

Series 3730
TROVIS SAFE 3730-6
Electropneumatic Positioner

with HART® communication and pressure sensors



TROVIS SAFE



HART 
COMMUNICATION PROTOCOL

**Mounting and
Operating Instructions**

EB 8384-6S EN

Firmware version 1.03

Edition February 2015

CE **Ex**
certified

Definition of signal words



DANGER!

Hazardous situations which, if not avoided, will result in death or serious injury



NOTICE

Property damage message or malfunction



WARNING!

Hazardous situations which, if not avoided, could result in death or serious injury



Note:

Additional information



Tip:

Recommended action

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Note:

The functions of the **EXPERTplus** Valve Diagnostics are described in the Operating Instructions ► **EB 8389-1S EN**. These Instructions are included on the enclosed CD-ROM and is available on our website.

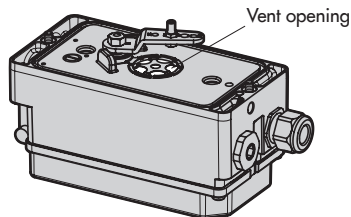
1 Important safety instructions

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

- The device 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 is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Explosion-protected versions of this device are to be operated only by personnel who has undergone special training or instructions or who is authorized to work on explosion-protected devices in hazardous areas. Refer to section 11.
- Any hazards that could be caused in the valve by the process medium, the signal pressure or by moving parts are to be prevented by taking appropriate precautions.
- If inadmissible motions or forces are produced in the pneumatic actuator as a result of the supply pressure level, it must be restricted using a suitable supply pressure reducing station.

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 storage are assumed.
- Do not ground electric welding equipment near to the positioner.



Note: The device with a CE marking fulfills the requirements of the Directive 94/9/EC and the Directive 2004/108/EC.

The declaration of conformity is included on the enclosed CD-ROM.

2 Article code

Positioner		TROVIS SAFE 3730-6 x x x x x x x x 0 x 0 0													
With HART® communication and pressure sensors															
Explosion protection															
ATEX: II 2G Ex ia IIC/IIB T6; II 2D Ex tb IIIC T6 IP66		1	1	0											
IECEx: Ex ia IIC/IIB T6; Ex d[ia] IIC/IIB T6; Ex tD A21 IP66 T80°C		1	1	1											
GOST: 1Ex ia IIC T6 Gb; 1Ex tb IIIC T80°C Db IP66		1	1	3											
FM: IS / Class I,II,III / Div. 1 / Gr. ABCDEFG; AEx ia IIC / Class I / Zone 0 NI / Class I / Div. 2 / Gr. ABCD; S / Class II / Div. 2 / Gr. FG		1	3	0											
ATEX: II 3G Ex nA II T6; II 3G Ex ic IIC/IIB T6; II 3D Ex tc IIIC T80°C IP66		8	1	0											
IECEx: Ex nA II T6, Ex nL IIC/IIB T6; Ex tD A22 IP66 T80°C		8	1	1											
GOST: 2Ex nA IIC T6 Gc; 2Ex ic IIC T6 Gc; 2Ex tc IIIC T80°C Dc IP66		8	1	3											
Additional equipment															
Inductive limit contact	Without			0											
	SJ2-SN (NC contact)			1				0							
	SJ2-S1N (NO contact)			2											
Venting function	Without			0											
	Solenoid valve 24 V DC			1											
	Forced venting 24 V DC			2											
Additional equipment	Without			0											
	Position transmitter			1											
	Leakage sensor (including cable and fixing screw)			2		0									
	Binary input			3											
External position sensor	Without			0											
	With, including 10 m connecting cable			1				1							
	Prepared for connection, without sensor			2											
Function	Standard (on/off valves)			0											
Emergency shutdown	3.8 mA							0							
	4.4 mA							1							
Housing material															
Aluminum (standard)								1							
Stainless steel 1.4581								2							
Special application															
Without														0	
Version compatible with paint														1	
Version compatible with paint														2	
Attachment according to VDI/VDE 3847 including interface														6	
Attachment according to VDI/VDE 3847 prepared for interface														7	

3 Design and principle of operation

The electropneumatic positioner is mounted on pneumatic control valves and is used to assign the valve position (controlled variable x) to the control signal (reference variable w). The positioner compares the electric control signal of a control system to the travel or opening angle of the control valve and issues a signal pressure (output variable y) for the pneumatic actuator.

The positioner consists of a travel sensor system (2) proportional to resistance, an analog i/p converter (6) with a downstream air capacity booster (7) and the electronics with microcontroller (5).

The positioner is fitted with three binary contacts as standard: A fault alarm output indicates a fault to the control room and two configurable software limit contacts are used to indicate the end positions of the valve.

The valve position (x) is transmitted as a either an angle of rotation or travel to the pick-up lever and to the travel sensor (2) and supplied to an analog PD controller. An A/D converter (4) transmits the position of the valve to the microcontroller (5). The PD controller (3) compares this actual position to the 4 to 20 mA DC control signal (reference variable) after it has been converted by the A/D converter (4). In case of a set point deviation, the activation of the i/p converter (6) is changed so that the actuator of the control valve (1) is pressurized or vented accordingly over the downstream booster (7). This

causes the valve plug to move to the position determined by the reference variable (w).

The supply air is supplied to the booster (7) and the pressure regulator (8). An intermediate flow regulator (9) with fixed settings is used to purge the positioner and, at the same time, guarantees trouble-free operation of the booster. The output signal pressure supplied by the booster can be limited by software. Both pressure sensors (23 and 24) monitors the supply pressure p_s and the signal pressure p_{out} .

The volume restriction Q (10) is used to optimize the positioner.

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 according to IEC 60534-6 (NAMUR): section 4.2
- Attachment according to VDI/VDE 3847: section 4.3
- Attachment to Type 3510 Micro-flow Valve: section 4.4
- Attachment to rotary actuators acc. to VDI/VDE 3845: section 4.5

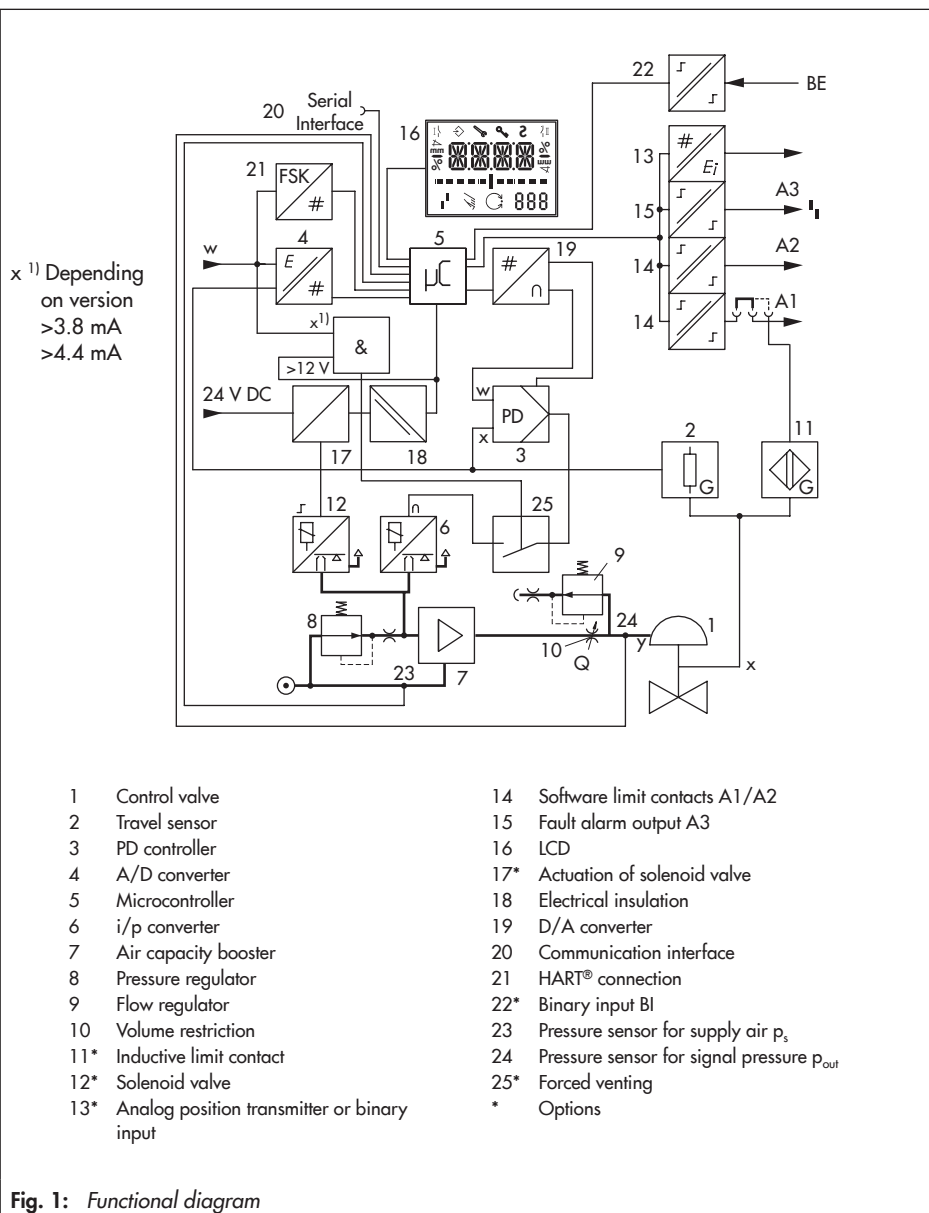


Fig. 1: Functional diagram

3.1 Safety function (SIL)

The safety function is based on the shutdown of the i/p converter (6). This causes the pneumatic actuator to be vented and the valve to move to its fail-safe position.

Monitoring of the input signal

The i/p converter is switched off when the input signal of the positioner at terminals +11/-12 falls below 3.8 mA or 4.4 mA depending on the positioner version (a signal range of 4 to 20 mA is required). See Fig. 20 on page 57.

Monitoring the voltage supply

(version with forced venting and solenoid valve)

The i/p converter and the solenoid valve (when installed) are shut down whenever the voltage at terminals +81/-82 falls below 12 V (an input voltage of 24 V DC is required). See Fig. 20 on page 57.

When the i/p converter is switched off as part of the monitoring of the input signal or the voltage supply, the fail-safe position **S** is activated and is indicated on the positioner display.

If required, the user can check the safety function using the software.

Details on EXPERTplus Valve Diagnostics in the Operating Instructions

► **EB 8389-1S EN.**


3.2 Valve diagnostics

The **EXPERTplus** valve diagnostics are integrated into the positioner. They provide information on the control valve and generate status messages, which allow faults to be pinpointed quickly.

Details on EXPERTplus Valve Diagnostics in the Operating Instructions

► **EB 8389-1S EN.**

3.3 Type of application

The application types 'Control valve' and 'On/off valve' are available. The manual mode  (MAN) and the automatic mode (AUTO) can be selected with both types of application.

Operating mode	Control valve	On/off valve
Automatic	The positioner uses the reference variable w to position the valve.	Discrete analysis of the reference variable w .
Reading on display	Valve position x in %	Valve position x in % and O/C (Open/Close) in alternating sequence
Manual	The positioner follows the manual set point given over local operation.	

Depending on the type of application, certain diagnostic functions cannot be performed or analyzed (► EB 8389-1S EN on EXPERTplus valve diagnostics).

After initialization and a reset, the type of application 'On/off valve' is set.



Note:

- Section 7.8 contains details on discrete analysis of on/off valves.
- In manual mode, an on/off valve can be moved past 100 % of the nominal range (with the closed position for AIR TO OPEN) or below 0 % of the nominal range (with the closed position for AIR TO CLOSE). See section 7.1 for the valve closed position.

3.4 Communication

The positioner is equipped with an interface for HART® protocol (Highway Addressable Remote Transducer) for communication purposes. Data are transmitted in a superimposed frequency (FSK = Frequency Shift Keying) on the existing signal loop for the 4 to 20 mA reference variable.

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

3.5 Configuration using the TROVIS-VIEW software

The positioner can be configured with SAMSON's TROVIS-VIEW Configuration and Operator Interface (version 4). For this purpose, the positioner has a digital interface (SSP) to allow the RS-232 or USB port of a computer to be connected to it over an adapter cable.

The TROVIS-VIEW software enables the user to easily configure the positioner as well as view process parameters online.



Note:

TROVIS-VIEW can be downloaded free of charge from our website at <http://www.samson.de> > Services > Software > TROVIS-VIEW.

3.6 Additional equipment

Inductive limit contact

In this version, the rotary shaft of the positioner carries an adjustable tag which actuates the built-in proximity switch. The optional inductive contact (11) is connected to A1, while the remaining software limit contact is connected to A2.

Solenoid valve

If the operating voltage for the solenoid valve (12) falls below 12 V, the supply pressure for the booster is vented to the atmosphere. As a result, the actuator is vented and the control valve moves to the fail-safe position. **In manual mode, the manual set point is reset to 0 %. A different manual set point must entered again.**

Forced venting

If the voltage signal at terminals +81/-82 falls below 12 V, the i/p converter (6) is de-energized. The positioner vents the actuator, causing valve to move to the fail-safe position determined by the actuator, independent of the reference variable.

Analog position transmitter

The position transmitter (13) is a two-wire transmitter and issues the travel sensor signal as a 4 to 20 mA signal processed by the microcontroller. Since this signal is issued independent of the positioner's input signal, the momentary travel/angle of rotation is controlled in real-time. Additionally, the position transmitter allows positioner faults to be indi-

cated over a signal current of <2.4 mA or >21.6 mA.

Leakage sensor



By upgrading the positioner with a leakage sensor, it is possible to detect seat leakage when the valve is in the closed position. Details on EXPERTplus Valve Diagnostics in the Operating Instructions ► EB 8389-1S EN.

Binary input

The optional binary input can be configured:

- To connect a floating contact
- To connect a non-floating contact (0 to 24 V DC)

By selecting a certain function, one of the following actions can be activated:

- Transmit switching state
The switching state of the binary input is logged.
- Activate local write protection
After the first initialization, a local write protection can be activated. While the binary input is active, no settings can be changed at the positioner. The positioner cannot be re-initialized. Enabling configuration over Code 3 is not active (🔒).
- Switch AUTO/MAN
The positioner changes from the automatic mode  (AUTO) to the manual mode  (MAN) or vice versa. This function is not performed if the positioner is in the fail-safe position mode (SAFE).

- Various diagnostic functions
Details on EXPERTplus Valve Diagnostics in the Operating Instructions
► EB 8389-1S EN.

Additionally, the external solenoid valve function can be selected if a non-floating contact is configured:

- External solenoid valve
The voltage for an external solenoid valve is connected in parallel to terminals +31/–32. This allows the switching state of the solenoid valve to be monitored.



Note:

The optional binary input can only be configured using the operator software e.g. TROVIS-VIEW. The switching state is transmitted when the switch is closed by default.

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.

3.7 Technical data

TROVIS SAFE 3730-6 Positioner (technical data in test certificates additionally apply to explosion-protected devices)		
Travel	Adjustable	Direct attachment to Type 3277 Actuator: 3.6 to 30 mm Attachment according to IEC 60534-6-1: 3.6 to 200 mm Attachment according to VDI/VDE 3847: 3.6 to 200 mm Rotary actuators: 24 to 100° opening angle
Travel range	Adjustable	Adjustable within the initialized travel/angle of rotation; travel can be restricted to 1/5 at the maximum
Reference variable w	Signal range	4 to 20 mA · Two-wire device, reverse polarity protection Minimum span 4 mA
	Static destruction limit	30 V
Minimum current		3.6 mA for display · Emergency venting at ≤3.8 mA or ≤4.4 mA depending on version
Load impedance		≤9.2 V (corresponding to 460 Ω at 20 mA)
Supply air	Supply air	1.4 to 7 bar (20 to 105 psi)
	Air quality acc. to ISO 8573-1 (edition 2001-02)	Maximum particle size and density: Class 4 · Oil content: Class 3 Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected
Signal pressure (output)		0 bar up to the capacity of the supply pressure · Can be limited between 1.4 and 7.0 bar by software

TROVIS SAFE 3730-6 Positioner (technical data in test certificates additionally apply to explosion-protected devices)		
Characteristic	Adjustable	Linear/equal percentage/reverse equal percentage User-defined (over operator software) Butterfly valve, rotary plug valve and segmented ball valve: Linear/equal percentage
	Deviation	≤1 %
Hysteresis		≤0.3 %
Sensitivity		≤0.1 %
Transit time		Filling with air or venting adjustable separately up to 240 s by software
Direction of action		Reversible
Air consumption, steady state		Independent of supply air approx. 110 l _n /h
Air output capacity	Actuator filled with air	At Δp = 6 bar: 8.5 m _n ³ /h · At Δp = 1.4 bar: 3.0 m _n ³ /h · K _{Vmax} (20 °C) = 0.09
	Actuator vented	At Δp = 6 bar: 14.0 m _n ³ /h · At Δp = 1.4 bar: 4.5 m _n ³ /h · K _{Vmax} (20 °C) = 0.15
Permissible ambient temperature		-20 to +80 °C for all versions -45 to +80 °C with metal cable gland -25 to +80 °C with inductive limit contact (SJ2-S1N) and metal cable gland The limits in the type examination certificate additionally apply for explosion-protected versions.
Influences	Temperature	≤0.15 %/10 K
	Supply air	None
	Effect of vibration	≤0.25 % up to 2000 Hz and 4 g according to IEC 770
Electromagnetic compatibility		Complying with EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21
Electrical connections		One M20 x 1.5 cable gland for 6 to 12 mm clamping range · Second M20 x 1.5 threaded connection additionally exists · Screw terminals for 0.2 to 2.5 mm ² wire cross-sections
Degree of protection		IP 66/NEMA 4X
Use in safety-instrumented systems according to IEC 61508/SIL		Suitable for use in safety-instrumented systems up to SIL 2 (single device/HFT = 0) and SIL 3 (redundant configuration/HFT = 1) according to IEC 61511. <ul style="list-style-type: none"> Triggered by the set point, emergency venting depending on positioner version at ≤3.8 mA or ≤4.4 mA By the optional solenoid valve, emergency venting at 0 V By the optional forced venting, emergency venting at <12 V
Communication (local)		SAMSON SSP interface and serial interface adapter, software requirement (SSP): TROVIS-VIEW with database module 3730-6
Communication (HART®)		HART® field communications protocol · Impedance in HART® frequency range: Receiving 350 to 450 Ω · Sending approx. 115 Ω
Software requirements (HART®)	For handheld communicator	Device description for TROVIS SAFE 3730-6
	For PC	DTM file according to specification 1.2, suitable for integrating the device into frame applications that support the use of FDT/DTM (e.g. PACTware)

Design and principle of operation








TROVIS SAFE 3730-6 Positioner (technical data in test certificates additionally apply to explosion-protected devices)		
Explosion protection		
ATEX, IECEx, ...		See article code in section 2
Binary contacts		
Two software limit contacts, reverse polarity protection, floating, configurable switching characteristics		
Signal state	No response	$\leq 1.0 \text{ mA}$
	Response	$\geq 2.2 \text{ mA}$
One fault alarm contact, floating		
Signal state	No response	$\geq 2.2 \text{ mA}$ · No fault alarm
	Response	$\leq 1.0 \text{ mA}$ · Fault alarm
For connection to		NAMUR switching amplifier acc. to EN 60947-5-6
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		M20 x 1.5, black polyamide
Weight		Approx. 1.0 kg
Conformity		 






Options for TROVIS SAFE 3730-6 Positioner

Electronic forced venting · Approval acc. to IEC 61508/SIL	
Input	24 V DC · Electrical isolation and reverse polarity protection · Static destruction limit 40 V Power consumption: $I = \frac{U - 5,7 \text{ V}}{3.84 \text{ k}\Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal '0' (no response)	≤ 12 V (emergency venting at 12 V)
Signal '1' (response)	> 19 V
Solenoid valve · Approval acc. to IEC 61508/SIL	
Input	24 V DC · Reverse polarity protection · Static destruction limit 40 V Power consumption: $I = \frac{U - 5,7 \text{ V}}{3.84 \text{ k}\Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal '0' (no response)	≤12 V (emergency venting at 12 V)
Signal '1' (response)	>19 V
Service life	>5 × 10 ⁶ switching cycles
Analog position transmitter	
Two-wire transmitter · Electrical isolation	
Power supply	12 to 30 V DC · Reverse polarity protection · Static destruction limit 40 V

Output signal	4 to 20 mA	
Operating direction	Reversible	
Operating range	−10 to +114 %	
Characteristic	Linear	
Hysteresis	Same as positioner	
High-frequency influence	Same as positioner	
Other influences	Same as positioner	
Fault alarm	Can be issued as current signal 2.4 ±0.1 mA or 21.6 ±0.1 mA	
Leakage sensor · Suitable for operation in hazardous areas		
Temperature range	−40 to +130 °C	
Tightening torque	20 ±5 Nm	
Inductive limit contact	For connection to switching amplifier acc. to EN 60947-5-6 Can be used in combination with a software limit contact	
SJ2-SN proximity switch	NAMUR NC contact	
	NAMUR NO contact	
External position sensor		
Travel	Same as positioner	
Cable	10 m · Flexible and durable · With M12x1 connector · Flame-retardant acc. to VDE 0472 · Resistant to oils, lubricants and coolants as well as other aggressive media	
Permissible ambient temperature	−60 to +105 °C Also observe the limits in the test certificate for explosion-protected versions.	
Immunity to vibration	Up to 10 g in the range of 10 to 2000 Hz	
Degree of protection	IP 67	
Binary input · Electrical isolation · Switching behavior configured over software		
Active switching behavior (default setting)		
Connection	For external switch (floating contact) or relay contact	
Electric data	Open-circuit voltage when contact is open: max. 10 V Pulsed DC current reaching peak value of 100 mA and RMS value of 0.01 mA when contact is closed	
Contact	Closed, R < 20 Ω	ON switching state (default setting)
	Open, R > 400 Ω	OFF switching state (default setting)
Passive switching behavior		
Connection	For externally applied DC voltage, reverse polarity protection	
Electric data	3 to 30 V DC · Static destruction limit 40 V · Current consumption 3.7 mA at 24 V	
Voltage	>6 V	ON switching state (default setting)
	<1 V	OFF switching state (default setting)

Summary of explosion protection certificates for TROVIS SAFE 3730-6 Positioner

TROVIS SAFE	Certification		Type of protection/Comments
-110	 EC type examination certificate	Number PTB 10 ATEX 2007 Date 18.08.2010	II 2G Ex ia IIC/IIB T6; II 2D Ex tb IIIC T80°C IP66
		Number GYJ12.1109X Date 08.10.2012 Valid until 07.10.2017	Ex ia IIC T4~T6 Ga; DIP A21 Ta, T4~T6
-111		Number IECEx PTB 10.0057 Date 10.01.2011	Ex ia IIC/IIB T6; Ex d[ia] IIC/IIB T6; Ex tD A21 IP66 T80°C
-112		Number GYJ12.1109X Date 08.10.2012 Valid until 07.10.2017	Ex ia II CT4~T6 Ga; DIP A21 Ta, T4~T6
-113		Number RU C-DE.08.B.00113 Date 15.11.2013 Valid until 14.11.2018	1Ex ia IIC T6 Gb; 1Ex tb IIIC T80°C Db IP66
-130		Number 3012394 Date 05.11.2014	IS / Class I,II,III / Div. 1 / Gr. ABCDEFG AEx ia IIC / Class I / Zone 0 NI / Class I / Div. 2 / Gr. ABCD S / Class II / Div. 2 / Gr. FG Enclosure Type 4X
-131		Number 2682094 Date 06.02.2015	Ex ia IIC T4/T5/T6; Class I, Zone 0 Class I, Groups A,B,C, and D Class II Groups E,F and G; Class III; Type 4 Enclosure
-210	 EC type examination certificate	Number PTB 10 ATEX 2007 Date 18.08.2010	mit Feldbarriere Typ 3770-1: II 2G Ex d[ia] IIC/IIB T6 Gb; II 2D Ex tb IIIC T80°C IP66
-211		Number IECEx PTB 10.0057 Date	Ex ia IIC/IIB T6; Ex d[ia] IIC/IIB T6; Ex tD A21 IP66 T80°C

TROVIS SAFE		Certification		Type of protection/Comments
3730-6-	-213		Number RU C-DE.08.B.00113 Date 15.11.2013 Valid until 14.11.2018	1Ex d[ia Ga]iiC T6 Gb X
	-810	 Statement of Conformity	Number PTB 10 ATEX 2008 X Date 18.08.2010	II 3G Ex nA ic IIC T6 Gc; II 3D Ex tc IIIC T80°C Dc IP66
	-811		Number IECEx PTB 10.0058X Date	Ex nA II T6, Ex nL IIC/IIB T6; Ex tD A22 IP66 T80°C
	-812		Number GYJ12.1110X Date 08.10.2012 Valid until 07.10.2017	Ex nL IIC T4~T6 Gc; Ex nA IIC T4~T6 Gc; DIP A22 Ta, T4~T6
	-813		Number RU C-DE.08.B.00113 Date 15.11.2013 Valid until 14.11.2018	2Ex nA IIC T6 Gc; 2Ex ic IIC T6 Gc; 2Ex tc IIIC T80°C Dc IP66

4 Attachment to the control valve – Mounting parts and accessories



NOTICE

Risk of malfunction due to incorrect sequence of mounting, installation and start-up!

Keep the following sequence.

1. Remove the protective film from the 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 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 according to VDI/VDE 3847
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators



NOTICE

Risk of malfunction due to incorrect mounting parts/accessories or incorrect assignment of lever and pin position.

Attach the positioner to the control valve only using the mounting parts and accessories as specified in Table 1 to Table 6. Observe the type of attachment.

Observe the assignment between lever and pin position (see travel tables on page 21).

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 21 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 equipped with the M lever (pin position 35) as standard.

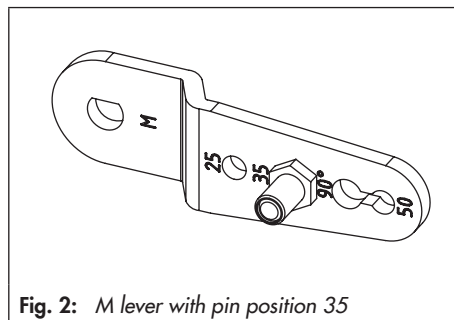


Fig. 2: M lever with pin position 35



NOTICE

Risk of malfunction because the newly mounted lever has not been adapted to the internal measuring lever.

Move the newly mounted lever (1) once all the way as far as it will go in both directions.

Travel tables

**Note:**

The **M** lever is included in the scope of delivery.

S, L, XL levers for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3).

Direct attachment to Type 3277-5 and Type 3277 Actuators

Actuator size [cm ²]	Rated travel [mm]	Adjustment range at positioner ¹⁾ Travel [mm]	Required lever	Assigned pin position
120	7.5	5.0 to 25.0	M	25
120/175/240/350	15	7.0 to 35.0	M	35
355/700/750	30	10.0 to 50.0	M	50

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves with Type 3271 Actuator		Adjustment range at positioner ¹⁾ Other control valves		Required lever	Assigned pin position
Actuator size [cm ²]	Rated travel [mm]	Min. travel [mm]	Max. travel [mm]		
60 and 120 with Type 3510 Valve	7.5	3.6	18.0	S	17
120	7.5	5.0	25.0	M	25
120/175/240/350	15	7.0	35.0	M	35
700/750	7.5				
355/700/750	15 and 30	10.0	50.0	M	50
1000/1400/2800	30	14.0	70.0	L	70
	60	20.0	100.0	L	100
1400/2800	120	40.0	200.0	XL	200

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

¹⁾ The min./max. adjustment range is based on the **NOM (nominal range)** initialization mode

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

- Required mounting parts and accessories: Table 1 on page 50
- Observe the travel table on page 21.

Actuator with 120 cm² (see Fig. 3)

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a hole 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 on the positioner, making sure the two seals are seated properly.
2. Remove screw plug (4) on the back of the positioner and seal the signal pressure 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 it 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 (Fig. 3, on the left) pointing towards the signal pressure connection.

Make sure that the gasket (14) points towards the actuator yoke.

5. **15 mm travel:** Keep the follower pin (2) on the **M** lever (1) on the back of the positioner in the pin position **35** (delivered state).
7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the hole for pin position **25** and screw tight.
6. Insert formed seal (15) into the groove of the positioner housing and insert the seal (10.1) on the back of the housing.
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 rotary pushbutton. 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.



Note applying to all types of attachment except for direct attachment to Type 3277-5:

The signal pressure output at the back must be sealed by the screw plug (4, order no. 0180-1254) and the associated O-ring (order no. 0520-0412).

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

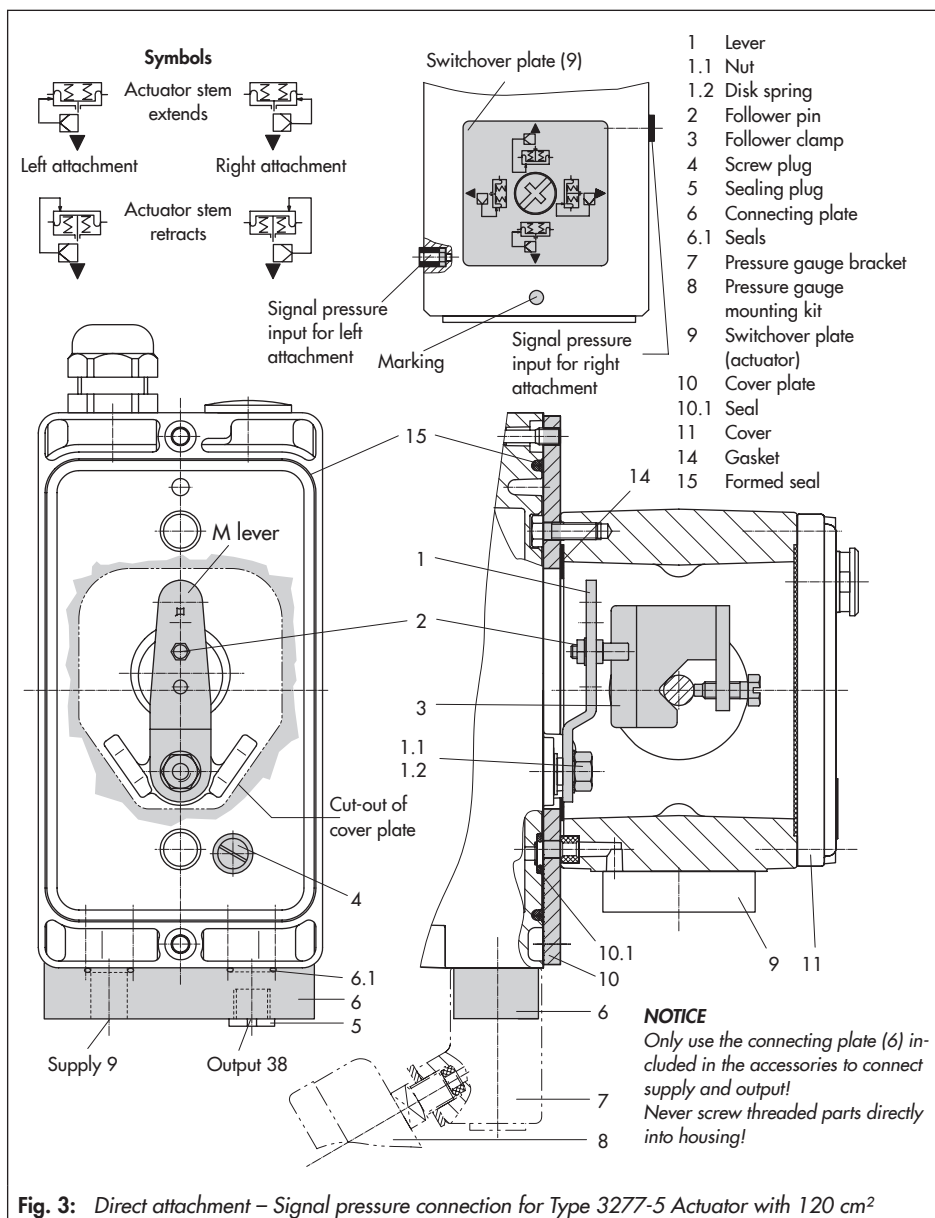


Fig. 3: Direct attachment – Signal pressure connection for Type 3277-5 Actuator with 120 cm²

4.1.2 Type 3277 Actuator

- Required mounting parts and accessories: Table 2 on page 51
- Observe the travel table on page 21.

Actuators with 175 to 750 cm² effective areas (see Fig. 4)

Mount the positioner on the yoke. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "actuator stem extends" internally through a hole in the valve yoke and for "actuator stem retracts" through an external pipe.

1. Place follower clamp (3) on the actuator stem, align it 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 (Fig. 4, on the left) pointing towards the signal pressure connection. Make sure that the gasket (14) points towards the actuator yoke.
3. For actuators with 355, 700 or 750 cm², remove the follower pin (2) on the **M** lever (1) on the back of the positioner from pin position **35**, reposition it in the hole for pin position **50** and screw tight.
For actuators 175, 240 and 350 cm² with 15 mm travel, keep the follower pin (2) in pin position **35**.
4. Insert formed seal (15) into the groove of the positioner housing.
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 rotary pushbutton. 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 is positioned to match the actuator symbol for the actuator's fail-safe action "actuator stem extends" or "actuator stem retracts". If this is not the case, unscrew the three fastening screws and lift off the cover. Turn the gasket (16) by 180° and re-insert it.
The old connection block version (Fig. 4, bottom) requires the switch plate (13) to be turned to align the actuator symbol with the arrow marking.
7. Place the connection block (12) with the associated seals against the positioner and the actuator yoke and fasten using the screw (12.1). For actuators with fail-safe action "actuator stem retracts", additionally remove the stopper (12.2) and mount the external signal pressure pipe.
8. Mount cover (11) on the other side.
Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

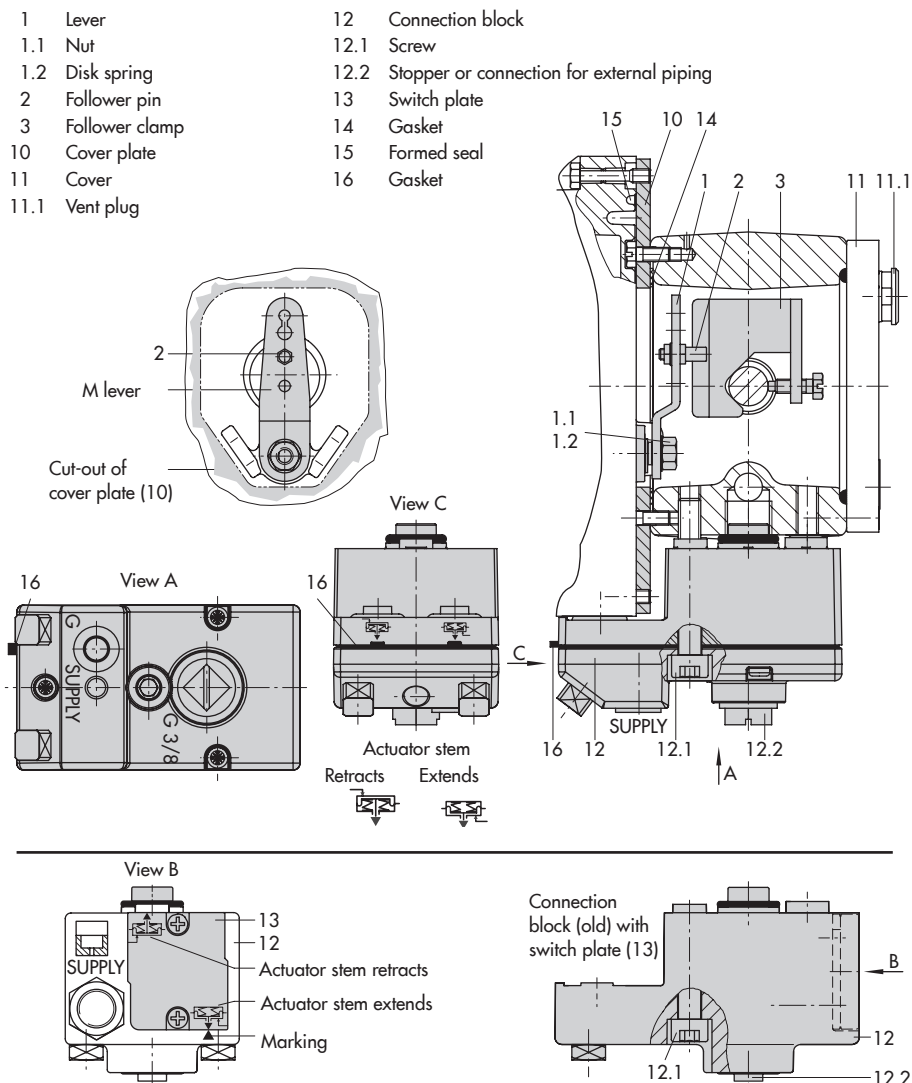


Fig. 4: Direct attachment – Signal pressure connection for Type 3277 Actuator with 175 to 750 cm²

4.2 Attachment according to IEC 60534-6

- Required mounting parts and accessories: Table 3 on page 52
- Observe the travel table on page 21.

Fig. 5

The positioner is attached to the control valve using 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) for fastening.

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

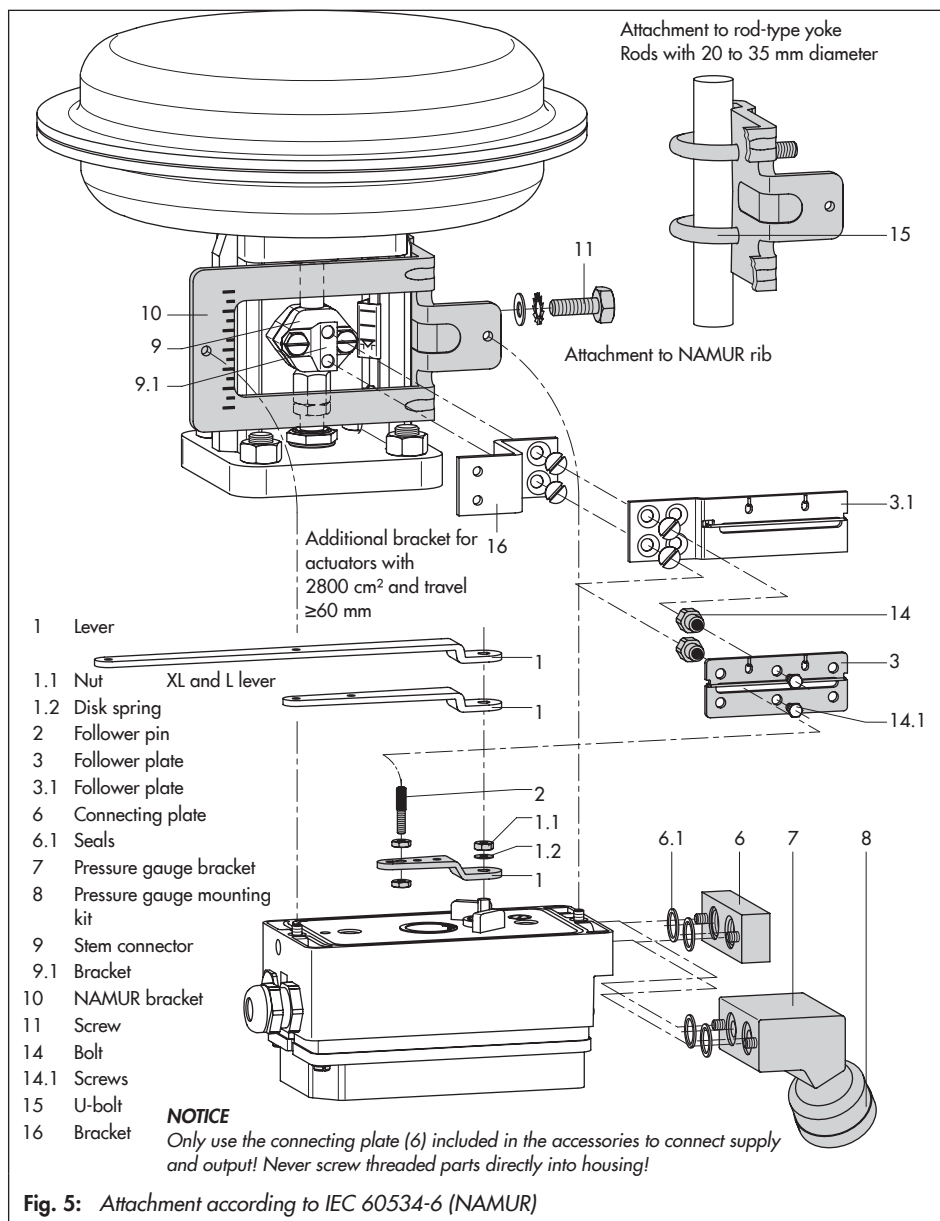
- For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
 - For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).
2. Mount NAMUR bracket (10) to the control valve as follows:
 - For **attachment to the NAMUR rib**, use an M8 screw (11) and toothed lock washer directly in the yoke hole.
 - For attachment to **valves with rod-type yokes**, use two U-bolts (15) around the yoke. Align the NAMUR bracket (10) according to the embossed scale so that the follower plate (3) is shifted by half the angle range to the NAMUR bracket (the slot of the follower plate is centrally

aligned with the NAMUR bracket at mid valve travel).

3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals (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 travel listed in the travel table on page 21.

Should a pin position other than position **35** with the standard **M** lever be required, or an **L** or **XL** lever size be required, proceed as follows:

5. Screw the follower pin (2) in the assigned lever hole (pin position as specified in the travel table). Only use the longer follower pin (2) included in the mounting kit.
6. Place the lever (1) on the shaft of the positioner and fasten it 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 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 mounting screws.



4.3 Attachment according to VDI/VDE 3847

TROVIS SAFE 3730-6-xxxxxxx0xx0600 and TROVIS SAFE 3730-6-xxxxxxx0xx0700 Positioners with air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

TROVIS SAFE 3730-6-xxxxxxx0xx0000 Positioner without air purging of the actuator's spring chamber can be attached according to VDI/VDE 3847.

This type of attachment allows the positioner to be replaced quickly while the process is running by blocking the air in the actuator.

The signal pressure can be blocked in the actuator by unscrewing the red retaining screw (20) and then turning the air blocker (19) on the bottom of the adapter block.

Attachment to Type 3277 Actuator (see Fig. 6)

- Required mounting parts and accessories: Table 4 on page 52

Mount the positioner on the yoke as shown in Fig. 6. The signal pressure is routed to the actuator over the connecting plate (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.

Only the Y1 port is required for positioner attachment. The Y2 port can be used for air purging of the spring chamber.

1. Place follower clamp (3) on the actuator stem, align it and screw tight so that the

mounting screw is located in the groove of the actuator stem.

2. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner. For positioners **without air purging**, replace the screw plug (4) with a vent plug.
3. For actuators with 355, 700 or 750 cm², remove the follower pin (2) on the M lever (1) on the back of the positioner from pin position 35, reposition it in the hole for pin position 50 and screw tight.
For actuators 175, 240 and 350 cm² with 15 mm travel, keep the follower pin (2) in pin position 35.
4. Insert the formed seal (6.2) in the groove of the adapter bracket (6).
5. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).
6. Mount the blank plate (18) to the turnboard (17) using the screws (18.1). Make sure that the seals are correctly seated.



Note:

A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determines the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (► AB 11 EN).

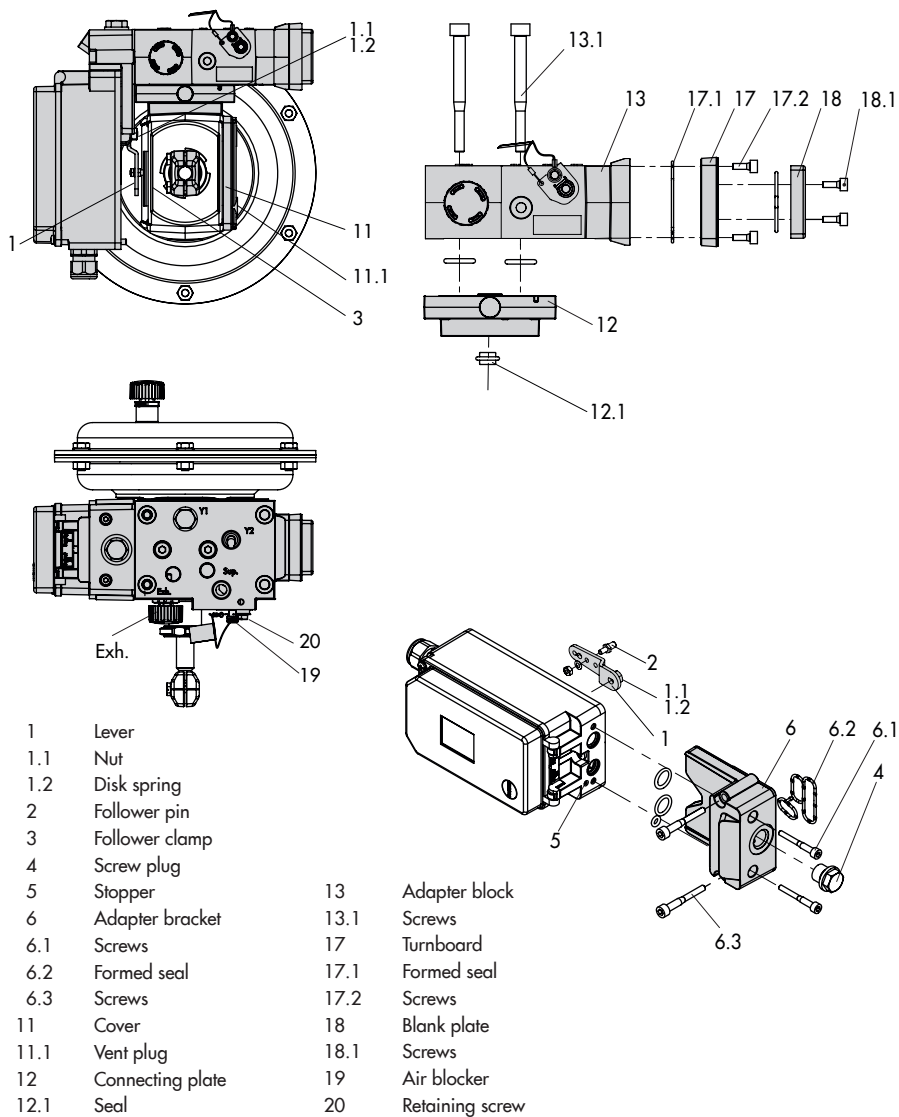
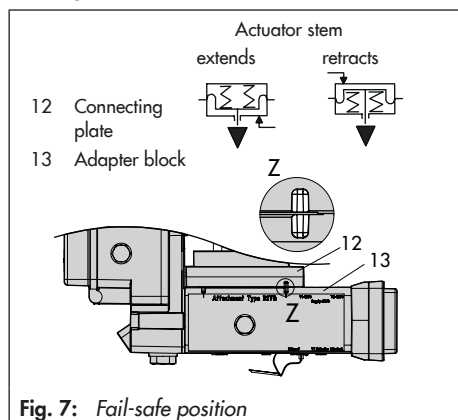


Fig. 6: Attachment according to VDI/VDE 3847 to Type 3277 Actuator

7. Insert the screws (13.1) through the middle holes of the adapter block (13).
8. Place the connecting plate (12) together with the seal (12.1) onto the screws (13.1) corresponding to the fail-safe action "actuator stem extends" or "actuator stem retracts". The fail-safe action that applies is determined by aligning the groove of the adapter block (13) with the groove of the connecting plate (12) (Fig. 7).



9. Mount the adapter block (13) together with the connecting plate (12) to the actuator using the screws (13.1).
10. Insert the vent plug (11.1) into the **Exh.** connection.
11. For fail-safe action "actuator stem extends", seal the Y1 port with a blanking plug.
For fail-safe action "actuator stem retracts", connect the Y1 port to the signal pressure connection of the actuator.

Place positioner on the adapter block (13) 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 rotary pushbutton.

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

Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.

12. Mount cover (11) on the other side to the yoke. Make sure that the vent plug is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

Attachment to NAMUR rib (see Fig. 8)

- Required mounting parts and accessories: Table 4 on page 52
- Observe the travel table on page 21.

1. **Series 240 Valves, actuator size up to 1400-60 cm²:** Screw the two bolts (14) to the bracket of the stem connector or directly to the stem connector (depending on the version), place the follower plate (3) on top and use the screws (14.1) to fasten it.

Type 3251 Valve, 350 to 2800 cm²:

Screw the longer follower plate (3.1) to the bracket of the stem connector or directly to the stem connector (depending on the version).

Type 3254 Valve, 1400-120 to 2800 cm²:

Screw the two bolts (14) to the bracket (16). Fasten the bracket (16) onto the stem connector, place the follower plate (3) on top and use the screws (14.1) to fasten it.

Mount the positioner on the NAMUR rib as shown in Fig. 8.

2. For **attachment to the NAMUR rib**, fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock washer (11). Align the marking on the NAMUR valve connection (on the side marked '1') to 50 % travel.

For attachment to **valves with rod-type yokes**, use the two U-bolts (15) around the yoke. Fasten the NAMUR connection block (10) directly into the existing yoke bore using the screw and toothed lock

washer (11). Align the marking on the NAMUR valve connection (on the side marked '1') to 50 % travel.

3. Place the adapter bracket (6) on the positioner and mount using the screws (6.1). Make sure that the seals are correctly seated. For positioners **with air purging**, remove the stopper (5) before mounting the positioner. For positioners **without air purging**, replace the screw plug (4) with a vent plug.
4. Select required lever size (1) M, L or XL and pin position according to the actuator size and valve travel listed in the travel table on page 21.

Should a pin position other than position 35 with the standard M lever be required, or an L or XL lever size be required, proceed as follows:

- Screw the follower pin (2) in the assigned lever hole (pin position as specified in the travel table). Only use the longer follower pin (2) included in the mounting kit.
- Place the lever (1) on the shaft of the positioner and fasten it 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.

5. Insert the formed seal (6.2) in the groove of the adapter bracket.
6. Insert the formed seal (17.1) into the turnboard (17) and mount the turnboard to the adapter block (13) using the screws (17.2).
7. Mount the blank plate (18) to the turnboard using the screws (18.1). Make sure that the seals are correctly seated.

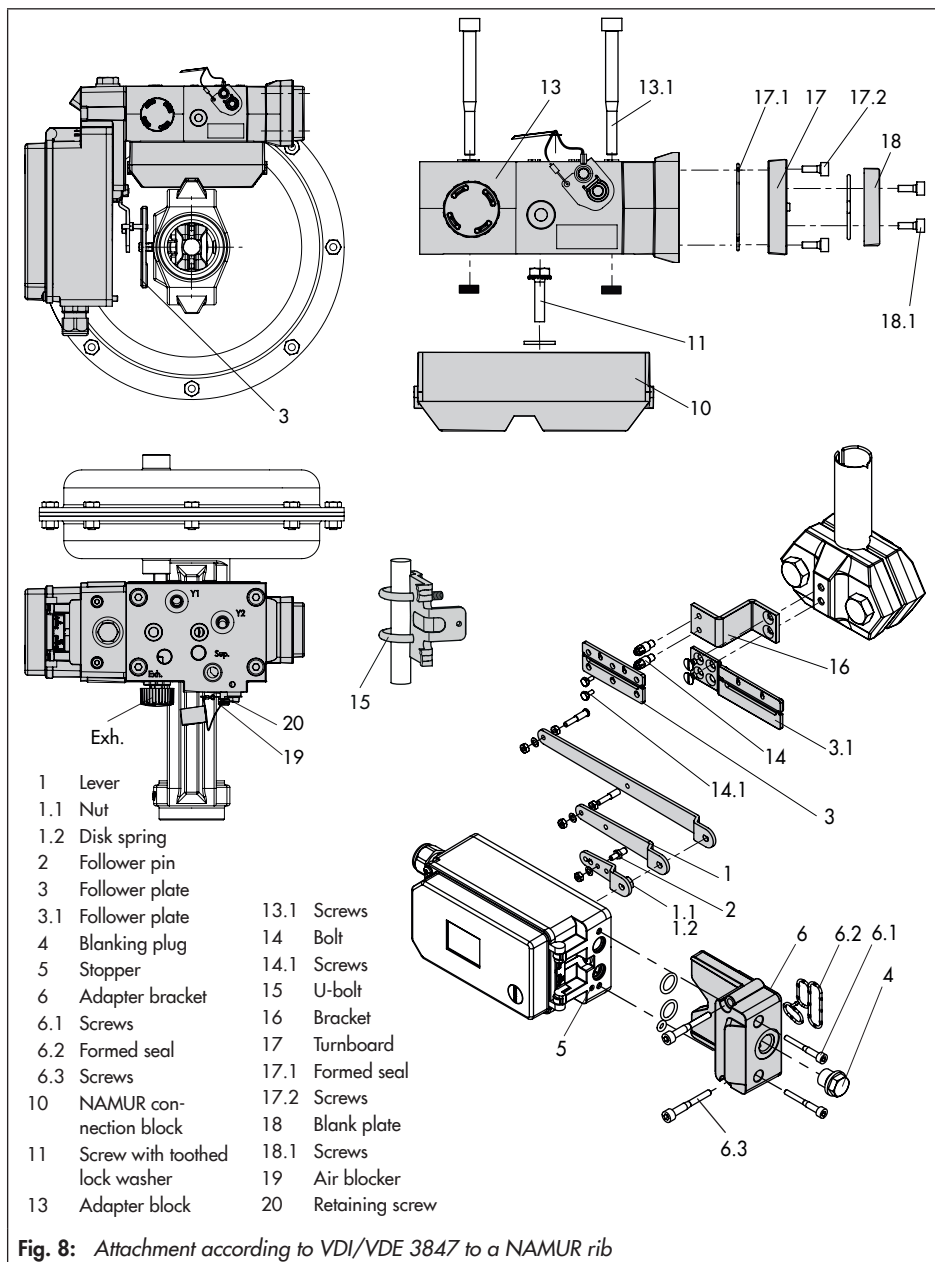
**Note:**

A solenoid valve can also be mounted in place of the blank plate (18). The orientation of the turnboard (17) determines the mounting position of the solenoid valve. Alternatively, a restrictor plate can be mounted (► AB 11 EN).

nection of the actuator. Seal the Y2 port with a blanking plug.

For **double-acting actuators and actuators with air purging**, connect the Y2 port of the adapter block to the signal pressure connection of the second actuator chamber or spring chamber of the actuator.

8. Fasten the adapter block (13) to the NAMUR connection block using the screws (13.1).
9. Insert the vent plug into the Exh. connection.
10. Place the positioner on the adapter block (13) in such a manner that the follower pin (2) rests on the top of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
Fasten the positioner to the adapter block (13) using the two fixing screws (6.3). Make sure the formed seal (6.2) is properly seated.
11. For **single-acting actuators without air purging**, connect the Y1 port of the adapter block to the signal pressure con-



4.4 Attachment to Type 3510 Micro-flow Valve

Fig. 9

- Required mounting parts and accessories: Table 3 on page 52
- Observe the travel table on page 21.

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

1. Fasten the bracket (9.1) to the stem connector.
2. Screw the two bolts (9.2) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (9.3) for fastening.
3. Mount the travel indication scale (accessories) to the outer side of the yoke using the hex screws (12.1), ensuring that the scale is aligned with the stem connector.
4. Fasten the hex bar (11) onto the outer side of yoke by screwing the M8 screws (11.1) directly into the holes on the yoke.
5. Fasten the bracket (10) to the hex bar (11) using the hex screw (10.1), washer and tooth lock washer.
6. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals are seated properly.
7. Unscrew the standard M lever (1) including follower pin (2) from the positioner shaft.
8. Take the S lever (1) and screw the follower pin (2) in the hole for pin position 17.

9. Place the S lever 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.

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

4.5 Attachment to rotary actuators

Fig. 11

- Required mounting parts and accessories: Table 5 on page 53
- Observe the travel table on page 21.

The positioner is mounted to the rotary actuator using two pairs of 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 adapter (5).

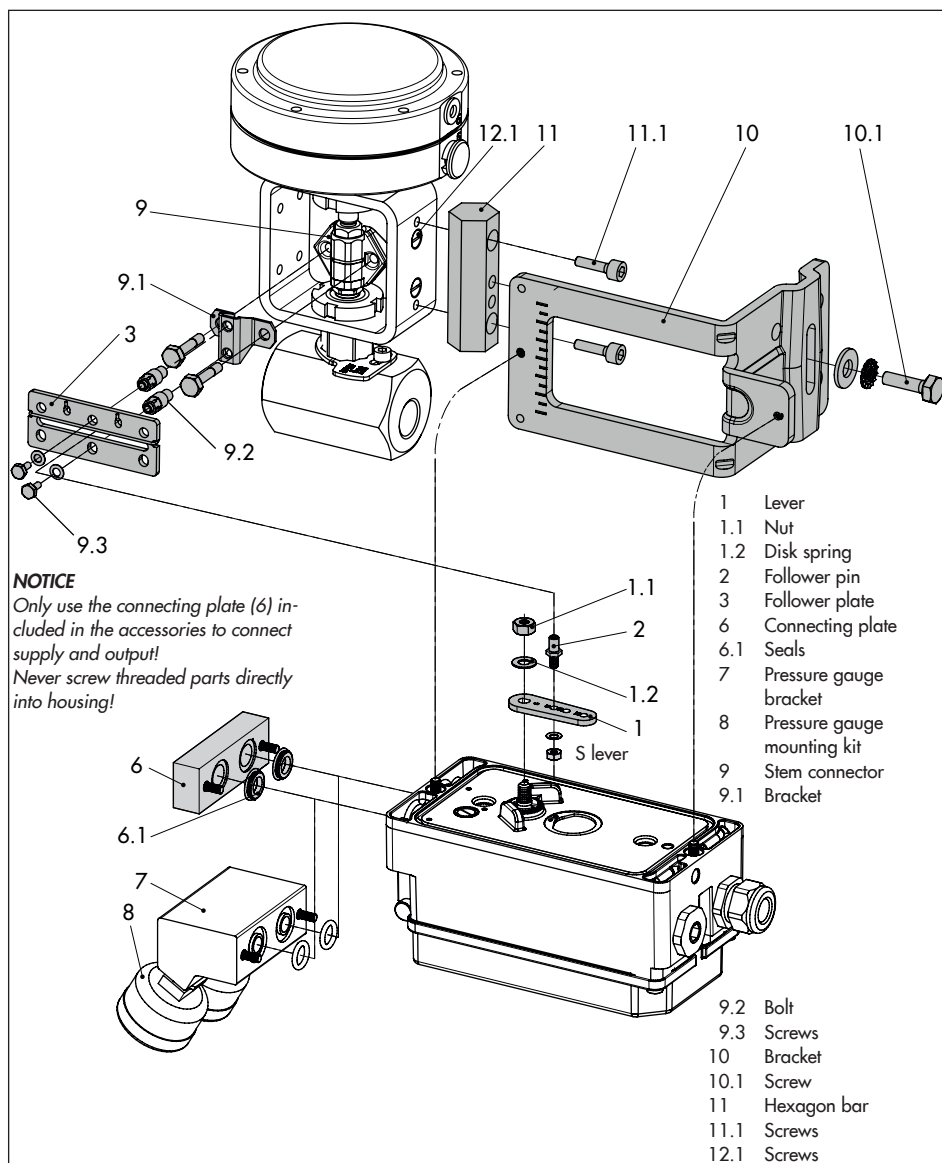


Fig. 9: Attachment to Type 3510 Micro-flow Valve

2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 11 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Fasten the coupling wheel (4) and follower clamp (3) tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Fasten the bottom pair of brackets (10.1) with the bends pointing either facing to the inside or to the outside (depending on the actuator size) onto the actuator housing. Position the top pair of brackets (10) and fasten.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals are seated properly. **Double-acting** springless rotary actuators require the use of a reversing amplifier on the connection side of the positioner housing (see section 4.6).
6. Unscrew the standard follower pin (2) from the positioner's **M** lever (1). Use the metal follower pin (\varnothing 5 mm) included in the mounting kit and screw tight into the hole for pin position **90°**.
7. Place positioner on the top bracket (10) and fasten tight. Taking the actuator's direction of rotation into account, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (Fig. 11). 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 the 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.

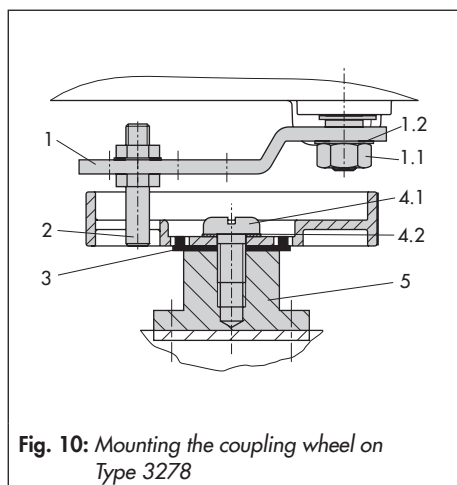


Fig. 10: Mounting the coupling wheel on Type 3278

4.5.1 Heavy-duty version

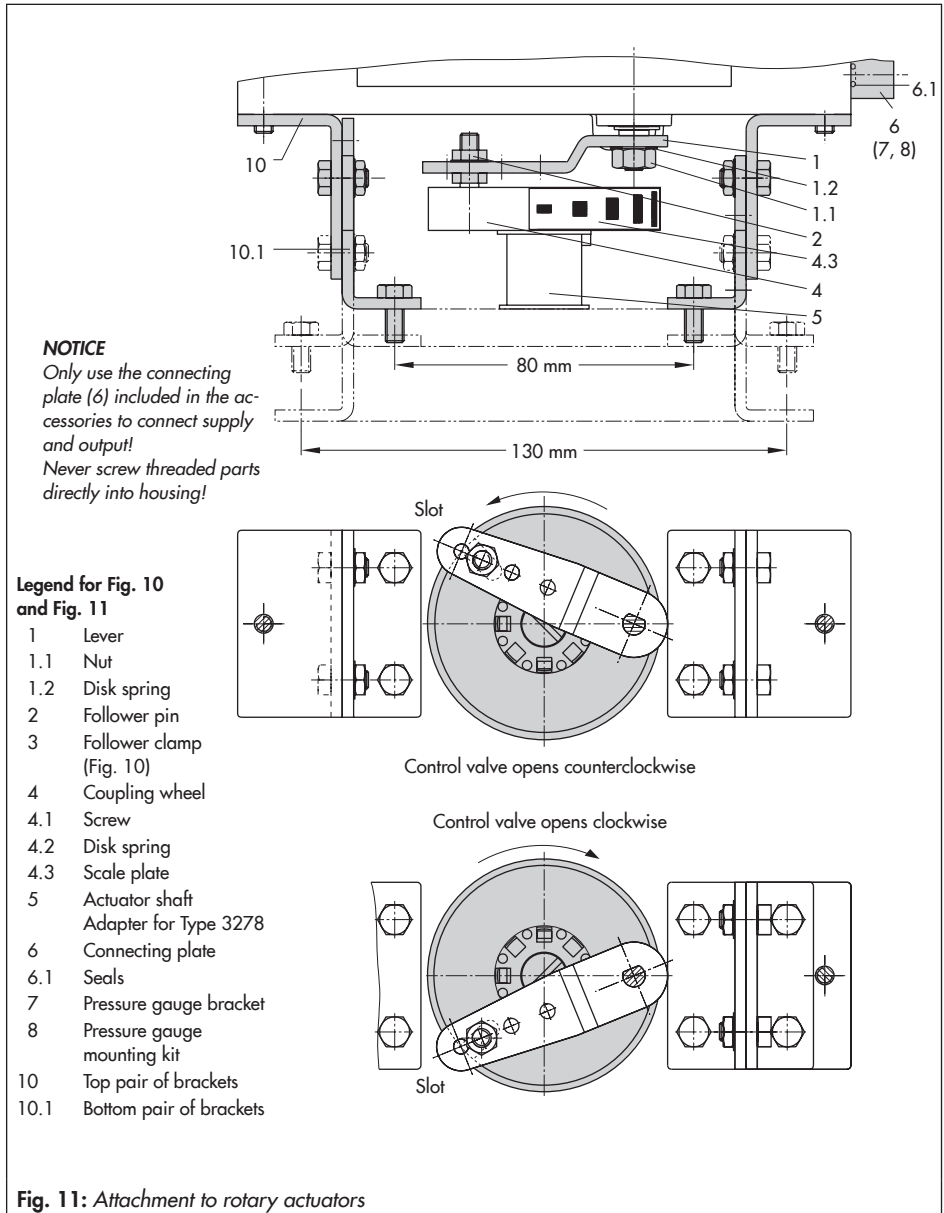
Fig. 12

- Required mounting parts and accessories: Table 5 on page 53

Both mounting kits contain all the necessary mounting parts. The parts for the actuator size used must be selected from the mounting kit.

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.
- For **SAMSON Type 3278 and VETEC S160 Rotary Actuators**, 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) on to **Type 3278, VETEC S160 and VETEC R Actuators**. For **VDI/VDE version**, this step depends on the actuator size.
 - Stick adhesive label (4.3) onto the coupling 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.
 - Fasten coupling (4) on the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).
 - Unscrew the standard follower pin (2) from the positioner's M lever (1). Attach the follower pin (Ø 5 mm) included in the mounting kit to pin position 90°.
 - Mount connecting plate (6) for required G 1/4 connecting thread or pressure gauge bracket (7) with pressure gauges on the positioner, making sure the two seals (6.1) are seated properly. Double-acting springless rotary actuators require the use of a reversing amplifier on the connection side of the positioner housing (refer to section 4.6).
 - For actuators with a volume of less than 300 cm³, fit the restriction (order no. 1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).
 - Place positioner on housing (10) and screw it tight. Taking the actuator's direction of rotation into account, adjust lever (1) so that it engages in the correct slot with its follower pin (Fig. 13).

4.6 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 4.6.1.

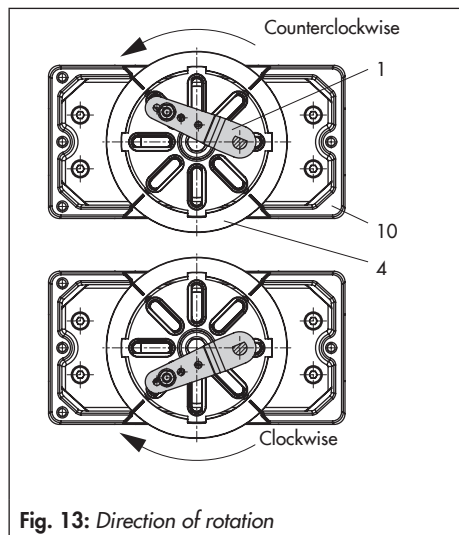


Fig. 13: Direction of rotation

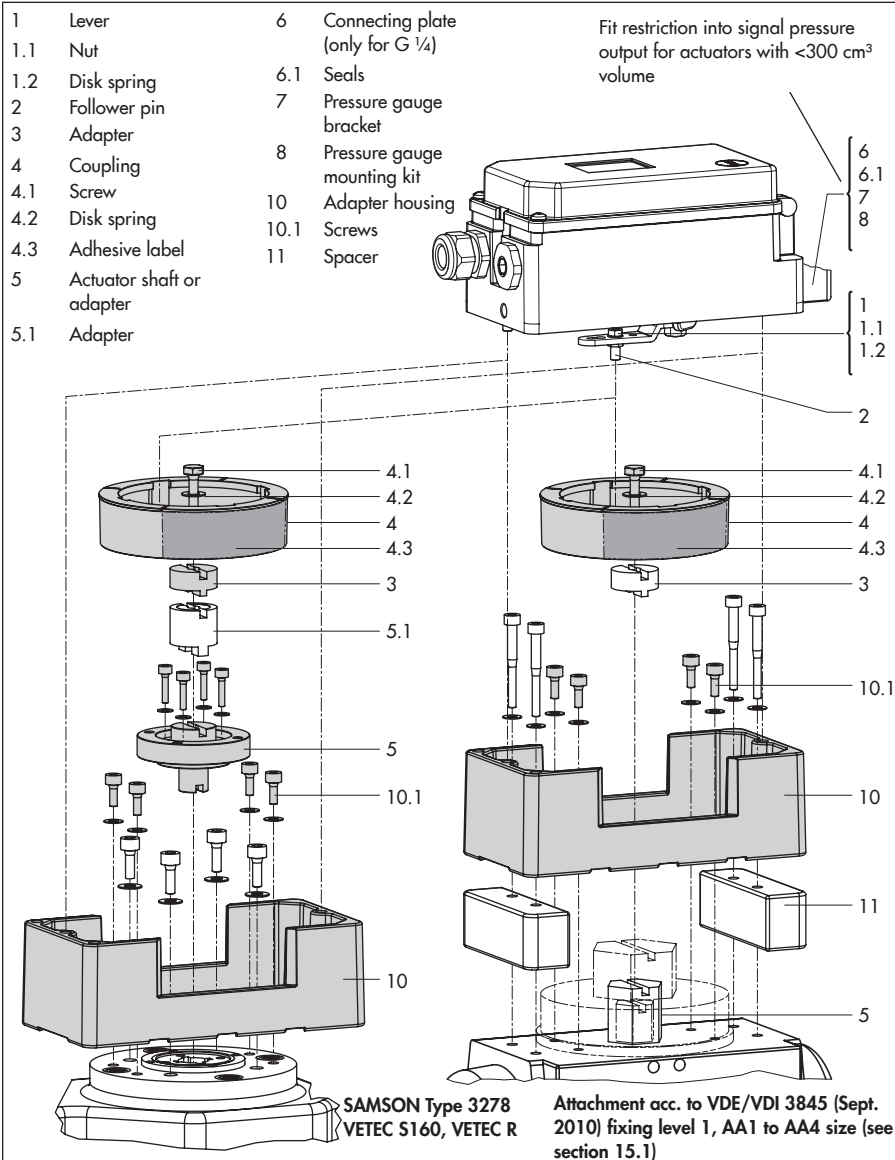


Fig. 12: Attachment to rotary actuators (heavy-duty version)

The following applies to all reversing amplifiers:

The signal pressure of the positioner is supplied at the output 1 of the reversing amplifier. An opposing pressure, which equals the required supply pressure (Z) when added to the pressure at output 1, is applied at output 2.

The following relationship applies:

Output 1 + Output 2 = Supply pressure (Z).

Connect output 1 to the loading pressure connection on the actuator that causes the valve to open when the pressure rises.

Connect output 2 to the loading pressure connection on the actuator that causes the valve to close when the pressure rises.

→ Set slide switch on positioner to AIR TO OPEN.

**Note:**

How the outputs are marked depends on the reversing amplifier used:

– **Type 3710:** Output 1/2 = Y_1/Y_2

– **1079-1118 and 1079-1119:**

Output 1/2 = A_1/A_2

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 slide 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 connection boreholes **A₁** and **Z**.

**NOTICE**

Air can escape uncontrolled from the signal pressure connection.

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

**Note:**

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

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

Fig. 14

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.

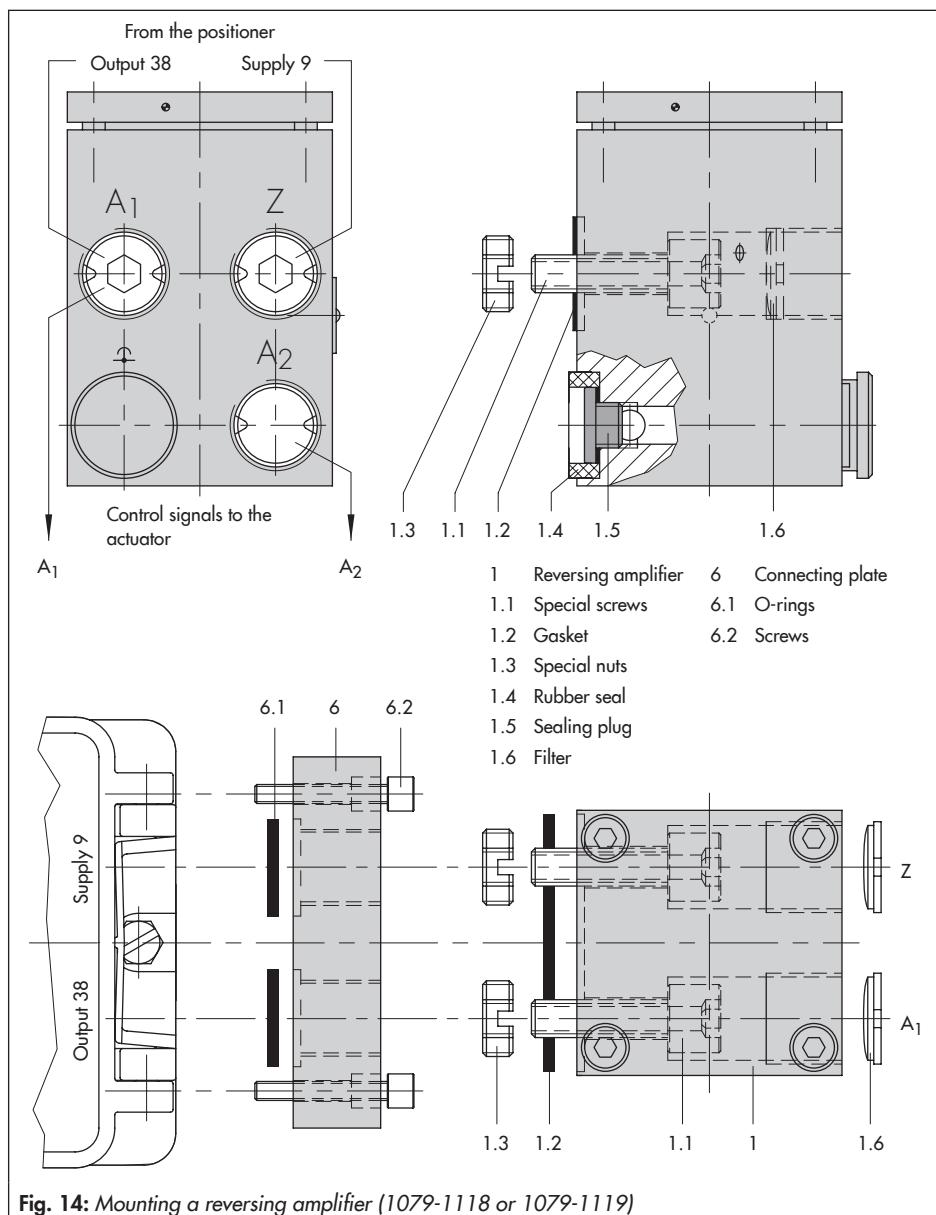
6. After initialization, set Code 16 (Pressure limit) to No.

Pressure gauge attachment

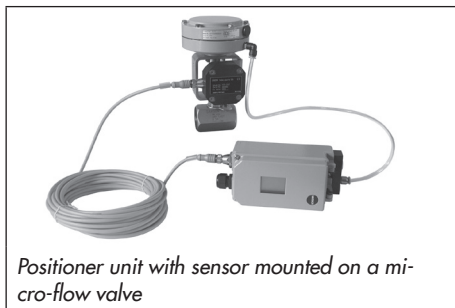
The mounting sequence shown in Fig. 14 remains unchanged. Screw a pressure gauge bracket onto the connections **A₁** and **Z**.

Pressure gauge	G 1/4	1400-7106
bracket	1/4 NPT	1400-7107

Pressure gauges for supply air Z and output **A₁** as listed in Table 1 to Table 7.



4.7 Attachment of external position sensor



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 Ø 8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. See Table 7.

- *Required mounting parts and accessories: Table 7 on page 54*

In the positioner version with an external position sensor, the sensor located 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 can be mounted as required to a wall or a pipe.

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

4.7.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm² (Fig. 15)

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 15 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

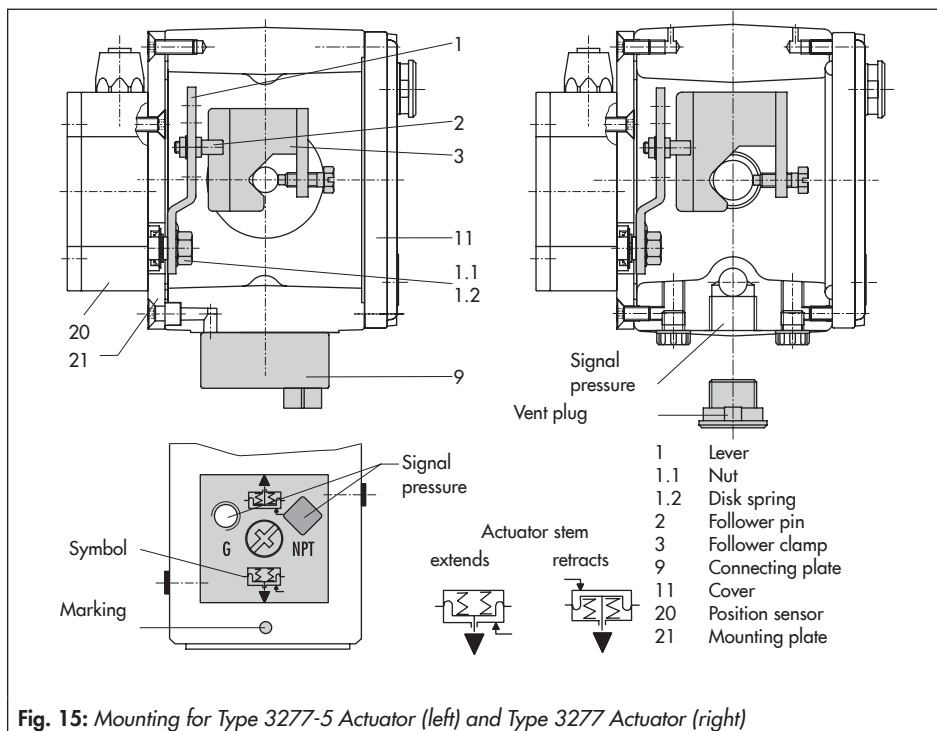
- Turn the connecting plate (9) so that the correct symbol for the fail-safe action "actuator stem extends" or "actuator stem

retracts" is aligned with the marking (Fig. 15, below).

- Make absolutely sure that the gasket for the connecting plate (9) is correctly inserted.
- The connecting plate has threaded holes with NPT and G threads. Seal the threaded connection that is not used with the rubber seal and square plug.

Type 3277 Actuator with 175 to 750 cm²:

The signal pressure is routed to the connection at the side of the actuator yoke for the version with "actuator stem extends" fail-safe



action. For the fail-safe action "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 which lever and position of the follower pin (2) is to be used from the travel table on page 21. The positioner is delivered with the **M** lever in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the hole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever in **mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place follower clamp (3) on the actuator stem, align it and screw tight so that the mounting screw is located in the groove of the actuator stem.
6. Place the mounting plate 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. Fasten 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 is located at the bottom when the control valve is installed to allow any condensed water that collects to drain off.

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

- Required mounting parts and accessories: Table 7 on page 54

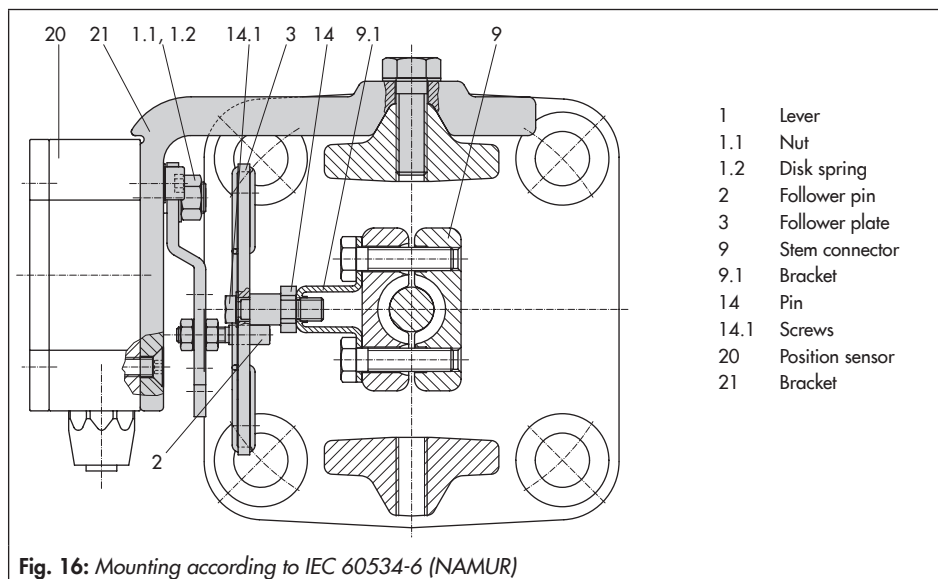
Fig. 16

1. Place the lever (1) on the position 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 **M** lever with the follower pin (2) at position **35** is designed for

120 to 350 cm² actuators with 15 mm rated travel. For other actuator sizes or travels, select the lever and pin position from the travel table on page 21. **L** and **XL** levers are included in the mounting kit.

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

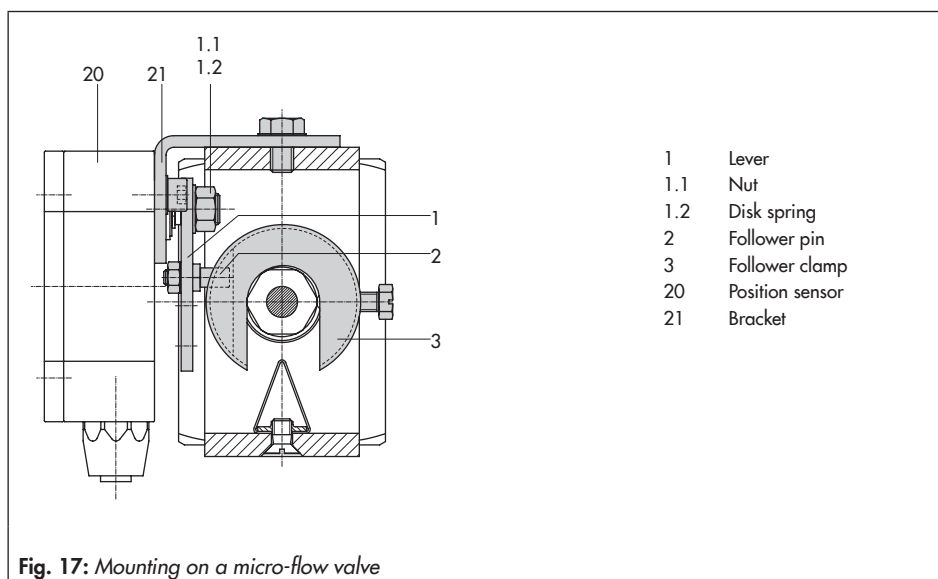


4.7.3 Mounting the position sensor to Type 3510 Micro-flow Valve

- Required mounting parts and accessories: Table 7 on page 54

Fig. 17

1. Place the lever (1) on the position sensor in **mid-position** and **hold it in place**. Unscrew the nut (1.1) and remove the standard attached **M** lever (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 **S** lever (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 in mid-position and hold it in place. Screw on the nut (1.1).
4. Place follower clamp (3) on the valve stem connector, align 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).



4.7.4 Mounting on rotary actuators

- Required mounting parts and accessories: Table 7 on page 54

Fig. 18

1. Place the lever (1) on the position 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. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (\varnothing 5 mm) 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 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 4.5.

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

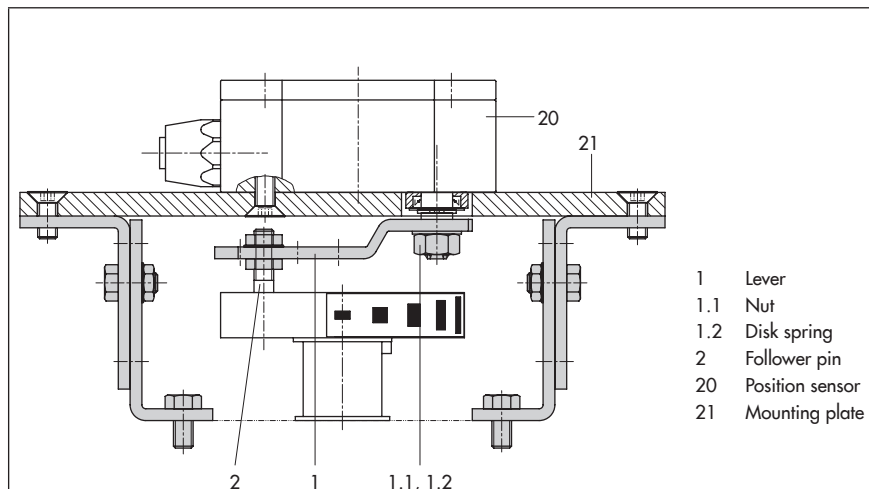


Fig. 18: Mounting on rotary actuators

4.8 Mounting the leakage sensor

Fig. 19

Normally, the control valve is delivered with positioner and leakage sensor already mounted.

If the leakage sensor is mounted after the valve has been installed or it is mounted on to another control valve, proceed as described in following.



NOTICE

Risk of malfunction due to incorrect fastening!

Fasten the leakage sensor using a torque of 20 ± 5 Nm.

The M8 threaded connection on the NAMUR rib should preferably be used to mount the sensor (Fig. 19).



Tip:

If the positioner was mounted directly onto the actuator (integral attachment), the NAMUR interfaces on either side of the valve yoke can be used to mount the leakage sensor.

The start-up of the leakage sensor is described in detail in the Operating Instructions for EXPERTplus Valve Diagnostics

► EB 8389-1S EN.

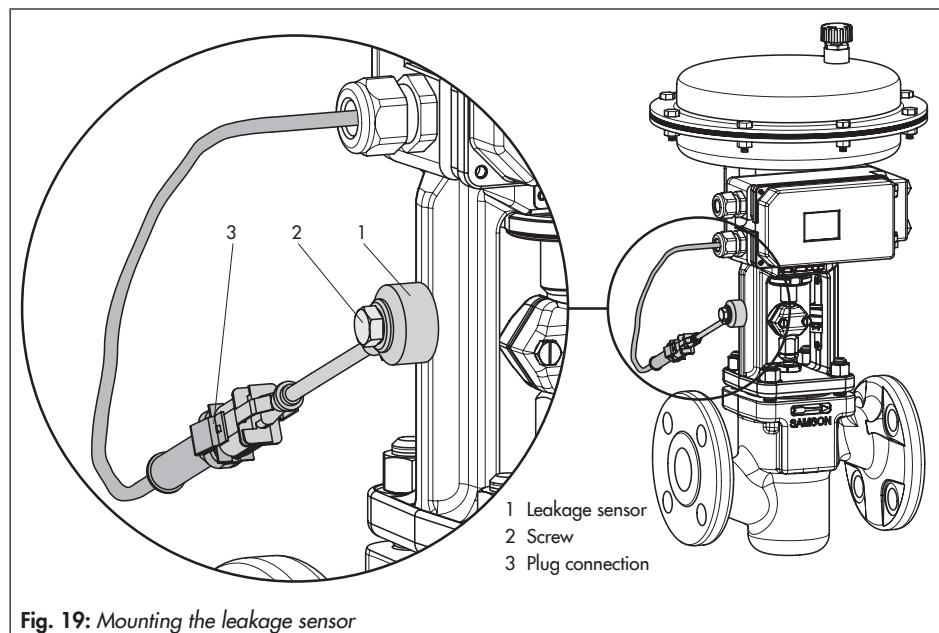


Fig. 19: Mounting the leakage sensor

4.9 Attaching positioners with stainless steel housings

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



Note:

The pneumatic connecting plate and pressure gauge bracket are available in stainless steel (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 (stainless steel)	G ¼ ¼ NPT	1402-0265 1400-7108

Table 1 to Table 6 apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment

All mounting kits from Table 1 and Table 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 5 can be used except for the heavy-duty version. Connecting plate in stainless steel.

4.10 Air purging function for single-acting actuators

The instrument air leaving 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, 175 to 750 cm²

FA: Remove the stopper (12.2, Fig. 4) at the black connection block and make a pneumatic connection to the spring chamber on the vented side.



NOTICE

Mounting possibly incorrect when old powder-paint-coated aluminum connection blocks are used.

Mount old powder-paint-coated aluminum connection blocks as described in sections on „Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)“ and Attachment to rotary actuators.

FE: The air purging function is automatically provided.

Attachment according 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 ¼	0310-2619
(M20 x 1.5)	¼ NPT	0310-2550

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 ¼, 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.



Note:

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

4.11 Required mounting parts and accessories

Table 1: Direct attachment to Type 3277-5 Actuator (Fig. 3)			Order no.
Mounting parts	Standard version for actuators 120 cm² or smaller		1400-7452
	Version compatible with paint for actuators 120 cm² or smaller		1402-0940
Accessories for actuator	Old switchover plate for Type 3277-5xxxxxx. 00 Actuator (old)		1400-6819
	New switchover plate for Type 3277-5xxxxxx. 01 Actuator (new) ¹⁾		1400-6822
	New connecting plate for Type 3277-5xxxxxx. 01 Actuator (new) ¹⁾ , G ½ and ⅝ NPT		1400-6823
	Old connecting plate for Type 3277-5xxxxxx. 00 Actuator (old): G ½		1400-6820
	Old connecting plate for Type 3277-5xxxxxx. 00 (old): ⅝ NPT		1400-6821
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 (8) up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951

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

Table 2: Direct attachment to Type 3277 Actuator (Fig. 4)			Order no.
Mounting parts	Standard version for actuators 175, 240, 350, 355, 700, 750 cm ²		1400-7453
	Version compatible with paint for actuators 175, 240, 350, 355, 700, 750 cm ²		1402-0941
Accessories	Piping with screw fittings – for "actuator stem retracts" fail-safe action – with air purging of the top diaphragm chamber	175 cm ²	Steel G 1/4 / G 3/8 1402-0970
			1/4 NPT / 3/8 NPT 1402-0976
			St. steel G 1/4 / G 3/8 1402-0971
			1/4 NPT / 3/8 NPT 1402-0978
		240 cm ²	Steel G 1/4 / G 3/8 1400-6444
			1/4 NPT / 3/8 NPT 1402-0911
			St. steel G 1/4 / G 3/8 1400-6445
			1/4 NPT / 3/8 NPT 1402-0912
		350 cm ²	Steel G 1/4 / G 3/8 1400-6446
			1/4 NPT / 3/8 NPT 1402-0913
			St. steel G 1/4 / G 3/8 1400-6447
			1/4 NPT / 3/8 NPT 1402-0914
		355 cm ²	Steel G 1/4 / G 3/8 1402-0972
			1/4 NPT / 3/8 NPT 1402-0979
			St. steel G 1/4 / G 3/8 1402-0973
			1/4 NPT / 3/8 NPT 1402-0980
		700 cm ²	Steel G 1/4 / G 3/8 1400-6448
			1/4 NPT / 3/8 NPT 1402-0915
			St. steel G 1/4 / G 3/8 1400-6449
			1/4 NPT / 3/8 NPT 1402-0916
		750 cm ²	Steel G 1/4 / G 3/8 1402-0974
			1/4 NPT / 3/8 NPT 1402-0981
			St. steel G 1/4 / G 3/8 1402-0975
			1/4 NPT / 3/8 NPT 1402-0982
	Connection block with seals and screw	G 1/4	1400-8819
		1/4 NPT	1402-0901
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	Stainless 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 (Fig. 5 and Fig. 9)

Travel in mm	Lever	For actuator	Order no.
7.5	S	Type 3271-5 with 60/120 cm ² on Type 3510 Micro-flow Valve (Fig. 9)	1402-0478
5 to 50	M ¹⁾	Actuators from other manufacturers and Type 3271 with 120 to 750 cm ² effective areas	1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271 with 1000 and 1400-60 cm ²	1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271 with 1400-120 and 2800 cm ² and with 120 mm travel	1400-7456
30 or 60	L	Type 3271 with 1400-120 and 2800 cm ² with 30/60 mm travel	1400-7466
		Mounting brackets for Emerson and Masoneilan linear actuators (in addition, a mounting kit according to IEC 60534-6 is required depending on the travel). See rows 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)	Stainless steel/brass	1400-6950
		St. steel/st. steel	1400-6951

¹⁾ M lever is mounted on basic device (included in the scope of delivery)

Table 4: Attachment according to VDI/VDE 3847 (Fig. 6 and Fig. 8)

Electropneumatic positioners with VDI/VDE 3847 interface (TROVIS SAFE 3730-6-xxxxxxx0xx0700)			Order no.
Mounting parts	Interface adapter		1402-0257
	Mounting kit for attachment to SAMSON Type 3277 Actuator		1402-0868
	Mounting kit for attachment to SAMSON Type 3271 Actuator or non-SAMSON actuators		1402-0869
	Travel pick-off for valve travel up to 100 mm		1402-0177
	Travel pick-off for 100 to 200 mm valve travel (SAMSON Type 3271 Actuator only)		1402-0178

Table 5: Attachment to rotary actuators (Fig. 10 and Fig. 11)			Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845 (September 2010), see section 15.1 for details		
	Actuator surface corresponds to fixing level 1		
	Size AA1 to AA4, version with CrNiMo steel bracket		1400-7448
	Size AA1 to AA4, heavy-duty version		1400-9244
	Size AA5, heavy-duty version (e.g. Air Torque 10 000)		1400-9542
	Bracket surface corresponds to fixing level 2, heavy-duty version		1400-9526
	Attachment for rotary actuators with max. 180° opening angle, fixing level 2		1400-8815 and 1400-9873
	Attachment to SAMSON Type 3278 with 160/320 cm ² , CrNiMo steel bracket		1400-7614
	Attachment to SAMSON Type 3278 with 160 cm ² and to VETEC Type S160, Type R and Type M, heavy-duty version		1400-9245
	Attachment to SAMSON Type 3278 with 320 cm ² and to VETEC Type S320, heavy-duty version		1400-5891 and 1400-9526
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/brass	1400-6951

Table 6: General accessories		Order no.
Reversing amplifier for double-acting actuators		Type 3710
Cable gland M20 x 1.5,	Black plastic (6 to 12 mm clamping range)	8808-1011
	Blue plastic (6 to 12 mm clamping range)	8808-1012
	Nickel-plated brass (6 to 12 mm clamping range)	1890-4875
	Nickel-plated brass (10 to 14 mm clamping range)	1922-8395
	Stainless steel 1.4305 (8 to 14.5 mm clamping range)	8808-0160
Adapter M20x1.5 to ½ NPT	Powder-coated aluminum	0310-2149
	Stainless steel	1400-4114
Retrofit kit for inductive limit contact 1 x SJ2-SN		1400-7460
Cover plate with list of parameters and operating instructions	DE/EN (delivered state)	1990-0761
	EN/ES	1990-3100
	EN/FR	1990-3142
TROVIS-VIEW 6661 with device module TROVIS SAFE 3730-6		

Table 6: General accessories	Order no.
Serial interface adapter (SAMSON SSP interface to RS-232 port on a PC)	1400-7700
Isolated USB interface adapter (SAMSON SSP interface to USB port on a PC) including TROVIS-VIEW CD-ROM	1400-9740

Table 7: Attachment of external position sensor			Order no.
Template for mounting position sensor on older mounting parts. See note on page 42			1060-0784
Direct attachment	Mounting parts for actuators with 120 cm². See Fig. 15 (left).		1400-7472
	Connecting plate (9, old) with Type 3277-5xxxxxx.00 Actuator	G 1/8	1400-6820
		1/8 NPT	1400-6821
	Connecting plate (new) with Type 3277-5xxxxxx.01 Actuator (new) ¹⁾		1400-6823
	Mounting parts for actuators with 175, 240, 350, 355 and 700 cm². See Fig. 15 (right).		1400-7471
NAMUR attachment	Mounting parts for attachment to NAMUR rib using L or XL lever. See Fig. 16.		1400-7468
Attachment to Type 3510 Micro-flow Valve	Mounting parts for Type 3271 Actuator with 60 cm². See Fig. 17.		1400-7469
Attachment to rotary actuators	VDI/VDE 3845 (September 2010), see section 15.1 for details.		
	Actuator surface corresponds to fixing level 1		
	Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket. See Fig. 18.		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 fixing level 2, heavy-duty version		1400-9974
	SAMSON Type 3278 with 160 cm² and VETEC Type S160 and Type R, heavy-duty version		1400-9385
Accessories for positioner	SAMSON Type 3278 with 320 cm² and VETEC Type S320, heavy-duty version		1400-5891 and 1400-9974
	Connecting plate (6)	G 1/4	1400-7461
		1/4 NPT	1400-7462
	Pressure gauge bracket (7)	G 1/4	1400-7458
		1/4 NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	Stainless steel/brass	1400-6950
		Stainless steel/stainless steel	1400-6951
Bracket to mount the positioner on a wall (Note: The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site).			0309-0111

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

5 Connections



WARNING!

*Risk of injury due to the actuator stem extending or retracting!
Do not touch or block the actuator stem!*



NOTICE

Malfunction due to incorrect sequence of mounting, installation and start-up.

Keep the following sequence.

1. Remove the protective film from the 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.

5.1 Pneumatic connections



NOTICE

Malfunction due to incorrect connection of the supply air.

Do not connect the compressed air directly to the threaded connections in the positioner housing. Screw the screw fittings into the connecting plate, pressure gauge mounting block or connection block from the accessories.

The pneumatic connections in the connecting plate, pressure gauge mounting block and connection block are optionally designed as

a bore with 1/4 NPT or G 1/4 thread. Customary fittings for metal or copper tubing or plastic hoses can be used.



NOTICE

Risk of malfunction due to failure to comply with required air quality.

Only use supply air that is dry and free of oil and dust.

Read the maintenance instructions for upstream pressure reducing stations.

Blow through all air pipes and hoses thoroughly before 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 mounting pressure gauges (see accessories in Table 2 to Table 7).

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 written on the nameplate either as the spring range or signal pressure range depending on the actuator. The direction of action is marked FA or FE, or by a symbol.



Note:

FLOW is indicated under Code 0 if the supply pressure p_s is lower than the upper spring range value determined during plotting of the valve signature.

Actuator stem extends FA (AIR TO OPEN)

Fail-close (for globe and angle valves):

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

Actuator stem retracts FE (AIR TO CLOSE)

Fail-open (for globe and angle valves):

For tight-closing valves, the maximum signal pressure $p_{st_{max}}$ is roughly estimated as follows:

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

d = Seat diameter [cm]

Δp = Differential pressure across the valve [bar]

A = Actuator diaphragm area [cm²]

F = Upper bench range value of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure = Upper bench range value + 1 bar

5.1.3 Signal pressure (output)

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

The limitation is not activated [7.0 bar] 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. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance.

The following regulations apply to installation in hazardous areas:

*EN 60079-14: 2008 (VDE 0165, Part 1) **Explosive Atmospheres – Electrical Installations Design, Selection and Erection.***



WARNING!

Incorrect electrical connection will render the explosion protection unsafe.

- Adhere to the terminal assignment.
- Do not undo the enameled screws in or on the housing.
- Do not exceed the maximum permissible values specified in the EC

type examination certificates 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

Observe **clause 12 of EN 60079-14** (VDE 0165, Part 1) for installation of the intrinsically safe circuits.

Clause 12.2.2.7 applies when running multi-core cables and wires with more than one intrinsically safe circuit.

The radial thickness of the insulation of a conductor for common insulating materials (e.g. polyethylene) must not be smaller than 0.2 mm. The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end

ferrules. When two separate cables or wires are used for connection, an additional cable gland can be installed. Seal cable entries left unused with plugs. Fit equipment used in ambient temperatures **below $-20\text{ }^{\circ}\text{C}$** with metal cable entries.

Equipment for use in zone 2/zone 22

In equipment operated according to type of protection Ex nA II (non-sparking equipment) according to EN 60079-15: 2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.

Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) according to EN 60079-15: 2003 may be switched under normal operating conditions.

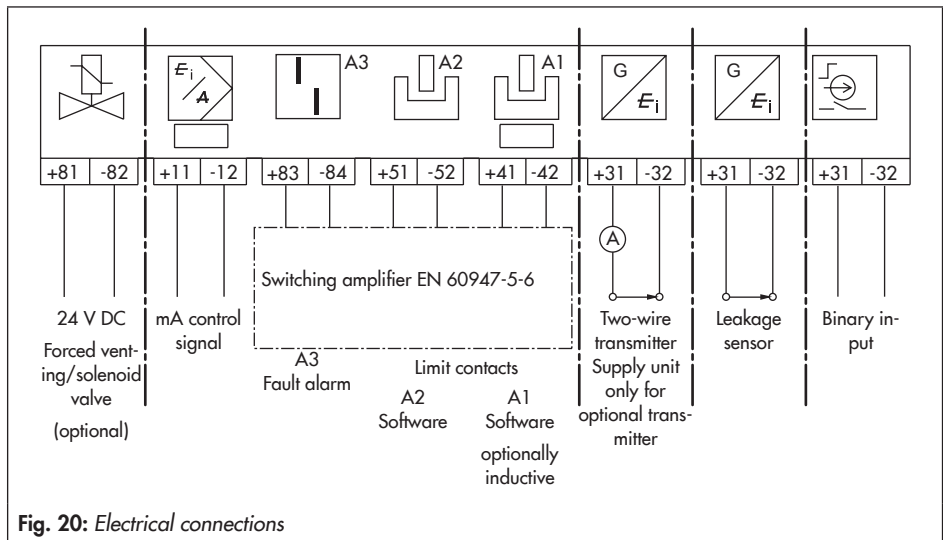


Fig. 20: Electrical connections

The maximum permissible values specified in the statement of conformity and its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.

Cable entry

Cable entry with M20 x 1.5 cable gland. See section on Accessories for clamping range.

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

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

The wires for the reference variable must be connected to the terminals 11 and 12 located in the housing.

Only use a **current source**.

≥3.6 mA: Microprocessor and display active

<3.7 mA: LOW reading on display

≤3.8 mA: Emergency shutdown (version with shutdown at 3.8 mA)

>3.9 mA: Actuator can be filled with air (version with shutdown at 3.8 mA)

≤4.4 mA: Emergency shutdown (version with shutdown at 4.4 mA)

>4.6 mA: Actuator can be filled with air (version with shutdown at 4.4 mA)

>22 mA: OVERLOAD reading on display

In general, it is not necessary to connect the positioner to a bonding conductor. Should this be required, however, this conductor can be connected inside the device.

Depending on the version, the positioner is equipped with inductive limit contacts and/or a solenoid valve.

The position transmitter is operated on a two-wire circuit. The usual supply voltage is 24 V DC. Taking the resistance of the supply leads into account, the voltage at the position transmitter terminals can be between 12 and 30 V DC.

Refer to Fig. 20 or to the label on the terminal block.

Accessories

Cable glands M20 x 1.5	Order no.
Black plastic (6 to 12 mm clamping range)	8808-1011
Blue plastic (6 to 12 mm clamping range)	8808-1012
Nickel-plated brass (6 to 12 mm clamping range)	1890-4875
Nickel-plated brass (10 to 14 mm clamping range)	1922-8395
Stainless steel 1.4305 (8 to 14.5 mm clamping range)	8808-0160

Adapter M20 x 1.5 to ½ NPT

Powder-coated aluminum	0310-2149
Stainless steel	1400-7114

5.2.1 Switching amplifier

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

Observe the relevant regulations for installation in hazardous areas.

5.2.2 Establishing communication

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

Viator FSK modem

- RS-232 No explosion protection Order no. 8812-0130
- PCMCIA No explosion protection Order no. 8812-0131
- USB No explosion protection Order no. 8812-0132

If the load impedance of the controller or control station is too low, an isolation amplifier must be connected between controller and positioner (interfacing as for positioner connected in hazardous areas). See Fig. 21.

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

Using the HART® protocol, all connected control room and field units can be addressed individually using a point-to-point connection or the standard (multidrop) bus.

Point-to-point:

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

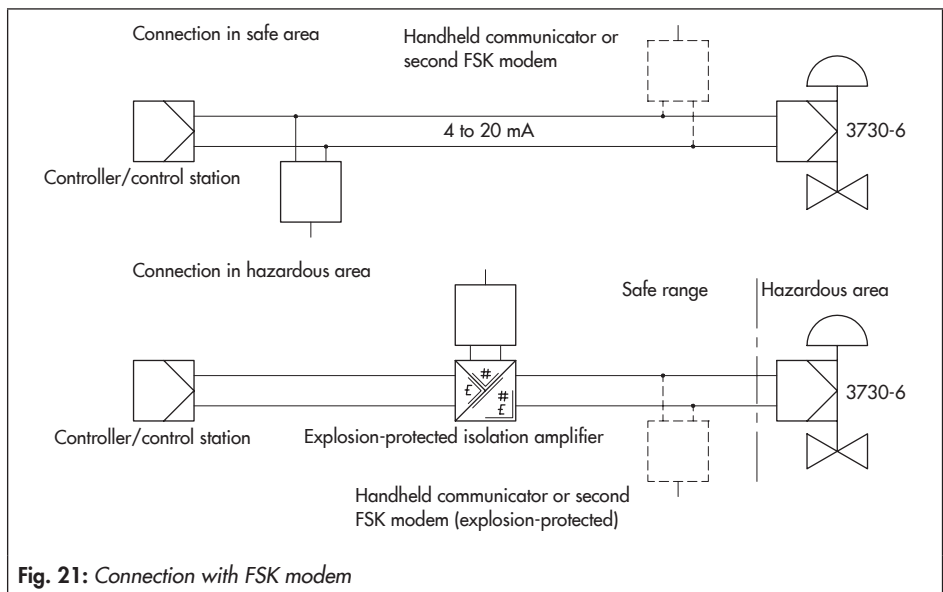


Fig. 21: Connection with FSK modem

Standard bus (multidrop):

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

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



Note:

Communication errors may occur when the process controller/control station output is not HART-compatible. For adaptation, the Z box (order no. 1170-2374) can be installed between output and communication interface. At the Z box a voltage of approx. 330 mV is released (corresponds to 16.5Ω at 20 mA).

Alternatively, a 250Ω resistor can be connected in series and a $22 \mu\text{F}$ capacitor can be connected in parallel to the analog output.

The following must be observed:

- The load for the controller output will increase as a result.
- The insertion of a capacitor is not permissible for intrinsically safe circuits (Ex ia), energy-limited circuits (Ex nL) and for the type of protection Ex nA.

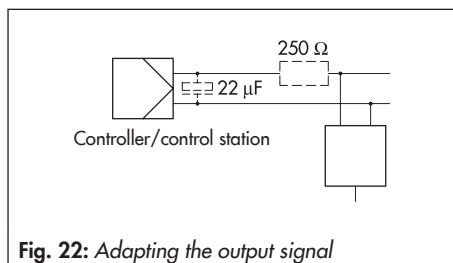


Fig. 22: Adapting the output signal

6 Operating 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 ⊗: Select codes and values

Press ⊗: Confirm setting

AIR TO OPEN/AIR TO CLOSE slide switch

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

The signal pressure is the pneumatic pressure at the output of the positioner applied to the actuator.

AIR TO OPEN always applies to positioners with a mounted reversing amplifier for dou-

ble-acting rotary actuators (connections according to section 4.1).

Volume restriction Q

The volume restriction serves to adapt the air output capacity to the size of the actuator. Depending on the air passage at the actuator, two fixed settings are available.

- For actuators smaller than 240 cm² (Type 3271-5), select MIN SIDE.
- For actuators 240 cm² and larger, select MAX SIDE for a side connection.

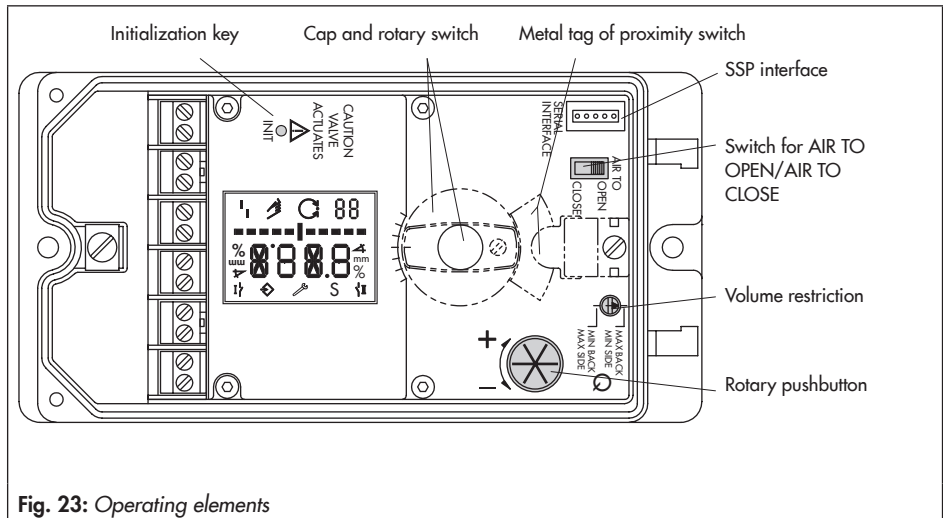





Fig. 23: Operating elements



Readings


Icons assigned to certain codes, parameters and functions are indicated on the display.

Operating modes:

-  Manual mode (see section 8.2.1)
The positioner follows the manual set point (Code 1) instead of the mA signal.
 blinks: The positioner is not initialized. Operation only possible over manual set point (Code 1).
-  Automatic mode (see section 8.2.1)
The positioner is in closed-loop operation and follows the mA signal.
- **S SAFE** (see section 8.2.2)
The positioner vents the output. The valve moves to the mechanical fail-safe position.




Bar graph:

In manual  and automatic  modes, the bars indicate the set point deviation that depends on the sign (+/-) and the value. One bar element appears per 1 % set point deviation.

If the positioner has not been initialized, ( blinks on the display), the bar graph indicates the lever position in degrees in relation to the mid-axis. One bar element corresponds to approximately a 5° angle of rotation. The fifth bar element blinks (reading > 30°) if the permissible angle of rotation has

been exceeded. Lever and pin position must be checked.

Status messages

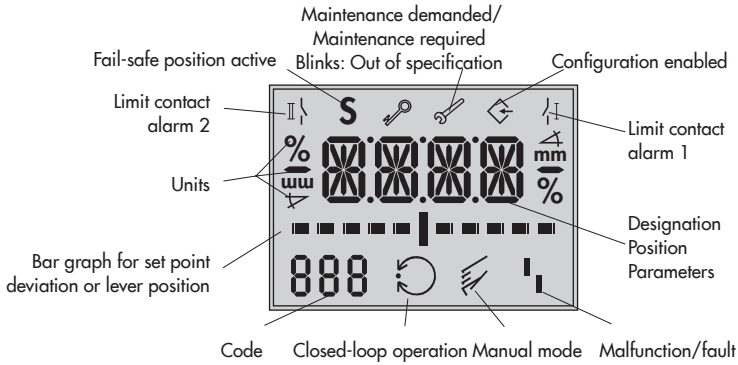
-  Failure
-  Maintenance demanded/Maintenance required
-  blinks: Out of specification

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 "Failure" (see section 14).

Enable configuration

This indicates that the codes marked with an asterisk (*) in the code list (section 14) are enabled for configuration (see section 8.1).



AUTO	Automatic		Emergency mode (see error code 62)
CL	Clockwise		Positioner not initialized
CCL	Counterclockwise	S	Valve in mechanical fail-safe position
ERR	Error		Failure
ESC	Cancel		Maintenance demanded/Maintenance required
HI	ix higher than 21.6 mA		Out of specification
LO	ix lower than 2.4 mA		Write protection active (over binary input option or HART® communication)
LOW	w lower than 3.7 mA	O/C and PST	in alternating sequence
MAN	Manual setting		Write protection active (time-controlled PST)
MAX	Maximum range		
No	Not available/not active		
NOM	Rated travel		
OVERLOAD	w > 22 mA		
PLOW	p ₂ lower than upper spring range value		
RES	Reset		
SAFE	Fail-safe position		
SUB	Substitute calibration		
TUNE	Initialization in progress		
YES	Available/active		
ZP	Zero calibration		
0 bar	No supply air		
	Increasing/increasing		
	Increasing/decreasing		

Fig. 24: Display

6.1 Serial interface

The positioner must be supplied with at least 3.8 mA.

The positioner can be connected directly to the PC over the local serial interface and the serial interface adapter. The operator software is TROVIS-VIEW (version 4) with installed device module 3730-6.

6.2 HART® communication

The positioner must be supplied with at least 3.6 mA. The FSK modem must be connected in parallel to the current loop.

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

For start-up and settings, proceed as described in section 7.1 to 7.4. Refer to the code list in section 14 for the parameters necessary for the operator interface.



Note:

*If complex functions are started in the positioner, which require a long calculation time or lead to a large quantity of data being saved in the volatile memory of the positioner, the alert 'busy' is issued by the DTM file. This alert is **not an error message** and can be simply confirmed.*

Locking HART® communication

The write access for HART® communication can be disabled over Code 47. This function can only be enabled or disabled locally at the positioner.

Write access is enabled by default.

Locking on-site operation

The on-site operation including the INIT key can be locked over HART® communication. The word 'HART' then blinks on the display when Code 3 is selected. This locking function can only be disabled over HART® communication. On-site operation is enabled by default.

6.3 Dynamic HART® variables

The HART® specification defines four dynamic variables consisting of a value and an engineering unit. These variables can be assigned to device parameters as required. The universal HART® command 3 reads the dynamic variables out of the device. This allows manufacturer-specific parameters to also be transferred using a universal command.

In the TROVIS SAFE 3730-6 Positioner, the dynamic variables can be assigned as follows in the Device settings folder (> Positioner > HART communication):

Table 8: *Dynamic HART® variables assignment*

Variable	Meaning	Unit
Set point	Set point	%
Direction of action set point	Direction of action set point	%
Set point after transit time specification	Set point after transit time specification	%
Valve position	Actual value (process variable)	%
Set point deviation e	Set point deviation e	%
Absolute total valve travel	Absolute total valve travel	–
Binary input status	0 = Not active 1 = Active 255 = –/–	–
Internal solenoid valve/forced venting status	0 = De-energized 1 = Energized 2 = Not installed	–
Condensed state	0 = No message 1 = Maintenance requested 2 = Maintenance demanded 3 = Failure 4 = Out of specification 7 = Function check	–
Temperature	Temperature	°C
Leakage sensor sound level	Leakage sensor sound level	dB
Ambient pressure	Ambient pressure	mbar
Signal pressure p _{out}	Signal pressure p _{out}	bar
Supply pressure	Supply pressure	bar
Flow rate	Flow rate	m ³ /h
Differential pressure	Differential pressure	bar
All active errors	0 = No errors 1 = Control loop 2 = Zero 4 = w too low 8 = PST/FST status 16 = On/off error activated 32 = SIL test 64 = Set point outside range 128 = Total valve travel exceeded 256 = Operating mode not AUTO	–

7 Start-up and settings



! NOTICE

Malfunction due to incorrect sequence of mounting, installation and start-up.

Keep the following sequence.

1. Remove the protective film from the 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 after connecting the electrical power supply:

 blinks and  appears on the display when the positioner has not yet been initialized. The reading indicates the lever position in degrees in relation to the mid-axis.



Reading when the positioner has not yet been initialized

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



WARNING!

Risk of injury due to the actuator stem extending or retracting!

Do not touch or block the actuator stem.



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.

Perform the start-up settings in the same sequence as described (section 7.1 to section 7.6).

7.1 Defining the valve closed position

Define the closed position of the valve (0 %) taking the valve type and the actuator's direction of action into account. Position the AIR TO OPEN/AIR TO CLOSE slide switch accordingly:

– AIR TO OPEN (ATO) setting

Signal pressure opens the valve e.g. for a fail-close valve

The AIR TO OPEN setting always applies to double-acting actuators.

– AIR TO CLOSE (ATC) setting

Signal pressure closes the valve e.g. for a fail-open valve

For checking purposes: After successfully completing initialization, the positioner display must 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.

7.2 Adjusting the volume restriction Q

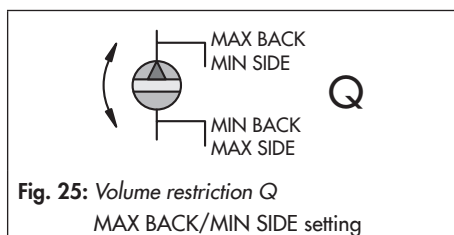


Fig. 25: Volume restriction Q
MAX BACK/MIN SIDE setting

The volume restriction Q serves to adapt the air output capacity to the size of the actuator:

- **MAX BACK/MIN SIDE** setting for actuators with a **transit time <1 s**, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate.
- **MIN BACK/MAX SIDE** setting for actuators with a **transit time ≥1 s** (the air flow rate does not need to be restricted.)

Intermediate settings are not permitted.


NOTICE

Malfunction due to changed start-up settings!

Initialize an initialized positioner again after the position of the volume restriction has been changed.

7.3 Adapting the display direction

To adapt the reading on the display to the mounting situation of the actuator, the display contents can be turned by 180°.



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 reading direction

Press to confirm reading direction.

7.4 Limiting the signal pressure

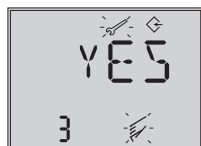
If the maximum actuator force may cause damage to the valve, the signal pressure must be limited.

Enable configuration at the positioner before limiting the signal pressure:



Note:

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



Enable configuration
Default: **No**

Turn → Code 3, display: **No**

Press , Code **3** blinks.

Turn → **YES**

Press , display:

Limit the signal pressure:



Pressure limit
Default: **No**

Turn → Code 16

Press , Code **16** blinks.

Turn until the required pressure limit 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 mode with the manual set point.

Select manual mode:



Operating mode
Default **MAN**

Turn → Code 0

Press , Code **0** blinks.

Turn → **MAN**

Press . The positioner changes to the manual mode ().

Check the operating range:



Manual set point 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 can be checked.

The angle of rotation of the lever 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 must 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 more than 30° and the outer right or left bar element blinks. The positioner goes to the fail-safe position (SAFE).

After canceling the fail-safe position (SAFE) (see section 8.2.2) it is **absolutely** essential that you check the lever and pin position as described in section 4.



WARNING!

Risk of injury due to the actuator stem extending or retracting! Before exchanging the lever or changing the pin position, disconnect the supply air and electrical auxiliary power.

7.6 Initialization



NOTICE

The process is disturbed by the movement of the actuator stem.

Do not initialize the positioner while the process is running; only perform an initialization during start-up with the shut-off valves closed.


A signal pressure above the maximum permissible limit will damage the valve.

Check the maximum permissible signal pressure of the control valve before starting initialization. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.

Malfunction due to changed mounting or installation circumstances! Reset the positioner to its default settings and re-initialize it after the positioner has been mounted on to another actuator or its mounting location has been changed.



Note:

When the write protection  is activated, initialization cannot be started.

During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure required by the control valve. The type and extent of auto tuning depends on the initialization mode selected:

- **Maximum range (MAX)** (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)
- **Nominal range (NOM)**
Initialization mode for all globe valves (see section 7.6.2)
- **Manually selected OPEN position (MAN)**
Initialization mode for globe valves requiring OPEN position to be entered manually (see section 7.6.3)
- **Manually selected end positions (MAN2)**
Initialization mode for globe valves with manual entry of both positions (see section 7.6.4)

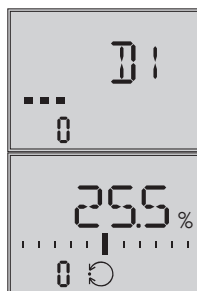
– Substitute calibration (Sub)

This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.5).



Note:

For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve and defining the fail-safe position and setting the volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.9).



Bar graph display indicating the progress of the initialization

Initialization successfully completed. Positioner in automatic mode (C)

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

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

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:

An error during the recording of the valve signature is indicated by Code 81.

The valve signature does not affect closed-loop operation.

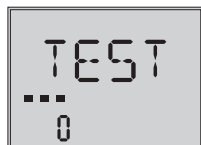


Alternating readings
Initialization in progress
Icon depending on
initialization mode selected



Bar graph indicating the
progress of the initialization

After the basic initialization, the reference curve for the valve signature is recorded (Code 48 - h0 = YES).



Reading in alternating
sequence: TEST/D1

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 (↗↘) after initialization has been completed. This results in the following assignment between reference variable and valve position:

Closed position	Direction of action	Reference variable w Valve	
		CLOSED at	OPEN at
AIR TO OPEN	↗↗	0 %	100 %
AIR TO CLOSE	↘↘	100 %	0 %

The tight-closing function has been activated.

Set Code 1.5 (final position w>) to 99 % **for three-way valves**.

Canceling an initialization process

An initialization procedure in progress can be canceled by pressing the rotary pushbutton (⊗). **STOP** appears for three seconds on the display and the positioner then changes to the fail-safe position.

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

7.6.1 MAX – Initialization based on maximum range

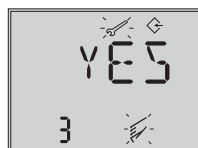
The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite travel stop and adopts this travel/angle of rotation as the operating range from 0 to 100 %.

Enable configuration:



Note:

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



Default: **No**

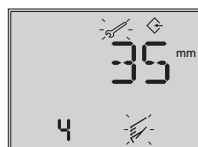
Turn ⊗ → Code 3, display: **No**

Press ⊗, Code **3** blinks.

Turn ⊗ → **YES**

Press ⊗, display: ⊠

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 ⊗.

Select the initialization mode:



Default: **MAX**

Turn ⊗ → Code 6

Press ⊗.

Turn ⊗ → **MAX**

Press ⊗ to confirm the MAX as the initialization mode.

Start initialization:

→ Press INIT key.

After initialization, the maximum travel/angle of rotation (Code 5) which was detected during initialization is indicated.

7.6.2 NOM – Initialization based on nominal range

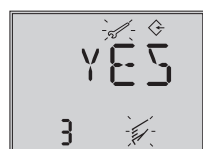
The calibrated sensor allows the exact valve travel to be measured very accurately. During initialization, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision. If this is the case, the indicated nominal range is adopted with the limits of travel/angle range start (Code 8) and travel/angle range end (Code 9) as the operating range.

Enable configuration:



Note:

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



Default: **No**

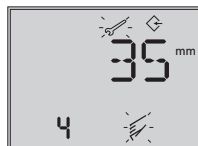
Turn → Code 3, display: **No**

Press , Code **3** blinks.

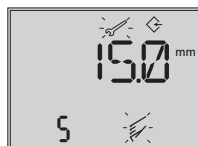
Turn → **YES**

Press , display:

Enter the pin position and nominal range:



Pin position
Default: **No**



Nominal range
(locked when 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 of the valve

Press .

Select the initialization mode:



Init 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.


Note:

If the nominal range determined during initialization is smaller than the range entered in Code 5, initialization is canceled and an error message (Code 52) is generated.

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

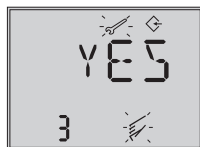
7.6.3 MAN – Initialization based on a manually selected OPEN position

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

Enable configuration:


Note:

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



Enable configuration
Default: **No**

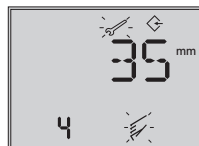
Turn → Code 3, display: **No**

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 .

Select the initialization mode:



Init 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 set point
(current angle of rotation is indicated)

Turn → Code 0


Press , Code **0** blinks.


Turn → **MAN**

Press .

Turn  → Code 1

Press , Code **1** blinks.

Turn  clockwise in small steps until the required valve position is reached. The valve must be moved with a monotonically increasing signal pressure.

Press  to confirm the OPEN position.

Start initialization:

→ Press INIT key.

After initialization, the maximum travel is indicated in mm or the maximum angle in ° in Code 5.

7.6.4 MAN2 – Initialization based on manually selected end positions

Before starting initialization, move the control valve manually to the end positions. The positioner calculates the travel/angle difference from the positions that the valve moved to and adopts it as the operating range with limits of lower travel/angle range value (Code 8) and upper travel/angle range value (Code 9).



Note:

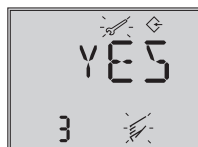
This initialization mode can only be started when the valve position differs in the end positions and the positioner has not yet been initialized.

Enable configuration:



Note:

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



Enable configuration
Default: **No**

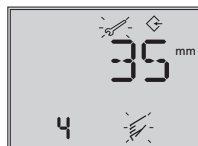
Turn  → Code 3, display: **No**

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 .

Select the initialization mode and enter end positions:



Init mode
Default: **MAX**



POS1 (end position 1)



POS2 (end position 2)

Turn → Code 6

Press , Code 6 blinks.

Turn → **MAN2**

Press to confirm the **MAN2** as the initialization mode. → **POS1** and the current angle position of the lever are indicated on the display in alternating sequence.

Turn clockwise in small steps until the required valve position is reached. The valve must be moved with a monotonically increasing signal pressure.

Press to confirm the valve position → **WAIT**. The valve position is adopted after the pressure settles. → **POS2** and the current angle position of the lever are indicated on the display in alternating sequence.

Turn until the valve reaches its OPEN position.

Press to confirm the valve position → **WAIT**. Initialization can be started as soon as **MAN2** is indicated again on the display.

Start initialization:

→ Press INIT key.

After initialization, the tight-closing function (Code 14) is deactivated.

7.6.5 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 substitute calibration 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. The blocking position can also be the fail-safe position when this condition is beneficial for the temporary phase.

→ Perform a reset before re-initializing the positioner if the substitute positioner has already been initialized. Refer to section 7.9.

Enable configuration:



Note:

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



Enable configuration
Default: **No**

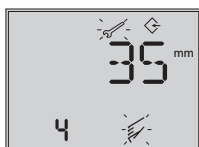
Turn → Code 3, display: **No**

Press , Code **3** blinks.

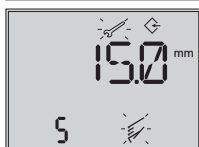
Turn → **YES**

Press , display:

Enter the pin position and nominal range:



Pin position
Default: **No**



Nominal range
(locked when 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 of the valve

Press .

Select the initialization mode:



Init mode
Default: **MAX**

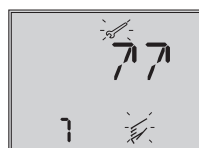
Turn → Code 6

Press .

Turn → **SUB**

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

Enter the direction of action:



Direction of action
Default:

Turn → Code 7

Press , Code **7** blinks.

Turn → Direction of action (/)

Press .

Deactivate travel limit:



Travel limit
Default: **No**

Turn → Code 11

Press , Code **11** blinks.

Turn → **No**

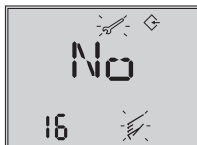
Press .

Change pressure limit and control parameters:

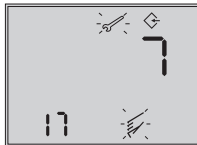


Note:

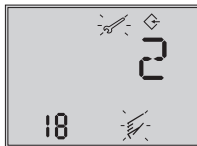
Do not change the pressure limit (Code 16). Only change the control parameters K_p (Code 17) and T_v (Code 18) if the settings of the the replaced positioner are known.



Pressure limit
Default: **No**



K_p level
Default **7**



T_v level
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 on to 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).


Set the fail-safe position:

→ Set switch for closed position AIR TO OPEN or AIR TO CLOSE according to section 7.1.

→ Set volume restriction as described in section 7.2.

Start initialization:

→ Press INIT key.

The operating mode is changed to automatic mode .



Note:

- Since initialization has not been completed, 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.
- If the positioner shows a tendency to oscillate in automatic mode, the parameters K_p and T_v must be slightly corrected. Proceed as follows:
 - ➔ Set T_v (Code 18) to **4**.
 - ➔ If the positioner still oscillates, the gain K_p (Code 17) must be decreased until the positioner shows a stable behavior.

Tuning the input filter



Tuning the input filter
Default MAX

Turn → Code 6

Press , Code **6** blinks.

Turn → **KP**

- ➔ Press INIT key to start the tuning. During the tuning, the valve moves through its whole range and the input filter is recalibrated.

7.7 Zero calibration

In case of inconsistencies in the closed position of the valve, e.g. with soft-seated plugs, it might be necessary to recalibrate zero.

Zero point calibration

Finally, if process operations allow it, the zero point must be calibrated according to section 7.7. On correcting the zero point, the valve moves again to the closed position.

7.6.6 Tuning the KP input filter

Changing the KP level (Code 17) affects the set point deviation. This effect can be compensated for by tuning the input filter without having to re-initialize the positioner.

Enable configuration:

Turn → Code 3, display: **No**

Press , Code **3** blinks.

Turn → **YES**

Press , display:



NOTICE


The process is disturbed by the movement of the actuator stem!
Do not perform zero calibration while the process is running. First isolate the plant by closing the shut-off valves.




Note:

- The positioner must be connected to the supply air to perform the zero calibration.
- A zero calibration is not possible if there is zero point shift of more than 5 %. In this case, Code 54 is activated. The positioner must be re-initialized.

Enable configuration:

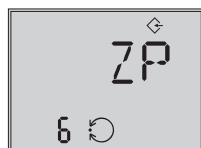
Turn  → Code 3, display: **No**

Press , Code **3** blinks.

Turn  → **YES**

Press , display: 

Perform zero calibration:



Init mode
Default MAX

Turn  → Code 6

Press , Code **6** blinks.

Turn  → **ZP**

→ Press INIT key.

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

7.8 Selecting the type of application

If the valve is to be operated using the on/off valve as the type of application, the operating point, test limits and limits for the discrete analysis must be defined.



Note:

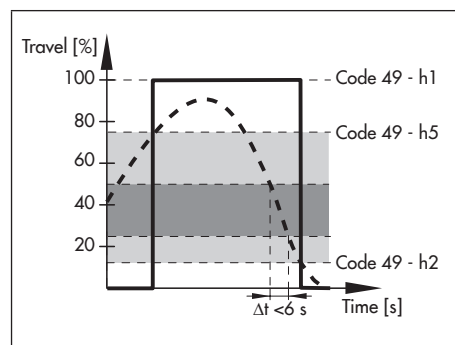
The travel range of on/off valves is defined by the fail-safe position and the operating point. As a result, the following parameters to determine the operating range and reference

variable range are not analyzed and cannot be changed:

- Lower travel/angle range value (Code 8)
- Upper travel/angle range value (Code 9)
- Lower travel/angle limit (Code 10)
- Upper travel/angle limit (Code 11)
- Set point, lower range value (Code 12)
- Set point, upper range value (Code 13)

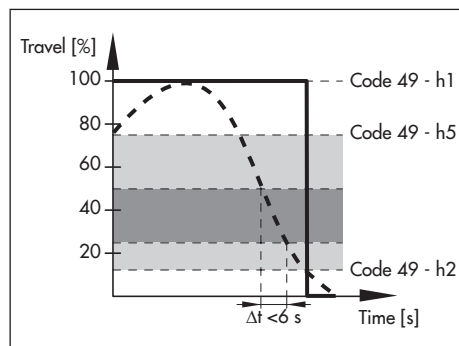
Discrete analysis

If the reference variable (w — — —) is below *Operating point limit* (Code 49 - h5) at the start of automatic operation, the valve (—) moves to the fail-safe position. If the reference variable increases and exceeds the *Operating point limit*, the valve moves to the *Operating point* (Code 49 - h1). The valve moves back to the fail-safe position if the reference variable continues and falls below the *Fail-safe action limit* (Code 49 - h2).



If the reference variable (w — — —) is above the *Operating point limit* (Code 49 - h5)

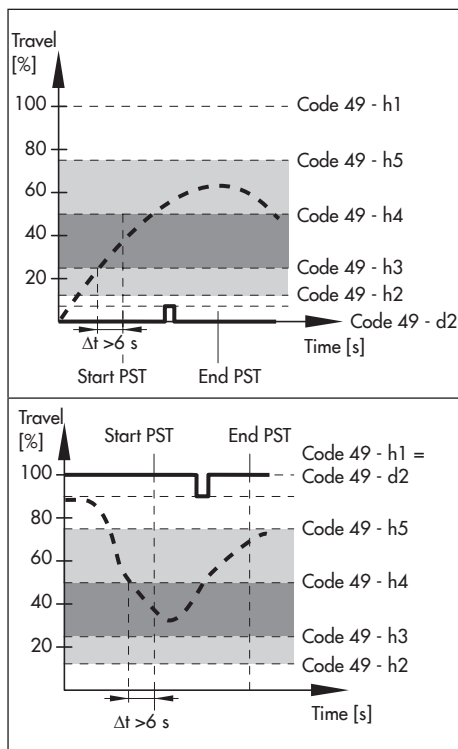
when automatic mode starts, the valve (—) moves to the *Operating point* (Code 49 - h1). The valve moves back to the fail-safe position if the reference variable continues and falls below the *Fail-safe action limit* (Code 49 - h2).



Starting the partial stroke test (PST)

A partial stroke test is started when the reference variable (w - - -) moves starting from the operating point into the range between 25 and 50 % of the travel range and remains there for longer than six seconds. The valve (—) moves from the last defined position to the lower range value (of step) (Code 49 - d2).

After the partial stroke test is completed, the valve moves back to its last position (fail-safe position or operating point).



Canceling the partial stroke test (PST)

The partial stroke test is canceled whenever the reference variable changes and falls below the *Fail-safe action limit*. The valve moves to the fail-safe position.

The type of application is set as follows:

Enable configuration:







Turn → Code 3, display: **No**

Press , Code **3** blinks.





Turn → **YES**

Press , display:

Select on/off valve as type of application:

- Turn  → Code 49
- Press , Code **49** blinks.
- Turn  → Code h0
- Press , Code **h0** blinks.
- Turn  → **YES**
- Press .

Enter operating point, test limits and limits for discrete analysis:





- Turn  Code h1/h2/h3/h4/h5
- Press , Code **h1/h2/h3/h4/h5** blinks.
- Turn  to set the parameter selected.
- Press  to confirm the setting.

Press , display: 

Reset start-up parameters:



Reset
Default: **No**

- Turn  → Code 36, display: ---
- Press , Code **36** blinks.
- Turn  → **DIAG/STD/DS**
- Press .

The parameters are reset depending on the option selected. See following Table 9.

7.9 Reset to default settings

A reset allows the positioner to be reset to the default settings. To reset the positioner, the options DIAG, STD and DS are available in Code 36. Table 9 lists the reset functions.



Note:

Code 36 – DS is usually selected when the valve is mounted in another position or when the positioner is to be mounted to another valve. Performing a reset does not necessarily mean the positioner must be re-initialized.

Enable configuration:




- Turn  → Code 3, display: **No**
- Press , Code **3** blinks.
- Turn  → **YES**

Table 9: *Reset functions*

		Reset Code 36		
		DIAG	STD	DS
Initialization		NO	YES	YES
Fail-safe action				
	Air supply failure	NO	NO	YES
	Power supply failure of positioner	NO	NO	YES
	Power supply failure of external solenoid valve	NO	NO	YES
Emergency mode		NO	NO	NO
Operating hours counter		NO	NO	NO
	Device in operation	NO	YES	YES
	Device switched on since initialization	NO	YES	YES
	Device in operation since initialization	NO	YES	YES
Logging		NO	YES	YES
Code	Parameters			
2	Reading direction	NO	YES	YES
4	Pin position	NO	YES	YES
5	Nominal range	NO	YES	YES
6	Initialization mode	NO	YES	YES
7	Direction of action	NO	YES	YES
8	Lower travel/angle range value	NO	YES	YES
9	Upper travel/angle range value	NO	YES	YES
10	Lower travel/angle range value	NO	YES	YES
11	Upper travel/angle range value	NO	YES	YES
12	Set point, lower range value	NO	YES	YES
13	Set point, upper range value	NO	YES	YES
14	CLOSED end position	NO	YES	YES
15	OPEN end position	NO	YES	YES
16	Pressure limit	NO	YES	YES
17	Proportional-action coefficient Kp level	NO	NO	NO
18	Derivative-action time Tv level	NO	NO	NO

		Reset Code 36		
		DIAG	STD	DS
19	Tolerance band	NO	YES	YES
20	Select characteristic	NO	YES	YES
21	Enter transit time OPEN	NO	YES	YES
22	Enter transit time CLOSED	NO	YES	YES
24	Total valve travel limit	NO	YES	YES
25	Alarm mode	NO	YES	YES
26	Limit A1	NO	YES	YES
27	Limit A2	NO	YES	YES
32	Error message in case of condensed state 'Function check'	NO	YES	YES
33	Error message in case of 'Maintenance required' and 'Out of specification' condensed states	NO	YES	YES
38	Inductive limit contact	NO	NO	NO
46	Bus address	NO	NO	YES
48 - 49 -	Diagnostics ► EB 8389-1S EN			

8 Operation



WARNING!

*Risk of injury due to the actuator stem extending or retracting.
Do not touch or block the actuator stem.*

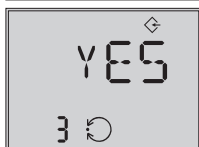
8.1 Enabling and selecting parameters

All codes and their meaning and default settings are listed in the code list in section 14.

Codes which are marked with an asterisk must be enabled with Code 3 before the associated parameters can be configured as described below.



Code 3
Configuration not
enabled



Configuration
enabled

Turn → Code 3, display: **No**

Press , Code **3** blinks.

Change the setting in Code 3.

Turn → **YES**

Press , display:

Configuration is enabled.

You can now configure codes one after the other:

Turn to select the required code.

Press to activate the selected code. The code number starts to blink.

Turn to 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 returns to Code 0.

Cancel the setting:



Canceling the reading

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

Switching to manual mode (MAN)



Turn → Code 0

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

Turn → **MAN**

Press . The positioner changes to the manual mode ().

The manual mode starts using the last set point of the automatic mode, ensuring a bumpless changeover. The current position is displayed in %.

Adjust the manual set point



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 Code 0 if no settings are made within 120 seconds, but remains in the manual mode.

Switch to automatic mode

Turn → Code 0

Press , Code 0 blinks.

Turn → **AUTO**

Press . The positioner switches to automatic mode.

8.2.2 Fail-safe position (SAFE)

If you want to move the valve to the 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.

If the positioner has been initialized, the current valve position in % is indicated on the display.

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 Fault/malfunction

A status classification is assigned to all status and fault alarms in the positioner. The default settings of the status classification are listed in the code list.



Note:

The assignment of the status classification can be changed in the operator software, e.g. TROVIS-VIEW (version 4). Refer to the Operating Instructions for the valve diagnostics on the enclosed CD-ROM for more details.

– Maintenance required

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 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.

– Out of specification

The positioner is running outside the specified operating conditions.



Note:





If an event is classified as “No message”, this event does not have any affect on the condensed state.

To provide a better overview, the classified messages are summarized in a condensed state for the positioner according to the NAMUR Recommendation NE 107. The status messages are divided into the following categories:

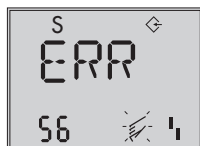
– Failure

The positioner cannot perform its control task due to a functional fault in the positioner itself or in one of its peripherals or an initialization has not yet been successfully completed.

The condensed state appears on the display represented by the following icons:

Condensed state	Positioner display	Priority
Function check	Text e.g. TUNE or TEST	
Failure		
Out of specification	 blinking	
Maintenance required/Maintenance demanded		

The message with the highest priority determines the condensed state in the positioner. If fault alarms exist, the possible source of error is displayed in Code 49 onwards. In this case, **ERR** appears on the display.



Example:
Error caused by pin position

Refer to the code list (section 14) for possible causes and the recommended action.

Fault alarm output

'Failure' as the condensed state causes the optional fault alarm output to be switched.

- The 'Function check' condensed state can also activate the fault alarm output (Code 32).
- The 'Maintenance required/Maintenance demanded' condensed state and 'Out of specification' can also activate the fault alarm output (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:

Confirming error message:

Turn → Select the error code that you want to confirm.

Press .

The error message is confirmed.

9 Adjusting the limit contact

The positioner version with an inductive limit contact has an adjustable tag (1) mounted on the axis of rotation, which operates the proximity switch (3).

For operation of the inductive limit contact, the corresponding switching amplifier according to EN 609475-6 (see section 5.2.1) must be connected to the output circuit.

When the tag (1) is located in the inductive field of the switch, the switch assumes a high resistance. When it moves outside the field, the switch assumes a low resistance.

Normally, the limit contact is adjusted such that the fail-safe position of the valve is indicated when the contact's switching state changes.



Note:

The inductive limit contact replaces the software limit contact A1 with terminal assignment +41/-42. Each switching position can optionally be set to indicate when the tag has entered the field, or when it has left the field.

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

Software adaptation

Code 38 (inductive alarm is set to **YES**). The inductive limit contact is connected to the terminals +41/-42. The device is set up accordingly in the delivered state.

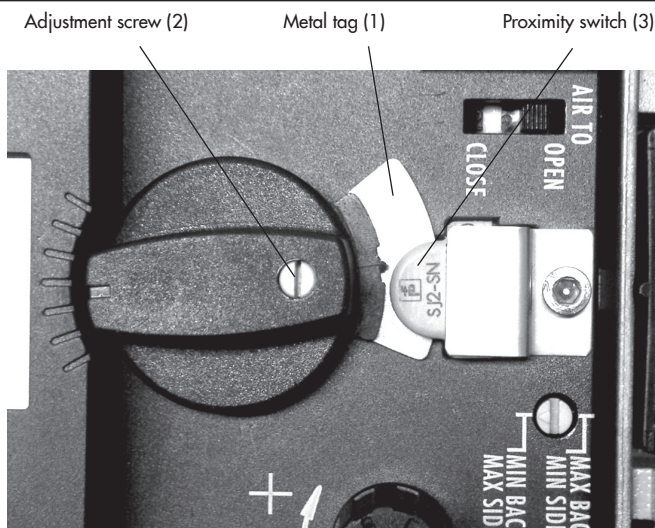


Fig. 26: Adjusting the limit contact

Adjusting the switching point:



Note:

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

To guarantee the switching under all ambient conditions, adjust the switching point approx. 5 % before the mechanical stop (OPEN – CLOSED).

For CLOSED position:

1. Initialize the positioner.
2. Move the valve to 5 % in the MAN mode (see display).
3. Adjust the tag at 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 > Proximity switch assumes low resistance
- Tag entering the field > Proximity switch assumes high resistance

For OPEN position:

1. Initialize the positioner.
2. Move the valve to 95 % in the MAN mode (see display).
3. Adjust the tag (1) at 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 > Proximity switch assumes low resistance
- Tag entering the field > Proximity switch assumes high resistance

9.1 Retrofitting an inductive limit contact

Required retrofit kit:

Limit contact Order no. 1400-7460



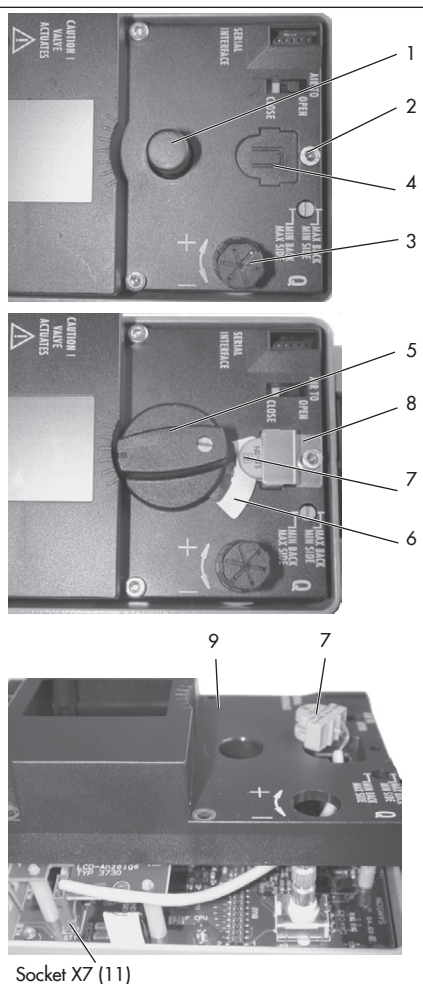
Note:

The same requirements apply to retrofitting an inductive limit contact as to servicing the positioner. For explosion-protected positioners, the requirements in section 11 (Servicing explosion-protected devices) need to be kept. Check the "Limit switch, inductive" box on the nameplate after installing the limit contact.

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fastening 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 prox-

imity 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. 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 Screw | 7 Proximity switch |
| 3 Rotary pushbutton | 8 Clamping plate |
| 4 Marking | 9 Plastic cover |
| 5 Rotary switch | 11 Connector |

Fig. 27: Retrofitting an inductive limit contact

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.

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 before putting it back into operation. Document the passing of the routine test by attaching a mark of conformity to the device. Replace explosion-protected components only with original, routine-tested components from the manufacturer.

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 operated

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.

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 device by the test mark assigned by SAMSON's Quality Assurance.

In all other cases, only plant operator personnel with written approval may perform updates. Updates are to be confirmed by approved personnel on the device.

Laptops and PCs connected to the power supply must not be used without an additional protective circuit.

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 testing purposes.

a) Updates outside the hazardous area:

Remove the positioners from the plant. Update them outside the hazardous area.

b) Updates on site:

Updates on site are only permitted after the plant operator 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

Interconnection with intrinsically safe circuits to check or calibrate the equipment inside or outside hazardous areas is to be performed only with intrinsically safe current/voltage calibrators and measuring instruments to rule out any damage to components relevant to explosion protection.

Observe the maximum permissible values specified in the certificates for intrinsically safe circuits.

14 Code list

Code no.	Parameter – Readings/values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
0	Operating mode [MAN] Manual mode AUTO Automatic mode SAFE Fail-safe position ESC Cancel	Switchover from automatic to manual mode is bumpless. Automatic mode only possible if positioner has been initialized. Display: Code 0, see section 6
1	Manual set point (manual w) [0] to 100 % of the nominal range	Adjust the manual <i>reference variable</i> with the rotary pushbutton. The current travel/angle is displayed in % when the positioner is initialized. If the positioner is not initialized, the position of the lever in relation to the longitudinal axis is indicated in degrees (°). Note: It can only be selected when Code 0 = MAN
2	Reading direction 1234, ↻, ESC	The reading direction of the display is turned by 180°.
3	Enable configuration [No], YES, ESC	Enables changing of data (automatically deactivated when the rotary pushbutton has not been operated for 120 seconds). Codes marked with an asterisk (*) can only be read and not overwritten when their configuration is not enabled. HART blinks on the display when the on-site operation is locked over HART® communication. PST appears on the display when the on-site operation is locked by the time-controlled partial stroke test. In these cases, codes can only read over the SSP interface.
4*	Pin position [No], 17, 25, 35, 50, 70, 100, 200 mm, 90° with rotary actuators, 300 mm with piston actuators, ESC	When attaching the positioner to the control valve, the follower pin must be inserted in the proper pin position on the lever depending on the travel/angle. For initialization using NOM (nominal range) or SUB (substitute calibration), the pin position must be entered. For initialization using MAX, MAN and MAN2, the pin position is not required, however, it is required under Code 5 to display the nominal range.

Code no.	Parameter – Readings/ values [default setting]	Description																											
4*	Pin position (continued) <i>If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety.</i>	<table><tr><th>Pin position Code 4</th><th>Standard Code 5</th><th>Adjustment range Code 5</th></tr><tr><td>17</td><td>7.5</td><td>3.6 to 17.7</td></tr><tr><td>25</td><td>7.5</td><td>5.0 to 25.0</td></tr><tr><td>35</td><td>15.0</td><td>7.0 to 35.4</td></tr><tr><td>50</td><td>30.0</td><td>10.0 to 50.0</td></tr><tr><td>70</td><td>40.0</td><td>14.0 to 70.7</td></tr><tr><td>100</td><td>60.0</td><td>20.0 to 100.0</td></tr><tr><td>200</td><td>120.0</td><td>40.0 to 200.0</td></tr><tr><td>90°</td><td>90.0</td><td>24.0 to 100.0</td></tr></table>	Pin position Code 4	Standard Code 5	Adjustment range Code 5	17	7.5	3.6 to 17.7	25	7.5	5.0 to 25.0	35	15.0	7.0 to 35.4	50	30.0	10.0 to 50.0	70	40.0	14.0 to 70.7	100	60.0	20.0 to 100.0	200	120.0	40.0 to 200.0	90°	90.0	24.0 to 100.0
Pin position Code 4	Standard Code 5	Adjustment range Code 5																											
17	7.5	3.6 to 17.7																											
25	7.5	5.0 to 25.0																											
35	15.0	7.0 to 35.4																											
50	30.0	10.0 to 50.0																											
70	40.0	14.0 to 70.7																											
100	60.0	20.0 to 100.0																											
200	120.0	40.0 to 200.0																											
90°	90.0	24.0 to 100.0																											
5*	Nominal range [15.0] mm or angle °, ESC	<p>For initialization using NOM (nominal range) or SUB (substitute calibration), the nominal range must be entered. The possible adjustment range depends on the pin position from the table for Code 4.</p> <p>After initialization to the maximum range (MAX), the maximum nominal travel/angle reached on initialization is displayed.</p>																											
6*	Initialization mode (init mode) [MAX], NOM, MAN, MAN2, SUB, KP, ZP, ESC	<p>MAX: Maximum range · For simple start-up of valves with two clearly defined mechanical end positions · The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite stop in the actuator</p> <p>NOM: Nominal range · For all globe valves · The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the specified nominal range</p> <p>MAN: Manual setting 1 · For all globe valves with unknown nominal range (OPEN position) · The positioner determines travel/angle of rotation from the manually selected OPEN position (100 %) to the CLOSED position</p> <p>MAN2: Manual setting 2 · For all globe valves with unknown nominal range (OPEN and CLOSED position) · The positioner determines travel/angle of rotation between the manually selected OPEN (100 %) and the manually selected CLOSED position (0 %)</p> <p>SUB: Substitute calibration · To replace a positioner while the plant is running, with the least amount of disruption to the plant</p>																											

Code no.	Parameter – Readings/ values [default setting]	Description
6*	Initialization mode (init mode) (continued)	<p>KP: Fine tuning of the input filter · The valve moves through its entire valve range.</p> <p>NP: Zero calibration · The zero point is recalibrated.</p> <p>NOTICE Valve will temporarily be moved from its operating point to CLOSED position.</p>
7*	Direction of action (w/x) [↗], ↘, ESC	<p>Direction of action of the set point in relation to the valve position</p> <p>↗: Increasing/increasing: a globe valve opens as the set point increases.</p> <p>↘: Increasing/decreasing: a globe valve closes as the set point increases.</p> <p>The direction of action is adapted to the change in closed direction as follows:</p> <p>ATO: AIR TO OPEN · On completing initialization, the direction of action remains increasing/ increasing (↗). A globe valve opens as the reference variable increases.</p> <p>ATC: AIR TO CLOSE · On completing initialization, the direction of action changes to increasing/decreasing (↘). A globe valve closes as the reference signal increases.</p>
8*	Lower travel/angle range value (lower x-range value) [0.0] to 80.0 % of the nominal range, ESC <i>Specified in mm or angle ° provided Code 4 is activated.</i>	<p>Lower range value for the travel/angle of rotation in the operating range.</p> <p>Nominal range and characteristic are automatically adapted.</p> <p>The operating range is the actual travel/angle of the valve and is limited by the lower travel/angle range value (Code 8) and the upper travel/angle range value (Code 9).</p> <p>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 travel/angle range values. The value is displayed or must be entered.</p> <p>See also the example in Code 9.</p>
9*	Upper travel/angle range value (upper x-range value) 20.0 to [100.0 %] of the nominal range, ESC <i>Specified in mm or angle ° provided Code 4 is activated.</i>	<p>Upper range value for the travel/angle of rotation in the operating range.</p> <p>Nominal range and characteristic are automatically adapted.</p> <p>Example: The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the set point is converted to the new limits.</p> <p>0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.</p>

Code no.	Parameter – Readings/values [default setting]	Description
10*	Lower travel/angle limit (lower x-limit) 0.0 to 49.9 % of the operating range, [No], ESC	Lower limitation of the travel/angle of rotation to the entered value. The characteristic is not adapted.
11*	Upper travel/angle limit (upper x-limit) 50.0 to 120.0 %, [100 %] of the operating range, No, ESC	Upper limitation of the travel/angle of rotation to the entered value. The characteristic is not adapted. Example: In some applications, it is better to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached. The lower limit must be adjusted with Code 10 and the upper limit with Code 11. If a tight-closing function has been set up, it has priority over the travel limitation. When set to No, the valve can be opened past the nominal travel with a set point outside of the 4 to 20 mA range.
12*	Set point, lower range value (w-start) [0.0] to 75.0 %, ESC	Lower range value (0 % = 4 mA) of the valid set point range. This value must be smaller than the upper range value. The set point range is the difference between Set point, upper range value – Set point, lower range value. The difference must be larger or equal to 25 % (= 4 mA). When the set point range of 0 to 100 % = 4 to 20 mA, the valve moves through its entire operating range from 0 to 100 % travel/angle of rotation. In split-range operation , the valves operate with smaller set points. The control signal of the control unit to control two valves is divided such, for instance, that the valves move through their full travel/angle of rotation at only half the input signal (first valve set to 0 to 50 % = 4 to 12 mA and second valve set to 50 to 100 % = 12 to 20 mA).
13*	Set point, upper range value (w-end) 25.0 to [100.0] %, ESC	Upper range value (100 % = 20 mA) of valid set point range This value must be greater than the lower range value.

Code no.	Parameter – Readings/ values [default setting]	Description
14*	CLOSED end position (end position $w <$) 0.0 to 49.9 %, [1.0 %] of the span adjusted in Code 12/13, No, ESC	Limit of the set point w Actuators with fail-safe action ATO are completely vented and actuators with fail-safe action ATC are completely filled with air when the set point falls below the adjusted limit. This action always lead to the tight-closing of the valve. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15.
15*	OPEN end position (end position $w >$) 50.0 to 100.0 % of the span adjusted in Code 12/13, [No], ESC	Limit of the set point w Actuators with fail-safe action ATO are completely filled with air and actuators with fail-safe action ATC are completely vented when the set point exceeds the adjusted limit. This action always lead to the valve to be opened to the maximum. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15. Example: Set the end position $w >$ to 99 % for three-way valves.
16*	Pressure limit 1.4 to 7.0 bar, [No], ESC <i>Do not activate pressure limitation for double-acting actuators (with closed position ATO).</i>	Signal pressure to actuator can be limited. After changing the pressure limit setting, the actuator must be vented once (e.g. by selecting the fail-safe position).
17*	Proportional-action coefficient Kp level 0 to 17 [7], ESC <i>KP level changes affect the set point deviation. This effect can be compensated for by tuning the input filter in Code 6. See section 7.6.6.</i>	During positioner initialization, the values for Kp and Tv are optimally set. If the value for the KP level is below 3, the error code 61 is activated. If the positioner tends to overshoot impermissibly due to other disturbances, the KP and TV levels can be adapted accordingly after initialization. Increment TV level until desired behavior is reached or when the maximum value of 4 is reached, the KP level can be decreased in increments.
18*	Derivative-action time Tv level 1, [2], 3, 4, No, ESC	See Code 19 A change of the TV level has no effect on the set point deviation.

Code no.	Parameter – Readings/values [default setting]	Description
19*	Tolerance band 0.1 to 10.0 %, [5.0 %] of the operating range, ESC	Used for error monitoring. If the set point deviation is greater than selected tolerance band for a time longer than the lag time [30 s], this causes the error code 57 (control loop) to be activated. Note: <i>The lag time can only be set using the operator software.</i>
20*	Select characteristic [0] to 9, ESC	Select characteristic. See section 16. 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 operator software)
21*	Transit time OPEN (w ramp OPEN) [0] to 240 s, ESC <i>The entered transit time does not apply when fail-safe action, solenoid valve or forced venting function are triggered nor when the auxiliary energy fails.</i>	The time required to move through the operating range when opening the valve. This parameter can be used to increase the Min. transit time OPEN (Code 40). 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.
22*	Transit time CLOSED (w ramp CLOSED) [0] to 240 s, ESC <i>The entered transit time does not apply when fail-safe action, solenoid valve or forced venting function are triggered nor when the auxiliary energy fails.</i>	The time required to move through the operating range when closing the valve. This parameter can be used to increase the Min. transit time CLOSED (Code 41). Code 22 has priority over Code 14.

Code no.	Parameter – Readings/ values [default setting]	Description
23*	Absolute total valve travel [0] to $99 \cdot 10^7$, YES, ESC Exponential reading from 9999 travel cycles onwards	Totaled full valve travel cycle Can be reset to 0 in Code 36 – STD and Code 36 – DS. Note: <i>The total valve travel is saved in a non-volatile memory after every 24 full valve travel cycle.</i>
24*	Total valve travel limit 1000 to $99 \cdot 10^7$ [1.000000], ESC Exponential reading from 9999 travel cycles onwards	Limit of total valve travel limit 'Total valve travel exceeded' message is generated depending on selected status classification if the limit is exceeded. Note: <i>The 'Total valve travel exceeded' message has the default status classification 'alarm required'. This classification can only be changed in the operator software (e.g. TROVIS-VIEW).</i>
25*	Alarm mode 0, 1, [2], 3, ESC	Switching mode of software limit contact alarms A1 and A2 when activated (when the positioner is initialized). Explosion-protected version according to EN 60947-5-6 0: $A1 \geq 2.2 \text{ mA}$ $A2 \leq 1.0 \text{ mA}$ 1: $A1 \leq 1.0 \text{ mA}$ $A2 \leq 1.0 \text{ mA}$ 2: $A1 \geq 2.2 \text{ mA}$ $A2 \geq 2.2 \text{ mA}$ 3: $A1 \leq 1.0 \text{ mA}$ $A2 \geq 2.2 \text{ mA}$ Version without explosion protection 0: $A1 R = 348 \Omega$ $A2$ non-conducting 1: $A1$ non-conducting $A2$ non-conducting 2: $A1 R = 348 \Omega$ $A2 R = 348 \Omega$ 3: $A1$ non-conducting $A2 R = 348 \Omega$ When a positioner has not been initialized, the software limit contacts always register the signal as in the state of no response. If there is no mA signal at the terminals 11/12, the software limit contacts both switch to $\leq 1.0 \text{ mA}$ (Ex) or non-conducting (without explosion protection). Note: <i>The fault alarm output always switches to $\leq 1.0 \text{ mA}$/non-conducting in case of a fault; it has $\geq 2.2 \text{ mA}/R = 348 \Omega$ when there is no fault.</i>




Code no.	Parameter – Readings/ values [default setting]	Description
26*	Limit A1 (alarm limit 1) 0.0 to 100.0 [2.0] % of the operating range, No, ESC <i>The setting has no effect when an inductive limit contact is installed.</i>	The valve position limit relating to the operating range. Alarm A1 responds when the value falls below the limit.
27*	Limit A2 (alarm limit 2) 0.0 to 100.0 [98.0] % of the operating range, No, ESC	The valve position limit relating to the operating range. Alarm A2 responds when the value falls below the limit.
28*	Alarm test Reading direction: Standard Turned [No] [No] A1 1A A2 2A A3 3A ESC ESC	Testing the software limit contact alarm A1 and A2 as well as the fault alarm contact A3. If the test is activated, the contact is switched five times. A1/1A: Software limit contact A1 to ≥ 2.2 mA A2/2A: Software limit contact A2 to ≥ 2.2 mA A3/3A: Fault alarm contact A3 to ≤ 1.0 mA
29*	Position transmitter x/ix ³⁾ [↗], ↗, ESC	Operating direction of the position transmitter. This indicates how the travel/angle position is assigned to the output signal i, based on the closed position. The operating range (see Code 8) of the valve is represented by the 4 to 20 mA signal. Values exceeding or falling below the limits 2.4 to 21.6 mA can be represented. When a positioner has not been connected (set point less than 3.6 mA), the signal is 0.9 mA and 3.8 mA or 4.4 mA when the positioner has not been initialized. When Code 32 = YES, the position transmitter issues the value as set in Code 30 during initialization or zero calibration. When Code 32 = No, 4 mA is issued during a running autotune.
30*	Fault alarm ix ³⁾ [No], HI, LO, ESC	Select if and how faults that cause the fault alarm contact to be switched are also indicated at the position transmitter output. HI ix = 21.6 ± 0.1 mA or LO ix = 2.4 ± 0.1 mA

Code no.	Parameter – Readings/ values [default setting]	Description
31*	Position transmitter test ³⁾ –10.0 to 110.0 % of the operating range · ESC, [default value is last indicated value of the position transmitter]	Testing the position transmitter. Values can be entered in relation to the operating range. The momentary valve position is used in initialized positioners locally as the start value (bumpless changeover to the test mode). On testing over software, the entered simulation value is issued as the position feedback signal for 30 seconds.
³⁾ Analog position transmitter: Code 29/30/31 can only be selected if the position transmitter (optional) is installed.		
32*	Error message in case of 'Function check' condensed state [YES], No, ESC	YES: 'Failure' and 'Function check' condensed state cause an error message to be generated. No: 'Failure' condensed state causes an error message to be generated.
33*	Error message in case of 'Maintenance required' and 'Out of specification' condensed states [YES], No, ESC	YES: 'Failure', 'Maintenance required' and 'Out of specification' condensed state cause an error message to be generated. No: 'Failure' condensed state causes an error message to be generated.
34*	Closing direction CL, [CCL], ESC	CL: Clockwise CCL: Counterclockwise Direction of rotation to reach the valve's CLOSED position (view onto rotary switch with positioner cover open). Note: Needs only be entered in initialization mode SUB (Code 6).
35*	Blocking position [0.0] mm/° /%, ESC	Distance to CLOSED position Note: Needs only be entered in initialization mode SUB (Code 6).
36*	Reset STD, DIAG, DS, ESC	STD: Resets start-up – Resets parameters to their default settings. – Resets diagnostics assessment. – Information parameters (read only) remain unchanged. – Re-initialize positioner.

Code no.	Parameter – Readings/ values [default setting]	Description
36*	Reset (continued)	<p>DAG: Reset diagnostics assessment</p> <ul style="list-style-type: none"> – Parameter settings, reference values and logs remain unchanged. – The positioner does not need to be re-initialized. <p>DS: Resets positioner to default settings.</p> <ul style="list-style-type: none"> – Resets parameters to their default settings. – Resets diagnostics assessment. – Information parameters (read only) are deleted. – Re-initialize positioner.
37	Options Read only	<p>Indicates which option (terminals 31 and 32, Fig. 20) is installed.</p> <p>No: No option installed</p> <p>POS: Analog position transmitter</p> <p>dl: Binary input</p> <p>LS: Leakage sensor</p> <p>XI: 4 to 20 mA x input</p> <p>When the binary input is used, DI and HIGH or LOW status are displayed in alternating sequence.</p> <p>When the leakage sensor is used, LS and the detected sound level in dB are displayed in alternating sequence.</p>
38*	Inductive limit contact [No], YES, ESC	Indicates whether the inductive limit contact option is installed or not.
39	Set point deviation e info Read only	Difference of the target position ($e = w - x$)
40	Min. transit time OPEN Read only	Minimum opening time determined during initialization
41	Min. transit time CLOSED Read only	Minimum closing time determined during initialization
42	Set point Read only	Set point w used in automatic mode 4 to 20 mA correspond to 0 to 100 %
43	Firmware version Read only	Device type and current firmware version (displayed in alternating sequence)

Code no.	Parameter – Readings/ values [default setting]	Description
44	y info Read only	Control signal y in % in relation to the travel range determined during initialization MAX: The positioner builds up its maximum output pressure, see description in Code 14 and 15. OP: The positioner vents completely, see description in Code 14 and 15. ---: The positioner is not initialized.
45	Internal solenoid valve/ forced venting Read only	Indicates whether a solenoid valve/forced venting is installed or not. If a voltage supply is connected at the terminals +81/-82, YES and HIGH 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 S icon), YES and LOW appear on the display in alternating sequence.
46*	Bus address [0] to 15, ESC	Using the HART® protocol, all connected control room and field units can be addressed individually using a point-to-point connection or the standard (multidrop) bus. Point-to-point connection: HART® master device connected to one HART® field unit. With this connection, the device address must also be set to '0'. Standard (multidrop) bus: Up to 15 field units connected in parallel to a single pair of wires. The master device distinguishes them by their preset addresses between 1 and 15.
47*	HART® write protection YES, [No], ESC	When write protection is active, device data can be read, but not overwritten over HART® communication.
48* 49*	Diagnostic parameters · Details on EXPERTplus Valve Diagnostics in the Operating Instructions ► EB 8389-1S EN.	

**Note:**

The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: , Out of specification:  blinking, Failure: ). 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 operator software (e.g. TROVIS-VIEW).

Initialization errors

Error codes – Recommended action		Condensed state message active, when prompted, ERR appears. When fault alarms exist, they are displayed here.
50	x > range	Value of measuring signal too high or too low; the lever operates near its mechanical stops. <ul style="list-style-type: none"> • Pin not mounted properly • NAMUR attachment: bracket slipped or follower pin not properly seated on the follower plate's slot. • Follower plate not mounted properly.
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> • Check attachment and pin position. • Re-initialize positioner.
51	Δx < range	Insufficient measuring span of the sensor <ul style="list-style-type: none"> • Pin not mounted properly. • Wrong lever mounted. • Pressure limit set too low. <p>An angle of rotation smaller than 16° at the positioner shaft only generates an alarm. An angle below 9° leads to the initialization being canceled.</p>
	Status classification	[Out of specification]
	Recommended action	<ul style="list-style-type: none"> • Check attachment and pressure limit. • Re-initialize positioner.

Error codes – Recommended action		Condensed state message active, when prompted, ERR appears. When fault alarms exist, they are displayed here.
52	Attachment	<ul style="list-style-type: none"> The nominal range could not be achieved during initialization with NOM initialization mode (the maximum travel/angle reached is indicated on the display). Wrong lever mounted. Supply pressure too low; valve cannot be moved to desired position.
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> Check attachment and supply pressure. Re-initialize positioner.
53	Initialization time exceeded (init time >)	Timeout detected during initialization <ul style="list-style-type: none"> Valve takes too long to open. Valve cannot find fixed end stops (e.g. when lined control butterfly valves are used). Valve tends to hunt considerably.
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> Check supply pressure and install pneumatic volume booster, if necessary. Adjust travel/angle stops. Reduce hunting tendency (e.g. restrict or open booster bypass). Then re-initialize the positioner.
54	Initialization - Internal solenoid valve/forced venting	<ol style="list-style-type: none"> Internal solenoid valve/forced venting not or improperly connected. An attempt was made to initialize the device from fail-safe position.
	Status classification	[Maintenance required]
	Recommended action	<ol style="list-style-type: none"> Check connection and supply voltage of solenoid valve/forced venting. Re-initialize positioner. Switch to manual mode. Re-initialize positioner.
55	Transit time not reached (transit time <)	Actuator transit times detected during initialization are so short (< 0.3 s) that optimal positioner tuning is impossible.
	Status classification	[Out of specification]
	Recommended action	<ul style="list-style-type: none"> Activate volume restriction in positioner output. Re-initialize positioner.

Error codes – Recommended action		Condensed state message active, when prompted, ERR appears. When fault alarms exist, they are displayed here.
56	Pin/switch position	<ol style="list-style-type: none"> 1) Pin position not entered for nominal range (NOM) or substitute (SUB) initialization. 2) ATO/ATC switch defective.
	Status classification	[Maintenance required]
	Recommended action	<ol style="list-style-type: none"> 1) Enter pin position and nominal range. Re-initialize positioner. 2) Return positioner to SAMSON for repair.

Operational error

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
57	Control loop Additional indication at the fault alarm contact!	Control loop error, the valve no longer follows the controlled variable within tolerable times (tolerance band alarm Code 19). <ul style="list-style-type: none"> • Actuator is blocked. • Positioner attachment has shifted subsequently. • Insufficient supply pressure
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> • Check attachment. • Check supply pressure.
58	Zero	<ul style="list-style-type: none"> • Mounting arrangement or linkage has slipped. • Valve trim, particularly with soft seat, is worn.
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> • Check valve and positioner attachment. • Calibrate zero. <p>We recommend to re-initialize the positioner if zero deviates by more than 5 %.</p>
59	Inconsistent data memory	The error is detected by automatic monitoring and corrected automatically.
	Status classification	Failure (cannot be classified)
60	Internal device error Additional indication at the fault alarm contact!	The positioner goes to the fail-safe position (SAFE).
	Status classification	Failure (cannot be classified)
	Recommended action	Return positioner to SAMSON for repair.

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
61	Kp too low	Proportional-action coefficient Kp level lower than 3 was detected during initialization. Note: A Kp level < 3 does not cause the initialization process to be canceled.
	Status classification	[Maintenance required]
	Recommended action	<ul style="list-style-type: none"> • Activate volume restriction in positioner output. • Increase the bypass restriction setting of booster (if installed).

Hardware error

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
62	x signal Additional indication at the fault alarm contact!	<ul style="list-style-type: none"> • Actuator's measured value recording failed. • Conductive plastic element defective. <p>The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position reading.</p> <p>Note on the closed-loop operation: 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 set point so that the process remains in a safe state.</p>
	Status classification	[Maintenance demanded]
	Recommended action	Return positioner to SAMSON for repair.
63	SIL shutdown/w too low	<ol style="list-style-type: none"> 1) Emergency shutdown of the i/p block is implemented by 3.8 mA or 4.4 mA (depending on the positioner version)'. 2) The set point w is lower than 3.7 mA. This state is indicated on the positioner display by LOW blinking.
	Status classification	[No message]
	Recommended action	<ol style="list-style-type: none"> 1) Raise the current (depending on version) above the limit. 2) Check set point w. If necessary, restrict lower limit of current source to ensure that a current below 3.7 mA cannot be issued.

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
64	i/p converter (y)	Current circuit of i/p converter interrupted.
	Status classification	Failure (cannot be classified)
	Recommended action	Return positioner to SAMSON for repair.

Error appendix

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
65	Hardware Additional indication at the fault alarm contact!	<ul style="list-style-type: none"> Initialization key jammed. A hardware error has occurred. The positioner changes to the fail-safe position (SAFE). <p>As long as the error exists, no EXPERTplus diagnostic messages are logged.</p>
	Status classification	[Failure]
	Recommended action	Confirm error and return to automatic mode, or perform a reset and re-initialize the positioner. If this is not successful, return positioner to SAMSON AG for repair.
66	Unassigned	
67	Check calculation Additional indication at the fault alarm contact!	Hardware controller monitored by test calculation.
	Status classification	[Failure]
	Recommended action	Confirm error. If this is not possible, return positioner to SAMSON AG for repair.

Data error

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
68 to 75	Unassigned	
76	No emergency mode	<p>The travel measuring system of the positioner has a self-monitoring function (see Code 62).</p> <p>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 automatically checks whether the actuator has such a function or not.</p>
	Status classification	[No message]
	Recommended action	Merely information, confirm, if necessary. No further action required.

Diagnosis errors

Error codes – Recommended action		Condensed state message active, when prompted, Err appears. When fault alarms exist, they are displayed here.
77	Unassigned	
78	Unassigned	
79	Collective error	Messages generated in EXPERTplus The error does not have any direct effect on the positioner's functioning.
	Status classification	Maintenance required (cannot be classified)
80	Unassigned	
81	Valve signature canceled	Error during automatic plotting of the valve signature Error messages are not yet saved in a non-volatile memory. They cannot be reset.
	Status classification	[Maintenance required]
	Recommended action	Restart the valve signature recording or start initialization including valve signature.
82	Unassigned	
83	Unassigned	
84	PST/FST	A partial stroke test or full stroke test cannot be started or has been canceled.
	Status classification	[No message]
	Recommended action	Read out test status (only in the operator software)
85	On/off valve	The transit time and breakaway time or the final travel/angle value of the on/off valve has changed.
	Status classification	[No message]
	Recommended action	Check valve and actuator.
86	SIL test	SIL operator test failed
	Status classification	Failure (cannot be classified)
	Recommended action	Return positioner to SAMSON for repair.

15 Dimensions in mm

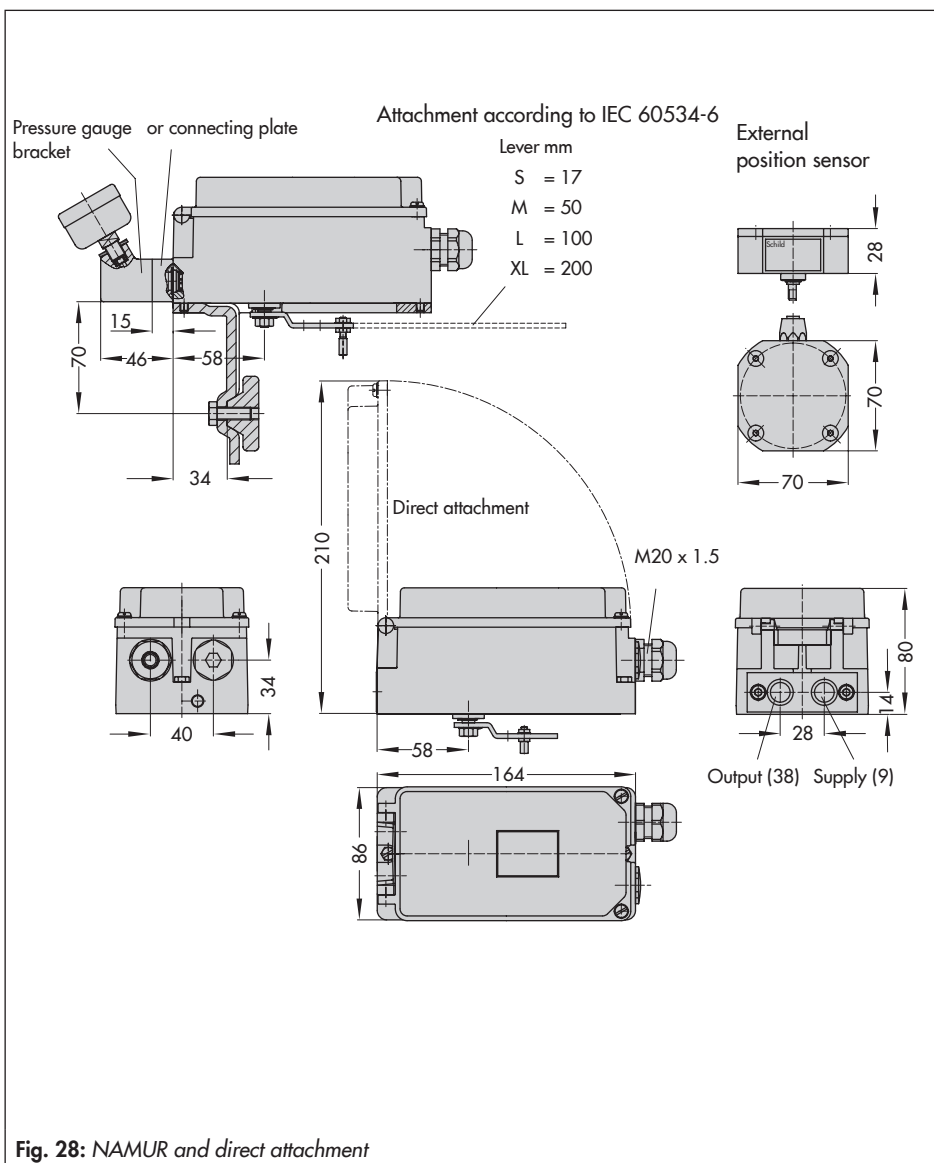
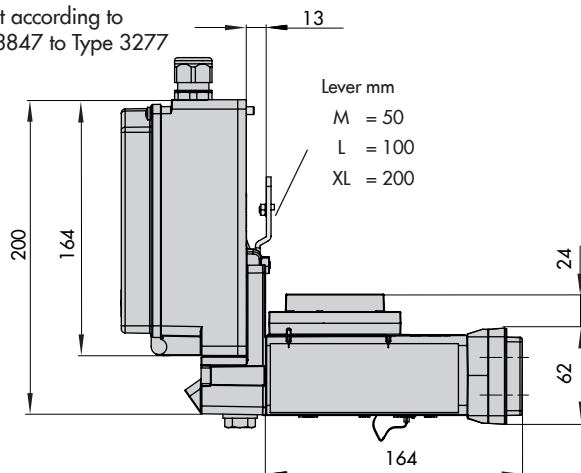


Fig. 28: NAMUR and direct attachment

Attachment according to
VDI/VDE 3847 to Type 3277



Attachment according to
VDI/VDE 3847 to a NAMUR
rib

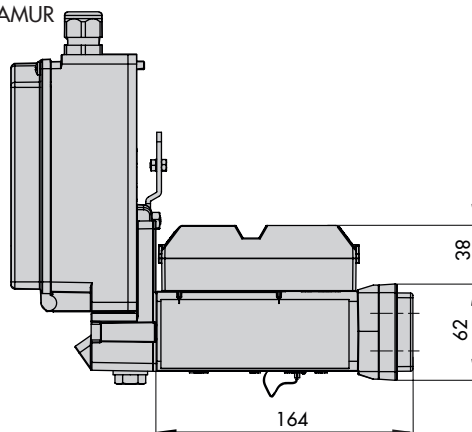
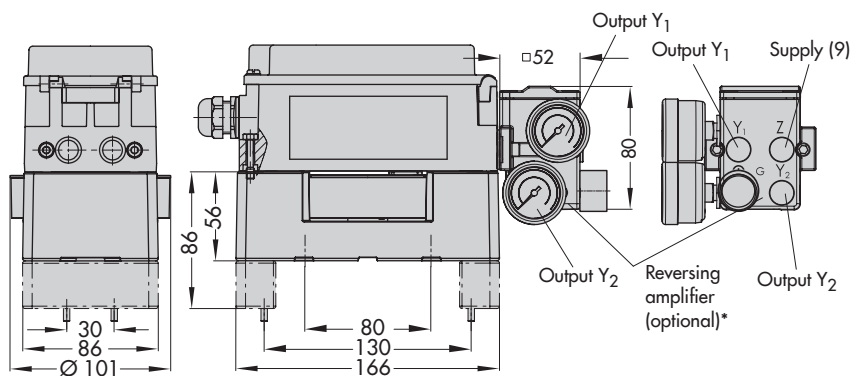
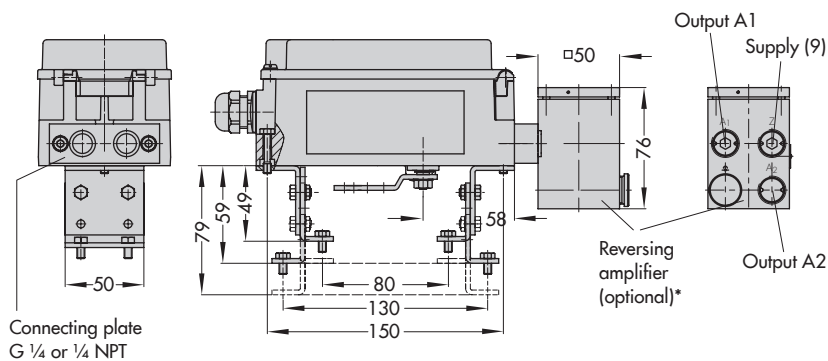


Fig. 29: Attachment according to VDI/VDE 3847

Heavy-duty version



Light version

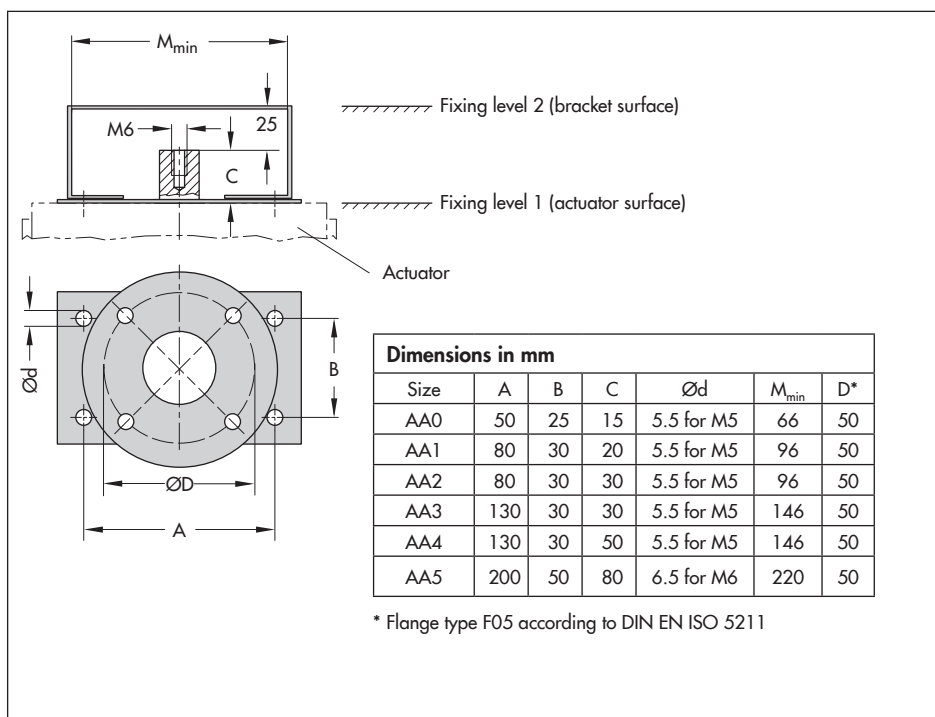


* Reversing amplifier

- 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. 30: Attachment to rotary actuators acc. to VDI/VDE 3845 (Sept. 2010), fixing level 1, AA1 to AA4 size

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



16 Valve characteristic selection

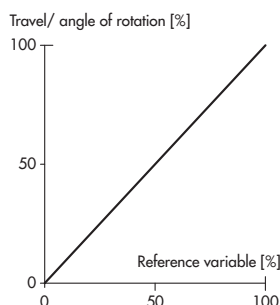
The characteristics that can be selected in Code 20 are shown in following in graph form.



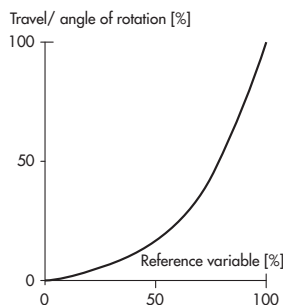
Note:

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

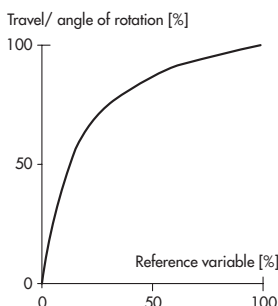
Linear (select characteristic: 0)



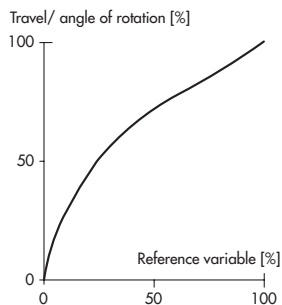
Equal percentage (select characteristic: 1)



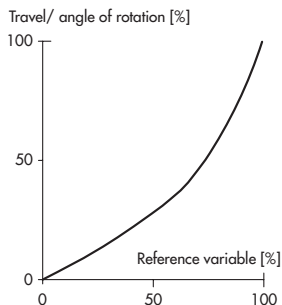
Reverse equal percentage (select characteristic: 2)



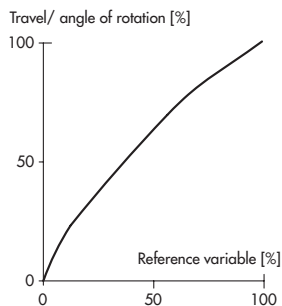
SAMSON butterfly valve linear (select characteristic: 3)



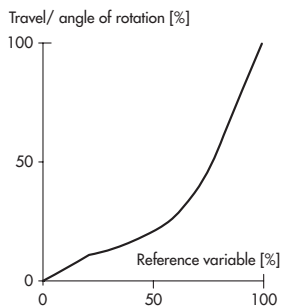
SAMSON butterfly valve equal percentage (select characteristic: 4)



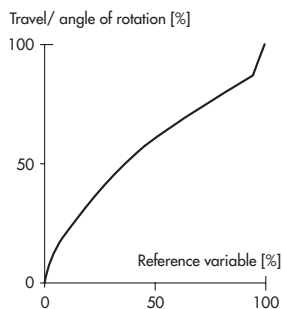
VETEC rotary plug valve linear (select characteristic: 5)



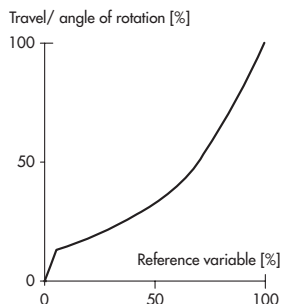
VETEC rotary plug valve equal percentage (select characteristic: 6)



Segmented valve ball linear (select characteristic: 7)



Segmented valve ball equal percentage (select characteristic: 8)




EC-TYPE-EXAMINATION CERTIFICATE

(Translation)

- (1) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC
 (2) EC-type-examination Certificate Number:
PTB 10 ATEX 2007

- (4) Equipment:
 Digital positioner, type 3730-6-110 and 3730-6-210
 with HART communication

- (5) Manufacturer:
SAISON AG Mess- und Regeltechnik

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

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

- (8) The Physikalisch-Technische Bundesanstalt, notified body No. 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 the protective systems intended for use in potentially explosive atmospheres, given in Annex I to the Directive.

- The examination and test results are recorded in the confidential assessment and test report PTB Ex 10-26351.

- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0:2006 EN 60079-11:2007 EN 61241-0:2006 EN 61241-1:2004

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

- (11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

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

 see (15) Description

Zertifizierungssektor Explosionschutz

On behalf of PTB

Dr.-Ing. U. Johann
 Direktor und Protokollant

sheet 1/7

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be cancelled only without alteration. Extracts from the certificates are not permitted. In case of dispute, the German text shall prevail.

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SCHEDULE


- (13) **EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007**

- (15) Description of equipment

The digital positioner with HART communication is a single or double acting positioner. It is used for the conversion of electrical actuating signals into pneumatic actuating pressure signals. The equipment is installed inside the hazardous area.

The equipment is available in two designs, type 3730-6-110 and type 3730-6-210 with a field barrier connected in series.

Marking
Type 3730-6-110

 II 2 G Ex ia IIC/IIB T6 and

 II 2 D Ex II 2 A21 IP66 T80 °C

Type 3730-6-210 with field barrier, type 3770-1

 II 2 G Ex d[ia] IIC/IIB T6 and

 II 2 D Ex II 2 A21 IP66 T80 °C

For relationship between type of protection, temperature class, options and permissible ambient temperature range, reference is made to the table.

Type of protection / Options	Permissible ambient temperature range
T8	60 °C
Ex ia IIC	70 °C
T5	-55 °C ... 70 °C
T4	80 °C
Option, structure-borne sound sensor	60 °C
	-40 °C ... 70 °C
	80 °C

sheet 2/7

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

Electrical data

Type 3730-6-210 with field barrier, type 3770-1 connected in series

Operating values: 4 ... 20 mA

Supply circuit: $U_n = 10$ V

or NAMUR-limit contact $U_m = 250$ V

Type 3730-6-110

The positioner may be connected to certified intrinsically safe circuits provided the permissible maximum values for U_i , I_i and P_i are not exceeded.

The circuits for the voltage/power supply, the serial SSP interface and the external position sensor are operationally interconnected and safely electrically isolated from the other circuits. The maximum voltage of the serial SSP interface is 60 V. The serial SSP interface and the other circuits are safely electrically isolated from each other up to a peak value of the nominal voltage of 80 V. All circuits are safely isolated from ground.

Operating values:

4 ... 20 mA

Voltage/power supply type of protection Ex ia IIC/IB only for connection to a certified intrinsically safe circuit (terminals 11/12)

Maximum values:

$U_i = 28$ V

$I_i = 115$ mA

or

$U_i = 32$ V

$I_i = 87$ mA

$P_i = 1$ W

$C_i = 5.3$ nF

L_i negligibly low

Position check-back, type of protection Ex ia IIC/IB only for connection to a certified intrinsically safe circuit (terminals 31/32)

Maximum values:

$U_i = 28$ V

$I_i = 115$ mA

sheet 3/7

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Entries in the German text shall prevail. In case of dispute, the German text shall prevail.

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

or

$U_i = 32$ V

$I_i = 87.5$ mA

$P_i = 1$ W

$C_i = 5.3$ nF

L_i negligibly low

or

Binary input type of protection Ex ia IIC/IB only for connection to a certified intrinsically safe circuit (terminals 31/32)

Maximum values:

$U_i = 30$ V

$I_i = 100$ mA

$C_i = 56.3$ nF

L_i negligibly low

or

Structure-borne sound sensor type of protection Ex ia IIC/IB only for connection to a certified intrinsically safe circuit (terminals 31/32)

Maximum values:

$U_i = 30$ V

$I_i = 100$ mA

$C_i = 1.4$ nF

$C_i = 5.3$ nF

L_i negligibly low

Inductive limit contact type of protection Ex ia IIC/IB only for connection to a certified intrinsically safe circuit (terminals 41/42)

Maximum values:

$U_i = 16$ V

$I_i = 52$ mA

$P_i = 169$ mW

or

$U_i = 16$ V

$I_i = 25$ mA

$P_i = 64$ mW

$C_i = 30$ nF

$L_i = 100$ μ H

sheet 4/7

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

For relationship between temperature class, permissible ranges of the ambient temperature, maximum short-circuit currents and maximum power for analyzing units, reference is made to the table:

Temperature class	Permissible ambient temperature range	I_b / P_s
T0	... 45 °C	
T5	-55 °C ... 60 °C	52 mA / 169 mW
T4	... 75 °C	
T0	... 60 °C	
T5	-55 °C ... 80 °C	25 mA / 64 mW
T4	... 80 °C	

Software-limit contact

(terminals 4 / 142 and 5 / 152)

type of protection Ex ia IIC/IIB
only for connection to a certified
intrinsically safe circuit

Maximum values:

U_i = 20 V
 I_i = 60 mA
 P_i = 250 mW
 C_i = 5.3 nF
 L_i negligibly low

Magnet valve

(terminals 8 / 152)

type of protection Ex ia IIC/IIB
only for connection to a certified
intrinsically safe circuit

Maximum values:

U_i = 28 V
 I_i = 115 mA
or
 U_i = 32 V
 I_i = 87.5 mA
 C_i = 5.3 nF
 L_i negligibly low

sheet 5/7

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

Fault signal output
(terminals 83/84)

type of protection Ex ia IIC/IIB
only for connection to a certified
intrinsically safe circuit

Maximum values:

U_i = 20 V
 I_i = 60 mA
 P_i = 250 mW
 C_i = 5.3 nF
 L_i negligibly low

Serial SSP interface
(plug connector)

type of protection Ex ia IIC/IIB

Maximum values (active):

U_o = 7.88 V
 I_o = 69.2 mA
 P_o = 137 mW
linear characteristic
 C_o = 650 nF
 L_o = 10 mH
or

only for connection to a certified
intrinsically safe circuit

Maximum values (passive):

U_i = 20 V
 I_i = 60 mA
 P_i = 200 mW
 C_i negligibly low
 L_i negligibly low

Extended position sensor
(Analog PCB, pins p8, p10, p11)

type of protection Ex ia IIC/IIB

Maximum values:

U_i = 7.88 V
 I_i = 13.2 mA
 P_i = 27 mW
linear characteristic
 L_i = 10 mH
 C_i = 1 μ F
 L_i = 370 μ H
 C_i = 66 nF

sheet 6/7

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

(16) Assessment and test report PTB Ex 10-29351

(17) Special conditions for safe use
none

(18) Essential health and safety requirements
met by compliance with the standards mentioned above



Braunschweig, August 18, 2010

Zertifizierungsdirektor
On behalf of PTB:
Dr.-Ing. U. Jochims
Direktor und Professor



CONFORMITY STATEMENT
(Translation)

- (1) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC
(2) Test Certificate Number:

PTB 10 ATEX 2008 X

- (3) Equipment: Digital positioner, type 3730-6-810
(4) Manufacturer: SAMSON AG Mess- und Regeltechnik
(5) Address: Weismüllerstr. 3, 60314 Frankfurt, Germany

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

- (7) The Physikalisch-Technische Bundesanstalt, on the basis 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, given in Annex II to the Directive.

- (8) The examination and test results are recorded in the confidential assessment and test report: PTB Ex 10-29352.

- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60075-0:2006 EN 60079-15:2005 EN 61241-0:2006 EN 61241-1:2004

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

- (11) This Conformity Statement relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

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

Ex II 3 G Ex nA II T6 or II 3 G Ex nL IIC/IIIB T6 or II 3 D Ex ID A22 IP66 T80 °C



Zertifizierungssektor Explosionsgeschützte Ausrüstung
On behalf of PTB:
Dr.-Ing. U. Joharathayal
Direktor und Professor

Sheet 1/6

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SCHEDULE

CONFORMITY STATEMENT PTB 10 ATEX 2008 X

- (13)
(14)
(15) Description of equipment

The digital positioner of type 3730-6-810 with HART communication is a single or double acting positioner. It is used for the conversion of electrical actuating signals into pneumatic actuating pressure signals.

The equipment is installed inside the hazardous area.

For relationship between type of protection, temperature class, options and permissible ambient temperature range, reference is made to the table.

Type of protection / Options	Permissible ambient temperature range
Ex nA IIC or Ex nL IIC	T6 60 °C T5 -55 °C ... 70 °C T4 60 °C
Option, structure-borne sound sensor	60 °C -40 °C ... 70 °C 80 °C

Electrical data

Signal circuit type of protection Ex nA II
(terminals 11/12) Maximum operational values:

I = 4 ... 20 mA

or

type of protection Ex nL IIC/IIIB

U = 32 V

I = 132 mA

P = 1.2 W

L = negligibly low

C = 5.3 nF

Sheet 2/6

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2008 X

Position check-back.....type of protection Ex nA II
or binary input
or structure-borne sound sensor
(terminals 31/32)

Maximum operational values:
U = 4 ... 20 mA

or

type of protection Ex nL IIC/IIIB
U = 32 V
I = 132 mA
L = negligibly low
C = 56.3 nF

Inductive limit contact.....type of protection Ex nA II
(terminals 41/42)

Maximum operational values:

U = 8 V
I = 8 mA

or

type of protection Ex nL IIC/IIIB
U = 20 V
I = 52 mA
P = 169 mW

or

U = 20 V
I = 25 mA
P = 64 mW
L = 100 µH
C = 30 nF

For relationship between temperature class, permissible ranges of the ambient temperature, maximum short-circuit currents and maximum power for analyzing units, reference is made to the table:

Temperature class	Permissible ambient temperature range	I _{sc} / P _{sc}
T8	... 45 °C	
T5	-55 °C ... 60 °C	52 mA / 169 mW
T4	... 75 °C	
T6	... 80 °C	
T5	-55 °C ... 80 °C	25 mA / 64 mW
T4	... 80 °C	

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Sheet 3/6

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Physikalisch-Technische Bundesanstalt

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SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2008 X

Software-limit contact.....type of protection Ex nA II
(terminals 41/42 and 51/52)

Maximum operational values:

U = 8 V
I = 8 mA

or

type of protection Ex nL IIC/IIIB
U = 20 V
I = 60 mA
P = 400 mW
L = negligibly low
C = 5.3 nF

Magnet valve.....type of protection Ex nA II
(terminals 61/62)

Maximum operational values:

U = 6 ... 24 VDC

or

type of protection Ex nL IIC/IIIB
U = 32 V
I = 132 mA
L = negligibly low
C = 5.3 nF

Fault signal output.....type of protection Ex nA II
(terminals 83/84)

Maximum operational values:

U = 8 V
I = 8 mA

or

type of protection Ex nL IIC/IIIB
U = 20 V
I = 60 mA
P = 400 mW
L = negligibly low
C = 5.3 nF

ZSE-10200e-dat

Sheet 4/6

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Serial SSP interface (plug connector) type of protection Ex nA II

Maximum operational values:

U = 8 V DC
I = 20 mA

or

type of protection Ex nL IIC/IIB

U = 20 V
I = 60 mA
P = 200 mW
L = negligibly low
C = 5.3 nF

External position sensor type of protection Ex nA II
(Analog PCB, pins p8, p10, p11) or Ex nL IIC/IIB

Maximum operational values:

U = 7.88 V
I = 51 mA
P = 120 mW
L = 10 mH
C = 1 µF

(16) Assessment and test report PTB Ex 10-29352

(17) Special conditions for safe use

Type of protection Ex nA II:

A fuse according to IEC 60127-2/II, 250 V F or IEC 60127-2/VI, 250 V T with a nominal fuse current of max. 80 mA shall be connected in series to the signal circuit and to the position check-back circuit.

A fuse according to IEC 60127-2/II, 250 V F or IEC 60127-2/VI, 250 V T with a nominal fuse current of max. 40 mA shall be connected in series to the serial SSP interface.

All fuses shall be installed outside of the hazardous area.

Type of protection Ex nL IIC:

No fuses are required for the operation with energy-limited circuits of type of protection Ex nL IIC.

Sheet 5/6

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ZSEK102006.dcf

(18) Essential health and safety requirements met by compliance with the standards mentioned above



Braunschweig, August 18, 2010

Sheet 6/6

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