Operating instructions
Hinge safety switch

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1. About this document

1.1 Function
This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety switchgear. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.

1.2 Target group: authorised qualified personnel
All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used

Information, hint, note:
This symbol is used for identifying useful additional information.

Caution: Failure to comply with this warning notice could lead to failures or malfunctions.
Warning: Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use
The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety switchgear must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions
The user must observe the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.6 Warning about misuse

In case of improper use or manipulation of the safety switchgear, personal hazards or damages to machinery or plant components cannot be excluded when safety switchgear is used. The relevant requirements of the standard ISO 14119 must be observed.

Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: www.schmersal.net.
2. Product description

2.1 Ordering code

This ordering instructions manual applies to the following types:

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<th>Option</th>
<th>Description</th>
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<td>A</td>
<td>without end stop</td>
</tr>
<tr>
<td>②</td>
<td>S</td>
<td>with additional hinge</td>
</tr>
<tr>
<td>③</td>
<td>CC</td>
<td>Screw connection</td>
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<td>.1</td>
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<td>⑥</td>
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<tr>
<td>U</td>
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<td>adjustable on site</td>
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2.2 Special versions

For special versions, which are not listed in the order code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.

2.3 Destination and use

The TESF hinge safety switch has been designed to prevent, in conjunction with the control part of a machine, movable safety guards from being opened before hazardous conditions have been eliminated. They are also suitable for fitting on profile sections and existing equipment.

Hinge safety switches can only be used for applications, in which the hazardous condition is terminated without delay (e.g. run-on movements) when the safety guard is opened.

The user must evaluate and design the safety chain in accordance with the relevant standards and on the required safety level.

The entire concept of the control system, in which the safety component is integrated, must be validated to the relevant standards.

2.4 Technical data

<table>
<thead>
<tr>
<th>Standards:</th>
<th>IEC 60947-5-1; BG-GS-ET-15</th>
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<td>self-extinguishing thermoplastic</td>
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<tr>
<td>Hinge bolt:</td>
<td>Stainless steel 1.4305</td>
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<tr>
<td>Contact material:</td>
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<tr>
<td>Protection class:</td>
<td>IP65</td>
</tr>
<tr>
<td>Contact type:</td>
<td>Change-over contact with double break Zb</td>
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<tr>
<td>Switching system:</td>
<td>IEC 60947-5-1; slow action, NC contact with positive break</td>
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2.5 Safety classification

Standards: ISO 13849-1

Envisaged structure: - Basically: applicable up to Cat. 1 / PL c
- With 2-channel usage and fault exclusion mechanism*: applicable up to Cat. 3 / PL d with suitable logic unit

B_{in}, NC contact: 2,000,000

B_{in}, NO contact at 10% ohmic contact load: 1,000,000

Service life: 20 years

* If a fault exclusion to the 1-channel mechanics is authorised.

\[
MTTF_D = \frac{B_{in}}{0.1 \times n_{op}} \quad n_{op} = \frac{d_{op} \times h_{op} \times 3600 \text{ s/h}}{t_{cycle}}
\]

(Determined values can vary depending on the application-specific parameters h_{op}, d_{op} and t_{cycle} as well as the load.)

If multiple safety components are wired in series, the Performance Level to ISO 13849-1 will be reduced due to the restricted error detection under certain circumstances.

---

**1.7 Exclusion of liability**

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden; the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

---

**Operating instructions Hinge safety switch TESF**

---

**Connection:** Screw terminals, cage clamps, connector

**Cable type:** solid wire

**Cable section:**
- Screw terminals: min. 0.14 mm², max. 1.5 mm²
- Cage clamps: min. 0.25 mm², max. 1 mm²

**Cable type:** stranded wire

**Cable section:**
- Screw terminals: min. 0.25 mm², max. 1 mm², with conductor ferrules,
- Cage clamps: min. 0.25 mm², max. 0.75 mm², with conductor ferrules

**Cable entry:** 2 x M16

**Positive break angle:** 10°

**Actuating speed:** max. 180°/0.3 s

**Actuating frequency:** max. 1200 operations/h

**Mechanical life:** > 1 million operations

**Ambient temperature:** -25 °C ... +65 °C

**Utilisation category:** AC-15, DC-13

**Rated operating current/voltage U_{op}/U_{AC}:** 2 A / 230 VAC, 1 A / 24 VDC

**Rated insulation voltage U_{ins}:**
- Connector ST24: 250 V
- Connector ST24: 36 V

**Rated impulse withstand voltage U_{imp}:**
- Connector ST24: 2.5 kV
- Connector ST24: 0.8 kV

**Thermal test current I_{max}:**
- Connector ST24: 2.5 A

**Max. rated operating voltage U_{max}:**
- Connector ST24: 24 VDC
- Connector ST24: 230 VAC

**Max. fuse rating:** 2 A gG D-fuse

**Required short-circuit current:** 1000 A

**Switching of low voltages:** 1 mA / 5 VDC

**Mechanical data (see Fig.):**
- F1: 5,000 N
- F2: 5,000 N
- F3: 1,900 N
- F4: 800 N

---

**2.4 Technical data**

<table>
<thead>
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Service life: 20 years

* If a fault exclusion to the 1-channel mechanics is authorised.
3. Mounting

3.1 General mounting instructions

⚠️ During fitting of the actuator and the sensor, the requirements of ISO 14119, especially paragraph 7 must be observed!

Four mounting holes are provided for fixing the switch. When used in applications with function for the protection of man, the components must be fitted so that disassembly is prevented (e.g. drill out the hexagonal recess of the fixing screws, blocking the hexagonal recess using a plastic cone diameter 5.1 mm). The hinge switch furthermore must not be used as an end stop. Any mounting position. The mounting position however is chosen so that the components are preferably fitted in the upper part of the safety guard to avoid the ingress of dirt and soil as well as damage to the components. In case of painting activities, the components must be covered. The supplied fixing material must be used. We recommend that the fixing screws are painted after the component is fitted.

Fig. 1

Legend:
A = Drill and pin in this area

Please observe the remarks of the standards ISO 12100, EN 953 and ISO 14119. Also observe the safety distances to the standards ISO 13857 and EN 349.

3.2 Dimensions
All measurements in mm.

TESFA

TESFA/S

4. Electrical connection

4.1 General information for electrical connection

⚠️ The electrical connection may only be carried out by authorised personnel in a de-energised condition. For the cable entry, only suitable cable glands and for the connector suitable plugs with an appropriate degree of protection must be used.

1. Open the enclosure cover of the hinge switch.
2. Connect the wires and cables. For flexible leads, conductor ferrules must be used. In the area of the metal thread at the cable input in the wiring compartment, the supplied protective tube (shrink tube) must be used.
3. After the switch has been fitted, the switching function and the opening angle of the safety guard must be checked. The switching angle of the NC contacts set in factory is approximately 3°. Caution: for the TESF.../U version, the following paragraph "Special instructions for the on-site setting" imperatively must be observed!
4. Follow the steps below to put back the enclosure cover:
   - Firmly push the enclosure cover under an angle of approx. 30° onto the retaining collar (Fig. 2) and simultaneously exercise a downwards pressure (Fig. 3).
   - Uniformly tighten the 3 cover screws (Fig. 4) with 0.6 Nm tightening torque.
   - The contact labelling can be found in the wiring compartment of the switch.

Fig. 2

Fig. 3

After the switch has been fitted, the switching function and the opening angle of the safety guard must be checked. The opening angle of the NC contacts set in factory is approximately 3°.
Operating instructions
Hinge safety switch

Special instructions for the on-site setting (version TESF.../U)
We recommend a setting including the following steps:
1. Open the safety guard up to the maximum authorised opening angle.
2. Open the enclosure cover of the hinge switch.
3. Wire both NC contacts parallel, connect terminal 11 with 31 and terminal 12 with 32 (Fig. 5).
4. Connect the continuity tester to the terminals 11/12 of the NC contacts or use the test handles at the terminals (Fig. 5).
5. Use the adjustment tool to set the NC contacts so that their opening is ensured at the maximum authorised safety guard opening angle. Turn clockwise to decrease the switching angle, turn counterclockwise to increase the switching angle (Fig. 6); when mounted inside accordingly reversed. The positive break angle is 7° larger than the set switching angle.
6. After the switch is set, the compliance of the switch with the safety-technical requirements of the application must be checked.
7. After the switching angle has been set and checked, the blanking plug for the adjustment opening located at the rear of the adjustment tool must be inserted in the adjustment opening (1) and torn down by making lateral movements (2) with the tool (Fig. 7).

After the desired switching point is set, the opening of the setting option imperatively must be sealed with a blanking plug. This measure prevents tampering at the set switching point within the meaning of ISO 14119 paragraph 7 and therefore avoids any loss of the safety function of the device.

We recommend an additional painting or glueing of the blanking plug.

Securing the setting screw by means of the blanking plug is a mandatory instruction for the user, which must be observed in order to maintain the CE-Conformity of the component.

Key
- Positive break NC contact
- Positive break travel / -angle, taking tolerances and wear into account

Accessibility
Connecting cable with M12 coupling, 8-pole, straight

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<tr>
<th>Type designation</th>
<th>Cable length</th>
<th>Ordering code</th>
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<tr>
<td>A-K8P-M12-S-G-2.5M-BK-2-X-A-4</td>
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<td>A-K8P-M12-S-G-5M-BK-2-X-A-4</td>
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<td>103007358</td>
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<td>103007359</td>
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</table>

Pin configuration

4.3 Switch travel

| 1 | WH |
| 2 | BN |
| 3 | GN |
| 4 | YE |
| 5 | GY |
| 6 | PK |
| 7 | BU |
| 8 | RD |

The versions TESF.../ST24 must only be used in PELV circuits according to EN 60204.
### 4.4 Door gap calculation
Calculation of the door gap depending on the opening angle, door width and overlapping

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<tr>
<th>β (°)</th>
<th>3°</th>
<th>4°</th>
<th>5°</th>
<th>6°</th>
<th>7°</th>
<th>8°</th>
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<th>10°</th>
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<td>D (mm)</td>
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</tbody>
</table>

β = Door opening angle  
C = Door width in mm  
D = Door gap in mm for overlapping B = 0 mm  
B = Door thickness

**Calculation example**

The actual door gap “D1” is calculated using door gap “D” calculated by means of the table above minus the overlapping “B” of door and frame:

\[ D1 = D - B \]

**Example:**

A door made of 40 mm aluminium profile with a length of 950 mm should be secured with a TESF. The safety contact of the TESF opens to 3° when new according to the technical safety sheet (10° at the end of its service life). The table above shows the door gap when new at approx. 49.7 mm. The real door gap can be calculated with the following equation:

\[ D1 = D - B; \quad (49.7 - 40 = 9.7); \quad D1 = 9.7 \text{ mm} \]

At the end of the service life the door gap is approx. 164.9 mm and the real door gap is:

\[ D1 = (164.9 - 40 = 124.9); \quad D1 = 124.9 \text{ mm} \]

---

### 5. Set-up and maintenance

#### 5.1 Functional testing

The safety function of the safety components must be tested. The following conditions must be previously checked and met:

1. Correct fixing of the component
2. Check the integrity of the cable entry and connections
3. Check the switch enclosure for damage

#### 5.2 Maintenance

A regular visual inspection and functional test, including the following steps, is recommended:

1. Check fitting of the hinge safety switch
2. Remove particles of dust and soiling
3. Check cable entry and connections
4. Examination of the switching angle

Damaged or defective components must be replaced.

### 6. Disassembly and disposal

#### 6.1 Disassembly

The safety switchgear must be disassembled in a de-energised condition only.

#### 6.2 Disposal

The safety switchgear must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.
7. EU Declaration of conformity

EU Declaration of conformity

Original
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We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.

**Name of the component:** TESF

**Type:** See ordering code

**Description of the component:** Hinge safety switch

**Relevant Directives:**
- Machinery Directive 2006/42/EC
- RoHS-Directive 2011/65/EU

**Applied standards:**
- DIN EN ISO 60947-5-1:2010,
- DIN EN ISO 14119:2014,
- DIN EN ISO 60947-5-1:2010,
- DIN EN ISO 14119:2014,

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**Place and date of issue:** Wuppertal, January 2, 2017

Authorised signature
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The currently valid declaration of conformity can be downloaded from the internet at www.schmersal.net.