Installation of single switches with safety functions

- Use **only** switches with the symbol ⊖ (see figure on the side).
- Connect the safety circuit to **the NC normally closed contacts (11-12, 21-22 or 31-32).**
- **The NO normally open contacts (13-14, 23-24, 33-34)** should be used **only for signalling**; these contacts are not to be connected with the safety circuit. However, if two or more switches are used on the same guard, a connection can be established between the NO contacts and the safety circuit.
  In this case at least one of the two switches must have positive opening and a normally closed contact NC (11-12, 21-22 or 31-32) must be connected to the safety circuit.
- Actuate the switch **at least up to the positive opening travel** shown in the travel diagrams with symbol ⊖.
- The actuation system must be able to exert a force that is greater than the **positive opening force**, as specified in brackets below each article, next to the minimum force value.
- The device must be affixed in compliance with EN ISO 14119.

Whenever the machine guard is opened and during the whole opening travel, **the switch must be pressed directly** (fig. 1) **or through a rigid connection** (fig. 2)**.**
Only in this way the positive opening of the normally closed NC contacts (11-12, 21-22, 31-32) is guaranteed.

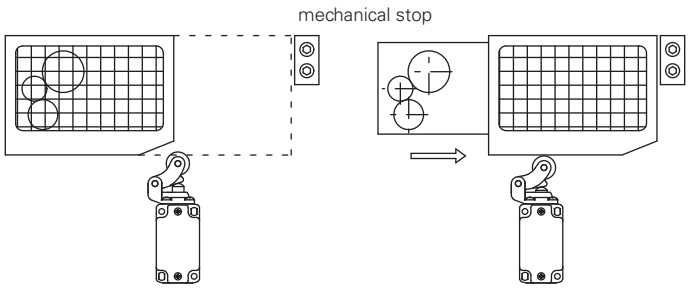


Fig.1

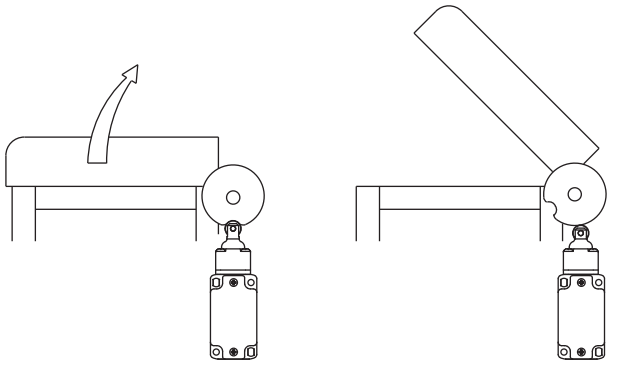


Fig.2

In safety applications with only one switch for each guard, the switches **must never be activated by a release** (fig. 3 and 4) **or through a non rigid connection** (i.e. by a spring).

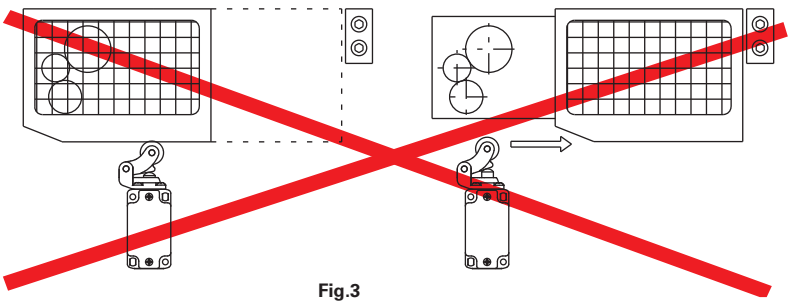


Fig.3

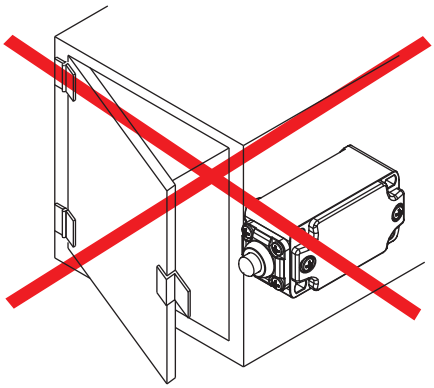
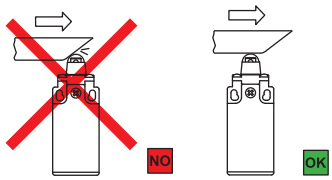


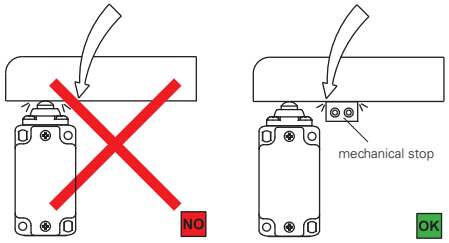
Fig.4

Mechanical stop

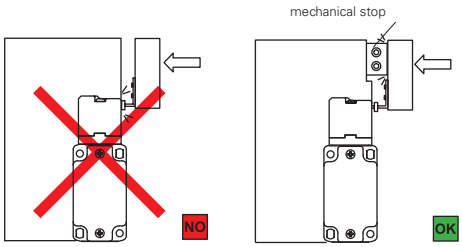
Acc. to EN ISO 14119 paragraph 5.2 letter h) the position sensors must not be used as mechanical stop.



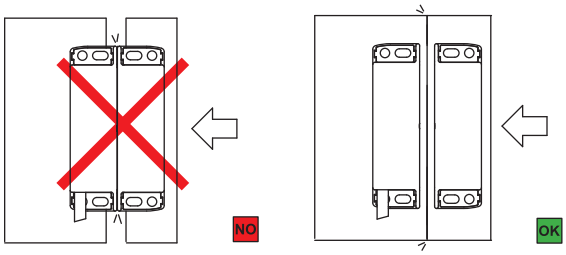
The actuator must not exceed the max. travel as indicated in the travel diagrams.



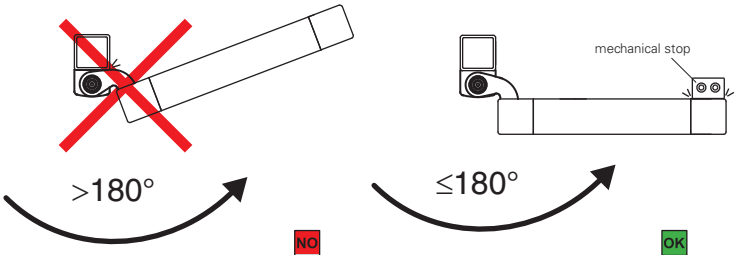
The guard must not use the switch head as a mechanical stop.



The actuator must not strike directly against the switch head.

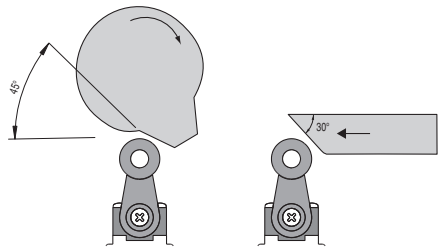
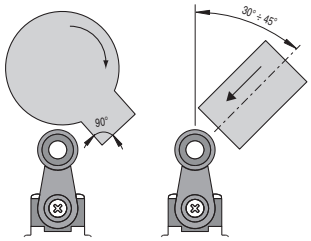
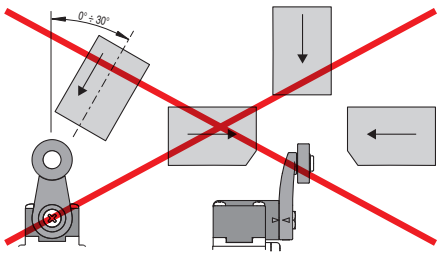
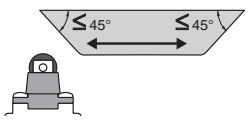
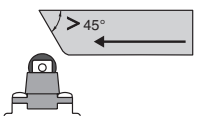
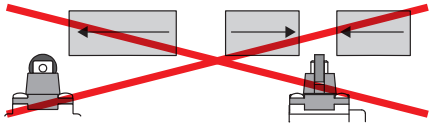
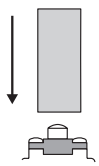
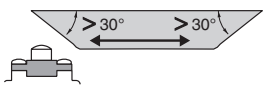
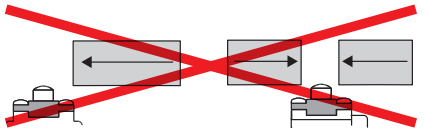


The actuator must not strike directly against the magnetic sensor.



The opening angle of safety hinge switch HP, HC and HX series must not exceed 180°.

Actuation modes

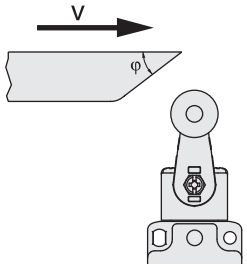
Recommended application	Application to avoid This application is possible, but increased mechanical stress may shorten the operating life of the switch	Forbidden application
		
		
		

Switches for heavy duty applications

Maximum and minimum actuation speed - FD-FL-FP-FC series

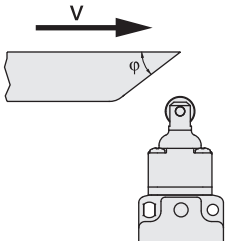
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



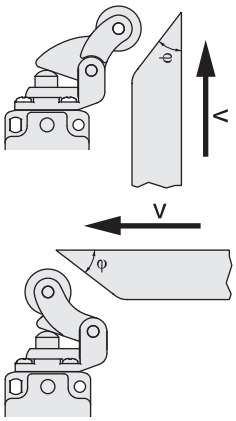
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015

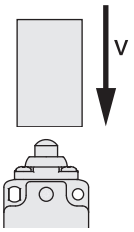


Contact type:

R = snap action
L = slow action

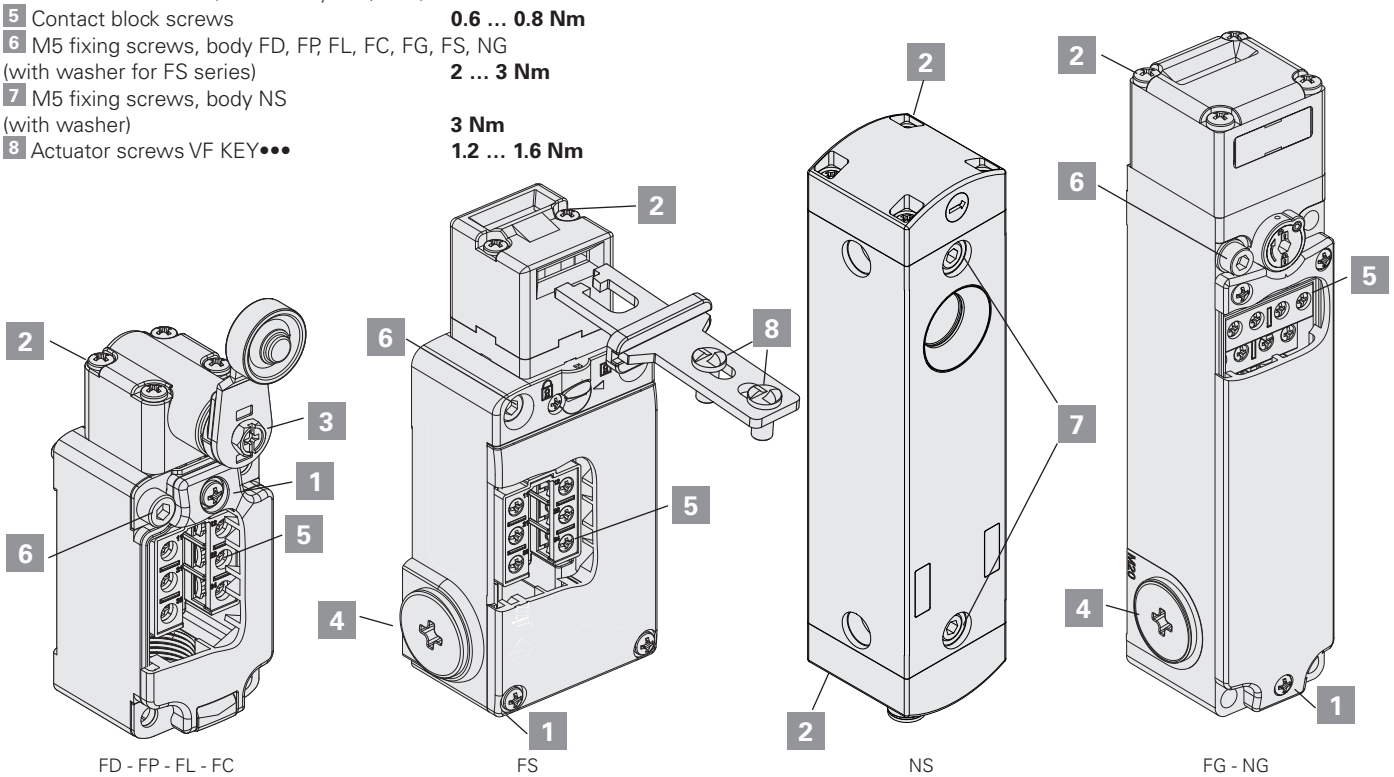
Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01



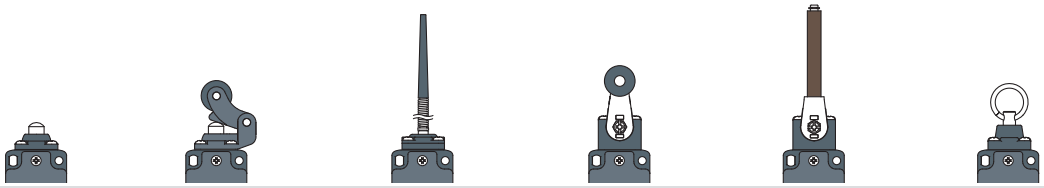
Tightening torques FD-FP-FL-FC-FG-FS-NG-NS series

1	Cover screws	**0.8 ... 1.2 Nm**
2	Head screws	**0.8 ... 1.2 Nm**
3	Lever screw	**0.8 ... 1.2 Nm**
4	Protection caps (conduit entry M20/PG13.5)	**1.2 ... 1.6 Nm**
	(conduit entry M16/PG11)	**1 ... 1.4 Nm**
5	Contact block screws	**0.6 ... 0.8 Nm**
6	M5 fixing screws, body FD, FP, FL, FC, FG, FS, NG (with washer for FS series)	**2 ... 3 Nm**
7	M5 fixing screws, body NS (with washer)	**3 Nm**
8	Actuator screws VF KEY•••	**1.2 ... 1.6 Nm**



FD-FP-FL-FC series switches for heavy duty applications

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6 inverted contacts
2 2x(1NO-1NC)	13 21 43 31 / 14 22 44 32	0 1.3 6 / 0.7	0 1.6 8 / 0.9	0 8° / 4°	0 20° 75° / 13°	0 20° 75° / 13°	0 3.3 8 / 2.5
3 1NO-1NC	13 21 / 14 22	0 1.3 6 / 0.8	0 1.7 8 / 1.1	0 10° / 5°	0 20° 75° / 13°	0 20° 75° / 13°	0 5.3 8 / 4.5
5 1NO+1NC	13 21 / 14 22	0 2.2 ⊖4 6 / 1.1	0 2.7 ⊖4.9 8 / 1.4	0 15° / 5°	0 30° ⊖60° 75° / 17°	0 22° ⊖52° 75° / 9°	0 2.9 8 / 1.7
6 1NO+1NC	11 23 / 12 24	0 1.5 ⊖3 6 / 3.4	0 1.8 ⊖3.7 8 / 4.2	/	0 22° ⊖42° 75° / 42°	0 14° ⊖34° 75° / 34°	0 2.3 8 / 0.8
7 1NO+1NC	11 23 / 12 24	0 3.1 ⊖4.6 6 / 1.6	0 3.8 ⊖5.7 8 / 2	/	0 40° 60° ⊖75° / 23°	0 32° ⊖52° 75° / 15°	0 1 8 / 2.2
9 2NC	11 21 / 12 22	0 2.9 ⊖4.4 6	0 3.6 ⊖5.4 8	/	0 40° 60° ⊖75°	0 32° ⊖52° 75°	0 1 8
10 2NO	13 23 / 14 24	0 1.4 6	0 1.7 8	0 9°	0 22° 75°	0 14° 75°	0 2.5 8
11 2NC	11 21 / 12 22	0 2 ⊖4 6 / 0.6	0 2.5 ⊖4.9 8 / 0.7	/	0° 27° ⊖57° 75° / 11°	/	0 3.5 8 / 2.1
12 2NO	13 23 / 14 24	0 2.9 6 / 1.5	0 3.6 8 / 1.8	/	0 38° 75° / 22°	0 30° 75° / 14°	0 2.6 8 / 1.1
13 2NC	11 21 / 12 22	0 0.8 ⊖2.3 6 / 3 ⊖4.5	0 1 ⊖2.8 8 / 3.7 ⊖5.5	/	0 14° ⊖34° 75° / 41° ⊖61°	0 6° ⊖26° 75° / 33° ⊖53°	0 1 8 / 3.2
14 2NC	11 21 / 12 22	0 1.4 ⊖2.9 6 / 3 ⊖4.5	0 1.7 ⊖3.6 8 / 3.7 ⊖5.5	/	0 22° ⊖42° 75° / 40° ⊖60°	0 14° ⊖34° 75° / 32° ⊖52°	0 0.9 8 / 2.5
15 2NO	13 23 / 14 24	0 1.4 6 / 3	0 1.7 8 / 3.7	/	0 22° 75° / 40°	0 14° 75° / 32°	0 1 8 / 2.6
16 2NC	11 21 / 12 22	/	/	/	66° 0 26° ⊖30° / ⊖37° 26° 66°	/	/
18 1NO+1NC	11 23 / 12 24	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
20 1NO+2NC	11 21 33 / 12 22 34	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
21 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6	0 1.8 ⊖3.7 8	0 10°	0 23° ⊖43° 75°	0 15° ⊖35° 75°	0 2.4 8
22 2NO+1NC	11 23 33 / 12 24 34	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 13°	0 23° ⊖43° 75° / 29°	0 15° ⊖35° 75° / 21°	0 2.4 8 / 1.9
28 1NO+2NC	11 21 33 / 12 22 34	0 1.5 ⊖3 4.5 6 / 2 ⊖5.5	0 1.8 ⊖3.7 5.6 8 / 2.5 ⊖6.9	/	0 23° ⊖43° 60° 75° / 29° ⊖70°	0 15° ⊖35° 52° 75° / 21° ⊖62°	/
29 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 1.8 ⊖3.7 8 / 5.6 ⊖6.9	/	0 23° ⊖43° 75° / 60° ⊖70°	0 15° ⊖35° 75° / 52° ⊖62°	/
30 3NC	11 21 31 / 12 22 32	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 1.8 ⊖3.7 8 / 5.6 ⊖6.9	/	0 23° ⊖43° 75° / 60° ⊖70°	0 15° ⊖35° 75° / 52° ⊖62°	/
33 1NO+1NC	13 21 / 14 22	0 1.5 ⊖3 6 / 2	0 1.8 ⊖3.7 8 / 2.5	0 10° / 12°	0 23° ⊖43° 75° / 27°	0 15° ⊖35° 75° / 19°	0 2.4 8 / 2.1
34 2NC	11 21 / 12 22	0 1.5 ⊖3 6	0 1.8 ⊖3.7 8	0 10°	0 23° ⊖43° 75°	0 15° ⊖35° 75°	0 2.4 8
37 1NO+1NC	11 23 / 12 24	0 3.4 ⊖4.9 6 / 1.5	0 4.3 ⊖6.2 8 / 1.9	/	0 45° 65° ⊖75° / 18°	0 37° ⊖57° 75° / 10°	0 3 8 / 1.1
66 1NC	11 / 12	0 1.4 ⊖2.9 6	0 1.7 ⊖3.6 8	/	0 22° ⊖42° 75°	0 14° ⊖34° 75°	0 0.9 8
67 1NO	13 / 14	0 1.4 6	0 1.7 8	0 9°	0 22° 75°	0 14° 75°	0 2.5 8

Legend

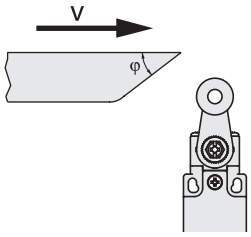
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

Switches for standard applications

Maximum and minimum actuation speed - FR-FM-FX-FZ-FK series

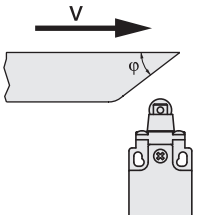
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



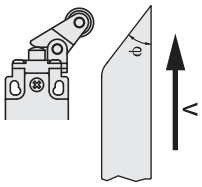
Roller plunger - Type 2

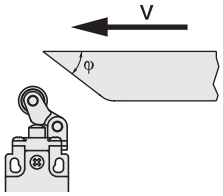
φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015



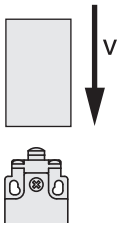


Contact type:

R = snap action
L = slow action

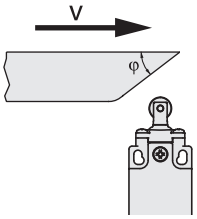
Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01



Roller plunger - Type 5

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	0,3	4	0,04
30°	0,2	2	0,02

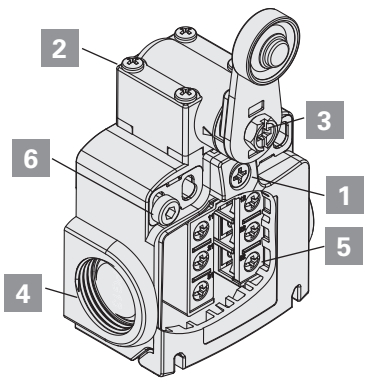


Tightening torques - FR, FX, FK and FW series

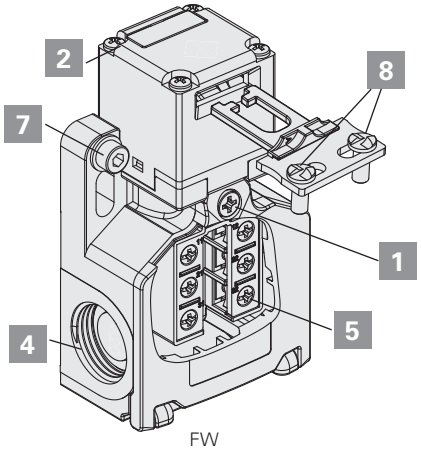
1	Cover screws	**0.7 ... 0.9 Nm**
2	Head screws	**0.5 ... 0.7 Nm**
3	Lever screw	**0.7 ... 0.9 Nm**
4	Protection caps	**1.2 ... 1.6 Nm**
5	Contact block screws	**0.6 ... 0.8 Nm**
6	M4 fixing screws, body (with washer for FR-FK series)	**2 ... 2.5 Nm**
7	M5 fixing screws, body (with washer for FW series)	**2 ... 2.5 Nm**
8	Actuator screws VF KEY•••	**1.2 ... 1.6 Nm**

Tightening torques - FM and FZ series

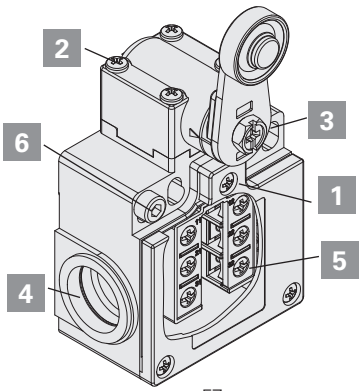
1	Cover screws	**0.5 ... 0.7 Nm**
2	Head screws	**0.5 ... 0.7 Nm**
3	Lever screw	**0.8 ... 1.2 Nm**
4	Protection caps	**1.2 ... 1.6 Nm**
5	Contact block screws	**0.6 ... 0.8 Nm**
6	M4 fixing screws, body	**2 ... 3 Nm**



FR - FX - FK - FM



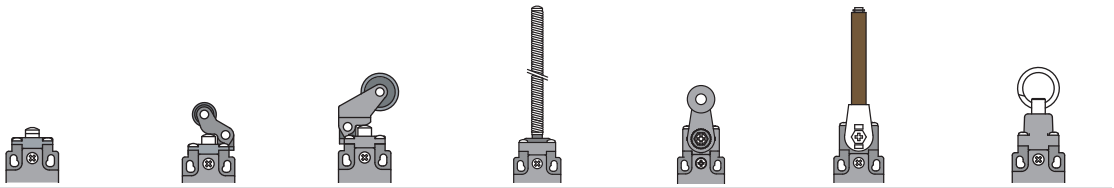
FW



FZ

FR-FM-FX-FZ-FK series switches for standard applications

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7 inverted contacts
2 2x(1NO-1NC)	0 1.3 6 / 0.7	0 2 8 / 1.1	0 3 13 / 1.6	0 9° / 4°	0 17° 75° / 10°	0 17° 75° / 10°	0 5.4 8 / 4.8
3 1NO-1NC	0 1.3 6 / 0.8	0 2 8 / 1.2	0 3 13 / 1.8	0 9° / 4°	0 17° 75° / 10°	0 17° 75° / 10°	0 3.4 8 / 2.9
5 1NO+1NC	0 2.2 ⊖4 6 / 1.1	0 3.3 ⊖6 8 / 1.7	0 5.1 ⊖9.2 13 / 2.5	0 17° / 6°	0 30° 60°⊖ 75° / 15°	0 25° ⊖55° 75° / 10°	0 5 8 / 3.8
6 1NO+1NC	0 1.5 ⊖3 6 / 3.1	0 2.3 ⊖4.5 8 / 4.7	0 3.5 ⊖6.9 13 / 7.1	/	0 20° ⊖40° 75° / 42°	0 15° ⊖35° 75° / 35°	0 4.6 8 / 3
7 1NO+1NC	0 3.1 ⊖4.6 6 / 1.6	0 4.7 ⊖6.9 8 / 2.4	0 7.1 ⊖10.6 13 / 3.7 13	/	0 41° 61°⊖ 75° / 22°	0 36° ⊖56° 75° / 17°	0 3 8 / 4.5
9 2NC	0 2.9 ⊖4.4 6	0 4.4 ⊖6.6 8	0 6.7 ⊖10.1 13	/	0 39° 75° / ⊖59°	0 34° ⊖54° 75°	0 3.1 8
10 2NO	0 1.4 6	0 2.1 8	0 3.2 13	0 10°	0 20° 75°	0 15° 75°	0 4.6 8
11 2NC	0 2 ⊖4 6 / 0.6	0 3 ⊖6 8 / 0.9	0 4.6 ⊖9.2 13 / 1.4	/	0° 26° 56°⊖ 75° / 7°	/	0 5.6 8 / 4
12 2NO	0 2.9 6 / 1.5	0 4.4 8 / 2.3	0 6.7 13 / 3.5	0 21° / 8°	0 37° 75° / 19°	0 32° 75° / 14°	0 4.7 8 / 3.3
13 2NC	0 0.8 ⊖2.3 6 / 3 ⊖4.5	0 1.2 ⊖3.5 8 / 4.5 ⊖6.8	0 1.8 ⊖5.3 13 / 6.9 ⊖10.4	/	0 11° ⊖31° 75° / 40° ⊖60°	6° ⊖26° 75° / 0 35° ⊖55°	0 3.1 8 / 5.3
14 2NC	0 1.4 ⊖2.9 6 / 3 ⊖4.5	0 2.1 ⊖4.4 8 / 4.5 ⊖6.8	0 3.2 ⊖6.7 13 / 6.9 ⊖10.4	/	0 19° ⊖39° 75° / 40° ⊖60°	0 14° ⊖34° 75° / 35° ⊖55°	0 3 8 / 4.7
15 2NO	0 1.4 6 / 3	0 2.1 8 / 4.5	0 3.2 13 / 6.9	/	0 19° 75° / 40°	0 14° 75° / 35°	0 4.7 8 / 3.1
16 2NC	/	/	/	/	75° 0 28° ⊖48° / 48°⊖ 28° 75°	/	/
18 1NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° ⊖21°* / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4.1
20 1NO+2NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° ⊖21°* / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4
21 3NC	0 1.5 ⊖3 6	0 2.3 ⊖4.5 8	0 3.5 ⊖6.9 13	0 10° ⊖21°*	0 20° ⊖40° 75°	0 15° ⊖35° 75°	0 4.6 8
22 2NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° ⊖21°* / 14°	0 20° ⊖40° 75° / 27°	0 15° ⊖35° 75° / 22°	0 4.6 8 / 4.1
28 1NO+2NC	0 1.5 ⊖3 4.5 6 / 2 ⊖5.5	0 2.3 ⊖4.5 6.5 8 / 3 ⊖7.5	0 3.5 ⊖6.9 13 / 4.6 10.2 ⊖12.5	/	0 20° 40°⊖ 58° 75° / 27° ⊖70°	0 15° ⊖35° 53° 75° / 22° ⊖65°	0 1.8 4.6 8 / 4
29 3NC	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 2.3 ⊖4.5 8 / 6.5 ⊖7.5	0 3.5 ⊖6.9 13 / 10.2 ⊖12.5	/	0 20° ⊖40° 75° / 58° ⊖70°	0 15° ⊖35° 75° / 53° ⊖65°	0 4.6 8 / 1.8
30 3NC	0 1.5 ⊖3 6 / 4.5 ⊖5.5	0 2.3 ⊖4.5 8 / 6.5 ⊖7.5	0 3.5 ⊖6.9 13 / 10.2 ⊖12.5	/	0 20° ⊖40° 75° / 58° ⊖70°	0 15° ⊖35° 75° / 53° ⊖65°	0 4.6 8 / 1.8
33 1NO+1NC	0 1.5 ⊖3 6 / 2	0 2.3 ⊖4.5 8 / 3	0 3.5 ⊖6.9 13 / 4.6	0 10° ⊖21°* / 14°	0 20° ⊖40° 75° / 25°	0 15° ⊖35° 75° / 20°	0 4.6 8 / 4.3
34 2NC	0 1.5 ⊖3 6	0 2.3 ⊖4.5 8	0 3.5 ⊖6.9 13	0 10° ⊖21°*	0 20° ⊖40° 75°	0 15° ⊖35° 75°	0 4.6 8
37 1NO+1NC	0 3.4 ⊖4.9 6 / 1.5	0 5.2 ⊖7.4 8 / 2.3	0 7.8 13 / 3.4 ⊖11.2	/	0 45° ⊖65° 75° / 18°	0 40° ⊖60° 75° / 13°	0 2.8 8 / 4.9
66 1NC	0 1.4 ⊖2.9 6	0 2.1 ⊖4.4 8	0 3.2 ⊖6.7 13	0 10° ⊖21°*	0 19° ⊖39° 75°	0 14° ⊖34° 75°	0 3 8
67 1NO	0 1.4 6	0 2.1 8	0 3.2 13	0 10°	0 20° 75°	0 15° 75°	0 4.6 8

(*) Positive opening of NC contacts (11-12 / 21-22 / 31-32) with 22 actuator with rigid rod only. Do not operate the 22 actuator with rigid rod at an angle of more than 27°.

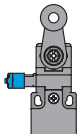
Legend

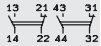
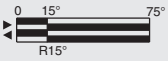
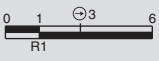
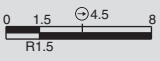
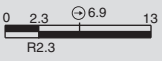
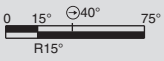
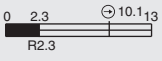
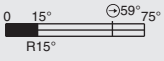
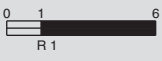
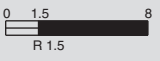
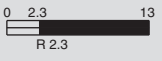
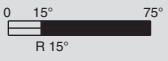
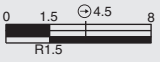
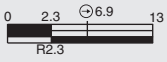
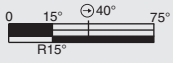
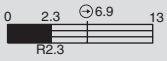
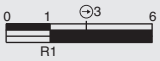
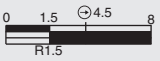
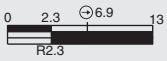
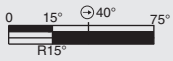
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

FR-FM-FX-FZ-FK series switches with W3 reset for standard applications

Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4
2 2x(1NO-1NC) 				
6 1NO+1NC 				
9 2NC 				
10 2NO 				
20 1NO+2NC 				
21 3NC 				
22 2NO+1NC 				
33 1NO+1NC 				
34 2NC				

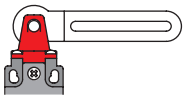
Legend

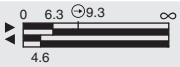
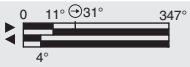
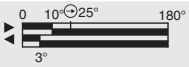
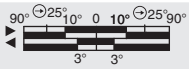
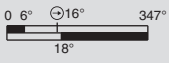
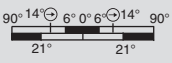
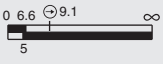
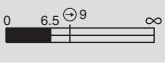
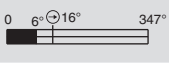
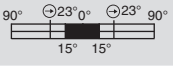
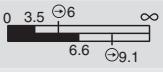
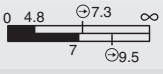
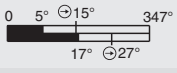
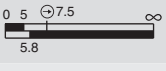
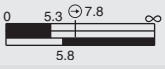
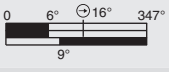
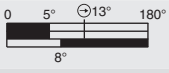
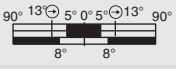
Closed contact | Open contact | Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released | R reset engagement travel

FR-FM-FX-FZ-FK-FW series switches for safety applications

Travel diagrams






Contact block		Group 8	Group 9	Group 10	Group 11
5 1NO+1NC					
6 1NO+1NC					
7 1NO+1NC				/	/
9 2NC					
11 2NC			/	/	/
13 2NC			/	/	/
14 2NC				/	/
18 1NO+1NC					
20 1NO+2NC					
21 3NC					
22 2NO+1NC					
33 1NO+1NC					
34 2NC					
37 1NO+1NC			/	/	/
66 1NC					

Legend

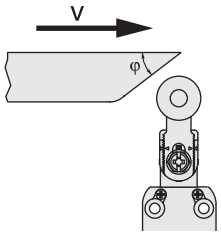
Closed contact | Open contact | Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

FA-NA-NB-NF series modular pre-wired switches

Maximum and minimum actuation speed

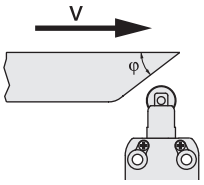
Roller lever - Type 1

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	2,5	9	0,07
30°	1,5	8	
45°	1	7	
60°	0,75	7	



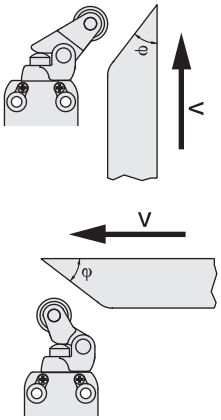
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	4	0,04
30°	0,5	2	0,02
45°	0,3	1	0,01



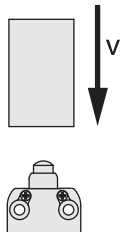
Roller lever - Type 3

φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	1	5	0,05
30°	0,5	2,5	0,025
45°	0,3	1,5	0,015



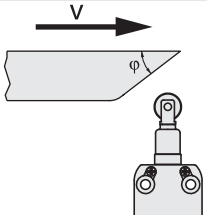
Plunger - Type 4

Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
0,5	1	0,01



Roller plunger - Type 5

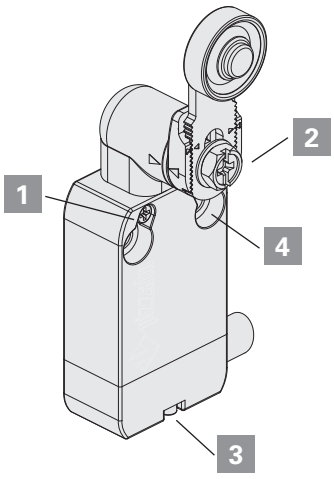
φ	Vmax (m/s)	Vmin (mm/s) L	Vmin (mm/s) R
15°	0,3	4	0,04



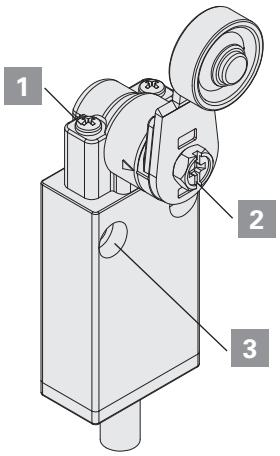
Contact type:

R = snap action
L = slow action

Screw tightening torques



NA - NB - NF



FA

For NA and NB series:

1	Head screws	**0.5 ... 0.7 Nm**
2	Lever screw	**0.8 ... 1.2 Nm**
3	Connector screw	**0.3 ... 0.6 Nm**
4	M4 fixing screws, body	**2 ... 3 Nm**

For NF series:

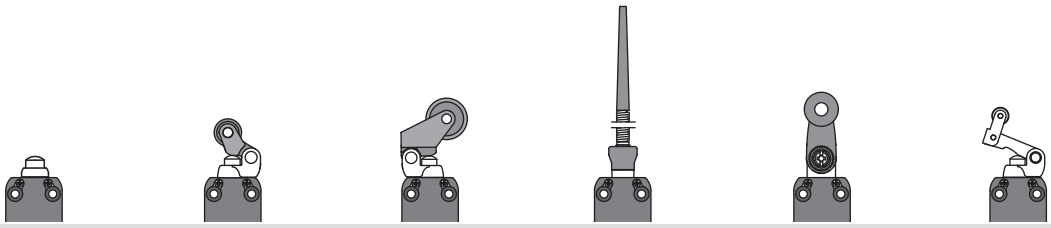
1	Head screws	**0.3 ... 0.4 Nm**
2	Lever screw	**0.8 ... 1.2 Nm**
3	Connector screw	**0.2 ... 0.3 Nm**
4	M4 fixing screws, body	**2 ... 3 Nm**

For FA series:

1	Head screws	**0.5 ... 0.7 Nm**
2	Lever screw	**0.8 ... 1.2 Nm**
3	M4 fixing screws, body	**2 ... 3 Nm**

NA-NB-NF series modular pre-wired switches

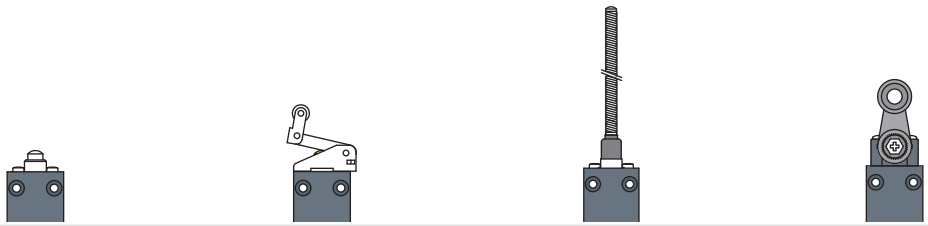
Travel diagrams



Contact block	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
B11 1NO+1NC	0 1.5 4⊖ 5 / 0.9	0 2.1 5.6⊖ 7 / 1.5	0 3.5 9.6⊖ 11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2⊖ 14 / 3.1
B02 2NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6⊖ 7 / 1.5	0 3.5 9.6⊖ 11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2⊖ 14 / 3.1
B12 1NO+2NC	0 1.5 4⊖ 5 / 0.9	0 2.1 5.6⊖ 7 / 1.5	0 3.5 9.6⊖ 11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2⊖ 14 / 3.1
B22 2NO+2NC	0 1.5 ⊖4 5 / 0.9	0 2.1 5.6⊖ 7 / 1.5	0 3.5 9.6⊖ 11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2⊖ 14 / 3.1
G11 1NO+1NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
G02 2NC	0 1.4 ⊖2.9 5	0 2 ⊖4.1 7	0 3.3 ⊖7 11	0 12°	0 18° ⊖38° 75°	0 4.1 ⊖8.1 14
G12 1NO+2NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
G22 2NO+2NC	0 1.4 ⊖2.9 5 / 3.1	0 2 ⊖4.1 7 / 4.5	0 3.3 ⊖7 11 / 7.3	/	0 18° ⊖38° 75° / 41°	0 4.1 ⊖8.1 14 / 9.5
H11 1NO+1NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
H12 1NO+2NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
H22 2NO+2NC	0 1.4 ⊖2.9 5 / 1	0 2 ⊖4.1 7 / 1.4	0 3.3 ⊖7 11 / 2.3	0 12° / 7°	0 18° ⊖38° 75° / 10°	0 4.4 ⊖8.1 14 / 2.8
L11 1NO+1NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
L12 1NO+2NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
L22 2NO+2NC	0 1.4 ⊖2.9 5 / 1.8	0 2 ⊖4.1 7 / 2.6	0 3.3 ⊖7 11 / 4.2	0 12° / 15°	0 18° ⊖38° 75° / 23°	0 3.8 ⊖8.1 14 / 5.2
BA1 1NO+1NC change-over	0 1.5 4⊖ 5 / 0.9	0 2.1 5.6⊖ 7 / 1.5	0 3.5 9.6⊖ 11 / 2.5	0 13° / 8°	0 20° ⊖50° 75° / 11°	0 4.6 11.2⊖ 14 / 3.1

FA series pre-wired switches

Travel diagrams



Contact block		Group 1	Group 2	Group 3	Group 4
41 1NO+1NC	13 21 / 14 22	0 1.8 5 / 1.1	0 4.2 9.9 / 2.3	0 12° / 4°	0 22° 70° / 8°
45 1NO+1NC	13 21 / 14 22	0 1.8 ⊖4 5 / 1	0 4.2 ⊖8 9.9 / 2	0 13° / 3°	0 22° ⊖52° 70° / 7°
46 1NO+1NC	13 21 / 14 22	0 1.3 ⊖2.8 5 / 3.2	0 2.7 ⊖5.6 9.9 / 6.8		0 13° ⊖33° 70° / 43°
48 1NO+1NC	13 21 / 14 22	0 1.3 ⊖2.8 5 / 1.8	0 2.7 ⊖5.6 9.9 / 4	0° 7° / 12°	0 14° ⊖34° 70° / 22°

Legend

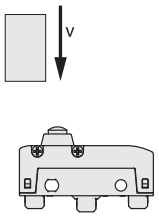
Closed contact | Open contact | ⊖ Positive opening travel acc. to EN 60947-5-1 | ► Switch pressed / ◄ Switch released

MK series microswitches

Maximum and minimum actuation speed

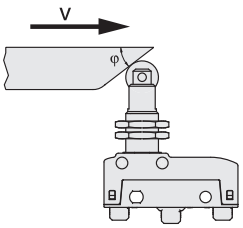
Plunger - Type 1

Vmax (m/s)	Vmin (mm/s)
0,5	0,05



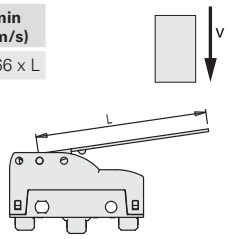
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,6	0,2
30°	0,3	0,1
45°	0,1	0,05



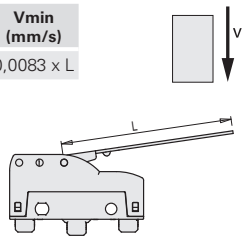
Lever with direct action (D) - Type 3

Vmax (m/s)	Vmin (mm/s)
0,03 x L	0,0166 x L



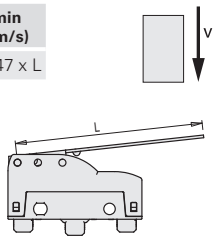
Lever with inverted action (R) - Type 4

Vmax (m/s)	Vmin (mm/s)
0,015 x L	0,0083 x L



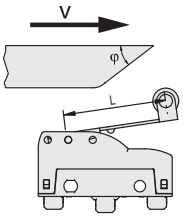
Lever with direct action, rear (F) - Type 5

Vmax (m/s)	Vmin (mm/s)
0,01 x L	0,0047 x L



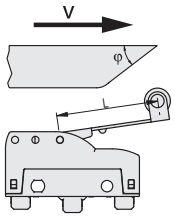
Roller lever with direct action (D) - Type 6

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,1 x L	0,0664 x L
30°	0,05 x L	0,0332 x L
45°	0,03 x L	0,0166 x L



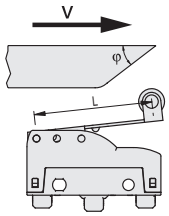
Roller lever with inverted action (R) - Type 7

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,048 x L	0,0332 x L
30°	0,024 x L	0,0166 x L
45°	0,015 x L	0,0083 x L



Roller lever with direct action, rear (F) - Type 8

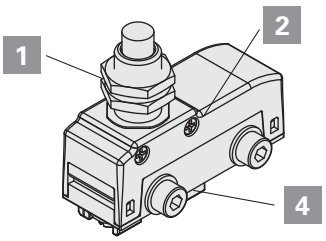
φ	Vmax (m/s)	Vmin (mm/s)
15°	0,032 x L	0,0188 x L
30°	0,016 x L	0,0094 x L
45°	0,01 x L	0,0047 x L

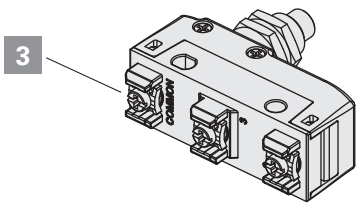


Tightening torques

1	Head nuts	**2 ... 3 Nm**
2	Head screws	**0.3 ... 0.4 Nm**
3	Terminal screws	**0.6 ... 0.8 Nm**
4	M4 fixing screws, body (insert washer)	**0.8 ... 1.2 Nm**

Attention: A tightening torque higher than 1.2 Nm can cause the breaking of the microswitch.



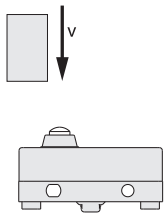


MS-MF series microswitches

Maximum and minimum actuation speed

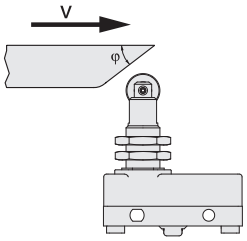
Plunger - Type 1

Vmax (m/s)	Vmin (mm/s)
0,5	0,05



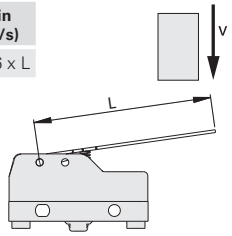
Roller plunger - Type 2

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,6	0,2
30°	0,3	0,1
45°	0,1	0,05



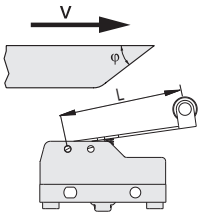
Lever with direct action (D) - Type 3

Vmax (m/s)	Vmin (mm/s)
0,03 x L	0,0166 x L



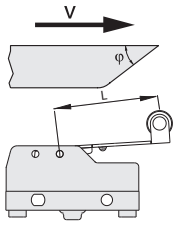
Roller lever with direct action (D) - Type 6

φ	Vmax (m/s)	Vmin (mm/s)
15°	0,1 x L	0,0664 x L
30°	0,05 x L	0,0332 x L
45°	0,03 x L	0,0166 x L



Roller lever with inverted action (R) - Type 7

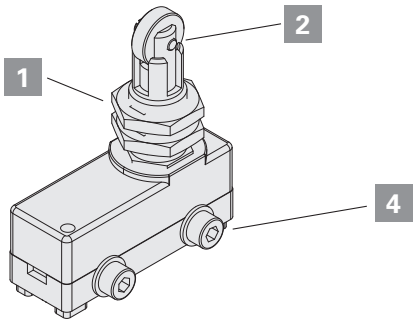
φ	Vmax (m/s)	Vmin (mm/s)
15°	0,048 x L	0,0332 x L
30°	0,024 x L	0,0166 x L
45°	0,015 x L	0,0083 x L

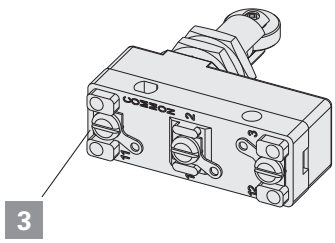


Tightening torques

1	Head nuts	**2 ... 3 Nm**
2	Head screw	**0.3 ... 0.4 Nm**
3	Terminal screws	**0.6 ... 0.8 Nm**
4	M4 fixing screws, body (insert washer)	**0.8 ... 1.2 Nm**

Attention: A tightening torque higher than 1.2 Nm can cause the breaking of the microswitch.





General requirements

The device is designed to be installed on industrial machineries.

The installation must be performed only by qualified staff aware of the regulations in force in the country of installation.

The device must be used exactly as supplied, properly fixed to the machine and wired.

It is not allowed to disassemble the product and use only parts of the same, the device is designed to be used in its assembly as supplied. It is prohibited to modify the device, even slightly e.g.: replace parts of it, drill it, lubricate it, clean it with gasoline or gas oil or any aggressive chemical agents.

The protection degree of the device refers to the electrical contacts only. Carefully evaluate all the polluting agents present in the application before installing the device, since the IP protection degree refers exclusively to agents such as dust and water according to EN 60529. Thus the device may not be suitable for installation in environments with dust in high quantity, condensation, humidity, steam, corrosive and chemical agents, flammable or explosive gas, flammable or explosive dust or other polluting agents.

Some devices are provided with a housing with openings for connecting the electrical cables. To guarantee an adequate protection degree of the device, the opening that the wiring passes through must be protected against the penetration of harmful materials by means of an appropriate seal. Proper wiring therefore requires the use of cable glands, connectors or other devices with IP protection degree that is equal to or greater than that of the device.

Store the products in their original packaging, in a dry place with temperature between -40° C and +70°C

Failure to comply with these requirements or incorrect use during operation can lead to the damage of the device and the loss of the function performed by the device itself. This will result in termination of the warranty on the item and will release the manufacturer from any liability.

Using the devices

- Before use, check if the national rules provide for further requirements in addition to those given here.
- Before installation, make sure the device is not damaged in any part.
- All devices are designed for actuation by moving parts of industrial machines.
- Do not use the device as mechanical stop of the actuator.
- Do not apply excessive force to the device once it has reached the end of its actuation travel.
- Do not exceed the maximum actuation travel.
- Avoid contact of the device with corrosive fluids.
- Do not stress the device with bending and torsion.
- Do not disassemble or try to repair the device, in case of defect or fault replace the entire device.
- In case the device is deformed or damaged it must be entirely replaced. Correct operation cannot be guaranteed when the device is deformed or damaged.
- Always attach the following instructions to the manual of the machine in which the device is installed.
- If specific operating instructions exist for a device (supplied or downloadable from www.pizzato.com), they must always be included with the machine manual and be available for the entire service life of the machine.
- These operating instructions must be kept available for consultation at any time and for the whole period of use of the device.

Wiring and installation

- Installation must be carried out by qualified staff only.
- Use of the device is limited to function as a control switch.
- Observe minimum distances between devices (if provided).
- Comply with the tightening torques indicated in this catalogue.
- Keep the electrical load below the value specified by the respective utilization category.
- Disconnect the power before to work on the contacts, also during the wiring.
- Do not paint or varnish the devices.
- Install the product on flat and clean surfaces only.
- Do not bend or deform the device during installation.
- Never use the device as support for other machine components (cable ducts, tubes, etc.)
- For installation on the machine, use the intended bore holes in the housing. The device must be fixed with screws of adequate length and resistance to the expected stress. At least two screws (fitted to holes most suitable for the intended use) are required to fix the housing to the machine.
- After and during installation, do not pull the electrical cables connected to the device. If excessive tension is applied to the cables (that is not supported by an appropriate cable gland), the contact block of the device may be damaged.
- Provided that the device has an electrical connector, always switch off the circuit voltage before disconnecting the connector from the switch. The connector is not suitable for separation of electrical loads.
- During wiring comply with the following requirements:
  - for terminals (if present), comply with the minimum and maximum cross-sections of the conductors;
  - tighten the electrical terminals (if present) with the torque indicated in this catalogue;
  - do not introduce polluting agents into the device as: talc, lubricants for cable sliding, powder separating agents for multipolar cables, small strands of copper and other pollutants that could affect the proper functioning of the device;
  - before closing the device cover (if present) verify the correct positioning of the gaskets;
  - verify that the electrical cables, wire-end sleeves, cable numbering systems and any other parts do not obstruct the cover from closing correctly or if pressed between them do not damage or compress the internal contact block;
  - for devices with integrated cable, the free end of the cable must be properly connected inside a protected housing. The electrical cable must be properly protected from cuts, impacts, abrasion, etc After installation and before commissioning of the machine, verify:
  - the correct operation of the device and all its parts;
  - the correct wiring and tightening of all screws;
  - the actuating travel of the actuator must be shorter than the maximum travel allowed by the device.
- After installation, periodically check for correct device operation.

Do not use in following environments:

- Environments where dust and dirt can cover the device and by sedimentation stop its correct working.
- Environment where sudden temperature changes cause condensation.
- Environments where coatings of ice may form on the device.
- Environments where the application causes knocks or vibrations that could damage the device.
- Environment with presence of explosive or flammable gas

or dust. The current limit does not apply to devices declared compliant with directive ATEX 2014/34/EU.

Limits of use

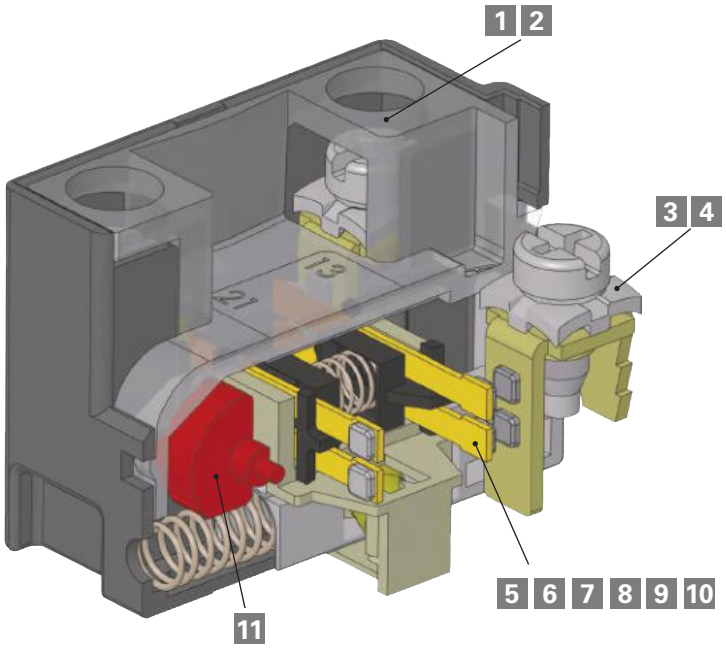
- Use the devices following the instructions, complying with their operation limits and the standards in force.
- The devices have specific application limits (min. and max. ambient temperature, mechanical endurance, protection degree, utilisation category, etc.) These limits are met by the different devices only if considered individually and not if combined with each other. For further information contact our technical department.
- The utilization implies knowledge of and compliance with following standards: EN 60204-1, EN 60947-5-1, ISO 12100, EN ISO 14119.
- Please contact our technical department for information and assistance (phone +39.0424.470.930/fax +39.0424.470.955 / e-mail tech@pizzato.com) in the following cases:
- Cases not mentioned in the present utilization requirements.
- In nuclear power stations, trains, airplanes, cars, incinerators, medical devices or any application where the safety of two or more persons depend on the correct operation of the device.

Additional requirements for safety applications

- Provided that all previous requirements for the devices are fulfilled, for installations with operator protection function additional requirements must be observed.
- The utilization implies knowledge of and compliance with following standards: IEC 60204-1, IEC 60947-5-1, ISO 12100, EN ISO 14119, EN 62061, EN ISO 13849-1, EN ISO 13850.
- The protection fuse (or equivalent device) must be always connected in series with the NC contacts of the safety circuit.
- Periodically verify the correct working of the safety devices; the periodicity of this verification is settled by the machine manufacturer based on the machine danger degree and it does not have to be less than one a year.
- After installation and before commissioning of the machine, verify:
  - the correct operation of the device and all its parts;
  - the correct wiring and tightening of all screws;
  - the actuating travel of the actuator must be shorter than the maximum travel allowed by the device;
  - the actuating travel of the actuator must be greater than the positive opening travel;
  - the actuation system must be able to exert a force that is greater than the positive opening force.
- Devices with a safety function have a limited service life. Although still functioning, after 20 years from the date of manufacture the device must be replaced completely.
- The production date can be derived from the production batch on the item. Example: A18 FD7-411. The batch's first letter refers to the month of manufacture (A=January, B=February, etc.) The second and third letters refer to the year of manufacture (18 =2018, 19=2019, etc…)

Features

The contact blocks developed by Pizzato Elettrica are the result of more than 30 years of development experience and millions of sold switches. The range of available contact blocks is one of the most extensive in the world in the sector of position switches.
This chapter introduces to some features of Pizzato Elettrica contact blocks, in order to give the final user a better understanding of the technologies behind that element simply named "contact".
We underline that contact blocks are not available for sale (to the public) separately from switches, both because some of them are mechanically connected to the switch and because some technical features may change in accordance with the switch and its function. The following data is only intended to serve as an aid for the initial selection of the contact block. It is not to be used for determining the characteristics of the switch that uses this contact block. For example, the use of a contact block with positive opening with a switch with flexible actuator results in the combination of the two devices not having positive opening.
In this chapter, the properties of the E1 electronic contact block are explained in detail. It is used with position switches with multiple monitoring tasks that would require extensive effort to realize with electronic sensors. There is no other electronic sensor on the market that can match this contact unit with respect to precision and repeatability, adjustment of the switching point, operating temperature and price.



Description

1 Captive screws

2 Finger protection

3 Clamping screw plates for cables with various diameters

4 Self-lifting clamping screw plates

5 Material of the contacts: Silver alloy or gold-plated silver alloy

6 Contact technology and reliability: Single bridge, double bridge

7 Operating voltages and currents for reliable switching

Description

8 Classification of the contact design acc. to EN 60947-5-1: X, Y, C, Za, Zb

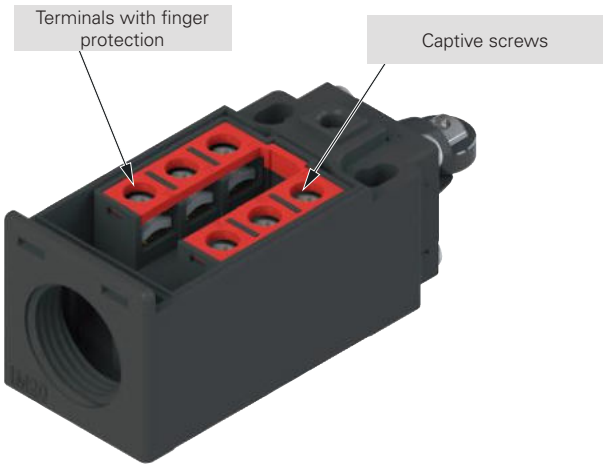
9 Contact type: Slow action / snap action / snap action with constant pressure

10 Force on contacts

11 Positive opening of contacts

1 Captive screws

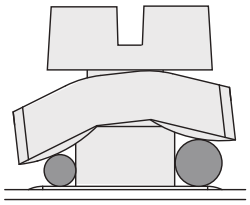
Switches with this characteristic have clamping screws that remain in place even if completely unscrewed. This feature reduces wiring time, since the operator does not have to be careful not to unscrew the screws completely and does not risk to lose them by mistake, which is very useful in case of wirings in uncomfortable position



2 Finger protection

All terminals in the contact blocks have protection degree IP20 in accordance with EN 60529, they are therefore protected against access to dangerous parts with a diameter greater than 12 mm.

3 Clamping screw plates for cables with various diameters



The clamping screw plates are provided with a particular "roofing tile" structure and are loosely coupled to the clamping screw. The design causes connection wires of different diameter to be pulled towards the screw when tightening the screw (see figure), preventing the wires from escaping towards the outside.

4 Self-lifting clamping screw plates

Switches with this feature are equipped with clamping screw plates that move up or down by turning the clamping screw; wiring is easier and faster as a result.

5 Contact material: gold-plated silver alloy

The contact blocks can be supplied with silver electric contacts with a special gold-plated surface, with total gold thickness of one micron. This type of treatment can be useful in environments which are aggressive against silver (very humid or sulphurous atmospheres) and in case of very small electric loads, usually with low voltages and supply currents. This thickness of the gold coating permits several million switching cycles.

6 Contact technology and reliability

Very rarely, an electric contact does not function. A failed switching operation is a typical consequence of an exceptionally high contact resistance caused by dust, a thin layer of oxidation or other impurities that could penetrate the switch during wiring. Thus, the repeated occurrence of faulty switching depends not only on the sensor type, but also on its environmental conditions and the load that the switch drives. These effects are more evident with low electrical loads if the electric voltage cannot penetrate the thin layers of oxide or small grains of dust.

This type of malfunction can normally be tolerated with hand-operated devices, because repeating the operation is enough to restore the function. This is not the case with position switches, as severe machine damage could result if the end position is not ascertained.

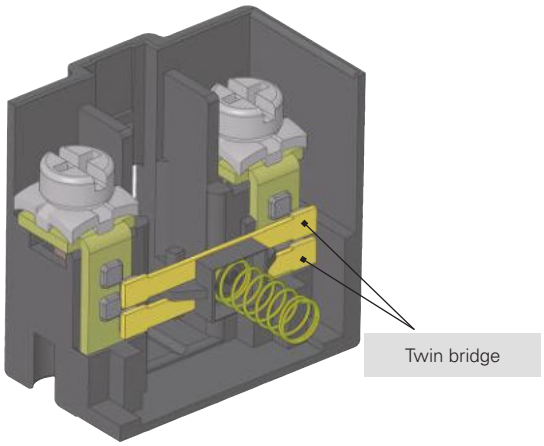
In the following table we refer to two typical contact structures (type A and B) normally used in the industry and the ones which have been used by Pizzato Elettrica for several years in most switches: movable contacts with double interruption and twin bridge (type C).

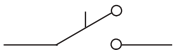
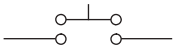
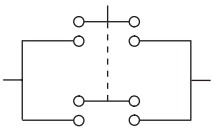
As you can see from the table below, the last structure (type C) has the same contact resistance (**R**) as the simple mobile contact (type A), but with a lower failure probability (**fe**).

With a failure probability of **x** for a single switching operation, the failure probability for type A is **fe=x**, for type B **fe 2·x**, whereas for type C it is **fe 4·x²**

This means that if the probability of a switching failure is x in a given situation, e.g., $1x10^{-4}$, (1 switching failure in 10,000), the result is as follows:

- for type A one failed commutation every 10,000.
- for type B one failed commutation every 5,000.
- for type C one failed commutation every 25,000,000.



Type	Diagram	Description	Contact resistance R	Probability of errors fe
A		simple mobile contact	R=Rc	fe=x
B		mobile contact with double interruption	R=2·Rc	$fe=2x-x^2$
C		mobile contact with double interruption and twin bridge	R= 2·Rc=Rc 2	$fe=4x^2-4x^3+x^4$

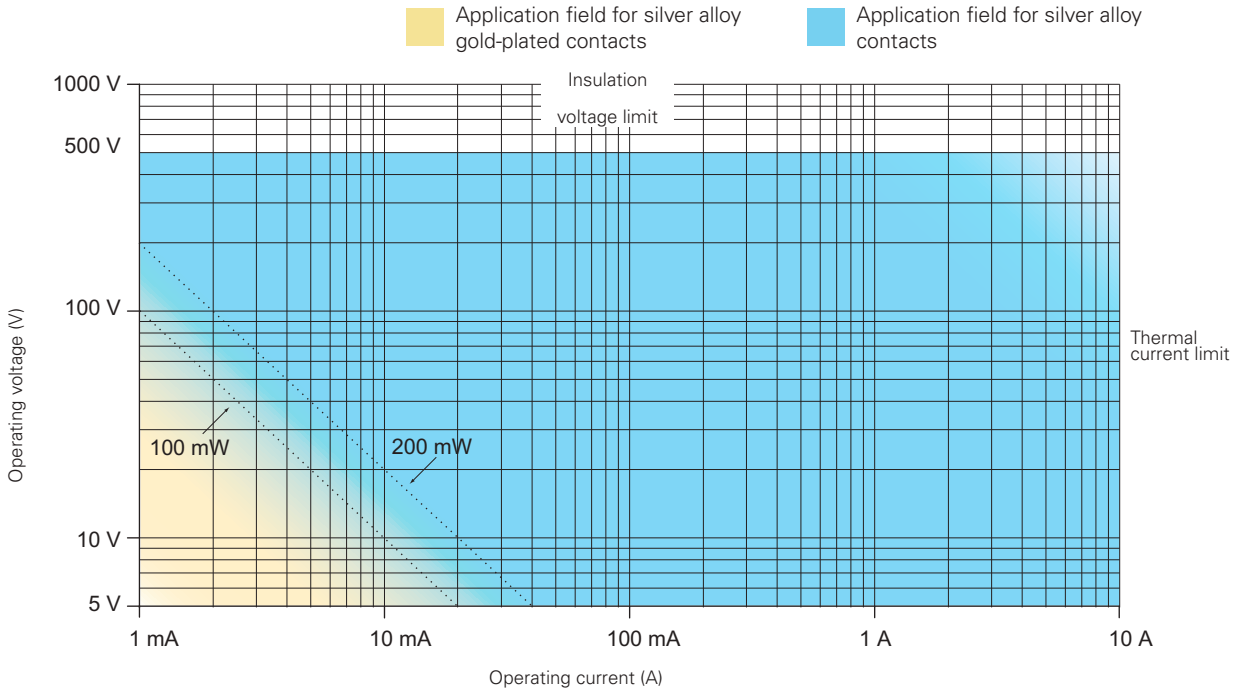
7 Minimum operating voltages and currents for reliable switching

The reliability of an electric contact depends on several factors, whose influence varies depending on the type of load. For high power loads is necessary for the contact to be able to dissipate the heat generated during switching. For low power loads, instead, it is important that it oxides and other impurities do not obstruct the passing of the electric signal. As a result, the material chosen for the electric contacts is a compromise among different and sometimes contrasting needs. In position switches contacts are usually made of a silver that has proved to be suitable for the switching of loads in the range of approximately 1 kW to 0.1 W. However, at lower loads, the effects of the oxide, which silver naturally develops upon contact with air, may occur; additionally to be taken into account are possible contaminations or impurities in the contact switching chamber (for example the talc powder in the cable sheaths that an installer could accidentally insert in the switch may have a similar effect).

It is impossible to define a fix threshold above which the "missing switching phenomenon" does not appear, because there are a lot of mechanical end electric parameters that influence this value. For example, in laboratory environment a good twin bridge electric contact is able to switch loads in the µW range for dozens of millions of handling operations, without losing signals. However, this does not mean that the same contact will have the same performance when the switch operates in environments with sudden changes of temperature (condensation) or where few switching occur (oxidation).

In order to avoid this kind of problem, gold plated contacts are used for very low loads profiting from the non-oxidability of this material. The gold-plating layer should be thick enough to be mechanically resistant to switching as well as electrically resistant to possible sparks that may vaporize it. For this reason Pizzato Elettrica uses micron thickness gold plating suitable for millions of working cycles. Thinner gold plating layers have often a purely aesthetic function and are only suitable to protect the product against oxidation during long time storage.

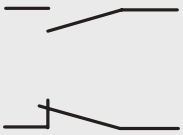
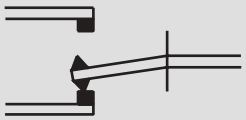
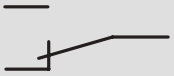
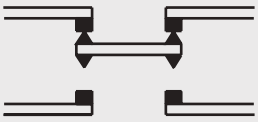
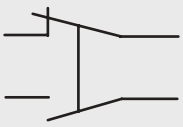
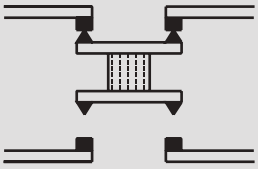
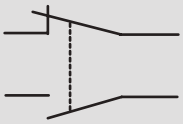
The minimum current and voltage values recommended by Pizzato Elettrica are shown in the diagram below, that is divided into two areas defined by a steady power limit. These values identify voltage and current combinations with high commutation reliability in most industrial fields. The lower voltage and current limits shown in the diagram are typical minimum values for industrial applications. They may also be reduced in non typical conditions. It is recommended, however, to always evaluate that the signal power to be switched is at least one magnitude order higher than the noise produced in the electric circuit, in particular when circuit cables are long and pass through areas with high electromagnetic fields and especially for powers lower than 10 mW.



100 mW Suggested limit for general applications with snap action contact blocks with silver alloy contacts.

200 mW Recommended limit for general applications with slow action contact blocks with silver alloy contacts.

8 Classification of the contact block acc. to the EN 60947-5-1

Design	Figure	Symbol	Description
X Y			Double interruption contact element with two terminals
C			Change-over contact element with single interruption and three terminals
Za			Change-over contact element with double interruption and four terminals. **The contacts have identical polarity**
Zb			Change-over contact element with double interruption and four terminals. **Mobile contacts are electrically separated**

Electrically separated contacts

The "**+**" symbol between two designs (e.g., X+X, Za+Za, X+X+Y, etc.) represents the combination of simple, **electrically separated** contact blocks.

The electrically separated contacts allow different voltages to be applied between the contacts and loads to be connected to different polarities (figure 1).

Requirements and restrictions for Za contacts

Electrical loads must be connected to the same phase or polarity. The contacts **are not** electrically separated. As a result, different voltages may not be applied to the NC and NO contacts (figures 2 and 3).

According to EN 60947-5-1 section K.7.1.4.6.1., the following restrictions apply for positive opening contacts of design Za when used for safety applications.

When the control switch has form C or form Za change-over contact elements, **only one contact element shall be used** (make or break).

In the case of form Zb change-over contact elements, both contacts may be used.

Contact design Zb

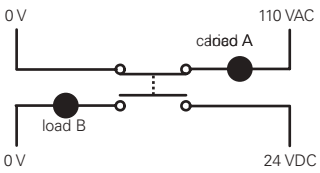


figure 1: **correct**

Contact design Za

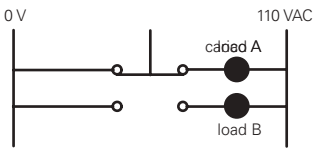


figure 2: **correct**

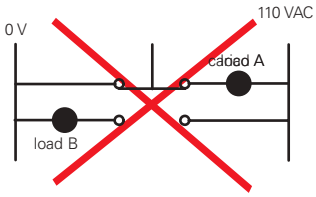
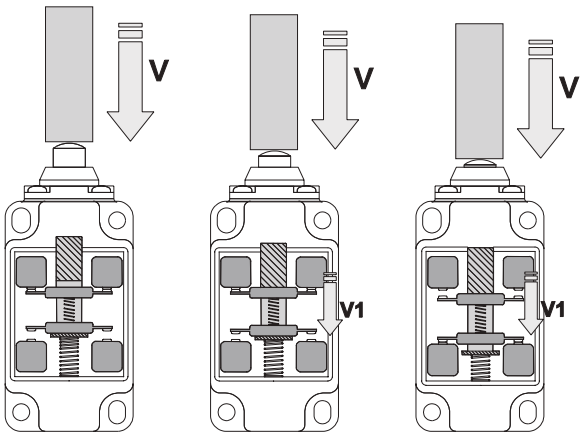


figure 3: **incorrect**

9 Contact blocks with different operating principle: slow action and snap action

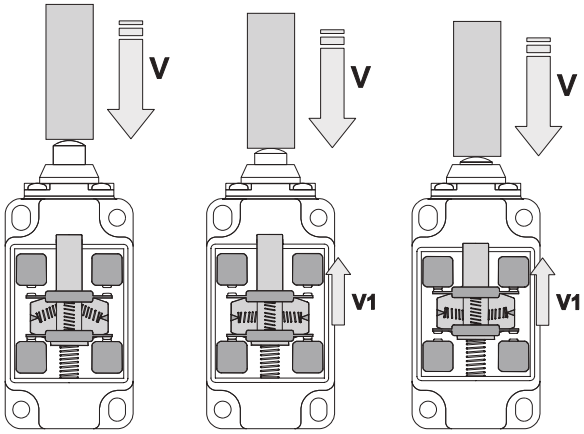
Contact blocks with slow action: component where the speed of the contact movement (**V1**) depends on the speed of the switch actuation (**V**). The contact carrier moves at a rate proportional to the actuation speed.
The slow action contact block is suitable for applications having low to medium currents and quick actuation movements. It has no differential travel.

$$V = V1$$



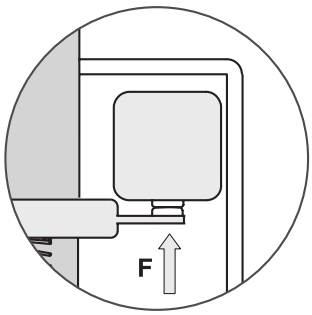
Contact block with snap action: component where the speed of the contact movement (**V1**) doesn't depend on the speed of the switch actuation (**V**). Upon reaching a predetermined point in the actuation travel, the contact carrier triggers and switches the contacts.
The snap action contact block is suitable for applications having high currents and/or slow actuation movements. This kind of contact block has a differential travel.

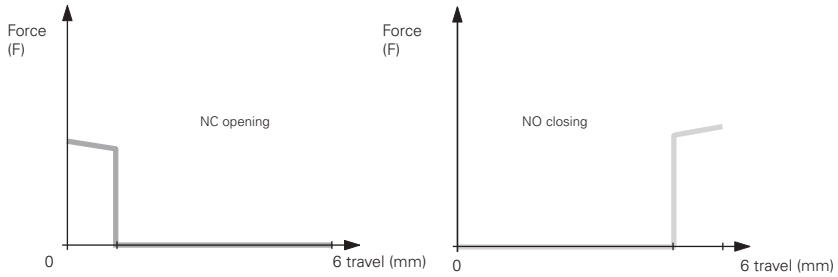
$$V \neq V1$$



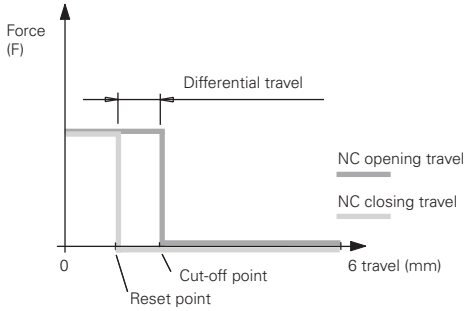
10 Contact blocks: diagrams of the force on the contacts

The following diagrams show the relationship between of the force exerted on the contacts (F) and the actuation travel to the end position.

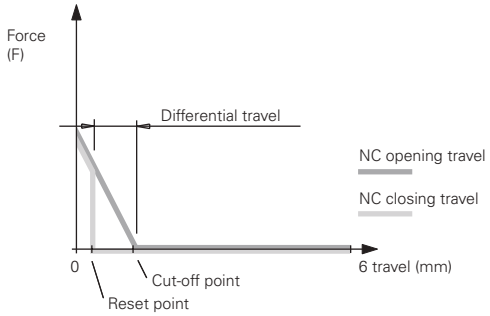




Contact block with slow action

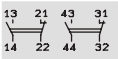
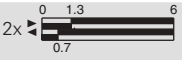
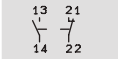
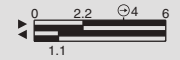
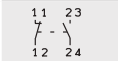
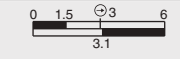
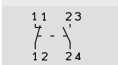
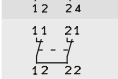
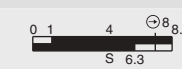
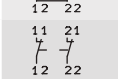
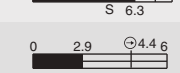
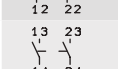
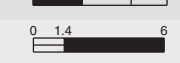
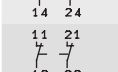
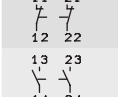
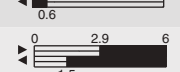
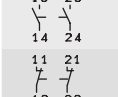
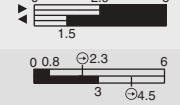
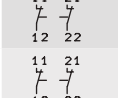
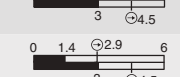
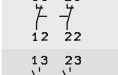
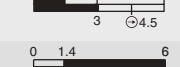
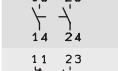
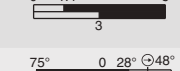
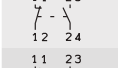
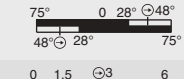
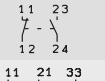
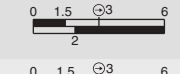
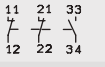
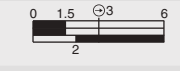
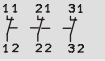
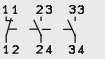
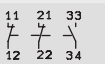
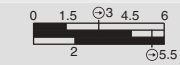


Contact block with snap action and constant pressure: 5, 11, 12.
The pressure on the contacts remains constant as the switching point is approached



Contact block with snap action: 2, 3, 17
The pressure on the contacts decreases as the switching point is approached

Contact blocks of the FD-FP-FL-FC-FR-FM-FX-FZ-FK-FW-FS series

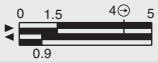
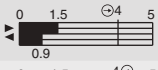
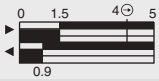
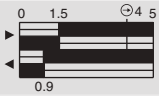
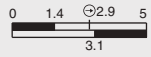
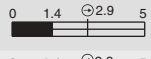
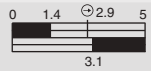
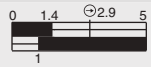
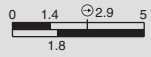
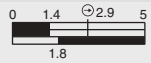
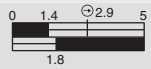
Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Wire cross-section min.	Wire cross-section max.	Wire stripping length	Captive screws	Terminals with finger protection	Gold-plated contacts
2	2x (1NO-1NC)			Za+Za	snap action	no	Double interruption	1 x 0.5 mm² 1 x AWG 20	2 x 1.5 mm² 2 x AWG 16	6 mm	no	no	G
3	1NO-1NC			Za	snap action	no	Double interruption	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	6 mm	no	no	G
5	1NO+1NC			Zb	snap action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
6	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
7	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
8	1NC			Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
9	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
10	2NO			X+X	slow action	no	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
11	2NC			Y+Y	snap action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
12	2NO			X+X	snap action	no	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
13	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
14	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
15	2NO			X+X	slow action	no	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
16	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
18	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
20	1NO+2NC			Y+Y+X	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
21	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
22	2NO+1NC			Y+X+X	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
28	1NO+2NC			Y+Y+X	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
29	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
30	3NC			Y+Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
33	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
34	2NC			Y+Y	slow action	yes	Double interruption, twin bridge	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G
37	1NO+1NC			Zb	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
66	1NC			Y	slow action	yes	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
67	1NO			X	slow action	no	Double interruption, twin bridge	1 x 0.5 mm² 1 x AWG 20	2 x 2.5 mm² 2 x AWG 14	8 mm	yes	yes	G / G1
E1	1NO-1NC			PNP	electronic	no	Electronic	1 x 0.5 mm² 1 x AWG 20	1 x 1.5 mm² 1 x AWG 16	7 mm	no	no	/

Legend: G = gold-plated contacts 1 µm, G1 = gold-plated contacts 2.5 µm

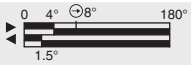
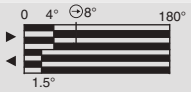
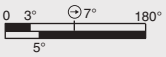
Contact blocks - FG series

Contact block	Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Wire cross-section min.	Wire cross-section max.	Wire stripping length	Captive screws	Terminals with finger protection	Gold-plated contacts
60•	Contact block with 4 poles and multiple contact designs. See page 107, General Catalogue Safety 2019-2020			Slow action	yes	Double interruption, twin bridge and double contact point	1 x 0.34 mm² 1 x AWG 22	2 x 1.5 mm² 2 x AWG 16	7 mm	yes	yes	G

Contact blocks - NA-NB-NF series

Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
B11	1NO+1NC			Zb	snap action	yes	Double interruption	/	/	G
B02	2NC			Y+Y	snap action	yes	Double interruption	/	/	G
B12	1NO+2NC			X+Y+Y	snap action	yes	Double interruption	/	/	G
B22	2NO+2NC			X+X+Y+Y	snap action	yes	Double interruption	/	/	G
G11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
G02	2NC			Y+Y	slow action	yes	Double interruption	/	/	G
G12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
G22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
H11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
H12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
H22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
L11	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
L12	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
L22	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
BA1	1NO+1NC change-over			C	snap action	yes	Double interruption	/	/	G

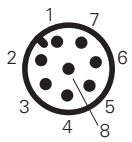
Contact blocks - HP series

Contact block		Contact diagram	Linear travel diagram	Contact design	Operation type	Positive opening ⊖	Contact type	Captive screws	Terminals with finger protection	Gold-plated contacts
50C	1NO+1NC			Zb	snap action	yes	Double interruption	/	/	G
50D	2NC			Y+Y	snap action	yes	Double interruption	/	/	G
50F	1NO+2NC			X+Y+Y	snap action	yes	Double interruption	/	/	G
50M	2NO+2NC			X+X+Y+Y	snap action	yes	Double interruption	/	/	G
52C	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
52D	2NC			Y+Y	slow action	yes	Double interruption	/	/	G
52F	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
52M	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G
53C	1NO+1NC			Zb	slow action	yes	Double interruption	/	/	G
53F	1NO+2NC			X+Y+Y	slow action	yes	Double interruption	/	/	G
53M	2NO+2NC			X+X+Y+Y	slow action	yes	Double interruption	/	/	G

Wiring diagram for assembled connectors

For FD - FL - FM - FZ - FC series with metal housing

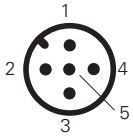
Contact block 2
2x(1NO-1NC)



M12 connector, 8-pole

Contacts	Pin no.
NO	3-4
NC	5-6
NC	7-8
NO	1-2

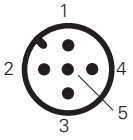
Contact block 5
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

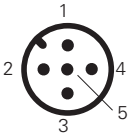
Contact block 6
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

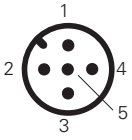
Contact block 7
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

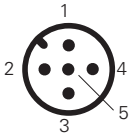
Contact block 9
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

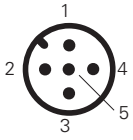
Contact block 10
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO	1-2
NO	3-4
ground	5

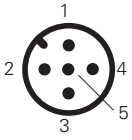
Contact block 11
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

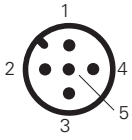
Contact block 12
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO	1-2
NO	3-4
ground	5

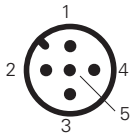
Contact block 13
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4
ground	5

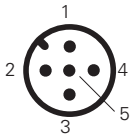
Contact block 14
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4
ground	5

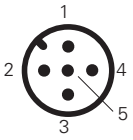
Contact block 15
2NO



M12 connector, 5-pole

Contacts	Pin no.
NO (1°)	1-2
NO (2°)	3-4
ground	5

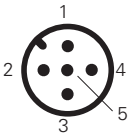
Contact block 16
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC, lever to the right	1-2
NC, lever to the left	3-4
ground	5

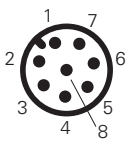
Contact block 18
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

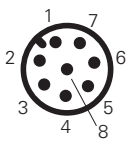
Contact block 20
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8
ground	1

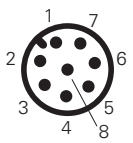
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

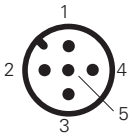
Contact block 22
2NO+1NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NO	5-6
NO	7-8
ground	1

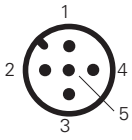
Contact block 33
1NO+1NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NO	3-4
ground	5

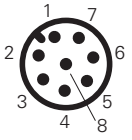
Contact block 34
2NC



M12 connector, 5-pole

Contacts	Pin no.
NC	1-2
NC	3-4
ground	5

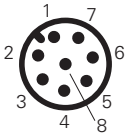
Contact block 28
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8
ground	1

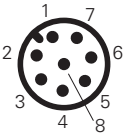
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

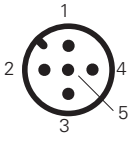
Contact block 30
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8
ground	1

Contact block E1
PNP

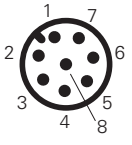


M12 connector, 5-pole

Contacts	Pin no.
+	1
-	3
NC	2
NO	4
ground	5

For FS series with technopolymer housing

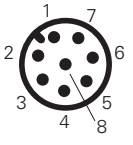
Contact block 18
1NO+1NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NO	5-6

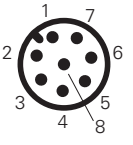
Contact block 20
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NO	7-8

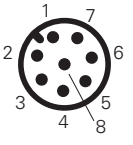
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

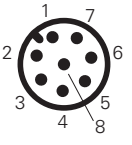
Contact block 28
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NO	7-8

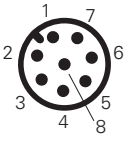
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

Contact block 30
3NC



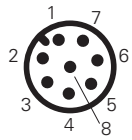
M12 connector, 8-pole

Contacts	Pin no.
A1-A2	1-2
NC	3-4
NC	5-6
NC	7-8

Wiring diagram for assembled connectors

For FP - FR - FX - FW series with technopolymer housing

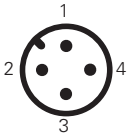
Contact block 2
2x(1NO-1NC)



M12 connector, 8-pole

Contacts	Pin no.
NO	3-4
NC	5-6
NC	7-8
NO	1-2

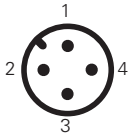
Contact block 5
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

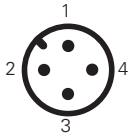
Contact block 6
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

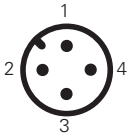
Contact block 7
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

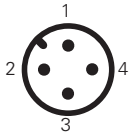
Contact block 9
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

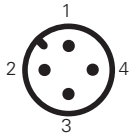
Contact block 10
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO	1-2
NO	3-4

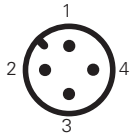
Contact block 11
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

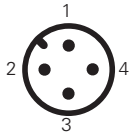
Contact block 12
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO	1-2
NO	3-4

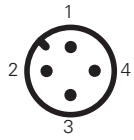
Contact block 13
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4

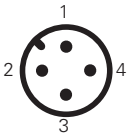
Contact block 14
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC (1°)	1-2
NC (2°)	3-4

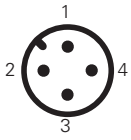
Contact block 15
2NO



M12 connector, 4-pole

Contacts	Pin no.
NO (1°)	1-2
NO (2°)	3-4

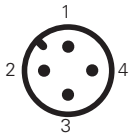
Contact block 16
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC, lever to the right 1-2	
NC, lever to the left 3-4	

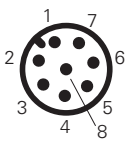
Contact block 18
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

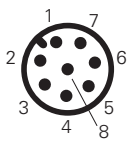
Contact block 20
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8

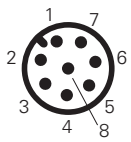
Contact block 21
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

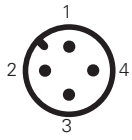
Contact block 22
2NO+1NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NO	5-6
NO	7-8

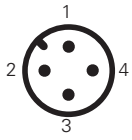
Contact block 33
1NO+1NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NO	3-4

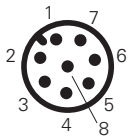
Contact block 34
2NC



M12 connector, 4-pole

Contacts	Pin no.
NC	1-2
NC	3-4

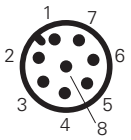
Contact block 28
1NO+2NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NO	7-8

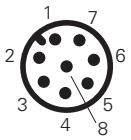
Contact block 29
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

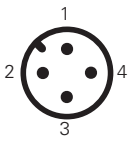
Contact block 30
3NC



M12 connector, 8-pole

Contacts	Pin no.
NC	3-4
NC	5-6
NC	7-8

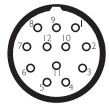
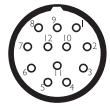
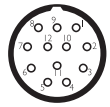
Contact block E1
PNP

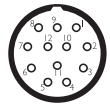
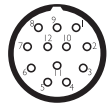


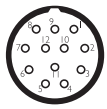
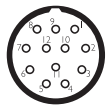
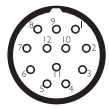
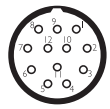
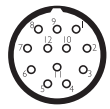
M12 connector, 4-pole

Contacts	Pin no.
+	1
-	3
NC	2
NO	4

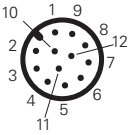
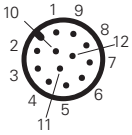
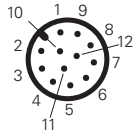
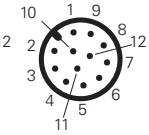
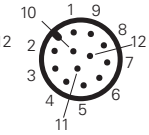
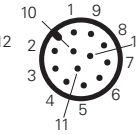
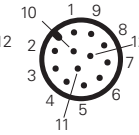
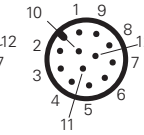
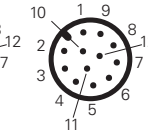
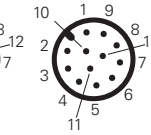
For FG series with metal housing and M23 connector

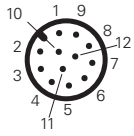
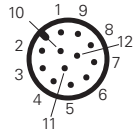
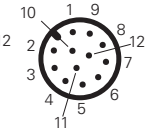
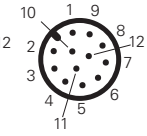
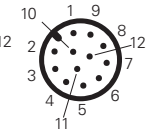
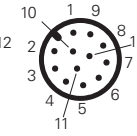
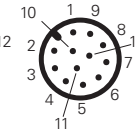
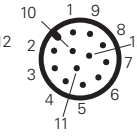
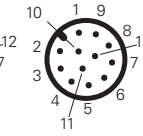
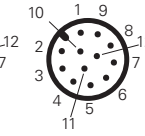
Contact block 60A 2NO+2NC	Contact block 60B 1NO+3NC	Contact block 60C 4NC	Contact block 60D 1NO+3NC	Contact block 60E 1NO+3NC	Contact block 60F 2NO+2NC	Contact block 60G 4NC	Contact block 60H 4NC	Contact block 60I 1NO+3NC	Contact block 60L 2NO+2NC
									
M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NC 3-4	NC 3-4	NC 3-4	NO 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NO 7-8	NC 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10
ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11

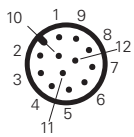
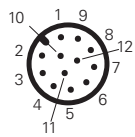
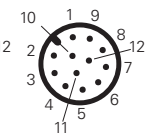
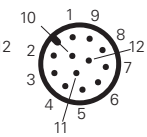
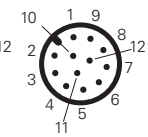
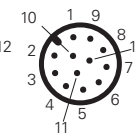
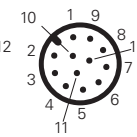
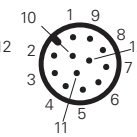
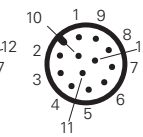
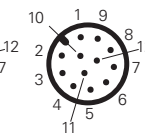
Contact block 60M 3NO+1NC	Contact block 60N 3NO+1NC	Contact block 60P 4NC	Contact block 60R 2NO+2NC	Contact block 60S 2NO+2NC	Contact block 60T 1NO+3NC	Contact block 60U 4NC	Contact block 60V 2NO+2NC	Contact block 60X 1NO+3NC	Contact block 60Y 2NO+2NC
									
M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NO 3-4	NO 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NO 3-4	NC 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NO 7-8	NO 7-8	NC 7-8	NO 7-8	NO 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NO 9-10	NO 9-10	NO 9-10	NC 9-10	NO 9-10	NC 9-10	NO 9-10
ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11

Contact block 61A 1NO+3NC	Contact block 61B 2NO+2NC	Contact block 61C 3NO+1NC	Contact block 61D 3NO+1NC	Contact block 61E 3NO+1NC	Contact block 61G 3NO+1NC	Contact block 61H 2NO+2NC	Contact block 61M 3NO+1NC	Contact block 61R 1NO+3NC	Contact block 61S 3NO+1NC
									
M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole	M23 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NC 3-4	NC 3-4	NO 3-4	NO 3-4	NO 3-4	NO 3-4	NC 3-4	NO 3-4	NC 3-4	NO 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NC 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10
ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11	ground 11

For FG series with metal housing and M12 connector

Contact block 60A 2NO+2NC	Contact block 60B 1NO+3NC	Contact block 60C 4NC	Contact block 60D 1NO+3NC	Contact block 60E 1NO+3NC	Contact block 60F 2NO+2NC	Contact block 60G 4NC	Contact block 60H 4NC	Contact block 60I 1NO+3NC	Contact block 60L 2NO+2NC
									
M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NC 3-4	NC 3-4	NC 3-4	NO 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NO 7-8	NC 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NC 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10

Contact block 60M 3NO+1NC	Contact block 60N 3NO+1NC	Contact block 60P 4NC	Contact block 60R 2NO+2NC	Contact block 60S 2NO+2NC	Contact block 60T 1NO+3NC	Contact block 60U 4NC	Contact block 60V 2NO+2NC	Contact block 60X 1NO+3NC	Contact block 60Y 2NO+2NC
									
M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NO 3-4	NO 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NC 3-4	NO 3-4	NC 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NO 7-8	NO 7-8	NC 7-8	NO 7-8	NO 7-8	NC 7-8	NC 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NC 9-10	NC 9-10	NO 9-10	NO 9-10	NC 9-10	NO 9-10	NC 9-10	NO 9-10

Contact block 61A 1NO+3NC	Contact block 61B 2NO+2NC	Contact block 61C 3NO+1NC	Contact block 61D 3NO+1NC	Contact block 61E 3NO+1NC	Contact block 61G 3NO+1NC	Contact block 61H 2NO+2NC	Contact block 61M 3NO+1NC	Contact block 61R 1NO+3NC	Contact block 61S 3NO+1NC
									
M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole	M12 connector, 12-pole
Contacts **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**	**Contacts** **Pin no.**
A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2	A1-A2 1-2
NC 3-4	NC 3-4	NO 3-4	NO 3-4	NO 3-4	NO 3-4	NC 3-4	NO 3-4	NC 3-4	NO 3-4
NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6	NC 5-6
NC 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NO 7-8	NC 7-8	NO 7-8
NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10	NO 9-10

Note: the wires connected to pins 11 and 12 of the M12 connector can be used to activate the LEDs in FG series configurations with freely connectable LEDs.

Definitions according to the EN 60947-1 and EN 60947-5-1 standards

Control switches
Devices or operating mechanisms for controlling the operation of equipment, including signalling, interlocking, etc.

Utilization category
Combination of specified requirements related to the conditions in which the switching device fulfils its purpose.

Operating cycle
Sequence of two operations, one for opening and one for closing.

Rated current Ie
This current depends on the rated operating voltage, the rated frequency, the utilization category and the type of protective enclosure, if present.

Thermal current Ith
Maximum current for heating tests on equipment without enclosure, in free air. Its value shall be least to equal to the maximum value of the rated operational current Ie of the equipment without enclosure, in eight-hour duty.

Electrical endurance
Number of on-load operating cycles, under the conditions defined by the corresponding product standard, which can be carried out without repair or replacement.

Mechanical endurance
Number of no-load operating cycles (i.e. without current on the main contacts), under the conditions defined by the corresponding product standard, which can be carried out without repair or replacement of mechanical parts.

Contact elements
The parts, fixed or movable, conducting or insulating, of a control switch necessary to close and open one single conducting path of a circuit.

Single interruption contact elements
Contact element opening or closing the circuit's conducting path at one point only.

Double interruption contact elements
Contact element opening or closing the circuit's conducting path at two points in series.

Make-contact elements (normally open)
Contact element closing a circuit's conducting path when the control switch is actuated.

Break-contact elements (normally closed)
Contact element opening a circuit's conducting path when the control switch is actuated.

Change-over contact elements
Contact element combination including one make-contact element and one break-contact element.

Electrically separated contact elements
Contact elements of the same control switch which are well isolated from each other and therefore can be connected to electric circuits with different voltages.

Contact elements with independent action (snap action)
Contact element of a manual or automatic device for control circuits where the motion speed of the contact is substantially independent from the motion speed of the actuator.

Contact elements with dependent action (slow action)
Contact element of a manual or automatic device for control circuits where the motion speed of the contact depends on the motion speed of the actuator.

Minimum actuating force
Minimum force to be applied to the actuator that will cause all contacts to reach their switched position.

Position switch
Control switch whose controller is actuated by a moving part of the machine, when this part arrives to a set position.

Foot switch
Control switch whose actuator is actuated by exerting force with a foot on the pedal.

Pre-travel of the actuator
The maximum travel of the actuator which does not cause any travel of the contact elements.

Ambient temperature
The air temperature surrounding the complete switching device, under prescribed conditions.

Rated operating voltage Ue
Voltage which, combined with the rated operational current Ie, determinates the application of the equipment and the referred utilization categories.

Rated insulation voltage Ui
Reference voltage for the dielectric test voltage and the creepage distances along surfaces.

Rated impulse withstand voltage Uimp
The highest peak value of an impulse voltage, of a prescribed shape and polarity, which does not cause destructive discharge under the specified test conditions.

Contact block
Contact element or contact elements combination which can be combined with similar units, operated by a common actuating system

Markings and quality marks

CE marking

The CE marking is a mandatory declaration made by the manufacturer of a product in order to indicate that the product satisfies all requirements foreseen by the directives (regulated by the European Community) in terms of safety and quality. Therefore, it ensures National bodies of the EU countries about the fulfilment of obligations laid down in the agreements.

IMQ mark

The IMQ (Italian Institute of the Quality Mark) is an association in Italy (independent third body) whose task is to check and certify the compliance of materials and equipment with safety standards (CEI standards in the electric and electronic sector). This voluntary conformity certification is a guarantee of quality, safety and technical value.

UL mark

UL (Underwriters Laboratories Inc.) is an independent non-profit body that tests materials, devices, products, equipment, constructions, methods and systems with regard to their risk for human life and goods according to the standard in force in the United States and Canada. Decisions made by UL are often recognized by many governing authorities concerning the compliance with local safety regulations.

CCC mark

The CQC is the organization in the Chinese Popular Republic whose task is to check and certify the low voltage electrical material. This organization issues the product mark CCC which certifies the passing of electrical/mechanical conformity tests by products and the compliance of the company quality system with required standards. To obtain the mark, the Chinese body makes preliminary company visits as well as periodical check inspections. Position switches cannot be sold in the Chinese territory without this mark.

TÜV SÜD mark

TÜV SÜD is an international authority claiming long-standing experience in the certification of operating safety for electrical, electromechanical and electronic products. In the course of type approval, TÜV SÜD closely inspects the quality throughout all the stages concerning product development, from software design and completion, to production and to the tests conducted according to ISO/IEC standards. The operating safety certification is obtained voluntarily and has a high technical value, since it not only certifies the electrical safety of the product, but also its specific operating suitability for use in safety applications according to the IEC 61508 standard.

EAC mark

The EAC certificate of conformity is a certificate issued by a Customs Union certification body formed by Russia, Belarus and Kazakhstan, with which the conformity of a product is certified with the essential safety requirements laid down by one or more Technical Regulations (Directives) of the Customs Union.

ECOLAB mark

ECOLAB is one of the world's leading providers of technologies and services for hygiene in food processing. ECOLAB certifies the compatibility of tested electrical devices in its own laboratories, using disinfectants and cleaning agents used in the area of food processing worldwide.

International and European Standards

EN 50041: Low voltage switchgear and controlgear for industrial use. Control switches. Position switches 42.5x80 mm. Dimensions and features
EN 50047: Low voltage switchgear and controlgear for industrial use. Control switches. Position switches 30x55 mm. Dimensions and features
EN ISO 14119: Safety of machinery. Interlocking devices associated with guards. Design and selection principles.
EN ISO 12100: Safety of machinery. General design principles. Risk assessment and risk reduction.
EN ISO 13849-1: Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
EN ISO 13850: Safety of machinery. Emergency stop devices, functional aspects. Design principles.
EN 61000-6-3 (equivalent to IEC 61000-6-3): Electromagnetic compatibility. Generic emission standard. Part 1: residential, commercial and light-industrial environments.
EN 61000-6-2 (equivalent to IEC 61000-6-2): Electromagnetic compatibility. Generic immunity standard. Part 2: Industrial environments.
EN ISO 13855: Safety of machinery. Positioning of safeguards with respect to the approach speeds of parts of the human body.
EN 1037: Safety of machinery. Prevention of unexpected start-up.
EN 574: Safety of machinery. Two-hand control devices. Functional aspects. Principles for design.
EN 60947-1 (equivalent to IEC 60947-1): Low-voltage switchgear and controlgear. Part 1: General rules.
EN 60947-5-1 (equivalent to IEC 60947-5-1): Low-voltage switchgear and controlgear. Part 5: Devices for control and operation circuits. Section 1: Electromechanical control circuit devices.
EN 60947-5-2: Low-voltage switchgear and controlgear. Part 5-2: Control circuit devices and switching elements - Proximity switches
EN 60947-5-3: Low-voltage switchgear and controlgear. Part 5-3: Control circuit devices and switching elements - Requirements for proximity devices with defined behaviour under fault conditions (PDF)
EN 60204-1 (equivalent to IEC 60204-1): Safety of machinery. Electrical equipment of machines. Part 1: General rules.
EN 60529 (equivalent to IEC 60529): Protection degree of the housings (IP codes).
ISO 20653: Road vehicles-degrees of protection (IP CODE)
EN 62326-1 (equivalent to IEC 62326-1): Printed boards. Part 1: Generic specification
EN 60664-1 (equivalent to IEC 60664-1): Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests.
EN 61508 (equivalent to IEC 61508): Functional safety of electrical, electronic and programmable electronic systems for safety applications.
EN 62061 (equivalent to IEC 62061): Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems.
EN 60079-0 (equivalent to IEC 60079-0): Electrical devices for potentially explosive atmospheres. General rules
EN 60079-11 (equivalent to IEC 60079-11): Electrical apparatus for potentially explosive atmospheres. Intrinsic safety "i"
EN 60079-31 (equivalent to IEC 60079-31): Electrical apparatus for potentially explosive atmospheres. Type of protection: "n".
EN 60079-28 (equivalent to IEC 60079-28): Electrical apparatus for use in the presence of combustible dust. Part 1-1: Construction and testing
EN 50581: Technical documentation for the evaluation of electrical and electronic products in relation to the restriction of hazardous substances
BG-GS-ET-15: Prescriptions about how to test switches with forced contact opening to be used in safety applications (German standard).
UL 508: Standards for industrial control equipment. (American standard).
CSA 22-2 No.14: Standards for industrial control equipment. (Canadian standard).

European directives

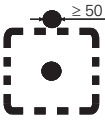
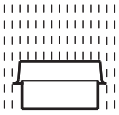
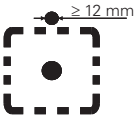
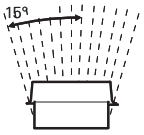
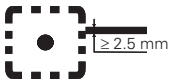
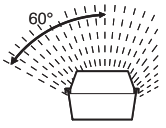
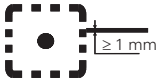
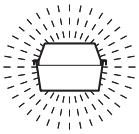
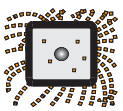
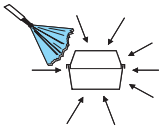
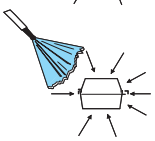
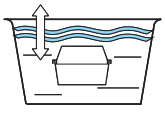
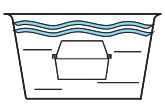
2014/35/EU	Directive on low-voltage switchgear and controlgear
2006/42/EC	Machinery Directive
2014/30/EU	Directive on electromagnetic compatibility
2014/34/EU	ATEX Directive
2011/65/UE	RoHS Directive

Regulatory Organisations

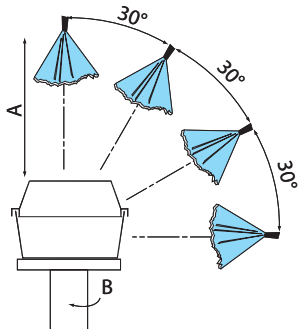
CEI	Comitato Elettrotecnico Italiano (IT)	**NF**	Normes Françaises (FR)
CSA	Canadian Standard Association (CAN)	**VDE**	Verband Deutscher Elektrotechniker (DE)
CENELEC	European Committee for Electrotechnical Standardisation	**UNI**	Ente Nazionale Italiano di Unificazione (IT)
CEN	European Committee for Standardisation	**UL**	Underwriter's Laboratories (USA)
IEC	International Electrotechnical Commission	**TÜV**	Technischer Überwachungs-Verein (DE)

Protection degree of housings for electrical material according to EN 60529

The following table reports the required protection degrees according to the IEC 60529, EN 60529, CEI 70-1 standards.
The protection degrees are indicated by the abbreviation IP and 2 following digits. 2 additional letters can be reported indicating protection of persons or other features. The first digit shows the degree of protection against penetration of external solid materials. The second digit identifies instead the protection degree against liquid penetration.

1st digit	Description	Protection for the machine	Protection for persons	2nd digit	Description	Protection for the machine
0		Not protected	Not protected	**0**		Not protected
1		Protected against solid objects greater than 50 mm	Against access to hazardous parts with the back of a hand (Ø 50 mm)	**1**		Protected against vertically falling water drops
2		Protected against solid objects greater than 12 mm	Against access to hazardous parts with a finger (Ø 12 mm)	**2**		Protected against water drops falling at max. 15° angle
3		Protected against solid objects greater than 2.5 mm	Against access to hazardous parts with a tool (Ø 2.5 mm)	**3**		Protected against rain drops falling at max. 60° angle
4		Protected against solid objects greater than 1 mm	Against access to hazardous parts with a wire (Ø 1 mm)	**4**		Protected against splash water from any direction
5		Protected against dust	Against access to hazardous parts with a wire (Ø 1 mm)	**5**		Protected against water jets from any direction
6		Totally protected against dust	Against access to hazardous parts with a wire (Ø 1 mm)	**6**		Protected against powerful water jets from any direction (e.g. waves)
				7		Protected against temporary water immersion (30 minutes at one-meter depth)
				8		Protected against continuous immersion in water

Protection degree IP69K according to ISO 20653



ISO 20653 envisages a particularly strenuous test. This test simulates the conditions of pressure washing in industrial environments with water jets having pressure between 80 and 100 bar, flow rate between 14 and 16 l/min. and a temperature of 80°C.

Test specifications:

Rotation speed (B):	5 ± 1 rpm
Distance from water jet (A):	100 +50/-0 mm
Water flow rate:	15 ± 1 l/min
Water pressure:	9000 ± 1000 kPa
Water temperature:	80 ± 5 °C
Test duration:	30 s per position

Housing data in accordance with UL (UL 508) and CSA (C22-2 no.14) approvals

The features required for a housing are determined by a specific environmental designation and other features such as the kind of gasket or the use of solvent materials.

Type	Intended use and description
1	Mainly for indoor utilization, supplied with protection against contact with the internal mechanism and against a limited quantity of falling dirt.
4X	Suitable for both indoor and outdoor use, provided with protection degree against falling rain, water splashes and direct coming water from a pipe. No damage caused by ice formation on the hosing. Corrosion-resistant.
12	Indoor utilization, provided with a protection degree against dust, dirt, flying fibres, dripping water and outside condensation of non-corrosive fluids.
13	Indoor utilization, supplied with a protection degree against gauze, dust penetration, outside condensation and sprinkling of water, oil and non-corrosive fluids.

Pollution degree (of environmental conditions) according to EN 60947-1

According to the EN 60947-1 standard, the pollution degree is a conventional number based on the quantity of conducting hygroscopic dust, ionized gas or salt, and on the relative humidity and its frequency of occurrence resulting in hygroscopic absorption or condensation of moisture leading to reduction in dielectric strength and/or surface resistivity. In equipment to be used inside a housing or having an integral enclosure as part of the device, the pollution degree applies to the inner part of housing. With the purpose of evaluating the air and surface insulation distances, the following four pollution degrees are defined:

Degree	Description
1	No pollution or only dry and non-conductive pollution occurs.
2	Normally, only non-conductive pollution is present. Occasionally some temporary conductivity caused by condensation may occur.
3	Some conductive pollution is present, or some dry non-conductive pollution that becomes conductive because of condensation.
4	Pollution causes persistent conductivity, for instance due to conductive dust or rain or snow.

Where not otherwise specified by the applicable standards for the product, equipment for industrial applications are generally intended for their use in environment with pollution degree 3. Nevertheless, other degrees can be considered, depending on the micro-environment or on particular applications.

Use in alternating and direct current of auxiliary devices acc. to EN 60947-5-1

Alternating current use

Utilization category	Intended use
AC12	Control of resistive loads and solid state loads with insulation by optocouplers.
AC13	Control of solid state loads with transformer isolation
AC14	Control of electromagnetic loads, power ≤ 72 VA
AC15	Control of electromagnetic loads, power ≥ 72 VA

Direct current use

Utilization category	Intended use
DC12	Control of resistive loads and solid state loads with insulation by optocouplers.
DC13	Control of electromagnetic loads without economy resistors in circuit
DC14	Control of electromagnetic loads with economy resistors in circuit