

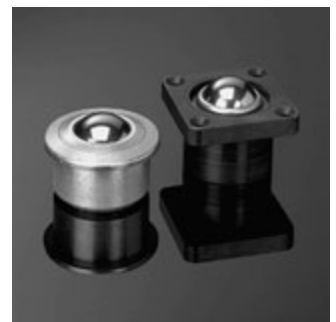
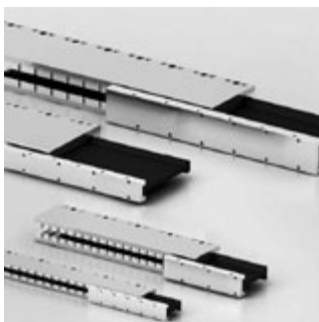
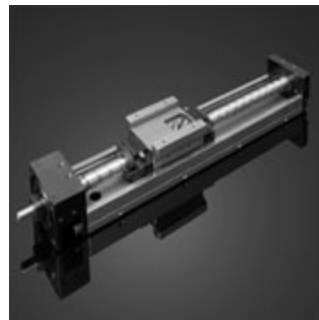
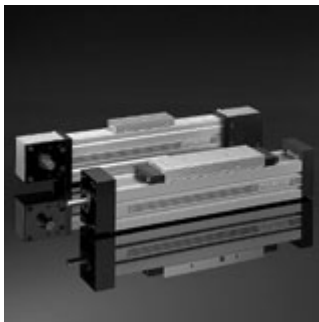
LINE TECH Compact Units

Ready-to-install compact carriages with drive

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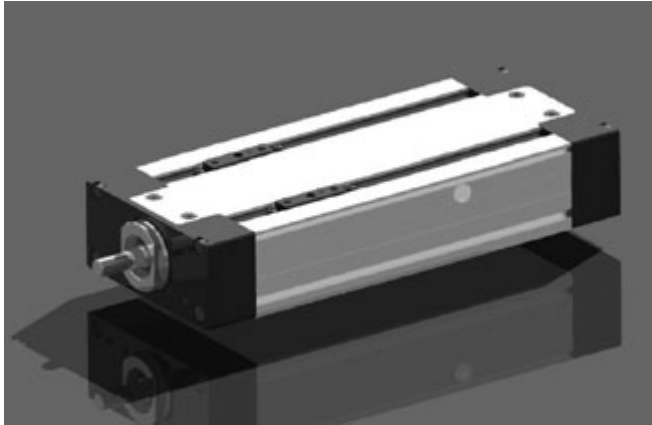
Table of Contents

Page(s)

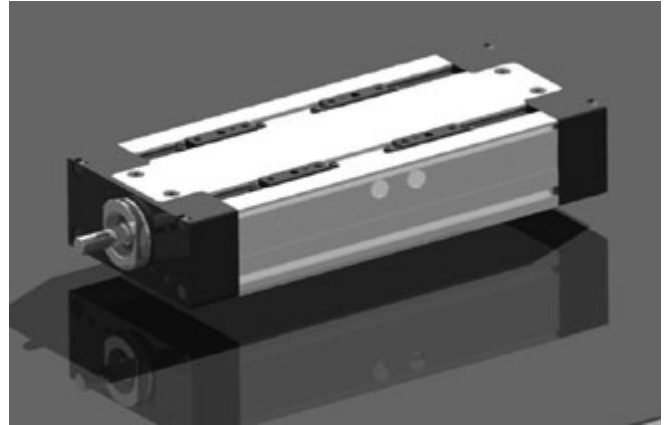
- Product overview	4
- Designation system with ball screw	6
- Design fundamentals / Greasing / Maintenance	8
- General technical data:	
- Load ratings and torques	9
- Notes on selection:	
- Motor mounting	12
- Limit switches	14
- Cable and mating plug	15
- Tables for cable assembly / plug code	16
- Permissible speeds	17
- Permissible deflection:	
- Definition of mounting position	18
- Permissible deflection (horizontal)	19
- Permissible deflection (vertical)	20
- Overview KE2	22
- Dimensions KE2.2 (with 1 carriage)	23
- Dimensions KE2.2 (with 2 carriages)	24
- Limit switch mounting KE2	25
- Overview KE3:	26
- Dimensions KE3.2 (with 1 carriage)	27
- Dimensions KE3.4 (with 2 carriages)	28
- Limit switch mounting KE3	29
- Dimensions of motor mounting:	
- Straight mounting	30
- Lateral mounting	31
- Dimensions of connecting plates:	
- for KEs with 2 carriages	32
- for KEs with 1 carriage	33
- Mounting accessories:	
- Mounting options	34
- Clamps	34
- Sliding blocks	35
- Cross table mounting	36
- Lubrication	37
- Calculation guidelines	38
- Formulary	39
- Sample calculation:	
- Dimensioning example	40
- Design of 3-phase stepper motor	41
- Design of synchronous servo motor	42

Product overview

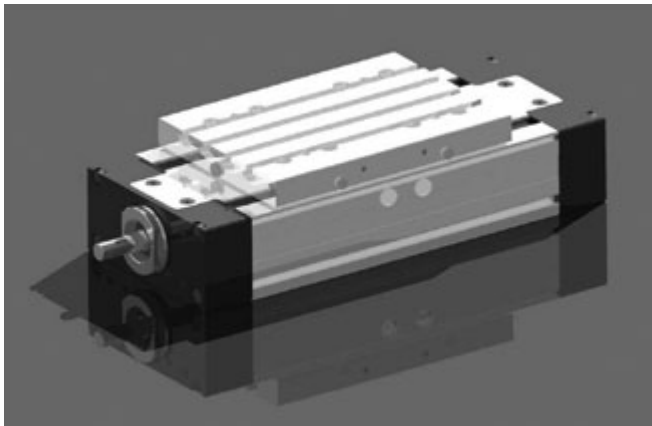
Compact unit with one carriage



Compact unit with two carriages



Compact unit with two carriages and connecting plate



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

Advantages

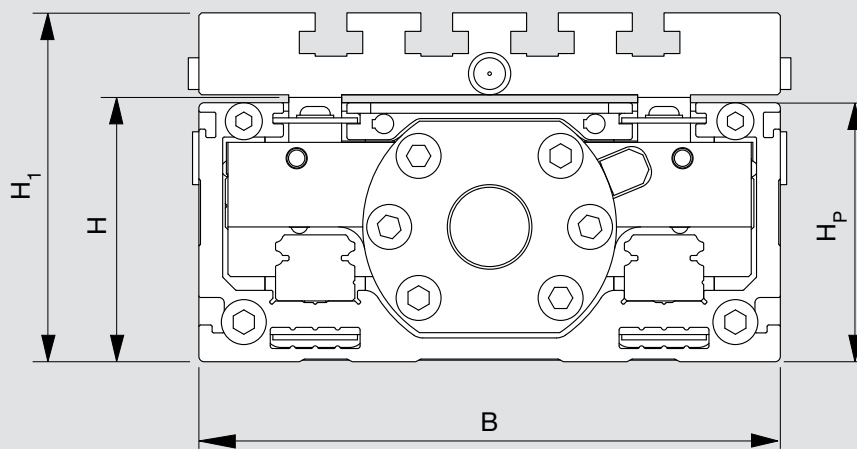
- Compact dimensions
- Available in any desired length
- Optimum running performance together with high load ratings and high rigidity due to two integral, free of play ball rail guide systems
- Simple motor mounting by centering and thread on driving head
- Greasing by central grease points
- Available 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

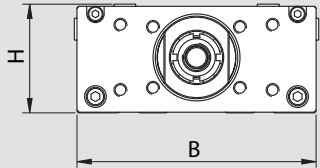
- Motor mounting
- Limit switches
- Multi-axis systems



Compact units	Dimensions [mm]			Dynamic load rating C [N]	
Type	B x H	H _p	H ₁	one carriage	two carriages
KE2	110 x 50	49	66	16 700	33 400
KE3	145 x 65	64	85	23 400	46 800

For loading capacity please see pages 9 and 10.

Designation system

Compact unit (sample designation)		K	E	2	.	2	.	0200	A	R	005	.	0
Compact unit KE													
Size (B x H)													
... =													
2 =		110 x 50 mm											
3 =		145 x 65 mm											
... =													
													
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]													
			KE2		KE3								
Rollenballschraube:			005, 010, 016 ¹⁾		005, 010, 020								
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

02

0

F

-

N

7

R

N

N

N

5

8

3

-

-

-

583... = Drawing type

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

- R = 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

Connecting plate

- N = without connecting plate ***
- V = with connecting plate

Motor mounting

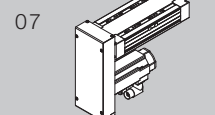
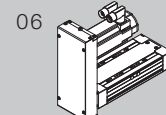
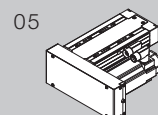
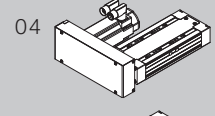
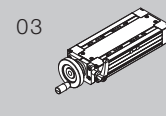
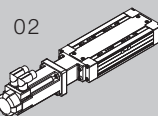
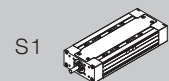
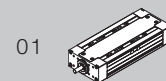
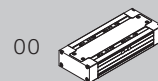
- N = without drive mount
- F = mounting plate for LINE TECH motor
- S = mounting plate for special motor

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*



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, fillings, 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

With the exception of re-greasing, LINE TECH compact units are maintenance-free.

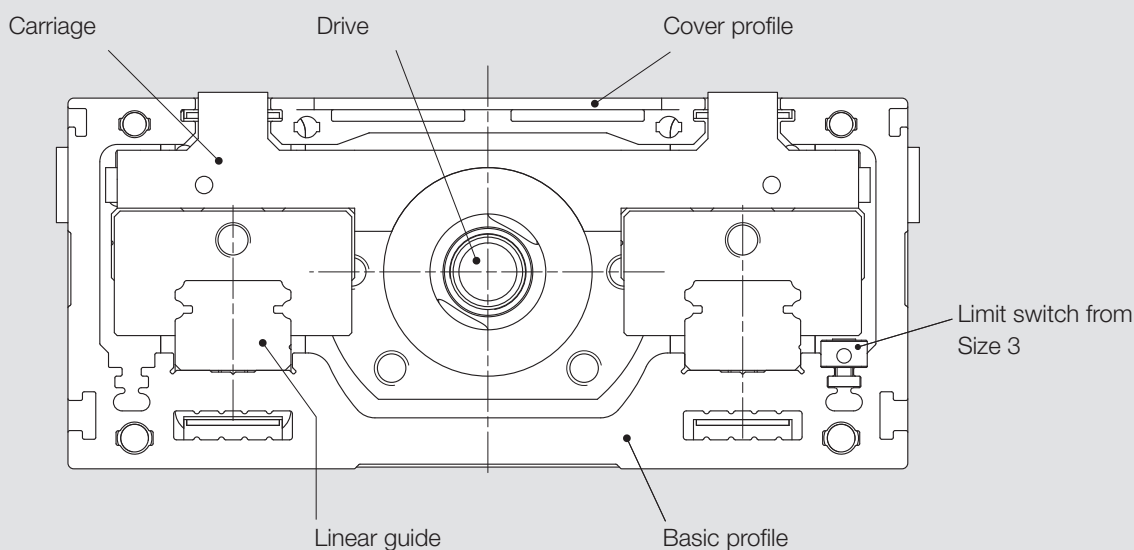
Maintenance-free due to K1 wipers

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.

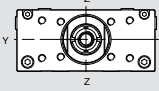
Service temperature

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.



General technical data Load ratings and torques

Size	Number of carriages	Ball screw $d_0 \times p$ [mm]	Dynamic load ratings C			Dynamic torques			Moment of inertia 		Max. length L_{max} [mm]	Moving mass m_b [kg]
			Guide [N]	Ball screw [N]	Fixed bearing [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	I_y [cm ⁴]	I_z [cm ⁴]		
KE2	1	16 x 5	16700	5460	13900	382	120	96	29.4	242.5	1480	0.79
		16 x 10		5460								
		16 x 16		9300								
	2 ($l_m = 85 \text{ mm}$)	16 x 5	33400	5460	13900	836	944	760	29.4	242.5	1480	1.37
		16 x 10		5460								
		16 x 16		9300								
KE3	1	20 x 5	23400	8790	16000	680	207	165	93.3	746.0	1970	1.46
		20 x 10		8790								
		20 x 20		9890								
	2 ($l_m = 100 \text{ mm}$)	20 x 5	46800	8790	16000	1520	1420	1190	93.3	746.0	1970	2.47
		20 x 10		8790								
		20 x 20		9890								

Note on dynamic load ratings and torques

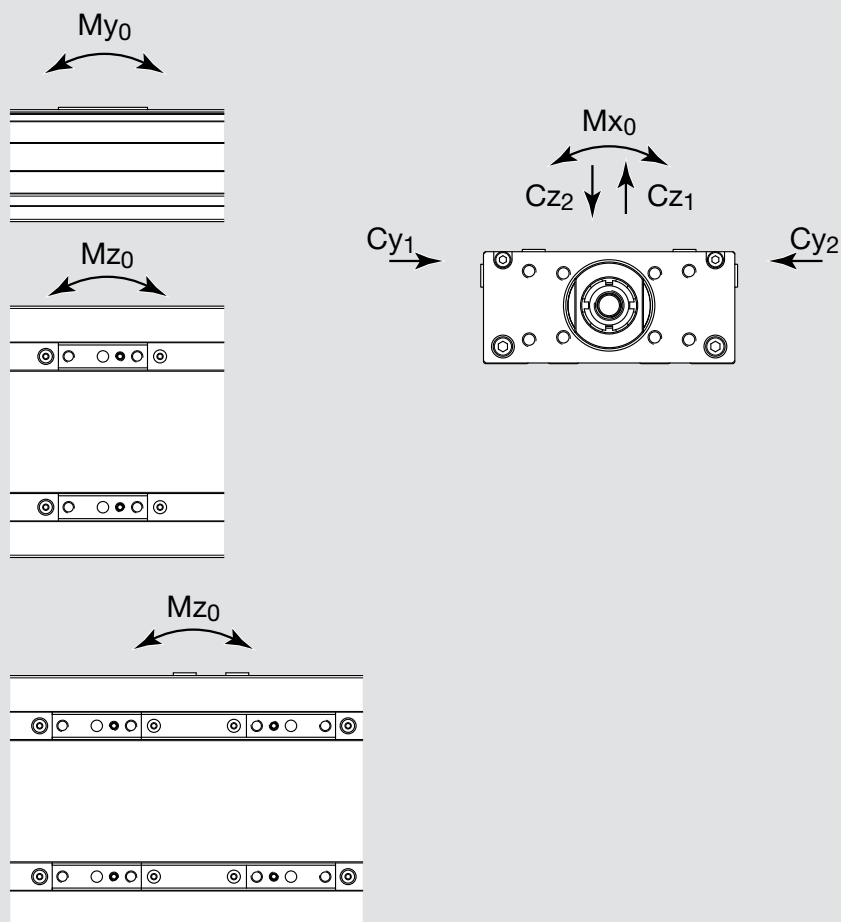
The determination of dynamic load ratings and torques is based on a 50,000 m stroke. If comparative values must be calculated for a 100,000 m stroke, the values for M_x , M_y , M_z and C must be divided by the factor 1.26.

Expedient load

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

General technical data Load ratings and torques

Load ratings and torques



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

Size	Number of carriages	Maximum permissible force [N]				Maximum permissible torque [Nm]					
		Static		Dynamic		Static			Dynamic		
		$Cy_{0,1,2}$	$Cz_{0,1,2}$	$Cy_{1,2}$	$Cz_{1,2}$	Mx_0	My_0	Mz_0	Mx	My	Mz
KE2	1	29 744	33 800	14 696	16 700	930	291	236	382	120	96
	2	59 488	67 600	29 392	33 400	2 030	2 292	1 923	836	944	790
KE3	1	41 360	47 000	20 592	23 400	1 700	500	398	680	207	165
	2	82 720	94 000	41 184	46 800	3 660	3 424	2 870	1 520	1 420	1 190

Notes on selection Motor mounting

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.

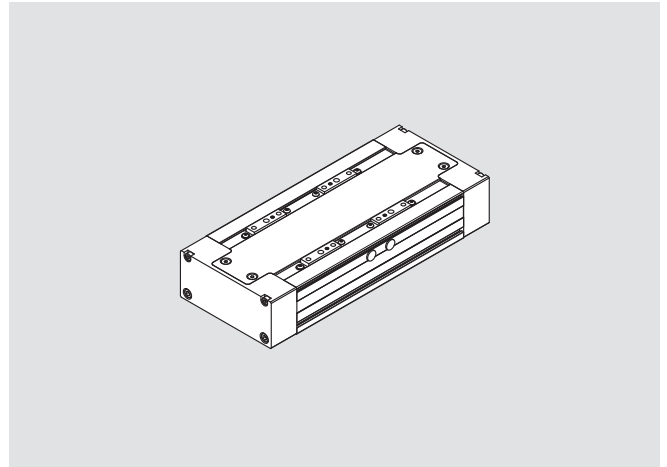


Fig. 1: without drive
(Assembly stage 00)

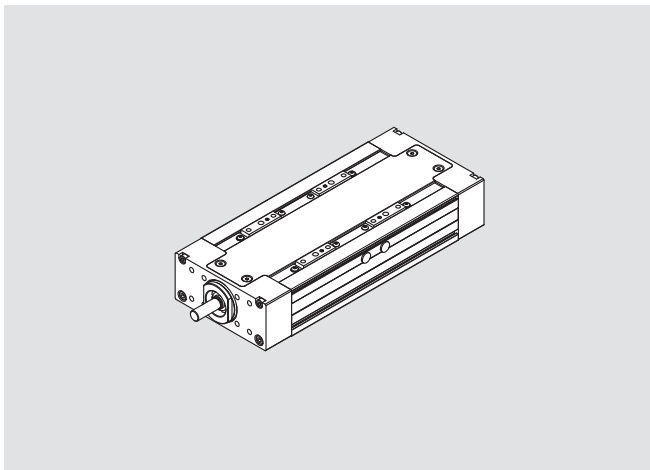


Fig. 2: free shaft end (special version)
(Assembly stage 01)

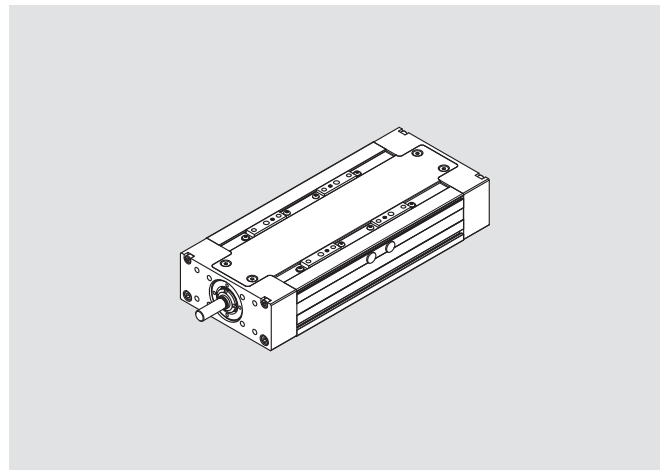


Fig. 3: free shaft end (special version)
(Assembly stage S1)

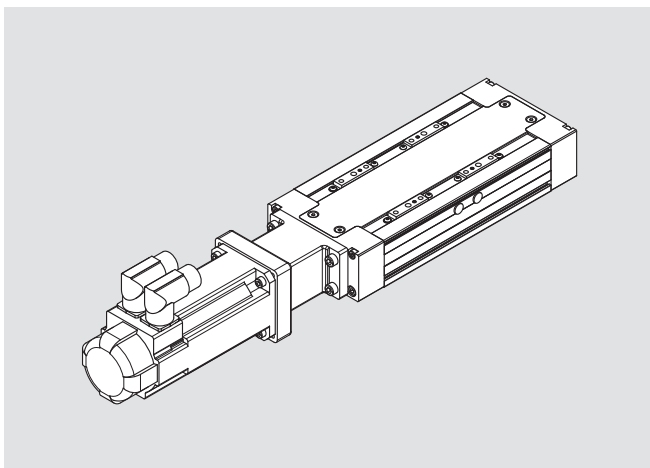


Fig. 4: with coupling and intermediate plate
(Assembly stage 02)

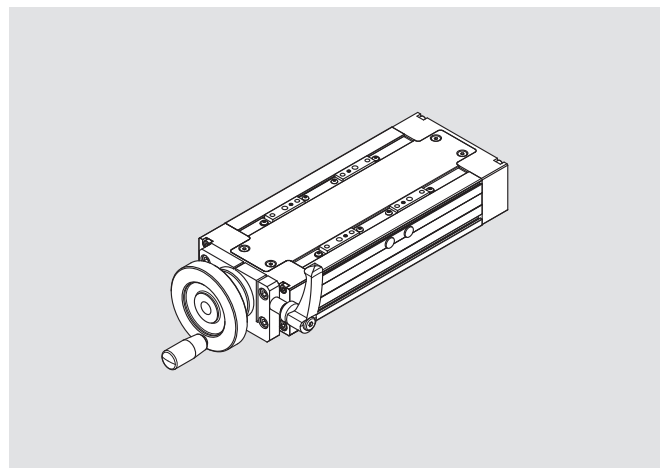


Fig. 5: with crank and clamp
(Assembly stage 03)

Notes on selection Motor mounting

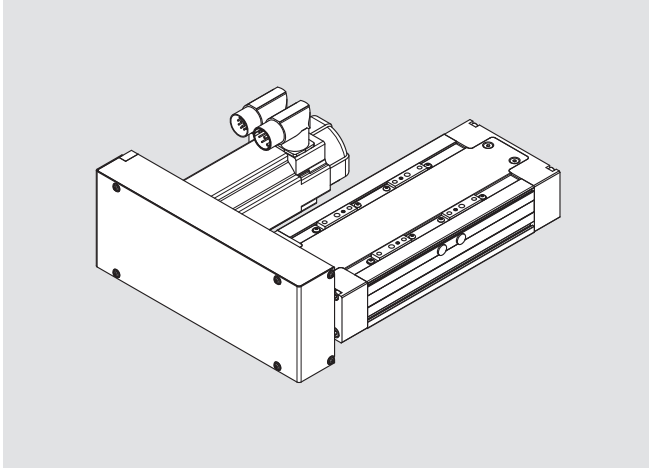


Fig. 6: lateral motor mounting right
(Assembly stage 04)

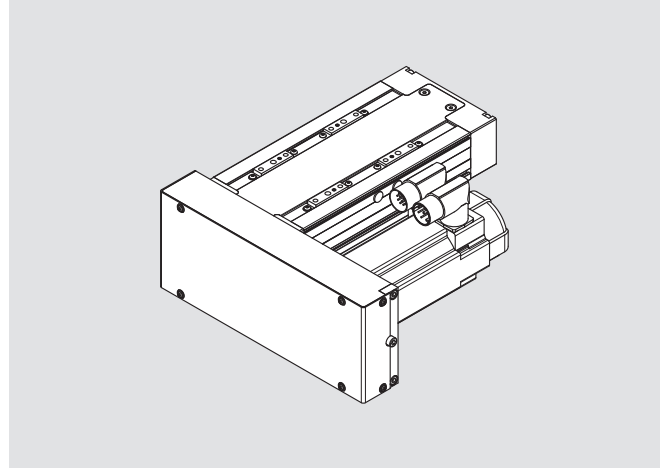


Fig. 7: lateral motor mounting left
(Assembly stage 05)

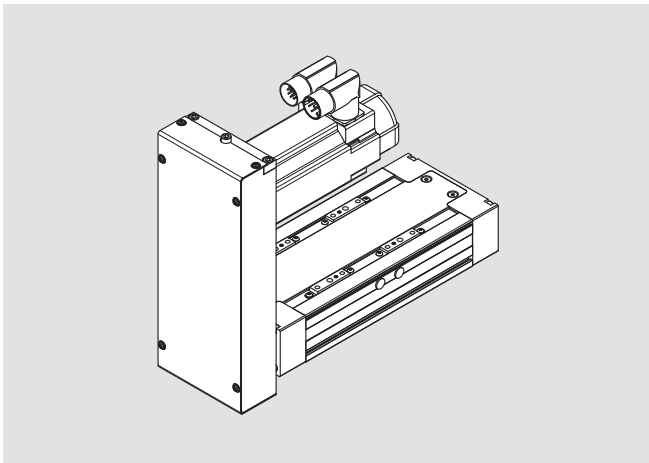


Fig. 8: lateral motor mounting top
(Assembly stage 06)

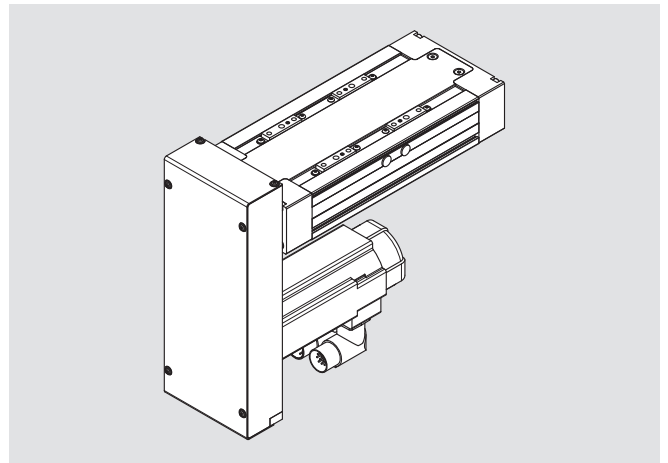


Fig. 9: lateral motor mounting bottom
(Assembly stage 07)

Limit switches

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).

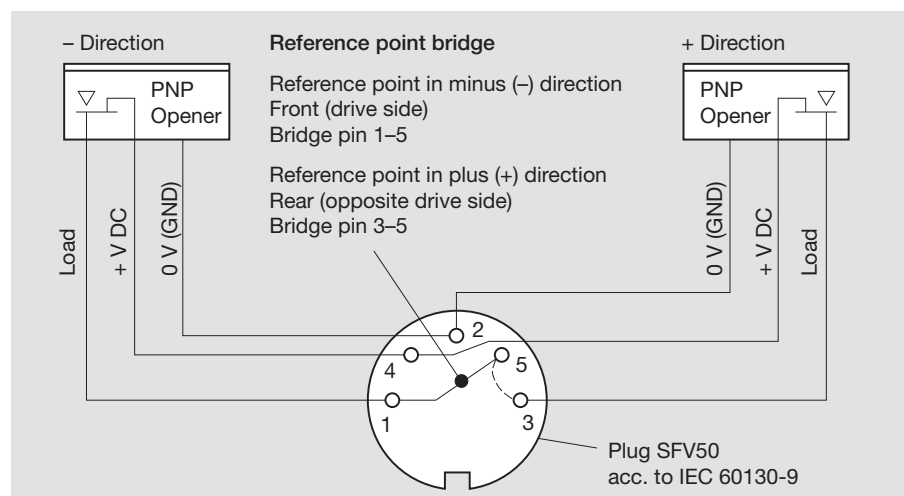


Fig. 10: Plug connector with reference point bridge

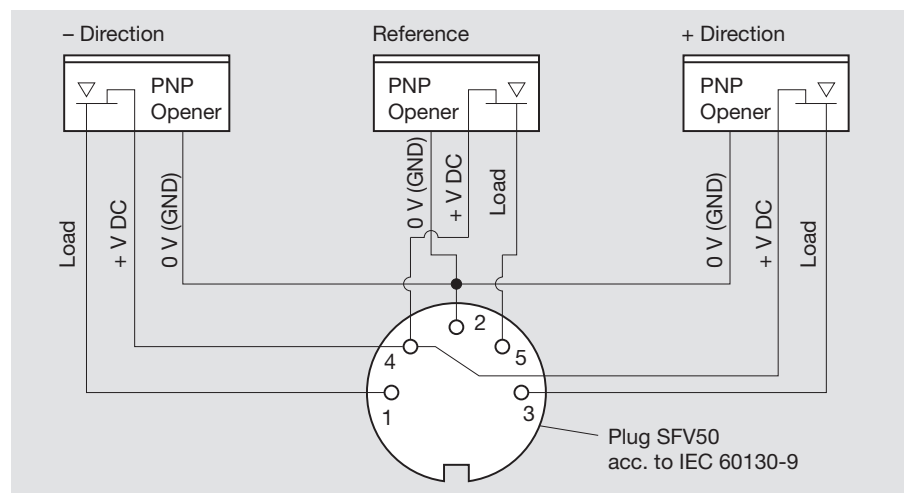


Fig. 11: Plug connector with additional reference switch

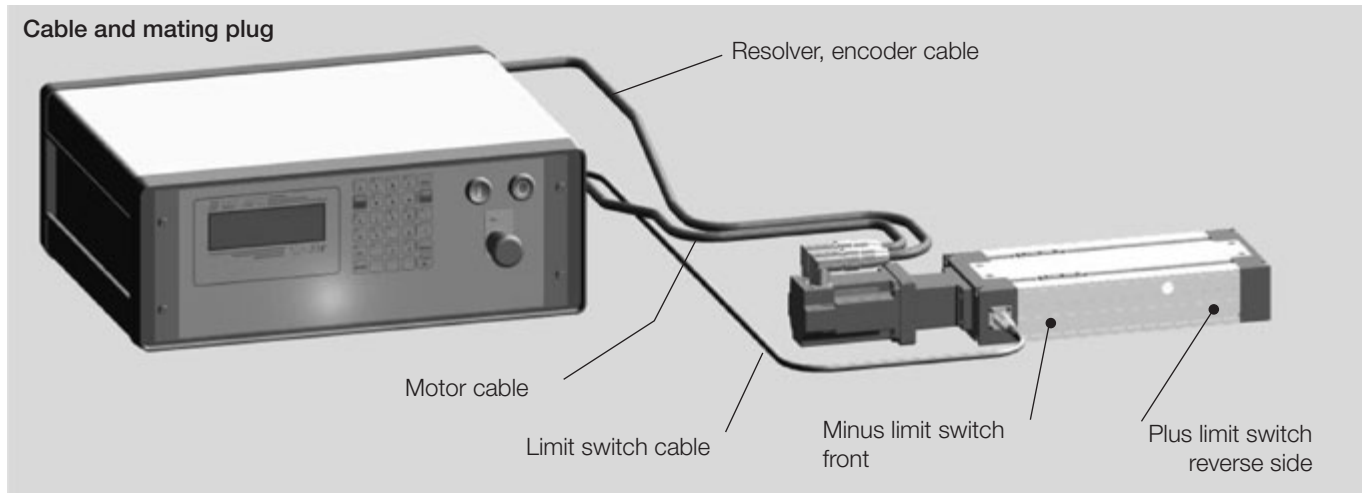


Fig. 12: Mounting position of limit switch

Cable

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

Cable K	K	L	05	R	001	000	103
Use							Plug code actor side according to table on next page
							Plug code feed side according to table on next page
							Code cable assembly according to table on next page
							Sheath definition
							Outer / inner
							M = PUR / PVC (E-chain suitable) *
							N = PVC / PVC (E-chain suitable)
							R = PUR / PUR (E-chain suitable)

* standard

Mating plug for limit switch connection

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

- Straight socket
Article no.: CFLKB05A
- Angle socket
Article no.: CFLKB05B

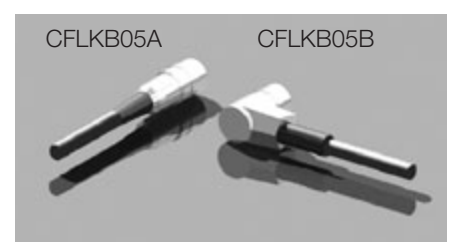


Fig. 13: Mating plug

Tables for cable assembly / plug code

Cable assembly

Code	Cable type	Use	Code	Cable type	Use
001	5x0.25C11Y-S	L, Z	011		
002	7x0.25C11Y-S	E, Z	012		
003	4x2.0X0.25C11Y-S	E, R	013		
004			014		
005	2x0.5x11Y-S	B	015		
006			016		
007	4G0.75C11Y	A, S, T	017		
008			018		
009	4G0.75+2x(2x0.75)C11Y-S	A, D	019		
010	4G1.5+2x(2x0.75)C11Y-S	A, D	020		

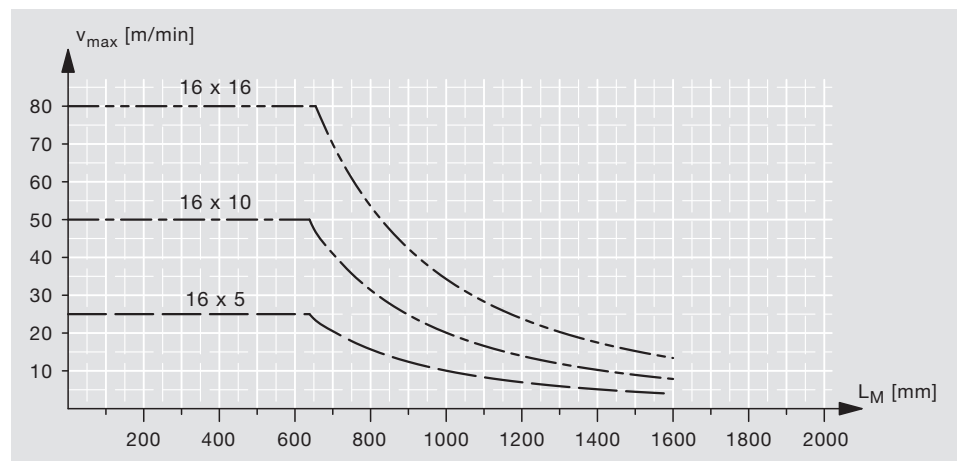
Plug code

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

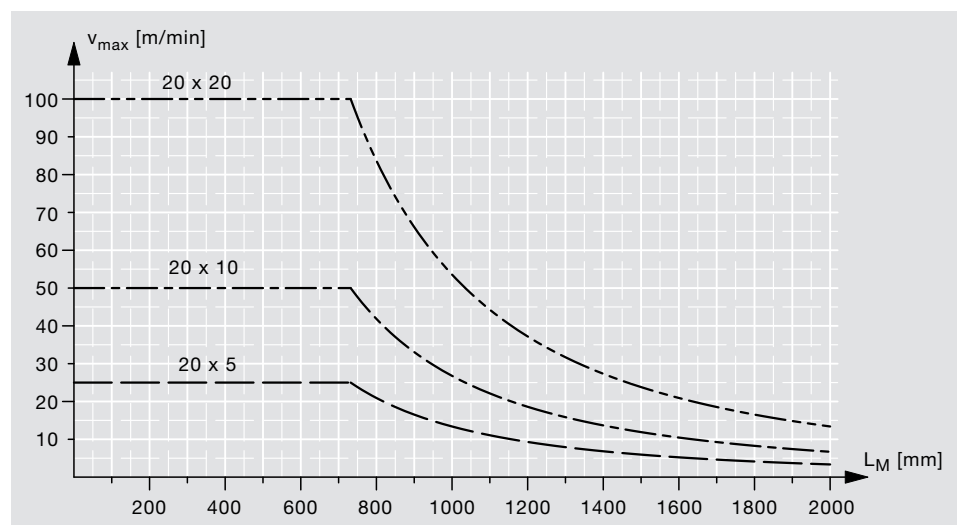
Permissible speeds

Please also pay attention to motor speeds!

KE 2



KE 3



Permissible deflection

Permissible deflection

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

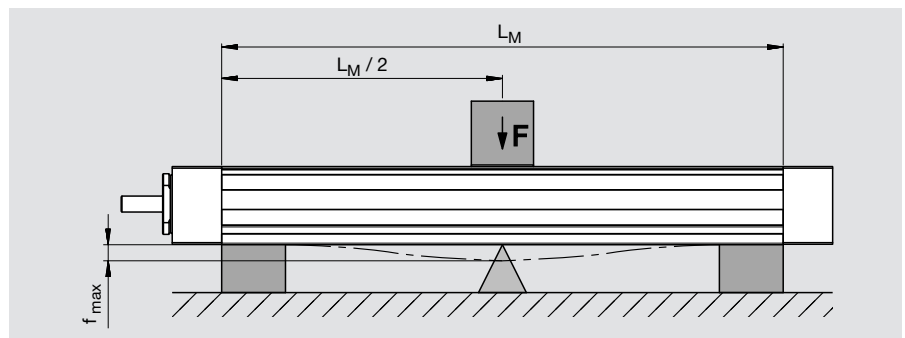
If the maximum permissible deflection is exceeded, the compact unit must be additionally supported.

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.

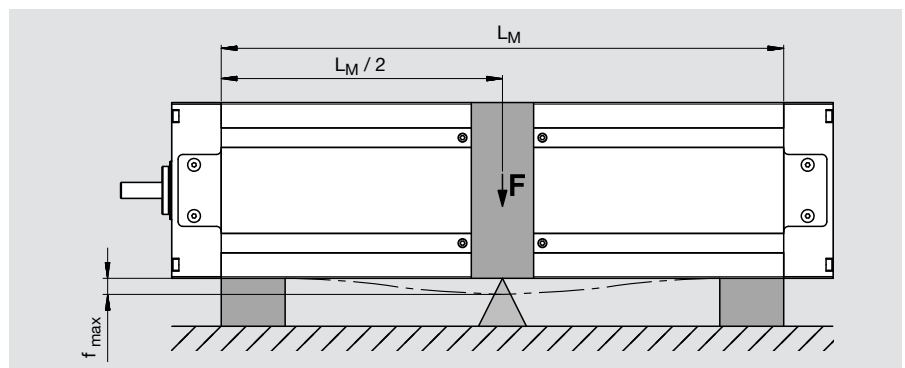
If increased demands are made on system accuracy we recommend supporting the compact unit along its entire length.

Definition of mounting positions:

- horizontal



- vertical

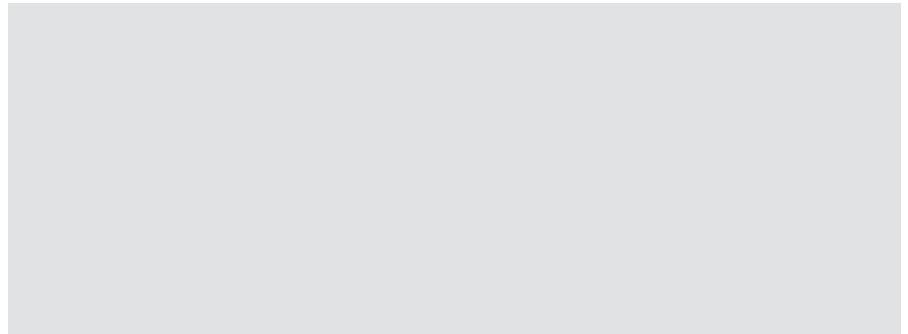


Permissible deflection (horizontal)

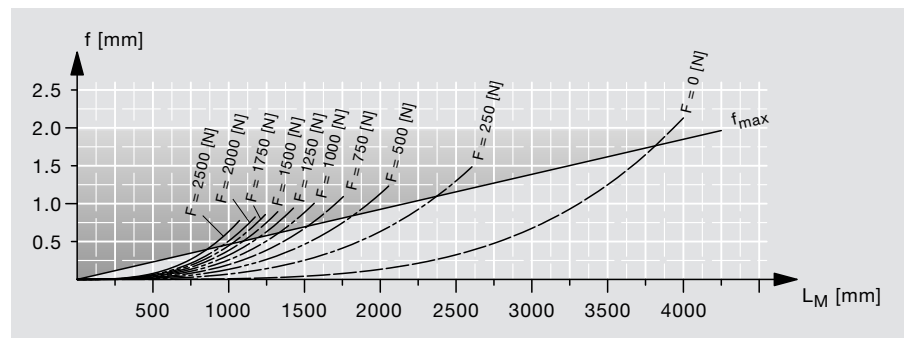
Permissible deflection (horizontal)

The following diagrams apply to:

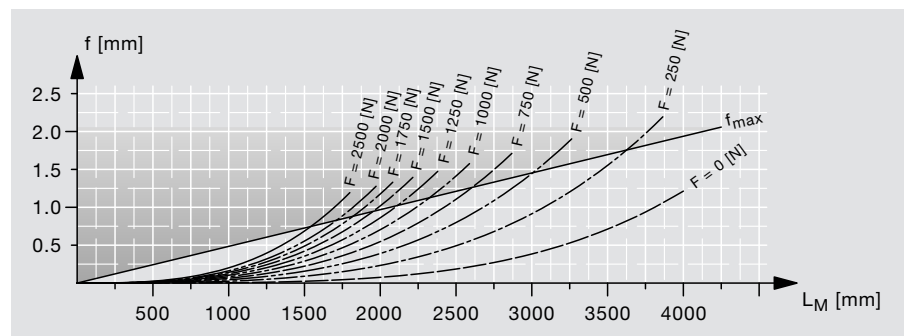
- firm clamping (40–50 mm per side)
- 3–4 screws per side
- solid substructure



KE 2



KE 3



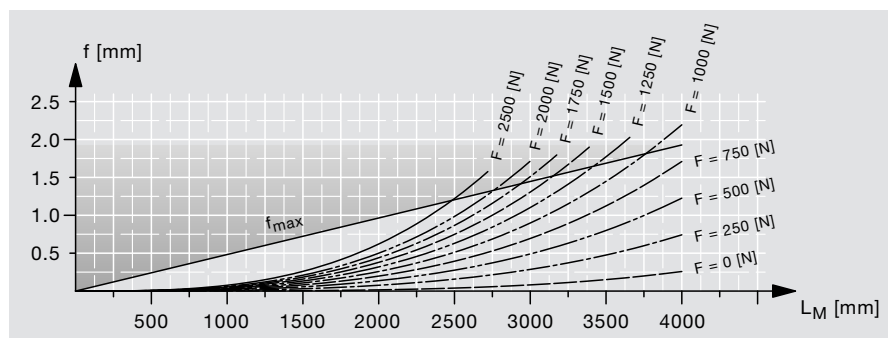
Permissible deflection (vertical)

Permissible deflection (vertical)

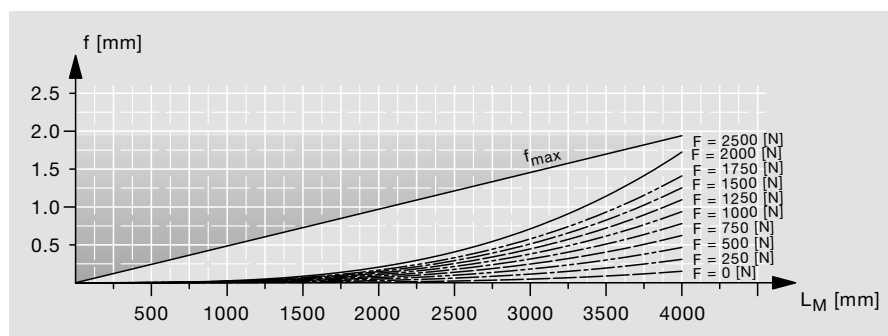
The following diagrams apply to:

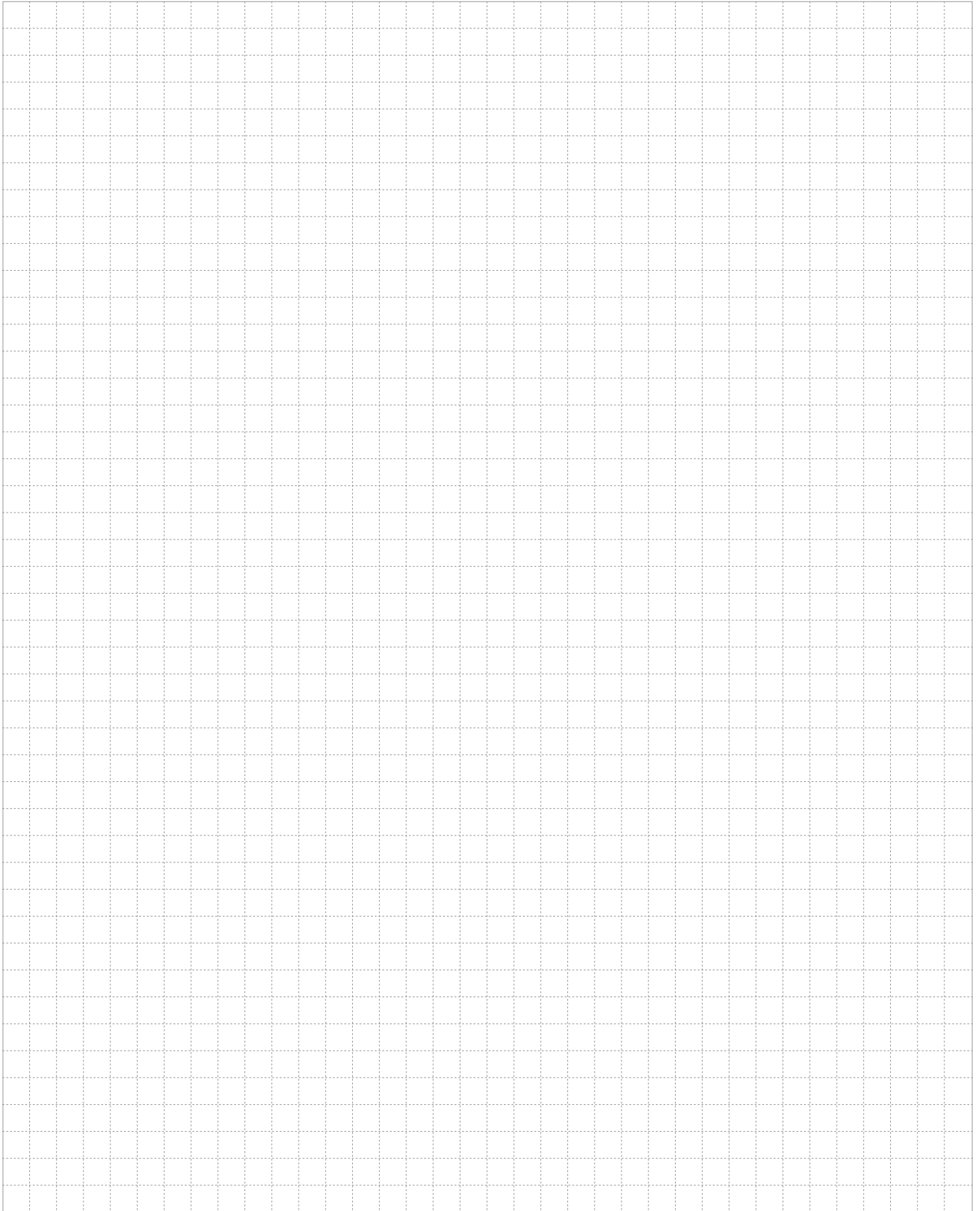
- firm clamping (40–50 mm per side)
- 3–4 screws per side
- solid substructure

KE 2



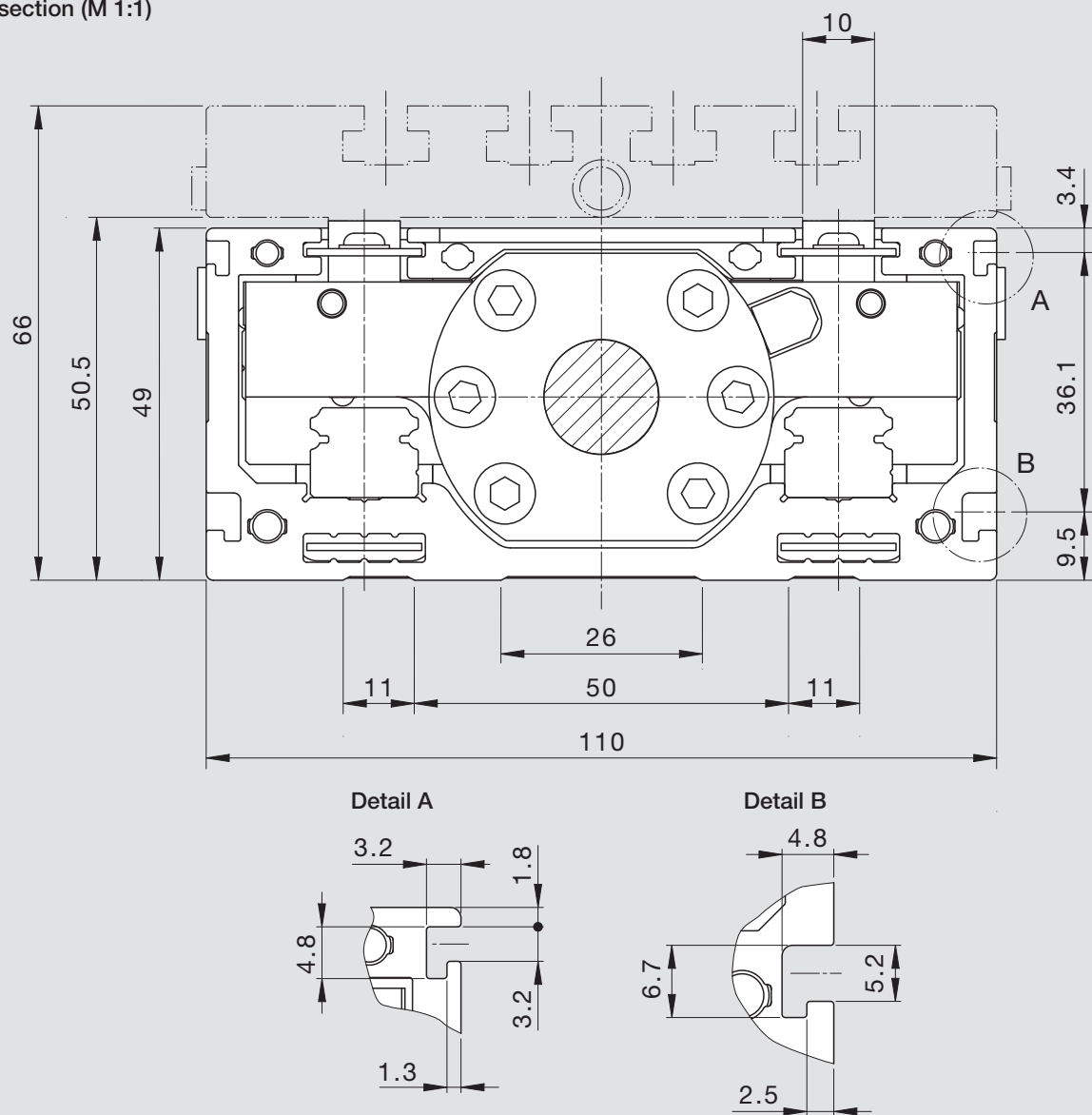
KE 3



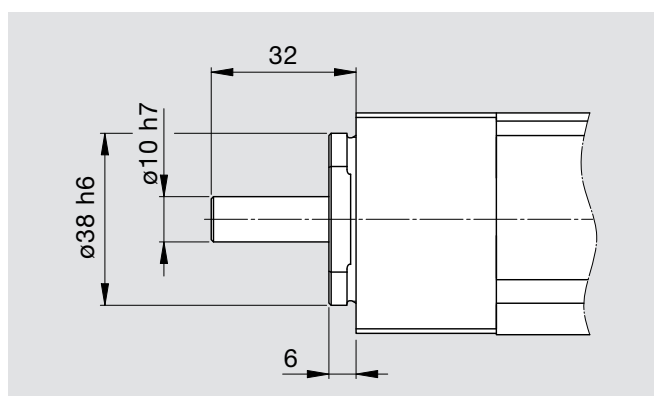


Overview KE2

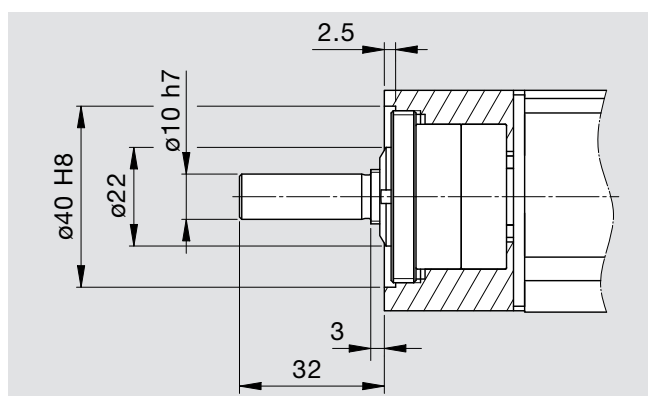
Cross-section (M 1:1)

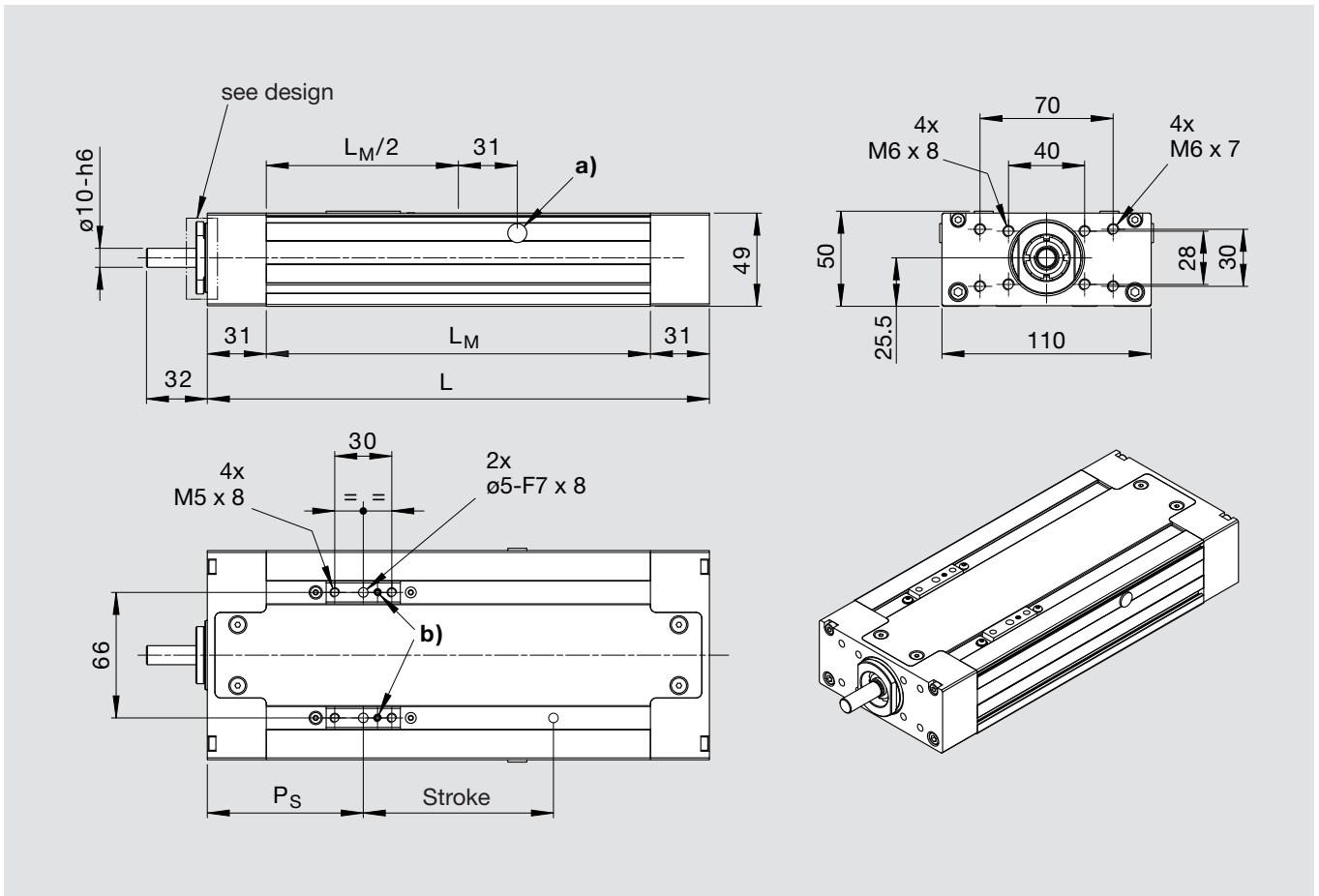


Design 01



Design S1





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

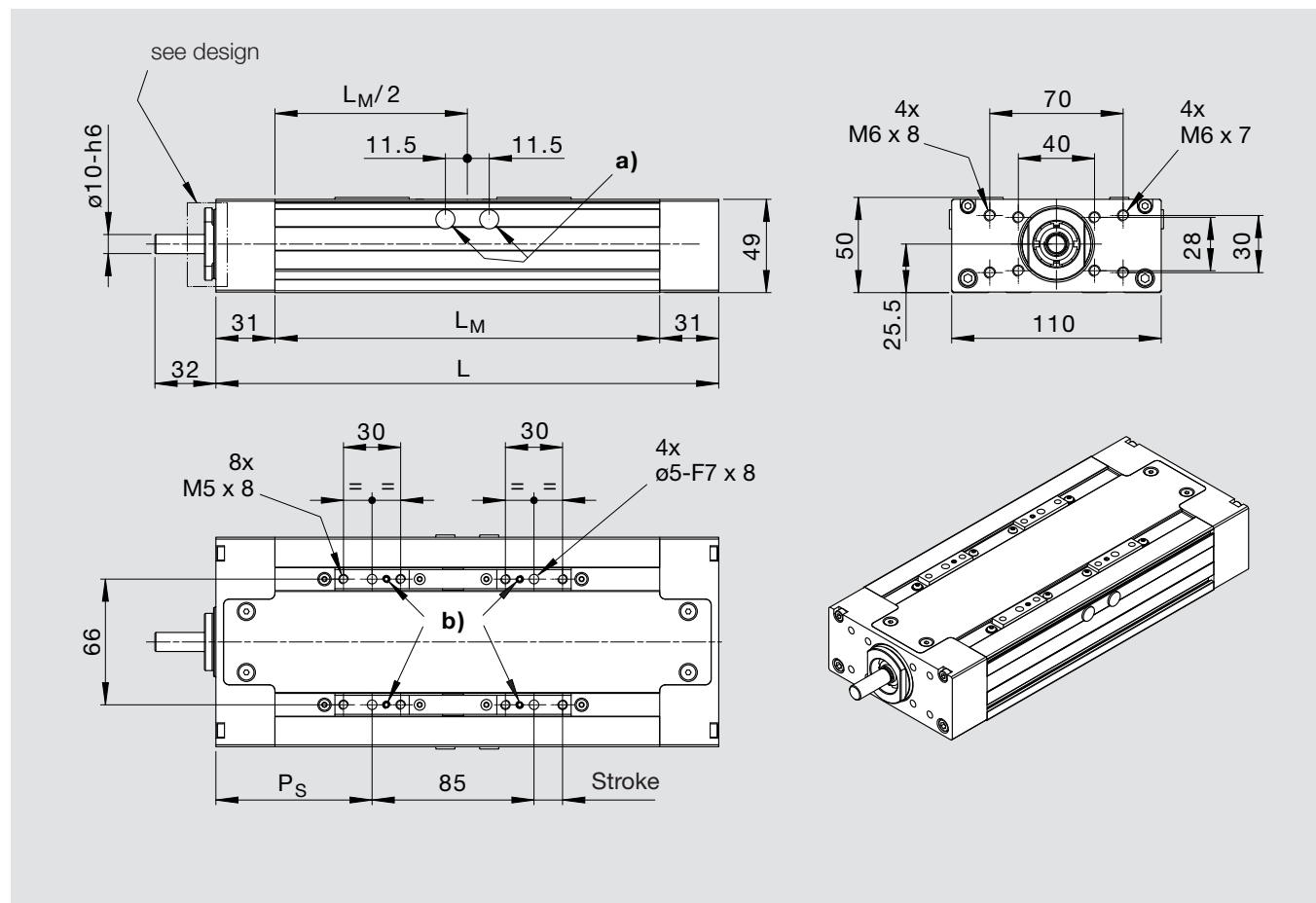
Dimensions without additional options (Option N)

Type	L [mm]	L_M	Spindle length	Length plastic strapping (2x)	P_S	Weight [kg]
KE2.2...N	Stroke + 164	$L - 62$	$L + 12$	$2 \times \text{Stroke} + 294$	82	$1.90 \text{ kg} + 0.852 \text{ kg}/100 \text{ mm Stroke}$

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

Type	L [mm]	L_M	Spindle length	Length plastic strapping (2x)	P_S	Weight [kg]
KE2.2...K, P, Z	Stroke + 182	$L - 62$	$L + 12$	$2 \times \text{Stroke} + 330$	91	$2.13 \text{ kg} + 0.852 \text{ kg}/100 \text{ mm Stroke}$

Dimensions KE2.4 (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.

CAD download:
www.linetech.ch

Dimensions without additional options (Option N)

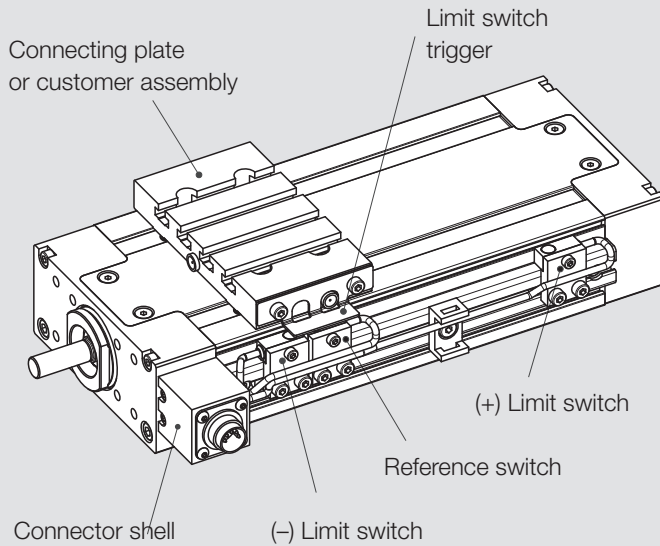
Type	L [mm]	L _M	Spindle length	Length plastic strapping (2x)	P _S	Weight [kg]
KE2.4...N	Stroke + 249	L – 62	L + 12	2 x Stroke + 379	82	3.25 kg + 0.852 kg/100 mm Stroke

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

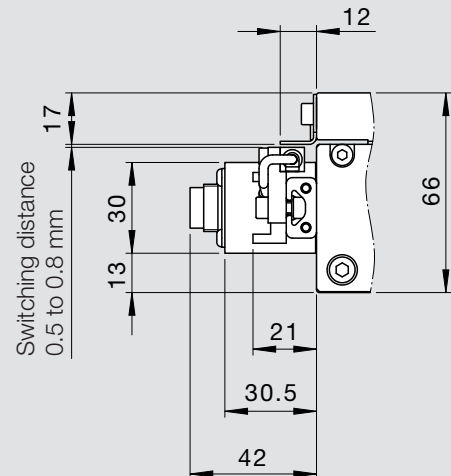
Type	L [mm]	L _M	Spindle length	Length plastic strapping (2x)	P _S	Weight [kg]
KE2.4...K, P, Z	Stroke + 267	L – 62	L + 12	2 x Stroke + 415	91	3.48 kg + 0.852 kg/100 mm Stroke

Limit switch mounting KE2

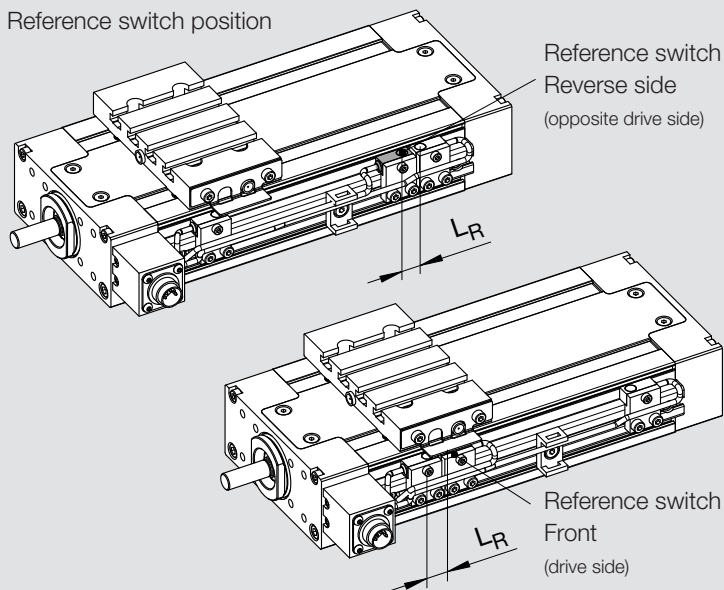
Limit switch mounting KE2



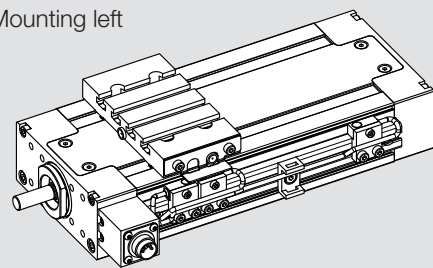
Dimensions for limit switch mounting



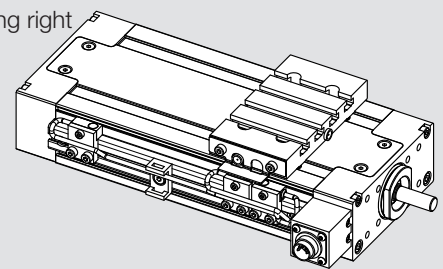
Reference switch position



Mounting left

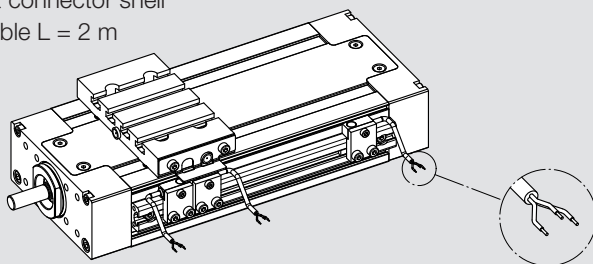


Mounting right

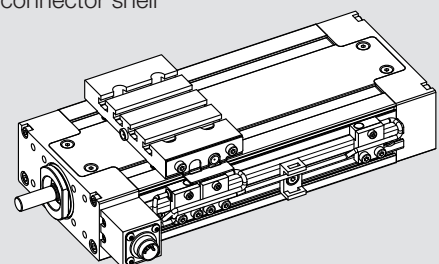


L_R = 20 mm (standard)
but at least 10 mm

without connector shell
with cable $L = 2$ m

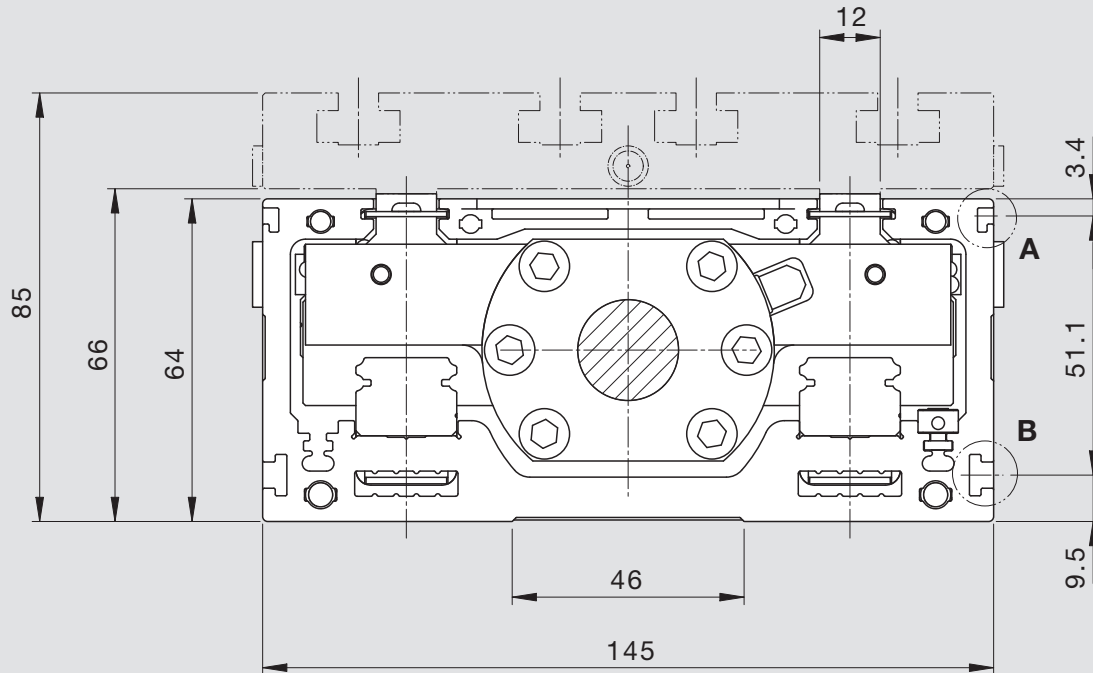


with connector shell

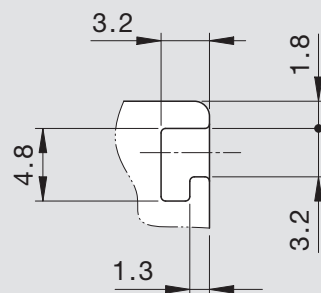


Overview KE3

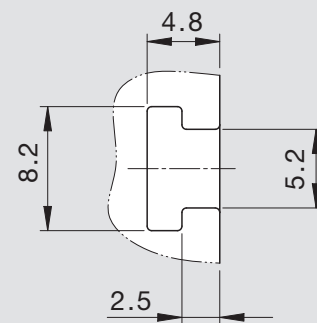
Cross-section (M 1:1.5)



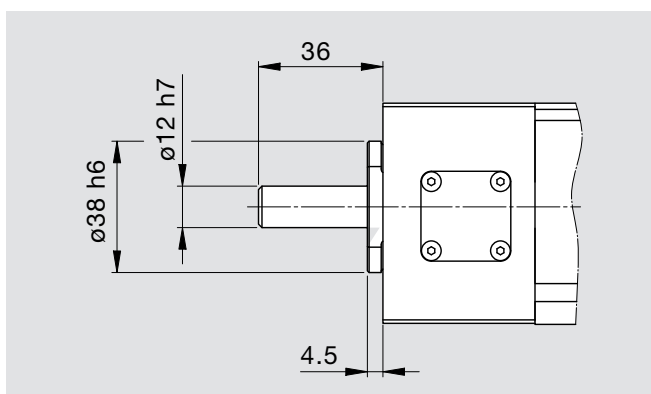
Detail A



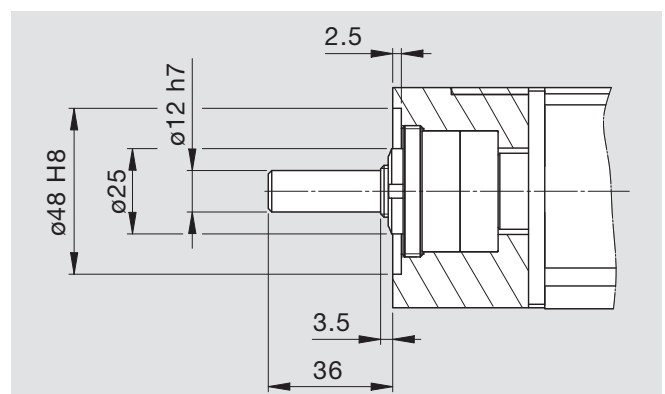
Detail B

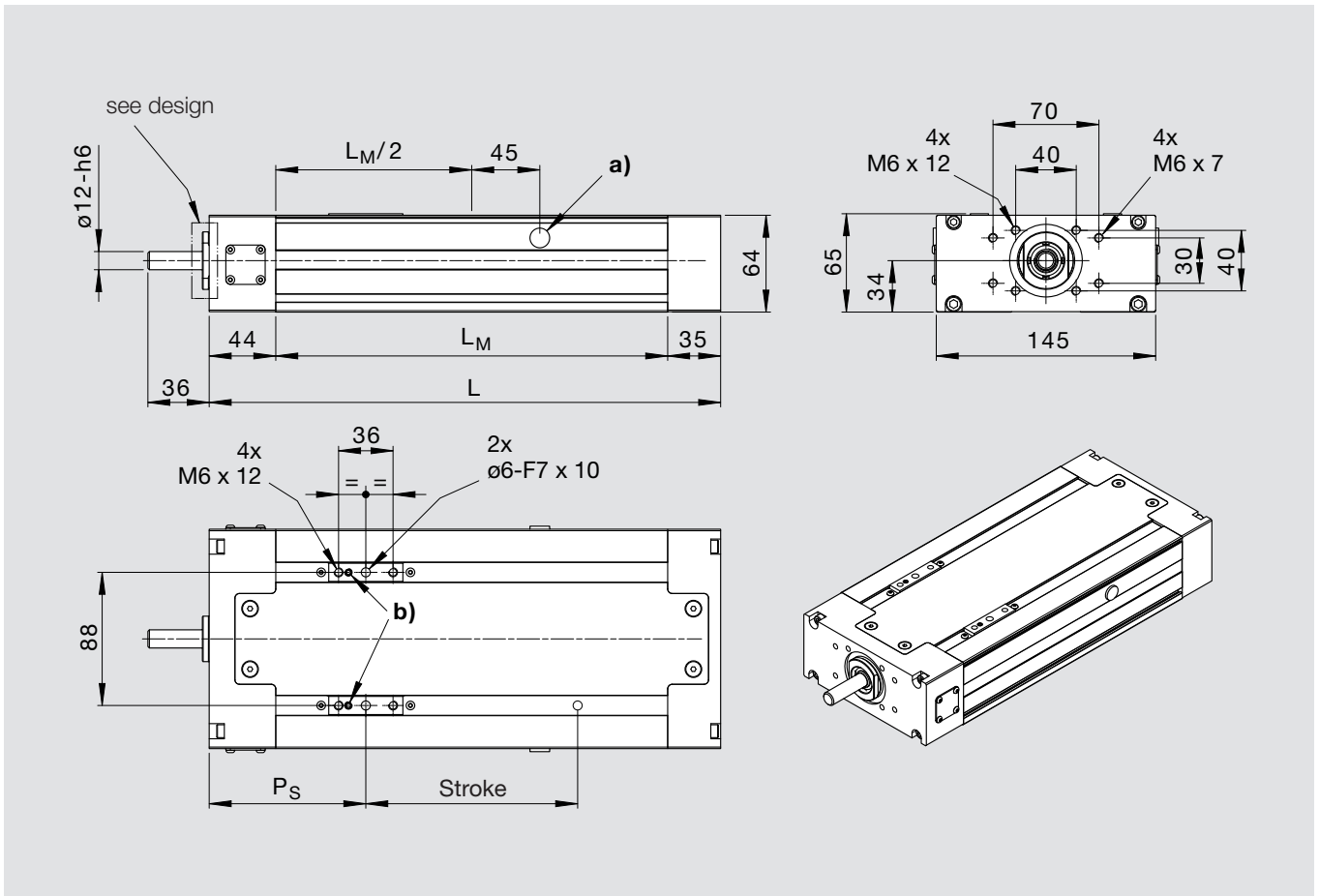


Design 01



Design S1





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

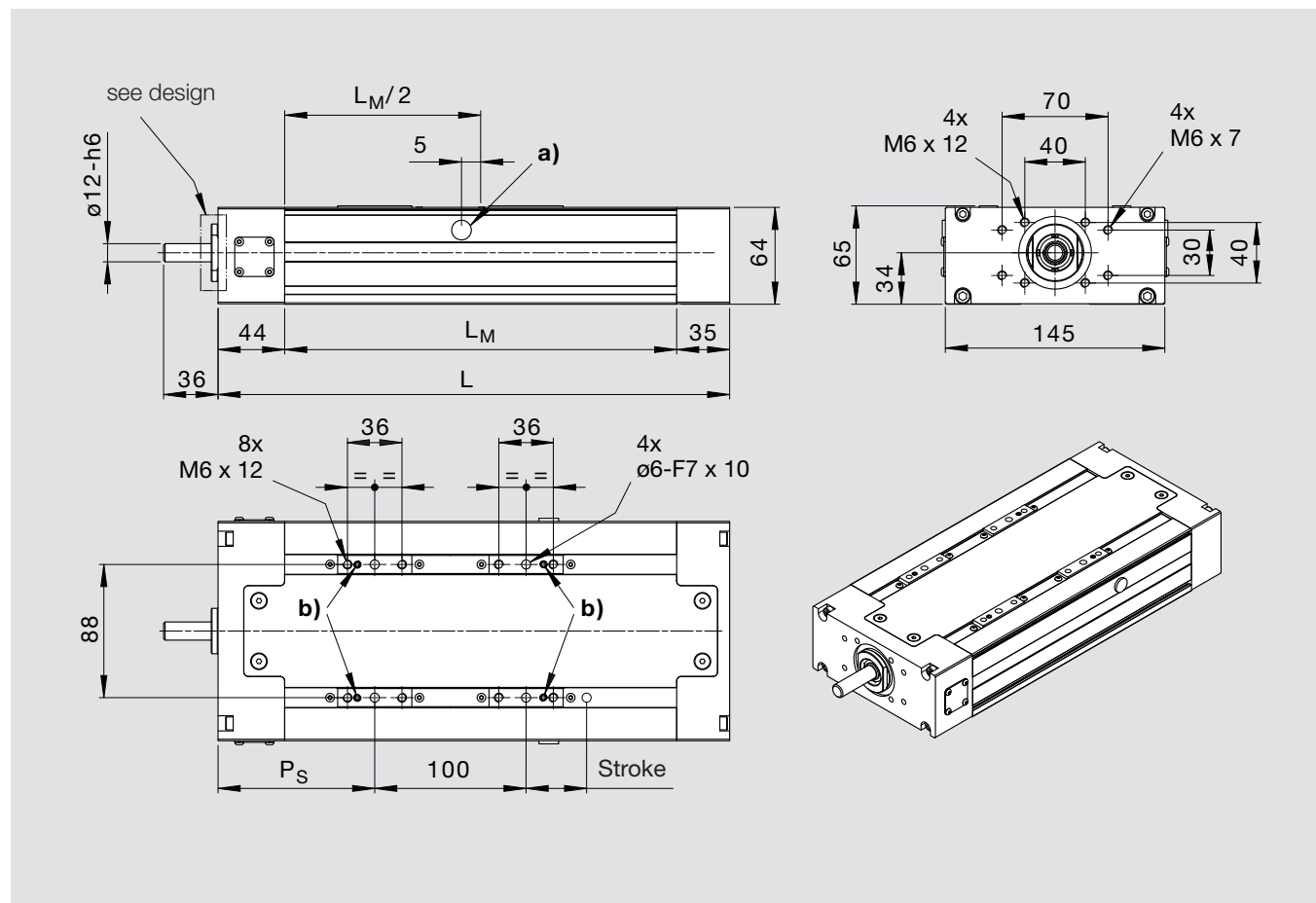
Dimensions without additional options (Option N)

Type	L [mm]	L_M	Spindle length	Length plastic strapping (2x)	P_S	Weight [kg]
KE3.2...N	Stroke + 198	$L - 79$	$L + 17$	$2 \times \text{Stroke} + 356$	103.5	$5.40 \text{ kg} + 1,232 \text{ kg}/100 \text{ mm Stroke}$

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

Type	L [mm]	L_M	Spindle length	Length plastic strapping (2x)	P_S	Weight [kg]
KE3.2...K, P, Z	Stroke + 205	$L - 79$	$L + 17$	$2 \times \text{Stroke} + 370$	107.0	$5.49 \text{ kg} + 1,232 \text{ kg}/100 \text{ mm Stroke}$

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.

CAD download:
www.linetech.ch

Dimensions without additional options (Option N)

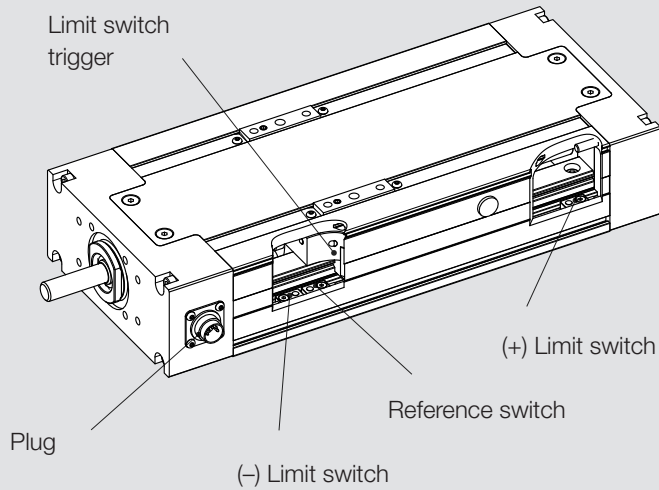
Type	L [mm]	L _M	Spindle length	Length plastic strapping (2x)	P _S	Weight [kg]
KE3.4...N	Stroke + 298	L – 79	L + 17	2 x Stroke + 456	103.5	7.62 kg + 1,232 kg/100 mm Stroke

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

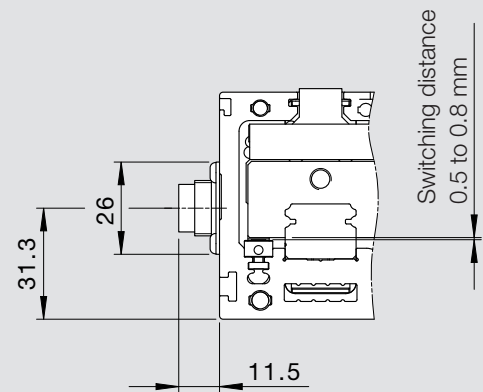
Type	L [mm]	L _M	Spindle length	Length plastic strapping (2x)	P _S	Weight [kg]
KE3.4...K, P, Z	Stroke + 305	L – 79	L + 17	2 x Stroke + 470	107.0	7.71 kg + 1,232 kg/100 mm Stroke

Limit switch mounting KE3

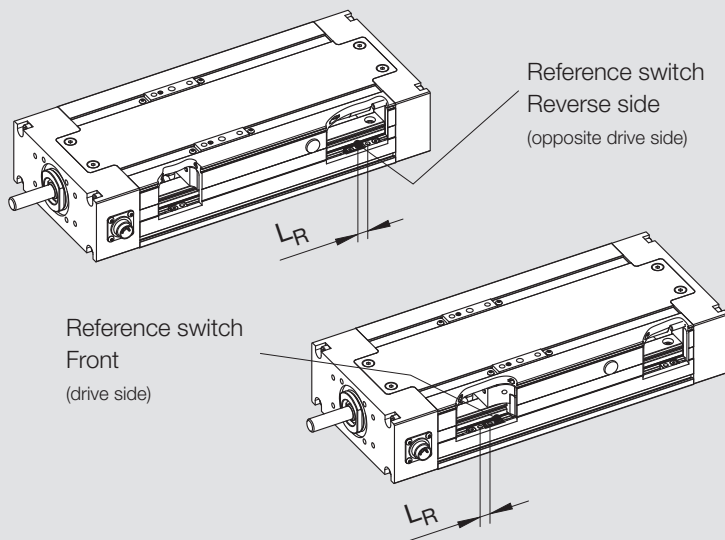
Limit switch mounting KE3



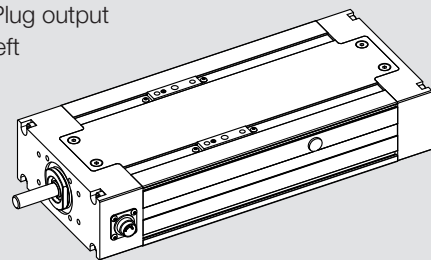
Dimensions of limit switch plug



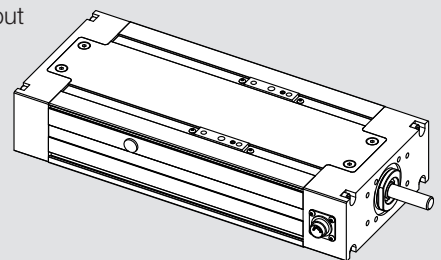
Reference switch position



Plug output left



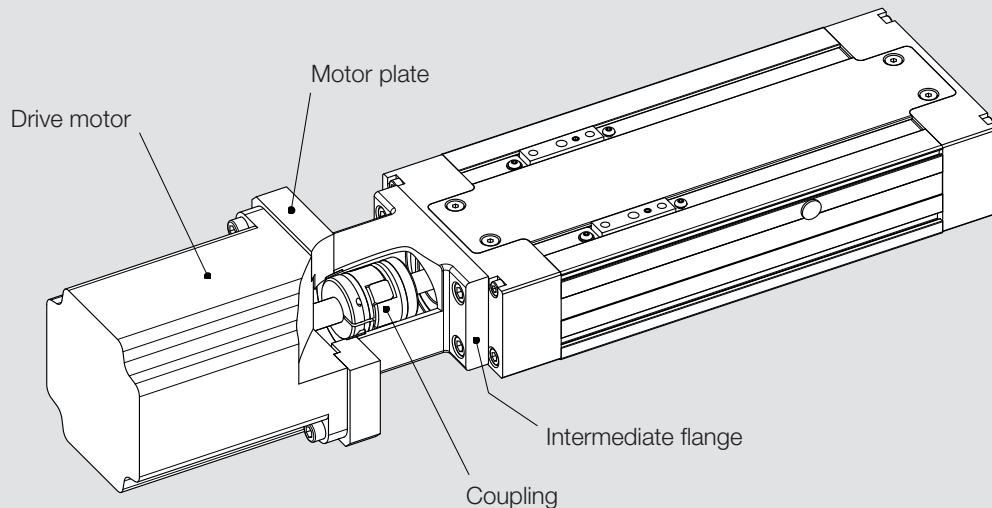
Plug output right



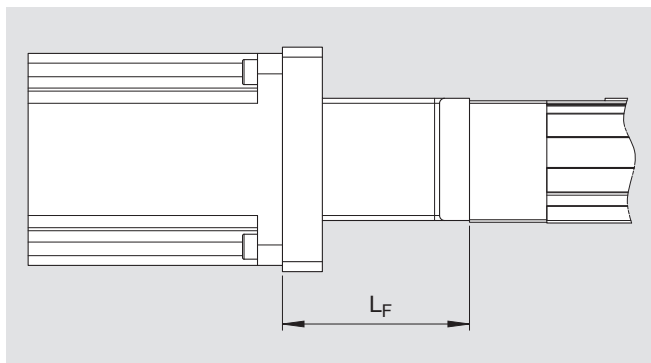
L_R = 20 mm (standard)
but at least 8 mm

Dimensions of motor mounting Straight mounting

Straight motor mounting

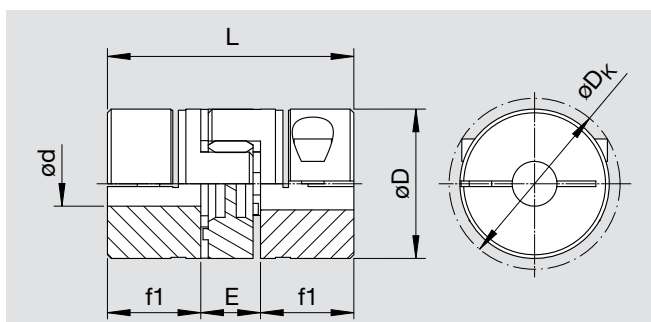


Length of motor mounting

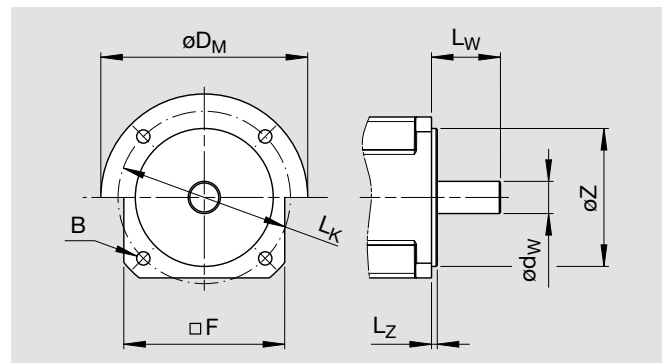


KE2 Dimensions [mm]		
L_W	L_F	Coupling
20 to 25	65	Size 14
30 to 35	75	Size 14

Coupling



Motor dimensions *



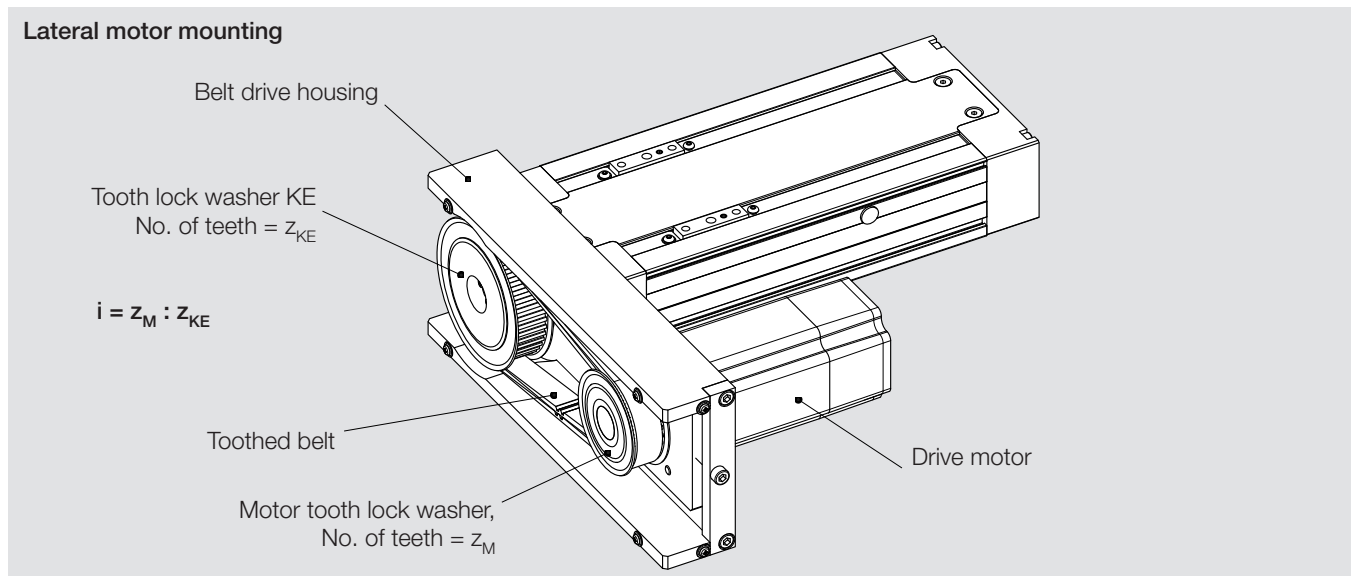
KE3 Dimensions [mm]		
L_W	L_F	Coupling
26 to 36	90	Size 19
36 to 46	100	Size 19

Coupling dimensions [mm]

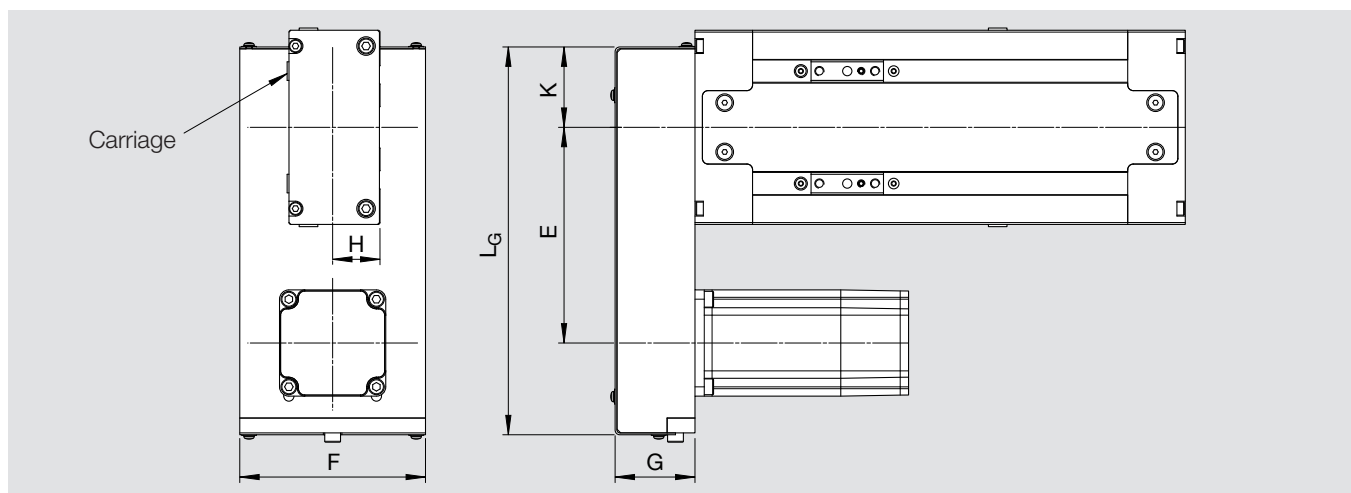
Size	L	øD	ød	f1	E	øD_K
14	35	30	max. 15	11	13	32.2
19	66	40	max. 20	25	16	46.0

* Dimensions ϕD_M , B, $\square F$, L_K , L_W , ϕd_Z , L_Z and ϕZ in the Motor dimensions diagram are only required for specifying the motor mounting.

Dimensions of motor mounting Lateral mounting



Dimensions for lateral motor mounting



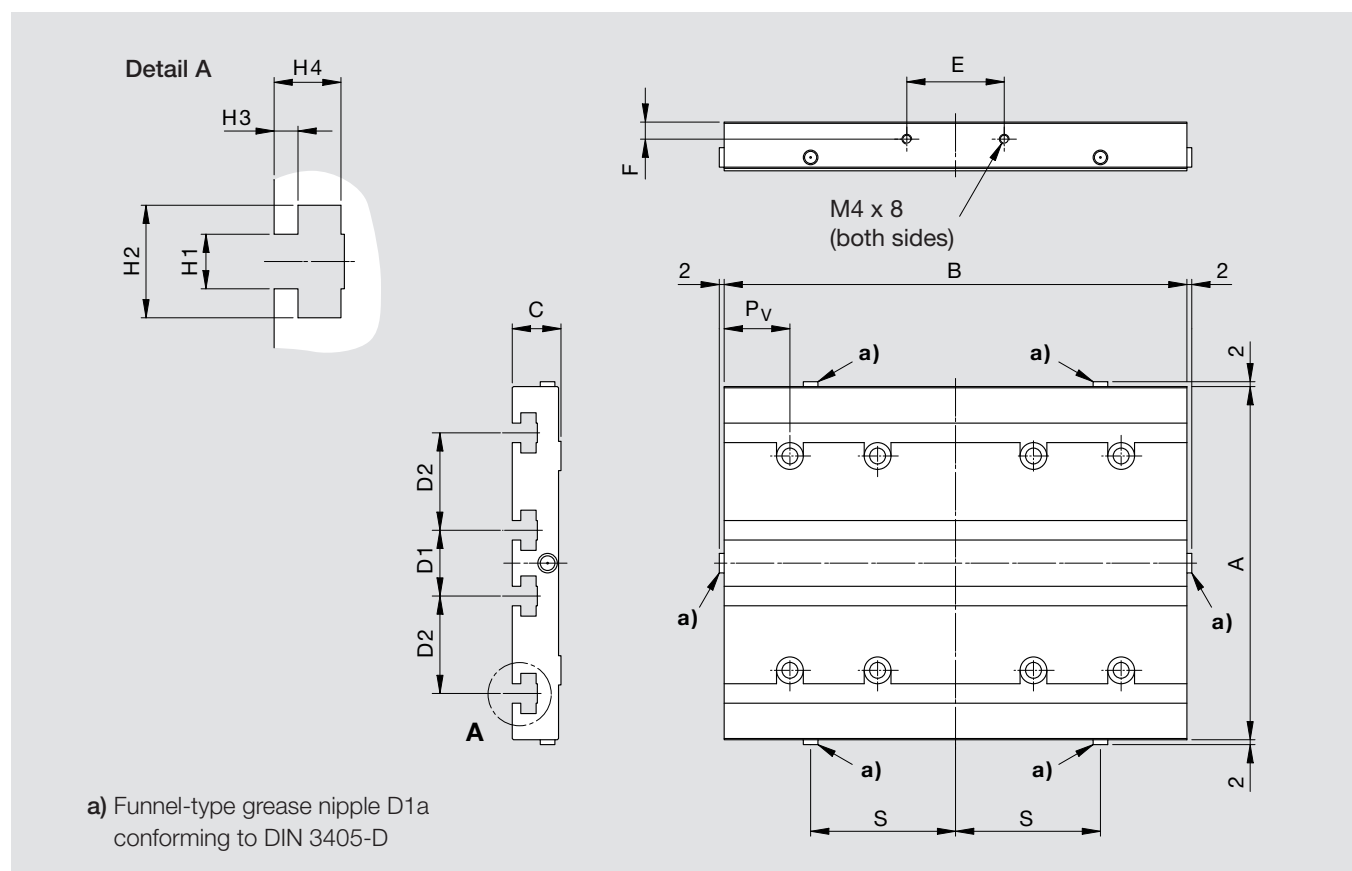
Size	Dimensions [mm]							No. of teeth		Max. ϕd_M	Belt length [mm]
	i	E	F	G	H	K	L _G	Z _M	Z _{KE}		
KE2	1:1	135 (132.5-137.5)	100	43	25.5	45	247	32	32	$\phi 19$	425
	1:1.5							32	48	$\phi 19$	475
	1:2							24	48	$\phi 12$	450
KE3	1:1	177	120	66	34	65	300	50	50	$\phi 22$	610
	1:1.5							30	45	$\phi 16$	545
	1:2							25	50	$\phi 14$	545

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.

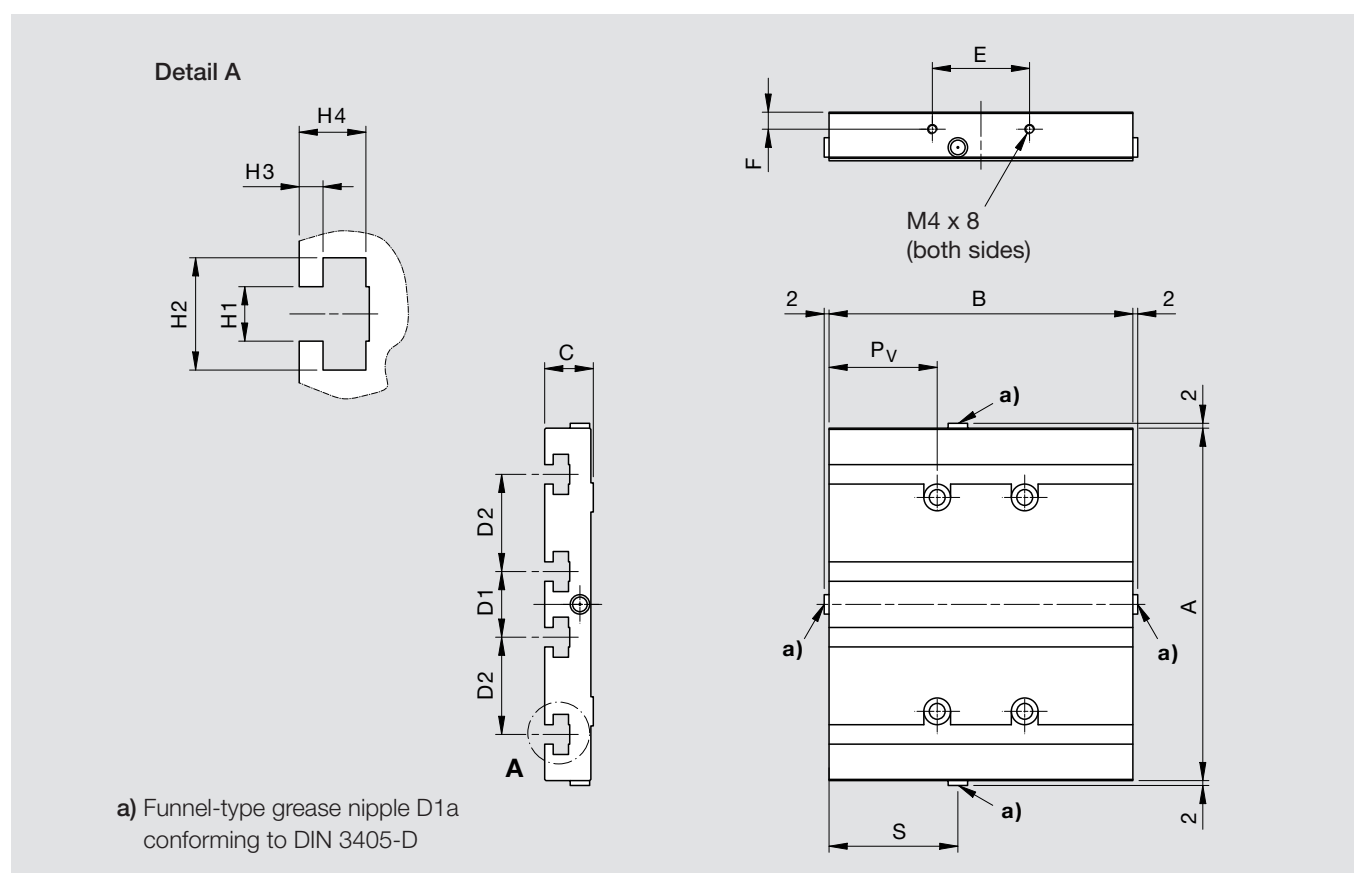
The connecting plates differ in design. The plate shown below is specified for size KE3.



Size	Dimensions [mm]													Weight [kg]	Art. no.
	A	B	C	D1	D2	E	F	H1	H2	H3	H4	P _V	S		
KE2	110	155	16	20	20	40	7	6	12.0	3.5	7.7	20	35.0	0.565	KE2.4.plate
KE3	145	190	20	27	40	40	7	8	16.5	3.5	9.8	27	59.5	1.100	KE3.4.plate

Dimensions of connecting plates for KEs with 1 carriage

Connecting plates for KEs with 1 carriage



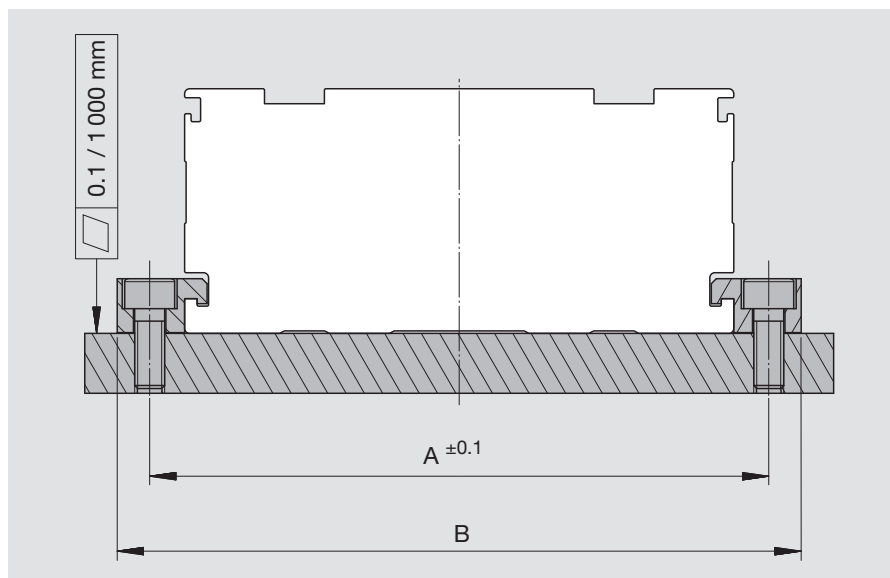
Size	Dimensions [mm]													Weight [kg]	Art. no.
	A	B	C	D1	D2	E	F	H1	H2	H3	H4	P _V	S		
KE2	110	60	16	20	20	40	7	6	12.0	3.5	7.7	15	37.5	0.213	KE2.2.plate
KE3	145	125	20	27	40	40	7	8	16.5	3.5	9.8	44.5	53.0	0.727	KE3.2.plate

Mounting accessories Clamps

Mounting options

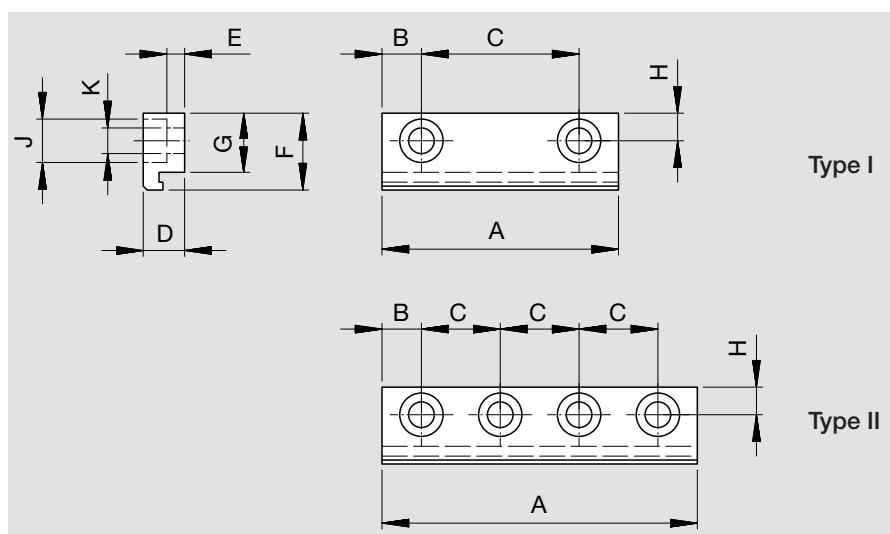
The compact units are fixed with clamps. Mounting and supporting the compact units only at the base body, not at the endplates.

Size	Dimensions [mm]	
	A	B
KE2	126	140
KE3	161	175



Dimensions of clamps

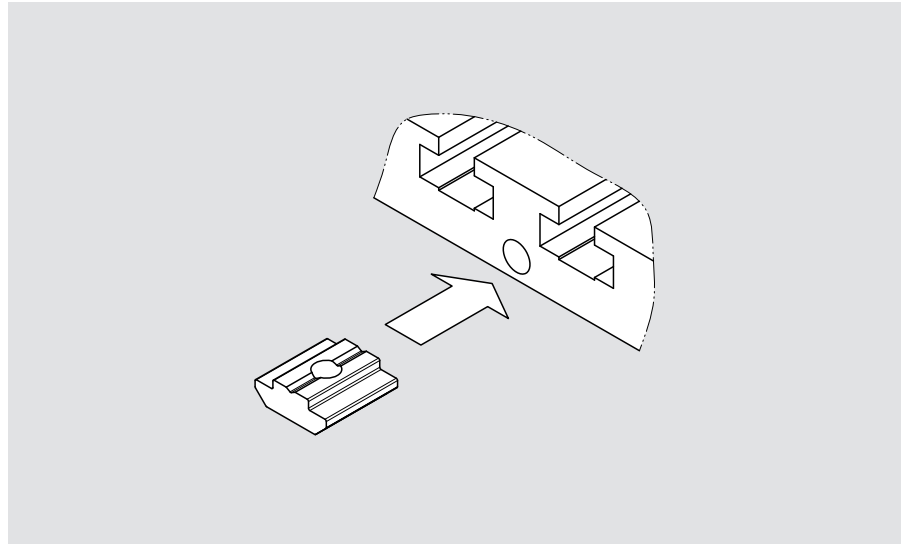
Recommended number of clamps:
4 per meter and side



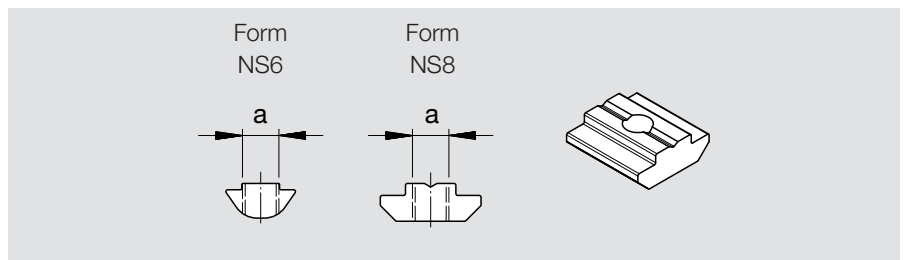
Size	Dimensions [mm]										Type	Weight [kg]	Art. no.
	A	B	C	D	E	F	G	H	J	K			
KE2 / KE3	60	10	40	10.5	4.5	19.5	15	7	ø11	ø 6.5	I	0.072	P-54179/1
	80	10	20	10.5							II	0.088	P-54181/1

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

Typ	Groove width [mm]	Material	Dimension "a" [mm]	suitable for
NS6	6	St, Inox	M4 / M5 / M6	KE2
NS8	8	St, Inox	M4 / M5 / M6 / M8	KE3

NS 6

Sliding block NS

Groove width

6
8

St

M5 -KE

for compact units KE

Thread size (dim. "a")

M4 / M5
M6 / M8

Material

St = Steel
Inox = Inox

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

Cross table mounting

Abbreviation for lower axis

KE2 / KE3

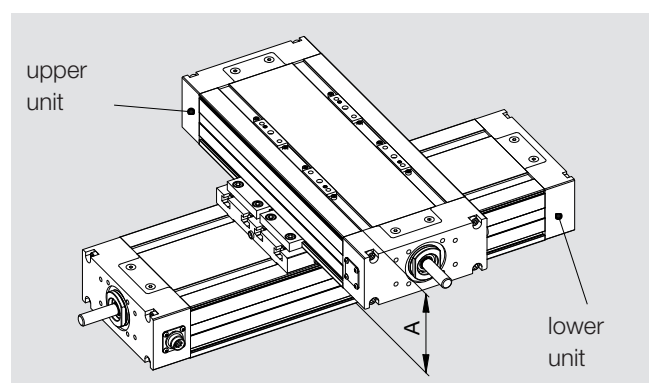
Abbreviation for upper axis

KE2 / KE3

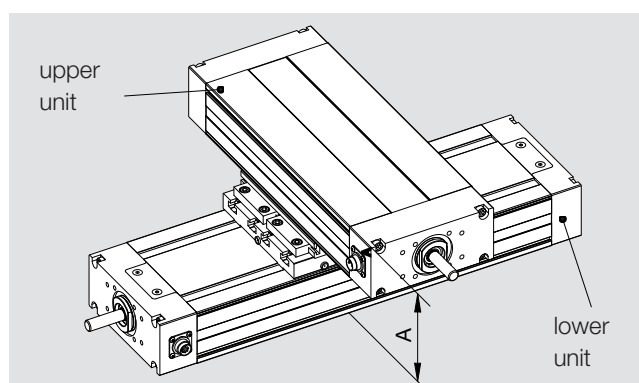
Mounting type

AC / AD / BC / BD

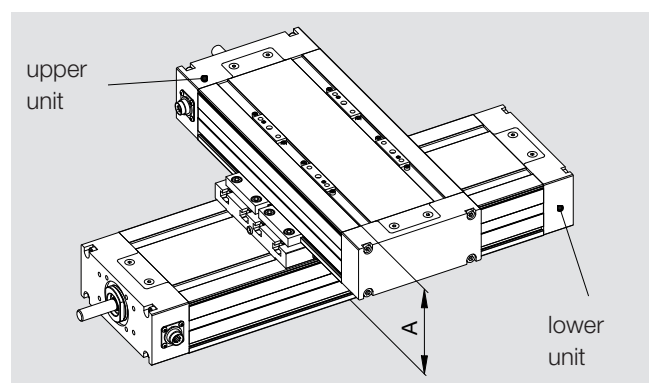
Dimension A [mm]		upper unit			
Mounting type				KE2	KE3
				A_	B_
lower unit	KE2			116	132
	KE3			135	151
				150	169



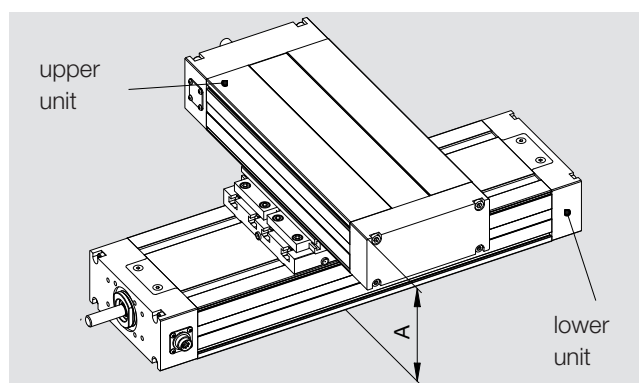
Mounting type: AC



Mounting type: BC

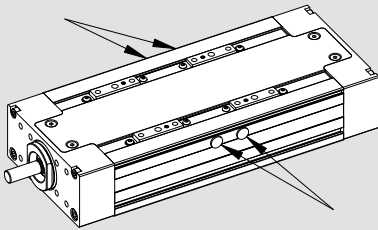


Mounting type: AD

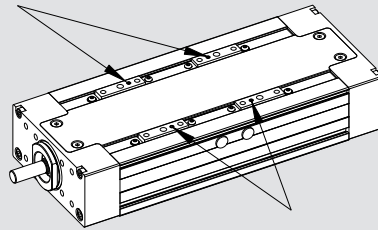


Mounting type: BD

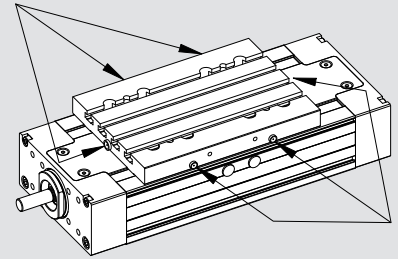
Grease nipples in base profile



Grease ports in carriage



Grease nipple in connecting plate

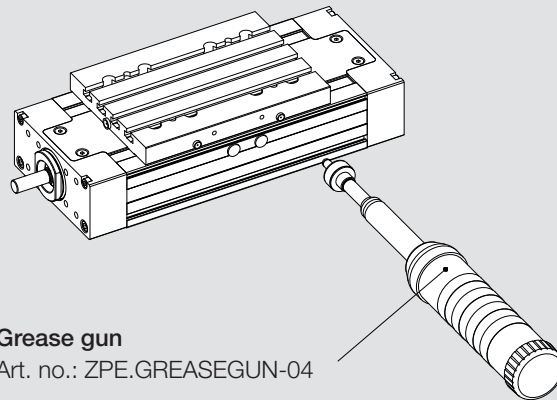


Grease points

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.

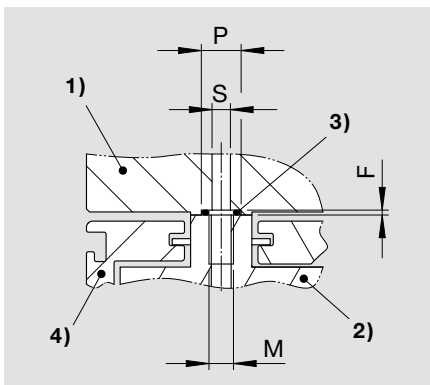
Grease gun

Art. no.: ZPE.GREASEGUN-04

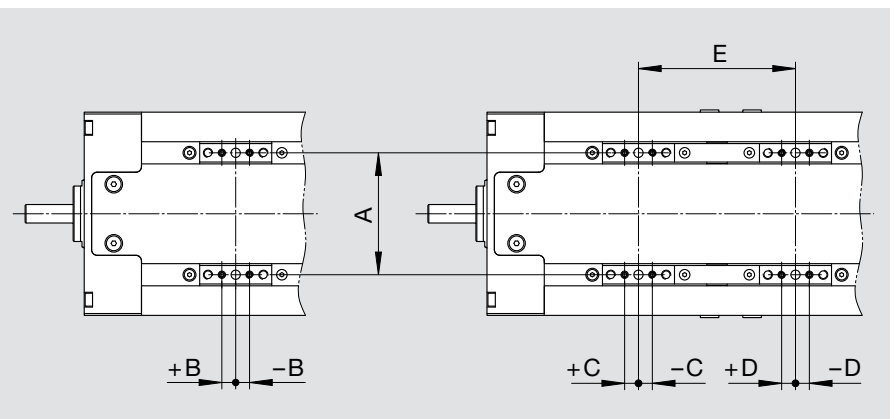


Grease ports for carriage superstructures

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.



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



Size	Weight [mm]									
	A	B	C	D	E	F	M	P	S	O-ring
KE2	66	-7.5	-7.5	7.5	85	0.8	M4	ø6.5	ø3	ø4x1
KE3	88	11.5	11.5	-11.5	100	0.8	M5	ø6.5	ø3	ø4x1

Calculation guidelines

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]:

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

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_0 [N] and the load F_r [N] it results in:

$$f_s = \frac{C_0}{F_r}$$

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.

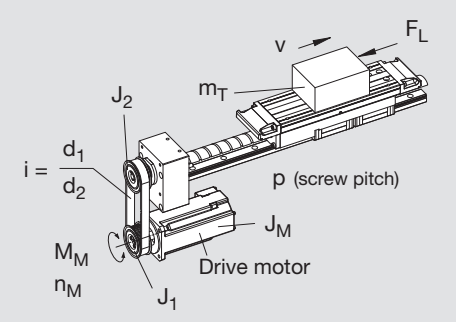
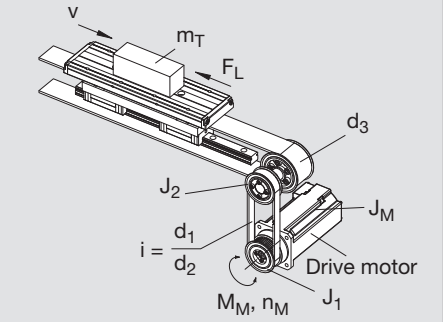
For the optimal drive unit configuration, LINE TECH offers different types of step-motors, DC and AC motors together with the appropriate continuous- or linear path control.

To enable you to determinate 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 _d	[Nm]	= Motor continuous torque (see motor specs.)
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
η	[-]	= Mechanical efficiency on motor shaft

			
Motor speed	[min ⁻¹]	$n_M = \frac{v \cdot 6 \cdot 10^4}{p \cdot i}$	$n_M = \frac{v \cdot 6 \cdot 10^4}{\pi \cdot d_3 \cdot i}$
Critical speed	[min ⁻¹]	$n_K = 120 \cdot 10^6 \cdot \frac{d}{l^2}$	
Load moment	[Nm]	$M_L = p \cdot i \cdot \frac{F_L}{2000 \cdot \pi}$	$M_L = d_3 \cdot i \cdot \frac{F_L}{2000}$
Translatory mass moment of inertia	[kgm ²]	$J_T = m_T \left(\frac{p}{2 \cdot \pi} \right)^2 \cdot 10^{-6}$	$J_T = m_T \left(\frac{d_3}{2} \right)^2 \cdot 10^{-6}$
Rotatory mass moment of inertia (for steel)	[kgm ²]	$J_R = 7,7 \cdot d^4 \cdot l \cdot 10^{-13}$	
Total of reduced mass moments mass moments of inertia	[kgm ²]	$J = J_M + J_1 + i^2 (J_R + J_T + J_2)$ (at gear reduction 1:2 => i = 0.5)	
Acceleration or Braking moment $M_B = f(n_M)$	[Nm]	$M_B = \frac{n_M \cdot J}{9.55 \cdot t_B}$	
Acceleration or Braking moment $M_B = f(s_B)$	[Nm]	$M_B = \frac{4 \cdot \pi \cdot s_B \cdot J}{p \cdot i \cdot t_B^2}$	$M_B = \frac{4 \cdot s_B \cdot J}{d_3 \cdot i \cdot t_B^2}$
Acceleration or Braking moment $t_B = f(n_M)$	[s]	$t_B = \frac{n_M \cdot J}{9.55 \cdot M_B}$	
Acceleration or Braking moment $t_B = f(s_B)$	[s]	$t_B = \sqrt{\frac{4 \cdot \pi \cdot s_B \cdot J}{p \cdot i \cdot M_B}}$	$t_B = \sqrt{\frac{4 \cdot s_B \cdot J}{d_3 \cdot i \cdot M_B}}$
Speed reached after acceleration	[min ⁻¹]	$n_M = \frac{120 \cdot s_B}{p \cdot i \cdot t_B}$	$n_M = \frac{120 \cdot s_B}{d_3 \cdot \pi \cdot i \cdot t_B}$
Distance travelled during acceleration	[mm]	$s_B = \frac{n_M \cdot t_B \cdot p \cdot i}{120}$	$s_B = \frac{n_M \cdot t_B \cdot d_3 \cdot \pi \cdot i}{120}$
Sum of torques to be overcome by the motor	[Nm]	$M_M = \frac{1}{\eta} (M_L + M_B)$	
Power output	[W]	$P_A = \frac{M_M \cdot n_M}{9.55}$	
Effective value of motor output torque	[Nm]	$M_{eff} = \sqrt{\frac{\sum t_B (M_M/M_d)^2 + \sum t_L (M_L/M_d)^2}{\sum t_B + \sum t_L + t_0}} \cdot M_d$	

Sample calculation

Dimensioning example

Compact unit KE3.2.0200AR010.1.02.0F-N7NNNN

Stroke	=	200	[mm]	External load	m_T	=	100	[kg]	
Spindle length	l	=	423	[mm]	Maximum feed force	F_L	=	500	[N]
Spindle pitch	p	=	10	[mm]	Advance speed	v	=	5	[m/min]
Spindle diameter	d	=	20	[mm]	Acceleration time	t_B	=	0.05	[s]

Load cycle:

Sum of all acceleration and braking times	$\sum t_B$	=	1	[s]
+ Sum of all run times with constant speed	$\sum t_L$	=	4	[s]
+ Stop time without load	t_0	=	1	[s]
<hr/>				
= Cycle time		=	6	[s]

Transmission:

Motor directly coupled with spindle	i	=	1
Moment of inertia of coupling	J_1	=	$0.04 \cdot 10^{-3}$ [kgm ²]

Load moment	$M_L = \frac{p \cdot i \cdot F_L}{200 \cdot \pi} = \frac{10 \cdot 1 \cdot 500}{200 \cdot \pi} = 0.8 \text{ [Nm]}$
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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	$J_R = 7.7 \cdot d^4 \cdot l \cdot 10^{-13} = 7.7 \cdot 20^4 \cdot 423 \cdot 10^{-13}$
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$$J_R = 0.052 \cdot 10^{-3} \text{ [kgm}^2\text{]}$$

Speed	$n_M = v \cdot \frac{6 \cdot 10^4}{p \cdot i} = \frac{5}{60} \cdot \frac{6 \cdot 10^4}{10 \cdot 1} = 500 \text{ [min}^{-1}\text{]}$
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Check of critical speed	$n_M \leq n_k = 120 \cdot 10^6 \cdot d/l^2 = 120 \cdot 10^6 \cdot 20/423^2 = 13413 \text{ [min}^{-1}\text{]}$
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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	=	1 000
Step angle	=	0.36 °
Resolution per step	=	$10 \cdot \frac{0.36}{360} = 0.01 \text{ [mm]}$ (tolerance: $\pm \frac{1}{2}$ step)
If $n_M = 500 \text{ min}^{-1}$:		
Number of full steps per rotation	=	8 333 / s
Torque	$M_d =$	2.0 [Nm]
Moment of inertia	$J_M =$	$0.11 \cdot 10^{-3} \text{ [kgm}^2\text{]}$
Sum of reduced moments of inertia	$J = J_M + J_1 + i^2 \cdot (J_T + J_R) =$	$(0.11 + 0.04 + 0.254 + 0.052) \cdot 10^{-3}$
	$J =$	$0.456 \cdot 10^{-3} \text{ [kgm}^2\text{]}$
Acceleration or braking torque	$M_B = \frac{n_M \cdot J}{9.55 \cdot t_B} = \frac{500 \cdot 0.456 \cdot 10^{-3}}{9.55 \cdot 0.05} =$	0.478 [Nm]
Resulting distance of acceleration	$M_M = \frac{1}{\eta} (M_L + M_B) = \frac{1}{0.8} (0.8 + 0.478) =$	1.60 [Nm]

Caution:

The speed-dependent torque of stepper motors must always be taken into consideration!

Sample calculation

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

$$M_{\max} = 7.26 \text{ [Nm]}$$

Moment of inertia

$$J_M = 0.06 \cdot 10^{-3} \text{ [kgm}^2\text{]}$$

Total of reduced mass moments

$$J = J_M + J_1 + i^2 \cdot (J_T + J_R) = (0.06 + 0.04 + 0.254 + 0.052) \cdot 10^{-3}$$

$$J = 0.406 \cdot 10^{-3} \text{ [kgm}^2\text{]}$$

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

$$M_M = \frac{1}{\eta} (M_L + M_B) = \frac{1}{0.8} (0.8 + 0.425) = 1.53 \text{ [Nm]}$$

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

$$\text{- during acceleration} \quad \frac{M_M}{M_d} = \frac{1.53}{1.45} = 1.06$$

$$\text{- at constant speed} \quad \frac{M_L}{M_d} = \frac{0.8}{1.45} = 0.55$$

Effective output torque of motor

$$M_{\text{eff}} = \sqrt{\frac{\sum t_B (M_M/M_d)^2 + \sum t_L (M_L/M_d)^2}{\sum t_B + \sum t_L + t_0}} \cdot M_d$$

$$M_{\text{eff}} = \sqrt{\frac{1 \cdot 1.06^2 + 4 \cdot 0.55^2}{1 + 4 + 1}} \cdot M_d$$

$$M_{\text{eff}} = 0.624 \cdot M_d$$

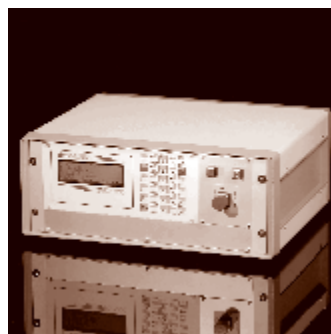
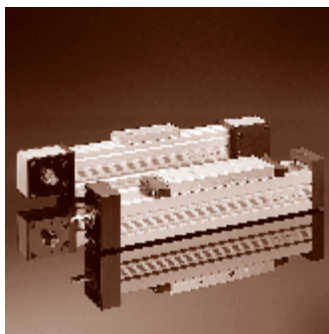
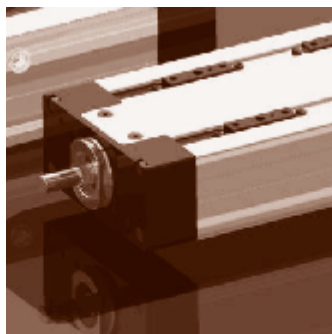
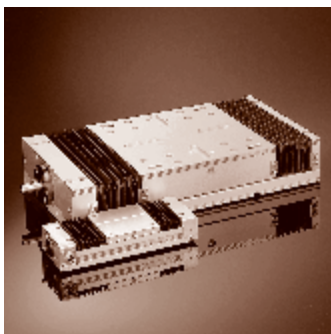
$$\text{- Thermal load of motor} = 63 \%$$

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

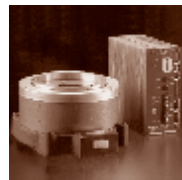
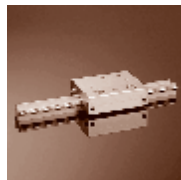
The LINE TECH product range includes mechanical, electrical and electronic components which meet all the requirements of modern handling technology and special purpose machine building.



Due to their superior design characteristics LINE TECH positioning units, compact units and 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-axe and multi-axe positioning units. The wide range of products includes continuous- and linear path control systems as well as step motors or 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.



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