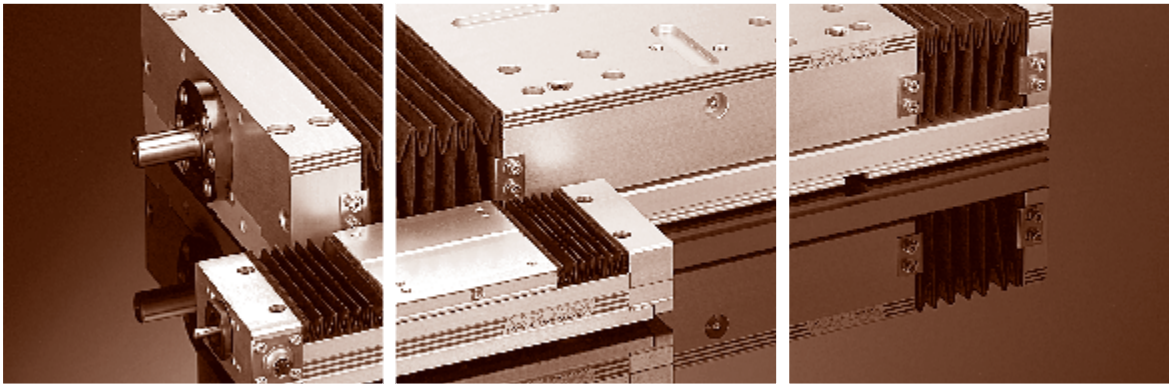
LINE TECH positioning units and integral axles



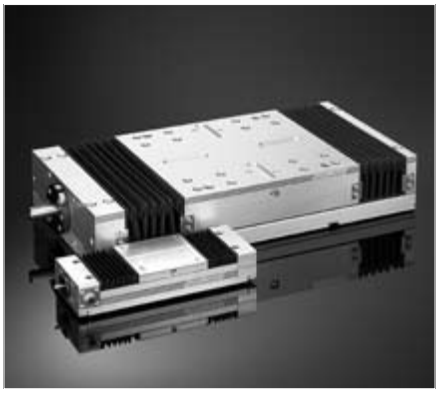
Ready to built-in linear slide units with drive (PE) and integrated motor (Integral)

CONSULTING
ENGINEERING
MANUFACTURING

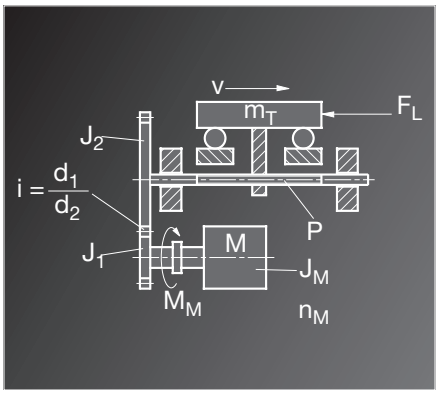
LINE TECH
LINEAR TECHNOLOGY

Foreword

LINE TECH positioning units and integral axles are of modular conception, ready to built-in linear slide units. Due to their design features, they're designated for use in applications whereas high precision and outstanding performance is a must.
The LINE TECH product range not only offers positioning units and integral axles but also linear modules, step- and servomotors as well as continuous and linear path controls and therefore connects the single units to a customized positioning system, thus fulfilling the requirements of almost any application in the field of handling technology.



Content-overview



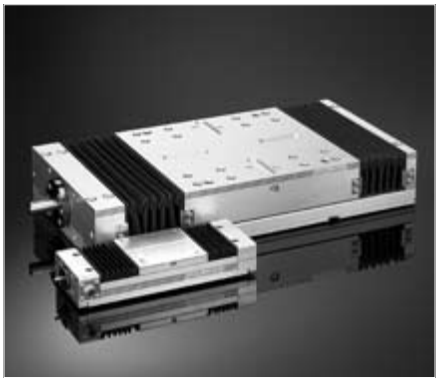


Table of content page/s

Basic design / Lubrication / Maintenance

LINE TECH positioning units

LINE TECH positioning units are of modular conception, ready to built-in linear slide units with drive.
For all sizes, sealed guiding elements are in use. For the power transmission, preferably rolled or ground ball screws, satellite roller screws or toothed belts are installed; but also high-helix lead screws „Speedy“, rod-less pneumatic cylinders and racks are available.
The guidance as well as the transmission elements are protected against external contamination such as dirt, dust and others by an expansion bellow made of special fabrics. This expansion bellow can be omitted, leading to a reduced overall length of the unit.
Base plate and slide body as well as the end plates are made of extrusion molded alloy. In the end plates integrated limit switches allow, in conjunction with the motor and the control unit, a perfect positioning and prevent against overrunning of the slide.
The chosen design allows for a very high performance at most compact dimensions.

Lubrication

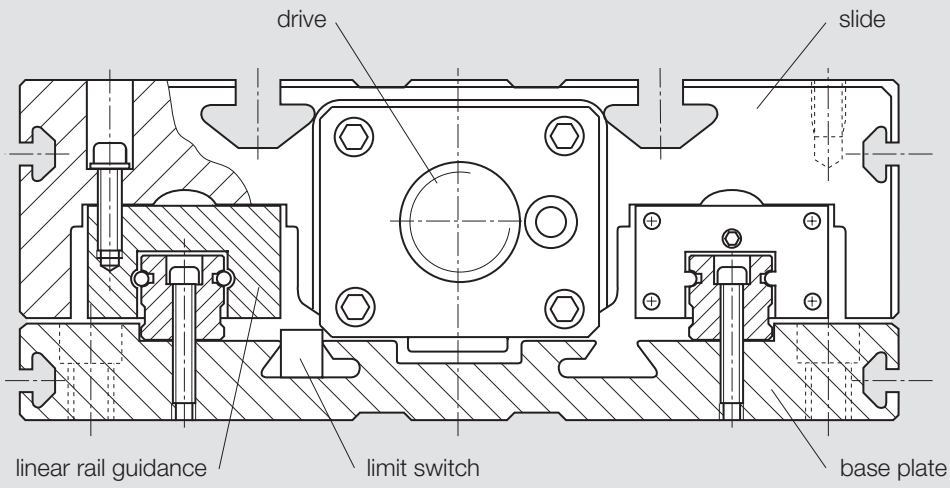
LINE TECH positioning units are pre-lubricated with „Microlube GBU Y 131“. This quality grease offers outstanding properties for the guidance and screw drive elements as well.
Depending on the specific requirements and the environmental condition, the unit shall be re-greased regularly. As an average, the re-greasing should be done every 500 running hours.
After removal of the expansion bellow, the guidance rail and the spindle can easily be greased through the lubricator nipples at the front face of the carriage. For the guide bloc, an elongation piece is necessary (article ZPE.ADAPTER), which can be obtained at the LINE TECH store.
All roller bearings installed have for-life lubrication and therefore do not need any maintenance.
Correct and regular re-greasing can remarkably prolong the equipments life cycle.

Maintenance

LINE TECH positioning units are in general maintenance-free. Depending on the application however, it is recommended to remove once in a while the expansion bellow in order to clean and to check the unit (especially in case of very fine machining-residuals).

Service temperature

The allowed service temperature is given by the composites installed. For the drives and controls refer to the specific publication.



Designation system for LINE TECH positioning units „PE“

Example PE 2 . 4 . 0500 F R 020 . 1 . 01 . 0 N

Size
1 = 110 mm slide width
2 = 155 mm slide width
3 = 225 mm slide width
4 = 310 mm slide width

Execution (see page 7)
4 = standard execution

Stroke [mm] (see page 9)

Expansion bellows (see page 9)
N = without expansion bellow
F = with expansion bellow

Drive (see pages 10/11)
N = without drive
S = ground ball screw
R = rolled ball screw
G = satellite roller screw
W = high-helix lead screw «Speedy»
Z = toothed belt
V = reverse drive (toothed belt)
T = rack gear
P = pneumatic cylinder

Stroke per revolution [mm] (see page 10)

Limit switch (see pages 12/13)
0 = without limit switch
1 = with limit switch and reference pos. at front (drive mount)
2 = with limit switch and reference pos. at rear (drive mount opposite)
3 = with limit switch and additional reference switch

Mounting condition (see pages 14/15)
00 = without drive

screw drive:
01 = free shaft end
02 = with coupling and intermediate plate
03 = with graduated collar and crank
04 = set up for lateral drive mount right*
05 = set up for lateral drive mount left*
06 = set up for lateral drive mount top
07 = set up for lateral drive mount bottom
08 = with crank and lateral millimeter scale

rack and belt drive:
11 = free shaft end right*
12 = free shaft end left*
13 = shaft end right with coupling and intermediate plate*
14 = shaft end left with coupling and intermediate plate*

21 = pneumatic cylinder

Gear reduction (see page 13)
0 = without reduction
1 = reduction 2:1
2 = reduction 2,5 : 1

available for lateral drive mount only

Motor mount (see page 13)
N = without mounting plate
F = mounting plate for LINE TECH motor
S = mounting plate for special motor

*= seen from motor opposite side towards motor

Cross tables

Cross tables

Line Tech positioning units are also available as two axle units (cross table). At this, the designation system as shown beside, based on the designation system of page 5, is to be used. There are totally four configurations possible. The correlation between the limit switch connector (black point) and the position of the drive (screw nose) will be shown on pages 12 and 13.

Designation system for cross table mounting

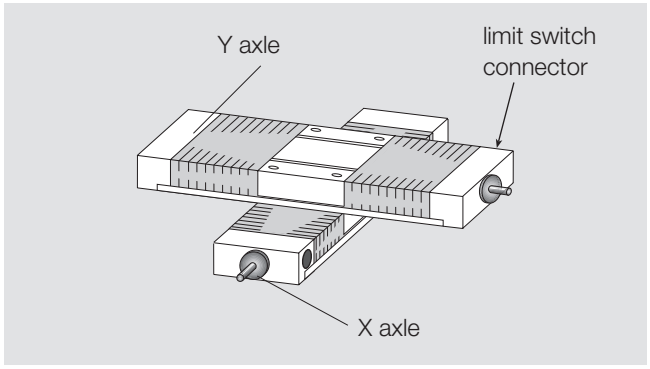
Example: KM . PE3 / PE2 . AC

- KM — Cross mounting
- PE3 — Symbol of the positioning unit of the lower axle
- PE2 — Symbol of the positioning unit of the upper axle
- AC — Mounting layout (see pictures 1–4)

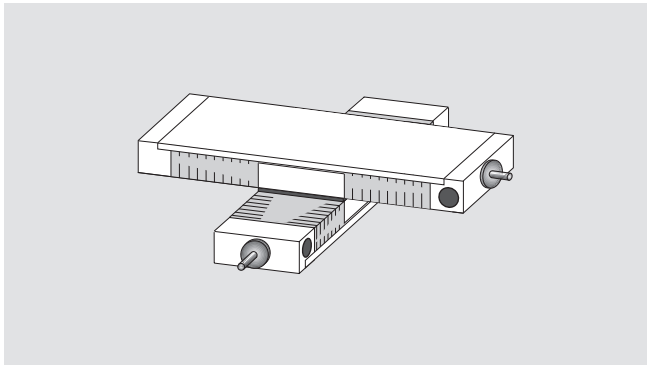
Cross table mountings of the same size of AC and AD layout are free of charge. The mounting layouts BC and BD as well as the combination of any different sizes need an intermediate plate and therefore are at a surcharge.

Standard precision for cross table mounting: 0.1mm / 300mm stroke.
Higher precision on request.

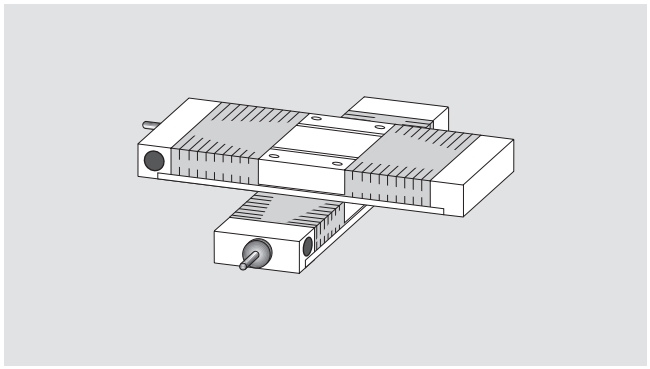
The individual positioning units must be ordered separately.



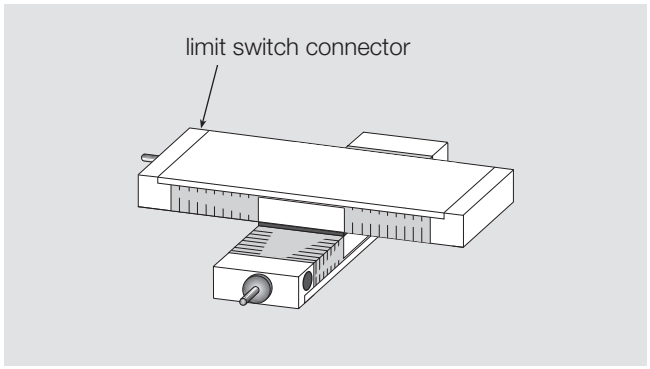
Picture 1
Mounting layout: AC



Picture 2
Mounting layout: BC



Picture 3
Mounting layout: AD



Picture 4
Mounting layout: BD

Selection notice

The selection notices take into consideration the various order options and are structured analog to the designation system. Thus permitting the optimal choice of the positioning unit meeting your specific requirements best.

Execution

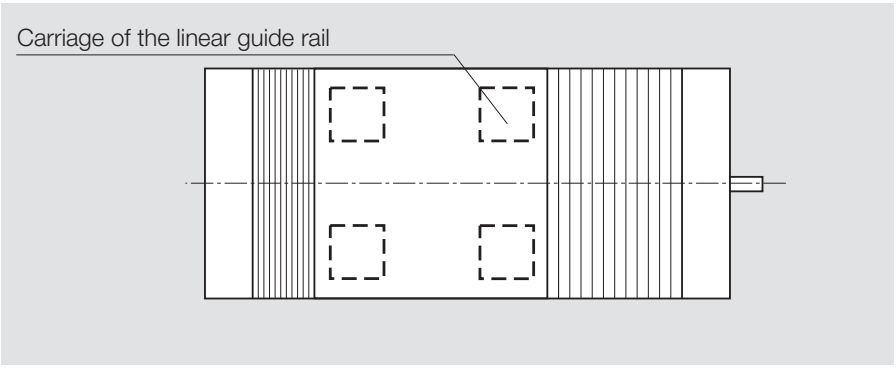
All sizes of the LINE TECH positioning units are equipped with two guiding rails and four guiding carriages (picture 6). This guiding system meets all standard-requirements regarding load capacity and precision.
In case of any higher requirements (rigidity, torque, load factor) it is possible to install linear guiding rails with a higher pre-load.

Stroke

Thanks to a most flexible manufacturing process, customer requirements for stroke length beyond the standard program can be fulfilled. However, it shall be taken into consideration that the maximum stroke length is related to the chosen drive type (see page 8). In case of the overall length of the positioning unit exceeding 2400 mm, the base plate will be compound of more then one. This doesn't have any consequence to the hole pattern whatsoever.

Expansion bellows

For the dirt protection of the bearing and drive, the positioning unit can be equipped with an expansion bellow. If the system goes without expansion bellow, the overall length of the unit for a given stroke length will be reduced.



Picture 6
Standard execution

Selection notice

Drive

In order to facilitate the selection of the best drive solution, you'll find hereafter the different possibilities and their characteristics. By this, the different arrangements can be compared and the solution meeting best the customer requirements easily be determined. In case of higher requirements to the positioning system please contact our technical support.

Drive	Size	Execution [1] diam. x pitch [mm]		Stroke range [mm]		Positioning accuracy [µm/mm]	
		rolled	ground	rolled	ground	rolled [6]	ground
Ball screw	PE 1	16x5	16x5	≤ 1500	≤ 500	52/300	23/300
		16x10	16x10	≤ 1500	≤ 500	52/300	23/300
		16x16		≤ 1500		52/300	
	PE 2	20x5	20x5	≤ 2000	≤ 750	52/300	23/300
		20x20		≤ 2000		52/300	
	PE 3	25x5	25x5	≤ 3000	≤ 1200	52/300	23/300
		25x10	25x10	≤ 3000	≤ 1200	52/300	23/300
		25x25		≤ 3000		52/300	
	PE 4	32x5	32x5	≤ 3000	≤ 1500	52/300	23/300
		32x10	32x10	≤ 3000	≤ 1500	52/300	23/300
		32x32		≤ 3000		52/300	
Satellite roller screw	PE 2	15x2	15x5	≤ 400		12/300	
	PE 3	23x2	23x5	≤ 500		12/300	
	PE 4	on request					
High-helix lead screw «Speedy»	PE 2	19x30		≤ 2000		200/300	
	PE 3	on request		≤ 3000		200/300	
Toothed belt revolving	PE 1	AT 5/16	100mm/r	400...2000		200/1000	
	PE 2	AT 5/32	75mm/r	500...2000		200/1000	
	PE 3	AT 10/50	190mm/r	600...3000		200/1000	
Toothed belt reversing	PE 1	—		—		—	
	PE 2	AT 5/50	175mm/r	≥ 500		150/1000	
	PE 3	—		—		—	
Rack gear	PE 1	—		—		—	
	PE 2	M5/14,5	100mm/r	1000...4000		15/300	
	PE 3	M7,5/24,5	150mm/r	1000...6000		15/300	
	PE 4	on request		1000...10000		15/300	
Pneumatic cylinder	PE 1	P210 ø10		100...500		—	
	PE 2	P210 ø16		100...1000		—	
	PE 3	P210 ø25		100...1500		—	

[1] additional executions on request

[2] not taking into account the reversal backlash

[3] depending upon the length of the spindle and the critical speed respectively (see pages 62/63)

Repeating accuracy [+/- mm]		Reversal backlash [mm]	Speed max. [m/s]		Accaleration max. [m/s²]	Axial load rates C_{dyn} [N]	C_0
rolled	ground		rolled	ground			
0,01	0,01		[3]	[3]	10	6950	3400
0,01	0,01		[3]	[3]	10		
0,01			[3]		10		
0,01	0,01		[3]	[3]	10	8000	4300
0,01			[3]		10		
0,01	0,01		[3]	[3]	10	10000	5500
0,01	0,01		[3]	[3]	10		
0,01			[3]		10		
0,01	0,01		[3]	[3]	10	25000	15000
0,01	0,01		[3]	[3]	10		
0,01			[3]		10		
0,005			[3]		10	8000	4300
0,005			[3]		10	10000	5500
0,05		0,1 [5]	[3]		10	—	1800
0,05		0,1 [5]	[3]		10	—	—
0,1			1,6 (optional 5)		[4]	390	565
0,1			1,6 (optional 5)		[4]	550	790
0,1			1,6 (optional 5)		[4]	2500	3110
—			—		—	—	—
0,05			1,6 (optional 5)		[4]	2350	3010
—			—		–	—	—
—		—	—		—		—
0,01 [2]		0,1	1,6 (optional 5)		[4]		3140
0,01 [2]		0,1	1,6 (optional 5)		[4]		4580
0,01 [2]		0,1	1,6 (optional 5)		[4]		6270
—			1,6 (optional 5)		[4]		43 (6 bar)
—			1,6 (optional 5)		[4]		78 (6 bar)
—			1,6 (optional 5)		[4]		250 (6 bar)

[4] no mechanical limit, depends upon the load

[5] special execution pre-loaded available

[6] special execution with positioning accuracy 23µm/300mm possible

Selection notice

Limit switches

The limit switches are used in conjunction with a control unit to limit the stroke (prevent overrunning of the carriage) and to define the reference position.
The widely used and LINE TECH standard inductive limit switches are of the PNP-break contact type and show the following characteristics:

Supply: 10…30 VDC
Current consumption off-load: < 10 mA
Load: max. 200 mA
Mechanical switch-ratio: < 0.4mm

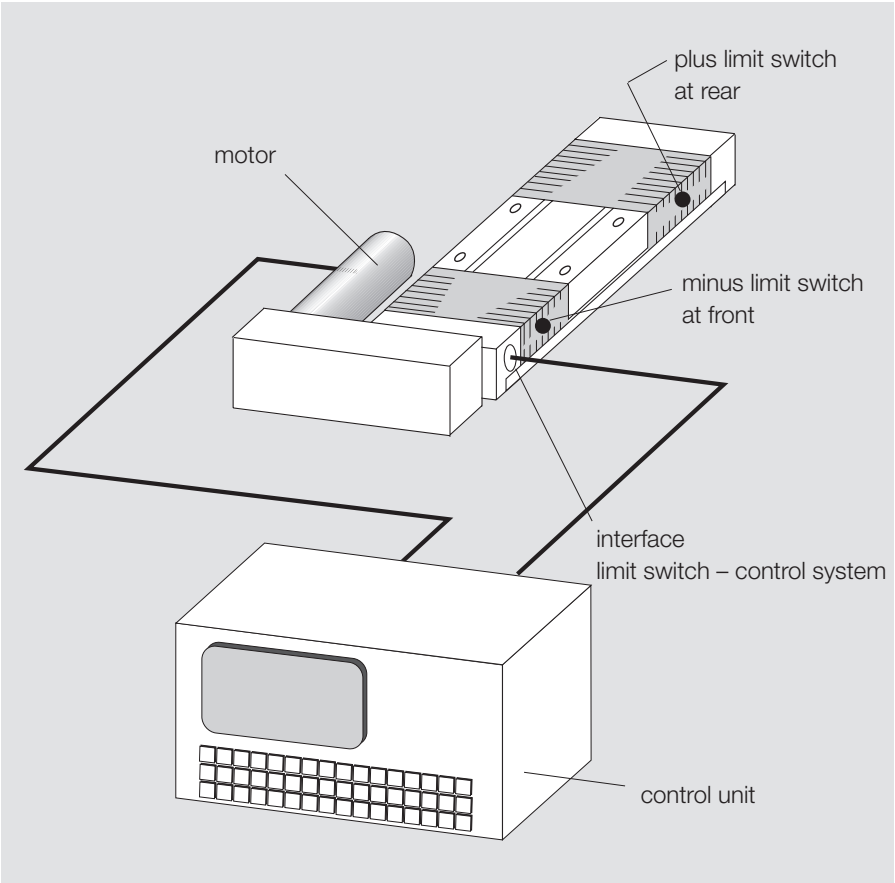
On request the following non standard limit switches are available:

– PNP-make type (PNP-NO)
– NPN-break type (NPN-NC)
– NPN-make type (NPN-NO)
– Mechanical limit switch (micro switch)

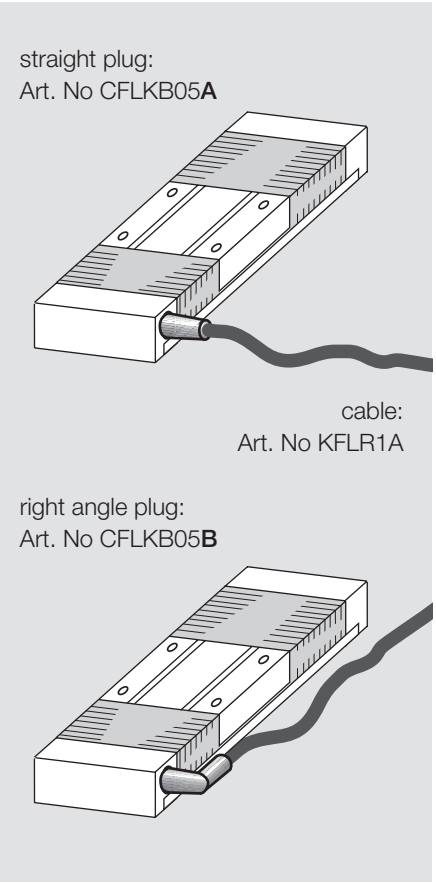
The LINE TECH product range includes continuous and linear path control systems as well as step motors, AC and DC servo drives. The individual components are tuned together and complete LINE TECH elements to custom made positioning systems.

Fitting of the limit switches

The fitting position of the limit switches is shown in picture 7a. The reference position can be allocated either to the plus (+) or to the minus (-) limit switch. Special applications often require a separate reference position switch which will be, upon customer definition, located between the plus- and minus limit switch.
The limit switch mounted closer to the drive (electrical motor) is named the front or forward limit switch.
Limit switch counterplugs with cable are not included in the delivery. However they can be ordered ready-made at LINE TECH (see picture 7b).



Picture 7a: Fitting position of the limit switches



Picture 7b: Limit switch plug and cable

Connector plug

The pin assignment for the standard limit switch is shown in the schemas 8a and 8b. The individual pins are assigned as follows:

Pin 1	minus (-) direction (load)
Pin 2	0V (GND)
Pin 3	plus (+) direction (load)
Pin 4	+10…30 VDC
Pin 5	reference (load)

Color-code legend to the schemas 8a and 8b:

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

Assembly condition

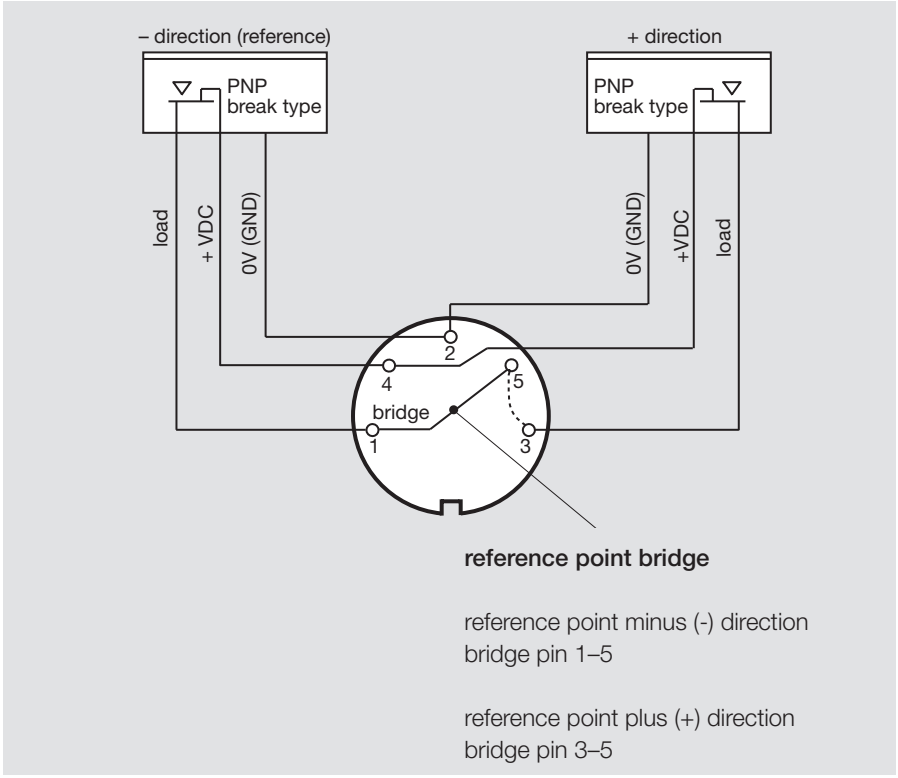
The different assembly conditions are shown on pages 14 and 15.

Reduction

On request, for the screw drive solution with lateral motor mounting the speed (rpm) can be reduced at a 2:1 or 2.5:1 ratio.

Motor mounting

LINE TECH offers a wide range of motors tuned to the positioning units. Furthermore, the installation of special motors according to the customer specification is possible.

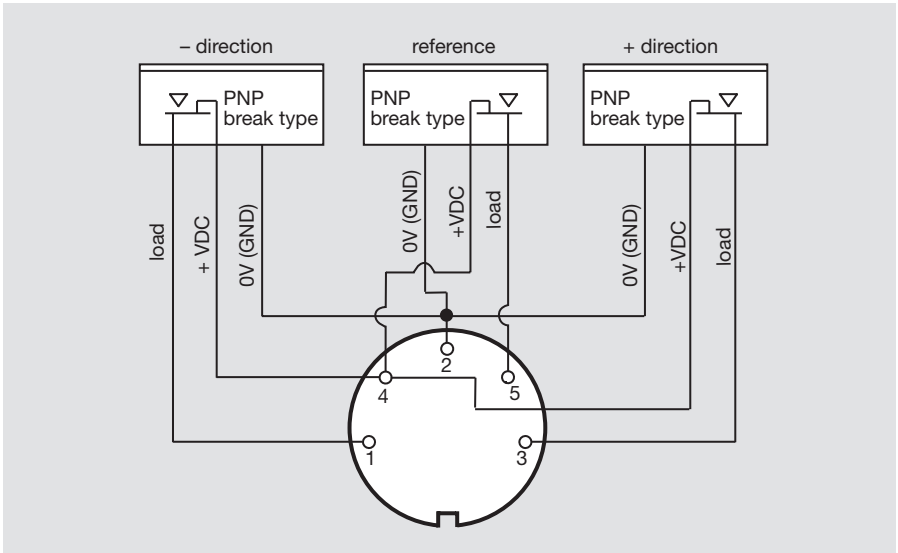


reference point bridge

reference point minus (-) direction
bridge pin 1–5

reference point plus (+) direction
bridge pin 3–5

Schema 8a
Connector plug with integrated reference switch



Schema 8b
Connector plug with separate reference switch

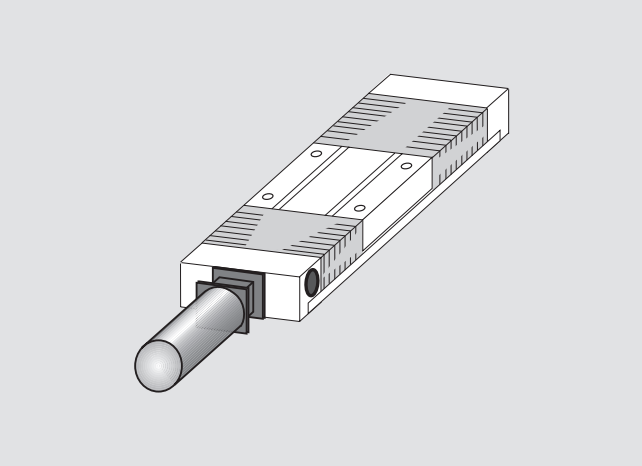
Selection notice

Mounting conditions

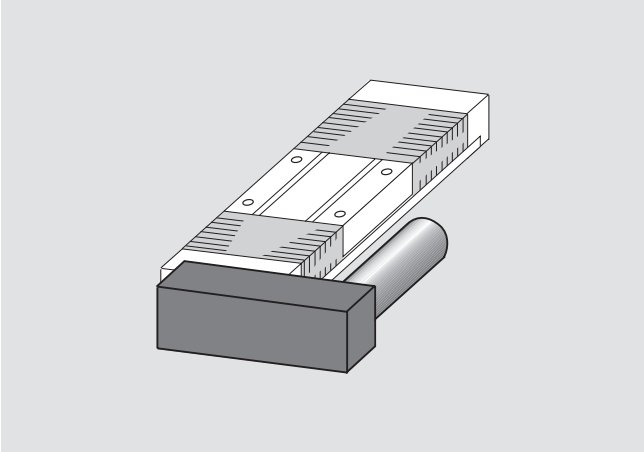
The positioning units can be supplied in different configurations (pictures 9–19). Depending on the drive solution, different executions are being offered as a standard. The difference between left and right hand mounting condition is given by the position of the limit switch connector plug. The respective location is marked with a black dot in the pictures 9–19.

● = limit switch connector plug (interface limit switch control)

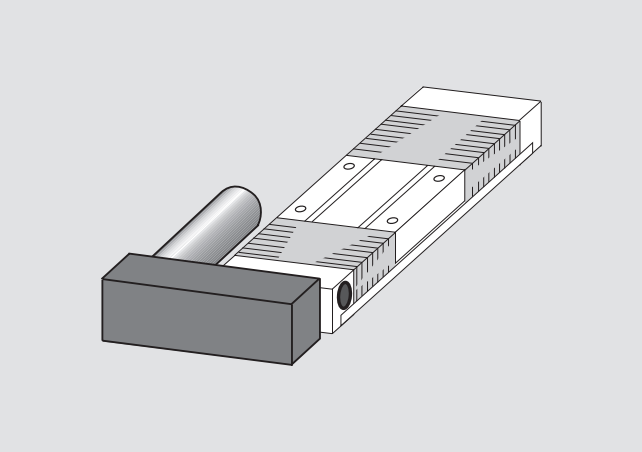
Dimensions see page 36.



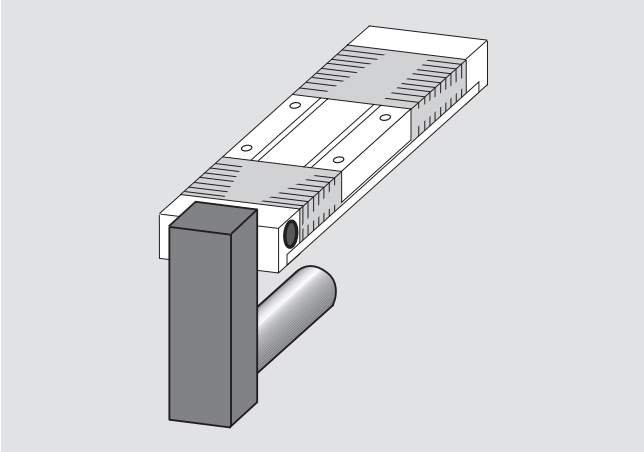
Picture 9: Screw drive with coupling and intermediate plate (Mounting condition 01 or 02)



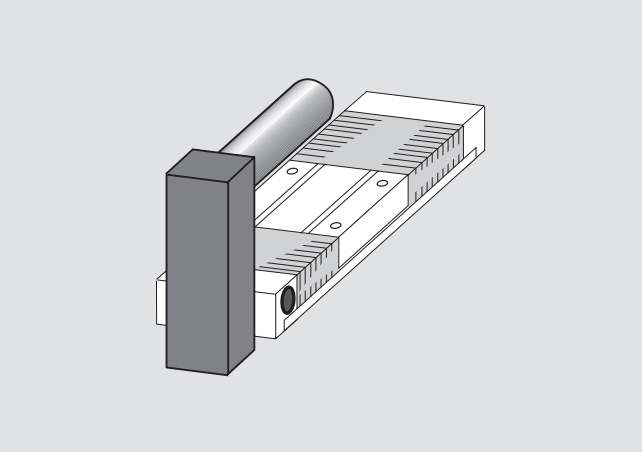
Picture 10: Screw drive with lateral motor mount at left hand side (Mounting condition 05)



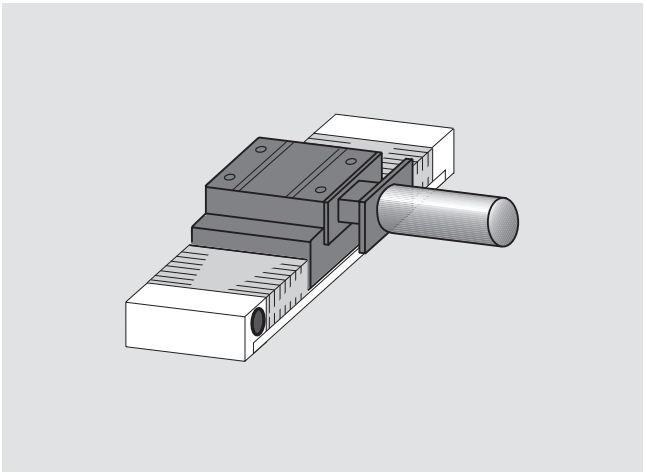
Picture 11: Screw drive with lateral motor mount at right hand side (Mounting condition 04)



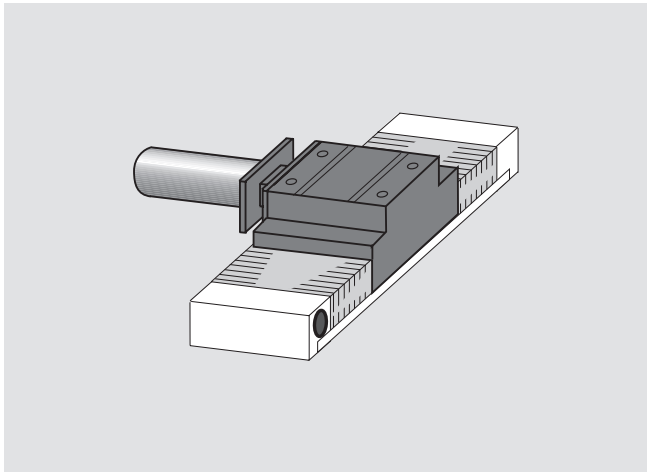
Picture 12: Screw drive with lateral motor mount at the bottom (Mounting condition 07)



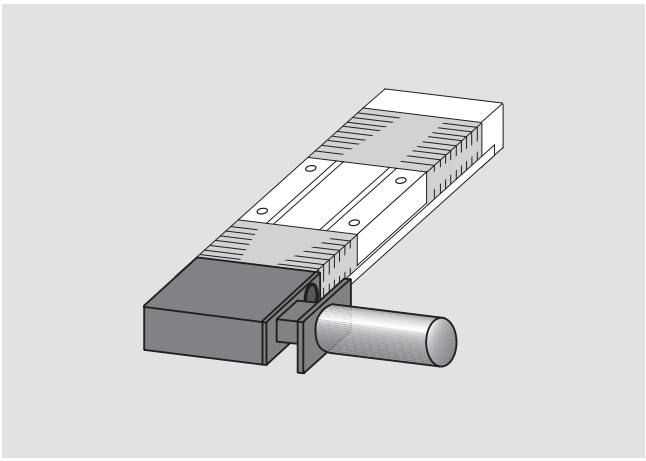
Picture 13: Screw drive with lateral motor mount at topside (Mounting condition 06)



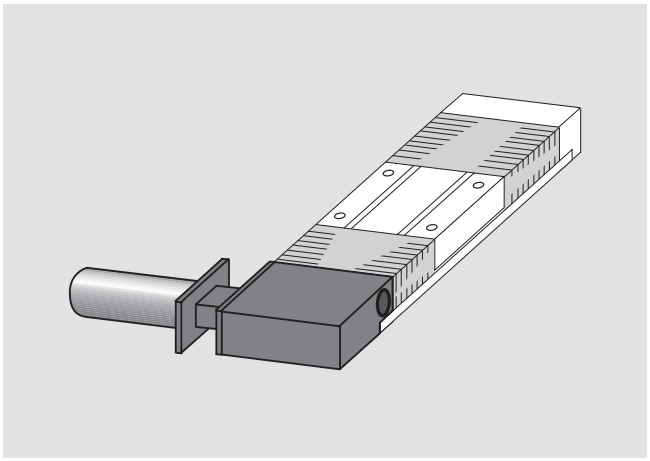
Picture 14: Reversing drive at left hand side (Mounting condition 12 or 14)



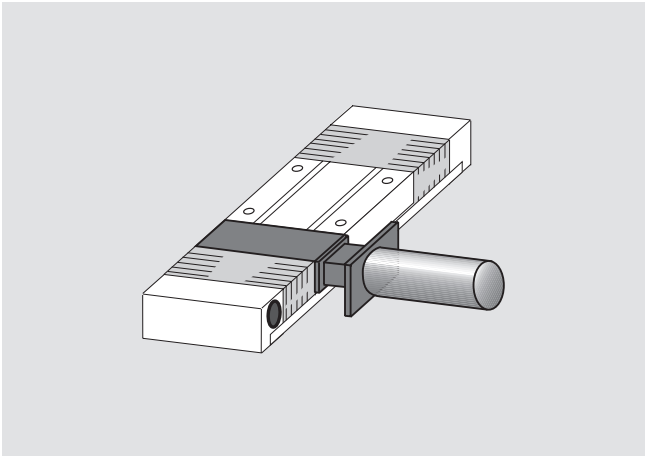
Picture 15: Reversing drive at right hand side (Mounting condition 11 or 13)



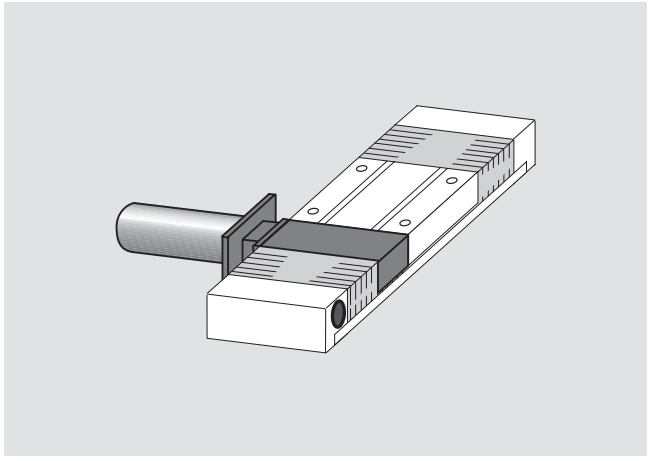
Picture 16: Belt drive at left hand side (Mounting condition 12 or 14)



Picture 17: Belt drive at right hand side (Mounting condition 11 or 13)



Picture 18: Rack gear drive at left hand side (Mounting condition 12 or 14)



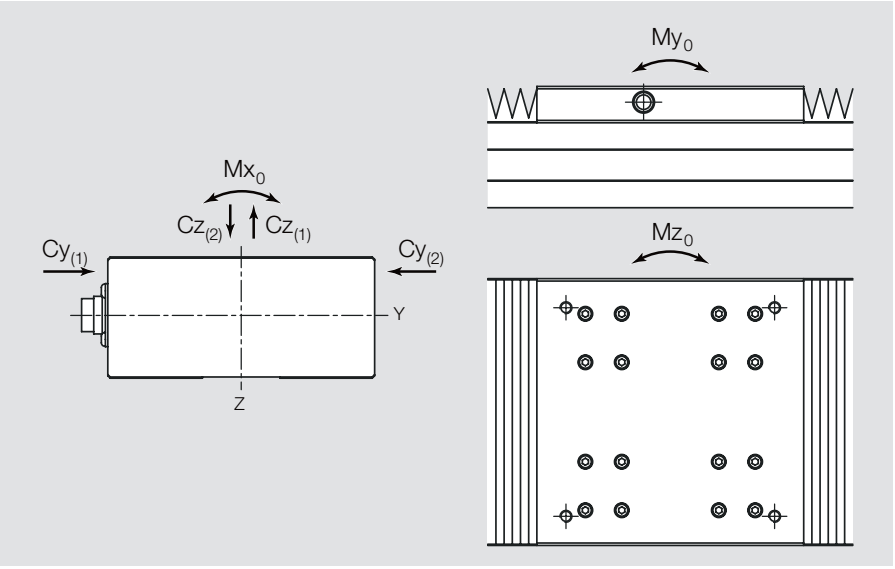
Picture 19: Rack gear drive at right hand side (Mounting condition 11 or 13)

Technical data

Load rate
The load rate is given by the guiding system. Considering the requested life time we recommend to apply max. 20% of the dynamic load rate to the unit.

Torque
Also for the torque, the values are determined by the execution of the guiding system. Picture 20 shows the directions of possible torque application.

Area momentum
For positioning units the maximum allowed deflection angle is of 5'. This value being exceeded will have an impact on the unit's life-cycle.

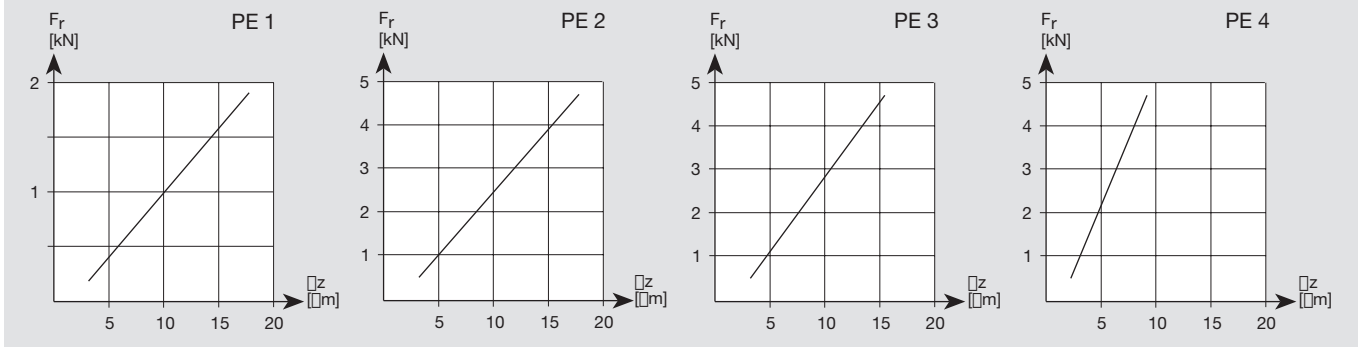


Picture 20: Torques

Type	Load rates * dynamic		Torques * dynamic			Load rates static			Torques static			Area momentum	
	$Cy_{(1,2)}$ [kN]	$Cz_{(1,2)}$	Mx_0 [Nm]	My_0	Mz_0	$Cy_{0\,(1,2)}$ [kN]	$Cz_{0\,(1)}$	$Cz_{0\,(2)}$	Mx_0 [Nm]	My_0	Mz_0	Iy_s [cm^4]	Iz_s
PE1	9.2	9.2	281	253	253	13.8	13.8	13.8	422	380	380	8.9	178.2
PE2	29.3	33.4	1618	1469	1290	42.5	50.7	67.6	2457	2230	1872	9.7	513.7
PE3	41.4	46.8	3157	3065	2691	59.2	70.5	94.0	4757	4617	3877	202.8	3940.0
PE4	161.9	184.0	20240	17847	15708	230.5	274.5	366.0	30195	26625	22365	125.1	8560.0

** recommended load of a positioning unit < 20% of the dynamic rate*

Rigidity
The values for the rigidity refer to the guiding rail only without considering the environmental condition; they are shown in picture 21.

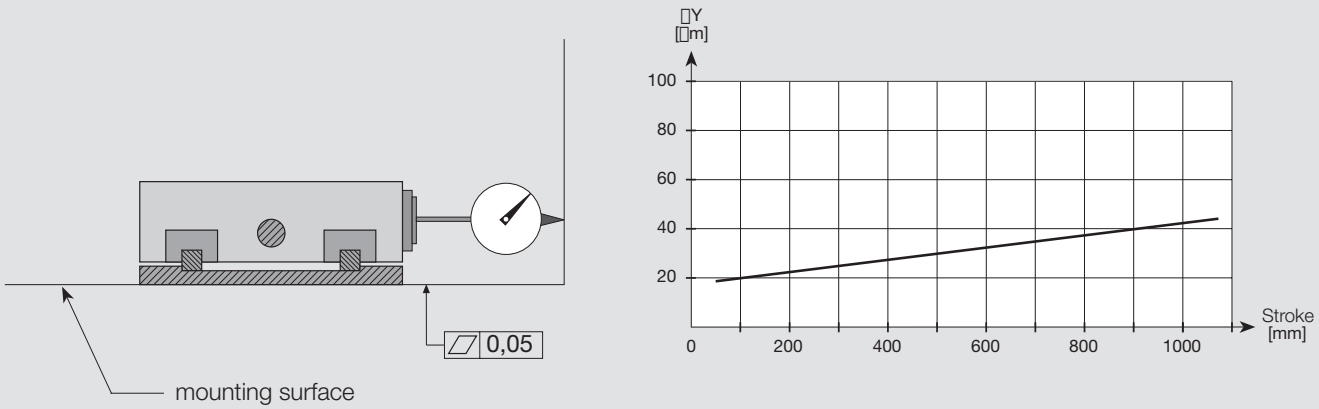


Picture 21: Rigidity

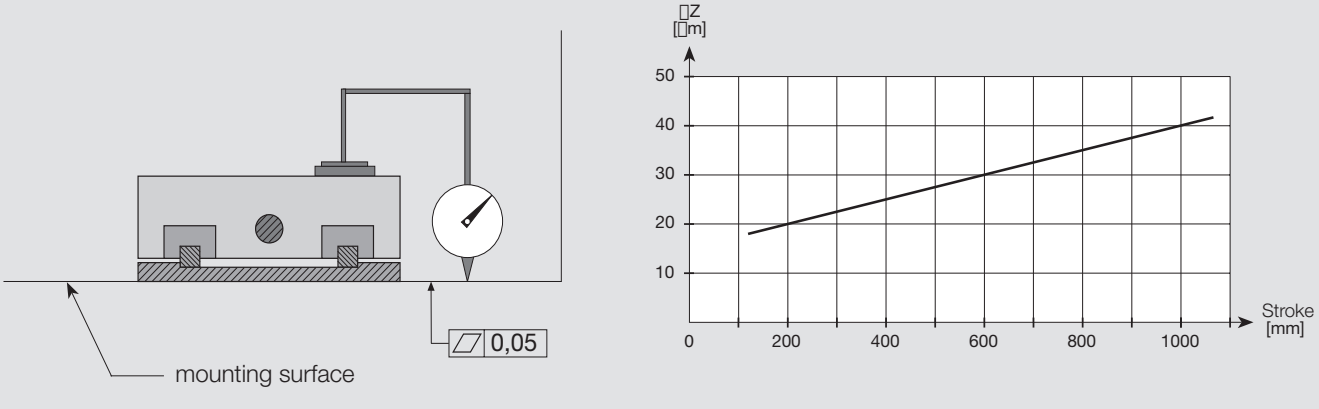
Precision

The precision of any linear system not only depends on the positioning and repeating accuracy but also on the track accuracy of the slide.
These values are indicated in the diagrams shown in picture 22 and 23.

Also the mounting surface of the positioning unit has a great influence on the slide accuracy since any inaccuracy of the mounting surface can hardly be compensated by the positioning unit itself.

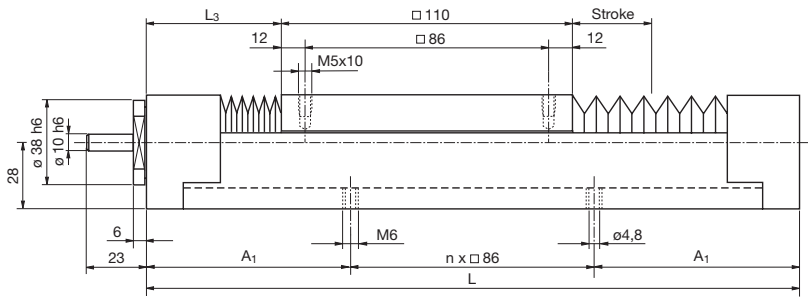


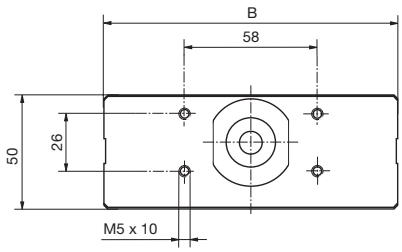
Picture 22
Accuracy diagram Y-axis



Picture 23
Accuracy diagram Z-axis

PE 1 with screw drive or pneumatic cylinder and expansion bellow

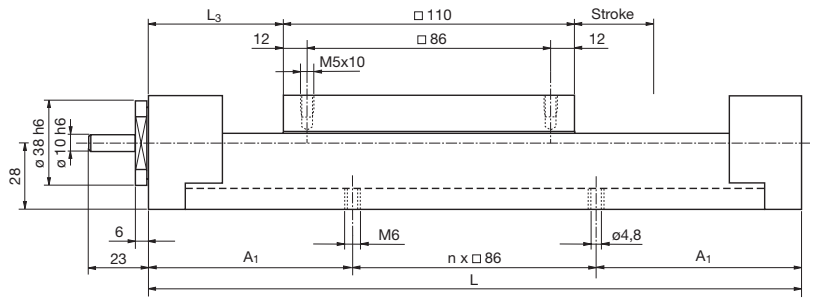


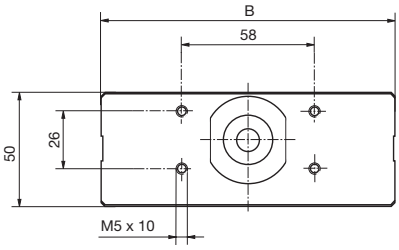


Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
50	110	255	47.5	2	41.5	225	3.0
100	110	330	60	2	79	275	3.5
150	110	400	70	3	71	350	4.0
200	110	475	82.5	4	65.5	483	4.5
250	110	550	95	5	60	558	5.0
300	110	620	105	6	52	628	5.5
350	110	690	115	7	44	659	5.9
400	110	765	127.5	7	81.5	721	6.4
450	110	840	140	8	76	784	6.9
500	110	910	150	9	68	844	7.4
550	110	985	162.5	10	62.5	906	7.9
600	110	1055	172.5	11	54.5	973	8.4
650	110	1130	185	12	49	1029	8.9
700	110	1200	195	13	41	1089	9.4
750	110	1275	207.5	13	78.5	1151	9.9
800	110	1345	217.5	14	70.5	1211	10.3
850	110	1420	230	15	65	1274	10.8
900	110	1490	240	16	57	1334	11.3
1000	110	1635	262.5	18	43.5	1456	12.3
1100	110	1780	285	19	73	1579	13.3
1200	110	1925	307.5	21	59.5	1701	14.2
1300	110	2070	330	23	46	1824	15.2
1400	110	2220	355	24	78	1949	16.2
1500	110	2365	377.5	26	64.5	2071	17.2

The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

PE 1 with screw drive or pneumatic cylinder without expansion bellow

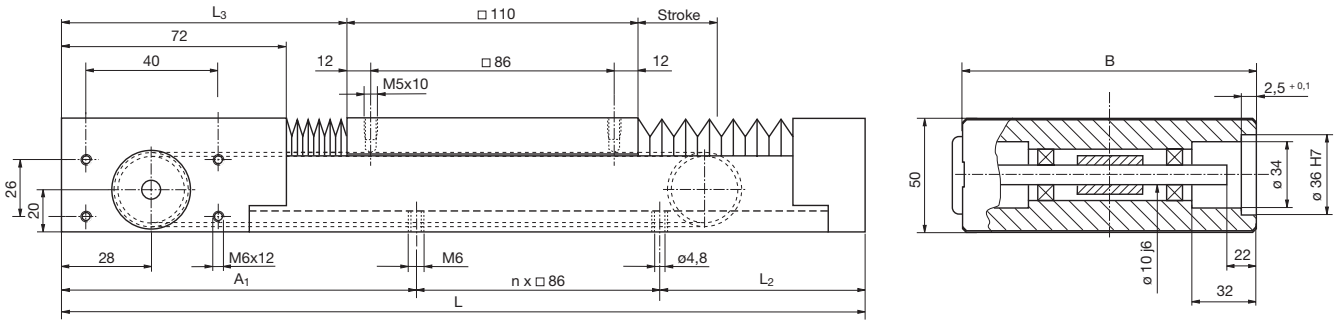




Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
50	110	255	47.5	2	41.5	225	3.0
125	110	330	47.5	2	79	275	3.5
195	110	400	47.5	3	71	350	4.0
270	110	475	47.5	4	65.5	483	4.5
345	110	550	47.5	5	60	558	5.0
415	110	620	47.5	6	52	628	5.5
485	110	690	47.5	7	44	698	5.9
560	110	765	47.5	7	81.5	773	6.4
635	110	840	47.5	8	76	848	6.9
705	110	910	47.5	9	68	918	7.4
780	110	985	47.5	10	62.5	993	7.9
850	110	1055	47.5	11	54.5	1063	8.4
925	110	1130	47.5	12	49	1138	8.9
995	110	1200	47.5	13	41	1208	9.4
1070	110	1275	47.5	13	78.5	1283	9.9
1140	110	1345	47.5	14	70.5	1353	10.3
1215	110	1420	47.5	15	65	1428	10.8
1285	110	1490	47.5	16	57	1498	11.3
1430	110	1635	47.5	18	43.5	1643	12.3
1575	110	1780	47.5	19	73	1788	13.3
1720	110	1925	47.5	21	59.5	1933	14.2
1865	110	2070	47.5	23	46	2078	15.2
2015	110	2220	47.5	24	78	2228	16.2
2160	110	2365	47.5	26	64.5	2373	17.2

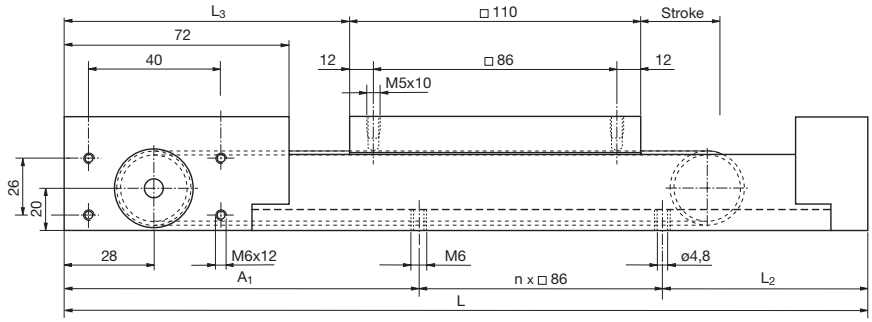
The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

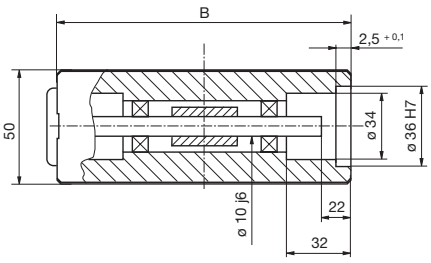
PE 1 with belt drive and expansion bellow



Nominal size		Dimensions					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
400	110	855	192.5	8	103.5	63.5	7.0
500	110	1005	217.5	10	92.5	52.5	7.9
600	110	1160	245	12	84	44	8.9
700	110	1310	270	13	116	76	9.9
800	110	1465	297.5	15	107.5	67.5	10.9
900	110	1615	322.5	17	96.5	56.5	11.8
1000	110	1770	350	19	88	48	12.8
1100	110	1920	375	20	120	80	13.8
1200	110	2100	415	23	81	41	14.9
1300	110	2275	452.5	25	82.5	42.5	16.0
1400	110	2375	452.5	25	132.5	92.5	16.6
1500	110	2530	480	27	124	84	17.6
1600	110	2680	505	29	113	73	18.6
1700	110	2835	532.5	31	104.5	64.5	19.6
1800	110	2985	557.5	33	93.5	53.5	20.5
1900	110	3135	582.5	35	82.5	42.5	21.5
2000	110	3305	617.5	37	81.5	41.5	22.6

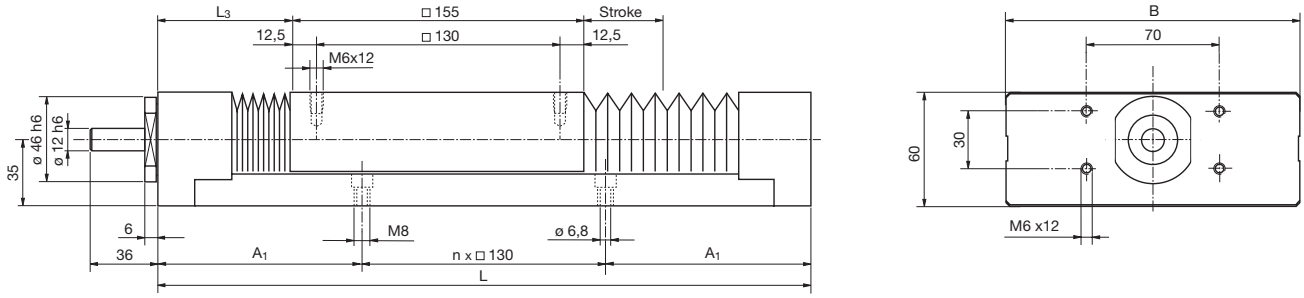
PE 1 with belt drive without expansion bellow





Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
495	110	855	120	8	103.5	63.5	7.0
645	110	1005	120	10	92.5	52.5	7.9
800	110	1160	120	12	84	44	8.9
950	110	1310	120	13	116	76	9.9
1105	110	1465	120	15	107.5	67.5	10.9
1255	110	1615	120	17	96.5	56.5	11.8
1410	110	1770	120	19	88	48	12.8
1560	110	1920	120	20	120	80	13.8
1740	110	2100	120	23	81	41	14.9
1915	110	2275	120	25	82.5	42.5	16.0
2015	110	2375	120	25	132.5	92.5	16.6
2170	110	2530	120	27	124	84	17.6
2320	110	2680	120	29	113	73	18.6
2475	110	2835	120	31	104.5	64.5	19.6
2625	110	2985	120	33	93.5	53.5	20.5
2775	110	3135	120	35	82.5	42.5	21.5
2945	110	3305	120	37	81.5	41.5	22.6

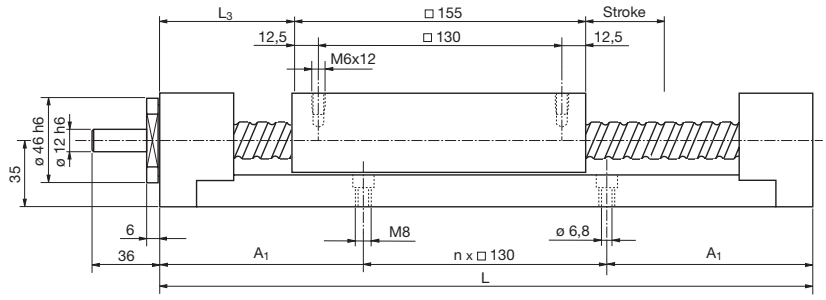
PE 2 with screw drive or pneumatic cylinder and expansion bellow

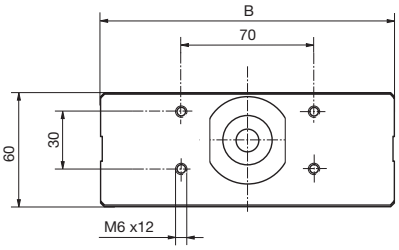


Nominal size		Dimensions					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
50	155	330	62.5	1	100	343	9.8
100	155	395	70	2	67.5	408	10.3
150	155	455	75	2	97.5	468	10.8
200	155	520	82.5	3	65	533	11.3
250	155	585	90	3	97.5	598	11.8
300	155	650	97.5	4	65	640	12.3
350	155	715	105	4	97.5	697	12.8
400	155	780	112.5	5	65	754	13.3
450	155	845	120	5	97.5	811	14.0
500	155	910	127.5	6	65	870	14.5
550	155	975	135	6	97.5	927	15.0
600	155	1040	142.5	7	65	984	15.5
650	155	1105	150	7	97.5	1040	16.0
700	155	1170	157.5	8	65	1097	16.5
750	155	1235	165	8	97.5	1157	17.0
800	155	1300	172.5	9	65	1213	17.5
850	155	1380	187.5	9	105	1293	18.0
900	155	1425	185	10	62.5	1327	18.5
950	155	1500	197.5	10	100	1396	19.0
1000	155	1555	200	11	62.5	1441	19.5
1200	155	1815	230	13	62.5	1671	21.5
1400	155	2075	260	15	62.5	1901	23.5
1600	155	2330	287.5	17	60	2131	25.5
1800	155	2590	317.5	19	60	2358	28.0
2000	155	2850	347.5	21	60	2588	30.0

The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

PE 2 with screw drive or pneumatic cylinder without expansion bellow

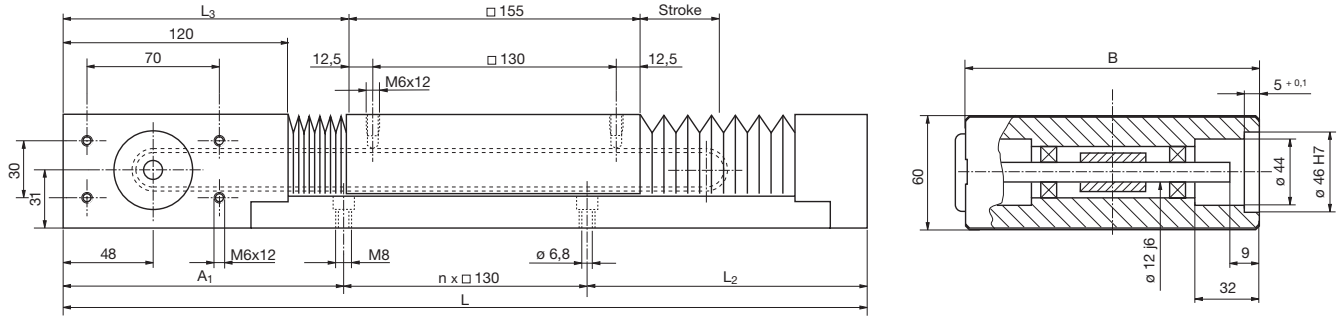




Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
50	155	330	62.5	1	100	343	9.8
115	155	395	62.5	2	67.5	408	10.3
175	155	455	62.5	2	97.5	468	10.8
240	155	520	62.5	3	65	533	11.3
305	155	585	62.5	3	97.5	598	11.8
370	155	650	62.5	4	65	663	12.3
435	155	715	62.5	4	97.5	728	12.8
500	155	780	62.5	5	65	793	13.3
565	155	845	62.5	5	97.5	858	14.0
630	155	910	62.5	6	65	923	14.5
695	155	975	62.5	6	97.5	988	15.0
760	155	1040	62.5	7	65	1053	15.5
825	155	1105	62.5	7	97.5	1118	16.0
890	155	1170	62.5	8	65	1183	16.5
955	155	1235	62.5	8	97.5	1248	17.0
1020	155	1300	62.5	9	65	1313	17.5
1100	155	1380	62.5	9	105	1393	18.0
1145	155	1425	62.5	10	62.5	1438	18.5
1220	155	1500	62.5	10	100	1513	19.0
1275	155	1555	62.5	11	62.5	1568	19.5
1535	155	1815	62.5	13	62.5	1828	21.5
1795	155	2075	62.5	15	62.5	2088	23.5
2050	155	2330	62.5	17	60	2343	25.5
2310	155	2590	62.5	19	60	2603	28.0
2570	155	2850	62.5	21	60	2863	30.0

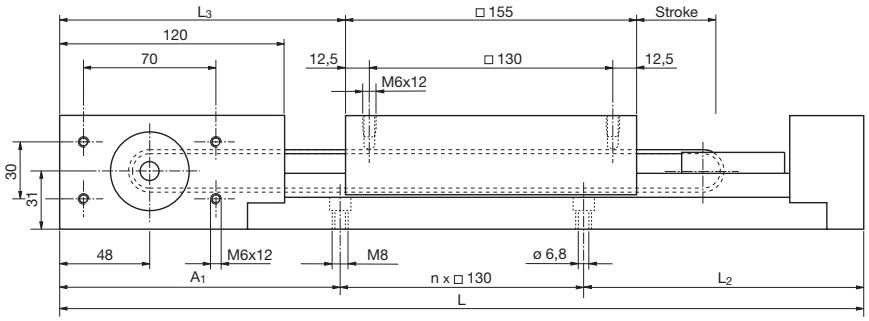
The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

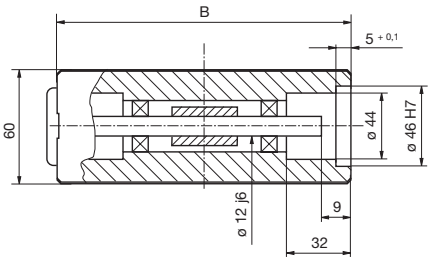
PE 2 with belt drive and expansion bellow



Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
500	155	1015	220	6	157.5	77.5	15.0
600	155	1130	227.5	7	150	70	16.0
700	155	1250	237.5	8	145	65	17.0
800	155	1380	252.5	9	145	65	18.0
900	155	1510	267.5	10	145	65	19.0
1000	155	1635	280	11	142.5	62.5	20.0
1100	155	1765	295	12	142.5	62.5	21.0
1200	155	1895	310	13	142.5	62.5	22.0
1300	155	2025	325	14	142.5	62.5	23.0
1400	155	2155	340	15	142.5	62.5	24.0
1500	155	2285	355	15	207.5	127.5	25.0
1600	155	2410	367.5	17	140	60	26.0
1700	155	2540	382.5	17	205	125	27.0
1800	155	2670	397.5	19	140	60	28.0
1900	155	2800	412.5	19	205	125	29.0
2000	155	2930	427.5	21	140	60	30.0

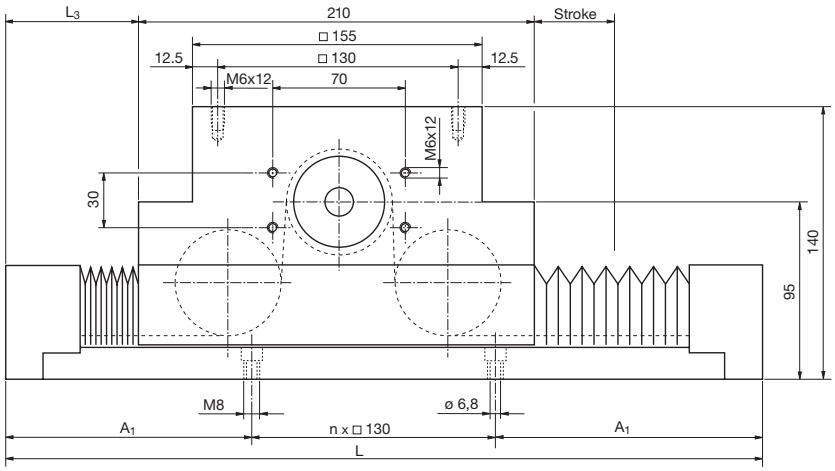
PE 2 with belt drive without expansion bellow

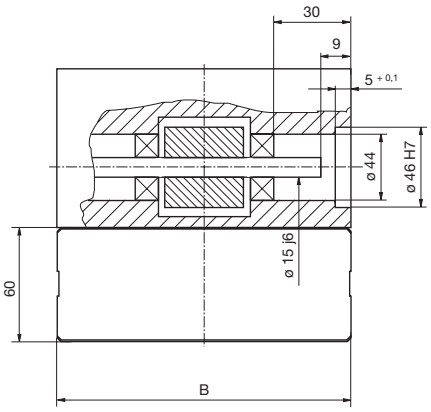




Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
510	155	1015	165	6	157.5	77.5	15.0
625	155	1130	165	7	150	70	16.0
745	155	1250	165	8	145	65	17.0
875	155	1380	165	9	145	65	18.0
1005	155	1510	165	10	145	65	19.0
1130	155	1635	165	11	142.5	62.5	20.0
1260	155	1765	165	12	142.5	62.5	21.0
1390	155	1895	165	13	142.5	62.5	22.0
1520	155	2025	165	14	142.5	62.5	23.0
1650	155	2155	165	15	142.5	62.5	24.0
1780	155	2285	165	15	207.5	127.5	25.0
1905	155	2410	165	17	140	60	26.0
2035	155	2540	165	17	205	125	27.0
2165	155	2670	165	19	140	60	28.0
2295	155	2800	165	19	205	125	29.0
2425	155	2930	165	21	140	60	30.0

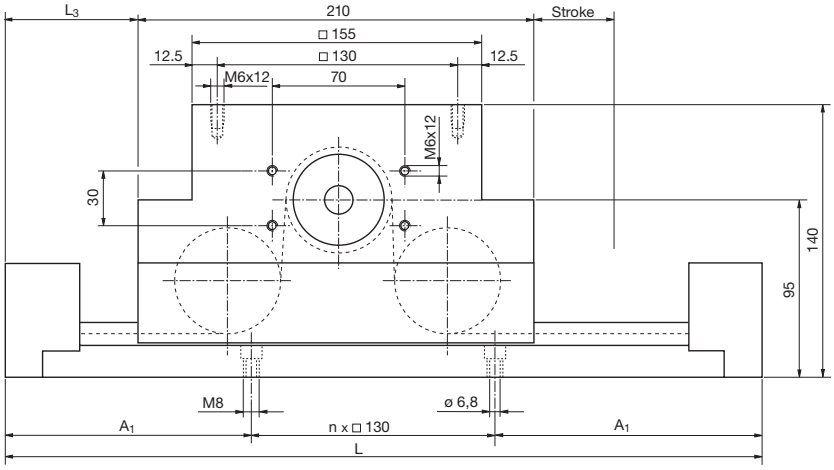
PE 2 with belt drive and expansion bellow (reversing drive)

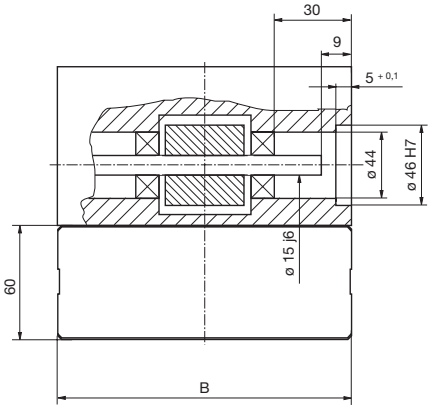




Nominal size		*Dimensions*				
Stroke	B	L	L_3	n	A_1	Weight
[mm]		[mm]				[kg]
1000	155	1620	205	11	95	20.0
1100	155	1740	215	12	90	21.0
1200	155	1870	230	13	90	22.0
1300	155	2000	245	14	90	23.0
1400	155	2130	260	15	90	24.0
1500	155	2315	302.5	17	52.5	25.0
1600	155	2385	287.5	17	87.5	26.0
1700	155	2570	330	19	50	27.0
1800	155	2645	317.5	19	87.5	28.0
1900	155	2830	360	21	50	29.0
2000	155	2915	352.5	21	92.5	30.0
2100	155	3090	390	23	50	31.0
2200	155	3165	377.5	23	87.5	32.0
2300	155	3350	420	25	50	33.0
2400	155	3420	405	25	85	34.0
2500	155	3635	462.5	27	62.5	35.0
2600	155	3680	435	27	85	36.0
2700	155	3875	482	29	52.5	37.0
2800	155	3940	465	29	85	38.0
2900	155	4130	510	31	50	39.0
3000	155	4195	492.5	31	82.5	40.0

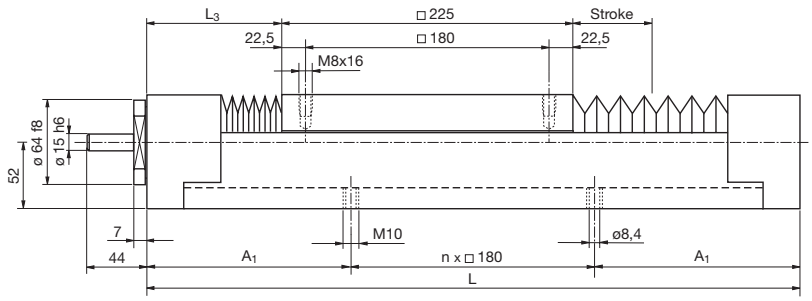
PE 2 with belt drive without expansion bellow (reversing drive)

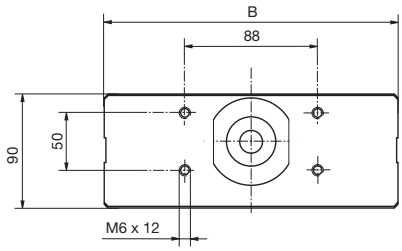




Nominal size		*Dimensions*				
Stroke	B	L	L_3	n	A_1	Weight
[mm]		[mm]				[kg]
1040	155	1620	185	11	95	20.0
1160	155	1740	185	12	90	21.0
1290	155	1870	185	13	90	22.0
1420	155	2000	185	14	90	23.0
1550	155	2130	185	15	90	24.0
1735	155	2315	185	17	52.5	25.0
1805	155	2385	185	17	87.5	26.0
1990	155	2570	185	19	50	27.0
2065	155	2645	185	19	87.5	28.0
2250	155	2830	185	21	50	29.0
2335	155	2915	185	21	92.5	30.0
2510	155	3090	185	23	50	31.0
2585	155	3165	185	23	87.5	32.0
2770	155	3350	185	25	50	33.0
2840	155	3420	185	25	85	34.0
3055	155	3635	185	27	62.5	35.0
3100	155	3680	185	27	85	36.0
3295	155	3875	185	29	52.5	37.0
3360	155	3940	185	29	85	38.0
3550	155	4130	185	31	50	39.0
3615	155	4195	185	31	82.5	40.0

PE 3 with screw drive or pneumatic cylinder and expansion bellow

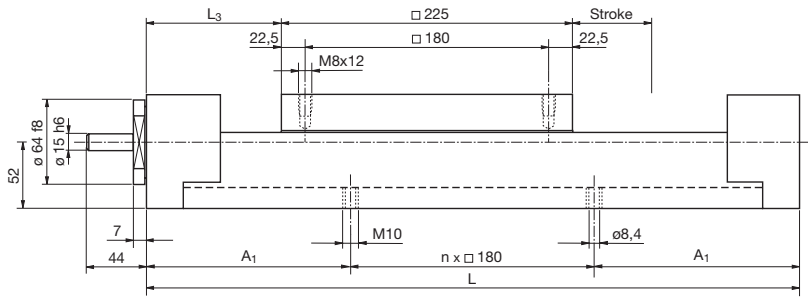


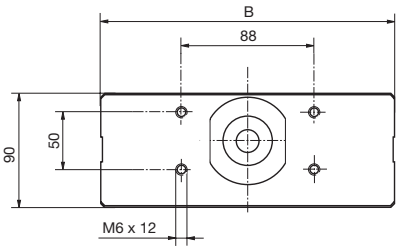


Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
50	225	405	65	1	112.5	429	17.5
100	225	470	72.5	2	55	494	19.0
150	225	540	82.5	2	90	564	20.5
200	225	605	90	2	122.5	629	22.0
250	225	675	100	3	67.5	699	23.5
300	225	745	110	3	102.5	738	25.5
350	225	810	117.5	3	135	798	27.0
400	225	880	127.5	4	80	857	28.5
450	225	950	137.5	4	115	916	30.0
500	225	1015	145	5	57.5	975	31.5
600	225	1150	162.5	5	125	1094	35.0
700	225	1290	182.5	6	105	1212	38.0
800	225	1425	200	7	82.5	1330	41.5
900	225	1560	217.5	8	60	1449	44.5
1000	225	1695	235	8	127.5	1567	47.5
1200	225	1970	272.5	10	85	1804	54.5
1400	225	2240	307.5	11	130	2036	60.5
1600	225	2515	345	13	87.5	2273	67.0
1800	225	2800	387.5	15	50	2529	73.5
2000	225	3060	417.5	15	180	2747	79.5
2200	225	3330	452.5	17	135	2983	86.0
2400	225	3605	490	19	92.5	3220	92.5
2600	225	3885	530	21	52.5	3467	99.0
2800	225	4150	562.5	21	185	3694	105.5
3000	225	4420	597.5	23	140	3926	111.5

The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

PE 3 with screw drive or pneumatic cylinder without expansion bellow

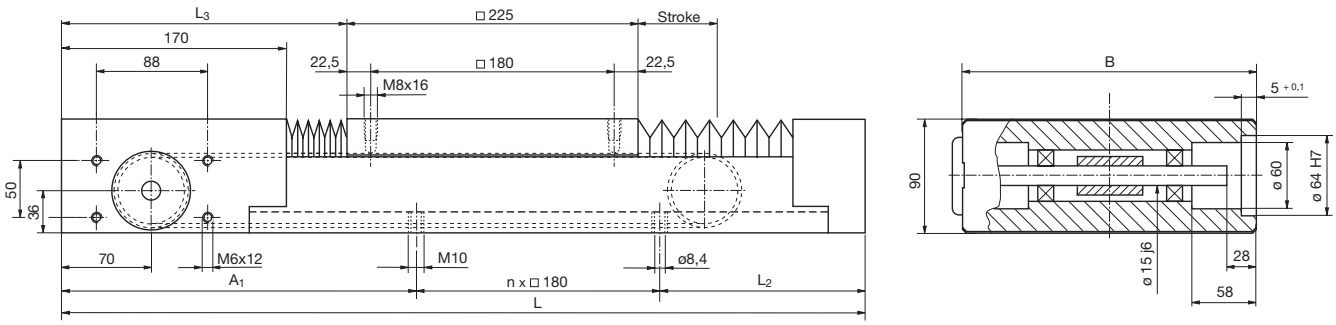




Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	Screw length	Weight
[mm]		[mm]					[kg]
40	225	405	70	1	112.5	429	17.5
105	225	470	70	2	55	494	19.0
175	225	540	70	2	90	564	20.5
240	225	605	70	2	122.5	629	22.0
310	225	675	70	3	67.5	699	23.5
380	225	745	70	3	102.5	769	25.5
445	225	810	70	3	135	834	27.0
515	225	880	70	4	80	904	28.5
585	225	950	70	4	115	974	30.0
650	225	1015	70	5	57.5	1039	31.5
785	225	1150	70	5	125	1174	35.0
925	225	1290	70	6	105	1314	38.0
1060	225	1425	70	7	82.5	1449	41.5
1195	225	1560	70	8	60	1584	44.5
1330	225	1695	70	8	127.5	1719	47.5
1605	225	1970	70	10	85	1994	54.5
1875	225	2240	70	11	130	2264	60.5
2150	225	2515	70	13	87.5	2539	67.0
2435	225	2800	70	15	50	2824	73.5
2695	225	3060	70	15	180	3084	79.5
2965	225	3330	70	17	135	3354	86.0
3240	225	3605	70	19	92.5	3629	92.5
3520	225	3885	70	21	52.5	3909	99.0
3785	225	4150	70	21	185	4174	105.5
4055	225	4420	70	23	140	4444	111.5

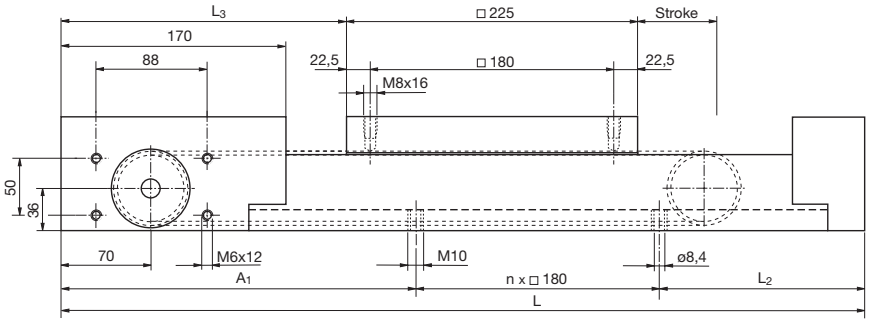
The drive solution „pneumatic cylinder“ goes without the measurements of the shaft end and eccentric ring.

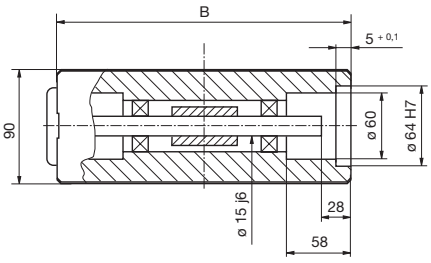
PE 3 with belt drive and expansion bellow



Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
600	225	1355	310	6	202.5	72.5	36.5
700	225	1435	320	6	242.5	112.5	39.5
800	225	1555	330	7	212.5	82.5	42.5
900	225	1690	347.5	8	190	60	45.5
1000	225	1825	365	8	257.5	127.5	48.5
1100	225	1995	400	9	252.5	122.5	52.0
1200	225	2115	410	10	222.5	92.5	55.0
1300	225	2235	420	11	192.5	62.5	58.0
1400	225	2370	437.5	11	260	130	61.0
1500	225	2570	487.5	13	180	50	65.5
1600	225	2645	475	13	217.5	87.5	67.0
1700	225	2780	492.5	13	285	155	70.0
1800	225	2930	517.5	15	180	50	73.5
1900	225	3055	530	15	242.5	112.5	76.5
2000	225	3190	547.5	15	310	180	79.5
2100	225	3325	565	17	197.5	67.5	82.5
2200	225	3460	582.5	17	265	135	85.5
2300	225	3655	630	19	182.5	52.5	89.5
2400	225	3735	620	19	222.5	92.5	91.5
2500	225	3890	647.5	19	300	170	95.0
2600	225	4015	660	21	182.5	52.5	98.0
2700	225	4190	697.5	21	270	140	102.0
2800	225	4280	692.5	21	315	185	104.0
2900	225	4415	710	23	202.5	72.5	107.0
3000	225	4550	727.5	23	270	140	110.0

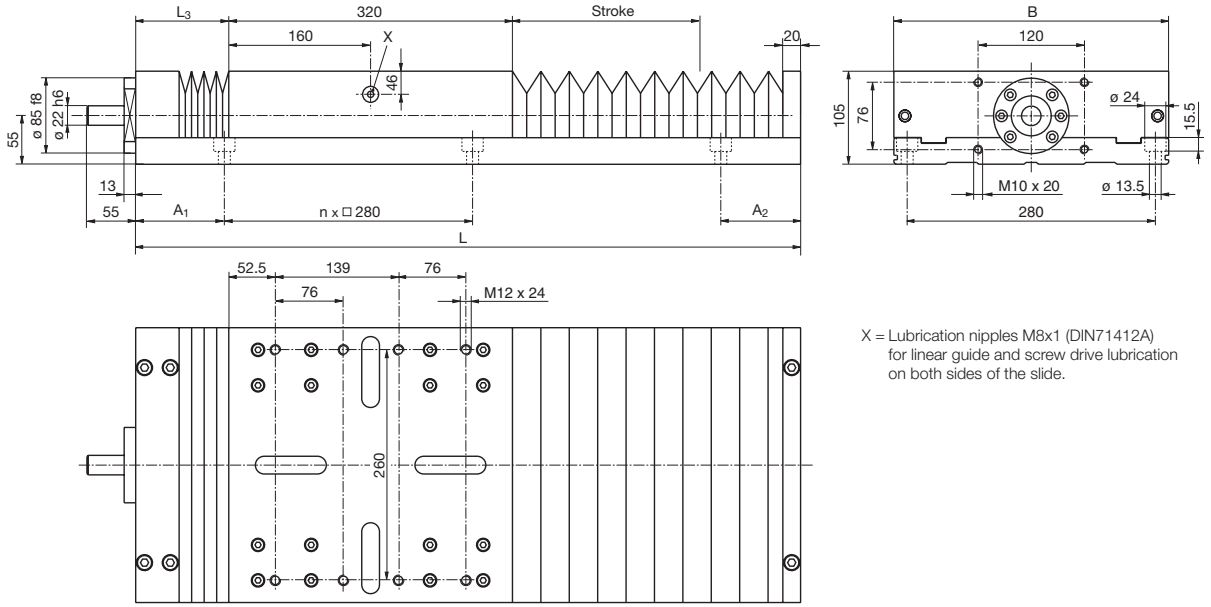
PE 3 with belt drive without expansion bellow





Nominal size		*Dimensions*					
Stroke	B	L	L_3	n	A_1	L_2	Weight
[mm]		[mm]					[kg]
755	225	1355	217.5	6	202.5	72.5	36.5
835	225	1435	217.5	6	242.5	112.5	39.5
955	225	1555	217.5	7	212.5	82.5	42.5
1090	225	1690	217.5	8	190	60	45.5
1225	225	1825	217.5	8	257.5	127.5	48.5
1395	225	1995	217.5	9	252.5	122.5	52.0
1515	225	2115	217.5	10	222.5	92.5	55.0
1635	225	2235	217.5	11	192.5	62.5	58.0
1770	225	2370	217.5	11	260	130	61.0
1970	225	2570	217.5	13	180	50	65.5
2045	225	2645	217.5	13	217.5	87.5	67.0
2180	225	2780	217.5	13	285	155	70.0
2330	225	2930	217.5	15	180	50	73.5
2455	225	3055	217.5	15	242.5	112.5	76.5
2590	225	3190	217.5	15	310	180	79.5
2725	225	3325	217.5	17	197.5	67.5	82.5
2860	225	3460	217.5	17	265	135	85.5
3055	225	3655	217.5	19	182.5	52.5	89.5
3135	225	3735	217.5	19	222.5	92.5	91.5
3290	225	3890	217.5	19	300	170	95.0
3415	225	4015	217.5	21	182.5	52.5	98.0
3590	225	4190	217.5	21	270	140	102.0
3680	225	4280	217.5	21	315	185	104.0
3815	225	4415	217.5	23	202.5	72.5	107.0
3950	225	4550	217.5	23	270	140	110.0

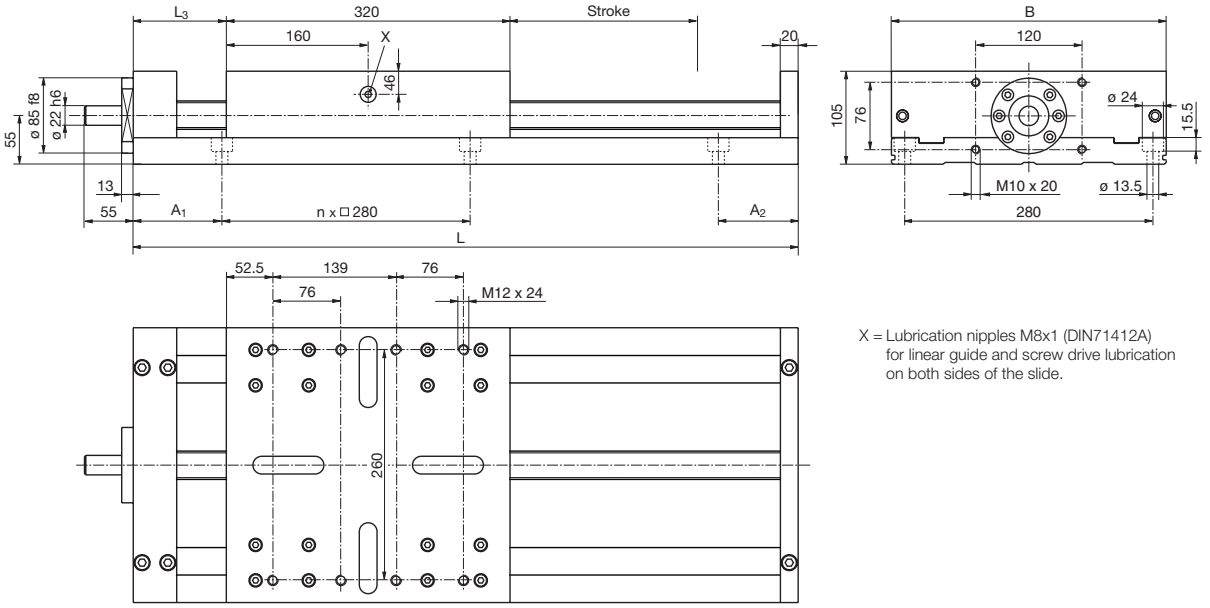
PE 4 with screw drive and expansion bellow



X = Lubrication nipples M8x1 (DIN71412A) for linear guide and screw drive lubrication on both sides of the slide.

Nominal size		*Dimensions*						
Stroke	B	L	L_3	n	A_1	A_2	Screw length	Weight
[mm]		[mm]						[kg]
50	310	510	85	1	115	115	350	45
100	310	560	85	1	140	140	400	47
150	310	625	92.5	1	172.5	172.5	500	50
200	310	690	100	2	65	65	550	53
250	310	760	110	2	100	100	600	56
300	310	825	117.5	2	132.5	132.5	650	59
350	310	895	127.5	2	167.5	167.5	700	62
400	310	965	137.5	3	62.5	62.5	750	65
450	310	1030	145	3	95	95	800	68
500	310	1100	155	3	130	130	1151	71
600	310	1235	172.5	3	197.5	197.5	1286	77
800	310	1505	207.5	4	192.5	192.5	1556	89
1000	310	1750	230	5	175	175	1801	100
1200	310	2000	255	6	160	160	2051	111
1600	310	2495	302.5	8	127.5	127.5	2546	133
2000	310	2990	350	9	235	235	3041	156
2400	310	3485	397.5	11	202.5	202.5	3536	178
3000	310	4225	467.5	13	292.5	292.5	4276	211

PE 4 with screw drive without expansion bellow



X = Lubrication nipples M8x1 (DIN71412A)
for linear guide and screw drive lubrication
on both sides of the slide.

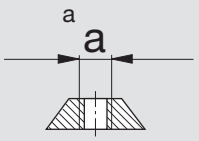
Nominal size		*Dimensions*						
Stroke	B	L	L_3	n	A_1	A_2	Screw length	Weight
[mm]		[mm]						[kg]
70	310	510	75	1	115	115	350	45
120	310	560	75	1	140	140	400	47
185	310	625	75	1	172.5	172.5	500	50
250	310	690	75	2	65	65	550	53
320	310	760	75	2	100	100	600	56
385	310	825	75	2	132.5	132.5	650	59
455	310	895	75	2	167.5	167.5	700	62
525	310	965	75	3	62.5	62.5	750	65
590	310	1030	75	3	95	95	800	68
660	310	1100	75	3	130	130	1151	71
795	310	1235	75	3	197.5	197.5	1286	77
1065	310	1505	75	4	192.5	192.5	1556	89
1310	310	1750	75	5	175	175	1801	100
1560	310	2000	75	6	160	160	2051	111
2055	310	2495	75	8	127.5	127.5	2546	133
2550	310	2990	75	9	235	235	3041	156
3045	310	3485	75	11	202.5	202.5	3536	178
3785	310	4225	75	13	292.5	292.5	4276	211

Grooves and Sliding blocs

Grooves and Sliding blocs

The positioning units size 2 and 3 come with grooves in both base plate and slide. The location of the grooves is shown in picture 24. For the grooves at topside the NS8 type of sliding blocs have to be used, for the collateral grooves at the slide and the base plate the NS5 type. The maximum depth of thread is indicated in the picture 24.
The positioning unit size 1 and 4 are not equipped with grooves at all.

The slide blocs can be purchased at LINE TECH. The order number must show the type, the material and the thread size, for instance NS5 St M5. The sizes available are shown in the table aside.



Groove width [mm]	Dimension „a“ [mm]	Material	Order number
5	M3 / M4 / M5	St / Inox	**NS5** __ __
8	M4 / M5 / M6 / M8	St / Inox	**NS8** __ __

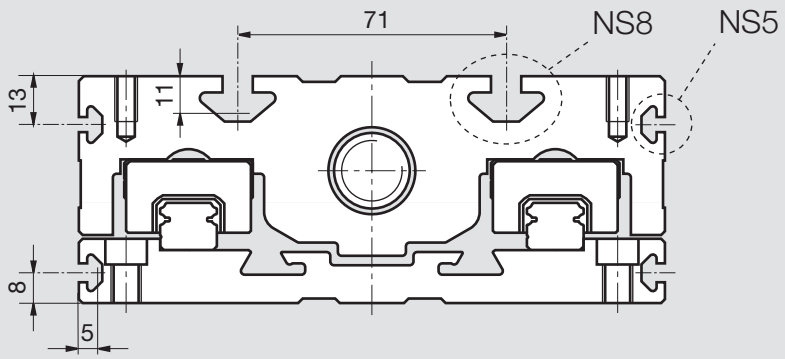
Material
Dim. „a“

Example: NS5 St M5

Bild 24
Groove design and location

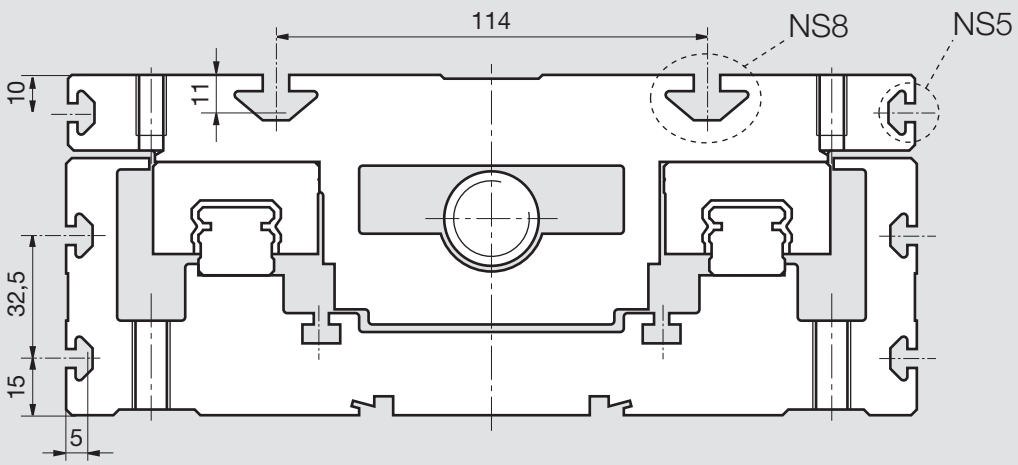
PE2

M1:2



PE3

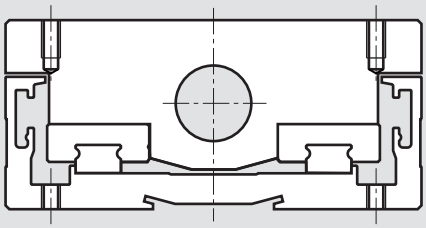
M1:2



Profile cross-sections PE1 and PE4

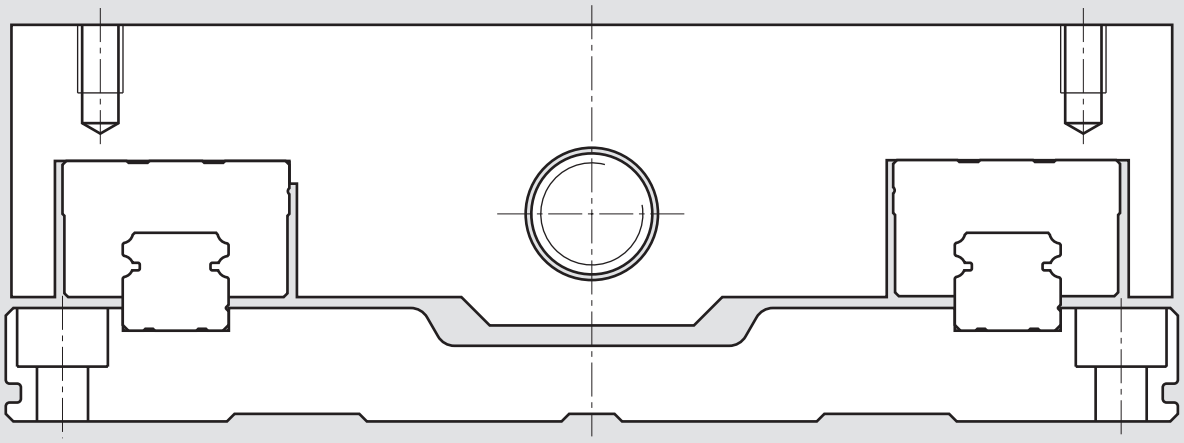
PE1

M1:2



PE4

M1:2



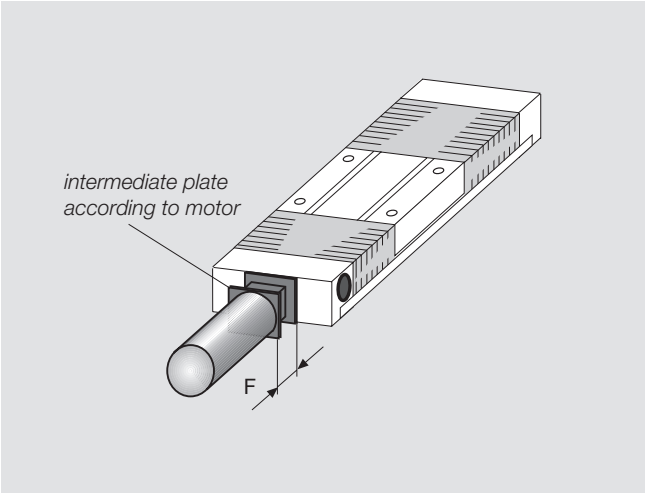
Dimensions motor mount

Dimensions motor mount

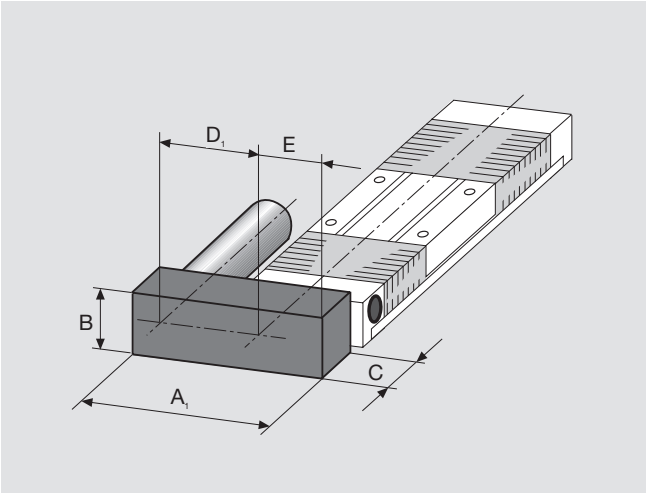
The principal measurements of the motor mount are described on this double-side page. The measurements shown in picture 26 to 30 are valid also for the respective axially symmetric versions (mount at left hand side or bottom).
The motor mount normally projects to the top and to the bottom (varying with the size of the motor and the positioning unit).

Nom. size	Dimensions A_1 [mm]	A_2	B	C	D_1	D_2	E	F	G	H
PE 1	220	220	90	50	130	130	45	45	—	—
PE 2	300	300	120	70	178	178	66	65	*	*
PE 3	350	350	120	70	228	228	66	80	—	—
PE 4	490	380	230	68	298	189	115	120	—	—

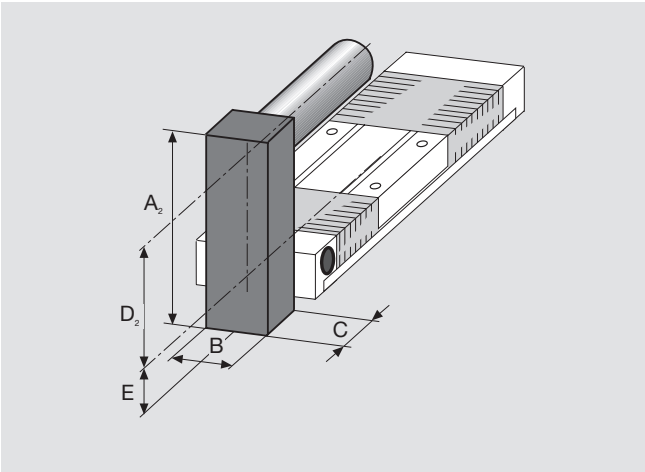
* related to the type of motor



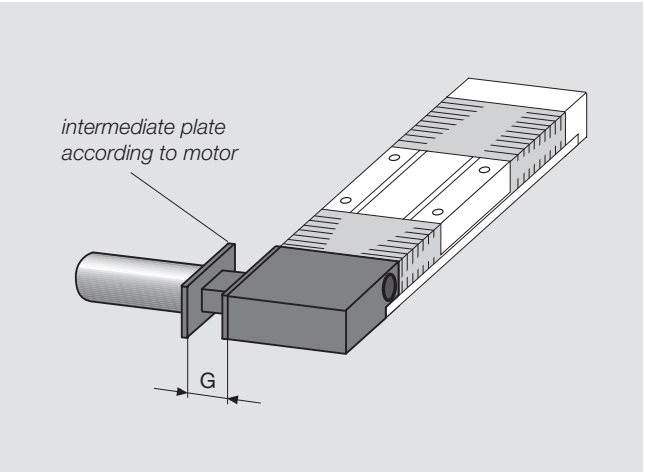
Picture 25
Screw drive with coupling and intermediate plate



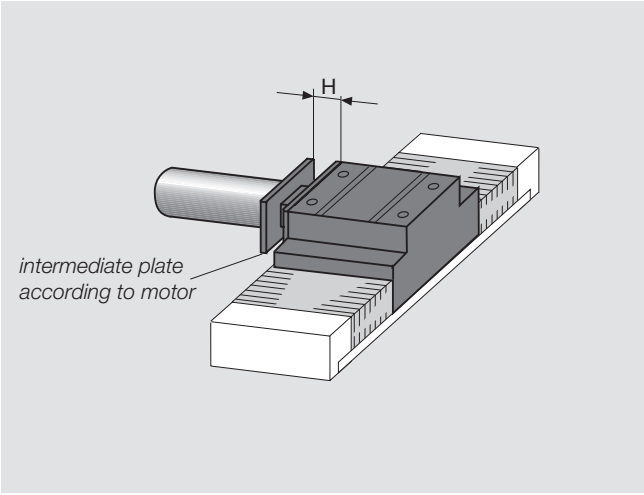
Picture 26
Screw drive with right hand side mounted motor



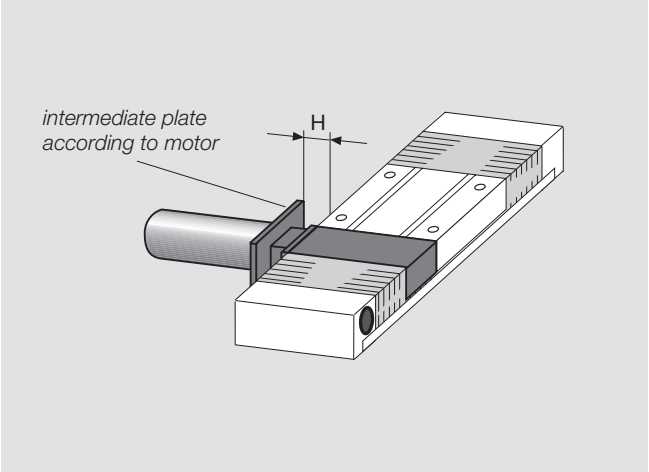
Picture 27
Screw drive with motor mount topside



Picture 28
Belt drive right hand side



Picture 29
Reversing belt drive right hand side



Picture 30
Rack gear drive right hand side

Table of content page/s

LINE TECH integral axles

LINE TECH integral axles are of modular conception, ready to built-in linear slide units with drive.
Everywhere sealed guiding elements are used. For the power transmission, preferably rolled or ground ball screws as well as satellite roller screws but also toothed belts, high-helix lead screws „Speedy“ and rod-less pneumatic cylinders are available.
The guidance as well as the transmission elements are protected against external contamination such as dirt, dust and others by a steel strapping.
The base plate and the slide body are made of extrusion molded alloy.
In the base plate integrated limit switches allow, in conjunction with the motor and the control unit, for the perfect positioning and prevent against overrunning of the slide.
The design chosen allows for a very high performance at most compact dimensions.

Lubrication

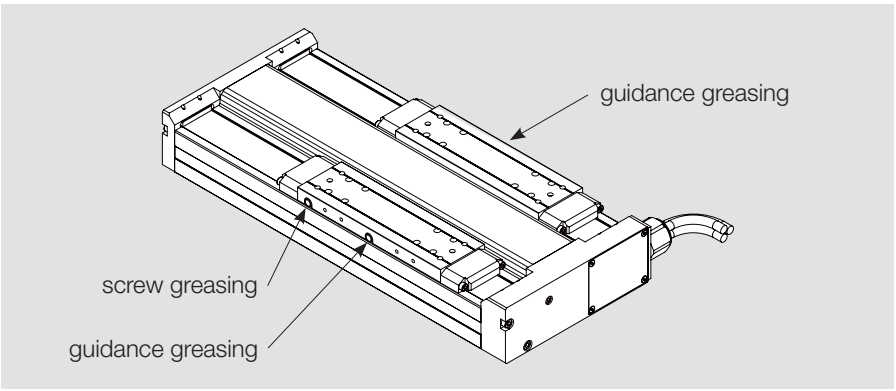
LINE TECH integral axles are pre-lubricated with „Microlube GBU Y 131“. This quality grease offers outstanding properties for the guidance- and screw drive elements.
Depending on the specific requirements and the environmental condition, the unit shall be re-greased regularly. As an average, the re-greasing should be done every 500 running hours.
The guiding rails and the screw can be greased through the three lateral mounted lubricator nipples at the slide (see picture 31).
All roller bearings installed have for-life lubrication and therefore do not need any maintenance.
Correct and regular re-greasing can remarkably prolong the equipments life cycle.

Maintenance

LINE TECH integral axles are in general maintenance-free. Depending on the application however, it is recommended to remove once in a while the steel strapping in order to clean and to check the axle (especially in case of very small machining-residuals).

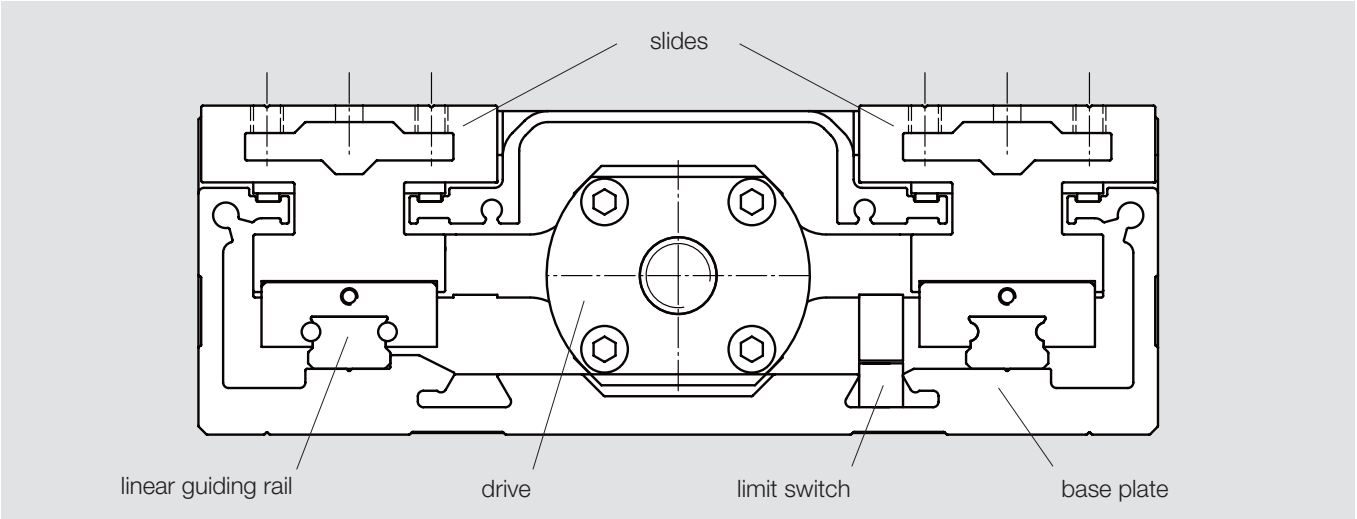
Service temperature

The allowed service temperature of 80° C is given by the composites installed. For the drives and controls refer to the specific publication.



Picture 31
Position of lubrication nipples

Picture 32: Design



Designation system for LINE TECH integral axles CP

Example CP 2 . 4 . 0500 B R 004 . 1 . 52 . 0 F

Size
2 = 175 mm slide width

Execution *(number of guiding carriages)* (see page 44)
4 = four guiding carriages

Stroke [mm] (see page 44)

Protection (see page 44)
N = without protection
F = with steel strapping

Drive (see pages 46/47)
N = without drive
S = ground ball screw
R = rolled ball screw
G = satellite roller screw
W = high-helix lead screw «Speedy»
Z = toothed belt
P = pneumatic cylinder

Stroke per revolution [mm] (see page 46)

Limit switch (see pages 48–50)
0 = without limit switch
1 = with limit switch and reference pos. at front (drive mount)
2 = with limit switch and reference pos. at rear (drive mount opposite)
3 = with limit switch and additional reference switch

Montagezustand (see pages 52/53)
00 = without drive

01 = free shaft end
02 = with coupling and intermediate plate
04 = set up for lateral drive mount right*
05 = set up for lateral drive mount left*
06 = set up for lateral drive mount top
07 = set up for lateral drive mount bottom
} for external motor mount only (projecting shaft end)

52 = with coupling and internal intermediate plate (motor installation by customer not possible)
53 = with coupling (external motor mounting direct on end plate)
} screw drive

11 = free shaft end right*
12 = free shaft end left*
13 = shaft end right with coupling and intermediate plate*
14 = shaft end left with coupling and intermediate plate*
} belt drive

Gear reduction (see page 50)
0 = without reduction
1 = reduction 2:1
2 = reduction 2,5 : 1
X = special (specify details with order)
} for external lateral drive mount only

Motor mount (see page 50)
N = without mounting plate
F = mounting plate for LINE TECH motor
S = mounting plate for special motor

*= seen from motor opposite side towards motor

Cross tables

Cross tables

LINE TECH integral axles are also available as two axle units (cross table). At this, the designation system as shown beside and based on the designation system of page 41, is to be used. There are totally four configurations possible. The correlation between the limit switch connector (black point) and the position of the drive (shaft end) will be shown on pages 52–53.

Designation system for cross table mounting

Example: **KM . CP2 / CP2 . AC**

Cross mounting

Symbol of the integral axle of the lower axle

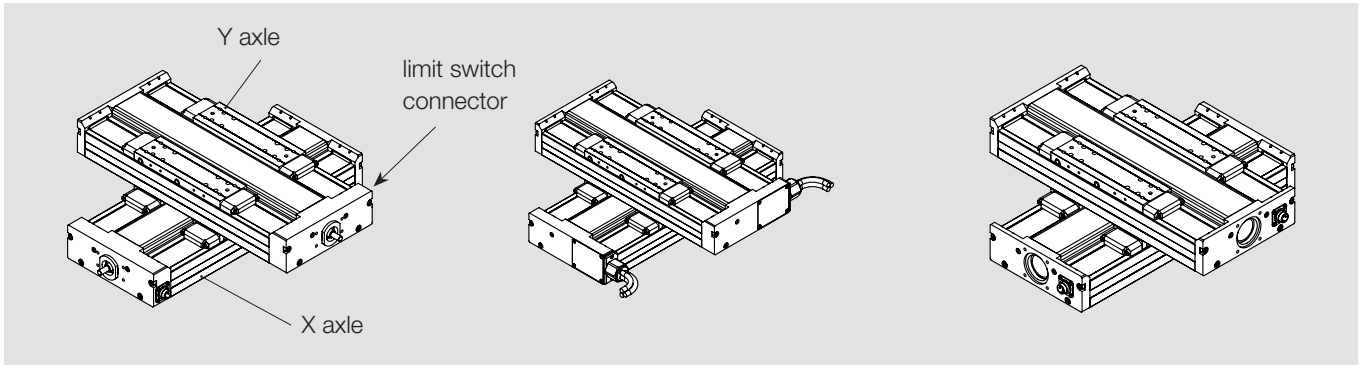
Symbol of the integral axle of the upper axle

Mounting layout (see pictures 32–35)

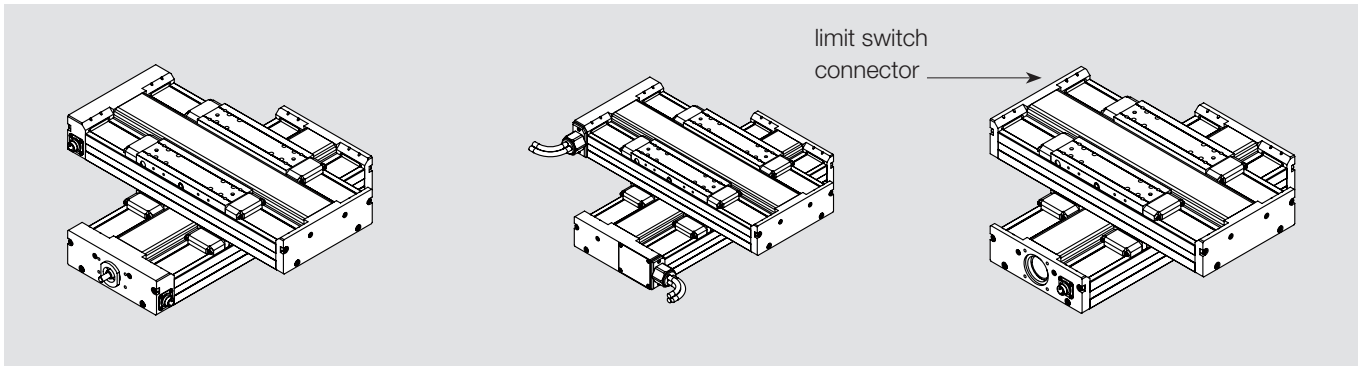
Cross table mountings of AC and AD layout are free of charge.
The mounting layout BC and BD need an intermediate plate and therefore are subject to a surcharge.

The standard precision for cross table mounting: 0.1mm / 300mm stroke.
Higher precision on request.

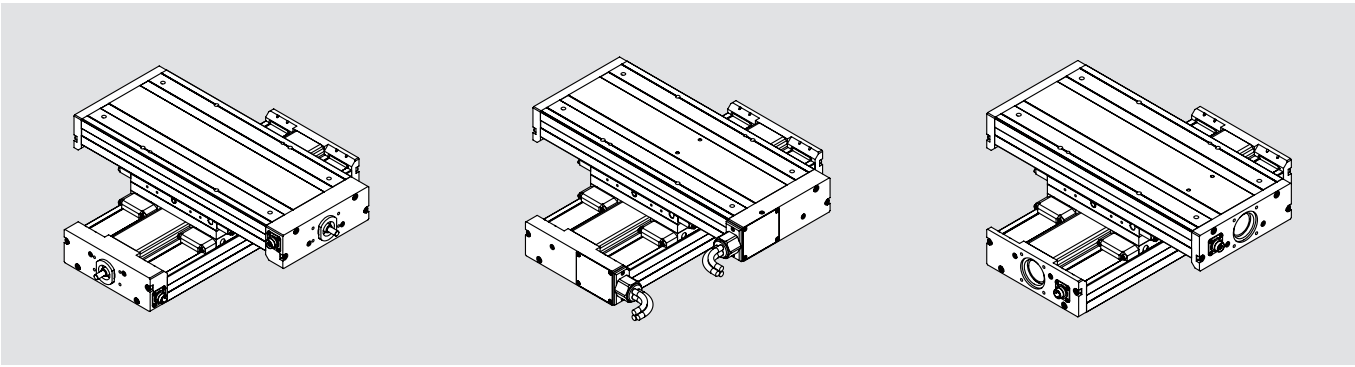
The individual integral axles must be ordered separately.



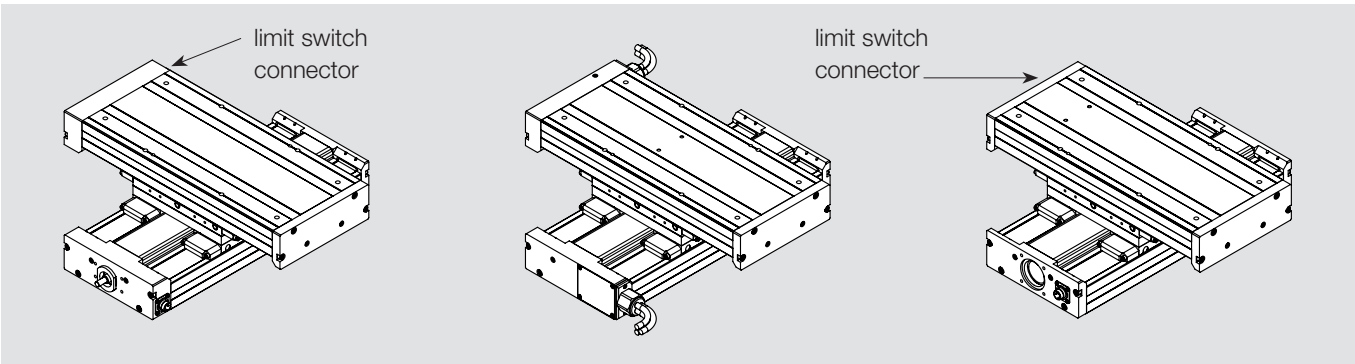
Picture 32
Mounting layout: AC



Picture 33
Mounting layout: AD



Picture 34
Mounting layout: BC



Picture 35
Mounting layout: BD

Selection notice

Selection notice

The selection notices take into account the various order options in details and are structured analog to the designation system. Thus permitting the optimal choice of the integral axle meeting best your specific requirements.

Execution

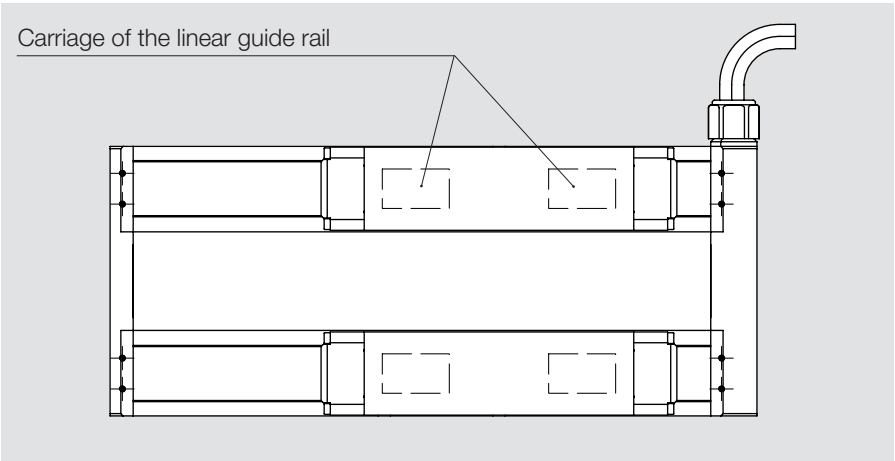
All sizes of the LINE TECH integral axles are each equipped with two guiding rails and four guiding carriages (picture 36). This guiding system meets all standard-requirements regarding load capacity ad precision.
In case of any higher requirements (rigidity, torque, load rate) it is possible to install linear guide rails with a higher pre-load.

Stroke

Thanks to a most flexible manufacturing process, customer requirements for stroke length beyond the standard program can be fulfilled. However, it shall be taken into consideration that the maximal stroke length is related to the chosen drive type (see page 46/47). In case of the overall length of the positioning unit exceeding 6000 mm the base plate will be compound of more then one. However, this goes without any consequence to the hole pattern.

Protection

For the dirt protection of the bearing and drive, the integral axles are equipped with steel strapping.



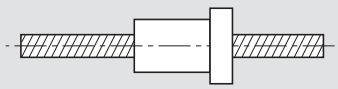
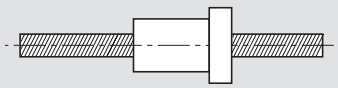
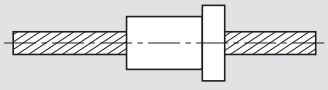
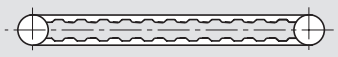
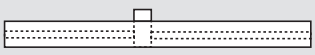
Picture 36
Standard execution

Notes

Selection notice

Drive

In order to facilitate the selection of the best drive solution, you'll find hereafter the different possibilities and their characteristics. By this, the different arrangements can be compared and the solution ideally meeting the customer requirements being determined. In case of higher requirements to the integral axle please contact the customer support at LINE TECH.

Drive	Size	Execution [1] diam. x pitch [mm]	Stroke [mm]	Positioning accuracy [µm/mm]
Ball screw 	CP 2	rolled 12x4 16x5, 16x10	≤ 1200 ≤ 1800	< 60/300 < 52/300 / < 25/300 [2]
Satellite roller screw 	CP 2	on request		
High-helix lead screw «Speedy» 	CP 2	on request		
Toothed belt 	CP 2	on request		
Pneumatic cylinder 	CP 2	on request		

[1] additional executions on request
[2] on request

Repeating accuracy [+/- mm]	Reversal backlash [mm]	Speed max. [m/s]	Acceleration max. [m/s²]	Axial load rate C_{dyn} [N]	C_0
< 0,02	0,02	3)	10	4400	1750
< 0,01	0,02	3)	10	6950	3400

3) depending upon the length of the spindle and the critical speed respectively (see pages 62/63)

Selection notice

Limit switches

The limit switches are used in conjunction with a control unit to limit the stroke (prevent overrunning of the carriage) and to define the reference position.
The widely used and LINE TECH standard inductive limit switches are of the PNP-break contact type and show the following characteristics:

Supply: 10…30 VDC
Current consumption off-load: < 10 mA
Load: max. 200 mA
Mechanical switch-ratio: < 0.4mm

On request the following non standard limit switches are available:

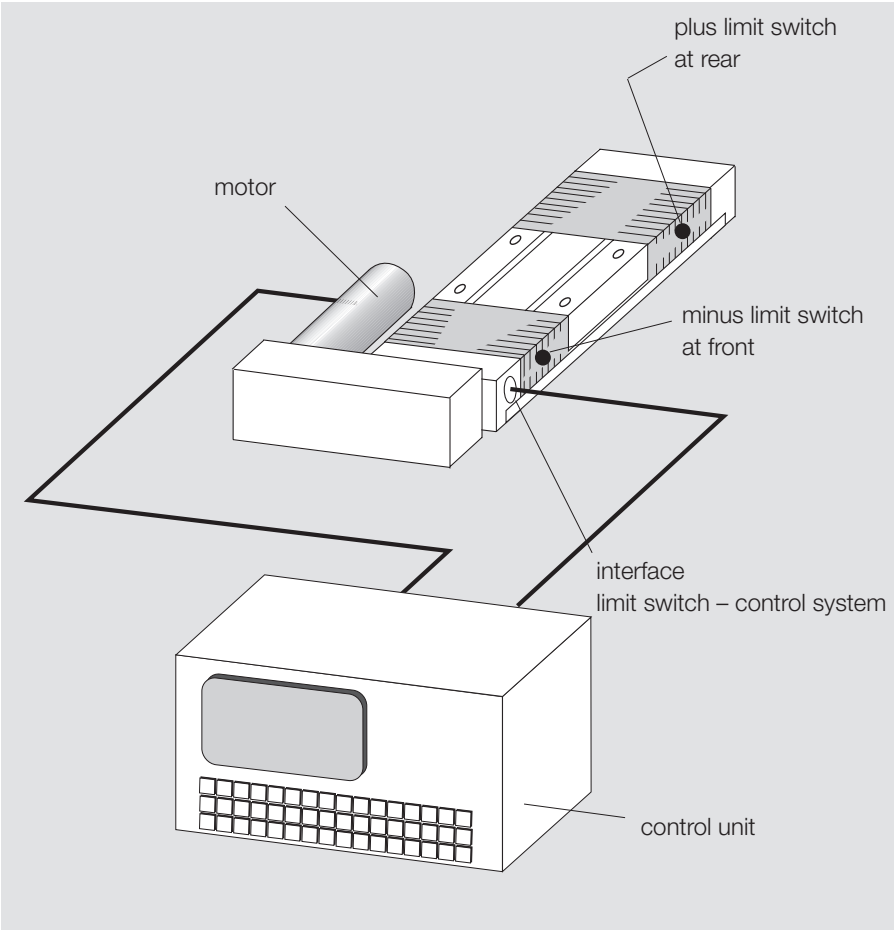
– PNP-make type (PNP-NO)
– NPN-break type (NPN-NC)
– NPN-make type (NPN-NO)

The LINE TECH product range includes continuous and linear path control systems as well as step motors, AC and DC servo drives. The individual components are tuned together and complete LINE TECH elements to custom made positioning systems.

Fitting of the limit switches

The fitting position of the limit switches is shown in picture 37. The reference position can be allocated either to the plus (+) or to the minus (-) limit switch. Special applications often require a separate reference position switch which will be, upon customer definition, located between the plus- and minus limit switch. The limit switch mounted closer to the drive (electrical motor) is named the front or forward limit switch.

Bild 37
Einbaulage der Endschalter



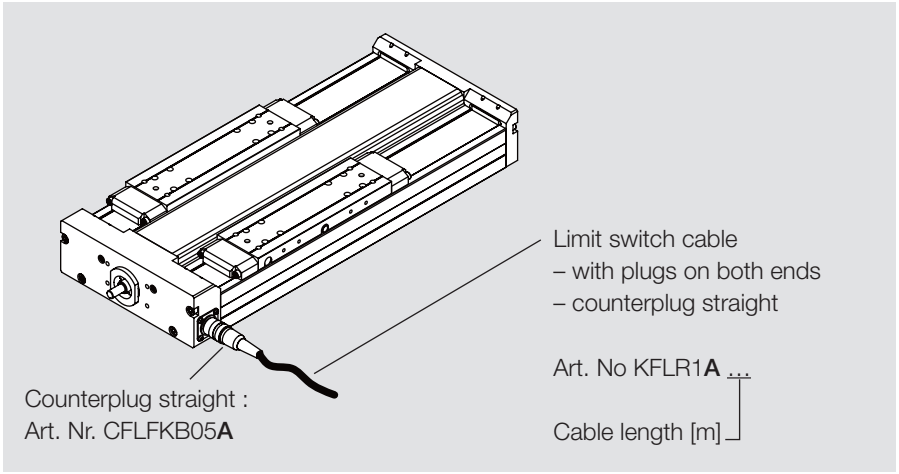
Picture 7a: Fitting position of the limit switches

Limit switch counterplugs and cables

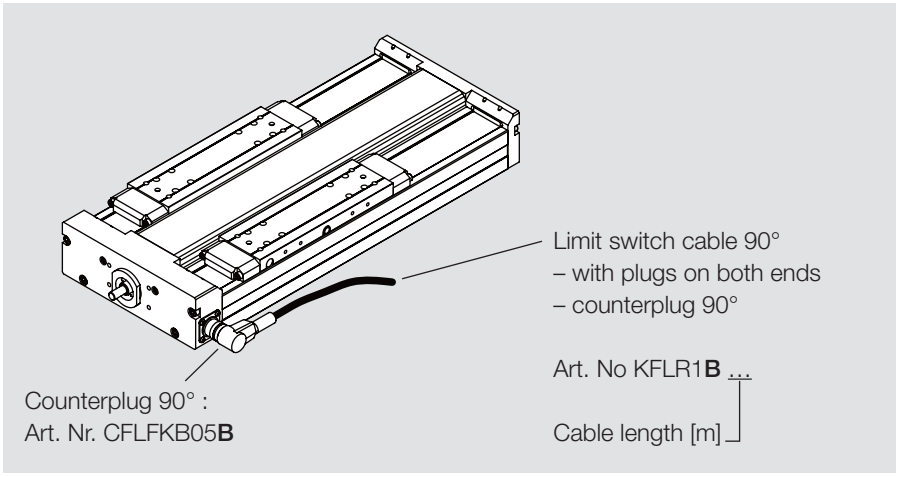
Limit switch-counterplugs and cables are not included in the delivery. However they can be ordered separately.
Counterplugs are available as straight and right angle plugs (see pictures 38 and 39).

Cable assembly

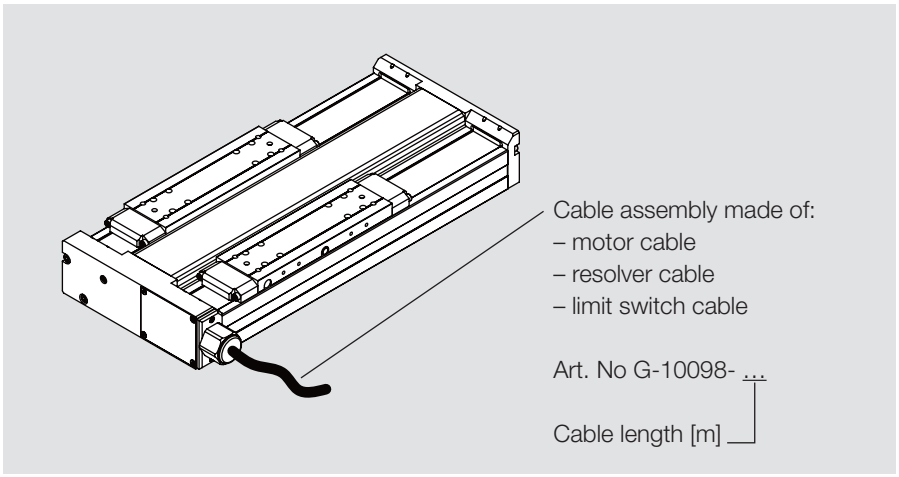
For integral axles with built-in motor (mounting condition 52) a cable assembly (picture 39) is available. This cable assembly fits to the servo controller „Servostar 400“ and „Servostar 600“ of Danaher Motion.



Picture 38
Counterplug straight with cable



Picture 39
Counterplug 90° with cable



Picture 40
Cable assembly for built-in motor (mounting condition 52)

Selection notice

Connector plug

The pin assignment for the standard limit switch is shown in the schemas 8a and 8b. The individual pins are assigned as follows:

Pin 1	minus (-) direction (load)
Pin 2	0V (GND)
Pin 3	plus (+) direction (load)
Pin 4	+10…30 VDC
Pin 5	reference (load)

Color-code legend to the schemas 41a and 41b:

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

Assembly condition

The different assembly conditions are shown on pages 52 and 53.

Reduction / multiplication

On request, for the screw drive solution with lateral motor mounting the speed (rpm) can be reduced or multiplied at a 2:1 or 2.5:1 ratio.

Motor mounting

LINE TECH offers a wide range of motors tuned to the positioning units. Furthermore, the installation of special motors according to the customer specification is possible.

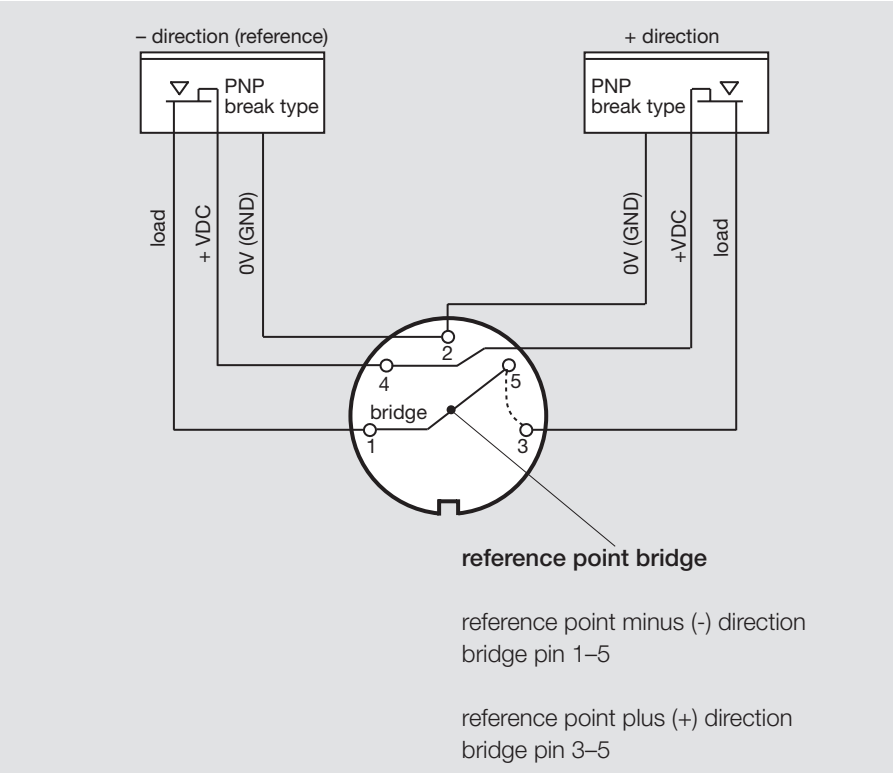
Specifications for built-in motor

(Mounting condition 52)

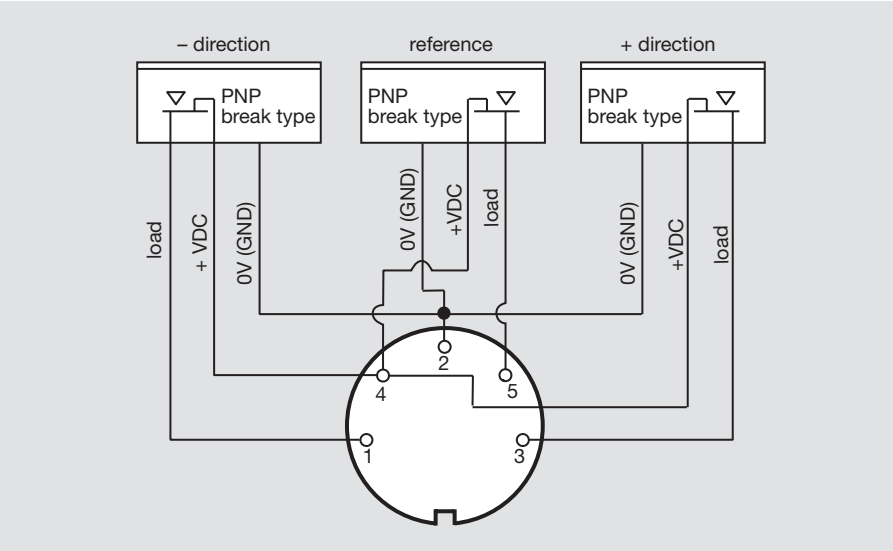
Nominal speed	= 4000 min^{-1}
Nominal torque	= 0.3 Nm

Suitable servo controllers:

„Servostar 400“ and „Servostar 600“ from Danaher Motion.



Schema 41a
Connector plug with integrated reference switch



Schema 41b
Connector plug with separate reference switch

Notes

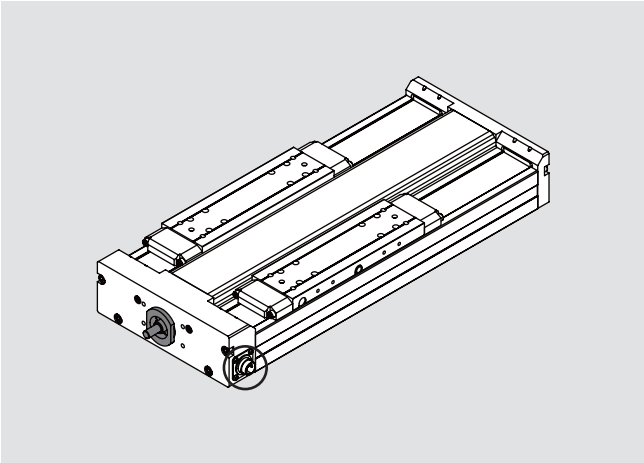
Selection notice

Mounting condition

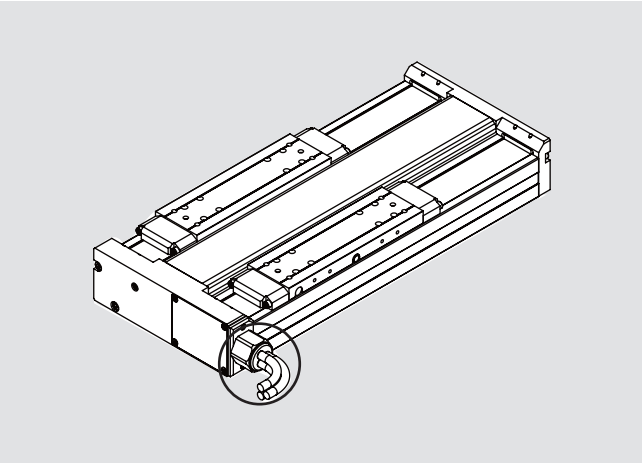
The positioning units can be supplied in different configurations (pictures 42-49).
Depending on the drive solution, different executions are being offered as a standard.
The difference between left- and right hand mounting condition is given by the position of the limit switch connector plug.
The respective location is marked in the pictures 42-49.

◯ = connector plug limit switch
(interface limit switch control)

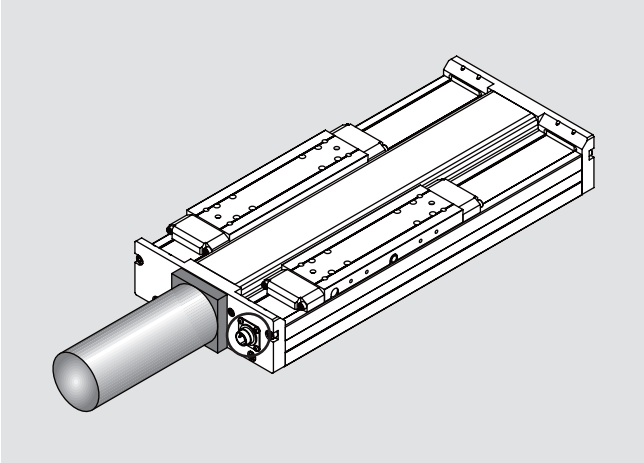
Dimensions see page 59.



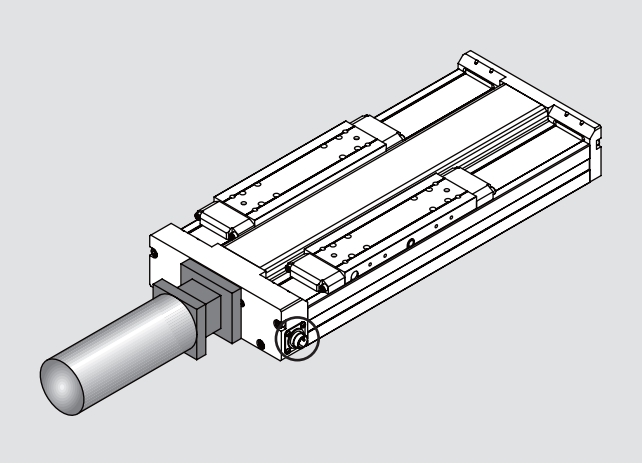
Picture 42: free shaft end
(Mounting condition 01)



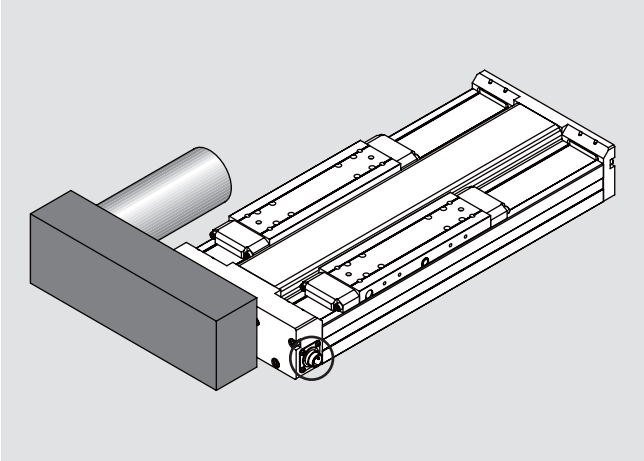
Picture 43: built-in motor
(Mounting condition 52)



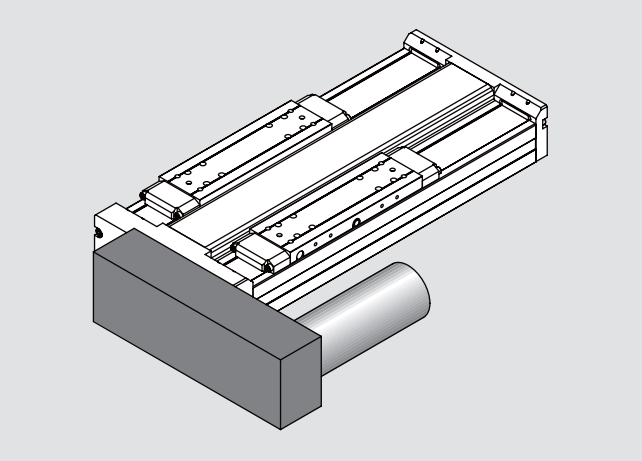
Picture 44: motor mounted direct on end plate
(Mounting condition 53)



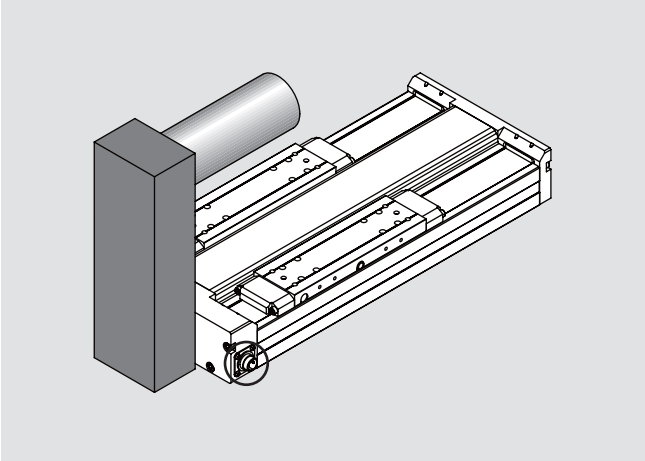
Picture 45: screw drive with coupling and intermediate plate
(Mounting condition 02)



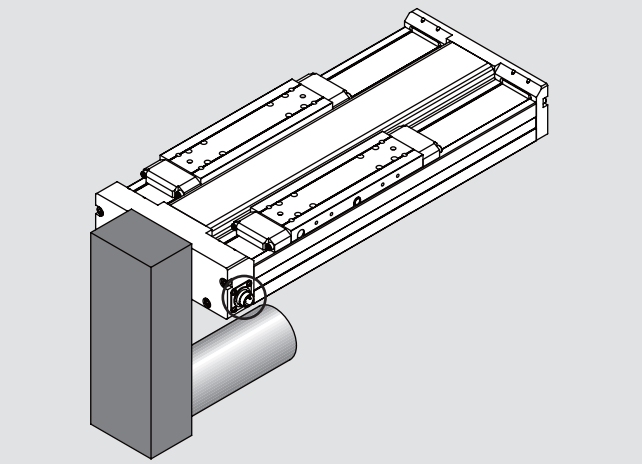
Picture 46: screw drive with lateral motor mount at right hand side (Mounting condition 04)



Picture 47: screw drive with lateral motor mount at left hand side (Mounting condition 05)



Picture 48: screw drive with lateral motor mount at left top side (Mounting condition 06)



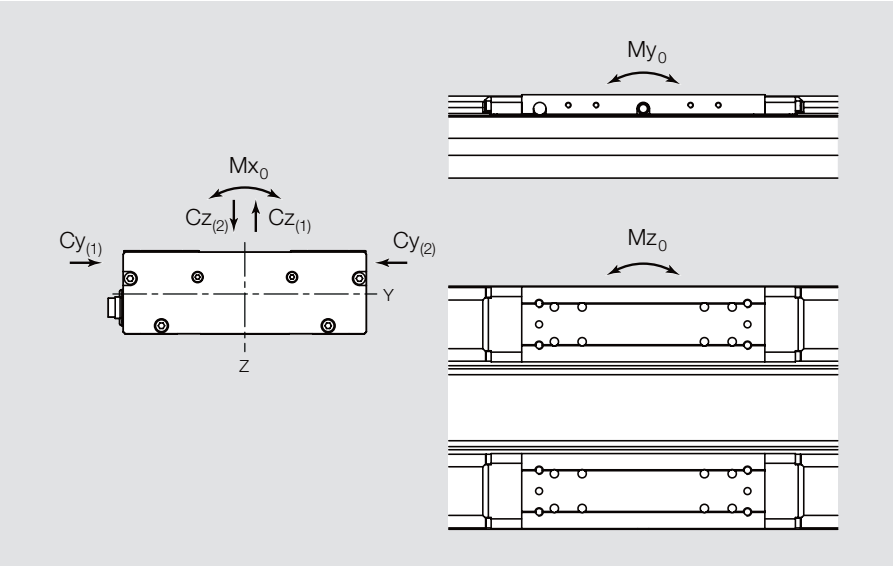
Picture 49: screw drive with lateral motor mount at the buttom (Mounting condition 07)

Technical data

Load rate
The load rate is given by the guiding system. Considering the requested life time we recommend to apply max. 20% of the dynamic load rate to the unit.

Torque
Also for the torque, the values are determined by the execution of the guiding system. Picture 50 shows the directions of possible torque application.

Area momentum
For integral axles the maximum allowed deflection angle is of 5'. This value being exceeded will have an impact on the unit's life-cycle.

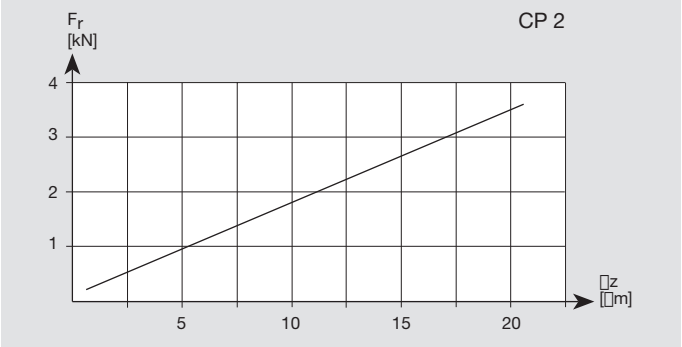


Picture 50: Torques

Type	Load rates * dynamic		Torques * dynamic			Load rates static			Torques static			Area momentum	
	$Cy_{(1,2)}$ [kN]	$Cz_{(1,2)}$	Mx_0 [Nm]	My_0	Mz_0	$Cy_{0\,(1,2)}$ [kN]	$Cz_{0\,(1)}$	$Cz_{0\,(2)}$	Mx_0 [Nm]	My_0	Mz_0	Iy_s [cm^4]	Iz_s
CP2.4	15.2	15.2	914	823	823	22.3	22.3	22.3	1341	1207	1207	28.1	797.3

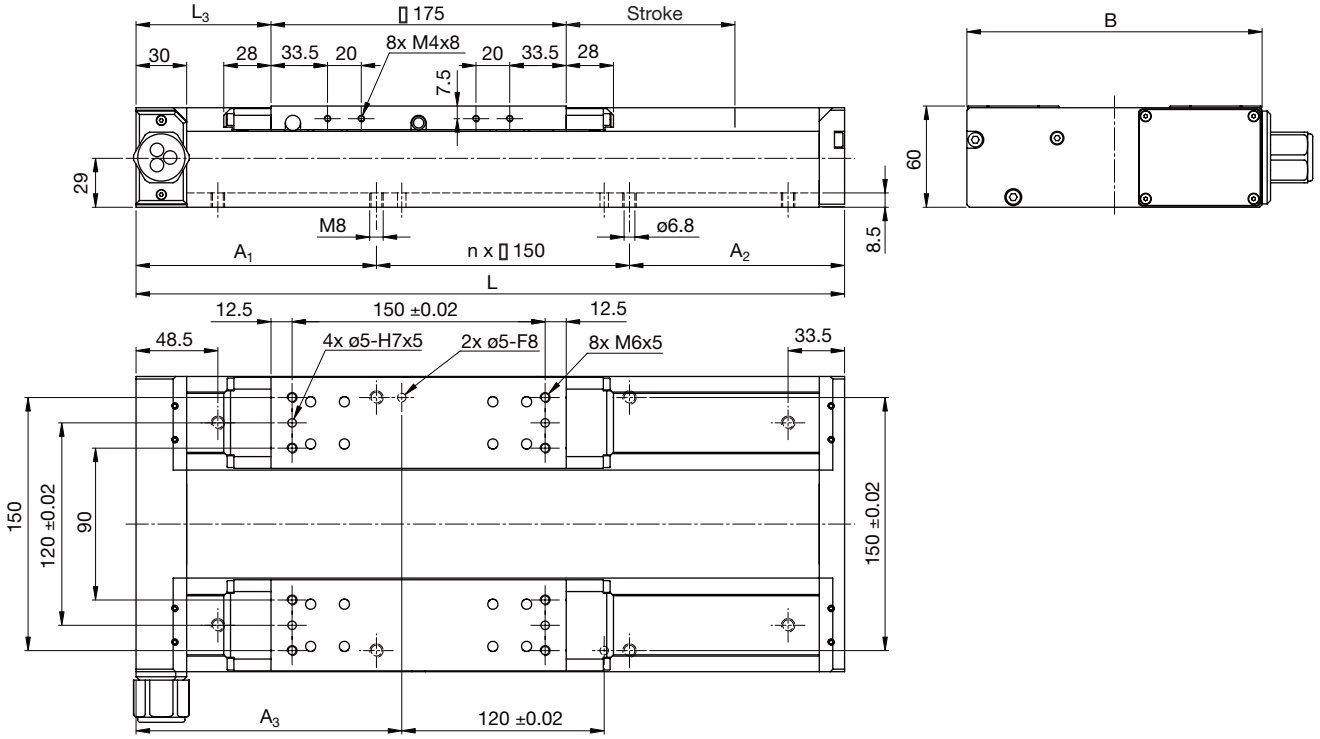
** recommended load of a integral axle < 20% of the dynamic rate*

Rigidity
The values for the rigidity refer to the guiding rail only without considering the environmental condition; they are shown in the diagram in picture 51.



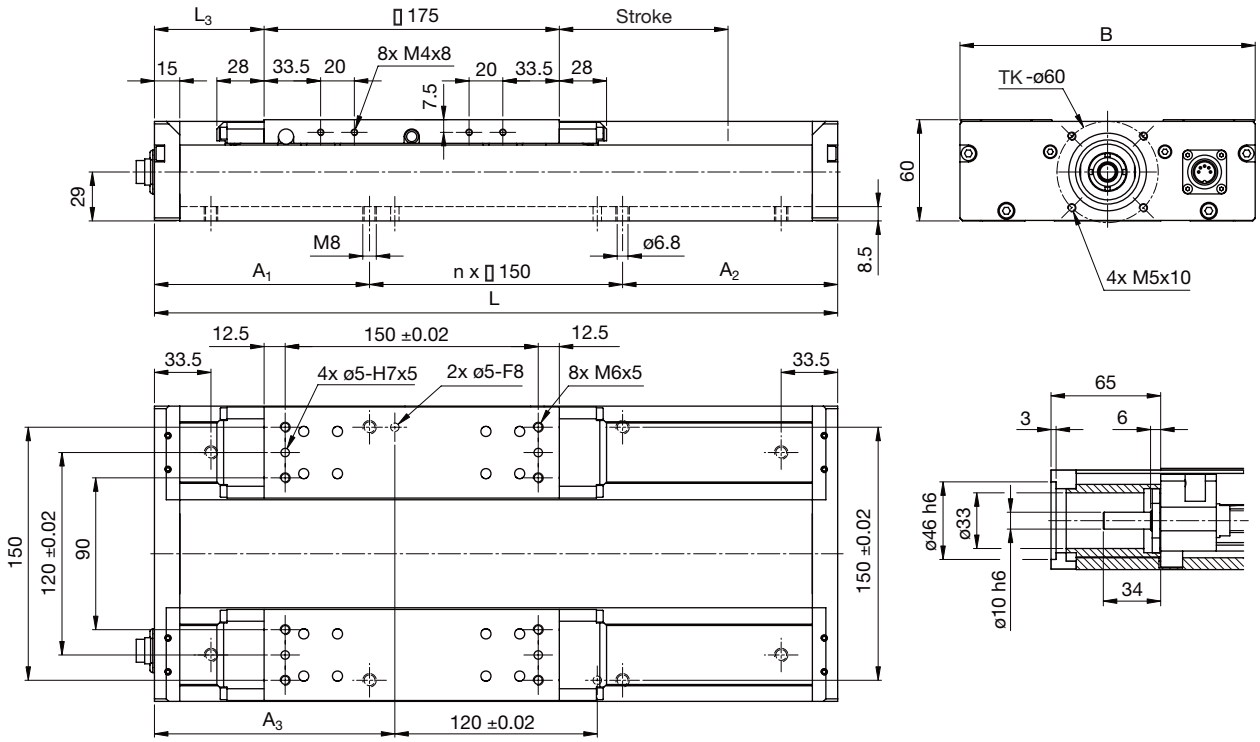
Picture 51: Rigidity

with screw drive and integrated motor (optional) (mounting condition 52)



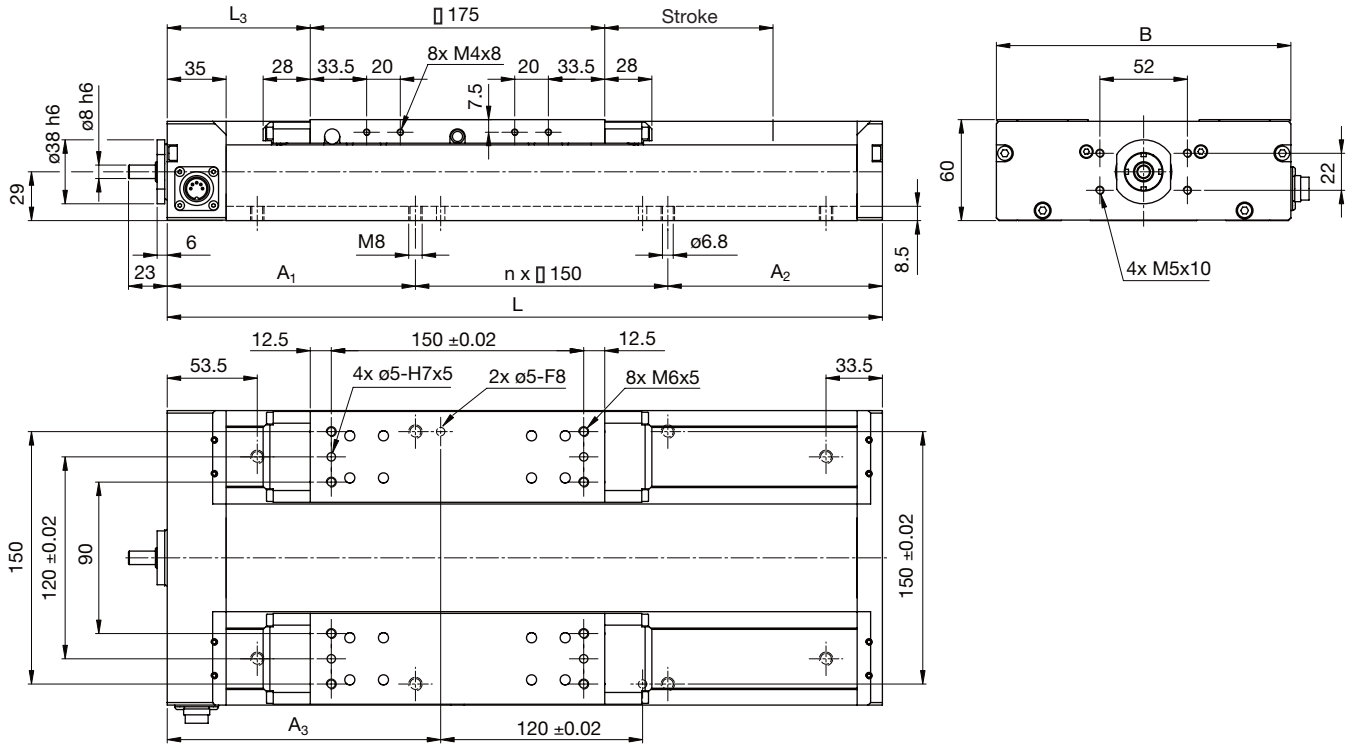
Nominal size		*Dimensions*							
Stroke	B	L	L_3	n	A_1	A_2	A_3	Screw length	Weight
[mm]		[mm]							[kg]
50	175	370	80	1	117.5	102.5	132.5	255.5	6.8
100	175	420	80	1	142.5	127.5	157.5	305.5	7.2
150	175	470	80	1	167.5	152.5	182.5	355.5	7.5
200	175	520	80	1	192.5	177.5	207.5	405.5	7.9
250	175	570	80	3	67.5	52.5	232.5	455.5	8.3
300	175	620	80	3	92.5	77.5	257.5	505.5	8.7
350	175	670	80	3	117.5	102.5	282.5	555.5	9.0
400	175	720	80	3	142.5	127.5	307.5	605.5	9.4
450	175	770	80	3	167.5	152.5	332.5	655.5	9.8
500	175	820	80	3	192.5	177.5	357.5	705.5	10.2
550	175	870	80	5	67.5	52.5	382.5	755.5	10.5
600	175	920	80	5	92.5	77.5	407.5	805.5	10.9
650	175	970	80	5	117.5	102.5	432.5	855.5	11.3
700	175	1020	80	5	142.5	127.5	457.5	905.5	11.7
750	175	1070	80	5	167.5	152.5	482.5	955.5	12.0
800	175	1120	80	5	192.5	177.5	507.5	1005.5	12.4
850	175	1170	80	7	67.5	52.5	532.5	1055.5	12.8
900	175	1220	80	7	92.5	77.5	557.5	1105.5	13.2
950	175	1270	80	7	117.5	102.5	582.5	1155.5	13.5
1000	175	1320	80	7	142.5	127.5	607.5	1205.5	13.9
1100	175	1420	80	7	192.5	177.5	657.5	1305.5	14.7
1200	175	1520	80	9	92.5	77.5	707.5	1405.5	15.4
1300	175	1620	80	9	142.5	127.5	757.5	1505.5	16.2
1400	175	1720	80	9	192.5	177.5	807.5	1605.5	16.9
1500	175	1820	80	11	92.5	77.5	857.5	1705.5	17.7

with screw drive; for motor mounting direct on end plate *(mounting condition 53)*



Nominal size		*Dimensions*							
Stroke	B	L	L_3	n	A_1	A_2	A_3	Screw length	Weight
[mm]		[mm]							[kg]
50	175	355	65	1	102.5	102.5	117.5	320.5	5.7
100	175	405	65	1	127.5	127.5	142.5	370.5	6.1
150	175	455	65	1	152.5	152.5	167.5	420.5	6.4
200	175	505	65	1	177.5	177.5	192.5	470.5	6.8
250	175	555	65	3	52.5	52.5	217.5	520.5	7.2
300	175	605	65	3	77.5	77.5	242.5	570.5	7.6
350	175	655	65	3	102.5	102.5	267.5	620.5	7.9
400	175	705	65	3	127.5	127.5	292.5	670.5	8.3
450	175	755	65	3	152.5	152.5	317.5	720.5	8.7
500	175	805	65	3	177.5	177.5	342.5	770.5	9.1
550	175	855	65	5	52.5	52.5	367.5	820.5	9.4
600	175	905	65	5	77.5	77.5	392.5	870.5	9.8
650	175	955	65	5	102.5	102.5	417.5	920.5	10.2
700	175	1005	65	5	127.5	127.5	442.5	970.5	10.6
750	175	1055	65	5	152.5	152.5	467.5	1020.5	10.9
800	175	1105	65	5	177.5	177.5	492.5	1070.5	11.3
850	175	1155	65	7	52.5	52.5	517.5	1120.5	11.7
900	175	1205	65	7	77.5	77.5	542.5	1170.5	12.1
950	175	1255	65	7	102.5	102.5	567.5	1220.5	12.4
1000	175	1305	65	7	127.5	127.5	592.5	1270.5	12.8
1100	175	1405	65	7	177.5	177.5	642.5	1370.5	13.6
1200	175	1505	65	9	77.5	77.5	692.5	1470.5	14.3
1300	175	1605	65	9	127.5	127.5	742.5	1570.5	15.1
1400	175	1705	65	9	177.5	177.5	792.5	1670.5	15.8
1500	175	1805	65	11	77.5	77.5	842.5	1770.5	16.6

with screw drive and free shaft end (mounting condition 01)

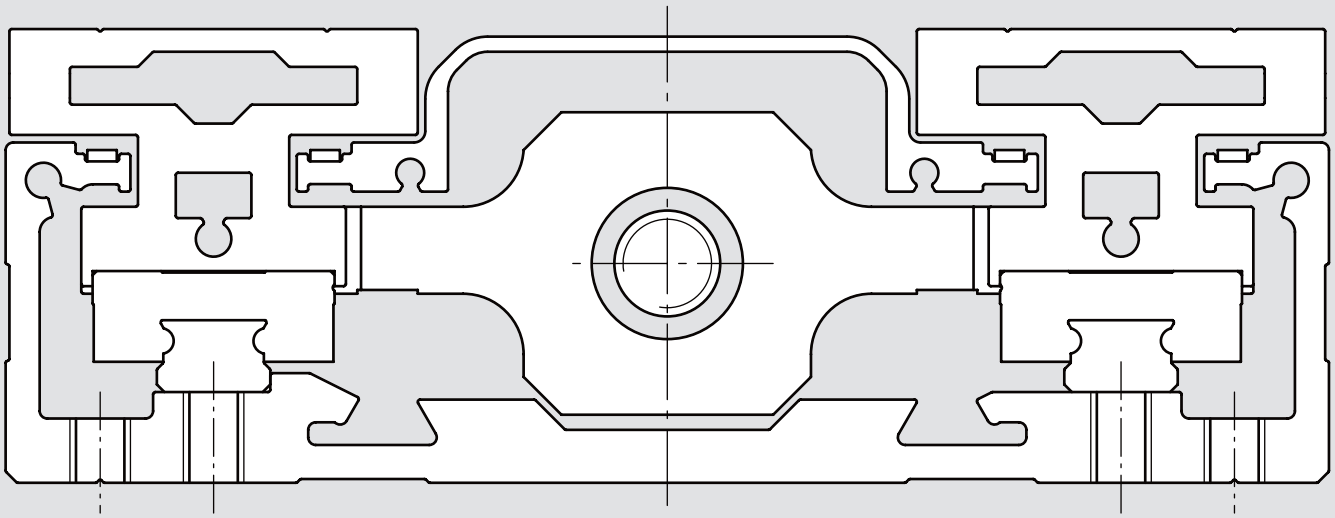


Nominal size		*Dimensions*							
Stroke	B	L	L_3	n	A_1	A_2	A_3	Screw length	Weight
[mm]		[mm]							[kg]
50	175	375	85	1	122.5	102.5	137.5	394.5	5.9
100	175	425	85	1	147.5	127.5	162.5	444.5	6.3
150	175	475	85	1	172.5	152.5	187.5	494.5	6.6
200	175	525	85	1	197.5	177.5	212.5	544.5	7.0
250	175	575	85	1	222.5	202.5	237.5	594.5	7.4
300	175	625	85	3	97.5	77.5	262.5	644.5	7.8
350	175	675	85	3	122.5	102.5	287.5	694.5	8.1
400	175	725	85	3	147.5	127.5	312.5	744.5	8.5
450	175	775	85	3	172.5	152.5	337.5	794.5	8.9
500	175	825	85	3	197.5	177.5	362.5	844.5	9.3
550	175	875	85	3	222.5	202.5	387.5	894.5	9.6
600	175	925	85	5	97.5	77.5	412.5	944.5	10.0
650	175	975	85	5	122.5	102.5	437.5	994.5	10.4
700	175	1025	85	5	147.5	127.5	462.5	1044.5	10.8
750	175	1075	85	5	172.5	152.5	487.5	1094.5	11.1
800	175	1125	85	5	197.5	177.5	512.5	1144.5	11.5
850	175	1175	85	5	222.5	202.5	537.5	1194.5	11.9
900	175	1225	85	7	97.5	77.5	562.5	1244.5	12.3
950	175	1275	85	7	122.5	102.5	587.5	1294.5	12.6
1000	175	1325	85	7	147.5	127.5	612.5	1344.5	13.0
1100	175	1425	85	7	197.5	177.5	662.5	1444.5	13.8
1200	175	1525	85	9	97.5	77.5	712.5	1544.5	14.5
1300	175	1625	85	9	147.5	127.5	762.5	1644.5	15.3
1400	175	1725	85	9	197.5	177.5	812.5	1744.5	16.0
1500	175	1825	85	11	97.5	77.5	862.5	1844.5	16.8

Profile cross-section

CP2

M1:1



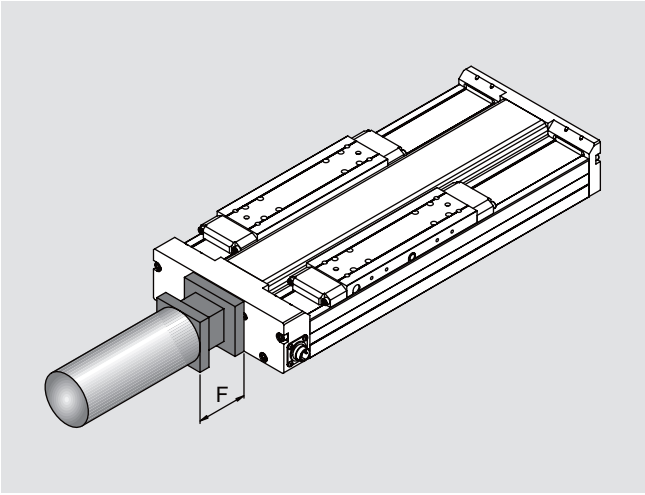
Picture 52
Profile cross-section of integral axle

Dimensions motor mount

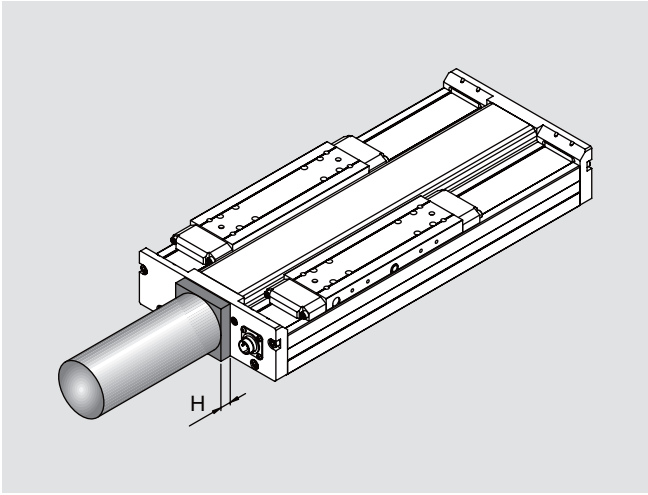
The principal measurements of the motor mount are described on this page. The measurements shown in pictures 53 to 56 are valid also for the respective axially symmetric versions (mount at left hand side or bottom).
The motor mount normally projects to the top and to the bottom (varying with the size of the motor).

Nom. size	Dimensions A_1 [mm]	A_2	B	C	D_1	D_2	E	F*	H*
CP2	300	300	120	70	178	178	66	*	*

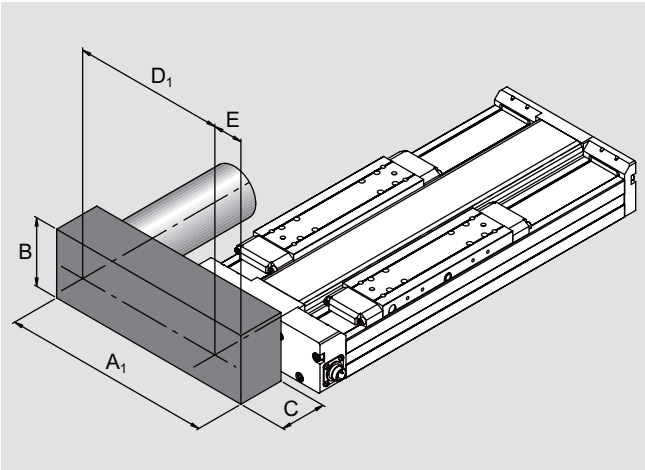
* related to the type of motor



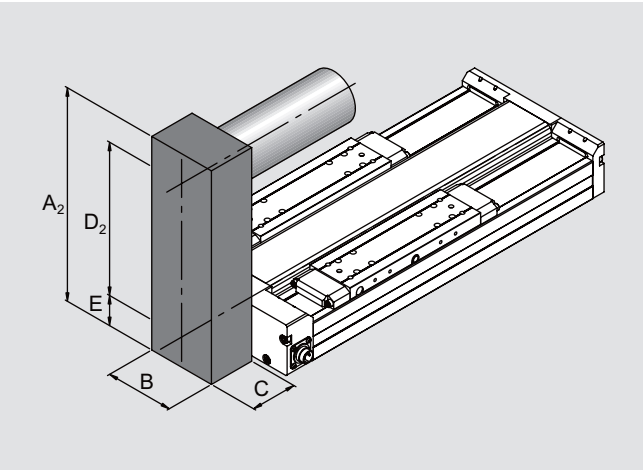
Picture 53: Screw drive with coupling and intermediate plate (mounting condition 02)



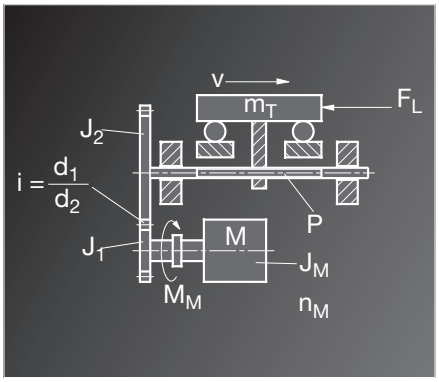
Picture 54: Screw drive with motor mount at end plate (mounting condition 53)



Picture 55: Screw drive with lateral motor mount at right hand side (mounting condition 04)



Picture 56: Screw drive with lateral motor mount at top side (mounting condition 06)



Tabel of content

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Calculation guidelines for positioning units and integral axles

Concept

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

It is the linear guide or roller guide system which normally determines the service life. Therefore the following rules can be applied for a coarse definition:

Dynamic load

The nominal service life L_{10} L10 is being calculated from the dynamic load factor 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

In case of only static load to be applied, the static index f_S is being calculated in order to show that a 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:

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

If $f_S \geq 1$, the safety margin is sufficient.
If $f_S \leq 1$, contact LINE TECH for further advise.

Remark

The above formulas are applicable only in case all bearings are equally loaded, i.e. the load F is applied at the center of the cradle. Especially in vertical arrangements of the positioning units, the drive (screw or belt) must be checked. LINE TECH disposes of different test programs.
If you provide us all the necessary information, we'll be pleased to assist you.

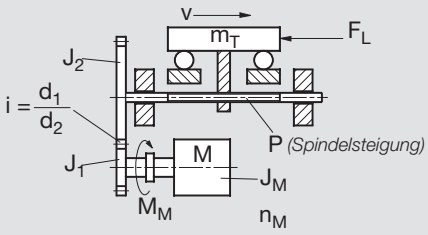
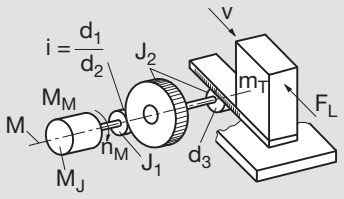
Definition of the drive motor

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 you different types of step-motors, DC and AC motors together with the appropriate continuous or linear path control.
To allow you the determination of the adequate drive motor for any specific application, always use the formulas and examples shown hereafter.

Key to the formulas at page 63:

d	[mm]	=	screw diameter
d_1	[mm]	=	diameter driving wheel
d_2	[mm]	=	diameter driven gear
d_3	[mm]	=	diameter pinion or belt pulley
F_L	[N]	=	feed power
i	[–]	=	gear 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 torque resp. breaking moment
M_d	[Nm]	=	motor – continuous torque (see motor spec.)
M_{eff}	[Nm]	=	motor – effective output torque
M_L	[Nm]	=	load moment
M_M	[Nm]	=	motor torque (see motor spec.)
M_{max}	[Nm]	=	motor torque peak
m_T	[kg]	=	external load (linear moving mass)
n_k	[min^{-1}]	=	critical speed for screw drive
n_M	[min^{-1}]	=	motor speed
p	[mm]	=	screw pitch
P_A	[W]	=	power output
s_B	[mm]	=	acceleration / brake path
t_B	[s]	=	acceleration / braking period
t_L	[s]	=	running time under load moment
t_0	[s]	=	stop period unloaded
v	[m/s]	=	rate of feed
η	[–]	=	mechanical efficiency on motor shaft

Calculation guidelines for positioning units and integral axles

			
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]	$M_L = p \cdot i \frac{F_L}{2000 \cdot \pi}$	$M_L = d_3 \cdot i \frac{F_L}{2000}$
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 of inertia	[kgm^2]	$J = J_M + J_1 + i^2 (J_R + J_T + J_2)$ *(at gear reduction 2:1 → i = 0,5)*	
Acceleration torque resp. breaking moment $M_B = f(n_M)$	[Nm]	$M_B = \frac{n_M \cdot J}{9{,}55 \cdot t_B}$	
Acceleration torque resp. breaking 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- / braking period $t_B = f(n_m)$	[s]	$t_B = \frac{n_M \cdot J}{9{,}55 \cdot M_B}$	
Acceleration- / braking period $t_B = f(s_B)$	[s]	$t_B = \sqrt{\frac{4 \cdot \pi \cdot s_B \cdot J}{p \cdot i \cdot M_B}}$	$t_B = \sqrt{\frac{4 \cdot s_B \cdot J}{d_3 \cdot i \cdot M_B}}$
Resulting speed (rpm) after acceleration	[min^{-1}]	$n_M = \frac{120 \cdot s_B}{p \cdot i \cdot t_B}$	$n_M = \frac{120 \cdot s_B}{d_3 \cdot \pi \cdot i \cdot t_B}$
Resulting distance of acceleration	[mm]	$s_B = \frac{n_M \cdot t_B \cdot p \cdot i}{120}$	$s_B = \frac{n_M \cdot t_B \cdot d_3 \cdot \pi \cdot i}{120}$
Total of moments to override 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 output torque of motor	[Nm]	$M_{eff} = \sqrt{\frac{\Sigma\ t_B\ (M/M_M)^2 + \Sigma\ t_L\ (M_L/M_M)^2}{\Sigma\ t_B + \Sigma\ t_L + t_0}} \cdot M_M$	

Calculation examples for positioning units and integral axles

Concept example

Positioning unit PE2·2·0200FR10·1·02·0F with ball screw drive 20x10

Stroke		=	200 mm	External load	m_T	=	100 kg
Screw length	l	=	533 mm	Max. feed force	F_L	=	500 N
Thread pitch	p	=	10 mm	Displacement speed	v	=	5 m/min
Screw diameter	d	=	20 mm	Acceleration time	t_B	=	0,05 s

Load cycle:

- total of all acceleration and break times	Σt_B	=	1 s
- total running time at constant speed	Σt_L	=	4 s
- downtime without load	t_0	=	1 s
- cycle time		=	6 s

Transmission:

Motor directly coupled to the screw $i = 1$

Moment of inertia at coupling $J_1 = 0{,}04 \cdot 10^{-3}$ kgm²

Load moment

$$M_L = \frac{p \cdot i \cdot F_L}{200 \cdot \pi} = \frac{10 \cdot 1 \cdot 500}{200 \cdot \pi} = 0{,}8 \text{ Nm}$$

Mass moments ot inertia:

– translatory

$$J_T = m_T \left(\frac{p}{2\pi}\right)^2 \cdot 10^{-6} = 100 \left(\frac{10}{2\pi}\right)^2 \cdot 10^{-6}$$
$$= 0{,}254 \cdot 10^{-3} \text{ kgm}^2$$

– rotatory

$$J_R = 7{,}7 \cdot d^4 \cdot l \cdot 10^{-13} = 7{,}7 \cdot 20^4 \cdot 533 \cdot 10^{-13}$$
$$= 0{,}066 \cdot 10^{-3} \text{ kgm}^2$$

Rotational speed (motor speed)

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

$$n_M \leq n_k = 120 \cdot 10^6 \cdot d/l^2 = 120 \cdot 10^6 \cdot 20/533^2 = 8448 \text{ min}^{-1}$$

If $n_M > n_k$, the speed must be reduced or the screw diameter and the thread pitch respectively be increased.

1. Motor concept for step motor

Number of full steps per revolution = 200

Step angle = 1,8°

at pitch p = 10 mm (without any screw fault) $= 10 \cdot \frac{1{,}8}{360} = 0{,}05$ mm

At $n_M = 500$ min^{-1}:

Number of full steps = 1667 / s

Torque $M_d = 2{,}2$ Nm

Mass moment of inertia $J_M = 0{,}13 \cdot 10^{-3}$ kgm²

Total of red. mass moment of inertia $J = J_M + J_1 + i^2 \cdot (J_T + J_R) = (0{,}13 + 0{,}04 + 0{,}254 + 0{,}066) \cdot 10^{-3}$
$= 0{,}49 \cdot 10^{-3}$ kgm²

Acceleration or break moment $M_B = \frac{500 \cdot 0{,}49 \cdot 10^{-3}}{9{,}55 \cdot 0{,}05} = 0{,}513 \text{ Nm}$

Motor moment during acceleration $M_M = \frac{1}{0{,}8} (0{,}8 + 0{,}513) = 1{,}64 \text{ Nm}$

Attention: for step motors watch the rpm-related torque

2. Motor concept for direct-current servo motor (DC servomotor)

In comparison to the two other motor types (step motor and AC servomotor) the DC motor shows a significant higher rotor-mass moment of inertia which asks for a higher acceleration moment.

At $n_M = 500 \text{ min}^{-1}$:

Constant torque $M_d = 1{,}2 \text{ Nm}$

Peak torque $M_{max} = 8 \text{ Nm}$

Mass moment of inertia $J_M = 0{,}6 \cdot 10^{-3} \text{ kgm}^2$

Total of red. mass moment of inertia $J = J_M + J_1 + i^2 (J_T + J_R) = (0{,}6 + 0{,}04 + 0{,}254 + 0{,}062) \cdot 10^{-3}$
$= 0{,}956 \cdot 10^{-3} \text{ kgm}^2$

Acceleration or break moment $M_B = \frac{n_M \cdot J}{9{,}55 \cdot t_B} = \frac{500 \cdot 0{,}956 \cdot 10^{-3}}{9{,}55 \cdot 0{,}05} = 1 \text{ Nm}$

Motor moment during acceleration $M_M = \frac{1}{\eta} (M_L + M_B) = \frac{1}{0{,}8} (0{,}8 + 1) = 2{,}25 \text{ Nm}$

Thermal stress on the motor: for acceleration and break actions servomotors can be overstressed for a short period of time, if by doing so the root mean square value or the effective value of the motor nominal torque are not exceeded.
At short load cycles with resulting high dynamic demands, the thermal stress of the motor shall be checked.

Ratio of the actual needed motor torque to the nominal motor torque:

– during acceleration $\frac{M_M}{M_d} = \frac{2{,}25}{1{,}2} = 1{,}875$

– at constant speed $\frac{M_L}{M_d} = \frac{0{,}8}{1{,}2} = 0{,}667$

Effective output torque of motor $M_{eff} = \sqrt{\frac{\Sigma\, t_B\, (M_M/M_d)^2 + \Sigma\, t_L\, (M_L/M_d)^2}{\Sigma\, t_B + \Sigma\, t_L + t_0}} \cdot M_d$

$= \sqrt{\frac{1 \cdot 1{,}875^2 + 4 \cdot 0{,}667^2}{1 + 4 + 1}} \cdot M_d$

$= 0{,}939 \cdot M_d$

→ the motor is thermally stressed at 94%.

3. Motor concept for synchronous servomotor (AC servomotor, brushless)

At $n_M = 500\ min^{-1}$:

Constant torque $M_d = 1{,}25\ Nm$

Peak torque $M_{max} = 8\ Nm$

Mass moment of inertia $J_M = 0{,}11 \cdot 10^{-3}\ kgm^2$

Total of red. mass moment of inertia

$$J = J_M + J_1 + i^2\ (J_T + J_R) = (0{,}11 + 0{,}04 + 0{,}254 + 0{,}062) \cdot 10^{-3}$$
$$= 0{,}47 \cdot 10^{-3}\ kgm^2$$

Acceleration or break moment

$$M_B = \frac{n_M \cdot J}{9{,}55 \cdot t_B} = \frac{500 \cdot 0{,}47 \cdot 10^{-3}}{9{,}55 \cdot 0{,}05} = 0{,}49\ Nm$$

Motor moment during acceleration

$$M_M = \frac{1}{\eta}\ (M_L + M_B) = \frac{1}{0{,}8}\ (0{,}8 + 0{,}49) = 1{,}61\ Nm$$

Thermal stress on the motor:

Ratio of the actual needed motor torque to the nominal motor torque

– during acceleration

$$\frac{M_M}{M_d} = \frac{1{,}61}{1{,}25} = 1{,}288$$

– at constant speed

$$\frac{M_L}{M_d} = \frac{0{,}8}{1{,}25} = 0{,}64$$

Effective output torque of motor

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

$$= \sqrt{\frac{1 \cdot 1{,}288^{\,2} + 4 \cdot 0{,}64^{\,2}}{1 + 4 + 1}} \cdot M_d$$

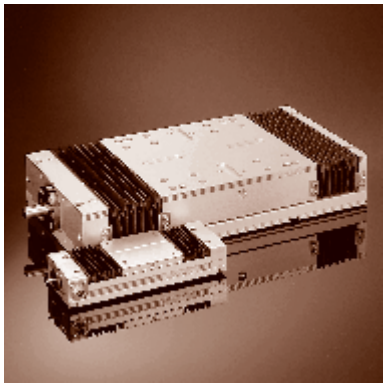
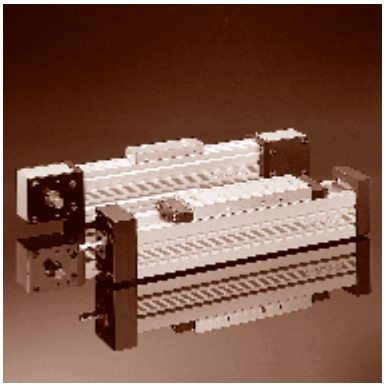
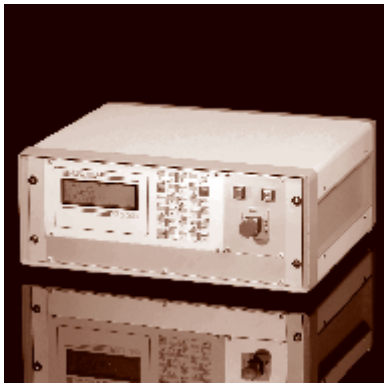
$$= 0{,}741 \cdot M_d$$

→ the motor is thermally stressed at 74%.

Notes

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.

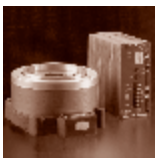
LINE TECH positioning units and LINE TECH linear modules – all built on a modular concept – are, due to their design features, dedicated for applications with high requirements on precision and performance. Various sizes and a multitude of drives allow for application specific problem solving.

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.

LINE TECH has, beside the manufacture of components, specialized in the development of system solutions. It goes without saying that this includes the offer for commissioning by the LINE TECH customer service.



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