

Series 3730
Electropneumatic Positioner
Type 3730-1



Fig. 1 · Type 3730-1

Mounting and Operating Instructions

EB 8384-1 EN

Firmware version 2.11

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Modifications in positioner firmware compared to the previous version	
Previous version	New
2.02	2.10
	New reset function in Code P0 , refer to section 5.8
	New manual adjustment function in Code P14 , refer to section 5.9
2.10	2.11
	Internal modifications



General safety instructions

- ▶ *The positioner may only be mounted, started up or operated 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 relevant standards.*
- ▶ *Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 8 on Servicing explosion-protected versions.*
- ▶ *Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.*
- ▶ *If inadmissible motions or forces are produced in the actuator as a result of the supply pressure level, it must be restricted by means of a suitable supply pressure reducing station.
Do not operate the positioner with the back of the positioner/exhaust air opening facing upwards. The exhaust air opening must not be sealed when the positioner is installed on site.*
- ▶ *Proper shipping and appropriate storage are assumed.*
- ▶ **Note:** *The device with a CE marking fulfils the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).
The declaration of conformity is available on request.*

Versions

Article code	Type 3730-1	X	0	0	0	0	0	0	0	0	X	0	0	X	0	0	0	0
Explosion protection																		
Without		0																
⊕ II 2 G EEx ia IIC T6 acc. to ATEX		1																
Ex ia/Ex n acc. to FM/CSA		3																
⊕ II 3 G EEx nA/nL II T6 and II 3 D IP 65 T 80 °C acc. to ATEX		8																
Housing material																		
Standard aluminum											0							
Stainless steel 1.4581											1							
Special applications																		
Without																		0
Compatible with paint																		1
Exhaust air with ¼ NPT connection																		2
Special version																		
Without																		0 0 0

Positioner		
Travel, adjustable	Direct attachment to Type 3277: 3.6 to 30 mm Attachment acc. to IEC 60534-6: 3.6 to 200 mm or 24° to 100° with rotary actuators	
Travel range	Adjustable within the initialized travel/angle of rotation; travel can be restricted to 1/5 at the maximum	
Reference variable w	Signal range 4 to 20 mA · Two-wire device, reverse polarity protection, split-range 4 to 11.9 mA and 12.1 to 20 mA, static destruction limit 100 mA.	
Minimum current	3.7 mA	
Load impedance	≤ 6 V (corresponding to 300 Ω at 20 mA)	
Supply air Air quality acc. to ISO 8573-1	Supply pressure from 1.4 to 7 bar (20 to 105 psi), Max. particle size and density: Class 4 · Oil content: Class 3, pressure dew point: Class 3 or at least 10 K beneath the lowest ambient temperature to be expected	
Signal pressure (output)	0 bar up to supply pressure, limitable to approx. 2.4 bar via software	
Characteristic	Selection: 1 characteristic for globe valves, 8 characteristics for opening angle	
Hysteresis	≤ 1 %	
Sensitivity	≤ 0.1 %	
Transit time	< 0.5 s for initialization not permissible, adaptation over volume restriction Q	
Direction of action	w/x reversible	
Air consumption, st. state	Independent from supply pressure approx. 110 l _n /h	
Air output capacity Actuator pressurized Actuator vented	At Δp = 6 bar: 8.5 m _n ³ /h, at Δp = 1.4 bar: 3.0 m _n ³ /h K _{Vmax(20 °C)} = 0.09 at Δp = 6 bar: 14.0 m _n ³ /h, at Δp = 1.4 bar: 4.5 m _n ³ /h K _{Vmax(20 °C)} = 0.15	
Permissible ambient temperature	-20 to +80 °C, with metal cable gland -45 to +80 °C Limits in EC Type Exam. Certificate additionally apply for explosion-protected devices.	
Influences	Temperature: ≤ 0.15 %/10 K Supply air: None Vibration: ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770	
Electromagnetic compatibility	Complying with requirements specified in EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21	
Explosion protection	⊕ II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C or ⊕ II 3 G EEx nA/nL IIC T6 / II 3 D IP 65 T 80 °C	
Degree of protection	IP 66 / NEMA 4X	
Materials	Die-cast aluminum EN AC-Al Si12(Fe) (EN AC-44300) acc. to DIN EN 1706, chromated and plastic coated; External parts: Stainless steel 1.4571 and 1.4301	
Weight	Approx. 1 kg	
Binary contacts	2 software limit switches with configurable limits (0.5 % steps), reverse polarity protection, floating	
Signal status No response: Response:	Without explosion protection Conductive (R = 348 Ω) Non-conducting	Explosion-protected version ≥ 2.1 mA ≤ 1.2 mA
Operating voltage	For connection to binary input of the PLC acc. to EN 61131, P _{max} = 400 mW	Only for connection to NAMUR signal converter acc. to EN 60947-5-6

1 Design and principle of operation

The electropneumatic positioner is mounted to pneumatic control valves and is used to assign the valve position (controlled variable x) to the control signal (reference variable w). The DC control signal received from a control unit is compared to the travel or rotational angle of the control valve and issues a signal pressure (output variable y).

The positioner is designed depending on the corresponding accessories for direct attachment to Type 3277 Actuators or for attachment to actuators according to IEC 60534-6 (NAMUR).

Additionally, a coupling wheel included in the accessories is required to transfer the rotary motion for rotary actuators according to VDI/VDE 3845.

Springless rotary actuators require an accessory reversing amplifier to permit the powered operation in either direction.

The positioner basically consists of a travel sensor system that functions proportional to resistance, an analog i/p module with downstream booster as well as the electronic unit with a microcontroller. The positioner is fitted with two adjustable software limit switches as standard to indicate the valve's end positions.

The position of the valve is transmitted as linear travel motion or angle of rotation via pick-up lever and travel sensor (2) to an analog PD controller (3). Simultaneously, an A/D converter (4) transmits the position of the valve to the microcontroller (5). The PD controller compares this actual position to the 4 to 20 mA DC control signal (reference

variable) after it has been converted by the A/D converter (4).

In case of a system deviation, the operation of the i/p converter (6) is changed so that the actuator (1) is filled or vented via the downstream air capacity booster (7). This causes the closure member of the control valve to move to the position determined by the reference variable.

The pneumatic air capacity booster (7) and the pressure regulator (8) are provided with supply air. An intermediate flow regulator (9) with fixed settings is used to purge the positioner and also guarantees trouble-free operation of the pneumatic booster.

The output signal pressure supplied by the booster can be limited to 2.4 bar by activating the parameter P9.

The volume restriction Q (10) is used to optimize the positioner by adapting it to the actuator size.

Tight-closing function:

The pneumatic actuator is completely filled with air or vented as soon as the reference variable falls below 1 % or exceeds 99 % (see end positions set over parameters P10 and P11).

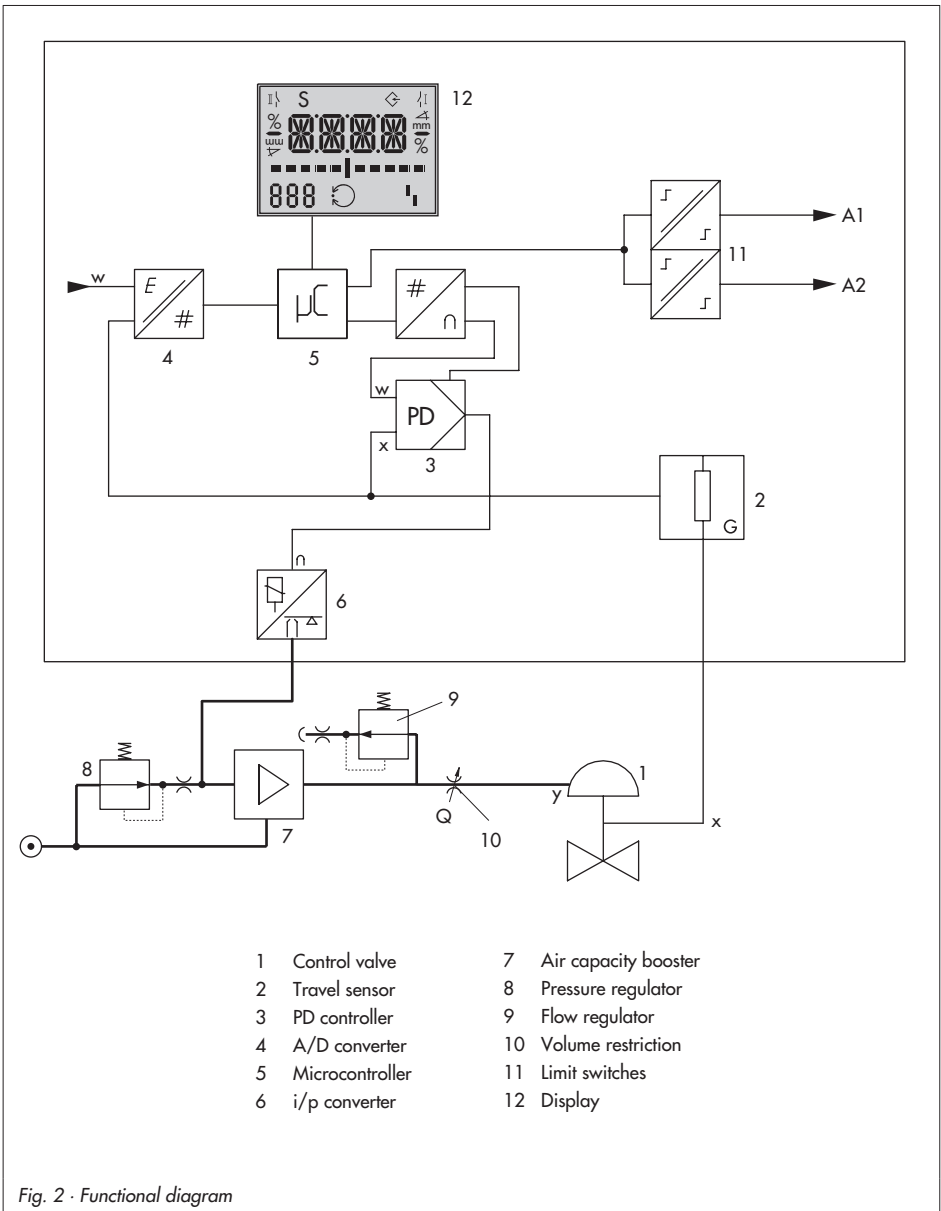


Fig. 2 · Functional diagram

2 Attachment to the control valve – mounting parts and accessories

The positioner can be attached either directly to a SAMSON Type 3277 Actuator or according to IEC 60534-6 (NAMUR) to control valves with cast yokes or rod-type yokes as well as to rotary actuators according to VDI/VDE 3845.

For attachment to the various actuators, corresponding mounting parts and accessories are required. These are listed with their order numbers in Tables 1 to 5.

On attaching the positioner, it is important to observe the assignment between lever and pin position according to the travels listed in the travel tables.

The actual valve travel that can be achieved is restricted by the pin position used and additionally by the actuator spring compression required.

The travel range listed in the **travel tables** can only be achieved if the nominal range is set to MAX.

The positioner is standard equipped with the lever **M** (pin position **35**).

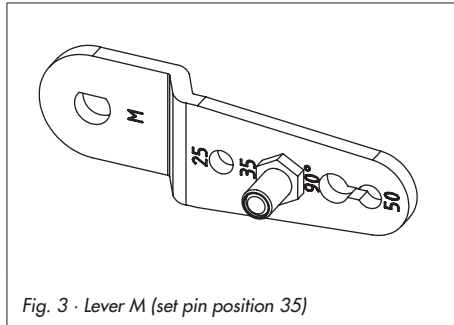


Fig. 3 · Lever M (set pin position 35)

Note: If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way as far as it will go in both directions to adapt it to the internal measuring lever.

Travel table for direct attachment to Type 3277 Actuator								
Type 3277-5 and 3277 Actuators	Actuator size cm ²	Rated travel mm	Adjustment range at positioner		Required lever	Assigned pin position		
			Min.	Travel			Max.	
	120	7.5	5.0		25.0	M	25	
	120/240/350	15	7.0		35.0	M	35	
700	30	10.0		50.0	M	50		
Travel table for attachment according to IEC 60534-6 (NAMUR)								
SAMSON valves			Other valves/actuators			Required lever	Assigned pin position	
cm ²	Rated travel mm	Min.	Travel	Max.				
Type 3271 Actuator	60 and 120 with Type 3510 Valve	7.5	3.6		18.0	S	17	
	120	7.5	5.0		25.0	M	25	
	120/240/350	15	7.0		35.0	M	35	
	700	7.5						
	700	15 and 30	10.0		50.0	M	50	
	1400/2800	30	14.0		70.0	L	70	
	1400/2800	60	20.0		100.0	L	100	
	1400/2800	120	40.0		200.0	XL	200	
Rotary actuators					Opening angle 24° to 100°		M	90°

Attachment to the control valve – mounting parts and accessories

Table 1		Direct attachment to Type 3277-5 Actuator		Order no.
Mounting parts	For actuators with 120 cm ² effective diaphragm area			1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx. 00 (old)			1400-6819
	Switchover plate new for Actuator Type 3277-5xxxxxx. 01 (new)			1400-6822
	Connecting plate for additional attachment of a solenoid valve G 1/8			1400-6820
	Connecting plate (old) for Actuator Type 3277-5xxxxxx. 00 (old) 1/8 NPT			1400-6821
	Connecting plate new for Actuator Type 3277-5xxxxxx. 01 (new)			1400-6823
<i>Note: Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.</i>				
Accessories for the positioner	Connecting plate (6)		G ¼: 1400-7461	¼ NPT: 1400-7462
	or pressure gauge bracket (7)		G ¼: 1400-7458	¼ NPT: 1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output and supply)		Stainless steel/Brass: 1400-6950	Stainless steel/St. steel: 1400-6951
Table 2		Direct attachment to Type 3277 Actuator		
Accessories	Mounting parts for actuators with 240, 350 and 700 cm ² , see Fig. 5			1400-7453
	Required piping with screw fittings for "Actuator stem retracts" or when the top diaphragm chamber is filled with air	cm ²	Steel	Stainless steel
		240	1400-6444	1400-6445
		350	1400-6446	1400-6447
700	1400-6448	1400-6449		
Connection block with seals and screw		G ¼: 1400-8811	¼ NPT: 1400-8812	
Pressure gauge mounting kit up to max. 6 bar (output and supply)		Stainless steel/Brass: 1400-6950	Stainl. steel/St. steel: 1400-6951	

Table 3 Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6, see Fig. 6			
Travel in mm	Lever	For actuators	Order no.
7.5	S	Type 3271-5 Actuator with 60/120 cm ² on Type 3510 Valve, see Fig. 7	1400-7457
5 to 50	Without (lever M on basic model)	Actuators from other manufacturers and Type 3271 with 120 to 700 cm ²	1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271, 1400-60 version	1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm ² with 120 mm travel	1400-7456
30 or 60	L	Type 3271 Actuator, versions 1400-120 and 2800 cm ² with 30 or 60 mm travel	1400-7466
Mounting brackets for Emerson and Masonellan linear actuators In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.			1400-6771
Accessories	Connecting plate		G ¼: 1400-7461 ¼ NPT: 1400-7462
	or pressure gauge bracket (7)		G ¼: 1400-7458 ¼ NPT: 1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)		St. steel/Brass: 1400-6950 St. steel/St. steel: 1400-6951

Table 4 Attachment to rotary actuators			
Mounting parts	With follower clamp and coupling wheel	VDI/VDE 3845 for all sizes of fixing level 2, see Figs. 8 and 9 for Type 3278 Actuator with 160/320 cm ² for Camflex II	1400-7448 1400-7614 1400-9120
	VDI/VDE 3845 for all sizes of the fixing level 2, heavy-duty version		1400-9244
	SAMSON Type 3278 160 cm ² / VETEC Type S160 and Type R, heavy-duty version		1400-9245
	AIR TORQUE 10 000, heavy-duty version		1400-9542
Accessories	Connecting plate		G ¼: 1400-7461 ¼ NPT: 1400-7462
	or pressure gauge bracket (7)		G ¼: 1400-7458 ¼ NPT: 1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)		Stainless steel/Brass: 1400-6950 Stainless steel/Stainless steel: 1400-6951

Table 5 General accessories				
Accessories	Pneumatic reversing amplifier for double-acting actuators	G ¼ ¼ NPT	1079-1118 1079-1119	
	Cable gland M20 x 1.5 Nickel-plated brass		1890-4875	
	Adapter M 20 x 1.5 to ½ NPT, aluminum			0310-2149
	Cover plate with list of parameters and operating instructions	German/English (standard) English/Spanish English/French	1990-7930 1990-8212 1990-8132	

2.1 Direct attachment

2.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 12 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 11!

Actuator with 120 cm²

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm. Depending on the fail-safe action of the actuator "Actuator stem extends" or "Actuator stem retracts" (valve closes or opens if the supply air fails), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove screw plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.
6. Insert formed seal (15) in the groove of the positioner casing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 12). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws. During the installation make sure that the seal ring (10.1) is inserted in the bore of the intermediate plate.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

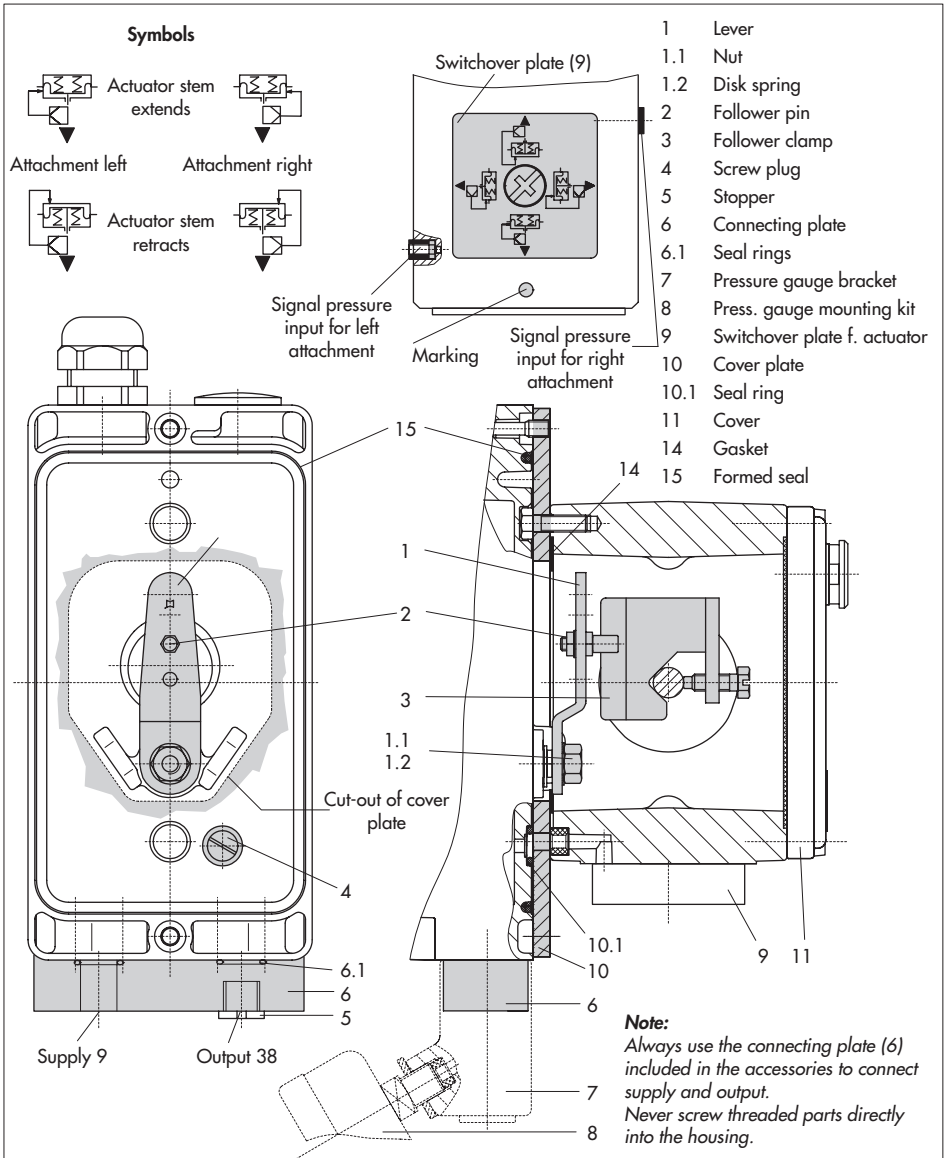


Fig. 4 · Direct attachment – Signal pressure connection for Type 3277-5 Actuator with 120 cm²

2.1.2 Type 3277 Actuator

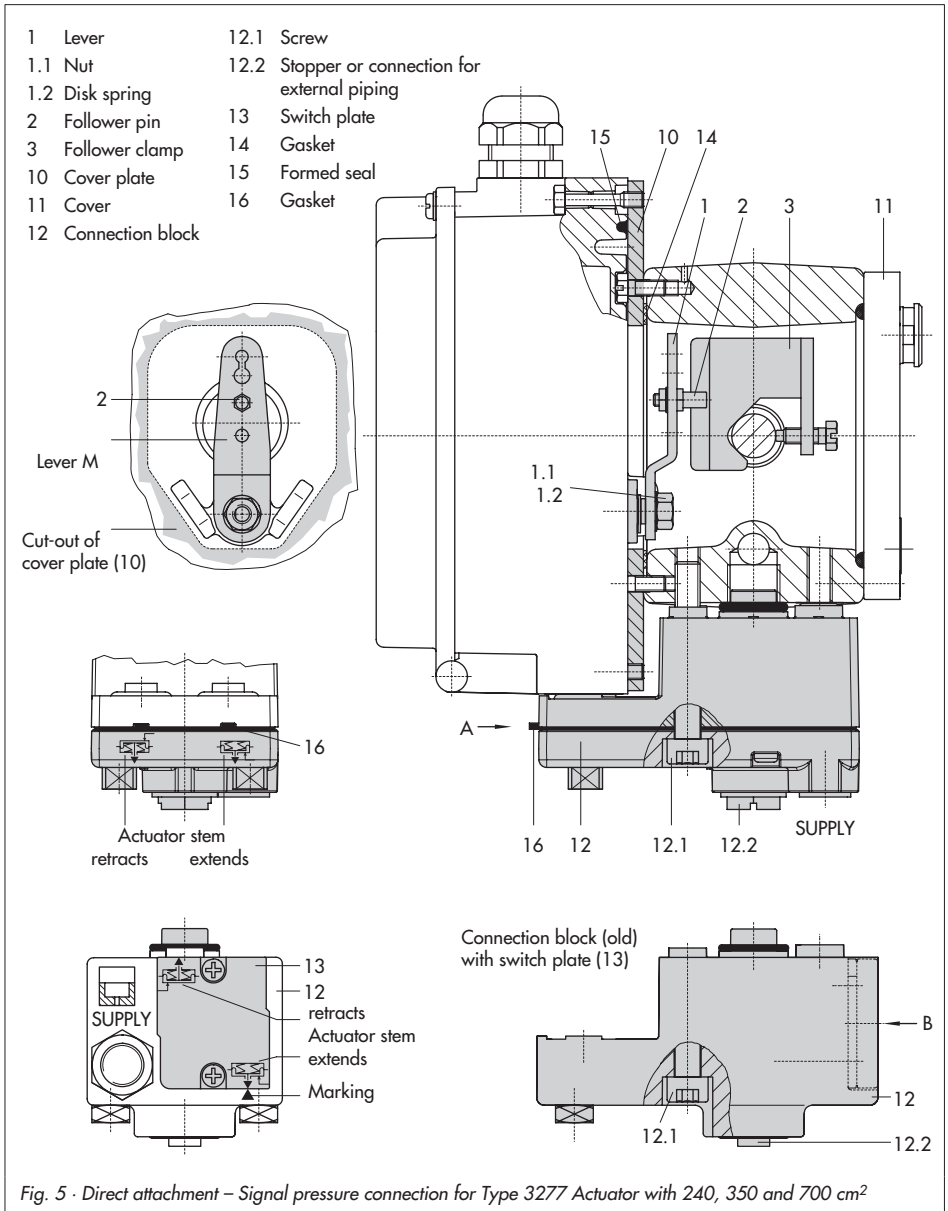
Refer to Table 2 on page 12 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 11!

Actuators with 240 to 700 cm²

The positioner can be mounted either on the left or on the right side of the yoke. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 700 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
For actuators 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 12). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.



2.2 Attachment according to IEC 60534-6

The positioner is attached to the control valve with a NAMUR bracket (10).

Refer to Table 3 on page 13 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 11!

1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.

Actuator size 2800 cm² and 1400 cm² with 120 mm travel:

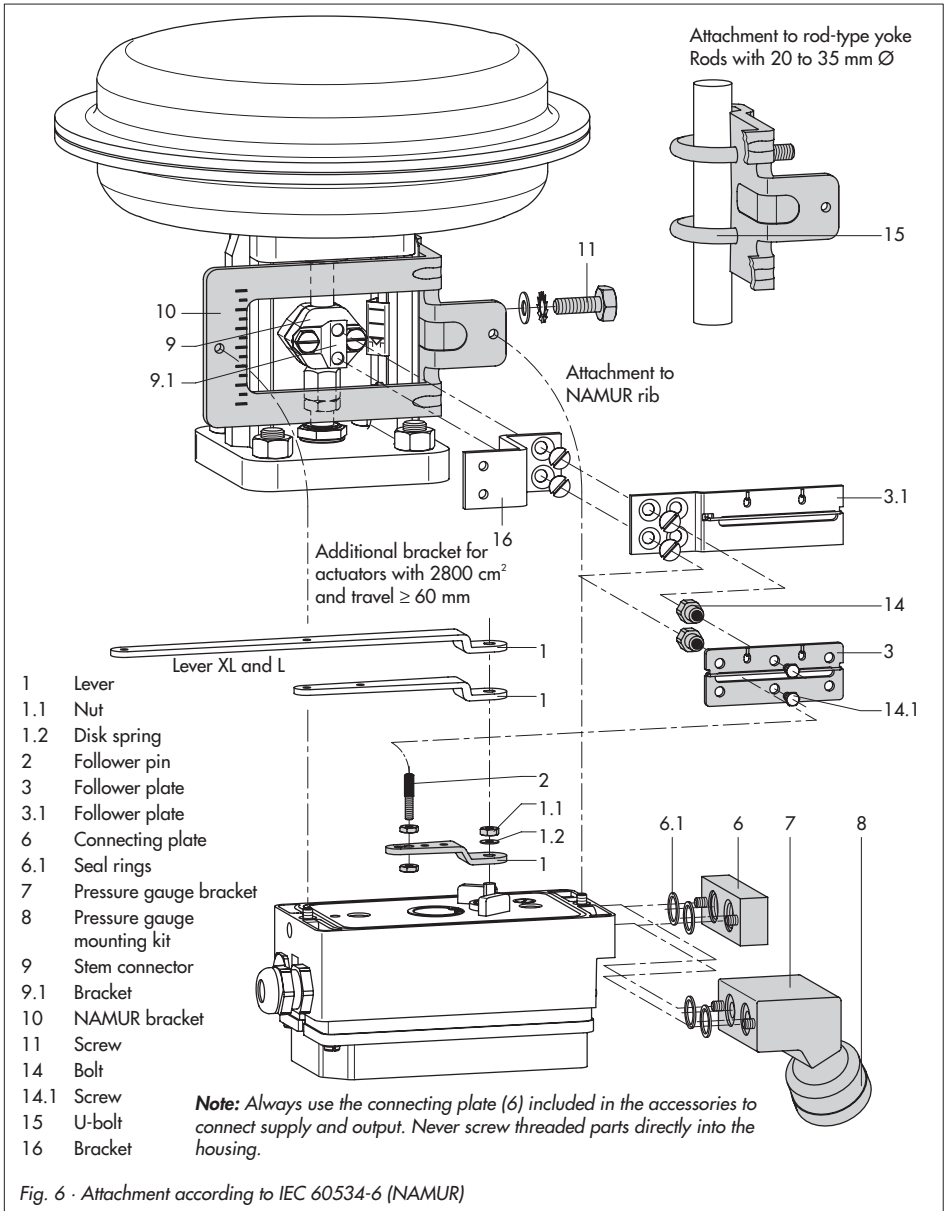
For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9). For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).

2. Mount NAMUR bracket (10) to the control valve as follows:
For attachment to the NAMUR rib, use an M8 screw (11) and toothed lock washer directly in the yoke bore.
For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke.
Align the NAMUR bracket (10) according to the embossed scale so that the slot of the follower plate (3) is centrally aligned with the NAMUR bracket at mid valve travel.

3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table below.
Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:
5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Note: *If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.*

7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
Screw the positioner to the NAMUR bracket using both its fixing screws.



2.3 Attachment to Type 3510 Micro-flow Valve

The positioner is attached to the valve yoke using a bracket.

Refer to Table 3 on page 13 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 11!

1. Place clamp (3) on the valve stem connector, align at a right angle and screw tight.
2. Screw bracket (10) to the valve yoke using two screws (11).
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both seal rings (6.1) are seated properly.
4. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
5. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
6. Place lever **S** on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
Move lever once all the way as far as it will go in both directions.
7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3). Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using both its screws.

- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 3 Clamp
- 6 Connecting plate
- 6.1 Seal rings
- 7 Pressure gauge bracket
- 8 Pressure gauge mounting kit
- 10 Bracket
- 11 Screw

Note:

Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

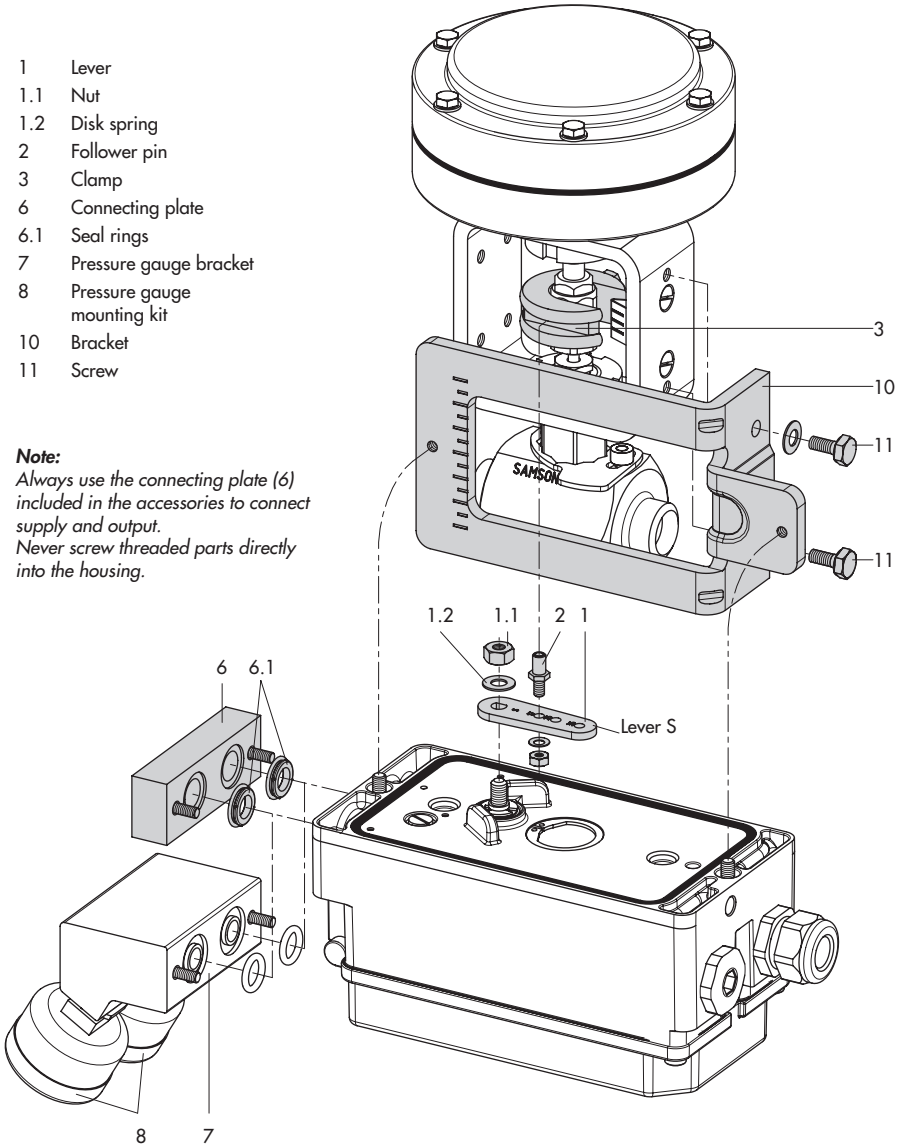


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

2.4 Attachment to rotary actuators

The positioner is mounted to the rotary actuator using two pairs of double brackets.

Refer to Table 4 on page 13 for the required mounting parts as well as the accessories with their order numbers.

Prior mounting the positioner to the SAMSON Type 3278 Rotary Actuator, you have to mount the associated adapter (5) to the free end of the rotary actuator shaft.

Note: During the installation of the positioner as described below, it is imperative that the actuator's direction of rotation be observed.

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 9 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using the screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.

5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both O-rings are seated properly. For **double-acting**, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator, see section 2.5.
6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin (Ø5) included in the accessories and screw tight into the bore for pin position **90°**.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (see Fig. 9). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

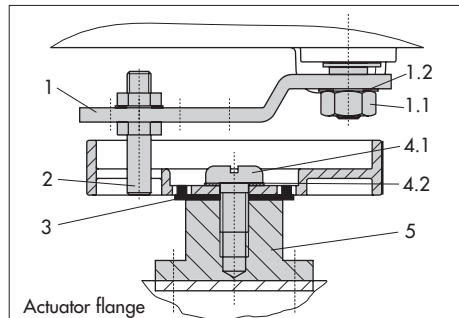
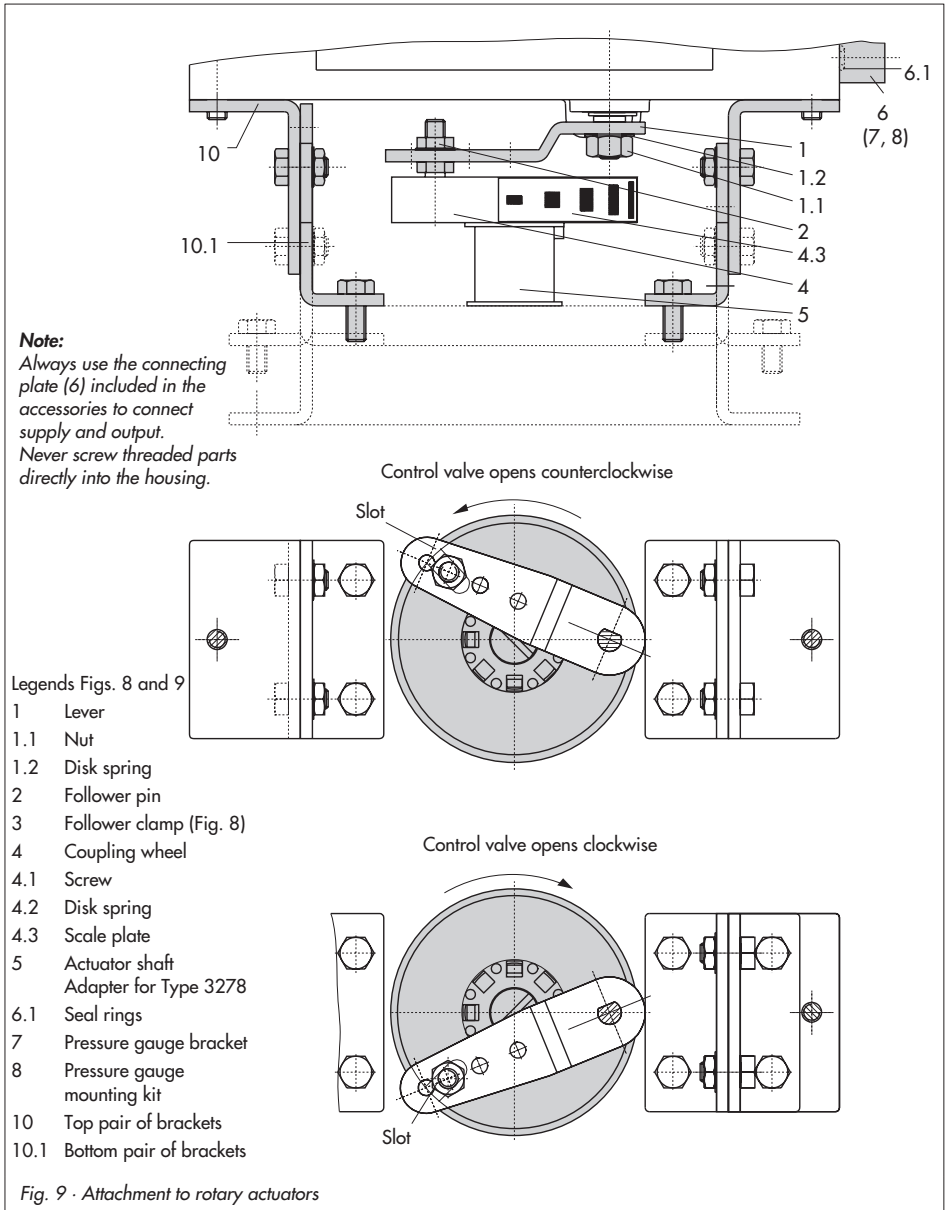


Fig. 8 · Mounting the coupling wheel with Type 3278



2.5 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier. The reversing amplifier is listed as an accessory in the Table 5 on page 13.

The output 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.

Mounting

1. Mount the connecting plate (6) from the accessories in Table 4 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the special hollow screws (1.1) into the connecting boreholes **A₁** and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes **A₁** and **Z**.

Note: The sealing plug (1.5) should not be unscrewed out of the reversing amplifier. The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

Signal pressure connections

A₁: Output **A₁** leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

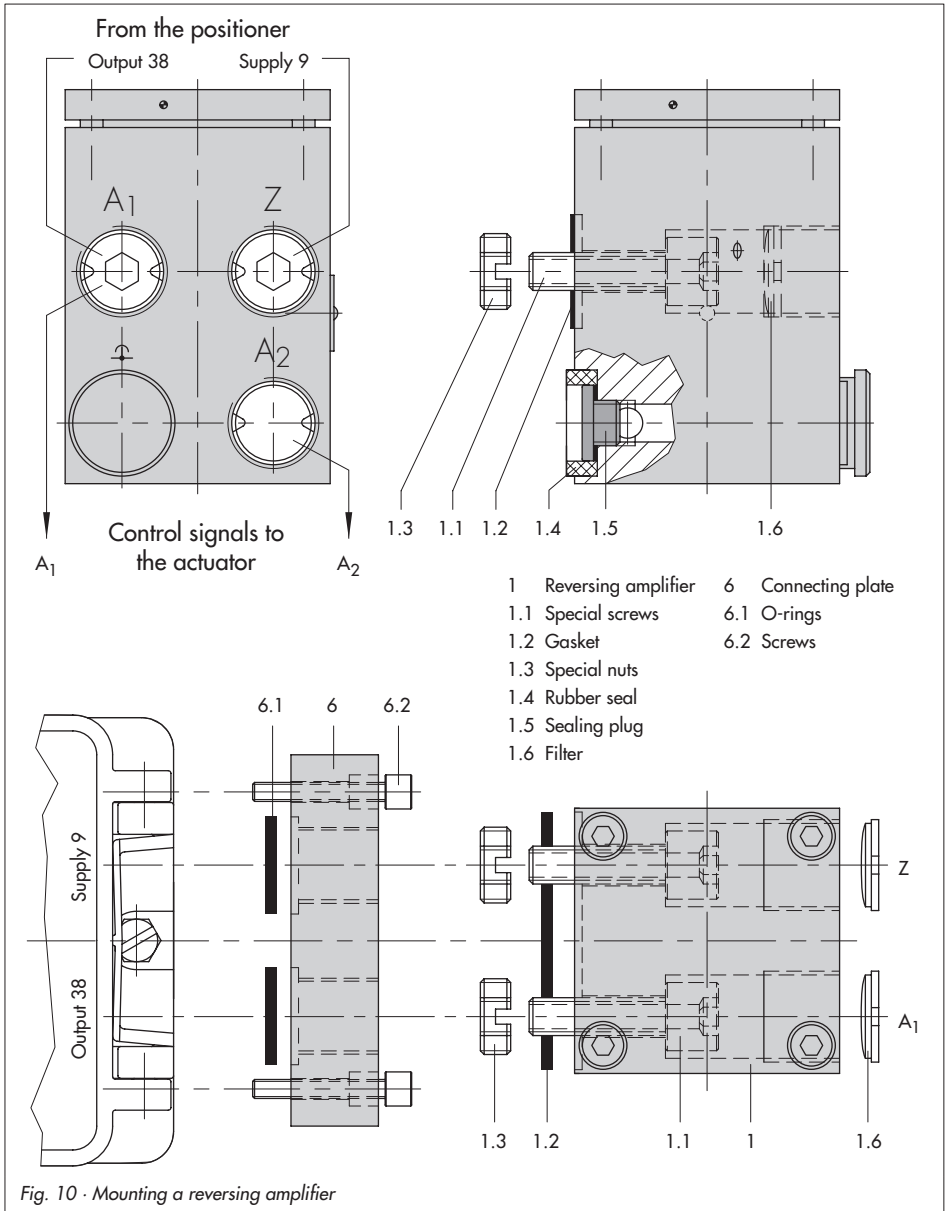
A₂: Output **A₂** leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

2.5.1 Pressure gauge attachment

The mounting sequence shown in Fig. 10 remains unchanged. Screw a pressure gauge bracket onto the connections **A₁** and **Z**.

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

Pressure gauges for supply air Z and output **A₁** as listed in Tables 1 to 4.



2.6 Attaching positioners with stainless steel housings

Positioners with stainless steel housings require mounting parts that are completely made of stainless steel or free of aluminum.

Note: *The pneumatic connecting plate and pressure gauge bracket are available made of stainless steel (order numbers listed below). A stainless steel version of the pneumatic reversing amplifier is **not** available.*

Connecting plate (stainless steel):	G ¼ ¼ NPT	1400-7476 1400-7477
Pressure gauge bracket (st. steel):	Only in ¼ NPT	1400-7108

The Tables 1 to 5 (pages 12 and 13) apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment

All mounting kits from Tables 1 and 2 can be used. The connection block is not required. The stainless steel version of the pneumatic connecting plate routes the air internally to the actuator.

Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)

All mounting kits from Table 3 can be used. Connecting plate in stainless steel.

Attachment to rotary actuators

All mounting kits from Table 4 can be used except for the heavy-duty version. Connecting plate in stainless steel.

2.7 Air purging function for single-acting actuators

The exhaust air from the positioner is diverted to the actuator spring chamber to provide corrosion protection inside the actuator. The following must be observed:

Direct attachment to Type 3277-5 (stem extends FA/stem retracts FE)

The air purging function is automatically provided.

Direct attachment to Type 3277, 240 to 700 cm²

FA: Remove the stopper 12.2 (Fig. 5 on page 17) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

FE: The air purging function is automatically provided.

Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators

The positioner requires an additional port for the exhaust air that can be connected over piping. An adapter available as an accessory is used for this purpose:

Threaded bushing (M20 x 1.5):	G ¼ ¼ NPT	0310-2619 0310-2550
-------------------------------	--------------	------------------------

Note: *The adapter uses one of the M20x1.5 connections in the housing which means **just one** cable gland can be installed.*

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.

3 Connections

3.1 Pneumatic connections

Caution!

The threads in the positioner housing are not designed for direct air connection!

The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories. The air connections are optionally designed as a bore with $\frac{1}{4}$ NPT or G $\frac{1}{4}$ thread.

The customary fittings for metal and copper pipes or plastic hoses can be used.

Note: *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 tubes and hoses thoroughly prior to 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".

For rotary actuators, the manufacturer's specifications for connection apply.

3.1.1 Signal pressure gauges

To monitor the supply air (Supply) and signal pressure (Output), we recommend that pressure gauges be attached (see accessories in Tables 1 to 5).

3.1.2 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 registered on the nameplate either as spring range or signal pressure range. The direction of action is marked **FA** or **FE**, or by a symbol.

Actuator stem extends FA (Air to open ATO)

Fail-safe position "Valve Closed"
(for globe and angle valves):

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

Actuator stem retracts FE (Air to close ATC)

Fail-safe position "Valve 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 of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar

Note: The signal pressure at the output (Output 38) of the positioner can be limited to approx. 2.4 bar by setting the parameter **P9 = ON**.

3.2 Electrical connections



For electrical installation, you are required to 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 association.

The following standards apply for installation in hazardous areas:

EN 60079-14: 2003 (VDE 0165 Part 1) "**Electrical apparatus for explosive gas atmospheres**" and EN 50281-1-2: 1999 (VDE 0165 Part 2) "**Electrical apparatus for use in the presence of combustible dust**".

For the interconnection of intrinsically safe electrical equipment, the permissible maximum values specified in the EC type examination certificate apply (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).

For EEx nA equipment (non-sparking apparatus), the standard EN 50021: 1999 specifies that connecting, interrupting, or switching circuits while energized is only allowed during installation, maintenance or repair work.

For EEx nL equipment (energy-limited apparatus), the standard EN 50021: 1999 allows this type of equipment to be switched under normal operating conditions.

Caution!

The terminal assignment specified in the certificate must be adhered to. Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective!

Do not tamper with enameled screws inside or on the housing.

Note on the selection of cables and wires:

To install intrinsically safe circuits, observe section 12 of the standard EN 60079-14: 2003 (VDE 0165 Part 1). To run multi-core cables or lines with more than one intrinsically safe circuit, section 12.2.2.7 of this standard applies.

An additional cable gland can be installed when connecting the device over two separate cables. Cable entries left unused must be sealed with blanking plugs. Devices used at ambient temperatures down to $-40\text{ }^{\circ}\text{C}$ must have metal cable entries.

Cable entries

The cable entry with M20x1.5 cable gland, 6 to 12 mm clamping area.

There is a second M20x1.5 threaded bore in the housing that can be used for additional connection, when required.

The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm². Tighten by at least 0.5 Nm.

The wires for the reference variable must be connected to the terminals 11 and 12 located in the housing. Only use a **current source!**

Caution!

The incorrect connection of a voltage source of just around 7 V (or around 2 V when connected to the wrong pole) by mistake can damage the positioner.

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.

For operation of the limit switches in Type 3730-11/-13/-18 Positioners, switching amplifiers which comply with EN 60947-5-6 must be connected to terminals 41/42 and 51/52 in the output circuit. If the positioner is to be installed in hazardous areas, the relevant regulations must be observed.

Refer to Fig. 11 for the terminal assignment.

Note: The minimum permissible reference variable should not fall below 3.7 mA.

Accessories:

- Plastic cable gland M20x1.5:
- Black Order no. 8808-1011
- Blue Order no. 8808-1012
- Nickel-plated brass Order no. 1890-4875
- Adapter M20 x 1.5 to ½ NPT
- Aluminum, powder-coated Order no. 0310-2149

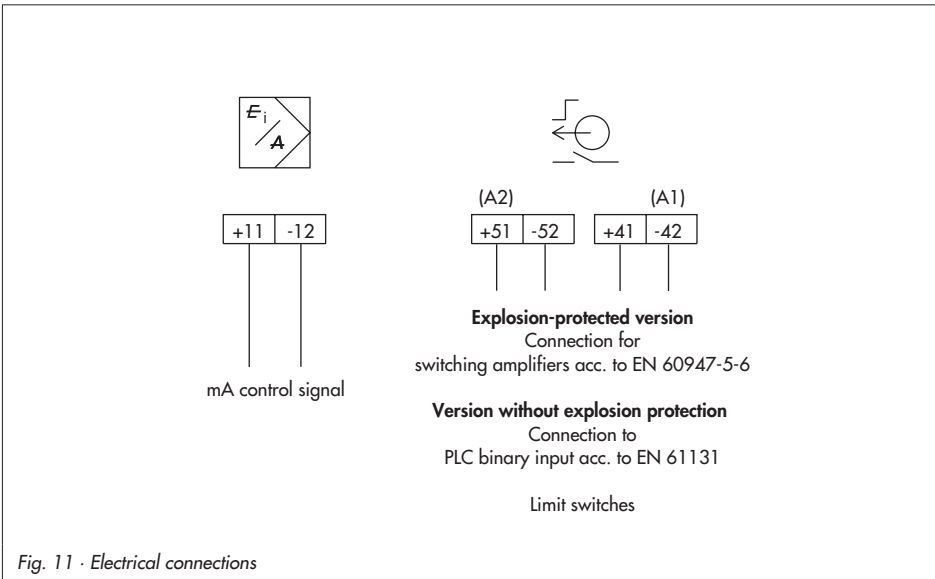





Fig. 11 · Electrical connections


4 Operation


The positioner is mainly operated with the rotary pushbutton.
The volume restriction must be set first to adapt the air delivery.

4.1 Operator controls

Rotary pushbutton

Turn the  button to select a parameter code (**P0** to **P16**) and then press it to confirm the parameter code selected.
If you want to change a parameter value, turn the  button to select the required valve. Then press the  button to confirm the value.

Note: Parameter codes that have been changed are first saved in the EEPROM (protected against power failure) when the display returns to the status indication mode. Turn  button to Code **P0** or wait three minutes until the display returns automatically.

The parameter code is not saved permanently as long as the  icon appears at the top of the display.

Note: The positioner must be re-initialized after the parameter codes **P2**, **P3**, **P4** and **P8** have been changed.

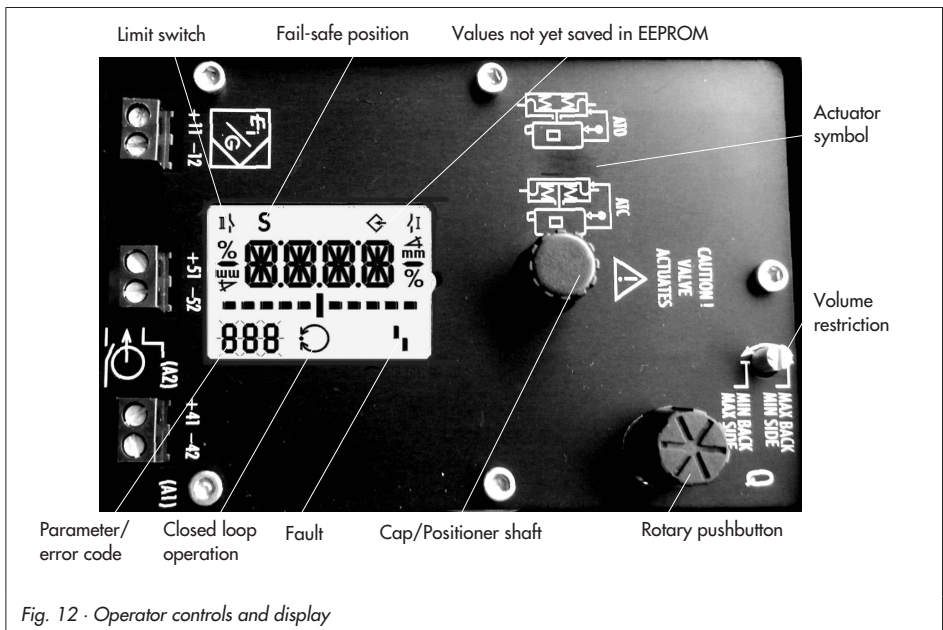


Fig. 12 · Operator controls and display



Volume restriction Q

The volume restriction is used to adapt the air delivery to the actuator size. Two fixed settings are possible depending on how the air is routed at the actuator. See section 5.1 for more details.

Display

The LC display indicates icons that are assigned to codes and functions. The bar graph indicates the system deviation that depends on the sign (+/-) and the value. One bar graph element appears per 1 % system deviation.

If the positioner is not initialized, the lever position in degrees in relation to the longitudinal axis is indicated instead of the system deviation. One bar graph element corresponds to approximately a 5° angle.

If the  fault icon appears on the display, turn the  button until **ERR** appears to view the error code(s) **E0** to **E15**. Refer to section 5.6 for details.

5 Start-up



Warning!

Do not perform a start-up while the process is running.

On applying supply air and the electric control signal, the control valve may move through its entire travel range/rotational angle range depending on the setting.

- ▶ Connect the supply air (Supply 9).
- ▶ Apply the electric reference variable 4 to 20 mA (terminals 11 and 12).

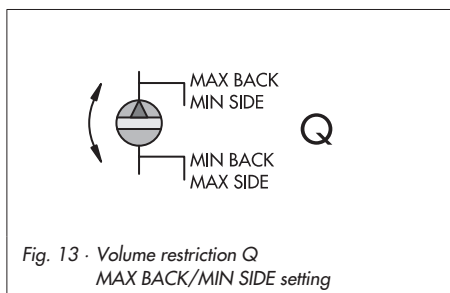
For most applications, the positioner is ready for operation with its default settings, provided it is attached properly. The positioner just needs to be initialized after the volume restriction has been set and the fail-safe position has been determined.

Note: *The positioner has a function to monitor the working range.*

*If the lever moves too close to the mechanical stops (risk of mechanical damage), the positioner vents the actuator and the valve moves to its fail-safe position (**S** displayed together with error code **E8** or **E9**).*

*In this case, check the positioner attachment. Reset the displayed error code using **RST** (see section 5.6.)*

5.1 Setting the volume restriction Q



The volume restriction Q is used to adapt the air delivery to the size of the actuator:

- ▶ Actuators with a **transit time** < 1 s, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate (MIN).
- ▶ Actuators with a **transit time** ≥ 1 s do not require the air flow rate to be restricted (MAX).

The position of volume restriction Q also depends on how the signal pressure is routed at the actuator in **SAMSON actuators**:

- ▶ The "SIDE" position applies for actuators with a loading pressure connection at the side, e.g. Type 3271-5.
- ▶ The "BACK" position applies for actuators with a loading pressure connection at the back, e.g. in Type 3277-5.

The "SIDE" restriction position always applies for **actuators from other manufacturers**.



Overview · Position of the volume restriction*			
Signal pressure	Transit time	< 1 s	≥ 1 s
Connection at the side		MIN SIDE	MAX SIDE
Connection at the back		MIN BACK	MAX BACK

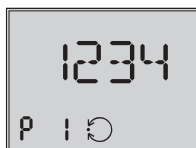
* Intermediate positions are not permitted.

Note: The positioner needs to be initialized again after the position of the restriction has been changed.



5.2 Adapting the display

The data representation on the positioner display can be turned by 180°. If the displayed data appear upside down, proceed as follows:

Turn the  button until Code **P1** appears, press  button to confirm the selected code. **P1** blinks.



Reading direction for right attachment of pneumatic connections

Turn  button until the display is adjusted to the desired direction, then confirm reading direction by pressing the  button.

5.3 Entering the opening direction

- ▶ AIR TO OPEN/ATO applies to a valve opening as the signal pressure increases.
- ▶ AIR TO CLOSE/ATC applies to a valve closing as the signal pressure increases.

The signal pressure is the air pressure at the output of the positioner, which is applied to the actuator.


AIR TO OPEN/ATO is always used with positioners fitted with a reversing amplifier for double-acting actuators (connections described in section 2.5)



Default ATO

Turn  until Code **P2** appears.

Press  to confirm **P2**. **P2** blinks.

Turn  until the required fail-safe position appears.

Press  to confirm the setting.

5.4 Setting other parameters

The following table lists all the parameter codes and their default settings.

Parameter codes			
Codes marked with * can be changed without having to re-initialize the positioner [...] Default setting			
P0	Display with status indication	P9 *	Pressure limit 2.4 bar [OFF]
P1 *	Reading direction	P10 *	End position w < [ON]
P2	Fail-safe position [ATO] / ATC	P11 *	End position w > [OFF]
P3	Pin position [35]	P12 *	Limit value A1 switching threshold [2 %]
P4	Nominal range [MAX]	P13 *	Limit value A2 switching threshold [98 %]
P5 *	Characteristic [1]	P14	Display of reference variable w
P6 *	Reference variable [4...20 mA]	P15	INIT Start initialization
P7 *	w/x direction of action [>>]	P16 *	ZERO Start zero calibration
P8	Gain K_p [50]		

If you want to change the default setting of a parameter, proceed in the same manner as previously described.

More details concerning the parameter codes can be found in section 6.

5.5 Initialization

During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure demand of the control valve.

The type and extent of self-adaptation depends on the preset parameters.

MAX is the default setting for the nominal range (Code **P4**). During the initialization process, the positioner determines the travel/rotational angle of the closing element from the CLOSED position as far as it will go in the other direction.

Note: For standard operation, after the positioner is mounted on the valve and the volume restriction has been set and the fail-safe position has been checked over Code **P2**, start initialization over Code **P15** to ensure the optimal functioning of the positioner.

The positioner works with its standard settings (default settings).



Warning!

During the initialization, the control valve moves through its entire travel/angle of rotation range.

Therefore, do not start initialization while a process is running, but only during start-up, when all shut-off valves are closed.

Start initialization by activating Code **P15** as follows:

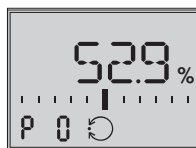


Turn  until Code **P15** appears


Press  button 6 seconds long, 6-5-4-3-2-1- is counted down on the display.


Initialization has started, the display blinks!

Note: The time required for the initialization procedure depends on the actuator transit time and can take a few minutes.




Initialization successfully completed, positioner runs in closed loop operation

After a successful initialization, the positioner runs in closed loop operation indicated by the  closed-loop operation icon and control position in % predetermined by the reference variable on the display.

A malfunctioning leads to the process being interrupted. The  fault icon appears on the display. See section 5.6 for details.

Canceling initialization

The initialization can be canceled by pressing . The positioner then moves to the fail-safe position (indicated by **S** on display).

A new initialization can be started directly afterwards.

Note: An attempt to re-initialize a positioner which has already been initialized is automatically canceled. The positioner then moves to the fail-safe position (indicated by **S** on the display). The positioner can only be initialized after a reset has been performed (see section 5.8).

To cancel the fail-safe position, proceed as follows:

When **P0** status indication mode of the display is selected:


Press , **ESC** appears.


Turn , **RST** appears.

Press  to reset the fail-safe position.

The positioner runs again using its original settings.

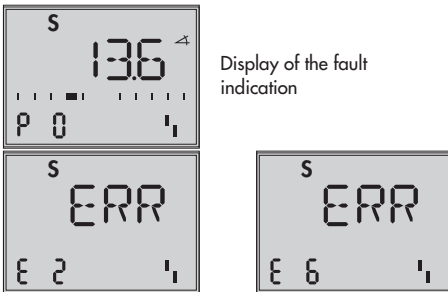
5.6 Faults

On the occurrence of a fault, the fault icon  appears at the bottom of the display.

By turning the  button past Code **P0** or **P16**, the respective error code **E0** to **E15** together with **ERR** appear on the display. Refer to the code list in section 6 for the cause of the errors and the recommended action.

Example:

If, for instance, a travel has been entered over Code **P4** (nominal range) which is larger than the maximum valve travel possible, the initialization process would be interrupted (error code **E2**) because the rated travel would not have been reached (error code **E6**). The valve moves to the fail-safe position (**S** indicated on the display).








The nominal range (Code **P4**) must be changed and the positioner re-initialized to remedy this problem.

Reset error codes

The error codes **E0**, **E1**, **E8** and **E9** can be reset as follows:



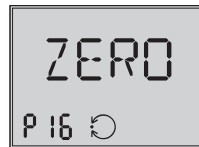
Turn  button until the error code appears, press  button, **ESC** appears, turn  button, **RST** appears, press  button to reset error.

The resetting procedure can be canceled by pressing  button when **ESC** appears.


5.7 Zero calibration

In case of inconsistencies in the closing position of the valve, e.g. with soft-sealed plugs, it may be necessary to recalibrate zero.

Start the zero calibration by activating Code **P16** as follows:



Turn  button until Code **P16** appears.


Press  button 6 seconds long, **6-5-4-3-2-1** is counted down on the display.

Zero calibration has started, the display blinks!

The positioner moves the control valve to the CLOSED position and recalibrates the internal electric zero point.

When the zero calibration has been successfully completed, the positioner returns to closed loop operation (status indication).

Canceling zero calibration

The zero calibration can be canceled by pressing . The positioner then moves to the fail-safe position (indicated by **S** on the display).


A new zero calibration can be started directly afterwards.

5.8 Reset

The positioner is in closed loop operation after the initialization has been successfully completed.

A reset causes an initialization to be canceled and all parameters settings are reset to the default settings (refer to section 6).

When **PO** status indication mode of the display is selected:

Press down  for six seconds, the display counts down **6-5-4-3-2-1** and **ESC** appears on the display.


Turn , **RST** appears on the display.

Press  to reset parameters to their default settings.

5.9 Manual adjustment

The valve position can be moved as follows using the **Manual adjustment** function:

Turn  until Code **P14** appears.

Press down  for six seconds, the display counts down **6-5-4-3-2-1**.

- The manual set point (w man) is indicated on the display of an **initialized positioner**.
- The lever position in degrees in relation to the longitudinal axis is indicated on the display of a **positioner that has not been initialized**.


Turn .

– Initialized positioner:

The manual set point is adjusted in steps of 0.1 %. You can move the valve controlled within its range.

– Positioner that has not been initialized:

By adjusting the manual set point, the valve is only moved in one direction uncontrolled.

Press  to deactivate the manual adjustment function.

Note: The Manual adjustment function can only be exited as described. The positioner **does not automatically** exit this function and return the display to the status indication mode after the positioner has not been operated for three minutes.

6 Code list

Code	Display, values [default setting]	Description														
Parameter codes Codes marked with * can be changed without having to re-initialize the positioner																
P0		Status indication mode of the display showing basic information. Reset, refer to section 5.8.														
P1 *	Reading direction	The reading direction of the display is turned by 180°.														
P2	ATO/ATC	Parameter to adapt the positioner to how the control valve functions: ATO – Air to open (valve CLOSED in fail-safe position) ATC – Air to close (valve OPEN in fail-safe position)														
P3	Pin position 17/25/[35]/50/70/ 100/200 mm/90°	The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation (select as per travel tables on page 11).														
P4	Nominal range [MAX] Values with default setting [35]: e.g. 7.5/8.92/10.6/12.6/ 15.0/17.8/21.2 mm	The possible adjustment range can be selected in stages depending on the selected pin position <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;">17</td> <td style="width: 90%;">from 3.75 to 10.6</td> </tr> <tr> <td>25</td> <td>from 5.3 to 15.0</td> </tr> <tr> <td>35</td> <td>from 7.5 to 21.2</td> </tr> <tr> <td>50</td> <td>from 10.6 to 30.0</td> </tr> <tr> <td>70</td> <td>from 15.0 to 42.4</td> </tr> <tr> <td>100</td> <td>from 21.2 to 60.0</td> </tr> <tr> <td>200</td> <td>from 42.4 to 120</td> </tr> </table> For 90° Maximum range only, if P3 = 90° MAX Maximum possible travel	17	from 3.75 to 10.6	25	from 5.3 to 15.0	35	from 7.5 to 21.2	50	from 10.6 to 30.0	70	from 15.0 to 42.4	100	from 21.2 to 60.0	200	from 42.4 to 120
17	from 3.75 to 10.6															
25	from 5.3 to 15.0															
35	from 7.5 to 21.2															
50	from 10.6 to 30.0															
70	from 15.0 to 42.4															
100	from 21.2 to 60.0															
200	from 42.4 to 120															
P5 *	Characteristic 1 to 8 [1]	Characteristic selection: Characteristic 1 for globe valves, Characteristic 1 to 8 with rotary actuators (P3 = 90°) <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1: Linear</td> <td style="width: 50%;">5: Butterfly valve linear</td> </tr> <tr> <td>2: Equal percentage</td> <td>6: Butterfly valve eq. percentage</td> </tr> <tr> <td>3: Rotary plug linear</td> <td>7: Segmented ball linear</td> </tr> <tr> <td>4: Rotary plug eq. percentage</td> <td>8: Segmented ball eq. percentage</td> </tr> </table>	1: Linear	5: Butterfly valve linear	2: Equal percentage	6: Butterfly valve eq. percentage	3: Rotary plug linear	7: Segmented ball linear	4: Rotary plug eq. percentage	8: Segmented ball eq. percentage						
1: Linear	5: Butterfly valve linear															
2: Equal percentage	6: Butterfly valve eq. percentage															
3: Rotary plug linear	7: Segmented ball linear															
4: Rotary plug eq. percentage	8: Segmented ball eq. percentage															
P6 *	Reference variable [4...20 mA] SRLO/SRHI	For split-range operation SRLO – low range 4 to 11.9 mA SRHI – high range 12.1 to 20 mA														

P7 *	w/x >> /<< [>>]	Direction of action of the reference variable w to the travel/rotational angle x (increasing/increasing or increasing/decreasing).
P8	Gain K_p 30/[50]	On initializing the positioner, the gain is set to the selected value.
P9 *	Pressure limit ON/[OFF]	The signal pressure can take on the same pressure as the supply air at the maximum [OFF] or, in the case that the maximum actuator force can damage the valve, the pressure is limited to approx. 2.4 bar.
P10 *	End position w < [ON]/OFF	Tight-closing function: If w reaches up to 1 % towards the final value that causes the valve to close, the actuator is immediately completely vented (with ATO - Air to open) or filled with air (with ATC - Air to close). This action always lead to maximum tight-closing of the valve.
P11 *	End position w > ON/ [OFF]	Tight-closing function: If w reaches up to 99 % towards the final value that causes the valve to open, the actuator is immediately completely filled with air (with ATO - Air to open) or vented (with ATC - Air to close). This action always lead to the valve being completely opened.
P12 *	Switching point A1 0 to 100 % [2 %]	Software limit value A1 is displayed or can be changed in relation to the operating range (steps of 0.5 %).
P13 *	Switching point A2 0 to 100 % [98 %]	Software limit value A2 is displayed or can be changed in relation to the operating range (steps of 0.5 %).
P14	Info w/Man w	Display only, indicates the reference variable applied in 0 to 100 % corresponding 4 to 20 mA. Manual adjustment, refer to section 5.9.
P15	Start initialization	The initialization process can be interrupted by pressing the rotary pushbutton. The control valve moves to its fail-safe position. Over parameter code P0 , the fail-safe position can be canceled again and the positioner then starts with the original setting. Also after a power supply failure, the positioner starts with its original setting.
P16 *	Start zero calibration	The zero calibration process can be interrupted by pressing the rotary pushbutton. The control valve moves to its fail-safe position. Over parameter code P0 , the fail-safe position can be canceled again and the positioner then starts with the original setting. Also after a power supply failure, the positioner starts with its original setting.

Error codes		
E0	Zero error	With tight-closing function P10 w < set to ON Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Recommended action	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code P16 (see section 5.7) or select the error code and reset with RST .
E1	Displayed and INIT values are not identical	Parameter codes were changed after the initialization had been completed.
	Recommended action	Select the error code and reset with RST .
E2	Positioner has not been initialized	
	Recommended action	Set parameter and initialize the positioner over Code P15 .
E3	K_p setting	Positioner hunts. Volume restriction set incorrectly, too much gain.
	Recommended action	Check the volume restriction setting as described in section 5.1. Limit gain K _p over Code P8 . Re-initialize the positioner.
E4	Transit time is too fast	The transit times of the actuator determined during initialization are so short (under 0.5 second) that the positioner cannot adapt itself well enough.
	Recommended action	Check the volume restriction setting as described in section 5.1. Re-initialize the positioner.
E5	Standstill detection is not possible	Supply pressure is too low or varies. Mounting incorrect.
	Recommended action	Check supply air and positioner mounting. Re-initialize the positioner.
E6	Travel is not achieved	Supply pressure is too low, actuator leaks, incorrect travel adjusted or pressure limit function activated.
	Recommended action	Check supply air, positioner mounting and setting. Re-initialize the positioner.

E7	Actuator does not move	No supply air, mounting blocked. No input signal or input signal below 3.7 mA
	Recommended action	Check supply air, positioner mounting and mA input signal. Re-initialize the positioner.
E8	Travel signal at lower limit	Wrong pin position, wrong lever, wrong attachment direction when NAMUR attachment is used.
	Recommended action	Check positioner mounting and re-initialize the positioner.
E9	Travel signal at upper limit	Wrong pin position, wrong lever, wrong attachment direction when NAMUR attachment is used.
	Recommended action	Check positioner mounting and re-initialize the positioner.
E10	Not assigned	
E11	Hardware	Defective ceramic oscillator, positioner continues to run with an internal RC oscillator, but it should be replaced as soon as possible.
	Recommended action	Return positioner to SAMSON AG for repair.
E12	No factory calibration	No factory calibration performed, memory defective.
	Recommended action	Return positioner to SAMSON AG for repair.
E13	Memory fault	Fault in the memory management
	Recommended action	Return positioner to SAMSON AG for repair.
E14	Checksum error data memory	Data memory defective
	Recommended action	Return positioner to SAMSON AG for repair.
E15	Checksum error calibration data	Data memory defective
	Recommended action	Return positioner to SAMSON AG for repair.

7 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 µm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

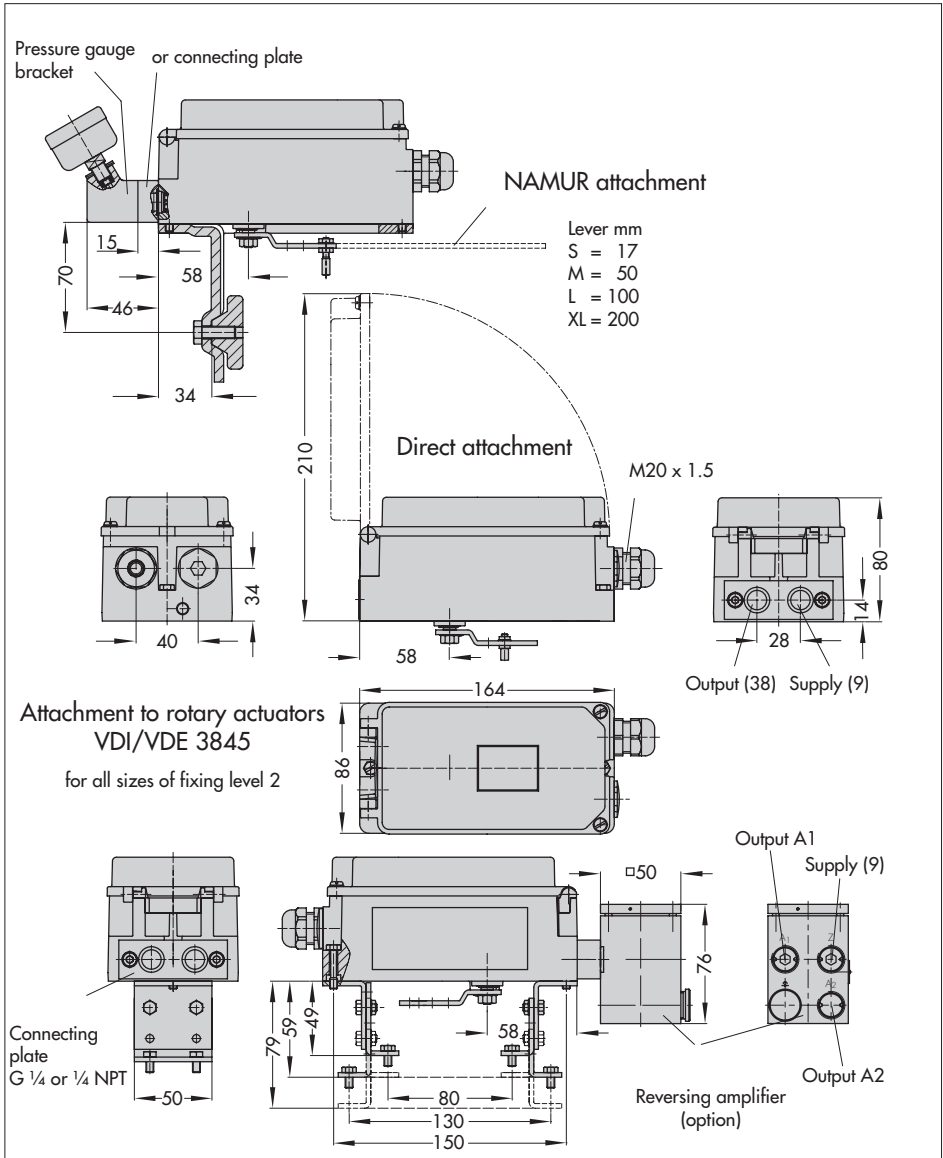
8 Servicing explosion-protected devices

If a part of the positioner on which the explosion protection is based needs to be serviced, the positioner must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.

Inspection by an expert is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device.

Devices that have already been used outside of hazardous areas and are intended for use in hazardous areas in future must comply with the safety demands placed on repaired devices. Prior to operation, they must be tested according to the specifications stipulated for "Repairing explosion-protected devices".

9 Dimensions in mm



TRANSLATION

Offenbach, 2005-11-21

Your ref.
2005-11-06
P. Opl

Our ref.
00010-0001/67325
FC633/bhh/wsh
Contact:
Tel. (069) 8306-249
Fax (069) 8306-716
gerhard.bhh@vde.com

Your ref.
2005-11-06
P. Opl

Our ref.
00010-0001/67325
FC633/bhh/wsh

Test report for Information of the Applicant

Testing of the Degree of Protection on enclosures of Type 3730 and Type 3731 Positioners

This test report contains the result of a single investigation carried out on the product submitted. A sample of this product was tested to find the accordance with the thereafter listed standards resp. parts of Standards.

The test report does not entitle to use a VDE Certification mark and the "GS – *geprüfte Sicherheit (test safety)*" and does not refer to all VDE specifications applicable to the tested product.

This report may only be passed to a third party in its complete wording including this preamble and the date of issue.

Any publication or reproduction requires the prior written approval of the VDE Testing and Certification Institute.

1 Assignment

The samples described in 2 below were tested for compliance with the IP 66 degree of protection.

2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

VDE VERBAND DER ELEKTROTECHNIK
ELEKTRONIK-INFORMATIONSTECHNIK e.V.

Merianstrasse 28
D-63069 Offenbach

Präferenz VDE a. EN 60529 IP-Schwarz-Datei **E-mail:** vde-institut@vde.com

Testing and Certification Institute
Merianstrasse 28
D-63069 Offenbach

Präferenz VDE a. EN 60529 IP-Schwarz-Datei **E-mail:** vde-institut@vde.com

3 Basis of assessment

DIN EN 60529/VDE 0470 Part 1/2000-09
Degree of protection provided by enclosures (IP Code)
German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-9010-0001/32752 and on the Type 3731 Positioner under the reference number: 479000-9010-0001/58985 with suction as per category 1 at the connecting enclosures of the positioners and solenoid valves. The under pressure was 2 kPa and the test lasted 8 hours.

5 Test results

The testing of the samples described in 2 above yielded the following results:

Protecting against access to hazardous parts and against ingress of water according to
DIN EN 60529/VDE 0470 Part 1:2000-09

IP6X satisfied

Protecting against ingress of water according to
DIN EN 60529/VDE 0470 Part 1:2000-09

IPX6 satisfied

The positioner enclosures in the versions submitted meet the requirements of IP 66 degree of protection.

There was no ingress of either dust or water.

VDE- Prüf- und Zertifizierungsinstitut
Fachgebiet FG35

(Signature)

(Signature)

Gerhard Bichl

VDE VERBAND DER ELEKTROTECHNIK
ELEKTRONIK-INFORMATIONSTECHNIK e.V.

Merianstrasse 28
D-63069 Offenbach

Präferenz VDE a. EN 60529 IP-Schwarz-Datei **E-mail:** vde-institut@vde.com

Testing and Certification Institute
Merianstrasse 28
D-63069 Offenbach

Präferenz VDE a. EN 60529 IP-Schwarz-Datei **E-mail:** vde-institut@vde.com

T R A N S L A T I O N

EC TYPE EXAMINATION CERTIFICATION

(11) This EC Type Examination Certificate relates only to the design and examination of the specified equipment in compliance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment. These requirements are not covered by this Certificate.

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

(3) EC Type Examination Certificate Number

PTB 04 ATEX 2033

(4) Equipment: Model 3730-11... e/p Positioner

(5) Manufacturer: SAAMSON AG Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, 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 in accordance with 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 as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report

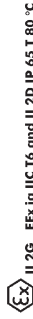
PTB Ex 04-23506

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

EN 50014:1997+A1+A2 EN 50020:2002 EN 50281-1-1:1998

(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.

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



Zertifizierungsstelle Explosionsschutz Braunschweig, 19 April 2004
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer

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.
Errors or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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

PTB43-3730.doc

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

PTB43-3730.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(13) **Schedule**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 04 ATEX 2033**

(15) **Description of Equipment**

The Model 3730-11 ... e/p Positioner is a single- or double-acting positioner for attachment to linear or rotary actuators.. It serves for translating control signal into valve stem positions.

The Model 3730-11 ... e/p Positioner is a passive two-terminal network which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of U_i , I_i and P_i are not exceeded.

For air supply non-combustible media are used.

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

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

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 55 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

Signal circuit (terminals 11/12)
Type of protection, Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
 I_i = 115 mA
 P_i = 1 W
 C_i = 6 nF,
 L_i = negligible

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 Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

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

PTB43-3730.de

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Software limit switches (terminals 41/42 and 51/52)

Type of protection, Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 20 V
 I_i = 60 mA
 P_i = 250 mW
 C_i = 1.6 nF,
 L_i = negligible

(16) Test Report: **PTB Ex 04-23506**

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

None

(18) **Special Health and Safety Requirements**

Satisfied by compliance with the standards specified above

Zertifizierungsstelle Explosionsschutz
 By order Braunschweig, 19 April 2004

(Signature) (seal)
 Dr.-Ing. U. Johannsmeyer
 Registrierungsdirektor

EC Type Examination Certificate 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

PTB43-3730.de

TRANSLATION

ADDENDUM No.: 1

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2033

Equipment:

Model 3730-11...e/p Positioner

Marking:



II 2G EEx ia IIC T6 and II 2D IP 65 T 80°C

Manufacturer:

SAMSON AG

Address:

Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The Model 3730-11e/p Positioner was supplemented by an LCD device. The layouts were modified. In future, the equipment may be manufactured in compliance with the test documents specified in the test report.

The electrical data and all the other data specified in the EC Type Examination Certificate apply without change also to this Amendment No. 1

Test report: **PTB Ex 05 24336**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 25 January 2005

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

EC Type Examination Certificate 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

PTB03AdF-1.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 04 ATEX 2114 X
- (3) Equipment: Model 3730-18 e/p Positioner
- (4) Manufacturer: SAMSON AG, Mess- und Regeltechnik
Weismüllerstr. 3, D-60314 Frankfurt, Germany
- (5) Address:
- (6) The equipment and any acceptable variations thereof 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 with 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 as specified in Annex II to the Directive.
- (8) The examination and test results are recorded in confidential report
PTB EX-04-24285.
- (9) The Essential Health and Safety Requirements are satisfied by compliance with
EN 50021:1999 EN 50281-1-1:1998
- (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.

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
ptb45-Ex-n.doc

- (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 the equipment.

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



Zertifizierungsstelle Explosionschutz Braunschweig, 09. Dezember 2004
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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
ptb45-Ex-n.doc

(13) **S c h e d u l e**(14) **Statement of Conformity PTB 04 ATEX 2114 X**(15) **Description of Equipment**

The Model 3730-18... e/p Positioners is a single or double acting positioner serving for adjusting valve steam positions in compliance with an actuating signal.

The device is intended for use within hazardous locations.

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

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 55 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

Signal circuit
(terminals 11/12)

Type of protection EEx nA II
or EEx nL IIC

Maximum values:

Ui = 28 V

Ii = 115 mA

Pi = 1 W

Ci = 6 nF

Li = negligible

Ui = 30 V

Ii = 100 mA

Pi = 1 W

Ci = 6 nF

Li = negligible

Software limit switches
(terminals 41 / 42 and 51 / 52)

Type of protection EEx nA II
or EEx nL IIC

Maximum values

Ui = 20 V

Ii = 60 mA

Pi = 250 mW

Ci = 16 nF

Li = negligible

(16) **Test Report: PTB Ex 04 24289**(17) **Special conditions for safe use**

If the signal circuit is to be connected to a circuit with type of protection EEx nA II, a series-connected fuse in compliance with IEC 60127-2/II, 250 V F or with IEC 60127-2/VI 250 V T, with a maximum fuse nominal current $I_N \leq 80$ mA shall precede the signal circuit. The fuse shall be installed outside of the hazardous location.

If the signal circuit is to be connected to a circuit with type of protection EEx nL IIC, no series fuse need to be provided outside of the hazardous location.

The manufacturer shall ensure and furnish evidence that the enclosure of the Model 3730-18... e/p Positioner including all cable entries, depending on the type of ventilation used, provides either degree of protection IP 54 or IP 65 in compliance with EN 60529. The cables shall be connected in such a manner that the connection facilities are not subjected to pull and/or twisting.

(18) **Special Health and Safety Requirements**

Are satisfied by compliance with the standards specified above

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 22 November 2004

(Signature) (seal)

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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 **ptb43-Ex-n.doc**

EC Type Examination Certificates without signature and seal are invalid
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Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig **ptb43-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

Control signal	Limit switches software
Circuit No. 1	2 and 3
Terminal No. 11/12	41/42 and 51/52
V _{max}	20V
I _{max}	60mA
P _{max}	250mW
C _i	16nF
L _i	0µH

Notes: Entry parameters must meet the following requirements:

$$V_{oc} \leq V_{max} / I_{sc} \leq I_{max} / P_o \leq P_{max} / C_o \geq C_i \text{ and } L_o \geq L_i$$

Table 2: CSA – certified barrier parameters of circuit 1

Barrier circuit 1	Supply barrier		Evaluation barrier	
	V _{oc}	R _{in}	V _{oc}	R _{in}
	≤28V	≥200Ω	≤28V	Diode

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	-40°C ... 55°C
T5	-40°C ... 70°C
T4	-40°C ... 80°C

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

CSA- certified for hazardous locations

Ex in IIC T6; Class I, Zone 0

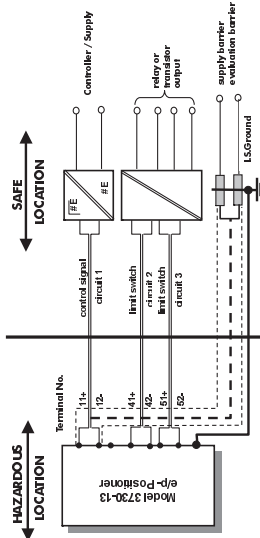
Class I; Groups A, B, C, D

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

Type 4 Enclosure

Notes:

- 1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with CSA certified apparatus. For maximum values of V_{max}; I_{max}; P_{max}; C and L of the various apparatus see Table 1 on page 1.
- 2.) For barrier selection see Table 2 on page 1.
- 3.) The installation must be in accordance with the C.E.C. Part 1.
- 4.) Use only supply wires suitable for 5°C above surrounding temperature.
- 5.) For CSA Certification, Safety Barrier must be CSA Certified and installed in accordance with C.E.C. Part 1. Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must extend as close to the terminals as possible.

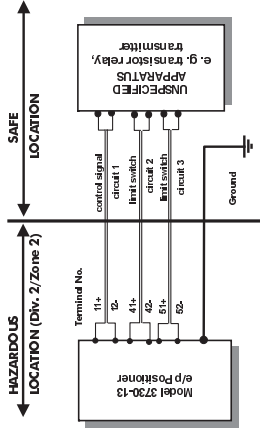


CSA-certified for hazardous locations

- Ex nC, Class I, Zone 2
- Class II, Div. 2 Groups A, B, C, D
- Class II, Div. 2 Groups E, F; G; Class III.

Type 4 Enclosure

e/p - positive/negative with software limit switches.



Notes:

- 1.) The installation must 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 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

	Control signal	Limit switches software
Circuit No.	1	2 and 3
Terminal No.	11/12	41/42 and 51/52
U or V _{max}	28V	20V
I or I _{max}	118mA	60mA
P or P _{max}	1W	250mW
C _i	6nF	16nF
L _i	0µH	0µH

Notes: Entry parameters shall meet the following requirements:

$U_e \leq U_i$ or $V_{max} / I_e \leq I_i$ or I_{max} / P_e or $P_{max} \leq P_i$ or P_{max}
 $C_e \geq C_i$ and $L_e \geq L_i$

Table 2: FM – approved barrier parameters of circuit 1

Barrier circuit 1	Supply barrier			Evaluation barrier		
	V _{oc}	R _{min}	I _{sc}	P _{max}	V _{oc}	I _{sc}
	≤28V	≥280Ω	≤118mA	≤1W	≤28V	≤6mA

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	-40°C ... 55°C
T5	-40°C ... 70°C
T4	-40°C ... 80°C

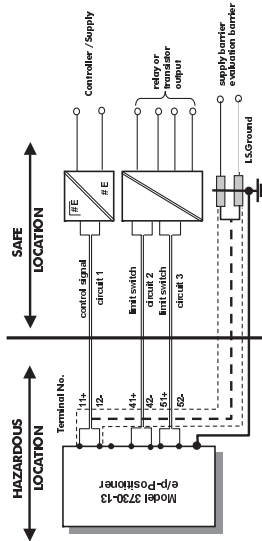
Intrinsically safe if installed as specified in manufacturer's installation manual.
FM- approved for hazardous locations

Class I, Zone 0, AEx in IIC T6;
Class I, II, III, Div. 1, Groups A, B, C, D, E, F + G;

NEMA 4X

Notes:

- 1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with FM approved apparatus. For maximum values of U or V_{max}, I or I_{max}; P or P_{max};
G and U of the various apparatus see Table 1 on page 4.
- 2.) For barrier selection see Table 2 on page 4.
- 3.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA-818.12.06.01.
- 4.) Use only supply wires suitable for 5°C above surrounding temperature.



For the permissible maximum values for the intrinsically safe circuits 1, 2 and 3 see Table 1

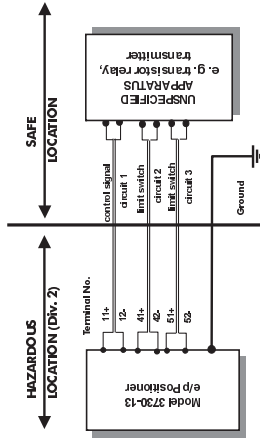
For the permissible barrier parameters for the circuits 1 see Table 2

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, Zone 2 AEx nA II;
Class I, Division 2, Groups A, B, C, D;
Class II, Division 2 Groups F + G.

NEMA 4X

e/p – posisther with software limit switches.



Notes:

- 1.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70
- 2.) For the maximum values for the individual circuits see Table 1
Cable entry only/rigid metal conduit



SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: <http://www.samson.de>

EB 8384-1 EN

S/Z 2008-08