ELGA-BS-KF
Spindle axis

Translation of the original instructions

1 Further applicable documents
All available documents for the product ➔ www.festo.com/sp.
Observe further applicable documents:
– Instruction manual for motor mounting kit.

2 Safety
2.1 General safety instructions
– The product may only be used in its original status without unauthorised modifications.
– Only use the product if it is in perfect technical condition.
– Observe product labelling.
– Take into consideration the ambient conditions at the location of use.
– Before working on the product, switch off the power supply and secure it against being switched back on. Only switch on the power supply when the product has been assembled and installation work is complete.
– Comply with the handling specifications for electrostatically sensitive devices.
– Observe tightening torques. Unless otherwise specified, the tolerance is ± 20 %.

2.2 Intended use
The spindle axis is intended to be used for positioning payloads in combination with tools or as a drive when external guides are used. A rotating ball screw drive converts the rotation of a motor into straight-line motion. As a result, the slide moves backwards and forwards. The slide is ball-bearing guided. The reference position of the slide can be queried by means of a proximity sensor.
The spindle axis is approved for slide and yoke operating modes ➔ Fig.1, ➔ Fig.2.

Fig. 1 Slider operating mode

Fig. 2 Yoke operating mode

2.3 Training of skilled personnel
– Installation, commissioning, service and disassembly should only be conducted by skilled personnel.
– The skilled personnel must be familiar with the installation of electrical and pneumatic control systems.

2.4 Approvals
The product fulfills the requirements of EU directives and comes with the CE marking. 

The product-relevant EC directives and standards are listed in the declaration of conformity ➔ www.festo.com/sp.

2.5 Further information
– Documents and literature ➔ www.festo.com/sp.

3 Product range overview

Table 1 Accessories

<table>
<thead>
<tr>
<th>Designation</th>
<th>Part number/type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure grease gun with needle-pointed nozzle</td>
<td>647958/LUB-1 ➔ <a href="http://www.festo.com/spareparts">www.festo.com/spareparts</a>.</td>
</tr>
<tr>
<td>Blast pipe, axial outlet port</td>
<td>647959/LUB-1-TR-1 ➔ <a href="http://www.festo.com/spareparts">www.festo.com/spareparts</a>.</td>
</tr>
<tr>
<td>Roller bearing grease</td>
<td>LUB KC1 from Festo ➔ <a href="http://www.festo.com/spareparts">www.festo.com/spareparts</a>.</td>
</tr>
</tbody>
</table>

3.2 Product design

Drive shaft ➔ 1
Thread for motor mounting kit ➔ 2
Cover strip ➔ 3
Slide ➔ 4
Thread/centring holes for attachment components ➔ 5
Thread for optional switch lug/measuring system ➔ 6
Relubrication opening for ball screw ➔ 7

Fig. 3 Product design

4 Transport and storage

Unexpected movement of components. The spindle axis is non-braking. Without input torque, the slide is freely movable.
– Secure slide during transport.
– Take product weight into account ➔ 9 Technical data: mechanical.
– Comply with maximum permitted support clearances when attaching transportation aids ➔ 10 Characteristic curves.
– Store and transport the product in its original packaging. The original packaging offers sufficient protection from typical stresses.
– Ensure short storage times.
– Choose cool, dry, well-shaded, corrosion-resistant locations.

5 Assembly

5.1 Mechanical installation
Prerequisites:
– Do not modify the screws and threaded pins. Exception: Direct request in these operating instructions to make changes.
– Select the motor and motor mounting kit from the Festo catalogue ➔ www.festo.com/catalogue. When using other motors, observe the limit values for forces, torques and speed ➔ 9 Technical data: mechanical.
– Assembling the motor ➔ 1 Further applicable documents.
– Connect motor cables only after the spindle axis is mounted.
The reference position is lost when the motor is dismounted (e.g., when turning the motor around).
- Start homing ➔ 6 Commissioning.

Mounting position vertical or diagonal:

**WARNING!**

Risk of injury due to falling working loads.
In a power failure or if the spindle nut breaks, the working load may fall.
- Only use motors with integrated spring-loaded brakes.
- Implement external safety precautions to prevent the spindle nut from breaking (e.g. tooth clinking, moveable bolts or emergency buffers).

Assembling the spindle axis
Prerequisites:
- Position the spindle axis in such a way that its operating elements are accessible (e.g. relubrication openings).
- Install spindle axis without tension or distortion.

Fasten spindle axis to a mounting surface with flatness of 0.05% of the stroke length, but max. 0.5mm. For gantry applications, attention must also be paid to parallel alignment or product heights in alignment of the axes. For additional information, contact your local Festo Service ➔ www.festo.com.
- Take the required support clearances into consideration ➔ 9 Technical data: mechanical.

Interfaces for mounting components

<table>
<thead>
<tr>
<th>On the cover</th>
<th>On the profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>k.e. with foot mounting HPE</td>
<td>k.e. with slot nuts NST</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>70</th>
<th>80</th>
<th>120</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw (cover)</td>
<td>M5</td>
<td>M8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightening torque [Nm]</td>
<td>6</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 3 Tightening torques of the retaining screws

**Mounting attachments**

Requirements

An uneven attachment component bends the slide and shortens the service life of the guide.
- Use an attachment component with an even surface. Evenness: \( t = 0.01 \) mm

Set down nominal load in such a way that the tilt moment resulting from force \( F \) (parallel to the axis of movement) and lever arm are kept as small as possible ➔ Fig.8.

Avoid collisions of the mounting part and payload with other mounting parts ➔ Fig.9.

For attachment components with their own guide:
- Adjust the guide and axis so that they are exactly parallel or use a connection that permits tolerance compensation. This will prevent overloading of the guide.

Mounting:

Fasten the attachment to the slide with screws and centring sleeves. Observe the maximum screw-in depth \( D \) and tightening torque ➔ Tab. 4 Mounting the payload.
Mounting accessories

To protect the end positions against uncontrolled excess travel:
- Check whether proximity sensors are necessary (as safety limit switches or hardware limit switches).

If proximity sensors are used as limit switches:
- Preferably use proximity sensors with normally-closed function. These will protect a spindle axis against excess travel of the end position in case of a broken proximity sensor cable.

If proximity sensors are used as reference switches:
- Use proximity sensors that correspond to the input of the controller being used.
- Use proximity sensors with switch lug. Assembly instructions: www.festo.com/sp.

Mounting options for proximity sensors

Tab. 4 Mounting the payload

Fig. 11 In the slots

Fig. 12 With sensor bracket

- Avoid external influence caused by magnetic or ferritic parts in the vicinity of the proximity sensors. Distance to slot nuts: ≥ 10 mm.
- Avoid contamination:
  - Use slot covers in all unused slots: www.festo.com/catalogue.

Fig. 13 Remove threaded pin

- Connect sealing air. To do this, remove the threaded pin on the cover and connect compressed air/vacuum: Fig. 13.

6 Commissioning

![Image of mounting options for proximity sensors]

![Image of mounting the payload]

![Image of expected movement of components]

Incorrect specification values for the braking ramp in STOP statuses (e.g. EMERGENCY OFF, Quick Stop) result in an overloading of the spindle axis and can destroy it or drastically reduce service life.

- Check the settings for all braking ramps in the controller or the higher-order control system (deceleration values and jerk).
- Taking the travel speed, moveable load and mounting position into account, set the delay values (brake delay and delay times) in such a way that the maximum drive torque or feed force of the spindle axis used is not exceeded.
- Take the travel speed, moveable load and mounting position into account.
- Use the Festo PositioningDrives design software to configure the spindle axis: www.festo.com.

Block-shaped acceleration profiles (without jerk limitation) cause high peaks in the drive force that can lead to an overloading of the drive. Due to overshooting effects, positions outside of the permissible range may also occur. A jerk-limited acceleration specification reduces vibrations in the entire system and has a positive effect on stress in the mechanical system.

- Check adjustments to the controller settings (e.g. jerk limitation, smoothing of the acceleration profile).

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Purpose</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel check</td>
<td>Determining the approach direction of the motor</td>
<td>Even with identical control, motors of the same design can turn in opposite directions due to different wiring.</td>
</tr>
<tr>
<td>Homing to reference switch</td>
<td>Comparison of real situation to the image of the controller</td>
<td>The homing run may only be performed towards the reference switch: <a href="http://www.festo.com/sp">www.festo.com/sp</a>.</td>
</tr>
</tbody>
</table>
| Test run             | Checking the overall behaviour | Check the requirements:
  - The slide moves through the intended positioning cycle completely.
  - Slide stops as soon as a limit switch is reached.

After a successful test run, the spindle axis is ready for operation.

Tab. 5 Commissioning

7 Maintenance

Check wear:
- Check reversing backlash (reverse play) of the slide for wear of the spindle nut during each maintenance procedure. The wear on the ball screw will lead to increased noise in the long term and eventually cause the ball screw drive to block or the spindle nut to break.

![Image of maximum permissible reversing backlash]

Tab. 6 Maximum permissible reversing backlash

Checking the cover strip:
- Check the cover strip after every 2000 km of operating distance. Waves on the cover strip are a sign of wear on the belt reversal device.
- Whenever waves form, retighten cover strip on both sides:
  1. Loosen the screws: Fig. 15, [5].
  2. Push the cover strip into the cover.
  3. Tighten cover strip with a clamping element: Fig. 15, [6].
  4. Tighten the screws. Tightening torque: 2 Nm.
- If the cover strip can no longer be retensioned:
  - Replace belt reversal devices: www.festo.com/spareparts.
  - Lubricating the spindle and guide:

6 Commissioning

![Image of expected movement of components]

Danger of crushing as a result of moving loads
- Do not reach into the path of the moving components.
- Install the corresponding protective devices (e.g. protective grille).
1. Relubrication opening of the ball screw
2. Cover strip
3. Relubrication openings of the guide
4. Cover
5. Screws
6. Clamping element

Fig. 15 Lubricating the ball screw and guide

1. Calculate load comparison factor \( f \) with the help of the formula for combined loads \( \rightarrow 9 \) Technical data: mechanical.

2. Read off lubrication interval \( S_{\text{lut}} \) \( \rightarrow \) Fig. 16.

3. Lubricate the guide and ball screw at all relubrication openings \( \rightarrow \) Fig. 15. Accessories and permitted lubricants \( \rightarrow 3.1 \) Not included in the delivery. Amount of lubricant at each relubrication opening:

<table>
<thead>
<tr>
<th>Size</th>
<th>Amount of lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball screw</td>
<td>g</td>
</tr>
<tr>
<td>Guide</td>
<td>g</td>
</tr>
</tbody>
</table>

Tab. 7 Amount of lubricant

7.1 Cleaning and maintenance

• Clean the spindle axis with a soft cloth as required. Cleaning agents include all non-abrasive media.

8 Malfunctions

8.1 Fault clearance

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squeaking noises, vibrations or the axis is not running smoothly.</td>
<td>Coupling distance incorrect</td>
<td>Observe the permissible coupling spacings ( \rightarrow ) <a href="http://www.festo.com/sp">www.festo.com/sp</a>.</td>
</tr>
<tr>
<td></td>
<td>Tensions</td>
<td>Install the axis so it is free of tension; maintain evenness of the bearing surface ( \rightarrow 5.1 ) Mechanical installation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change arrangement of the tool/payload.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Align the spindle axis so that it is exactly parallel to the second spindle axis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change the travel speed</td>
</tr>
<tr>
<td></td>
<td>Controller is incorrectly set</td>
<td>Changing the parameters</td>
</tr>
<tr>
<td></td>
<td>Insufficient lubrication at guide.</td>
<td>Lubricate the spindle axis ( \rightarrow 7 ) Maintenance.</td>
</tr>
</tbody>
</table>
| | | \(| S_{\text{lut}} \text{ is dependent on the load acting on the product. Load factors:}
| | | \bullet Dusty and dirty environment
| | | \bullet Nominal stroke > 2000 mm or < 300 mm
| | | \bullet Travel profile ≠ triangular operation (frequent acceleration and braking)
| | | \bullet Ambient temperature > + 40 °C
| | | \bullet Age of the product > 3 years
| | If one of these factors applies, halve the lubrication interval \( S_{\text{lut}} \).
| | If several factors apply at the same time, reduce the lubrication interval \( S_{\text{lut}} \) by three-quarters. |
| | | \( \rightarrow \) Recirculating ball bearing guide |
| | | Mounting position | Any |
| | | | Max. feed force \( \mathcal{F}_z \) [N] | 650 | 1600 | 3400 | 6400 |
| | | | Max. no-load driving torque \( \mathcal{F}_\text{n} \) [Nm] | 0.45 | 0.75 | 2.25 | 6.5 |
| | | | Maximum speed \( \mathcal{V}_\text{max} \) [r/min] | 3000 | 3600 | 3000 |
| | | | Max. speed \( \mathcal{V}_\text{max} \) [m/s] | 0.5 | 1 | 0.6 | 1.5 |
| | | | Max. acceleration \( \mathcal{a}_\text{max} \) [m/s²] | 15 |
| | | | Repeatency accuracy \( \mathcal{m} \) ± 0.02 |
| | | | Reversing backlash (new) \( \mathcal{m} \) – 0.01 |
| | | | Reversing backlash (limit value) \( \mathcal{m} \) \( \rightarrow 7 \) Maintenance |
| | | | Feed constant \( \mathcal{F}_\text{c} \) [mm/U] | 10 | 20 | 10 | 25 |
| | | | Ambient temperature \( \mathcal{E}_\text{a} \) [°C] | -10 – +60 |
| | | | Degree of protection | IP40 |

8.2 Repair

• Remove motor cables and mounting components. If repairs are required:
  – Send the spindle axis to the Festo repair service.
  – Information about spare parts and accessories \( \rightarrow \) www.festo.com/spareparts.

8.3 Disposal

Dispose of the packaging and the axis at the end of its useful life through environmentally friendly recycling in accordance with applicable specifications.

9 Technical data: mechanical

<table>
<thead>
<tr>
<th>Size</th>
<th>70</th>
<th>80</th>
<th>120</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle pitch</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Design</td>
<td>Electromechanical axis with ball screw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guide</td>
<td>Recirculating ball bearing guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting position</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. feed force ( \mathcal{F}_z ) [N]</td>
<td>1650</td>
<td>3100</td>
<td>10³</td>
<td>1.24 x 10⁶</td>
</tr>
<tr>
<td>Max. no-load driving torque ( \mathcal{F}_\text{n} ) [Nm]</td>
<td>0.472 x 10³</td>
<td>9.77 x 10³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum speed ( \mathcal{V}_\text{max} ) [r/min]</td>
<td>3.80 x 10³</td>
<td>11.81 x 10³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. radial force on drive shaft ( \mathcal{F}_s ) [N]</td>
<td>220</td>
<td>250</td>
<td>500</td>
<td>4000</td>
</tr>
<tr>
<td>Maximum permissible forces on the slide</td>
<td>( \mathcal{F}_s ) [N]</td>
<td>1500</td>
<td>2500</td>
<td>5500</td>
</tr>
<tr>
<td></td>
<td>( \mathcal{F}_s ) [N]</td>
<td>1850</td>
<td>3050</td>
<td>6890</td>
</tr>
<tr>
<td>Maximum permissible torques on the slide</td>
<td>( \mathcal{M}_s ) [Nmm]</td>
<td>16</td>
<td>36</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>( \mathcal{M}_s ) [Nmm]</td>
<td>132</td>
<td>228</td>
<td>680</td>
</tr>
<tr>
<td>Determination of the load compensation factor for combined loads:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information on materials</td>
<td>Contains paint-wetting impairment substances</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>Cover, profile, slide</td>
<td>Anodised aluminium</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 10 Characteristic curves

Force $F_y/F_z$ and support spacing $L$ at a max. sag of 0.5 mm

**Fig. 17 Support clearance**

**Fig. 18 Force distribution**

- **Fig. 19**
  - ELGA-BS-KF-70
  - ELGA-BS-KF-80
  - ELGA-BS-KF-120
  - ELGA-BS-KF-150

- **Fig. 20**
  - Graphs on maximum feed force (N) of all sizes → www.festo.com/catalogue.