

**Series 3730**  
**Electropneumatic Positioner**  
**Type 3730-4**



with PROFIBUS-PA communication



Fig. 1 · Type 3730-4

## **Mounting and Operating Instructions**

**EB 8384-4 EN (1300-1613)**

Firmware version **1.5x**

Edition July 2012



## Definitions of the signal words used in these instructions

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### **DANGER!**

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

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### **WARNING!**

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

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### **NOTICE**

*indicates a property damage message.*

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**Note:** *Supplementary explanations, information and tips*

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Revisions of the positioner firmware compared to the previous version – Control R	
Control R 1.43	<b>R 1.44</b>
	Internal revisions
	<b>R 1.45</b>
	Internal revisions
	<b>R 1.46</b>
	Internal revisions
	<b>R 1.52</b>
Diagnosis	All EXPERTplus diagnostic functions are available without having to activate them in the positioner (see EB 8389 EN on EXPERTplus Valve Diagnostics).
Codes 48 extended	The following subitems have been added to Code 48: h0: Activation/deactivation reference test h1: Reference test completed (YES/No) h3: Automatic reset of diagnosis after this time h4: Remaining time until diagnosis time See section 14.

Revisions to the communication firmware are listed in the Configuration Manual KH 8384-4 EN.

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**Note:**

- These Mounting and Operating Instructions **EB 8384-4 EN** are valid for positioners with firmware versions **R 1.52 to R 1.59**.  
The latest edition of these instructions, detailing the firmware version and modifications compared to the previous version, is available on the Internet at <http://www.samson.de>.
  - The functions of **EXPERTplus** valve diagnostics are described in the Mounting and Operating Instructions **EB 8389 EN**
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## Note concerning these Mounting and Operating Instructions

These instructions EB 8384-4 EN describe the mounting, start up and on-site operation of the Type 3730-4 Positioner.

You can find additional information on the enclosed CD-ROM (CD 8384-4) or on the Internet at <http://www.samson.de>.

The CD-ROM (CD 8384-4) contains further information on the Type 3730-4 Positioner:

### ► [Documentation]

- **KH 8384-4 EN:** Configuration Manual for Type 3730-4 Electropneumatic Positioner, configuration and operation over PROFIBUS-PA
- **T 8384-4 EN:** Data Sheet for Type 3730-4 Electropneumatic Positioner
- **EB 8389 EN:** Instructions for Series 373x Positioners; EXPERTplus Valve Diagnostics
- **T 8389 EN:** Data Sheet for EXPERT/EXPERTplus Valve Diagnostics
- **T 6661 EN:** Data Sheet for TROVIS-VIEW software

### ► [Approvals]

- |            |                   |
|------------|-------------------|
| – PTB/ATEX | – CERTUSP/INMETRO |
| – CSA      | – NEPSI           |
| – FM       | – GOST            |
| – IECEX    | – CCoE            |

### ► [Declarations of Conformity]

### ► [Integrations]

- Device Description data (GDD)
- DTM/PACTware™
- Siemens SIMATIC PDM

### ► [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.

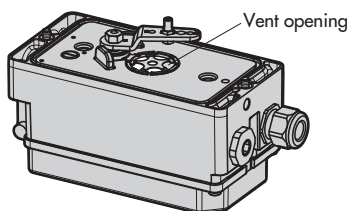
### 1 Important safety instructions

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

- ▶ The positioner is to be mounted, started up or operated only by trained and experienced personnel familiar with the product.  
According to these Mounting and Operating Instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- ▶ 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 11.
- ▶ 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, the supply pressure 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.
- ▶ Do not ground electric welding equipment near to the positioner.

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**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 CD-ROM (CD 8384-4).

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## 2 Article code

Positioner		Type 3730-4	x	x	x	0	x	0	x	0	x	0	0	x	0	x	x					
With LCD and autotune, PROFIBUS-PA																						
<b>Explosion protection</b>																						
Without		0																				
ATEX: II 2G Ex ia IIC T6, II 2D Ex tb IIIC T 80°C IP 66		1																				
FM/CSA:		3																				
Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A–G;																						
Class I, Div.2, Groups A–D; Class II, Div.2, Groups F, G/																						
Ex ia IIC T6; Class I, II, Div.1, Groups A–G;																						
Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A–G; Class II, Div.1, Groups E–D																						
ATEX: II 3G Ex nA II T6, II 3G Ex ic IIC T6, II 3D Ex ic IIIC T 80 °C IP 66		8																				
<b>Additional equipment</b>																						
Inductive limit switch	Without	0																				
	SJ2-SN	1																				
	SJ2-S1N	2																				
Solenoid valve	Without					0																
	With, 24 V DC					4																
External position sensor	Without							0														
	With					0		1		0			0									
Binary input	Without									0												
	Floating contact							0		1												
<b>Diagnostics</b>																						
EXPERTplus													4									
<b>Housing material</b>																						
Aluminum (standard)															0							
Stainless steel 1.4581								0							1							
<b>Special applications</b>																						
None																0						
Positioner compatible with paint																	1					
Vent connection with ¼-18 NPT thread, back of housing sealed						0	0		0	0							2					
<b>Special version</b>																						
None																0	0	0				
NEPSI: Ex ia IIC T6		1															0	0	9			
NEPSI: Ex nA II T6; Ex nL IIC T6		8																0	1	0		
IECEX: Ex ia IIC T6		1																	0	1	2	
GOST: 1Ex ia IIC T6		1																		0	1	4

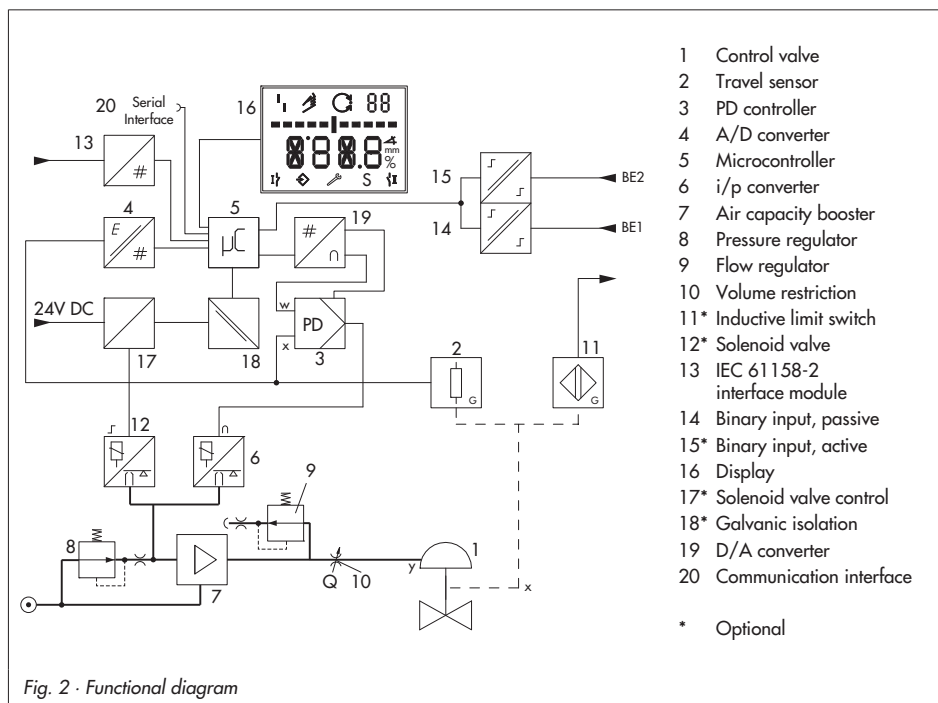
### 3 Design and principle of operation

The electropneumatic 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 pneumatic signal pressure (output variable  $y$ ) is produced.

The positioner consists of a travel sensor system proportional to resistance, an analog i/p converter with a downstream booster and the electronics unit with microcontroller.

When a deviation occurs, the actuator is pressurized or vented. If required, the changes in the signal pressure can be slowed down by a connectable Q restriction. The signal pressure supplied to the actuator can be limited by software or on site to 1.4, 2.4 or 3.7 bar.

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 case as well as to optimize the air capacity booster. The i/p module (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply air pressure.



*Fig. 2 · Functional diagram*

The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to the PROFIBUS-PA specification.

As a standard feature, the positioner comes with a binary input for DC voltage signals to signalize process information over the PROFIBUS-PA.

The extended EXPERTplus diagnostics are integrated into the positioner. They provide 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

### Solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the i/p module is vented to the atmosphere. 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.

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### NOTICE

*In manual mode (MAN), the manual set point is also reset to 0 %. A different manual set point must be entered again (Code 1).*

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### Inductive limit switch

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

### External position sensor

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve.

The connection of x and y signals to the valve is established by cable and piping for air (only without inductive limit switch).

### Binary contact

All positioners are fitted with a binary input for DC voltage signals over which process information can be issued over the PROFIBUS-PA network.

Another optional binary input is an active input powered by the positioner to connect a floating contact. Its switching condition can

also be issued over the PROFIBUS-PA network.

### 3.2 Communication

The positioner is completely controlled over the digital signal transmission implemented complying with PROFIBUS-PA Profile B as per DIN EN 50170 and DIN 19245 Part 4.

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.

Usually, the positioner settings are made on a computer which is connected to one or more positioners linked over a segment coupler to the PROFIBUS segment of the computer..

**The Configuration Manual KH 8384-4 EN contains a description on how to configure and operate the positioner over PROFIBUS-PA.**

#### 3.2.1 Configuration using TROVIS-VIEW software

The positioner can be configured using TROVIS-VIEW Configuration and Operator Interface software.

The positioner is equipped with an additional digital **SERIAL INTERFACE** to connect the RS-232 or USB port of the computer to the positioner over an adapter cable. The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

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**Note:** The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device.

The device-specific module for Type 3730-4 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW).

Additional information on TROVIS-VIEW (e.g. system requirements) can be found on the SAMSON website and in the Data Sheet T 6661 EN.

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### 3.3 Technical data

Type 3730-4 Positioner (technical data in test certificates additionally apply for explosion-protected devices)	
Rated travel, adjustable	Direct attachment to Type 3277: 3.6 to 30 mm Attachment acc. to IEC 60534-6: 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 $\frac{1}{5}$ at the maximum
Bus connection	Fieldbus interface acc. to IEC 61158-2 bus-powered Field device acc. to FISCO (Fieldbus Intrinsically Safe Concept)
Communication	
Fieldbus	Data transmission as in PROFIBUS-PA specification, acc. to IEC 61158 and IEC 61784
	Certified DTM acc. to FDT Specification 1.2 for integration of the device into suitable FDT framework applications · Other integrations, e.g. EDD in SIMATIC PDM
Local	Over SAMSON SSP interface and serial interface adapter
Software requirements	SAMSON TROVIS-VIEW with database module 3730-4
Permissible operating voltage	9 to 32 V DC, power supply over bus line The limits in the test certificate additionally apply for explosion-protected devices
Max. operating current	15 mA
Add. current in case of fault	0 mA
Supply air	Supply pressure from 1.4 to 7 bar (20 to 105 psi), Air quality acc. to ISO 8573-1 Edition 2001: 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, limitable to 1.4/2.4/3.7 bar $\pm 0.2$ bar via software
Characteristic	Linear/equal percentage/reverse equal percentage · User-defined (over operating software and communication) · Butterfly valve linear/equal percentage · Rotary plug valve linear/equal percentage · Segmented ball valve linear/equal percentage Deviation from terminal-based conformity $\leq 1\%$
Hysteresis	$\leq 0.3\%$
Sensitivity	$\leq 0.1\%$
Direction of action	Reversible
Air consumption	Independent from supply pressure approx. 110 l <sub>n</sub> /h
Air output capacity Actuator pressurized Actuator vented	At $\Delta p = 6$ bar: 8.5 m <sup>3</sup> /h, at $\Delta p = 1.4$ bar: 3.0 m <sup>3</sup> /h $K_{Vmax(20^\circ C)} = 0.09$ At $\Delta p = 6$ bar: 14.0 m <sup>3</sup> /h, at $\Delta p = 1.4$ bar: 4.5 m <sup>3</sup> /h $K_{Vmax(20^\circ C)} = 0.15$

Type 3730-4 Positioner (technical data in test certificates additionally apply for explosion-protected devices)	
Permissible ambient temperature	-20 to +80 °C for all versions -45 to +80 °C with metal cable gland -25 to +80 °C with inductive limit switch (SJ2-S1N) and metal cable gland The limits in test certificate additionally apply for explosion-protected devices.
Influences	Temperature ≤ 0.15 %/10 K
	Supply air None
	Vibration ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770
Electromagnetic compatibility	Complying with requirements of EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21
Explosion protection	ATEX Type 3730-41: II 2G Ex ia IIC T6, II 2D Ex tb IIIC T 80 °C IP 66 Type 3730-48: II 3G Ex nA IIC T6, II 3D Ex tc IIIC T 80 °C IP 66 FM Type 3730-43: Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A-G; Class I, Div.2, Groups A-D; Class II, Div.2, Groups F, G CSA Type 3730-43: Ex ia IIC T6; Class I, II, Div.1, Groups A-G; Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A-G; Class II, Div.1, Groups E-D NEPSI Type 3730-41xx0x0xx0x00x009: Ex ia IIC T6 Type 3730-48xx0x0xx0x00x010: Ex nA II T6; Ex nL IIC T6 IECEx Type 3730-41xx0x0xx0x00x012: Ex ia IIC T6 GOST Type 3730-41xx0x0xx1x00x014: 1Ex ia IIC T6
Electrical connection	One M20 x 1.5 cable gland, for 6 to 12 mm clamping range · Second additional threaded M20 x 1.5 hole · Screw terminals for 0.2 to 2.5 mm² wire cross-section
Degree of protection	IP 66/NEMA 4X
Implementation in safety-related systems in compliance with IEC 61508/SIL	Probability of failure on demand of safety functions PFD < $2.8 \times 10^{-7}$ for a confidence level of 95 %. The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99. The valves are therefore suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.
Binary input BE1	
Input	0 to 30 V DC reverse polarity protection, static destruction limit 40 V, current consumption 3.5 mA at 24 V, galvanically isolated
Signal	Signal "1" at $U_e > 5 \text{ V}$ · Signal "0" at $U_e < 3 \text{ V}$
Materials	
Housing	Die-cast aluminum EN AC-ALSi12(Fe) (EN AC-44300) acc. to DIN EN 1706; chromated and powder paint coated · Special version: stainless steel 1.4581
External parts	Stainless steel 1.4571 and 1.4301
Cable gland	Nickel-plated brass, M20x1.5
Weight	Approx. 1 kg

Options for Type 3730-4	
<b>Binary input BE2</b> for floating contact	
Switching input	$R < 100 \Omega$ , contact loadability 100 mA, static destruction limit 20 V / 5.8 mA, galvanically isolated
<b>Solenoid valve</b>	Approval acc. to IEC 61508/SIL
Input	24 V DC, reverse polarity protection, static destruction limit 40 V Current consumption $I = \frac{U - 5.7 \text{ V}}{3840 \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal "0" no pick-up	$\leq 15 \text{ V}$
Signal "1" safe pick-up	$> 19 \text{ V}$
Service life	$> 5 \times 10^6$ switching cycles
$K_v$ coefficient	0.15
Implementation in safety-related systems in compliance with IEC 61508/SIL	Same as positioner pneumatics
<b>Inductive limit switch</b>	For connection to switching amplifier acc. to EN 60947-5-6
SJ2-SN proximity switch	NAMUR NC contact
SJ2-S1N proximity switch	NAMUR NO contact
<b>External position sensor</b>	
Travel	Same as positioner
Cable	10 m with M12x1 connector, designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media
Perm. ambient temperature	$-60$ to $+105 \text{ }^\circ\text{C}$
Vibration immunity	Up to 10 g in the range between 10 and 2000 Hz
Degree of protection	IP 67

## 4 Attachment to the control valve – Mounting parts and accessories

- Observe the assignment between lever and pin position (see travel tables on page 17)!

### WARNING!

Mount the positioner, keeping the following sequence:

1. Remove protective film from pneumatic connections.
2. Mount the positioner on the control valve
3. Connect the supply air
4. Connect the electrical power
5. Perform the start-up settings

### 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 17 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is additionally restricted 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**).

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 39 to 41) to mount the positioner. Observe the type of attachment!

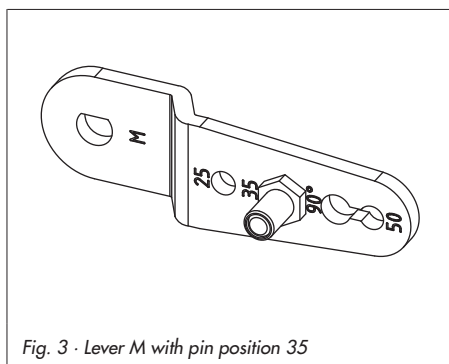


Fig. 3 · Lever M with pin position 35

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



## Travel 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 40).

### Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm <sup>2</sup> ]	Rated travel [mm]	Adjustment range at positioner			Required lever	Assigned pin position
		Min.	Travel	Max.		
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		Other valves/actuators			Required lever	Assigned pin position
Actuator size [cm <sup>2</sup> ]	Rated travel [mm]	min.	Travel	max.		
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				Required lever	Assigned pin position
Min.	Opening angle	Max.			
24	to	100°		M	90°

## 4.1 Direct attachment

### 4.1.1 Type 3277-5 Actuator

*Refer to Table 1 on page 39 for the required mounting parts as well as the accessories with their order numbers.*

*Note the travel table on page 17!*

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

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

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove vent plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, left) point-

ing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.

5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).

**7.5 mm travel:** Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.

6. Insert formed seal (15) in the groove of the positioner casing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 20).

The lever (1) must rest on the follower clamp with spring force.

Mount the positioner on the cover plate (10) using the two fixing screws. During the installation make sure that the seal ring (10.1) is inserted in the bore of the cover plate.

8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

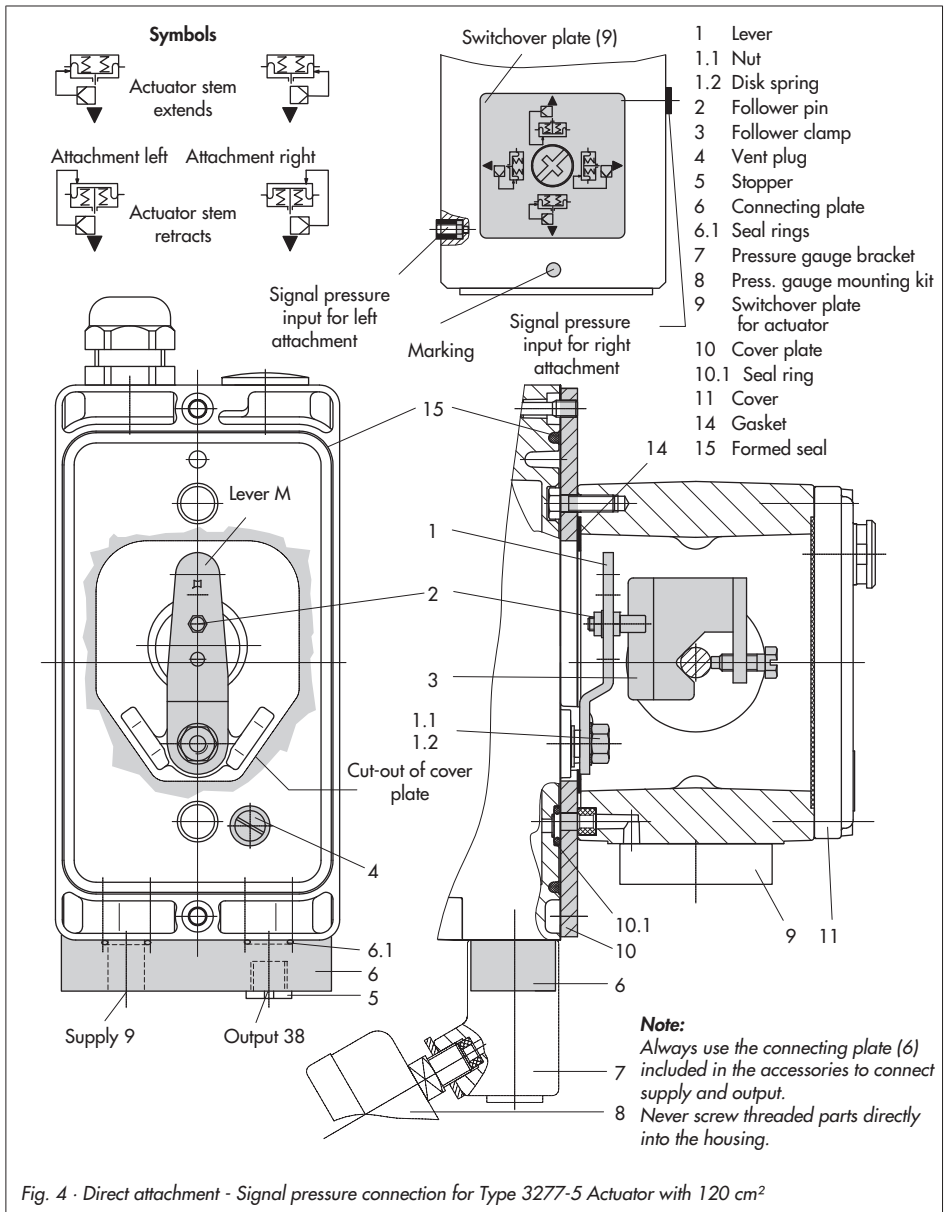


Fig. 4 · Direct attachment - Signal pressure connection for Type 3277-5 Actuator with 120 cm<sup>2</sup>

### 4.1.2 Type 3277 Actuator

*Refer to Table 2 on page 39 or the required mounting parts as well as the accessories with their order numbers.*

*Note the travel table on page 17!*

#### Actuators with 240 to 700 cm<sup>2</sup>

Mount the positioner on the yoke as shown in Fig. 5. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 355/700 cm<sup>2</sup>, remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.  
For actuators 240 and 350 cm<sup>2</sup> with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp
- (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 20). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

- |                  |  |
|------------------|--|
| 1 Lever          | 12 Connection block                            |
| 1.1 Nut          | 12.1 Screw                                     |
| 1.2 Disk spring  | 12.2 Stopper or connection for external piping |
| 2 Follower pin   | 13 Switch plate                                |
| 3 Follower clamp | 14 Gasket                                      |
| 10 Cover plate   | 15 Formed seal                                 |
| 11 Cover         | 16 Gasket                                      |
| 11.1 Vent plug   |  |

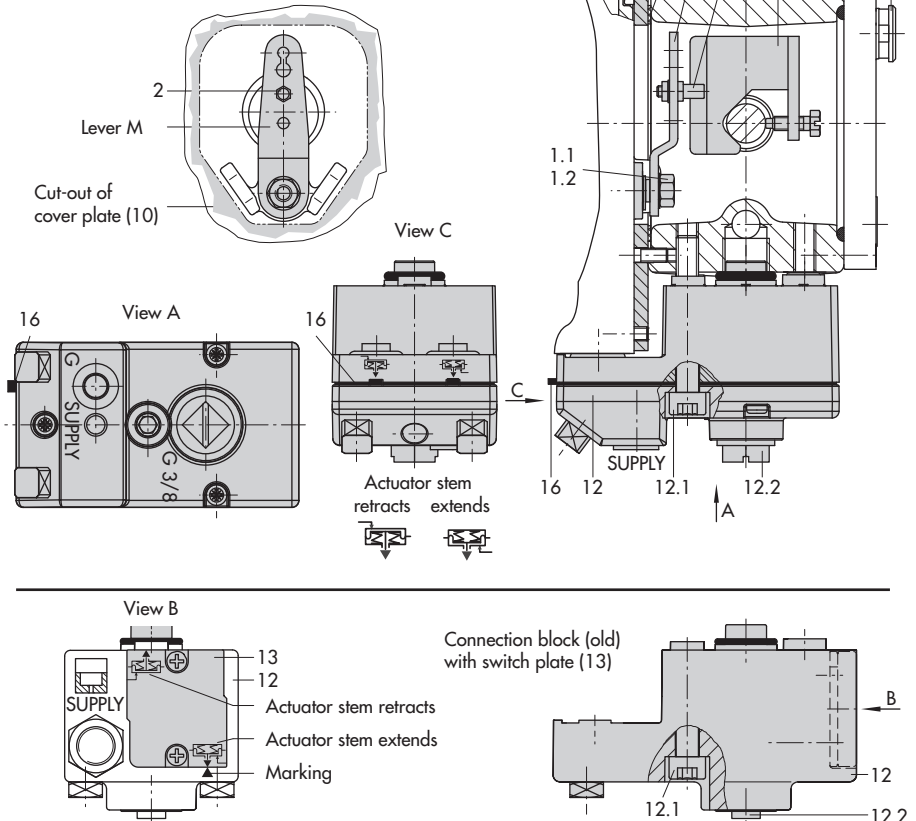


Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm<sup>2</sup>

## 4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 3 on page 40 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 19!

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

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

**Actuator size 2800 cm<sup>2</sup> and 1400 cm<sup>2</sup> (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) is centrally aligned with the NAMUR bracket at mid valve travel.

3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.

4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 19.

Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:

5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

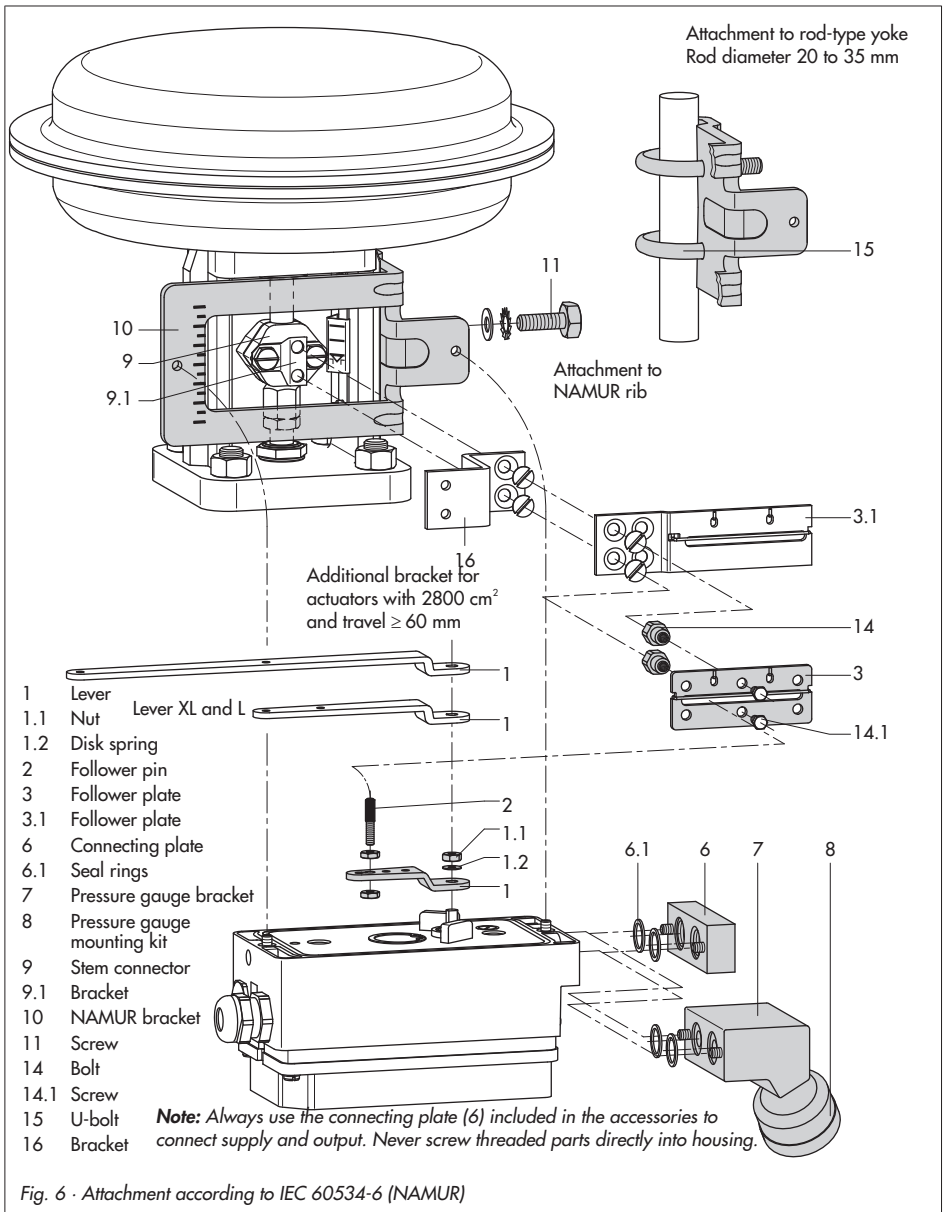
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**Note:** If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.

---

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

Screw the positioner to the NAMUR bracket using both its fixing screws.



### 4.3 Attachment to Type 3510 Micro-flow Valve

*Refer to Table 3 on page 40 for the required mounting parts as well as the accessories with their order numbers.*

*Note the travel table on page 19!*

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. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both seal rings (6.1) are seated properly.
4. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
5. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
6. Place lever **S** on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Move lever once all the way as far as it will go in both directions.

7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3). Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using both its screws.



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

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

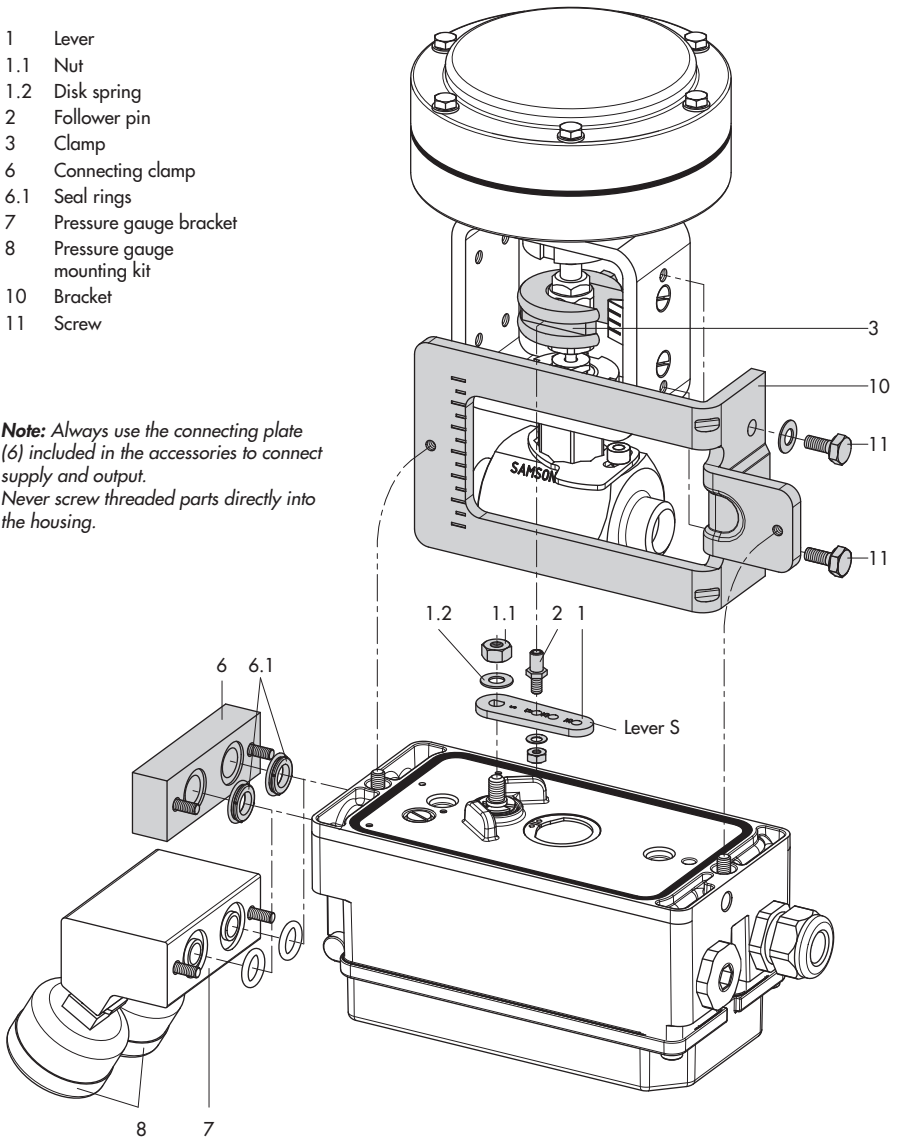


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

## 4.4 Attachment to rotary actuators

Refer to Table 4 on page 40 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 19!

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

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

**Note:** On attaching the positioner as described below, it is imperative that the actuator's direction of rotation is observed.

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 9 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both

O-rings are seated properly.

For **double-acting**, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator, see section 4.5.

6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin (Ø5) included in the mounting kit and screw tight into the bore for pin position **90°**.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (Fig. 9). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

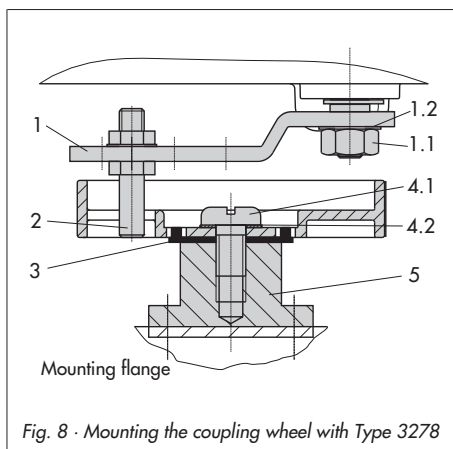
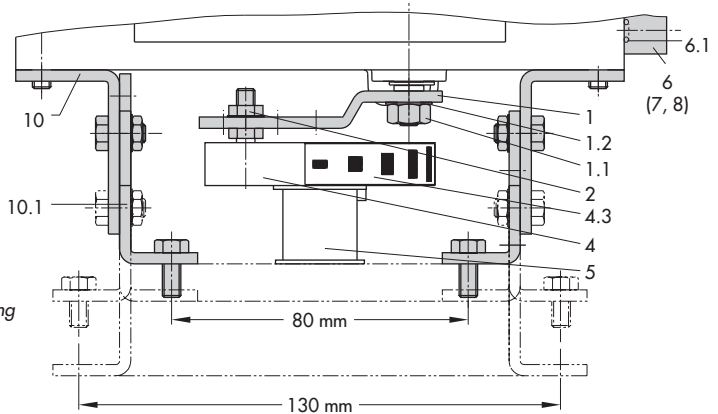


Fig. 8 · Mounting the coupling wheel with Type 3278

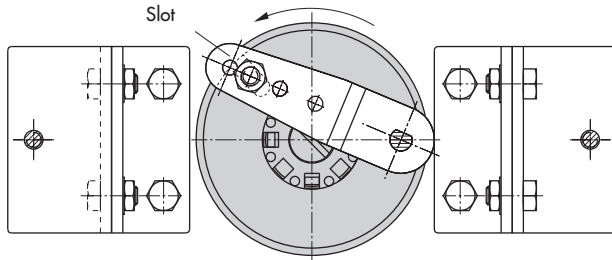
## Note:

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



## Legends Figs. 8 + 9

- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 3 Follower clamp (Fig. 8)
- 4 Coupling wheel
- 4.1 Screw
- 4.2 Disk spring
- 4.3 Scale plate
- 4.3 Scale plate
- 5 Actuator shaft  
Adapter for Type 3278
- 6.1 Seal rings
- 7 Pressure gauge bracket
- 8 Pressure gauge mounting kit
- 10 Top pair of brackets
- 10.1 Bottom pair of brackets



Control valve opens counterclockwise

Control valve opens clockwise

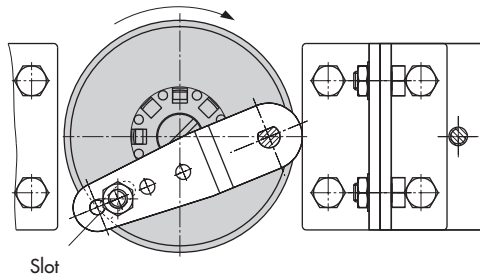


Fig. 9 · Attachment to rotary actuators

### 4.4.1 Heavy-duty version

Refer to Table 4 on page 40 for the required mounting parts as well as the accessories with their order numbers.

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 1/4 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 cm<sup>3</sup>, 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 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. 10).

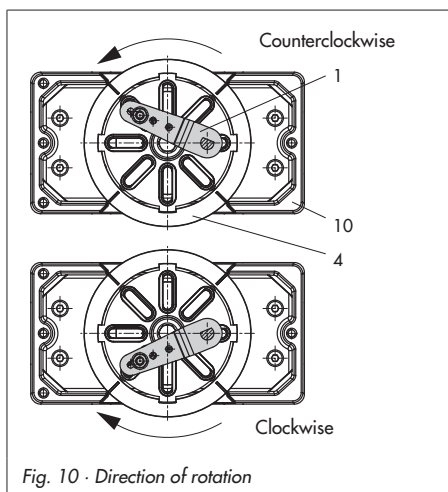


Fig. 10 · Direction of rotation

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

Fit screw-in restriction into signal pressure output for actuators with < 300 cm<sup>3</sup> volume

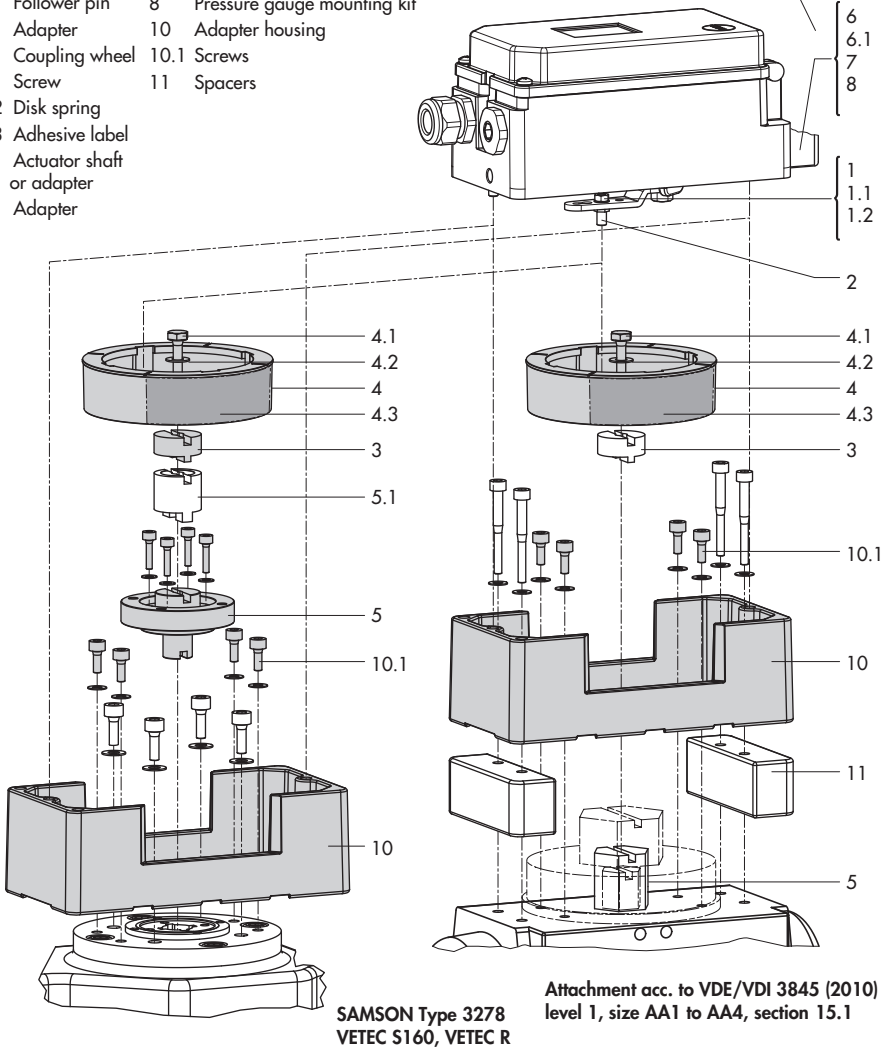


Fig. 11 · Attachment to rotary actuators (heavy-duty version)

## 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 **A1** of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at **A1**, is applied at output **A2**.

The rule **A1** + **A2** = **Z** applies.

#### Mounting

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes **A1** and **Z**.

4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes **A1** and **Z**.

#### NOTICE

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

*The rubber seal (1.4) is not required and can be removed when the sealing plug is used.*

#### Signal pressure connections

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

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

- Set slide switch on positioner to **AIR TO OPEN**.

6. After the initialization is completed, set Code 16 (Pressure limit) to **No**.

#### Pressure gauge attachment

The mounting sequence shown in Fig. 12 remains unchanged. Screw a pressure gauge bracket onto the connections **A1** and **Z**.

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

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

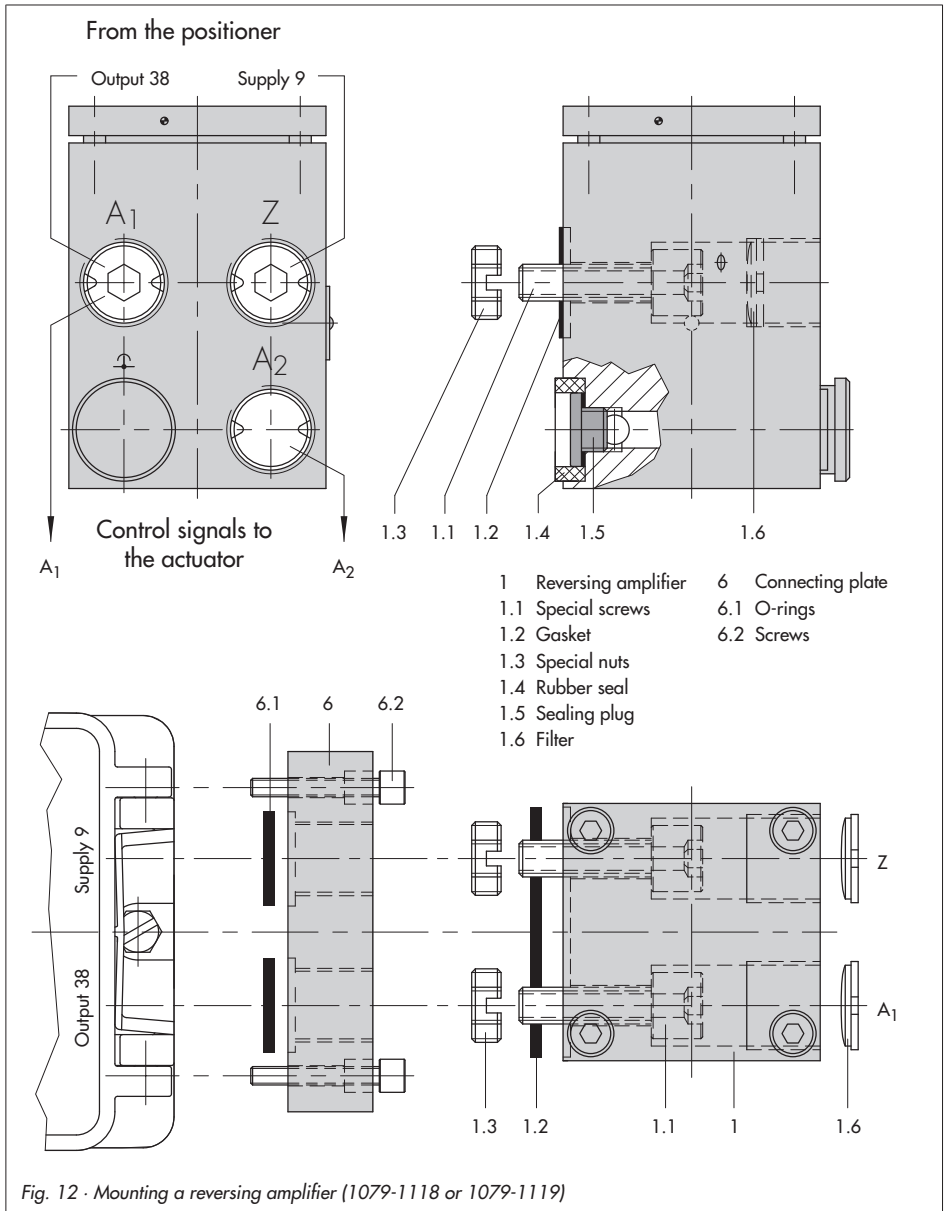


Fig. 12 · Mounting a reversing amplifier (1079-1118 or 1079-1119)

## 4.6 Attaching an external position sensor

Refer to Table 6 on page 41 for the mounting parts and accessories required.

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

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

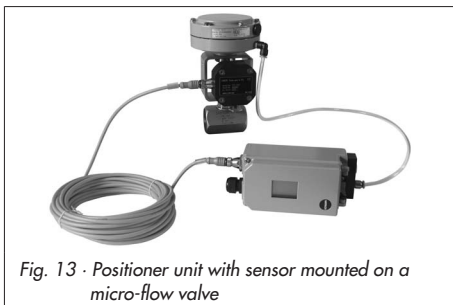


Fig. 13 · Positioner unit with sensor mounted on a micro-flow valve

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

**For the electrical connection** a 10 meter connecting lead with M12x1 connectors is included in the scope of delivery.

### Note:

- In addition, the instructions in sections 5.1 and 5.2 apply for the pneumatic and electrical connection.

Operation and setting are described in sections 7 and 8.

- Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. Refer to Table 6 on page 41.

### 4.6.1 Mounting the position sensor with direct attachment

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

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 14 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

- ▶ Turn the connecting plate (9) so that the correct symbol for the fail-safe position "Actuator stem extends" or "Actuator stem retracts" is aligned with the marking (Fig. 14, below).
- ▶ Make sure that the gasket for the connecting plate (9) is correctly inserted.
- ▶ The connecting plate has boreholes with NPT and G threads.  
Seal the threaded connection that is not used with the rubber seal and square plug.

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

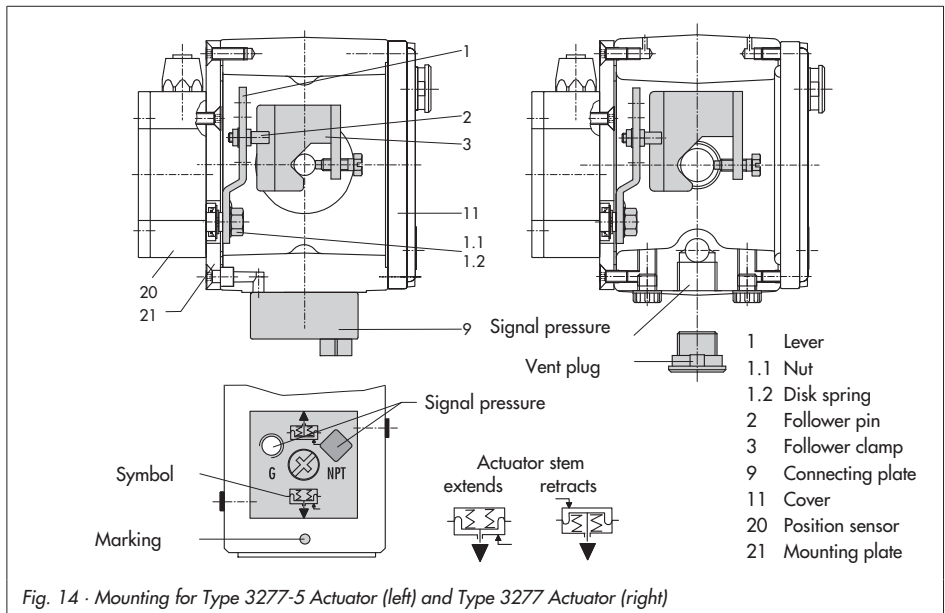
The signal pressure is routed to the connection at the side of the actuator yoke for the



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

### Mounting the position sensor

1. Place the lever (1) on the sensor in mid-position and hold it in place. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top



of the follower clamp (3). It must rest on it with spring force.

Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.

7. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

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

*For the required mounting parts and the accessories, refer to Table 6 on page 41.*

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

Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.

2. Screw the position sensor (20) onto the bracket (21).

The standard attached lever **M** with the follower pin (2) at position **35** is designed for 120, 240 and 350 cm<sup>2</sup> actuators with 15 mm rated travel.

For other actuator sizes or travels, select the lever and pin position from the travel table on page 19. Lever **L** and **XL** are included in the mounting kit.

3. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) in **mid-position** and **hold it in place**. Screw on the nut (1.1).
4. Screw both bolts (14) to the bracket (9.1) of the stem connector (9). Attach

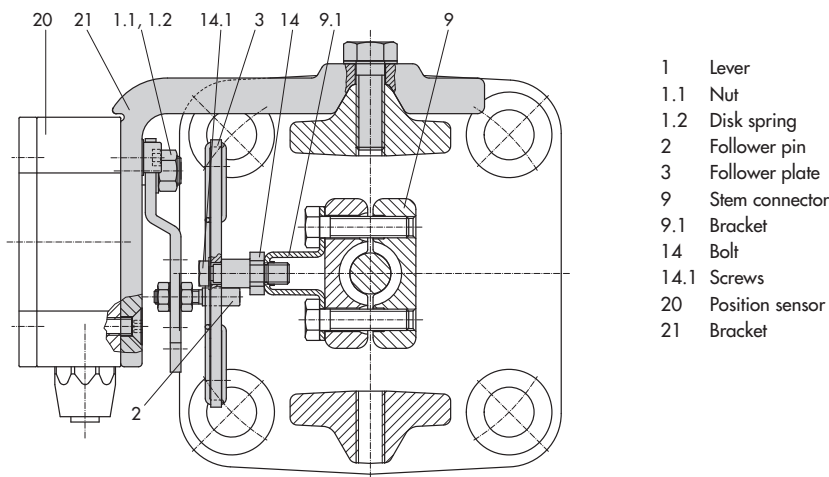


Fig. 15 · Mounting according to IEC 60534-6 (NAMUR)

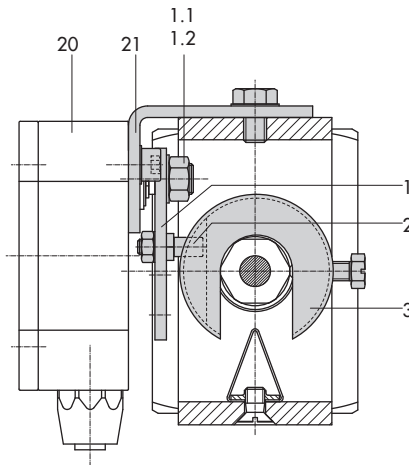
the follower plate (3) and fix with the screws (14.1).

5. Place the bracket with the sensor at the NAMUR rib in such a manner that the follower pin (2) rests in the slot of the follower plate (3), then screw the bracket using its fixing screws onto the valve.

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

For the required mounting parts and the accessories, refer to Table 6 on page 41.

1. Place the lever (1) in **mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the bracket (21).
3. Select the lever **S** (1) from the accessories and screw the follower pin (2) into the hole for pin position **17**. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) in mid-position and hold it in place. Screw on the nut (1.1).
4. Place the follower clamp (3) on the stem connector, align it at a right angle and screw tight.
5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).



- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 3 Follower clamp
- 20 Position sensor
- 21 Bracket

Fig. 16 · Mounting on a micro-flow valve

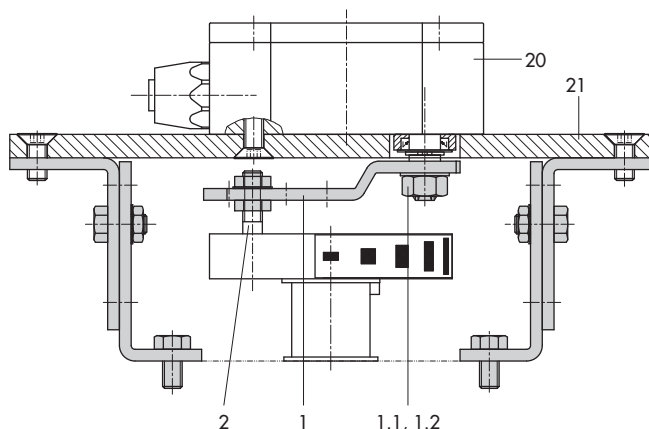
#### 4.6.4 Mounting the position sensor to rotary actuators

For the required mounting parts and the accessories, refer to Table 6 on page 41.

1. Place the lever (1) **in mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached lever **M** (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (Ø 5) from the accessories and screw it into the hole for pin position 90°.

4. Place the lever (1) and disk spring (1.2) on the sensor shaft.  
Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).

Follow the instructions describing attachment to the standard positioner in section 4.4. Instead of the positioner, attach the position sensor (20) with its mounting plate (21).



- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 20 Position sensor
- 21 Mounting plate

Fig. 17 · Positioner unit with sensor mounted on rotary actuators

## 4.7 Attaching positioners with stainless steel housings

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

**Note:** *The pneumatic connecting plate and a pressure gauge bracket made of stainless steel are available (order numbers listed below). The Type 3710 Pneumatic Reversing Amplifier is also available in stainless steel.*

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

The Tables 1 to 5 (pages 39 and 41) apply for attaching positioners with stainless steel housings with the following restrictions:

### Direct attachment

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

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

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

### Attachment to rotary actuators

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

## 4.8 Air purging function for single-acting actuators

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

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

The air purging function is automatically provided.

### Direct attachment to Type 3277, 240 to 700 cm<sup>2</sup>

FA: Remove the stopper 12.2 (Fig. 5 on page 21) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

### NOTICE

*The method described does not apply to old connection blocks in powder-paint-coated aluminum. In this case, follow the instructions for attachment described below in "Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators".*

FE: The air purging function is automatically provided.

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

The positioner requires an additional port for the exhaust air that can be connected

over piping. An adapter available as an accessory is used for this purpose:

Threaded bushing G $\frac{1}{4}$	0310-2619
(M20 x 1.5): $\frac{1}{4}$ NPT	0310-2550

---

### NOTICE

*The adapter uses one of the M20 x 1.5 connections in the housing which means **just one** cable gland can be installed.*

---

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve (e.g. check valve G  $\frac{1}{4}$ , order no. 8502-0597) mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.

## 4.9 Mounting parts and accessories

Table 1 · Direct attachment to Type 3277-5 Actuator (Fig. 4)			Order no.
Mounting parts	Mounting parts for actuators 120 cm <sup>2</sup> or smaller		1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx. <b>00</b> (old)		1400-6819
	Switchover plate <b>new</b> for Actuator Type 3277-5xxxxxx. <b>01</b> (new) <sup>1)</sup>		1400-6822
	Connecting plate <b>new</b> for Actuator Type 3277-5xxxxxx. <b>01</b> (new) <sup>1)</sup> ; G ¼ and ¼ NPT		1400-6823
	Connecting plate <b>old</b> for Actuator Type 3277-5xxxxxx. <b>00</b> (old); G ¼		1400-6820
	Connecting plate <b>old</b> for Actuator Type 3277-5xxxxxx. <b>00</b> (old); ¼ NPT		1400-6821
Accessories for the positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	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. steel/brass	1400-6950
		St. steel/St. st.	1400-6951

<sup>1)</sup> 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 Actuator (Fig. 5)				Order no.
Mounting parts	Attachment to actuators with 240, 350, 355, 700 cm <sup>2</sup>			1400-7453
Accessories	Required piping with screw fittings – for "Actuator stem retracts" – when the top diaphragm chamber is filled with air	240 cm <sup>2</sup>	Steel	1400-6444
			Stainless steel	1400-6445
		350 cm <sup>2</sup>	Steel	1400-6446
			Stainless steel	1400-6447
		355 cm <sup>2</sup> / 700 cm <sup>2</sup>	Steel	1400-6448
			Stainless steel	1400-6449
	Connection block with seals and screw	G ¼		1400-8819
		¼ NPT		1400-8820
	Pressure gauge mounting kit up to max. 6 bar (output and supply)	St. steel/brass		1400-6950
		St. steel/st. steel		1400-6951

Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 7)			
Travel in mm	Lever	For actuators	Order no.
7.5	S	Type 3271-5 with 60/120 cm <sup>2</sup> on Type 3510 Valve (Fig. 7)	1400-7457
5 to 50	M <sup>1)</sup>	Actuators from other manufacturers and Type 3271 with 120 to 700 cm <sup>2</sup>	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 cm <sup>2</sup> with 120 mm travel	1400-7456
30 or 60	L	Type 3271, versions 1400-120 and 2800 cm <sup>2</sup> with 30/60 mm travel	1400-7466
		Mounting bracket for Emerson and Masoneilan linear actuators In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.	1400-6771
		Valtek Type 25/50	1400-9554
Accessories	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. st.	1400-6951

<sup>1)</sup> Lever M is mounted on basic device (included in the scope of delivery)

<b>Table 4 · Attachment to rotary actuators (Figs. 8 and 9)</b>				Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845 (September 2010), refer to section 15.1 for details			
	Actuator surface corresponds to level 1			
	Size AA1 to AA4, version with CrNiMo steel bracket			1400-7448
	Size AA1 to AA4, heavy-duty version			1400-9244
	Heavy-duty version (e.g. Air Torque 10 000)			1400-9542
	Bracket surface corresponds to level 2, heavy-duty version			1400-9526
	Attachment for SAMSON Type 3278 with 160/320 cm <sup>2</sup> , CrNiMo steel bracket			1400-7614
Accessories	Attachment for SAMSON Type 3278 with 160 cm <sup>2</sup> and for VETEC Type S160, Type R and Type M, heavy-duty version			1400-9245
	Attachment for SAMSON Type 3278 with 320 cm <sup>2</sup> and for VETEC Type S320, heavy-duty version			1400-5891 and 1400-9526
	Attachment to Camflex II			1400-9120
	Connecting plate (6)	G ¼		1400-7461
		¼ NPT		1400-7462
	Pressure gauge bracket (7)	G ¼		1400-7458
		¼ NPT		1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass		1400-6950
		St. steel/st. steel		1400-6951



**Table 5 · General accessories**

Accessories	Pneumatic reversing amplifier for double-acting actuators		Type 3710
	Cable gland M20 x 1.5, nickel-plated brass		1890-4875
	EMC cable gland M20 x 1.5		8808-0143
	Adapter M20 x 1.5 to ½ NPT, aluminum		0310-2149
	Retrofit kit for inductive limit switch 1x SJ 2-SN		1400-7460
	List of parameters and operating instructions inside cover	German/English (std)	1990-5328
	TROVIS-VIEW with device module, see section		
	Serial interface adapter (SAMSON SSP interface - RS-232 port on computer)		1400-7700
	Isolated USB interface adapter (SAMSON SSP interface - USB port on computer) including TROVIS-VIEW CD-ROM		1400-9740

**Table 6 · Attachment of external position sensor**

			Order no.
Template for mounting position sensor on older mounting parts. See note on page 32.			1060-0784
Direct attachment	Mounting parts for actuators with 120 cm <sup>2</sup> see Fig. 14 left		1400-7472
	Connecting plate (9, old) for Actuator Type 3277-5xxxxxx.00	G ¼	1400-6820
		¼ NPT	1400-6821
	Connecting plate (new) for Actuator Type 3277-5xxxxxx.01 (new) <sup>1)</sup>		1400-6823
	Mounting parts for actuators with 240, 350, 355 and 700 cm <sup>2</sup> , see Fig. 14 right		1400-7471
NAMUR attachmt.	Mounting parts for attachment to NAMUR rib w. lever L and XL, see Fig. 15		1400-7468
Micro-flow valve	Mounting parts for Type 3510 Micro-flow Valve, see Fig. 16		1400-7469
Attachment to rotary actuators	VDI/VDE 3845 (September 2010), refer to section 15.1 for details		
	Actuator surface corresponds to level 1		
	Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 17		1400-7473
	Size AA1 to AA4, heavy-duty version		1400-9384
	Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-9992
	Bracket surface corresponds to level 2, heavy-duty version		1400-9974
	SAMSON Type 3278 with 160 cm <sup>2</sup> (also for VETEC Type S160 and Type R), heavy-duty version		1400-9385
Accessories for positioner	Connecting plate (6)		
		G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951
	Bracket to mount the positioner on a wall <b>Note:</b> The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site.		0309-0111

<sup>1)</sup> Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

## 5 Connections

### WARNING!

Mount the positioner, keeping the following sequence:

1. Remove protective film from pneumatic connections.
2. Mount the positioner on the control valve
3. **Connect the supply air**
4. **Connect the electrical power**
5. Perform the start-up settings

The connection of the electrical auxiliary 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

#### NOTICE

Follow the instructions below to avoid damaging the positioner.

- The threaded connections in the positioner housing are not designed direct air connection!
- The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories.  
The air connections are optionally designed as a bore with  $\frac{1}{4}$  NPT or G  $\frac{1}{4}$  thread.  
The customary fittings for metal and copper pipes or plastic hoses can be used.
- 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 air pressure depends on the bench range and the actuator's operating direction (fail-safe action).

The bench range is registered on the nameplate either as spring range or signal pressure range 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  $p_{st_{max}}$  is roughly estimated as follows:

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

$d$  = Seat diameter [cm]

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

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

**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, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.

**NOTICE**

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

## Selecting cables and wires:

*To install and select cables and wires as well as to run several intrinsically safe circuits in one multi-core cable, observe the installation regulations valid in the country of use. The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferules.*

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

*Seal cable entries left unused with plugs.*

*Devices used at ambient temperatures below  $-20\text{ }^{\circ}\text{C}$  must be fitted with metal cable glands.*

## Equipment for use in zone 2/zone 22

*In equipment operated with type of protection EEx nA II (non-sparking equipment) Ex nL (energy-limited equipment), circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.*

*Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) may be switched under normal operating conditions.*

***The maximum permissible values specified in the national explosion protection certificates also apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.***

## Cable entries

The cable entry with M20 x 1.5 cable gland, 6 to 12 mm clamping range.

There is a second M20 x 1.5 threaded bore in the housing that can be used for additional connection, when required.

The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm<sup>2</sup>. Tighten by at least 0.5 Nm.

---

**Note:** The power supply for the positioner can be supplied 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.**

---

## Bus line

Route the two-wire bus line to the screw terminals marked "IEC 1158-2", whereby no polarity has to be observed.

Refer to the PROFIBUS-PA User + Installation Guide (PNO document 2.092) for more information.

## NOTICE

*To connect the limit switch, binary inputs, and forced venting, an additional cable gland that needs to be fitted in place of the existing blanking plug is necessary.*

*Open cable glands are not permissible as the degree of protection IP 66 only applies when the positioner housing is sealed.*

---

## Limit switch

For operation of the limit switches, switching amplifiers have to be connected in the output circuit. Their function is to control the limit values of the control circuit according to EN 60947-5-6, thus ensuring operational reliability of the positioner. If the positioner is installed in hazardous areas, the relevant regulations must be observed.

## Binary input BE1

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

## Binary input BE2

A passive, floating contact can be operated at binary input 2.

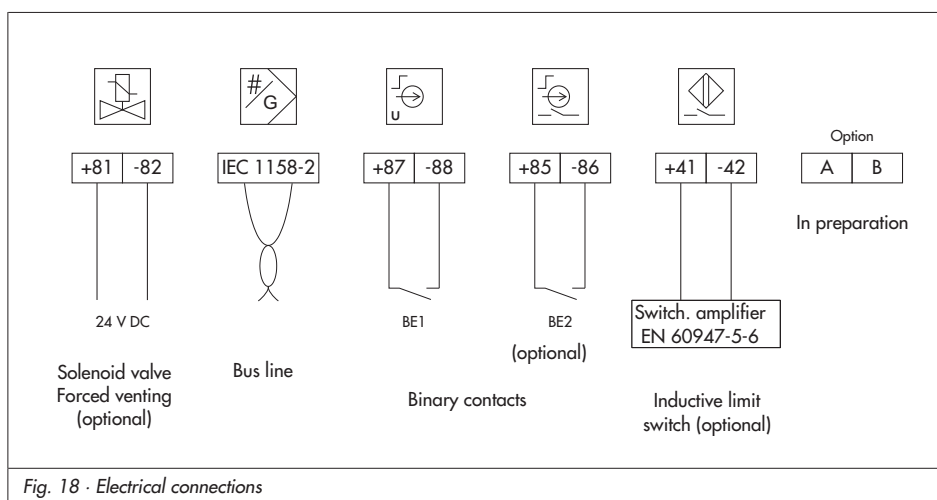
The positioner can report the switching state over the bus protocol.

## Solenoid valve (forced venting function)

For positioners fitted with the optional solenoid valve for the forced venting function, a voltage of 24 V DC must be connected to the relevant terminals +81 and -82.

### NOTICE

*If there is no voltage connected for the solenoid valve at terminals +81 and -82 or when the voltage signal is interrupted, the positioner vents the actuator and does not respond to the reference variable. Observe the switching thresholds specified in the technical data.*



### **5.2.1 Establishing communication**

The communication structure between the controller, logic solvers (PLC) or automation system, or between a PC or work station and the positioner(s) is implemented by a segment coupler (see Fig. 19) conforming to PROFIBUS directives.

Explosion-protected versions of PROFIBUS-PA segment couplers must be used in hazardous areas.

A maximum of 32 positioners may be operated in parallel over a segment coupler in one PROFIBUS-PA segment. In hazardous areas, the number of positioners that can be connected is reduced.

Each positioner connected in the segment must be assigned a unique bus address between 0 and 125 (refer to section 7.10).

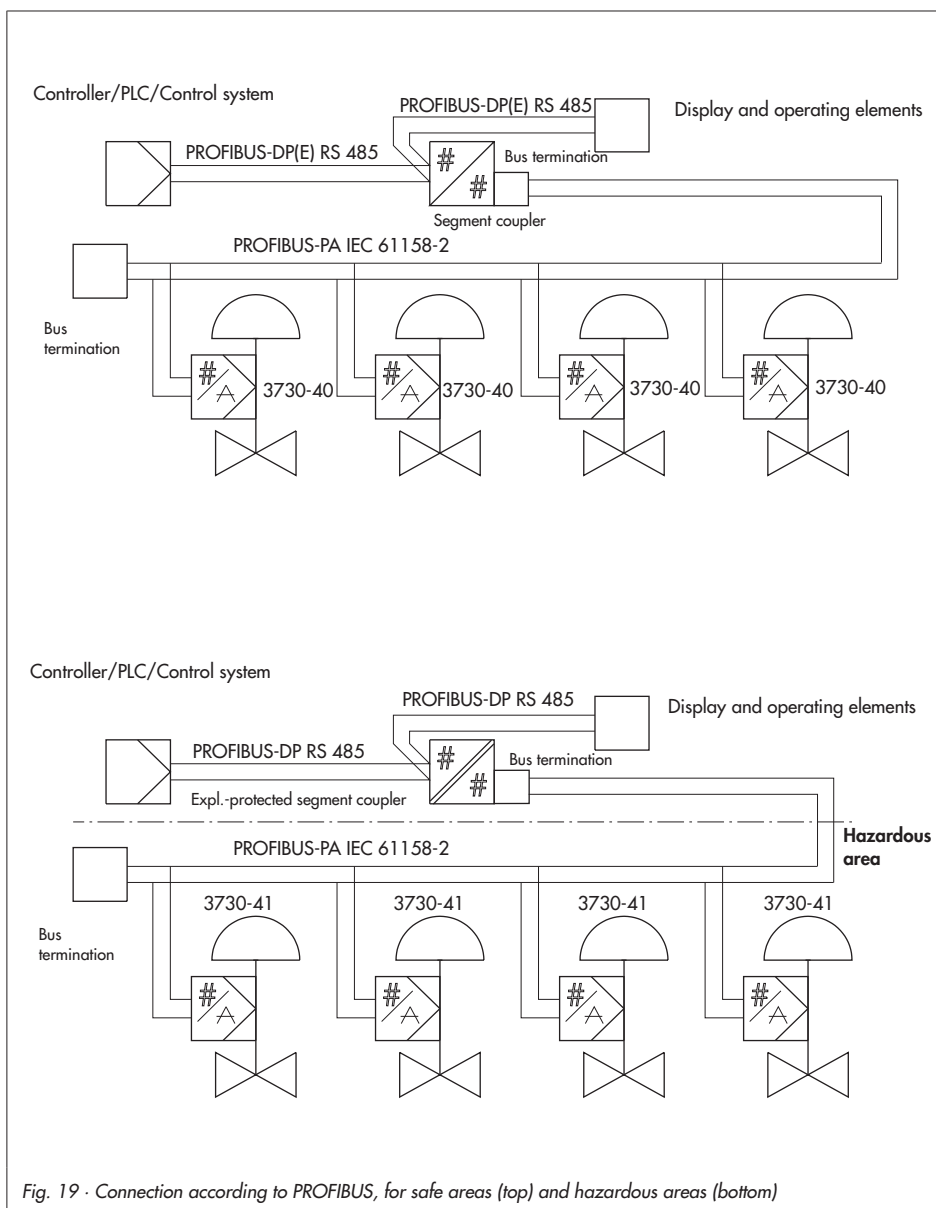


Fig. 19 · Connection according to PROFIBUS, for safe areas (top) and hazardous areas (bottom)


## 6 Operator controls and readings

### Rotary pushbutton

The rotary pushbutton is 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.

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

- ▶ AIR TO OPEN applies when the increasing signal pressure opens the valve
- ▶ AIR TO CLOSE applies when the increasing signal pressure closes the valve

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

For positioners with an attached reversing amplifier for double-acting rotary actuators (section 4.5): switch position AIR TO OPEN.

### Volume restriction Q

The volume restriction is used to adapt the air delivery to the actuator size. Two fixed settings are possible depending on how the air is routed at the actuator:

- ▶ For actuators smaller than 240 cm<sup>2</sup> with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
- ▶ For a connection at the back (Type 3277-5), set restriction to MIN BACK.
- ▶ For actuators 240 cm<sup>2</sup> and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

### Readings on display

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

#### Operating modes:

- ✎ Manual mode (section 8.2.1) blinking: not initialized
- ⌚ Automatic mode (section 8.2.1) blinking: emergency mode (see page 86)
- S SAFE (section 8.2.2) blinking: valve moved to fail-safe position by SET\_FAIL\_SAFE\_POS parameter or due to invalid set point (see KH 8384-4 EN)
- ✎ and ⌚ : AO Transducer Block is in MAN mode

#### Bar elements:

In ✎ manual and ⌚ automatic 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 blinks 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 alarms

■ : Maintenance alarm

🔧 : Maintenance required/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" and "Maintenance alarm" (see section 8.3).



► **Configuration enabled**

This indicates that the codes marked with an asterisk (\*) in the code list (section 14)

are enabled for configuration (see section 8.1).

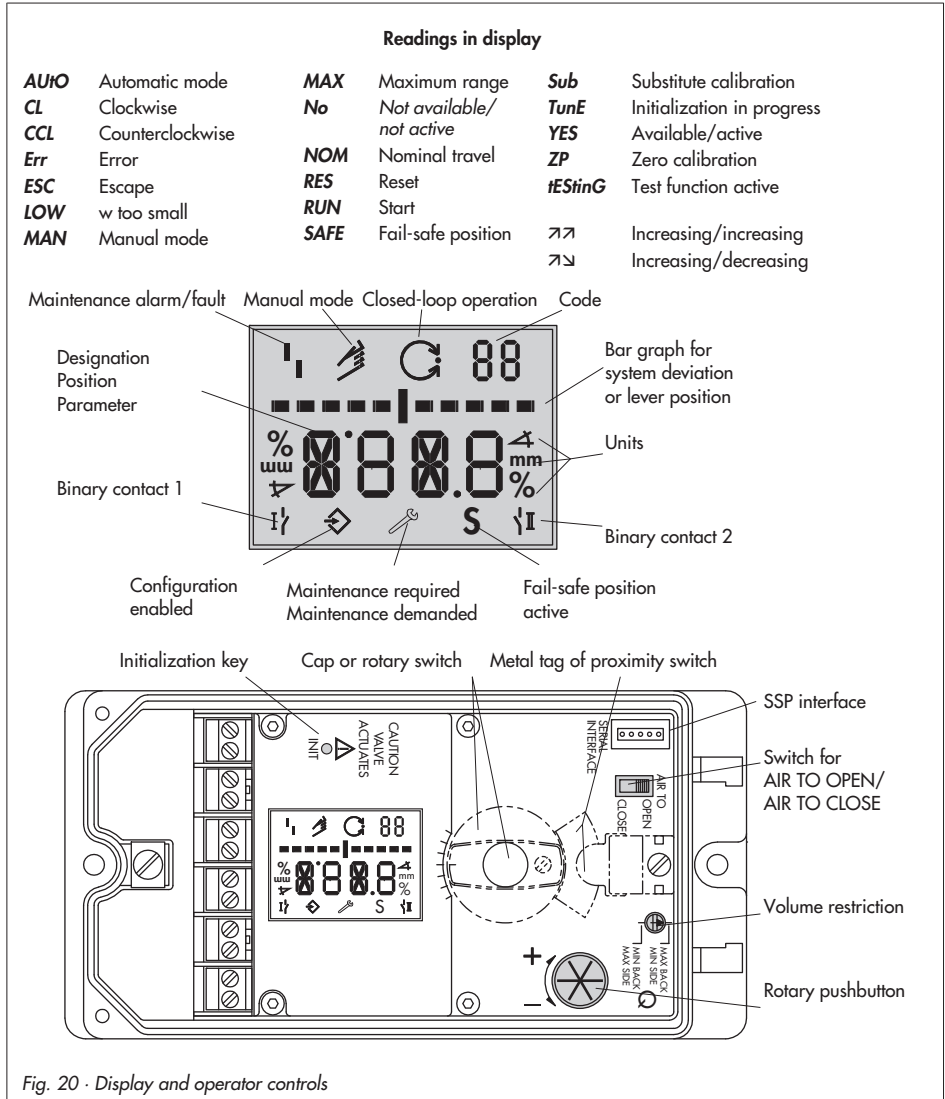


Fig. 20 · Display and operator controls

## 7 Start-up – Settings

### WARNING!

Mount the positioner, keeping the following sequence:

1. Remove protective film from pneumatic connections.
2. Mount the positioner on the control valve
3. Connect the supply air
4. Connect the electrical power
5. **Perform the start-up settings**

### Reading on display after connecting the electrical auxiliary power:

- ▶ **iEStinG** 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

- ▶ If 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 7.6).*

**Note:** *The positioner performs a test in the start-up phase while following its automation task at the same time. During the start-up phase, operation on site is unrestricted, yet write access is limited.*

## 7.1 Defining the valve closed position

To adapt the positioner to the operating direction of the actuator, set slide switch to **AIR TO OPEN** or **AIR TO CLOSE**.

- ▶ **AIR TO OPEN** = Signal pressure opens the valve, for fail-safe position: actuator stem extends/fail close
- ▶ **AIR TO CLOSE** = Signal pressure closes the valve, for fail-safe position: actuator stem retracts/fail open.

### NOTICE

*The **AIR TO OPEN (A+O)** setting always applies to double-acting actuators.*

### For checking purposes:

After successfully completing initialization, the positioner display should read 0 % when the valve is closed and 100 % when the valve is open. If this is not the case, change the slide switch position and re-initialize the positioner.

**Note:** The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.  
The positioner only needs to be initialized again after the fail-safe action of the actuator has been changed.

7.2 Setting the volume restriction Q

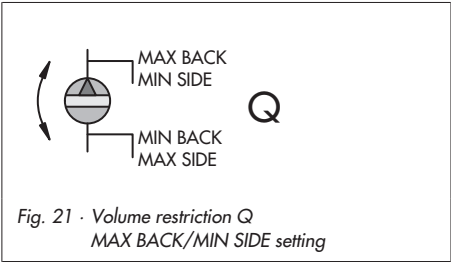


Fig. 21 · Volume restriction Q  
MAX BACK/MIN SIDE setting

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

- ▶ Actuators with a **transit time < 1 s**, e.g. linear actuators with an effective area smaller than 240 cm<sup>2</sup>, require a restricted air flow rate (MIN).
- ▶ Actuators with a **transit time ≥ 1 s** do not require the air flow rate to be restricted (MAX).

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

- ▶ The “SIDE” position applies for actuators with a loading pressure connection at the side, e.g. Type 3271-5.

- ▶ The “BACK” position applies for actuators with a loading pressure connection at the back, e.g. in Type 3277-5.
- ▶ The “SIDE” restriction position always applies for actuators from other manufacturers.

Overview · Position of volume restriction Q\*

Signal pressure \ Transit time	< 1 s	≥ 1 s
Connection at the side	MIN SIDE	MAX SIDE
Connection at the back	MIN BACK	MAX BACK

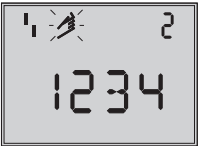
\* Intermediate positions are not permitted.

NOTICE

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

7.3 Adapting the display

The data representation on the positioner display can be turned by 180° to adapt it to how the positioner is mounted.



Reading direction for right attachment of pneumatic connections




Reading direction for left attachment of pneumatic connections

If the displayed data appear upside down, proceed as follows:

Turn  → Code **2**

Press  → Code **2** blinks.

Turn  → Required direction

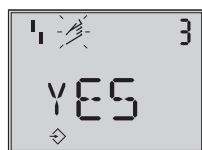
Press  to confirm reading direction.

## 7.4 Limiting the signal pressure

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

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: **No**

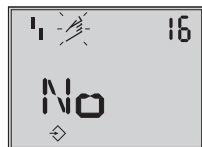
Turn  → Code **3**, display: **No**

Press  → Code **3** blinks.


Turn  → **YES**

Press  → display 


### Limiting the signal pressure:




Pressure limit  
Default: **No**


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 setting.


## 7.5 Checking the operating range of the positioner

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

### Selecting manual operating mode:





Operating mode  
Default **MAN**

Turn  → Code **0**

Press  → Code **0** blinks.

Turn  → **MAN**

Press . The positioner changes to the  manual operating mode.


### Checking the operating range:



Manual reference variable  
w (current angle of rotation  
is indicated)

Turn  → Code **1**

Press  → Code **1** and  blink.

Turn  until the pressure in the positioner builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked.

The angle of rotation on the back of the positioner is indicated. 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.

Exit Code **1** 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.*

## 7.6 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**

*After the positioner has been mounted on to another actuator or its mounting location has been changed and prior to re-initializing the positioner, the positioner needs to be reset to its basic setting (default values). Refer to section 7.8.*

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

- **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 7.6.1)

- ▶ **NOM nominal range**  
Initialization mode for all globe valves (see section 7.6.2)
- ▶ **MAN manually selected range**  
Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)
- ▶ **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 7.6.4)

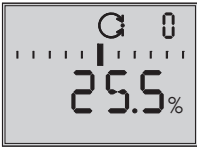
**Note:** For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve and defining the valve closed position and setting the volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.8).



Alternating displays  
Initialization running  
Symbol depending on initialization mode selected



Bar graph display  
indicating the progress of  
the initialization



Initialization successful,  
positioner in automatic  
operating mode

The time required for an initialization process depends on the transit time of the actuator and take several minutes. After a successful initialization, the positioner runs in closed-loop operation indicated by . A malfunctioning leads to the process being canceled. The initialization error appears on the display according to how it has been classified by the condensed state. See section 8.3.

**Note:** When **Code 48 - h0** = YES, the diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed.

**tESt d1** or **tESt d2** appear on the display in an alternating sequence.  
An error during the plotting of the reference graphs is indicated on the display over **Code 48 - h1** and **Code 81**.  
The positioner still works properly, even though the reference graph plotting has not been completed successfully.

### Valve closed position AIR TO CLOSE

If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing () on successful completion of initialization.

This results in the following assignment between reference variable and valve position:

Valve closed position	Direction of action	Reference variable Valve Closed at Open at	
AIR TO OPEN		0 %	100 %
AIR TO CLOSE		100 %	0 %

The tight-closing function is activated.

### NOTICE

Set Code **15** (final position w>) to 99 % for three-way valves.

### Canceling an initialization process

The initialization procedure can be canceled while running by pressing the rotary pushbutton (⊗). **STOP** appears three seconds long and the positioner then changes to the fail-safe position (SAFE).

Exit the fail-safe position again over Code **0** (see section 8.2.2).

## 7.6.1 MAX – Initialization based on 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.



Default **No**

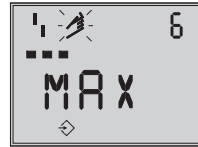
Turn ⊗ → Code **3**, display: **No**

Press ⊗ → Code **3** blinks

Turn ⊗ → **YES**

Press ⊗, display ⊡

### Select the initialization mode:



Initialization mode  
Default **MAX**

Turn ⊗ → Code **6**

Press ⊗

Turn ⊗ → **MAX**

Press ⊗ to confirm the **MAX** as the initialization mode.

### Start initialization:

► Press INIT key to start initialization!

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 the pin position:



Pin position  
Default **No**

Turn → Code **4**

Press , Code **4** blinks

Turn → Pin position on lever (see relevant section on attachment)

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

## 7.6.2 NOM – Initialization based on 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 alarm 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.



Default **No**

Turn → Code **3**, display: **No**

Press , Code **3** blinks

Turn → **YES**

Press , display

## Enter the pin position and nominal range:



Pin position  
Default **No**



Nominal range  
(locked with Code **4** = No)

Turn → Code **4**

Press , Code **4** blinks


Turn → Pin position on lever (see relevant section on attachment)

Press .

Turn → Code **5**

Press , Code **5** blinks




Turn  → Nominal travel/angle

Press .


### Select the initialization mode:




Initialization mode  
Default **MAX**

Turn  → Code **6**

Press , Code **6** blinks

Turn  → **NOM**


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

### Start initialization:

► Press INIT key to start initialization!

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

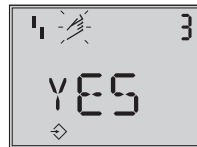
## 7.6.3 MAN – Initialization based on a manually selected range

Before starting initialization, move the control valve manually to the OPEN position by turning  in small steps. The valve must move to the required valve position with a monotonically increasing signal pressure. 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**).

### Enable configuration:

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



Default **No**

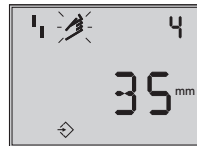
Turn  → Code **3**, display: **No**

Press , Code **3** blinks


Turn  → **YES**

Press , display 


### Enter the pin position:




Pin position  
Default **No**

Turn  → Code **4**

Press , Code **4** blinks

Turn  → Pin position on lever (see relevant section on attachment)

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

## Select the initialization mode:



Initialization mode  
Default **MAX**

Turn → Code **6**

Press , Code **6** blinks

Turn → **MAN**

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

## 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 valve reaches its OPEN position.

Press to confirm the OPEN position.

## Start initialization:

- ▶ Press INIT key to start initialization!

## 7.6.4 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.

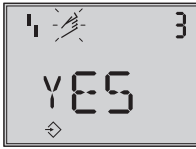
By entering the blocking position (Code **35**), closing direction (Code **34**), pin position (Code **4**), nominal range (Code **5**) and direction of action (Code **7**), the positioner can calculate the positioner configuration.

### NOTICE

*Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section 7.8.*

## Enable configuration:

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

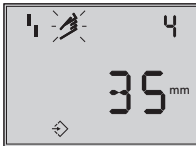

Default **No**

Turn → Code **3**, display: **No**

Press , Code **3** blinks

Turn → **YES**

Press , display

**Enter the pin position and nominal range:**

Default **No**

Nominal range  
(locked with Code **4** = No)

Turn → Code **4**

Press , Code **4** blinks

Turn → Pin position on lever (see relevant section on attachment)

Press .

Turn → Code **5**

Press , Code **5** blinks

Turn → Nominal travel/angle

Press .

**Select the initialization mode:**

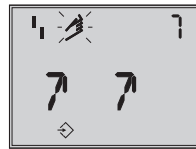
Initialization mode  
Default **MAX**

Turn → Code **6**

Press , Code **6** blinks

Turn → **Sub**

Press to confirm the **Sub** as the initialization mode.

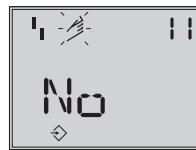
**Enter the direction of action:**

Default **↗**

Turn → Code **7**

Press , Code **7** blinks

Turn → Direction of action (↗ or ↘)

Press .

**Deactivate travel limit:**

Default **100.0**

Turn → Code **11**

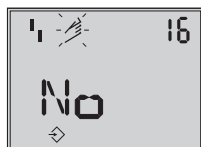
Press , Code **11** blinks

Turn → **No**

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 **No**



$K_P$   
Default **7**



$T_V$   
Default **2**

Turn  → Code **16/17/18**

Press , Code **16/17/18** blinks

Turn  to set the control parameter selected.

Press  to confirm the setting.


## Enter closing direction and blocking position:



Closing direction  
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 counterclockwise/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  to confirm the setting.

## Set the valve closed position:


- ▶ Set switch for **valve closed position** AIR TO OPEN or AIR TO CLOSE as described in section 7.1 on page 50.
- ▶ Set volume restriction as described in section 7.2 on page 51.


**Start initialization:**

- ▶ Press INIT key!  
The positioner switches to **MAN** mode.  
The blocking position is indicated.


**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 alarms 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 as follows:

Turn  → Code **1**

Press , Code **1** and  blink


Turn  in order to move the valve slightly past the blocking position.

Press  to cancel mechanical blocking.

Turn  → Code **0**

Press , Code **0** blinks.

Turn  → **AUTO**

Press . The positioner switches to automatic operating mode. The current valve position is indicated in %.

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

- Set  $T_V$  to 4 (Code **18**).
- If the positioner still oscillates, the gain  $K_P$  (Code **17**) must be decreased until the positioner shows a stable behavior.

**Zero point calibration**

Finally, if process operations allow it, the zero point must be adjusted according to section 7.7.

**7.7 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 positioner must be connected to the supply air to perform the zero calibration.

**Enable configuration:**

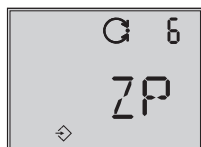
Turn  → Code **3**

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 .

### ► Press INIT key!

Zero calibration starts. The positioner moves the valve to the CLOSED position and reads the internal electrical zero point.

## 7.8 Reset to default values

This function resets all parameters to the factory default values (see code list in section 14).

### Enable configuration:

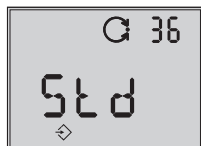
Turn → Code **3**, display **No**

Press , Code **3** blinks

Turn → **ON**

Press , display

### Reset start-up parameters:



Reset  
Default **No**

Turn → Code **36**, display **•••••**

Press , Code **36** blinks

Turn → **Std**

Press . All start-up parameters and the diagnosis are reset to their default values.

### Note:

- Code **36 - diAG** allows just the diagnosis data (EXPERTplus) to be reset. Refer to EB 8389 EN on EXPERTplus valve diagnostics.
- Reset the control and identification parameters as well as the bus address with the **FACTORY\_RESET** parameter (refer to Configuration Manual KH 8384-4 EN).

## 7.9 Start-up via local interface (SSP)

The positioner can either be commissioned, configured, and operated on site, using the Fieldbus configuration or operating system, or TROVIS-VIEW operator interface connected over the serial interface in the positioner.

Use the TROVIS-VIEW software with 3730-4 device module installed.

To connect the positioner directly to the PC via the local serial interface, an adapter (order no. 1400-7700) is required.

The positioner can be supplied with power by connecting it to a fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner. The simultaneous operation of TROVIS-VIEW and the fieldbus system is possible without any restrictions when connected to a PROFIBUS-PA segment.

## 7.10 Setting the bus address

A maximum of 32 positioners in a safe (non-hazardous) area can be operated over a segment coupler in one PROFIBUS-PA segment.

Each positioner connected in the segment must be assigned a unique bus address between 0 and 125.



Default 126

Turn → Code **3**, display: **No**

Press , Code **3** blinks.

Change the setting of Code **3**.

Turn → **YES**

Press , display:

The configuration is enabled.

Turn → Code **46**, press ,

turn → required address,

press 10 seconds → The address is adopted straightaway, provided that cyclic data exchange is **not** taking place.

During the cyclic data exchange, the newly set address for the positioner is saved and adopted after the cyclic data exchange is finished.

The newly assigned address is indicated under Code 46 in alternating sequence with the current address. The new address is marked with "n" (new) and the currently used address with "o" (old).

---

**Note:** The bus address can only be implemented by the PROFIBUS command SET\_ADDRESS when the bus address is set to the default setting [126]. Refer to Configuration Manual KH 8384-4 EN.

---

## 8 Operation

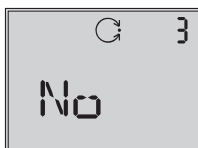
### WARNING!

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

The codes which are marked with an asterisk (\*) in section 1.4 on page 73 onwards 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: **No**

Press , Code 3 blinks.

Change the setting of Code 3.


Turn  → **YES**

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 changes to Code 0.

#### Cancel the setting:



Canceling the setting

To cancel a value before it is confirmed (by pressing ) proceed as follows:


Turn  → **ESC**

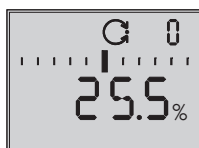
Press . The entered value is not adopted.



## 8.2 Operating modes

### 8.2.1 Automatic and manual modes

After initialization has been completed successfully, the positioner is in  automatic mode (AUTO).




Automatic mode



Switch to  manual operating mode (MAN)



Turn  → Code 0


Press , display: **AUTO**, Code 0 blinks.

Turn  → **MAN**


Press  to switchover to  manual mode. The switchover is smooth since the manual mode starts up with the set point last used during automatic mode. The current position is displayed in %.

Adjust the manual reference variable




Turn  → Code 1

Press , Code 1 blinks.


Turn  until sufficient pressure has been built up in the positioner and the control valve moves to the required position.

---

**Note:** The positioner automatically returns to  manual mode with Code 0 if no settings are made within 120 seconds.

---

Switch to  automatic operating mode

Turn  → Code 0

Press , Code 0 blinks.


Turn  → **AUTO**

Press . The positioner changes to  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 7.1), 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.

Once the positioner is initialized, the current valve position is indicated on the digital 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 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 status classification can be changed in TROVIS-VIEW and over the PROFIBUS-PA parameters.

Refer to the Configuration Manual KH 8384-4 EN on the supplied CD-ROM (CD 8384-4) for more details.

---

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

► **Process-related faults/outside of specifications**

The positioner is being operated outside the specified conditions of use.


► **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.

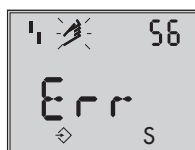
The condensed state appears on the display with the following icons:

Condensed state	Positioner display
Maintenance alarm	
Function check	Text
Maintenance required/ Maintenance demanded	
Process-related faults/ outside of specifications	—
No message	—

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 14).



Example  
Error caused by pin  
position

## Fault alarm output

The “Maintenance alarm” as the condensed state causes the optional fault alarm output to be switched.

- The “Function check” condensed state can also switch the fault alarm contact in Code 32.
- The “Maintenance required/demanded” condensed state can also switch the fault alarm contact in Code 33.

## 8.3.1 Confirming error messages

### Enable configuration:

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

Turn  → Code 3, display: **No**

Press , Code 3 blinks

Turn  → **YES**

Press , display: 

### Confirm error messages:

Turn  → Error code which you want to confirm.

Press  to confirm the error message.

### 9 Adjusting the limit switch

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

For operation of the inductive limit switch, the corresponding switching amplifier (see section 5.2.1) must be connected to the output.

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

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

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

#### Setting the switching point:

##### **NOTICE**

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

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

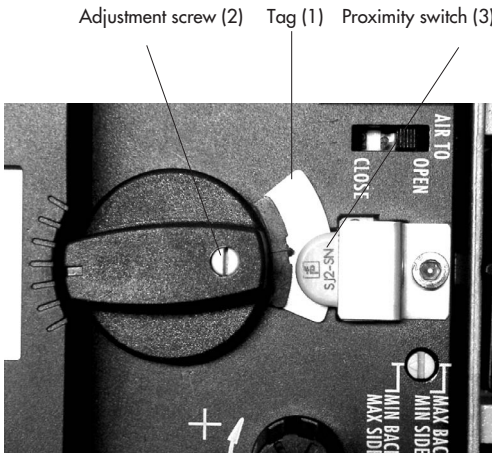


Fig. 22 · Adjustment of the limit switch

**For CLOSED position:**

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

**Contact function:**

Tag leaving the field > contact is made.

Tag entering the field > contact is opened.

**For OPEN position:**

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

**Contact function:**

Tag leaving the field > Contact is made.

Tag entering the field > Contact is opened.

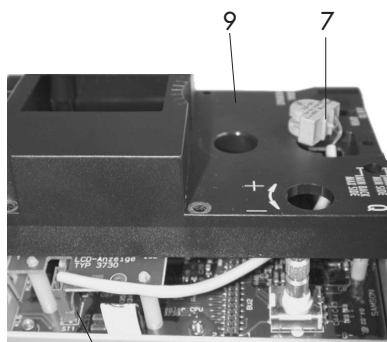
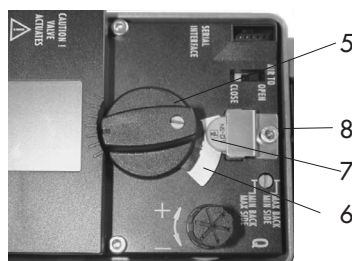
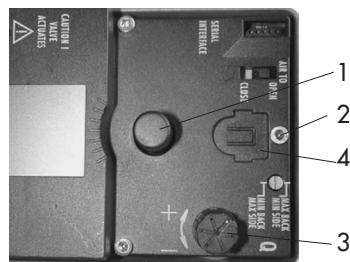
## 9.1 Retrofitting an inductive limit switch

### Required retrofit kit:

Limit switch Order no. 1400-7460

**Note!** For explosion-protected devices, the requirements in section 11 need to be kept.

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9) together with the display, **taking care not to damage the ribbon cable (between PCB and display)**.
2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper (8801-2267) at the socket X7 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.
7. **Note:** On start-up of the positioner, set the option inductive alarm under Code **38** from **No** to **YES**.



Socket X7 (11)

- |                     |                    |
|---------------------|--------------------|
| 1 Cap               | 6 Metal tag        |
| 2 Screws            | 7 Proximity switch |
| 3 Rotary pushbutton | 8 Clamping plate   |
| 4 Marking           | 9 Plastic cover    |
| 5 Rotary switch     | 11 Connector       |

Fig. 23 · Retrofitting an inductive limit switch

## 10 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.

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

Read section 13 for maintenance, calibration and adjustment work inside and outside hazardous areas.

## 11 Servicing explosion-protected devices

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

Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device 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. Replace explosion-protected components only by original, routine-tested components from the manufacturer.

## 12 Firmware update (serial interface)

Firmware updates on positioners currently in operation can be performed as follows:

When updates are performed by a service employee appointed by SAMSON, the update is confirmed on the positioner by the test mark assigned by SAMSON's Quality Assurance.

In all other cases, only persons from the plant operator with written approval may perform updates. This person must confirm the update on the positioner.

Laptops and PCs connected to the power supply must use an additional safety barrier.

This does not apply to laptops in battery operation. In this case, it is assumed that a battery-powered laptop runs briefly for software programming or for testing purposes.

### a) Updates outside the hazardous area:

Remove the positioners from the plant and update them outside the hazardous area.

### b.) Updates on site:

Updates on site are only permitted after the plant operator has presented a signed hot work permit.

After updating has been completed, add the current firmware to the nameplate; this can be done using labels.

## 13 Maintenance, calibration and work on equipment

The interconnection with intrinsically safe circuits to check or calibrate the apparatus must only be performed with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant for explosion protection.

The maximum values for intrinsically safe circuits specified in the approvals must be kept.



## 14 Code list

Code no.	Parameter – Display, values [default setting]	Description																														
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.																																
<b>0</b>	<b>Operating mode</b> [MAN] Manual mode AUTO Automatic mode SAFE Fail-safe position ESC Escape	Switchover from automatic to manual mode is smooth. In fail-safe mode, the symbol <b>S</b> appears on the display. In MAN and AUTO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °.																														
<b>1</b>	<b>Manual w</b> 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. <b>Note:</b> Can only be selected when Code 0 = MAN																														
<b>2</b>	<b>Reading direction</b> 1234 ↻ZL, ESC	The reading direction of the display is turned by 180°.																														
<b>3</b>	<b>Enable configuration</b> [No], YES, ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) <b>FF</b> blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only read over the SSP interface.																														
<b>4*</b>	<b>Pin position</b> 17, 25, 35, 50, 70, 100, 200 mm 90° with rotary actuators [No], ESC  <b>Note:</b> If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety	The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. For initialization using NOM or SUB, this pin position must be entered. <table> <tr> <th>Pin position</th><th>Standard</th><th>Adjustment range</th></tr> <tr> <th>Code 4</th><th>Code 5</th><th>Code 5</th></tr> <tr> <td><b>17</b></td><td>7.5</td><td>3.6 to 17.7</td></tr> <tr> <td><b>25</b></td><td>7.5</td><td>5.0 to 25.0</td></tr> <tr> <td><b>35</b></td><td>15.0</td><td>7.0 to 35.4</td></tr> <tr> <td><b>50</b></td><td>30.0</td><td>10.0 to 50.0</td></tr> <tr> <td><b>70</b></td><td>40.0</td><td>14.0 to 70.7</td></tr> <tr> <td><b>100</b></td><td>60.0</td><td>20.0 to 100.0</td></tr> <tr> <td><b>200</b></td><td>120.0</td><td>40.0 to 200.0</td></tr> <tr> <td><b>90°</b></td><td>90.0</td><td>24.0 to 100.0</td></tr> </table>	Pin position	Standard	Adjustment range	Code 4	Code 5	Code 5	<b>17</b>	7.5	3.6 to 17.7	<b>25</b>	7.5	5.0 to 25.0	<b>35</b>	15.0	7.0 to 35.4	<b>50</b>	30.0	10.0 to 50.0	<b>70</b>	40.0	14.0 to 70.7	<b>100</b>	60.0	20.0 to 100.0	<b>200</b>	120.0	40.0 to 200.0	<b>90°</b>	90.0	24.0 to 100.0
Pin position	Standard	Adjustment range																														
Code 4	Code 5	Code 5																														
<b>17</b>	7.5	3.6 to 17.7																														
<b>25</b>	7.5	5.0 to 25.0																														
<b>35</b>	15.0	7.0 to 35.4																														
<b>50</b>	30.0	10.0 to 50.0																														
<b>70</b>	40.0	14.0 to 70.7																														
<b>100</b>	60.0	20.0 to 100.0																														
<b>200</b>	120.0	40.0 to 200.0																														
<b>90°</b>	90.0	24.0 to 100.0																														

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>5*</b>	<b>Nominal range</b> mm or angle ° ESC	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 <b>No</b> , 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.
<b>6*</b>	<b>Init mode</b> [MAX] NOM MAN SUB ZP ESC	Select the initialization mode MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. MAN: Manually selected range Sub: Substitute calibration (without initialization)
<b>7*</b>	<b>w/x</b> [↗↗] increasing/increasing ↗↘ increasing/decreasing ESC	Direction of action of the reference variable w in relation to the travel/angle of rotation x Automatic adaptation: AIR TO OPEN: On completing initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases. AIR TO CLOSE: On completing initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.
<b>8*</b>	<b>Travel/angle range start (lower x-range value)</b> 0.0 to 80.0 [0.0] % of the nominal range ESC  <b>Note:</b> Specified in mm or angle ° provided Code 4 is set	Lower range value for the travel/angle of rotation in the nominal or operating range. The <b>operating range</b> is the actual travel/angle of the control valve and is limited by the lower x-range value (Code 8) and the upper x-range value (Code 9). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. Value is displayed or must be entered.  The characteristic is adapted. See also the example in Code 9!

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>9*</b>	<b>Travel/angle range end (upper x-range value)</b> 20.0 to 100.0 [100.0] % of the nominal range ESC  <i><b>Note:</b> Specified in mm or angle ° provided Code 4 is set</i>	Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted.  <b>Example:</b> 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.
<b>10*</b>	<b>Travel/angle lower limit (lower x-limit)</b> 0.0 to 49.9 % of the operating range [No], ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted.  The characteristic is not adapted to the reduced range. See also example in Code 11.
<b>11*</b>	<b>Travel/angle upper limit (upper x-limit)</b> 50.0 to 120.0 [100] % of the operating range No, ESC	Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted.  <b>Example:</b> In some applications, it 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!  When set to No, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range.
<b>14*</b>	<b>Reference variable range start (w-start)</b> 0.0 to 49.9 [1.0] % of the span adjusted via Code 12/13 No, ESC	If w approaches the percentage adjusted at the final value 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.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
15*	<b>Reference variable range end (w-end)</b> 50.0 to 100.0 % of the span adjusted via Code 12/13 [No], ESC	If w approaches the percentage adjusted at the final value 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. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15. Example: Set the final position w > to 99 % for three-way valves.
16*	<b>Pressure limit</b> 1.4 2.4 3.7 bar [No], ESC	The signal pressure to the actuator can be limited in stages. After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position (SAFE) over Code 0). <b>NOTICE</b> <i>Do not activate the pressure limit for double-acting actuators with valve closed position AIR TO OPEN (AtO).</i>
17*	<b>Proportional-action coefficient KP (step)</b> 0 to 17 [7] ESC	Displaying or changing $K_p$ <b>Note on changing the <math>K_p</math> and <math>T_V</math> steps:</b> <i>During the initialization of the positioner, the <math>K_p</math> and <math>T_V</math> values are optimized.</i> <i>Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the <math>K_p</math> and <math>T_V</math> steps can be adapted after the initialization.</i> <i>For this, either the <math>T_V</math> step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the <math>K_p</math> step can be decreased in increments.</i> <b>NOTICE</b> Changing the $K_p$ step influences the system deviation.
18*	<b>Rate time TV (step)</b> 1 [2] 3 4 No, ESC	Displaying or changing $T_V$ , see note under $K_p$ step A change of the $T_V$ step has no effect on the system deviation.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
19*	<b>Tolerance band</b> 0.1 to 10.0 [5] % of the operating range ESC	Used for error monitoring Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If a transit time is determined during initialization which is six times > 30 s, the six-fold transit time is accepted as the lag time.
20*	<b>Characteristic</b> 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) <b>Note:</b> The various characteristics are listed in the Appendix (section 16).
21*	<b>Required transit time OPEN (w ramp open)</b> 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 recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process. Code 21 has priority over Code 15. <b>NOTICE</b> The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.
22*	<b>Required transit time CLOSED (w ramp closed)</b> [0] to 240 s ESC	The time required to pass through the operating range when the valve closes. Code 22 has priority over Code 14. <b>NOTICE</b> The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>23*</b>	<b>Total valve travel</b> 0 to $99 \cdot 10^7$ [0] Exponential reading from 9999 travel cycles onwards RES, ESC	Totaled double valve travel. Can be reset to 0 by RES. <b>Note:</b> The total valve travel is saved in a non-volatile memory after every 1000 double travel.
<b>24*</b>	<b>LV total valve travel</b> 1000 to $99 \cdot 10^7$ [1 000 000] Exponential reading from 9999 travel cycles onwards ESC	Limit value of total valve travel. If the limit is exceeded, the fault symbol and the wrench symbol corresponding with the collective status appear.
<b>34*</b>	<b>Closing direction</b> CL Clockwise [CCL] Counterclockwise ESC	Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). Needs only be entered in initialization mode SUB (Code 6).
<b>35*</b>	<b>Blocking position</b> [0] mm/° /% ESC	Entering the blocking position. Distance up to the CLOSED position. Only necessary in initialization mode SUB.
<b>36*</b>	<b>Reset</b> [No], Std, diAG, ESC	Std: Resets all parameters to default (factory setting) as well as the diagnosis data. After a reset, the positioner must be re-initialized. diAG: Resets diagnosis data only. Plotted reference graphs and logs remain unaffected. The positioner does not need to be re-initialized.
<b>38*</b>	<b>Inductive alarm</b> [No], YES, ESC	Indicates whether the inductive limit switch option is installed or not.
<b>39</b>	<b>System deviation e info</b> -99.9 to 999.9 %	Read only, indicates the deviation from the position required.
<b>40</b>	<b>Transit time Open info</b> 0 to 240 s [0]	Read only, minimum opening time determined during initialization.
<b>41</b>	<b>Transit time Closed info</b> 0 to 240 s [0]	Read only, minimum closing time determined during initialization.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code <b>3</b> prior to configuration.		
<b>42</b>	<b>Auto-w/manual-w info</b> 0.0 to 100.0 % of the span	Read only, Auto mode: indicates the supplied automatic reference variable Man mode: indicates the supplied manual reference variable
<b>43</b>	<b>Firmware info control</b>	Read only, indicates the positioner type and current firmware version in alternating sequence.
<b>44</b>	<b>y info</b> [0] to 100 % OP, MAX, – – –	Read only. Indicates the control signal y in % based on the travel range determined on initialization MAX: The positioner builds up its maximum output pressure, see description in Code <b>14</b> and <b>15</b> . OP: The positioner vents completely, see description in Code <b>14</b> and <b>15</b> . – – –: The positioner is not initialized.
<b>45</b>	<b>Solenoid valve info</b> YES, HIGH/LOW, No	Read only, indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, <i>YES</i> and <i>HIGH</i> appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the <b>S</b> icon), <i>YES</i> and <i>LOW</i> appear on the display in alternating sequence.
<b>46*</b>	<b>Bus address</b> ESC	Select bus address
<b>47*</b>	<b>Write protection PA</b> YES, [No], ESC	When the write protection function is activated, device data can only be read, but not overwritten over PA communication.
<b>48*</b>	<b>Diagnostic parameters d</b>	
	<b>d0</b> Current temperature –55.0 to 125.0	Operating temperature [°C] inside the positioner
	<b>d1</b> Minimum temperature [20]	The lowest temperature below 20 °C that has ever occurred.
	<b>d2</b> Maximum temperature [20]	The highest temperature above 20 °C that has ever occurred.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>48*</b>	<b>d3</b> Number of zero calibrations	The number of zero calibrations since the last initialization.
	<b>d4</b> Number of initializations	The number of initializations that have been performed.
	<b>d5</b> Zero point limit 0.0 to 100.0 % [5 %]	Limit for the zero point monitoring.
	<b>d6</b> Condensed status	Condensed status, made up from the individual states. 0 OK: Okay 1 C: Maintenance required 2 CR: Maintenance demanded 3 B: Maintenance alarm 7 I: Function check
	<b>d7</b> Start reference run [No], YES, ESC	Triggering of a reference run for the functions: Drive signal y steady-state and drive signal y hysteresis. The reference run can only be activated in manual operating mode as the valve moves through its entire travel range. If EXPERT* is activated at later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.
	<b>d8</b> EXPERT* activation	<b>Only for firmware version 1.51 or lower:</b> Enter the activation code for EXPERT*. After the activation procedure has been successfully completed, <b>YES</b> appears under d8. <b>The EXPERTplus diagnostics are always activated for firmware 1.52 or higher</b>
	<b>Diagnostic parameters h</b>	
	<b>h0</b> Initialization with reference test [No] · YES · ESC	The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) are plotted during the reference test.
	<b>h1</b> Reference test result [No] · YES	Display only No A reference test has not been performed. YES The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) have been plotted successfully.
	<b>h2</b> – Unassigned	



Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>48*</b>	<b>h3</b> Auto reset diAG 0 to 365 days; [0 days]	After an adjustable time period, the diagnosis data are reset automatically according to the settings in Code <b>36 - diAG</b> . <b>Example:</b> A start-up behavior of the plant which is untypical for the process is not to be included in the total diagnosis.
	<b>h4</b> Rest time for auto reset diAG	Display only Remaining time until the diagnosis data are reset automatically according to the settings in Code <b>48 - h3</b>
	<b>PA parameters PA-P</b>	
	<b>F0</b> Firmware Rev. Communication	
	<b>F1</b> Binary input1	1 Active    0 Inactive
	<b>F2</b> Binary input2	1 Active    0 Inactive
	<b>F3</b> Counter device start-ups	
	<b>F4</b> Counter reset communication	
	<b>F5</b> Counter reset control	
	<b>F6</b> Counter reset bus connection	
	<b>F7</b> Slave status	0 Undefined    2 wait_cfg 1 wait_prm    3 data_exchg
	<b>AO Function Block A</b>	
	<b>A0</b> Target Mode	Required operating mode <sup>1)</sup>
	<b>A1</b> Actual Mode	Actual operating mode <sup>1)</sup>
	<b>A2</b> SP Value	Displays the setpoint (reference variable) and its status
	<b>A3</b> SP Status	
	<b>A4</b> Readback Value	Displays the current position
	<b>A5</b> Readback Status	and its status
<sup>1)</sup> See page 83		

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>48*</b>	<b>A6</b> Out Value	Displays the manipulated variable (output value)
	<b>A7</b> Out Status	and its status
	<b>A8</b> Unassigned	
	<b>A9</b> Simulate	Positioner simulation 1 Enabled 0 Disabled
	<b>Transducer Blocks A0, DI1, DI2 †</b>	
	<b>t0</b> Target Mode AO Trd	Required operating mode <sup>1)</sup>
	<b>t1</b> Actual Mode AO Trd	Actual operating mode <sup>1)</sup>
	<b>t2</b> Final_Position_Value. Value	Displays the current valve position in relation to the operating position
	<b>t3</b> Final_Position_Value. State	and its status
	<b>t4</b> AO Feedback Value	Displays the current valve position [OUT_SCALE]
	<b>t5</b> AO Feedback State	and its status
	<b>t6</b> AO Final_Value.Value	Displays the output value [FVR]
	<b>t7</b> AO Final_Value.State	and its status
	<b>t8</b> AO Final_Position_ Value.Value	Displays the current valve position [FVR]
	<b>t9</b> AO Final_Position_ Value.State	and its status
	<b>Resource Block S</b>	
	<b>S0</b> Resource Target Mode	Required operating mode <sup>1)</sup>
	<b>S1</b> Resource Actual Mode	Actual operating mode <sup>1)</sup>
	<b>DI1Function Block I</b>	
	<b>I0</b> Target Mode DI1	Required operating mode <sup>1)</sup>
	<b>I1</b> Actual Mode DI1	Actual operating mode <sup>1)</sup>
<sup>1)</sup> See page 83		


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*	I2 DI1 Trd PV_D.Value	Displays the discrete input variable and its status										
	I3 DI1 Trd PV_D.State											
	I4 DI1 Fb Target Mode	Required operating mode FB										
	I5 DI1 Fb Actual Mode	Actual operating mode FB										
	I6 DI1 Fb OUT_D.Value	Displays the discrete output variable										
	I8 DI1 FSAFE_VAL_D	Default value when the sensor reports an error										
	I9 Simulate	Simulation										
	D2 Function Block L											
	L0 Target Mode DI2	Required operating mode <sup>1)</sup>										
	L1 Actual Mode DI2	Actual operating mode <sup>1)</sup>										
	L2 DI2 Trd PV_D.Value	Displays the discrete input variable and its status										
	L3 DI2 Trd PV_D.State											
	L4 DI2 Fb Target Mode	Required operating mode FB										
	L5 DI2 Fb Actual Mode	Actual operating mode FB										
	L6 DI2 Fb OUT_D.Value	Displays the discrete output variable and its status										
	L7 DI2 Fb OUT_D.State											
	L8 DI2 FSAFE_VAL_D	Default value when the sensor reports an error										
	L9 Simulate	Simulation										
<div><div><sup>1)</sup> Display of actual/required operating mode</div><table><tr><th>Operating mode</th><th>Displayed value (display)</th></tr><tr><td>Auto</td><td>8</td></tr><tr><td>MAN</td><td>16</td></tr><tr><td>External cascade RCAS</td><td>2</td></tr><tr><td>O/S</td><td>128</td></tr></table></div>			Operating mode	Displayed value (display)	Auto	8	MAN	16	External cascade RCAS	2	O/S	128
Operating mode	Displayed value (display)											
Auto	8											
MAN	16											
External cascade RCAS	2											
O/S	128											

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>49*</b>	<b>Partial stroke test (PST)</b>	
<b>A</b>	<b>Partial stroke test (PST)</b>	
<b>A0</b>	Start Partial Stroke Test [No] · YES · ESC	Operating mode and PST testing mode must be set to MAN.
<b>A1</b>	Time until the next automatic PST test takes place	Remaining time [d_h] until the next partial stroke test is performed. Only applies to PST Auto mode. Read only
<b>A2</b>	Desired PST testing mode Auto · [Man] · ESC	Activates (PST Auto) or deactivates (PST Man) the scheduled automatic partial stroke test.
<b>A3</b>	Auto test time	Time [h] between for partial stroke tests (PST)
<b>A4</b>	Status classification PST status [C] · OK · CR · b · S ESC	C Maintenance required OK No message CR Maintenance demanded b Maintenance alarm S Out of specification
<b>A5</b>	Min. recommended scan time	Scan time [s] required to plot the complete step response test in a graph. Read only
<b>A6</b>	– Unassigned	
<b>A7</b>	y-monitoring reference value	The valve moves to the valve position <i>Step start</i> (Code 49 - d2) and <i>Step end</i> (Code 49 - d3) with certain control pulses. The difference between these control pulses creates the delta y value [1/s]. The y-monitoring reference value applies to the adjusted step values (Code 49 - d2 and Code 49 - d3) and for the selected ramp times (Code 49 - d5 and Code 49 - d6). The y-monitoring reference value must be determined again if any of the above mentioned values change. Read only

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>49*</b>	<b>A8</b> Activation delta y-monitoring [No] · YES · ESC	Activates/deactivates delta y-monitoring
	<b>A9</b> delta y-monitoring value 0 to 100 %; [10 %]	The percentage [%] of the entire range of the control pulse between 1 and 10000 1/s ( <b>Example:</b> 10 % = 10000 1/s) The partial stroke test is canceled if the change in control signal (delta y) varies from the y-monitoring reference value by this amount.
	<b>d Step parameters for the partial stroke test (PST)</b>	
	<b>d1</b> – Unassigned	
	<b>d2</b> Step start 0.0 to 100.0 %; [95.0 %]	Start value to perform the step response test
	<b>d3</b> Step end 0.0 to 100.0 %; [90.0 %]	End value to perform the step response test
	<b>d4</b> Activation of the ramp function [No] · YES	Activates/deactivates the ramp function.
	<b>d5</b> Ramp time (rising) 0 to 9999 s; [15 s]	Ramp time for 0 to 100 % travel (rising) of the ramp function. Do not enter a ramp time which is lower than the value automatically given during initialization.
	<b>d6</b> Ramp time (falling) 0 to 9999 s; [15 s]	Ramp time for 0 to 100 % travel (falling) of the ramp function. Do not enter a ramp time which is lower than the value automatically given during initialization.
	<b>d7</b> Settling time before test start 1.0 to 240.0 s; [10.0 s]	Waiting time before the test starts to allow the valve to safely reach the step start value.
	<b>d8</b> Delay time after step 1.0 to 240.0 s; [2.0 s]	Time after the first step until the second step starts.
	<b>d9</b> Scan time 0.2 to 250.0 s; [0.2 s]	Scan time of the step response test

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>49*</b>	<b>E Cancellation conditions of the partial stroke test (PST)</b>	
<b>E0</b>	Activation x control [No] - YES	Activates/deactivates x control.
<b>E1</b>	x control value -10.0 to 110.0 % of total travel; [0.0 %]	The test is automatically canceled as soon as the valve position falls below this value.
<b>E2</b>	- Unassigned	
<b>E3</b>	- Unassigned	
<b>E4</b>	- Unassigned	
<b>E5</b>	Activation tolerance band control [No] - YES	Activates/deactivate tolerance band control.
<b>E6</b>	PST Tolerance band 0.1 to 100.0 %; [5.0 %]	The test is automatically canceled as soon as the <i>Step end</i> (Code <b>49 - d3</b> ) exceeds this value.
<b>E7</b>	Max. test duration 30 to 25000 s; [30 s]	Maximum time within which a test can be completed before the test is canceled automatically.
	<b>F Partial stroke test (PST) information - Read only</b>	
<b>F0</b>	No test available	No test exists or the test has been canceled manually.
<b>F1</b>	Test OK	
<b>F2</b>	x cancelation	The test was canceled by the x cancelation function.
<b>F3</b>	y cancelation	The test was canceled by the y cancelation function.
<b>F4</b>	Tolerance band exceeded	The test was canceled. The x-values exceeded the tolerance band.
<b>F5</b>	Max. test time exceeded	The test was not completed within the maximum test time and was automatically canceled.
<b>F6</b>	Test man. canceled	The test has been manually canceled by the user.

Code no.	Parameter – Display, values [default setting]	Description
<b>Note:</b> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
<b>49*</b>	<b>F7</b> Measured data storage out of memory	The maximum capacity of the memory for measured data has been reached. After 100 measured data per measured variable have been recorded, the logging stops. However, the test is continued.
	<b>F8</b> Int. solenoid valve	The test was canceled by the activation of the solenoid valve.
	<b>F9</b> Supply pressure/friction	An insufficient supply pressure or excessive friction occurred during the test.

**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: '1'). 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).

## Initialization errors

Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
50	<b>x &gt; range</b>	<p>The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit.</p> <ul style="list-style-type: none"> <li>• Pin positioned incorrectly.</li> <li>• Bracket slipped in case of NAMUR attachment or positioner is not central.</li> <li>• Follower plate incorrectly attached.</li> </ul>
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	<b><math>\Delta x &lt; \text{range}</math></b>	<p>The measuring span of the sensor is too low.</p> <ul style="list-style-type: none"> <li>• Pin positioned incorrectly.</li> <li>• Wrong lever.</li> </ul> <p>A rotational angle smaller than 16° at the positioner shaft creates just an alarm. An angle below 9° leads to the initialization being canceled.</p>
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.
52	<b>Attachment</b>	<ul style="list-style-type: none"> <li>• Positioner attachment incorrect.</li> <li>• Nominal travel/angle (Code 5) could not be achieved during initialization under NOM (no tolerance downwards permissible).</li> <li>• Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.</li> </ul>
	Status classification	[Maintenance required]
	Recommended action	<p>Check attachment and supply pressure. Re-initialize the positioner.</p> <p>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.</p> <p>After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle.</p>



Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
53	<b>Initialization time exceeded (Init time &gt;)</b>	<p>The initialization routine lasts too long.</p> <ul style="list-style-type: none"> <li>• No pressure on the supply line or there is a leak.</li> <li>• Supply air failure during initialization.</li> </ul>
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner.
54	<b>Initialization - solenoid valve</b>	<p>1) A solenoid valve is installed (Code <b>45</b> = 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.</p> <p>2) If you attempt to initialize the device from the fail-safe position (SAFE).</p>
	Status classification	[Maintenance required]
	Recommended action	<p>Re. 1) Check connection and supply voltage of the forced venting Code <b>45</b> HIGH/LOW</p> <p>Re. 2) Set the <b>MAN</b> operating mode over Code <b>0</b>. Then initialize the positioner.</p>
55	<b>Transit time too short (transit time &lt;)</b>	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 7.2, re-initialize the positioner.
56	<b>Pin position</b>	Initialization was canceled because you are required to enter the pin position for the selected initialization modes <b>NOM</b> and <b>SUB</b> .
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code <b>4</b> and nominal travel/angle over Code <b>5</b> . Re-initialize the positioner.

## Operational errors

Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
57	<b>Control loop</b>	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code <b>19</b> ). <ul style="list-style-type: none"> <li>• Actuator mechanically blocked.</li> <li>• Attachment of the positioner subsequently shifted.</li> <li>• Supply pressure not sufficient.</li> </ul>
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	<b>Zero point</b>	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 <b>6</b> (see section 7.7 on page 61). 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	<b>Autocorrection</b>	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	<b>Fatal error</b>	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code <b>36</b> . Re-initialize the positioner.

## Hardware errors

Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
62	x signal	<p>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 operation icon and 4 dashes instead of the position indication.</p> <p><b>Note on the closed-loop operation:</b> <i>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.</i></p>
	Status classification	[Maintenance demanded]
	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.

## Error appendix

Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
65	<b>Hardware</b>	A hardware error has occurred, the positioner changes to the fail-safe position ( <b>SAFE</b> ).
	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	<b>Data memory</b>	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return the positioner to SAMSON AG for repair.
67	<b>Test calculation</b>	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

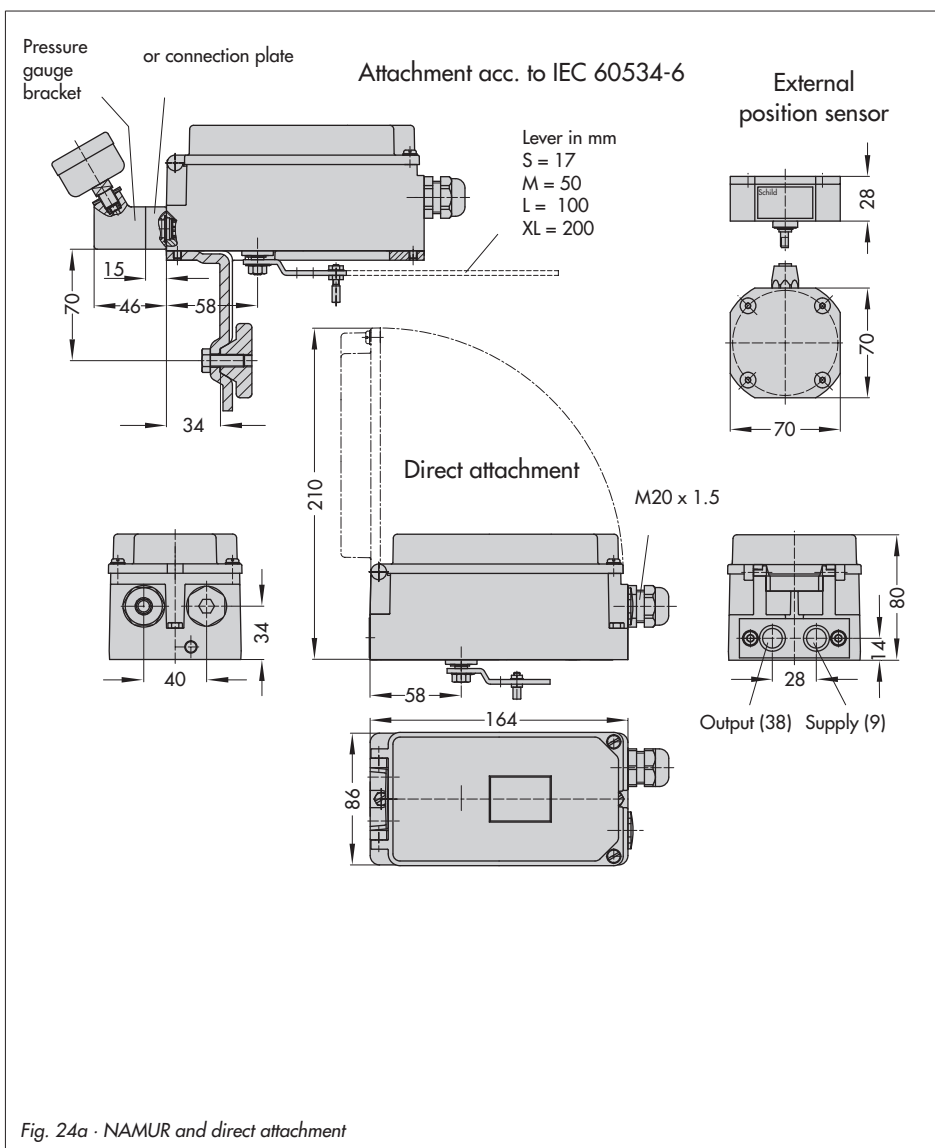
Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
68	<b>Control parameter</b>	Control parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
69	<b>Poti parameter</b>	Parameter error of the digital potentiometer.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
70	<b>Calibration parameter</b>	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	<b>General parameters</b>	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
73	<b>Internal device error 1</b>	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
74	<b>PA parameters</b>	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error and perform reset.

Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
76	<b>No emergency mode</b>	The travel measuring system of the positioner has a self-monitoring function (see Code <b>62</b> ). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner changes to the fail-safe position (SAFE) 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	<b>Program loading error</b>	When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test ( <b>tESinG</b> 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	<b>Options parameter</b>	Errors in options parameters
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.

## Diagnosis errors

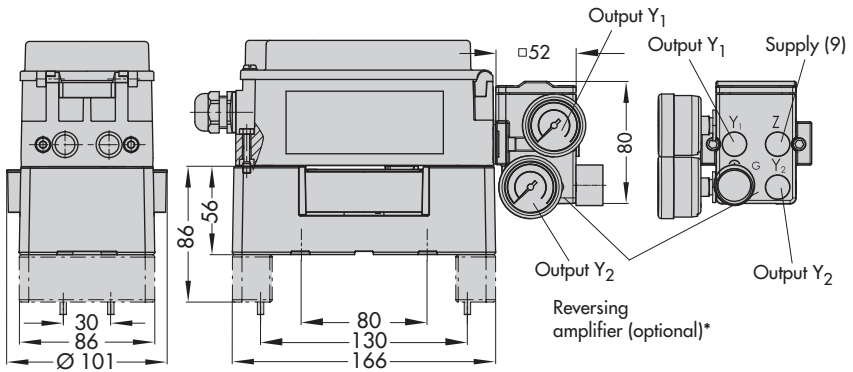
Error codes – Recommended action		Condensed state alarm active, when prompted, <b>Err</b> appears. When fault alarms exist, they are displayed here.
79	<b>Diagnostic alarms</b>	Alarms are generated by the extended EXPERTplus diagnostics
	Status classification	Maintenance required (cannot be classified)
80	<b>Diagnostic parameters</b>	Errors that are not critical for control.
	Status classification	Maintenance required (cannot be classified)
81	<b>Reference graphs</b>	An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. <ul style="list-style-type: none"> <li>• Reference test was interrupted</li> <li>• Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted.</li> </ul>
	Status classification	[No message]
	Recommended action	Check and, if necessary, perform a new reference test

## 15 Dimensions in mm

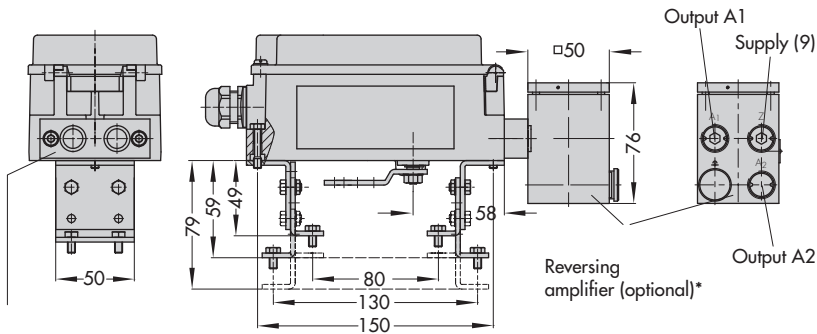




### Heavy-duty version



### Light version



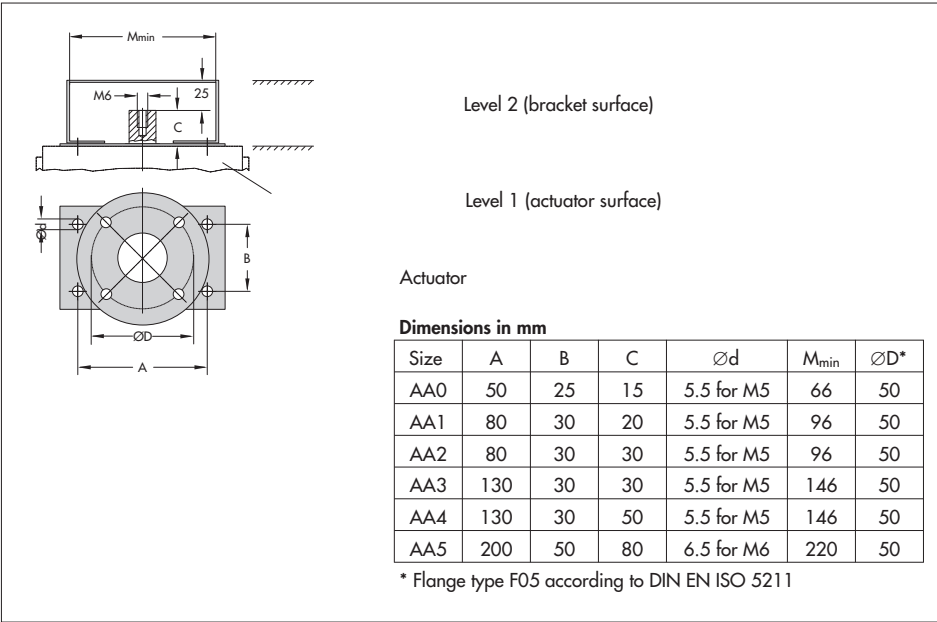
Connecting plate G 1/4 or 1/4 NPT

\* Reversing amplifier

- Type 3710 (see drawing of heavy-duty version for dimensions)
- 1079-1118/1079-1119, no longer available (see drawing of light version for dimensions)

Fig. 24b · Attachment to rotary actuators VDI/VDE 3845 (Sept. 2010), fixing level 1, size AA1 to AA4

15.1 Fixing levels according to VDI/VDE 3845 (September 2010)

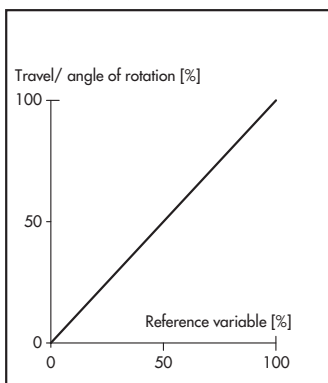


## 16 Valve characteristic selection

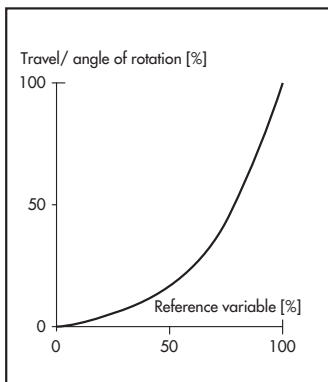
The characteristics that can be selected in Code **20** are shown in following **in graph form**.

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

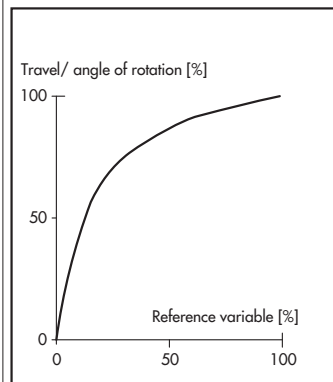
**Linear** (select characteristic: 0)



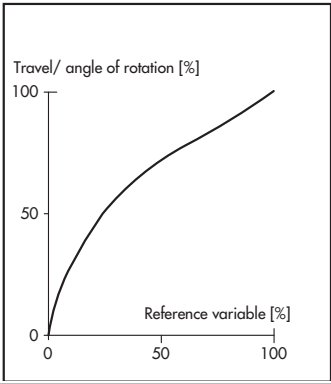
**Equal percentage** (select characteristic: 1)



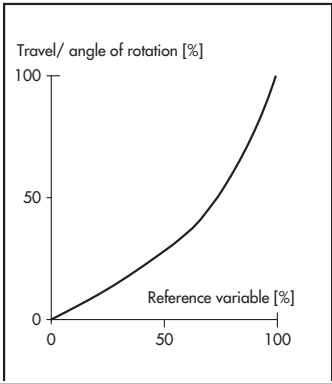
**Rev. equal percentage** (select characteristic: 2)



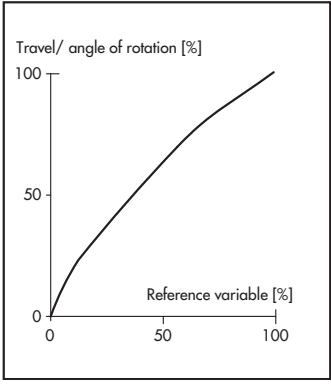
**SAMSON butterfly valve linear**  
(select characteristic: 3)



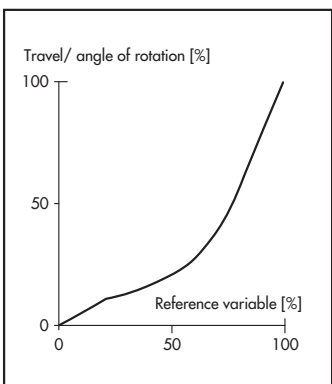
**SAMSON butterfly valve equal percentage**  
(select characteristic: 4)



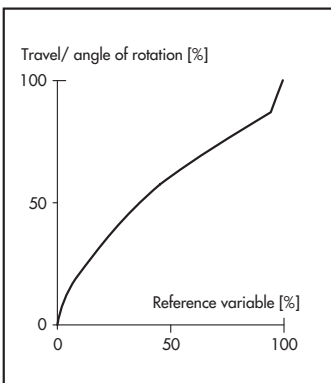
**VETEC rotary plug valve linear**  
(select characteristic: 2)



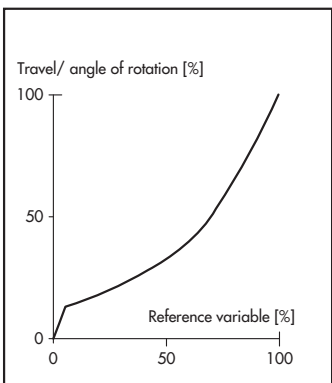
**VETEC rotary plug valve equal percentage**  
(select characteristic: 6)



**Segmented valve ball linear**  
(select characteristic: 7)



**Segmented ball valve equal percentage**  
(select characteristic: 7)



# TRANSLATION

<p> <b>Name of:</b>  <b>P. Opt</b> </p>	<p> <b>Name letter:</b>  <b>2005-11-08</b> </p>	<p> <b>Our ref:</b>  <b>479000-9010-0001/67325</b>  <b>FC33/bhl-wab</b> </p>	<p> <b>Offenbach, 2005-11-21</b>  <b>Contact:</b>  <b>H. Biehl</b>  <b>Tel. (069) 8306-249</b>  <b>Fax (069) 8306-716</b>  <b>gerhard.biehl@vde.com</b> </p>
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## Test report for Information of the Applicant

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

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

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

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

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

#### 1 Assignment

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

#### 2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

#### 3 Basis of assessment

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

#### 4 Execution of the tests

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

#### 5 Test results

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

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

IP6X satisfied

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

IPX6 satisfied

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



There was no ingress of either dust or water.

VDE- Prüf- und Zertifizierungsinstitut  
Fachgebiet FC33

(Signature)

(Signature)

Gerhard Biehl



# IECEx Certificate of Conformity

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit [www.iecex.com](http://www.iecex.com)

Certificate No.: IECEx PTB 06.0054

Status: Current

Date of Issue: 2006-11-02

Applicant: SAMSON AG Mess- und Regeltechnik  
Wiesendellstrasse 3  
D-60314 Frankfurt am Main  
Germany

Issue No.: 0

Page 1 of 4

**Bus-powered field lip-Positioners types 3730-41 and 3730-51**

Electrical Apparatus:  
Optional accessory:

Type of Protection: General Requirements, Intrinsic Safety

Marking: Ex ia IIC T6

Approved for issue on behalf of the IECEx Certification Body:  
Position: Dr.-Ing. Ulrich Jahnsmeyer  
Department Head of "Intrinsic Safety and Safety of Systems"

Signature: \_\_\_\_\_  
(for printed version)


Date: \_\_\_\_\_



1. The certificate and schedule may only be reproduced in full.  
2. The certificate is issued on behalf of the IECEx Certification Body.  
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by

### Physikalisch-Technische Bundesanstalt (PTB)

Bundesallee 100  
38116 Braunschweig  
Germany





# IECEx Certificate of Conformity

Certificate No.: IECEx PTB 06.0054

Date of Issue: 2006-11-02

Manufacturer: SAMSON AG Mess- und Regeltechnik  
Wiesendellstrasse 3  
D-60314 Frankfurt am Main  
Germany

Manufacturing location(s):

Issue No.: 0



Page 2 of 4

This certificate is issued as verification that a sample(s) representative of production, was assessed and tested and found to comply with the IECEx Quality system relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

**STANDARDS:**  
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:  
**IEC 60079-0 - 2004** Electrical apparatus for explosive gas atmospheres - Part 0: General requirements  
Edition: 4.0  
**IEC 60079-11 : 1999** Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety "Y"  
Edition: 4

This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.

**TEST & ASSESSMENT REPORTS:**  
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in Test Report:  
DE/PTBEX-TR06.0056/00  
Quality Assessment Report:  
DE/TUNIDA506.0011/00

# IECEx Certificate of Conformity

Certificate No.: IECEx PTB 06.0054  
Date of Issue: 2006-11-02

Issue No.: 0  
Page 3 of 4

## Schedule



**EQUIPMENT:**  
Equipment and systems covered by this certificate are as follows:

The Model 3730-41 and 3730-51 I/p-Positioners are bus-powered field devices with communication capability and serve for adjusting the valve stem positions in compliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication with field devices programmable logic control systems and distributed control systems is optionally either according to Profibus PA (Model 3730-41 . . .), or in accordance with the FOUNDATION™ Fieldbus Specification (Typ 3730-51 . . .).

For further information see annex.

**CONDITIONS OF CERTIFICATION: NO**

# IECEx Certificate of Conformity

Certificate No.: IECEx PTB 06.0054  
Date of Issue: 2006-11-02

Issue No.: 0  
Page 4 of 4

**Additional information:**  
for further information see annex

Annexes: 3730-41\_51 Technical Data.pdf



TRANSLATION

EC TYPE EXAMINATION CERTIFICATION

(1) (2) (3) (4) (5) (6) (7) (8) (10)

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

EC Type Examination Certificate Number

PTB 04 ATEX 2109

Equipment: Model 3730-4.. and 3730-5.. I/P Positioners  
Manufacturer: SAMSON AG, Mess- und Regeltechnik  
Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

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

The examination and test results are recorded in confidential report  
PTB Ex 04-24202.

The Essential Health and Safety Requirements are satisfied by compliance with

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

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.

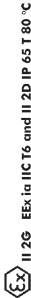
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PTB-3730-4-1.doc



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

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



Zertifizierungsstelle Explosionsschutz Braunschweig, 25 October 2004  
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

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PTB-3730-4-1.doc



(13)

Schedule

(14) EC TYPE EXAMINATION CERTIFICATE No. PTB 04 ATEX 2109

(15) Description of Equipment

The Model 3730-4 and 3730-5.. I/P Positioners are bus-powered field devices with communication capability and serve for adjusting valve stem positions in response to a control signal. They are intended for attachment to linear or rotary actuators.

Communication is optionally either according to Profibus PA, in compliance with the FISCO concept (Model 3730-4..) or in compliance with the FOUNDATION™ Fieldbus Specification (Model 3730-5.)

The Model 3730-4.. and 3730-5.. I/P Positioners are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values for Ui, Ii and Pi are not exceeded.

For air supply non-combustible media are used

The devices are intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

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

Electrical data

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

The correlation between type of protection and the electrical data is shown in the table

Maximum values:  
Model 3730-4..

EEx ia IIC/IIB
Ui = 17.5 V DC
Ii = 380 mA
Pi = 5.32 W

or  
Model 3730-5..

FOUNDATION™	
EEx ia IIC	EEx ia IIB
Ui = 24 V DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

CI = 5 nF, LI = 10 µH

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

Maximum values

Ui = 16 V  
Ii = 52 mA  
Pi = 169 mW  
LI = 100 µH  
CI = 30 nF

or

Ui = 16 V  
Ii = 25 mA  
Pi = 64 mA  
LI = 100 µH  
CI = 30 nF

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

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Temperature class	Permissible ambient temperature range	I <sub>0</sub> / P <sub>0</sub>
T <sub>6</sub>	45°C	52mA / 169mW
T <sub>5</sub>	-40°C...60°C	
T <sub>4</sub>	75°C	
T <sub>6</sub>	60°C	25mA / 64mW
T <sub>5</sub>	-40°C...80°C	
T <sub>4</sub>	80°C	

Forced venting function (terminals 81/82)

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

Maximum values:

- U<sub>i</sub> = 28 V
- I<sub>i</sub> = 115 mA
- P<sub>i</sub> = 500 W
- L<sub>i</sub> = negligible
- C<sub>i</sub> = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

- U<sub>i</sub> = 30 V
- I<sub>i</sub> = 100 mA
- L<sub>i</sub> = negligible
- C<sub>i</sub> = negligible

Binary input 2 (terminals 85 / 86)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

- U<sub>0</sub> = 588 V
- I<sub>0</sub> = 1 mA
- P<sub>0</sub> = 7.2 mW

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

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
C <sub>0</sub> = 2 µF	C <sub>0</sub> = 4 µF
L <sub>0</sub> = 10 mH	L <sub>0</sub> = 1 H

- C<sub>i</sub> = negligible
- L<sub>i</sub> = negligible

Type of protection: intrinsic safety EEx ia IIC

- U<sub>0</sub> = 8,61 V
- I<sub>0</sub> = 55 mA
- P<sub>0</sub> = 250 mW

Serial interface BU

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
C <sub>0</sub> = 0,61 µF	C <sub>0</sub> = 4 µF
L <sub>0</sub> = 9 mH	L <sub>0</sub> = 9 mH

only for connection to a certified intrinsically safe circuit

Maximum values:

- U<sub>i</sub> = 16 V
- I<sub>i</sub> = 25 mA
- P<sub>i</sub> = 64 mW
- L<sub>i</sub> = negligible
- C<sub>i</sub> = negligible

For interconnection, the rules for interconnecting intrinsically safe circuits shall be complied with

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

- U<sub>0</sub> = 8,61 V
- I<sub>0</sub> = 55 mA
- P<sub>0</sub> = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

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EEx ia IIC	EEEx ia IIB
Co = 0,61 $\mu$ F	Co = 4 $\mu$ F
Lo = 9 mH	Lo = 9 mH

Li = 370  $\mu$ H  
Ci = 730 nF

(16) Test Report: PTB Ex 04-24202

(17) Special conditions for safe use

None

(18) Special Health and Safety Requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz  
By order

Braunschweig, 25 October 2004



(Signature) (seal)  
Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

EC Type Examination Certificates without signature and seal are invalid.  
This EC Type Examination Certificate is not valid if any of the following conditions are not fulfilled:  
- The EC Type Examination Certificate is not signed by the responsible official of the Physikalisch-Technische Bundesanstalt.  
- Errors or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

TRANSLATION

ADDENDUM No. 1

in compliance with Directive 94/9/EC Annex III Clause 6  
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment: Model 3730-41... and 3730-51  
Marking:  II 2G EEx ia IIC T6 and  II 2D IP 65 T80°C  
Manufacturer: SAMSON AG Mess- und Regeltechnik  
Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

1. Description of the additions and modifications

The Model 3730-4... and 3730-5... are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the PCB layout has been adapted.

The clause below replaces Clause (15) Para. 2 of the EC Type Examination Certificate.

“Bus connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation™ Fieldbus Specification.”

The tabular presentation of the electrical data relating to the bus connection signal circuit has been modified.

“BUS connection signal circuit ... Type of protection EEx ia IIC/TiB only for connection (Terminals 1/1/2) to a certified intrinsically safe circuit.

The interrelationship between type of protection and the electrical data is shown in the table below.

Addendum No. 1 to the EC Type Examination Certificate PTB 04 ATEX 2109

Maximum values:

Model 3730-4 ... and 3730-5 ... resp.

FISCO supply unit	BUS supply unit, general
EEx ia IIC/TiB	EEx ia IIC
U <sub>i</sub> = 17,5 V DC	U <sub>i</sub> = 24 V DC
I <sub>i</sub> = 380 mA	I <sub>i</sub> = 360 mA
P <sub>i</sub> = 5,32 W	P <sub>i</sub> = 1,04 W
	P <sub>i</sub> = 2,56 W

C<sub>i</sub> = 5 nF  
L<sub>i</sub> = 10 µH

All the other electrical data and other data specified in the EC Type Examination certificate apply also this Amendment No. 1

Test report: PTB Ex 06-20085

Zertifizierungsstelle Explosionsschutz

By order

(Signature)  
Dr.-Ing. U. Johannsmeier  
Director and Professor  
(Seal)



Braunschweig, 13 July 2005

TRANSLATION

ADDENDUM o.: 2

in compliance with Directive 94/9/EC Annex III Clause 6  
to the EC Type Examination Certificate PTB 04 ATEX 2109

Equipment: Model 3730-4 ..., and Model 3730-5 ... Positioners

Marking:  II 2 G EEx ia IIC T 6 and  
 II 2 D IP 65 T 80 °C

Manufacturer: SAMSON AG Mess- und Regeltechnik  
Address: Weismüllerstrasse 3  
60314 Frankfurt am Main, Germany

Description of the additions and modifications

The Model 3730-4 ... and 3730-5... Positioners are permitted to be manufactured in the future also in compliance with the test documents specified in the Test Report.

The electrical data of the forced ventilation modules of the Models 3730-4 I and 3750-5 I are modified as follows:

Forced ventilation  
only for (terminals 8/182)

Type of protection: Intrinsic Safety EEx ia IIC  
connection to a certified intrinsically safe circuit

Maximum values:

U <sub>n</sub>	=	28 V
I <sub>n</sub>	=	115 mA
L <sub>i</sub>	=	negligible
C <sub>i</sub>	=	5,3 nF

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

Test report: PTB Ex 07-27260

Zertifizierungsstelle Explosionsschutz

Braunschweig, 24. August 2007

By order  
(Signature) (Seal)  
Dr.-Ing. U. Johnsmeyer  
Director and Professor

Page 1 of 1

This EC Type Examination Certificate may only be reproduced in its entirety and any changes, whether included or not, shall be clearly marked. The present version of the certificate is the only valid one.

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

PTB47-2730-4/51.040-2.doc



TRANSLATION

Statement of Conformity

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

(2) EC Type Examination Certificate Number

**PTB 05 ATEX 2010 X**

(3) Equipment: Model 3730-48... and 3730-58... Positioners

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

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

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

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

The examination and test results are recorded in confidential report  
PTB Ex 05-24319.

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

**EN 50021:1999 EN 50281-1-1:1998**

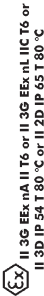
(9) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Statement of conformity without signature and seal are invalid.  
This Statement is Conformity may be reproduced in its entirety any changes.  
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.  
**Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig**  
PNA7 Ex n.doc



(10) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of the equipment.

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



Zertifizierungsstelle Explosionsschutz  
By order  
Braunschweig, 16 February 2005

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

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**Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig**  
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(13)

Schedule

(14) EC TYPE EXAMINATION CERTIFICATE No PTB 05 ATEX 2010 X

(15) Description of Equipment

The Model 3730-48 and 3730-58. Positioners are bus-powered field devices with communication capability and serve for transmitting control signals into valve stem positions. They are intended for attachment to linear or rotary actuators.

For instrument air non-combustible media are used.

The equipment is intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

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

Electrical data

BUS connection, signal circuit  
(terminals 11/12)

Type of protection: EEx nA II or Ex nL IIC resp.

Gas group	Maximum values
IIC	U <sub>b</sub> = 20V; I <sub>b</sub> = 464mA, P <sub>b</sub> = 2,32W U <sub>b</sub> = 24V; I <sub>b</sub> = 261mA, P <sub>b</sub> = 1,56W U <sub>b</sub> = 30V; I <sub>b</sub> = 152mA, P <sub>b</sub> = 1,14W
IIB	U <sub>b</sub> 20V; I <sub>b</sub> 1,17A, P <sub>b</sub> 5,88W U <sub>b</sub> = 24V; I <sub>b</sub> = 650mA, P <sub>b</sub> = 3,89W U <sub>b</sub> = 30V; I <sub>b</sub> = 379mA, P <sub>b</sub> = 2,85W

CI = 5 nF; LI = 10 µH

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Inductive proximity switch  
(terminals 41/42)

Type of protection: EEx nA II or Ex nL IIC resp.

Maximum values

UI = 20 V  
II = 52 A  
PI = 169 W  
LI = 100µH  
CI = 30nF

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

Temperature class	Permissible ambient temperature range	I <sub>o</sub> / P <sub>o</sub>
T6	+43°C	
T5	-40°C ... +60°C	52mA / 169mW
T4	+75°C	
T6	+60°C	
T5	-40°C...+80°C	25mA / 64mW
T4	+80°C	

Forced venting function  
(terminals 81/82)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values:

UI = 30 V  
II = 100 mA  
LI = negligible  
CI = 53 nF

Binary input 1  
(terminals 87 / 88)

Type of protection: EEx nA II or Ex nL IIC/IIB resp

Maximum values:

UI = 30 V  
II = 100 mA  
LI = negligible  
CI = negligible

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Physikalisch-Technische Bundesanstalt  
Braunschweig und Berlin

PTB

Binary input 2  
(terminals 85 / 86)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.  
only for connection of a floating passive contact circuit

Maximum values:

- U<sub>0</sub> = 588 V
- I<sub>0</sub> = 1 mA
- P<sub>0</sub> = 7.2 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C <sub>0</sub> = 1.8µF	C <sub>0</sub> = 15.8µF
L <sub>0</sub> = 9.7mH	L <sub>0</sub> = 1H

- Ci = negligible
- Li = negligible

Serial interface BU

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

- U<sub>0</sub> = 8,61 V
- I<sub>0</sub> = 55 mA
- P<sub>0</sub> = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C <sub>0</sub> = 0.61µF	C <sub>0</sub> = 4µF
L <sub>0</sub> = 9mH	L <sub>0</sub> = 9mH

Maximum values (passive):

- U<sub>i</sub> = 20V
- I<sub>i</sub> = 25mA
- P<sub>i</sub> = 64mW
- Li = negligible
- Ci = negligible

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Physikalisch-Technische Bundesanstalt  
Braunschweig und Berlin

PTB

External positioner sensor  
(analog PCB pins p9, p10, p11)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.  
Maximum values (active):

- U<sub>0</sub> = 8,61 V
- I<sub>0</sub> = 55 mA
- P<sub>0</sub> = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C <sub>0</sub> = 0.61µF	C <sub>0</sub> = 4µF
L <sub>0</sub> = 9mH	L <sub>0</sub> = 9mH

- Li = 370µH
- Ci = 730nF

(16) Test Report: PTB Ex 05-24312

(17) Special conditions for safe use

(18) Basic safety and health requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz  
By order

Braunschweig, 16 February 2005

(Signature)

(seal)





Dr. Ing. U. Johannsmeyer  
Regierungsdirektor

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PNAZ Ex n.doc



ADDENDUM No. 1  
to the Statement of Conformity PTB 05 ATEX 2010 X

Equipment: Model 3730-48... and 3730-58 Positioners

Marking:  II 3G EX nA II T6 or  II 3G EX nL IIC T6  
 II 3D IP 54 T 80°C or  II 3D IP 65 T 80°C

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstr. 3  
66314 Frankfurt am Main

Description of the additions and modifications

The Model 3730-48... and 3730-58 Positioners are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

The clause below supplements the description of the equipment under clause (15) Para. 2 of the EC Type Examination Certificate.

“BUS connection (coupling) can be made according to the FISCO Concept both for the Profibus PA and the Foundation™ Fieldbus Specification.”

The electrical data, special conditions and all the other data of the EC Type Examination Certificate continue to apply unaltered also to this Addendum No. 1.

Test report: PTB Ex 06-26086

Zertifizierungsstelle Explosionsschutz  
By order Braunschweig, 13. July 2006

(Signature) (Seal)

Dr. Ing. U. Johannsmeier  
Director and Professor

**Installation Manual for apparatus certified by CSA for use in hazardous locations.**  
Communication is optionally either according to the **FOUNDATION™** Fieldbus Specification or according to **PROFIBUS PA** in compliance **FISCO-Concept**

The **FISCO Concept** shows interconnection of intrinsically safe apparatus to the current (I<sub>max</sub>) and the power (P<sub>max</sub>) which such combination. The criteria for interconnection is that the voltage (V<sub>max</sub>) the current (I<sub>max</sub>) and the power (P<sub>max</sub>) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (V<sub>oc</sub>) the current (I<sub>sc</sub>) and the power (P<sub>oc</sub>) level which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unimpeded capacitance (C) and inductance (L) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The allowed voltage (V<sub>oc</sub>) of the associated apparatus is limited to the range of **14V DC to 24V DC**. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

- Loop resistance R: 15 ... 150 Ohm/km
- Inductance per unit length L: 0.4 ... 1 mH/km
- Capacitance per unit length C: 80 ... 200 nF/km
- $C' = C \cdot \text{line/line} + 0.5 \text{ C} \cdot \text{line/screen}$ , if both lines are floating or,  $C' = C' \cdot \text{line/line} + C' \cdot \text{line/screen}$ , if the screen is connected to one line
- Length of spur cable: ≤ 30 m
- Length of trunk cable: ≤ 1 km
- At each end of the trunk cable an approved infillable line termination with the following parameters is suitable:  
 $R = 90 \dots 100 \text{ Ohm}$   
 $C = 0 \dots 2.2 \text{ pF}$

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

**Notes:**

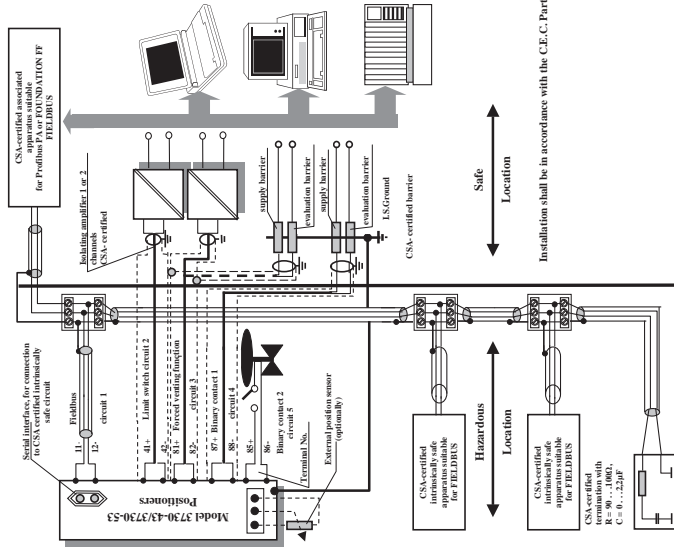
1. Approved associated apparatus must be installed in accordance with manufacturer instructions.
2. Approved associated apparatus must meet the following requirements:  
 $V_{oc} \leq V_{max}$ ,  $I_{sc} \leq I_{max}$ ,  $P_{oc} \leq P_{max}$
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the Canadian Electrical code Part 1.
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I.S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I.S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal resistor.
9. FISCO concept applies to Fieldbus (circuit only).
10. Entry parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:  
 $C_0 > C_1 + C_{cable}$ ,  $L_0 \geq L_1 + L_{cable}$

**Intrinsically safe if installed as specified in manufacturer's installation manual.**  
**CSA- certified for hazardous locations**  
**Ex in IIC T6**  
**Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F + G; Class III.**

**CSA- certified for PROFIBUS PA**

**Ex in IIC T6**

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



Installation shall be in accordance with the C.E.C. Part 1

Table 2: CSA – certified barrier parameters of circuit 4

Barrier	Supply barrier		Evaluation barrier	
	V <sub>oc</sub>	R <sub>in</sub>	V <sub>oc</sub>	R <sub>in</sub>
circuit 3	≤8V	≥24Ω	≤8V	
circuit 4	≤8V	≥800Ω	≤8V	

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

Table 3:

Temperature class	Permissible ambient temperature range
T <sub>6</sub>	+60 °C
T <sub>5</sub>	-40 °C ≤ T <sub>a</sub> ≤ +70 °C
T <sub>4</sub>	+80 °C

Table 4: Energy-Limited (Non-Incendive) Parameters

Terminal	Foundation Fieldbus or Profibus PA (Non Incendive Equipment)						Limit- switches inductive	Forced venting function	Binary- Input 1
	11 / 12 (IEC 1148-2)						41 / 42	81 / 82	87 / 88
Groups	A, B and IIC						C, D and IIB		
U <sub>i</sub> or V <sub>max</sub> [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	28V 28V 32V
I <sub>0</sub> or I <sub>max</sub> [mA]	464	261	152	130	1.117 A	650	379	324	115mA 115mA 90mA
P <sub>0</sub> or P <sub>max</sub> [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW 169mW
C <sub>i</sub>	2nF						30	5,3	0
L <sub>i</sub>	10µH						100	0	0

Table 1

Maximum values for serial-interface and binary input 2 see									
Binary-Input 1	##	##	##	##	##	##	##	##	##
Binary-Input 2	##	##	##	##	##	##	##	##	##

Table 1: Intrinsic Safety Parameters

Circuit No.	Fieldbus		Binary-input		Serial-interface	
	Foundation	Profibus	1	2	Active	Passive
Terminal No.	11 / 12 (IEC 1148-2)	11 / 12 (IEC 1148-2)	87 / 82	85 / 86	plug	##
Groups	IIC	IIB	IIC	IIB	##	##
V <sub>max</sub> [V]	24	17,5	16	##	##	##
U <sub>0</sub> or V <sub>oc</sub>	##	##	##	##	##	##
I <sub>max</sub> [mA]	360	380	380	115 100	##	25
I <sub>0</sub> or I <sub>SC</sub>	##	##	##	1mA	55mA	##
P <sub>max</sub> [W]	1,04	2,58	5,32	64mW 169mW	##	64 mW
C <sub>i</sub> [nF]	2	##	60	5,3	##	0
C <sub>0</sub> or C <sub>a</sub>	##	##	##	2nF	0,61µF	##
L <sub>i</sub> [µH]	10	##	100	0	##	0
L <sub>0</sub> or L <sub>a</sub>	##	##	##	10mH	9mH	##

Binary-input 1: For connection of an active signal circuit

Binary-input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

1. Entity parameters must meet the following requirements:

$$V_{oc} \leq V_{Vmax}, I_{0SC} \leq I_{max}, P_0 \leq P_{max}$$

$$C_0 \text{ or } C_a \geq C_i + C_{cable} \text{ and } L_0 \text{ or } L_a \geq L_i + L_{cable}$$

2. Install in accordance with the Canadian Electrical Code Part I

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0540

\* Circuit 3 can be connected to a CSA Certified zener barrier that is rated as follows:

- Supply channel (connect to Terminal 87): V<sub>oc</sub> ≤ 28V max. and R<sub>in</sub> ≥ 245 Ω
- Return channel (connect to Terminal 82): V<sub>oc</sub> ≤ 28V max with diodes Return (zero current)

\*\* Circuit 4 can be connected to a CSA Certified zener barrier that is rated as follows:

- Supply channel (connect to Terminal 87): V<sub>oc</sub> ≤ 30V and R<sub>in</sub> ≥ 300 Ω
- Return channel (connect to Terminal 88): V<sub>oc</sub> ≤ 30V max with diodes Return (zero current)

Revisions Control No. 1: March.2006

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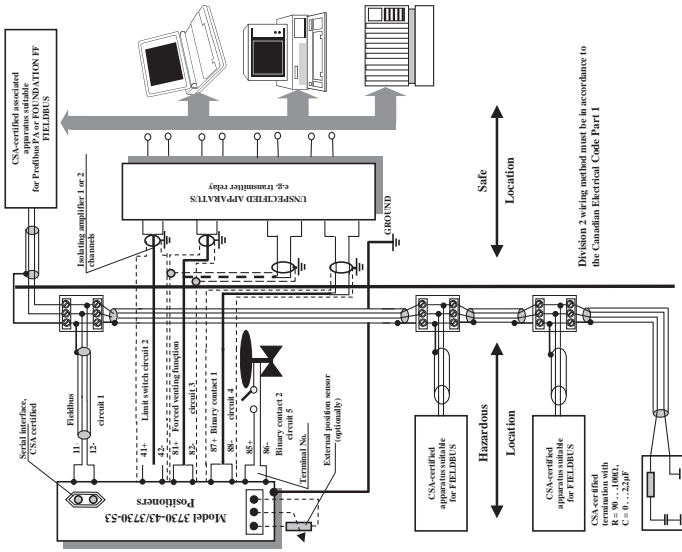
Addendum to EB 8384-5 EN

CSA certified for hazardous locations:

Ex nA II T6 / Ex d IIC T6

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

Type 4 Enclosure

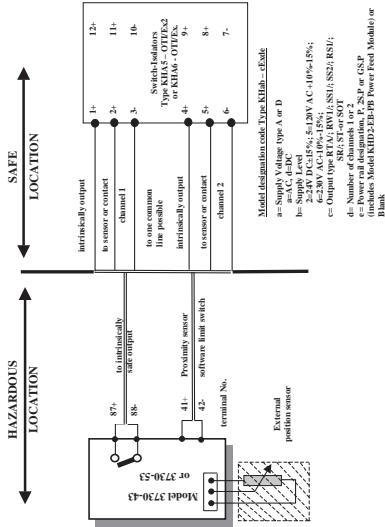


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Addendum to EB 8384-5 EN

Installation drawing Control Relay KHA5-OT/Ex2, KHA6-OT/Ex1 or KHA6-OT/Ex2 With Model SJ3b-N Proximity Sensors



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

System parameters

Control Relay Terminal No.	Group	L [mH]	C [pF]	VDC [V]	ISC [mA]	Vmax [V]	Ratein [1/s]
1-3, 2-3, 4-6, 5-6	A + B	192	2,66	↑	↑	↑	↑
	C + E	671	79	↑	↑	↑	↑
	D, F, G	1000	21,3	↑	↑	↑	↑

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

maximum capacitance of each inductive sensor: 30nF  
maximum inductance of each inductive sensor: 100mH



Table 1: Maximum values

	Fieldbus		Forced venting- function	Limit- switches inductive	Binary- input		Serial-Interface	
	Foundation	Profibus			1	2	active	passive
Circuit No.	1	1	3	2	4	5	6	6
Terminal No.	11/ 12	11/ 12	81/ 82	41/ 42	87/ 88	85/ 86	plug	
	A, B IIC	C, D IBB	A, B, C, D IIC/ IIB	##	##	##		
U <sub>0</sub> or V <sub>max</sub> [ V ]	24	17,5	28	16	V <sub>0C</sub> 5,88	V <sub>0C</sub> 8,61	##	##
I <sub>0</sub> or I <sub>max</sub> [ mA ]	360	380	115	25	I <sub>0C</sub> 1	I <sub>0C</sub> 55	V <sub>0C</sub>	V <sub>max</sub>
P <sub>0</sub> or P <sub>max</sub> [ W ]	1,04	2,58	##	64 mW	72,mW	250 mW	64 mW	I <sub>max</sub> 25
G [ nF ]	5		5,3	60	0	2pF	0,6µF	0
L [ µH ]	10		0	100	0	10mH	5mH	0

Binary- input 1: For connection of an active signal circuit  
Binary- input 2: For connection of an passive contact circuit directly on the control valve, e.g. passive pressure switch for leakage monitoring

Notes:

- Entity parameters must meet the following requirements:  
 $U_0 \leq U_0 \text{ or } V_{max}$ ,  $I_0 \leq I_0 \text{ or } I_{max}$ ,  $P_0 \leq P_0 \text{ or } P_{max}$   
 $C_0 \text{ or } G_0 \geq C_0 \text{ or } G_0$  and  $L_0 \text{ or } L_0 \geq L_0 \text{ or } L_0$
- The installation must be in accordance with the National Electrical Code  
ANSI/NFPA 70 and ANSI/ISA RP 12.06.01
- Cable entry M 20 x 1,5 or metal conduit acc. to dwg. No. 1050-0540

Table 2: FM – approved barrier parameters of circuit 4

Barrier	Supply barrier			Evaluation barrier	
	V <sub>0C</sub>	R <sub>0in</sub>	I <sub>0C</sub>	P <sub>max</sub>	V <sub>0C</sub>
circuit 3	≤28V	≥45Ω	≤15mA	##	≤8V
circuit 4	≤30V	≥300Ω	≤10mA	##	≤0V

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

Table 3:

Temperature class	Permissible ambient temperature range
T6	-60°C
T5	-40°C ≤ T <sub>a</sub> ≤ +70°C
T4	+80°C

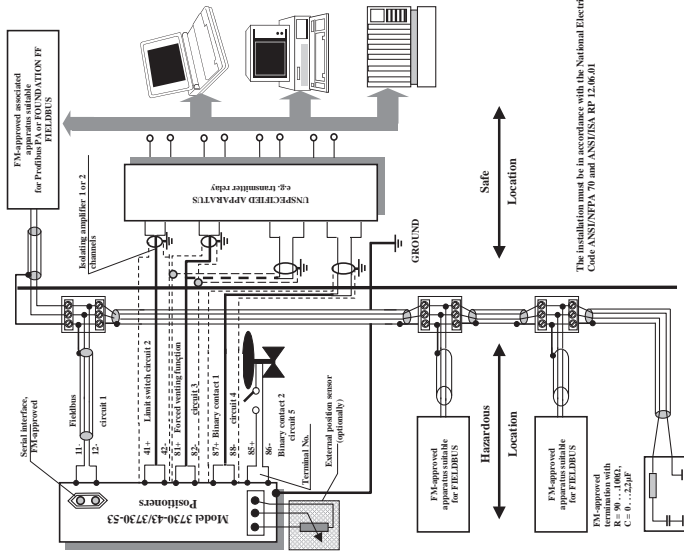
Table 4:

Maximum values for serial-interface and binary input 2									
see table 1									
Terminal	Foundation Fieldbus or Profibus PA (Non inductive Field wiring)						Fixed venting function	Binary- Input 1	##
	A, B and IIC		C, D and IIB						
Groups							##	##	##
U <sub>0</sub> or V <sub>max</sub> [VDC]	20V	24V	30V	32V	20V	24V	30V	20V	30V
I <sub>0</sub> or I <sub>max</sub> [mA]	464	261	152	130	1317 A	650	379	324	100mA
P <sub>0</sub> or P <sub>max</sub> [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	##
C <sub>0</sub>	5nF								
L <sub>0</sub>	10µH								

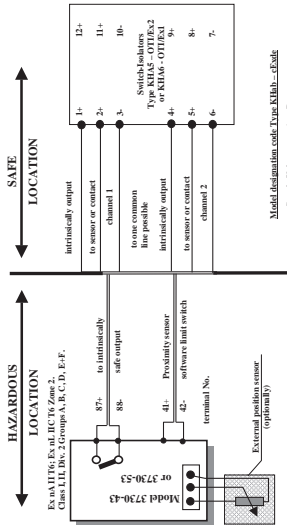
see Table 1

Maximum values for serial-Interface and Binary Input 2

FM approved for hazardous locations:  
Ex na II T6 Ex II IC T6 Zone 2,  
Class I, II, Div. 2 Groups A, B, C, D, E, F,  
Field enclosure NEMA 4X



Installation drawing Control Relay KH45-OT/EX-2, KH46-OT/EX-1 or KH46-OT/EX-2 with Model SJ45-N Proximity Sensor



Model designation code Type KH45 - ExII  
a=Supply Voltage type A or D  
b=Supply Level  
c=30V AC-10%-15%;  
6-230V AC-10%-15%;  
d= Output type RTA; RSU; RS2; RSH;  
e= Number of channels 1 or 2;  
f= Paper or plastic enclosure, P or G, P  
g= Model KH45-EX-2 or KH46-EX-2  
Model or Blank

maximum capacitance of each inductive sensor: 30nF  
maximum inductance of each inductive sensor: 100uH

Each pair of L/S wires must be protected by a shield that is grounded at the L/S Ground. The shield must be extend as close to the terminals as possible installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.60.01.

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

System parameters

Control Relay Terminal No.	Groups	L [mH]	C [pF]	V <sub>DC</sub> [V]	I <sub>EC</sub> [mA]	V <sub>max</sub> [V]	R <sub>min</sub> [Ω]
1-3; 2-3	A + B	192	266	↑	↑	9.5	31
4-6; 5-6	C + E	571	79	10.5	13	↑	↑
	D, E, G	1000	21.3	↑	↑	↑	↑



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

**EB 8384-4 EN**

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