Series 3731
Electropneumatic Ex d Positioner
Type 3731-3

with HART® communication

Mounting and Operating Instructions

EB 8387-3 EN
Firmware version 1.53
Edition July 2008
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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Modifications to positioner firmware compared to the previous version

<table>
<thead>
<tr>
<th>1.41 (old)</th>
<th>1.42 (new)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After performing a reset to default values, the allocation of the closing position AIR TO OPEN (AtO) / AIR TO CLOSE (AtC) is not reset to the default setting. The setting is kept.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.42 (old)</th>
<th>1.51 (new)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting can be performed at the positioner to determine whether the valve is to operate as a control valve or an on/off (open/close) valve (see section 3.1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.51 (old)</th>
<th>1.52 (new)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All EXPERTplus diagnostic functions are available in the positioner without having to activate them first (refer to EB 8389 EN on EXPERTplus valve diagnostics)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.52 (old)</th>
<th>1.53 (new)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional binary input with following actions (refer to EB 8389 EN on EXPERTplus valve diagnostics):</td>
<td></td>
</tr>
<tr>
<td>- Set local operation write protection</td>
<td></td>
</tr>
<tr>
<td>- Start Partial Stroke Test (PST)</td>
<td></td>
</tr>
<tr>
<td>- Go to fail-safe reference variable</td>
<td></td>
</tr>
<tr>
<td>- Switch between AUTO/MAN</td>
<td></td>
</tr>
<tr>
<td>- Start data logger</td>
<td></td>
</tr>
<tr>
<td>- Reset diagnosis</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.53 (old)</th>
<th>1.54 (new)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal modifications</td>
<td></td>
</tr>
</tbody>
</table>

Note:
The functions of EXPERTplus valve diagnostics are described in the Mounting and Operating Instructions EB 8389 EN.
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 relevant standards.

- Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 10.

- Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.

- If inadmissible motions or forces are produced in the actuator as a result of the supply pressure, 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.
## 2 Article code

<table>
<thead>
<tr>
<th>Positioner</th>
<th>Type 3731 - 3</th>
<th>x x x x x x x x x x 0 0 x 1 x 0 0 0</th>
</tr>
</thead>
</table>

**With LCD, autotune, HART® communication**

**Explosion protection**

ATEX: II 2G Ex db IIC T6, II 2G Ex db eb IIC T6, II 2G Ex db [ia] IIC T6, II 2G Ex ia IIC T6, II 2D Ex tb IIIC T 80 °C IP 66

FM/CSA:

Class I, Div.1+2, Groups B–D; Class II+III, Div.1+2, Groups E–G; Class I, Zone 1, IIB+H2/Class I, Div.1+2, Groups B–D T6…T4; Class II, Div.1+2, Groups E–G; Class III; Class I, Zone 1, Group IIB+H2, T6…T4

JIS: Ex d IIC T6

**Options (additional equipment)**

| Without | 0 0 |
| Position transmitter | 0 1 |
| Binary input | 0 3 |
| Forced venting | 0 5 |
| Binary output (NAMUR/PLC) | 0 6 |

**Diagnostics**

EXPERTplus | 4 |

**Electrical connections**

| 2x M20 x 1.5 | 1 |
| 2x ½ NPT | 2 |

**Emergency shutdown**

Emergency shutdown with the reference variable of 0 mA* | 0 |

Emergency shutdown when the reference variable is smaller than 3.85 mA | 1 |

**Explosion-protection certificates**

As specified in Explosion protection | 0 |

NEPSI: Ex d IIC T6~T4; Ex de IIC T6~T4 | 2 1 |

IECEx: Ex d IIC T6; II 2 D IP 65 T 80 °C | 2 1 |

GOST: 1Ex d IIC T6/T5/T4 | 2 1 |

**Special applications**

None | 0 |

Positioner compatible with paint (IP 41/NEMA 1) | 1 |

**Special version**

Without | 0 0 0 |

* Version no longer available
3 Design and principle of operation

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

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

In case of a system deviation, the actuator is either vented or filled with more air. The signal pressure supplied to the actuator can be limited to 1.4 bar, 2.4 bar or 3.7 bar by...
software or on site at the positioner. A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the housing as well as to optimize the air capacity booster (7). The i/p converter (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply pressure.

All parts are enclosed in an Ex d housing. The electrical wires are connected over a separate terminal compartment which is also designed with Ex d protection.

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

The positioner is suitable for the following types of attachment using the corresponding accessories:
- Direct attachment to SAMSON Type 3277 Actuator: Section 4.1
- Attachment to actuators acc. to IEC 60534-6 (NAMUR): Section 4.2
- Attachment to Type 3510 Micro-flow Valve: Section 4.3
- Attachment to rotary actuators acc. to VDI/VDE 3845: Section 4.4

3.1 Application type

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

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

<table>
<thead>
<tr>
<th></th>
<th>Control valve</th>
<th>Open/close valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO ☺</td>
<td>The positioner follows the reference variable continuously. The valve position (current position) appears in % on the display.</td>
<td>Discrete analysis of the reference variable. The valve position (current position) in % and O/C (Open/Close) appear in alternating sequence on the display.</td>
</tr>
<tr>
<td>MAN ✰</td>
<td>The positioner follows the reference variable given over local operation.</td>
<td></td>
</tr>
</tbody>
</table>

The application type is set in Code 49 - h (see section 7.7).

**Note:** Depending on the application type, certain diagnostic functions cannot be performed or analyzed. Refer to EB 8389 EN on EXPERTplus valve diagnostics.
3.2 Additional equipment

Forced venting

The i/p converter stops working if the operating voltage supply to the relevant terminals is interrupted. The positioner can no longer operate and the control valve moves to the fail-safe position (SAFE) determined by the actuator, independent of the reference variable.

Binary contact

The positioner has three internal binary signals which can be analyzed over terminals A/B/C. Two of these signals are intended for the valve end positions and one signal for a collective fault alarm. The assignment of these signals to the A/B/C terminals is determined over Code 25.

Position transmitter

The position transmitter (13) is a two-wire transmitter and issues the travel sensor signal as a 4 to 20 mA signal processed by the microcontroller. Since this signal is issued independent of the positioner’s input signal (min. current 3.8 mA), the actual travel/angle of rotation is controlled in real-time. Additionally, the position transmitter provides the possibility of signaling a positioner fault over a signal current of 2.4 mA or 21.6 mA.

Binary input

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

- **Transfer switching state [default]**
  The switching state of the binary input is logged.

- **Set local operation write protection**
  Settings cannot be changed at the positioner while the binary input is active. The configuration enabled function in Code 3 is not active.

- **Start partial stroke test (PST)**
  The positioner starts a single partial stroke test. The test is performed according to the settings in Code 49 - d2 to Code 49 - d9 (refer to EB 8389 EN on EXPERTplus valve diagnostics).

- **Go to fail-safe reference value**
  An open/close valve moves to the entered fail-safe reference value when the positioner is in automatic mode (AUTO).
  No action is started when the positioner is in manual mode (MAN) or fail-safe position (SAFE).

- **Switch between AUTO/MAN**
  The positioner changes from automatic mode (AUTO) mode into manual mode (MAN) and vice versa.
  No action is started if the positioner is in the fail-safe position (SAFE).

- **Start data logger**
  The data logger is started when the binary input is active (refer to EB 8389 EN on EXPERTplus valve diagnostics).

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

- **External solenoid valve connected**
  The triggering of an external solenoid valve is recognized.

- **Leakage sensor**
  The “External leakage soon to be expected” error is set. The error is reset when the edge control is set to OFF. The message remains saved in the logging.

---

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

**Connection to terminals A-B:** Binary input for DC voltage signals

**Connection to terminals B-C:** Contact input for an external contact

---

### 3.3 Communication

The positioner is equipped with an interface for HART® protocol (Highway Addressable Remote Transducer) for communication purposes. Data are transmitted in a superimposed frequency (FSK = Frequency Shift Keying) on the existing signal loop for the 4 to 20 mA reference variable. Either a HART® capable handheld communicator or a computer with FSK modem can be used to establish communication and operate the positioner.

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### 3.3.1 Configuration using TROVIS-VIEW software

Refer to Table 5 on page 31 for order numbers.

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

**Note:** The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device. The device-specific module for Type 3731-3 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW). Additional information on TROVIS-VIEW (e.g. system requirements) can found on the SAMSON website and in the Data Sheet T 6661 EN.
### 3.4 Technical data

<table>
<thead>
<tr>
<th>Type 3731-3 Ex d Positioner (technical data in test certificates additionally apply for explosion-protected devices)</th>
</tr>
</thead>
</table>
| **Rate travel** | Adjustable | Direct attachment to Type 3277: 3.6 to 30 mm  
Attachment acc. to IEC 60534-6 (NAMUR): 3.6 to 200 mm  
Attachment to rotary actuators (VDI/VDE 3845): 24° to 100° |
| **Travel range** | Adjustable | Adjustable within the initialized travel/angle of rotation;  
travel can be restricted to ± at the maximum |
| **Reference variable** | **w** | Signal range 4 to 20 mA, 2-wire unit, reverse polarity protection,  
min. span 4 mA, static destruction limit 40 V, internal current limit 60 mA |
| **Shutdown action** | | Type 3731-3xxxxxx  
Type 3731-3xxxxxx000x1x00: Emergency shutdown at 0 mA  
Type 3731-3xxxxxx100x1x00: Emergency shutdown at 3.85 mA |
| **Minimum current** | | 3.6 mA for display · 3.8 mA for operation  
Load impedance ≤ 9 V corresponds to 450 Ω at 20 mA |

**Communication**

<table>
<thead>
<tr>
<th>Local communication</th>
<th>SAMSON SSP interface and serial interface adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software requirements</td>
<td>TROVIS-VIEW with device-specific module for Type 3731-3</td>
</tr>
</tbody>
</table>
| **HART® communication** | HART® field communication protocol  
Impedance in HART® frequency range: Receiving approx. 455 Ω, sending 185 Ω |
| Software requirements | For handheld communicator: device description for Type 3731-3  
For PC: DTM file acc. to Specification 1.2, suitable for integrating the positioner in frame applications that supports the FDT/DTM concept (e.g. PACTware);  
integration into AMS™ Suite available. |

<table>
<thead>
<tr>
<th><strong>Supply air</strong></th>
<th><strong>Pressure</strong></th>
<th>1.4 to 6 bar (20 to 90 psi)</th>
</tr>
</thead>
</table>
| Air quality acc. to ISO 8573-1 edition 2004 | Max. particle size and density: Class 4 · Oil content: Class 3  
Moisture and water: Class 3  
Pressure dew point: At least 10 K beneath the lowest ambient temperature to be expected |
| **Signal pressure (output)** | 0 bar up to supply pressure · Limitable to 1.4/2.4/3.7 ±0.2 bar via software |
| **Characteristic** | Linear/equal percentage/reverse equal percentage  
Butterfly valve/Rotary plug valve/Segmented ball valve: linear/equal percentage  
User-defined (over operating software and communication)  
Deviation from terminal-based conformity ≤ 1 % |
| **Hysteresis** | ≤ 0.3 % |
| **Sensitivity** | ≤ 0.1% |
| **Transit time** | Separately adjustable up to 240 seconds for supply air and exhaust air |
| **Direction of action** | Reversible |
| **Air consumption, steady-state** | Independent from supply pressure < 110 l/h |
**Type 3731-3 Ex d Positioner (technical data in test certificates additionally apply for explosion-protected devices)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
</table>
| **Air output capacity to actuator**  | Pressurized: $8.5 \text{ m}^3/\text{h} \cdot \text{At}$ at $\Delta p = 6 \text{ bar}$; $3.0 \text{ m}^3/\text{h} \cdot \text{K}_{\text{Vmax}}(20^\circ \text{C}) = 0.09$
|                                      | Vented: $14.0 \text{ m}^3/\text{h} \cdot \text{At}$ at $\Delta p = 6 \text{ bar}$; $4.5 \text{ m}^3/\text{h} \cdot \text{K}_{\text{Vmax}}(20^\circ \text{C}) = 0.15$
| **Permissible ambient temperature**  | $-40$ to $80 \degree \text{C}$
|                                      | The limits in the test certificate additionally apply.                       |
| **Influences**                        | Temperature: $\leq 0.2/10 \text{ K}$; Supply air: None
|                                      | Vibration: $0.25 \%$ up to $2000 \text{ Hz}$ and $4 \text{ g}$ acc. to IEC 770 |
| **EMC**                              | Complying with the requirements of EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21 |
| **Electrical connections**            | Two threaded connections with $\frac{1}{2}$ NPT thread, optionally with M20 x 1.5 Screw terminals for $2.5 \text{ mm}^2$ wire cross-section |
| **Explosion protection**              | ATEX Type 3730-321: II 2G Ex db IIC T6, II 2G Ex db eb IIC T6, II 2G Ex ia IIC T6, II 2D Ex ib III C T $80 \degree \text{C}$ IP 66
|                                      | FM Type 3730-323: XP/I/1/BCD/T4 $\text{T}=80 \degree \text{C}$, $\text{T}=70 \degree \text{C}$, $\text{T}=60 \degree \text{C}$; Type 4X/IP $66$
|                                      | DIP/II, III/1/EFG/T4 $\text{T}=80 \degree \text{C}$, $\text{T}=70 \degree \text{C}$, $\text{T}=60 \degree \text{C}$; Type 4X/IP $66$
|                                      | CSA Type 3730-323: Class 2258-02: Class I, Division 1 and 2, Groups B, C, D
|                                      | Class II and III, Division 1 and 2, Groups E, F, G
|                                      | Class I, Zone 1, II B+H2; Type 4X/IP $66$
|                                      | JIS Type 3730-327: Ex d IIC T6
|                                      | NEPSI Type 3731-321xxxxxx00x11: Ex d IIC T6~T4; Ex de IIC T6~T4
|                                      | IECEx Type 3731-321xxxxxx00x12: Ex d IIC T6; II 2 D IP 65 T $80 \degree \text{C}$
|                                      | GOST Type 3731-321xxxxxx00x13: 1Ex d IIC T6/T5/T4 |
| **Degree of protection**              | IP 66/NEMA 4 X
| **Use in safety-instrumented systems in compliance with IEC 61508** | Suitable for use in safety-relevant applications up to SIL 2 (single device) and SIL 3 (with redundant configuration).
|                                      | Type 3731-3xxxxxx0...: Emergency shutdown at a reference variable of 0 mA
|                                      | Type 3731-3xxxxxx1...: Emergency shutdown at a reference variable $\leq 3.85 \text{ mA}$ |
| **Materials**                         | Housing Die-cast aluminum EN AC-ALS10Mg(Fe) (EN AC-44300) acc. to DIN EN 1706 chromated and powder paint coating
|                                      | External parts Stainless steel 1.4301/1.4305/1.4310
| **Weight**                           | Approx. 2.5 kg
### Additional equipment

#### Optional binary output, software limit switch, galvanically isolated

Connection: Optionally NAMUR EN 60947-5-6 or PLC, configurable as a limit switch or fault alarm output

<table>
<thead>
<tr>
<th>Signal status</th>
<th>Terminals B-C Switching output AC/DC (PLC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conductive/remaining voltage &lt; 1.7 V</td>
</tr>
<tr>
<td></td>
<td>≥ 2.1 mA</td>
</tr>
<tr>
<td></td>
<td>Non-conducting/high resist. I &lt; 100 µA</td>
</tr>
<tr>
<td></td>
<td>≤ 1.2 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Switching output AC/DC (PLC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only for connection to NAMUR signal converter acc. to EN 60947-5-6</td>
</tr>
</tbody>
</table>

#### Optional forced venting, galvanically isolated

<table>
<thead>
<tr>
<th>Input</th>
<th>0 to 40 V DC/0 to 28 V AC, static destruction limit 45 V DC/32 V AC, input resistance ≥ 7 kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>Fail-safe position at an input voltage ≤ 3 V Normal operation at an input voltage &gt; 5.5 V</td>
</tr>
</tbody>
</table>

#### Optional analog position transmitter, two-wire transmitter

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>11 to 35 V DC, reverse polarity protection, static destruction limit 45 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td>Direction of action</td>
<td>Reversible</td>
</tr>
<tr>
<td>Operating range</td>
<td>−1.25 to 103 % of the travel range, corresponding to 3.8 to 20.5 mA, optionally also for fault alarm over 2.4 or 21.6 mA acc. to NAMUR Recommendation NE 43</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Linear</td>
</tr>
<tr>
<td>Hysteresis and HF influence</td>
<td>Same as positioner</td>
</tr>
<tr>
<td>Other influences</td>
<td>Same as positioner</td>
</tr>
<tr>
<td>Fault alarm</td>
<td>Can be issued with current signal 2.4 mA or 21.6 mA</td>
</tr>
</tbody>
</table>

#### Optional binary input, galvanically isolated, optionally for detection of an externally applied voltage or for operation of an external floating contact · Switching behavior configured as required, default setting (see below)

<table>
<thead>
<tr>
<th>Voltage input function</th>
<th>Polarity insensitive, 0 to 24 V DC voltage to be applied, input resistance 6.5 kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static destruction limit</td>
<td>40 V</td>
</tr>
<tr>
<td>Voltage</td>
<td>&gt; 6 V: Switching state ON · &lt; 4 V: Switching state OFF</td>
</tr>
</tbody>
</table>

#### Contact input function, for external switch (floating contact)

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>Open-circuit voltage when contact is open: 10 V, pulsed DC current, peak value 100 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Closed: Switching state ON · Open: Switching state OFF</td>
</tr>
</tbody>
</table>
Attachment to the control valve – Mounting parts and accessories

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

The positioner is suitable for the following types of attachment:
- Direct attachment to SAMSON Type 3277 Actuator
- Attachment to actuators according to IEC 60534-6 (NAMUR)
- Attachment to Type 3510 Micro-flow Valve
- Attachment to rotary actuators

**NOTICE**
Attach the positioner to the control valve, observing the following instructions to avoid damaging the positioner.
- Use only the mounting parts/accessories listed in the Tables 1 to 5 (pages 30 and 31) to mount the positioner. Observe the type of attachment!
- The positioner is fitted with pneumatic connections with ¼ NPT threads. If you need G ¼ threads, attach the connecting plate (6) listed in the accessories.
- Observe the assignment between lever and pin position (see travel tables on page 16)!

- Fit a signal pressure restriction (Table 5 on page 31) for actuators with diaphragm areas smaller than 240 cm².

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

The travel tables on page 16 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).

![Lever M with pin position 35 (delivered state)](image)

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

Travel tables

**Note:** The lever M is included in the scope of delivery.
Levers S, L, XL for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 30).

### 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>M</td>
<td>25</td>
</tr>
<tr>
<td>120/240/350</td>
<td>15</td>
<td>7.0 to 35.0</td>
<td>M</td>
<td>35</td>
</tr>
<tr>
<td>355/700</td>
<td>30</td>
<td>10.0 to 50.0</td>
<td>M</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.</td>
<td>Travel</td>
</tr>
<tr>
<td>60 and 120 with Type 3510 Valve</td>
<td>7.5</td>
<td>3.6</td>
<td>to</td>
</tr>
<tr>
<td>120</td>
<td>7.5</td>
<td>5.0</td>
<td>to</td>
</tr>
<tr>
<td>120/240/350</td>
<td>15</td>
<td>7.0</td>
<td>to</td>
</tr>
<tr>
<td>700</td>
<td>7.5</td>
<td>10.0</td>
<td>to</td>
</tr>
<tr>
<td>1400/2800</td>
<td>30</td>
<td>14.0</td>
<td>to</td>
</tr>
<tr>
<td>1400/2800</td>
<td>60</td>
<td>20.0</td>
<td>to</td>
</tr>
<tr>
<td>1400/2800</td>
<td>120</td>
<td>40.0</td>
<td>to</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>to</td>
<td>100°</td>
</tr>
</tbody>
</table>
4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 30 for required mounting parts and accessories.

Actuator with 120 cm²

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

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm.

1. Refer to Fig. 4 to select the symbol to match the required fail-safe position and how the positioner is attached:
   **Fail-safe position:**
   - Actuator stem extends = Fail-to-close
   - Actuator stem retracts = Fail-to-open
   **Positioner attachment:** Left or right with view looking onto the switchover plate
2. Align the marking of the switchover plate (9) to the corresponding symbol
3. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
4. Remove screw plug (4) on the back of the positioner and seal the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
5. Place follower clamp (3) on the actuator stem, align and screw it tight so that the mounting screw is located in the groove of the actuator stem.
6. Press brass restriction (order no. 1400-6964) into the seal of the signal pressure input at the actuator yoke.
7. Mount cover plate (10) with the narrow side of the cut-out opening (Fig. 4, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
8. **15 mm travel:** Keep the follower pin (2) at lever M (1) on the back of the positioner in the pin position 35 (delivered state).
   **7.5 mm travel:** Remove the follower pin (2) from the pin position 35, reposition it in the hole for pin position 25 and screw tight.
9. Insert formed seal (1.5) into the groove of the positioner housing, pressing the
four retaining rings over the housing screws and both fittings into the housing recesses.

10. Thread the bias spring (17) through the crosspiece underneath the lever (1) and push into the hole in the housing. Push the lever (1) until it engages into place. Place positioner on the cover plate (10) and fasten it using the three fixing screws.

Check to make sure that the follower pin (2) rest on top of the follower clamp (3). The lever (1) must rest on the follower clamp with spring force.

Make sure that the seal ring (10.1) is inserted in the borehole of the cover plate.

11. Mount cover (11) on the other side. Make sure that the vent plug (11.1) points downwards when the control valve is installed to allow any condensed water that collects to drain off.
Fig. 4 · Direct attachment for Type 3277-5 Actuator with 120 cm²
4.1.2 Type 3277 Actuator

Refer to Table 2 on page 30 for the required mounting parts and accessories.

Actuators with 240 to 700 cm²

Mount the positioner onto 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 it tight so that the mounting screw is located in the groove of the actuator stem.

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

3. **Actuators with 355/700 cm²**: Remove the follower pin (2) at lever M (1) on the back of the positioner from pin position 35, reposition it in the hole for pin position 50 and screw tight.

**Actuators 240 and 350 cm² with 15 mm travel**: The follower pin (2) remains in pin position 35 (delivered state).

4. Insert formed seal (15) into the groove of the positioner housing, pressing the four retaining rings over the housing screws and both fittings into the housing recesses.

5. Thread the bias spring (17) through the crosspiece underneath the lever (1) and push into the hole in the housing. Push the lever (1) until it engages into place. Place positioner on the cover plate (10) and fasten it using three fixing screws. Check whether the follower pin (2) rests on top of the follower clamp (3). The lever (1) must rest on the follower clamp with spring force.

6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover plate. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.

7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and attach the external signal pressure line.

8. Mount cover (11) on the other side. Make sure that the vent plug (11.1) points to the back when the control valve is installed to allow any condensed water that collects to drain off.
Fig. 5 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm²
4.2 Attachment according to IEC 60534-6 (NAMUR)

Refer to Table 3 on page 30 for the required mounting parts and accessories.

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

1. **Actuator sizes 120 to 700 cm²:**
   - Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and tighten it using the screws (14.1).

2. **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).

3. **Mount NAMUR bracket (10) to the control valve as follows:**
   - For attachment to the NAMUR rib, use an M8 screw (11), washer and toothed lock washer directly in the yoke bore.
   - For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke. Align the NAMUR bracket (10) in such a way that the slot of the follower plate (3/3.1) is centrally aligned with the NAMUR bracket at mid valve travel.

4. 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.

5. **Fit screw-in restriction (order no. 1400-6964) into the signal pressure output for actuators with diaphragm areas smaller than 240 cm².**

6. Select required lever (1) size M, L or XL and pin position according to the actuator size and valve travels listed in the table on page 16.

   **Lever M with pin position 25 or 50:**
   - Remove follower pin (2) from pin position 35 and screw it into the required hole.

   **Lever L or XL:**
   - Unscrew the standard lever M from the shaft of the positioner.
   - Screw the long follower pin (2) included in the mounting kit in the pin position of the required lever (1) assigned in the table.

   **Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).**

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

7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3/3.1). Adjust the lever (1) correspondingly. Screw the positioner to the NAMUR bracket using three fixing screws.
Fig. 6 · Attachment according to IEC 60534-6 (NAMUR)
4.3 Attachment to Type 3510 Micro-flow Valve

Refer to Table 3 on page 30 for the required mounting parts and accessories.

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

1. Place clamp (3) on the valve stem connector, align at a right angle and screw tight.
2. Screw bracket (10) to the valve yoke using two screws (11).
3. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G ¼ threaded connections are required, the connecting plate (6), making sure both seal rings (6.1) are seated properly.
4. Fit screw-in restriction (order no. 1400-6964) into the signal pressure output of the positioner (or output of the pressure gauge bracket or connecting plate).
5. Unscrew the standard installed lever M (1) including follower pin (2) from the positioner shaft.
6. Remove follower pin (2) from lever M and screw it into the hole for pin position 17 of lever S.
7. Place lever S on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
8. Move the lever once all the way as far as it will go in both directions.
9. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3).

Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using three fixing screws.
Attachment to the control valve – Mounting parts and accessories

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

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

Fit screw-in restriction into output (38)
4.4 Attachment to rotary actuators

Refer to Table 4 on page 31 for the required mounting parts and accessories.

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

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

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

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

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

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

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

7. For actuators with a volume of less than 300 cm³, fit the screw-in restriction (order no. 1400-6964) into the signal pressure output of the positioner (or the output of the pressure gauge bracket or connecting plate).

8. Place positioner on housing (10) and screw it tight. Considering the actuator's direction of rotation, align lever (1) so that it engages in the correct slot of the coupling wheel with its follower pin (Fig. 8).
Attachment to the control valve – Mounting parts and accessories

- Lever
- Nut
- Disk spring
- Follower pin
- Adapter
- Coupling wheel
- Screw
- Disk spring
- Adhesive label
- Actuator shaft
- or adapter
- Adapter housing
- Spacers
- Seal rings
- Pressure gauge bracket
- Pressure gauge mounting kit
- Screws
- Connecting plate (only for G ¼)
- Adapter housing
- 6.1 Seals

Fit screw-in restriction into signal pressure output for actuators with < 300 cm³ volume

SAMSON Type 3278
VETEC S160, VETEC R
Attachment acc. to VDI/VDE 3845 (Sept. 2010) level 1, size AA1 to AA4 (see section 12.1)

Fig. 9 · Attachment to rotary actuators
4.5 Reversing amplifier for double-acting actuators

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

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

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

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

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

Mounting

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

1. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the positioner. Remove the rubber seal (1.4).
2. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes \( A_1 \) and \( Z \).
3. Position the reversing amplifier (1) and screw tight using both the special screws (1.1).
4. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes \( A_1 \) and \( Z \).

**Signal pressure connections**

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

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

**NOTICE**
On start up of double-acting actuators, the following settings as described in section 7 must be made:

- Pressure limit (Code 16) = No
- Fail-safe position (Code 0) = AtO (AIR TO OPEN)

**Pressure gauge attachment**

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

Pressure gauge \( G \frac{1}{4} \) 1400-7106
bracket: \( \frac{1}{4} \) NPT 1400-7107

Pressure gauges for supply air \( Z \) and output \( A_1 \) as listed in Tables 1 to 4.
Attachment to the control valve – Mounting parts and accessories

From the positioner
Output 38  Supply 9

Control signals to the actuator

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

1  Reversing amplifier
1.1 Special screws
1.2 Gasket
1.3 Special nuts
1.4 Rubber seal
1.5 Sealing plug
1.6 Filter
### 4.6 Required Mounting Parts and Accessories

#### Table 1 · Direct attachment to Type 3277-5 (Fig. 4)

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Accessories for the actuator</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>For actuators with 120 cm² effective diaphragm area</td>
<td>Switchover plate (old) for Actuator Type 3277-5xxxxxx.00 (old)</td>
<td>1400-7452</td>
</tr>
<tr>
<td></td>
<td>Switchover plate <strong>new</strong> for Actuator Type 3277-5xxxxxx.01 (new)</td>
<td>1400-6819</td>
</tr>
<tr>
<td></td>
<td>Connecting plate <strong>new</strong> for Actuator Type 3277-5xxxxxx.01 (new), G ¼ and ¼ NPT</td>
<td>1400-6822</td>
</tr>
<tr>
<td></td>
<td>Connecting plate <strong>old</strong> for Actuator Type 3277-5xxxxxx.00 (old): G ¼</td>
<td>1400-6823</td>
</tr>
<tr>
<td></td>
<td>Connecting plate <strong>old</strong> for Actuator Type 3277-5xxxxxx.00 (old): ¼ NPT</td>
<td>1400-6824</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Accessories for the positioner</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connecting plate (6)</td>
<td>G ¼</td>
</tr>
<tr>
<td></td>
<td>Pressure gauge bracket (7)</td>
<td>G ¼</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¼ NPT</td>
</tr>
<tr>
<td></td>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td>St. st./Brass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. st./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 2 · 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>Required piping with screw fitting</td>
<td>240 cm²</td>
</tr>
<tr>
<td></td>
<td>- for &quot;Actuator stem retracts&quot;</td>
<td>Steel</td>
</tr>
<tr>
<td></td>
<td>- with air purging of the top diaphragm chamber</td>
<td>350 cm²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stainless steel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>355/700 cm²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stainless steel</td>
</tr>
<tr>
<td></td>
<td>Connection block with seals and screw</td>
<td>G ¼</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¼ NPT</td>
</tr>
<tr>
<td></td>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td>St. st./Brass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. st./St. st.</td>
</tr>
</tbody>
</table>

#### Table 3 · Attachment to NAMUR ribs or control valves with rod-type yokes (20 to 35 mm rod diameter) according to IEC 60534-6 (Figs. 6 and 7)

<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 w. 60/120 cm² on Type 3510 Valve (Fig. 7)</td>
<td>1400-7457</td>
</tr>
<tr>
<td>5 to 50</td>
<td>M</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, 1400-60 version</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>
</tbody>
</table>
### Table 3 continued

<table>
<thead>
<tr>
<th>Travel in mm</th>
<th>Lever</th>
<th>For actuators</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<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 Masonellian linear actuators; a mounting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>kit acc. to IEC 60534-6 is necessary depending on the travel (see above)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valtek Type 25/50</td>
<td>1400-9554</td>
</tr>
</tbody>
</table>

### Accessories

- **Connecting plate**
  - G ¼ 1400-7461
  - G ½ 1400-7458
  - ½ NPT 1400-7459

- **Pressure gauge bracket (7)**
  - G ¼ 1400-7461
  - G ½ 1400-7458
  - ½ NPT 1400-7459

- **Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)**
  - St. steel/Brass 1400-6950
  - St. steel/St. steel 1400-6951

### Table 4 · 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), see section 12.1 for details</td>
<td>1400-7448</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></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></td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 160 cm² and for VETEC Type S160, R and M, heavy-duty version</td>
<td>1400-9245</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version</td>
<td>1400-5891 1400-9526</td>
</tr>
<tr>
<td>Attachment to Camflex II</td>
<td>1400-9120</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</td>
</tr>
<tr>
<td></td>
<td>½ NPT 1400-7462</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td>G ¼ 1400-7458</td>
</tr>
<tr>
<td></td>
<td>½ 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</td>
</tr>
<tr>
<td></td>
<td>St. steel/st. steel 1400-6951</td>
</tr>
</tbody>
</table>

### Table 5 · General accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic reversing amplifier for double-acting actuators</td>
<td>Type 3710</td>
</tr>
<tr>
<td>Signal pressure restrictions (screw-in and brass restrictions)</td>
<td>1400-6964</td>
</tr>
<tr>
<td>TROVIS-VIEW with device-specific module for Type 3731-3 (refer to section 3.3.1)</td>
<td></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>
</tbody>
</table>

---

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

The maximum input pressure (supply pressure) must not exceed 6 bar.

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

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

The maintenance instructions for upstream pressure reducing stations must be observed.
Blow through all air pipes and hoses thoroughly prior to connecting them.

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

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

5.1.2 Supply pressure

The required supply pressure (of supply air) depends on the bench range and the actuator's operating direction (fail-safe action). The bench range is registered on the nameplate either as spring range or signal pressure range depending on the actuator. The direction of action is marked FA or FE, or by a symbol.

Actuator stem extends FA (AIR TO OPEN)

Fail-safe position "Valve Closed"
(for globe and angle valves):
Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.

Actuator stem retracts FE (AIR TO CLOSE)

Fail-safe position "Valve Open"
(for globe and angle valves):
For tight-closing valves, the maximum signal pressure \(p_{s,t_{\text{max}}}\) is roughly estimated as follows:

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

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

If there are no specifications, calculate as follows:

Required supply pressure = Upper bench range value + 1 bar

5.1.3 Signal pressure (output)

The signal pressure at the output (Output 38) of the positioner can be limited to 1.4, 2.4 or 3.7 bar in Code 16.
The limitation is not activated [No] by default.
5.2 Electrical connections

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

- For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.
- The following standard applies for assembly and installation in hazardous areas: **EN 60079-14** (VDE 0165 Part 1) *Explosive atmospheres - Electrical installations design, selection and erection*.

**Connection to conform with the type of protection Ex d (EN 60079-1):**

The Type 3731-321 Positioner must be connected over the appropriate cable glands or conduit systems which meet the requirements of EN 60079-1 (Electrical apparatus for explosive gas atmospheres - Part 1: Flameproof enclosures "d") Clauses 13.1 and 13.2 and for which a special test certificate exists.

Do not use simple types of cable glands or blanking plugs.

Seal any cable entries that are not used using blanking plugs approved for this purpose for installations according to the type of protection Ex db.

Install the connecting line rigidly and ensure it is protected adequately from being damaged. In case the temperature exceeds 70 °C at the cable entries, use appropriate temperature-resistant connecting cables.

Integrate the positioner into the equipotential bonding system on site.

**Connection to conform with the type of protection Ex e (EN 60079-7):**

The cable and cable entries or blanking plugs must be certified according to the type of protection Ex e (ATEX) and for which a special test certificate exists.

Devices used at ambient temperatures below −20 °C must have metal cable entries.

In cases where more than one cable core is connected to the same terminal, make sure that each cable core is clamped adequately.

Two cables with varying cross-sections may only be connected to one terminal, if this is not explicitly allowed in the documentation related to the electrical apparatus, when the two cables are secured with a common crimp sleeve beforehand.
Connection to conform with the type of protection Ex i (EN 60079-11):

For connection to a certified, external intrinsically safe circuit, the terminal compartment of the positioner may be opened within the hazardous area.

Only the terminal compartment is to be opened within the hazardous area to connect it to a certified intrinsically safe circuit.

Positioners that are connected to non-intrinsically safe circuits are no longer permitted to be used as intrinsically safe equipment.

The IP rating of the cable, cable entries and blanking plugs must be the same as the positioner's degree of protection.

Table 6 · Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable gland M20 x 1.5; EEx e, black plastic</td>
<td>8808-0178</td>
</tr>
<tr>
<td>Blanking plugs; EEx de; stainless steel (approvals: CENELEC, CSA, GOST, IECEx)</td>
<td>M20 x 1.5 8323-1203, 1/2 NPT 8323-1204</td>
</tr>
<tr>
<td>Cable entry for unarmored cables; EEx e, EEx d, EEx tD A21 (approvals: CENELEC, IECEx)</td>
<td>M20 x 1.5 8808-0200, 1/2 NPT 8808-2010</td>
</tr>
</tbody>
</table>
Cable entry

The threaded connections for the terminal compartment are designed with ½ NPT or M20x1.5 threads.
The electrical connections are screw terminals for wire cross-sections of 0.2 to 2.5 mm² using a tightening torque of at least 0.5 Nm.
The wires for the reference variable are to routed to the enclosure terminals marked **Signal** and are polarity insensitive.

- If the reference variable exceeds 22 mA, **OVERLOAD** appears on the LC display as a warning.
- If the reference variable falls below 3.7 mA, **LOW** appears on the LC display as a warning.

Depending on the version, the positioner is equipped with an additional binary output, a forced venting function, a position transmitter or a binary input.

The position transmitter is operated in 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 11 V at the minimum and 35 V DC at the maximum (reverse polarity protection, see Technical data).

Refer to Fig. 12 or the nameplate for terminal assignment.

**NOTICE**
The positioner changes to the fail-safe position if the reference variable drops below 3.8 mA.
### Connections

#### Signal

<table>
<thead>
<tr>
<th>Signal</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4...20 mA HART®</td>
<td></td>
<td>2-wire transmitter Supply unit for position transmitter</td>
</tr>
<tr>
<td>Control signal polarity insensitive</td>
<td></td>
<td>Forced venting</td>
</tr>
<tr>
<td>L/+ N/-</td>
<td></td>
<td>Binary output Signal converter acc. to EN 60947-5-6</td>
</tr>
<tr>
<td>0...40 V DC</td>
<td></td>
<td>Binary output PLC DC/AC</td>
</tr>
<tr>
<td>0...28 V AC</td>
<td></td>
<td>Binary input Voltage input, polarity insensitive</td>
</tr>
<tr>
<td>0...24 V DC</td>
<td></td>
<td>Binary input Contact input for external contact</td>
</tr>
</tbody>
</table>

---

**Fig. 12 · Electrical connections**
5.2.1 Establishing communication

Communication between PC and the FSK modem or handheld communicator and positioner is based on the HART® protocol.

Type Viator FSK modem

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

If the load impedance of the controller or control station is too low, an isolation amplifier functioning as load converter is to be connected between controller and positioner.

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

---

**Connections**

**Connection in non-hazardous area**

- Controller/control station
- FSK modem
- Handheld communicator or second FSK modem
- 4 to 20 mA
- 3731-30

**Connection in hazardous area**

- Controller/control station
- FSK modem
- Ex isolating amplifier
- Safe area
- Hazardous area
- Handheld communicator or second FSK modem (explosion-protected)
- 3731-31

*Fig. 13 · Connection with a FSK modem*
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 that in this case, the controller output load will increase.

![Diagram](Fig. 14 · Adapting the output signal)
6 Operator controls and readings

6.1 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.

6.2 Serial interface

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

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

The positioner needs to be supplied with at least 4 mA.

To use the TROVIS-VIEW software, connect the positioner over an adapter (see accessories in Table 5) to the RS-232 or USB port of the computer.

6.3 Readings on display

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

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

**Bar elements:**
In manual and automatic modes, the bars indicate the system deviation that depends on the sign (+/−) and the value.
One bar element appears per 1 % system deviation.
If the device has not yet been initialized, the icon blinks on the display and the lever position in degrees in relation to the longitudinal axis is indicated. One bar element corresponds to approximately a 5° angle of rotation.
If the fifth bar element blinks (reading > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

**Status messages**
- Maintenance alarm
- Maintenance required/Maintenance demanded
- Blinking: 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”, “Out of specification” and “Maintenance alarm” (see section 8.3).

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

## Readings and their meanings

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU1O</td>
<td>Automatic mode</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>Input greater than 21.6 mA</td>
</tr>
<tr>
<td>LO</td>
<td>Input smaller than 2.4 mA</td>
</tr>
<tr>
<td>LOW</td>
<td>Input lower than 3.7 mA</td>
</tr>
<tr>
<td>MAN</td>
<td>Manual mode</td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum range</td>
</tr>
<tr>
<td>No</td>
<td>Not available/active</td>
</tr>
<tr>
<td>NOM</td>
<td>Nominal travel</td>
</tr>
<tr>
<td>O/C</td>
<td>Open/close (on/off)</td>
</tr>
<tr>
<td>OVERLOAD</td>
<td>w &gt; 22 mA</td>
</tr>
<tr>
<td>RES</td>
<td>Reset</td>
</tr>
<tr>
<td>RUN</td>
<td>Start</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>tEShG</td>
<td>Self test</td>
</tr>
<tr>
<td>tEST</td>
<td>Test function active</td>
</tr>
</tbody>
</table>

## Status indicators

- Blinking: Emergency mode, see Code 62
- Blinking: Not initialized
- Blinking: Valve in mechanical fail-safe position

## Condensed state:
- Maintenance alarm
- Maintenance required

## Configuration:
- Enabled

## Bar elements for system deviation or lever position

## Units

## Limit switch Alarm 1

## Limit switch Alarm 2

## Code

## Serial interface

---

**Fig. 15 · Readings and operator controls**
6.4 HART® communication

The positioner must be supplied with at least 3.8 mA current.

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.

**Note:** In the case, complex functions are started in the positioner, which require a long calculation time or lead to a large quantity of data being stored in the volatile memory of the positioner, the alert “busy” is issued by the DTM file. This alert is not a fault alarm and can simply be confirmed.

### Write protection

- The write protection for HART communication can be disabled over Code 47. You can only disable or enable this function locally at the positioner. The write protection is enabled by default.

- The on-site operation can be locked over HART communication. 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.

---

7 Start-up – Settings

**WARNING!**

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

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

- tESTinG runs across the display and then the fault alarm icon \( \mathcal{E} \) appears and \( \mathcal{F} \) 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.

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

**WARNING!**

The actuator stem moves while the start-up settings are being performed. Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.
NOTICE
Perform the start-up settings in the same sequence as listed (section 7.1 to section 7.5).

7.1 Adapting the display

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

If the display appears upside down, proceed as follows:

Turn \( \bigcirc \rightarrow \) Code 2
Press \( \bigcirc \), Code 2 blinks.
Turn \( \bigcirc \rightarrow \) Desired reading direction.
Press \( \bigcirc \) to confirm the reading direction.

7.2 Limiting the signal pressure

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

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.

---

**NOTICE**
Do not activate the pressure limit function in double-acting actuators (with fail-safe action AIR TO OPEN (AtO)) \( \text{(No = default)} \).
7.3 Checking the operating range of the positioner

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

Select manual operating mode (MAN) : 

Turn \( \odot \rightarrow \text{Code } 0 \)
Press \( \odot \), Code 0 blinks.
Turn \( \odot \rightarrow \text{MAN} \)
Press \( \odot \) to change the positioner to manual mode.

Checking the operating range:

A horizontal lever (mid-position) is equal to 0°.

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

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

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

Taking into account the type of valve and the operating direction of the actuator, allocate the closed position (0 % travel):

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

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

Turn [ ] Code 0
Press [ ], display: **MAN**
Code 0 blinks.
Turn [ ] → **Init**
Press [ ]

Turn [ ] until the required closed position appears on the display.
Press [ ] to confirm the closed position.
Turn [ ] → **ESC**
Press [ ] to exit or:
Start initialization as described in section 7.5.

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

7.5 Positioner initialization

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

Before starting initialization, check the maximum permissible signal pressure of the control valve. During initialization, the positioner issues an output signal pressure up to the maximum supply pressure supplied. If necessary, limit the signal pressure by connecting an upstream pressure reducing valve.
NOTICE
If the positioner is mounted onto another actuator or its mounting position is changed, reset the positioner to its default settings before re-initializing it. Refer to section 7.8.

During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure requirements of the control valve.

The type and extent of self-adaptation depends on the initialization mode selected:

- **MAX** maximum range (standard range)
  Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.5.1)

- **NOM** nominal range
  Initialization mode for all globe valves (see section 7.5.2)

- **MAN** manually selected range
  Initialization mode for globe valves with an unknown nominal range (see section 7.5.3)

- **SUB** substitute calibration (emergency mode)
  This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.5.4)

**Note:** The initialization procedure can be interrupted while running by pressing the rotary pushbutton (©). **STOP** appears three seconds long and the positioner then changes to the fail-safe position (SAFE). The fail-safe position can be canceled again over Code 0 (see section 8.2.2).

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

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

A malfunctioning leads to the process being interrupted. The initialization error appears on the display according to how it has been classified by the condensed state. See section 8.3 on page 60).

**Note:** The setting of Code 48 - h0 = YES starts the plotting of the reference graphs required for valve diagnostics (drive signal steady-state d1 and hysteresis d2) after initialization. **tEST** and **d1** and **d2** appear on the display in an alternating sequence. An unsuccessful plotting of the reference graphs is indicated on the display by Code 48 - h1 and Code 81 (see error code list). The positioner still works properly, even though the reference graph plotting has not been completed successfully.
7.5.1 Initialization based on MAX maximum range

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

Enable configuration:

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

![Configuration enabled]

Default: No

---

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

Press \( \odot \), Code 3 blinks.

Turn \( \odot \) \( \rightarrow \) **YES**

Press \( \odot \), display:

Select initialization mode:

![Initialization mode]

Default: MAX

---

Turn \( \odot \) \( \rightarrow \) Code 6

Press \( \odot \)

Turn \( \odot \) \( \rightarrow \) **MAX**

Press \( \odot \) to confirm the **MAX** initialization mode.

---

**Start initialization:**

Initialization

Fail-safe position setting

Progress indicated until initialization starts

Turn \( \odot \) \( \rightarrow \) Code 0

Press \( \odot \), Code 0 blinks.

Turn \( \odot \) \( \rightarrow \) **Init**

Press \( \odot \). The setting of the fail-safe position \( \text{AtO} \) or \( \text{AtC} \) appears.

Keep \( \odot \) pressed down for 6 seconds. Initialization starts after the progress indication has stopped.

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

For a reading in \( \text{mm/°} \), enter the pin position (Code 4).
Enter pin position:

![Pin position display]

Turn 🔄 → Code 4
Turn 🔄 → Pin position on lever (see relevant section on attachment).
Press 🔄. The reading of the nominal range appears in mm/°.

7.5.2 Initialization based on NOM nominal range

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

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

Enable configuration:

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

![Configuration enabled display]

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

Enter pin position and nominal travel:

![Pin position and nominal range display]

Turn 🔄 → Code 4
Turn 🔄 → Pin position on lever (see relevant section on attachment).
Press 🔄
Turn 🔄 → Code 5
Press 🔄, Code 5 blinks.
Turn 🔄 → Nominal valve travel
Press \( \odot \)

**Select initialization mode:**

![Initialization mode](Image)

Default: MAX

Turn \( \odot \) \( \rightarrow \) Code 6

Press \( \odot \), Code 6 blinks.

Turn \( \odot \) \( \rightarrow \) NOM

Press \( \odot \) to confirm the NOM initialization mode.

**Start initialization:**

![Initialization](Image)

Fail-safe position setting

![Progress indicated](Image)

Press \( \odot \) pressed down for 6 seconds.

Initialization starts after the progress indication has stopped.

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

### 7.5.3 Initialization based on MAN manually selected range

Before starting initialization, move the control valve manually to the OPEN position by turning \( \odot \) in small steps. The valve must move to the required valve position with a monotonically increasing signal pressure. The positioner calculates the differential travel/angle using the OPEN and CLOSED positions and adopts it as the operating range with limits of travel/angle range start (Code 8) and travel/angle range end (Code 9).

**Enter OPEN position:**

![Manual reference variable](Image)

Enter OPEN position:

Turn \( \odot \) \( \rightarrow \) Code 0

Press \( \odot \), Code 0 blinks.

Turn \( \odot \) \( \rightarrow \) Init

Press \( \odot \). The setting of the fail-safe position \( A10 \) or \( A1C \) appears.

Keep \( \odot \) pressed down for 6 seconds. Initialization starts after the progress indication has stopped.

**Note:** After initialization, check the direction of action and, if necessary, change it (Code 7).
Turn \( \bigcirc \) until the OPEN position of the valve is reached.
Press \( \bigcirc \) to confirm the OPEN position.

**Enable configuration:**

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

Turn \( \bigcirc \) \( \rightarrow \) Code 3, display: No
Press \( \bigcirc \), Code 3 blinks.
Turn \( \bigcirc \) \( \rightarrow \) YES
Press \( \bigcirc \), display: ☑

**Enter pin position:**

Turn \( \bigcirc \) \( \rightarrow \) Code 4
Press \( \bigcirc \), Code 4 blinks.
Turn \( \bigcirc \) \( \rightarrow \) Pin position on lever (see relevant section on attachment).
Press \( \bigcirc \)

**Select initialization mode:**

Turn \( \bigcirc \) \( \rightarrow \) Code 6
Press \( \bigcirc \), Code 6 blinks.
Turn \( \bigcirc \) \( \rightarrow \) MAN
Press \( \bigcirc \) to confirm the MAN initialization mode.

**Start initialization:**

Turn \( \bigcirc \) \( \rightarrow \) Code 0
Press \( \bigcirc \), Code 0 blinks.
Turn \( \bigcirc \) \( \rightarrow \) Init
Press \( \bigcirc \). The setting of the fail-safe position \( \texttt{AtO} \) or \( \texttt{AtC} \) appears.
Keep \( \bigcirc \) pressed down for 6 seconds.
Initialization starts after the progress indication has stopped.
7.5.4 SUB substitute calibration

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

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

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

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

Enable configuration:

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

Turn $\rightarrow$ Code 6
Press $\circ$
Turn $\rightarrow$ SUB
Press $\circ$ to confirm the SUB initialization mode.

Enter direction of action:

Turn $\rightarrow$ Code 7
Press $\circ$, Code 7 blinks.
Turn $\rightarrow$ Direction of action (カフ/カフ)
Press $\circ$

Deactivate travel limit:

Turn $\rightarrow$ Code 11
Press $\circ$, Code 11 blinks.
Turn $\rightarrow$ No
Press $\circ$

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.

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

Press , Code 34
Press , Code 34 blinks.

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

Press , Code 35

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

Start initialization:

Initialization

Fail-safe position setting

Progress indicated until initialization starts

Blocking position

Turn → Code 0
Press , Code 0 blinks.

Turn → Init
Press . The setting of the fail-safe position AtO or AtC appears.
Keep pressed down for 6 seconds.
Initialization starts after the progress indication has stopped.
The operating mode changes to MAN.
The blocking position appears.

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

Cancel the blocking position and change to automatic mode (AUTO):

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

Turn → Code 1
Press , Code 1 and the icon blink.
Turn until the pressure in the positioner builds up and the valve moves slightly past the blocking position.
Press to cancel the blocking position.

Turn → Code 0
Press , Code 0 blinks.

Turn → AUTO
Press  
The positioner changes to automatic mode (AUTO). The current valve position is indicated in % on the display.

**Note:** If the positioner shows a tendency to hunt in automatic operating mode, the parameters $K_P$ and $T_V$ must be slightly corrected. Proceed as follows:
- Set $T_V$ (Code 18) to 4.
- Reduce $K_P$ (Code 17) until the positioner shows a stable behavior.

**Zero point correction**

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

### 7.6 Zero calibration

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

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

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

**Enable configuration:**

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

Turn  → **YES**
Press , display: ⚙

**Perform zero calibration:**

![Initialization mode Default: MAX]

Turn  → Code 6

Turn  → **ZP**
Press  

Turn  → Code 0
Press \( \rightarrow \) display: MAN, Code 0 blinks.

Turn \( \rightarrow \rightarrow \text{Init} \)

Press \( \rightarrow \)
The setting of the fail-safe position AtO or AtC appears.

Keep \( \rightarrow \) pressed down for 6 seconds.

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

7.7 Performing settings for open/close valves

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

**Note:** The travel range of open/close valves is defined using the fail-safe position and the given Operating point. As a result, the following parameters to define the operating range and the range of the reference variable cannot be changed or analyzed:
- Travel/angle range start (Code 8)
- Travel/angle range end (Code 9)
- Travel/angle lower limit (Code 10)
- Travel/angle upper limit (Code 11)
- Reference variable range start (Code 12)
- Reference variable range end (Code 13)

**Discrete analysis**

If the reference variable \( \rightarrow \) is below Limit operating point (Code 49 - h5) at the start of automatic operation, the valve \( \rightarrow \) moves to the fail-safe position. If the reference variable increases and exceeds the Limit operating point, the valve moves to the Operating point (Code 49 - h1). The valve moves back to the fail-safe position if the reference variable then falls below the Limit fail-safe position (Code 49 - h2).

If the reference variable \( \rightarrow \) is above Limit operating point (Code 49 - h5) at the start of automatic operation, the valve \( \rightarrow \) moves to the Operating point. If the reference variable then drops below the Limit fail-safe position (Code 49 - h2), the valve moves to the fail-safe position.
Starting the partial stroke test (PST)

A partial stroke test is started when the reference variable (⊗) moves from a defined position (fail-safe position or Operating point) into the range between Lower limit test start (Code 49 - h3) and Upper limit test start (Code 49 - h4) and remains there for longer than six seconds. The valve (⊗) moves from the last defined position to Step start (Code 49 - d2).

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

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

Cancelation of the partial stroke test (PST)

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

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

Performing settings

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

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

Select open/close valve:

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

After setting the application type as open/close valve, enter the operating point, test limits and limits for discrete analysis:
Turn \(\circ\) \(\rightarrow\) Code \(h1/h2/h3/h4/h5\)
Press \(\circ\), Code \(h1/h2/h3/h4/h5\) blinks.
Turn \(\circ\) and set the selected parameter.
Press \(\circ\) to confirm the setting.

**7.8 Reset to default values**

This function resets all start-up parameters and diagnosis data to their default values (see code list in section 11).

**Enable configuration:**

Turn \(\circ\) \(\rightarrow\) Code 3, display: \(\text{No}\)
Press \(\circ\), Code 3 blinks.
Turn \(\circ\) \(\rightarrow\) \(\text{YES}\)
Press \(\circ\), display: \(\text{✓}\)

**Reset start-up parameters:**

Turn \(\circ\) \(\rightarrow\) Code 36, display: \(\text{••--••}\)
Press \(\circ\), Code 36 blinks.
Turn \(\circ\) \(\rightarrow\) \(\text{Std}\)
Press \(\circ\). All start-up parameters and diagnosis data are reset to their default values.

---

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

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

8.1 Enabling and selecting parameters

All codes with their meanings and default settings are listed in the code list in section 11 on page 63 onwards. The codes which are marked with an asterisk (*) must be enabled with Code 3 before the associated parameters can be configured as described below.

<table>
<thead>
<tr>
<th>Code 3</th>
<th>Configuration not enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>Configuration enabled</td>
</tr>
</tbody>
</table>

Turn  → Code 3, display: No
Press , Code 3 blinks.
Change the setting of Code 3.
Turn  → YES
Turn , display: ✓
The configuration is enabled.

You can now configure codes one after the other:

Turn  and select the required code.
Press  to access the selected code. The code number starts to blink.
Turn  and select the setting.
Press  to confirm the selected setting.

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

Canceling the setting

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

Turn  → ESC
Press  to confirm the cancelation.
The entry is ended without the value you have just selected being adopted.
8.2 Operating modes

8.2.1 Automatic (AUTO) and manual (MAN) modes

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

![Automatic mode]

Switching to manual mode (MAN)

Turn ♂ → Code 0
Press ☒, display: AUTO,
Code 0 blinks.

Turn ♂ → MAN

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

![Switching to manual mode]

Adjust the manual reference variable

Turn ☒ → Code 1
Press ☒, Code 1 blinks.

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

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

Switching to automatic mode (AUTO):

Turn ♂ → Code 0
Press ☒, Code 0 blinks.

Turn ♂ → AUTO

Press ☒ to switchover to automatic 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 7.4), proceed as follows:

Turn → Code 0
Press , display: current operating mode ( or ), Code 0 blinks.

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

Exit the fail-safe position

Turn → Code 0
Press , Code 0 blinks.
Turn and select the required operating mode or .
Press The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

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

Note: The status classification can be changed in TROVIS-VIEW and over the parameters in the DD file. Refer to EB 8389 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:

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

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

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

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

The condensed state is represented by the following icons on the positioner display:

<table>
<thead>
<tr>
<th>Condensed state</th>
<th>Positioner display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance alarm</td>
<td>⌒</td>
</tr>
<tr>
<td>Function check</td>
<td>Text e.g. tESTing, Tune or tEST</td>
</tr>
<tr>
<td>Maintenance required/Maintenance demanded</td>
<td>⌒</td>
</tr>
<tr>
<td>Out of specification</td>
<td>⌒ blinking</td>
</tr>
</tbody>
</table>

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

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

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

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

8.3.1 Confirming error messages

Enable configuration:
Turn ⚙ → Code 3, display: No
Press ⚙, Code 3 blinks.
Turn ⚙ → YES
Press ⚙, display: ✅

Confirming error message:
Turn ⚙ → Select error code which you want to confirm.
Press ⚙.
The error message is confirmed.

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

The positioner does not require any maintenance.
There are filters with a 100 μm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.
The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

10 Servicing explosion-protected devices

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

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Operating mode [MAN]</td>
<td>AUtO Automatic mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAN Manual mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAFE Fail-safe position</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESC Escape</td>
</tr>
<tr>
<td></td>
<td>Init · AtO · AtC</td>
<td>Init Start initialization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allocate closed position: AtO: AIR TO OPEN (valve CLOSED in fail-safe position) or AtC: AIR TO CLOSE (valve OPEN in fail-safe position)</td>
</tr>
<tr>
<td>1</td>
<td>Manual reference variable w [0] to 100 % of the nominal range</td>
<td>Setting the manual reference variable w</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The current travel/angle is displayed in % when the positioner has been initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can only be selected when Code 0 = MAN.</td>
</tr>
<tr>
<td>2</td>
<td>Reading direction [Normal] or upside down ESC</td>
<td>The reading direction of the display is turned by 180°.</td>
</tr>
<tr>
<td>3</td>
<td>Enable configuration [No] YES ESC</td>
<td>Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HART blinks on the display when the on-site operation is locked over HART® communication.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Codes marked with an asterisk (*) can only be read and not overwritten.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Codes can also only be read over the SSP interface.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong></td>
<td><strong>Pin position</strong> [No] 17, 25, 35, 50, 70, 100, 200 mm 90° with rotary actuators ESC</td>
<td>The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. The pin position must be entered for initialization using NOM or SUB. Note: If you select a pin position in Code 4 that is too small, the positioner switches to the fail-safe position mode (SAFE) for reasons of safety.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td><strong>Nominal range</strong> mm or angle ° ESC</td>
<td>For initialization using NOM or SUB, the nominal travel/angle of rotation of the valve must be entered. The permissible adjustment range depends on the pin position according to the table for Code 4. Code 5 is generally locked until Code 4 is set to No, i.e. after a pin position has been entered, Code 5 can be configured. After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td><strong>Initialization mode</strong> [MAX] NOM · MAN · SUB · ZP ESC</td>
<td>Select the initialization mode MAX: Maximum range of the control valve, the travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator. NOM: Nominal range of the control valve, the travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position. MAN: Manually selected range SUB: Substitute calibration (without initialization) ZP: Zero calibration</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7</strong></td>
<td><strong>Direction of action w/x</strong></td>
<td>Direction of action of the reference variable w in relation to the travel/angle of rotation x (increasing/increasing or increasing/decreasing).</td>
</tr>
<tr>
<td></td>
<td>[.VISIBLE]</td>
<td>Automatic adaptation:</td>
</tr>
<tr>
<td></td>
<td>↗↘</td>
<td>AIR TO OPEN: After initialization, the direction of action remains increasing/increasing (↙↘), a globe valve opens as the reference variable increases.</td>
</tr>
<tr>
<td></td>
<td>ESC</td>
<td>AIR TO CLOSE: After initialization, the direction of action changes to increasing/decreasing (↙↘), a globe valve closes as the reference variable increases.</td>
</tr>
<tr>
<td><strong>8</strong></td>
<td><strong>Travel/angle range start</strong> (lower x-range value)</td>
<td>Starting value for the travel/angle of rotation in the nominal or operating range.</td>
</tr>
<tr>
<td></td>
<td>0.0 to 80.0 [0.0] % of the nominal range</td>
<td>The operating range is the actual travel/angle of the control valve and is limited by the travel/angle range start (Code 8) and the travel/angle range end (Code 9).</td>
</tr>
<tr>
<td></td>
<td>Specified in mm or angle ° provided Code 4 is set</td>
<td>Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the travel/angle range start and end. Value is displayed or must be entered.</td>
</tr>
<tr>
<td></td>
<td>ESC</td>
<td>The characteristic is adapted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See also the example in Code 9.</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td><strong>Travel/angle range end</strong> (upper x-range value)</td>
<td>End value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered.</td>
</tr>
<tr>
<td></td>
<td>20.0 to 100.0 [100.0] % of the nominal range</td>
<td>The characteristic is adapted.</td>
</tr>
<tr>
<td></td>
<td>Specified in mm or angle ° provided Code 4 is set</td>
<td>Example: The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the adjusted lower limit and 100 % to the adjusted upper limit.</td>
</tr>
<tr>
<td></td>
<td>ESC</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td><strong>Travel/angle lower limit</strong> (lower x-limit)</td>
<td>Limitation of the travel/angle of rotation downwards to the entered value.</td>
</tr>
<tr>
<td></td>
<td>[No]</td>
<td>The characteristic is not adapted.</td>
</tr>
<tr>
<td></td>
<td>0.0 to 49.9 % of the operating range ESC</td>
<td>See also example in Code 11.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>11</strong></td>
<td>Travel/angle upper limit (upper x-limit)</td>
<td>Limitation of the travel/angle of rotation upwards to the entered value. When set to No, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range. The characteristic is not adapted. <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 Code <strong>10</strong>, and the upper limit with Code <strong>11</strong>. If a tight-closing function has been set up, it has priority over the travel limitation.</td>
</tr>
<tr>
<td></td>
<td>50.0 to 120.0 [100] % of the operating range</td>
<td>No · ESC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12</strong></td>
<td>Reference variable range start (w-start)</td>
<td>Lower range value of the applicable reference variable range must be smaller than the final value w-end, 0 % = 4 mA. The reference variable range is the difference between w-end and w-start, and must be ( \Delta w \geq 25 % = 4 \text{ mA} ). For an adjusted reference variable range of 0 to 100 % = 4 to 20 mA, the control valve must move through its entire operating range from 0 to 100 % travel/angle of rotation. In <strong>split-range operation</strong>, the valves operate with smaller reference variables. The control signal of the control unit to control two valves is divided such, for instance, that the valves move through their full travel/angle of rotation at only half the input signal (first valve set to 0 to 50 % = 4 to 12 mA and the second valve set to 50 to 100 % =12 to 20 mA reference variable).</td>
</tr>
<tr>
<td></td>
<td>0.0 to 75.0 % of the reference variable range</td>
<td>[0.0 %] ESC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>13</strong></td>
<td>Reference variable range end (w-end)</td>
<td>Upper range value of the applicable reference variable range, must be greater than w-start. 100 % = 20 mA</td>
</tr>
<tr>
<td></td>
<td>25.0 to 100.0 % of the reference variable range</td>
<td>[100.0 %] ESC</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14*</td>
<td>Setpoint cutoff decrease (final position w &lt;) 0.0 to 49.9 [1.0] % No · ESC</td>
<td>If reference variable w reaches the percentage adjusted that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes <strong>14/15</strong> have priority over Codes <strong>8/9/10/11</strong>. Codes <strong>21/22</strong> have priority over Codes <strong>14/15</strong>.</td>
</tr>
<tr>
<td>15*</td>
<td>Setpoint cutoff increase (final position w &gt;) [No] 50.0 to 100.0 % ESC</td>
<td>If reference variable w reaches the percentage adjusted that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. A signal pressure limit is possible over Code <strong>16</strong>. Codes <strong>14/15</strong> have priority over Codes <strong>8/9/10/11</strong>. Codes <strong>21/22</strong> have priority over Codes <strong>14/15</strong>. <strong>Example:</strong> Set the cutoff to 99 % for three-way valves.</td>
</tr>
<tr>
<td>16*</td>
<td>Pressure limit [No] P 1.4 · 2.4 · 3.7 ESC</td>
<td>The signal pressure to the actuator can be limited in stages. After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position (SAFE) over Code <strong>0</strong>). <strong>NOTICE</strong> Do not activate the pressure limit for double-acting actuators with fail-safe position AIR TO OPEN (AtO).</td>
</tr>
<tr>
<td>17*</td>
<td>Proportional-action coefficient KP (step) 0 to 17 [7] ESC</td>
<td>Displaying or changing the KP and TV steps: During initialization, the KP and TV values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the KP and TV steps can be adapted after initialization. For this, either the TV step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the KP step can be decreased in increments. <strong>Note:</strong> Changing the KP step influences the system deviation.</td>
</tr>
<tr>
<td>18*</td>
<td>Rate time TV (step) [2] 1 3 4 No ESC</td>
<td>Changing TV, see Code <strong>17</strong>. <strong>Note:</strong> Changing the TV step has no effect on the system deviation.</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19</strong></td>
<td>Tolerance band</td>
<td>Used for error monitoring&lt;br&gt;Determination of the tolerance band in relation to the operating range.&lt;br&gt;Associated lag time [30] s is a reset criterion.&lt;br&gt;If a lag time is determined during initialization which is six times &gt; 30 s, the six-fold lag time is accepted as the lag time.</td>
</tr>
<tr>
<td><strong>20</strong></td>
<td>Characteristic</td>
<td>Select the characteristic:&lt;br&gt;0  Linear&lt;br&gt;1  Equal percentage&lt;br&gt;2  Reverse equal percentage&lt;br&gt;3  SAMSON butterfly valve linear&lt;br&gt;4  SAMSON butterfly valve equal percentage&lt;br&gt;5  VETEC rotary plug valve linear&lt;br&gt;6  VETEC rotary plug valve equal percentage&lt;br&gt;7  Segmented ball valve linear&lt;br&gt;8  Segmented ball valve equal percentage&lt;br&gt;9  User-defined (defined over operating software)&lt;br&gt;Note: The various characteristics are listed in the Appendix (section 13.1).</td>
</tr>
<tr>
<td><strong>21</strong></td>
<td>Required transit time OPEN (w ramp open)</td>
<td>The time required to pass through the operating range when the valve opens.&lt;br&gt;Limitation of the transit time (Code 21 and 22): For some applications it is better to limit the actuating speed of the actuator to prevent it from engaging too fast in the running process.&lt;br&gt;Code 21 has priority over Code 15.</td>
</tr>
<tr>
<td><strong>22</strong></td>
<td>Required transit time CLOSED (w ramp closed)</td>
<td>The time required to pass through the operating range when the valve closes.&lt;br&gt;Code 22 has priority over Code 14.</td>
</tr>
<tr>
<td><strong>23</strong></td>
<td>Total valve travel</td>
<td>Totaled double valve travel.&lt;br&gt;Can be reset to 0 via RES.&lt;br&gt;Note: The number of travel cycles (in steps of 1000) is saved in a non-volatile memory.</td>
</tr>
<tr>
<td>Code no.</td>
<td>Parameter – Display, values [default setting]</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>24</strong></td>
<td>Limit of total valve travel</td>
<td>Limit value of total valve travel. If the limit is exceeded, the fault alarm and the wrench icons appear on the display.</td>
</tr>
<tr>
<td></td>
<td>1000 to 99 · 10^7 [1 000 000] Exponential reading from 9999 travel cycles onwards ESC</td>
<td></td>
</tr>
<tr>
<td><strong>25</strong></td>
<td>Binary output [A1 - / -] ESC</td>
<td>This code allows you to find out on site whether the positioner has an optional binary output or not. When a binary output exists, its switching performance can be read and set. If there is no binary output, - - - - appears on the display of the positioner. The binary contacts A1, A2 and the fault alarm output can be configured at the output as follows:</td>
</tr>
<tr>
<td></td>
<td>Alternating display</td>
<td>Meaning</td>
</tr>
<tr>
<td></td>
<td>A1 - / -</td>
<td>A1 functioning as NO contact</td>
</tr>
<tr>
<td></td>
<td>A1 ----</td>
<td>A1 functioning as NC contact</td>
</tr>
<tr>
<td></td>
<td>A2 - / -</td>
<td>A2 functioning as NO contact</td>
</tr>
<tr>
<td></td>
<td>A2 ----</td>
<td>A2 functioning as NC contact</td>
</tr>
<tr>
<td></td>
<td>FAUL FAUL</td>
<td>Fault alarm output (always NC contact)</td>
</tr>
<tr>
<td><strong>26</strong></td>
<td>Limit value A1 No 0.0 to 100.0 [2.0] % of the operating range ESC</td>
<td>Displaying or changing the software limit value A1 in relation to the operating range.</td>
</tr>
<tr>
<td><strong>27</strong></td>
<td>Limit value A2 No 0.0 to 100.0 [98.0] % of the operating range ESC</td>
<td>Displaying or changing the software limit value A2 in relation to the operating range.</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28*</td>
<td><strong>Alarm test</strong>&lt;br&gt;Reading direction: Standard [No]&lt;br&gt;Run 1 RUN&lt;br&gt;Run 2 RUN&lt;br&gt;Run 3 RUN&lt;br&gt;ESC</td>
<td>Testing the software limit switches alarm A1 and A2 as well as the fault alarm contact A3. If the test is activated, the respective limit switches five times. &lt;br&gt;RUN1/1 RUN: Software limit switch A1&lt;br&gt;RUN2/2 RUN: Software limit switch A2&lt;br&gt;RUN3/3 RUN: Fault alarm contact A3</td>
</tr>
<tr>
<td>29*</td>
<td><strong>Position transmitter x/ix</strong>&lt;br&gt;[No] [No]&lt;br&gt;Run 1 RUN&lt;br&gt;Run 2 RUN&lt;br&gt;Run 3 RUN&lt;br&gt;ESC</td>
<td>Operating direction of the position transmitter; indicates how the travel/angle position is assigned to the output signal i, based on the closed position. &lt;br&gt;The operating range (see Code 8) of the valve is represented by the 4 to 20 mA signal. &lt;br&gt;When a positioner is not connected (reference variable less than 3.6 mA), the signal is 0.9 mA and when the positioner has not been initialized 3.8 mA.</td>
</tr>
<tr>
<td>30*</td>
<td><strong>Fault alarm ix</strong>&lt;br&gt;[No] HI LO&lt;br&gt;ESC</td>
<td>Used to select whether faults causing the fault alarm contact to switch should also be signaled by the position transmitter output and how they should be signaled HI ix = 21.6 mA or LO ix = 2.4 mA</td>
</tr>
<tr>
<td>31*</td>
<td><strong>Position transmitter test</strong>&lt;br&gt;–10.0 to 110.0 [default value is the last indicated value of the position transmitter] % of the operating range&lt;br&gt;ESC</td>
<td>Testing the position transmitter. Values can be entered in relation to the operating range. The current actual value is used in initialized positioners locally as the start value (bumpless changeover to the test mode). On testing over software, the entered simulation value is issued as the position feedback signal for 30 seconds.</td>
</tr>
</tbody>
</table>

*Analog 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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32*</td>
<td>“Function check” alarm</td>
<td>The condensed state can be used for a fault alarm output over the optional binary contact and the optional position transmitter (see Code 25).</td>
</tr>
<tr>
<td></td>
<td>No · [YES] ESC</td>
<td>No “Function check” condensed state has no affect on the fault alarm output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YES “Function check” condensed state switches the fault alarm output</td>
</tr>
<tr>
<td>33*</td>
<td>“Maintenance required” alarm</td>
<td>Only the “Maintenance alarm” condensed state switches the fault alarm output, “Maintenance required”/“Maintenance demanded”, however, does not</td>
</tr>
<tr>
<td></td>
<td>No · [YES] ESC</td>
<td>Both the “Maintenance alarm” condensed state and “Maintenance required”/“Maintenance demanded” condensed state switch the fault alarm output</td>
</tr>
<tr>
<td>34*</td>
<td>Closing direction</td>
<td>Turning direction of the lever in which the valve is moved to the CLOSED position (view onto the display of the positioner).</td>
</tr>
<tr>
<td></td>
<td>[CCL] Counterclockwise</td>
<td>Needs only be entered in SUB initialization mode.</td>
</tr>
<tr>
<td></td>
<td>CL Clockwise</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ESC</td>
<td></td>
</tr>
<tr>
<td>35*</td>
<td>Blocking position</td>
<td>Distance up to the CLOSED position (0 % position).</td>
</tr>
<tr>
<td></td>
<td>[0] mm/°/% ESC</td>
<td>Only needs to be entered in SUB initialization mode.</td>
</tr>
<tr>
<td>36*</td>
<td>Reset</td>
<td>Resets all parameters to default (factory setting) as well as the diagnosis data. After a reset, the positioner must be re-initialized.</td>
</tr>
<tr>
<td></td>
<td>[No] Std · diAG</td>
<td>Resets diagnosis data only. Plotted reference graphs and logs remain unaffected. The positioner does not need to be re-initialized.</td>
</tr>
<tr>
<td>37*</td>
<td>Position transmitter</td>
<td>Display only, indicates whether the position transmitter option is installed.</td>
</tr>
<tr>
<td></td>
<td>[No] YES ESC</td>
<td></td>
</tr>
<tr>
<td>38*</td>
<td>Inductive alarm</td>
<td>Type 3731-3 does not have an optional inductive alarm.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>System deviation e</td>
<td>Deviation from the target position ($e = w - x$)</td>
</tr>
<tr>
<td></td>
<td>−99.9 to 999.9 %</td>
<td>Display only</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Minimum transit time OPEN 0 to 240 s [0 s]</td>
<td>Time [s] needed by the system (positioner, actuator and valve) to move through the nominal travel/angle to open the valve (100 % position). Display only</td>
</tr>
<tr>
<td>41</td>
<td>Minimum transit time CLOSED 0 to 240 s [0 s]</td>
<td>Time [s] needed by the system (positioner, actuator and valve) to move through the nominal travel/angle to close the valve (0 % position). Display only</td>
</tr>
<tr>
<td>42</td>
<td>Auto-w/manual-w 0.0 to 100.0 % of the span 4 to 20 mA</td>
<td>Supplied manual and automatic reference variable Display only</td>
</tr>
<tr>
<td>43</td>
<td>Firmware version control Xxxx</td>
<td>Positioner type and current firmware version (in alternating sequence) Display only</td>
</tr>
</tbody>
</table>
| 44       | y info 0 to 100 %, [0 %] | Control signal y [%] based on the travel range determined on initialization. Display only
MAX: The positioner builds up its maximum output pressure, see description in Code 14 and 15.
0 P: The positioner vents completely, see description in Code 14 and 15.
– – –: The positioner has not been initialized. |
| 45       | Forced venting status No · HIGH/LOW · YES | Indicates whether the option is installed or not. Display only
No No forced venting installed
YES Forced venting installed
If a voltage supply is connected at the terminals of the optional forced venting, YES and HIGH appear on the display in alternating sequence. If a voltage supply is not applied (actuator vented, fail-safe position indicated on the display by the $ icon), YES and LOW appear on the display in alternating sequence. |
| 46*      | Polling address 0 to 15/63 [0] ESC | Select bus address
0 to 15 for active HART® Revision 5 (default setting)
0 to 63 for active HART® Revision 6
The address can only be switched over using the operating software. |
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, 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>47*</td>
<td>Write protection HART [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*</td>
<td><strong>Diagnostics</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Diagnosis parameters d</strong></td>
<td></td>
</tr>
<tr>
<td>d0</td>
<td>Temperature –55 to 125 °C</td>
<td>Current operating temperature [°C] inside the positioner (accuracy 3 %) Display only</td>
</tr>
<tr>
<td>d1</td>
<td>Minimum temperature [20]</td>
<td>The lowest temperature below 20 °C that has ever occurred. Display only</td>
</tr>
<tr>
<td>d2</td>
<td>Maximum temperature [20]</td>
<td>The highest temperature above 20 °C that has ever occurred. Display only</td>
</tr>
<tr>
<td>d3</td>
<td>Number of zero calibrations [0]</td>
<td>The number of zero calibrations since the last initialization. Display only</td>
</tr>
<tr>
<td>d4</td>
<td>Number of initializations [0]</td>
<td>The number of initializations that have been performed since the last reset. Display only</td>
</tr>
<tr>
<td>d5</td>
<td>Zero point limit 0.0 to 100.0 % [5.0 %] of the nominal range</td>
<td>User-defined zero point monitoring Used for error monitoring of the zero point shift.</td>
</tr>
<tr>
<td>d6</td>
<td>Condensed state</td>
<td>Condensed state, made up from the individual states · Display only · Display only OK Okay C Maintenance required CR Maintenance demanded b Maintenance alarm S Out of specification</td>
</tr>
</tbody>
</table>
# Code list

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>48*</td>
<td><strong>d7 Start reference test</strong>&lt;br&gt;[No]&lt;br&gt;ON · ESC</td>
<td>Starts reference test for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests). The reference test can only be activated in manual mode (MAN) as the valve moves through its entire working range. If EXPERTplus is activated in older positioners at a later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.</td>
</tr>
<tr>
<td></td>
<td><strong>d8 Unassigned</strong></td>
<td>Firmware version 1.4x and lower: Enter the activation code for EXPERTplus.</td>
</tr>
</tbody>
</table>

## Diagnosis parameters h

| h0 | Initialization with reference test<br>[No] · YES · ESC | The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) are plotted during the reference test. |
| h1 | Reference test result<br>[No] · YES | Display only<br>No  No reference test has been performed.<br>YES  The reference graphs for Drive signal y steady-state (d1) and drive signal y hysteresis (d2) (Tests) have been plotted successfully. |
| h2 | – Unassigned |  |
| h3 | Auto reset diAG<br>0 to 365 days; [0 days] | After an adjustable time period, the diagnosis data are reset automatically according to the settings in Code 36 – diAG. **Example:** A start-up behavior of the plant which is untypical for the process is not to be included in the total diagnosis. |
| h4 | Rest time for auto reset diAG | Display only<br>Remaining time until the diagnosis data are reset automatically according to the settings in Code 48 – h3 |

## 49* Partial stroke test (PST)/Full stroke test (FST) – Application type

<p>| A | Partial stroke test (PST) |  |
| A0 | Start Partial Stroke Test&lt;br&gt;[No] · YES · ESC | Operating mode and PST testing mode must be set to MAN. |</p>
<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>49*</td>
<td><strong>A1</strong> Time until the next automatic PST test takes place</td>
<td>Display only Remaining time [d_h] until the next partial stroke test is performed. Only applies to PST Auto mode.</td>
</tr>
<tr>
<td></td>
<td><strong>A2</strong> Desired PST testing mode</td>
<td>Activates (PST Auto) or deactivates (PST Man) the scheduled automatic partial stroke test.</td>
</tr>
<tr>
<td></td>
<td>Auto · [Man] · ESC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A3</strong> Auto test time</td>
<td>Time [h] between for partial stroke tests (PST)</td>
</tr>
<tr>
<td></td>
<td><strong>A4</strong> Status classification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PST status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[C] · OK · CR · b · S ESC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A5</strong> Min. recommended scan time</td>
<td>Display only Scan time [s] required to plot the complete step response test in a graph.</td>
</tr>
<tr>
<td></td>
<td><strong>A6</strong> – Unassigned</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A7</strong> y-monitoring reference value</td>
<td>Display only The valve moves to the valve position Step start (Code 49 - d2) and Step end (Code 49 - d3) with certain control pulses. The difference between these control pulses creates the delta y value [1/s]. The y-monitoring reference value applies to the adjusted step values (Code 49 - d2 and Code 49 - d3) and for the selected ramp times (Code 49 - d5 and Code 49 - d6). The y-monitoring reference value must be determined again if any of the above mentioned values change.</td>
</tr>
<tr>
<td></td>
<td><strong>A8</strong> Activation delta y-monitoring</td>
<td>Activates/deactivates delta y-monitoring</td>
</tr>
<tr>
<td></td>
<td>[No] · YES · ESC</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A9</strong> delta y-monitoring value</td>
<td>The percentage [%] of the entire range of the control pulse between 1 and 10000 1/s (Example: 10 % = 10000 1/s) The partial stroke test is canceled if the change in control signal (delta y) varies from the y-monitoring reference value by this amount.</td>
</tr>
<tr>
<td></td>
<td>0 to 100 %; [10 %]</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Parameter – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>d1</td>
<td>– Unassigned</td>
<td></td>
</tr>
<tr>
<td>d2</td>
<td>Step start 0.0 to 100.0 %; [95.0 %]</td>
<td>Start value to perform the step response test</td>
</tr>
<tr>
<td>d3</td>
<td>Step end 0.0 to 100.0 %; [90.0 %]</td>
<td>End value to perform the step response test</td>
</tr>
<tr>
<td>d4</td>
<td>Activation of the ramp function [No] · YES</td>
<td>Activates/deactivates the ramp function.</td>
</tr>
<tr>
<td>d5</td>
<td>Ramp time (rising) 0 to 9999 s; [15 s]</td>
<td>Ramp time for 0 to 100 % travel (rising) of the ramp function. Do not enter a ramp time which is lower than the value automatically given during initialization.</td>
</tr>
<tr>
<td>d6</td>
<td>Ramp time (falling) 0 to 9999 s; [15 s]</td>
<td>Ramp time for 0 to 100 % travel (falling) of the ramp function. Do not enter a ramp time which is lower than the value automatically given during initialization.</td>
</tr>
<tr>
<td>d7</td>
<td>Settling time before test start 1.0 to 240.0 s; [10.0 s]</td>
<td>Waiting time before the test starts to allow the valve to safely reach the step start value.</td>
</tr>
<tr>
<td>d8</td>
<td>Delay time after step 1.0 to 240.0 s; [2.0 s]</td>
<td>Time after the first step until the second step starts.</td>
</tr>
<tr>
<td>d9</td>
<td>Scan time 0.2 to 250.0 s; [0.2 s]</td>
<td>Scan time of the step response test</td>
</tr>
</tbody>
</table>

#### E Cancelation conditions of the partial stroke test (PST)

<table>
<thead>
<tr>
<th>E0</th>
<th>Activation x control [No] · YES</th>
<th>Activates/deactivates x control.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>x control value –10.0 to 110.0 % of total travel; [0.0 %]</td>
<td>The test is automatically canceled as soon as the valve position falls below this value.</td>
</tr>
<tr>
<td>E2</td>
<td>– Unassigned</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>49</strong></td>
<td>E3 – Unassigned</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E4 – Unassigned</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E5 Activation tolerance band control</td>
<td>Activates/deactivates tolerance band control.</td>
</tr>
<tr>
<td></td>
<td>[No] · YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E6 PST Tolerance band</td>
<td>The test is automatically canceled as soon as the Step end (Code 49 - d3) exceeds this value.</td>
</tr>
<tr>
<td></td>
<td>0.1 to 100.0 %; [5.0 %]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E7 Max. test duration</td>
<td>Maximum time within which a test can be completed before the test is canceled automatically.</td>
</tr>
<tr>
<td></td>
<td>30 to 25000 s; [30 s]</td>
<td></td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>Partial stroke test (PST) information – Display only</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F0 No test available</td>
<td>No test exists or the test has been canceled manually.</td>
</tr>
<tr>
<td></td>
<td>F1 Test OK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F2 x cancelation</td>
<td>The test was canceled by the x cancelation function.</td>
</tr>
<tr>
<td></td>
<td>F3 y cancelation</td>
<td>The test was canceled by the y cancelation function.</td>
</tr>
<tr>
<td></td>
<td>F4 Tolerance band exceeded</td>
<td>The test was canceled. The x-values exceeded the tolerance band.</td>
</tr>
<tr>
<td></td>
<td>F5 Max. test time exceeded</td>
<td>The test was not completed within the maximum test time and was automatically canceled.</td>
</tr>
<tr>
<td></td>
<td>F6 Test man. canceled</td>
<td>The test has been manually canceled by the user.</td>
</tr>
<tr>
<td></td>
<td>F7 Measured data storage out of memory</td>
<td>The maximum capacity of the memory for measured data has been reached. After 100 measured data per measured variable have been recorded, the logging stops. However, the test is continued.</td>
</tr>
<tr>
<td></td>
<td>F8 Aborted by int. solenoid valve</td>
<td>The test was canceled by the activation of the solenoid valve.</td>
</tr>
<tr>
<td></td>
<td>F9 Supply pressure/friction</td>
<td>An insufficient supply pressure or excessive friction occurred during the test.</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>49</strong></td>
<td><strong>h Application type of valve</strong></td>
<td></td>
</tr>
<tr>
<td>h0</td>
<td>Application type [No] · YES · ESC</td>
<td>No Control valve&lt;br&gt;YES Open/close (on/off) valve&lt;br&gt;Depending on the application type of valve that has been selected, the positioner has different diagnostic functions and behaves differently in the automatic mode (AUTO).</td>
</tr>
<tr>
<td>h1</td>
<td>Operating point 0.0 to 100.0 % valve position; [100.0 %]</td>
<td>The valve moves to this position as soon as the reference variable exceeds the Limit operating point (Code 49 - h5).</td>
</tr>
<tr>
<td>h2</td>
<td>Limit fail-safe position 0.0 to 20.0 % reference variable; [12.5 %]</td>
<td>The valve moves to the fail-safe position (SAFE) when the reference variable falls below this limit.</td>
</tr>
<tr>
<td>h3</td>
<td>Lower limit test start [25.0 % reference variable]</td>
<td>Display only&lt;br&gt;The valve remains in its last valid position when the reference variable is between the Limit fail-safe position and Lower limit test.&lt;br&gt;A partial stroke test is started when the reference variable moves to the range between Lower limit test and Upper limit test and remains there longer than six seconds.</td>
</tr>
<tr>
<td>h4</td>
<td>Upper limit test start [50.0 % reference variable]</td>
<td>Display only&lt;br&gt;The valve remains in its last valid position when the reference variable is between the Upper limit test and Limit operating point.</td>
</tr>
<tr>
<td>h5</td>
<td>Limit operating point 55.0 to 100.0 % reference variable; [75.0 %]</td>
<td>The valve moves to the Operating point when the reference variable exceeds the Limit operating point.</td>
</tr>
<tr>
<td>h6</td>
<td>– Unassigned</td>
<td></td>
</tr>
<tr>
<td>h7</td>
<td>Limit value time analysis 0.6 to 30.0 s; [0.6 s]</td>
<td>Time limit for the difference between the reference value and the latest recorded value. It determines at which difference value an alarm is to be generated.</td>
</tr>
<tr>
<td>h8</td>
<td>Limit value travel analysis 0.1 to 100.0 % valve position; [0.3 %]</td>
<td>Travel limit for the difference between the reference value and the latest recorded value. It determines at which difference value an alarm is to be generated.</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 – Display, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>49*</td>
<td>Status classification Close/open</td>
<td>C Maintenance required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OK No message</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CR Maintenance demanded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b Maintenance alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S Out of specification</td>
</tr>
</tbody>
</table>

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

**Note:** The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded: 
/out of specification: blinking, Maintenance alarm: ). If “No message” is assigned to the error code as the status classification, the error is not included in the condensed state. A status classification is assigned to every error code in the default setting. The status classification of error codes can also be changed as required using an operating software (e.g. TROVIS-VIEW).
### Initialization errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
| **50** \( x > \text{range} \) | The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit.  
- Pin positioned incorrectly.  
- Bracket slipped in case of NAMUR attachment or positioner is not central.  
- Follower plate incorrectly attached. |
| Status classification | [Maintenance required] |
| Recommended action | Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner. |
| **51** \( \Delta x < \text{range} \) | The measuring span of the sensor is too low.  
- Pin positioned incorrectly.  
- Wrong lever.  
A rotational angle smaller than 16° at the positioner shaft creates just an error message. An angle below 9° leads to the initialization being canceled. |
| Status classification | [Maintenance required] |
| Recommended action | Check attachment and re-initialize the positioner. |
| **52** Attachment | Positioner attachment incorrect.  
- Nominal travel/angle (Code 5) could not be achieved during initialization under NOM (no tolerance downwards permissible).  
- Mechanical or pneumatic fault, e.g. wrong lever selected or supply pressure too low to move to the required position. |
| Status classification | [Maintenance required] |
| Recommended action | Check attachment and supply pressure. Re-initialize the positioner.  
Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX.  
After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle. |
<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <em>Err</em> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
| 53 Initialization time exceeded (Init time >) | The initialization routine lasts too long.  
• No pressure on the supply line or there is a leak.  
• Supply air failure during initialization. |
| Status classification | [Maintenance required] |
| Recommended action | Check attachment and supply pressure. Re-initialize the positioner. |
| 54 Initialization/forced venting | 1) A solenoid valve is installed (Code 45 = YES) and was not or not properly connected so that an actuator pressure could not be built up. The message is generated when you attempt to initialize the positioner.  
2) If you attempt to initialize the device from the fail-safe position (SAFE). |
| Status classification | [Maintenance required] |
| Recommended action | Re. 1) Check connection and supply voltage of the forced venting Code 45 HIGH/LOW  
Re. 2) Set the MAN operating mode over Code 0. Then initialize the positioner. |
| 55 Transit time too short (transit time <) | The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally. |
| Status classification | [Maintenance required] |
| Recommended action | Check the volume restriction setting as described in section 4, re-initialize the positioner. |
| 56 Pin position | Initialization was canceled because you are required to enter the pin position for the selected initialization modes NOM and SUB. |
| Status classification | [Maintenance required] |
| Recommended action | Enter pin position over Code 4 and nominal travel/angle over Code 5. Re-initialize the positioner. |
### Operational errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>57</strong> Control loop</td>
<td>Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19).</td>
</tr>
<tr>
<td>Additional alarm at the fault alarm output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Actuator mechanically blocked.</td>
</tr>
<tr>
<td></td>
<td>• Attachment of the positioner subsequently shifted.</td>
</tr>
<tr>
<td></td>
<td>• Supply pressure not sufficient.</td>
</tr>
<tr>
<td><strong>Status classification</strong></td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td><strong>Recommended action</strong></td>
<td>Check attachment.</td>
</tr>
<tr>
<td><strong>58</strong> Zero point</td>
<td>Zero point incorrect.</td>
</tr>
<tr>
<td></td>
<td>Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.</td>
</tr>
<tr>
<td><strong>Status classification</strong></td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td><strong>Recommended action</strong></td>
<td>Check valve and mounting of the positioner. If OK, perform a zero calibration over Code 6 (see section 7.6 on page 54).</td>
</tr>
<tr>
<td></td>
<td>If the lever position on the back of the positioner has been changed (e.g. while exchanging the lever), move the lever as far as it will go in both directions to adapt it to the internal measuring lever.</td>
</tr>
<tr>
<td><strong>59</strong> Autocorrection</td>
<td>Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.</td>
</tr>
<tr>
<td><strong>Status classification</strong></td>
<td>[No message]</td>
</tr>
<tr>
<td><strong>Recommended action</strong></td>
<td>Automatic</td>
</tr>
<tr>
<td><strong>60</strong> Fatal error</td>
<td>An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances.</td>
</tr>
<tr>
<td></td>
<td>The positioner changes to the fail-safe position (<strong>SAFE</strong>).</td>
</tr>
<tr>
<td><strong>Status classification</strong></td>
<td>Maintenance alarm (cannot be classified)</td>
</tr>
<tr>
<td><strong>Recommended action</strong></td>
<td>Reset over Code 36.</td>
</tr>
<tr>
<td></td>
<td>Re-initialize the positioner (see sections 7.8 and 7.5).</td>
</tr>
</tbody>
</table>
## Hardware errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <em>Err</em> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
| **62** x signal  
Additional alarm at the fault alarm output | Determination of the measured data for the actuator has failed. Conductive plastic element is defective.  
The positioner continues to run in emergency mode, but should be replaced as soon as possible.  
The emergency mode on the display is indicated by a blinking closed-loop control icon and 4 dashes instead of the position indication.  

**Note on the control:**  
If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues operation according to its reference variable signal so that the process remains in a safe state. |
| Status classification | [Maintenance required] |
| Recommended action | Return the positioner to SAMSON AG for repair. |
| **63** w too low | The reference variable w is lower than 3.7 mA. This message occurs whenever the power source that drives the positioner does not comply with the standard.  
This condition is indicated on the positioner display by *LOW* blinking.  
The positioner changes to the fail-safe position (SAFE). |
| Status classification | [No message] |
| Recommended action | Check the reference variable.  
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.  
The positioner changes to the fail-safe position (SAFE). |
| Status classification | Maintenance alarm (cannot be classified) |
| Recommended action | Cannot be remedied.  
Return the positioner to SAMSON AG for repair. |
<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>65</strong> Hardware Additional alarm at the fault alarm output</td>
<td>A hardware error has occurred, the positioner changes to the fail-safe position (SAFE).</td>
</tr>
<tr>
<td>Status classification</td>
<td>Maintenance alarm (cannot be classified)</td>
</tr>
<tr>
<td>Recommended action</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>
<tr>
<td><strong>66</strong> Data memory Additional alarm at the fault alarm output</td>
<td>The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.</td>
</tr>
<tr>
<td>Status classification</td>
<td>Maintenance alarm (cannot be classified)</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Return the positioner to SAMSON AG for repair.</td>
</tr>
<tr>
<td><strong>67</strong> Test calculation Additional alarm at the fault alarm output</td>
<td>The hardware controller is monitored by means of a test calculation.</td>
</tr>
<tr>
<td>Status classification</td>
<td>Maintenance alarm (cannot be classified)</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.</td>
</tr>
</tbody>
</table>
## Data errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <em>Err</em> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td>68 Control parameter</td>
<td><strong>Control parameter error</strong></td>
</tr>
<tr>
<td>Additional alarm at the fault</td>
<td></td>
</tr>
<tr>
<td>alarm output</td>
<td></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error, perform reset and re-initialize the positioner.</td>
</tr>
<tr>
<td>69 Poti parameter</td>
<td><strong>Parameter error of the digital potentiometer.</strong></td>
</tr>
<tr>
<td>Additional alarm at the fault</td>
<td></td>
</tr>
<tr>
<td>alarm output</td>
<td></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error, perform reset and re-initialize the positioner.</td>
</tr>
<tr>
<td>70 Calibration parameter</td>
<td><strong>Error in the production calibration data. Subsequently, the device runs on default values.</strong></td>
</tr>
<tr>
<td>Additional alarm at the fault</td>
<td></td>
</tr>
<tr>
<td>alarm output</td>
<td></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Return the positioner to SAMSON AG for repair.</td>
</tr>
<tr>
<td>71 General parameters</td>
<td><strong>Parameter errors that are not critical for the control.</strong></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error. Check and, if necessary, reset required parameters.</td>
</tr>
<tr>
<td>72 Start-up parameters</td>
<td><strong>Start-up parameter error</strong></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error, perform reset and re-initialize the positioner.</td>
</tr>
<tr>
<td>73 Internal device error 1</td>
<td><strong>Internal device error</strong></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Return the positioner to SAMSON AG for repair.</td>
</tr>
<tr>
<td>74 HART parameters</td>
<td><strong>Parameter errors that are not critical for the control.</strong></td>
</tr>
<tr>
<td>Status classification</td>
<td>[Maintenance required]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Confirm error and perform reset.</td>
</tr>
</tbody>
</table>
### Error codes – Recommended action

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>75</strong></td>
<td><strong>Info parameters</strong>&lt;br&gt;Condensed state message active, when prompted, <em>Err</em> appears. When fault alarms exist, they are displayed here.</td>
</tr>
<tr>
<td><strong>76</strong></td>
<td><strong>No emergency mode</strong>&lt;br&gt;The travel measuring system of the positioner has a self-monitoring function (see Code 62). An emergency mode (open-loop control) is not available for certain actuators, such as double-acting actuators. In this case, the positioner changes to the fail-safe position (SAFE) when a measuring error occurs. During the initialization, the positioner checks whether the actuator has such a function or not.</td>
</tr>
<tr>
<td><strong>77</strong></td>
<td><strong>Program loading error</strong>&lt;br&gt;When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test (<em>tEstinG</em> runs across the display). If the positioner loads the wrong program, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again.</td>
</tr>
<tr>
<td><strong>78</strong></td>
<td><strong>Options parameter</strong>&lt;br&gt;Errors in options parameters</td>
</tr>
</tbody>
</table>

#### Code list

<table>
<thead>
<tr>
<th>Error code</th>
<th>Status classification</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>75</strong> Info parameters</td>
<td>[Maintenance required]</td>
<td>Confirm error. Check and, if necessary, reset required parameters.</td>
</tr>
<tr>
<td><strong>76</strong> No emergency mode</td>
<td>[No message]</td>
<td>Merely information, confirm, if necessary. No further action necessary.</td>
</tr>
<tr>
<td><strong>77</strong> Program loading error</td>
<td>Maintenance alarm (cannot be classified)</td>
<td>Interrupt current and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.</td>
</tr>
<tr>
<td><strong>78</strong> Options parameter</td>
<td>[Maintenance required]</td>
<td>Return the positioner to SAMSON AG for repair.</td>
</tr>
</tbody>
</table>
## Diagnosis errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state message active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>79</strong> Diagnostic alarms</td>
<td>Error messages are generated in the extended EXPERTplus diagnostics (refer to EB 8389 EN on EXPERTplus valve diagnostics)</td>
</tr>
<tr>
<td></td>
<td><strong>Status classification</strong> Maintenance required (cannot be classified)</td>
</tr>
<tr>
<td><strong>80</strong> Diagnostic parameters</td>
<td>Errors that are not critical for control.</td>
</tr>
<tr>
<td></td>
<td><strong>Status classification</strong> Maintenance required (cannot be classified)</td>
</tr>
</tbody>
</table>
| **81** Reference test canceled  | An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis.  
|                                 | • Reference test was interrupted  
|                                 | • Reference line for drive signal y steady-state or drive signal y hysteresis was not adopted.  
|                                 | Error messages are saved in EEPROM. They cannot be reset.                                                |
|                                 | **Status classification** [Maintenance required]                                                        |
|                                 | **Recommended action** Check and, if necessary, perform a new reference test                            |
Dimensions in mm

12 Dimensions in mm

![Diagram showing dimensions and attachment details.]

Attachment acc. to IEC 60534-6 →

Direct attachment →

Pressure gauge bracket or connecting plate (G ¼ only)

Lever in mm

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

Electrical connections:
2 x female thread
½ NPT or M20 x 1.5

Output Supply

NPT ½, ¼

1/4 NPT

Fig. 16a - Attachment to IEC 60534-6 and direct attachment
Fig. 16b · Attachment to rotary actuators VDI/VDE 3845 (Sept. 2010), level 1, size AA1 to AA4
12.1 Fixing levels according to VDI/VDE 3845 (September 2010)

Dimensions in mm

<table>
<thead>
<tr>
<th>Size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Ød</th>
<th>Mmin</th>
<th>ØD*</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
13 Appendix

13.1 Selecting the valve characteristic

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

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

---

**Linear** (select characteristic: 0)

---

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

---

**Rev. equal percentage** (select characteristic: 2)
SAMSON butterfly valve linear (select characteristic: 3)

SAMSON butterfly valve equal percentage (select characteristic: 4)

VETEC rotary plug valve linear (select characteristic: 5)

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

Segmented valve ball linear (select characteristic: 7)

Segmented ball valve equal percentage (select characteristic: 8)
EC-TYPE-EXAMINATION CERTIFICATE

(Translation)


2. EC-type-examination Certificate Number:

PTB 11 ATEX 1014 X

3. Equipment:
Electro-pneumatic position controller, type 3731-21

4. Manufacturer:
SAMSON AG Mess- und Regeltechnik

5. Address:
Weissmüllerstr. 3, 60314 Frankfurt am Main, Germany

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

7. The Physikalisch-Technische Bundesanstalt, notified body No. 0100, 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.

8. The examination and test results are recorded in the confidential assessment and test report PTB Ex 11-11094.

9. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-3:2009 and EN 60079-7:2007.

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 designs, examination and tests of the specified equipment in accordance with the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

12. The meaning of the equipment shall include the following:

Ex d IIC T6, T5, T4 Gb and Ex de IIC T6, T5, T4 Gb

Zertifizierungsverordnung Explosionsschutz

On behalf of PTB:

Dr.-Ing. U. Kleeswinter
Direktor und Professor

Braunschweig, May 3, 2011

(13) SCHEDULE

(14) EC-TYPE-EXAMINATION CERTIFICATE PTB 11 ATEX 1014 X

(15) Description of equipment

The electro-pneumatic position controller, type 3731-21, is a single-/double-action position controller with communication capabilities which can be attached to any commercially available lift or pan-lift actuator. The position controller compares the output signal of a control unit within the 4 - 20 mA region with the lift of the control valve and adjusts the pneumatic actuating pressure as an output parameter. The position controller is configured and parameterized with a HART protocol, using the signal line of the 4 - 20 mA signal (version 3731-21). Data are transmitted with a superimposed frequency via the 4 - 20 mA signal cable. The 3731-21 and 3731-521 versions are intended for connection to fieldbus systems corresponding to PROFIBUS PA, in accordance with the FISCO concept or the FOUNDATION Fieldbus specification.

For field application, the apparatus is installed in a metal enclosure of Ex "d" or Ex "e" types of protection.

Technical data

Supply voltage: 10...35 VDC
Signal circuit: 4...20 mA
Dissipation: max. 7.6 W

(16) Assessment and Test Report, PTB Ex 11-11094

(17) Special conditions for safe use

Reparis of flameproof joints may only be performed in accordance with the manufacturer's design specifications. Repair on the basis of the values in tables 1 and 2 of EN 60079-1 is not permitted.

Additional notes for safe operation

Connection conditions

1. When the terminal compartment of the electro-pneumatic position controller, type 3731-21, is designed to Ex "n" type of protection, the following must be complied with:

- The device shall be connected to reliable cable glands or conduit systems that meet the requirements stipulated in EN 60079-1, sections 13.1 and 13.2, and for which a separate test certificate has been issued. If the device is connected to conduit systems, the required sealing device shall be provided immediately at the enclosures.
- Cable glands (P type glands) and blanking plugs of a simple design must not be used.

EC-type-examination Certificates without signatures and official stamps shall not be valid. The certificates may be cancelled only without alteration. Extracts and copies are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of doubt, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • 38124 Braunschweig • GERMANY
SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 11 ATEX 1014 X

1. Openings that are not used shall be sealed in compliance with the specifications in EN 60079-1, section 11.9.

2. The connecting cable of the electro-pneumatic position controller, type 3731-21, shall be fixed and routed so that it will be adequately protected against mechanical damage.

3. If the temperature at the input parts exceeds 70 °C, temperature-resistant connecting cables shall be used.

4. The electro-pneumatic position controller, type 3731-21, shall be included in the local equipotential bonding system of the potentially explosive area.

These notes and instructions shall accompany each device in an adequate form.

Components attached or installed (terminal compartments, busbars, Ex-type cable glands, connectors) shall be of a technical standard that complies with a minimum of specifications on the cover sheet, and they shall have separate examination certificates. The operating conditions specified in the component certificates must be complied with.

Ambient temperature

The field of application of the electro-pneumatic position controller, type 3731-21, is as follows:

in temperature class T3: to ambient temperatures between +40 °C and +60 °C;

in temperature class T5: to ambient temperatures between +40 °C and +70 °C;

in temperature class T4: to ambient temperatures between +40 °C and +80 °C.

Operating medium in the pneumatic section

1. The maximum ingoing-air pressure is 8 bar.

2. The equipment operator must ensure that the operating medium does not form an explosive atmosphere, i.e. the gases used must not contain any substances whose presence in the medium may cause an explosive atmosphere (no flammable gases, no oxygen or oxygen-enriched gas).

Health and safety requirements

Met by compliance with the above-mentioned standards.
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