

# MOUNTING AND OPERATING INSTRUCTIONS



## EB 8355-1 EN

### Translation of original instructions



## Type 3766 Pneumatic Positioner

## Definition of signal words

### **DANGER**

*Hazardous situations which, if not avoided, will result in death or serious injury*

### **WARNING**

*Hazardous situations which, if not avoided, could result in death or serious injury*

### **NOTICE**

*Property damage message or malfunction*

### **Note**

*Additional information*

### **Tip**

*Recommended action*

<b>1</b>	<b>General safety instructions</b> .....	<b>5</b>
<b>2</b>	<b>Design and principle of operation</b> .....	<b>6</b>
2.1	Versions and article code.....	9
2.2	Technical data .....	10
2.3	Additional equipment.....	12
2.4	Summary of explosion protection approvals .....	13
<b>3</b>	<b>Mounting on control valves</b> .....	<b>14</b>
3.1	Direct attachment to Type 3277 Actuator .....	14
3.2	Attachment according to IEC 60534-6.....	20
3.2.1	Mounting sequence .....	22
3.2.2	Initial adjustment of travel .....	22
3.3	Attachment to rotary actuators .....	25
3.3.1	Mounting the lever with feeler roll.....	26
3.3.2	Mounting the intermediate piece .....	26
3.3.3	Basic setting of the cam disk .....	28
3.3.4	Reversing amplifier for double-acting actuators .....	32
<b>4</b>	<b>Connections</b> .....	<b>34</b>
4.1	Pneumatic connections.....	34
4.1.1	Pressure gauges .....	34
4.1.2	Supply pressure .....	34
4.2	Electrical connections .....	36
4.2.1	Switching amplifier .....	37
<b>5</b>	<b>Operation</b> .....	<b>38</b>
5.1	Tuning the positioner mounted onto the control valve.....	38
5.1.1	Adjusting the proportional band $X_p$ and air delivery $Q$ .....	39
5.1.2	Settings for actuator with "actuator stem extends" fail-safe action.....	39
5.1.3	Settings for actuator with "actuator stem retracts" fail-safe action .....	40
5.2	Changing the operating direction .....	41
5.3	Adjusting the limit contacts .....	42
5.4	Adjusting the position transmitter.....	44
<b>6</b>	<b>Upgrading the positioner</b> .....	<b>47</b>
<b>7</b>	<b>After-sales service</b> .....	<b>49</b>
7.1	Servicing explosion-protected devices.....	49
7.2	Maintenance and calibration .....	49

## Contents

8	Dimensions in mm.....	50
9	Disposal.....	51

# 1 General safety instructions

For your own safety, follow these instructions concerning the mounting, start up and operation of the device:

- The device must be mounted, started up or operated only by trained and experienced personnel familiar with the product. According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Any hazards that could be caused in the valve by the process medium, the signal pressure or by moving parts are to be prevented by taking appropriate precautions. If inadmissible motions or forces are produced in the pneumatic actuator as a result of the supply pressure, it must be restricted using a suitable supply pressure reducing station.
- Explosion-protected versions of this device must be operated only by personnel who has undergone special training or instructions or who is authorized to work on explosion-protected devices in hazardous areas.

To avoid damage to any equipment, the following also applies:

- Proper shipping and storage are assumed.

---

## **i** Note

*The device with a CE marking fulfills the requirements of the Directive 2014/34/EU and the Directive 2014/30/EU. The Declaration of Conformity is available on request.*

---

## **!** NOTICE

*Models with index 3766-x...x.03 and higher are equipped with a hinged cover without their own exhaust air port.*

*The required exhaust air connection is now included in the mounting accessories.*

*If these positioners are mounted on older actuator models, make sure that there is an exhaust air connection. If necessary, replace the mounting accessories as well.*

---

## 2 Design and principle of operation

The pneumatic positioner is used to assign the valve position (controlled variable) to the input signal (reference variable). The positioners compare the control signal of a control system to the travel of the control valve and issues a signal pressure (output variable) for the pneumatic actuator.

The positioner consists of a lever for travel pick-up, a measuring diaphragm and the pneumatic control system with nozzle, diaphragm lever (flapper plate) and booster.

The positioner is designed either for direct attachment to SAMSON Type 3277 Actuators or for attachment according to NAMUR (IEC 60534-6-1) with an adapter housing.

The positioner can be additionally equipped with either inductive limit contacts and/or a solenoid valve or position transmitter.

The positioner operates according to the force-balance principle. The valve travel, i.e. the valve position, is transmitted to the pick-up lever (1) over the pin (1.1) and determines the force of the range spring (4). This force is compared to the positioning force generated by the pressure  $p_e$  at the measuring diaphragm (5).

If either the control signal or the valve position changes, the diaphragm lever (3) moves, altering the distance to the nozzle (2.1 or 2.2), depending on the adjusted operating direction of the positioner.

The supply air is supplied to the booster (10) and the pressure regulator (9). The controlled supply air flows through the  $X_p$  restriction (8)

and the nozzle (2.1, 2.2) and hits the diaphragm lever (flapper plate).

Any change in the reference variable or the valve position causes the pressure to change upstream or downstream of the booster.

The air controlled by the booster (signal pressure  $p_{st}$ ) flows through the volume restriction (11) to the pneumatic actuator, causing the plug stem to move to a position corresponding to the reference variable.

The adjustable  $X_p$  restriction (8) and volume restriction (11) are used to optimize the positioner control loop.

The pick-up lever (1) and the range spring (4) must be selected to match the rated valve travel and the nominal span of the reference variable.

### Positioner with inductive limit contacts

In this version, the rotary shaft of the positioner carries two adjustable tags which actuate the built-in proximity switches.

### Positioner with solenoid valve

When the positioner is equipped with a solenoid valve, the valve can be moved to the fail-safe position, regardless of the positioner's output signal. If a control signal corresponding to the binary signal '0' (OFF) is applied to the input, the signal pressure  $p_{st}$  is shut off and the actuator is vented. The actuator springs move the valve to its fail-safe position.

When a control signal corresponding to the binary signal '1' (ON) is applied to the input, the signal pressure  $p_{st}$  is applied to the actuator, allowing the valve to move according to the input signal issued by the control equipment.

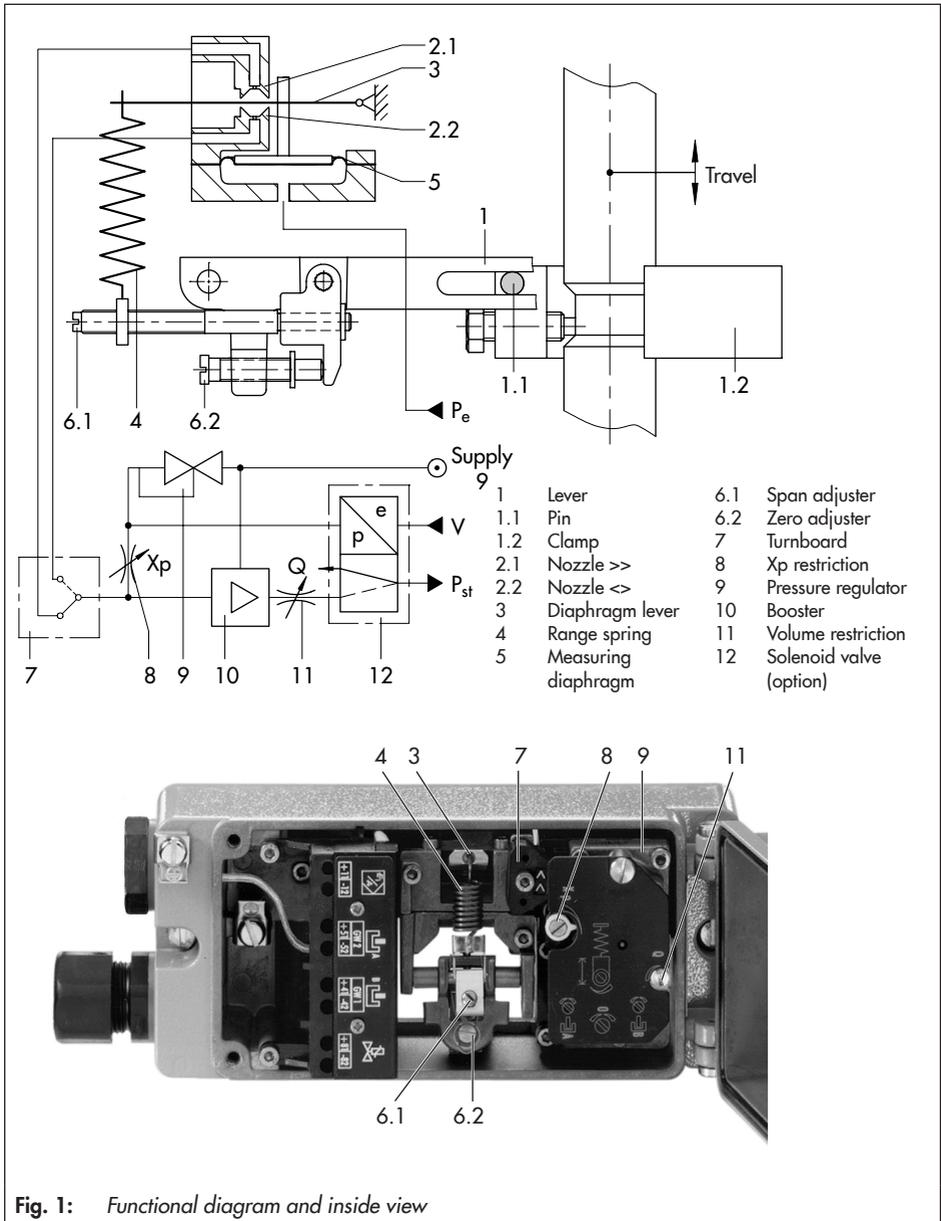


Fig. 1: Functional diagram and inside view

## Design and principle of operation

### Positioner with position transmitter

A positioner containing a position transmitter cannot be equipped with integrated limit contacts or an integrated solenoid valve since the position transmitter requires most of the space inside.

The position transmitter is used to assign the valve position, i.e. the valve travel, to an output signal of 4 to 20 mA.

The tuning of the position transmitter ensures that both end positions "valve CLOSED" or "valve OPEN" as well as all intermediate positions can be signalized. Since the valve position is signalized independently of the input signal to the positioner, the position transmitter is a suitable option for checking the actual valve position.

## 2.1 Versions and article code

Pneumatic positioner	Type	3	7	6	6	0	1	x	x	x	x	1	x	0	x	0	
<b>Explosion protection</b>																	
Without		0							2								
⊗ II 2G Ex ia IIC T6 according to ATEX		1															
CSA/FM intrinsically safe/non incandive		3															
Ex ia I/IIC T6 IP65, Ex nI/IIC T6 IP65 according to IECEx		6															
⊗ II 3G Ex nA II T6 acc. to ATEX		8															
<b>Additional equipment</b>																	
Without		0															
Inductive limit contacts 2x SJ2-SN		2															
(Analog position transmitter 4 to 20 mA) <sup>1)</sup>		6	0										0				
<b>3/2-way solenoid valve</b>																	
Without			0														
6 V DC			2														
12 V DC			3														
24 V DC			4														
<b>Pneumatic connections</b>																	
¼-18 NPT							1										
ISO 228/1-G ¼							2										
<b>Electrical connections</b>																	
Without (no additional equipment or solenoid valve)		0	0				0	0									
Plastic cable gland M20x1.5, blue							1	0					0				
Plastic cable gland M20x1.5, black							2	0					0				
M20x1.5 cable gland, nickel-plated brass							2	1					3				
<b>Housing version</b>																	
Die-cast aluminum												0					
(CrNiMo steel) <sup>2)</sup>												2					
<b>Temperature range</b>																	
Standard													0				
Low-temperature version																	
T <sub>min</sub> ≥ -50 °C; optional limit contacts, solenoid valve							2	1					3				
<b>Special versions</b>																	
Without															0	0	0

<sup>1)</sup> No longer available since March 2011

Device functioning only as analog position transmitter: 3766-x60 000xxx00 000 0

<sup>2)</sup> No longer available since April 2020

## 2.2 Technical data

Type 3766 Positioner			
Travel range		7.5 to 30 mm	Direct attachment to Type 3277 Actuator
		7.5 to 120 mm for attachment according to IEC 60534 (NAMUR)	
Opening angle		70°, 75° or 90° depending on the cam disk	
Reference variable w	Signal range	0.2 to 1 bar (3 to 15 psi)	
	Span	0.4 to 0.8 bar (6 to 12 psi)	
	Overloadable Max.	2 bar (29 psi)	
Supply	Supply air	1.4 to 6 bar (20 to 90 psi)	
	Air quality acc. to ISO 8573-1, edition 2001-02	Maximum particle size and density: Class 4 · Oil content: Class 3 Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected.	
Signal pressure p <sub>st</sub> (output)		Can be limited between: 0 to approx. 2.5 bar and 0 to 6 bar (0 to approx. 35 psi and 0 to 90 psi)	
Characteristic		Linear characteristic · Deviation from terminal-based conformity: ≤1 %	
Hysteresis		≤0.6 %	
Sensitivity		≤0.1 %	
Operating direction		Reversible	
Proportional band X <sub>p</sub>		0.5 to 2.5 % (proportional-action coefficient K <sub>p</sub> : > 200 to 40)	
Air consumption		At 1.4 bar supply pressure	At 6 bar supply pressure
		≤230 l <sub>n</sub> /h	≤230 l <sub>n</sub> /h <sup>1)</sup>
Air output capacity	Actuator (supply)	3.0 m <sub>n</sub> <sup>3</sup> /h · K <sub>Vmax</sub> (20 °C) = 0.09	8.5 m <sub>n</sub> <sup>3</sup> /h · K <sub>Vmax</sub> (20 °C) = 0.09
	Actuator (exhaust)	4.5 m <sub>n</sub> <sup>3</sup> /h · K <sub>Vmax</sub> (20 °C) = 0.15	14.0 m <sub>n</sub> <sup>3</sup> /h · K <sub>Vmax</sub> (20 °C) = 0.15
Permissible ambient temperature <sup>2)</sup>	Standard	-20 to 80 °C:	Optional limit contacts/solenoid valve/position transmitter with plastic cable gland
		-40 to 80 °C:	Optional limit contacts/solenoid valve with metal cable gland
	Low-temperature version	-50 to 80 °C:	Optional limit contacts/solenoid valve with metal cable gland
Technical data in test certificates additionally apply to explosion-protected devices			

Influence	Temperature: $\leq 0.3 \text{ \%}/10 \text{ K}$ Supply air: $\leq 1 \text{ \%}$ between 1.4 and 6 bar
Electromagnetic compatibility	According to EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21
Effect of vibration	None between 10 and 150 Hz and 4 g
Explosion protection	Refer to article code or list of approvals in Data Sheet ► T 8355
Degree of protection	IP54 (IP65 and NEMA 4X possible by fitting a filter check valve. See table on accessories on page 19)
Conformity	<b>CE</b>
Weight	Approx. 1 kg

- 1) With lowest setting of pressure regulator
- 2) The limits in the type examination certificate additionally apply to explosion-protected versions.

## 2.3 Additional equipment

Limit contacts					
2 inductive proximity switches		SJ2-SN			
Control circuit		Values according to downstream transistor relay			
Hysteresis at rated travel		≤1 %			
Solenoid valve					
Input		Binary DC voltage signal			
Nominal signal		6 V DC	12 V DC	24 V DC	
Signal '0' (no response) <sup>2)</sup>		≤1.2 V	≤2.4 V	≤4.7 V	
Signal '1' (response) <sup>3)</sup>		≥5.4 V	≥9.6 V	≥18.0 V	
Maximum permissible signal		28 V	25 V	32 V	
Coil resistance R <sub>i</sub> at 20 °C		2909 Ω	5832 Ω	11714 Ω	
Air consumption in steady state		In addition to that of the positioner: OFF ≤60 I <sub>n</sub> /h · ON ≤10 I <sub>n</sub> /h <sup>1)</sup>			
Closing time for rated travel and signal pressure range (K <sub>VS</sub> 0.13)	Type 3277 Actuator	≤120 cm <sup>2</sup>	240 cm <sup>2</sup>	350 cm <sup>2</sup>	700 cm <sup>2</sup>
	0.2 to 1 bar	≤0.5 s	≤0.8 s	≤1.1 s	≤4 s
	0.4 to 2 bar	≤0.5 s	≤2 s	≤2.5 s	≤8 s
	0.6 to 3 bar	<sup>5)</sup>	≤1 s	≤1.5 s	≤5 s
Analog position transmitter <sup>6)</sup>					
Output		Two-wire connection 4 to 20 mA			
Supply		Minimum terminal voltage: 12 V, max.: 45 V		The position transmitter must only be connected to a certified intrinsically safe circuit. <sup>4)</sup>	

<sup>1)</sup> With lowest setting of pressure regulator

<sup>2)</sup> DC voltage signal at 25 °C

<sup>3)</sup> DC voltage signal at +80 °C

<sup>4)</sup> e.g. using a Type 994-0103-KFD2-STC4-Ex1 Loop Isolator.

<sup>5)</sup> 120 cm<sup>2</sup> actuator in all signal pressure ranges: ≤0.5 s

<sup>6)</sup> Available until March 2011

## 2.4 Summary of explosion protection approvals

Type	Certification		Type of protection
3766-1	<b>ATEX</b>	Number PTB 01 ATEX 2171 Date 2001-11-26	II 2G Ex ia IIC T6
3766-3	<b>CSA</b>	Number 1607848 Date 2005-09-16	Ex ia IIC T6; Class I Zone 0; Class I, II, Div. 1, Groups A, B, C, D, E, F, G; Class I, II, Div. 2, Groups A, B, C, D, E, F, G;
	<b>FM</b>	Number FM24US0232 Date 2025-01-02	S Class I,II,III, Div.1,GP A,B,C,D,E,F,G, T* Type 4X IS Class I, Zn 0, AEx ia IIC, T* NI Class I, Div.2,GP A,B,C,D,F,G T* * See Addendum
3766-6	<b>IECEX</b>	Number IECEX TSA 05.0004X Date 2005-05-24	Ex ia I/IIC T6 IP65, Ex nI/IIC T6 IP65
3766-8	<b>ATEX</b>	Number PTB 01 ATEX 2195 X Date 2002-03-07	II 3G Ex nA II T6

### 3 Mounting on control valves

The positioner can be mounted either directly to SAMSON Type 3277 Actuator or to control valves with cast yokes or rod-type yokes according to IEC 60534-6 (NAMUR).

Combined with an intermediate piece, the positioner can also be mounted on rotary actuators. The standard positioner is delivered without accessories. Any additionally required accessories are listed together with their order numbers in the following tables. Do not remove the protective cover on the back of the positioner until you actually start to attach the positioner.

#### Mounting position and operating direction

The operating direction of the positioner also determines its mounting position on the actuator as illustrated in Fig. 2, Fig. 3 and Fig. 5.

The turnboard (7 in Fig. 1) at the positioner must be mounted correspondingly.

For an increasing input signal (reference variable), the signal pressure  $p_{st}$  can either be increasing (direct action  $\gg$ ) or decreasing (reverse action  $\langle \rangle$ ). Similarly, as the reference variable decreases, the signal pressure can either decrease (direct action  $\gg$ ) or increase (reverse action  $\langle \rangle$ ).

On the turnboard (7), the operating direction is indicated by symbols (direct  $\gg$ , reverse  $\langle \rangle$ ). Depending on the position of the turnboard, the adjusted operating direction and the associated symbol is visible.

If the required operating direction does not correspond to the visible symbol or if you want to change the operating direction, remove the fastening screw at the turnboard, turn the board by  $180^\circ$  and refasten the turnboard. Make sure the three rubber gaskets inserted in the housing remain in position.

---

#### **i** NOTICE

*When any subsequent changes are made, e.g. reversing the operating direction of the positioner control loop or changing the actuator fail-safe action from "actuator stem extends" to "actuator stem retracts" or vice versa, the positioner's mounting position must be changed accordingly.*

---

### 3.1 Direct attachment to Type 3277 Actuator

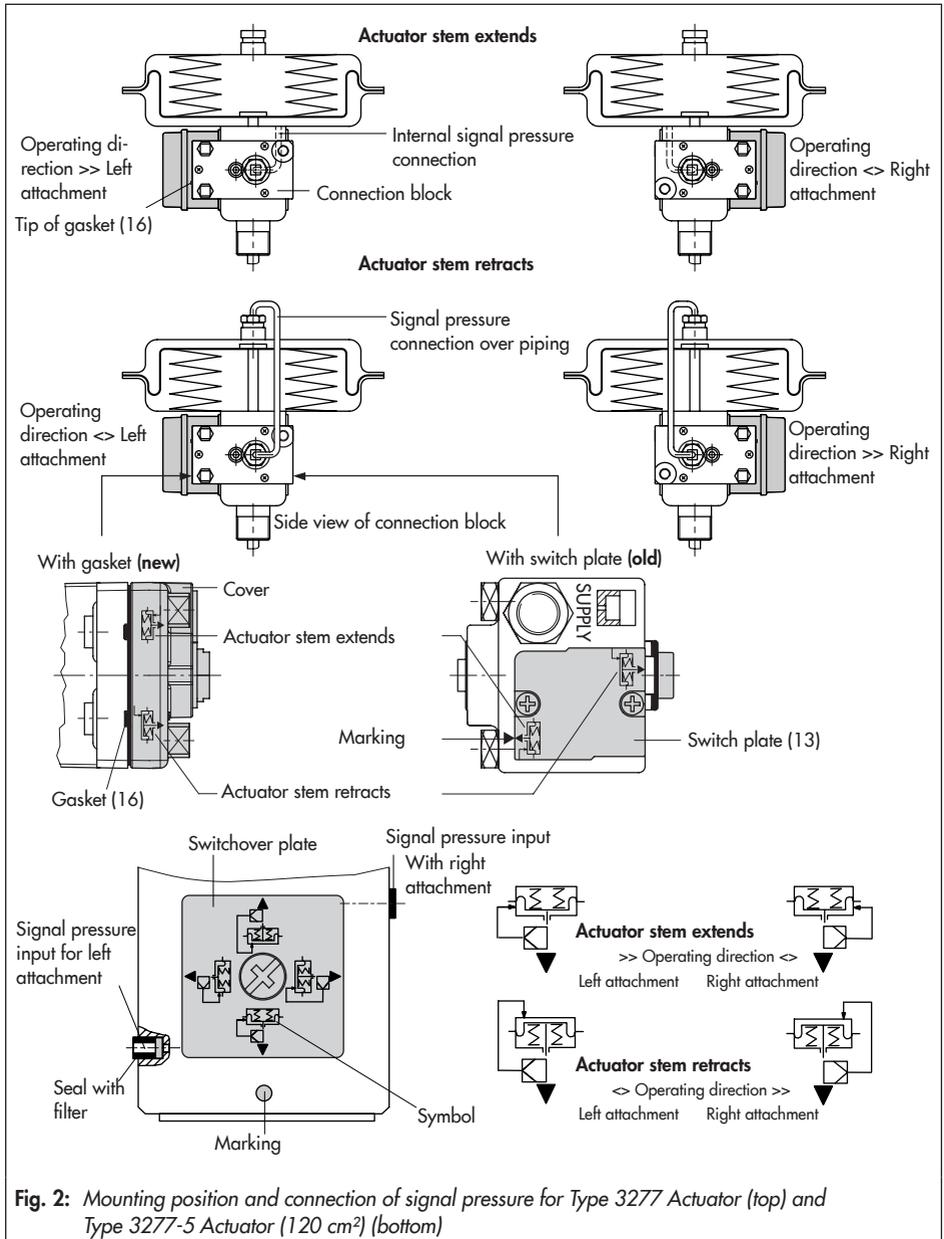
---

#### **i** Note

*The required accessories are listed in Table 1 to Table 4 on page 18.*

---

The attachment of the positioner either on the left or right side of the actuator (always looking onto the signal pressure connection or switchover plate) is determined by the required operating direction of the positioner, i.e.  $\gg$  or  $\langle \rangle$ .



**Fig. 2:** Mounting position and connection of signal pressure for Type 3277 Actuator (top) and Type 3277-5 Actuator (120 cm<sup>2</sup>) (bottom)

## Mounting on control valves

1. Fasten the clamp (1.2) to the actuator stem, making sure that the fastening screw rests in the groove of the actuator stem.
2. Fasten the associated pick-up lever D1 or D2 (with 355/700 cm<sup>2</sup> actuators) to the feedback lever of the positioner.
3. Secure the intermediate plate (15) with the gasket facing towards the actuator yoke.
4. Position the positioner such that the pick-up lever slides in line over the pin (1.1) of the clamp (1.2). Fasten the positioner to the intermediate plate (15).
5. Mount cover (16).
6. Check whether the correct range spring has been installed as listed in Table 4! Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and fix it at the outer hook-in holes.

### Actuators with 240, 350, 355 and 700 cm<sup>2</sup> diaphragm areas

7. Make sure that the tip of the gasket (16) projecting from the side of the connection block (Fig. 2, middle) is positioned to match the actuator symbol for the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts". If this is not the case, unscrew the three fastening screws and lift off the cover. Turn the gasket (16) by 180° and re-insert it.  
The old connection block version requires the switch plate (13) to be turned to align the actuator symbol with the arrow marking.

8. Place the connection block with the associated gaskets against the positioner and the actuator yoke. Fasten it using the screw.

For actuators with fail-safe action "actuator stem retracts", additionally mount the external signal pressure pipe.

### Actuator (120 cm<sup>2</sup>)

The signal pressure is transmitted to the diaphragm chamber over the switchover plate (Fig. 2 and Fig. 3, bottom).

7. Remove screw plug on the back of the positioner (Fig. 4) and seal the side signal pressure output with the stopper included in the accessories.
8. Mount the positioner so that the hole in the intermediate plate (15) covers the seal in the hole of the actuator yoke.
9. Align the switchover plate with the corresponding actuator symbol. Fasten it to the actuator yoke.

---

#### **NOTICE**

*If a solenoid valve or a similar device is additionally mounted onto a 120 cm<sup>2</sup> actuator, do not remove the M3 screw plug at the back of positioner. In this case, the signal pressure must be transmitted from the signal pressure output to the actuator over an additional **connecting plate** (Table 2). The switchover plate is not used in this case.*

---

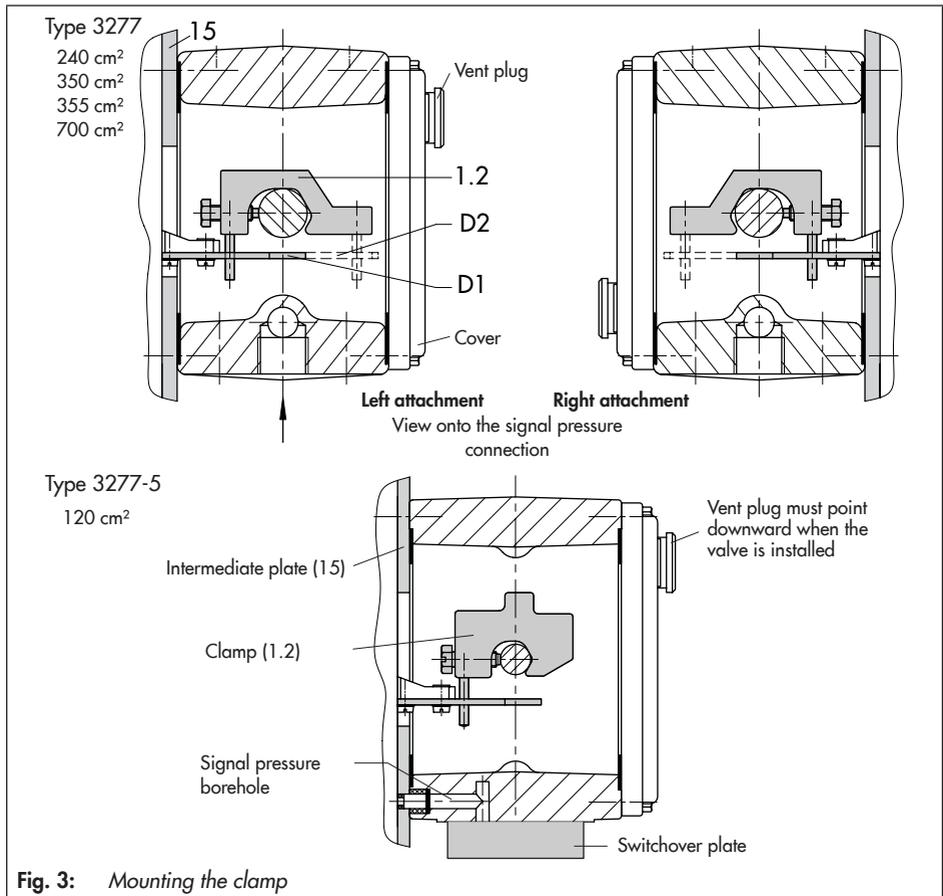
**Air purging of the spring chamber**

If the spring chamber of the actuator is to be purged with the exhaust air from the positioner, use piping (Table 3) to connect the spring chamber (with "actuator stem extends" version) to the connection block. To do so, remove the stopper from the connection block. For an actuator with fail-safe action "actuator stem retracts" and in Type 3277-5 Actuators with an effective dia-

phragm area of 120 cm<sup>2</sup>, the exhaust air from the positioner is connected to the actuator chamber over an internal hole.

**NOTICE**

*When the valve is installed, the side cover of the actuator must be mounted such that the vent plug points downward.*



**Fig. 3:** Mounting the clamp

## Mounting on control valves

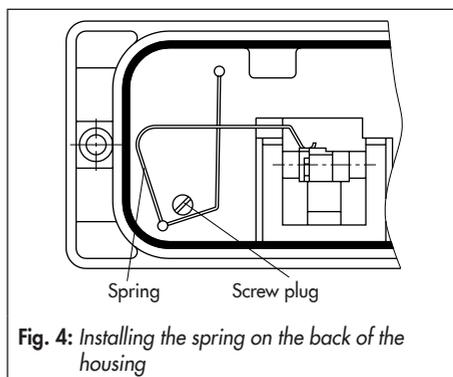
Table 1: Lever (see Fig. 3)		Mounting kit	
Actuator size	Lever with associated clamp and intermediate plate	Order no.	
120 cm <sup>2</sup>	D1 lever with stopper for output (38)	Standard version 1400-7116	
		Version compatible with paint 1402-0944	
240/350 cm <sup>2</sup>	D1 lever (33 mm long with 17 mm clamp)	Standard version 1400-6370	
		Version compatible with paint 1402-0942	
355/700 cm <sup>2</sup>	D2 lever (44 mm long with 13 mm clamp)	Standard version 1400-6371	
		Version compatible with paint 1402-0943	
Table 2: Switchover plates and connecting plates		Order no.	
Switchover plate (for 120 cm <sup>2</sup> actuator)	Type 3277-5xxxxxx. <b>00</b> Actuator (old)	1400-6819	
New switchover plate	Type 3277-5xxxxxx. <b>01</b> Actuator (new) or higher	1400-6822	
Connecting plate for additional attachment of, e.g. a solenoid valve	Type 3277-5xxxxxx. <b>00</b> Actuator (old), G 1/8	1400-6820	
	Type 3277-5xxxxxx. <b>00</b> Actuator (old), 1/8 NPT	1400-6821	
New connecting plate	Type 3277-5xxxxxx. <b>01</b> Actuator (new) or higher G 1/8 and 1/8 NPT	1400-6823	
<b>Note:</b> Only new switchover and connecting plates can be used with new actuators (index <b>01</b> ). Old and new plates are not interchangeable.			
Required connection block for 240, 350, 355 and 700 cm <sup>2</sup> actuator (including gaskets and fastening screw)	G 1/4	1400-8819	
	1/4 NPT	1402-0901	
Table 3: Pipe connection	Material	Actuator size [cm <sup>2</sup> ]	Order no.
Required pipe connection including screw fitting  For actuator with "actuator stem retracts" or with air purging of the top diaphragm chamber	Steel	240	1400-6444
	Stainless steel	240	1400-6445
	Steel	350	1400-6446
	Stainless steel	350	1400-6447
	Steel	355/700	1400-6448
	Stainless steel	355/700	1400-6449
Table 4: Range spring	Travel [mm]	Actuator size [cm <sup>2</sup> ]	Order no.
2 (4.5 coils)	7.5	120, 240	1400-6443
1 (9.5 coils, installed as standard)	10 to 15	120, 240 and 350	1400-6442
2	15	355/700	1400-6443
1	30	355/700	1400-6442

Accessories		Order no.
Pressure gauge mounting block (only for 120 cm <sup>2</sup> )	G ¼	1400-7458
	¼ NPT	1400-7459
Pressure gauge mounting kit for supply pressure and signal pressure	Stainless steel/brass	1400-6950
	Stainless steel/stainless steel	1400-6951
Filter check valve, replaces vent plug and increases the degree of protection to IP65		
Filter check valve in housing with G ¼ thread	Polyamide, IP65 degree of protection	1790-7408
	1.4301, IP65 degree of protection	1790-7253
	Polyamide, NEMA 4 degree of protection	1790-9645
	1.4301, NEMA 4 degree of protection	1790-9646
Assortment of spare parts including gaskets and diaphragms		1400-9895

### 3.2 Attachment according to IEC 60534-6

Required mounting parts are listed in Table 5. The rated travel of the valve determines which lever and range spring (Table 6) are required.

An adapter housing is used for attachment (Fig. 6). The valve travel is transmitted by the lever (18) and the shaft (25) to the bracket (28) of the adapter housing and then passed on to the pin (27a) on the lever of the positioner. To ensure that the pin (27a) is properly located in the bracket (28), fix the spring included in the accessories at the back of the positioner housing as illustrated in Fig. 4.



**Fig. 4:** *Installing the spring on the back of the housing*

The positioner can be mounted either on the left or right side of the control valve (Fig. 5 and Fig. 6). Turn the positioner at the adapter housing by 180° to determine or change the operating direction of the positioner/control valve unit.

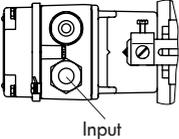
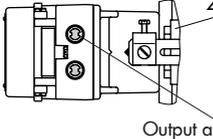
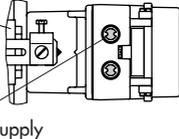
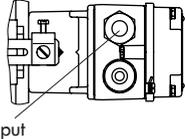
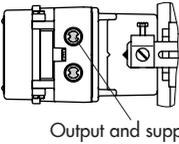
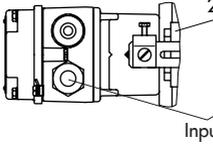
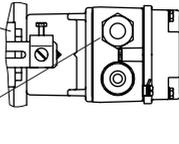
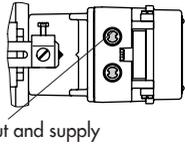
Left attachment		Right attachment	
Mounting position on the plate looking onto the travel pick-off (20), actuator facing upward (see also Fig. 6)			
Actuator with "actuator stem extends" (FA) fail-safe action			
Direct operating direction >>	Reverse operating direction <<	Direct operating direction >>	Reverse operating direction <<
			
Actuator with "actuator stem retracts" (FE) fail-safe action			
Direct operating direction >>	Reverse operating direction <<	Direct operating direction >>	Reverse operating direction <<
			

Fig. 5: Attachment to the left or right of the valve for NAMUR attachment (IEC 60534-6)

### 3.2.1 Mounting sequence

➔ Mounting parts and range spring: see Table 4/Table 5; mounting according to Fig. 6.

#### Valve with cast yoke

1. Screw the plate (20) to the stem connector of the actuator and plug stems using the countersunk screws.  
Use the additional bracket (32) for 2100 and 2800 cm<sup>2</sup> actuators with 120 mm travel.
2. Remove the rubber stopper from the adapter housing and fasten the adapter housing either on the left or right of the NAMUR rib using the hex head screw as shown in Fig. 5.

#### Valve with rod-type yoke

1. Screw the plate (20) to the follower clamp of the plug stem.
2. Screw the studs (29) into the adapter housing.
3. Place the adapter housing with the plate (30) onto either the left or right valve rod and screw tight using the nut (31). Make sure that the adapter housing is at the correct height to mount the lever (18) so that it is in a horizontal position when the valve is at mid-travel.
4. Screw the pin (19) into the middle row of holes on the plate (20) and lock it into position over the correct lever marking (1 or 2) as indicated in Table 6.
5. Clamp the clip (21) onto the lever (18). The clip must be clamped onto the lever (18) with the open side facing down-

ward when the positioner is attached with the air connection at the front.

6. Attach the lever (18) including clamping plate (22) to the shaft (25), making sure that the clip clasps the pin (19).

### 3.2.2 Initial adjustment of travel

1. Move the valve to 50 % travel.
2. Move the shaft (25) in the adapter housing so that the black pointer (24) matches the cast marking on the adapter housing.
3. Fasten the clamping plate (22) in this position using the screw (23).
4. Screw the pin (27a) into the positioner lever on the side where the press nut is located. Lock it in position with the hex nut on the other side, observing the mounting position **A** or **B** according to Table 6 and Fig. 6.
5. Place the positioner on the adapter housing, taking into account the mounting direction. Fasten it, making sure that the pin (27a) rests against the bracket (28). The pin must not slip out of the bracket once installed.
6. Check whether the correct range spring has been installed as listed in Table 6. Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and fix it at the outer hook-in holes.
7. Perform positioner setting as described in Chapter 5.1.

Mounting position

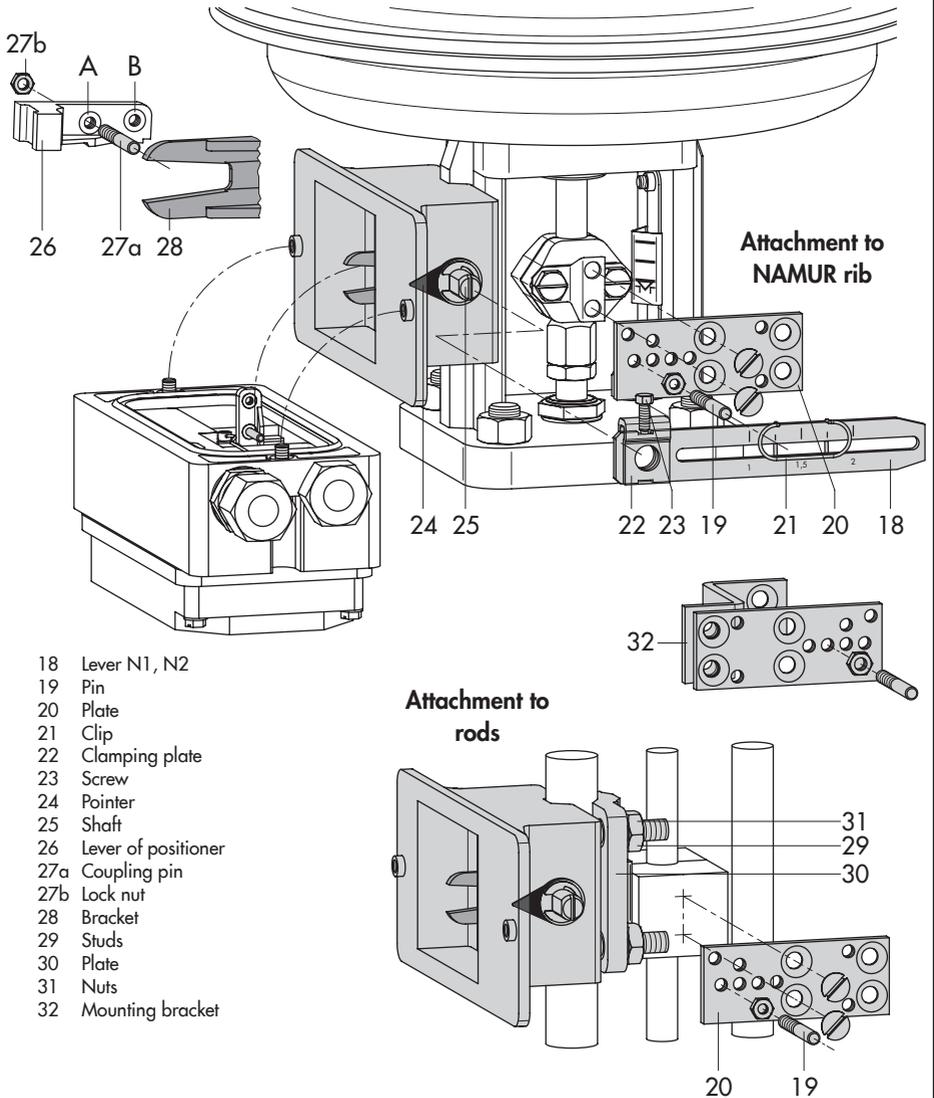


Fig. 6: Attachment according to IEC 60534-6 (NAMUR)

## Mounting on control valves

Table 5: Mounting kits		Control valve		Travel [mm]		With lever		Order no.				
NAMUR mounting kit, See Fig. 6 for parts	Valve with cast yoke		7.5 to 60		N1 (125 mm)		1400-6787					
			22.5 to 120		N2 (212 mm)		1400-6789					
	Rod diameter [mm] of rod-type yoke	20 to 25				N1		1400-6436				
		20 to 25				N2		1400-6437				
		25 to 30				N1		1400-6438				
		25 to 30				N2		1400-6439				
		30 to 35				N1		1400-6440				
		30 to 35				N2		1400-6441				
Attachment to Fisher and Masoneilan linear actuators (one of each mounting kits is required per actuator)								1400-6771 and 1400-6787				
Additional range spring acc. to Table 6		Range spring 1 (9.5 coils, installed as standard) Range spring 2 (4.5 coils)						1400-6442 1400-6443				
<b>Accessories</b>								Order no.				
Pressure gauge mounting block			G ¼						1400-7458			
			¼ NPT						1400-7459			
Pressure gauge kit			Stainless steel/brass						1400-6950			
			Stainless steel/stainless steel						1400-6951			
Filter check valve, replaces vent plug and increases the degree of protection to IP65												
Filter check valve in housing with G ¼ thread			Polyamide, IP65 degree of protection								1790-7408	
			1.4301, IP65 degree of protection								1790-7253	
			Polyamide, NEMA 4 degree of protection								1790-9645	
			1.4301, NEMA 4 degree of protection								1790-9646	
Assortment of spare parts including gaskets and diaphragms								1400-9895				

Table 6: Mounting position											
Travel [mm] <sup>1)</sup>	7.5	15	15	30	30	60	30	60	60	120	
Pin at marking <sup>1)</sup>	1	2	1	2	1	2	1	2	1	2	
Distance between pin and lever fulcrum	42 to 84 mm						84 to 168 mm				
With lever	N1 (125 mm long)						N2 (212 mm long)				
Pin (27a) at position	A		A		B		A		B		
Required range spring (see Table 5)	2		1		1		1		1		

<sup>1)</sup> Calculate intermediate values

### 3.3 Attachment to rotary actuators

The positioner can also be mounted on rotary actuators according to VDI/VDE 3845 (September 2010) using the mounting parts listed in Table 7.

pneumatic control unit of the positioner using the cam disk of the actuator shaft and a feeler roll on the positioner lever.

The rotary motion of these actuators is converted into a linear motion required by the

<b>Table 7: Complete mounting parts, including range spring 2, but not including the cam disk</b>		Order no.
Actuator acc. to VDI/VDE 3845 (September 2010), fixing level 2		1400-8815
SAMSON Type 3278 Actuator VETEC Type S	160 cm <sup>2</sup>	1400-7103
	320 cm <sup>2</sup>	1400-7104
VETEC Type R	R 110 to R 250	1400-7117
Attachment Masoneilan	Camflex I, DN 25 to 100	1400-7118
	Camflex I, DN 125 to 250	1400-7119
	Camflex II	1400-7120
<b>Required range spring</b>		Order no.
Standard operation of reference variable, range spring 2 (4.5 coils)		1400-6443
Split-range operation, range spring 1 (9.5 coils, installed as standard)		1400-6442
<b>Cam disk with accessories</b>		Order no.
~, linear basic characteristic <sup>3)</sup>	(0050-0072), 0 to 90° opening angle, also for Type 3310	1400-6664
~, equal percentage basic characteristic <sup>3)</sup>	(0050-0073), 0 to 90° opening angle	1400-6665
~, linear <sup>1)</sup>	(0050-0080), 0 to 70° opening angle, for control butterfly valves	1400-6774
~, equal percentage <sup>2)</sup>	(0050-0081), 0 to 70° opening angle, for control butterfly valves	1400-6775
~, linear <sup>1)</sup>	(0050-0074, VETEC), 0 to 75° opening angle	1400-6666
~, equal percentage <sup>2)</sup>	(0050-0075, VETEC), 0 to 75° opening angle	1400-6667
~, linear <sup>1)</sup>	(0059-0007, Camflex) to be set between 0 and 55°	1400-6637
~, equal percentage <sup>2)</sup>	(0059-0008, Camflex) to be set between 0 and 55°	1400-6638
<b>Accessories</b>		
See list on page 24		

<sup>1)</sup> Linearizes the flow characteristic

<sup>2)</sup> Creates an equal percentage flow characteristic

<sup>3)</sup> Based on opening angle

### NOTICE

Check whether the correct range spring has been installed as listed in Table 7. Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and fix it at the outer hook-in holes.

Double-acting springless rotary actuators require the use of a **reversing amplifier** on the connection side of the positioner housing (see Chapter 3.3.4).

When using a reversing amplifier, the pressure regulator (9, Fig. 1) must be turned clockwise as far as it will go (also see Chapter 4.1.2).

When attaching the positioner to the SAMSON Type 3278 Rotary Actuator (Fig. 7, left), the inside of the actuator and the unused reverse side of the diaphragm are purged with the positioner's exhaust air. Additional piping is not required.

When attaching the positioner to actuators from other manufacturers (Fig. 7, right), the reverse side of the diaphragm can be purged with air over a pipe connection installed between the actuator and intermediate piece.

### 3.3.1 Mounting the lever with feeler roll

1. Place the lever with feeler roll (35) on the side of the lever (37) opposite to where the press nuts are located and secure it using the supplied screws (38) and washers.

### NOTICE

To ensure a close physical contact between the lever with feeler roll and the cam disk, attach the spring contained in the accessories kit (order no. 1400-6660) to the back of the positioner housing (see Fig. 4).

## 3.3.2 Mounting the intermediate piece

### SAMSON Type 3278 Actuator

1. Fasten the adapter (36) to the free shaft end of the rotary actuator.
2. Fasten the intermediate piece (34) to the actuator housing using two screws. Align the intermediate piece so that the air connections of the positioner point toward the diaphragm case side.
3. Align the cam disk (40) and scale (39) as described in Chapter 3.3.3 and fasten.

### Actuators according to VDI/VDE 3845 (09/2010) (fixing level 2)

1. Place the assembled intermediate piece (34, 44, 45 and 42) onto the mounting bracket included in the scope of actuator delivery and fasten.
2. Align the cam disk (40) and scale (39) as described in Chapter 3.3.3 and fasten.

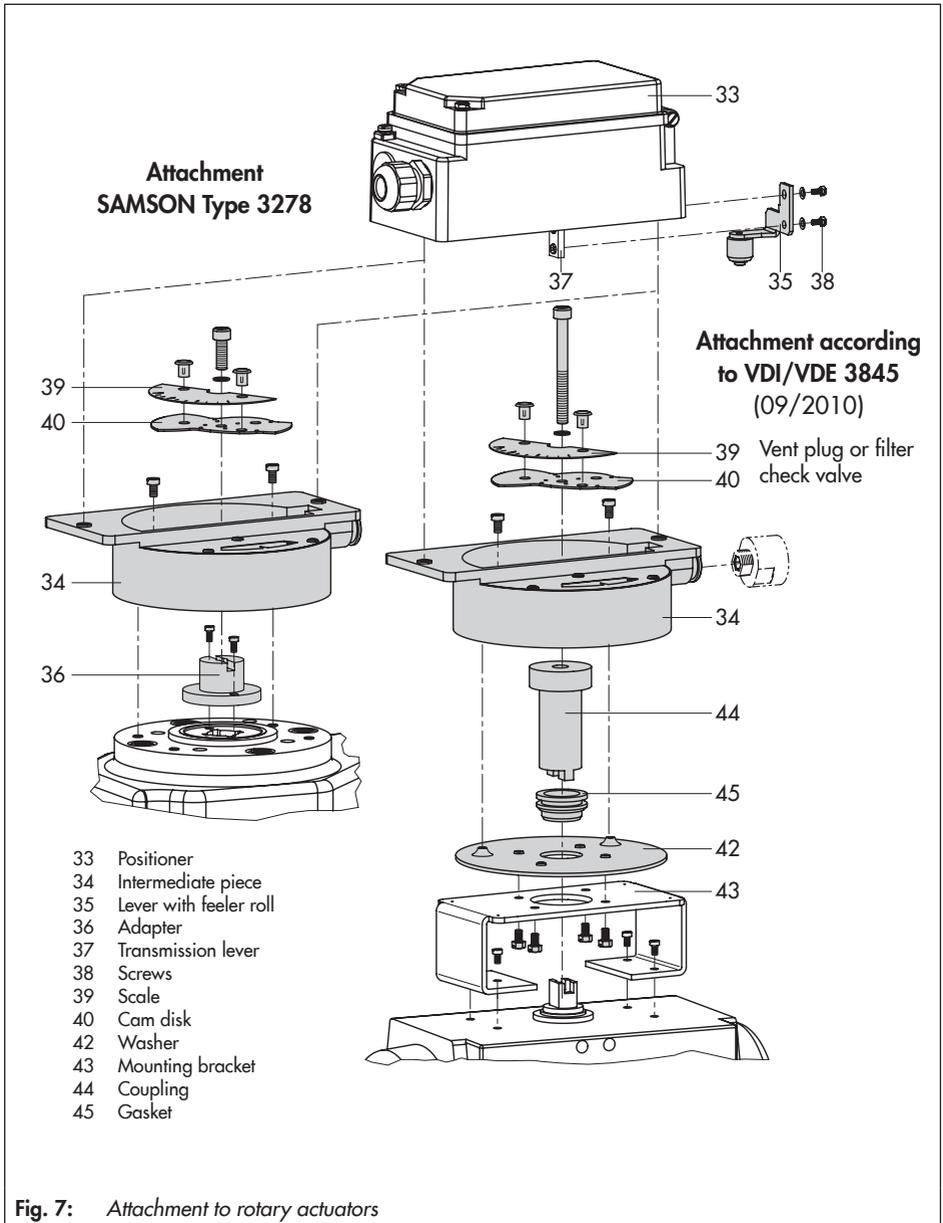


Fig. 7: Attachment to rotary actuators

### 3.3.3 Basic setting of the cam disk

The valve model used determines the basic setting of the cam disk.

---

**NOTICE**

*Cam disks tailored to the special characteristic of a valve cause the valve to open in a non-linear or non-equal percentage way. The visible difference between the set point (4 to 20 mA) and the actual position (opening angle) does not constitute a system deviation of the positioner.*

---

Fig. 8 and Fig. 9 show linear cam disks.

Fig. 8 illustrates a control valve assembly with a rotary actuator with spring-return mechanism that opens counterclockwise. The arrangement of the springs in the actuator determines the fail-safe position of the valve.

Fig. 9 shows how to adjust the cam disk when a double-acting springless rotary actuator is used. The direction of rotation (either counterclockwise or clockwise) depends on the actuator and valve model used. The cam disk must be set when the valve is closed.

Use the turnboard (7) to adjust the operating direction of the positioner, i.e. whether the valve opens or closes when the reference variable increases (direct >> or reverse <>).

Each cam disk carries two cam sections whose starting points are indicated by small holes. Depending on the operating direction of the rotary actuator (air-to-open or air-to-close), the starting point of the cam, either marked **N** (standard characteristic) or **I** (reverse characteristic), must point towards the lever with feeler roll. When the starting point is located on the back of the cam disk, turn over the cam disk.

---

**NOTICE**

*The starting point (hole) of the selected cam must be aligned so that the fulcrum of the cam disk and 0° position on the scale as well as the arrow on the window are in line with each other.*

---

When aligning the cam disk, clip the double-sided scale disk on the cam disk, while making sure that the value on the scale matches the valve's direction of rotation.

---

**NOTICE**

*Make sure the 0° position of the scale always corresponds to CLOSED position. Therefore, for fail-open actuators and for springless actuators, the maximum supply pressure needs to be applied to the actuator before aligning the cam disk.*

---

**Single-acting rotary actuator with spring-return mechanism**

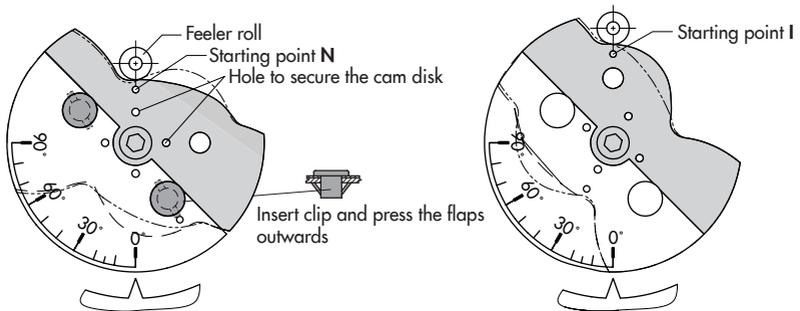
**Linear cam disk** (equal percentage cam disk is represented by a broken and dotted line)

**Control valve opens counterclockwise**

For valves that open clockwise, the cam disk must be turned over so that lever with feeler roll moves over the same disk segments as shown in the images below, but with the cam disk turning clockwise.

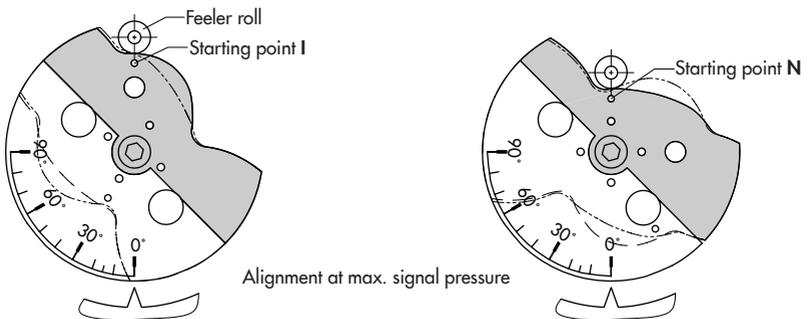
Fail-safe action: **fail-close valve**

Direct operating direction >>				Reverse operating direction <<			
Reference variable	Signal pressure	Valve	Characteristic	Reference variable	Signal pressure	Valve	Characteristic
increases	increases	opens	N	decreases	increases	opens	I



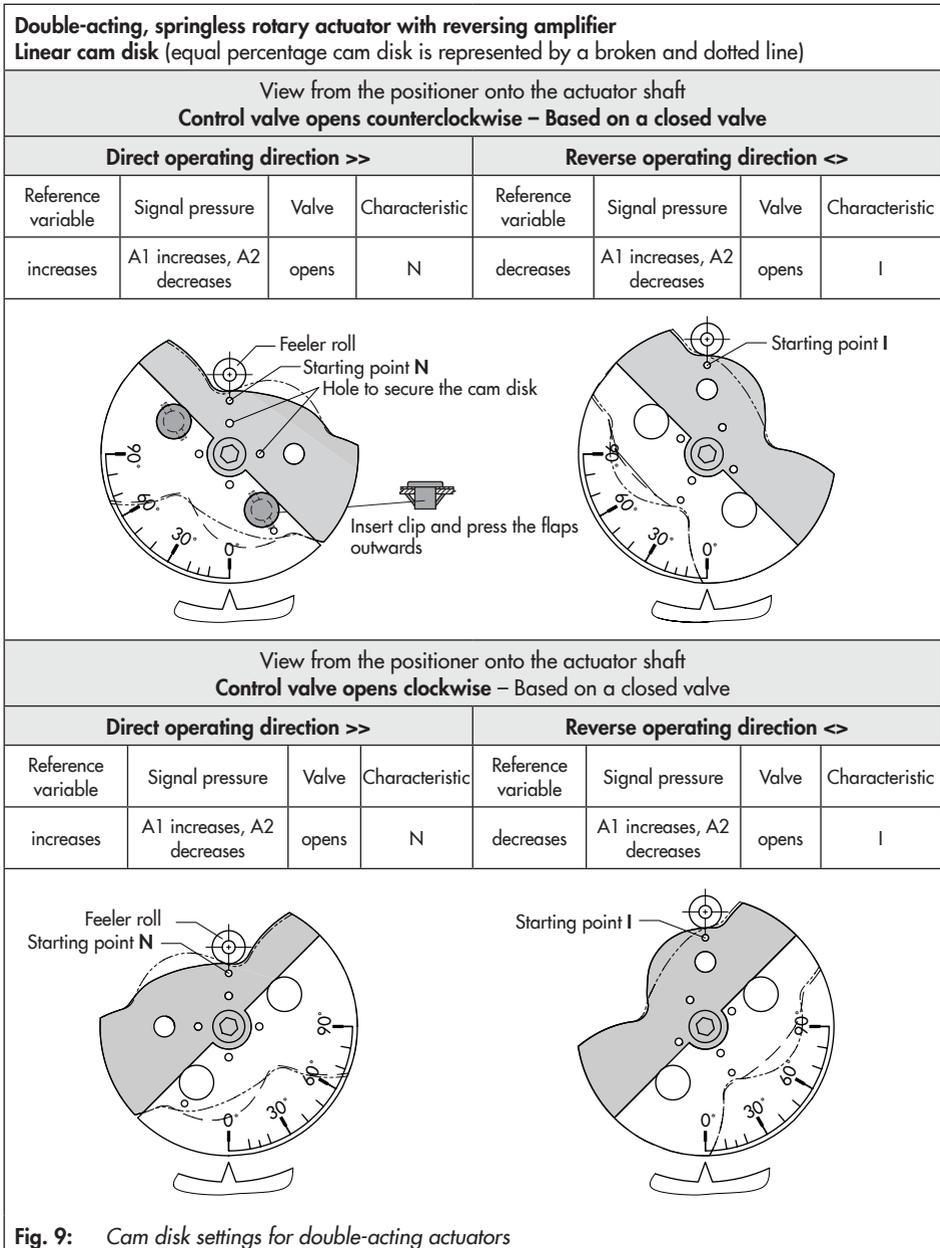
Fail-safe action: **fail-open valve**

Direct operating direction >>				Reverse operating direction <<			
Reference variable	Signal pressure	Valve	Characteristic	Reference variable	Signal pressure	Valve	Characteristic
decreases	decreases	opens	I	increases	decreases	opens	N



**Fig. 8:** Cam disk settings for single-acting actuators

## Mounting on control valves



### Securing the aligned cam disk

To prevent the cam disk from turning, drill a hole into the adapter (36) or coupling (44) to allow a 2 mm dowel pin to be inserted.

Select one of the four holes located around the center hole of the cam disk to secure the cam disk in position.

### 3.3.4 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier, e.g. the SAMSON Type 3710 Reversing Amplifier (see Mounting and Operating Instructions ► EB 8392).

The signal pressure of the positioner is supplied at the output  $A_1$  of the reversing amplifier. An opposing pressure, which equals the required supply pressure  $Z$  when added to the pressure at  $A_1$ , is applied at output  $A_2$ . The rule  $A_1 + A_2 = Z$  applies.

If a different reversing amplifier (item no. 1079-1118 or 1079-1119) is used, follow the mounting instructions described below:

#### Mounting

##### **NOTICE**

*When using a reversing amplifier, the pressure regulator (9) must be turned as far as it will go in the clockwise direction.*

*Remove the sealing plug (1.5) before mounting the reversing amplifier. The rubber seal (1.4) must remain installed.*

1. Screw the special nuts (1.3) from the accessories of the reversing amplifier into the threaded connections of the positioner.
2. Insert the flat gasket (1.2) into the recess of the reversing amplifier and slide both the hollowed special screws (1.1) into the connecting boreholes  $A_1$  and  $Z$ .

3. Place the reversing amplifier onto the positioner and screw tight using the two special screws (1.1).
4. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes  $A_1$  and  $Z$ .

#### Signal pressure connections

**A<sub>1</sub>:** Connect output  $A_1$  to the signal pressure connection on the actuator that causes the valve to open when the pressure rises.

**A<sub>2</sub>:** Connect output  $A_2$  to the signal pressure connection on the actuator that causes the valve to close when the pressure rises.

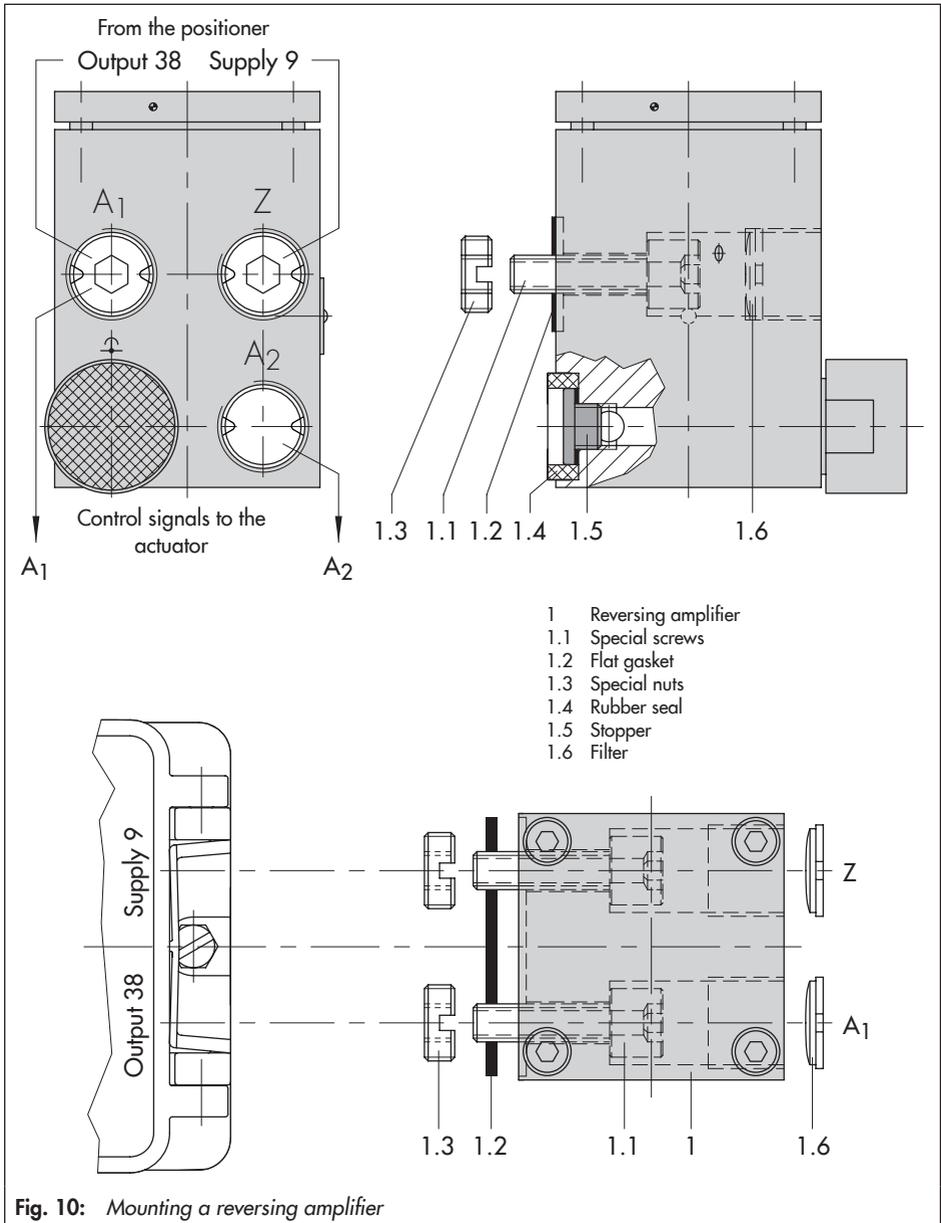
#### Pressure gauge attachment

The mounting sequence shown in Fig. 10 remains unchanged. Screw a pressure gauge bracket onto the connections  $A_1$  and  $Z$ .

Pressure gauge bracket:

- G 1/4: 1400-7106
- 1/4 NPT: 1400-7107

Pressure gauges for supply air  $Z$  and output  $A_1$  as listed in Table 4, Table 5 and Table 7.



## 4 Connections

### 4.1 Pneumatic connections

The pneumatic connections are optionally designed as a bore with  $\frac{1}{4}$  NPT or G  $\frac{1}{4}$  thread. Customary fittings for metal or copper tubing or plastic hoses can be used.

#### ! NOTICE

*The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.*

*Blow through all air pipes and hoses thoroughly before connecting them.*

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts".

#### Exhaust air

Models with index 3766-x...x.03 and higher are equipped with a hinged cover without its own exhaust air port. The exhaust air connections for these models are included in the accessories.

The vent plug is located on the plastic cover of the actuator for direct attachment, whereas for NAMUR attachment, it is located on the adapter housing. The vent plug is located

on the intermediate piece or reversing amplifier for attachment to rotary actuators.

#### ! NOTICE

*If you intend to replace older models with index 3766-x...x.02 or lower, the mounting parts may need to be replaced as well.*

### 4.1.1 Pressure gauges

To precisely tune the positioner, we recommend installing pressure gauges for the supply air and signal pressure.

The required parts are listed as accessories in Table 4, Table 5 and Table 7.

### 4.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action).

The bench range is written on the nameplate either as the bench range or signal pressure range. The operating direction is marked **FA** or **FE** or by a symbol.

#### Actuator stem extends (FA):

#### Fail-close

(for globe and angle valves)

Required supply pressure =  
Upper bench range value + 0.2 bar,  
at least 1.4 bar.

**Actuator stem retracts (FE):****Fail-open**

(for globe and angle valves)

For tight-closing valves, the maximum signal pressure  $p_{st_{max}}$  is roughly estimated as follows:

$$p_{st_{max}} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A} \text{ [bar]}$$

$d$  = Seat diameter [cm]

$\Delta p$  = Differential pressure across the valve [bar]

$A$  = Actuator area [cm<sup>2</sup>]

$F$  = Upper bench range value of the actuator [bar]

**If there are no specifications, calculate as follows:**

Required supply pressure =

Upper bench range value + 1 bar

**Pressure regulator**

After tilting the cover plate back, the pressure regulator (9) can be continuously adjusted. When the adjuster is turned counter-clockwise as far as it will go, signal pressures for spring ranges up to 2.5 bar are controlled. When the adjuster is turned clockwise all the way, signal pressures for spring ranges up to 6.0 bar are controlled.

If the signal pressure must not exceed a certain value, this limit can be adjusted using a pressure gauge (accessories).

## 4.2 Electrical connections

### DANGER

*For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance.*

*The following regulations apply to installation in hazardous areas: EN 60079-14: 2008 (VDE 0165, Part 1) Explosive Atmospheres – Electrical Installations Design, Selection and Erection.*

*Adhere to the terminal assignment. Switching the assignment of the electrical terminals may cause the explosion protection to become ineffective. Do not loosen enameled screws in or on the housing. The maximum permissible values specified in the EC-type examination certificates apply when interconnecting intrinsically safe electrical equipment ( $U_i$  or  $U_o$ ,  $I_i$  or  $I_o$ ,  $P_i$  or  $P_o$ ,  $C_i$  or  $C_o$  and  $L_i$  or  $L_o$ ).*

### Selecting cables and wires

Observe **clause 12 of EN 60079-14: 2008** (VDE 0165, Part 1) for installation of the intrinsically safe circuits.

Clause 12.2.2.7 applies when running multi-core cables and wires with more than one intrinsically safe circuit.

The radial thickness of the insulation of a conductor for common insulating materials (e.g. polyethylene) must not be smaller than 0.2 mm.

The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules.

When two separate cables are used for connection, an additional cable gland can be installed.

Seal cable entries left unused with plugs.

Fit equipment used in ambient temperatures **below  $-20\text{ }^{\circ}\text{C}$**  with metal cable entries.

### Zone 2/Zone 22

In equipment operated according to type of protection Ex nA II (non-sparking equipment) according to EN 60079-15:2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.

Equipment connected to energy-limited circuits with type of protection Ex nL according to EN 60079-15:2003 may be switched under normal operating conditions.

**The maximum permissible values specified in the statement of conformity and its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.**

The wires for the reference variable must be connected to the terminals 11 and 12 located in the housing.

In general, it is not necessary to connect the device to a bonding conductor. Should this be required, however, this conductor can be connected inside the device or outside on the device.

Depending on the version, the positioner is equipped with inductive limit contacts and/or a solenoid valve.

Versions with position transmitter do not permit the connection of additional equipment.

The position transmitter is operated on a two-wire circuit. The usual supply voltage is 24 V DC.

Taking the resistance of the supply leads into account, the voltage at the position transmitter terminals can be between 12 and 45 V DC.

Refer to Fig. 11 or to the label on the terminal block.

## Accessories

M20x1.5 cable gland:

Version	Order no.	Clamping range
Black plastic	1400-6985	5.5 to 13 mm
Blue plastic	1400-6986	5.5 to 13 mm
Nickel-plated brass	1890-4875	6 to 12 mm

Adapter M20x1.5 to NPT:

Powder-coated aluminum,  
order no. 0310-2149

### 4.2.1 Switching amplifier

The operation of the inductive limit contacts requires switching amplifiers in accordance with EN 60947-5-6 to be connected in the output circuit. Observe the relevant regulations for installation in hazardous areas.

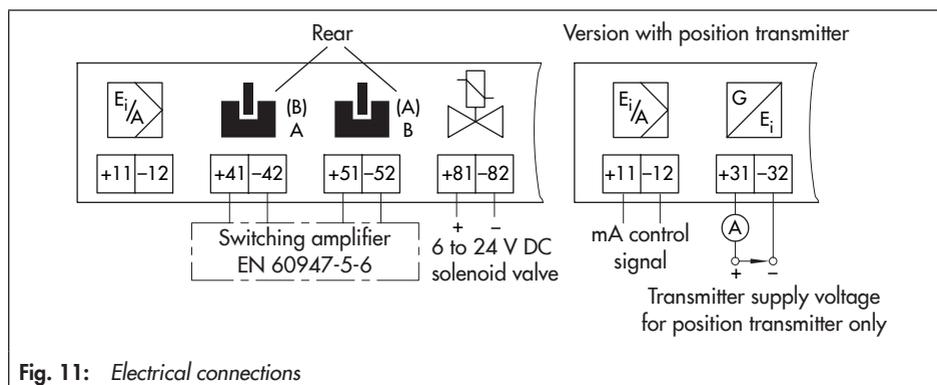


Fig. 11: Electrical connections

## 5 Operation

### 5.1 Tuning the positioner mounted onto the control valve

#### Starting point and reference variable

When adjusting the positioner directly at the control valve, the travel (opening angle) must be adapted to the reference variable.

With a reference variable, for example 0.2 to 1 bar, the valve must move through its entire travel range from 0 to 100 % (Fig. 12, left).

For positioners for rotary actuator, an opening angle, for example 0 to 70° must be assigned to the reference variable.

The starting point is based on the CLOSED position of the valve.

Depending on the actuator version ("actuator stem extends" or "actuator stem retracts") and the operating direction of the positioner

(> or <), this starting point can be either the lower or upper range value (0.2 or 1 bar) of the reference variable.

The reference variable range and thus the upper range value determine the travel of the valve.

In split-range operation (Fig. 12, right), the control valves work with smaller reference variable ranges. The controller output signal is used to control two control valves, dividing it such that the valves move through their entire travel range at half the input signal range each (e.g. first valve set to 0.2 to 0.6 bar, second valve set to 0.6 to 1 bar). To avoid overlapping, allow for a dead band of  $\pm 0.05$  bar as shown in Fig. 12.

The **starting point** (zero) is adjusted at the zero adjuster (**6.2**); the span, i.e. the upper range value, is adjusted at the span adjuster (**6.1**).

During the adjustment, connect a suitable pressure adjuster to the signal input and apply air to the supply air input.

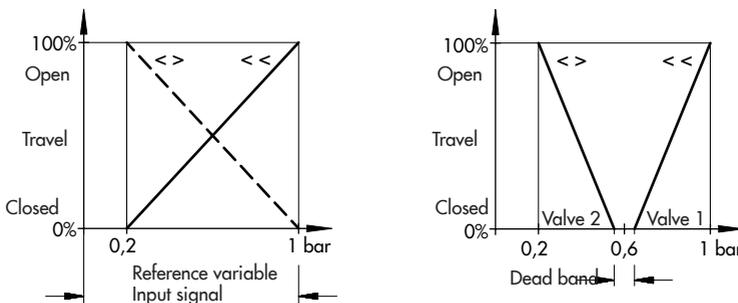


Fig. 12: Normal or split-range operation

### 5.1.1 Adjusting the proportional band Xp and air delivery Q

1. Close the volume restriction (11) as far as the required positioning speed permits.  
Check the positioning speed by pushing the diaphragm lever (3) as far it will go.
2. Adjust the reference variable at the input to approx. 50 % of its range.
3. Turn the zero adjuster (6.2) until the valve has reached approx. mid-travel.
4. Use the adjuster (8) to set the proportional band Xp to a value half way (half turn).
5. Check the valve's tendency to hunt and the positioning speed by briefly tapping the diaphragm lever (3).  
The Xp value is to be adjusted to be as small as possible, without considerable overshooting occurring.

#### NOTICE

*Always adjust the Xp restriction before setting the starting point.  
Changing it later will cause the zero point to be shifted!*

### 5.1.2 Settings for actuator with "actuator stem extends" fail-safe action

#### NOTICE

*To allow the valve to close with full force, the diaphragm chamber must be fully vented when the reference variable reaches its lower value (operating direction <<) or upper value (operating direction <>).*

*As a result, adjust the input signal to a slightly increased starting point of 0.23 bar for direct operating direction <<; for reverse operating direction <>, adjust the input signal to a slightly reduced starting point of 0.97 bar.*

#### Starting point (e.g. 0.23 bar)

1. Adjust the input signal to 0.2 bar at the pressure adjuster.
2. Turn the zero adjuster (6.2) until the valve just starts to move from its initial position.
3. Reduce the input signal to 0 bar and slowly increase it again. Check whether the valve starts to move at exactly 0.23 bar.  
Correct any deviation at the zero adjuster (6.2).

#### Upper range value (span) e.g. 1 bar

1. Once the starting point has been set, increase the input signal to 1 bar at the pressure adjuster.

*At exactly 1 bar, the plug stem must stand still, having moved through 100 % travel (watch the travel indicator at the valve).*

## Operation

If the upper range value is incorrect, turn the span adjuster (travel). Four turns correspond to a travel change of 10 % in standard operation. In split-range operation, this value is reduced by half.

Turn the adjuster clockwise to reduce the travel and counterclockwise to increase it.

2. After the correction has been completed, reduce the input signal and slowly increase it again.  
Check the starting point and the upper range value.  
Repeat the correction procedure until both values are correct.

### 5.1.3 Settings for actuator with "actuator stem retracts" fail-safe action

#### NOTICE

*When using an actuator with fail-safe action "actuator stem retracts", the diaphragm chamber must be pressurized with a signal pressure that is high enough to tightly close the valve against the upstream pressure in the plant. This applies to an upper range value of the reference variable (1 bar) with operating direction >> as well as a lower range value of the reference variable (0.2 bar) with operating direction <>.*

The **required signal pressure** is either indicated on the positioner label or the required supply pressure can be roughly calculated as described in Chapter 4.1.2.

#### Starting point (e.g. 1 bar)

1. Adjust the input signal to 1 bar at the pressure adjuster.
2. Turn the zero adjuster (6.2) until the valve just starts to move from its initial position.
3. Increase the input signal and slowly reduce it again to 1 bar. Check whether the valve starts to move at exactly 0.1 bar.
4. Correct any deviation at the zero adjuster (6.2). Turning the adjuster counterclockwise causes the valve to move from its end position earlier; turning clockwise causes the valve to move from its end position later.

#### Upper range value (span) e.g. 0.2 bar

1. Once the starting point has been set, increase the input signal to 0.2 bar at the pressure adjuster.  
At exactly 0.2 bar, the plug stem must stand still, having moved through 100 % travel (watch the travel indicator at the valve).
2. If the upper range value is incorrect, turn the span adjuster (travel). Four turns correspond to a travel change of 10 % in standard operation. In split-range operation, this value is reduced by half.  
Turn the adjuster clockwise to reduce the travel and counterclockwise to increase it.
3. After the correction has been completed, set the input signal to 1 bar again.

4. Turn the zero adjuster (6.2) again until the pressure gauge indicates the required signal pressure (see Chapter 4.1.2).
5. If no pressure gauge has been installed, set the starting point to 0.97 bar instead.

---

**! NOTICE**

*After attaching and tuning of the positioner, make sure that the vent plug of the housing cover faces downward when the valve is installed.*

---

## 5.2 Changing the operating direction

If the operating direction of directly attached positioners (Fig. 2) is to be changed after they have been installed, turn the turnboard (7) and change the position of the connection block, positioner and clamp (1.2).

For attachment according to IEC 60534-6 (NAMUR), turn the turnboard (7) and the positioner on the adapter housing (Fig. 5).

In **positioners for rotary actuators**, reassign the cam disk as shown in Fig. 8 and Fig. 9.

For details on changing the turnboard (7), see Chapter 3.

### 5.3 Adjusting the limit contacts

The positioner version with inductive limit contacts has two adjustable tags mounted on a rotary shaft which operate the associated proximity switches (50).

The operation of the inductive limit contact requires switching amplifiers to be connected in the output circuit (see Chapter 4.2.1). When the tag (51) is located in the inductive field of the switch, the switch assumes a high resistance. When it moves outside the field, the switch assumes a low resistance.

The limit contacts are usually adjusted to issue a signal for both end positions. The switching points can also be adjusted to indicate intermediate positions.

The switches **A** and **B** must be assigned to the end positions of the control valve (valve OPEN or CLOSED) depending on the operating direction and the mounting position according to Table 8 and Table 9.

The terminals 41/42 and 51/52 can optionally be assigned to the switches **A** and **B** by turning the associated label on the terminal block (also see Fig. 11).

#### **NOTICE**

*Since the tags of the limit contacts cannot be turned by 360°, it is important to observe the correct assignment of switches **A** and **B** to the valve positions (valve CLOSED and valve OPEN), especially when the limit contacts are to be connected in safety circuits.*

The required switching function, i.e. whether the output relay is to be picked up or released when the tag enters the field, must be determined by jumpers for either load current or no-load current at the switching amplifier.

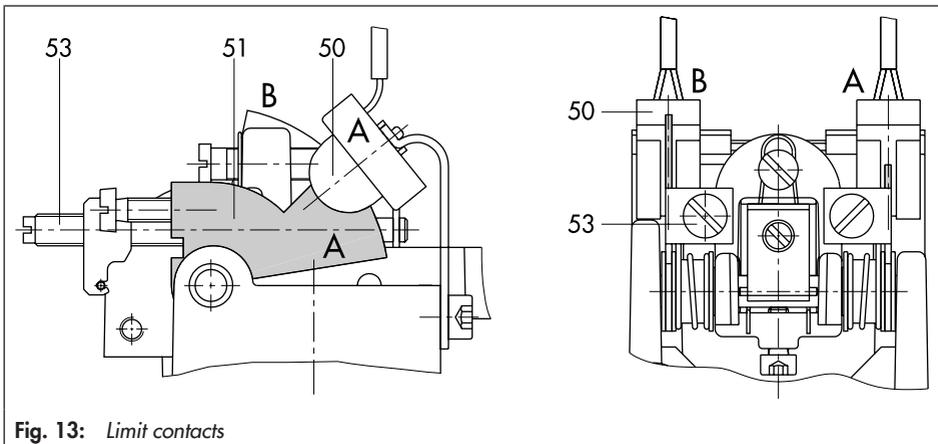


Fig. 13: Limit contacts

### Adjusting the switching point

Move the valve to the switching point and adjust the tag by turning the adjustment screw (53) so that the switching point is reached and indicated by the LED on the switching amplifier.

To guarantee the switching under all ambient conditions, adjust the switching point approx. 2 % before the mechanical stop (OPEN/CLOSED).

**NOTICE**

After tuning the positioner, make sure that the vent plug of the housing cover faces downward when the valve is installed.

**Table 8:** Direct attachment to Type 3277 Actuator (Fig. 2)

Valve position	Left attachment		Right attachment	
	Switch			
	Tag outside inductive field	Tag inside inductive field	Tag outside inductive field	Tag inside inductive field
Closed	B	A	A	B
Open	A	B	B	A

**Table 9:** Right or left attachment according to NAMUR (Fig. 5) and attachment to rotary actuators (Fig. 7)

Operating direction	Valve position	Actuator stem extends (FA)		Actuator stem retracts (FE)	
		Switch Tag		Switch Tag	
		Outside inductive field	Inside inductive field	Outside inductive field	Inside inductive field
>>	Closed	B	A	A	B
	Open	A	B	B	A
<<	Closed	A	B	B	A
	Open	B	A	A	B

## 5.4 Adjusting the position transmitter

**NOTICE**

The starting point (zero) and upper range value (span) must be set before adjusting the position transmitter.

Depending on the position of the multi-pin connector (symbol on connector: >> or <<), the feedback signal can be set to either a range of 4 to 20 mA or 20 to 4 mA for 0 to 100 % travel.

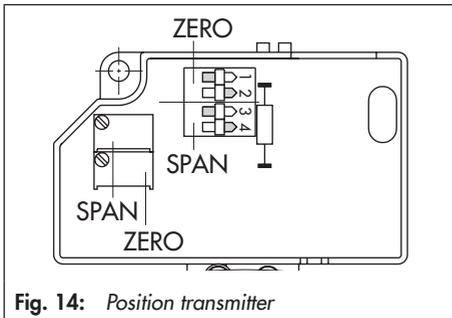


Fig. 14: Position transmitter

### Zero point

Use the switches 1 and 2 to roughly set the zero point and the ZERO potentiometer for fine-tuning. The adjusted value is always based on a 4 mA signal.

### Span

Use the switches 3 and 4 to roughly set the span, i.e. the upper range value and the SPAN potentiometer for fine-tuning. The adjusted value is always based on a 20 mA signal.

### Example:

Move the valve to the open position while observing the position transmitter signal. If the signal does not move in the desired direction, change the position of the multi-pin connector.

Adjust the zero point (4 mA) and span (20 mA) for the valve positions according to Table 10.

Valve movement	Observed feedback signal	Direction of signal	Set zero/span to
Open ↑ Closed	Signal increases ↑	OK	20 mA Valve OPEN 4 mA Valve CLOSED
		Not OK → Change connector's position	4 mA Valve OPEN 20 mA Valve CLOSED
	Signal drops ↓	OK	4 mA Valve OPEN 20 mA Valve CLOSED
		Not OK → Change connector's position	20 mA Valve OPEN 4 mA Valve CLOSED

**Zero adjustment**

1. Use the input signal of the positioner to move the valve to closed position (valve CLOSED, travel 0 %).
2. The ammeter must now indicate approx. 4 mA.
3. Correct smaller deviations at the ZERO potentiometer until the meter shows exactly 4 mA.  
For larger deviations that cannot be corrected using the potentiometer (adjustment range of approx. 20 turns), set the switches 1 and 2 to indicate an mA value which is within the adjustment range of the ZERO potentiometer.
4. Set the zero point to exactly 4 mA using the ZERO potentiometer.

**Span adjustment**

1. Use the input signal of the positioner to move the valve to end position (valve OPEN, travel 100 %).
2. The ammeter must now indicate approx. 20 mA.
3. Correct smaller deviations at the SPAN potentiometer until the meter shows exactly 20 mA. If deviations are too high, set the switches 3 and 4 to indicate an mA signal which is within the adjustment range of the SPAN potentiometer.
4. Turn the SPAN potentiometer until the ammeter shows exactly 20 mA.  
Since the zero point and span have a mutual influence on each other, repeat the correction procedure at both potentiometers until both values are correct.

### **i Note**

***The following applies to positioners with adapter housing for NAMUR attachment:***

*When the positioner and the position transmitter signal have different operating directions (<< and <>), it may be impossible to adjust the zero point of the transmitter signal due to the additional deflection caused by the bracket (28) of the adapter housing.*

*In this case, readjust the black pointer (Chapter 3.2.2 on page 22) so that the sensor of the position transmitter reaches the control range.*

*Unscrew the clamp. For "actuator stem extends" (FA), shift the pointer upward towards the actuator; for "actuator stem retracts" (FE), shift the pointer downward towards the valve. For valves with rod-type yoke, slightly shift the positioner on the rod in the downward (FE) or upward (FA) direction.*

---

### **! NOTICE**

*Every time you make a change as described above, the zero point and span of the positioner must be readjusted before adjusting the position transmitter.*

*After tuning the positioner, make sure that the vent plug of the housing cover faces downward when the valve is installed.*

---

## 6 Upgrading the positioner

The pneumatic positioner (3766-x...x.04 and higher) can be converted to form a Type 3767 Electropneumatic Positioner.

### NOTICE

*Upgrade of explosion-protected versions only on request.*

Besides the Type 6112 i/p Module (see Table 11), the associated conversion kit (including cable gland, fastening screw, clamps and cables) must be ordered.

1. Remove the holder with the terminal block (if used).
2. Unscrew the connecting plate (3) and remove the silicone hose (2). Remove the guard plate (4) and pneumatic screw fitting (1).
3. Connect the connecting cable to the terminal block and the i/p module (6). Lead the blue cable to the minus side and the red cable to the plus side. Fasten the cables with terminal screws.
4. Check whether the seals (7, 8) are properly inserted on the bottom section of the i/p module. When the module is installed (broken line in Fig. 16), the seal including restriction and filter must be located on the right above the inner hole (supply).
5. Fasten the i/p module and terminal block holder each with two screws.
6. Seal the housing on the side using the cable gland (5) or a stopper with seal.

7. Change model index on the nameplate to Type 3767 i/p Positioner.

### Note

*For details on Type 3767 Positioners, refer to Mounting and Operating Instructions*

► EB 8355-2.

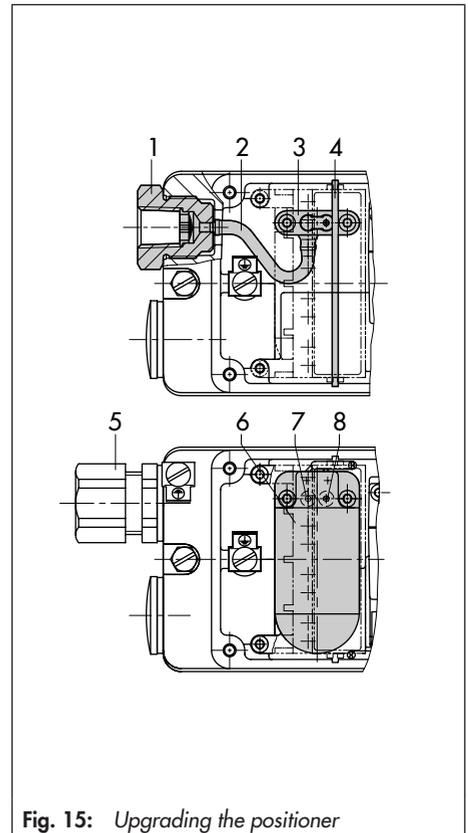


Fig. 15: Upgrading the positioner

## Upgrading the positioner

**Table 11:** *Conversion kits*

Required input signal (reference variable)	Required i/p module (order no.)	Required upgrade kit (order no.)
4 to 20 mA	6112-041110	1400-7574
0 to 20 mA	6112-042110	
1 to 5 mA	6112-043110	

## 7 After-sales service

### 7.1 Servicing explosion-protected devices

If a part of the device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity.

Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device before putting it back into operation and the passing of the routine test is documented by attaching a mark of conformity to the device.

Replace explosion-protected components only with original, routine-tested components by the manufacturer.

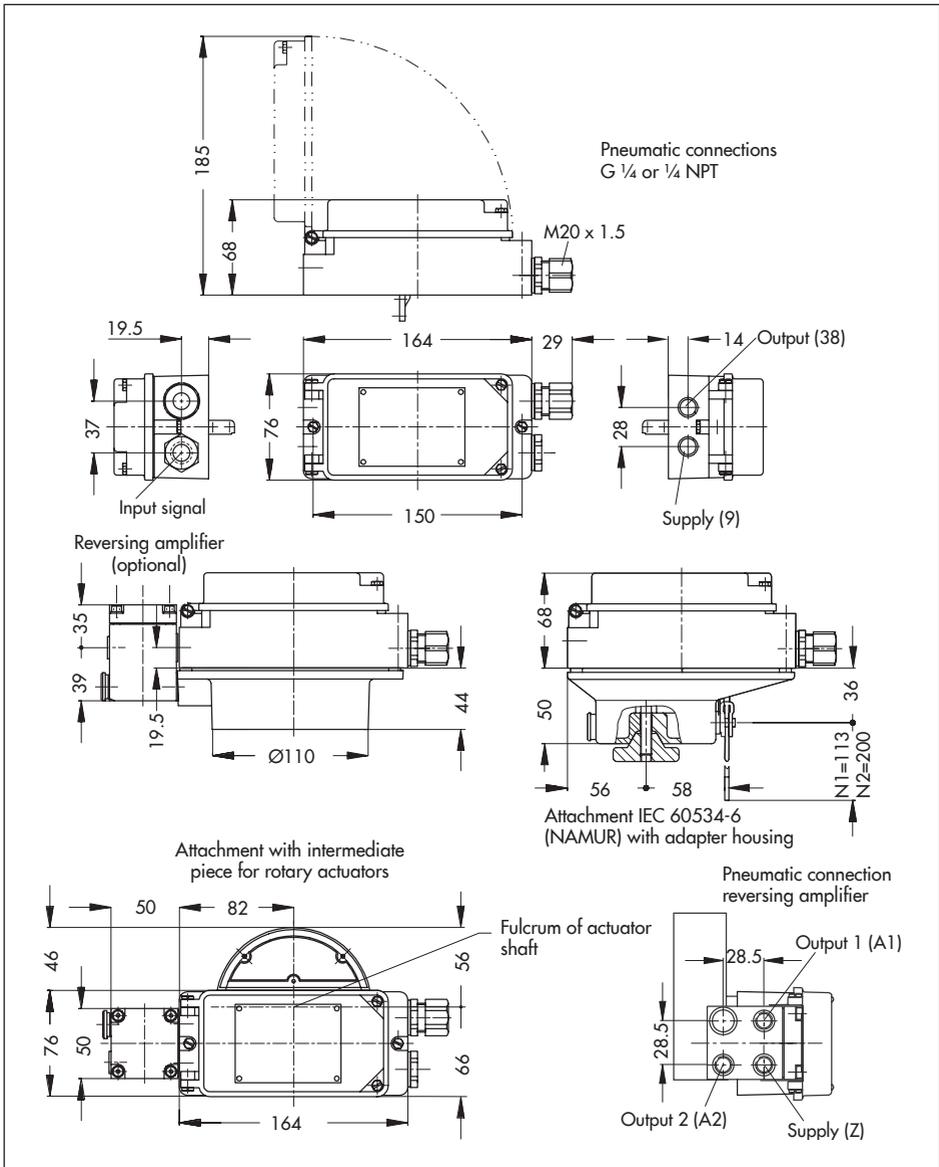
**Devices that have already been used outside hazardous areas and are intended for future use inside hazardous areas must comply with the safety requirements placed on serviced devices. Before being operated inside hazardous areas, test the devices according to the specifications for servicing explosion-protected devices. Observe EN 60079-17 during servicing.**

### 7.2 Maintenance and calibration

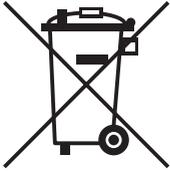
Interconnection with intrinsically safe circuits to check or calibrate the equipment inside or outside hazardous areas must be performed only with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant to explosion protection.

Observe the maximum permissible values specified in the certificates for intrinsically safe circuits.

## 8 Dimensions in mm



## 9 Disposal



SAMSON is a producer registered in Europe, agency in charge ► <https://www.ewrn.org/national-registers/national-registers>.  
WEEE reg. no.:  
DE 62194439/FR 025665

- Observe local, national and international refuse regulations.
- Do not dispose of components, lubricants and hazardous substances together with your other household waste.

---

### **i** Note

*SAMSON can provide you with a recycling passport according to PAS 1049 on request. Simply e-mail us at [offersaleservice@samsongroup.com](mailto:offersaleservice@samsongroup.com) giving details of your company address.*

---

### Tip

*On request, SAMSON can appoint a service provider to dismantle and recycle the product.*

---

## TRANSLATION

- (1) **EC TYPE EXAMINATION CERTIFICATE**
- (2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**
- (3) EC Type Examination Certificate Number
- PTB 01 ATEX 2171**
- (4) Equipment: Model 3766-1.. Positioner
- (5) Manufacturer: SAMSON AG Mess- und Regeltechnik
- (6) Address: Weismüllerstr. 3, 60314 Frankfurt am Main, Germany
- (7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.
- (8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres specified in Annex II to the Directive.
- The examination and test results are recorded in confidential report.
- PTB Ex 01-21198**
- (9) The essential health and safety requirements are satisfied by compliance with
- EN 50014: 1997 + A1 + A2    EN 50020: 1994**
- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use as specified in the schedule to this certificate.
- (11) According to the Directive 94/9/EC, this EC Type Examination Certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the Manufacture and supply of this equipment.

---

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only in its entirety without any changes.  
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt    Bundesallee 100    D-38116 Braunschweig

Ptb15.doc

(12) The marking of the equipment shall include the following:



Zertifizierungsstelle Explosionsschutz  
By order

Braunschweig, 26 November 2001

(Signature)

(Seal)

Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

---

Statements of Conformity without signature and seal are invalid. This Statement of Conformity  
may be reproduced only in its entirety without any changes.  
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt Bundesallee 100 D-38116 Braunschweig

Ptb15.doc



Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-45 °C ... 45 °C	
T5	-45 °C ... 60 °C	52 mA or
T4	-45 °C ... 75 °C	
T6	-45 °C ... 60 °C	
T5	-45 °C ... 80 °C	25 mA
T4	-45 °C ... 80 °C	

**Model 3766-16 with Position Indicator**

Signal Circuit (terminals 31/32)      Type of protection: Intrinsic safety EEx ia IIC

**Maximum values:**

$U_i$	=	28 V
$I_i$	=	115 mA
$P_i$	=	1 W
$C_i$	=	5.3 nF, $L_i$ = negligible

**Model 3766-1.2/ ...-1.3/...-1.4 with Solenoid Valve**

Signal Circuit (terminals 81/82)      Type of protection: Intrinsic safety EEx ia IIC

The correlation between version, temperature classification, permissible ambient temperature ranges and maximum power dissipation is shown in the table below:

---

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only in its entirety without any changes. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.



Version	U <sub>N</sub>	6 V	12 V	24 V
Temperature class	T6	60 °C		
	T5	-45 °C ≤ T <sub>a</sub> ≤ 70 °C		
	T4	80 °C		
Characteristic linear or rectangular	P <sub>i</sub>	*	**	

C<sub>i</sub> negligible; L<sub>i</sub> negligible

- \* The permissible maximum power dissipation P<sub>i</sub> in the 6 V version is 250 mW  
 \*\* The maximum values for connection to a certified intrinsically safe circuit are shown in the table below:

U <sub>i</sub>	25 V	27 V	28 V	30 V	32 V
I <sub>i</sub>	150 mA	125 mA	115 mA	100 mA	85 mA
P <sub>i</sub>	no limitation				

C<sub>i</sub> negligible; L<sub>i</sub> negligible

(16) Test report PTB Ex.01-21198

(17) Special conditions for safe use

None

(18) Special health and safety requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz  
By order

Braunschweig, 26 November 2001

(Signature) (seal)

Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

---

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only in its entirety without any changes.  
 Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.



## **T R A N S L A T I O N**

- (1) **Statement of Conformity**
- (2) **Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – Directive 94/9/EC**
- (3) **EC Type Examination Certificate Number**

### **PTB 01 ATEX 2195 X**

- (4) **Equipment:** Model 3766-8 Positioner
- (5) **Manufacturer:** SAMSON AG
- (6) **Address:** Weismüllerstr. 3, D-60314 Frankfurt, Germany
- (7) This equipment and any acceptable variation therefor are specified in the schedule to this certificate and the documents referred to therein.
- (8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in accordance to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report

### **PTB Ex 01-21199.**

- (9) The Essential Health and Safety Requirements are satisfied by compliance with
- EN 50021: 1999**
- (10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of this equipment.

1/4

EC Type Examination Certificates without signature and seal are invalid.

This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig

Ptb15 Ex n.doc



(12) The marking of the equipment shall include the following:



Zertifizierungsstelle Explosionsschutz      Braunschweig,.....  
By order

(Signature)                      (Seal)

Dr. Ing. U. Johannmeyer  
Regierungsdirktor

- (13) **Schedule**
- (14) **Statement of Conformity PTB 01 ATEX 2195 X**
- (15) **Description of Equipment**

The Model 3766-8... Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of 0.2 to 1bar from a control device into a pneumatic signal pressure of 6bar max. For pneumatic auxiliary power non-combustible media are used. The inductive limit switches, position indicators and solenoid valves are passive two networks.

The device is intended for use inside and outside of hazardous areas...

**Electrical data**

Versions:

- a.) With dual inductive limit switches:  
Inductive limit switch (terminals 41/42, 51/52) Type of protection EEx nA II
- b.) With position indicator:  
Signal circuit (terminals 31/32) Type of protection EEx nA II
- c.) With solenoid valve:  
Signal circuit, nominal signal (terminals 81/82) Type of protection EEx nA II

The correlation between temperature classification and permissible ambient temperature range is shown in the table below:

Version U <sub>N</sub>	6V	12 V	24 V
Temperatur class T6	60°C		
T5	-45°C . . .70°C		
T4	80°C		

- (16) Test report: **PTB Ex 01-21199**



**Schedule of the Statement of Conformity PTB 02 ATEX 2007 X**

(17) **Special conditions for safe use**

The Model 3766-8 . . . Positioner shall be installed in an enclosure providing at least Degree of Protection IP 54 in compliance with the IEC Publication 60529:1989.  
This requirement applies also to the cable entries and/or plug connectors.

The wiring shall be connected in such a manner that the connection facilities are not subjected to insole and/or torsional stress.

The signal current circuit (terminals 31/32) shall be provided with a series-connected fuse outside of the hazardous area. This fuse shall comply with IEC 127-2/II, 250V F, or with IEC 127-2/VI, 250V T, with a fuse nominal current  $I_n$  of  $\leq 50\text{mA}$  max.

(18) **Basic health and safety requirements**

Are satisfied by compliance with the standard specified.

Zertifizierungsstelle Explosionsschutz  
By order

Braunschweig, .....

(Signature)                      (seal)

Dr. Ing. U. Johannsmeyer

4/4

EC Type Examination Certificates without signature and seal are invalid.  
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.  
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig

Ptb15 Ex n.doc

## Installation Manual for apparatus certified by CSA for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

	Position-indicator	Limit switches (inductive)	Solenoid valve
Circuit No.	1	2 and 3	4
Terminal No.	31 / 32	41 / 42 and 51 / 52	81 / 82
$U_i$ or $V_{max}$	28V	16V	28V
$I_i$ or $I_{max}$	115mA	25/52 mA	115mA
$P_i$ or $P_{max}$	1W	64/168mW	250mW (##)
$C_i$	5.3nF	30nF	0nF
$L_i$	0μH	100μH	0μH

**Notes:** Entity parameters must meet the following requirements:  
(##) Solenoid valve 12V and 24V version  $P_i$  or  $P_{max}$  no limited

$U_0$  or  $V_{oc} \leq U_i$  or  $V_{max}$  /  $I_0$  or  $I_{oc} \leq I_i$  or  $I_{max}$  /  $P_0 \leq P_i$  or  $P_{max}$ ;  $C_0 \geq C_i$  and  $L_0 \geq L_i$

Table 2: CSA- certified barrier parameters of circuit 1 and 4

Barrier	Supply barrier		Evaluation barrier	
	$V_{max}$	$R_{min}$	$V_{max}$	
circuit 1	$\leq 28V$	$\geq 280\Omega$	$\leq 28V$	Diode Return
circuit 4 (##)	$\leq 28V$	$\geq 280\Omega$	$\leq 28V$	Diode Return
circuit 4(###)	$\leq 28V$	$\geq 280\Omega$	$\leq 28V$	Diode Return

circuit 4 (##) = 12V and 24V version; (###) = 6V version.

**Table 3:** The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

<b>Temperature class</b>	<b>Permissible ambient temperature range</b>
T6	- 45°C ... 60°C
T5	- 45°C ... 70°C
T4	- 45°C ... 80°C

**Table 4:** For the Model 3766– 3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short- circuit current is shown in the table below:

<b>Temperature class</b>	<b>Permissible ambient temperature range</b>	<b>Maximum short-circuit current</b>
T6	- 45°C ... 45°C	52mA
T5	- 45°C ... 60°C	
T4	- 45°C ... 75°C	
T6	- 45°C ... 60°C	25mA
T5	- 45°C ... 80°C	
T4	- 45°C ... 80°C	

**Intrinsically safe if installed as specified in manufacturer’s installation manual.**

**CSA- certified for hazardous locations**

**Ex ia IIC T6; Class I, Zone 0**

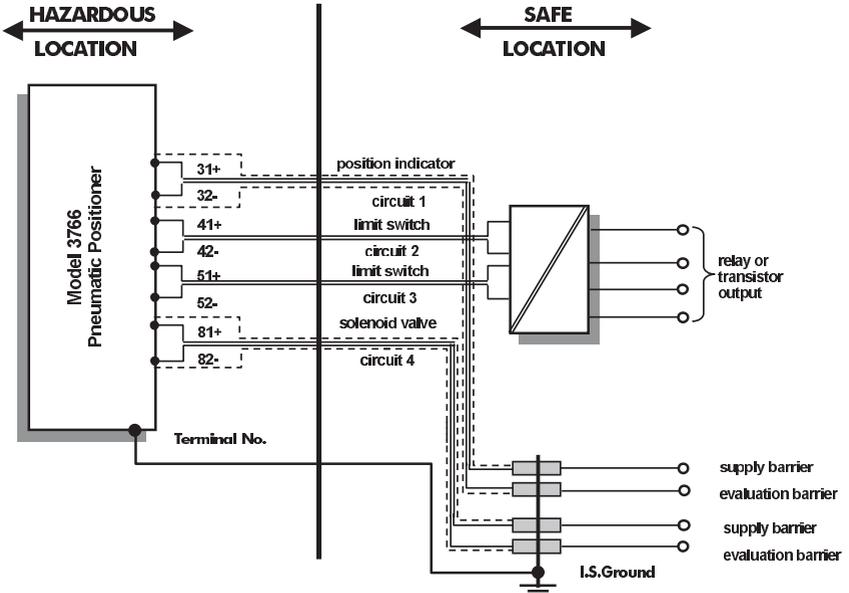
**Class I; Groups A, B, C, D**

**Class II; Groups E, F + G; Class III**

**Type 4 Enclosure**

**Notes:**

- 1.) Max. two cable entries per positioner
- 2.) Each pair of wire shall be provided with a grounded shield. The shield shall extend as close to the terminal as possible. Each shield shall be grounded as the I.S. barrier ground.
- 3.) The installation shall be in accordance with the Canadian Electrical Code Part 1.
- 4.) Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield shall extend as close to terminals as possible.



**Version:** Model 3766-3 with inductive limit switch(es) and solenoid valve.  
 Model 3766-36 with position indicator

Relay or transistor output 2 or channel(s) resp. CSA certified.

Supply and evaluation barrier CSA- certified

Position indicator channel 1 only version 3766-36

For the permissible maximum values for the intrinsically safe circuits see Table 1  
 For the permissible barrier parameters for the circuits 1 and 4 see Table 2

Cable entry M 20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T  
 or 1050 – 0540 T

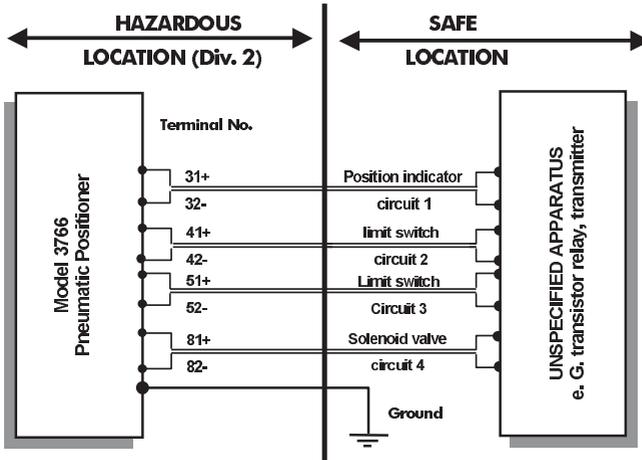
On interconnection to form ground- free signal circuits, only evaluation barriers shall be installed in the return line. Correct polarity shall be ensured.

**CSA- certified for hazardous locations**

**Class I; Div. 2, Groups A, B, C, D  
Class II; Div. 2, E, F + G, Class III**

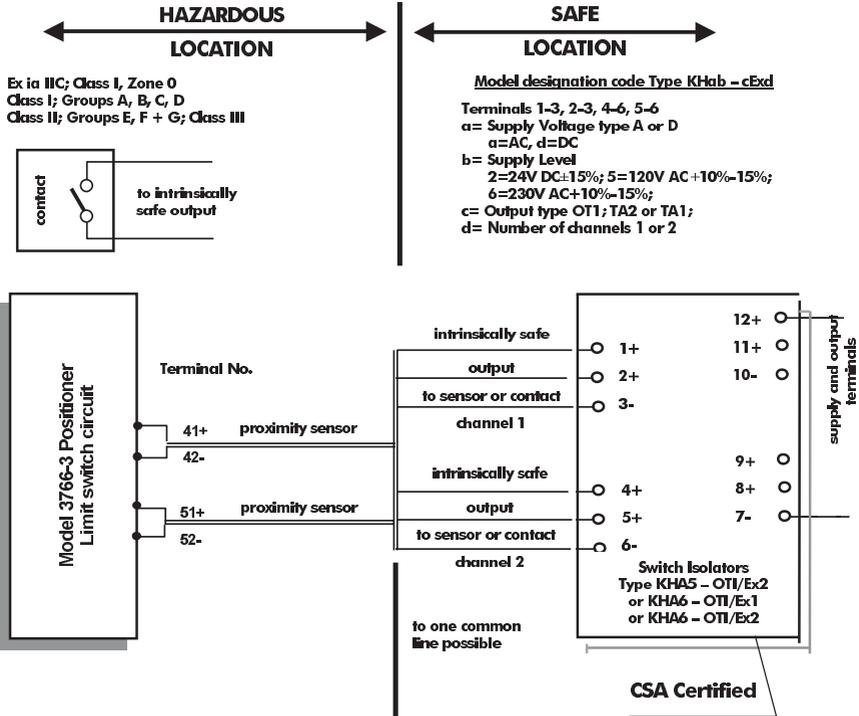
**Type 4 Enclosure**

Positioner with position indicator, solenoid valve and limit switches.



- 1.) The installation shall be in accordance with the Canadian Electrical Code Part 1.
- 2.) For the maximum values for the individual circuits see Table 1 and 2.
- 3.) The cables shall be protected by conduits.
- 4.) Cable entry only rigid metal conduit according to drawing No. 1050-0539 T and 1050-0540 T

**Installation drawing Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensors**



The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

maximum capacitance of each inductive sensor 30nF  
maximum inductance of each inductive sensor 100µH

**System parameters**

Control Relay Terminal No.	Groups	L [mH]	C [µF]	V <sub>0C</sub> [V]	I <sub>sc</sub> [mA]	V <sub>max</sub> [V]	R <sub>min</sub> [Ω]
1-3; 2-3 4-6; 5-6	A + B	84.88	1.273	↑	↑	↑	↑
	C + D	298.7	3.82	12.6	19.8	12.6	650
	E, F, G	744.4	10.18	↓	↓	↓	↓

Division 2 wiring method shall be in accordance to the Canadian Electrical Code Part 1.

Revisions Control Number: 1 May.05

Addendum to EB 8355-1 EN

Installation Manual for apparatus approved by FM for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

	Position-indicator	Limit switches inductive	Solenoid valve
Circuit No.	1	2 and 3	4
Terminal No.	31 / 32	41 / 42 and 51 / 52	81 / 82
U <sub>i</sub> or V <sub>max</sub>	28V	16V	28V
I <sub>i</sub> or I <sub>max</sub>	115mA	25/52 mA	115mA
P <sub>i</sub> or P <sub>max</sub>	1W	64/169mW	250mW (##)
C <sub>i</sub>	5.3nF	30nF	0nF
L <sub>i</sub>	0μH	100μH	0μH

Notes: Entity parameters must meet the following requirements:

(##) Solenoid valve 12V and 24V version P<sub>i</sub> or P<sub>max</sub> no limited

(##) Solenoid valve 6V version P<sub>i</sub> or P<sub>max</sub> 250mW

$U_0 \text{ or } V_0 \text{ or } V_i \leq U_i \text{ or } V_{max} / I_0 \text{ or } I_{sc} \text{ or } I_i \leq I_i \text{ or } I_{max} / P_0 \text{ or } P_{max} \leq P_i \text{ or } P_{max}$

$C_a \geq C_i + C_{cable} \text{ and } L_a \geq L_i + L_{cable}$

Table 2: FM – approved barrier parameters of circuit 1 and 4

Barrier	Supply barrier				Evaluation barrier		
	V <sub>oc</sub>	R <sub>min</sub>	I <sub>sc</sub>	P <sub>max</sub>	V <sub>oc</sub>	R <sub>min</sub>	I <sub>sc</sub>
circuit 1	≤ 28V	≥ 196Ω	≤ 115mA	≤ 1W	≤ 28V	#	0mA
circuit 4 (#)	≤ 28V	≥ 200Ω	≤ 115mA	(#)	≤ 28V	#	0mA
circuit 4 (##)	≤ 28V	≥ 785Ω	≤ 115mA	(##)	≤ 28V	#	0mA

circuit 4: (#) = 12V and 24V version; (##) = 6V version.

**Table 3:** The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

<b>Temperature class</b>	<b>Permissible ambient temperature range</b>
T6	60°C
T5	- 40°C ≤ ta ≤ 70°C
T4	80°C

**Table 4:** For the Model 3766 – 3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short- circuit current is shown in the table below:

<b>Temperature class</b>	<b>Permissible ambient temperature range</b>	<b>Maximum short-circuit current</b>
T6	45°C	52mA
T5	- 40°C ≤ ta ≤ 60°C	
T4	75°C	
T6	60°C	25mA
T5	- 40°C ≤ ta ≤ 80°C	
T4	80°C	

**Intrinsically safe if installed as specified in manufacturer’s installation manual.**

**FM- approved for hazardous locations**

**Class I, Zone 0 A Ex ia IIC T6**

**Class I, II, III Division 1, Groups A, B, C, D; E, F + G**

**NEMA Type 4X**

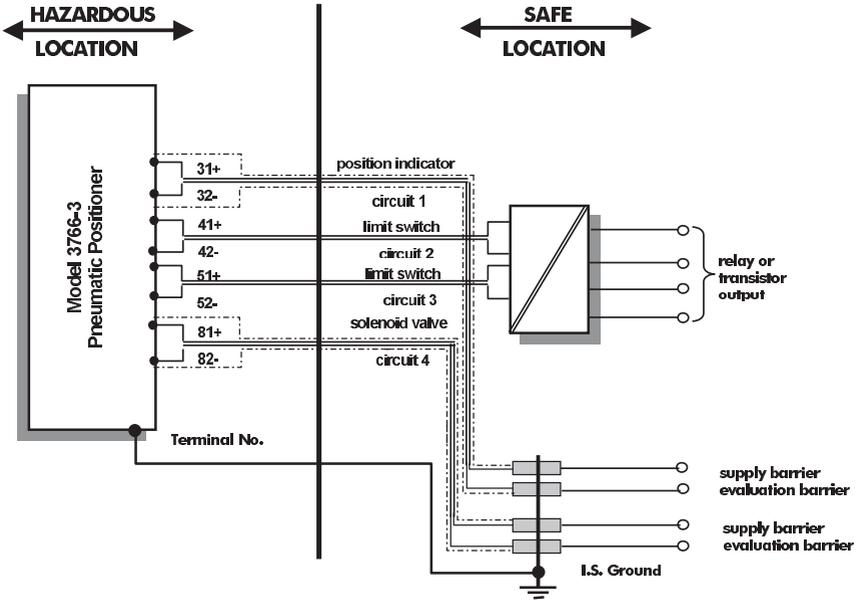
**Notes:**

- 1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with the FM approved apparatus. For maximum values of  $U_i$  or  $V_{max}$ ;  $I_i$  or  $I_{max}$ ;  $P_i$  or  $P_{max}$ ;  $C_i$  and  $L_i$  of the various apparatus see Table 1.
- 2.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with the FM approved intrinsically safe barrier. For barrier selection see Table 2.
- 3.) Installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

**Revisions Control Number: 1 August 2004**

**Addendum to EB 8355-1 EN**

4.) Use only supply wires suitable for 5°C above surrounding temperature.



**Version:** Model 3766-3 with solenoid valve and inductive limit switch(es.)  
 Model 3766-36 with position indicator.

Relay or transistor output 2 or 3 channel(s) resp. FM/CSA approved.

Supply and evaluation barrier FM/CSA- approved.

Position indicator channel 1 only version 3766-36

For the permissible maximum values for the intrinsically safe circuits see Table 1

For the permissible barrier parameters for the circuits 2 and 4 see Table 2

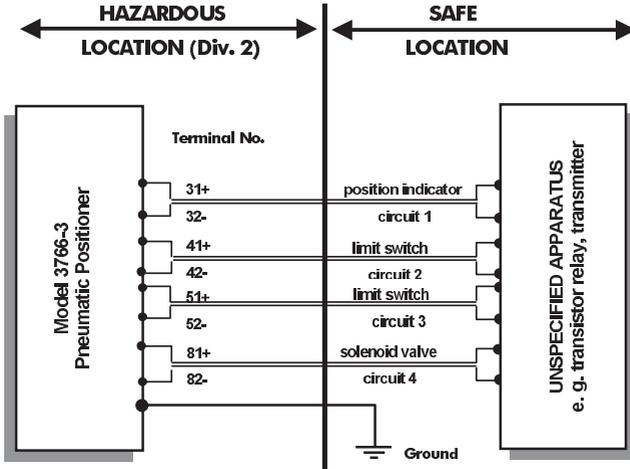
Cable entry M 20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T  
 or 1050 – 0540 T

**FM- approved for hazardous locations**

**Class I, Division 2, Groups A, B, C, D.  
Class II Division 2, Groups F + G; Class III**

**NEMA Type 4X**

pneumatic positioner with position indicator, solenoid valve and limit switches.



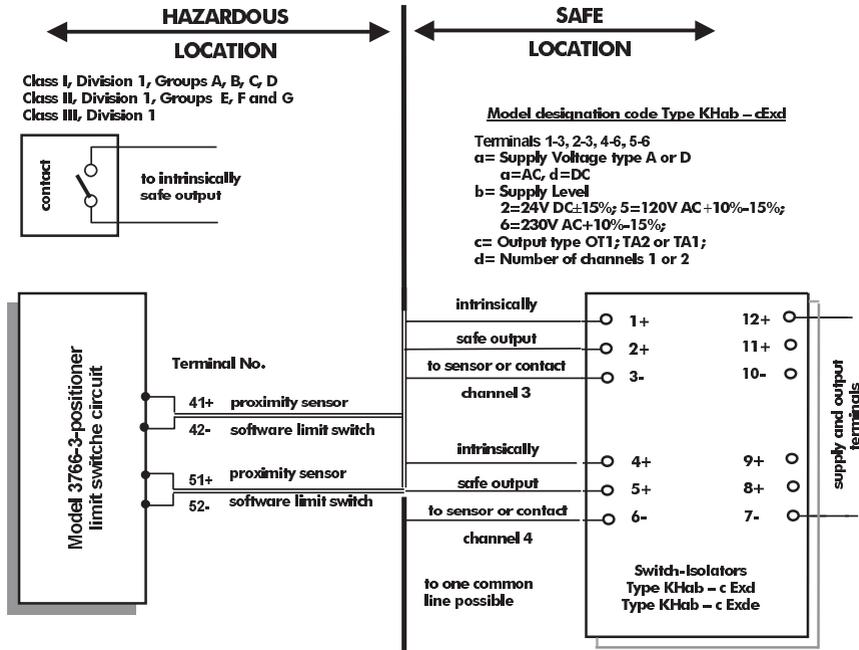
**Notes:**

- 1.) The installation must be in accordance with the National Electrical Code ANSI/NFPA 70
- 2.) For the maximum values for the individual circuits see Table 1 and 2.
- 3.) The cables shall be protected by conduits.
- 4.) Cable entry only rigid metal conduit according to drawing No. 1050-0539 T and 1050-0540 T

**Revisions Control Number: 1 August 2004**

**Addendum to EB 8355-1 EN**

Installation drawing Control Relay Hab – cEx de with proximity sensors typ SJ-b-N



maximum capacitance of each inductive sensor 30nF  
 maximum inductance of each inductive sensor 100µH

The total series inductance and shunt capacitance of shield wiring must be restricted to the following maximum values

Control Relay Terminal No.	Groups	L [mH]	C [µF]	VOC [V]	ISC [mA]
1-3; 2-3 4-6; 5-6	A + B	84,8	1,27	↑	↑
	C + E	299	3,82	12,9	19,8
	D, F, G	744	10,2	↓	↓

**Model designation code Type KHab – cExde**

a= Supply Voltage type A or D  
 a=AC, d=DC  
 b= Supply Level  
 2=24V DC±15%; 5=120V AC+10%-15%;  
 6=230V AC+10%-15%;  
 c= Output type RTA/; RW1/; SS1/; SS2/; RS1/;  
 SR/; ST-or SOT  
 d= Number of channels 1 or 2  
 e= Power rail designation, P, 2S.P or GS.P  
 (includes Model KHD2-EB-PB Power Feed Module) or Blank

Revisions Control Number: 1 August 2004

Addendum to EB 8355-1 EN



## EU Konformitätserklärung / EU Declaration of Conformity / Déclaration UE de conformité

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller/  
This declaration of conformity is issued under the sole responsibility of the manufacturer/  
La présente déclaration de conformité est établie sous la seule responsabilité du fabricant.  
Für das folgende Produkt / For the following product / Nous certifions que le produit

### **Pneumatischer Stellungsregler / Pneumatic Positioner / Positionneur électropneumatique Typ/Type/Type 3766**

wird die Konformität mit den einschlägigen Harmonisierungsrechtsvorschriften der Union bestätigt /  
the conformity with the relevant Union harmonisation legislation is declared with /  
est conforme à la législation d'harmonisation de l'Union applicable selon les normes:

EMC 2014/30/EU

EN 61000-6-2:2005, EN 61000-6-3:2007  
+A1:2011, EN 61326-1:2013

RoHS 2011/65/EU

EN 50581:2012

Hersteller / Manufacturer / Fabricant:

SAMSON AKTIENGESELLSCHAFT  
Weismüllerstraße 3  
D-60314 Frankfurt am Main  
Deutschland/Germany/Allemagne

Frankfurt / Francfort, 2017-07-29

Im Namen des Herstellers/ On behalf of the Manufacturer/ Au nom du fabricant.

Hanno Zager  
Leiter Qualitätssicherung/Head of Quality Management/  
Responsable de l'assurance de la qualité

Dirk Hoffmann  
Zentralabteilungsleiter/Head of Department/Chef du département  
Entwicklungsorganisation/Development Organization



## EU Konformitätserklärung / EU Declaration of Conformity / Déclaration UE de conformité

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller/  
This declaration of conformity is issued under the sole responsibility of the manufacturer/  
La présente déclaration de conformité est établie sous la seule responsabilité du fabricant.  
Für das folgende Produkt / For the following product / Nous certifions que le produit

### **Pneumatischer Stellungsregler / Pneumatic Positioner / Positionneur électropneumatique Typ/Type/Type 3766-1...**

entsprechend der EU-Baumusterprüfbescheinigung PTB 01 ATEX 2171 ausgestellt von der/  
according to the EU Type Examination PTB 01 ATEX 2171 issued by/  
établi selon le certificat CE d'essais sur échantillons PTB 01 ATEX 2171 émis par:

Physikalisch Technische Bundesanstalt  
Bundesallee 100  
D-38116 Braunschweig  
Benannte Stelle/Notified Body/Organisme notifié 0102

wird die Konformität mit den einschlägigen Harmonisierungsrechtsvorschriften der Union bestätigt/  
the conformity with the relevant Union harmonisation legislation is declared with/  
est conforme à la législation d'harmonisation de l'Union applicable selon les normes:

EMC 2014/30/EU

EN 61000-6-2:2005, EN 61000-6-3:2007  
+A1:2011, EN 61326-1:2013

Explosion Protection 94/9/EC (bis/to 2016-04-19)  
Explosion Protection 2014/34/EU (ab/from 2016-04-20)

EN 60079-0:2009, EN 60079-11:2012

RoHS 2011/65/EU

EN 50581:2012

Hersteller / Manufacturer / Fabricant:

SAMSON AKTIENGESELLSCHAFT  
Weismüllerstraße 3  
D-60314 Frankfurt am Main  
Deutschland/Germany/Allemagne

Frankfurt / Francfort, 2017-07-29

Im Namen des Herstellers/ On behalf of the Manufacturer/ Au nom du fabricant.

Hanno Zager  
Leiter Qualitätssicherung/Head of Quality Management/  
Responsable de l'assurance de la qualité

Dirk Hoffmann  
Zentralabteilungsleiter/Head of Department/Chef de département  
Entwicklungsorganisation/Development Organization



## EU Konformitätserklärung / EU Declaration of Conformity / Déclaration UE de conformité

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller/  
This declaration of conformity is issued under the sole responsibility of the manufacturer/  
La présente déclaration de conformité est établie sous la seule responsabilité du fabricant.  
Für das folgende Produkt / For the following product / Nous certifions que le produit

### Pneumatischer Stellungsregler / Pneumatic Positioner / Positionneur électropneumatique Typ/Type/Type 3766-8...

entsprechend der EU-Baumusterprüfbescheinigung PTB 01 ATEX 2195 X ausgestellt von der/  
according to the EU Type Examination PTB 01 ATEX 2095 X issued by/  
établi selon le certificat CE d'essais sur échantillons PTB 01 ATEX 2195 X émis par:

Physikalisch Technische Bundesanstalt  
Bundesallee 100  
D-38116 Braunschweig

Benannte Stelle/Notified Body/Organisme notifié 0102

wird die Konformität mit den einschlägigen Harmonisierungsrechtsvorschriften der Union bestätigt /  
the conformity with the relevant Union harmonisation legislation is declared with/  
est conforme à la législation d'harmonisation de l'Union applicable selon les normes:

EMC 2014/30/EU

EN 61000-6-2:2005, EN 61000-6-3:2007  
+A1:2011, EN 61326-1:2013

Explosion Protection 94/9/EC (bis/to 2016-04-19)  
Explosion Protection 2014/34/EU (ab/from 2016-04-20)

EN 60079-0:2009, EN 60079-15:2010

RoHS 2011/65/EU

EN 50581:2012

Hersteller / Manufacturer / Fabricant:

SAMSON AKTIENGESELLSCHAFT  
Weismüllerstraße 3  
D-60314 Frankfurt am Main  
Deutschland/Germany/Allemagne

Frankfurt / Francfort, 2017-07-29

Im Namen des Herstellers/ On behalf of the Manufacturer/ Au nom du fabricant.

*H. Zager*

Hanno Zager  
Leiter Qualitätssicherung/Head of Quality Management/  
Responsable de l'assurance de la qualité

*D. Hoffmann*

Dirk Hoffmann  
Zentralabteilungsleiter/Head of Department/Chef du département  
Entwicklungsorganisation/Development Organization

ce\_27668\_dr\_en\_fm\_rev07.pdf





**EB 8355-1 EN**



SAMSON AKTIENGESELLSCHAFT  
Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany  
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507  
samson@samsongroup.com · www.samsongroup.com