


# Limit-Switch Style Machine Safety Switches



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)

Kit Model *	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.

\* 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](mailto: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

ISO/TR 12100-1 (EN 292-1 & -2) 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

ISO 13849-1 (EN 954-1) Safety-Related Parts of Control Systems

ISO 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

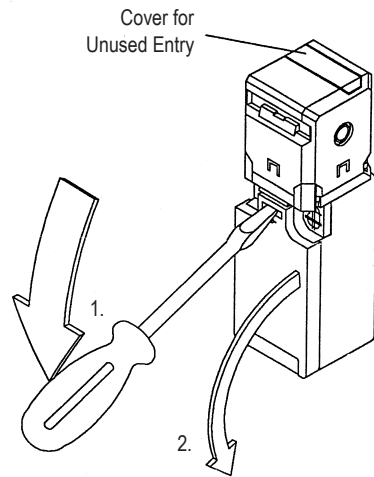
IEC 60204-1 Electrical Equipment of Machines Part 1: General Requirements

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

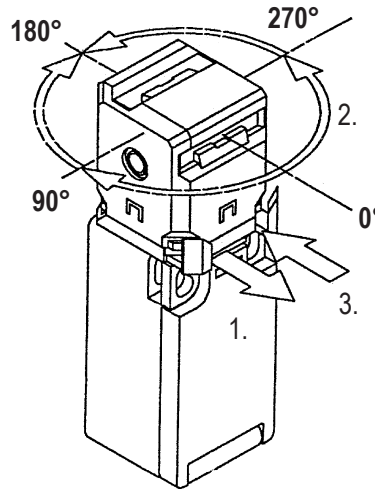
Contact: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, Tel.: 800-854- 7179

## Overview

### Easy Access



### Rotating the Actuator Head



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

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

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 Interlock Switches**

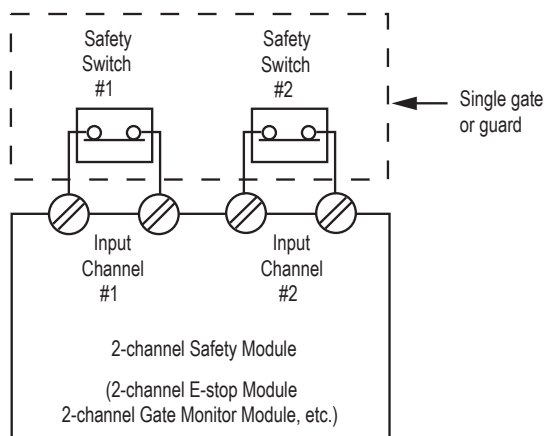
Monitoring multiple guards with a series connection of safety interlock switches may result in a failure being masked or not detected at all. When such a configuration is used, periodic checks must be performed regularly to verify proper operation. All failures must be immediately corrected ( e.g. immediately replacing a failed switch), or the loss of the safety stop signal or an inappropriate reset could 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 7 .

**Connection to a Machine**

As illustrated in [Figure 1. Switch Wiring to Safety Module](#) 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

- 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:

- Breakage of the switch body or actuator,
- Good alignment and full engagement of the actuator with the receptor,
- Confirmation that the safety switch is not being used as an end stop,
- Loosening of the switch or actuator mounting hardware, and
- 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:

- Check the wiring chamber for signs of contamination.
- Check the contacts for signs of deterioration or damage.
- Inspect the electrical wiring for continuity and damage.
- 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 Module. It contains no field-replaceable components.** Return it to the factory for warranty repair or replacement by contacting Banner Factory Application Engineering. They will attempt to troubleshoot the system from your description of the problem. If they conclude a component is defective, they will issue a return merchandise authorization (RMA) number for your paperwork and give you the proper shipping address.

**Pack the Module carefully. 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

10A @ 24V ac, 10A @ 110V ac, 6A @ 230V ac; 6A @ 24V dc  
2.5 kV max. transient tolerance  
NEMA A300 P300

### Contact Material

Silver-nickel alloy

### Maximum Switching Speed

30 operations per minute

### European Rating

Utilization categories: AC15 and DC13 (IEC 60947-5-1)  
Switches with 1 and 2 contact pairs:  $U_i = 500V$  ac;  $I_{th} = 10$  A  
Switches with 3 contact pairs:  $U_i = 400V$  ac;  $I_{th} = 5A$

40-60 Hz		
$U_e$	$I_e/AC-15$	$I_e/DC-13$

**Maximum Actuator Speed**

1 m/second (39"/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)

**Environmental Rating**

IEC IP65

NOTE: Addition of a No. 3 x 1/4" screw (max) to the wiring access door increases sealing to IEC IP67, NEMA 4X

**Operating Conditions**

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

40-60 Hz		
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 mm<sup>2</sup>) to 18 AWG (1.0 mm<sup>2</sup>) for one wire

Stranded: 20 AWG (0.5 mm<sup>2</sup>) to 18 AWG (1.0 mm<sup>2</sup>) 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.

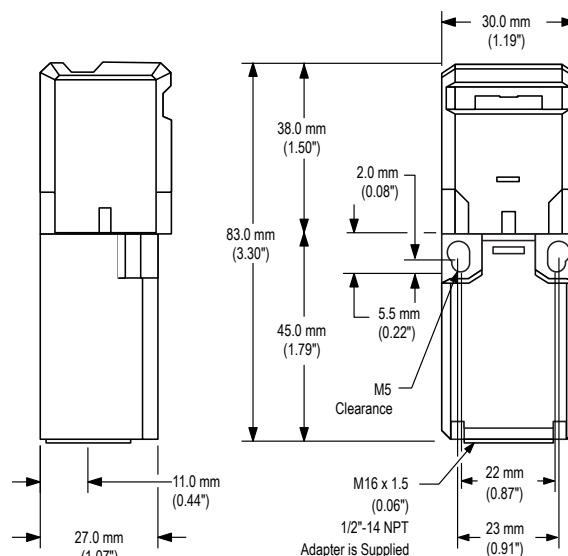
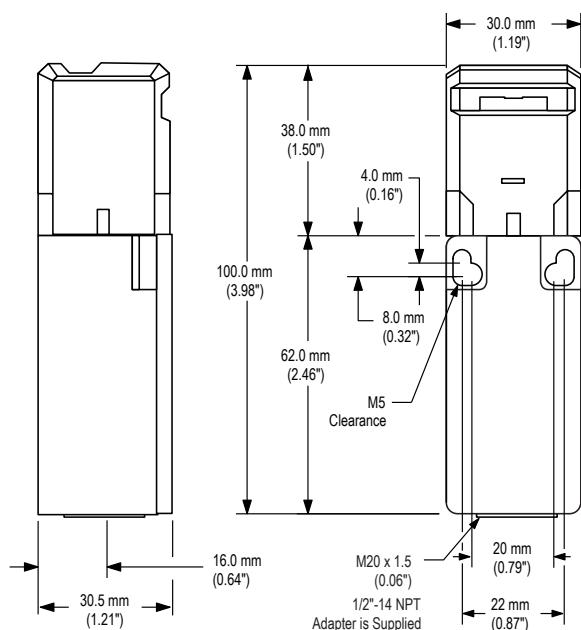
**Certifications**



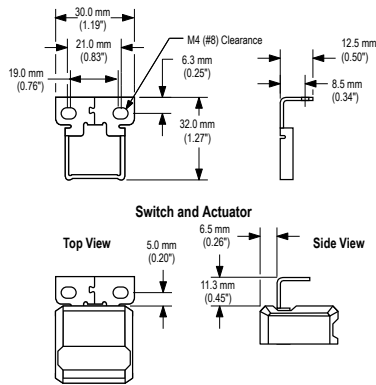
**Dimensions**

Model SI-LS-100F Interlock Body

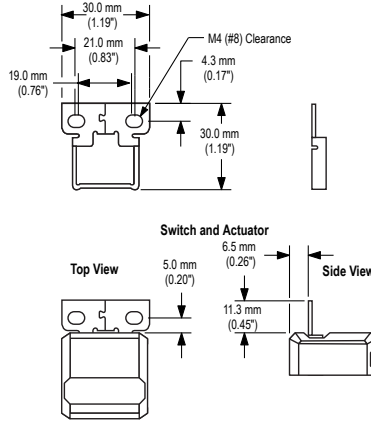
Model SI-LS-83x Interlock Body



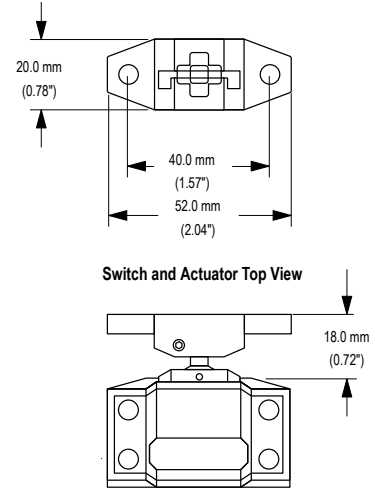
**Model SI-QS-SSA-3 Right-Angle Actuator**



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



**Model SI-QS-SSU Flexible Actuator**



**Accessories**

**Cable Glands**

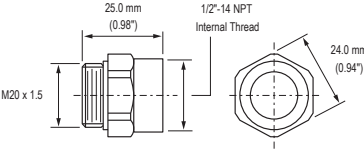
Model	Size	For Cable Diameter	Dimensions	Used With
SI-QS-CGM16	M16 x 1.5 Plastic	3.0 to 8.0 mm (0.12 to 0.31 inches)		SI-QS75 Safety Interlock Switches SI-LS83 Safety Interlock Switches

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



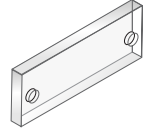
**Conduit Adapters**

One conduit adapter is supplied with each switch.

Model	Size	Thread Conversion	Dimensions	Used With
SI-QS-M16	1/2"-14 NPT Plastic	M16 x 1.5 to 1/2"-14 NPT		SI-QS75 Safety Interlock Switches SI-LS83 Safety Interlock Switches

Model	Size	Thread Conversion	Dimensions	Used With
SI-QS-M20	½"-14 NPT Plastic	M20 x 1.5 to ½"-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 could 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.

**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.**

Banner Engineering Corp. reserves the right to change, modify or improve the design of the product without assuming any obligations or liabilities relating to any product previously manufactured by Banner Engineering Corp.

