Snap-action switches

S870, S970 Series

Snap-action switches
Positive opening operation
Self-cleaning contacts

Catalogue D70.en
**Snap-action switches S870/S970 Series**

Single break SPDT switches with positive opening operation and wiping contacts

S870/S970 Series snap-action switches feature positive opening operation, which guarantees that even contacts which have become welded together due to a short-circuit will open reliably. Wiping contacts protected against dust, humidity and contaminants ensure high reliability even with small contact loads. Versions with gold contacts are especially suited for switching low voltages and small currents.

A defined as well as repeatable switching action is possible thanks to the snap mechanism whose switching speed is virtually independent of the actuation speed. That is why snap-action switches are preferred in applications with slow actuation speeds, where they are used, for instance, as motor switches, position switches, or gear limit switches.

**Features**

Series S870/S970

- **Variants for extreme conditions:** Ruggedized housing made from polyetherimide (PEI). Designed for use in harsh environments. Improved resistance to extremes of temperature, chemicals and impact.
- **Positive opening operation:** Reliable breaking of the normally closed (NC) circuit even if the contacts have become welded together, in compliance with IEC 60947-5-1, Annex K.
- **Single break contacts:** Changeover switch, also available as NC or NO versions with leads or cable connection. Compact design.
- **IP Rating:** Degrees of protection against dust, humidity, contaminants, or access to hazardous parts to IEC 60529: Contacts: IP40, IP60 or IP67 / Terminals: IP00, IP20 or IP67
- **Self-cleaning contacts:** Continuous low contact resistance ensures high contact reliability over the entire design life of the switch.
- **Contact material:** Silver or gold

**Design and function**

Series S870/S970

- **Actuator**
  - Standard: Push button
  - Actuators: roller lever, plain lever or simulated roller lever
- **Contact area**
- **Mounting**
  - Flat tabs / solder lugs / PCB
  - Factory-potted cable or leads
- **Terminals**
  - Screw-type
  - Leads, opposite actuator side, length = 500 mm
  - PCB, 180°
  - M3 screws with saddle clamp
  - Flat tabs / solder lugs / PCB
  - Ganging (side mount)

**Variants for extreme conditions**

Schaltbau has developed special variants for use in harsh environments. The S970 Series has a ruggedized housing made from polyetherimide (PEI) that stands for improved resistance to:

- Temperatures from -55 °C to +150 °C
- Chemicals (e.g. acids and alkalis)
- Impact (IEC 50% more resistant than PC)

The amber, transparent switches are ideally suited for applications where impact forces are high and/or frequent as well as for use in products that are exposed to strong chemicals or extremes of temperature.

The S9xx Series switches have the same design, dimensions and technical features as the switches of the standard S8xx series, allowing for easy replacement and upgrade from a standard switch without additional implementation effort.

**Applications**

S970 switches are typically used with systems and components that require a high degree of safety and reliability, such as:

- Limit switches for machine, door and plant control systems
- Control switches for the driver’s desk of rail vehicles or crane consoles
- Switching elements for automation
- Safety limit switches for control systems and plant control.

**Ordering code**

Series S870/S970

- **Series**
  - S870
  - S970
- **Contact configuration**
  - W: SPDT
  - O: SPST-NC
  - S: SPST-NO
- **Ingress protection rating (IP code)**
- **Contact material**
  - Silver
  - Gold

**Specifications subject to alteration!**

![Image of Snap-action switches S870/S970 Series snap-action switches](Image)
### Specifications

**Series S870/S970**

#### Dimensions S870 W1D1a / S970 W1D1a

- Dimensions: 20.2 x 10.3 x 3.1 mm
- Pins: 4
- Actuator: SPDT
- Contact material: silver
- Terminals: IP40
- Cable: length 500 mm
- Material: brass, silver or gold plated
- Weight: approx. 7 g

#### Dimensions S870 W2D1a / S970 W2D1a

- Dimensions: 20.2 x 10.3 x 3.1 mm
- Pins: 4
- Actuator: SPDT
- Contact material: silver
- Terminals: IP40
- Cable: length 500 mm
- Material: brass, silver or gold plated
- Weight: approx. 7 g

#### Dimensions S870 W3L1a / S970 W3L1a

- Dimensions: 20.2 x 10.3 x 3.1 mm
- Pins: 4
- Actuator: SPDT
- Contact material: silver
- Terminals: IP40
- Cable: length 500 mm
- Material: brass, silver or gold plated
- Weight: approx. 7 g

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**Notes:**

- Data valid for new switches under delivery conditions and at normal temperatures, unless otherwise mentioned.
- *1: Data for gold contacts upon request
- *2: Measured rect to push button
- *3: General Purpose
- *4: Other upon request  
  *5: A closed or open circuit may occur by rapidly changing air pressure
- *6: Only versions coded to IP55/56/57 are IEC 60529 PD3

Specifications are subject to alteration without prior notice. Dimensions in mm.
**Actuator styles, actuator positions**

**Series S870/S970**

- **Push button (standard)** Actuator style
  - Actuator position: Push button (standard) [A]
  - Dimensions in mm:
    - Free position: 16.0 x 0.1
    - Operating position: 14.8 x 0.2
    - Release position: 15.1 x 0.4
  - Total positive opening travel: 13.3
  - Total travel position: 13.0
  - Movement differential (between operating and release position): 0.3 (typical)

- **Plain lever, short** Actuator style [K]
  - Actuator position: Plain lever, short [K]
  - Dimensions in mm:
    - Lever length: 25.7
    - Free position: 17.5 x 0.2
    - Operating position: 15.9 x 0.3
    - Release position: 16.2 x 0.3
    - Total positive opening travel: 13.7
    - Total travel position: 13.4
  - Movement differential (between operating and release position): 0.3 (typical)

- **Plain lever, long** Actuator style [L]
  - Actuator position: Plain lever, long [L]
  - Dimensions in mm:
    - Lever length: 40.2
    - Free position: 21.4 x 0.5
    - Operating position: 18.0 x 0.6
    - Release position: 18.8 x 0.6
    - Total positive opening travel: 13.0
    - Total travel position: 12.9
  - Movement differential (between operating and release position): 0.8 (typical)

- **Simulated roller lever, medium** Actuator style [M]
  - Actuator position: Simulated roller lever, medium [M]
  - Dimensions in mm:
    - Lever length: 34.9
    - Free position: 19.0 x 0.25
    - Operating position: 16.7 x 0.35
    - Release position: 17.3 x 0.35
    - Total positive opening travel: 13.5
    - Total travel position: 13.2
  - Movement differential (between operating and release position): 0.6 (typical)

- **Simulated roller lever, long** Actuator style [N]
  - Actuator position: Simulated roller lever, long [N]
  - Dimensions in mm:
    - Lever length: 27.6
    - Free position: 23.3 x 0.3
    - Operating position: 21.5 x 0.4
    - Release position: 22.0 x 0.4
    - Total positive opening travel: 19.2
    - Total travel position: 18.8
  - Movement differential (between operating and release position): 0.3 (typical)

**Note:** To ensure the proper working of the positive opening operation it is necessary to depress the plunger to the point of total positive opening travel. However, it must not be pushed beyond total travel position. Data is valid for new switches.

**Data is valid for new switches. However, it must not be pushed beyond total travel position.**

**Dimensions in mm / Specifications are subject to alteration without prior notice**
**Terminals (continued)**

### Series S870/S970

- **M3 screws** terminal style (A)
  - Note:
    - Single and multiple-wire connection with wire gauges AWG 20...12 (0.5 mm² ... 3.5 mm²) can be clamped with or without end ferrules.
    - 2 conductors max. with same wire gauge can be clamped per terminal.
    - Tightening torque of terminal screws should be 1.6 Nm max.

- **Leads, on side opposite actuator** terminal style (B)
  - Note:
    - Contact configuration:
      - Lead AWG18 / blue
      - Lead AWG18 / grey
      - Lead AWG18 / black

- **Flat tabs, straight** terminal style (D)
  - Note:
    - Flat tabs 6.3 x 0.8 mm

- **PCB terminals, straight** terminal style (F)
  - Note:
    - Hand soldering:
      - Soldering apparatus: Hand-held soldering iron
      - Solder: Flux-filled solder wire, lead-free
      - Temperature/duration: 400 °C; 5 s max.
    - Selective soldering:
      - Soldering apparatus: Selective soldering station
      - Solder: Lead-free solder for selective and wave soldering
      - Temperature/duration: 300 °C, 2.5 s, 3 mm wave distance; Flux time 1 s
    - Wave soldering:
      - Soldering apparatus: Wave soldering station, T wave (Minimum wave speed)
      - Solder: Lead-free solder for selective and wave soldering
      - Temperature/duration: 260 °C; 5 s; 66 mm wave distance; conveyor speed 0.8 m/min
      - Preheating approx. 113 s at 110 ... 145 °C (typical)

- **Solder lugs, straight** terminal style (G)
  - Note:
    - Hand soldering:
      - Soldering apparatus: Hand-held soldering iron
      - Solder: Flux-filled solder wire, lead-free
      - Temperature/duration: 400 °C; 5 s max., pre-tinned leads

- **Cable, on side opposite actuator** terminal style (L)
  - Note:
    - Contact configuration:
      - Lead AWG18 / blue
      - Lead AWG18 / grey
      - Lead AWG18 / black
      - Cable Y - UL 2517

**Note:**
- Single and multiple-wire conductor with wire gauges AWG 20...12 (0.5 mm² ... 3.5 mm²) can be clamped with or without end ferrules.
- 2 conductors max. with same wire gauge can be clamped per terminal.
- Tightening torque of terminal screws should be 1.6 Nm max.

**Dimensions in mm / Specifications are subject to alteration without prior notice**
Series S870/S970

Safety instructions

With the following features:

- For mounting the switches on uninsulated surfaces use mounting plates
- Material: polyamide PA66, flammability rating UL 94V-0

A roller lever, however, is required if the direction of actuation deviates more than ±15° from the plunger axis.

Mounting

- Through the two transversal holes in the body of the switch by means of a collar screw or threaded bolt.
- Tightening torque 0.7 Nm max.
- Alternatively, DUO-clips or retaining rings can be used.

Mounting on PCB (only S870 Wx Fxx / S970 Wx Fxx)

- Holes for PCB terminals, straight
- 3x Ø1.5 max.
- 7.6 ± 0.15

Mounting plates

For mounting the switches on uninsulated surfaces use mounting plates with the following features:

- Suitable for side mounting of the switch on the left and on the right
- Material: polyamide PA66, flammability rating UL 94V-0

Long mounting plate, ordering code: MP g

Short mounting plate, ordering code: MP k

Mounting instructions:

- Only use adequate fastening elements such as cylinder head or collar screws and DUO-clips, including washers. The value for maximum tightening torque must not be exceeded.
- The actuator should not be pre-tensioned when in the free position. When actuated the actuator should travel beyond the operating position for at least 50% of the predefined overtravel, all the way to the total travel position.
- Avoid hitting the screw when mounting to prevent mechanical tension on the housing.
- To ensure the proper function of the positive opening action it is necessary to depress the plunger to the total travel position.
- To prevent mechanical destruction of the switch, make sure that actuation of the switch does not exceed the specified total travel position. Avoid using the switch as a mechanical end stop.
- High impact actuation of the switch can have a negative effect on its mechanical life.
- When securing stripped wire ends in the terminal clamp, make sure the wire insulation is flush with the clamp.
- Prevent a transfer of forces to the switch terminals, and ensure that connected leads have a functioning strain relief.

Non-permissible environmental conditions:

- Cleaning agents, adhesives, solvents, or screw-retaining varnish must be compatible with polycarbonate (S870) and polyetherimide (S970) respectively. Never use chemicals not compatible with polycarbonate for S870 Series switches or not compatible with polyetherimide for S970 Series snap-action switches.
- Using such chemicals can result in cracks, deformation, breakage and dissolution of the housing or complete destruction of the respective switch.

Mounting and safety instructions, environmental conditions

Standards

- IEC 60947-1: Low-voltage switchgear and controlgear; Part 1: General rules
- IEC 60947-5-1, Annex K: Special requirements for control switches with direct opening action
- UL508: Industrial control equipment
- IEC 60529: Degrees of protection provided by enclosures (IP Code)
- UL 94V-0: Flammability Standard
- DIN 41636-6: Sensitive switches for communication technology; dimensions, type A
- DIN EN ISO 13849-1: Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- IEC 60608-2-6: Environmental testing - Part 2-6: Tests - Test F: Vibration (sinusoidal)
- In case of moisture of any kind or impact of aggressive substances, chemicals, solvents or acids appropriate protective measures must be taken by the user in accordance with IEC 60364-4-41:2005, modified (Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock). One such measure is the limitation of the voltage range.
- Be sure to make regular visual inspections.
- Improper handling of the switch, e.g. when hitting the floor with some impact, can result in breakage, visible cracks and deformation.
- The switch suitability has to be confirmed by the customer for the specific application, and under application conditions.
- For applications with both a high ambient temperature of >40°C and a high Icu current, a correction factor i.e. DIN EN 60608-1 Tab. 6 and Table D.1 must be applied for the wire and current.

Safety instructions

Defective parts must be replaced immediately!

For a detailed list of all safety instructions see here:

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Electrical Components and Systems for Railway Engineering and Industrial Applications

Connectors

- Connectors manufactured to industry standards
- Connectors to suit the special requirements of communications engineering (MIL connectors)
- Charging connectors for battery-powered machines and systems
- Connectors for railway engineering, including UIC connectors
- Special connectors to suit customer requirements

Snap-action switches

- Snap-action switches with positive opening operation
- Snap-action switches with self-cleaning contacts
- Enabling switches
- Special switches to suit customer requirements

Contactors

- Single and multi-pole DC contactors
- High-voltage AC/DC contactors
- Contactors for battery powered vehicles and power supplies
- Contactors for railway applications
- Terminal bolts and fuse holders
- DC emergency disconnect switches
- Special contactors to suit customer requirements

Electrics for rolling stock

- Equipment for driver's cab
- Equipment for passenger use
- High-voltage switchgear
- High-voltage heaters
- High-voltage roof equipment
- Equipment for electric brakes
- Design and engineering of train electrics to customer requirements

We reserve the right to make technical alterations without prior notice.
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