Series 3731
Electropneumatic Ex d Positioner
Type 3731-5

with FOUNDATION™ fieldbus communication

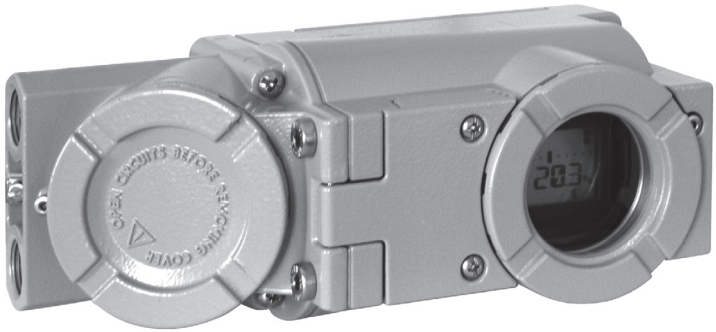

Fig. 1 · Type 3731-5

FOUNDATION™

Mounting and Operating Instructions

EB 8387-5 EN

Firmware version R 1.45

Edition April 2008

Definitions of the signal words used in these instructions

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

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

NOTICE
NOTICE indicates a property damage message.

Note: *Supplementary explanations, information and tips*

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Note concerning these Mounting and Operating Instructions

These instructions EB 8387-5 EN describe the mounting, start up and on-site operation of the Type 3731-5 Positioner.
You can find additional information on the enclosed CD-ROM (CD 8387-5) or on the Internet at http://www.samson.de.

The CD-ROM (CD 8387-5) contains further information on the Type 3731-5 Positioner:

- **[Documentation]**
  - **KH 8387-5 EN:** Configuration Manual for Type 3731-5 Electropneumatic Ex d Positioner, configuration and operation over FOUNDATION™ fieldbus and TROVIS-VIEW software
  - **T 8387-5 EN:** Data Sheet for Type 3731-5 Electropneumatic Ex d Positioner
  - **EB 8388-5 EN:** Instructions for Type 373x-5 Electropneumatic Ex d Positioner with EXPERT+ Valve Diagnostics including partial stroke test
  - **T 8388 EN:** Data Sheet for EXPERT/EXPERT+ Valve Diagnostics
  - **T 6661 EN:** Data Sheet for TROVIS-VIEW software
- **[Approvals]**
  - PTB/ATEX
  - CSA International
  - FM Approvals
  - JIS
  - CERTUSP/IMMETRO
- **[Declarations of Conformity]**
- **[Integrations]**
  - FOUNDATION™ fieldbus device description files
  - 375 Field Communicator
  - Emerson AMS™/DeltaV™
  - Yokogawa PRM - Device Viewer
- **[TROVIS-VIEW (demo version)]**

The HTML-based CD-ROM allows you to easily find any required information using a web browser.
The PDF documents can be read using Acrobat Reader software.
The entire range of information is available in both German and English.

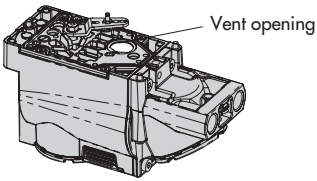
1 Important safety instructions

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

- The positioner may only be assembled, started up or operated by trained and experienced personnel familiar with the product.
  According to these Mounting and Operating Instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.
- Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 10.
- Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.
- If inadmissible motions or forces are produced in the actuator as a result of the supply pressure level, it must be restricted by means of a suitable supply pressure reducing station.

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

- Do not operate the positioner with the back of the positioner/vent opening facing upwards. The vent opening must not be sealed when the positioner is installed on site.



- Proper shipping and appropriate storage are assumed.

Note: *The device with a CE marking fulfills the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).*
The Declaration of Conformity is included on the enclosed CD-ROM (CD 8387-5).

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2 Article code

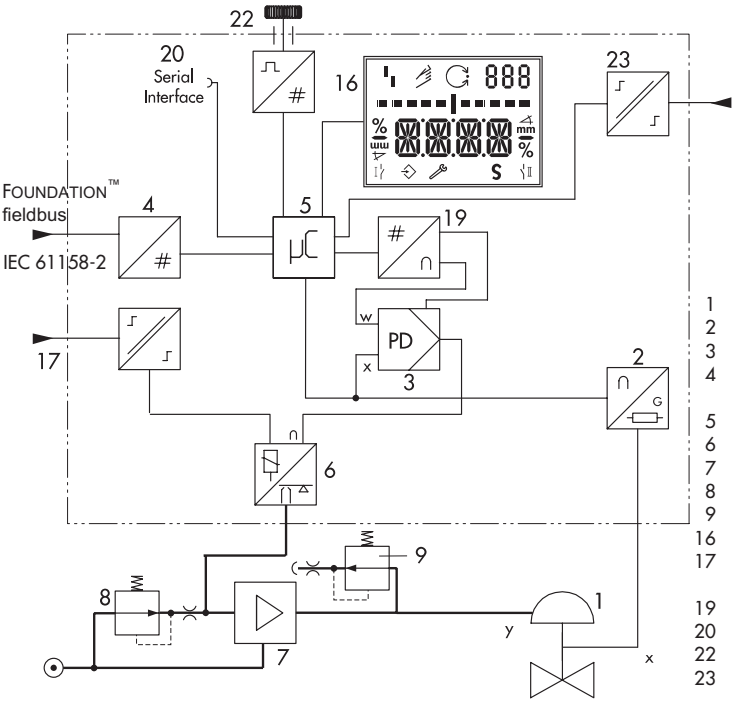
Positioner	**Type 3731 - 5**	x	x	x	x	x	x	0	0	0	x	1	x	0	0	0
With LCD, autotune, FOUNDATION™ fieldbus																
Explosion protection																
⟨Ex⟩ 2 G EEx d IIC T6/EEx de IIC T6/II 2 D IP 65 T 80 °C (ATEX)		2	1													
Ex d acc. to FM/CSA		2	3													
Ex d acc. to JIS		2	7													
Options (additional equipment)																
None				0	0											
Binary input				0	3											
Forced venting				0	5											
Diagnostics																
EXPERT						1										
EXPERT+/PST						2										
Electrical threaded connections																
2x M20 x 1.5							1									
2x ½ NPT							2									
Explosion-protection certificates																
As specified in "Explosion protection"										0						
IECEx		2	1							2						
GOST explosion-protection approval		2	1							3						
Special applications																
None													0			
Device compatible with paint (IP 41/NEMA 1)													1			
Special version																
None														0	0	0

3 Design and principle of operation

The electropneumatic Ex d positioner is attached to pneumatic control valves. It is used to assign the valve stem position (controlled variable x) to the control signal (reference variable w). The input signal received from a control system is compared to the travel or rotational angle of the control valve, and a signal pressure (output variable y) is produced for the pneumatic actuator.

The positioner basically consists of an electrical travel sensor system (2), an analog i/p converter (6) with downstream air capacity booster (7) and the electronic unit with a microcontroller (5).

In case of a system deviation, the actuator is either vented or filled with more air. The signal pressure supplied to the actuator can be limited to 1.4 bar, 2.4 bar or 3.7 bar by software or on site at the positioner.



1 Control valve
2 Travel sensor
3 PD controller
4 IEC 61158-2 interface module
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
16 Display
17 Forced venting control (optional)
19 D/A converter
20 Serial interface (SSP)
22 Rotary pushbutton
23 Binary input (optional)

Fig. 2 · Functional diagram

A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the housing as well as to optimize the air capacity booster (7). The i/p converter (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply pressure.

All parts are enclosed in an Ex d housing. The electrical cables are connected over a separate terminal compartment which also has Ex d protection.

The standard EXPERT diagnostics are integrated into the positioner. It provides information on the positioner and generates diagnostic and status messages, which allow faults to be pinpointed quickly.

The positioner is suitable for the following types of attachment using the corresponding accessories:

- Direct attachment to SAMSON Type 3277 Actuator: Section 4.1
- Attachment to actuators acc. to IEC 60534-6 (NAMUR): Section 4.2
- Attachment to Type 3510 Micro-flow Valve: Section 4.3
- Attachment to rotary actuators acc. to VDI/VDE 3845: Section 4.4

3.1 Additional equipment

Binary input

The positioner has an optional binary input.

Connected at terminals A-B:
The binary input for DC voltage signals allows process information to be exchanged over the FOUNDATION™ fieldbus network.

Connected at terminals B-C:
This input connects a floating contact which is powered by the positioner. The switching state of the binary input can be indicated over the FOUNDATION™ fieldbus network.

Forced venting

The i/p converter stops working if the operating voltage supply to the relevant terminals is interrupted. 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.

Extended EXPERT+ valve diagnostics

Refer to Table 5 on page 30 for order numbers.

EXPERT+ is an optional diagnostic firmware integrated in the positioner which allows the predictive, status-oriented maintenance of pneumatic control valves. It upgrades the standard EXPERT diagnostics firmware incorporated in the positioner. The upgraded version provides extended functions to pinpoint valve parameters that have worsened, allowing the user to plan predictive maintenance and service work before malfunctions can affect the process, causing unscheduled plant shutdowns.
The extended EXPERT+ diagnostics can be activated later at the positioner by purchasing an activation code or using a USB dongle in conjunction with TROVIS-VIEW software when EXPERT+ is not already activated on delivery of the positioner.

3.2 Communication

The positioner is completely controlled over the digital signal transmission implemented according to FOUNDATION™ fieldbus specification.

Data are transmitted as bit-synchronous current modulation at a rate of 31.25 kbit/s over twisted-pair cables conforming to IEC 61158-2.

3.2.1 Configuration using TROVIS-VIEW software

Refer to Table 5 on page 30 for order numbers.

The positioner can be configured using the TROVIS-VIEW configuration and operator interface.
The positioner is equipped with an additional digital **SERIAL INTERFACE** to allow a computer to be connected over an adapter cable from the RS-232 or USB port of the computer to the positioner.
The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

Note: *Instructions on how to install and operate the TROVIS-VIEW software are included in the Configuration Manual KH 8387-5 EN on the CD-ROM.*

3.2.2 Configuration using the NI-BUS™ Configurator

The NI-FBUS™ Configurator from National Instruments can also be used to configure the positioner. For this purpose, an interface card must be installed in a computer to connect it to the FOUNDATION™ fieldbus.

The integrated function blocks are linked using the NI-FBUS™ Configurator.

3.3 Technical data

Type 3731-5 Electropneumatic Ex d Positioner with FOUNDATION™ fieldbus communication		
Rated travel	Adjustable	Direct attachment to Type 3277: 3.6 to 30 mm Attachment acc. to IEC 60534-6 (NAMUR): 3.6 to 200 mm Attachment to rotary actuators (VDI/VDE 3845): 24° to 100°
Travel range	Adjustable	Adjustable within the initialized travel/angle of rotation; travel can be restricted to ⅕ at the maximum
Bus connection		Fieldbus interface acc. to IEC 61158-2 bus-powered Physical Layer Class: 113 (without ex. protection) und 111 (with ex. protection) Field device acc. to FM 3610 Entity and FISCO
Communication		
Local communication		SAMSON SSP interface and serial interface adapter
Software requirements (SSP)		TROVIS-VIEW with database module 3731-5 (order no. 6661-1065)
Fieldbus communication		Data transmission as per FOUNDATION™ fieldbus specification, Communication Profile Class: 31 PS, 32 L; Interoperability tested according to Interoperability Test System (ITK) Revision 4.6
Permissible operating voltage		9 to 32 V DC · Powered over bus line The limits specified in the EC Type Examination Certificate additionally apply.
Max. operating current		15 mA
Additional current in case of fault		0 mA
Supply air	Pressure	1.4 to 6 bar (20 to 90 psi)
	Air quality	Compliance with ISO 8573-1: 2004 Max. particle size and density: Class 4 Oil content: Class 3 Moisture and water: Class 3 Pressure dew point: At least 10 K beneath the lowest ambient temperature to be expected
Signal pressure (output)		0 bar up to supply pressure
Characteristic		Linear/equal percentage/reverse equal percentage User-defined (over operating software and communication) Butterfly valve/Rotary plug valve/Segmented ball valve: linear/equal percentage Deviation from terminal-based conformity ≤ 1 %
Hysteresis		≤ 0.3 %
Sensitivity		≤ 0.1 %
Direction of action		Reversible
Air consumption		Independent from supply pressure 110 l_n/h
Air output capacity to actuator	Pressurized	At Δp = 6 bar: 8.5 m_n^3/h · At Δp = 1.4 bar: 30 m_n^3/h · $K_{Vmax(20° C)}$ = 0.09
	Vented	At Δp = 6 bar: 14.0 m_n^3/h · At Δp = 1.4 bar: 4.5 m_n^3/h · $K_{Vmax(20° C)}$ = 0.15
Permissible ambient temperature		–40 to 80 °C The limits specified in the EC Type Examination Certificate additionally apply.

Type 3731-5 Electropneumatic Ex d Positioner with FOUNDATION™ fieldbus communication			
Influences		Temperature: ≤ 0.15/10 K · Supply air: None Vibration: ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770	
EMC		Complying with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21	
Electrical connections		2 threaded connections with ½ NPT thread, optionally with M20 x 1.5 Screw terminals for 2.5 mm² wire cross-section	
Explosion protection	ATEX	II 2 G EEx d IIC T6 · II 2 G EEx de IIC T6 · II 2 D IP 66 T 80 °C	
	FM	XP/I/1/BCD/T4 Ta=80 °C, T5 Ta=70 °C, T6 Ta=60 °C; Type 4X/IP 66 XP/I/1/IIB+H_2/T4 Ta=80 °C, T5 Ta=70 °C, T6 Ta=60 °C; Type 4X/IP 66 DIP/II, III/1/EFG/T4 Ta=80 °C, T5 Ta=70 °C, T6 Ta=60 °C, Type 4X/IP 66 Class I, Division 1 and 2, Groups B, C, D Class II and III, Division 1 and 2, Groups E, F, G Class I, Zone 1, IIB+H_2; Type 4X/IP 66	
	CSA	Class I, Division 1 and 2; Groups B, C, D, T6…T4 Class II, Division 1 and 2, Groups E, F, G; Class III Class I, Zone 1, Group IIB+H_2, T6…T4; Type 4X/IP 66	
	IECEx	Ex d IIC T6 IP 65 T 80 °C	
	JIS	Ex d IIC T6	
Degree of protection		IP 66/NEMA 4 X	
Materials	Housing	Die-cast aluminum EN AC-AlSi10Mg(Fe) (EN AC-44300) acc. to DIN EN 1706 chromated and powder paint coated	
	External parts	Stainless steel 1.4571 and 1.4301	
Weight		Approx. 2.5 kg	
Additional equipment			
Option: Binary input, galvanically isolated			
Connection		Terminals A-B Voltage input 0 to 30 V DC, reverse polarity protection	Terminals B-C for external floating contact
Input		Current consumption: 3.5 mA at 24 V Static destruction limit: 40 V	R < 100 Ω; contact loadability: 100 mA Static destruction limit: 20 V/5.8 mA
		Signal "1" at Ue > 5 V Signal "0" at Ue < 3 V	
Option: Forced venting, galvanically isolated			
Input		0 to 40 V DC/0 to 28 V AC, reverse polarity protection 45 V DC/32 V AC, input resistance ≥ 7 kΩ	
Signal		Fail-safe position at an input voltage ≤ 3 V · Normal operation at an input voltage > 5.5 V	

4 Attachment to the control valve – Mounting parts and accessories

WARNING!
Attach the positioner, keeping the following sequence:
1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

The positioner is suitable for the following types of attachment:

- Direct attachment to SAMSON Type 3277 Actuator
- Attachment to actuators according to IEC 60534-6 (NAMUR)
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators

NOTICE
Attach the positioner to the control valve, observing the following instructions to avoid damaging the positioner.
- *Use only the mounting parts/accessories listed in the Tables 1 to 5 (pages 28 and 30) to mount the positioner. Observe the type of attachment!*
- *The positioner is fitted with pneumatic connections with ¼ NPT threads. If you need G ¼ threads, attach the connecting plate (6) listed in the accessories.*
- *Observe the assignment between lever and pin position (see travel tables on page 14).*
- *Fit a signal pressure restriction (Table 5 on page 30) for actuators with diaphragm areas less than 240 cm².*

Lever and pin position

The positioner is adapted to the actuator and to the rated travel by the lever on the back of the positioner and the pin inserted into the lever.

The travel tables on page 14 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is restricted by the pin position used and additionally by the selected fail-safe position and the required compression of the actuator springs.

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

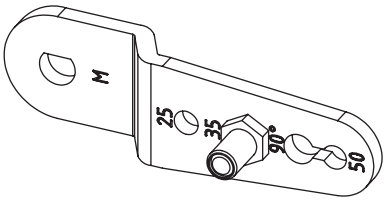


Fig. 3 · Lever M with pin position 35 (delivered state)

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

Travel tables

Note: *The lever **M** is included in the scope of delivery.*
*Levers **S**, **L**, **XL** for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 29).*

Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm²]	Rated travel [mm]	Adjustment range at positioner Min.	Travel	Max.	Required lever	Assigned pin position
120	7.5	5.0	to	25.0	M	25
120/240/350	15	7.0	to	35.0	M	35
355/700	30	10.0	to	50.0	M	50

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves/Type 3271 Actuator Actuator size [cm²]	Rated travel [mm]	Other valves/actuators Min.	Travel	Max.	Required lever	Assigned pin position
60 and 120 with Type 3510 Valve	7.5	3.6	to	18.0	S	17
120	7.5	5.0	to	25.0	M	25
120/240/350	15	7.0	to	35.0	M	35
700	7.5					
700	15 and 30	10.0	to	50.0	M	50
1000/1400/2800	30	14.0	to	70.0	L	70
1000/1400/2800	60	20.0	to	100.0	L	100
1400/2800	120	40.0	to	200.0	XL	200

Attachment to rotary actuators according to VDI/VDE 3845

Rotary actuators Min.	Opening angle	Max.	Required lever	Assigned pin position
24	to	100°	M	90°

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 28 for required mounting parts and accessories.

Actuator with 120 cm²

NOTICE
If a solenoid valve or similar is additionally mounted to the control valve, observe the following instructions which differ from the instructions otherwise described:
- *The switchover plate (9) is omitted.*
- *The signal pressure must be routed from the signal pressure output over the connecting plate (order no. 1400-6820) to the actuator.*
- *Fit the screw-in restriction (order no. 1400-6964) into the signal pressure output.*
- *Do not remove the screw plug (4) at the back of the positioner.*

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.

1. Refer to Fig. 4 to select the symbol to match the required fail-safe position and how the positioner is attached:
   Fail-safe position:
   "Actuator stem extends" = Air-to-open
   "Actuator stem retracts" = Air-to-close
   Positioner attachment: Left or right with view looking onto the switchover plate
2. Align the marking of the switchover plate (9) to the corresponding symbol and mount the plate on the actuator yoke.
3. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
4. Remove screw plug (4) on the back of the positioner and seal the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
5. 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.
6. Press brass restriction (order no. 1400-6964) into the seal of the signal pressure input at the actuator yoke.
7. Mount cover plate (10) with the 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.
8. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the hole for pin position **25** and screw tight.
9. Insert formed seal (15) into the groove of the positioner housing, pressing the

four retaining rings over the housing screws and both fittings into the housing recesses.

10. Thread the bias spring (17) through the crosspiece underneath the lever (1) and push into the hole in the housing. Push the lever (1) until it engages into place. Place positioner on the cover plate (10) and fasten it using the three fixing screws.
    Check to make sure that the follower pin (2) rest on top of the follower clamp (3). The lever (1) must rest on the follower clamp with spring force.
    Make sure that the seal ring (10.1) is inserted in the borehole of the cover plate.
11. Mount cover (11) on the other side. Make sure that the vent plug (11.1) points downwards when the control valve is installed to allow any condensed water that collects to drain off.

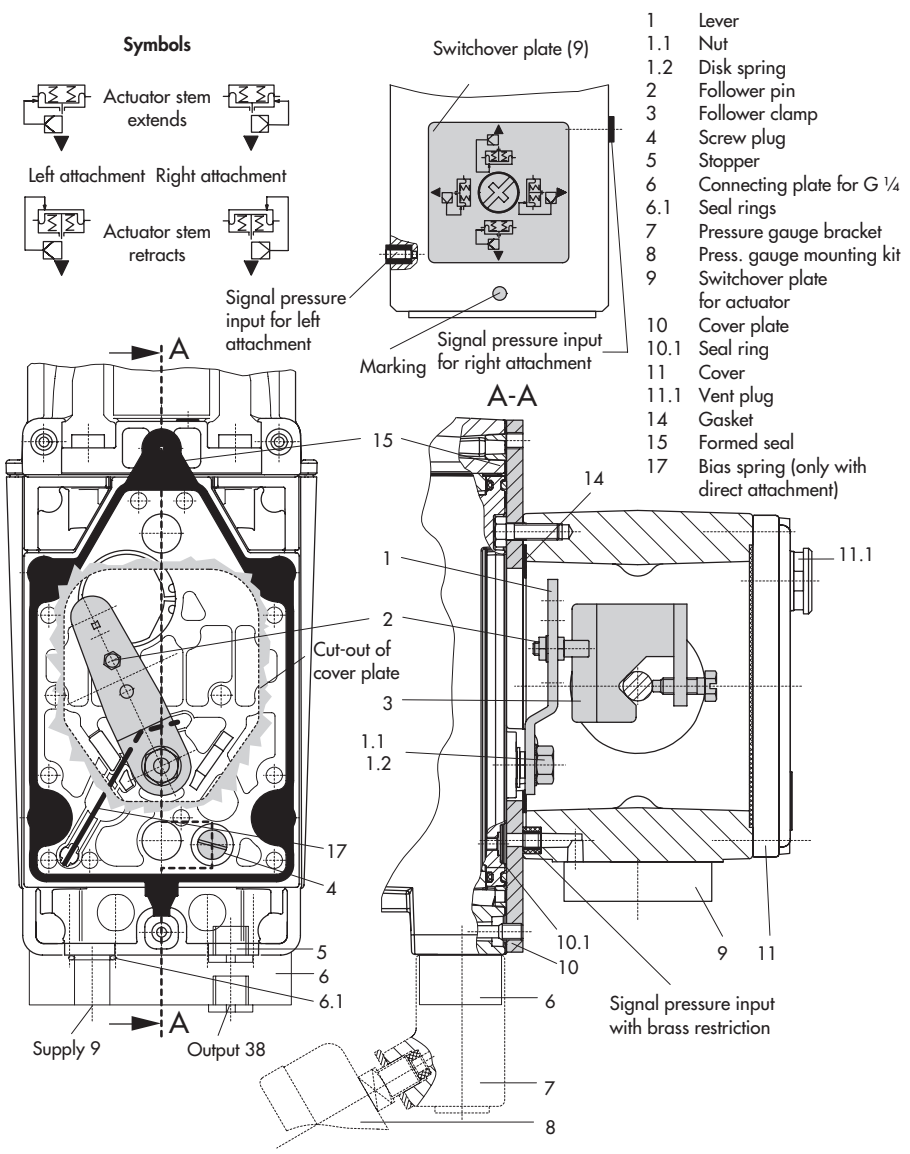


Fig. 4 · Direct attachment for Type 3277-5 Actuator with 120 cm²

4.1.2 Type 3277 Actuator

Refer to Table 2 on page 28 for the required mounting parts and accessories.

Actuators with 240 to 700 cm²

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

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with the narrow side of the cut-out opening (Fig. 5, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. **Actuators with 355/700 cm²:** Remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the hole for pin position **50** and screw tight.
   Actuators 240 and 350 cm² with 15 mm travel: The follower pin (2) remains in pin position **35** (delivered state).
4. Insert formed seal (15) into the groove of the positioner housing, pressing the four retaining rings over the housing screws and both fittings into the housing recesses.
5. Thread the bias spring (17) through the crosspiece underneath the lever (1) and push into the hole in the housing. Push the lever (1) until it engages into place. Place positioner on the cover plate (10) and fasten it using three fixing screws. Check whether the follower pin (2) rests on top of the follower clamp (3).
   The lever (1) must rest on the follower clamp with spring force.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover plate. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and attach the external signal pressure line.
8. Mount cover (11) on the other side. Make sure that the vent plug (11.1) points to the back when the control valve is installed to allow any condensed water that collects to drain off.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
10 Cover plate G ¼
11 Cover
11.1 Vent plug
12 Connection block
12.1 Screw
12.2 Stopper or connection for external piping
13 Switch plate
14 Gasket
15 Formed seal
16 Gasket
17 Bias spring (only for direct attachment)

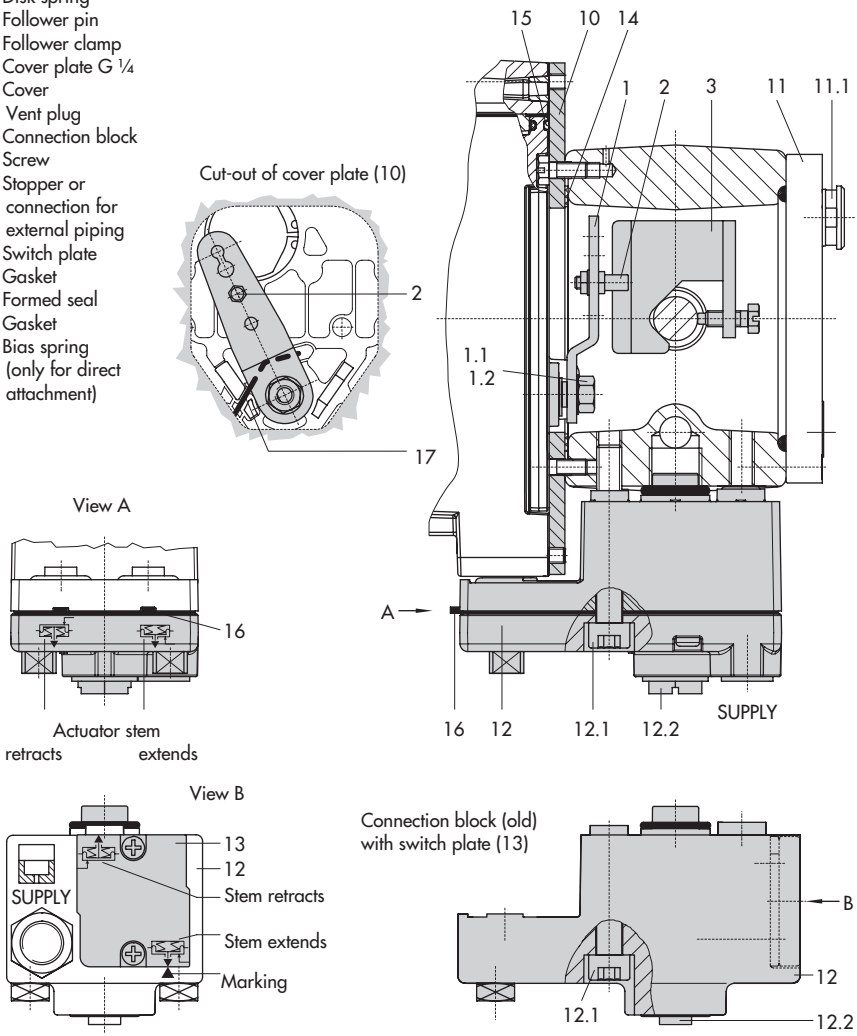


Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm²

4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 3 on page 29 for the required mounting parts and accessories.

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

1. **Actuator sizes 120 to 700 cm²:**
   Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.
   Actuator size 2800 cm² and 1400 cm² (120 mm travel):
   – For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
   – For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).
2. Mount NAMUR bracket (10) to the control valve as follows:
   – For attachment to the NAMUR rib, use an M8 screw (11), washer 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) in such a way that the slot of the follower plate (3/3.1) is centrally aligned with the NAMUR bracket at mid valve travel.
3. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
4. Fit screw-in restriction (order no. 1400-6964) into the signal pressure output for actuators with diaphragm areas smaller than 240 cm².
5. Select required lever (1) size **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 14.
   Lever M with pin position 25 or 50:
   5.1 Remove follower pin (2) from pin position **35** and screw it into the required hole
   Lever L or XL:
   5.1 Unscrew the standard lever **M** from the shaft of the positioner.
   5.2 Screw the long follower pin (2) included in the mounting kit in the pin position of the required lever (1) assigned in the table.
   5.3 Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
   5.4 Move the lever once all the way as far as it will go in both directions.
6. 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 three fixing screws.

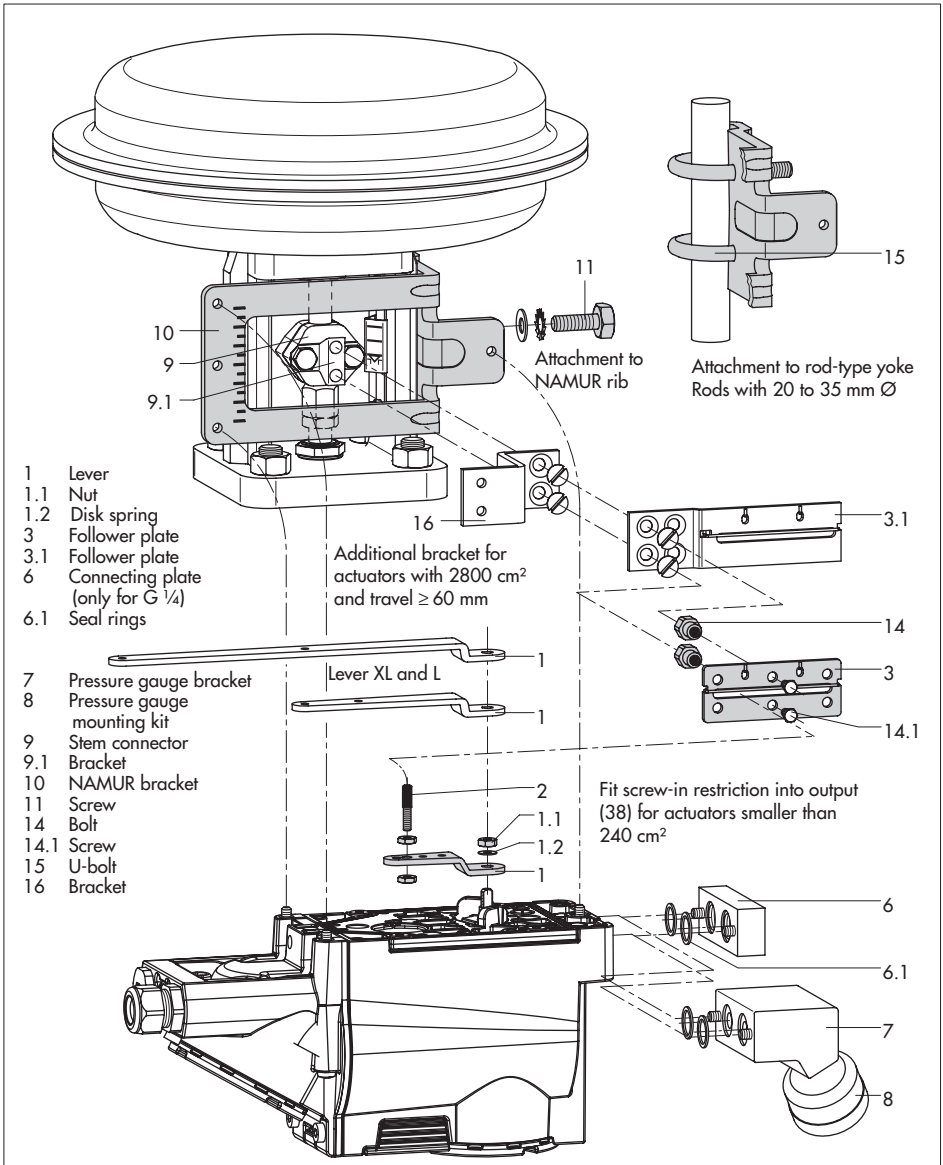


Fig. 6 · Attachment according to IEC 60534-6 (NAMUR)

4.3 Attachment to Type 3510 Micro-flow Valve

Refer to Table 3 on page 29 for the required mounting parts and accessories.

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

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. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
4. Fit screw-in restriction (order no. 1400-6964) into the signal pressure output of the positioner (or output of the pressure gauge bracket or connecting plate).
5. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
6. Remove follower pin (2) from lever **M** and screw it into the hole for pin position **17** of lever **S**.
7. Place lever S on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
8. Move the lever once all the way as far as it will go in both directions.
9. 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 three fixing screws.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Clamp
6 Connecting plate (only for G ¼)
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Bracket
11 Screw

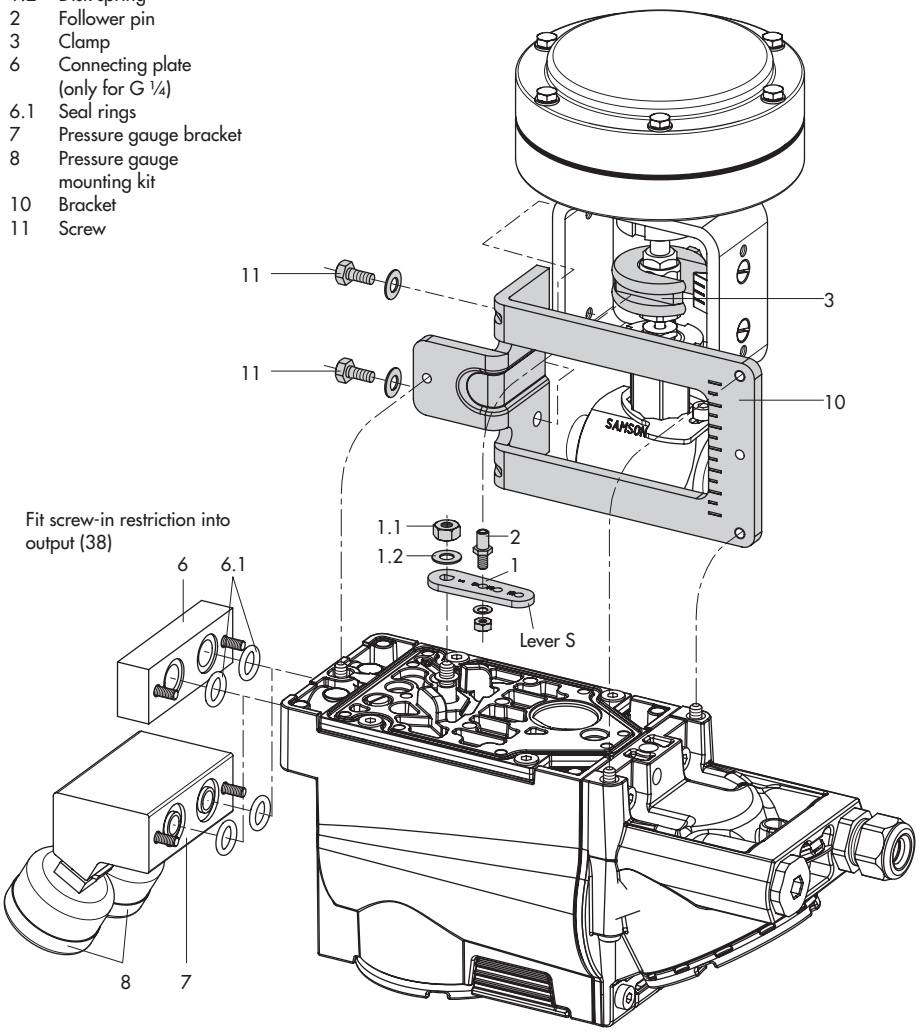


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

4.4 Attachment to rotary actuators

Refer to Table 4 on page 29 for the required mounting parts and accessories.

Both mounting kits contain all the necessary mounting parts. First select correct actuator size. Prepare actuator, and mount required adapter supplied by the actuator manufacturer, if necessary.

1. Mount the housing (10) onto the rotary actuator. In case of VDI/VDE attachment, place spacers (11) underneath, if necessary.
2. **For SAMSON Type 3278 and VETEC S160 Rotary Actuator**, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the **VETEC R Actuator.** Place adapter (3) onto **Type 3278, VETEC S160 and VETEC R Actuator**. For VDI/VDE version, this step depends on the actuator size.
3. Stick adhesive label (4.3) onto the coupling wheel in such a manner that the yellow part of the sticker is visible in the window of the housing when the valve is OPEN. Adhesive labels with explanatory symbols are enclosed and can be stuck on the housing, if required.
4. Screw tight coupling wheel (4) onto the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).
5. Undo the standard follower pin (2) on the lever M (1) of the positioner. Attach the follower pin (Ø 5) included in the mounting kit to pin position 90°.
6. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
   For double-acting, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator. Refer to section 4.5.
7. For actuators with a volume of less than 300 cm³, fit the screw-in restriction (order no.1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).
8. Place positioner on the housing (10) and screw it tight. Considering the actuator's direction of rotation, align lever (1) so that it engages in the correct slot of the coupling wheel with its follower pin (Fig. 8).

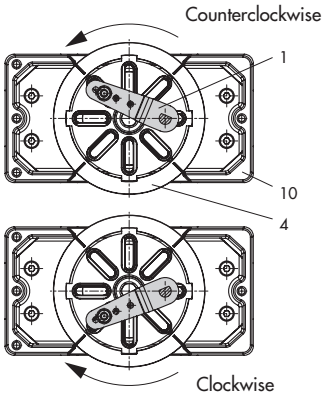


Fig. 8 · Direction of rotation

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Adapter
4 Coupling wheel
4.1 Screw
4.2 Disk spring
4.3 Adhesive label
5 Actuator shaft or adapter
5.1 Adapter
6 Connecting plate (only for G ¼)
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Adapter housing
10.1 Screws
11 Spacers

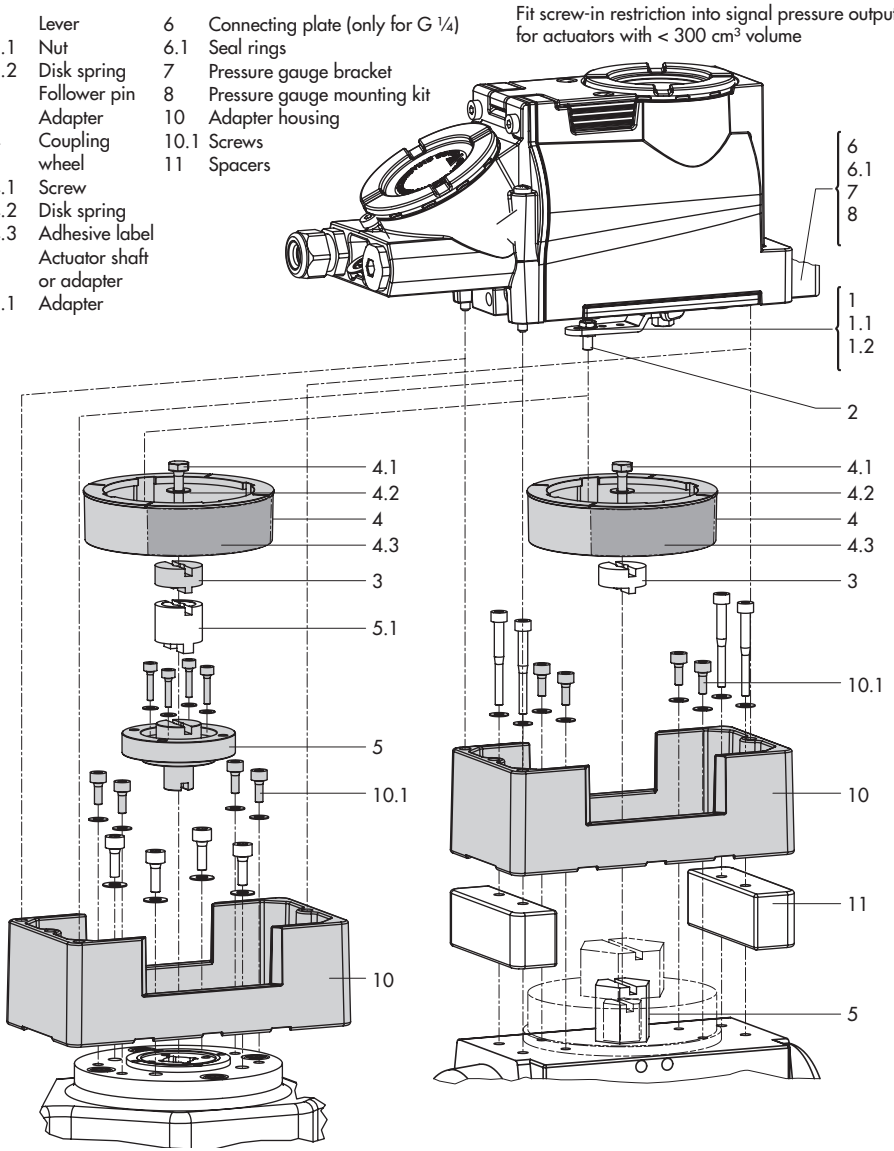


Fig. 9 · Attachment to rotary actuators

4.5 Reversing amplifier for double-acting actuators

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

If a different reversing amplifier (item no. 1079-1118 or 1079-1119) is used, follow the mounting instructions described in section 4.5.1.

4.5.1 Reversing amplifier (1079-1118 or 1079-1119)

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

Mounting

NOTICE
Do not unscrew sealing plug (1.5) out of the reversing amplifier.

1. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the positioner. Remove the rubber seal (1.4).
2. 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_1** and **Z**.
3. Position the reversing amplifier (1) and screw tight using both the special screws (1.1).
4. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes **A_1** and **Z**.

Signal pressure connections

A_1: Output **A_1** leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

A_2: Output **A_2** leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

NOTICE
On start up of double-acting actuators, the following settings as described in section must be made:
- *Pressure limit (Code **16**) = **OFF***
- *Fail-safe position (Code **0**) = AIR TO OPEN (**AtO**)*

Pressure gauge attachment

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

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

Pressure gauges for supply air Z and output A_1 as listed in Tables 1 to 4.

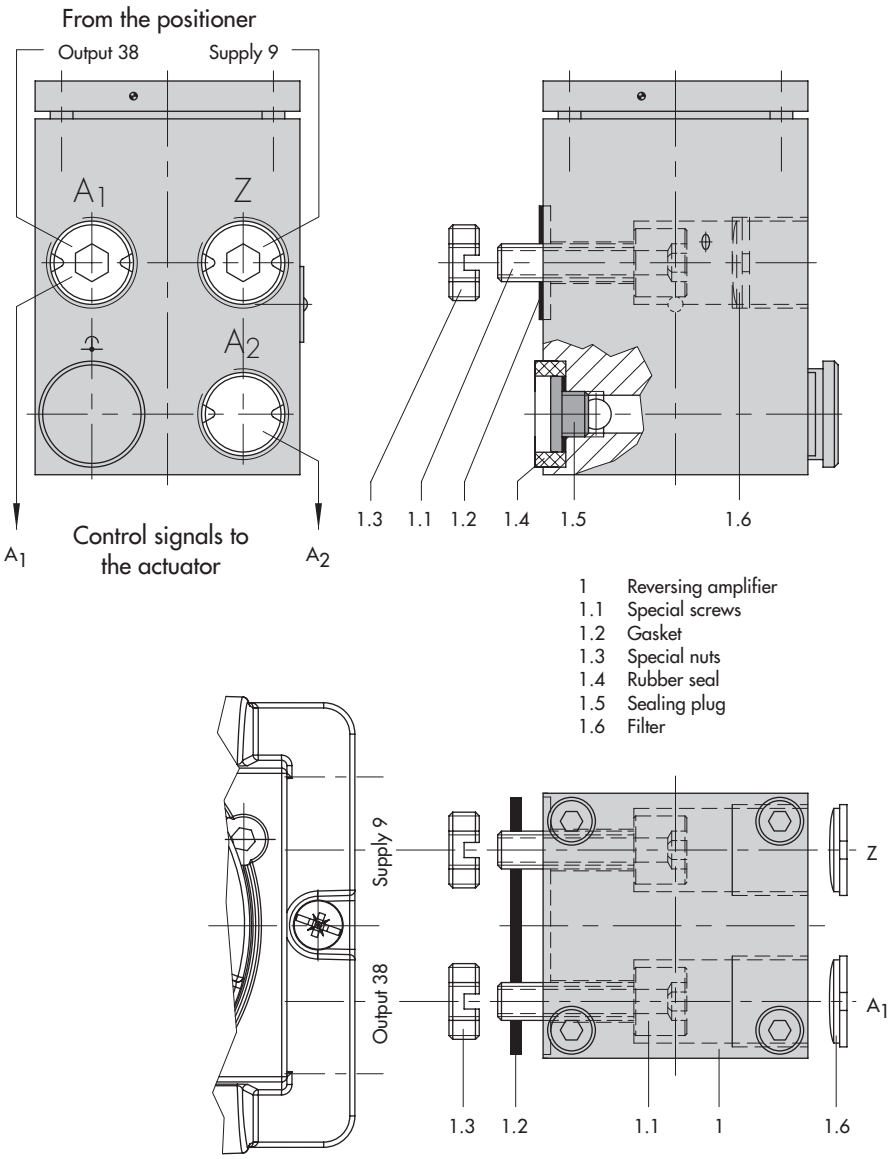


Fig. 10 · Mounting a reversing amplifier (1079-1118 or 1079-1119)

4.6 Required mounting parts and accessories

Table 1 · Direct attachment to Type 3277-5 (Fig. 4)			Order no.
Mounting parts	For actuators with 120 cm² effective diaphragm area		1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx.**00** (old)		1400-6819
	Switchover plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1]		1400-6822
	Connecting plate for additional attachment of a solenoid valve: G ⅛		1400-6820
	Connecting plate (old) for Actuator Type 3277-5xxxxxx.**00** (old): ⅛ NPT		1400-6821
	Connecting plate **new** for Actuator Type 3277-5xxxxxx.**01** (new) [1]		1400-6823
Accessories for the positioner	Connecting plate (6)	G ¼	1400-7461
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. st./Brass	1400-6950
		St. st./St. st.	1400-6951

[1] Only new switchover and connecting plates can be used with new actuators (Index 01).
Old and new plates are **not** interchangeable.

Table 2 · Direct attachment to Type 3277 (Fig. 5)				
Mounting parts	For actuators with 240, 350, 355 and 700 cm²			1400-7453
Accessories	Required piping with screw fitting – for "Actuator stem retracts" – when the top diaphragm chamber is filled with air	240 cm²	Steel	1400-6444
			Stainless steel	1400-6445
		350 cm²	Steel	1400-6446
			Stainless steel	1400-6447
		355/700 cm²	Steel	1400-6448
			Stainless steel	1400-6449
	Connection block with seals and screw		G ¼	1400-8811
			¼ NPT	1400-8812
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)		St. st./Brass	1400-6950
			St. st./St. st.	1400-6951

Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 7)				Order no.
Travel in mm	**Lever**	**For actuators**		
7.5	S	Type 3271-5 Actuator w. 60/120 cm² on Type 3510 Valve (Fig. 7)		1400-7457
5 to 50	M [1]	Actuators from other manufacturers and Type 3271with 120 to 700 cm²		1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271, versions 1000 and 1400-60		1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm² with 120 mm travel		1400-7456
30 or 60	L	Type 3271, versions 1400-120 and 2800 cm² (30 or 60 mm travel)		1400-7466
		Mounting bracket for Emerson and Masoneilan linear actuators; a mounting kit acc. to IEC 60534-6 is necessary depending on the travel (see above)		1400-6771
		Valtek Type 25/50		1400-9554
Accessories	Connecting plate		G ¼	1400-7461
	Pressure gauge bracket (7)		G ¼	1400-7458
			¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)		St. st./Brass	1400-6950
			St. st./St. st.	1400-6951

[1] Lever M is attached to basic positioner (included in the scope of delivery)

Table 4 · Attachment to rotary actuators (Figs. 8 and 9)			Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845, fixing level 2, heavy-duty version		1400-9244
	Attachment acc. to VDI/VDE 3845, fixing level 1, heavy-duty version (e.g. Type 3278, 320 cm² with 1400-5891)		1400-9526
	Attachment for SAMSON Type 3278 160 cm² and VETEC Types S160, R and M, heavy-duty version		1400-9245
	Attachment for Camflex II		1400-9120
	Attachment for Air Torque 10 000		1400-9542
Accessories	Connecting plate	G ¼	1400-7461
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. st./Brass	1400-6950
		St. st./St. st.	1400-6951

Table 5 · General accessories		Order no.
Accessories	Reversing amplifier for double-acting actuators	Type 3710
	Signal pressure restrictions (screw-in and brass restrictions)	1400-6964
	Activation code for EXPERT+ for Type 3731-5 Positioner	1400-9318
	USB dongle for EXPERT+ (specify the number of activations) Only can be used in combination with TROVIS-VIEW 6661-1065	1400-9555
	TROVIS-VIEW with database module 3731-5	6661-1065
	Serial interface adapter (SAMSON SSP interface – RS-232 port of computer)	1400-7700
	Isolated USB interface adapter (SAMSON SSP interface – USB port of computer)	1400-9740

5 Connections

WARNING!
Mount the positioner, keeping the following sequence:
1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

The connection of the electrical auxilary power may cause the actuator stem to move, depending on the operating mode.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

5.1 Pneumatic connections

⚠ ***DANGER!***
Danger from the formation of an explosive atmosphere!
The operator of the apparatus must ensure that the working medium cannot form an explosive atmosphere, i.e. only such gases may be used which are free from substances whose presence in the medium might lead to the formation of an explosive atmosphere (e.g. do not use flammable gases, oxygen or oxygen-enriched gases).

Follow the instructions below to avoid damaging the positioner.
- ***The supply pressure at the input must not exceed 6 bar.***
- *The screw fittings with ¼ NPT thread can be screwed directly into the positioner. In case G ¼ threaded connections are required, the fittings must be screwed into the connecting plate (6) or pressure gauge mounting block or connection block available from the accessories. Customary screw-in fittings for metal and copper pipes or plastic hoses can be used.*
- *The supply air must be dry and free from oil and dust.*
  The maintenance instructions for upstream pressure reducing stations must be observed.
  Blow through all air pipes and hoses thoroughly prior to connecting them.

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

5.1.1 Signal pressure gauges

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

5.1.2 Supply pressure

The required supply pressure (of supply air) depends on the bench range and the actuator's operating direction (fail-safe action). The bench range is registered on the nameplate either as spring range or signal pressure range depending on the actuator. The direction of action 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 pst_{max} is roughly estimated as follows:

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

d = Seat diameter [cm]
Δp = Differential pressure across the valve [bar]
A = Actuator diaphragm area [cm^2]
F = Upper bench range of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar

5.1.3 Signal pressure (output)

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

The limitation is not activated [OFF] by default.

5.2 Electrical connections

DANGER!
Risk of electric shock and/or the formation of an explosive atmosphere!

- *For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance association.*
- *The following standards apply for assembly and installation in hazardous areas **EN 60079-14: 2003** (VDE 0165 Part 1/1.98) "Electrical apparatus for explosive gas atmospheres" and **EN 50281-1-2: 1999** (VDE 0165 Part 2/11.99) "Electrical apparatus for use in the presence of combustible dust".*
- *Install the connecting line rigidly and ensure it is protected adequately from being damaged.*
- *In case the temperature exceeds 70 °C at the cable entries, use appropriate temperature-resistant connecting lines.*
  Integrate the positioner into the equipotential bonding system on site.

Connection to conform with the type of protection EEx d

- *The Type 3731 Positioner must be connected over the appropriate cable glands or conduit systems which meet the requirements of **EN 60079-1: 2004** "Electrical apparatus for explosive gas atmospheres" - Part 1: Flameproof enclosures "d" Clauses 13.1 and 13.2 and for which a special test certificate exists.*
- *Do not use simple types of cable glands or blanking plugs.*
- *Seal any openings that are not used as specified in Clause 11.9 of **EN 50018: 2004.***
- *For installation in type of protection Ex d, observe in particular Clauses 9.4 and 10 of **EN 60079-14: 2003**.*

Connection to conform with the type of protection EEx e

- *Clause 11 of **EN 60079-14: 2003** applies.*
- *On connecting cables to electrical apparatus with the type of protection "Increased safety" according to **EN 60079-7: 2004** "Electrical apparatus for explosive gas atmospheres" - Part 7: Increased safety "e", entries must be used which are suitable for the type cable being used.*

- *The cable entries and blanking plugs must conform to the type of protection "Ex e" and a special test certificate must be issued for them. They must contain a suitable sealing element to achieve the required degree of protection (at least IP 54) of the positioner.*
- *Devices used at ambient temperatures below –20 °C must have metal cable entries*
- *In cases where more than one cable core is connected to the same terminal, make sure that each cable core is clamped adequately. Two cables with varying cross-sections may only be connected to one terminal after being secured with a common crimp sleeve beforehand if it is not explicitly allowed in the documentation related to the electrical apparatus.*

Table 6 · Accessories		Order no.
Cable gland M20 x 1.5; EEx e, black plastic		8808-0178
Blanking plugs; EEx de; stainless steel (approvals: CENELEC, CSA, GOST, IECEx)	M20 x 1.5	8323-1203
	½ NPT	8323-1204
Cable entry for unarmored cables; EEx e, EEx d, EEx tD A21 (approvals: CENELEC, IECEx)	M20 x 1.5	8808-0200
	½ NPT	8808-2010

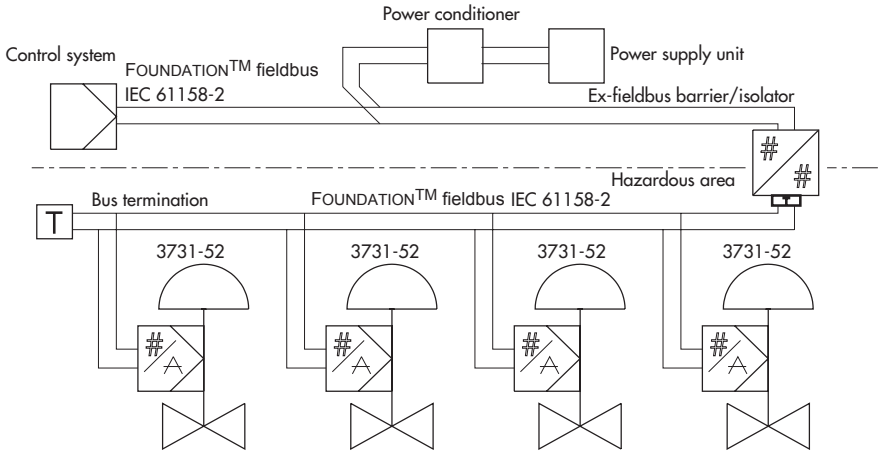


Fig. 11 · Connection according to FOUNDATION™ fieldbus *for hazardous areas*

Cable entry

The threaded connections for the terminal compartment are designed with ½ NPT or M20x1.5 threads.

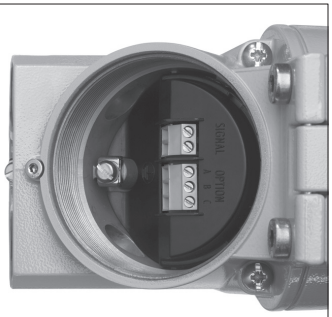


Fig. 12 · Location of the terminals (lid unscrewed)

The electrical connections are screw terminals for wire cross-sections of 0.2 to 2.5 mm² using a tightening torque of at least 0.5 Nm.

Note: *The positioner is powered either over the connection to the fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner.* ***You are required to observe the relevant regulations for use in hazardous areas!***

Electrical auxiliary power supplied over the bus line

- Route the two-wire bus line to the screw terminals marked "Signal". Polarity does not have to be observed.
  Refer to Fig. 13 or the nameplate for the terminal assignment.
  After connecting the electrical auxiliary power, ***tEStinG*** runs across the display of the positioner.

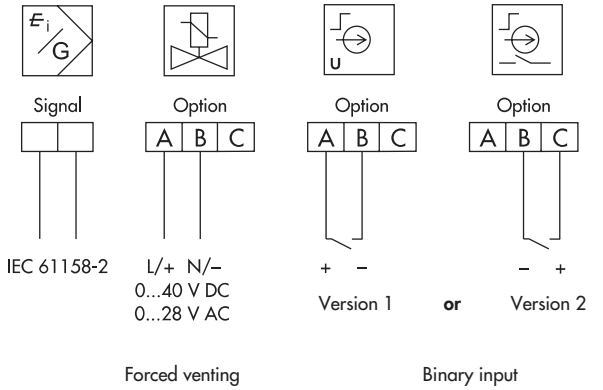


Fig. 13 · Electrical connections

Note: *Just one binary input is available (either version 1* ***or*** *version 2).*

Version 1 of binary input (terminals A–B)

An active contact can be operated at version 1 of the binary input. The positioner signal the switching state over the bus protocol.

Version 2 of binary input (terminals B–C)

A floating passive contact can be operated at version 2 of the binary input. The positioner receives the switching state over the bus protocol.

5.2.1 Establishing communication

Communication between the controller or automation system, or between a computer or work station and the positioner(s) is implemented to conform with EN 61158-2.

Note: *Refer to the Configuration Manual KH 8387-5 EN for more information.*

---

6 Operator controls and readings

Rotary pushbutton

The operator controls are located underneath the front protective cover.

The positioner is operated on site using the rotary pushbutton:

Turn to select codes and values.

Press to confirm setting.

Serial interface

The serial interface connection is located underneath the display lid: Unscrew and remove retaining screw and then unscrew display lid.

NOTICE

The explosion protection is ineffective as soon as the display lid is opened!

To use the TROVIS-VIEW software, connect the positioner over an adapter to the RS-232 or USB port of the computer.

Display

Icons appear on the display that are assigned to parameters, codes and functions.

Operating modes:

– Manual operating mode (see section 8.2.1)

– Automatic operating mode (see section 8.2.1)

S – SAFE (see section 8.2.2)

Bar elements

In manual and automatic operating modes, the bars indicate the system deviation that depends on the sign (+/–) and the value.

One bar element appears per 1 % system deviation.

If the device has not yet been initialized, the icon appears on the display and the lever position in degrees in relation to the longitudinal axis is indicated. One bar element corresponds to approximately a 5° angle of rotation.

If the fifth bar element blinks (reading > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Status messages:

Maintenance alarm

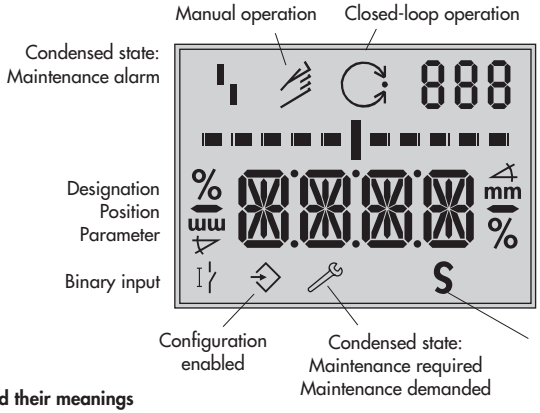
Maintenance required/Maintenance demanded

These icons indicate that an error has occurred.

A classified status can be assigned to each error. Classifications include “No message”, “Maintenance required”, “Maintenance demanded” or “Maintenance alarm“ (see section 8.3).

Configuration enabled:

This indicates that the codes marked with an asterisk (*) in the code list (section 11) are enabled for configuration (see section 8.1).



Readings and their meanings

AUtO	Automatic mode
CL	Clockwise
CCL	Counterclockwise
Err	Error
ESC	Escape
MAN	Manual setting
MAX	Maximum range
NO	Not available
NOM	Nominal travel
ON	On
OFF	Off

RES	Reset
RUN	Start
SAFE	Fail-safe position
SUb	Substitute calibration
TunE	Initialization in progress
YES	Exists
ZP	Zero calibration
tEStinG	Self-test
tESt	Test function active
↗↗	Increasing/increasing
↗↘	Increasing/decreasing

and	together: AO Transducer Block is in MAN operating mode
blinks	Emergency mode, see Code 62
blinks	Not initialized
S blinks	Valve in mechanical fail-safe position

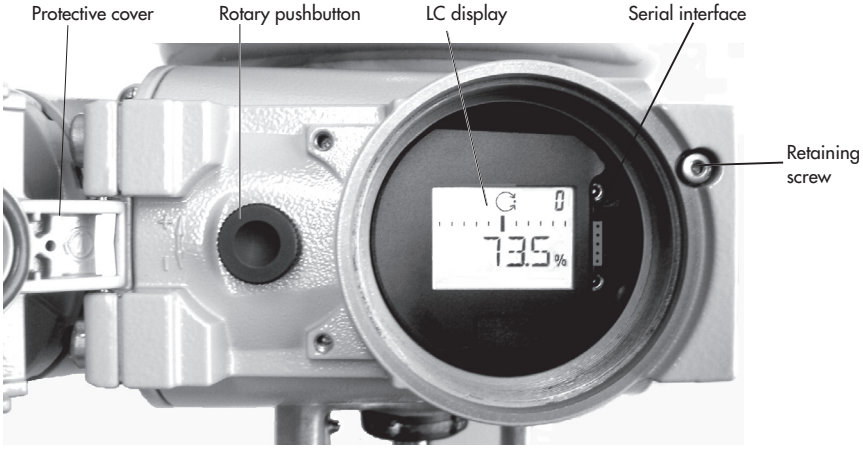


Fig. 14 · Readings and operator controls

7 Start-up – Settings

WARNING!
Attach the positioner, keeping the following sequence:
1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

Reading on display after connecting the electrical auxiliary power:

- ***tEStinG*** runs across the display and then the fault alarm icon appears and blinks on the display when the positioner has **not yet been initialized**. The reading indicates the lever position in degrees in relation to the longitudinal axis.

Reading when the positioner has not yet been initialized

- Code ***0*** appears on the display when a positioner has been **initialized**. The positioner is in the last active operating mode.

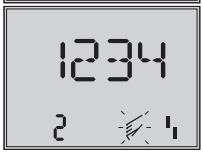
WARNING!
The actuator stem moves while the start-up settings are being performed.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

NOTICE
Perform the start-up settings in the same sequence as listed (section 7.1 to section 7.5).

7.1 Adapting the display

The reading on the display can be turned by 180° to adapt it to how the positioner is attached.

Reading direction for right attachment of pneumatic connections



Reading direction for left attachment of pneumatic connections

If the display appears upside down, proceed as follows:

Turn ◎ → Code ***2***

Press ◎, Code ***2*** blinks.

Turn ◎ → Desired reading direction.

Press ◎ to confirm the reading direction.

7.2 Limiting the signal pressure

If the maximum actuator force may cause damage to the valve, the signal pressure must be limited.

NOTICE

*Do not activate the pressure limit function in actuators with fail-safe action AIR TO OPEN (AtO), e.g. double-acting actuators (**OFF** = default).*

Enable configuration at the positioner before activating the pressure limit function:

***Note:** If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Configuration enabled
Default: OFF

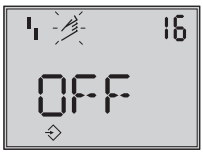
Turn ◎ → Code **3**, display: ***OFF***

Press ◎, Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎, display: ⇨

Pressure limit function:



Pressure limit
Default: OFF

Turn ◎ → Code ***16***

Press ◎, Code ***16*** blinks.

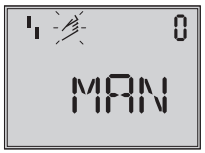
Turn ◎ until the required pressure limit (1.4/2.4/3.7 bar) appears.

Press ◎ to confirm the pressure limit.

7.3 Checking the operating range of the positioner

To check the mechanical attachment, the valve should be moved through the operating range of the positioner in the ✋ manual operating mode using the manual reference variable w.

Select manual operating mode:



Mode
Default: MAN

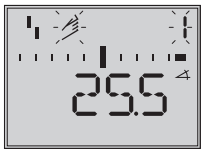
Turn ◎ → Code ***0***

Press ◎, Code ***0*** blinks.

Turn ◎ → ***MAN***

Press ◎ to change the positioner to ✋ manual mode.

Checking the operating range:



Manual reference variable (the current opening angle appears)

Turn ◎ → Code ***1***

Press ◎, Code ***1*** and ✋ blink.

Turn ◎ until the pressure builds up in the positioner, and the control valve moves to its end positions to check the travel range/angle of rotation.

The angle of the lever on the back of the positioner is indicated on the display.
A horizontal lever (mid-position) is equal to 0°.

To ensure the positioner is working properly, the outer bar elements may not blink while the valve is moving through the operating range.
The manual operating mode can be exited by pressing the rotary pushbutton (◎).

The permissible range has been exceeded when the displayed angle is greater than 30°, and the outer right or left bar element blinks.
The positioner changes to the fail-safe position ***SAFE***.
After canceling the fail-safe position SAFE (see section 8.2.2) it is **absolutely necessary** to **check** the lever and pin position as described in section 4.

WARNING!
To avoid personal injury or property damage caused by the supply air or electrical auxiliary power, disconnect the supply air and electrical auxiliary power (bus line) before exchanging the lever or changing the pin position.

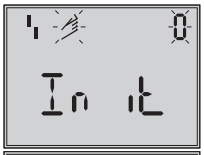
7.4 Determining the fail-safe position

To adapt the positioner to the operating direction of the actuator, the fail-safe position of the positioner must be determined:

- AIR TO OPEN (***AtO***)
  Signal pressure opens the valve.
  Fail-safe position: Valve CLOSED
- AIR TO CLOSE (***AtC***)
  Signal pressure closes the valve.
  Fail-safe position: Valve OPEN

NOTICE
*Double-acting actuators must always be set to AIR TO OPEN (**AtO**).*

Note: *The fail-safe position setting remains set even when the positioner is started up again after the power supply has been disconnected.*



Initialization

Fail-safe position
AIR TO OPEN

Fail-safe position
AIR TO CLOSE

Turn ◎ → Code ***0***

Press ◎ , display: ***MAN***
Code ***0*** blinks.

Turn ◎ → ***Init***

Press ◎ .

Turn ◎ until the required fail-safe position appears on the display.

Press ◎ to confirm the fail-safe position.

Turn ◎ → ***ESC***

Press ◎ to exit **or:**

Start initialization as described in section 7.5.

For checking purposes: *After the positioner has been initialized successfully, the valve closed position is indicated on the positioner display as 0 %, whereas the valve open position is indicated by 100 %. If this is not the case, the closing direction has to be adapted correspondingly and the positioner needs to be re-initialized.*

7.5 Positioner initialization

WARNING!
During initialization, the control valve moves through its entire travel/angle of rotation range. Therefore, do not start the initialization procedure while a process is running, but only during start-up when all shut-off valves are closed.

Before starting initialization, check the maximum permissible signal pressure of the control valve. During initialization, the positioner issues an output signal pressure up to the maximum supply pressure supplied. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.

NOTICE
If the positioner is mounted onto another actuator or its mounting position is changed, reset the positioner to its default settings before re-initializing it. Refer to section 7.7.

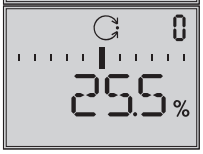
During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure requirements of the control valve.
The type and extent of self-adaptation depends on the initialization mode selected:

- ***MAX* maximum range** (standard range)
  Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.5.1)
- ***NOM* nominal range**
  Initialization mode for all globe valves (see section 7.5.2)
- ***MAN* manually selected range**
  Initialization mode for globe valves with an unknown nominal range (see section 7.5.3)
- ***SUB* substitute calibration** (emergency mode)
  This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.5.4)

Note: *The initialization procedure can be interrupted while running by pressing the rotary pushbutton (◎). **StOP** appears three seconds long and the positioner then moves to the fail-safe position.*
*The fail-safe position can be canceled again over Code **0**.*

Alternating displays:
Initialization running

Initialization progress indicated
(MAX, NOM, MAN or SUB appears, depending on the initialization mode selected)



Initialization successful
Positioner in ↻ automatic operating mode

The time required for an initialization process depends on the stroking speed of the actuator and may take several minutes.

After a successful initialization, the positioner runs in automatic mode indicated by the ↻ closed-loop operation icon.

A malfunctioning leads to the process being interrupted. The initialization error appears on the display according to how it has been classified by the condensed state. See section 8.3 on page 56).

Note: *Positioner with extended EXPERT+ diagnostics automatically start to plot the reference graphs (drive signal y d1 and hysteresis d2) after initialization has been completed. TEST d1 and d2 appear on the display in alternating sequence.*
An unsuccessful plotting of the reference graphs is indicated on the display by Code 81.
The positioner still works properly, even though the reference graph plotting has not been completed successfully.

7.5.1 Initialization based on MAX maximum range

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

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Configuration enabled
Default: OFF

Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎ , display: ⇨

Select initialization mode:

Init mode
Default: MAX

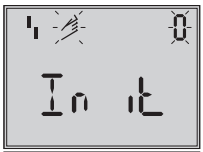
Turn ◎ → Code ***6***

Press ◎

Turn ◎ → ***MAX***

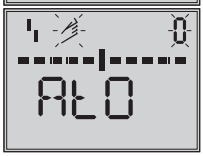
Press ◎ to confirm the ***MAX*** initialization mode.

Start initialization:



Initialization

Fail-safe position setting



Progress indicated until initialization starts

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***Init***

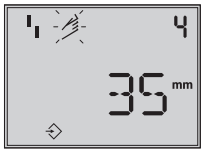
Press ◎ . The setting of the fail-safe position ***AtO*** or ***AtC*** appears.

Keep ◎ pressed down for 6 seconds. Initialization starts after the progress indication has stopped.

The nominal travel/angle of rotation is indicated in % after initialization. Code ***5*** (nominal range) remains locked. The parameters for travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***) can also only be displayed and modified in %.

For a reading in mm/°, enter the pin position (Code ***4***).

Enter pin position:



Pin position
Default: OFF

Turn ◎ → Code ***4***

Press ◎ , Code ***4*** blinks.

Turn ◎ → Pin position on lever (see sections on attachment)

Press ◎ . The reading of the nominal range appears in mm/°.

7.5.2 Initialization based on NOM nominal range

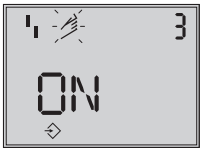
The calibrated sensor allows the effective valve travel to be set very accurately. During the initialization process, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision.
If this is the case, the indicated nominal range is adopted with the limits of

travel/angle range start (Code **8**) and travel/angle range end (Code **9**) as the operating range.

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

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*



Configuration enabled
Default: OFF

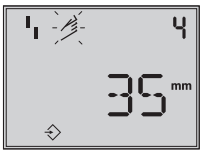
Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

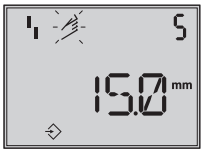
Turn ◎ → ***ON***

Press ◎ , display: ⇨

Enter pin position and nominal travel:



Pin position
Default: OFF



Nominal range
(with Code 4 = OFF locked)

Turn ◎ → Code ***4***

Press ◎ , Code ***4*** blinks.

Turn ◎ → Pin position on lever (see sections on attachment)

Press ◎ .

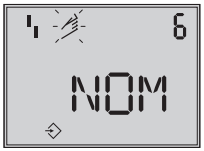
Turn ◎ → Code ***5***

Press ◎ , Code ***5*** blinks.

Turn ◎ → Nominal valve travel

Press ◎ .

Select initialization mode:



Initialization mode
Default: MAX

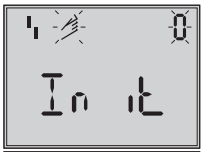
Turn ◎ → Code ***6***

Press ◎ , Code ***6*** blinks.

Turn ◎ → ***NOM***

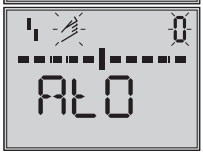
Press ◎ to confirm the ***NOM*** initialization mode.

Start initialization:



Initialization

Fail-safe position setting



Progress indicated until initialization starts

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***Init***

Press ◎. The setting of the fail-safe position ***AtO*** or ***AtC*** appears.

Keep ◎ pressed down for 6 seconds. Initialization starts after the progress indication has stopped.

Note: *After initialization, check the direction of action and, if necessary, change it (Code **7**).*

7.5.3 Initialization based on MAN manually selected range

Before starting initialization, move the control valve manually to the OPEN position. The positioner calculates the differential travel/angle using the OPEN and CLOSED positions and adopts it as the operating range with limits of travel/angle range start (Code ***8***) and travel/angle range end (Code ***9***).

Enter OPEN position:

Manual reference variable (the current angle of rotation is displayed)

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***MAN***

Press ◎.

Turn ◎ → Code ***1***

Press ◎, Code ***1*** blinks.

Turn ◎ until the OPEN position of the valve is reached.

Press ◎ to confirm the OPEN position.

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Configuration enabled
Default: OFF

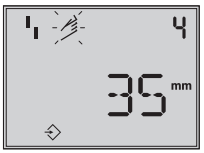
Turn ◎ → Code ***3***, display: ***OFF***

Press ◎, Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎ , display: ⇨

Enter pin position:



Pin position
Default: OFF

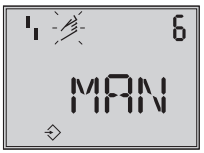
Turn ◎ → Code ***4***

Press ◎, Code ***4*** blinks.

Turn ◎ → Pin position on lever (see sections on attachment).

Press ◎.

Select initialization mode:



Initialization mode
Default: MAX

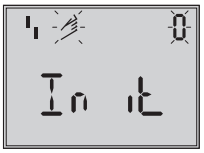
Turn ◎ → Code ***6***

Press ◎, Code ***6*** blinks.

Turn ◎ → ***MAN***

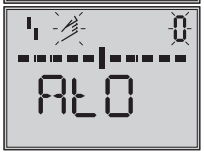
Press ◎ to confirm the ***MAN*** initialization mode.

Start initialization:



Initialization

Fail-safe position setting



Progress indicated until initialization starts

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***Init***

Press ◎. The setting of the fail-safe position ***AtO*** or ***AtC*** appears.

Keep ◎ pressed down for 6 seconds. Initialization starts after the progress indication has stopped.

7.5.4 SUB substitute calibration

A complete initialization procedure takes several minutes and requires the valve to move through its entire travel range several times. This initialization mode, however, is an emergency mode, in which the control parameters are estimated and not determined by an initialization procedure. As a result, a high level of accuracy cannot be expected.
You should always select a different initialization mode if the plant allows it.

The ***SUB*** initialization mode is used to replace a positioner while the process is running. 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 with this valve position.

By entering the blocking position (Code ***35***), closing direction (Code ***34***), pin position (Code ***4***), nominal range (Code ***5***) and direction of action (Code ***7***), the positioner can calculate the positioner configuration.

NOTICE
Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section .

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Configuration enabled
Default: OFF

Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎ , display: ⇨

Enter pin position and nominal travel:

Pin position
Default: OFF

Nominal range
(with Code 4 = OFF locked)

Turn ◎ → Code ***4***

Press ◎ , Code ***4*** blinks.

Turn ◎ → Pin position on lever (see sections on attachment).

Press ◎ .

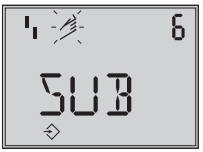
Turn ◎ → Code ***5***

Press ◎ , Code ***5*** blinks.

Turn ◎ → Nominal travel of the valve

Press ◎ .

Select initialization mode:



Initialization mode
Default: MAX

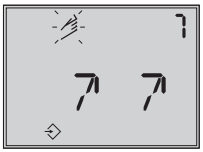
Turn ◎ → Code ***6***

Press ◎ .

Turn ◎ → ***SUB***

Press ◎ to confirm the ***SUB*** initialization mode.

Enter direction of action:



Direction of action
Default: ↗↗

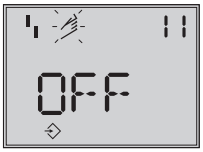
Turn ◎ → Code ***7***

Press ◎ , Code ***7*** blinks.

Turn ◎ → Direction of action (↗↗/↗↘)

Press ◎ .

Deactivate travel limit:



Travel limit
Default: 100.0

Turn ◎ → Code ***11***

Press ◎ , Code ***11*** blinks.

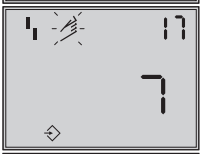
Turn ◎ → ***OFF***

Press ◎ .

Change pressure limit and control parameters:

Note: *Do not change the pressure limit (Code **16**). Only change the control parameters K_P (Code **17**) and T_V (Code **18**) if the settings of the replaced positioner are known.*

Pressure limit
Default: OFF



KP stage
Default: 7

TV stage
Default: 2

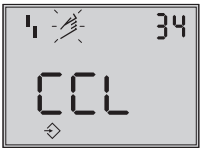
Turn ◎ → Code ***16/17/18***

Press ◎ , Code ***16/17/18*** blinks.

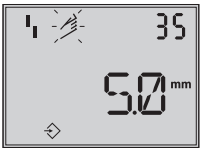
Turn ◎ and set the selected control parameter.

Press ◎ to confirm setting.

Enter closing direction and blocking position:



Closing position
Direction of rotation causing the valve to move to the CLOSED position (view onto positioner display)
Default: CCL (counterclockwise)



Blocking position
Default: 0

Turn ◎ → Code ***34***

Press ◎ , Code ***34*** blinks.

Turn ◎ → Closing direction (CCL counter-clockwise/CL clockwise)

Press ◎ .

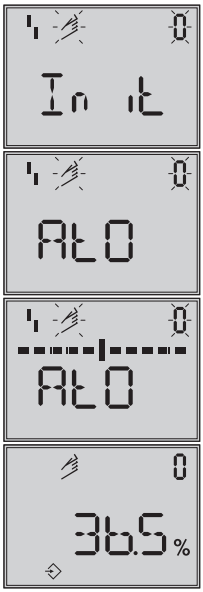
Turn ◎ → Code ***35***

Press ◎ , Code ***35*** blinks.

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

Press ◎ .

Start initialization:



Initialization

Fail-safe position setting

Progress indicated until initialization starts

Blocking position

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***Init***

Press ◎ . The setting of the fail-safe position ***AtO*** or ***AtC*** appears.

Keep ◎ pressed down for 6 seconds.
Initialization starts after the progress indication has stopped.
The operating mode changes to ***MAN***.
The blocking position appears.

Note: *As initialization has not been carried out completely, the error code **76** (no emergency mode) and possibly also error code **57** (control loop) may appear on the display.*
These messages do not influence the positioner's readiness for operation.

Cancel the blocking position and change to automatic operating mode:

For the positioner to follow its reference variable again, the blocking position must be canceled and the positioner must be set to ↻ automatic operating mode.

Turn ◎ → Code ***1***

Press ◎ , Code ***1*** and ⚒ blink.

Turn ◎ until the pressure in the positioner builds up and the valve moves slightly past the blocking position.

Press ◎ to cancel the blocking position.

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***AUtO***

Press ◎ . The positioner changes to the automatic operating mode. The current valve position is indicated in % on the display.

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 (Code **18**) to 4.*
- *Reduce K_P (Code **17**) until the positioner shows a stable behavior.*

Zero point correction

Finally, if process operations allow it, the zero point must be calibrated as described in section 7.6.

7.6 Zero calibration

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

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

Note: *The supply air must be connected to peform a zero calibration.*

Enable configuration:

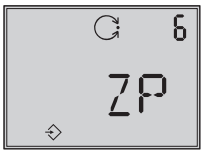
Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎ , display: ⇨

Perform zero calibration:



Initialization mode
Default: MAX

Turn ◎ → Code ***6***

Press ◎ , Code ***6*** blinks.

Turn ◎ → ***ZP***

Press ◎ .

Turn ◎ → Code ***0***

Press ◎ .
Display: ***MAN***, Code ***0*** blinks.

Turn ◎ → ***Init***

Press ◎ . The setting of the fail-safe position ***AtO*** or ***AtC*** appears.

Keep ◎ pressed down for 6 seconds.
Zero calibration is started, the positioner moves the control valve to the CLOSED position and recalibrates the internal electrical zero point.

7.7 Reset to default values

This function resets all parameters to the factory default values (see code list in section 11).

Enable configuration:

Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎, display: ⇨

Reset start-up parameters:

Reset
Default: OFF

Turn ◎ → Code ***36***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***RUN***

Press ◎ . All start-up parameters are reset to their default values.

8 Operation

WARNING!
The actuator stem moves while the positioner is being operated.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

8.1 Enabling and selecting parameters

All codes with their meanings and default settings are listed in the code list in section 11 on page 59 onwards.
The codes which are marked with an asterisk (*) must be enabled with Code **3** before the associated parameters can be configured as described below.

Code ***3***
Configuration
not enabled

Configuration
enabled

Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks
Change the setting of Code ***3***.

Turn ◎ → ***ON***

Press ◎ , display: ⇨
The configuration is enabled.

You can now configure codes one after the other:

Turn ◎ and select the required code.

Press ◎ to access the selected code. The code number starts to blink.

Turn ◎ and select the setting.

Press ◎ to confirm the selected setting.

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

Canceling the setting

Canceling the setting

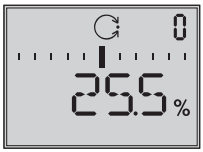
To cancel a value before it is confirmed (rotary pushbutton ◎) without the value you have just selected being adopted:

Turn ◎ → ***ESC***
Press ◎ to confirm the cancelation.
The entry is completed without the value you have just selected being adopted.

8.2 Operating modes

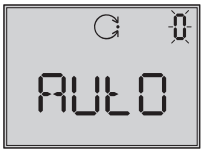
8.2.1 Automatic and manual operating modes

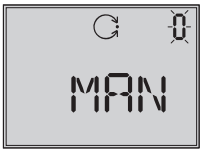
After initialization has been completed successfully for the first time, the positioner is automatically in ↻ automatic operating mode.



↻ automatic operating mode

Switching to ✋ manual operating mode





Turn ◎ → Code ***0***

Press ◎ , display: ***AUtO***,
Code ***0*** blinks.

Turn ◎ → ***MAN***

Press ◎ to switchover to ✋ 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 current position is displayed in %.

Adjust the manual reference variable

Turn ◎ → Code ***1***

Press ◎ , Code ***1*** blinks.

Turn ◎ until the positioner has built up enough pressure and the control valve moves to the required position.

Note: *If no settings are entered within approx. two minutes, the positioner automatically returns to Code **0**, but remains in ✋ manual operating mode.*

Switching to ↻ automatic operating mode:

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ → ***AUtO***

Press ◎ to switchover to the ↻ automatic operating mode.

8.2.2 SAFE – Fail-safe position

If you want to move the valve to fail-safe position determined during start-up (see section 7.4), proceed as follows:

Turn ◎ → Code ***0***

Press ◎ , display: current operating mode (***AUtO*** or ***MAN***), Code ***0*** blinks.

Turn ◎ → ***SAFE***

Press ◎ , display: ***S***
The valve moves to the fail-safe position.
If the positioner is initialized, the current valve position is indicated on the display in %.

Exit the fail-safe position

Turn ◎ → Code ***0***

Press ◎ , Code ***0*** blinks.

Turn ◎ and select the required operating mode ***AUtO*** or ***MAN***.

Press ◎ .
The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

All status messages and fault alarms are assigned to a classified status in the positioner. The default settings of the status classification are listed in the code list.

Note: *The classification of the status messages can be changed in TROVIS-VIEW and over the parameters in the DD file. Refer to the Configuration Manual KH 8387-5 EN on the supplied CD-ROM (CD 8387-5) for more information.*

To provide a better overview, the classified alarms are summarized in a condensed state. The following status messages are available:

- **Maintenance alarm**
  The positioner cannot perform its control task due to a functional fault in the device or in one of its peripherals or an initialization has not yet been successfully completed.
- **Maintenance required**
  The positioner still performs its control task (with restrictions). A maintenance requirement or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.
- **Maintenance demanded**
  The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at

a faster rate than expected. Maintenance is necessary in the short term.

Function check
Test or calibration procedures are being performed. The positioner is temporarily unable to perform its control task until this procedure is completed

Note: *If an event is assigned to the "No message" status, this event does not have any effect on the condensed state.*

The condensed state is represented by the following icons:

Condensed state	Positioner display
Maintenance alarm	
Maintenance required/ Maintenance demanded	
Function check	***tESting***, ***TunE*** or ***tESt***

If the positioner has not been initialized, the maintenance alarm icon ( ) appears on the display as the positioner cannot follow its reference variable.

If fault alarms exist, the possible source of error is displayed in Code **49** onwards. In this case, ***Err*** appears on the display.

The cause and recommended action are listed in the code list (section 11).

Error: Pin position

Note: *The optional EXPERT+ valve diagnostics generate further diagnostic messages which are included in the condensed state according on how they have been classified. A diagnostic alarm generated by the extended EXPERT+ diagnostics is issued by Code 79.*

8.3.1 Confirming error messages

Enable configuration:

Note: *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.*

Configuration enabled
Standard: OFF

Turn ◎ → Code ***3***, display: ***OFF***

Press ◎ , Code ***3*** blinks.

Turn ◎ → ***ON***

Press ◎, display: ⇨

Confirming alarm:

Turn ◎ → Error code that is to be confirmed.

Press ◎ to confirm the errror message.

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

If a part of the positioner on which the explosion protection is based needs to be serviced, the positioner must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.
Inspection by an expert is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device.

11 Code list

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
0	**Operating mode** [MAN] AUtO · SAFE ESC	AUtO Automatic mode MAN Manual mode SAFE Fail-safe position ESC Escape In MAN and AUtO mode, the system deviation is represented by bar elements on the display. If the positioner has been initialized, the numerical reading indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °. Switchover from automatic to manual mode is smooth. In fail-safe position, the **S** icon appears on the display.
	Init AtO · AtC	Init Start initialization Determine fail-safe position: AtO: AIR TO OPEN (valve CLOSED in fail-safe position) or AtC: AIR TO CLOSE (valve OPEN in fail-safe position)
1	**Manual reference variable w** 0 to 100 [0] % of the nominal range	Setting the manual reference variable w The current travel/angle is displayed in % when the positioner has been initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. Can only be selected when Code **0** = MAN.
2	**Reading direction** [Normal] or upside down ESC	The reading direction of the display is turned by 180°.
3	**Enable configuration** [OFF] ON ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) ***FF*** blinks on the display when the on-site operation is locked over the FF network. Codes marked with an asterisk (*) can only be read and not overwritten. Codes can also only be read over the SSP interface.

<table>
<tr><th>Code no.</th><th>Parameter – Display, values [default setting]</th><th>Description</th></tr>
<tr><td colspan="3">Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td></tr>
<tr><td>4*</td><td>Pin position
[OFF]
17, 25, 35, 50, 70, 100, 200 mm
90° with rotary actuators
ESC

Note! If you select a pin position in Code 4 that is too small, the positioner switches to the fail-safe position (SAFE mode) for reasons of safety.</td><td>The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation.
The pin position must be entered for initialization using NOM or SUb.
<table><tr><th>Pin position
Code 4</th><th>Standard
Code 5</th><th>Adjustment range
Code 5</th></tr><tr><td>17</td><td>7.5</td><td>3.6 to 17.7</td></tr><tr><td>25</td><td>7.5</td><td>5.0 to 25.0</td></tr><tr><td>35</td><td>15.0</td><td>7.0 to 35.4</td></tr><tr><td>50</td><td>30.0</td><td>10.0 to 50.0</td></tr><tr><td>70</td><td>40.0</td><td>14.0 to 70.7</td></tr><tr><td>100</td><td>60.0</td><td>20.0 to 100.0</td></tr><tr><td>200</td><td>120.0</td><td>40.0 to 200.0</td></tr><tr><td>90°</td><td>90.0</td><td>24.0 to 100.0</td></tr></table></td></tr>
<tr><td>5*</td><td>Nominal range
mm or angle °
ESC</td><td>For initialization using NOM or SUb, the nominal travel/angle of rotation of the valve must be entered.
The permissible adjustment range depends on the pin position according to the table for Code 4.
Code 5 is generally locked until Code 4 is set to OFF, i.e. after a pin position has been entered, Code 5 can be configured.
After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.</td></tr>
<tr><td>6*</td><td>Initialization mode
[MAX]
NOM · MAN · SUb · ZP
ESC</td><td>Select the initialization mode
MAX: Maximum range of the control valve, the travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator.
NOM: Nominal range of the control valve, the travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position.
MAN: Manually selected range
SUb: Substitute calibration (emergency mode)
ZP: Zero calibration</td></tr>
</table>

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
7*	**Direction of action** [↗↗] ↗↘ ESC	Direction of action of the reference variable w in relation to the travel/angle of rotation x (increasing/increasing or increasing/decreasing). **Automatic adaptation:** AIR TO OPEN: After initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the reference variable increases. AIR TO CLOSE: After initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the reference variable increases.
8*	**Travel/angle range start (lower x-range value)** 0.0 to 80.0 [0.0] % of the nominal range Specified in mm or angle ° provided Code 4 is set ESC	Starting value for the travel/angle of rotation in the nominal or operating range. The **operating range** is the actual travel/angle of the control valve and is limited by the travel/angle range start (Code **8**) and the travel/angle range end (Code **9**). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the travel/angle range start and end. Value is displayed or must be entered. The characteristic is adapted. See also the example in Code **9**.
9*	**Travel/angle range end (upper x-range value)** 20.0 to 100.0 [100.0] % of the nominal range Specified in mm or angle ° provided Code 4 is set ESC	End value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. **Example:** The operating range is modified, for example, to limit the range of a control valve which has been 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 adjusted lower limit and 100 % to the adjusted upper limit.
10*	**Travel/angle lower limit (lower x-limit)** [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**.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
11*	**Travel/angle upper limit (upper x-limit)** 50.0 to 120.0 [100] % of the operating range OFF · ESC	Limitation of the travel/angle of rotation upwards to the entered value. When set to OFF, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range. The characteristic is not adapted. **Example:** In some applications, it is better 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.
14*	**Setpoint cutoff decrease (final position w <)** 0.0 to 49.9 [1.0] % OFF · ESC	If reference variable w reaches the percentage adjusted that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**.
15*	**Setpoint cutoff increase (final position w >)** [OFF] 50.0 to 100.0 % ESC	If reference variable w reaches the percentage adjusted that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. A signal pressure limit is possible over Code **16**. Codes **14/15** have priority over Codes **8/9/10/11**. Codes **21/22** have priority over Codes **14/15**. **Example:** Set the cutoff to 99 % for three-way valves.
16*	**Pressure limit** [OFF] P 1.4 2.4 3.7 ESC	The pressure limit determined during initialization is displayed in bar. The pressure limit can be changed for fail-safe position AIR TO OPEN (AtO). After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position over Code **0**). **NOTICE** Do not activate the pressure limit for actuators with fail-safe position AIR TO OPEN (AtO), e.g. double-acting actuators.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
17*	**Proportional-action coefficient KP (step)** 0 to 17 [7] ESC	**Displaying or changing the K_P and T_V steps:** During initialization, the K_P and T_V values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the K_P and T_V steps can be adapted after initialization. For this, either the T_V step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the K_P step can be decreased in increments. **Note:** Changing the K_P step influences the system deviation.
18*	**Rate time TV (step)** [2] 1 3 4 OFF ESC	Changing T_V, see Code **17**. **Note:** Changing the T_V step has no effect on the system deviation.
19*	**Tolerance band** 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 a lag time is determined during initialization which is six times > 30 s, the six-fold lag time is accepted as the lag time.
20*	**Characteristic** 0 to 9 [0] ESC	Select the characteristic: 0 Linear 1 Equal percentage 2 Reverse equal percentage 3 SAMSON butterfly valve linear 4 SAMSON butterfly valve equal percentage 5 VETEC rotary plug valve linear 6 VETEC rotary plug valve equal percentage 7 Segmented ball valve linear 8 Segmented ball valve equal percentage 9 User-defined (defined over operating software) **Note:** The various characteristics are listed in the Appendix (section 13.1).

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
21*	**Required transit time OPEN (w ramp open)** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve opens. Limitation of the transit time (Code **21** and **22**): For some applications it is better to limit the actuating speed of the actuator to prevent it from engaging too fast in the running process. Code **21** has priority over Code **15**.
22*	**Required transit time CLOSED (w ramp closed)** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve closes. Code **22** has priority over Code **14**.
23*	**Total valve travel** 0 to 99 · 10^7 [0] Exponential reading from 9999 travel cycles onwards RES · ESC	Totaled double valve travel. Can be reset to 0 via *RES*.
24*	**Limit of total valve travel** 1000 to 99 · 10^7 [1 000 000] Exponential reading from 9999 travel cycles onwards ESC	Limit value of total valve travel. If the limit is exceeded, the fault alarm and the wrench icons appear on the display.
34*	**Closing direction** [CCL] Counterclockwise CL Clockwise ESC	Turning direction of the lever in which the valve is moved to the CLOSED position (view onto the display of the positioner). Needs only be entered in SUb initialization mode.
35*	**Blocking position** [0] mm/° /% ESC	Distance up to the CLOSED position (0 % position). Only needs to be entered in SUb initialization mode.
36*	**Reset** [OFF] RUN · ESC	Resets all parameters to default settings. **Note:** After setting ***RUN***, the positioner must be re-initialized.

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
39	**System deviation e** –99.9 to 999.9 %	Deviation from the target position (e = w – x) Display only
40	**Minimum transit time OPEN** 0 to 240 s [0]	Time [s] needed by the system (positioner, actuator and valve) to move through the nominal travel/angle to open the valve (100 % position). Display only
41	**Minimum transit time CLOSED** 0 to 240 s [0]	Time [s] needed by the system (positioner, actuator and valve) to move through the nominal travel/angle to close the valve (0 % position). Display only
42	**Auto-w/manual-w** 0.0 to 100.0 % of the span	Supplied manual and automatic reference variable Display only
43	**Firmware version** control Xxxx	Positioner type and current firmware version (in alternating sequence) Display only
44	**y info** 0 to 100 %, [0 %]	Control signal y [%] based on the travel range determined on initialization · Display only MAX: The positioner builds up its maximum output pressure, see description in Code **14** and **15**. 0 P: The positioner vents completely, see description in Code **14** and **15**. – – –: The positioner has not been initialized.
45	**Forced venting status** YES · HIGH/LOW · NO	Indicates whether the option is installed or not · Display only NO No forced venting installed YES Forced venting installed If a voltage supply is connected at the terminals of the forced venting option, *YES* and *HIGH* appear on the display in alternating sequence. If a voltage supply is not applied (actuator vented, fail-safe position indicated on the display by the S icon), *YES* and *LOW* appear on the display in alternating sequence.
46*	**Bus address** ESC	Display only

Code no.	**Parameter** – Display, values [default setting]	**Description**
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
47*	**Status of write protection switch** [NO] YES · ESC	When the write protection function is activated, device data can only be read, but not overwritten over FF communication.
48*	**Diagnostics**	
	Diagnostic parameters d	
	d0 Temperature –55 to 125 °C	Current operating temperature [°C] inside the positioner (accuracy ±3 %) Display only
	d1 Minimum temperature [20]	The lowest temperature below 20 °C that has ever occurred. Display only
	d2 Maximum temperature [20]	The highest temperature above 20 °C that has ever occurred. Display only
	d3 Number of zero calibrations [0]	The number of zero calibrations since the last initialization. Display only
	d4 Number of initializations [0]	The number of initializations that have been performed since the last reset. Display only
	d5 Zero point limit [5 %] 0.0 to 100.0 % of the nominal range	User-defined zero point monitoring Used for error monitoring of the zero point shift.
	d6 Condensed state	Condensed state, made up from the individual states · Display only OK Okay C Maintenance required CR Maintenance demanded B Maintenance alarm I Function check

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	**d7 Start reference test** [OFF] ON · ESC	Starting of a reference test (for the EXPERT$^+$ functions: Drive signal y steady-state (d1) and drive signal y hysteresis (d2). The reference test can only be activated in manual operating mode as the valve moves through its entire working range. If EXPERT$^+$ is activated at later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.
	d8 EXPERT$^+$ activation	Enter the activation code for EXPERT$^+$. After the activation procedure has been successfully completed, ***YES*** appears under d8.
	FF parameters	
	F0 Firmware Rev. Communication	Display only
	F1 Binary input	Display only 1 Active · 2 Inactive
	F3 Simulate PV	Activation of simulation mode
	Positioner (AO)	
	A0 Target Mode	Target operating mode
	A1 Actual Mode	Actual operating mode · Display only
	A2 CAS_IN Value	Analog reference variable adopted from an upstream function block (value) · Display only
	A3 CAS_IN Status	Analog reference variable adopted from an upstream function block (status) · Display only
	A4 SP Value	Reference variable w (value) · Display only
	A5 SP Status	Reference variable w (status) · Display only
	A6 OUT Value	Manipulated variable (value) · Display only
	A7 OUT Status	Manipulated variable (status) · Display only
	A8 BLOCK ERR	Active block error · Display only

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	**Process controller (PID)**	
	P0 Target Mode	Target operating mode
	P1 Actual Mode	Actual operating mode · Display only
	P2 CAS_IN Value	Analog reference variable adopted from an upstream function block (value) · Display only
	P3 CAS_IN Status	Analog reference variable adopted from an upstream function block (status) · Display only
	P4 SP Value	Reference variable w (value) · Display only
	P5 SP Status	Reference variable w (status) · Display only
	P6 OUT Value	Manipulated variable (value) · Display only
	P7 OUT Status	Manipulated variable (status) · Display only
	P8 BLOCK ERR	Active block error · Display only
	Positioner (AO TRD), binary input (DI1 TRD, DI2 TRD)	
	t0 Target Mode (AO TRD)	Target operating mode
	t1 Actual Mode (AO TRD)	Actual operating mode · Display only
	t2 Transducer State	State of the Transducer Block · Display only
	t3 BLOCK ERR AO TRD	Active block error · Display only
	t4 Target Mode (DI1 TRD)	Target operating mode
	t5 Actual Mode (DI1 TRD)	Actual operating mode · Display only
	t6 BLOCK ERR DI1 TRD	Active block error · Display only
	t7 Target Mode (DI2 TRD)	Target operating mode
	t8 Actual Mode (DI2 TRD)	Actual operating mode · Display only
	t9 BLOCK ERR DI2	Active block error · Display only

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	**Operating unit (RES)**	
	S0 Target Mode (RES)	Target operating mode
	S1 Actual Mode (RES)	Actual operating mode · Display only
	S2 BLOCK ERR (RES)	Active block error · Display only
	Binary input (DI1)	
	I0 Target Mode (DI1)	Target operating mode
	I1 Actual Mode (DI1)	Actual operating mode · Display only
	I2 Field_Val_D Value	Discrete process variable field hardware (value) · Display only
	I3 Field_Val_D Status	Discrete process variable field hardware (status) · Display only
	I4 OUT_D Value	Discrete output variable (value) · Display only
	I5 OUT_D Status	Discrete output variable (status) · Display only
	I6 BLOCK ERR	Active block error · Display only
	Binary input DI2	
	L0 Target Mode (DI2)	Target operating mode
	L1 Actual Mode (DI2)	Actual operating mode · Display only
	L2 Field_Val_D Value	Discrete process variable field hardware (value) · Display only
	L3 Field_Val_D Status	Discrete process variable field hardware (status) · Display only
	L4 OUT_D Value	Discrete output variable (value) · Display only
	L5 OUT_D Status	Discrete output variable (status) · Display only
	L6 BLOCK ERR	Active block error · Display only
	D2 Function Block L	
	L0 Target Mode DI2	Required operating mode
	L1 Actual Mode DI2	Actual operating mode
	L2 Field_Val_D Value	Displays the discrete input variable

Code no.	**Parameter** – Display, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code **3** prior to configuration.		
48*	**L3** Field_Val_D Status	and its status
	L4 OUT_D Value	Displays the discrete output variable
	L5 OUT_D Status	and its status
	L6 BLOCK ERR	Displays the current block error
49*	**PST**	Description of partial stroke test function (refer to EB 8388-5 EN)

Note: *The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: , Maintenance alarm:). If "No message" is assigned to the error code as the status classification, the error is not included in the condensed state.*

A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operating software (e.g. TROVIS-VIEW). Refer to the Configuration Manual KH 8387-5 EN.

Initialization errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
50	**x > range**	The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit. • Pin positioned incorrectly. • Bracket slipped in case of NAMUR attachment or positioner is not central. • Follower plate incorrectly attached.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	**Δx < range**	The measuring span of the sensor is too low. • Pin positioned incorrectly. • Wrong lever. A rotational angle smaller than 11° at the positioner shaft creates just an alarm. An angle below 6° leads to the initialization being canceled.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.
52	**Attachment**	• Positioner attachment incorrect. • Nominal travel/angle (Code 5) could not be achieved on initialization under NOM or SUb (no tolerance downwards permissible). • Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX. After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
53	**Initialization time exceeded (Init time >)**	The initialization routine lasts too long. The positioner returns to its previous operating mode. • No pressure on the supply line or there is a leak. • Supply air failure during initialization.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner.
54	**Initialization/forced venting**	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 alarm is generated when you attempt to initialize the positioner. 2) If you attempt to initialize the device from the fail-safe position (SAFE).
	Status classification	[Maintenance required]
	Recommended action	Re. 1) Check connection and supply voltage of the forced venting Code 45 HIGH/LOW Re. 2) Set the ***MAN*** operating mode over Code 0. Then initialize the positioner.
55	**Transit time too short (transit time <)**	The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Status classification	[Maintenance required]
	Recommended action	Check the volume restriction setting as described in section 4, re-initialize the positioner.
56	**Pin position**	Initialization was canceled because you are required to enter the pin position for the selected initialization modes ***NOM*** and ***SUb***.
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code **4** and nominal travel/angle over Code **5**. Re-initialize the positioner.

Operational errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
57	**Control loop**	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19). • Actuator mechanically blocked. • Attachment of the positioner subsequently shifted. • Supply pressure not sufficient.
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	**Zero point**	Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Status classification	[Maintenance required]
	Recommended action	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code 6 (see section 7.6 on page 52). If the lever position on the back of the positioner has been changed (e.g. while exchanging the lever), move the lever as far as it will go in both directions to adapt it to the internal measuring lever.
59	**Autocorrection**	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Status classification	[No message]
	Recommended action	Automatic
60	**Fatal error**	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The control valve moves to its fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code 36. Re-initialize the positioner (see sections 7.7 and 7.5).

Hardware errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
62	**x signal**	Determination of the measured data for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking closed-loop control icon and 4 dashes instead of the position indication. **Note on the control:** 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.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
64	**i/p converter**	The circuit of the i/p converter has been interrupted.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Cannot be remedied. Return the positioner to SAMSON AG for repair.
65	**Hardware**	A hardware error has occurred, the positioner moves to the fail-safe position ***SAFE***.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error and return to the automatic operating mode, or perform a reset and re-initialize the device. If this is not successful, return device to SAMSON AG for repair.
66	**Data memory**	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.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return the positioner to SAMSON AG for repair.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
67	**Test calculation**	The hardware controller is monitored by means of a test calculation.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.

Data errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
68	**Control parameter**	Control parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
69	**Poti parameter**	Parameter error of the digital potentiometer.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
70	**Calibration**	Error in the production calibration data. Subsequently, the device runs on default values.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
71	**General parameters**	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
72	**Start-up parameters**	Start-up parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
73	**Internal device error 1**	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
74	**FF parameters**	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error and perform reset.
75	**Info parameters**	Info parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
76	**No emergency mode**	The travel measuring system of the positioner has a self-monitoring function (see Code 62). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner moves to the fail-safe position when a measuring error occurs. During the initialization, the positioner checks whether the actuator has such a function or not.
	Status classification	[No message]
	Recommended action	Merely information, confirm, if necessary. No further action necessary.
77	**Program loading error** Additional alarm at the fault alarm contact	When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test (***tEStinG*** runs across the display). If the positioner loads the wrong program, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Interrupt current and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.
78	**Options parameter**	Errors in options parameters
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.

Diagnosis errors

Error codes – Recommended action		Condensed state alarm active, when prompted, ***Err*** appears. When fault alarms exist, they are displayed here.
79	**Extended diagnostics**	Error messages are generated in the extended EXPERT$^+$ diagnostics if EXPERT$^+$ has been successfully activated in Code 48.
	Status classification	Maintenance required (cannot be classified)
80	**Diagnostic parameters**	Errors that are not critical for control.
	Status classification	Maintenance required (cannot be classified)
81	**Reference test canceled**	The reference graphs were not plotted or an error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. • Reference test was interrupted • Reference line y steady-state or y hysteresis was not adopted. Error messages are saved in EEPROM. They cannot be reset.
	Status classification	[Maintenance required]
	Recommended action	Check and, if necessary, perform a new reference test

12 Dimensions in mm

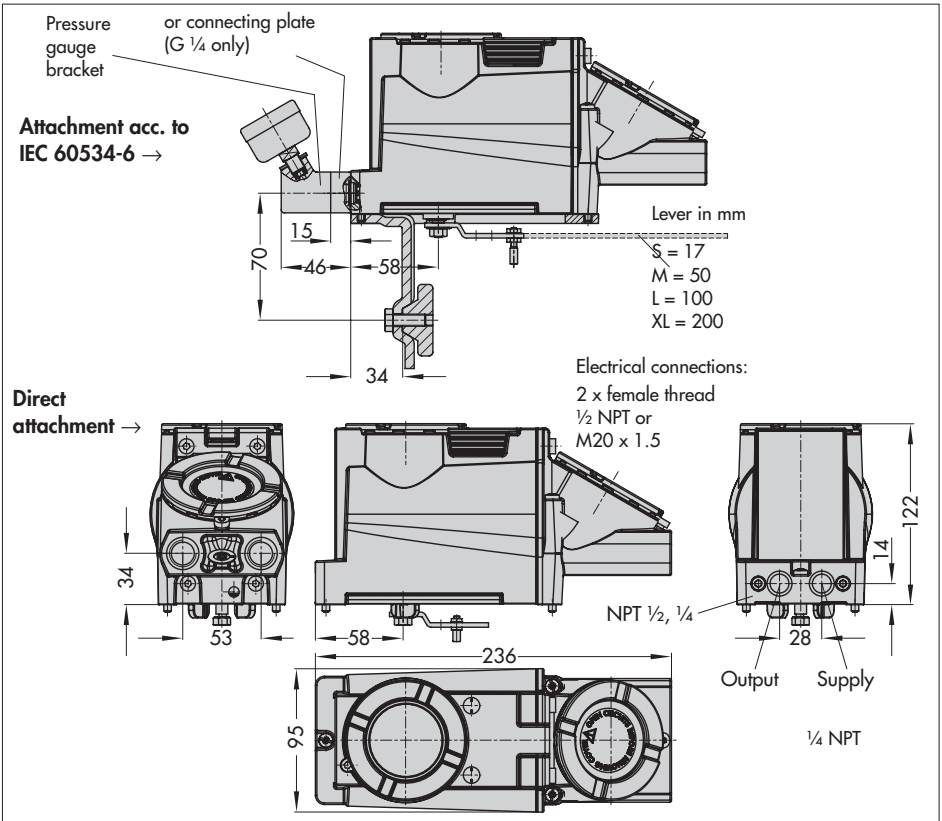


Fig. 15a · Attachment according to IEC 60534-6 and direct attachment

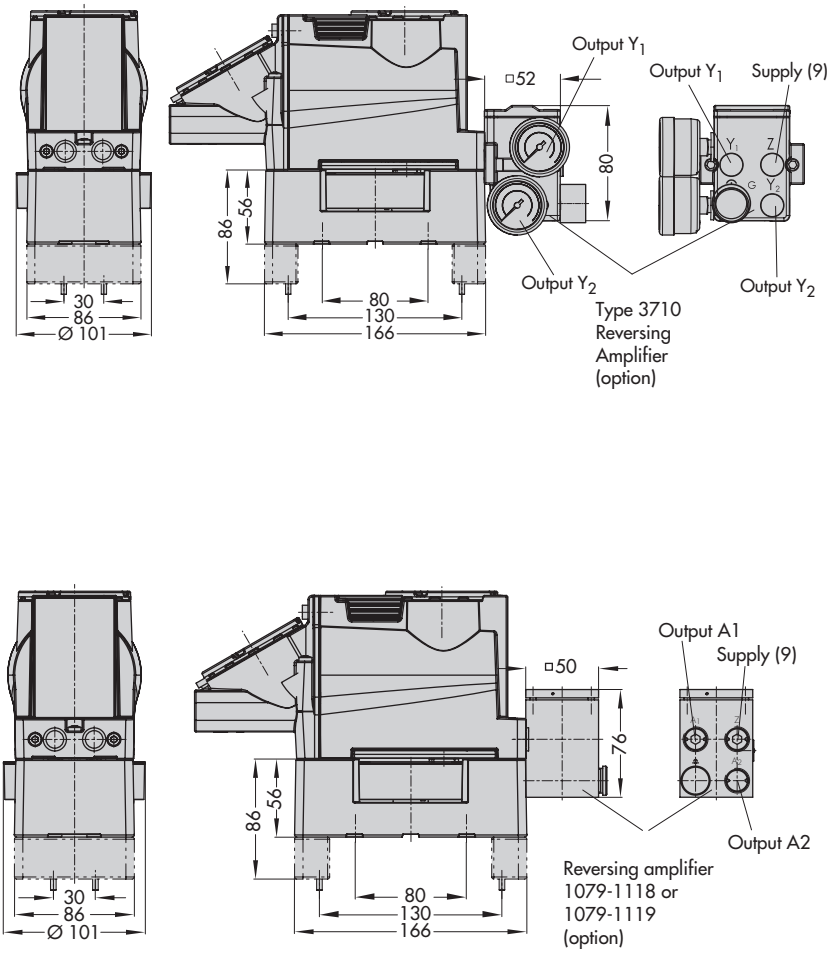


Fig. 15b · Attachment to rotary actuators (for all sizes of fixing level 2)

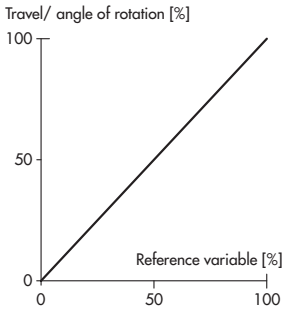
13 Appendix

13.1 Selecting the valve characteristic

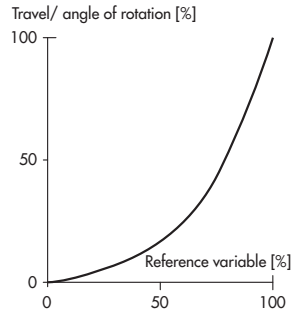
The characteristics that can be selected in Code **20** are shown in following **in graph form**.

Note: *A characteristic can only be defined (user-defined characteristic) using a workstation/ operating software (e.g. TROVIS-VIEW).*

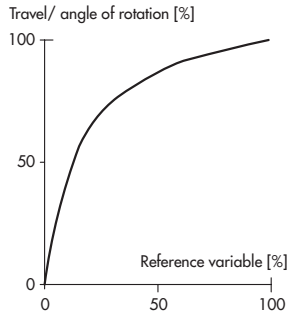
Linear (select characteristic: 0)



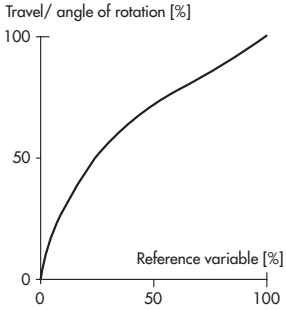
Equal percentage (select characteristic: 1)



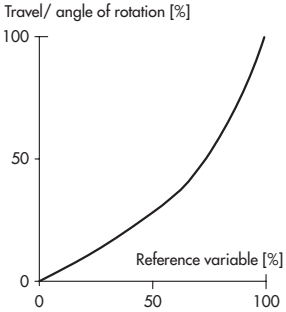
Rev. equal percentage (select characteristic: 2)



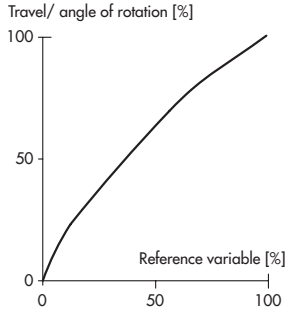
SAMSON butterfly valve linear
(select characteristic: 3)



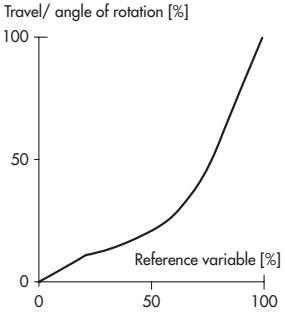
SAMSON butterfly valve equal percentage
(select characteristic: 4)



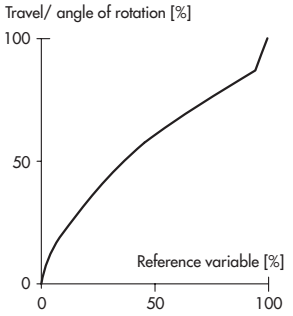
VETEC rotary plug valve linear
(select characteristic: 5)



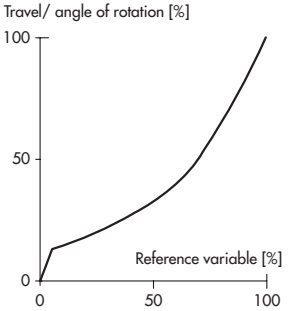
VETEC rotary plug valve equal percentage
(select characteristic: 6)



Segmented valve ball linear
(select characteristic: 7)



Segmented ball valve equal percentage
(select characteristic: 7)



Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

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

(3) EC Type Examination Certificate Number

PTB 05 ATEX 1058

(4) Equipment: Model 3731-321.Electropneumatic Positioner

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

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

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

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

The examination and test results are recorded in confidential report PTB Ex 05-13010.

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

EN 50014:1997+A1+A2 EN 50018: 2000 + A1 EN50019: 2000
EN 50281-1-1: 1998 + A1

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

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

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

II 2G EEx d IIC T6, T5 or T4 or EEx de IIC T6, T5 or T4

II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 19 July 2005
By order

(Signature) (Seal)

Dr. Ing. M. Thedens

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PTB

(13) **Schedule**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 05 ATEX 1058**

(15) **Description of Equipment**

The Model 3731-321 Electro pneumatic Positioner is a single- or double acting positioner with communication capability intended for attachment to any current linear or rotary actuator. The positioner compares the control signal of 4 to 20 mA from a control system with the travel of the control valve and supplies a pneumatic pressure signal. configuration and parameterization of the positioner are achieved by means of the HART protocol via the signal line for the 4 to 20 mA signal. Data transmission is achieved by a superposed frequency on the 4 to 20 mA signal lines.

Technical Data

Supply voltage:	10 to 35 V DC
Signal circuit:	4 to 20 mA
Power dissipation:	max. 7.5 W

(16) Test Report: **PTB Ex 05-13010**

(17) Special conditions for safe use

None

Additional notes on safe operation

Connection requirements for the terminal compartment version with type of protection "flameproof enclosure"

1. The Model 3731-321 Electro pneumatic Positioner shall be connected via suitable cable entries or conduit systems satisfying the requirements of En 50018 Clause 13.1 and 13.2 and for which a separate certificate has been issued.

2. Cable entries (Pg glands) and simple closing plugs must not be used.

3. Apertures not used shall be closed in compliance with En 50018 Class 11, 9.

4. The connecting cable of the Model 3731-321 Electro pneumatic Positioner shall be installed rigidly and in such a manner that it is protected adequately from mechanical damage.

5. If the temperature at the entry facilities exceeds 70 °C adequately temperature-resistance connecting leads shall be used.

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6. The model 3731-321 Electro pneumatic Positioner shall be included in the local equal-potential bonding system.

These notes shall be attached to each unit in a suitable form.

Ambient temperature

The Model 3731-321 Electro pneumatic Positioner is intended for use in.

temperature class T6 with ambient temperatures from –40 °C to + 60 °C
temperature class T5 with ambient temperatures from –40 °C to +70 °C
temperature class T4 with ambient temperatures from –40 °C to +80 °C

Pneumatic working medium

1. The maximum supply pressure is 6 bar.

2. The user of the apparatus shall ensure that the working medium cannot form an explosive atmosphere, i. e. only gases max be used that are free of substances the existence of which could result in an explosive atmosphere (non-combustible gases and no oxygen or gases enriched with oxygen).

(18) Basic Health and Safety Requirements

Satisfied by compliance with the standards specified above

Zertifizierungsstelle Explosionsschutz Braunschweig, 19 July 2005
By order

(Signature) (seal)

Dr. Ing. M. Theden

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Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.:

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 05 ATEX 1058

Equipment: Model 3731-.21 Electro pneumatic Positioner

Marking: Ex **II 2G EEx d IIC T6, T5 or T4, or**
EEx de IIC T6, T5 or T4
Ex **II 2D IP 65 or IP 66 T 80°C**

Manufacturer: SAMSON AG Mess- und Regeltechnik

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

Description of the additions and modifications

The model versions 3731-421(Profibus PA) and 3731-521 (FOÜNDATION Fieldbus) are also included in this Certificate.

The type of protection of the enclosure has been extended to include IP 66 in compliance with EN 60529.

Applicable standards

EN 50014: 1997 + A1 + A2
EN 60079-7 : 2003
EN 50018: 2000 + A1
EN 50281-1-1: 1998 + A1

Test report: **PTB Ex 06-1621**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 21 July 2006

(Signature) (Seal)

Dr. Ing. M. Thedens
Regierungsrat

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Physikalisch Technische Bundesanstalt - Bundesallee 100 -D - 38116 Braunschweig

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