Linear Module MKK 12-40

Product Description

Outstanding features

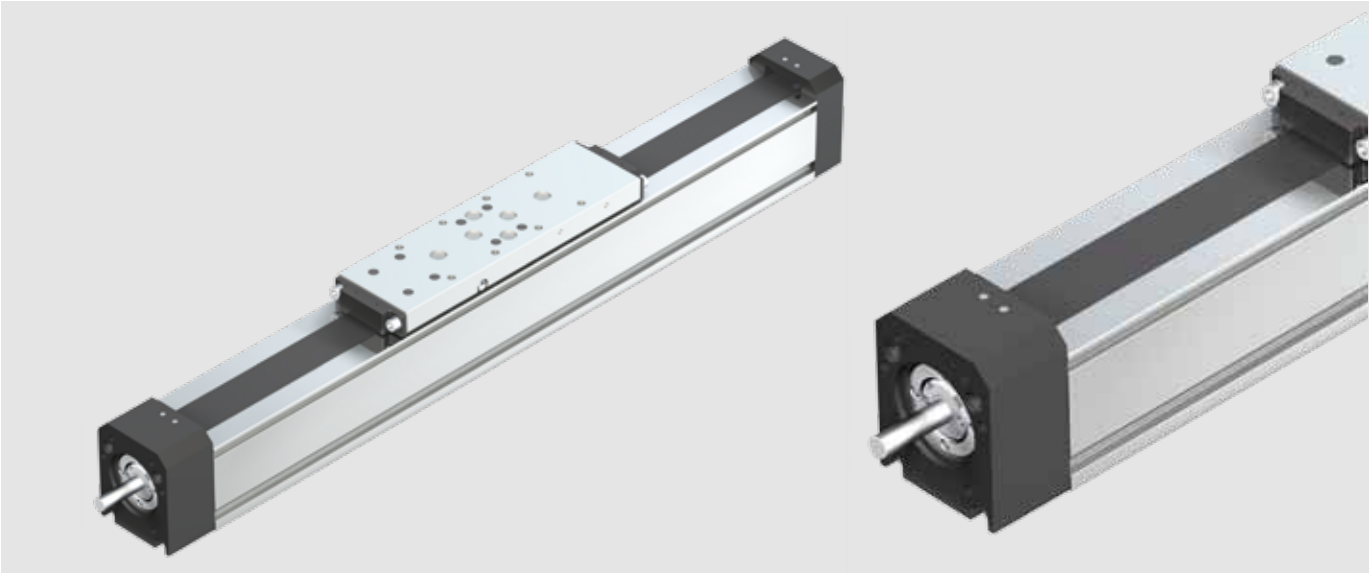
Rexroth Miniature Linear Modules are precise, ready-to-install linear motion systems that combine high performance with compact dimensions.
They are especially suitable for handling tasks requiring high precision within restricted spaces. Rexroth offers favorable price/performance ratios and fast delivery.

Structural design
- Extremely compact extruded aluminum profile (frame) with integrated Rexroth Ball Rail System
- With Precision Ball Screw Assembly
- Special protective plastic sealing strip
- Ready-to-install linear modules in any length up to L_{max}

Attachments
- Maintenance-free digital AC servo drives with integrated brake and attached feedback, or 3-phase stepping motors
- Motor mount and coupling or timing belt side drive for motor attachment
- Proximity switches or magnetic field sensors with various mounting options
- Available as complete drive units with drive controller and control unit
- Standardized mounting interfaces

Further highlights

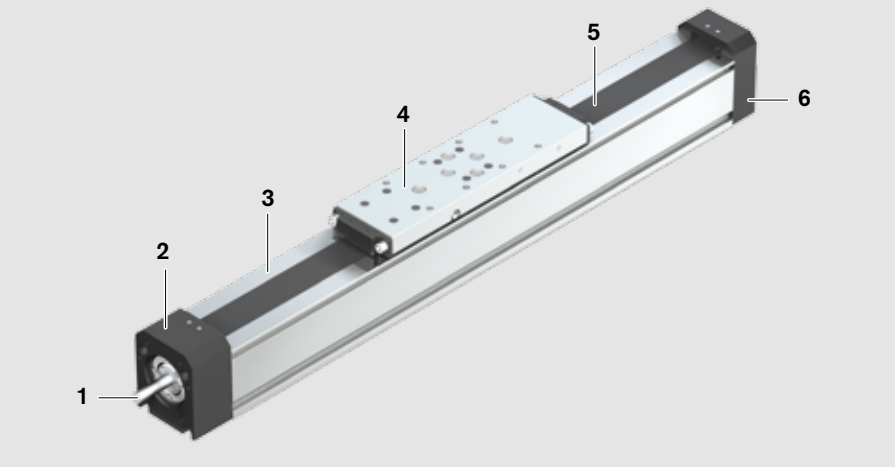
- Optimal travel performance due to integrated, zero-clearance Ball Rail System
- High load capacities and high rigidity
- Especially compact design due to integrated Ball Screw Drive
- High positioning accuracy and repeatability due to Precision Ball Screw Assembly with zero-backlash nut system
- High travel speeds combined with high precision and smooth running over long travel ranges
- Low-cost maintenance provided by one-point lubrication (grease) for Ball Rail System and Precision Ball Screw Assembly
- Easy motor attachment via locating feature and fastening threads
- Switches adjustable over the entire travel range
- Fully compatible with the camoLINE-system
- Positive-locking connection technology with centering rings
- Same outside dimensions mean that accessories and attachments can be used on either the MKK or the MKR
- Mounting in any orientation



MKK with screw journal

Structural Design

1 Ball screw with zero-backlash cylindrical single nut
2 Fixed bearing end block
3 Frame
4 Carriage
5 Sealing strip
6 Floating bearing end block

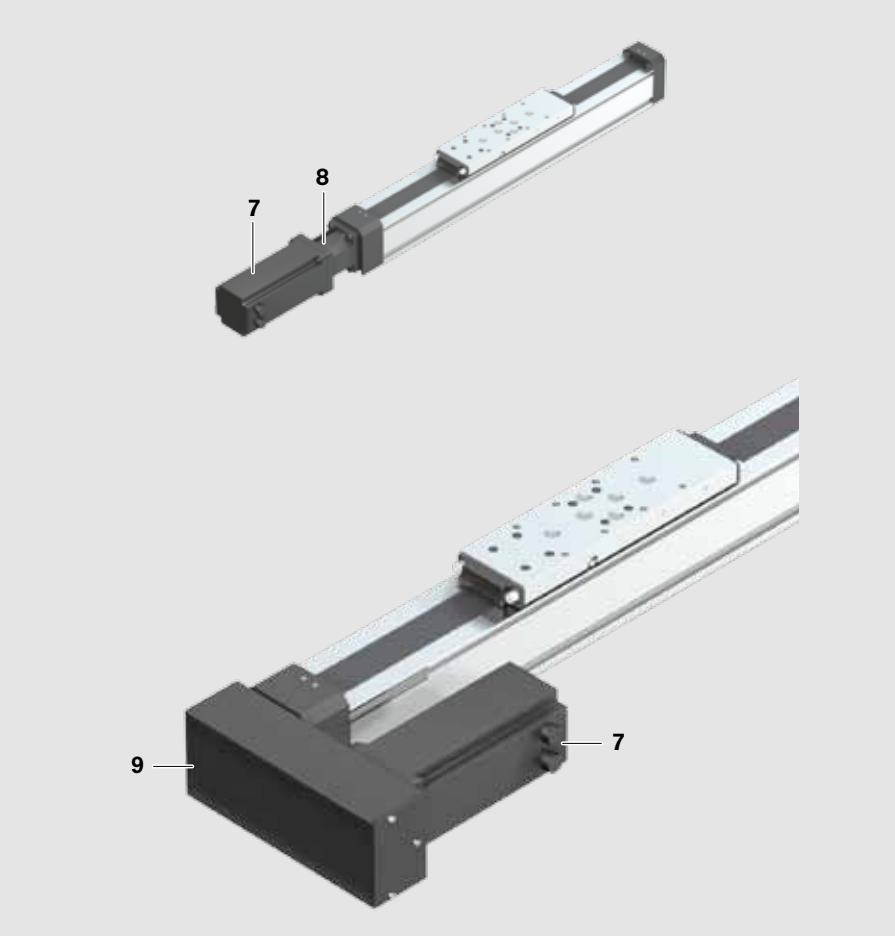


Motor attachment

7 Motor
8 Motor mount and coupling
9 Timing belt side drive

Motor mount and coupling

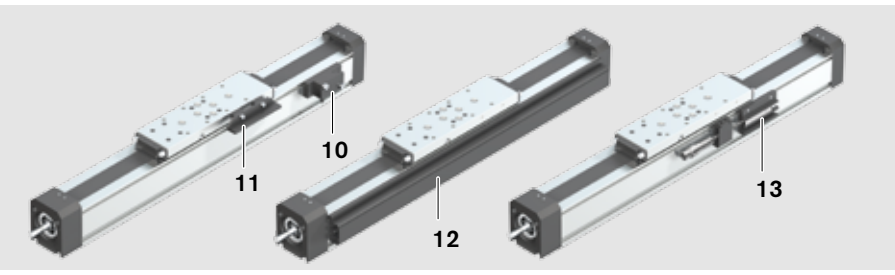
A motor can be attached to the Linear Module MKK 12-40 by means of a motor mount and coupling.
The motor mount serves to fasten the motor to the Linear Module and acts as a closed housing for the coupling.
The coupling transmits the motor drive torque free of distortive stresses to the Linear Module's ball screw journal.



Timing belt side drive

On Linear Modules MKK 12-40 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 serves as protection for the belt and as a motor bracket. Different gear ratios are available:
– i = 1 : 1
– i = 1 : 1.5

The timing belt side drive can be mounted in four different directions:
– below, above (RV01 and RV02)
– left, right (RV03 and RV04)



Switch Mounting Arrangements

10 Proximity switch
11 Switching cam
12 Cable duct
13 Magnetic field sensor

Linear Module MKK 12-40

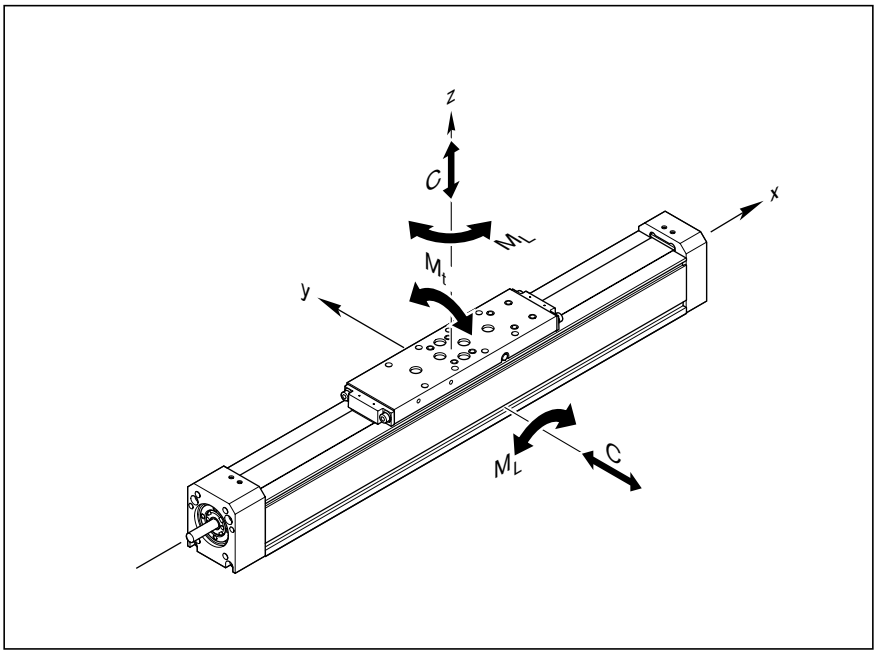
Technical Data

Dynamic characteristics

Linear module	Guideway			Ball Screw		Fixed bearing
	Dyn. load capacity	Dyn. load moments		Size	Dyn. load rating	Dyn. load rating
	C	M_t	M_L	d_0 x P	C	C
	(N)	(Nm)	(Nm)		(N)	(N)
MKK 12-40	3 750	22.3	93.8	12 x 2	2 240	4000
				12 x 5	3 800	
				12 x 10	2 500	

d_0 = screw diameter (mm)
P = lead (mm)

Suitable loads (recommended values on the basis of past experience)
As far as the desired service life is concerned, loads of up to approximately 20% of the dynamic characteristic values (**C, M_t, M_L**) have proved acceptable.
At the same time, the following may not be exceeded:
– maximum permissible loads
– permissible drive torque
– permissible travel speed



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.

General Technical Data

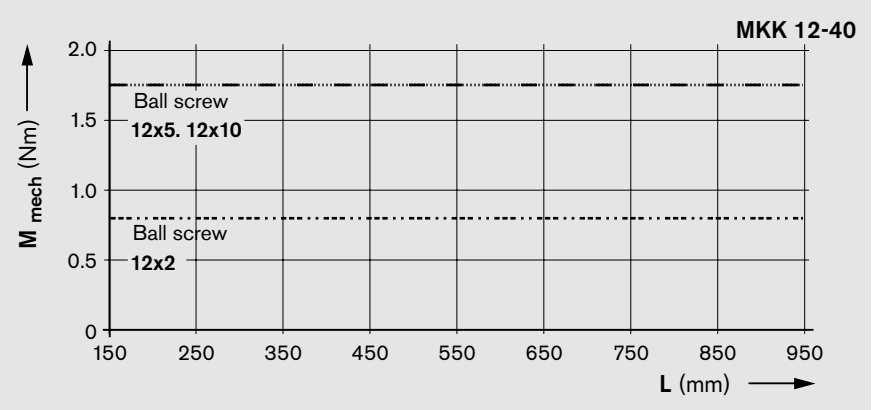
Linear module	Planar moment of inertia		Length of carriage	Length of linear module L		Mass of linear system m_s (kg)		Moved mass of system m_{ca}
	I_y	I_z		min.	max.	without drive	with drive	
	(cm^4)	(cm^4)	(mm)	(mm)	(mm)			(kg)
MKK 12-40	11.96	11.55	135	250	1000	0.0021 · L (mm) + 0.53	0.0021 · L (mm) + 0.65	0.39

Modulus of elasticity E E = 70,000 N/mm^2

Maximum permissible drive torque for mechanical system M_{mech}

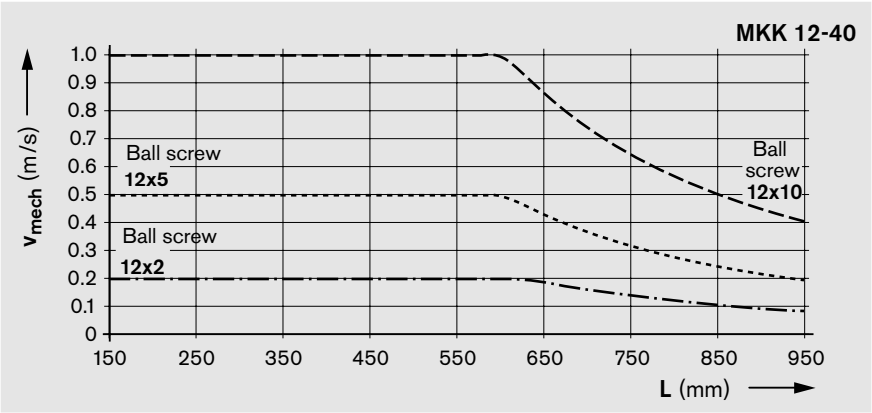
The values shown for M_{mech} are applicable under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw shaft

Consider the rated torque of the coupling used!



Maximum permissible linear speed of mechanical system v_{mech}

Consider the motor speed!

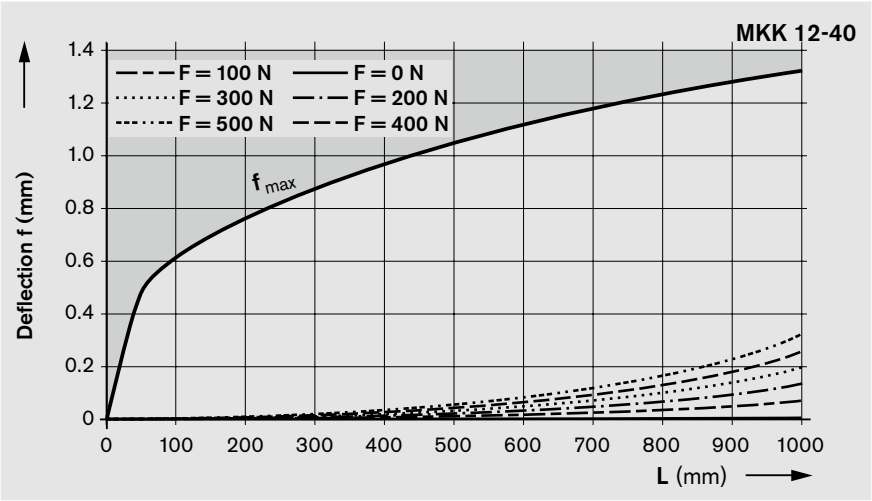


Deflection f

The chart applies under the following conditions:
- Both ends firmly fixed (6 to 8 screws per side)
- Solid mounting base

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

⚠ **f_{max} must not be exceeded!**



Linear Module MKK 12-40

Technical Data

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

Motor		MSM 030B / MSM 030C / MSK 030C				
Frictional torque M_{Rsd} (Nm)		0.15				
		Permissible torque up to length L = ... at			Reduced mass moment of inertia at	
Gear ratio			i = 1	i = 1.5	i = 1	i = 1.5
Linear module	Ball screw size d_0 x P (mm)	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm^2)	J_{sd} (10^{-6} kgm^2)
MKK 12-40	12 x 2	1000	0.80	0.50	45.6	17.7
	12 x 5	1000	1.60	1.10	45.6	17.7
	12 x 10	1000	1.60	1.10	45.6	17.7

$M_{R\,sd}$ = frictional torque of timing belt side drive at motor journal (Nm)
M_{sd} = maximum permissible drive torque of the timing belt side drive (Nm) Consider the maximum torque of the motor M_{max}
J_{sd} = reduced mass moment of inertia of timing belt side drive (kgm^2)
i = timing belt side drive reduction
d_0 = screw diameter (mm)
P = lead (mm)

Mass moment of inertia of linear system J_S and frictional torque of the linear system M_{Rs}

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

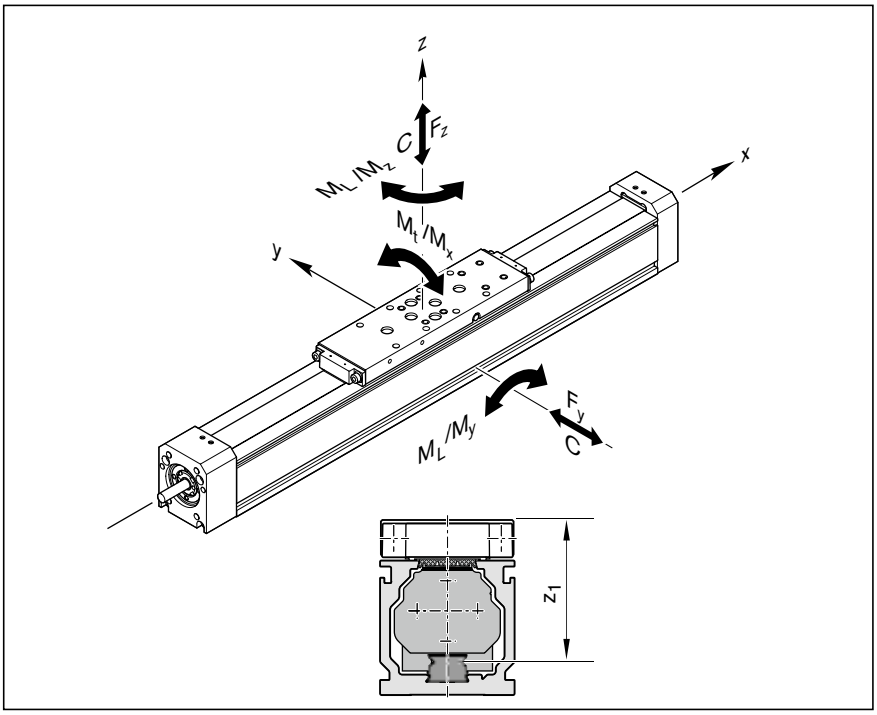
Linear module	Ball screw size d_0 x P	$k_{J\,fix}$	$k_{J\,var}$	M_{Rs} (Nm)
MKK 12-40	12 x 2	1.2744	0.013	0.08
	12 x 5	1.4678	0.011	0.09
	12 x 10	2.2011	0.011	0.11

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 (10^6 kgm^2)
$k_{J\,var}$ = constant for variable-length portion of mass moment of inertia (10^9 kgm)
L = length (mm)
M_{Rs} = Frictional torque of linear motion system (Nm)

Coupling data

Linear module	Motor attachment	Coupling data		
		Rated torque M_{cN} (Nm)	Mass moment of inertia J_c (10^{-6} kgm^2)	Mass m_c (kg)
MKK 12-40	MSM 020B	1.9	2.1	0.039
	MSM 030B MSK 030C	3.7	7.0	0.075
	VRDM 368	5.5	20.0	0.040

Calculations



Combined equivalent load on bearing of the linear guide

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

	z_1 (mm)
MKK 12- 40	42

Nominal life

Nominal life of the guideway in meters:

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

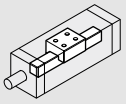
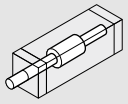
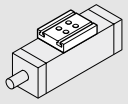
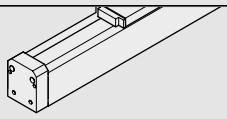
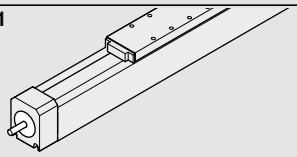
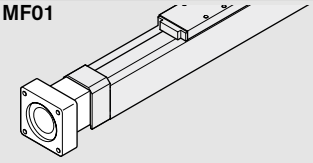
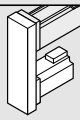
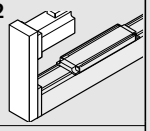
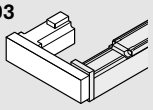
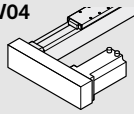
Nominal life of the guideway in hours:

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

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)
L	=	nominal life	(m)
L_h	=	nominal life	(h)
M_L	=	dynamic longitudinal moment load capacity	(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)

Linear Module MKK 12-40

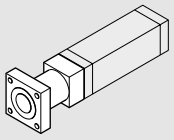
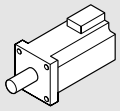
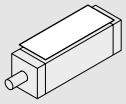
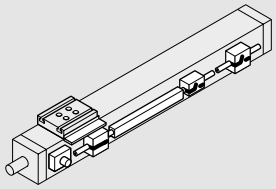
Linear Module MKK 12-40 Components and Ordering Data

Part number, length R1160 660 00, ... mm			Guideway	Drive unit				Carriage	
									
Version				Screw journal	Ball screw size d_0 x P			L_{ca} = 135 mm	
					12x2	12x5	12x10		
without drive	OA1 	OA01	02		00			02	
with ball screw, w/o motor mount	OF01 	OF01	01	Ø 6	01	02	03	01	
with ball screw and motor mount	MF01 	MF01	01	Ø 6	01	02	03	01	
with ball screw and timing belt side drive	RV01  RV02 	RV01 - RV04	01	Ø 6	01	02	03	01	
	RV03  RV04 			Ø 6	01	02	03	01	

⚠ **Ordering example: See “Inquiry/Order” form**

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

d_0 = screw diameter (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	with sealing strip			Standard report	Measurement report
–	00	–		00		00	01	Without switches	00	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–		00							
–	04	MSM 020B		68	69						
–	03	MSM 030B		70	71						
–	01	MSK 030C		84	85						
–	02	VRDM 368		35	36						
i = 1	17	MSM 030B		70	71						
i = 1.5	18										
i = 1	15	MSK 030C		84	85						
i = 1.5	16										

Proximity switch

PNP NC	36-.±....	Switching cam	18
PNP NO	38-.±....	Cable duct	25
		Socket/plug	27

Switch type
Mounting side (R/L)
Direction of travel
Switching distance

Magnetic field sensor with cable

Reed sensor	51	Cable duct	25
Hall sensor PNP NC	52	Socket/plug	27

Magnetic field sensor with connector

Reed sensor	58
Hall sensor PNP NC	59

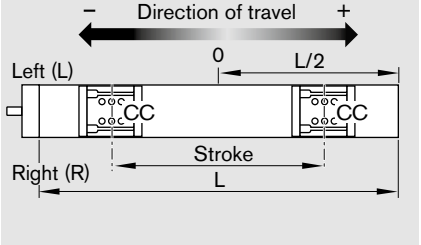
1) Attachment kit also available without motor (when ordering: enter “00” for motor).

Length of the Linear Module MKK 12-40:

L = max. travel + 160 mm

Max travel = effective stroke + 2 · excess travel

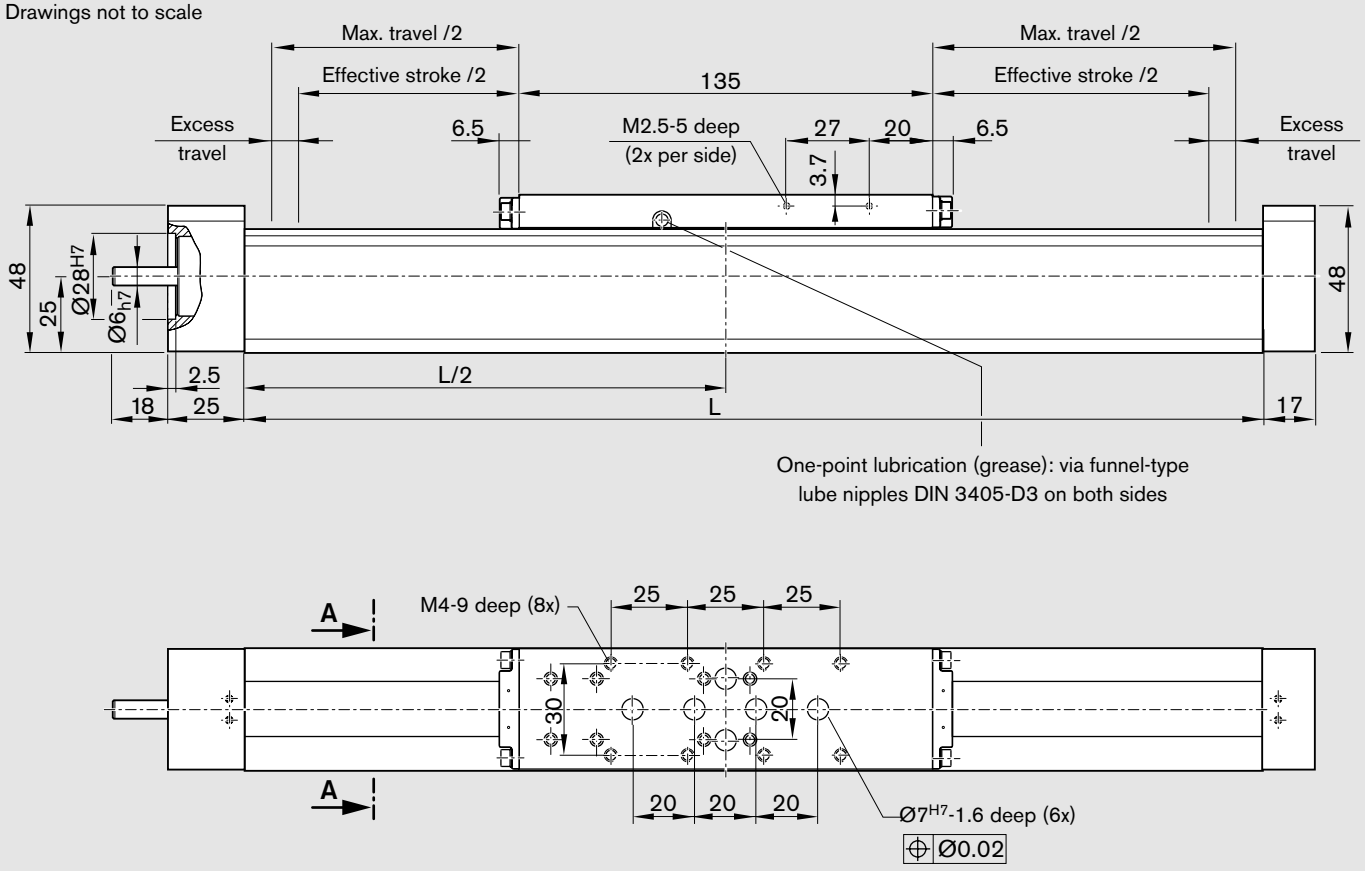
Stroke = maximum travel of carriage center (CC) between the outermost switch activation points
Excess travel:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 12 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10 mm = 20 mm



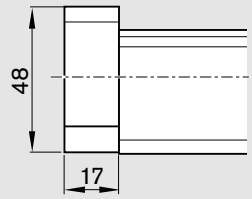
Linear Module MKK 12-40

Linear Module MKK 12-40 Dimensions

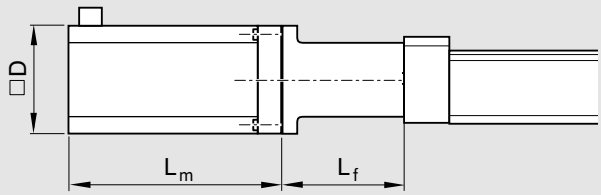
All dimensions in mm.
Drawings not to scale



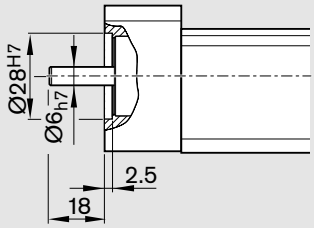
Version OA01



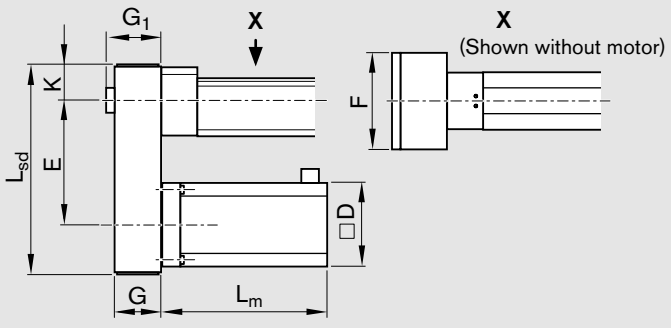
Version MF01

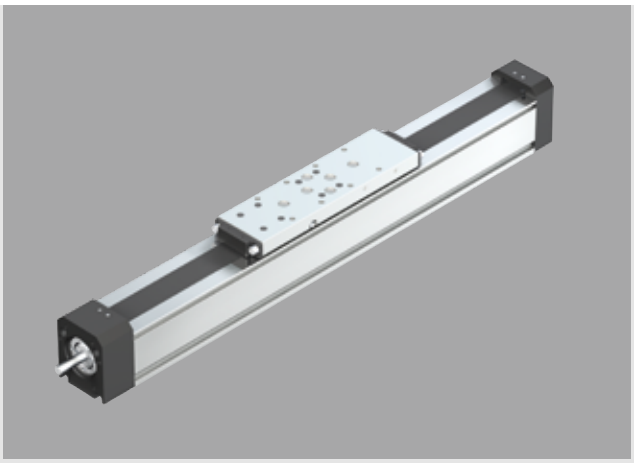


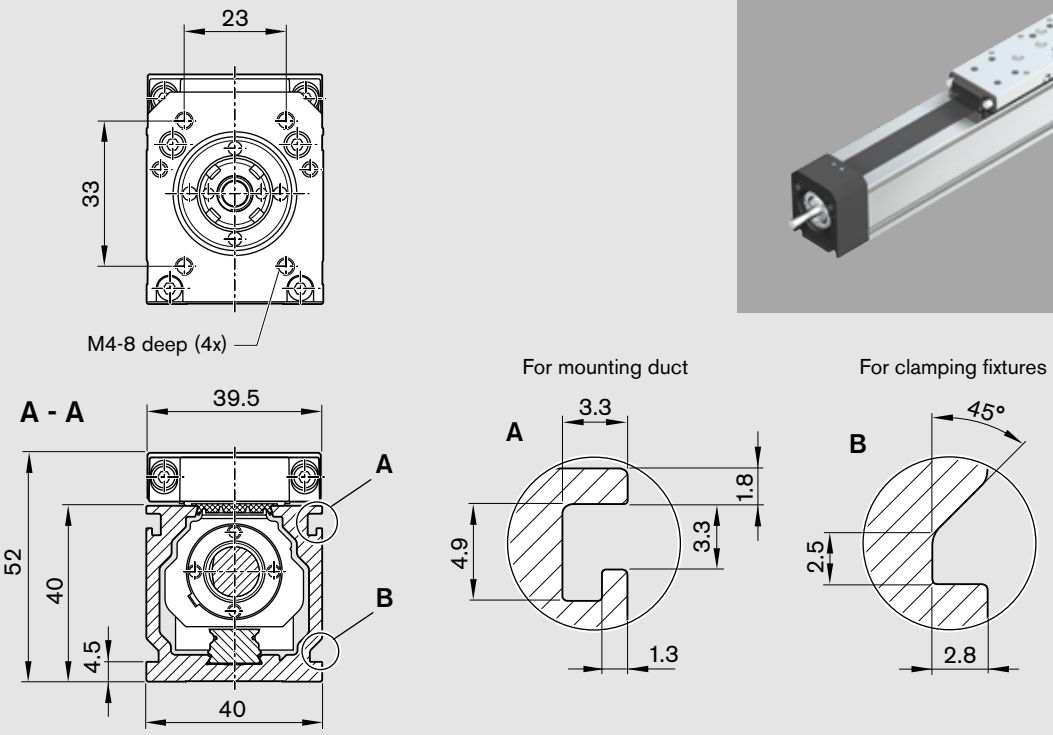
Version OF01



Version RV01 - RV04







Version	Motor	Dimensions (mm)										
		D	E		F	G	G_1	K	L_f	L_m		L_{sd}
			i = 1	i = 1.5						without brake	with brake	
RV01 - RV04	**MSM 030B**	60	78	75	64.5	37	43.5	33.5	–	111	144	157
	MSK 030C	54	78	75	64.5	37	43.5	33.5	–	188	213	154
MF01	**MSM 020B**	42	–	–	–	–	–	–	44	109	140	–
	MSM 030B	60	–	–	–	–	–	–	50	111	144	–
	MSK 030C	54	–	–	–	–	–	–	50	188	213	–
	VRDM 368	57.2	–	–	–	–	–	–	50	116	157	–