

TL4024

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

- ▶ EN ISO 13849-1, Safety of machinery. Safety related parts of control systems. General principles for design
- ▶ EN ISO 12100, Safety of machinery - General principles for design - Risk assessment and risk reduction
- ▶ IEC 62061, Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems.

Correct use includes compliance with the relevant requirements for installation and operation, in particular

- ▶ EN ISO 13849-1, Safety of machinery. Safety related parts of control systems. General principles for design
- ▶ EN 1088, Safety of machinery. Interlocking devices associated with guards. Principles for design and selection
- ▶ EN 60204-1, Safety of machinery. Electrical equipment of machines. General requirements.

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 devices are connected one after the other.
- ▶ If a product data sheet is included with the product, the information on the data sheet applies in case of discrepancies with the operating instructions.

⚠ 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.

Function

The safety switch permits the locking of movable safety guards.

In the switch head there is a rotating cam that is blocked/released by the guard locking pin. The guard locking pin is moved on the insertion / removal of the actuator and on the activation / deactivation of the guard locking. During this process the switching contacts are actuated. If the cam is blocked, the actuator cannot be pulled out of the switch head, guard locking is active.

Versions 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.

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

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

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).

- ▶ Unscrew locking screw
- ▶ Using a screwdriver, turn the mechanical release by appr. 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

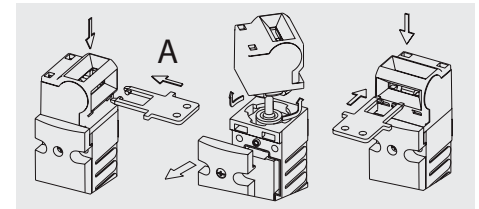


Figure 1: Changing the actuating direction

- ▶ 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!

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Electrical Connection

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

For TL4024 without plug connector:

For use and applications as per the requirements of \ominus , a rigid copper wire 60/75° is to be used.

For TL4024 with plug connector:

For use and applications as per the requirements of \ominus , 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 jumpered if a current of 2 A can be supplied when the solenoid is switched on for $T_{IMP} = 250 ms$.

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.
In the case of guard locking by solenoid force, activate guard locking.
 - The machine must not start automatically.
 - It must not be possible to open the safety guard.
 3. Enable operation in the control system.
It must not be possible to deactivate the guard locking as long as operation is enabled.
 4. Disable operation in the control system and deactivate guard locking.
 - The safety guard must remain locked until there is no longer any risk of injury.
 - It must not be possible to start the machine as long as the guard locking is deactivated.
- Repeat steps 2 - 4 for each safety guard.

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:

- incorrect use
- 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

Standards applied:
EN 60947-5-1:2004 + Cor.:2005 + A1:2009
EN 1088:1995+A2:2008

Fremont, August 2012

Marty Krikorian
Director, Quality Control

The signed EC Declaration of Conformity is included with the product.

Technical data

Parameter	Value
Housing material	Die-cast alloy, cathodically dipped
Degree of protection according to IEC 60529 with cable gland	IP 67
Mech. operating cycles	>1x10 ⁶
Ambient temperature	-20+80°C
Degree of contamination - (external, according to EN 60947)	3 (industrial)
Installation position	any, preferably actuator head down
Approach speed, max.	20 m/min
Switching principle	Slow-action switching contact
Contact material	Silver alloy, gold flashed
Connection type to switching element	Screw terminals
Connection type to printed circuit board	Cage-pull clamps
Conductor cross-section (rigid/flexible)	0,34 ... 1.5 mm ²
Rated insulation voltage with cable gland	$U_i = 250 V$
Rated impulse withstand voltage with cable gland	$U_{imp} = 2.5 kV$
Rated short-circuit current	100 A
Utilization category of the switching element according to EN 60947-5-1	
AC-15	4 A 230 V
DC-13	4 A 24 V
Switching voltage, min.	12 V
Switching current, min., at 24V	1 mA
Short circuit protection according to IEC 60269-1	4 A gG
Solenoid operating voltage U_B / solenoid power consumption (TL4024...024: $I_B = 2 A$ for $T_{IMP} = 250 ms$)	AC/DC 24 V 8 W AC/DC 110 V 10 W
Duty cycle	100 %
Switching frequency max. for TL4024-3	45 min ⁻¹
Control voltage U_S for TL4024...024	AC/DC 24 V
Actuating force	35 N
Extraction force	35 N
Retention force	20 N
Locking force F_{max}	1,700 N
Locking force F_{Zh} in accordance with test principles GS-ET-19 ($F_{Zh} = \frac{F_{max}}{1,3} = 1,300 N$)	
Actuation frequency	1200/h
Reliability figures according to EN ISO 13849-1	
B_{10d}	6×10^6

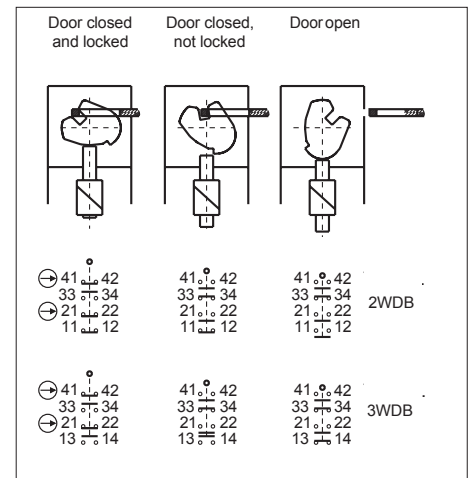


Fig. 2 Switching elements and switching functions

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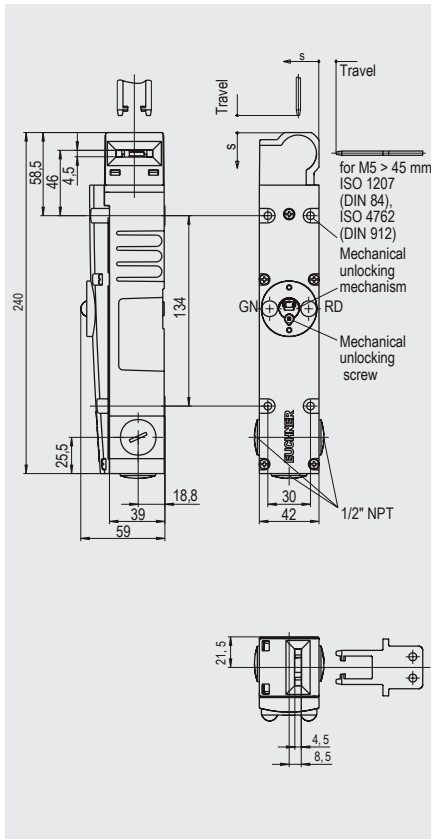


Fig. 3: Dimension drawing

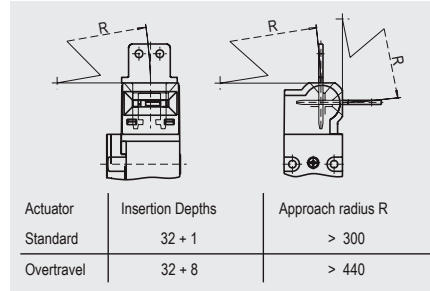


Fig. 4: Insertion depth and approach radius

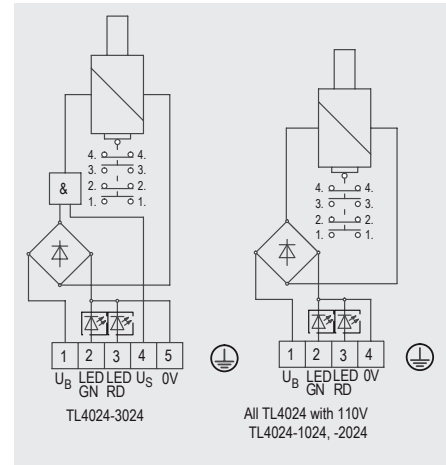


Fig. 5: Connection diagrams



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Original Instructions

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