

**Operating Instructions for TL4019 Series Safety Switches**

**Correct Use**

Safety switches series TL4019 are electromagnetic interlock devices with guard locking. In combination with a separating safety guard and the machine control, this safety component prevents the safety guard from being opened while a dangerous machine movement is being performed. 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 14121, Safety of machinery. Risk assessment. Principles
- ▶ 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, particularly

- ▶ 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, electrical equipment of machines

**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 fulfill 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 active.

**Version TL4019-1, TL4019-3 and TL4019-5**  
(Guard locking by spring force)

The guard locking pin is held in the locked position by spring force and unlocked by electromagnetic actuation. The spring interlock 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.

**Versions TL4019-2 and TL4019-4**  
(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 the locked position by electromagnetic force and released by spring force. The guard locking operates in accordance with the open-circuit current principle.

- ▶ Close safety guard and activate guard locking  
The guard locking pin is released by insertion of the actuator into the safety switch.  
**TL4019-1, TL4019-3 and TL4019-5:** The guard locking pin is moved to locked position by spring force.  
**TL4019-2 and TL4019-4:** The guard locking pin is moved to locked position when the solenoid operating voltage is applied.  
The safety contacts are closed.

- ▶ Deactivate guard locking, open safety guard  
**TL40191/TL4019-5:** The guard locking pin releases the cam when the solenoid operating voltage is applied. For switching function see Figure 3 column 2 **Door closed and not locked**. The actuator can be removed.  
**TL4019-2:** The guard locking pin releases the cam when the solenoid operating voltage is switched off. For switching function see Figure 3 column 2 **Door closed and not locked**. The actuator can be removed.  
**TL4019-3** (with door monitoring contact): The guard locking pin releases the cam when the solenoid operating voltage is applied. For switching function see Figure 3 column 2 **Door closed and not locked**. The actuator can be removed.  
On the removal of the actuator, the door monitoring contact switches and signals that the safety guard is open (see Figure 3 column 3, **Door open** ).  
**TL4019-4** (with door monitoring contact): The guard locking pin releases the cam when the solenoid operating voltage is switched off. For switching function see Figure 3 column 2 **Door closed and not locked**. The actuator can be removed.  
On the removal of the actuator, the door monitoring contact switches and signals that the safety guard is open (see Figure 3 column 3, **Door open** ).

- ▶ Door request (TL4019-5)  
When the actuator is in the locked state positively driven contact 21-22 is opened by pulling the safety guard (6 mm actuator stroke) as a result of which a signal is forwarded to the higher-order control system. Depending on the control concept, the safety guard can be unlocked automatically - when machine components which were still running have stopped.

**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 2).

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

The mechanical release or the mechanical key release must be returned to its original position and sealed after use (for example with sealing lacquer or using wire). Please observe the supplied dimension drawing in the case of key release.

**Lock and Escape Release**

On the actuation of the lock or the escape release, the actuator must not be under tension. The contacts 21-22 and 41-42 are opened and the switch mechanically unlocked. The state of contacts 1x-1x and 3x-3x can vary.

**Mounting**

- ⚠ Safety switches and actuators must not be used as an end stop.
- ⚠ Mount the safety switch only in assembled condition!
- ⚠ Caution! Risk of burns due to high surface temperature at ambient temperatures above 40°C! Protect switch against touching by personnel or contact with inflammable material.

- 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.
  - ▶ the escape release can be actuated from the hazard area.
  - ▶ Fit an additional end stop for the movable part of the safety guard.
  - ▶ Insert the actuator in the actuating head.
  - ▶ Mount the safety switch positively.
  - ▶ 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**

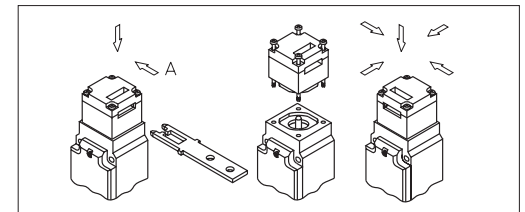


Fig. 1: Changing the actuating direction

- ▶ Remove the screws from the actuating head.
- ▶ Set the required direction.
- ▶ Tighten the screws with a torque of 0.6 Nm.
- ▶ Cover the unused actuating slot with the enclosed slot cover.

**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.

### Electrical Connection

- ⚠ When choosing the insulation material and wire for the connections, pay attention to the over-temperature in the housing (depending on the operating conditions)!
- ⚠ Only switching contacts marked with the positively driven NC contact symbol  $\ominus$  are to be used for the safety circuit.
- ⚠ For switching elements with four positively driven NC contacts only the contacts 21-22 and 41-42 are actuated on activating and deactivating the guard locking. In applications with potentially hazardous states (e.g. overtravelling movements), contact 21-22 and/or 41-42 must always be integrated into the safety circuit.

For TP without plug connector:

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

The operating voltage for the interlocking solenoid must match the value on the rating plate (e.g.  $U_S = AC/DC 24 V$ ).

- ▶ Cable entry M20x1.5
- ▶ Break out the required entry opening.
- ▶ Fit the cable gland with the appropriate degree of protection.
- ▶ For pin assignment see Figure 3.
- ▶ 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.  
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 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

- ▶ if the unit is not used for its intended purpose
- ▶ non-compliance with safety regulations
- ▶ non-compliance with safety regulations
- ▶ 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

Representative in EU: J. J. P. W. Vogelaar  
European Quality & Environment Operation Manager  
Omron Europe B.V.  
Zilverenberg 2, 5234 GM,  
's-Hertogenbosch,  
The Netherlands

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

### Technical Data

Parameters	Value
Housing material	Reinforced thermoplastic
Degree of protection according to IEC 60529	IP67
Cable entry	IP67
Mechanical life	1 x 10 <sup>6</sup> operating cycles
Ambient temperature	-20 ... +55° C
Degree of contamination (external, according to EN 60947-1)	3 (industrial)
Installation position	Any
Approach speed, max.	20 m/min
Actuating force, max. at 20° C	10 N
Extraction force	20 N
Retention force	10 N
Locking force F <sub>max</sub>	1,300 N
All TL4019 except TL4019-5	800 N
Locking force F <sub>zh</sub> in accordance with test principles GS-ET-19	(F <sub>zh</sub> = $\frac{F_{max}}{1,3}$ ) = 1,000 N
All TL4019 except TL4019-5	
Actuation frequency	1,200/h
Switching principle	Slow-action switching contact
Contact material	Silver alloy, gold flashed
Connection type	Screw terminal with cable entry
Conductor cross-section (rigid/flexible)	0.34 ... 1.5 mm <sup>2</sup>
Rated insulation voltage	U <sub>i</sub> = 250 V
Rated impulse withstand voltage	U <sub>imp</sub> = 2.5 kV
Rated short-circuit current	100 A
Switching voltage, min. at 10 mA	12 V
Utilization category to EN 60947-5-1	AC-15 4 A 230 V DC-13 4 A 24 V
Switching current, min.,	at 24 V 1 mA
Short circuit protection to IEC 60269-1	4 A gG
Conv. thermal current I <sub>th</sub>	4 A
Solenoid operating voltage/solenoid power consumption	AC/DC 24 V (+10%/-15%) 8 W 110AC 110 V (+10%/-15%) 10 W
Duty cycle	100 %
Reliability figures according to EN ISO 13849-1	
B10d	3 x 10 <sup>6</sup>

# TL4019

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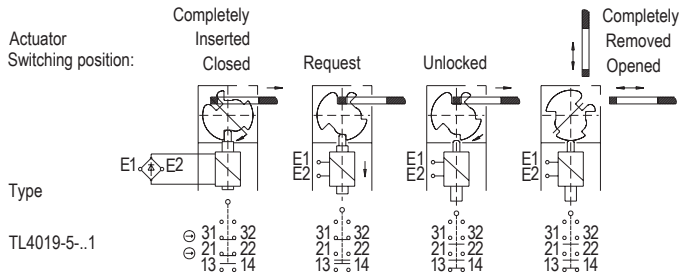
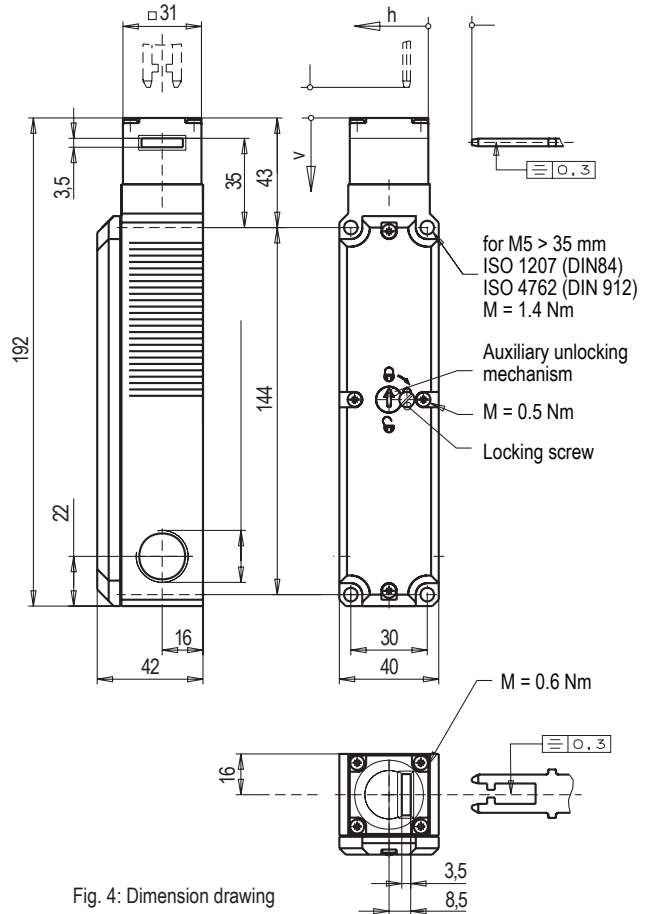
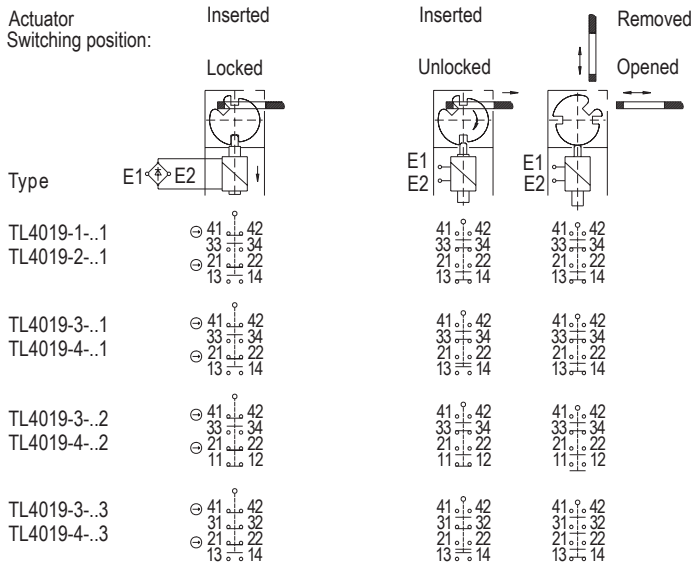


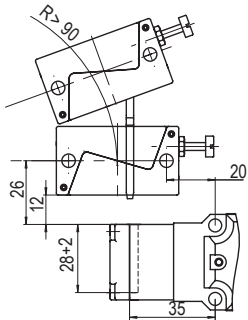
Fig. 2: Switching elements and functions

Fig. 4: Dimension drawing

Approached direction	Standard actuator	Overtravel actuator
horizontal (H)	28 + 2	28 + 7
vertical (V)	29.5 + 1.5	-

Fig. 3: Minimum travel + overtravel

### Flex 2 Actuator



### Flex 1 Actuator

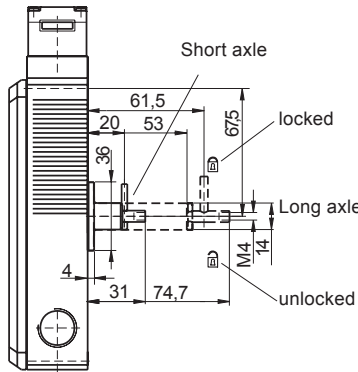
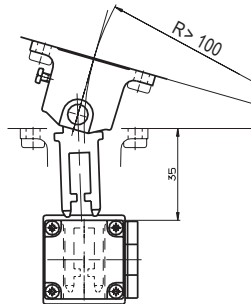


Figure 3d: With rare release

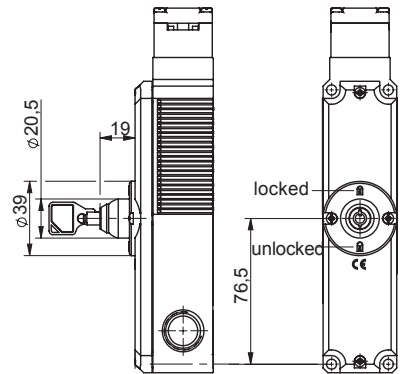


Figure 3e: With mechanical key release

Actuator type	Door radius min. [mm]
Flat	1000
90 Degree	1000
Flex 2	90
Flex 1	100

Figure 4: Min. door radii



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Original Instructions

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