Series 3730
Electropneumatic Positioner
Type 3730-5

with FOUNDATION™ fieldbus communication
FF Device Rev 2

Mounting and Operating Instructions
EB 8384-5 EN (1300-1619)
Firmware version 1.55
Edition July 2012
<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Important safety instructions</td>
</tr>
<tr>
<td>2</td>
<td>Article code</td>
</tr>
<tr>
<td>3</td>
<td>Design and principle of operation</td>
</tr>
<tr>
<td>3.1</td>
<td>Application type</td>
</tr>
<tr>
<td>3.2</td>
<td>Additional equipment</td>
</tr>
<tr>
<td>3.3</td>
<td>Communication</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Configuration using TROVIS-VIEW software</td>
</tr>
<tr>
<td>3.3.2</td>
<td>Configuration using the NI-FBUS™ Configurator</td>
</tr>
<tr>
<td>3.4</td>
<td>Technical data</td>
</tr>
<tr>
<td>4</td>
<td>Attachment to the control valve – Mounting parts and accessories</td>
</tr>
<tr>
<td>4.1</td>
<td>Direct attachment</td>
</tr>
<tr>
<td>4.1.1</td>
<td>Type 3277-5 Actuator</td>
</tr>
<tr>
<td>4.1.2</td>
<td>Type 3277 Actuator</td>
</tr>
<tr>
<td>4.2</td>
<td>Attachment according to IEC 60534-6</td>
</tr>
<tr>
<td>4.3</td>
<td>Attachment to Type 3510 Micro-flow Valve</td>
</tr>
<tr>
<td>4.4</td>
<td>Attachment to rotary actuators</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Heavy-duty version</td>
</tr>
<tr>
<td>4.5</td>
<td>Reversing amplifier for double-acting actuators</td>
</tr>
<tr>
<td>4.5.1</td>
<td>Reversing amplifier (1079-1118 or 1079-1119)</td>
</tr>
<tr>
<td>4.6</td>
<td>Attaching an external position sensor</td>
</tr>
<tr>
<td>4.6.1</td>
<td>Mounting the position sensor with direct attachment</td>
</tr>
<tr>
<td>4.6.2</td>
<td>Mounting the position sensor with attachment according to IEC 60534-6</td>
</tr>
<tr>
<td>4.6.3</td>
<td>Mounting the position sensor to Type 3510 Micro-flow Valve</td>
</tr>
<tr>
<td>4.6.4</td>
<td>Mounting the position sensor to rotary actuators</td>
</tr>
<tr>
<td>4.7</td>
<td>Attaching positioners with stainless steel housings</td>
</tr>
<tr>
<td>4.8</td>
<td>Air purging function for single-acting actuators</td>
</tr>
<tr>
<td>4.9</td>
<td>Mounting parts and accessories</td>
</tr>
<tr>
<td>5</td>
<td>Connections</td>
</tr>
<tr>
<td>5.1</td>
<td>Pneumatic connections</td>
</tr>
<tr>
<td>5.1.1</td>
<td>Signal pressure gauges</td>
</tr>
<tr>
<td>5.1.2</td>
<td>Supply pressure</td>
</tr>
<tr>
<td>5.1.3</td>
<td>Signal pressure (output)</td>
</tr>
<tr>
<td>5.2</td>
<td>Electrical connections</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Establishing communication</td>
</tr>
<tr>
<td>6</td>
<td>Operator controls and readings</td>
</tr>
<tr>
<td>7</td>
<td>Start-up – Settings</td>
</tr>
</tbody>
</table>
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.

NOTICE
indicates a property damage message.

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

Note: Supplementary explanations, information and tips
## Revisions of the positioner firmware compared to the previous version – Control R

<table>
<thead>
<tr>
<th>Control R 1.43</th>
<th>R 1.44</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internal revisions</td>
</tr>
<tr>
<td>R 1.45</td>
<td>Internal revisions</td>
</tr>
<tr>
<td>R 1.46</td>
<td>Internal revisions</td>
</tr>
<tr>
<td>R 1.52</td>
<td>Application type</td>
</tr>
</tbody>
</table>

- The user determines in the positioner whether the valve is to operate as a control valve or an open/close (on/off valve) (see section 3.1)

### Diagnosis

- All EXPERTplus diagnostic functions are available without having to activate them in the positioner (see EB 8389 EN on EXPERTplus Valve Diagnostics).

### Additional function blocks

- 2x DO (Discrete Output)
- 1x IS (Input Selector)
- 1x MAI (Multiple Analog Input)
- 1x MAO (Multiple Analog Output)

Refer to Configuration Manual KH 8384-5 EN

### New functions

In the DO Function Block (Discrete Output), the following new functions are implemented:

- Discrete analysis of on/off valves
- Start partial stroke test (PST)
- Start and reset the data logger
- Reset diagnosis
- Stop diagnosis
- Move to fail-safe position
- Lock local operation

Refer to Configuration Manual KH 8384-5 EN

### Action on fault detection

If the AO Transducer Block is in Out of Service mode and the condensed state changes to 'Maintenance alarm', the following actions can be started:

- Hold last value
- Move valve to fail-safe position
- Move to a predefined fault state value

Refer to Configuration Manual KH 8384-5 EN
Revisions of the positioner firmware compared to the previous version – Control R

<table>
<thead>
<tr>
<th>Codes 48 extended</th>
<th>The following subitems have been added to Code 48:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>h0: Activation/deactivation reference test</td>
</tr>
<tr>
<td></td>
<td>h1: Reference test completed (YES/No)</td>
</tr>
<tr>
<td></td>
<td>h3: Automatic reset of diagnosis after this time</td>
</tr>
<tr>
<td></td>
<td>h4: Remaining time until diagnosis time</td>
</tr>
<tr>
<td></td>
<td>See section 14.</td>
</tr>
</tbody>
</table>

R 1.54 and R 1.55

Internal revisions

Revisions to the communication firmware are listed in the Configuration Manual KH 8384-5 EN.
Note concerning these Mounting and Operating Instructions

These instructions EB 8384-5 EN describe the mounting, start up and on-site operation of the Type 3730-5 Positioner.
You can find additional information on the enclosed CD-ROM (CD 8384-5) or on the Internet at http://www.samson.de.

The CD-ROM (CD 8384-5) contains further information on the Type 3730-5 Positioner:

- **[Documentation]**
  - KH 8384-5 EN: Configuration Manual for Type 3730-5 Electropneumatic Positioner, configuration and operation over FOUNDATION™ fieldbus
  - T 8384-5 EN: Data Sheet for Type 3730-5 Electropneumatic Positioner
  - EB 8389 EN: Instructions for Series 373x Positioners; EXPERTplus Valve Diagnostics
  - T 8389 EN: Data Sheet for EXPERT/EXPERT+ Valve Diagnostics
  - T 6661 EN: Data Sheet for TROVIS-VIEW software

- **[Approvals]**
  - PTB/ATEX – NEPSI
  - CSA – GOST
  - FM – STCC
  - IECEx – JIS
  - CERTUSP/INMETRO – CCoE

- **[Declarations of Conformity]**

- **[Integrations]**
  - Enhanced Electronic Device Description (DD)
  - 375/475 Field Communicator
  - Emerson AMS™/DeltaV™
  - Yokogawa PRM – Device Viewer

- **[TROVIS-VIEW (demo version)]**

The HTML-based CD-ROM allows you to easily find any required information using a web browser.
The PDF documents can be read using Acrobat Reader software.
1 Important safety instructions

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

- The positioner is to be mounted, started up or operated only by trained and experienced personnel familiar with the product. According to these Mounting and Operating Instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.

- Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 11.

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

- If inadmissible motions or forces are produced in the actuator as a result of the supply pressure, the supply pressure must be restricted by means of a suitable supply pressure reducing station.

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

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

- Proper shipping and appropriate storage are assumed.

- Do not ground electric welding equipment near to the positioner.
**Note:** The device with a CE marking fulfills the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).
The Declaration of Conformity is included on the CD-ROM (CD 8384-5).
### Article code

#### Positioner

| Type 3730-5 | x x x 0 x 0 x 0 x 0 x x |

**With LCD and autotune, FOUNDATION™ fieldbus**

#### Explosion protection

| Without | 0 |

ATEX: II 2G Ex ia IIC T6; II 2D Ex tb IIC T 80°C IP 66  
FM/CSA:

Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A–G;
Class I, Div.2, Groups A–D; Class II, Div.2, Groups F, G/
Ex ia IIC T6; Class I, II, Div.1, Groups A–G;
Ex nA II T6; Ex nL IIC T6; Class I, II, Div.2, Groups A–G; Class II, Div.1, Groups E–D

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#### Additional equipment

<table>
<thead>
<tr>
<th>Inductive limit switch</th>
<th>Without</th>
<th>SJ2-SN</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SJ2-S1N</td>
<td>2</td>
</tr>
<tr>
<td>Solenoid valve</td>
<td>Without</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With, 24 V DC</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>External position sensor</td>
<td>Without</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>With</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Binary input</td>
<td>Without</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Floating contact</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Diagnostics

**EXPERTplus**  

#### Housing material

| Aluminum (standard) | 0 |
| Stainless steel 1.4581 | 1 |

#### Special applications

| None | 0 |
| Positioner compatible with paint | 1 |
| Vent connection with ¼-18 NPT thread, back of housing sealed | 0 0 0 0 2 |

#### Special version

| None | 0 0 0 |
| NEPSI: Ex ia IIC T6 | 1 0 0 9 |
| NEPSI: Ex nA II T6; Ex nL IIC T6 | 8 0 1 0 |
| IECEx: Ex ia IIC T6 | 1 0 1 2 |
| GOST: 0Ex ia IIC T8 X | 1 0 1 4 |
3 Design and principle of operation

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

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

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

A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the case as well as to optimize the air capacity booster. The i/p module (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply air pressure.

Fig. 2 · Functional diagram

1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume regulator
11* Inductive limit switch
12* Solenoid valve
13 IEC 61158-2 interface module
14 Binary input, passive
15* Binary input, active
16 Display
17* Solenoid valve control
18* Galvanic isolation
19 D/A converter
20 Communication interface

* Optional
The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to FOUNDATION™ fieldbus specification.

As a standard feature, the positioner comes with a binary input for DC voltage signals to signalize process information over the FOUNDATION™ fieldbus.

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

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

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

### 3.1 Application type

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

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

Control over FOUNDATION™ fieldbus is performed over the AO Function Block (control valve) and over the DO1 Function Block (on/off valve). The application type can be entered in the Resource Block over the SELECT_DO_1 parameter (see Configuration Manual KH 8384-5 EN) or at the positioner using Code 49 - h0. See section 14.

<table>
<thead>
<tr>
<th>AUTO</th>
<th>Control valve</th>
<th>Open/close valve</th>
</tr>
</thead>
<tbody>
<tr>
<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>
<td></td>
</tr>
</tbody>
</table>

**MAN**

The positioner follows the reference variable given over local operation.

**Note:**

- Depending on the application type, certain diagnostic functions cannot be performed or analyzed. Refer to EB 8389 EN on EXPERTplus valve diagnostics.
- In manual mode, an on/off valve can be moved past 100 % of the nominal range (with the closed position for ATO) or below 0 % of the nominal range (with the closed position for ATC). See section 7.1 for the valve closed position.

### 3.2 Additional equipment

**Solenoid valve**

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

**NOTICE**

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

**Inductive limit switch**

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

**External position sensor**

In this version, only the sensor is mounted to the control valve. The positioner is located separately from the valve. The connection of x and y signals to the valve is established by cable and piping for air (only without inductive limit switch).

**Binary inputs**

Binary input BE1 (14):
The positioner has an binary input for DC voltage signals as standard, which allows process information to be exchanged over the FOUNDATION™ fieldbus network.

Binary input BE2 (15):
This binary input is optional. It is an active input which connects a floating contact which is powered by the positioner. The switching state of the binary input can be indicated over the FOUNDATION™ fieldbus network.

**3.3 Communication**

The positioner is completely controlled over the digital signal transmission implemented according to FOUNDATION™ fieldbus specification.

Data are transmitted as bit-synchronous current modulation at a rate of 31.25 kbit/s over twisted-pair cables conforming to IEC 61158-2.

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

The Configuration Manual KH 8384-5 EN contains a description on how to configure and operate the positioner over FOUNDATION™ fieldbus.
3.3.1 Configuration using TROVIS-VIEW software

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

*Note:* The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device. The device-specific module for Type 3730-5 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW). Additional information on TROVIS-VIEW (e.g. system requirements) can be found on the SAMSON website and in the Data Sheet T 6661 EN.

3.3.2 Configuration using the NI-FBUS™ Configurator

The NI-FBUS™ Configurator from National Instruments can also be used to configure the positioner. For this purpose, an interface card must be installed in a computer to connect it to the FOUNDATION™ fieldbus. The integrated function blocks are linked using the NI-FBUS™ Configurator.
### 3.4 Technical data

<table>
<thead>
<tr>
<th>Type 3730-5 Positioner (technical data in test certificates additionally apply for explosion-protected devices)</th>
</tr>
</thead>
</table>
| **Rated travel, adjustable** | Direct attachment to Type 3277: 3.6 to 30 mm  
Attachment acc. to IEC 60534-6: 3.6 to 200 mm  
Attachment to rotary actuators (VDI/VDE 3845): 24° to 100° |
| **Travel range, adjustable** | Adjustable within the initialized travel/angle of rotation; travel can be restricted to 1/2 at the maximum |
| **Bus connection** | Fieldbus interface acc. to IEC 61158-2 bus-powered  
Physical Layer Class: 113 (without explosion protection) und 111 (with ex. protection)  
Field device acc. to FM 3610 Entity, FISCO and FNICO |

**Communication**

**Fieldbus**  
Data transmission as per FOUNDATION™ fieldbus specification,  
Communication Profile Class: 31 PS, 32 L;  
Interoperability tested according to Interoperability Test System (ITK 5.2) Revision 4.6

**Local**  
Over SAMSON SSP interface and serial interface adapter

**Software requirements (SSP)**  
SAMSON TROVIS-VIEW with database module 3730-5

**Permissible operating voltage**  
9 to 32 V DC, power supply over bus line  
The limits in the test certificate additionally apply for explosion-protected devices

**Max. operating current**  
15 mA

**Add. current in case of fault**  
0 mA

**Supply air**  
Supply pressure from 1.4 to 7 bar (20 to 105 psi),  
Air quality acc. to ISO 8573-1 Edition 2001: Max. particle size and density: Class 4  
Oil content: Class 3; Moisture and water: Class 3; Pressure dew point: At least 10 K beneath the lowest ambient temperature to be expected

**Signal pressure (output)**  
0 bar up to supply pressure, limitable to 1.4/2.4/3.7 bar ±0.2 bar via software

**Characteristic**  
Linear/equal percentage/reverse equal percentage · User-defined (over operating software and communication) · Butterfly valve linear/equal percentage · Rotary plug valve linear/equal percentage · Segmented ball valve linear/equal percentage  
Deviation from terminal-based conformity ≤ 1 %

**Hysteresis**  
≤ 0.3 %

**Sensitivity**  
≤ 0.1 %

**Direction of action**  
Reversible

**Air consumption**  
Independent from supply pressure approx. 110 l/h

**Air output capacity**  
- Actuator pressurized: At Δp = 6 bar: 8.5 m³/h, at Δp = 1.4 bar: 3.0 m³/h  
K_{max (20 °C)} = 0.09  
At Δp = 6 bar: 14.0 m³/h, at Δp = 1.4 bar: 4.5 m³/h  
K_{max (20 °C)} = 0.15  
- Actuator vented
## Design and principle of operation

### Type 3730-5 Positioner (technical data in test certificates additionally apply for explosion-protected devices)

| Permissible ambient temperature | -20 to +80 °C for all versions  
|                                | -45 to +80 °C with metal cable gland  
|                                | -25 to +80 °C with inductive limit switch (SJ2-S1N) and metal cable gland  
| The limits in test certificate additionally apply for explosion-protected devices. |

| Influences | Temperature | ≤ 0.15 %/10 K |
|           | Supply air  | None          |
| Influence | Vibration   | ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770 |

### Electromagnetic compatibility

- Complying with requirements of EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21

### Explosion protection

- **ATEX**
  - Type 3730-51: II 2G Ex ia IIC T6, II 2D Ex tb IIC T 80 °C IP 66
  - Type 3730-58: II 3G Ex na IIC T6, II 3G Ex ic IIC T6, II 3D Ex tc IIC T 80 °C IP 66

- **FM**
  - Type 3730-53: Class I, Zone 0 AEx ia IIC; Class I, II, III, Div.1, Groups A–G; Class I, Div.2, Groups A–D; Class II, Div.2, Groups F, G

- **CSA**
  - Type 3730-53: Ex ia IIC T6; Class I, II, Div.1, Groups A–G; Ex na II T6; Ex nl IIC T6; Class I, II, Div.2, Groups A–G; Class II, Div.1, Groups E–D

- **NEPSI**
  - Type 3730-51x0x0xx0xx0x00x009: Ex ia IIC T6
  - Type 3730-58xx0x0xx0xx0xx0x010: Ex na II T6; Ex nl IIC T6

- **IECEx**
  - Type 3730-51xx0x0xx0xx0xx0x012: Ex ia IIC T6

- **GOST**
  - Type 3730-51xx0x0xx0xx0xx0x014: 0Ex ia IIC T8 X

### Electrical connection

- One M20 x 1.5 cable gland, for 6 to 12 mm clamping range · Second additional threaded M20 x 1.5 hole · Screw terminals for 0.2 to 2.5 mm² wire cross-section

### Degree of protection

- IP 66/NEMA 4X

### Implementation in safety-related systems in compliance with IEC 61508/SIL

- Probability of failure on demand of safety functions PFD < 2.8 x 10⁻⁷ for a confidence level of 95 %.

  - The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99.

  - The valves are therefore suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.

### Binary input BE1

- **Input**
  - 0 to 30 V DC reverse polarity protection, static destruction limit 40 V, current consumption 3.5 mA at 24 V, galvanically isolated

- **Signal**
  - Signal “1” at Ue > 5 V · Signal “0” at Ue < 3 V

### Materials

#### Housing

- Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706; chromated and powder paint coated · Special version: stainless steel 1.4581

#### External parts

- Stainless steel 1.4571 and 1.4301

#### Cable gland

- Nickel-plated brass, M20x1.5

#### Weight

- Approx. 1 kg
### Options for Type 3730-5

<table>
<thead>
<tr>
<th><strong>Binary input BE2</strong> for floating contact</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switching input</strong></td>
<td>R &lt; 100 Ω, contact loadability 100 mA, static destruction limit 20 V / 5.8 mA, galvanically isolated</td>
</tr>
<tr>
<td><strong>Solenoid valve</strong></td>
<td>Approval acc. to IEC 61508/SIL</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>24 V DC, reverse polarity protection, static destruction limit 40 V</td>
</tr>
<tr>
<td></td>
<td>Current consumption $I = \frac{U - 5.7 \text{ V}}{3840 \text{ Ω}}$ (corresponding to 4.8 mA at 24 V/114 mW)</td>
</tr>
<tr>
<td><strong>Signal “0” no pick-up</strong></td>
<td>≤ 15 V</td>
</tr>
<tr>
<td><strong>Signal “1” safe pick-up</strong></td>
<td>&gt;19 V</td>
</tr>
<tr>
<td><strong>Service life</strong></td>
<td>&gt;5 x 10⁴ switching cycles</td>
</tr>
<tr>
<td><strong>Kₜ coefficient</strong></td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Implementation in safety-related systems in compliance with IEC 61508/SIL</strong></td>
<td>Same as positioner pneumatics</td>
</tr>
</tbody>
</table>

| **Inductive limit switch** | For connection to switching amplifier acc. to EN 60947-5-6 |
| SJ2-SN proximity switch | NAMUR NC contact |
| SJ2-S1N proximity switch | NAMUR NO contact |

| **External position sensor** | Same as positioner |
| **Travel** |  |
| **Cable** | 10 m with M12x1 connector, designed for continuous flexing, flame retardant acc. to VDE 0472, resistant to oils, lubricants, coolants as well as other corrosive media |
| **Perm. ambient temperature** | –60 to +105 °C |
| **Vibration immunity** | Up to 10 g in the range between 10 and 2000 Hz |
| **Degree of protection** | IP 67 |
4 Attachment to the control valve – Mounting parts and accessories

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

The 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 41 to 43) to mount the positioner. Observe the type of attachment!

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

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

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

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

**Note:** The lever **M** is included in the scope of delivery. Levers **S, L, XL** for attachment according to IEC 60534-6 (NAMUR) are available as accessories (see Table 3 on page 42).

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

<table>
<thead>
<tr>
<th>Actuator size [cm²]</th>
<th>Rated travel [mm]</th>
<th>Adjustment range at positioner Min. Travel Max.</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>Actuator size [cm²]</th>
<th>Rated travel [mm]</th>
<th>Other valves/actuators min. Travel max.</th>
<th>Required lever</th>
<th>Assigned pin position</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 and 120 with Type 3510 Valve</td>
<td>7.5</td>
<td>3.6 to 18.0</td>
<td>S</td>
<td>17</td>
</tr>
<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>700</td>
<td>7.5</td>
<td>7.0 to 35.0</td>
<td>M</td>
<td>35</td>
</tr>
<tr>
<td>1000/1400/2800</td>
<td>30</td>
<td>14.0 to 70.0</td>
<td>L</td>
<td>70</td>
</tr>
<tr>
<td>1000/1400/2800</td>
<td>60</td>
<td>20.0 to 100.0</td>
<td>L</td>
<td>100</td>
</tr>
<tr>
<td>1400/2800</td>
<td>120</td>
<td>40.0 to 200.0</td>
<td>XL</td>
<td>200</td>
</tr>
</tbody>
</table>

### Attachment to rotary actuators according to VDI/VDE 3845

<table>
<thead>
<tr>
<th>Rotary actuators Min. Opening angle Max.</th>
<th>Required lever</th>
<th>Assigned pin position</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 to 100°</td>
<td>M</td>
<td>90°</td>
</tr>
</tbody>
</table>
4.1 Direct attachment

4.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 41 for the required mounting parts as well as the accessories with their order numbers. Note the travel table on page 19!

Actuator with 120 cm²

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

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove vent plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.

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

6. **7.5 mm travel**: Remove the follower pin (2) from the pin position 35, reposition it in the bore for pin position 25 and screw tight.

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

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

Symbols

Actuator stem extends
Attachment left
Attachment right
Actuator stem retracts

Switchover plate (9)

1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
4 Vent plug
5 Stopper
6 Connecting plate
6.1 Seal rings
7 Pressure gauge bracket
8 Press. gauge mounting kit
9 Switchover plate for actuator
10 Cover plate
10.1 Seal ring
11 Cover
14 Gasket
15 Formed seal

Marking

Signal pressure input for left attachment
Signal pressure input for right attachment

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

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

Symbols

Actuator stem extends
Attachment left
Attachment right
Actuator stem retracts

Switchover plate (9)

1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
4 Vent plug
5 Stopper
6 Connecting plate
6.1 Seal rings
7 Pressure gauge bracket
8 Press. gauge mounting kit
9 Switchover plate for actuator
10 Cover plate
10.1 Seal ring
11 Cover
14 Gasket
15 Formed seal

Marking

Signal pressure input for left attachment
Signal pressure input for right attachment

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

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

Refer to Table 2 on page 41 or the required mounting parts as well as the accessories with their order numbers. Note the travel table on page 19!

**Actuators with 240 to 700 cm²**

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

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 5, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 355/700 cm², remove the follower pin (2) at lever M (1) on the back of the positioner from pin position 35, reposition it in the bore for pin position 50 and screw tight.
   For actuators 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position 35.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 20). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 5, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.
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

Refer to Table 3 on page 42 for the required mounting parts as well as the accessories with their order numbers. Note the travel table on page 19!

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

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

**Actuator size 2800 cm² and 1400 cm² (120 mm travel):**
- For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9).
- For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).

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

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

4. Select required lever size (1) M, L or XL and pin position according to the actuator size and valve travels listed in the table on page 19. Should you require a pin position other than position 35 with the standard installed lever M, or require a lever size L or XL, proceed as follows:

5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.

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

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

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

Attachment to rod-type yoke
Rod diameter 20 to 35 mm

Additional bracket for actuators with 2800 cm² and travel ≥ 60 mm

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

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

Fig. 6 · Attachment according to IEC 60534-6 (NAMUR)
4.3 Attachment to Type 3510 Micro-flow Valve

Refer to Table 3 on page 42 for the required mounting parts as well as the accessories with their order numbers.

Note the travel table on page 19!

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

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

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

*Fig. 7 · Attachment to Type 3510 Micro-flow Valve*
4.4 Attachment to rotary actuators

Refer to Table 4 on page 42 for the required mounting parts as well as the accessories with their order numbers. Note the travel table on page 19!

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

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

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

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

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

6. Unscrew the standard follower pin (2) from the positioner’s lever M (1). Use the metal follower pin (Ø5) included in the mounting kit and screw tight into the bore for pin position 90°.

7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator’s direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (Fig. 9). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.

8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

![Mounting flange](image-url)
Note:
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

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

Fig. 9 · Attachment to rotary actuators
4.4.1 Heavy-duty version

Refer to Table 4 on page 42 for the required mounting parts as well as the accessories with their order numbers.

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

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

2. For SAMSON Type 3278 and VETEC S160 Rotary Actuator, screw the adapter (5) onto the free end of the shaft or place adapter (5.1) onto the shaft of the VETEC R Actuator.

   Place adapter (3) onto Type 3278, VETEC S160 and VETEC R Actuator. For VDI/VDE version, this step depends on the actuator size.

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

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

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

6. If applicable, mount pressure gauge bracket (7) with pressure gauges or, in case G 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. 10).

![Fig. 10 · Direction of rotation](image-url)
Fig. 11 · Attachment to rotary actuators (heavy-duty version)

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

**Attachment acc. to VDE/VDI 3845 (2010) level 1, size AA1 to AA4, section 15.1**

*Fit screw-in restriction into signal pressure output for actuators with < 300 cm³ volume*
4.5 Reversing amplifier for double-acting actuators

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

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

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

The output signal pressure of the positioner is supplied at the output \( A_1 \) 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

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes \( A_1 \) and \( Z \).
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes \( A_1 \) and \( Z \).

**NOTICE**

Do not unscrew the sealing plug (1.5) out of the reversing amplifier. The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

**Signal pressure connections**

**A1**: Output \( A_1 \) leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

**A2**: Output \( A_2 \) leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

Set slide switch on positioner to AIR TO OPEN.

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

**Pressure gauge attachment**

The mounting sequence shown in Fig. 12 remains unchanged. Screw a pressure gauge bracket onto the connections \( A_1 \) and \( Z \).

Pressure gauge G ¼ 1400-7106 bracket: ¼ 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

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

From the positioner
Output 38 Supply 9

Control signals to the actuator

A1 A2

1 1.1 1.2 1.3 1.4 1.5 1.6
1 Reversing amplifier 6 Connecting plate
1.1 Special screws 6.1 O-rings
1.2 Gasket 6.2 Screws
1.3 Special nuts
1.4 Rubber seal
1.5 Sealing plug
1.6 Filter

Output 38 Supply 9

6.1 6 6.2
4.6 Attaching an external position sensor

Refer to Table 6 on page 43 for the mounting parts and accessories required.

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

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

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

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

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

Operation and setting are described in sections 7 and 8.
- Since 2009, the back of the position sensor (20) is fitted with two pins acting as mechanical stops for the lever (1). If this position sensor is mounted using old mounting parts, two corresponding Ø8 mm holes must be drilled into the mounting plate/bracket (21). A template is available for this purpose. Refer to Table 6 on page 43.

4.6.1 Mounting the position sensor with direct attachment

Type 3277-5 Actuator with 120 cm²

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

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

Type 3277 Actuator with 240 to 700 cm²:

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

**Mounting the position sensor**

1. Place the lever (1) on the sensor in mid-position and hold it in place. Unthread the nut (1.1) and remove the lever together with the disk spring (1.2) from the sensor shaft.
2. Screw the position sensor (20) onto the mounting plate (21).
3. Depending on the actuator size and rated valve travel, determine the required lever and position of the follower pin (2) from the travel table on page 19. The positioner is delivered with lever M in pin position 35 on the sensor. If necessary, remove the follower pin (2) from its pin position and move it to the borehole for the recommended pin position and screw tight.
4. Place the lever (1) and disk spring (1.2) on the sensor shaft. Place the lever (1) in mid-position and hold it in place. Screw on the nut (1.1).
5. Place the follower clamp (3) on the actuator stem, align and fasten it, making sure that the fastening screw rests in the groove of the actuator stem.
6. Place the mounting plate (21) together with the sensor onto the actuator yoke so that the follower pin (2) rests on the top

**Fig. 14 · Mounting for Type 3277-5 Actuator (left) and Type 3277 Actuator (right)**
of the follower clamp (3). It must rest on it with spring force.
Screw tight the mounting plate (21) onto the actuator yoke using both fixing screws.

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

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

For the required mounting parts and the accessories, refer to Table 6 on page 43.

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

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

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

The standard attached lever M with the follower pin (2) at position 35 is designed for 120, 240 and 350 cm² actuators with 15 mm rated travel.

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

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

4. Screw both bolts (14) to the bracket (9.1) of the stem connector (9). Attach

---

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

1. Lever
1.1 Nut
1.2 Disk spring
2. Follower pin
3. Follower plate
9. Stem connector
9.1 Bracket
14. Bolt
14.1 Screws
20. Position sensor
21. Bracket
the follower plate (3) and fix with the screws (14.1).

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

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

*For the required mounting parts and the accessories, refer to Table 6 on page 43.*

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

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

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

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

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

---

**Fig. 16 · Mounting on a micro-flow valve**
### 4.6.4 Mounting the position sensor to rotary actuators

For the required mounting parts and the accessories, refer to Table 6 on page 43.

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

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

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

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

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

---

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

1. Lever
2. Follower pin
1.1 Nut
1.2 Disk spring
20 Position sensor
21 Mounting plate
4.7 Attaching positioners with stainless steel housings

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

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

<table>
<thead>
<tr>
<th>Connecting plate</th>
<th>G ¼</th>
<th>1400-7476</th>
</tr>
</thead>
<tbody>
<tr>
<td>(stainless steel):</td>
<td>¼ NPT</td>
<td>1400-7477</td>
</tr>
<tr>
<td>Pressure gauge bracket (st. steel):</td>
<td>Only in</td>
<td>¼ NPT</td>
</tr>
</tbody>
</table>

The Tables 1 to 5 (pages 41 and 43) apply for attaching positioners with stainless steel housings with the following restrictions:

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

**Attachment according to IEC 60534-6 (NAMUR rib or attachment to rod-type yokes)**
All mounting kits from Table 3 can be used. Connecting plate in stainless steel.

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

4.8 Air purging function for single-acting actuators

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

**Direct attachment to Type 3277-5 (stem extends FA/stem retracts FE)**
The air purging function is automatically provided.

**Direct attachment to Type 3277, 240 to 700 cm²**
FA: Remove the stopper 12.2 (Fig. 5 on page 23) at the connection block and make a pneumatic connection to the spring chamber on the vented side.

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

FE: The air purging function is automatically provided.

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

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

---

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

---

Should other valve accessories be used which vent the actuator (e.g. solenoid valve, volume booster, quick exhaust valve), this exhaust air must also be included in the purging function. The connection over the adapter at the positioner must be protected with a check valve (e.g. check valve G ¼, order no. 8502-0597) mounted in the piping. Otherwise the pressure in the positioner housing would rise above the ambient pressure and damage the positioner when the exhausting components respond suddenly.
# 4.9 Mounting parts and accessories

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

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Mounting parts for actuators 120 cm² or smaller</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories for the actuator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switchover plate (old) for Actuator Type 3277-5xxxxxx.00 (old)</td>
<td>1400-6819</td>
<td></td>
</tr>
<tr>
<td>Switchover plate new for Actuator Type 3277-5xxxxxx.01 (new)</td>
<td>1400-6822</td>
<td></td>
</tr>
<tr>
<td>Connecting plate new for Actuator Type 3277-5xxxxxx.01 (new)</td>
<td>1400-6823</td>
<td></td>
</tr>
<tr>
<td>Connecting plate old for Actuator Type 3277-5xxxxxx.00 (old): G ¼</td>
<td>1400-6820</td>
<td></td>
</tr>
<tr>
<td>Connecting plate old for Actuator Type 3277-5xxxxxx.00 (old): ¼ NPT</td>
<td>1400-6821</td>
<td></td>
</tr>
<tr>
<td>Connecting plate (6)</td>
<td>G ¼</td>
<td>1400-7461</td>
</tr>
<tr>
<td></td>
<td>¼ NPT</td>
<td>1400-7462</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td>G ¼</td>
<td>1400-7458</td>
</tr>
<tr>
<td></td>
<td>¼ NPT</td>
<td>1400-7459</td>
</tr>
<tr>
<td>Pressure gauge mounting kit (8) up to max. 6 bar (output/supply)</td>
<td>St. steel/brass</td>
<td>1400-6950</td>
</tr>
<tr>
<td></td>
<td>St. steel/St. st.</td>
<td>1400-6951</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 Actuator (Fig. 5)

<table>
<thead>
<tr>
<th>Mounting parts</th>
<th>Attachment to actuators with 240, 350, 355, 700 cm²</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required piping with screw fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-- for “Actuator stem retracts”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-- when the top diaphragm chamber is filled with air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240 cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>350 cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>355 cm²/700 cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection block with seals and screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G ¼</td>
<td>1400-8819</td>
</tr>
<tr>
<td></td>
<td>¼ NPT</td>
<td>1400-8820</td>
</tr>
<tr>
<td>Pressure gauge mounting kit up to max. 6 bar (output and supply)</td>
<td>St. steel/brass</td>
<td>1400-6950</td>
</tr>
<tr>
<td></td>
<td>St. steel/St. st.</td>
<td>1400-6951</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 with 60/120 cm² on Type 3510 Valve (Fig. 7)</td>
<td>1400-7457</td>
</tr>
<tr>
<td>5 to 50</td>
<td>M ¹)</td>
<td>Actuators from other manufacturers and Type 3271 with 120 to 700 cm²</td>
<td>1400-7454</td>
</tr>
<tr>
<td>14 to 100</td>
<td>L</td>
<td>Actuators from other manufacturers and Type 3271, versions 1000 and 1400-60</td>
<td>1400-7455</td>
</tr>
<tr>
<td>40 to 200</td>
<td>XL</td>
<td>Actuators from other manufacturers and Type 3271, versions 1400-120 and 2800 cm² with 120 mm travel</td>
<td>1400-7456</td>
</tr>
<tr>
<td>30 or 60</td>
<td>L</td>
<td>Type 3271, versions 1400-120 and 2800 cm² with 30/60 mm travel</td>
<td>1400-7466</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mounting bracket for Emerson and Masoneilan linear actuators</td>
<td>1400-6771</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valtek Type 25/50</td>
<td>1400-9554</td>
</tr>
</tbody>
</table>

²) Lever M is mounted on basic device (included in the scope of delivery)

### 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>Actuator surface corresponds to level 1</td>
<td>1400-7448</td>
</tr>
<tr>
<td>Size AA1 to AA4, version with CrNiMo steel bracket</td>
<td>1400-9244</td>
</tr>
<tr>
<td>Size AA1 to AA4, heavy-duty version</td>
<td>1400-9542</td>
</tr>
<tr>
<td>Heavy-duty version (e.g. Air Torque 10 000)</td>
<td>1400-9526</td>
</tr>
<tr>
<td>Bracket surface corresponds to level 2, heavy-duty version</td>
<td>1400-7614</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 160/320 cm², CrNiMo steel bracket</td>
<td>1400-9245</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 160 cm² and for VETEC Type S160, Type R and Type M, heavy-duty version</td>
<td>1400-5891 and 1400-9526</td>
</tr>
<tr>
<td>Attachment for SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version</td>
<td>1400-9120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting plate (6)</td>
<td>1400-7461</td>
</tr>
<tr>
<td>G ¼ NPT</td>
<td>1400-7462</td>
</tr>
<tr>
<td>Pressure gauge bracket (7)</td>
<td>1400-7458</td>
</tr>
<tr>
<td>G ¼ NPT</td>
<td>1400-7459</td>
</tr>
<tr>
<td>Pressure gauge mounting kit up to max. 6 bar (output/supply)</td>
<td>1400-6950</td>
</tr>
<tr>
<td>St. steel/brass</td>
<td>1400-6951</td>
</tr>
<tr>
<td>St. steel/st. steel</td>
<td>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>Cable gland M20 x 1.5, nickel-plated brass</td>
<td>1890-4875</td>
</tr>
<tr>
<td>EMC cable gland M20 x 1.5</td>
<td>8808-0143</td>
</tr>
<tr>
<td>Adapter M 20 x 1.5 to ½ NPT, aluminum</td>
<td>0310-2149</td>
</tr>
<tr>
<td>Retrofit kit for inductive limit switch 1x SJ 2-SN</td>
<td>1400-7460</td>
</tr>
<tr>
<td>Cover plate with list of parameters and operating instructions German/English (std)</td>
<td>1990-5328</td>
</tr>
<tr>
<td>TROVIS-VIEW with device module 3730-5</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)</td>
<td>1400-9740</td>
</tr>
</tbody>
</table>

### Table 6 · Attachment of external position sensor

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Template for mounting position sensor on older mounting parts. See note on page 34.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1060-0784</td>
<td>Mounting parts for actuators with 120 cm² see Fig. 14 left</td>
</tr>
<tr>
<td>1400-7472</td>
<td>Connecting plate (9, old) for Actuator Type 3277-5xxxxxx.00 G ½ 1400-6820 1400-6821</td>
</tr>
<tr>
<td>1400-7473</td>
<td>Connecting plate (new) for Actuator Type 3277-5xxxxxx.01 (new) 1) 1400-6823</td>
</tr>
<tr>
<td>1400-7471</td>
<td>Mounting parts for actuators with 240, 350, 355 and 700 cm², see Fig. 14 right</td>
</tr>
<tr>
<td>1400-7468</td>
<td>NAMUR attachment. Mounting parts for attachment to NAMUR rib w. lever L and XL, see Fig. 15</td>
</tr>
<tr>
<td>1400-7469</td>
<td>Micro-flow valve. Mounting parts for Type 3510 Micro-flow Valve, see Fig. 16</td>
</tr>
</tbody>
</table>

**Attachment to rotary actuators**

- VDI/VDE 3845 (September 2010), refer to section 15.1 for details
  - Actuator surface corresponds to level 1
    - Size AA1 to AA4 with follower clamp and coupling wheel, version with CrNiMo steel bracket, see Fig. 17
    - Size AA1 to AA4, heavy-duty version
    - Size AA5, heavy-duty version (e.g. Air Torque 10 000)
  - Bracket surface corresponds to level 2, heavy-duty version
- SAMSON Type 3278 with 160 cm² (also for VETEC Type S160 and Type R), heavy-duty version
- SAMSON Type 3278 with 320 cm² and for VETEC Type S320, heavy-duty version

**Accessories for positioner**

- Connecting plate (6) G ½ 1400-7461 1400-7462
- Pressure gauge bracket (7) G ½ 1400-7458 1400-7459
- Pressure gauge mounting kit up to max. 6 bar (output/supply) St. steel/brass 1400-6950 St. steel/st. steel 1400-6951

- Bracket to mount the positioner on a wall

**Note:** The other fastening parts are to be provided at the site of installation as wall foundations vary from site to site.

1) Only new switchover and connecting plates can be used with new actuators (Index 01).

Old and new plates are not interchangeable.
5 Connections

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

The connection of the electrical auxiliary power may cause the actuator stem to move, depending on the operating mode.
Do not touch the actuator stem or obstruct it to avoid risk of injury to hands or fingers.

5.1 Pneumatic connections

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

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

5.1.1 Signal pressure gauges

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

5.1.2 Supply pressure

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

Actuator stem extends FA (AIR TO OPEN)
Fail-safe position "Valve Closed" (for globe and angle valves):
Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.
**Actuator stem retracts FE (AIR TO CLOSE)**

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

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

- $d$ = Seat diameter [cm]
- $\Delta p$ = Differential pressure across the valve [bar]
- $A$ = Actuator diaphragm area [cm$^2$]

If there are no specifications, calculate as follows:

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

**5.1.3 Signal pressure (output)**

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

The limitation is not activated [OFF] by default.

---

**5.2 Electrical connections**

---

**DANGER!**

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

- For electrical installation, observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use.

**NOTICE**

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

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

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

Seal cable entries left unused with plugs.

Devices used at ambient temperatures below –20 °C must be fitted with metal cable glands.

Equipment for use in zone 2/zone 22

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

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

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

Cable entries

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

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

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

Note: The power supply for the positioner can be supplied either over the connection to the fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner.

You are required to observe the relevant regulations for use in hazardous areas.

Bus line

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

NOTICE

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

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

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

Binary input BE1

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

Binary input BE2

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

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

Solenoid valve (forced venting function)

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

**NOTICE**

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

---

**Connections**

<table>
<thead>
<tr>
<th>Option</th>
<th>-81</th>
<th>-82</th>
<th>+87</th>
<th>-88</th>
<th>+85</th>
<th>-86</th>
<th>+41</th>
<th>-42</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 V DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>溶断阀 (强制通风功能)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus line</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE1</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE2 (optional)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Switch, amplifier EN 60947-5-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binary contacts</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Inductive limit switch (optional)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Fig. 18: Electrical connections*
5.2.1 Establishing communication

The communication structure between the controller, logic solvers (PLC) or automation system, or between a PC or work station and the positioner(s) is implemented to conform with IEC 61158-2.
Fig. 19 · Connection acc. to FOUNDATION™ fieldbus, without (top) and with explosion protection (bottom)
6 Operator controls and readings

Rotary pushbutton

The rotary pushbutton is located underneath the front protective cover. The positioner is operated on site using the rotary pushbutton:

- Turn to select codes and values.
- Press to confirm setting.

Slide switch AIR TO OPEN or AIR TO CLOSE

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

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

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

Volume restriction Q

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

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

Readings on display

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

Operating modes:

- Manual mode (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 alarms

- Maintenance alarm
- Maintenance required/Maintenance demanded

These icons indicate that an error has occurred.

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

Configuration enabled

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

<table>
<thead>
<tr>
<th>Designation</th>
<th>Position</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUtO</td>
<td>Manual mode</td>
<td>Closed-loop operation</td>
</tr>
<tr>
<td>CL</td>
<td>Clockwise</td>
<td></td>
</tr>
<tr>
<td>CCL</td>
<td>Counterclockwise</td>
<td></td>
</tr>
<tr>
<td>Err</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>ESC</td>
<td>Escape</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>w too small</td>
<td></td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum range</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Not available/ not active</td>
<td></td>
</tr>
<tr>
<td>NOM</td>
<td>Nominal travel</td>
<td></td>
</tr>
</tbody>
</table>

- **AUtO**: Automatic mode
- **CL**: Clockwise
- **CCL**: Counterclockwise
- **Err**: Error
- **ESC**: Escape
- **LOW**: w too small
- **MAX**: Maximum range
- **No**: Not available/ not active
- **NOM**: Nominal travel

**Code**

- **RES**: Reset
- **RUN**: Start
- **SAFE**: Fail-safe position
- **Sub**: Substitute calibration
- **YES**: Available/active
- **ZP**: Zero calibration
- **tEStinG**: Test function active
- **YES**: Available/active
- **ZP**: Zero calibration

**Configuration**

- **MAN**: Manual mode
- **RES**: Reset
- **RUN**: Start
- **SAFE**: Fail-safe position
- **Sub**: Substitute calibration
- **YES**: Available/active
- **ZP**: Zero calibration
- **tEStinG**: Test function active

**Units**

- **%**
- **mm**

**AO Transducer Block**

- **MAN**: Manual mode
- **RES**: Reset
- **RUN**: Start
- **SAFE**: Fail-safe position
- **Sub**: Substitute calibration
- **YES**: Available/active
- **ZP**: Zero calibration
- **tEStinG**: Test function active

**Fail-safe position active**

- **INIT**: INIT
- **CAUTION**: VALVE ACTUATES
- **MIN SIDE**: MIN SIDE
- **MAX BACK**: MAX BACK
- **MIN BACK**: MIN BACK
- **Q**: Q
- **S**: S

**Code**

- **FF**: Blinking in Code 3: Local operation locked

**Maintenance alarm/fault**

- **Configuration enabled**
- **Maintenance required**
- **Maintenance demanded**

**SSP interface**

- **Switch for AIR TO OPEN/AIR TO CLOSE**
- **Volume restriction**
- **Rotary pushbutton**

*Fig. 20 - Display and operator controls*
7 Start-up – Settings

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

Reading on display after connecting the electrical auxiliary power:

- \texttt{tEStinG} runs across the display and then the fault alarm icon appears and blinks on the display when the positioner has \textbf{not yet been initialized}. The reading indicates the lever position in degrees in relation to the longitudinal axis.

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

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

7.1 Defining the valve closed position

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

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

\textbf{NOTICE}
The \textbf{AIR TO OPEN (AtO)} setting always applies to double-acting actuators.

\textbf{FOR checking purposes:}
After successfully completing initialization, the positioner display should read 0 % when the valve is closed and 100 % when the valve is open. If this is not the case, change the slide switch position and re-initialize the positioner.
Note: The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner. The positioner only needs to be initialized again after the fail-safe action of the actuator has been changed.

7.2 Setting the volume restriction Q

The volume restriction Q is used to adapt the air delivery to the size of the actuator:
- Actuators with a transit time < 1 s, e.g. linear actuators with an effective area smaller than 240 cm², require a restricted air flow rate (MIN).
- Actuators with a transit time ≥ 1 s do not require the air flow rate to be restricted (MAX).

The position of volume restriction Q also depends on how the signal pressure is routed at the actuator in SAMSON actuators:
- The “SIDE” position applies for actuators with a loading pressure connection at the side, e.g. Type 3277-5.
- The “SIDE” restriction position always applies for actuators from other manufacturers.

Overview · Position of volume restriction Q*

<table>
<thead>
<tr>
<th>Signal pressure</th>
<th>Transit time</th>
<th>&lt; 1 s</th>
<th>≥ 1 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection at the side</td>
<td>MIN SIDE</td>
<td>MAX SIDE</td>
<td></td>
</tr>
<tr>
<td>Connection at the back</td>
<td>MIN BACK</td>
<td>MAX BACK</td>
<td></td>
</tr>
</tbody>
</table>

* Intermediate positions are not permitted.

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

7.3 Adapting the display

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

If the displayed data appear upside down, proceed as follows:
Turn \( \odot \rightarrow \) Code 2
Press \( \odot \rightarrow \) Code 2 blinks.

7.4 Limiting the signal pressure

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

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

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

Turn \( \odot \rightarrow \) Code 3, display: No
Press \( \odot \rightarrow \) Code 3 blinks.

Turn \( \odot \rightarrow \) YES
Press \( \odot \rightarrow \) display \( \odot \)

Limiting the signal pressure:

Turn \( \odot \rightarrow \) Code 16
Press \( \odot \rightarrow \) Code 16 blinks.

Turn \( \odot \rightarrow \) until the required pressure limit (1.4/2.4/3.7 bar) appears.
Press \( \odot \) to confirm the pressure limit setting.

7.5 Checking the operating range of the positioner

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

Selecting \( \odot \) manual operating mode:

Turn \( \odot \rightarrow \) Code 0
Press \( \odot \rightarrow \) Code 0 blinks.

Turn \( \odot \rightarrow \) MAN
Press \( \odot \). The positioner changes to the \( \odot \) manual operating mode.

Checking the operating range:

Turn \( \odot \rightarrow \) Code 1
Press \( \odot \rightarrow \) Code 1 and \( \odot \) blink.
Turn until the pressure in the positioner builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked.

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

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

Exit Code 1 by pressing the rotary pushbutton ( ).

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

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

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

WARNING!

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

7.6 Initialization

WARNING!

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

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

NOTICE

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

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

- **MAX maximum range** (standard range) Initialization mode for simple start-up of valves with two clearly defined mechanical end positions, e.g. three-way valves (see section 7.6.1)
NOM nominal range
Initialization mode for all globe valves (see section 7.6.2)

MAN manually selected range
Initialization mode for globe valves with an unknown nominal range (see section 7.6.3)

SUB substitute calibration (emergency mode)
This mode allows a positioner to be replaced while the plant is running, with the least amount of disruption to the plant (see section 7.6.4)

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

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

Note: When Code 48 - h0 = YES, the diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed. tESd1 or tESd2 appear on the display in an alternating sequence. An error during the plotting of the reference graphs is indicated on the display over Code 48 - h1 and Code 81. The positioner still works properly, even though the reference graph plotting has not been completed successfully.

Valve closed position AIR TO CLOSE
If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing (↑↓) on successful completion of initialization.
This results in the following assignment between reference variable and valve position:

<table>
<thead>
<tr>
<th>Valve closed position</th>
<th>Direction of action</th>
<th>Reference variable Valve Closed at Open at</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR TO OPEN</td>
<td>↑↓</td>
<td>0 % 100 %</td>
</tr>
<tr>
<td>AIR TO CLOSE</td>
<td>↑↓</td>
<td>100 % 0 %</td>
</tr>
</tbody>
</table>

Note: Code 48 - h0 = YES, the diagnostics automatically start to plot the reference graphs (drive signal steady-state d1 and hysteresis d2) after initialization has been completed. tESd1 or tESd2 appear on the display in an alternating sequence. An error during the plotting of the reference graphs is indicated on the display over Code 48 - h1 and Code 81. The positioner still works properly, even though the reference graph plotting has not been completed successfully.
The tight-closing function is activated.

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

Canceling an initialization process

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

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

7.6.1 **MAX – Initialization based on maximum range**

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

Enable configuration:

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

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

Select the initialization mode:

![Initialization mode](image)

Initialization mode
Default MAX

Turn ➔ Code 6
Press ➔

Turn ➔ MAX
Press ➔ to confirm the MAX as the initialization mode.

Start initialization:

- Press INIT key to start initialization!

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

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

Turn \(\bigcirc\) → Code 4

Press \(\bigcirc\), Code 4 blinks

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

Press \(\bigcirc\). The reading of the nominal range appears in mm/°.

Enable configuration:

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

Enter the pin position and nominal range:

7.6.2 NOM – Initialization based on nominal range

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

Note: The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, initialization is interrupted (error alarm Code 52) because the nominal travel is not achieved.
Turn \( \text{\textcircled{6}} \) → Nominal travel/angle
Press \( \text{\textcircled{6}} \).

Select the initialization mode:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>NOM</td>
</tr>
</tbody>
</table>

Initialization mode
Default \( \text{MAX} \)

Turn \( \text{\textcircled{6}} \) → Code 6
Press \( \text{\textcircled{6}} \), Code 6 blinks
Turn \( \text{\textcircled{6}} \) → NOM
Press \( \text{\textcircled{6}} \) to confirm the NOM as the initialization mode.

Start initialization:

Press INIT key to start initialization!

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

7.6.3 MAN – Initialization based on a manually selected range

Before starting initialization, move the control valve manually to the OPEN position by turning \( \text{\textcircled{6}} \) in small steps. The valve must move to the required valve position with a monotonically increasing signal pressure. The positioner calculates the differential travel/angle using the OPEN and CLOSED positions and adopts it as the operating range with limits of travel/angle range start (Code 8) and travel/angle range end (Code 9).

Enable configuration:

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

Enter the pin position:

Pin position
Default No

Turn \( \text{\textcircled{6}} \) → Code 4
Press \( \text{\textcircled{6}} \), Code 4 blinks
Turn \( \text{\textcircled{6}} \) → Pin position on lever (see relevant section on attachment)
Press \( \text{\textcircled{6}} \). The reading of the nominal range appears in mm/°.
Select the initialization mode:

Select the initialization mode:

![Initialization mode]

Initialization mode
Default \textit{MAX}

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

Enter OPEN position:

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

Turn \(\bigcirc\) \(\rightarrow\) Code 0
Press \(\bigcirc\), Code 0 blinks
Turn \(\bigcirc\) \(\rightarrow\) MAN
Press \(\bigcirc\)
Turn \(\bigcirc\) \(\rightarrow\) Code 1
Press \(\bigcirc\), Code 1 blinks
Turn \(\bigcirc\) until the valve reaches its OPEN position.
Press \(\bigcirc\) to confirm the OPEN position.

Start initialization:

- Press INIT key to start initialization!

### 7.6.4 SUb substitute calibration

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

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

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

**NOTICE**

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

Enable configuration:

**Note:** If no settings are entered within 120 seconds, the enabled configuration function becomes invalid.
Start-up – Settings

Select the initialization mode:

Enter the direction of action:

Deactivate travel limit:
**Change pressure limit and control parameters:**

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

- **Pressure limit**
  - Default: No
  - Turn $\circ$ to Code 16
  - Press $\circ$, Code 16 blinks

- **$K_p$**
  - Default: 7
  - Turn $\circ$ to Code 17

- **$T_v$**
  - Default: 2
  - Turn $\circ$ to Code 18

**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)
  - Turn $\circ$ to Code 34
  - Press $\circ$, Code 34 blinks

- **Blocking position**
  - Default: 0
  - Turn $\circ$ to Code 35
  - Press $\circ$, Code 35 blinks
  - Turn $\circ$ to Blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).

**Set the valve closed position:**

- Set switch for **valve closed position**
  - AIR TO OPEN or AIR TO CLOSE as described in section 7.1 on page 52.
- Set volume restriction as described in section 7.2 on page 53.
Start initialization:

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

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

Cancel the blocking position and change to automatic operating mode

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

- Turn Code 1
- Press , Code 1 and blink
- Turn in order to move the valve slightly past the blocking position.
- Press to cancel mechanical blocking.
- Turn Code 0
- Press , Code 0 blinks.
- Turn AUTO
- Press . The positioner switches to automatic operating mode. The current valve position is indicated in %.

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

Zero point calibration

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

### 7.7 Zero calibration

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

**NOTICE**

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

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

Enable configuration:

- Turn Code 3
- Press , Code 3 blinks
- Turn ON
- Press , display 

---

**EB 8384-5 EN 63**
Perform zero calibration:

Initialization mode
Default MAX

Turn \( \circ \rightarrow \) Code 6
Press \( \circ \), Code 6 blinks
Turn \( \circ \rightarrow \) ZP
Press \( \circ \).

Press INIT key!
Zero calibration starts. The positioner moves the valve to the CLOSED position and readjusts the internal electrical zero point.

7.8 Selecting the application type

The application type is set as follows:

Enable configuration:
Turn \( \circ \rightarrow \) Code 3, display No
Press \( \circ \), Code 3 blinks.
Turn \( \circ \rightarrow \) ON
Press \( \circ \), display \( \ominus \)

Select the application type:
Turn \( \circ \rightarrow \) Code 49
Press \( \circ \), Code 49 blinks.
Turn \( \circ \rightarrow \) Code h0
Press \( \circ \), Code h0 blinks.
Turn \( \circ \rightarrow \) YES (on/off valves) or No (control valves)
Press \( \circ \).

Note: Control over FOUNDATION™ fieldbus is performed over the AO Function Block (control valve) and over the DO1 Function Block (on/off valve). Refer to Configuration Manual KH 8384-5 EN.

7.9 Reset to default values

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

Enable configuration:
Turn \( \circ \rightarrow \) Code 3, display No
Press \( \circ \), Code 3 blinks
Turn \( \circ \rightarrow \) ON
Press \( \circ \), display \( \ominus \)

Reset start-up parameters:

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

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

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

8.1  Enabling and selecting parameters

The codes which are marked with an asterisk (*) in section 14 on page 74 onwards must be enabled with Code 3 before the associated parameters can be configured as described below.

You can now configure codes one after the other:

Turn  and select the required code.

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

Turn  and select the setting.

Press  to confirm the selected setting.

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

Cancel the setting:

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

Turn  ESC

Press . The entered value is not adopted.

Code 3
Configuration not enabled

Turn  → Code 3, display: No

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

Turn  → YES

Press , display:
The configuration is enabled.
8.2 Operating modes

8.2.1 Automatic and manual modes

After initialization has been completed successfully, the positioner is in \(\text{AUTO}\) mode.

Switch to \(\text{MAN}\) mode.

Adjust the manual reference variable

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

Note: The positioner automatically returns to \(\text{MAN}\) mode with Code 0 if no settings are made within 120 seconds.

Switch to \(\text{AUTO}\) mode

Turn \(\circ\) → Code 0
Press \(\circ\), Code 0 blinks.
Turn \(\circ\) → \(\text{AUTO}\)
Press \(\circ\). The positioner changes to \(\text{AUTO}\) mode.

Adjust the manual reference variable

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

Note: The positioner automatically returns to \(\text{MAN}\) mode with Code 0 if no settings are made within 120 seconds.

Switch to \(\text{MAN}\) mode

Turn \(\circ\) → Code 0
Press \(\circ\), Code 0 blinks.
Turn \(\circ\) → \(\text{MAN}\)
Press \(\circ\) to switchover to \(\text{MAN}\) mode. The switchover is smooth since the manual mode starts up with the set point last used during automatic mode. The current position is displayed in \%.

Adjust the manual reference variable

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

Note: The positioner automatically returns to \(\text{MAN}\) mode with Code 0 if no settings are made within 120 seconds.

Switch to \(\text{AUTO}\) mode

Turn \(\circ\) → Code 0
Press \(\circ\), Code 0 blinks.
Turn \(\circ\) → \(\text{AUTO}\)
Press \(\circ\). The positioner changes to \(\text{AUTO}\) mode.
8.2.2 SAFE – Fail-safe position

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

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

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

Exit the fail-safe position

Turn ➔ → Code 0
Press ➔, Code 0 blinks.

Turn ➔ and select the required operating mode AUTO or MAN.
Press ➔. The positioner switches to the operating mode selected.

8.3 Malfunction/maintenance alarm

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

Note: The status classification can be changed in TROVIS-VIEW and over the FOUNDATION fieldbus parameters. Refer to the Configuration Manual KH 8384-5 EN on the supplied CD-ROM (CD 8384-5) for more details.

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

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

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

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

- **Outside of specifications**
The positioner is being operated outside the specified conditions of use.

- **Function check**
Test or calibration procedures are being performed. The positioner is temporarily unable to perform its control task until this procedure is completed.

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

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

<table>
<thead>
<tr>
<th>Condensed state</th>
<th>Positioner display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance alarm</td>
<td>![Icon]</td>
</tr>
<tr>
<td>Function check</td>
<td><code>Test, Tune</code> or <code>tESt</code></td>
</tr>
<tr>
<td>Maintenance required/</td>
<td>![Icon] blinking</td>
</tr>
<tr>
<td>Maintenance demanded</td>
<td></td>
</tr>
<tr>
<td>Outside of specifications</td>
<td></td>
</tr>
</tbody>
</table>

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

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

The cause and recommended action are listed in the code list (section 14).

---

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

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

### 8.3.1 Confirming error messages

#### Enable configuration:

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

- Turn ![Icon] → Code 3, display: `No`
- Press ![Icon], Code 3 blinks
- Turn ![Icon] → `YES`
- Press ![Icon], display: ![Icon]

#### Confirm error messages:

- Turn ![Icon] → Error code which you want to confirm.
- Press ![Icon] to confirm the error message.
9 Adjusting the limit switch

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

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

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

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

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

Setting the switching point:

**NOTICE**

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

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

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

**Contact function:**
Tag leaving the field > contact is made.
Tag entering the field > contact is opened.

For OPEN position:

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

**Contact function:**
Tag leaving the field > Contact is made.
Tag entering the field > Contact is opened.
9.1 Retrofitting an inductive limit switch

Required retrofit kit:
Limit switch Order no. 1400-7460

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

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9) together with the display, taking care not to damage the ribbon cable (between PCB and display).

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

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

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

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

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

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

The positioner does not require any maintenance.

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

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

11 Servicing explosion-protected devices

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

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

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

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

12 Firmware update (serial interface)

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

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

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

Laptops and PCs connected to the power supply must use an additional safety barrier. This does not apply to laptops in battery operation. In this case, it is assumed that a battery-powered laptop runs briefly for software programming or for testing purposes.
a) Updates outside the hazardous area:

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

b.) Updates on site:

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

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

13 Maintenance, calibration and work on equipment

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

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

<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</td>
<td>Switchover from automatic to manual mode is smooth. In fail-safe mode, the symbol S appears on the display. In MAN and AUTO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the lever in relation to the central axis is displayed in degrees °.</td>
</tr>
<tr>
<td>1</td>
<td>Manual w</td>
<td>Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the position of the lever in relation to the central axis is indicated in degrees °. <strong>Note:</strong> Can only be selected when Code 0 = MAN</td>
</tr>
<tr>
<td>2</td>
<td>Reading direction</td>
<td>The reading direction of the display is turned by 180°.</td>
</tr>
<tr>
<td>3</td>
<td>Enable configuration</td>
<td>Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) FF blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only read over the SSP interface.</td>
</tr>
<tr>
<td>4*</td>
<td>Pin position</td>
<td>The follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation. For initialization using NOM or SUB, this pin position must be entered. <strong>Note:</strong> If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin position</th>
<th>Standard</th>
<th>Adjustment range</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>7.5</td>
<td>3.6 to 17.7</td>
</tr>
<tr>
<td>25</td>
<td>7.5</td>
<td>5.0 to 25.0</td>
</tr>
<tr>
<td>35</td>
<td>15.0</td>
<td>7.0 to 35.4</td>
</tr>
<tr>
<td>50</td>
<td>30.0</td>
<td>10.0 to 50.0</td>
</tr>
<tr>
<td>70</td>
<td>40.0</td>
<td>14.0 to 70.7</td>
</tr>
<tr>
<td>100</td>
<td>60.0</td>
<td>20.0 to 100.0</td>
</tr>
<tr>
<td>200</td>
<td>120.0</td>
<td>40.0 to 200.0</td>
</tr>
<tr>
<td>90°</td>
<td>90.0</td>
<td>24.0 to 100.0</td>
</tr>
</tbody>
</table>

**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>
</table>
| 5*       | **Nominal range**  
mm or angle °  
ESC       | For initialization using NOM or SUB, the nominal travel/angle of rotation of the valve must be entered.  
The permissible adjustment range depends on the pin position according to the table for Code 4.  
Code 5 is generally locked until Code 4 is set to 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. |
| 6*       | **Init mode**  
[**MAX**]  
NOM  
MAN  
SUB  
ZP  
ESC       | Select the initialization mode  
MAX: Travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator.  
NOM: Travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position.  
MAN: Manually selected range  
SUB: Substitute calibration (without initialization) |
| 7*       | **w/x**  
[烝烝] increasing/increasing  
흡흡 increasing/decreasing  
ESC       | Direction of action of the reference variable w in relation to the travel/angle of rotation x  
Automatic adaptation:  
AIR TO OPEN:  
On completing initialization, the direction of action remains increasing/increasing (烝烝), a globe valve opens as the mA signal increases.  
AIR TO CLOSE:  
On completing initialization, the direction of action changes to increasing/decreasing (흡흡), a globe valve closes as the mA signal increases. |
| 8*       | **Travel/angle range start**  
(lower x-range value)  
0.0 to 80.0 [0.0] % of the nominal range  
ESC       | Lower range value for the travel/angle of rotation in the nominal or operating range.  
The **operating range** is the actual travel/angle of the control valve and is limited by the lower x-range value (Code 8) and the upper x-range value (Code 9).  
Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values.  
Value is displayed or must be entered.  
The characteristic is adapted. See also the example in Code 9! |

**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>9</strong></td>
<td><strong>Travel/angle range end</strong>&lt;br&gt;(upper x-range value)&lt;br&gt;20.0 to 100.0 [100.0] % of the nominal range&lt;br&gt;ESC&lt;br&gt;Note: Specified in mm or angle ° provided Code 4 is set</td>
<td>Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted.&lt;br&gt;&lt;br&gt;<strong>Example:</strong> 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><strong>10</strong></td>
<td><strong>Travel/angle lower limit</strong>&lt;br&gt;(lower x-limit)&lt;br&gt;0.0 to 49.9 % of the operating range&lt;br&gt;[No], ESC</td>
<td>Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted.&lt;br&gt;&lt;br&gt;The characteristic is not adapted to the reduced range. See also example in Code 11.</td>
</tr>
<tr>
<td><strong>11</strong></td>
<td><strong>Travel/angle upper limit</strong>&lt;br&gt;(upper x-limit)&lt;br&gt;50.0 to 120.0 [100] % of the operating range&lt;br&gt;No, ESC</td>
<td>Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted.&lt;br&gt;&lt;br&gt;<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 10, and the upper limit with Code 11.&lt;br&gt;&lt;br&gt;If a tight-closing function has been set up, it has priority over the travel limitation!&lt;br&gt;&lt;br&gt;When set to No, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range.</td>
</tr>
<tr>
<td><strong>14</strong></td>
<td><strong>Reference variable range start</strong>&lt;br&gt;(w-start)&lt;br&gt;0.0 to 49.9 [1.0] % of the span adjusted via Code 12/13&lt;br&gt;No, ESC</td>
<td>If w approaches the percentage adjusted at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve.&lt;br&gt;&lt;br&gt;Codes 14/15 have priority over Codes 8/9/10/11.&lt;br&gt;Codes 21/22 have priority over Codes 14/15.</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>15*</td>
<td>Reference variable range end (w-end)</td>
<td>If ( w ) approaches the percentage adjusted at the final value that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. Codes 14/15 have priority over Codes 8/9/10/11. Codes 21/22 have priority over Codes 14/15. Example: Set the final position ( w ) to 99% for three-way valves.</td>
</tr>
<tr>
<td>16*</td>
<td>Pressure limit</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 0). <strong>NOTICE</strong> Do not activate the pressure limit for double-acting actuators with valve closed position AIR TO OPEN (ATO).</td>
</tr>
<tr>
<td>17*</td>
<td>Proportional-action coefficient ( K_P ) (step)</td>
<td>Displaying or changing ( K_P ). <strong>Note on changing the ( K_P ) and ( T_V ) steps:</strong> During the initialization of the positioner, the ( K_P ) and ( T_V ) values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the ( K_P ) and ( T_V ) steps can be adapted after the initialization. For this, either the ( T_V ) step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the ( K_P ) step can be decreased in increments. <strong>NOTICE</strong> Changing the ( K_P ) step influences the system deviation.</td>
</tr>
<tr>
<td>18*</td>
<td>Rate time ( T_V ) (step)</td>
<td>Displaying or changing ( T_V ), see note under ( K_P ) step. A change of the ( T_V ) step has no effect on the system deviation.</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>19*</td>
<td><strong>Tolerance band</strong>&lt;br&gt;0.1 to 10.0 [5] % of the operating range ESC</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 transit time is determined during initialization which is six times &gt; 30 s, the six-fold transit time is accepted as the lag time.</td>
</tr>
<tr>
<td>20*</td>
<td><strong>Characteristic</strong>&lt;br&gt;0 to 9 [0] ESC</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 16).</td>
</tr>
<tr>
<td>21*</td>
<td><strong>Required transit time OPEN</strong> (w ramp open)&lt;br&gt;0 to 240 s [0] ESC</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):&lt;br&gt;For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process.&lt;br&gt;Code 21 has priority over Code 15.&lt;br&gt;<strong>NOTICE</strong>&lt;br&gt;The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.</td>
</tr>
<tr>
<td>22*</td>
<td><strong>Required transit time CLOSED</strong> (w ramp closed)&lt;br&gt;[0] to 240 s ESC</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.&lt;br&gt;<strong>NOTICE</strong>&lt;br&gt;The function is not activated when the fail-safe function or solenoid valve is triggered nor upon failure of the auxiliary power.</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>23*</td>
<td>Total valve travel</td>
<td>Totaled double valve travel. Can be reset to 0 by RES. <strong>Note:</strong> The total valve travel is saved in a non-volatile memory after every 1000 double travel.</td>
</tr>
<tr>
<td>24*</td>
<td>LV total valve travel</td>
<td>Limit value of total valve travel. If the limit is exceeded, the fault symbol and the wrench symbol corresponding with the collective status appear.</td>
</tr>
<tr>
<td>34*</td>
<td>Closing direction</td>
<td>Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). Needs only be entered in initialization mode SUb (Code 6).</td>
</tr>
<tr>
<td>35*</td>
<td>Blocking position</td>
<td>Entering the blocking position. Distance up to the CLOSED position. Only necessary in initialization mode SUb.</td>
</tr>
<tr>
<td>36*</td>
<td>Reset</td>
<td>Std: Resets all parameters to default (factory setting) as well as the diagnosis data. After a reset, the positioner must be re-initialized. diAG: Resets diagnosis data only. Plotted reference graphs and logs remain unaffected. The positioner does not need to be re-initialized.</td>
</tr>
<tr>
<td>38*</td>
<td>Inductive alarm</td>
<td>Indicates whether the inductive limit switch option is installed or not.</td>
</tr>
<tr>
<td>39</td>
<td>System deviation e info</td>
<td>Read only, indicates the deviation from the position required.</td>
</tr>
<tr>
<td>40</td>
<td>Transit time Open info</td>
<td>Read only, minimum opening time determined during initialization.</td>
</tr>
<tr>
<td>41</td>
<td>Transit time Closed info</td>
<td>Read only, minimum closing time determined during initialization.</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>42</td>
<td>Auto-w/manual-w info 0.0 to 100.0 % of the span</td>
<td>Read only, Auto mode: indicates the supplied automatic reference variable Man mode: indicates the supplied manual reference variable</td>
</tr>
<tr>
<td>43</td>
<td>Firmware info control</td>
<td>Read only, indicates the positioner type and current firmware version in alternating sequence.</td>
</tr>
<tr>
<td>44</td>
<td>y info [0] to 100 %</td>
<td>Read only. Indicates the control signal y in % based on the travel range determined on initialization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MAX: The positioner builds up its maximum output pressure, see description in Code 14 and 15.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OP: The positioner vents completely, see description in Code 14 and 15.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-- -- : The positioner is not initialized.</td>
</tr>
<tr>
<td>45</td>
<td>Solenoid valve info YES, HIGH/LOW, No</td>
<td>Read only, indicates whether a solenoid valve is installed or not.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If a voltage supply is connected at the terminals of the installed solenoid valve, YES and HIGH appear on the display in alternating sequence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the S icon), YES and LOW appear on the display in alternating sequence.</td>
</tr>
<tr>
<td>46*</td>
<td>Bus address ESC</td>
<td>Select bus address</td>
</tr>
<tr>
<td>47*</td>
<td>Write protection FF YES, [No], ESC</td>
<td>When the write protection function is activated, device data can only be read, but not overwritten over FF communication.</td>
</tr>
<tr>
<td>48*</td>
<td>Diagnostic parameters d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d0 Current temperature -55.0 to 125.0</td>
<td>Operating temperature [°C] inside the positioner</td>
</tr>
<tr>
<td></td>
<td>d1 Minimum temperature [20]</td>
<td>The lowest temperature below 20 °C that has ever occurred.</td>
</tr>
<tr>
<td></td>
<td>d2 Maximum temperature [20]</td>
<td>The highest temperature above 20 °C that has ever occurred.</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>48*</td>
<td>d3 Number of zero calibrations</td>
<td>The number of zero calibrations since the last initialization.</td>
</tr>
<tr>
<td></td>
<td>d4 Number of initializations</td>
<td>The number of initializations that have been performed.</td>
</tr>
<tr>
<td></td>
<td>d5 Zero point limit</td>
<td>Limit for the zero point monitoring.</td>
</tr>
<tr>
<td></td>
<td>0.0 to 100.0 % [5 %]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d6 Condensed status</td>
<td>Condensed status, made up from the individual states.</td>
</tr>
<tr>
<td></td>
<td>0   OK: Okay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1   C: Maintenance required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2   CR: Maintenance demanded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3   B: Maintenance alarm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7   I: Function check</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d7 Start reference run [No], YES, ESC</td>
<td>Triggering of a reference run for the functions: Drive signal y steady-state and drive signal y hysteresis. The reference run can only be activated in manual operating mode as the valve moves through its entire travel range. If EXPERT+ is activated at later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.</td>
</tr>
<tr>
<td></td>
<td>d8 EXPERT+ activation</td>
<td>Enter the activation code for EXPERT+. After the activation procedure has been successfully completed, YES appears under d8.</td>
</tr>
</tbody>
</table>

**FF parameters FF-P**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Firmware Rev. Communication</td>
</tr>
<tr>
<td>F1</td>
<td>Binary input 1</td>
</tr>
<tr>
<td>F2</td>
<td>Binary input 2</td>
</tr>
<tr>
<td>F3</td>
<td>Simulate</td>
</tr>
<tr>
<td>F4 to F7</td>
<td>Unassigned</td>
</tr>
</tbody>
</table>

**AO Function Block (AO)**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>Target Mode Required operating mode. See section 14.1.</td>
</tr>
<tr>
<td>A1</td>
<td>Actual Mode Actual operating mode. See section 14.1.</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>48</strong></td>
<td>A2 CAS_IN value</td>
<td>Display of the analog reference variable adopted from an upstream function block</td>
</tr>
<tr>
<td></td>
<td>A3 CAS_IN status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td></td>
<td>A4 SP value</td>
<td>Displays the set point (reference variable)</td>
</tr>
<tr>
<td></td>
<td>A5 SP status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td></td>
<td>A6 Out value</td>
<td>Displays the manipulated variable (output value)</td>
</tr>
<tr>
<td></td>
<td>A7 Out status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td></td>
<td>A8 Block error</td>
<td>Displays the current block error</td>
</tr>
</tbody>
</table>

### PID Function Block (PID)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0 Target Mode</td>
<td>Required operating mode. See section 14.1.</td>
</tr>
<tr>
<td>P1 Actual Mode</td>
<td>Actual operating mode. See section 14.1.</td>
</tr>
<tr>
<td>P2 CAS_IN value</td>
<td>Display of the analog reference variable adopted from an upstream function block</td>
</tr>
<tr>
<td>P3 CAS_IN status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td>P4 SP value</td>
<td>Displays the set point (reference variable)</td>
</tr>
<tr>
<td>P5 SP status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td>P6 Out value</td>
<td>Displays the manipulated variable (output value)</td>
</tr>
<tr>
<td>P7 Out status</td>
<td>and its status. See section 14.2.</td>
</tr>
<tr>
<td>P8 Block error</td>
<td>Displays the current block error</td>
</tr>
</tbody>
</table>

### Transducer Blocks (A0 TRD, DI1 TRD, DI2 TRD)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>t0 Target Mode AO TRD</td>
<td>Required operating mode. See section 14.1.</td>
</tr>
<tr>
<td>t1 Actual Mode AO TRD</td>
<td>Actual operating mode. See section 14.1.</td>
</tr>
<tr>
<td>t2 Transducer state</td>
<td>State of the Transducer Block</td>
</tr>
<tr>
<td>t3 Block error AO TRD</td>
<td>Displays the current block error</td>
</tr>
<tr>
<td>t4 Target Mode DI1</td>
<td>Required operating mode. See section 14.1.</td>
</tr>
<tr>
<td>t5 Actual Mode DI1 TRD</td>
<td>Actual operating mode. See section 14.1.</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>48*</td>
<td>t6  Block error DI1 TRD</td>
<td>Displays the current block error</td>
</tr>
<tr>
<td></td>
<td>t7  Target Mode DI2 TRD</td>
<td>Required operating mode. See section 14.1.</td>
</tr>
<tr>
<td></td>
<td>t8  Actual Mode DI2</td>
<td>Actual operating mode. See section 14.1.</td>
</tr>
<tr>
<td></td>
<td>t9  Block error DI2</td>
<td>Displays the current block error</td>
</tr>
</tbody>
</table>

**Resource Block (RES)**

|          | S0  Resource Target Mode                   | Required operating mode. See section 14.1. |
|          | S1  Resource Actual Mode                   | Actual operating mode. See section 14.1. |
|          | S2  Resource Block Error                   | Displays the current block error |

**DI1 Function Block (DI1)**

|          | I0  Target Mode DI1                        | Required operating mode. See section 14.1. |
|          | I1  Actual Mode DI1                        | Actual operating mode. See section 14.1. |
|          | I2  Field_Val_D value                      | Displays the discrete input variable |
|          | I3  Field_Val_D status                     | and its status. See section 14.2. |
|          | I4  OUT_D value                            | Displays the discrete output variable |
|          | I5  OUT_D status                           | and its status. See section 14.2. |
|          | I6  Block error                            | Displays the current block error |

**D2 Function Block (DI2)**

|          | L0  Target Mode DI2                        | Required operating mode. See section 14.1. |
|          | L1  Actual Mode DI2                        | Actual operating mode. See section 14.1. |
|          | L2  Field_Val_D value                      | Displays the discrete input variable |
|          | L3  Field_Val_D status                     | and its status. See section 14.2. |
|          | L4  OUT_D value                            | Displays the discrete output variable |
|          | L5  OUT_D status                           | and its status. See section 14.2. |
|          | L6  Block error                            | Displays the current block error |

**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>Note: Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49*</td>
<td>Partial stroke test (PST)/Full stroke test (FST) - Application type</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Partial stroke test (PST)</td>
<td></td>
</tr>
<tr>
<td>A0</td>
<td>Start Partial Stroke Test [No] · YES · ESC</td>
<td>Operating mode and PST testing mode must be set to MAN.</td>
</tr>
<tr>
<td>A1</td>
<td>Time until the next automatic PST test takes place</td>
<td>Remaining time [d_h] until the next partial stroke test is performed. Only applies to PST Auto mode. Read only</td>
</tr>
<tr>
<td>A2</td>
<td>Desired PST testing mode Auto · [Man] · ESC</td>
<td>Activates (PST Auto) or deactivates (PST Man) the scheduled automatic partial stroke test.</td>
</tr>
<tr>
<td>A3</td>
<td>Auto test time</td>
<td>Time [h] between for partial stroke tests (PST)</td>
</tr>
<tr>
<td>A4</td>
<td>Status classification PST status [C] · OK · CR · b · S ESC</td>
<td>C Maintenance required OK No message CR Maintenance demanded b Maintenance alarm S Out of specification</td>
</tr>
<tr>
<td>A5</td>
<td>Min. recommended scan time</td>
<td>Scan time [s] required to plot the complete step response test in a graph. Read only</td>
</tr>
<tr>
<td>A6</td>
<td>– Unassigned</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>y-monitoring reference value</td>
<td>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. Read only</td>
</tr>
</tbody>
</table>
### Code list

**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>A8 Activation delta y-monitoring [No] · YES · ESC</td>
<td>Activates/deactivates delta y-monitoring</td>
</tr>
<tr>
<td></td>
<td>A9 delta y-monitoring value 0 to 100 %; [10 %]</td>
<td>The percentage [%] of the entire range of the control pulse between 1 and 10000 1/s <em>(Example: 10 % = 10000 1/s)</em>. 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>
</tbody>
</table>

### Step parameters for the partial stroke test (PST)

<table>
<thead>
<tr>
<th>d1</th>
<th>Unassigned</th>
<th></th>
</tr>
</thead>
<tbody>
<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>
<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>E</td>
<td>Cancelation conditions of the partial stroke test (PST)</td>
<td></td>
</tr>
<tr>
<td>49*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E0</td>
<td>Activation x control [No] · YES</td>
<td>Activates/deactivates x control.</td>
</tr>
<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>
<tr>
<td>E3</td>
<td>– Unassigned</td>
<td></td>
</tr>
<tr>
<td>E4</td>
<td>– Unassigned</td>
<td></td>
</tr>
<tr>
<td>E5</td>
<td>Activation tolerance band control [No] · YES</td>
<td>Activates/deactivate tolerance band control.</td>
</tr>
<tr>
<td>E6</td>
<td>PST Tolerance band 0.1 to 100.0 %; [5.0 %]</td>
<td>The test is automatically canceled as soon as the Step end (Code 49 - d3) exceeds this value.</td>
</tr>
<tr>
<td>E7</td>
<td>Max. test duration 30 to 25000 s; [30 s]</td>
<td>Maximum time within which a test can be completed before the test is canceled automatically.</td>
</tr>
<tr>
<td>F</td>
<td>Partial stroke test (PST) information · Read only</td>
<td></td>
</tr>
<tr>
<td>F0</td>
<td>No test available</td>
<td>No test exists or the test has been canceled manually.</td>
</tr>
<tr>
<td>F1</td>
<td>Test OK</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>x cancelation</td>
<td>The test was canceled by the x cancelation function.</td>
</tr>
<tr>
<td>F3</td>
<td>y cancelation</td>
<td>The test was canceled by the y cancelation function.</td>
</tr>
<tr>
<td>F4</td>
<td>Tolerance band exceeded</td>
<td>The test was canceled. The x-values exceeded the tolerance band.</td>
</tr>
<tr>
<td>F5</td>
<td>Max. test time exceeded</td>
<td>The test was not completed within the maximum test time and was automatically canceled.</td>
</tr>
<tr>
<td>F6</td>
<td>Test man. canceled</td>
<td>The test has been manually canceled by the user.</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>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 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>
| h       | Application type of valve                   | No Control valve  
YES Open/close (on/off) valve  
Depending on the application type of valve that has been selected, the positioner has different diagnostic functions and behaves differently in the automatic mode (AUTO). |
| h0      | Application type [No] · YES · ESC           | No Control valve  
YES Open/close (on/off) valve |
|         | h1 No function                              |             |
|         | h2 No function                              |             |
|         | h3 No function                              |             |
|         | h4 No function                              |             |
|         | h5 No function                              |             |
|         | h6 No function                              |             |
|         | h7 No function                              |             |
|         | h8 No function                              |             |
|         | h9 No function                              |             |

**Note:** The error codes listed in following appear in the display corresponding to their status classification set over the condensed state (Maintenance required/Maintenance demanded; 🛠, Maintenance alarm: ⚠). 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>Description</th>
<th>Status classification</th>
<th>Recommended action</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. | [Maintenance required] | 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 alarm. An angle below 9° leads to the initialization being canceled. | [Maintenance required] | 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. | [Maintenance required] | 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 alarm active, when prompted, <strong>Err</strong> 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 - solenoid valve** | 1) A solenoid valve is installed (Code 45 = YES) and was not or not properly connected so that an actuator pressure could not be built up. The alarm is generated when you attempt to initialize the positioner.  
2) If you attempt to initialize the device from the fail-safe position (SAFE). |
| Status classification | [Maintenance required] |
| Recommended action | Re. 1) Check connection and supply voltage of the forced venting Code 45 HIGH/LOW  
Re. 2) Set the **MAN** operating mode over Code 0. Then initialize the positioner. |
| **55** **Transit time too short** *(transit time <)* | The actuator positioning rates determined during the initialization are so short that the positioner cannot adapt itself optimally. |
| Status classification | [Maintenance required] |
| Recommended action | Check the volume restriction setting as described in section 7.2, re-initialize the positioner. |
| **56** **Pin position** | Initialization was canceled because you are required to enter the pin position for the selected initialization modes **NOM** and **Sub**. |
| Status classification | [Maintenance required] |
| Recommended action | Enter pin position over Code 4 and nominal travel/angle over Code 5. Re-initialize the positioner. |
## Operational errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
</table>
| **57** Control loop               | Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19).  
  - Actuator mechanically blocked.  
  - Attachment of the positioner subsequently shifted.  
  - Supply pressure not sufficient. |
| Status classification            | [Maintenance required]                                                                                   |
| Recommended action               | Check attachment.                                                                                         |
| **58** Zero point                 | Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs. |
| Status classification            | [Maintenance required]                                                                                   |
| Recommended action               | Check valve and mounting of the positioner. If OK, perform a zero calibration over Code 6 (see section 7.7 on page 63).  
  If the lever position on the back of the positioner has been changed (e.g. while exchanging the lever), move the lever as far as it will go in both directions to adapt it to the internal measuring lever. |
| **59** Autocorrection             | Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it. |
| Status classification            | [No message]                                                                                              |
| Recommended action               | Automatic                                                                                                |
| **60** Fatal error                | An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances.  
  The positioner changes to the fail-safe position (SAFE). |
| Status classification            | Maintenance alarm (cannot be classified)                                                                    |
| Recommended action               | Reset over Code 36.  
  Re-initialize the positioner. |
## Hardware errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <em>Err</em> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>62</strong> x signal</td>
<td>Determination of the measured data for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking closed-loop operation icon and 4 dashes instead of the position indication. <strong>Note on the closed-loop operation:</strong> 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.</td>
</tr>
<tr>
<td><strong>64</strong> i/p converter</td>
<td>The circuit of the i/p converter has been interrupted. <strong>Status classification</strong> Maintenance alarm (cannot be classified) <strong>Recommended action</strong> Cannot be remedied. Return the positioner to SAMSON AG for repair.</td>
</tr>
</tbody>
</table>
## Error appendix

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>65</strong> Hardware</td>
<td>A hardware error has occurred, the positioner changes to the fail-safe position (<strong>SAFE</strong>).</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</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</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 alarm active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>68</strong> Control parameter</td>
<td>Control parameter error</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><strong>69</strong> Poti parameter</td>
<td>Parameter error of the digital potentiometer.</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><strong>70</strong> Calibration parameter</td>
<td>Error in the production calibration data. Subsequently, the device runs on default values.</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><strong>71</strong> General parameters</td>
<td>Parameter errors that are not critical for the control.</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><strong>73</strong> Internal device error 1</td>
<td>Internal device error</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><strong>74</strong> FF parameters</td>
<td>Parameter errors that are not critical for the control.</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>

EB 8384-5 EN 93
### Code list

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, <strong>Err</strong> appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td>76 <strong>No emergency mode</strong></td>
<td>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>Status classification</td>
<td>[No message]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Merely information, confirm, if necessary. No further action necessary.</td>
</tr>
<tr>
<td>77 <strong>Program loading error</strong></td>
<td>When the positioner starts operation for the first time after the input signal has been applied, it carries out a self-test (<strong>tEStinG</strong> 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>Status classification</td>
<td>Maintenance alarm (cannot be classified)</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Interrupt current and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.</td>
</tr>
<tr>
<td>78 <strong>Options parameter</strong></td>
<td>Errors in options parameters</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>
</tbody>
</table>
## Diagnosis errors

<table>
<thead>
<tr>
<th>Error codes – Recommended action</th>
<th>Condensed state alarm active, when prompted, Err appears. When fault alarms exist, they are displayed here.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>79</strong> Diagnostic alarms</td>
<td>Alarms are generated by the extended EXPERT+ diagnostics if EXPERT+ has been activated under Code <strong>48</strong></td>
</tr>
<tr>
<td>Status classification</td>
<td>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>Status classification</td>
<td>Maintenance required (cannot be classified)</td>
</tr>
<tr>
<td><strong>81</strong> Reference graphs</td>
<td>An error occurred during plotting the reference graphs for drive signal y steady-state or drive signal y hysteresis.</td>
</tr>
<tr>
<td>Status classification</td>
<td>[No message]</td>
</tr>
<tr>
<td>Recommended action</td>
<td>Check and, if necessary, perform a new reference test</td>
</tr>
</tbody>
</table>
### 14.1 Decimal values of the modes in the FOUNDATION™ fieldbus blocks (Code 48)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Decimal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO</td>
<td>8</td>
</tr>
<tr>
<td>AUTO/CAS</td>
<td>12</td>
</tr>
<tr>
<td>AUTO/RCAS</td>
<td>134</td>
</tr>
<tr>
<td>O/S</td>
<td>128</td>
</tr>
<tr>
<td>MAN</td>
<td>16</td>
</tr>
</tbody>
</table>

### 14.2 Decimal values of the states in the FOUNDATION™ fieldbus blocks (Code 48)

<table>
<thead>
<tr>
<th>Status</th>
<th>Decimal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good (NC) – Non-specific</td>
<td>128</td>
</tr>
<tr>
<td>Good (NC) – Active block alarm</td>
<td>132</td>
</tr>
<tr>
<td>Good (NC) – Active advisory alarm</td>
<td>136</td>
</tr>
<tr>
<td>Good (NC) – Active critical alarm</td>
<td>140</td>
</tr>
<tr>
<td>Good (NC) – Unacknowledged block alarm</td>
<td>144</td>
</tr>
<tr>
<td>Good (NC) – Unacknowledged advisory alarm</td>
<td>148</td>
</tr>
<tr>
<td>Good (NC) – Unacknowledged critical alarm</td>
<td>152</td>
</tr>
<tr>
<td>Uncertain – Non-specific</td>
<td>64</td>
</tr>
<tr>
<td>Uncertain – Last usable value</td>
<td>68</td>
</tr>
<tr>
<td>Uncertain – Substitute/manual entry</td>
<td>72</td>
</tr>
<tr>
<td>Uncertain – Initial value</td>
<td>76</td>
</tr>
<tr>
<td>Uncertain – Sensor conversion not accurate</td>
<td>80</td>
</tr>
<tr>
<td>Uncertain – Engineering unit range violation</td>
<td>84</td>
</tr>
<tr>
<td>Uncertain – Sub-normal</td>
<td>88</td>
</tr>
<tr>
<td>Status</td>
<td>Decimal value</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Good (C) – Non-specific</td>
<td>192</td>
</tr>
<tr>
<td>Good (C) – Initialization acknowledge</td>
<td>196</td>
</tr>
<tr>
<td>Good (C) – Initialization request</td>
<td>200</td>
</tr>
<tr>
<td>Good (C) – Not invited</td>
<td>204</td>
</tr>
<tr>
<td>Good (C) – Not selected</td>
<td>208</td>
</tr>
<tr>
<td>Good (C) – Local override</td>
<td>216</td>
</tr>
<tr>
<td>Good (C) – Fault state active</td>
<td>220</td>
</tr>
<tr>
<td>Bad – Non-specific</td>
<td>0</td>
</tr>
<tr>
<td>Bad – Configuration error</td>
<td>4</td>
</tr>
<tr>
<td>Bad – Not connected</td>
<td>8</td>
</tr>
<tr>
<td>Bad – Device failure</td>
<td>12</td>
</tr>
<tr>
<td>Bad – Sensor failure</td>
<td>16</td>
</tr>
<tr>
<td>Bad – No communication, with last usable value</td>
<td>20</td>
</tr>
<tr>
<td>Bad – No communication, no last usable value</td>
<td>24</td>
</tr>
<tr>
<td>Bad – Out of service</td>
<td>28</td>
</tr>
</tbody>
</table>
Fig. 24a · NAMUR and direct attachment
Fig. 24b · Attachment to rotary actuators VDI/VDE 3845 (Sept. 2010), fixing level 1, size AA1 to AA4

* Reversing amplifier
  - Type 3710 (see drawing of heavy-duty version for dimensions)
  - 1079-1118/1079-1119, no longer available
    (see drawing of light version for dimensions)
15.1 Fixing levels according to VDI/VDE 3845 (September 2010)

| Size  | A  | B  | C  | \(\od\) | \(M_{\text{min}}\) | \(\od\)\(|\)*  |
|-------|----|----|----|---------|-----------------|------------|
| AA0   | 50 | 25 | 15 | 5.5 for M5 | 66             | 50         |
| AA1   | 80 | 30 | 20 | 5.5 for M5 | 96             | 50         |
| AA2   | 80 | 30 | 30 | 5.5 for M5 | 96             | 50         |
| AA3   | 130| 30 | 30 | 5.5 for M5 | 146            | 50         |
| AA4   | 130| 30 | 30 | 5.5 for M5 | 146            | 50         |
| AA5   | 200| 50 | 80 | 6.5 for M6 | 220            | 50         |

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

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

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

**Linear** (select characteristic: 0)

![Linear Graph]

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

![Equal Percentage Graph]

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

![Reverse Equal Percentage Graph]
Translation

VDE
VDE Prüf und Zertifizierungsinstitut

Test report for Information of the Applicant

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

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

The test report does not aim to use a VDE Certification mark and the "QS - zertifizierte Sicherheit (test safety)" and does not refer to all VDE specifications applicable to the tested product.

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

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

1 Assignment

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

2 Samples

2.1 Type 3730 Positioner

2.2 Type 3731 Positioner

3 Basis of assessment

DIN EN 60529/VDE 0470 Part 12000-04
Degree of protection provided by enclosures (IP Code)
German version EN 60529:1999+A1:2000

4 Execution of the tests

The dust test had already been carried out on the Type 3730 Positioner under the reference number: 479000-001-00031252 and on the Type 3731 Positioner under the reference number: 479000-001-00031253 with products in category 1 at the connecting enclosures of the positioners and solenoid valves. The inside pressure was 2 kPa and the test lasted 8 hours.

5 Test results

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

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

IPX8 satisfied

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

There was no ingress of either dust or water.

VDE-Prüf- und Zertifizierungsinstitut

Gerhard Bielh

(Firmname)

(Signature)
IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
For rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx PTB 03.0054
Status: Current
Date of Issue: 2006-11-02
Issue No.: 0

Applicant: SABION AG Mess- und Regeltechnik Vomathofstrasse 3 60314 Frankfurt am Main Germany

Electrical Apparatus: Bus-powered Field Up-Positioner types 3738-41 and 5739-61

Certified as per IECEx 16

Approved for use on behalf of the IECEx Certification Body
Dr. Ing. Uwe Johannsen
Department Head of "Intrinsic Safety and Safety of Electrical Equipment"

Physicalkaft-Technische Bundesanstalt (PTB)
Bundesszahl 100
36118 Braunschweig Germany

IECEx Certificate of Conformity

Certificate No.: IECEx PTB 08.0054
Date of Issue: 2006-11-02
Item No.: 0
Page 2 of 4

Manufacturer: SAMSON AG Mess- und Regeltechnik Vomathofstrasse 3 23551 Frankfurt am Main Germany

Manufacturing Location:

This certificate is issued as confirmation that the type of apparatus, hereinafter referred to as the "apparatus", has been tested and found to comply with the IECEx Scheme. The type of apparatus conforming to this certificate are manufactured and tested in compliance with the IECEx Scheme. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The type of apparatus and any accessories as to its position in the schedule of this certificate and the certified documents, was found to comply with the following standards:

IEC 60079-0: 2004 Electrical apparatus for explosive gas atmospheres - Part 0: General requirements Edition 4.3


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

TEST & ASSESSMENT REPORTS:
A sample of the equipment listed has been subjected to the examination and test requirements as included in:

Test Report:
ECRIL Test ID 0806.00883D
Quality Assessment Report:
DPTUN039400.001935
Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

The Model 3730-41 and 3735-81 actuated field devices with communication capability and serve for adjusting the valve stem positions in compliance with a control signal. They are intended for attachment to either linear or rotary actuators.

Communication with field devices programmable logic control systems and distributed control systems is optionally either according to Profibus DP (Model 3730-41.), or in accordance with the FOUNDATION™ Fieldbus Specification (Typ. 3730-81.).

For further information see annex.

CONDITIONS OF CERTIFICATION: NO
Annex to Certificate of Conformity IECEx PTB 06 0054

Equipment:
Model 3730-41-20, 200V, 4 wires
Model 3730-51-10, 200V, 4 wires

Submitted by:
SASCHEN-AG Mueh.- und Regeltechnik
Wolfgang Sasse, 60514 Frankfurt

Manufactured by:
SASCHEN-AG Mueh.- und Regeltechnik
Wolfgang Sasse, 60514 Frankfurt

Groups:
Type of Protection: IH / HII
Temperature Classification: T4 / T6
Degree of Ingress Protection: IP 54, IP 65

Conditions of Manufacture
Routine testing and high-voltage testing between the individual circuits and for units with 500V, 50Hz, 3min.

Schedule
The positioners come in several versions. The following model designation code applies:

- Model code number
- Positioner
- 1 = ProField PA
- 2 = FOUNDATION Fieldbus
- 3 = additional equipment
- 4 = Inductive limit switches
- 1 = provided
- 0 = not provided
- 5 = external position sensor
- 1 = provided
- 0 = not provided
- 6 = external position sensor
- 1 = provided
- 0 = not provided

Table: Summary of results

<table>
<thead>
<tr>
<th>Group</th>
<th>FOUNDATION</th>
<th>FISCO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IH</td>
<td>HII</td>
</tr>
<tr>
<td>U [V]</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>I [mA]</td>
<td>174</td>
<td>160</td>
</tr>
<tr>
<td>P [W]</td>
<td>2.04</td>
<td>1.04</td>
</tr>
</tbody>
</table>

*Multiplier: 3000000 to obtain the maximum value*
Annex to Certificate of Conformity IECEx PTB 06.0054

For instrument air non-combustible media are used.

The equipment is intended for use in hazardous locations.

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-40°C...60°C</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C...70°C</td>
</tr>
<tr>
<td>T4</td>
<td>-40°C...80°C</td>
</tr>
</tbody>
</table>

**Electrical data**

B1S connection signal circuit (terminals 11/12)

Type of protection: Intrinsically safe Ex ia IIC/IBB
only for connection to an intrinsically safe circuit

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

<table>
<thead>
<tr>
<th>Maximum values: Model 5730-4-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefixed PA</td>
</tr>
<tr>
<td>Ex ia IIC/IBB</td>
</tr>
<tr>
<td>Ui = 12.5 V DC</td>
</tr>
<tr>
<td>Ii = 150 mA</td>
</tr>
<tr>
<td>Pi = 2.5 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum values: Model 5730-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex ia IIC</td>
</tr>
<tr>
<td>Li = 25 V DC</td>
</tr>
<tr>
<td>Ii = 25 mA</td>
</tr>
<tr>
<td>Pi = 2.5 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limit switch, inductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>(terminals 41/42</td>
</tr>
</tbody>
</table>
| Type of protection: Intrinsically safe Ex ia IIC, only for connection to an intrinsically safe circuit

<table>
<thead>
<tr>
<th>Maximum values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li = 16 V; Ii = 52 mA</td>
</tr>
<tr>
<td>Pi = 160 mW</td>
</tr>
<tr>
<td>Li = 00 μH; Ci = 30 nF</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>Li = 16 V; Ii = 25 mA</td>
</tr>
<tr>
<td>Pi = 64 mA</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Ex ia IIC</th>
<th>Ex ia IIB</th>
<th>Cia = 3 μF</th>
<th>Cia = 4 μF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li = 10 mH</td>
<td>Le = 1 H</td>
<td>Li = 10 mH</td>
<td>Le = 1 H</td>
</tr>
</tbody>
</table>

| Serial interface 9U          |
| Type of protection: Intrinsically safe Ex ia IIC

<table>
<thead>
<tr>
<th>Maximum values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li and Ci negligible</td>
</tr>
<tr>
<td>Li = 10 mH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex ia IIC</th>
<th>Ex ia IIB</th>
<th>Cia = 3 μF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li = 10 mH</td>
<td>Le = 1 H</td>
<td></td>
</tr>
</tbody>
</table>

4 of 5
Annex to Certificate of Conformity Ex iECEx PTB 05.0064

Ue = 8.6 V, Ie = 55 mA

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

<table>
<thead>
<tr>
<th>Ex in IEC</th>
<th>Ex in IEC Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx = 0.68 μF</td>
<td>Cx = 4 μF</td>
</tr>
<tr>
<td>Lx = 9 mH</td>
<td>Lx = 9 mH</td>
</tr>
</tbody>
</table>

Only for connection to a certified intrinsically safe circuit

Maximum values:
U1i = 16 V, I1i = 25 mA

In case of interconnection the rules for interconnecting intrinsically safe circuits shall be complied with.

External position sensor
[analogue, p=1, p=9, p=10, p=11]

Type of protection: Intrinsically safe Ex iE

Maximum values:
Ue = 8.6 V, Ie = 55 mA

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

<table>
<thead>
<tr>
<th>Ex in IEC</th>
<th>Ex in IEC Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx = 0.68 μF</td>
<td>Cx = 4 μF</td>
</tr>
<tr>
<td>Lx = 9 mH</td>
<td>Lx = 9 mH</td>
</tr>
</tbody>
</table>

Lx = 170 μH, L3 = 750 μH
EC TYPE EXAMINATION CERTIFICATION

(1) TRANSLATION


(3) EC Type Examination Certificate Number

PTB 04 ATEX 2109

(4) Equipment: Model 3730-4 and 3730-5, I/P Positioners

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

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

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

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

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


(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.

Zertifizierungsstelle Explosionsschutz Braunschweig, 25 October 2004

By order

(Signature) 

Dr. Ing. U. Johannesmeyer
Regierungssekretär
**Schedule**

**EC TYPE EXAMINATION CERTIFICATE No. PTB 04 ATEX 2109**

**Description of Equipment**

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

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

The Model 3730-4, and 3730-5, I/P Positioners are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values for UI, II, and PI are not exceeded. For air supply non-combustible media are used.

The devices are intended for use inside the hazardous locations.

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-40 °C ... 60 °C</td>
</tr>
<tr>
<td>T5</td>
<td>-40 °C ... 70 °C</td>
</tr>
<tr>
<td>T4</td>
<td>-40 °C ... 80 °C</td>
</tr>
</tbody>
</table>

**Electrical data**

**BUS connection, signal circuit**

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

<table>
<thead>
<tr>
<th>BUS connection, signal circuit (terminals 11/12)</th>
<th>Type of protection: Intrinsic safety, Ex ia IIC, only for connection to a certified intrinsically safe circuit</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EEx ia IIC/IEX</td>
<td>EEx ia IIC/IEX</td>
</tr>
<tr>
<td>UI = 17.5 V DC</td>
<td>UI = 24 v DC</td>
</tr>
<tr>
<td>II = 380 mA</td>
<td>II = 360 mA</td>
</tr>
<tr>
<td>PI = 5.32 W</td>
<td>PI = 2.32 W</td>
</tr>
</tbody>
</table>

Inductive proximity switch (terminals 11/12)

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

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EEx ia IIC/IEX</td>
<td>EEx ia IIC/IEX</td>
</tr>
<tr>
<td>UI = 16 V</td>
<td>UI = 24 v DC</td>
</tr>
<tr>
<td>II = 50 mA</td>
<td>II = 24 mA</td>
</tr>
<tr>
<td>PI = 169 mW</td>
<td>PI = 64 mA</td>
</tr>
<tr>
<td>LI = 100 µH</td>
<td>LI = 100 µH</td>
</tr>
<tr>
<td>CI = 30 nF</td>
<td>CI = 30 nF</td>
</tr>
</tbody>
</table>

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below:
The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below.

### Temperature class

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>le / Po</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>45°C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ... 60°C</td>
<td>52mA / 169mW</td>
</tr>
<tr>
<td>T4</td>
<td>75°C</td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>60°C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ... 80°C</td>
<td>25mA / 64mW</td>
</tr>
<tr>
<td>T4</td>
<td>80°C</td>
<td></td>
</tr>
</tbody>
</table>

**Forced venting function (terminals 81/82)**
- Type of protection: Intrinsic safety EEEx ia IIC
- Maximum values:
  - U1 = 78 V
  - I1 = 115 mA
  - P1 = 500 W
  - C1 = negligible
  - li = negligible

**Binary input 1 (terminals 87 / 88)**
- Type of protection: Intrinsic safety EEEx ia IIC/IIB
- Maximum values:
  - U1 = 30 V
  - I1 = 100 mA
  - U2 = negligible
  - li = negligible

**Binary input 2 (terminals 85 / 86)**
- Type of protection: Intrinsic safety EEEx ia IIC/IIB
- Maximum values:
  - U1 = 5.88 V
  - P1 = 7.2 mW
  - U2 = 5.88 V
  - P2 = 7.2 mW

---

**Serial interface BU Type of protection: Intrinsic safety EEEx ia IIC**

- Uo = 8.61 V
- io = 55 mA
- Po = 250 mW

**EC Type Examination Certificate, without signature and seal are valid**

**PTB**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin

---

**PTB**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin

---

**EC Type Examination Certificate, without signatures and seal are valid**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin

---

**EC Type Examination Certificate, without signature and seal are valid**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin

---

**PTB**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin

---

**EC Type Examination Certificate, without signature and seal are valid**

**Physikalisch-Technische Bundesanstalt**

Braunschweig und Berlin
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

<table>
<thead>
<tr>
<th>EEx ia IIC</th>
<th>EEx ia IIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co = 0.61 μF</td>
<td>Co = 4 μF</td>
</tr>
<tr>
<td>Lo = 9 mH</td>
<td>Lo = 9 mH</td>
</tr>
</tbody>
</table>

U1 = 370 μH  
Cl = 730 nF

(16) Test Report: PTB Ex 04-24202

(17) Special conditions for safe use

None

(18) Special Health and Safety Requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz  
Braunschweig, 25 October 2004

By order

(Signature)  
( Seal)

Dr. Ing. U. Johannsmeyer  
Regierungsdirektor
**Translation**

**Addendum No.: 1**

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

Equipment: Model 3730-41, and 3730-51

Marking: 

- II 2G Ex ia IIC T6 and
- II 2D Ex T5 PC

Manufacturer: SAMSON AG Micro- und Regeltechnik

Address: Westendstr. 3, D-60314 Frankfurt, Germany

1. Description of the additions and modifications

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

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

"Bus connection (coupling) can be made according to the HSCO Concept both for the Profibus PA and the Foundation Fieldbus Specifications."

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

- **BUS connection signal circuit**
  - Type of protection Ex ia IIC T6 only for connection to a certified intrinsically safe circuit.

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

<table>
<thead>
<tr>
<th>FISCO supply unit</th>
<th>BUS supply unit, general</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_0 = 17.5 V DC</td>
<td>U_0 = 24 V DC</td>
</tr>
<tr>
<td>I_0 = 380 mA</td>
<td>I_0 = 360 mA</td>
</tr>
<tr>
<td>P_0 = 5.52 W</td>
<td>P_0 = 1.04 W</td>
</tr>
<tr>
<td>L = 5 μF</td>
<td>L = 0.01 μH</td>
</tr>
</tbody>
</table>

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

Test report: PTB Ex 00-26085

Zertifizierungsstelle: Explosionsschutz

By order

(Signed)

Dr.-Ing. U. Johannsen
Director and Professor

(Neapel)

Braunschweig, 13 July 2005

Page 2 of 2
TRANSLATION

ADDENDUM No. 2

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

Equipment: Model 3750-4 and Model 3750-5 - Positioners

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

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Wefinhenkerstr. 3
60314 Frankfurt am Main, Germany

Description of the additions and modifications

The Model 3750-4 and 3750-5 Positioners are permitted to be manufactured in the future also in compliance with the test documentation specified in the Test Report.

The electrical data of the forced ventilation modules of the Models 3750-41 and 3750-51 are modified as follows:

- Forced ventilation only for (terminals 81/92)
- Type of protection: Intrinsically Safe, EEx ia IIC
- Connection to a certified intrinsically safe circuit

Maximum values:

- U = 28 V
- I = 115 mA
- I = negligible
- C = 5.3 nF

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

Test report: PTB Ex 07-27260

Zertifizierungsstelle Explosionsschutz

By order

Dr.-Ing. U. Johannsen
Director and Professor


Page 1 of 1
TRANSLATION

Statement of Conformity


(2) EC Type Examination Certificate Number

PTB 05 ATX 2010 X

(3) Equipment: Model 3730-4B and 3730-5B, Positioners

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

(5) Address: Westmühlenstr. 1, D-60314 Frankfurt, Germany

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

(7) The equipment is subject to special conditions for safe use specified in the schedule to this certificate.

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

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

(9) EN 50021:1999, EN 50281-1-1:1998

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

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

II 3G Ex nA II T6 or II 3G Ex nIIC T6 or II 3D IP 54 T 80 °C or II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz

Braunschweig, 16 February 2005

By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeier
Regierungsdirektor

Phystalisch-Technische Bundesanstalt
Braunschweig
EC TYPE EXAMINATION CERTIFICATE No. PTB 05 ATEX 2010 X

**Schedule**

(13) Inductive proximity switch
(14) Type of protection: EEx nA II or Ex nL IIC resp.
(15) Maximum values:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>41/42</td>
<td>52 mA</td>
<td>169 mW</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>Ie / Po</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>+45°C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ... +60°C</td>
<td>52 mA</td>
</tr>
<tr>
<td>T4</td>
<td>+75°C</td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>+60°C</td>
<td>25 mA</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ... +80°C</td>
<td>64 mA</td>
</tr>
<tr>
<td>T4</td>
<td>+80°C</td>
<td></td>
</tr>
</tbody>
</table>

**Electrical data**

BUS connection, signal circuit
(terminal 11/12)

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

<table>
<thead>
<tr>
<th>Gas group</th>
<th>Maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIC</td>
<td>Ue = 20V, Ie = 464mA, Pe = 2.32W</td>
</tr>
<tr>
<td></td>
<td>Ue = 24V, Ie = 261mA, Pe = 1.56W</td>
</tr>
<tr>
<td></td>
<td>Ue = 30V, Ie = 152mA, Pe = 1.14W</td>
</tr>
<tr>
<td>IIB</td>
<td>Ue = 20V, Ie = 1.17A, Pe = 5.88W</td>
</tr>
<tr>
<td></td>
<td>Ue = 24V, Ie = 656mA, Pe = 3.93W</td>
</tr>
<tr>
<td></td>
<td>Ue = 30V, Ie = 579mA, Pe = 2.83W</td>
</tr>
<tr>
<td></td>
<td>Ci = 5 nF, Li = 10 µH</td>
</tr>
</tbody>
</table>

**Statement of conformity**

This document contains the essential requirements of Directive 94/9/EC, all other relevant provisions of the ATEX directive and the applicable EC standards.

PTB
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

116
EB 8364.5-EN

Statement of conformity without signature and seal are invalid.

Excerpts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.
Binary input 2 (terminals 85 / 86)

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

Maximum values:

- $U_0 = 5.88\, \text{V}$
- $I_0 = 1\, \text{mA}$
- $P_0 = 7.7\, \text{mW}$

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

<table>
<thead>
<tr>
<th>Gas group IIC</th>
<th>Gas group IIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_0 = 1.8\mu\text{F}$</td>
<td>$C_0 = 15.8\mu\text{F}$</td>
</tr>
<tr>
<td>$L_0 = 9.7, \text{mH}$</td>
<td>$L_0 = 1, \text{mH}$</td>
</tr>
</tbody>
</table>

- $R_0 =$ negligible
- $I_0 =$ negligible

Serial interface BU

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

Maximum values (active):

- $U_0 = 8.61\, \text{V}$
- $I_0 = 55\, \text{mA}$
- $P_0 = 250\, \text{mW}$

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

<table>
<thead>
<tr>
<th>Gas group IIC</th>
<th>Gas group IIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_0 = 0.61\mu\text{F}$</td>
<td>$C_0 = 0.4\mu\text{F}$</td>
</tr>
<tr>
<td>$L_0 = 9, \text{mH}$</td>
<td>$L_0 = 0.9, \text{mH}$</td>
</tr>
</tbody>
</table>

| $I_0 =$ negligible
| $C_0 =$ negligible

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

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

Maximum values (active):

- $U_0 = 8.61\, \text{V}$
- $I_0 = 55\, \text{mA}$
- $P_0 = 250\, \text{mW}$

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

<table>
<thead>
<tr>
<th>Gas group IIC</th>
<th>Gas group IIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_0 = 0.61\mu\text{F}$</td>
<td>$C_0 = 0.4\mu\text{F}$</td>
</tr>
<tr>
<td>$L_0 = 9, \text{mH}$</td>
<td>$L_0 = 0.9, \text{mH}$</td>
</tr>
</tbody>
</table>

- $I_0 =$ negligible
- $C_0 =$ negligible

(16) Test Report: PTB Ex 05-24319
(17) Special conditions for safe use
(18) Basic safety and health requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionssicherheit
Braunschweig, 16 February 2005

By order

[Signature]

[Signature]

Dr. Ing. U. Janssensmeyer
Regierungspräsident
ADDENDUM No. 1

to the Statement of Conformity PTB 05 ATEX 2010 X

Equipment: Model 3730-48, and 3736-58 Positioners

Marking: 113G EEx ia IIC T6 or 113G EEx ia IIC T6
          113D IP 54 T 80°C or 113D IP 65 T 80°C

Manufacturer: SAMSON AG Mess- und Regeltechnik

Address: Weinmüllerstr. 3
         60314 Frankfurt am Main

Description of the additions and modifications

The Model 3730-48, and 3736-58 Positioners are permitted to be manufactured in the future also in compliance with the documents specified in the Test Report. The input wiring of the bus connection circuit has been modified and the pcb layout has been adapted.

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

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

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

Test report: PTB Ex 06-26086

Zertifizierungsstelle Explosionsschutz
Braunschweig, 11. July 2006

(Signature) (Seal)

Dr. Ing. U. Jünemann
Director and Professor
Intrinsically safe if installed as specified in manufacturer's installation manual.

CSA-certified for hazardous locations

Type 4 Enclosure

Exia IIC T6
Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F + G; Class III.

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (Vmax) the current (Imax) and the power (Pmax) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C) and inductance (L) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The allowed voltage (V0C) of the associated apparatus is limited to the range of 14V DC to 24V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to leakage current of 30mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

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

- Loop resistance (R): 15 ... 150 Ohm/km
- Inductance per unit length (L): 0.6 ... 1 mH/km
- Capacitance per unit length (C): 30 ... 200 nF/km, if both lines are floating or, C = C' line/line + 0.5 C' line/screen, if both lines are floating or, C = C' line/line + C' line/screen, if the screen is connected to one line
- Length of spur cable: ≤ 30 m
- Length of trunk cable: ≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

- R = 90 ... 1010 Ohm
- C = 0 ... 22 µF

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

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

Notes:

1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:
   - Vdc ≤ 250V
   - I ≤ Imax
   - P ≤ Pmax
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the Canadian Electrical Code Part 1.
5. Each set of wires must be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I.S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I.S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier
9. FISCO concept applies to fieldbus / circuit only
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
    - C ≤ C' + Cable + I ≤ C + L + L+cable
Table 1: Intrinsic Safety Parameters

<table>
<thead>
<tr>
<th>Fieldbus</th>
<th>Profibus</th>
<th>Limit-</th>
<th>Force-vending</th>
<th>Binary -</th>
<th>Serial-</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>No.</td>
<td>switch</td>
<td>function</td>
<td>Input</td>
<td>Interface</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5/6/6</td>
</tr>
<tr>
<td>Terminal No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 / 32 (IEC 1148-2)</td>
<td>31 / 32 (IEC 1148-2)</td>
<td>41 / 42</td>
<td>81 / 82</td>
<td>87 / 87</td>
<td>85 / 86 plug</td>
</tr>
<tr>
<td>Groups</td>
<td>IC</td>
<td>IB</td>
<td>IC</td>
<td>IB</td>
<td>IC</td>
</tr>
<tr>
<td>Vmax</td>
<td>24</td>
<td>17,5</td>
<td>16</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>V0C R min</td>
<td>≤28V</td>
<td>≥245</td>
<td>≤28V</td>
<td>Diode</td>
<td></td>
</tr>
<tr>
<td>Diode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: CSA – certified barrier parameters of circuit 4

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Supply barrier</th>
<th>Evaluation barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toc</td>
<td>Voc</td>
<td>Rmin</td>
</tr>
<tr>
<td>circuit 3</td>
<td>≤28V</td>
<td>≤245Ω</td>
</tr>
<tr>
<td>circuit 4</td>
<td>≤30V</td>
<td>≤300Ω</td>
</tr>
</tbody>
</table>

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

Table 3:

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-60°C</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ≤ Tc ≤ 70°C</td>
</tr>
<tr>
<td>T4</td>
<td>-80°C</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Foundation Fieldbus or ProFieldbus PA (Non incendive Equipment)</th>
<th>Limit-switches</th>
<th>Force-vending function</th>
<th>Binary-Input 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal No.</td>
<td>11 / 12 (IEC 1148-2)</td>
<td>41 / 42</td>
<td>81 / 82</td>
</tr>
<tr>
<td>U1 or Umax [VDC]</td>
<td>20V</td>
<td>24V</td>
<td>30V</td>
</tr>
<tr>
<td>I1 or Imax [mA]</td>
<td>264</td>
<td>261</td>
<td>152</td>
</tr>
<tr>
<td>P1 or Pmax [W]</td>
<td>2,32</td>
<td>1,56</td>
<td>1,14</td>
</tr>
<tr>
<td>C1</td>
<td>2nF</td>
<td>60</td>
<td>5,3</td>
</tr>
<tr>
<td>L1</td>
<td>10µH</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:
1. Entity parameters must meet the following requirements:
   \[ V_{oc} \leq V_{max} \leq V_{oc} \]
   \[ I_{oc} \leq I_{max} \leq I_{oc} \]
   \[ C_{0} \geq C_{1} + C_{cable} \]
   \[ L_{0} \geq L_{1} + L_{cable} \]
2. Install in accordance with the Canadian Electrical Code Part I
3. Cable entry M 20 x 1,5 or metal conduit acc. to dwg. No. 3050-0540

* Circuit 3 can be connected to a CSA Certified zener barrier that is rated as follows:
  - Supply channel (connect to Terminal 81): \[ V_{oc} \leq 28V \text{ max. and } R_{min} \geq 245 \Omega \]
  - Return channel (connect to Terminal 82): \[ V_{oc} \leq 28V \text{ max with diodes Return (zero current)} \]

** Circuit 4 can be connected to a CSA Certified zener barrier that is rated as follows:
  - Supply channel (connect to Terminal 87): \[ V_{oc} \leq 30V \text{ and } R_{min} \geq 300 \Omega \]
  - Return channel (connect to Terminal 88): \[ V_{oc} \leq 30V \text{ max with diodes Return (zero current)} \]
CSA certified for hazardous locations:
Ex nA II T6 / Ex nL IIC T6
Class I, Div. 2; Groups A, B, C, D; Class II, Div. 2 Groups E, F + G; Class III

Type 4 Enclosure

CSA certified apparatus suitable for PROFIBUS

System parameters

Control Relay Control Terminal No. Groups L (uH) C (µF) Vsc (V) Inc (mA) Vmax (V) Rate (kV)
1, 2, 3 4-6, 5-6 A + B 192 2.66 16.5 16.5 8.11
C + E 671 7.9 11 10.5 8.11
D, F, G 1000 21.3

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

- Maximum capacitance of each inductive sensor: 30 nF
- Maximum inductance of each inductive sensor: 100 µH

The installation drawing for Control Relay KHA5-OTI/Ex2, KHA6-OTI/Ex1 or KHA6-OTI/Ex2 with Model SJ-b-N Proximity Sensors includes diagrams for Hazardous and Safe locations, with connections for external position sensors, fieldbus circuits, and isolating amplifiers. The model designation code for the relay includes supply voltage type (A, D), supply level (2 = 24V DC ±15%; 5 = 120V AC ±10% -15%; 6 = 230V AC ±10% -15%), output type (RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT), and number of channels (1 or 2). The diagram also shows the terminal connections for each circuit.

Communication is optionally either according to the FOUNDATION™ Fieldbus Specification or according to PROFIBUS PA in compliance with FISCO Concept.

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined with such combination. The criteria for interconnection is that the voltage (Ve/Ui) and the power (P) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 V and 10 mW respectively.

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

The cable used to interconnect the devices need to have the parameters in the following range:
- Loop resistance R: 15 ... 100 Ohm/km
- Inductance per unit length L: 0.2 ... 1 mH/km
- Capacitance per unit length C: 0.1 ... 0.2 nF/km

Wire the cables according to the manufacturer's instructions.

Notes:
1. Approved associated apparatus must be installed in accordance with manufacturer instructions.
2. Approved associated apparatus must meet the following requirements:
   - Use of We Max/1 or We Max, 1 or be ≤ 8 or linear, for ≤ 8 or linear.
   - The maximum non-hazardous area voltage must not exceed 250 V.
3. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.
4. Each segment must be connected to the terminal(s) as possible and must be grounded shield at I.S. Barrier ground.
5. Use only supply wires suitable for 5°C above surrounding.
6. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
7. The FISCO concept applies to fieldbus / circuit only.
8. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
   - L₁ = L₁ + 5 nF
   - C₁ = C₁ + 2.2 µF
9. The installation must be in accordance with the National Electric Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions:
### Table 1: Maximum values

<table>
<thead>
<tr>
<th>Fieldbus</th>
<th>Limit-switches inductive</th>
<th>Forced venting-function</th>
<th>Binary-input</th>
<th>Serial-Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation</td>
<td>*</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Profinbus</td>
<td>*</td>
<td></td>
<td>active</td>
<td>passive</td>
</tr>
<tr>
<td>Circuit No.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Terminal No.</td>
<td>11 / 12</td>
<td>11 / 12</td>
<td>41 / 42</td>
<td>81 / 82</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>87 / 88</td>
<td>85 / 86</td>
</tr>
<tr>
<td>Groups</td>
<td>A, B</td>
<td>C, D</td>
<td>H, B</td>
<td>H, B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td>Ui or Vmax [V]</td>
<td>24</td>
<td>17.5</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vcc</td>
<td>Vcc</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Vmax</td>
<td>Vmax</td>
</tr>
<tr>
<td>Ii or Imax [mA]</td>
<td>360</td>
<td>300</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>115</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>250</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Pi or Pmax [W]</td>
<td>1.04</td>
<td>2.58</td>
<td>5.32</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>2mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.61uF</td>
<td>0</td>
</tr>
<tr>
<td>Ci [nF]</td>
<td>5</td>
<td>60</td>
<td>5.3</td>
<td>0</td>
</tr>
<tr>
<td>Li [µH]</td>
<td>10</td>
<td>100</td>
<td>0</td>
<td>10mH</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
<td>9mH</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

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

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

**Notes:**

1. Entity parameters must meet the following requirements:
   
   $U_i \leq U_{max}$, $I_i \leq I_{max}$, $P_i \leq P_{max}$
   
   $C_i \geq C_{min}$, and $L_i \geq L_{min}$.

2. The installation must be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

3. Cable entry M 20 x 1.5 or metal conduit acc. to dwg. No. 3050-0540

### Table 2: FM – approved barrier parameters of circuit 4

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Supply barrier</th>
<th>Evaluation barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voc</td>
<td>$\geq 28V$</td>
<td>$\leq 115mA$</td>
</tr>
<tr>
<td>Rmin</td>
<td>$\geq 245\Omega$</td>
<td>$###$</td>
</tr>
<tr>
<td>Icc</td>
<td>$\leq 100mA$</td>
<td>$##$</td>
</tr>
<tr>
<td>Pmax</td>
<td>$\leq 300mW$</td>
<td>$##$</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_0$</td>
<td>$+60^\circ C$</td>
</tr>
<tr>
<td>$T_5$</td>
<td>$-40^\circ C \leq T_5 \leq 70^\circ C$</td>
</tr>
<tr>
<td>$T_4$</td>
<td>$+8^\circ C$</td>
</tr>
</tbody>
</table>

### Table 4:

<table>
<thead>
<tr>
<th>Foundation Fieldbus or Profinbus PA</th>
<th>Limit-switches inductive</th>
<th>Forced venting-function</th>
<th>Binary-input 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Non incendive Field wiring)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit-switches (inductive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal No.</td>
<td>11 / 12</td>
<td>41 / 42</td>
<td>81 / 82</td>
</tr>
<tr>
<td>Groups</td>
<td>A, B and HC</td>
<td>C, D and IIB</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
<tr>
<td></td>
<td>R/R</td>
<td>R/R</td>
<td>R/R</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ii or Imax [mA]</th>
<th>464</th>
<th>261</th>
<th>152</th>
<th>130</th>
<th>1.17</th>
<th>650</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pi or Pmax [W]</td>
<td>232</td>
<td>1.06</td>
<td>1.14</td>
<td>1.14</td>
<td>5.88</td>
<td>3.89</td>
</tr>
<tr>
<td>Pu or Pmax [W]</td>
<td>644</td>
<td>644</td>
<td>644</td>
<td>644</td>
<td>644</td>
<td>644</td>
</tr>
</tbody>
</table>

Maximum values for serial-interface and binary input 1 see table 1.
Addendum Page 11

FM approved for hazardous locations:
Ex nA II T6; Ex nL IIC T6 Zone 2.
Class I, II, Div. 2 Groups A, B, C, D, E+F.

Field enclosure NEMA 4X

FM-approved associated apparatus suitable for Profinet IRT FOUNDATION FF FIELDBUS

Serial interface, FM-approved

Addendum Page 12

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

<table>
<thead>
<tr>
<th>HAZARDOUS LOCATION</th>
<th>SAFE LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>to sensor or contact</td>
<td>1+</td>
</tr>
<tr>
<td>channel 1</td>
<td>2+</td>
</tr>
<tr>
<td>to one common line possible</td>
<td>3+</td>
</tr>
<tr>
<td>intrinsically output</td>
<td>4+</td>
</tr>
<tr>
<td>to sensor or contact</td>
<td>5+</td>
</tr>
<tr>
<td>channel 2</td>
<td>6+</td>
</tr>
</tbody>
</table>

External position sensor (optionally)

Model designation code Type KHab-cExde
a = Supply voltage type A or D
AC, AC, DC
b = Supply level
2x24V DC±15%, 5x120VAC ±10% -15% ; 6x230V AC+10% -15%
c = Output type (RTA/; RW1/; SS1/; SS2/; RS1/; RS1/; SR/; ST-or SOT
d = Number of channels 1 or 2
e = Power rail designation, P, 2S.P or GS.P
includes Model KHD2-EB-PB Power Feed Module or Blank

Each pair of I.S. wires must be protected by a shield that is grounded at the I.S. Ground. The shield must be extended as close to the terminals as possible installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01.

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

| Maximum capacitance of each inductive sensor | 30nF |
| Maximum inductance of each inductive sensor | 100µH |

System parameters

<table>
<thead>
<tr>
<th>Control Relay Terminal No.</th>
<th>Groups</th>
<th>L [mH]</th>
<th>C [µF]</th>
<th>Voc [V]</th>
<th>Isc [mA]</th>
<th>Vinus [V]</th>
<th>Rms [Ω]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3, 4, 5, 7, 8, 10, 11</td>
<td>A + B</td>
<td>192</td>
<td>2.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 3, 4, 5, 7, 8, 10, 11</td>
<td>C + E</td>
<td>671</td>
<td>7.9</td>
<td>4.5</td>
<td>13.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 3, 4, 5, 7, 8, 10, 11</td>
<td>D, E, G</td>
<td>1000</td>
<td>25.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>