Electronic Limit Switch
Type 3738-20

with optional integrated solenoid valve
for rotary actuators for on/off applications
Definitions of the signal words used in these instructions

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

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

**NOTICE**
indicates a property damage message.

**Note:** Supplementary explanations, information and tips
## Firmware revisions

<table>
<thead>
<tr>
<th>Firmware</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.12</td>
<td><strong>Changes to parameters and error messages (see section 12)</strong></td>
</tr>
<tr>
<td></td>
<td>- Parameter renumbered due to parameters being added or removed.</td>
</tr>
<tr>
<td></td>
<td>- Removed parameters:</td>
</tr>
<tr>
<td></td>
<td>• PST initialization (the partial stroke test no longer needs to be initialized)</td>
</tr>
<tr>
<td></td>
<td>• Info: Rotary motions</td>
</tr>
<tr>
<td></td>
<td>- Added parameters:</td>
</tr>
<tr>
<td></td>
<td>• Actuator type (rotary or linear actuator). See section 8.3</td>
</tr>
<tr>
<td></td>
<td>• Switching function of contacts (NO or NC contact). See section 8.5</td>
</tr>
<tr>
<td></td>
<td>- Error message renumbered due to error messages being removed.</td>
</tr>
<tr>
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<td>- Removed error messages:</td>
</tr>
<tr>
<td></td>
<td>• PST target range not reached</td>
</tr>
<tr>
<td></td>
<td>• PST target range exceeded</td>
</tr>
<tr>
<td></td>
<td>- The new parameter <em>Actuator type</em> as well as the parameter <em>Direction of action of actuator</em> are locked after the electronic limit switch has been initialized. See sections 8.3 and 8.4.</td>
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<tr>
<td></td>
<td>- The actuator transit time monitoring (F4) depends on the value adjusted in <em>Status readout F4</em> (P13). This is adjustable between 0.5 and 1800 s or can be deactivated (OFF).</td>
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<tr>
<td></td>
<td>- The dead time is already included in the information parameters <em>Actuator transit time when SV is de-energized</em> (P22) and <em>Actuator transit time when SV is energized</em> (P23).</td>
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<tr>
<td></td>
<td>- The monitoring of the rotary motion counter can be deactivated by configuring <em>Maximum rotary motions</em> (P26) = OFF.</td>
</tr>
</tbody>
</table>

|          | **Changes to the partial stroke test (PST) (see section 9.2)** |
|          | - The minimum pulse length at contact C is three seconds during partial stroke testing. |
|          | - The PST target range is made up of *PST step final value* (P14) ± ½ *PST tolerance band* (P15). |
|          | - After a successfully completed partial stroke test, the assessment of the transit times when the solenoid valve is de-energized and energized (*PST transit time when SV is de-energized* and *PST transit time when SV is energized*). In firmware version 1.01 only the duration of the entire test could be read. |
|          | - In the TROVIS-VIEW software, a diagram plotting the valve position against time when the solenoid valve is de-energized and energized is shown (256 measuring points). The data can be read out by connecting the device at the SSP interface to a PC. |
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Important safety instructions</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Article code</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Design and principle of operation.</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>3.1 Versions</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>3.2 Technical data</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>3.2.1 Electronic limit switch</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>3.2.2 Solenoid valve</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>3.3 Communication</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>3.4 Safety-related information</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>Attachment to rotary actuators – Mounting parts and accessories</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>4.1 Version with integrated solenoid valve</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>4.1.1 Attachment to rotary actuators with 20 mm shaft height</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>4.1.2 Attachment to rotary actuators with 30 mm shaft height</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>4.1.3 Attachment to rotary actuators with 50 mm shaft height</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>4.2 Version for external solenoid valve</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>4.2.1 Attachment to rotary actuators with 20 mm shaft height</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>4.2.2 Attachment to rotary actuators with 30 mm shaft height</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>4.2.3 Attachment to rotary actuators with 50 mm shaft height</td>
<td>27</td>
</tr>
<tr>
<td>5</td>
<td>Connections</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>5.1 Pneumatic connections</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>5.1.1 Version with integrated solenoid valve</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>5.1.2 Version with external solenoid valve</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>5.2 Electrical connections</td>
<td>29</td>
</tr>
<tr>
<td>6</td>
<td>Operator controls and readings</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>6.1 Rotary pushbutton</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>6.2 SAMSON SSP interface</td>
<td>33</td>
</tr>
<tr>
<td>7</td>
<td>Operating structure</td>
<td>34</td>
</tr>
<tr>
<td>8</td>
<td>Start-up – Settings</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>8.1 Adapting the display</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>8.2 Verifying readings on display</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>8.3 Determining the actuator type</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>8.4 Determining the direction of action</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>8.5 Determining the switching function of contacts</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>8.6 Adjusting the limit switches</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>8.7 Initialization</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>8.8 Start-up after replacing an electronic limit switch</td>
<td>45</td>
</tr>
</tbody>
</table>
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.9</td>
<td>45</td>
</tr>
<tr>
<td>8.10</td>
<td>46</td>
</tr>
<tr>
<td>9</td>
<td>46</td>
</tr>
<tr>
<td>9.1</td>
<td>46</td>
</tr>
<tr>
<td>9.1.1</td>
<td>46</td>
</tr>
<tr>
<td>9.1.2</td>
<td>47</td>
</tr>
<tr>
<td>9.2</td>
<td>47</td>
</tr>
<tr>
<td>9.2.1</td>
<td>49</td>
</tr>
<tr>
<td>9.2.2</td>
<td>50</td>
</tr>
<tr>
<td>9.2.3</td>
<td>51</td>
</tr>
<tr>
<td>9.3</td>
<td>53</td>
</tr>
<tr>
<td>9.4</td>
<td>55</td>
</tr>
<tr>
<td>9.5</td>
<td>55</td>
</tr>
<tr>
<td>9.5.1</td>
<td>55</td>
</tr>
<tr>
<td>9.5.2</td>
<td>56</td>
</tr>
<tr>
<td>9.5.3</td>
<td>56</td>
</tr>
<tr>
<td>10</td>
<td>57</td>
</tr>
<tr>
<td>11</td>
<td>57</td>
</tr>
<tr>
<td>12</td>
<td>58</td>
</tr>
<tr>
<td>12.1</td>
<td>63</td>
</tr>
<tr>
<td>12.2</td>
<td>65</td>
</tr>
<tr>
<td>13</td>
<td>67</td>
</tr>
<tr>
<td>Index</td>
<td>72</td>
</tr>
</tbody>
</table>
1 Important safety instructions

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

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

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

- Any hazards that could be caused by moving parts are to be prevented by means of the appropriate measures.

- For use within hazardous areas, the Special conditions for safe use (17) in the EC Type Examination Certificate must be observed.

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

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

- Proper shipping and appropriate storage are assumed.

- Do not ground electric welding equipment near to the electronic limit switch.

---

**Note:** The device with a CE marking fulfills the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).
## Article code

<table>
<thead>
<tr>
<th>Electronic Limit Switch</th>
<th>Type 3738-20-</th>
<th>x x x 1 x 0 0 x x x 0 x</th>
</tr>
</thead>
<tbody>
<tr>
<td>With LC display</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosion protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without</td>
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<tr>
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<td></td>
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<tr>
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<tr>
<td>GOST: 0 Ex ia IIC T6 x, DIP A21 T80°C IP 66</td>
<td>1 1 3</td>
<td></td>
</tr>
<tr>
<td>GOST: 2 Ex e [ia] IIC T4X, DIP A21 T80°C IP 66</td>
<td>3 1 3</td>
<td></td>
</tr>
</tbody>
</table>

| Solenoid valve          |              |                         |
| External                | 0            |                         |
| Integrated              | 4            |                         |

| Company version         |              |                         |
| SAMSON                  | 0            |                         |
| AIR TORQUE              | 1            |                         |

| Housing                 |              |                         |
| Standard aluminum, black structured RAL 9005 | 1 | |

| Housing cover           |              |                         |
| Gray-beige              | 0            |                         |
| Black                   | 1            |                         |
| Silver-gray             | 3            |                         |

| Safety approval (refer to section 3.4) |              |                         |
| TÜV/IEC 61508            | 2            |                         |

| Special applications    |              |                         |
| None                    | 0            |                         |
3 Design and principle of operation

The Type 3738-20 Electronic Limit Switch can replace conventional solenoid valves and limit switches used for the automation of on/off valves without the need to change the wiring or signal level. Major features of the electronic limit switch include:

- Unification of the functions featured in limit switches and a solenoid valve in one housing
- Power supplied in a two-wire system from the connection of contact A, without the need for additional auxiliary power
- Non-contact sensing of the rotation angle by a magnetoresistive sensor system
- Integrated diagnostics with partial stroke test (PST)
- Suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration). Refer to section 3.4.

The electronic limit switch is designed for attachment to rotary actuators. The angle of rotation is measured without contact using a magnet positioned centrically on the actuator shaft by a screw. The screw with magnet does not need to be adjusted. The AMR (anisotropic magnetoresistive) sensor located in the device together with the measuring electronics (1) can detect the directional change of the applied magnetic field and, as a result, sense the rotation of the actuator.

The rotary actuator is actuated by a solenoid valve (7) which converts the binary signal issued by electric control equipment (6) into a binary pressure signal.

The electronic limit switch is fitted with four NAMUR contacts: The contact for fail-safe position (contact A, 13) and the contact for operating position (contact B, 14) issue a limit signal when the valve reaches the corresponding end position. Contact C (15) indicates when the PST target range of the partial stroke test has been reached. The fault alarm contact St (16) indicates the generation of status and error messages.

An electronic limit switch version for an external solenoid valve (Fig. 4) is available for higher air capacities required by large actuators. The principle of operation is the same.
Design and principle of operation

Electronic limit switch

Fig. 3 · Schematic diagram · Type 3738-20-xxx1400xxxx000 with integrated solenoid valve

1 AMR sensor with measuring electronics
2 A/D converter
3 Microcontroller
4, 5 Galvanic isolation
6 Actuation of solenoid valve
7 Solenoid valve
8 Air capacity booster
9 Display
10 Rotary pushbutton (on-site operation)
11 LED for solenoid valve
12 Internal supply
13 Contact A (limit switch for fail-safe position)
14 Contact B (limit switch for operating position)
15 Contact C (signal when PST target range reached)
16 Fault alarm contact St
Design and principle of operation

Electronic limit switch

Actuator

1. AMR sensor with measuring electronics
2. A/D converter
3. Microcontroller
4, 5. Galvanic isolation
6. Actuation of solenoid valve
7. Solenoid valve
9. Display
10. Rotary pushbutton (on-site operation)
11. LED for solenoid valve
12. Internal supply
13. Contact A (limit switch for fail-safe position)
14. Contact B (limit switch for operating position)
15. Contact C (signal when PST target range reached)
16. Fault alarm contact St

Signal for solenoid valve: V1

Power Supply

Fig. 4 · Schematic diagram - Type 3738-20-xxx1000xxxx00 with external solenoid valve
NAMUR contacts A, B, C

The contacts can be configured as either NO or NC contacts. See Fig. 5 and section 8.5.

NAMUR contact St

This contact is a NC contact.

3.1 Versions

Type 3738-20-xxx1400xxx000 with integrated solenoid valve

The electronic limit switch with integrated solenoid valve forms a compact automation unit together with a rotary actuator, which is easy to mount. The 3/2-way or 5/2-way function of the solenoid valve is selected by changing the position of a molded seal.

Based on VDI/VDE 3845, level 2, its version can be mounted onto Pfeiffer Type 31b Rotary Actuators. External air lines are not required.

Type 3738-20-xxx1000xxxx000 for external solenoid valve

The electronic limit switch for an external solenoid valve allows switching capacities up to max. 18 W at 24 V DC, meaning all common solenoid valves, even the Ex e versions, can be combined with the electronic limit switch.

This version is suitable for rotary actuators according to VDI/VDE 3845, level 2. See Fig. 6.

Changes to the electronic limit switch’s settings do not effect the external solenoid valve.

---

### Fig. 5 · NO and NC contacts

**NC contact**
- Wire breakage: 0.05 mA
- Responds: 1.2 mA
- No response: 2.1 mA
- Metal tag inside the inductive field

**NO contact**
- Wire breakage: 0.05 mA
- No response: 1.2 mA
- Responds: 2.1 mA
- Metal tag outside the inductive field
3.2 Technical data

3.2.1 Electronic limit switch

<table>
<thead>
<tr>
<th>Electronic limit switch</th>
<th>Type</th>
<th>3738-20-xxx1400xxxx000</th>
<th>3738-20-xxx1000xxxx000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
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<td>With internal solenoid valve</td>
<td>For external solenoid valve</td>
</tr>
<tr>
<td>Permissible range of rotation</td>
<td></td>
<td>Minimum: 0 to 30° · Maximum: 0 to 170°</td>
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<tr>
<td>Communication</td>
<td></td>
<td>Local communication</td>
<td>SAMSON SSP interface with serial interface adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Software requirements</td>
<td>TROVIS-VIEW with database module 3738-20</td>
</tr>
<tr>
<td>Supply air</td>
<td></td>
<td>Supply pressure</td>
<td>2.4 to 6 bar</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. particle size and density: Class 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Oil content: Class 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Moisture and water: Class 3</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Pressure dew point: At least 10 K beneath the lowest ambient temperature to be expected</td>
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<tr>
<td>Electric power supply</td>
<td></td>
<td>Powered over contact A acc. to IEC 60947-5-6 (e.g. NAMUR isolating switch amplifier)</td>
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<tr>
<td>Permissible ambient temperature</td>
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<td>–25 to 80 °C</td>
<td>–40 to 80 °C</td>
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<td>Limits specified in the examination certificate additionally apply</td>
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<tr>
<td>Influences</td>
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<td>Temperature</td>
<td>± 0.7 %/90° angle above the permissible temperature range</td>
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<td></td>
<td>Vibrations</td>
<td>≤ 0.25 % up to 2500 Hz and 4 g according to IEC 770</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
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<td>Requirements conforming to EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21</td>
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<tr>
<td>Electrical connections</td>
<td></td>
<td>Four M20 x 1.5 cable glands for 6 to 12 mm clamping range, screw terminals for 0.2 to 2.5 mm² wire cross-sections</td>
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<tr>
<td>Explosion protection</td>
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<td>Type 3738-20-000…:</td>
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<tr>
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<td>ATEX: Type 3738-20-110…:</td>
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</tbody>
</table>
## Design and principle of operation

### Electronic limit switch

<table>
<thead>
<tr>
<th>Type</th>
<th>3738-20-xxx1400xxxx000</th>
<th>3738-20-xxx1000xxxx000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>With internal solenoid valve</td>
<td>For external solenoid valve</td>
</tr>
<tr>
<td>Safety approval</td>
<td>Safety-related end position monitoring</td>
<td>The contacts are suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) acc. to IEC 61508. Refer to section 3.4.</td>
</tr>
<tr>
<td>Emergency venting</td>
<td>Refer to section 3.4</td>
<td>Same as specifications given by the solenoid valve manufacturer</td>
</tr>
<tr>
<td>Materials</td>
<td>Housing</td>
<td>Die-cast aluminum EN AC-AlSi12(Fe) (EN AC-44300) acc. to DIN EN 1706, powder paint coated</td>
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<tr>
<td></td>
<td>Housing cover</td>
<td>PC</td>
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<tr>
<td></td>
<td>Cover seal</td>
<td>PU</td>
</tr>
<tr>
<td></td>
<td>Visual indicator wheel</td>
<td>PC</td>
</tr>
<tr>
<td></td>
<td>Magnet material</td>
<td>Hard ferrite</td>
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<tr>
<td>Weight</td>
<td>Approx. 1.2 kg</td>
<td>Approx. 1.0 kg</td>
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</tbody>
</table>

### Contacts

- Only for connection acc. to IEC 60947-5-6, reverse polarity protection, galvanic isolation

<table>
<thead>
<tr>
<th>Switching function</th>
<th>NC contact</th>
<th>NO contact</th>
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</thead>
<tbody>
<tr>
<td>Switching contacts</td>
<td>No response/ no fault</td>
<td>≥ 2.1 mA</td>
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<td></td>
<td>Responds/ fault indication</td>
<td>≤ 1.2 mA</td>
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<tr>
<td>Hysteresis</td>
<td>1 %</td>
<td></td>
</tr>
</tbody>
</table>

#### Contacts

- Contact A
  - Limit switch for fail-safe position (solenoid valve de-energized)
  - **PTO (power to open):** Responds when the valve moves through the switching contact towards the lower end position (P7)
  - **PTC (power to close):** Responds when the valve moves through the switching contact towards the upper end position (P8)

- Contact B
  - Limit switch for operating position (solenoid valve energized)
  - **PTO (power to open):** Responds when the valve moves through the switching contact towards the upper end position (P8)
  - **PTC (power to close):** Responds when the valve moves through the switching contact towards the lower end position (P7)
  - Signal for wire breakage acc. to IEC 60947-5-6

- Contact C
  - Limit switch for intermediate position
  - **PTO (power to open):** Responds when the valve moves through the switching contact towards the operating position (P14)
  - **PTC (power to close):** Responds when the valve moves through the switching contact towards the fail-safe position (P14)

- Contact C
  - Signal when target range reached during partial stroke test
  - PST target range = PST step final value (P14) ± ½ PST tolerance band (P15)

- **Signal for wire breakage** acc. to IEC 60947-5-6
###Electronic limit switch

<table>
<thead>
<tr>
<th>Type</th>
<th>3738-20-xxx1400xxx000</th>
<th>3738-20-xxx1000xxxx000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>With internal solenoid valve</td>
<td>For external solenoid valve</td>
</tr>
<tr>
<td>Contacts</td>
<td>Contact St</td>
<td>Responds when a status or error message is generated</td>
</tr>
<tr>
<td></td>
<td>Fault alarm contact</td>
<td>Switching function of NC contact cannot be changed</td>
</tr>
<tr>
<td>Current specifications when contact A is not connected</td>
<td>Contact B: I = 50 µA (wire breakage)</td>
<td>Contact C: I = 1.2 mA</td>
</tr>
<tr>
<td></td>
<td>Contact St: I = 1.2 mA</td>
<td></td>
</tr>
</tbody>
</table>

###3.2.2 Solenoid valve

####Integrated solenoid valve (Type 3738-20-xxx1400xxx000)

| Current draw | \( I = \frac{2.7 \times U}{3650 \ \Omega} - 3.325 \) mA (corresponds to 14.4 mA at 24 V) |
| Version       | 3/2-way or 5/2-way-function |
|               | Function determined by the position of the molded seal |
| \( K_{VS} \) coefficient | 0.32 |
| Service life  | 1,000,000 switching cycles |
| Temperature range (operation) | -25 to +80 °C |
| Switching voltage | 24 V DC, reverse polarity protection, galvanic isolation |
| Nominal voltage | 24 V DC, reverse polarity protection, galvanic isolation |
| Signal 0      | No response < 6 V DC |
| Signal 1      | Min. 19.6 V DC, max. 32 V DC |
| Switching capacity | 24 V DC, 15.2 mA (0.36 W) |
| Duty cycle    | 100 % |
| Destruction limit | 32 V DC |

####External solenoid valve (Type 3730-20-xxx100000xxx00x)

Read manufacturer’s specifications!

<table>
<thead>
<tr>
<th>24 V DC, max. 18 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching voltage</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
3.3 Communication

The electronic limit switch can be configured on a computer using the TROVIS-VIEW Configuration and Operator Interface software. The electronic limit switch has for this purpose a local SAMSON SSP interface to allow the RS-232 or USB port of a computer to be connected to it over a serial interface adapter cable. The TROVIS-VIEW software enables the user to easily configure the electronic limit switch as well as view and document process parameters on a computer.

See Table 1 on page 20 for order numbers.

Note: The TROVIS-VIEW software is a common operator interface for various smart SAMSON devices. The software together with a device-specific module allow the configuration and parameterization of the device. The device-specific module for Type 3738 can be downloaded free of charge from the SAMSON website (Services > Software > TROVIS-VIEW). Additional information on TROVIS-VIEW (e.g. system requirements) can found on the SAMSON website and in the Data Sheet T 6661 EN.

3.4 Safety-related information

The Type 3738-20 Electronic Limit Switch was developed to meet the requirements stipulated in IEC 61508. The safety-related data are listed in the Manufacturer’s Declaration HE 1163.

The conformity of the development process, performed FMEDA and the statements in the Manufacturer’s Declaration HE 1163 are certified by TÜV Rheinland Industrie Service GmbH in the Certificate 968/EL 485.01/09 dated 9 November 2009.

Type 3738-20-xxx1000xxxx00 in combination with an external solenoid valve

The forwarding of the switching voltage for the external solenoid valve by the Type 3738-20-xxx1000xxxx00 Electronic Limit Switch has the same quality as wiring and does not lead to a change in the safety-related data of the circuit.

Safety-related assumptions

Safety-related end position monitoring

All switching contacts of the Type 3738-20 Electronic Limit Switch behave as stipulated in IEC 60947-5-6 and are suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) according to TÜV/IEC 61508. The contacts can be used either as NC or NO contacts. Their switching states are indicated according to IEC 60947-5-6. Contact A is assigned to the end position for the fail-safe position (limit switch for fail-safe position). The fail-safe position is the end position to which the single-acting actuator is moved by the spring-return mechanism when the solenoid valve is de-energized.

Emergency venting

When the optional integrated solenoid valve is used, the electronic limit switch discharges its pneumatic output to the atmosphere when
the solenoid valve is de-energized. This causes the mounted actuator to be vented. The function is suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) according to IEC 61508.

**Note:** Safety-related end position monitoring and emergency venting work independently from one another to meet the device design requirements to conform with SIL.

**Preconditions**

- Short mean time to repair compared to the average rate of demand
- Normal exposure to industrial environment and fluids
- The user is responsible for ensuring that the device is used as intended.

**Useful lifetime**

According to IEC 61508-2, section 7.4.9.5, a useful lifetime of 8 to 12 years can be assumed. Other values can be used based on the user’s experience.

**Notes concerning diagnostics**

- A diagnostics are performed cyclically inside the device. Critical errors (device error E9) are indicated by contact B as wire breakage according to IEC 60947-5-6. Existing errors must be remedied as described in these Mounting and Operating Instructions. If this is not possible, the electronic limit switch must not be used in safety loops.
- The proper functioning of the display can be verified over P3 parameter. Refer to section 8.2.
- The correct setting of all parameters must be verified before every start-up.

**Proof tests**

All switching contacts need to be activated for the proof test. This can be done by:

- Using the mounted actuator to move the valve to the end position
- Simulating the outputs using P19 parameter. Refer to section 9.3.

During the proof test, check that the outputs switch properly.

**Intended use**

The specifications and information in the data sheet and in these instructions must be observed.

**Note concerning diagnosis of connected solenoid valve and actuator**

The diagnostics functions performed in the device, e.g. actuator transit time monitoring, are suitable for diagnosis of connected devices, such as solenoid valve, pneumatic actuator and valve.

**Repair**

Devices which are used in safety-instrumented systems must be repaired by the manufacturer.
4 Attachment to rotary actuators – Mounting parts and accessories

⚠️ Risk of electrostatic charging!
Due to the high surface resistance of the housing cover ($R_{\text{insulation}} \geq 10^9 \, \Omega$), set up the device so that electrostatic charging does not take place.
For the use in combustible dust atmospheres complying with the type of protection Ex tD (protection by enclosure for dust), observe section 18.2 of EN 60079-14: 2008 for Procedure A.

WARNING!
Mount the electronic limit switch, keeping the following sequence:
1. **Mount the electronic limit switch on the actuator**
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

The electronic limit switch is suitable for attachment to rotary actuators.

NOTICE
Observe the following instructions to avoid damaging the electronic limit switch:
- Use only the accessories listed in the Table 1 to mount the electronic limit switch!
- Observe the shaft height of the actuator!
**Attachment to rotary actuators – Mounting parts and accessories**

Fig. 6 · Attachment to rotary actuators according to VDI/VDE 3845, level 2

<table>
<thead>
<tr>
<th>Shaft height B [mm]</th>
<th>20</th>
<th>30</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance between holes A [mm]</td>
<td>80</td>
<td>80/130</td>
<td>130</td>
</tr>
</tbody>
</table>

*C = Max. shaft diameter (with clamping ring)*

On selecting the mounting unit, a clamping ring on the shaft must also be included in the shaft height!
## Table 1 - Accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attachment to rotary actuators according to VDI/VDE 3845, fixing level 2</strong></td>
<td></td>
</tr>
<tr>
<td>Attachment (20 mm shaft height), e.g. Pfeiffer Type 31b, size 100 to 150</td>
<td>1400-9859</td>
</tr>
<tr>
<td>Attachment (30 mm shaft height), e.g. Pfeiffer Type 31b, size 220 to 600</td>
<td>1400-9860</td>
</tr>
<tr>
<td>Attachment (50 mm shaft height), e.g. Pfeiffer Type 31b, size 900 to 1200</td>
<td>1400-9861</td>
</tr>
<tr>
<td>Attachment (50 mm shaft height, shaft height ≥ 88 mm), e.g. Pfeiffer Type 31b, size 2000</td>
<td>1402-0332</td>
</tr>
<tr>
<td>Mounting platform (black) G ¼</td>
<td>1380-1266</td>
</tr>
<tr>
<td>Mounting platform (black) ¼ NPT</td>
<td>1380-1268</td>
</tr>
<tr>
<td>Mounting platform (black)</td>
<td></td>
</tr>
<tr>
<td>for piping G ¼ as required</td>
<td>1380-1738</td>
</tr>
<tr>
<td>Mounting platform (black)</td>
<td></td>
</tr>
<tr>
<td>for piping ¼ NPT as required</td>
<td>1380-1739</td>
</tr>
<tr>
<td><strong>Cable glands (M20 x 1.5)</strong></td>
<td></td>
</tr>
<tr>
<td>Nickel-plated brass</td>
<td>1880-4875</td>
</tr>
<tr>
<td>Stainless steel 1.1305</td>
<td>8808-0160</td>
</tr>
<tr>
<td>Version for EEx e: black plastic</td>
<td>8808-0180</td>
</tr>
<tr>
<td>Version for EEx e: blue plastic</td>
<td>8808-0181</td>
</tr>
<tr>
<td><strong>TROVIS-VIEW Configuration and Operator Interface software</strong></td>
<td></td>
</tr>
<tr>
<td>TROVIS-VIEW with device module 3738-20</td>
<td></td>
</tr>
<tr>
<td>Serial interface adapter (SAMSON SSP interface – RS-232 port of computer)</td>
<td>1400-7700</td>
</tr>
<tr>
<td>Isolated USB interface adapter (SAMSON SSP interface – USB port of computer)</td>
<td>1400-9740</td>
</tr>
</tbody>
</table>
4.1 Version with integrated solenoid valve

Type 3738-20-xxx1400xxx000

This version can be mounted both to standard actuators according to VDI/VDE 3845 (level 2) and onto Pfeiffer Type 31b Rotary Actuator with integrated air holes.

There are two different mounting platforms (Fig. 7):

- Standard mounting platform for mounting onto Pfeiffer Type 31b Rotary Actuator with integrated air holes
- Mounting platform for piping as required for mounting to standard actuators according to VDI/VDE 3845 (level 2)

The supply air is connected at the side of both mounting platforms. The blanking plug needs to be removed from the air connection.

The type of actuator is determined by the location of the molded seal (7) in the mounting platform (3). See Fig. 8:

- **Fig. 8, top**: 3/2-way function for single-acting rotary actuators
- **Fig. 8, bottom**: 5/2-way function for double-acting rotary actuators

**NOTICE**
The hole for air on the molded seal (7) must be fitted with an O-ring!
4.1.1 Attachment to rotary actuators with 20 mm shaft height

See Table 1 for required accessories.

1. Place spacers (13) on the inner bores of the actuator.
2. Press molded seal (6) onto the bottom of the mounting platform (3).
3. Use screws (11) to fasten the mounting platform (3) onto the actuator, making sure the air holes are aligned properly.
4. Insert the molded seal (7) with O-ring (page 21), depending on the type of actuator, into the mounting platform (3).
5. Place adapter (5) and visual indicator wheel (8) one after the other onto the actuator shaft.
6. Insert plate (10) into the visual indicator wheel (8).

**NOTICE**

Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (2)!

7. Fasten screw with magnet (2) onto the actuator shaft.
8. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (2).
9. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 9 and fasten it using the two screws (ready-mounted on the device).
4.1.2 Attachment to rotary actuators with 30 mm shaft height

See Table 1 for required accessories.

1. Place spacers (13) on the inner bore-holes of the actuator.
2. Press molded seal (6) onto the bottom of the mounting platform (3).
3. Use screws (11) to fasten the mounting platform (3) onto the actuator, making sure the air holes ( ) are aligned properly.
4. Insert the molded seal (7) with O-ring (page 21), depending on the type of actuator, into the mounting platform (3).
5. Place visual indicator wheel (8) onto the actuator shaft.
6. Insert plate (10) into the visual indicator wheel (8).

**NOTICE**
Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (1).

7. Fasten screw with magnet (1) onto the actuator shaft.
8. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (1).
9. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 10 and fasten it using the two screws (ready-mounted on the device).

**Fig. 10 · Mounting the electronic limit switch with integrated solenoid valve onto the rotary actuator with 30 mm shaft height**
4.1.3 **Attachment to rotary actuators with 50 mm shaft height**

*See Table 1 for required accessories.*

1. Press molded seal (6) onto the bottom of a distance piece (9).
2. Place distance pieces (9) on the actuator, making sure the holes are aligned properly. The distance piece with inserted molded seal (6) must be located on the side with the air holes.
3. Press molded seal (6) onto the bottom of the mounting platform (3).
4. Use screws (11) to fasten the mounting platform (3) onto the actuator, making sure the air holes are aligned properly.
5. Insert the molded seal (7) with O-ring (page 21), depending on the type of actuator, into the mounting platform (3).
6. Place visual indicator wheel (8) onto the actuator shaft.
7. Insert plate (10) into the visual indicator wheel (8).
8. Fasten screw with magnet (1) onto the actuator shaft.
9. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (1).
10. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 11 and fasten it using the two screws (ready-mounted on the device).

---

**NOTICE**

*Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (1).*

---

![Diagram showing the attachment process for rotary actuators with 50 mm shaft height.](Image)
4.2 Version for external solenoid valve

Type 3738-20-xxx1000xxxx00
This version is suitable for rotary actuators according to VDI/VDE 3845, level 2.

4.2.1 Attachment to rotary actuators with 20 mm shaft height

See Table 1 for required accessories.

1. Place spacers (13) on the inner bores of the actuator.
2. Use screws (11) to fasten the mounting platform (3) onto the actuator.
3. Place adapter (5) and visual indicator wheel (8) one after the other onto the actuator shaft.
4. Insert plate (10) into the visual indicator wheel (8).

**NOTICE**
Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (2)!

5. Fasten screw with magnet (2) onto the actuator shaft.
6. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (2).
7. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 12 and fasten it using the two screws (ready-mounted on the device).

---

**Fig. 12** · Mounting the electronic limit switch for external solenoid valve onto the rotary actuator with 20 mm shaft height

1 Screw with magnet (SW 24, 30 mm)
2 3 Mounting platform
5 Adapter
8 Visual indicator wheel
10 Plate
11 Fillister-head screws (4x M5x16)
13 Spacer
4.2.2 Attachment to rotary actuators with 30 mm shaft height

See Table 1 for required accessories.

1. Place spacers (13) on the inner boreholes of the actuator.
2. Use screws (11) to fasten the mounting platform (3) onto the actuator.
3. Place visual indicator wheel (8) onto the actuator shaft.
4. Insert plate (10) into the visual indicator wheel (8).

**NOTICE**
Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (1).

5. Fasten screw with magnet (1) onto the actuator shaft.
6. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (1).
7. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 13 and fasten it using the two screws (ready-mounted on the device).

---

**Fig. 13** · Mounting the electronic limit switch for external solenoid valve onto the rotary actuator with 30 mm shaft height

1. Screw with magnet (SW 24, 20 mm)
3. Mounting platform
8. Visual indicator wheel
10. Plate
11. Fillister-head screws (4x M5x16)
13. Spacer

---

EB 8390 EN
4.2.3 Attachment to rotary actuators with 50 mm shaft height

See Table 1 for required accessories.

1. Place distance pieces (9) on the actuator, making sure the holes are aligned properly.

2. Use screws (12) to fasten the mounting platform (3) onto the actuator.

3. Place visual indicator wheel (8) onto the actuator shaft.

4. Insert plate (10) into the visual indicator wheel (8).

**NOTICE**

Do not exceed the maximum torque of 8 Nm when fastening the screw with magnet (1).

5. Fasten screw with magnet (1) onto the actuator shaft.

6. Bend the two flaps on the plate (10) towards the width flats of the screw with magnet (1).

7. Place the electronic limit switch on the mounting platform (3) as shown in Fig. 14 and fasten it using the two screws (ready-mounted on the device).

---

![Fig. 14 - Mounting the electronic limit switch for External solenoid valve onto the rotary actuator with 50 mm shaft height](image_url)
5  Connections

WARNING!
Mount the electronic limit switch, keeping the following sequence:
1. Mount the electronic limit switch on the actuator
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

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

5.1  Pneumatic connections

Follow the instructions below to avoid damaging the electronic limit switch and/or solenoid valve.

- **Version with internal solenoid valve**
  (Type 3738-20-xxx1400xxx000): The supply pressure at the inlet must not exceed 6 bar.

- **Version with external solenoid valve**
  (Type 3738-20-xxx1000xxxx00): The inlet pressure must not exceed the maximum supply pressure of the external solenoid valve (see specifications of the solenoid valve manufacturer). Do not remove the blanking plug on the air connection of the mounting platform (3)!

- The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.
  Blow through all air pipes and hoses thoroughly prior to connecting them.

Note: The customary fittings for metal and copper pipes or plastic hoses can be used to fit the mounting platform used (ISO 228/1–G ¼ or ¼–18 NPT).

5.1.1  Version with integrated solenoid valve

(Type 3738-20-xxx1400xxx000)
Connect the supply air (supply) and, if applicable, the signal pressure (output) at the side of the mounting platform (see Figs. 7 to 11)

5.1.2  Version with external solenoid valve

(Type 3738-20-xxx1000xxxx00)
Connect the supply air to the external solenoid valve following the instructions given by the solenoid valve manufacturer.)
5.2 Electrical connections

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

For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers’ liability insurance association.

The following standards apply for assembly and installation in hazardous areas: EN 60079-14: 2008 (VDE 0165 Part 1) Explosive atmospheres - Electrical installations design, selection and erection.

For the connection of intrinsically safe circuits, the permissible maximum values specified in the EC type examination certificate apply.

It is absolutely essential to adhere to the terminal assignment specified in the certificate. Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective!

In the electronic limit switch with intrinsically safe external solenoid valve, the operating voltage and the external solenoid valve are connected in compliance with EN 60079-11 (Ex i).
Ex i terminals and cable entry: blue or black

In electronic limit switch with non-intrinsically safe external solenoid valve, the operating voltage and the external solenoid valve are connected in compliance with EN 60079-7 (Ex e). The following applies to the external connections:
Ex i terminals: blue.
Ex e terminals: black
Cable entry: Ex e cable entry black · Ex i cable entry: blue

The cable entries of the electronic limit switch with non-intrinsically safe external solenoid valve must be certified in compliance with type of protection Ex e according to ATEX.

Do not tamper with enameled screws inside or on the housing.

Notes on the selection of cables and wires:

For installation of non-intrinsically safe circuits, observe section 11.2 of EN 60079-14: 2008 (VDE 0165 Part 1) and for installation of intrinsically safe circuits, section 12.2 of the same standard. To run multi-core cables and lines with more than one intrinsically safe circuit, observe section 12.2.2.7 of EN 60079-14: 2008.
The connection of the contact A supplies the electronic limit switch with electrical auxiliary power. An additional electrical auxiliary power supply is not required.

The function of the contacts A and B as well as the terminal labeling 41/42 or 51/52 depend on the direction of action:

<table>
<thead>
<tr>
<th>Connection</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 41 42</td>
<td>Fail-safe position (0 %)</td>
</tr>
<tr>
<td>- 51 52</td>
<td>Operating position (100 %)</td>
</tr>
</tbody>
</table>

### Cable entry

The threaded connection for the terminal compartment is designed with an M20 x 1.5 thread.

The screw terminals are designed for wire cross-sections from 0.2 to 1.5 mm². Tighten by at least 0.5 Nm.

#### NOTICE
- The switching voltage of the integrated solenoid valve is connected either at the terminals V1 (81/82) or at the terminals V3 (281/282) (Type 3738-20-xxx1400xxx000).
- Do not connect the switching voltage to the contacts A-St! Otherwise, the device will be damaged.

Especially for commonly used insulating materials, such as polyethylene, the radial thickness of the conductor insulation must have a minimum thickness of 0.2 mm. The diameter of a single wire of a flexible conductor must not be smaller than 0.1 mm. The conductor ends must be protected against unlaying, e.g. by using wire-end ferrules.

An additional cable gland can be installed when connecting the device over two separate cables.

Cable entries left unused must be sealed with blanking plugs.

Devices used at ambient temperatures down to –40 °C must have metal cable glands.
Connections

**Fig. 15 · Electrical connection – Version for internal solenoid valve (Type 3738-20-xxx1400xxx000)**

Connection of integrated solenoid valve: optionally V1 or V3

Connection of electronic limit switch: A, B, C, St

- Display
- LED for solenoid valve
- Rotary pushbutton
- SAMSON SSP interface
Connections

Fig. 16 · Electrical connection – Version for external solenoid valve (Type 3738-20-xxx1000xxxx00)
6 Operator controls and readings

6.1 Rotary pushbutton

The rotary pushbutton (⚙️) is located underneath the housing cover.

The electronic limit switch is operated on site using the rotary pushbutton:
Turn ⚙️ to select parameters and values.
Push ⚙️ to confirm setting/exit parameter.

6.2 SAMSON SSP interface

The SAMSON SSP interface is located underneath the housing cover.

The local SAMSON SSP interface of the electronic limit switch needs to be connected over a serial interface adapter cable (see Table 1 on page 20) to the RS-232 or USB port of the computer before the TROVIS-VIEW Configuration and Operator Interface can be used.
7 Operating structure

The P2 parameter allows the user to switch between the **RUN** operating mode and **SET** configuration mode. In the **SET** configuration mode, the parameters marked with an asterisk (*) (see section 12) can be changed and the device can be initialized.

To switch over modes, the key code must be entered first. The key code is listed on page 74.

To prevent unauthorized access to the key code, remove it from the instructions or make it unreadable.

To meet the device design requirements to conform with SIL, the **SET** configuration mode is indicated by the fault alarm contact St responding after the device has been initialized successfully. In the display, the **SET** configuration mode is additionally indicated by the icon . If the device has not yet been initialized or it has been reset to its default settings (P21), the three contacts A, B and C also respond.

After the device has been initialized and is in **RUN** operating mode, various states of the contacts can be set (see Table 2) assigned to the control and status or error messages. Parameters cannot be changed or, for example, the device cannot be re-initialized in the **RUN** operating mode for reasons of safety.

Errors E0 to E8 have priority over the switching positions for reasons of safety. A serious device error E9 is additionally signalized by a wire breakage in accordance with IEC 60947-5-6.

Contact C can be used for monitoring the partial stroke test (PST). It responds when the valve position exceeds the selected limit (PST step final value ± ½ PST tolerance band (P14 ± ½ P15).

It is possible to monitor the PST target range when the P12 parameter (status readout F6 and F7) is activated. In this case, the fault alarm contact St responds whenever the valve position is above or below the limit (PST step final value ± ½ PST tolerance band). This monitoring function is not active by default.

If the partial stroke test is not used, a third switching position can be indicated by contact C.

The contacts can indicate the operating states listed in Table 2.

The operating structure is shown on the following pages in the form of schematic diagrams:

- Placing the electronic limit switch into operation using its default settings (page 36)
- Changing the operating mode (page 37)
- Confirming status/error message (page 38)
Table 2 · Indication of operating states
Contacts A, B, C can be configured as required (NC or NO contact)
Contact St is always a NC contact

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>St</th>
</tr>
</thead>
</table>

Possible operating states in SET configuration mode

- ✗ ✗ ✗ ✗: Device not initialized/default settings
- ✗ ✗ ✗ ✗: Device initialized, fail-safe position
- ✗ ✗ ✗ ✗: Device initialized, operating position

Possible operating states in RUN operating mode

- ✗ ✗ ✗ ✗: Fail-safe position
- ✗ ✗ ✗ ✗: Operating position
- ✗ ✗ ✗ ✗: Fail-safe position, status message F0 to F10 or error E10
- ✗ ✗ ✗ ✗: Operating position, status message F0 to F10 or error E10
- ✗ ✗ ✗ ✗: Status F10, errors E1 to E8
- ✗ ✗ ✗ ✗: Error E9 (serious device error)

Possible operating states during partial stroke test (PST), refer to section 9.2 for further details

- ✗ ✗ ✗ ✗: PST started, PST target range not reached yet
- ✗ ✗ ✗ ✗: PST target range reached/PST completed successfully
- ✗ ✗ ✗ ✗: PST not completed successfully, P12 = NO
- ✗ ✗ ✗ ✗: PST not completed successfully, P12 = YES

1) The contact remains activated three seconds after the valve moves out of the PST target range

- ✗ Contact not responding; ✗ Contact responded; ✗ Wire breakage
Operating structure

Placing the electronic limit switch using its default settings into operation · The switching voltage must be applied!

Initial reading (electronic limit switch not initialized)

P1: Reading direction [1234]

P4: Direction of action of actuator [PTO] power to open

P5: Direction of action of actuator [PTO] power to open

P6: Switching function of contacts A, B, C [NC]

P7: Switching point for lower end position [2.0 %]

P8: Switching point for upper end position [98.0 %]

P9: Automatic initialization

Initial reading (initialized electronic limit switch)

Return to RUN mode

Enter key code: If the wrong key code is entered, the mode does not change

Gray background: SET configuration mode (no operation, settings of parameters Px can be changed)

Turn rotary pushbutton clockwise

Turn rotary pushbutton counterclockwise

Press rotary pushbutton 6 seconds
Changing the operating modes

**Initial reading**
(initialized electronic limit switch)

Enter key code:
If the wrong key code is entered, the mode does not change.

Change to configuration mode SET
(device not in service, parameters Px can be set)

Example:
Determining switching function

Enter key code:
If the wrong key code is entered, the mode does not change.

Other configurations possible
Operating structure

Confirming status/error messages

**Initial reading**
(initialized electronic limit switch; Example: Status message F5)

Enter key code:
If the wrong key code is entered, the mode does not change.

Change to **SET configuration mode**
(device not in service, parameters Px can be changed)

Status message F5:
Actuator does not move after switching demand

Confirm status message

Enter key code:
If the wrong key code is entered, the mode does not change.
8  Start-up – Settings

WARNING!
Mount the electronic limit switch, keeping the following sequence:
1. Mount the electronic limit switch on the actuator
2. Connect the supply air
3. Connect the electrical power
4. Perform the start-up settings

Reading on display after connecting the electrical auxiliary power:

- P0: Display when the electronic limit switch has not yet been initialized
- The fault alarm icon and -- -- -- appear on the display when the electronic limit switch has not yet been initialized. The electronic limit switch is not in service. Parameter settings can be changed (P2 = SET).

Note: The current angle of rotation is set to 0° by pressing the rotary pushbutton (©).

- The current angle of rotation is displayed in % when the electronic limit switch has been initialized. To change parameter settings, the configuration mode (SET) must be activated. See page 37.

---

NOTICE
Perform the start-up settings in the same sequence as listed (section 8.1 to 8.7).

8.1 Adapting the display
The reading on the electronic limit switch display can be turned by 180° to adapt it to how the electronic limit switch is mounted.

- P1: Reading direction

If the reading appears upside down, proceed as follows:

Turn © → P1
Press ©, P1 blinks
Turn © → 1234/4321
Press © to confirm reading direction and to exit the parameter.

8.2 Verifying readings on display

NOTICE
For safety-instrumented systems, the display’s functioning must be tested.

The display’s functioning is checked using the P3 parameter.
Turn \( \odot \rightarrow P3 \)
Press \( \odot \), display reading 1
Turn \( \odot \rightarrow \) display reading 2 \ldots 10
Press \( \odot \) to confirm the parameter. The last test of the display readings is saved with a time stamp in the electronic limit switch. The time stamp can be read in TROVIS-VIEW.

### 8.3 Determining the actuator type

The setting is made using \( P4 \) parameter.

The type of actuator is set to 'Rotary actuator' by default. **Do not change this setting** since the electronic limit switch can currently only be mounted onto rotary actuators. Mounting units for linear actuators are planned.

\( P4: \) Actuator type
Default: ROT (rotary actuator)
8.4 Determining the direction of action

The setting is made using P5 parameter. Observe the assignment of contacts A and B depending on the direction of action (see page 75)!

Turn ⚫ → P5
Press ⚫, P5 blinks
Turn ⚫ → PTO (power to open)/PTC (power to close)
Press ⚫ to confirm the direction of action and to exit the parameter.

8.5 Determining the switching function of contacts

The setting is made using P6 parameter.

Note: The local operation allows the contacts A, B and C to be defined together as NO or NC contacts. The contacts can be configured separately in TROVIS-VIEW.

Turn ⚫ → P6
Press ⚫, P6 blinks
Turn ⚫ → NC or NO
Press ⚫ to confirm the switching function and to exit the parameter.

8.6 Adjusting the limit switches

A limit signal is issued by the limit switches for fail-safe position (contact A) and for operating position (contact B). The contacts A and B can be adjusted within the range.

The switching points are set in P7 (lower end position) and P8 (upper end position) parameters.
**Note:** The following correlations apply to the setting ranges of the switching points for lower end position (P7) and the upper end position (P8):

- **P7:** 0.5 % to (P8 – 2.0 %)
- **P8:** (P7 + 2.0 %) to 99.5 %

---

Observe the assignment of contacts A and B depending on the direction of action (see page 75)!

---

### 8.7 Initialization

**WARNING!**

The initialization must only be started when the switching voltage is connected and the actuator is in the operating position.

Before starting initialization, check the maximum permissible signal pressure of the valve.

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

---

**NOTICE**

After the electronic limit switch has been mounted onto another actuator or its mounting location has been changed and prior to re-initializing, the electronic limit switch needs to be reset to its default setting (Code P21). Refer to section 8.10.
Note: If an electronic limit switch is replaced with another electronic limit switch of the same type, the replaced electronic limit switch may not need to be re-initialized, provided certain conditions are met. Refer to section 8.8.

After the electronic limit switch has been initialized, the current angle of rotation appears in % on selecting P0. Keep the rotary pushbutton (○) pressed to display the reading as an angle (°).

Two types of initialization are available:

- Automatic initialization with P9 parameter
- Manual initialization with P10 parameter by manually confirming the end positions (POS1 and POS2)

Start automatic initialization

Note: The automatic initialization can be canceled by pressing the rotary pushbutton (○). ESC appears on the display.
Data saved in the electronic limit switch prior to the initialization can be restored by pressing the rotary pushbutton (○) again.

P9: Initialization in progress

P9: Initialization successfully completed

Turn ◎ → P9
Press ◎ six seconds long. The seconds remaining until the initialization starts appear on the display.

Initialization starts (display: INIT): The valve moves twice from the operating position to the fail-safe position and back again to the operating position. It measures the angle of the end stops as well as the dead time and transit times for opening and closing the valve.

After the initialization has been successfully completed, the current valve position in % is indicated.

The electronic limit switch is in the configuration mode (SET).
To start operation, exit the configuration mode. See page 37.

The automatic initialization is automatically canceled if a fault occurs (ERR on the display). The initialization error can be read in the ERR parameter level:

- E0: No initialization
- E1: Actuator does not move
- E2: Max. angle of rotation not reached
E3: Max. angle of rotation exceeded
E4: Actuator moves too quickly
E5: Switching voltage not applied
E6: Timeout

Start manual initialization

Note: Select ESC on the display and press the rotary pushbutton (enting) to cancel the manual initialization.
Data saved in the electronic limit switch prior to the initialization can be restored by pressing the rotary pushbutton (enting) again.

![Diagram of initialization process]

Turn → P10
Press six seconds long. The seconds remaining until the position check starts appear on the display.

→ Display: POS1
Move the valve to the fail-safe position manually (de-energize the solenoid valve).
Press to confirm the fail-safe position
→ WAIT
The electronic limit switch saves the angle of the fail-safe position.

→ Display: POS2
Move the valve to the operating position manually (energize the solenoid valve).
Press to confirm the operating position
→ WAIT
The electronic limit switch saves the angle of the operating position.

After the initialization has been successfully completed, the current angle of rotation in % is indicated.

The electronic limit switch is in the configuration mode (SET).
To start operation, exit the configuration mode. See page 37.

The manual initialization is automatically canceled if a fault occurs (ERR on the display). The initialization error can be read in the ERR parameter level:
8.8 Start-up after replacing an electronic limit switch

An (old) electronic limit switch can be replaced by another (new) electronic limit switch of the same type by performing an end position calibration in the operating or fail-safe position, but without having to initialize the new one, provided the following conditions are met:

- Data from the electronic limit switch being replaced are downloaded and saved in TROVIS-VIEW.
- The screw with magnet must not be unfastened while the electronic limit switch is being replaced.
- The end stops of the valve must not be changed while the electronic limit switch is being replaced.

Start-up after replacing an electronic limit switch

- Load data from TROVIS-VIEW onto the new electronic limit switch.
- Perform an end position calibration as described in section 8.9.

8.9 Zero/end position calibration

When the zero point or end positions are incorrect, it may be necessary to recalibrate them. Always perform an end position calibration for the fail-safe position and for the operating position.

The electronic limit switch must be in the configuration mode (SET). See page 37.

P11: End position calibration in progress

Turn ⚫ → P11

Press ⚫ six seconds long. The seconds remaining until the end position calibration starts appear on the display.

The current valve position is set to the end stop (0% or 100%).

The electronic limit switch is in the configuration mode (SET). To start operation, exit the configuration mode. See page 37.

The end position calibration is automatically canceled if a fault occurs (ERR on the display). The error can be read in the ERR parameter level:

- E6: Timeout
8.10 Reset to default settings

This function resets all parameters to the factory default settings (see parameter list in section 12). All error and status messages are also reset.

**NOTICE**
After performing a reset, the electronic limit switch needs to be re-initialized (see section 8.7).

The electronic limit switch must be in the configuration mode (SET). See page 37.

Turn → P21
Press , P21 blinks
Turn , → RST
Press . All parameters are reset to their default settings.

- Re-initialize the electronic limit switch (see section 8.7).
- Set PST parameters (see section 9.2).

9 Operation

**WARNING!**
The actuator shaft moves while the electronic limit switch is operating. Do not touch the actuator shaft or obstruct it to avoid risk of injury to hands or fingers.

9.1 Lock operation

Both the on-site operation of the electronic limit switch as well as the remote operation using TROVIS-VIEW can be locked.

9.1.1 Locking TROVIS-VIEW

When the locking is active, device data can only be read over the SAMSON SSP interface, but not overwritten. The locking is activated using P18 parameter.

The electronic limit switch must be in the configuration mode (SET). See page 37.

Turn , → P18, display: NO
Press , P18 blinks
Turn , → SSP
Press . The operation over the SAMSON SSP interface is locked.

Deactivate locking
Turn , → P18, display: SSP
Press \( \odot \), P18 blinks

Turn \( \odot \) \( \rightarrow \) NO

Press \( \odot \). Operation over the SAMSON SSP interface is enabled.

### 9.1.2 Locking on-site operation

When the locking is active, the electronic limit switch can only be operated remotely using the TROVIS-VIEW operator interface. The locked on-site operation is indicated on the display by the icon \( \sigma' \).

The on-site operation is locked and enabled in the TROVIS-VIEW operator interface.

---

### 9.2 Partial stroke test (PST)

**WARNING!**

Ear protection must be worn if the test is performed on the version with integrated solenoid valve while the housing cover is open!

The probability of failure on demand (PFD) can be reduced and maintenance intervals can be extended by the partial stroke test (PST). This helps prevent the valve from seizing up in its operating position.

The following conditions must be met before the partial stroke test (PST) can be performed:

- An automatic initialization must have been performed. Refer to section 8.7.
- The switching voltage must be applied.

**Test procedure** (Fig. 19)

The electronic limit switch issues pulses of various lengths to the solenoid valve (briefly de-energizing it) during the partial stroke test (PST), moving the valve further towards the fail-safe position.

The test has been completed successfully when the valve has reached the target range (PST step final value \( \pm \frac{1}{2} \) PST tolerance band) by one pulse, but not exceeded it. When the target range is reached, contact C responds (see Fig. 19).
**Operation**

**Direction of action PTO**

- **Contact B**
- **Contact C**

- **SV off**
- **SV on**
- **Holding time**
- **Dead time**

**Direction of action PTC**

- **Contact B**
- **Contact C**

**PST start**

**PST duration**

**Fig. 19 · Partial stroke test (PST)**
The analysis of a successfully completed test provides the following data:

- PST pulse length
- PST dead time
- PST transit time when SV de-energized
- PST holding time
- PST transit time when SV energized
- PST travel
- PST status

If the test could not be completed, the corresponding status message F8 or F9 is generated:

- F8: No switching voltage during PST
- F9: PST timeout

**Note:**
- If the travel of the PST is monitored and, if necessary, the status messages F6 (min. value for PST not reached) and F7 (max. value for PST exceeded) are to be generated, P12 parameter must be set to YES.
- Contact C can be used to indicate a third switching position. Refer to following example for direction of action PTO.

### 9.2.1 Defining the PST target range

Define the target range by defining P14 and P15 parameters.

PST target range = PST step final value (P14) ± ½ PST tolerance band (P15)

**NOTICE**
It is important to take the process conditions (e.g. pressure, medium, dead time, breakaway torque and torque of the valve) into account on defining the PST target range. A valve that opens (PTC) and closes (PTO) too far may affect the process!

![Diagram of PST target range]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P14</td>
<td>PST step final value</td>
</tr>
<tr>
<td></td>
<td>Default: 90.0 %</td>
</tr>
<tr>
<td>P15</td>
<td>PST tolerance band</td>
</tr>
<tr>
<td></td>
<td>Default: 10 %</td>
</tr>
</tbody>
</table>

Turn ⬇️ P14/P15
Press ⬇️, P14/P15 blinks
Turn ⬇️ Step final value/PST tolerance band
Press ⬇️ to confirm the value and to exit the parameter.
9.2.2 Start the partial stroke test

A single PST test can be started manually or a regular PST test can be started automatically at defined time intervals.

Start PST automatically at defined intervals (RUN mode)

The test is performed automatically after a time interval (days) entered in P16 (automatic PST).

**NOTICE**
The automatic test causes the valve to leave its operating position without a switching demand.

**Note:** The default setting OFF causes the automatic test to be deactivated.

---

Start PST manually

(SET configuration mode or RUN)

One single test is started by P17 parameter.

---

**P16:** Start automatic PST

Turn → P16

Press , P16 blinks

Turn → Required time interval [days]

Press to confirm the setting and to exit the parameter.

*Note:* A running test can be canceled by pressing the rotary pushbutton (ESC) (display: ESC).
9.2.3 Configuration example based on direction of action PTO

The valve is constantly open (operating position = 100 %). In the event of emergency, the valve is to close (fail-safe position = 0 %). The valve's direction of action is therefore PTO (power to open), set in P5 parameter.

The upper end position (P8) is set at 98 %. This value is the same as the default setting. Contact B is activated when the valve moves beyond this value.

To prevent the valve seizing in the open position, a partial stroke test is to be performed on weekly basis. During the partial stroke test, the valve is moved from the operating position towards the fail-safe position to a step final value of 90 % by briefly de-energizing the solenoid valve. During the test, the valve must not move beyond a position of 85 % and a status message is activated if the PST target range is not reached or exceeded.

The following settings are made to the initialized electronic limit switch in the example taking the process conditions into consideration:

1. Select configuration mode SET (P2)

   The parameters required to configure the partial stroke test can only be set in the SET configuration mode (P2 = SET).

2. Define PST target range (P14, P15)

   The PST target range is made up of the step final value (P14) and the PST tolerance band (P15). The test has been completed successfully when the valve has reached or not exceeded the target range (PST step final value ± ½ PST tolerance band).

   \[
   \begin{align*}
   P14 & \text{ (PST step final value) } = 90 \% \\
   P15 & \text{ (PST tolerance band) } = 10 \% \\
   \text{PST target range} & = 90 \% \pm 5 \% \\
   & = 85 \% \ldots 95 \% 
   \end{align*}
   \]

3. Activate the monitoring of the PST target range (P12)

   The monitoring of the target range as well as the status readout F6 'Min. value for PST not reached' and F7 'Max. value for PST exceeded' are activated by P12 parameter = YES.

   When the status message F6 or F7 is generated, check the attachment, supply air lines and valve. If necessary, the settings of the target range must be changed accordingly (P14 and P15). See 'Define PST target range (P14, P15)' in point 2.

4. Start of automatic PST (P16)

   P16 = 7 days

   The test starts automatically once a week after switching to RUN operating mode. The valve leaves the operating position (100 %) without a switching demand.
Fig. 20 · Example: Course of first two partial stroke tests
The graph shows the states when A, B and C contact setting = NC (P6)
5. Select RUN operating mode (P2)

The countdown starts after the electronic limit switch has been switched to the RUN operating mode (P2 = RUN).

6. Evaluate PST (Fig. 20)

A partial stroke test is successfully completed when the valve reaches the defined PST target range, but not moved beyond it. Contact C responds when the valve enters the PST target range and remains activated three seconds after the valve leaves the PST target range again.

The status contact St remains in the no response state (> 2.1 mA) as long as the PST target range is reached and not exceeded. If the status contact St is activated by the valve not reaching the PST target range, it remains activated until the next partial stroke test is started. This partial stroke test is reevaluated.

The evaluation of the performed test provides the following data:

- PST pulse length
- PST dead time
- PST transit time when SV de-energized
- PST hold time
- PST transit time when SV energized
- PST travel
- PST status

Check the voltage supply and solenoid valve wiring when the status message F8 (no switching voltage during PST) is generated.

Check the attachment and supply air line when the status message F9 (PST time-out) is generated.

The last 10 evaluations are saved in a non-volatile memory in the electronic limit switch and can be read out over TROVIS-VIEW software.

The solenoid valve is briefly de-energized by pulses issued by the electronic limit switch to close the valve. In this example, the valve does not reach the PST target range during the first partial stroke test and then moves beyond it. The test was not successfully completed. In the second automatic test, the valve initially does not reach the PST target range. The next step though ends in the PST target range, meaning the test has been successfully completed.

9.3 Testing the contacts

The following contacts can be tested in P19 parameter.

- **Contact A**: Limit switch for fail-safe position
- **Contact B**: Limit switch for operating position and simulation of wire breakage (B_LB appears on the display to meet requirements of IEC 60947-5-6)
- **Contact C**: Indicates that the target range has been reached during the partial stroke test or that an intermediate position has been reached. See section 9.2
- **Contact St**: Fault alarm contact

The electronic limit switch must be in the SET configuration mode. See page 37.
Display when P6 = NC

P19: Simulation of wire breakage at contact B

P19: Simulation of contact C:
(signal on reaching target range during partial stroke test)

P19: Simulation of fault alarm contact

Note: When P6 = NO, the logic for contacts A, B and C is reversed. B_LB on the display means the contact C is activated.

Turnoncé→P19
Press ●, P19 blinks.
All contacts respond.

Turnoncé→A/B/B_LB/C/St
All contacts are activated.

Press ●. The contact selected is deactivated while the rotary pushbutton is pressed.

Turnoncé→ESC
Press  ● to exit the parameter setting.
9.4 Testing the solenoid valve

You can de-energize the solenoid valve while the voltage is still applied using P20 parameter. In this case, the valve moves to the fail-safe position.

Observe the assignment of contacts A and B depending on the direction of action (see page 75)!

The electronic limit switch must be in the SET configuration mode. See page 37.

9.5 Faults

9.5.1 Status messages

When a status message is generated, the fault icon \( \square \) appears on the display in RUN operating mode. In addition, the fault alarm contact \( St \) is activated.

The possible cause of a fault is indicated by the parameter reading \( St \) under \( F0 \) to \( F10 \).

**Note:**
- The status message \( F4 \) (actuator transit time exceeded) is only generated when a fault occurs and \( P13 \) setting \( \neq \) OFF.
- The status messages \( F6 \) (Min. value for PST not reached) and \( F7 \) (Max. value for PST exceeded) are only generated when a fault occurs and \( P12 \) setting = YES.
- The status message \( F10 \) indicates that one of the error messages \( E0 \) to \( E10 \) has been generated.

Refer to the parameter list (section 12.1) for possible causes and the recommended action.
9.5.2 Error messages

When an error message is generated, the fault icon \( \text{\textbullet} \) appears on the display in RUN operating mode. The possible cause is indicated by the parameter reading \text{ERR} \text{to E10}.

If an error \text{E0} to \text{E8} exists, all contacts (A, B, C and St) respond for reasons of safety.

Error \text{E9} (device error 1) causes the signal wire breakage (contact B) to additionally respond to meet requirements of IEC 60947-5-6.

Error \text{E10} (device error 2) causes the switching position to be displayed unchanged.

![Error icons](image)

Example:

\text{E0: No initialization}

Refer to the parameter list (section 12.2) for possible causes and the recommended action.

9.5.3 Confirming status and error messages

\textbf{Note:} The status messages \text{F0, F1, F3} and \text{F10} as well as the error message \text{E0} cannot be confirmed.

The electronic limit switch must be in the SET configuration mode. See page 37.

Turn \( \text{Cómo} \rightarrow \text{F0/.../F10, St or E0/.../E10, ERR} \)

Press \( \text{Cómo, F0/.../F10, E0/.../E10} \text{blinks} \)

Turn \( \text{Cómo} \rightarrow \text{RST} \)

Press \( \text{Cómo} \) to confirm the status/error message.
10 Maintenance

The electronic limit switch does not require any maintenance when used for its intended purpose.

⚠️ Risk of electrostatic charging!
Due to the high surface resistance of the housing cover ($R_{\text{insulation}} \geq 10^9 \, \Omega$), set up the device so that electrostatic charging does not take place.
For the use in combustible dust atmospheres complying with the type of protection Ex tD (protection by enclosure for dust), observe section 18.2 of EN 60079-14: 2008 for Procedure A.

Version with integrated solenoid valve (Type 3738-20-xxx1400xxx000)
There are filters with a 100 \( \mu \)m mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.
The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

11 Servicing explosion-protected devices

If a part of the electronic limit switch on which the explosion protection is based needs to be serviced, the electronic limit switch must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.

Inspection by an expert is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device.

Explosion-protected components must only be replaced by original components supplied by the manufacturer that have been subjected to a routine test. Devices that were previously used in safe areas and are to be used inside hazardous areas are subject to regulations for serviced devices. They must undergo a test before they are used inside hazardous areas as stipulated by the regulations that apply to servicing explosion-protected devices.
## Parameter list

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameters marked with an asterisk (*) can only be changed when the electronic limit switch is in <strong>SET</strong> configuration mode (set in <strong>P2</strong>).</td>
<td></td>
</tr>
</tbody>
</table>

### P0
Info: Actual value

- **After initialization:** Current valve position in %
- **Keep** pressed down —> current valve position in ° (angle)
- **Prior to initialization:** Angle of rotation in °

See section 8

### P1
Reading direction [1234], ESC

- Reading direction on the display can be turned by 180°

See section 8.1

### Start-up

<table>
<thead>
<tr>
<th>P2</th>
<th>Configuration RUN · [SET] ESC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>RUN:</strong> Operation mode, parameter settings cannot be changed</td>
</tr>
<tr>
<td></td>
<td><strong>SET:</strong> Configuration mode (device not in service, parameter settings can be changed, icon ,</td>
</tr>
</tbody>
</table>

See section 7

### P3
Verify LCD segments 0000 to 9999

- Display only

See section 8.2

### P4*
Actuator type [ROT] · LIN ESC

- **ROT (rotary):** Rotary actuator
- **LIN (linear):** Linear actuator

**Note:** This parameter is locked after initialization and can only be selected and changed first after a reset to default settings (P21).

See section 8.3
<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameters marked with an asterisk (*) can only be changed when the electronic limit switch is in SET configuration mode (set in P2).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| P5* | Direction of action of actuator [PTO] · PTC ESC | **PTO (power to open)**  
Fail-safe position = Valve CLOSED, 0 % of travel range  
Operating position = Valve OPEN, 100 % of travel range  
**PTC (power to close)**  
Fail-safe position = Valve OPEN, 100 % of travel range  
Operating position = Valve CLOSED, 0 % of travel range  
*Note:* Observe the assignment of contacts A and B depending on the direction of action (see page 75)!  
This parameter is locked after initialization and can only be selected and changed first after a reset to default settings (P21). | See section 8.4 |
| P6* | Switching function of contacts A, B, C [NC] · NO NX1 … NX6 ESC | **NC contact**  
**NO contact**  
*Note:* The contacts A, B and C can be individually configured in the TROVIS-VIEW software. This indicated on the display as NX1 … NX6. All the contacts are configured together as NC contact (1) or NO contact (2) by the local operation. | See section 8.5 |
| P7* | Switching point for lower end position 0.5 % to (P8 – 2.0 %), [2.0 %] ESC | **The following applies:**  
PTO → Switching point for fail-safe position  
PTC → Switching point for operating position  
*Note:* Observe the assignment of contacts A and B depending on the direction of action (see page 75)! | See section 8.6 |
## Parameter list

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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameters marked with an asterisk (*) can only be changed when the electronic limit switch is in SET configuration mode (set in P2).</td>
<td></td>
</tr>
<tr>
<td>P8*</td>
<td>Switching point for upper end position (P7 + 2.0 %) to 99.5 %, [98.0 %] ESC</td>
<td>The following applies: PTO → Switching point for operating position PTC → Switching point for fail-safe position <strong>Note:</strong> Observe the assignment of contacts A and B depending on the direction of action (see page 75)! See section 8.6</td>
</tr>
<tr>
<td>P9*</td>
<td>Automatic initialization (INIT)</td>
<td>Starts initialization See section 8.7</td>
</tr>
<tr>
<td>P10*</td>
<td>Manual initialization (INIT)</td>
<td>Initialization after manual confirmation of fail-safe position (POS1) and operating position (POS2) See section 8.7</td>
</tr>
<tr>
<td>P11*</td>
<td>End position calibration</td>
<td>A calibration at the current position is performed See section 8.8</td>
</tr>
</tbody>
</table>

### Status readout

| P12* | Status readout F6 and F7 YES · [NO] ESC | Status readout F6/F7 when the PST target range (PST step final value ± ½ PST tolerance band) is not reached or exceeded. See sections 9.2 und 9.5.1 |
| P13* | Status readout F4 [OFF], 0.5 to 1800.0 s ESC | Status readout F4 when the actuator transit time has been exceeded. See section 9.5.1 |

### Partial stroke test (PST)

**Note:** The PST step range is limited between 2 and 98 % (PST step final value ± ½ PST tolerance band)

<p>| P14* | PST step final value 4.0 to 96.0 % [90.0 %] ESC | Step final value which the valve should move to during the partial stroke test Contact C can be used to indicate a third switching position when partial stroke testing is not used. See section 9.2 |
| P15* | PST tolerance band 4.0 to 96.0 % [10.0 %] ESC | Tolerance added to the step final value A partial stroke test has been successfully completed when the valve reaches the position (PST step final value ± ½ PST tolerance band), but does not exceed it. See section 9.2 |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameters marked with an asterisk (*) can only be changed when the electronic limit switch is in SET configuration mode (set in P2).</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>P16</strong> Start of automatic PST [OFF], 1 to 999 days ESC</td>
<td>Time interval between automatic partial stroke test</td>
</tr>
<tr>
<td></td>
<td><strong>P17</strong> Manual start of PST</td>
<td>One single automatic partial stroke test is started</td>
</tr>
<tr>
<td></td>
<td><strong>Locking function</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>P18</strong> Locking operation [NO] · SSP HMI ESC</td>
<td>HMI: Locking of on-site operation (icon: ⚒) Only using TROVIS-VIEW! SSP: Operation in TROVIS-VIEW locked. Can only be set over on-site operation!</td>
</tr>
<tr>
<td></td>
<td><strong>Test functions of contacts</strong></td>
<td></td>
</tr>
</tbody>
</table>
|     | **P19** Testing contacts A, B, B_LB, C, St ESC | Checking of contacts A/B/C/St  
**Note:** B_LB on the display simulates a wire breakage according to NAMUR at contact B. | See section 9.3 |
|     | **P20** Testing solenoid valve | Solenoid valve de-energized (fail-safe position) | See section 9.4 |
|     | **Reset function** |
|     | **P21** Reset electronic limit switch RST ESC | Resets all settings of electronic limit switch to the factory default settings | See section 8.10 |
|     | **Display functions · Read only** |
|     | **P22** Info: Actuator transit time when solenoid valve is de-energized | Time [s] required by the actuator to move to the fail-safe position (dead time + transit time) Reading of values determined during automatic initialization (P9) |
|     | **P23** Info: Actuator transit time when solenoid valve is energized | Time [s] required by the actuator to move to the operating position (dead time + transit time) Reading of values determined during automatic initialization (P9) |
### Parameter list

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter – Readings, values [default setting]</th>
<th>Description</th>
</tr>
</thead>
</table>
| P24 | Info: Temperature                              | Current operating temperature [°C] inside the electronic limit switch  
Keep ⚪ pressed down → Reading in °F | – |
| P25 | Info: Operating hours                          | Number of operating hours | – |

**Rotary motion**

| P26* | Maximum rotary motions  
0 to 9.9E7, [1.0E4] ESC | After the maximum rotary motion has been reached, the status message P2 is generated | – |
| P27* | Reset rotary motion counter  
RST ESC | The unopened parameter indicates the number of rotary motions from one end position to the other.  
To reset the counter, open the parameter, select RST and confirm. | – |

**Firmware version**

| P28 | Info: Firmware version                          | Current firmware version | – |
## 12.1 Status messages

<table>
<thead>
<tr>
<th>No.</th>
<th>Status message</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Status messages marked with an asterisk (*) can be confirmed in SET configuration mode. See section 9.5.3.</td>
</tr>
<tr>
<td></td>
<td><strong>TROVIS-VIEW:</strong> Current status messages are saved with a time stamp in [Diagnosis – Status messages].</td>
<td></td>
</tr>
</tbody>
</table>
| **F0** | Standstill outside of end positions | • Mechanical blockage  
• Supply pressure too low  
• External leakage  
**Recommended action**  
• Check attachment and supply air line. | |
| **F1** | Valve moved from end position without demand | • Incorrect voltage supplied to solenoid valve  
• Supply pressure too low  
• External leakage  
**Recommended action**  
• Check voltage supply to electronic limit switch/external solenoid valve.  
• Check supply air line. | |
| **F2** | Limit for max. rotary motion (P26) exceeded | • The value entered in P26 for the maximum rotary motion was exceeded.  
**Recommended action**  
• Deactivate function or enter higher value. | |
| **F3** | Temperature limits exceeded | • The temperature in the electronic limit switch is too low/too high.  
**Recommended action**  
• Check the operating conditions. | |
| **F4** | Actuator transit time exceeded  
**Note:** The status message is only generated when P13 ≠ OFF. | • The actuator transit time has exceeded the limit entered in P13.  
**Recommended action**  
• Check attachment. |
### Status messages

Status messages marked with an asterisk (*) can be confirmed in SET configuration mode. See section 9.5.3.

<table>
<thead>
<tr>
<th>No.</th>
<th>Status message</th>
<th>Possible causes</th>
</tr>
</thead>
</table>
| F5* | Actuator does not move after switching demand | • Mechanical blockage  
• Supply pressure too low  
• External leakage  
**Recommended action**  
• Check attachment and supply air line. |
|     | **Note:**  
If the valve moves after a delay, F5 remains active until the next successful switching demand. |

### Partial stroke test (PST)

<table>
<thead>
<tr>
<th>F6*</th>
<th>Min. value for PST not reached</th>
</tr>
</thead>
<tbody>
<tr>
<td>F7*</td>
<td>Max. value for PST exceeded</td>
</tr>
</tbody>
</table>

**Note:** The status message is only generated when P12 = YES.

• Mechanical blockage  
• Friction too high  
• Supply pressure too low  
**Recommended action**  
• Check attachment and supply air line.  
• Check valve.

### F8*

No switching voltage during PST

• Incorrect voltage supplied to solenoid valve  
• Breakage of wire to external solenoid valve  
**Recommended action**  
• Check voltage supply of electronic limit switch/external solenoid valve.  
**Note:** It is only evaluated when the partial stroke test is started manually (P17).

### F9*

PST timeout

• Mechanical blockage  
• Supply pressure too low  
• External leakage  
**Recommended action**  
• Check attachment and supply air line.

### Error messages

<table>
<thead>
<tr>
<th>F10</th>
<th>Error E0 to E10 exists</th>
</tr>
</thead>
</table>

See section 12.2
### 12.2 Error messages

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Error messages marked with an asterisk (*) can be confirmed in SET configuration mode. See section 9.5.3.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TROVIS-VIEW:</strong> The last 32 error messages are saved with a time stamp in [Diagnosis – Logger device error].</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>E0</strong> No initialization The electronic limit switch has not yet been initialized. <strong>Recommended action</strong> • Start initialization with P9 or P10 parameter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>E1</strong> INIT: Actuator does not move • Mechanical blockage • Supply pressure too low • External leakage • Incorrect voltage supplied to solenoid valve <strong>Recommended action</strong> • Check attachment and supply air line. • Check voltage supply of electronic limit switch/external solenoid valve.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>E2</strong> INIT: Min. angle of rotation not reached • Mechanical blockage • Supply pressure too low • External leakage <strong>Recommended action</strong> • Check attachment and supply air line. • Increase the actuator’s angle of rotation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>E3</strong> INIT: Max. angle of rotation exceeded • Maximum angle of rotation 170° exceeded <strong>Recommended action</strong> • Reduce the actuator’s angle of rotation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>E4</strong> INIT: Actuator moves too quickly • $K_V$ coefficient of solenoid valve too high <strong>Recommended action</strong> • Install a restriction. Version for external solenoid valve (Type 3738-20-xxx1000xxx00) • Reduce $K_V$ coefficient at solenoid valve.</td>
</tr>
<tr>
<td>No.</td>
<td>Error message</td>
<td>Possible causes</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Error messages marked with an asterisk (*) can be confirmed in SET configuration mode. See section 9.5.3.</strong></td>
</tr>
</tbody>
</table>
| E5* | INIT: Switching voltage not applied | • Incorrect voltage supplied to solenoid valve  
**Recommended action**  
• Check voltage supply of electronic limit switch/external solenoid valve. |
| E6* | INIT: Timeout | • Supply pressure too low  
• Friction too high  
• KV coefficient of solenoid valve too low  
**Recommended action**  
• Check attachment and supply air line.  
Version for external solenoid valve (Type 3738-20-xxx10000xxx00)  
• Use a different solenoid valve with a higher KV coefficient. |
| E7* | Function canceled | • Internal error  
**Recommended action**  
• Repeat functioninitialization. |
| E8* | End position calibration could not be performed | • The end stops have shifted by 10° at the minimum.  
**Recommended action**  
• Re-initialize the electronic limit switch. |
| E9* | Device error 1 | • Internal error  
**Recommended action**  
The electronic limit switch must be replaced. The safe functioning of the device can no longer be guaranteed. |
| E10* | Device error 2 | • Internal error  
**Recommended action**  
The electronic limit switch should be replaced in the near future. The safe functioning of the device can no longer be guaranteed. |

**Note:** When E9 is generated, the signal wire breakage (contact BLB) is additionally set in accordance with IEC 60947-5-6.
13 Dimensions in mm

Dimensions in mm:

- 231 mm
- 20 mm
- 17 mm
- 97 mm
- 130 mm
- 185 mm
- 84 mm
- 42 mm
- 10 mm
- 30 mm
- 40 mm
- 97 mm
EC Type Examination Certificate


3. EC type examination certificate number: PTB 08 A 1 EX 2039 X

4. Equipment: Type 3738-L-110, Electronic Valve Position Monitor

5. Manufacturer: SAMSUNG AG Mess- und Regeltechnik

6. Address: Weisantlerstraße 2, 60314 Frankfurt am Main, Germany

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

8. Physikalisch-Technische Bundesanstalt, notified body no. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive. The examination and test results are recorded in the confidential Assessment and Test Report PTB Ex 09-28163.

9. Compliance with the essential health and safety requirements has been assured by compliance with:

   EN 60079-0:2006
   EN 60079-11:2007
   EN 61241-1:2006

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

11. This EC type examination certificate relates only to the design and construction of the specified equipment or protective system in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment. These requirements are not covered by this certificate.
Enclosure

EC Type Examination Certificate PTB 88 ATEX 2039 X

Description of the equipment or protective system:
The Type 3738...110... Electronic Valve Position Monitor is designed to safely indicate the end positions of on/off control valves and includes different diagnostic functions for safe valve operation. The valve monitor in type of protection Ex ia IIC HEx is used for connection to intrinsically safe NAMUR contacts with intrinsically safe internal or external solenoid valves. The valve monitor is intended for use in hazardous areas.

The following table lists the relation between equipment type, type of protection, temperature classes and permissible ambient temperature range:

<table>
<thead>
<tr>
<th>Type</th>
<th>Type of protection</th>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>3738...110...</td>
<td>Ex ia IIC</td>
<td>T6</td>
<td>−40°C to 55°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T5</td>
<td>−40°C to 70°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4</td>
<td>−40°C to 80°C</td>
</tr>
</tbody>
</table>

Electric data:

Supply current circuit using limit switch (A) NAMUR contact............. in type of protection Ex ia IIC

For connection to a certified intrinsically safe current circuit only

Max. values:

\[ U_i = 20 \text{ V} \]
\[ I_i = 60 \text{ mA} \]
\[ P_i = 400 \text{ mW} \]
\[ I_a \text{ negligibly small} \]
\[ C_i = 5 \text{ m} \]

Limit switches (BC) NAMUR contact............. in type of protection Ex ia IIC

For connection to a certified intrinsically safe current circuit only

Max. values:

\[ U_i = 20 \text{ V} \]
\[ I_i = 60 \text{ mA} \]
\[ P_i = 600 \text{ mW} \]
\[ I_a \text{ negligibly small} \]
\[ C_i = 15 \text{ m} \]
Schedule to the EC Type Examination Certificate PTB 08 ATEX 2039 X

(terminal 281/282 external solenoid valve)..............in type of protection Ex ia IIC

Ua = 28 V
ln = 115 mA
or
Ua = 32 V
ln = 87.6 mA
Po = 1 W

Linear characteristic
Ia negligible small
Gia = 3 mH
Gia = 3 mH
Ua = 56 mV

Observe the rules governing the interconnection of intrinsically safe current circuits (if applicable) and ensure that the application range is observed.

SSP interface..............................................in type of protection Ex ia IIC

For connection to a certified intrinsically safe current circuit only.

Max. values:
Uia = 20 V
Iia = 60 mA
Pia = 200 mW
Iia negligibly small
Gia negligibly small

or

in type of protection Ex ia IIC

Ua = 9.55 V
ln = 32 mA
Po = 147 mW

Linear characteristic
Ia negligibly small
Gia negligibly small
Ua = 10 mV
Gia = 640 mV

Observe the rules governing the interconnection of intrinsically safe current circuits (if applicable) and ensure that the application range is observed.

Certification Sector for Explosion Protection
Dr. Ing. U. Johannsmeier
Director and Professor

Braunschweig, 16 March 2009

[Signature: Johannsmeier, stm sp: Physikalisch-Technische Bundesanstalt 56]
1. Addendum to EC Type Examination Certificate PTB 08 ATEX 2039 X

Max. values:

<table>
<thead>
<tr>
<th>Type</th>
<th>Type of protection</th>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>3738-..110..</td>
<td>Ex ia IIC</td>
<td>T6</td>
<td>-40°C to 55°C</td>
</tr>
<tr>
<td>3738-..310..</td>
<td>Ex e IIC</td>
<td>T4</td>
<td>40°C to 80°C</td>
</tr>
<tr>
<td>3738-..310..</td>
<td>Ex e IIC</td>
<td>T4</td>
<td>-40°C to 80°C</td>
</tr>
</tbody>
</table>

Applied Standards

- EN 60079-0:2006
- EN 60079-7:2007
- EN 61241-6:2006
- EN 61241-1:2004

Assessment and Test Report

PTB Ex 09-29233

Certification Centre for Explosion Protection

[Signature Gerlach, stamp: Physikalisch-Technische Bundesanstalt 561]

Dr. Jürgen Gerlach
Oberregierungsrat [senior government official]
Index

Index_en

A

Accessories ........................................... 20
Advanced partial stroke test ...................... 47
  parameters ....................................... 61
  status message ................................ 49
  target range .................................... 49
  test procedure .................................. 47
Article code ......................................... 8
Attachment to rotary actuator .................... 18 - 27
  version for external solenoid valve
    20 mm shaft height ....................... 25
    30 mm shaft height ....................... 26
    50 mm shaft height ....................... 27
  version with integrated solenoid valve
    20 mm shaft height ....................... 22
    30 mm shaft height ....................... 23
    50 mm shaft height ....................... 24

C

Cable entry ........................................ 30
Communication ..................................... 16
Configuration and operator interface ........... 16, 20
Connections
  electrical .................................... 29
  pneumatic .................................... 28
Contacts
  function test ................................. 53
  limit switches
    adjusting .................................. 41

D

Default values ................................... 46
Design ............................................ 9 - 17
Dimensions ....................................... 67 - 68
Direction of action
  determining .................................. 41
  displaying .................................... 33
  adapting ...................................... 39
  device initialized ........................... 39
  device not yet initialized .................. 39
  verifying readings ......................... 39

E

End position calibration ......................... 45
  errors ......................................... 45
Error messages ................................... 56, 65 - 66
Explosion protection .............................. 8, 13

F

Faults ............................................... 55

I

Info parameters
  actuator transit time, temperature, operating hours .................................. 61
  firmware version ................................ 62
Initialization ...................................... 42
  automatic ..................................... 43
  manual ......................................... 44
Initialization errors ............................. 43 - 44
Interface ......................................... 16, 33

L

Locking operation ................................ 46
  on-site ........................................ 47
  parameters .................................... 61
  TROVIS-VIEW .................................. 46

M

Maintenance ....................................... 57

O

Operating structure ................................ 34 - 38
Operation ......................................... 46 - 56
Operator controls . . . . . . . . . . . . . . . . . 33

P
Parameter list
  error messages . . . . . . . . . . . . . . . . . . . 65 - 66
  status messages . . . . . . . . . . . . . . . . . . 63 - 64
Partial stroke test
  parameters . . . . . . . . . . . . . . . . . . . . . 60
  test start . . . . . . . . . . . . . . . . . . . . . . 50
Principle of operation . . . . . . . . . . . . 9 - 17
PST (advanced partial stroke test) . . . . . . 47
  parameters . . . . . . . . . . . . . . . . . . . . . 60 - 61
  status message . . . . . . . . . . . . . . . . . . 49
  target range . . . . . . . . . . . . . . . . . . . . 49
PST (partial stroke test)
  test start . . . . . . . . . . . . . . . . . . . . . . 50

R
Replacing the electronic limit switch . . . 45
Reset . . . . . . . . . . . . . . . . . . . . . . . . 46
Rotary motion
  parameter . . . . . . . . . . . . . . . . . . . . . . 62
Rotary pushbutton . . . . . . . . . . . . . . . . . 33

S
Safety approval . . . . . . . . . . . . . . . . . . 14
Serial interface . . . . . . . . . . . . . . . . . . 16, 33
Servicing . . . . . . . . . . . . . . . . . . . . . . . 57
Solenoid valve
  function test . . . . . . . . . . . . . . . . . . . . 55
  technical data . . . . . . . . . . . . . . . . . . . 15

Start-up . . . . . . . . . . . . . . . . . . . . . 39 - 45
  replacing the electronic limit switch . 45
Start-up parameters . . . . . . . . . . . . . . . 58 - 60
Status messages . . . . . . . . . . . . . . . . . 55, 63 - 64
Status readout . . . . . . . . . . . . . . . . . . 60

T
Technical data . . . . . . . . . . . . . . . . . . . . 13, 15
  solenoid valve . . . . . . . . . . . . . . . . . . . 15
Test functions
  parameters . . . . . . . . . . . . . . . . . . . . . 61
TROVIS-VIEW . . . . . . . . . . . . . . . . . . . . 16, 20

V
Version
  for external solenoid valve attachment . . . . . 25, 27
  electrical connection . . . . . . . . . . . . . . 31 - 32
  schematic diagram . . . . . . . . . . . . . . . 11
  technical data . . . . . . . . . . . . . . . . . . . 15
  with integrated solenoid valve attachment . . . . . 12, 21 - 24
  schematic diagram . . . . . . . . . . . . . . . 10
  technical data . . . . . . . . . . . . . . . . . . . 15

W
Wire breakage . . . . . . . . . . . . . . . . . . . . . 53
Key code: 42
### Assignment depending on direction of action

#### PTO (power to open)

<table>
<thead>
<tr>
<th>Position Parameter for switching point of end position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact A: Fail-safe position (0 %) · Valve CLOSED</td>
</tr>
<tr>
<td>Contact B: Operating position (100 %) · Valve OPEN</td>
</tr>
</tbody>
</table>

#### PTC (power to close)

<table>
<thead>
<tr>
<th>Position Parameter for switching point of end position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact A: Fail-safe position (100 %) · Valve OPEN</td>
</tr>
<tr>
<td>Contact B: Operating position (0 %) · Valve CLOSED</td>
</tr>
</tbody>
</table>

### Parameter list

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Info: Actual value</td>
</tr>
<tr>
<td>P1</td>
<td>Reading direction</td>
</tr>
<tr>
<td>P2</td>
<td>Configuration: RUN/SET</td>
</tr>
<tr>
<td>P3</td>
<td>Verify LCD segments</td>
</tr>
<tr>
<td>P4*</td>
<td>Actuator type: ROT/LIN</td>
</tr>
<tr>
<td>P5*</td>
<td>Direction of action of actuator</td>
</tr>
<tr>
<td>P6*</td>
<td>Switching function of contacts A, B, C</td>
</tr>
<tr>
<td>P7*</td>
<td>Switching point lower end pos.</td>
</tr>
<tr>
<td>P8*</td>
<td>Switching point upper end pos.</td>
</tr>
<tr>
<td>P9*</td>
<td>Automatic initialization</td>
</tr>
<tr>
<td>P10*</td>
<td>Manual initialization</td>
</tr>
<tr>
<td>P11*</td>
<td>End position calibration</td>
</tr>
<tr>
<td>P12*</td>
<td>Status readout F6 and F7</td>
</tr>
<tr>
<td>P13*</td>
<td>Status readout F4</td>
</tr>
<tr>
<td>P14*</td>
<td>PST step final value</td>
</tr>
<tr>
<td>P15*</td>
<td>PST tolerance band</td>
</tr>
<tr>
<td>P16*</td>
<td>Start of automatic PST</td>
</tr>
<tr>
<td>P17*</td>
<td>Manual start of PST</td>
</tr>
<tr>
<td>P18*</td>
<td>Locking operation</td>
</tr>
<tr>
<td>P19*</td>
<td>Testing contacts A, B, B_LB, C, St</td>
</tr>
<tr>
<td>P20*</td>
<td>Testing solenoid valve</td>
</tr>
<tr>
<td>P21</td>
<td>Reset electronic limit switch</td>
</tr>
<tr>
<td>P22</td>
<td>Info: Actuator transit time when SV is de-energized</td>
</tr>
<tr>
<td>P23</td>
<td>Info: Actuator transit time when SV is energized</td>
</tr>
<tr>
<td>P24</td>
<td>Info: Temperature</td>
</tr>
<tr>
<td>P25</td>
<td>Info: Operating hours</td>
</tr>
<tr>
<td>P26*</td>
<td>Maximum rotary motions</td>
</tr>
<tr>
<td>P27*</td>
<td>Reset rotary motion counter</td>
</tr>
<tr>
<td>P28</td>
<td>Info: Firmware version</td>
</tr>
</tbody>
</table>

### Status messages

<table>
<thead>
<tr>
<th>Status message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Standstill outside of end positions</td>
</tr>
<tr>
<td>F1</td>
<td>Valve moved from end position without demand</td>
</tr>
<tr>
<td>F2</td>
<td>Limit for max. rotary motion (P26) exceeded</td>
</tr>
<tr>
<td>F3</td>
<td>Temperature limits exceeded</td>
</tr>
<tr>
<td>F4</td>
<td>Actuator transit time exceeded</td>
</tr>
<tr>
<td>F5</td>
<td>Actuator does not move after switching demand</td>
</tr>
<tr>
<td>F6</td>
<td>Min. value for PST not reached</td>
</tr>
<tr>
<td>F7</td>
<td>Max. value for PST exceeded</td>
</tr>
<tr>
<td>F8</td>
<td>No switching voltage during PST</td>
</tr>
<tr>
<td>F9</td>
<td>PST timeout</td>
</tr>
<tr>
<td>F10</td>
<td>Error E0 to E10 exists</td>
</tr>
</tbody>
</table>

### Error messages

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0</td>
<td>No initialization</td>
</tr>
<tr>
<td>E1</td>
<td>INIT: Actuator does not move</td>
</tr>
<tr>
<td>E2</td>
<td>INIT: Min. angle of rotation not reached</td>
</tr>
<tr>
<td>E3</td>
<td>INIT: Max. angle of rotation exceeded</td>
</tr>
<tr>
<td>E4</td>
<td>INIT: Actuator moves too quickly</td>
</tr>
<tr>
<td>E5</td>
<td>INIT: Switching voltage not applied</td>
</tr>
<tr>
<td>E6</td>
<td>INIT: Timeout</td>
</tr>
<tr>
<td>E7</td>
<td>Function canceled</td>
</tr>
<tr>
<td>E8</td>
<td>End position calibration could not be performed</td>
</tr>
<tr>
<td>E9</td>
<td>Device error 1</td>
</tr>
<tr>
<td>E10</td>
<td>Device error 2</td>
</tr>
</tbody>
</table>