Correct use

Precision single limit switches series N01/NB01/SN01 are interlocking devices without guard locking (with safety function). The actuator is uncoded (e.g. dog). In combination with a movable safety guard and the machine control, this safety component prevents dangerous machine functions from occurring while the safety guard is open. A stop command is triggered if the safety guard is opened during the dangerous machine function.

For general applications, snap-action switching elements that are not positively driven are used. For usage as safety switches, only the switching element ES588 with positively driven NC contacts is allowed.

This means:

- Starting commands that cause a dangerous machine function must become active only when the safety guard is closed.
- Opening the safety guard triggers a stop command.
- Closing a safety 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 can be used as safe position encoders.

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, Safety of machinery – Safety-related parts of control systems – Part 1: 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 observing the relevant requirements for installation and operation, particularly based on the following standards:

- EN ISO 13849-1, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- EN ISO 14119, Safety of machinery – Interlocking devices associated with guards – Principles for design and selection
- EN 60204-1, Safety of machinery – Electrical equipment of machines.

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 personal 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.
- Mounting, electrical connection and setup only by authorized personnel possessing special knowledge about handling safety components.

Function

Precision single limit switches are used for positioning and control applications in mechanical and systems engineering.

The switching elements are actuated by means of plungers. Different plunger types and trip dogs are used depending on the application (operating point accuracy and approach speed) (see Figure 2).

In general applications the plunger is actuated by trip dogs in accordance with DIN 69639 which are mounted with an interference fit in trip rails in accordance with DIN 69638.

The switching contacts are actuated when the actuating element is moved from the free position to the end position. The safety contacts ⊖ are positively opened in this process.

Switching states

The detailed switching states for your switch can be found in Figure 11. All available switching elements are described there.

Actuating element in free position

The safety contacts ⊖ are closed.

Actuating element in end position

The safety contacts ⊖ are open.

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 fastening the safety switch and the actuator.
- Observe EN ISO 14119:2013, section 7, for information about reducing the possibilities for bypassing an interlocking device.
- It is imperative that dimension $11_{-0.5}$ (distance from switch reference surface to trip dog, see Figure 3) is maintained in safety circuits to ensure safe contact opening.
- Protect the switch head against damage.

Protection against environmental influences

Safety venting valves (see Figure 3, for example) are used to compensate for the pumping action of the plungers. They must not be sealed with paint.

- Mask plunger, plunger guide, safety venting valves and rating plate during painting work!

Changing the actuating direction

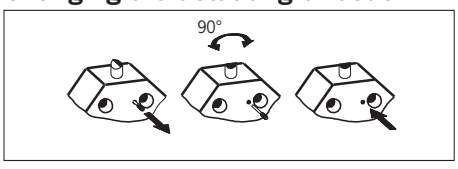


Figure 1: Changing the actuating direction

1. Unscrew the locking screw.
2. Set the required direction.
3. Screw in the locking screw again.

Electrical connection

⚠ WARNING

Loss of the safety function due to incorrect connection.

- Use only safe contacts (⊖) for safety functions.

Use of the safety switch as an interlocking device for personnel protection

At least one contact ⊖ must be used. This signals the position of the safety guard (for terminal assignment, see Figure 11).

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 (for terminal assignment, see Figure 11; for tightening torque values, see technical data).
4. Check that the cable entry is sealed.
5. Close the switch cover and screw in place (tightening torque 0.5 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 area.
- 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 actuating element must move easily. Close the safety guard several times to check the function.

Electrical function test

1. Switch on operating voltage.
2. Close all safety guards.
➡ The machine must not start automatically.
3. Start the machine function.
4. Open the safety guard.
➡ The machine must switch off and it must not be possible to start it as long as the safety guard is open.

Repeat steps 2 - 4 for each safety guard.

Inspection and service

⚠ WARNING

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

- In safety circuits, the entire switch must be replaced in case of damage or wear. 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
- precise adjustment of trip dog in relation to single limit switch
- damage, heavy contamination, dirt and wear

- sealing of cable entry
- loose cable connections or plug connectors.

Information: The year of manufacture can be seen in the bottom, right corner of the rating plate.

Exclusion of liability and warranty

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

Notes about c UL us

The following information applies to devices with plug connector:

For use and applications as per the requirements of c UL us, a class 2 power supply according to UL1310 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 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 service support is required, please contact:

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

Service telephone:
+49 711 7597-500

Fax:
+49 711 753316

E-mail:
support@euchner.de

Internet:
www.euchner.de

Technical data

Parameter		Value
Housing material		Die-cast aluminum, anodized
Plunger material		Stainless steel
Degree of protection		IP 67
Mech. operating cycles		30 x 10^6
Ambient temperature with switching element		
ES550/553/556/558/562/620		-5 ... +80 °C
ES572 (high temp. version)		-5 ... +125 °C (200 h at 180 °C)
ES588 ⊖		-25 ... +70 °C
ES560/593		-5 ... +125 °C (manufacturer's data max. +140 °C)
Installation position		Any
Max. approach speed		
Plunger	Chisel D	20 m/min
	Roller R (slide bearing)	50 m/min
	Ball K	8 m/min
Min. approach speed		0.01 m/min
Actuating force with switching element		≥ 15 N
Switching element		
ES550/553/556/560/562/572/593/620		1 changeover contact
ES558		1 NC contact + 1 NO contact
ES588 ⊖		1 positively driven contact
Switching principle		
ES550/553/556/558/560/562/572/593/620		Snap-action switching contact
ES588 ⊖		Positively driven slow-action switching contact
Switching hysteresis		
ES550/553/556/560/562/572/593/620		max. 0.1 mm
ES558		0.5 mm
Connection		
ES550/558/560/562/572/593		Soldered connection
ES553/556/588/620		Screw terminal
Tightening torque of screw terminal		
ES553/556 (hexagon socket head screw, AF 1.3 mm)		0.2 Nm
ES588 (slot head screw)		0.3 Nm
ES620 (slot head screw)		0.5 Nm
Conductor cross-section		
ES553/556/620		0.14 ... 1.0 mm²
ES588		max. 1.5 mm²
Contact material		
ES550/553/556/558/572/588/593/620		Silver
ES560/562		Gold cross cut contacts
Rated impulse withstand voltage		
with cable entry		U_{imp} = 2.5 kV
with plug connector, 4-pin		U_{imp} = 2.0 kV
with plug connector, 5-pin		U_{imp} = 1.5 kV
Rated insulation voltage		
with cable entry		U_i = 250 V
with plug connector		U_i = 50 V
with B-coded plug connector		U_i = 250 V
Rated short-circuit current		100 A
Rated data for the switching elements		
ES558		
Conventional thermal current I_{th}		10 A
Utilization category AC-15		230 V/4 A
Utilization category DC-13		24 V/3 A
Min. switching current at		10 mA
Switching voltage		DC 5 V
Short circuit protection		10 A gG
Mechanical life		Up to 10 x 10^6 operating cycles
ES550/553/556/620		
Conventional thermal current I_{th}		6 A
Utilization category AC-15		230 V/2 A
Utilization category DC-13		24 V/2 A
Min. switching current at		10 mA
Switching voltage		DC 24 V
Short circuit protection		6 A gG
Mechanical life		Up to 10 x 10^6 operating cycles
ES560		
Conventional thermal current I_{th}		2 A
Utilization category DC-12		30 V/1 A
Min. switching current at		1 mA
Switching voltage		DC 5 V
Short circuit protection		2 A gG
Mechanical life		Up to 10 x 10^6 operating cycles
Ideal application		1 mA/5 V ... 0.3 A/30 V
ES562		
Conventional thermal current I_{th}		0.1 A
Utilization category AC-12		30 V/0.1 A
Utilization category DC-13		30 V/0.1 A
Min. switching current at		5 mA
Switching voltage		DC 5 V
Short circuit protection		0.125 A gG
Mechanical life		Up to 15 x 10^6 operating cycles
ES572 (high temperature version)		
Conventional thermal current I_{th}		5 A
Utilization category AC-15		230 V/4 A
Utilization category DC-13		24 V/1 A
Min. switching current at		10 mA
Switching voltage		DC 12 V
Short circuit protection		5 A gG
Mechanical life		5 x 10^5 operating cycles (or 100 h at 204 °C; manufacturer's data)
ES588 ⊖		
Conventional thermal current I_{th}		10 A
Utilization category AC-15		230 V/4 A
Utilization category DC-13		24 V/3 A
Min. switching current at		1 mA
Switching voltage		DC 5 V
Short circuit protection		10 A gG
Mechanical life		Up to 10 x 10^6 operating cycles
ES593		
Conventional thermal current I_{th}		3 A
Utilization category AC-15		230 V/3 A
Utilization category DC-13		24 V/1 A
Min. switching current at		10 mA
Switching voltage		DC 24 V
Short circuit protection		3 A gG
Mechanical life		5 x 10^5 operating cycles (manufacturer's data 5 x 10^6)
Rated data with plug connector		
N01.550SVM5		
Utilization category AC-15		30 V/2 A
Utilization category DC-13		24 V/2 A
N01.550C1526		
Utilization category DC-13		24 V/2 A
SN01.558SVM5		
Utilization category AC-15		30 V/4 A
Utilization category DC-13		24 V/3 A
Reliability values acc. to EN ISO 13849-1 for NB01 with switching element ES588		
B_{10d}		2 x 10^7

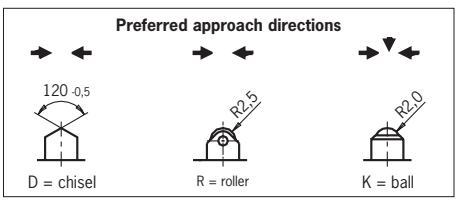
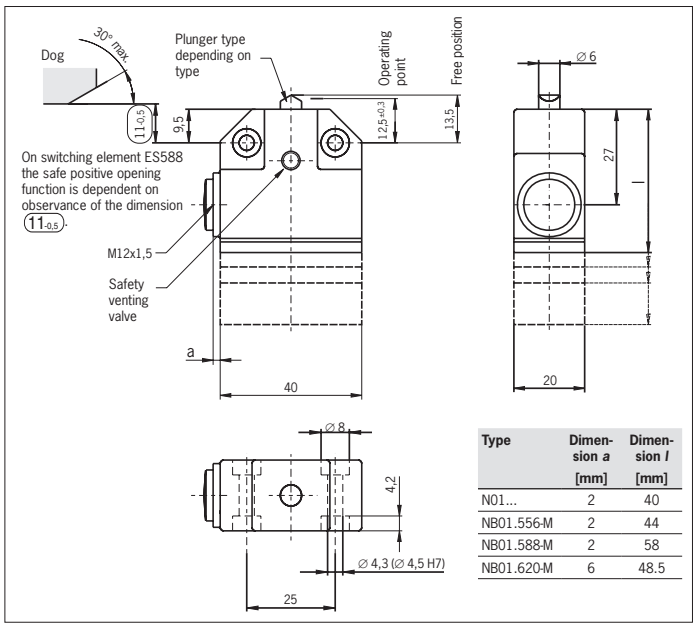


Figure 2: Plungers and approach directions



Type	Dimension *a* [mm]	Dimension *l* [mm]
N01...	2	40
NB01.556-M	2	44
NB01.588-M	2	58
NB01.620-M	6	48.5

Figure 3: Dimension drawing of N01.../NB01... with cable entry

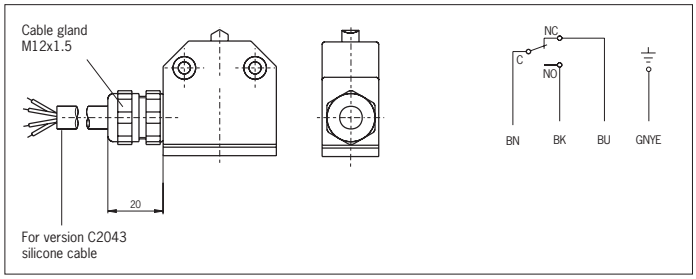


Figure 4: Dimension drawing/connection diagram of N01.550X... with connection cable (PUR cable, 4x0.5 mm²)

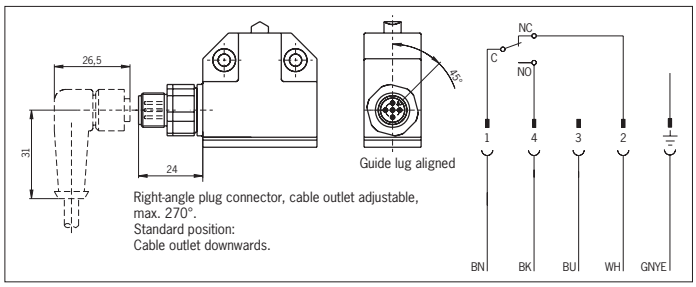


Figure 5: Dimension drawing/connection diagram of N01.550/562SVM5 with plug connector M12 (SVM5, 5-pin)

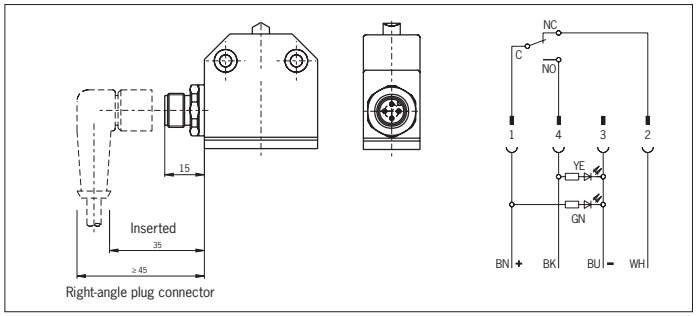


Figure 6: Dimension drawing/connection diagram of N01.550C1526 with plug connector M12 (4-pin)

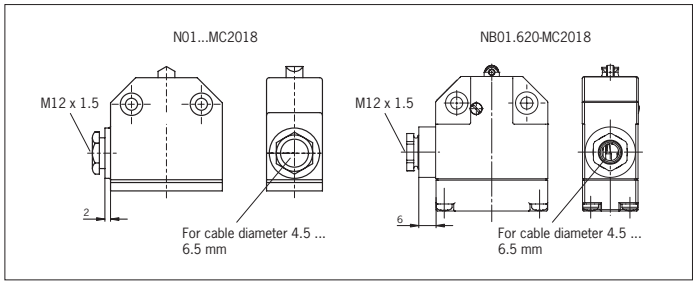


Figure 7: Dimension drawing of N01...MC2018/NB01.620-MC2018 with special cable gland

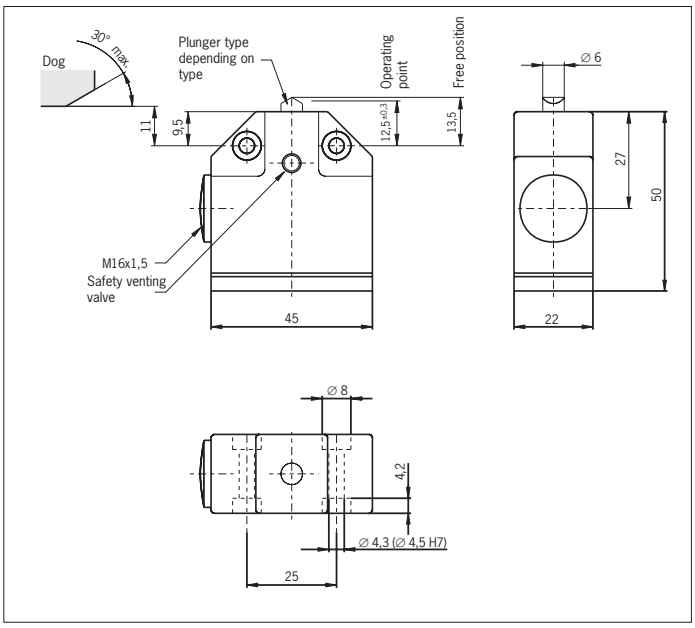


Figure 8: Dimension drawing of SN01.. with cable entry

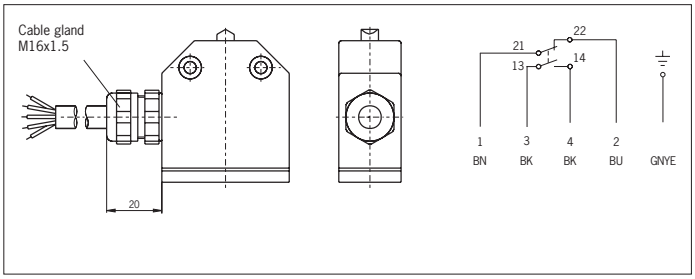


Figure 9: Dimension drawing/connection diagram of SN01.558X... with connection cable (PUR cable, 5x0.5 mm²)

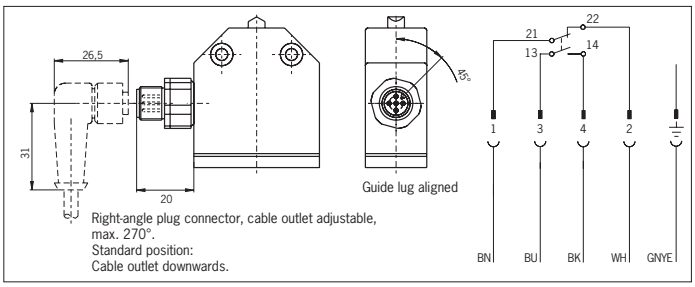


Figure 10: Dimension drawing/connection diagram of SN01.558SVM5 with plug connector M12 (SVM5, 5-pin)

Switching element	Wiring diagram	Terminal assignment
ES550 ES560 ES593	1 (C) — 2 (NC) 4 (NO)	1 4 2
ES553		1 4 2
ES556		
ES562		1 4 2
ES572		1 4 2
ES620		1 4 2
ES558	1 (NC) — 2 (NC) 3 (NO) — 4 (NO)	4 1 2 3
ES588	1 (C) — 2 (NC)	

Figure 11: Switching elements, wiring diagrams and terminal assignment of N01.../NB01.../SN01... with cable entry