

# Documentation

about  
limit switch boxes 2 - 6 sensors  
with



i ... 8 V DC or 24 V DC inductive sensors  
for  
pneumatic rotary- and linear actuators



Topic:	Page:
<b>1. Objectives and practical use</b>	<b>2</b>
<b>2. Technical specification</b>	<b>3</b>
<b>3. Mounting on the actuator</b>	<b>4</b>
3.1 Mechanical mounting	4
3.2 Electrical mounting	4
<b>4. Adjustment the switching cams</b>	<b>4</b>
<b>5. Connecting sensors</b>	<b>5</b>
<b>6. Appendix</b>	<b>6</b>
6.1 examples limit switch boxes 2 - 6 sensors	6
6.2 housing variations limit switch boxes 2 - 6 sensors	8
<b>7. Data sheets sensors</b>	<b>10</b>
<b>8. Drawings limit switch boxes</b>	<b>15</b>
<b>9. Brackets limit switch boxes rotary actuators</b>	<b>18</b>
<b>10. Mounting set limit switch boxes linear actuators</b>	<b>20</b>

## 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 which the end position of the valve like **OPEN** and **CLOSED** or for example **45°** is reported back to a control system. This is done via a mounted limit switch box which is placed at or above the actuator, see images 1-21.

With this special limit switch boxes you can save for example Position OPEN with 3 sensors.

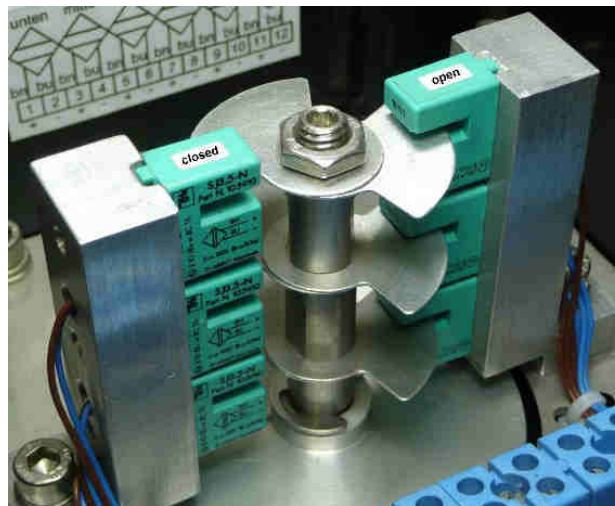


Image 1: 3x SJ 3,5-N for position closed and 3x SJ 3,5-N for position open

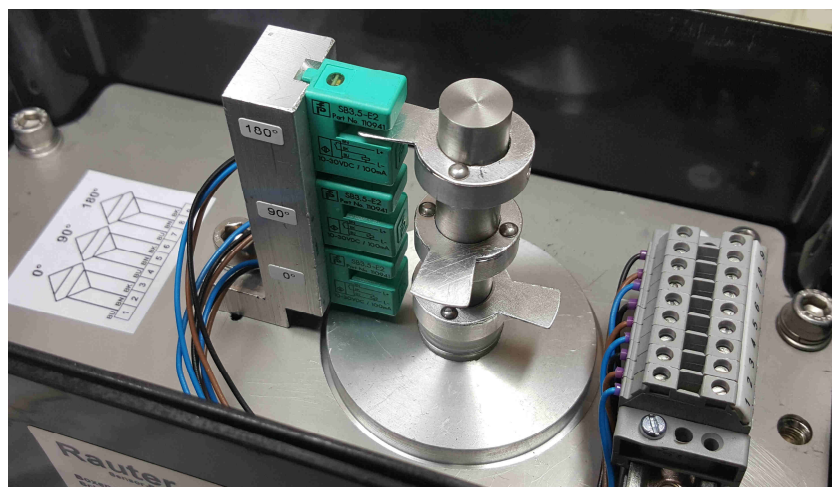


Image 2: 3x P+F sensor SB 3,5-E2, 24 V DC for position 0°, 90° and 180°

## 2. Technical specifications

- polyester housing black or aluminium housing grey, size: 160x160x90mm or 220x120x90mm, closed cover
- 2 - 6x inductive Ex ... i ... Pepperl+Fuchs sensors SJ 3,5-N, SJ 3,5-SN, SJ 3,5-S1N, SB 3,5-E2 or NJ2-12GK-N, nominal voltage 8 V DC, more details see 7. data sheets, page 10
- 4 - 12-pole clamp blue, grey, wiring diagram with position OPEN/CLOSED
- 1 - 4x plastic cable gland M20x1,5mm blue/black, clamp range 13mm-5,5mm, metal cable gland nickel coated M20x1,5mm, clamp range 13mm-9mm, M25x1,5mm plastic cable gland blue/black, clamp range 17.0-8,0mm
- 2 - 6x adjustable aluminium switching cams, 0° - 360°
- 2 - 3x stainless steel shaft with O-ring sealing, Ø12mm, Aisi 304 ground plate with aluminium holder for sensors
- protection class: IP 65
- stainless steel brackets for rotary actuators acc. to VDI/VDE 3845
- stainless steel mounting set for linear actuators acc. to NAMUR IEC 534
- temperature range complete limit switch box: - 25°C up to +70°C
- temperature range complete limit switch box (low temperature version):  
- 45°C up to +70°C

### **3. Mounting on the actuator**

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

3.2 Electrical mounting: The limit switch boxes are electrically mounted to the 4-12 pole connection clamp within the housing through the bush and cable entry points tightening torque as follow.

Plastic cable glands: M20x1,5mm = 5 Nm tightening torque.

Metal cable glands: M20x1,5mm = 10 Nm tightening torque.

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

### **4. Adjustment the switching cams**

Image 9-11+14: The below switching cams are fixed with the over shaft part via a spanner for hexagon nuts SW 10mm. The middle switching cams are fixed as well with the over shaft part via a spanner for hexagon nuts SW 10mm. Ultimately the above switching cams are fixed with a hexagon screw M4 via a hex head wrench 4mm.

The threads from the shaft parts are pasted into with Loctite 243 (medium).

Image 12+13: These switching cams are adjustable switching cams. The switching cams are fixed with a hexagon screw M4 via a hex head wrench 2mm.

### 5. Connecting sensors

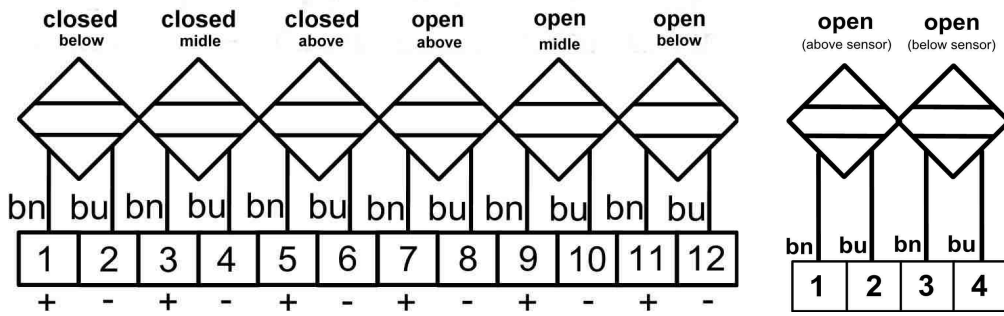


Image 1, 3+4: left: wiring diagram acc. to image 9+14, right: wiring diagram acc. to image 10

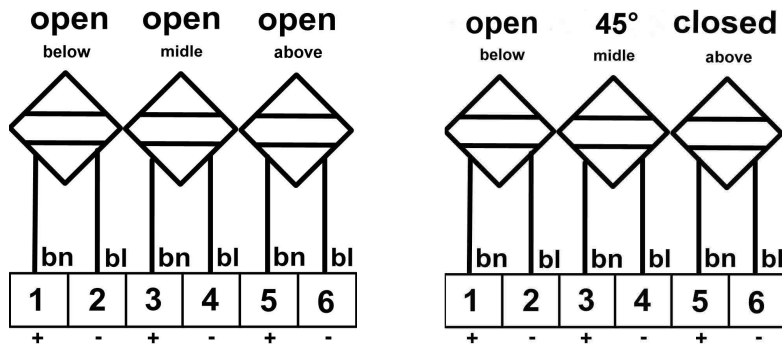


Image 5+6: left: wiring diagram acc. to image 11+12, right: : not available

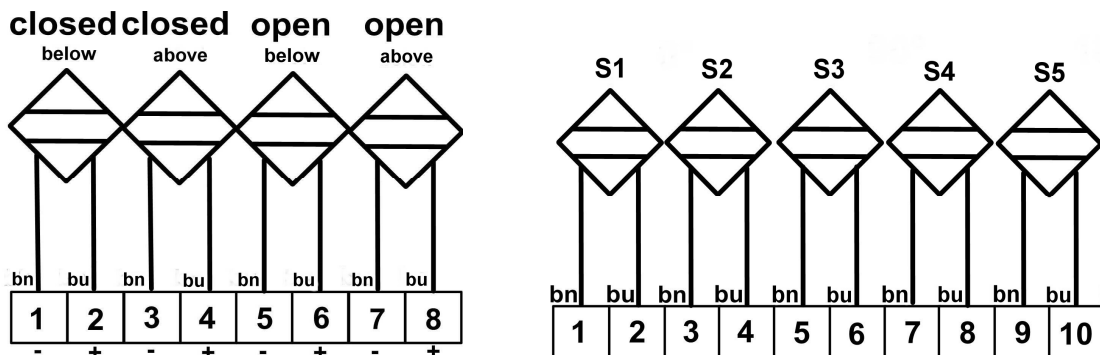
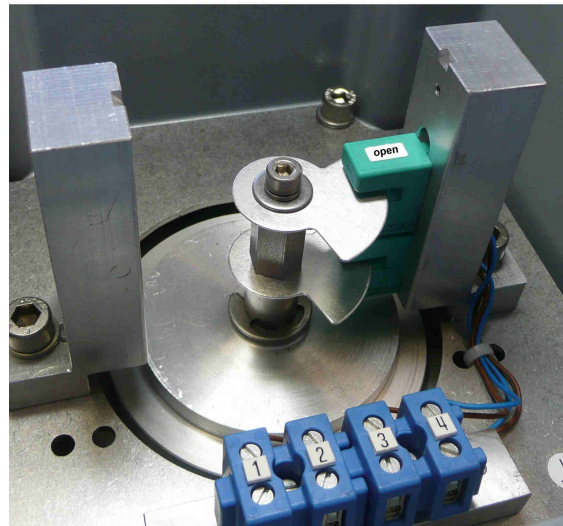
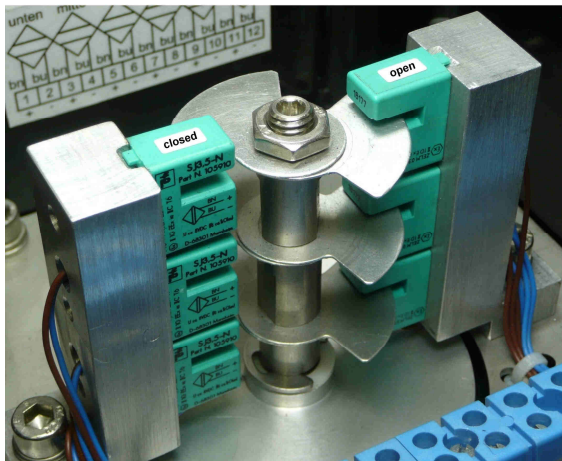


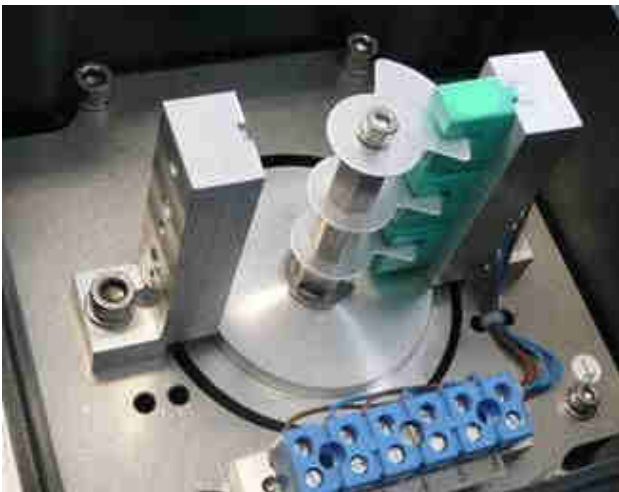
Image 7: left: wiring diagram acc. to image 16, right: wiring diagram acc. to image 13

## 6. Appendix

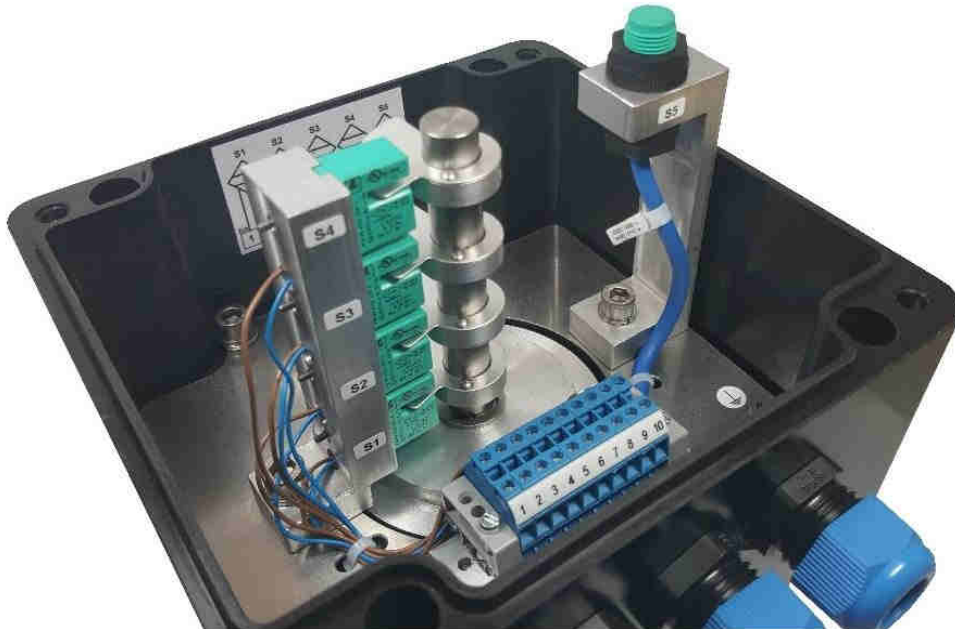
### 6.1 examples limit switch boxes 2 - 6 sensors



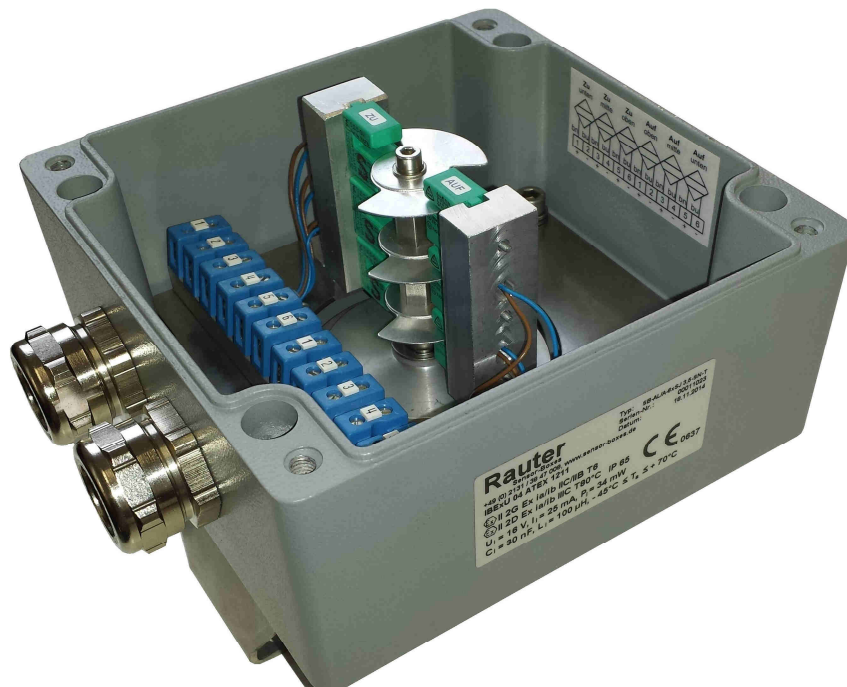
**Image 9+10:** Inner view: left: 3x SJ 3,5-N for position **CLOSED** and 3x SJ 3,5-N for position **OPEN**, right: 2x SJ 3,5-N for position **OPEN**



**Image 11+12:** Inner view: left and right 3x SJ 3,5-N for position **OPEN**

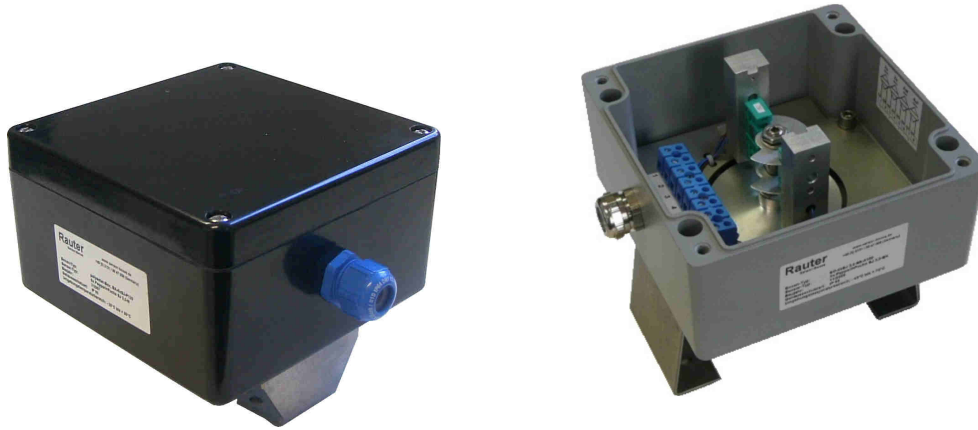


**Image 13:** 4x Ex i ... P+F sensor SJ 3,5-N, 8 V DC for any positions **S1-S4** and 1x Ex i ... P+F sensor NJ2-12GK-N, 8 V DC for the security of the closed top, position **S5**



**Image 14:** Aluminium housing, 160x160x90mm with 6x Ex i ... P+F sensor SJ 3,5-SN, 8 V DC for 3x position OPEN and 3x position CLOSED for pneumatic rotary actuators acc. to VDI/VDE 3845, temperature range complete limit switch box: - 45°C up to +70°C

6.2 housing variations limit switch boxes 2 - 6 sensors



**Image 15+16:** Polyester- and aluminium limit switch box, 160x160x90mm for pneumatic rotary actuators acc. to VDI/VDE 3845

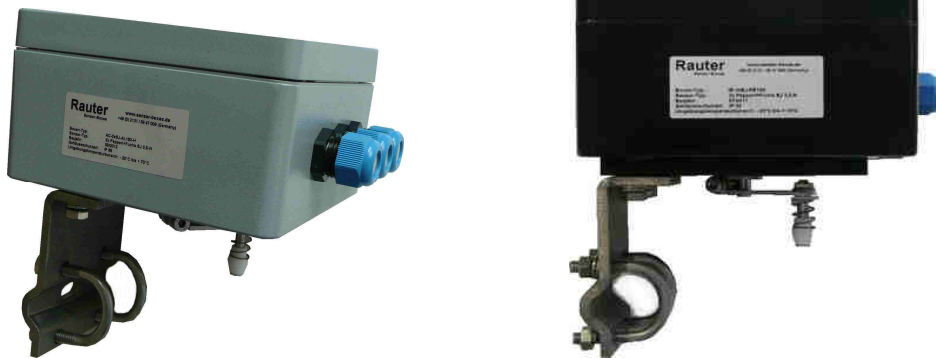


**Image 17+18:** Aluminium- and polyester limit switch box, 220x120x90mm for pneumatic rotary actuators acc. to VDI/VDE 3845



**Image 19:** Polyester limit switch box, 160x160x120x90mm for pneumatic rotary actuators acc. to VDI/VDE 3845





**Image 20+21:** Aluminium- and polyester limit switch box, 160x160x90mm for pneumatic linear actuators with mounting set acc. to NAMUR IEC 534

## 7. Data sheets sensors (only the first page): SJ 3,5-N, SJ 3,5-SN, SJ 3,5-S1N, SB 3,5-E2 and NJ2-12GK-N

Inductive slot sensor

SJ3,5-N



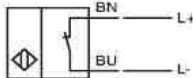
### Model Number

SJ3,5-N

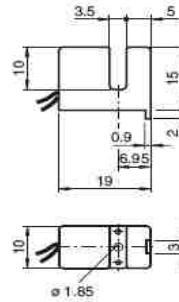
### Features

- 3.5 mm slot width
- Usable up to SIL2 acc. to IEC 61508

### Connection



### Dimensions



### Technical Data

<b>General specifications</b>	
Switching element function	NAMUR, NC
Slot width	3.5 mm
Depth of immersion (lateral)	5 ... 7 mm, typ. 6 mm
Installation	
Output polarity	NAMUR
<b>Nominal ratings</b>	
Nominal voltage	$U_0$ 2.2 V ( $R_f$ approx. 1 k $\Omega$ )
Operating voltage	$U_B$ 5 ... 25 V
Switching frequency	$f$ 0 ... 3000 Hz
Hysteresis	H 0.41 ... 0.6 mm
Suitable for 2:1 technology	yes, Reverse polarity protection diode not required
Current consumption	
Measuring plate not detected	$\geq 3$ mA
Measuring plate detected	$\leq 1$ mA
<b>Functional safety related parameters</b>	
MTTF <sub>d</sub>	8415 a
Mission Time ( $T_M$ )	20 a
Diagnostic Coverage (DC)	0 %
<b>Ambient conditions</b>	
Ambient temperature	-25 ... 100 °C (-13 ... 212 °F)
<b>Mechanical specifications</b>	
Connection type	flexible leads LIY, 500 mm
Core cross-section	0.14 mm <sup>2</sup>
Housing material	PBT/PPS
Protection degree	IP67
<b>General information</b>	
Use in the hazardous area	see instruction manuals
Category	1G; 2G; 1D
<b>Compliance with standards and directives</b>	
<b>Standard conformity</b>	
NAMUR	EN 60947-5-6:2000 IEC 60947-5-6:1999
Standards	EN 60947-5-2:2007 IEC 60947-5-2:2007
<b>Approvals and certificates</b>	
<b>FM approval</b>	
Control drawing	116-0165F
<b>UL approval</b>	
cULus Listed, General Purpose	
<b>CSA approval</b>	
cCSAus Listed, General Purpose	
<b>CCC approval</b>	
Products with a maximum operating voltage of $\leq 36$ V do not bear a CCC marking because they do not require approval.	

Release date: 2013-02-07 16:24 Date of issue: 2013-02-07 10:59:10\_eng.xml

Subject to modifications without notice

Pepperl+Fuchs Group  
www.pepperl-fuchs.com

USA: +1 330 486 0001  
fa-info@us.pepperl-fuchs.com

Germany: +49 621 776-4411  
fa-info@pepperl-fuchs.com

Copyright Pepperl+Fuchs  
Singapore: +65 6779 9091  
fa-info@sg.pepperl-fuchs.com

**PF PEPPERL+FUCHS** 1  
SENSING YOUR NEEDS

## Inductive slot sensor

SJ3,5-SN



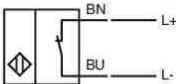
### Model Number

SJ3,5-SN

### Features

- 3.5 mm slot width
- Usable up to SIL 3 acc. to IEC 61508
- Extended temperature range

### Connection



### Application

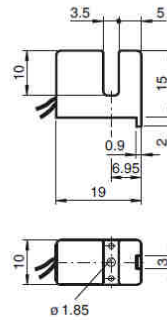


#### Danger!

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](http://www.pepperl-fuchs.com) as an integral part of this product's documentation.

Release date: 2013-05-29 09:50 Date of issue: 2013-06-26 10:57:10\_eng.xml

### Dimensions



### Technical Data

#### General specifications

Switching element function	NAMUR, NC
Slot width	3.5 mm
Depth of immersion (lateral)	5 ... 7 typ. 6 mm
Installation	
Output polarity	Safety Function

#### Nominal ratings

Nominal voltage	U <sub>o</sub>	8 V
Switching frequency	f	0 ... 3000 Hz
Hysteresis	H	with NAMUR switch amplifier: 0.045 mm (e. g. Pepperl+Fuchs KCD2-SR-Ex1, LB) with safety switch amplifier 0.025 mm (e. g. Pepperl+Fuchs KFD2-SH-Ex1)

Suitable for 2:1 technology  
Rate of current rise  
Current consumption

Measuring plate not detected	≥ 3 mA
Measuring plate detected	≤ 1 mA

#### Functional safety related parameters

MTTF <sub>d</sub>	7970 a
Mission Time (T <sub>M</sub> )	20 a
Diagnostic Coverage (DC)	0 %

#### Ambient conditions

Ambient temperature	-50 ... 100 °C (-58 ... 212 °F)
---------------------	---------------------------------

#### Mechanical specifications

Connection type	flexible leads LIY, 500 mm
Core cross-section	0.14 mm <sup>2</sup>
Housing material	PBT
Protection degree	IP67
Note	adjustable stop Security relevant only up to -40°C

#### General information

Use in the hazardous area	see instruction manuals
Category	1G; 2G; 3G; 1D

#### Compliance with standards and directives

Standard conformity	
NAMUR	EN 60947-5-6:2000 IEC 60947-5-6:1999
Standards	EN 60947-5-2:2007 IEC 60947-5-2:2007

#### Approvals and certificates

FM approval	
Control drawing	116-0165F
UL approval	cULus Listed, General Purpose
CSA approval	cCSAus Listed, General Purpose
CCC approval	CCC approval / marking not required for products rated ≤36 V

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

Pepperl+Fuchs Group  
[www.pepperl-fuchs.com](http://www.pepperl-fuchs.com)

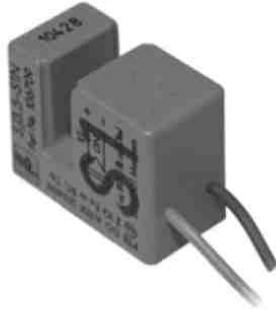
USA: +1 330 486 0001  
fa-info@us.pepperl-fuchs.com

Germany: +49 621 776 4411  
fa-info@de.pepperl-fuchs.com

Singapore: +65 6779 9091  
fa-info@sg.pepperl-fuchs.com

## Inductive slot sensor

SJ3,5-S1N



### Model Number

SJ3,5-S1N

### Features

- 3.5 mm slot width
- Usable up to SIL 3 acc. to IEC 61508
- Nonferrous targets

### Application



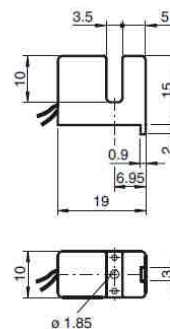
#### Danger!

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](http://www.pepperl-fuchs.com) as an integral part of this product's documentation.

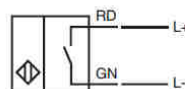
### Technical Data

General specifications	
Switching element function	NAMUR, NO
Slot width	3.5 mm
Depth of immersion (lateral)	5 ... 7 typ. 6 mm
Installation	
Output polarity	Safety Function
Nominal ratings	
Nominal voltage	$U_o$ 8 V
Switching frequency	f 0 ... 2500 Hz
Hysteresis	H with NAMUR switch amplifier: 0.09 mm (e. g. Pepperl+Fuchs KCD2-SR-Ex1 LB) with safety switch amplifier 0.05 mm (e. g. Pepperl+Fuchs KFD2-SH-Ex1)
Suitable for 2:1 technology	yes, with reverse polarity protection diode
Rate of current rise	2.1 mA / mm
Current consumption	
Measuring plate not detected	≤ 1 mA
Measuring plate detected	≥ 3 mA
Functional safety related parameters	
MTTF <sub>d</sub>	7974 a
Mission Time (T <sub>M</sub> )	20 a
Diagnostic Coverage (DC)	0 %
Ambient conditions	
Ambient temperature	-25 ... 100 °C (-13 ... 212 °F)
Mechanical specifications	
Connection type	flexible leads LIY, 500 mm
Core cross-section	0.14 mm <sup>2</sup>
Housing material	PBT
Protection degree	IP67
Note	only for non-ferrous metal Adjustable stop
General information	
Use in the hazardous area	see instruction manuals
Category	1G; 2G; 3G; 1D
Compliance with standards and directives	
Standard conformity	
Standards	EN 60947-5-2:2007 IEC 60947-5-2:2007
Approvals and certificates	
FM approval	
Control drawing	116-0165F
UL approval	cULus Listed, General Purpose
CSA approval	cCSAus Listed, General Purpose
CCC approval	CCC approval / marking not required for products rated ≤36 V

### Dimensions



### Electrical Connection



Release date: 2013-09-20 14:52 Date of issue: 2013-09-20 106709\_eng.xml

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

Pepperl+Fuchs Group

USA: +1 330 486 0001

Germany: +49 621 776 4411

Singapore: +65 6779 9091

**PF** PEPPERL+FUCHS

1

## Inductive slot sensor

SB3,5-E2



### Model Number

SB3,5-E2

### Features

- 3.5 mm slot width
- 3-wire DC

### Technical Data

#### General specifications

Switching function	Normally open (NO)
Output type	PNP
Slot width	3.5 mm
Depth of immersion (lateral)	5 ... 7 mm
Output polarity	DC
Output type	3-wire

#### Nominal ratings

Operating voltage	$U_B$	10 ... 30 V DC
Switching frequency	$f$	0 ... 3000 Hz
Hysteresis	H	0 ... 0.6 mm
Reverse polarity protection		reverse polarity protected
Short-circuit protection		pulsing
Voltage drop	$U_d$	$\leq 3$ V
Operating current	$I_L$	0 ... 100 mA
No-load supply current	$I_0$	$\leq 7$ mA
Switching state indicator		LED, yellow

#### Functional safety related parameters

MTTF <sub>d</sub>	2590 a
Mission Time (T <sub>M</sub> )	20 a
Diagnostic Coverage (DC)	0 %

#### Ambient conditions

Ambient temperature	-25 ... 70 °C (-13 ... 158 °F)
---------------------	--------------------------------

#### Mechanical specifications

Connection type	flexible leads LiY, 500 mm
Core cross-section	0.14 mm <sup>2</sup>
Housing material	PBT
Degree of protection	IP67

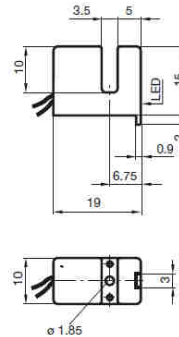
#### Compliance with standards and directives

Standard conformity	
Standards	EN 60947-5-2:2007 IEC 60947-5-2:2007

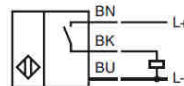
#### Approvals and certificates

UL approval	cULus Listed, General Purpose
CSA approval	cCSAus Listed, General Purpose
CCC approval	CCC approval / marking not required for products rated $\leq 36$ V

### Dimensions



### Electrical Connection



Release date: 2017-01-09 10:42 Date of issue: 2017-01-09 11:0941\_eng.xml

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

Pepperl+Fuchs Group  
www.pepperl-fuchs.com

USA: +1 330 486 0001  
fa-info@us.pepperl-fuchs.com

Germany: +49 621 776 4411  
fa-info@de.pepperl-fuchs.com

Singapore: +65 6779 9091  
fa-info@sg.pepperl-fuchs.com

**PEPPERL+FUCHS**  
SENSING YOUR NEEDS

1

## Inductive sensor

NJ2-12GK-N



### Model Number

NJ2-12GK-N

### Features

- 2 mm flush
- Usable up to SIL 2 acc. to IEC 61508

### Accessories

BF 12  
Mounting flange, 12 mm

### Technical Data

#### General specifications

Switching function	Normally closed (NC)
Output type	NAMUR
Rated operating distance	$s_n$ 2 mm
Installation	flush
Assured operating distance	$s_a$ 0 ... 1.62 mm
Reduction factor $r_{AJ}$	0.4
Reduction factor $r_{Cu}$	0.3
Reduction factor $r_{304}$	0.85

#### Nominal ratings

Nominal voltage	$U_o$	8.2 V (R; approx. 1 k $\Omega$ )
Switching frequency	f	0 ... 2000 Hz
Suitable for 2:1 technology		yes, Reverse polarity protection diode not required
Current consumption		
Measuring plate not detected		$\geq 3$ mA
Measuring plate detected		$\leq 1$ mA

#### Functional safety related parameters

MTTF <sub>d</sub>	5887 a
Mission Time (T <sub>M</sub> )	20 a
Diagnostic Coverage (DC)	0 %

#### Ambient conditions

Ambient temperature	-25 ... 100 °C (-13 ... 212 °F)
---------------------	---------------------------------

#### Mechanical specifications

Connection type	cable PVC, 2 m
Core cross-section	0.34 mm <sup>2</sup>
Housing material	PBT
Sensing face	PBT
Degree of protection	IP66 / IP68
Cable	
Bending radius	> 10 x cable diameter

#### General information

Use in the hazardous area	see instruction manuals
Category	2G; 1D

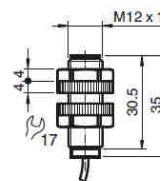
#### Compliance with standards and directives

Standard conformity	
NAMUR	EN 60947-5-6:2000 IEC 60947-5-6:1999
Standards	EN 60947-5-2:2007 IEC 60947-5-2:2007

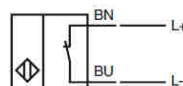
#### Approvals and certificates

FM approval	
Control drawing	116-0165
UL approval	cULus Listed, General Purpose
CSA approval	cCSAus Listed, General Purpose
CCC approval	CCC approval / marking not required for products rated $\leq 36$ V

### Dimensions



### Electrical Connection



Release date: 2016-11-08 17:29 Date of issue: 2016-11-08 10:53:59\_eng.xml

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

Pepperl+Fuchs Group  
www.pepperl-fuchs.com

USA: +1 330 486 0001  
fa-info@us.pepperl-fuchs.com

Germany: +49 621 776 4411  
fa-info@de.pepperl-fuchs.com

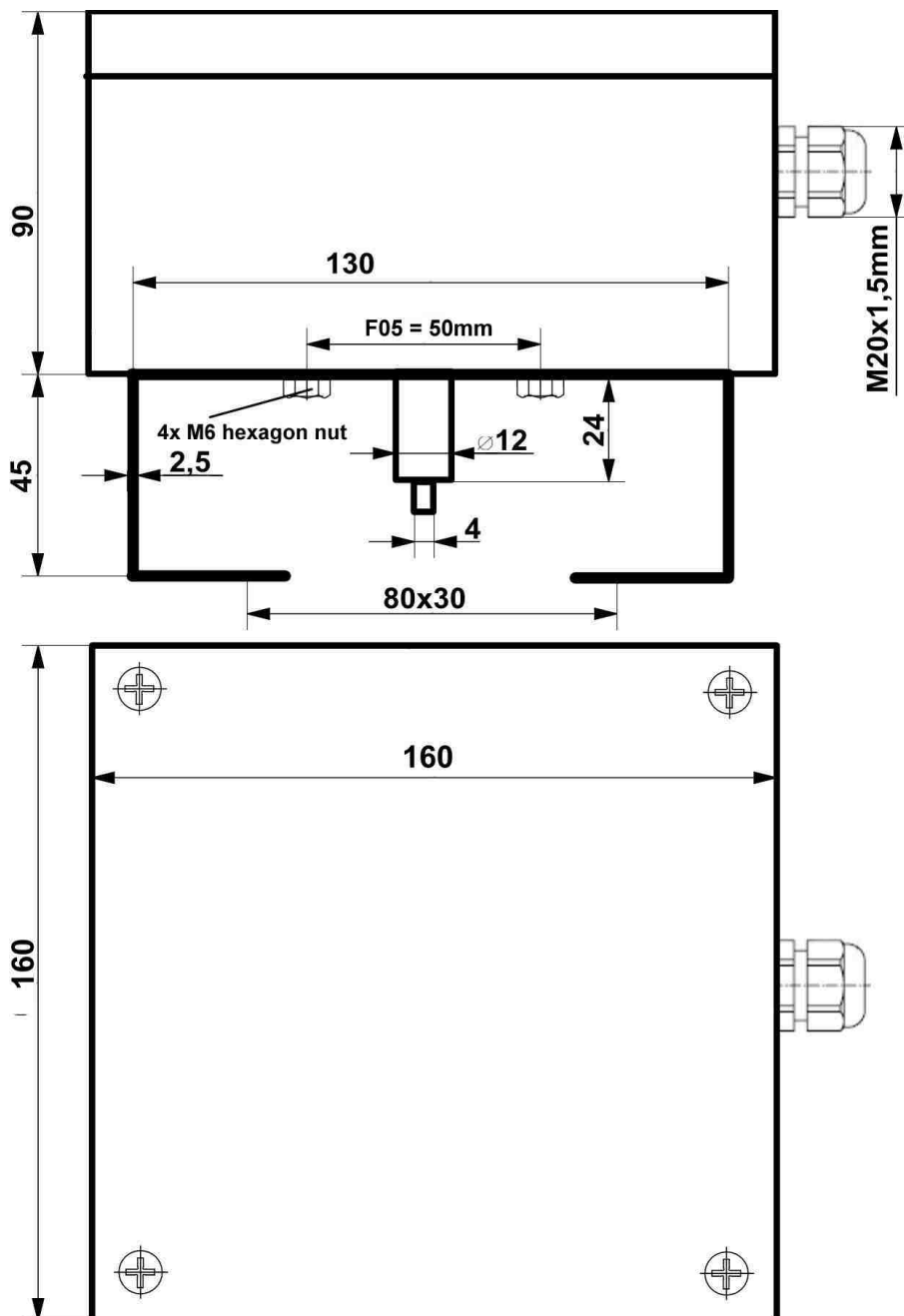
Singapore: +65 6779 9091  
fa-info@sg.pepperl-fuchs.com

**PEPPERL+FUCHS**  
SENSING YOUR NEEDS

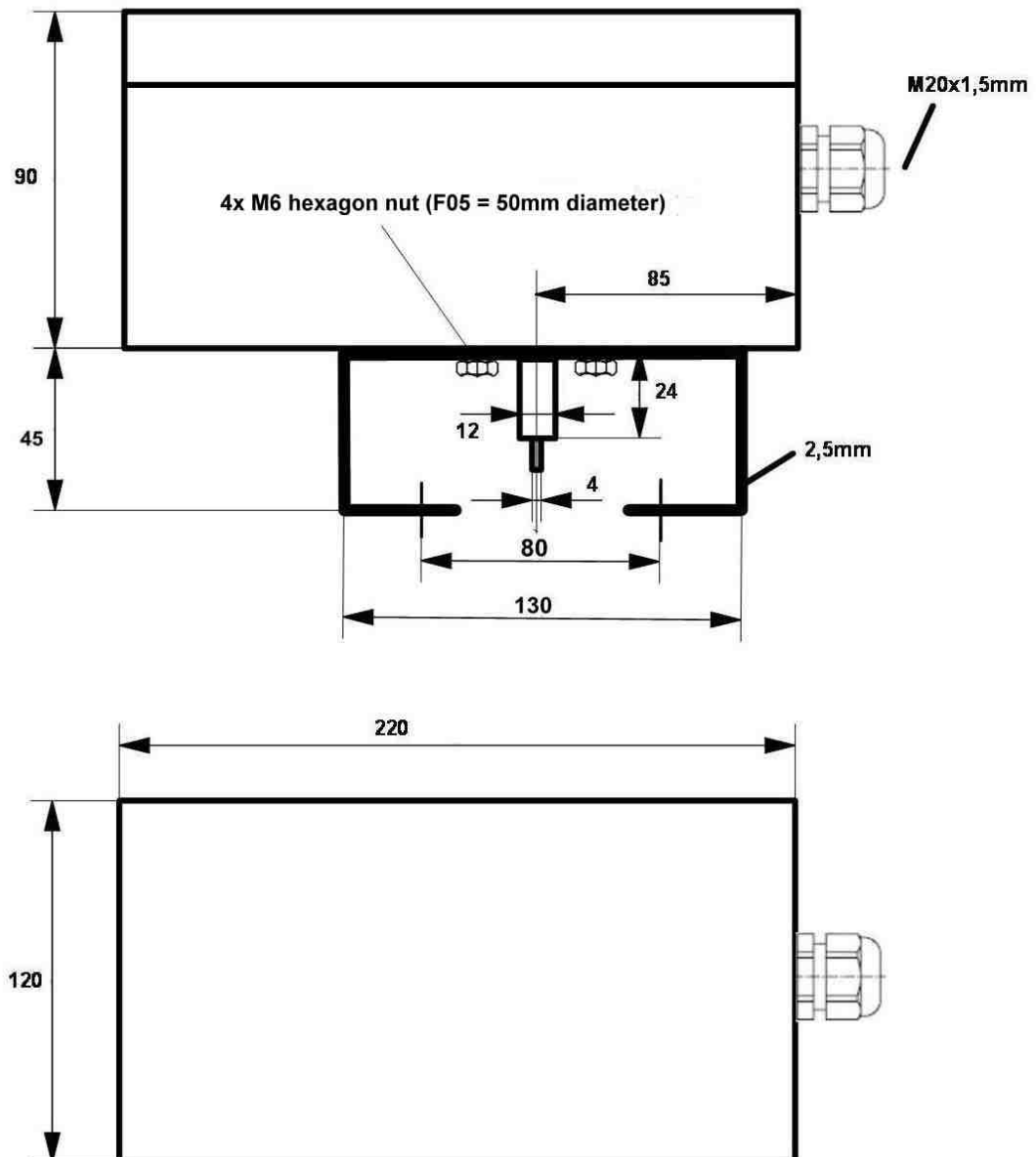
1

### 8. Drawings limit switch boxes

Drawing from polyester- and aluminium limit switch boxes for pneumatic rotary actuators

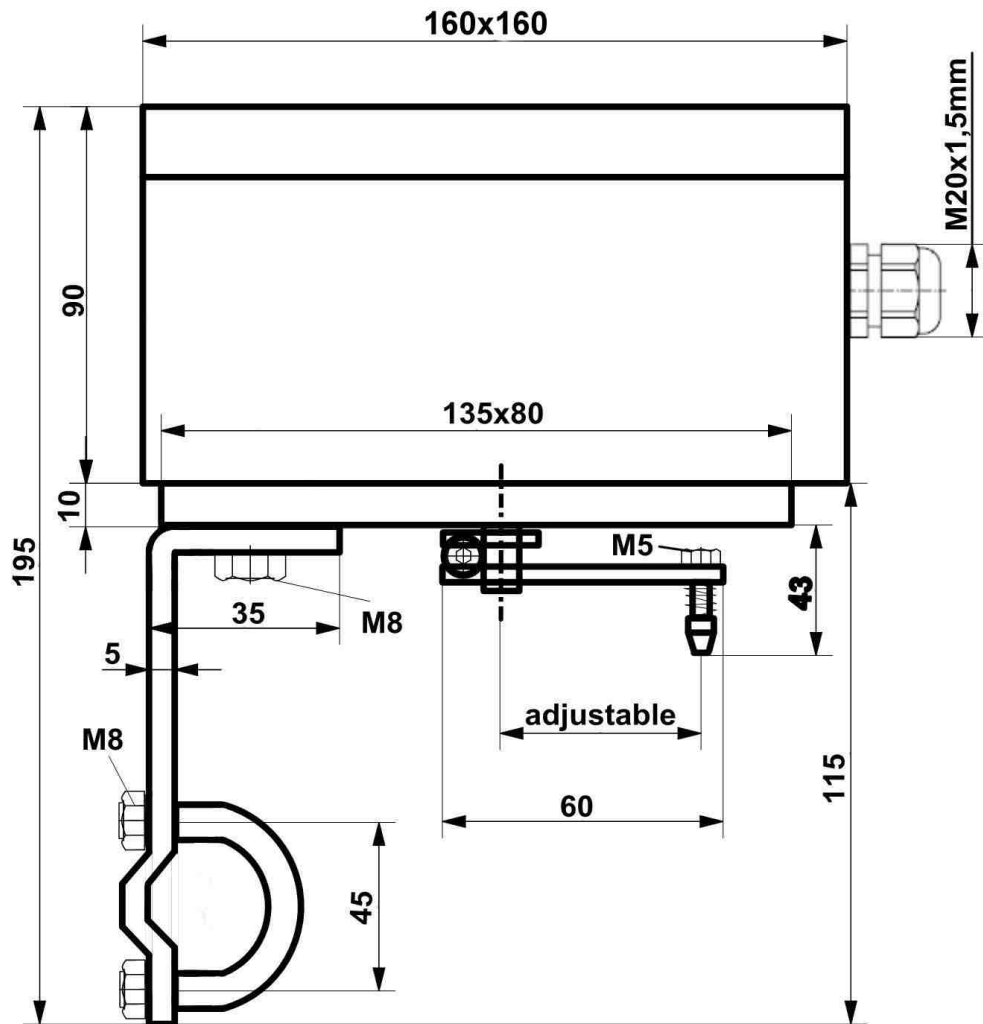


Drawing from polyester- and aluminium limit switch boxes for pneumatic rotary actuators





Drawing from polyester- and aluminium limit switch boxes for pneumatic linear actuators



### 9. Brackets limit switch boxes rotary actuators

stainless steel brackets size 1 - 4 for limit switch boxes, rotary actuators

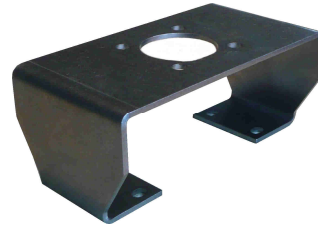
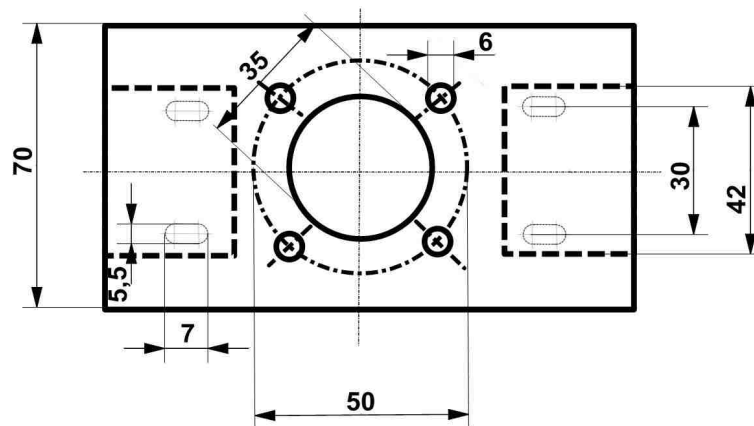
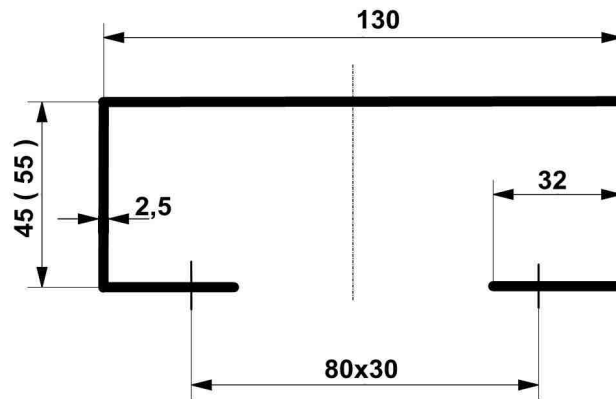


image.: brackets size 1 - 2 for actuators acc. to VDI/VDE 3845, steam high 20mm and 30mm, hole spacing 80x30mm

dimensions: without ( ) = bracket size 1 ( ) = bracket size 2

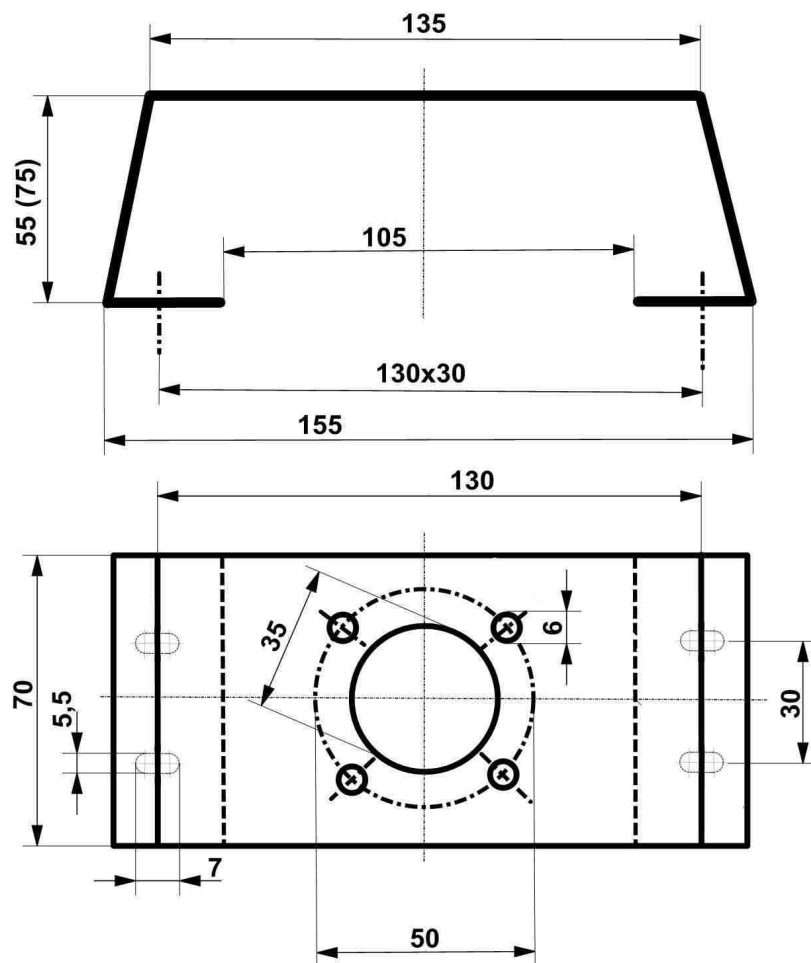


material = Aisi 304



image.: brackets size 3 - 4 for actuators  
acc. to VDI/VDE 3845, steam high 30mm  
and 50mm, hole spacing 130x30mm

dimensions: without ( ) = bracket size 3 ( ) = bracket size 4

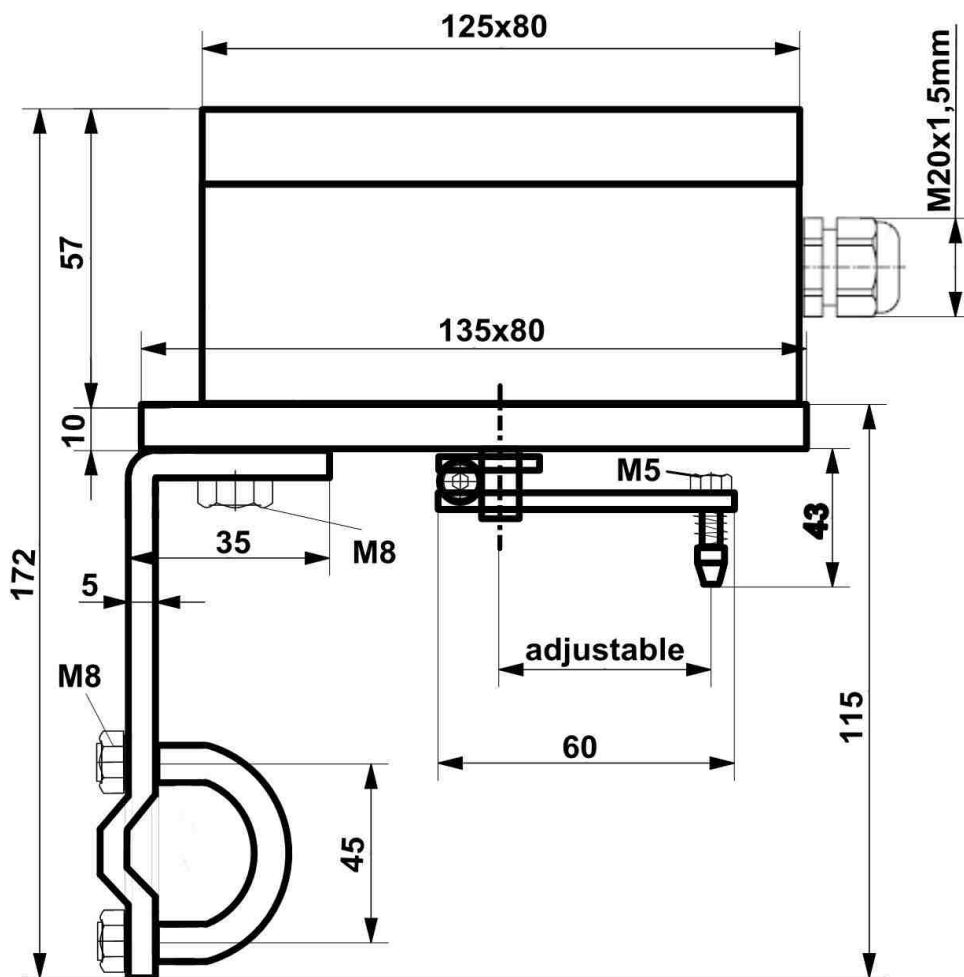


material = Aisi 304

### 10. Mounting set limit switch boxes linear actuators



**image:** mounting set for linear actuators acc. to NAMUR IEC 534 with aluminium plate, the aluminium plate is not included in the set.



**material:** Aisi 304 and aluminium