

Limit-Switch Style Machine Safety Switch



Datasheet

SI-LS83 and SI-LS100 Series Limit Switch Style – 83 mm and 100 mm



- Positive opening safety contacts (IEC 60947-5-1) (not dependent on springs)
- Limit switch design (EN 50047)
- Mechanically-coded actuators use two independent operating elements to minimize intentional tampering or defeat
- Rotating head allows actuator engagement from four sides or four top positions; no tools are required to rotate head
- Low-profile design for limited space requirements; only 30.5 mm (1.3") depth
- Tough, glass-reinforced thermoplastic housing; metal actuator
- Choice of two in-line actuators or a flexible actuator
- Insulated device (IEC 60947-5-1)

Models

Kit Model ¹	Actuator Type	Interlock Body	Contact Configuration (Actuator Engaged)	Contact Configuration (Actuator Removed)	Switching Diagrams
SI-LS100SF	SI-QS-SSA-2 Straight Rigid In-Line	SI-LS100F	Two N.C. and One N.O. Contact		
SI-LS100SRAF	SI-QS-SSA-3 Right-angle In-Line				
SI-LS100MRFF (Direct replacement for models SI-LS100MRHF and SI-LS100MRVF)	SI-QS-SSU Flexible In-Line				
SI-LS83SD	SI-QS-SSA-2 Straight Rigid In-Line	SI-LS83D	One N.C. and One N.O. Contact		
SI-LS83SRAD	SI-QS-SSA-3 Right-angle In-Line				
SI-LS83MRFD (Direct replacement for models SI-LS83MRHD and SI-LS83MRVD)	SI-QS-SSU Flexible In-Line				
SI-LS83SE	SI-QS-SSA-2 Straight Rigid In-Line	SI-LS83E	Two N.C. Contacts		
SI-LS83SRAE	SI-QS-SSA-3 Right-angle In-Line				
SI-LS83MRFE (Direct replacement for models SI-LS83MRHE and SI-LS83MRVE)	SI-QS-SSU Flexible In-Line				

Switching Diagram Key Contacts:



Open



Closed



Transition

This symbol is used in the switching diagrams to identify the point in actuator travel where the normally closed safety contact is fully open.

¹ A kit contains an interlock and actuator. Individual interlock bodies or actuators are for replacement purposes only.



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

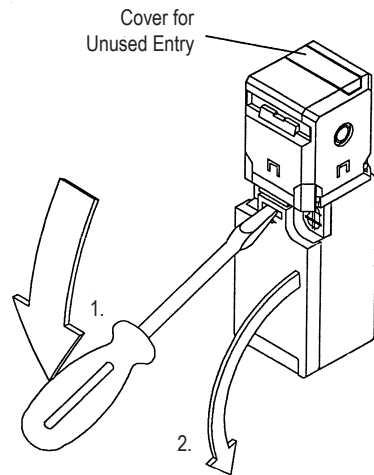
IEC 60947-5-1 Low Voltage Switchgear – Electromechanical Control Circuit Devices

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

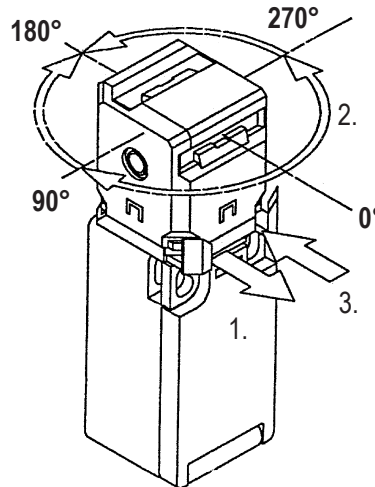
Overview

Easy Access

Rotating the Actuator Head



The wiring chamber is accessed via a hinged door. Simply insert a flat-blade screwdriver, as shown, and pry gently down to open.



1. Pull holding clamp
2. Turn actuator head
3. Push holding clamp

The actuator head may be rotated in 90° increments to create eight possible actuator engagement locations. To rotate the head, pull the holding clamp forward, rotate the head to the desired position, and push the holding clamp back in to lock.

Mechanical Installation

All mounting hardware is supplied by the user. Fasteners must be of sufficient strength to guard against breakage. Use of permanent fasteners or locking hardware is recommended to prevent loosening or displacement of the actuator and the switch body. The mounting holes in the switch body and the actuator accept M5 screws (see *Dimensions* on page 6).

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.

IMPORTANT:

1. A safety switch must be installed in a manner which discourages tampering or defeat. Mount each switch to prevent bypassing of the switching function at the terminal chamber.
2. A switch and its actuator must never be used as a mechanical stop.

Electrical 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.



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: Series Connection of Safety Switches

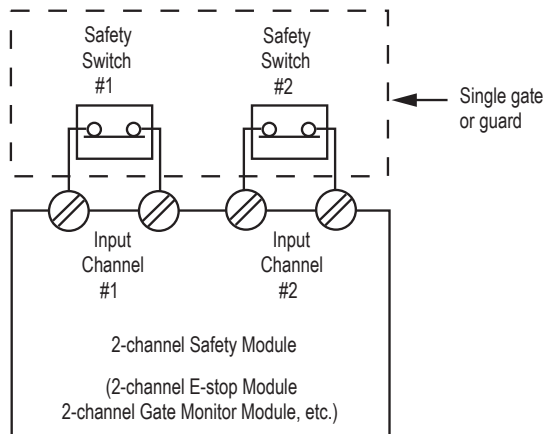
Monitoring multiple guards with a series connection of safety interlock switches may result in a failure being masked or not detected at all. When such a configuration is used, periodic checks must be performed regularly to verify proper operation. All failures must be immediately corrected (for example, immediately replacing a failed switch), or the loss of the safety stop signal or an inappropriate reset may lead to serious injury or death.

Access to the Wiring Chamber

The wiring chamber is accessed via the hinged door (see [Overview](#) on page 3). The SI-LS83 switches have a wire entrance of M16 x 1.5. The SI-LS100 models have a wire entrance of M20 x 1.5. All models come with an adaptor to convert to 1/2"–14 NPT. M16 x 1.5 and M20 x 1.5 cable glands are available, see [Accessories](#) on page 6.

Connection to a Machine

As illustrated in [Figure 1](#) on page 4, 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 interlocked 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. Examples of appropriate safety modules include 2-channel emergency stop (E-stop) safety modules and gate monitor safety modules.



NOTE: 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.

Figure 1. Switch Wiring to Safety Module

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 to:

1. 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. 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 switch status to 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.

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

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.



CAUTION: Abuse of 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 by a physical impact to the housing. An internal relay may have failed in such a manner that its replacement is required.

If the Module is not immediately replaced or repaired, **multiple** simultaneous failures may accumulate such that the safety **function** can not be guaranteed.

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 max. transient tolerance
NEMA A300 P300

Contact Material

Silver-nickel alloy

Maximum Switching Speed

30 operations per minute

Maximum Actuator Speed

1 m/second (39 inches/second)

Minimum Actuator Engagement Radius

In-line actuators: 150 mm (6 inches)
Flexible actuators: 50 mm (2 inches) in all directions

Actuator Extraction Force

12 Newtons (2.6 lbf)

Short Circuit Protection

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

Construction

Glass fiber-reinforced polyamide thermoplastic housing; UL 94-V0 rating

Weight

SI-LS83 models: 0.12 kg (0.26 lb)
SI-LS100 models: 0.13 kg (0.29 lb)

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

European Rating

Utilization categories: AC15 and DC13 (IEC 60947-5-1)
Switches with 1 and 2 contact pairs: Ui = 500V ac; Ith = 10 A
Switches with 3 contact pairs: Ui = 400V ac; Ith = 5 A

40 to 60 Hz		
Ue	Ie/AC-15	Ie/DC-13
V	A	A
24	10	6
110	10	1
230	6	0.4

Mechanical Life

1 million operations

Wire Connections

Stranded and solid: 20 AWG (0.5 mm²) to 18 AWG (1.0 mm²) for one wire
Stranded: 20 AWG (0.5 mm²) to 18 AWG (1.0 mm²) for two wires

Cable Entry

SI-LS83 models: M16 x 1.5 threaded entrance
SI-LS100 models: M20 x 1.5 threaded entrance
Adapter supplied with each switch to convert to 1/2"-14 NPT threaded entrance.

Environmental Rating

IEC IP65



Note: Addition of a No. 3 x 1/4-in screw (maximum) to the wiring access door increases sealing to IEC IP67, NEMA 4x

Operating Conditions

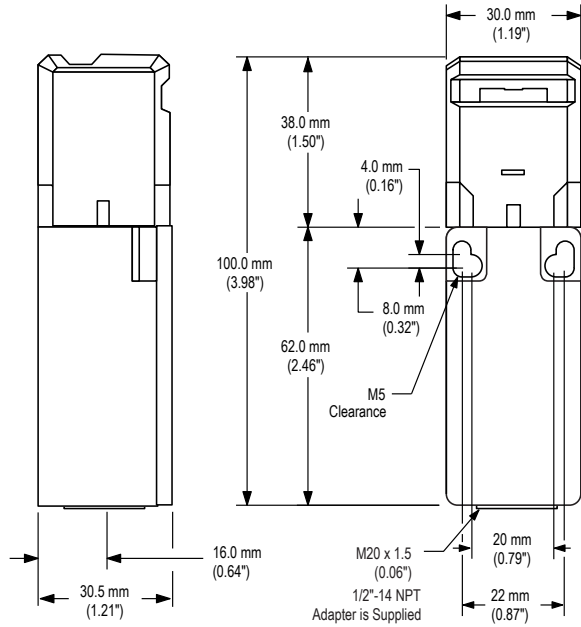
Temperature: -30 °C to +80 °C (-22 °F to +176 °F)

Certifications

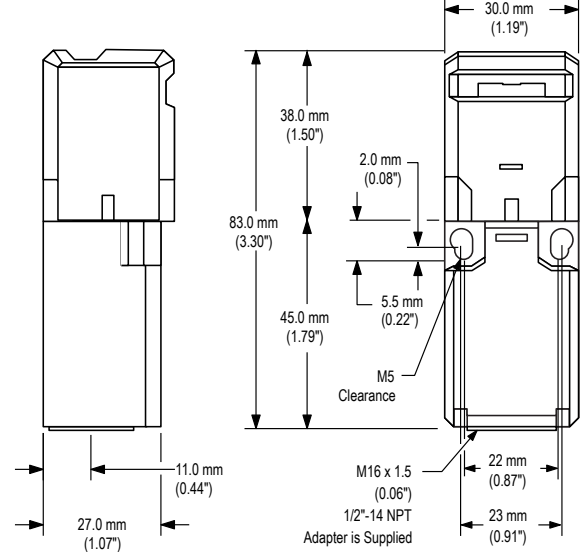


Dimensions

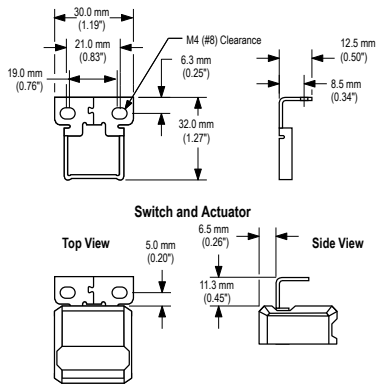
Model SI-LS-100F Interlock Body



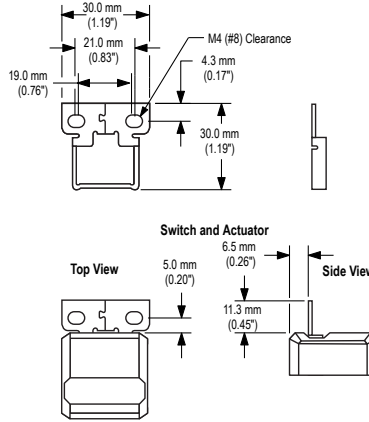
Model SI-LS-83x Interlock Body



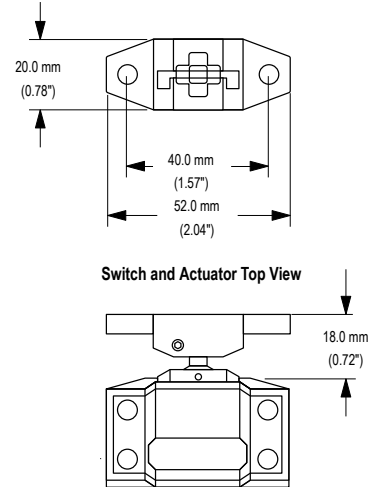
Model SI-QS-SSA-3 Right-Angle Actuator



Model SI-QS-SSA-2 In-line Actuator



Model SI-QS-SSU Flexible Actuator



Accessories

Cable Glands

Model	Size	For Cable Diameter	Dimensions	Used With
SI-QS-CGM16	M16 x 1.5 Plastic	3.0 to 8.0 mm (0.12 to 0.31 inches)		SI-QS75 Safety Interlock Switches SI-LS83 Safety Interlock Switches

Model	Size	For Cable Diameter	Dimensions	Used With
SI-QS-CGM20	M20 × 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

Conduit Adapters

One conduit adapter is supplied with each switch.

Model	Size	Thread Conversion	Dimensions	Used With
SI-QS-M16	½ in-14 NPT Plastic	M16 × 1.5 to ½ in-14 NPT		SI-QS75 Safety Interlock Switches SI-LS83 Safety Interlock Switches

Model	Size	Thread Conversion	Dimensions	Used With
SI-QS-M20	½ in-14 NPT Plastic	M20 × 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

Replacement Actuators

Type	Model	Application
	SI-QS-SSA-3 (Inline) SI-QS-SSA-2 (Inline)	For doors or covers with a radius of 150 mm (6"), or greater. (Pictured from left to right: -SSA-3 and -SSA-2).
	SI-QS-SSU (Flexible)	For hinged doors with a radius of 50 mm (2") or greater. Flexes in four directions. The actuator is die-cast steel.
	SI-QS-SSUA (Adapter Plate)	Clear acrylic adapter plate used to retrofit SI-QS-SSU to older flexible actuators SI-QS-HMA and SI-QS-VMA.



WARNING: Spare Actuators

Spare actuators must NEVER be used to bypass or otherwise defeat the protective function of a safety switch. To do so may create an unsafe situation which may lead to serious injury or death.

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.

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