

SI-LM40KH Safety Limit Switch



Datasheet

SI-LM40 Series Limit Switch Style with In-Line Actuator



- Positive opening safety contacts (IEC 60947-5-1) (not dependent upon springs)
- Standard limit switch metal housing (EN 50041)
- Choose either of two stainless steel actuator types: rigid in-line or flexible in-line
- Protective Earth Terminal (IEC 60947-1)

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

Kit Model ¹	Actuator	Interlock Body	Contact Configuration		Switching Diagram
			Actuator Engaged	Actuator Removed	
SI-LM40MKHD	SI-QM-SSA Straight, Rigid, In-Line	SI-LM40KHD with Metal Housing			
SI-LM40MKHFD	SI-QM-SMFA Right-angle, Flexible, In-Line				
SI-LM40MKHE	SI-QM-SSA Straight, Rigid, In-Line	SI-LM40KHE with Metal Housing			
SI-LM40MKHFE	SI-QM-SMFA Right-angle, Flexible, In-Line				
SI-LM40MKHF	SI-QM-SSA Straight, Rigid, In-Line	SI-LM40KHF with Metal Housing			
SI-LM40MKHFF	SI-QM-SMFA Right-angle, Flexible, In-Line				

Contacts: Open
 Closed
 Transition

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

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 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

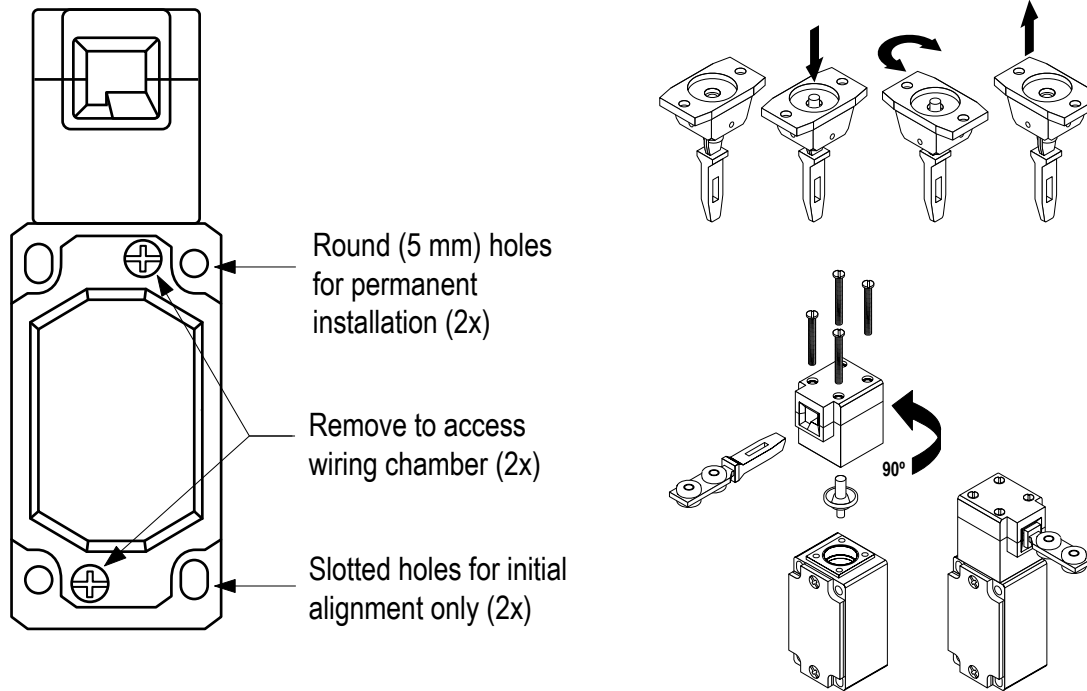
Contact: Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, Tel.: 800-854- 7179

Installation Instructions

Mechanical **Installation**

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



The mounting holes in the switch body accept M5 (#10) screws. There are four holes on a standard limit switch mounting pattern of 30 × 60 millimeters. The two mounting holes on the actuator are spaced 20 millimeters 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 (rigid) in-line actuators 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: 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. Never use a switch and its actuator as a mechanical stop. Over-travel may cause damage to the switch.



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



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.

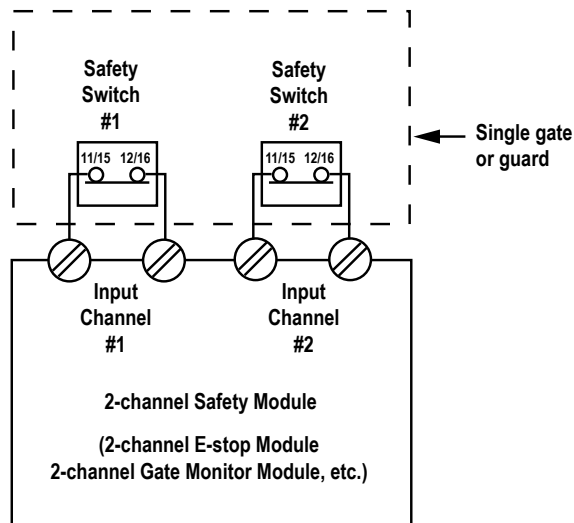
Accessing the Wiring Chamber

The wiring chamber is accessed via a cover plate. The metal switch body uses two screws to hold the cover plate on. A conduit adapter is supplied to convert the M20 x 1.5 thread to ½"-14 NPT. An accessory cable gland that fits the M20 x 1.5 thread is available.

Connection to a Machine

Two types of contacts are offered. The NC contact is the safety contact, which is closed (i.e., it conducts) when the actuator is engaged. The NO contact is considered a monitoring contact, which should not be used for safety switching.

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. 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.

- 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

Maximum Actuator Speed

1.5 m/second (5' /second)

Minimum Actuator Engagement Radius

Rigid actuators: 400 mm (16 in)
 Flexible actuators: 150 mm (6 in)

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 –
 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

Mechanical Life

1 million operations

Construction

Aluminum alloy die-cast housing

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

40–60 Hz		
U _e (V)	I _e /AC-15 (A)	I _e /AC-13 (A)
24	10	6
110	10	1
230	6	0.4

Actuator Extraction Force

10 N (2.2 lbf)

Weight

0.34 kg (0.75 lb)

Cable Entry

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

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.

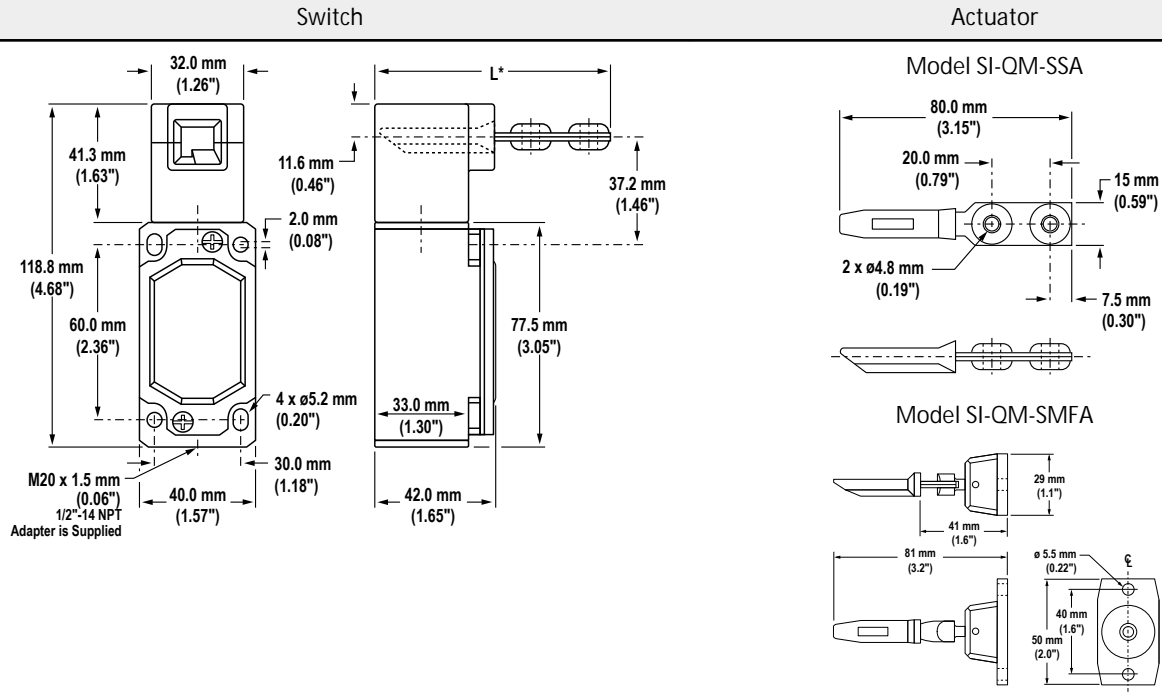
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

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-QM-CGM20	M20 x 1.5 Metal	5.0 to 12.0 mm (0.20 to 0.47 inches)	<p>35.5 mm (1.40") 24.0 mm (0.94") M20 x 1.5</p>	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

Conduit Adapter Replacement Part

Model	Size	Thread Conversion	Dimensions	Used With
SI-QM-M20	½ in-14 NPT Metal	M20 x 1.5 to ½ in-14 NPT	<p>23.0 mm (0.91") 1/2"-14 NPT Internal Thread 24.0 mm (0.94") O-ring M20 x 1.5</p>	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

One conduit adapter is supplied with each switch.

Actuators

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 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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