Pneumatic Positioner
Type 3766

Mounting and Operating Instructions

EB 8355-1 EN
Edition November 2011
Safety instructions

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

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

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

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

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.

Note on modification:
Positioners with model index 3766-...x.03 and higher are equipped with a hinged cover without venting connection.
The required exhaust air connection is now included in the mounting accessories. If these positioners are mounted on older actuator models, make absolutely sure that there is a vent connection. If necessary, replace the mounting accessories as well.
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Design and principle of operation

The positioners ensure a fixed assignment between the valve stem position (controlled variable x) and the pneumatic or electric input signal (reference variable w). They compare the input signal received from the control unit with the travel of the control valve and, issue the corresponding output signal pressure p_st (output variable).

The positioner consists of 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 60534-6-1) 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 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 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 reference variable.

The adjustable X_p restriction (8) and volume restriction Q (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 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 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 valve is in closed-loop operation.
Design and principle of 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.

1.1 Versions (article code)

<table>
<thead>
<tr>
<th>Pneumatic positioner Type 3766-</th>
<th>x x x 0 1 x x x 1 x 0 x 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion protection</td>
<td></td>
</tr>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>II 2 G EEx ia IIC T6 acc. to ATEX</td>
<td>1</td>
</tr>
<tr>
<td>FM/CSA intrinsically safe/non incendive</td>
<td>3</td>
</tr>
<tr>
<td>Ex ia / Ex n I/IIC T6 IP 65 IECEx TSA Australia</td>
<td>6</td>
</tr>
<tr>
<td>II 3 G EEx nA II T6 acc. to ATEX</td>
<td>8</td>
</tr>
<tr>
<td>Additional equipment</td>
<td></td>
</tr>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>Limit switch, inductive 2x SJ2 SN</td>
<td>2</td>
</tr>
<tr>
<td>(Analog position transmitter 4 to 20 mA *)</td>
<td>6 0 0</td>
</tr>
<tr>
<td>3/2-way solenoid valve</td>
<td></td>
</tr>
<tr>
<td>Without</td>
<td>0</td>
</tr>
<tr>
<td>6 V DC</td>
<td>2</td>
</tr>
<tr>
<td>12 V DC</td>
<td>3</td>
</tr>
<tr>
<td>24 V DC</td>
<td>4</td>
</tr>
</tbody>
</table>
Design and principle of operation

<table>
<thead>
<tr>
<th>Pneumatic positioner Type 3766-</th>
<th>x x x 0 1 x x x 1 x 0 x 0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pneumatic connections</strong></td>
<td></td>
</tr>
<tr>
<td>¼-18 NPT</td>
<td>1</td>
</tr>
<tr>
<td>ISO 228/1 - G ¼</td>
<td>2</td>
</tr>
<tr>
<td><strong>Electrical connections</strong></td>
<td></td>
</tr>
<tr>
<td>Without (no additional equipment or solenoid valve)</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>Cable gland</td>
<td></td>
</tr>
<tr>
<td>M20 x 1.5, blue (plastic)</td>
<td>1 0 0</td>
</tr>
<tr>
<td>M20 x 1.5, black (plastic)</td>
<td>2 0 0</td>
</tr>
<tr>
<td>M20 x 1.5 (nickel-plated brass)</td>
<td>2 1 3</td>
</tr>
<tr>
<td><strong>Housing version</strong></td>
<td></td>
</tr>
<tr>
<td>Die-cast aluminum</td>
<td>0</td>
</tr>
<tr>
<td>Stainless steel (CrNiMo)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>0</td>
</tr>
<tr>
<td>Low temperature</td>
<td></td>
</tr>
<tr>
<td>$T_{\text{min}} \geq -50 \degree\text{C}$; optional limit switches, solenoid valve</td>
<td>2 1 3</td>
</tr>
<tr>
<td><strong>Special version</strong></td>
<td></td>
</tr>
<tr>
<td>Without</td>
<td>0 0 0</td>
</tr>
<tr>
<td>GOST Ex approval 0Ex ia IIC T8 X</td>
<td>1 0 1 0</td>
</tr>
</tbody>
</table>

* Available until March 2011

Device functioning only as analog position transmitter: 3766-x60 000xxx00 000 0
1.2 Technical data

<table>
<thead>
<tr>
<th>Type 3766 Positioner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel range</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Opening angle</strong></td>
</tr>
<tr>
<td><strong>Reference variable w</strong></td>
</tr>
<tr>
<td><strong>Signal range</strong></td>
</tr>
<tr>
<td><strong>Span</strong></td>
</tr>
<tr>
<td><strong>Overloadable max.</strong></td>
</tr>
<tr>
<td><strong>Supply air</strong></td>
</tr>
<tr>
<td><strong>Auxiliary power</strong></td>
</tr>
<tr>
<td><strong>Air quality acc. to ISO 8573-1, edition 2001-02</strong></td>
</tr>
<tr>
<td><strong>Signal pressure p_st (output)</strong></td>
</tr>
<tr>
<td><strong>Characteristic</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
</tr>
<tr>
<td><strong>Operating direction</strong></td>
</tr>
<tr>
<td><strong>Proportional band X_p</strong></td>
</tr>
<tr>
<td><strong>Air consumption</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Air delivery</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Permissible ambient temperature 2) Standard</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Low temperature version</strong></td>
</tr>
<tr>
<td><strong>Influences</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Design and principle of operation

#### Electromagnetic compatibility
- Complying with requirements specified in EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21

#### Explosion protection
- Refer to article code or list of approvals in Data Sheet T 8355 EN

#### Degree of protection
- IP 54 (special version IP 65)

#### Weight
- Approx. 1 kg

### Additional equipment

#### Limit switches
- Two inductive proximity switches: Type SJ 2-SN
- Control circuit: Ratings according to downstream transistor relay
- Hysteresis at rated travel: ≤ 1%

#### 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)</td>
<td>≤ 1.2 V</td>
</tr>
<tr>
<td>Signal 1 (safe pick-up)</td>
<td>≥ 5.4 V</td>
</tr>
<tr>
<td>Maximum permissible signal</td>
<td>28 V</td>
</tr>
<tr>
<td>Coil resistance $R_i$ at 20 °C</td>
<td>2909 Ω</td>
</tr>
</tbody>
</table>

#### Air consumption in steady state
- In addition to that of the positioner: 'Off' ≤ 60 l/h · 'On' ≤ 10 l/h

<table>
<thead>
<tr>
<th>Type 3277 Actuator</th>
<th>120 cm²</th>
<th>240 cm²</th>
<th>350 cm²</th>
<th>700 cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 to 1 bar</td>
<td>≤ 0.5 s</td>
<td>≤ 0.8 s</td>
<td>≤ 1.1 s</td>
<td>≤ 4 s</td>
</tr>
<tr>
<td>0.4 to 2 bar</td>
<td>≤ 0.5 s</td>
<td>≤ 2 s</td>
<td>≤ 2.5 s</td>
<td>≤ 8 s</td>
</tr>
<tr>
<td>0.6 to 3 bar</td>
<td>≤ 1 s</td>
<td>≤ 1.5 s</td>
<td>≤ 5 s</td>
<td></td>
</tr>
</tbody>
</table>

#### Analog position transmitter

<table>
<thead>
<tr>
<th>Output signal</th>
<th>Two-wire circuit 4 to 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary power</td>
<td>Min. terminal voltage: 12 V, max.: 45 V</td>
</tr>
<tr>
<td>The position transmitter must only be connected to a certified intrinsically safe circuit</td>
<td></td>
</tr>
</tbody>
</table>

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1) With lowest setting of pressure regulator  
2) The limits of the EC-Type Examination Certificate additionally apply  
3) DC voltage at −25 °C  
4) DC voltage at +80 °C  
5) e.g. using a SAMSOMATIC Type 994-0103-KFD2-STC4-Ex1 Loop Isolator  
6) Actuator 120 cm² in all signal pressure ranges: ≤ 0.5 s
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 60534-6-1 (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 in 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 $\gg$) or decreasing (reverse action $\ll$).

This also applies when the reference variable decreases: direct action $\gg$ causes the signal pressure to decrease, reverse action $\ll$ causes the signal pressure to increase.

On the turnboard (7), the operating direction is indicated by symbols (direct $\gg$, reverse $\ll$).

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 $180^\circ$ and refasten the turnboard with the screw. Make sure the three rubber gaskets inserted in the housing remain in position.

NOTICE

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. $\gg$ or $\ll$.

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.
Fig. 3 · Mounting position and connections of Type 3277 (top) and Type 3277-5 120 cm² (bottom) Actuators
2. Screw the associated lever D1 or D2 (for 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 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 switch 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 side signal pressure 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.

**NOTICE**

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 (Figs. 3 and 4) 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.

**NOTICE**
When the valve is installed, the side cover of the actuator must be mounted such that the vent plug points downward.
### Table 1

<table>
<thead>
<tr>
<th>Required lever with associated clamp and distance plate</th>
<th>Actuator size [cm²]</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 with vent plug for output (38) Connecting thread</td>
<td>G ¼</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>¼ NPT</td>
<td>1400-6790</td>
</tr>
<tr>
<td>D1 (33 mm long with 17-mm-high clamp)</td>
<td></td>
<td>1400-6791</td>
</tr>
<tr>
<td>D2 (44 mm long with 13-mm-high clamp)</td>
<td></td>
<td>240 and 350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1400-6370</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1400-6371</td>
</tr>
</tbody>
</table>

### Table 2

| Switchover plate for actuators 120 cm²                  | Actuator 3277-5xxxxxx.00 (old) | 1400-6819 |
| Switchover plate new                                    | Actuator 3277-5xxxxxx.01 or higher (new) | 1400-6822 |
| Connecting plate for additional attachment of, e.g. a solenoid valve | Actuator 3277-5xxxxxx.00 (old), G ½ | 1400-6820 |
|                                                        | Actuator 3277-5xxxxxx.00 (old), ¼ NPT | 1400-6821 |
| Connecting plate new                                    | Actuator 3277-5xxxxxx.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.

### Table 3

<table>
<thead>
<tr>
<th>Piping required including screw fitting</th>
<th>Material</th>
<th>Actuator size [cm²]</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>For actuator: “Actuator stem retracts” or when the top diaphragm case is filled with exhaust air from the positioner</td>
<td>Steel</td>
<td>240</td>
<td>1400-6444</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
<td></td>
<td>1400-6445</td>
</tr>
<tr>
<td></td>
<td>Steel</td>
<td>350</td>
<td>1400-6446</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
<td></td>
<td>1400-6447</td>
</tr>
<tr>
<td></td>
<td>Steel</td>
<td>700</td>
<td>1400-6448</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
<td></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>700</td>
<td>1400-6443</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>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></td>
</tr>
<tr>
<td>Pressure gauge kit for supply pressure and signal pressure</td>
</tr>
<tr>
<td></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

Note: 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><strong>Actuator with fail-safe action “Actuator stem extends” (FA)</strong></td>
<td></td>
</tr>
<tr>
<td>Direct op. direction &gt;&gt;</td>
<td>Reverse op. direction &lt;&gt;</td>
</tr>
</tbody>
</table>

![Fig. 5 · Installing the spring on the back of the housing](image)

![Fig. 6 · Attachment to the left or right of the valve when NAMUR attachment is used](image)
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. Attach the clip (21) to the lever (18). If the actuator is attached with its air connection pointing to the front (Fig. 6), the clip must be attached to 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. Hang the required range spring (Table 6) between the diaphragm lever (3) and span adjuster screw (6.1) using the outer slot.
7. Adjust positioner as described in section 4.1.
Fig. 7 · Attachment according to IEC 60534-6 (NAMUR)
## Attachment to control valve

### Table 5

<table>
<thead>
<tr>
<th>Control valve</th>
<th>Travel [mm]</th>
<th>With lever</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAMUR mounting kit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refer to Fig. 7 concerning parts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve with cast yoke</td>
<td>7.5 to 60</td>
<td>N1 (125 mm)</td>
<td>1400-6787</td>
</tr>
<tr>
<td></td>
<td>22.5 to 120</td>
<td>N2 (212 mm)</td>
<td>1400-6789</td>
</tr>
<tr>
<td>Valve with rod-type yoke, rod diameter [mm]</td>
<td>20 to 25</td>
<td>N1</td>
<td>1400-6436</td>
</tr>
<tr>
<td></td>
<td>20 to 25</td>
<td>N2</td>
<td>1400-6437</td>
</tr>
<tr>
<td></td>
<td>25 to 30</td>
<td>N1</td>
<td>1400-6438</td>
</tr>
<tr>
<td></td>
<td>25 to 30</td>
<td>N2</td>
<td>1400-6439</td>
</tr>
<tr>
<td></td>
<td>30 to 35</td>
<td>N1</td>
<td>1400-6440</td>
</tr>
<tr>
<td></td>
<td>30 to 35</td>
<td>N2</td>
<td>1400-6441</td>
</tr>
<tr>
<td>Attachment to Fisher and Masoneilan linear actuators (one each of both mounting kits is required per actuator)</td>
<td></td>
<td></td>
<td>1400-6771 and 1400-6787</td>
</tr>
<tr>
<td>Additional range spring acc. to Table 6</td>
<td>Range spring 1 (9.5 coils, installed as standard)</td>
<td></td>
<td>1400-6442</td>
</tr>
<tr>
<td></td>
<td>Range spring 2 (4.5 coils)</td>
<td></td>
<td>1400-6443</td>
</tr>
</tbody>
</table>

#### 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>60</th>
<th>60</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin on marking*</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</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>
</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>
</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>
</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>
</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.

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.

<table>
<thead>
<tr>
<th>Table 7 - Complete mounting parts, including range spring 2, but excluding the cam disk</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment acc. to VDI/VDE 3845, level 1</td>
<td>1400-8815</td>
</tr>
<tr>
<td>SAMSON Type 3278 Actuator</td>
<td>160 cm²</td>
</tr>
<tr>
<td>VETEC Type S</td>
<td>320 cm²</td>
</tr>
<tr>
<td>VETEC Type R</td>
<td>R 100 to R 250</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>

<table>
<thead>
<tr>
<th>Range spring required</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard operation of reference variable, range spring 2 (4.5 coils)</td>
<td>1400-6443</td>
</tr>
<tr>
<td>Split-range operation, range spring 1 (9.5 coils, installed as standard)</td>
<td>1400-6442</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cam disk with accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear basic characteristic 3)</td>
<td>(0050-0072), op. angle 0 to 70°, also for Type 3310</td>
</tr>
<tr>
<td>Equal percentage basic characteristic 3)</td>
<td>(0050-0073), opening angle 0 to 90°</td>
</tr>
<tr>
<td>Linear 1)</td>
<td>(0050-0080), op. angle 0 to 70°, for control butterfly valves</td>
</tr>
<tr>
<td>Equal percentage 2)</td>
<td>(0050-0081), op. angle 0 to 70°, for control butterfly valves</td>
</tr>
<tr>
<td>Linear 1)</td>
<td>(0050-0074, VETEC), opening angle 0 to 75°</td>
</tr>
<tr>
<td>Equal percentage 2)</td>
<td>(0050-0075, VETEC), opening angle 0 to 75°</td>
</tr>
<tr>
<td>Linear 1)</td>
<td>(0050-0079, Camflex) set to between 0 and 55°</td>
</tr>
<tr>
<td>Equal percentage 2)</td>
<td>(0059-0008, Camflex) set to between 0 and 55°</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure gauge build-on block</td>
<td>G ¼</td>
</tr>
<tr>
<td></td>
<td>¼ NPT</td>
</tr>
<tr>
<td>Pressure gauge kit</td>
<td>St. steel/Brass</td>
</tr>
<tr>
<td></td>
<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>
<td>1790-7408</td>
</tr>
<tr>
<td>Assortment of spare parts including seals and diaphragms</td>
<td>1400-9895</td>
</tr>
</tbody>
</table>
**NOTICE**
Use the correct range spring (1 or 2)! Range spring 1 is installed as standard.

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.

**NOTICE**
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 back 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.
Attachment to SAMSON Type 3278

Attachment acc. to VDI/VDE 3845

33 Positioner
34 Intermediate piece
35 Lever with cam follower roll
36 Adapter
37 Feedback lever
38 Screws
39 Scale
40 Cam disk
41 Actuator shaft
42 Plate
43 Mounting bracket
44 Coupling
45 Seal

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.

**NOTICE**

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.

**NOTICE**

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.

**NOTICE**

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.
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>

Cam follower roll
Starting point N
Holes to secure the cam disk
Insert clip and press tongue outwards

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>

Cam follower roll
Starting point I

Position at max. signal pressure

Fig. 9: Setting the cam disk for single-acting rotary actuators
Double-acting springless rotary actuator with reversing amplifier

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

View from the positioner onto the actuator shaft

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

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

Cam follower roll  
Starting point N

Insert clip and press tongue outwards

Holes to secure the cam disk

View from the positioner onto the actuator shaft

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

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

Cam follower roll  
Starting point N

Starting point I

Fig. 10 · Setting the cam disk for double-acting actuators
Securing the aligned cam disk

To additionally prevent the cam disk from being turned, drill a hole into the adapter (36) or the coupling (44) and install a 2 mm dowel pin.

Four bore holes are located centrically around the center hole on the cam disk. Select a suitable hole 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.

Type 3710

Refer to the Mounting and Operating Instructions EB 8392 EN for the mounting of the SAMSON Type 3710 Reversing Amplifier.

1079-1118 or 1079-1119

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

The output signal pressure of the positioner is supplied at the output $A_1$ of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at $A_1$, is applied at output $A_2$.

The rule $A_1 + A_2 = Z$ applies.

On using the reversing amplifier, make sure that the adjuster of the pressure regulator (9 in Fig. 2) is turned as far as it will go in the clockwise direction. Refer also to section 3.1.2.

Mounting

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

1. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the threaded holes of the positioner.
2. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the special hollow screws (1.1) into the connecting boreholes $A_1$ and $Z$.
3. Place the reversing amplifier onto the positioner and screw tight using both the special screws (1.1).

Signal pressure connections

$A_1$: Connect output $A_1$ to the signal pressure connection on the actuator that opens the valve when the pressure increases.

$A_2$: Connect output $A_2$ 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 $A_1$ and $Z$.

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

Pressure gauges for supply air $Z$ and output $A_1$ as listed in Tables 4, 5 and 7.
Fig. 11 · Mounting a reversing amplifier

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

NOTICE
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 3766-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 3766-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 \( p_{\text{stmax}} \):

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

\( d = \) Seat diameter [cm]
\( \Delta p = \) Differential pressure at the valve [bar]
\( A = \) Actuator diaphragm area [cm²]
\( F = \) 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 pres-
sure regulator (9) can be continuously ad-
justed. When the adjuster is turned counter-
clockwise as far as it will go, signal pres-
sures 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 cer-
tain 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 atmo-
sphere!

- For electrical installation, observe the rel-
evant 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 instal-
lations 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 pro-
tection to become ineffective!
- Do not loosen enameled screws in or on
the housing.
- The maximum permissible values speci-
ified in the national EC type examination
certificates apply when interconnecting
intrinsically safe electrical equipment \((U_i \ or \ U_o; \ I_i \ or \ I_o; \ P_i \ or \ P_o; \ C_i \ or \ C_o; \ and \ L_i \ or \ L_o)\).

Depending on the version use, the positioner
is equipped with inductive limit switches
and/or a solenoid valve.

Versions with position transmitter do not
permit the connection of this additional
equipment.
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.

**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.

---

**Connections**

On the rear

Version with position transmitter

![Electrical connections diagram](image-url)
Accessories

Cable gland M20 x 1.5
Black plastic Order no. 1400-6985
Blue plastic Order no. 1400-6986
Nickel-plated brass Order no. 1890-4875
Adapter M20 x 1.5 to NPT:
Aluminum, powder-coated 0310-2149

3.2.1 Switching amplifier

For operation of the limit switches, switching amplifiers must be connected in the output circuit. To ensure the operating reliability of the positioner, the amplifiers should comply with the limit values of the output circuits conforming to NAMUR. If the positioner is to be installed in hazardous areas, the relevant regulations must be observed.
4 Operation

4.1 Setting 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 (0.2 or 1 bar) 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, bottom), 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 0.2 to 0.6 bar, second valve set to 0.6 to 1 bar). To avoid overlapping, allow for a dead band of ±0.05 bar 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 pressure adjuster to the signal input and apply supply pressure to the supply air input.

![Fig. 13 · Normal and split-range operation](image-url)
4.1.1 Adjusting the proportional band Xp and air delivery Q

1. Close the volume restriction Q (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 Xp to a medium value (½ turn).
5. Check the valve’s tendency to hunt and the positioning speed by briefly tapping the diaphragm lever (3).
   The Xp value is to be adjusted to be as small as possible, without considerable overshooting occurring.

Note: Always adjust the Xp restriction before setting the starting point.
Later modifications shift the zero point!

4.1.2 Settings for actuator: "Actuator stem extends"

NOTICE
To ensure that the valve can be closed with full force, fully vent the diaphragm chamber when the reference variable reaches its lower (operating direction <<) and upper (operating direction <> ) value.
As a result, adjust the input signal to a slightly increased starting point of 0.23 bar for direct operating direction <<; for reverse operating direction <>, adjust the input signal to a slightly reduced starting point of 0.97 bar.

Starting point (e.g. 0.23 bar)

1. Use the pressure adjuster to set the input signal to 0.2 bar.
2. Turn the zero adjuster (6.2) until the valve just starts to move from its initial position.
3. Shut off the input signal and slowly increase it again. Check whether the valve starts to move at exactly 0.23 bar.
   Correct any deviation at the zero adjuster (6.2).

Upper range value (e.g. 1 bar)

1. Once the starting point has been set, increase the input signal to 1 bar using the pressure adjuster.
   At exactly 1 bar, 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, shut off the input signal and slowly increase it again. Check the starting point and the upper range value. Repeat the correction procedure until both values are correct.

4.1.3 Settings for actuator:  
"Actuator stem retracts"

**NOTICE**
When using an actuator with fail-safe action "Actuator stem retracts", the diaphragm chamber must be pressurized with a signal pressure that suffices to tightly close the valve even when an upstream pressure is applied in the plant. This applies to an upper range value of the reference variable (1 bar) and operating direction >> as well as a lower range value of the reference variable (0.2 bar) 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. 1 bar)
1. Use the pressure adjuster to set the input signal to 1 bar.
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 1 bar again. Check whether the valve starts to move at exactly 1 bar.
4. Correct any deviation on the zero adjuster (6.2). Turning the adjuster counterclockwise causes the valve to move from its end position earlier; turning clockwise causes the valve to move from its end position later.

Upper range value (e.g. 0.2 bar)
1. Once the starting point has been set, adjust the control signal to 0.2 bar using the pressure adjuster. At exactly 0.2 bar, the plug stem must stand still, having passed through 100% travel (watch the 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 1 bar.
4. Turn the zero adjuster (6.2) again until the pressure gauge indicates the required signal pressure (see section 3.1.2).
If no pressure gauge is available, set the starting point to 0.97 bar instead.

**NOTICE**
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, of the positioner, and of 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 positioners for rotary actuators, reassign the cam disk as shown in Figs. 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.
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.

<table>
<thead>
<tr>
<th>Table 8</th>
<th>Direct attachment to Type 3277 Actuator (Fig. 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left attachment</td>
</tr>
<tr>
<td></td>
<td>Switch</td>
</tr>
<tr>
<td>Valve position</td>
<td>Tag OUT</td>
</tr>
<tr>
<td>CLOSED</td>
<td>B</td>
</tr>
<tr>
<td>OPEN</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 9</th>
<th>NAMUR attachment on right or left (Fig. 6) and attachment to rotary actuators (Fig. 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating direction</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;</td>
<td>CLOSED</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>CLOSED</td>
</tr>
<tr>
<td></td>
<td>OPEN</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>Transmitter signal</th>
<th>Direction of signal</th>
<th>Set zero/span to</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
<td>Current increases ↑</td>
<td>OK</td>
<td>20 mA 4 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not OK Change plug</td>
<td>4 mA 20 mA</td>
</tr>
<tr>
<td>CLOSED</td>
<td>Current drops ↓</td>
<td>OK</td>
<td>4 mA 20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not OK Change plug</td>
<td>20 mA 4 mA</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 in 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 the positioner

The pneumatic positioner (3766-x...04 and higher) can be converted to form a Type 3767 Electropneumatic Positioner.

Note: Conversion of explosion-protected versions only on request.

Apart from the Type 6112 i/p Module (see Table 11), the associated conversion kit including screw gland, fastening screw, clamps and cables must be ordered.

1. Remove the support with the terminal case (if existing).
2. Unscrew the connecting plate (3) and remove the silicone hose (2). Remove the guard plate (4) and pneumatic screw gland (1).
3. Connect the connecting cable to the terminal base and the i/p module (6). Lead the blue cable to the minus side and the red cable to the plus side. Fasten the cables with terminal screws.
4. Check that the sealing hoses (7, 8) are properly inserted on the bottom section of the i/p module. When the module is installed (broken line in Fig. 16), the sealing hose including restriction and filter must be located on the right above the inner of the two bore holes (supply).
5. Fasten the i/p module and terminal base using two screws each.
6. Close the housing on the side using the cable gland (5) or a plug with sealing ring.
7. Change model index on the nameplate to Type 3767 i/p Positioner.

Table 11

<table>
<thead>
<tr>
<th>Required input signal (reference variable)</th>
<th>Required i/p module (order no.)</th>
<th>Required conversion kit (order no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ... 20 mA</td>
<td>6112-041110</td>
<td>1400-7574</td>
</tr>
<tr>
<td>0 ... 20 mA</td>
<td>6112-042110</td>
<td></td>
</tr>
<tr>
<td>1 ... 5 mA</td>
<td>6112-043110</td>
<td></td>
</tr>
</tbody>
</table>
Note: For details on Type 3767 Positioners, refer to Mounting and Operating Instructions EB 8355-2 EN.
6 Service

6.1 Servicing explosion-protected devices

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

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

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

6.2 Maintenance, calibration and work on equipment

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

The maximum values for intrinsically safe circuits specified in the approvals must be kept.
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

Pneum. connection
of reversing amplifier

Output 1 (A1)

Output 2 (A2)

Supply (Z)
TRANSLATION

EC TYPE EXAMINATION CERTIFICATE


(2) EC Type Examination Certificate Number

PTB 01 ATEX 2171

(4) Equipment: Model 3766-1.. Positioner

(5) Manufacturer: SAMSON AG Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, 60314 Frankfurt am Main, Germany

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

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0107 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 specified in Annex II to the Directive.

The examination and test results are recorded in confidential report.

PTB Ex 01-21198

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


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

(11) According to the Directive 94/9/EC, this EC Type Examination Certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the Manufacture and supply of this equipment.

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

II 2 G Ex ia IIC T6

Zertifizierungsstelle Explosionsschutz

By order

(Signature)  (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, 26 November 2001
Schedule

EC TYPE EXAMINATION CERTIFICATE No. PTB 01 ATEX 2171

Description of Equipment

The model 3766-1.1. Positioner is intended for attachment to pneumatic control valves and serves for converting control signals of 0.2 to 1 bar from a control device into a pneumatic signal pressure of 6 bar max. for pneumatic auxiliary power non-combustible media are used.

The inductive limit switches, position indicator and solenoid valves are passive two-terminal networks which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of U, I, and Pt are not exceeded.

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

Electrical data

Models 3766 - 11/..- 12. with Inductive Limit Switches

Inductive limit switch Type of Protection: Intrinsic safety EEx ia IIC or EEx ia II B respectively only for connection to a certified intrinsically safe circuit

Maximum values

| Ua | 16 V |
| Ia | 52 mA |
| Pt | 169 W |
| Ct | 5 nF |

The correlation between version, temperature classification, permissible ambient temperature ranges and maximum power dissipation 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 or</td>
</tr>
<tr>
<td>T4</td>
<td>-45 °C ... 75 °C</td>
<td>25 mA or</td>
</tr>
<tr>
<td>T6</td>
<td>-45 °C ... 60 °C</td>
<td>25 mA or</td>
</tr>
<tr>
<td>T5</td>
<td>-45 °C ... 80 °C</td>
<td>25 mA or</td>
</tr>
</tbody>
</table>

Model 3766-16 with Position Indicator

Signal Circuit Type of protection: Intrinsic safety EEx ia IIC (terminals 31/32)

Maximum values:

| Ua | 28 V |
| Ia | 115 mA |
| Pt | 1 W |
| Ct | 5.3 nF |

Model 3766-1.2/..-1.3/..-1.4 with Solenoid Valve

Signal Circuit Type of protection: Intrinsic safety EEx ia IIC (terminals 81/82)

The correlation between version, temperature classification, permissible ambient temperature ranges and maximum power dissipation is shown in the table below:

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.

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

<table>
<thead>
<tr>
<th>Version</th>
<th>Un</th>
<th>6V</th>
<th>12 V</th>
<th>24 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature class</td>
<td>T6</td>
<td>60 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T5</td>
<td>-45 °C ≤ Ts ≤ 70 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>80 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic linear or rectangular</td>
<td>Pi</td>
<td>*</td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>

Ci negligible, Li negligible

* The permissible maximum power dissipation Pi in the 6 V version is 230 mW
** The maximum values for connection to a certified intrinsically safe circuit are shown in the table below:

<table>
<thead>
<tr>
<th>Ui</th>
<th>25 V</th>
<th>27 V</th>
<th>28 V</th>
<th>30 V</th>
<th>32 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>150 mA</td>
<td>125 mA</td>
<td>115 mA</td>
<td>100 mA</td>
<td>85 mA</td>
</tr>
<tr>
<td>Pi</td>
<td>no limitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ci negligible; Li negligible

(16) Test report PTB Ex 01-21198

(17) Special conditions for safe use

None

(18) 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
TRANSLATION
Statement of Conformity


(2) EC Type Examination Certificate Number

PTB 01 ATEX 2195 X

(4) Equipment: Model 3766-B Positioner

(5) Manufacturer: SAMSON AG

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

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

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

The examination and test results are recorded in confidential report

PTB Ex 01-21199

(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.
Schedule of Conformity PTB 02 ATEX 2007 X

17) Special conditions for safe use

The Model 3766-8... Positioner shall be installed in an enclosure providing at least Degree of Protection IP 64 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 tensile and/or torsional stress.

The signal current circuit (terminals 21/32) shall be provided with a series-connected fuse outside of the hazardous area. This fuse shall comply with IEC 127-2/3, 250V T, with a fuse nominal current In of ≤ 50mA max.

18) Basic health and safety requirements

Are satisfied by compliance with the standard specified.

Zertifizierungsstelle Explosionschutz Braunschweig, ....................

By order

(Signature) (seal)

Dr. Ing. U. Johannsmeyer

Test report: PTB Ex 01-21199

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

Physikalisch-Technische Bundesanstalt, Bundesallee 100, D-38116 Braunschweig
PTB15 Ex n.doc
Manufacturer Declaration

made out to:
BASF Aktiengesellschaft, Carl-Bosch-Str. 38, D-67056 Ludwigshafen

types:
Inductive sensors FJ,,, NB,,, LC,,, NJ,,, RG,,, RJ,,, TG,,, SC,,, SJ,,
capacitive sensors CB,,, CC,,, CJ,,

Applies only to sensors that have an EC-Type Examination Certificate according Directive 94/9/EC category 2G or 1G.

Pepper+Fuchs GmbH Mannheim declares in its sole responsibility that the above mentioned sensors are according to the requirements of Zone 2. The type of protection is

II 3G Ex nL IIC T6

conform to standard: EN50021:1999

In deviation to this standard the sensors are not marked with II 3G Ex nL IIC T6.
The sensors are marked according to the EC-Type Examination Certificate category 2G or 1G.

The sensors have to be connected to energy-limited circuits only with type of protection Ex nL.
The values of the equivalent internal reactances C, and L, and the maximum permissible ambient temperature are given in the EC-Type Examination Certificate category 2G.

The maximum permissible ambient temperature has to be taken from the temperature table, which is subdivided into different types and temperature classes, of the assigned EC-Type Examination Certificate.
The maximum input values U, I, P are given in the following table (type 4 only if this type is listed in the assigned EC-Type Examination Certificate).

<table>
<thead>
<tr>
<th>Type</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>20V</td>
<td>20V</td>
<td>20V</td>
</tr>
<tr>
<td>I</td>
<td>25 mA</td>
<td>25 mA</td>
<td>62 mA</td>
</tr>
<tr>
<td>P</td>
<td>34 mW</td>
<td>64 mW</td>
<td>169 mW</td>
</tr>
</tbody>
</table>

The special conditions of the EC-Type Examination Certificate category 2G and the instructions according category 5G have to be taken into account.

For use according to Directive 94/9/EC within the European Community this manufacturer declaration is not sufficient, because the following requirements of the Directive 94/9/EC are not met: marking on the sensor, instruction, declaration of conformity.

Pepper+Fuchs Mannheim is subject to the rules of a quality management system according to DIN EN ISO 9001

Signature of Manufacturer: i.V. Ehrenfried
Function of the signer: head of R&D EMS factory automation
i.A. Wanninger
standards expert factory automation

date: 2003-03-14
Addendum Page 1

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

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

<table>
<thead>
<tr>
<th>Table 1: Maximum values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position - Indicator</strong></td>
</tr>
<tr>
<td><strong>Limit switches</strong> (Inductive)</td>
</tr>
<tr>
<td><strong>Solenoid valve</strong></td>
</tr>
<tr>
<td><strong>Circuit No.</strong></td>
</tr>
<tr>
<td><strong>Terminal No.</strong></td>
</tr>
<tr>
<td><strong>Ua or Vmax</strong></td>
</tr>
<tr>
<td><strong>Ia or Imax</strong></td>
</tr>
<tr>
<td><strong>R or Pmax</strong></td>
</tr>
<tr>
<td><strong>G</strong></td>
</tr>
<tr>
<td><strong>Ia</strong></td>
</tr>
</tbody>
</table>

**Notes:**
- All parameters must meet the following requirements:
  - \[ U_{oa} \leq U \text{ or } V_{max} \]
  - \[ I_{oa} \leq I \text{ or } I_{max} \]
  - \[ P_{oa} \leq R \text{ or } P_{max} \]
  - \[ G \geq G_0 \text{ and } I_a \geq I_a \]

Addendum Page 2

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

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>- 45°C - 60°C</td>
</tr>
<tr>
<td>T5</td>
<td>- 45°C - 70°C</td>
</tr>
<tr>
<td>T4</td>
<td>- 45°C - 80°C</td>
</tr>
</tbody>
</table>

**Table 4:** For the Mode 3766-3 Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short circuit current is shown in the table below.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>Maximum short current</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>- 45°C - 60°C</td>
<td>52mA</td>
</tr>
<tr>
<td>T5</td>
<td>- 45°C - 70°C</td>
<td>28mA</td>
</tr>
<tr>
<td>T4</td>
<td>- 45°C - 80°C</td>
<td>28mA</td>
</tr>
</tbody>
</table>

**Installation Manual for apparatus certified by CSA for hazardous locations.**

**Class I, Group A, B, C, D**
- Class II: Group E, F, G
- Class III: Type 4 Enclosure

**Notes:**
1. The Instrantion shall be in accordance with the Canadian Electrical Code Part 1.
2. Each pair of wires shall be provided with a grounded shield. The shield shall extend as close to the terminal as possible. Each shield shall be grounded to the L.S. bus in terminal 3.
3. Each pair of wires must be protected by a shield that is grounded to the L.S. Ground. The shield shall extend as close to the terminal as possible.

**Revisions Control Numbers:**
- Addendum to EB 8355-1 EN
- Addendum to EB 8355-1 EN
HAZARDOUS LOCATION

SAFE LOCATION

Version: Mode 3766-3 with a monitor, limit switch(s), and safety valve.
Mode 3766-3 with position indicator.

Relay or transistor output 2 or channel [a] vs. CSA certified.

Supply and safety barrier CSA certified.

Position indicator channel 1 on version 3766-36

For the permissible maximum values for the intrinsic safety circuits, see Table 1.
For the permissible barrier parameters for the circuits 1 and 4, see Table 2.

Cable entry M 30 x 1.5 or metal conduit according to drawing No. 1050-0539 T or 1050-0540 T

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

Revisions Control Number 1 May 05
Addendum to EB 8355-1 EN
Table 3: The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>65°C</td>
</tr>
<tr>
<td>T5</td>
<td>-40°C ≤ ta ≤ 70°C</td>
</tr>
<tr>
<td>T4</td>
<td>80°C</td>
</tr>
</tbody>
</table>

Table 4: For the Mode 376.6 - 3 Positioner temperature classification, permissible ambient temperature ranges and maximum short-circuit current 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</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>75°C</td>
<td></td>
</tr>
</tbody>
</table>

Intrinsically safe if installed as specified in manufacturer’s installation manual.

FM approved for hazardous locations

Class I, Zone 0, ATEX IIC T6

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

NEMA Type 4X

Notes:

1) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with the FM approved apparatus. For maximum values of overload, motor, motor power, etc and if the wiring apparatus see Table 1.

2) The apparatus may be installed in intrinsically safe circuits only when used in conjunction with the FM approved intrinsically safe barrier. For barrier selection see Table 2.

3) Installation must be in accordance with the National Electrical Code ANSI/NEPA 70 and ANSI/ISA RS 12.0.6.01

4) Use only supplies suitable for 5°C above surrounding temperature.

Versions: Mode 376.6-3 with solid state and inductive limit switches.

Mode 376.6-36 with position indicator.

Reactor or transformer output 2 or 3 channel(s) and FM/CSA approved.

Supply and guard barrier FM/CSA approved.

Position indicator channel 1 on version 376.6-36

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

For the permissible barrier parameters for the circuits 2 and 4 see Table 2.

Cab e entry M 20 x 1.5 or metal conduit according to drawing No. 1036-0539 T or 1036-0540 T

Revisions Control Number 1 August 2004 Addendum to EB8355-1 EN
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 e 1 and 2.
3.) The cables shall be protected by conduits.
4.) Cables entry only rigid metal conduit according to drawing No. 1050-0539 T and 1050-0540 T