

SI-LS31R Machine Safety Switch



Datasheet

SI-LS31R Series 31mm Limit-Switch Style with Rotary Hinge Actuator



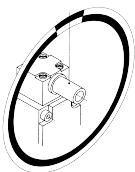
- Limited switch design (EN 50047)
- Rotating shaft connects directly to door hinge
- Positive opening safety contacts (IEC 60947-5-1), not dependent on springs
- Glass-reinforced thermoplastic switch housing with plated steel actuator
- Insulated device (IEC 60947-5-1) on all models with plastic housings
- Actuator head is rotatable in 90 degree increments



Note: This symbol for a positive-opening safety contact (IEC 60947-5-1) is used in the switching diagrams to identify the point in actuator travel where the normally closed safety contact is fully open.

Models

Model	Actuator	Contact Configuration (Axle in home position = 0°)	Contact Configuration (Axle rotated 45° in either direction)	Switching Diagram
SI-LS31RTD	Rotary Shaft	<p>0°/360°</p>	<p>>45°</p>	<p>Safety Monitor</p>
SI-LS31RTE		<p>0°/360°</p>	<p>>45°</p>	<p>Safety Safety</p>



The closed contact (11-12) fully opens (i.e., positive break occurs) within $\pm 30^\circ$ of the neutral shaft position.

Contacts: Open
 Closed
 Transition



Important Information Regarding the Use of Safety Switches

In the United States, the functions that Banner safety switches are intended to perform are regulated by the Occupational Safety and Health Administration (OSHA). Whether or not any particular safety switch installation meets all applicable OSHA requirements depends upon factors that are beyond the control of Banner Engineering Corp. These factors include the details of how the safety switches are applied, installed, wired, operated, and maintained.

Banner Engineering Corp. has attempted to provide complete application, installation, operation, and maintenance instructions. This information is found in the instruction manual packaged with each safety switch. In addition, we suggest that any questions regarding the use or installation of safety switches be directed to the factory applications department at the telephone numbers or address shown below.

Banner Engineering Corp. recommends that safety switches be applied according to the guidelines set forth in international (ISO/IEC) standards listed below. Specifically, Banner Engineering Corp. recommends application of these safety switches in a configuration which meets safety category 4, per ISO 13849 (EN954-1).

In addition, the user of Banner safety switches has the responsibility to ensure that all local, state, and national laws, rules, codes, and regulations relating to the use of Banner safety switches in any particular application are satisfied. Extreme care is urged that all legal requirements have been met and that all installations and maintenance instructions are followed.

Application Assistance
Toll Free: 1-888-3-SENSOR (1-888-373-6767)
Email: sensors@bannerengineering.com
9714 Tenth Avenue North
Minneapolis, MN 55441

U.S. Regulations Applicable to Use of Banner Safety Switches

OSHA Code of Federal Regulations: Title 29, Parts 1900 to 1910

Available from: Superintendent of Documents, Government Printing Office, P.O. Box 371954, Pittsburgh, PA 15250-7954, Tel: 202-512-1800

U.S. Standards Applicable to Use of Banner Safety Switches

ANSI B11 Standards for Machine Tools Safety

Contact: Safety Director, AMT – The Association for Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102, Tel.: 703-893-2900

Applicable European and International Standards

EN ISO 12100 Safety of Machinery – Basic Concepts, General Principles for Design

ISO 13852 (EN 294) Safety of Machinery—Safety Distances to Prevent Danger Zones Being Reached by the Upper Limbs

ISO 13853 (EN 811) Safety of Machinery—Safety Distances to Prevent Danger Zones Being Reached by the Lower Limbs

EN ISO 13849-1 Safety-Related Parts of Control Systems

EN 13855 (EN 999) The Positioning of Protective Equipment in Respect to Approach Speeds of Parts of the Human Body

ISO 14119 (EN 1088) Interlocking Devices Associated with Guards – Principles for Design and Selection

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

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

Contact: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, Tel.: 800-854- 7179

Installation

Mechanical Installation



WARNING: Hazard Point

It must not be possible for personnel to reach any hazard point through an opened guard (or any opening) before hazardous machine motion has completely stopped.

Please reference OSHA CFR 1910.217 and ANSI B11 standards for information on determining safety distances and safe opening sizes for your guarding devices.



Important: Install a safety switch in a manner that discourages tampering or defeat. Mount switches to prevent bypassing of the switching function at the terminal chamber.

The actuator head can be rotated to any of four positions in 90° increments. See [Figure 1](#) on page 3. To reposition the actuator head, follow these steps.

1. With the actuator at 0°, loosen the four screws holding the actuator head to the switch body.
2. Loosen the four screws holding the actuator head to the switch body.
3. Lift the actuator head away from the spring and gasket and rotate it to the desired position.
4. Press the actuator head down firmly to compress the spring, and re-fasten the four screws.

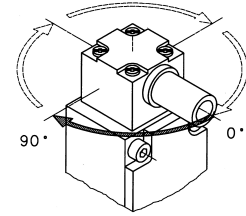


Figure 1. Loosen four screws to rotate actuator head to any of four 90° positions

All mounting hardware is supplied by the user. The fasteners must be of sufficient strength to guard against incidental breakage. Use of permanent fasteners or locking hardware is recommended to prevent loosening or displacement of the actuator and switch body. The mounting holes in the switch body accept M4 (#8) screws.

Position the switch, with its actuator fully engaged, in the mounting location and mark the mounting holes. Drill the required holes and fasten the switch body and the actuator in place. After the mounting hardware is secure, check the actuator/switch engagement for misalignment and binding.

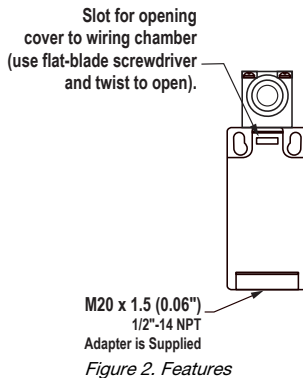


Figure 2. Features

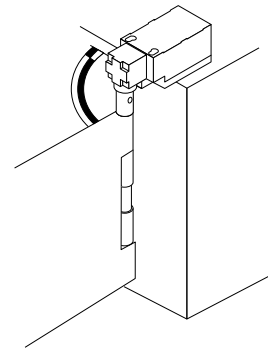


Figure 3. Typical alignment on a door

Electrical Installation



CAUTION: Electrical Installation

Two safety switches must be used for each interlock guard to achieve control reliability or Safety Category 4 (per ISO 13849-1, EN 954-1) of a machine stop circuit. Use of only one safety switch per interlock guard is not recommended.

In addition, normally-closed safety contacts from each of the two safety switches should be connected to the two separate inputs of a 2-channel safety module or safety interface. This is required to provide monitoring for safety switch contact failure, and to provide the necessary reset routine, as required by IEC 60204-1 and NFPA 79 machine safety standards.



WARNING:

- **A Series Connection of Safety Interlock Switches**—Monitoring multiple guards with a series connection of multiple safety interlock switches is not a Safety Category 4 Application (per ISO 13849-1, EN 954-1).
- A single failure may be masked or not detected at all.
- When such a configuration is used, procedures must be performed regularly to verify proper operation of each switch.

Access to the Wiring Chamber

Access the wiring chamber using the hinged door. Insert a flat-blade screwdriver and pry gently down to open. A conduit adapter is supplied to convert the German M20 × 1.5 thread to ½ 14 NPT. An accessory cable gland that fits the M20 × 1.5 thread is available.

Connection to a Machine

Two types of contacts are offered. The contacts between terminals 11–12 and 21–22 are the safety contacts, which are closed (i.e., they conduct) when the actuator is engaged. The contacts located between terminals 23–24 are considered monitoring contacts, which should not be used for safety switching.

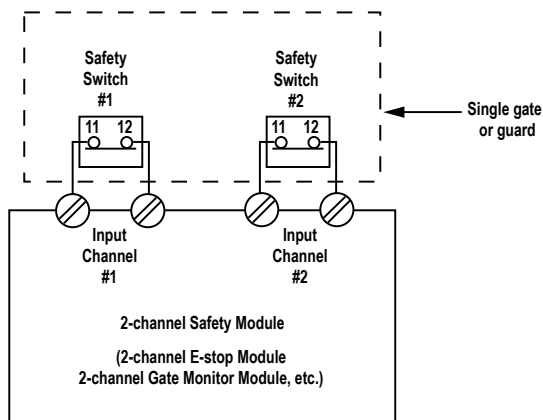


Figure 4. Connect two redundant safety switches per interlock guard to an appropriate 2-channel input safety module.

A normally closed safety contact (i.e., a safety contact that is closed when the actuator is engaged) from each of two safety switches per interlock guard must connect to a 2-channel safety module or safety interface in order to achieve a control reliable interface to the master stop control elements of a machine. See [Figure 4](#) on page 4. Examples of appropriate safety modules include 2-channel emergency stop (E-stop) safety modules and gate monitor safety modules.

Refer to the installation instructions provided with the safety module for information regarding the interface of the safety module to the machine stop control elements.

Connect two redundant safety switches per interlock guard to an appropriate 2-channel input safety module.

Two functions of the safety module or safety interface are:

1. To provide a means of monitoring the contacts of both safety switches for contact failure, and to prevent the machine from restarting if either switch fails; and
2. To provide a reset routine after closing the guard and returning the safety switch contacts to their closed position. This prevents the controlled machinery from restarting by simply reinserting the safety switch actuators. This necessary reset function is required by ANSI B11 and NFPA 79 machine safety standards.

Use only a positively driven, normally closed safety contact from each switch for connection to the safety module. The normally open contact may be used for control functions that are not safety-related. A typical use is to communicate with a process controller. Refer to the installation instructions provided with the safety modules for more information regarding the interface of the safety module to the machine stop control elements.

Maintenance

Periodic Checks

Safety switches should be checked at each shift change or machine setup by a designated person for:

1. Breakage of the switch body or actuator,
2. Good alignment and full engagement of the actuator with the receptor,
3. Confirmation that the safety switch is not being used as an end stop,
4. Loosening of the switch or actuator mounting hardware, and
5. Verification that it is not possible to reach any hazard point through an opened guard (or any opening) before hazardous machine motion has completely stopped.

In addition, a qualified person should check for the following on a periodic schedule determined by the user based upon the severity of the operating environment and the frequency of switch actuations:

1. Check the wiring chamber for signs of contamination.
2. Check the contacts for signs of deterioration or damage.
3. Inspect the electrical wiring for continuity and damage.
4. Verify the wiring conforms to the instructions given in this datasheet.

A designated person is identified in writing by the employer as being appropriately trained to perform a specified checkout procedure. A qualified person possesses a recognized degree or certificate or has extensive knowledge, training, and experience to be able to solve problems relating to the safety switch installation (ANSI B30.2).

Repairs

Do not attempt any repairs to the safety interlocking switch. It contains no field-replaceable components. Return it to Banner Engineering for warranty repair or replacement.

Contact Banner Factory Application Engineering. They will attempt to troubleshoot the system from your description of the problem. If they conclude that a component is defective, they will issue a return merchandise authorization (RMA) number for your paperwork, and give you the proper shipping address.



Important: Pack the safety switches carefully. **Damage that occurs in return shipping is not covered by warranty.**

Specifications

Contact Rating

10 A at 24 V ac, 10 A at 110 V ac, 6 A at 230 V ac
 6 A at 24 V dc
 2.5 kV maximum transient tolerance
 NEMA A300 P300

Contact Material

Silver-nickel alloy

Maximum Switching Speed

50 operations per minute

Short Circuit Protection

6 amp Slow Blow, 10 amp Fast Blow
 Recommended external fusing or overload protection

Mechanical Life

1 million operations

Weight

0.09 Kg (0.20 lbs.)

Connections

Screw terminals with pressure plates accept the following wire sizes:
 Stranded and solid: 20 AWG (0.5 mm²) to 16 AWG (1.5 mm²) for one wire
 Stranded: 20 AWG (0.5 mm²) to 18 AWG (1.0 mm²) for two wires

Cable Entry

M20 x 1.5 threaded entrance
 Adapter supplied to convert M20 x 1.5 to 1/2"-14 NPT threaded entrance

Construction

Glass fiber-reinforced thermoplastic UL94-VO rating; plated steel actuator

Environmental Rating

IEC IP65

Operating Conditions

-30 °C to +80 °C (-22 °F to +176 °F)

Certifications



European Rating

Utilization categories: AC15 and DC13
 Switches with 1 and 2 contact pairs:

$U_i = 500$ V ac
 $I_{th} = 10$ A

40 to 60 Hz		
U_e (V)	$I_e/AC-15$ (A)	$I_e/AC-13$ (A)
24	10	6
110	10	1
230	6	0.4

Actuation Extraction Force

10 N cm (0.9 lbf-in)

Required Overcurrent Protection

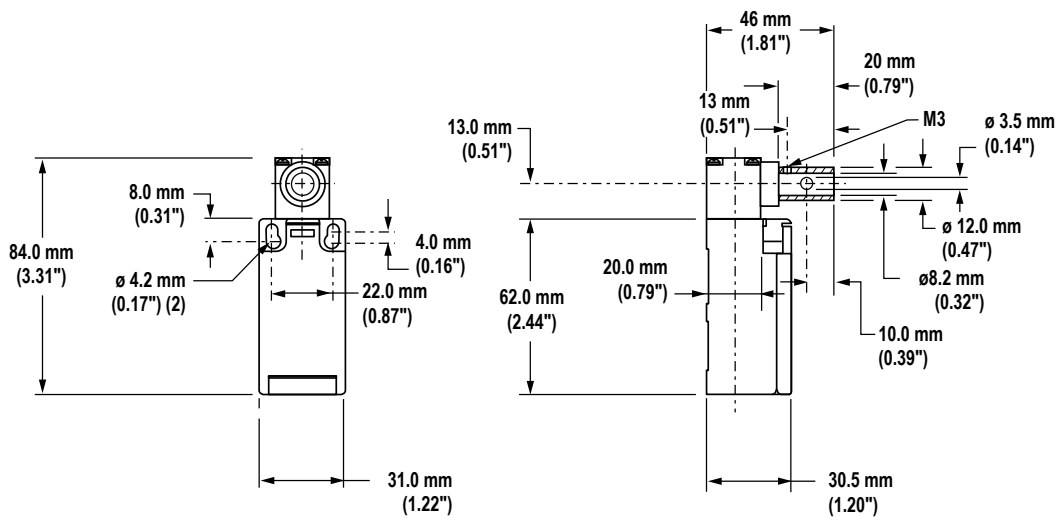


WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.
 Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
 Supply wiring leads < 24 AWG shall not be spliced.
 For additional product support, go to www.bannerengineering.com.

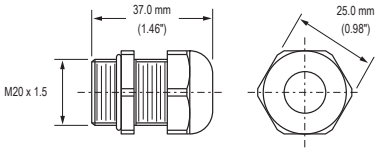
Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Dimensions



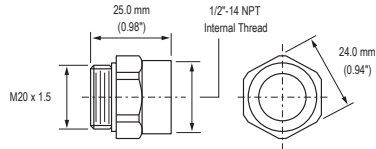
Accessories

Cable Glands

Model	Size	For Cable Diameter	Dimensions	Used With
SI-QS-CGM20	M20 x 1.5 Plastic	5.0 to 12.0 mm (0.20 to 0.47 inches)		SI-QS90 Safety Interlock Switches SI-LS100 Safety Interlock Switches SI-LS31 Safety Interlock Switches SI-LS42 Safety Interlock Switches RP-LS42 Rope Pull Switches

Replacement Parts

Plastic Conduit Adapter

Model	Size	Thread Conversion	Dimensions	Used With
SI-QS-M20	½ in-14 NPT Plastic	M20 x 1.5 to ½ in-14 NPT		SI-QS90 Safety Interlock Switches SI-LS100 Safety Interlock Switches SI-LS31 Safety Interlock Switches SI-LS42 Safety Interlock Switches RP-LS42 Rope Pull Switches

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