Series 3730
Electropneumatic Positioner
Type 3730-6

with HART® communication and pressure sensors

Mounting and
Operating Instructions

EB 8384-6 EN (1300-1623)
Firmware version 1.01
Edition February 2012
Definitions of the signal words used in these instructions

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

---

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

---

**NOTICE**
indicates a property damage message.

---

**Note:** Supplementary explanations, information and tips
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1 Important safety instructions

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

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

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

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

- Proper shipping and appropriate storage are assumed.
- Do not ground electric welding equipment near to the positioner.

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.
### Article code

### Positioner

With HART® communication and pressure sensors

<table>
<thead>
<tr>
<th>Type</th>
<th>3730-6-xxxxxx x 0 x 0 x 0 0</th>
</tr>
</thead>
</table>

### Explosion protection

ATEX: II 2G Ex ia IIC/IIB T6; II 2D Ex tb IIC T6 IP 66

IECEx: Ex ia IIC/IIB T6; Ex d[ia] IIC/IIB T6; Ex tD A21 IP 66 T 80°C

GOST: IEx ia IIC T6 X, DIP A21 Ta80°C, IP 66

ATEX: II 3G Ex nA II T6; II 3G Ex ic IIC/IIB T6; II 3D Ex tc IIIC T 80°C IP 66

IECEx: Ex nA II T6; Ex nL IIC/IIB T6; Ex tD A22 IP 66 T 80°C

GOST: Ex nA II T6, Ex nL IIC T6, DIP A22 Ta80°C, IP 66

### Options (additional equipment)

<table>
<thead>
<tr>
<th>Inductive limit switch</th>
<th>Without</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With SJ2-SN</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>With SJ2-S1N</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Venting function</th>
<th>Without</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solenoid valve 24 V DC</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Forced venting 24 V DC</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional equipment</th>
<th>Without</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Position transmitter</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Leakage sensor</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Binary input</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External position sensor</th>
<th>Without</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including 10 m connecting cable</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Prepared for connection, without sensor</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emergency shutdown</th>
<th>3.8 mA</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.4 mA</td>
<td>1</td>
</tr>
</tbody>
</table>

### Housing material

| Standard aluminum | 1 |
| Stainless steel 1.4581 | 2 |

### Special applications

| None | 0 |
| Compatible with paint | 1 |
| Exhaust air connection with ¼–18 NPT thread, back of positioner housing sealed | 2 |
| Attachment according to VDI/VDE 3847 | 6 |
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 electronics 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 valve position ($x$) is transmitted as a linear travel motion or an angle of rotation by the 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 valve position to the 4 to 20 mA DC control signal supplied by the controller after it has been converted by the A/D converter (4). In case of a system deviation, the actuator (1) is either vented or filled with more air by changes to the i/p converter (6). This causes the valve plug to adopt the position corresponding to the reference variable ($w$).

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. Both pressure sensors (23 and 24) monitors the supply pressure $p_s$ and the signal pressure $p_{out}$.

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

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

- Direct attachment to SAMSON
  - Type 3277 Actuator: Section 4.1
- Attachment to actuators 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
Design and principle of operation

1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13* Analog position transmitter or binary input
14 Software limit switches A1/A2
15 Fault alarm output A3
16 LCD
17* Solenoid valve control
18* Galvanic isolation
19 D/A converter
20 Communication interface
21 HART® modulation
22* Binary input BE
23 Pressure sensor for supply pressure p_s
24 Pressure sensor for signal pressure p_out
25* Forced venting
* Option

Fig. 2 · Functional diagram

\[ x^{11} \text{ depending on version} \]
\[ > 3.8 \text{ mA} \]
\[ > 4.4 \text{ mA} \]
3.1 Safety function (SIL)

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

**Monitoring of the input signal**

The i/p converter is switched off when the input signal of the positioner at terminals +11/–12 falls below 3.8 mA or 4.4 mA depending on the positioner version (a signal range of 4 to 20 mA is required). See Fig. 18 on page 48.

**Monitoring the voltage supply** (version with forced venting and solenoid valve)

The i/p converter and the solenoid valve (when installed) are shut down whenever the voltage at terminals +81/–82 falls below 12 V (an input voltage of 24 V DC is required). See Fig. 18 on page 48.

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

If required, the user can check the safety function using the software. For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.

3.2 Valve diagnostics

The EXPERTplus valve diagnostics are integrated into the positioner. They provide information on the valve condition (see Table 1) and generate status messages to quickly pinpoint faults.

For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.

3.3 Flow rate calculation

Due to the differential pressure measurement $\Delta p$ out, EXPERTplus is able to calculate the flow rate in a SAMSON Type 3241 or Type 3251 Valve, provided all the parameters regarding the medium and the process have been defined in the positioner.

For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.
### Table 1: Diagnostic functions and diagnosis,
(refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics for more details)

<table>
<thead>
<tr>
<th>Diagnostic function</th>
<th>Control valve</th>
<th>On/off valve</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data logger</td>
<td>•</td>
<td>•</td>
<td>Depending on trigger condition selected</td>
</tr>
</tbody>
</table>
| Valve signature     | •             | ☒            | – Friction  
|                     |               |              | – Supply pressure  
|                     |               |              | – Actuator springs  
|                     |               |              | – Pneumatic leakage |
| On/off valve        | –             | •            | – Breakaway time  
|                     |               |              | – Transit time  
|                     |               |              | – Final travel/angle value |
| Valve position histo- | •             | ☒            | – Course of the manipulated variable range  
| gram                |               |              | – Manipulated variable range |
| Set point deviation | •             | •            | – Manipulated variable range limitation  
| histogram           |               |              | – Seat leakage  
|                     |               |              | – Positioner-valve linkage  
|                     |               |              | – Max. set point deviation |
| Cycle counter histo- | •             | •            | – Packing leakage  
| gram                |               |              | – Dynamic load factor |
| Leakage sensor      | •             | •            | – Seat leakage |
| Course of end posi- | •             | •            | – Course of end position  
| tion                |               |              | – Zero point shift |
| **Dynamic tests**   |               |              |           |
| Valve dead band     | •             | •            | – Dead band |
| Partial stroke test | •             | •            | – Overshooting  
| (PST)               |               |              | – Dead time  
|                     |               |              | – T86  
|                     |               |              | – Settling time |
| Full stroke test (FST) | •            | •            | – Overshooting  
|                     |               |              | – Dead time  
|                     |               |              | – T86  
|                     |               |              | – Settling time |

- Full scope of functions
- Function is performed, but not analyzed
- Function is not performed
3.4 Type of application

There are two different types of application: Control valve and On/off valve. The automatic mode (AUTO) and manual mode (MAN) can be selected in both types of applications.

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

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. See Table 1.
- Section 7.8 contains details on discrete analysis of on/off valves.
- In manual mode, an on/off valve can be moved past 100 % of the nominal range (with the closed position for ATO) or below 0 % of the nominal range (with the closed position for ATC). See section 7.1 for valve closed position.

3.5 Communication

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

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

3.5.1 Configuration using TROVIS-VIEW 4

The positioner can be configured using the TROVIS-VIEW 4 software for configuration and operation. 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 4 software enables the user to easily set parameters in the positioner and view process parameters online.

Note: TROVIS-VIEW 4 is a free software which can be downloaded from the SAMSON website (www.samson.de > Services > Software > TROVIS-VIEW).
3.6 Additional equipment

Inductive limit switch

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

Solenoid valve

If the operating voltage for the solenoid valve (12) falls under 12 V, the supply pressure for the i/p converter (6) 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. In manual mode, the manual set point is reset to 0 %. A different manual set point must entered again.

Forced venting

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

Analog position transmitter

The position transmitter (13) is a two-wire transmitter and issues the travel sensor signal as a 4 to 20 mA signal processed by the microcontroller. Since this signal is issued independent of the positioner’s input signal, the momentary travel/angle of rotation is controlled in real-time. Additionally, the position transmitter allows positioner faults to be indicated over a signal current of < 2.4 mA or > 21.6 mA.

Leakage sensor

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

Binary input

The optional binary input can be configured:
- To connect a floating contact
- To connect a non-floating contact (0 to 24 V DC)

By selecting a certain function, one of the following actions can be activated:
- Transmit switching state
- Activate local write protection
  After the first initialization, a local write protection can be activated. While the binary input is active, no settings can be changed at the positioner. The positioner cannot be re-initialized. Configuration enabling over Code 3 is not active (\(\varphi^0\)).
- Start PST
  The positioner start a single partial stroke test. The test is performed with the settings in Code 49 - d2 to Code 49 - d9
  (refer to Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics).
- Move valve to safety set point
  An on/off valve moves to the predeter-
mined safety set point when the positioner is in automatic mode (AUTO). This function is not performed in the manual mode (MAN) or fail-safe position mode (SAFE).

- **Switch AUTO/MANUAL**
  The positioner changes from the automatic mode (AUTO) to the manual mode (MAN) or vice versa. This function is not performed if the positioner is in the fail-safe position mode (SAFE).

- **Start data logger**
  The data logger starts recording when the binary input is activated (refer to Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics).

- **Reset diagnostics**
  Active tests and monitoring are stopped and the diagnostic data is reset once.

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

- **External solenoid valve**
  The voltage for an external solenoid valve is connected in parallel to terminals +81/–82. This allows the switching state of the solenoid valve to be monitored.

---

**Note:** The optional binary input can only be configured using the operator software e.g. TROVIS-VIEW 4. The switching state is transmitted when the switch is closed by default.

---

**External position sensor**
In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve. The connection of controlled variable (x) and output variable (y) signals to the valve is established by cable and piping for air.
### 3.7 Technical data

**Type 3730-6 Positioner (technical data in test certificates additionally apply for explosion-protected devices)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel, adjustable</td>
<td>Direct attachment to Type 3277: 3.6 to 30 mm</td>
</tr>
<tr>
<td></td>
<td>Attachment acc. to IEC 60534-6: 3.6 to 200 mm</td>
</tr>
<tr>
<td></td>
<td>Rotary actuators: 24° to 100°</td>
</tr>
<tr>
<td>Travel range</td>
<td>Adjustable within the initialized travel/angle of rotation</td>
</tr>
<tr>
<td></td>
<td>Travel can be restricted to $\frac{1}{2}$ at the maximum</td>
</tr>
<tr>
<td>Ref. variable w Signal range</td>
<td>4 to 20 mA · Two-wire unit with reverse polarity protection · Min. span 4 mA</td>
</tr>
<tr>
<td></td>
<td>Static destruction limit limit 30 V</td>
</tr>
<tr>
<td>Minimum current</td>
<td>3.6 mA for display · Emergency venting at $\leq 3.8$ mA</td>
</tr>
<tr>
<td>Load impedance</td>
<td>$\leq 9.2$ V (corresponding to $460 \Omega$ at 20 mA)</td>
</tr>
<tr>
<td>Supply air</td>
<td>Supply pressure 1.4 to 7 bar (20 to 105 psi)</td>
</tr>
<tr>
<td></td>
<td>Air quality ISO 8573-1 (2001-02) 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</td>
</tr>
<tr>
<td>Signal pressure (output)</td>
<td>0 bar up to the capacity of supply pressure · Limitable between 1.4 and 7.0 bar by software</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Adjustable Linear, equal percentage, reverse equal percentage, user-defined (by software) Butterfly, rotary plug and segmented ball valves: linear/equal percentage</td>
</tr>
<tr>
<td>Deviation</td>
<td>$\leq 1%$</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>$\leq 0.3%$</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>$\leq 0.1%$</td>
</tr>
<tr>
<td>Transit time</td>
<td>Separately adjustable up to 240 seconds for supply air and exhaust air by software</td>
</tr>
<tr>
<td>Direction of action</td>
<td>Reversible</td>
</tr>
<tr>
<td>Air consumption, steady state</td>
<td>Independent from supply pressure approx. 110 l/h</td>
</tr>
<tr>
<td>Actuator pressurized</td>
<td>At $\Delta p = 6$ bar: 8.5 $m^3/h$ · At $\Delta p = 1.4$ bar: 3.0 $m^3/h$ · $K_{V_{max}} (20 , ^\circ C) = 0.09$</td>
</tr>
<tr>
<td>Actuator vented</td>
<td>At $\Delta p = 6$ bar: 14.0 $m^3/h$ · At $\Delta p = 1.4$ bar: 4.5 $m^3/h$ · $K_{V_{max}} (20 , ^\circ C) = 0.15$</td>
</tr>
<tr>
<td>Permissible ambient temperature</td>
<td>$-20$ to $+80 , ^\circ C$ for all versions</td>
</tr>
<tr>
<td></td>
<td>$-45$ to $+80 , ^\circ C$ with metal cable gland</td>
</tr>
<tr>
<td></td>
<td>$-25$ to $+80 , ^\circ C$ with inductive limit switch (SJ2-S1N) and metal cable gland</td>
</tr>
<tr>
<td></td>
<td>Limits in test certificate additionally apply for explosion-protected devices</td>
</tr>
<tr>
<td>Influences</td>
<td>Temperature $\leq 0.15 % / 10 , ^\circ K$</td>
</tr>
<tr>
<td></td>
<td>Supply air None</td>
</tr>
<tr>
<td></td>
<td>Vibration $\leq 0.25$ % up to 2000 Hz and 4 g acc. to IEC 770</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>Complying with requirements of EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21</td>
</tr>
</tbody>
</table>
## Design and principle of operation

**Type 3730-6 Positioner** (technical data in test certificates additionally apply for explosion-protected devices)

<table>
<thead>
<tr>
<th>Electrical connections</th>
<th>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 mm² wire cross-section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection</td>
<td>IP 66/NEMA 4X</td>
</tr>
</tbody>
</table>
| Use in safety-instrumented systems in compliance with IEC 61508/SIL | **Suitable for use in safety-instrumented systems up to SIL 2**  
- triggered by the set point, emergency venting at ≤ 3.8 mA or ≤ 4.4 mA depending on the positioner version  
- by the optional forced venting, emergency venting at ≤ 12 V  
**Suitable for use in safety-instrumented systems up to SIL 3**  
The current circuit of the set point and the forced venting must both be operated in a safety-related system |
| Communication | Local SAMSON SSP interface and serial interface adapter  
Software requirement (SSP): TROVIS-VIEW with database module 3730-6 |
| HART® | HART® field communication protocol  
Impedance in HART frequency range: receive 350 to 450 Ω, send: approx. 155 Ω  
Software requirements (handheld communicator): device description for Type 3730-6  
Software requirements (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) |
| Explosion protection | ATEX Type 3730-6-110: II 2G Ex ia IIC/IIB T6; II 2D Ex tfb IIC T6 IP 66  
Type 3730-6-810: II 3G Ex na II T6; II 3G Ex ic IIC/IIB T6; II 3D Ex tc IIC T 80 °C IP 66  
IECEx Type 3730-6-111: Ex ia IIC/IIB T6; Ex d [ia] IIC/IIB T6; Ex td A21 IP 66 T 80 °C  
Type 3730-6-811: Ex na II T6; Ex nl IIC/IIB T6; Ex td A22 IP 66 T 80 °C  
GOST Type 3730-6-113: 1Ex ia IIC T6 X, DIP A21 Ta80°C, IP 66  
Type 3730-6-813: Ex na II T6, Ex nl IIC T6, DIP A22 Ta80°C, IP 66 |
| Binary contacts | 2 software limit switches, reverse polarity protection, floating, configurable switching characteristics (default settings according to table)  
Signal status | No response | ≤ 1.2 mA  
| | Response | ≥ 2.1 mA  
| 1 fault alarm contact, floating  
| Signal status | No response/No alarm | ≥ 2.1 mA  
| | Response/Fault alarm | ≤ 1.2 mA  
For connection to NAMUR switching amplifier acc. to EN 60947-5-6 |
| Materials | Housing Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706, chromated and powder paint coated · Special version: Stainless steel 1.4581  
External parts Stainless steel 1.4571 and 1.4301  
Cable gland Polyamide, black, M20 x 1.5  
Weight Approx. 1.0 kg |
### Options for Type 3730-6 Positioner

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inductive limit switch</strong></td>
<td>For connection to switching amplifier acc. to EN 60947-5-6. Can be used in combination with a software limit switch.</td>
</tr>
<tr>
<td><strong>SJ2-SN proximity switch</strong></td>
<td>NAMUR NC contact</td>
</tr>
<tr>
<td><strong>SJ2-S1N proximity switch</strong></td>
<td>NAMUR NO contact</td>
</tr>
<tr>
<td><strong>Solenoid valve</strong></td>
<td>Approval acc. to IEC 61508/SIL</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>24 V DC reverse polarity protection, static destruction limit 40 V</td>
</tr>
<tr>
<td></td>
<td>Current consumption $I = \frac{U - 5.7 V}{3840 \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)</td>
</tr>
<tr>
<td><strong>Signal &quot;0&quot; no pick-up</strong></td>
<td>$\leq 12$ V</td>
</tr>
<tr>
<td><strong>Signal &quot;1&quot; safe pick-up</strong></td>
<td>$&gt; 19$ V</td>
</tr>
<tr>
<td><strong>Service life</strong></td>
<td>$&gt; 5 \times 10^6$ switching cycles</td>
</tr>
<tr>
<td><strong>Use in safety-instrumented systems in compliance with IEC 61508/SIL</strong></td>
<td>Suitable for use in safety-instrumented systems up to SIL 2</td>
</tr>
<tr>
<td></td>
<td>– triggered by the set point, emergency venting at $\leq 3.8$ mA or $\leq 4.4$ mA depending on the positioner version</td>
</tr>
<tr>
<td></td>
<td>– by the optional forced venting, emergency venting at $\leq 12$ V</td>
</tr>
<tr>
<td><strong>Suitable for use in safety-instrumented systems up to SIL 3</strong></td>
<td>The current circuit of the set point and the forced venting must both be operated in a safety-related system</td>
</tr>
<tr>
<td><strong>Forced venting</strong></td>
<td>Approval acc. to IEC 61508/SIL</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>24 V DC reverse polarity protection, static destruction limit 40 V</td>
</tr>
<tr>
<td></td>
<td>Current consumption $I = \frac{U - 5.7 V}{3840 \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)</td>
</tr>
<tr>
<td><strong>Signal &quot;0&quot; no pick-up</strong></td>
<td>$\leq 12$ V</td>
</tr>
<tr>
<td><strong>Signal &quot;1&quot; safe pick-up</strong></td>
<td>$&gt; 19$ V</td>
</tr>
<tr>
<td><strong>Use in safety-instrumented systems in compliance with IEC 61508/SIL</strong></td>
<td>Suitable for use in safety-instrumented systems up to SIL 2</td>
</tr>
<tr>
<td></td>
<td>– triggered by the set point, emergency venting at $\leq 3.8$ mA or $\leq 4.4$ mA depending on the positioner version</td>
</tr>
<tr>
<td></td>
<td>– by the optional forced venting, emergency venting at $\leq 12$ V</td>
</tr>
<tr>
<td><strong>Suitable for use in safety-instrumented systems up to SIL 3</strong></td>
<td>The current circuit of the set point and the forced venting must both be operated in a safety-related system</td>
</tr>
<tr>
<td><strong>Analog position transmitter</strong></td>
<td>Two-wire transmitter · Galvanically isolated</td>
</tr>
<tr>
<td><strong>Supply voltage</strong></td>
<td>12 to 30 V DC · Reverse polarity protection · Static destruction limit 40 V</td>
</tr>
<tr>
<td><strong>Output signal</strong></td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td><strong>Direction of action</strong></td>
<td>Reversible</td>
</tr>
<tr>
<td><strong>Operating range</strong></td>
<td>$-10$ to $+114$ %</td>
</tr>
<tr>
<td><strong>Characteristic</strong></td>
<td>Linear</td>
</tr>
<tr>
<td><strong>Hysteresis and HF influence or other influences</strong></td>
<td>Same as positioner</td>
</tr>
<tr>
<td><strong>Fault indication</strong></td>
<td>Can be issued with current signal $2.4 \pm 0.1$ mA or $21.6 \pm 0.1$ mA</td>
</tr>
</tbody>
</table>
### Design and principle of operation

#### Options for Type 3730-6 Positioner

**Binary input** · Galvanically isolated · Switching behavior configured over software

**Active switching behavior (default setting)**

<table>
<thead>
<tr>
<th>Connection</th>
<th>For external switch (floating contact) or relay contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical data</strong></td>
<td>Open-circuit voltage when contact is open: max. 10 V, pulsed DC current with peak value of 100 mA and RMS current 0.01 mA when the contact is closed</td>
</tr>
<tr>
<td><strong>Contact</strong></td>
<td>Closed, R &lt; 20 Ω  Switching state ON (default)</td>
</tr>
<tr>
<td></td>
<td>Open, R &gt; 400 Ω  Switching state OFF (default)</td>
</tr>
</tbody>
</table>

**Passive switching behavior**

<table>
<thead>
<tr>
<th>Connection</th>
<th>For externally applied DC voltage, reverse polarity protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical data</strong></td>
<td>3 to 30 V  Destruction limit: 40 V  Current draw at 24 V: 3.7 mA</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>&gt; 6 V  Switching state ON (default)</td>
</tr>
<tr>
<td></td>
<td>&lt; 1 V  Switching state OFF (default)</td>
</tr>
</tbody>
</table>

#### 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 |
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 2 to 6 (pages 41 to 43) to mount the positioner. Observe the type of attachment!
- Observe the assignment between lever and pin position (see travel tables on page 21)!

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

The travel tables on page 21 show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is additionally restricted by the selected fail-safe position and the required compression of the actuator springs.

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

NOTICE
The lever must be held stationary in the mid position while undoing or fastening the nut to ensure that the lever does not move to one of the end stops.
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 4 on page 42).

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

<table>
<thead>
<tr>
<th>Actuator size [cm²]</th>
<th>Rated travel [mm]</th>
<th>Adjustment range at positioner</th>
<th>Required lever</th>
<th>Assigned pin position</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>7.5</td>
<td>5.0 to 25.0</td>
<td><em>M</em></td>
<td>25</td>
</tr>
<tr>
<td>120/240/350</td>
<td>15</td>
<td>7.0 to 35.0</td>
<td><em>M</em></td>
<td>35</td>
</tr>
<tr>
<td>355/700</td>
<td>30</td>
<td>10.0 to 50.0</td>
<td><em>M</em></td>
<td>50</td>
</tr>
</tbody>
</table>

Attachment according to IEC 60534-6 (NAMUR)

<table>
<thead>
<tr>
<th>SAMSON valves/Type 3271 Actuator</th>
<th>Other valves/actuators</th>
<th>Required lever</th>
<th>Assigned pin position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator size [cm²]</td>
<td>Rated travel [mm]</td>
<td>min. Travel max.</td>
<td></td>
</tr>
<tr>
<td>60 and 120 with Type 3510 Valve</td>
<td>7.5</td>
<td>3.6 to 18.0</td>
<td><em>S</em></td>
</tr>
<tr>
<td>120</td>
<td>7.5</td>
<td>5.0 to 25.0</td>
<td><em>M</em></td>
</tr>
<tr>
<td>120/240/350</td>
<td>15</td>
<td>7.0 to 35.0</td>
<td><em>M</em></td>
</tr>
<tr>
<td>700</td>
<td>7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>15 and 30</td>
<td>10.0 to 50.0</td>
<td><em>M</em></td>
</tr>
<tr>
<td>1000/1400/2800</td>
<td>30</td>
<td>14.0 to 70.0</td>
<td><em>L</em></td>
</tr>
<tr>
<td>1000/1400/2800</td>
<td>60</td>
<td>20.0 to 100.0</td>
<td><em>L</em></td>
</tr>
<tr>
<td>1400/2800</td>
<td>120</td>
<td>40.0 to 200.0</td>
<td><em>XL</em></td>
</tr>
</tbody>
</table>

Attachment to rotary actuators according to VDI/VDE 3845

<table>
<thead>
<tr>
<th>Rotary actuators</th>
<th>Required lever</th>
<th>Assigned pin position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Opening angle Max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>100°</td>
<td><em>M</em></td>
</tr>
</tbody>
</table>
4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 2 on page 41 for the required mounting parts and accessories. 
Note the travel table on page 21!

Actuator with 120 cm²

1. Mount connecting plate (9) on the actuator.
2. 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.
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 connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever M (1) on the back of the positioner in the pin position 35 (delivered state).
   **7.5 mm travel:** Remove the follower pin (2) from the pin position 35, reposition it in the bore for pin position 25 and screw tight.
6. Insert formed seal (15) in the groove of the positioner housing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 21 on page 53).
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.
9. Connect output (38) over the piping/tubing to the connecting plate on the actuator (9).

**NOTICE**
The signal pressure output at the back is not used in the Type 3730-6 (see EB 8384-0 to -5 EN).
Attachment to the control valve – Mounting parts and accessories

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

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
5 Stopper
6 Connecting plate
6.1 Seal rings

7 Pressure gauge bracket
8 Pressure gauge mounting kit
9 Connecting plate for actuator
10 Cover plate
11 Cover
14 Gasket
15 Formed seal

Note:
Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.
4.1.2 Type 3277 Actuator

Refer to Table 3 on page 42 or the required mounting parts and the accessories.
Note the travel table on page 21!

Actuators with 240 to 700 cm²

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

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.

2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.

3. For actuators with 355/700 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 15 mm travel, the follower pin (2) remains in pin position 35.

4. Insert formed seal (15) in the groove of the positioner housing.

5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 21 on page 53).

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.
Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350, 355 and 700 cm²
4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 4 on page 42 for the required mounting parts and the accessories. Note the travel table on page 21!

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 existing 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 21.

   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:

   **NOTICE**
   The lever must be held stationary in the mid position while undoing or fastening the nut to ensure that the lever does not move to one of the end stops.

5. Fasten 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).

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 fixing screws.
Attachment to the control valve – Mounting parts and accessories

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

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. 6 · Attachment according to IEC 60534-6 (NAMUR)
4.3 Attachment to Type 3510 Micro-flow Valve with Type 3271-5 Actuator

Refer to Table 4 on page 42 for the required mounting parts and accessories.
Note the travel table on page 21!

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.

**NOTICE**
The lever must be held stationary in the mid position while undoing or fastening the nut to ensure that the lever does not move to one of the end stops.

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).
7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3).
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 5 on page 43 for the required mounting parts and accessories. Note the travel table on page 21!

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

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

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

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 9 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both O-rings are seated properly.
6. Unscrew the standard follower pin (2) from the positioner's lever M (1). Use the metal follower pin (Φ5) 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.
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. 9 ·Attachment to rotary actuators

Legends Figs. 8 + 9
1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp (Fig. 8)
4 Coupling wheel
4.1 Screw
4.2 Disk spring
4.3 Scale plate
5 Actuator shaft
   Adapter for Type 3278
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Top pair of brackets
10.1 Bottom pair of brackets

Control valve opens counterclockwise
Control valve opens clockwise
4.4.1 Heavy-duty version

Refer to Table 4 on page 42 for the required mounting parts and accessories.

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

1. Mount the housing (10) onto the rotary actuator. In case of VDI/VDE attachment, place spacers (11) underneath, if necessary.

2. For SAMSON Type 3278 and VETEC S160 Rotary Actuator, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the VETEC R Actuator. Place adapter (3) onto Type 3278, VETEC S160 and VETEC R Actuator. For VDI/VDE version, this step depends on the actuator size.

3. Stick adhesive label (4.3) onto the coupling wheel in such a manner that the yellow part of the sticker is visible in the window of the housing when the valve is OPEN. Adhesive labels with explanatory symbols are enclosed and can be stuck on the housing, if required.

4. Screw tight coupling wheel (4) onto the slotted actuator shaft or adapter (3) using screw (4.1) and disk spring (4.2).

5. Undo the standard follower pin (2) on the lever M (1) of the positioner. Attach the follower pin (Ø 5) included in the mounting kit to pin position 90°.

6. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly. For double-acting, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator. Refer to section 4.5.

7. Place positioner on housing (10) and screw it tight. Considering the actuator’s direction of rotation, align lever (1) so that it engages in the correct slot of the coupling wheel with its follower pin (Fig. 10).
Attachment to the control valve – Mounting parts and accessories

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

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

SAMSON Type 3278 VETEC S160, VETEC R

Attachment acc. to VDI/VDE 3845 (Sept. 2010) level 1, size AA1 to AA4 (see section 15.1)
4.5 Reversing amplifier for double-acting actuators

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

4.6 Attaching an external position sensor

Refer to Table 7 on page 44 for the required mounting parts and accessories.

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 accessories chosen. Make sure the seal rings (6.1) are correctly inserted (see Fig. 6 on page 27, bottom right).

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

Note:
- In addition, the instructions in sections 5.1 and 5.2 apply for the pneumatic and electrical connection. Operation and setting are described in sections 7 and 8.
- Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø 8 mm holes must be drilled into the mounting plate bracket (21).

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. 13 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. 13, 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 lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower pin (2) from the travel table on page 21. 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.

Fig. 13 · Mounting for Type 3277-5 Actuator (left) and Type 3277 Actuator (right)
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 accessories, refer to Table 7 on page 44.

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.

---

**Fig. 14 · Mounting according to IEC 60534-6 (NAMUR)**

1. Lever
2. Follower pin
3. Follower plate
9. Stem connector
9.1. Bracket
14. Bolt
14.1. Screws
20. Position sensor
21. Bracket
For other actuator sizes or travels, select the lever and pin position from the travel table on page 21. 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 accessories, refer to Table 7 on page 44.

1. Place the lever (1) in mid-position and hold it in place. Unscrew the nut (1.1) and remove the standard attached lever M (1) together with the disk spring (1.2) from the sensor shaft.

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

3. Select the lever S (1) from the accessories and screw the follower pin (2) into the hole for pin position 17.
   Place the lever (1) and disk spring (1.2) on the sensor shaft.
Place the lever (1) in mid-position and hold it in place. Screw on the nut (1.1).

4. Place the follower clamp (3) on the stem connector, align it at a right angle and screw tight.

5. Position the bracket (21) with the position sensor on the valve yoke and screw tight, making sure the follower pin (2) slides into the groove of the follower clamp (3).

4.6.4 Mounting the position sensor to rotary actuators

For the required mounting parts and accessories, refer to Table 7 on page 44.

1. Place the lever (1) in mid-position and hold it in place. Unscrew the nut (1.1) and remove the standard attached lever M (1) together with the disk spring (1.2) from the sensor shaft.

2. Screw the position sensor (20) onto the mounting plate (21).

3. Replace the follower pin (2) normally attached to the lever (1) with the metal follower pin (Ø 5) from the accessories and screw it into the hole for pin position 90°.

4. Place the lever (1) and disk spring (1.2) on the sensor shaft.

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).

---

**Fig. 16 · Positioner unit with sensor mounted on rotary actuators**

1. Lever
1.1 Nut
1.2 Disk spring
2. Follower pin
20. Position sensor
21. Mounting plate
4.7 Mounting the leakage sensor

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

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

**NOTICE**

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

The hole with M8 thread on the NAMUR rib should preferably be used to mount the sensor (Fig. 17).

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

The start-up of the leakage sensor is described in detail in the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.

---

**Fig. 17 · Mounting the leakage sensor**

1. Leakage sensor
2. Screw
3. Plug-type connection
4.8 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, pressure gauge bracket and Type 3710 Pneumatic Reversing Amplifier are available in stainless steel (see Table 6 for order numbers).

The Tables 2 to 6 (pages 41 to 43) apply for attaching positioners with stainless steel housings with the following restrictions:

- **Direct attachment**
  All mounting kits from Tables 2 and 3 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 4 can be used. Connecting plate in stainless steel.

- **Attachment to rotary actuators**
  All mounting kits from Table 5 can be used except for the heavy-duty version. Connecting plate in stainless steel.

4.9 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 25) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

**NOTICE**

The method described does not apply to old connection blocks in powder-paint-coated aluminum.

In this case, follow the instructions for attachment described below in “Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)” and to rotary actuators.

FE: The air purging function is automatically provided.

- **Attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes) and to rotary actuators**
  The positioner requires an additional port for the exhaust air that can be connected over piping. An adapter available as an accessory is used for this purpose. See Table 6.
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.

### 4.10 Required mounting parts and accessories

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Mounting parts for actuators 120 cm² or smaller</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting plate (9) (new) for Actuator Type 3277-5xxxxxx.01 (new)</td>
<td>G ¼ and ¼ NPT</td>
<td>1400-6823</td>
</tr>
<tr>
<td>Connecting plate (old) for Actuator Type 3277-5xxxxxx.00 (old): G ¼</td>
<td></td>
<td>1400-6820</td>
</tr>
<tr>
<td>Connecting plate (old) for Actuator Type 3277-5xxxxxx.00 (old): G ¼</td>
<td></td>
<td>1400-6821</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessories for the positioner</th>
<th>Mounting parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting plate (6)</td>
<td>G ¼</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td>¼ NPT</td>
</tr>
<tr>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td>St. steel/brass</td>
</tr>
<tr>
<td></td>
<td>St. steel/St. st.</td>
</tr>
</tbody>
</table>

1) Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.
### Table 3 · Direct attachment to Type 3277 (Fig. 5)

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>For actuators with 240, 350, 355 and 700 cm²</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>240 cm² Steel 1400-6444</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless steel 1400-6445</td>
<td></td>
</tr>
<tr>
<td></td>
<td>350 cm² Steel 1400-6446</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless steel 1400-6447</td>
<td></td>
</tr>
<tr>
<td></td>
<td>355 cm²/700 cm² Steel 1400-6448</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless steel 1400-6449</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Required piping with screw fitting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– for &quot;Actuator stem retracts&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– with air purging of the top diaphragm chamber</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connection block with seals and screw</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4 · 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)

<table>
<thead>
<tr>
<th>Travel in mm</th>
<th>Lever</th>
<th>For actuators</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>S</td>
<td>Type 3271-5 Actuator with 60/120 cm² on Type 3510 Valve (Fig. 7)</td>
<td>1400-7457</td>
</tr>
<tr>
<td>5 to 50</td>
<td>M ¹</td>
<td>Actuators from other manufacturers and Type 3271 with 120 to 700 cm²</td>
<td>1400-7454</td>
</tr>
<tr>
<td>14 to 100</td>
<td>L</td>
<td>Actuators from other manufacturers and Type 3271, versions 1000 and 1400-60</td>
<td>1400-7455</td>
</tr>
<tr>
<td>40 to 200</td>
<td>XL</td>
<td>Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm² with 120 mm travel</td>
<td>1400-7456</td>
</tr>
<tr>
<td>30 or 60</td>
<td>L</td>
<td>Type 3271, versions 1400-120 and 2800 cm² (30 or 60 mm travel)</td>
<td>1400-7466</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mounting bracket for Emerson and Masoneilan linear actuators; a mounting kit acc. to IEC 60534-6 is necessary depending on the travel (see above)</td>
<td>1400-6771</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valtek Type 25/50</td>
<td>1400-9554</td>
</tr>
<tr>
<td>Accessories</td>
<td></td>
<td>Connecting plate (6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pressure gauge bracket (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td></td>
</tr>
</tbody>
</table>

¹ Lever M is mounted on the standard positioner (included in the scope of delivery)
## Table 5 · Attachment to rotary actuators (Figs. 8 and 9)

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment acc. to VDI/VDE 3845 (September 2010), refer to section 15.1 for details</td>
<td>1400-7448, 1400-9244, 1400-9542</td>
</tr>
<tr>
<td>Actuator surface corresponds to level 1</td>
<td></td>
</tr>
<tr>
<td>Size AA1 to AA4, version with CrNiMo steel bracket</td>
<td>1400-9526</td>
</tr>
<tr>
<td>Size AA1 to AA4, heavy-duty version</td>
<td></td>
</tr>
<tr>
<td>Heavy-duty version (e.g. Air Torque 10 000)</td>
<td></td>
</tr>
<tr>
<td>Bracket surface corresponds to level 2, heavy-duty version</td>
<td>1400-7614</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 160/320 cm², CrNiMo steel bracket</td>
<td>1400-89245</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 160 cm² and for VETEC Type S160, Type R and Type R, heavy-duty version</td>
<td>1400-5891 and 1400-9526</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version</td>
<td>1400-9120</td>
</tr>
<tr>
<td>Attachment to Camflex II</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting plate (6)</td>
<td>G ¼ 1400-7461, ¼ NPT 1400-7462</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td>G ¼ 1400-7458, ¼ NPT 1400-7459</td>
</tr>
<tr>
<td>Pressure gauge mounting kit up to max. 6 bar (output/supply)</td>
<td>St. steel/brass 1400-6950, St. steel/st. steel 1400-6951</td>
</tr>
</tbody>
</table>

## Table 6 · General accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic reversing amplifier for double-acting actuators Type 3710</td>
<td>1890-4875</td>
</tr>
<tr>
<td>Cable gland M20 x 1.5, nickel-plated brass</td>
<td>0310-2149</td>
</tr>
<tr>
<td>Adapter M 20 x 1.5 to ½ NPT, aluminum</td>
<td>1400-7460</td>
</tr>
<tr>
<td>Retrofit kit for inductive limit switch 1x SJ 2-SN</td>
<td>1499-0761, 1990-3100, 1990-3142</td>
</tr>
<tr>
<td>Cover plate with list of parameters and operating instructions</td>
<td>German/English (standard)</td>
</tr>
<tr>
<td>TROVIS-VIEW with device module 3730-3 (order no. 6661-1056)</td>
<td>1043732</td>
</tr>
<tr>
<td>Serial interface adapter (SAMSON SSP interface - RS-232 port on computer)</td>
<td>1400-7700</td>
</tr>
<tr>
<td>Isolated USB interface adapter (SAMSON SSP interface - USB port on computer) including TROVIS-VIEW CD-ROM</td>
<td>1400-9740</td>
</tr>
<tr>
<td>Positioner with stainless steel housing Connecting plate (stainless steel)</td>
<td>G ¼ 1400-7476, ¼ NPT 1400-7477</td>
</tr>
<tr>
<td>Pressure gauge bracket (stainless steel) Only in ¼ NPT</td>
<td>1400-7108</td>
</tr>
<tr>
<td>Air purging function Adapter with threaded bushing (M20 x 1.5) for attachment acc. to IEC 60534-6 (NAMUR rib or attachment to rod-type yoke) and to rotary actuators</td>
<td>G ¼ 0310-2619, ¼ NPT 0310-2550</td>
</tr>
</tbody>
</table>
## Table 7 - Attachment of external position sensor

<table>
<thead>
<tr>
<th>Direct attachment</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting parts for actuators with 120 cm² see Fig. 13 left</td>
<td>1400-7472</td>
</tr>
<tr>
<td>Connecting plate (9, old) for Actuator Type 3277-5xxxxxxx.00</td>
<td></td>
</tr>
<tr>
<td>G ¼”</td>
<td>1400-6820</td>
</tr>
<tr>
<td>¾ NPT</td>
<td>1400-6821</td>
</tr>
<tr>
<td>Connecting plate (new) for Actuator Type 3277-5xxxxxxx.01 (new)</td>
<td>1400-6823</td>
</tr>
<tr>
<td>Mounting parts for actuators with 240, 350, 355 and 700 cm², see Fig. 13 right</td>
<td>1400-7471</td>
</tr>
<tr>
<td>NAMUR attachmt.</td>
<td>1400-7468</td>
</tr>
<tr>
<td>Mounting parts for attachment to NAMUR rib with lever L and XL, see Fig. 14</td>
<td>1400-7468</td>
</tr>
<tr>
<td>Micro-flow valve</td>
<td>1400-7469</td>
</tr>
<tr>
<td>Mounting parts for Type 3510 Micro-flow Valve, see Fig. 15</td>
<td>1400-7469</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attachment to rotary actuators</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDI/VDE 3845 (September 2010), refer to section x for details</td>
<td></td>
</tr>
<tr>
<td>Actuator surface corresponds to level 1</td>
<td></td>
</tr>
<tr>
<td>Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 16</td>
<td>1400-7473</td>
</tr>
<tr>
<td>Size AA1 to AA4, heavy-duty version</td>
<td>1400-9384</td>
</tr>
<tr>
<td>Size AA5, heavy-duty version (e.g. Air Torque 10 000)</td>
<td>1400-9992</td>
</tr>
<tr>
<td>Bracket surface corresponds to level 2, heavy-duty version</td>
<td>1400-9974</td>
</tr>
<tr>
<td>SAMSON Type 3278 with 160 cm² (also for VETEC Type S160 and Type R), heavy-duty version</td>
<td>1400-9385</td>
</tr>
<tr>
<td>SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version</td>
<td>1400-5891</td>
</tr>
<tr>
<td>and 1400-9974</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessories for positioner</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting plate (6)</td>
<td></td>
</tr>
<tr>
<td>G ¼”</td>
<td>1400-7461</td>
</tr>
<tr>
<td>¾ NPT</td>
<td>1400-7462</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td></td>
</tr>
<tr>
<td>G ¼”</td>
<td>1400-7458</td>
</tr>
<tr>
<td>¾ NPT</td>
<td>1400-7459</td>
</tr>
<tr>
<td>Pressure gauge mounting kit up to max. 6 bar (output/supply)</td>
<td></td>
</tr>
<tr>
<td>St. steel/brass</td>
<td>1400-6950</td>
</tr>
<tr>
<td>St. steel/st. steel</td>
<td>1400-6951</td>
</tr>
<tr>
<td>Bracket to mount the positioner on a wall</td>
<td></td>
</tr>
<tr>
<td>Note: The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site.</td>
<td>0309-0111</td>
</tr>
</tbody>
</table>

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 for direct air connection!
- The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories.
  The air connections are optionally designed as a bore with \( \frac{1}{4} \) NPT or G \( \frac{1}{4} \) thread.
  The customary fittings for metal and copper pipes or plastic hoses can be used.
- The supply air must be dry and free from oil and dust.
  The maintenance instructions for upstream pressure reducing stations must be observed.

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 2 to 6).

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.

Note: If the supply pressure \( p_s \) is lower than the upper spring range value detected during plotting of the valve signature, PLOW is indicated under Code 0.
Actuator stem extends FA (air to open)
Fail-safe position "Valve closed"
(for globe and angle valves):

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 $p_{\text{stmax}}$ is roughly estimated as follows:

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

$d$ = Seat diameter [cm]
$\Delta p$ = Differential pressure across the valve [bar]
$A$ = Actuator diaphragm area [cm²]
$F$ = Upper bench range value [bar]

If there are no specifications, calculate as follows:

Required supply pressure = Upper bench range value + 1 bar.

5.1.3 Signal pressure (output)
The signal pressure at the output (Output 38) of the positioner can be limited in steps of 0.1 bar to a pressure between 1.4 and 7.0 bar in Code 16.
The limitations is not activated [7.0 bar] by default.

5.2 Electrical connections

DANGER!
Risk of electric shock and/or the formation of an explosive atmosphere!
- For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.

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

Selecting cables and wires:
For installing intrinsically safe circuits, observe Paragraph 12 in EN 60079-14: 2008 (VDE 0165 Part 1).
To install and select cables and wires as well as to run several intrinsically safe circuits in one multi-core cable, observe the installation regulations valid in the country of use. The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules.
When two separate cables are used for con-
nection, an additional cable gland can be installed. Seal cable entries left unused with plugs. Devices used at ambient temperatures below –20 °C must be fitted with metal cable glands.

**Equipment for use in zone 2/zone 22**

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

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

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

**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*!

- ≥ 3.6 mA: Microprocessor and display active
- < 3.7 mA: **LOW** on display
- ≤ 3.8 mA: Emergency shutdown
- > 3.9 mA: Actuator can be filled with air
- > 22 mA: **OVERLOAD** on display

In general, it is not necessary to connect the positioner to a bonding conductor. Should this be required, however, this conductor can be connected inside the device. Depending on the version, the positioner is equipped with inductive limit 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. 18 or the label on the terminal strip for terminal assignment.
Accessories:
Plastic cable gland M20 x 1.5:
- black Order no. 8808-1011
- blue Order no. 8808-1012
- Brass, nickel-pl. Order no. 1890-4875
- St. steel 1.4305 Order no. 8808-0160
Adapter M20 x 1.5 to ½ NPT
- Aluminum, powder-coated Order no. 0310-2149
- Stainless steel Order no. 1400-7114

5.2.1 Switching amplifiers
For operation of the limit switches, switching amplifiers must be connected in the output circuit. To ensure the operational 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. 18 · Electrical 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. 19).

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

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

Point-to-point:
The bus address/polling address must always be set to zero (0).

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

---

**Fig. 19 · Connection with FSK modem**

Connections

4 to 20 mA

Controller/control station

Handheld communicator or second FSK modem

Safe area

Hazardous area

Explosion-protected isolating amplifier

Handheld communicator or second FSK modem (explosion-protected)
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-μF capacitor can be connected in parallel to the analog output.

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

---

**Fig. 20 · 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 actuators 240 cm² and larger, select MAX SIDE for a side connection.

Readings on display

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

Operating mode:

- Manual mode (see section 8.2.1)
- Automatic mode (see section 8.2.1)
- SAFE (see 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 (blinks on the display), the lever position in degrees in relation to the longitudinal axis is indicated. One bar element corresponds to approximately a 5° angle of rotation.
If the fifth bar element blinks (reading > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Status messages

- Failure: Maintenance required/Maintenance demanded
- blinks: Out of specification
These icons indicate that an error has occurred.
A classified status can be assigned to each error. Classifications include 'No message', 'Maintenance required', 'Maintenance demanded' and 'Failure' (see section 14).

Configuration enabled
Indicates that codes marked with an asterisk (*) in the code list (section 14) are enabled for configuration (section 8.1).
Displays and their meaning

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO</td>
<td>Automatic</td>
</tr>
<tr>
<td>CL</td>
<td>Clockwise</td>
</tr>
<tr>
<td>CCL</td>
<td>Counterclockwise</td>
</tr>
<tr>
<td>Err</td>
<td>Error</td>
</tr>
<tr>
<td>ESC</td>
<td>Escape</td>
</tr>
<tr>
<td>HI</td>
<td>ix ≥ 21.6 mA</td>
</tr>
<tr>
<td>LO</td>
<td>ix ≤ 2.4 mA</td>
</tr>
<tr>
<td>LOW</td>
<td>w ≤ 3.7 mA</td>
</tr>
<tr>
<td>MAN</td>
<td>Manual</td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum range</td>
</tr>
<tr>
<td>No</td>
<td>Not available/</td>
</tr>
<tr>
<td>NOM</td>
<td>Nominal travel</td>
</tr>
<tr>
<td>OVERLOAD</td>
<td>w &gt; 22 mA</td>
</tr>
<tr>
<td>PLOW</td>
<td>p_s lower than upper spring range value</td>
</tr>
<tr>
<td>RES</td>
<td>Reset</td>
</tr>
<tr>
<td>SAFE</td>
<td>Fail-safe position</td>
</tr>
<tr>
<td>SUB</td>
<td>Substitute calibration</td>
</tr>
<tr>
<td>TUNE</td>
<td>Initialization in progress</td>
</tr>
<tr>
<td>YES</td>
<td>Available/Active</td>
</tr>
<tr>
<td>ZP</td>
<td>Zero calibration</td>
</tr>
<tr>
<td>0 bar</td>
<td>No supply air</td>
</tr>
<tr>
<td>S</td>
<td>Valve in mechanical</td>
</tr>
<tr>
<td></td>
<td>fail-safe position</td>
</tr>
<tr>
<td></td>
<td>Failure</td>
</tr>
<tr>
<td></td>
<td>Maintenance required/demanded</td>
</tr>
<tr>
<td></td>
<td>Out of specification</td>
</tr>
<tr>
<td></td>
<td>Write protection active</td>
</tr>
<tr>
<td></td>
<td>(over binary input option or</td>
</tr>
<tr>
<td></td>
<td>HART® communication)</td>
</tr>
<tr>
<td>O/C</td>
<td>Write protection active</td>
</tr>
<tr>
<td></td>
<td>(time-controlled PST)</td>
</tr>
<tr>
<td>PST</td>
<td>Configuration enabled</td>
</tr>
<tr>
<td></td>
<td>Blinking: Out of specification</td>
</tr>
<tr>
<td></td>
<td>Blinking: Not initialized</td>
</tr>
<tr>
<td></td>
<td>Blinking: Fail-safe position</td>
</tr>
<tr>
<td></td>
<td>Blinking: Maintenance</td>
</tr>
<tr>
<td></td>
<td>required/demanded</td>
</tr>
<tr>
<td></td>
<td>Blinking: Out of specification</td>
</tr>
<tr>
<td></td>
<td>Blinking: Write protection</td>
</tr>
<tr>
<td></td>
<td>active (over binary input</td>
</tr>
<tr>
<td></td>
<td>option or HART® communication)</td>
</tr>
<tr>
<td></td>
<td>Blinking: Write protection</td>
</tr>
<tr>
<td></td>
<td>active (time-controlled PST)</td>
</tr>
<tr>
<td></td>
<td>Blinking: Out of specification</td>
</tr>
</tbody>
</table>

Fig. 21 · Display and operator controls
6.1 Serial interface

The positioner must be supplied with at least 3.8 mA.

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

The operator software is TROVIS-VIEW 4 with installed device module 3730-6.

6.2 HART® communication

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

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

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

---

**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® communication. 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 an error message** and can simply be confirmed.

6.3 Dynamic HART® variables

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

The dynamic variables of Type 3730-6 can be assigned as follows in TROVIS-VIEW [Device settings > Positioner > HART® communication]:

---
<table>
<thead>
<tr>
<th>Variable</th>
<th>Meaning</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set point</td>
<td>Set point</td>
<td>%</td>
</tr>
<tr>
<td>Direction of action set point</td>
<td>Direction of action set point</td>
<td>%</td>
</tr>
<tr>
<td>Set point after transit time specification</td>
<td>Set point after transit time specification</td>
<td>%</td>
</tr>
<tr>
<td>Valve position</td>
<td>Valve position</td>
<td>%</td>
</tr>
<tr>
<td>Set point deviation e</td>
<td>Set point deviation e</td>
<td>%</td>
</tr>
<tr>
<td>Absolute total valve travel</td>
<td>Absolute total valve travel</td>
<td>–</td>
</tr>
<tr>
<td>Binary input status</td>
<td>0 = Not active</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1 = Active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>255 = –/-</td>
<td></td>
</tr>
<tr>
<td>Internal solenoid valve/forced venting status</td>
<td>0 = De-energized</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1 = Energized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 = Not installed</td>
<td></td>
</tr>
<tr>
<td>Condensed state</td>
<td>0 = No message</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>1 = Maintenance required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 = Maintenance demanded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 = Failure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 = Out of specification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 = Function check</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Leakage sensor sound level</td>
<td>Sound pressure level (leakage sensor)</td>
<td>dB</td>
</tr>
<tr>
<td>Ambient pressure</td>
<td>Ambient pressure</td>
<td>mbar</td>
</tr>
<tr>
<td>Signal pressure p_out</td>
<td>Signal pressure p_{out}</td>
<td>bar</td>
</tr>
<tr>
<td>Supply pressure</td>
<td>Supply pressure</td>
<td>bar</td>
</tr>
<tr>
<td>Flow rate</td>
<td>Flow rate</td>
<td>m³/h</td>
</tr>
<tr>
<td>Differential pressure</td>
<td>Differential pressure</td>
<td>bar</td>
</tr>
</tbody>
</table>
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:
- The fault alarm icon \( \text{\textcelsius} \) appears and \( \text{\textcelsius} \) 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Initialized</td>
</tr>
<tr>
<td>1</td>
<td>Not initialized</td>
</tr>
</tbody>
</table>

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

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

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

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

7.1 Defining the valve closed position

Taking into account the valve type and actuator's direction of action, assign the closed position (0 \%) by positioning the AIR TO OPEN/CLOSE slide switch:

- AIR TO OPEN (ATO) position
  - Signal pressure opens the valve, e.g. for valve with fail-close

- AIR TO CLOSE (ATC) position
  - Signal pressure closes the valve, e.g. for valve with fail-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:

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

Intermediate positions are not permitted.

**NOTICE**

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

#### Fig. 22 · Volume restriction $Q$

**MAX BACK/MIN SIDE setting**

### 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.

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

1. Turn $\Rightarrow$ **Code 2**
2. Press $\Rightarrow$, Code 2 blinks
3. Turn $\Rightarrow$ **Required direction**
4. Press $\Rightarrow$ to confirm reading direction.

### 7.4 Limiting the signal pressure

If the maximum actuator force may cause damage to the valve, the signal pressure $p_{\text{out}}$ 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 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 set point.

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 set point  
(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 of the lever on the back of the positioner is indicated. A horizontal lever (mid position) is equal to 0°.

To ensure the positioner is working properly, the outer bar elements may not blink while the valve is moving through the operating range.
Exit Code 1 by pressing the rotary pushbutton ( ).
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.

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

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:

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

- **Nominal range (NOM)**
  Initialization mode for all globe valves (see section 7.6.2)

- **Manually selected OPEN position (MAN)**
  Initialization mode for globe valves with manual entry of the OPEN position (see section 7.6.3)

- **Manually selected end positions (MAN2)**
  Initialization mode for globe valves with manual entry of both positions (see section 7.6.4)

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

Alternating displays
Initialization running
Icon depending on initialization mode selected

Bar graph display indicating the progress of the initialization
After the basic initialization, the reference curve for the valve signature is recorded (Code 48 - h0 = YES).

Reading in alternating sequence:
TEST/D1

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:** An error during the recording of the valve signature is indicated by Code 81. The valve signature does not affect closed-loop operation.

**Valve closed position AIR TO CLOSE**

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

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

<table>
<thead>
<tr>
<th>Valve closed position</th>
<th>Direction of action</th>
<th>Reference variable w</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR TO OPEN</td>
<td>↗↘</td>
<td>w = 0 %</td>
</tr>
<tr>
<td>AIR TO CLOSE</td>
<td>↘↗</td>
<td>w = 100 %</td>
</tr>
</tbody>
</table>

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). 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.

**Select the initialization mode:**

![Image of the display showing MAX]

Turn \(\uparrow\) → **Code 6**
Press \(\downarrow\)
Turn \(\uparrow\) → **MAX**
Press \(\downarrow\) to confirm **MAX** as the initialization mode.

**Start initialization:**

- Press INIT key to start initialization!

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

### 7.6.2 NOM – Initialization based on nominal range

The calibrated sensor allows the 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 lower travel/angle range value (Code 8) and upper travel/angle range value (Code 9) as the operating range.
Enable configuration:

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

- **Default**: No
- **Turn**: Code 3, display: No
- **Press**: Code 3 blinks
- **Turn**: Code 3
- **Press**: display

Enter pin position and nominal range:

- **Default**: No
- **Turn**: Code 4
- **Press**: Code 4 blinks
- **Turn**: Code 4
- **Press**: Pin position on lever (read relevant section on attachment)
- **Press**: Code 5
- **Turn**: Code 5
- **Press**: Code 5 blinks

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

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

### 7.6.3 MAN – Initialization based on a manually selected OPEN position

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

Enable configuration:

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

Enable configuration

![Enable configuration](image)

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

**Enter the pin position:**

![Enter the pin position](image)

**Turn** → **Code 4**
Press ****, Code 4 blinks
**Turn** → Pin position on lever (see relevant section on attachment)
Press **

Turn **→ Skip nominal range (Code 5) and go to Code 6.**

Select the initialization mode:

![Initialization mode](image)

**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:**

![Enter OPEN position](image)

**Manual set point**
(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** clockwise in small steps until the required valve position is reached. The valve must be moved with a monotonically increasing signal pressure.
Press ** to confirm the OPEN position.

**Start initialization:**

- Press INIT key to start initialization!
After initialization, the maximum travel is indicated in mm or the maximum angle in ° in Code 5.

7.6.4 MAN2 – Initialization based on manually selected end positions

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

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

Enable configuration:

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

Turn → YES
Press , display

Enter the pin position:

Turn → Code 4
Press , Code 4 blinks
Turn → Pin position on lever (see relevant section on attachment)
Press
Turn → Skip nominal range (Code 5) and go to Code 6.

Select the initialization mode and enter end positions:

Turn → Code 3, display: No
Press , Code 3 blinks

Turn → Code 6
Press , Code 6 blinks
Turn \(\circ\) \(\rightarrow\) **MAN2**

Press \(\circ\) to adopt the initialization mode **MAN2** \(\rightarrow\) **POS1** and the current angle position of the lever are indicated on the display in alternating sequence.

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

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

Turn \(\circ\) until the required OPEN position of the valve is reached.

Press \(\circ\) to confirm the valve position \(\rightarrow\) **WAIT**. Initialization can be started as soon as **MAN2** is indicated again on the display.

**Start initialization:**

- Press INIT key to start initialization!

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

---

**7.6.5 SUB – Substitute calibration**

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

The **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.

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

**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.

---

Enable configuration

[Enable configuration]

**Default**

No

Turn \(\circ\) \(\rightarrow\) **Code 3**, display: **No**

Press \(\circ\), Code 3 blinks

Turn \(\circ\) \(\rightarrow\) **YES**

Press \(\circ\), display \(\bullet\)
Enter the pin position and nominal range:

- **Pin position**: Default No
  - 35 mm
  - Nominal range (locked with Code 4 = No)

  **Turn [button] → Code 4**
  **Press [button], Code 4 blinks**
  **Turn [button] → Pin position on lever (see relevant section on attachment)**
  **Press [button]**

- **Nominal range**: (locked with Code 4 = No)
  - 15.0 mm

  **Turn [button] → Code 5**
  **Press [button], Code 5 blinks**
  **Turn [button] → Nominal travel/angle**
  **Press [button]**

Select the initialization mode:

- **Initialization mode**: Default MAX
  - SUB

  **Turn [button] → Code 6**
  **Press [button]**
  **Turn [button] → SUB**
  **Press [button] to confirm SUB as the initialization mode.**

Enter the direction of action:

- **Direction of action**: Default tes
  - 7.7

  **Turn [button] → Code 7**
  **Press [button], Code 7 blinks**
  **Turn [button] → Direction of action (tes/tes)**
  **Press [button]**

Deactivate travel limit:

- **Travel limit**: Default 100.0
  - NO

  **Turn [button] → Code 11**
  **Press [button], Code 11 blinks**
  **Turn [button] → No**
  **Press [button]**

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

**KP level**
Default 7

**TV level**
Default

Turn \(\mathcal{C}\) → **Code 16/17/18**
Press \(\mathcal{C}\), Code 16/17/18 blinks
Turn \(\mathcal{C}\) to set the control parameter selected
Press \(\mathcal{C}\) 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 \(\mathcal{C}\) → **Code 34**
Press \(\mathcal{C}\), Code 34 blinks
Turn \(\mathcal{C}\) → Closing direction (CCL counterclockwise/CL clockwise)

**Define the valve closed position:**
- Set switch for **valve closed position AIR TO OPEN or AIR TO CLOSE** as described in section 7.1 on page 56.
- Set volume restriction as described in section 7.2 on page 57.

**Start initialization:**
- Press INIT key!
The operating mode is changed to automatic mode.

**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.
- If the positioner shows a tendency to oscillate in automatic operating mode, the parameters \(K_P\) and \(T_V\) must be slightly corrected. Proceed as follows:
  - Set \(T_V\) to 4 (**Code 18**).
  - If the positioner still oscillates, the gain \(K_P\) (**Code 17**) must be decreased until the positioner shows a stable behavior.
**Zero point calibration**

If the process allows it (valve move once to the closed position), perform a zero point calibration according to section 7.7.

### 7.6.6 Tuning the KP input filter

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

**Enable configuration:**

Turn \(\bullet\) → **Code 3**, display: **No**

Press \(\bullet\), Code 3 blinks

Turn \(\bullet\) → **YES**

Press \(\bullet\), display \(\bullet\)

**Tuning the input filter:**

Turn \(\bullet\) → **Code 6**

Press \(\bullet\), Code 6 blinks

Turn \(\bullet\) → **KP**

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

---

**7.7 Zero calibration**

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

**NOTICE**

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

**Note:**

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

**Enable configuration:**

Turn \(\bullet\) → **Code 3**, display: **No**

Press \(\bullet\), Code 3 blinks

Turn \(\bullet\) → **YES**

Press \(\bullet\), display \(\bullet\)

**Perform zero calibration:**

Turn \(\bullet\) → **Code 6**

Press \(\bullet\), Code 6 blinks
Turn \( \Theta \rightarrow ZP \)

- 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 Settings for on/off valves

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

**Note:** The travel range of on/off valves is defined 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 (set point) cannot be changed or analyzed:

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

**Discrete analysis**

If the reference variable \((w)\) is below the *Operating point limit* (Code 49 - h5) when automatic mode starts, the valve moves to the *Operating point* (Code 49 - h1). The valve moves back to the fail-safe position if the reference variable continues and falls below the *Fail-safe action limit* (Code 49 - h2).

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

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

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

Canceling the partial stroke test (PST)

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

Enable configuration:

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

Select on/off valve as type of application:

Turn → Code 49
Press , Code 49 blinks
Turn → Code h0
Press , Code h0 blinks
Turn → YES
Press

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

Turn → Code h1/h2/h3/h4/h5
Press , Code h1/h2/h3/h4/h5 blinks
Turn to adjust the parameter selected
Press to confirm the setting.
7.9 Reset to default values

A reset allows the positioner to be reset to the default settings. To reset the positioner, the options Diag, Std and DS are available in Code 36. Table 8 lists the reset functions.

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

**Enable configuration:**

Turn \( \circ \) \rightarrow Code 3, display: No

Press \( \circ \), Code 3 blinks

Turn \( \circ \) \rightarrow YES

Press \( \circ \), display \( \circ \)

**Reset start-up parameters:**

Turn \( \circ \) \rightarrow Code 36, display: – – –

Press \( \circ \), Code 36 blinks

Turn \( \circ \) \rightarrow DIAG/STD/DS

Press \( \circ \). The parameters are reset depending on the option selected. Refer to Table 9.
### Start-up – Settings

#### Table 9 · Reset functions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reset Code 36</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diag</td>
</tr>
<tr>
<td>Initialization</td>
<td>NO</td>
</tr>
<tr>
<td>Fail-safe behavior</td>
<td></td>
</tr>
<tr>
<td>Air supply failure</td>
<td>NO</td>
</tr>
<tr>
<td>Power supply failure of positioner</td>
<td>NO</td>
</tr>
<tr>
<td>Power supply failure of external solenoid valve</td>
<td>NO</td>
</tr>
<tr>
<td>Emergency mode</td>
<td>NO</td>
</tr>
<tr>
<td>Operating hours counter</td>
<td>NO</td>
</tr>
<tr>
<td>Device in operation</td>
<td>NO</td>
</tr>
<tr>
<td>Device switched on since initialization</td>
<td>NO</td>
</tr>
<tr>
<td>Device in operation since initialization</td>
<td>NO</td>
</tr>
<tr>
<td>Logging</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter</th>
<th>Reset Code 36</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Reading direction</td>
<td>NO</td>
</tr>
<tr>
<td>4</td>
<td>Pin position</td>
<td>NO</td>
</tr>
<tr>
<td>5</td>
<td>Nominal range</td>
<td>NO</td>
</tr>
<tr>
<td>6</td>
<td>Initialization mode</td>
<td>NO</td>
</tr>
<tr>
<td>7</td>
<td>Direction of action</td>
<td>NO</td>
</tr>
<tr>
<td>8</td>
<td>Lower travel/angle range value</td>
<td>NO</td>
</tr>
<tr>
<td>9</td>
<td>Upper travel/angle range value</td>
<td>NO</td>
</tr>
<tr>
<td>10</td>
<td>Lower travel/angle range limit</td>
<td>NO</td>
</tr>
<tr>
<td>11</td>
<td>Upper travel/angle range limit</td>
<td>NO</td>
</tr>
<tr>
<td>12</td>
<td>Set point, lower range value</td>
<td>NO</td>
</tr>
<tr>
<td>13</td>
<td>Set point, upper range value</td>
<td>NO</td>
</tr>
<tr>
<td>14</td>
<td>CLOSED end position</td>
<td>NO</td>
</tr>
<tr>
<td>15</td>
<td>OPEN end position</td>
<td>NO</td>
</tr>
<tr>
<td>16</td>
<td>Pressure limit</td>
<td>NO</td>
</tr>
<tr>
<td>17</td>
<td>Proportional-action coefficient Kp level</td>
<td>NO</td>
</tr>
<tr>
<td>18</td>
<td>Derivative-action time Tv level</td>
<td>NO</td>
</tr>
<tr>
<td>19</td>
<td>Tolerance band</td>
<td>NO</td>
</tr>
<tr>
<td>20</td>
<td>Select characteristic</td>
<td>NO</td>
</tr>
<tr>
<td>21</td>
<td>Enter transit time OPEN</td>
<td>NO</td>
</tr>
<tr>
<td>22</td>
<td>Enter transit time CLOSED</td>
<td>NO</td>
</tr>
<tr>
<td>24</td>
<td>Total valve travel limit</td>
<td>NO</td>
</tr>
<tr>
<td>25</td>
<td>Alarm mode</td>
<td>NO</td>
</tr>
</tbody>
</table>
# Start-up – Settings

## Table 9 - Reset functions

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Diag</th>
<th>Std</th>
<th>DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Limit A1</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>27</td>
<td>Limit A2</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>32</td>
<td>Error message in case of 'Function check' condensed state</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>33</td>
<td>Error message in case of 'Maintenance required' and 'Out of specification' condensed state</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>38</td>
<td>Inductive limit switch</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>46</td>
<td>Bus address</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>48</td>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d5</td>
<td>Zero point limit</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>d11</td>
<td>Principle of operation (actuator)</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>h0</td>
<td>Initialization including valve signature</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>h3</td>
<td>Desired time until 'Reset diagnostic measured data'</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>49</td>
<td>Partial stroke test (PST)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Test start</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>A3</td>
<td>Enter test interval</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>A8</td>
<td>Activate $\Delta p$ out monitoring</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>A9</td>
<td>$\Delta p$ out monitoring value</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d2</td>
<td>Lower range value</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d3</td>
<td>Upper range value</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d4</td>
<td>Activate ramp function</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d5</td>
<td>Ramp time (increasing)</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d6</td>
<td>Ramp time (decreasing)</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d7</td>
<td>Settling time before starting test</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d8</td>
<td>Waiting time after step change</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>d9</td>
<td>Sampling time</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>E0</td>
<td>Activate x monitoring</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>E1</td>
<td>x monitoring value</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>E5</td>
<td>Activate PST tolerance band monitoring</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>E6</td>
<td>PST tolerance band</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>E7</td>
<td>Max. test duration</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>h0</td>
<td>Type of application</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>h1</td>
<td>Operating point</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>h2</td>
<td>Fail-safe action limit</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>h5</td>
<td>Operating point limit</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
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 code list in section 14 on page 83 onwards contains all codes with their meaning and default settings.
The codes which are marked with an asterisk (*) must be enabled with Code 3 before the associated parameters can be configured as described below.

Turn Code 3, display: No

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

Turn Code 3, display: YES

Press , display: 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.

Canceling a value before it is confirmed

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 the automatic mode (AUTO).

### Automatic mode

**Switch to manual operating mode**

- Turn \( \rightarrow \) Code 0
- Press \( \), display: AUTO, Code 0 blinks
- Turn \( \rightarrow \) MAN
- Press \( \) to change to the manual operating 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 set point

- Turn \( \rightarrow \) Code 1
- Press \( \), Code 1 blinks
- Turn \( \) until sufficient pressure has been built up in the positioner and the control valve moves to the required position.

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

**Switch to automatic operating mode**

- Turn \( \rightarrow \) Code 0
- Press \( \), Code 0 blinks
- Turn \( \rightarrow \) 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 \( \mathcal{O} \) → Code 0

Press \( \mathcal{O} \), display: current operating mode (AUTO or MAN), Code 0 blinks

Turn \( \mathcal{O} \) → SAFE

Press \( \mathcal{O} \), 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 \( \mathcal{O} \) → Code 0

Press \( \mathcal{O} \), Code 0 blinks

Turn \( \mathcal{O} \) and select the required operating mode AUTO or MAN.

Press \( \mathcal{O} \).
The positioner switches to the operating mode selected.

8.3 Malfunction/Failure

All status and error messages 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 only be changed in the operator software, e.g. TROVIS-VIEW 4. For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.

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

- **Failure**
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 the 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.

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

<table>
<thead>
<tr>
<th>Condensed state</th>
<th>Positioner display</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function check</td>
<td>Text, e.g. TUNE or TEST</td>
<td></td>
</tr>
<tr>
<td>Failure</td>
<td>ø</td>
<td></td>
</tr>
<tr>
<td>Out of specification</td>
<td>ø blinking</td>
<td></td>
</tr>
<tr>
<td>Maintenance required/ Maintenance demanded</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Example:
Error caused by pin position

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

- The 'Function check' condensed state can also activate the fault alarm contact in Code 32.
- The 'Maintenance required/ Maintenance demanded' condensed state and 'Out of specification' can also activate the fault alarm contact in Code 33.

8.3.1 Confirming error messages
Enable configuration:

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

Turn Code 3, display: No
Press , Code 3 blinks
Turn YES
Press , display:

Confirm error messages:
Turn Error code which you want to confirm.
Press to confirm the error message.
9 Adjusting the limit switch

The positioner version with 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 according to EN 60947-5-6 (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.

**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.

**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 in the delivered state.

---

![Fig. 23 · Adjustment of the limit switch](image-url)
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.
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 screws (2) and lift off the plastic cover (9) together with the display, taking care not to damage the flat ribbon cable (between PCB and display).

2. Use a knife to cut an opening at the marked location (4).

3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.

4. Remove the jumper (8801-2267) at the socket X7 of the top board and insert the cable connector (11).

5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.

6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.

7. **Note:** On start-up of the positioner, set the option 'inductive alarm' under Code 38 from No to YES.

Fig. 24 · 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 device on which the explosion protection is based needs to be serviced, the device must not be put back into operation until a qualified inspector has assessed it according to explosion protection requirements, has issued an inspection certificate or given the device a mark of conformity.

Inspection by a qualified inspector is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device. Replace explosion-protected components only by original, routine-tested components from the manufacturer.

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

Refer to section 13 for maintenance, calibration and settings within and outside potentially explosive areas.

12 Firmware update (serial interface)

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

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

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

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

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

a) Updates outside hazardous area:

Remove the positioners from the plant and update them outside the hazardous area.
b.) Updates on site:

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

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

13 Maintenance, calibration and work on equipment

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

The maximum values for intrinsically safe circuits specified in the approvals must be kept.
# 14 Code list

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong></td>
<td>Operating mode [MAN] Manual mode</td>
<td>Switchover from automatic to manual mode is smooth.</td>
</tr>
<tr>
<td></td>
<td>AUTO Automatic mode</td>
<td>Automatic mode is only possible after the positioner has been initialized.</td>
</tr>
<tr>
<td></td>
<td>SAFE Fail-safe position</td>
<td>Refer to section 6 for reading under Code 0</td>
</tr>
<tr>
<td></td>
<td>ESC Escape</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.

| **1**    | Manual set point (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 °.  |
|          | An on/off valve can be moved past 100 % of the nominal range (with the closed position for ATO) or below 0 % of the nominal range (with the closed position for ATC). | Note: Can only be selected when Code 0 = MAN |

| **2**    | Reading direction Normal or upside down ESC | The reading direction of the positioner display, depending on the location of the pneumatic connection |

| **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.) Codes marked with an asterisk (*) can only be read and not overwritten.  |
|          |                                           | HART blinks on the display when the on-site operation is locked over HART® communication.  |
|          |                                           | PST appears on the display when the on-site operation is locked by the time-controlled partial stroke test.  |
|          |                                           | In these cases, codes can only read over the SSP interface.  |
### Code list

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong></td>
<td>Pin position [No] 17, 25, 35, 50, 70, 100, 200 mm · 90° with rotary actuators · 300 mm with piston actuators · ESC</td>
<td>The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. For initialization using NOM (nominal range) or SUB (substitute calibration), the pin position must be entered. For initialization using MAX, MAN and MAN2, the pin position is not required, however, it is required under Code 5 to display the nominal range.</td>
</tr>
<tr>
<td></td>
<td>NOTICE If you select a pin position in <strong>Code 4</strong> that is too small, the positioner switches to SAFE mode for reasons of safety</td>
<td>Pin position</td>
</tr>
<tr>
<td>Code 4</td>
<td>Code 5</td>
<td>Code 5</td>
</tr>
<tr>
<td>17</td>
<td>7.5</td>
<td>3.6 to 17.7</td>
</tr>
<tr>
<td>25</td>
<td>7.5</td>
<td>5.0 to 25.0</td>
</tr>
<tr>
<td>35</td>
<td>15.0</td>
<td>7.0 to 35.4</td>
</tr>
<tr>
<td>50</td>
<td>30.0</td>
<td>10.0 to 50.0</td>
</tr>
<tr>
<td>70</td>
<td>40.0</td>
<td>14.0 to 70.7</td>
</tr>
<tr>
<td>100</td>
<td>60.0</td>
<td>20.0 to 100.0</td>
</tr>
<tr>
<td>200</td>
<td>120.0</td>
<td>40.0 to 200.0</td>
</tr>
<tr>
<td>90°</td>
<td>90.0</td>
<td>24.0 to 100.0</td>
</tr>
<tr>
<td>300</td>
<td>200.0</td>
<td>60.0 to 300.0</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Nominal range [15.0] mm or angle ° ESC</td>
<td>For initialization using NOM (nominal range) or SUB (substitute calibration), the nominal range must be entered. The possible adjustment range depends on the pin position from the table for Code 4. After initialization to the maximum range (MAX), the maximum nominal travel/angle reached on initialization is displayed.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Initialization mode (init mode) [MAX] · NOM · MAN MAN2 · SUB KP · ZP ESC</td>
<td>MAX: Maximum range · For simple start-up of valves with two clearly defined mechanical end positions · The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite stop in the actuator NOM: Nominal range · For all globe valves · The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the specified nominal range MAN: Manual setting 1 · For all globe valves with unknown nominal range (OPEN position) · The positioner determines travel/angle of rotation from the manually selected OPEN position (100 %) to the CLOSED position</td>
</tr>
<tr>
<td>Code no.</td>
<td>Parameter – Readings, values [default setting]</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| **6** | **Initialization mode (init mode)** | **MAN2**: Manual setting 2 · For all globe valves with unknown nominal range (OPEN and CLOSED position) · The positioner determines travel/angle of rotation between the manually selected OPEN (100 %) and the manually selected CLOSED position (0 %)  
**SUB**: Substitute calibration · To replace a positioner while the plant is running, with the least amount of disruption to the plant  
**KP**: Fine tuning of the input filter · The valve moves through its entire valve range.  
**NP**: Zero calibration · The zero point is recalibrated.  
**NOTICE** The valve moves briefly from the operating point to the closed position! |
| **7** | **Direction of action (w/x)** | Direction of action of the set point in relation to the valve position  
**كثرَهُّ**: Increasing/increasing: a globe valve opens as the set point increases.  
**كثرَّهُّ**: Increasing/decreasing: a globe valve closes as the set point increases.  
The direction of action is adapted to the change in closed direction as follows:  
**ATO**: AIR TO OPEN · After initialization, the direction of action remains increasing/increasing (كثرَهُّ), a globe valve opens as the mA signal increases.  
**ATC**: AIR TO CLOSE · After initialization, the direction of action changes to increasing/decreasing (كثرَّهُّ), a globe valve opens as the mA signal increases. |
| **8** | **Lower travel/angle range value (lower x-range value)** | Lower range value for the travel/angle of rotation in the operating range.  
Nominal range and characteristic are automatically adapted.  
The operating range is the actual travel/angle of the valve and is limited by the lower travel/angle range value (Code 8) and the upper travel/angle range value (Code 9).  
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.  
See also the example in Code 9! |
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9*</td>
<td><strong>Upper travel/angle range value</strong> (upper x-range value)</td>
<td>Upper range value for the travel/angle of rotation in the operating range. Nominal range and characteristic are automatically adapted. <strong>Example:</strong> The operating range is modified, for example, to limit the range of a valve which has been sized too large. For this function, the entire resolution range of the set point is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.</td>
</tr>
<tr>
<td></td>
<td>20.0 to [100.0] % of the nominal range · ESC</td>
<td>Specified in mm or angle°, provided <strong>Code 4</strong> is activated.</td>
</tr>
<tr>
<td>10*</td>
<td><strong>Lower travel/angle limit</strong> (lower x-limit)</td>
<td>Lower limitation of the travel/angle of rotation to the entered value. The characteristic is not adapted.</td>
</tr>
<tr>
<td></td>
<td>[No] · 0.0 to 49.9 % of the operating range · ESC</td>
<td></td>
</tr>
<tr>
<td>11*</td>
<td><strong>Upper travel/angle limit</strong> (upper x-limit)</td>
<td>Upper limitation of the travel/angle of rotation to the entered value. The characteristic is not adapted. <strong>Example:</strong> 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 <strong>Code 10</strong> and the upper limit with <strong>Code 11</strong>. If a tight-closing function has been set up, it has priority over the travel limitation! When set to 'No', the valve can be opened past the nominal travel with a set point outside of the 4 to 20 mA range.</td>
</tr>
<tr>
<td></td>
<td>No · 50.0 to 120.0 % of the operating range · ESC, [100.0]</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Codes with marked with an asterisk (*) must be enabled with **Code 3** prior to configuration.
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Note:</strong> Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td>
<td></td>
</tr>
<tr>
<td>12*</td>
<td><strong>Set point, lower range value</strong> <em>(w-start)</em></td>
<td>Lower range value <em>(0 % = 4 mA)</em> of the valid set point range. This value must be smaller than the upper range value <em>(w-end)</em>. The set point range is the difference between <em>Set point, upper range value – Set point, lower range value</em>. The difference must be larger or equal to 25 % (= 4 mA). When the set point range of 0 to 100 % = 4 to 20 mA, the valve moves through its entire operating range from 0 to 100 % travel/angle of rotation. In split-range operation, the valves operate with smaller set points. The control signal of the control unit to control two valves is divided such, for instance, that the valves move through their full travel/angle of rotation at only half the input signal (first valve set to 0 to 50 % = 4 to 12 mA and second valve set to 50 to 100 % =12 to 20 mA).</td>
</tr>
<tr>
<td>13*</td>
<td><strong>Set point, upper range value</strong> <em>(w-end)</em></td>
<td>Upper range value <em>(100 % = 20 mA)</em> of the valid set point range. This value must be greater than the lower range value <em>(w-start)</em>.</td>
</tr>
<tr>
<td>14*</td>
<td><strong>CLOSED end position</strong> <em>(end position w &lt;)</em></td>
<td>Limit of the set point w When the set point falls below the limit, an actuator with ATO is completely vented and an actuator with ATC is filled with air. This action always lead to the tight-closing of the valve. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15.</td>
</tr>
<tr>
<td>15*</td>
<td><strong>OPEN end position</strong> <em>(end position w &gt;)</em></td>
<td>Limit of the set point w When the set point falls below the limit, an actuator with ATO is filled with air and an actuator with ATC is completely vented. This action always lead to the maximum opening of the valve. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15. <strong>Example:</strong> Set the end position w &gt; to 99 % for three-way valves.</td>
</tr>
<tr>
<td>16*</td>
<td><strong>Pressure limit</strong></td>
<td>The signal pressure to the actuator can be limited. After changing the pressure limit setting, the actuator must be vented once (e.g. by selecting the fail-safe position).</td>
</tr>
<tr>
<td>Code no.</td>
<td>Parameter – Readings, values [default setting]</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>17*</td>
<td>Proportional-action coefficient Kp level 0 to 17 · ESC, [7]</td>
<td>During the initialization of the positioner, the Kp and Tv values are optimized. If the value for the Kp level is below 3, the error code 61 is activated. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the Kp and Tv levels can be adapted after the initialization. For this, either the Tv level can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the Kp level can be decreased in increments.</td>
</tr>
<tr>
<td></td>
<td>NOTICE Changing the Kp level influences the system deviation. This influence can be balanced out by tuning the input filter in Code 6. See section 7.6.6.</td>
<td></td>
</tr>
<tr>
<td>18*</td>
<td>Derivative-action time Tv level No · 1 to 4 · ESC, [2]</td>
<td>See Code 19. A change of the Tv level has no effect on the set point deviation.</td>
</tr>
<tr>
<td>19*</td>
<td>Tolerance band 0.1 to 10.0 % of the operating range · ESC, [5.0]</td>
<td>Used for error monitoring. If the system deviation is greater than selected tolerance band for a time longer than the lag time [30 s], this causes the error code 57 (control loop) to be activated. Note: The lag time can only be set using the operator software.</td>
</tr>
<tr>
<td>20*</td>
<td>Select characteristic [0] to 9 · ESC</td>
<td>Select the characteristic. See section 16 0: Linear 1: Equal percentage 2: Reverse equal percentage 3: SAMSON butterfly valve, linear 4: SAMSON butterfly valve, equal percentage 5: VETEC rotary plug valve, linear 6: VETEC rotary plug valve, equal percentage 7: Segmented ball valve, linear 8: Segmented ball valve, equal percentage 9: User-defined (defined in operator software)</td>
</tr>
</tbody>
</table>

**Note:** Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21*</td>
<td>Transit time OPEN (w ramp OPEN) [0] to 240 s · ESC **NOTICE** The transit time entered in this code does not apply when the safety function is triggered, the solenoid valve/forced venting is activated or when the auxiliary power fails.</td>
<td>The time required to pass through the operating range when the valve opens. This parameter can be used to increase the Min. transit time OPEN (Code 40). Limitation of the transit time (Code 21 and 22): For some applications it is advisable 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.</td>
</tr>
<tr>
<td>22*</td>
<td>Transit time CLOSED (w ramp CLOSED) [0] to 240 s · ESC **NOTICE** The transit time entered in this code does not apply when the safety function is triggered, the solenoid valve/forced venting is activated or when the auxiliary power fails.</td>
<td>The time required to pass through the operating range when the valve closes. This parameter can be used to increase the Min. transit time CLOSED (Code 41). Code 22 has priority over Code 14.</td>
</tr>
<tr>
<td>23*</td>
<td>Absolute total valve travel YES - [0] to 99 · 10^7 · ESC Exponential reading after value reaches 9999</td>
<td>Totaled double valve travel Can be reset to 0 in Code 36 – STD and – DS. **Note:** The value is saved in a non-volatile memory every 24 hours.</td>
</tr>
<tr>
<td>24*</td>
<td>Total valve travel limit 1000 to 99 · 10^7 · ESC, [1 000 000] Exponential reading after value reaches 9999</td>
<td>Limit of total valve travel. A 'Total valve travel exceeded' message is issued with the selected status classification when the limit is exceeded. **Note:** The 'Total valve travel exceeded' message has the default status classification 'Maintenance required'. This classification can only be changed in the operator software (e.g. TROVIS-VIEW 4).</td>
</tr>
</tbody>
</table>

**Note:** Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25*</td>
<td>Alarm mode</td>
<td>Switching mode of software limit switches alarm A1 and A2 in responding state (when positioner has been initialized).</td>
</tr>
<tr>
<td></td>
<td>0 to 3 · ESC, [2]</td>
<td>Explosion-protected version according to EN 60947-5-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: ( A1 \geq 2.1 \text{ mA} ) ( A2 \leq 1.2 \text{ mA} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: ( A1 \leq 1.2 \text{ mA} ) ( A2 \leq 1.2 \text{ mA} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2: ( A1 \geq 2.1 \text{ mA} ) ( A2 \geq 2.1 \text{ mA} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3: ( A1 \leq 1.2 \text{ mA} ) ( A2 \geq 2.1 \text{ mA} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version without explosion protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: ( A1 = 348 \Omega ) ( A2 = \text{Non-conducting} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: ( A1 = \text{Non-conducting} ) ( A2 = \text{Non-conducting} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2: ( A1 = 348 \Omega ) ( A2 = 348 \Omega )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3: ( A1 = \text{Non-conducting} ) ( A2 = 348 \Omega )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When a positioner has not been initialized, the software limit switches always register the signal as in the state of no response.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If there is no mA signal at the terminals 11/12, the software limit switches both switch to ( \leq 1.2 \text{ mA} ) signal (Ex) or non-conducting (without explosion protection).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>\textbf{Note}: The fault alarm output always switches to ( \leq 1.2 \text{ mA} ) / non-conducting in case of a fault. It has ( \geq 1.2 \text{ mA} = 348 \Omega ) when there is no fault.</td>
</tr>
<tr>
<td>26*</td>
<td>Limit A1</td>
<td>Valve position limit in relation to the operating range</td>
</tr>
<tr>
<td></td>
<td>No · 0.0 to 100.0 % of the operating range · ESC, [2.0]</td>
<td>Alarm A1 responds when the value falls below the limit.</td>
</tr>
<tr>
<td></td>
<td>\textbf{NOTICE}</td>
<td>The setting has no effect when an inductive limit switch has been installed.</td>
</tr>
<tr>
<td>27*</td>
<td>Limit A2</td>
<td>Valve position limit in relation to the operating range</td>
</tr>
<tr>
<td></td>
<td>No · 0.0 to 100.0 % of the operating range · ESC, [98.0]</td>
<td>Alarm A2 responds when the value falls below the limit.</td>
</tr>
<tr>
<td>Code no.</td>
<td>Parameter – Readings, values [default setting]</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td>
<td></td>
</tr>
<tr>
<td>28*</td>
<td>Alarm test</td>
<td>Test Testing the software limit switches alarm A1 and A2 as well as the fault alarm contact A3. On activating the test, the contacts switch 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</td>
</tr>
<tr>
<td>29*</td>
<td>Position transmitter x/ix 3) [Ｇ] · [ψ] · ESC</td>
<td>Operating direction of the position transmitter. This indicates how the travel/angle position is assigned to the output signal I, based on the closed position. The operating range (see Code 8) of the valve is represented by the 4 to 20 mA signal. Values exceeding or falling below the limits 2.4 to 21.6 mA can be represented. When a positioner has not been connected (set point less than 3.6 mA), the signal is 0.9 mA and 3.8 mA or 4.4 mA when the positioner has not been initialized. When Code 32 = YES, the position transmitter issues the value as set in Code 30 during initialization or zero calibration. When Code 32 = No, 4 mA is issued during a running self-adaptation.</td>
</tr>
<tr>
<td>30*</td>
<td>Fault alarm ix 3) [No] · HI · LO · ESC</td>
<td>Used to select whether faults causing the fault alarm contact to switch should also be indicated 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</td>
</tr>
<tr>
<td>31*</td>
<td>Position transmitter test 3) –10.0 to 110.0 % of the operating range · ESC, [default value is last indicated value of the position transmitter]</td>
<td>Testing the position transmitter. Values can be entered in relation to the operating range. The momentary valve position is used in initialized positioners locally as the start value (bumpless changeover to the test mode). On testing over software, the entered simulation value is issued as the position feedback signal for 30 seconds.</td>
</tr>
<tr>
<td>32*</td>
<td>Error message in case of 'Function check' condensed state [YES] · No · ESC</td>
<td>YES: 'Failure' and 'Function check' condensed state cause an error message to be generated. No: Only 'Failure' condensed state causes an error message to be generated.</td>
</tr>
</tbody>
</table>

3Analog position transmitter: Code 29/30/31 can only be selected if the position transmitter (optional) is installed.
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
</table>
| 33*     | Error message in case of 'Maintenance required' and 'Out of specification' condensed states [YES] · No · ESC | YES: 'Failure', 'Maintenance required' and 'Out of specification' condensed state cause an error message to be generated.  
No: Only 'Failure' condensed state causes an error message to be generated. |
| 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).  
**Note:** Only needs to be entered when the SUB initialization mode (Code 6) is selected. |
| 35*     | Blocking position  
[0] mm/°/% · ESC | Distance up to CLOSED position  
**Note:** Only needs to be entered when the SUB initialization mode (Code 6) is selected. |
| 36*     | Reset  
STD · DIAG · DS · ESC | STD: Reset start-up  
– Parameters are reset to their default settings  
– Diagnosis data are reset  
– Information parameters (read only) remain unchanged  
– Positioner must be re-initialized  
DIAG: Reset diagnosis data  
– Parameter settings, reference data and logging remain unchanged  
– Re-initialization not required  
DS: Reset positioner to default settings  
– Parameters are reset to their default settings  
– Diagnosis data are reset  
– Information parameters (read only) are deleted  
– Positioner must be re-initialized |
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter - Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
</table>
| 37      | Options                                    | Indicate which option (connected to terminals 31 and 32, Fig. 18) is installed:  
No: No option installed  
POS: Analog position transmitter  
dI: Binary input  
LS: Leakage sensor  
When the binary input is used, DI and HIGH or LOW status are displayed in alternating sequence.  
When the leakage sensor is used, LS and the detected sound level in dB are displayed in alternating sequence. |
| 38*     | Inductive limit switch [No] · YES · ESC     | Indicates whether the inductive contact option is installed. |
| 39      | Set point deviation e                        | Shows the set point deviation (e = w - x) |
| 40      | Min. transit time OPEN                       | Minimum opening time determined during initialization |
| 41      | Min. transit time CLOSED                     | Minimum closing time determined during initialization |
| 42      | Set point                                   | Set point w applied for automatic mode  
4 to 20 mA corresponds with 0 to 100 % |
| 43      | Firmware version                             | Device type and current firmware version (displayed in alternating sequence) |
| 44      | Info y                                      | Control signal y in %, in relation to the travel range determined during initialization  
MAX: The positioner builds up its maximum output pressure. See description for Code 14, 15.  
0 P: The positioner vents completely. See description for Code 14, 15.  
-- --: The positioner is not initialized. |
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Internal solenoid valve/forced venting Read only</td>
<td>Indicates whether a solenoid valve/forced venting is installed. If a voltage supply is connected at the terminals +81/–82, YES and HIGH appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the $ icon), YES and LOW appear on the display in alternating sequence.</td>
</tr>
<tr>
<td>46*</td>
<td>Bus address [0] to 15 · ESC</td>
<td>Using the HART® protocol, all connected control room devices and field devices can be addressed individually using a point-to-point connection or the standard (multidrop) bus. Point-to-point: HART® master drive connected on HART® field device. With this connection, the positioner address must always be set to '0'. Standard (multidrop) bus: A maximum of 15 field devices can be connected in parallel to a single pair of wires. The HART® master drive tells them apart by their addresses in the range from 1 to 15.</td>
</tr>
<tr>
<td>47*</td>
<td>HART® write protection [No] · YES · ESC</td>
<td>When the write protection function is activated, device data can only be read, but not overwritten over HART® communication.</td>
</tr>
<tr>
<td>48 - Diagnosis Note: For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d0</td>
<td>Temperature Read only</td>
<td>Current operating temperature [°C] inside the positioner (accuracy ±3 %)</td>
</tr>
<tr>
<td>d1</td>
<td>Minimum Temperature Read only</td>
<td>Lowest temperature [°C] inside the positioner since the operating hours counter started counting</td>
</tr>
<tr>
<td>d2</td>
<td>Maximum temperature Read only</td>
<td>Highest temperature [°C] inside the positioner since the operating hours counter started counting</td>
</tr>
<tr>
<td>d3</td>
<td>Number of zero calibrations Read only</td>
<td>The number of zero calibrations performed since the last initialization.</td>
</tr>
<tr>
<td>d4</td>
<td>Number of initializations Read only</td>
<td>The number of initializations that have been performed since the last start with default settings.</td>
</tr>
<tr>
<td>Code no.</td>
<td>Parameter – Readings, values [default setting]</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td>
<td></td>
</tr>
<tr>
<td>d5*</td>
<td>Zero point limit</td>
<td>Valve position limit in relation to the nominal range. When the limit is exceeded, a 'Zero point' message (Code 58) is generated according to the status classification selected. <strong>Note:</strong> The 'Zero point' message (Code 58) has the default status classification 'Maintenance required'. This classification can only be changed in the operator software (e.g. TROVIS-VIEW 4).</td>
</tr>
<tr>
<td>d6</td>
<td>Condensed state</td>
<td>Summary of all the classified status messages according to the NAMUR Recommendation NE 107. OK: No message, C: Maintenance required, CR: Maintenance demanded, S: Out of specification, B: Failure, I: Function check.</td>
</tr>
<tr>
<td>d7</td>
<td>Supply pressure $p_s$</td>
<td>Current supply pressure [bar]</td>
</tr>
<tr>
<td>d8</td>
<td>Signal pressure $p_{out}$</td>
<td>Current signal pressure [bar]</td>
</tr>
<tr>
<td>d9</td>
<td>Flow rate</td>
<td>Current flow rate through the valve. <strong>Note:</strong> – – – – appears on the display when the flow rate calculation is not active or has failed.</td>
</tr>
<tr>
<td>d10</td>
<td>Differential pressure</td>
<td>Current differential pressure [bar]</td>
</tr>
<tr>
<td>d11*</td>
<td>Direction of action (actuator) [/-/] · SA · DA · ELSE · ESC</td>
<td>Indicates the actuator's direction of action. SA: Single-acting, DA: Double-acting, ELSE: Other.</td>
</tr>
</tbody>
</table>
## Code list

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>h0</strong></td>
<td><strong>Initialization including valve signature</strong></td>
<td>Initialization with [YES] or without [No] plotting the valve signature. The valve signature involves the signal pressure $p_{out}$ being plotted in relation to the valve position. The valve signature is plotted during initialization of an uninitialized positioner (e.g. after initialization has been reset (<a href="#">Code 36 - STD</a> and <a href="#">Code 36 - DS</a>)). The valve signature is also plotted during each further initialization when one of the settings in Initialization mode (<a href="#">Code 6</a>), Pin position (<a href="#">Code 4</a>), Direction of action (<a href="#">Code 7</a>), Pressure limit (<a href="#">Code 16</a>), Proportional-action coefficient $K_p$ level (<a href="#">Code 17</a>) or Derivative-action time $T_v$ level (<a href="#">Code 18</a>) is changed as well as when the switch position (ATO/ATC) has been changed. <strong>Note:</strong> The valve signature is required to perform diagnostic functions. For more details, refer to the Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.</td>
</tr>
<tr>
<td>h1</td>
<td>– Unassigned –</td>
<td></td>
</tr>
<tr>
<td>h2</td>
<td>– Unassigned –</td>
<td></td>
</tr>
<tr>
<td><strong>h3</strong></td>
<td><strong>Desired time until 'Reset diagnostic measured data'</strong></td>
<td>Time interval between scheduled reset of diagnosis data</td>
</tr>
<tr>
<td>h4</td>
<td><strong>Remaining time until 'Reset diagnostic measured data'</strong></td>
<td>Remaining time (time and unit of time displayed in alternating sequence) until the next scheduled reset of the diagnosis data</td>
</tr>
<tr>
<td>49</td>
<td><strong>Partial stroke test (PST)</strong></td>
<td><strong>Note:</strong> The Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics contain further details on the partial stroke test (PST).</td>
</tr>
<tr>
<td>A0</td>
<td><strong>Start test</strong></td>
<td>Start partial stroke test (Test D4). The valve moves through the test range (Lower range value (<a href="#">Code 49 - d2</a>) to Upper range value (<a href="#">Code 49 - d3</a>)) and back again in a ramp or in steps. The time, set point, valve position, set point deviation and the control signal are recorded.</td>
</tr>
<tr>
<td>A1</td>
<td><strong>Time until next test</strong></td>
<td>Remaining time (time and unit of time displayed in alternating sequence) until the next time-controlled test starts</td>
</tr>
</tbody>
</table>

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</tr>
</thead>
</table>
| A2*     | **Test**  
AUTO · [MAN] · ESC  
**NOTICE**  
The write protection is active in the AUTO setting (local operation and operation over software locked)  
Activates (AUTO) or deactivates (MAN) the time-controlled partial stroke test. |
| A3*     | **Test interval**  
Test interval (time and unit of time displayed in alternating sequence) until starting the time-controlled test |
| A4      | – Unassigned – |
| A5      | **Recommended min. sampling time**  
Read only  
Sampling time [s] used to record entire step response in the graph of the partial stroke test. |
| A6      | – Unassigned – |
| A7      | **Δp_out reference value**  
Read only  
The valve moves to the lower range value (Code 49 - d2) and upper range value (Code 49 - d3) with a certain signal pressure. The Δp_out reference value [bar] is calculated from the two signal pressures.  
**Note:** The reference value only applies to the adjusted step and ramp values. |
| A8*     | **Activate Δp_out monitoring**  
[No] · YES · ESC  
Activates (YES) or deactivates (No) the Δp_out monitoring. |
| A9*     | **Δp_out monitoring value**  
0.00 to 7.00 bar · ESC, [1.00]  
The test is canceled whenever the signal pressure change falls below and exceeds the reference value. The reference value is made up of Δp_out reference value (Code 49 - A7) and the Δp_out monitoring value. |
| d0      | – Unassigned – |
| d1      | – Unassigned – |
| d2*     | **Lower range value**  
0.0 to [100.0] % · ESC  
Start value of the test  
**Note:** To perform the partial stroke test, the Lower range value must be within the range of the current operating point ± Tolerance limit.  
The Tolerance limit is 2.0 % by default. It can be changed in the operator software, e.g. TROVIS-VIEW 4. |

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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>d3*</td>
<td>Upper range value</td>
<td>Final value of the test</td>
</tr>
<tr>
<td></td>
<td>0.0 to 100.0 % · ESC, [90.0]</td>
<td></td>
</tr>
</tbody>
</table>
| d4*     | Activate ramp function                         | YES: The valve is ramped through the test range within the adjusted ramp time.  
|          | No · [YES]                                     | No: The valve is moved in steps through the test range (step response). |
| d5*     | Ramp time (decreasing)                         | Time period in which the valve moves through the operating range from the closed to the open position  
|          | 0 to 9999 s · ESC, [45]                        | The time to move from Lower range value (Code 49 - d2) to Upper range value (Code 49 - d3) is calculated:  
|          |                                               | Upper range value – Lower range value / 100 x Ramp time (increasing) |
| d6*     | Ramp time (increasing)                         | Time period in which the valve moves through the operating range from the open to the closed position  
|          | 0 to 9999 s · ESC, [45]                        | The time to move from Upper range value (Code 49 - d3) to Lower range value (Code 49 - d2) is calculated:  
|          |                                               | Lower range value – Upper range value / 100 x Ramp time (decreasing) |
| d7*     | Settling time before starting test            | Settling time between reaching the upper range value (Code 49 - d3) and the valve moving through the test range in the reverse direction |
|          | 1 to 240 s · ESC, [10]                         |             |
| d8*     | Waiting time after step change                 | Waiting time between step change from Lower range value (Code 49 - d2) to Upper range value (Code 49 - d3) and vice versa |
|          | 1.0 to 240.0 s · ESC                           |             |
| d9*     | Sampling time                                  | Time interval between measuring data |
|          | [0.2] to 250.0 s · ESC                         |             |
| E0*     | Activate x monitoring                          | Activates x monitoring (YES) or deactivates it (No) |
|          | No · [YES]                                    |             |
| E1*     | x monitoring value                             | The test is canceled when the valve moves below the adjusted value. |
|          | –10.0 to 110.0 % of the entire travel · ESC, [85.0] |             |
| E2      | – Unassigned –                                 |             |
| E3      | – Unassigned –                                 |             |

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</thead>
<tbody>
<tr>
<td>E4</td>
<td>– Unassigned –</td>
<td></td>
</tr>
<tr>
<td>E5*</td>
<td>Activate PST tolerance band monitoring</td>
<td>Activates PST tolerance band monitoring (YES) or deactivates it (No)</td>
</tr>
<tr>
<td></td>
<td>[No] · YES</td>
<td></td>
</tr>
<tr>
<td>E6*</td>
<td>PST tolerance band</td>
<td>The test is canceled when the deviation in valve position (in relation to the upper range value of the step) exceeds the adjusted value.</td>
</tr>
<tr>
<td></td>
<td>0.1 to 100.0 % · ESC, [5.0]</td>
<td></td>
</tr>
<tr>
<td>E7*</td>
<td>Max. test duration</td>
<td>The test is canceled when the maximum test duration is reached.</td>
</tr>
<tr>
<td></td>
<td>30 to 25000 s · ESC [30]</td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td>– Unassigned –</td>
<td></td>
</tr>
<tr>
<td>E9*</td>
<td>Reset 'Partial stroke test parameters'</td>
<td>Resets partial stroke test parameters</td>
</tr>
<tr>
<td>F0</td>
<td>No test available</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>– Unassigned –</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>x cancelation</td>
<td>The test was canceled.</td>
</tr>
<tr>
<td></td>
<td>The valve position fell below the x monitoring value (Code 49 - E1).</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>△p_out cancelation</td>
<td>The test was canceled.</td>
</tr>
<tr>
<td></td>
<td>The change in signal pressure (△p_out) fell below or exceeded the reference value (Code 49 - A9).</td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>Tolerance band exceeded</td>
<td>The deviation of the valve position exceeded the adjusted PST tolerance band (Code 49 - E6).</td>
</tr>
<tr>
<td>F5</td>
<td>Max. test duration exceeded</td>
<td>The test was canceled.</td>
</tr>
<tr>
<td></td>
<td>The Max. test duration (Code 49 - E7) was reached.</td>
<td></td>
</tr>
<tr>
<td>F6</td>
<td>Test canceled manually</td>
<td></td>
</tr>
<tr>
<td>F7</td>
<td>Measured data memory full</td>
<td>The Sampling time (Code 49 - d9) is too low. After recording 100 data points per variable, logging is stopped, but the test continues until it is completed.</td>
</tr>
<tr>
<td>F8</td>
<td>Cancelled by internal solenoid valve/forced venting</td>
<td>The test was canceled.</td>
</tr>
<tr>
<td></td>
<td>The internal solenoid valve has been energized/the forced venting has been activated.</td>
<td></td>
</tr>
</tbody>
</table>

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### Code list

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<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F9</td>
<td>Canceled by control loop error</td>
<td>The test was canceled. A control loop error has occurred.</td>
</tr>
</tbody>
</table>

**Type of application**

*Note: Section 7.8 contains details on the on/off valve.*

| h0       | Type of application [No] · YES · ESC         | No: Control valve  
|          |                                              | YES: On/off valve  
|          |                                              | Depending on the selected type of application, the positioner behaves differently in automatic mode and has different diagnostic functions. Refer to section 3.4. |
| h1       | Operating point 0.0 to [100.0] % valve position · ESC | Valve position when set point $w > \text{Operating point limit (Code 49 - h5)}$ |
| h2       | Fail-safe action limit 0.0 to 20.0 % set point · ESC, [12.5] | Limit of set point $w$  
|          |                                              | A limit violation causes the valve to move to the fail-safe position. |
| h3       | Lower limit to start test [25.0 % set point] | If the set point is between Lower limit to start test (25 %) and Fail-safe action limit (Code 49 - h2), the valve remains in its last valid position.  
|          |                                              | If the set point remains between Lower limit to start test (25 %) and Upper limit to start test (50 %) for six seconds, a partial stroke starts. After the partial stroke test is completed, the valve moves back to the last valid position. |
| h4       | Upper limit to start test [50.0 % set point] | If the set point is between Operating point limit and Upper limit to start test (50 %), the valve remains in its last valid position.  
|          |                                              | If the set point remains between Lower limit to start test (25 %) and Upper limit to start test (50 %) for six seconds, a partial stroke starts. After the partial stroke test is completed, the valve moves back to the last valid position. |
| h5       | Operating point limit 55.0 to 100.0 % set point · ESC, [75.0] | Limit of set point $w$  
|          |                                              | A limit violation causes the valve to move to the Operating point (Code 49 - h1). |
**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: \( \bigstar \), Out of specification: \( \bigstar \) blinking, Failure alarm: \( \dag \)).

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 in an operator software, e.g. TROVIS-VIEW 4.
## Initialization errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When error messages exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>50 x &gt; range</strong></td>
<td>The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit.</td>
</tr>
<tr>
<td></td>
<td>– Pin positioned incorrectly</td>
</tr>
<tr>
<td></td>
<td>– NAMUR attachment: bracket slipped or follower pin is not in the slot of the follower plate</td>
</tr>
<tr>
<td></td>
<td>– Follower plate incorrectly attached</td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>– Check attachment and pin position.</td>
</tr>
<tr>
<td></td>
<td>– Re-initialize the positioner.</td>
</tr>
<tr>
<td><strong>51 Δx &lt; range</strong></td>
<td>The measuring span of the sensor is too low.</td>
</tr>
<tr>
<td></td>
<td>– Pin positioned incorrectly</td>
</tr>
<tr>
<td></td>
<td>– Incorrect lever installed</td>
</tr>
<tr>
<td></td>
<td>– Pressure limit selected too low</td>
</tr>
<tr>
<td></td>
<td>A rotational angle smaller than 16° at the positioner shaft creates just an alarm. An angle below 9° leads to the initialization being canceled.</td>
</tr>
<tr>
<td>Status classification</td>
<td>[Out of specification]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>– Check attachment and pressure limit.</td>
</tr>
<tr>
<td></td>
<td>– Re-initialize the positioner.</td>
</tr>
<tr>
<td><strong>52 Attachment</strong></td>
<td>– The nominal range could not be achieved during initialization with NOM initialization mode (the maximum travel/angle reached is indicated on the display).</td>
</tr>
<tr>
<td></td>
<td>– Incorrect lever installed</td>
</tr>
<tr>
<td></td>
<td>– Supply pressure too low. The valve cannot move to the required position.</td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>– Check attachment and supply pressure.</td>
</tr>
<tr>
<td></td>
<td>– Re-initialize the positioner.</td>
</tr>
<tr>
<td>Error codes – Recommended action</td>
<td>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When error messages exist, they are displayed here.</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **53 Initialization time exceeded**<br>(Init time >) | The initialization routine lasts too long.  
- The valve opens after a considerable delay.  
- The valve does not have fixed end stops (possible with a lined control butterfly).  
- The valve has a strong tendency to hunt. |
| Status classification | [Maintenance required] |
| Recommended action |  
- Check supply pressure. If necessary, install a pneumatic booster.  
- Adjust end stops.  
- Reduce tendency to hunt (e.g. restrict or open booster bypass).  
Then re-initialize the positioner. |
| **54 Initialization - internal solenoid valve/forced venting** | 1) Internal solenoid valve/forced venting not connected or incorrectly connected.  
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 solenoid valve/forced venting  
- Re-initialize the positioner.  
Re. 2) – Switch to **MAN** operating mode.  
- Re-initialize the positioner. |
| **55 Transit time too short**<br>(transit time <) | The actuator positioning rates determined during the initialization are so short (< 0.3 s) that the positioner cannot adapt itself optimally. |
| Status classification | [Out of specification] |
| Recommended action |  
- Activate the volume restriction in the positioner output.  
- Re-initialize the positioner. |
| **56 Pin position/switch position** | 1) The pin position was not entered for the initialization modes **NOM** and **SUB**.  
2) The switch (ATO/ATC) is defective |
| Status classification | [Maintenance required] |
| Recommended action |  
Re. 1) – Enter pin position and nominal range.  
- Re-initialize the positioner.  
Re. 2) – Return the positioner to SAMSON for repair. |
<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
## Hardware errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
| **62** x signal                | - Measured data recording for actuator has failed.  
- Conductive plastic element is defective.  
The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position indication.  
### Open-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. |
| Additional indication at the fault alarm contact! | |
| Status classification | [Maintenance required] |
| Recommended action | Return the positioner to SAMSON AG for repair. |
| **63** SIL shutdown/w too small | 1) Emergency shutdown of the i/p block is implemented by 3.8 mA or 4.4 mA (depending on the positioner version)  
2) The set point w is smaller than 3.7 mA.  
This state is indicated on the positioner display by a blinking **LOW** |
| Status classification | [No message] |
| Recommended action | Re. 1) Raise the current (depending on version) above the limit.  
Re. 2) Check set point.  
If necessary, limit the current source downwards so that no values below 3.7 mA can be issued. |
| **64** i/p converter | – The circuit of the i/p converter has been interrupted. |
| Status classification | Failure (status classification change not possible) |
| Recommended action | Return the positioner to SAMSON AG for repair. |
## Error Appendix

<table>
<thead>
<tr>
<th>Error Codes</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>65 Hardware</strong></td>
<td>A hardware error has occurred, the positioner changes to the fail-safe position (<em>SAFE</em>). As long as the error exists, no EXPERTplus diagnostic messages are logged.</td>
</tr>
<tr>
<td><strong>Status Classification</strong></td>
<td>[Failure]</td>
</tr>
<tr>
<td><strong>Recommended Action</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>

| **67 Test Calculation** | The hardware controller is monitored by means of a test calculation. |
| **Status Classification** | [Failure] |
| **Recommended Action** | Confirm error. If this is not possible, return the positioner to SAMSON AG for repair. |

## Data Errors

<table>
<thead>
<tr>
<th>Error Codes</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>68 to 75 – Unassigned –</strong></td>
<td>The travel measuring system of the positioner has a self-monitoring function (see <strong>Code 62</strong>). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner vents the output when a measuring error occurs or A1 with double-acting actuators. During the initialization, the positioner checks whether the actuator has such a function or not.</td>
</tr>
<tr>
<td><strong>Status Classification</strong></td>
<td>[No Message]</td>
</tr>
<tr>
<td><strong>Recommended Action</strong></td>
<td>Merely information, confirm, if necessary. No further action necessary.</td>
</tr>
</tbody>
</table>
## Diagnostic errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td>77 – Unassigned –</td>
<td></td>
</tr>
<tr>
<td>78 – Unassigned –</td>
<td></td>
</tr>
<tr>
<td>79 <strong>Collective error</strong></td>
<td>Messages generated by EXPERTplus exist. The error does not have any direct effect on the positioner’s functioning. Refer to Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics</td>
</tr>
<tr>
<td>Status classification</td>
<td>Maintenance required (status classification change not possible)</td>
</tr>
<tr>
<td>80 – Unassigned –</td>
<td></td>
</tr>
<tr>
<td>81 <strong>Valve signature canceled</strong></td>
<td>Error during automatic plotting of the valve signature. Error messages are saved in a non-volatile memory. They cannot be reset.</td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Restart plotting of the valve signature or start initialization including valve signature.</td>
</tr>
<tr>
<td>83 – Unassigned –</td>
<td></td>
</tr>
<tr>
<td>84 <strong>Partial stroke test (PST)/full stroke test (FST)</strong></td>
<td>A partial stroke test or full stroke test cannot be started or has been canceled. Refer to Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.</td>
</tr>
<tr>
<td>Status classification</td>
<td>No message</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Read out test status (only in the operator software)</td>
</tr>
<tr>
<td>85 <strong>On/off valve</strong></td>
<td>The transit time and breakaway time or the final travel/angle value of the on/off valve has changed.</td>
</tr>
<tr>
<td>Status classification</td>
<td>No message</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Check valve and actuator.</td>
</tr>
</tbody>
</table>
### Code list

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>ERR</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>86</strong> SIL tests</td>
<td>The SIL operator test has failed. Refer to Operating Instructions EB 8389-1 EN on EXPERTplus Valve Diagnostics.</td>
</tr>
<tr>
<td>Status classification</td>
<td>Failure (status classification change not possible)</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Return the positioner to SAMSON AG for repair.</td>
</tr>
</tbody>
</table>
15 Dimensions in mm

Attachment acc. to IEC 60534-6

External position sensor

Lever mm
S = 17
M = 50
L = 100
XL = 200

Pressure gauge or connecting plate

Direct attachment

M20 x 1.5

Output (38) Supply (9)

Fig. 23a - NAMUR and direct attachment
15.1 Fixing levels according to VDI/VDE 3845 (September 2010)

<table>
<thead>
<tr>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>d</th>
<th>$M_{\text{min}}$</th>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA0</td>
<td>50</td>
<td>25</td>
<td>15</td>
<td>5.5 for M5</td>
<td>66</td>
<td>50</td>
</tr>
<tr>
<td>AA1</td>
<td>80</td>
<td>30</td>
<td>20</td>
<td>5.5 for M5</td>
<td>96</td>
<td>50</td>
</tr>
<tr>
<td>AA2</td>
<td>80</td>
<td>30</td>
<td>30</td>
<td>5.5 for M5</td>
<td>96</td>
<td>50</td>
</tr>
<tr>
<td>AA3</td>
<td>130</td>
<td>30</td>
<td>30</td>
<td>5.5 for M5</td>
<td>146</td>
<td>50</td>
</tr>
<tr>
<td>AA4</td>
<td>130</td>
<td>30</td>
<td>50</td>
<td>5.5 for M5</td>
<td>146</td>
<td>50</td>
</tr>
<tr>
<td>AA5</td>
<td>200</td>
<td>50</td>
<td>80</td>
<td>6.5 for M6</td>
<td>220</td>
<td>50</td>
</tr>
</tbody>
</table>

* Flange type F05 according to DIN EN ISO 5211
16 Valve characteristic selection

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

**Note:** A characteristic can only be defined (user-defined characteristic) using the operator software (e.g. TROVIS-VIEW 4).

---

**Linear** (select characteristic: 0)

Travel/ angle of rotation [%]

0 50 100

Reference variable [%]

0 50 100

---

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

Travel/ angle of rotation [%]

0 50 100

Reference variable [%]

0 50 100

---

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

Travel/ angle of rotation [%]

0 50 100

Reference variable [%]

0 50 100
EC-TYPE-EXAMINATION CERTIFICATE
(Translation)

PTB 10 ATEX 2007


(3) EC-type-examination Certificate number:

PTB 10 ATEX 2007

(4) Equipment:

Digital positioner, type 3736-6-110 and 3736-6-210
with HART communication

(5) Manufacturer:

SAMSON AG Mass- und Regeltechnik

(6) Address:

Weismüllerstr. 3, 85314 Frankfurt, Germany

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

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential assessment and test report PTB Ex 15-25351.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2006
EN 60079-11:2007
EN 61508-1:2004

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

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

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

Certificate and execution no.: see (15) Description

On behalf of PTB

Prof. Dr.-Ing. G. Johannes
Dipl.-Ing. und Professor

Braunschweig, August 18, 2010

(15) Description of equipment

The digital positioner with HART communication is a single or double acting positioner. It is used for the conversion of electrical actuating signals into pneumatic actuating pressure signals. The equipment is installed inside the hazardous area. The equipment is available in two designs, type 3736-6-110 and type 3736-6-210 with a field barrier connected in series.

Marking

Type 3736-6-110

II 2 G Ex ia IIC T6

II 2 D Ex ia A1 IP66 T80 °C

Type 3736-6-210 with field barrier, type 3770-4

II 2 G Ex ia IIC T6

II 2 D Ex ia A1 IP66 T80 °C

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

<table>
<thead>
<tr>
<th>Type of protection/Options</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>60 °C</td>
</tr>
<tr>
<td>Ex ia IIC T6</td>
<td>-55 °C ... 70 °C</td>
</tr>
<tr>
<td>T4</td>
<td>80 °C</td>
</tr>
<tr>
<td>Option, structure-borne</td>
<td>-40 °C ... 70 °C</td>
</tr>
<tr>
<td>sound sensor</td>
<td>80 °C</td>
</tr>
</tbody>
</table>
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

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

Electrical data
Type 3730-6-210 with field barrier, type 3770-1 connected in series
Operating values: 4...20 mA
Supply circuit: \( U_s = 10 \) V
or NAMUR-limit contact: \( U_m = 250 \) V

Type 3730-6-110
The positioner may be connected to certified intrinsically safe circuits provided the permissible maximum values for \( U_s \), \( I_s \) and \( P_s \) are not exceeded.

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

Operating values: 4...20 mA
Voltage/power supply (terminals 11/12)

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Ex ia IIC/IIIB</th>
<th>only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 28 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 115 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 32 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 87 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_s = 1 ) W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_s = 5.3 ) nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( L_s ) negligibly low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Position check-back (terminals 31/32)

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Ex ia IIC/IIIB</th>
<th>only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 28 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 115 ) mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Ex ia IIC/IIIB</th>
<th>only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 32 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 87 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_s = 1 ) W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_s = 5.3 ) nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( L_s ) negligibly low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Structure-borne sound sensor (passive) (terminals 31/32)

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Ex ia IIC/IIIB</th>
<th>only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 30 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 100 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_s = 6.3 ) nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( L_s ) negligibly low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inductive limit contact (terminals 41/42)

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Ex ia IIC/IIIB</th>
<th>only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 16 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 52 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_s = 189 ) mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( U_s = 16 ) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_s = 52 ) mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_s = 189 ) mW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_s = 30 ) nF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( L_s = 100 ) ( \mu F )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.
Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38116 Braunschweig • GERMANY
SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 10 ATEX 2007

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>$I_{c} / P_{c}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>0 °C - 45 °C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-55 °C - 60 °C</td>
<td>52 mA / 169 mW</td>
</tr>
<tr>
<td>T4</td>
<td>-75 °C - 60 °C</td>
<td></td>
</tr>
<tr>
<td>T9</td>
<td>-95 °C - 60 °C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-55 °C - 60 °C</td>
<td>25 mA / 84 mW</td>
</tr>
<tr>
<td>T4</td>
<td>-80 °C - 60 °C</td>
<td></td>
</tr>
</tbody>
</table>

Software-limit contact only for connection to a certified intrinsically safe circuit

- Maximum values:
  - $U_{c} = 20$ V
  - $I_{c} = 60$ mA
  - $P_{c} = 250$ mW
  - $C_{c} = 5.3$ nF
  - $L_{c}$ negligibly low

- Magnet valve only for connection to a certified intrinsically safe circuit

  - Maximum values:
    - $U_{c} = 28$ V
    - $I_{c} = 115$ mA
    
  or

  - $U_{c} = 32$ V
  - $I_{c} = 87.5$ mA
  - $C_{c} = 5.3$ nF
  - $L_{c}$ negligibly low

Fault signal output
(type of protection Ex ia IIC/IIIB
(terminal 83/84)

Maximum values:

- $U_{c} = 20$ V
- $I_{c} = 60$ mA
- $P_{c} = 250$ mW
- $C_{c} = 5.3$ nF
- $L_{c}$ negligibly low

Serial SSP interface
(type of protection Ex ia IIC/IIIB
(plug connector)

Maximum values (active):

- $U_{c} = 7.68$ V
- $I_{c} = 69.2$ mA
- $P_{c} = 137$ mW
- $C_{c} = 650$ nF
- $L_{c} = 10$ mH

or

- only for connection to a certified intrinsically safe circuit

Maximum values (passive):

- $U_{c} = 20$ V
- $I_{c} = 60$ mA
- $P_{c} = 250$ mW
- $C_{c} = 5.3$ nF
- $L_{c}$ negligibly low

External position sensor
(type of protection Ex ia IIC/IIIB
(Analog PCB, pins p9, p10, p11)

Maximum values:

- $U_{c} = 7.68$ V
- $I_{c} = 13.2$ mA
- $P_{c} = 27$ mW
- $C_{c} = 1$ nF
- $L_{c} = 370$ µH
- $C_{c} = 66$ nF
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

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

(16) Assessment and test report: PTB Ex 10-26351

(17) Special conditions for safe use
   none

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

Zertifizierungssektor Explosions
On behalf of PTB.

Dr.-Ing. U. Johannesmeier
Direktor und Professor

Braunschweig, August 18, 2010

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

CONFORMITY STATEMENT
(Translation)


(2) Test Certificate Number:
   PTB 10 ATEX 2008 X

(4) Equipment: Digital positioner, type 3736-6-810

(5) Manufacturer: SAMSON AG Mess- und Regeltechnik

(6) Address: Wessmüllerstr. 3, 60314 Frankfurt, Germany

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

(8) The Physikalisch-Technische Bundesanstalt, on behalf 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 the confidential assessment and test report: PTB Ex 10-26352.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

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

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

(12) The marking of the equipment shall include the following:
   II 3 G Ex nA II T6 or II 3 G Ex nL IIC/IIIB T6 or II 3 D Ex IIB A22 IP66 T80 °C

Zertifizierungssektor Explosions
On behalf of PTB.

Dr.-Ing. U. Johannesmeier
Direktor und Professor

Braunschweig, August 18, 2010
SCHEDULE

CONFORMITY STATEMENT PTB 10 ATEX 2008 X

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

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

<table>
<thead>
<tr>
<th>Type of protection / Options</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex nA II or Ex nL IIC</td>
<td>T6 60 °C</td>
</tr>
<tr>
<td>Ex nA IIC or Ex nL IIC</td>
<td>T5 -55 °C ... 70 °C</td>
</tr>
<tr>
<td></td>
<td>T4 60 °C</td>
</tr>
<tr>
<td>Option, structure-borne sound sensor</td>
<td>-40 °C ... 70 °C</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Electrical data:
Signal circuit, type of protection Ex nA II
(terminals 11/12)

Maximum operational values:
I = 4 ... 20 mA
U = 32 V
L = negligibly low
C = 5.3 nF

Table:

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>I, / P,</th>
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</thead>
<tbody>
<tr>
<td>T6</td>
<td>-45 °C</td>
<td>25 mA / 84 mW</td>
</tr>
<tr>
<td>T5</td>
<td>-55 °C ... 60 °C</td>
<td>52 mA / 190 mW</td>
</tr>
<tr>
<td>T4</td>
<td>-70 °C</td>
<td></td>
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</tbody>
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For relationship between temperature class, permissible ranges of the ambient temperature, maximum short-circuit currents and maximum power for analyzing units, reference is made to the table:

<table>
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<td>T6</td>
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<td></td>
</tr>
<tr>
<td>T5</td>
<td>-55 °C ... 60 °C</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>-70 °C</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>... 80 °C</td>
<td></td>
</tr>
</tbody>
</table>
Software-limit contact..............................................................type of protection Ex nA II
(terminals 41/42 and 51/52)

Maximum operational values:
U = 8 V
I = 8 mA
or
type of protection Ex nL IIC/IIB
U = 20 V
I = 60 mA
P = 400 mW
L = negligibly low
C = 5.3 nF

Magnet valve.................................................................type of protection Ex nA II
(terminals 61/82)

Maximum operational values:
U = 8 ... 24 V DC
or
type of protection Ex nL IIC/IIB
U = 32 V
I = 132 mA
L = negligibly low
C = 5.3 nF

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

Maximum operational values:
U = 8 V
I = 8 mA
or
type of protection Ex nL IIC/IIB
U = 20 V
I = 60 mA
P = 400 mW
L = negligibly low
C = 5.3 nF

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

Maximum operational values:
U = 8 V DC
I = 20 mA
or
type of protection Ex nL IIC/IIB
U = 20 V
I = 60 mA
P = 200 mW
L = negligibly low
C = 5.3 nF

External position sensor..................................................type of protection Ex nA II
(Analog PCB, pins p9, p10, p11)

or Ex nL IIC/IIB

Maximum operational values:
U = 7.88 V
I = 81 mA
P = 120 mW
L = 10 mH
C = 1 μF

Assessment and test report: PTB Ex 10-20052

(16) Special conditions for safe use

Type of protection Ex nA II:

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

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

All fuses shall be installed outside of the hazardous area.

Type of protection Ex nL IIC:

No fuses are required for the operation with energy-limited circuits of type of protection Ex nL IIC.
(18) Essential health and safety requirements
met by compliance with the standards mentioned above

Zertifi zierungssektor Explosionsschutz
On behalf of PTB:

Dr.-Ing. U. Johannsen
Direktor und Professor

Braunschweig, August 16, 2010
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