Mounting and Operating Instructions

EB 8355-2 EN
Edition April 2011
<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Design and principle of operation</td>
<td>4</td>
</tr>
<tr>
<td>1.1 Versions</td>
<td>7</td>
</tr>
<tr>
<td>1.2 Technical data</td>
<td>8</td>
</tr>
<tr>
<td>2 Attachment to control valve</td>
<td>10</td>
</tr>
<tr>
<td>2.1 Direct attachment to Type 3277 Actuator</td>
<td>10</td>
</tr>
<tr>
<td>2.2 Attachment according to IEC 60534-6</td>
<td>15</td>
</tr>
<tr>
<td>2.2.1 Mounting sequence</td>
<td>16</td>
</tr>
<tr>
<td>2.2.2 Presetting the travel</td>
<td>16</td>
</tr>
<tr>
<td>2.3 Attachment to rotary actuators</td>
<td>19</td>
</tr>
<tr>
<td>2.3.1 Mounting the cam follower lever</td>
<td>20</td>
</tr>
<tr>
<td>2.3.2 Mounting the intermediate piece</td>
<td>20</td>
</tr>
<tr>
<td>2.3.3 Default setting of the cam disk</td>
<td>22</td>
</tr>
<tr>
<td>2.3.4 Reversing amplifier for double-acting actuators</td>
<td>26</td>
</tr>
<tr>
<td>3 Connections</td>
<td>28</td>
</tr>
<tr>
<td>3.1 Pneumatic connections</td>
<td>28</td>
</tr>
<tr>
<td>3.1.1 Pressure gauge</td>
<td>28</td>
</tr>
<tr>
<td>3.1.2 Supply pressure</td>
<td>28</td>
</tr>
<tr>
<td>3.2 Electrical connections</td>
<td>30</td>
</tr>
<tr>
<td>3.2.1 Switching amplifiers</td>
<td>31</td>
</tr>
<tr>
<td>4 Operation</td>
<td>32</td>
</tr>
<tr>
<td>4.1 Adjusting the positioner at the valve</td>
<td>32</td>
</tr>
<tr>
<td>4.1.1 Adjusting the proportional band Xp and air delivery Q</td>
<td>33</td>
</tr>
<tr>
<td>4.1.2 Adjusting the actuator: &quot;Actuator stem extends&quot;</td>
<td>33</td>
</tr>
<tr>
<td>4.1.3 Adjusting the actuator: &quot;Actuator stem retracts&quot;</td>
<td>34</td>
</tr>
<tr>
<td>4.2 Changing the operating direction</td>
<td>35</td>
</tr>
<tr>
<td>4.3 Adjusting the limit switches</td>
<td>36</td>
</tr>
<tr>
<td>4.4 Adjusting the position transmitter</td>
<td>38</td>
</tr>
<tr>
<td>5 Converting and retrofitting the positioner</td>
<td>40</td>
</tr>
<tr>
<td>5.1 Converting from electropneumatic to pneumatic</td>
<td>40</td>
</tr>
<tr>
<td>5.2 Fitting limit switches</td>
<td>41</td>
</tr>
<tr>
<td>5.3 Fitting a solenoid valve</td>
<td>41</td>
</tr>
<tr>
<td>5.4 Removing the solenoid valve</td>
<td>42</td>
</tr>
<tr>
<td>6 Servicing explosion-protected versions</td>
<td>42</td>
</tr>
<tr>
<td>7 Dimensions in mm</td>
<td>43</td>
</tr>
<tr>
<td>Test certificates</td>
<td>44</td>
</tr>
</tbody>
</table>
General safety instructions

The positioner may only be assembled, started up or operated by trained and experienced personnel familiar with the product. According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.

Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 6 on Servicing explosion-protected versions.

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 level, it must be restricted by means of a suitable supply pressure reducing station.

Proper shipping and appropriate storage are assumed.

Note: The device with a CE marking fulfils the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC). The declaration of conformity is available on request.
1 Design and principle of operation

The positioner consists of an electro-pneumatic converter unit (i/p converter) and a pneumatic unit equipped with a lever for travel pick-up, a measuring diaphragm, and the pneumatic control system with nozzle, diaphragm lever (flapper plate) and booster.

The positioner is designed either for direct attachment to SAMSON Type 3277 Actuators or for attachment according to NAMUR (IEC 60534-6) with an adapter housing. The positioner can be additionally equipped with either inductive limit switches and/or a solenoid valve or a position transmitter.

The DC control signal, e.g. 4 to 20 mA, issued by the control unit is transmitted to the electropneumatic conversion unit (13) where it is converted into a proportional pressure signal \( p_e \).

The positioner operates according to the force-balance principle. The valve travel, i.e. the valve position, is transmitted to the pick-up lever (1) over the pin (1.1) and determines the force of the measuring spring (4). This force is compared to the positioning force generated by the pressure \( p_e \) at the measuring diaphragm (5).

If either the control signal or the valve position changes, the diaphragm lever (3) moves, altering the distance to the nozzle (2.1 or 2.2), depending on the set operating direction of the positioner.

The air is supplied to the booster (10) and the pressure regulator (9). The controlled supply air is fed to the i/p module, then flows through the \( X_p \) restriction (8) and the nozzle (2.1, 2.2) to finally stream on the diaphragm lever (flapper plate). Any change in the reference variable or the valve stem position cause the pressure to change upstream or downstream of the booster. The air controlled by the booster (signal pressure \( p_{st} \)) flows through the volume restriction (11) to the pneumatic actuator, causing the plug stem to move to a position corresponding to the DC input signal (reference variable).

The adjustable \( X_p \) restriction (8) and volume restriction (11) are used to optimize the positioner control loop. The pick-up lever (1) and the range spring (4) must be selected to match the rated valve travel and the nominal span of the reference variable.

Positioner with inductive limit switches

In this version, the rotary shaft of the positioner carries two adjustable tags which actuate the built-in proximity switches.

Positioner with solenoid valve

When the positioner is equipped with a solenoid valve, the control valve can be moved to the fail-safe position regardless of the positioner's output signal. If a control signal corresponding to the binary signal "0" (off) is applied to the input, the signal pressure \( p_{st} \) is shut off and the actuator is vented. The actuator springs move the control valve to its fail-safe position. If a control signal corresponding to the binary signal "1" (on) is applied to the input, the signal pressure \( p_{st} \) is supplied to the actuator. The control valve is in control operation.
Fig. 2 · Functional diagram and inside view
Positioner with position transmitter

A positioner containing a position transmitter cannot be equipped with integrated limit switches or an integrated solenoid valve since the position transmitter requires most of the space inside. The position transmitter is used to establish a certain relationship between the valve position, i.e. the valve travel, and a controller output signal of 4 to 20 mA. The position transmitter setting ensures that both end positions "valve CLOSED" or "valve OPEN" as well as all intermediate positions can be signalized. Since the valve position is signalized independently of the input signal to the positioner, the position transmitter is a suitable option for checking the current valve position.
## 1.1 Versions

<table>
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<tr>
<th>Electropneumatic positioner</th>
<th>Type 3767-</th>
<th>x</th>
<th>x</th>
<th>x</th>
<th>0</th>
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<tr>
<td>$T_{\text{min}} \geq -45 ^\circ \text{C};$ optional limit switches, solenoid valve</td>
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* Available until December 2011
1.2 Technical data

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<td>Travel range, adjustable</td>
<td>Direct attachment: 7.5 to 30 mm</td>
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<tr>
<td>Opening angle</td>
<td>Attachment acc. to IEC 60534-6: 7.5 to 120 mm or</td>
</tr>
<tr>
<td></td>
<td>Depending on the cam disk: 30 to 90°</td>
</tr>
<tr>
<td>Reference variable</td>
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<tr>
<td>Signal range</td>
<td>4 (0) to 20 mA</td>
</tr>
<tr>
<td>Span</td>
<td>8 to 20 mA</td>
</tr>
<tr>
<td>Coil reference R, at 20 °C</td>
<td>200 Ω</td>
</tr>
<tr>
<td>Supply air</td>
<td>1.4 to 6 bar (20 to 90 psi)</td>
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<tr>
<td>Air quality acc. to ISO 8573-1: Max. particle size and density: Class 4, Oil content: Class 3, pressure dew point: Class 3</td>
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<tr>
<td>Signal pressure p_s (output)</td>
<td>Can be limited between approx. 2.5 to 6.0 bar (38 to 90 psi)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Linear characteristic, deviation from terminal-based conformity ≤ 1 %</td>
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<td>Hysteresis</td>
<td>≤ 0.3 %</td>
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<tr>
<td>Sensitivity</td>
<td>≤ 0.1 %</td>
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<tr>
<td>Operating direction</td>
<td>Reversible</td>
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<td>Proportional band X_p</td>
<td>&lt; 1 to 2.5 % (proportional-action coefficient K_p &gt; 100 to 40)</td>
</tr>
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<td>Air consumption</td>
<td>With supply air = 1.4 bar: ≤ 280 l/h</td>
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<td></td>
<td>With supply air = 6 bar: ≤ 280 l/h with min. adjusted pressure regulator</td>
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<tr>
<td>Air delivery</td>
<td>Actuator pressurized: 3.0 m³/h</td>
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<td>Actuator vented: 4.5 m³/h</td>
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<td>8.5 m³/h</td>
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<td>14.0 m³/h</td>
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<td>Permissible ambient temperature</td>
<td>−20 to 80 °C with plastic cable gland</td>
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<td>−40 to 80 °C with metal cable gland (special version down to −45 °C)</td>
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<td>−20 to 70 °C for positioners with position transmitter</td>
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<td>See attached certificate for explosion-protected devices</td>
</tr>
<tr>
<td>Influences</td>
<td>Temperature: ≤ 0.3 %/10 K</td>
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<tr>
<td></td>
<td>Supply air: ≤ 1 % between 1.4 and 6 bar</td>
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<td></td>
<td>Vibration: None between 10 and 150 Hz and 4 g</td>
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<tr>
<td>Explosion protection</td>
<td>Type of protection EEx ia IIC T6, see attached certificate</td>
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<tr>
<td>Degree of protection</td>
<td>IP 54 (upgradable to IP 65 using a filter check valve, see Accessories table)</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>Complying with requirements specified in EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 1 kg</td>
</tr>
</tbody>
</table>
## Technical data

### Inductive limit switches

<table>
<thead>
<tr>
<th>2 proximity switches</th>
<th>Type SJ 2-SN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control circuit</td>
<td>Ratings according to downstream transistor relay</td>
</tr>
<tr>
<td>Hysteresis at rated travel</td>
<td>( \leq 1 % )</td>
</tr>
</tbody>
</table>

### Solenoid valve

<table>
<thead>
<tr>
<th>Input</th>
<th>Binary direct current signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal signal</td>
<td>6 V DC</td>
</tr>
<tr>
<td>Signal 0 (no pick-up), DC signal at –25 °C</td>
<td>( \leq 1.2 \text{ V} )</td>
</tr>
<tr>
<td>Signal 1 (safe pick-up), DC signal at 80 °C</td>
<td>( \geq 5.4 \text{ V} )</td>
</tr>
<tr>
<td>Maximum permissible signal</td>
<td>28 V</td>
</tr>
<tr>
<td>Coil resistance R, at 20 °C</td>
<td>2909 ( \Omega )</td>
</tr>
<tr>
<td>Air consumption in steady state</td>
<td>In addition to that of the positioner: &quot;Off&quot; ( \leq 60 \text{ L/h} ), &quot;On&quot; ( \leq 10 \text{ L/h} )</td>
</tr>
<tr>
<td>Closing time with Rated travel and signal pressure range (( K_v = 0.14 ))</td>
<td>Type 3277 Actuator</td>
</tr>
<tr>
<td>0.2 to 1 bar</td>
<td>120 cm(^2)</td>
</tr>
<tr>
<td>0.4 to 2 bar</td>
<td>240 cm(^2)</td>
</tr>
<tr>
<td>0.6 to 3 bar</td>
<td>350/355 cm(^2)</td>
</tr>
<tr>
<td>0.6 to 3 bar</td>
<td>700 cm(^2)</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 1 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 2 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 1.5 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 1.5 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 4 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 8 s</td>
</tr>
<tr>
<td>≤ 0.5 s</td>
<td>≤ 5 s</td>
</tr>
</tbody>
</table>

### Position transmitter*

<table>
<thead>
<tr>
<th>Output signal</th>
<th>Two-wire circuit 4 to 20 mA, reversible operating direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>Min. terminal voltage 12 V DC, max. 45 V DC</td>
</tr>
<tr>
<td>Performance</td>
<td>Characteristic: output linear to input, deviation from characteristic ( \leq 1 % )</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>( \leq 0.6 % )</td>
</tr>
<tr>
<td>Response</td>
<td>( \leq 0.1 % )</td>
</tr>
<tr>
<td>Influence of power supply</td>
<td>( \leq 1 % ) when voltage changes occur within the specified limits</td>
</tr>
<tr>
<td>HF influence</td>
<td>( \leq 0.1 % ), ( f = 150 \text{ MHz} ), 1 W power output at a distance of 0.5 m</td>
</tr>
<tr>
<td>Load influence</td>
<td>( \leq 0.1 % )</td>
</tr>
<tr>
<td>Permissible ambient temperature</td>
<td>–20 to 70 °C</td>
</tr>
<tr>
<td>Ambient temperature influence</td>
<td>–20 to … Refer to certificate</td>
</tr>
<tr>
<td>Ripple of output signal</td>
<td>( \leq 0.4 % ) on lower measuring range value, ( \leq 0.2 % ) on measuring span</td>
</tr>
</tbody>
</table>

* Data refer to standard spring (15 mm travel with Type 3277 Actuator) and gain of 100.
2 Attachment to control valve

The positioner is attached either directly to SAMSON Type 3277 Actuator or to valves with cast yokes or with rod-type yokes in accordance with IEC 60534-6 (NAMUR). When combined with an intermediate piece, the device can also be attached to rotary actuators as a rotary positioner. As the positioner is also available as a basic unit without accessory equipment, refer to the tables on the following pages for both the required mounting parts and their associated order numbers.

Do not remove the protective cover on the back of the positioner before actually starting to attach the positioner.

Mounting position and operating direction

The operating direction of the positioner also determines its mounting position on the actuator as illustrated in Figs. 3, 4 and 6. The turnboard (7, Fig. 2) at the positioner must be mounted correspondingly. For an increasing input signal (reference variable), the signal pressure $p_{st}$ can either be increasing (direct action $>>$) or decreasing (reverse action $<$>). This also applies when the reference variable decreases: direct action $>>$ causes the signal pressure to decrease, reverse action $<$> causes the signal pressure to increase.

On the turnboard (7), the operating direction is indicated by symbols (direct $>>$, reverse $<$>). Depending on the position of the turnboard, the adjusted operating direction and the associated symbol become visible.

If the required operating direction does not correspond to the visible symbol, or if you want to change the operating direction, remove the fastening screw at the turnboard, turn the board by 180°, and refasten the turnboard with the screw. Make sure the three rubber gaskets inserted in the housing remain in position.

Note: When any subsequent changes are made, e.g. reversing the operating direction of the positioner control loop or changing the actuator from “Actuator stem extends” to “Actuator stem retracts” or vice versa, the positioner’s mounting position must be changed accordingly.

2.1 Direct attachment to Type 3277 Actuator

Required accessories are listed in Tables 1 to 4 on page 14.

The attachment of the positioner either on the left or right side of the actuator (always looking at the signal pressure connection or switchover plate) is determined by the required operating direction of the positioner, i.e. $>>$ or $<$>.
Fig. 3 - Mounting position and connections of Type 3277 (top) and Type 3277-5 120 cm² (bottom) Actuators

Attachment to control valve

Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Actuator stem retracts
- Signal pressure connection over piping
- Side view of connection block
- With gasket (new)
- Cover plate
- Actuator stem extends
- Marking
- Actuator stem retracts
- Switch plate (13)
- Switching plate for attachment right
- Signal pressure input for attachment right
- Seal with filter
- Marking
- Symbol

Operating direction >>
- Attachment left → Attachment right

Operating direction <=
- Attachment left ← Attachment right

With switch plate (old)

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction >>
- Attachment left → Attachment right
- Switching plate for attachment right
- Signal pressure input for attachment right
- Seal with filter
- Marking
- Symbol

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction <=
- Attachment left ← Attachment right

With gasket (new)

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction >>
- Attachment left → Attachment right
- Switching plate for attachment right
- Signal pressure input for attachment right
- Seal with filter
- Marking
- Symbol

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction <=
- Attachment left ← Attachment right

With switch plate (old)

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction >>
- Attachment left → Attachment right
- Switching plate for attachment right
- Signal pressure input for attachment right
- Seal with filter
- Marking
- Symbol

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction <=
- Attachment left ← Attachment right

With gasket (new)

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction >>
- Attachment left → Attachment right
- Switching plate for attachment right
- Signal pressure input for attachment right
- Seal with filter
- Marking
- Symbol

Attachment left
- Actuator stem extends
- Internal signal pressure connection
- Connection block
- Tip of gasket (16)

Attachment right
- Operating direction <=
- Attachment left ← Attachment right

With switch plate (old)
1. Screw the clamp (1.2) to the actuator stem. Make sure that the fastening screw is located in the groove of the actuator stem.
2. Screw the associated lever D1 or D2 (for 355/700 cm² actuator) to the pick-up lever of the positioner.
3. Fasten the distance plate (15) with the seal pointing towards the actuator yoke.
4. Attach the positioner such that the lever D1 or D2 slides centrically over the pin (1.1) of the clamp (1.2). Screw the positioner to the distance plate (15).
5. Mount the cover (16).
6. Check whether the correct measuring spring has been installed as listed in Table 4. Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and fix it at the outer slot.

**Actuators with 240, 350, 355 and 700 cm² diaphragm area**

7. Make sure that the tip of the gasket (16) projecting from the side of the connection block (Fig. 3, middle) is positioned to match the actuator symbol that corresponds to the actuator’s fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Reposition the gasket (16) turned by 180°. The old connection block version requires the switchover plate (13) to be turned such that the corresponding actuator symbol points to the marking.

8. Place the connection block with its seals on the positioner and the actuator yoke and screw tight using the fastening screw. Actuators with "Actuator stem retracts" require the ready-made signal pressure line to be installed.

**Actuators with 120 cm² diaphragm area**

The signal pressure is transmitted to the diaphragm chamber over the switchover plate (Figs. 3 and 4, bottom).

7. Remove the screw in the rear cover of the positioner (Fig. 5) and seal the lateral signal pressure output "output" with the plug contained in the accessories kit.
8. Mount the positioner such that the bore in the distance plate (15) mates with the seal in the bore of the actuator yoke.
9. Align the switchover plate with the corresponding symbol and fasten it to the actuator yoke.

**Note:** When a solenoid valve or a similar device is attached to the 120 cm² actuator in addition to the positioner, do not remove the rear M3 screw plug. In this case, the signal pressure must be transmitted from the signal pressure output to the actuator over an additional connecting plate (Table 2). The switchover plate is not used.

**Filling the actuator with air**

If the spring chamber of the actuator must be filled with the positioner's exhaust air,
use piping (Table 3) to connect the spring chamber (with version "Actuator stem extends") to the connection block. To do so, remove the plug from the connection block.

For version "Actuator stem retracts" and Type 3277-5 Actuators with an effective diaphragm area of 120 cm², an internal bore hole ensures that the spring chamber is filled with air.

Note: When the valve is installed, the side cover of the actuator must be mounted such that the vent plug points downward.
### Attachment to control valve

**Table 1**  
<table>
<thead>
<tr>
<th>Required lever with associated clamp and distance plate</th>
<th>Actuator size [cm²]</th>
<th>Mounting kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 with vent plug for output (38) Connecting thread</td>
<td>G ¼ 1/4 NPT</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1400-6790</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1400-6791</td>
</tr>
<tr>
<td>D1 (33 mm long with 17-mm-high clamp)</td>
<td></td>
<td>240 and 350</td>
</tr>
<tr>
<td>D2 (44 mm long with 13-mm-high clamp)</td>
<td></td>
<td>355/700</td>
</tr>
</tbody>
</table>

**Table 2**  
| Switchover plate for actuators 120 cm²                | Actuator 3277-5xxxxx.00 (old) | 1400-6819     |
| Switchover plate new                                  | Actuator 3277-5xxxxx.01 or higher (new) | 1400-6822     |
| Connecting plate for additional attachment of, e.g. a solenoid valve | Actuator 3277-5xxxxx.00 (old), G ⅝ | 1400-6820     |
|                                                       | Actuator 3277-5xxxxx.00 (old), ⅝ NPT  | 1400-6821     |
| Connecting plate new                                  | Actuator 3277-5xxxxx.01 or higher (new) | 1400-6823     |

*Note! Only the new switchover and connecting plates can be used for new actuators (model index 01). Old and new plates cannot be interchanged.*

| Connection block required for actuators with 240, 350, 355 and 700 cm² diaphragm area (including seals and fastening screw) |                     | 1400-8819     |
| Piping required including screw fitting                | G ¼ 1/4 NPT         | 1400-8812     |

**Table 3**  
<table>
<thead>
<tr>
<th>Material</th>
<th>Actuator size [cm²]</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>including screw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fitting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For actuator: “Actuator stem retracts” or when the top diaphragm case is filled with exhaust air from the positioner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>240</td>
<td>1400-6444</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>240</td>
<td>1400-6445</td>
</tr>
<tr>
<td>Steel</td>
<td>350</td>
<td>1400-6446</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>350</td>
<td>1400-6447</td>
</tr>
<tr>
<td>Steel</td>
<td>355/700</td>
<td>1400-6448</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>355/700</td>
<td>1400-6449</td>
</tr>
</tbody>
</table>

**Table 4**  
<table>
<thead>
<tr>
<th>Range spring required</th>
<th>Travel [mm]</th>
<th>Actuator size [cm²]</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (4.5 coils)</td>
<td>7.5</td>
<td>120, 240</td>
<td>1400-6443</td>
</tr>
<tr>
<td>1 (9.5 coils, installed as standard)</td>
<td>10 to 15</td>
<td>120, 240 and 350</td>
<td>1400-6442</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>355/700</td>
<td>1400-6443</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>355/700</td>
<td>1400-6442</td>
</tr>
</tbody>
</table>

**Accessories**  
<table>
<thead>
<tr>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge build-on block (only for 120 cm²)</td>
</tr>
<tr>
<td>Pressure gauge kit for supply pressure and signal pressure</td>
</tr>
<tr>
<td>Filter check valve, replaces the vent plug and increases the degree of protection to IP 65</td>
</tr>
<tr>
<td>Assortment of spare parts including seals and diaphragms</td>
</tr>
</tbody>
</table>
2.2 Attachment according to IEC 60534-6

Required mounting parts are listed in Table 5. The rated travel of the valve determines which lever and range spring (Table 6) are required.

An adapter housing (Fig. 7) is required for NAMUR attachment. The valve travel is transmitted over the lever (18) and shaft (25) to the bracket (28) of the adapter housing and then passed on to the pin (27a) located on the positioner lever. Fix the spring included in the accessories at the back of the positioner housing as illustrated in Fig. 5 to ensure that the pin (27a) is properly located in the bracket (28).

The positioner can be attached either to the left or the right of the control valve (Figs. 6 and 7). Turn the positioner at the adapter housing by 180° to set or change the operating direction of the positioner/control valve unit.

<table>
<thead>
<tr>
<th>Attachment left</th>
<th>Attachment right</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mounting position</strong></td>
<td>on the plate looking onto the travel pick-up (20), actuator facing upward (see also Fig. 7)</td>
</tr>
<tr>
<td>Actuator with fail-safe action “Actuator stem extends” (FA)</td>
<td></td>
</tr>
<tr>
<td>Direct op. direction &gt;&gt;</td>
<td>Reverse op. direction &lt;&gt;</td>
</tr>
<tr>
<td>Electrical connection</td>
<td>Pneumatic connections</td>
</tr>
</tbody>
</table>

| Actuator with fail-safe action “Actuator stem retracts” (FE) | |
| Direct op. direction >> | Reverse op. direction <> | Direct op. direction >> | Reverse op. direction <> |
| Pneumatic connection | Electrical connections | Pneumatic connection |

Fig. 5 · Installing the spring on the back of the housing
Fig. 6 · Attachment to the left or right of the valve when NAMUR attachment is used
2.2.1 Mounting sequence

Choose the required mounting parts and range spring from Table 4 or 5 and install them as illustrated in Fig. 7.

Control valve with cast yoke

1. Screw the plate (20) to the stem connector connecting the actuator and plug stems using countersunk screws. For 2100 and 2800 cm² actuators, use an additional mounting bracket (32).

2. Remove the rubber plug from inside the adapter housing. Fasten the housing to the left or right side of the NAMUR rib (as shown in Fig. 6) using a hexagon screw.

Control valve with rod-type yoke

1. Screw the plate (20) to the follower clamp of the plug stem.

2. Screw the studs (29) into the adapter housing.

3. Place the housing with the mounting plate (30) on either the right or left side (Fig. 6) of the plug stem and fasten it with the nuts (31). Make sure that the lever (18) to be mounted subsequently is in horizontal position when the valve is at mid-travel.

4. Screw the pin (19) into the center row of holes in the plate (20) and lock it in a position approximately above the correct lever marking (1 to 2) as in Table 6.

5. Clamp the clip (21) onto the lever (18). If the actuator is attached with its air connection pointing to the front (Fig. 6), the clip must be clamped onto the lever (18) with the open side pointing downward.

6. Plug the lever (18) together with the clamping plate (22) on the shaft (25). The clip must clasp the pin (19).

2.2.2 Presetting the travel

1. Move the valve to 50 % travel.

2. Adjust the shaft (25) in the adapter housing such that the black pointer (24) matches the cast mark on the adapter housing.

3. Fasten the clamp (22) tightly in this position using the screw (23).

4. Screw in the pin (27a) at the positioner lever on the side of the insert nut and secure it with a hex nut (27b) on the opposite side. Observe the mounting position A or B according to Table 6 and Fig. 7.

5. Place the positioner on the adapter housing, observing the operating direction. Make sure that the pin (27a) rests against the bracket (28) and screw it tight.

Caution! The pin must not slip out of the bracket once it has been installed.

6. Check whether the correct range spring has been installed as listed in Tables 5/6.

Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and fix it at the outer slot.

7. Adjust the positioner as described in section 4.1.
Attachment to control valve

Mounting position

18 Lever N1, N2
19 Pin
20 Plate
21 Clip
22 Clamping plate
23 Screw
24 Pointer
25 Shaft
26 Lever of the positioner
27a Pin
27b Lock nut
28 Bracket
29 Studs
30 Plate
31 Nuts
32 Mounting bracket

Fig. 7 · Attachment according to IEC 60534-6 (NAMUR)
### Table 5

| NAMUR mounting kit, 
Refer to Fig. 7 concerning parts | Valve with cast yoke | Valve with rod-type yoke, rod diameter [mm] | Control valve | Travel [mm] | With lever | Order no. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20 to 25</td>
<td></td>
<td>7.5 to 60</td>
<td>N1 (125 mm)</td>
<td>1400-6787</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.5 to 120</td>
<td></td>
<td>22.5 to 120</td>
<td>N2 (212 mm)</td>
<td>1400-6789</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 to 30</td>
<td></td>
<td>15 to 30</td>
<td>N1</td>
<td>1400-6436</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 to 35</td>
<td></td>
<td>30 to 35</td>
<td>N2</td>
<td>1400-6437</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 to 35</td>
<td>N1</td>
<td>1400-6438</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 to 35</td>
<td>N2</td>
<td>1400-6439</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 to 35</td>
<td>N1</td>
<td>1400-6440</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 to 35</td>
<td>N2</td>
<td>1400-6441</td>
</tr>
</tbody>
</table>

**Attachment to Fisher and Masoneilan linear actuators**
(one each of both mounting kits is required per actuator)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th>1400-6771</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1400-6787</td>
</tr>
</tbody>
</table>

**Additional range spring acc. to Table 6**

| Range spring 1 (9.5 coils, installed as standard) | 1400-6442 |
| Range spring 2 (4.5 coils)                       | 1400-6443 |

### Accessories

<table>
<thead>
<tr>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400-7458</td>
</tr>
<tr>
<td>1400-7459</td>
</tr>
<tr>
<td>1400-6950</td>
</tr>
<tr>
<td>1400-6951</td>
</tr>
<tr>
<td>1790-7408</td>
</tr>
<tr>
<td>1400-9895</td>
</tr>
</tbody>
</table>

### Table 6

<table>
<thead>
<tr>
<th>Travel [mm] *</th>
<th>7.5</th>
<th>15</th>
<th>15</th>
<th>30</th>
<th>30</th>
<th>60</th>
<th>30</th>
<th>60</th>
<th>60</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin on marking*</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Distance pin/fulcrum of the lever</td>
<td>42 to 84 mm</td>
<td>84 to 168 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With lever</td>
<td>N1 (125 mm long)</td>
<td>N2 (212 mm long)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin (27a) on position</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range spring required (see Table 5)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Intermediate values must be interpolated
2.3 Attachment to rotary actuators

The positioner can also be attached to rotary actuators according to VDI/VDE 3845 when the mounting kits and accessories listed in Table 7 are used.

Table 7 - Complete mounting parts, including range spring 2, but excluding the cam disk

<table>
<thead>
<tr>
<th>Attachment acc. to VDI/VDE 3845, level 1</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMSON Type 3278 Actuator 160 cm²</td>
<td>1400-7103</td>
</tr>
<tr>
<td>VETEC Type S 320 cm²</td>
<td>1400-7104</td>
</tr>
<tr>
<td>VETEC Type R R 100 to R 250</td>
<td>1400-7117</td>
</tr>
<tr>
<td>Attachment to Masoneilan actuators</td>
<td></td>
</tr>
<tr>
<td>Camflex I, DN 25 to 100</td>
<td>1400-7118</td>
</tr>
<tr>
<td>Camflex I, DN 125 to 250</td>
<td>1400-7119</td>
</tr>
<tr>
<td>Camflex II</td>
<td>1400-7120</td>
</tr>
</tbody>
</table>

Range spring required

<table>
<thead>
<tr>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard operation of reference variable, range spring 2 (4.5 coils)</td>
</tr>
<tr>
<td>Split-range operation, range spring 1 (9.5 coils, installed as standard)</td>
</tr>
</tbody>
</table>

Cam disk with accessories

<table>
<thead>
<tr>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>~, linear basic characteristic (3)\</td>
</tr>
<tr>
<td>~, equal percentage basic characteristic (3)\</td>
</tr>
<tr>
<td>~, linear (1)\</td>
</tr>
<tr>
<td>~, equal percentage (2)\</td>
</tr>
<tr>
<td>~, linear (1)\</td>
</tr>
<tr>
<td>~, equal percentage (2)\</td>
</tr>
<tr>
<td>~, linear (1)\</td>
</tr>
<tr>
<td>~, equal percentage (2)\</td>
</tr>
</tbody>
</table>

\(1)\ Linearizes the flow characteristic  
\(2)\ Creates an equal percentage flow characteristic  
\(3)\ Based on opening angle

Accessories

<table>
<thead>
<tr>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge build-on block G (\frac{1}{4})</td>
</tr>
<tr>
<td>(\frac{1}{4}) NPT</td>
</tr>
<tr>
<td>Pressure gauge kit St. steel/Brass</td>
</tr>
<tr>
<td>St. steel/St. steel</td>
</tr>
<tr>
<td>Filter check valve, replaces the vent plug and increases the degree of protection to IP 65</td>
</tr>
<tr>
<td>Assortment of spare parts including seals and diaphragms</td>
</tr>
</tbody>
</table>
The rotary motion of these actuators is converted into a linear motion required by the pneumatic control unit of the positioner using the cam disk of the actuator shaft and a cam follower roll on the positioner lever.

Note: Use Table 7 to check whether the proper range spring (1 or 2) has been installed. Range spring 1 is installed as standard. If necessary, replace it with range spring 2 included in the accessories and attach it at the outer slot.

Double-acting springless rotary actuators require the use of a reversing amplifier on the connection side of the positioner housing (see section 2.3.4). When using a reversing amplifier, the pressure regulator (9, Fig. 2) must be turned clockwise as far as it will go (also see section 3.1.2).

When attaching the positioner to the SAMSON Type 3278 Rotary Actuator (Fig. 8, left), the actuator's inside and the unused reverse side of the diaphragm are filled with the positioner's exhaust air. Additional piping is not required. When attaching the positioner to actuators from other manufacturers (Fig. 8, right), the reverse side of the diaphragm can be filled with air over a pipe connection installed between the actuator and the intermediate piece.

2.3.1 Mounting the cam follower lever

1. Place the lever with the cam follower roll (35) on the side of the feedback lever (37) opposite the insert nuts. Fasten with the supplied screws (38) and washers.

Note: To ensure a close physical contact between the cam follower roll and the cam disk, fix the spring contained in the accessories kit (order no. 1400-6660) at the rear of the positioner housing (see Fig. 5).

2.3.2 Mounting the intermediate piece

SAMSON Type 3278 Actuator

1. Screw the adapter (36) to the free end of the actuator shaft.
2. Attach the intermediate piece (34) to the actuator housing using two screws. Align the intermediate piece to ensure that the air connections of the positioner point towards the diaphragm housing.
3. Align the cam disk (40) and scale (39) as described in section 2.3.3 and fasten with screws.

Actuators according to VDI/VDE 3845 (fixing level 1)

1. Place the complete intermediate piece (34, 44, 45, and 42) onto the mounting bracket that came with the actuator and fasten with screws.
2. Align the cam disk (40) and scale (39) as described in section 2.3.3 and fasten with screws.
Fig. 8 · Attachment to rotary actuators
2.3.3 Default setting of the cam disk

The valve model used determines the default setting of the cam disk.

**Note:** Cam disks tailored to the special characteristic of a valve cause the valve to open in a non-linear or non-equal percentage way. The visible difference between the set point (4 to 20 mA) and the actual value (opening angle) does not constitute a system deviation of the positioner.

Figs. 9 and 10 show linear cam disks.

Fig. 9 illustrates a control valve assembly with a spring-loaded rotary actuator that opens counterclockwise. The arrangement of the springs in the actuator determines the fail-safe position of the valve.

Fig. 10 shows how to adjust the cam disk when a double-acting springless rotary actuator is used. The direction of rotation, either counterclockwise or clockwise, depends on the actuator and valve model used. The cam disk must be set when the valve is closed.

Use the turnboard (7) to adjust the operating direction of the positioner, i.e. whether the valve opens or closes when the reference variable increases (direct >> or reverse <=>). Each cam disk carries two cam sections whose starting points are indicated by small bores. Depending on the operating direction of the rotary actuator – signal pressure opens or closes the valve – the starting point of the cam, either marked N (standard characteristic) or I (reverse characteristic), must point towards the cam follower roll. When the starting point is located on the back of the cam disk, turn over the cam disk.

**Note:** The starting point (bore) of the selected cam section must be aligned with the fulcrum of the cam disk, the 0° position of the scale, and the arrow symbol on the inspection glass.

When aligning the cam disk, the double-sided scale disk must be clipped on the cam disk such that the value on the scale corresponds to the control valve's direction of rotation.

**Note:** Make sure the 0° position of the scale always corresponds to CLOSED position. For actuators with fail-safe position "Valve OPEN" and for springless actuators, it is therefore necessary to apply the maximum supply pressure to the actuator before aligning the cam disk.
**Attachment to control valve**

**Single-acting spring-loaded rotary actuator**

**Linear cam disk** (equal percentage cam disk is represented by a broken and dotted line)

**Valve opens counterclockwise**

For valves that open clockwise, the cam disk must be turned over so that the cam follower roll moves over the same disk segments as shown in the figures below, but with the cam disk turning clockwise.

---

**Fail-safe position: Valve CLOSED without supply air**

<table>
<thead>
<tr>
<th>Direct operating direction &gt;&gt;</th>
<th>Reversible operating direction &lt;&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference variable</td>
<td>Signal pressure</td>
</tr>
<tr>
<td>increases</td>
<td>increases</td>
</tr>
</tbody>
</table>

---

**Fig. 9 · Setting the cam disk**

---

**Fail-safe position: Valve OPEN without supply air**

<table>
<thead>
<tr>
<th>Direct operating direction &gt;&gt;</th>
<th>Reversible operating direction &lt;&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference variable</td>
<td>Signal pressure</td>
</tr>
<tr>
<td>decreases</td>
<td>decreases</td>
</tr>
</tbody>
</table>

---

**Position at max. signal pressure**
**Double-acting springless rotary actuator with reversing amplifier**

**Linear cam disk** (equal percentage cam disk is represented by a broken and dotted line)

<table>
<thead>
<tr>
<th>Direct operating direction &gt;&gt;</th>
<th>Reversible operating direction &lt;-&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference variable</strong></td>
<td><strong>Signal pressure</strong></td>
</tr>
<tr>
<td>increases</td>
<td>A1 increases, A2 decreases</td>
</tr>
</tbody>
</table>

View from the positioner onto the actuator shaft

**Valve opens counterclockwise** – Starting position: valve CLOSED

- Cam follower roll
- Starting point N
- Boreholes to secure the cam disk
- Insert clip and press tongues outwards

View from the positioner onto the actuator shaft

**Valve opens clockwise** – Starting position: valve CLOSED

- Cam follower roll
- Starting point N
- Boreholes to secure the cam disk

**Fig. 10 · Setting the cam disk**
Securing the aligned cam disk

To additionally prevent the cam disk from being turned, drill a bore into the adapter (36) or the coupling (44) and install a 2 mm dowel pin. Four bore holes are located centrically around the center bore hole on the cam disk. Select a suitable bore to install the pin.
2.3.4 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).

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

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

**NOTICE**

When using the reversing amplifier, the pressure regulator (9) must be turned clockwise as far as it will go.

**Mounting**

**Note:** Remove the sealing plug (1.5) before installing the reversing amplifier. The rubber seal (1.4) must remain installed.

1. Screw the special nuts (1.3) included in the accessories of the reversing amplifier into the threaded connections of the positioner.

2. Insert the gasket (1.2) into the recess of the reversing amplifier and push the two hollowed special screws (1.1) into the connecting bore holes A1 and Z.

3. Place the reversing amplifier onto the positioner and screw tight using the two special screws (1.1).

4. Screw the supplied filter (1.6) using a screwdriver (8 mm wide) into the connecting bore holes A1 and Z.

**Signal pressure connections**

**A1:** Connect output A1 to the signal pressure connection on the actuator that opens the valve when the pressure increases.

**A2:** Connect output A2 to the signal pressure connection on the actuator that closes the valve when the pressure increases.

**Pressure gauge attachment**

The mounting sequence shown in Fig. 11 remains unchanged. Screw a pressure gauge bracket onto the connections A1 and Z.

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

Pressure gauges for supply air Z and output A1 as listed in Tables 4 to 5.
Attachment to control valve

From the positioner
Output 38  Supply 9

Control signals to the actuator

A1  A2

1  Reversing amplifier
1.1  Special screws
1.2  Gasket
1.3  Special nuts
1.4  Rubber seal
1.5  Sealing plug
1.6  Filter

Fig. 11 · Mounting a reversing amplifier (1079-1118 or 1079-1119)
3 Connections

3.1 Pneumatic connections

The pneumatic connections are designed as tapped holes with ¼ NPT or G ¼ thread. The conventional male connections for metal and copper pipes (or plastic hoses) can be used.

Note: The supply air must be dry and free of any oil and dust. Always observe the maintenance instructions applicable to the connected pressure reducing stations. Blow out air lines thoroughly before connecting them.

When attaching the Type 3277 Actuator directly, the signal pressure connection is fixed. When using NAMUR attachment, the signal pressure line is connected to either the upper or lower diaphragm chamber of the actuator depending on the actuator's fail-safe action, i.e. "Actuator stem retracts" or "Actuator stem extends".

Exhaust air

Positioners with model index 3767-x...x.03 or higher are equipped with a hinged cover without a vent connection. The required exhaust air connection for these models are now included in the mounting accessories. For direct positioner attachment, the vent plug is located on the plastic cover of the actuator; for NAMUR attachment, it is located on the adapter housing, and for attachment to rotary actuators the vent plug can be found on the intermediate piece or the reversing amplifier.

Note: When using older models with index 3767-x...x.02 or lower, mounting parts will have to be replaced as well.

3.1.1 Pressure gauge

To monitor the positioner, we recommend to install pressure gauges for the supply air and the signal pressure. The required parts are listed as accessories in Tables 4, 5 or 7.

3.1.2 Supply pressure

The required supply pressure is determined by the bench range and the operating direction (fail-safe action) of the actuator. The bench range is written on the nameplate as spring range or signal pressure range depending on the type of actuator. FA (actuator stem extends) or FE (actuator stem retracts) or a symbol indicates the operating direction.

Actuator stem extends (FA):
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):
Fail-safe position "Valve OPEN"
(for globe and angle valves)

The required supply pressure for a
tight-closing valve is roughly estimated from
the maximum signal pressure $p_{st\text{max}}$:

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

$d$ = Seat diameter [cm]
$\Delta p$ = Differential pressure at the valve [bar]
$A$ = Actuator diaphragm area [cm$^2$]
$F$ = Upper range value of the actuator

In the absence of such specifications, proceed as follows:
Required supply pressure =
Upper bench range value + 1 bar

Pressure regulator

After tilting the cover plate back, the pressure regulator (9) can be continuously adjusted. When the adjuster is turned counterclockwise as far as it will go, signal pressures for spring ranges up to 2.5 bar are controlled. When the adjuster is turned clockwise all the way, signal pressures for spring ranges up to 6.0 bar are controlled.

If the signal pressure must not exceed a certain value, this limit can be adjusted using a pressure gauge (accessories).
3.2 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.
- The following regulations apply to mounting and installation in hazardous areas: EN 60079-14: 2008 *Explosive atmospheres – Part 14: Electrical installations design, selection and erection* (or VDE 0165 Part 1).

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

**Selecting cables and wires:**
Observe Clause 12 of EN 60079-14: 2008 (VDE 0165 Part 1) when installing intrinsically safe circuits. The Subclause 12.2.2.7 applies when running multi-core cables containing more than one intrinsically safe circuit.

In particular, the radial thickness of the conductor insulation for common insulation materials, such as polyethylene, must have a minimum radial thickness of 0.2 mm.

The diameter of an individual wire in a fine-stranded conductor must not be smaller than 0.1 mm. Protect the conductor ends against splicing, e.g. by using wire-end ferrules.

When two separate cables 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 Ex nA II (non-sparking equipment) according to EN 60097-15: 2003, circuits may be connected, interrupted or switched while energized only during installation, maintenance or repair.

Equipment connected to energy-limited circuits with type of protection Ex nL (energy-limited equipment) according to EN 60097-15: 2003 may be switched under normal operating conditions.

The maximum permissible values specified in the Statement of Conformity or its addenda apply when interconnecting the equipment with energy-limited circuits in type of protection Ex nL IIC.
The wiring for the reference variable is led to the terminals 11 and 12.

The positioner does not have to be connected to a bonding conductor. If need be, the bonding conductor can be connected either inside or outside of the housing.

Depending on the version used, the positioner is equipped with inductive limit switches and/or a solenoid valve. Versions with position transmitter do not permit the connection of these accessories.

The position transmitter is operated on a two-wire circuit. The usual supply voltage is 24 V DC. Considering the resistance of the supply leads, the voltage at the position transmitter terminals can be between 12 and 45 V DC.

For terminal assignment, refer to Fig. 12 or the label on the terminal strip.

### Accessories:

- **Positioner index 3767-x...x. 03 or lower**
  - Cable gland PG 13.5
  - Plastic, black Order no. 1400-6781
  - Plastic, blue Order no. 1400-6782
  - Brass, nickel-plated Order no. 1400-6979

- **Adapter PG 13.5 to ½ NPT:**
  - Metallic Order no. 1400-7109
  - Painted blue Order no. 1400-7110

- **Positioner index 3767-x...x. 04 or higher**
  - Cable gland M 20 x 1.5
  - Plastic, black Order no. 1400-6985
  - Plastic, blue Order no. 1400-6986
  - Brass, nickel-plated Order no. 1890-4875

- **Adapter M 20 x 1.5 to ½ NPT:**
  - Aluminum, powder-coated Order no. 0310-2149

### 3.2.1 Switching amplifiers

To operate the inductive limit switches, switching amplifiers complying with EN 60947-5-6 must be connected in the output circuit. Observe the relevant regulations when installing the positioner in hazardous areas.

---

**Fig. 12 · Electrical connections**

![Fig. 12](image-url)
4 Operation

4.1 Adjusting the positioner at the valve

Starting point and reference variable

When adjusting the positioner directly at the control valve, the travel (opening angle) must be adapted to the reference variable. With a reference variable, for example, 4 to 20 mA, the valve must pass through its entire travel range from 0 to 100 % (Fig. 13, left).

For rotary positioners, an opening angle, for example, 0 to 70° must be assigned to the reference variable.

The starting point refers to CLOSED position of the valve.

Depending on the actuator version ("Actuator stem extends" or "Actuator stem retracts") and the operating direction of the positioner (>>) or <>, this starting point can be represented by either the lower or upper range value (4 or 20 mA) of the reference variable. The reference variable range and thus the upper range value determine the travel of the valve.

In split-range operation (Fig. 13, right), the control valves operate on smaller reference variables. The controller output signal is used to control two control valves, dividing it such that the valves pass through their entire travel range at half the input signal range each (e.g. first valve set to 4 to 12 mA, second valve set to 12 to 20 mA). To avoid overlapping, allow for a dead band of ±0.5 mA as shown in Fig. 13.

The starting point (zero) is adjusted at the zero adjuster screw (6.2); the span, i.e. the upper range value, is adjusted at the span adjuster screw (6.1).

When adjusting, connect a suitable ammeter to the signal input and apply a supply pressure to the supply air input.

---

![Diagram showing standard and split-range operation](image-url)
4.1.1 Adjusting the proportional band \( X_p \) and air delivery \( Q \)

1. Close the volume restriction (11) as far as the required positioning speed permits.  
   To check, push the diaphragm lever (3) as far it will go.

2. Adjust the reference variable at the input to approx. 50\% of its range.

3. Turn the zero adjuster (6.2) until the valve has reached approx. mid-travel.

4. Use the adjuster (8) to set the proportional band \( X_p \) to a medium value (\( \frac{1}{2} \) turn).

5. Check the valve’s tendency to hunt and the positioning speed by briefly tapping the diaphragm lever (3).  
The \( X_p \) value is to be adjusted to be as small as possible, without considerable overshooting occurring.

   **Note:** Always adjust the \( X_p \) restriction before setting the starting point.  
   Later modifications shift the zero point!

### 4.1.2 Adjusting the actuator: "Actuator stem extends"

#### Starting point (e.g. 4 mA)

1. Set the input signal to 4 mA using an ammeter.

2. Turn the zero adjuster (6.2) until the control valve just starts to move from its initial position.

3. Switch off the input signal and slowly increase it again. Check whether the valve starts to move at exactly 4.5 mA. Correct any deviation on the zero adjuster (6.2).

#### Upper range value (e.g. 20 mA)

1. Once the starting point has been set, increase the input signal to 20 mA using the ammeter.

   At exactly 20 mA, the plug stem must stand still, having passed through 100\% travel (watch the travel indicator at the valve).  
   If the upper range value is incorrect, turn the span adjuster (travel). Four turns correspond to a travel change of 10\% in standard operation. In split-range operation, this value is reduced by half. Turn the adjuster clockwise to reduce the travel and counterclockwise to increase it.

2. After correction has been completed, switch off the control signal and increase it again. Check the starting point and the upper range value. Repeat the correction procedure until both values are correct.

   **Note:** When setting the zero adjuster (6.2), check whether the actuator is relieved of pressure.
4.1.3 Adjusting the actuator: "Actuator stem retracts"

When the input signal is 4 mA and the operating direction >>, or the input signal is 20 mA and the operating direction <<, the pressure gauge must indicate 0 bar. Correct zero accordingly!

Note: When using an actuator with fail-safe action "Actuator stem retracts", the diaphragm chamber must be pressurized with a signal pressure sufficient to close the valve tightly even when an upstream pressure is applied in the plant. This applies to an upper range value of the reference variable of 20 mA and operating direction >>, and a lower input range value of 4 mA and operating direction <<.

The required signal pressure is either indicated on the positioner label or can be roughly calculated as described in section 3.1.2.

Starting point (e.g. 20 mA)

1. Set the input signal to 20 mA using an ammeter.
2. Turn the zero adjuster (6.2) until the valve just starts to move from its initial position.
3. Increase the input signal and slowly reduce it to 20 mA again. Check whether the valve starts to move at exactly 20 mA.

4. Correct any deviations on the zero adjuster (6.2). Turning the adjuster counterclockwise causes the valve to move from its end position earlier; turning it clockwise causes the valve to move from its end position later.

Upper range value (e.g. 4 mA)

1. Once the starting point has been set, adjust the input signal to 4 mA using the ammeter. At exactly 4 mA, the plug stem must stand still, having passed through 100 % travel (watch travel indicator at the valve).
2. If the upper range value is incorrect, turn the span adjuster (travel). Four turns correspond to a travel change of 10 % in standard operation. In split-range operation, this value is reduced by half. Turn the adjuster clockwise to reduce the travel and counterclockwise to increase it.
3. After correction has been completed, reset the control signal to 20 mA.
4. Turn the zero adjuster (6.2) again until the pressure gauge indicates the required signal pressure (see section 3.1.2).

Note: After attaching and calibrating the positioner, make sure that the vent plug on the housing cover points downward when the valve is installed in the plant.
4.2 Changing the operating direction

If you want to change the operating direction of directly attached positioners (Fig. 3) after they have been installed, turn the turnboard (7) and change the position of the connection block, the positioner, and the clamp (1.2).

For attachment according to IEC 60534-6 (NAMUR), turn the turnboard (7) and the positioner on the adapter housing (Fig. 6).

For rotary positioners, reassign the cam disk as shown in Fig. 9 and 10.

For details on changing the turnboard (7), refer to section 2.
4.3 Adjusting the limit switches

The positioner version with inductive limit switches has two adjustable tags mounted on a rotary axis which operate the associated proximity switches (50).

To operate the inductive limit switches, connect the corresponding switching amplifiers in the output circuit (see section 3.2.1).

When the tag (51) is inside the inductive field of the switch, the switch assumes a high resistance. When the tag is outside the field, the switch assumes a low resistance. The limit switches are usually adjusted to issue a signal for both end positions. Nevertheless, they can also be set to signalize intermediate positions. The switches A and B must be assigned to the end positions of the control valve (valve OPEN or CLOSED) depending on the operating direction and the mounting position according to Tables 8 and 9. The terminals 41/42 and 51/52 can optionally be assigned to the switches A and B by turning the associated nameplate on the terminal block (also see Fig. 12).

**Note:** As the tags of the limit switches cannot be turned by 360°, make sure that the switches A and B are correctly assigned to the end positions "valve OPEN" and "valve CLOSED", especially when the limit switches are to be used for fail-safe circuits.

The desired switching function, i.e. whether the output relay must be picked up or released when the tag has entered the field, must be determined by means of jumpers for either working current or closed circuit current at the switching amplifier.

![Fig. 14 · Limit switch](image-url)
### Setting the switching point

Move the valve to the switching position and adjust the tag by turning the adjustment screw (53) so that the switching point is reached and indicated by the LED on the switching amplifier. To ensure safe switching under any condition, the switching point is to be adjusted to stop approx. 2 % before the mechanical stop (OPEN – CLOSED) is reached.

**Note:** After calibrating the positioner, make sure that the vent plug on the housing cover points downward when the valve is installed in the plant.

### Table 8
Direct attachment to Type 3277 Actuator (Fig. 3)

<table>
<thead>
<tr>
<th>Valve position</th>
<th>Attachment left</th>
<th>Attachment right</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tag OUT</td>
<td>Tag IN</td>
</tr>
<tr>
<td>CLOSED</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>OPEN</td>
<td>A</td>
<td>B</td>
</tr>
</tbody>
</table>

### Table 9
NAMUR attachment right or left (Fig. 6) and attachment to rotary actuators (Fig. 8)

<table>
<thead>
<tr>
<th>Operating direction</th>
<th>Valve position</th>
<th>Actuator stem extends FA</th>
<th>Actuator stem retracts FE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Switch Tag</td>
<td>Switch Tag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OUT</td>
<td>IN</td>
</tr>
<tr>
<td>&gt;&gt;</td>
<td>CLOSED</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>CLOSED</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
<td>B</td>
<td>A</td>
</tr>
</tbody>
</table>
4.4 Adjusting the position transmitter

**Note:** The starting point (zero) and upper range value (span) must be set before calibrating the position transmitter.

Depending on the position of the 4-pin plug (symbol on plug: >> or <<), the feedback signal can be set to either a range of 4 to 20 mA or 20 to 4 mA for 0 to 100 % travel.

**Zero point (ZERO)**

Use the switches 1 and 2 to preset the zero point and the ZERO potentiometer for fine-tuning. The adjusted value always refers to 4 mA.

**Span (SPAN)**

Use the switches 3 and 4 to preset the span, i.e. the upper range value, and the SPAN potentiometer for fine-tuning. The adjusted value always refers to 20 mA.

**Example:**

Move the valve to open position while observing the position transmitter signal. If the signal does not move in the desired direction, switch over the multi-pin plug. Adjust the zero point (4 mA) and span (20 mA) for the valve positions according to Table 10.

---

**Table 10**

<table>
<thead>
<tr>
<th>Valve movement</th>
<th>Observed transmitter signal</th>
<th>Direction of signal</th>
<th>Adjust zero/span to</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN ↑ CLOSED</td>
<td>Current increases ↑</td>
<td>OK</td>
<td>20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve OPEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve CLOSED</td>
</tr>
<tr>
<td></td>
<td>Not OK</td>
<td>4 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>→ Reconnect plug</td>
<td>20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve OPEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve CLOSED</td>
</tr>
<tr>
<td></td>
<td>Current decreases ↓</td>
<td>OK</td>
<td>4 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve OPEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve CLOSED</td>
</tr>
<tr>
<td></td>
<td>Not OK</td>
<td>20 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>→ Reconnect plug</td>
<td>4 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve OPEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Valve CLOSED</td>
</tr>
</tbody>
</table>

---

**Fig. 15 · Position transmitter**
Adjusting the zero point

1. Use the input signal of the positioner to move the valve to closed position (valve CLOSED – travel 0 %).

2. The ammeter must now indicate approx. 4 mA.

3. Correct smaller deviations on the ZERO potentiometer until the meter shows exactly 4 mA. If deviations are too high and cannot be corrected using the potentiometer (adjustment range of approx. 20 turns), set the switches 1 and 2 to indicate an mA value which is within the adjustment range of the ZERO potentiometer.

4. Set the zero point to exactly 4 mA using the ZERO potentiometer.

Adjusting the span

1. Use the input signal of the positioner to move the valve to open position (valve OPEN – travel 100 %).

2. The ammeter must now indicate approx. 20 mA.

3. Correct smaller deviations on the SPAN potentiometer until the meter shows exactly 20 mA. If deviations are too high, set the switches 3 and 4 to indicate an mA value which is within the adjustment range of the SPAN potentiometer.

4. Turn the SPAN potentiometer until the meter shows exactly 20 mA. Since zero and span have a mutual influence on each other, repeat the correction procedure at both potentiometers until both values are correct.

Note on adjusting the position transmitter for positioners with NAMUR adapter housing

When the positioner and the position transmitter signal have different operating directions (<< and <>), the zero point of the transmitter signal could be unadjustable due to the additional deflection caused by the bracket (28, Fig. 7) of the adapter housing. If so, readjust the black pointer (section 2.2.2 on page 16) so that the sensor of the position transmitter reaches the control range.

Unscrew the clamp. For “Actuator stem extends” (FA), shift the pointer upward towards the actuator; for "Actuator stem retracts" (FE), shift the pointer downward towards the valve. For valves with rod-type yoke, slightly shift the positioner on the rod in downward (FE) or upward (FA) direction.

Note: Every time you make a change as described above, the zero point and span of the positioner must be readjusted before calibrating the position transmitter.
5 Converting and retrofitting the positioner

Read instructions in section 6 for explosion-protected versions!

5.1 Converting from electropneumatic to pneumatic

The electropneumatic positioner can be converted into a Type 3766 Pneumatic Positioner with the following conversion kit:

M20 x 1.5, order no. 1400-7575

1. Remove the support including the terminal base and disconnect the cable to the i/p module.

2. Unscrew the fastening screws and remove the i/p module (6) including the seals (7, 8).

3. Place the connecting plate (3) with the seal on the housing bores and screw tight. The restriction must be seated in the seal above the right internal bore.

4. Replace the cable gland (5) with the pneumatic screw gland (1).

5. Connect the silicone hose (2) and insert the guard plate (4) into the housing.

6. Reattach the support with terminal base.

7. Change the type designation (model no.) on the nameplate to Type 3766.

The Mounting and Operating Instructions EB 8355-1 EN apply for the Type 3766 Positioner.
5.2 Fitting limit switches

**Accessories:** Limit switch retrofit kit depending on model index 3767-xxxxxxxxxx.04
Order no. 1400-8810 for index .06 or higher
Order no.1400-7573 for index .04/.05
Order no.1400-6389 for index .03

1. Unscrew the bracket with plate (1).
2. Remove the screws (2) and replace the entire input unit (3) with a unit including limit switches. Make sure the O-ring is inserted in the housing.
3. Attach the terminal block for the limit signals 41/42 and 51/52 in the terminal base.
4. Guide the connecting cable to the terminals and fasten, (brown = +, blue = –).
5. Refasten the bracket with plate (1) and stick the adhesive label for the limit switches on the housing cover.
6. Screw additional cable gland on the housing.

5.3 Fitting a solenoid valve

**Accessories:** Solenoid valve retrofit kit
Order no. 1400-7122 (index .05 or lower)
Order no. 1400-8808 (index .06 or higher)

1. Push the plate (5) to one side.
2. Unscrew the four screws (7). Lift off the black cover with the rubber gasket and insert the solenoid valve (6). The rubber gasket with the restriction is located in the rear of the solenoid valve.
3. Unscrew the plate (1).
4. Attach the terminal block (10) for the solenoid valve in the terminal base.

---

*Fig. 17 · Retrofitting limit switches and solenoid valve*
5. Insert the panel (9) at the rear of the positioner and attach it to the input unit using two screws.

6. Guide the connecting cable down behind the mounted panel of the input unit and up again to terminals 81/82 and fasten (brown = +, blue = -).

7. Screw the bracket with plate (1) back on.

8. Screw additional cable gland on the housing.

5.4 Removing the solenoid valve

**Accessories:** Cover retrofit kit for solenoid valve opening, order no. 1400-6949

1. Unscrew bracket with plate (1). Remove the connecting cable of the solenoid valve from terminals 81/82.

2. Unscrew the two screws (7) that are not sealed with paint and remove the solenoid valve with its connecting cable.

3. Place the rubber gasket on the spigot of the cover and screw it into the housing.

4. Screw on the bracket with plate (1).

6. **Servicing explosion-protected versions**

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 used 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.

Observe requirements stated in EN 60079-17: 2003 for servicing explosion-protected devices.
7 Dimensions in mm

Pneumatic connections
G ¼ or ¼ NPT

Reversing amplifier (optional)

Attachment with intermediate piece for rotary actuators

Attachment IEC 60534-6 (NAMUR) with adapter housing

Fulcrum of actuator shaft

Output 1 (A1)

Output 2 (A2)

Supply (Z)

Supply (9)

Output (38)
The marking of the equipment shall include the following:

II 2 G Ex ia IIC T6
Schedule

EC TYPE EXAMINATION CERTIFICATE No. PTB 01 ATEX 2167

Description of Equipment

The model 3767-1... Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of 0 to 20mA from a control device into a pneumatic signal pressure of 6 bar max. For pneumatic auxiliary power non-combustible media are used.

V/p-converter, inductive limit switches, solenoid valves and position indicator are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of U_i, I_i and P_i are not exceeded.

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

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>Maximum short-circuit current</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-45 °C ... 60 °C</td>
<td>85mA or</td>
</tr>
<tr>
<td>T5</td>
<td>-45 °C ... 70 °C</td>
<td>100mA or</td>
</tr>
<tr>
<td>T4</td>
<td>-45 °C ... 80 °C</td>
<td>120mA</td>
</tr>
</tbody>
</table>

Electrical data

Model 3767-1...

V/p converter signal circuit (terminals 11/12) Type of protection: Intrinsic safety

EEEx ia IIC intrinsically safe circuit

<table>
<thead>
<tr>
<th>Maximum values</th>
<th>U_i = 28 V</th>
<th>I_i = 100 mA or 85 mA C negligible</th>
<th>P_i = 0.7 W</th>
<th>L_i negligible or</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_t = 25 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I_t = 120 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_t = 0.7 W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Models 3767 – 11./.- 12. with inductive Limit Switches

Inductive limit switch (terminals 41/42 and 51/52)

Type of Protection: Intrinsic safety

EEEx ia IIC or EEEx ia IIC respectively only for connection to a certified intrinsically safe circuit

Maximum values

<table>
<thead>
<tr>
<th>U</th>
<th>I</th>
<th>P_i</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 V</td>
<td>52 mA</td>
<td>169 mW</td>
</tr>
<tr>
<td>100 nF</td>
<td>U_i = 16 V</td>
<td>P_i = 64 mW</td>
</tr>
<tr>
<td>100 μH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For positioners with inductive limit switches the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit currents is shown in the table below.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>Maximum short-circuit current</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-45 °C ... 45 °C</td>
<td>52 mA or</td>
</tr>
<tr>
<td>T5</td>
<td>-45 °C ... 60 °C</td>
<td>25 mA</td>
</tr>
<tr>
<td>T4</td>
<td>-45 °C ... 75 °C</td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>-45 °C ... 60 °C</td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>-45 °C ... 80 °C</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>-45 °C ... 80 °C</td>
<td></td>
</tr>
</tbody>
</table>

Statements of Conformity without signature and seal are invalid. This Statement of Conformity may be reproduced only in its entirety without any changes. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.
### Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

#### Model 3767-16 with Position Indicator

- **Signal Circuit (terminals 31/32)**: Type of protection: Intrinsic safety EEx ia IIC
- **Maximum values:**
  - $U_i = 28\, \text{V}$
  - $I_i = 115\, \text{mA}$
  - $P_i = 1\, \text{W}$
  - $C_i = 5.3\, \text{nF}$, $L_i = \text{negligible}$

#### Model 3767-1.2/...1.3/...1.4 with Solenoid Valve

- **Signal Circuit (terminals 81/82)**: Type of protection: Intrinsic safety EEx ia IIC
- **The correlation between version, temperature classification, permissible ambient temperature ranges and maximum power dissipation is shown in the table below:**

<table>
<thead>
<tr>
<th>Version</th>
<th>$U_i$</th>
<th>$6, \text{V}$</th>
<th>$12, \text{V}$</th>
<th>$24, \text{V}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature class</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T6</td>
<td>60 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td>$-45, \text{°C} \leq T_a \leq 70, \text{°C}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>80 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>linear</td>
<td>#</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rectangular</td>
<td>##</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- $C_i = \text{negligible}$, $L_i = \text{negligible}$

### Special conditions for safe use

None

### Special health and safety requirements

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz: Braunschweig, 26 November 2001

By order

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

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(16) **Test report** PTB Ex 01-21200

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TRANSLATION

Statement of Conformity


(2) EC Type Examination Certificate Number

PTB 01 ATEX 2170 X

(4) Equipment: Model 3767-B Positioner

(5) Manufacturer: Samson AG

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

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

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

The examination and test results are recorded in confidential report

PTB Ex 01-21201.

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

EN 50021: 1999

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

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

[12] The marking of the equipment shall include the following:

II 3 G Ex nA II T6

Zertifizierungsstelle Explosionsschutz 
Braunschweig,.................................

By order

(Signature) 
(Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor
Schedule

Statement of Conformity PTB 01 ATEX 2170 X

Description of Equipment

The Model 3767-8... Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of (0)4...20mA from a control devices into a pneumatic signal pressure of 6bar max. For pneumatic auxiliary power non-combustible media are used. The inductive limit switches, position indicators and solenoid valves are passive two networks.

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

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>
<th>Maximum short-circuit current</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-45°C..60°C</td>
<td>85mA or</td>
</tr>
<tr>
<td>T5</td>
<td>-45°C..70°C</td>
<td>100mA or</td>
</tr>
<tr>
<td>T4</td>
<td>-45°C..80°C</td>
<td>120mA</td>
</tr>
</tbody>
</table>

Electrical data

Model 3767-8...

Signal circuit ([/p-converter) (terminals 11/12) Type of protection: EEEx nA II

Inductive limit switch (terminals 41/42 and 51/52) Type of protection EEEx nA II

Model 3767-86 with Position Indicator

Signal circuit (terminals 31/32) Type of protection EEEx nA II

The correlation between version and temperature classification is shown in the table below:

<table>
<thead>
<tr>
<th>Version</th>
<th>Un</th>
<th>6V</th>
<th>12V</th>
<th>24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td></td>
<td>60°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T5</td>
<td></td>
<td>-45°C...70°C</td>
<td>80°C</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td>-45°C...80°C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test report: PTB Ex 01-21201

Schedule of the Statement of Conformity PTB 01 ATEX 2170 X

Special conditions for safe use

The Model 3767-8... Positioner shall be installed in an enclosure providing at least Degree of Protection IP 54 in compliance with the IEC Publication 60529:1989. This requirement applies also to the cable entries and/or plug connectors.

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

The signal circuit (terminals 11/12 [p-converter] and the signal circuit (terminals 31/32 position indicator) shall be provided with a series-connected fuse outside of the hazardous area. This fuse shall comply with IEC 127-2/II, 250V F, or with IEC 127-2/VI, 250V T, with a fuse nominal current In of ≤ 50mA max.

Basic health and safety requirements

Are satisfied by compliance with the standard specified.

Zertifizierungsstelle Explosionsschutz Braunschweig, 07 März 2002

By order

(Signature) (seal)

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

**Addendum No.: 1**

In compliance with Directive 94/9/EC Annex III Clause 6 to the EC Type Examination Certificate PTB 00 ATEX 2170

**Equipment:** Model 3767-B., Positioner

**Marking:** II 3 G Ex nA II T6

**Manufacturer:** SAMSON AG

**Address:** Weismüllerstr. 3, D-60314 Frankfurt, Germany

**Description of the additions and modifications:**
The coverage of the existing Statement of Conformity is supplemented by the electrical data of the model series 3767-B.2, -B.3, -B.4 with solenoid valve module. The design of the equipment was not changed.

**Electrical data**

- **Model 3767-B.**
  - **Signal circuit (Terminals 11/12):** Type of protection Ex nA II

- **Inductive proximity switch (Terminals 41/42 and 51/52):** Type of protection Ex nA II

- **Model 3767-B.6, with Position Indicator Signal circuit (Terminals 31/32):** Type of protection Ex nA II

- **Models 3767-B.2, -B.3, -B.4 with Solenoid Valve Signal circuit, nominal signal (Terminals 81/82):** Type of protection Ex nA II

**Table: Correlation between equipment version and temperature classification**

<table>
<thead>
<tr>
<th>Version</th>
<th>Un</th>
<th>6V</th>
<th>12V</th>
<th>24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td></td>
<td></td>
<td>60°C</td>
<td></td>
</tr>
<tr>
<td>Temperatur class T5</td>
<td></td>
<td></td>
<td>-45°C to 70°C</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td></td>
<td></td>
<td>80°C</td>
<td></td>
</tr>
</tbody>
</table>

All other data apply unchanged also to this Addendum No. 1.

**Test report:** PTB EX 03-23230

Zertifizierungsstelle Explosionsschutz

By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, 28. May 2003

This EC Type Examination Certificate without signature and seal are invalid.

This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.

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

Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig
Table 3. The core shows a temperature range and an ambient temperature range which are both to be one of the temperature ranges shown in the table. The core temperature range is ±2°C and the ambient temperature range is ±5°C.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>-45°C to -60°C</td>
<td>-45°C to -60°C</td>
</tr>
<tr>
<td>T4</td>
<td>-45°C to -60°C</td>
<td>-45°C to -60°C</td>
</tr>
</tbody>
</table>

Table 4. The core shows a temperature range and an ambient temperature range which are both to be one of the temperature ranges shown in the table. The core temperature range is ±2°C and the ambient temperature range is ±5°C.

<table>
<thead>
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</table>

Table 5. The core shows a temperature range and an ambient temperature range which are both to be one of the temperature ranges shown in the table. The core temperature range is ±2°C and the ambient temperature range is ±5°C.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Exclusively for hazardous locations</td>
<td>1. Exclusively for hazardous locations.</td>
</tr>
<tr>
<td>B</td>
<td>Exclusively for hazardous locations</td>
<td>2. Each unit in the course of the equipment is required to be marked with the explosive group or class number.</td>
</tr>
<tr>
<td>C</td>
<td>Exclusively for hazardous locations</td>
<td>3. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>D</td>
<td>Exclusively for hazardous locations</td>
<td>4. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>E</td>
<td>Exclusively for hazardous locations</td>
<td>5. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>F</td>
<td>Exclusively for hazardous locations</td>
<td>6. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>G</td>
<td>Exclusively for hazardous locations</td>
<td>7. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>H</td>
<td>Exclusively for hazardous locations</td>
<td>8. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>I</td>
<td>Exclusively for hazardous locations</td>
<td>9. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>J</td>
<td>Exclusively for hazardous locations</td>
<td>10. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>K</td>
<td>Exclusively for hazardous locations</td>
<td>11. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>L</td>
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<td>12. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>M</td>
<td>Exclusively for hazardous locations</td>
<td>13. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
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<td>O</td>
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</tr>
<tr>
<td>P</td>
<td>Exclusively for hazardous locations</td>
<td>16. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
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<tr>
<td>Q</td>
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<td>17. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
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<tr>
<td>R</td>
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<td>18. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>S</td>
<td>Exclusively for hazardous locations</td>
<td>19. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>T</td>
<td>Exclusively for hazardous locations</td>
<td>20. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>U</td>
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<td>21. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>V</td>
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<td>22. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
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<tr>
<td>W</td>
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<td>23. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>X</td>
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<td>24. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>Y</td>
<td>Exclusively for hazardous locations</td>
<td>25. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
<tr>
<td>Z</td>
<td>Exclusively for hazardous locations</td>
<td>26. The marking is in accordance with the Canadian Electrical Code Part 1.</td>
</tr>
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</tr>
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<td>Exclusively for hazardous locations</td>
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</tr>
</tbody>
</table>
Circuit 1: Controller CSA-certified or CSA-certified barriers

Rayor or transistor output 3 or 4 channels (as per CSA certified).

Supply and supply barrier CSA-certified

Position indicator channel 2 not on version 3767-36.

For the permissible maximum values for the intrinsically safe circuits see Table 1.

For the permissible barrier parameters for the circuits 2 and 5 see Table 2.

Cables M20 x 1.5 or metal conduit according to drawing No. 1050-0539 T or 1030-0540 T.

On interconnection to form ground-free signal circuits, one way or barrier should be

installed in the return line. Correct polarity should be ensured.

Addendum Page 3

CSA-certified for hazardous locations

Class II, Div. 2, Groups A, B, C, D

Type 4 Enclosure

L/P: Positioner with position indicator, solenoid valve and limit switches.

Addendum Page 4

1) The installation shall be in accordance with the Canadian Electrical Code Part 1.
2) For the maximum values for the individual circuits see Table 1 and 2.
3) The cables shall be protected by conduits.
4) Cables on electrical metal conduit according to drawing No. 1050-0539 T and 1050-0540 T.
Addendum Page 5

Installation drawing Control Relay KHA6-OT1/ES2, KHA6-OT1/ES1 or KHA6-OT1/ES2 with Model S1-b-N Proximity Sensors

HAZARDOUS LOCATION

SAFE LOCATION

Table 1: Maximum values

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>1</th>
<th>2</th>
<th>3 and 4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal No.</td>
<td>11/12</td>
<td>31/32</td>
<td>41/42 and 51/52</td>
<td>81/82</td>
</tr>
<tr>
<td>U or Vmax</td>
<td>28V</td>
<td>28V</td>
<td>16V</td>
<td>28V</td>
</tr>
<tr>
<td>I or Imax</td>
<td>115mA</td>
<td>115mA</td>
<td>25/62 mA</td>
<td>115mA</td>
</tr>
<tr>
<td>P or Pmax</td>
<td>0.7W</td>
<td>1W</td>
<td>64/169mW</td>
<td>232mW (608)</td>
</tr>
<tr>
<td>G</td>
<td>O/N</td>
<td>O/N</td>
<td>30mF</td>
<td>O/F</td>
</tr>
<tr>
<td>L</td>
<td>G/H</td>
<td>G/H</td>
<td>100μH</td>
<td>G/H</td>
</tr>
</tbody>
</table>

Notes: Entity parameters must meet the following requirements

1/28V 12V and 24V version both Max no limited

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

<table>
<thead>
<tr>
<th>Barier</th>
<th>Supply barrier</th>
<th>Evaluation barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voc</td>
<td>Rmin</td>
<td>Ioc</td>
</tr>
<tr>
<td>circuit 1</td>
<td>28V</td>
<td>≥ 280Ω</td>
</tr>
<tr>
<td>circuit 2</td>
<td>28V</td>
<td>≥ 160Ω</td>
</tr>
<tr>
<td>circuit 5 (#)</td>
<td>28V</td>
<td>≥ 100Ω</td>
</tr>
<tr>
<td>circuit 5 (#)</td>
<td>28V</td>
<td>≥ 78Ω</td>
</tr>
</tbody>
</table>

References: Control Numbers 1 May 2005

52 EB 8355-2 EN

Addendum Page 6

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

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

Table 1: Maximum values

<table>
<thead>
<tr>
<th>Circuit No.</th>
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<tr>
<td>G</td>
<td>O/N</td>
<td>O/N</td>
<td>30mF</td>
<td>O/F</td>
</tr>
<tr>
<td>L</td>
<td>G/H</td>
<td>G/H</td>
<td>100μH</td>
<td>G/H</td>
</tr>
</tbody>
</table>

Notes: Entity parameters must meet the following requirements

1/28V 12V and 24V version both Max no limited

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

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</tr>
<tr>
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</tr>
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<td>28V</td>
<td>≥ 160Ω</td>
</tr>
<tr>
<td>circuit 5 (#)</td>
<td>28V</td>
<td>≥ 100Ω</td>
</tr>
<tr>
<td>circuit 5 (#)</td>
<td>28V</td>
<td>≥ 78Ω</td>
</tr>
</tbody>
</table>

References: Control Numbers 1 August 2004

Addendum to EB 8355-2 EN
Table 3: The correlation between temperature classification and permissible ambient temperature ranges 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>60°C</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ≤ ta ≤ 60°C</td>
</tr>
<tr>
<td>T4</td>
<td>70°C</td>
</tr>
</tbody>
</table>

Table 4: For the Mode 3767-3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short-circuit current shown in the table below.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>Maximum short-circuit current</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>45°C</td>
<td>50mA</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ≤ ta ≤ 60°C</td>
<td>25mA</td>
</tr>
<tr>
<td>T4</td>
<td>50°C</td>
<td>25mA</td>
</tr>
</tbody>
</table>

**FM + approved for hazardous locations**

Class I, Zone 0, ATEX in HCT6
Class II, III Divisions 1, Groups A, B, C, D; E, F & G

**Notes:**

1. The apparatus may be installed in itself and safe circuits on any type of apparatus in the FM approved apparatus, for maximum voltage of 4,000 V or lower, not more than 1 A and 5 A for the various apparatus as shown in Table 1.
2. The apparatus may be installed in itself and safe circuits only when used in conjunction with the FM approved apparatus, for the voltage of 4,000 V or lower, not more than 1 A and 5 A for the various apparatus as shown in Table 2.
3. Installation must be in accordance with the National Electrical Code ANSI/NEPD 70 and ANSI/ESD RP 12.0.6.01.
4. Use only supply wires suitable for use at 2°C above surrounding temperature.

---

**Hazardous Location Diagrams**

**Version:** Mode 3767-3 with E/P converter, so a fluid valve and inductive limit switches.
Mode 3767-36 with E/P converter and position indicator.

**Circuit Monitor:**

Controller / Supply

Control signal circuit 1

Position indicator circuit 2

Supply indicator circuit 3

Supply indicator circuit 4

Supply indicator circuit 5

Terminal No.

**Cable entry M 20 x 1.5 or metal conduit according to drawing, No. T050-0539 T or T050-0540 T**
FM approved for hazardous locations

Class I, Division 2, Groups A, B, C, D
Class II Division 2, Groups F, G; Class III

NEMA Type 4X

i/p - positioner with position indicator, so e-n L ove and limit switches.

HAZARDOUS LOCATION (Div. 2)

SAFE LOCATION

Notes:
1) The installation must be in accordance with the National Electrical Code ANSI NFPA 70
2) For the maximum values for the individual circuits see Tab 1 and 2.
3) The cabinet shall be protected by conduits.
4) Cab is encrusted rigid metal conduit according to drawing No. 1050-0530 T and 1050-0560 T

Revisions Control Number: 1 August 2004

Addendum to EB 8355-2 EN