Correct use

Safety switches series TQ are interlocking devices with guard locking solenoid (type 2) for process protection without safe guard lock monitoring. The actuator has a low coding level. In combination with a movable guard and the machine control, this safety component prevents dangerous machine functions from occurring while the guard is open. A stop command is triggered if the guard is opened during the dangerous machine function.

This means:

- Starting commands that cause a dangerous machine function must become active only when the guard is closed.
- Opening the guard triggers a stop command.
- Closing a guard must not cause automatic starting of a dangerous machine function. A separate start command must be issued. For exceptions, refer to EN ISO 12100 or relevant C-standards.

Devices from this series are suitable only for process protection.

Before the device is used, a risk assessment must be performed on the machine, e.g. in accordance with the following standards:

- EN ISO 13849-1
- EN ISO 12100
- IEC 62061

Correct use includes observing the relevant requirements for installation and operation, particularly based on the following standards:

- EN ISO 13849-1
- EN ISO 14119
- EN 60204-1

Important!

- The user is responsible for the proper integration of the device into 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 of EN ISO 13849-1:2015 is used for determining the Performance Level (PL), the PL might be reduced if several devices are connected in series.
- Logical series connection of safe contacts is possible up to PL d in certain circumstances. More information about this is available in ISO TR 24119.
- 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

⚠ WARNING

Danger to life due to improper installation or due to bypassing (tampering). Safety components perform a personnel protection function.

- Safety components must not be bypassed, 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 ISO 14119:2013, section 7.
- The switching operation must be triggered only by actuators designated for this purpose.
- Prevent bypassing by means of replacement actuators. For this purpose, restrict access to actuators and to keys for releases, for example.
- Mounting, electrical connection and setup only by authorized personnel possessing special knowledge about handling safety components.

⚠ CAUTION

Danger due to high housing temperature.

- Protect switch against touching by personnel or contact with flammable material.

Function

The safety switch permits the locking of movable guards for process protection.

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/release of the guard locking. During this process the switching contacts are actuated.

If the cam is blocked (guard locking active), the actuator cannot be pulled out of the switch head. For design reasons, guard locking can be activated only when the guard is closed (prevention of inadvertent locking position (faulty closure protection)).

Position monitoring of the guard and monitoring of interlocking are performed via two separate switching elements (see Fig. 1).

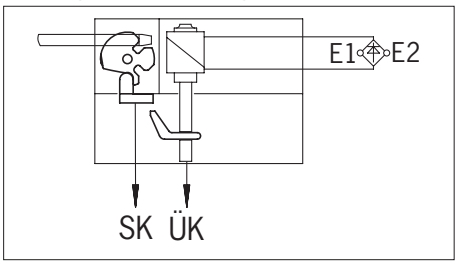


Fig. 1: Function of safety switch TQ

The safety switch is designed so that fault exclusions for internal faults in accordance with EN ISO 13849-2:2013, Table A4, can be assumed.

Monitoring contacts for the guard locking position

All versions feature at least one contact for monitoring guard locking. These contacts are opened when guard locking is released.

Version TQ1

(guard locking actuated by spring force and released by power-ON)

- Activating guard locking: close guard; no voltage at the solenoid
- Releasing guard locking: apply voltage to the solenoid

The spring-operated guard locking functions in accordance with the closed-circuit current principle. If the voltage is interrupted at the solenoid, the guard locking remains active and the guard cannot be opened directly.

If the guard is open when the power supply is interrupted and is then closed, guard locking is activated. This can lead to persons being locked in unintentionally.

Version TQ2

(guard locking actuated by power-ON and released by spring force)

- Activating guard locking: apply voltage to the solenoid
- Releasing guard locking: disconnect voltage from the solenoid

The magnetically actuated guard locking operates in accordance with the open-circuit current principle. If the voltage at the solenoid is interrupted, the guard locking is released and the guard can be opened directly!

Switching states

The detailed switching states for your switch can be found in Fig. 4. All available switching elements are described there.

Guard open

TQ1 and TQ2:
The safety contacts ⊖ are open.

Guard closed and not locked

TQ1 and TQ2:
The safety contacts ⊖ are closed, the guard lock monitoring contacts are open.

Guard closed and locked

TQ1 and TQ2:
The safety contacts ⊖ are closed, the guard lock monitoring contacts are closed.

Selection of the actuator

NOTICE

Damage to the device due to unsuitable actuator. Make sure to select the correct actuator (see table in Fig. 5).

Additionally pay attention to the door radius and the mounting options (see Fig. 6).

Manual release

Some situations require the guard locking to be released manually (e.g. malfunctions or an emergency). A function test should be performed after release.

More information on this topic can be found in the standard EN ISO 14119:2013, section 5.7.5.1. The device can feature the following release functions:

Auxiliary release with screwdriver

Important!

Only use in an emergency!

- After release, the screw must be tightened to 0.3 to max. 0.5 Nm.

In the event of malfunctions, the guard locking can be released with the auxiliary release irrespective of the state of the solenoid.

The guard locking monitoring contacts are opened when the auxiliary release is actuated.

Actuating auxiliary release

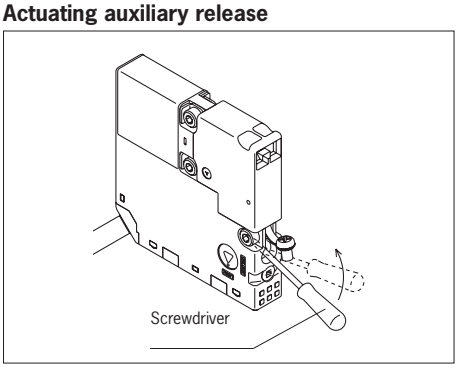


Fig. 2: Auxiliary release with screwdriver

1. Remove screw on the side of the safety switch (under the actuating slot).
2. Using a small screwdriver, press the tongue inside in the direction of the LED until the actuator is released.

➡ Guard locking is released.

Important!

- The actuator must not be under tensile stress during manual release.
- To prevent tampering, the auxiliary release must be sealed (with sealing lacquer, for example) before the switch is set up.
- After use, reset the auxiliary release and tighten the locking screw to 0.3 to max. 0.5 Nm.

Auxiliary release with triangular wedge

Important!

Always turn triangular key to the respective end stop.

If the key is not turned to the end stop, incorrect switching or even damage to the safety switch may result.

Same function as for auxiliary release with screwdriver.

Actuating auxiliary release

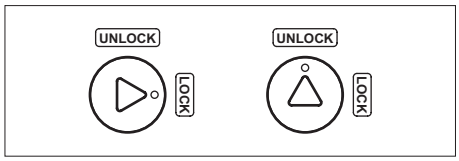


Fig. 3: Auxiliary release with triangular wedge

- Insert triangular key into the release on the switch and turn 90° to the released position.

Important!

The actuator must not be under tensile stress during manual release.

Mounting

NOTICE

Device damage due to improper mounting and unsuitable ambient conditions

- Safety switches and actuators must not be used as an end stop.
- Insert the actuator into the switch head prior to mounting.
- Observe EN ISO 14119:2013, sections 5.2 and 5.3, for information about mounting the safety switch and the actuator.
- After a hinged actuator is positioned, the adjusting screws should be secured (e.g. with Loctite).
- Observe EN ISO 14119:2013, section 7, for information about reducing the possibilities for bypassing an interlocking device.
- Protect the switch head against damage, as well as penetrating foreign objects such as swarf, sand and blasting shot, etc.
- The specified IP degree of protection is applicable only if the housing screws, cable entries and plug connectors are properly tightened. Observe the tightening torques.

Electrical connection

⚠ WARNING

Loss of the safety function due to incorrect connection.

- Use only safe contacts ⊖ for safety functions. Monitoring contacts must not be used for safety functions.
- When choosing the insulation material and wires for the connections, pay attention to the required temperature resistance and the max. mechanical load!
- Strip the insulation from the ends of the individual wires over a length of $6^{\pm 1}$ mm to ensure a reliable contact.

Use of the safety switch as guard locking for process protection

At least one contact ⊖ must be used (see Fig. 4 for terminal assignment).

Function test

⚠ WARNING

Fatal injury due to faults during the function test.

- Before carrying out the function test, make sure that there are no persons in the danger zone.
- Observe the valid accident prevention regulations.

Check the device for correct function after installation and after every fault.

Proceed as follows:

Mechanical function test

The actuator must slide easily into the actuating head. Close the guard several times to check the function. The function of any manual releases (except for the auxiliary release) must also be tested.

Electrical function test

1. Switch on operating voltage.
2. Close all guards and activate guard locking.

➡ The machine must not start automatically.

➡ It must not be possible to open the guard.

3. Start the machine function.

➡ It must not be possible to release guard locking as long as the machine function is active.

4. Stop the machine function and release guard locking.

➡ The guard must remain locked until the process is no longer at risk.

➡ It must not be possible to start the machine function as long as guard locking is released.

Repeat steps 2 - 4 for each guard.

Inspection and service

⚠ WARNING

Danger of severe injuries due to the loss of the safety function.

- If damage or wear is found, the complete switch and actuator assembly must be replaced. Replacement of individual parts or assemblies is not permitted.
- Check the device for proper function at regular intervals and after every fault. For information about possible time intervals, refer to EN ISO 14119:2013, section 8.2.

Inspection of the following is necessary to ensure trouble-free long-term operation:

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

Info: The year of manufacture can be seen in the bottom, right corner of the type label.

Exclusion of liability and warranty

In case of failure to comply with the conditions for correct use stated above, or if the safety regulations are not followed, or if any servicing is not performed as required, liability will be excluded and the warranty void.

EU declaration of conformity

The declaration of conformity is part of the operating instructions, and it is included as a separate sheet with the device.

The original EU declaration of conformity can also be found at: www.euchner.com

Service

If servicing is required, please contact:

EUCHNER GmbH + Co. KG
Kohlhammerstraße 16
70771 Leinfelden-Echterdingen
Germany

Service telephone:
+49 711 7597-500

E-mail:
support@euchner.de

Internet:
www.euchner.com

Technical data

Parameter	Value
Housing material	Reinforced thermoplastic
Degree of protection	IP67
Mechanical life	1 x 10^6 operating cycles
Electrical life DC-13 1 A/24 V	1 x 10^5
Ambient temperature	-25 ... +50 °C
Degree of contamination (external, acc. to EN 60947-1)	3 (industrial)
Installation orientation	Any
Approach speed, max.	0.05 ... 1.0 m/min
Extraction force (not locked)	10 N
Retention force	1 N
Actuating force, max., at 20 °C	5 N
Actuation frequency	900/h
Switching principle	Slow-action switching contact
Contact material	Silver alloy, gold flashed
Connection	Connecting cable, 5 m
Rated insulation voltage	
Safety contact SK Monitoring contact ÜK	U_i = 250 V U_i = 150 V
Rated impulse withstand voltage	U_{imp} = 2.5 kV (1.5 kV between the contacts)
Conditional short-circuit current	100 A
Switching voltage, min., at 10 mA	12 V
Utilization category acc. to EN 60947-5-1	AC-15 1 A 125 V / DC-13 1 A 24 V
Switching current, min., at 24 V	1 mA
Short circuit protection (control circuit fuse) acc. to IEC 60269-1	2.5 A gG
Convent. thermal current I_{th}	2.5 A
Solenoid operating voltage/ solenoid power consumption	DC 24 V (+10%/-15%) 2.7 W
Duty cycle	100%
Locking force F_{max}	F_S = 650 N (F_S = 130 N with actuator Q-WT)
Locking force F_{Zh} acc. to EN ISO 14119	($F_{Zh} = \frac{F_{max}}{1.3}$) = 500 N ($F_{Zh}$ = 100 N with actuator Q-WT)
Technical data as per TÜV and UL	
Utilization category	Safety contact U_i 300 V AC-15 0.75 A/240 VAC: pilot duty DC-13 0.27 A/250 VDC: pilot duty
	Monitoring contact U_i 150 V AC-15 1 A/125 VAC: pilot duty DC-13 0.22 A/125 VDC: pilot duty
Reliability values acc. to EN ISO 13849-1	
B_{10D}	2 x 10^6

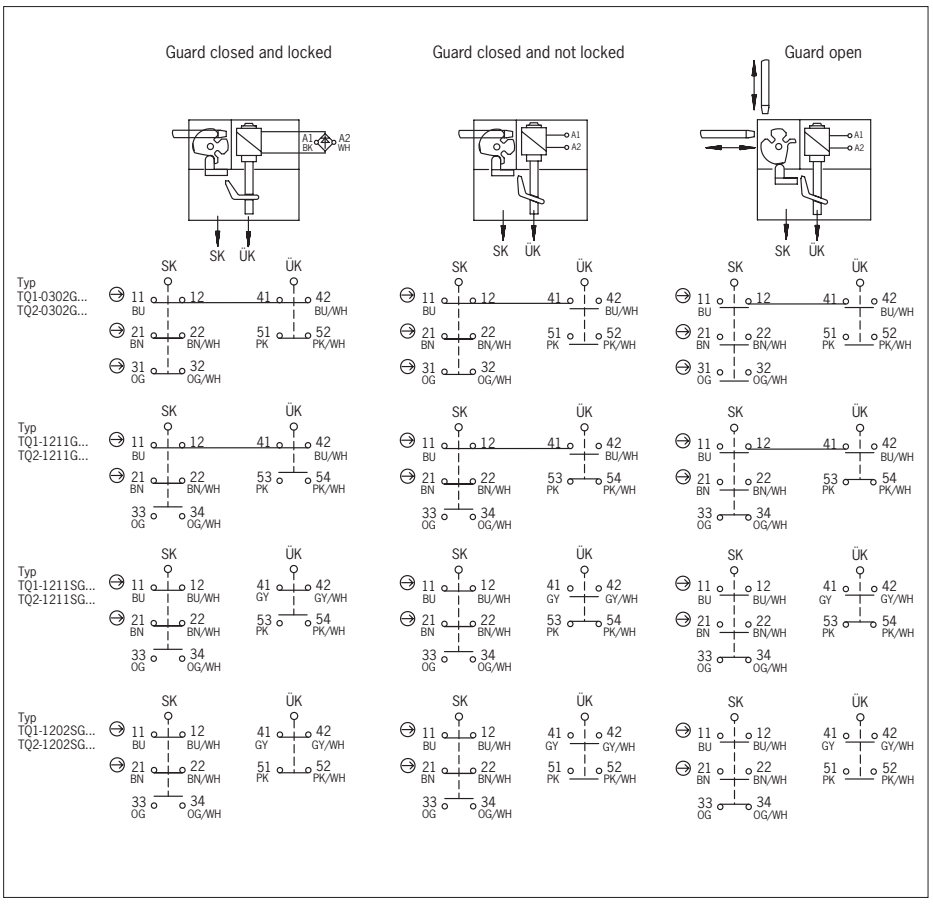


Fig. 4: Switching elements and switching functions

Necessary minimum travel + perm. overtravel

Approach direction	Actuator	
	Q-GT/Q-LU/Q-RO/Q-WT	Q-WTB
Vertical (v)	26.3 + 1.9	26.3 + 1.3

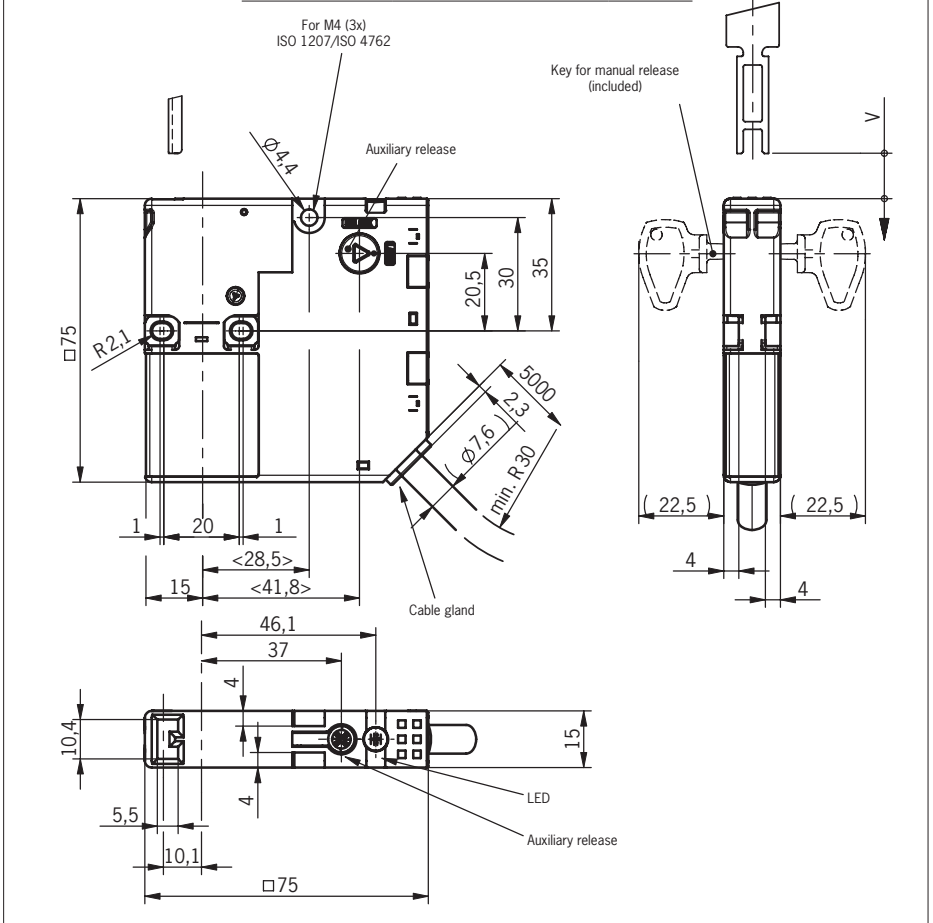
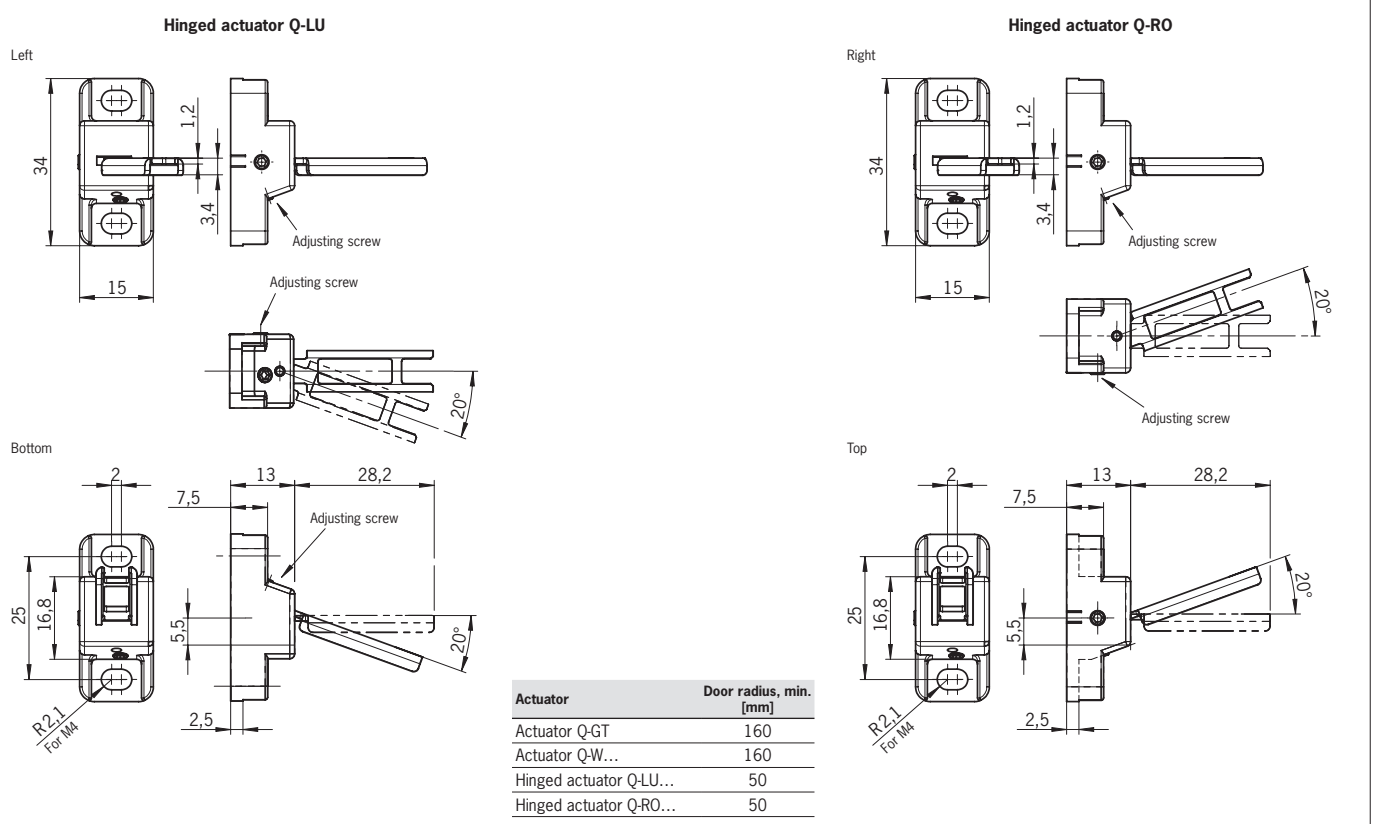


Fig. 5: Dimension drawing for TQ...; minimum travel and overtravel



Actuator	Door radius, min. [mm]
Actuator Q-GT	160
Actuator Q-W...	160
Hinged actuator Q-LU...	50
Hinged actuator Q-RO...	50

Fig. 6: Minimum door radii