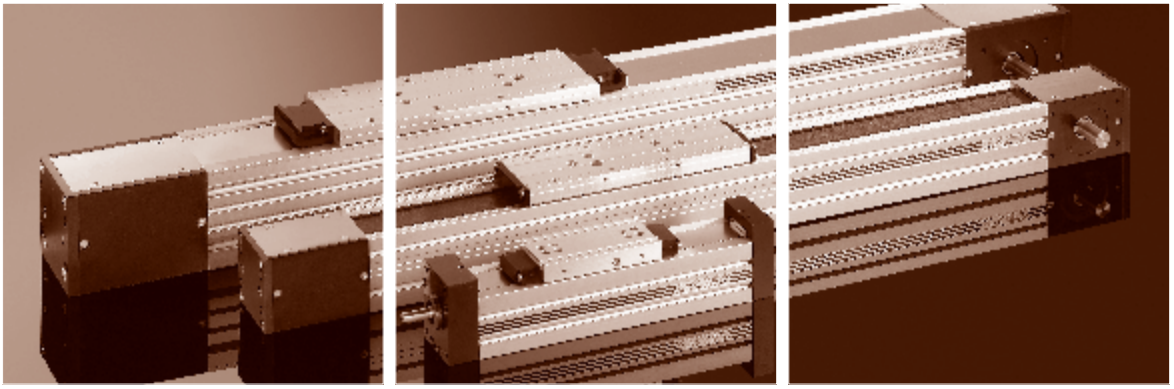
LINE TECH linear modules



Ready to built-in linear modules with drive

CONSULTING
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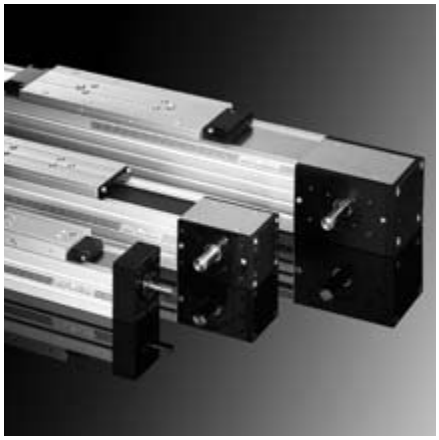
LINEAR TECHNOLOGY



– Anodized profile, produced in extrusion molding method

– Linear rail guiding system (LM3–LM5), roller guides for minor load (RM3–RM5)

– Actuation by ball screw, high-helix lead screw or toothed belt

– Optional inductive or mechanical limit switches

– AC servo drives or step motors, appropriate continuous or linear path control

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Design fundamentals

LINE TECH linear modules

LINE TECH linear modules are of modular conception, ready to built-in linear carriages with drive unit. A linear rail guide with two guiding carriages (LM3–LM5) or a roller guide with four or six rollers (RM3–RM5) are used as guiding elements.
The drive unit preferably consists of ball screws or toothed belts. With little axial load, also high-helix lead screws “Speedy” can be used.
The guidance as well as the actuation are protected by a steel strapping (LM3–LM5) or by the drive belt (LM3–LM5, RM3–RM5) against the intrusion of dirt, chipping etc.
The housing as well as the cradle are made of colorless anodized aluminium bars, prefabricated in an extrusion molding process.
Additional, external mounted inductive proximity switches allow, in conjunction with servo drives or step motors and the control unit, for the perfect positioning and prevent from the carriage over run.

Lubrication

LINE TECH linear modules stand for a long lasting, maintenance free use. The guide system is therefore equipped with a specially developed device for continuous lubrication.
Only the ball screws shall be lubricated approx. every 500 running hours through the provided grease point.

Service temperature

The permissible service temperature of 80° C is predetermined by the composites in use.
For the motors and controls refer to the values in the respective publications.

Designation system for LINE TECH linear modules

Examples: LM 3 . 2 . 0500 B R 016 . 1 . 02 . 0 F

Design
LM = linear guide
RM = roller guide

Size
3 = size 65
4 = size 80
5 = size 110

Construction
2 = with 2 guiding carriages
4 = with 4 guide rollers
6 = with 6 guide rollers

Stroke (mm)

Protection
N = without protection
B = with steel strapping

Drive (see page 6/7)
N = without drive
S = ground ball screw
R = rolled ball screw
W = high-helix lead screw “Speedy”
Z = toothed belt

Stroke length per revolution [mm] (see page 6)

Limit switch (see page 10)
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 2 limit switches and additional reference position

Mounting conditions (see page 8/9)
00 = without 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
} 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*
15 = shaft end right with lateral drive mount*
16 = shaft end left with lateral drive mount*
17 = free screw noses on both sides (passing screw)
18 = screw noses on both sides, one side with coupling and intermediate plate
} belt drive

21 = special design

Gear reduction
0 = without reduction
1 = reduction 2:1
2 = reduction 2,5 : 1
} available for lateral drive mount only

Motor mount (see page 36)
N = without mounting plate
F = mounting plate for LINE TECH motor
S = mounting plate for special motor

* seen from motor opposite side towards motor

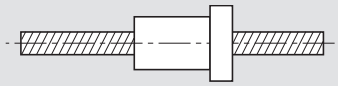
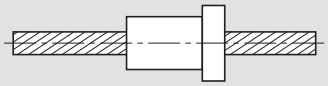
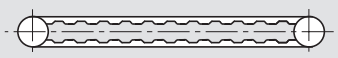
Selection evidence

Drive

In order to simplify the selection of the optimal drive, you'll find hereafter the various drive solutions in line with the most important performance data.

This allows for the comparison of the different drives and the selection of the drive solution appropriate to the customers individual need.

In case of any specific or higher requirements to the positioning system we ask you to get in contact with LINE TECH customer service.

Drive	Size	Execution [1] diam. x pitch [mm]	Stroke range [mm]	Positioning accuracy [µm/mm]
Ball screw		rolled	rolled	elective
	LM3	16x5, 16x10, 16x16	≤ 2000	standard: 130/300
	LM4	20x5, 20x20, 16x50	≤ 3000	optional: 52/300
	LM5	32x5, 32x10, 32x32	≤ 3000	23/300
High-helix lead screw «Speedy»	LM3	16x25, 16x90	≤ 2000	200/300
	LM4	24x40, 18x100	≤ 3000	200/300
	LM5	30x50, 34x80	≤ 3000	200/300
Toothed belt, circumferential	LM3	GT 5/25 155 mm/U	≤ 7600	200/1000
	RM3	GT 5/25 155 mm/U	≤ 7600	200/1000
	LM4	GT 5/40 205 mm/U	≤ 7500	200/1000
	RM4	GT 5/40 205 mm/U	≤ 7500	200/1000
	LM5	ST 8/50 296 mm/U	≤ 7400	200/1000
	RM5	ST 8/50 296 mm/U	≤ 7400	200/1000

[1] additional executions on request

[2] max. strength of extension at 1.6 m/sec

[3] subject to screw length and critical RPM (speed) as well as thread pitch

Repeating accuracy * [+/- mm]	Reversal backlash [mm]	Speed max. [m/s]	Acceleration max. [m/s²]	Axial load rate C_{dyn} [N]	C_0
rolled	normal backlash	rolled			
0,01	max. 0,04	3)	10	6950	3400
0,01	or	3)	10	8000	4300
0,01	pre-loaded	3)	10	25000	15000
0,05	0,1 5)	3)	10	—	1500
0,05	0,1 5)	3)	10	—	2300
0,05	0,1 5)	3)	10	—	4200
0,1	zero backlash	1,6 (optional 5)	4)	1560 2)	
0,1	zero backlash	1,6 (optional 5)	4)	1560 2)	
0,1	zero backlash	1,6 (optional 5)	4)	2200 2)	
0,1	zero backlash	1,6 (optional 5)	4)	2200 2)	
0,1	zero backlash	1,6 (optional 5)	4)	3720 2)	
0,1	zero backlash	1,6 (optional 5)	4)	3720 2)	

4) no mechanical delimitation, depending on charge

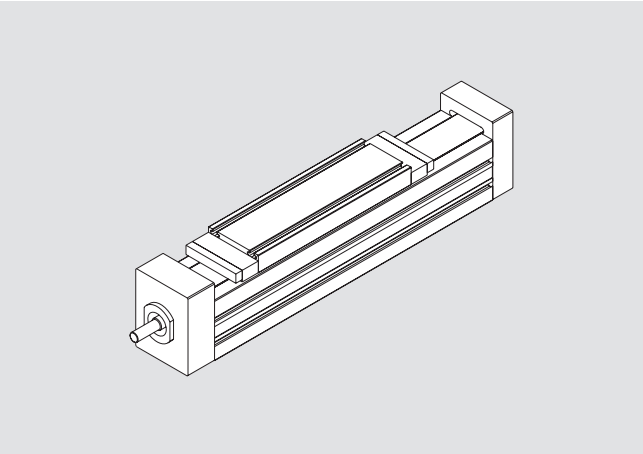
5) special execution preloaded

* without considering reversal backlash

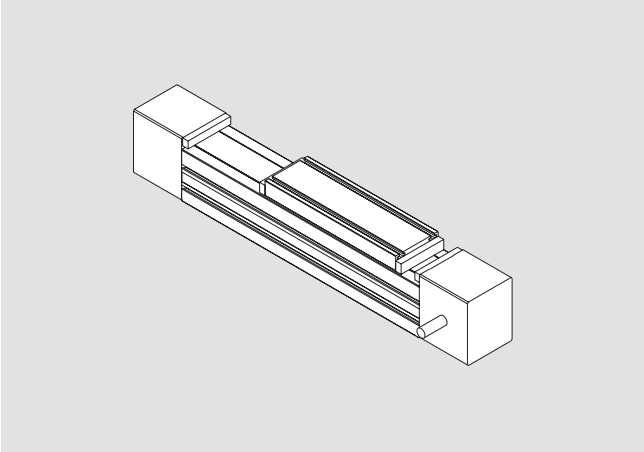
Mounting condition

The LINE TECH positioning systems can be purchased in various mounting conditions (picture 1 to 10). Depending on the drive selection there are different standard configurations available.

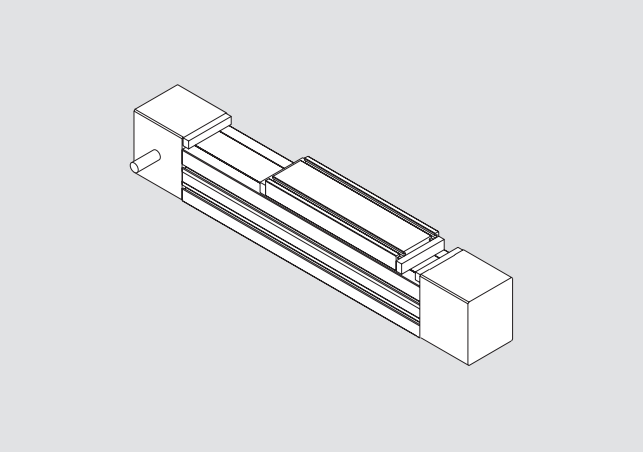
For the dimensions see page 36.



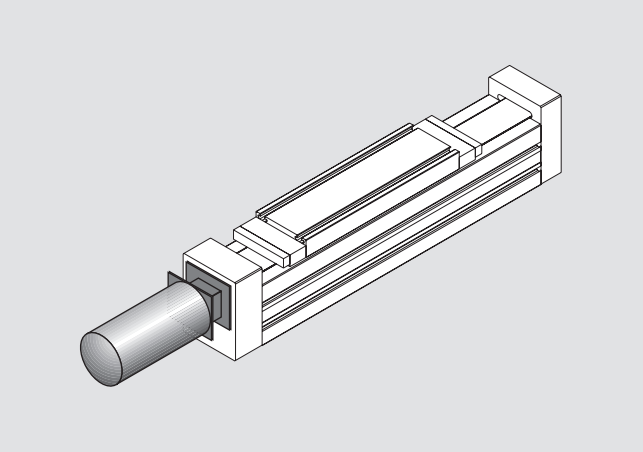
Picture 1: Free shaft end straight (Mounting condition 01)



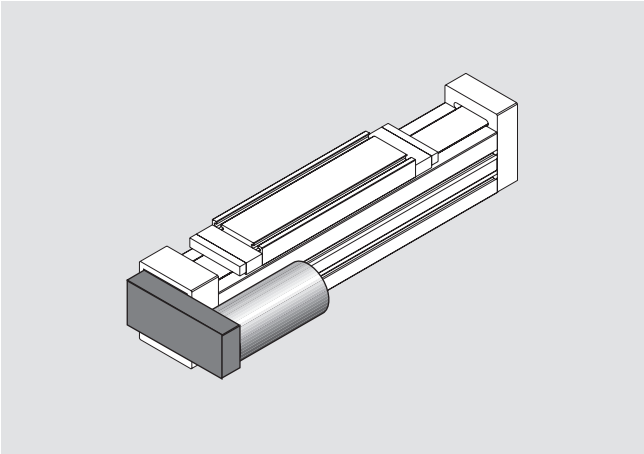
Picture 2: Free shaft end right hand side (Mounting condition 11)



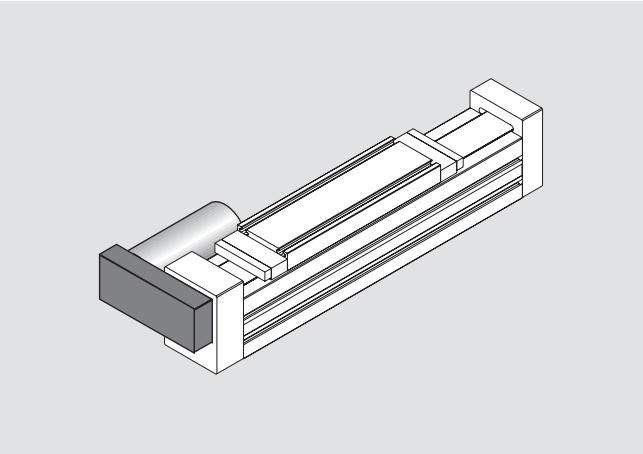
Picture 3: Free shaft end left hand side (Mounting condition 12)



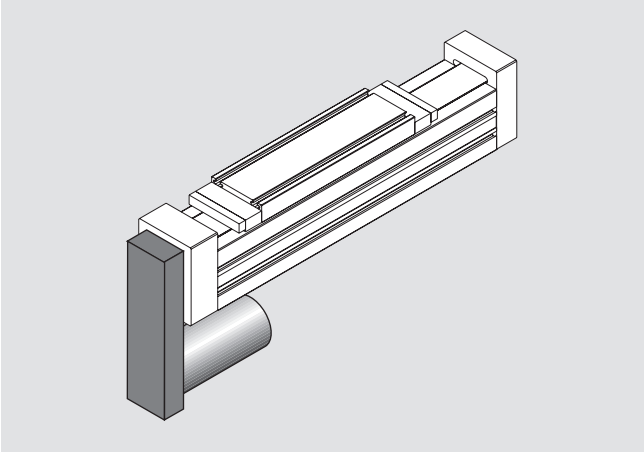
Picture 4: Screw drive with coupling and intermediate plate (Mounting condition 02)



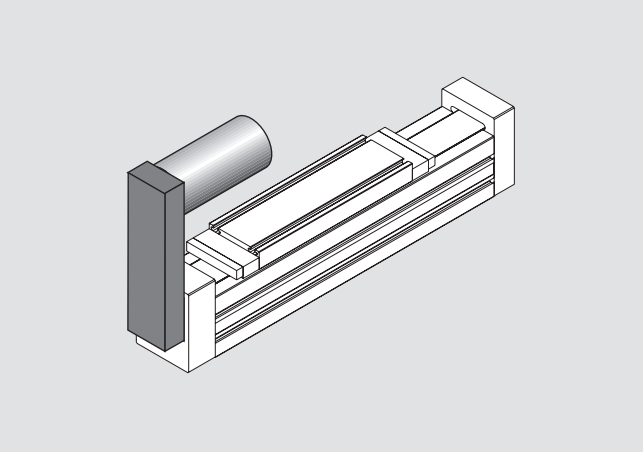
Picture 5: Screw drive with lateral drive mount left (Mounting condition 05)



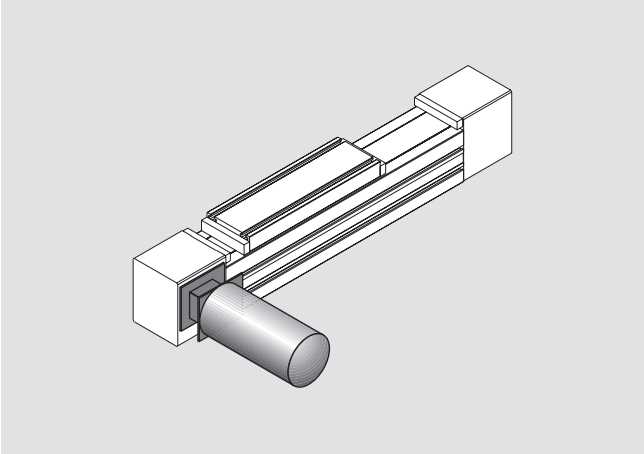
Picture 6: Screw drive with lateral drive mount right (Mounting condition 04)



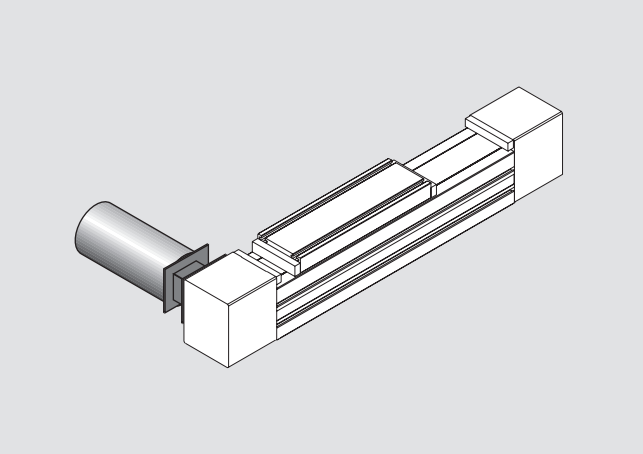
Picture 7: Screw drive with lateral drive mount bottom (Mounting condition 07)



Picture 8: Screw drive with lateral drive mount top (Mounting condition 06)



Picture 9: Belt drive left with coupling and intermediate plate (Mounting condition 14)



Picture 10: Belt drive right with coupling and intermediate plate (Mounting condition 13)

Selection evidence

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.

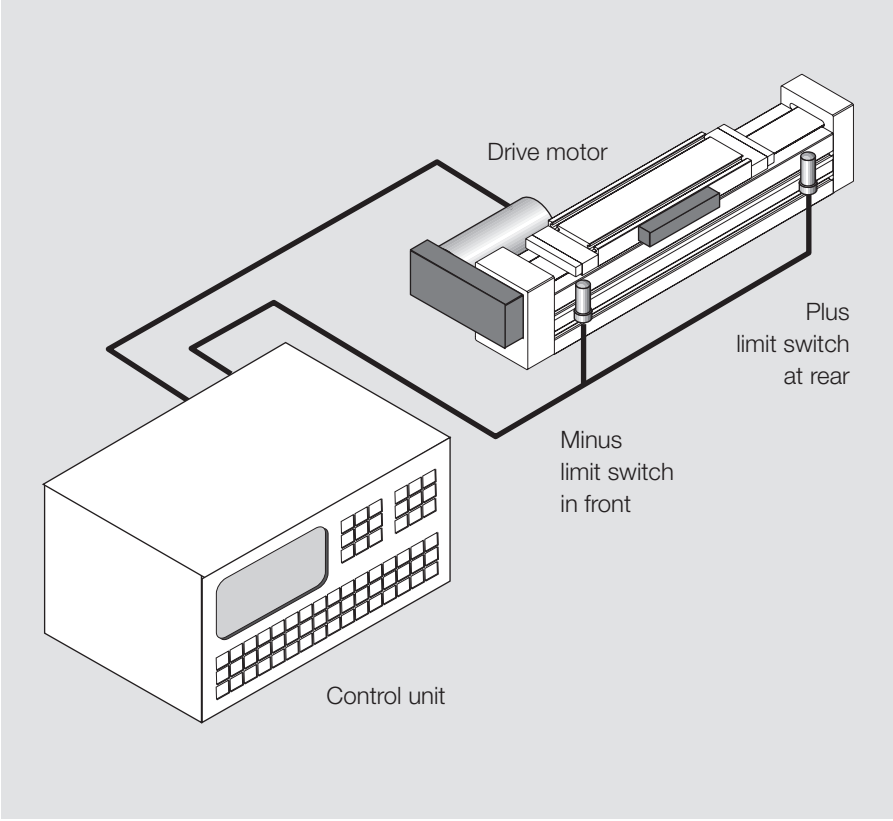
Fitting of the limit switches

The fitting position of the limit switches is shown in picture 12a. 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.

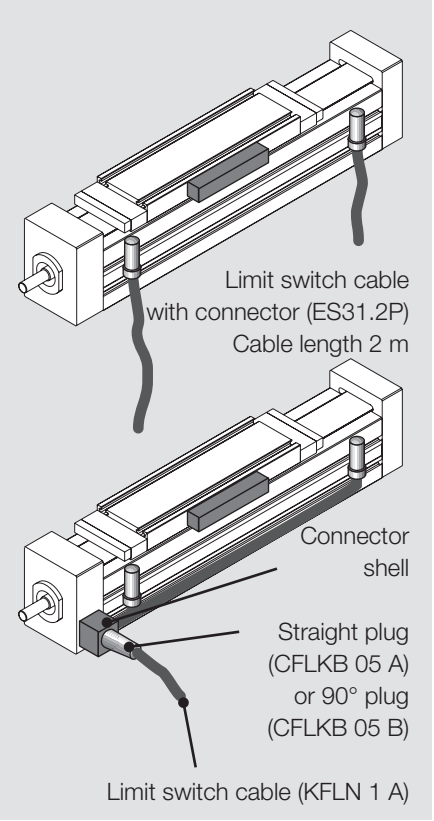
Limit switch-counterplugs with cable are not included in the delivery. However they can be ordered ready-made at LINE TECH (picture 11b).

On request the limit switches can be connected to a connector shell (picture 11b).

The limit switch cable (article ES31.2P) is equipped with a plug on one side.



Picture 11a: Fitting position of the limit switches



Picture 11b: Connector shell and cable

Load rate

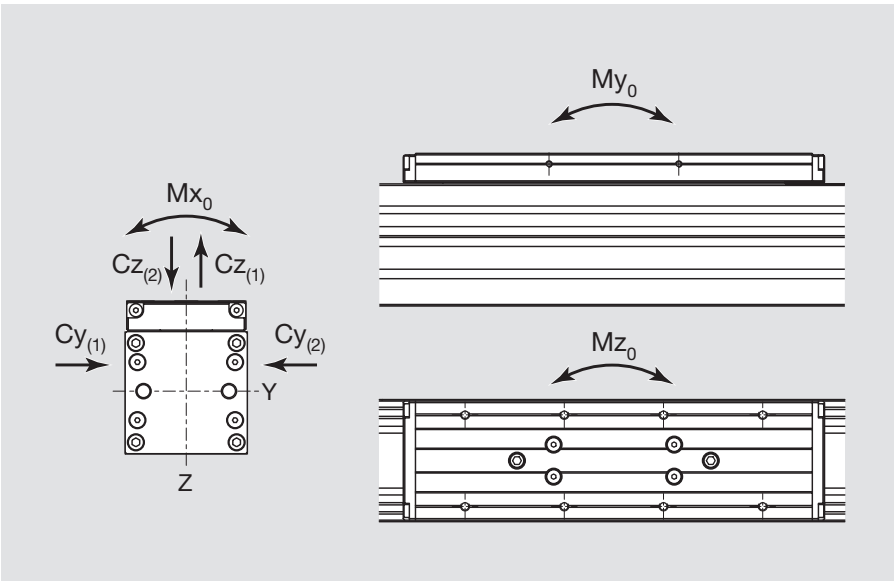
The load rate is given by the guiding system. Considering the requested life time we recommend to apply max. 20% of the dynamic load rate to the unit.

Torque

Also for the torque, the values are determined by the execution of the guiding system. The illustration at right (picture 12) shows the directions of possible torque application.

Area momentum

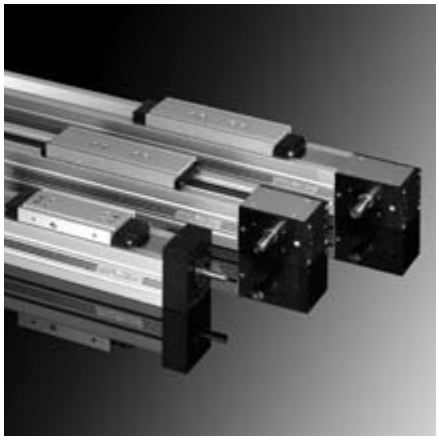
For positioning units the maximum allowed deflection angle is of 5'. This value being exceeded will have an impact on the unit's life-cycle.



Picture 12: Directions of possible torque application

Type	Drive	Load rates dynamic				Load rates static				Torques static			Area momentum	
		$Cy_{(1)}$ [kN]	$Cy_{(2)}$	$Cz_{(1)}$	$Cz_{(2)}$	$Cy_{0\,(1)}$ [kN]	$Cy_{0\,(2)}$	$Cz_{0\,(1)}$	$Cz_{0\,(2)}$	Mx_0 [Nm]	My_0	Mz_0	Iy_s [cm^4]	Iz_s
LM3	Screw drive	14.6	14.6	16.7	16.7	21.2	21.2	25.3	33.8	170	1'483	1'245	64.5	81.7
LM3	Toothed belt	14.6	14.6	16.7	16.7	21.2	21.2	25.3	33.8	170	1'330	1'117	66.9	82.4
RM3.4	Toothed belt	7.3	7.3	2.1	2.1	4.5	4.5	1.1	1.1	16	82	169	67.2	87.0
RM3.6	Toothed belt	11.0	11.0	3.2	3.2	6.8	6.8	1.6	1.6	24	118	184	67.2	87.0
LM4	Screw drive	20.5	20.5	23.4	23.4	29.6	29.6	35.2	47.0	320	1'827	1'535	106.5	152.7
LM4	Toothed belt	20.5	20.5	23.4	23.4	29.6	29.6	35.2	47.0	320	2'590	2'176	131.2	197.8
RM4.4	Toothed belt	17.1	17.1	5.0	5.0	10.2	10.2	2.4	2.4	31	233	484	134.2	209.1
RM4.6	Toothed belt	25.7	25.7	7.5	7.5	15.3	15.3	3.6	3.6	47	344	533	134.2	209.1
LM5	Screw drive	33.0	33.0	37.6	37.6	45.9	45.9	54.7	73.0	572	3'476	2'920	432.7	594.0
LM5	Toothed belt	33.0	33.0	37.6	37.6	45.9	45.9	54.7	73.0	572	5'803	4'874	451.9	623.9
RM5.4	Toothed belt	31.2	31.2	9.1	9.1	18.2	18.2	4.3	4.3	22	529	1'000	451.9	669.6
RM5.6	Toothed belt	46.8	46.8	13.6	13.6	27.3	27.3	6.5	6.5	32	983	1'528	451.9	669.6

Size 65



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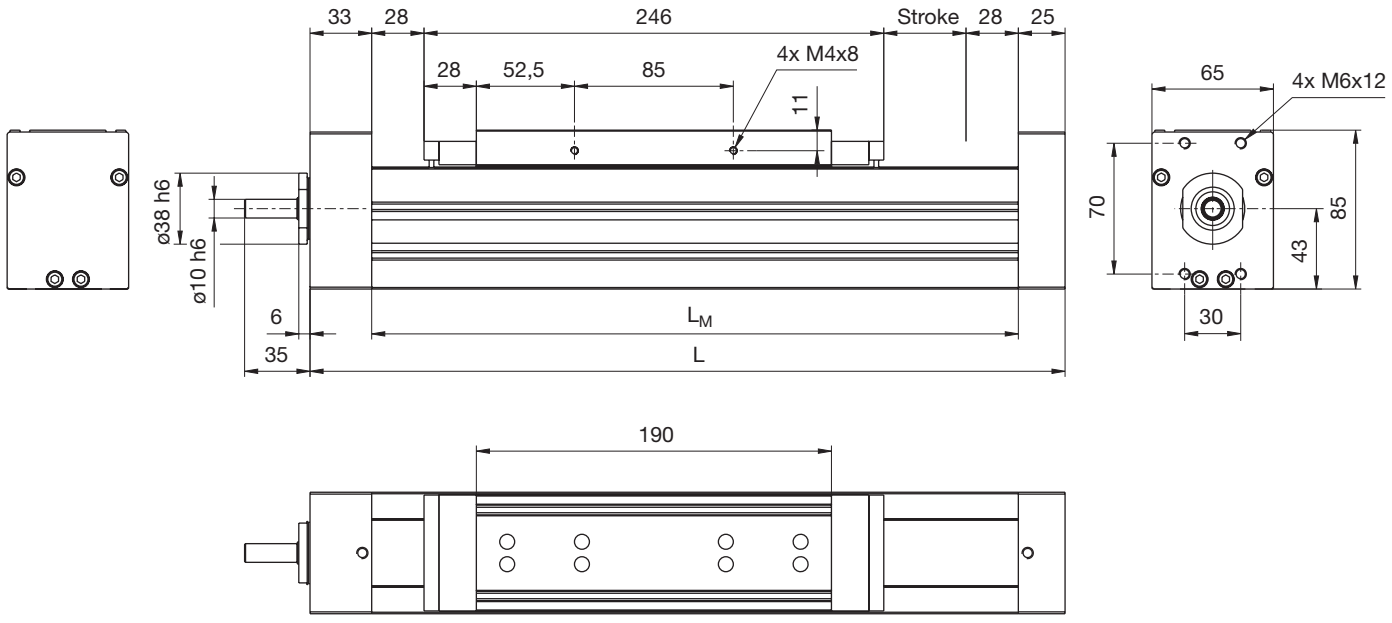
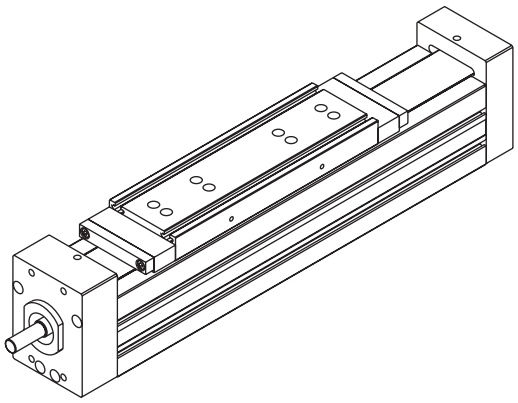
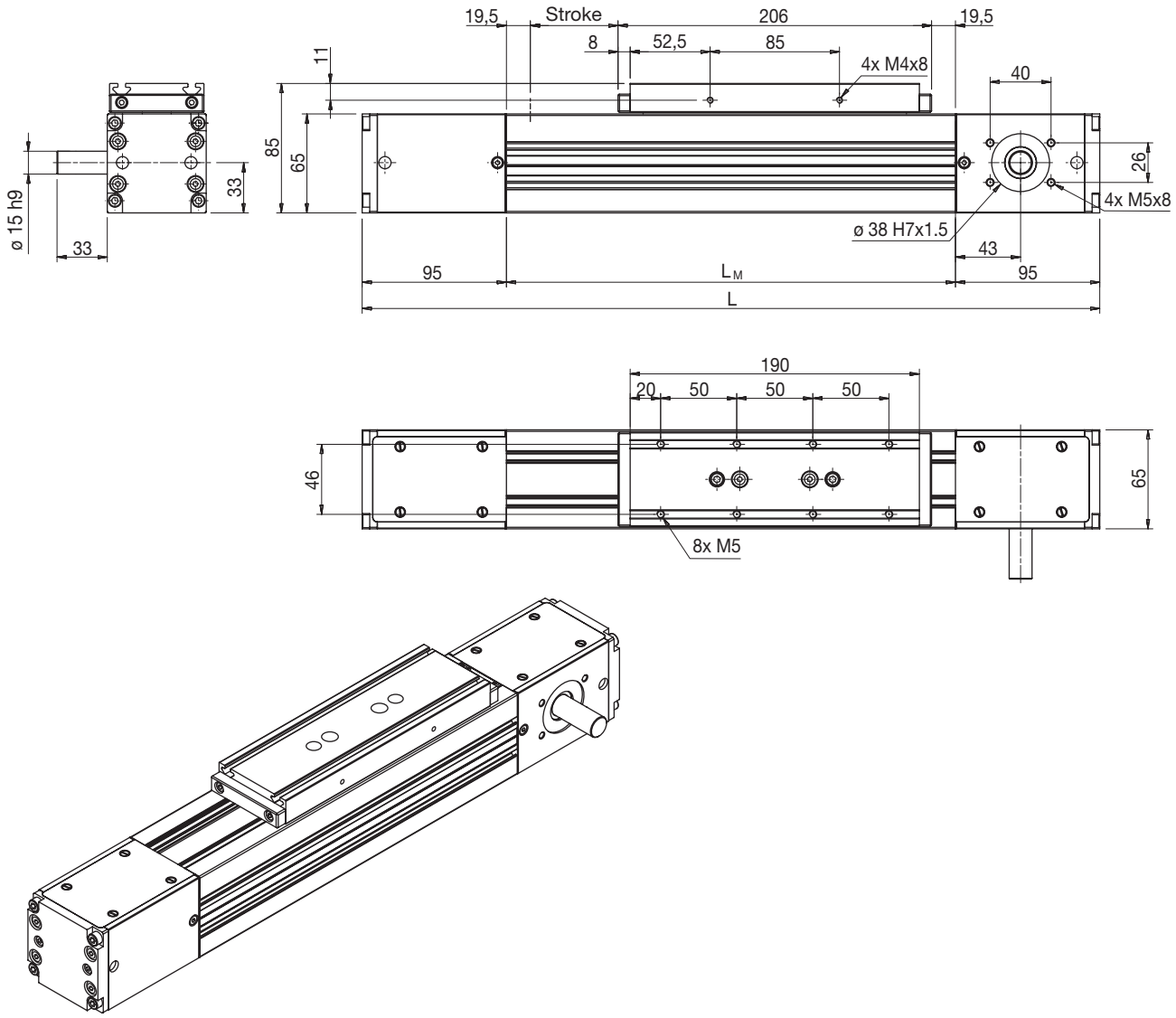




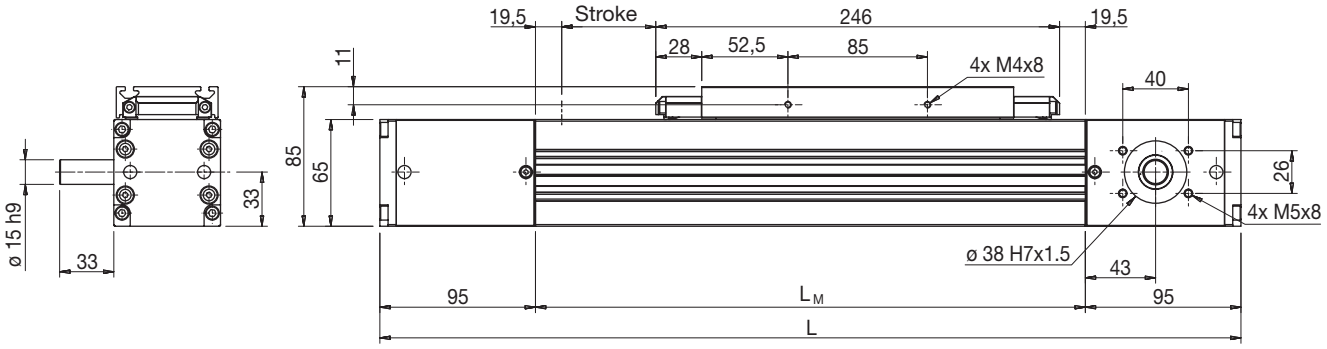
Nominal size	***Dimensions***				
Designation	L [mm]	L_M	Screw length	Length steel strapping	Weight [kg]
LM3.2.____	Stroke + 360	L – 58	L + 25	L – 18	4,6 kg + 0,65 kg/100 mm Stroke

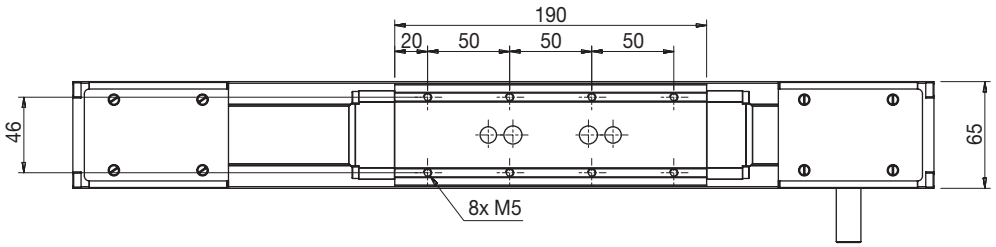
with linear rail guiding system and toothed belt drive *(without protection)*

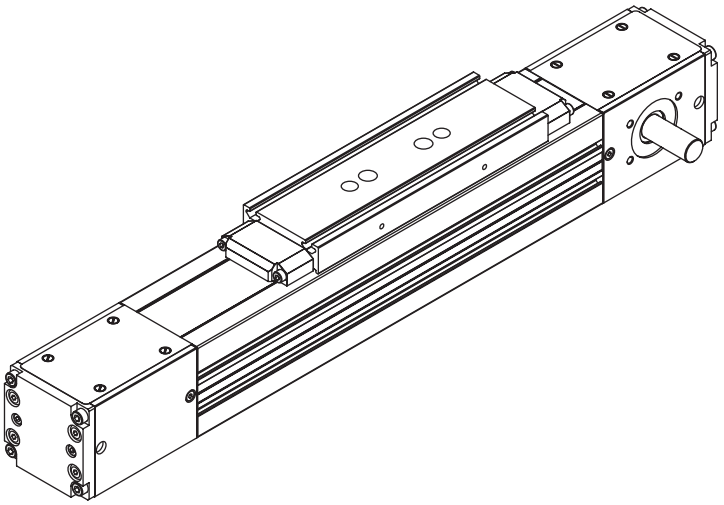


Nominal size Designation	*Dimensions* L [mm]	L_M	Belt length	Weight [kg]
LM3.2.____NZ	Stroke + 435	L – 190	2 x Stroke + 730	4,5 kg + 0,60 kg/100 mm Stroke

with linear rail guiding system and toothed belt drive *(with steel strapping)*

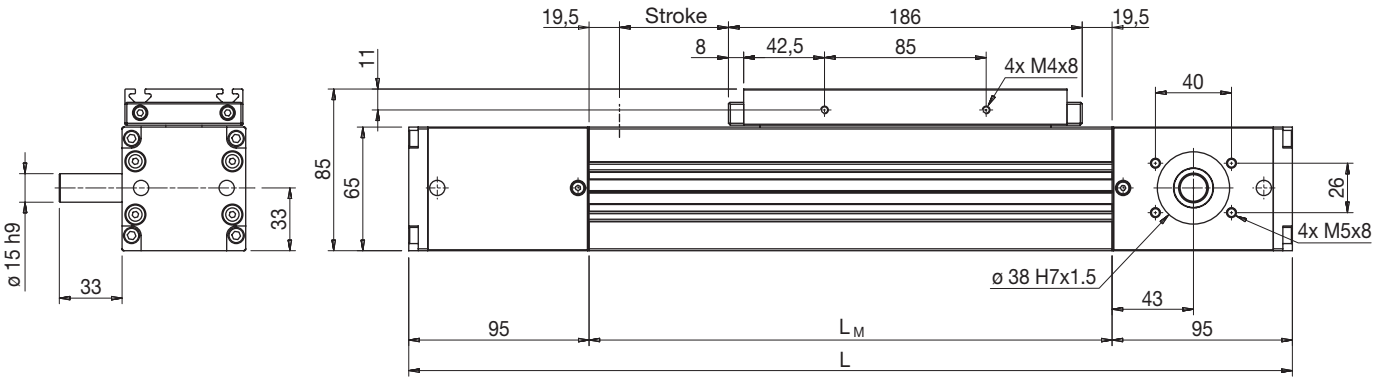


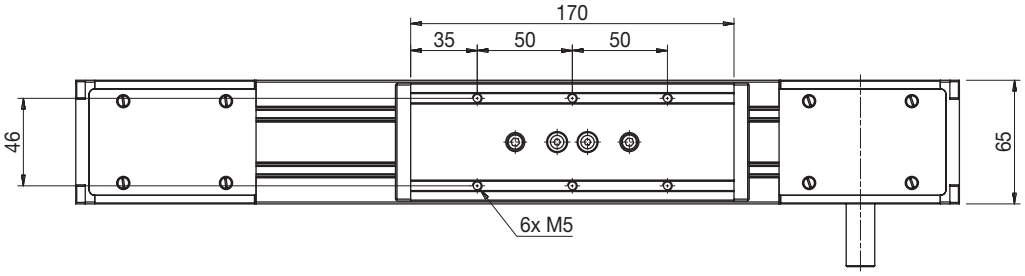


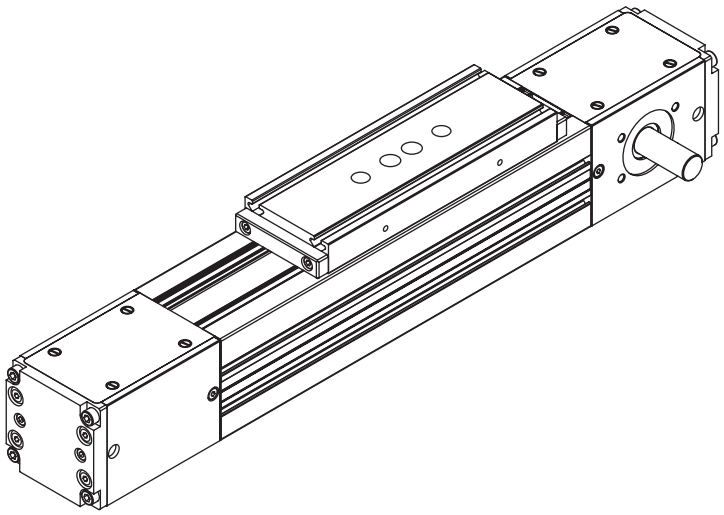


Nominal size	***Dimensions***				
Designation	L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
LM3.2.____BZ	Stroke + 475	L – 190	2 x Stroke + 810	L – 10	4,8 kg + 0,60 kg/100 mm Stroke

with roller guides (with 4 rolls) and toothed belt drive *(without protection)*

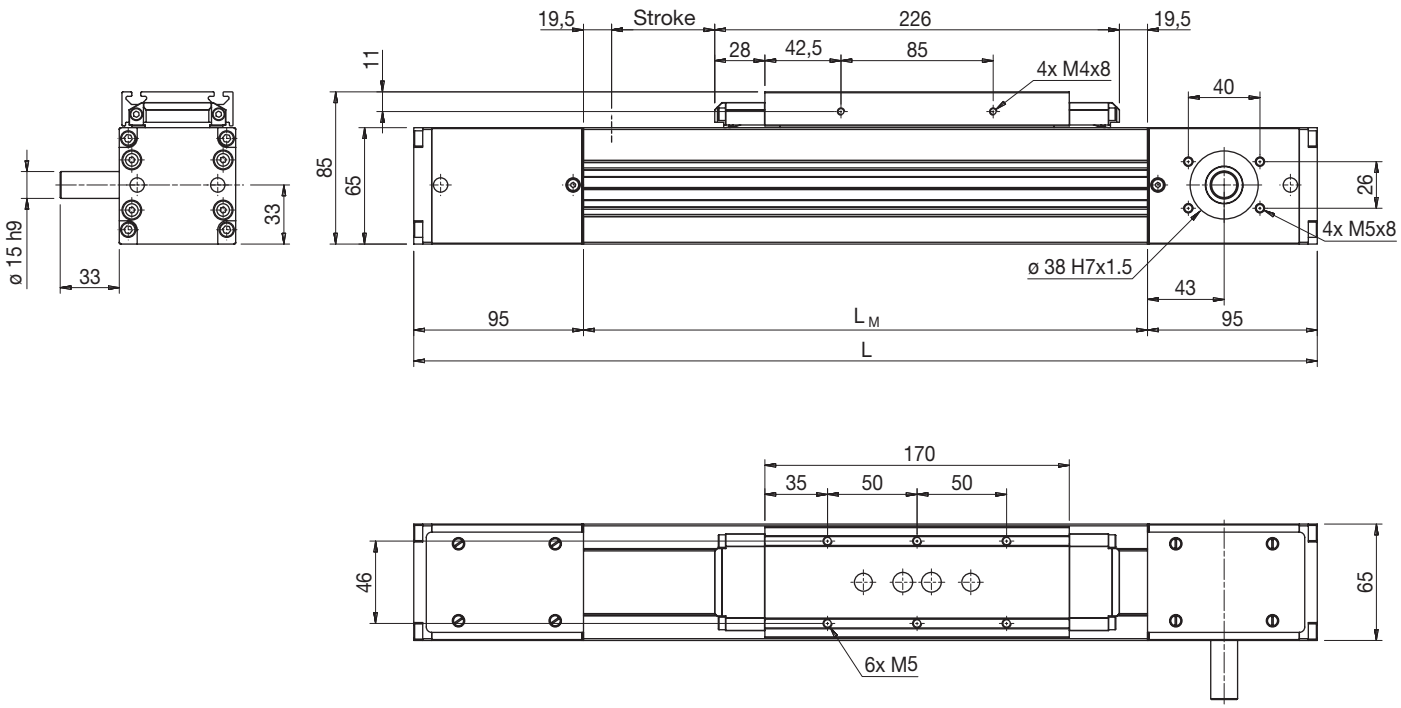


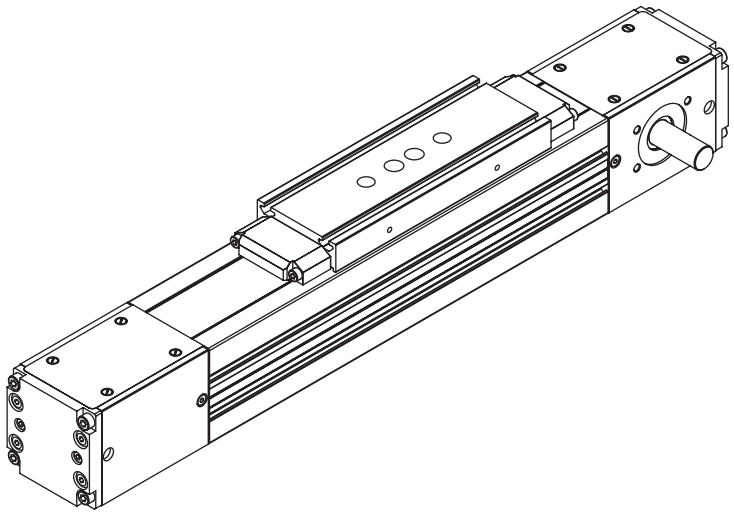




Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
RM3.4.____NZ	Stroke + 415	L – 190	2 x Stroke + 710	4,4 kg + 0,53 kg/100 mm Stroke

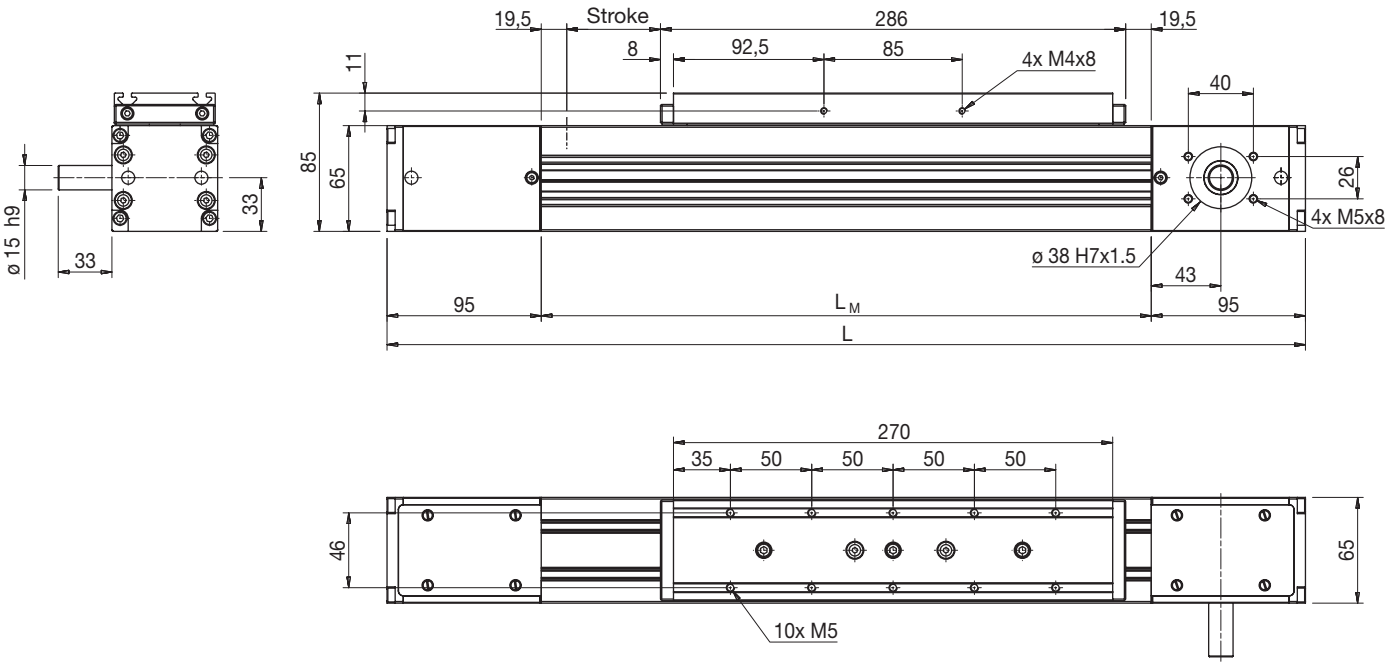
with roller guides (with 4 rolls) and toothed belt drive *(with steel strapping)*

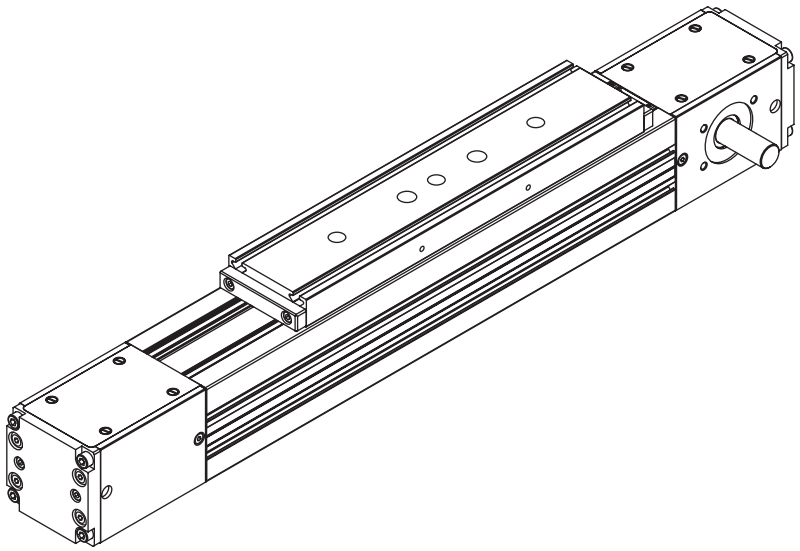




Nominal size Designation	*Dimensions* L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM3.4.____BZ	Stroke + 455	L – 190	2 x Stroke + 790	L – 10	4,7 kg + 0,54 kg/100 mm Stroke

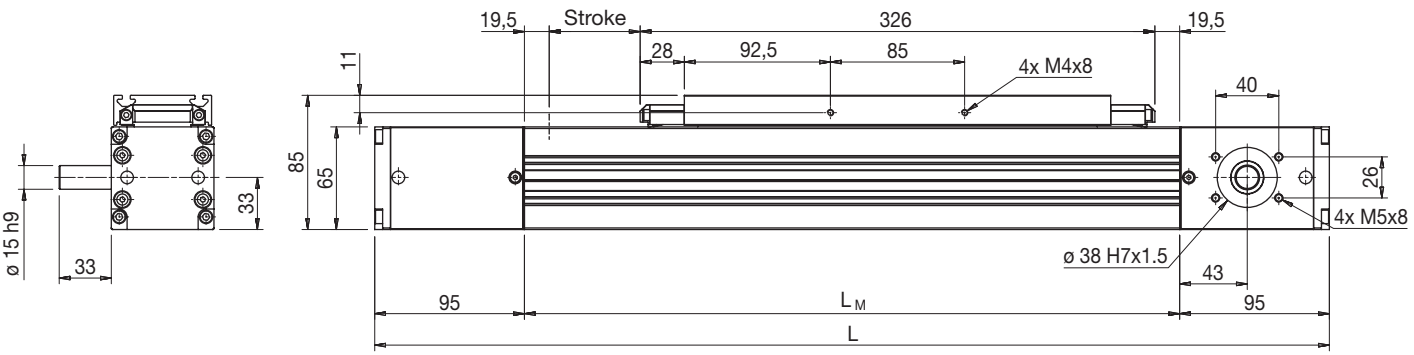
with roller guides (with 6 rolls) and toothed belt drive *(without protection)*

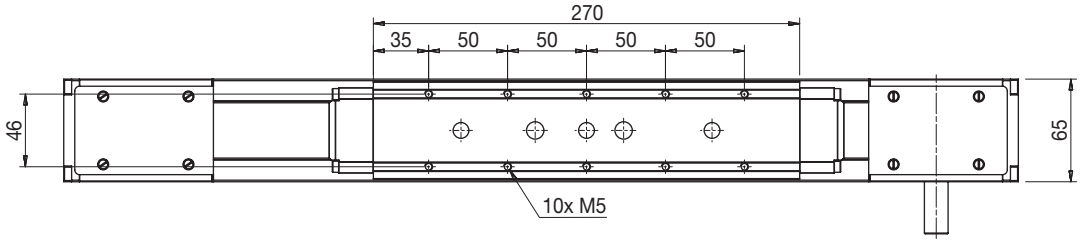


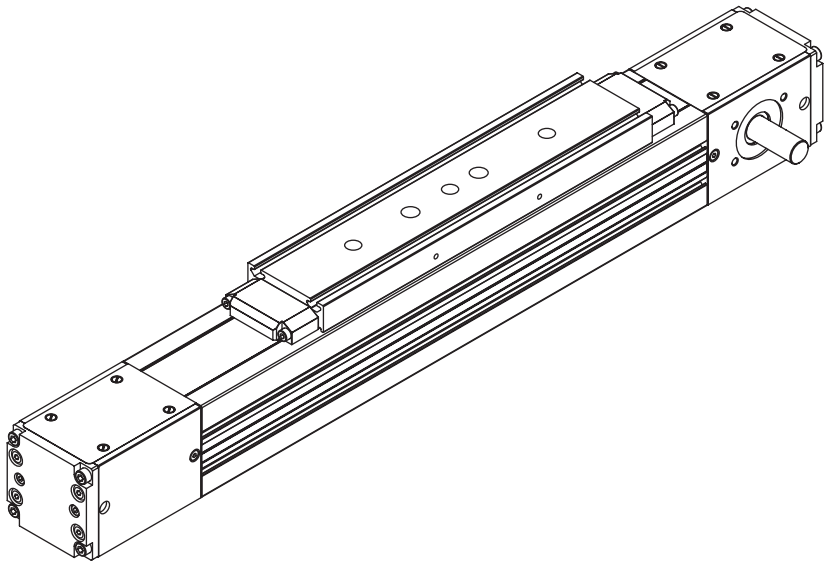


Nominal size Designation	*Dimensions* L [mm]	L_M	Belt length	Weight [kg]
RM3.6.____NZ	Stroke + 515	L – 190	2 x Stroke + 910	4,9 kg + 0,53 kg/100 mm Stroke

with roller guides (with 6 rolls) and toothed belt drive *(with steel strapping)*







Nominal size	***Dimensions***				
Designation	L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM3.6.____BZ	Stroke + 555	L – 190	2 x Stroke + 990	L – 10	5,2 kg + 0,54 kg/100 mm Stroke

Size 80

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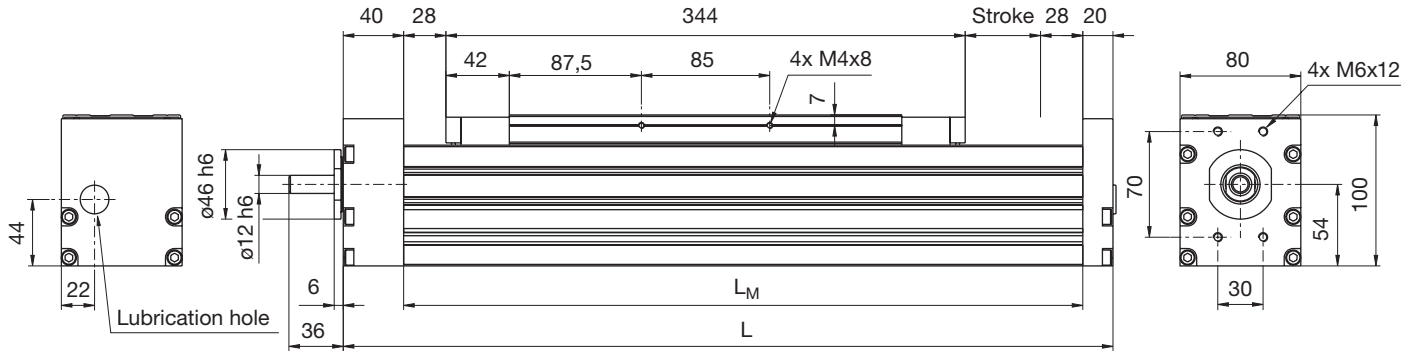
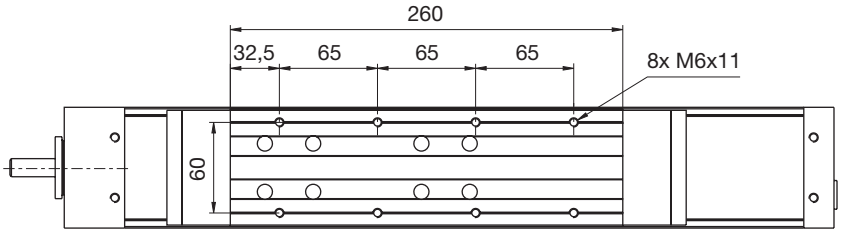
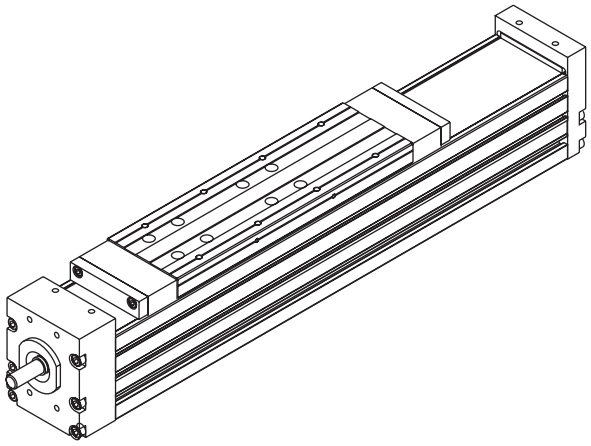
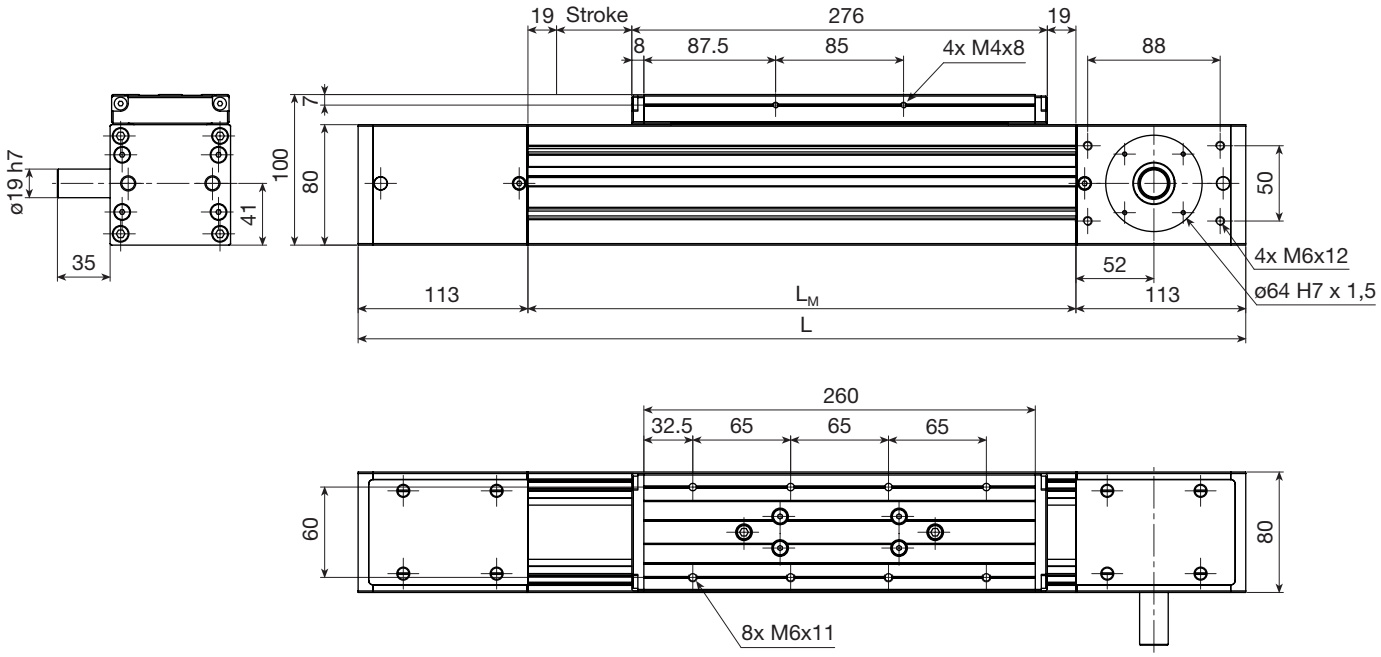


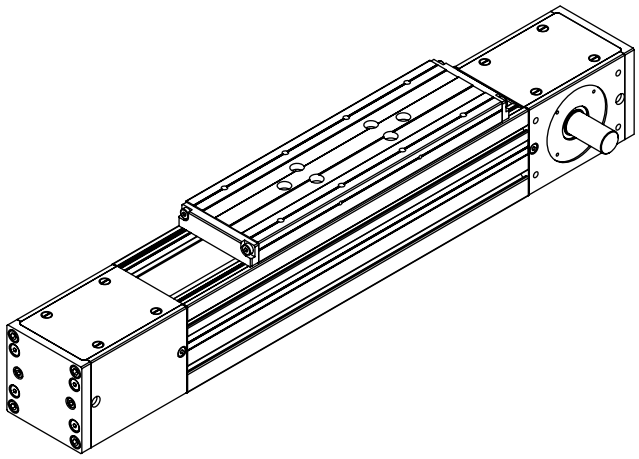




Nominal size Designation	*Dimensions* L [mm]	L_M	Screw length	Length steel strapping	Weight [kg]
LM4.2.____	Stroke + 460	L – 60	L + 30	L – 28	7,8 kg + 0,95 kg/100 mm Stroke

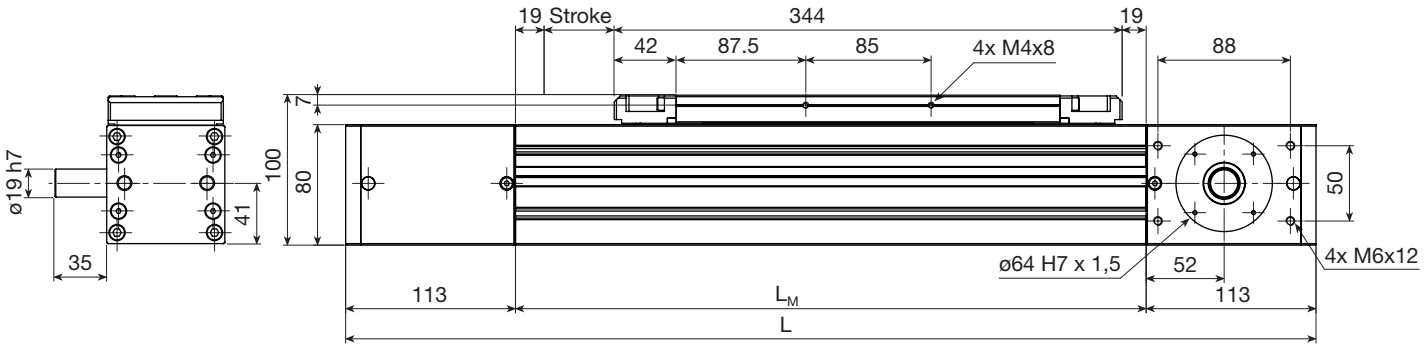
with linear rail guiding system and toothed belt drive *(without protection)*

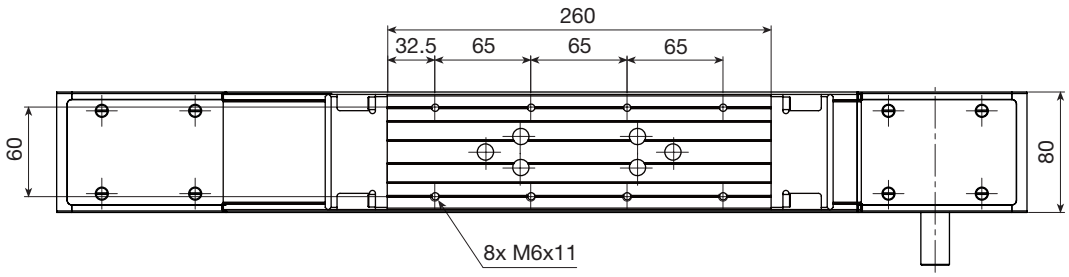


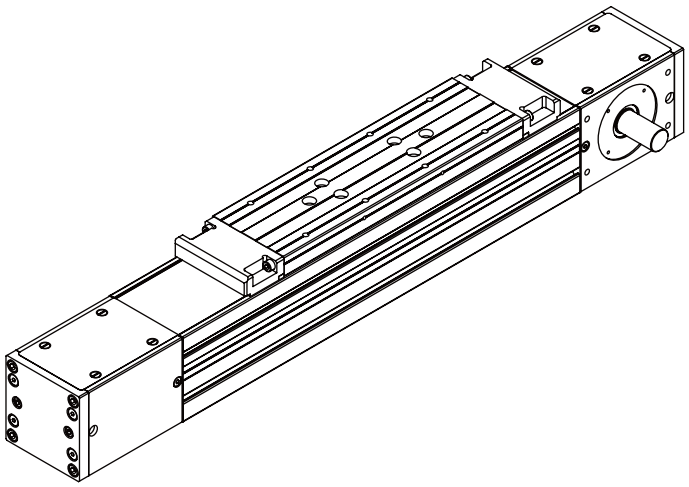


Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
LM4.2.____NZ	Stroke + 540	L – 226	2 x Stroke + 900	8,4 kg + 0,93 kg/100 mm Stroke

with linear rail guiding system and toothed belt drive *(with steel strapping)*

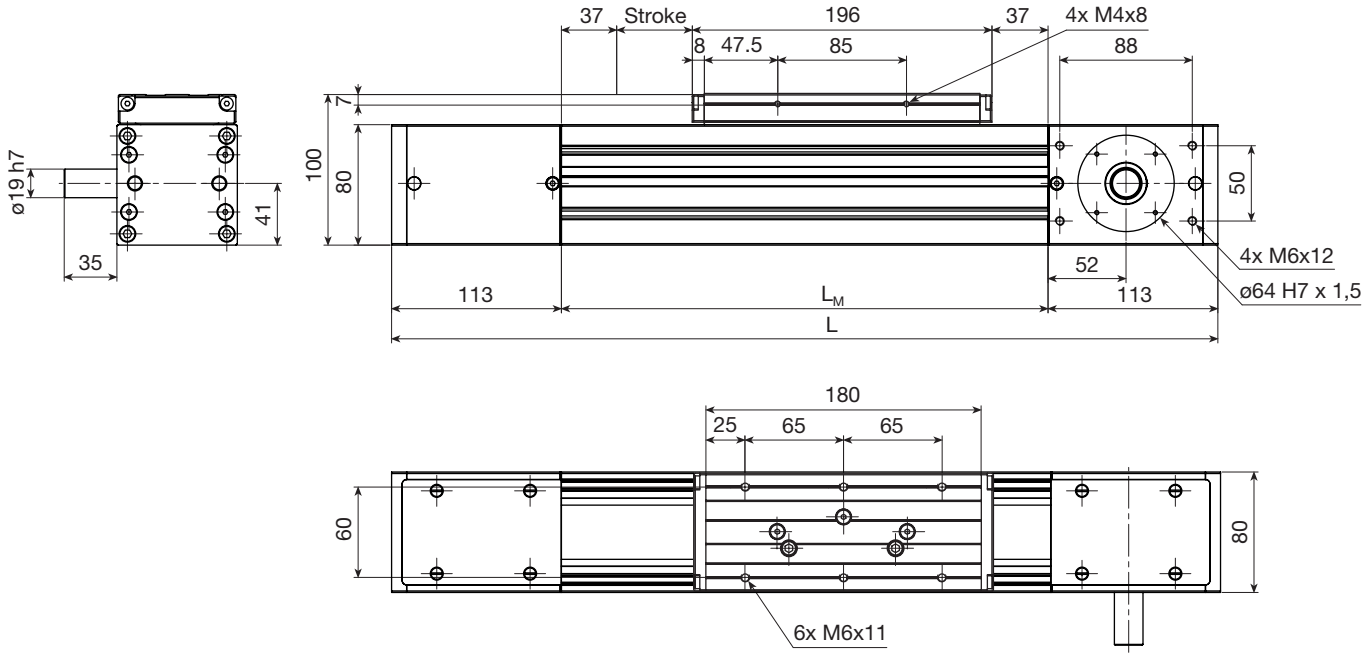


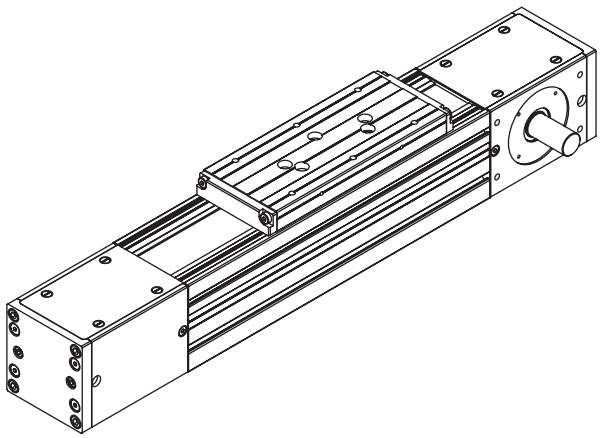




Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
LM4.2.____BZ	Stroke + 608	L – 226	2 x Stroke + 1040	L – 12	9,1 kg + 0,95 kg/100 mm Stroke

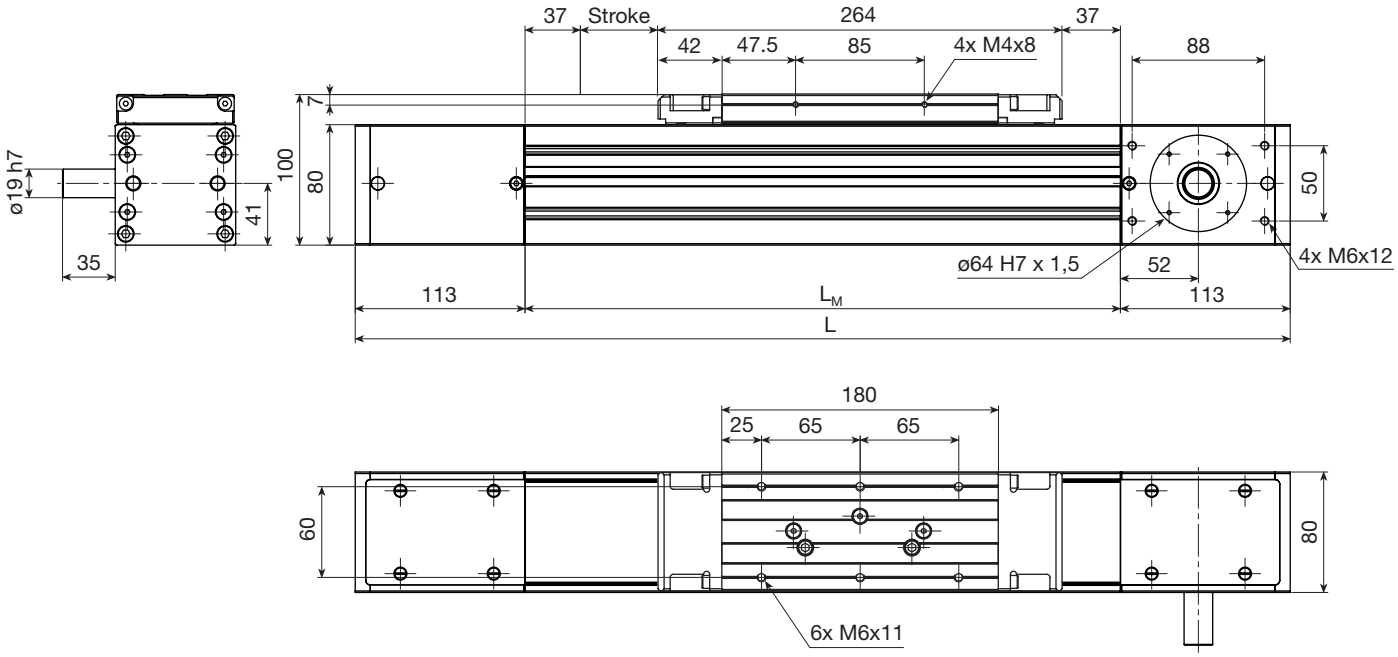
with roller guides (with 4 rolls) and toothed belt drive *(without protection)*

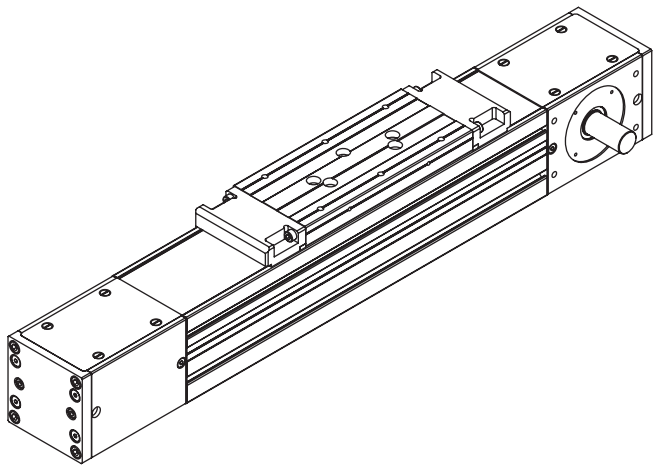




Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
RM4.4.____NZ	Stroke + 496	L – 226	2 x Stroke + 860	7,4 kg + 0,81 kg/100 mm Stroke

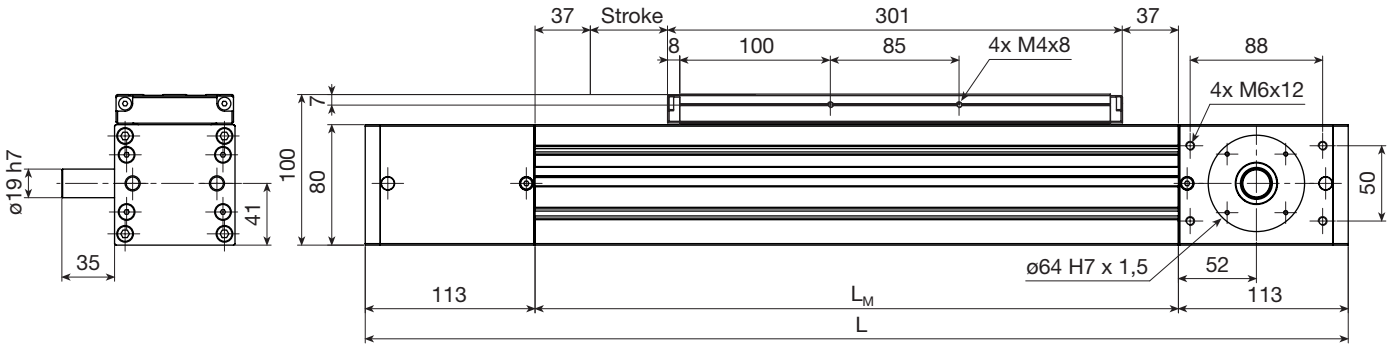
with roller guides (with 4 rolls) and toothed belt drive *(with steel strapping)*

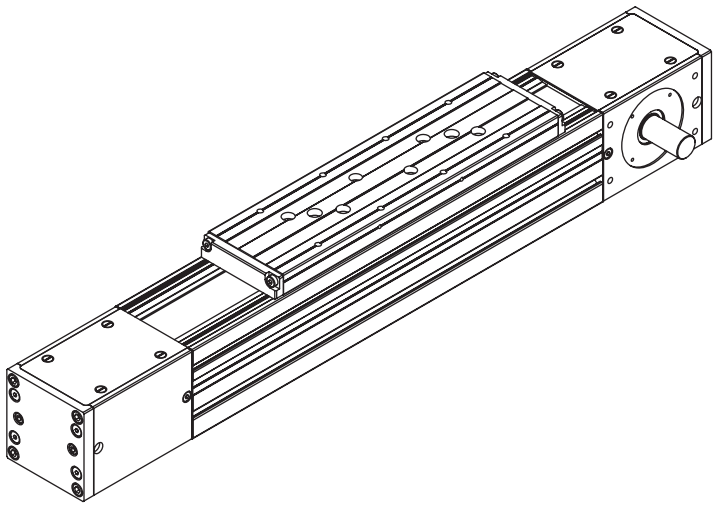




Nominal size Designation	*Dimensions* L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM4.4.____BZ	Stroke + 564	L – 226	2 x Stroke + 995	L – 12	8,2 kg + 0,83 kg/100 mm Stroke

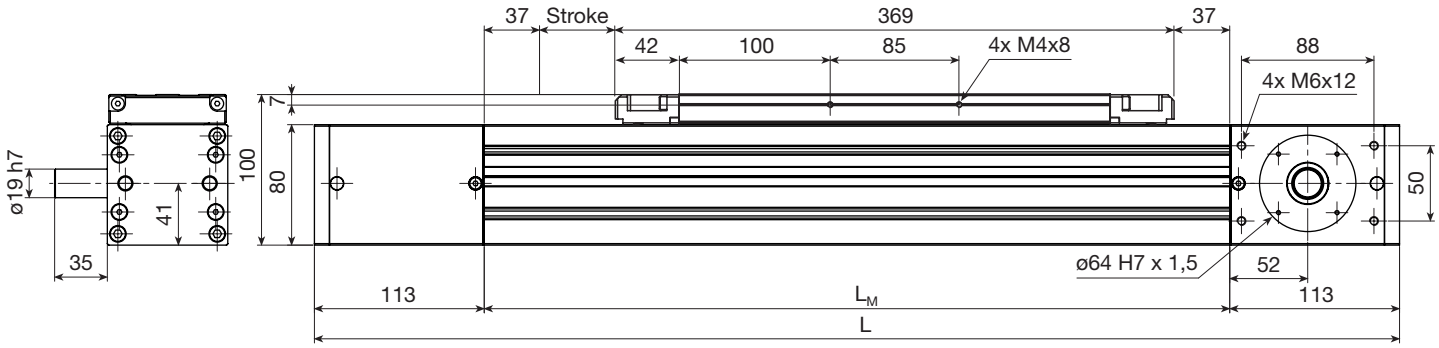
with roller guides (with 6 rolls) and toothed belt drive *(without protection)*

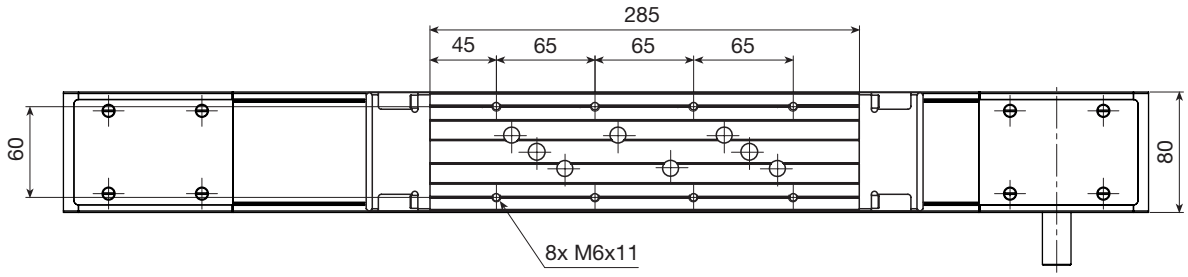


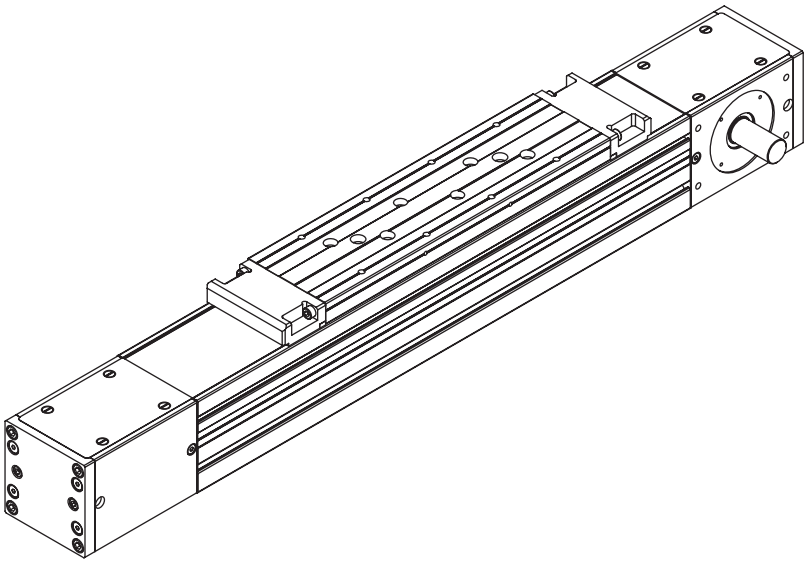


Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
RM4.6.____NZ	Stroke + 601	L – 226	2 x Stroke + 965	9,2 kg + 0,81 kg/100 mm Stroke

with roller guides (with 6 rolls) and toothed belt drive *(with steel strapping)*

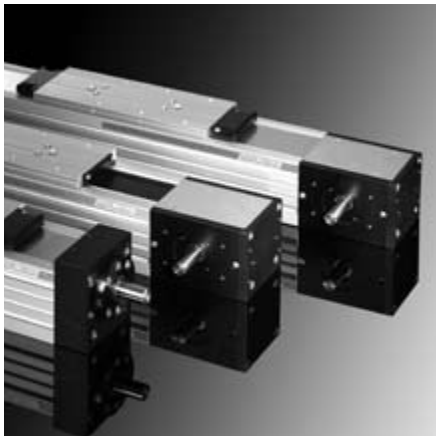






Nominal size	***Dimensions***				
Designation	L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM4.6.____BZ	Stroke + 669	L – 226	2 x Stroke + 1100	L – 12	10,0 kg + 0,83 kg/100 mm Stroke

Size 110



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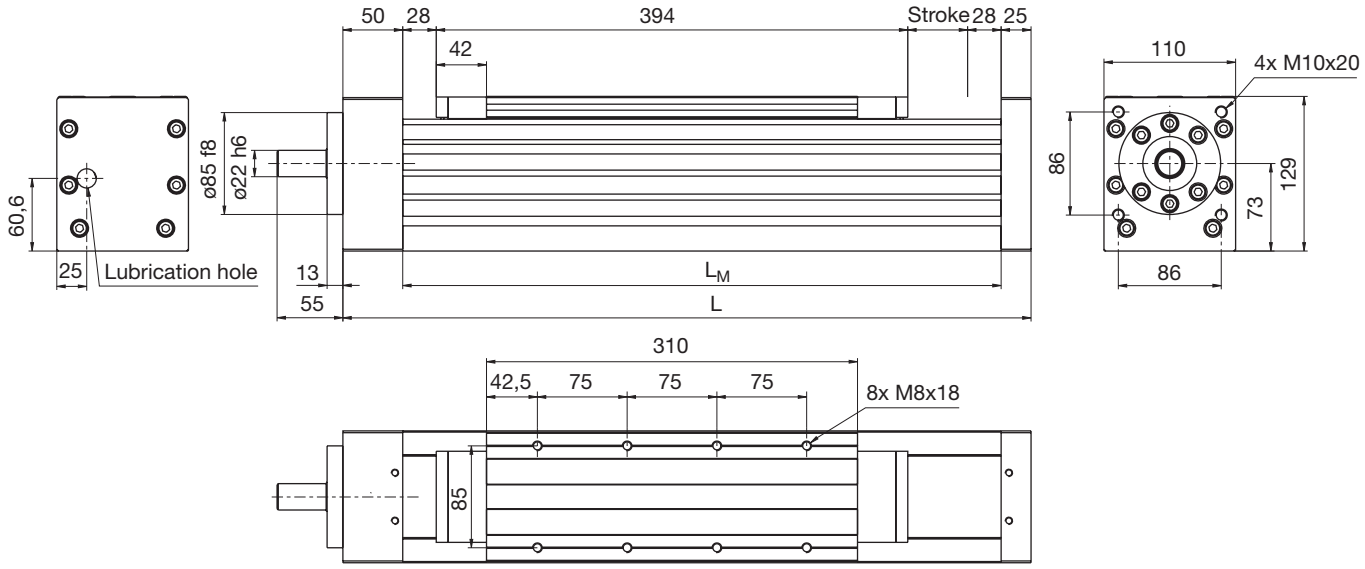
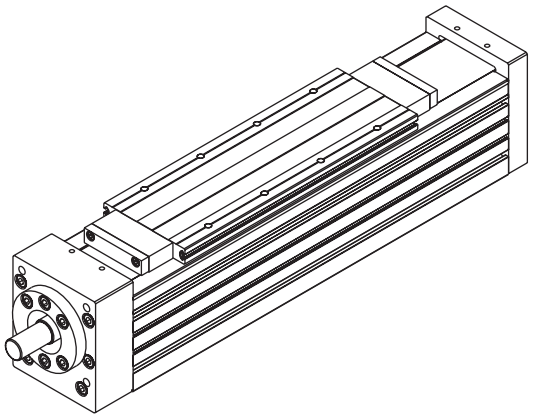
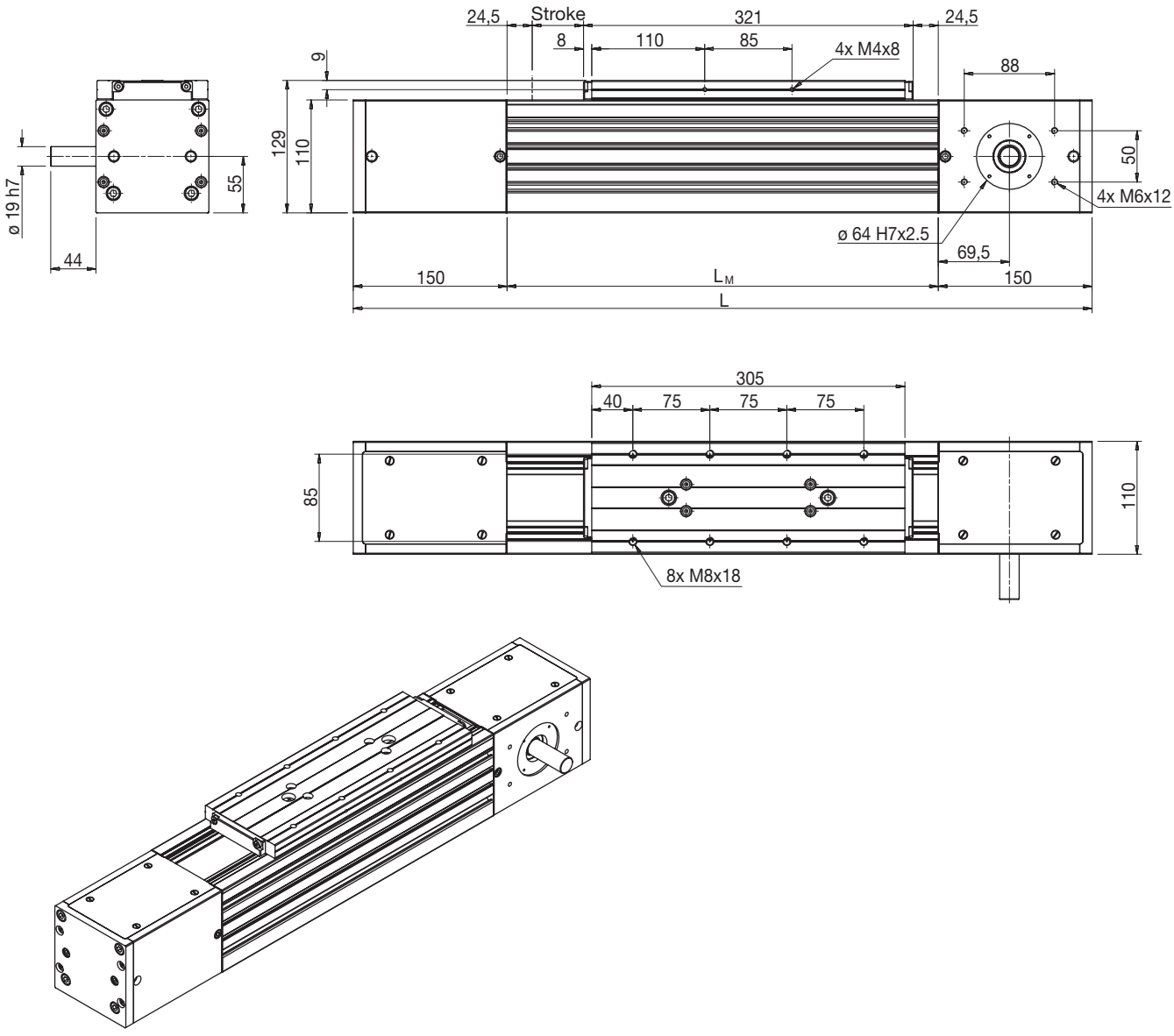




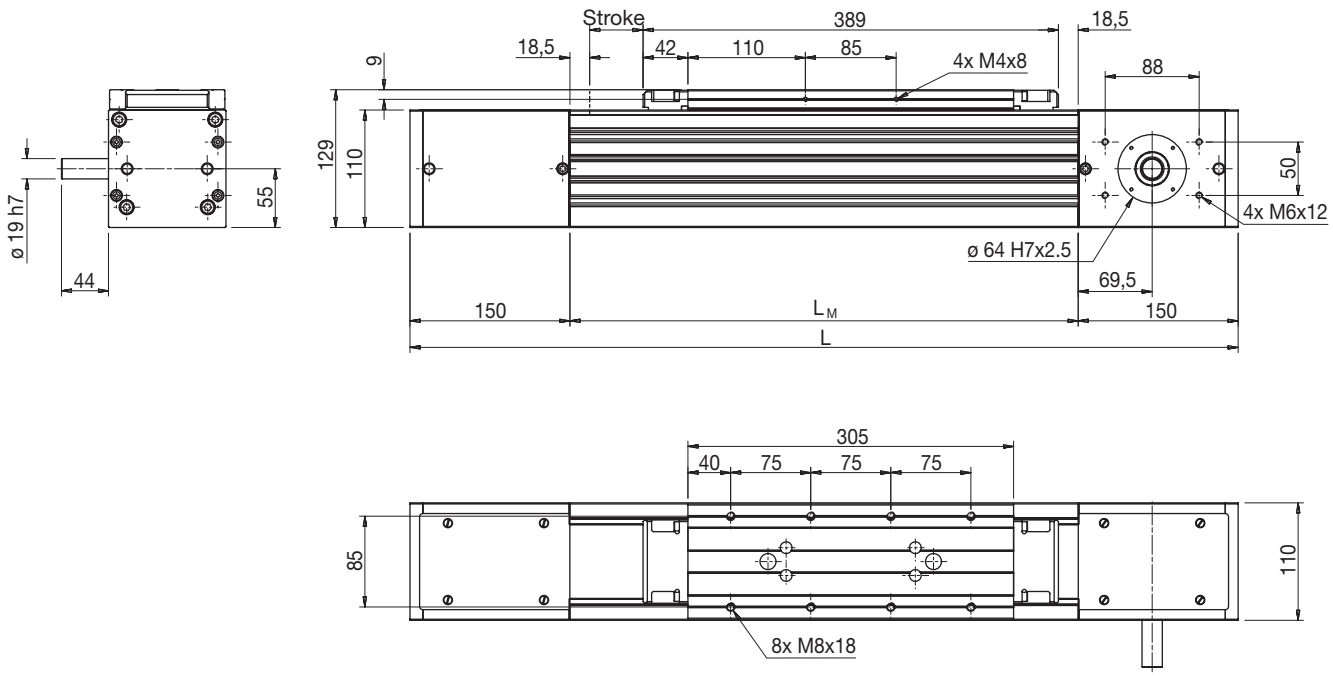
Nominal size Designation	*Dimensions* L [mm]	L_M	Screw length	Length steel strapping	Weight [kg]
LM5.2.____	Stroke + 525	L – 75	L + 50	L – 30	16,8 kg + 1,90 kg/100 mm Stroke

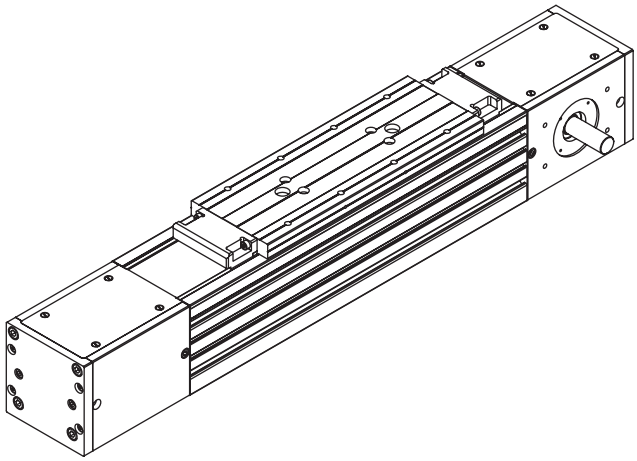
with linear rail guiding system and toothed belt drive *(without protection)*



Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
LM5.2.____NZ	Stroke + 670	L – 300	2 x Stroke + 1144	18,6 kg + 1,48 kg/100 mm Stroke

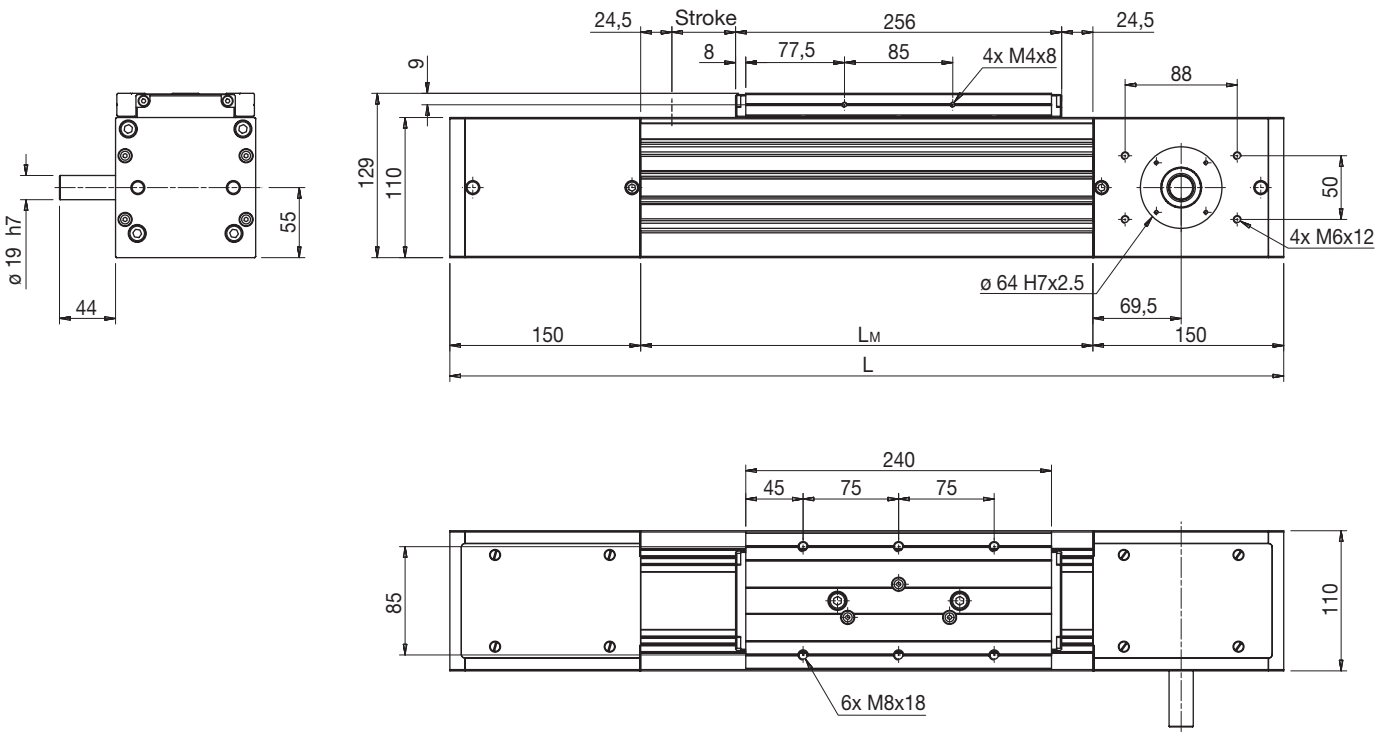
with linear rail guiding system and toothed belt drive *(with steel strapping)*

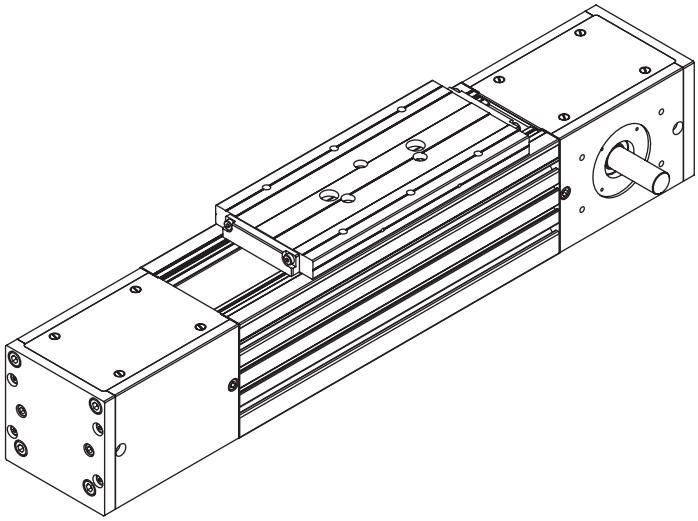




Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
LM5.2.____BZ	Stroke + 726	L – 300	2 x Stroke + 1256	L – 14	19,5 kg + 1,50 kg/100 mm Stroke

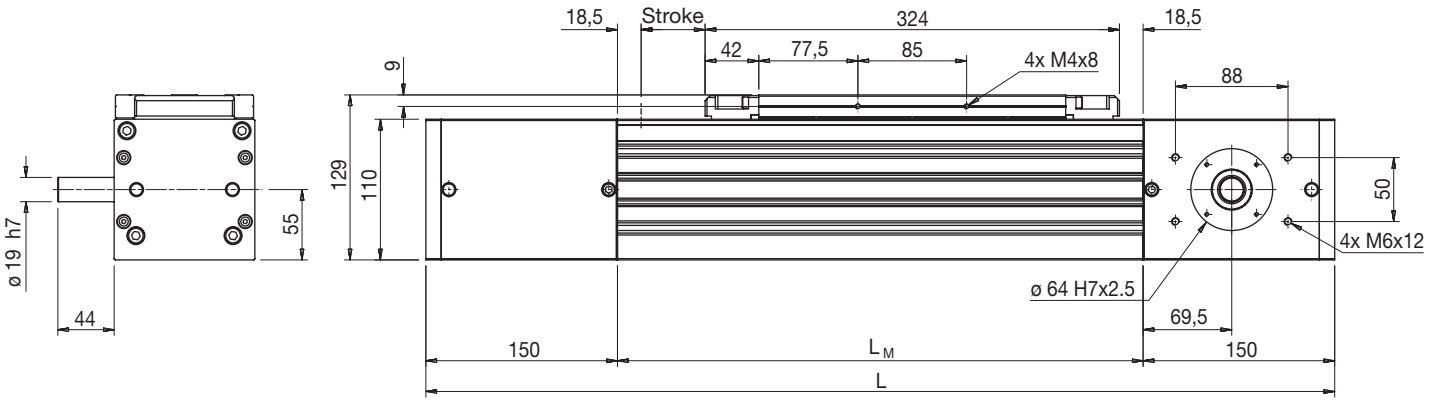
with roller guides (with 4 rolls) and toothed belt drive *(without protection)*

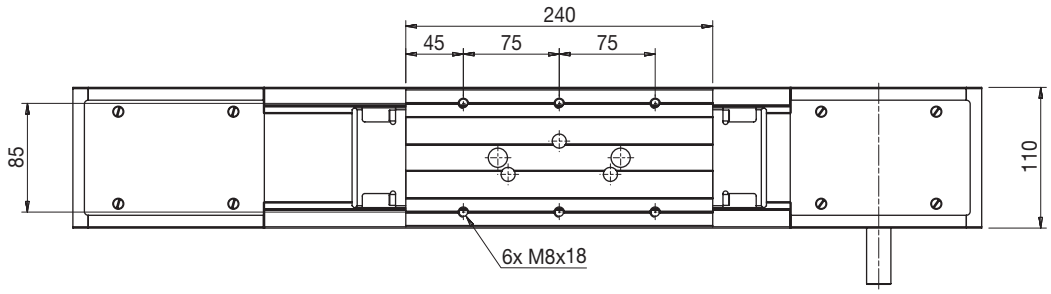


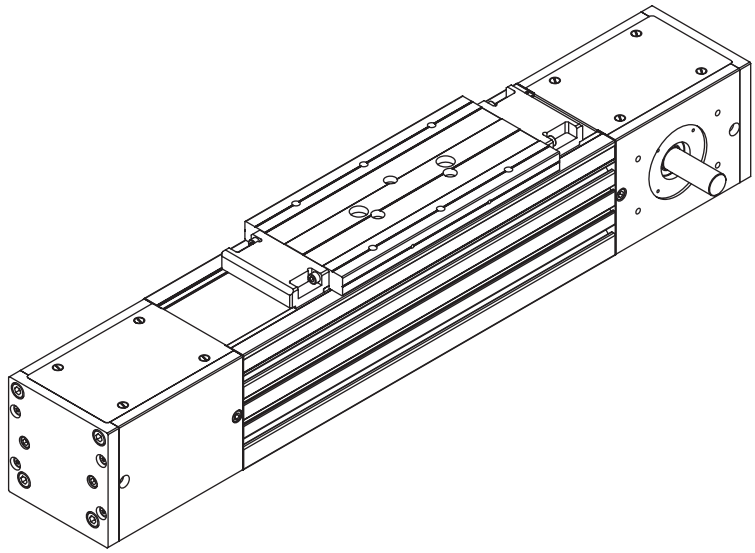


Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Weight [kg]
RM5.4.____NZ	Stroke + 605	L – 300	2 x Stroke + 1080	17,3 kg + 1,46 kg/100 mm Stroke

with roller guides (with 4 rolls) and toothed belt drive *(with steel strapping)*

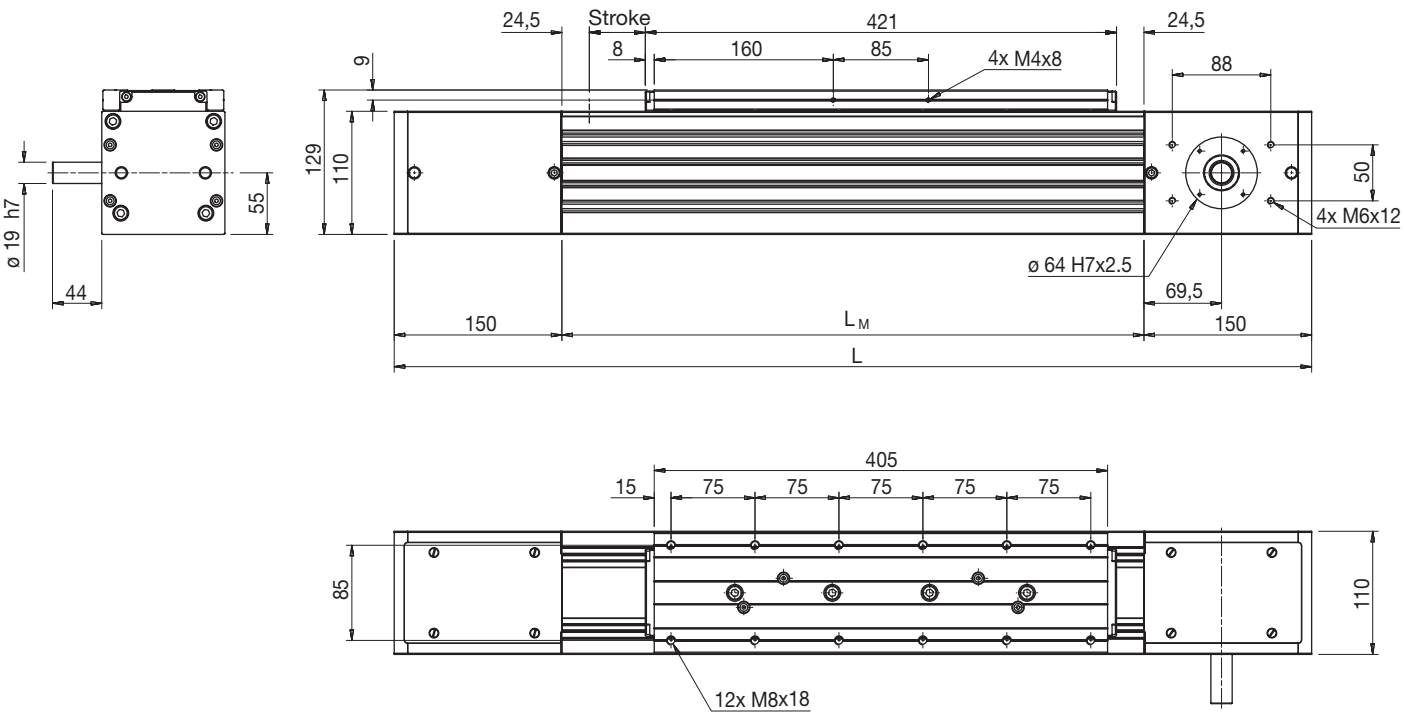


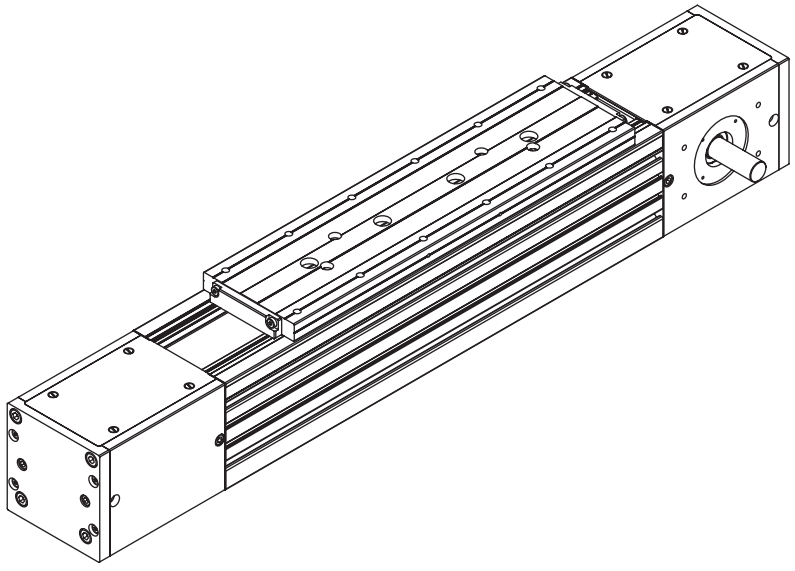




Nominal size	***Dimensions***				
Designation	L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM5.4.____BZ	Stroke + 661	L – 300	2 x Stroke + 1192	L – 14	18,4 kg + 1,48 kg/100 mm Stroke

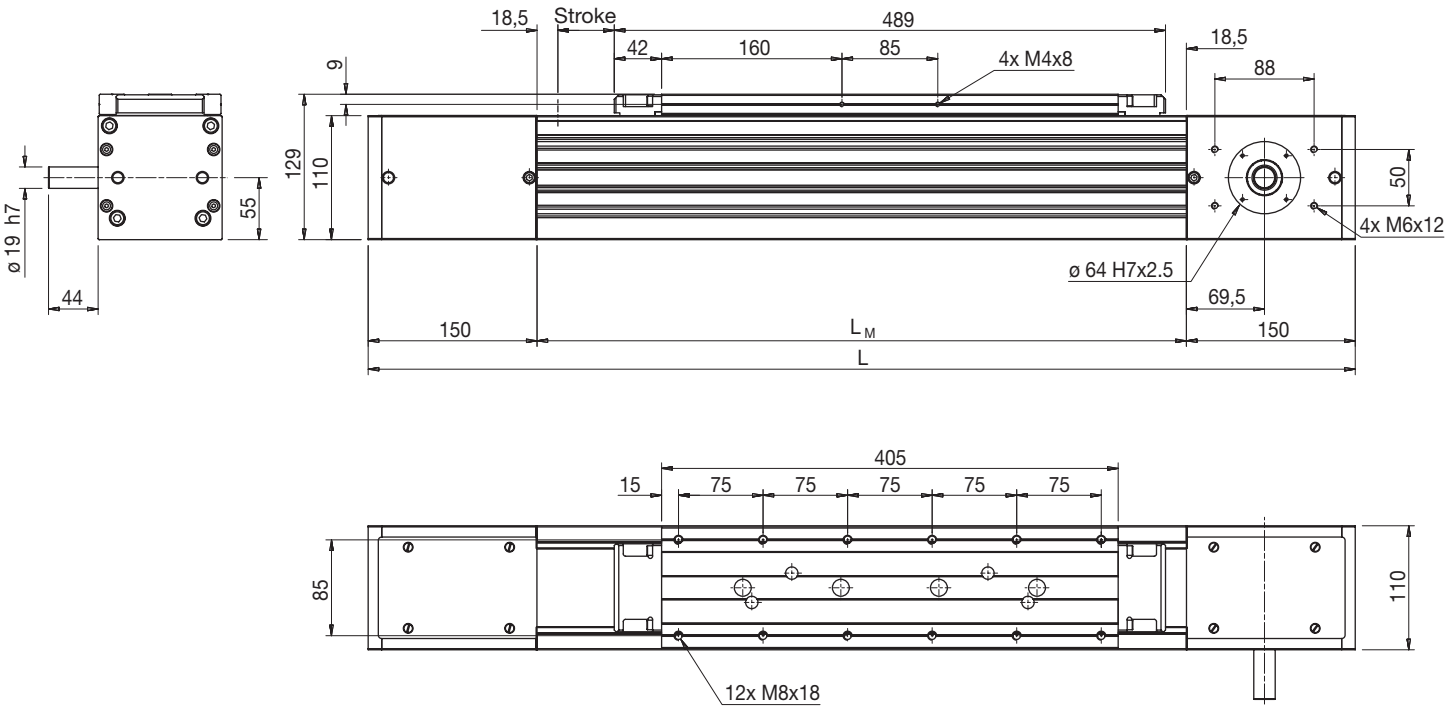
with roller guides (with 6 rolls) and toothed belt drive *(without protection)*

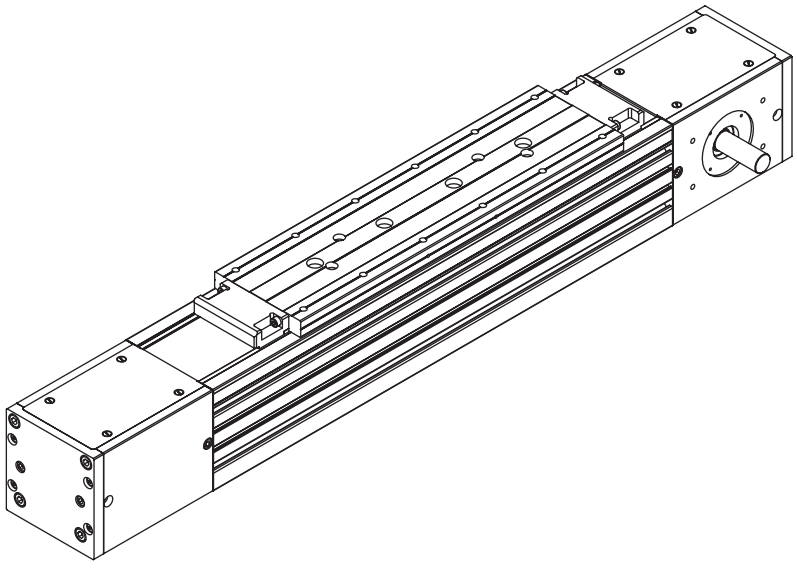




Nominal size Designation	*Dimensions* L [mm]	L_M	Belt length	Weight [kg]
RM5.6.____NZ	Stroke + 770	L – 300	2 x Stroke + 1240	21,8 kg + 1,46 kg/100 mm Stroke

with roller guides (with 6 rolls) and toothed belt drive *(with steel strapping)*





Nominal size Designation	***Dimensions*** L [mm]	L_M	Belt length	Length steel strapping	Weight [kg]
RM5.6.____BZ	Stroke + 826	L – 300	2 x Stroke + 1352	L – 14	22,8 kg + 1,48 kg/100 mm Stroke

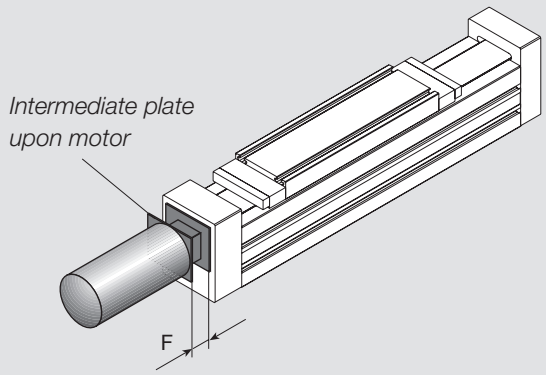
Dimensions motor mount

Dimensions motor mount

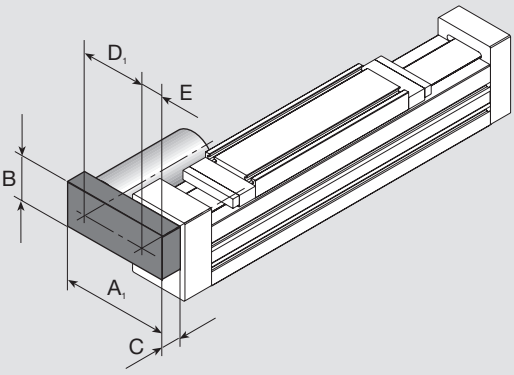
The basic dimensions for the drive mount are shown in this chapter. The dimensions shown in pictures 13 to 16 are also valid for the respective axially symmetric executions (drive mount left or bottom). The drive mount is likely to protrude above or below in most cases (depending on the size of the drive and the module respective.

Type	Dimensions								
	A_1 [mm]	A_2	B	C	D_1	D_2	E	F*	G*
LM3	300	300	120	70	178	178	66	*	*
RM3	—	—	—	—	—	—	—	—	*
LM4	300	300	120	70	178	178	66	*	*
RM4	—	—	—	—	—	—	—	—	*
LM5	300	300	120	70	178	178	66	*	*
RM5	—	—	—	—	—	—	—	—	*

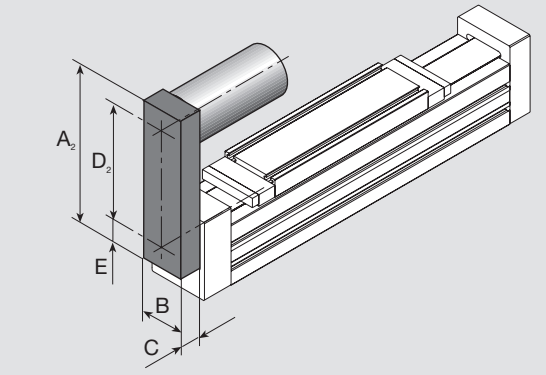
* dimension depending on motor type



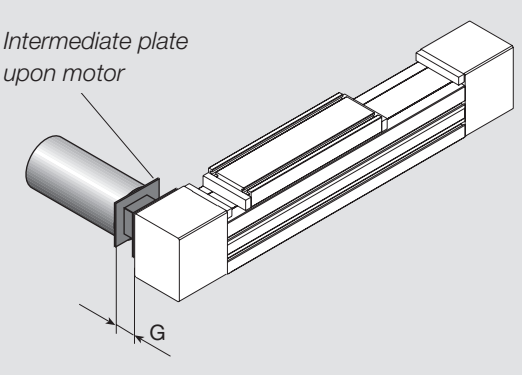
Picture 13
Screw drive with coupling and intermediate plate



Picture 14
Screw drive with lateral drive mount right



Picture 15
Screw drive with lateral drive mount top



Picture 16
Belt drive right with coupling and intermediate plate

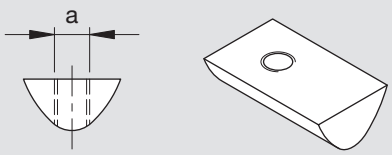
Notes

Grooves and sliding blocks, Profile cross-sections LM3/RM3

Grooves and sliding blocks

For all unit sizes the profiles, and often the carriages as well, come with grooves. The cradles of the linear modules LM4/RM4 and LM5/RM5 are not equipped with such. The fixing on those two types is made through threaded holes.
The positions of the grooves as well as the maximum thread reach are shown in profile cross-sections.

According to the groove width, sliding blocks of the types NS5, NS6 and NS8 are suitable. The sliding blocks are available at LINE TECH. The order number must show type, material and thread size (e.q. NS5 St M5).
The available types are shown in the chart beside.



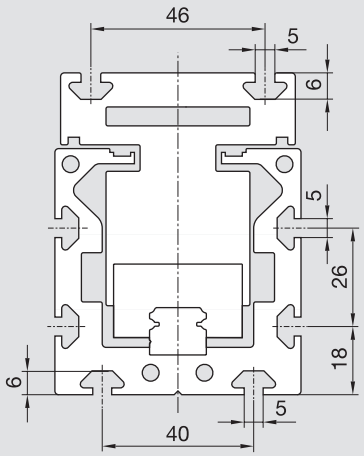
Groove width [mm]	Dimension „a“ [mm]	Material	Order number
5	M3 / M4 / M5	St / Inox	**NS5** __ __
6	M4 / M5 / M6	St / Inox	**NS6** __ __
8	M4 / M5 / M6 / M8	St / Inox	**NS8** __ __

Material
Dim. „a“

Sample: NS5 St M5

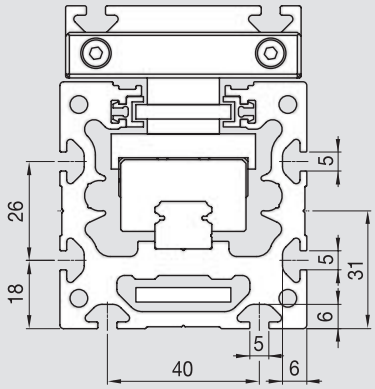
Profile cross-sections

LM3.2
with linear rail guiding system and screw drive



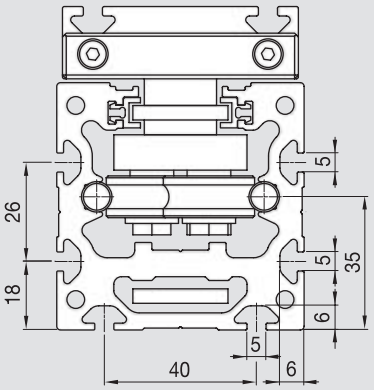
M1:2

LM3.2
with linear rail guiding system and toothed belt drive



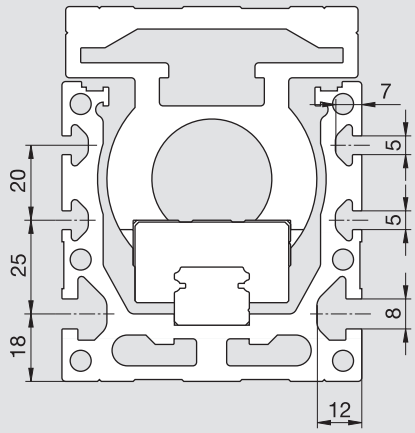
M1:2

RM3.4/6
with roller guides and toothed belt drive



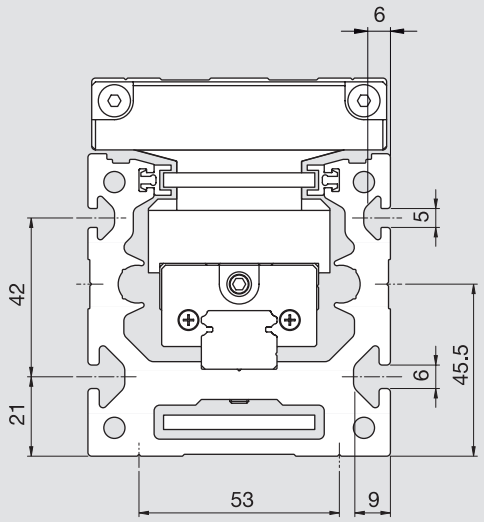
M1:2

LM4.2
with linear rail guiding system and screw drive



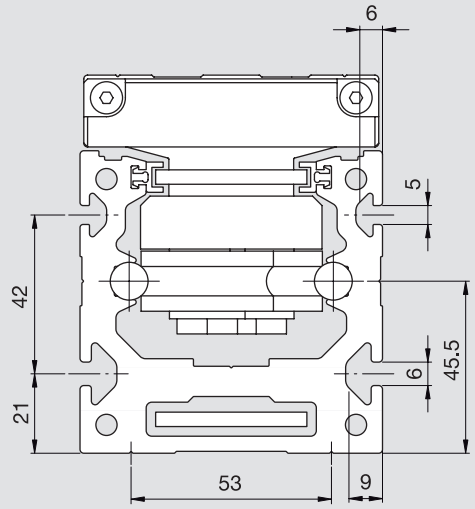
M1:2

LM4.2
with linear rail guiding system and toothed belt drive



M1:2

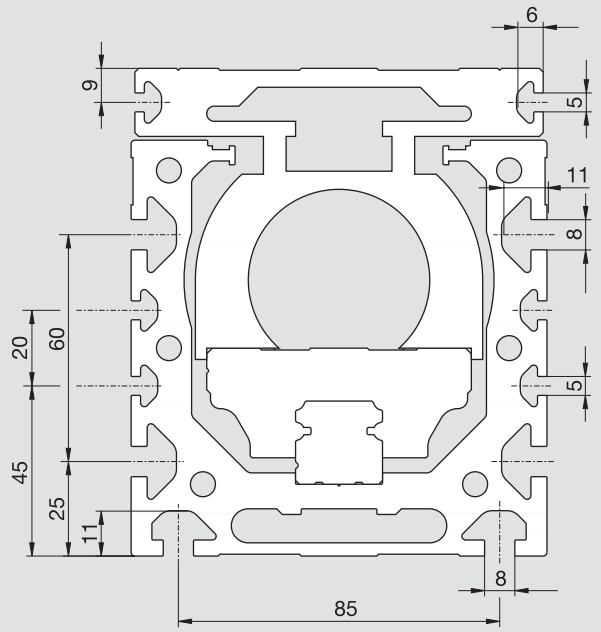
RM4.4/6
with roller guides and toothed belt drive



M1:2

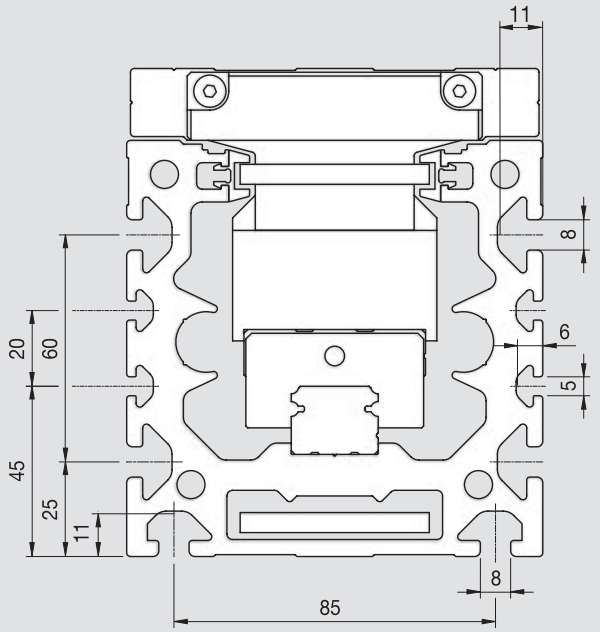
Profile cross-sections LM5/RM5

LM5.2
with linear rail guiding system and screw drive



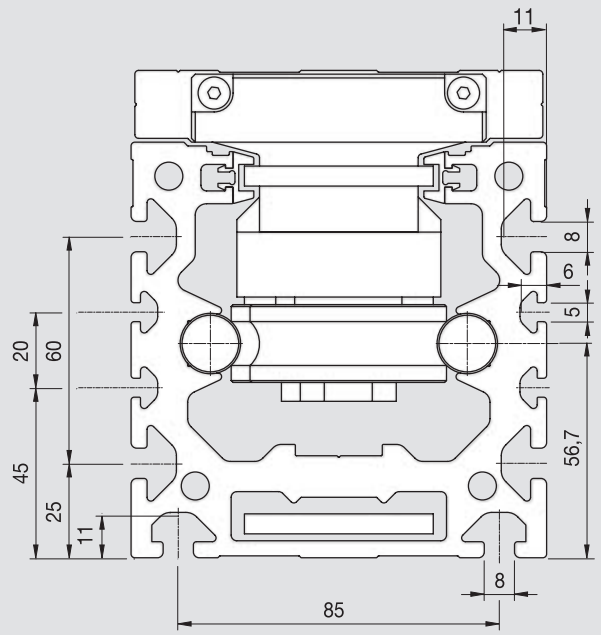
M1:2

LM5.2
with linear rail guiding system and toothed belt drive



M1:2

RM5.4/6
with roller guides and toothed belt drive



M1:2

Notes

Calculation guidelines

Concept

The determination of service life must be calculated based on the respective documents of the linear guide bar system and the ball screw drives. Also for the drive belts we shall refer to the specific literature.
It is the guide bar or guide roller system which normally determines the service life. Therefore the following rules can be applied for a coarse definition.

Dynamic load

The nominal service life 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 module 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

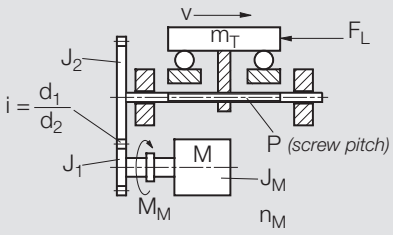
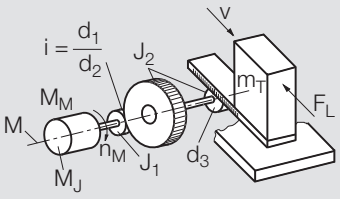
The above formulas are applicable only in case all bearings are equally loaded, i.e. the load F_r F is applied at the center of the cradle. Especially in vertical arrangements of the linear modules, the drive (screw or belt) must be checked. LINE TECH disposes of different test programs.
If you provide 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.

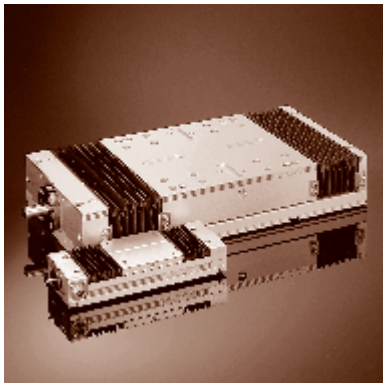
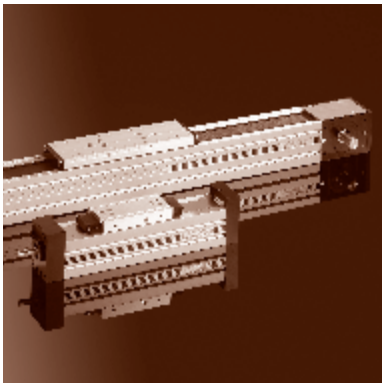
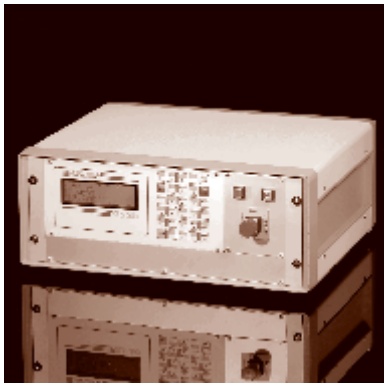
Key to the formulas at page 33:

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

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

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.

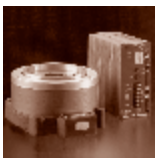
LINE TECH positioning units and LINE TECH linear modules – all built on a modular concept – are, due to their design features, dedicated for applications with high requirements on precision and performance. Various sizes and a multitude of drives allow for application specific problem solving.

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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