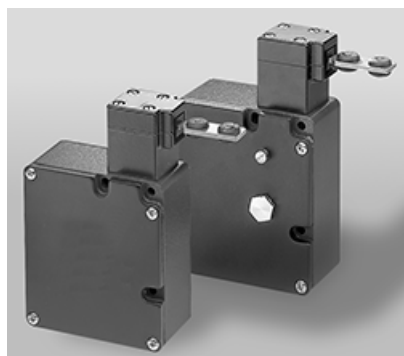


# Machine Safety Switches

SI-QM100 Series Locking Style Switch



- Positive opening safety contacts (IEC 60947-5-1)
- Protective Earth Terminal (IEC 60947-1)
- Keyed actuators discourage intentional tampering or defeat
- Choice of two locking mechanism types
  - Spring lock with energized solenoid release
  - Energized solenoid lock with spring unlock
- Both types are available with choice of 24V dc or 120V ac solenoid operating voltage
- Actuator head rotatable in 90° increments
- Monitor contacts for both switching contact and solenoid status
- Standard mounting hole pattern (EN 50041)


The following models all use actuator type SI-QM-SSA Straight, Rigid In-Line.

Kit Model *	Solenoid Voltage	Interlock Body *	Locking Configuration	Contact Configuration (Actuator Engaged and Locked)	Contact Configuration (Actuator Removed and Unlocked)	Switching Diagram
SI-QM100DMSG	24V dc	SI-QM100DSG	Spring Lock, Solenoid Unlock	Switching Contacts 	Switching Contacts 	
SI-QM100AMSG	120V ac	SI-QM100ASG		Solenoid Contacts 	Solenoid Contacts 	
SI-QM100DMMG	24V dc	SI-QM100DMG	Solenoid Lock, Spring Unlock	Switching Contacts 	Switching Contacts 	
SI-QM100AMMG	120V ac	SI-QM100AMG		Solenoid Contacts 	Solenoid Contacts 	
SI-QM100DMSH	24V dc	SI-QM100DSH	Spring Lock, Solenoid Unlock	Switching Contacts 	Switching Contacts 	
				Solenoid Contacts 	Solenoid Contacts 	

## Switching Diagram Key

Contacts: Open Closed Transition



This symbol () for a positive-opening safety contact (IEC 60947-5-1) is used in the switching diagram 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

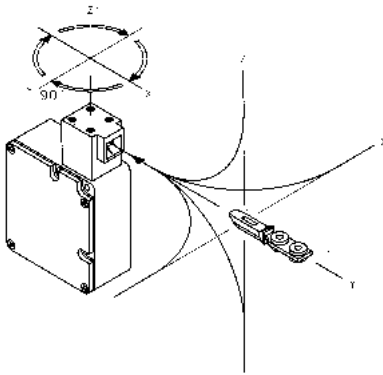
Contact: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, Tel.: 800-854- 7179

## Overview

**Spring Lock, Solenoid Unlock (Models SI-QM100DMSG and SI-QM100AMSG).** The actuator is mechanically locked when it is fully inserted into the actuator head. The actuator is unlocked by applying voltage to the solenoid.

**Solenoid Lock, Spring Unlock (Models SI-QM100DMMG and SI-QM100AMMG).** The fully inserted actuator is locked when voltage is applied to the solenoid. The actuator is unlocked when voltage is removed from the solenoid.

## Mechanical Installation



The actuator head may be rotated, if desired, to any of four 90 degree positions. To reposition the actuator head, unscrew the four mounting bolts, turn the head to the desired position, and re-tighten the bolts.

**IMPORTANT:** Verify the actuator is fully engaged before removing the actuator head screws during the rotation process.

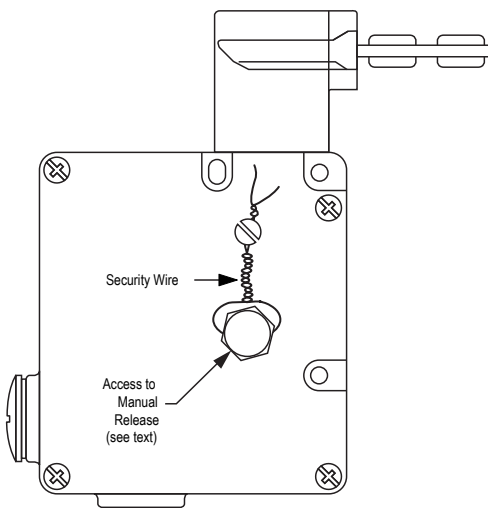
All mounting hardware is supplied by the user. The fasteners must be of sufficient strength to avoid incidental breakage. Use of permanent fasteners or locking hardware is recommended to prevent loosening or displacement of the actuator and switch body.

The mounting holes in the switch body accept M5 (#10) screws. There are three holes on a standard limit switch mounting pattern of 30 x 60 mm. The two mounting holes on the actuator are spaced 20 mm apart. The grommet and sleeve design allows a small amount of movement (i. e., misalignment) when the actuator engages the switch body. The sleeves accept M4.5 (#8) screws.

Position the switch, with its actuator fully engaged, in the mounting location and mark the mounting holes. Fasten the switch body and the actuator in place. The non-adjustable in-line actuator includes floating sleeves in the mounting holes to allow some forgiveness for switch-to-actuator alignment. Take care to not over-tighten the actuator fasteners so as to allow this movement. After the mounting hardware is secure, check the actuator/switch engagement for misalignment and binding.

**IMPORTANT:** A safety switch must be installed to discourage tampering or defeat. Mount each switch to prevent bypassing of the switching function at the terminal chamber. A switch and its actuator must never be used as a mechanical stop.

### Manual Release for Spring Lock Models



Models with solenoid unlock may be manually unlocked by depressing the button located beneath the large hex cover screw on the switch body. The manual release button is only for emergency use when there has been system power loss or solenoid failure. Access to the manual release button must be restricted by installing a security wire between the hole in the hex cover and the hole in the screw immediately above the hex cover.



#### **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.

## Electrical Installation



#### **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.

**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.

**Access to the Wiring Chamber**

The wiring chamber is accessed via a cover plate that is held in place by four screws. A conduit adapter is supplied to convert the M20 x 1.5 thread to ½" x 14 NPT. An accessory cable gland that fits the M20 x 1.5 thread is available (see [Accessories](#) on page 7).

**Connection to a Machine**

Four contacts are offered. Two are safety contacts that must be wired in series, and the other two are considered monitoring contacts that may be used, if desired.

The contact between terminals 11 and 12 or 21 and 22 is a safety contact that is closed (i.e., it conducts) when the actuator is engaged. The contact between terminals 13 and 14 is the associated actuator monitoring contact.

The contact between terminals 31 and 32 is a safety contact that is closed when the solenoid is in its locking state. The contact between terminals 43 and 44 is the associated solenoid monitoring contact.

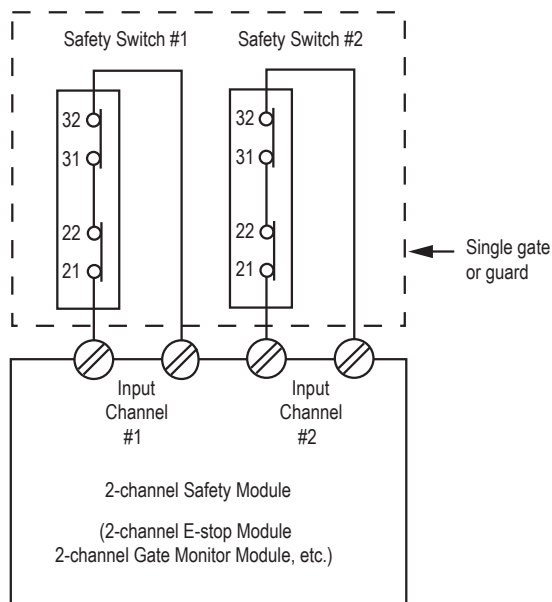
See the switching diagrams in the models table for contact state information.

As illustrated in [Figure 1. Switch Wiring to Safety Module](#) on page 5, the normally-closed safety contact (i.e., safety contacts that are closed when the actuator is engaged and the solenoid is in its locking state) from each of two safety switches per interlock guard must connect to a 2-channel safety module or safety interface 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. Refer to [Figure 2. Switch Electrical Connections for SI-GM100xG Models](#) on page 5 and [Figure 3. Switch Electrical Connections for SI-GM100xDSH Models](#) on page 5 for terminal connections.

Two functions of the safety module or safety interface are to:

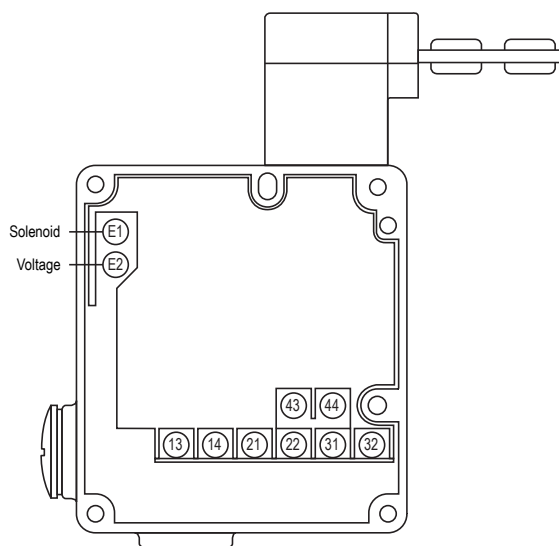
1. provide a means of monitoring the contacts of both safety switches for contact failure, and to prevent the machine from restarting if either switch fails; and
2. provide a reset routine after closing the guard and returning the safety contacts to their closed position. This prevents the controlled 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 positively driven, normally closed safety contacts from each switch for connection to the safety module. *The normally open contacts 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.

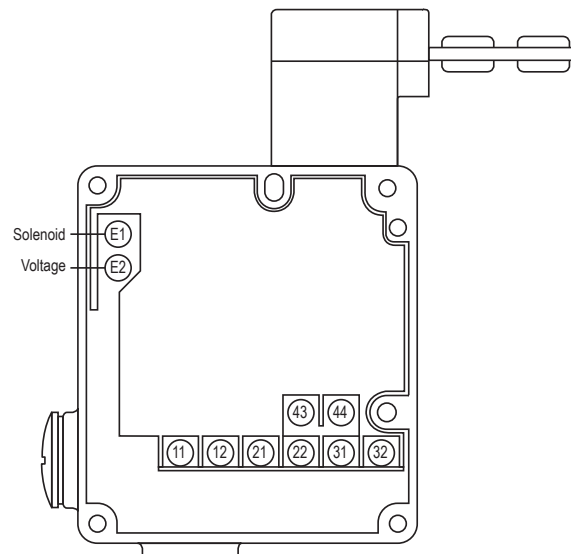


**Figure 1. Switch Wiring to Safety Module**

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.



**Figure 2. Switch Electrical Connections for SI-GM100xG Models**



**Figure 3. Switch Electrical Connections for SI-GM100xDSH Models**

## 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 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

4A @ 250V ac max.  
2.5 kV max. transient tolerance  
NEMA A300 P300

### Contact Material

Silver-nickel alloy

### Solenoid Power Consumption

5.2 W

### Maximum Actuator Speed

1.5 m/second (5 ft/second)

### Minimum Actuator Engagement Radius

In-line actuators: 400 mm (16 inches)  
Flexible actuators: 150 mm (6 inches)

### Actuator Extraction Force

1000 Newtons (220 lbf) when locked

### Mechanical Life

1 million operations

### Construction

Aluminum die-cast housing

### Weight

0.81 kg (1.79 lb)

### Environmental Rating

IEC IP67

### Operating Conditions

Temperature: -30° to +60° C (-22° to +140° F)

### European Rating

Utilization categories: AC15 and DC13 (IEC 60947-5-1)  
Switches with 1 and 2 contact pairs:  $U_i = 250V$  ac;  $I_{th} = 10A$

40-60 Hz		
Ue V	Ie/AC-15 A	Ie/AC-13 A
24	4	3
110	4	0.7
230	4	0.3

### Short Circuit Protection

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

### Wire Connections

Screw terminals with pressure plates accept the following wire sizes—  
16 AWG (1.5 mm<sup>2</sup>) max. solid; 14 AWG (2.5 mm<sup>2</sup>) max. stranded, 18 AWG (1 mm<sup>2</sup>) when using all 11 terminals

### Cable Entry

M20 x 1.5 threaded entrance. Adapter supplied to convert M20 x 1.5 to ½" - 14 NPT threaded entrance.

**Application Notes:** When rotating the actuator head, the actuator **MUST BE FULLY ENGAGED.**

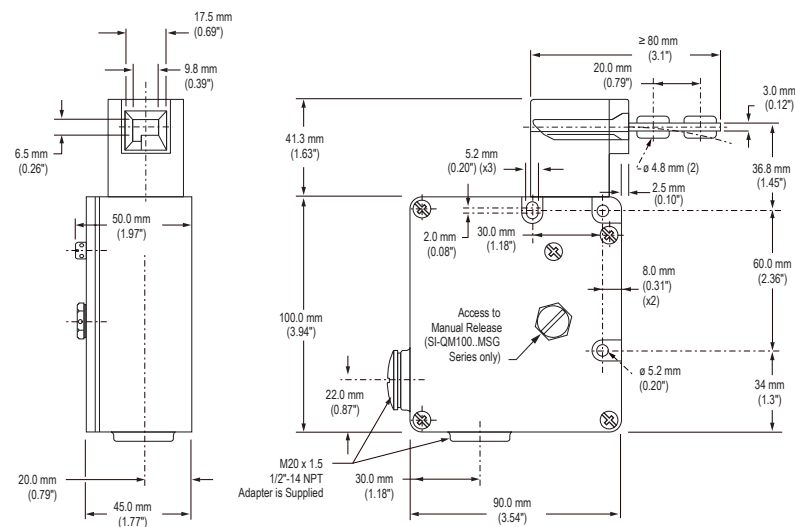
When using a model with solenoid locking, the lock mechanism will disengage upon solenoid power failure.

**Certifications:**

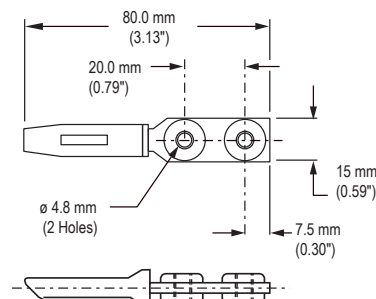


## Dimensions

### Switch Dimensions



### Actuator Dimensions



## Accessories

### Cable Glands

Model	Size	For Cable Diameter	Dimensions	Used With
SI-QM-CGM20	M20 × 1.5 Metal	5.0 to 12.0 mm (0.20 to 0.47 inches)		SI-LM40 Safety Interlock Switches SI-QM100 Safety Interlock Switches RP-RM83 Rope Pull Switches RP-LM40 Rope Pull Switches RP-QM72/QMT72 Rope Pull Switches RP-QM90 Rope Pull Switches

### Replacement Parts

Model	Size	Thread Conversion	Dimensions	Used With
SI-QM-M20	½"-14 NPT Metal	M20 x 1.5 to ½"-14 NPT		SI-LM40 Safety Interlock Switches SI-QM100 Safety Interlock Switches RP-RM83 Rope Pull Switches RP-LM40 Rope Pull Switches RP-QM72/QMT72 Rope Pull

Model	Size	Thread Conversion	Dimensions	Used With
				Switches RP-QM90 Rope Pull Switches

One conduit adapter is supplied with each switch.

### Accessory Actuators

Model	Application	Dimensions
SI-QM-SMFA	Inline Flexible Metal	

Model	Application	Dimensions
SI-QM-SB	Rigid in-line metal actuator used for doors or covers. Slide-bolt design for use in heavy-duty applications where alignment is difficult to maintain.	



#### 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.

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