
Technical Documentation

of
ATEX stainless steel limit switch boxes
for
rotary and linear actuators
acc. to **94/9/EC, IExU 04 ATEX 1211**

 II 2G Ex ia/ib IIC/IIB T6  II 2D Ex ia/ib IIIC T 80°C

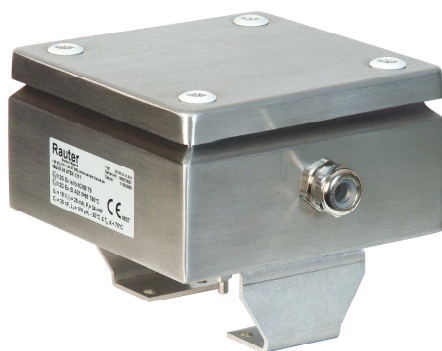


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1. Objectives and practical use

The positions of industrial valves represent an important piece of information for the course of action of a production. These valves are e.g. actuated with pneumatic rotary and linear drives at which the end position of the valve like “open” or “closed” is reported back to a control system. This is done via mounted a limit switch box which is placed above the actuator, see image 1-5 and appendix image 12+13, page 12.

For pressure compensation can be use a membrane vent witch is fixed in the ground of the limit switch boxes, see 6.1-6.3, page 8.

Use of the above mentioned limit switch boxes can be found in endangered explosive areas as in the chemicals industry, equipment group II, category 2G, zones 1 and 2 as well as the zones 21 and 22.





Image 1-2: Stainless steel limit switch boxes, A2, IP 65, 150x150x80mm with F05-slot, left: for rotary actuators acc. to VDI/VDE 3845 with bracket, right: with mounting set for linear actuators acc. to NAMUR IEC 534



Image 3-5: Pepperl+Fuchs sensors 2x SJ 3,5-N, 2x NJ2-12GK-N and 2x NJ2-V3-N

2. Technical specifications

Table 1: Technical specifications as well as conditions of use for the limit switch boxes equipment group II, category 2G, zones 1, 2 and 2D, zones 21, 22

Term / Identifier:	Technical specifications:
Potential recyclables and measurements	Stainless steel A2 (=1.4301), 150x150x80mm
Interface: Box to bracket ¹⁾	4xM6-winding at the bottom hole circle Ø 50 mm, F05-slot
Interface: - Box to bracket for rotary actuator - mounting set for linear actuators	- acc. to VDI/VDE, screw height 20,30 or 50mm, hole spacing 80x30 or 130x30mm - acc. to NAMUR IEC 534
Surrounding temperature array	- 25°C ≤ T _a ≤ + 70°C (for all versions acc. to table 2)
Protection class of the housings	IP 65
Ignition protection class	 II 2G Ex ia/ib IIC/IIB T6  II 2D Ex ia/ib IIIC T80° C
Temperature class	T6
• Nominal voltage • Nominal current • Power	U _i = 16 V (for all versions acc. to table 2) I _i = 25 mA P _i = 34 mW
Bush and cable entry points	M20x1,5mm, Ø9-13mm
Joint clamp ^{1), 2)}	max. 2,5 mm ²
Weight (without bridge)	1,8kg
Display and switching range ^{1), 2)}	0 bis 180°

3. Possible versions

Table 2: Possible versions of the limit switch boxes, equipment group II and I with the special intrinsically safe, inductive sensors of Pepperl+Fuchs

sensor-boxes type:	slot-sensors:	C_I (nF)/ L_i (µH)
SB-VA-SC 3,5-G-N0	2 oder 1 x SC 3,5-G-N0	150/150
SB-VA-SC 3,5-N0	2 oder 1 x SC 3,5-N0	150/150
SB-VA-SJ 3,5-N	2 oder 1 x SJ 3,5-N	50/250
SB-VA-SJ 3,5-SN	2 oder 1 x SJ 3,5-SN	30/100
SB-VA-SJ 3,5-S1N	2 oder 1 x SJ 3,5-S1N	30/100
sensor-boxes type:	cylindrical sensors:	
SB-VA-NJ2-11-N-G	2 oder 1 x NJ2-11-N-G	30/50
SB-VA-NJ2-12-GM-N	2 oder 1 x NJ2-12GM-N	30/50
SB-VA-NJ2-12GK-N	2 oder 1 x NJ2-12GK-N	45/50 ¹⁾
SB-VA-NJ4-12GK-N	2 oder 1 x NJ4-12GK-N	45/50 ²⁾
SB-VA-NJ2-12GK-SN	2 oder 1 x NJ2-12GK-SN	50/150
SB-VA-NJ2-11-SN-G	2 oder 1 x NJ2-11-SN-G	50/150
SB-VA-NCB2-12GM35-N0	2 oder 1 x NCB2-12GM35-N0	90/100
SB-VA-NCN4-12GM35-N0	2 oder 1 x NCN4-12GM35-N0	95/100
SB-VA-NJ3-18GK-S1N	2 oder 1 x NJ3-18GK-S1N	70/200 ³⁾
SB-VA-NJ4-12-GM-N	2 oder 1 x NJ4-12GM-N	45/50
SB-VA-NJ5-18GM-N	2 oder 1x NJ5-18GM-N	70/50
SB-VA-NJ8-18GK-SN	2 oder 1x NJ8-18GK-SN	120/200
sensor-boxes type:	V3-sensors:	
SB-VA-NJ2-V3-N	2 x NJ2-V3-N	40/50
SB-VA-NCB2-V3-N0	2 x NCB2-V3-N0	100/100
SB-VA-NCN4-V3-N0	2 x NCN4-V3-N0	100/100

SB = Sensor-Box VA = Edelstahl C_I = Kapazität L_i = Induktivität

¹⁾ approve according by IBExU-declaration from v. 24.11.05 (He/Hüb 8491/05)

²⁾ approve according by IBExU-declaration from v. 13.08.07 (He/Hüb 6095/07)

³⁾ approve according by IBExU-declaration from v. 04.3.09 (He/Leh 1413/09)

4. Connection of the sensors

The trench, cylinder and cuboid shaped sensors are all mounted according to the circuit diagram which always can be found within the inside of the housing, attached to the left long surface or directly on the pcb. There is the following circuit diagram, image 6 for the above mentioned sensors.

In image 6a see the circuit diagram for the sensor SJ 3,5-S1N and 6c sensor NJ3-18GK-S1N.

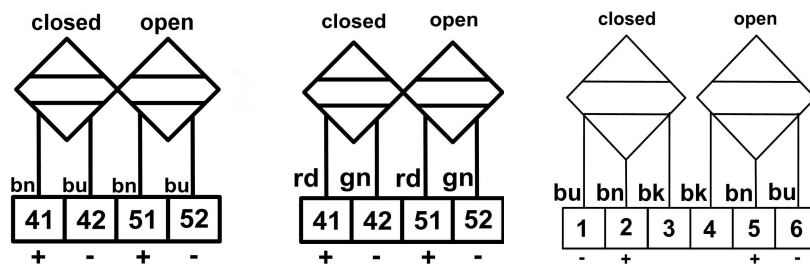


Image 6 and 6a, 6c: bn=brown cable +, bu = blue cable -, rd=red cable +, gn=green cable -, (bk=black), 41 42 51 52 (1-6, only for sensor NJ3-18GK-S1N) = clamp allocation, closed = left sensor, open = right sensor

The left sensor usually is mounted at the clamp 41 42 and labelled with a small sticker "closed". The right sensor is being connected analogically.

5. Cam switches / Cams

Table 3: Overview over the standard cam switches and special cam switches

Term/Identifier:	Technical specification:
Standard cam switch for trench shaped sensors	Image 7: 2 pieces separately adjustable cam switches made from AL, 0 - 180° possible
Standard cam switch for cylinder shaped sensors	Image 8: one-piece cam switch of 1.4301, 0 - 90°
Standard cam switch for cuboid shaped sensors	Image 9: POM-cam with 2 pieces of brass switching points, 0 - 90°
Special cam switch for cylinder shaped sensors	Image 10: 2 pieces cam switch of 1.4301, 0 - 180° possible
Special cam switch for trench shaped sensors	Image 11: one-pieces cam switch of 1.4301, 0 - 90° or 0 - 180° (de-energized)



Image 7



Image 8



Image 9



Image 10



Image 11

6. Mounting on the actuator / technical indication of membrane vent

6.1 Mechanical mounting: The limit switch box with the mounted bracket or the mounted aluminium plate (via F05-slot) and the mounting set is placed on the actuator and screwed together.

6.2 Electrical mounting: Limit switch box is electrically mounted to the 4-pole connection clamp within the housing through the bush and cable entry points tightening torque, see operating instructions 1+2 in the appendix. Data like cable thickness and cable cross section are shown in table 1, page 4. You also have to take the attached circuit diagrams into consideration which can always be found on the left long surface within the housing or directly on the pcb-see image 6, 6a + 6c, page 6.

Metal parts have to be grounded or the metal housing has to be connected to the equipotential bonding.

6.3 technical indication of membrane vent: The safety or rather the protection class of the housing is only when the membrane vent resident sealed fixed in the housing ground (between actuator and housing with mounted kid).

At use in the group II outside of the normal temperature range at a minimal ambient temperature up to - 40°C the membrane vent must be installed and operated mechanically protected according to the low risk of mechanical danger according to EN 60079-0: 2004, paragraph 26.4.2.

At the use of the membrane vent in group I the mounting location must be selected in such a way, that it is protected against the risk of mechanical danger during the normal operation based on the requirements of EN 60079-0: 2004, paragraph 9.2.

Damaged membrane vents have to be replaced immediately.

7. Components and parts lists

7.1 Trench shaped sensors

Table 4: Components and parts list of limit switch boxes for trench shaped P+F sensors

Term/Identifier	Article-No.	Material	Comments
Stainless steel empty housing with closed cover and 4x screw	SB-VA-L-2	A2 (1.4301)	150x150x80mm, silver
Aluminium shaft bearing body	SB-AL-E	AL	Ø75x25mm, Z.-No 020
Cable gland fixed with 2x hexagonal nuts	SB-KL-MS	Nickel coated	M20x1,5, Ø 9-13mm
Cable gland fixed with 2x hexagonal nuts	SB-KL-VA	A2 (1.4301)	M20x1,5, Ø 9-13mm
Clamp, 2x	SB-V	Polyester or PA	max. 2,5mm ² , blue
Ground plate for slot sensors	SB-PL	A2 (1.4301)	93x70x1mm, Z.-No 001
Ground plate	SB-PL-1	A2 (1.4301)	125x79x1,5mm, Z.-No 021
4x screw for ground plate	SB-B	A2	M3x4mm
Shaft for slot sensors for rotary actuators	SB-W-schl.1	A2 (1.4305)	Ø12x67mm, Z.-No 022
Shaft for slot sensors for linear actuators	SB-W-schl-H	A2 (1.4305)	Ø12x53mm, Z.-No 060
O-Ring for shaft	SB-O	NBR 70	9x1,5mm
O-Ring for Aluminium shaft bearing body	SB-O-1	NBR 70	65x3mm
Washer for shaft, 2x	SB-U	POM	Ø18/Ø12x1,2mm
Lock washer for shaft, 2x	SB-S	A2	DIN 6799-9
Switching cam for shaft, 2x	SB-S-s	AL	Z.-No 003
Screws for switching cams	SB-B-S	A2	M8/M4-screw M8-nut, washer for M8
Cable binder, 2x	SB-K	Neylon	99x2,5 mm
Circuit diagram and sensor label	SB-Sch-S	PVC	30x32mm u. 2x 8x4 mm
Membrane vent with sealing and 2x hexagonal nuts	SB-D	Nickel coated	M12x1,5mm x 21,5mm, Fa. Gore
Stainless steel plate for mounting the mounting set for linear actuators acc. to Namur IEC 534	SB-AB	A2 (1.4301)	135x80x10mm, Z.-No 061
Sensors	see table 5, page 5	Housing PBT	10x15x19mm

7.2 Cylindrical shaped sensors

Table 5: Components and parts list of limit switch boxes for cylinder shaped P+F sensors

Term/Identifier	Article-No.	Material	Comments
Stainless steel empty housing with closed cover and 4x screw	SB-VA-L-2	A2 (1.4301)	150x150x80mm, silver
Aluminium shaft bearing body	SB-AL-E	AL	∅75x25mm, Z.-No 020
Cable gland fixed with 2x hexagonal nuts	SB-KL-MS	Nickel coated	M20x1,5, L.37mm, ∅ 9-13mm
Cable gland fixed with 2x hexagonal nuts	SB-KL-VA	A2 (1.4301)	M20x1,5, L.37mm, ∅ 9-13mm
Clamp, 2x	SB-V	Polyester or PA	max. 2,5mm ² , blue
Ground plate for slot sensors	SB-zy	A2 (1.4301)	93x70x1mm, Z.-No 004
Ground plate	SB-PL-1	A2 (1.4301)	125x79x1,5mm, Z.-No 021
4x screw for ground plate	SB-B	A2	M3x4mm
Shaft for slot sensors for rotary actuators	SB-W-zyl.1	A2 (1.4305)	∅12x67mm, Z.-No 023
Shaft for slot sensors for linear actuators	SB-W-schl-H	A2 (1.4305)	∅12x53mm, Z.-No 060
O-Ring for shaft	SB-O	NBR 70	9x1,5mm
O-Ring for Aluminium shaft bearing body	SB-O-1	NBR 70	65x3mm
Washer for shaft, 2x	SB-U	POM	∅18/∅12x1,2mm
Lock washer for shaft, 2x	SB-S	A2	DIN 6799-9
Switching cam for shaft	SB-S-S	AL	Z.-Nr.: 006
Screws for switching cams	SB-B-z	A2	M4x6-screw
Cable binder, 2x	SB-K	Neylon	99x2,5mm
Circuit diagram and sensor label	SB-Sch-S	PVC	30x32mm u. 2x 8x4 mm
Membrane vent with sealing and 2x hexagonal nuts	SB-D	Nickel coated	M12x1,5mm x 21,5mm, Fa. Gore
Stainless steel plate for mounting the mounting set for linear actuators acc. to Namur IEC 534	SB-AB	A2 (1.4301)	135x80x10mm, Z.-No 061
Sensors	see table 2, page 5	Housing PBT	M12x40mm, M14x35mm and M18x40mm

7.3 V3-sensors

Table 6: Components and parts list of limit switch boxes for cuboid shaped P+F sensors

Term/Identifier	Article-No.	Material	Comments
Stainless steel empty housing with closed cover and 4x screw	SB-VA-L-2	A2 (1.4301)	150x150x80mm, silver
Aluminium shaft bearing body	SB-AL-E	AL	Ø75x25mm, Z.-No 020
Cable gland fixed with 2x hexagonal nuts	SB-KL-MS	Nickel coated	M20x1,5, L.37mm, Ø 9-13mm
Cable gland fixed with 2x hexagonal nuts	SB-KL-VA	A2 (1.4301)	M20x1,5, L.37mm, Ø 9-13mm
Clamp, 2x	SB-V	Polyester or PA	max. 2,5mm ² , blue
Ground plate for slot sensors	SB-zy	A2 (1.4301)	93x70x1mm, Z.-No 004
Ground plate	SB-PL-1	A2 (1.4301)	125x79x1,5mm, Z.-No 021
4x screw for ground plate	SB-B	A2	M3x4mm
Shaft for V3-sensors, rotary actuators	SB-W-q.1	A2 (1.4305)	Ø12x77mm, Z.-No 024
Shaft for V3-sensors, linear actuators	SB-W-schl-H	A2 (1.4305)	Ø12x53mm, Z.-No 060
O-Ring for shaft	SB-O	NBR 70	9x1,5mm
O-Ring for Aluminium shaft bearing body	SB-O-1	NBR 70	65x3mm
Washer for shaft, 2x	SB-U	POM	Ø18/Ø12x1,2mm
Lock washer for shaft, 2x	SB-S	A2	DIN 6799-9
Switching cam for shaft	SB-S-q	POM/MS	Z.-No 009
Mounting part with screws for sensors	SB-B-S-q	PA/A2	17x29x9,5mm, 2x M3x32mm
Cable binder, 2x	SB-K	Neylon	99x2,5mm
Circuit diagram and sensor label	SB-Sch-S	PVC	30x32mm and 2x 8x4mm
Membrane vent with sealing and 2x hexagonal nuts	SB-D	Nickel coated	M12x1,5mm x 21,5mm, Fa. Gore
Stainless steel plate for mounting the mounting set for linear actuators acc. to Namur IEC 534	SB-AB	A2 (1.4301)	135x80x10mm, Z.-No 061
Sensors	see table, page 5	Housing PBT	16x28x10mm

8. Appendix

8.1 Stainless steel limit switch box for rotary actuators



Image 12: Stainless steel limit switch box, 150x150x80mm, IP 65,
- 25 °C up to + 70 °C, for rotary actuators acc. to VDI/VDE 3845 with bracket



Image 13: Stainless steel limit switch box, 150x150x80mm, IP 65,
- 25 °C up to + 70 °C, for linear actuators acc. to Namur IEC 534 with mounting set

Operating instructions 1



Operating and assembly instructions for cable glands (KV/CG) of the ignition protective class Ex "e"

Type: U 2. UNI Ex e, brass nickel-plated

Application

The cable glands (KV/CGs) U 2. UNI Ex e are used to insert permanently laid lines and cables into a connection space or housing of an explosion-protected electrical operating material of the appliance group II and categories 2 G/D and 3 G/D. The connection space or housing must conform to the ignition protective class "Increased safety - Ex e" in accordance with the standards EN 60079-0:2004, EN 60079-7:2003 and EN 50281-1-1:1999.

The KLE is suitable for operating material with the degree of mechanical risk "high" as per EN 60079.

In selecting the material for the sealing insert, the ambient, surface and operating temperature at the installation point is to be observed.

With proper assembly of the KLE, the protective class IP 68 according to IEC 529 or EN 60529 can be attained.

Designation

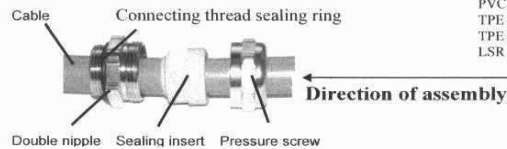
The KLE U 2. UNI Ex e conforms with the standards EN 60079-0:2004, EN 60079-7:2003 and EN 50281-1-1:1999. They were subjected to an EC design test in accordance with EC directive 94/9/EC by the Physical-Technical Federal Institute (PTB).

They are therefore designated as follows:

and with the connecting thread type and size, e.g. M 16 or Pg 21.

Material	Temperature range
PVC	-20° C - + 85° C
TPE - V	-40° C - + 135° C
TPE	-40° C - + 115° C
LSR	-60° C - + 180° C

Assembly



The Pflitsch socket spanner M28 can be used as a tool.

Minimum wall thicknesses for installation in appliances with threaded holes: 5.0 mm (plastic); 3.0 mm (metal)

Minimum wall thicknesses for installation in appliances with throughholes: 2.0 mm (plastic); 1.0 mm (metal)

Pointer for strain relief of the cable gland:

The KLE with the standard pressure screw is only suitable for permanently laid lines and cables. In this case, the operator must adopt appropriate measures to ensure strain relief.

Sealing rings must not be cut out with a knife

Housing holes that are not used must be sealed with an Ex closure plug. KLEs with corresponding thread sizes are to be sealed with a closed sealing insert or with a UNI Ex e blind sealing insert. Non-used holes of multi-sealing inserts are to be sealed with a bolt.

Disassembly:

Disassembly is carried out in the reverse order.

Maintenance:

The KLEs are to be included in the inspection and maintenance of the electrical operating material.

Connection dimensions for throughholes										
metr.	M 10	M 12	M 16	M 20	M 25	M 32	M 40	M 50	M 63	M 72
d [mm] 0/+ 0,3	10,0	12,0	16,0	20,0	25,0	32,0	40,0	50,0	63,0	72,0
Pg	7	9	11	13,5	16	21	29	36	42	48
d [mm] 0/+0,3	12,5	15,5	19	20,5	22,5	28,5	37	47	54	59,5
NPT	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"			
d [mm] 0/+0,3	17,1	21,3	26,6	33,3	42,0	48,1	60,1			

Tightening torque

thread	M10	M12	M16	M20	M25	M32	M40	M50	M63	
Nm	6	6	8	10	10	15	20	20	20	
thread	Pg 7	Pg 9	Pg 11	Pg 13,5	Pg 16	Pg 21	Pg 29	Pg 36	Pg 42	Pg 48
Nm	6,25	6,25	6,25	6,25	7,5	10	10	10	10	10

RAUTER

Sensor-Boxes

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09/2012

Operating instructions 2



Operating and assembly instructions for cable glands (KV/CG) of the ignition protective class Ex "e"

Type: U 28, UNI Ex e, stainless steel:

Application

The cable glands (KV/CGs) U 28, UNI Ex e are used to insert permanently laid lines and cables into a connection space or housing of an explosion-protected electrical operating material of the appliance group II and categories 2 G/D and 3 G/D.

The connection space or housing must conform to the ignition protective class "Increased safety – Ex e" in accordance with the standards EN 60079-0:2004, EN 60079-7:2003 and EN 50281-1-1:1999.

The KLE is suitable for operating material with the degree of mechanical risk "high" as per EN 60079.

In selecting the material for the sealing insert, the ambient, surface and operating temperature at the installation point is to be observed.

With proper assembly of the KLE, the protective class IP 68 according to IEC 529 or EN 60529 can be attained.

Designation

The KLE U 28, UNI Ex e conforms with the standards EN 60079-0:2004, EN 60079-7:2003 and EN 50281-1-1:1999.

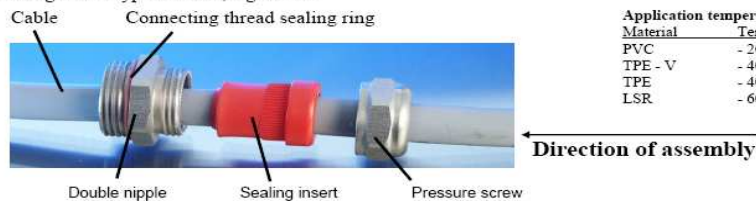
They were subjected to an EC design test in accordance with EC directive 94/9/EC by the Physical-Technical Federal Institute (PTB).

They are therefore designated as follows:

II 2 G/D Ex e II PTB 01 ATEX 3104X IP 68 XX CE 0102

and with the connecting thread type and size, e.g. M 16.

Assembly



The Pflitsch socket spanner M28 can be used as a tool.

Minimum wall thicknesses for installation in appliances with threaded holes: 5.0 mm (plastic); 3.0 mm (metal)

Minimum wall thicknesses for installation in appliances with throughholes: 2.0 mm (plastic); 1.0 mm (metal)

Pointer for strain relief of the cable gland:

The KLE with the standard pressure screw is only suitable for permanently laid lines and cables. In this case, the operator must adopt appropriate measures to ensure strain relief.

Sealing rings must not be cut out with a knife

Housing holes that are not used must be sealed with an Ex closure plug. KLEs with corresponding thread sizes are to be sealed with a closed sealing insert or with a UNI Ex e blind sealing insert. Non-used holes of multi-sealing inserts are to be sealed with a bolt.

Disassembly:

Disassembly is carried out in the reverse order.

Maintenance:

The KLEs are to be included in the inspection and maintenance of the electrical operating material.

Connection dimensions for throughholes										
metr.	M 10	M 12	M 16	M 20	M 25	M 32	M 40	M 50	M 63	M 72
d [mm] 0/+ 0,3	10,0	12,0	16,0	20,0	25,0	32,0	40,0	50,0	63,0	72,0
Pg	7	9	11	13,5	16	21	29	36	42	48
d [mm] 0/+0,3	12,5	15,5	19	20,5	22,5	28,5	37	47	54	59,5
NPT	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"			
d [mm] 0/+0,3	17,1	21,3	26,6	33,3	42,0	48,1	60,1			

Tightening torque

thread	M10	M12	M16	M20	M25	M32	M40	M50	M63	
Nm	6	6	8	10	10	15	20	20	20	
thread	Pg 7	Pg 9	Pg 11	Pg 13,5	Pg 16	Pg 21	Pg 29	Pg 36	Pg 42	Pg 48
Nm	6,25	6,25	6,25	6,25	7,5	10	10	10	10	10