

Correct use

Safety switches series TP are interlocking devices with guard locking solenoid (type 2). The actuator has a low coding level. In combination with a movable guard and the machine control, this safety component prevents the guard from being opened while a dangerous machine function is being performed. This means:

- ▶ Starting commands that cause a dangerous machine function must become active only when the guard is closed and locked.
- ▶ The guard locking must not be released until the dangerous machine function has ended.
- ▶ Closing and locking 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 also suitable 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 fulfill 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 at ambient temperatures above 40 °C.

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

Function

The safety switch permits the locking of movable 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/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)).

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.

Guard lock monitoring

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

Door monitoring contact

Versions TP3 and TP4 additionally feature at least one door monitoring contact. Depending on the switching element, the door monitoring contacts can be either positively driven (contacts ) or not positively driven.

The door monitoring contacts are actuated when the guard is opened.

Door unlock request contact

Versions TP5 and TP6 feature a door unlock request contact. When guard locking is active, pulling the guard (6 mm actuator stroke) opens positively driven contact 21-22 and thereby forwards a signal to the higher-level control system. Depending on the control concept, the guard can be unlocked automatically when machine components that were still running have stopped.

Versions TP1, TP3 and TP5

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

- ▶ Activating guard locking: close guard, disconnect voltage from 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.

Versions TP2, TP4 and TP6

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

Important!

Use as guard locking for personnel protection is possible only in special cases, after strict assessment of the accident risk (see EN ISO 14119:2013, section 5.7.1)!

- ▶ Activating guard locking: close guard, 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 Figure 3. All available switching elements are described there.

Guard open

TP1, TP2, TP5 and TP6:


The safety contacts  are open.

TP3 and TP4:



The safety contacts  and  are open.

Guard closed and not locked

TP1, TP2, TP5 and TP6:


The safety contacts  are open.

TP3 and TP4:



The safety contacts  are closed. The safety contacts  are open.

Guard closed and locked

TP1, TP2, TP5 and TP6:

The safety contacts  are closed.

TP3 and TP4:

The safety contacts  and  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 Figure 2).

Increased overtravel of the actuator with a vertical approach direction is possible only with the versions TP...K....

Additionally pay attention to the door radius and the mounting options (see Figure 4).

The following versions are available:

- ▶ Standard actuator for a permissible overtravel of 2 mm horizontally and 1.5 mm vertically.
- ▶ Overtravel actuator for an increased permissible overtravel of 7 mm (horizontally and vertically) and for versions with insertion funnel.


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

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

The contacts  are opened when the auxiliary release is actuated. A stop command must be generated with these contacts.

Actuating auxiliary release

1. Unscrew locking screw.
 2. Using a screwdriver, turn the auxiliary release to  in the direction of the arrow.
- ➔ Guard locking is released.

Important!

- The actuator must not be under tensile stress during manual release.
- After use, reset the auxiliary release and screw in and seal the locking screw (e.g. with sealing lacquer).

Auxiliary key release/auxiliary release with triangular wedge

Function as for auxiliary release.

Important!


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

Escape release

Permits opening of a locked guard from the danger zone without tools.

Important!

- It must be possible to actuate the escape release manually from inside the protected area without tools.
- It must not be possible to reach the escape release from the outside.
- The actuator must not be under tensile stress during manual release.
- The escape release meets the requirements of Category B according to EN ISO 13849-1:2015.


The contacts  are opened when the escape release is actuated. A stop command must be generated with these contacts.

Emergency release

Permits opening of a locked guard from outside the danger zone without tools.

Important!

- It must be possible to operate the emergency release manually from outside the protected area without tools.
- The emergency release must possess a marking indicating that it may be used only in an emergency.
- The actuator must not be under tensile stress during manual release.
- The release function meets all other requirements from EN ISO 14119.
- The emergency release meets the requirements of Category B according to EN ISO 13849-1:2015.

The contacts  are opened when the emergency release is actuated. A stop command must be generated with these contacts.

Wire front release (bowden)

Release via a pull wire. Depending on the type of attachment, the wire front release can be used as emergency release or escape release.

Important!

- The wire front release meets the requirements of Category B according to EN ISO 13849-1:2015.
- The correct function depends on the laying of the pull wire and the attachment of the pull handle, and this is the responsibility of the plant manufacturer.
- 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.
- Observe EN ISO 14119:2013, sections 5.2 and 5.3, for information about mounting the safety switch and the actuator.
- 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.

Changing the actuating direction

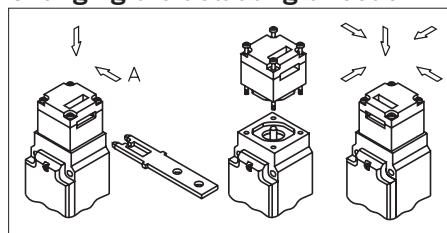




Figure 1: Changing the actuating direction

1. Remove the screws from the actuating head.
2. Set the required direction.
3. Tighten the screws with a torque of 0.8 Nm.
4. Cover the unused actuating slot with the enclosed slot cover.


Electrical connection

⚠ WARNING



Loss of the safety function due to incorrect connection.

- Use only safe contacts ( and ) 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±1 mm to ensure a reliable contact.

Use of the safety switch as guard locking for personnel protection

At least one contact  must be used. It signals the guard locking state (for terminal assignment, see Figure 3).

Use of the safety switch as guard locking for process protection

At least one contact  must be used. Contacts with the  symbol can also be used (for terminal assignment, see Figure 3).

The following information applies to devices with plug connector:

- Check that the plug connector is sealed.

The following information applies to devices with cable entry:

1. Use a suitable tool to open the desired insertion opening.
2. Fit the cable gland with the appropriate degree of protection.
3. Connect and tighten the terminals with 0.5 Nm (for terminal assignment, see Figure 3).
4. Check that the cable entry is sealed.
5. Close the switch cover and screw in place (tightening torque 0.8 Nm).

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 dangerous machine function is active.
4. Stop the machine function and release guard locking.
- ➔ The guard must remain locked until there is no longer any risk of injury (e.g. due to movements with overtravel).
- ➔ 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.

Notes about

The following information applies to devices with cable entry:

For use and application as per the requirements of  a copper wire for the temperature range 60/75 °C must be used.

The following information applies to devices with plug connector:

This device is intended to be used and applied with a Class 2 power source in accordance with UL1310. Connecting 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 that 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 that possess an identical or higher dielectric strength compared to the other relevant parts of the system.

EU declaration of conformity

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

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 acc. to IEC 60529	
Cable entry	IP67
Plug connector SR6/SR11	IP65
Mechanical life	1 x 10 ⁶ operating cycles
Ambient temperature	-20 ... +55 °C
Degree of contamination (external, acc. to EN 60947-1)	3 (industrial)
Installation orientation	Any
Approach speed, max.	20 m/min
Extraction force (not locked)	20 N
Retention force	10 N
Actuating force, max.	10 N
Actuation frequency	1,200/h
Switching principle	Slow-action switching contact
Contact material	Silver alloy, gold flashed
Connection	
TP...	Cable entry
TP...SR6	Plug connector SR6, 6-pin+PE (PE not connected)
TP...SR11	Plug connector SR11, 11-pin+PE (PE not connected)
Conductor cross-section (flexible/rigid)	0.34 ... 1.5 mm ²
Operating voltage for optional LED indicator	L024 24 V
Rated insulation voltage	
TP..., TP...SR6	U _i = 250 V
TP...SR11	U _i = 50 V
Rated impulse withstand voltage	
TP..., TP...SR6	U _{imp} = 2.5 kV
TP...SR11	U _{imp} = 1.5 kV
Conditional short-circuit current	100 A
Switching voltage, min., at 10 mA	12 V
Utilization category acc. to EN 60947-5-1	
TP..., TP...SR6	AC-15 4 A 230 V / DC-13 4 A 24 V
TP...SR11	AC-15 4 A 50 V / DC-13 4 A 24 V
Switching current, min., at 24 V	1 mA
Short circuit protection (control circuit fuse) acc. to IEC 60269-1	4 A gG
Convent. thermal current I _{th}	4 A
Solenoid operating voltage/solenoid power consumption	
TP...024	AC/DC 24 V (+10%/-15%) 8 W
TP...048	AC/DC 48 V (+10%/-15%) 8 W
TP...110	AC 110 V (+10%/-15%) 10 W
TP...230	AC 230 V (+10%/-15%) 11 W
Duty cycle	100%
Locking force F _{max}	
TP1/TP2/TP3/TP4	F _{max} = 1,300 N
TP5/TP6	F _{max} = 800 N
Locking force F _{Zh}	(F _{Zh} = $\frac{F_{max}}{1.3}$)
acc. to EN ISO 14119	
TP1/TP2/TP3/TP4	F _{Zh} = 1,000 N
TP5/TP6	F _{Zh} = 600 N
Reliability values acc. to EN ISO 13849-1	
B ₁₀₀ at DC-13 100 mA/24 V	3 x 10 ⁶

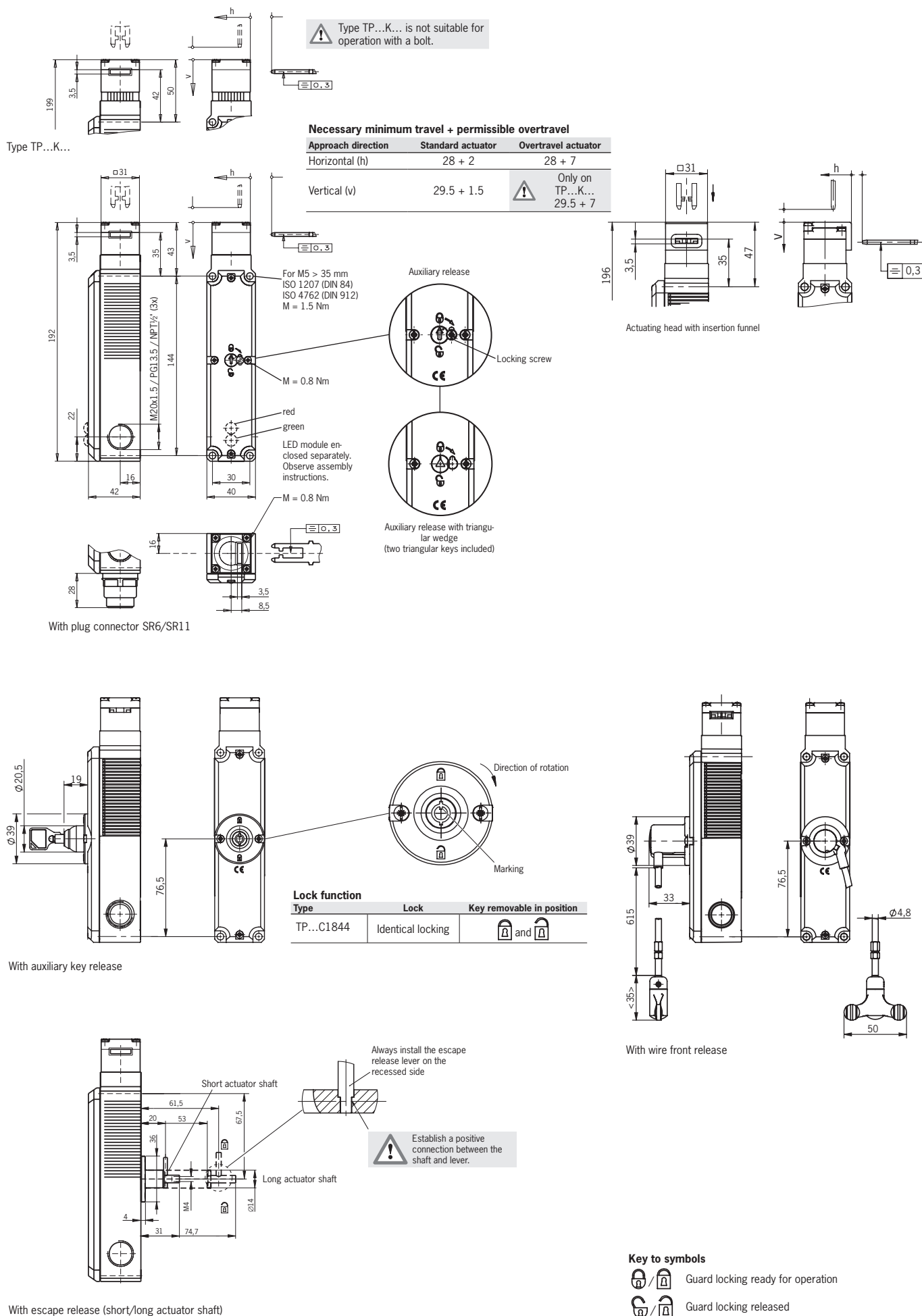


Figure 2: Dimension drawing for TP...

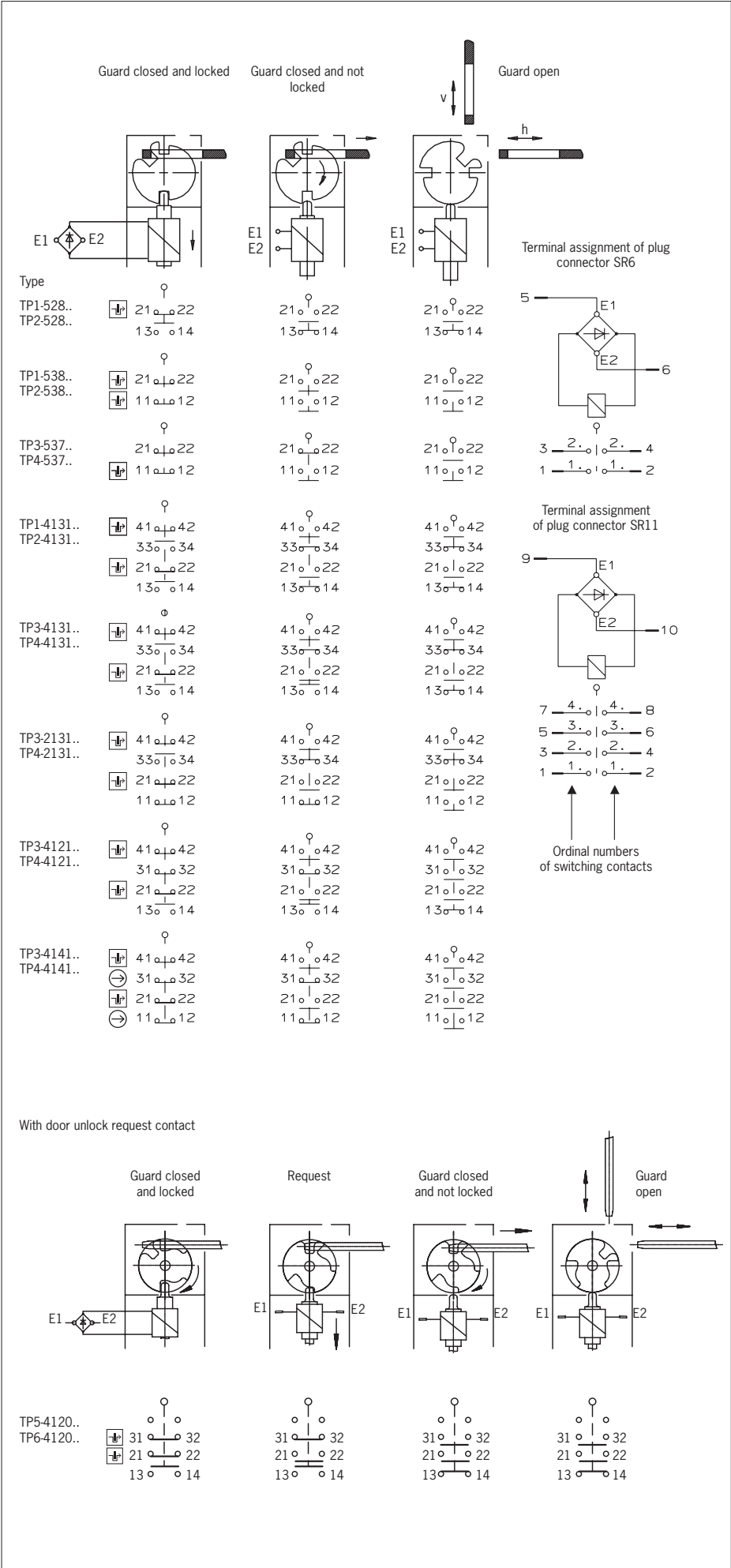


Figure 3: Switching elements and switching functions

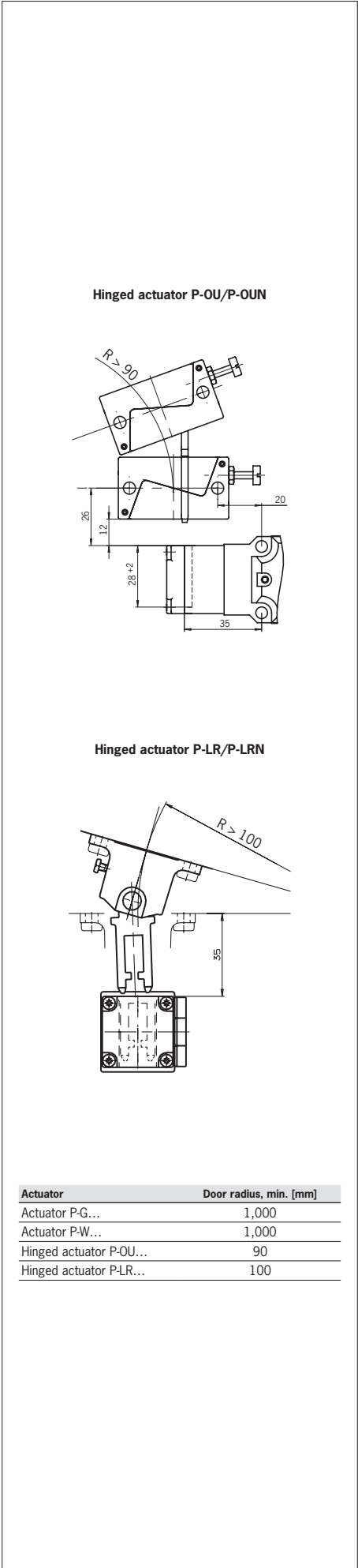


Figure 4: Minimum door radii