

## Features



- Positive opening safety contacts (IEC 60947-5-1) (not dependent upon springs)
- Protective Earth Terminal (IEC 60947-1)
- Keyed actuators discourage intentional tampering or defeat
- Choice of two locking mechanism types:
  - Spring lock with energized solenoid unlock
  - 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)

## Models

Kit Model†	Solenoid Voltage	Actuator Type†	Interlock Body†	Locking Configuration	Contact Configuration (Actuator Engaged and Locked)	Contact Configuration (Actuator Unlocked and Removed)	Switching Diagram
SI-QM100DMSG	24V dc	SI-QM-SSA Straight, Rigid In-Line	SI-QM100DSG	Spring Lock	<b>Switching Contacts</b> 	<b>Switching Contacts</b> 	<p>Engaged</p> <p>Disengaged</p> <p>Safety Monitor</p> <p>0 (0) 10 (0.39) 11 (0.43) 12 (0.47) 41 (1.61) mm (in)</p> <p>Contacts: <input type="checkbox"/> Open <input checked="" type="checkbox"/> Closed <input type="checkbox"/> Transition</p>
SI-QM100AMSG	120V ac		SI-QM100ASG	Solenoid Unlock			
SI-QM100DMMG	24V dc		SI-QM100DMG	Solenoid Lock	<b>Solenoid Contacts</b> 	<b>Solenoid Contacts</b> 	
SI-QM100AMMG	120V ac		SI-QM100AMG	Spring Unlock			
SI-QM100DMSH	24V dc		SI-QM100DSH	Spring Lock Solenoid Unlock	<b>Switching Contacts</b>  <b>Solenoid Contacts</b> 	<b>Switching Contacts</b>  <b>Solenoid Contacts</b> 	

NOTE: 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. See Warning on page 8.



# Machine Safety Switch – SI-QM100 Series, Locking Style

## 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 safety switches in a configuration which meets safety category 4, per ISO 13849-1 (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.

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

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

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 Construction, Care, and Use of Machine Tools"  
Available from: Safety Director  
AMT—The Association for Manufacturing Technology  
7901 Westpark Drive  
McLean, VA 22102  
Tel: 703-893-2900

### Applicable European and International Standards

ISO 12100-1/-2 "Safety of Machinery—Basic Concepts, General Principles for Design"  
(EN292-1/-2)  
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 of Machinery—Safety Related Parts of Control Systems"  
ISO 13855 (EN 999) "Safety of Machinery—The Positioning of Protective Equipment in Respect to Approach Speeds of Parts of the Human Body"  
ISO 14119 (EN 1088) "Safety of Machinery—Interlocking Devices Associated with Guards—Principles for Design and Selection"  
IEC/EN 60204-1 "Safety of Machinery—Electrical Equipment of Machines"  
IEC/EN 60947-5-1 "Low Voltage Switchgear—Electromechanical Control Circuit Devices"

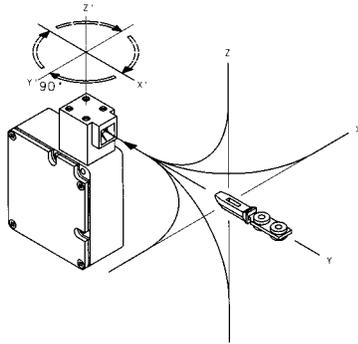
Available from: Global Engineering Documents  
15 Inverness Way East  
Englewood, CO 80112-5704  
Phone: 1-800-854-7179  
Fax: 303-397-2740

# Machine Safety Switch – SI-QM100 Series, Locking Style

Spring Lock,  
Solenoid Unlock



Spring Unlock,  
Solenoid Lock



## 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 (see the drawing at left).

**IMPORTANT:** Be certain that 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 in a manner which discourages 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.

# Machine Safety Switch – SI-QM100 Series, Locking Style

## Manual Release for Spring Lock Models

Models with solenoid unlock may be manually unlocked by depressing the button which is located beneath the large hex cover screw on the switch body (see Figure 1). 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 (see Figure 1).**

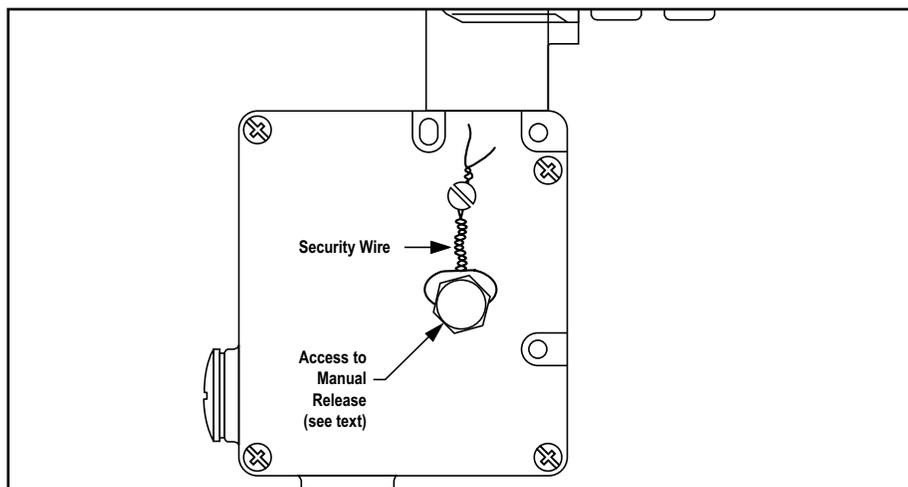


Figure 1. Manual spring lock release

## Electrical Installation

### Access to the Wiring Chamber

The wiring chamber is accessed via a cover plate which 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 which fits the M20 x 1.5 thread is available (see page 10).

### Connection to a Machine

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

The contact between terminals 11 and 12 or 21 and 22 is a safety contact which 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 which 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 on page 1 for contact state information.

As illustrated in Figure 2, 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 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. Refer to Figures 3 and 4 for terminal connections.

### **WARNING . . .**

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 (see page 2) for information on determining safety distances and safe opening sizes for your guarding devices.

### **CAUTION . . . Auxiliary Electrical Installation**

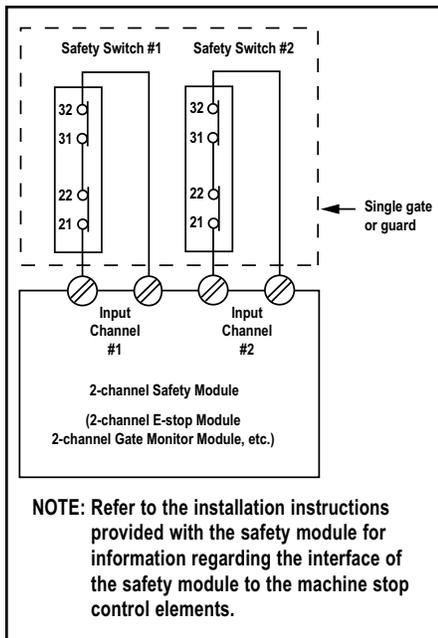
Two safety switches must be used for each interlock guard to achieve control reliability or Safety Category 4 (per ISO 13849-1, EN 954-1) of a machine stop circuit. Use of only one safety switch per interlock guard is not recommended.

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, as illustrated in Figure 2. 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.

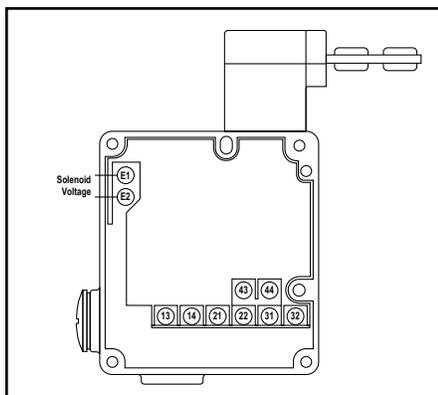
### **WARNING . . . Series Connection of Safety Interlock Switches**

Monitoring multiple guards with a series connection of 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.

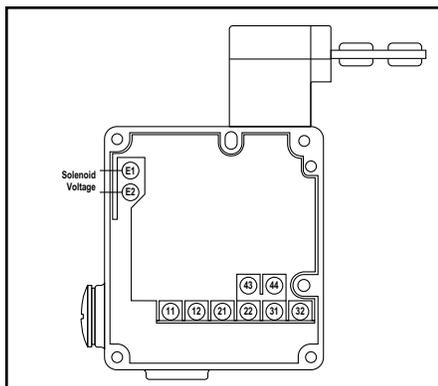
# Machine Safety Switch – SI-QM100 Series, Locking Style



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



**Figure 3. Switch electrical connections – models SI-QM100..G**



**Figure 4. Switch electrical connections – models SI-QM100..DSH**

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 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.

## Periodic Checks

Safety switches should be checked at each shift change or machine setup by a *designated person* (see below) 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 that wiring conforms to the instructions on pages 4 and 5 of this data sheet.

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.

# Machine Safety Switch – SI-QM100 Series, Locking Style

## Repairs

Do not attempt any repairs to the switch. It contains no field-replaceable components. Return the switch to the factory for warranty repair or replacement.

If it ever becomes necessary to return a switch to the factory, please do the following:

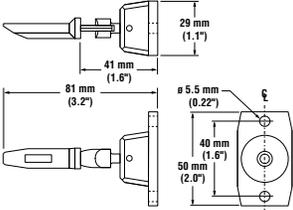
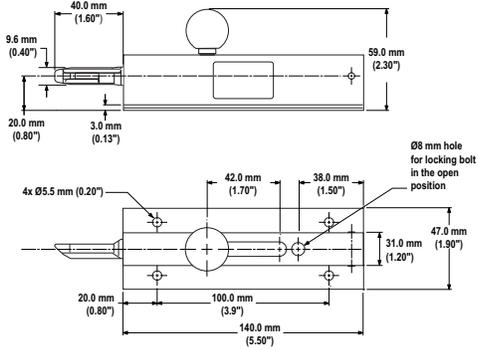
1. Contact the Banner applications engineering department at the number or address listed on the back cover. They will attempt to troubleshoot the system from your description of the problem. If they conclude that a component is defective, they will issue an RMA (Return Merchandise Authorization) number for your paperwork, and give you the proper shipping address.
2. Pack the switch carefully. Damage which occurs in shipping is not covered by warranty.

## Specifications

<b>Contact Rating</b>	4A @ 250V ac max. 2.5 kV max. transient tolerance NEMA A300 P300		
<b>European Rating</b>	<b>Utilization categories:</b> AC15 and DC13 (IEC 60947-5-1) <b>Switches with 1 and 2 contact pairs:</b> $U_i = 250V$ ac $I_{th} = 10A$		40-60 Hz
	$U_e$ V	$I_e/AC-15$ A	$I_e/AC-13$ A
	24	4	3
	110	4	0.7
	230	4	0.3
<b>Contact Material</b>	Silver-nickel alloy		
<b>Solenoid Power Consumption</b>	5.2 W		
<b>Maximum Actuator Speed</b>	1.5 m/second (5'/second)		
<b>Minimum Actuator Engagement Radius</b>	<b>In-line actuators:</b> 400 mm (16") <b>Flexible actuators:</b> 150 mm (6")		
<b>Actuator Extraction Force</b>	1000 Newtons (220 lbf) when locked		
<b>Short Circuit Protection</b>	6 amp Slow Blow, 10 amp Fast Blow. Recommended external fusing or overload protection.		
<b>Mechanical Life</b>	1 million operations		
<b>Wire Connections</b>	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		
<b>Cable Entry</b>	M20 x 1.5 threaded entrance. Adapter supplied to convert M20 x 1.5 to 1/2" - 14 NPT threaded entrance.		
<b>Construction</b>	Aluminum die-cast housing		
<b>Environmental Rating</b>	IEC IP67		
<b>Operating Conditions</b>	<b>Temperature:</b> -30° to +60° C (-22° to +140° F)		
<b>Weight</b>	0.81 kg (1.79 lb)		
<b>Application Notes</b>	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.		
<b>Certifications</b>	   Auxiliary Devices LISTED		



# Machine Safety Switch – SI-QM100 Series, Locking Style

Accessory Actuators				
	Description	Model	Used with Switch Models	Dimensions
	In-line Flexible Metal	SI-QM-SMFA	All	
	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.	SI-QM-SB	All	



## 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.



P/N 49374 rev. E

**WARRANTY:** Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.