurrent, meaning that input channel 1 and input channel 2 must be in the same state in both the STOP and RUN condition, with a 3-second simultaneity requirement between channels going from OFF to ON.

The solid-state dual-channel wiring cannot detect short circuits between input channels or to secondary sources of +24 V DC. To achieve higher levels of safety performance, the safety device that is connected to the inputs must be capable of detecting these short circuits and properly responding by turning both channels OFF. This circuit can meet ISO 13849-1 Category 2, 3, or 4 requirements depending on the safety rating, installation, and the fault detection (for example, short circuit) capabilities of the safety input device. If short circuit detection is not provided, the circuit can meet only Category 3.

NOTE: The RSr relay is designed to be controlled by a dual-channel device to maintain its level of safety. Wiring a [single-channel](#) device to both inputs of the RSr relay will not maintain a Category 4 or 3 safety rating.

It is recommended that in all circumstances the safety relay and its associated safety input devices are installed to eliminate or minimize the possibility of failures and faults that could result in the loss of the safety function(s). Methods to eliminate or minimize the possibility of these failures include, but are not limited to:

- Physically separating interconnecting control wires from each other and from secondary sources of power
- Routing interconnecting control wires in separate conduit, runs, or channels
- Properly installing multi-conductor cabling and multiple wires through strain-relief fittings (over-tightening of a strain-relief can cause short circuits at that point)
- Periodically checking the functional integrity / safety function and training operators, maintenance personnel, and others associated with the operation of the machine to recognize and immediately correct such failures

If you have any questions about your intended use, please contact a Banner applications engineer.

WARNING:



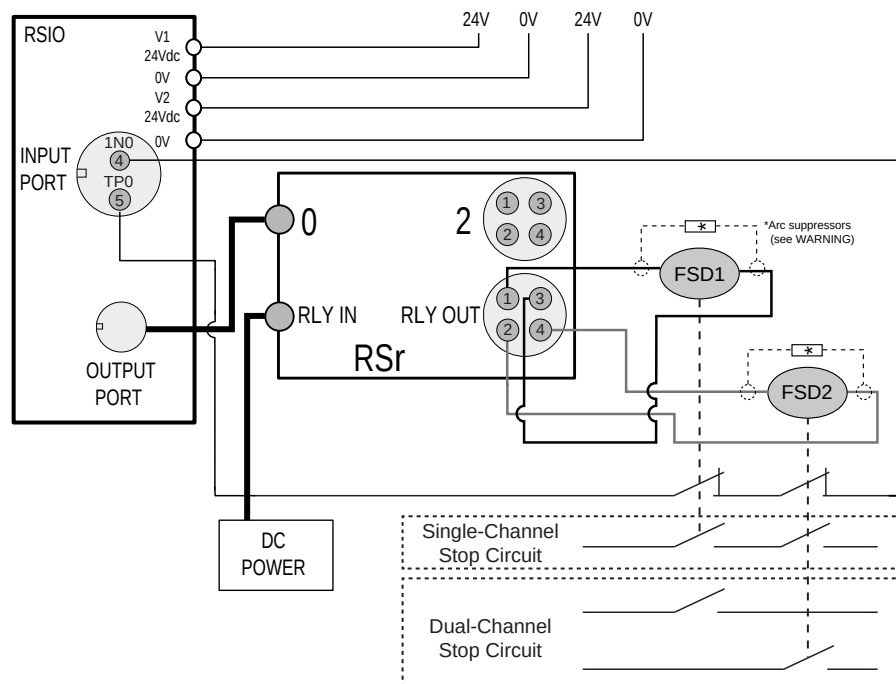
- **Properly install arc or transient suppressors**
- Failure to follow these instructions could result in serious injury or death.
- Install any suppressors as shown across the coils of the machine primary control elements. Do not install suppressors directly across the output contacts of the safety or interface module. In such a configuration, it is possible for suppressors to fail as a short circuit.

WARNING:



- **Interfacing master stop controls**
- Failure to follow these instructions could result in serious injury or death.
- Unless the same degree of safety is maintained, never wire an intermediate device(s) (PLC, PES, PC) between the safety module outputs and the master stop control element it switches such that a failure causes a loss of the safety stop command or the failure allows the safety function to be suspended, overridden, or defeated.
- When forced-guided, mechanically linked relays are added as intermediate switching devices, a normally closed (N.C.) forced-guided monitor contact from each relay must be added to the series feedback loop or properly wired external device monitoring channel.

Figure 9. Generic Wiring Example



5.5.2 Connection of Reset Switches

The reset circuit switch can be any mechanical switch, such as a normally open momentary switch, or a two-position key switch. The reset switch must be capable of reliably switching **24 V DC at 2 milliamps**. The reset switch can also be an electronic device with a PNP output.

See the hookup configurations in "[Module Port Wiring](#)" on [page 10](#), the reset switch input connects to either pin 5 of port 2 or pin 4 of port 0 of the Latch models.

The reset input is a monitored input which requires the reset signal to transition from low (0 V DC) to high (24 V DC) and then back to low. The high state duration must be 0.35 seconds to 2 seconds. This is called a trailing edge event.

The reset switch must be located outside of – and not be accessible from – the area of dangerous motion, and must be positioned so that any area of dangerous motion may be observed by the switch operator during the reset procedure. See the following warning.

WARNING:



- **Install reset switches properly**
- Failure to properly install reset switches could result in serious injury or death.
- Install reset switches so that they are accessible only from outside, and in full view of, the safeguarded space. Reset switches cannot be accessible from within the safeguarded space. Protect reset switches against unauthorized or inadvertent operation (for example, through the use of rings or guards). If there are any hazardous areas that are not visible from the reset switches, provide additional safeguarding.

5.5.3 Automatic Reset Relays - Trip Models

The RSr relay will reset and the outputs energize as soon as the inputs return to an ON state.

The [automatic reset](#) mode is useful for some automated processes. However, if automatic reset is used, it is necessary to provide an alternate means of preventing resumption of hazardous machine motion, until an alternate reset procedure is performed. The alternate procedure must include a reset/restart switch, located outside the area of dangerous motion, which

is positioned so that any area of dangerous motion may be observed by the switch operator during the reset procedure. See the following warning.

WARNING:

- **Reset routine required**
- Failure to prevent the machine from restarting without actuating the normal start command/device can create an unsafe condition that could result in serious injury or death.
- Do not allow the machine to restart without actuating the normal start command/device. Perform the reset routine after clearing the cause of a stop condition, as required by U.S. and international standards.

NOTE: The minimum amount of time required for the Module to be in a STOP or OFF condition is 80 milliseconds. This “recovery time” (OFF-state) is required for the internal circuitry of the RSr to normalize, allowing a reliable reset to occur. The relay ignores the ON state if the relay inputs are cycled too quickly. To return the relay to the ON state, turn the inputs off for at least 80 milliseconds before turning the inputs back ON.

5.5.4 Connection to the Machine to be Controlled

The machine hookup diagram shows a generic connection of the Safety Module's redundant output circuits to the master stop control elements (MSCs). An MSC is defined as an electrically powered device, external to the RSr, which stops the machinery being controlled by immediately removing electrical power to the machine and (when necessary) by applying braking to dangerous motion. This stopping action is accomplished by removing power to the actuator of either MSC.

Chapter 6 Checkout Procedures

Banner Engineering highly recommends performing the System checkouts as described. However, a [Qualified Person](#)⁽³⁾ (or team) should evaluate these generic recommendations considering their specific application and determine the appropriate frequency of checkouts. This will generally be determined by a risk assessment, such as the one contained in ANSI B11.0. The result of the risk assessment will drive the frequency and content of the periodic checkout procedures and must be followed.

CAUTION:



- **Disconnect power prior to checkout**
- Dangerous voltages might be present along the module wiring barriers whenever power to the machine control elements is on.
- Before performing the initial checkout procedure, disconnect all power from the machine to be controlled. Exercise extreme caution whenever machine control power is or might be present.

At installation or replacement and at machine set up, a [Designated Person](#)⁽⁴⁾ must test each input device connected to the RSr for proper machine shutdown response. A Designated Person must check for proper operation, physical damage, mounting (looseness), and excessive environmental contamination. This must also take place on a periodic schedule determined by the user, based on the severity of the operating environment and the frequency of switching. Adjust, clean, repair, or replace components as needed when any parts or assemblies are damaged, broken, deformed, or badly worn; or if the electrical/mechanical specifications (for the environment and operating conditions) have been exceeded. Always test the control system for proper functioning under machine control conditions after performing maintenance, replacing a RSr, or replacing any component(s) of the safety circuit.

6.1 Initial Checkout

1. Remove power from the machine control elements (or to the outputs of the RSr relay).
2. Make sure that the controlling device is in the OFF state.
3. Apply power to the RSr relay (pins 1 and 3 of port 0 or port 2).
4. Verify that the Status LED is ON amber. If the Relay Status LED is on, disconnect the input power and check all wiring (make sure the output of controlling device are OFF).
5. Turn the controlling device ON, supplying OSSD signals to the RSr relay. The Safety Input Status LEDs turn on.
6. Reset the RSr relay. After the reset, the Relay Status LED turns on.
 - Auto-Reset models: the relays should automatically pull in, turning on the Relay Status LEDs.
 - Latch Reset models: require a 24-volt signal to one of the reset inputs. (Input must be at zero, go to 24 V for a minimum of 0.35 second and a maximum of 3 seconds, then back to zero for a proper reset signal.)
7. Cause the controlling device to generate a STOP signal (turn its output OFF). The Safety Input Status LEDs and Relay Status LEDs turn off simultaneously.
8. If more than one safety device is connected to the controlling device, run the above test procedure individually for each device.
9. Apply power to the machine control elements and perform the "[Periodic Checkout](#)" on page 23.

⁽³⁾ A person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

⁽⁴⁾ A person who is identified in writing by the employer as being appropriately trained to perform a specified checkout procedure.

**WARNING:**

- **Test multiple safety devices individually**
- Failure to test each safety device individually could result in undetected faults and create an unsafe condition that could result in serious injury or death.
- When two or more safety devices are used, individually actuate each device, causing a stop or open-contact condition, then reset/rearm the safety module (if using manual reset mode). This allows the monitoring circuits to check each device and its wiring to detect faults.

6.2 Periodic Checkout

The functioning of the Remote Safety Relay and the device(s) connected to it must be verified on a regular periodic basis to ensure proper operation (see also the machine manufacturer's recommendations).

1. With the machine running, cause the safety device to generate a STOP state. Verify that the machine stops as expected.
2. Reset or otherwise cause the safety device to reach an ON state. Verify that the machine does not restart. If using manual reset mode, close the reset switch for approximately 0.35 second and then open it. Verify that the machine can be restarted by normal initiation.
3. If more than one safety device is connected to the controlling device, complete the above checkout procedure individually for EACH device.

Chapter 7 System Operation

For Trip models, the relay outputs will turn ON after power is applied and the RSr passes its internal self-test. The relay outputs turn OFF when the controlling OSSD inputs turn OFF. The relay outputs will also turn ON immediately after the controlling OSSD inputs turn back ON.

For Latch models, when power is applied and after the RSr passes its internal self-test, a [manual reset](#) is required to turn the relay outputs ON. The relay outputs turn OFF when the controlling OSSD inputs turn OFF. When the controlling OSSD inputs turn back ON, a manual reset is required to turn the relay outputs ON.

Chapter 8 Product Support and Maintenance

8.1 Cleaning Instructions

Clean as necessary using only a lint-free cloth or a water-dampened lint-free cloth. Do not use any other chemicals for cleaning.

8.2 Repairs and Translations (No Field-Replaceable Parts)

English

Contact Banner Engineering for troubleshooting of this device. **Do not attempt any repairs to this Banner device; it contains no field-replaceable parts or components.** If the device, device part, or device component is determined to be defective by a Banner Applications Engineer, they will advise you of Banner's RMA (Return Merchandise Authorization) procedure.

IMPORTANT: If instructed to return the device, pack it with care. Damage that occurs in return shipping is not covered by warranty.

Obtain assistance with product repairs by contacting your local Banner Engineering Corp distributor or by calling Banner directly at (763) 544-3164. Access literature translated into your native language on the Banner website at www.bannerengineering.com or contact Banner directly at (763) 544-3164.

Deutsch

Wenden Sie sich zur Fehlerbehebung dieses Geräts an Banner Engineering. **Versuchen Sie nicht, Reparaturen an diesem Banner-Gerät vorzunehmen. Das Gerät enthält keine am Einsatzort auszuwechselnden Teile oder Komponenten.** Wenn ein Banner-Anwendungstechniker zu dem Schluss kommt, dass dieses Gerät, ein Teil oder eine Komponente davon defekt ist, erhalten Sie von dem Techniker Erläuterungen zu Banners RMA-Verfahren (Return Merchandise Authorization) für die Warenrückgabe.

WICHTIG: Wenn Sie der Techniker anweist, das Gerät zurückzusenden, verpacken Sie es bitte sorgfältig. Transportschäden bei der Rücksendung werden von der Garantie nicht abgedeckt.

Unterstützung bei Produktreparaturen erhalten Sie von Ihrem örtlichen Banner Engineering Corp Händler oder direkt von Banner unter Tel. (763) 544-3164. Die in Ihre Muttersprache übersetzte Literatur finden Sie auf der Banner-Website unter www.bannerengineering.com oder kontaktieren Sie Banner direkt unter Tel. (763) 544-3164.

Français

Pour plus d'informations sur le dépannage du produit, contactez Banner Engineering. **Ne tentez pas de réparer ce dispositif Banner. Il ne contient aucun composant ou pièce qui puisse être remplacé sur place.** Si un ingénieur de Banner conclut que le dispositif ou l'une de ses pièces ou composants est défectueux, il vous informera de la procédure à suivre pour le retour des produits (RMA).

Important : Si vous devez retourner le dispositif, emballez-le avec soin. Les dégâts occasionnés pendant le transport de retour ne sont pas couverts par la garantie.

Pour vous aider lors de la réparation de produits, contactez votre distributeur Banner local ou appelez directement Banner au (763) 544-3164. La documentation traduite dans votre langue est disponible sur le site internet de Banner www.bannerengineering.com ou contactez directement Banner au (763) 544-3164.

Italiano

Per le procedure di individuazione e riparazione dei guasti di questo dispositivo, contattare Banner Engineering. **Non tentare di riparare questo dispositivo Banner, in quanto non contiene parti o componenti sostituibili dall'utente.** Se il dispositivo, una parte del dispositivo o un componente del dispositivo viene riscontrato difettoso da un tecnico Banner, il nostro personale vi comunicherà la procedura da seguire per ottenere l'autorizzazione al reso.

Importante: Se si ricevono istruzioni di rispedire il dispositivo al produttore, imballarlo con cura. I danni dovuti al trasporto non sono coperti dalla garanzia.

Per assistenza nelle riparazioni dei prodotti, contattare il distributore locale Banner Engineering Corp o contattare direttamente Banner al numero (763) 544-3164. È possibile accedere alla documentazione tradotta nella propria lingua madre sul sito Web Banner all'indirizzo www.bannerengineering.com o contattare direttamente Banner al numero (763) 544-3164.

Español

Comuníquese con Banner Engineering para solucionar de problemas de este dispositivo. **No intente ninguna reparación a este dispositivo de Banner, contiene piezas o componente que no se pueden cambiar en terreno.** Si algún ingeniero de aplicaciones de Banner determina que el dispositivo, alguna de las piezas o alguno de los componentes del dispositivo está defectuoso, le informará el procedimiento de autorización de devolución de mercancía (RMA, por sus siglas en inglés) de Banner.

Importante: Si se le solicita devolver el dispositivo, empáquelo con cuidado. Puede haber daños durante el envío de devolución que no estén cubiertos por la garantía.

Para reparaciones de productos, por favor contacte a su distribuidor local de Banner Engineering o llame a Banner directamente al 00 1 (763) 544-3164. Vea la literatura traducida en su idioma en el sitio web Banner en www.bannerengineering.com o comuníquese con Banner directamente al 00 1 (763) 544-3164.

中国人

如需对本装置进行故障排查, 请联系邦纳。请勿尝试自行维修该邦纳装置; 本装置不包含任何可在现场更换的部件或组件。若经邦纳应用工程师确认设备、设备部件或组件存在缺陷, 他们将告知您邦纳退货授权 (RMA) 流程。

重要注意事项: 如被要求退回装置, 请妥善包装后寄回。退货运输过程中发生的损坏不在保修范围内。

请联系当地的 Banner Engineering Corp 经销商或直接致电 Banner +1 (763) 544-3164, 以获得产品维修帮助。请访问邦纳网站 www.bannerengineering.com 或直接拨打 +1 (763) 544-3164 联系邦纳, 获取翻译成您母语的资料。

한국인

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日本語

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重要： 返品を指示された場合は、装置を丁寧に梱包してください。返品時に発生した破損は保証の対象外となります。

製品の修理については、最寄りのBanner Engineering Corp代理店にお問い合わせいただくか、米国+1 (763) 544-3164まで直接お電話でお問い合わせください。バナーのウェブサイト（www.bannerengineering.com）でお客様の言語に翻訳された資料にアクセスするか、米国+1 (763) 544-3164まで直接お電話でお問い合わせください。

čeština

Pro řešení problémů se zařízením kontaktujte společnost Banner Engineering. **Neprovádějte žádné opravy zařízení Banner. Neobsahují žádné komponenty nebo části, které by byly vyměnitelné.** Pokud je zařízení, jeho část nebo díl označen technikem společnosti Banner jako poškozený, bude Vám doporučeno vyplnit reklamční RMA protokol.

Důležité: Pokud byl vydán požadavek na vrácení zařízení, pečlivě ho zabalte. Poškození vzniklé při dopravě není považováno za záruční opravu.

Pokud produkt potřebuje opravu, vyžádejte si pomoc od místního distributora společnosti Banner Engineering Corp nebo přímo na telefonním čísle (763) 544-3164. Dokumentaci přeloženou do vašeho jazyka si vyhledejte na webových stránkách společnosti Banner na adrese www.bannerengineering.com nebo se obraťte přímo na společnost Banner na telefonním čísle (763) 544-3164.

Polski

W celu rozwiązania problemów z urządzeniem należy skontaktować się z działem technicznym firmy Banner Engineering. **Pod żadnym pozorem nie próbuj naprawiać tego urządzenia firmy Banner; nie zawiera ono części ani elementów, które można wymieniać samodzielnie.** Jeśli urządzenie, jego część lub element zostaną uznane za wadliwe przez inżyniera technicznego Banner, poinformuje on użytkownika o firmowej procedurze zwrotu towaru (RMA) firmy Banner.

Ważne: Jeśli urządzenie ma zostać zwrócone, należy je starannie zapakować. Uszkodzenia powstałe podczas odsyłki nie są objęte gwarancją.

Aby uzyskać pomoc w zakresie naprawy produktu, należy skontaktować się z lokalnym dystrybutorem Banner Engineering Corp lub zadzwonić bezpośrednio do firmy Banner pod numer (763) 544-3164. Dostęp do literatury przetłumaczonej na swój język ojczysty można uzyskać na stronie internetowej firmy Banner pod adresem www.bannerengineering.com lub kontaktując się bezpośrednio z firmą Banner pod numerem (763) 544-3164.

Português

Entre em contato com a Engenharia da Banner para a solução de problemas deste dispositivo. **Não tente fazer nenhum reparo neste dispositivo Banner; ele não contém peças ou componentes substituíveis em campo.** Se um técnico de aplicações da Banner determinar que o dispositivo, peça ou componente do dispositivo está com defeito, ele o informará sobre o procedimento de RMA (Autorização de Devolução de Mercadoria) da Banner.

Importante: Se for instruído a devolver o dispositivo, embale-o com cuidado. Os danos ocorridos no transporte de devolução não são cobertos pela garantia.

Obtenha assistência para reparos do produto entrando em contato com o distribuidor local da Banner Engineering Corp ou ligando diretamente para a Banner no telefone (763) 544-3164. Acesse a literatura traduzida para seu idioma nativo no site da Banner em www.bannerengineering.com ou entre em contato diretamente com a Banner pelo telefone (763) 544-3164.

Türkçe

Bu cihazda sorun giderme işlemleri için Banner Engineering ile iletişime geçin. **Bu Banner cihazını onarmaya çalışmayın; cihaz sahada değiştirilebilir parça veya bileşen içermez.** Bir Banner Uygulama Mühendisi tarafından cihazın, cihazın bir parçasının veya bir cihaz bileşeninin kusurlu olduğu tespit edilirse, Banner RMA (İade Mal Yetkilendirme) prosedürü hakkında bilgilendirilirsiniz.

ÖNEMLİ: İade etmeniz istenirse, cihazı dikkatli bir şekilde paketleyin. İade nakliyesinde meydana gelecek hasarlar garanti kapsamında değildir.

Yerel Banner Engineering Corp distribütörünüzle iletişime geçerek veya doğrudan (763) 544-3164 numaralı telefondan Banner'ı arayarak ürün onarımlarıyla ilgili yardım alın. Ana dilinize çevrilmiş dokümanlara www.bannerengineering.com adresindeki Banner web sitesinden erişilebilir veya (763) 544-3164 numaralı telefondan doğrudan Banner ile iletişime geçebilirsiniz.

8.3 Contact Us

Banner Engineering Corp. | 9714 Tenth Avenue North | Plymouth, MN 55441, USA | Phone: + 1 888 373 6767

For worldwide locations and local representatives, visit www.bannerengineering.com.

8.4 Disposal

Devices that are no longer in use should be disposed of according to the applicable national and local regulations.

8.5 Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

THIS LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE), AND WHETHER ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE.

This Warranty is exclusive and limited to repair or, at the discretion of Banner Engineering Corp., replacement. **IN NO EVENT SHALL BANNER ENGINEERING CORP. BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR ANY EXTRA COSTS, EXPENSES, LOSSES, LOSS OF PROFITS, OR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT OR FROM THE USE OR INABILITY TO USE THE PRODUCT, WHETHER ARISING IN CONTRACT OR WARRANTY, STATUTE, TORT, STRICT LIABILITY, NEGLIGENCE, OR OTHERWISE.**

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For patent information, see www.bannerengineering.com/patents.

Chapter 9 Accessories

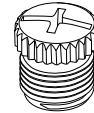
RSr-MBK-01

- Bracket for mounting the Remote Safety Relay
- Includes two M4 × 0.7 screws and washers
- Stainless steel
- CAD Files: [DXF](#), [PDF](#), [IGS](#), [STP](#)



ACC-CAP M12-10

- 10 caps
- Polybutylene Terephthalate
- Seal and protect exposed, unterminated M12 quick-disconnect connectors



9.1 Cordsets

9.1.1 4-Pin Single-Ended Cordsets

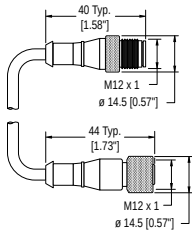
4-Pin A-Code Single-Ended M12 Female Cordsets (datasheet p/n [235937](#))

Model	Length	Dimensions (mm)	Pinout (Female)	
BC-M12F4-22-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused
BC-M12F4-22-2	2 m (6.56 ft)			
BC-M12F4-22-5	5 m (16.4 ft)			
BC-M12F4-22-8	8 m (26.25 ft)			
BC-M12F4-22-10	10 m (30.81 ft)			
BC-M12F4-22-15	15 m (49.2 ft)			
BC-M12F4-22-20	20 m (65.61 ft)			
BC-M12F4-22-25	25 m (82.02 ft)			
BC-M12F4-22-30	30 m (98.42 ft)			

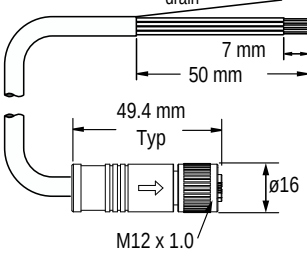
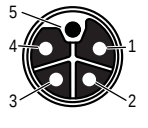
4-Pin A-Code Single-Ended M12 Male Cordsets (datasheet p/n [235940](#))

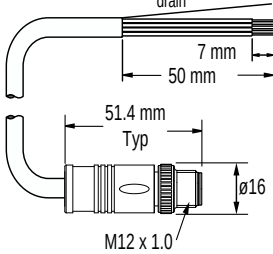
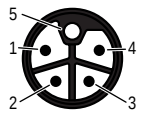
Model	Length	Dimensions (mm)	Pinout (Male)	
BC-M12M4-22-0.3	0.3 m (1 ft)			1 = Brown 2 = White 3 = Blue 4 = Black
BC-M12M4-22-1	1 m (3.28 ft)			
BC-M12M4-22-2	2 m (6.56 ft)			
BC-M12M4-22-5	5 m (16.4 ft)			
BC-M12M4-22-8	8 m (26.25 ft)			
BC-M12M4-22-10	10 m (30.81 ft)			
BC-M12M4-22-15	15 m (49.2 ft)			

9.1.2 4-Pin Double-Ended Cordsets

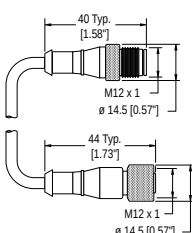
4-Pin A-Code Double-Ended M12 Female to M12 Male Cordsets (datasheet p/n 236186)				
Model	Length	Dimensions (mm)	Pinouts	
BC-M12F4-M12M4-22-1	1 m (3.28 ft)		Female	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Unused 
BC-M12F4-M12M4-22-2	2 m (6.56 ft)		Male	
BC-M12F4-M12M4-22-3	3 m (9.84 ft)			
BC-M12F4-M12M4-22-4	4 m (13.12 ft)			
BC-M12F4-M12M4-22-5	5 m (16.4 ft)			
BC-M12F4-M12M4-22-10	10 m (30.81 ft)			
BC-M12F4-M12M4-22-15	15 m (49.2 ft)			

9.1.3 5-Pin Single-Ended Cordsets

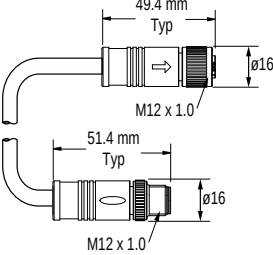
5-Pin L-Code Single-Ended M12 Female Cordsets (datasheet p/n 242454)				
Model	Length	Dimensions (mm)	Pinout (Female)	
BCP-M12LF5-14-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow/Green Shell = Braid
BCP-M12LF5-14-2	2 m (6.56 ft)			
BCP-M12LF5-14-5	5 m (16.4 ft)			
BCP-M12LF5-14-10	10 m (32.8 ft)			
BCP-M12LF5-14-15	15 m (49.2 ft)			
BCP-M12LF5-14-20	20 m (65.6 ft)			

5-Pin L-Code Single-Ended M12 Male Cordsets (datasheet p/n 242455)				
Model	Length	Dimensions (mm)	Pinout (Male)	
BCP-M12LM5-14-1	1 m (3.28 ft)			1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow/Green Shell = Braid
BCP-M12LM5-14-2	2 m (6.56 ft)			
BCP-M12LM5-14-5	5 m (16.4 ft)			
BCP-M12LM5-14-10	10 m (32.8 ft)			
BCP-M12LM5-14-15	15 m (49.2 ft)			
BCP-M12LM5-14-20	20 m (65.6 ft)			

9.1.4 5-Pin Double-Ended Cordsets

5-Pin A-Code Double-Ended M12 Female to M12 Male Cordsets (datasheet p/n 236183)				
Model	Length	Dimensions (mm)	Pinouts	
BC-M12F5-M12M5-22-1	1 m (3.28 ft)		Female	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
BC-M12F5-M12M5-22-2	2 m (6.56 ft)		Male	
BC-M12F5-M12M5-22-5	5 m (16.4 ft)			
BC-M12F5-M12M5-22-8	8 m (26.25 ft)			
BC-M12F5-M12M5-22-10	10 m (30.81 ft)			
BC-M12F5-M12M5-22-15	15 m (49.2 ft)			

9.1.5 Double-Ended Power Cordsets L-Code

5-Pin L-Code Double-Ended M12 Female to M12 Male Cordsets (datasheet p/n 242456)				
Model	Length	Dimensions (mm)	Pinout (Female)	Pinout (Male)
BCP-M12LF5-M12LM5-14-1	1 m (3.28 ft)			
BCP-M12LF5-M12LM5-14-2	2 m (6.56 ft)			
BCP-M12LF5-M12LM5-14-5	5 m (16.4 ft)			
BCP-M12LF5-M12LM5-14-10	10 m (32.8 ft)			
BCP-M12LF5-M12LM5-14-15	15 m (49.2 ft)			
BCP-M12LF5-M12LM5-14-20	20 m (65.6 ft)			

9.2 Splitters

5-Pin M12 Female to M12 Male Splitter Tee			
Model		Pinout (Male)	Pinout (Female)
CSB-M1250M1250-T - Trunk: One 5-pin M12 male quick-disconnect connector - Branches: Two 5-pin M12 female quick-disconnect connectors - Parallel wiring			

5-Pin M12 Male to M12 Female Splitter			
Model		Pinout (Male)	Pinout (Female)
CSB-M1250M1250A - Trunk: One 5-pin M12 male quick-disconnect connector - Branches: Two 5-pin M12 female quick-disconnect connectors - Parallel wiring			

5-Pin M12 Female to M12 Male and M12 Female Splitter			
Model		Pinout (Male)	Pinout (Female)
CSB-M1250M1250 - Trunk: One 5-pin M12 female quick-disconnect connector - Branch: One 5-pin M12 male quick-disconnect connector - Branch: One 5-pin M12 female quick-disconnect connector - Parallel wiring			

Chapter 10 Standards and Regulations

The list of standards below is included as a convenience for users of this Banner device. Inclusion of the standards below does not imply that the device complies specifically with any standard, other than those specified in the Specifications/Design Standards section of this manual. See the American National Standards Institute (ANSI) at <https://webstore.ansi.org/> or another source for applicable documents.

10.1 Applicable U.S. Application Standards

Not inclusive

ANSI B11 Standards for Machine Tools Safety

NFPA 79 Electrical Standard for Industrial Machinery

10.2 International/European Application Standards

Not inclusive

ISO 12100 Safety of Machinery – General Principles for Design – Risk Assessment and Risk Reduction

EN 60204-1 Electrical Equipment of Machines Part 1: General Requirements

ISO 14119 Interlocking Devices Associated with Guards – Principles for Design and Selection

ISO 14120 Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards

ISO 13857 Safety of Machinery – Safety Distances to Prevent Hazard Zones Being Reached

ISO 13850 Emergency Stop Devices, Functional Aspects – Principles for Design

EN 13855 The Positioning of Protective Equipment in Respect to Approach Speeds of Parts of the Human Body

ISO 13849-1 Safety of Machinery – Safety-Related Parts of Control Systems – Part 1: General Principles for Design

IEC 60947-1 Low Voltage Switchgear – General Rules

IEC 60947-5-1 Low Voltage Switchgear – Electromechanical Control Circuit Devices

IEC 60947-5-5 Low Voltage Switchgear – Electrical Emergency Stop Device with Mechanical Latching Function

IEC 60529 Degrees of Protection Provided by Enclosures

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Glossary

automatic reset

An automatic reset is the safety input device control operation setting where the assigned safety output automatically turns on when all of its associated input devices are in the Run state. No manual reset operation is required for the safety output to turn on when controlled only by safety input devices configured for automatic reset. When automatic reset is selected, the input device may be said to be configured to run in auto start/restart mode.

control reliability

Control reliability is a method of ensuring the performance integrity of a control system or device. Control circuits are designed and constructed so that a single failure or fault within the system does not prevent the normal stopping action from being applied to the machine when required, or does not create unintended machine action, but does prevent initiation of successive machine action until the failure is corrected.

Designated Person

A Designated Person is a person or persons identified and designated in writing, by the employer, as being appropriately trained and qualified to perform a specified checkout procedure.

dual-channel

A dual-channel device or configuration has redundant signal lines for each safety input or safety output.

external device monitoring

External device monitoring (EDM) is a means by which a safety device (such as a safety light curtain) actively monitors the state (or status) of external devices that are controlled by the safety device. A lockout of the safety device will result if an unsafe state is detected in the external device. External device(s) may include, but are not limited to: MPCs, captive contact relays/contactors, and safety modules.

fault

A fault is a state of a device characterized by the inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources. A fault is often the result of a failure of the device itself, but may exist without prior failure.

harm

Harm is defined as physical injury or damage to the health of people, which may result through direct interaction with the machine or through indirect means, as a result of damage to property or to the environment.

manual reset

A manual reset is the safety input device control operation setting where the assigned safety output turns on only after a manual reset is performed and if the other associated input devices are in their run state. When manual reset is selected, the input device may be said to be configured to run in manual start/restart (latch) mode; meaning that the controlled output has latched to the off state and requires a manual reset to turn back on. This reset is sometimes called a manual latch reset.

output signal switching device

The output signal switching devices (OSSD) are the safety outputs that are used to initiate a stop signal.

Qualified Person

A Qualified Person is a person who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.

risk

Risk is the probability of occurrence of harm and the severity of that harm.

safety distance

The safety distance is the minimum distance an engineered control (guard or device) is installed from a hazard such that individuals cannot reach the hazard point before it is stopped (or made safe). The safety distance required for an application depends on several factors, including the speed of the hand (or individual or object), the total system stopping time (which includes several response time components), and the depth penetration factor. Refer to the relevant standard to determine the appropriate distance or means to ensure that individuals cannot be exposed to the hazard(s).

single-channel

Single-channel refers to having only one signal line for a safety input or safety output.

