

Series 3730 Electropneumatic Positioner Type 3730-3



with HART® communication



Fig. 1 · Type 3730-3

Mounting and Operating Instructions

EB 8384-3 EN

Firmware version 1.52
Edition September 2008



Definitions of the signal words used in these instructions

DANGER!

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

WARNING!

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

NOTICE

NOTICE indicates a property damage message.

Note: *Supplementary explanations, information and tips*

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Modifications of positioner firmware in comparison to previous versions	
Previous	New
1.00	<p>1.10</p> <p>The HART protocol as per HART[®] specification Revision 5 is supported by default setting. The setting can be changed to HART[®] Revision 6 over TROVIS-VIEW. HART[®] tools as well as AMS or handheld communicators are currently not supported by the Revision 6 version.</p> <p>The following additional status messages were implemented: Code 76 - No emergency mode Code 77 - Program loading error Displays number of zero calibrations performed since the last initialization.</p> <p>For initialization of "AIR TO CLOSE" actuators, the direction of action (Code 7) is automatically set to increasing/decreasing.</p> <p>Code 3, the activation period of the enabled configuration function was extended to 120 s.</p>
1.10	<p>1.20</p> <p>Electronics changed, no new functions added.</p>
1.20	<p>1.30</p> <p>New EXPERT⁺ diagnostics functions (Code 48) added Positioner in EXPERT⁺ version with extended diagnostics features.</p> <p>A running initialization can be canceled by pressing the rotary pushbutton.</p> <p>The position transmitter (Code 37) and solenoid valve (Code 45) options are automatically recognized.</p>
1.30	<p>1.40</p> <p>All EXPERT⁺ functions can be used over HART[®] communication in this firmware version and higher.</p> <p>The fault alarm contact is triggered by the condensed state of the positioner. It is always active when condensed state = "Maintenance alarm". If Code 32 is set to Yes: Also active with "Function check" condensed state If Code 33 is set to Yes: Also active with "Maintenance required/Maintenance demanded" condensed state</p> <p>The "Function check" condensed state is additionally set for Test A1, A2, fault alarm output and position transmitter.</p> <p>The min./max. values of the temperature monitoring can be reset.</p>

Modifications of positioner firmware in comparison to previous versions	
Previous	New
1.40	1.41
	Internal modifications
1.41	1.42
	Internal modifications
1.42	1.51
	Setting can be performed at the positioner to determine whether the valve is to operate as a control valve or an on/off (open/close) valve (see section 3.1)
	All EXPERT ⁺ diagnostic functions are available in the positioner without having to activate them first (refer to EB 8389 EN on EXPERT ⁺ valve diagnostics)
	Optional binary input with following actions (refer to EB 8389 EN on EXPERT ⁺ valve diagnostics): <ul style="list-style-type: none"> – Set local operation write protection – Start Partial Stroke Test (PST) – Go to fail-safe reference variable – Switch between AUTO/MAN – Start data logger – Reset diagnosis – External solenoid valve connected – Leakage sensor
	The pressure limit (Code 16) is no longer automatically set during initialization.
1.51	1.52
	Internal modifications

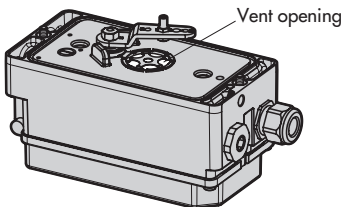
1 Important safety instructions

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

- ▶ The positioner may only be mounted, started up or operated by trained and experienced personnel familiar with the product.
According to these Mounting and Operating Instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.
- ▶ Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 11.
- ▶ Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.
- ▶ If inadmissible motions or forces are produced in the actuator as a result of the supply pressure, the supply pressure must be restricted by means of a suitable supply pressure reducing station.

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

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



- ▶ Proper shipping and appropriate storage are assumed.

Note: The device with a CE marking fulfills the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).
The Declaration of Conformity is available on request.

2 Article code

Article code	Type 3730-3	x	x	x	x	0	x	x	0	x	0	0	0	x	0	x	x
With LC display, autotune, HART® communication																	
Explosion protection																	
Without	0																
⊕ II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C acc. to ATEX	1																
CSA/FM intrinsically safe/non incandive	3																
⊕ II 3 G EEx nA/nL II T6 / II 3 D IP 65 T 80 °C acc. to ATEX	8																
Options (additional equipment)																	
Inductive limit switch		Without	0														
		With Type SJ 2-SN	1	0													
Solenoid valve SIL 4		Without	0														
		24 V DC	4														
Analog position transmitter		Without		0													
		With		1													
External position sensor		Without		0													
		With	0	1													
Binary input		Without					0										
		With				0	2										
Diagnostics																	
EXPERT plus									4								
Housing material																	
Aluminum													0				
Stainless steel 1.4581						0							1				
Special applications																	
None																	0
Free of paint-impairing substances																	1
Exhaust air connection with ¼ NPT thread																	2
Special versions																	
None																	0 0
IECEX			1														1 2

3 Design and principle of operation

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

The positioner basically consists of an electrical travel sensor system (2), an analog i/p converter (6) with downstream air capacity

booster (7) and the electronic unit with a microcontroller (5).

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

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

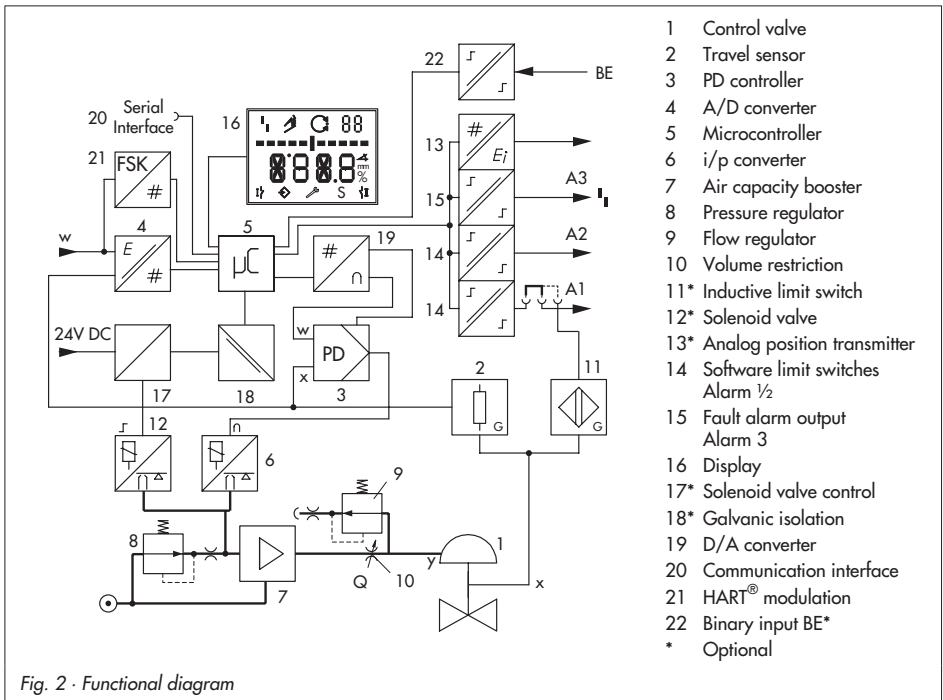


Fig. 2 · Functional diagram



variable) after it has been converted by the A/D converter (4). In case of a system deviation, the actuator is either vented or filled with more air. The supply air is supplied to the air capacity booster (7) and the pressure regulator (8). An intermediate flow regulator (9) with fixed settings is used to purge the positioner and also guarantees trouble-free operation of the air capacity booster. The output signal pressure supplied by the booster can be limited over the software. The volume restriction Q (10) is used to optimize the positioner by adapting it to the actuator size.


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



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

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

3.1 Application type

Two application types for the valve are available: **Control valve** and **Open/Close (on/off) valve**. The manual mode  (MAN) and the automatic mode  (AUTO) can be selected with both application types.

Depending on the application type that has been selected, the positioner behaves differently in the automatic mode  (AUTO):

	Control valve	Open/close valve
AUTO 	The positioner follows the reference variable continuously. The valve position (current position) appears in % on the display.	Discrete analysis of the reference variable. The valve position (current position) in % and O/C (Open/Close) appear in alternating sequence on the display.
MAN 	The positioner follows the reference variable given over local operation.	

The application type is set in Code **49 - h** (see section 7.8).

Note: Depending on the application type, certain diagnostic functions cannot be performed or analyzed. Refer to EB 8389 EN on EXPERT+ valve diagnostics.

3.2 Additional equipment

Solenoid valve

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

NOTICE

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

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 (min. current 3.8 mA), the actual travel/angle of rotation is controlled in real-time. Additionally, the position transmitter provides the possibility of signaling a positioner fault over a signal current of < 2.4 mA or > 21.6 mA.

Inductive limit switch

The rotary shaft of the positioner carries an adjustable tag which actuates the installed proximity switch. The optional inductive limit switch (11) is connected to A1, while the remaining software limit switch is connected to A2.





External position sensor

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

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

Binary input

The positioner has an optional binary input. The following actions can be performed over the binary input:

- ▶ **Transfer switching state** [default]
The switching state of the binary input is logged.
- ▶ **Set local operation write protection**
Settings cannot be changed at the positioner while the binary input is active. The configuration enabled function in Code 3 is not active.
- ▶ **Start partial stroke test (PST)**
The positioner starts a single partial stroke test. The test is performed according to the settings in Code 49 - d2 to Code 49 - d9 (refer to EB 8389 EN on EXPERT+ valve diagnostics).
- ▶ **Go to fail-safe reference value**
An open/close valve moves to the entered fail-safe reference value when the positioner is in automatic mode  (AUTO).
No action is started when the positioner is in manual mode  (MAN) or fail-safe position (SAFE).
- ▶ **Switch between AUTO/MAN**
The positioner changes from automatic mode  (AUTO) mode into manual mode  (MAN) and vice versa.

No action is started if the positioner is in the fail-safe position (SAFE).

▶ **Start data logger**

The data logger is started when the binary input is active (refer to EB 8389 EN on EXPERT+ valve diagnostics).

▶ **Reset diagnosis**

Any active diagnostic functions in *Statistical information* (in-service monitoring) and *Tests* (out-of-service diagnostics) are canceled and the diagnosis data are reset once.

▶ **External solenoid valve connected**

The triggering of an external solenoid valve is recognized.

▶ **Leakage sensor**

The "External leakage soon to be expected" error is set. The error is reset when the edge control is set to OFF. The alarm remains saved in the logging.

Note: *The optional binary input can only be configured using the TROVIS-VIEW software and over the DD parameters (refer to EB 8389 EN on EXPERT+ valve diagnostics). The default switching state is with an open switch.*

3.3 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.

3.3.1 Configuration using TROVIS-VIEW software

Refer to Table 5 on page 40 for order numbers.

The positioner can be configured using the TROVIS-VIEW software.

The positioner is equipped for this purpose with an additional digital **SERIAL INTERFACE** to allow a computer to be connected over an adapter cable from the RS-232 or USB port of the computer to the positioner.

The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

3.4 Technical data

Type 3730-3 Positioner	
Travel, adjustable	Direct attachment to Type 3277: 3.6 to 30 mm Attachment acc. to IEC 60534-6: 3.6 to 200 mm Rotary actuators: 24° to 100°
Travel range	Adjustable within the initialized travel/angle of rotation; travel can be restricted to $\frac{1}{5}$ at the maximum
Reference variable w	Signal range 4 to 20 mA, 2-wire unit, reverse polarity protection, min. span 4 mA, static destruction limit 100 mA
Minimum current	3.6 mA for display, 3.8 mA for operation
Load impedance	≤ 8.2 V (corresponding to 410 Ω at 20 mA)
Supply air	Supply pressure from 1.4 to 7 bar (20 to 105 psi), Air quality acc. to ISO 8573-1 (2001): Max. particle size and density: Class 4 Oil content: Class 3, pressure dew point: Class 3 or at least 10 K beneath the lowest ambient temperature to be expected
Signal pressure (output)	0 bar up to the capacity of supply pressure, limitable to 1.4/2.4/3.7 ±0.2 bar via software
Characteristic, user-defined adjustable over operating software	Linear/equal percentage/reverse equal percentage/butterfly valve linear/ butterfly valve eq. percentage/rotary plug valve linear/rotary plug valve eq. percentage/segmented ball valve linear/segmented ball valve equal percentage Deviation from terminal-based conformity ≤ 1 %
Hysteresis	≤ 0.3 %
Sensitivity	≤ 0.1 %
Transit time	Separately adjustable up to 240 seconds for supply air and exhaust air
Direction of action	Reversible
Air consumption, steady state	Independent from supply pressure approx. 110 l _n /h
Air output capacity Actuator pressurized Actuator vented	At Δp = 6 bar: 8.5 m _n ³ /h, at Δp = 1.4 bar: 3.0 m _n ³ /h K _{Vmax} (20 °C) = 0.09 at Δp = 6 bar: 14.0 m _n ³ /h, at Δp = 1.4 bar: 4.5 m _n ³ /h K _{Vmax} (20 °C) = 0.15
Permissible ambient temperature	-20 to +80 °C · -45 to +80 °C with metal cable gland Limits in EC Type Examination Certificate also apply for expl.-protected devices.
Influences	Temperature: ≤ 0.15 %/10 K Supply air: None Vibration: ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770
Electromagnetic compatibility	Complying with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21
Electrical connections	One M20 x 1.5 cable gland for 6 to 12 mm clamping range · Additional second M20 x 1.5 threaded hole · Screw terminals for 0.2 to 2.5 mm ² wire cross-section
Degree of protection	IP 66/NEMA 4X

Type 3730-3 Positioner		
Implementation in safety-relevant systems in compliance with IEC 61508/SIL	Probability of failure on demand of safety functions PFD <math>< 2.8 \times 10^{-7}</math> for a confidence level of 95 %. The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99. The valves are therefore suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.	
Explosion protection	Ⓢ II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C or Ⓢ II 3 G EEx nA II T6 / II 3 D IP 65 T 80 °C IECEx ia IIC T6 / IP 54 and IP 65 T 80 °C FM/CSA intrinsically safe Class I, II, III, Division 1, Group A, B, C, D, E, F, G, T6 FM/CSA non incendive Class I, Division 2, Group A, B, C, D, T6	
Communication (local)	SAMSON SSP interface and serial interface adapter	
Software requirements	TROVIS-VIEW with database module 3730-3	
Communication (HART®)	HART® field communication protocol Impedance in the HART frequency range: receive 350 to 450 Ω , send: approx. 155 Ω	
Software requirements (HART®)	For handheld communicator: device description for 3730-3, For PC: DTM file acc. to Specification 1.2, suitable for integrating the positioner in frame applications that supports the FDT/DTM concept (e.g. PACTware); other integration options (e.g. AMS, PDM) available.	
Binary contacts		
2 software limit switches, reverse polarity protection, floating, configurable switching characteristics, default settings as per table		
Signal status:	Without explosion protection:	Exp.-protected version:
No response:	Non-conducting	≤ 1.2 mA
Response:	Conductive (R = 348 Ω)	≥ 2.1 mA
1 fault alarm contact, floating		
Signal status:	Without explosion protection:	Exp.-protected version:
No response/No alarm	Conductive (R = 348 Ω)	≥ 2.1 mA
Response/Fault alarm	Non-conducting	≤ 1.2 mA
For connection to	- Binary input of the PLC acc. to EN 61131, $P_{\max} = 400$ mW - NAMUR switching amplifier acc. to EN 60947-5-6	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	M20x1.5, black polyamide	
Weight	Approx. 1.0 kg	

Options for Type 3730-3 Positioner	
Solenoid valve · Approval acc. to IEC 61508/SIL	
Input	24 V DC reverse polarity protection, static destruction limit 40 V; Current consumption $I = \frac{U - 5.7 \text{ V}}{3840 \ \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)
Signal "0" no pick-up	≤ 15 V
Signal "1" safe pick-up	> 19 V
Service life	> 5 × 10 ⁶ switching cycles
K _V coefficient	0.15
Implementation in safety-relevant systems acc. to IEC 61508/SIL	Same as positioner pneumatics
Analog position transmitter	
Supply voltage	12 to 30 V DC, reverse polarity protection, static destruction limit 40 V
Output signal	4 to 20 mA
Direction of action	Reversible
Operating range	-10 to +114 %
Characteristic	Linear
Hysteresis and HF influence	Same as positioner
Other influences	Same as positioner
Fault indication	Can be issued with current signal 2.4 ±0.1 mA or 21.6 ±0.1 mA
Inductive limit switch	
Type SJ 2SN Proximity Switch	For connection to switching amplifier acc. to EN 60947-5-6. Can be used in combination with a software limit switch.
External position sensor	
Travel	Same as positioner
Cable	10 m with M12x1 connector, designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media
Permissible ambient temperature	-60 to +105 °C · Limits specified in the EC Type Examination Certificate additionally apply for explosion-protected devices.
Vibration immunity	Up to 10 g in the range between 10 and 2000 Hz
Degree of protection	IP 67
Binary input , galvanically isolated, for external switch (floating contact)	
Electrical data	Open-circuit voltage when contact is open: 10 V, pulsed DC current, peak value 100 mA
Contact	Closed: Switching state ON · Open: Switching state OFF

4 Attachment to the control valve – Mounting parts and accessories

WARNING!

Attach the positioner, keeping the following sequence:

1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

The positioner is suitable for the following types of attachment:

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

NOTICE

Attach the positioner to the control valve, observing the following instructions to avoid damaging the positioner.

- Use only the mounting parts/accessories listed in the Tables 1 to 5 (pages 38 to 40) to mount the positioner. Observe the type of attachment!
- Observe the assignment between lever and pin position (see travel tables on page 19)!

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

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

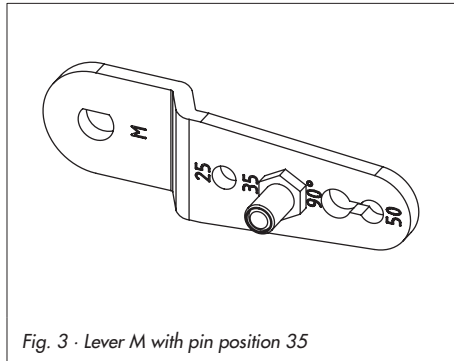


Fig. 3 · Lever M with pin position 35

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

Travel tables

Note: The lever **M** is included in the scope of delivery.
Levers **S**, **L**, **XL** for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 39).

Direct attachment to Type 3277-5 and Type 3277 Actuators

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

Attachment according to IEC 60534-6 (NAMUR)

SAMSON valves/Type 3271 Actuator		Other valves/actuators			Required lever	Assigned pin position
Actuator size [cm ²]	Rated travel [mm]	min.	Travel	max.		
60 and 120 with Type 3510 Valve	7.5	3.6	to	18.0	S	17
120	7.5	5.0	to	25.0	M	25
120/240/350	15	7.0	to	35.0	M	35
700	7.5					
700	15 and 30	10.0	to	50.0	M	50
1400/2800	30	14.0	to	70.0	L	70
1400/2800	60	20.0	to	100.0	L	100
1400/2800	120	40.0	to	200.0	XL	200

Attachment to rotary actuators according to VDI/VDE 3845

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

4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 38 for the required mounting parts as well as the accessories.
Note the travel table on page 19!

Actuator with 120 cm²

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

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

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

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

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

6. Insert formed seal (15) in the groove of the positioner casing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 19).

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

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

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

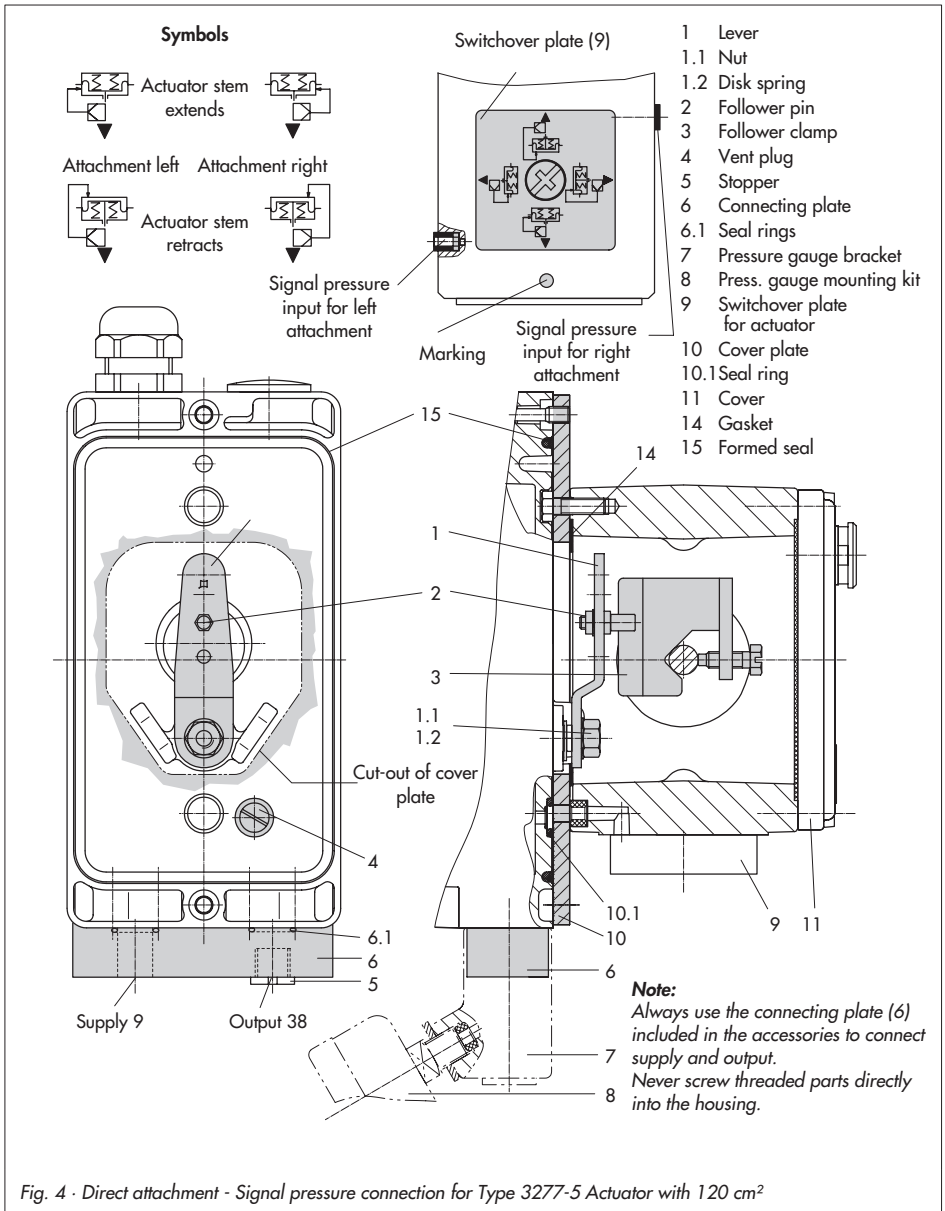


Fig. 4 - Direct attachment - Signal pressure connection for Type 3277-5 Actuator with 120 cm²

4.1.2 Type 3277 Actuator

Refer to Table 2 on page 39 or the required mounting parts as well as the accessories.
Note the travel table on page 19!

Actuators with 240 to 700 cm²

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

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 700 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
For actuators 240 and 350 cm² with 1.5 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 19). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

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

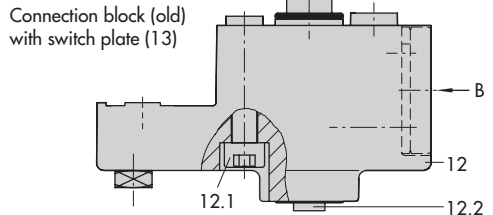
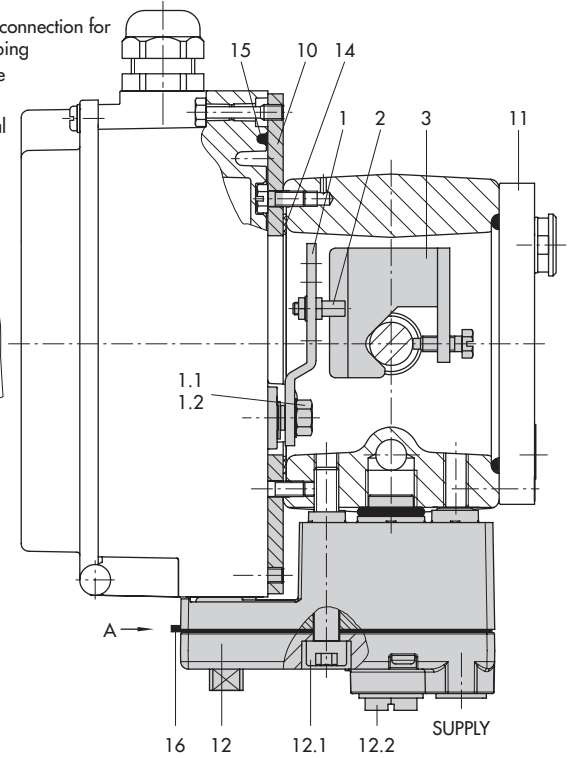
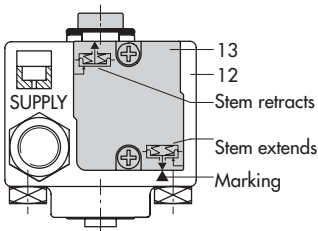
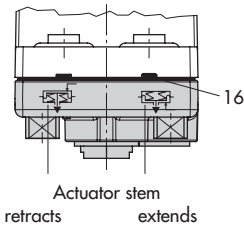
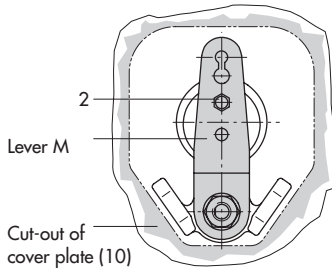


Fig. 5 - Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm²

4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 3 on page 39 for the required mounting parts as well as the accessories.
Note the travel table on page 19!

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

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

Actuator size 2800 cm² and 1400 cm² (120 mm travel):

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

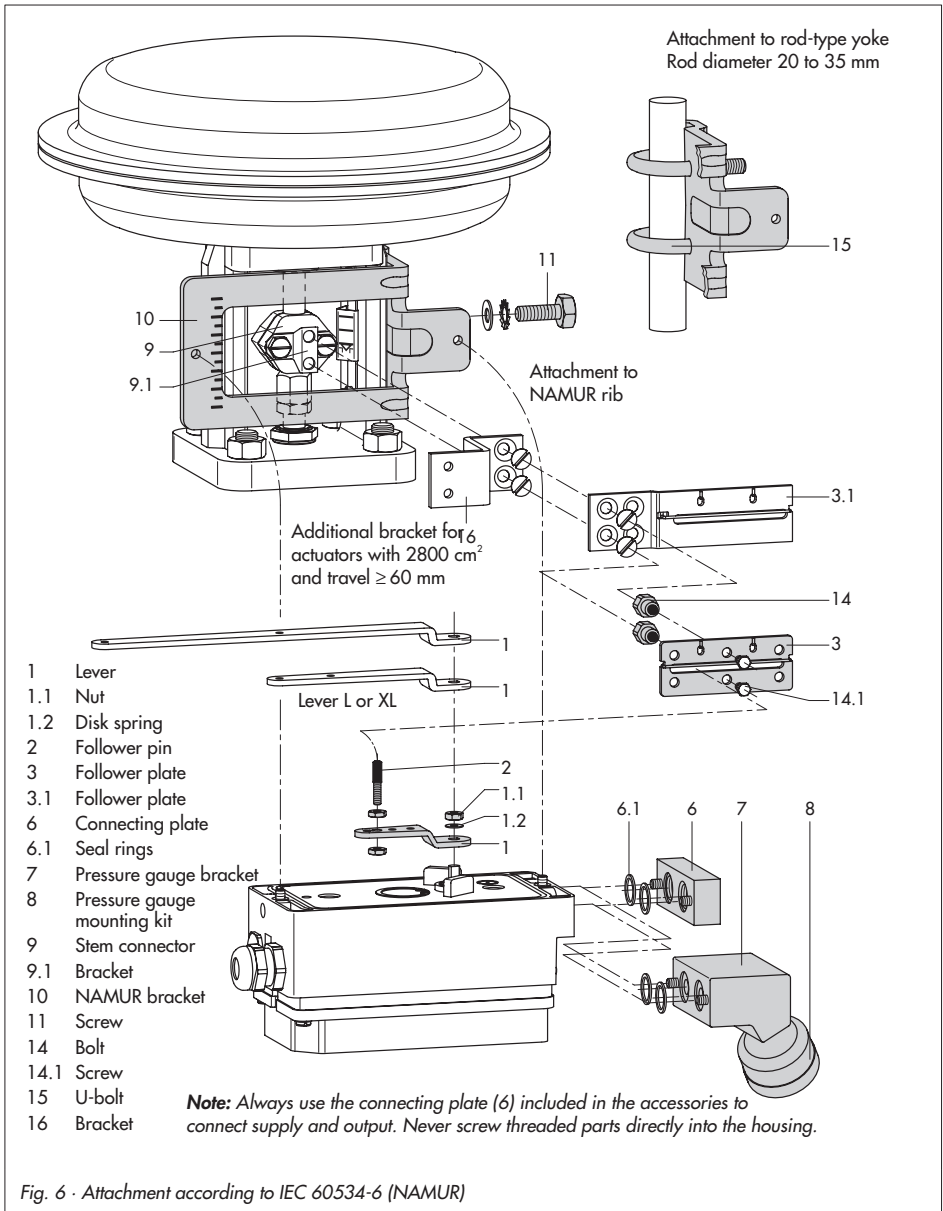
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 19.

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

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

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

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



- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 3 Follower plate
- 3.1 Follower plate
- 6 Connecting plate
- 6.1 Seal rings
- 7 Pressure gauge bracket
- 8 Pressure gauge mounting kit
- 9 Stem connector
- 9.1 Bracket
- 10 NAMUR bracket
- 11 Screw
- 14 Bolt
- 14.1 Screw
- 15 U-bolt
- 16 Bracket

4.3 Attachment to Type 3510 Micro-flow Valve

*Refer to Table 3 on page 39 for the required mounting parts as well as the accessories.
Note the travel table on page 19!*

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

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

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

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

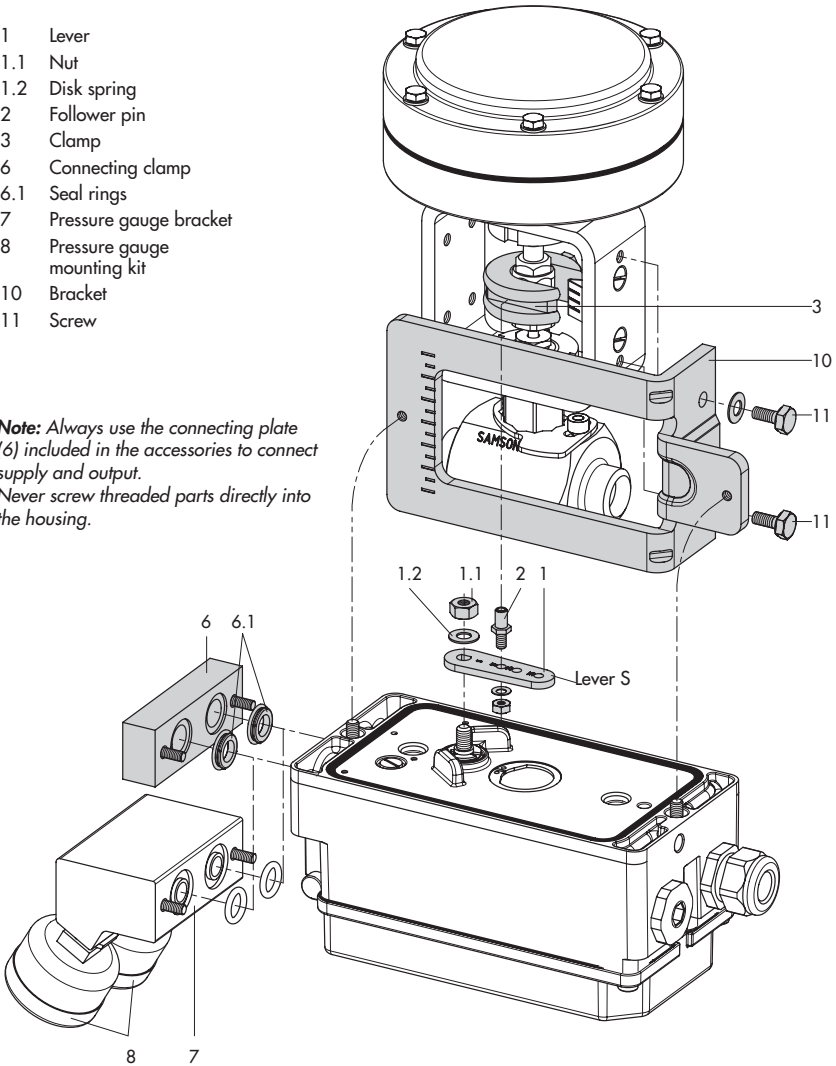


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

4.4 Attachment to rotary actuators

Refer to Table 4 on page 40 for the required mounting parts as well as the accessories.
Note the travel table on page 19!

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

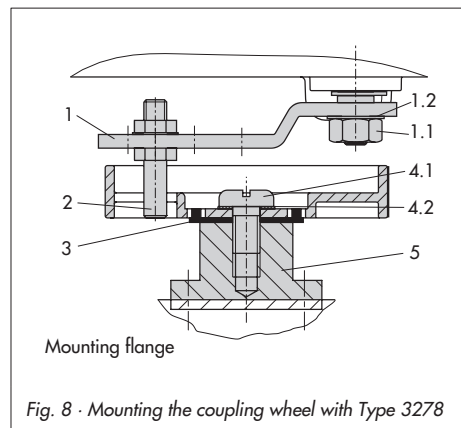
Prior to attaching the positioner to the SAMSON Type 3278 Rotary Actuator, mount the associated adapter (5) to the free end of the rotary actuator shaft.

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

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

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

6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin ($\varnothing 5$) included in the mounting kit and screw tight into the bore for pin position **90°**.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (see Fig. 9). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.



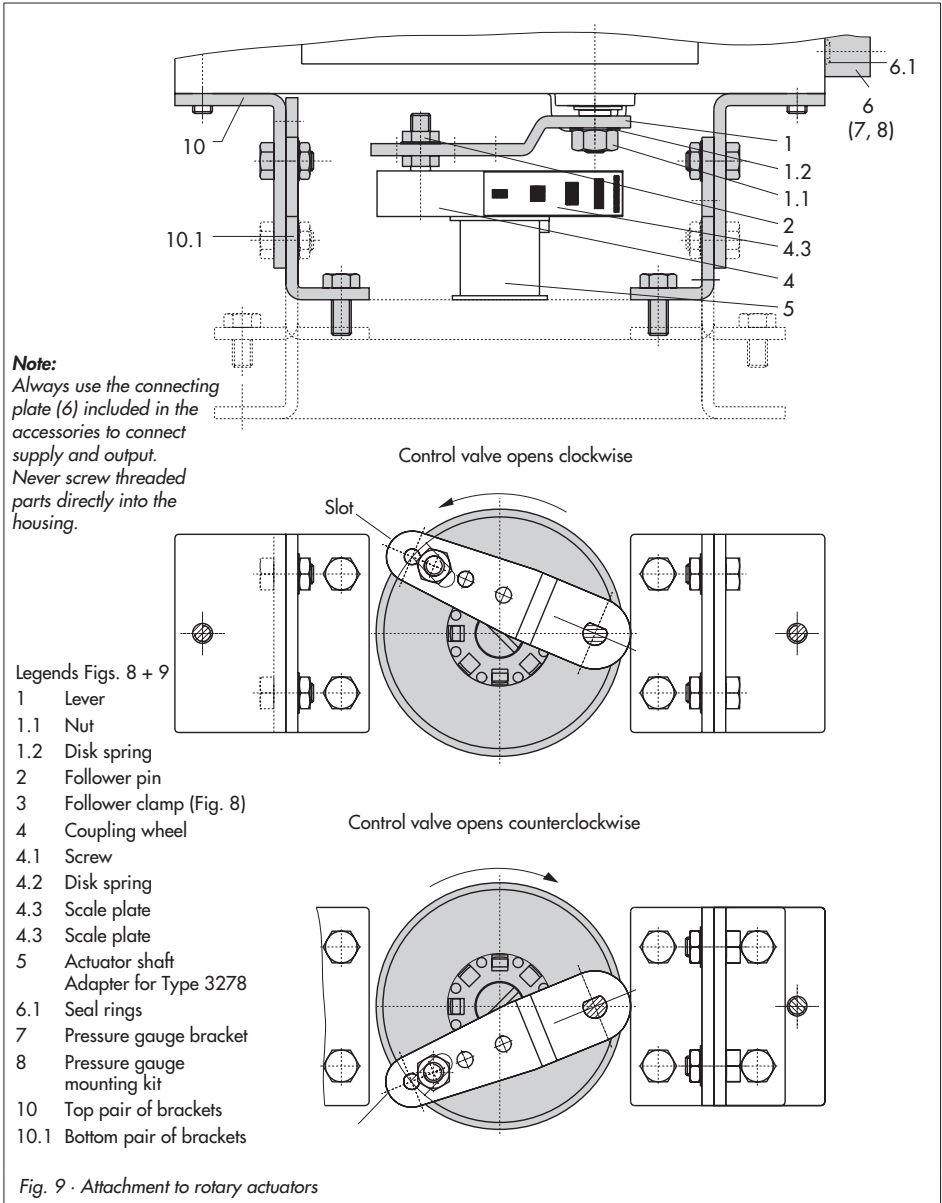


Fig. 9 · Attachment to rotary actuators

4.5 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier. The reversing amplifier is listed as an accessory in the Table 5 on page 40.

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

The rule **A₁ + A₂ = Z** applies.

Mounting

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

NOTICE

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

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

Signal pressure connections

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

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

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

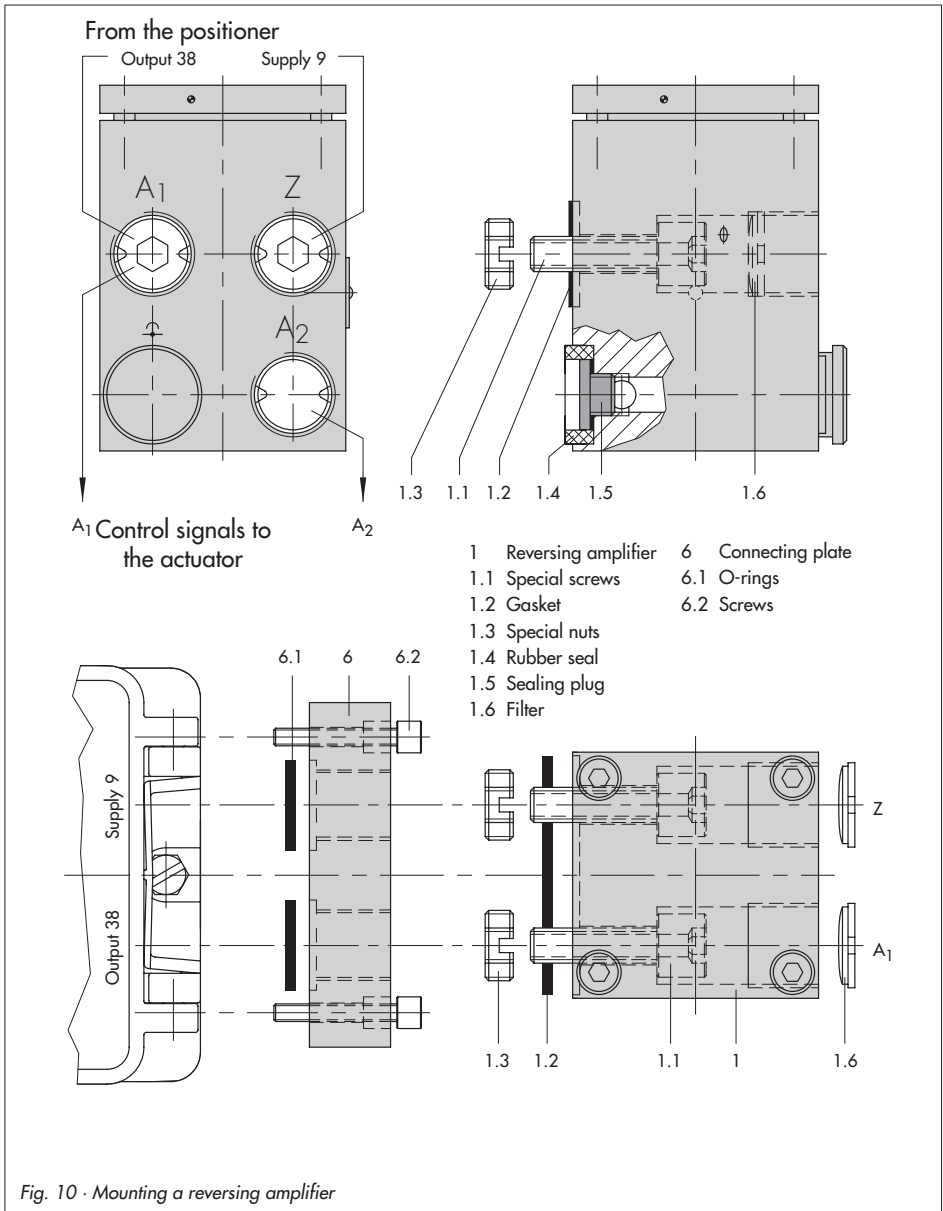
6. After the initialization is completed, set Code 16 (Pressure limit) to **No**.

4.5.1 Pressure gauge attachment

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

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

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



4.6 Attaching an external position sensor

Refer to Table 6 on p. 41 for the mounting parts as well as the accessories required.

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

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

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

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

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

Operation and setting are described in sections 7 and 8.

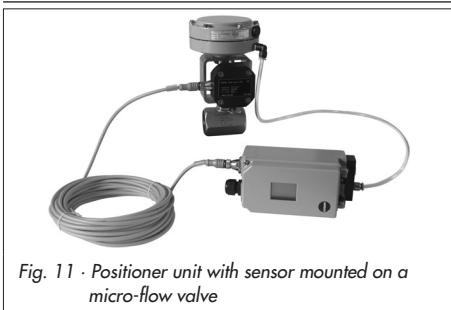


Fig. 11 · Positioner unit with sensor mounted on a micro-flow valve

4.6.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm²

The signal pressure from the positioner is routed over the signal pressure connection of the connecting plate (9, Fig. 12 left) to the actuator diaphragm chamber. To proceed, first screw the connecting plate (9) included in the accessories onto the actuator yoke.

- ▶ Turn the connecting plate (9) so that the correct symbol for the fail-safe position "Actuator stem extends" or "Actuator stem retracts" is aligned with the marking (Fig. 12, below).
- ▶ Make sure that the gasket for the connecting plate (9) is correctly inserted.
- ▶ The connecting plate has boreholes with NPT and G threads.
Seal the threaded connection that is not used with the rubber seal and square plug.

Type 3277 Actuator with 240 to 700 cm²:

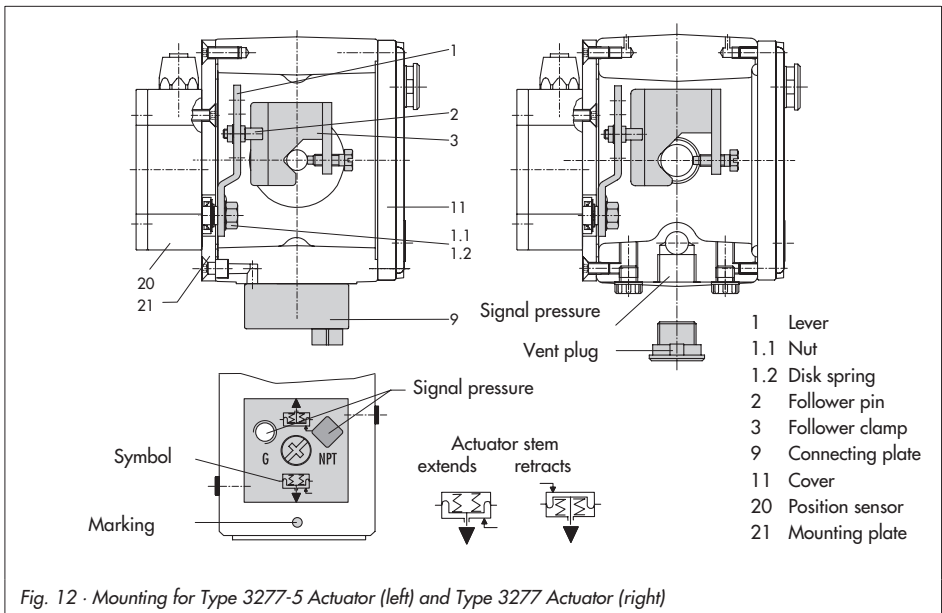
The signal pressure is routed to the connection at the side of the actuator yoke for the version "Actuator stem extends".

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

Mounting the position sensor

1. Place the lever (1) on the sensor in mid-position and hold it in place.
Unthread the nut (1.1) and remove the

1. Place the lever (1) together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower pin (2) from the travel table on page 19. The positioner is delivered with lever **M** in pin position **35** on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the borehole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) **in mid-position** and **hold it in place**. Screw on the nut (1.1).
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top of the follower clamp (3). It must rest on it with spring force. Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.
7. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.



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

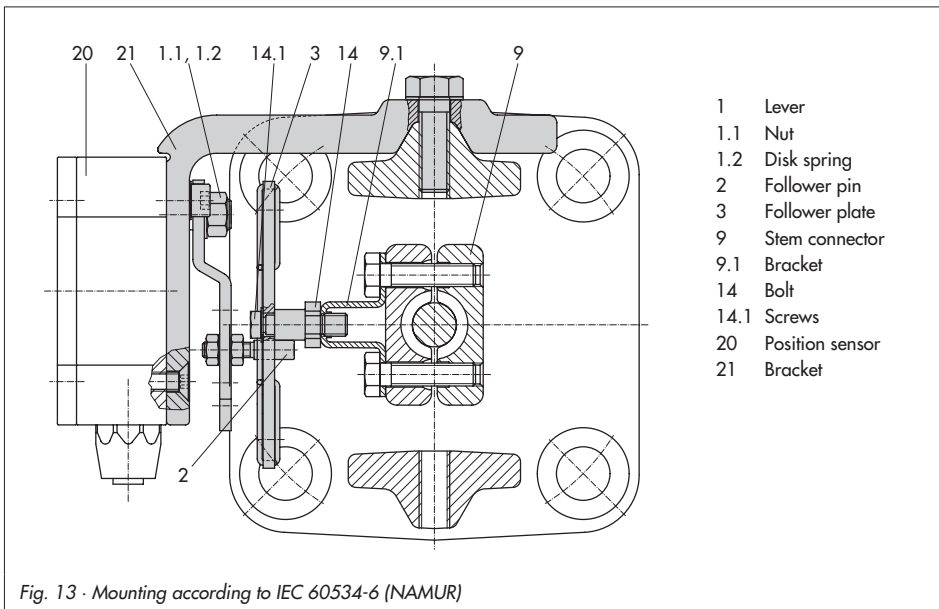
For the required mounting parts and the accessories, refer to Table 6 on page 41.

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

The standard attached lever **M** with the follower pin (2) at position **35** is designed for 120, 240 and 350 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 19. Lever **L** and **XL** are included in the mounting kit.

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

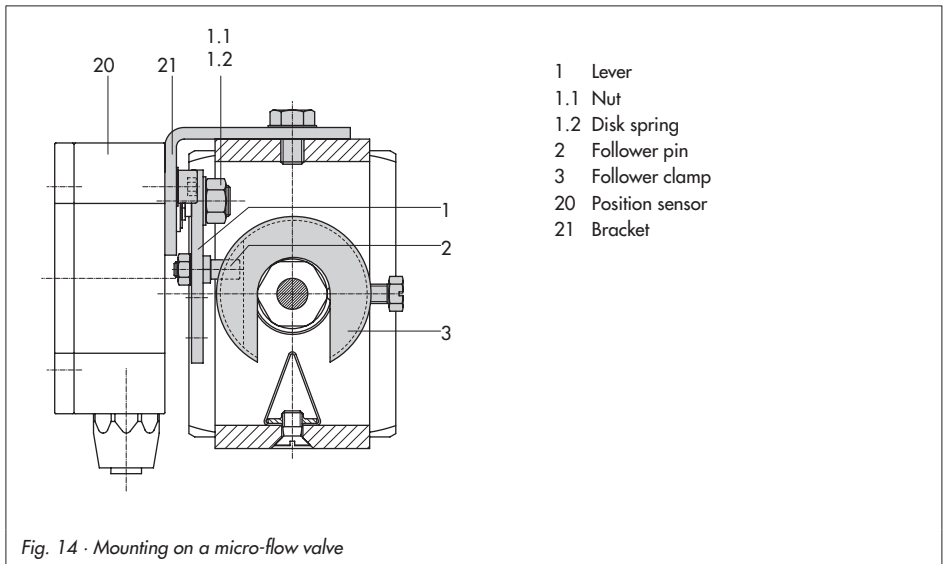


4.6.3 Mounting the position sensor to Type 3510 Micro-flow Valve

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

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

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



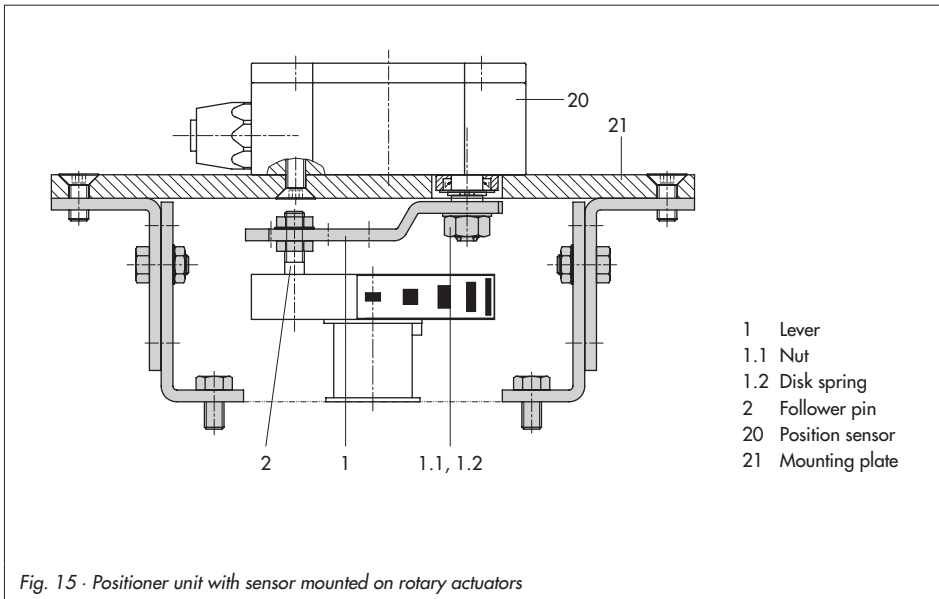
4.6.4 Mounting the position sensor to rotary actuators

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

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

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

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



4.7 Attaching positioners with stainless steel housings

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

Note: *The pneumatic connecting plate and a pressure gauge bracket made of stainless steel are available (order numbers listed below). The pneumatic reversing amplifiers in stainless steel is **not** available.*

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

The Tables 1 to 5 (pages 38 and 40) apply for attaching positioners with stainless steel housings with the following restrictions:

Direct attachment

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

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

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

Attachment to rotary actuators

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

4.8 Air purging function for single-acting actuators

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

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

The air purging function is automatically provided.

Direct attachment to Type 3277, 240 to 700 cm²

FA: Remove the stopper 12.2 (Fig. 5 on page 23) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

FE: The air purging function is automatically provided.

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

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

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

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

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve, e.g. check valve G 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.

4.9 Required mounting parts and accessories

Table 1 · Direct attachment to Type 3277-5 Actuator (Fig. 4)		Order no.	
Mounting parts	Mounting parts for actuators 120 cm ² or smaller	1400-7452	
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx. 00 (old)	1400-6819	
	Switchover plate new for Actuator Type 3277-5xxxxxx. 01 (new) ¹⁾	1400-6822	
	Connecting plate for additional attachment of a solenoid valve: G ½	1400-6820	
	Connecting plate (old) for Actuator Type 3277-5xxxxxx. 00 (old): ½ NPT	1400-6821	
	Connecting plate new for Actuator Type 3277-5xxxxxx. 01 (new) ¹⁾	1400-6823	
Accessories for the positioner	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/St. st.	1400-6951

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

Table 2 · Direct attachment to Type 3277 (Fig. 5)				Order no.
Mounting parts	For actuators with 240, 350 and 700 cm ²			1400-7453
Accessories	Required piping with screw fitting – for "Actuator stem retracts" – with air purging of the top diaphragm chamber	240 cm ²	Steel	1400-6444
			Stainless steel	1400-6445
		350 cm ²	Steel	1400-6446
			Stainless steel	1400-6447
		700 cm ²	Steel	1400-6448
			Stainless steel	1400-6449
	Connection block with seals and screw	G ¼	1400-8811	
		¼ NPT	1400-8812	
	Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)	St. st./Brass	1400-6950	
St. st./St. st.		1400-6951		

Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 7)				Order no.
Travel in mm	Lever	For actuators		
7.5	S	Type 3271-5 Actuator with 60/120 cm ² on Type 3510 Valve (Fig. 7)		1400-7457
5 to 50	M ¹⁾	Actuators from other manufacturers and Type 3271 with 120 to 700 cm ²		1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271, 1400-60 version		1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm ² with 120 mm travel		1400-7456
30 or 60	L	Type 3271, versions 1400-120 and 2800 cm ² (30 or 60 mm travel)		1400-7466
		Mounting bracket for Emerson and Masonellan linear actuators; a mounting kit acc. to IEC 60534-6 is necessary depending on the travel (see above)		1400-6771
		Valtek Type 25/50		1400-9554
Accessories	Connecting plate (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. st./Brass	1400-6950
			St. steel/St. st.	1400-6951

¹⁾ Lever M is mounted on the standard positioner (included in the scope of delivery)

Table 4 - Attachment to rotary actuators (Figs. 8 and 9)			Order no.
Mounting parts	Attachment acc. to VDI/VDE 3845, fixing level 2		1400-7448
	Attachment for SAMSON Type 3278 with 160/320 cm ²		1400-7614
	Attachment for Camflex II		1400-9120
	Attachment acc. to VDI/VDE 3845, fixing level 2, heavy-duty version		1400-9244
	Attachment acc. to VDI/VDE 3845, fixing level 1, heavy-duty version		1400-9526
	Attachment for SAMSON Type 3278 with 160 cm ² (also for VETEC Type S160 and Type R), heavy-duty version		1400-9245
	Attachment for AIR TORQUE 10 000, heavy-duty version		1400-9542
Accessories	Connecting plate (6)	G ¼	1400-7461
		¼ NPT	1400-7462
	Pressure gauge bracket (7)	G ¼	1400-7458
		¼ NPT	1400-7459
	Pressure gauge mounting kit up to max. 6 bar (output/supply)	St. steel/brass	1400-6950
		St. steel/st. steel	1400-6951

Table 5 - General accessories			Order no.
Accessories	Pneumatic reversing amplifier for double-acting actuators	G ¼	1079-1118
		¼ NPT	1079-1119
	Cable gland M20 x 1.5, nickel-plated brass		1890-4875
	Adapter M 20 x 1.5 to ½ NPT, aluminum		0310-2149
	Retrofit kit for inductive limit switch 1x SJ 2-SN		1400-7460
	Cover plate with list of parameters and operating instructions	German/English (standard)	1990-0761
		English/Spanish	1990-3100
		English/French	1990-3142
	TROVIS-VIEW with device module 3730-3 (order no. 6661-1056)		1043732
	Serial interface adapter (SAMSON SSP interface - RS-232 port on computer)		1400-7700
	Isolated USB interface adapter (SAMSON SSP interface - USB port on computer)		1400-9740

Table 6 - Attachment of external position sensor			Order no.
Direct attachment	Mounting parts for actuators with 120 cm ² see Fig. 12 left		1400-7472
	Connecting plate (9, old) for Actuator Type 3277-5xxxxxx.00	G 1/8	1400-6820
		1/8 NPT	1400-6821
	Connecting plate (new) for Actuator Type 3277-5xxxxxx.01 (new) ¹⁾		1400-6823
	Mounting parts for actuators with 240, 350 and 700 cm ² , see Fig. 12 right		1400-7471
NAMUR attachmt.	Mounting parts for attachment to NAMUR rib w. lever L and XL, see Fig. 13		1400-7468
Micro-flow valve	Mounting parts for Type 3510 Micro-flow Valve, see Fig. 14		1400-7469
Attachment to rotary actuators	VDI/VDE 3845, fixing level 2 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 15		1400-7473
	VDI/VDE 3845, fixing level 2, heavy-duty version		1400-9384
	SAMSON Type 3278 with 160 cm ² (also for VETEC Type S160 and Type R), heavy-duty version		1400-9385
Accessories for positioner	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)	St. steel/brass	1400-6950
		St. steel/st. 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 switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.

5 Connections

WARNING!

Mount the positioner, keeping the following sequence:

1. Mount the positioner on the control valve
2. **Connect the supply air**
3. **Connect the electrical power**
4. Perform the start-up settings

The connection of the electrical auxiliary power may cause the actuator stem to move, depending on the operating mode.

Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

5.1 Pneumatic connections

NOTICE

Follow the instructions below to avoid damaging the positioner.

- The threaded connections in the positioner housing are not designed direct air connection!
- The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories.
The air connections are optionally designed as a bore with ¼ NPT or G ¼ thread.
The customary fittings for metal and copper pipes or plastic hoses can be used.
- The supply air must be dry and free from oil and dust.
The maintenance instructions for upstream pressure reducing stations must be observed.

Blow through all air pipes and hoses thoroughly prior to connecting them.

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

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

5.1.1 Signal pressure gauges

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

5.1.2 Supply pressure

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

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

Actuator stem extends FA (Air to open)

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

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

Actuator stem retracts FE (Air to close)

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

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

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

d = Seat diameter [cm]

Δp = Differential pressure across the valve
[bar]

A = Actuator diaphragm area [cm²]

If there are no specifications, calculate as follows:

Required supply pressure =

Upper bench range value + 1 bar.

5.1.3 Signal pressure (output)

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

The limitation is not activated [No] by default.

5.2 Electrical connections



DANGER!

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

- For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance association.
- The following standards apply for assembly and installation in hazardous areas: **EN 60079-14: 2003 (VDE 0165 Part 1/8.98)** "Electrical apparatus for explosive gas atmospheres" and **EN 50281-1-2: 1999 (VDE 0165 Part 2/11.99)** "Electrical apparatus for use in the presence of combustible dust".
- For the interconnection of intrinsically safe electrical equipment, the permissible maximum values specified in the EC type examination certificate apply (U_i or U_o , I_i or I_o , P_i or P_o , C_i or C_o , and L_i or L_o).
- The following applies for equipment with type of protection EEx nA (non-sparking apparatus) according to the standard **EN 50021 (1999)**: Connecting, interrupting, or switching circuits while energized is only allowed during installation, maintenance or repair work.
- The following applies for equipment connected to energy-limited circuits with type of protection EEx nL (energy-limited apparatus) according to the standard **EN 50021 (1999)**: This type of equip-

ment may be switched under normal operating conditions.

- For the interconnection of equipment to energy-limited circuits with type of protection EEx nL IIC, the permissible maximum values specified in the statement of conformity or the addenda to the statement of conformity apply.

NOTICE

- The terminal assignment specified in the certificate must be adhered to. Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective!
Do not tamper with enameled screws inside or on the housing.
- **Note on the selection of cables and wires:** To install intrinsically safe circuits, observe **Paragraph 12** of the standard **EN 60079-14: 2003 (VDE 0165 Part 1)**. To run multi-core cables or lines with more than one intrinsically safe circuit, **Paragraph 12.2.2.7** of this standard applies.
An additional cable gland can be installed when connecting the device over two separate cables. Cable entries left unused must be sealed with blanking plugs. Devices used at ambient temperatures down to $-20\text{ }^{\circ}\text{C}$ must have metal cable entries.

Cable entries

The cable entry with M20 x 1.5 cable gland, 6 to 12 mm clamping range. There is a second M20 x 1.5 threaded bore in the housing that can be used for additional connection, when required. The screw terminals are designed for wire cross-sections of 0.2 to 2.5 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!**

If the reference variable exceeds 22 mA, **OVERLOAD** appears on the LC display to warn the user.

NOTICE

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

In general, it is not necessary to connect the positioner to a bonding conductor. Should this be required, however, this conductor can be connected inside the device. Depending on the version, the positioner is equipped with inductive limit switches and/or a solenoid valve.

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

Refer to Fig. 16 or the label on the terminal strip for terminal assignment.

NOTICE

The minimum permissible reference variable should not fall below 3.8 mA for operating the positioner.

Accessories

- Plastic cable gland M20 x 1.5:
 - Black Order no. 8808-1011
 - Blue Order no. 8808-1012
- Nickel-plated brass
Order no. 1890-4875

- Adapter M20 x 1.5 to 1/2 NPT
Aluminum, powder-coated
Order no. 0310-2149

5.2.1 Switching amplifiers

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

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

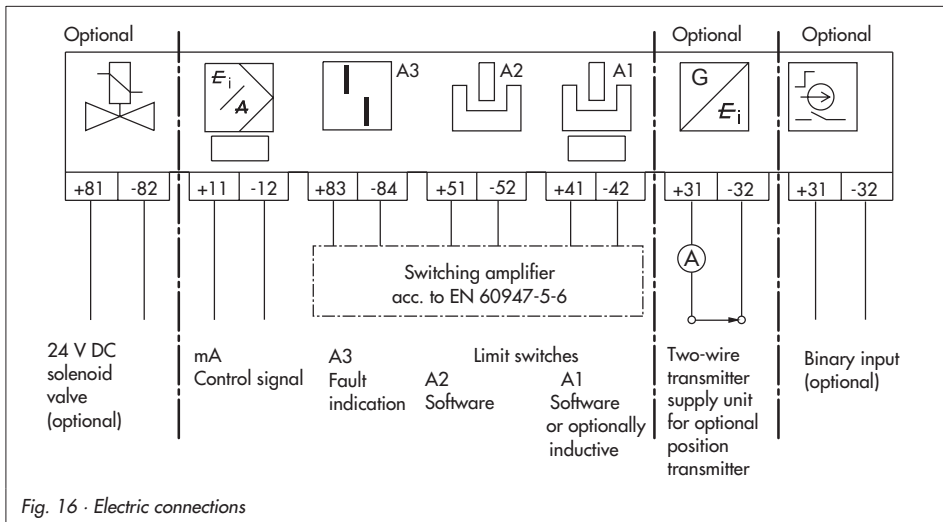


Fig. 16 · Electric connections

5.2.2 Establishing communication

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

Type Viator FSK modem

RS 232	not ex.	Order no. 8812-0130
PCMCIA	not ex.	Order no. 8812-0131
USB	not ex.	Order no. 8812-0132

If the supply voltage of the controller or control station becomes too low because it has been reduced by the load in the circuit, an isolation amplifier is to be connected between controller and positioner (interfacing

as for positioner connected in hazardous areas, see Fig. 17).

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

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

Point-to-point:

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

Standard bus (Multidrop):

In the standard bus (Multidrop) mode, the positioner follows the analog current signal

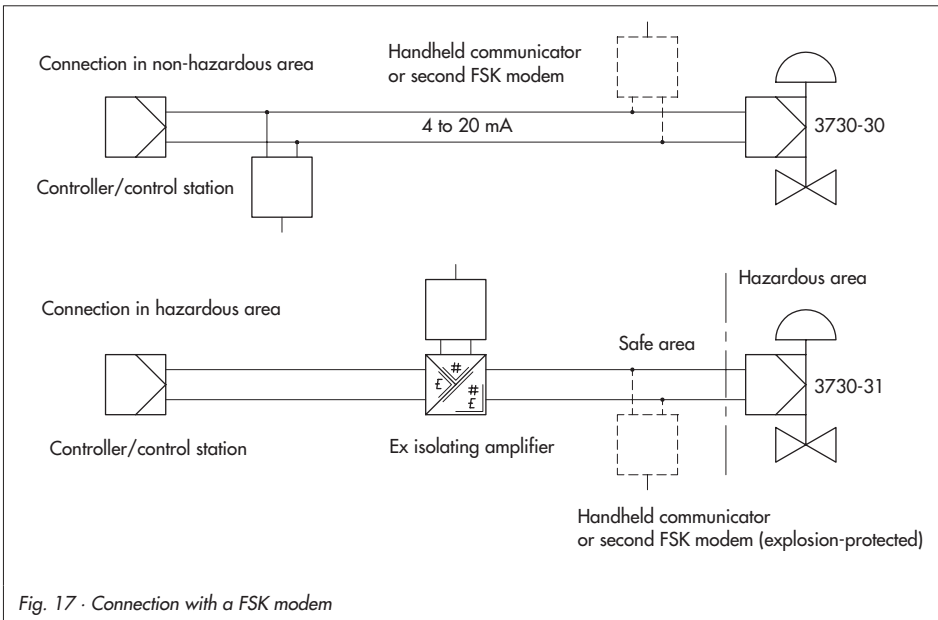


Fig. 17 · Connection with a FSK modem

(reference variable) as for point-to-point communication. This operating mode is, for example, suitable for split-range operation of positioners (series connection). The bus 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 330 mV is released (16.5 Ω at 20 mA).

Alternatively, a 250- Ω resistor can be connected in series and a 22- μ F capacitor can be connected in parallel to the analog output. Note that in this case, the controller output load will increase.

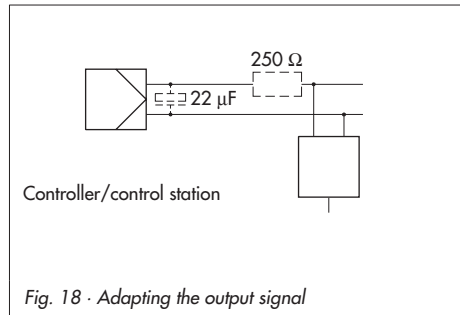


Fig. 18 · Adapting the output signal

6 Operator controls and readings

Rotary pushbutton

The rotary pushbutton is located underneath the front protective cover.

The positioner is operated on site using the rotary pushbutton:

Turn  to select codes and values.

Press  to confirm setting.

Slide switch AIR TO OPEN or AIR TO CLOSE

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

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

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

Volume restriction Q



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

- ▶ For actuators smaller than 240 cm² with a loading pressure connection at the side (Type 3271-5) → MIN SIDE.
- ▶ For a connection at the back (Type 3277-5), → MIN BACK.
- ▶ For actuators 240 cm² and larger, → MAX SIDE for a side connection and to MAX BACK for a connection at the back.



Readings on display


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

Operating modes:

-  Manual mode (MAN), section 8.2.1
-  Automatic mode (AUTO), section 8.2.1
- S** Fail-safe position (SAFE), section 8.2.2

▶ Bar elements:


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

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

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

▶ Status alarms

 : Maintenance alarm

 : Maintenance required/Maintenance demanded

These icons indicate that an error has occurred.

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

▶ Configuration enabled

This indicates that the codes marked with an asterisk (*) in the code list (section 12) are enabled for configuration (see section 8.1).

Displays and their meaning

AUTO	Automatic mode	No	Not available/ Not active	iESinG	Test function active
CL	Clockwise				
CCL	Counterclockwise	NOM	Nominal travel	↗↗	Increasing/increasing
Err	Error	OVERLOAD	w > 22 mA	↘↘	Increasing/decreasing
ESC	Escape	RES	Reset		
HI	ix ≥ 21.6 mA	RUN	Start	⦿ blinking	Emergency mode (see error code 62)
LO	ix ≤ 2.4 mA	SAFE	Fail-safe position	⚡ blinking	Not initialized
LOW	w too small	Sub	Substitute calibration		
MAN	Manual range	TunE	Initialization in progress	S blinking	Valve in mechanical fail-safe position
MAX	Maximum range	YES	Available/Active		
		ZP	Zero calibration		

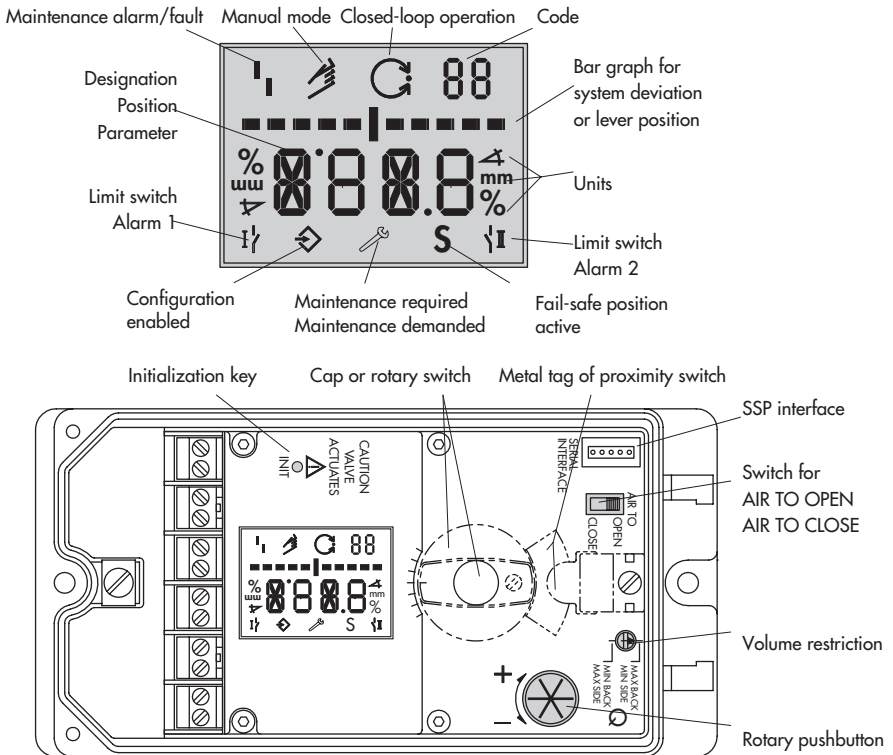


Fig. 19 · Display and operator controls

6.1 Serial interface

The positioner must be supplied with at least 4 mA.

The positioner can be connected directly to the PC via the local serial interface and the serial interface adapter.

Use the TROVIS-VIEW software with 3730-3 device module installed. Refer to section 13 for more details.

6.2 HART[®] communication

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

A DTM file (Device Type Manager) conforming to the Specification 1.2 is available for communication. This allows the device, for example, to be run with the PACTware operator interface. All the positioner's parameters are then accessible over 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 12 for the parameters necessary for the operator interface.

NOTICE

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

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

munication. On-site operation is enabled by default.

Note:

In the case, complex functions are started in the positioner, which require a long calculation time or lead to a large quantity of data being stored in the volatile memory of the positioner, the alert "busy" is issued by the DTM file.

*This alert is **not a fault alarm** and can simply be confirmed.*



7 Start-up – Settings

WARNING!

Attach the positioner, keeping the following sequence:

1. Mount the positioner on the control valve
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

Reading on display after connecting the electrical auxiliary power:

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



Reading when the positioner has not yet been initialized

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

WARNING!

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

NOTICE

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

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

7.1 Determining the fail-safe position

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

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

NOTICE

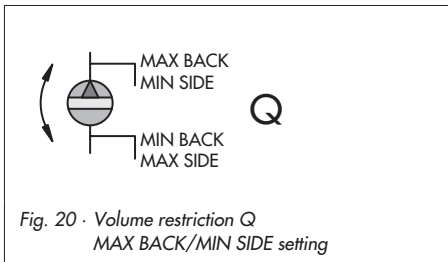
The **AIR TO OPEN (Ato)** setting always applies to double-acting actuators.

For checking purposes:

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

Note: The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.

7.2 Setting the volume restriction Q



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

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

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

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

- ▶ The “SIDE” restriction position always applies for actuators from other manufacturers.

Overview · Position of volume restriction Q*

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

* Intermediate positions are not permitted.

NOTICE

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

7.3 Adapting the display

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



Reading direction for right attachment of pneumatic connections





Reading direction for left attachment of pneumatic connections

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

Turn → Code 2

Press → Code 2 blinks.

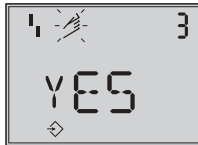
Turn  → Required direction
 Press  to confirm reading direction.

7.4 Limiting the signal pressure






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

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

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






Configuration enabled
 Default: **No**


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

Limiting the signal pressure:




Pressure limit
 Default: **No**

Turn  → Code **16**
 Press  → Code **16** blinks.
 Turn  until the required pressure limit (1.4/2.4/3.7 bar) appears.

Press  to confirm the pressure limit setting.






7.5 Checking the operating range of the positioner

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

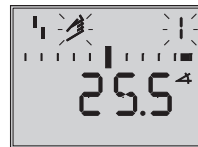
Selecting manual operating mode:






Operating mode
 Default **MAN**


Turn  → Code **0**
 Press  → Code **0** blinks.
 Turn  → **MAN**
 Press . The positioner changes to the  manual operating mode.

Checking the operating range:



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

Turn  → Code **1**
 Press  → Code **1** and  blink.

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

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

To ensure the positioner is working properly, the outer bar elements may not blink while the valve is moving through the operating range.

Exit Code 1 by pressing the rotary pushbutton (⊗).

The permissible range has been exceeded when the displayed angle is greater than 30°, and the outer right or left bar element blinks.

The positioner changes to the fail-safe position (**SAFE**).

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

WARNING!

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

7.6 Initialization

WARNING!

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

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

NOTICE

After the positioner has been mounted on to another actuator or its mounting location has been changed and prior to re-initializing the positioner, the positioner needs to be reset to its basic setting (default values). Refer to section 7.9.

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

- ▶ **MAX maximum range** (standard range)
Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.6.1)

- ▶ **NOM nominal range**
Initialization mode for all globe valves (see section 7.6.2)
- ▶ **MAN manually selected range**
Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)
- ▶ **SUB substitute calibration** (emergency mode)
This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.4)

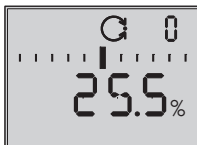
Note: For normal operation, simply start initialization by pressing the INIT key after mounting the positioner on the valve and setting the fail-safe position and volume restriction. The positioner only needs to work with its default settings. If necessary, perform a reset (see section 7.9).



Alternating displays
Initialization running
Icon depending on initialization mode selected




Bar graph display
indicating the progress of
the initialization



Initialization successful,
positioner in automatic
operating mode

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

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

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

Note: Positioner with extended EXPERT⁺ diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed. **tEst d1** or **tEst d2** appear on the display in an alternating sequence. An error during the plotting of the reference graphs is indicated by Code **48 - h1** and Code **81**.

The positioner still works properly, even though the reference graph plotting has not been completed successfully.

Fail-safe position AIR TO CLOSE

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

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

Fail-safe position	Direction of action	Valve Closed at Open at	
		Closed	Open
Actuator stem extends FA AIR TO OPEN	↗↗	0 %	100 %
Actuator stem retracts FE AIR TO CLOSE	↘↘	100 %	0 %

The tight-closing function is activated.

NOTICE

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

Canceling an initialization process

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

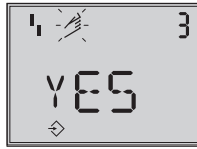
Exit the fail-safe position again over Code 0 (see section 8.2.2).

7.6.1 MAX – Initialization based on maximum range

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

Enable configuration:

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



Default **No**

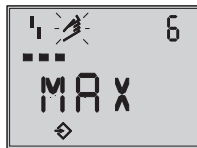
Turn ⊗ → Code 3, display: **No**

Press ⊗ → Code 3 blinks

Turn ⊗ → **YES**

Press ⊗, display ◊

Select the initialization mode:



Initialization mode
Default **MAX**

Turn ⊗ → Code 6

Press ⊗

Turn ⊗ → **MAX**

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

Start initialization:

- ▶ Press INIT key to start initialization!

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

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

Enter the pin position:

Pin position
Default **No**

Turn → Code **4**

Press , Code **4** blinks

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

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

7.6.2 NOM – Initialization based on nominal range

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

If this is the case, the indicated nominal range is adopted with the limits of travel/angle range start (Code **8**) and travel/angle range end (Code **9**) as the operating range.

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

Enable configuration:

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



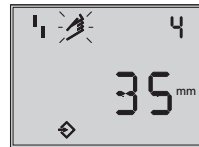
Default **No**

Turn → Code **3**, display: **No**

Press , Code **3** blinks

Turn → **YES**

Press , display

Enter the pin position and nominal range:

Pin position
Default **No**



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

Turn → Code **4**

Press , Code **4** blinks

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

Press .

Turn → Code **5**

Press , Code **5** blinks


Turn  → Nominal travel/angle

Press .


Select the initialization mode:




Initialization mode
Default **MAX**

Turn  → Code **6**

Press , Code **6** blinks

Turn  → **NOM**

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

Start initialization:

▶ Press INIT key to start initialization!

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

7.6.3 MAN – Initialization based on a manually selected range

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

Enable configuration:

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



Default **No**

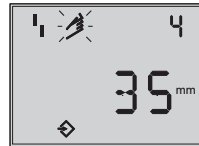
Turn  → Code **3**, display: **No**

Press , Code **3** blinks


Turn  → **YES**

Press , display 

Enter the pin position:




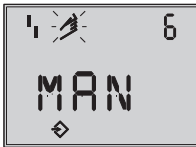
Pin position
Default **No**

Turn  → Code **4**

Press , Code **4** blinks

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

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

Select the initialization mode:

Initialization mode
Default **MAX**

Turn → Code **6**

Press , Code **6** blinks

Turn → **MAN**

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

Enter OPEN position:

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

Turn → Code **0**

Press , Code **0** blinks

Turn → **MAN**

Press .

Turn → Code **1**

Press , Code **1** blinks

Turn until the valve reaches its OPEN position.

Press to confirm the OPEN position.

Start initialization:

▶ Press INIT key to start initialization!

7.6.4 SUB substitute calibration

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

The **SUB** initialization mode is used to replace a positioner while the process is running. For this purpose, the control valve is usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate with this valve position.

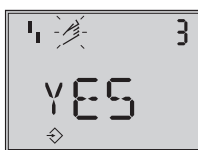
By entering the blocking position (Code **35**), closing direction (Code **34**), pin position (Code **4**), nominal range (Code **5**) and direction of action (Code **7**), the positioner can calculate the positioner configuration.

NOTICE

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

Enable configuration:

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



Default **No**

Turn → Code **3**, display: **No**

Press , Code **3** blinks

Turn → **YES**

Press , display

Enter the pin position and nominal range:



Default **No**

Turn → Code **4**

Press , Code **4** blinks

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

Press .

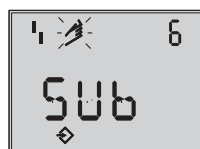
Turn → Code **5**

Press , Code **5** blinks

Turn → Nominal travel/angle

Press .

Select the initialization mode:



Initialization mode
Default **MAX**

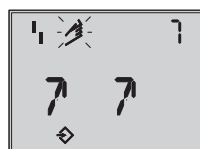
Turn → Code **6**

Press , Code **6** blinks

Turn → **SUB**

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

Enter the direction of action:



Default

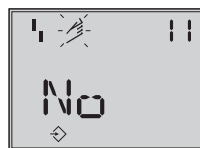
Turn → Code **7**

Press , Code **7** blinks

Turn → Direction of action (or)

Press .

Deactivate travel limit:



Default **100.0**

Turn → Code **11**

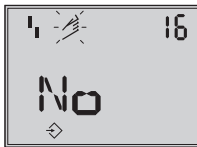
Press , Code **11** blinks

Turn → **No**

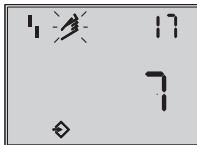
Press .

Change pressure limit and control parameters:

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



Pressure limit
Default **No**



K_P
Default 7



T_V
Default 2

Turn  → Code **16/17/18**

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

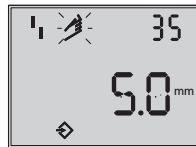
Turn  to set the control parameter selected.

Press  to confirm the setting.


Enter closing direction and blocking position:




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




Blocking position
Default: 0

Turn  → Code **34**


Press , Code **34** blinks

Turn  → Closing direction (CCL counterclockwise/CL clockwise)

Press .

Turn  → Code **35**

Press , Code **35** blinks

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

Press  to confirm the setting.

Set the fail-safe position:

- ▶ Set switch for **fail-safe position** AIR TO OPEN or AIR TO CLOSE as described in section 7.1 on page 51.
- ▶ Set volume restriction as described in section 7.2 on page 52.


Start initialization:


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

Note: As initialization has not been carried out completely, the error code **76** (no emergency mode) and possibly also error code **57** (control loop) may appear on the display.


These alarms do not influence the positioner's readiness for operation.


Cancel the blocking position and change to automatic operating mode


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

Turn  → Code **1**


Press , Code **1** and  blink


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

Press  to cancel mechanical blocking.

Turn  → Code **0**

Press , Code **0** blinks.

Turn  → **AUTO**

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

Note: If the positioner shows a tendency to oscillate in automatic operating mode, the parameters K_p and T_V must be slightly cor-

rected. Proceed as follows:

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

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

Zero point calibration

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

7.7 Zero calibration

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

We recommend re-initializing the positioner in case of deviations in the zero point over 5%.

NOTICE

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

Note: The positioner must be connected to the supply air to perform the zero calibration.

Enable configuration:

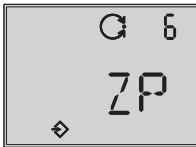
Turn  → Code **3**, display: **No**

Press , Code **3** blinks

Turn  → **YES**

Press , display 

Perform zero calibration:



Initialization mode
Default **MAX**

Turn \otimes → Code **6**

Press \otimes , Code **6** blinks

Turn \otimes → **ZP**

Press \otimes .

▶ **Press INIT key!**

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

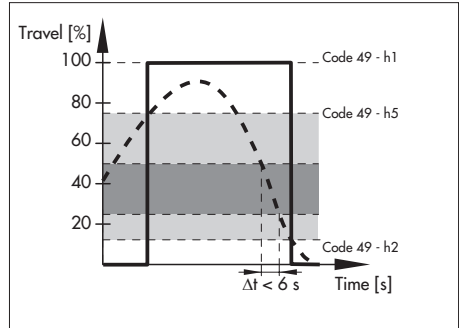
7.8 Performing settings for open/close valves

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

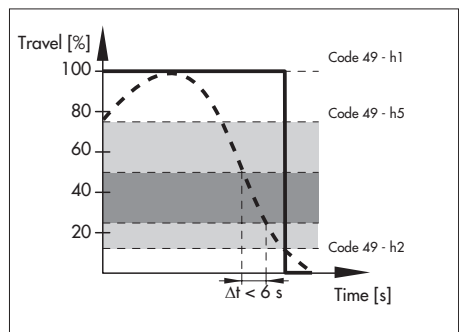
Note: The travel range of open/close valves is defined using the fail-safe position and the given Operating point. As a result, the following parameters to define the operating range and the range of the reference variable cannot be changed or analyzed:
 Travel/angle range start (Code **8**)
 Travel/angle range end (Code **9**)
 Travel/angle lower limit (Code **10**)
 Travel/angle upper limit (Code **11**)

Reference variable range start (Code **12**)
 Reference variable range end (Code **13**)

Discrete analysis



If the reference variable (---) is below *Limit operating point* (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 *Limit operating point*, the valve moves to the *Operating point* (Code **49 - h1**). The valve moves back to the fail-safe position if the reference variable then falls below the *Limit fail-safe position* (Code **49 - h2**).



If the reference variable (— — —) is above *Limit operating point* (Code 49 - h5) at the start of automatic operation, the valve (—) moves to the *Operating point* (Code 49 - h1). If the reference variable then drops below the *Limit fail-safe position* (Code 49 - h2), the valve moves to the fail-safe position.

Starting the partial stroke test (PST)

A partial stroke test is started when the reference variable (— — —) moves from a defined position (fail-safe position or *Operating point*) into the range between *Lower limit test start* (Code 49 - h3) and *Upper*

limit test start (Code 49 - h4) and remains there for longer than six seconds. The valve (—) moves from the last defined position to *Step start* (Code 49 - d2).

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

Note: The partial stroke test (PST) is performed according to the settings in Code 49 - d2 to 49 - d9. Refer to EB 8389 EN on EXPERT+ valve diagnostics.

Cancellation of the partial stroke test (PST)

The partial stroke test is canceled whenever the reference variable leaves the range between *Limit fail-safe position* and *Limit operating point*.

After the test has been canceled, the valve moves back to its last position (fail-safe position or *Operating point*).



Performing settings

Configuration at the positioner must be enabled before the application type (open/close valve) can be set:


Turn  → Code 3, display: **No**

Press , Code 3 blinks.


Turn  → **YES**

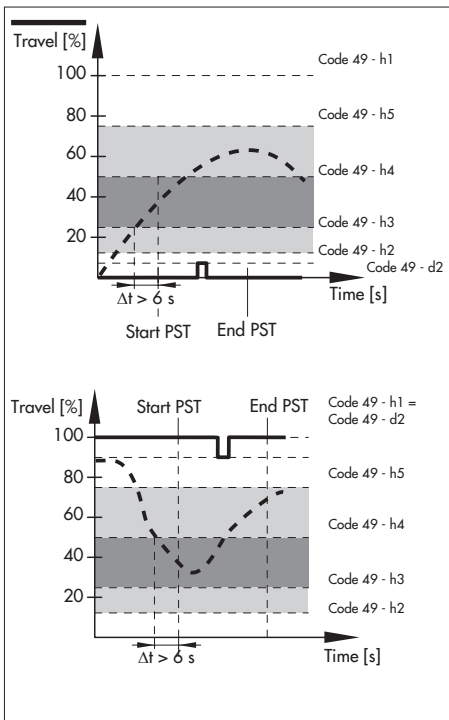
Press , display: 

Select open/close valve:

Turn  → Code 49

Press , Code 49 blinks.

Turn  → Code h0



Press , Code **h0** blinks.


Turn  → **YES**

Press .

After setting the application type as open/close valve, enter the 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  and set the selected parameter.

Press  to confirm the setting.

7.9 Reset to default values

This function resets all parameters to the factory default values (see code list in section 12).

Enable configuration:

Turn  → Code **3**, display: **No**

Press , Code **3** blinks

Turn  → **YES**

Press , display 

Reset start-up parameters:




Reset
Default **No**

Turn  → Code **36**, display: **••••-**

Press , Code **36** blinks

Turn  → **Std**

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

Note: Code **36 - diAG** allows just the diagnosis data (EXPERT+) to be reset. Refer to EB 8389 EN on EXPERT+ valve diagnostics.

8 Operation

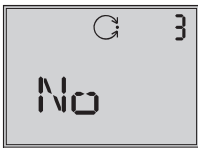
WARNING!

The actuator stem moves while the positioner is being operated.

Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

8.1 Enabling and selecting parameters

The codes which are marked with an asterisk (*) in section 12 on page 74 onwards must be enabled with Code 3 before the associated parameters can be configured as described below.



Code 3
Configuration
not enabled



Configuration
enabled

Turn → Code 3, display: **No**

Press , Code 3 blinks.

Change the setting of Code 3.

Turn → **YES**

Press , display:

The configuration is enabled.

You can now configure codes one after the other:

Turn and select the required code.

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

Turn and select the setting.

Press to confirm the selected setting.

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

Cancel the setting:



Canceling the setting


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

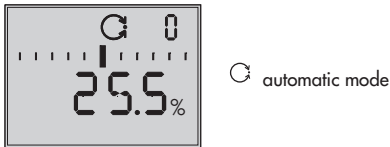
Turn → **ESC**

Press . The entered value is not adopted.

8.2 Operating modes


8.2.1 Automatic and manual modes


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





Switch to  manual operating mode



Turn  → Code **0**


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

Turn  → **MAN**


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


Adjust the manual reference variable




Turn  → Code **1**

Press , Code **1** blinks.

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

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

Switch to  automatic operating mode

Turn  → Code **0**

Press , Code **0** blinks.


Turn  → **AUTO**

Press . The positioner changes to  automatic operating mode

8.2.2 Fail-safe position (SAFE)


If you want to move the valve to fail-safe position determined during start-up (see section 7.1), proceed as follows:



Turn  → Code **0**

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


Turn  → **SAFE**

Press , display: **S**.


The valve moves to the fail-safe position.


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

Exit the fail-safe position

Turn  → Code **0**

Press , Code **0** blinks.

Turn  and select the required operating mode **AUTO** or **MAN**.

Press . The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

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

Note: The status classification can be changed in TROVIS-VIEW and over the parameters in the DD file. Refer to EB 8389 EN on EXPERT⁺ valve diagnostics.

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

▶ Maintenance alarm

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

▶ Maintenance required

The positioner still performs its control task (with restrictions). A maintenance requirement or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.

▶ Maintenance demanded

The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the short term.


► **Out of specification**

The positioner is operated outside specified operating conditions.

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

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

Condensed state	Positioner display
Maintenance alarm	
Function check	Text, e.g. <i>tESing</i> , <i>TunE</i> or <i>tESr</i>
Maintenance required/ Maintenance demanded	
Out of specification	

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

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

The cause and recommended action are listed in the code list (section 12).



Example
Error caused by pin
position

Fault alarm output


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

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

8.3.1 Confirming error messages



Enable configuration:

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

Turn  → Code 3

Press , Code 3 blinks

Turn  → **ON**

Press , display: 

Confirm error messages:

Turn  → Error code which you want to confirm.

Press  to confirm the error message.

9 Adjusting the limit switch

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

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

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

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

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

Note!

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

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

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

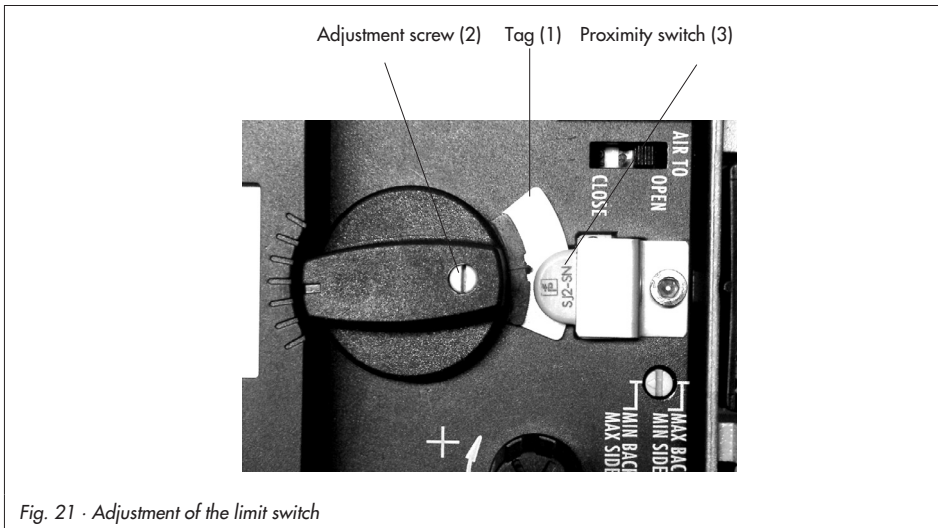


Fig. 21 · Adjustment of the limit switch

Software adaptation

Code **38** (inductive alarm is set to **YES**).
 The inductive limit switch is connected to the terminals +41/-42.
 The device is set up accordingly when delivered ex works SAMSON.

Setting the switching point:

NOTICE

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

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

For CLOSED position:

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

Contact function:

- ▶ Tag leaving the field > contact is made
- ▶ Tag entering the field > contact is opened.

For OPEN position:

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

Contact function:

- ▶ Tag leaving the field > Contact is made.
- ▶ Tag entering the field > Contact is opened.

9.1 Retrofitting an inductive limit switch

Required retrofit kit:

Limit switch Order no. 1400-7460

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

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9).
2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper (item no. 8801-2267) at the socket X7 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.
7. **Note:** On start-up of the positioner, set the option "inductive alarm" under Code 38 from **NO** to **YES**.

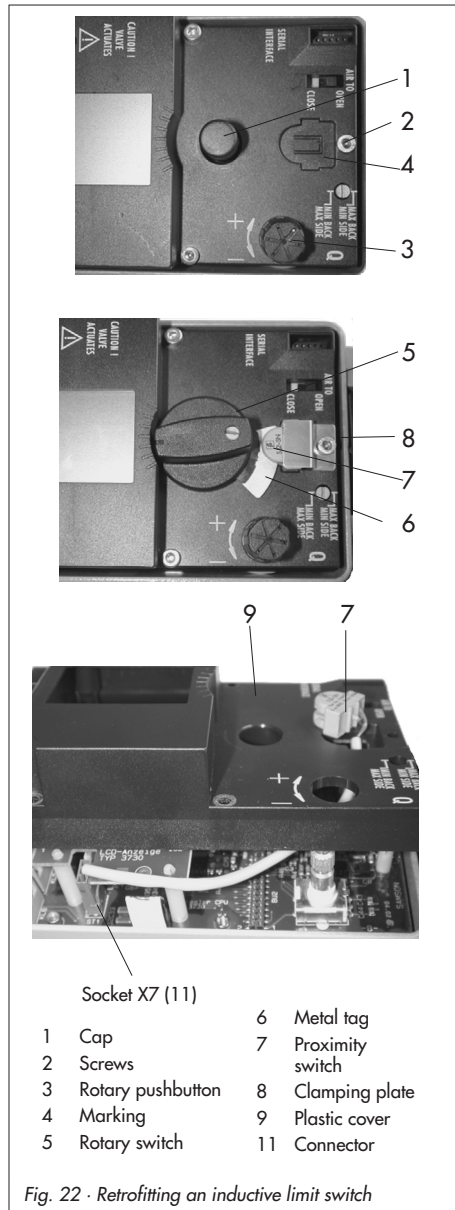


Fig. 22 · Retrofitting an inductive limit switch

10 Maintenance

The positioner does not require any maintenance.

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

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

11 Servicing explosion-protected devices

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

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

Explosion-protected components may only be replaced by original, checked components from the manufacturer.

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

12 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 Escape	Switchover from automatic to manual mode is smooth. In fail-safe mode, S appears on the display. In MAN and AUTO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °.
1	Manual w 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. Note: Can only be selected when Code 0 = MAN
2	Reading direction [Normal] or upside down ESC	The reading direction of the display is turned by 180°.
3	Enable configuration [No] YES ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) HART blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only read over the SSP interface.



Code no.	Parameter – Readings, values [default setting]	Description																											
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.																													
4*	Pin position [No] 17, 25, 35, 50, 70, 100, 200 mm 90° with rotary actuators ESC Note: If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety	The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. For initialization using NOM or SUB, this pin position must be entered. <table border="1" data-bbox="538 427 1005 703"> <thead> <tr> <th>Pin position</th> <th>Standard Code 4</th> <th>Adjustment range Code 5</th> </tr> </thead> <tbody> <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> </tbody> </table>	Pin position	Standard Code 4	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	Standard Code 4	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	For initialization using NOM or SUB, the nominal travel/angle of rotation of the valve must be entered. The permissible adjustment range depends on the pin position according to the table for Code 4. After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.																											
6*	Init mode [MAX] NOM MAN SUB ZP ESC	Select the initialization mode MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. MAN: Manually selected range SUB: Substitute calibration (without initialization) ZP: Zero calibration																											

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
7*	w/x [↗↗] increasing/increasing ↗↘ increasing/decreasing ESC	Direction of action of the reference variable w in relation to the travel/angle of rotation x Automatic adaptation: AIR TO OPEN: On completing initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases. AIR TO CLOSE: On completing initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.
8*	Travel/angle range start (lower x-range value) 0.0 to 80.0 [0.0] % of the nominal range ESC Note: Specified in mm or angle ° provided Code 4 is set	Lower range value for the travel/angle of rotation in the nominal or operating range. The operating range is the actual travel/angle of the control valve and is limited by the lower x-range value (Code 8) and the upper x-range value (Code 9). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. Value is displayed or must be entered. The characteristic is adapted. See also the example in Code 9!
9*	Travel/angle range end (upper x-range value) 20.0 to 100.0 [100.0] % of the nominal range ESC Note: Specified in mm or angle ° provided Code 4 is set	Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. Example: The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.
10*	Travel/angle lower limit (lower x-limit) 0.0 to 49.9 % of the operating range [No], ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted. The characteristic is not adapted to the reduced range. See also example in Code 11.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
11*	Travel/angle upper limit (upper x-limit) 50.0 to 120.0 [100] % of the operating range No, ESC	Limitation of the travel/angle of rotation upwards 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 reference variable outside of the 0 to 100 % range.
12*	w-start 0.0 to 75.0 [0.0] % of the reference variable range ESC	Lower range value of the applicable reference variable range must be smaller than the final value w-end, 0 % = 4 mA The reference variable range is the difference between w-end and w-start, and must be $\Delta w \geq 25\% = 4 \text{ mA}$. For an adjusted reference variable range of 0 to 100 % = 4 to 20 mA, the control valve must move through its entire operating range from 0 to 100 % travel/angle of rotation. In split-range operation , the valves operate with smaller reference variables. 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 reference variable).
13*	w-end 25.0 to 100.0 [100.0] % of the reference variable range ESC	Upper range value of the applicable reference variable range, must be greater than w-start. 100 % = 20 mA
14*	Reference variable range start (w-start) 0.0 to 49.9 [1.0] % of the span adjusted via Code 12/13 No, ESC	If w approaches the percentage adjusted at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15.

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

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
19*	Tolerance band 0.1 to 10.0 [5.0] % of the operating range ESC	Used for error monitoring Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If a transit time is determined during initialization which is six times > 30 s, the six-fold transit time is accepted as the lag time.
20*	Characteristic 0 to 9 [0] ESC	Select the characteristic: 0 Linear 1 Equal percentage 2 Reverse equal percentage 3 SAMSON butterfly valve linear 4 SAMSON butterfly valve equal percentage 5 VETEC rotary plug valve linear 6 VETEC rotary plug valve equal percentage 7 Segmented ball valve linear 8 Segmented ball valve equal percentage 9 User-defined (defined over operating software) Note: The various characteristics are listed in the Appendix (section 15).
21*	Required transit time OPEN (w ramp open) 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve opens. Limitation of the transit time (Code 21 and 22): For some applications it is 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. NOTICE The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.
22*	Required transit time CLOSED (w ramp closed) [0] to 240 s ESC	The time required to pass through the operating range when the valve closes. Code 22 has priority over Code 14. NOTICE The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.


Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
23*	Total valve travel 0 to 99 · 10 ⁷ [0] Exponential reading from 9999 travel cycles onwards RES, ESC	Totaled double valve travel. Can be reset to 0 over Code 36 - Std. Note: The total valve travel is saved in a non-volatile memory after every 1000 double travel.
24*	LV total valve travel 1000 to 99 · 10 ⁷ [1 000 000] Exponential reading from 9999 travel cycles onwards ESC	Limit value of total valve travel. If the limit is exceeded,  and  icons appear on the display.
25*	Alarm mode 0 to 3 [2] ESC	Switching mode of software limit switches alarm A1 and A2 in responding state (when positioner has been initialized). 1) Explosion-protected version according to EN 60947-5-6 0: A1 ≥ 2.1 mA A2 ≤ 1.2 mA 1: A1 ≤ 1.2 mA A2 ≤ 1.2 mA 2: A1 ≥ 2.1 mA A2 ≥ 2.1 mA 3: A1 ≤ 1.2 mA A2 ≥ 2.1 mA 2) Version without explosion protection 0: A1 R = 348 Ω A2 Non-conducting 1: A1 Non-conducting A2 Non-conducting 2: A1 R = 348 Ω A2 R = 348 Ω 3: A1 Non-conducting A2 R = 348 Ω When a positioner has not been initialized, the software limit switches 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 switches both switch to ≤ 1.2 mA signal (Ex) or non-conducting (without explosion protection). Note: The fault alarm output always switches to ≤ 1.2 mA/ non-conducting in case of fault arises; it has ≥ 1.2 mA/R = 348 Ω when there is no fault.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
26*	Limit value A1 No 0.0 to 100.0 [2.0] % of the operating range ESC	Alarm A1 goes into the state of response when the value exceeds the limit. Displaying or changing the software limit value A1 in relation to the operating range. Setting has no effect when an inductive limit switch has been installed.
27*	Limit value A2 No 0.0 to 100.0 [98.0] % of the operating range ESC	Alarm A2 goes into the state of response when the value falls below the limit. Displaying or changing the software limit value A2 in relation to the operating range.
28*	Alarm test Reading direction: Standard Turned [No] [No] RUN 1 1 RUN RUN 2 2 RUN RUN 3 3 RUN ESC ESC	Testing the software limit switches alarm A1 and A2 in addition to the fault alarm contact A3. If the test is activated, the respective limit switches five times. RUN1/1 RUN: Software limit switch A1 to ≥ 2.1 mA RUN2/2 RUN: Software limit switch A2 to ≥ 2.1 mA RUN3/3 RUN: Fault alarm contact A3 to ≤ 1.2 mA
29*	Position transmitter x/ix³⁾ [↻] ↻ ESC	Operating direction of the position transmitter; 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 initialized (reference variable less than 3.6 mA), the power consumption of the feedback signal is effective (current approx. 1.8 mA). When YES is set in Code 32, the position transmitter issues the value as per Code 30 during initialization or zero calibration. When NO is set in Code 32, 4 mA is issued during a running self-adaptation.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
30*	Fault alarm ix ³⁾ [No] HI LO ESC	Used to select whether faults causing the fault alarm contact to switch should also be signaled by the position transmitter output and how they should be signaled HI ix = 21.6 ±0.1 mA or LO ix = 2.4 ±0.1 mA
31*	Position transmitter test ³⁾ -10.0 to 110.0 [default value is last indicated value of the position transmitter] % of the operating range ESC	Testing the position transmitter. Values can be entered in relation to the operating range. The current actual value 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*	Fault alarm with “Function check” condensed state [YES] · No ESC	YES: Fault alarm also with “Function check” condensed state No: “Function check” condensed state does not cause a fault alarm to be issued
33*	Fault alarm with “Maintenance alarm” or “Maintenance required” condensed state [YES] · No ESC	YES: Fault alarm only with “Maintenance alarm” condensed state and with “Maintenance required” condensed state No: Fault alarm only with “Maintenance alarm” condensed state
34*	Closing direction CL [CCL] ESC	CL: Clockwise, CCL: Counterclockwise Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). Needs only be entered in initialization mode SUB (Code 6).
35*	Blocking position [0] mm/° / % ESC	Entering the blocking position. Distance up to the CLOSED position. Note: Only necessary in initialization mode SUB.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
36*	Reset [No] Std · diAG ESC	Std: Resets all parameters to default (factory setting) as well as the diagnosis data. After a reset, the positioner must be re-initialized. diAG: Resets diagnosis data only. Plotted reference graphs and logs remain unaffected. The positioner does not need to be re-initialized.
37	Position transmitter No · YES	Display only, indicates whether the position transmitter option is installed.
38*	Inductive alarm [No], YES, ESC	Indicates whether the inductive limit switch option is installed or not.
39	System deviation e info -99.9 to 999.9 %	Display only, indicates the deviation from the target position ($e = w - x$).
40	Transit time Open info 0 to 240 s [0]	Display only, minimum opening time determined during initialization.
41	Transit time Closed info 0 to 240 s [0]	Display only, minimum closing time determined during initialization.
42	Auto-w/manual-w info 0.0 to 100.0 % of the span 4 to 20 mA	Display only, Supplied automatic reference variable according to 4 to 20 mA
43	Firmware info Xxxx	Display only, indicates the positioner type and current firmware version in alternating sequence.
44	y info [0] to 100 % 0 P, MAX, ---	Display only. Indicates the control signal y in % based on the travel range determined on initialization MAX: The positioner builds up its maximum output pressure, see description in Code 14 and 15. 0 P: The positioner vents completely, see description in Code 14 and 15. ---: The positioner is not initialized.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
45	Solenoid valve info YES HIGH/LOW No	Display only, indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, <i>YES</i> and <i>HIGH</i> appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the S icon), <i>YES</i> and <i>LOW</i> appear on the display in alternating sequence.
46*	Bus address 0 to 63 [0] ESC	Select bus address
47*	Write protection HART YES, [No], ESC	When the write protection function is activated, device data can only be read, but not overwritten over HART® communication.
48*	Diagnostics	
	Diagnosis parameters d	
d0	Temperature –55 to 125 °C	Current operating temperature [°C] inside the positioner (accuracy ± 3 %) Display only
d1	Minimum temperature [20 °C]	The lowest temperature below 20 °C that has ever occurred. Display only
d2	Maximum temperature [20 °C]	The highest temperature above 20 °C that has ever occurred. Display only
d3	Number of zero calibrations [0]	The number of zero calibrations since the last initialization. Display only
d4	Number of initializations [0]	The number of initializations that have been performed since the last reset. Display only
d5	Zero point limit 0.0 to 100.0 % [5.0 %] of the nominal range	User-defined zero point monitoring Used for error monitoring of the zero point shift.

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
48*	d6 Condensed state OK · C · CR · b · S	Condensed state, made up from the individual states · Display only · Display only OK Okay C Maintenance required CR Maintenance demanded b Maintenance alarm S Out of specification
	d7 Start reference test [No] ON · ESC	Starts reference test for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests). The reference test can only be activated in manual mode  (MAN) as the valve moves through its entire working range. If EXPERT ⁺ is activated in older positioners at a later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.
	d8 Unassigned	Firmware version 1.4x and lower: Enter the activation code for EXPERT ⁺ .
48*	Diagnosis parameters h	
	h0 Initialization with reference test [No] · YES ESC	The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) are plotted during the reference test.
	h1 Reference test result [No] · YES	Display only No No reference test has been performed. YES The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) have been plotted successfully.
	h2 – Unassigned	
	h3 Auto reset diAG 0 to 365 days; [0 days]	After an adjustable time period, the diagnosis data are reset automatically according to the settings in Code 36 - diAG . Example: A start-up behavior of the plant which is untypical for the process is not to be included in the total diagnosis.




Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
48*	h4 Rest time for auto reset diAG	Display only Remaining time until the diagnosis data are reset automatically according to the settings in Code 48 - h3
49*	Partial stroke test (PST)/Full stroke test (FST) · Application type	
	A Partial stroke test (PST)	
A0	Start Partial Stroke Test [No] · YES · ESC	Operating mode and PST testing mode must be set to MAN.
A1	Time until the next automatic PST test takes place	Display only Remaining time [d_h] until the next partial stroke test is performed. Only applies to PST Auto mode.
A2	Desired PST testing mode Auto · [Man] · ESC	Activates (PST Auto) or deactivates (PST Man) the scheduled automatic partial stroke test.
A3	Auto test time	Time [h] between for partial stroke tests (PST)
A4	Status classification PST status [C] · OK · CR · b · S ESC	C Maintenance required OK No message CR Maintenance demanded b Maintenance alarm S Out of specification
A5	Min. recommended scan time	Display only Scan time [s] required to plot the complete step response test in a graph.
A6	– Unassigned	

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
49*	A7 y-monitoring reference value	<p>Display only</p> <p>The valve moves to the valve position <i>Step start</i> (Code 49 - d2) and <i>Step end</i> (Code 49 - d3) with certain control pulses. The difference between these control pulses creates the delta y value [1/s].</p> <p>The y-monitoring reference value applies to the adjusted step values (Code 49 - d2 and Code 49 - d3) and for the selected ramp times (Code 49 - d5 and Code 49 - d6). The y-monitoring reference value must be determined again if any of the above mentioned values change.</p>
	A8 Activation delta y-monitoring [No] · YES · ESC	Activates/deactivates delta y-monitoring
	A9 delta y-monitoring value 0 to 100 %, [10 %]	<p>The percentage [%] of the entire range of the control pulse between 1 and 10000 1/s (Example: 10 % = 10000 1/s)</p> <p>The partial stroke test is canceled if the change in control signal (delta y) varies from the y-monitoring reference value by this amount.</p>
	d Step parameters for the partial stroke test (PST)	
	d1 – Unassigned	
	d2 Step start 0.0 to 100.0 % [95.0 %]	Start value to perform the step response test
	d3 Step end 0.0 to 100.0 % [90.0 %]	End value to perform the step response test
	d4 Activation of the ramp function [No] · YES	Activates/deactivates the ramp function.
d5 Ramp time (rising) 0 to 9999 s, [15 s]	<p>Ramp time for 0 to 100 % travel (rising) of the ramp function.</p> <p>Do not enter a ramp time which is lower than the value automatically given during initialization.</p>	

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
49*	d6 Ramp time (falling) 0 to 9999 s, [1.5 s]	Ramp time for 0 to 100 % travel (falling) of the ramp function. Do not enter a ramp time which is lower than the value automatically given during initialization.
	d7 Settling time before test start 1.0 to 240.0 s, [10.0 s]	Waiting time before the test starts to allow the valve to safely reach the step start value.
	d8 Delay time after step 1.0 to 240.0 s, [2.0 s]	Time after the first step until the second step starts.
	d9 Scan time 0.2 to 250.0 s, [0.2 s]	Scan time of the step response test
E Cancellation conditions of the partial stroke test (PST)		
E0 Activation x control [No] · YES	Activates/deactivates x control.	
E1 x control value -10.0 to 110.0 % of total travel, [0.0 %]	The test is automatically canceled as soon as the valve position falls below this value.	
E2 – Unassigned		
E3 – Unassigned		
E4 – Unassigned		
E5 Activation tolerance band control [No] · YES	Activates/deactivate tolerance band control.	
E6 PST Tolerance band 0.1 to 100.0 %, [5.0 %]	The test is automatically canceled as soon as the <i>Step end</i> (Code 49 - d3) exceeds this value.	
E7 Max. test duration 30 to 25000 s, [30 s]	Maximum time within which a test can be completed before the test is canceled automatically.	
F Partial stroke test (PST) information · Display only		
F0 No test available	No test exists or the test has been canceled manually.	
F1 Test OK		

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
49*	F2 x cancelation	The test was canceled by the x cancelation function.
	F3 y cancelation	The test was canceled by the y cancelation function.
	F4 Tolerance band exceeded	The test was canceled. The x-values exceeded the tolerance band.
	F5 Max. test time exceeded	The test was not completed within the maximum test time and was automatically canceled.
	F6 Test man. canceled	The test has been manually canceled by the user.
	F7 Measured data storage out of memory	The maximum capacity of the memory for measured data has been reached. After 100 measured data per measured variable have been recorded, the logging stops. However, the test is continued.
	F8 Aborted by int. solenoid valve	The test was canceled by the activation of the solenoid valve.
	F9 Supply pressure/friction	An insufficient supply pressure or excessive friction occurred during the test.
	h Application type of valve	
h0 Application type [No] · YES · ESC	No Control valve YES Open/close (on/off) valve Depending on the application type of valve that has been selected, the positioner has different diagnostic functions and behaves differently in the automatic mode (AUTO).	
h1 Operating point 0.0 to 100.0 % valve position, [100.0 %]	The valve moves to this position as soon as the reference variable exceeds the <i>Limit operating point</i> (Code 49 - h5).	
h2 Limit fail-safe position 0.0 to 20.0 % reference variable, [12.5 %]	The valves moves to the fail-safe position (SAFE) when the reference variable falls below this limit.	

Code no.	Parameter – Readings, values [default setting]	Description
Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
49*	h3 Lower limit test start [25.0 % reference variable]	Display only The valve remains in its last valid position when the reference variable is between the <i>Limit fail-safe position</i> and <i>Lower limit test</i> . A partial stroke test is started when the reference variable moves to the range between <i>Lower limit test</i> and <i>Upper limit test</i> and remains there longer than six seconds.
	h4 Upper limit test start [50.0 % reference variable]	Display only The valve remains in its last valid position when the reference variable is between the <i>Upper limit test</i> and <i>Limit operating point</i> .
	h5 Limit operating point 55.0 to 100.0 % reference variable, [75.0 %]	The valve moves to the <i>Operating point</i> when the reference variable exceeds the <i>Limit operating point</i> .
	h6 – Unassigned	
	h7 Limit value time analysis 0.6 to 30.0 s, [0.6 s]	Time limit for the difference between the reference value and the latest recorded value. It determines at which difference value an alarm is to be generated.
	h8 Limit value travel analysis 0.1 to 100.0 % valve position, [0.3 %]	Travel limit for the difference between the reference value and the latest recorded value. It determines at which difference value an alarm is to be generated.
	h9 Status classification Close/open [C] · OK · CR · b · S ESC	C Maintenance required OK No message CR Maintenance demanded b Maintenance alarm S Out of specification

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, Maintenance alarm: ). If "No message" is assigned to the error code as the status classification, the error is not included in the condensed state. A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operating software (e.g. TROVIS-VIEW). Refer to section 13.6.

Initialization errors

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
50	x > range	The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit. <ul style="list-style-type: none"> • Pin positioned incorrectly. • Bracket slipped in case of NAMUR attachment or positioner is not central. • Follower plate incorrectly attached.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	$\Delta x < \text{range}$	The measuring span of the sensor is too low. <ul style="list-style-type: none"> • Pin positioned incorrectly. • Wrong lever. <p>A rotational angle smaller than 11° at the positioner shaft creates just an alarm. An angle below 6° leads to the initialization being canceled.</p>
	Status classification	[Maintenance required]
	Recommended action	Check attachment and re-initialize the positioner.
52	Attachment	<ul style="list-style-type: none"> • Positioner attachment incorrect. • Nominal travel/angle (Code 5) could not be achieved on initialization under NOM or SUB (no tolerance downwards permissible). • Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX. After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle.

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
53	Initialization time exceeded (Init time >)	The initialization routine lasts too long. <ul style="list-style-type: none"> • No pressure on the supply line or there is a leak. • Supply air failure during initialization.
	Status classification	[Maintenance required]
	Recommended action	Check attachment and supply pressure. Re-initialize the positioner.
54	Initialization - solenoid valve	1) A solenoid valve is installed (Code 45 = YES) and was not or not properly connected so that an actuator pressure could not be built up. The alarm is generated when you attempt to initialize the positioner. 2) If you attempt to initialize the device from the fail-safe position (SAFE).
	Status classification	[Maintenance required]
	Recommended action	Re. 1) Check connection and supply voltage of the forced venting Code 45 HIGH/LOW Re. 2) Set the MAN operating mode over Code 0 . Then initialize the positioner.
55	Transit time too short (transit time <)	The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Status classification	[Maintenance required]
	Recommended action	Check the volume restriction setting as described in section 7.2, re-initialize the positioner.
56	Pin position	Initialization was canceled because you are required to enter the pin position for the selected initialization modes NOM and Sub .
	Status classification	[Maintenance required]
	Recommended action	Enter pin position over Code 4 and nominal travel/angle over Code 5 . Re-initialize the positioner.

Operational errors

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
57	Control loop	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19). <ul style="list-style-type: none"> • Actuator mechanically blocked. • Attachment of the positioner subsequently shifted. • Supply pressure not sufficient.
	Status classification	[Maintenance required]
	Recommended action	Check attachment.
58	Zero point	Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Status classification	[Maintenance required]
	Recommended action	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code 6 (see section 7.7 on page 62). If the lever position on the back of the positioner has been changed (e.g. while exchanging the lever), move the lever as far as it will go in both directions to adapt it to the internal measuring lever.
59	Autocorrection	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Status classification	[No message]
	Recommended action	Automatic
60	Fatal error	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The positioner changes to the fail-safe position (SAFE).
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Reset over Code 36 - Std. Re-initialize the positioner.

Hardware errors

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
62	x signal	<p>Determination of the measured data for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position indication.</p> <p>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 reference variable signal so that the process remains in a safe state.</p>
	Status classification	[Maintenance demanded]
	Recommended action	Return the positioner to SAMSON AG for repair.
63	w too small	<p>The reference variable is much smaller than 4 mA (0 %); occurs if the power source that drives the positioner does not comply with the standard. This state is indicated on the positioner display by a blinking LOW.</p>
	Recommended action	[No message]
	Remedy	<p>Check reference variable. If necessary, limit the current source downwards so that no values below 4 mA can be issued.</p>
64	i/p converter	The circuit of the i/p converter has been interrupted.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	<p>Cannot be remedied. Return the positioner to SAMSON AG for repair.</p>

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
65	Hardware	A hardware error has occurred, the positioner changes to the fail-safe position (SAFE).
	Status classification	[Maintenance alarm]
	Recommended action	Confirm error and return to the automatic operating mode, or perform a reset and re-initialize the device. If this is not successful, return device to SAMSON AG for repair.
66	Data memory	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Status classification	Maintenance alarm (cannot be classified)
	Recommended action	Return the positioner to SAMSON AG for repair.
67	Test calculation	The hardware controller is monitored by means of a test calculation.
	Status classification	[Maintenance alarm]
	Recommended action	Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.

Data errors

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
68	Control parameter	Control parameter error
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
69	Poti parameter	Parameter error of the digital potentiometer.
	Status classification	[Maintenance required]
	Recommended action	Confirm error, perform reset and re-initialize the positioner.
70	Calibration parameter	Error in the production calibration data. Subsequently, the device runs on default values.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
71	General parameters	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error. Check and, if necessary, reset required parameters.
73	Internal device error 1	Internal device error
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.
74	HART parameters	Parameter errors that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Confirm error and perform reset.
75	Info parameters	Error in the info parameters that are not critical for the control.
	Status classification	[Maintenance required]
	Recommended action	Return the positioner to SAMSON AG for repair.

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

Diagnosis errors

Error codes – Recommended action		Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.
79	Extended diagnostics	Alarms are generated by the extended EXPERT ⁺ diagnostics if EXPERT ⁺ has been activated under Code 48
	Status classification	Maintenance required (cannot be classified)
80	Diagnostic parameters	Errors that are not critical for control.
	Status classification	Maintenance required (cannot be classified)
	Recommended action	Confirm error. Check and, if necessary, perform a new reference test
81	Reference graphs	An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis. <ul style="list-style-type: none"> • Reference test was interrupted • Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted. Fault alarms are saved in a non-volatile memory. They cannot be reset.
	Status classification	[Maintenance required]
	Recommended action	Check and, if necessary, perform a new reference test

13 Settings in TROVIS-VIEW software

13.1 General

The TROVIS-VIEW software allows various smart SAMSON devices to be configured over a common operator interface. It consists of the operator interface, communication server, and the device-specific module. The software has a Windows Explorer® look and feel. The entire configuration of the positioner can be performed over the TROVIS-VIEW Configuration and Operator Interface. It is not possible to link function blocks of other devices with the TROVIS-VIEW software. The TROVIS-VIEW software containing online help and the database module for Type 3730-3 Positioner is delivered on a CD-ROM (order number 6661-1056). Software updates are available in Internet (<http://www.samson.de>) in Products > Support and downloads.

Note: The following instructions include a description on the key functions of the TROVIS-VIEW software in conjunction with Type 3730-3 Positioner. Refer to the online help in the ? menu for a detailed description.

13.1.1 System requirements

Hardware requirements

- ▶ PC with Pentium II processor or equivalent (300 MHz or higher), 500 MHz recommended
- ▶ Serial interface and USB/RS-232 adapter
- ▶ Min. 96 MB RAM, 192 MB RAM recommended
- ▶ Min. 150 MB free hard disk space plus approx. 10 to 15 MB additional hard disk space per SAMSON module
- ▶ SVGA graphic card (min. 800 x 600)
- ▶ CD-ROM drive

Software requirements

- ▶ Operating system: Windows® 2000 (min.SP2), Windows® XP, Windows® Vista
- ▶ Microsoft.NET Framework Version 2.0 or higher (included on the installation CD-ROM)
- ▶ Internet browser: Microsoft Internet Explorer, version 6.0 or higher

Accessories

- ▶ Serial interface adapter, order no. 1400-7700 (SAMSON SSP interface/ RS-232 port of computer)
- ▶ Isolated USB interface adapter, order no. 1400-9740 (SAMSON SSP interface/ USB port of computer)

13.2 Installing TROVIS-VIEW software

1. Insert the installation CD-ROM to start the installation program.
Once inserted, the CD-ROM usually starts the installation program automatically, depending on the configuration of the operating system. If the program does not start automatically, double-click setup.exe in the root directory of the CD-ROM in order to install TROVIS-VIEW.
2. Follow the on-screen prompts and instructions of the installation program.

The TROVIS-VIEW Operator Interface can be used for different SAMSON devices. Note that the installation program also offers you the option of installing a demo module. To use the software without restrictions, the software needs to be activated by entering a CD key as follows:

3. After installation, a dialog box will appear, prompting you to enter the CD key, which you will find on the cover of the original CD-ROM.
Once you have entered the correct CD key, an activation is necessary. The software can be activated automatically or manually. Internet access on the computer on which TROVIS-VIEW is installed is required for automatic activation.

Manual activation:

Once you have entered the correct CD key, a request code will be automatically generated and displayed which contains computer identification details.

- ▶ Enter request code in SAMSON's product activation server over the Internet.
(http://support.samson-ag.com:8082/activate_eng.html)
An activation code is generated which allows TROVIS-VIEW to be used without any restrictions in the purchased scope.
- ▶ Enter this activation code in TROVIS-VIEW.
The TROVIS-VIEW software is now ready for use.

Automatic activation:

A request code containing the computer identification details is transferred to the SAMSON product activation server when an Internet connection is active and an activation code is automatically entered into TROVIS-VIEW.

The TROVIS-VIEW software is now ready for use.

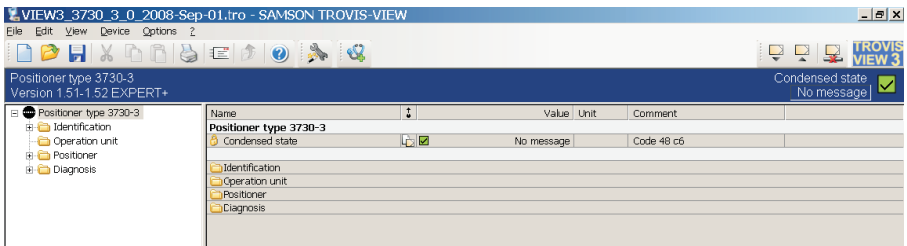
Note: Refer to the readme.txt file in the root directory of the CD-ROM for further information on installation, software updates and current system requirements.

13.3 Starting TROVIS-VIEW and performing basic settings

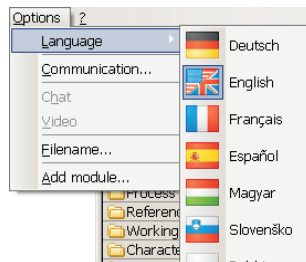
You can perform the settings in TROVIS-VIEW either when the positioner is connected (online) to the computer or not connected (offline).

Note: When the positioner is not connected, the default settings appear on the operator interface or, alternatively, a stored TROVIS-VIEW file (*.tro) can be loaded and overwritten by selecting *Open* in the *File* menu.

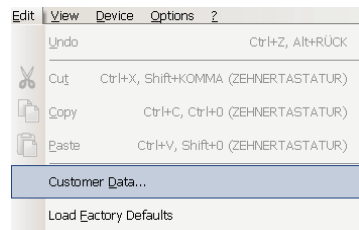
1. Start TROVIS-VIEW. The operator interface appears with menubar and toolbar as well as various folders.



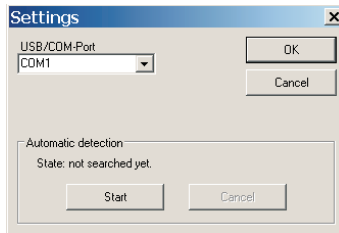
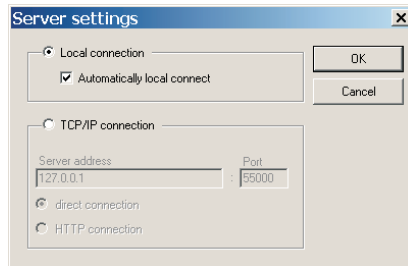
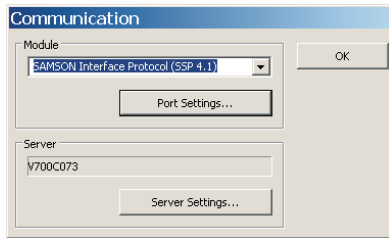
2. In *Options* menu, select *Language* to change the interface language.



3. Select *Customer data* in, *Edit* menu to enter data relevant to the plant, e. g. project name, plant location, operator.
4. Select *Load Factory Defaults* in *Edit* menu if you want to load default settings (see code list in section 12) onto the operator interface.



5. Set the communications port for data communication. Proceed as follows:
 - ▶ Connect the port (RS-232 or USB) of the computer using the corresponding adapter to the SAMSON SSP interface of the positioner.
 - ▶ Select *Communications* in *Options* menu to open the server settings window. Click *Server settings* button.
 - ▶ Check *Local connection* and *Automatically local connect* boxes and click *OK* button to confirm server settings. The *Communication* window reappears.
 - ▶ Click *Port settings* button.
 - ▶ The settings window opens and *State: not yet searched* appears in the Automatic detection field. Click *Start* button. TROVIS-VIEW has found the positioner when *State: Device found on COM* appears.
 - ▶ Click on *OK* button twice to confirm settings.



6. If required, add a new TROVIS-VIEW module by selecting *Add module* in the *Options* menu. Enter the CD key (written on the installation CD-ROM) in the open window.
7. If required, enter the type, date and selectable parameters which are used to automatically create the TROVIS-VIEW file name. The file name created in this way appears on saving a TROVIS-VIEW file (e.g. VIEW3_3730_3.tro) and can be adopted or altered.

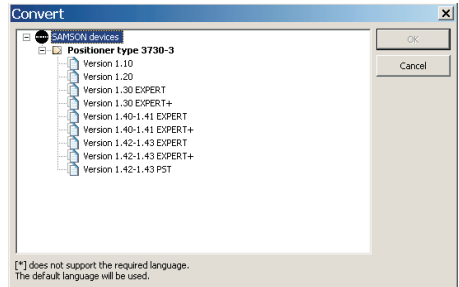
Converting the software version

The TROVIS-VIEW software version must match the firmware of the positioner.

On exchanging data between the positioner and TROVIS-VIEW, the software automatically checks whether the versions are compatible and, if necessary, converts the data.

If you want to adapt the firmware version without exchanging any data, proceed as follows:

1. Select *Convert* in the *File* menu.
A window with a drop-down list of all the available firmware versions appears.
2. Select the corresponding version.
3. Click on *OK* button to confirm the selected version.







13.4 Data transmission

Settings performed in the operator interface can be made both when the positioner is connected or not connected. When the positioner is connected, data uploaded from the positioner can be overwritten.

The default setting appear on the operator interface when no positioner is connected. A stored TROVIS-VIEW file (*.tro) can be loaded and overwritten by selecting *Open* in the *File* menu.

Connection to the positioner can also be made by clicking the icons on the top right in the device toolbar:


-  Data from the positioner are uploaded and shown in the operator interface.
-  The complete set of data is downloaded to the positioner from the operator interface.
To transfer individual parameters, open the corresponding context-sensitive menu. Select *Write* to just download the selected parameter, refer to section 13.4.3.
-  The positioner is in the online mode, indicated by the TROVIS-VIEW 3 logo on the top right in blue.
-  The positioner is in the offline mode.

The listed functions can be activated in the *Device* menu.

Note: Perform the electrical connection as described in section 5.2 first before downloading any data to the positioner.

13.4.1 Offline operation (indirect data transmission)

In offline mode, there is no constant data communication between the computer and positioner. Communication must first be established to upload data from the positioner and download data to the positioner.


- ▶ **Downloading data to the positioner:** Select *Download to the device* in *Device* menu to transfer data to the positioner. The control task is implemented after data are downloaded from TROVIS-VIEW.
 - ▶ **Uploading data from the positioner:** Select *Upload from device* in *Device* menu to transfer all the data from the positioner. Uploaded data are indicated in TROVIS-VIEW by the  icon.
-

Note:

Data transmission can also be performed by clicking the icons in the device toolbar: click  to download data from TROVIS-VIEW to the positioner and, click  to upload data from the positioner and to display them in TROVIS-VIEW.

13.4.2 Online operation (direct data transmission)

The positioner and TROVIS-VIEW are constantly connected in online operation. Current configuration and operating data are uploaded from the positioner cyclically and displayed in TROVIS-VIEW. Likewise, any settings performed in TROVIS-VIEW are directly transferred to the positioner.

- ▶ **Activate online operation:** Select *Online* in *Device* menu to activate online mode. In online mode,  on the device toolbar is animated.
 - ▶ **Deactivate online operation:** Select *Online* in *Device* menu while the online mode is activated. The online mode is canceled.
-

Note: Alternatively, click  on the device toolbar to activate and deactivate online operation.











Operational data graphs (Trend Viewer)


In online mode, process data (positioning value TRD, actual valve position and set point deviation [e]) are plotted in a graph over time. Select *Trend Viewer* in the *View* menu. You can modify the graphs, for example, by adding data points that should be recorded, or even remove data points. Right-click on the graph to save the analysis in a file.

Note: Drag and drop other data points in the Trend Viewer to add them.

13.4.3 Setting parameters

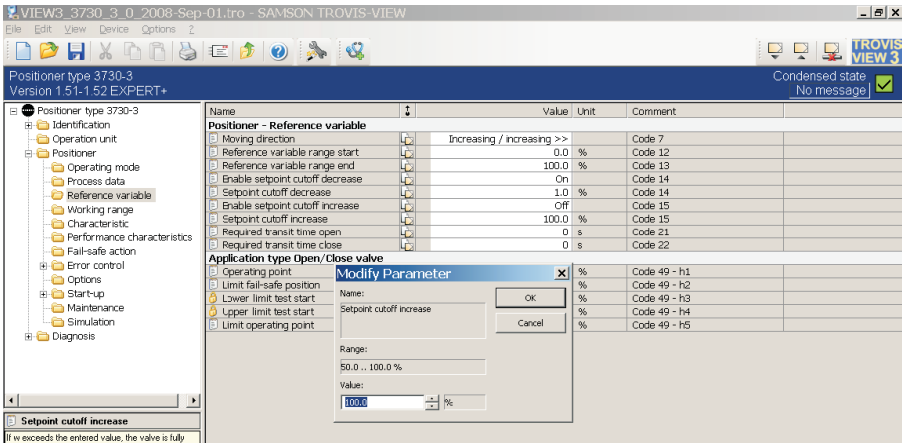
Properties of data points are indicated by icons on clicking on a folder:

Icon	Meaning
	Data cannot be changed
	Data can be changed
	Data point can be executed
	Data point is user-defined
	Mark to indicate status/error
	Value has exceeded maximum limit
	Value has fallen below minimum limit
Source of data:	
	Value has been modified manually
	Value has been uploaded from the positioner. In online mode, ^x in the icon indicates a value has been updated.
	Value originates from a stored file

Parameters are data points whose settings can be changed. They are marked by the  icon. Their settings can be made either in online or offline mode.

1. Click on one of the folders in the left tree directory to view the parameter settings on the right. Place the cursor over a data point to open a tool tip providing more information on the parameter.

2. Double-click the required parameter to open a pop-up window to modify parameter setting.



Right-click the required parameter to open pop-up window to modify parameter settings:

Modify Opens pop-up window to modify parameter settings.

Read Uploads parameter value from device.

Write Downloads parameter value to device.

Default: ... Resets parameter to default setting (setting in gray to indicate that the parameter value is the same as the default setting)

Min ... Set parameter to the displayed minimum value.

Max ... Set parameter to the displayed maximum value

Note: Refer to the code list (section 12 on page 74 onwards) for descriptions of each parameter. The code number assigned to a parameter is listed in the Comment column in TROVIS-VIEW.

13.5 Initializing the positioner

Initializing the positioner is only possible in TROVIS-VIEW when the positioner has been attached properly to the control valve and has been connected (see sections 4 and 5). The positioner must be connected to the computer over the serial interface adapter.

NOTICE

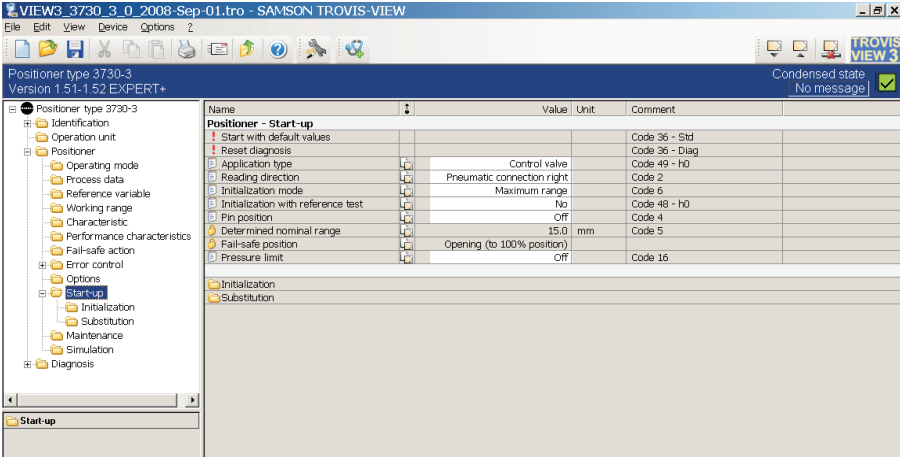
During the initialization, the control valve moves through its entire travel/angle of rotation range. Therefore, do not start initialization while a process is running, but only during start-up, when all shut-off valves are closed.

Initialization using the Start Up Wizard

1. Start the Start Up Wizard by clicking the  button.
2. Follow the on-screen prompts.

Manual initialization

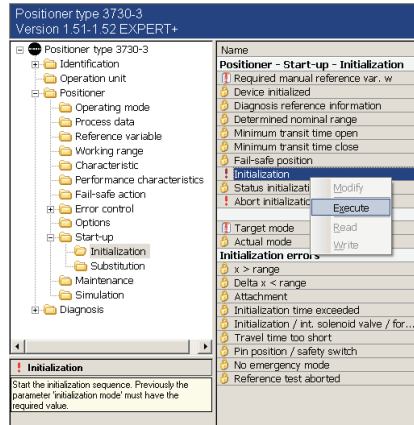
1. Set the parameters in the *Positioner* folder (> *Start-up*).



Name	Value	Unit	Comment
Positioner - Start-up			
Start with default values			Code 36 - Std
Reset diagnosis			Code 36 - Diag
Application type	Control valve		Code 49 - h0
Reading direction	Pneumatic connection right		Code 2
Initialization mode	Maximum range		Code 6
Initialization with reference test	No		Code 48 - h0
Pin position	Off		Code 4
Determined nominal range	15.0	mm	Code 5
Fail-safe position	Opening (to 100% position)		
Pressure limit	Off		Code 16
Initialization			
Substitution			

2. Enter the required initialization mode: Maximum range (MAX), nominal range (NOM), manually selected range (MAN), substitute calibration (SUB) in the *Positioner* folder (> *Start-up*-> *Initialization*).

- Start initialization by right-clicking *Initialization* and selecting *Execute*. How long the initialization procedure lasts depends on the actuator transit time and may take a few minutes.



13.6 Status classification

Alarms are classified in the positioner with a status when an error occurs. States include "Maintenance alarm", "Maintenance required", "Maintenance demanded", "Out of specification" and "No message".

▶ Maintenance alarm

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

▶ Maintenance required

The positioner still performs its control task (with restrictions). A maintenance 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 operated out of specification.

▶ No message


When this classification is active, it does not have any affect on the condensed state.

You can change the status classification in the *Positioner* folder (> *Error control* > *Classification report*).









Status classification of a single alarm	TROVIS-VIEW3/DTM
Maintenance alarm	 red
Maintenance required/demanded	 blue
Out of specification	 yellow
No message	 white

To provide a better overview, the classified alarms are summarized in a condensed state which is made up from a summary of all classified positioner alarms.

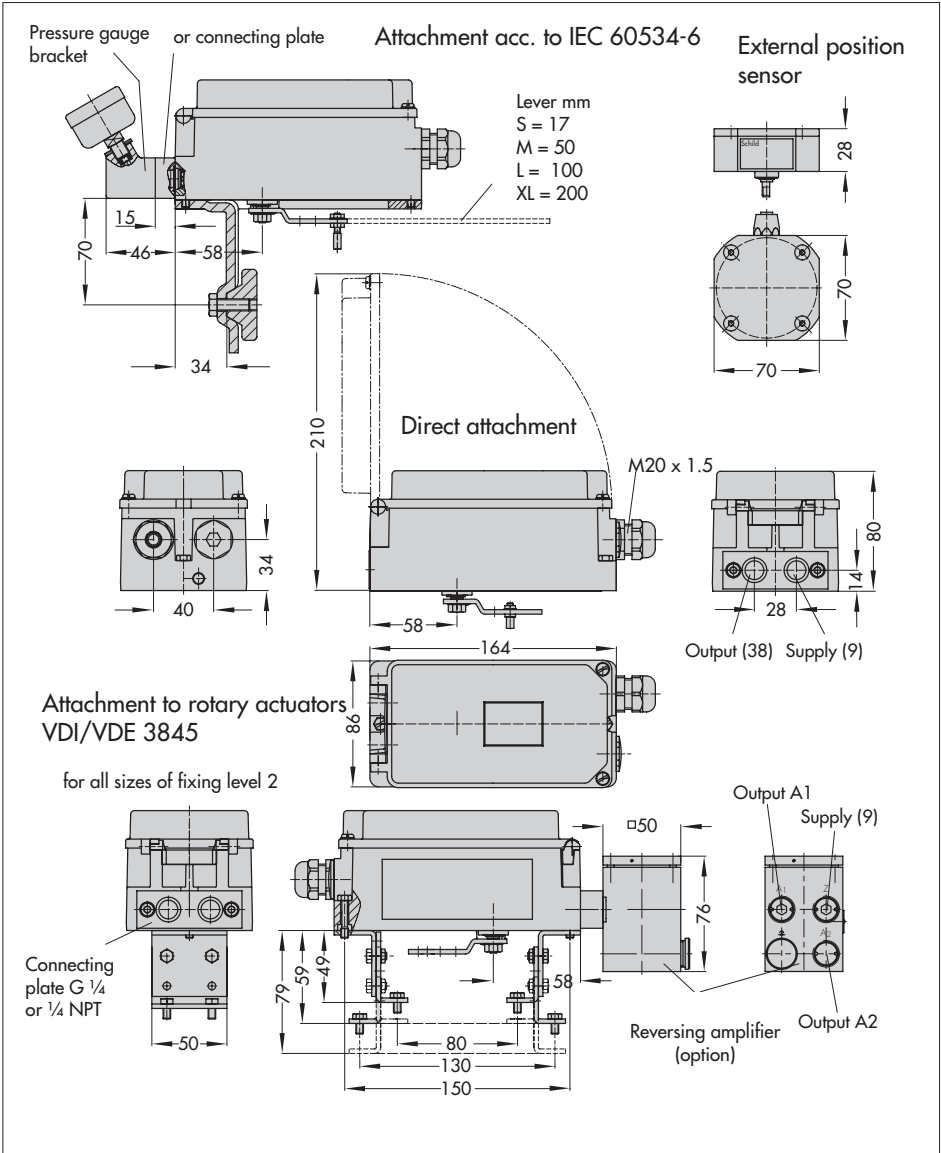
The condensed state appears in TROVIS-VIEW3 on the right-hand side of the info bar and in the *Diagnosis* folder (> *Status messages*). The *Diagnosis* folder (> *Status messages*) indicates which errors are responsible for setting the condensed state.

Note: Condensed state and status alarms are marked with  in TROVIS-VIEW3 until they are read out.

The reading of the condensed state is as follows:

Condensed state	TROVIS-VIEW3/DTM	Positioner display
Maintenance alarm	 red	
Maintenance required/ Maintenance demanded	 blue	
Function check	 orange	Text, e.g. tESing, TunE or tESt
Out of specification	 yellow	 blinking
No message	 green	

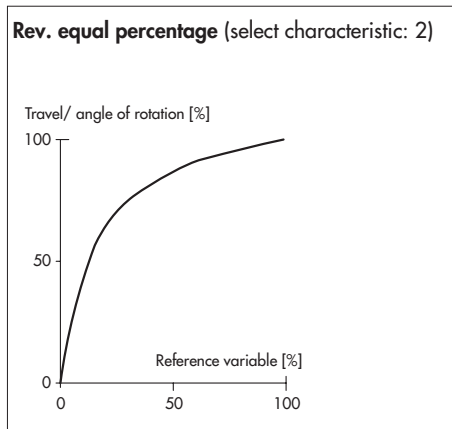
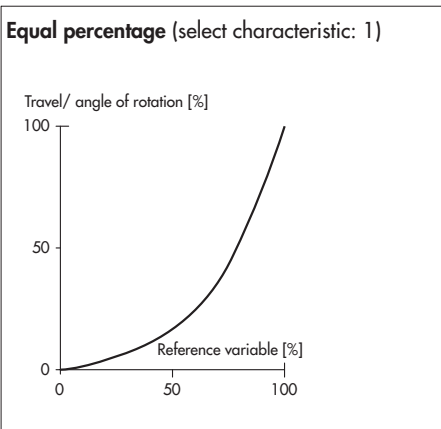
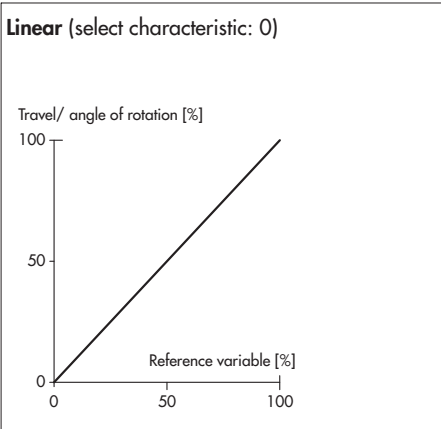
14 Dimensions in mm



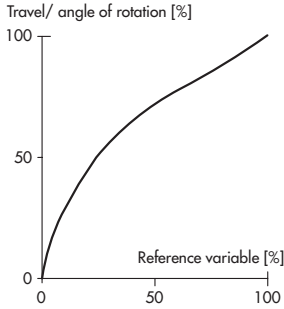
15 Valve characteristic selection

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

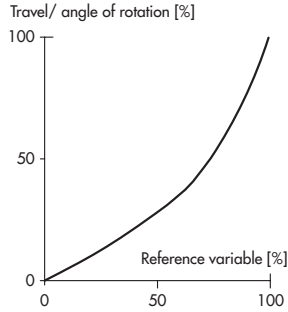
Note: A characteristic can only be defined (user-defined characteristic) using a workstation/operating software (e.g. TROVIS-VIEW).



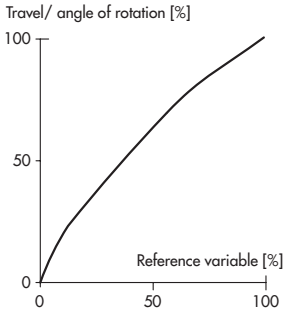
SAMSON butterfly valve linear
(select characteristic: 3)



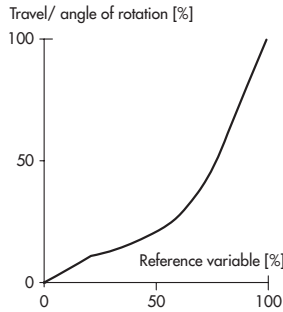
SAMSON butterfly valve equal percentage
(select characteristic: 4)



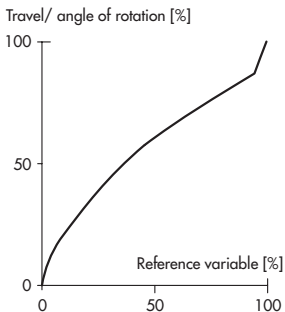
VETEC rotary plug valve linear
(select characteristic: 5)



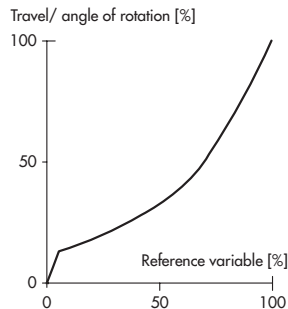
VETEC rotary plug valve equal percentage
(select characteristic: 6)



Segmented valve ball linear
(select characteristic: 7)



Segmented ball valve equal percentage
(select characteristic: 7)



TRANSLATION

Your ref. 2005-11-08
 Your letter 2005-11-08
 Our ref. 479000-9010-0000/067325
 FG33/0hh/wah
 Contact
 IL Biehl
 Tel. (069) 8306-249
 Fax. (069) 8306-716
 gerhard.biehl@vde.com

3 Basis of assessment

DIN EN 60720/VDE 0470 Part 1:2006-09
 Details of protection provided by enclosures (IP Code)
 German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-9010-0000/067325. The test was carried out in accordance with the requirements of EN 60529:1999+A1:2000/158885 with suction as per category 1 at the connecting enclosures of the positioners and solenoid valves. The under pressure was 2 kPa and the test lasted 8 hours.

5 Test results

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

Protecting against access to hazardous parts and against ingress of solid foreign objects according to DIN EN 60529/VDE 0470 Part 1:2006-09 IP6X satisfied
 Protecting against ingress of water according to DIN EN 60529/VDE 0470 Part 1:2006-09 IPX6 satisfied

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

There was no ingress of either dust or water.

VDE-Prüf- und Zertifizierungsinstitut
 Postfach 11 633

(Signature)
 Gerhard Biehl

VDE VERBAND DER ELEKTROTECHNIK
 ELEKTRONIK INFORMATIONSTECHNIK e.V.
 Fraubertweg VDE n. FN 60529 IP-Schutzartkde. Le-mail: vde-institut@vde.com

Training and Certification Institute
 Merxhausen 28
 D-43069 Offenbach

Training and Certification Institute
 ELEKTRONIK INFORMATIONSTECHNIK e.V.
 D-43069 Offenbach
 Fraubertweg VDE n. FN 60529 IP-Schutzartkde. Le-mail: vde-institut@vde.com

Test report for Information of the Applicant

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

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

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

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

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

1 Assignment

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

2 Samples

2.1 Type 3730 Positioner 2.2 Type 3731 Positioner



IECEX Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEX Scheme, visit www.iecex.com

Certificate No.: IECEX PTB 05.0008 Issue No.: 0

Status: Current Page 1 of 3

Date of Issue: 2005-02-21

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

Electrical Apparatus: HART capable positioner type 3730-31-
Optional accessory:

Type of Protection: General Requirements, Intrinsic Safety, Protection by Enclosure

Marking: Ex Ia IIC T6/T5T4
IP 54 and IP 65 T 80 °C

Approved for Issue on behalf of the IECEX
Certification Body

Position: Department Head 'Intrinsic Safety and Safety of
Systems'

Signature:
(by printed version)

Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEX Website.

Certificate issued by:

**Physikalisch-Technische
Bundesanstalt (PTB)**
Bundesallee 100
38116 Braunschweig
Germany



IECEX Certificate of Conformity

Certificate No.: IECEX PTB 05.0008 Issue No.: 0
Date of Issue: 2005-02-21 Page 2 of 3

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

Manufacturing location(s):

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

STANDARDS:

The electrical apparatus and any acceptable variations to it, specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2000

Edition: 3.1

IEC 60079-11 : 1999

Edition: 4

IEC 61211-14 : 1999

Edition: 2

Electrical apparatus for explosive gas atmospheres - Part 0: General requirements

Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'Y'

Electrical apparatus for use in the presence of combustible dust - Part 1-1: Electrical apparatus protected by enclosure and surface temperature limitation - Specification for apparatus

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

TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment subjected successfully met the examination and/or test requirements as recapped in

IECEX ATR: File Reference:

DEPTB06-005 502114

TRANSLATION

EC TYPE EXAMINATION CERTIFICATION

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

(2) EC Type Examination Certificate Number

(3) PTB 02 ATEX 2174

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

(5) Manufacturer: SAAMSON AG Mess- und Regellechnik

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

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

(8) The Physikalisch-Technische Bundesanstalt, notified body number 01 02, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report

PTB Ex 02-22832.

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

EN 50014: 1997

EN 50020: 1994

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

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Errors or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig
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PIB32-3730.doc

(11) According to the Directive 94/9/EC, this EC TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of the equipment.

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



Zertifizierungsstelle Explosionsschutz Braunschweig, 02. Dezember 2002
By order

(Signature) (Seal)

Dr. Ing. U. Johannmeyer
Regierungsdirktor

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PTB
Physikalisch-Technische Bundesanstalt
 Braunschweig und Berlin

(13) **Schedule**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 02 ATEX 2174**

(15) **Description of Equipment**

The HART® capable positioner Type 3720-31 is a single- or double-acting positioner with communication capability intended for attachment to all current linear or rotary actuators. It serves for adjusting valve stem position to the control signal.

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

The HART® capable positioner Type 3730-31 is a passive two-terminal network which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of U_i, I_i and P_i are not exceeded.

For instrument air non-combustible media are used.

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

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

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

Electrical data

Signal circuit (terminals 11/12)
 Type of protection: Intrinsic safety Ex i IIC only for connection to a certified intrinsically safe circuit

Maximum values:

- U = 28 V
- I_i = 115 mA
- P_i = 1 W
- C_i = 5.3 nF, L_i = negligible

EC Type Examination Certificates without signature and seal are invalid.
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Physikalisch-Technische Bundesanstalt
 Braunschweig und Berlin

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

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

Maximum values:

- U_i = 20 V
- I_i = 60 mA
- P_i = 250 mW
- C_i = 5.3 nF, L_i = negligible

Limit switch, inductive (terminals 41/42)

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

Maximum values:

- U_i = 16 V
- I_i = 52 mA
- P_i = 169 mW
- C_i = 60 nF, L_i = 200 µH, or
- U_i = 16 V
- I_i = 25 mA
- P_i = 64 mW
- C_i = 60 nF, L_i = 200 µH

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

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

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

- (16) Test Report: **PTB Ex.02-22323**
(17) **Special conditions for safe use**

Not applicable

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

In compliance with the standards specified above

Braunschweig, 02 December 2002

Zertifizierungsstelle Explosionschutz
By order

(Signature) (seal)

Dr.-Ing. U. Johannmeyer
Regierungsdirektor

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Pha32-3730.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Fault alarm output
(terminals 83/84)

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

Maximum values:

U = 20 V

I_i = 60 mA

P = 250 mW

C_i = 5.3 nF, L_i = negligible

Serial interface BU

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

U₀ = 7.88 V

I₀ = 61.8 mA

P₀ = 120 mW, Linear characteristic

C₀ = 0.65 µF, L₀ = 10 mH

only for connection to a certified intrinsically safe circuit

U_i = 1.6 V

I_i = 25 mA

P_i = 64 mW

C_i = negligible,

L_i = negligible

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

External position sensor
(analog p10, p11s, p5', p10,
p11)

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

U₀ = 7.88 V

I₀ = 61 mA

P₀ = 120 mW, Linear characteristic

C₀ = 0.66 µF, L₀ = 10 mH

C_i = 730 nF, L_i = 370 µH

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Pha32-3730.doc

TRANSLATION

ADDENDUM No.: 1

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

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

Description of the additions and modifications

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

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

Electrical data

Forced venting function
(terminal 81/82)
safe

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

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 500 mW
L_i negligible
C_i = 3.3 nF

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
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PH32-3730-31Add-1.doc

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

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

Test report: PTB EX 03-23171

Zertifizierungsstelle Explosionsschutz
By order Braunschweig, 18 June 2002

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirktor


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

PH32-3730-31Add-1.doc

ADDENDUM No.: 2

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


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

Description of the additions and modifications

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

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

The modifications relate to the internal and external design.

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

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PtB32Add2.doc

Electrical data

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

Maximum values:
U_i = 28 V
I_i = 115 mA
P_i = 1 W
Li negligible
Ci = 35 nF

Version 3730-1-1

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

Maximum values:
U_i = 28 V
I_i = 115 mA
P_i = 1 W
Li negligible
Ci = 5,3 nF

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

Test report: PTB Ex 04-23430
Zertifizierungsstelle Explosionsschutz
By order Braunschweig, 16 February 2004

(Signature) (Seal)

Dr. Ing. U. Gerlach

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PtB32Add2.doc

T R A N S L A T I O N
A D D E N D U M No. 3

According to Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 04 ATEX 2174

Equipment:

Model 37730-31 - HART Capable Positioner

Marking:

 H1.2 G EEx ia IIC T 6 or  H1.2 IP 65 T 80 °C resp.

Manufacturer:

SAMSON AG Mess- und Regeltechnik

Address:

Weissenfurterstrasse 3
60514 Frankfurt am Main, Germany

Description of the additions and modifications

The Model 37730 - 31, HART Capable Positioner is permitted to be manufactured in the future also in compliance with the documents specified in the test records included in the test report.

The technical data are modified as follows:

Forced ventilation
(terminals 81/82)

Type of protection: Intrinsic Safety EEx ia IIC

only for connection to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V

I_i = 115 mA

C_i = 5,3 nF

L_i negligible

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

Maximum values:

U_i = 30 V

I_i = 100 mA

C_i = 56,3 nF

L_i negligible

Addendum No. 3 to the EC Type Examination Certificate PTB 04 ATEX 2174

Version 3730-1,....1
(vibration sensor)

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

Maximum values:

U_i = 30 V

I_i = 100 mA

C_i = 5,3 nF

L_i negligible

All other electrical data and particulars specified in the EC Type Examination Certificate shall apply also to this Addendum No. 3.

Test report: **PTB Ex 07-27063**

Zertifizierungsstelle Explosionsschutz

By order

Braunschweig, 10 September 2007

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

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PTB21Ad3-3.doc

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PTB21Ad3-3.doc

Physikalisch Technische Bundesanstalt - Bundesallee 100 - D - 38116 Braunschweig

4th ADDENDUM
according to Directive 94/9/EC, Annex III, item 6
to the EC Type Examination Certificate PTB 02 ATEX 2174

Device: Type 3750-3 L...HART[®]-capable Positioner
Marking:  II 2G Ex ia IIC T6 or II 2D Ex td A21 IP 65 T80 °C
Manufacturer: SAMSON AG Mess- und Regeltechnik
Address: Weismüllerstraße 3, 60314 Frankfurt am Main, Germany

Description of additions and modifications

In the future, the Type 3750-3 L...HART[®]-capable Positioner may also be manufactured according to the certification documents listed in the test report.
The permissible ambient temperature range is extended.
The editions of standards are updated.
The following table lists the relation between the temperature classes and the permissible ambient temperature ranges:

Temperature class	Permissible ambient temperature range
T6	-55 °C to 60 °C
T5	-55 °C to 70 °C
T4	-55 °C to 80 °C

Electric data

Signal current circuit: in type of protection Ex ia IIC
(terminals 11/12) For connection to a certified intrinsically safe current circuit only

Max. values:
U_i = 28 V
I_i = 115 mA
P_i = 1 W
L_i negligible
C_i = 35 nF

4th Addendum to the EC Type Examination Certificate PTB 02 ATEX 2174

Version 3730-1...1 in type of protection Ex ia IIC
Position transmitter: For connection to a certified intrinsically safe current circuit only

Max. values:
U_i = 28 V
I_i = 115 mA
L_i negligible
C_i = 5,3 nF

Version 3730-1...1 in type of protection Ex ia IIC
(structure-borne sound sensor) For connection to a certified intrinsically safe current circuit only

Sensor connection (terminals 31/32)
Max. values:
U_i = 30 V
I_i = 100 mA
L_i negligible
C_i = 5,3 nF

Version 3730-1...1 in type of protection Ex ia IIC
(binary sensor) For connection to a certified intrinsically safe current circuit only

Binary input (terminals 31/32)
Max. values:
U_i = 30 V
I_i = 100 mA
P_i = 250 mW
L_i negligible
C_i = 56,3 nF

Software limit switches (terminals 41/42, 51/52) in type of protection Ex ia IIC
For connection to a certified intrinsically safe current circuit only

Max. values:
U_i = 20 V
I_i = 60 mA
P_i = 250 mW
L_i negligible
C_i = 5,3 nF

4th Addendum to the EC Type Examination Certificate PTB 02 ATEX 2174

Inductive limit switch..... in type of protection Ex ia IIC
For connection to a certified intrinsically safe
current circuit only

- Max. values:
 U_i = 16 V
 I_i = 52 mA
 P_i = 169 mW
 L_i = 200 µH
 C_i = 60 nF

or

- U_i = 16 V
 I_i = 25 mA
 P_i = 64 mW
 L_i = 200 µH
 C_i = 60 nF

The following table lists the relation between the temperature classes, the permissible ambient temperature ranges, the max. short-circuit currents and the max. capacity for evaluators:

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

Forced venting..... in type of protection Ex ia IIC
(terminals 8/182)

For connection to a certified intrinsically safe current circuit only

- Max. values:
 U_i = 28 V
 I_i = 115 mA
 L_i negligible
 C_i = 5.3 nF

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4th Addendum to the EC Type Examination Certificate PTB 02 ATEX 2174

Fault indication output..... in type of protection Ex ia IIC
For connection to a certified intrinsically safe current circuit only

- Max. values:
 U_i = 20 V
 I_i = 60 mA
 P_i = 250 mW
 L_i negligible
 C_i = 5.3 nF

Serial interface..... in type of protection Ex ia IIC
(programming socket B1)

- Max. values:
 U₀ = 7.88 V
 I₀ = 61.8 mA
 P₀ = 120 mW
 Linear characteristic
 L₀ = 10 mH
 C₀ = 0.65 µF

or

For connection to a certified intrinsically safe current circuit only

- Max. values:
 U_i = 16 V
 I_i = 25 mA
 P_i = 64 mW
 L_i negligible
 C_i negligible

When interconnecting, the rules for interconnecting intrinsically safe current circuits are to be observed.

External position sensor..... in type of protection Ex ia IIC
(analog PCB, pins p9, p10, p11)

- Max. values:
 U₀ = 7.88 V
 I₀ = 61 mA
 P₀ = 120 mW
 Linear characteristic

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[Translation of German original]

Physikalisch-Technische Bundesanstalt
Braunschweig and Berlin

[PTB logo]

4th Addendum to the EC Type Examination Certificate PTB 02.ATEX.2174

L₀ = 10 mH
L₀ = 0,66 mH
L₁ = 370 mH
C₁ = 730 nF

All other specifications for manufacture and operation mentioned in the statement of conformity are not affected by this addendum and remain valid without changes.

Referenced standards

EN 60079-0:2006 EN 60079-11:2007 EN 61241-0:2006 EN 61241-1:2004

Test report

PTB Ex 08-28327

Certification Body for Explosion Protection Braunschweig, 10 December 2008

O/o

[Signature Johannesmeyer, stamp: Physikalisch-Technische Bundesanstalt 56]

Dr.-Ing. U. Johannesmeyer
Director and Professor



TRANSLATION

Statement of Conformity

- (1) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**
- (2) EC Type Examination, Certificate Number
- (3) **PTB 03 ATEX 2180 X**
- (4) Equipment: Model 3730-38 HART-capable Positioner
- (5) Manufacturer: SAMSON AG Mess- und Regeltechnik
- (6) Address: Weismüllerstr. 3., 60314 Frankfurt am Main, Germany
- (7) The equipment and any acceptable variation thereof are specified in the schedule to this certificate and the documents referred to therein.
- (8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 according to Article 9 of the Council Directive 94/9/ 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 specified in Annex II to the Directive.

The examination and test results are recorded in confidential report.

PTB Ex 03-23301

(9) The essential health and safety requirements are satisfied by compliance with

EN 50021 : 1999

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

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

Statements of Conformity without signature and seal are invalid.
This Statement of Conformity is subject to change.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.



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



Zertifizierungsstelle Explosionschutz

By order

(Signature) (Seal)

Dr.-Ing. U. Lohmannsmeyer
Regierungsdirktor

Braunschweig,

Statements of Conformity without signature and seal are invalid.
This Statement of Conformity is subject to change.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

(13) **S c h e d u l e**

(14) **Statement of Conformity PTB 03 ATEX 21 80 X**

(15) **Description of Equipment**

The Model 3730-38... HART-capable Positioner is a single- or double-acting positioner with communication capability intended for attachment, to any current linear or rotary actuator. It serves for translating control signals into valve stem positions.

The Model 3730-38... version is capable of communicating according to the SSP and the HART protocol.

For instrument air non-combustible media are used.

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

The correlation between temperature classification and permissible temperature ranges is shown in the table below.

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

Electrical data

Signal circuit (terminals 11/12)	Type of protection EEx nA II
Software limit switch (terminals 41/42, 51/52)	Type of protection EEx nA II
Inductive limit switch (terminals 41/42)	Type of protection EEx nA II
Forced venting function (terminals 81/82)	Type of protection EEx nA II
Fault alarm output (terminals 83/84)	Type of protection EEx nA II
Serial interface adapter	Type of protection EEx nA II
External position sensor (analog board, pins p9, p10, p11)	Type of protection EEx nA II

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

(16) Test report **PTB Ex 03-29301**

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

The signal circuit (terminals 11/12) shall be protected by a fuse installed outside of the hazardous location. This fuse shall comply with IEC 60127-2/II, 250 V F, or with IEC 60127-2/VI, 250 T, with a fuse nominal current of $I_n \leq 63$ mA.

The serial interface adapter shall be preceded in the Vcc connection by a fuse in compliance with IEC 60127-2/II, 250 V F, or with IEC 60127-2/VI, 250 T, with a fuse nominal current of $I_n \leq 40$ mA.

The serial interface adapter shall be installed outside the hazardous location.

The Model 3730-38... HART-capable Positioner shall be mounted in an enclosure providing at least Degree of Protection IP 54 in compliance with the IEC Publication 60529. This requirement applies also to cable entries and/or cable couplers..

The wiring shall be connected in such a manner that the connection facilities are not subjected to pull and/or twisting.

(18) **Basis health and safety requirements**

Are satisfied by compliance with the standard specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig,


(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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**TRANSLATION
ADDENDUM No. 1**

to the Statement of conformity **PTB 03 ATEX 2180 X**

Equipment: Model 3730-38... HART capable Positioner
 Marking:  **Ex II 3G EEx nA II T6**
 Manufacturer: SAWSON AG, Mess- und Regeltechnik
 Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The Model 3730-38...HART capable Positioner is permitted in future to be also to energy-limited circuits with type of protection EEx nL IIC T6.

The correlation between temperature classification and permissible temperature ranges is shown in the table below.

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

The electrical data will be supplemented as follows:

Electrical data

Signal circuit (terminals 11/12) Type of protection **EEx nA II**
 or **EEx nL IIC**
 Maximum values
 $U_i = 30 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 1 \text{ W}$

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Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig
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 PtB32Em Add-1.doc

$C_i = 5.3 \text{ nF}$
 $I_i = \text{negligible}$
 Type of protection **EEx nA II**
 or **EEx nL IIC**
 Maximum values
 $U_i = 30 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 1 \text{ W}$

Position indicator (terminals 31/32)

$C_i = 5.3 \text{ nF}$
 $I_i = \text{negligible}$
 Type of protection **EEx nA II**
 or **EEx nL IIC**
 Maximum values
 $U_i = 20 \text{ V}$
 $I_i = 52 \text{ mA}$
 $P_i = 169 \text{ mW}$

Limit switch (inductive) (terminals 41/42)

$C_i = 60 \text{ nF}$
 $I_i = 100 \text{ }\mu\text{H}$
 or
 Maximum value
 $U_i = 20 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$
 $C_i = 60 \text{ nF}$
 $I_i = 100 \text{ }\mu\text{H}$

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

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

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 PtB32Em Add-1.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Limit switch (software)
(terminals 41/42; 51/52)

Type of protection EEx nA II
or
EEx nL IIC
Maximum values
U_i = 20 V
I_i = 60 mA
P_i = 400 mW
C_i = 5.3 nF
L_i = negligible

Forced venting function
(terminals 81/82)

Type of protection EEx nA II
or
EEx nL IIC
Maximum values
U_i = 30 V
I_i = 100 mA

C_i = 5.3 nF
L_i = negligible

Fault alarm output
(terminals 83/84)

Type of protection EEx nA II
or
EEx nL IIC
Maximum values
U_i = 20 V
I_i = 60 mA
P_i = 400 mW

C_i = 5.3 nF
L_i = negligible

Serial interface

Type of protection EEx nA II
or
EEx nL IIC
Maximum values (active)
U_i = 7.88 V
I_i = 62 mA
P_i = 120 mW

C_i = 0.62 µF
L_i = 10 mH

Maximum values
U_i = 20 V
I_i = 23 mA
P_i = 64 mW

C_i = negligible
L_i = negligible

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PTB

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

External position sensor


Type of protection EEx nA II
or
EEx nL IIC
Maximum values (active)
U_e = 7.88 V
I_e = 61 mA
P_e = 120 mW
C_e = 0.66 µF
L_e = 10 mH

Maximum values
U_i = 20 V
I_i = 25 mA
P_i = 64 mW

C_i = 730 nF
L_i = 370 µH

The equipment is mounted in a metallic enclosure which ensures at least degree of protection IP 54.

The marking of the Model 3730-3B HART capable positioner is complemented as follows:

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

The special conditions are complemented as follows:

All the other data apply unaltered also to this Addendum No. 1

Test report: PTB Ex-05-25053

Zertifizierungsstelle Explosionsschutz
By order Braunschweig, 26 April 2005

(Signature) (Seal)
Dr. Ing. U. Johannsmeyer
Regierungsdirktor

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

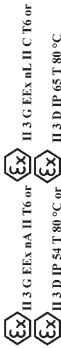
Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig
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TRANSLATION

ADDITION No. 2

to the Statement of Conformity PTB 03 ATEX 2180 X

Equipment: Model 3730-38... HART Capable Positioner

Marking: 

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weismüllerstraße 3
60314 Frankfurt am Main, Germany

Description of the additions and modifications

The Model 3730-38... HART Capable Positioner is permitted to be manufactured in the future also in compliance with the documents specified in the test records included in the test report.

The technical data are modified as follows:

Version 3730_8...1
(binary sensor)

Binary input
(terminals 31/32)

Type of protection EEx nA II
or
EEx nL II C

Maximum values:

U_i = 30 V
I_t = 100 mA

C_i = 56.3 nF
L_i = negligible

Version 3730_8...1
(vibration-sensor)

Type of protection EEx nA II
or
EEx nL II C

Maximum values:

U_i = 28 V
I_t = 115 mA

C_i = 5.3 nF
L_i = negligible

Page 1 of 2

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PTBEx a 1042.doc

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Addendum No. 2 to the Statement of Conformity PTB 03 ATEX 2180 X

The special conditions and all the other particulars shall apply also to this Addendum No. 2

Test report: PTB Ex 07-27064

Zertifizierungsstelle Explosionschutz

By order

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

Braunschweig, 10 September 2007

PTBEx a 1042.doc

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

T R A N S L A T I O N
(of German original)

3rd ADDENDUM
to Statement of Conformity PTB-03 ATEX 2180 X

Device: Type 3730-38... HART[®]-capable Positioner

Marking:  **II 3G Ex nA II T6 or  II 3D Ex II A22 IP 65 T80 °C**

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

Description of additions and modifications

In the frames the Type 3730-38... HART[®]-capable Positioner may also be manufactured according to the certification documents listed in the test report.

The permissible ambient temperature range is extended.

The editions of standards are updated.

The following table lists the relation between the temperature classes and the permissible ambient temperature ranges:

Temperature class	Permissible ambient temperature range
T6	-55 °C to 60 °C
T5	-55 °C to 70 °C
T4	-55 °C to 80 °C

Electric data

Signal current circuit: in type of protection Ex nA II
or Ex nL JIC

Max. values during operation:

- U_i = 30 V
- I_i = 100 mA
- P_i = 1 W
- C_i = 35 nF
- L_i negligible

Version 3730-38-1
Position indicator: in type of protection Ex nA II
or Ex nL JIC

Max. values during operation:

- U_i = 28 V
- I_i = 115 mA
- L_i Negligible

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PTBEx n. A03-3-06

Version 3730-38...I..... in type of protection Ex nA II
(structure-borne sound sensor) or Ex nL JIC

Sensor commission (terminals 31/32)

Max. values during operation:

- U_i = 30 V
- I_i = 100 mA
- L_i negligible
- C_i = 3,5 nF

Version 3730-38...I..... in type of protection Ex nA II
(binary sensor) or Ex nL JIC

Binary input (terminals 31/32)

Max. values during operation:

- U_i = 30 V
- I_i = 100 mA
- P_i = 250 mW
- L_i negligible
- C_i = 56,3 nF

Inductive limit switch: in type of protection Ex nA II
(terminals 41/42) or Ex nL JIC

Max. values during operation:

- U_i = 20 V
- I_i = 52 mA
- P_i = 169 mW
- L_i = 200 µH
- C_i = 60 nF

- or
- U_i = 20 V
- I_i = 2,5 mA
- P_i = 64 mW
- L_i = 200 µH
- C_i = 60 nF

The following table lists the relation between the temperature classes, the permissible ambient temperature ranges, the max. short-circuit currents and the max. capacity for evaluators:

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

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only without changes. The results laid down in this test report refer exclusively to the test object and the technical documentation submitted. Extracts or changes will require the approval of the Physikalisch-Technische Bundesanstalt.

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

PTBEx n. A03-3-06



Software limit switches..... in type of protection Ex nA II
(terminals 41/42, 51/52) or Ex nL IIC

Max. values during operation:

- U_i = 20 V
- I_i = 60 mA
- P_i = 400 mW
- C_i = 5.3 nF
- L_i negligible

Forced venting..... in type of protection Ex nA II
(terminals 81/82) or Ex nL IIC

Max. values during operation:

- U_i = 30 V
- I_i = 100 mA
- C_i = 5.3 nF
- L_i negligible

Fault indication output..... in type of protection Ex nA II
(terminals 83/84) or Ex nL IIC

Max. values during operation:

- U_i = 20 V
- I_i = 60 mA
- P_i = 60 mW
- C_i = 5.3 nF
- L_i negligible

Serial interface..... in type of protection Ex nA II
(programming socket BU) or Ex nL IIC

Max. values during operation (active):

- U_i = 7.88 V
- I_i = 62 mA
- P_i = 120 mW
- C_i = 0.65 nF
- L_i = 10 mH

Max. values during operation (passive):

- U_i = 20 V
- I_i = 25 mA
- P_i = 64 mW
- L_i negligible
- C_i negligible

Statements of Conformity with CE marking shall be filed. This Statement of Conformity may be reproduced only without changes. The results laid down in this test report are exclusively valid in the context and the technical document mentioned. Extracts or changes will require the approval of the Physikalisch-Technische Bundesanstalt.

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

PTB25 v. a. 0403-06c



External position sensor..... in type of protection Ex nA II
(analog PCB, pins p9, p10, p11) or Ex nL IIC

Max. values during operation (active):

- U_i = 7.88 V
- I_i = 61 mA
- P_i = 120 mW
- C_i = 0.66 nF
- L_i = 10 mH

Max. values during operation (passive):

- U_i = 20 V
- I_i = 25 mA
- P_i = 64 mW
- L_i = 370 mH
- C_i = 730 nF

All other specifications mentioned in the statement of conformity are not affected by this addendum and remain valid without changes.

Special conditions

If the signal current circuit is connected to a current circuit in type of protection Ex nL IIC, it is not necessary to connect a fuse in series.

If the position transmitter current circuit is connected to a current circuit in type of protection Ex nA II, a fuse according to IEC 60127-2/VI, 250 V T with a rated current of max. I_N < 40 mA is to be connected in series. The fuse is to be installed outside the hazardous area. If the position transmitter current circuit is connected to a current circuit in type of protection Ex nL IIC, it is not necessary to connect a fuse in series.

The manufacturer must ensure and document that the housing of the device, including all cable entries, complies with degree of protection IP 54 or IP 65 according to EN 60529, depending on the kind of application.

Referenced standards: EN 60779-1:5:2005

Test report: PTB Ex_08-285238

Certification Body for Explosion Protection

Braunschweig, 10 December 2008

[Signature: Johannsmeyer, stamp: Physikalisch-Technische Bundesanstalt 56]

Dr.-Ing. U. Johannsmeyer
Director and Professor

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only without changes. The results laid down in this test report are exclusively valid in the context and the technical document mentioned. Extracts or changes will require the approval of the Physikalisch-Technische Bundesanstalt.

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

PTB25 v. a. 0403-06c

Installation Manual for apparatus certified by CSA for use in hazardous locations.

Electrical rating of intrinsically safe apparatus, and apparatus for installation in hazardous locations.

Table 1: Maximum values

Circuit No.	Control signal	Position indicator	Forced venting function Solenoid valve	Limit switches		Fault signal
				Inductive	software	
	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U ₁ or V _{max}	28V	28V	28V	16V	20V	20V
I ₁ or I _{max}	115mA	115mA	115mA	2552 mA	60mA	60mA
P ₁ or P _{max}	1W	1W	500mW	64/168mW	250mW	250mW
C ₁	35nF	5.3nF	5.3nF	60nF	13.3nF	13.3nF
L ₁	0µH	0µH	0µH	100µH	0µH	0µH

Circuit	Serial interface BU		External position sensor	
	Connector	U ₀ or V _{cc}	U ₀ or V _{cc}	U ₀ or I _{sc}
U ₁ or V _{max}	16V	U ₀ or V _{cc}	7.88V	7.88V
I ₁ or I _{max}	25mA	I ₀ or I _{sc}	61.8mA	61mA
P ₁ or P _{max}	64mW	P ₀	120mW	120mW
C ₁	0nF	C ₀	0.65µF	C ₀ =730nF
L ₁	0µH	L ₀	10mH	L ₀ =370µH

Notes: Entity parameters must meet the following requirements:

U₀ or V_{cc} or V₁ ≤ U₁ or V_{max} / I₀ or I_{sc} or I₁ ≤ I₁ or I_{max} / P₀ or P_{max} ≤ P₁ or P_{max}
 C₀ ≥ C₁ + C_{able} and L₀ ≥ L₁ + L_{able}

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

Barrier circuit	Supply barrier			Evaluation barrier		
	V _{oc}	R _{min}	I _{sc}	V _{oc}	R _{min}	I _{sc}
circuit 2	≤28V	≥300Ω	≤115mA	≤28V	#	0mA
circuit 5	≤28V	≥382Ω	≤115mA	≤28V	#	0mA

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

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

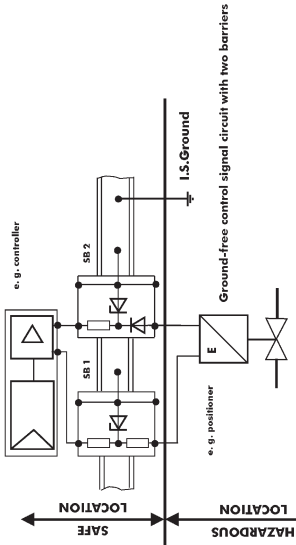
Table 4: For the Model 3730 – 331 ... Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-40°C ... 45°C	52mA
T5	-40°C ... 60°C	52mA
T4	-40°C ... 75°C	52mA
T6	-40°C ... 60°C	25mA
T5	-40°C ... 80°C	25mA
T4	-40°C ... 80°C	25mA

Intrinsically safe if installed as specified in manufacturer's installation manual.
CSA- certified for hazardous locations
Ex in IIC T6; Class I, Zone 0
Class I, Div. 1, Groups A, B, C, D,
Class II Div. 1, Groups E, F + G; Class III.
Type 4 Enclosure

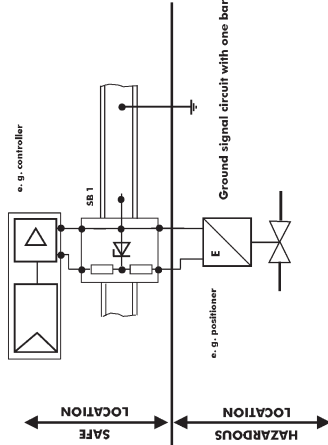
On interconnection to form ground- free signal circuits, only evaluation barriers must be installed in the return line. Correct polarity must be ensured.

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

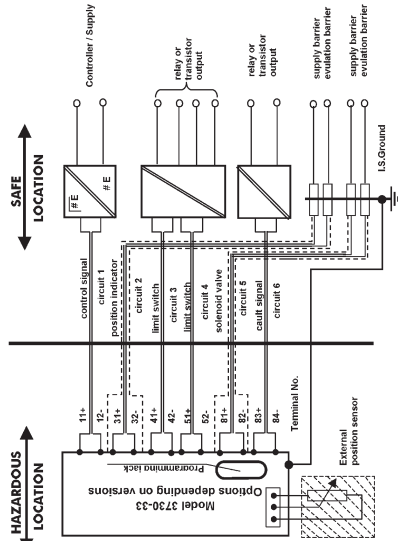


In grounded signal circuits with only one barrier, the return line must be grounded or included in the potential equalization network of the system.

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



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



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

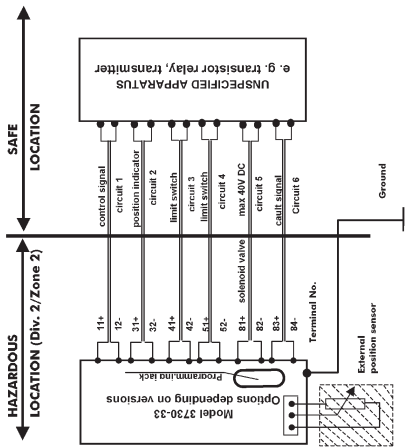
For the permissible maximum values for the intrinsically safe circuits 1, 3, 4 and 6 see Table 1
 For the permissible barrier parameters for the circuits 2 and 5 see Table 2
 Cable entry M 20 x 1,5 or metal conduit according to drawing No. 1050 - 0539 T
 or 1050 - 0540 T

CSA- certified for hazardous locations

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

Type 4 Enclosure

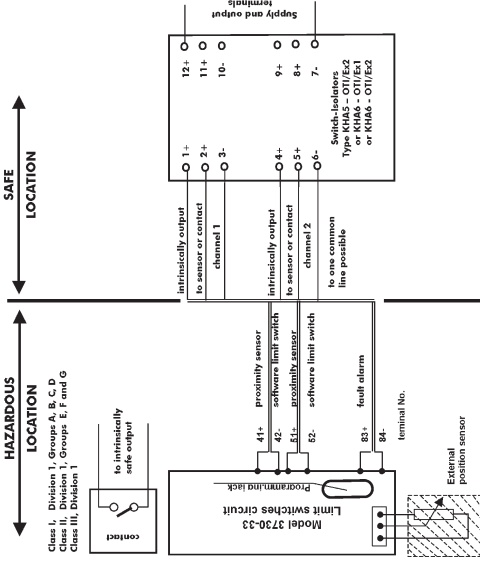
HART-capable positioner with position indicator, forced venting function (solenoid valve), fault signal and limit switches.



Notes:

- 1.) The installation must be in accordance with the Canadian Electrical Code, Part 1
- 2.) For the maximum values for the individual circuits see Table 1 and 2.
- 3.) The cables shall be protected by conduits.
- 4.) Cable entry only, rigid metal conduit according to drawing No. 1050-0539 T and 1050-0540 T

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



maximum capacitance of each inductive sensor 60nF
 maximum inductance of each inductive sensor 200µH

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

Control Relay Terminal No.	Groups	L [mH]	C [pF]	VOC [V]	Isc [mA]
1-3, 2-3	A + B	94,8	1,27	↔	↔
4-6, 5-6	C	299	3,82	12,9	19,8
	D	744	10,2	↔	↔

Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must extend as close to the terminals as possible. Install per C.T.C. Part 1.

Installation Manual for apparatus approved by FM for use in hazardous locations.
Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

Circuit No.	Control signal	Position Indicator	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
	1	2	5	3 and 4	3 and 4	6
Terminal No.	11 / 12	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U _{or} V _{max}	28V	28V	28V	16V	20V	20V
I _{or} I _{max}	115mA	115mA	115mA	2552 mA	60mA	60mA
P _{or} P _{max}	1W	1W	500mW	64/169 mW	250mW	250mW
C	35nF	5.3nF	5.3nF	60nF	13.4nF	13.4nF
Li	0µH	0µH	0µH	100µH	0µH	0µH

Circuit	Seal interface BU		External position sensor	
	Connector		Analog pcb pin p9, p10, p11	
U _{or} V _{max}	16V	U _{or} V _{cc}	7.88V	U _{or} V _{cc}
I _{or} I _{max}	25mA	I _{or} I _{sc}	61.8mA	I _{or} I _{sc}
P _{or} P _{max}	64mW	P _o	120mW	P _o
C _i	0nF	C _o	0.66µF	C _o
Li	0µH	L _o	10mH	L _o

Notes: Entity parameters shall meet the following requirements:

$$U_{or} V_{cc} \text{ or } V_i \leq U_{or} V_{max} / I_{or} \text{ or } I_{sc} \text{ or } I_i \leq I_{or} I_{max} / P_{or} \text{ or } P_{max} \leq P_i \text{ or } P_{max}$$

$$C_a \geq C_i \text{ Cable and } L_a \geq L_i + L_{cable}$$

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

Barrier	Supply barrier			Evaluation barrier		
	V _{oc}	R _{min}	I _{sc}	V _{oc}	R _{min}	I _{sc}
circuit 2	≤28V	≥196Ω	≤115mA	≤28V	#	0mA
circuit 5	≤28V	≥392Ω	≤115mA	≤28V	#	0mA

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

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

Table 4: For the Model 3720 – 321 ... Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current is shown in the table below:

Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-40°C ... 45°C	52mA
T5	-40°C ... 60°C	
T4	-40°C ... 75°C	
T6	-40°C ... 60°C	25mA
T5	-40°C ... 80°C	
T4	-40°C ... 80°C	

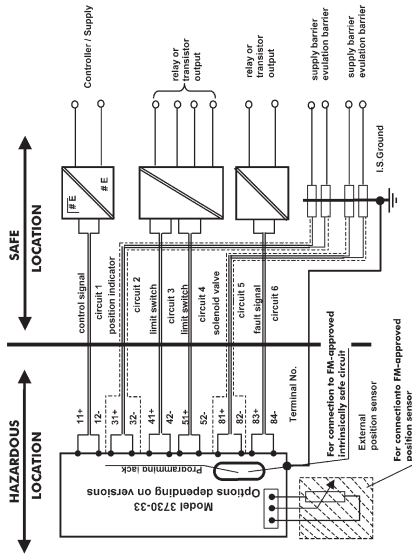
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Intrinsically safe if installed as specified in manufacturer's installation manual.
FM- approved for hazardous locations

Class I, Zone 0 A, Ex Ia IIC T6:
Class I, II, III, Div. 1, Groups A, B, C, D, E, F + G;
NEMA 4

Notes:

- 1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with FM/CSA approved apparatus. For maximum values of U_o or V_{max}; If or I_{max}; Pt or P_{max}; C_i and L_i of the various apparatus see Table 1 on page 7.
- 2.) For barrier selection see Table 2 on page 8.
- 3.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.
- 4.) Use only supply wires suitable for 5°C above surrounding temperature.



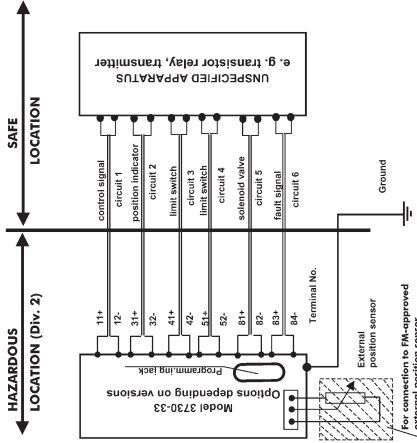
For the permissible maximum values for the intrinsically safe circuits 1,3,4 and 6 see Table 1
 For the permissible barrier parameters for the circuits 2 and 5 see Table 2
 Cable entry M 20 x 1,5 or metal conduit according to drawing No. 1050 – 0539 T
 or 1050 – 0540 T

FM- approved for hazardous locations

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

NEMA 4

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



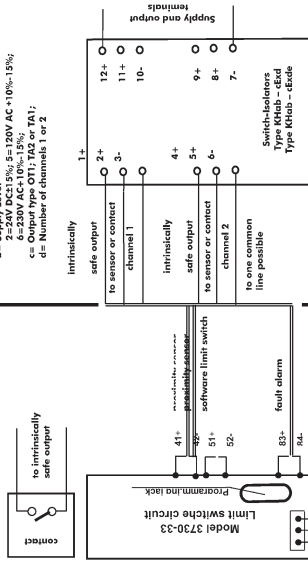
Notes:

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

Addendum Page 11
Installation drawing Control Relay KHab-cEx de Model 5J-b-N Proximity Sensors



Model designation code Type KHab-...cExd
 Terminals 1-3, 2-3, 4-6, 5-6
 a= Supply Voltage type A or D
 b= Supply Level
 c= Output type OT1; TAZ or TAI;
 d= Number of channels 1 or 2



Model designation code Type KHab-...cExd
 a= Supply Voltage type A or D
 a= AC, d= DC
 b= Supply Level
 b= 100%, f= 120V AC -10% -15%;
 b= 230V AC -10% -15%;
 c= Output type RTA / RW / SS1 / SS2 / RS1 /
 RS2 / RS3 / RS4 / RS5 / RS6
 d= Number of channels 1 or 2
 e= Power call designation, P, 2&P or 65.P
 (includes values in KHD2-EB-PB Power Feed
 (KHD2) or BHM)

maximum capacitance of each inductive sensor 60nF
 maximum inductance of each inductive sensor 200µH

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

Control Relay	L	C	V _{OC} [V]	I _{SC} [mA]	
				←	→
1-3; 2-3 4-6; 5-6	C	299	3,82	12,9	10,8
				D	744

Installation Manual for apparatus approved by FM for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

Circuit No.	Control signal	Position indicator	Forced venting function Solenoid valve	Limit switches		Fault signal
				inductive	software	
1	11 / 12	2	5	3 and 4	3 and 4	6
Terminal No.	31 / 32	81 / 82	41 / 42 and 51 / 52	41 / 42 and 51 / 52	41 / 42 and 51 / 52	83 / 84
U _{or} V _{max}	28V	28V	16V	20V	20V	20V
I _{or} I _{max}	115mA	115mA	25/52 mA	60mA	60mA	60mA
P _{or} P _{max}	1W	500mW	64/189mW	250mW	250mW	250mW
C	35nF	5.3nF	60nF	13.4nF	13.4nF	13.4nF
Li	0µH	0µH	100µH	0µH	0µH	0µH

Circuit	Serial interface BU		External position sensor	
	Connector	Analog pcb, pin p9, p10, p11	U _{or} V _{cc}	U _{or} V _{cc}
U _{or} V _{max}	16V	U _{or} V _{cc}	7.88V	7.88V
I _{or} I _{max}	25mA	I _{or} I _{cc}	61.8mA	61mA
P _{or} P _{max}	64mW	P _o	120mW	120mW
C _i	0nF	C _o	0.65µF	C _i =730nF
Li	0µH	L _o	10mH	L _i =370µH

Notes: Entity parameters shall meet the following requirements:

$$U_{or} V_{cc} \text{ or } V_i \leq U_{or} V_{Vmax} / I_{or} I_{cc} \text{ or } I_i \leq I_{or} I_{max} / P_{or} P_{max} \leq P_{or} P_{max}$$

$$C_i \geq C_i + C_{cable} \text{ and } L_i \geq L_i + L_{cable}$$

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

Barrier	Supply barrier				Evaluation barrier			
	V _{oc}	R _{min}	I _{sc}	P _{max}	V _{oc}	R _{min}	I _{sc}	Is _c
circuit 2	528V	≥198Ω	≤116mA	≤1W	528V	#	#	0mA
circuit 5	528V	≥392Ω	≤116mA	≤500mW	528V	#	#	0mA

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

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

Table 4: For the Model 3730 – 331 . . . Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current is shown in the table below:

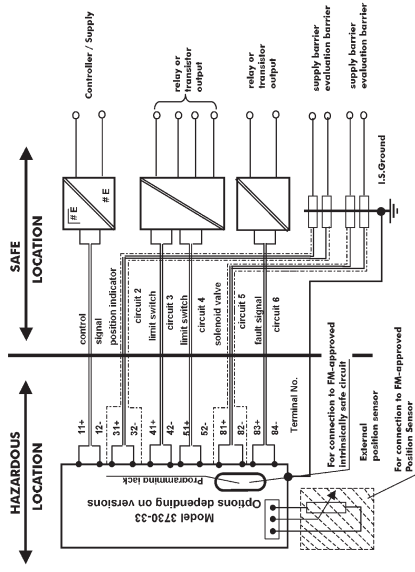
Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	-40°C ... 45°C	52mA
T5	-40°C ... 60°C	
T4	-40°C ... 75°C	
T6	-40°C ... 60°C	25mA
T5	-40°C ... 80°C	
T4	-40°C ... 80°C	

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

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

NEMA 4X

- Notes:**
- 1.) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with FM/CSA approved apparatus. For maximum values of U_o or V_{max} , I_o or I_{max} , P_o or P_{max} ; C and L_i of the various apparatus see Table 1 on page 7.
 - 2.) For barrier selection see Table 2 on page 8.
 - 3.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.
 - 4.) Use only supply wires suitable for 5°C above surrounding temperature.



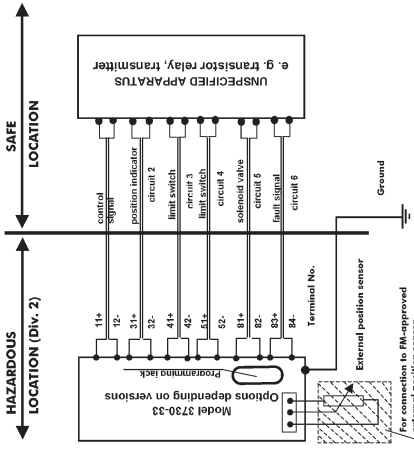
For the permissible maximum values for the intrinsically safe circuits 1, 3, 4 and 6 see Table 1
 For the permissible barrier parameters for the circuits 2 and 5 see Table 2
 Cable entry M 20 x 1.5 or metal conduit according to drawing No. 1050 – 0539 T
 or 1050 – 0540 T

FM- approved for hazardous locations

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

NEMA 4X

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



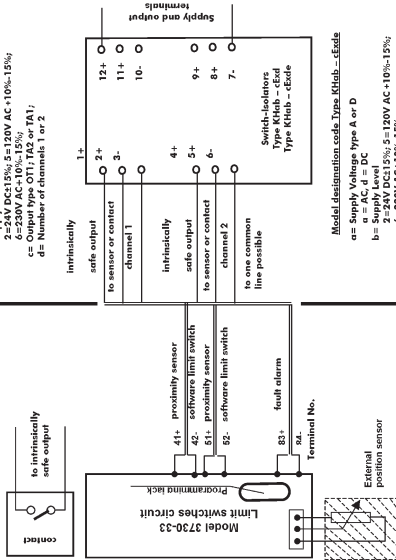
- Notes:**
- 1.) The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70
 - 2.) For the maximum values for the individual circuits see Table 1
 Cable entry only rigid metal conduit

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Installation drawing Control Relay KHab--Ex de Model SJ-b-N Proximity Sensors

← HAZARDOUS LOCATION SAFE LOCATION →

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

Model designation code Type KHab...eEd
Terminals 1, 2, 3, 4, 5, 6, 6+, 7, 8, 9, 10, 11, 12
a = AC, d = DC
b = Supply Level
c = Output type OT1; TA2 or TA1;
d = Number of channels 1 or 2



Model designation code Type KHab...eEd
a = Supply Voltage type A or D
b = AC, d = DC
c = Output type OT1; TA2 or TA1;
d = Number of channels 1 or 2

maximum capacitance of each inductive sensor 60nF
maximum inductance of each inductive sensor 200µH

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

Control Relay Terminal No.	Groups	L [mH]	C [µF]	VOC [V]	I _{SC} [mA]
1-3, 2-3	A + B	84,8	1,27	←	←
	C	299	3,82	12,9	19,9
4-6, 5-6	D	744	10,2	→	→

Revision Control Number: 2 Nov. 04

Addendum to EB 6384-3EN



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