

# Electropneumatic Positioner Type 3730-3



HART capable



Fig. 1 · Type 3730-3

## Mounting and Operating Instructions

### EB 8384-3 EN

Firmware version 1.10  
Edition March 2004



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- ▶ *Assembly, start-up and operation of the device may only be performed by trained and experienced personnel familiar with this product. According to these mounting and operating instructions, trained personnel is referred to individuals who are able to judge the work they are assigned to and recognize possible hazards due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.*
  - ▶ *Explosion-protected versions of this device 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.*
  - ▶ *Any hazards which could be caused by the process medium, the operating pressure, the signal pressure and moving parts of the control valve are to be prevented by means of appropriate measures.*
  - ▶ *If inadmissible motions or forces are produced in the pneumatic actuator as a result of the level of the supply pressure, this must be restricted by means of a suitable pressure reducing station.*
  - ▶ *Proper shipping and appropriate storage are assumed.*
  
  - ▶ **Note:** *Devices with the CE mark meet the requirements specified in the Directive 94/9/EC and the Directive 89/336/EEC. The Declaration of Conformity can be viewed and downloaded from the SAMSON website at [www.samson.de](http://www.samson.de).*
-

**Positioner versions**

Model		<b>3730-3</b>	x	x	x	x	x
4 to 20 mA with HART communication							
Explosion protection	None	0					
	Ex II G EEx ia IIC T6 as per ATEX	1					
	EEx ia FM/CSA	3					
	Ex II 3 G EEx nA II T6 for Zone 2 as per ATEX	8					
Accessories							
Inductive limit switch	Without	0					
	With Type SJ 2-SN	1					
Solenoid valve	Without			0			
	24 V DC			4			
Analog position transmitter	Without					0	
	With					1	
External position sensor	Without						0
	With			0			1

**Modifications of positioner firmware in comparison to previous version**

Previous	New
<b>1.00</b>	<b>1.10</b> The HART protocol as per HART specification Revision 5 is supported by default setting. The setting can be changed to HART Revision 6 over TROVIS-VIEW. HART tools as well as AMS or handheld communicators are currently not supported by the Revision 6 version.
	Additional status indications are implemented Code 76 - No emergency mode Code 77 - Program loading error Displays number of zero calibrations since the last initialization.
	For initialization of actuators with "AIR TO CLOSE", the direction of action (Code 7) is automatically set to increasing/decreasing.

## Technical data

Positioner		
Nominal travel, adjustable	Direct attachment to Type 3277: 3.6 to 30 mm, attachment acc. to IEC 60534-6: 5 to 200 mm or for rotary actuators 24 to 100° angle of rotation.	
Travel range	Adjustable within the nominal travel, max. transmission ratio 1 : 5.	
Reference variable w	Signal range 4 to 20 mA, 2-wire unit, reverse polarity protection, min. span 4 mA, static destruction limit 100 mA.	
Minimum current	3.6 mA for display, 3.8 mA for operation	
Load impedance	≤ 8.2 V (corresponds to 410 Ω at 20 mA)	
Supply air	1.4 to 6 bar (20 to 90 psi), air quality acc. to ISO 8573-1: Max. particle size and density: Class 2, oil contents: Class 3, the pressure dew point must be 10 °C below the lowest ambient temperature that can be expected.	
Signal pressure (output)	0 bar to supply air pressure, can be limited to 1.4/2.4/3.7 ± 0.2 bar over software.	
Characteristic, can be user-defined via operating software	Linear/equal percentage/reverse equal percentage/butterfly valve linear/ butterfly valve equal percentage/rotary plug linear/rotary plug equal percentage/segmented ball linear/ segmented ball equal percentage, deviation from terminal-based conformity ≤ 1 %.	
Hysteresis	≤ 0.3 %	
Sensitivity	≤ 0.1 %	
Transit time	For supply and exhaust air separately adjustable up to 240 s over software.	
Direction of action	Reversible	
Air consumption, steady state	Depends on supply air, approx. 110 l <sub>n</sub> /h	
Air delivery	Actuator filled Actuator vented	
Perm. ambient temperature	For Δp=6 bar: ≥ 8.5 m <sup>3</sup> /h, for Δp=1.4 bar: 3.0 m <sup>3</sup> /h For Δp=6 bar: ≤ 14.0 m <sup>3</sup> /h, for Δp=1.4 bar: 4.5 m <sup>3</sup> /h	
Effects	Temperature: ≤ 0.15 %/10 K supply air: none. Vibrations: ≤ 0.25 % to 2000 Hz and 4 g according to IEC 770.	
Electromag. compatibility	Requirements according to EN 61000-6-2, EN 61000-6-3 and NE 21 fulfilled.	
Explosion protection	Ex II G EEx ia IIC T6 as per ATEX, see type examination certificate in appendix	
Degree of protection	IP 65	
<b>Binary contacts</b>	1 fault alarm contact, 2 software limit switches with configurable limit values, reverse polarity protection.	
Signal status: not triggered: triggered:	<b>Version without explosion protection</b> Conductive (R = 348 Ω) Non-conductive	<b>Ex version</b> ≥ 2.1 mA ≤ 1.2 mA
Operating voltage	For connection to NAMUR switching amplifier as per EN 60947-5-6 or for the connection to the binary input of a PLC acc. to EN 61131, P <sub>max</sub> = 400 mW	Only for connection to NAMUR switching amplifier as per EN 60947-5-6

<b>Communication (local)</b>	SAMSON SSP interface and serial interface adapter	
Software requirements (SSP)	TROVIS-VIEW with database module 3730-3	
<b>Communication (HART)</b>	HART® communication protocol Impedance in the HART frequency range: receive 350 to 450 Ω ; send approx. 115 Ω	
Software requirements (HART)	For handheld communicator: device description for 3730-3, For PC: DTM file acc. to Specification 1.2, suitable for integrating the positioner in frame applications that supports the FDT/DTM concept (e.g. PACWare); other integration options (e.g. AMS, PDM) available.	
<b>Solenoid valve</b>		
Input	24 VDC, reverse polarity protect., static destruction limit 40V; current consumption 4.5 mA at 24 V	
Signal	Signal "0" no pick-up ≤15 V	Signal "1" safe pick-up >19 V
Service life	>2 × 10 <sup>7</sup> switching cycles	
<b>Analog position transmitter</b>		
Supply voltage	12 to 30 V DC, reverse polarity protection, static destruction limit 40 V	
Output signal	4 to 20 mA	
Operating direction	Reversible	
Operating range	0 to 100 % of the travel range, optionally also for fault indication with 2.4 or 21.6 mA	
Characteristic	Linear	
Hysteresis and high-freq. influence	Same as positioner	
Ripple content of output signal	0.6 % at 28 Hz according to IEC 381 T1	
Other effects	Same as positioner	
Fault indication	Can be issued with signal current <2.4 mA or >21.6 mA	
<b>Inductive limit switch</b>		
Type SJ 2SN Proximity Switch	For connection to switching amplifier according to EN 60947-5-6. Can be used in combination with a software limit switch.	
<b>External position sensor</b>		
Nominal travel	Adjustable same as positioner	
Cable	Max. 10 m with M12x1 connector; designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media.	
Ambient conditions	Perm. temp.: -40 to +105 °C, vibration immunity: up to 10 g in range 10 to 2000 Hz	
Degree of protection	IP 67	
<b>Materials</b>		
Housing	Die-cast aluminum GD AlSi12 acc. to DIN 1725 (3.2582), chromized and plastic-coated	
External parts	Stainless steel 1.4571 and 1.4301	

### 1 Design and principle of operation

The electropneumatic positioner is attached to pneumatic control valves and is used to assign the valve stem position (controlled variable  $x$ ) to the input signal (reference variable  $w$ ). In this case, the input signal accepted from the control system is compared to the travel/angle of rotation of the control valve, and a signal pressure (output variable  $y$ ) is produced.

Depending on the accessories selected, the positioner is suitable for direct attachment to SAMSON Type 3277 Actuators or for attachment to actuators according to NAMUR (IEC 60534-6).

For the attachment to rotary actuators according to VDI/VDE 3845, an additional coupling wheel, which is included in the accessories, is required to transmit the rotary motion.

Springless rotary actuators require an accessory reversing amplifier to permit the powered operation in either direction (retracting or extending the actuator stem).

The positioner consists of a travel sensor system which is proportional to resistance, an analog i/p converter with downstream air capacity booster, and electronic components including a microcontroller.

The positioner is standard equipped with three binary contacts: one fault alarm output used to indicate a fault to the control room and two configurable software limit switches used 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 value 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 (e.g. the plug) 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 of the booster can be limited via software.

The volume restriction Q (10) which can be connected is used to optimize the positioner.

#### Serial interface

The positioner is fitted with an interface. The SAMSON **TROVIS-VIEW** Configuration and Operator Interface software can be used to transmit data and parameters via adapter cable from the RS-232 interface of a PC to the positioner.

## 1.1 Communication

The positioner is equipped with an interface for HART protocol (Highway Addressable Remote Transducer) for communication purposes.

Data are transmitted in a superimposed frequency (FSK = Frequency Shift Keying) on the existing signal loop for the 4 to 20 mA reference variable.

Either a HART capable handheld communicator or a PC with FSK modem can be used to establish communication and operate the positioner.

## 1.2 Additional equipment

As an option, the device can be additionally equipped with a solenoid valve for forced venting, an analog position transmitter, an inductive limit switch or an external position sensor.

### Version with solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the i/p module is vented. The positioner can no longer operate and the control valve moves to the fail-safe position determined by the actuator, independent of the reference variable.

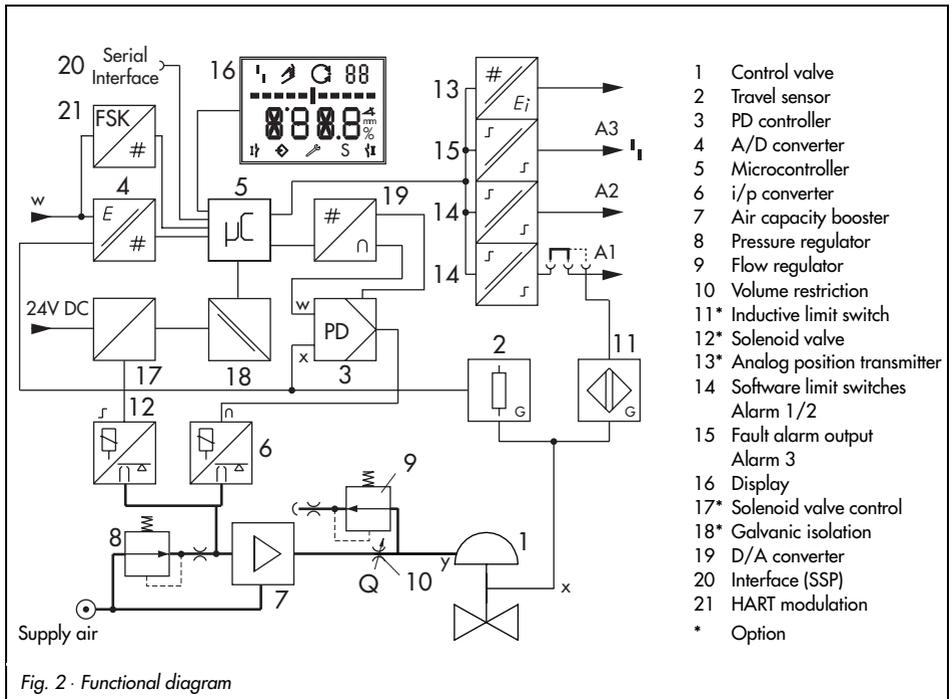


Fig. 2 · Functional diagram

### Version with position transmitter

The position transmitter (13) is a two-wire transmitter and issues the travel sensor signal as a 4 to 20 mA signal processed via the microcontroller.

Since this signal is issued independent of the positioner's input signal (min. current 3.8 mA), the actual travel/angle of rotation is controlled in real-time. Additionally, the position transmitter provides the possibility of signaling a positioner fault over a signal current of  $< 3.8 \text{ mA}$  or  $> 20.5 \text{ mA}$ .

### Version with inductive limit switch

The rotary shaft of the positioner carries an adjustable tag which actuates the installed proximity switch.

The optional inductive limit switch (11) leads to A1, while the software limit switch, which remains in operation, leads to A2.

### Version with external position sensor

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve. The connection of x and y signal to the valve is established via cable and air tube (only for non-hazardous areas and without inductive limit switch).

## 2 Attachment to control valves – 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 and 6.

The travels listed in Table 3 are nominal travels that apply to SAMSON valves.

For other travels for attachment according to NAMUR, refer to the assignment of lever and pin position according to the travels listed in the table on page 18.

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

### **IMPORTANT!**

*If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way from stop to stop to adapt it to the internal measuring lever.*

Table 1	Direct attachment	Order no.
Mounting parts	for actuators with 120 cm <sup>2</sup> , see Fig. 3	1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxx.00 (old)	1400-6819
	Switchover plate <b>new</b> for Actuator Type 3277-5xxxxx.01 (new)	1400-6822
	Connecting plate for additional attachment, e.g. of a solenoid valve G 1/8	1400-6820
	Connecting plate (old) for Type 3277-5xxxxx.00 (old) 1/8 NPT	1400-6821
	Connecting plate <b>new</b> for Actuator Type 3277-5xxxxx.01 (new)	1400-6823
<b>Note:</b> Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.		
Accessories for the positioner	Connecting plate (6)	G 1/4 1/4 NPT 1400-7461 1400-7462
	or pressure gauge bracket (7)	G 1/4 1/4 NPT 1400-7458 1400-7459
	plus pressure gauge mounting kit (8) (Output and Supply)	St. st./Brass St. st./St. st. 1400-6950 1400-6951

## Attachment to control valves – mounting parts and accessories

Table 2		Direct attachment	Order no.
Mounting parts	For actuators with 240,350 and 700 cm <sup>2</sup> , see Fig. 4		1400-7453
Accessories	Connection block with gaskets and mounting screw	G 1/4 1/4 NPT	1400-8811 1400-8812
	Pressure gauge mounting kit (Output and Supply)	Stainless steel/brass Stainless steel/stainless steel	1400-6950 1400-6951
Required piping including screw fittings for actuator: Actuator stem retracts or when the top diaphragm chamber is filled with air	Actuator cm <sup>2</sup>	Material	Order no.
	240	Steel	1400-6444
	240	Stainless steel	1400-6445
	350	Steel	1400-6446
	350	Stainless steel	1400-6447
	700	Steel	1400-6448
700	Stainless steel	1400-6449	
Table 3 Attachment to NAMUR rib or attachment to rod-type yoke (IEC 60534-6), see Fig. 5			
Travel in mm	Lever	For actuator	Order no.
7.5	S	3271-5 with 60/120 cm <sup>2</sup> for Type 3510 Micro Valve	1400-7457
5 to 50	Without, (lever M is attached to the basic model)	Actuators from other manufacturers and Type 3271 with 120 to 700 cm <sup>2</sup>	1400-7454
14 to 100	L	From other manuf. and Type 3271 with 1400 cm <sup>2</sup>	1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271 with 2800 cm <sup>2</sup> and 120 mm travel	1400-7456
30 or 60	L	Type 3271 with 2800 cm <sup>2</sup> and 30 or 60 mm travel	1400-7466
Accessories	Connecting plate	G 1/4 : 1400-7461    1/4 NPT: 1400-7462	
	or pressure gauge bracket	G 1/4 : 1400-7458    1/4 NPT: 1400-7459	
	Pressure gauge mounting kit (Output/Supply)	St. st./Brass : 1400-6950    St. st./St. st. : 1400-6951	
Table 4 Attachment to Type 3510 Micro-flow Valve, see Fig. 6			
Actuators cm <sup>2</sup> 60 /120	Mounting parts with lever S		1400-7457
Accessories	Connecting plate (6)	G 1/4 : 1400-7461    1/4 NPT: 1400-7462	
	or pressure gauge bracket (7)	G 1/4 : 1400-7458    1/4 NPT: 1400-7459	
	Pressure gauge mounting kit (Output/Supply)	St. st./Brass : 1400-6950    St. st./St. st. : 1400-6951	

## Attachment to control valves – mounting parts and accessories

<b>Table 5</b>		Attachment to rotary actuators		Order no.
Mounting parts	Follower clamp and coupling wheel	VDI/VDE 3845 for all sizes of level 2, see Figs. 7 and 8 for Type 3278 Actuator with 160/320 cm <sup>2</sup> for Camflex II		1400-7448 1400-7614 1400-9120
		Connecting plate (6)	G 1/4 : 1400-7461	1/4 NPT: 1400-7462
Accessories	or pressure gauge bracket (7)	G 1/4 : 1400-7458	1/4 NPT: 1400-7459	
	Pressure gauge mounting kit (Output/Supply)	St. st./Brass : 1400-6950	St. st./St. st.: 1400-6951	
<b>Table 6</b>		General accessories		
Accessories	Pneumatic reversing amplifier for double-acting actuators	G 1/4 1/4 NPT	1079-1118 1079-1119	
	Cable gland M 20x1.5 nickel-plated brass	1890-4875		
	Adapter M20x1.5 to 1/2 NPT, aluminum	0310-2149		
	Retrofit kit for inductive limit switch 1 x SJ 2-SN	1400-7460		
	Cover label with parameter list and operating instructions	German/English (standard) English/Spanish English/French	1990-0761 1990-3100 1990-3142	

## 2.1 Direct attachment

### 2.1.1 Type 3277-5 Actuator

*For the required mounting parts as well as the accessories, refer to the order numbers listed in Table 1 on page 11.*

#### Actuator with 120 cm<sup>2</sup>

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 position 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 vent 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 plug (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. 3, 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 pin position **35** (delivery state).  
7.5 mm travel:  
Remove the follower pin (2) from 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. 18). 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.

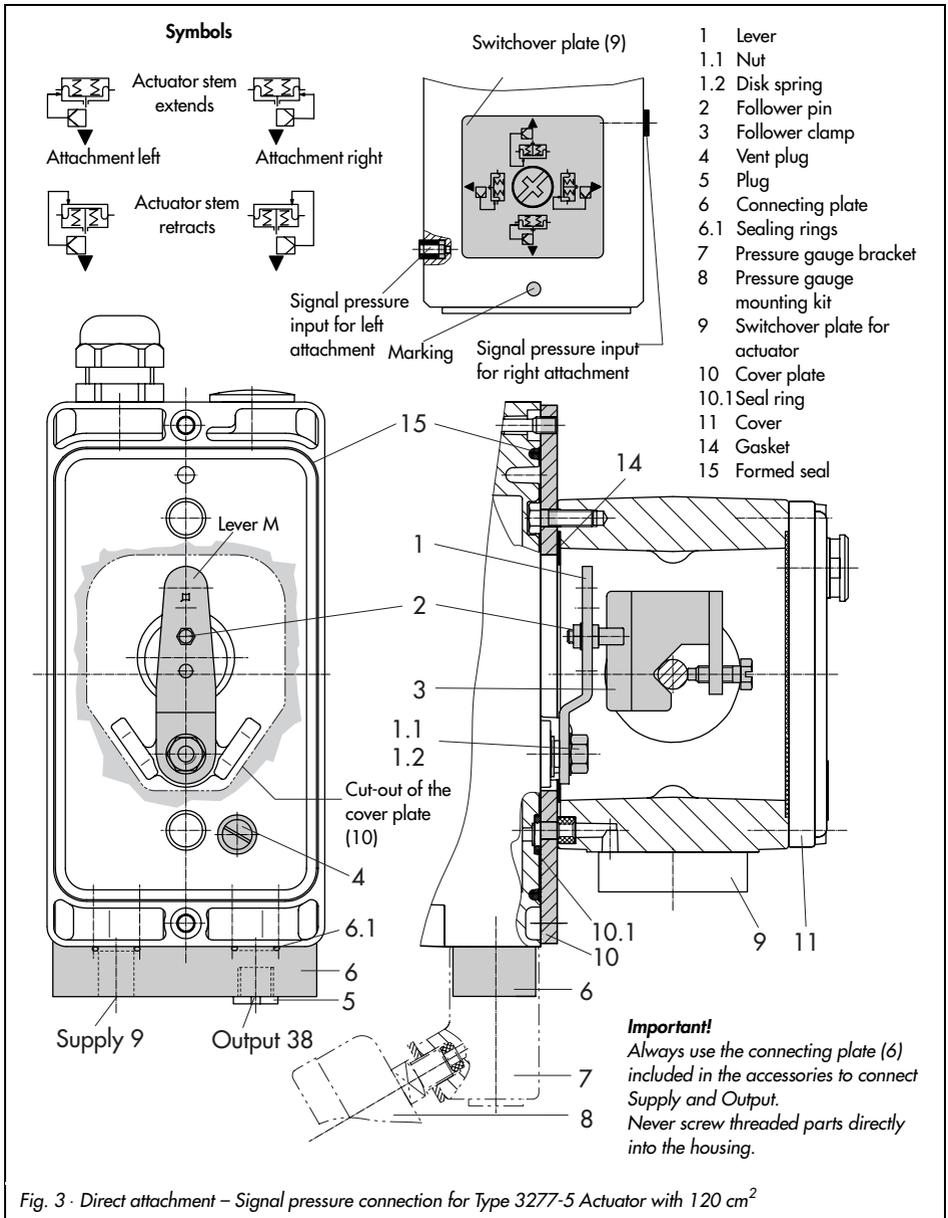


Fig. 3 · Direct attachment – Signal pressure connection for Type 3277-5 Actuator with 120 cm<sup>2</sup>

## 2.1.2 Type 3277 Actuator

*For the required mounting parts as well as the accessories, refer to the order numbers listed in Table 2 on page 12.*

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

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 an external pipe connection.

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. 4, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 700 cm<sup>2</sup>, 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 cm<sup>2</sup> 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. 18). 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.

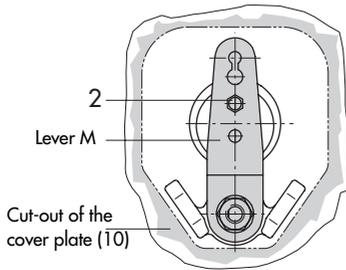
6. Check whether the tongue of the gasket (16) is aligned at the side of the connection block (12), so that the actuator symbols for "actuator stem extends" or "actuator stem retracts" match the actuator version.

If this is not the case, remove the three fixing screws, lift off the cover plate and reposition the gasket (16) turned by 180°.

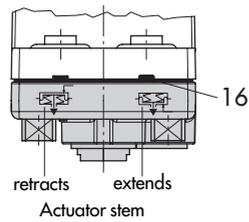
In versions with the **old** connection block, (Fig. 4, bottom), the switch plate (13) must be turned to align the corresponding actuator symbol with the arrow.

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 position "actuator stem retracts", additionally remove the plug (12.2) and install the external signal pressure tube.
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.

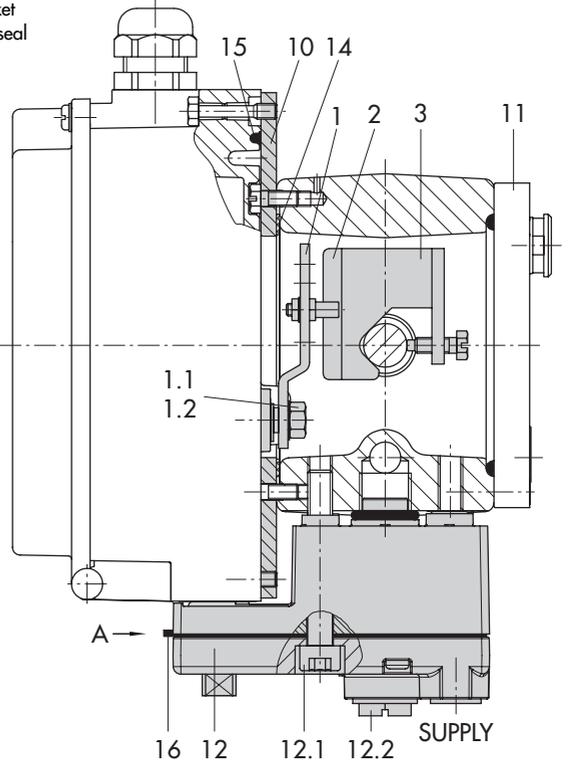
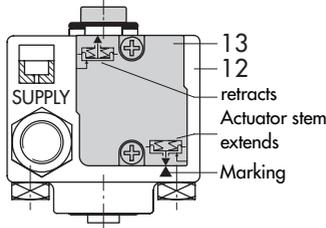
- |      |                  |      |  |
|------|------------------|------|--|
| 1    | Lever            | 12.2 | Plug or connection for external piping |
| 1.1  | Nut              | 13   | Switch plate                           |
| 1.2  | Disk spring      | 14   | Flat gasket                            |
| 2    | Follower pin     | 15   | Formed seal                            |
| 3    | Follower clamp   | 16   | Gasket                                 |
| 10   | Cover plate      |      |  |
| 11   | Cover            |      |  |
| 12   | Connection block |      |  |
| 12.1 | Screw            |      |  |



View A



View B



Connection block (old) with switch plate (13)

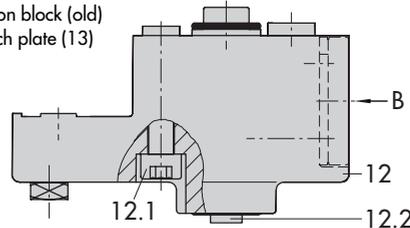


Fig. 4 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm<sup>2</sup>

## 2.2 Attachment acc. to IEC 60534-6

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

*For the required mounting parts as well as the accessories, refer to the order numbers listed in Table 3 on page 12.*

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 cm<sup>2</sup>:

For travels up to 60 mm, screw the longer follower plate (3.1) directly to the stem connector (9).

For travels 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 properly seated.
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:

Travel table for attachment according to DIN IEC 60534-6 (NAMUR)							
SAMSON valves			Other valves			Required lever	Assigned pin position
Type 3271 Actuator	cm <sup>2</sup>	Nom. travel in mm	min.	travel	max.		
	60 and 120	7.5	3.6	17.6	17.6	S	17
			5.0	17.6		M	25
	120/240/350	15	7.5	35.4		M	35
	700/2800	15 and 30/30	10	50.0		M	50
			14.0	70.8		L	70
	1400/ 2800	60	20.0	100		L	100
	2800	120	40.0	200.0		XL	200
Rotary actuators		angle of rotation	24 to 100°			M	90°

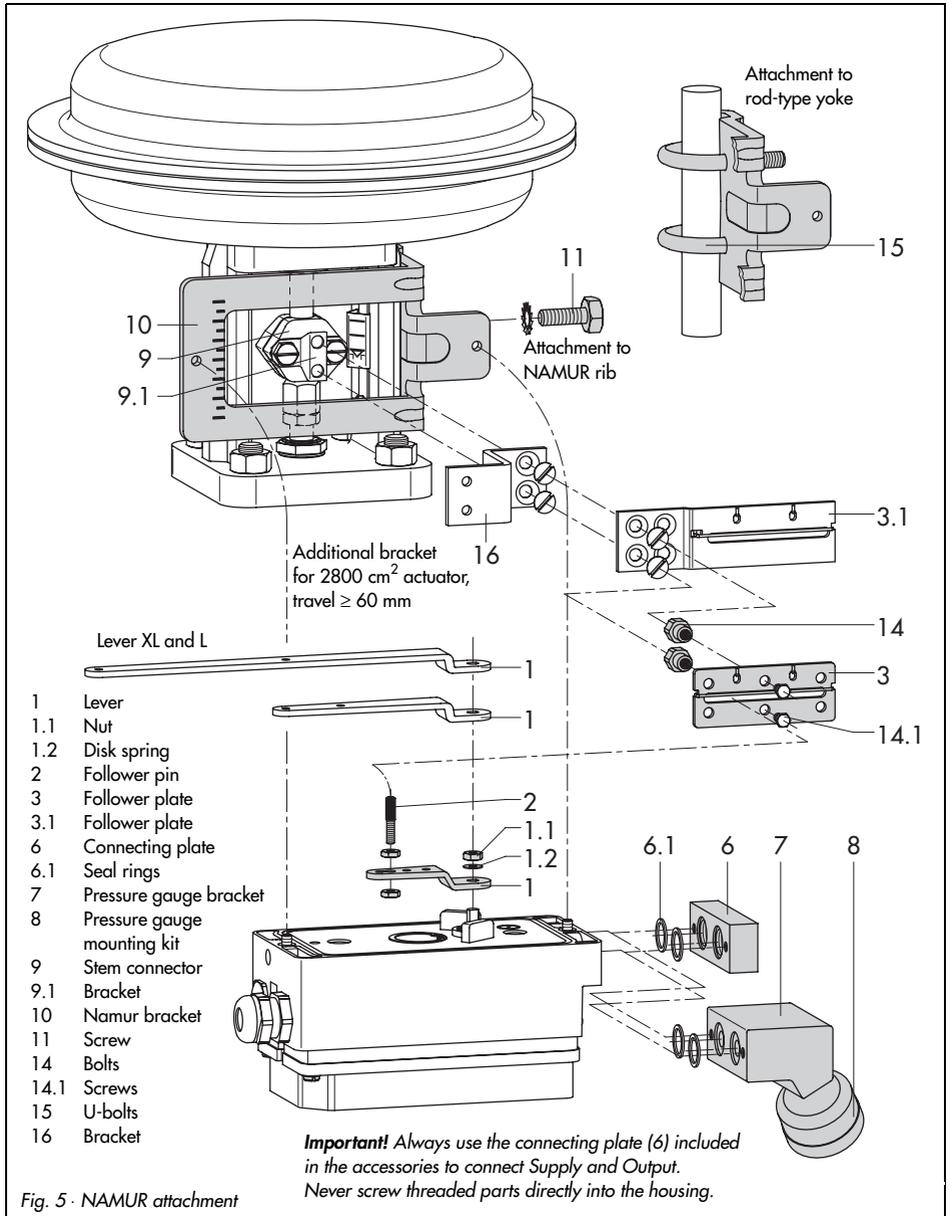


Fig. 5 · NAMUR attachment

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).

### **IMPORTANT!**

*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.

---

*For the required mounting parts and the accessories, refer to the order numbers listed in Table 4 on page 12.*

---

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 properly seated.
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 hexagon 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

**Important!** Always use the connecting plate (6) included in the accessories to connect Supply and Output. Never screw threaded parts directly into the housing.

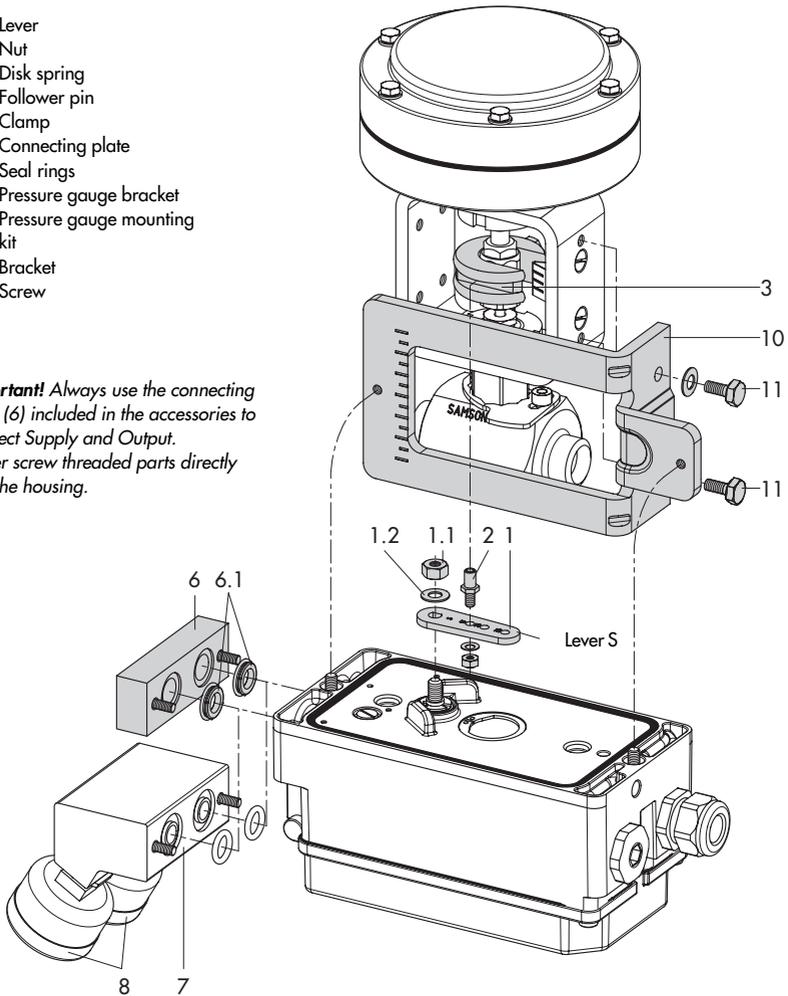


Fig. 6 · Attachment to Type 3510 Micro-flow Valve

## 2.4 Attachment to rotary actuators

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

*For the required mounting parts as well as the accessories, refer to the order numbers listed in Table 5 on page 13.*

Prior to the attachment of the positioner to the SAMSON Type 3278 Rotary Actuator, you have to mount the associated distance piece (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 distance piece (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 8 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 including screw (4.1) and disk spring (4.2) tightly on the actuator shaft.
4. Screw the two bottom 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 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 ( $\varnothing 5$ ) included in the mounting kit and screw tight into the bore for pin position  $90^\circ$ .
7. Place positioner on the top 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. 8). 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.

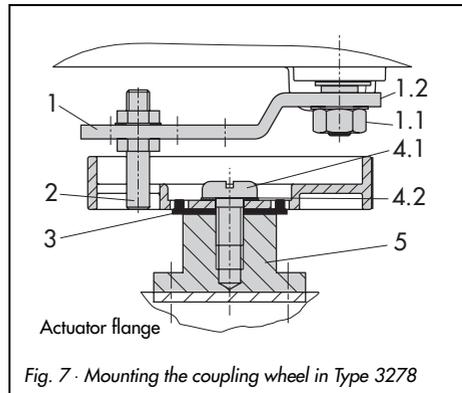
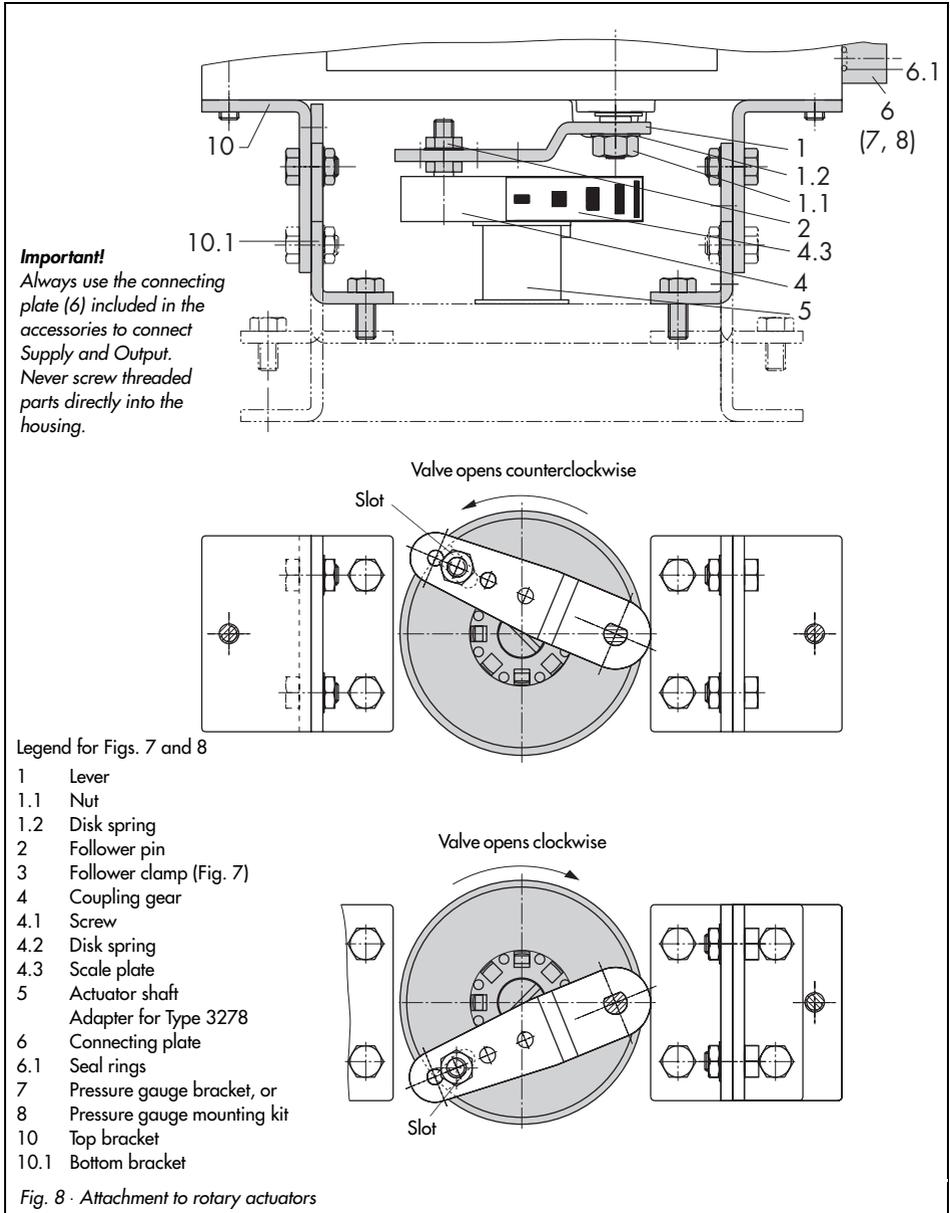


Fig. 7 · Mounting the coupling wheel in Type 3278



### 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 6 on page 13.

The output signal pressure of the positioner is supplied at the output A<sub>1</sub> of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at A<sub>1</sub>, is applied at output A<sub>2</sub>. The rule  $A_1 + A_2 = Z$  applies.

#### Mounting

1. Mount the connecting plate (6) from the accessories in Table 5 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 hollowed special screws (1.1) into the connecting boreholes A<sub>1</sub> and Z.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).

---

#### NOTE:

*In the Type 3730 Positioner 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 plug is in use.*

---

#### Signal pressure connections

**A<sub>1</sub>** : Output A<sub>1</sub> leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

**A<sub>2</sub>** : Output A<sub>2</sub> leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

- Set the slide switch in the positioner to **AIR TO OPEN**.

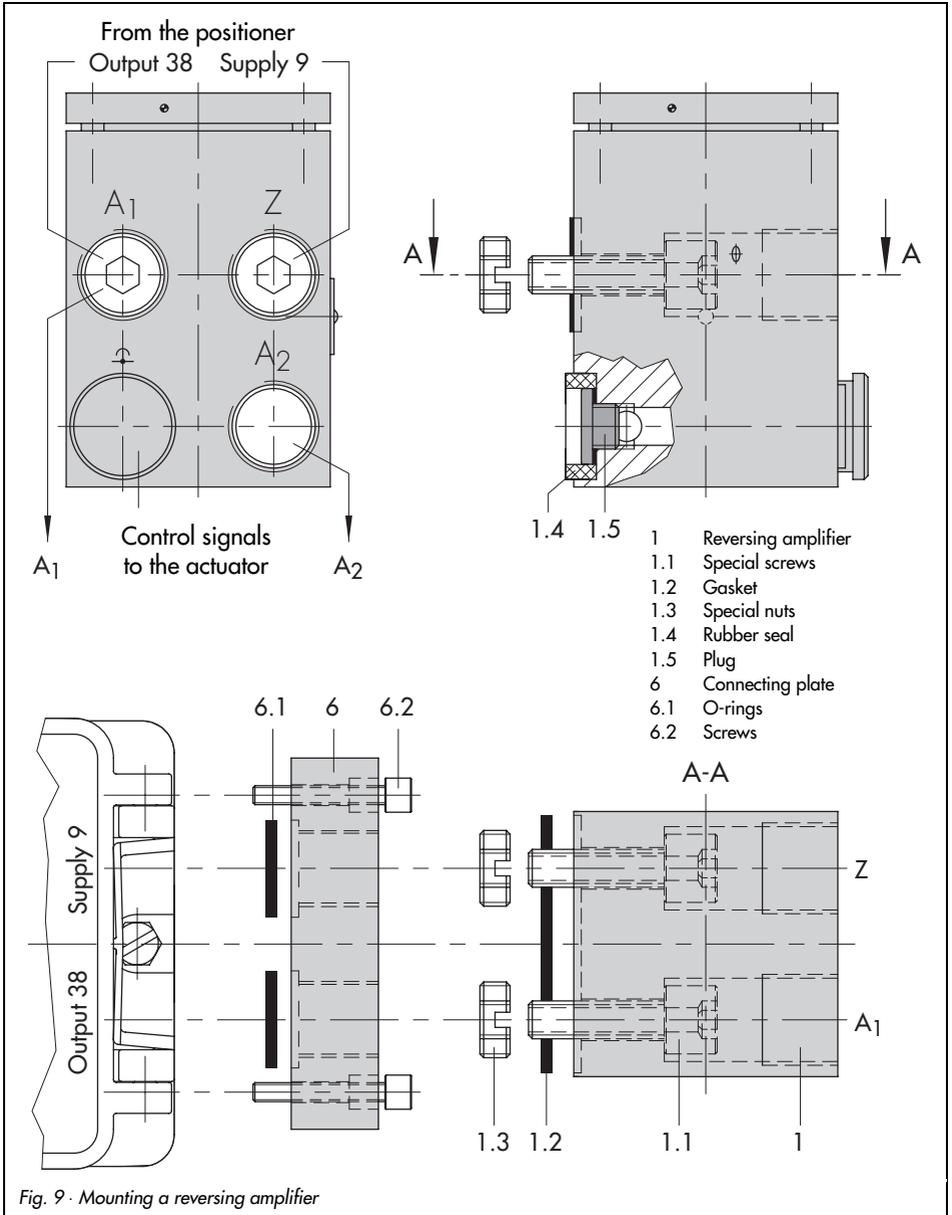


Fig. 9 · Mounting a reversing amplifier

### 2.6 Attaching an external position sensor

Refer to Table 7 on page 31 for a list of the mounting parts as well as the accessories required for the position sensor. Accessories for the pneumatic connection to the positioner housing can be found in Table 8.

In the positioner version with an external position sensor, the sensor placed in a separate housing is attached over a plate or bracket to the control valve. The travel pick-off corresponds to that of a standard device.

The positioner unit can be mounted as required to a wall or a pipe.

**For the pneumatic connection** either a connecting plate (6) or a pressure gauge bracket (7) must be fixed to the housing, depending on the accessory chosen. Make sure the seal rings (6.1) are correctly inserted (see Fig. 5, bottom right).

**For the electrical connection** the connecting lead must be fitted with a M12x1 connector plug at one end. The lead end without the plug can be shortened, if required, and wired with the connector included (section 3.2, page 33).

The electrical and pneumatic connections between the sensor and the positioner unit may be a maximum of 10 meters.

**Note:** In addition, the instructions in section 3.1 and 3.2 apply for the pneumatic and electrical connection.

Operation and setting are described in sections 4 and 5.

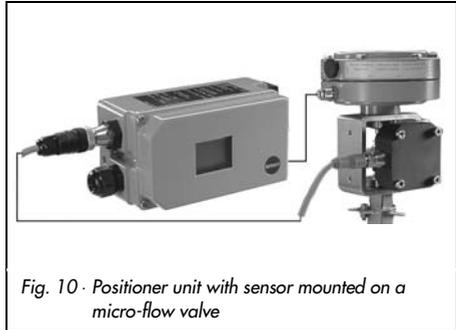


Fig. 10 · Positioner unit with sensor mounted on a micro-flow valve

#### 2.6.1 Mounting the position sensor with direct attachment

##### Type 3277-5 Actuator with 120 cm<sup>2</sup>:

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 11 left) to the actuator diaphragm chamber.

To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

- ▶ Turn the connecting plate (9) so that the correct symbol for the fail-safe position "Actuator stem extends" or "Actuator stem retracts" is aligned with the marking (Fig. 11, below).
- ▶ Make sure that the gasket for the connecting plate (9) is correctly inserted.
- ▶ The connecting plate has boreholes with NPT and G threads. Seal the threaded connection that is not used with the rubber seal and square plug.

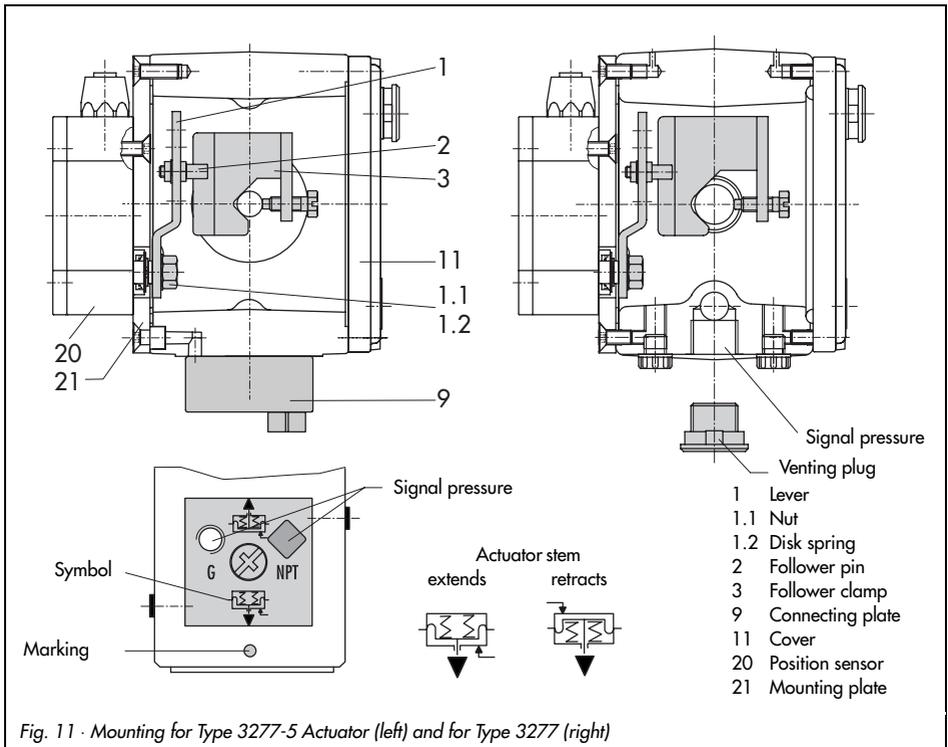
##### Type 3277 Actuator with 240 to 700 cm<sup>2</sup>:

The signal pressure is routed to the connection at the side of the actuator yoke for the version "Actuator stem extends".

For the fail-safe position "Actuator stem retracts" the connection on the top diaphragm case is used. The connection at the side of the yoke must be fitted with a venting plug (accessories).

## Mounting the sensor

- Place the lever (1) on the sensor in **mid-position** and **hold it in place**. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
- Screw the position sensor (20) onto the mounting plate (21).
- Depending on the actuator size and rated travel of the valve, determine the required lever and position of the follower pin (2) from the table on page 18. The positioner is delivered with lever **M** in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the borehole for the recommended pin position and screw tight.
- Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) in **mid-position** and **hold it in place**. Screw on the nut (1.1).



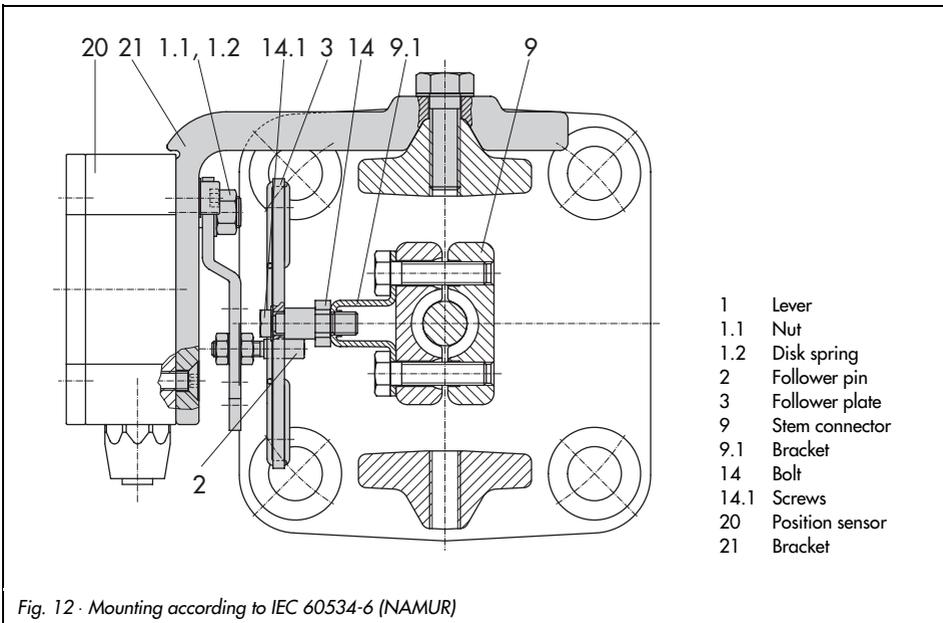
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top of the follower clamp (3). It must rest on it with spring force.  
Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.
7. 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.

### 2.6.2 Mounting the position sensor with attachment according to IEC 60534-6

*For the required mounting parts as well as the accessories, refer to the order numbers listed in Tables 7 and 8 on page 31.*

1. Place the lever (1) on the sensor in **mid-position** and **hold it in place**. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).

The standard attached lever **M** with the follower pin (2) at position **35** is designed



for 120, 240 and 350 cm<sup>2</sup> actuators with 15 mm travel. For other actuator sizes or travels, select the lever and pin position from the table on page 18. Lever L and XL are included in the mounting kit.

3. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) in **mid-position** and **hold it in place**. Screw on the nut (1.1).
4. Screw both bolts (14) to the bracket (9.1) of the stem connector (9). Attach the follower plate (3) and fix with the screws (14.1).
5. Place the bracket with the sensor at the NAMUR rib in such a manner that the follower pin (2) rests in the slot of the follower plate (3), then screw the bracket using its fixing screws onto the valve.

### 2.6.3 Mounting the position sensor to Type 3510 Micro-flow Valve

For the required mounting parts as well as the accessories, refer to the order numbers listed in Tables 7 and 8 on page 31.

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).
3. Select the lever **S** (1) from the accessories and screw the follower pin (2) into the hole for pin position **17**. Place the lever (1) and disk spring (1.2) on

the sensor shaft.

Place the lever (1) in **mid-position** and **hold it in place**. Screw on the nut (1.1).

4. Place the follower clamp (3) on the stem connector, align it at a right angle and screw tight.
5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).

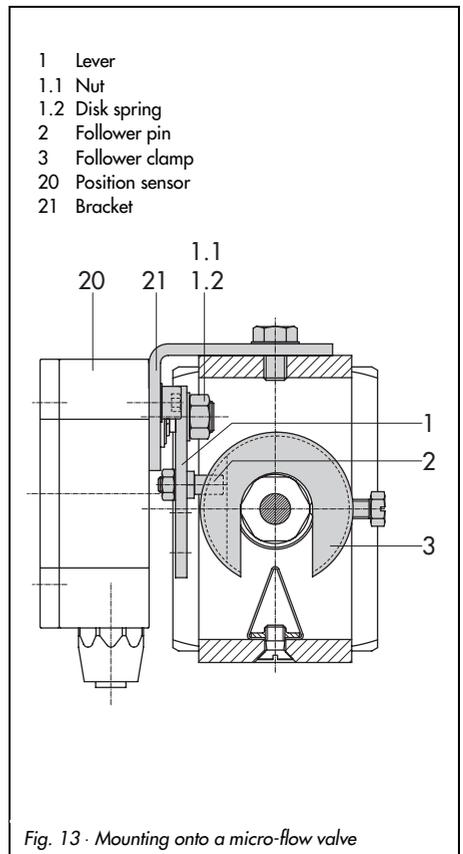


Fig. 13 · Mounting onto a micro-flow valve

### 2.6.4 Mounting the position sensor to rotary actuators

For the required mounting parts as well as the accessories, refer to the order numbers listed in Tables 7 and 8 on page 31.

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).

3. Replace the follower pin (2) normally attached to the lever (1) with the plain follower pin ( $\varnothing 5$ ) from the accessories and screw it into the hole for pin position  $90^\circ$ .
4. Place the lever (1) and disk spring (1.2) on the sensor shaft.  
Place the lever (1) in **mid-position** and **hold it in place**. Screw on the nut (1.1).

Follow the instructions describing attachment to the standard positioner in section 2.4.

Instead of the positioner, attach the position sensor (20) with its mounting plate (21).

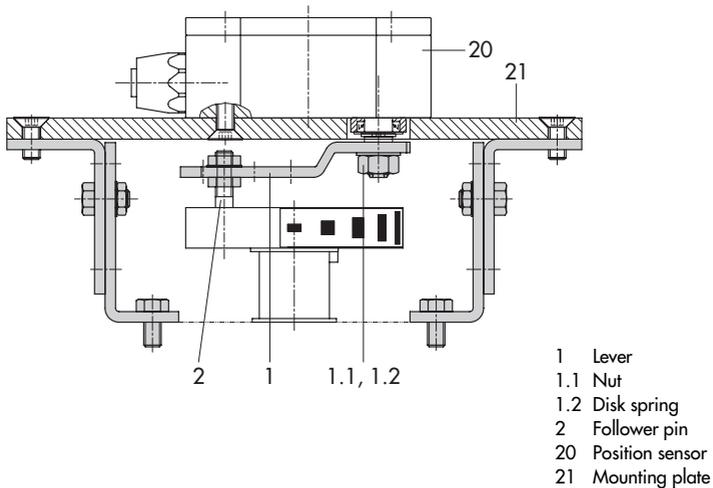


Fig. 14 · Mounting to rotary actuators

<b>Table 7</b>		Mounting parts for position sensor		Order no.
Direct attachment	Mounting parts for actuators with 120 cm <sup>2</sup> , see Fig. 11 left			1400-7472
Accessories for actuator 120 cm <sup>2</sup>	Connecting plate (9, old) for Actuator Type 3277-5xxxxx. <b>00</b> (old) G 1/8 Connecting plate (9, old) 1/4 NPT		1400-6820	1400-6821
	Connecting plate (9, <b>new</b> for Actuator Type 3277-5xxxxx. <b>01</b> (new)		1400-6823	
	<b>Note:</b> Only new connecting plates (9) can be used with new actuators (Index <b>01</b> ). Old and new plates are not interchangeable.			
Direct attachment	Mounting parts for actuators with 240, 350 and 700 cm <sup>2</sup> , see Fig. 11 right			1400-7471
NAMUR attachment	Mounting parts f. attachment to NAMUR rib w. lever L and XL, see Fig. 12			1400-7468
Attachment micro valve	Mounting parts for Type 3510 Micro-flow Valve, see Fig. 13			1400-7469
Attachmt. rotary actuators	Mounting parts with follower clamp and coupling wheel, see Fig. 14			1400-7473
<b>Table 8</b>				Order no.
Accessories for positioner	Connecting plate (6)		G 1/4 1/4 NPT	1400-7461 1400-7462
	or pressure gauge bracket (7)		G 1/4 1/4 NPT	1400-7458 1400-7459
	plus pressure gauge mounting kit (8) (Output and Supply)		St. st./Brass St. st./St. st.	1400-6950 1400-6951

### 3 Connections

#### 3.1 Pneumatic connections

**CAUTION!**

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

The thread connections must be screwed into the connecting plate, the gauge assembly or the connection block from the accessories. The air connections are optionally designed as bore with 1/4 NPT or G 1/4 thread.

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

**IMPORTANT:**

*The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed. Thoroughly blow through all air tubes and hoses 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 Namur attachment, the signal pressure can be applied to either the upper or lower diaphragm chamber of the actuator, depending on the actuator's fail-safe position.

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 Tables 1 to 5 for accessories).

#### 3.1.2 Supply air pressure

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

The bench range is registered 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 (Air to open)**

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)**

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:

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

- $d$  = Seat diameter [cm]  
 $\Delta p$  = Differential pressure across valve [bar]  
 $A$  = Actuator area [cm<sup>2</sup>]  
 $F$  = Upper bench range value of actuator [bar]

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

Required supply air pressure =  
upper bench range value + 1 bar

**NOTE:**

The signal pressure output (Output 38) of the positioner can be limited via Code 16 to pressures of 1.4, 2.4, or 3.7 bar or deactivated (MAX).

### 3.2 Electrical connections



As far as the electrical installation of the device is concerned, the relevant national regulations governing the installation of electrical equipment and the national accident prevention regulations of the country of destination must be adhered to.

In Germany, these are the VDE regulations and accident prevention regulations of the employer's liability insurance.

For installation in hazardous areas, the following standards apply: EN 60079-14: 1997; VDE 0165 Part 1/8.98 "Electrical apparatus for explosive gas areas" and EN 50281-1-2: VDE 0165 Part 2/11.99 "Electrical apparatus for use in the presence of combustible dust".

For intrinsically safe electrical apparatus that are certified according to the Directive 79/196/EEC, the data specified in the certificate of conformity apply for connection of intrinsically safe circuits.

For intrinsically safe electrical apparatus that are certified according to the Directive 94/9/EC, the data specified in the EC type examination certificate apply for connection of intrinsically safe circuits.

**Caution:** Always use the same terminal assignment as specified in the certificate. Reversal of the electrical connections may cause the explosion protection to be ineffective!

**Note on the selection of cables and wires:**

To run several intrinsically safe circuits in a multi-core cable, observe paragraph 12 of EN 60079-14; VDE 0165/8.98.

Especially for generally used insulating materials, for example polyethylene, the radial thickness of the conductor insulation must be at least 0.2 mm.

The diameter of a single wire in a flexible conductor must not be smaller than 0.1 mm.

The conductor ends must be protected against unlaying, e.g. by using wire end ferrules.

If the positioner is connected via 2 separate cables, an additional cable gland can be mounted.

Cable entries that are left unused must be sealed with plugs.

The wires for the reference variable must be connected to the terminals 11 and 12 in the housing, observing the polarity shown in Fig. 15.

The terminals should only be connected to an electrical current source.

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.

Depending on the version supplied, the positioner is equipped with either inductive limit switches and/or a solenoid valve or an analog position transmitter.

The position transmitter is operated in a two-wire circuit. In general, the supply voltage is 24 V DC. With regard to the resistance of the supply leads, the voltage directly at the position transmitter terminals must not be lower than 12 V and not higher than 30 V DC.

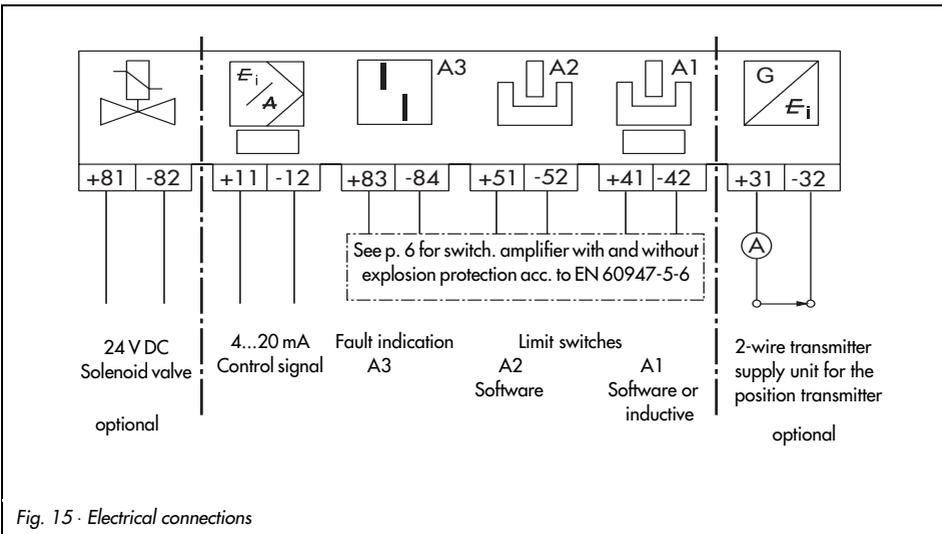


Fig. 15 · Electrical connections

Refer to Fig. 15 or the label on the terminal block for the terminal assignment.

---

**Caution!**

*It is not permissible to leave cable glands open. They must be sealed with protective caps.*

*The degree of protection IP 65 only applies to a closed positioner housing.*

---

**Accessories:**

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 M20 x 1.5 to 1/2 NPT

Aluminum, powder-coated

Order no. 0310-2149

**Connection for version with external position sensor**

The terminal assignment is fixed by the connector of the connecting lead.

- ▶ Shorten the connecting lead to the required length and strip the insulation off. Route the strands to the following contacts of the free connector:

Contact	Cable color
1	Brown
2	White
3	Blue
4	Black    shielding
5	Green/yellow

- ▶ Connect the fixed M12x1 plug connector to the position sensor and the mounted connector to the positioner unit.

### 3.2.1 Switching amplifiers

For operation of the limit switches, switching amplifiers must be connected in the output circuit. To ensure the operating reliability of the positioner, the amplifiers should comply with the limit values of the output circuits conforming to EN 60947-5-6.

If the positioner is to be installed in hazardous areas, the relevant regulations must be observed.

### 3.2.2 Establishing communication

Communication between PC and positioner (via FSK modem or handheld communicator, if necessary, using an isolation amplifier) is based on the HART protocol.

Type Viator FSK modem

RS 232 EExia Order no. 8812-0129

RS 232 not ex Order no. 8812-0130

PCMCIA Order no. 8812-0131

If the supply voltage of the controller or control station becomes too low because it has been reduced by the load in the circuit, an isolation amplifier is to be connected between controller and positioner (interfacing as for positioner connected in hazardous areas, see Fig. 16).

If the positioner is used in hazardous areas, an explosion-protected isolation amplifier is to be used.

By means of the HART protocol, all control room and field devices connected in the loop are individually accessible through their address via point-to-point or standard bus (Multidrop).

**Point-to-point:**

The bus address/polling address must always be set to zero (0).

**Standard bus (Multidrop):**

In the standard bus (Multidrop) mode, the positioner follows the analog current signal (reference variable) as for point-to-point communication. This operating mode is, for example, suitable for split-range operation of positioners (series connection). The bus

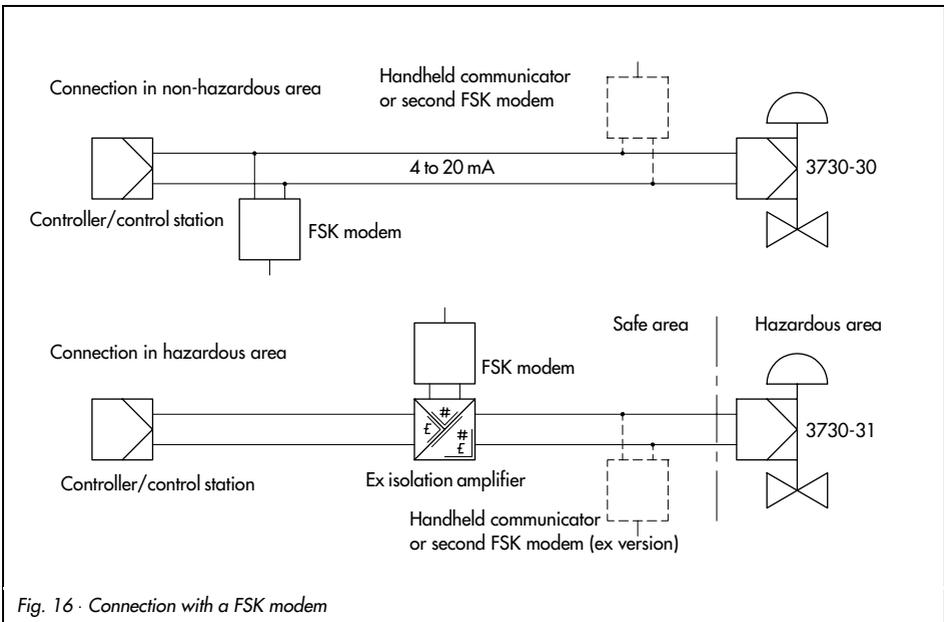


Fig. 16 · Connection with a FSK modem

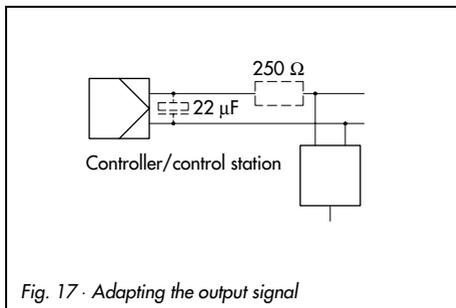
address/polling address has to be within a range of 1 to 15.

**Note:**

**Communication faults** may occur when the process controller/control station output is not HART-compatible.

For adaptation, the Z box, order no. 1170-2374, can be installed between output and communication interface. At the Z box a voltage of 330 mV is released ( $\geq 16.5 \Omega$  at 20 mA).

Alternatively, a  $250\text{-}\Omega$  resistor can be connected in series and a  $22\text{-}\mu\text{F}$  capacitor can be connected in parallel to the analog output. Note that in this case, the controller output load will increase.



*Fig. 17 · Adapting the output signal*

# 4 Operation

### Note:

A summary about operation and start up can be found in section 7, page 56. A leaflet including the same summary is also enclosed with the positioner.

## 4.1 Operator controls and displays

### Rotary pushbutton

The positioner is mainly operated with the rotary pushbutton. Codes, parameters and values are selected or set by turning the  button and confirmed by pressing it.

### Slide switch AIR TO OPEN or AIR TO CLOSE

This switch is used to adapt the positioner to the operating direction of the actuator.

- ▶ For actuator where the supply pressure opens the valve, fail-safe position: "springs close valve": switch position AIR TO OPEN.
- ▶ For actuator where the supply pressure closes the valve, fail-safe position: "springs open valve": switch position AIR TO CLOSE.
- ▶ For positioners with an attached reversing amplifier for double-acting rotary actuators (see section 2.5): switch position AIR TO OPEN.

### 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:

- ▶ For actuators smaller than 240 cm<sup>2</sup> and with lateral signal pressure connection (Type 3271-5) → choose MIN SIDE,
- ▶ Signal pressure connection on the back (Type 3277-5) → choose MIN BACK.
- ▶ For larger actuators, choose MAX SIDE for lateral connection and MAX BACK for connection on the back.

### Displays

The LC display indicates symbols that are assigned to codes, parameters and functions. In the operating modes Manual  and Automatic , 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 device is not initialized, (see section 4.3.1), the lever position in degrees relative to the longitudinal axis is indicated instead of the system deviation. One bar graph element corresponds to approximately a 5° angle of rotation. If the fifth element blinks (displayed value > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Displays and their meanings

<b>AUTO</b>	Automatic	<b>MAN</b>	Manual setting	<b>tunE</b>	Initialization in progress
<b>CL</b>	Clockwise	<b>MAX</b>	Maximum range	<b>YES</b>	Available
<b>CCL</b>	Counterclockwise	<b>NO</b>	Not available	<b>ZP</b>	Zero point adjustment
<b>Err</b>	Error	<b>NOM</b>	Nominal travel		
<b>ESC</b>	Escape (cancel)	<b>ON</b>	On	↗↗	Increasing/increasing
<b>HI</b>	ix greater than 20.5 mA	<b>OFF</b>	Off	↘↘	Increasing/decreasing
<b>LO</b>	ix smaller than 3.8 mA	<b>RES</b>	Reset	⦿	blinking Controlled operation
<b>LOW</b>	w too low	<b>RUN</b>	Start	⚡	blinking Not initialized
		<b>SAFE</b>	Fail-safe position		
		<b>SUB</b>	Substitute calibration		

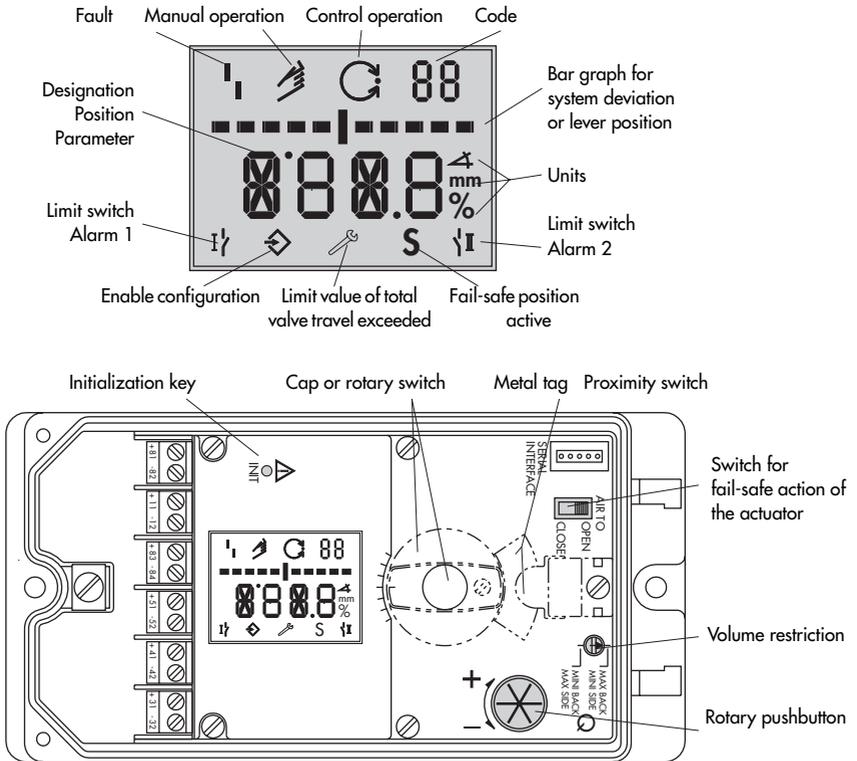


Fig. 18 · Display and operator controls

## 4.2 Enabling and selecting the parameters

The codes which are marked with an asterisk (\*) on page 59 onwards in section 8 must be enabled with Code 3 before the associated parameters can be configured as described below.



Code 3  
Configuration not  
enabled



Configuration  
enabled

- ▶ From the current display, turn the rotary pushbutton until Code **3** and **OFF** appears on the display. Confirm Code **3** by pressing the  button, the code number blinks.
- ▶ Turn  button until **ON** appears. Confirm setting by pressing the  button.

Configuration is enabled and is indicated by the  symbol appearing on the display. Now you can adjust the codes, parameters and values for the control valve in any desired order by turning the  button. Confirm settings by pressing the  button.

### IMPORTANT:

To cancel a value that you have just entered under a code, turn the  button until **ESC** appears on the display and press to confirm.



Canceling the setting

### CAUTION!

If no settings are entered within 120 s, the enabled configuration function becomes invalid and the display resets to Code 0.

The Code list on page 59 onwards in section 8 shows all parameters that can be adjusted, including their description and the factory settings with the default values.

### IMPORTANT:

After attaching the positioner to the valve as well as adjusting the fail-safe position and the volume restriction, it is sufficient in standard operation to activate the initialization key in order to ensure optimum positioner operation (see section 5.4.3 on page 44). For this purpose, the positioner must be operated with its default values. If necessary, a reset must be carried out (see section 5.9, page 53).

## 4.3 Operating modes

### 4.3.1 Automatic and manual operating modes

#### Prior to initialization:

If the positioner has not been initialized yet, the automatic operating mode **AUTO** cannot be selected.

The valve can only be positioned manually with the positioner.

To do this, turn  button clockwise until Code **1** appears, then confirm Code **1** by pressing the  button.



If both the code number and the hand symbol are blinking, the valve can be manually positioned by turning the  button.

This type of manual adjustment is used to check the operating range of the positioner, see also page 43, section 5.4.

#### After initialization:

After successful initialization in the **MAX**, **NOM** or **MAN** mode (section 5.4.3), the positioner is in automatic operating mode .



#### Switching to manual operating mode

With Code **0**, press the  button, **AUTO** appears in the display, Code **0** blinks.

Turn  button until **MAN** appears.



Press  button to confirm, the hand symbol appears and then the current position in %, Turn  button until Code **1** appears,

Turn  button until Code **1** appears,



Press  button to confirm, Code **1** blinks.

The positioner is in manual operating mode .

The switchover is smooth since the manual operating mode starts up with the set point last used during automatic operating mode.

The required valve position can be adjusted by turning the  button.

#### NOTE:

Switching from manual to automatic operating mode works in the same manner.

First, you must reset the positioner to Code **0** and then set it to automatic mode **AUTO** and confirm.

### 4.3.2 SAFE – Fail-safe position

If you want to move the valve to fail-safe position, proceed as follows:

With Code **0**, press the  button, **AUTO** or **MAN** appear on the display, Code **0** blinks.

Turn the  button until **SAFE** appears



Press the  button to confirm.

Operating mode **SAFE** has been selected, symbol **S** for the fail-safe action appears.

**CAUTION!** The valve moves to the fail-safe position.

Once the positioner is initialized, the current valve position is indicated on the digital display in %.

If you want to reset the valve from the fail-safe position to the operating mode **AUTO** or **MAN**, the  button must be pressed while Code **0** is active.

When the code number blinks, turn the  button to switch to the desired operating mode.

Press the  button to confirm.

## 5 Start-up and settings

### NOTE:

A summary about operation and start-up can be found in section 7 on page 56. A leaflet including the same summary is also enclosed with the positioner.

- ▶ Connect pneumatic supply air (Supply 9), making sure the pressure is correct as described in section 3.1.
- ▶ Impose electrical reference variable of 4 to 20 mA (terminals 11 and 12).
- ▶ The voltage supply for versions with a solenoid valve must be connected at >19 V DC (terminals 81(+) and 82(-)).



### WARNING!

The signal pressure delivered may cause the actuator stem to move, be aware of risk of injury!

### 5.1 Determining the fail-safe position

- ▶ To adapt the positioner to the operating direction of the actuator, set slide switch to AIR TO OPEN or AIR TO CLOSE.
- ▶ AIR TO OPEN = Signal pressure opens the valve, for fail-safe position actuator stem extends/valve closed.
- ▶ AIR TO CLOSE = Signal pressure closes the valve, for fail-safe position actuator stem retracts/valve open.

## 5.2 Adjusting volume restriction Q

- ▶ For actuators smaller than 240 cm<sup>2</sup> and with lateral connection of the signal pressure (Type 3271-5):  
Restriction position to MIN SIDE,
- ▶ For connection at the back (Type 3277-5) Restriction position to MIN BACK.
- ▶ For actuators of 240 cm<sup>2</sup> and larger, select MAX SIDE for lateral connection and MAX BACK for connection on the back.

### CAUTION!

If you change the position of the restriction after initialization, the positioner must be re-initialized.

## 5.3 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:



Reading direction for right attachment of pneumatic connections



Reading direction for left attachment of pneumatic connections

1. Turn the button until Code **2** appears, then confirm Code **2** by pressing the button, Code **2** blinks.

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

## 5.4 Start-up at the positioner

### 5.4.1 Limiting the signal pressure

The signal pressure must be restricted in cases where the maximum actuator force can lead to valve damage. To proceed, first select Code **3** for enabling configuration and then set the pressure limit to 1.4, 2.4 or 3.7 over Code **16**.

### 5.4.2 Checking the operating range of the positioner

To check the mechanical attachment and the proper functioning, the valve should be moved through the operating range of the positioner in the manual operating mode with the manual reference variable.



Code 0  
Select manual operation  
Default **MAN**



Code 1  
Position valve using the rotary pushbutton, the current angle of rotation is indicated

1. Turn the button until Code **0** appears, then confirm Code **0** by pressing the button.

2. Turn  button until **MAN** appears in the display, i.e. manual operating mode, confirm adjusted operating mode by pressing the  button.
3. Turn the  button until Code **1** appears, confirm Code **1** by pressing the  button.  
The hand symbol and Code **1** blink.
4. Position control valve by turning the  button several times until pressure builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked. The permissible range has been exceeded when the displayed angle is higher than 30°, and the outer right or left bar graph element blinks. If this is the case, it is absolutely necessary to check lever and pin position as described in section 2.

---

### NOTE:

If the selected pin position is smaller than intended for the respective travel range, the positioner switches to the **SAFE** mode, the valve moves to the fail-safe position (see section 4.3.2 on page 42).

---

5. Initialize positioner as described in section 5.4.3.

## 5.4.3 Initialization

During initialization the positioner adapts itself optimally to the friction conditions and signal pressure demand of the control valve. The type and extent of self-adaptation depends on the set initialization mode (see section 5.4.4.). Default setting is **MAX**, i.e. in-

itiation based on the maximum range (factory default).

If configuration is enabled via Code **3**, Code **6** can be used to switch to other initialization modes.

If the positioner has been initialized once already, it will automatically go to the operating mode used last after the electric reference variable is imposed, Code **0** appears on the display.

During first-time initialization, the  symbol blinks on the display.

---

### IMPORTANT:

Every time you re-initialize the positioner, it should be reset to its basic settings including all default values (see section 5.9 on p. 53).

### NOTE:

The initialization process can be started by pressing the INIT key with a suitable tool. The time required for the initialization procedure depends on the running time of the actuator and can take a few minutes.

---

---



### WARNING!

During the initialization, the control valve moves through its entire travel/angle of rotation range. Therefore, never initialize while a process is running, but only during start-up, when all shut-off valves are closed.

During initialization, full supply pressure may be applied to the actuator. In cases where this may cause impermissible positioning forces to occur, the maximum signal pressure supplied to the actuator must be limited (see section 5.4.1)

---



Alternating displays  
Initialization running



Bar graph display  
indicating the initializa-  
tion's progress



Initialization successful,  
positioner in automatic  
operating mode

If initialization is successful, the positioner moves to automatic operation which is indicated by the control symbol **G**.

The reference variable appears in % on the display. In case of malfunctions, the process is canceled and the fault symbol **I** appears, see section 5.7 on page 52.

During initialization, the direction of action is set to match the fail-safe position of the valve. This results in the following relation between reference variable and valve position:

Fail-safe position	Direction of action	Valve	
		Closed at	Open at
Actuator stem extends (FA) AIR TO OPEN	↗↗	4 mA	20 mA
Actuator stem retracts (FE) AIR TO CLOSE	↗↘	20 mA	4 mA

The tight-closing function is activated.  
Set Code 15 (final position  $w>$ ) to 99 % for three-way valves.

Following this, other valve-specific parameters can be set.

### 5.4.4 Initialization mode

After enabling configuration with Code **3** and accessing Code **6**, you can choose one of the initialization modes **MAX**, **NOM**, **MAN** or **Sub** to start initialization. **ZP** which is zero point adjustment, is described in section 5.8 on page 53.

#### MAX - Initialization based on maximum range

Initialization mode for simplified start-up for valves with two definite mechanical final positions, e.g. for three-way valves.

The positioner determines travel/angle of rotation of the throttling element from the CLOSED position to the opposite stop and adopts this travel/angle of rotation as operating range from 0 to 100 %.



Enable configuration:

Default **OFF**

Turn → Code **3**, Press ,  
Turn → **ON**, Press .

After enabling:



Default **MAX**

Turn → Code **6**, Press   
Turn → **MAX**, Press .

### Press INIT key to start the initialization procedure!



*The initialization procedure may take several minutes, depending on the actuator size, because the valve moves through its entire travel/angle of rotation range.*

#### **NOTE:**

After **MAX** initialization, the positioner cannot indicate nominal travel/angle of rotation in mm/°, Code 5 remains disabled. In addition, the lower (Code 8) and the upper (Code 9) x-range value can only be displayed and modified in %.

If you want the display to indicate mm/°, proceed as follows after the configuration has been enabled:

Turn  → Code **4**,      Press 

Turn  → Select pin position entered during installation,

Press .

If you now switch to Code **5**, the nominal range appears in mm/°.

The lower and upper x-range values for Code 8 and 9 are displayed in mm/° and can be adapted accordingly.

### NOM - Initialization based on nominal range

Initialization mode for all globe valves.

For this initialization mode, the following parameters must be entered: pin position (Code **4**), nominal travel/angle (Code **5**) and, if required, the direction of action (Code **7**).

The calibrated sensor enables the effective valve travel to be preset very accurately.

During the initialization procedure, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision.

In case of a positive result, the indicated nominal range is adopted with the limits of lower x-range and upper x-range values as the operating range.

#### **NOTE:**

*The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, the initialization is aborted (error message Code 52) because the nominal travel is not achieved.*

Enable configuration:



Default **OFF**

Turn  → Code **3**,

Press 

Turn  → **ON**,

Press .

After enabling:



Default **OFF**

Turn → Code **4**, Press ,  
 Turn → Select pin position entered during the installation, Press .



Default **15**

Turn → Code **5**, Press ,  
 Turn → Enter nominal valve travel, Press .



Default **MAX**

Turn → Code **6**, Press ,  
 Turn → **NOM**, Press .

**Press INIT key to start the initialization procedure!**



*The initialization procedure may take several minutes, depending on the actuator size, because the valve passes through its entire travel/angle of rotation range.*

**MAN - Initialization based on nominal range** with default upper x-range value by means of manual adjustment.

Initialization mode just as **NOM**, however, for starting up valves with unknown nominal range.

In this mode, the positioner expects the control valve to be moved manually to the desired OPEN position prior to enabling the initialization procedure.

The upper range travel/angle of rotation value is adjusted using the rotary pushbutton. The positioner uses this OPEN position and the CLOSED position to calculate the differential travel/angle and accepts it as the operating range with the lower x-range value and upper x-range value being the limits.



Default **MAN**

Turn → Code **0**, Press ,  
 Turn → Choose **MAN**, Press .



Turn → Code **1**, Press ,  
 Code **1** blinks,  
 Turn , until the valve is in OPEN position.  
 Press .

Enable configuration:



Default **OFF**

Turn → Code **3**,      Press ,

Turn → **ON**,      Press .

After configuration has been enabled:

Turn → Code **4**,      Press ,

Turn → Select pin position entered during the installation.

Press .



Default **MAX**

Turn → Code **6**,      Press ,

Turn → **MAN**,      Press .

**Press INIT key to start the initialization procedure!**



*The initialization procedure may take several minutes, depending on the actuator size, because the valve moves through its entire travel/angle of rotation range.*

### SUB

(substitute configuration, without initialization)

This initialization mode is an emergency mode. The positioner parameters are estimated and not determined by an initialization procedure, so that a high stationary accuracy cannot be expected.

You should always select a different initialization mode if the system allows it.

The initialization mode **Sub** is used to replace a positioner while the process is in operation.

For this purpose, the control valve is usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate in this valve position.

After the old positioner has been replaced with a new one, the following parameters must be entered: pin position (Code **4**), nominal range (Code **5**), direction of action (Code **7**) and closing direction (Code **34**). The default travel limit of 100 % (Code **11**) must be disabled with **OFF**.

In addition, the blocking position (Code **35**) must be adjusted with the button so that it matches the position of the previously blocked valve.

The parameters  $K_P$  (Code **17**),  $T_V$  (Code **18**) and the pressure limit (Code **16**) should remain set to their default values.

If the configuration data of the new positioner are known, it is recommended to accept its  $K_P$  and  $T_V$  values.

After setting the AIR TO OPEN/CLOSE switch for the fail-safe position, adapting the volume restriction and pressing the INIT key, the positioner calculates its configuration data on the basis of the blocking position and the closing direction as well as the other entered data.

The positioner switches to manual operation, subsequently the blocking position should be canceled as described beforehand.

Enable configuration:



Default **OFF**

Turn → Code **3**,      Press ,  
 Turn → **ON**,      Press .

After enabling:



Default **OFF**

Turn → Code **4**,      Press ,  
 Turn → Select pin position entered during the installation,  
 Press .



Default **15 mm**

Turn → Code **5**,      Press ,  
 Turn → Enter nominal travel/angle  
 Press .



Default **MAX**

Turn → Code **6**,      Press ,  
 Turn → **Sub**,      Press .



Default **77**

Turn → Code **7**, Press ,  
 Turn → Retain direction of action  
 [>>] **77** or select << **77**,  
 Press .



Default **100.0**

Turn → Code **11**,      Press ,  
 Turn → Disable mechanical stop,  
 Press .



Default **OFF**

Turn → Code **16**,  
 Retain default value for pressure limit,  
 change value only if necessary.



Default Kp = 7

Turn → Code **17**,  
Retain default. Proceed as follows only if known:  
Press .  
Turn → Select Kp,  
Press .



Default 2

Turn → Code **18**,  
Retain default Tv, change only if known.



Default CCL

Turn → Code **34**, Press .

Turn → Select closing direction.  
CCL = counterclockwise, CL = clockwise.  
Direction of rotation which causes the valve to move to the CLOSED position (view onto the rotary pushbutton movement while positioner cover is open).  
Press .



Default 0.0

Turn → Code **35**, Press .

Turn → Enter blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).  
Press .

- ▶ Move switch for **fail-safe position** to AIR TO OPEN or AIR TO CLOSE acc. to section 5.1 on page 42.
- ▶ Adjust volume restriction acc. to section 5.2 on page 43.

**Press INIT key!**

**The positioner switches to manual operating mode!**



The adjusted blocking position is indicated

Error 76 (no emergency mode) appears on the display and, in some cases, error 57 because the initialization procedure has not yet been completed. These error codes do not have any influence on the positioner's ability to operate.

### Canceling the blocking position

For the positioner to follow its reference variable again, the blocking position must be canceled and the positioner must be set to automatic operation **AUTO** as follows:

Turn  → Code **1**, Press , Code **1** blinks.

Turn  in order to move the valve slightly past the blocking position, then cancel mechanical blocking.

Press 

Turn  → Code **0**, Press , Code **0** blinks.

Turn  until **AUTO** appears,

Press  to confirm the operating mode.

### The positioner switches to automatic operating mode!

The current valve position is indicated in %.

---

### NOTE:

*If the positioner shows a tendency to hunt in automatic operating mode, the parameters  $K_P$  and  $T_V$  must be slightly corrected. Proceed as follows:*

*Set  $T_V$  to 4 (Code **18**)*

*If the positioner still oscillates, the gain  $K_P$  (Code **17**) must be decreased until the positioner shows a stable behavior.*

---

### Zero point correction

Finally, if process operations allow it, zero point must be adjusted according to section 5.8 on page 53.

---

### CAUTION!

*The positioner automatically moves to zero point.*

---

## 5.5 Start-up over local interface (SSP)

The positioner must be supplied with at least 4 mA current.

The positioner can be directly connected to the PC over the SERIAL INTERFACE and serial interface adapter (order no. 1400-7700).

You can access all the positioner's parameters by using the TROVIS-VIEW software with installed device module 3730-3.

Proceed as described in section 5.3 to 5.4.3 for start-up and settings.

## 5.6 Start-up over HART communication

The positioner must be supplied with at least 4 mA current. The FSK modem must be connected in parallel to the current loop.

A DTM file (Device Type Manager) conforming to the Specification 1.2 is available for communication. This allows the device, for example, to be run with the PACTware operator interface. All the positioner's parameters are then accessible over DTM and the operator interface.

Proceed as described in section 5.3 to 5.4.4 for start-up and settings.

### NOTE!

*The write access for HART communication can be disabled over Code 47. You can only disable or enable this function locally at the positioner.*

*The write access is enabled by default.*

*The on-site operation including the INIT key can be locked over HART communication.*

*The word "HART" then blinks on the display when Code 3 is selected.*

*This locking function can only be disabled over HART communication.*

*On-site operation is enabled by default.*

## 5.7 Fault

In case of fault, the fault symbol  appears on the display in the top left corner.

Additionally, for some faults a signal is issued via the fault alarm contact (see error code list).

To access the error codes, turn the  button to Code 50 and higher.

**Err** appears on the display with the respective error code.

For the cause of the fault and its remedy, refer to the codes listed in section 8 on page 59 onwards.



Display indicating an error code

After an error code has occurred, you should first try to acknowledge it as follows:

Enable configuration:

Turn  → Code **3**,      Press ,

Turn  → **ON**,      Press .

Turn  until the error code number appears, then press the  button to confirm.

Should the error occur again, read the remedy instructions in the error code list.

## 5.8 Adjusting the zero point

In case of discrepancies with the closing position of the valve, e.g. with soft-sealing plugs, it may become necessary to recalibrate the zero point.

Enable configuration:



Default **OFF**

Turn → Code **3**,  
Turn → **ON**,

Press ,  
Press .

After enabling:



Default **MAX**

Turn → Code **6**,  
Turn → **ZP**,

Press ,  
Press .

### Press INIT key.

Zero point adjustment is enabled, the positioner moves the control valve to the CLOSED position and readjusts the internal electrical zero point.



*The valve briefly moves from the current travel/angle of rotation position to the closed position.*

## 5.9 Reset to default values

This function resets all parameters to the factory default values (see list of codes in section 8).

Enable configuration:



Default **OFF**

Turn → Code **3**,  
Turn → **ON**,

Press ,  
Press .

After enabling:



Default **OFF**

Turn → Code **36**,  
Turn → **RUN**,

Press ,  
Press .

All parameters are reset and can be re-configured.

### 6 Adjusting the limit switch

The positioner version with inductive limit switch has one adjustable tag (1) mounted on the shaft which operates the proximity switch (3).

For operation of the inductive limit switch, the corresponding switching amplifier (see section 3.2.1) must be connected to the output.

If the tag (1) is in the field of the switch, the switch assumes a high resistance. If the tag is out of the field, the switch assumes a low resistance.

Normally, the limit switch is adjusted such that it will provide a signal in both end positions of the valve. The switch, however, can also be adjusted to indicate intermediate valve positions.

The desired switching function, i.e. whether the output relay shall be picked up or released when the tag has entered the field, has to be determined, if necessary, at the switching amplifier.

---

#### **NOTE:**

*The inductive limit switch replaces the software limit switch A1 with terminal assignment +41/-42.*

*Each switching position can optionally be set to indicate when the tag has entered the field, or when it has left the field.*

*The second software limit switch remains effective, the function of the software limit switch A1 is disabled.*

---

#### **Adapting the software**

Code **38** (inductive alarm is set to **YES**).

The inductive limit switch is connected to the terminals +41/-42.

The device is set up accordingly when delivered ex works SAMSON.

#### **Adjusting the switching point:**

---

**IMPORTANT:** *During adjustment or testing, the switching point must always be approached from mid-position (50 %).*

---

To ensure safe switching under any ambient conditions, the switching point should be adjusted to a value of approx. 5 % before the mechanical stop (OPEN – CLOSED).

#### **For CLOSED position:**

1. Initialize positioner.
2. Use the **MAN** function to move the positioner to 5 % (see LC display).
3. Adjust the tag using the yellow adjustment screw (2) until the tag enters or leaves the field and the switching amplifier responds. You can measure the switching voltage as an indicator.

#### **Contact function:**

Tag leaving the field > contact is made.

Tag entering the field > contact is opened.

**For OPEN position:**

1. Initialize positioner.
2. Use **MAN** function to move positioner to 95 % (see LC display).
3. Adjust the tag (1) using the yellow adjustment screw (2) until the tag enters or leaves the field. You can measure the switching voltage as an indicator.

**Contact function:**

Tag leaving the field > contact is made.

Tag entering the field > contact is opened.

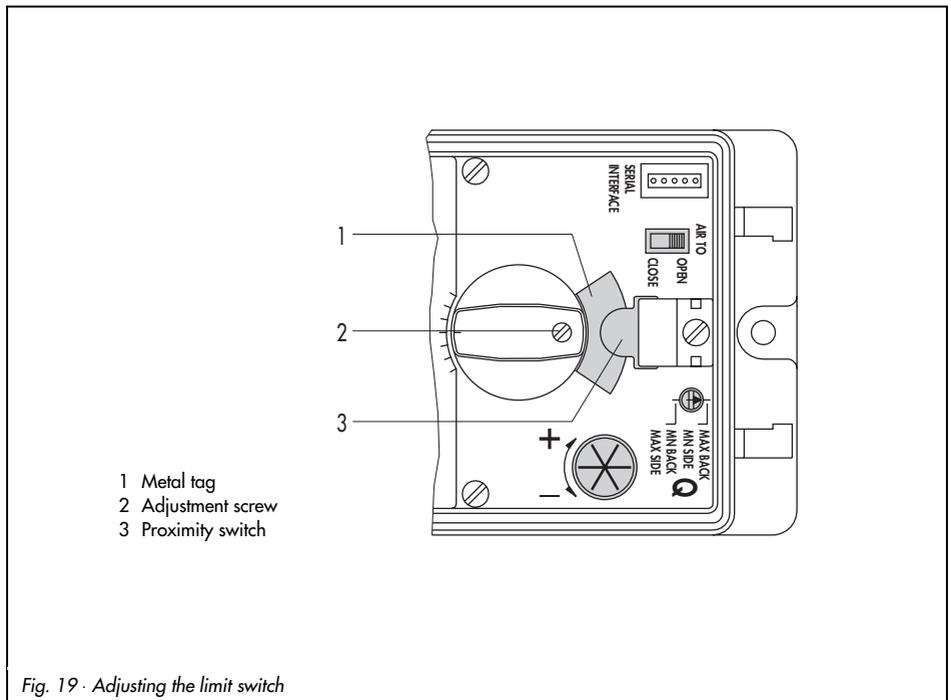


Fig. 19 · Adjusting the limit switch

## 7 Quick start-up guide

### 7.1 Mounting

#### Direct attachment

to SAMSON Type 3277 Actuator

Travel mm	Actuator cm <sup>2</sup>	Pin position
7.5	120	25
15	120/240/350	35
15/30	700	50

#### Note:

*Standard delivery includes lever M ready assembled with the follower pin on 35 mm pin position for 15 mm travel!*

- ▶ To mount the positioner, lift the lever so that the follower pin rests on the follower clamp of the actuator stem.

#### NAMUR attachment

- ▶ Determine the maximum travel range of the control valve from the closed position to as far it will go in the other direction.
- ▶ Select the lever to match the maximum travel range as well the next largest pin position and screw onto the shaft of the positioner.
- ▶ Lever option/pin distance: see table on page 61 or on cover plate of the positioner.
- ▶ Screw the Namur bracket onto the valve yoke so that it is aligned centrally to the slot of the follower plate when the travel position is at 50 %.
- ▶ Secure the positioner to the Namur bracket, making sure that the follower pin is in the slot of the follower plate. Make sure the lever can still move.

#### Attachment to rotary actuators

- ▶ Lever **M** Pin position 90°
- ▶ Put the valve into the closed position, determine the opening direction.
- ▶ Place the follower plate on the slotted actuator shaft and fasten it to the coupling wheel. Attach the upper and lower brackets to the actuator.
- ▶ Place the positioner on the brackets and screw tight, making sure that the lever with its follower pin engages the slot of the coupling wheel, while taking into account the opening direction. It is important to make sure that the lever's mid position corresponds to the mid travel of the valve (lever's mid position = the lever is parallel to the long side of the positioner casing).

#### Pneumatic connections

- ▶ Screw the threaded connections only into the attached mounting block, connecting plate or pressure gauge block from the accessories.

## 7.2 Start-up

- ▶ Connect pneumatic supply air (1.4 to 6 bar).
- ▶ Impose electrical reference variable (4 to 20 mA).

### Set the fail-safe position

Place the slide switch acc. to fail-safe position of the control valve:

AIR TO OPEN (signal pressure opens the valve) or

AIR TO CLOSE (signal pressure closes the valve).

### Adapt the volume restriction Q to the actuator size

Only set the restriction for actuators < 240 cm<sup>2</sup> to

MIN SIDE for connection at the side or

MIN BACK for connection at the back.

---

### CAUTION!

*After each change of the restriction position, the positioner must be re-initialized.*

---

### Changing the reading direction of the display (if necessary)

Turn  → Code **2**, ↓,

turn  → Display ok, ↓

## Operation

### Selecting the parameters or values

Each parameter has a code number which is shown in the display. Use the  rotary pushbutton to select. Turn the button to select parameters or values and then push ↓ to confirm.

Press **ESC** to prevent an entered value from being accepted.

### Enabling parameters

Parameters that have a code marked with an asterisk (\*) can only be changed when they are enabled beforehand using Code **3**. The configuration mode is shown in the display with the  symbol.

See list of codes from page 59 onwards or cover plate of the positioner for a description of the menu codes.

## 7.3 Initialization

---

### Important:

Carry out a reset (Code 36) prior to each initialization

---

Turn  → Code 3, ↓,

Turn  → ON, ↓

Turn  → Code 36, ↓,  
select RUN, ↓

---

### CAUTION

During initialization, the valve runs through its whole range of travel/rotation.

---

### 7.3.1 Simplest method (MAX)

---



Mount and start up the positioner and press the **INIT key!**  
**READY!**

The positioner adapts itself automatically to the maximum travel/angle of rotation range of the control valve.

---

### 7.3.2 Precise method (NOM)

Positioner adapts itself precisely to the nominal travel/rotational angle of the control valve!

Mount and start up the positioner, then proceed as follows:

Turn  → Code 3, ↓,

Turn  → ON, ↓

Turn  → Code 4, ↓,

Select pin position, ↓

Turn  → Code 5, ↓,

Enter rated travel/angle, ↓

Turn  → Code 6, ↓,

Select **NOM**, ↓

Press **INIT key!**

---

### 7.3.3 Manual method (MAN)

Initialization mode same as NOM, but for start-up of control valves with unknown rated range.

The final position of travel/angle of rotation (valve open) is entered manually.

Mount and start up the positioner, then proceed as follows:

Turn  → Code 0, ↓,

Turn  → select **MAN**, ↓

Turn  → Code 1, ↓,

Turn  → valve **open** position, ↓

Turn  → Code 3, ↓,

Turn  → **ON**, ↓

Turn  → Code 6, ↓, select **MAN**, ↓

Press **INIT key!**

---

### Note:

After imposing the electrical reference variable, the positioner is in the last used operating mode. Code 0 appears in the display. If the positioner has not yet been initialized, the  symbol blinks.

---

## 8 List of codes

Code no.	Parameters - Display - Values [Default]	Description
<b>IMPORTANT:</b> Codes marked with an asterisk (*) must be enabled with Code 3 prior to configuration		
<b>0</b>	<b>Operating mode</b> [MAN] AUtO SAFE ESC	AUtO = automatic mode      MAN = manual mode SAFE = fail-safe position      ESC = escape (cancel) Switchover from automatic to manual mode is smooth. In fail-safe mode, the symbol <b>S</b> appears on the display. In MAN and AUtO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the sensor in relation to the central axis is displayed in degrees °.
<b>1</b>	<b>Manual w</b> 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the sensor position in relation to the central axis is indicated in degrees °.
<b>2</b>	<b>Reading direction</b> [1234] or ɾɛɹl ESC	The reading direction of the display is turned by 180°.
<b>3</b>	<b>Enable configuration</b> [OFF] ON ESC	Activates the option to modify data (automatically deactivated after 120 s, when no data are entered). <b>HART</b> blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only be read over the SSP interface.
<b>4*</b>	<b>Pin position</b> [OFF] 17, 25, 35, 50 mm 70, 100, 200 mm, 90° for rotary actuators ESC	The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation (select as per table on page 61). For initialization using NOM or SUB, this pin position must be entered.

## List of codes

5*	<b>Nominal range</b> [15.0] mm or angle ° ESC	For initialization using NOM or SUB, the nominal travel/angle of rotation of the valve must be entered. The possible adjustment range depends on the pin position as shown in the table on page 61. Code 5 is generally disabled, provided Code 4 is OFF, i.e. first after entering a pin position, Code 5 can be changed. After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.
6*	<b>Init mode</b> [MAX] NOM MAN SUB ZP ESC	Select the initialization mode <b>MAX:</b> Maximum range of the control valve, the travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. <b>NOM:</b> Nominal range of the control valve, the travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. <b>MAN:</b> Manual adjustment: upper x-range value <b>SUB:</b> No self-adjustment (emergency mode) <b>ZP:</b> Zero point adjustment
7*	<b>w/x</b> [↗↗] ↗↘ ESC	Direction of action of the reference variable w in relationship to the travel/angle of rotation x (increasing/increasing or increasing/decreasing)  Automatic adaption: <b>AIR TO OPEN</b> After initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases. <b>AIR TO CLOSE</b> After initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.
8*	<b>Lower x-range value</b> 0.0 to 80.0 [0.0] % of the nominal range, displayed in mm or angle °, provided Code 4 is set ESC	Lower range value for the travel/angle of rotation in the nominal or operating range. The <b>operating range</b> is the actual travel/angle of the control valve and is limited by the lower x-range value (Code 8) and the upper x-range value (Code 9). Value is displayed or must be entered. Usually, the operating range and nominal range are identical. The nominal range can be limited to the operating range by the lower x-range value and the upper x-range value. The characteristic is adapted. See also the example for Code 9!

9*	<b>Upper x-range value</b> 20.0 to 100.0 [100.0] % of the nominal range, displayed in mm or angle °, provided Code 4 is set ESC	Upper range travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. Example: The modified (limited) operating range is used for control valves that are sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the set lower limit and 100 % to the set upper limit.		
<b>Pin position table</b>		Pin position Code 4	Standard Code 5	Adjustment range Code 5
Data displayed in mm or in degrees of an angle for rotary actuators.  <b>NOTE:</b> If the pin distance has been selected too small with Code 4, the device switches to the SAFE mode for safety reasons.		<b>17</b> <b>25</b> <b>35</b> <b>50</b> <b>70</b> <b>100</b> <b>200</b> <b>90°</b>	7.5 7.5 15.0 30.0 40.0 60.0 120.0 90.0	3.6 to 17.7 5.0 to 25.0 7.0 to 35.4 10.0 to 50.0 14.0 to 70.7 20.0 to 100.0 40.0 to 200.0 24.0 to 110.0
10*	<b>Lower x-limit</b> OFF 0.0 to 49.9 % of the operating range  ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted.  See also example in Code 11.		
11*	<b>Upper x-limit</b> [100 %] 50.0 to 120.0 [100] % of the operating range OFF  ESC	Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted.  <b>Example:</b> In some applications, it makes sense to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached.  The lower limit must be adjusted with Code 10, and the upper limit with Code 11. If a tight-closing function has been set up, it has priority over the travel limitation!  When this function is set to OFF, the valve can be moved with a reference variable outside of the 4 to 20 mA range beyond the nominal travel.		

<p><b>12*</b></p>	<p><b>w-start</b> 0.0 to 75.0 [0.0] % of the reference variable range</p> <p>ESC</p>	<p>Lower range value of the applicable reference variable range, must be smaller than the final value w-end, <math>0\% \pm 4\text{ mA}</math>. The reference variable range is the difference between w-end and w-start, and must be as <math>\Delta w \geq 25\% \pm 4\text{ mA}</math>.</p> <p>For an adjusted reference variable range of 0 to 100 % <math>\pm 4</math> to 20 mA, the control valve must move through its entire operating range from 0 to 100 % travel/angle of rotation.</p> <p>In <b>split-range operation</b>, the valves operate with smaller reference variables. The control signal of the controller to control two valves is divided such, for instance, that the valves move through their full travel/angle of rotation at only half the input signal (first valve set to 0 to 50 % <math>\pm 4</math> to 12 mA and second valve set to 50 to 100 % <math>\pm 12</math> to 20 mA reference variable).</p>
<p><b>13*</b></p>	<p><b>w-end</b> 25.0 to 100.0 [100.0] % of the reference variable range.</p> <p>ESC</p>	<p>Upper range value of the applicable reference variable range, must be higher than w-start. <math>100\% \pm 20\text{ mA}</math></p>
<p><b>14*</b></p>	<p><b>Final position w &lt;</b> OFF 0.0 to 49.9 [1.0] % of the span set over Code 12/13</p> <p>ESC</p>	<p>If w reaches the adjusted percentage which causes the valve to close, the actuator is automatically completely vented (for AIR TO OPEN) or filled with air (for AIR TO CLOSE). The action always leads to the maximum tight-closing of the valve. A signal pressure limitation is possible over Code 16.</p> <p>Codes 14/15 have priority over 8/9/10/11.</p>
<p><b>15*</b></p>	<p><b>Final position w &gt;</b> [OFF] 50.0 to 100.0 % of the span set over Code 12/13</p> <p>ESC</p>	<p>If w reaches the adjusted percentage which causes the valve to open, the actuator is automatically filled with air (for AIR TO OPEN) or (for AIR TO CLOSE) completely vented . The action always leads to the valve moving to its maximum opening position. A signal pressure limitation is possible over Code 16.</p> <p>Code 14/15 has priority over the Codes 8/9/10/11.</p> <p><b>Example:</b> Set the final position w&gt; to 99 % for three-way valves.</p>

16*	<b>Pressure limit</b> [OFF] 1.4 2.4 3.7 bar ESC	The pressure limit determined during initialization is displayed and can be modified. (Only applicable for fail-safe position valve CLOSED/AIR TO OPEN; for valve OPEN/AIR TO CLOSE always [OFF] after initialization, i.e. full supply pressure to the actuator. The supply pressure can be limited also prior to initialization to prevent inadmissibly high actuating forces). <b>NOTE:</b> After changing an adjusted pressure limit, the actuator must be vented once (e.g. by selecting the fail-safe position, Code 0).
17*	<b>Kp step</b> 0 to 17 [7] ESC	Displaying or changing Kp  <b>Note on changing the Kp and Tv steps:</b> During the initialization of the positioner, the Kp and Tv values are optimized. Should the positioner show a tendency for inadmissibly high post-pulse oscillation due to additional interference, the Kp and Tv steps can be adapted after the initialization. For this, either the Tv step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the Kp step can be decreased in increments. CAUTION! Changing the Kp step influences the system deviation. This effect decreases as the Kp step increases.
18*	<b>Tv step</b> [OFF] 1 2 3 4 ESC	Displaying or changing Tv See note under Kp step! A change of the Tv step has no effect on the system deviation.
19*	<b>Tolerance band</b> 0.1 to 10.0 [5] % of the operating range. ESC	Used for error monitoring. Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If, during initialization, a transit time is determined which is 6 times > 30 s, the 6fold transit time is accepted as lag time.
20*	<b>Characteristic</b> 0 to 9 [0] ESC	Select the characteristic 0: Linear 1: Equal percentage 2: Reverse equal percentage 3: Butterfly valve linear 4: Butterfl. valve eq. perc. 5: Rotary plug valve linear 6: Rotary plug valve eq. perc. 7: Segmented ball valve linear 8: Segmented ball valve eq.perc. 9: User-defined * * Definition via SSP interface with SAMSON TROVIS-VIEW software or HART communication.

## List of codes

21*	<b>W-ramp Open</b> 0 to 240 s [0] ESC	<p>The time required to pass through the operating range when the valve opens.</p> <p>Limitation of the transit time (Code 21 and 22):          For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process.</p>																
22*	<b>W-ramp Closed</b> 0 to 240 s [0] ESC	<p>The time required to pass through the operating range when the valve closes.</p>																
23*	<b>Total valve travel</b> 0 to 9999 [0] subsequently 10E3-99E7 RES ESC	<p>Totaled double valve travel.          Can be reset to 0 via RES.</p>																
24*	<b>LV total valve travel</b> 1000 to 9999 [100 000] subsequently 10E3-99E7 ESC	<p>Limit value of total valve travel. If the limit value is exceeded, the fault symbol and the wrench symbol appear.          Exponential display for 10 000 travel cycles onwards.</p>																
25*	<b>Alarm mode</b> 0 to 3 [2] ESC	<p>Switching mode of software limit switches alarm A1 and A2 when triggered (after the positioner has been initialized).</p> <p>1) Ex version according to EN 60947-5-6</p> <table data-bbox="426 938 817 1043"> <tr> <td>0: A1 <math>\geq 2.1</math> mA</td> <td>A2 <math>\leq 1.2</math> mA</td> </tr> <tr> <td>1: A1 <math>\leq 1.2</math> mA</td> <td>A2 <math>\leq 1.2</math> mA</td> </tr> <tr> <td>2: A1 <math>\geq 2.1</math> mA</td> <td>A2 <math>\geq 2.1</math> mA</td> </tr> <tr> <td>3: A1 <math>\leq 1.2</math> mA</td> <td>A2 <math>\geq 2.1</math> mA</td> </tr> </table> <p>2) Version without explosion protection</p> <table data-bbox="426 1102 893 1208"> <tr> <td>0: A1 R= 348 <math>\Omega</math></td> <td>A2 Non-conducting</td> </tr> <tr> <td>1: A1 Non-conducting</td> <td>A2 Non-conducting</td> </tr> <tr> <td>2: A1 R= 348 <math>\Omega</math></td> <td>A2 R= 348 <math>\Omega</math></td> </tr> <tr> <td>3: A1 Non-conducting</td> <td>A2 R= 348 <math>\Omega</math></td> </tr> </table> <p>When a positioner has not been initialized, the software limit switches always register the signal as in the untriggered state. If there is no mA signal at the terminals 11/12, the software limit switches both switch to <math>\leq 1.2</math> mA signal (Ex) or non-conducting (without explosion protection).</p>	0: A1 $\geq 2.1$ mA	A2 $\leq 1.2$ mA	1: A1 $\leq 1.2$ mA	A2 $\leq 1.2$ mA	2: A1 $\geq 2.1$ mA	A2 $\geq 2.1$ mA	3: A1 $\leq 1.2$ mA	A2 $\geq 2.1$ mA	0: A1 R= 348 $\Omega$	A2 Non-conducting	1: A1 Non-conducting	A2 Non-conducting	2: A1 R= 348 $\Omega$	A2 R= 348 $\Omega$	3: A1 Non-conducting	A2 R= 348 $\Omega$
0: A1 $\geq 2.1$ mA	A2 $\leq 1.2$ mA																	
1: A1 $\leq 1.2$ mA	A2 $\leq 1.2$ mA																	
2: A1 $\geq 2.1$ mA	A2 $\geq 2.1$ mA																	
3: A1 $\leq 1.2$ mA	A2 $\geq 2.1$ mA																	
0: A1 R= 348 $\Omega$	A2 Non-conducting																	
1: A1 Non-conducting	A2 Non-conducting																	
2: A1 R= 348 $\Omega$	A2 R= 348 $\Omega$																	
3: A1 Non-conducting	A2 R= 348 $\Omega$																	

26*	<b>Limit value A1</b> OFF 0.0 to 120.0 [2.0] % of the operating range. ESC	Displaying or changing the software limit value A1 in relation to the operating range.  Setting has no effect when an inductive contact has been installed.												
27*	<b>Limit value A2</b> OFF 0.0 to 120.0 [98.0] % of the operating range. ESC	Displaying or changing the software limit value A2 in relation to the operating range.												
28*	<b>Alarm test</b> Reading direction: <table border="1" data-bbox="193 555 451 722"> <thead> <tr> <th>Default</th> <th>Turned around</th> </tr> </thead> <tbody> <tr> <td>[OFF]</td> <td>[OFF]</td> </tr> <tr> <td>RUN 1</td> <td>1 RUN</td> </tr> <tr> <td>RUN 2</td> <td>2 RUN</td> </tr> <tr> <td>RUN 3</td> <td>3 RUN</td> </tr> <tr> <td>ESC</td> <td>ESC</td> </tr> </tbody> </table>	Default	Turned around	[OFF]	[OFF]	RUN 1	1 RUN	RUN 2	2 RUN	RUN 3	3 RUN	ESC	ESC	Testing the software limit switches alarm A1 and A2 in addition to the fault alarm contact A3. If the test is activated, the respective contact switches five times. RUN1/1RUN: Software limit switch A1 RUN2/2RUN: Software limit switch A2 RUN3/3RUN: Fault alarm contact A3
Default	Turned around													
[OFF]	[OFF]													
RUN 1	1 RUN													
RUN 2	2 RUN													
RUN 3	3 RUN													
ESC	ESC													
29*	<b>Positioner x/ix<sup>3)</sup></b> [↗↗] >> ↘↘ << ESC	Operating direction of the positioner; indicates how the travel/angle position is assigned to the output signal i, based on the closed position. The operating range (see Code 8) of the valve is represented as a 4 to 20 mA signal. When the positioner has not yet been initialized, a constant 4 mA signal is issued. If the positioner is not connected (reference variable <3.6 mA), just the power consumption of the feedback signal is effective (current approx. 1.8 mA).												
30*	<b>Fault alarm ix<sup>3)</sup></b> [OFF] HI LO ESC	Used to select whether faults causing the fault alarm contact to switch should also be signaled through the position transmitter output and how they should be signaled.  HI ix > 21.6 mA or LO ix < 2.4 mA												
31*	<b>Position transmitter test<sup>3)</sup></b> 0.0 to 100.0 [50.0] % of the operating range. ESC	Testing the position transmitter. Values can be entered in relation to the operating range. For example, the current signal 12 mA must be appear at 50%.												
<sup>3)</sup> Analog position transmitter: You can only access the Codes 29/30/31 if the position transmitter (optional) is installed and the installation has been confirmed with Code 37.														

## List of codes

32*	<b>Display special functions</b> NO [YES] ESC	Fault alarm via display and fault alarm contact for special functions, e.g. zero point adjustment, initialization and test.
33*	<b>Display total valve travel</b> NO [YES] ESC	Fault alarm via display and fault alarm contact when the limit value for the total valve travel is exceeded.
34*	<b>Closing direction</b> CL [CCL] ESC	CL : clockwise CCL: counterclockwise Turning direction in which the valve is moved to the closed position (view onto the rotary switch motion when the positioner cover is open). Only necessary for initialization mode SUB (Code 6).
35*	<b>Blocking position</b> [0] mm/° ESC	Entering the blocking position. Distance up to the Closed position. Only necessary for initialization mode SUB (Code 6).
36*	<b>Reset</b> [OFF] RUN ESC	Resets all parameters to default (factory setting). <b>Note:</b> After setting <b>RUN</b> , the device must be re-initialized.
37*	<b>Position transmitter</b> [NO] YES ESC	Indicates whether the position transmitter option is installed. Must generally be set as the existence of a position transmitter is not automatically recognized.
38*	<b>Inductive alarm</b> [NO] YES ESC	Indicates whether the inductive contact option is installed or not .
39	<b>System deviation e info</b> -99.9 to 999.9 % ,	Display only, indicates the deviation from the set point position.
40	<b>Transit time Open info</b> 0 to 240 s [0]	Display only, minimum opening time is determined during initialization.
41	<b>Transit time Closed info</b> 0 to 240 s [0]	Display only, minimum closing time is determined during initialization.
42	<b>Auto-w info</b> 0.0 to 100.0 % of the span 4 to 20 mA	Display only, indicates the supplied automatic reference variable corresponding 4 to 20 mA.
43	<b>Firmware info</b> Xxxx	Display only, indicates the current firmware version of the device.

44	<b>Info y</b> -200 to 200 [0]	Display only, blocked prior to initialization. After initialization: indicates the actuator pressure in %. 0 to 100 % $\Delta$ pressure range which adjusts the travel/angle range from 0 to 100 %. If the actuator pressure is 0 bar, e.g. due to tight-closing on bottom or fail-safe action, <b>OP</b> appears on the display. If the actuator pressure is higher than the pressure required for X = 100 %, e.g. due to tight-closing on top, <b>MAX</b> appears on the display. Value is determined during initialization.
45	<b>Solenoid valve info</b> Yes No	Display only, indicates, whether a solenoid valve is installed.
46*	<b>Polling address</b> 0 to 63 [0] ESC	Select bus address
47*	<b>Write protection HART</b> YES [NO] ESC	When the write protection function is activated, device data can only be read, but not overwritten over HART communication.
<b>Error codes – remedy</b>		Fault alarm symbol active, when prompted, <b>Err</b> appears. If any fault messages exist, they are displayed here. Any remaining fault messages can be acknowledged after selecting Code 3 "Enable configuration" and by selecting the error code and pressing  twice.
Initialization error (indicated by the "Fault" symbol on the display)		
50	<b>x &gt; range</b>	The value supplied by the measuring signal is either too high or too low, the measuring sensor is located near its mechanical limit. <ul style="list-style-type: none"> <li>• Pin positioned incorrectly.</li> <li>• Slipped bracket in case of NAMUR attachment or positioner not central.</li> <li>• Follower plate incorrectly attached.</li> </ul> In case the error occurs prior to initialization, the valve is moved to its fail-safe position to protect mechanical parts from being damaged.
	Remedy	Check attachment and pin position, re-initialize the device.

51	$\Delta x < \text{range}$	<p>The measuring span of the sensor is too low.</p> <ul style="list-style-type: none"> <li>• Pin positioned incorrectly.</li> <li>• Incorrect lever.</li> </ul> <p>An angle of rotation at the positioner shaft that is smaller than 11° only generates a fault message. An angle below 6° leads to the initialization process being aborted.</p>
	Remedy	Check attachment, re-initialize device.
52	<b>Attachment</b>	<ul style="list-style-type: none"> <li>• Incorrect device attachment.</li> <li>• Nominal travel/angle (Code 5) could not be reached (no tolerance downwards permissible) on initialization over NOM or SUB modes.</li> <li>• Mechanical or pneumatic error, e.g. incorrect lever selected or supply pressure too low to move to the required position.</li> </ul>
	Remedy	<p>Check attachment and supply pressure, re-initialize device.</p> <p>Checking the maximum travel/rotational angle may in some circumstances be possible by entering the actual pin position and then initializing under MAX.</p> <p>After initialization is completed, the Code 5 shows the maximum travel or angle of rotation that the valve reached.</p>
53	<b>Init time &gt;</b>	<p>The initialization routine lasts too long:</p> <ul style="list-style-type: none"> <li>• No pressure on the supply line or leak exists.</li> <li>• Air supply interruption during initialization.</li> </ul>
	Remedy	Check attachment and supply pressure line, re-initialize device.
54	<b>Init – SV</b>	<ol style="list-style-type: none"> <li>1) A solenoid valve is installed (Code 45 = YES) and was not or not properly connected so that an actuator pressure could not be built up. The message appears when you attempt to initialize the device despite of this.</li> <li>2) You attempt to initialize the device from the fail-safe position (SAFE).</li> </ol>
	Remedy	<p>Ref. 1) Check connection and supply voltage of the solenoid valve.</p> <p>Ref. 2) Set the <b>MAN</b> operating mode via Code 0. Re-initialize the device subsequently.</p>

55	<b>Transit time &lt;</b>	The actuator transit times determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Remedy	Check the position of the volume restriction as described in section 4.1, re-initialize the device.
56	<b>Pin pos. ?</b>	Initialization was aborted because you are required to enter the pin position for the selected initialization modes <b>NOM</b> and <b>SUB</b> .
	Remedy	Enter pin position with Code <b>4</b> and nominal travel/angle with Code <b>5</b> . Re-initialize.
Operating error indicated on the display by the fault symbol		
57	<b>Control loop</b>	Control loop fault, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19). <ul style="list-style-type: none"> <li>• Actuator mechanically blocked.</li> <li>• Attachment of the positioner subsequently postponed.</li> <li>• Supply pressure not sufficient.</li> </ul>
	Remedy	Check attachment.
58	<b>Zero point</b> Additional message at the fault alarm contact!	Zero point position shifted by more than $\pm 5\%$ . This error can occur due to a shifted arrangement/deflection of the positioner or when the valve trim is worn, especially with soft-sealing plugs.
	Remedy	Check valve and positioner attachment, if everything is o.k., use Code 6 to adjust zero point (see section 5.8, page 53).
59	<b>Autocorrection</b>	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Remedy	Automatic
60	<b>Fatal error</b>	An error was detected in the data relevant for safety, autocorrection is not possible. The cause can be EMC disturbances. The control valve is moved to the fail-safe position.
	Remedy	Reset with Code 36, re-initialize device.

Hardware errors (the fault symbol appears on the display)		
62	<p><b>x signal</b></p> <p>Additional message at the fault alarm contact!</p>	<p>The determination of the measuring value for the actuator has failed.</p> <p>Conductive plastic is defect.</p> <p>Device continues to run in an emergency mode, but should be replaced as soon as possible.</p> <p>The emergency mode on the display is indicated by a blinking control symbol and 4 dashes instead of the position indication.</p> <p><b>Note on the control:</b> If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues operation according to its reference variable signal so that the process remains in a safe state.</p>
	Remedy	Send device to SAMSON AG for repair.
63	<p><b>w too small</b></p>	<p>The reference variable is much smaller than 4 mA (0 %); occurs if the power source that drives the positioner does not comply with the standard.</p> <p>This state is indicated on the positioner display by a blinking <b>LOW</b>.</p> <p>The positioner moves to the fail-safe position <b>SAFE</b>.</p>
	Remedy	Check reference variable. If necessary, limit the current source downwards so that no values below 4 mA can be issued.
64	<p><b>i/p converter (y)</b></p> <p>Additional message at the fault alarm contact!</p>	<p>The circuit of the i/p converter has been interrupted.</p> <p>The positioner moves to the fail-safe position <b>SAFE</b>.</p>
	Remedy	Cannot be remedied. Send device to SAMSON AG for repair.

Error appendix		
65	<b>Hardware</b>	A hardware error has occurred, the positioner moves to the fail-safe position <b>SAFE</b> .
	Additional message at the fault alarm contact!	
	Remedy	Confirm error and return to the automatic operating mode, otherwise perform a reset and re-initialize the device. If this is not successful, send device to SAMSON AG for repair.
66	<b>Data memory</b>	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Additional message at the fault alarm contact!	
	Remedy	Send device to SAMSON AG for repair.
67	<b>Test calculation</b>	The hardware positioner is monitored by means of a test calculation.
	Additional message at the fault alarm contact!	
	Remedy	Confirm error. If this is not possible, send the device to SAMSON AG for repair.
Data error		
68	<b>Control parameter</b>	Control parameter error, e.g. due to EMC disturbances.
	Additional message at the fault alarm contact!	
	Remedy	Confirm error and perform a reset, re-initialize the device.
69	<b>Poti parameter</b>	Parameter error of the digital potentiometer.
	Additional message at the fault alarm contact!	
	Remedy	Confirm error and perform a reset, re-initialize the device.
70	<b>Configuration</b>	Error in the production calibration data, e.g. due to EMC disturbances. Subsequently, the device runs on default values.
	Additional message at the fault alarm contact!	
	Remedy	Send device to SAMSON AG for repair.

## List of codes

71	<b>General parameters</b>	Parameter errors that are not critical for the control.
	Remedy	Confirm error. Check and, if necessary, readjust required parameters.
73	<b>Internal device error 1</b>	Internal device error.
	Remedy	Send device to SAMSON AG for repair.
74	<b>HART parameters</b>	Error in the HART parameters that are not critical for the control function.
	Remedy	Confirm error. Check and, if necessary, readjust required parameters.
75	<b>Info parameters</b>	Error in the info parameters that are not critical for the control function.
	Remedy	Confirm error. Check and, if necessary, reset required parameters.
Other messages		
76	<b>No emergency running properties</b>	The travel measurement of the positioner includes a self-monitoring function (see Code 62). A controlled emergency mode is not available in certain actuators, such as double-acting actuators. In this case, the positioner moves to the fail-safe position when an error in the travel measurement occurs. The positioner recognizes automatically during initialization whether the actuator has such a function or not.
	Remedy	Just information, if necessary, acknowledge it. No further course of action needed.
77	<b>Program loading error</b>	When the positioner starts up for the first time after being connected to the power supply, it performs a self-test ( <b>TESTING</b> runs across the display). If the positioner loads a program which does not match the positioner's specifications, the valve is moved to its fail-safe position and cannot be moved from this position.
	Remedy	Interrupt the power supply and restart the positioner. If necessary, send device to SAMSON AG for repair.

78	Options parameter	Error in options parameters, e.g. due to EMC disturbances.
	Remedy	Send device to SAMSON AG for repair.

## **9 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.

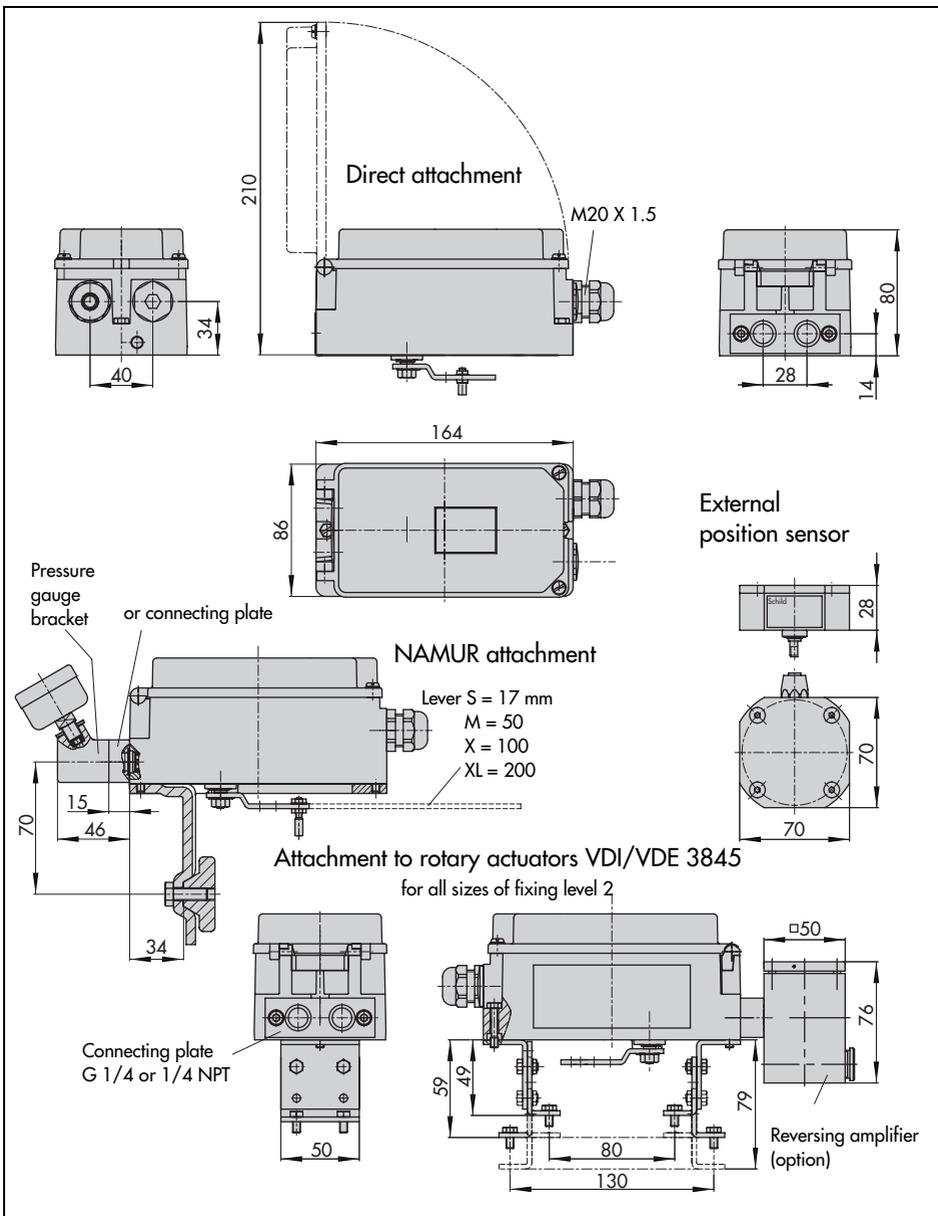
The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

## **10 Servicing explosion-protected devices**

In the event that a positioner's part on which the explosion protection is based must be serviced, the positioner must not be put back into operation again 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 does not have to be carried out, if the manufacturer performs a routine check test on the device prior to taking it into operation again, and the success of the routine check test is documented by attaching a mark of conformity to the device.

# Dimensional drawing





## TRANSLATION

### EC TYPE EXAMINATION CERTIFICATION

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

(3) EC Type Examination Certificate Number

**PTB 02 ATEX 2174**

(4) Equipment: HART® capable positioner Type 3730-31

(5) Manufacturer: SAMSON AG Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) This equipment and any acceptable variation thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in accordance with Article 9 of Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report

**PTB Ex 02-22323.**

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

**EN 50014: 1997**      **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 specified in the schedule to this certificate.

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

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(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 the equipment.

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



Zertifizierungsstelle Explosionsschutz      Braunschweig, 02. Dezember 2002  
 By order

(Signature)      (Seal)

Dr. Inq. U. Johannsmeyer  
 Regierungsdirektor

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(13) **S c h e d u l e**(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 02 ATEX 2174**(15) **Description of Equipment**

The HART<sup>®</sup> capable positioner Type 3730-31 is a single- or double-acting positioner with communication capability intended for attachment to all current linear or rotary actuators. It serves for adjusting valve stem position to the control signal.

In the 3730-31, version communication, is according to the SSP (SAMSON Serial Interface Protocol) and the HART protocol.

The HART<sup>®</sup> capable positioner Type 3730-31 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 instrument air 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 ... 60 °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:**

$U_i = 28 \text{ V}$

$I_i = 115 \text{ mA}$

$P_i = 1 \text{ W}$

$C_i = 5.3 \text{ nF}$ ,  $L_i =$  negligible

Software limit switches  
(terminals 41/42, 31/32)

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

**Maximum values:**

$U_i = 20 \text{ V}$

$I_i = 60 \text{ mA}$

$P_i = 250 \text{ mW}$

$C_i = 5.3 \text{ nF}$ ,  $L_i =$  negligible

Limit switch, inductive  
(terminals 41/42)

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

**Maximum values:**

$U_i = 16 \text{ V}$

$I_i = 52 \text{ mA}$

$P_i = 169 \text{ mW}$

$C_i = 60 \text{ nF}$ ,  $L_i = 200 \text{ } \mu\text{H}$ , or

$U_i = 16 \text{ V}$

$I_i = 25 \text{ mA}$

$P_i = 64 \text{ mW}$

$C_i = 60 \text{ nF}$ ,  $L_i = 200 \text{ } \mu\text{H}$

The correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current for analysers is shown in the table below:

Temperature class	Permissible ambient temperature range	$I_b / P_b$
T6	-40 °C ... 45 °C	52mA/169mW
T5	-40 °C ... 60 °C	
T4	-40 °C ... 75 °C	
T6	-40 °C ... 60 °C	25mA/64mW
T5	-40 °C ... 80 °C	
T4	-40 °C ... 80 °C	

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**Physikalisch-Technische Bundesanstalt**  
 Braunschweig und Berlin

 (16) Test Report: **PTB Ex 02-22323**

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

Not applicable

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

In compliance with the standards specified above

Braunschweig, 02 December 2002

 Zertifizierungsstelle Explosionsschutz  
 By order

(Signature) (seal)

 Dr.-Ing. U. Johannsmeyer  
 Regierungsdirektor

**Physikalisch-Technische Bundesanstalt**  
 Braunschweig und Berlin

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

**Maximum values:**
 $U_i = 20 \text{ V}$ 
 $I_i = 60 \text{ mA}$ 
 $P = 250 \text{ mW}$ 
 $C_i = 5.3 \text{ nF}$ ,  $L_i = \text{negligible}$ 

Serial interface BU

Type of protection: Intrinsic safety EEx ia IIC

**Maximum values:**
 $U_o = 7.88 \text{ V}$ 
 $I_o = 61.8 \text{ mA}$ 
 $P_o = 120 \text{ mW}$ , Linear characteristic

 $C_o = 0.65 \text{ }\mu\text{F}$ ,  $L_o = 10 \text{ mH}$ 

 only for connection to a certified  
 intrinsically safe circuit

 $U_i = 16 \text{ V}$ 
 $I_i = 25 \text{ mA}$ 
 $P_i = 64 \text{ mW}$ 
 $C_i = \text{negligible}$ ,

 $L_i = \text{negligible}$ 

 For interconnecting the rules for interconnecting intrinsically safe circuit shall be  
 complied with.

 External position sensor  
 (analog pcb, pins, p9, p10,  
 p11)

Type of protection: Intrinsic safety EEx ia IIC

**Maximum values:**
 $U_o = 7.88 \text{ V}$ 
 $I_o = 61 \text{ mA}$ 
 $P_o = 120 \text{ mW}$ , Linear characteristic

 $C_o = 0.66 \text{ }\mu\text{F}$ ,  $L_o = 10 \text{ mH}$ 
 $C_i = 730 \text{ nF}$ ,  $L_i = 370 \text{ }\mu\text{H}$ 

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PAB.32-3730.doc

## TRANSLATION

### ADDENDUM N o.: 1

in compliance with Directive 94/9/EC Annex III Clause 6  
to the EC Type Examination Certificate PTB 02 ATEX 2174

**Equipment:** Model 3730-31 .. HART-capable Positioner  
**Marking:**  II 2 G Ex ia IIC T6  
**Manufacturer:** SAMSON AG  
**Address:** Weismüllerstr. 3, D-60314 Frankfurt, Germany

#### Description of the additions and modifications

In future the Model 3730-31 .. HART-capable Positioner is permitted to be manufactured also in compliance with the documents listed below.

The modem board will be modified and the optional "Forced Venting Function" will be added. The electrical data will be supplemented as follows:

#### Electrical data

**Forced venting function**  
(terminal 81/82)  
safe  
Type of protection: Intrinsic safety Ex ia IIC  
only for connection to a certified intrinsically  
circuit

Maximum values:

U<sub>I</sub> = 28 V

I<sub>I</sub> = 115 mA

P<sub>I</sub> = 500 mW

L<sub>I</sub> negligible

C<sub>I</sub> = 5.3 nF

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PTB32-3730-31Add-1.doc

Addendum No. 1 to the EX Type Examination Certificate PTB 02 ATEX 2174

All the other electrical data and particulars specified in the EC Type Examination Certificate apply unchanged also to this Addendum No. 1.

**Test report:** PTB EX 03-23171

Zertifizierungsstelle Explosionsschutz  
By order: Braunschweig, 18 June 2002

(Signature) (Seal)

Dr.-Ing. U. Johannsmeyer  
Regierungsdirektor

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PTB32-3730-31Add-1.doc

**ADDENDUM N o.: 2**

in compliance with Directive 94/9/EC Annex III Clause 6  
to the EC Type Examination Certificate PTB 02 ATEX 2174

**Equipment:** Model 3730-31... HART capable Positioner  
**Marking:**  II 2G Ex ia IIC T6  
**Manufacturer:** SAMSON AG  
**Address:** Weismüllerstr. 3, D-40314 Frankfurt, Germany

**Description of the additions and modifications**

The Model 3731-31... HART capable Positioner is permitted to be manufactured in future also in compliance with the documents specified in the attached test report PTB Ex 04-23430.

Attachment to pneumatic control valves or butterfly valves is either directly to the Series 3277 Actuators or by means of NAMUR adapter plates to actuators of conventional design.

The modifications relate to the internal and external design.

- a) The Model 3730-31... HART capable Positioner satisfies the requirements of EN 50281-1-1:1998 relating to electrical apparatus with protection provided by enclosures. According to this standard, the positioner shall be provided in addition with the following marking:
-  II 2D IP 65 T 80 °C
- b) The circuitry of the multifunction printed circuit board will be modified and the option "position indicator" will be added (version 3730-1...1), the electrical data will be supplemented as follows:

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PTB32Add2.doc

**Electrical data****Signal circuit**

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

Maximum values:

U<sub>i</sub> = 28 V  
I<sub>i</sub> = 115 mA

P<sub>i</sub> = 1 W

L<sub>i</sub> negligible

C<sub>i</sub> = 35 nF

**Version 3730-1-1**

Position indicator  
(terminals 31/32)  
Type of protection: Intrinsic safety EEx ia IIC  
Only for connection to a certified intrinsically safe circuit

Maximum values:

U<sub>i</sub> = 28 V  
I<sub>i</sub> = 115 mA

P<sub>i</sub> = 1 W

L<sub>i</sub> negligible

C<sub>i</sub> = 5,3 nF

All the other electrical data and information contained in the EC Type Examination Certificate apply unchanged also to this Addendum No. 2.

**Test report:** PTB EX 04-23430

Zertifizierungsstelle Explosionsschutz  
By order Braunschweig, 16 February 2004

(Signature) (Seal)

Dr. Ing. U. Gerlach

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PTB32Add2.doc



**Konformitätsausgabe**

- (1) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - Richtlinie 94/9/EG
- (2) Prüfbescheinigungsnummer



**PTB 03 ATEX 2180 X**

- (4) Gerät: HART capable positioner Type 3730-38..
- (5) Hersteller: SAMSON AG Mess- und Regeltechnik
- (6) Anschrift: Weismüllerstraße 3, 60314 Frankfurt am Main, Deutschland
- (7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage und den dem aufgeführten Untertitel zu dieser Prüfbescheinigung festgelegt.
- (8) Die Physikalisch-Technische Bundesanstalt bescheinigt als benannte Stelle Nr. 0102 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der in dieser Richtlinie und den Besonderen Bestimmungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.
- (9) Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht PTB Ex 03-23301 festgehalten. Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 50021:1999

- (10) Falls das Zeichen „X“ hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.
- (11) Diese Konformitätsausgabe bezieht sich nur auf Konzeption und Bau des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes.
- (12) Die Kennzeichnung des Gerätes muß die folgenden Angaben enthalten:

**II 3 G EEx nA II T6**  
 Zertifizierungsstelle Explosionsgeschützt  
 Im Auftrag  
  
 Dr.-Ing. U. Johannsmeyer  
 Regierungsdirektor



Konformitätsausgabe ohne Unterschrift und ohne Siegel haben keine Gültigkeit.  
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**Anlage**

**Konformitätsausgabe PTB 03 ATEX 2180 X**

- (13) Beschreibung des Gerätes
  - (14) Der HART capable positioner Type 3730-38... ist ein kommunikationsfähiger, einfach bzw. doppelt wirkender, Stellungsregler zum Anbau an alle gängigen Hub- oder Schwenkantriebe. Er dient der Zuordnung von Verteilstellungen zu einem Stejsignal.
  - (15) In der Ausführung 3730-38.. erfolgt die Kommunikation nach dem SSP- und dem HART-Protokoll.
- Als pneumatische Hilfsenergie werden nicht brennbare Medien verwendet.  
 Der Einsatz erfolgt innerhalb oder außerhalb explosionsgefährdeter Bereiche.  
 Der Zusammenhang zwischen der Temperaturklasse und den zulässigen Umgebungstemperaturbereichen ist der nachfolgenden Tabelle zu entnehmen.

Temperaturklasse	Zulässiger Umgebungstemperaturbereich
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

- Elektrische Daten
- Signalstromkreis..... in Zündschutzart EEx nA II (Klemmen 1/1/2)
- Software-Grenzkontakt..... in Zündschutzart EEx nA II (Klemmen 41/42, 51/52)
- Induktiver Grenzkontakt..... in Zündschutzart EEx nA II (Klemmen 41/42)
- Zwangsenüftung..... in Zündschutzart EEx nA II (Klemmen 81/82)
- Störmeldeausgang..... in Zündschutzart EEx nA II (Klemmen 82/84)
- Serial Interface Adapter..... in Zündschutzart EEx nA II

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Externer Positionssensor ..... In Zündschutzart EEx nA II  
(Analogplatine Pms p8, p10, p11)

(16) Prüfbericht PTB Ex 03-23301

(17) Besondere Bedingungen

Dem Signalkreis (Klemmen 11/12) ist außerhalb des explosionsgefährdeten Bereichs eine Sicherung nach IEC 60127-2/II, 250 V F bzw. nach IEC 60127-2/VI, 250 V T mit einem Sicherungsstrom von maximal  $I_N \leq 63$  mA vorzuschalten.

Dem Programm Interface Adapter ist in die Verbindung Vcc eine Sicherung nach IEC 60127-2/II, 250 V F bzw. nach IEC 60127-2/VI, 250 V T mit einem Sicherungsstrom von maximal  $I_N \leq 40$  mA vorzuschalten.

Der Programm Interface Adapter ist außerhalb des explosionsgefährdeten Bereiches zu installieren.

Die Kabelanschlüsse des Gehäuses für den HART capable positioner Type 3730-38... müssen mindestens den Schutzgrad IP 54 gemäß EN 60529 gewährleisten. Der Anschluss der Leitungen muss so erfolgen, dass die Anschlussverbindung frei von Zug- und Verdrehbeanspruchung ist.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit der vorgenannten Norm

Zertifizierungsstelle Explosionschutz  
Im Auftrag  
  
Dr.-Ing. U. Johanngeyer  
Regelungsdirektor

Braunschweig, 30. September 2003

Note: Only versions with cable gland and connectors (Model 727) are qualified for Class II/III.

**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**

Circuit No.	Control signal	Position Indicator	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U <sub>l</sub> or V <sub>max</sub>	28V	28V	28V	16V	20V	20V
I <sub>l</sub> or I <sub>max</sub>	115mA	115mA	115mA	25/62 mA	60mA	60mA
P <sub>l</sub> or P <sub>max</sub>	1W	1W	500mW	64/168 mW	250mW	250mW
C <sub>i</sub>	35nF	5.3nF	5.3nF	60nF	13.3nF	13.3nF
L <sub>i</sub>	0µH	0µH	0µH	100µH	0µH	0µH

**Table 2: CSA/FM – certified barrier parameters of circuit 2 and 5**

Barrier	Supply barrier				Evaluation barrier			
	V	R	I	P	V	R	I	
circuit 2	528V	≥300Ω	≤115mA	≤1W	528V	#	0mA	0mA
circuit 5	528V	≥382Ω	≤115mA	≤500mW	528V	#	0mA	0mA

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 ... 60°C
T5	-40°C ... 70°C
T4	-40°C ... 80°C

Table 4: For the Model 3730 – 331 ... 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	-40°C ... 45°C	52mA
T5	-40°C ... 60°C	
T4	-40°C ... 75°C	25mA
T6	-40°C ... 60°C	
T5	-40°C ... 80°C	
T4	-40°C ... 80°C	

**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**

Circuit No.	Control signal	Position Indicator	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U <sub>l</sub> or V <sub>max</sub>	28V	28V	28V	16V	20V	20V
I <sub>l</sub> or I <sub>max</sub>	115mA	115mA	115mA	25/62 mA	60mA	60mA
P <sub>l</sub> or P <sub>max</sub>	1W	1W	500mW	64/168 mW	250mW	250mW
C <sub>i</sub>	35nF	5.3nF	5.3nF	60nF	13.3nF	13.3nF
L <sub>i</sub>	0µH	0µH	0µH	100µH	0µH	0µH

Circuit	Serial interface BU		External position sensor	
	Connector		Analog pcb pin p9, p10, p11	
Terminal			U <sub>o</sub> or V <sub>oc</sub>	
U <sub>l</sub> or V <sub>max</sub>	16V	U <sub>o</sub> or V <sub>oc</sub>	7.88V	7.88V
I <sub>l</sub> or I <sub>max</sub>	25mA	I <sub>o</sub> or I <sub>sc</sub>	61.8mA	61mA
P <sub>l</sub> or P <sub>max</sub>	64mW	P <sub>o</sub>	120mW	120mW
C <sub>i</sub>	0nF	C <sub>o</sub>	0.65µF	C <sub>i</sub> =730nF
L <sub>i</sub>	0µH	L <sub>o</sub>	10mH	L <sub>i</sub> =370µH

Notes: Entity parameters must meet the following requirements:

U<sub>o</sub> or V<sub>oc</sub> or V<sub>i</sub> ≤ U<sub>l</sub> or V<sub>max</sub> / I<sub>o</sub> or I<sub>sc</sub> or I<sub>i</sub> ≤ I<sub>l</sub> or I<sub>max</sub> / P<sub>o</sub> or P<sub>max</sub> ≤ P<sub>l</sub> or P<sub>max</sub>  
 C<sub>o</sub> ≥ C<sub>i</sub> + C<sub>able</sub> and L<sub>o</sub> ≥ L<sub>i</sub> + L<sub>able</sub>

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

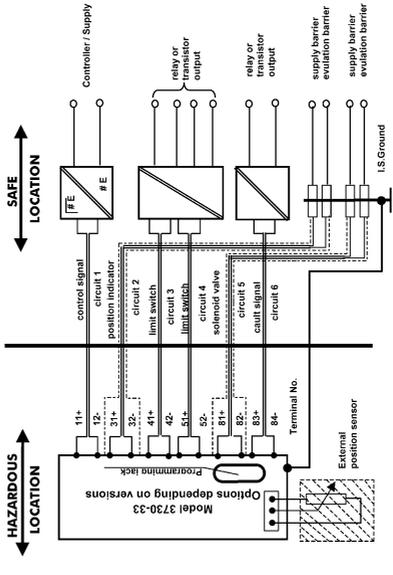
CSA - certified for hazardous locations

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

**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  $U_i$  or  $V_{max}$ ,  $I_i$  or  $I_{max}$ ,  $P_i$  or  $P_{max}$ ,  $C$  and  $L_i$  of the various apparatus see Table 1 on page 1.
- 2.) For barrier selection see Table 2 on page 2.
- 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.



**Controller CSA/FM - certified,  
 Relay or transistor output 1 or 2 channel(s) resp. CSA/FM - certified  
 Supply and evaluation barrier CSA/FM - certified**

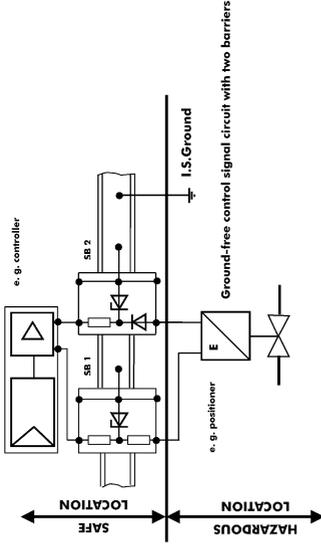
For the permissible maximum values for the intrinsically safe circuits 1,3,4 and 6 see Table 1  
 For the permissible barrier parameters for the circuits 2 and 3 see Table 2 and 3 see Table 2  
 Cable entry 2x2 x 1,3 or metal conduit according to drawing No. 1050 - 0539 T  
 or 1050 - 0540 T

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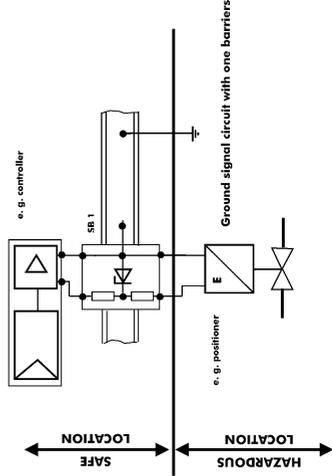
On interconnection to form ground-free signal circuits, only evaluation barriers must be installed in the return line. Correct polarity must be ensured.

**Circuit diagram of a ground-free signal circuit**  
 (position indicator and forced venting function)



In grounded signal circuits with only one barrier, the return line must be grounded or included in the potential equalization network of the system.

**Circuit diagram of a grounded signal circuit**  
 (position indicator and forced venting function)

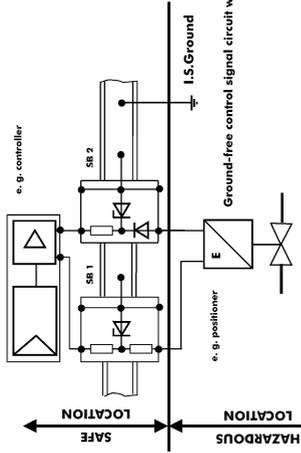


Revision Control Number: 0/ October 2003

Addendum to EB 8384-3EN

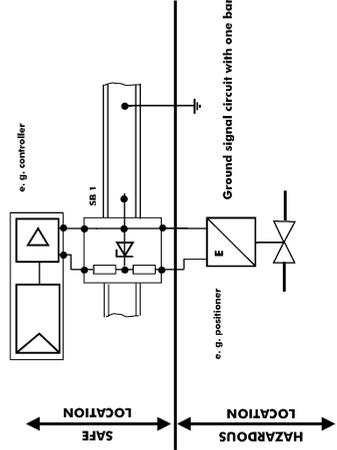
On interconnection to form ground-free signal circuits, only evaluation barriers must be installed in the return line. Correct polarity must be ensured.

Circuit diagram of a ground-free signal circuit  
(position indicator and forced venting function)



In grounded signal circuits with only one barrier, the return line must be grounded or included in the potential equalization network of the system.

Circuit diagram of a grounded signal circuit  
(position indicator and forced venting function)

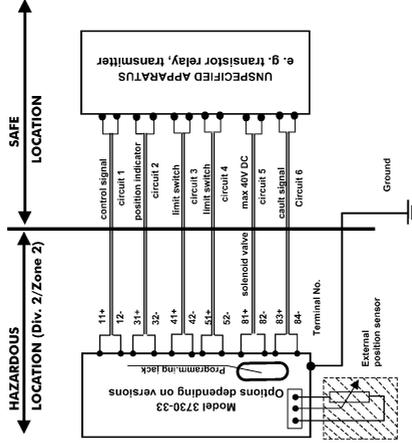


CSA- certified for hazardous locations

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

Type 4 Enclosure

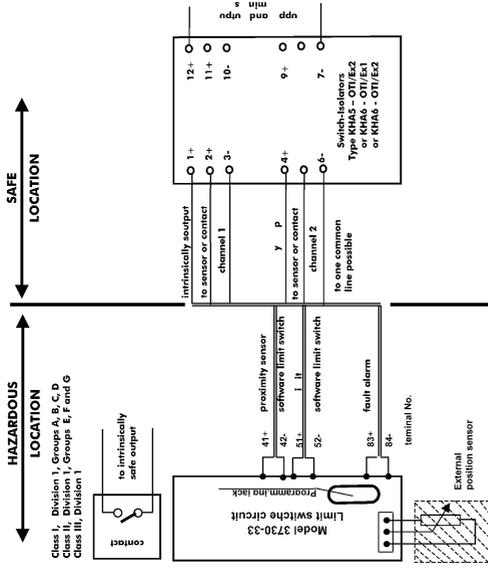
HART-capable positioner with position indicator, forced venting function (solenoid valve), fault signal and limit switches.



**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 1 and 1050-0540 1

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



maximum inductance of each inductive sensor 200µH

The total series inductances and ohmic resistances of shield wiring shall be restricted to the following maximum values

Control Relay Terminal No.	Groups	L [mH]	C [µF]	V <sub>OC</sub> [V]	I <sub>5C</sub> [mA]
1-3, 2-3 4-5, 5-6	A + B	56,8	1,27	↔	↔
	C	299	3,82	12,9	19,8
	D	744	10,2	↔	↔

Each pair of L.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. Install per C.E.C. Part 1.

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**EB 8384-3 EN**

S/Z 2004-04