

Door-Flap Switch



Door-Hinge Switch



Key Interlock Switch



RS2 Safety Interlock Switch



1.0 Introduction

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1.1 LS-Titan Safety Interlock Switches

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1.2 RS Safety Interlock Switches

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Online

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in Canada call 1-800-268-3578.
For Application Assistance in the U.S. and Canada
call 1-800-426-9184.

Technical Reference

LS-Titan



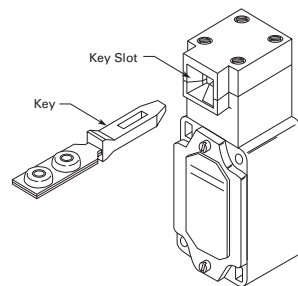
To protect personnel and equipment, often the need arises for a device to provide a signal indicating that a door or a panel has been closed before a machine can be turned on or operations can be restarted.

While a standard limit switch or sensor may be able to do this function, the possibility exists that the unit could be false tripped or false actuated either accidentally or deliberately, thereby posing a danger to the machine operator.

In response to this problem, many switch manufacturers offer safety-rated interlock switches.

Designed with two parts—the sensor and the actuator, the sensor is typically mounted on the stationary portion of a structure and the actuator is mounted on the movable portion. The sensor is designed to work with the correct actuator (keyed or coded magnet) to reduce tampering and increase safety.

Interlock Switch



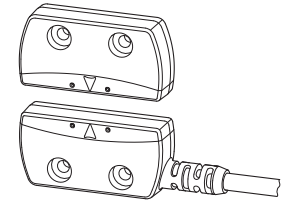
Actuation of the interlock switch occurs only when the corresponding key is inserted into the key slot. The key is usually mounted on a door or machine guard in such a way that when the door or the guard is closed, the key fits into the slot actuating the switch. The special key design makes the safety interlock switch extremely difficult to defeat. When inserted into the slot, the key performs three separate mechanical functions.

In addition to being difficult to override, the safety interlock is also designed to fail to a safe mode. If, by chance, the contacts were to become welded together, removal of the key will physically tear the contacts apart, resulting in a safe condition.

LS-Titan™ key interlock switches by Eaton's Electrical Sector are available in both NEMA® and DIN style interlock switches feature durable metal housings, which remove power to the machine when the guard is opened.

DIN style key interlock switches feature a reduced size and economical plastic housings. They remove power to the machine when the guard is opened.

Non-Contact Interlock Switch



Activation of the non-contact interlock switch occurs only when the corresponding magnetic actuator is within operating range. The actuator is usually mounted on a door or machine guard in such a way that when the door or the guard is closed, the actuator is within operating range and actuates the sensor. The design of the sensor/actuator combination reduces the likelihood of defeating the sensor with a simple magnet.

Product Overview

LS-Titan Safety Products



LS-Titan Miniature DIN Safety Interlock Switches



LS-Titan Full-Size DIN Safety Interlock Switches



LS-Titan Solenoid Safety Interlock Switches

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RS Safety Interlock Switches



RS2 Interlock Switches



RS2R Interlock Switches



RS4 Interlock Switches

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LS-Titan Safety Interlock Switches



LS-Titan Safety Interlock Switches

Product Description

Eaton's LS-Titan safety interlock switches have been specifically designed for monitoring the position of protective guards, such as doors, flaps, hoods and grilles. All switches in this family are safety-rated, include positively opening NC contacts, and cannot be defeated using simple tools, such as pliers, screwdrivers and nails.

The LS-Titan safety interlock family is comprised of three types of safety switches: key interlock, door-flap and door-hinge switches.

Key interlock switches are a two-piece design, made up of the switch and key (actuator). The key portion of the switch is affixed to a movable door, cover or other such guard. The switch itself is mounted to a rigid portion of the machine. When the guard is opened, the key is removed from the switch, thereby positively breaking the NC contacts. This interrupts the control circuit, stopping machine operation.

The door-flap and door-hinge switches are one-piece designs, suitable for when a key cannot be mounted in the application. When an attempt is made to open a protected door hinge or flap during operation, these switches disconnect the power supply to the machine or installation. Both switches feature four-way adjustable heads.

All LS-Titan safety interlock switches are approved to protect personnel and processes.

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Features

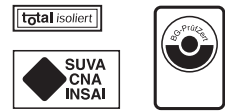
- Broad family of safety interlock switches in industry-standard enclosure sizes: miniature DIN; full-size DIN; and larger, solenoid key interlocks providing the highest degree of personnel and process protection
- Large selection of actuators (keys), including those for sliding doors, swing doors and doors that do not close precisely
- Miniature DIN models have a five-way adjustable head, while full-size DIN models have four-way adjustable heads
- Fully safety-rated as interlocking devices per EN 1088, with safety function by positive opening contacts per IEC/EN 60947-5-1
- Door-flap and door-hinge safety switches provide a unique solution when actuators (keys) cannot be used
- IP65 degree of protection

Standards and Certifications

- UL® listed
- CSA® approved
- CCC



- Positive opening NC contacts per EN 60947-5-1



Safety Notes

Do not use as a mechanical stop/shipping brace.

Any change to an original Eaton safety position switch is not permitted and automatically leads to the loss of all approvals.

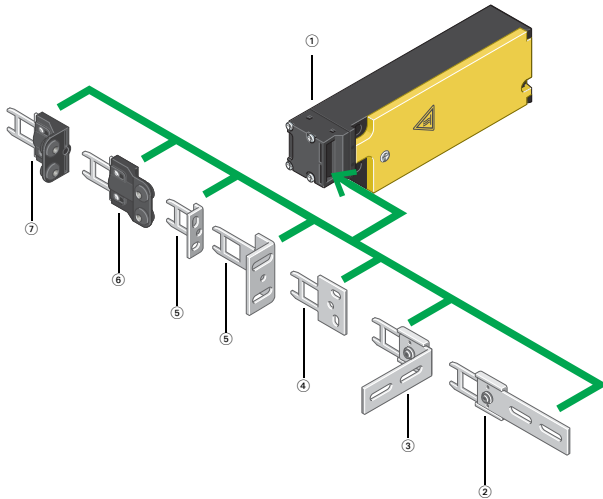
Switch must never be used as a mechanical stop.

For the most current information on this product, visit our Web site: www.eaton.com

For Customer Service in the U.S. call 1-877-ETN CARE (386-2273), in Canada call 1-800-268-3578. For Application Assistance in the U.S. and Canada call 1-800-426-9184.

Product Identification

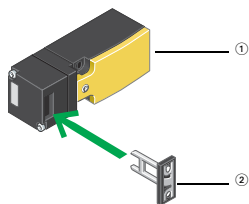
Solenoid Safety Interlock Switches (LS-...ZBZ)



Notes

- ① **Basic device** (see Page V8-T1-7)
Spring or magnet-powered interlock
For increased personnel and process protection
Tamper-proof
Multiple coded actuators
Contacts: 1NO-1NC or 2NC
- ② **Flat flexible actuator** (see Page V8-T1-8)
For doors that do not close precisely
- ③ **Angled flexible actuator** (see Page V8-T1-8)
For doors that do not close precisely
- ④ **Flat actuator** (see Page V8-T1-8)
- ⑤ **Angled actuator** (see Page V8-T1-8)
For sliding doors
- ⑥ **Flat compensating actuator** (see Page V8-T1-8)
For increased tolerance compensation in the direction of door closure
- ⑦ **Angled compensating actuator** (see Page V8-T1-8)
For increased tolerance compensation in the direction of door closure

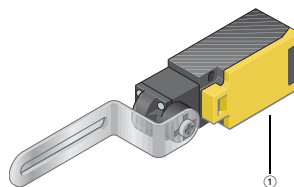
Miniature DIN Safety Interlock Switch (LS-...ZB)



Notes

- ① **Complete device** (see Page V8-T1-6)
For personnel protection
Contacts: 1NC, 1NO-1NO or 2NC
Five directions of operation possible
- ② **Actuator** (see Page V8-T1-6)
Included with switch
Multiple coding protection against tampering

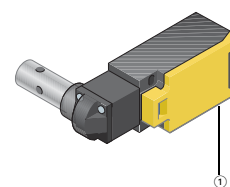
Door Flap Safety Switch (LSR-...TKG)



Note

- ① **Complete device** (see Page V8-T1-6)
For personnel protection
Contacts: 1NO-1NC or 2NC
For swing doors with fixed connection to the door/hinge pin

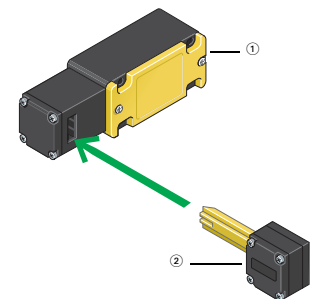
Door Hinge Safety Switch (LSR-...TS)



Note

- ① **Complete device** (see Page V8-T1-6)
For personnel protection
Contacts: 1NO-1NC or 2NC
For swing doors with fixed connection to the door/hinge pin

Full-Size DIN Safety Interlock Switch (LS4-...ZB)



Notes

- ① **Complete device** (see Page V8-T1-7)
Narrow enclosure version
For personnel protection
Contacts: 1NO, 1NO-1NC
- ② **Actuator**
Included with switch, not orderable as a separate item
Multiple coding
For horizontal or vertical operation

Product Selection

LS-Titan Miniature DIN Safety Interlock Switches

Key Interlock Switch



Key Interlock Switch—LS...ZB ①

Contacts	Contact Sequence	Contact Travel	Connection	Catalog Number (Includes Key)
2NC with positive opening		—	Screw terminal	LS-S02-ZB
1NO and 1NC with positive opening		—	Screw terminal	LS-S11-ZB
		Snap action contacts	Screw terminal	LS-S11S-ZB

Door-Flap Switch



Door-Flap Switch—LSR...TKG ①

Contacts	Contact Sequence	Contact Travel	Connection	Catalog Number (Includes Key)
2NC with positive opening			Screw terminal	LSR-S02-1-I-TKG
1NO and 1NC with positive opening			Screw terminal	LSR-S11-1-I-TKG

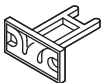
Door-Hinge Switch



Door-Hinge Switch—LSR...TS ①

Contacts	Contact Sequence	Contact Travel	Connection	Catalog Number (Includes Key)
2NC with positive opening			Screw terminal	LSR-S02-1-I-TS
1NO and 1NC with positive opening			Screw terminal	LSR-S11-1-I-TS

Replacement Safety Interlock Key



Replacement Safety Interlock Key ①

Description	Catalog Number
Replacement key for miniature DIN key interlock switches (only models LS...ZB).	LS-XB-ZB

Note

① For dimensions, see **Page V8-T1-11**.

LS-Titan Full-Size DIN Safety Interlock Switches

Key Interlock Switch

Full-Size DIN—LS4...ZB ①②



Contacts	Contact Sequence	Contact Travel	Connection	Catalog Number (Includes Key)
1NO and 1NC with positive opening		—	Screw terminal	LS4-S11-1-I-ZB

LS-Titan Solenoid Safety Interlock Switches

Switch Body without Key

Switch Body without Key—LS...ZBZ ①②③



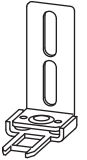
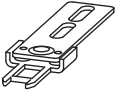
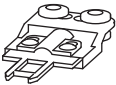
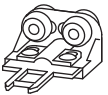


Operation	Operating Voltage	Contacts	Contact Sequence	Catalog Number (Key not Included)
Power to unlock (mechanical bypass present)	24 Vdc	1NO and 1NC with positive opening		LS-S11-24DFT-ZBZ-X
		2NC with positive opening		LS-S02-24DFT-ZBZ-X
	120 Vac (50/60 Hz)	1NO and 1NC with positive opening		LS-S11-120AFT-ZBZ-X
		2NC with positive opening		LS-S02-120AFT-ZBZ-X
Power to lock	24 Vdc	1NO and 1NC with positive opening		LS-S11-24DMT-ZBZ-X
		2NC with positive opening		LS-S02-24DMT-ZBZ-X
	120 Vac (50/60 Hz)	1NO and 1NC with positive opening		LS-S11-120AMT-ZBZ-X
		2NC with positive opening		LS-S02-120AMT-ZBZ-X

Notes

- ① For dimensions, see **Page V8-T1-11**.
- ② For mounting instructions, see **Page V8-T1-10**.
- ③ Key ordered separately, see **Page V8-T1-8**.

LS-Titan Solenoid Safety Interlock Keys**Keys Only—LS...ZBZ** ^{①②}

	Description	Application	Catalog Number
LS-XG-ZBZ 	Flat actuator	For sliding doors	LS-XG-ZBZ
LS-X...ZBZ 	Angled actuator, short	For swing doors starting at 250 mm in width	LS-XW-ZBZ
	Angled actuator, long	For swing doors starting at 250 mm in width	LS-XWA-ZBZ
LS-XF-ZBZ 	Angled, flexible actuator	For doors that do not close precisely	LS-XF-ZBZ
LS-XFG-ZBZ 	Even, flexible coasting actuator	For doors that do not close precisely	LS-XFG-ZBZ
LS-XNG-ZBZ 	Flat, compensating actuator	Increased tolerance in closing direction for inaccurately closing doors	LS-XNG-ZBZ
LS-XNW-ZBZ 	Angled, compensating actuator	Increased tolerance in closing direction for inaccurately closing doors	LS-XNW-ZBZ

Notes

① Switch body ordered separately, see **Page V8-T1-7**.

② For mounting instructions, see **Page V8-T1-10**.

Technical Data and Specifications

LS-Titan Safety Interlock Switches

	Units		LS...ZBZ	LS...ZB	LS4...ZB
General					
Standards			IEC/EN 60947	IEC/EN 60947	IEC/EN 60947
Climatic proofing			①	①	①
Ambient temperature	°C		-25... +0	-25... +70	-25... +70
Mounting position			As required	As required	As required
Protection type			IP65	IP65	IP65
Terminal capacities					
Solid	mm ²		1 x (0.75–2.5)/2 x (0.75–1.5)	1 x (0.75–2.5)/2 x (0.75–1.5)	1 x (0.75–2.5)/2 x (0.75–1.5)
Flexible with ferrule	mm ²		1 x (0.75–2.5)/2 x (0.75–1.5)	1 x (0.75–2.5)/2 x (0.75–1.5)	1 x (0.75–2.5)/2 x (0.75–1.5)
Contacts/Switching Capacity					
Rated impulse withstand voltage	U _{imp}	Vac	4000	6000	6000
Rated insulation voltage	U _i	V	400	500	500
Overvoltage category/pollution degree			III/3	III/3	III/3
Burden Current					
AC-15					
24V	I _e	A	6	10	10
230V/240V	I _e	A	6	6	6
400V/415V	I _e	A	4	4	4
DC-13					
24V	I _e	A	3	3	3
110V	I _e	A	0.8	0.8	0.8
220V	I _e	A	0.3	0.3	0.3
Supply frequency		Hz	max. 400	max. 400	max. 400
Short-circuit rating to IEC/EN 60947-5-1 Max. fuse		A gG/gL	6	6	6
Repetition accuracy		mm	± 0.02	± 0.02	± 0.02
Mechanical Variables					
Lifespan					
Standard-action contact	Operations	x 10 ⁶	1	10	10
Snap-action contact	Operations	x 10 ⁶	—	—	—
Mechanical shock resistance (half-sinusoidal shock, 20 ms)					
Standard-action contact		g	10	25	5
Snap-action contact		g	—	—	—
Operating frequency	Operations/h		≤ 800	≤ 1800	≤ 1800
Actuation					
Mechanical					
Actuating force at beginning/end of stroke					
ZB/ZBZ (push in/pull out)		N	25/15	10/5	15/20
Mechanical holding force according to GS-ET-19 (04/2004)					
XG, XW		N	1500	N/A	N/A
XFF, XNG, XWA		N	1300	N/A	N/A
XF		N	750	N/A	N/A
XNW		N	500	N/A	N/A
Electromechanical					
For magnet					
Power consumption					
at 120 Vac		VA	8	N/A	N/A
at 230 Vac		VA	11	N/A	N/A
at 24 Vdc		W	8	N/A	N/A
Pickup and dropout values		x U _s	0.85–1.1	N/A	N/A
Magnet duty factor		% ED	100	N/A	N/A

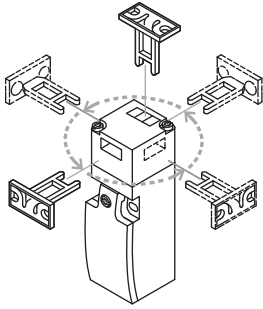
Note

① Damp heat, constant, to IEC 60068-2-78; damp heat, cyclical, to IEC 60068-2-30.

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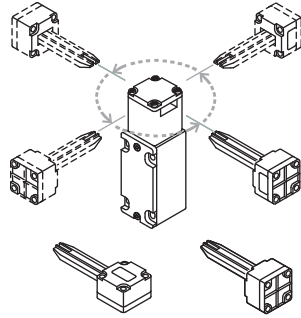
Mounting Instructions

LS-...ZB, TKG, TS



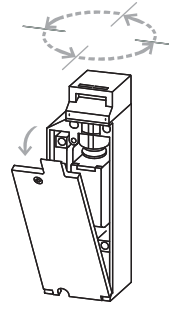
Actuator can be repositioned for horizontal or vertical installation. The operating heads can be rotated manually in 90° steps to suit the specified direction of operation.

LS4-...ZB

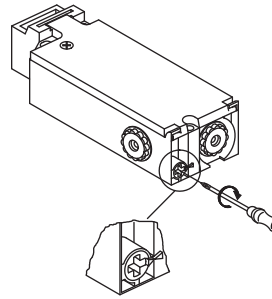


Actuator can be repositioned for horizontal or vertical installation. The operating heads can be rotated manually in 90° steps to suit the specified direction of operation.

LS-...ZBZ



The operating head can be rotated manually in 90° steps to suit the specified level of actuation.



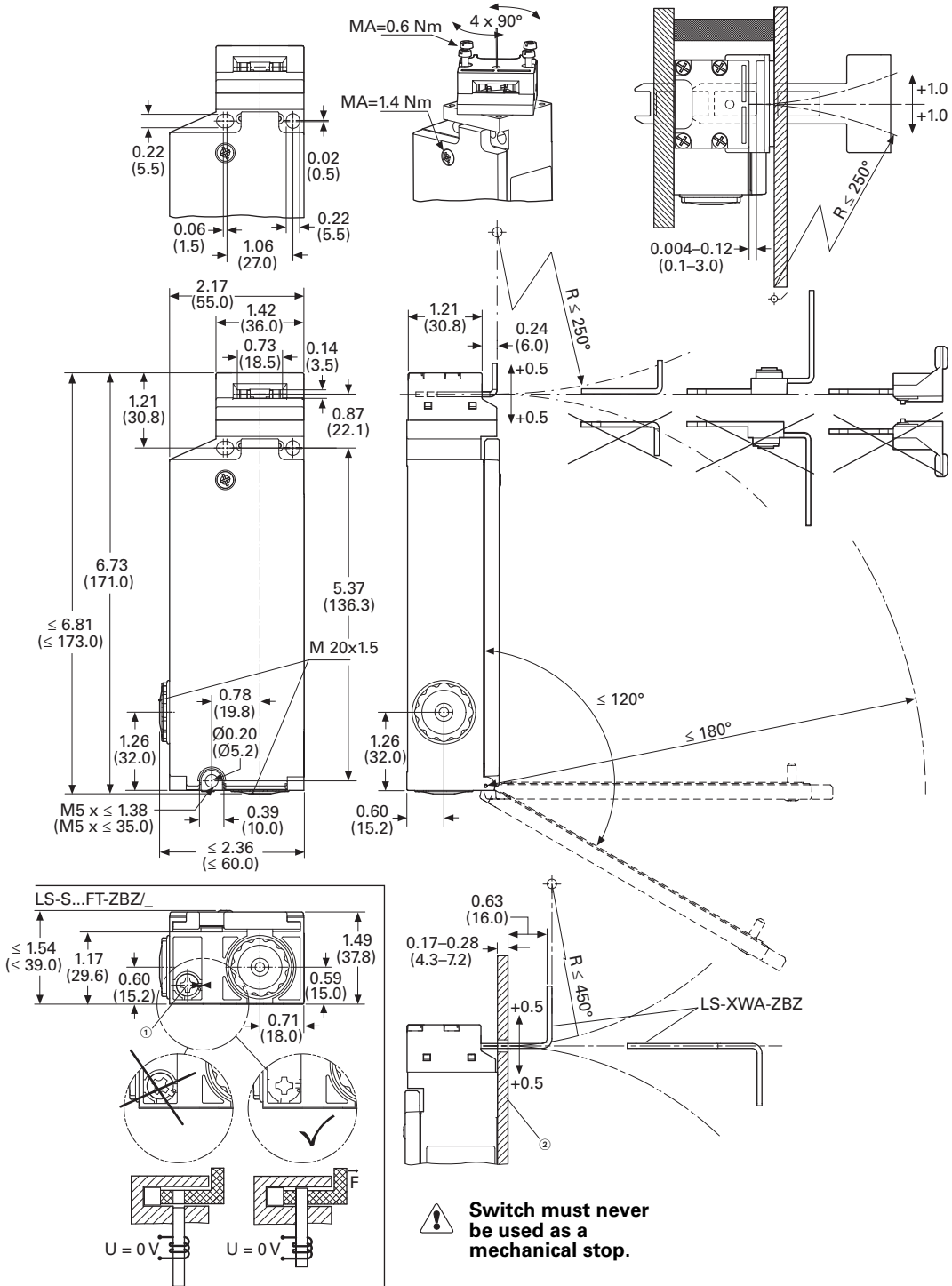
In the event of a loss of voltage, (for example, during commissioning), the spring-powered LS-...-...FT-ZBZ can be released with a screwdriver. **The auxiliary release mechanism must be sealed.**

Dimensions

Approximate Dimensions in Inches (mm)

Safety Position Switches

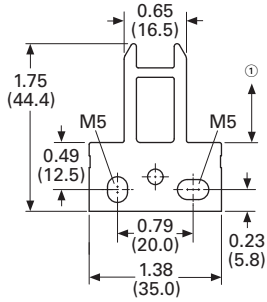
LS...ZB



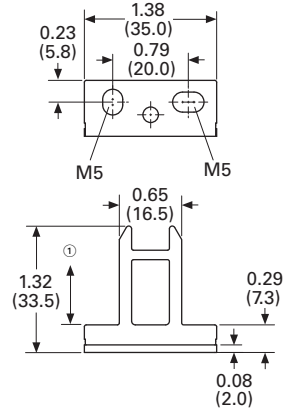
Approximate Dimensions in Inches (mm)

Actuators

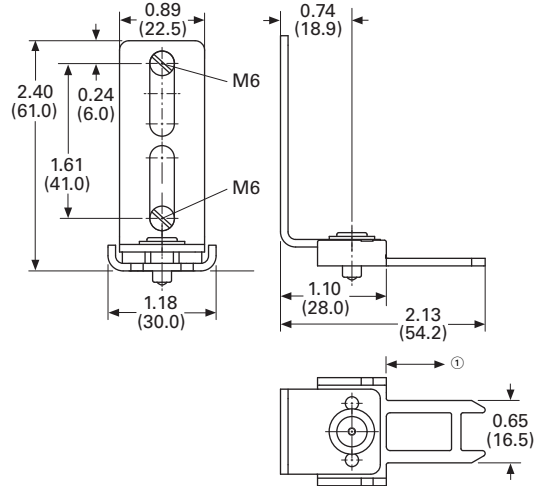
LS-XG-ZBZ



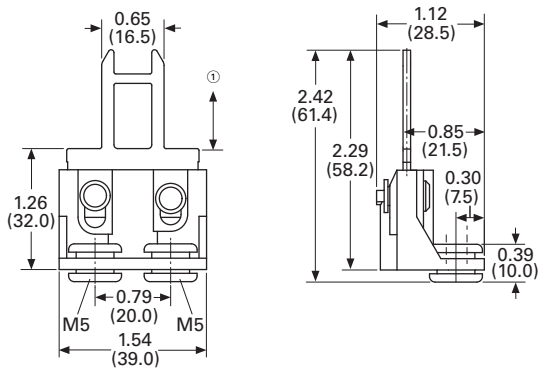
LS-XW-ZBZ



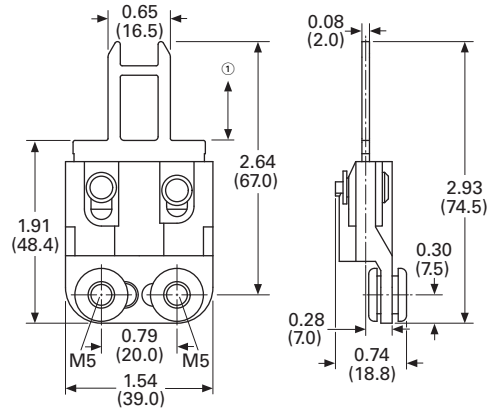
LS-XF-ZBZ



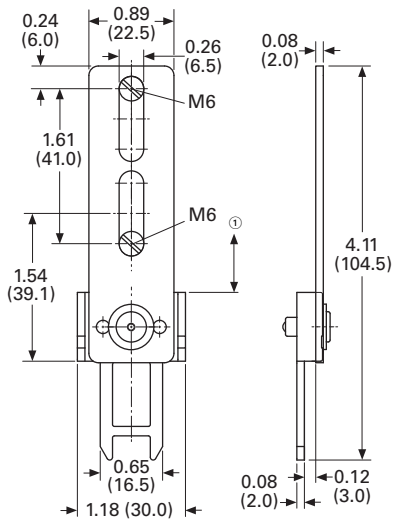
LS-XNW-ZBZ^②



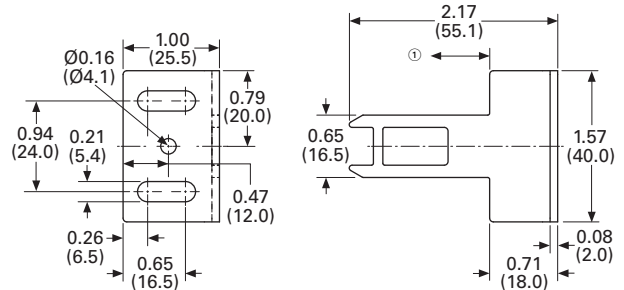
LS-XNG-ZBZ^②



LS-XFG-ZBZ



LS-XWA-ZBZ^③



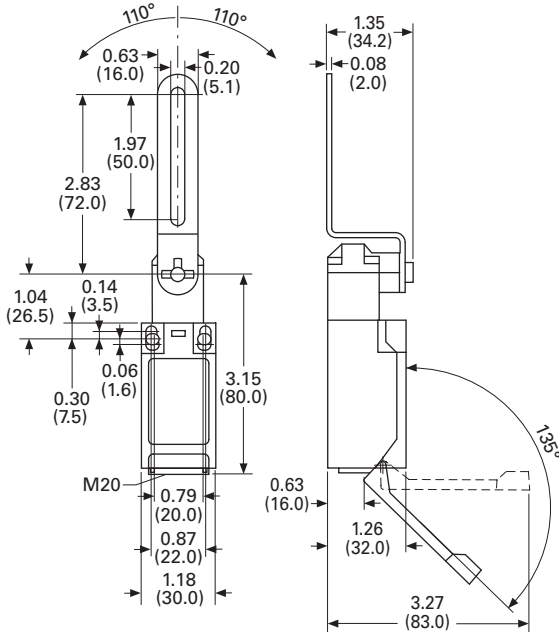
Notes

- ① Distance to device head = 0.1–3.0 mm.
- ② Fixing only allowed with M5 fixing screw and washer according to DIN EN ISO 7093.
- ③ Pin with a 4 mm pin after mounting.

Approximate Dimensions in Inches (mm)

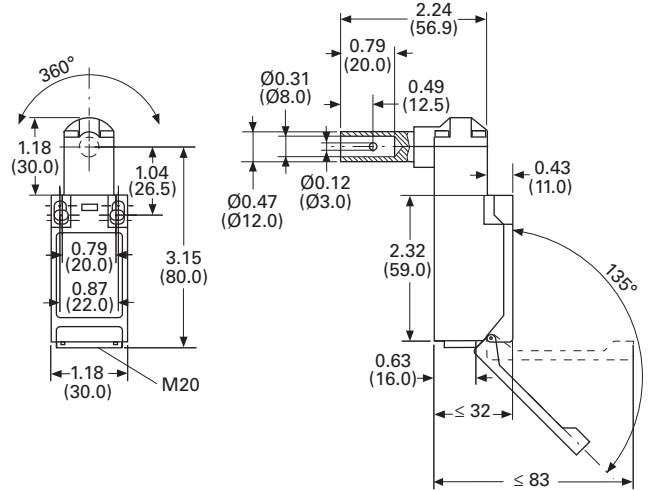
Safety Door Flap Switch

LSR-.../TKG



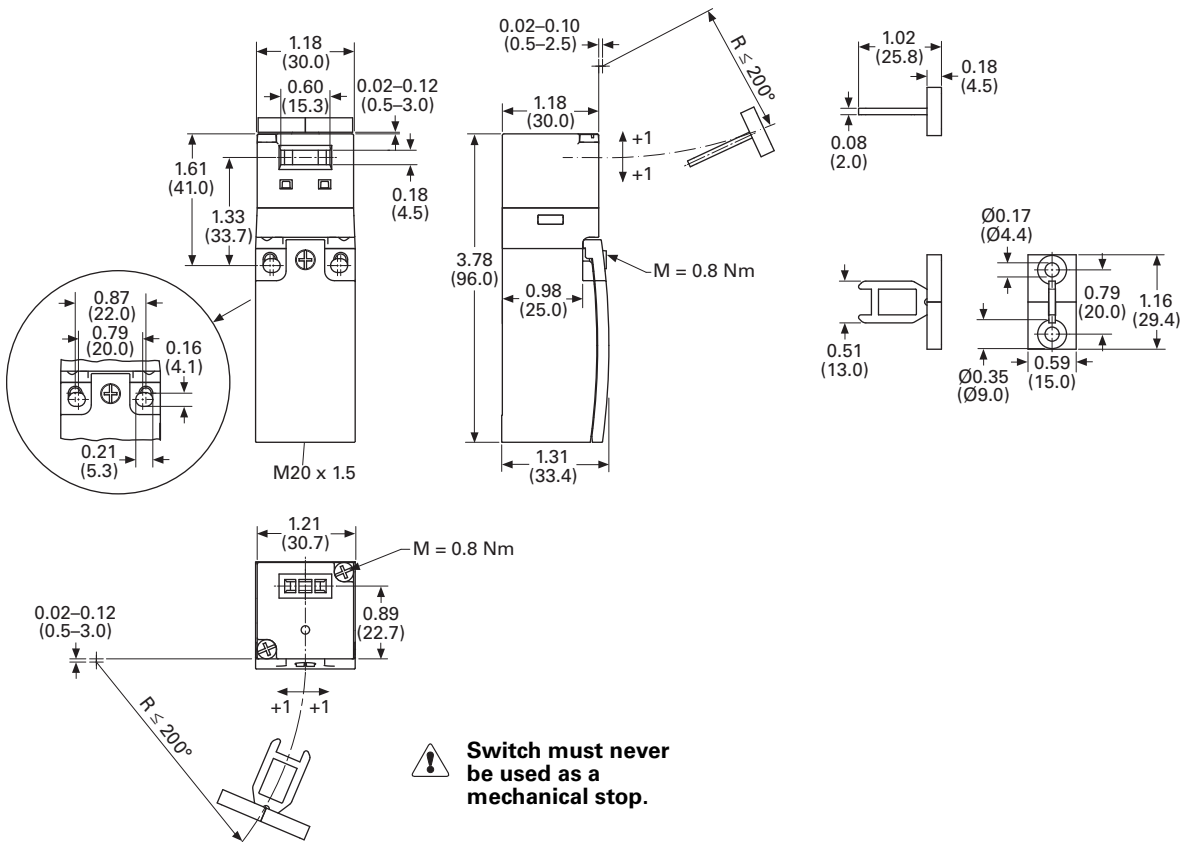
Safety Hinge Switch

LSR-.../TS



Safety Position Switches

LS-...-ZB



1.1

Safety Products

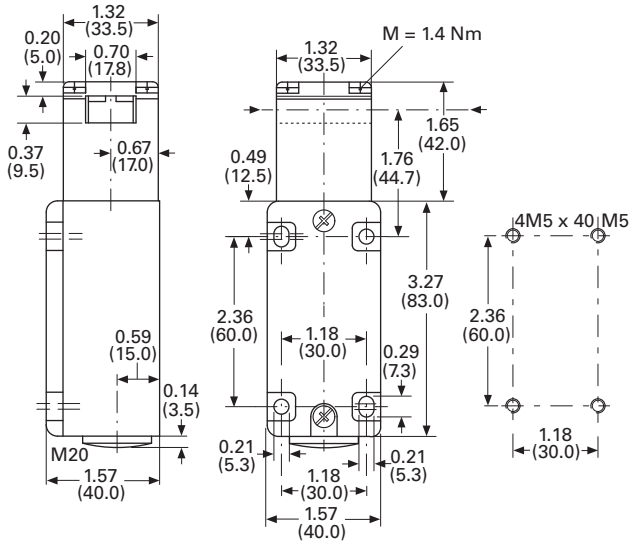
LS-Titan Safety Interlock Switches

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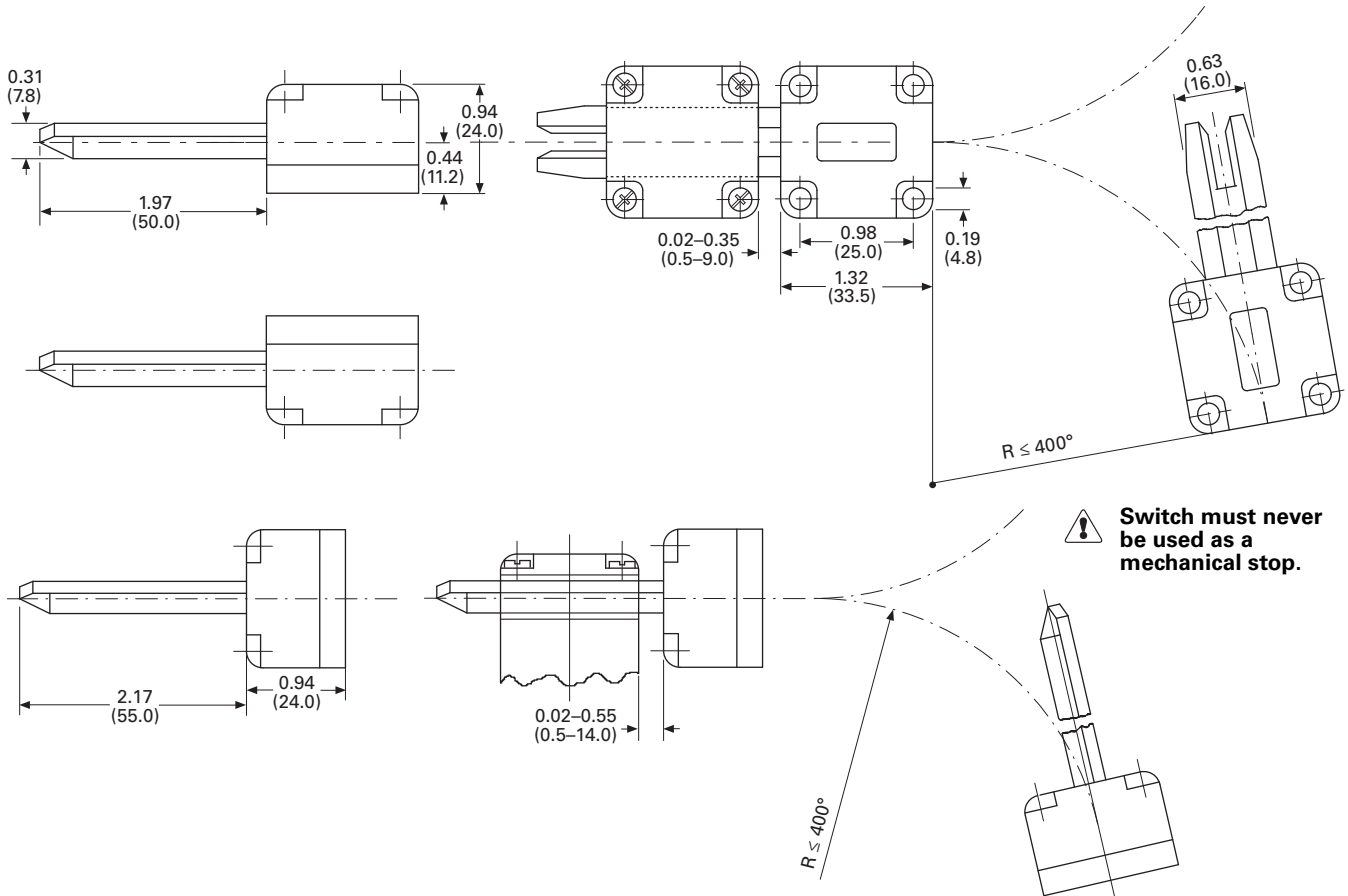
Approximate Dimensions in Inches (mm)

Safety Position Switches

LS4...ZB



Actuator—Included with Switch Above



RS Safety Interlock Switches



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Description

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RS Safety Interlock Switches

Product Description

Eaton’s RS safety interlock switches have been specifically designed for monitoring of protective guards, such as doors, flaps and hoods. All switches in this family are safety-rated and use magnetically coded actuators to minimize defeat by simple magnets. With correct installation, the RS family complies with EN ISO 13849-1 and IEC 62061 guidelines.

Operation

The RS safety interlock family is comprised of three series: RS2, RS2R and RS4. The assembly comprises a sensor component and a separate magnet actuator component. The sensor is typically mounted to a stationary portion of a structure and the magnet to a movable portion. When the sensor and the actuator are within operating range, the NC contacts will be closed and the NO contacts will be open.

Features

- Non-contact actuation
- Reversible mounting
- High misalignment tolerance
- Up to SIL 3 and up to PLe ratings
- –10 to +55°C temperature range
- IP67

Standards and Certifications


- IEC 61508
- ISO 13849
- EN 1088
- cUL
- CE
- TÜV



Safety Notes

Do not use as a mechanical stop/shipping brace.

Any change to an original Eaton safety position switch is not permitted and automatically leads to the loss of all approvals.

 **Switch must never be used as a mechanical stop.**

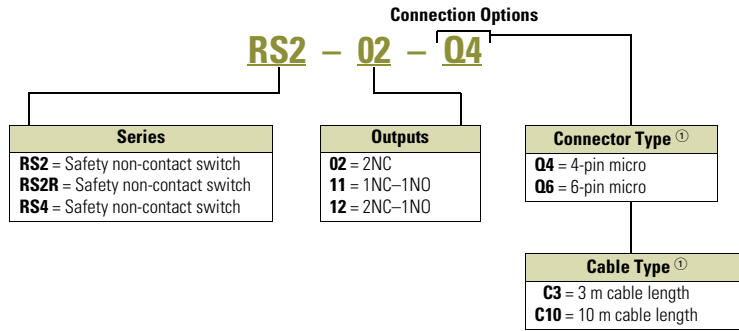
For the most current information on this product, visit our Web site: www.eaton.com

For Customer Service in the U.S. call 1-877-ETN CARE (386-2273), in Canada call 1-800-268-3578. For Application Assistance in the U.S. and Canada call 1-800-426-9184.

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Catalog Number Selection

RS2 Safety Non-Contact Switch





Note

^① For cable, replace **Q4** or **Q6** connector with **C3** or **C10** cable in catalog number.

Product Selection


RS2 Safety Interlock Switches

RS2—Standard Models

	Outputs	Description	Catalog Number
RS2 DC Connector Style 	2NC	4-pin micro connector	RS2-02-Q4
	1NC–1NO	4-pin micro connector	RS2-11-Q4
	2NC–1NO	6-pin micro connector, dual key	RS2-12-Q6
RS2 DC Cable Style 	2NC	3 m cable length	RS2-02-C3
	1NC–1NO	3 m cable length	RS2-11-C3
	2NC–1NO	3 m cable length	RS2-12-C3
	2NC	10 m cable length	RS2-02-C10
	1NC–1NO	10 m cable length	RS2-11-C10
	2NC–1NO	10 m cable length	RS2-12-C10

RS2 SmartWire-DT™ Compatible Models

RS2—Standard Models, SmartWire-DT Compatible

	Outputs	Description	Catalog Number
RS2 SmartWire-DT Compatible 	2NC	150 mm SmartWire-DT connector	RS2-02-Q4-SWD
	1NC–1NO	150 mm SmartWire-DT connector	RS2-11-Q4-SWD

RS2R Safety Interlock Switches

RS2R Connector



RS2R—Standard Models

Outputs	Description	Catalog Number
2NC	150 mm 4-pin micro connector	RS2R-02-Q4
1NO-1NC	150 mm 4-pin micro connector	RS2R-11-Q4
1NO-2NC	150 mm 6-pin micro connector, dual key	RS2R-12-Q6
2NC	3 m cable length	RS2R-02-C3
1NO-1NC	3 m cable length	RS2R-11-C3
1NO-2NC	3 m cable length	RS2R-12-C3

RS2R SmartWire-DT Compatible Models

RS2R SmartWire-DT Compatible



RS2R—Standard Models, SmartWire-DT Compatible

Outputs	Description	Catalog Number
2NC	150 mm SmartWire-DT connector	RS2R-02-Q4-SWD
1NC-1NO	150 mm SmartWire-DT connector	RS2R-11-Q4-SWD

RS4 Safety Interlock Switches

RS4 Connector



RS4—Standard Models

Outputs	Description	Catalog Number
2NC	150 mm 4-pin micro connector	RS4-02-Q4
1NO-2NC	150 mm 6-pin micro connector, dual key	RS4-12-Q6

RS4 SmartWire-DT Compatible Models

RS4 SmartWire-DT Compatible



RS4—Standard Models, SmartWire-DT Compatible

Outputs	Description	Catalog Number
2NC	150 mm SmartWire-DT connector	RS4-02-Q4-SWD

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Recommended Logic Interfaces

ESR5



- Use for the highest safety requirements in accordance with EN ISO 13849-1, IEC 62061 and EC 61508
- Suitable for the global market with UL, cUL certifications and TÜV Rhineland functional safety certifications
- Applicable for EN 60204 stop categories 0 or 1
- Plug-in screw terminals for fast and fault-free replacement
- Multi-voltage versions

ESR5 Safety Relays

Safety Inputs	Safety Outputs (NO)	Power Supply	Catalog Number
1	4	24 Vac/Vdc	ESR5-NO-41-24VAC-DC
2	2	24 Vac/Vdc	ESR5-NO-21-24VAC-DC
2	3	24 Vac/Vdc	ESR5-NO-31-24VAC-DC
2	3	240 Vac	ESR5-NO-31-230VAC
2	3	24–230 Vac/Vdc	ESR5-NO-31-AC-DC

Accessories

RS Safety Interlock Switches

Description	Catalog Number
RS2 spare actuator	RS2-A

easySafety



- All-in-one—safety and control functions combined in one device
- Simple configuration through prefabricated and tested safety components
- Direct state display and increased machine availability due to fast error diagnosis through integrated display
- Multistep password concept prevents unwanted manipulation

easySafety

Safety Inputs	Safety Outputs (NO)	Reset Type	Power Supply	Catalog Number
14	1 (6 A relay), 4 (transistor)		24 Vdc	ES4P-221-DMXD1
14	4 (6 A relay)		24 Vdc	ES4P-221-DRXD1

Cordset

4-Pin Connectors

Description	Catalog Number
2 m cable	CSDS4A4CY2202
5 m cable	CSDS4A4CY2205
10 m cable	CSDS4A4CY2210
20 m cable	CSDS4A4CY2220

6-Pin Connectors

Description	Catalog Number
3 m cable	CSAS6A6CY2203
5 m cable	CSAS6A6CY2205

Technical Data and Specifications

RS Safety Interlock Switches

Description	RS2/RS2R/RS4 Specification
Safety classification	Up to SIL 3, IEC 61508
Outputs	NO and NC circuit combinations
Sensing range	On: 8 mm / Off: 19 mm
Enclosure rating	IP67, IP69K
Output switching	300 mA at 24 Vdc
Operating voltage	24 Vdc
Temperature range	-10° to +55°C (14° to 131°F)
Shock	30 G, 11 ms, 1/2 sine wave
Vibration	1 mm, 0-2000 Hz
Radio frequency immunity	IEC 61000-4-3
Repeat accuracy	10%
Housing material	Polyamide
Actuator material	Polyamide
Color	Black/yellow
Connection types	Cable and micro connector (4-pin or 6-pin)
Wire size	22 AWG
Standards and certifications	CULUS UL 508 Type 1, CSA 22.2 no.14
B10d	15,000,000
Contact response time	3 ms
Maintenance schedule	≤6 months

Wire Colors—RS2, RS2R and RS4 Models

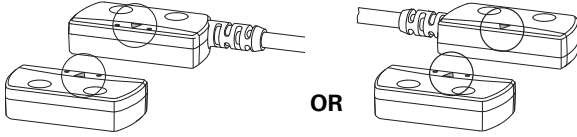
Description	2NC	2NC-1NO (SAF3 NO)	1NC-1NO (SAF2 NO)
4-pin micro		—	
6-pin micro (dual key)	—		—
SmartWire-DT		—	
Cordset (4-pin)			
Cordset (6-pin)			

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Mounting Instructions

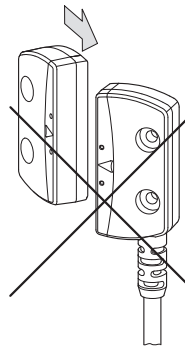
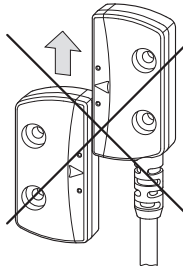
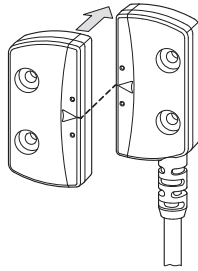
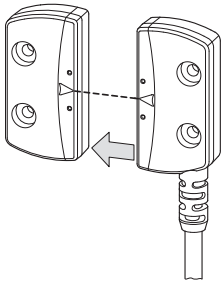
Reversible

The RS family has reversible mounting to adjust to field wiring needs.



Alignment

Direction of approach is perpendicular to the plane of the sensing face.

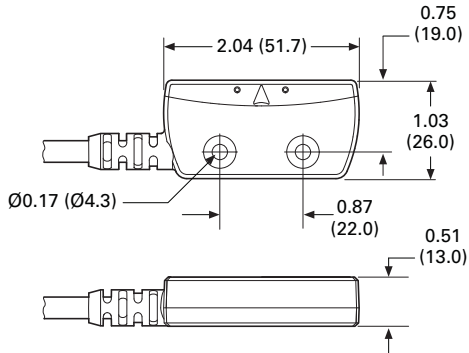


Dimensions

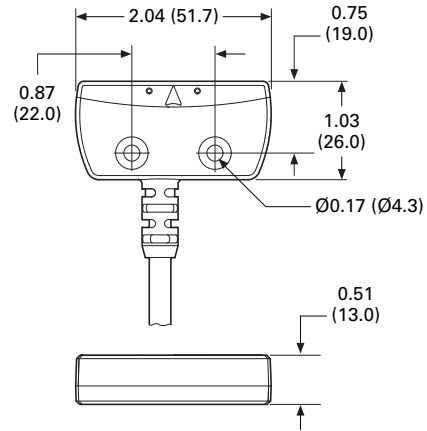
Approximate Dimensions in Inches (mm)

RS Safety Interlock Switches

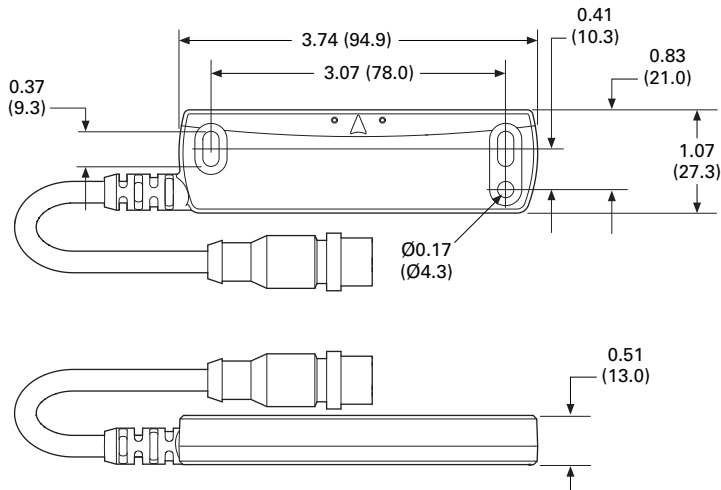
RS2



RS2R



RS4



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Safety Products

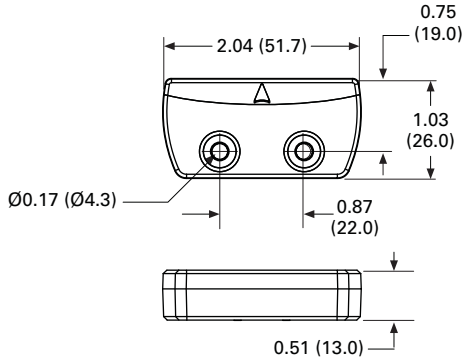
RS Safety Interlock Switches

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Approximate Dimensions in Inches (mm)

RS Safety Interlock Actuators

RS2A



RS4A

