LS-Titan Miniature DIN Switches

LS-Titan Safety Interlock Switches

## 46.3 LS-Titan Miniature DIN Switches


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## 45.1 LS-Titan Safety Interlock Switches


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**Note:** Supplement to Volume 8—Sensing Solutions, CA08100010E, Tabs 46 and 45.

LS-Titan Miniature DIN Switches

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## LS-Titan Miniature DIN Switches

### Product Description

Eaton's LS-Titan™ limit switch line is a complete offering of safety position switches designed for worldwide application. Economical insulated plastic or rugged metal enclosures and modular, plug-in operating heads and bodies make LS-Titan a flexible switching solution.

A highlight of the LS-Titan switch line is the world's first electronic position switch (LSE models). These switches feature freely programmable operating points that can be set individually at any time. Additional LSE models provide analog outputs proportional to the actuator position.

LS-Titan switches are suitable for use in safety applications designed to protect persons or processes.

### Features

- Modular, plug-in system (head and body components)
- Positive opening NC contacts for safety applications
- Wide variety of economical plastic and rugged metal versions available
- Operating heads can be rotated 90 degrees to suit specific direction of operation
- Unique electronic safety position switches (LSE models) provide analog (0–10 Vdc or 4–20 mA) outputs proportional to the actuator position and allow for easy configuration of a custom trip point
- Can be ordered as separate components (head and body) or as completely assembled switches
- Screw and Cage Clamp® (standard on LSE models and optionally available on mechanical models) connections provide larger wiring areas for easier installation
- Approved for worldwide application

### Standards and Certifications

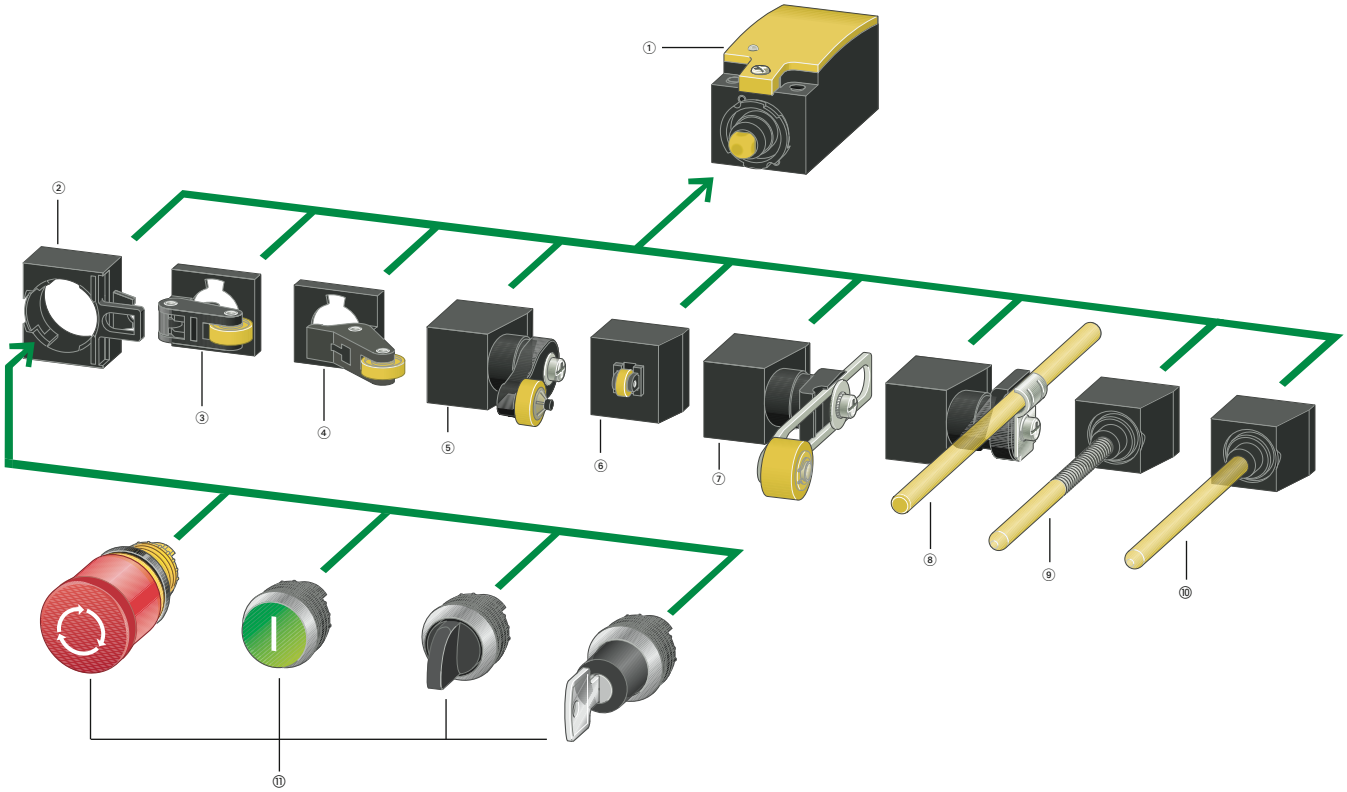
- Safety function by positive opening contacts per IEC/EN 60947-5-1 up to Category 4 per EN 954-1
- TÜV-Rheinland Certified for Functional-Safety (LSE models)
- CSA® certified
- UL® listed
- CE
- CCC

Listed

**Note:** Cage Clamp is a registered trademark of Wago Kontakttechnik, 32423 Minden, Germany.

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

## Product Identification




***Notes***

① **Basic device** (see **Pages 4**–**12**)
According to EN 50047
With screw-on cover
Contacts: 1NO-1NC, 2NO, 2NC
Cage Clamp, screw terminal
As snap-action or standard-action switch
As electronic snap-action switch (individually adjustable)
As 4–20 mA analog signal encoder
As 0–10 Vdc analog signal encoder

② **Fixing adapter** (see **Page 14**)
Allows mounting of M22 pushbuttons

③ **Roller lever** (see **Pages 4** and **7**)
For one-sided operation with higher operating speed

④ **Angled roller lever** (see **Pages 4**, **7** and **11**)
For actuation along the unit axis

⑤ **Rotary lever** (see **Pages 4**, **8** and **11**)
For actuation from the side, for pendulum movements

⑥ **Roller plunger** (see **Pages 4**, **7** and **11**)
For actuation from the side with low actuating force

⑦ **Adjustable roller lever** (see **Pages 5**, **8**, **9** and **11**)
For length adjustment as required

⑧ **Actuating rod** (see **Pages 6**, **10** and **12**)
On conveyor belts for lightweight goods

⑨ **Spring-rod** (see **Pages 6**, **10** and **12**)
For flexible actuation from all sides

j **Actuating rod** (see **Pages 6**, **10** and **12**)
Withdrawable mechanism from front

k Pushbuttons from the M22 family; see M22 catalog (CA04716001E) or www.eaton.com/m22

***Operating heads can be rotated by 90 degrees.***

## Product Selection

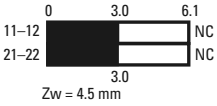
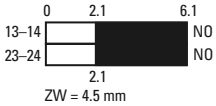
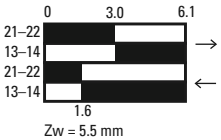


### *LS-Titan Plastic Safety Switches*

**Plastic Safety Switch Body**

**Assembled Switch**

### Plastic Safety Switches

| | | | |
|---|---|---|---|
| **Switch Body Catalog Number** | **LS-S02** | **LS-S20A** | **LS-S11S** |
| **Output Function** | 2NC with positive opening contacts | 2NO with slow make/break | 1NO and 1NC with positive opening contact |
| **Terminal Connection** | Screw terminal ① | Screw terminal ① | Screw terminal ① |
| **Contact Sequence** | | | |
| **Contact Travel** ■ = contact closed □ = contact open |   |   | Snap-action contact   |
| **Operating Head Type** ② | | | |
| **Head Only Catalog Number** / **Assembled Switch Catalog Number** | | | |
| **Top Push Roller Plunger** | **LS-XP** | **LS-S02-P** | **LS-S20A-P** | **LS-S11S-P** |
| **Long Roller Lever** | **LS-XL** | **LS-S02-L** | **LS-S20A-L** | **LS-S11S-L** |
| **Short Roller Lever** | **LS-XLS** | **LS-S02-LS** | **LS-S20A-LS** | **LS-S11S-LS** |
| **Large Roller Lever** | **LS-XLB** | **LS-S02-LB** | **LS-S20A-LB** | **LS-S11S-LB** |
| **Angled Roller** | **LS-XLA** | **LS-S02-LA** | **LS-S20A-LA** | **LS-S11S-LA** |
| **Rotary Lever** | **LS-XRL** | **LS-S02-RL** | **LS-S20A-RL** | **LS-S11S-RL** |

***Notes***

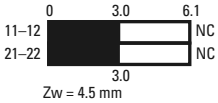
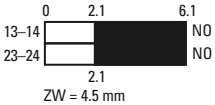
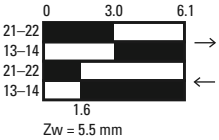
① Cage Clamp versions available. Contact Application Engineering.

② For operating head dimensions, see **Page 21**.

## Plastic Safety Switches, continued

**Plastic Safety Switch Body**

**Assembled Switch**

| Switch Body Catalog Number | LS-S02 | LS-S20A | LS-S11S |
|---|---|---|---|
| Output Function | 2NC with positive opening contacts | 2NO with slow make/break | 1NO and 1NC with positive opening contact |
| Terminal Connection | Screw terminal ① | Screw terminal ① | Screw terminal ① |
| Contact Sequence | | | |
| Contact Travel<br>■ = contact closed<br>□ = contact open |  |  | Snap-action contact<br>  |
| | Zw = 4.5 mm | ZW = 4.5 mm | Zw = 5.5 mm |

**Operating Head Type** ②

| Head Only Catalog Number | Assembled Switch Catalog Number | | |
|---|---|---|---|
| **Adjustable Roller Lever (with 18 mm Roller)** | LS-XRLA | LS-S02-RLA | LS-S20A-RLA | LS-S11S-RLA |
| **Adjustable Roller Lever (with 30 mm Roller)** | LS-XRLA30 | LS-S02-RLA30 | LS-S20A-RLA30 | LS-S11S-RLA30 |
| **Adjustable Roller Lever (with 40 mm Roller)** | LS-XRLA40 | LS-S02-RLA40 | LS-S20A-RLA40 | LS-S11S-RLA40 |
| **Adjustable Roller Lever (with 40 mm Rubber Roller)** | LS-XRLA40R | LS-S02-RLA40R | LS-S20A-RLA40R | LS-S11S-RLA40R |

***Notes***

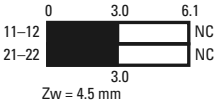
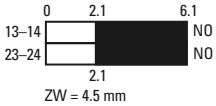
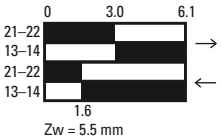
① Cage Clamp versions available. Contact Application Engineering.

② For operating head dimensions, see **Page 21**.

## Plastic Safety Switches, continued

**Plastic Safety Switch Body**

**Assembled Switch**

| **Switch Body Catalog Number** | **LS-S02** | **LS-S20A** | **LS-S11S** |
|---|---|---|---|
| **Output Function** | 2NC with positive opening contacts | 2NO with slow make/break | 1NO and 1NC with positive opening contact |
| **Terminal Connection** | Screw terminal ① | Screw terminal ① | Screw terminal ① |
| **Contact Sequence** | | | |
| **Contact Travel** ■ = contact closed □ = contact open |   |   | Snap-action contact   |
| **Operating Head Type** ② | | | |
| **Head Only Catalog Number** / **Assembled Switch Catalog Number** | | | |
| **Plastic Rod Lever** | **LS-XRR** | **LS-S02-RR** | **LS-S20A-RR** | **LS-S11S-RR** |
| **Metal Rod** | **LS-XRRM** | **LS-S02-RRM** | **LS-S20A-RRM** | **LS-S11S-RRM** |
| **Spring Rod (Wobble)** ③ | **LS-XS** | **LS-S02-S** | **LS-S20A-S** | **LS-S11S-S** |
| **Actuating Rod** | **LS-XOR** | **LS-S02-OR** | **LS-S20A-OR** | **LS-S11S-OR** |

***Notes***

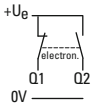
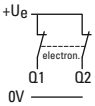
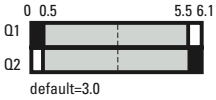
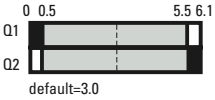
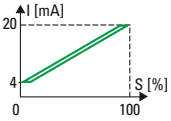
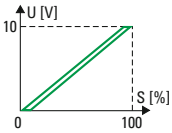
① Cage Clamp versions available. Contact Application Engineering.
② For operating head dimensions, see **Page 21**.
③ Not to be used as a safety position switch. Use only in conjunction with snap-action contact.

*LS-Titan Plastic Electronic Safety Position Switches*

## Plastic Electronic Safety Position Switches

**Plastic Electronic Safety Position Switch Body**

**Assembled Switch**

| Switch Body Catalog Number | LSE-11 | LSE-02 | LSE-AI | LSE-AU |
|---|---|---|---|---|
| Output Function | 1NO and 1 NC | 2NC | Analog 4–20 mA | Analog 0–10V |
| Terminal Connections | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① |
| Safety Functions and Approvals | These models may be used in safety-oriented circuits. Visual status LED indication is comparable to positive opening contacts. Certified by TÜV as a "Functional-Safety" device. Suitable for protection of people or processes. | | Additional diagnostic output that registers a 0V signal in the event of a fault. Self-test function continuously tests both outputs for overloads, short circuits to 0V and short circuits to $+U_e$. Certified by TÜV to EN 954-1, Category 3 or 4. Suitable for protection of people or processes. | |
| Contact Sequence |  |  | Analog 4–20 mA | Analog 0–10V |
| Contact Travel ■ = contact closed □ = contact open |  |  |  |  |









**Operating Head Type** ②

| | Head Only Catalog Number | Assembled Switch Catalog Number | | | |
|---|---|---|---|---|---|
| **Top Push Roller Plunger** | LS-XP | LSE-11-P | LSE-02-P | LSE-AI-P | LSE-AU-P |
| **Long Roller Lever** | LS-XL | LSE-11-L | LSE-02-L | LSE-AI-L | LSE-AU-L |
| **Short Roller Lever** | LS-XLS | LSE-11-LS | LSE-02-LS | LSE-AI-LS | LSE-AU-LS |
| **Large Roller Lever** | LS-XLB | LSE-11-LB | LSE-02-LB | LSE-AI-LB | LSE-AU-LB |
| **Angled Roller** | LS-XLA | LSE-11-LA | LSE-02-LA | LSE-AI-LA | LSE-AU-LA |

***Notes***

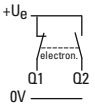
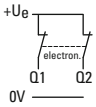
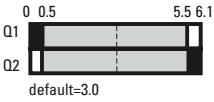
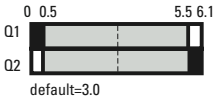
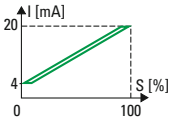
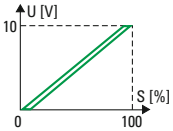
① A compatible Cage Clamp tool is available as an accessory on **Page 14**.

② For operating head dimensions, see **Page 21**.

## Plastic Electronic Safety Position Switches, continued

**Plastic Electronic Safety Position Switch Body**

**Assembled Switch**

| Switch Body Catalog Number | LSE-11 | LSE-02 | LSE-AI | LSE-AU |
|---|---|---|---|---|
| **Output Function** | 1NO and 1NC | 2NC | Analog 4–20 mA | Analog 0–10V |
| **Terminal Connections** | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① |
| **Safety Functions and Approvals** | These models may be used in safety-oriented circuits. Visual status LED indication is comparable to positive opening contacts. Certified by TÜV as a "Functional-Safety" device. Suitable for protection of people or processes. | | Additional diagnostic output that registers a 0V signal in the event of a fault. Self-test function continuously tests both outputs for overloads, short circuits to 0V and short circuits to $+U_e$. Certified by TÜV to EN 954-1, Category 3 or 4. Suitable for protection of people or processes. | |
| **Contact Sequence** |  |  | Analog 4–20 mA | Analog 0–10V |
| **Contact Travel** ■ = contact closed □ = contact open |  |  |  |  |









**Operating Head Type** ②

| Head Only Catalog Number | Assembled Switch Catalog Number | | | |
|---|---|---|---|---|
| **Rotary Lever** | LS-XRL | LSE-11-RL | LSE-02-RL | LSE-AI-RL | LSE-AU-RL |
| **Adjustable Roller Lever (with 18 mm Roller)** | LS-XRLA | LSE-11-RLA | LSE-02-RLA | LSE-AI-RLA | LSE-AU-RLA |
| **Adjustable Roller Lever (With 30 mm Roller)** | LS-XRLA30 | LSE-11-RLA30 | LSE-02-RLA30 | LSE-AI-RLA30 | LSE-AU-RLA30 |

***Notes***

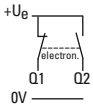
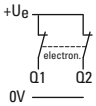
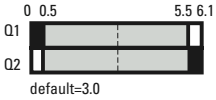
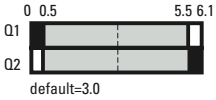
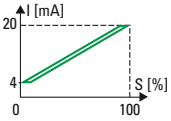
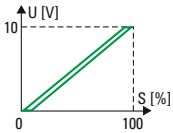
① A compatible Cage Clamp tool is available as an accessory on **Page 14**.

② For operating head dimensions, see **Page 21**.

## Plastic Electronic Safety Position Switches, continued

**Plastic Electronic Safety Position Switch Body**

**Assembled Switch**

| Switch Body Catalog Number | LSE-11 | LSE-02 | LSE-AI | LSE-AU |
|---|---|---|---|---|
| **Output Function** | 1NO and 1NC | 2NC | Analog 4–20 mA | Analog 0–10V |
| **Terminal Connections** | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① |
| **Safety Functions and Approvals** | These models may be used in safety-oriented circuits. Visual status LED indication is comparable to positive opening contacts. Certified by TÜV as a "Functional-Safety" device. Suitable for protection of people or processes. | | Additional diagnostic output that registers a 0V signal in the event of a fault. Self-test function continuously tests both outputs for overloads, short circuits to 0V and short circuits to $+U_e$. Certified by TÜV to EN 954-1, Category 3 or 4. Suitable for protection of people or processes. | |
| **Contact Sequence** |  |  | Analog 4–20 mA | Analog 0–10V |
| **Contact Travel** ■ = contact closed □ = contact open |  |  |  |  |









**Operating Head Type** ②

| Head Only Catalog Number | Assembled Switch Catalog Number | | | |
|---|---|---|---|---|
| **Adjustable Roller Lever (With 40 mm Roller)** | | | | |
| LS-XRLA40 | LSE-11-RLA40 | LSE-02-RLA40 | LSE-AI-RLA40 | LSE-AU-RLA40 |
| **Adjustable Roller Lever (With 40 mm Roller)** | | | | |
| LS-XRLA40R | LSE-11-RLA40R | LSE-02-RLA40R | LSE-AI-RLA40R | LSE-AU-RLA40R |
| **Plastic Rod Lever** | | | | |
| LS-XRR | LSE-11-RR | LSE-02-RR | LSE-AI-RR | LSE-AU-RR |

***Notes***

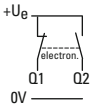
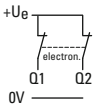
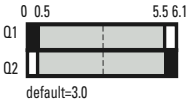
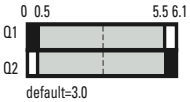
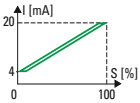
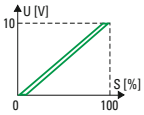
① A compatible Cage Clamp tool is available as an accessory on **Page 14**.

② For operating head dimensions, see **Page 21**.

## Plastic Electronic Safety Position Switches, continued

**Plastic Electronic Safety Position Switch Body**

**Assembled Switch**

| Switch Body Catalog Number | LSE-11 | LSE-02 | LSE-AI | LSE-AU |
|---|---|---|---|---|
| **Output Function** | 1NO and 1NC | 2NC | Analog 4–20 mA | Analog 0–10V |
| **Terminal Connections** | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① | Cage Clamp ① |
| **Safety Functions and Approvals** | These models may be used in safety-oriented circuits. Visual status LED indication is comparable to positive opening contacts. Certified by TÜV as a "Functional-Safety" device. Suitable for protection of people or processes. | | Additional diagnostic output that registers a 0V signal in the event of a fault. Self-test function continuously tests both outputs for overloads, short circuits to 0V and short circuits to $+U_e$. Certified by TÜV to EN 954-1, Category 3 or 4. Suitable for protection of people or processes. | |
| **Contact Sequence** |   |   | Analog 4–20 mA | Analog 0–10V |
| **Contact Travel** ■ = contact closed □ = contact open |   |   |   |   |

**Operating Head Type** ②

| Head Only Catalog Number | Assembled Switch Catalog Number | | | |
|---|---|---|---|---|
| **Metal Rod** | **LS-XRRM** | **LSE-11-RRM** | **LSE-02-RRM** | **LSE-AI-RRM** | **LSE-AU-RRM** |
| | | | | | |
| **Spring Rod (Wobble)** ③ | **LS-XS** | **LSE-11-S** | **LSE-02-S** | **LSE-AI-S** | **LSE-AU-S** |
| | | | | | |
| **Actuating Rod** | **LS-XOR** | **LSE-11-OR** | **LSE-02-OR** | **LSE-AI-OR** | **LSE-AU-OR** |
| | | | | | |

***Notes***

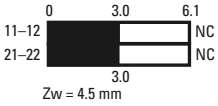
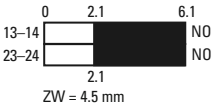
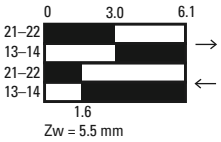
① A compatible Cage Clamp tool is available as an accessory on **Page 14**.
② For operating head dimensions, see **Page 21**.
③ Not to be used as a safety position switch. Use only in conjunction with snap-action contact.

### *LS-Titan Metal Safety Switches*

**Metal Safety Switch Body**

**Assembled Switch**

## Metal Safety Switches

| | | | |
|---|---|---|---|
| **Switch Body Catalog Number** | **LSM-02** | **LSM-20A** | **LSM-11S** |
| **Output Function** | 2NC with positive opening contacts | 2NO with slow make/break | 1NO and 1NC with positive opening contact |
| **Terminal Connection** | Cage Clamp | Cage Clamp | Cage Clamp |
| **Contact Sequence** | | | |
| **Contact Travel** ■ = contact closed □ = contact open |  |  | Snap-action contact  |
| **Operating Head Type** ① | | | |
| **Head Only Catalog Number** / **Assembled Switch Catalog Number** | | | |
| **Top Push Roller Plunger** | **LSM-XP** | **LSM-02-P** | **LSM-20A-P** | **LSM-11S-P** |
| **Long Roller Lever** | **LSM-XL** | **LSM-02-L** | **LSM-20A-L** | **LSM-11S-L** |
| **Angled Roller** | **LSM-XLA** | **LSM-02-LA** | **LSM-20A-LA** | **LSM-11S-LA** |
| **Rotary Lever** | **LSM-XRL** | **LSM-02-RL** | **LSM-20A-RL** | **LSM-11S-RL** |
| **Adjustable Roller Lever** | **LSM-XRLA** | **LSM-02-RLA** | **LSM-20A-RLA** | **LSM-11S-RLA** |

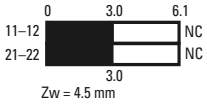
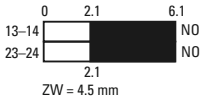
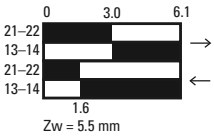
***Note***

① For operating head dimensions, see **Page 21**.

## Metal Safety Switches, continued

**Metal Safety Switch Body**

**Assembled Switch**

| | | | |
|---|---|---|---|
| **Switch Body Catalog Number** | **LSM-02** | **LSM-20A** | **LSM-11S** |
| **Output Function** | 2NC with positive opening contacts | 2NO with slow make/break | 1NO and 1NC with positive opening contact |
| **Terminal Connection** | Cage Clamp | Cage Clamp | Cage Clamp |
| **Contact Sequence** | | | |
| **Contact Travel** ■ = contact closed □ = contact open |  |  | Snap-action contact  |
| **Operating Head Type** ① | | | |
| **Head Only Catalog Number** | **Assembled Switch Catalog Number** | | |
| **Plastic Rod Lever** | **LSM-XRR** | **LSM-02-RR** | **LSM-20A-RR** | **LSM-11S-RR** |
| **Metal Rod Lever** | **LSM-XRRM** | **LSM-02-RRM** | **LSM-20A-RRM** | **LSM-11S-RRM** |
| **Spring Rod (Wobble)** | **LSM-XS** | **LSM-02-S** | **LSM-20A-S** | **LSM-11S-S** |

***Note***

① For operating head dimensions, see **Page 21**.

### *Understanding LS-Titan Electronic Safety Position Switches*

All four LS-Titan LSE switch bodies are safety-rated products. The LSE-11 and LSE-02 switch bodies both have a freely programmable operating point and can be individually adjusted to suit the application, and can be changed as often as required. These devices feature an LED on the body, providing simple indication during programming and operation.

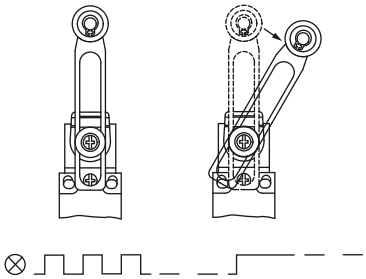
The LSE-AI (4–20 mA) and LSE-AU (0–10V) analog position switches take position data and convert to an analog current or voltage value that can then be continuously fed into an automation system. These two switches also feature a diagnostic output for additional data processing.

This ensures that a safe operating state can be monitored and evaluated at any time. A self-test function is also present on these models. Outputs Q1 and Q2 are continuously tested for overloads, short circuits to 0V and short circuits to $+U_e$.

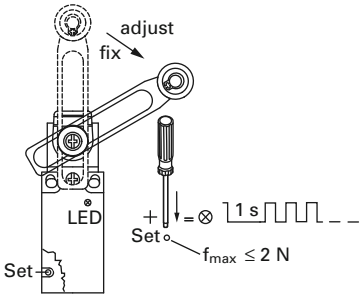
Like the electromechanical position switches, LS-Titan electronic position switches meet Category 3 or 4 of the EN 954-1 standard for machine safety when configured as a redundant system. All devices are thus suitable for safety applications that are used for the protection of persons or processes.

### *Operating Point Adjustment*

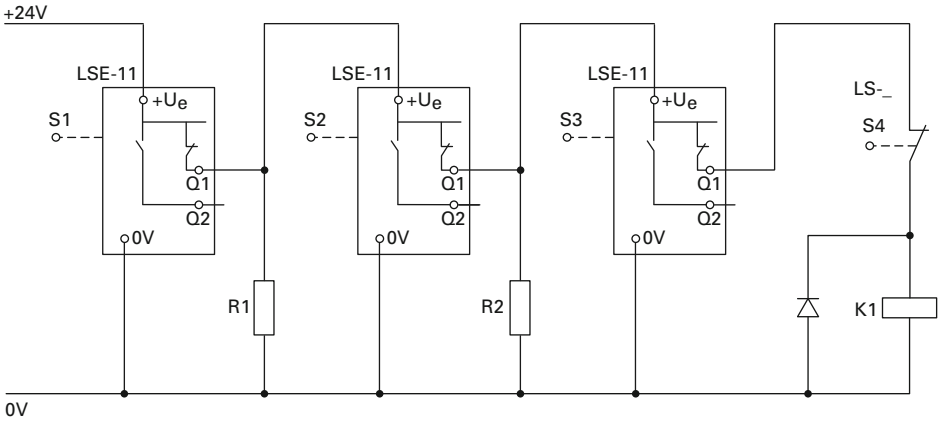
**LSE-11**



**LSE-02**




### Example of LS-Titan LSE Models in a Safety-Oriented Circuit




***Notes***

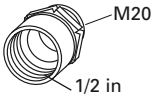
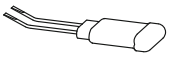
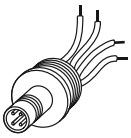
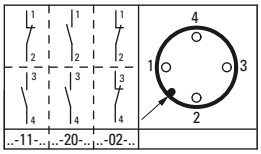
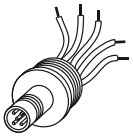
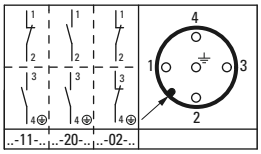
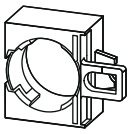
LSE-11 and LSE-02—individual operating point adjustment.

LSE-11 and LSE-02 can be used in safety circuits.
S1 is connected to 24 Vdc
S2, S3 each switch with a delay of 0.7s
R1, R2, e.g., series element M22-XLED60 (2820 ohms/0.5W)

## Accessories



### LS-Titan Safety Switches

| | For Use With | Description | Notes | Catalog Number |
|---|---|---|---|---|
| **V1-2-M20**   | Any | M20 screw terminal in 1/2 in. For use with American pipe thread, metal. | The screw connection must be earthed. Not total insulation. | **V1-2-M20-NA** |
| | Any | M20 screw terminal in 1/2 in. For use with American pipe thread, molded material. | — | **V1-2-M20** |
| **EMS20** | Any | M20 diaphragm bolt. With internal push-through membrane. Will fit cable with an external diameter of up to 13 mm. Rated IP65 with cable inserted. | — | **EMS20** |
| **LS-XTW**  | Any | Cage Clamp tool. | — | **LS-XTW** |
| **M12A**  | LS-Titan plastic bodies (LS-_) | Plug connector, 12 mm, 4-pin male connector M12x1 (M12x1). Rated IP65. Molded material. Color coded to IEC/EN 60947-5-2. |   | **MS12A** |
| **M12A5**  | LS-Titan metal bodies (LSM-_) | Plug connector, 12 mm, 5-pin male connector (M12x1). Rated IP65. Molded material. Color coded to IEC/EN 60947-5-2. |   | **MS12A5** |
| **M22-LS**  | Any | Allows mounting of M22 pushbuttons. (See the M22 catalog, CA04716001E, for a full selection of pushbuttons.) | — | **M22-LS** |

## Technical Data and Specifications

### LS-Titan Miniature DIN Switches—IP66, IP67 Complete Units

| | Units | | LS, LSM | LSE-11/LSE-02 | LSE-AI ① | LSE-AU ① |
|---|---|---|---|---|---|---|
| **General** | | | | | | |
| Standards | | | IEC/EN 60947 | IEC/EN 60947<br>EN 61000-4 | IEC/EN 60947<br>EN 61000-4 | IEC/EN 60947<br>EN 61000-4 |
| Climatic proofing | | | Damp heat, constant, to IEC 60068-2-78; damp heat, cyclical, to IEC 60068-2-30 | Damp heat, constant, to IEC 60068-2-78; damp heat, cyclical, to IEC 60068-2-30 | Damp heat, constant, to IEC 60068-2-78; damp heat, cyclical, to IEC 60068-2-30 | Damp heat, constant, to IEC 60068-2-78; damp heat, cyclical, to IEC 60068-2-30 |
| Ambient temperature | | °F (°C) | –13° to 158°F (–25° to 70°C) | –13° to 158°F (–25° to 70°C) | –13° to 158°F (–25° to 70°C) | –13° to 158°F (–25° to 70°C) |
| Mounting position | | | As required | As required | As required | As required |
| Protection type | | | IP66, IP67 | IP66, IP67 | IP66, IP67 | IP66, IP67 |
| Terminal capacity of screw terminal and Cage Clamp | | | | | | |
| Solid | | $mm^2$ | 1 x (0.5–2.5) | 1 x (0.5–2.5) | 1 x (0.5–2.5) | 1 x (0.5–2.5) |
| Flexible with ferrules to DIN 46228 | | $mm^2$ | 1 x (0.5–1.5) | 1 x (0.5–1.5) | 1 x (0.5–1.5) | 1 x (0.5–1.5) |
| **Power Supply** | | | | | | |
| Rated voltage | $U_e$ | Vdc | N/A | 12–30 | 24 (–15%/+20%) | 24 (–15%/+20%) |
| Burden current | | | | | | |
| 12V | $I_e$ | mA | N/A | 15 | N/A | N/A |
| 24V | $I_e$ | mA | N/A | 18 | 28–45 | 24 |
| 30V | I | mA | N/A | 19 | N/A | N/A |
| **Contacts/Switching Capacity** | | | | | | |
| Rated impulse withstand voltage | $U_{imp}$ | Vac | 4000 | N/A | N/A | N/A |
| Rated insulation voltage | $U_i$ | V | 400 | N/A | N/A | N/A |
| Overvoltage category/ pollution degree | | | III/3 | III/3 | N/A | N/A |
| **Rated Operational Current** | | | | | | |
| AC-15 | | | | | | |
| 24V | $I_e$ | A | 6 | N/A | N/A | N/A |
| 230V/240V | $I_e$ | A | 6 | N/A | N/A | N/A |
| 400V/415V | $I_e$ | A | 4 | N/A | N/A | N/A |
| DC-13 | | | | | | |
| 24V | $I_e$ | A | 3 | 0.2 | N/A | N/A |
| 110V | $I_e$ | A | 0.8 | N/A | N/A | N/A |
| 220V | $I_e$ | A | 0.3 | N/A | N/A | N/A |

***Note***

① The following applies for LSE-11 and LSE-02: ensure that the power supply operates correctly when setting the operating point.

## LS-Titan Miniature DIN Switches—IP66, IP67 Complete Units. continued

| | | Units | LS, LSM | LSE-11/LSE-02 | LSE-AI ① | LSE-AU ① |
|---|---|---|---|---|---|---|
| **Burden Current** | | | | | | |
| Analog output Q1 | | | | | | |
| Output voltage (max. 10 mA) | | Vdc | N/A | N/A | | 0–10 |
| Output current | | mA | N/A | N/A | 4–20 | |
| Fault scenario | | V | N/A | N/A | 0 | 0 |
| Resolution | | Steps | N/A | N/A | 100 | 100 |
| Step tolerance | | Steps | N/A | N/A | 1 | 1 |
| Shunt resistor, resistive load | | ohms | N/A | N/A | <400 | >1000 |
| Digital diagnostics output Q2 (switching to + pole PNP) | | | | | | |
| Response threshold | | V | N/A | N/A | Approx. $U_e$ | Approx. $U_e$ |
| | | mA | N/A | N/A | <200 | <200 |
| Control circuit reliability | | | | | | |
| At 24 Vdc/5 mA | $H_F$ | Fault probability | $<10^{-7}$, <1 fault in $10^7$ operations | N/A | N/A | N/A |
| At 5 Vdc/1 mA | $H_F$ | Fault probability | $<10^{-6}$, <1 failure at 5 x $10^6$ operations | N/A | N/A | N/A |
| Supply frequency | | Hz | Max. 400 | N/A | N/A | N/A |
| Short-circuit rating to IEC/EN 60947-5-1 | | | | | | |
| Maximum fuse | | A gG/gL | 6 | N/A | N/A | N/A |
| Repetition accuracy | | mm | ±0.02 | ±0.02 | ±0.02 | ±0.02 |

***Note***

① The following applies for LSE-11 and LSE-02: ensure that the power supply operates correctly when setting the operating point.

## LS-Titan Miniature DIN Switches—IP66, IP67 Complete Units

| | Units | | LS, LSM | LSE-11/LSE-02 | LSE-AI/LSE-AU | LSE-AI/LSE-AU |
|---|---|---|---|---|---|---|
| **Mechanical Variables** | | | | | | |
| Lifespan | | | | | | |
| Standard-action contact | Operations | X $10^6$ | 8 | N/A | N/A | N/A |
| Snap-action contact | Operations | X $10^6$ | 8 | 3 (electronic) | N/A | N/A |
| Contact temperature of roller head | | °C | ≤100 | ≤100 | ≤100 | ≤100 |
| Mechanical shock resistance (half-sinusoidal shock, 20 ms) | | | | | | |
| Standard-action contact | | g | 25 | N/A | N/A | N/A |
| Snap-action contact | | 9 | N/A | N/A | N/A | N/A |
| Basic unit | | g | N/A | 30 | 30 | 30 |
| Operating frequency | Operations/h | | ≤6000 | ≤3000 | ≤3000 | ≤3000 |
| Switching point | | | N/A | 0.5–5.5 mm freely adjustable | N/A | N/A |
| Hysteresis | | mm | N/A | 0.4 | 0.4 | 0.4 |
| Contact sequence (contact closed open Zw = positive opening clearance) | | mm | N/A | 0.04 | 0.06 | 0.06 |
| **Actuation** | | | | | | |
| Mechanical | | | | | | |
| Actuating force at beginning/ end of stroke | | | | | | |
| Basic units | | N | 1.0/8.0 | 3.5/8.0 | 3.5/8.0 | 3.5/8.0 |
| LS(M)-XP | | N | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 |
| LS(M)-XL | | N | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 |
| LS(M)-XLA | | N | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 | 1.0/8.0 |
| Actuating torque of rotary drives | | Nm | 0.2 | 0.2 | 0.2 | 0.2 |
| Maximum operating speed with DIN cam | | | | | | |
| Basic units for angle of actuation | $\alpha$ = 0°/30° | m/s | 1/0.5 | 1/0.5 | 1/0.5 | 1/0.5 |
| LS(M)-XRL for angle of actuation | $\alpha$ = 0° | m/s | 1.5 | 1.5 | 1.5 | 1.5 |
| LS(M)-XRLA for angle of actuation | $\alpha$ = 30°, L = 125 mm | m/s | 1.5 | 1.5 | 1.5 | 1.5 |
| LS(M)-XRR for angle of actuation | L = 130 mm | m/s | 1.5 | 1.5 | 1.5 | 1.5 |
| LS(M)-XL for angle of actuation | $\alpha$ = 30°/45° | m/s | 1 | 1 | 1 | 1 |
| LS(M)-XLA for angle of actuation | $\alpha$ = 30°/45° | m/s | 1 | 1 | 1 | 1 |
| LS(M)-XP for angle of actuation | $\alpha$ = 0°/30° | m/s | 1/1 | 1/1 | 1/1 | 1/1 |
| **Electromagnetic Compatibility (EMC)** | | | | | | |
| Electrostatic discharge (IEC/EN 61000-4-2, Level 3 ESD) | | | | | | |
| Air discharge | | kV | | 8 | 8 | 8 |
| Contact discharge | | kV | | 4 | 4 | 4 |
| Electromagnetic fields (IEC/EN 61000-403, RFI) | | V/m | | 10 | 10 | 10 |
| Burst pulses (IEC/EN 61000-4-4, Level 3) | | | | | | |
| Supply cables | | kV | | 2 | 2 | 2 |
| Signal lines | | kV | | 2 | 2 | 2 |
| High-energy pulses (surge) (IEC/EN 61000-4-5) | | kV | | 0.5 | 0.5 | 0.5 |
| Immunity to line-conducted interference to (IEC/EN 610000-4-6) | | V | | 10 | 10 | 10 |

## Contact Travel Diagrams



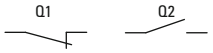
### LSE

**Contact Travel**

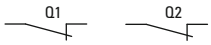
■ = contact closed
□ = contact open

**Description**

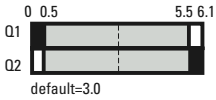
**LSE-11**

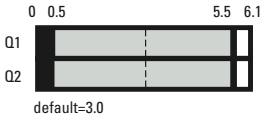



**LSE-02**




**Basic Units**

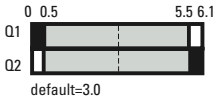


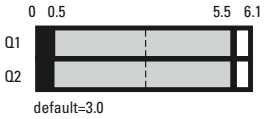




**Operating Heads**

Roller plunger

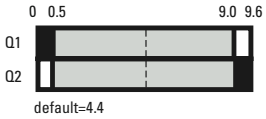
LS-XP
LSM-XP



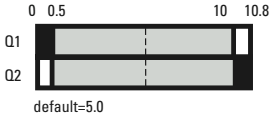

Roller lever

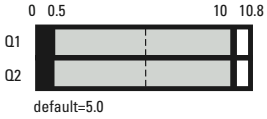
LS-XL
LSM-XL
LS-XL
LS-XLB



Angled roller lever

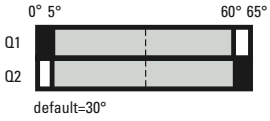
LS-XLA
LSM-XLA

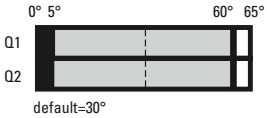



Rotary lever

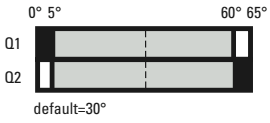
LS-XRL
LSM-XRL

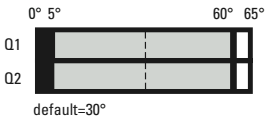



Adjustable roller lever

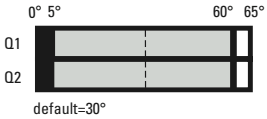
LS-XRLA
LSM-XRLA
LS-XRLA30
LS-XRLA40
LS-XRLA40R




Actuating rod

LS-XRR
LSM-XRR
LS-XRRM
LSM-XRRM



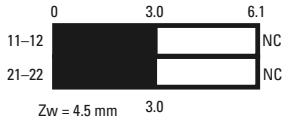
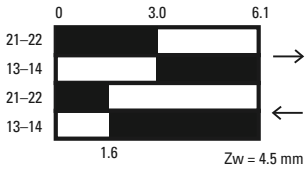
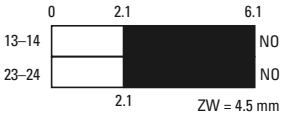
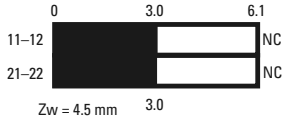
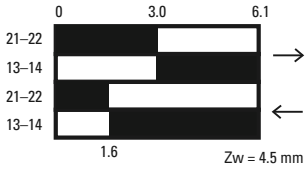
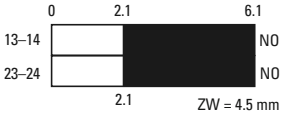
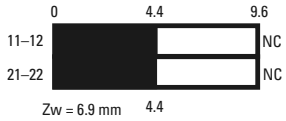
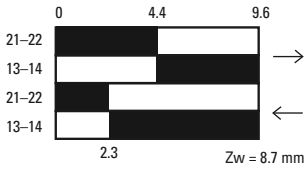
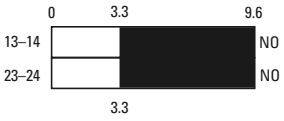
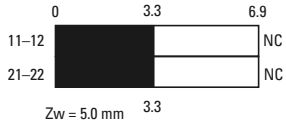
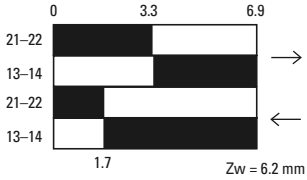
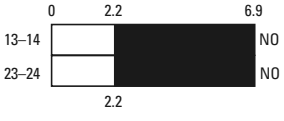
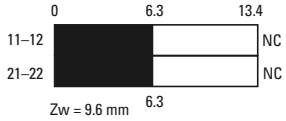
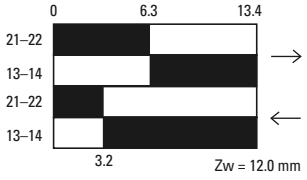

Spring rod

LS-XS
LSM-XS

## LS and LSM

**Contact Travel**

■ = contact closed
□ = contact open

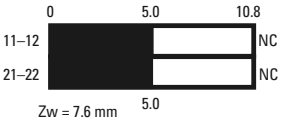
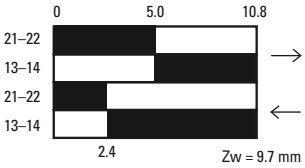
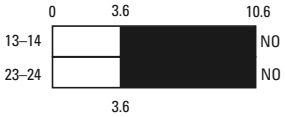
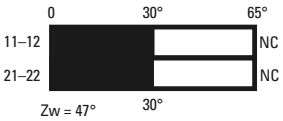
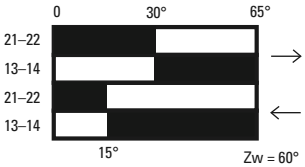
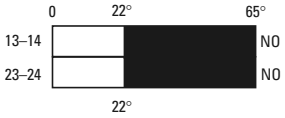
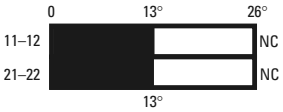
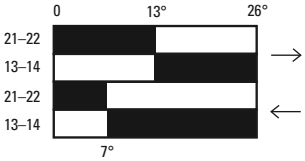
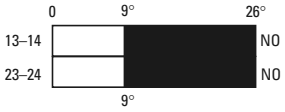
| Description | LS-02, LS-S02, LSM-02 | LS-11S, LS-S11S, LSM-11S | LS-20A, LS-S20A, LSM-20A |
|---|---|---|---|
| | NC 12–11, NC 22–21 | NO 14–13, NC 22–21 | NO 14–13, NO 24–23 |
| **Basic Units** |  |  |  |
| **Operating Heads** | | | |
| Roller plunger | | | |
| LS-XP, LSM-XP |  |  |  |
| Roller lever | | | |
| LS-XL, LSM-XL |  |  |  |
| Roller lever, short | | | |
| LS-XLS |  |  |  |
| Roller lever, large | | | |
| LS-XLB |  |  | |

## LS and LSM, continued



**Contact Travel**

■ = contact closed
□ = contact open

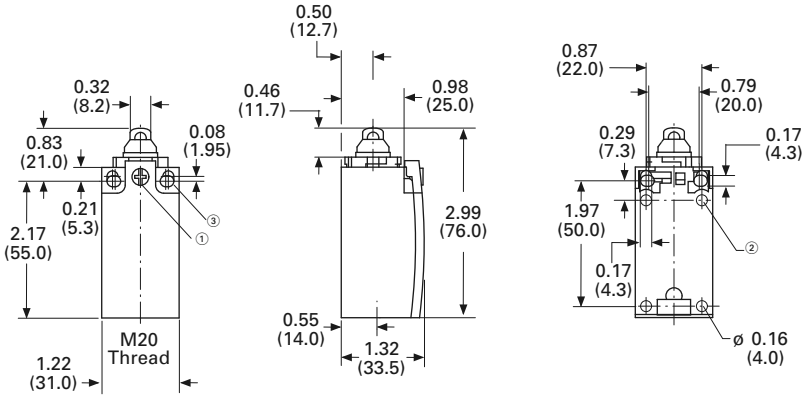
| Description | LS-02, LS-S02, LSM-02 | LS-11S, LS-S11S, LSM-11S | LS-20A, LS-S20A, LSM-20A |
|---|---|---|---|
| | NC 12–11; NC 22–21 | NO 14–13; NC 22–21 | NO 14–13; NO 24–23 |
| **Operating Heads, continued** | | | |
| Angled roller lever<br>LS-XLA, LSM-XLA |  |  |  |
| Rotary lever<br>LS-XRL, LSM-XRL<br>Adjustable roller lever<br>LS-XRLA, LSM-XRLA<br>LS-XRLA30, LS-XRLA40<br>LS-XRLA40R<br>Actuating rod<br>LS-XRR, LSM-XRR<br>LS-XRRM, LSM-XRRM |  |  |  |
| Spring rod<br>LS-XS, LSM-XS |  |  |  |

## Dimensions

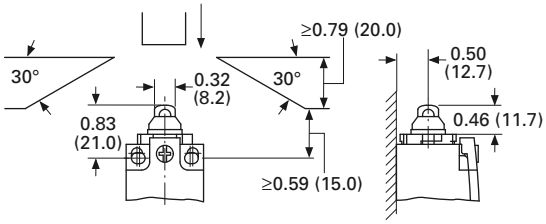
Approximate Dimensions in Inches (mm)

### *Position Switches*

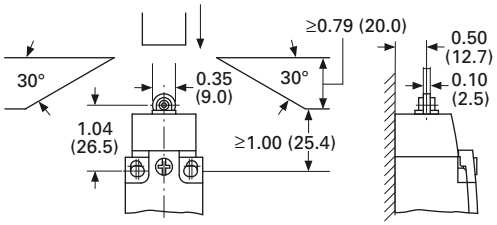
#### LS-_, LSM-_, LSE-_



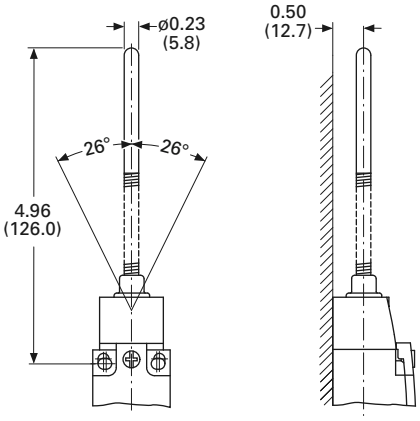

#### LS-_, LSM-_, LSE-_




#### LS(M)-_/P




#### LS(M)-_/S




***Notes***

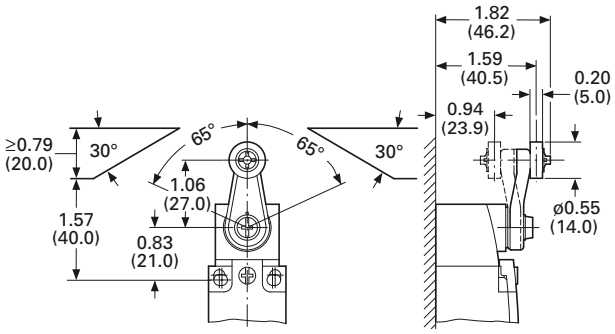
① Tightening torque of cover screws: 0.8 Nm ±0.2 Nm.
② Only with LS (insulated version).
③ Fixing screws 2 x M4 ≥30
$M_A$ = 1.5 Nm

Approximate Dimensions in Inches (mm)



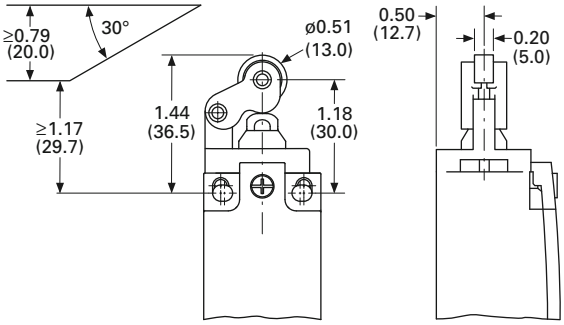
***Rotary Lever***

**LS(M)-_/RL**



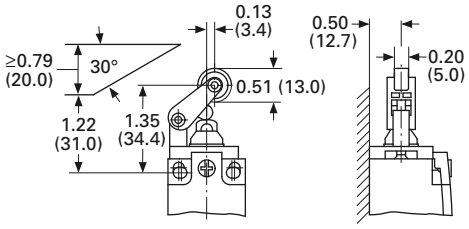

***Roller Lever, Short***

**LS(M)-_/LS**



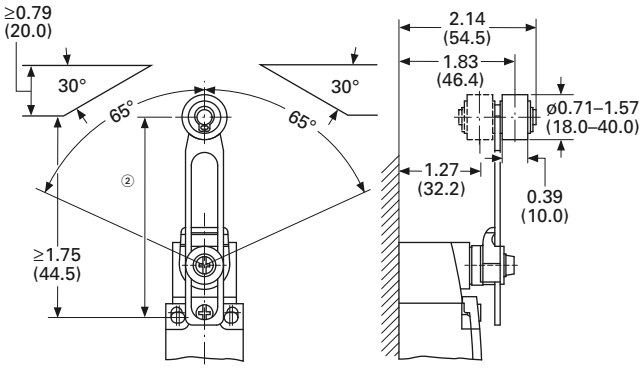

***Roller Lever***

**LS(M)-_/L**



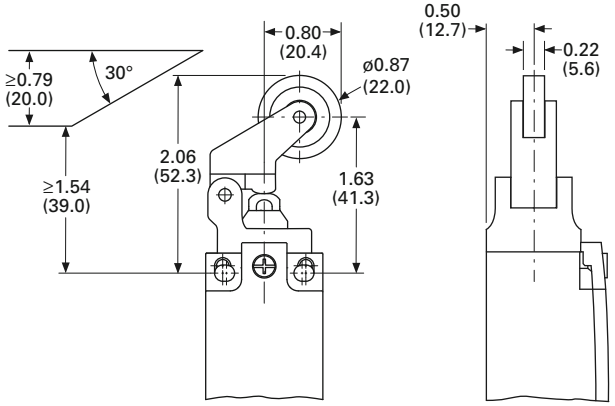

***Adjustable Roller Lever***

**LS(M)-_/RLA**



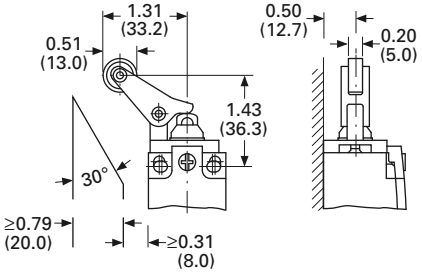

***Roller Lever, Large***

**LS(M)-_/LB** ①




***Angled Roller Lever***

**LS(M)-_/XLA**




***Notes***

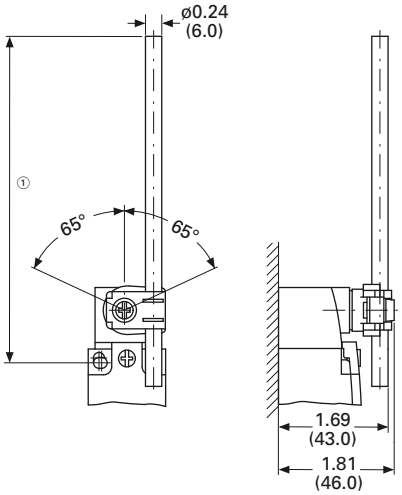
① Tightening torque of cover screws: 0.8 Nm ±0.2 Nm.

② Setting range of 54.5 to 97.

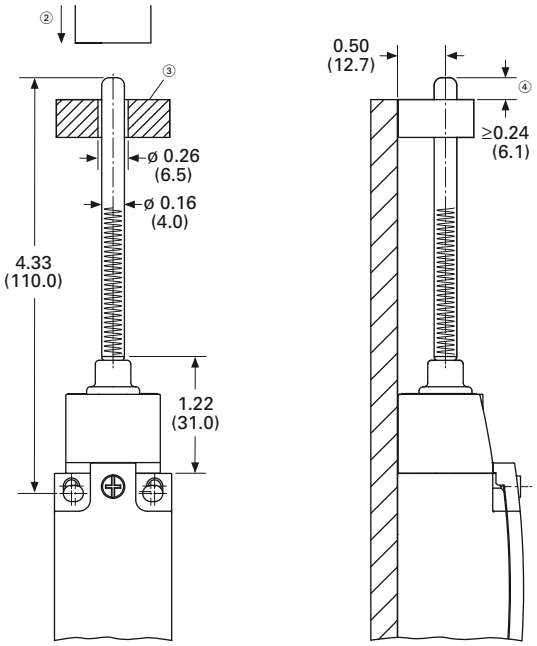
Approximate Dimensions in Inches (mm)

***Actuating Rod***

**LS(M)-_/RR**




**LS(M)-_/OR**




***Notes***

① LS_/RR ≤150
LS_/RRM ≤210
② Approach direction, vertical.
③ Guide is done by customer, not included.
④ Maximum push-through.

LS-Titan Safety Interlock Switches

## Contents


| *Description* | *Page* |
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| Technical Data and Specifications | 29 |
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| Dimensions | 31 |


## 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.

### 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

Listed

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

total isoliert

SUVA CNA INSAI

BG-Prüfzeichen

#### *Safety Notes*

**Do not use as a mechanical stop/shipping brace.**

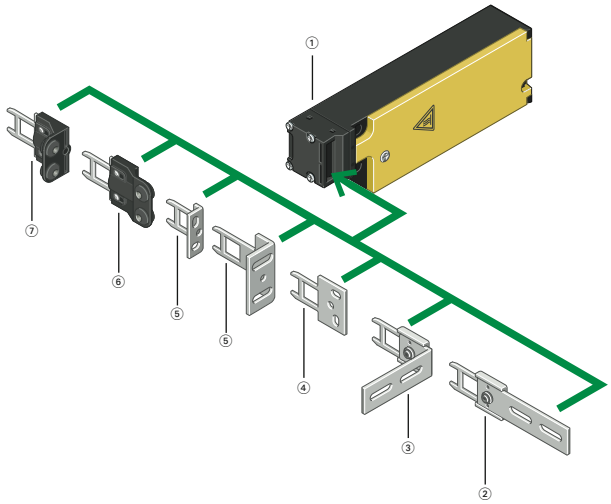
**Any change to an original Eaton safety position switch is not permitted and automatically leads to the loss of all approvals.**

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

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

## Product Identification

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




***Notes***

① **Basic device** (see **Page 27**)
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 28**)
For doors that do not close precisely

③ **Angled flexible actuator** (see **Page 28**)
For doors that do not close precisely

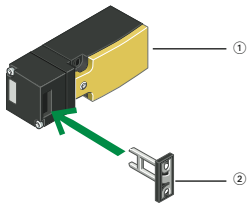
④ **Flat actuator** (see **Page 28**)
For sliding doors

⑤ **Angled actuator** (see **Page 28**)
For swing doors

⑥ **Flat compensating actuator** (see **Page 28**)
For increased tolerance compensation in the direction of door closure

⑦ **Angled compensating actuator** (see **Page 28**)
For increased tolerance compensation in the direction of door closure

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

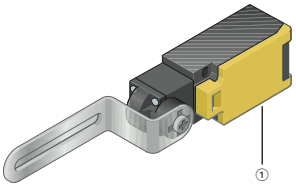



***Notes***

① **Complete device** (see **Page 26**)
For personnel protection
Contacts: 1NC, 1NO-1NO or 2NC
Five directions of operation possible

② **Actuator** (see **Page 26**)
Included with switch
Multiple coding protection against tampering

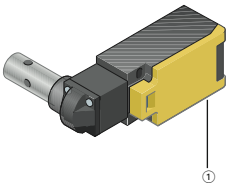
### Door Flap Safety Switch (LSR-...TKG)




***Note***

① **Complete device** (see **Page 26**)
For personnel protection
Contacts: 1NO-1NC or 2NC
For swing doors with fixed connection to the door/hinge pin

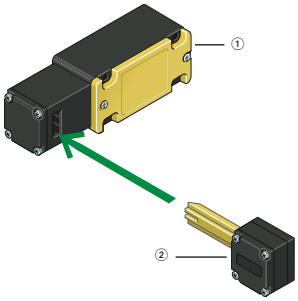
### Door Hinge Safety Switch (LSR-...TS)




***Note***

① **Complete device** (see **Page 26**)
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 27**)
Narrow enclosure version
For personnel protection
Contacts: 1NO, 1NO-1NC

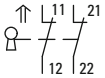
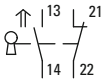
② **Actuator**
Included with switch, not orderable as a separate item
Multiple coding
For horizontal or vertical operation

## Product Selection

### *LS-Titan Miniature DIN Safety Interlock Switches*

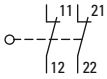
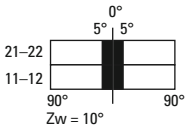
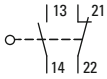
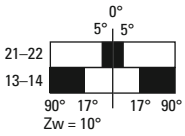
**Key Interlock Switch**

#### 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** |

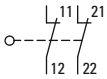
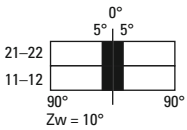
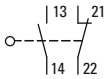
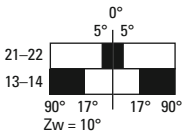
**Door-Flap Switch**

#### Door-Flap Switch—LSR-…TKG ①

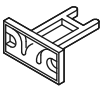
| Contacts | Contact Sequence | Contact Travel | Connection | Catalog Number (Includes Key) |
|---|---|---|---|---|
| 2NC with positive opening |   |   | Screw terminal | **LSR-S02-1-I-TKG** |
| 1NO and 1NC with positive opening |   |   | Screw terminal | **LSR-S11-1-I-TKG** |

**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** |

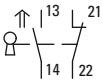
***Note***

① For dimensions, see **Page 31**.

### *LS-Titan Full-Size DIN Safety Interlock Switches*

**Key Interlock Switch**

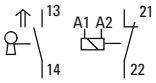
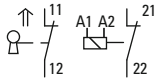
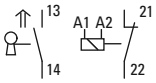
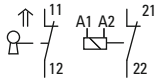
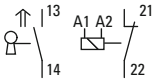
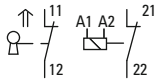
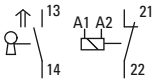
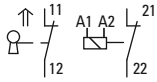
## Full-Size DIN—LS4-…ZB ①②

| 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

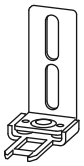
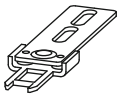
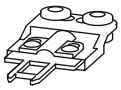
| Operation | Operating Voltage | Contacts | Contact Sequence | Catalog Number (Key not Included) |
|---|---|---|---|---|
| Power to unlock (mechanical bypass present) | 24 Vdc | 1NO and 1NC with positive opening |   | **LS-S11-24DFT-ZBZ-X** |
| | | 2NC with positive opening |   | **LS-S02-24DFT-ZBZ-X** |
| | 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 (mechanical bypass present) | 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 31**.
② For mounting instructions, see **Page 30**.
③ Key ordered separately, see **Page 28**.

### *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 27**.

② For mounting instructions, see **Page 30**.

## Technical Data and Specifications

### LS-Titan Safety Interlock Switches

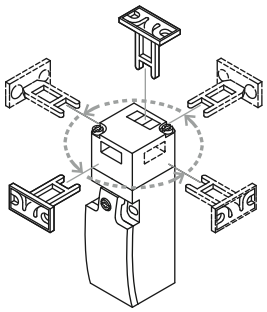
| | Units | | LS-...ZBZ | LS-...ZB | LS4...ZB |
|---|---|---|---|---|---|
| **General** | | | | | |
| Standards | | | IEC/EN 60947 | IEC/EN 60947 | IEC/EN 60947 |
| Climatic proofing | | | ① | ① | ① |
| Ambient temperature | | °C | –25… +0 | –25… +70 | –25… +70 |
| Mounting position | | | As required | 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.

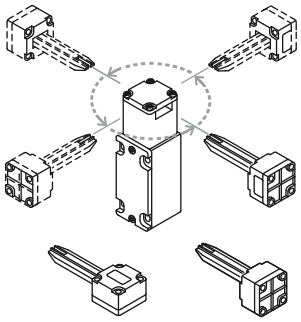
## Mounting Instructions

### LS-…ZB, TKG, TS



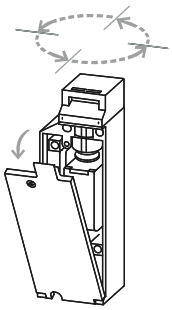
Actuator can be repositioned for horizontal or vertical installation. The operating heads can be rotated manually in 90° steps to suit the specified direction of operation.

### LS4-…ZB

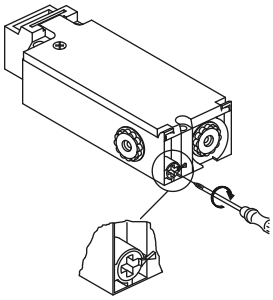


Actuator can be repositioned for horizontal or vertical installation. The operating heads can be rotated manually in 90° steps to suit the specified direction of operation.

### LS-…ZBZ



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



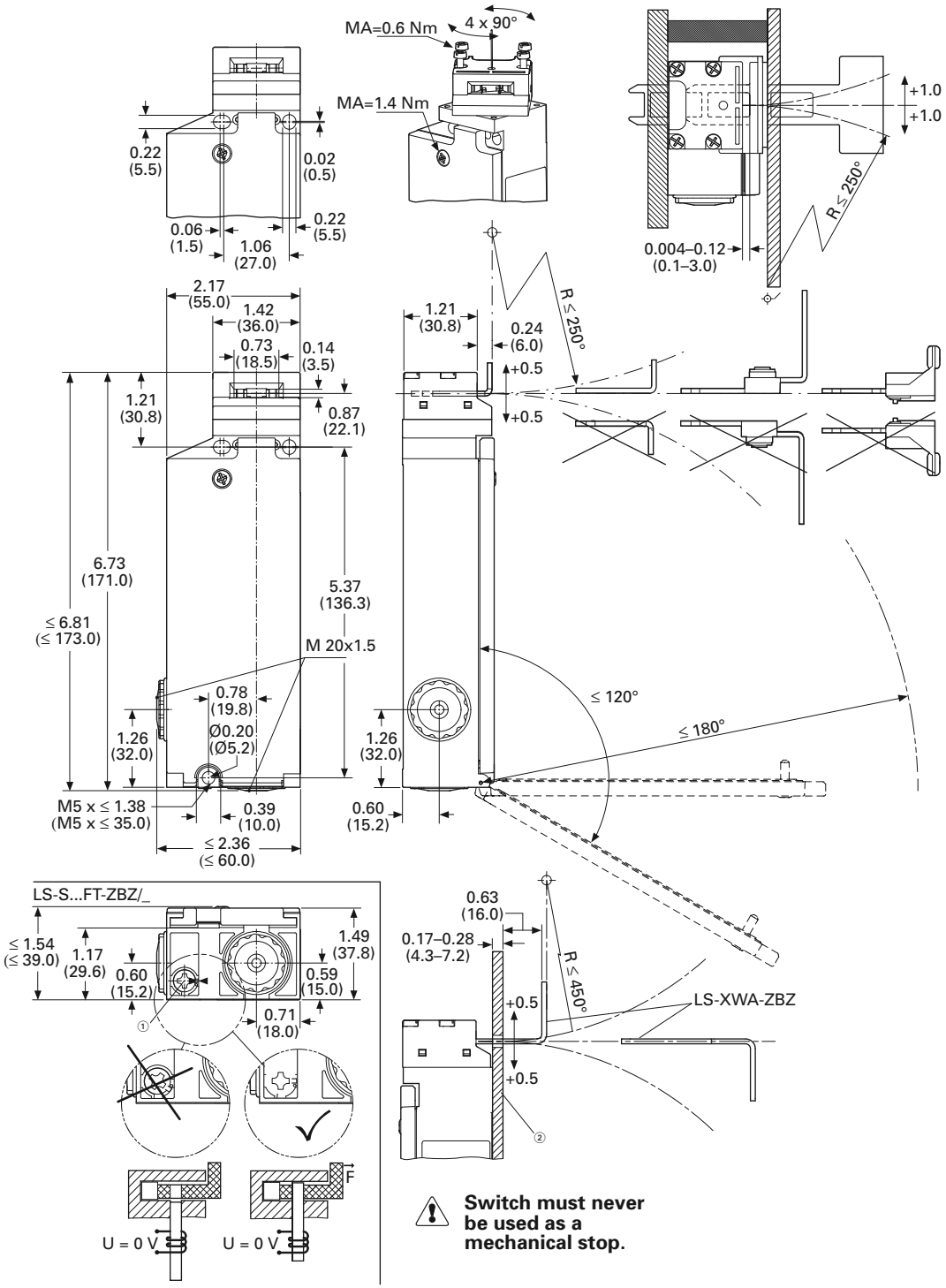
In the event of a loss of voltage, (e.g., during commissioning), the spring-powered LS-…-….FT-ZBZ can be released with a screwdriver. **The auxiliary release mechanism must be sealed**.

## Dimensions

Approximate Dimensions in Inches (mm)

***Safety Position Switches***

**LS…-ZB**




***Notes***

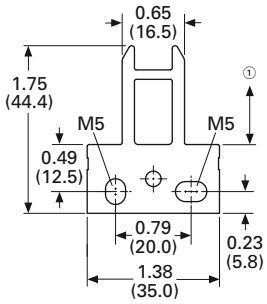
① The auxiliary release mechanism must be sealed for proper operation.

② Can be used as stop with the corresponding material selection and design.

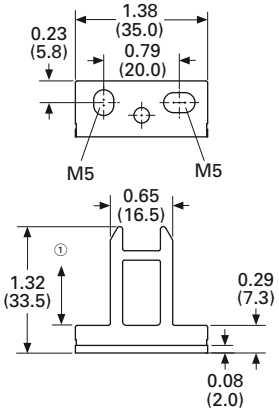
Approximate Dimensions in Inches (mm)

***Actuators***

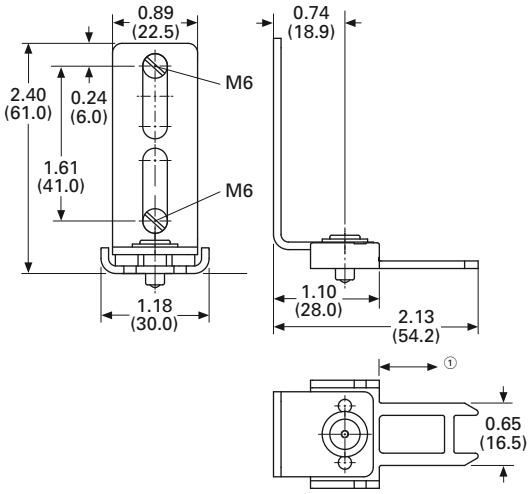
### LS-XG-ZBZ



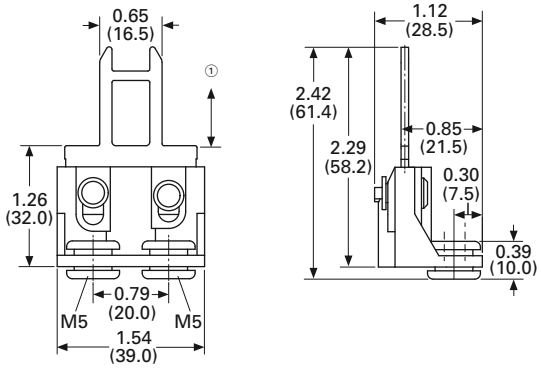

### LS-XW-ZBZ



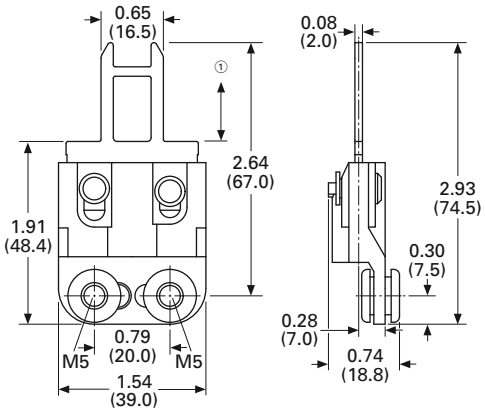

### LS-XF-ZBZ



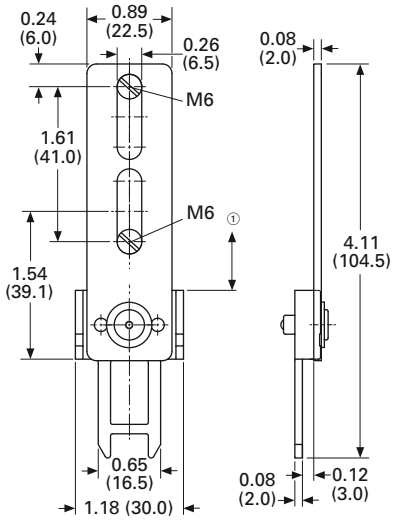

### LS-XNW-ZBZ ②



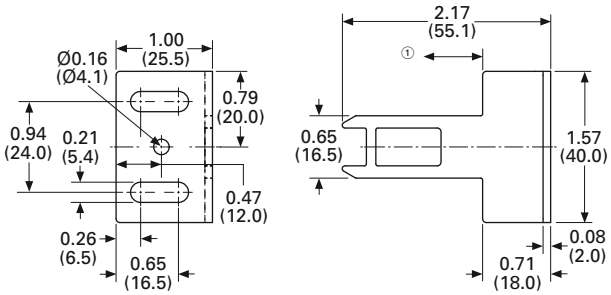

### LS-XNG-ZBZ ②




### LS-XFG-ZBZ




### LS-XWA-ZBZ ③



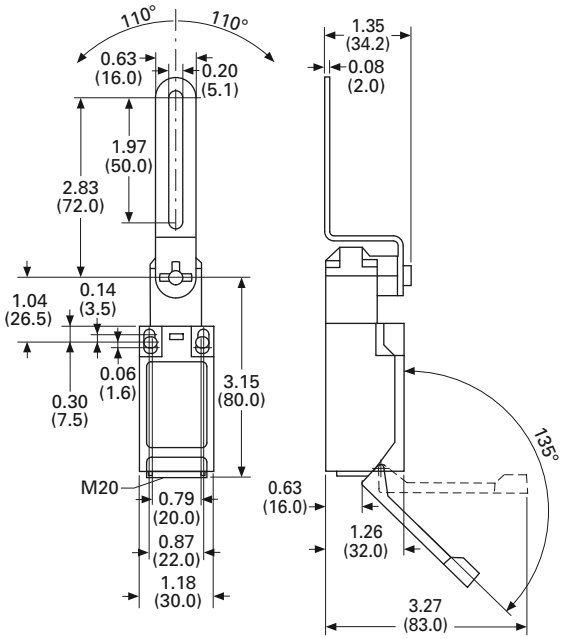

***Notes***

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)

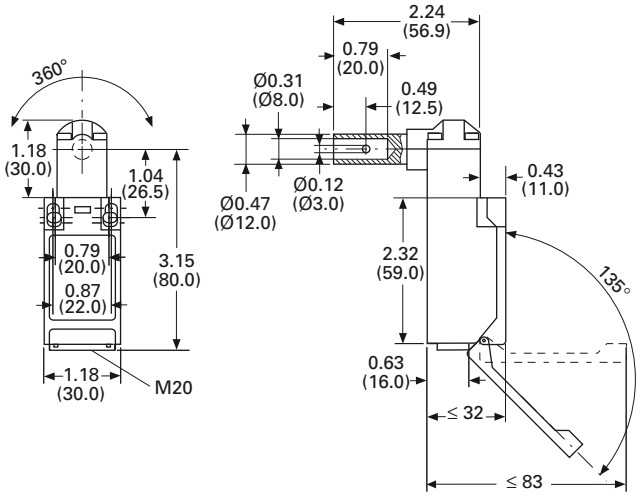
***Safety Door Flap Switch***

**LSR-.../TKG**



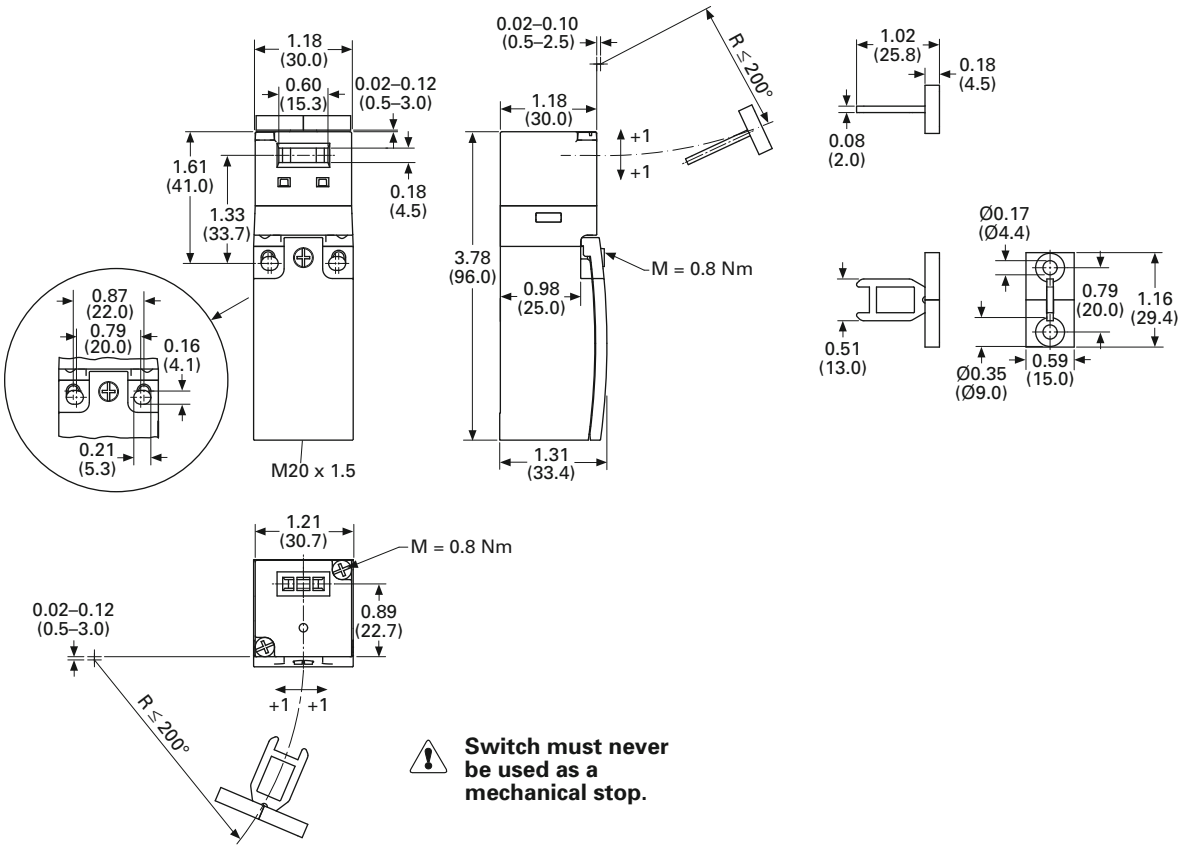

***Safety Hinge Switch***

**LSR-.../TS**




***Safety Position Switches***

**LS...-ZB**

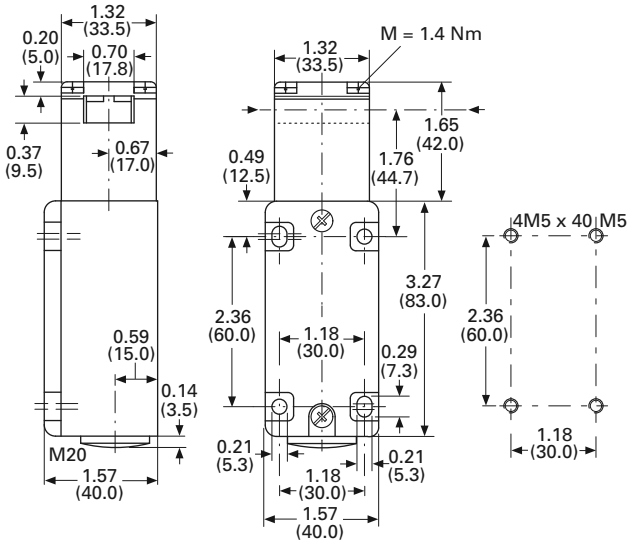



**Switch must never be used as a mechanical stop.**

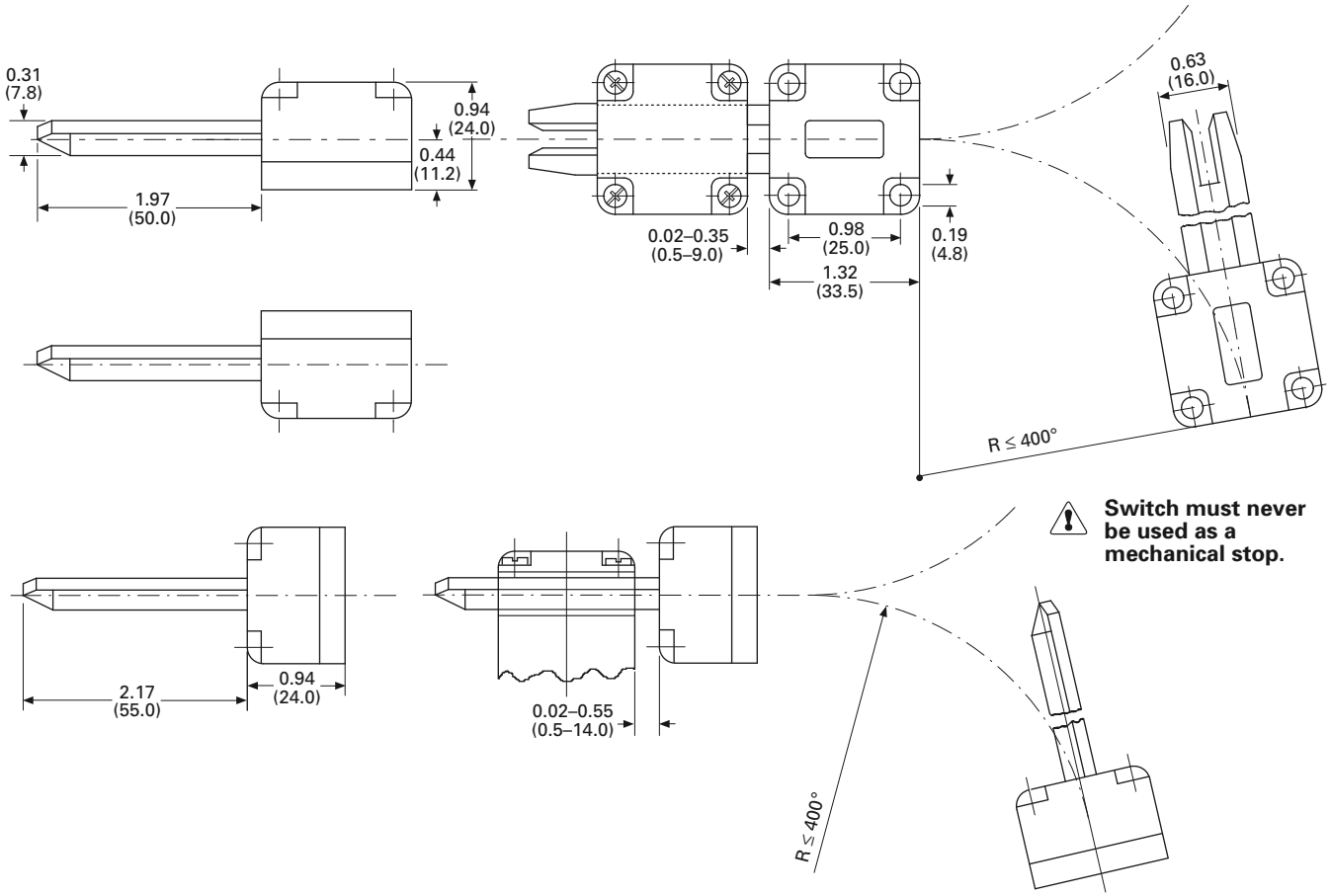
Approximate Dimensions in Inches (mm)

***Safety Position Switches***

**LS4...ZB**




**Actuator—Included with Switch Above**




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

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