

Correct use

Safety switches series TX are electromagnetic interlock devices with guard locking.

They interlock movable safety guards so that

- ▶ dangerous work on machines can only be carried out if the safety guard is closed and locked
- ▶ the safety guard cannot be opened when the machine is running.

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 954-1, Safety of machinery. Safety related parts of control systems. General principles for design, Annex B
- ▶ EN 1050, Safety of machinery. Principles for risk assessment
- ▶ 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 954-1, 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 60 204-1, Safety of machinery. Electrical equipment of machines. General requirements.



Safety Precautions



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

- ▶ Safety switches must **not** be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.
- ▶ The switching operation must only be triggered by actuators specifically provided for this purpose which are permanently connected to the safety guard.

Function

Safety switches series TX permit locking of movable safety guards.

Position monitoring of the safety guard and monitoring of interlocking are performed via the same switching element.

Version TX1 and TX3

(spring interlock)

The guard locking pin is held in 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 TX2 and TX4

(solenoid interlock)

- ▶ This type may 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 and locking

The guard locking pin is released by insertion of the actuator into the safety switch.

TX1 and TX3: The guard locking pin is moved to locked position by spring force.

TX2 and TX4...110/230: The guard locking pin is moved to locked position when the solenoid operating voltage is applied.

TX4...024: The guard locking pin is moved to locked position by applying the control voltage when the solenoid operating voltage is present.

The safety contacts are closed.

Unlocking

TX1 and TX3...110/230: When the operating voltage is applied to the solenoid, the guard locking pin unlocks the actuator / safety guard to the switch position *Unlocked* (see Figure 2).

TX3...024: On the application of the control voltage when the solenoid operating voltage is present, the guard locking pin unlocks the actuator / safety guard to the switch position *Unlocked* (see Figure 2).

TX2 and TX4...110/230: When the operating voltage is removed from the solenoid, the guard locking pin unlocks the actuator / safety guard to the switch position *Unlocked* (see Figure 2).

TX4...024: When the operating voltage is removed from the solenoid and/or the control voltage is removed, the guard locking pin unlocks the actuator / safety guard to the switch position *Unlocked* (see Figure 2).

On the versions TX3 and TX4 the actuator can be unlocked by pulling it.

The safety contacts are opened.

Opening

The guard locking pin is blocked when the actuator is pulled out. The safety contacts remain positively opened.

- ▶ Only switching elements marked with the positive opening symbol shall be used for the safety circuit.

Mechanical release

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

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

Mounting

- ▶ Mounting must be performed only by authorized personnel.

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.

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

- ▶ Mount the safety switch only in assembled condition!

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

Changing the actuating direction

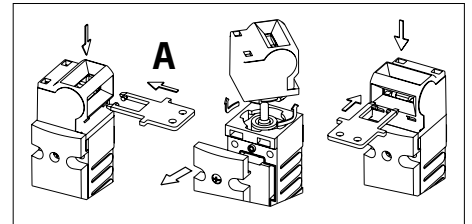


Figure 1: Changing the actuating direction

- ▶ 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 effects

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

- ▶ Electrical connection must be performed only by authorized personnel.

The solenoid operating voltage, the LED operating voltage and the control voltage (only TX3...024 and TX4...024) for the locking solenoid must comply with the information on the rating plate (e.g. UB = AC/DC 24 V).

Solenoid operating voltage and control voltage can be bridged if a current of 2A can be supplied for TIMP = 250ms on switching on the solenoid.

- ▶ Version TX...M/N (cable entry)
- ▶ Unscrew locking screw for the required insertion opening.
- ▶ Fit the cable gland with the appropriate degree of protection.
- ▶ For pin assignment see Figure 5.
- ▶ Tighten the screws for the switching element with a torque of 0.5 Nm.
- ▶ Check that the cable entry is sealed.
- ▶ Close the cover and screw in position.
- ▶ Version TX..RC18/BH12 (plug connector)
- ▶ For pin assignment see Figure 6.

Setup

- ▶ 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

- ▶ Close the safety guard. Start the machine. It must **not** be possible to open the safety guard!
- ▶ Switch off the machine. Open the safety guard. The machine must **not start** when the safety guard is open!

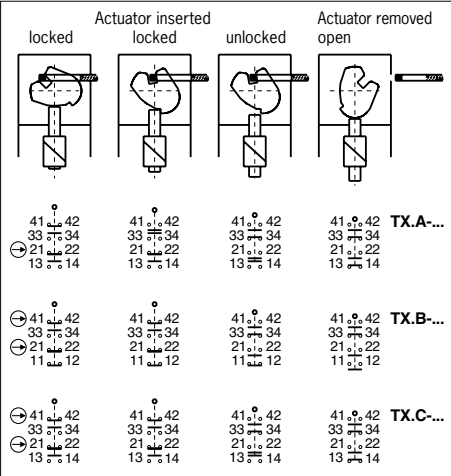


Figure 2: Switching elements and switching functions

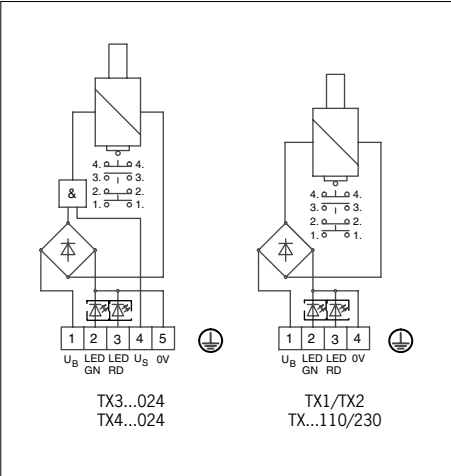


Figure 5: Circuit diagrams

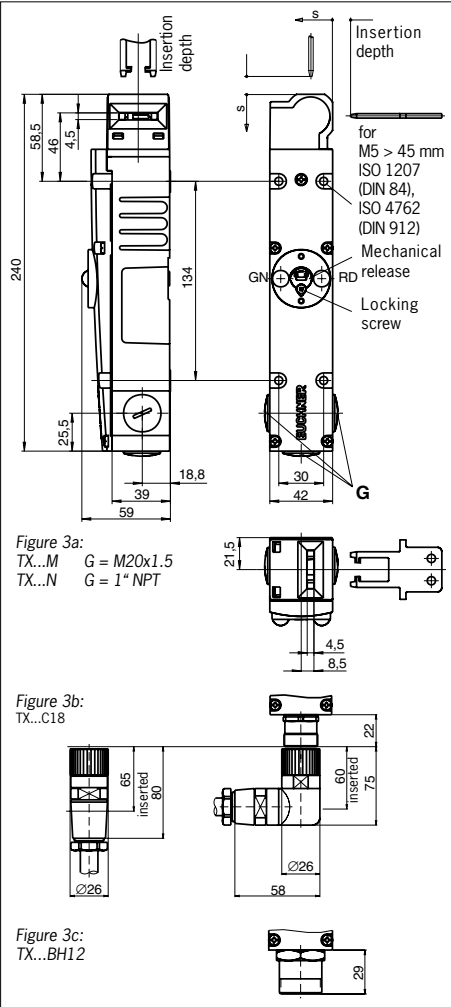


Figure 3: Dimension drawings

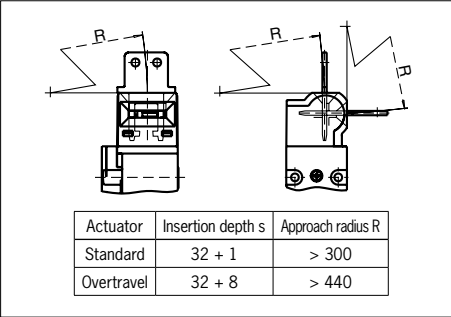


Figure 4: Insertion depth and approach radii

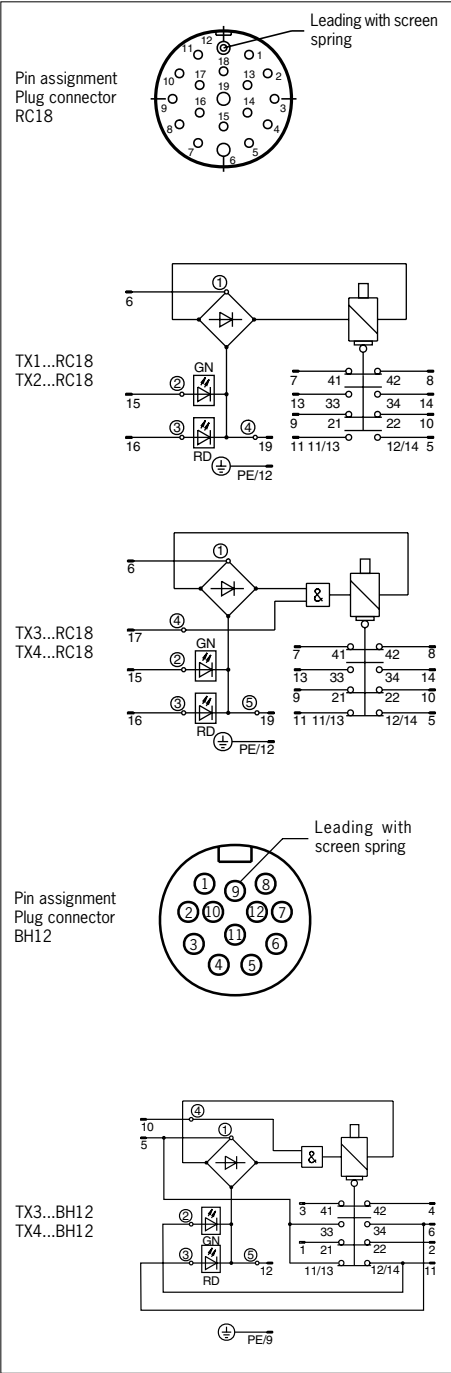


Figure 6: Pin assignment

Service and inspection

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.

⚠ If damage or wear is found, the complete switch and actuator assembly must be replaced.
Replacement of individual parts or assemblies is not permitted!

Safety switches must be exchanged completely after 1 million switching operations.

Exclusion of liability under the following conditions:

- ▶ if the unit is not used for its intended purpose
- ▶ non-compliance with safety regulations
- ▶ installation and electrical connection not performed by authorized personnel
- ▶ failure to perform functional checks.

Technical data

Parameters	Value
Housing material	Die-cast alloy, cathodically dipped
Degree of protection according to IEC 529 with cable gland with plug connector	IP 67 IP 65
Mech. operating cycles	>1x10 ⁶
Ambient temperature	-20...+80°C
Installation position	Any, actuating head down preferred
Approach speed, max.	20 m/min
Switching principle	Slow-action switching element
Contact material	Silver alloy, gold flashed
Connection type on switching element	Screw terminals
Connection type on circuit board	Cage-pull clamps
Conductor cross-section	Max. 1.5 mm ²
Rated insulation voltage with cable gland with plug connector	U _i = 250 V U _i = 50 V
Utilization category for the switching element to IEC 947-5-1	AC-15 4 A 230 V DC-13 4 A 24 V
Switching voltage, min.	12 V
Switching current, min., at 24 V	1 mA
Short circuit protection (control circuit fuse)	4 A gG
Solenoid operating voltage U _b / power input (TX3...024 and TX 4...024: I _b = 2 A for T _{imp} = 250 ms)	AC/DC 24 V 8 W AC/DC 110 V 10 W AC/DC 230 V 11 W
Duty cycle	100 %
Operating frequency max. on TX3 and TX4	45 min-1
Control voltage U _s on TX3...024 / TX4...024	AC/DC 24 V
Actuating force	35 N
Extraction force	35 N
Retention force	20 N
Locking force F _{max}	1700 N
Locking force F _{zh} in accordance with Test Principles GSET-19 (F _{zh} = F _{max} / 1.3)	(F _{zh} = F _{max} / 1.3) = 1300 N