Operating Instructions for TL4024 Series Safety Switches

Correct Use
Safety switches series TL4024 are electromagnetic interlock devices with guard locking.

In combination with a movable safety guard and the machine control, this safety component prevents the safety guard from being opened while a dangerous machine movement is being performed.

The Safety switches series TL4024 comply with the regulations of EN 60947-5-1, Annex K.

For the control system, this means that

- starting commands which cause hazardous situations must become active only when the safety guard is in protective position and the guard locking is in locked position.
- The locked position of the guard locking must be released only when the hazardous situation is no longer present.

Before safety switches are used, a risk assessment must be performed on the machine in accordance with the regulations of EN 60947-5-1, Safety of machinery. Safety related parts of control systems. General principles for design - Risk assessment and risk reduction.

Version TL4024-1 and TL4024-3

(Guard locking by spring force)

The guard locking pin is held in the locked position by spring force and released by electromagnetic actuation. The guard locking functions in accordance with the closed-circuit current principle. The safety guard cannot be opened immediately in the event of interruption of the solenoid power supply.

Version TL4024-2

(Guard locking by solenoid force)

This type must be used only in special cases after strict assessment of the accident risk!

The safety guard can be opened immediately in the event of interruption of the solenoid power supply!

The guard locking pin is held in locked position by electromagnetic force and released by spring force. The guard locking operates in accordance with the open-circuit current principle.

- Closing safety guard and activating guard locking.
- The guard locking pin is released by insertion of the actuator into the safety switch.

 Versions TL4024-1 and TL4024-3: The guard locking pin is moved to locked position by spring force.

 TL4024-2: The guard locking pin is moved to locked position when the solenoid operating voltage is applied.

The safety contacts are closed.

- Deactivating guard locking, opening safety guard TL4024-1110... and TL4024-3110...: The guard locking pin releases the cam when the solenoid operating voltage is applied.

For switching function see Figure 2 Door closed and not locked

The actuator can be removed.

- TL4024 - 3024: The guard locking pin releases the cam when the solenoid operating voltage is applied when the control voltage is present.

For switching function see Figure 2 Door closed and not locked.

The actuator can be removed.

- TL4024-2: The guard locking pin releases the cam when the solenoid operating voltage is switched off.

For switching function see Figure 2 Door closed and not locked.

The actuator can be removed.

- Door monitoring contact

Mechanical Release

In the event of malfunctions, the guard locking can be deactivated using the mechanical release, irrespective of the state of the solenoid (see Figure 3).

- Unscrewing guard locking screw
- Using a screwdriver, turn the mechanical release by approx. 180° in the direction of the arrow

The locking screw must be returned to its original position and sealed after use (for example with sealing lacquer).

Installation

Safety switches and actuators must not be used as an end stop.

Mount the safety switch only in assembled condition!

Assemble the safety switch so that

- access to the switch is difficult for operating personnel when the safety guard is open
- it is possible to operate the mechanical release and check and replace the safety switch.

Fit an additional end stop for the movable part of the safety guard.

- Insert the actuator in the actuating head.
- Mount the safety switch securely.
- Permanently connect the actuator to the safety guard so that it cannot be detached, e.g. using the enclosed non-removable screws, rivets or welding.

Changing the Actuating Direction

Figure 1: Changing the actuating direction

- Unscrew and open switch cover.
- Remove actuating head from the switch by turning and refit in the required position (bayonet fastening).
- Fit locking pins supplied for protection against twisting.
- Close the cover and screw in position.
- Cover the unused actuating slot with the enclosed slot covers.

Protection Against Environmental Influences

A lasting and correct safety function requires that the actuating head must be protected against the penetration of foreign bodies such as swarf, sand, blasting shot, etc.

Cover the actuating slot, the actuator and the rating plate during painting work!

TL4024-3024: The guard locking pin releases the cam when the solenoid operating voltage is applied when the control voltage is present.

For switching function see Figure 2 Door closed and not locked.

The actuator can be removed.

- Door monitoring contact

TL4024-2: The guard locking pin releases the cam when the solenoid operating voltage is switched off.

For switching function see Figure 2 Door closed and not locked.

The actuator can be removed.

- Door monitoring contact

On the removal of the actuator, the door monitoring contact switches and signals that the safety guard is open (see Figure 2, Door open).

Safety Precautions

Safety switches perform a personal protection function. Incorrect installation or tampering can lead to severe injuries to personnel.

Safety components must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.

On this topic pay attention in particular to the measures for reducing the possibility of bypassing according to EN 1088:1995.A2:2008, sec. 5.7.

The switching operation may only be triggered by actuators specially provided for this purpose which are permanently connected to the protective guard. Mounting, electrical connection and setup only by authorized personnel.

Important!

- The user is responsible for safe integration of the device in a safe overall system. For this purpose the overall system must be validated, e.g. in accordance with EN ISO 13849-2.
- If the simplified method according to section 6.3 EN ISO 13849-1:2008 is used for validation, the Performance Level (PL) may be reduced if several guard locking operates in accordance with the open-circuit current principle.

This type must be used only in special cases after strict assessment of the accident risk!
**TL4024**

**Operating Instructions for TL4024 Series Safety Switches**

**Electrical Connection**

⚠️ Only switching contacts marked with the positively driven NC contact symbol ⚠️ are to be used for the safety circuit.

For **TL4024 without plug connector**:

- For use and applications as per the requirements of ⚠️, a rigid copper wire 60/75° is to be used.
- For **TL4024 with plug connector**:
  - For use and applications as per the requirements of ⚠️, a class 2 power supply or a class 2 transformer according to UL1310 or UL1585 must be used.

Connection cables for safety switches installed at the place of use must be separated from all moving and permanently installed cables and un-insulated active elements of other parts of the system which operate at a voltage of over 150 V. A constant clearance of 50.8 mm must be maintained. This does not apply if the moving cables are equipped with suitable insulation materials which possess an identical or higher dielectric strength compared to the other relevant part of the system.

The solenoid operating voltage, the LED operating voltage and the control voltage (only TL4024-3024...) for the interlocking solenoid must comply with the information on the rating plate (e.g. \(U_b = AC/DC 24\) V).

Solenoid operating voltage and control voltage can be jumped if a current of 2 A can be supplied when the solenoid is switched on for \(t_{MP} = 250\) ms.

**Cable Entry**

- Unscrew locking screw for the required insertion opening.
- Fit the cable gland with the appropriate degree of protection.

For connector assignment see Figure 5.

- Tighten the screws with a torque of 0.5 Nm.
- Check that the cable entry is sealed.
- Close the cover and screw in position.

**Functional Check**

⚠️ Warning! Danger of fatal injury as a result of faults in installation and functional check. Before carrying out the functional check, make sure that there are no persons in the danger area. Observe the valid accident prevention regulations.

After installation and any fault, the safety function must be fully checked. Proceed as follows:

- **Mechanical function test**
  - The actuator must slide easily into the actuating head. Close the safety guard several times to check the function.
- **Electrical function test**
  1. Switch on operating voltage.
  2. Close all safety guards.
  3. Verify that there are always persons in the danger area.
  4. Disable operation in the control system.
  5. Release the safety guard and check the guard locking.
  6. Close the safety guard and check the guard locking.

**Inspection and Service**

⚠️ If damage or wear is found, the complete switch and actuator assembly must be replaced.

⚠️ Replacement of individual parts or assemblies is not permitted!

No servicing is required, but regular inspection of the following is necessary to ensure trouble-free long-term operation:

- correct switching function
- secure mounting of components
- dirt and wear
- sealing of cable entry
- loose cable connections or plug connectors.

**Note:** The year of manufacture can be seen in the bottom, right corner of the rating plate.

**Exclusion of Liability under the Following Conditions:**

- non-compliance with safety regulations
- installation and electrical connection not performed
- by authorized personnel
- failure to perform functional checks.

**EC declaration of conformity**

The manufacturer named below herewith declares that the product fulfills the provisions of the directive(s) listed below and that the related standards have been applied.

OMRON Scientific Technologies Inc.
6550 Dumbarton Circle
Fremont, CA 94555, U.S.A.

**Directives applied:**

- Machinery directive 2006/42/EC
- Technical standards applied:
  - EN 60947-5-1
  - EN 60529

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>Die-cast alloy, cathodically dipped</td>
</tr>
<tr>
<td>Degree of protection according to IEC 60529 with cable gland</td>
<td>IP67</td>
</tr>
<tr>
<td>Mech. operating cycles</td>
<td>&gt;1 x 10⁶</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20° to +80°C</td>
</tr>
<tr>
<td>Degree of contamination</td>
<td>3 (industrial)</td>
</tr>
<tr>
<td>Installation position</td>
<td>any, preferably actuator head down</td>
</tr>
<tr>
<td>Approach speed, max.</td>
<td>20 mm/min</td>
</tr>
<tr>
<td>Switching principle</td>
<td>Slow-action switching contact</td>
</tr>
<tr>
<td>Contact material</td>
<td>Silver alloy, gold flashed</td>
</tr>
<tr>
<td>Connection type to switching element</td>
<td>Screw terminals</td>
</tr>
<tr>
<td>Connection type to printed circuit board</td>
<td>Cage-pull clamps</td>
</tr>
<tr>
<td>Conductor cross-section (rigid/flexible)</td>
<td>0.34...1.5 mm²</td>
</tr>
<tr>
<td>Rated insulation voltage with cable gland</td>
<td>(U_b = 250) V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage with cable gland</td>
<td>(U_{imp} = 2.5) kV</td>
</tr>
<tr>
<td>Rated short-circuit current</td>
<td>100 A</td>
</tr>
<tr>
<td>Utilization category of the switching element according to EN 60947-5-1</td>
<td>AC-15 DC-13</td>
</tr>
<tr>
<td>Switching voltage, min.</td>
<td>12 V</td>
</tr>
<tr>
<td>Switching current, min., at 24V</td>
<td>1 mA</td>
</tr>
<tr>
<td>Short circuit protection according to IEC 60269-1</td>
<td>4 A gG</td>
</tr>
<tr>
<td>Solenoid operating voltage (U_b/) solenoid power consumption (TL4024-3024)</td>
<td>AC/DC 24 V 8 W</td>
</tr>
<tr>
<td>(I_b = 2) A for (t_{MP} = 250) ms</td>
<td>AC/DC 110 V 10 W</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>100 %</td>
</tr>
<tr>
<td>Switching frequency max. for TL4024-3</td>
<td>45 min⁻¹</td>
</tr>
<tr>
<td>Control voltage (U_b) for TL4024, 10/24</td>
<td>AC/DC 24 V</td>
</tr>
<tr>
<td>Actuating force</td>
<td>35 N</td>
</tr>
<tr>
<td>Extraction force</td>
<td>35 N</td>
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<tr>
<td>Retention force</td>
<td>20 N</td>
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<tr>
<td>Locking force (F_Z) max.</td>
<td>1,700 N</td>
</tr>
<tr>
<td>Locking force (F_Z) in accordance with test principles GS-ET-19</td>
<td>(F_Z = 1,300) N</td>
</tr>
<tr>
<td>Actuation frequency</td>
<td>1200/h</td>
</tr>
</tbody>
</table>

**Reliability figures according to EN ISO 13849-1**

| \(B_{10d}\) | 6 x 10⁷ |

**Fig. 2 Switching elements and switching functions**
Fig. 3: Dimension drawing

Fig. 4: Insertion depth and approach radius

Fig. 5: Connection diagrams

TL4024-3024 All TL4024 with 110V
TL4024-1024, -2024
Authorized Distributor:

- Automation Control Systems
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