

Documentation

about
Ex i ... 8 V DC limit switch box
 with
P+F NJ3-18GK-S1N or P+F NJ5-18GK-SN
 for
pneumatic rotary- and linear actuators
 acc to
guidline 2014/34/EU, IBEU 04 ATEX 1211



II 2G Ex ia/ib IIC/IIB T6 Gb



II 2D Ex ia/ib IIIC T 80 °C Db

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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 actuators 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 of/at the actuators, see image 1-6.

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 or 2 as well as the zones 21 and 22.

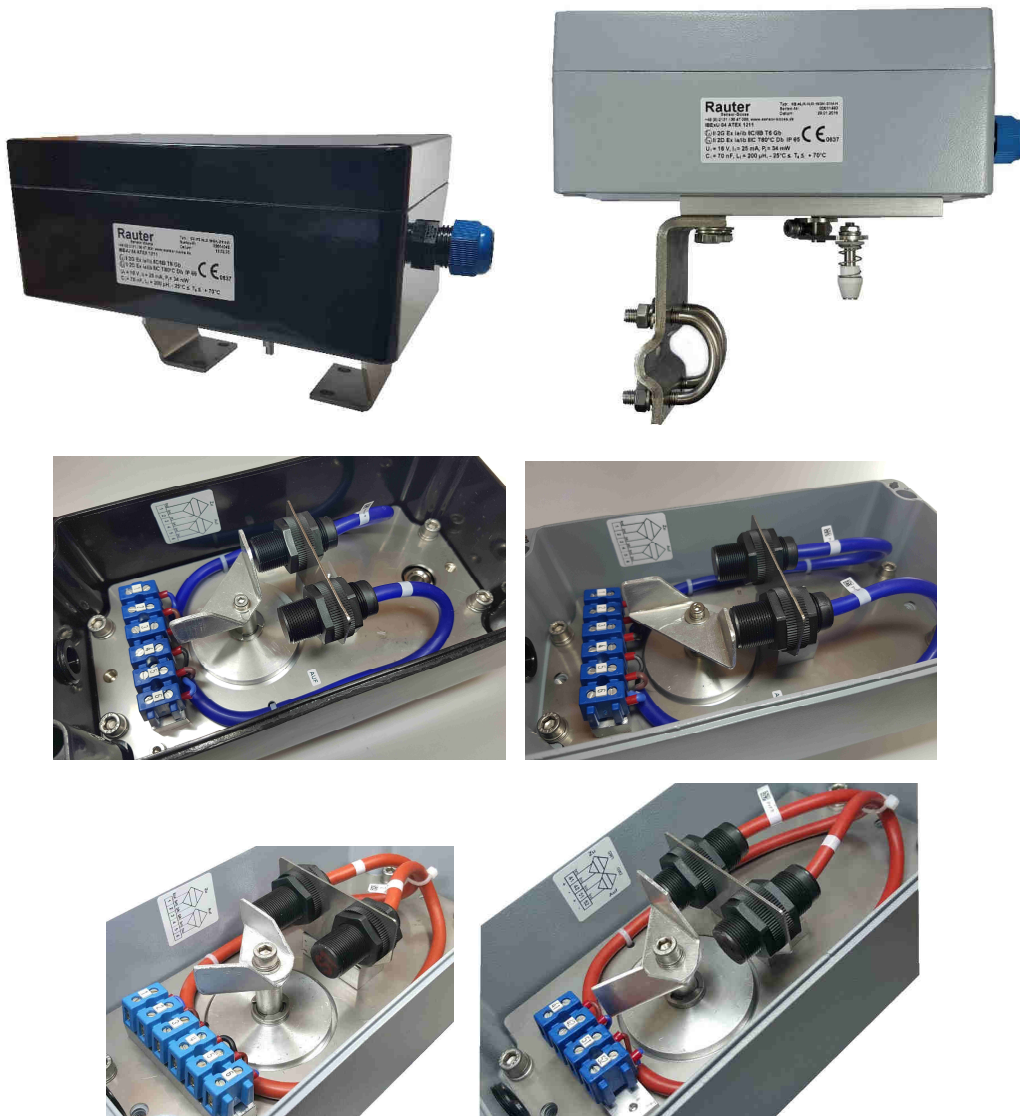




Image 1-6: Limit switch boxes, polyester- and aluminium-housing with closed cover, size: 220x120x90 mm, F05-slot, Stainless steel bracket for rotary actuators and aluminium plate with mounting set for linear actuators, 2x P+F NJ3-18GK-S1N (with or without metal membrane vent), image 3-5, with 2x3-pole mini-terminals or 2x NJ5-18GK-SN, image 6, with 2x2-pole mini-terminals, one-piece aluminium switching cam 0° and 90° and two-piece adjustable aluminium switching cam

2. Technical specification

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

Term / Identifier:	Technical specifications:
Materials and dimensions housings	Polyester housing, black, $R_o \leq 10^9 \Omega$, 220x120x90 mm Aluminium housing, aluminium-Si-12, grey RAL 7001, 220x120x90 mm
Connection: Box to bracket and to aluminium plate	4xM6-winding at the bottom hole circle \varnothing 50 mm, F05-slot
- Connection: Box/bracket to rotary actuator - Connection: Box/aluminium plate to linear actuator	- acc. to VDI/VDE, steam hight 20,30 or 50 mm, hole spacing 80x30 mm or 130x30 mm - mounting set acc. to NAMUR IEC 534
Ambient temperature range from the complete limit switch boxes	$-25 \text{ }^\circ\text{C} \leq T_a \leq +70 \text{ }^\circ\text{C}$
Protection class of the housings	IP 65
ATEX indentification	 II 2G Ex ia/ib IIC/IIB T6 Gb  II 2D Ex ia/ib IIIC T 80 °C Db
Temperature class	T6
• Nominal voltage • Nominal current • Power	$U_i = 16 \text{ V}$ $I_i = 25 \text{ mA}$ $P_i = 34 \text{ mW}$
Cable gland	M20x1,5 mm clamp range \varnothing 11-9,5 mm, \varnothing 9-7 mm, \varnothing 7-5,5 mm
Mini-terminals	2x 2-pole and 2x 3-pole, maximum 2,5 mm ²
Weights: - Polyester limit switch box - Aluminium limit switch box - Stainless steel limit switch box - Aluminium plate with mounting set	- 1,7 kg - 2,1 kg - 0,3 kg - 1,1 kg
Display and switching range	0° - 180°

3. Mounting of/at the actuator and connection sensors

3.1 Mechanical mounting: The limit switch box with the mounted stainless steel bracket or the aluminium plate (via F05-slot) and the mounting set is placed at/of the actuator and screwed together.

3.2 Electrical mounting: The limit switch box is connected to the mini-terminals using the cable gland. Connection to the mini-terminals acc. to the following wiring diagrams, see image 4+5. The tightening torque for M20x1,5mm = **4 Nm**, check operating instruction page 10.

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

3.3 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.

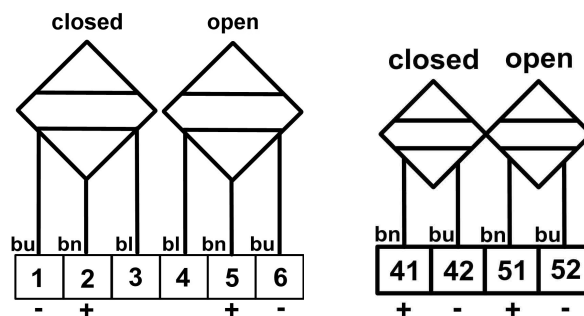


image 4+5: wiring diagram 2x P+F NJ3-18GK-S1N at the 2x3-pole mini-terminals, image 4. 2x NJ5-18GK-SN at the 2x2-pole mini-terminals, image 5.


4. Components and parts lists

Table 2: Components and parts list of limit switch boxes boxes equipment group II, category 2G, zones 1, 2 or 2D, zones 21,22

Term / Identifier:	Article-No.	Material	Technical specifications, dimensions, drawing-No. ...
Polyester empty housing with closed cover with sealing and 4x cover screws and sealing	PE-220	Polyester, $R_o \leq 10^9 \Omega$	220x120x90 mm
Aluminium empty housing with closed cover with sealing and 4x cover screws and sealing	AL-220	Aluminium-Si-12	220x120x90 mm
Cable gland, blue-black	SB-KL-25	Polyamide	M20x1,5 mm, clamp range: \varnothing 11-9,5 mm, \varnothing 9-7 mm, \varnothing 7-5,5 mm, Cooper Crouse-Hinds-type: GHG9601955R0109
2x mini-terminals 2-pole and 3-pole with clamp indicators	SB-V	Thermoplastic and copper alloy	Maximum., 2,5 mm ² , blue, Bartec-type: 07-9702-0220/2 and 07-9702-0320/2
Plate: AL-220	PL-220	Stainless steel	207x107x1,5 mm
4x Screws for aluminium plate	B-Sch, B-F	Stainless steel	M6x10 mm, \varnothing 6 mm
O-Ring	O-1-WA	NBR 70	\varnothing 62x3 mm
Aluminium shaft bearing body AL-220	WA-2	Aluminium	\varnothing 74x9 mm, drawing-No.: 0030
Shaft	WO	Stainless steel	\varnothing 12x71 mm, drawing-No.: 60a
O-Ring for shaft	O-WE	NBR 70	\varnothing 9x1,5 mm
Washer for shaft	U	Stainless steel	\varnothing 18 / \varnothing 12x1 or 0,2 mm
2x lock washer for shaft	S	Stainless steel	DIN 6799-9
2x Aluminium switching cams with M6 screws	Sch	Aluminium	adjustable 0° up to 180°
Fastening block for sensors	B	Aluminium	15x10x36 mm
Sensor fixture	S-H	Stainless steel	70x40x1 mm
Cable ties	K	Nylon	99x2,5 mm
Stainless steel membrane vent, option		Stainless steel	M12x1,5 mm, company RST
Wiring diagram/ sensor indication	Sch-S	Polyvinylchlorid self-adhesive	approx 30x30 mm and 8x4 mm
Type label	SB-type	Aluminium foil self-adhesive	70x32 mm
2x P+F-sensors	NJ3-18GK-S1N	Housing PBT	\varnothing 18 mm x40 mm, check page 6
2x P+F-sensors	NJ5-18GK-SN	Housing PBT	\varnothing 18 mm x40 mm, check page 8
Stainless steel standard bracket for rotary actuator	SB-VA-A	Stainless steel and polyamide	acc. to Namur IEC 534
Aluminium plate for linear actuator with 4x screws.	SB-AL-P	Aluminium	135x80x10mm, drawing-No.: 061

5. Data sheets sensors

Extract from Pepperl+Fuchs sensor NJ3-18GK-S1N data sheet page 1+2

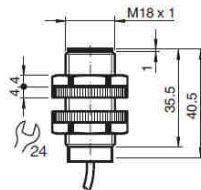


Inductive sensor
NJ3-18GK-S1N

- Nonferrous targets
- 3 mm flush in ST37 / 1.0037
- Usable up to SIL 3 acc. to IEC 61508
- ATEX approval Ex-i and Ex-nA/tc for zone 0-2 and zone 20-22
- Degree of protection IP68



Dimensions



Technical Data

General specifications

Switching function		Normally open (NO)
Output type		NAMUR with safety function
Rated operating distance	S_n	3 mm
Installation		flush in mild steel
Assured operating distance	S_a	0 ... 2.4 mm
Actual operating distance	S_r	2.7 ... 3.3 mm typ.
Reduction factor r_{A1}		1
Reduction factor r_{Cu}		1
Reduction factor r_{304}		0
Safety Integrity Level (SIL)		up to SIL3 acc. to IEC 61508 Danger! In safety-related applications the sensor must be operated with a qualified fail safe interface from Pepperl+Fuchs, such as KFD2-SH-EX1. Consider the "exida Functional Safety Assessment" document which is available on www.pepperl-fuchs.com as an integral part of this product's documentation.
Output type		2-wire
Nominal ratings		
Nominal voltage	U_o	8.2 V (R_i approx. 1 k Ω)
Switching frequency	f	0 ... 200 Hz

Release date: 2020-12-15 Date of issue: 2020-12-15 Filename: 250895_eng.pdf

Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

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1

Inductive sensor

NJ3-18GK-S1N

Technical Data

Suitable for 2:1 technology	yes , Reverse polarity protection diode not required
Current consumption	
Measuring plate not detected	≤ 1 mA
Measuring plate detected	≥ 3 mA
Functional safety related parameters	
Safety Integrity Level (SIL)	SIL 3
MTTF _d	7666 a
Mission Time (T _M)	20 a
Diagnostic Coverage (DC)	0 %
Compliance with standards and directives	
Standard conformity	
Standards	EN 60947-5-2:2007 EN 60947-5-2/A1:2012 IEC 60947-5-2:2007 IEC 60947-5-2 AMD 1:2012
Approvals and certificates	
IECEx approval	
Equipment protection level Ga	IECEx PTB 11.0092X
Equipment protection level Gb	IECEx PTB 11.0092X
Equipment protection level Da	IECEx PTB 11.0092X
Equipment protection level Mb	IECEx PTB 11.0092X
ATEX approval	
Equipment protection level Ga	PTB 00 ATEX 2049 X
Equipment protection level Gb	PTB 00 ATEX 2049 X
Equipment protection level Gc (Ic)	PF13CERT2895 X
Equipment protection level Gc (nA)	PF15CERT3754X
Equipment protection level Da	PTB 00 ATEX 2049 X
Equipment protection level Dc (tc)	PF15CERT3774X
EAC conformity	TR CU 012/2011
FM approval	
Control drawing	116-0165
UL approval	
Ordinary Location	E87056
Hazardous Location	E501628
Control drawing	116-0454
CCC approval	
Hazardous Location	2020322315002308
NEPSI approval	
NEPSI certificate	GYJ16.1392X
Ambient conditions	
Ambient temperature	-25 ... 100 °C (-13 ... 212 °F)
Mechanical specifications	
Connection type	cable silicone , 2 m
Core cross-section	0.75 mm ²
Housing material	Crastin (PBT), black
Sensing face	Crastin (PBT), black
Degree of protection	IP68
Cable	
Cable diameter	6.8 mm ± 0.2 mm
Bending radius	> 10 x cable diameter
Note	only for non-ferrous metal
General information	
Use in the hazardous area	see instruction manuals

Release date: 2020-12-15 Date of issue: 2020-12-15 Filename: 2559595_eng.pdf

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Extract from Pepperl+Fuchs sensor NJ5-18GK-SN data sheet page 1+2



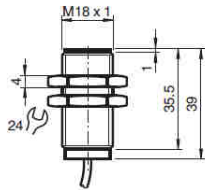
Inductive sensor

NJ5-18GK-SN

- 5 mm flush
- Usable up to SIL 3 acc. to IEC 61508
- ATEX approval Ex-i and Ex-nA/tc for zone 0-2 and zone 20-22
- Degree of protection IP68



Dimensions



Technical Data

Release date: 2020-12-15 Date of issue: 2020-12-15 Filename: 250929_eng.pdf

General specifications		
Switching function		Normally closed (NC)
Output type		NAMUR with safety function
Rated operating distance	s_n	5 mm
Installation		flush
Assured operating distance	s_a	0 ... 4.05 mm
Reduction factor r_{AI}		0.4
Reduction factor r_{Cu}		0.3
Reduction factor r_{304}		0.85
Safety Integrity Level (SIL)		up to SIL3 acc. to IEC 61508 Danger! In safety-related applications the sensor must be operated with a qualified fail safe interface from Pepperl+Fuchs, such as KFD2-SH-EX1. Consider the "exida Functional Safety Assessment" document which is available on www.pepperl-fuchs.com as an integral part of this product's documentation.
Output type		2-wire
Nominal ratings		
Nominal voltage	U_o	8.2 V (R_i approx. 1 k Ω)
Switching frequency	f	0 ... 500 Hz
Current consumption		

Refer to "General Notes Relating to Pepperl+Fuchs Product Information".

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1

Inductive sensor

NJ5-18GK-SN

Technical Data

Measuring plate not detected	≥ 3 mA
Measuring plate detected	≤ 1 mA
Functional safety related parameters	
Safety Integrity Level (SIL)	SIL 3
MTTF _d	11850 a
Mission Time (T _M)	20 a
Diagnostic Coverage (DC)	0 %
Compliance with standards and directives	
Standard conformity	
NAMUR	EN 60947-5-6:2000 IEC 60947-5-6:1999
Standards	EN 60947-5-2:2007 EN 60947-5-2/A1:2012 IEC 60947-5-2:2007 IEC 60947-5-2 AMD 1:2012
Approvals and certificates	
IECEX approval	
Equipment protection level Ga	IECEX PTB 11.0092X
Equipment protection level Gb	IECEX PTB 11.0092X
Equipment protection level Da	IECEX PTB 11.0092X
Equipment protection level Mb	IECEX PTB 11.0092X
ATEX approval	
Equipment protection level Ga	PTB 00 ATEX 2049 X
Equipment protection level Gb	PTB 00 ATEX 2049 X
Equipment protection level Gc (ic)	PF13CERT2895 X
Equipment protection level Gc (nA)	PF15CERT3754X
Equipment protection level Da	PTB 00 ATEX 2049 X
Equipment protection level Dc (tc)	PF15CERT3774X
EAC conformity	TR CU 012/2011
FM approval	
Control drawing	116-0165
UL approval	
Ordinary Location	E87056
Hazardous Location	E501628
Control drawing	116-0454
CCC approval	
Hazardous Location	2020322315002308
NEPSI approval	
NEPSI certificate	GYJ16.1392X
Ambient conditions	
Ambient temperature	-40 ... 100 °C (-40 ... 212 °F)
Mechanical specifications	
Connection type	cable silicone , 2 m
Core cross-section	0.75 mm ²
Housing material	Crastin (PBT), black
Sensing face	Crastin (PBT), black
Degree of protection	IP68
Cable	
Cable diameter	6 mm ± 0.2 mm
Bending radius	> 10 x cable diameter
General information	
Use in the hazardous area	see instruction manuals

Release date: 2020-12-15 Date of issue: 2020-12-15 Filename: 250929_eng.pdf

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2

6. Operating instruction cable gland

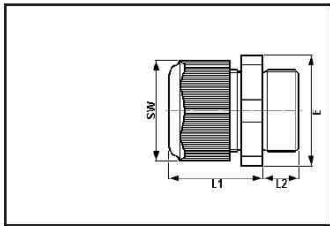
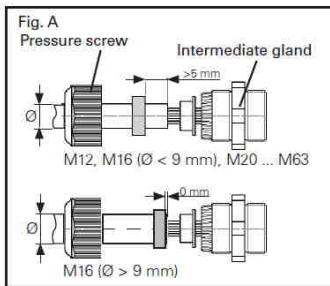
Tightening torque **M20x1,5 mm = 4 Nm**

Extract from Cooper-Crouse-Hinds operating instruction, page 13+14

GB

Cable entries, blanking plugs, screw plugs, trumpet-shaped cable glands, reducing glands and drain plugs

Dimension drawings and dimensions in mm



1 Technical data

1.1 Technical details for:
Cable entries (KLE) M12x1,5 to M63x1,5

ATEX type examination certificate:	PTB 14 ATEX 1015 X ^(A)
Marking acc. to 2014/34/EU and standard:	EN 60079-0
	II 2 G Ex e IIC Gb
	II 2 D Ex tb IIIC Db
IECEX type examination certificate:	IECEX PTB 14.0027X ^(A)
Category of application:	IEC60079-0 Ex e IIC Gb
	Ex tb IIIC Db

^(A)The EC-Type Examination Certificate and any future supplements thereto shall, at the same time, be regarded as supplements to the EC-Type Examination Certificates PTB 99 ATEX 3128 X and PTB 99 ATEX 3101 X

Perm. storage temperature in original packing: -20° C to +70° C

Degree of protection to IEC/EN 60529: IP 66*¹⁾ (when fully assembled)

*¹⁾ M40, M50 und M63 with suitable flange seal

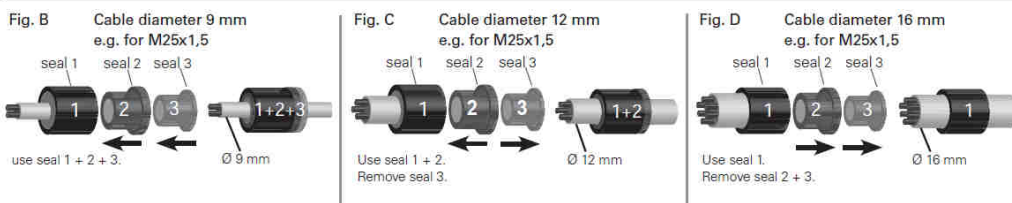
Type	SW	L1	L2	E	weight app.
M12x1,5	15 mm	19,3 mm	12 / 8 mm	16,2 mm	3,4 g
M16x1,5	20 mm	23,0 mm	12 / 8 mm	22,0 mm	6,5 g
M20x1,5	24 mm	25,0 mm	13 / 8 mm	26,5 mm	10,1 g
M25x1,5	29 mm	29,5 mm	13 / 8 mm	32,0 mm	16,9 g
M32x1,5	36 mm	35,5 mm	15 / 10 mm	40,0 mm	27,6 g
M40x1,5	46 mm	39,5 mm	15 / 10 mm	50,5 mm	50,3 g
M50x1,5	55 mm	44,0 mm	16 / 12 mm	60,0 mm	75,9 g
M63x1,5	68 mm	47,0 mm	16 / 12 mm	75,0 mm	117,6 g

Type	operating temperature	impact resistance	Cable diameter										Screw-in thread in enclosure	Colour of dust protection cover	
			Seal 1+2+3 ⁽¹⁾⁽²⁾			Seal 1+2 ⁽¹⁾⁽²⁾			Seal 1 ⁽¹⁾						
	°C	Joule	min.	max.	Nm**	min.	max.	Nm**	min.	max.	Nm**	min.	max.	Nm**	
M12x1,5	-20 - 70	4	Ø	Nm**	Ø ⁽¹⁾⁽²⁾	Nm**	Ø	Nm**	Ø ⁽¹⁾⁽²⁾	Nm**	Ø	Nm**	Ø ⁽²⁾	Nm**	
M16x1,5	-20 - 70	4				5,5	1,0	7,0	1,0	7,0	1,0	10,0	1,4	3,3	
M20x1,5	-20 - 70	7	5,5	1,5	7,0	1,0	7,0	1,5	9,0	1,4	9,5	1,0	13,0	1,7	2,7
M20x1,5	-40 - 70	4	5,5	1,5	7,0	1,0	7,0	1,5	9,0	1,4	9,5	1,0	11,0	1,7	2,7
M25x1,5	-20 - 70	7	8,0	1,5	10,0	2,0	10,0	2,3	13,0	2,6	13,5	1,3	17,5	2,3	3,0
M25x1,5	-55 - 70	7	8,0	1,5	10,0	2,0	10,0	2,3	13,0	2,6	13,5	1,5	15,0	2,3	3,0
M32x1,5	-20 - 70	7					14,0	3,0	17,0	4,0	17,5	1,5	21,0	1,3	5,0
M32x1,5	-55 - 70	7					14,0	3,0	17,0	4,0	17,5	1,5	21,0	1,3	5,0
M40x1,5	-55 - 70	7					19,0	3,3	22,0	5,5	22,0	3,3	28,0	6,7	7,5
M50x1,5	-55 - 70	7					24,0	6,0	28,0	7,0	28,0	5,0	35,0	7,0	7,5
M63x1,5	-55 - 70	7					29,0	12,0	35,0	12,0	36,0	12,0	41,0	13,0	7,5
additional seal							41,0	13,0	48,0	7,8					

** Test torques at 20°C

⁽¹⁾ The tests of clamping ranges and torque values were performed with metal mandrel. The clamping range can vary by using cables with different manufacturing tolerances and material properties. Please use the combination of sealing 1 + 2 + 3 for the intermediate region.

⁽²⁾ When selecting the seal rubber, ensure that the cap nut can be tightened when carrying out any future maintenance work on the cable entry.



F.T.N

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Cable entries, blanking plugs, screw plugs, trumpet-shaped cable glands, reducing glands and drain plugs

Dimension drawings and dimensions in mm

1.2 Multiple glands

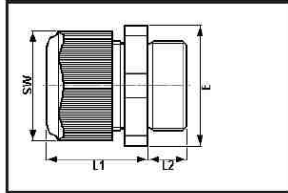
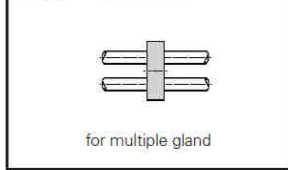


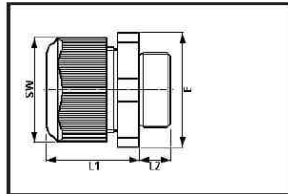
Fig. D/1 Seal insert



Type	SW	L1	L2	E	weight app.
M25x1,5 2- times	29 mm	29,5 mm	13 / 8 mm	32,0 mm	16,9 g
M32x1,5 4- times	36 mm	35,5 mm	15 / 10 mm	40,0 mm	27,6 g

Type	Operating temperature	Impact resistant	Cable diameter				
			Seal 1		Seal 2		
	°C	Joule		min.	max.		
				Ø	Nm	Ø	Nm
M25x1,5 2- times	-20 - 70	< 7	2x	4,5	2,0	7,0	2,0
M32x1,5 4- times	-20 - 70	< 7	4x	4,5	3,0	7,0	3,5

1.3 Enlargement glands



Type	SW	L1	L2	E	weight app.
M16x1,5 / M20x1,5	24 mm	25,0 mm	12 mm	26,5 mm	9,2 g
M20x1,5 / M25x1,5	29 mm	29,5 mm	13 mm	32,0 mm	16,7 g
M25x1,5 / M32x1,5	36 mm	35,5 mm	15 mm	40,0 mm	27,0 g
M32x1,5 / M40x1,5	46 mm	39,5 mm	15 mm	50,5 mm	46,5 g
M40x1,5 / M50x1,5	55 mm	44,0 mm	15 mm	60,0 mm	73,5 g
M50x1,5 / M63x1,5	68 mm	47,0 mm	16 mm	75,0 mm	106,4 g

Type	Operating temperature	Impact resistant	Cable diameter												Screw-in thread in enclosure
			Seal 1+2+3 (1)(2)(3)				Seal 1+2 (1)(2)				Seal 1 (1)				
			min.		max.		min.		max.		min.		max.		
°C	Joule	Ø	Nm**	Ø ⁽¹⁾⁽²⁾	Nm**	Ø	Nm**	Ø ⁽¹⁾⁽²⁾	Nm**	min.	Nm**	Ø ⁽¹⁾	Nm**	Nm**	
M16x1,5 / M20x1,5	-20 - 70	< 7	5,5	1,5	7,0	1,0	7,0	1,5	9,0	1,4	9,5	1,0	13,0	1,7	3,3
	-40 - 70	< 4	5,5	1,5	7,0	1,0	7,0	1,5	9,0	1,4	9,5	1,0	11,0	1,7	3,3
M20x1,5 / M25x1,5	-20 - 70	< 7	8,0	1,5	10,0	2,0	10,0	2,3	13,0	2,6	13,5	1,3	17,5	2,3	2,7
	-40 - 70	< 4	8,0	1,5	10,0	2,0	10,0	2,3	13,0	2,6	13,5	1,5	15,0	2,3	2,7
M25x1,5 / M32x1,5	-55 - 70	< 7					14,0	3,0	17,0	4,0	17,5	1,5	21,0	1,3	3,0
M32x1,5 / M40x1,5	-55 - 70	< 7					19,0	3,3	22,0	5,5	22,0	3,3	28,0	6,7	5,0
M40x1,5 / M50x1,5	-55 - 70	< 7					24,0	6,0	28,0	7,0	28,0	5,0	35,0	7,0	7,5
M50x1,5 / M63x1,5	-55 - 70	< 7					29,0	12,0	35,0	12	36,0	12,0	41,0	13,0	7,5
additional seal							41,0	13,0	48,0	7,8					

** Test torques at 20°C

(1) The tests of clamping ranges and torque values were performed with metal mandrel. The clamping range can vary by using cables with different manufacturing tolerances and material properties. Please use the combination of sealing 1 + 2 + 3 for the intermediate region.

(2) When selecting the seal rubber, ensure that the cap nut can be tightened when carrying out any future maintenance work on the cable entry.

7. Applicable standards

EN 60079-0: 2018

Explosive atmospheres - Part 0: Equipment - General requirements

EN 60079-11: 2012

Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"