

Fig. 1: Type 3767

Mounting and Operating Instructions

EB 8355-2 EN

Edition April 2011



Definition of the signal words used in these mounting and operating instructions



DANGER!

indicates a hazardous situation which, if not avoided, will result in death or serious injury.



NOTICE

indicates a property damage message.



WARNING!

indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Note:

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1 General safety instructions

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

- The positioner is to 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 level, it must be restricted using a suitable supply pressure reducing station.
- Explosion-protected versions of this positioner are to 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. Refer to section 7.

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

- Proper shipping and storage are assumed.

**Note:**

Devices with a CE marking fulfill the requirements of the Directives 94/9/EC and 2004/108/EC.

The Declaration of Conformity is available on request.

2 Design and principle of operation

The positioner consists of an electropneumatic converter unit (i/p converter) and a pneumatic unit equipped with 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 to actuators according to NAMUR (IEC 60534-6) using an adapter housing.

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

The DC control signal, e.g. 4 to 20 mA, issued by the control equipment is transmitted to the electropneumatic converter (13) where it is converted into a proportional pressure signal p_e .

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 switches

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.

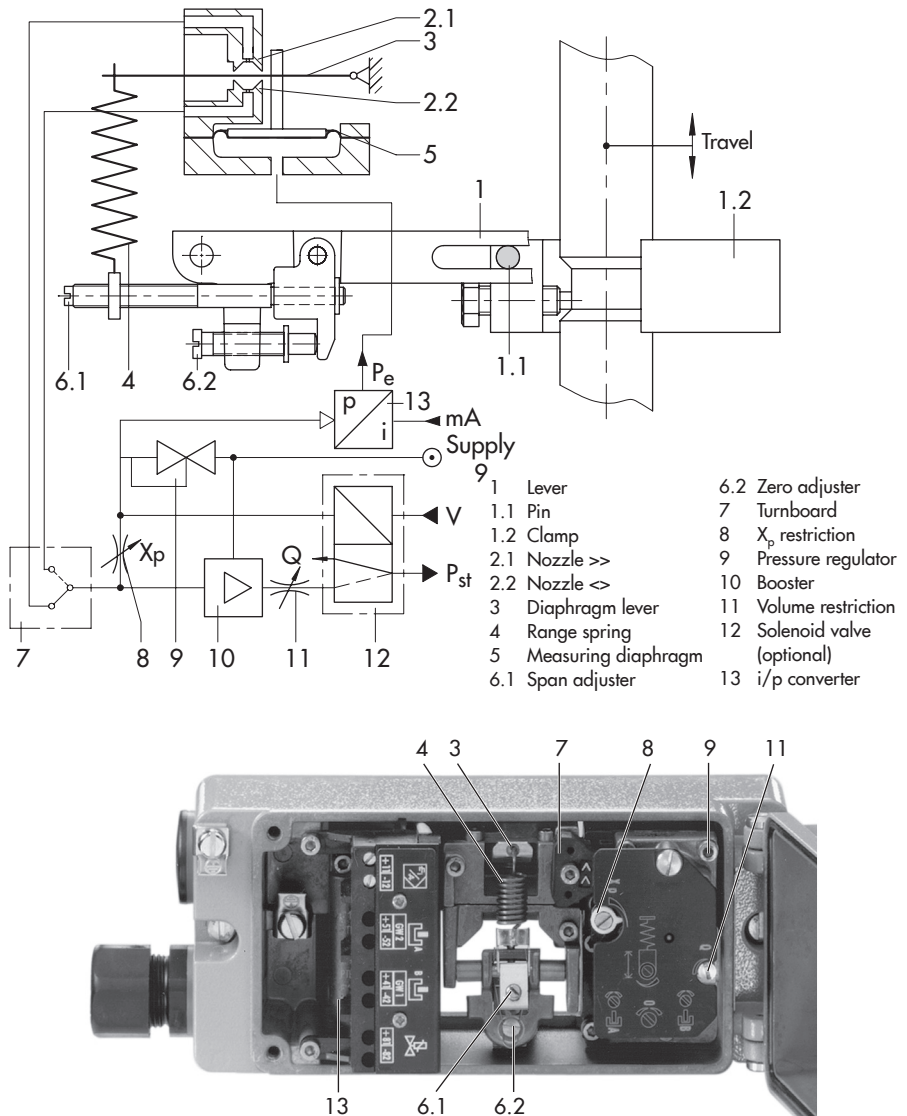


Fig. 2: Functional diagram and inside view

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.

Positioner with position transmitter

A positioner containing a position transmitter cannot be equipped with integrated limit switches 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

Electropneumatic Positioner	Type 3767-	x	x	x	0	1	x	x	x	x	x	x	0	0	0
Explosion protection															
Without	0							2							
⊕ II 2G Ex ia IIC T6 acc. to ATEX	1														
CSA/FM intrinsically safe/non incandive	3														
⊕ II 3G Ex nA II T6 acc. to ATEX	8														
Additional equipment															
Without	0														
Inductive limit switches 2x SJ 2-SN	2														
(Analog position transmitter 4 to 20 mA) ¹⁾	6	0										0			
3/2-way solenoid valve															
Without	0														
6 V DC	2														
12 V DC	3														
24 V DC	4														
Type of mounting															
Standard range spring				0	1										
Pneumatic connections															
1/4-18 NPT						1									
ISO 221/1-G 1/4						2									
Electrical connections															
Plastic cable gland M20 x 1.5, blue							1	0							
Plastic cable gland M20 x 1.5, black							2	0							
Cable gland M20 x 1.5, nickel-plated brass							2	1							
Housing version															
Die-cast aluminum									1						
CrNiMo steel									2						
Reference variable															
4 to 20 mA										1					
0 to 20 mA										2					
1 to 5 mA										3					
Temperature range															
Standard												0			
Low-temperature version															
T _{min} ≥ -45 °C; optional limit switches, solenoid valve							2	1				2			
Special versions															
Without													0	0	0

¹⁾ Available until March 2011

2.2 Technical data

Positioner		
Travel range, adjustable	Direct attachment: 7.5 to 30 mm Attachment according to IEC 60534-6: 7.5 to 120 mm or Depending on the cam disk: 30° to 90°	
Opening angles		
Reference variable		
Signal range	0/4 to 20 mA	1 to 5 mA
Span	8 to 20 mA	2 to 4 mA
Coil resistance R_i at 20 °C	200 Ω	880 Ω
Supply air	1.4 to 6 bar (20 to 90 psi)	
Air quality acc. to ISO 8573-1	Max. 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_{st} (output)	Can be limited between approx. 2.5 to 6 bar (38 to 90 psi)	
Characteristic	Linear characteristic, deviation from terminal-based conformity $\leq 1\%$	
Hysteresis	$\leq 0.3\%$	
Sensitivity	$\leq 0.1\%$	
Operating direction	Reversible	
Proportional band X_p	< 1 to 2.5% (proportional-action coefficient K_p : > 100 to 40)	
Air consumption	At 1.4 bar supply pressure: ≤ 280 l/h	At 6 bar supply pressure: ≤ 280 l/h with lowest setting of pressure regulator
Air output capacity	Actuator filled with air: 3.0 m ³ /h Actuator vented: 4.5 m ³ /h	8.5 m ³ /h 14.0 m ³ /h
Permissible ambient temperature	-20 to 80 °C with plastic cable gland -40 to 80 °C with metal cable gland (special version down to -45 °C) -20 to 70 °C with position transmitter See test certificates in the appendix for explosion-protected devices	
Influences	Temperature: $\leq 0.3\%/10$ K Supply air: $\leq 1\%$ between 1.4 and 6 bar Vibration: None between 10 and 150 Hz and 4 g	
Explosion protection	See test certificate in the appendix for type of protection Ex ia IIC T6	
Degree of protection	IP 54 (IP 65 and NEMA 4X possible by fitting a filter check valve. See table on accessories on page 17)	
Electromagnetic compatibility	Complying with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21	
Weight	Approx. 1 kg	

Inductive limit switches					
Two proximity switches	SJ 2-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) DC signal at -25 °C	≤ 1.2 V	≤ 2.4 V	≤ 4.7 V		
Signal '1' (response) DC signal at 80 °C	≥ 5.4 V	≥ 9.6 V	≥ 18 V		
Maximum permissible signal	28 V	25 V	32 V		
Coil resistance R _i at 20 °C	2909 Ω	5832 Ω	11714 Ω		
Air consumption in steady state	In addition to that of the positioner: OFF ≤ 60 l _n /h · ON ≤ 10 l _n /h				
Closing time for Type 3277 Actuator	120 cm ²	240 cm ²	350/355 cm ²	700 cm ²	
rated travel and signal pressure range (K _{VS} 0.14)	0.2 to 1 bar	≤ 0.5 s	≤ 1 s	≤ 1.5 s	≤ 4 s
	0.4 to 2 bar		≤ 2 s	≤ 2.5 s	≤ 8 s
	0.6 to 3 bar		≤ 1 s	≤ 1.5 s	≤ 5 s
Position transmitter ^{1), 2)}	–		Output circuit, intrinsically safe		
Output signal	Two-wire connection 4 to 20 mA, reversible operating direction				
Supply air	Minimum terminal voltage: 12 V DC, max.: 45 V DC		Only with intrinsically safe circuit		
Characteristic	Characteristic: Output linear to input, deviation from terminal-based linearity ≤ 1 %				
Hysteresis	≤ 0.6 %				
Response	≤ 0.1 %				
Influence of power supply	≤ 1 % when voltage changes occur within the specified limits				
High-frequency influence	≤ 0.1 %, f = 150 MHz, 1 W power output at a distance of 0.5 m				
Load influence	≤ 0.1 %				
Permissible ambient temperature	-20 to 70 °C		-20 to temperature specified in test certificate		
Ambient temperature influence	≤ 0.4 % on lower measuring range value, ≤ 0.2 % on measuring span				
Ripple of output signal	≤ 0.3 %				

¹⁾ Data refer to standard spring (15 mm travel with Type 3277 Actuator) and gain of 100.

²⁾ Available until March 2011

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 Figs. 3, 4 and 6.

The turnboard (7 in Fig. 2) 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 >>) or decreasing (reverse action <>). Similarly, as the reference variable decreases the signal pressure can either decrease (direct action >>) or increase (reverse action <>).

On the turnboard (7), the operating direction is indicated by symbols (direct >>, reverse <>). Depending on the position of the turnboard, the adjusted operating direction and the associated symbol become 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° and refasten the turnboard. Make sure the three rubber gaskets inserted in the housing remain in position.



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



Note:

The required accessories are listed in Table 1 to Table 4 on page 16.

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. >> or <>.

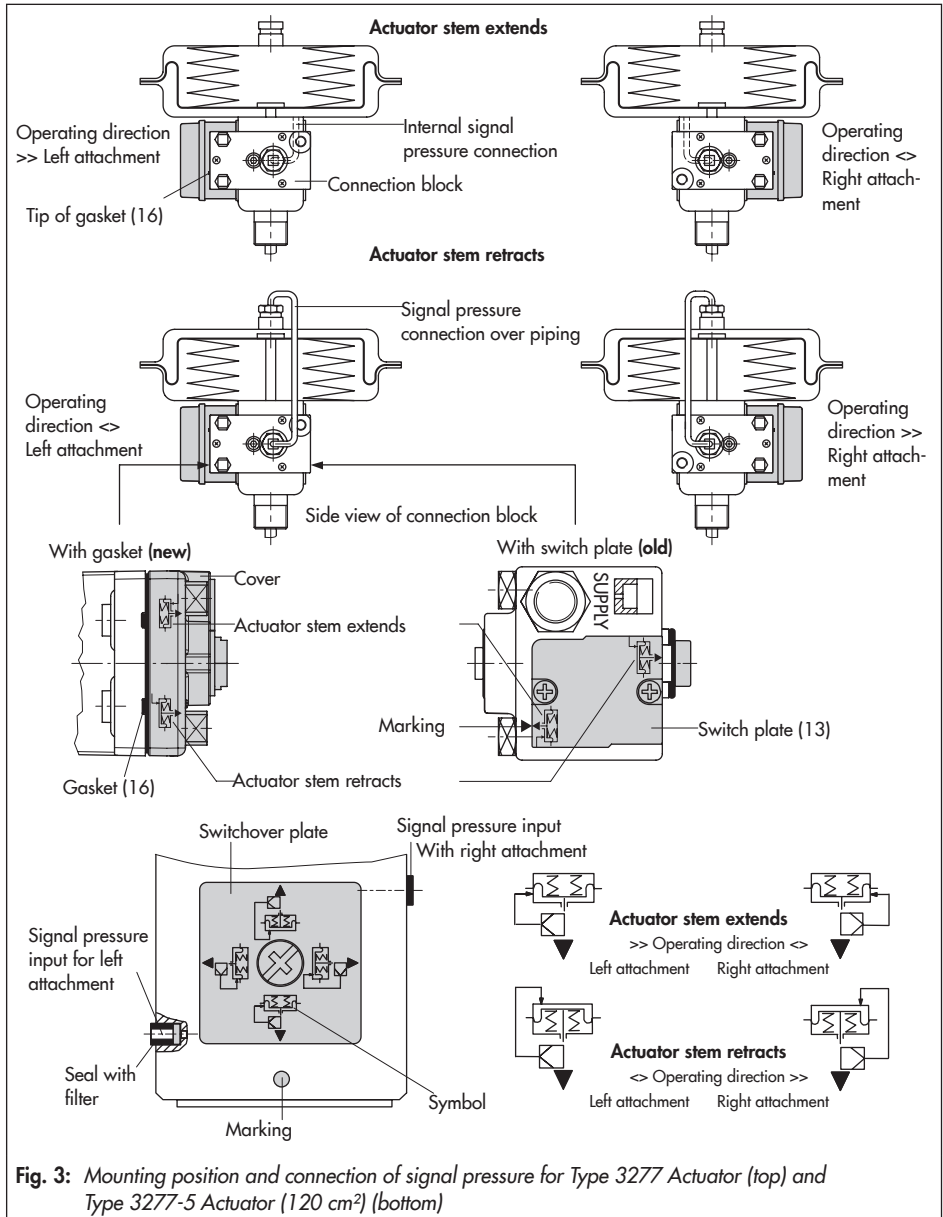


Fig. 3: Mounting position and connection of signal pressure for Type 3277 Actuator (top) and Type 3277-5 Actuator (120 cm²) (bottom)

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 cm² 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 cm² diaphragm areas

7. Make sure that the tip of the gasket (16) projecting from the side of the connection block (Fig. 3, 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 "actuator stem retracts" fail-safe action, additionally mount the external signal pressure pipe.

Actuator with 120 cm² diaphragm area

The signal pressure is transmitted to the diaphragm chamber over the switchover plate (Figs. 3 and 4, bottom).

7. Remove screw plug on the back of the positioner (Fig. 5) 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 cm² 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 required 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 "actuator stem retracts" fail-safe action and in Type 3277-5 Actuators with an effective diaphragm area of 120 cm²,

the exhaust air from the positioner is connected to the spring 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.

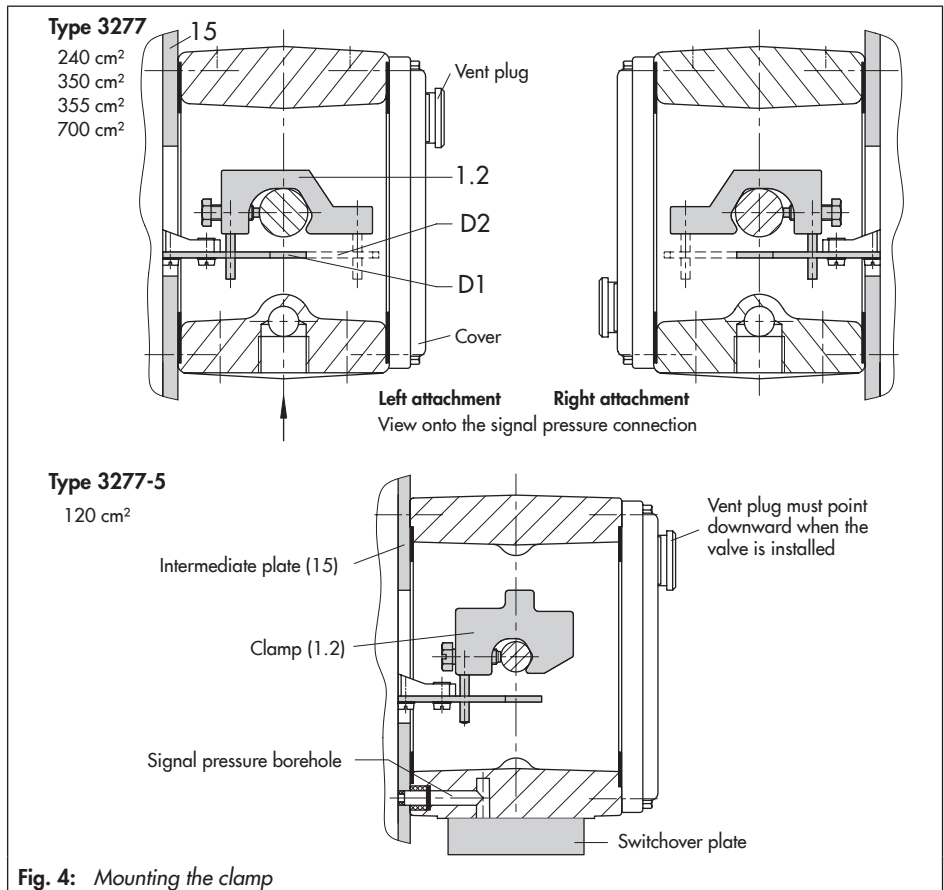


Fig. 4: Mounting the clamp

Table 1: Lever and dimensions			Mounting kit	
Actuator size	Lever with associated clamp and intermediate plate		Order no.	
120 cm²	D1 lever with stopper for output (38)	Standard version	1400-7116	
		Version compatible with paint	1402-0944	
240/350 cm²	D1 lever (33 mm long with 17 mm clamp)	Standard version	1400-6370	
		Version compatible with paint	1402-0942	
355/700 cm²	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 cm² actuator)		Type 3277-5xxxxxx. 00 Actuator (old)	1400-6819	
New switchover plate		Type 3277-5xxxxxx. 01 Actuator (new) or higher	1400-6822	
Connecting plate for additional attachment of, e.g. a solenoid valve		Type 3277-5xxxxxx. 00 Actuator (old), G ¼	1400-6820	
		Type 3277-5xxxxxx. 00 Actuator (old), ½ NPT	1400-6821	
New connecting plate		Type 3277-5xxxxxx. 01 Actuator (new) or higher, G ¼ and ½ NPT	1400-6823	
Note: Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.				
Required connection block for 240, 350, 355 and 700 cm² actuator (including gaskets and fastening screw)		G ¼	1400-8819	
		¼ NPT	1400-8812	
Table 3: Pipe connection		Material	Actuator size [cm²]	Order no.
Required pipe connection including screw fitting For actuator: "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 [cm²]	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 ²)	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 IP 65		
Filter check valve in housing with G ¼ thread	Polyamide, IP 65 degree of protection	1790-7408
	1.4301, IP 65 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 (NAMUR)

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 required for attachment (Fig. 7). The valve travel is transmitted over the lever (18) and shaft (25) to the bracket (28) of the adapter housing and then passed on to the pin (27a) located on the positioner lever. 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. 5.

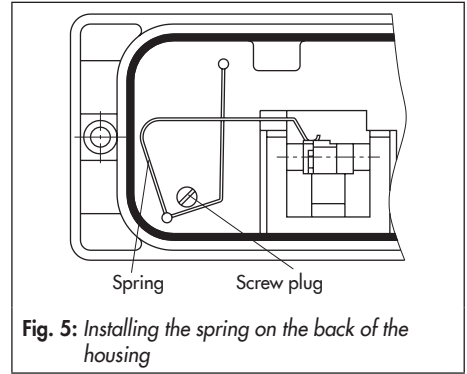


Fig. 5: Installing the spring on the back of the housing

The positioner can be mounted either on the left or right side of the control valve (Figs. 6 and 7). 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-up (20), actuator facing upward (see also Fig. 7)			
Actuator with "actuator stem extends" (FA) fail-safe action			
Direct operating direction >>	Reverse operating direction <<	Direct operating direction >>	Reverse operating direction <<
Electrical connection	Pneumatic connections		Electrical connection
Actuator with "actuator stem retracts" (FE) fail-safe action			
Direct operating direction >>	Reverse operating direction <<	Direct operating direction >>	Reverse operating direction <<
Pneumatic connection	Electrical connections		Pneumatic connection

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

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

3.2.1 Mounting sequence

Select the required mounting parts and range spring from Table 4 or Table 5 and install them as illustrated in Fig. 7:

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 cm² actuators.
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 hexagon head screw as shown in Fig. 6.

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 (Fig. 6) 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 downward when the positioner is attached with the air connection at the front (Fig. 6).

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. 7.
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).



NOTICE

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 5 and 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 section 5.1.

Mounting position

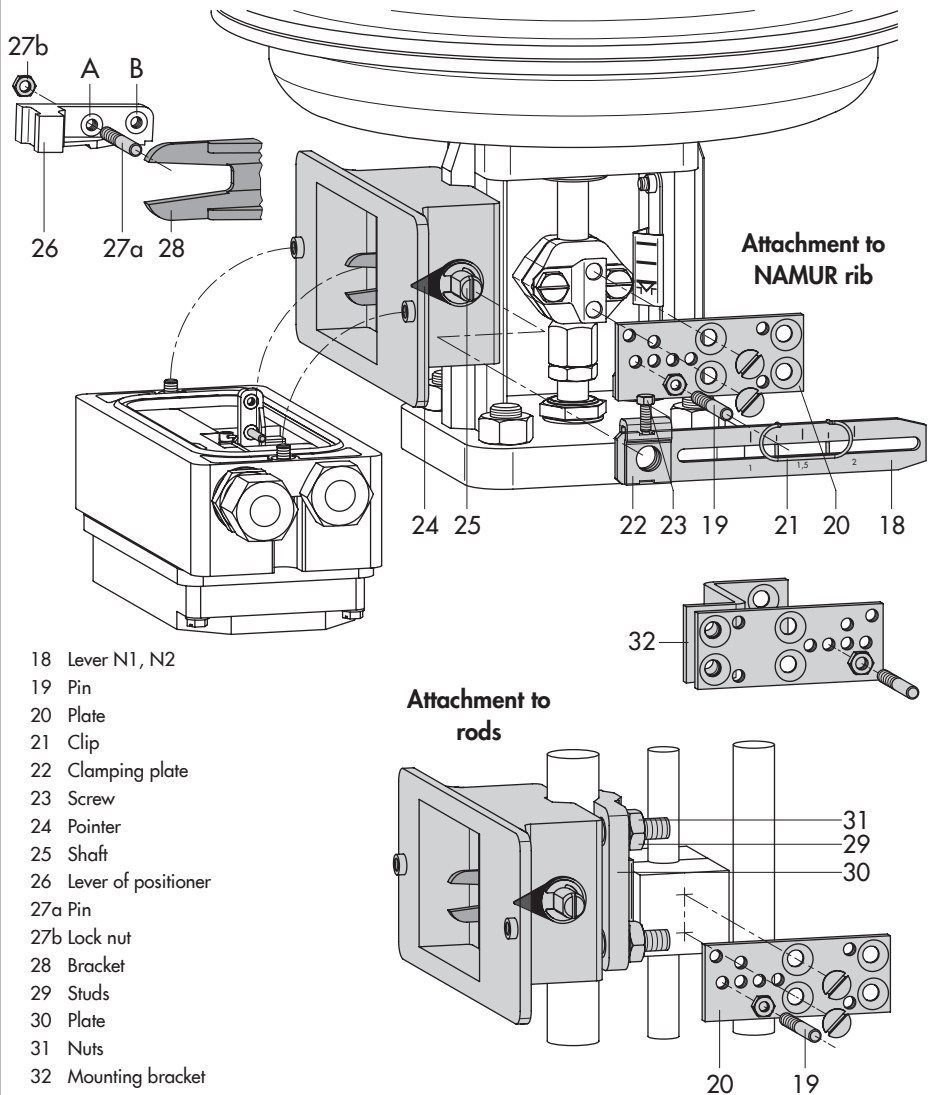


Fig. 7: Attachment according to IEC 60534-6 (NAMUR)

Mounting on control valves

Table 5: Mounting kits		Control valve		Travel [mm]	With lever	Order no.
NAMUR mounting kit Refer to Fig. 7 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	
Accessories						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 IP 65						
Filter check valve in housing with G ¼ thread			Polyamide, IP 65 degree of protection			1790-7408
			1.4301, IP 65 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] ¹⁾	7.5	15	15	30	30	60	30	60	60	120	
Pin at marking ¹⁾	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		

¹⁾ 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.

Table 7: Complete mounting parts, including range spring 2, but not including the cam disk		Order no.
Actuator acc. to VDI/VDE 3845 (September 2010), level 1		1400-8815
SAMSON Type 3278 Actuator VETEC Type S	160 cm ²	1400-7103
	320 cm ²	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
Required range spring		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
Cam disk with accessories		Order no.
~, linear basic characteristic ³⁾	(0050-0072), 0 to 90° opening angle, also for Type 3310	1400-6664
~, equal percentage basic characteristic ³⁾	(0050-0073), 0 to 90° opening angle	1400-6665
~, linear ¹⁾	(0050-0080), 0 to 70° opening angle, for control butterfly valves	1400-6774
~, equal percentage ²⁾	(0050-0081), 0 to 70° opening angle, for control butterfly valves	1400-6775
~, linear ¹⁾	(0050-0074, VETEC), 0 to 75° opening angle	1400-6666
~, equal percentage ²⁾	(0050-0075, VETEC), 0 to 75° opening angle	1400-6667
~, linear ¹⁾	(0059-0007, Camflex) to be set between 0 and 55°	1400-6637
~, equal percentage ²⁾	(0059-0008, Camflex) to be set between 0 and 55°	1400-6638
Accessories		
See list on page 22		

- ¹⁾ Linearizes the flow characteristic
- ²⁾ Creates an equal percentage flow characteristic
- ³⁾ Based on opening angle

The rotary motion of these actuators is converted into a linear motion required by the pneumatic control unit of the positioner using the cam disk of the actuator shaft and a feeler roll on the positioner lever.

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 section 3.3.4).

When using a reversing amplifier, the pressure regulator (9, Fig. 2) must be turned clockwise as far as it will go (also see section 4.1.2).

When attaching the positioner to the SAMSON Type 3278 Rotary Actuator (Fig. 8, 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. 8, 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. 5).

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 section 3.3.3 and fasten.

Actuators according to VDI/VDE 3845

(09/2010, (fixing level 1))

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 section 2.3.3 and fasten.

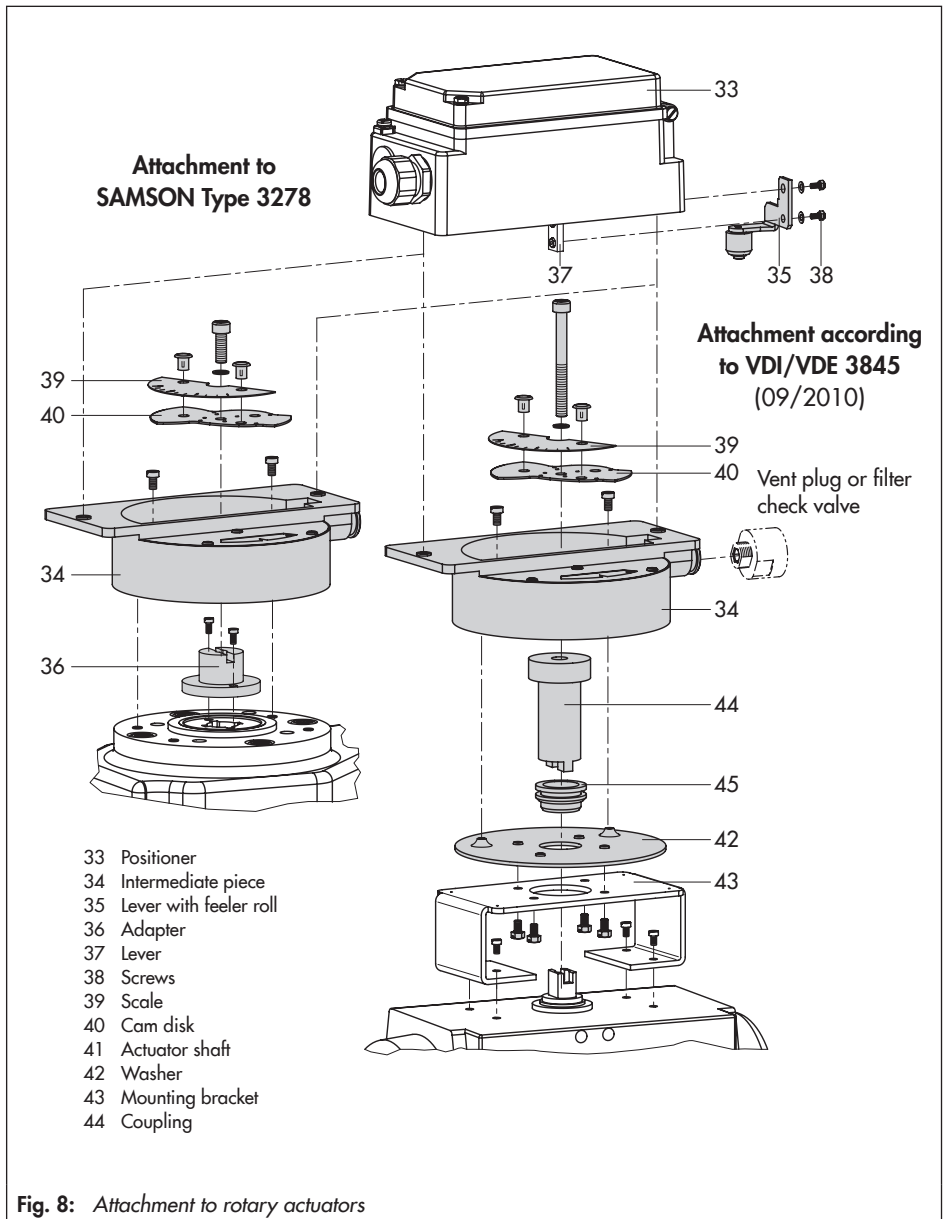


Fig. 8: Attachment to rotary actuators

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. 9 and Fig. 10 show linear cam disks.

Fig. 9 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. 10 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

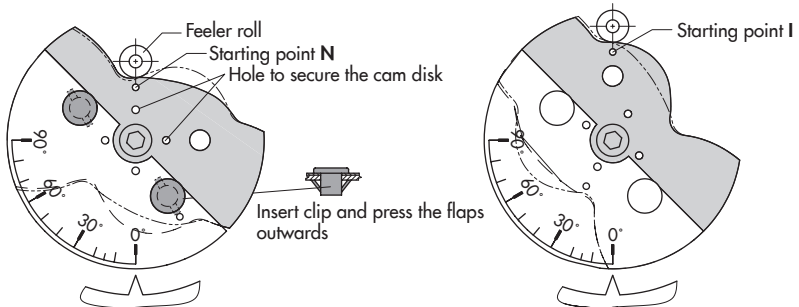
Linear cam disk (equal percentage cam disk is represented by a broken and dotted line)

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 position: **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 position: **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

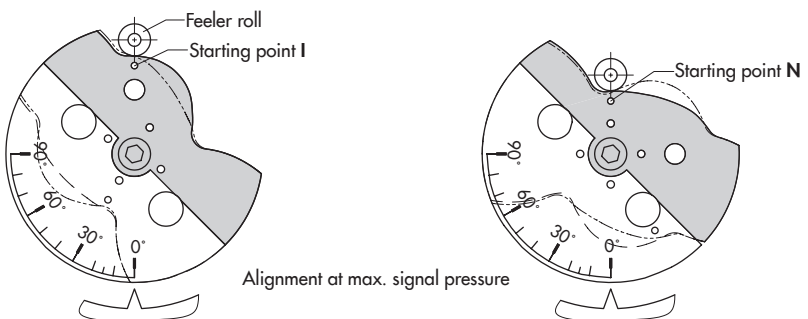


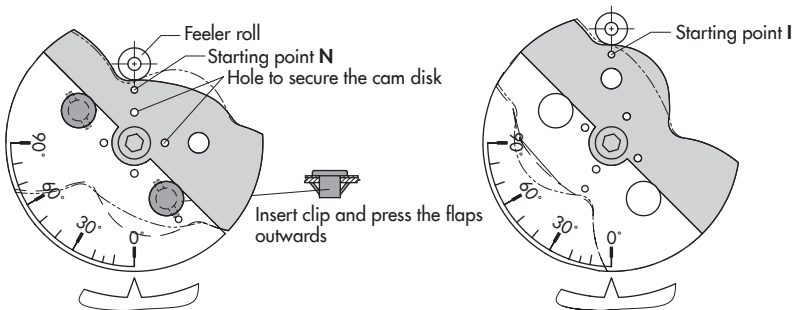
Fig. 9: Cam disk settings for single-acting actuators

Double-acting, springless rotary actuator with reversing amplifier

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

View from the positioner onto the actuator shaft
Control valve opens counterclockwise – Based on a closed valve

Direct operating direction >>				Reverse operating direction <<			
Reference variable	Signal pressure	Valve	Characteristic	Reference variable	Signal pressure	Valve	Characteristic
increases	A1 increases, A2 decreases	opens	N	decreases	A1 increases, A2 decreases	opens	I



View from the positioner onto the actuator shaft
Control valve opens counterclockwise – Based on a closed valve

Direct operating direction >>				Reverse operating direction <<			
Reference variable	Signal pressure	Valve	Characteristic	Reference variable	Signal pressure	Valve	Characteristic
increases	A1 increases, A2 decreases	opens	N	decreases	A1 increases, A2 decreases	opens	I

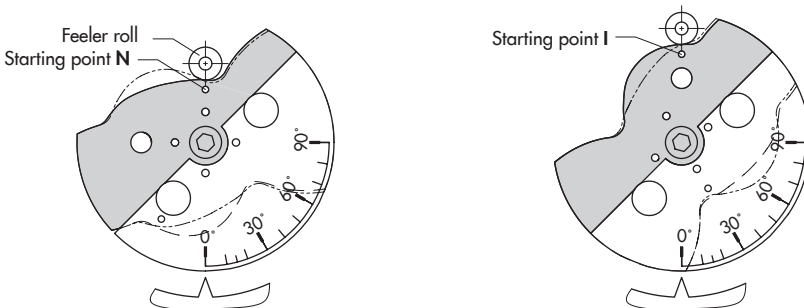


Fig. 10: Cam disk settings for double-acting actuators

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 EN).

The signal pressure of the positioner is supplied at the output A₁ of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at A₁, is applied at output A₂. The rule A₁ + A₂ = 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.

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 connection boreholes A₁ and Z.

Signal pressure connections

A₁: Connect output A₁ to the loading pressure connection on the actuator that causes the valve to open when the pressure rises.

A₂: Connect output A₂ to the loading pressure connection on the actuator that causes the valve to close when the pressure rises.

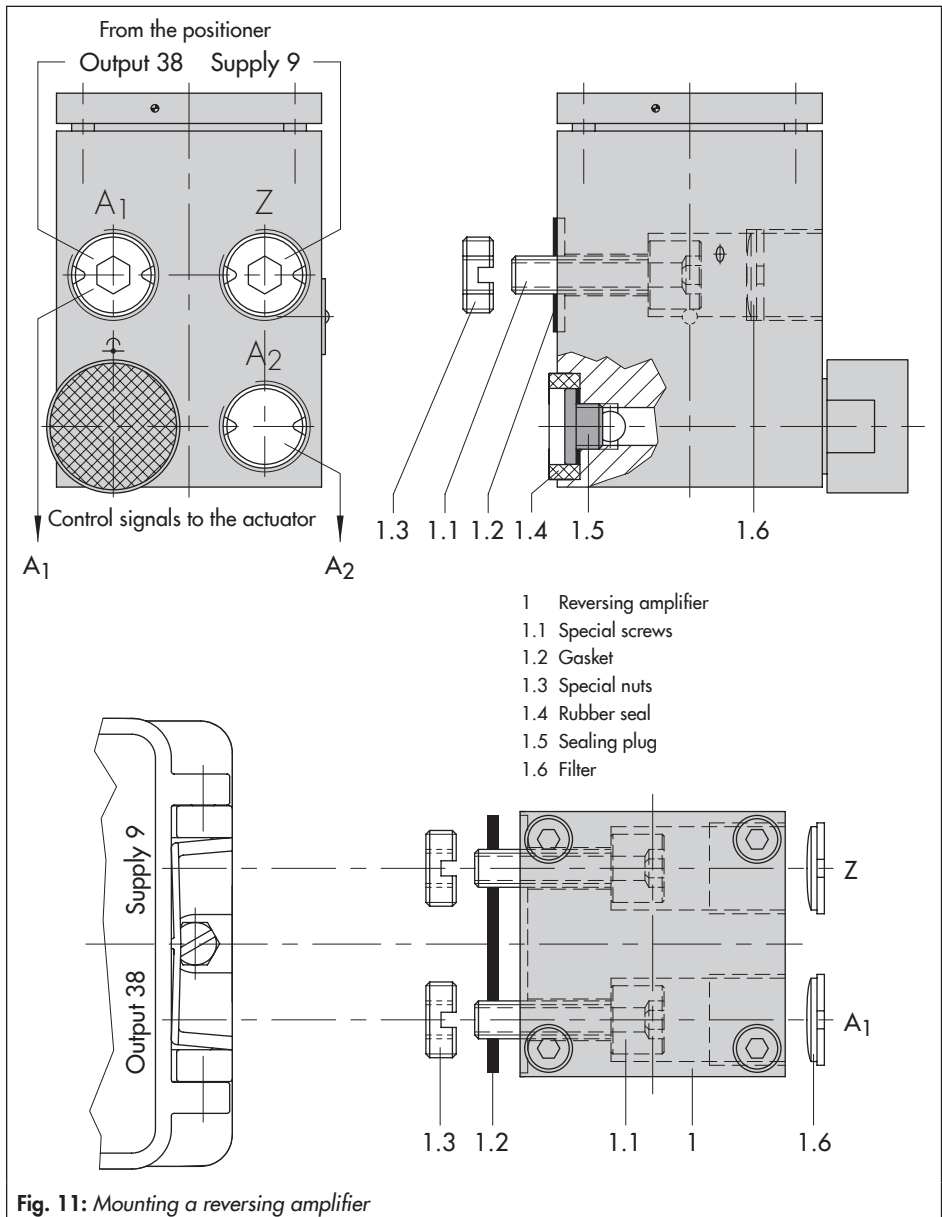
Pressure gauge attachment

The mounting sequence shown in Fig. 11 remains unchanged. Screw a pressure gauge bracket onto the connections A_1 and Z.

Pressure gauge bracket	G ¼	1400-7106
	¼ NPT	1400-7107

Pressure gauges for supply air Z and output A₁ as listed in Table 4 and 5.

1. Screw the special nuts (1.3) from the accessories of the reversing amplifier into the threaded connections of the positioner.
2. Insert the gasket (1.2) into the recess of the reversing amplifier and slide both the hollowed special screws (1.1) into the connecting boreholes A₁ and Z.



4 Connections

4.1 Pneumatic connections

The pneumatic connections are optionally designed as a bore with 1/4 NPT or G 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.

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



NOTICE

If you intend to replace older models with index 3767-x...x.02 or lower, the mounting parts may need to be replaced as well.

4.1.1 Pressure gauge

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, 5 and 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 spring 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.

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 3767-x...x.03 and higher are equipped with a hinged cover without its own exhaust air hole. 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

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]

Δp = Differential pressure across the valve [bar]

A = Actuator diaphragm area [cm²]

F = Upper bench range value of the actuator

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 counterclockwise 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 (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).

(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 or its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.

Selecting cables and wires

Observe **clause 12 of EN 60079-14** (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

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 positioner 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 switches 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. 12 or to the label on the terminal block.

Accessories:

Device index 3767-x...x.**03 and lower**

Cable gland PG 13.5

Black plastic Order no. 1400-6781

Blue plastic Order no. 1400-6782

Nickel-plated brass Order no. 1400-6979

Adapter PG 13.5 to ½ NPT:

Metal Order no. 1400-7109

Blue paint finish Order no. 1400-7110

Device index 3767-x...x.**04 and higher**

Cable gland M20 x 1.5

Black plastic Order no. 1400-6985

Blue plastic Order no. 1400-6986

Nickel-plated brass Order no. 1890-4875

Adapter M20x1.5 to ½ NPT:

Powder-coated aluminum

Order no. 0310-2149

4.2.1 Switching amplifier

The operation of the inductive limit switches 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.

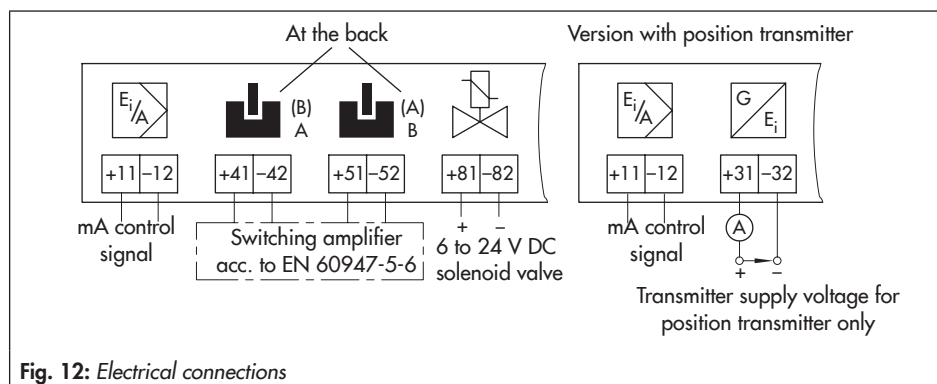


Fig. 12: Electrical connections

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, 4 to 20 mA, the valve must move through its entire travel range from 0 to 100 % (Fig. 13, 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 (4 or 20 mA) 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. 13, 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 4 to 12 mA, second valve set to 12 to 20 mA). To avoid overlapping, allow for a dead band of ± 0.5 mA as shown in Fig. 13.

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 ammeter to the signal input and apply air to the supply air input.

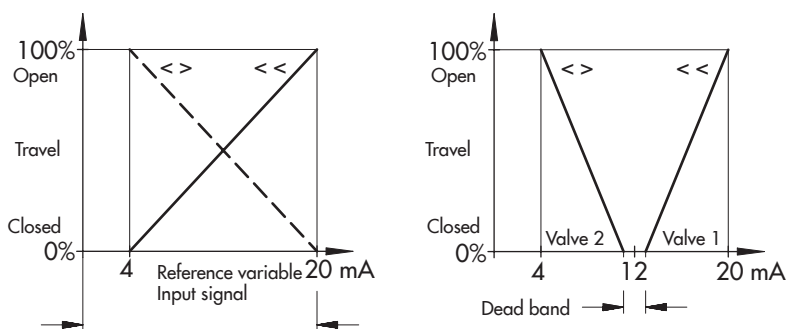


Fig. 13: Normal or split-range operation

**NOTICE**

When the positioner is controlled by a computer whose signal is limited, e.g. between 4 to 20 mA, set the positioner to the range from 4.5 to 20 mA.

This is the only way to ensure that the actuator is completely vented and the valve completely closed when the controller issues a 4 mA signal.

For operating direction \leftrightarrow , set the range to 4 to 19.5 mA.

5.1.1 Adjusting the proportional band X_p 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 X_p 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 X_p value is to be adjusted to be as small as possible, without considerable overshooting occurring.

**NOTICE**

Always adjust the X_p 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

Starting point (e.g. 4 mA)

1. Set the input signal at the ammeter to 4.5 mA
2. Turn the zero adjuster (6.2) until the valve just starts to move from its initial position.
3. Turn off the input signal and slowly increase it again. Check whether the valve starts to move at exactly 4.5 mA. Correct any deviation on the zero adjuster (6.2).

Upper range value (e.g. 20 mA)

1. Once the starting point has been set, increase the input signal to 20 mA at the ammeter.

At exactly 20 mA, the plug stem must stand still, having moved through 100 % travel (watch the travel indicator at the valve).

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.
3. Check the starting point and the upper range value. Repeat the correction procedure until both values are correct.



NOTICE

When setting the zero adjuster (6.2), check whether the actuator is relieved of pressure.

When the input signal is 4 mA and the operating direction >>, or the input signal is 20 mA and the operating direction <>, the pressure gauge must indicate 0 bar.

Correct zero accordingly!

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



NOTICE

When using an actuator with "actuator stem retracts" fail-safe action, 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 (20 mA) with operating direction >> as well as a lower range value of the reference variable (4 mA) with operating direction <>.

The **required signal pressure** is either indicated on the positioner label or the required sup-

ply pressure can be roughly calculated as described in section 4.1.2.

Starting point (e.g. 20 mA)

1. Set the input signal at the ammeter to 20 mA
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 20 mA. Check whether the valve starts to move at exactly 20 mA.
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 (e.g. 4 mA)

1. Once the starting point has been set, increase the input signal to 4 mA at the ammeter. At exactly 4 mA, 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 20 mA again.
4. Turn the zero adjuster (6.2) again until the pressure gauge indicates the **required signal pressure** (see section 4.1.2).

**NOTICE**

After mounting and tuning 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. 3) 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. 6).

In positioners for rotary actuators, reassign the cam disk as shown in Fig. 9 and 10.

For details on changing the turnboard (7), refer to section 3.

5.3 Adjusting the limit switches

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

The operation of the inductive limit switch requires switching amplifiers to be connected in the output circuit. Refer to section 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 switches 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 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. 12).

NOTICE

The tags of the limit switches cannot be turned by 360°. As a result, 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 switches 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 at the switching amplifier.

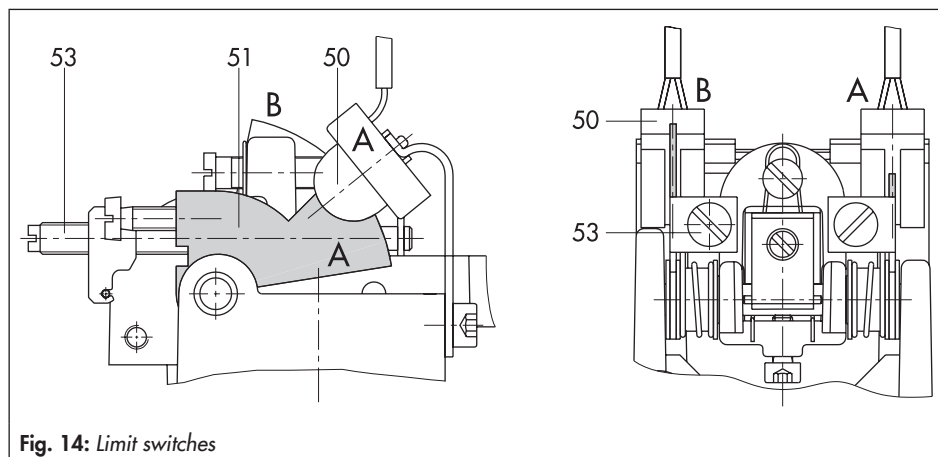


Fig. 14: Limit switches

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. 3)

	Left attachment		Right attachment	
	Switch			
Valve position	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. 6) and attachment to rotary actuators (Fig. 8)

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 four-pin connector (symbol on connector: \gg or \ll), 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.

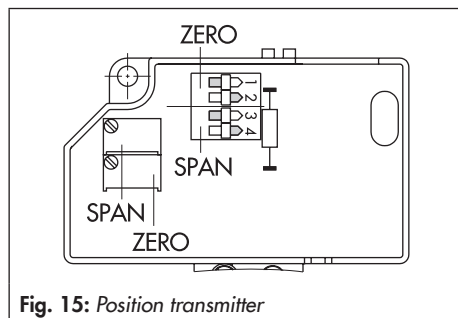


Fig. 15: Position transmitter

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.

Table 10: Position transmitter

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 point 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.

Adjusting the span

1. Use the input signal of the positioner to move the valve to closed position (valve CLOSED – 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.



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 (section 3.2.2) 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 and retrofitting the positioner



NOTICE

Read instructions in section 7 for explosion-protected versions!

6.1 Converting from electro-pneumatic to pneumatic

The electropneumatic positioner can be converted into a Type 3766 Pneumatic Positioner with the following conversion kit:

Required conversion kit:

M20 x 1.5, order no.: 1400-7575

1. Remove the holder with the terminal block.
Disconnect the cable to the i/p module.

2. Unscrew the fastening screws and remove the i/p module (6) including the seals (7, 8).
3. Place the connecting plate (3) with the seal on the housing bores and screw tight. The restriction must be seated in the seal above the right inner bore.
4. Replace the cable gland (5) with the pneumatic screw fitting (1).
5. Connect the silicone hose (2) and insert the guard plate (4) into the housing.
6. Remount the holder with terminal block.
7. Change type designation (model number) on the nameplate to Type 3766 Pneumatic Positioner.

For details on Type 3766 Positioners, refer to Mounting and Operating Instructions
► EB 8355-1 EN.

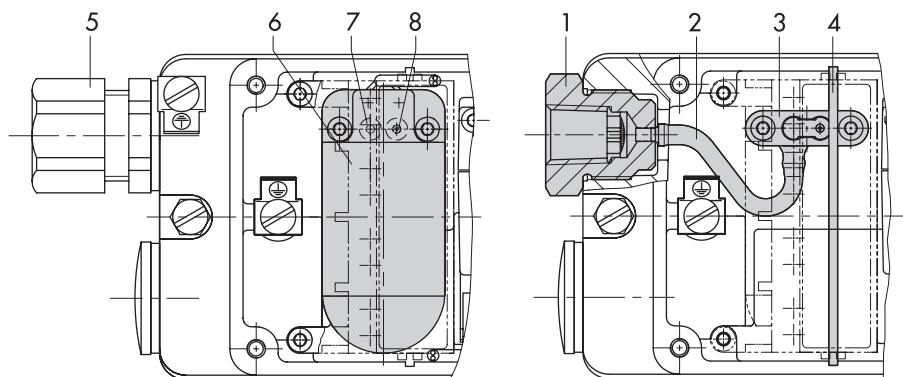


Fig. 16: Upgrading the positioner

6.2 Installing the limit contacts

Accessories: Limit switch retrofit kit depending on model index 3767-xxxxxxxxx. **04**
 Order no. 1400-8810 for index .06 or higher
 Order no. 1400-7573 for index .04/.05
 Order no. 1400-6389 for index .03

1. Unscrew the bracket with plate (1).
2. Remove the screws (2) and replace the entire input unit (3) with a unit including limit switches. Make sure the O-ring is inserted into the housing.
3. Attach the terminal block for the limit signals 41/42 and 51/52 in the terminal base.
4. Guide the connecting cable to the terminals and fasten.
 (brown = +, blue = -)

5. Refasten the bracket with plate (1) and stick the adhesive label for the limit switches on the housing cover.
6. Screw additional cable gland onto the housing.

6.3 Installing a solenoid valve

Accessories: Solenoid valve retrofit kit
 Order no. 1400-7712 for index .05 or lower
 Order no. 1400-8808 for index .06

1. Push the plate (5) to one side.
2. Unscrew the four screws (7). Lift off the black cover with the rubber gasket and insert the solenoid valve (6). The rubber gasket with the restriction is located in the rear of the solenoid valve.
3. Unscrew the plate (1).

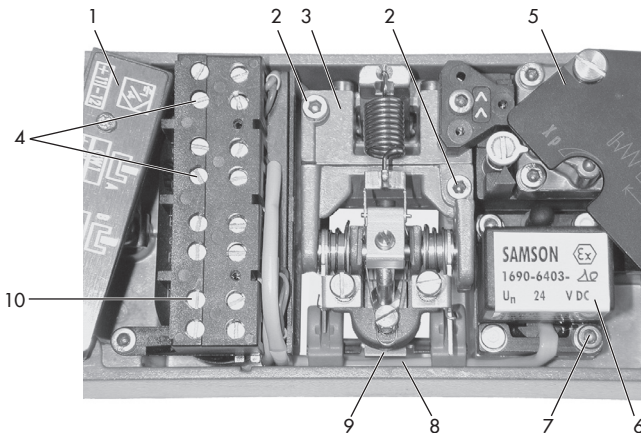


Fig. 17: Installing the limit switches and solenoid valve

4. Attach the terminal block (10) for the solenoid valve in the terminal base.
5. Insert the panel (9) at the rear of the positioner and attach it to the input unit using two screws.
6. Guide the connecting cable down behind the mounted panel of the input unit and up again to terminals 81/82 and fasten. (brown = +, blue = -)
7. Screw on the bracket with plate (1).
8. Screw additional cable gland onto the housing.

6.4 Removing the solenoid valve

Accessories: Retrofit kit containing cover for solenoid valve opening: order no. 1400-6949

1. Unscrew bracket with plate (1). Remove the connecting cable of the solenoid valve from terminals 81/82.
2. Unscrew the two screws (7) that are not sealed with paint and remove the solenoid valve with its connecting cable.
3. Place the rubber gasket on the spigot of the cover and screw it into the housing.
4. Screw on the bracket with plate (1).

7 Servicing explosion-protected devices

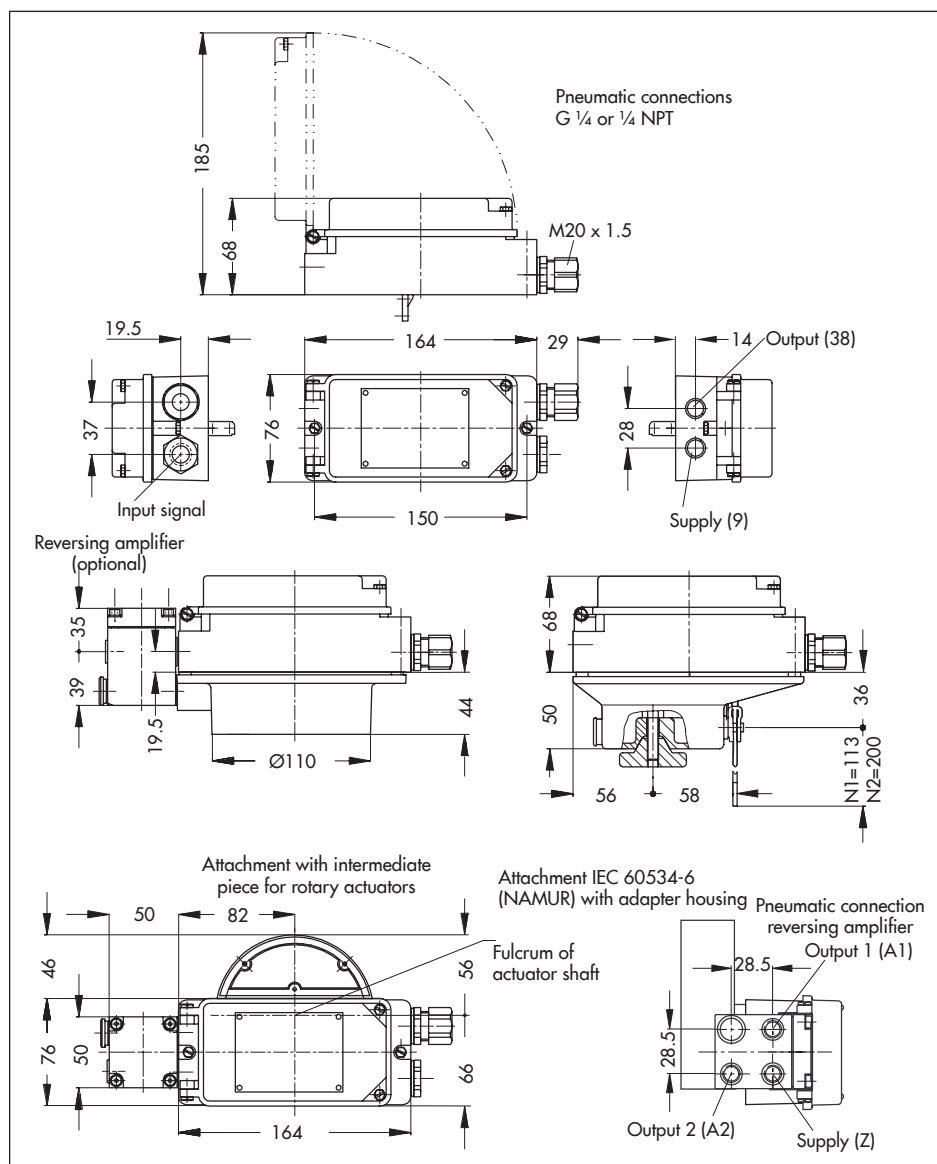
If a part of the device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity. Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device before putting it back into operation. Document the passing of the routine test by attaching a mark of conformity to the device.

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

Replace explosion-protected components only by original, routine-tested components provided 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.

8 Dimensions in mm





TRANSLATION

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 2167

- (4) Equipment: Model 3767-1... 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.

(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 is not valid for parts of the equipment or for accessories not covered by the certificate. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt Bundesallee 100 D-38116 Braunschweig
PTB 03/3767.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 is not valid for parts of the equipment or for accessories not covered by the certificate. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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PTB 03/3767.doc

(13)

Schedule

(14)

EC TYPE EXAMINATION CERTIFICATE No. PTB 01 ATEX 2167

(15)

Description of Equipment

The model 3767-1, Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of (0)4 to 20mA from a control device into a pneumatic signal pressure of 6 bar max. For pneumatic auxiliary power non-combustible media are used.

i/p-converter, inductive limit switches, solenoid valves and position indicator are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of U_i and P_i are not exceeded.

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

The correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit currents is shown in the table below.

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-45 °C ... 60 °C	85mA or
T5	-45 °C ... 70 °C	100mA or
T4	-45 °C ... 80 °C	120mA

Electrical data

Model 3767-1 . . .

i/p converter signal circuit
(terminals 11/12)

Type of protection: Intrinsic safety
EEx ia IIC

intrinsically safe circuit

U_i = 28 V

I_i = 100 mA or 85 mA C_i negligible

P_i = 0.7 W L_i negligible or

U_i = 25 V

I_i = 120 mA

P_i = 0.7 W L_i negligible

Maximum values

Models 3767 – 11, /, - 12, with inductive Limit Switches

Inductive limit switch
(terminals 41/42 and 51/52)

Type of Protection: Intrinsic safety
EEx ia IIC or EEx ia IIB respectively
only for connection to a certified
intrinsically safe circuit

Maximum values

U_i = 16 V

I_i = 52 mA

P_i = 169 mW

C_i = 30 nF L_i = 100 μ H or

U_i = 16 V

I_i = 25 mA

P_i = 64 mW

C_i = 30 nF L_i = 100 μ H

For positioners with inductive limit switches the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit currents is shown in the table below.

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

Model 3767-16 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 3767-1, 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:

Version	UN	6V	12 V	24 V
Temperature class	T6	60 °C		
	T5	-45 °C ≤ T _a ≤ 70 °C		
	T4	80 °C		
Characteristic linear or rectangular	P _i	#	#	##

C_i negligible L_i negligible

The permissible maximum power dissipation P_i 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 _i	25 V	27 V	28 V	30 V	32 V
I _i	150 mA	125 mA	115 mA	100 mA	85 mA
P _i	no limitation				

C_i negligible L_i negligible

(16) Test report PTB-Ex-01-21200

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Physikalisch-Technische Bundesanstalt Bundesallee 100 D-38116 Braunschweig
PTB 16-3767.doc

(17) Special conditions for safe use

None

(18) Special health and safety requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz

Braunschweig, 26 November 2001

By order

(Signature) (seal)

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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PTB 16-3767.doc



TRANSLATION

Statement of conformity

(1) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres –
Directive 94/9/EC

(2) EC Type Examination Certificate Number

PTB 01 ATEX 2170 X

(3) Equipment: Model 3767-8 Positioner

(4) Manufacturer: Simson AG

(5) Address: Weisenthalerstr. 3, D-60314 Frankfurt, Germany

(6) This equipment and any acceptable variation (therefore are specified in the schedule to this
certificate and the documents referred to therein.

(7) 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 the equipment specified. Further requirements of this Directive
relating to the marking and the documents referred to therein are 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 01-21201.

(8) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50021: 1999

(9) 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.

(10) 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
relating to the marking and the documents referred to therein are intended for use in potentially
explosive atmospheres given in Annex II to the Directive.

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PTB-Ex n.doc



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



Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 2002-03-07

(Signature)

(Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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PTB-Ex n.doc

(16) Test report: **PTB-Fs-01-21291**

(13) **Schedule**

(14) **Statement of Conformity PTB 01 ATEX 2170 X**

(15) **Description of Equipment**

The Model 3767-8... Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of (0)4 ... 20mA from a control devices into a pneumatic signal pressure of 0bar 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 equipped for use inside and outside of hazardous areas...

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

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	60°C	85mA or
T5	-45°C ≤ Ta ≤ 70°C	100mA or
T4	80°C	120mA

Electrical data

Model 3767-8...

Signal circuit (I/p-Converter) (terminals 11/12)

Type of protection: EEx nA II

Inductive limit switch (terminals 41/42 and 51/52)

Type of protection EEx nA II

Model 3767-86 with Position Indicator

Signal circuit (terminals 31/32)

Type of protection EEx nA II

The correlation between version and temperature classification is shown in the table below:

Version	UN	6V	12 V	24 V
Temperature class	T6	T5	T4	

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PTB14-Ex n.doc

(17) Special conditions for safe use

Schedule of the Statement of Conformity PTB 01 ATEX 2170 X

The Model 3767-8... 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 pull and twisting.

The signal circuit (terminals 11/12 I/p-converter) and the signal circuit (terminals 31/32 position indicator) 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 ≤ 50mA max.

Basic health and safety requirements

Are satisfied by compliance with the standard specified.

Zertifizierungsstelle Explosionschutz
By order

Braunschweig, 07 März 2002

(Signature) (seal)

Dr. Ing. U. Johannsmeyer

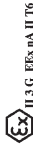
Statement of Conformity without signature and seal are invalid.
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PTB14-Ex n.doc

ADDENDUM No. 1

to the Statement of Conformity PTB 01 ATEX 2170 X

Equipment: Model 3767-s, Positioner



Marking: II 3 G EEx nA II T6

Manufacturer: SAMSON AG

Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The coverage of the existing Statement of Conformity is supplemented by the electrical data of the model series 3767-s.2, -8.3, - 8.4 with solenoid valve module. The design of the equipment was not changed.

Electrical data

Model 3767-s, Signal circuit (terminals 11/12)	Type of protection EEx nA II
Inductive proximity switch (terminals 41/42 and 51/52)	Type of protection EEx nA II
Model 3767-s6, with Position Indicator Signal circuit (terminals 31/32)	Type of protection EEx nA II
Models 3767-s.2, -8.3, -8.4 with Solenoid Valve Signal circuit, nominal signal (terminals 81/82)	Type of protection EEx nA II

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Physikalisch-Technische Bundesanstalt – Bundesallee 100 • D 38116 Braunschweig

PTB/EEA n. 4404-Loc

Addendum No. 1 to the Statement of Conformity PTB 00 ATEX 2170 X

The correlation between equipment version and temperature classification is shown in the table below:

Version	UN	6V	12V	24V
Temperature class	T6		60°C	
	T5		-45°C ≤ Ta ≤ 70°C	
	T4		80°C	

All the other data apply unchanged also to this Addendum No. 1.

Test report: PTB EX 03-23230

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 28. May 2003

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only without changes. The results laid down in this test report refer exclusively to the test object and the technical documentation submitted. Extracts or changes will require the approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt – Bundesallee 100 • D 38116 Braunschweig

PTB/EEA n. 4404-Loc

Manufacturer Declaration

made out to:
BASF Aktiengesellschaft, Carl-Bosch-Str. 38, D- 67056 Ludwigshafen

types
inductive sensors FJ..., NB..., NC..., NJ..., RG..., RJ..., TG..., SC..., SJ...,
capacitive sensors CB..., CC..., CJ...,

Pepperl+Fuchs GmbH Mannheim declares in its sole responsibility that the products named as above are manufactured following the standard EN 30 021: 1999.

Applies only to sensors that have an EC-Type Examination Certificate according Directive 94/9/EC category 2G or 1G.

Pepperl+Fuchs GmbH Mannheim declares in its sole responsibility that the above mentioned sensors are according to the requirements of Zone 2.
The type of protection is

II 3G EEx nL IIC T6

conform to standard EN5021: 1999
The sensors are not marked with II 3G EEx nL IIC T6.
The sensors are marked according to the EC-Type Examination Certificate category 2G or 1G.

The sensors have to be connected to energy-limited circuits only with type of protection EEx nL.
The values of the equivalent internal reactances C and L and the maximum permissible ambient temperature are given in the EC-Type Examination Certificate category 2G.

The maximum permissible ambient temperature has to be taken from the temperature table, which is subdivided into different types and temperature classes, of the assigned EC-Type Examination Certificate. P. use given in the following table (type 4 only if this type is listed in the assigned EC-Type Examination Certificate).

	type 1	type 2	type 3	type 4
U	20 V	20 V	20 V	20 V
I	25 mA	25 mA	50 mA	75 mA
P	34 mW	64 mW	100 mW	242 mW

The special conditions of the EC-Type Examination Certificate category 2G and the instructions according category 2G have to be taken into account.

For use according to Directive 94/9/EC within the European Community the manufacturer declaration is not sufficient because the following requirements of the Directive 94/9/EC are not met: marking on the sensor, instruction, declaration of conformity.

Pepperl+Fuchs Mannheim is subject to the rules of a quality management system according to DIN EN ISO 9001



Signature of Manufacturer: I.A. Werninger
Function of the signat: Head of EMS
standards department
factory automation
date: 2003-05-14

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: Minimum values

Circuit No.	I/p-circuit	Position-Indicator	Limit switches (Inductive)	Solenoid valve
1	11/12	2	3 and 4	5
Terminated No.	41/42 and 51/52	31/32		81/82
U ₀ or V _{max}	28V	28V	16V	28V
I ₀ or I _{max}	118mA	118mA	25.62 mA	118mA
P ₀ or P _{max}	0.7W	1W	64/168mW	250mW (##)
Q	0nF	5.3nF	30nF	0nF
L	0µH	0µH	100µH	0µH

Notes: Entry parameters must meet the following requirements:
((##) Solenoid valve 12V and 24V version P₀ or P_{max} no limited
U₀ or V_{0c} ≤ U₀ or V_{max} / I₀ or I_{0c} ≤ I₀ or I_{max} / P₀ ≤ P₀ or P_{max} Q₀ ≥ Q₀ and L₀ ≥ L₀

Table 2: CSA- certified barrier parameters of circuit 1, 2 and 5

Barrier	Supply barrier		Evaluation barrier	
	V _{max}	R _{min}	V _{max}	
circuit 1	≤ 28V	≥ 280Ω	≤ 28V	Diode Return
circuit 2	≤ 28V	≥ 280Ω	≤ 28V	Diode Return
circuit 5 (##)	≤ 28V	≥ 280Ω	≤ 28V	Diode Return
circuit 5 (##)	≤ 28V	≥ 280Ω	≤ 28V	Diode Return

circuit 5: (##) = 12V and 24V version; (##) = 6V version.

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

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

Table 4: For the Model 37/57 - 3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-45°C ... 48°C	
T5	-45°C ... 60°C	52mA
T4	-45°C ... 75°C	
T6	-45°C ... 60°C	
T5	-45°C ... 80°C	25mA
T4	-45°C ... 80°C	

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

CSA- certified for hazardous locations

Type 4 Enclosure

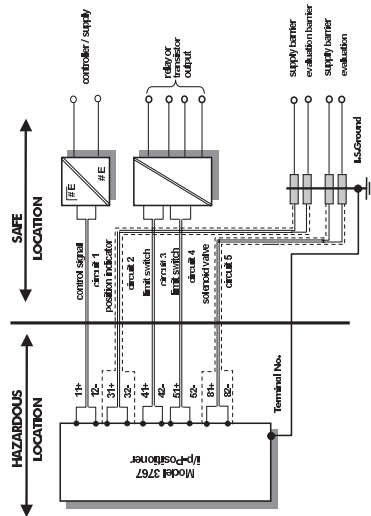
Ex in IIC T6; Class I, Zone 0

Class I: Groups A, B, C, D

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

Notes:

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



Versions Model 3767-3 with i/p-converter, solenoid valve and inductive limit switches.
Model 3767-36 with i/p-converter and position indicator.

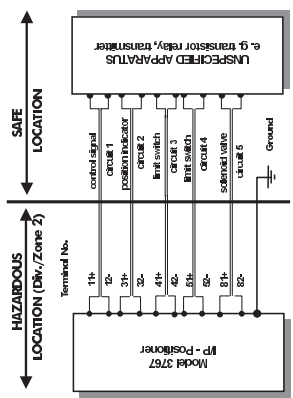
Circuit 1: Controller CSA- certified or CSA- certified barriers

Relay or transistor output 3 or 4 channel(s) resp. CSA certified.
Supply and evaluation barrier CSA- certified
Position indicator channel 2 only version 3767-36
For the permissible maximum values for the intrinsically safe circuits see Table 1
For the permissible barrier parameters for the circuits 2 and 5 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, Groups, E, F + G, Class III

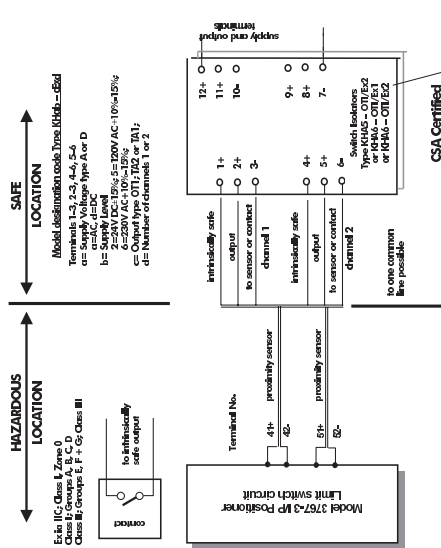
Type 4 Endorsement

I/P - 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-OT1/E2, KHA6-OT1/E1 or KHA6-OT1/E2 with Model SL-B-N Proximity Sensors



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

Control Relay Terminal No.	Groups	L [mH]	C [pF]	Voc [V]	Isc [mA]	Vmax [V]	Rmin [Ω]
1-3/2-3	A + B	84,88	1,273	↑	↑	↑	↑
4-6/5-6	C + D	298,7	3,82	72,6	19,8	17,6	600
	E + G	744,4	10,18	↑	↑	↑	↑

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

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

Circuit No.	I/p-circuit	Position-indicator	Limit switches inductive	Solenoid valve
	1	2	3 and 4	5
Terminal No.	11 / 12	31 / 32	41 / 42 51 / 52	81 / 82
U ₀ or V _{max}	28V	28V	16V	28V
I ₀ or I _{max}	115mA	115mA	25/52 mA	115mA
P ₀ or P _{max}	0,7W	1W	64/163mW	250mW (##)
Q	0nF	5,3nF	30nF	0nF
Li	0μH	0μH	100μH	0μH

Notes: Entry parameters must meet the following requirements
(##) Solenoid valve 12V and 24V version P₀ or P_{max} no limited
(##) Solenoid valve 6V version P₀ or P_{max} 250mW

U₀ or V₀ or V_i ≤ U₀ or V_{max} / I₀ or I₀ or I_i ≤ I₀ or I_{max} / P₀ or P_{max} ≤ P₀ or P_{max}
Q₀ ≤ Q₀ + Q₀ and L₀ ≤ L₀ + L₀

Table 2: FM/CSA - approved barrier parameters of circuit 2 and 5

Barrier	Supply barrier				Evaluation barrier			
	Voc	Rmin	Isc	Pmax	Voc	Pmax	Rmin	Isc
circuit 1	≤ 28V	≥ 280Ω	≤ 115mA	≤ 0,7W	≤ 28V	≤ 0,7W	#	0mA
circuit 2	≤ 28V	≥ 198Ω	≤ 115mA	≤ 1W	≤ 28V	≤ 1W	#	0mA
circuit 5 (##)	≤ 28V	≥ 200Ω	≤ 115mA	(#)	≤ 28V	(#)	#	0mA
circuit 5 (##)	≤ 28V	≥ 785Ω	≤ 115mA	(##)	≤ 28V	(##)	#	0mA

circuit 5: (##) = 12V and 24V version; (##) = 6V version.

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

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

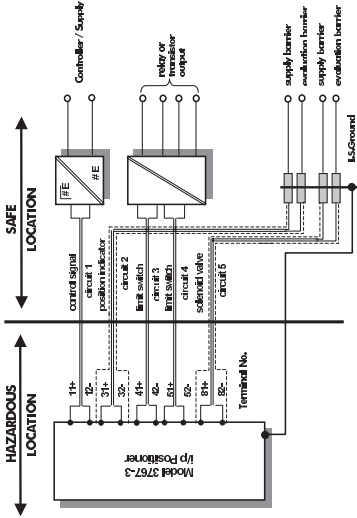
Table 4: For the Model 3767 – 3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current is shown in the table below:

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

FM- approved for hazardous locations
Class I, Zone 0, AEx 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_{sc} or I_{max}; P_{sc} or P_{max}; C_i and U_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.
 - 3.) Installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01
 - 4.) Use only supply wires suitable for 5°C above surrounding temperature.

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Version: Model 3767-3 with i/p-converter, solenoid valve and inductive limit switch(yes).
Model 3767-36 with i/p-converter and position indicator.

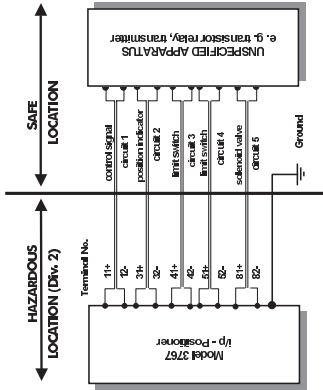
Circuit 1: Controller FM/CSA- approved or FM/CSA – approved barriers
Relay or transistor output 3 or 4 channel(s) resp. FM/CSA approved.
Supply barrier evaluation barrier
Position indicator channel 2 only version 3767-36

For the permissible maximum values for the intrinsically safe circuits see Table 1
For the permissible barrier parameters for the circuits 2 and 5 see Table 2
Cable entry M20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T
or 1050 – 0540 T

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FIM- 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

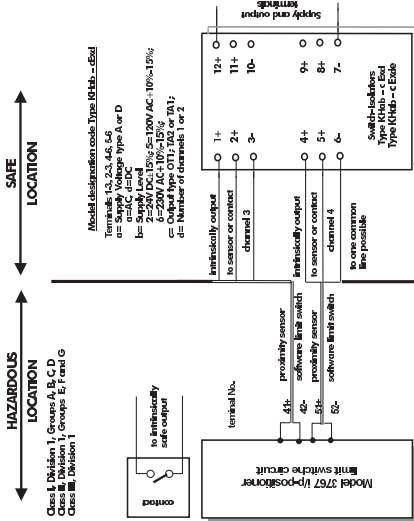
i/p - positioner with position indicator, solenoid valve and limit switches.



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. 1050-0539.1 and 1050-0540.1

Installation drawing Control Risky KHA-B-Ex with Model SJ-B-N Proximity Sensors



Maximum inductance of each inductive sensor 20mH
Maximum inductance of each inductive sensor 100µH

The total cable inductance and total capacitance of cable wiring shall be restricted to the following maximum values

Control Relay Terminated No.	Groups	L [mH]	C [pF]	V _{OC} [V]	I _{SC} [mA]
1-3/2-3 4-wire 5-wire	A + B	89.8	1.27	↑	↑
	C + E	299	3.82	12.9	10.8
	D, F, G	748	10.2	↓	↓



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