LINE TECH Compact Units

Ready-to-install compact carriages with drive
LINE TECH Compact Units

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☐ Positioning units  ☐ Monocarriers (NSK)  ☐ Roller guides
☐ Linear path control systems  ☐ Linear rail guide systems (CPC)  ☐ Ball /cup casters

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LINE TECH Compact Units

Product overview

LINE TECH compact units are ready-to-install, precision linear systems of modular design with exceptional performance characteristics.

Compact unit with one carriage

Compact unit with two carriages

Compact unit with two carriages and connecting plate

Advantages
- Compact dimensions
- Available in any desired length
- Optimum running performance together with high load ratings and high rigidity due to two integral, free of play ball rail guide systems
- Simple motor mounting by centering and thread on driving head
- Greasing by central grease points
- Available in maintenance-free design
- Precise alignment and fastening of mounted parts by thread and pin holes in table section.

Structure
- Compact aluminium profile base frame
- Ready-to-install compact units in any desired length
- Carriages made of aluminium

Customised options
- Motor mounting
- Limit switches
- Multi-axis systems
### Compact units Dimensions [mm]

<table>
<thead>
<tr>
<th>Compact units</th>
<th>Dimensions [mm]</th>
<th>Dynamic load rating $C$ [N]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B \times H$</td>
<td>$H_p$</td>
</tr>
<tr>
<td>KE2</td>
<td>110 x 50</td>
<td>49</td>
</tr>
<tr>
<td>KE3</td>
<td>145 x 65</td>
<td>64</td>
</tr>
</tbody>
</table>

For loading capacity please see pages 9 and 10.
# Designation system

**Compact unit (sample designation)**

<table>
<thead>
<tr>
<th>KE 2.2.0200</th>
<th>A</th>
<th>R</th>
<th>005.0</th>
</tr>
</thead>
</table>

## Compact unit KE

### Size (B x H)

- \( \ldots \) = 110 x 50 mm
- 2 = 110 x 50 mm
- 3 = 145 x 65 mm
- \( \ldots \) =

### Configuration

- 2 = 1 carriage (2 guide carriages)
- 4 = 2 carriages (4 guide carriages)

### Stroke absolute [mm]

### Cover

- A = with plastic strapping
- N = without cover

### Drive

- N = without drive (for assembly stage “00”)
- R = rolled ball screw

### Stroke per revolution [mm]

<table>
<thead>
<tr>
<th>Rolled ball screw:</th>
<th>KE2</th>
<th>KE3</th>
</tr>
</thead>
<tbody>
<tr>
<td>005, 010, 016(^1)</td>
<td>005, 010, 020</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) not possible with options K and Z

### Limit switches

- 0 = without limit switch
- 1 = with 2 limit switches and reference pos. at front (drive mount)
- 2 = with 2 limit switches and reference pos. at rear (drive mount opposite)
- 3 = with 2 limit switches and additional reference switch at front (drive side)
- 4 = with 2 limit switches and additional reference switch at rear (opposite drive side)

---

* seen from motor opposite side towards motor
** available for lateral motor mounting only
*** Standard version
**LINE TECH Compact Units**

**Designation system**

- **Options**
  - N = without options ***
  - K = with K1 greasing units
  - P = with stop buffer
  - Z = with stop buffer and K1 greasing units

- **Connector shell** (up to and with size 2)
  - N = without connector shell (KE2 only; loose cable L = 2.0 m) ***
  - S = with connector shell (KE3 with connector)

- **Position limit switch mounting / connector position**
  - N = without limit switch
  - L = left *
  - R = right *

- **Preload ball screw**
  - N = reduced play (play < 0.01 mm) ***
  - A = with axial play max. 0.2 mm
  - V = preloaded
  - N = without drive

- **Tolerance class ball screw**
  - 7 = 52 µm / 300 mm ***
  - 5 = 23 µm / 300 mm
  - 9 = 130 µm / 300 mm
  - N = without drive

- **Motor mounting**
  - N = without drive mount
  - F = mounting plate for LINE TECH motor
  - S = mounting plate for special motor

- **Gear reduction**
  - 0 = without gear reduction (1:1 ** lateral motor mounting)
  - 1 = reduction 1:1.5 **
  - 2 = reduction 1:2 **

- **Assembly stage**
  - 00 = without drive (in conjunction with drive type "N")
  - 01 = free shaft end (standard version)
  - S1 = free shaft end (special version)
  - 02 = with coupling and intermediate plate
  - 03 = with crank and clamp
  - 04 = set up for lateral motor mounting right *
  - 05 = set up for lateral motor mounting left *
  - 06 = set up for lateral motor mounting top *
  - 07 = set up for lateral motor mounting bottom *

---

- 583... = Drawing type
LINE TECH Compact Units

LINE TECH linear units are modular-designed, ready-to-install linear carriages with drive unit. Sealed guide elements in all sizes are employed. Rolled ball screws are primarily used as drive units. The guides and drive element are protected by a plastic strapping made of special fabric against the intrusion of dirt, filings, etc. The basic and cover profile are made of aluminium alloy and manufactured by extrusion process. From size KE3 upwards the integral limit switches on the basic profile and up to size KE3 exterior mounted limit switches, together with motors and a control unit, ensure correct positioning of the carriage and prevent overrunning. The selected design provides for a high level of performance with the most compact dimensions.

Lubrication

LINE TECH compact units are greased at the factory with Microlube GBU Y 131. This grease ensures outstanding characteristics of both the guide elements and spindle drive. Greasing should be carried out at regular intervals, depending on the load and area of operation. On an average, re-greasing is required every 500 hours. All roller bearings are greased for life and thus do not require any maintenance. Correct and sufficient greasing can substantially extend the life of the compact units.

Maintenance-free due to K1 wipers

The guides and ball screws are optionally available in maintenance-free design with K1 wipers (lubrication units). The compact unit is maintenance-free for 25,000 km or 5 years, i.e. no re-greasing is necessary.

Service temperature

The permissible operating temperature of 80 °C is predetermined by the composites in use. For motors and control units refer to the values in the respective publications.
### Load ratings and torques

#### Note on dynamic load ratings and torques

The determination of dynamic load ratings and torques is based on a 50,000 m stroke. If comparative values must be calculated for a 100,000 m stroke, the values for $M_x$, $M_y$, $M_z$, and $C$ must be divided by the factor 1.26.

#### Expedient load

With a view to durability, loads of less than 20% of the dynamic load ratings have generally proved to be expedient.

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of carriages</th>
<th>Ball screw</th>
<th>Dynamic load ratings C</th>
<th>Dynamic torques</th>
<th>Moment of inertia</th>
<th>Max. length</th>
<th>Moving mass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>d₀ x p</td>
<td>Guide Ball screw Fixed bearing</td>
<td>$M_x$</td>
<td>$M_y$</td>
<td>$M_z$</td>
<td>$M_y$</td>
</tr>
<tr>
<td>KE2</td>
<td>1</td>
<td>15 x 5</td>
<td>16700 5460 13900 382 120 96 29.4 242.5 1480 0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 x 10</td>
<td>5460</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 x 16</td>
<td>9300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (lₘ = 85 mm)</td>
<td>33400 5460 13900 836 944 760 29.4 242.5 1480 1.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 x 5</td>
<td>5460</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 x 10</td>
<td>5460</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 x 16</td>
<td>9300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KE3</td>
<td>1</td>
<td>20 x 5</td>
<td>23400 8790 16000 680 207 165 93.3 746.0 1970 1.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 x 10</td>
<td>8790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 x 20</td>
<td>8790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 (lₘ = 100 mm)</td>
<td>46800 8790 16000 1520 1420 1190 93.3 746.0 1970 2.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 x 5</td>
<td>8790</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>20 x 10</td>
<td>8790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 x 20</td>
<td>8790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Load ratings and torques**

The recommended load is less than 20 % of the dynamic values.

<table>
<thead>
<tr>
<th>Size</th>
<th>Number of carriages</th>
<th>Maximum permissible force [N]</th>
<th>Maximum permissible torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Static Cy0&lt;sub&gt;1,2&lt;/sub&gt;</td>
<td>Dynamic Cy&lt;sub&gt;1,2&lt;/sub&gt;</td>
</tr>
<tr>
<td>KE2</td>
<td>1</td>
<td>29744</td>
<td>33800</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>59488</td>
<td>67600</td>
</tr>
<tr>
<td>KE3</td>
<td>1</td>
<td>41360</td>
<td>47000</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>82720</td>
<td>94000</td>
</tr>
</tbody>
</table>
Assembly stages for ball screw

LINE TECH positioning systems are available in various assembly stages (figs. 1 to 10).

For dimensions see pages 30 and 31.
Notes on selection
Motor mounting

Fig. 6: lateral motor mounting right
(Assembly stage 04)

Fig. 7: lateral motor mounting left
(Assembly stage 05)

Fig. 8: lateral motor mounting top
(Assembly stage 06)

Fig. 9: lateral motor mounting bottom
(Assembly stage 07)
Limit switches

The limit switches are used in conjunction with a control unit to limit the stroke (preventing overrunning of the carriage) and to define the reference position.

LINE TECH employs the following standard inductive limit switches:
- PNP openers (PNP-NC)
  Supply: 10...30 V DC
  Current consumption off-load: < 10 mA
  Load: max. 200 mA

On request the following non-standard limit switches are available:
- PNP make type (PNP-NO)
- NPN break type (NPN-NC)
- NPN make type (NPN-NO)
- Reed switches
- Mechanical switches

Plug connector

The plug pin assignment for standard limit switches is shown in Figs. 10 and 11. The individual pins are assigned as follows:

Pin 1 Minus (–) direction (load)
Pin 2 0 V (GND)
Pin 3 Plus (+) direction (load)
Pin 4 +10...30 V DC
Pin 5 Reference (load)

Colour code legend for Figs. 10 and 11

Load = black
+V DC = brown
0 V (GND) = blue

The LINE TECH product range also includes continuous- and linear-path control systems as well as step motors and AC servo drives. The individual components are optimally coordinated and supplement LINE TECH compact units to custom-made systems.

Fitting position of the limit switches

The mounting position of the limit switches is shown in Fig. 12. The reference position can be allocated either to the plus (+) or to the minus (–) limit switch.

Special applications often require a separate reference point switch to be mounted between the plus and minus limit switch. The limit switch mounted closer to the plug connector (interface limit switch control) is known as the forward limit switch.

Limit switch mating plugs with cable are not included in the shipping contents, but can be ordered ready-assembled from LINE TECH (see Figs. 12 and 13).
**Cable**

LINE TECH will assemble your cable to your specifications. Single cables can be obtained as per the following order reference:

**Cable K**

**Use**

- A = AC motor cable
- B = Brake cable
- D = DC motor cable
- E = Encoder cable
- L = Limit switch cable
- N = Power cable
- R = Resolver cable
- S = Stepper motor cable (3-phase)
- T = Stepper motor cable (2-phase)
- Z = Special cable

**Cable length**

03 = 3 m  
05 = 5 m  
10 = 10 m

(for intermediate lengths use next longer cable)

**Plug code actor side**

<table>
<thead>
<tr>
<th>K</th>
<th>L</th>
<th>05</th>
<th>R</th>
<th>001</th>
<th>000</th>
<th>103</th>
</tr>
</thead>
</table>

**Plug code feed side**

according to table on next page

**Code cable assembly**

according to table on next page

**Sheath definition**

<table>
<thead>
<tr>
<th>Outer</th>
<th>/</th>
<th>Inner</th>
</tr>
</thead>
<tbody>
<tr>
<td>M =</td>
<td>PUR</td>
<td>/</td>
</tr>
<tr>
<td>N =</td>
<td>PVC</td>
<td>/</td>
</tr>
<tr>
<td>R =</td>
<td>PUR</td>
<td>/</td>
</tr>
</tbody>
</table>

* standard

**Mating plug for limit switch connection**

LINE TECH can supply the following plug types for connecting limit switches:

- Straight plug
  - Article no.: CFLKB05A

- Angle plug
  - Article no.: CFLKB05B

---

**Fig. 12: Mounting position of limit switch**

**Fig. 13: Mating plug**
### Cable assembly

<table>
<thead>
<tr>
<th>Code</th>
<th>Cable type</th>
<th>Use</th>
<th>Code</th>
<th>Cable type</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>5x0.25C11Y-S</td>
<td>L, Z</td>
<td>011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>002</td>
<td>7x0.25C11Y-S</td>
<td>E, Z</td>
<td>012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>003</td>
<td>4x2.0x0.25C11Y-S</td>
<td>E, R</td>
<td>013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>004</td>
<td></td>
<td></td>
<td>014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>005</td>
<td>2x0.5x11Y-S</td>
<td>B</td>
<td>015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>006</td>
<td></td>
<td></td>
<td>016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>007</td>
<td>4G0.75C11Y</td>
<td>A, S, T</td>
<td>017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>008</td>
<td></td>
<td></td>
<td>018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>009</td>
<td>4G0.75+2x(2x0.75)C11Y-S</td>
<td>A, D</td>
<td>019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>010</td>
<td>4G1.5+2x(2x0.75)C11Y-S</td>
<td>A, D</td>
<td>020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Plug code

<table>
<thead>
<tr>
<th>Code</th>
<th>Plug designation</th>
<th>Use</th>
<th>Code</th>
<th>Cable type</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>loose cable end</td>
<td>all</td>
<td>200</td>
<td>9-pole SUB-D socket</td>
<td>E, R</td>
</tr>
<tr>
<td>00…</td>
<td></td>
<td></td>
<td>201</td>
<td>9-pole SUB-D plug</td>
<td>E, R</td>
</tr>
<tr>
<td>00…</td>
<td></td>
<td></td>
<td>202</td>
<td>15-pole SUB-D plug</td>
<td>E, R</td>
</tr>
<tr>
<td>010</td>
<td>loose cable end for Servostar 300</td>
<td></td>
<td>203</td>
<td>12-pole M23 socket counter-rotating</td>
<td>E, R</td>
</tr>
<tr>
<td>011</td>
<td>loose cable end for Servostar 400</td>
<td></td>
<td>204</td>
<td>12-pole M23 socket co-rotating</td>
<td>E</td>
</tr>
<tr>
<td>012</td>
<td>loose cable end for Servostar 600</td>
<td></td>
<td>205</td>
<td>12-pole F-code M23 socket counter-rotating</td>
<td>E</td>
</tr>
<tr>
<td>013</td>
<td>loose cable end for Servostar 700</td>
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<td>20…</td>
<td></td>
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</tr>
<tr>
<td>01…</td>
<td></td>
<td></td>
<td>20…</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0……</td>
<td></td>
<td></td>
<td>2……</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0……</td>
<td></td>
<td></td>
<td>2……</td>
<td></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>5-pole DIN41524 M16 straight plug</td>
<td>L</td>
<td>301</td>
<td>6-pole 20A 300V M23 plug</td>
<td>A</td>
</tr>
<tr>
<td>102</td>
<td>5-pole DIN 41524 90° angle plug</td>
<td>L</td>
<td>302</td>
<td>4+3+PE 9/26A 300/600 V M23 socket</td>
<td>A</td>
</tr>
<tr>
<td>103</td>
<td>5-pole DIN 41524 M16 straight socket</td>
<td>L</td>
<td>303</td>
<td>4+3+PE 7.5/11A 60/300 V M23 socket</td>
<td>A</td>
</tr>
<tr>
<td>104</td>
<td>5-pole DIN 41524 90° angle socket</td>
<td>L</td>
<td>304</td>
<td>6-pole 11A 380V M23 socket</td>
<td>S</td>
</tr>
<tr>
<td>10…</td>
<td></td>
<td></td>
<td>30…</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>2-pole M16 straight plug</td>
<td>B</td>
<td>3……</td>
<td></td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>4-pole 90° angle socket</td>
<td>B</td>
<td>3……</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Permissible speeds

Please also pay attention to motor speeds!
Permissible deflection

Compact units may be assembled self-supporting. However, the deflection (which limits the possible load) must be taken into consideration.

If the maximum permissible deflection is exceeded, the compact unit must be additionally supported.

The maximum permissible deflection is limited by the maximum deflection angle of 5°. Exceeding this value without support will have a negative effect on the units durability.

If increased demands are made on system accuracy we recommend supporting the compact unit along its entire length.

Definition of mounting positions:

- horizontal

- vertical
Permissible deflection (horizontal)

The following diagrams apply to:
- firm clamping (40–50 mm per side)
- 3–4 screws per side
- solid substructure
Permissible deflection (vertical)

The following diagrams apply to:
- firm clamping (40–50 mm per side)
- 3–4 screws per side
- solid substructure

**KE 2**

**KE 3**
LINE TECH Compact Units

Overview KE2

Cross-section (M 1:1)

Design 01

Design S1
LINE TECH Compact Units

Dimensions KE2.2 (with 1 carriage)

a) Central lubrication (greasing); 1 lubrication hole per side for funnel-type grease nipple DIN 3405-D Position carriage in middle stroke position.

b) Grease ports for connecting plates closed with M4 setscrew

CAD download: www.linetech.ch

---

**Dimensions without additional options** (Option N)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>(L_M)</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>(P_S)</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2.2...N</td>
<td>Stroke + 164</td>
<td>L − 62</td>
<td>L + 12</td>
<td>2 x Stroke + 294</td>
<td>82</td>
<td>1.90 kg + 0.852 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>

**Dimensions with additional options** (options K, P or Z, see designation system page 7)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>(L_M)</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>(P_S)</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2.2...K, P, Z</td>
<td>Stroke + 182</td>
<td>L − 62</td>
<td>L + 12</td>
<td>2 x Stroke + 330</td>
<td>91</td>
<td>2.13 kg + 0.852 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>
**Dimensions KE2.2 (with 2 carriages)**

**a)** Central lubrication (greasing):
2 Central lubrication holes per side for funnel-type grease nipple DIN 3405-D
Position carriage in middle stroke position.

**b)** Grease ports for connecting plates closed with M4 setscrew.

**Dimensions without additional options** (Option N)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>L_M</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>P_s</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2.4...N</td>
<td>Stroke + 249</td>
<td>L - 62</td>
<td>L + 12</td>
<td>2 x Stroke + 379</td>
<td>82</td>
<td>3.25 kg + 0.852 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>

**Dimensions with additional options** (options K, P or Z, see designation system page 7)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>L_M</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>P_s</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2.4...K, P, Z</td>
<td>Stroke + 267</td>
<td>L - 62</td>
<td>L + 12</td>
<td>2 x Stroke + 415</td>
<td>91</td>
<td>3.48 kg + 0.852 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>
**LINE TECH Compact Units**

**Limit switch mounting KE2**

- **Dimensions for limit switch mounting**
  - Switching distance: 0.5 to 0.8 mm
  - LR = 20 mm (standard)
  - but at least 10 mm

- **Reference switch position**
  - LR = 20 mm (standard)
  - but at least 10 mm
  - Reverse side (opposite drive side)
  - Front (drive side)

- **Mounting left**
  - Without connector shell
  - With cable L = 2 m

- **Mounting right**
  - With connector shell
LINE TECH Compact Units

Overview KE3

Cross-section (M 1:1.5)

Detail A

- 3.2
- 1.8
- 4.8
- 1.3

Detail B

- 4.8
- 8.2
- 5.2
- 2.5

Design 01

- ø38 h6
- ø12 h7
- 44
- 4.5

Design S1

- ø48 H8
- ø25
- 2.5
- 3.5
- 44
a) Central lubrication (greasing); 1 lubrication hole per side for funnel-type grease nipple DIN 3405-D Position carriage in middle stroke position.

b) Grease ports for connecting plates closed with M5 setscrew.

**CAD download:**
www.linetech.ch

**Dimensions KE3.2 (with 1 carriage)**

### Dimensions without additional options (Option N)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>( L_M )</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>( P_S )</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE3.2...N</td>
<td>Stroke + 198</td>
<td>L - 79</td>
<td>L + 25</td>
<td>2 x Stroke + 356</td>
<td>103.5</td>
<td>5.40 kg + 1,232 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>

### Dimensions with additional options (options K, P or Z, see designation system page 7)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>( L_M )</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>( P_S )</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE3.2...K, P, Z</td>
<td>Stroke + 205</td>
<td>L - 79</td>
<td>L + 25</td>
<td>2 x Stroke + 370</td>
<td>107.0</td>
<td>5.49 kg + 1,232 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>
**Dimensions KE3.4 (with 2 carriages)**

**a)** Central lubrication (greasing);
- 1 lubrication hole per side for funnel-type grease nipple DIN 3405-D
- For greasing
  - Carriage 1: position carriage in middle stroke position
  - Carriage 2: position carriage in middle stroke position – 10 mm

**b)** Grease ports for connecting plates closed with M5 setscrew.

---

### Dimensions without additional options (Option N)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>Lm</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>Ps</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE3.4...N</td>
<td>Stroke + 298</td>
<td>L – 79</td>
<td>L + 25</td>
<td>2 x Stroke + 456</td>
<td>103.5</td>
<td>7.62 kg + 1,232 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>

### Dimensions with additional options (options K, P or Z, see designation system page 7)

<table>
<thead>
<tr>
<th>Type</th>
<th>L [mm]</th>
<th>Lm</th>
<th>Spindle length</th>
<th>Length plastic strapping (2x)</th>
<th>Ps</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE3.4...K, P, Z</td>
<td>Stroke + 305</td>
<td>L – 79</td>
<td>L + 25</td>
<td>2 x Stroke + 470</td>
<td>107.0</td>
<td>7.71 kg + 1,232 kg/100 mm Stroke</td>
</tr>
</tbody>
</table>
**Line switch mounting KE3**

- **Limit switch trigger**
- **Plug**
- **Reference switch**
- **(+/-) Limit switch**

**Reference switch position**
- **Reverse side** (opposite drive side)
- **Front** (drive side)

**Switching distance**
- 0.5 to 0.8 mm

**Dimensions of limit switch plug**

**Plug output**
- **Left**
- **Right**

**Reference switch position**

\[
L_R = 20 \text{ mm (standard)}
\]

but at least 8 mm
LINE TECH Compact Units

Dimensions of motor mounting
Straight mounting

Straight motor mounting

Length of motor mounting

Motor dimensions *

KE2 Dimensions [mm]

<table>
<thead>
<tr>
<th>$L_W$</th>
<th>$L_K$</th>
<th>Coupling</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 25</td>
<td>65</td>
<td>Size 14</td>
</tr>
<tr>
<td>30 to 35</td>
<td>75</td>
<td>Size 14</td>
</tr>
</tbody>
</table>

KE3 Dimensions [mm]

<table>
<thead>
<tr>
<th>$L_W$</th>
<th>$L_K$</th>
<th>Coupling</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 to 36</td>
<td>90</td>
<td>Size 19</td>
</tr>
<tr>
<td>36 to 46</td>
<td>100</td>
<td>Size 19</td>
</tr>
</tbody>
</table>

Coupling dimensions [mm]

<table>
<thead>
<tr>
<th>Size</th>
<th>$L$</th>
<th>$\phi D$</th>
<th>$\phi d$</th>
<th>$f_1$</th>
<th>$E$</th>
<th>$\phi D_K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>35</td>
<td>30</td>
<td>max. 15</td>
<td>11</td>
<td>13</td>
<td>32.2</td>
</tr>
<tr>
<td>19</td>
<td>66</td>
<td>40</td>
<td>max. 20</td>
<td>25</td>
<td>16</td>
<td>46.0</td>
</tr>
</tbody>
</table>

* Dimensions $\phi D_M$, $B$, $\phi F$, $L_K$, $L_W$, $\phi d_m$, $L_Z$ and $\phi Z$ in the Motor dimensions diagram are only required for specifying the motor mounting.
**Dimensions of motor mounting**

**Lateral mounting**

**Belt drive housing**

**Tooth lock washer KE**

No. of teeth = \(z_{KE}\)

\[i = \frac{z_M}{z_{KE}}\]

**Toothed belt**

**Motor tooth lock washer**, No. of teeth = \(z_{M}\)

---

**Dimensions for lateral motor mounting**

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions [mm]</th>
<th>No. of teeth</th>
<th>Max. od, [mm]</th>
<th>Belt length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>i E F G H K Lg</td>
<td>(z_M) (z_{KE}) (\delta d_M)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KE2</td>
<td>1:1 135 (132.5-137.5) 100 43 25.5 45 247</td>
<td>32 32 (\delta 19)</td>
<td>425</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:1.5 177 120 66 34 65 300</td>
<td>50 50 (\delta 22)</td>
<td>610</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:2 25 50 (\delta 14)</td>
<td>545</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LINE TECH Compact Units

Dimensions of connecting plates
for KEs with 2 carriages

Connecting plates for KEs with 2 carriages

Aluminium connecting plates for LINE TECH compact units extend the mounting options. They also permit position-independent greasing, as sufficient lube points are available on the connecting plates.

The connecting plates differ in design. The plate shown below is specified for size KE3.

![Connecting Plates Diagram]

- **Detail A**
  - M4 x 8 (both sides)
  - Funnel-type grease nipple D1a conforming to DIN 3405-D

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions [mm]</th>
<th>Weight [kg]</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>KE2</td>
<td>110</td>
<td>155</td>
<td>16</td>
</tr>
<tr>
<td>KE3</td>
<td>145</td>
<td>190</td>
<td>20</td>
</tr>
</tbody>
</table>
Connecting plates for KEs with 1 carriage

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions [mm]</th>
<th>Weight [kg]</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>KE2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>60</td>
<td>16</td>
</tr>
<tr>
<td>KE3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>145</td>
<td>125</td>
<td>20</td>
</tr>
</tbody>
</table>
Mounting options

The compact units are fixed with clamps. Mounting and supporting the compact units only at the base body, not at the endplates.

Dimensions of clamps

Recommended number of clamps: 4 per metre and side

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions [mm]</th>
<th>Weight [kg]</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE2</td>
<td>A 126 B 140</td>
<td>I 0.072</td>
<td>P-54179/1</td>
</tr>
<tr>
<td>KE3</td>
<td>A 161 B 175</td>
<td>I 0.100</td>
<td>P-54180/1</td>
</tr>
<tr>
<td>KE2 / KE3</td>
<td>A 80 B 10 C 60 E 4.5</td>
<td>I 0.088</td>
<td>P-54181/1</td>
</tr>
</tbody>
</table>
Sliding blocks

Sliding blocks with the corresponding groove width may be used to mount superstructures on the connecting plates.

According to the groove width, sliding blocks of the types NS6 and NS8 are suitable. The sliding blocks are available at LINE TECH. The order number must specify size, material and connecting thread (e.g. NS6 St M5-KE). The available types are listed opposite.

Order designation for sliding blocks
Sample: NS6 St M5-KE

<table>
<thead>
<tr>
<th>Groove width [mm]</th>
<th>Dim. “a” [mm]</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>M4 / M5 / M6</td>
<td>St, Inox</td>
</tr>
<tr>
<td>8</td>
<td>M4 / M5 / M6 / M8</td>
<td>St, Inox</td>
</tr>
</tbody>
</table>

Sliding block NS

<table>
<thead>
<tr>
<th>Groove width</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

Sliding block NS

<table>
<thead>
<tr>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>St = Steel</td>
</tr>
<tr>
<td>Inox = Inox</td>
</tr>
</tbody>
</table>
LINE TECH Compact Units

Cross table mounting

Cross tables

LINE TECH compact units are also available as double-axis units (cross table). The designation system opposite applies. A total of four mounting types are possible. The method of mounting is determined by the correlation between limit switch plug and drive position.

Mounting type AC and AD cross tables are mounted with clamps. An intermediate plate is required for mounting types BC and BD.

The individual compact units must be ordered separately.

Accuracy

Standard accuracy for mounting cross tables is 0.1 mm/300 mm stroke. Greater accuracy on request.

Designation system

KM . KE3 / KE2 . AC

Abbreviation for lower axis
KE2 / KE3

Abbreviation for upper axis
KE2 / KE3

Mounting type
AC / AD / BC / BD

Dimension A [mm]

<table>
<thead>
<tr>
<th>Mounting type</th>
<th>upper unit</th>
<th>KE2</th>
<th>KE3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A_ B_ A_ B_</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lower unit</td>
<td>KE2</td>
<td>116</td>
<td>132</td>
</tr>
<tr>
<td></td>
<td>KE3</td>
<td>135</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>169</td>
</tr>
</tbody>
</table>

Mounting type: AC

Mounting type: BC

Mounting type: AD

Mounting type: BD
**Grease points**

Holes for accessing the grease nipples in the carriage have been provided on each side of the base profile of the compact units. It suffices to grease from one side, as all grease nipples are connected.

**Grease ports for carriage superstructures**

Grease ports are closed by setscrews when delivered without connecting plates. Upon connection by the customer the connection dimensions must be observed and O-rings used.

---

**Grease gun**

Art. no.: ZPE.GREASEGUN-04

---

**Size | Weight [mm]**

<table>
<thead>
<tr>
<th>KE2</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>M</th>
<th>P</th>
<th>S</th>
<th>O-ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE3</td>
<td>88</td>
<td>11.5</td>
<td>11.5</td>
<td>-11.5</td>
<td>100</td>
<td>0.8</td>
<td>M5</td>
<td>ø6.5</td>
<td>ø3</td>
<td>ø4x1</td>
</tr>
</tbody>
</table>

---

1) Mounting by customer
2) Carriage
3) O-ring
4) Base profile
Concept

The determination of service life must be calculated based on the respective documents of the linear rail guide system and the ball screw drives. Also for the drive belts we shall refer to the specific literature.

Since the service life is normally dependent on the linear rail guide system, the following formulary can be applied for approximate determination:

Dynamic load

The nominal service life \( L_{10} \) is calculated from the dynamic load rating \( C_{dyn} \) [N] and the applied load \( F_r \) [N]:

\[
L_{10} = \left( \frac{C_{dyn}}{F_r} \right)^3 [10^5 \text{ m run}]
\]

Static load

For a purely static load or shocks, the static index \( f_s \) is calculated to show that a compact unit with an adequate load capacity has been selected. Taking into account the static load factor \( C_o \) [N] and the load \( F_r \) [N] it results in:

\[
f_s = \frac{C_o}{F_r}
\]

If \( f_s \geq 1 \), the safety margin is sufficient.
If \( f_s \leq 1 \), please consult LINE TECH.

Remark

The above formulas are applicable only in case all bearings are equally loaded, i.e. the load \( F_r \) is applied at the centre of the cradle.

Particularly in vertical arrangements of the compact units, the drive (screw, belt, etc.) must be checked. LINE TECH has a variety of test programs. If you provide us with all the necessary information, we will be pleased to advise you.

Definition of the drive motor

The drive motor forms the link between the control signal and the movement to be applied to a given load.

Size and type of the drive motor primarily depend on the load, the required displacement speed and the acceleration factor.

Calculation and choice of a positioning unit shall be based on the worst case service conditions.

For the optimal drive unit configuration, LINE TECH offers different types of stepmotors, DC and AC motors together with the appropriate continuous- or linear path control.

To enable you to determine the determination of the adequate drive motor for any specific application, always use the formulas and examples shown hereafter.

Key to the following formulary:

- \( d \) [mm] = Screw diameter
- \( d_1 \) [mm] = Driving wheel diameter
- \( d_2 \) [mm] = Driven gear diameter
- \( d_3 \) [mm] = Pinion or belt pulley diameter
- \( F_L \) [N] = Feed force
- \( i \) [-] = Reduction
- \( J \) [kgm\(^2\)] = Mass moment of inertia
- \( J_1 \) [kgm\(^2\)] = Mass moment of inertia driving wheel
- \( J_2 \) [kgm\(^2\)] = Mass moment of inertia driven gear
- \( J_M \) [kgm\(^2\)] = Mass moment of inertia drive motor
- \( J_R \) [kgm\(^2\)] = Rotatory mass moment of inertia
- \( J_T \) [kgm\(^2\)] = Translatory mass moment of inertia
- \( l \) [mm] = Screw length
- \( M_B \) [Nm] = Acceleration or braking torque
- \( M_m \) [Nm] = Motor continuous torque (see motor spec.)
- \( M_{eff} \) [Nm] = Effective motor output torque
- \( M_L \) [Nm] = Load torque
- \( M_M \) [Nm] = Motor torque (see motor spec.)
- \( M_{max} \) [Nm] = Motor peak torque
- \( m_T \) [kg] = External load (linear moved mass)
- \( n_k \) [min\(^{-1}\)] = Critical speed for spindle drive
- \( n_M \) [min\(^{-1}\)] = Motor speed
- \( p \) [mm] = Screw pitch
- \( P_A \) [W] = Power output
- \( s_B \) [mm] = Acceleration/braking path
- \( t_B \) [s] = Acceleration/braking time
- \( t_L \) [s] = Running time under load torque
- \( t_0 \) [s] = Stop time without load
- \( v \) [m/s] = Feed rate
- \( \eta \) [-] = Mechanical efficiency on motor shaft
### Motor speed

\[
\eta_M = \frac{v \cdot 6 \cdot 10^4}{\rho \cdot i}
\]

### Critical speed

\[
\eta_K = 120 \cdot 10^6 \cdot \frac{d}{\rho}
\]

### Load moment

\[
M_L = \frac{p \cdot i \cdot F_L}{2000 \cdot \pi}
\]

### Translatory mass moment of inertia

\[
J_I = m_T \left( \frac{p}{2 \cdot \pi} \right)^2 \cdot 10^6
\]

### Rotatory mass moment of inertia (for steel)

\[
J_R = 7.7 \cdot d^4 \cdot l \cdot 10^{13}
\]

### Total of reduced mass moments

\[
J = J_M + J_1 + i^2 (J_R + J_I + J_2)
\]

(at gear reduction 1:2 => \(i = 0.5\))

### Acceleration or Braking moment

\[
M_B = n_M \cdot \frac{J}{9.55 \cdot t_B}
\]

### Acceleration or Braking moment (for steel)

\[
M_B = \frac{4 \cdot \pi \cdot s_B \cdot J}{p \cdot i \cdot t_B^2}
\]

### Acceleration or Braking moment

\[
t_B = \frac{n_M \cdot J}{9.55 \cdot M_B}
\]

\[
t_B = \sqrt{\frac{4 \cdot \pi \cdot s_B \cdot J}{p \cdot i \cdot M_B}}
\]

\[
t_B = \frac{4 \cdot s_B \cdot J}{d_3 \cdot i \cdot t_B^2}
\]

### Speed reached after acceleration

\[
\eta_M = \frac{120 \cdot s_B}{p \cdot i \cdot t_B}
\]

### Distance travelled during acceleration

\[
s_B = \frac{120 \cdot s_B \cdot \eta_M \cdot d_3 \cdot \pi \cdot i}{120}
\]

### Sum of torques to be overcome by the motor

\[
M_M = \frac{1}{\eta} (M_L + M_B)
\]

### Power output

\[
P_A = \frac{M_M \cdot \eta_M}{9.55}
\]

### Effective value of motor output torque

\[
M_{eff} = \sqrt{\frac{\Sigma t_B (M_M)^2 + \Sigma t_J (M_L)^2}{\Sigma t_B + \Sigma t_J + t_0}} \cdot M_M
\]
Sample calculation

Dimensioning example

Compact unit KE3.2.0200AR010.1.02.0F-N7NNNN

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>200</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle length</td>
<td>423</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle pitch</td>
<td>10</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle diameter</td>
<td>20</td>
<td>mm</td>
</tr>
<tr>
<td>External load</td>
<td>100</td>
<td>kg</td>
</tr>
<tr>
<td>Maximum feed force</td>
<td>500</td>
<td>N</td>
</tr>
<tr>
<td>Advance speed</td>
<td>5</td>
<td>m/min</td>
</tr>
<tr>
<td>Acceleration time</td>
<td>0.05</td>
<td>s</td>
</tr>
<tr>
<td>Stroke</td>
<td>200</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle length</td>
<td>423</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle pitch</td>
<td>10</td>
<td>mm</td>
</tr>
<tr>
<td>Spindle diameter</td>
<td>20</td>
<td>mm</td>
</tr>
<tr>
<td>External load</td>
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<tr>
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<td>0.05</td>
<td>s</td>
</tr>
</tbody>
</table>

Load cycle:

\[ \sum t_B = 1 \text{ [s]} \]
\[ \sum t_L = 4 \text{ [s]} \]
\[ t_0 = 1 \text{ [s]} \]
\[ = \text{ Cycle time} = 6 \text{ [s]} \]

Transmission:

Motor directly coupled with spindle

\[ i = 1 \]

Moment of inertia of coupling

\[ J_1 = 0.04 \cdot 10^{-3} \text{ [kgm}^2\text{]} \]

Load moment

\[ M_L = \frac{p \cdot i \cdot F_L}{200 \cdot \pi} = \frac{10 \cdot 1 \cdot 500}{200 \cdot \pi} = 0.8 \text{ [Nm]} \]

Moments of inertia:

- Translatory

\[ J_T = m_T \left( \frac{p}{2\pi} \right)^2 \cdot 10^{-6} = 100 \left( \frac{10}{2\pi} \right)^2 \cdot 10^{-6} \]
\[ J_T = 0.254 \cdot 10^{-3} \text{ [kgm}^2\text{]} \]

- Rotatory

\[ J_R = 7.7 \cdot d^4 \cdot l \cdot 10^{-13} = 7.7 \cdot 20^4 \cdot 423 \cdot 10^{-13} \]
\[ J_R = 0.052 \cdot 10^{-3} \text{ [kgm}^2\text{]} \]

Speed

\[ n_M = v \cdot \frac{6 \cdot 10^4}{p \cdot i} = \frac{5}{60} \cdot \frac{6 \cdot 10^4}{10 \cdot 1} = 500 \text{ [min}^{-1}\text{]} \]

Check of critical speed

\[ n_M \leq n_k = 120 \cdot 10^6 \cdot d/l^2 = 120 \cdot 10^6 \cdot 20/423^2 = 13413 \text{ [min}^{-1}\text{]} \]

If \( n_M > n_k \) the speed must be reduced or the diameter/pitch of the spindle increased.
1. Motor design for 3-phase stepper motor

Number of full steps per rotation = 1000
Step angle = 0.36 °
Resolution per step = 10 · \frac{0.36}{360} = 0.01 [\text{mm}] \quad \text{(tolerance: } \pm \frac{1}{2} \text{ step)}

If \( n_M = 500 \text{ min}^{-1} \):

Number of full steps per rotation = 8333 / s

Torque \( M_d = 2.0 [\text{Nm}] \)

Moment of inertia \( J_M = 0.11 \cdot 10^{-3} [\text{kgm}^2] \)

Sum of reduced moments of inertia \( J = J_M + J_1 + i^2 \cdot (J_T + J_R) = (0.11 + 0.04 + 0.254 + 0.052) \cdot 10^{-3} \)

\( J = 0.456 \cdot 10^{-3} [\text{kgm}^2] \)

Acceleration or braking torque \( M_B = \frac{n_M \cdot J}{9.55 \cdot t_{ib}} = \frac{500 \cdot 0.456 \cdot 10^{-3}}{9.55 \cdot 0.05} = 0.478 [\text{Nm}] \)

Resulting distance of acceleration \( M_M = \frac{1}{\eta} (M_L + M_B) = \frac{1}{0.8} (0.8 + 0.478) = 1.60 [\text{Nm}] \)

Caution:
The speed-dependent torque of stepper motors must always be taken into consideration!
2. Motor design for synchronous servo motor (AC servo motor, brushless)

If \( n_m = 500 \text{ min}^{-1} \):

- Continuous torque \( M_d = 1.45 \text{ [Nm]} \)
- Peak torque \( M_{\text{max}} = 7.26 \text{ [Nm]} \)
- Moment of inertia \( J_M = 0.06 \cdot 10^{-3} \text{ [kgm}^2\text{]} \)

Total of reduced mass moments
\[
J = J_M + J_t + \sum (J_t + J_d) = (0.06 + 0.04 + 0.254 + 0.052) \cdot 10^{-3}
\]
\[
J = 0.406 \cdot 10^{-3} \text{ [kgm}^2\text{]}
\]

Acceleration or braking torque
\[
M_b = \frac{n_m \cdot J}{9.55 \cdot t_b} = \frac{500 \cdot 0.406 \cdot 10^{-3}}{9.55 \cdot 0.05} = 0.425 \text{ [Nm]}
\]

Resulting distance of acceleration
\[
M_{\text{mm}} = \frac{1}{\eta} \left( M_L + M_d \right) = \frac{1}{0.8} (0.8 + 0.425) = 1.53 \text{ [Nm]}
\]

Thermal load on motor:
Servo motors may be subjected to a momentary overload during acceleration and braking, provided the root mean square or effective value of the output torque does not exceed the rated torque of the motor. For short load cycles with a high demand on the dynamics the thermal load of the motor should thus be checked.

Ratio of momentarily required motor torque to rated motor torque

- during acceleration
\[
\frac{M_{\text{mm}}}{M_d} = \frac{1.53}{1.45} = 1.06
\]

- at constant speed
\[
\frac{M_L}{M_d} = \frac{0.8}{1.45} = 0.55
\]

Effective output torque of motor
\[
M_{\text{eff}} = \sqrt{\frac{\sum t_b (M_{\text{mm}}/M_d)^2 + \sum t_c (M_L/M_d)^2}{\sum t_b + \sum t_c + t_0}} \cdot M_d
\]

- Thermal load of motor
\[
= \frac{1 - 0.624 M_d}{1 + 4 + 1} = 63 \%
\]

Caution:
The sum of reduced moments of inertia may not be more than three times the motor moment of inertia. If this factor is greater, please contact the motor dealer or LINE TECH AG.
**Product range**

The LINE TECH product range includes mechanical, electrical and electronic components which meet all the requirements of modern handling technology and special purpose machine building.

Due to their superior design characteristics LINE TECH positioning units and LINE TECH linear modules – linear carriages of modular design – are ideally suited to applications with high precision and performance requirements. Various sizes and a multitude of drives allow for application specific problem solving.

LINE TECH controls and drives are specifically designed for single-axle and multi-axle positioning units. The wide range of products includes continuous- and linear path control systems as well as step motors, DC and AC servo motors and thus meeting any requirement of control systems.

Besides the manufacture of components, LINE TECH specializes in the development of system solutions. It goes without saying that this includes commissioning by LINE TECH customer service upon request.