Linear Modules MKK

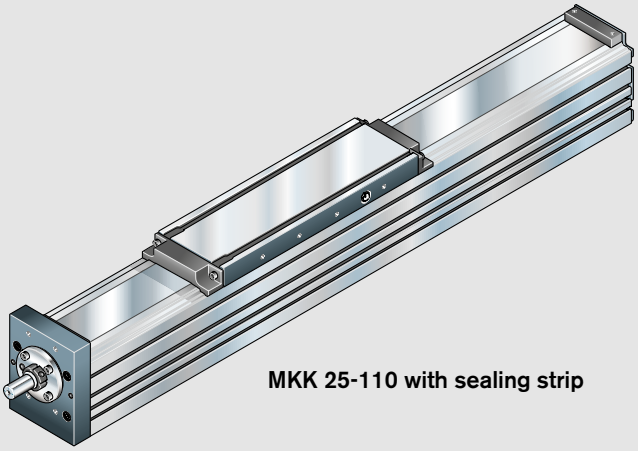
Product Description

Characteristic features

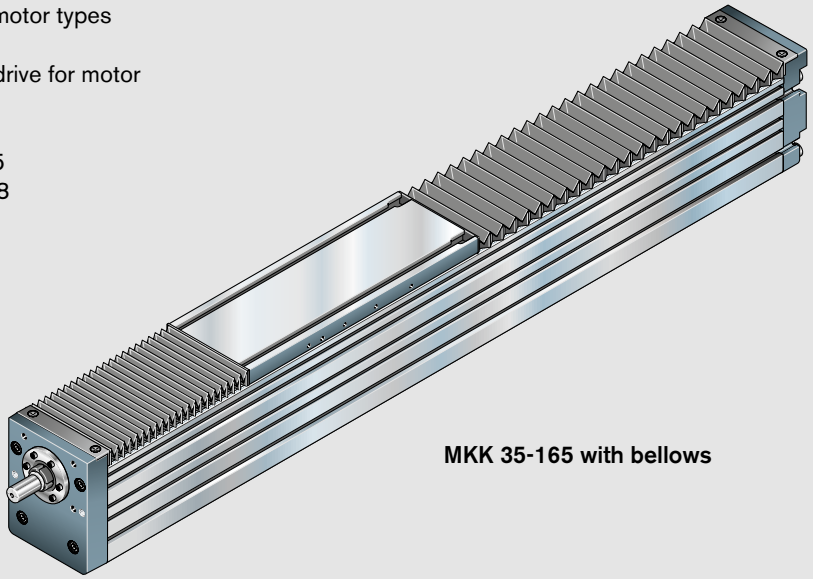
MKK...: Linear Modules with Ball Rail System and Precision Ball Screw Assembly for high thrust forces, accurate positioning and repeatability

– Greater travel distance thanks to special sealing strip

The MKK... Linear Modules comprise:
– a compact, anodized aluminum frame
– the integrated Rexroth Ball Rail System
– a carriage with T-slots or threaded holes (for MKK 15-65 and MKK 20-80) for attachments, and one-point lubrication
– the zero-backlash Rexroth Ball Screw Assembly (also available in MKK... design without drive unit)
– mountable switches
– an AC servo drive or a stepping motor (other motor types on request)
– motor mount and coupling or timing belt side drive for motor attachment
– cover provided by:
  – plastic strip on MKK 12-40 and MKK 15-65
  – corrosion-resistant steel strip per EN 10088 on MKK 20-80 and MKK 25-110
  – bellows on MKK 35-165
– a screw support for MKK 25-110
– control units



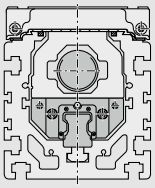
MKK 25-110 with sealing strip



MKK 35-165 with bellows

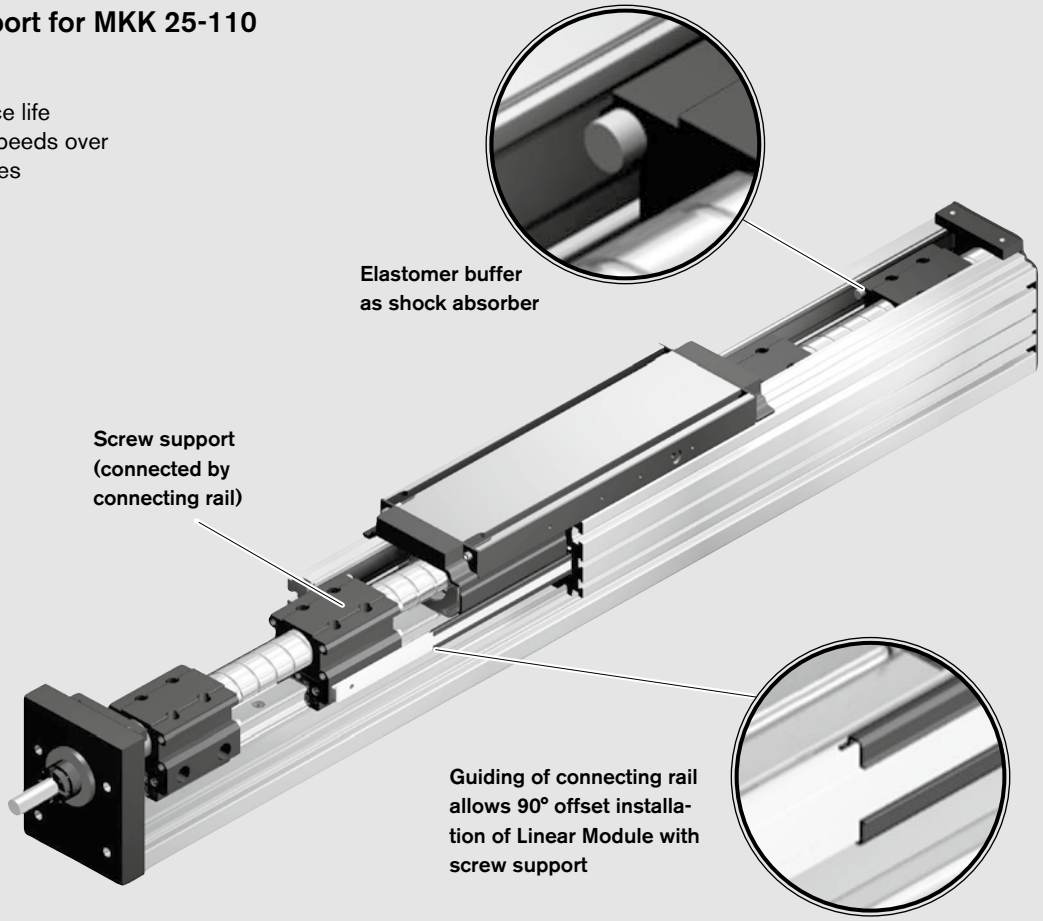
For mounting and maintenance, see the relevant Instructions.

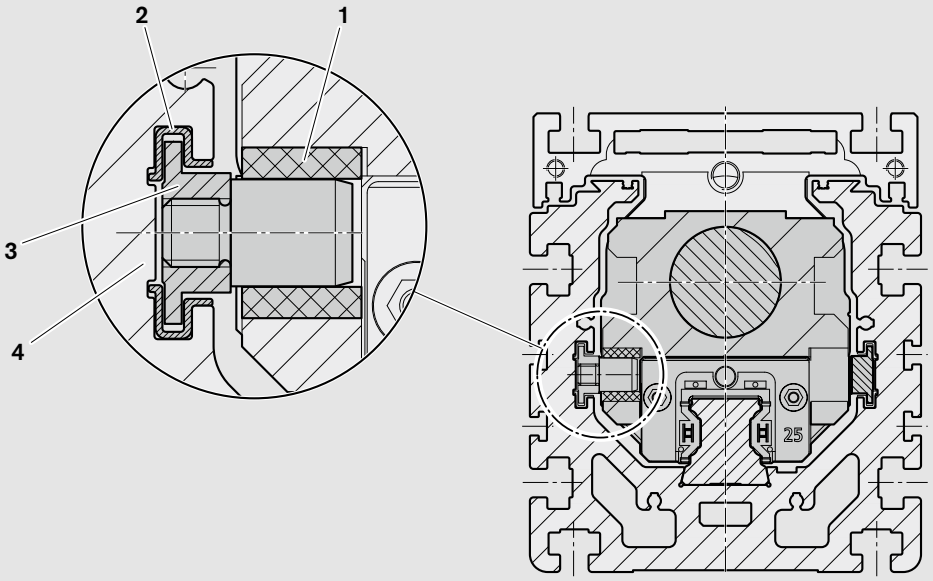
MKK



Screw Support for MKK 25-110

Enables:
- longer service life
- high travel speeds over long distances





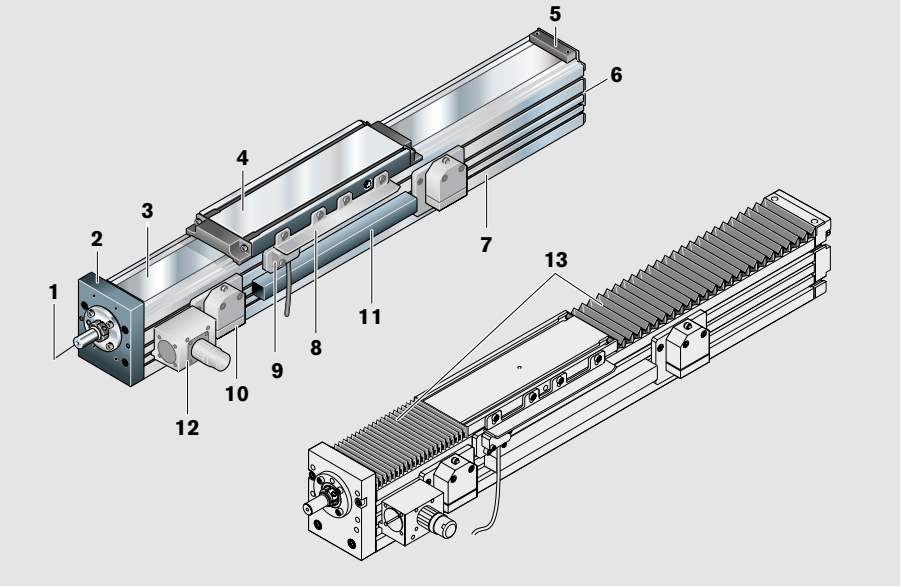
1 Elastomer ring
2 Plastic profiles
3 Aluminum connecting rail
4 Frame

Linear Modules MKK

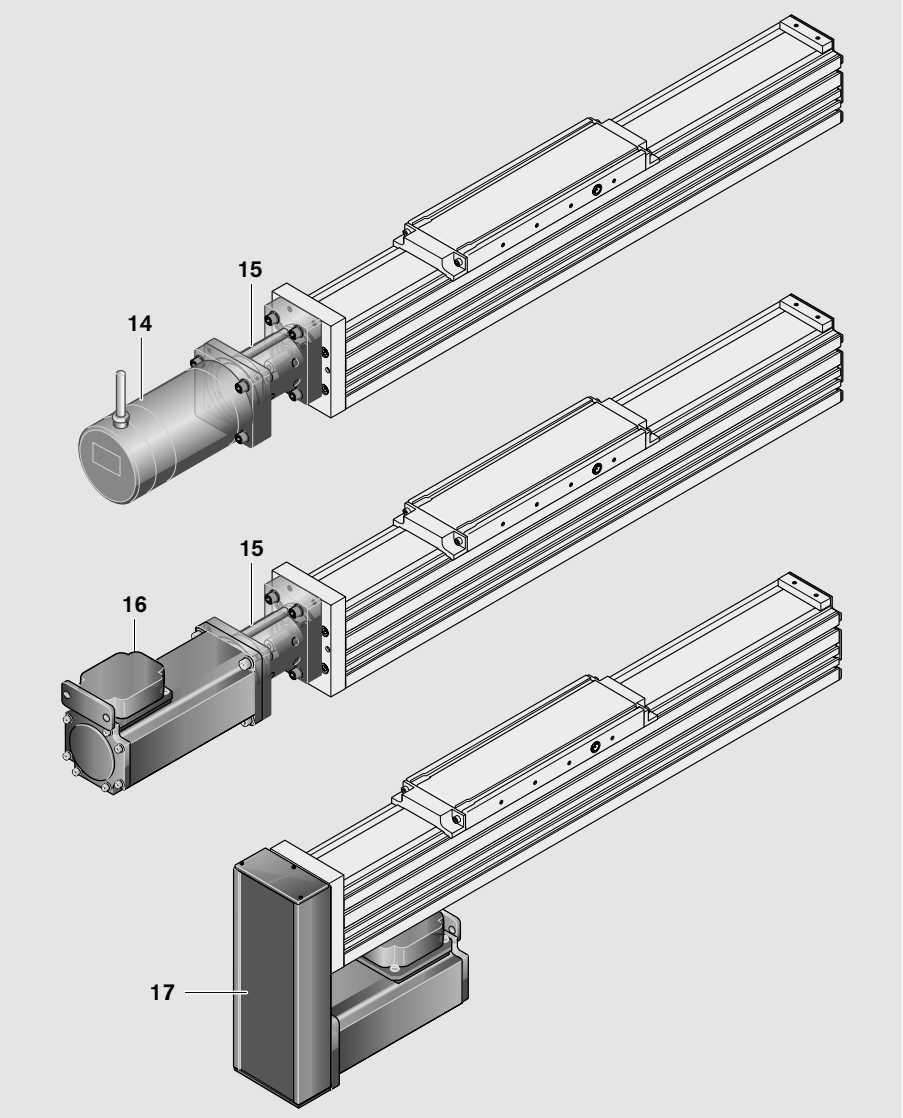
Structural Design

1 Precision ball screw assembly with zero-backlash cylindrical single nut
2 End block fixed bearing
3 Sealing strip on MKK 15-65, MKK 20-80, MKK 25-110
4 Carriage with runner blocks
5 Strip fixing
6 End plate
7 Frame
13 Bellows cover on MKK 35-165

Attachments:
8 Switching cam
9 Proximity switch
10 Mechanical switch
11 Cable duct
12 Socket-plug



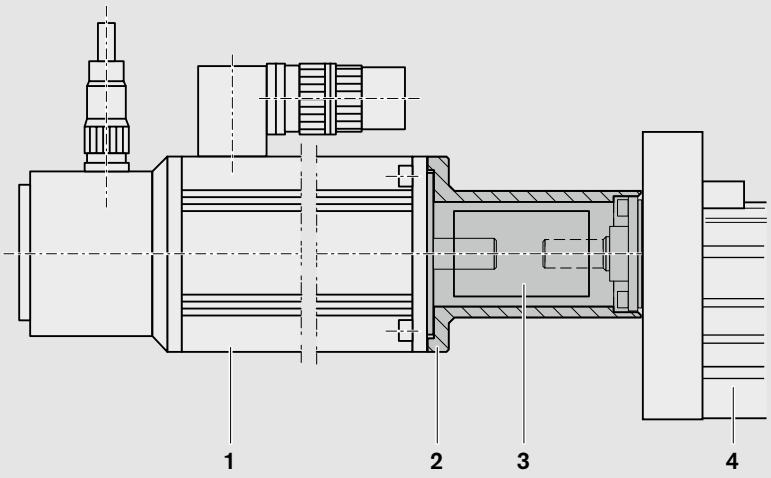
14 Stepping motor
15 Motor mount
16 Servo motor
17 Timing belt side drive



Motor attachment with mount and coupling

A motor can be attached via a mount and coupling to all Linear Modules equipped with a ball screw drive.
The motor mount serves to fasten the motor to the Linear Module and acts as a closed housing for the coupling. The coupling transmits the motor drive torque free of distortive stresses to the Linear Module's drive shaft.

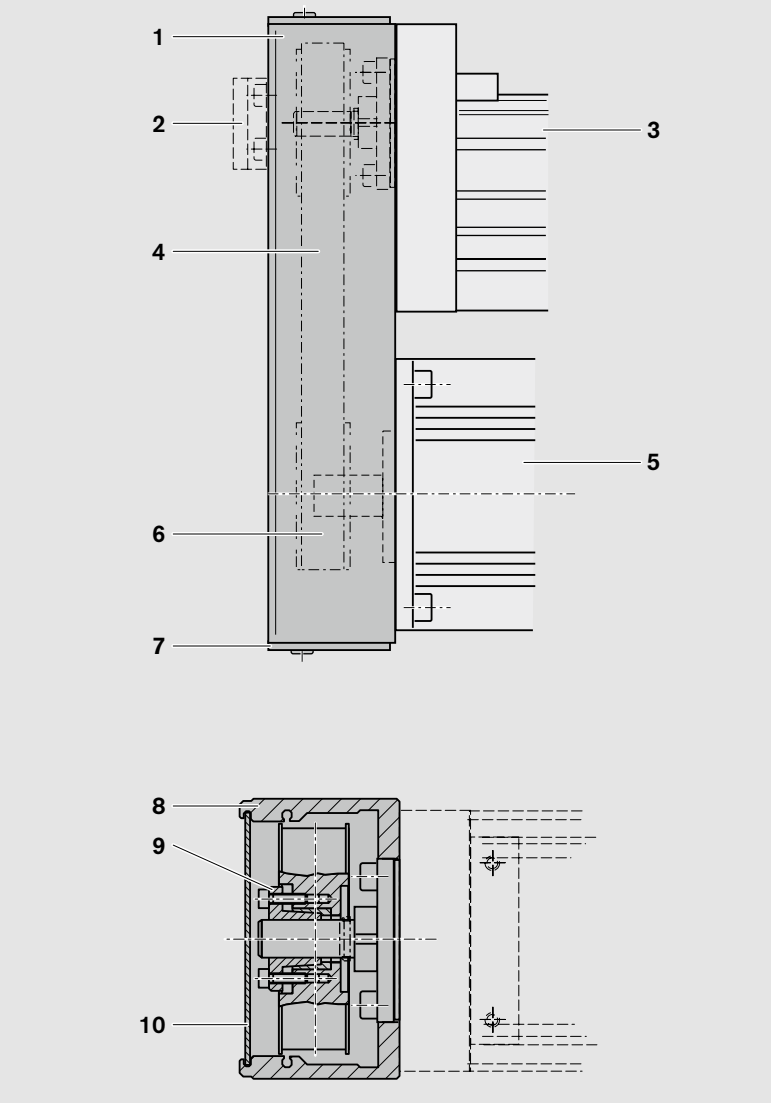
1 Motor
2 Motor mount
3 Coupling
4 Linear Module



Motor attachment via timing belt side drive

On all Linear Modules with ball screw drive the motor can be attached via a side drive with timing belt.
This makes the overall length shorter than when attaching the motor with a motor mount and coupling.
The compact, closed housing protects the belt and secures the motor. In addition, different gear ratios are available (4).
The timing belt side drive can be mounted in four different directions:
– bottom (RV01)
– top (RV02)
– left, right (RV03 and RV04)

1 Compact, closed housing protects the belt and secures the motor
2 Support bearing for ball screw journal on some models
3 Linear Module
4 Timing belt drive with reduction: i = 1 : 1; i = 1 : 1.5; i = 1 : 2
5 AC servo motor
6 To pre-tension the toothed belt, apply pre-tensioning force F_V to the motor. F_V is marked in the housing.
7 Cover
8 Drawn, anodized aluminum profile
9 Belt pulleys attached using tensioning units
10 Cover plate

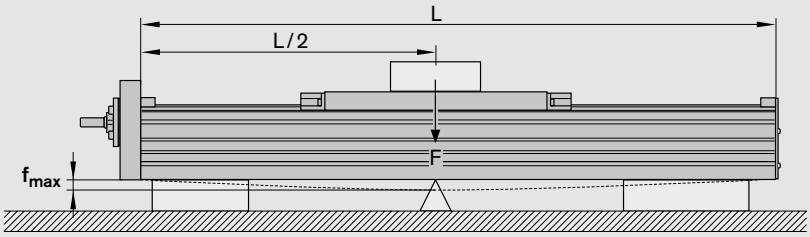


Linear Modules MKK

Technical Data

Deflection

A particular feature of Linear Modules is that they can be installed as cantilevered axes.
Deflection must, however, be taken into consideration, because it limits the possible load.
If the maximum permissible deflection is exceeded, additional supports must be provided.



Maximum permissible deflection f_{max}

The maximum permissible deflection f_{max} depends on the length L and the load F.

⚠ **f_{max} must not be exceeded! If high system dynamics are required, supports must be provided every 300 to 600 mm.**

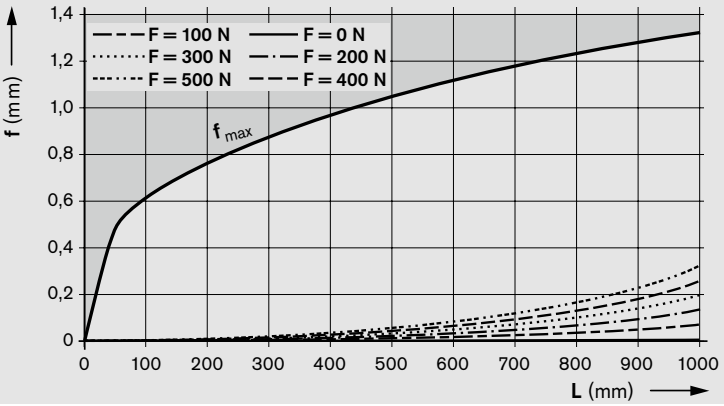
Example

Linear Module MKK 20-80:
L = 2500 mm
F = 1500 N
From chart MKK 20-80:
f = 1.1 mm
f_{max} = 3.1 mm

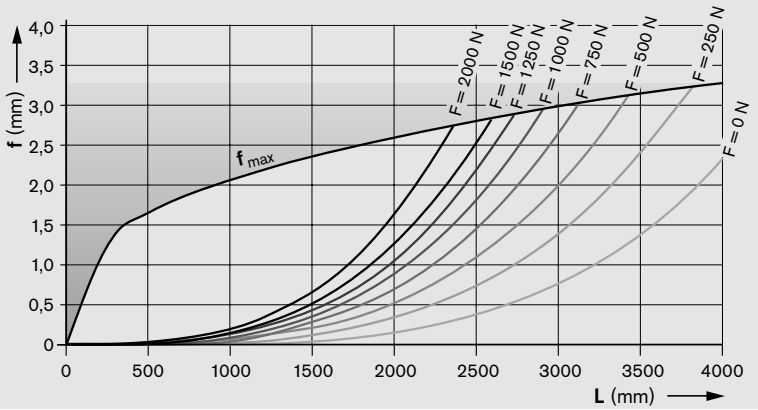
The deflection f lies well below the maximum permissible deflection f_{max}, so no additional supports are required.

The graphs apply under the following conditions:
- Both ends firmly fixed (200 to 250 mm per end)
- 6 to 8 screws per side
- Solid mounting base

MKK 12-40

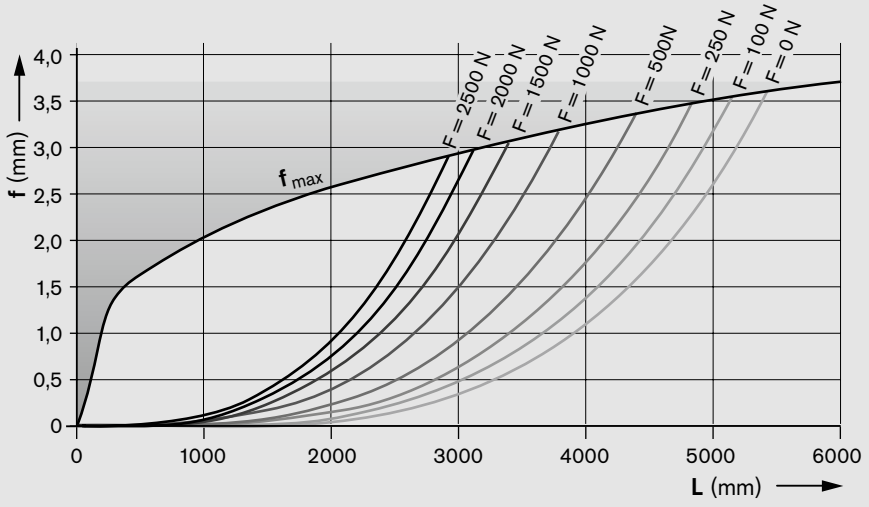


MKK 15-65

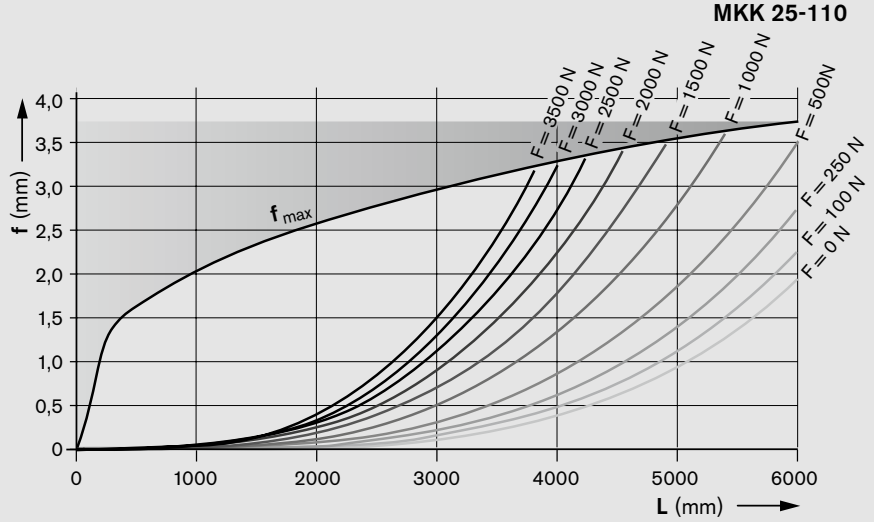


The graphs apply under the following conditions:
- Both ends firmly fixed (200 to 250 mm per end)
- 6 to 8 screws per side
- Solid mounting base

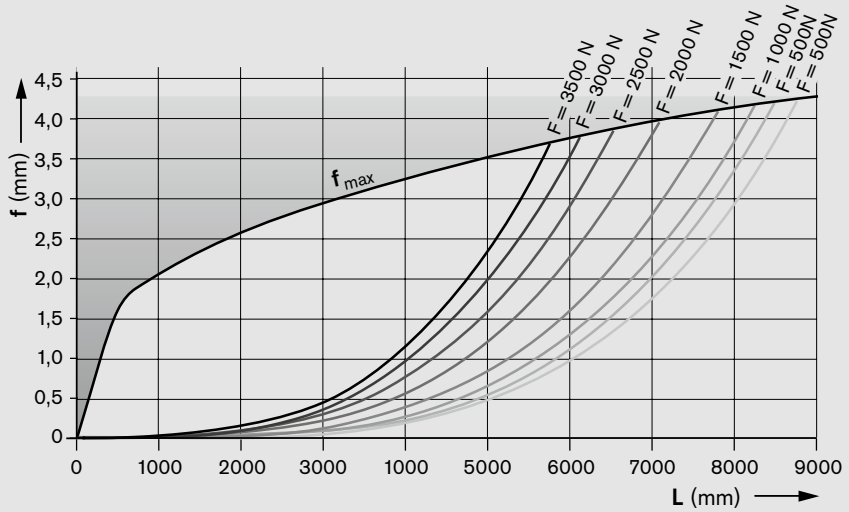
MKK 20-80



MKK 25-110



MKK 35-165



Linear Modules MKK

Technical Data

Maximum permissible drive torque for mechanical system M_{mech}

The values shown for M_{mech} are applicable under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw journal

Consider the rated torque of the coupling used!

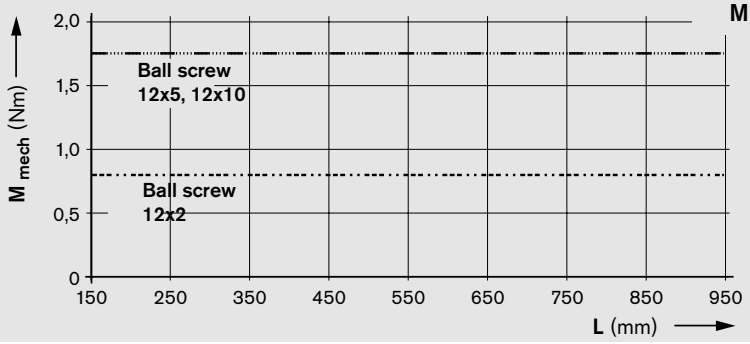
Ball screw journal with keyway
For reasons of stress concentration and a reduction of the effective diameter, do not exceed the following maximum values for drive torque!

	$M_{mech\ max}$ (Nm)
MKK 15-65	4.5
MKK 20-80	4.5
MKK 25-110	18
MKK 35-165	74

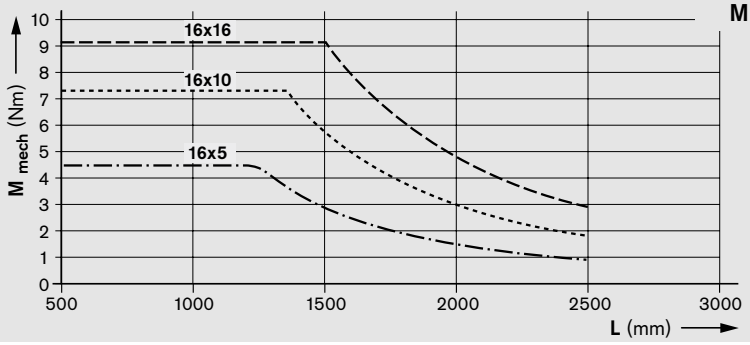
⚠ **When comparing the chart and table, the lower of the two values will always apply!**

Example:
MKK 15-65, ball screw 16 x 5,
motor MSK 40C, length 1000 mm, i = 1.
Drive torque M_{mech} from chart:
≈ 4.5 Nm
Maximum permissible drive torque
as per table: 2.2 Nm
Drive torque for sizing: 2.2 Nm

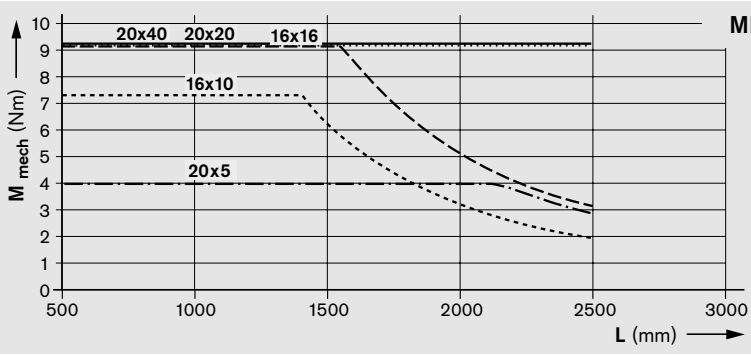
MKK 12-40



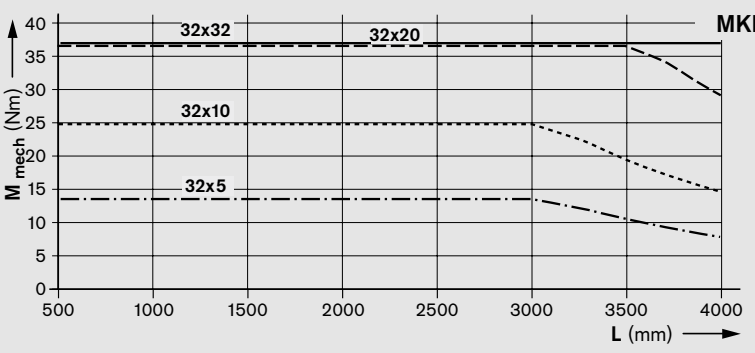
MKK 15-65



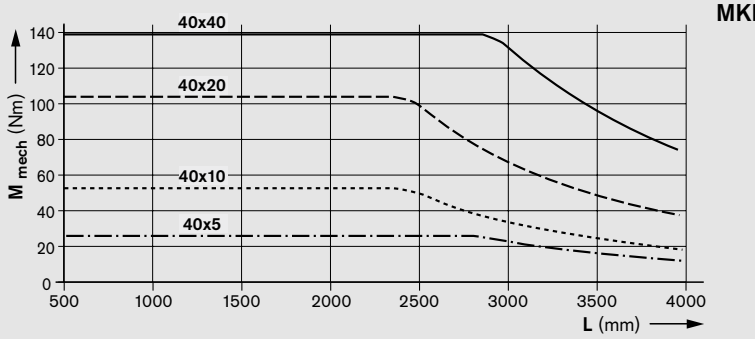
MKK 20-80



MKK 25-110

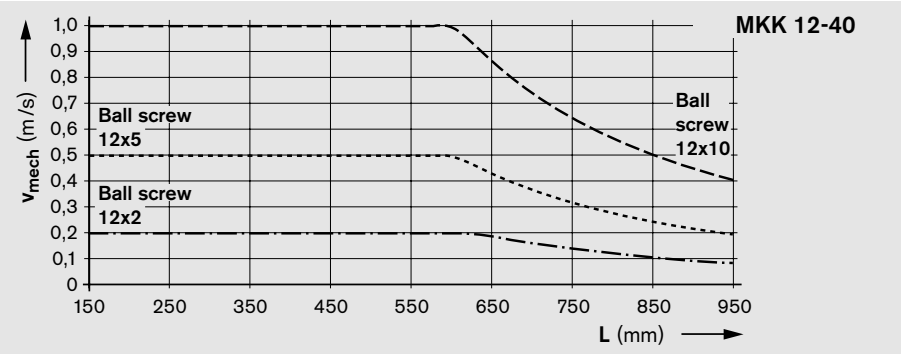


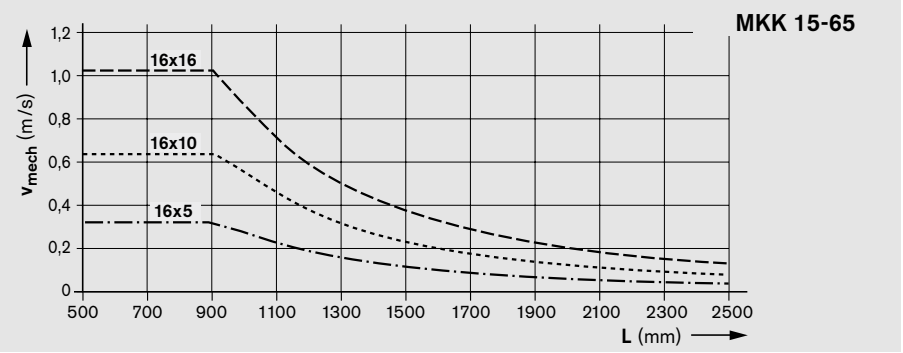
MKK 35-165

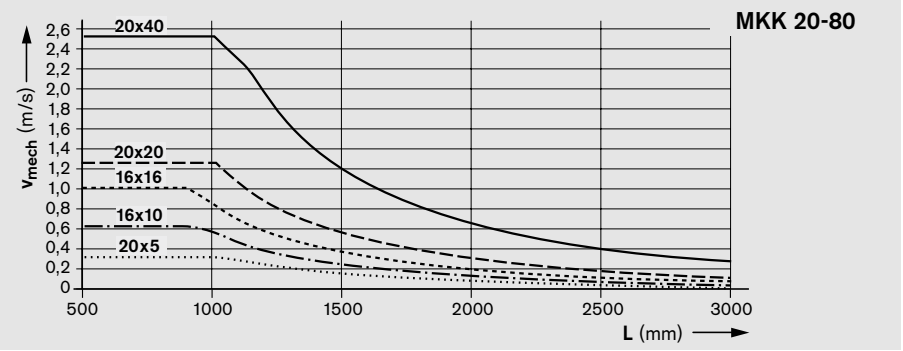


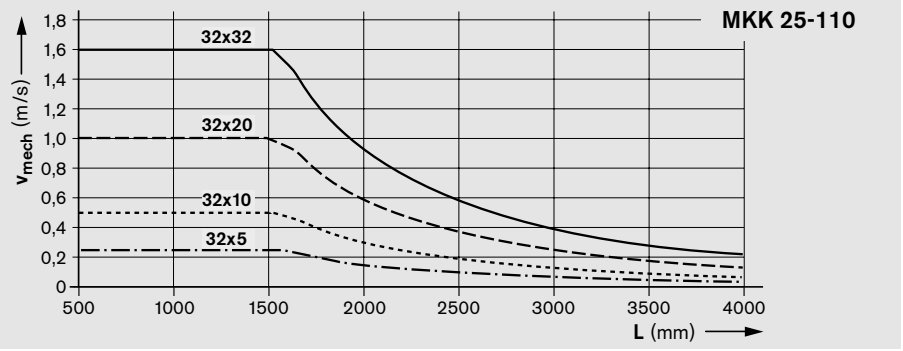
Maximum permissible linear speed of mechanical system v_{mech}

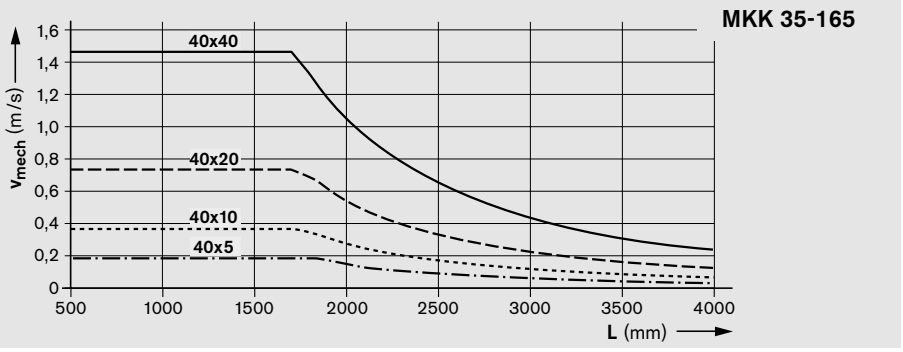
Consider the motor speed!











Linear Modules MKK

Technical Data

General technical data

	Ball screw	Carriage length	Dynamic load capacity C			Dynamic load moments		
	d_0 x P	L_{ca} (mm)	Guideway (N)	Ball screw (N)	Fixed bearing (N)	M_t (Nm)	M_L (Nm)	
MKK 12-40	without	135	3 750	–	–	22.3	93.8	
	12 x 2			2 240	4 000			
	12 x 5			3 800				
	12 x 10			2 500				
MKK 15-65	without	190	11 820	–	–	120	365	
	16 x 5			12 300	17 000			
	16 x 10			9 600				
	16 x 16			9 300				
MKK 20-80	without	260	28 300	–	–	389	1 314	
	16 x 10			9 600	17 000			
	16 x 16			9 300				
	20 x 5			14 300				
	20 x 20			13 300				
	20 x 40			8 000				
MKK 25-110	without	310	34 600	–	–	519	1 560	
	32 x 5			21 500	26 000			
	32 x 10			31 700				
	32 x 20			19 700				
	32 x 32			19 500				
MKK 35-165	without	400	68 200	–	–	1 445	9 690	
	40 x 5			29 100	29 000		4 170	
	40 x 10			50 000				
	40 x 20			37 800				
	40 x 40			37 000				

All carriages are equipped with two runner blocks.

d_0 = nominal diameter of ball screw (mm)

P = lead of ball screw (mm)

Modulus of elasticity E

$E = 70\,000\ N/mm^2$

Lengths in excess of L_{max}

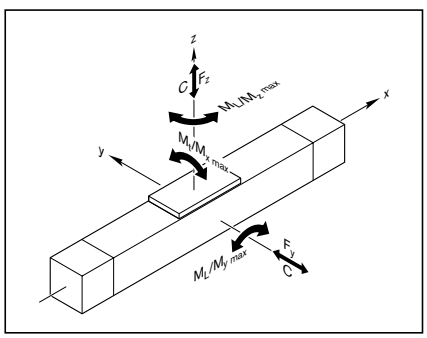
Lengths in excess of L_{max} are available on request.

Temperature

up to 40 °C

Note on dynamic load capacities and moments

Determination of the dynamic load capacities and moments is based on a travel life of 100,000 m.
Often only 50,000 m are actually stipulated.
For comparison:
Multiply values C, M_t and M_L from the table by 1.26.
Load ratings for the ball screw as per DIN 69051.



Maximum permissible loads				Planar moment of inertia		Length of linear module		Moved mass of system	Mass of the linear system
Forces		Moments				min.	max.		
$F_{x\,max}$ (N)	$F_{y\,max}$ (N)	$M_{t\,max}$ (Nm)	$M_{l\,max}$ (Nm)	I_x (cm^4)	I_y (cm^4)	L_{min} [1] (mm)	L_{max} (mm)	m_{ca} (kg)	m_s (kg)
1875	1875	11	47	11.98	11.56	250	1 000	0.39	$0.0021 \cdot L + 0.53$ $0.0021 \cdot L + 0.65$
5910	5910	60	182	79.2	90.2	380	6 000	1.80	$0.0063 \cdot L + 2.0$
						400 420 450	2 500		$0.0077 \cdot L + 3.0$
14150	14150	195	657	169	211	480	6 000	2.20	$0.0100 \cdot L + 2.3$
						520 550 500 560 640	2 500	2.60	$0.0120 \cdot L + 3.8$
17300	17300	260	780	505	656	550	10 000	3.80	$0.0160 \cdot L + 4.0$
						570 590 630 680	4 900	4.90	$0.0217 \cdot L + 7.2$
34100	34100	723	2085	2 468	3 527	570	12 000	14.00	$0.0368 \cdot L + 18.5$
						590 620 660 760	4 000	16.00	$0.0448 \cdot L + 23.5$

1) With sealing strip, for a theoretical stroke of 100 mm

Mass of the linear motion system m_s
Weight calculation does not include motor, switches or timing belt side drive.

m_s = mass (kg/mm) x length L (mm) + mass of all parts of fixed length (carriage, end plates, etc.) (kg)

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Technical Data

Drive data of timing belt side drive, fixed bearing end for motor attachment via timing belt side drive

Motor		MSM 019B					MSM 031B / MSK 030C				
M_{Rsd} (Nm)		0.12					0.15				
i (–)			i = 1	i = 1.5	i = 1	i = 1.5		i = 1	i = 1.5	i = 1	i = 1.5
Belt type		20 AT3					20 AT3				
	Ball screw d_0 x P	L (mm)	M_{sd} (1) (Nm)	M_{sd} (1) (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)	L (mm)	M_{sd} (1) (Nm)	M_{sd} (1) (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)
MKK 12-40	12 x 2	1000	0.80	0.50	10.7	4.1	1000	0.80	0.50	45.6	17.7
	12 x 5		1.20	0.80				1.60	1.10		
	12 x 10		1.20	0.80				1.60	1.10		

Motor		MSK 040C, MSM 041B					MSK 050C				
M_{Rsd} (Nm)		0.4					0.45				
i (–)			i = 1	i = 1.5	i = 1	i = 1.5		i = 1	i = 2	i = 1	i = 2
Belt type			16 AT5	16 AT5	16 AT5	16 AT5		25 AT5	25 AT5	25 AT5	25 AT5
	Ball screw d_0 x P	L (mm)	M_{sd} (1) (Nm)	M_{sd} (1) (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)
MKK 15-65	16 x 5	1500	2.2	2	250	85					
	16 x 10	1600	3.2	3.2							
	16 x 16	1600	3.7	4.2							
MKK 20-80	20 x 5	2500	2.1	1.9	250	85	2500	2.3	1.4	1420	230
	20 x 20	2500	3.6	4.9			2500	4.3	3.5		
	20 x 40	2500	3.6	4.9			2500	4.3	3.5		
	16 x 10	1600	2.9	3.5			1600	3.3	2.5		
	16 x 16	1600	3.4	4.4			1700	4.0	3.2		

Motor		MSK 060C					MSK 076C				
M_{Rsd} (Nm)		0.5					0.6				
i (–)			i = 1	i = 2	i = 1	i = 2		i = 1	i = 2	i = 1	i = 2
Belt type			25 AT5	32 AT5	25 AT5	32 AT5		50 AT10	50 AT10	50 AT10	50 AT10
	Ball screw d_0 x P	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)
MKK 25-110	32 x 5	3000	12	6	1400	260					
	32 x 10		19	11							
	32 x 20		19	13							
	32 x 32		19	13							
MKK 35-165	40 x 5						2500	26	13.0	7780	1260
	40 x 10						2250	52	26.0		
	40 x 20						2500	67	33.5		
	40 x 40						2860	67	33.5		

1) For longer lengths, please ask.

d_0 = nominal diameter of ball screw (mm)
i = gear ratio of timing belt side drive
J_{sd} = reduced mass moment of inertia of timing belt side drive
M_{sd} = maximum permissible drive torque of the timing belt side drive
M_{Rsd} = frictional torque of timing belt side drive at motor journal
P = lead of ball screw (mm)

Constants $k_{J\,fix}$, $k_{J\,var}$, $k_{J\,m}$ and frictional torque M_{Rs} at the ball screw journal

	Ball screw	Constant			Frictional torque
	d_0 x P	$k_{J\,fix}$	$k_{J\,var}$	$k_{J\,m}$	M_{Rs} (Nm)
MKK 12-40	12 x 2	1.2744	0.013	–	0.08
	12 x 5	1.4678	0.011	–	0.09
	12 x 10	2.2011	0.011	–	0.11
MKK 15-65	16 x 5	2.2424	0.0310	0.6333	0.30
	16 x 10	5.6620	0.0310	2.5330	0.40
	16 x 16	12.7747	0.0340	6.4846	0.40
MKK 20-80	16 x 10	8.650	0.0310	2.5330	0.40
	16 x 16	19.7194	0.0340	6.4846	0.40
	20 x 5	3.3357	0.0840	0.6333	0.40
	20 x 20	29.9326	0.0810	10.1321	0.50
	20 x 40	110.9896	0.0860	40.5285	0.50
MKK 25-110	32 x 5	50.5832	0.6050	0.6333	0.80
	32 x 10	60.0820	0.6400	2.5330	0.90
	32 x 20	98.0775	0.6760	10.1321	0.90
	32 x 32	177.1080	0.6890	25.9382	1.00
MKK 35-165	40 x 5	94.3867	1.5640	0.6333	1.60
	40 x 10	122.8833	1.3550	2.5330	1.80
	40 x 20	241.9357	1.3520	10.1321	1.90
	40 x 40	713.0792	1.3420	40.5285	2.20

Coupling data

	For motors	Coupling data		
		Rated torque	Mass moment of inertia	Weight
		M_{cN} (Nm)	J_c (10^{-6} kgm^2)	m_c (kg)
MKK 12-40	MSM 019B	1.9	2.1	0.039
	MSM 031B MSK 030C	3.7	7.0	0.075
	VRDM 368	5.5	20.0	0.040
MKK 15-65	For all MSM, MSK, VRDM	19	57	0.26
MKK 20-80		19	57	0.26
MKK 25-110		50	200	0.70
MKK 35-165		98	390	0.90

Linear Modules MKK

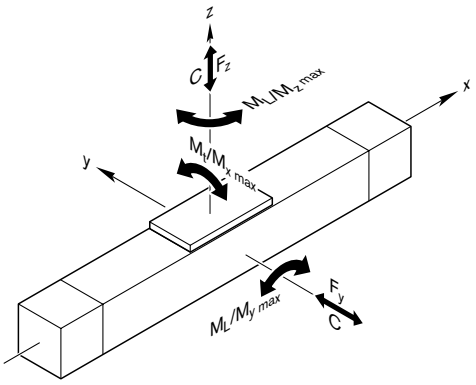
Calculations

Calculation principles

Combined equivalent load on bearing of the linear guide

$$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$

	Dimension (mm)
	Z_1
MKK 12-40	42
MKK 15-65	47
MKK 20-80	68
MKK 25-110	90
MKK 35-165	123



Service life

Nominal life of the guideway in meters:

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5$$

Nominal life of the guideway in hours:

$$L_h = \frac{L}{3600 \cdot v_m}$$

Frictional torque

for motor attachment via motor mount and coupling:

$$M_R = M_{Rs}$$

for motor attachment via timing belt side drive:

$$M_R = \frac{M_{Rs}}{i} + M_{R\,sd}$$

Mass moment of inertia of the linear motion system J_s referred to the drive journal

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

C = dynamic load capacity (N)
F_{comb} = combined equivalent load on bearing (N)
F_y = force in y-direction (N)
F_z = force in z-direction (N)
i = gear ratio of timing belt side drive
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
$k_{J\,fix}$ = constant for fixed-length portion of mass moment of inertia (–)
$k_{J\,var}$ = constant for variable-length portion of mass moment of inertia (–)
L = nominal life in meters (m)
L_h = nominal life in hours (h)
M_L = dynamic longitudinal moment load capacity (Nm)
M_R = frictional torque at motor journal (Nm)
M_{Rs} = frictional torque of system (Nm)
$M_{R\,sd}$ = frictional torque of timing belt side drive at motor journal (Nm)
M_t = dynamic torsional moment load capacity (Nm)
M_x = torsional moment about the x-axis (Nm)
M_y = torsional moment about the y-axis (Nm)
M_z = torsional moment about the z-axis (Nm)
v_m = average travel speed (m/s)
Z_1 = application point of the effective force (mm)

Mass moment of inertia of the mechanical system referred to the motor journal

Motor attachment via motor mount and coupling

$$J_{ex} = J_s + J_t + J_c$$

Motor attachment via timing belt side drive

$$J_{ex} = \frac{J_s + J_t}{i^2} + J_{sd}$$

Translatory mass moment of inertia of external load referred to the drive journal

$$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$$

Mass moment of inertia of the drive train referred to the motor journal

$$J_{dc} = J_{ex} + J_{br}$$

Mass moment of inertia ratio

$$V = \frac{J_{dc}}{J_m}$$

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

Total mass moment of inertia referred to the motor journal

$$J_{tot} = J_{dc} + J_m$$

Maximum permissible rotary speed for mechanical system

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P}$$

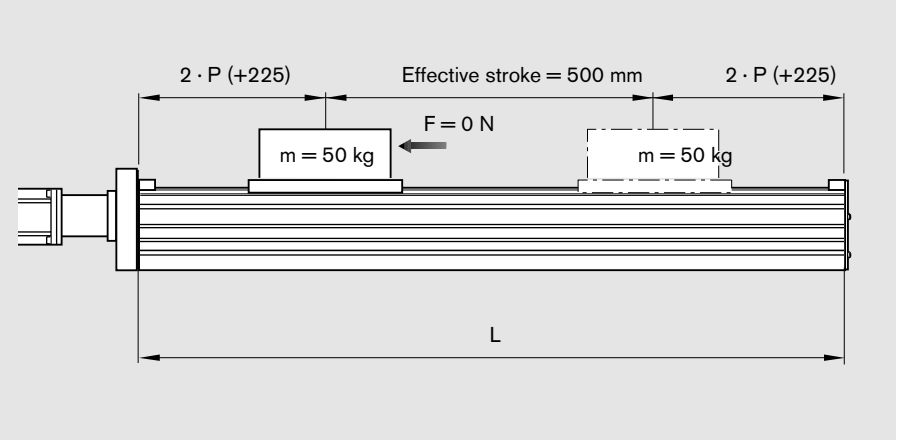
$$n_{mech} < n_{m\,max}$$

J_{br} = mass moment of inertia, motor brake (kgm^2)
J_c = mass moment of inertia, coupling (kgm^2)
J_{dc} = mass moment of inertia, drive train (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
J_{sd} = mass moment of inertia of timing belt side drive at motor journal (kgm^2)
J_t = translatory mass moment of inertia of external load referred to the drive journal (kgm^2)
J_{tot} = total mass moment of inertia (kgm^2)
i = gear ratio of timing belt side drive (–)
$k_{J\,m}$ = constant for mass-specific portion of mass moment of inertia ($10^6\ m^{2)}$
m_{ex} = moved external load ($kgm^{)}$
$n_{m\,max}$ = maximum permissible rotary speed of motor with controller (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
P = screw lead (mm)
V = ratio of mass moments of inertia of drive train and motor (–)
v_{mech} = maximum permissible linear speed of mechanical system (m/s)

Linear Modules MKK

Calculation example

When sizing the drive, the motor-controller combination must always be considered, as the motor type and performance data (e.g. maximum useful speed and maximum torque) will depend on the controller or control system used. (See also Product Overview, “Motor Selection based on drive controllers and control system”.)



Given data

A mass of 50 kg is to be moved 500 mm at a maximum travel speed of 0.66 m/s. The following was selected based on the technical data and the connection dimensions:

Linear Module MKK 25-110
- L_{ca} = 310 mm
- 2% preload
- With sealing strip
- With motor MSK 060C attached via motor mount and coupling

Estimation of the length L

Excess travel	=	2 · P = 2 · 32 mm = 64 mm
Max. travel	=	$stroke_{eff}$ + 2 · excess travel
	=	500 mm + 2 · 64 mm
	=	628 m
Length:	=	max. travel + 450 mm
L	=	1078 mm

Selection of ball screw
See charts in “Technical Data” section.

General recommendation:
Always select the lowest lead (resolution, braking distance, length).

Permissible ball screws according to the “Permissible travel speed” chart at v = 0.66 m/s and L = 1078 mm:
Ball screw 32 x 20 and ball screw 32 x 32
Ball screw selected (lower lead)

Ball screw 32 x 20
with a maximum permissible drive torque of 36.5 Nm as per “Permissible drive torque” chart for L = 1078 mm

Calculation of length L

Excess travel	=	2 · P = 2 · 20 mm = 40 mm
Max. travel	=	$stroke_{eff}$ + 2 · excess travel
	=	500 mm + 2 · 40 mm
	=	580 mm
L	=	580 mm + 450 mm
	=	1030 mm

Frictional torque M_R

M_R	=	M_{Rs} (see “Technical Data”)
M_R	=	0.9 Nm

Mass moment of inertia of the mechanical system

$J_{ex} = J_S + J_t + J_C$

$J_S = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}\ kgm^2$
$= (98.08 + 0.667 \cdot 1030\ mm) \cdot 10^{-6}\ kgm^2$
$= 788.2 \cdot 10^{-6}\ kgm^2$ (see “Technical Data”)

$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}\ kgm^2$
$= 50 \cdot 10.13 \cdot 10^{-6}\ kgm^2$
$= 506.5 \cdot 10^{-6}\ kgm^2$ (see “Technical Data”)

$J_C = 200 \cdot 10^{-6}\ kgm^2$ (see “Technical Data”)

$J_{ex} = (788.2 + 506.5 + 200) \cdot 10^{-6}\ kgm^2$
$= 1495 \cdot 10^{-6}\ kgm^2$

$J_{dc} = J_{ex} + J_{br}$

$J_{br} = 55 \cdot 10^{-6}\ kgm^2$ (see “Motors”)

$J_{dc} = (1495 + 55) \cdot 10^{-6}\ kgm^2$
$= 1550 \cdot 10^{-6}\ kgm^2$

Mass moment of inertia for handling ($V \leq 6$)

$$V = \frac{J_{dc}}{J_m} \leq 6$$

$$= \frac{1550 \cdot 10^{-6}\ kgm^2}{800 \cdot 10^{-6}\ kgm^2}$$

$= 1.9 \leq 6$

The selected motor (MSK 060C) is therefore suitable.

Rotary speed n
at v = 0.66 m/s

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P} = \frac{0.66\ m/s \cdot 1 \cdot 1000 \cdot 60}{20\ mm} = 1980\ min^{-1}$$

$v_{mech} = 0.66$ m/s If the permissible travel speed of 0.66 m/s is not sufficient, switch to size 32 x 32 and repeat the calculation.

Result

Linear Module MKK 25-110
Length L = 1030 mm
Ball screw:
Diameter 32 mm;
Lead 20 mm;
Carriage length: L_{ca} = 310 mm;
Preload: 2%

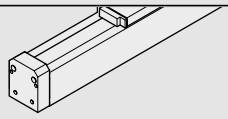
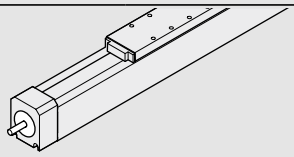
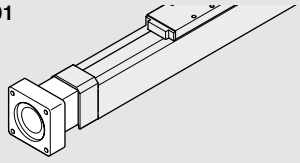
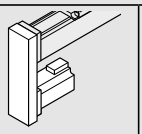
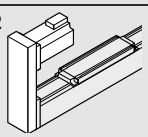
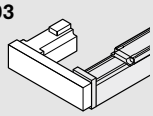
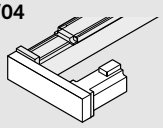
Motor attachment via motor mount and coupling
Motor with:
- maximum useful speed $n_{m\,max} > 2000\ min^{-1}$
- mass moment of inertia $J_m > 450 \cdot 10^{-6}\ kgm^2$
- maximum permissible drive torque $M_{max} < 36.5$ Nm
  Consider the rated coupling torque M_{cN} and the frictional torque M_R (M_{cN} = 50 Nm; M_R = 1.21 Nm)

These requirements are fulfilled by all AC servo motors approved for MKK 25-110 in the “Components and Ordering Data” table.

The specific motor is selected:
- according to the criteria in the “Motors” section
- and by recalculating the drive unit with performance data from the “IndraDrive Cs” and “IndraDrive for Linear Motion Systems” catalogs.

Linear Modules MKK

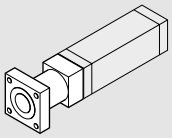
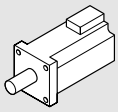
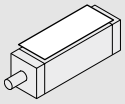
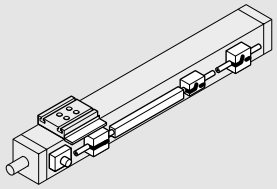
Linear Modules MKK 12-40 Components and Ordering Data

Part number, length R1160 660 00, ... mm Version		Guideway	Drive unit Screw journal	Drive unit Ball screw size d_0 x P 12x2	 12x5	 12x10	Carriage L_{ca} = 135 mm	
Without drive unit	OA01 	02		00			02	
With ball screw, w/o motor mount	OF01 	01	Ø 6	01	02	03	01	
With ball screw and motor mount	MF01 	01	Ø 6	01	02	03	01	
With ball screw and timing belt side drive	RV01  RV02  RV03  RV04 	01	Ø 6	01	02	03	01	

Ordering example: see “Inquiry/Order”

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
L_{ca} = carriage length

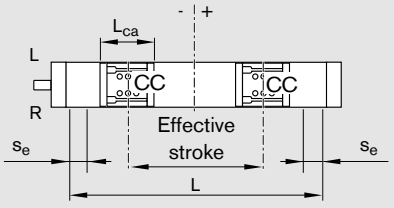
Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Reduction i =	Attachment kit [1]	for motor		without	with	without	with		Standard report	Measurement report
–	00	–		00				Without switches 00		
–	00	–		00				Proximity switch: PNP NC 36-.±.... / PNP NO 38-.±.... / Switch type / Mounting side (R/L) / Direction of travel / Switching distance; Switching cam 18, Cable duct 25, Socket-plug 28		02 Friction moment
–	05	MSM 019B		104	105	00	01	Magnetic field sensor with cable: Reed sensor 51, Hall sensor PNP NC 52; Cable duct 25, Socket-plug 28	01	03 Lead deviation
–	03	MSM 031B		106	107					
–	01	MSK 030C		84	85					
–	02	VRDM 368		35	36					
i = 1	22	MSM 019B		104	105			Magnetic field sensor with connector: Reed sensor 58, Hall sensor PNP NC 59		05 Positioning accuracy
i = 1.5	23									
i = 1	17	MSM 031B		106	107					
i = 1.5	18									
i = 1	15	MSK 030C		84	85					
i = 1.5	16									

1) Attachment kit also available without motor (when ordering: enter “00” for motor)
2) Plastic sealing strip

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 25\ \text{mm} + L_{ca}$$

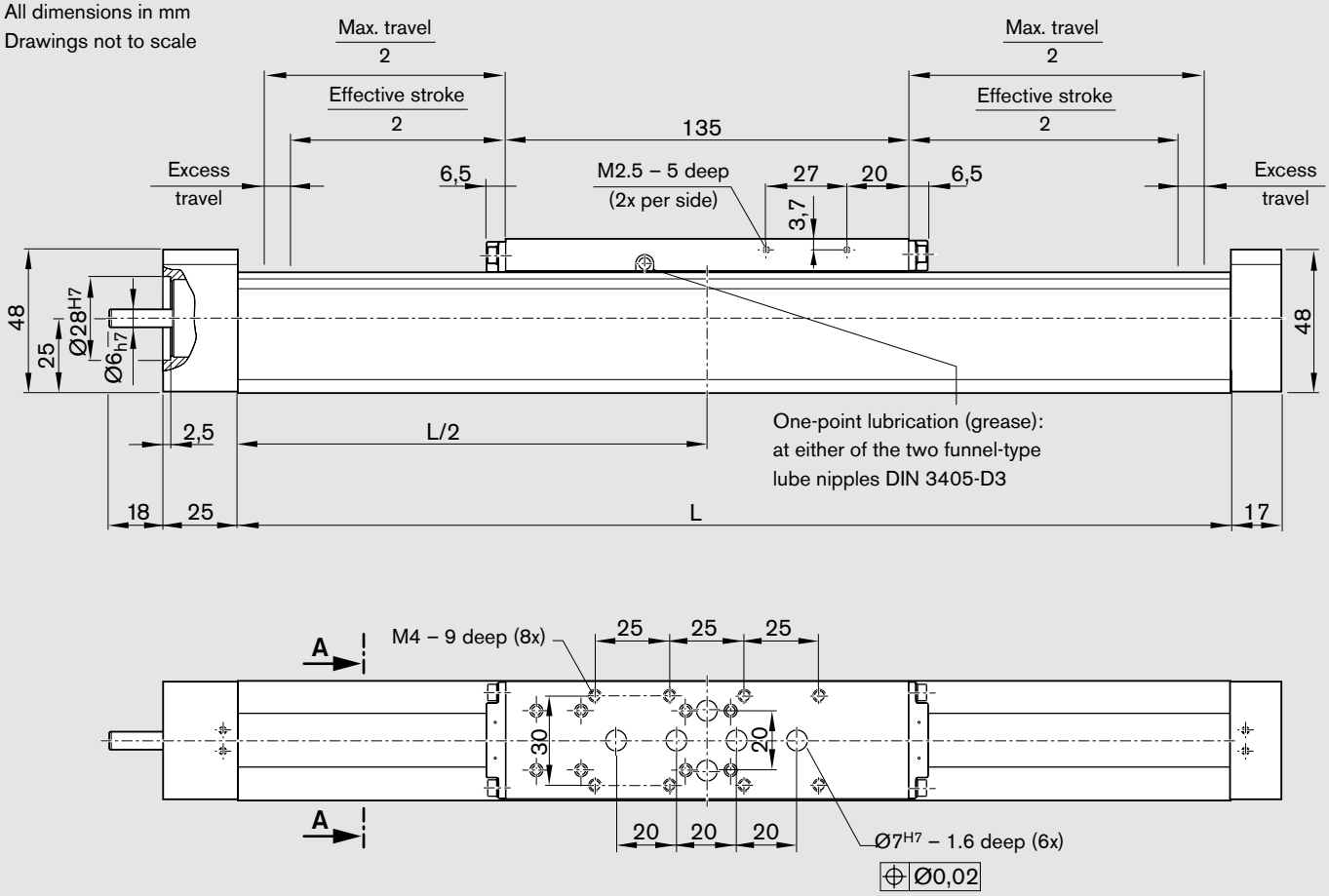
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 12 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm



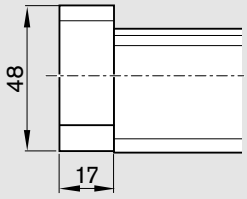
Linear Modules MKK

Linear Modules MKK 12-40 Dimensions

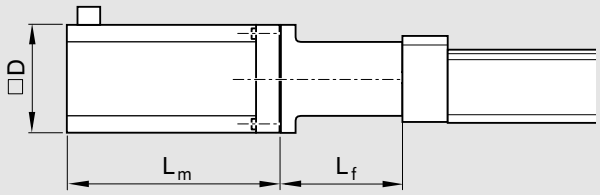
All dimensions in mm
Drawings not to scale



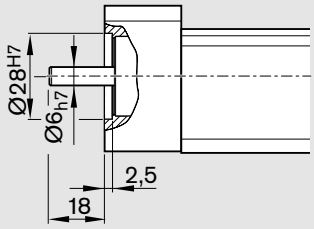
OA01



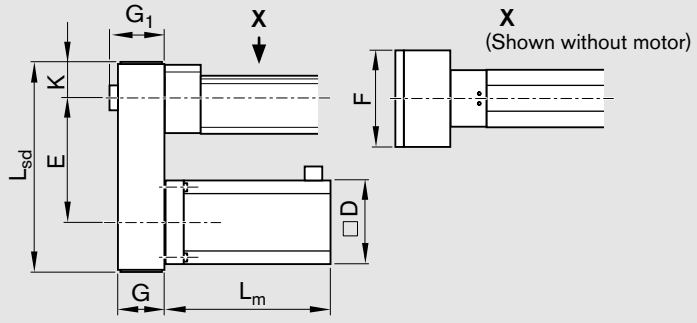
MF01

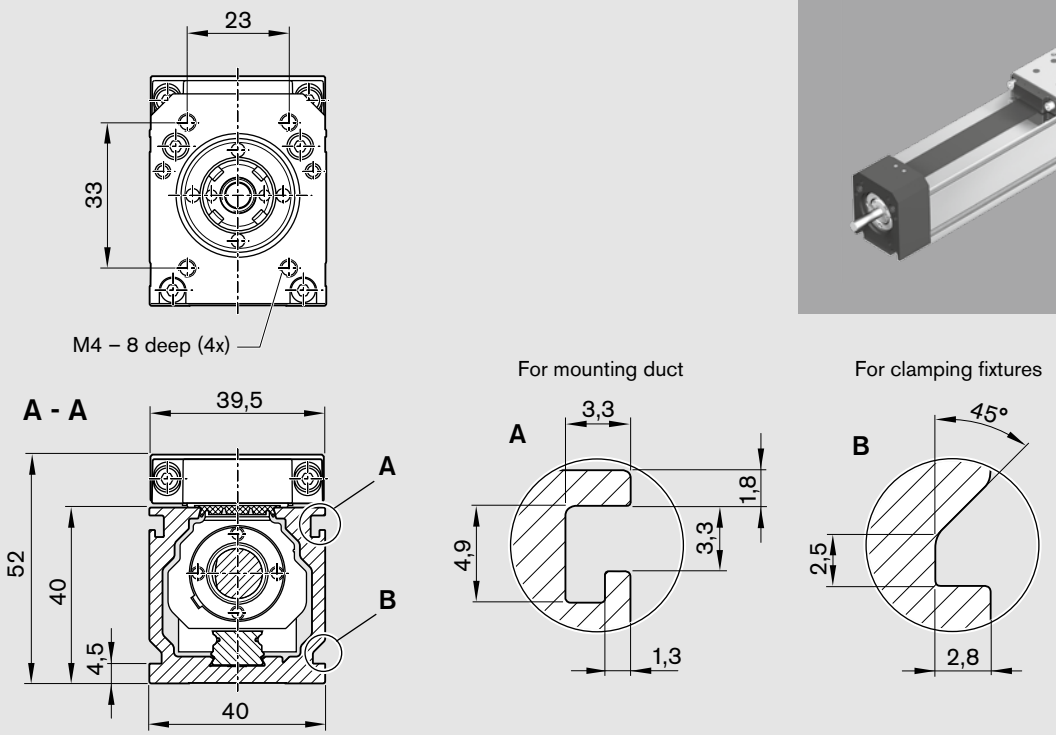


OF01



RV01 - RV04



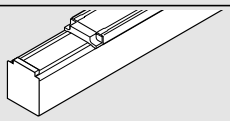
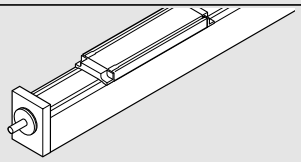
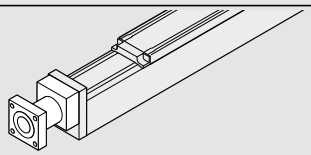
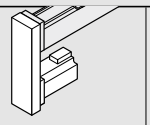
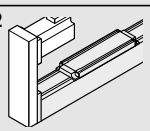
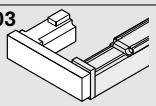
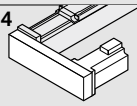


Version	Motor	Dimensions (mm) D	E		F	G	G_1	K	L_f	L_m without brake	L_m with brake	L_{sd}
			i = 1	i = 1.5								
RV01 - RV04	**MSM 019B**	38.0	76.5	76.5	48.0	27	29.0	27.5	–	92	122.0	139
	MSM 031B	60.0	78.0	75.0	64.5	37	43.5	33.5	–	79	115.5	157
	MSK 030C	54.0	78.0	75.0	64.5	37	43.5	33.5	–	188	213.0	154
MF01	**MSM 019B**	38.0	–			–			45	92	122.0	–
	MSM 031B	60.0	–			–			50	79	115.5	–
	MSK 030C	54.0	–			–			50	188	213.0	–
	VRDM 368	57.2	–			–			50	116	157.0	–

CAD configurator available on the Internet at www.boschrexroth.com/dcl

Linear Modules MKK

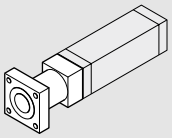
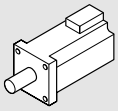
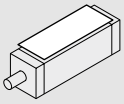
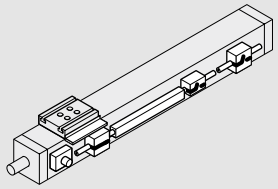
Linear Modules MKK 15-65 Components and Ordering Data

Part number, length R1160 060 00, ... mm Version		Guideway	Drive unit Screw journal	Ball screw size d_0 x P 16x5	16x10	16x16	Carriage L_{ca} = 190 mm With T-slots	With threaded holes
Without drive unit	OA01 	02		00			11	15
With ball screw, w/o motor mount	OF01 	01	Ø10	01	02	03	01	05
			Ø10 with keyway	11	12	13		
With ball screw and motor mount	MF01 	01	Ø10	01	02	03	01	05
With ball screw and timing belt side drive	RV01  RV02  RV03  RV04 	01	i = 1 Ø10	01	02	03	01	05
			i = 1.5* Ø10	31	32	33		

Ordering example: see “Inquiry/Order”

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
L_{ca} = carriage length

Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Reduction i =	Attachment kit [1]	for motor		without Brake	with Brake	without Sealing strip [2]	with Sealing strip [2]		Standard report	Measurement report
–	00	–		–		00	01 without side sealing	**Without switch and cable duct** 00	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–		–		00		**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm **Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	02	**MSK 040C**	86	87		00				
	06	**MSM 041B**	110	111						
–	04	**VRDM 397**	37	38						
		VRDM 3910	39	40						
	05	**VRDM 3913**	41	42						
i = 1	30	**MSK 040C**	86	87		00	02 with side sealing	**Cable duct (loose)** – Length 20, ... mm		
	32	**MSM 041B**	110	111						
i = 1.5*	31	**MSK 040C**	86	87				**External socket/ plug (loose)** 17		
	33	**MSM 041B**	110	111				**External switching cam** 16		

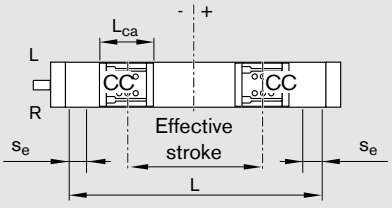
* with support bearing

1) Attachment kit also available without motor (when ordering: enter “00” for motor)

2) Plastic sealing strip

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 90\ \text{mm} + L_{ca}$$

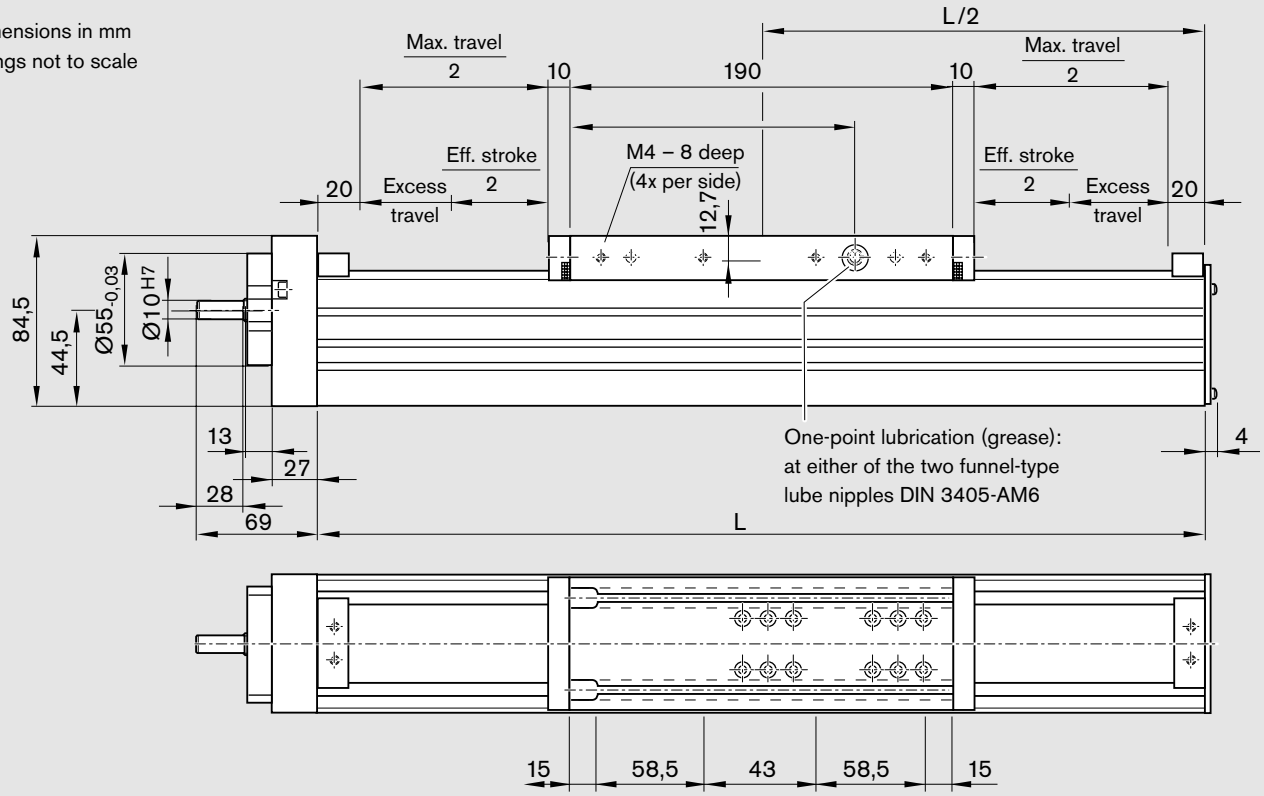


Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 16 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm

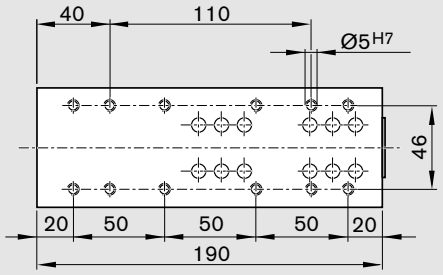
Linear Modules MKK

Linear Modules MKK 15-65 Dimensions

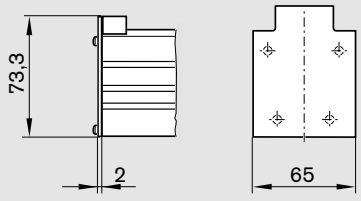
All dimensions in mm
Drawings not to scale



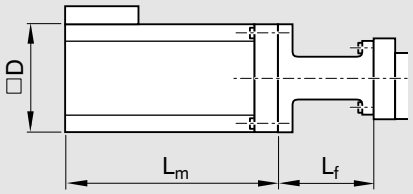
Carriage with threads



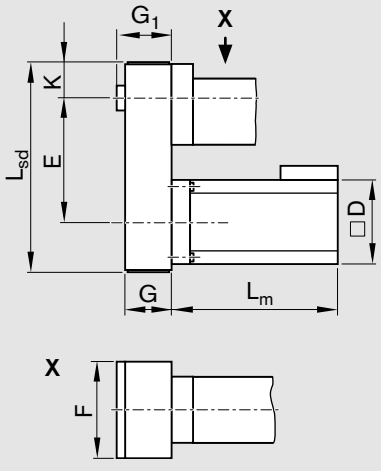
OA01



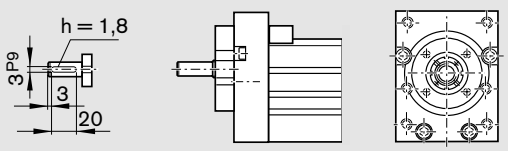
MF01

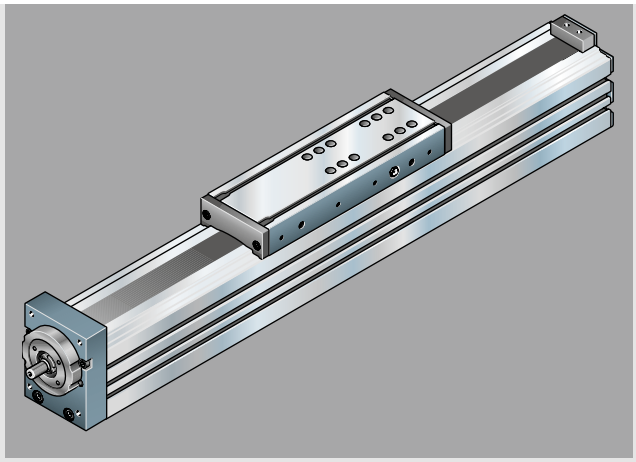


RV01 - RV04



OF01



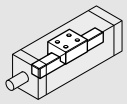
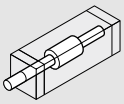
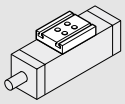
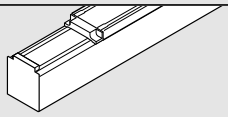
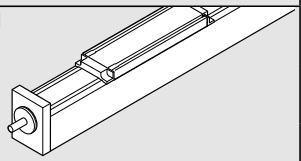
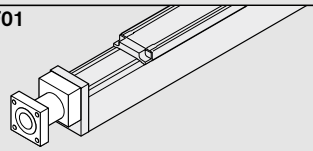
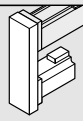
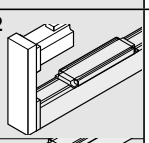
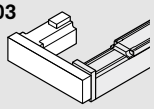
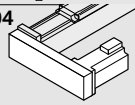


Version	Motor	Dimensions (mm)											
		D	E			F	G	G_1	K	L_f	L_m		L_{sd}
			i = 1	i = 1.5	i = 2						without brake	with brake	
RV01 - RV04	MSK 040C	82	122	122	–	88	51	81	47.5	–	185.5	215.5	231
	MSM 041B	80	122	122	–	88	51	81	47.5	–	112.0	149.0	231
MF01	MSK 040C	82	–							95	185.5	215.5	
	MSM 041B	80	–							90	112.0	149.0	
	VRDM 397	85	–							90	110.0	156.5	–
	VRDM 3910	85	–							90	140.0	186.5	
	VRDM 3913	85	–							90	170.0	216.5	

CAD configurator available on the Internet at www.boschrexroth.com/dcl

Linear Modules MKK

Linear Modules MKK 20-80 Components and Ordering Data

Part number, length R1160 160 10, ... mm		Guideway	Drive unit						Carriage			
												
Version			Screw journal	Ball screw size d_0 x P					L_{ca} = 260 mm			
				16x10	16x16	20x5	20x20	20x40	With T-slots		With threaded holes[1]	
Without drive unit	OA1 	02		00					12	–	15	
With ball screw, w/o motor mount	OF01 	01	Ø 10	01	02	03	04	05	01	02 Ball screw 20x40	05	
			Ø 10 with keyway	11	12	13	14	15				
With ball screw and motor mount	MF01 	01	Ø 10	01	02	03	04	05	01	02 Ball screw 20x40	05	
With ball screw and timing belt side drive	RV01  RV02  RV03  RV04 	01	i = 1 Ø 10	01	02	03	04	05	01	02 Ball screw 20x40	05	
			i = 1.5* Ø 10	31	32	33	34	35				
			i = 2* Ø 10	21	22	23	24	25				

Ordering example: see “Inquiry/Order”

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
L_{ca} = carriage length

1) Not for ball screw 20x40

Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit [2]	for motor		without Brake	with Brake	without Sealing strip [3]	with Sealing strip [3]		Standard report	Measurement report
–	00	–		00		00	20 without side sealing	**Without switch and cable duct** 00	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–		00				**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm **Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	02	**MSK 040C**		86	87					
	06	**MSM 041B**		110	111					
–	04	**VRDM 397**		37	38	00				
		VRDM 3910		39	40					
	05	**VRDM 3913**		41	42					
i = 1	23	**MSK 050C**		88	89		21 with side sealing	**Cable duct (loose)** – Length 20, ... mm		
	30	**MSK 040C**		86	87					
	32	**MSM 041B**		110	111					
i = 1.5*	31	**MSK 040C**		86	87			**External socket/ plug (loose)** 17		
	33	**MSM 041B**		110	111					
i = 2*	26	**MSK 050C**		88	89			**External switching cam** 16		

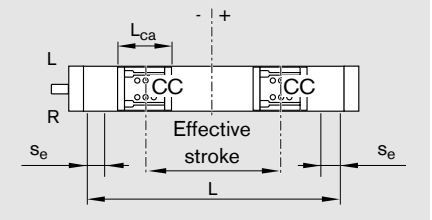
* with support bearing

2) Attachment kit also available without motor (when ordering: enter “00” for motor)

3) Steel sealing strip, permissible up to 3500 mm

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 120\ \text{mm} + L_{ca}$$

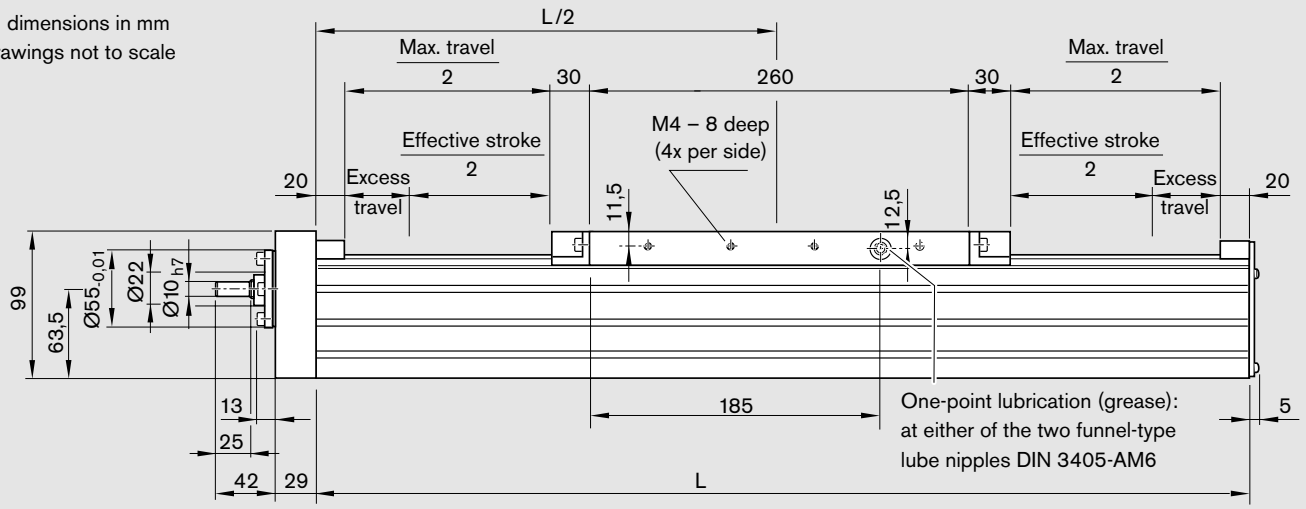


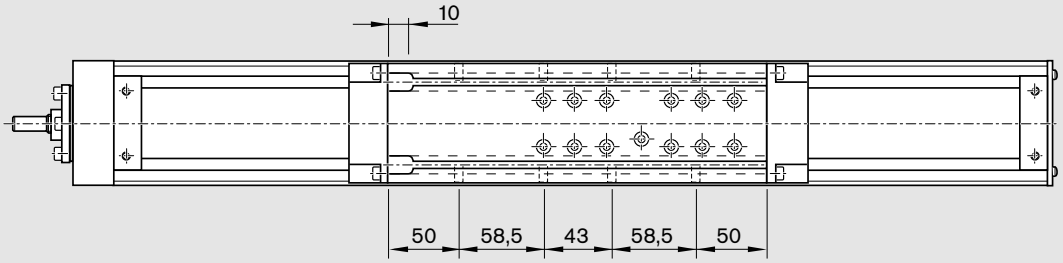
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 16 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm

Linear Modules MKK

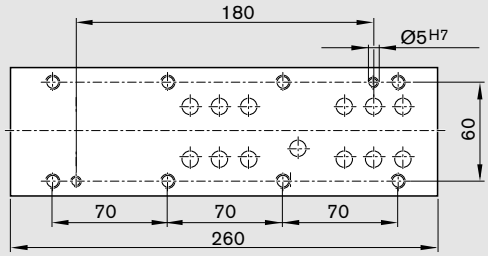
Linear Modules MKK 20-80 Dimensions

All dimensions in mm
Drawings not to scale

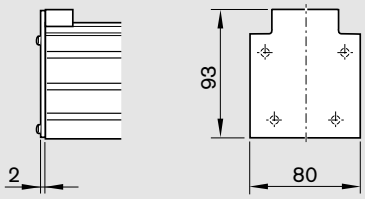




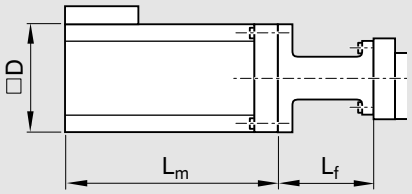
Carriage with threads



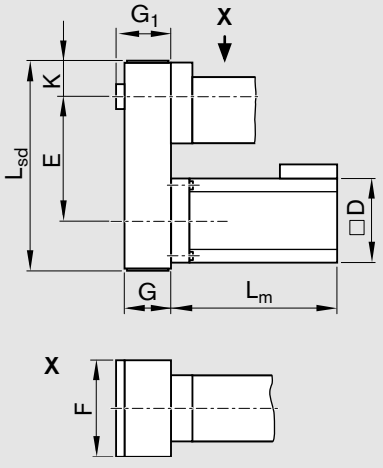
OA01



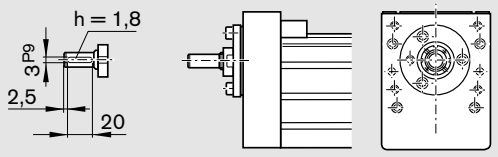
MF01

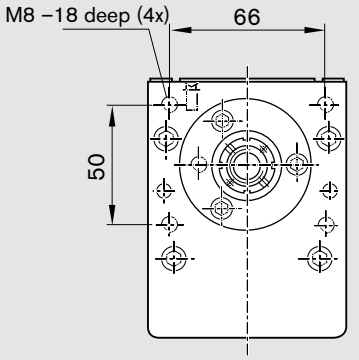


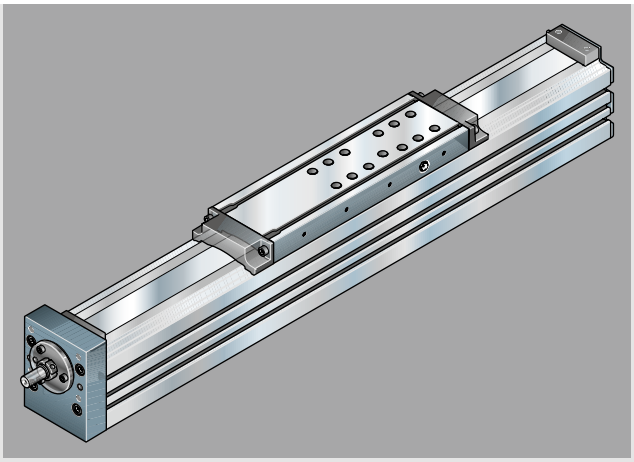
RV01 - RV04

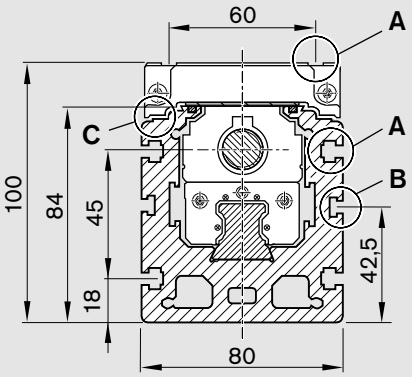


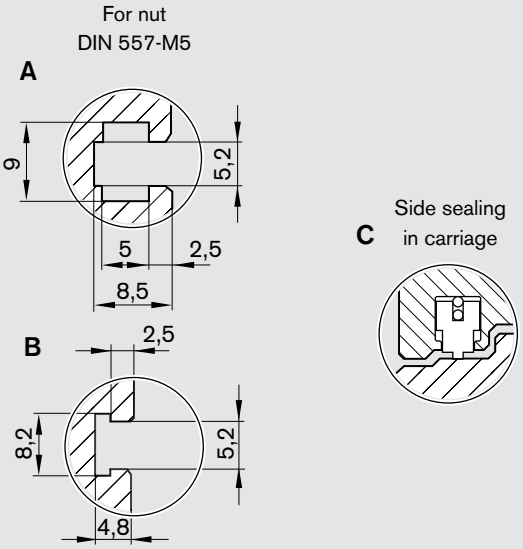
OF01











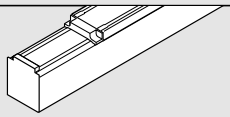
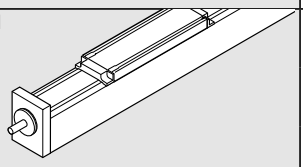
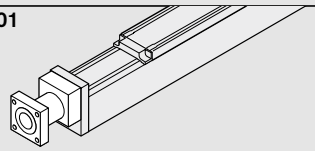
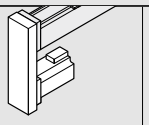
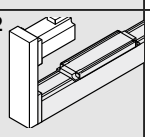
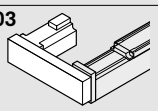
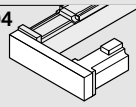
Version	Motor	Dimensions (mm)											
		D	E			F	G	G_1*)	K	L_f	L_m without brake	L_m with brake	L_{sd}
			i = 1	i = 1.5	i = 2								
RV01 - RV04	MSK 040C	82	122	122	–	88	51	57	47.5	–	185.5	215.5	231
	MSK 050C	98	155	–	152	116	66	78	56.0	–	203.0	233.0	287
	MSM 041B	80	122	122	–	88	51	57	47.5	–	112.0	149.0	231
MF01	MSK 040C	82		–			–			95	185.5	215.5	–
	MSM 041B	80		–			–			90	112.0	149.0	–
	VRDM 397	85		–			–			90	110.0	156.5	–
	VRDM 3910	85		–			–			90	140.0	186.5	–
	VRDM 3913	85		–			–			90	170.0	216.5	–

*) For i = 1.5 and i = 2 only

CAD configurator available on the Internet at www.boschrexroth.com/dcl

Linear Modules MKK

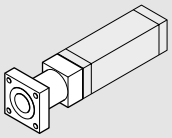
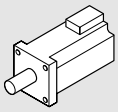
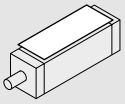
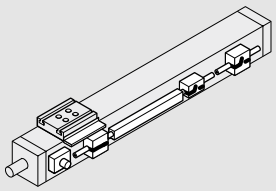
Linear Modules MKK 25-110 Components and Ordering Data

Version	Part number, length R1160 260 10, ... mm	Guideway	Drive unit: Screw journal	Drive unit: Ball screw size d_0 x P 32x5	32x10	32x20	32x32	Carriage L_{ca} = 310 mm: without SPU	with 1 SPU	with 2 SPUs
Without drive unit	OA1 	02		00				12	–	–
With ball screw, w/o motor mount	OF01 	01	Ø 16	01	02	03	04	01	03	04
			Ø 16 with keyway	11	12	13	14			
With ball screw and motor mount	MF01 	01	Ø 16	01	02	03	04	01	03	04
With ball screw and timing belt side drive	RV01  RV02  RV03  RV04 	01	Ø 16	01	02	03	04	01	03	04

Ordering example: see “Inquiry/Order”

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

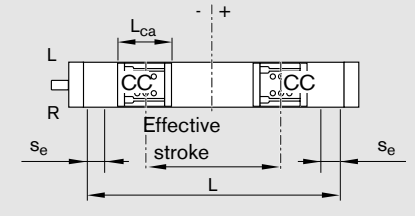
d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
SPU = screw support
L_{ca} = carriage length

Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
									
Reduction i =	Attachment kit[1]	for motor	without Brake	with Brake	without Sealing strip[2]	with Sealing strip[2]		Standard report	Measurement report
–	00	–	00		00	20 without side sealing	**Without switch and cable duct** 00	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–	00				**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm **Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	03	**MSK 060C**	90	91					
–	02	**MSK 076C**	92	93		21 with side sealing	**Cable duct (loose)** – Length 20, ... mm		
i = 1	23	**MSK 060C**	90	91			**External socket/ plug (loose)** 17		
i = 2	24	**MSK 060C**	90	91			**External switching cam** 16		

1) Attachment kit also available without motor (when ordering: enter “00” for motor)
2) Steel sealing strip, permissible up to 3500 mm

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 140 \text{ mm} + L_{ca}$$

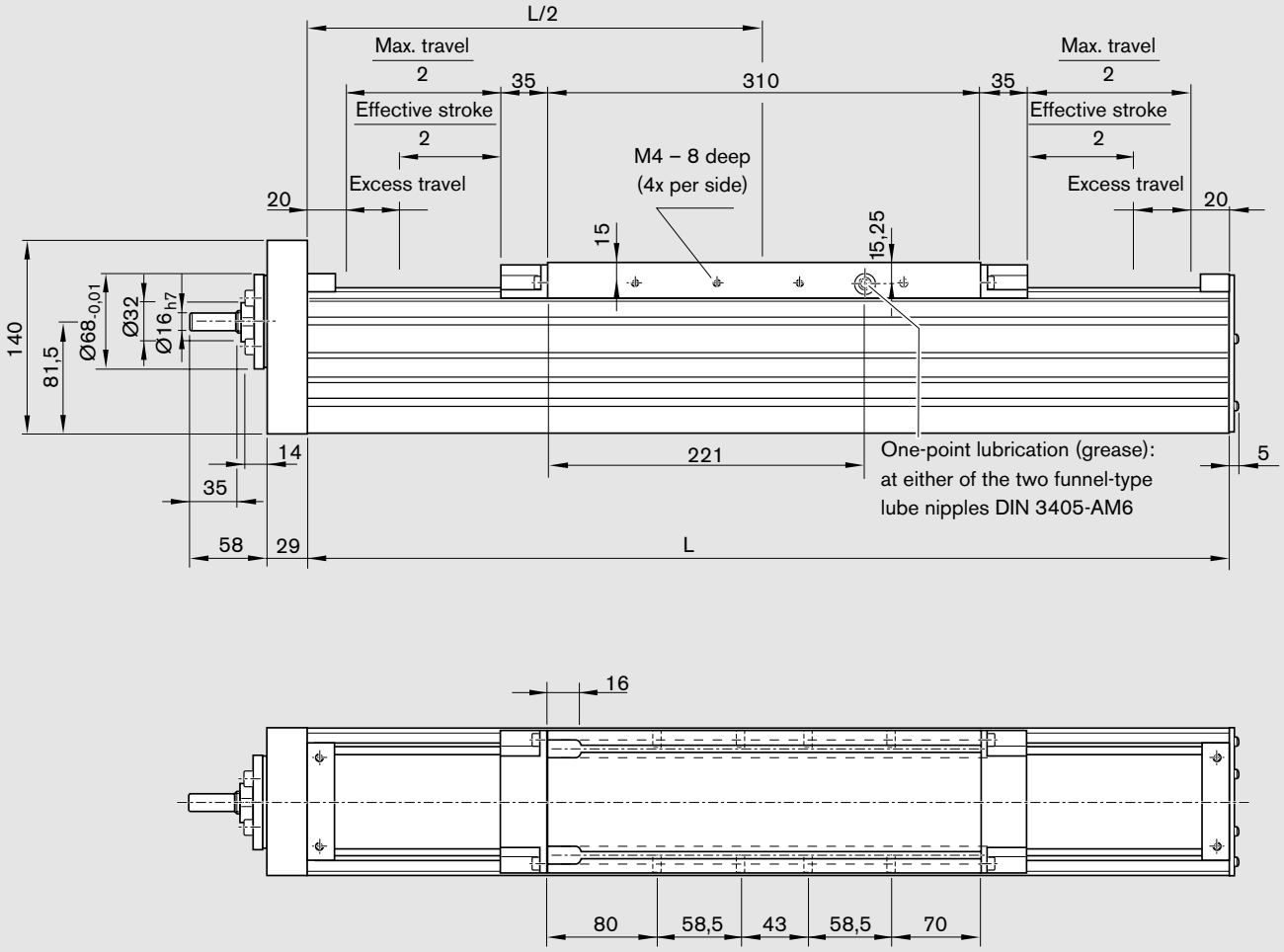


Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 32 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm

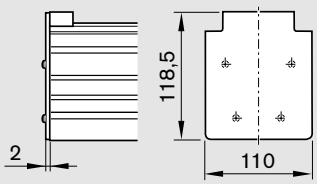
Linear Modules MKK

Linear Modules MKK 25-110 Dimensions

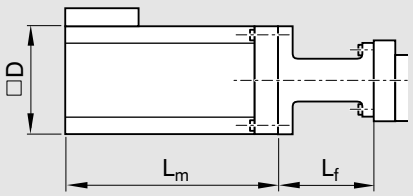
All dimensions in mm
Drawings not to scale



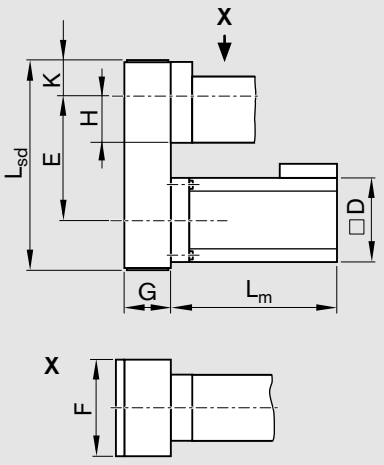
OA01



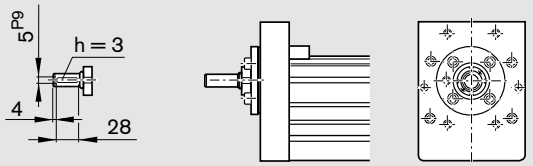
MF01

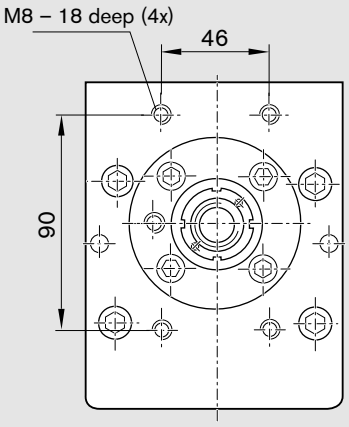


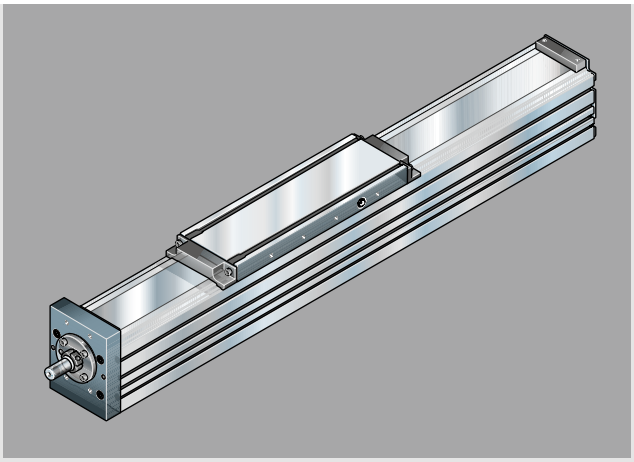
RV01 - RV04

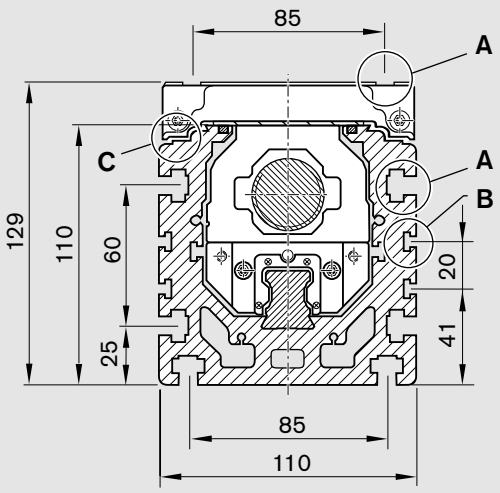


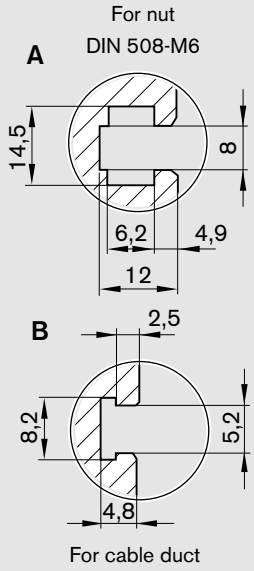
OF01

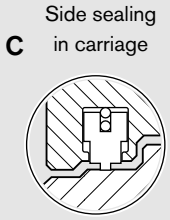












Version	Motor	Dimensions (mm)											
		D	E			F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd}
			i = 1	i = 1.5	i = 2								
RV01 - RV04	MSK 060C	116	165	–	162	116	66	81.5	58.5	–	226.0	259.0	300
MF01	MSK 060C	116	–			–				125	226.0	259.0	–
	MSK 076C	140	–			–				125	292.5	292.5	–

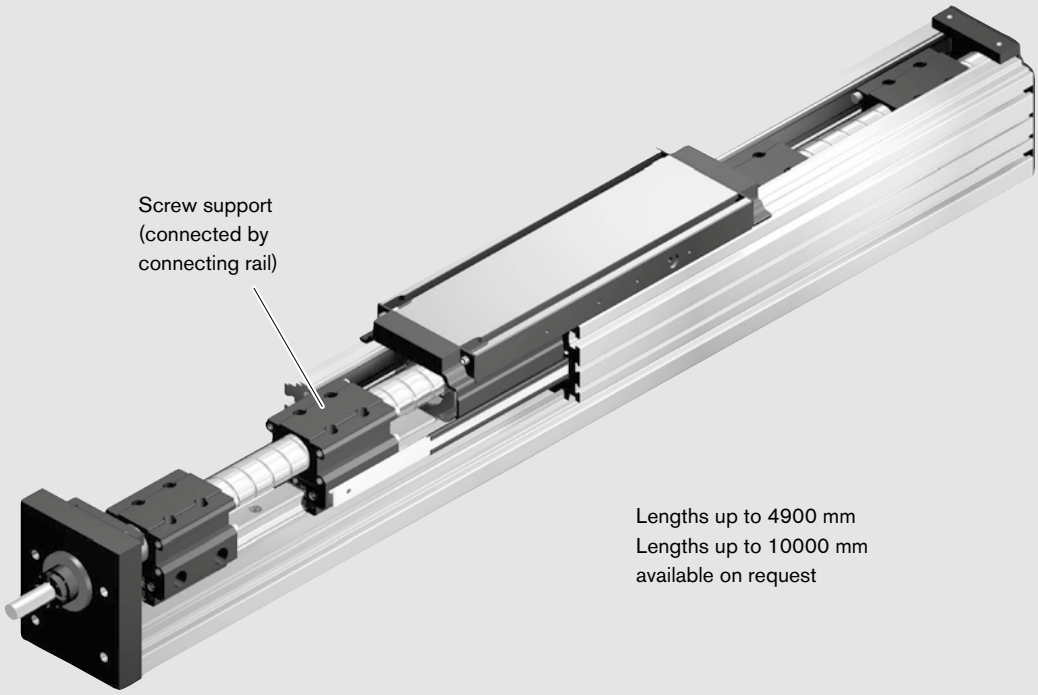
CAD configurator available on the Internet at www.boschrexroth.com/dcl

Linear Modules MKK

Screw Support for Linear Modules MKK 25-110

Product Overview

The Screw Support (SPU) offers the following advantages:
- Low weight thanks to aluminum runner block and aluminum connecting rail
- Connecting rail guided within the frame. Integrated plastic profiles ensure optimal sliding of the connecting rail in the frame.
- Elastomer buffer as shock absorber between carriage and screw support. Additional cushioning provided by elastomer ring between connecting rail and screw support.
- Up to 2 screw supports can be integrated per module on either side of the carriage.
- Runner block of screw support lubricated for life (no in-service lubrication required)
- Screw support protected by sealing strip of Linear Module
- Screw support selectable as a standard option by stating the option number
- The screw support is suitable for horizontal operation only



Lengths up to 4900 mm
Lengths up to 10000 mm
available on request

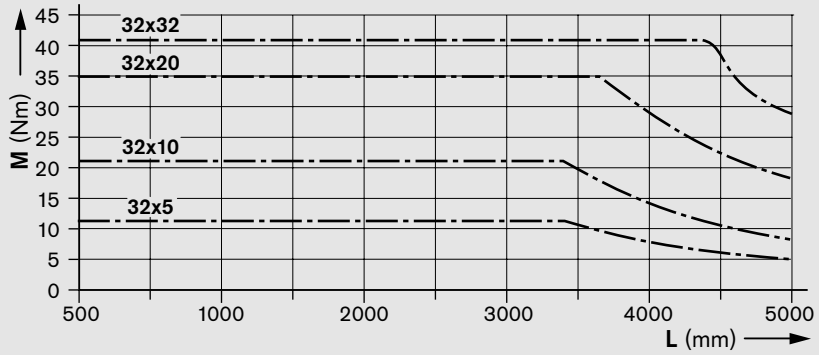
Technical Data

The values shown for M_R are applicable under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw journal

Ball screw d_0 x P	Friction moment M_R (Nm) without SPU	with 1 SPU	with 2 SPUs
32 x 5	0.8	0.9	0.9
32 x 10	0.9	1.1	1.2
32 x 20	0.9	1.2	1.4
32 x 32	1.0	1.5	1.9

Permissible drive torque M_{perm}

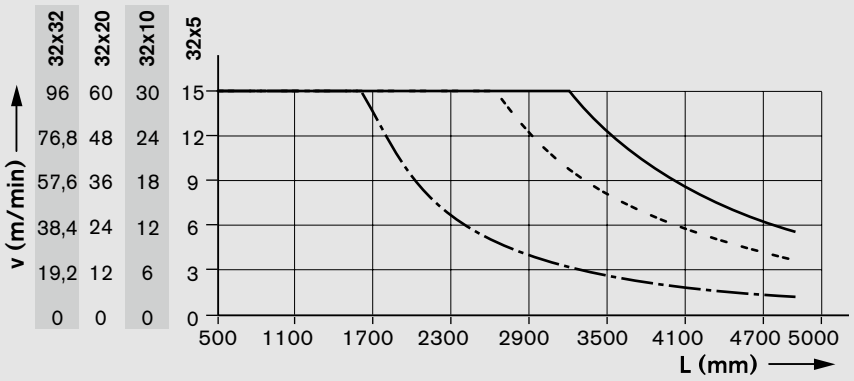
—·— with and without SPU



Permissible travel speed v

Consider the motor speed!

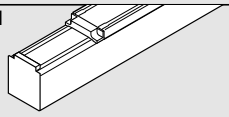
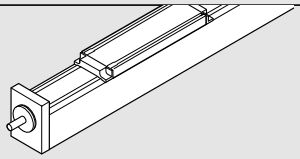
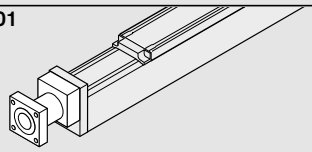
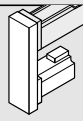
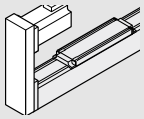
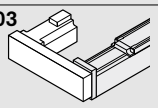
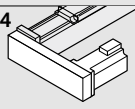
——— with 2 SPUs
-- -- -- with 1 SPU
—·— without SPU



Version	Weight (kg)	Length $_{max.}$ (mm)	Length calculation
Without screw support	0.0217 x L + 7.2	3000	L = stroke + 2 x excess travel + 450
With one screw support	0.0217 x L + 8.5	4900	L = stroke + 2 x excess travel + 626
With two screw supports	0.0217 x L + 9.8	4900	L = stroke + 2 x excess travel + 802

Linear Modules MKK

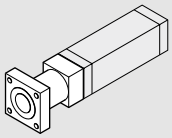
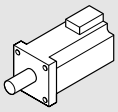
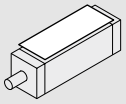
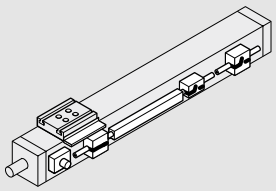
Linear Modules MKK 35-165 Components and Ordering Data

Part number, length R1160 360 00, ... mm Version		Guideway	Drive unit Screw journal	Ball screw size d_0 x P 40x5	40x10	40x20	40x40	Carriage L_{ca} = 400 mm	
Without drive unit	OA1 	01		00				10	
With ball screw, w/o motor mount	OF01 	01	Ø 25	01	02	03	04	01	
			Ø 25 with keyway	11	12	13	14		
With ball screw and motor mount	MF01 	01	Ø 25	01	02	03	04	01	
With ball screw and timing belt side drive	RV01  RV02  RV03  RV04 	01	Ø 25	01	02	03	04	01	

Ordering example: see “Inquiry/Order”

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

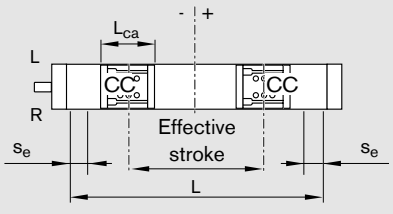
d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
L_{ca} = carriage length

	Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
	Reduction i =	Attachment kit [1]	for motor	without Brake	with Brake	without Polyurethane bellows	with Polyurethane bellows		Standard report	Measurement report
	–	00	–	00		00	01	**Without switch and cable duct** 00	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
	–	00	–	00		00	01	**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm **Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
	–	02	**MSK 076C**	92	93	00	01	**Cable duct (loose)** – Length 20, ... mm		
	i = 1	23	**MSK 076C**	92	93	00	01	**External socket/ plug (loose)** 17		
	i = 2	24	**MSK 076C**	92	93			**External switching cam** 16		

1) Attachment kit also available without motor (when ordering: enter “00” for motor)

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) \cdot 1.17^* + 50\ \text{mm} + L_{ca}$$



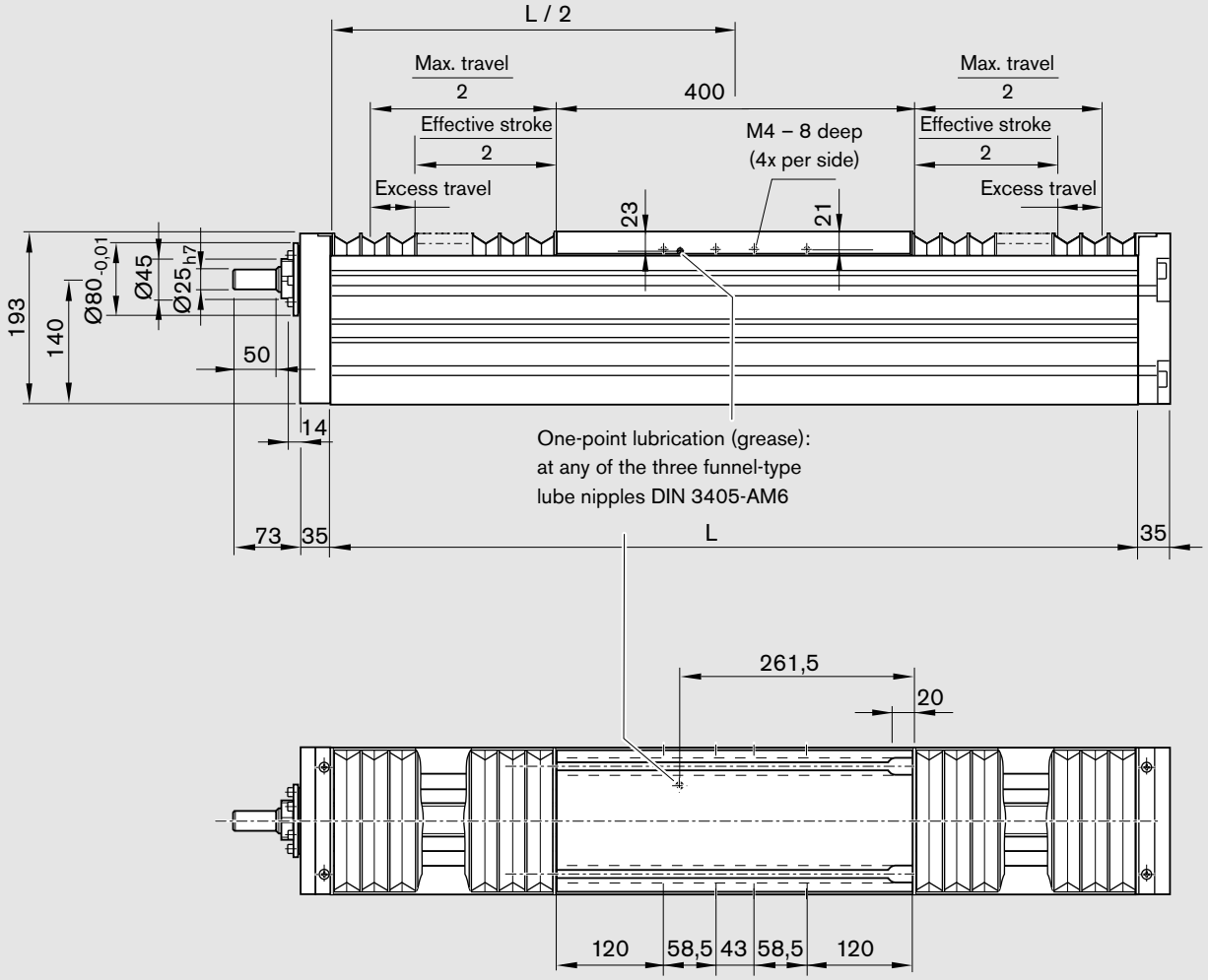
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 40 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm

* with protective bellows

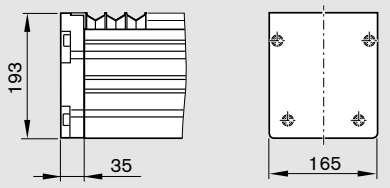
Linear Modules MKK

Linear Modules MKK 35-165 Dimensions

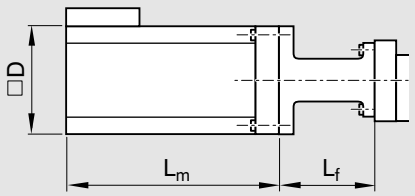
All dimensions in mm
Drawings not to scale



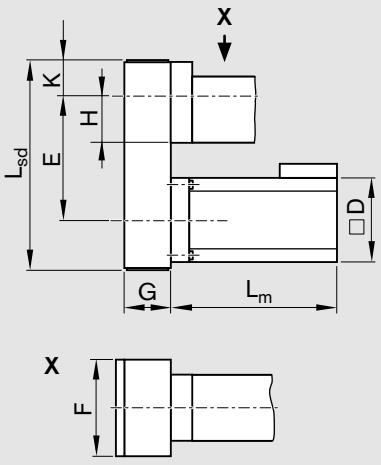
OA01



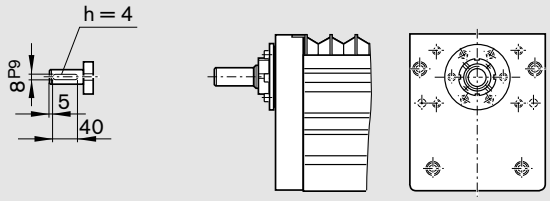
MF01

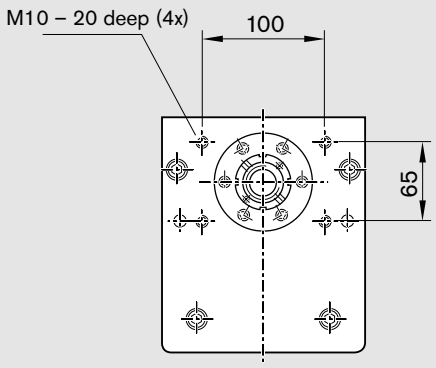


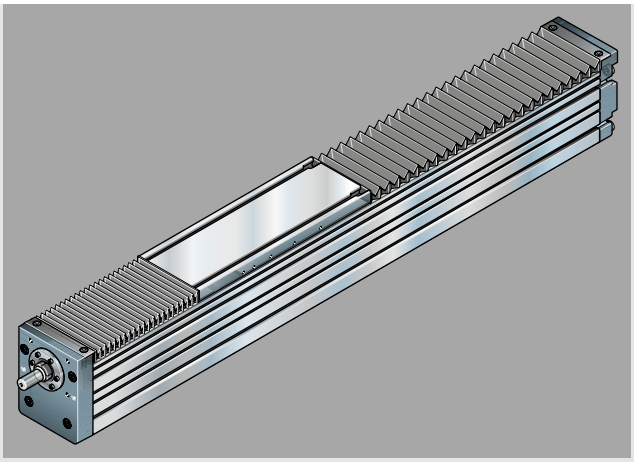
RV01 - RV04

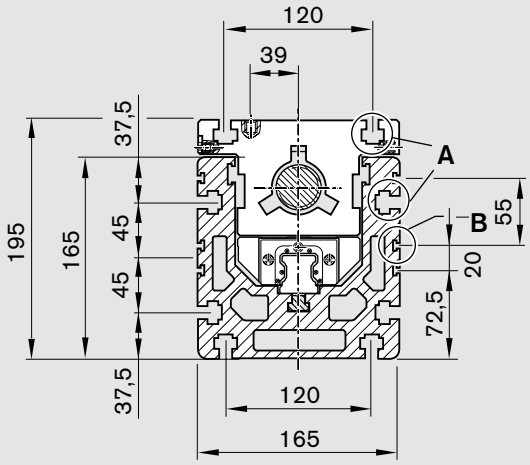


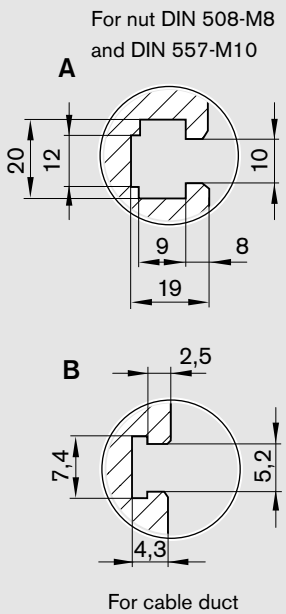
OF01











Version	Motor	Dimensions (mm)											
		D	E			F	G	H	K	L_f	L_m without brake	L_m with brake	L_{sd}
			i = 1	i = 1.5	i = 2								
RV01 - RV04	MSK 076C	140	240	–	238	160	90	140	53	–	292.5	292.5	409
MF01	MSK 076C	140	–			–				140	292.5	292.5	–