Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Linear Modules

Robotic Erector System for Linear Modules

R310EN 2402 (2010.12)

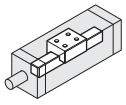
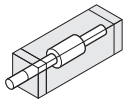
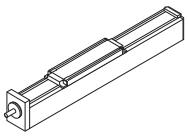
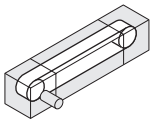
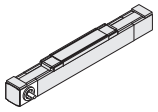
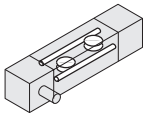
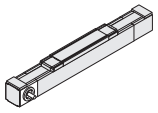
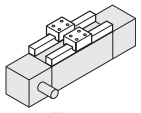
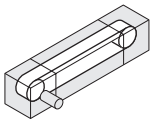
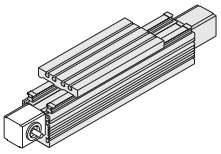
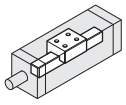
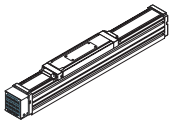
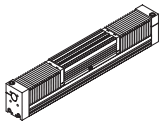
The Drive & Control Company



General Product Description

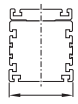
Rexroth Linear Modules

Rexroth Linear Modules

Type	Guideway	Drive unit	Linear Module
MKK	 Ball Rail System (K)	 Ball screw (K)	
MKR		 Toothed belt (R)	
MLR	 Cam Roller Guide (L)		
MKR 25-145	 Two Ball Rail Systems (K)	 Toothed belt (R)	
MKL*	 Ball Rail System (K)	 Linear motor (L)	
LKL*			

*** For more information, please refer to separate catalogs.**

Identification system for short product names

Name		Type			Size	
Linear Module (example)		M	K	R	20-	80
System	Linear Module, closed type (M) Linear Module, open type (L)				Guideway size	Frame size 
Guideway	Ball Rail System (K) Cam Roller Guide (L)					Ball Rail System  Cam Roller Guide 
Drive unit	Toothed belt (R) Ball screw (K) Linear motor (L) Pneumatic drive (P) Rack and pinion drive (Z)					

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General Product Description

Standards and Safety

New standards with new requirements – no problem, thanks to Rexroth

Whether the task involves machine tools, packaging and printing machines, assembly, handling or robot applications, the protection of personnel, machines and tools is absolutely paramount. Safety is therefore a topic of prime concern to users and manufacturers alike, and one which demands intensive cooperation between the automation partner and the machine manufacturer. As an all-around automation partner, Rexroth provides access to unique know-how across all drive and control technologies and complying with requirements such as “safe motion”, “safe processing of peripheral signals” and “safe communication.”

As a technology leader, Rexroth offers consistent functional safety on all automation levels: from components through to system solutions including software, Rexroth provides machine manufacturers and end users with high-quality products based on the newest safety engineering.

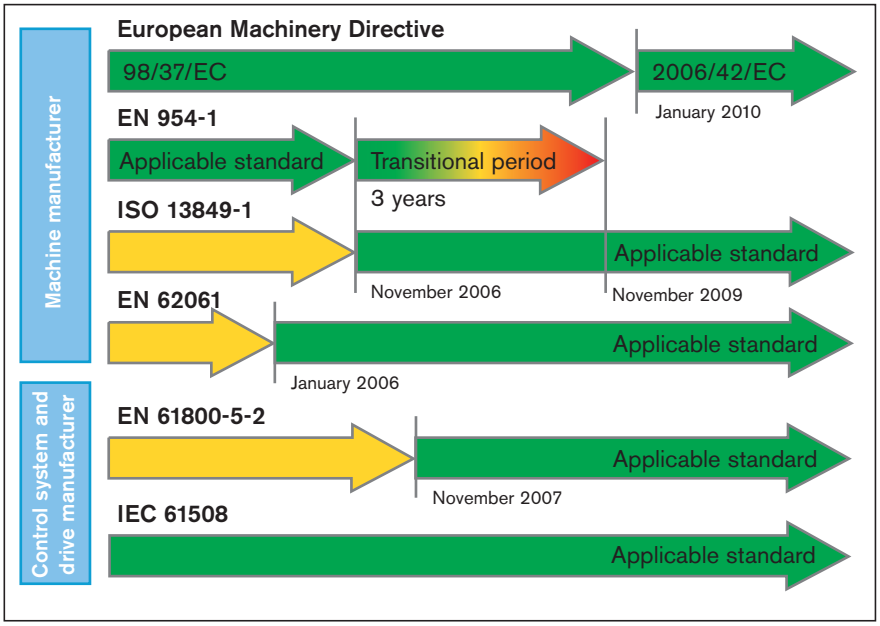
Every manufacturer of plant and machinery is responsible for ensuring that his products meet basic safety requirements. The new European Machinery Directive 2006/42/EC and the Machinery Safety Standards EN ISO 13849-1 – in the latest revision – and EN 62061 provide the framework: In an extensive evaluation with statistical parameters, machine manufacturers must proof protection of personnel under consideration of all components and systems installed into the machine or production system.

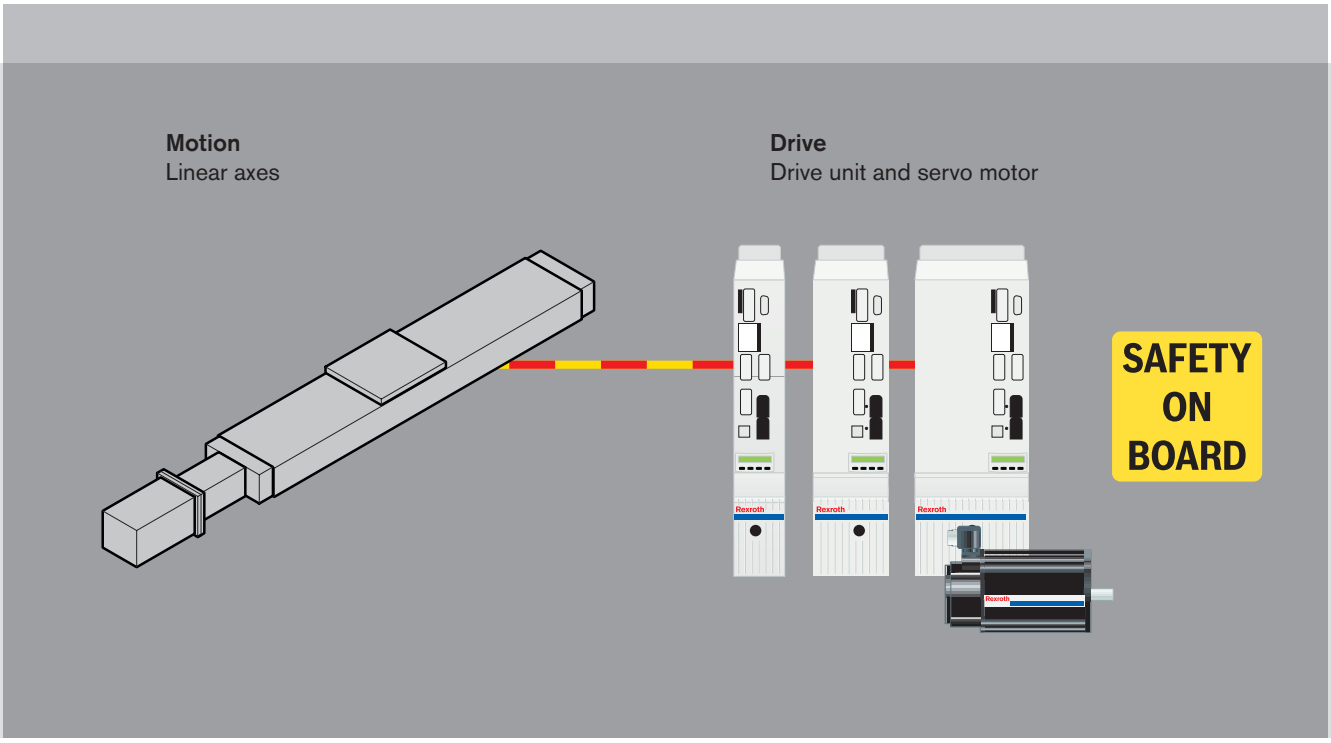
The goal is to identify and reduce risks. Intrinsically safe designs therefore always have higher priority over protective safeguards and warning notices in the documentation. If hazards are to be minimized by the use of safety-critical control components, the EN ISO 13849-1 comes to bear. The machine manufacturer must specify the required performance level, i.e. the reliability, of the safety functions.

Your tasks...

In order to comply with the standards, machine manufacturers and their suppliers must perform the following tasks:

- As per European Machinery Directive 2006/42/EC: Risk assessment and reduction of risks.
- As per ISO 13849: Estimation of the reliability of safety functions dependent upon, e.g.
  - the hardware-oriented structure
  - the mean time to dangerous failure (MTTFd)
  - the diagnostic coverage (DC) of a safety function.





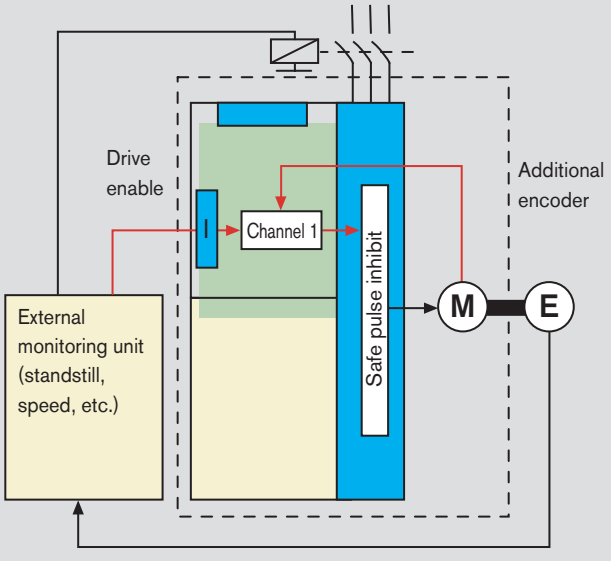
...our solutions

Rexroth provides perfectly matched certified control systems, controllers and motors with integrated functional safety, thereby making work easier for designers and machine manufacturers.

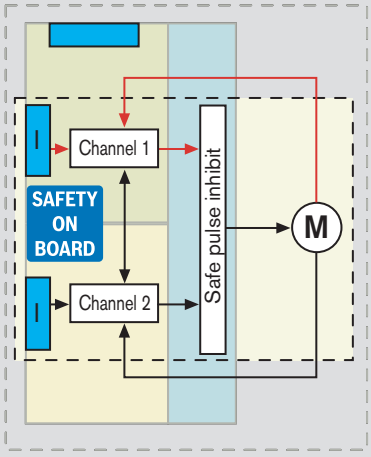
The benefits for you are:

- **reduced development effort** to comply with the new standards, e.g. through automation products with certified safety functions, certified components and tested circuits;
- **simplified design process** for safe machinery through single-source drive and control technologies;
- **effective protection of personnel** through safe movements in all drive technologies and the fast reaction of monitoring functions.

Conventional safety solution involving external relays



IndraDrive drive-integrated safety technology



General Product Description

Standards and Safety

Our drives and controls – your safety

The safety technology is exclusively available for linear axes with MSK motors and IndraDrive.
The appropriate products carry a “SAFETY ON BOARD” label.

SAFETY ON BOARD

Safety on Board merges drive-based and controller-based safety solutions to form a smart comprehensive safety concept.

These safety solutions in our drive systems (IndraDrive) and controllers assure a high level of diagnostic coverage and hence a high availability of the safety functions.

Your advantages:
- Maximum protection for personnel
- Maximum safety and reliability
- Safety components tested and certified in accordance with the latest safety standards
- Functional and legal assurance
- Reduced downtime
- Increased availability
- Simplified start-up and validation
- Minimized cost and effort for validation
- Easy upgrading of standard components to full-fledged safety components
- Flexible use as stand-alone safety components or as part of a system solution

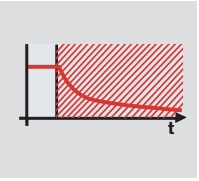
SafeMotion

The drive-integrated safety technology in IndraDrive from Rexroth monitors movements where they are generated. The results are very rapid response times of just 2 milliseconds upon triggering of the internal monitors.
Even in the case of a power failure, a hydraulic feed axis with mechanical clamping can come to a safe stop within milliseconds.
Rexroth provides these intelligent drive solutions as certified safety components with all the necessary proofs. SafeMotion is thus the first step in the realization of safe machine concepts.

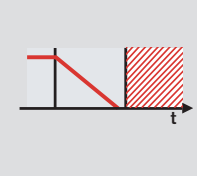
Your advantages:
- Effective protection of personnel
- High reliability thanks to certified and integrated solution
- Maximum assurance against tampering through drive-integrated monitoring system
- Reduced design effort through savings on time and money spent on certification
- Increased availability through reduced downtimes
- Increased machine productivity as a result of shorter special mode times
- No unnecessary idle times because the line circuit breaker does not have to be opened when undertaking work on the machine
- No need for re-synchronization of coupled axes after intervention work on the machine
- Savings on limit switches, measurement and analysis units and control cabinet size
- Fault detection without the need for any periodic machine shutdown
- Can be integrated into any kind of system architecture
- Easy start-up
- Easy to service

For more information, refer to the brochure
“Safety on Board – Functional Safety in Automation Technology”, R911 322 823.

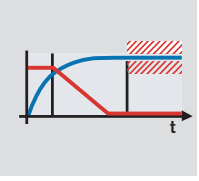
SafeMotion – Certified safety functions



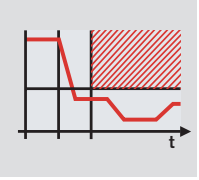
Safe Torque Off (STO)
Stop category 0 in accordance with EN 60204-1: Safe drive torque cut off



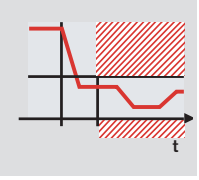
Safe Stop 1 (Emergency Stop) (SS1)
Stop category 1 in accordance with EN 60204-1: Safely monitored stop, control or drive controlled with safe drive torque cut off



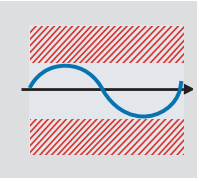
Safe Stop 2 (SS2)
Safe Operating Stop (SOS)
Stop category 2 in accordance with EN 60204-1: Safely monitored stop with safely monitored standstill at controlled torque



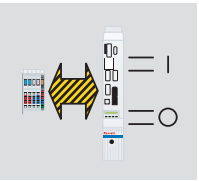
Safely Limited Speed (SLS)
If enable signal is given, a safely limited speed is monitored in special operating mode



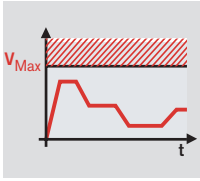
Safe Direction (SDI)
A safe direction (clockwise, counterclockwise) is also monitored in addition to safe motion



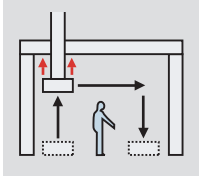
Safely Monitored Position (SMP)
A safe absolute position range is also monitored in addition to safe motion



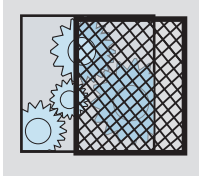
Safe Inputs/Outputs (SIO)
Dual-channel safety peripherals can be connected to the drive and made available to the controller via the safety bus



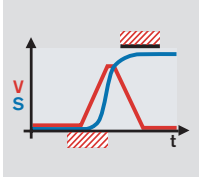
Safe Maximum Speed (SMS)
The maximum speed is safely monitored irrespective of the mode of operation



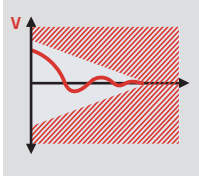
Safe Braking and Holding System (SBS)
The safe braking and holding system controls and monitors two independent brakes



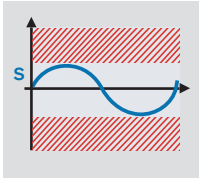
Safe Door Locking (SDL)
When all the drives in one protection zone are in safe status, the safety door lock is released



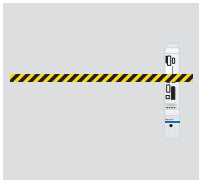
Safely Limited Increment (SLI)
If enable signal is given, a safely limited increment is monitored in special operating mode



Safely Monitored Deceleration (SMD)
Safely monitored deceleration ramp when stopping



Safely Limited Position (SLP)
Monitoring of safe software limit switches



Safe Communication (SCO)
Selection/deselection of safety functions and transfer of process data (e.g. actual position values) via safety bus

All safety functions are certified as compliant with standards ISO 13849-1:2006[1)], IEC 61800-5-2:2007[1)], IEC 61508:1998-2000[1)], IEC 62061[1)], ISO 13849-1:1999, EN 954-1:1996, ISO 13849-2:2003, IEC 60204-1:1997, EN 50178-1:1997, IEC 61800-3:2004, UL 508C R7.03, C22.2 No. 0.8-M86 (R2003), CAN/CSA C22.2 No. 14-95, NFPA 79:2007 ER1 through TÜV Rheinland, TÜV Rheinland North America Inc. and SIBE Switzerland.

1) In preparation

General Product Description

A Solution for Many Tasks

The Tasks

– Driving

– Transporting

– Positioning

Length

Load capacities and moments

Static load

Speed

Precision

System complete with drive unit

Switch mounting arrangements

Multiple axis unit

Accessories

Documentation

Up to 12 meters
Load capacity C up to 49700 N Longitudinal moment M_L up to 2900 Nm Torsional moment M_t up to 1040 Nm
Up to 1000 kg
Up to 10 m/s
Repeatability up to 0.005 mm Positioning accuracy up to 0.01 mm
AC servomotor or stepping motor with motor mount, coupling or timing belt side drive; complete with controller and control system
Mechanical and proximity switches over the entire travel range
Combination option provided by connectors
Clamping fixtures, motor mounts, T-nuts, etc.
Moment of friction measurement Lead deviation Positioning accuracy

The solution

Rexroth Linear Modules

General Product Description

Product Description MKK

Characteristic features

Rexroth Linear Modules are precise, ready-to-mount guide systems that combine high performance with compact dimensions. Rexroth offers favorable price/performance ratios and fast delivery.

Structural design
- Ready-to-install Linear Modules in any length up to L_{max}
- Extremely compact extruded aluminum profile (frame) with integrated Rexroth Ball Rail Systems
- Driven by Rexroth Precision Ball Screw Assembly

Attachments
- AC servo motor or stepping motor with control units
- Switches (proximity and mechanical)
- Socket and plug
- Aluminum profile cable duct

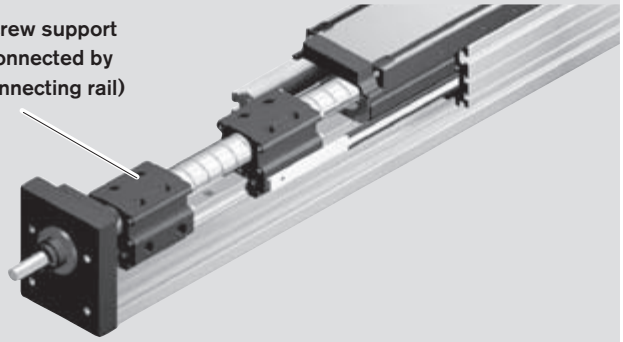
Further highlights
- One-point, in-service lubrication of the Rexroth Ball Rail System and Rexroth Precision Ball Screw Assembly from either side; suitable for grease only
- Rexroth Precision Ball Screw Assembly in rolled quality with zero-backlash cylindrical single nut, tolerance grade 7, leads up to 40 mm
- End block with centering bore and mounting holes for drive units
- Mounting of attachments to carriage via T-slots or threads

Screw Support for MKK 25-110

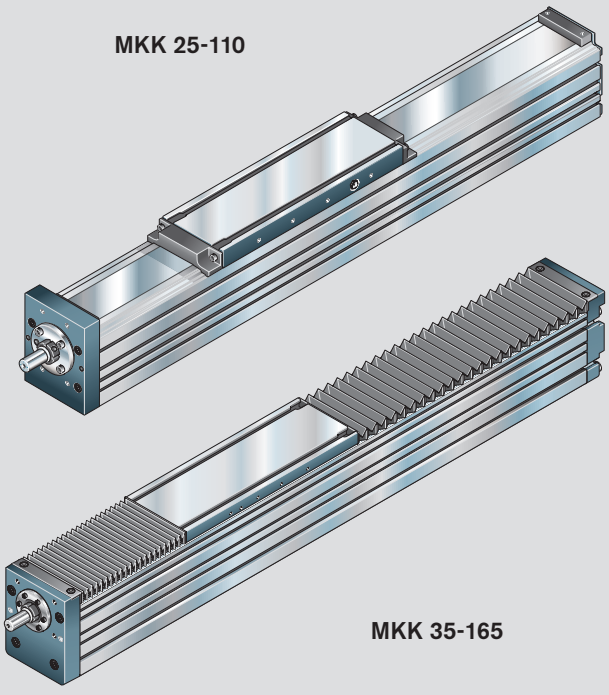
The Screw Support (SPU) offers the following advantages:
- Screw lengths up to 4,900 mm; for special applications, lengths up to 10,000 mm
- Low weight thanks to aluminum runner block and aluminum connecting rail
- Up to 2 screw supports can be integrated per module
- Runner block of screw support lubricated 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

Structural design
- Plastic screw support
- Aluminum connecting rail guided within the frame by integrated plastic profiles
- Elastomer buffer and rings as shock absorbers

Screw support (connected by connecting rail)

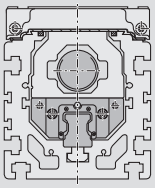


MKK 25-110



MKK 35-165

MKK



Linear Module with Ball Rail System and Precision Ball Screw Assembly
- For high load capacities, high positioning accuracy and repeatability
- For MKK 12-40 and MKK 15-65: Sealing by means of a special plastic strip
- For MKK 20-80 and MKK 25-110: Sealing by means of a corrosion-resistant steel strip
- For MKK 35-165: Sealed bellows-type protective cover of polyester fabric, coated with polyurethane inside and out. Oil- and moisture-resistant.

Product Description MKR

Characteristic features

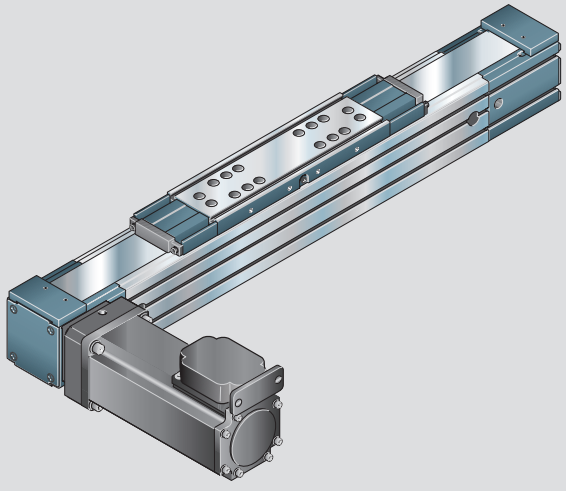
Rexroth Linear Modules are precise, ready-to-mount guide systems that combine high performance with compact dimensions. Rexroth offers favorable price/performance ratios and fast delivery.

Structural design
- Ready-to-install Linear Modules in any length up to L_{max}
- Extremely compact extruded aluminum profile (frame) with integrated Rexroth Ball Rail Systems
- Driven by toothed belt drive for travel speeds up to 5 m/s

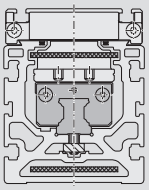
Attachments
- AC servo motor or stepping motor with control units
- Gear reducer with various gearing reductions
- Switches (proximity and mechanical)
- Socket and plug
- Aluminum profile cable duct

Further highlights

- Gap-type sealing and guiding of the belt by the aluminum frame. This sealing system is maintenance-free.
- Sealing for MKR 20-80 and MKR 25-110 by means of a corrosion-resistant steel strip (also available without sealing strip)
- Idler (non-drive) end enclosure: with integrated belt tensioning system. The belt pulley system is equipped with ball bearings lubricated for life.
- Mounting of attachments: with the aid of T-slots or tapped holes in the carriage
- One-point, in-service lubrication of the Rexroth Ball Rail System from either side; suitable for grease only
- Maintenance-free digital AC servo motor with integrated brake and attached feedback
- Choice of gear ratios to optimally match the external load and the motor's inertia
- The planetary gear can be integrated in the belt drive pulley or mounted as a separate gear unit for high-dynamic drive performance.



MKR



Linear Module with Ball Rail System and Toothed Belt Drive
High load capacities and optimal travel performance enable the integrated, clearance-free Rexroth Ball Rail System to move large loads at high speed.

General Product Description

Product Description MKR, Food & Packaging

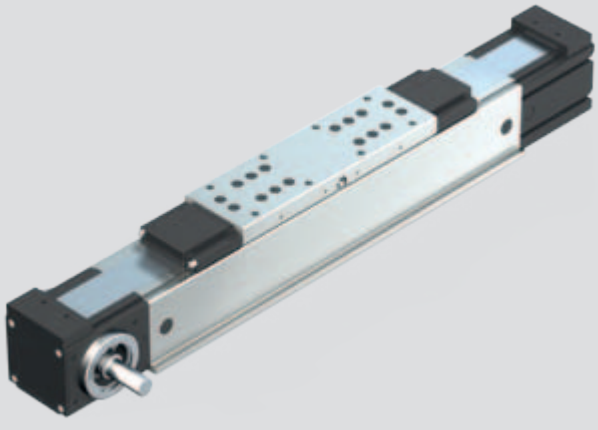
Characteristic features

Linear Modules for Food & Packaging have been designed for use in environments requiring a high level of hygiene and ease of cleaning. They are equipped with a Ball Rail System and toothed belt drive.

Structural design
- Compact, anodized aluminum profile frame with no slots, resulting in an especially smooth, easy-to-clean surface
- Integrated Rexroth Ball Rail System (also available with Resist NR II)
- Carriage with sealable threads and one-point lubrication
- Pre-tensioned toothed belt
- Stainless steel sealing strip per EN 10088

Attachments
- AC servo motor
- Gear reducer for motor attachment
- Control units

For more information, please refer to the catalog "Linear Modules for Food & Packaging" (R310EN 2406).



Product Description MLR

Characteristic features

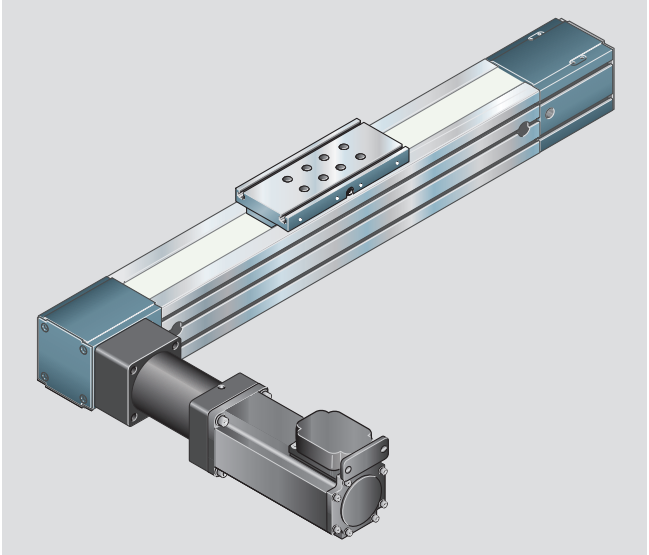
Rexroth Linear Modules are precise, ready-to-mount guide systems that combine high performance with compact dimensions.
Rexroth offers favorable price/performance ratios and fast delivery.

Structural design
- Ready-to-install Linear Modules in any length up to L_{max}
- Extremely compact extruded aluminum profile (frame) with integrated Rexroth Cam Roller Guides
- Driven by toothed belt drive for travel speeds up to 10 m/s

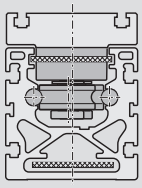
Attachments
- AC servo motor with control units
- Gear reducer with various gearing reductions
- Switches (proximity and mechanical)
- Socket and plug
- Aluminum profile cable duct

Further highlights

- Gap-type sealing and guiding of the belt by the aluminum frame. This sealing system is maintenance-free.
- Sealed by means of the toothed belt
- Idler (non-drive) end enclosure: with integrated belt tensioning system. The belt pulley system is equipped with ball bearings lubricated for life.
- Carriage with T-slots for fastening of attachments
- One-point, in-service lubrication of the Rexroth Cam Roller Guide from either side; suitable for oil only
- Maintenance-free digital AC servo motor with integrated brake and attached feedback
- Choice of gear ratios to optimally match the external load and the motor's inertia
- The planetary gear can be integrated in the belt drive pulley or mounted as a separate gear unit for high-dynamic drive performance.



MLR



Linear Module with Cam Roller Guide and Toothed Belt Drive
The special design of the integrated zero-clearance Rexroth Cam Roller Guide makes it ideal for very high speeds (up to 10 m/s).

General Product Description

Product Description MKR 25-145

Characteristic features

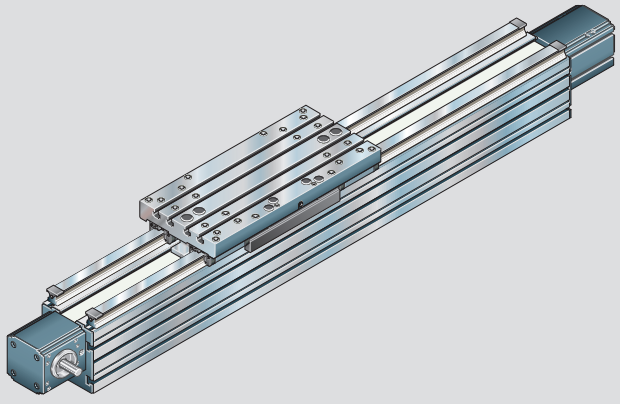
Rexroth Linear Modules are precise, ready-to-mount guide systems that combine high performance with compact dimensions.
Rexroth offers favorable price/performance ratios and fast delivery.

Structural design
- Anodized aluminum frame of high inherent rigidity
- Two Rexroth Ball Rail Systems with sealing strips
- Profiled aluminum carriage with four long runner blocks
- Driven by toothed belt drive for travel speeds up to 5 m/s

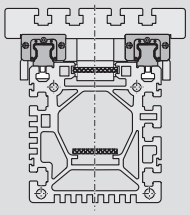
Attachments
- With or without gear reducer for attachment of the motor
- AC servo motor (other motor types on request)
- Switches (proximity and mechanical)
- Control units

Further highlights

- One-point, in-service lubrication of the Rexroth Ball Rail System from either side; suitable for grease only
- Choice of gear ratios to optimally match the external load and the motor's inertia
  The planetary gear can be integrated in the belt drive pulley or mounted as a separate gear unit for high-dynamic drive performance.



MKR 25-145



Linear Module with two Ball Rail Systems and Toothed Belt Drive
For high moment capacity and high speeds.

Product Description LKL, MKL

Characteristic features

For uniform thrust over the entire speed range. Extremely simple mechanical design without conventional motors and gears.

Structural design
- Ready-to-install Linear Modules in any length up to L_{max}
- Extremely compact extruded aluminum profile (frame) with integrated Rexroth Ball Rail System
- Carriage with one-point lubrication
- Linear motor drive
- Integrated position sensing
- Sealing strip (MKL)
- Fan for motor cooling (MKL)

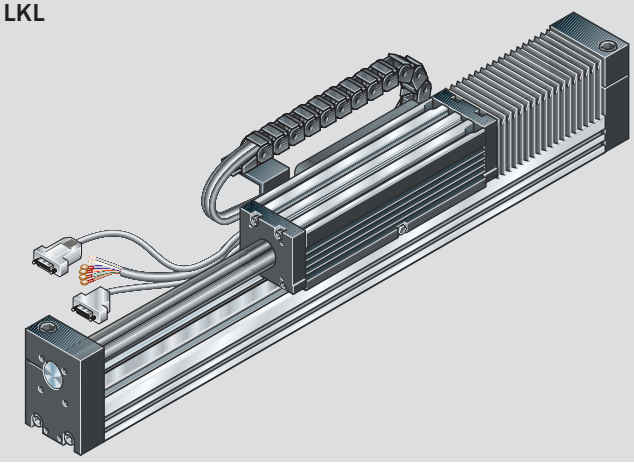
Controller
- Standard servo controller

For more information, please refer to the catalogs for Linear Modules LKL or MKL.

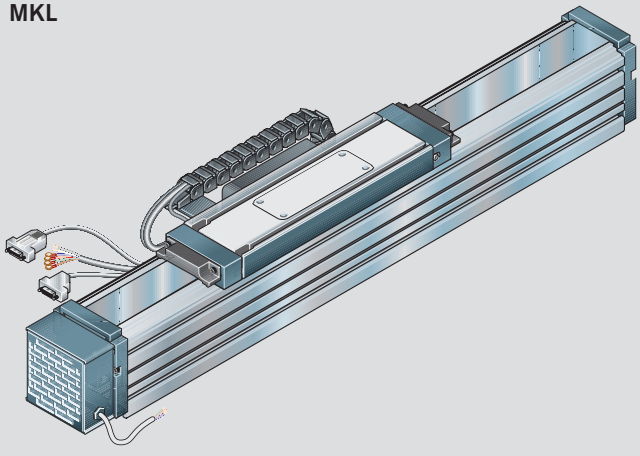
Further highlights

- Rapid implementation
- Convenient DriveTop start-up software
- Thrust generated directly at the payload
- High speed range, high dynamic response
- Silent operation
- Cost savings through shorter cycle times
- Supplied as a complete “plug and play” linear module with matching servo amplifier
- High positional repeatability
- Ball Rail System unaffected by magnetic forces

LKL



MKL



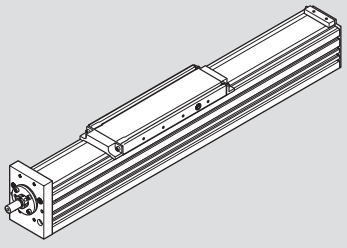
General Product Description

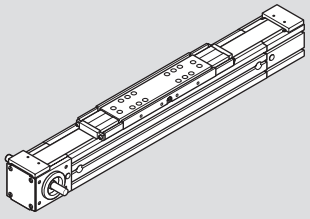
Product Overview, Motors and Control Systems

Motor Selection

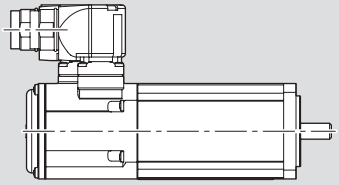
Based on drive controllers and control system

A choice can be made between several different motor/controller combinations to achieve the most cost-effective solution for each customer application.
When sizing the drive, always consider the motor-controller combination.
For more detailed information on motors and control systems, please refer to the catalogs “IndraDrive Cs” and “IndraDrive C for Linear Motion Systems.”

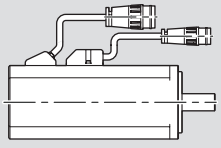




SAFETY ON BOARD

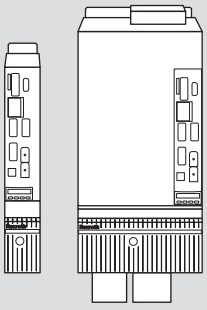


Digital AC Servo Motor MSK

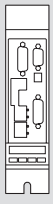


Digital AC Servo Motor MSM

SAFETY ON BOARD

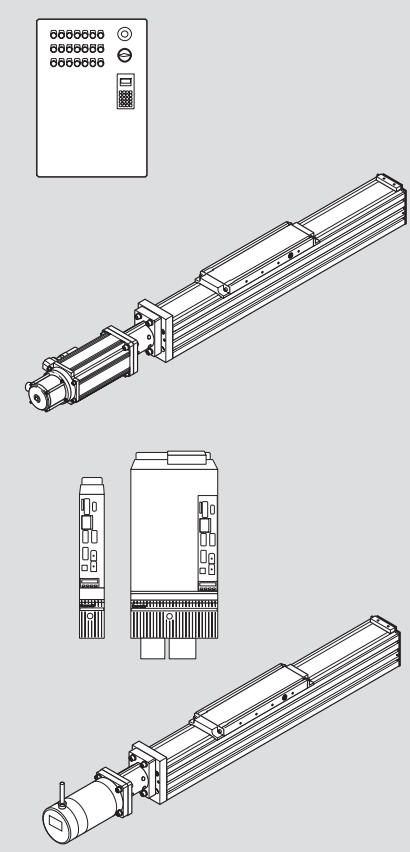


Digital controller
IndraDrive C
Power unit HCS02
Control unit CSH



Digital controller
IndraDrive Cs
HCS01

Compact and dynamic solution for lower power ranges



Linear Modules can be supplied complete with motor, controller and control system.

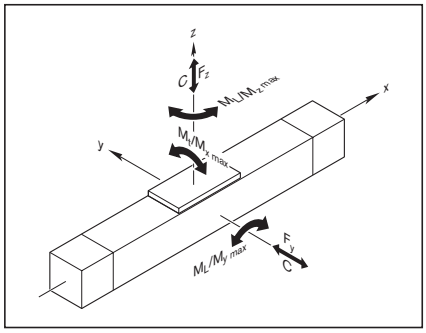
General Product Description

Overview of Types with Load Capacities

Suitable loads

With respect to the desired service life, loads up to about 20% of the characteristic dynamic values (C, M_t, M_L) have proved acceptable.

At the same time, the following may not be exceeded:
- the maximum permissible deflection
- the permissible drive torque
- the maximum permissible loads
- the permissible travel speed.

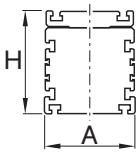


Rexroth Linear Modules

Type	Guideway	Drive unit	Linear Module	
MKK	Ball Rail System	Ball screw		
MKR		Toothed belt		
MLR	Cam Roller Guide			
MKL*)	Ball Rail System	Linear motor		
MKR 25-145	Two Ball Rail Systems	Toothed belt		
LKL*)	Ball Rail System	Linear motor		

Note: All Linear Modules can also be supplied without drive unit.

*) See separate catalogs



	Dimensions A x H (mm)									
	40 x 52		65 x 85		80 x 100			110 x 129		165 x 195	
		C_x (N) / C_y (N)		C_x (N) / C_y (N)		C_x (N) / C_y (N)			C_x (N) / C_y (N)		Cx (N) / Cy (N)
	MKK 12-40	3 750	**MKK 15-65**	11 820	**MKK 20-80**	28 300		**MKK 25-110**	34 600	**MKK 35-165**	68 200
	MKR 12-40	3 750	**MKR 15-65**	11 820	**MKR 20-80**	28 300		**MKR 25-110**	44 770	**MKR 35-165**	68 200
					MLR 10-80	17 150	10 050	**MLR 10-110**	31 000	18 200	
								MKL 20-110	23 550		
			70 x 90		**85 x 110**			**145 x 215**			
								MKR 25-145	98 700		
			LKL 15-70	6 820	**LKL 20-85**	23 550					

C_x / C_y = dynamic load capacities

Linear Modules MKK

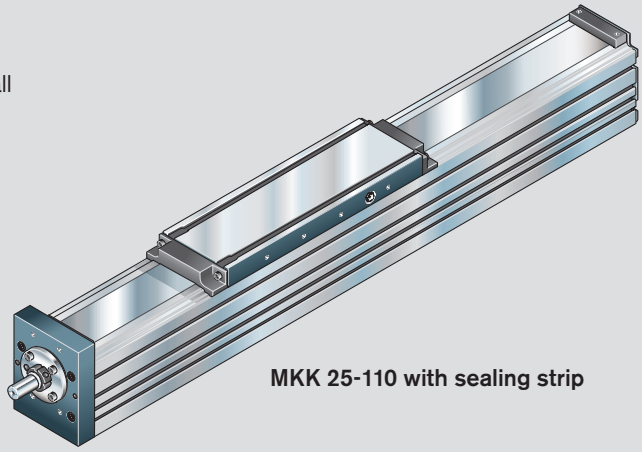
Product Description

Characteristic features

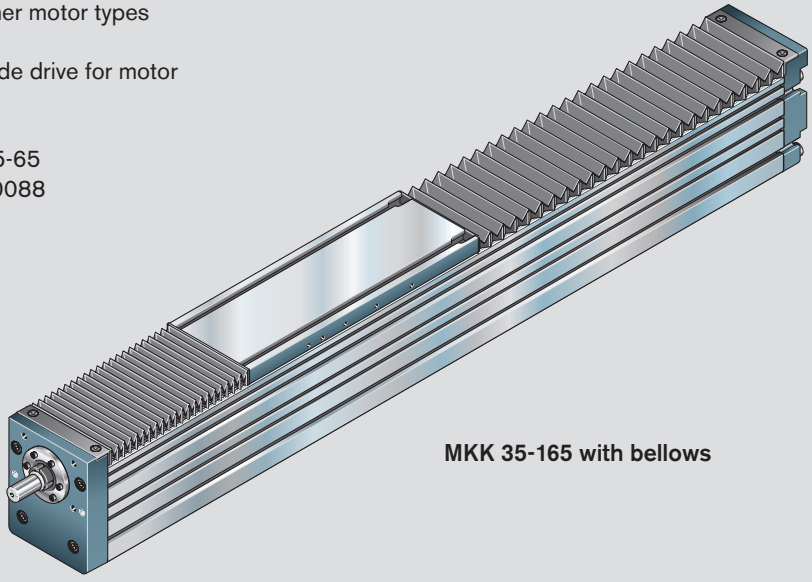
MKK...: Linear Modules with Ball Rail System and Precision Ball Screw Assembly for high thrust forces, accurate positioning and repeatability

– 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



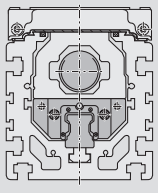
MKK 25-110 with sealing strip



MKK 35-165 with bellows

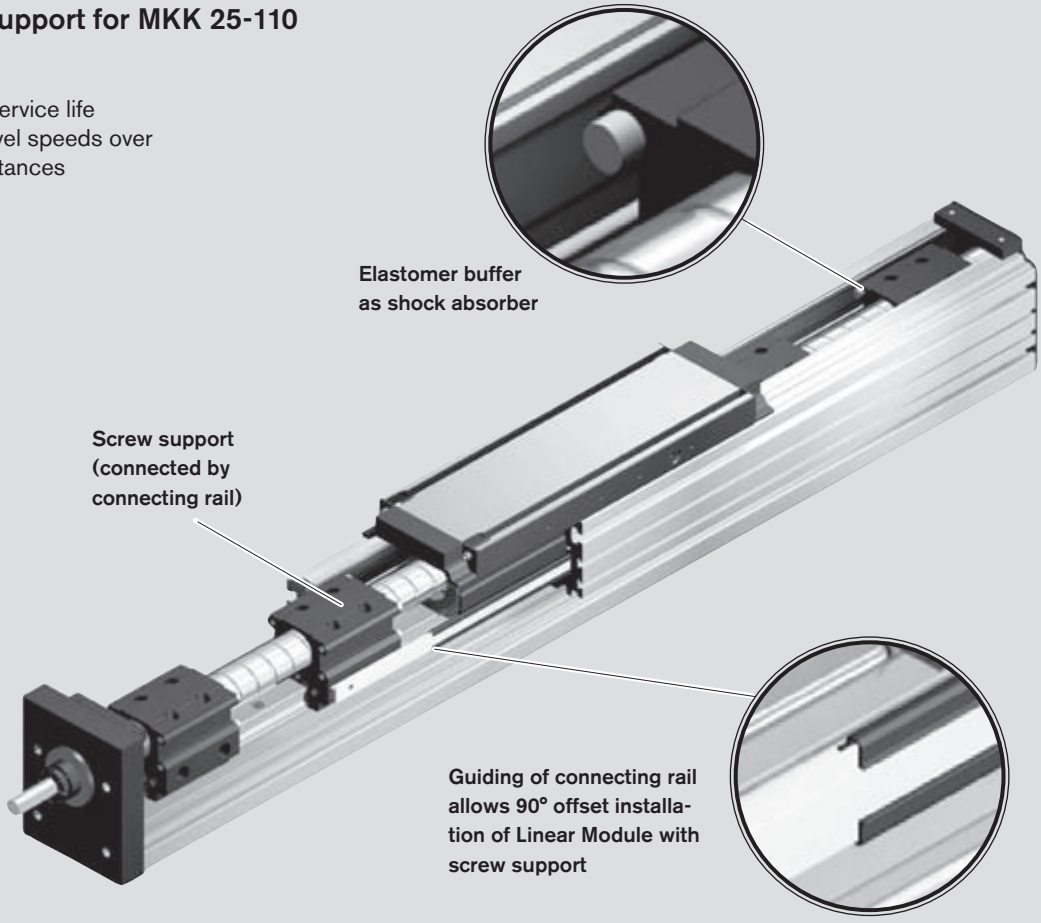
For mounting and maintenance, see the relevant Instructions.

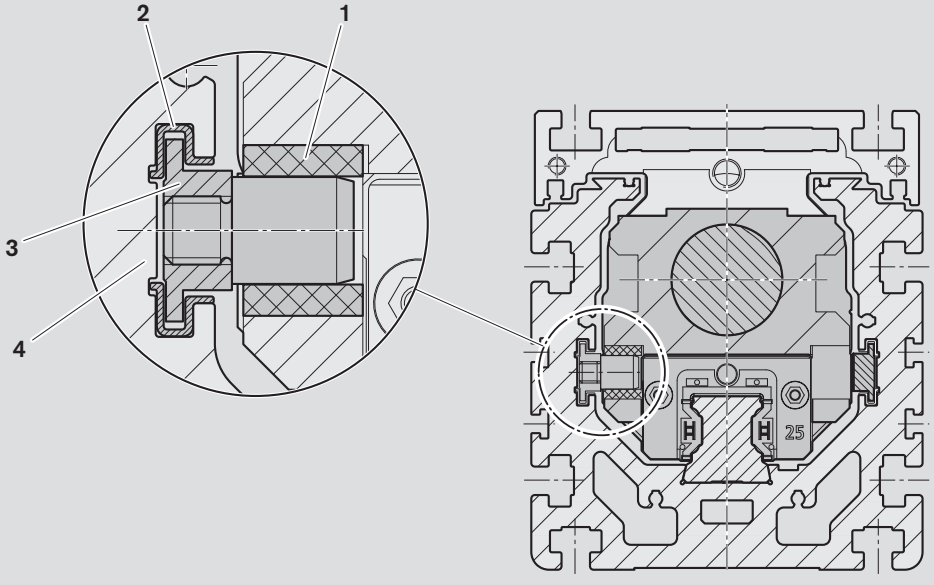
MKK



Screw Support for MKK 25-110

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





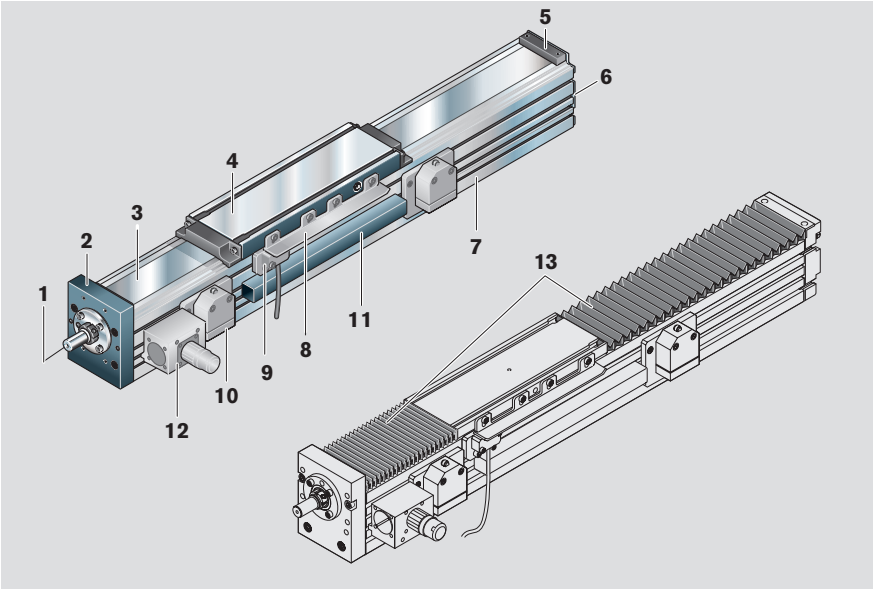
1 Elastomer ring
2 Plastic profiles
3 Aluminum connecting rail
4 Frame

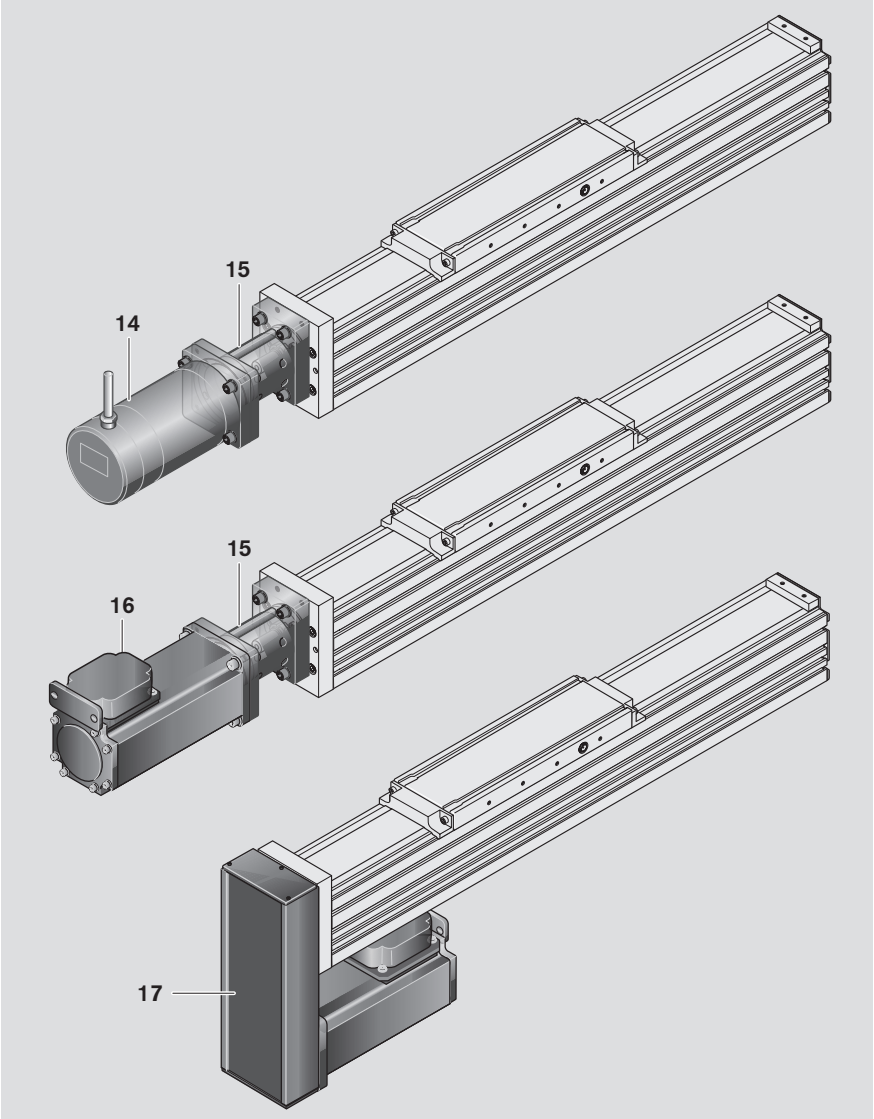
Linear Modules MKK

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



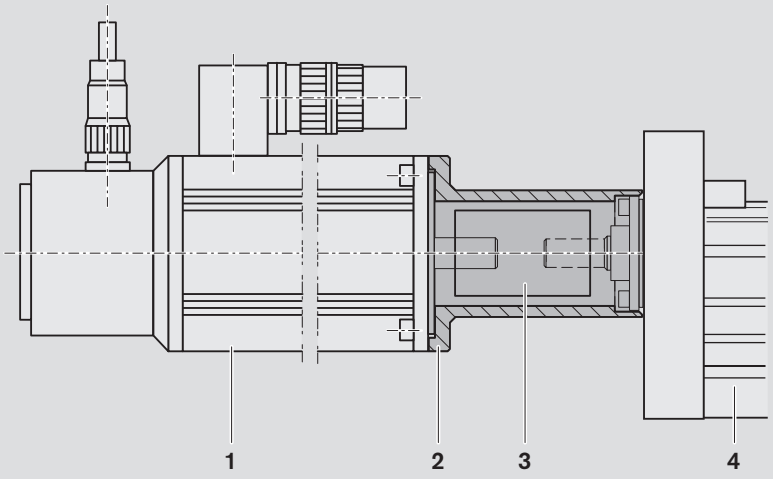


14 Stepping motor
15 Motor mount
16 Servo motor
17 Timing belt side drive

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.

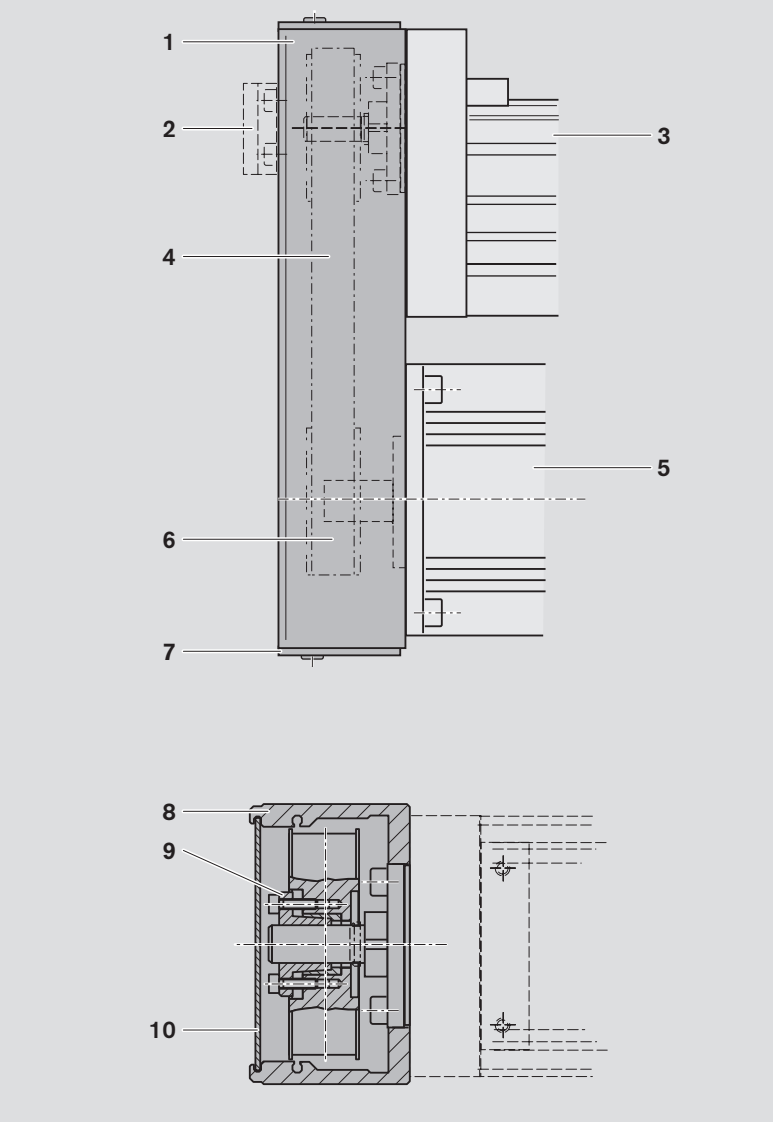
1 Motor
2 Motor mount
3 Coupling
4 Linear Module



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

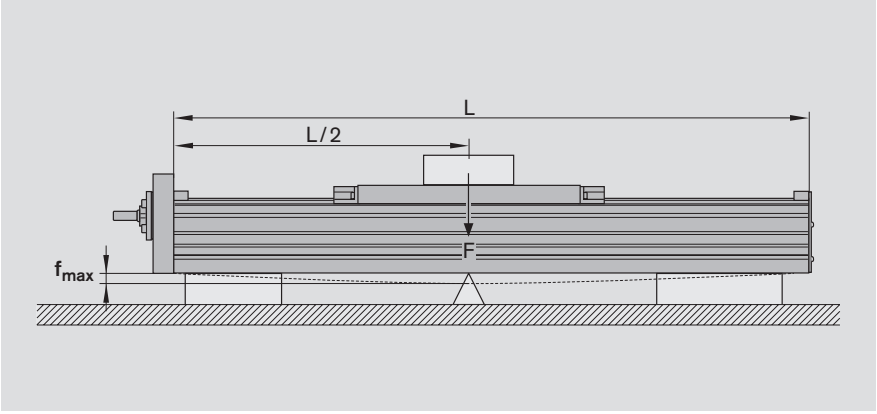


Linear Modules MKK

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.**

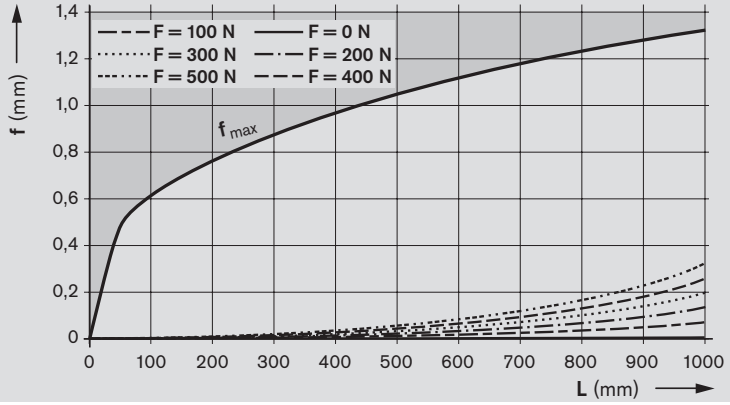
Example

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

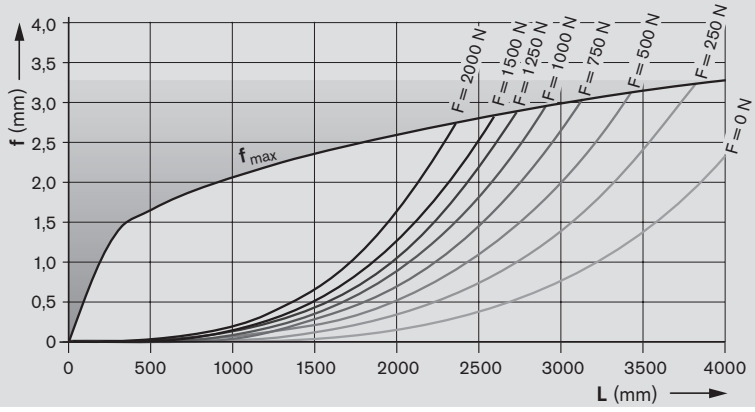
The deflection f lies well below the maximum permissible deflection f_{max}, so no additional supports are required.

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

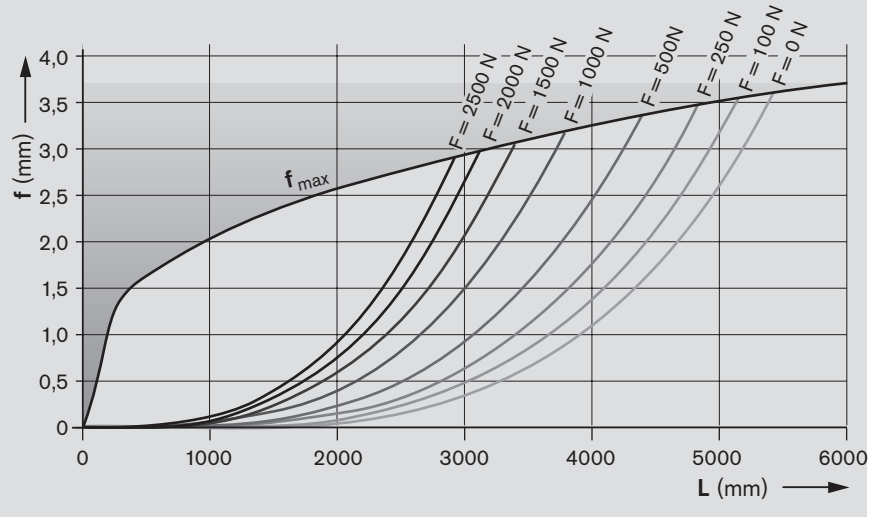


MKK 15-65

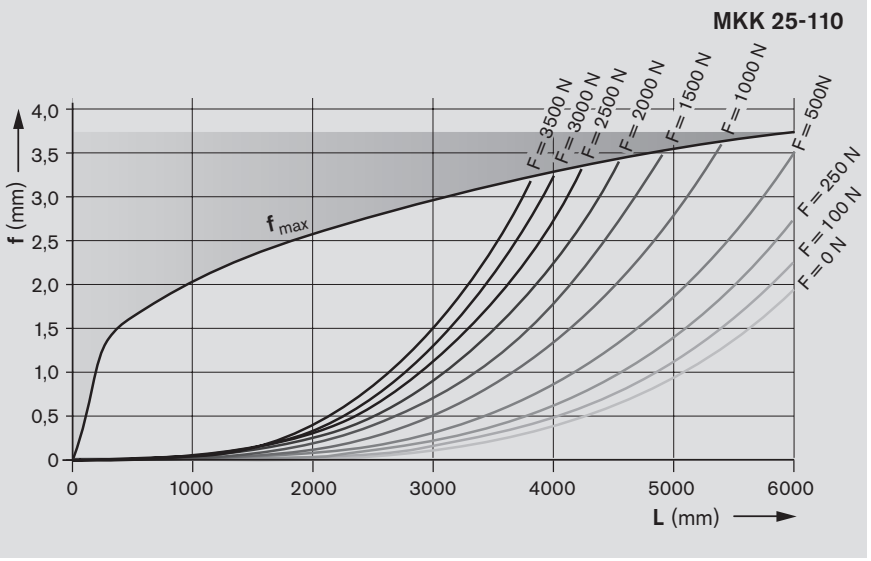


The graphs apply under the following conditions:
- Both ends firmly fixed (200 to 250 mm per end)
- 6 to 8 screws per side
- Solid mounting base

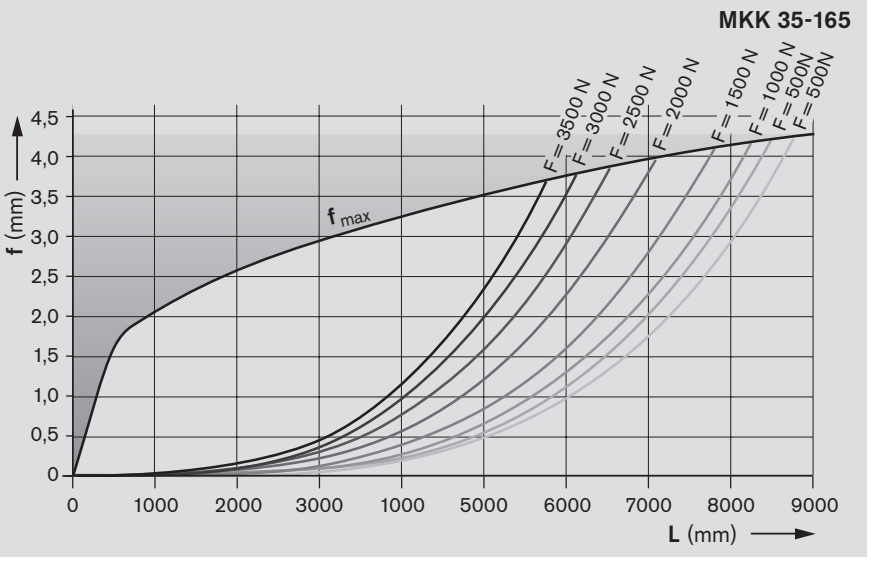
MKK 20-80



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

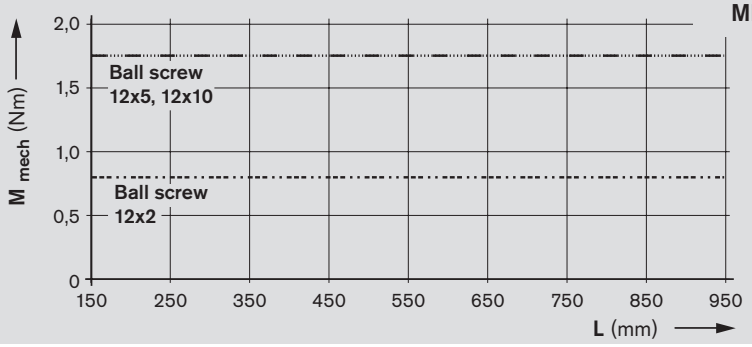
Consider the rated torque of the coupling used!

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!

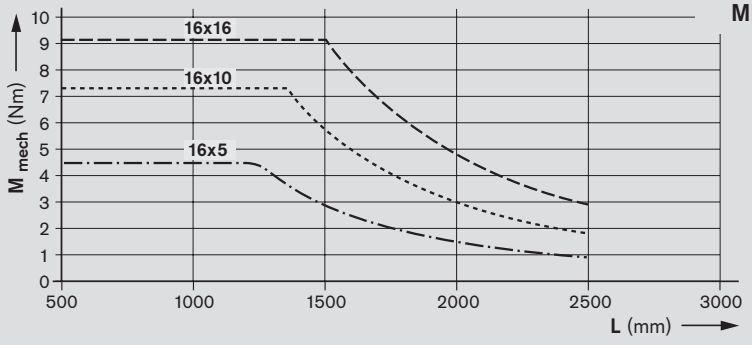
	$M_{mech\ max}$ (Nm)
MKK 15-65	4.5
MKK 20-80	4.5
MKK 25-110	18
MKK 35-165	74

⚠ **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

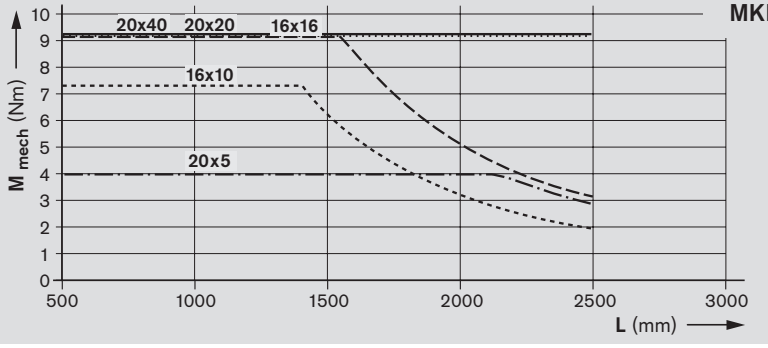
MKK 12-40



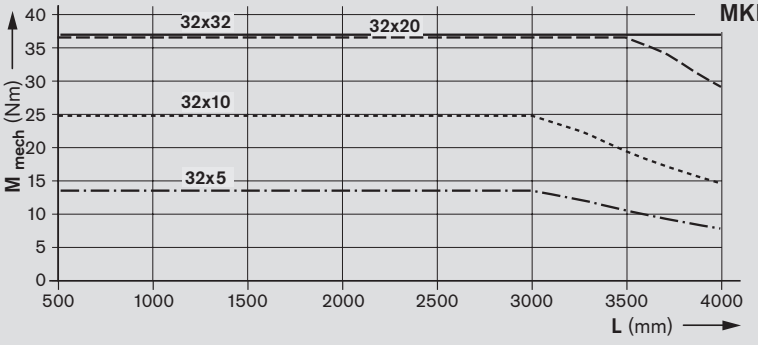
MKK 15-65



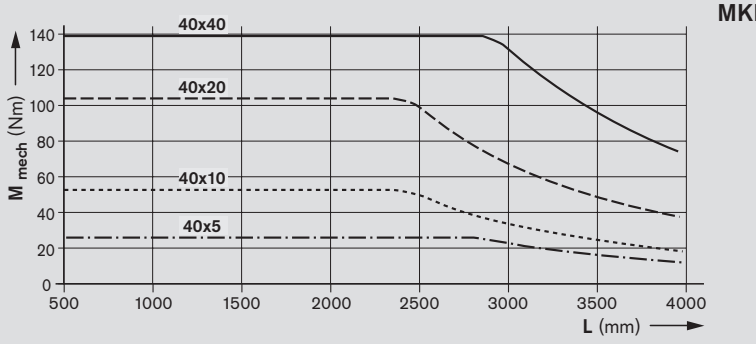
MKK 20-80



MKK 25-110



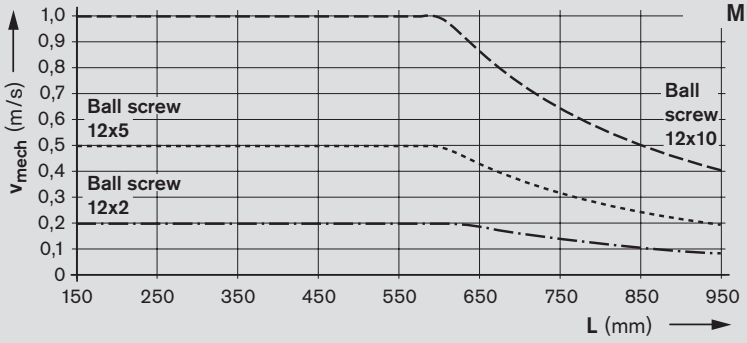
MKK 35-165



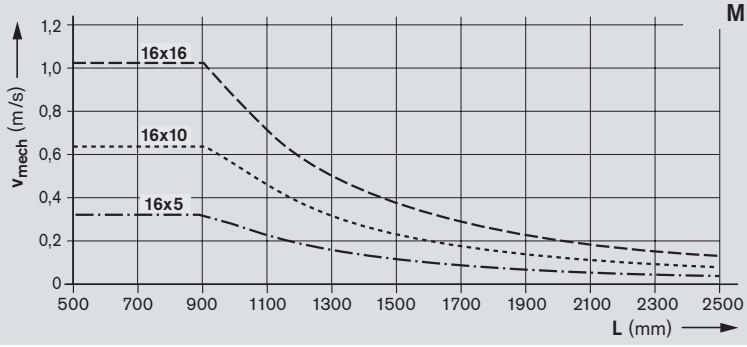
Maximum permissible linear speed of mechanical system v_{mech}

Consider the motor speed!

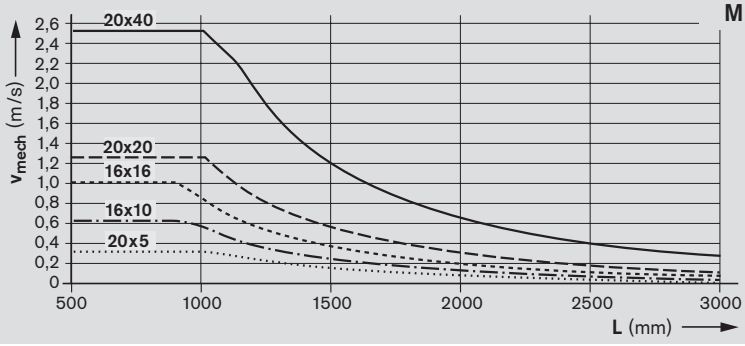
MKK 12-40



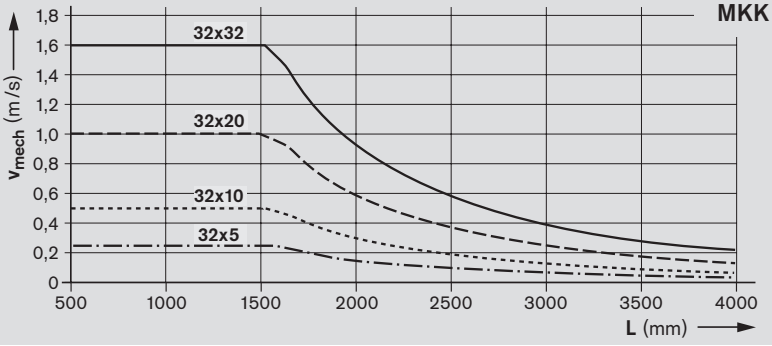
MKK 15-65



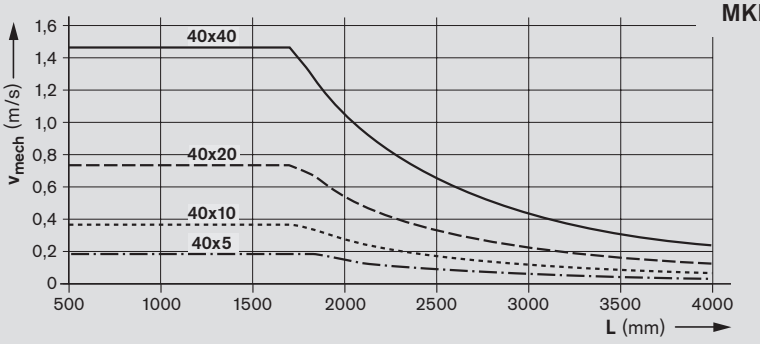
MKK 20-80



MKK 25-110



MKK 35-165



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}

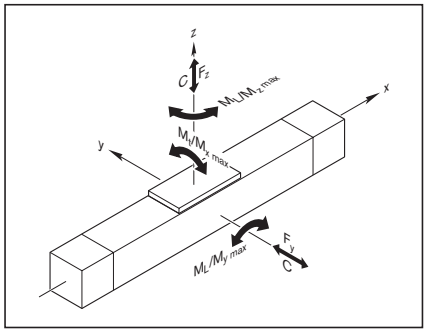
Lengths in excess of L_{max} are available on request.

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 · L + 0.53 0.0021 · L + 0.65
5910	5910	60	182	79.2	90.2	380	6 000	1.80	0.0063 · L + 2.0
						400 420 450	2 500		0.0077 · L + 3.0
14150	14150	195	657	169	211	480	6 000	2.20	0.0100 · L + 2.3
						520 550 500 560 640	2 500	2.60	0.0120 · L + 3.8
17300	17300	260	780	505	656	550	10 000	3.80	0.0160 · L + 4.0
						570 590 630 680	4 900	4.90	0.0217 · L + 7.2
34100	34100	723	2085	2 468	3 527	570	12 000	14.00	0.0368 · L + 18.5
						590 620 660 760	4 000	16.00	0.0448 · 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)

Linear Modules MKK

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

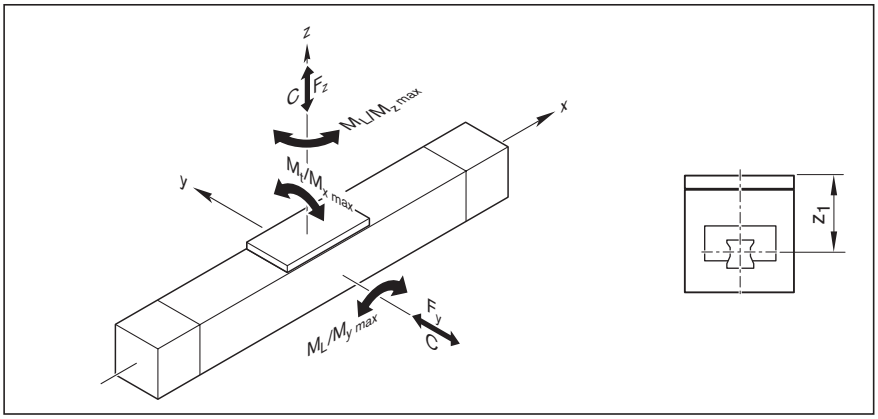
Calculations

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

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

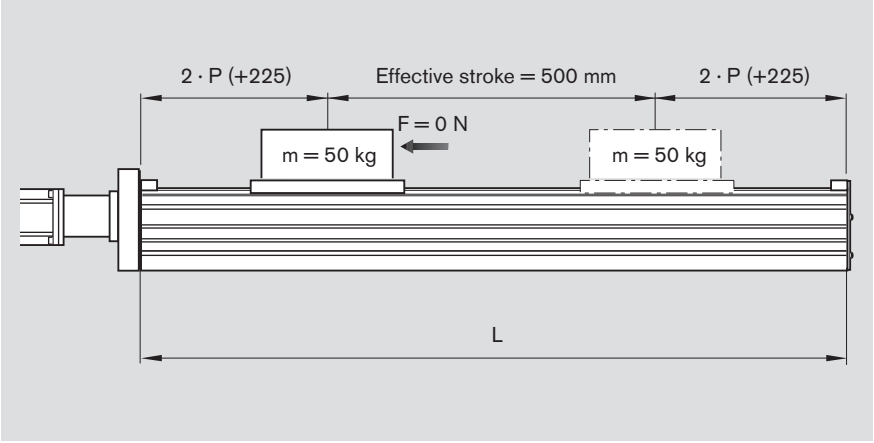
$$n_{mech} < n_{m\,max}$$

J_{br} = mass moment of inertia, motor brake (kgm²)
J_c = mass moment of inertia, coupling (kgm²)
J_{dc} = mass moment of inertia, drive train (kgm²)
J_{ex} = mass moment of inertia of mechanical system (kgm²)
J_m = mass moment of inertia, motor (kgm²)
J_s = mass moment of inertia of linear motion system (without external load) (kgm²)
J_{sd} = mass moment of inertia of timing belt side drive at motor journal (kgm²)
J_t = translatory mass moment of inertia of external load referred to the drive journal (kgm²)
J_{tot} = total mass moment of inertia (kgm²)
i = gear ratio of timing belt side drive (–)
$k_{J\,m}$ = constant for mass-specific portion of mass moment of inertia (10^6 m²)
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%

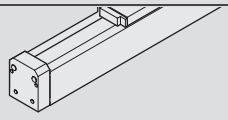
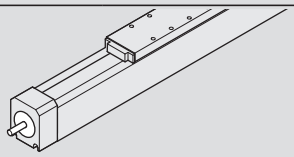
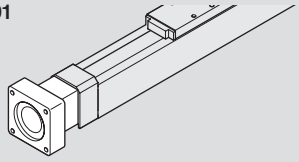
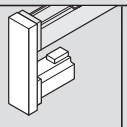
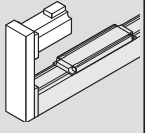
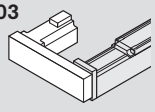
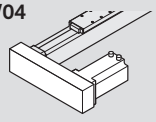
Motor attachment via motor mount and coupling
Motor with:
- maximum useful speed $n_{m\,max} > 2000\ min^{-1}$
- mass moment of inertia $J_m > 450 \cdot 10^{-6}\ kgm^2$
- maximum permissible drive torque $M_{max} < 36.5$ Nm
  Consider the rated coupling torque M_{cN} and the frictional torque M_R ($M_{cN}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

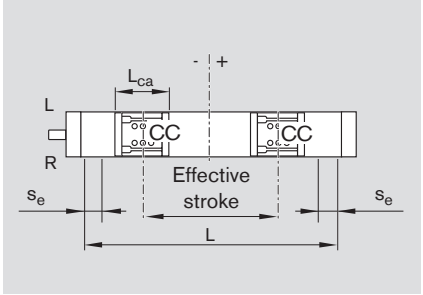
Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit [1]	for motor		without Brake	with Brake	without	with Sealing strip [2]		Standard report	Measurement report
–	00	–		00		00	01	Without switches 00 Proximity switch PNP NC 36-.±.... Switching cam 18 PNP NO 38-.±.... Cable duct 25 Switch type / Mounting side (R/L) / Direction of travel / Switching distance Socket-plug 28 Magnetic field sensor with cable Reed sensor 51 Cable duct 25 Hall sensor PNP NC 52 Socket-plug 28 Magnetic field sensor with connector Reed sensor 58 Hall sensor PNP NC 59	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–		00						
–	05	MSM 019B		104	105					
–	03	MSM 031B		106	107					
–	01	MSK 030C		84	85					
–	02	VRDM 368		35	36					
i = 1	22	MSM 019B		104	105					
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

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

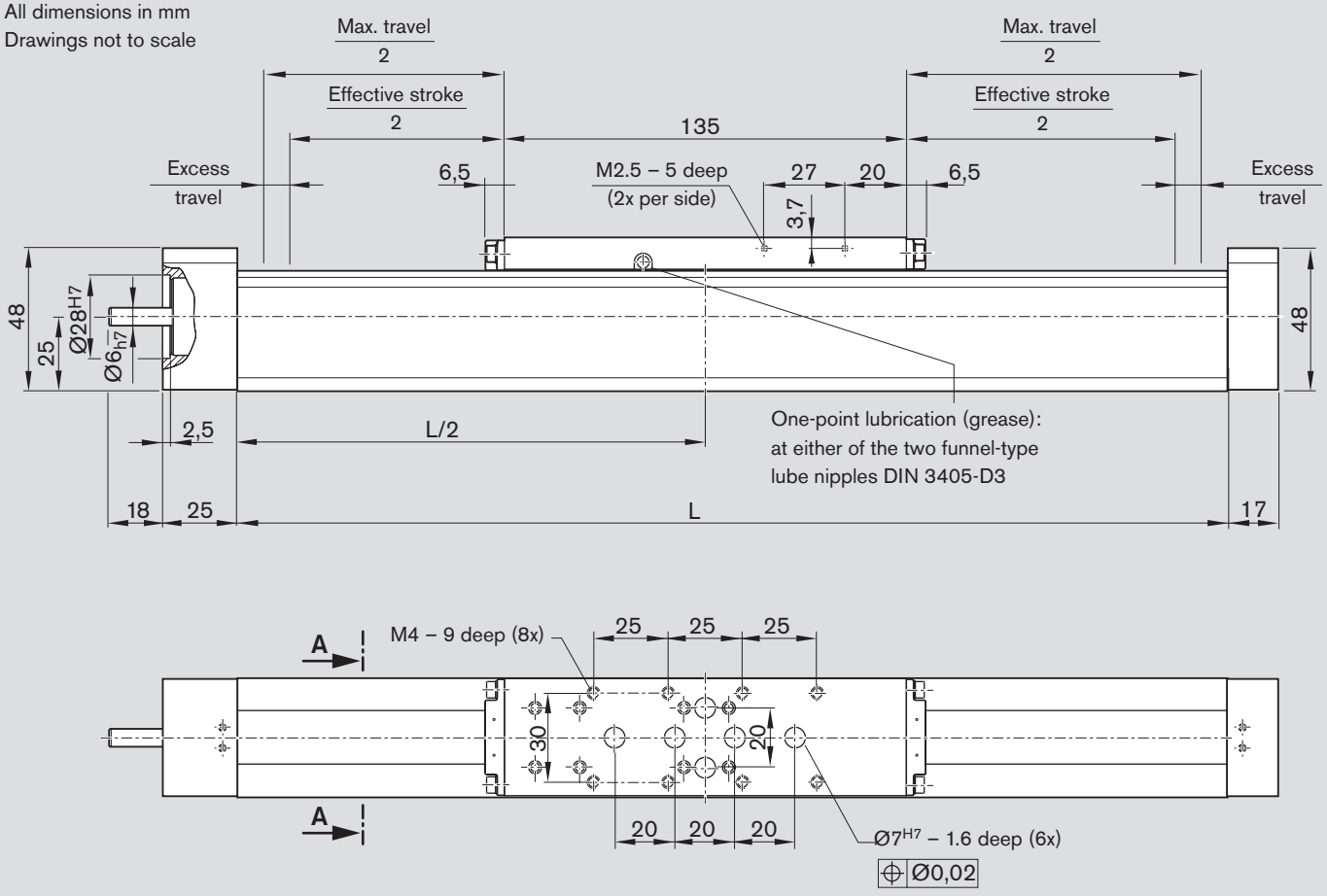
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 12 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10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



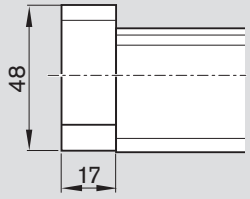
Linear Modules MKK

Linear Modules MKK 12-40 Dimensions

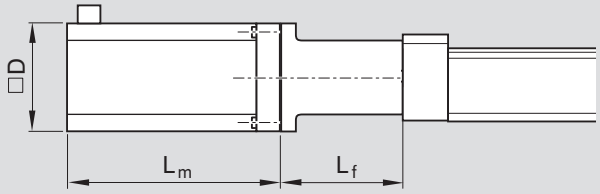
All dimensions in mm
Drawings not to scale



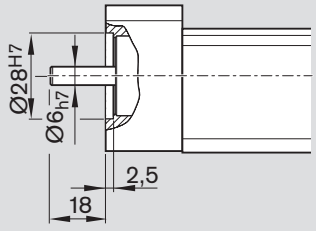
OA01



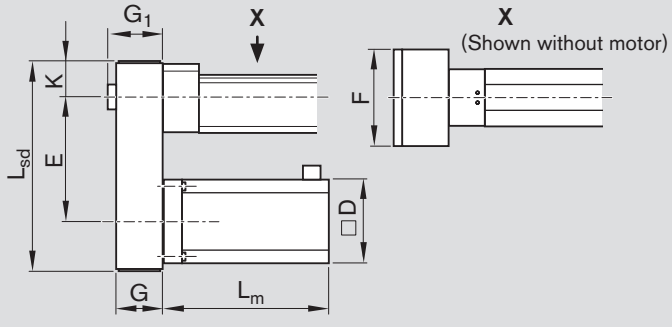
MF01



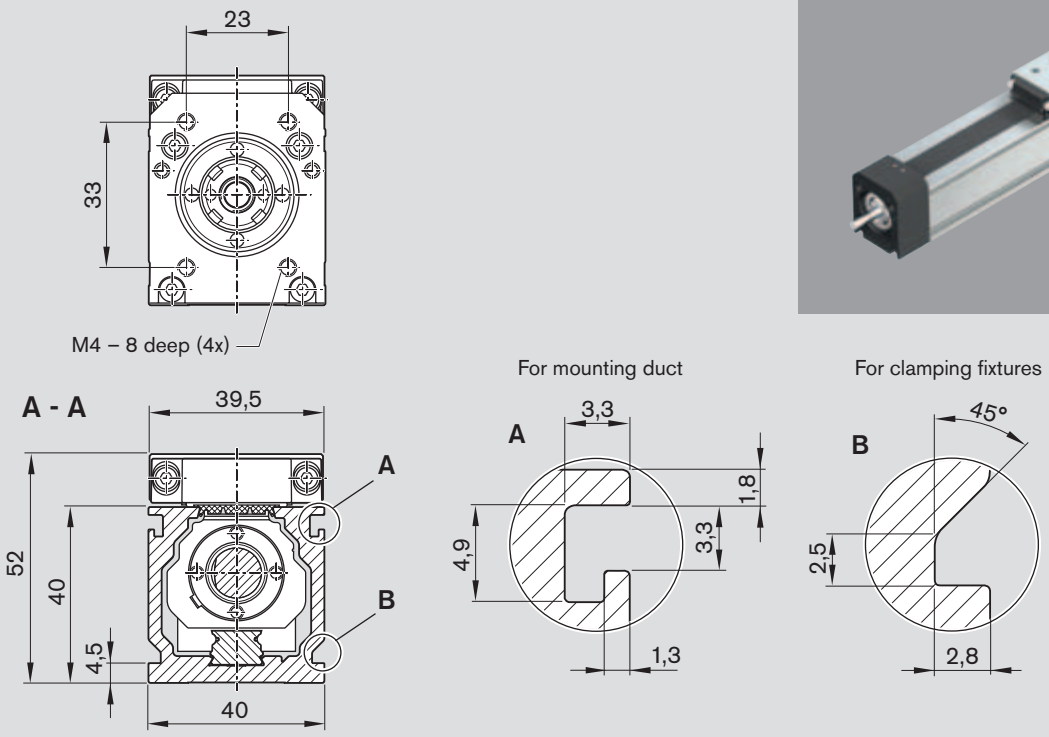
OF01



RV01 - RV04





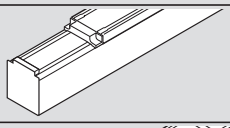
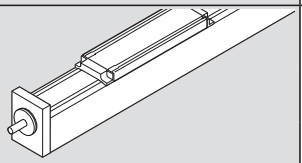
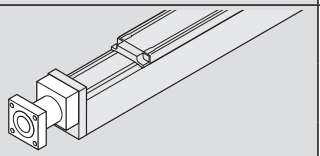
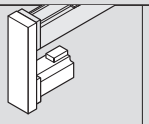
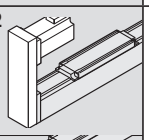
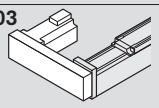
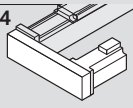


Version	Motor	Dimensions (mm) D	E i = 1	E i = 1.5	F	G	G_1	K	L_f	L_m without brake	L_m with brake	L_{sd}
RV01 - RV04	MSM 019B	38.0	76.5	76.5	48.0	27	29.0	27.5	–	92	122.0	139
	MSM 031B	60.0	78.0	75.0	64.5	37	43.5	33.5	–	79	115.5	157
	MSK 030C	54.0	78.0	75.0	64.5	37	43.5	33.5	–	188	213.0	154
MF01	MSM 019B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

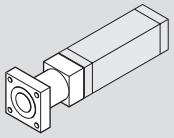
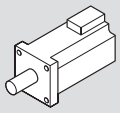
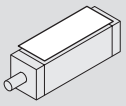
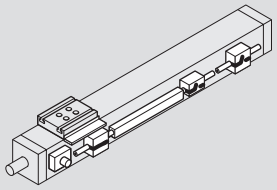
Linear Modules MKK 15-65 Components and Ordering Data

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		with-out	with	without	with		Standard report	Measurement report
				Brake		Sealing strip [2]				
–	00	–		–		00		**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	01 without side sealing			
	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		

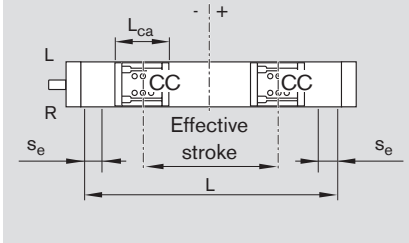
* with support bearing

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

2) Plastic sealing strip

Length L

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

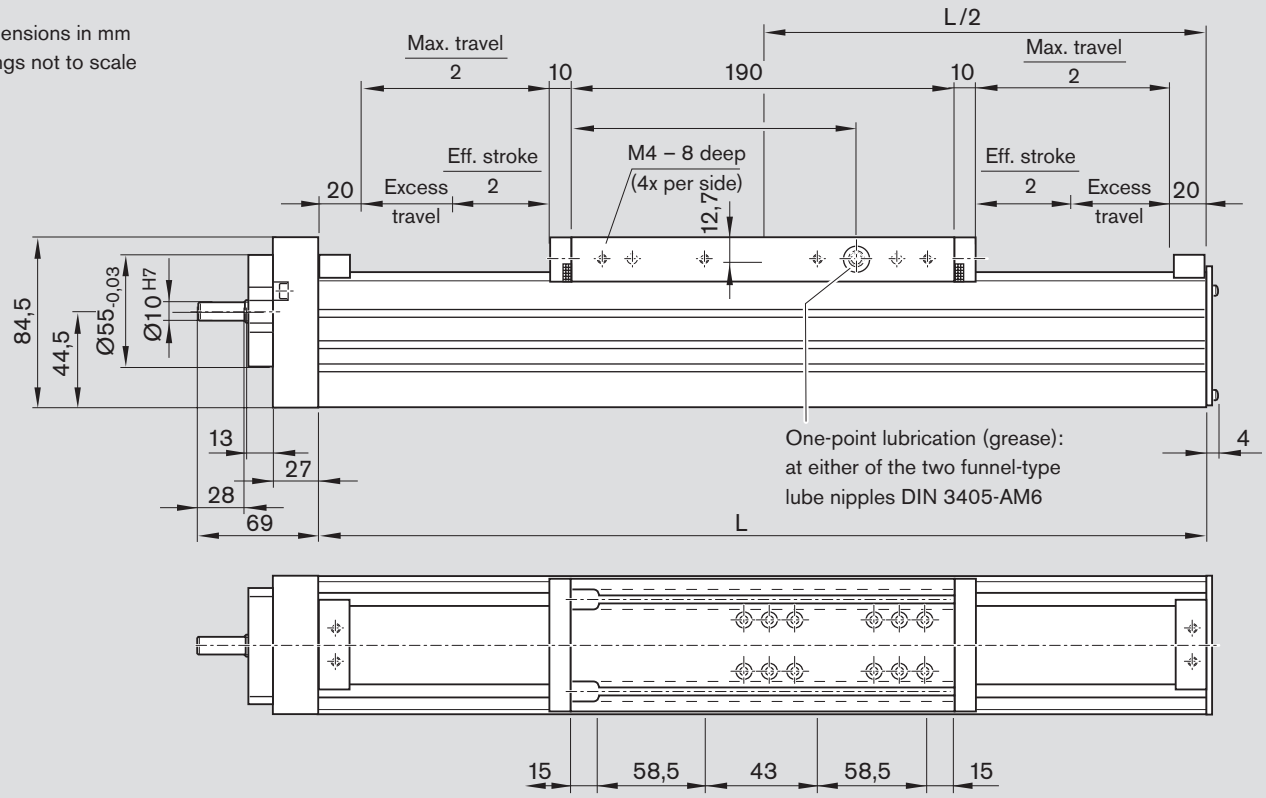


Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 16 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10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

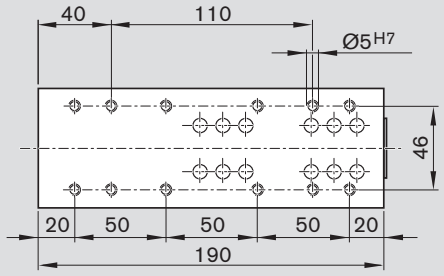
Linear Modules MKK

Linear Modules MKK 15-65 Dimensions

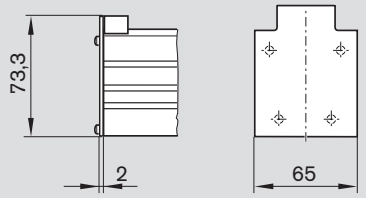
All dimensions in mm
Drawings not to scale



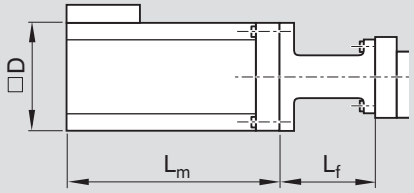
Carriage with threads



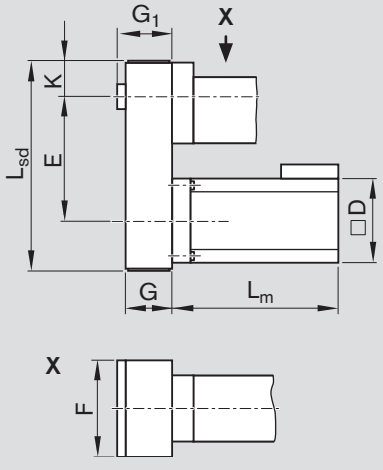
OA01



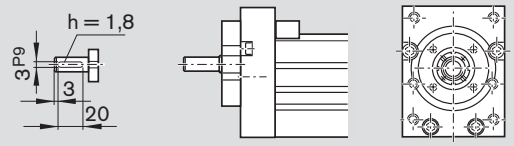
MF01

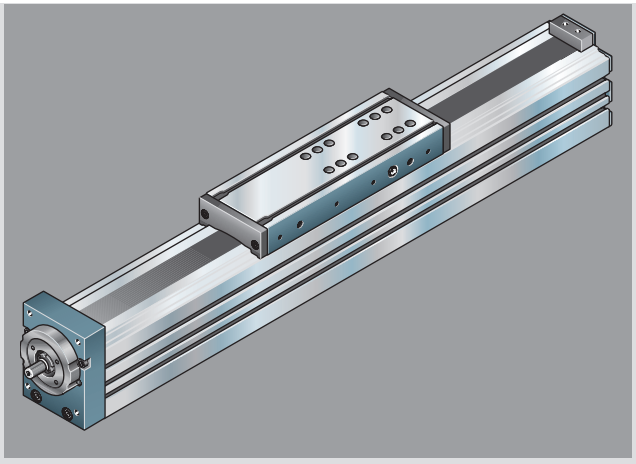


RV01 - RV04



OF01



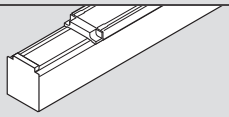
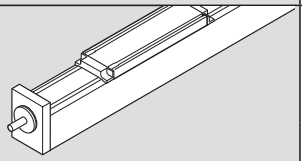
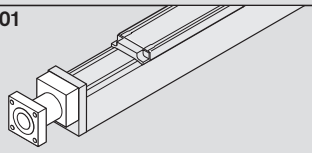
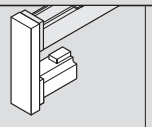
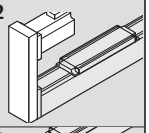
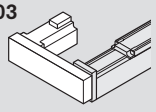
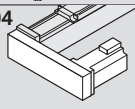


Version	Motor	Dimensions (mm) D	E i = 1	E i = 1.5	E i = 2	F	G	G_1	K	L_f	L_m without brake	L_m with brake	L_{sd}
RV01 - RV04	MSK 040C	82	122	122	–	88	51	81	47.5	–	185.5	215.5	231
	MSM 041B	80	122	122	–	88	51	81	47.5	–	112.0	149.0	231
MF01	MSK 040C	82	–							95	185.5	215.5	
	MSM 041B	80	–							90	112.0	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 **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 **Cable duct (loose)** – Length 20, ... mm **External socket/ plug (loose)** 17 **External switching cam** 16	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–		00						
–	02	**MSK 040C**		86	87					
–	06	**MSM 041B**		110	111					
–	04	**VRDM 397**		37	38					
–	04	**VRDM 3910**		39	40					
–	05	**VRDM 3913**		41	42					
i = 1	23	**MSK 050C**		88	89					
i = 1	30	**MSK 040C**		86	87					
i = 1	32	**MSM 041B**		110	111					
i = 1.5*	31	**MSK 040C**		86	87					
i = 1.5*	33	**MSM 041B**		110	111					
i = 2*	26	**MSK 050C**		88	89					

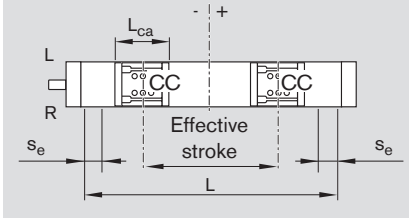
* with support bearing

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

3) Steel sealing strip, permissible up to 3500 mm

Length L

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

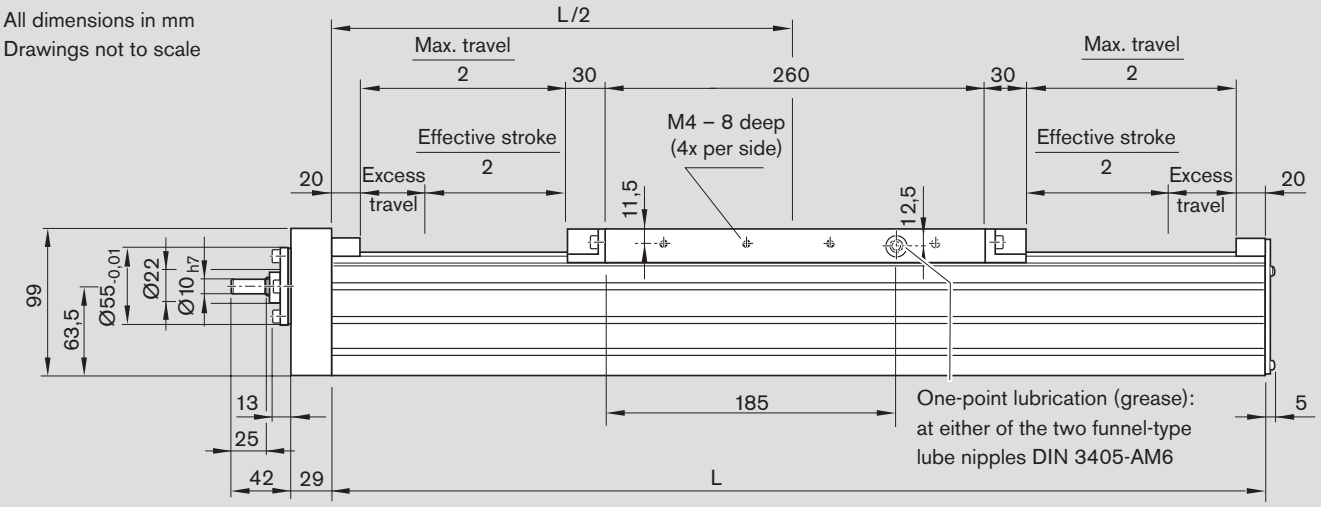


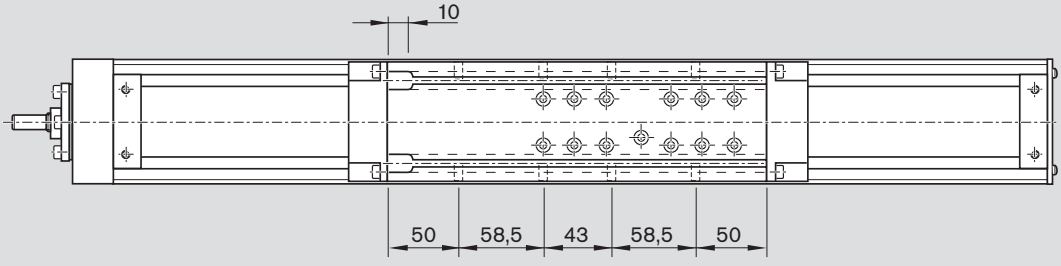
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 16 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10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

Linear Modules MKK

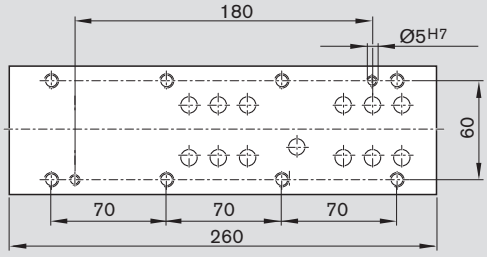
Linear Modules MKK 20-80 Dimensions

All dimensions in mm
Drawings not to scale

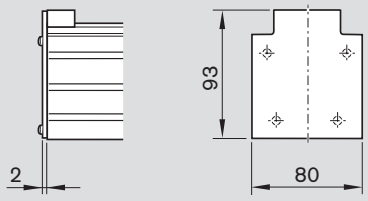




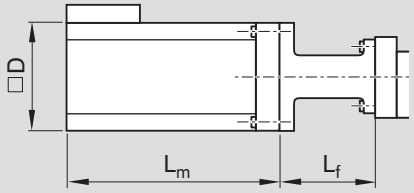
Carriage with threads



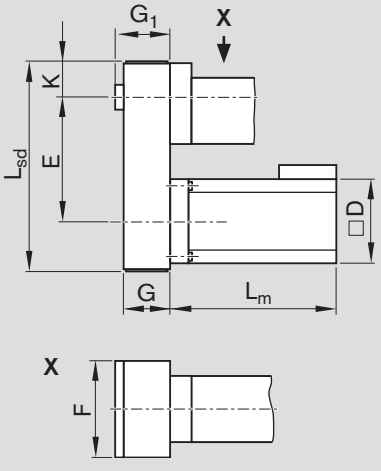
OA01



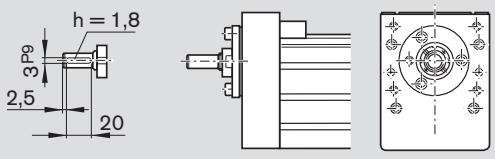
MF01

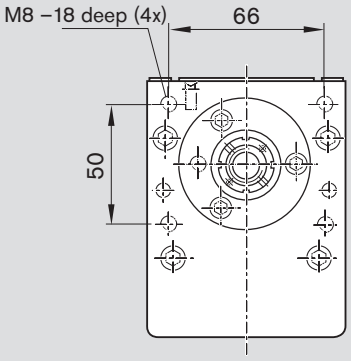


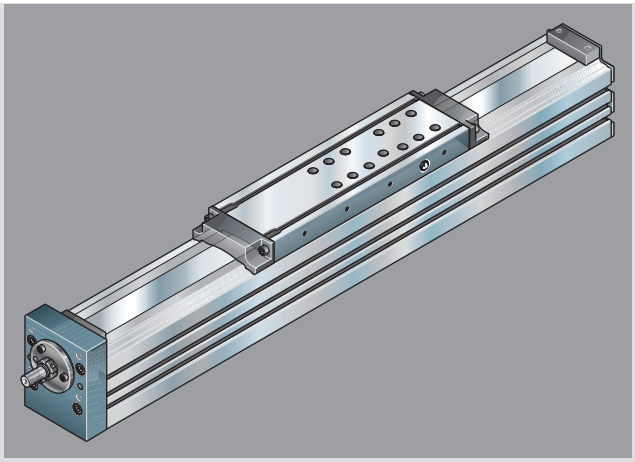
RV01 - RV04

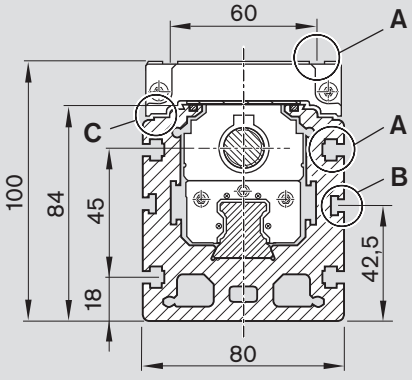


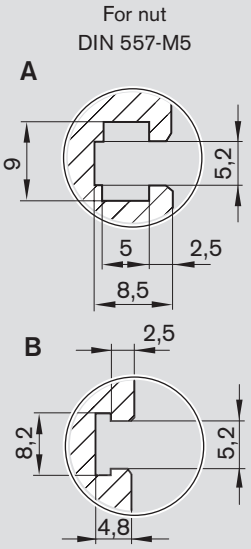
OF01

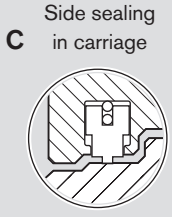












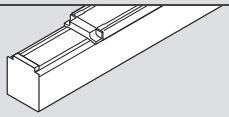
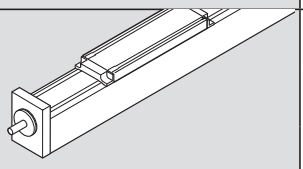
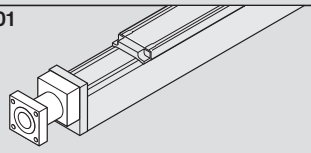
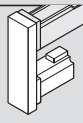
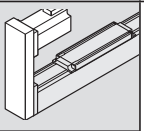
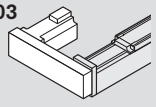
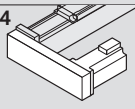
Version	Motor	Dimensions (mm) D	E			F	G	G_1*)	K	L_f	L_m without brake	L_m with brake	L_{sd}
			i = 1	i = 1.5	i = 2								
RV01 - RV04	MSK 040C	82	122	122	–	88	51	57	47.5	–	185.5	215.5	231
	MSK 050C	98	155	–	152	116	66	78	56.0	–	203.0	233.0	287
	MSM 041B	80	122	122	–	88	51	57	47.5	–	112.0	149.0	231
MF01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

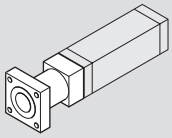
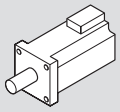
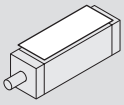
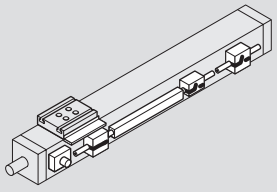
Linear Modules MKK 25-110 Components and Ordering Data

Part number, length R1160 260 10, ... mm Version		Guideway	Drive unit Screw journal	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.)!

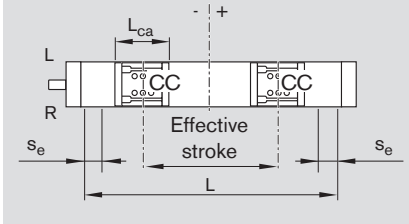
d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
SPU = screw support
L_{ca} = carriage length

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					
i = 1	23	**MSK 060C**	90	91		21 with side sealing	**Cable duct (loose)** – Length 20, ... mm		
i = 2	24	**MSK 060C**	90	91			**External socket/ plug (loose)** 17		
							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

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

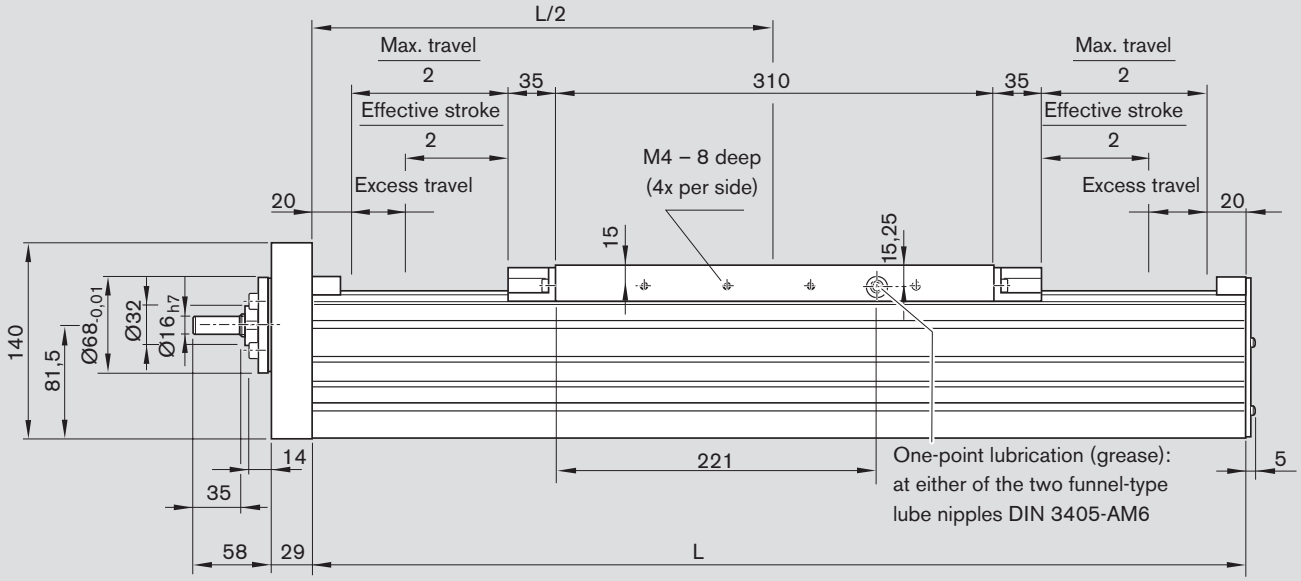


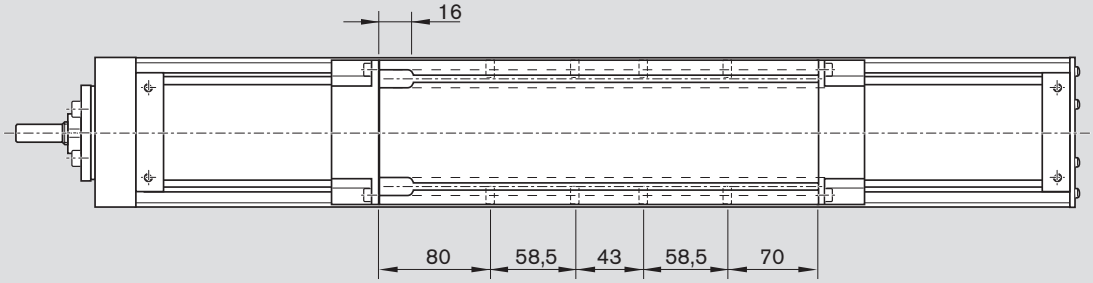
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 32 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10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

Linear Modules MKK

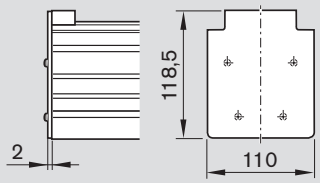
Linear Modules MKK 25-110 Dimensions

All dimensions in mm
Drawings not to scale

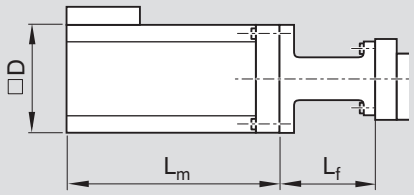




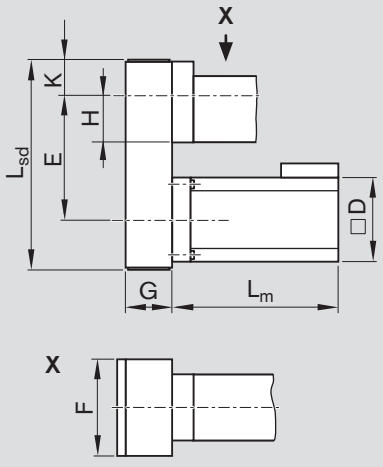
OA01



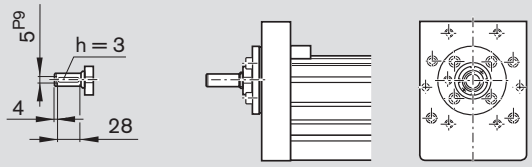
MF01

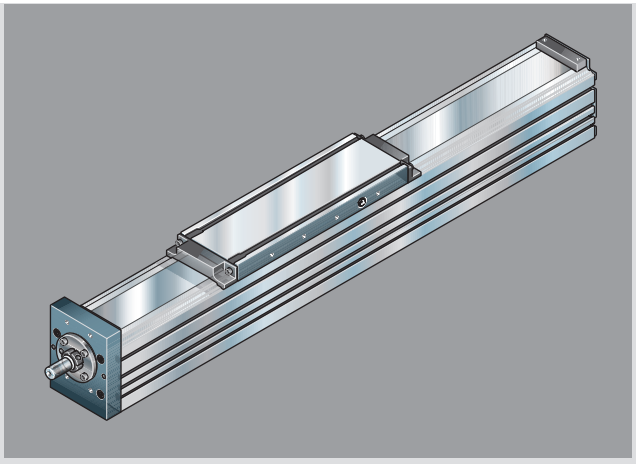


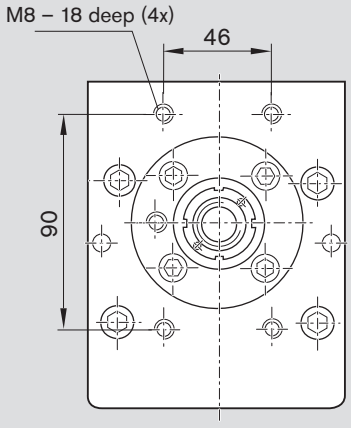
RV01 - RV04

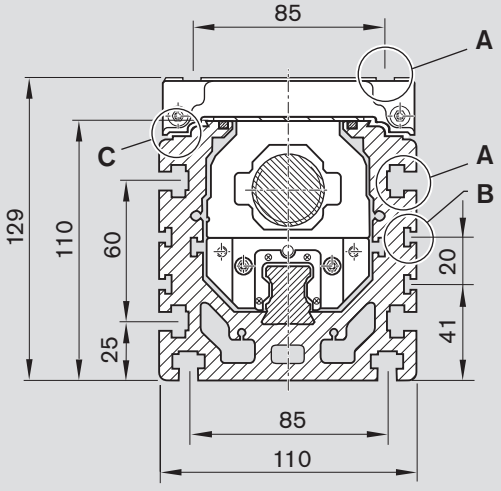


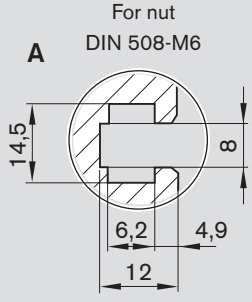
OF01

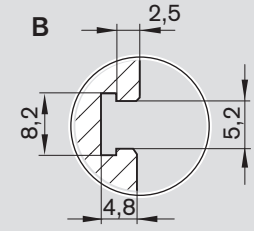




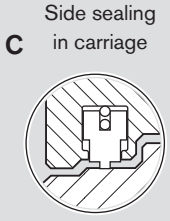








For cable duct



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	–

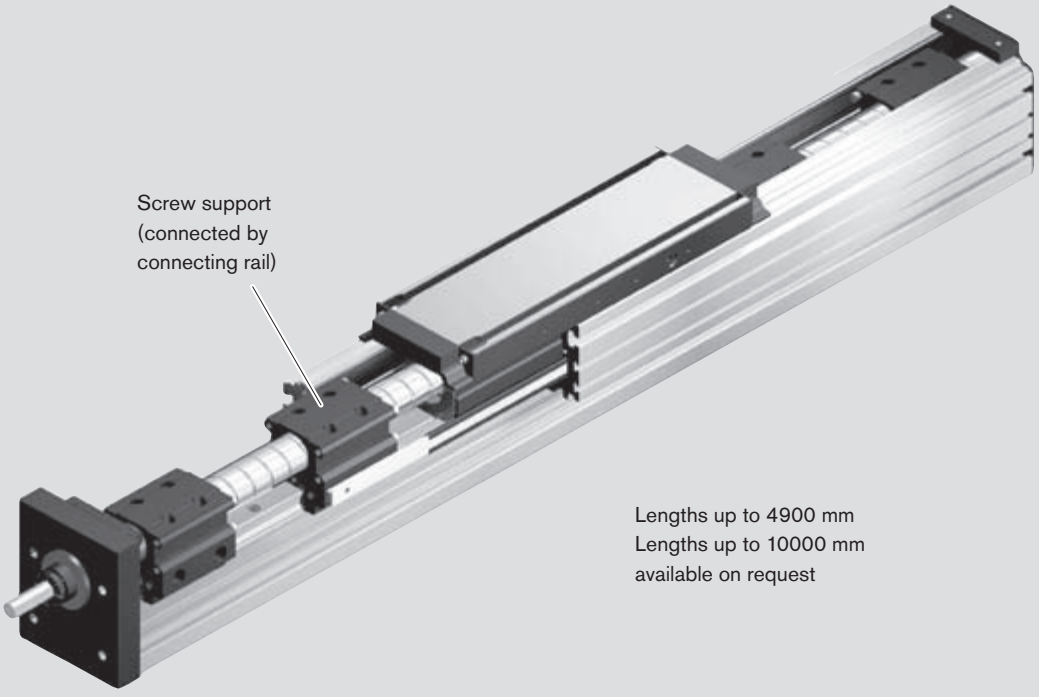
CAD configurator available on the Internet at www.boschrexroth.com/dcl

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

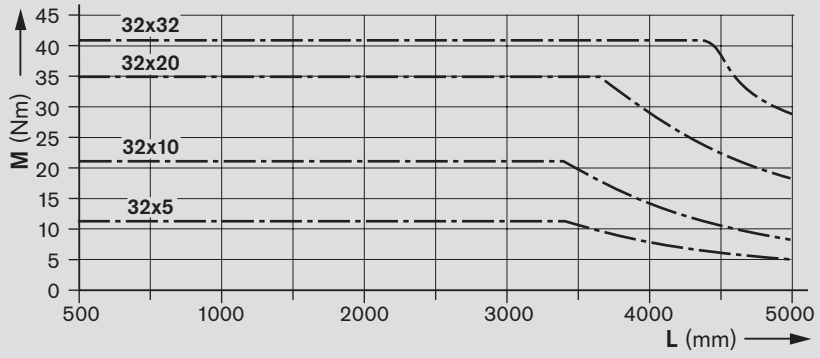
Technical Data

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}

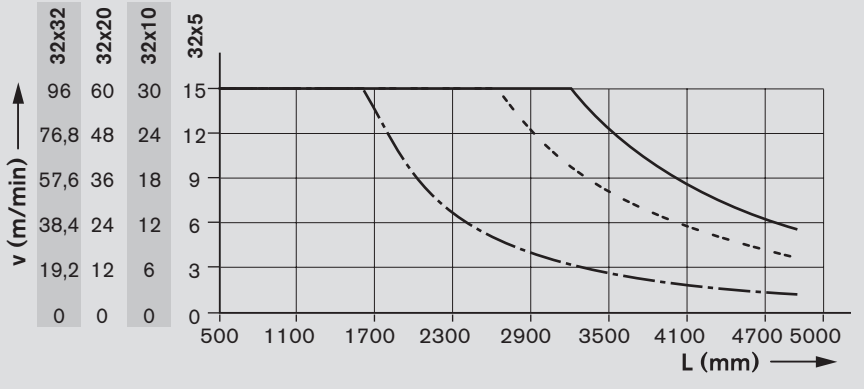
—·— with and without SPU



Permissible travel speed v

Consider the motor speed!

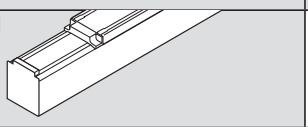
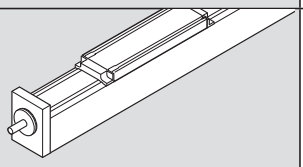
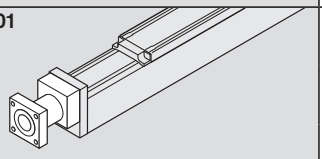
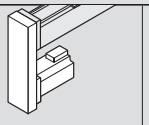
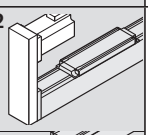
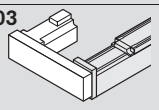
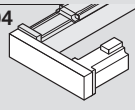
——— with 2 SPUs
-- -- -- with 1 SPU
—·— without SPU



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

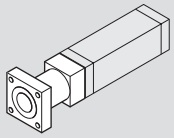
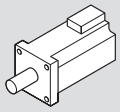
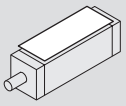
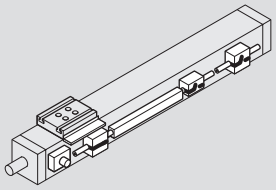
Linear Modules MKK 35-165 Components and Ordering Data

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.)!

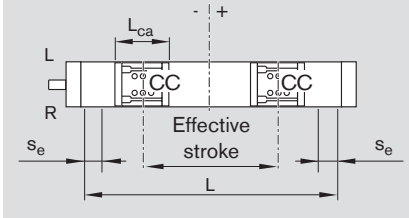
d_0 = nominal diameter of screw (mm)
P = screw lead (mm)
L_{ca} = carriage length

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			
i = 1	23	**MSK 076C**	92	93	00	01	**Cable duct (loose)** – Length 20, ... mm **External socket/ plug (loose)** 17 **External switching cam** 16		
i = 2	24	**MSK 076C**	92	93					

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

Length L

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



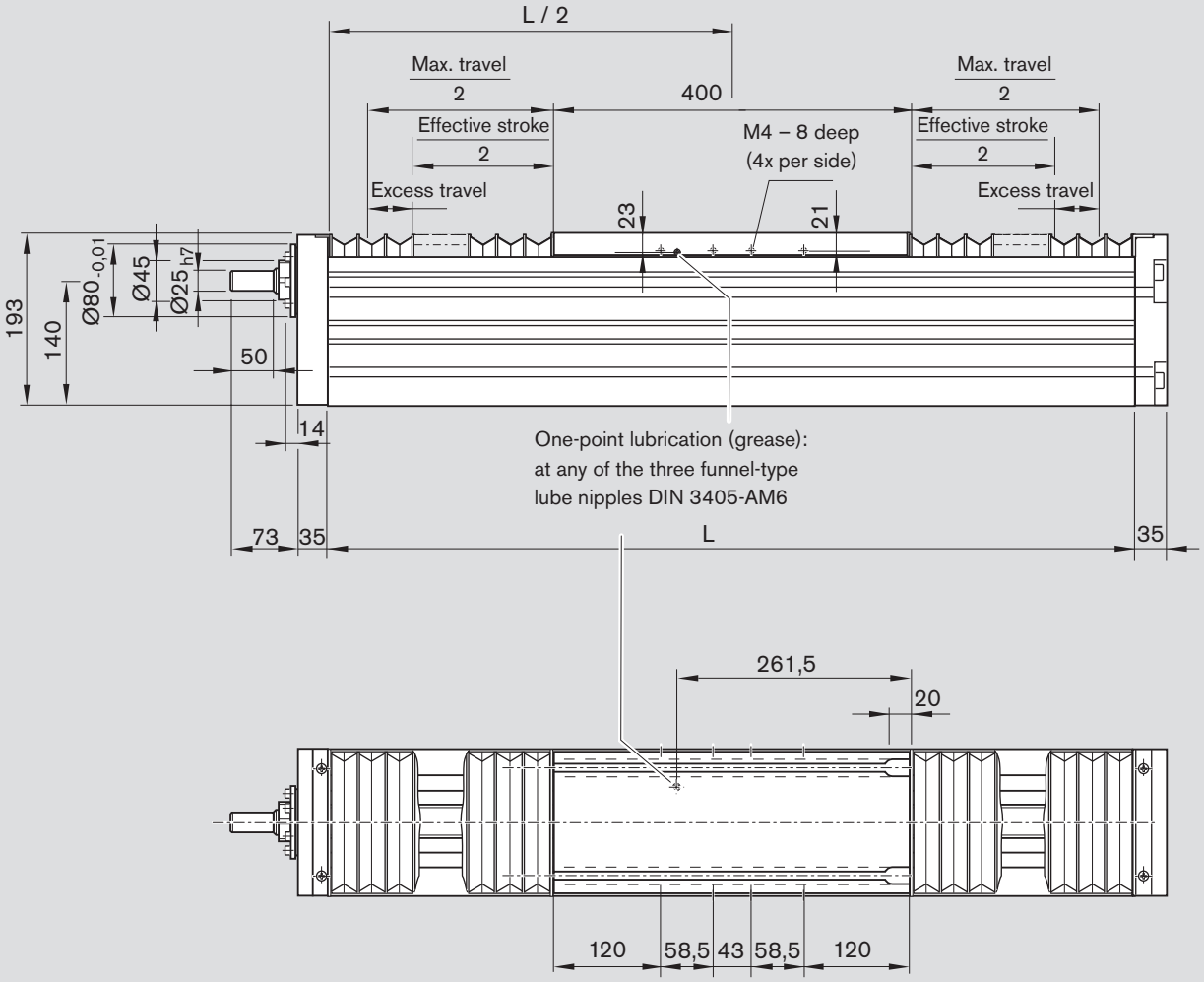
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
Excess travel s_e:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 · screw lead P
Example: Ball screw 40 x 10 (d_0 x P),
Excess travel = 2 · P = 2 · 10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

* with protective bellows

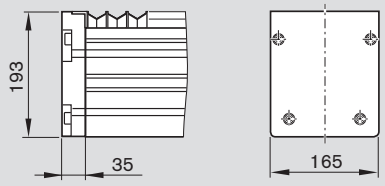
Linear Modules MKK

Linear Modules MKK 35-165 Dimensions

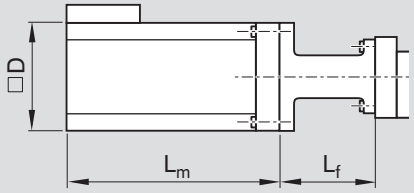
All dimensions in mm
Drawings not to scale



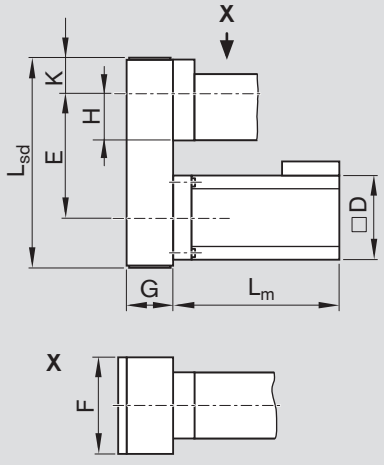
OA01



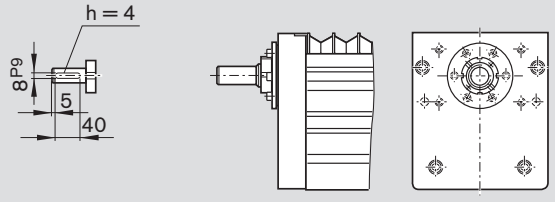
MF01

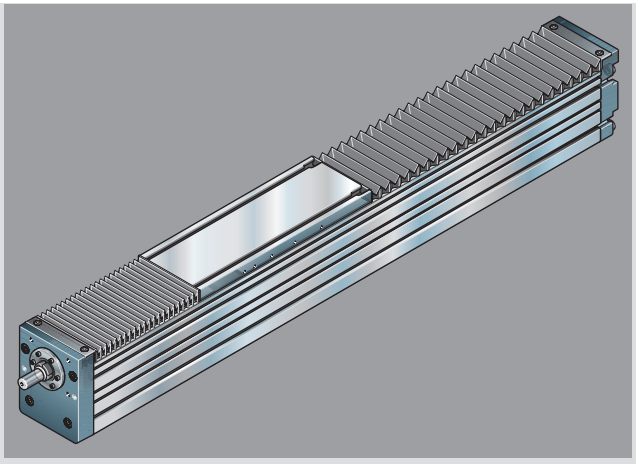


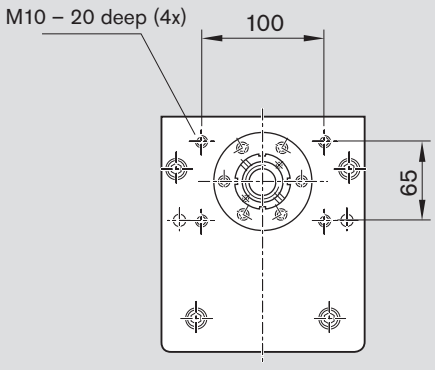
RV01 - RV04

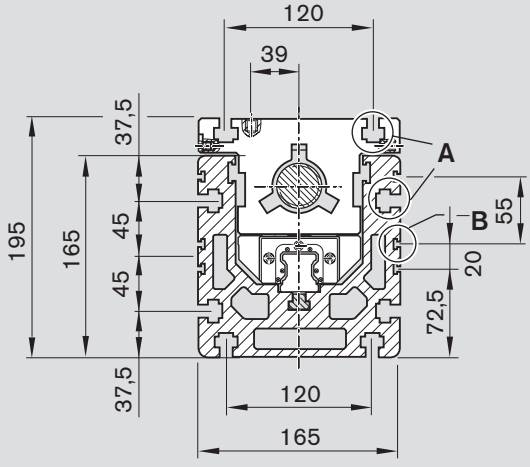


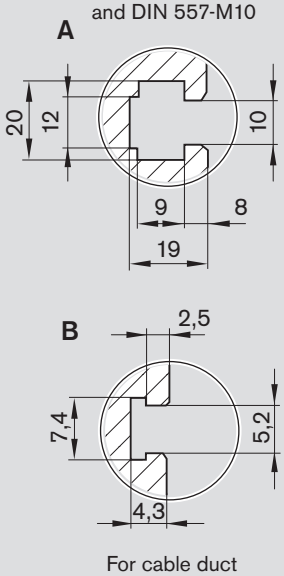
OF01











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	–

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

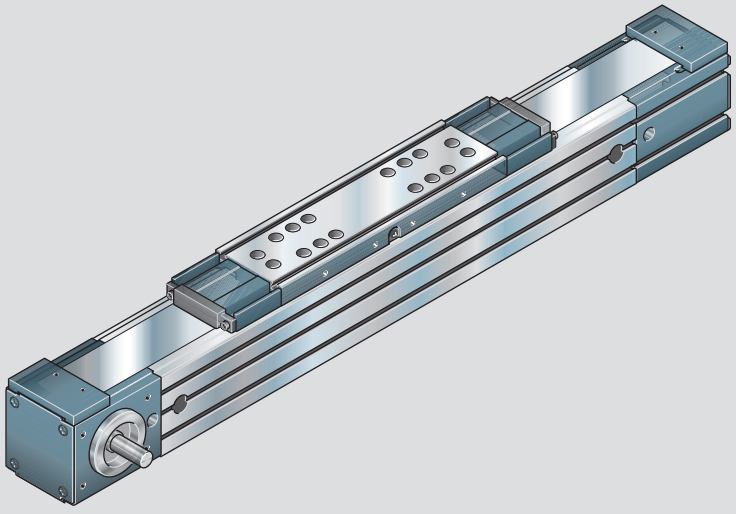
Linear Modules MKR

Product Description

Characteristic features

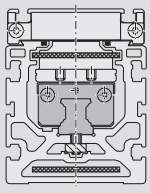
MKR...: Linear Modules with Ball Rail System and Toothed Belt Drive for demanding speed and load requirements

The MKR... Linear Modules comprise:
- a compact, anodized aluminum profile frame
- the integrated Rexroth Profiled Rail System
- a carriage with one-point lubrication
- the pre-tensioned toothed belt (also available without drive unit)
- cover provided by:
  - plastic strip on MKR 12-40 and MKR 15-65
  - corrosion-resistant steel strip per EN 10088 on MKR 20-80 and MKR 25-110
  - the toothed belt on MKR 35-165
- mountable switches
- AC servo motor
- gear reducer for motor attachment
- control units



For mounting and maintenance, see the relevant Instructions.

MKR



Linear Module with one Ball Rail System and Toothed Belt Drive
High load capacities and optimal travel performance enable the integrated, clearance-free Rexroth Profiled Rail System to move large loads at high speed.

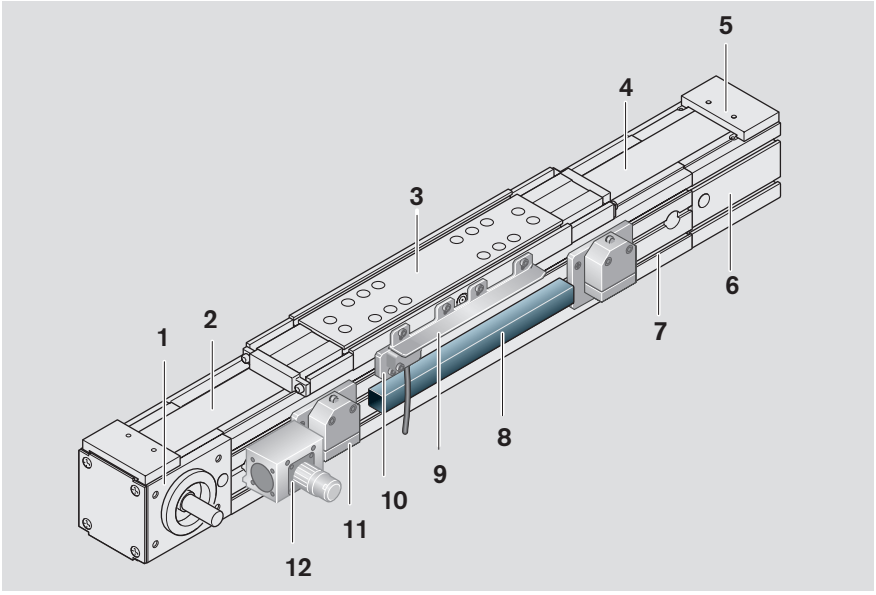
Structural Design

Structural design

1 Drive end enclosure
2 Toothed belt (under sealing strip)
3 Carriage with runner blocks
4 Sealing strip
5 Strip fixing
6 Idler (non-drive) end enclosure
7 Frame

Attachments:

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



Versions

MA01 and MA02

With drive unit (MA) without gear reducer (i = 1), journal for motor attachment right or left.

MA03

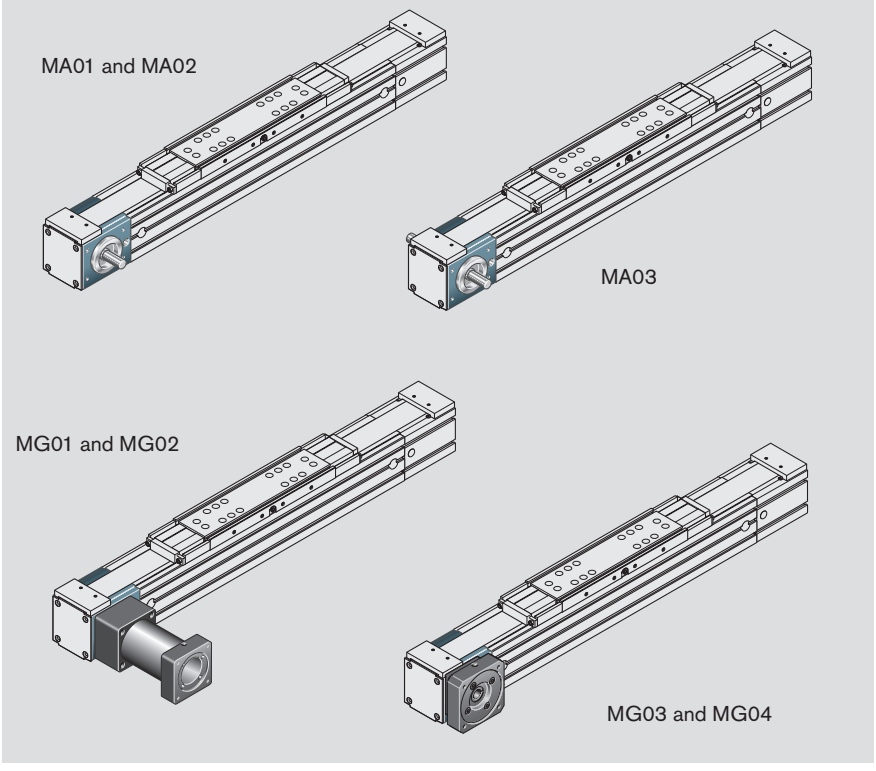
As MA01 and MA02, journal for motor attachment on both sides.

MG01 and MG02

With gear reducer, motor attachment via motor mount and socket.

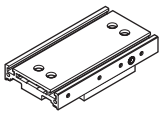
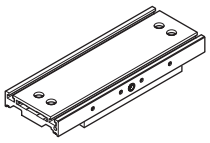
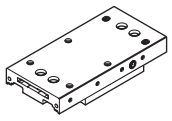
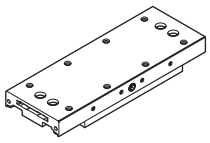
MG03 and MG04

With integrated gear reducer, motor attachment via motor mount and socket.



Carriage variants

For MKR 20-80 and MKR 25-110

Carriage with T-slots		with threaded holes	
Short	Long	Short	Long
			

Linear Modules MKR

Technical Data

General technical data

	Carriage length	Dynamic load capacity	Dynamic load moments		Maximum permissible loads			
					Forces		Moments	
	L_{ca} (mm)	C (N)	M_t (Nm)	M_L (Nm)	$F_{x\,max}$ (N)	$F_{y\,max}$ (N)	$M_{t\,max}$ (Nm)	$M_{l\,max}$ (Nm)
MKR 12-40	135	3750	22.3	129.5	1875	1875	12	65
MKR 15-65	190	11820	112	416	5910	5190	56	208
MKR 20-80	190	17420	221	121	8710	8710	110	60
	260	28300	359	1840	14150	14150	180	920
MKR 25-110	210	21320	300	168	10660	10660	150	84
	305	44670	631	2574	22335	22335	316	1287
MKR 35-165	400	68200	1445	4160	34100	34100	720	2130

1) For a theoretical stroke of 100 mm and excess travel of 30 mm at each end

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.

Maximum operating temperature

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.

Mass of the linear system

Weight calculation does not include motor or switch attachments.

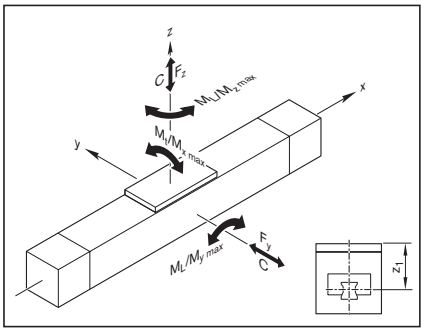
Weight formula:
Weight factor (kg/mm) x length L (mm) + weight of all parts of fixed length (carriage, end blocks, etc.) (kg)

Planar moment of inertia		Length of linear module		Moved mass of system	Drive units	Mass of the linear system
I_x (cm⁴)	I_y (cm⁴)	min. L_{min} [1] (mm)	max. L_{max} (mm)	(kg)		m_s (kg)
10.53	14.61	250	2 500	0.29	Drive i = 1	0.0027 · L + 0.81
					With gear reducer	0.0027 · L + 1.72
81.5	98.8	390	6 000	1.0	Without drive unit	0.0074 · L + 3.0
					Drive i = 1	0.0074 · L + 4.0
					With gear reducer	0.0074 · L + 6.0
141.4	184.0	370	6 000	1.4	Without drive unit	0.0093 · L + 4.1
					Drive i = 1	0.0093 · L + 4.6
					With LP gear reducer	0.0093 · L + 8.0
					With LPB gear reducer	0.0093 · L + 6.0
		430		2.2	Without drive unit	0.0093 · L + 4.9
					Drive i = 1	0.0093 · L + 5.4
					With LP 70 gear reducer	0.0093 · L + 8.8
					With LPB gear reducer	0.0093 · L + 6.8
444.1	608.4	390	10 000	2.5	Without drive unit	0.0158 · L + 8.9
					Drive i = 1	0.0158 · L + 9.2
					With LP 90 gear reducer	0.0158 · L + 16.1
					With LPB gear reducer	0.0158 · L + 13.0
444.1	608.4	458	10 000	5.7	Without drive unit	0.0158 · L + 12.1
					Drive i = 1	0.0158 · L + 12.5
					With LP 90 gear reducer	0.0158 · L + 19.3
					With LPB gear reducer	0.0158 · L + 17.3
2574.0	3527.0	600	12 000	11.5	Drive i = 1	0.0384 · L + 41.0
					With gear reducer	0.0384 · L + 53.0

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
MKR 12-40	34.5
MKR 15-65	39.5
MKR 20-80	59.5
MKR 25-110	74.5
MKR 35-165	123.0



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:

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

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 in meters	(m)
L_h	=	nominal life in hours	(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 Modules MKR

Technical Data

Drive data

	Gear reducer ratio i (–)	Maximum drive torque for mechanical system M_a (Nm)	Lead constant (mm/rev)	Maximum travel speed for mechanical system v_{mech} (m/s)	
MKR 12-40	1	3.90	90.00	3.0	
	5	0.78	18.00	2.4	
	10	0.39	9.00	1.2	
MKR 15-65	1	9.10	110.00	5.0	
	1 with keyway	9.10	110.00	5.0	
	3	2.60	36.67	2.5	
	7	1.10	15.72	1.8	
MKR 20-80	1	32.00	205.00	5.0	
	1 with keyway	27.00	205.00	5.0	
	3	10.70	68.66	5.0	
	5	6.40	41.00	3.0	
	10	3.20	20.50	1.5	
MKR 25-110	1	80.00	290.00	5.0	
	1 with keyway	27.00	290.00	5.0	
	3	26.60	96.66	5.0	
	5	16.00	58.00	4.0	
	10	8.00	29.00	2.0	
MKR 35-165	1	367.00	440.00	5.0	
	1 with keyway	200.00	440.00	5.0	
	6	60.00	73.30	3.0	
	12	30.00	36.70	1.5	

	Belt data					
	Belt type	Width (mm)	Tooth pitch (mm)	Max. belt drive transmission force (N)	Belt elasticity limit (N)	Specific spring rate c_{spec} (N)
	AT 3	20	3	250	760	$0.2 \cdot 10^5$
	AT 5	32	5	520	2740	$0.56 \cdot 10^6$
	AT 5	50	5	980	3500	$0.875 \cdot 10^6$
	AT 10	50	10	1740	7500	$2.12 \cdot 10^6$
	AT 20	75	20	5250	18000	$4.20 \cdot 10^6$

Toothed belt stretch

$\Delta l = (F \cdot L^*)/c_{spec}$

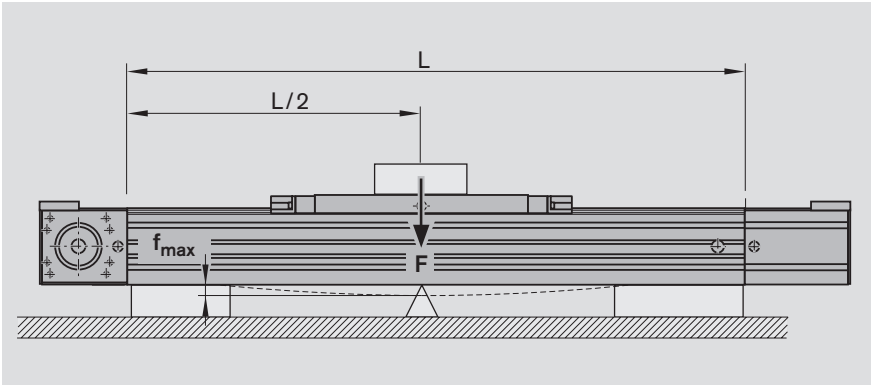
* Length of the toothed belt

Linear Modules MKR

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.**

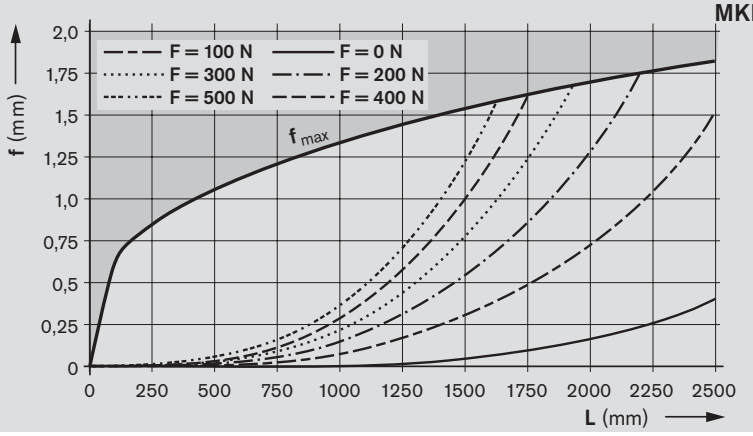
Example

Linear Module MKR 20-80:
L = 3000 mm
F = 500 N
From chart 20-80:
f = 0.9 mm
f_{max} = 3.4 mm

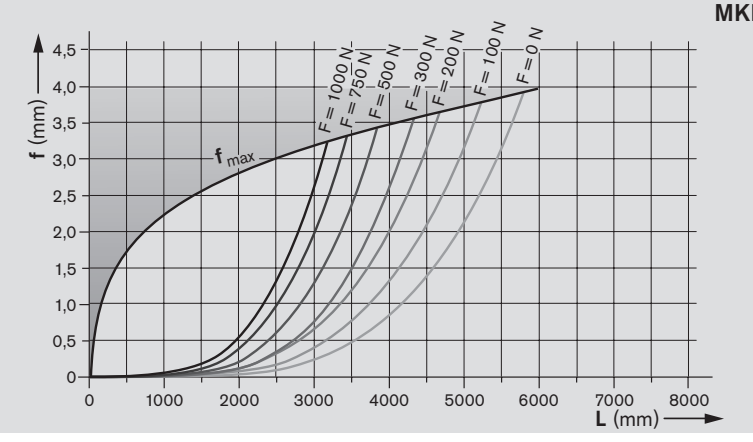
The deflection f lies well below the maximum permissible deflection f_{max}, so no additional supports are required.

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

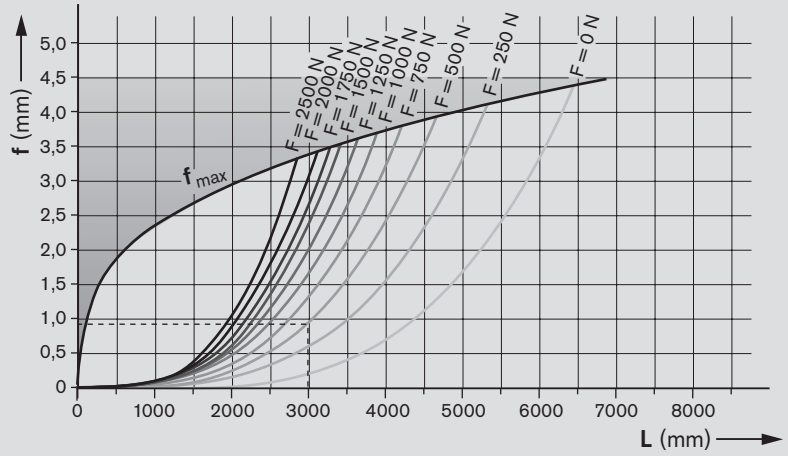
MKR 12-40



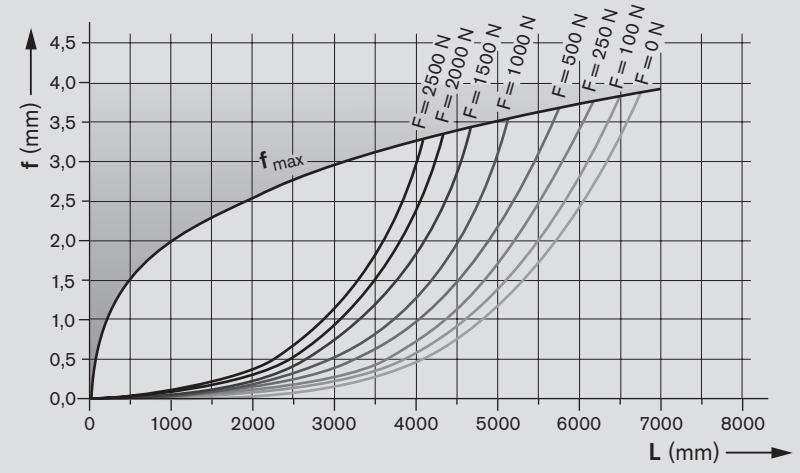
MKR 15-65



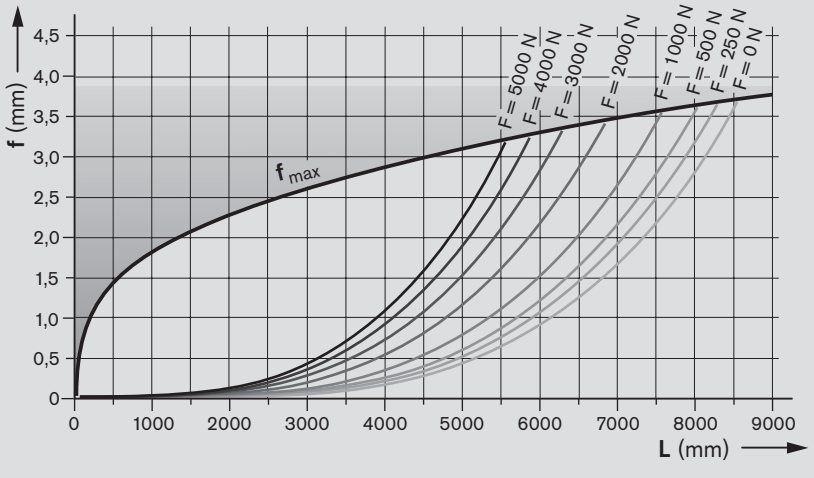
MKR 20-80



MKR 25-110



MKR 35-165



Linear Modules MKR

Performance Data

The tables contain performance data examples for gear-motor-controller combinations. They are intended as a rough guide for selection. The precise performance data must be calculated for each application case.
For more information on motors, controllers and control systems, please refer to the catalogs “IndraDrive Cs” and “IndraDrive C for Linear Motion Systems.” These figures do not include any assessment of the effective torque of the motor-controller combination.

MKR 12-40

Drive data without motor (i = 1)

Belt pulley drive diameter	28.85 mm
Lead constant	90 mm/revolution
Travel speed v_{mech}	Up to 3 m/s
Mass moment of inertia J_s	$(67.84 + L \cdot 0.0181) \cdot 10^{-4}$ kgm²

Horizontal operation

MSK 030C, HCS02.1E-W0012, 3 x 400 V

i		**5**						**10**							
m_{ex}	(kg)	2	4	6	8	10	12	2	4	6	8	10	12	14	16
t_a	(ms)	121	153	185	216	248	280	205	223	240	258	276	293	311	329
s_a	(mm)	146	184	222	260	298	336	123	134	144	155	165	176	187	197
a	(m/s^2)	19.8	15.7	13.0	11.1	9.7	8.6	5.9	5.4	5.0	4.7	4.4	4.1	3.9	3.7
v_{dc}	(m/s)	2.4						1.2							
*	(mm)	± 0.1													

MSM 031B, HCS01.1E-W0006, 230 V

i		**5**					**10**						
m_{ex}	(kg)	1	2	3	4	5	2	4	6	8	10	12	14
t_a	(ms)	24	30	36	42	48	42	48	55	62	68	75	82
s_a	(mm)	11	13	16	19	21	9	11	12	14	15	17	18
a	(m/s^2)	37.7	30.2	25.2	21.6	18.9	10.8	9.3	8.2	7.3	6.6	6.0	5.8
v_{dc}	(m/s)	0.90					0.45						
*	(mm)	± 0.1											

MSM 031C, HCS01.1E-W0009, 230 V

i		**5**					**10**							
m_{ex}	(kg)	2	4	6	8	10	2	4	6	8	10	12	14	16
t_a	(ms)	38	50	62	74	86	61	68	74	81	88	94	101	108
s_a	(mm)	17	23	28	33	39	14	15	17	18	20	21	23	24
a	(m/s^2)	23.4	17.9	14.5	12.1	10.5	7.4	6.6	6.0	5.6	5.1	4.8	4.5	4.2
v_{dc}	(m/s)	0.90					0.45							
*	(mm)	± 0.1												

a = acceleration (m/s^2)
i = gear reduction (-)
m_{ex} = mass (kg)
s_a = acceleration travel (mm)
t_a = acceleration time (ms)
v_{dc} = travel speed (m/s)
* = reproducibility (mm)

MSK = servo motor
MSM = servo motor
VRDM = stepping motor
HCS = digital controller

MKR 15-65

Drive data without motor (i = 1)

Belt pulley drive diameter	35.02 mm
Lead constant	110 mm/revolution
Travel speed v_{mech}	Up to 5 m/s
Mass moment of inertia J_s	$(3.66 + L \cdot 0.000748) \cdot 10^{-4}$ kgm^2

Horizontal operation

MSK 030C, HCS02.1E-W0012, 3 x 400 V

i		3			7				
m_{ex}	(kg)	1	2	3	4	8	12	16	22
t_a	(ms)	73	86	100	135	165	195	225	270
s_a	(mm)	110	129	150	90	105	125	145	175
a	(m/s^2)	41	35	30	9.7	7.9	6.7	5.8	4.8
v_{dc}	(m/s)	3			1.3				
*	(mm)	± 0.1							

MSK 040C, HCS02.1E-W0012, 3 x 400 V

i		3						7					
m_{ex}	(kg)	2	6	10	14	18	22	4	8	12	20	30	38
t_a	(ms)	140	195	245	300	360	430	285	325	350	400	480	524
s_a	(mm)	215	290	375	450	540	643	185	211	230	260	310	352
a	(m/s^2)	21	15.5	12	10	8.3	7	4.5	4	3.7	3.2	2.7	2.4
v_{dc}	(m/s)	3						1.3					
*	(mm)	± 0.1											

MSM 031C, HCS01.1E-W0009, 230 V

i		7					
m_{ex}	(kg)	6	8	10	12	14	16
t_a	(ms)	63	68	75	83	88	95
s_a	(mm)	24	26	29	32	32	36
a	(m/s^2)	12	11	10	9	8.5	7.9
v_{dc}	(m/s)	0.75					
*	(mm)	± 0.1					

MSM 041B, HCS01.1E-W0013, 230 V

i		3				
m_{ex}	(kg)	2	4	8	12	16
t_a	(ms)	52	67	95	120	150
s_a	(mm)	47	60	86	108	135
a	(m/s^2)	34.5	27	19	15	12
v_{dc}	(m/s)	1.8				
*	(mm)	± 0.1				

Vertical operation (frame stationary, carriage travels)

MSK 030C, HCS02.1E-W0012, 3 x 400 V

i		3			7					
m_{ex}	(kg)	1	2	3	2	4	6	8	10	12
t_a	(ms)	75	100	115	135	175	220	285	385	520
s_a	(mm)	110	145	175	85	110	140	184	250	338
a	(m/s^2)	40	31	26	9.8	7.5	6	4.6	3.4	2.5
v_{dc}	(m/s)	3			1.3					
*	(mm)	± 0.1								

MSK 040C, HCS02.1E-W0012, 3 x 400 V

i		3						7				
m_{ex}	(kg)	1	2	4	6	8	10	2	4	8	12	14
t_a	(ms)	130	150	200	255	335	430	300	360	540	430	630
s_a	(mm)	195	225	295	385	500	645	195	235	350	130	190
a	(m/s^2)	23	20	15.2	11.7	9	7	4.3	3.6	2.4	1.4	0.95
v_{dc}	(m/s)	3						1.3			0.6	
*	(mm)	± 0.1										

Linear Modules MKR

Performance Data

MKR 20-80

Drive data without motor (i = 1)

Belt pulley drive diameter	65.27 mm
Travel speed with sealing strip v_{mech}	Up to 5 m/s
Mass moment of inertia J_s (short carriage)	$(21.1 + L\ (mm) \cdot 0.00379) \cdot 10^{-4}$ kgm²
Mass moment of inertia J_s (long carriage)	$(29.7 + L\ (mm) \cdot 0.00379) \cdot 10^{-4}$ kgm²

Horizontal operation

MSK 040C, HCS02.1E-W0028, 3 x 400 V

i		3				5					10				
m_{ex}	(kg)	1	2	3	4	4	6	10	14	18	10	20	40	60	80
t_a	(ms)	77	89	100	110	75	85	105	130	155	110	145	210	280	364
s_a	(mm)	190	220	250	278	120	145	180	220	263	110	145	210	280	364
a	(m/s^2)	65	56	50	45	47	40	32	26	22	18	13.5	9.4	7	5.5
v_{dc}	(m/s)	5				3.4					2				
*	(mm)	± 0.1													

MSK 050C, HCS02.1E-W0028/W0054, 3 x 400 V

i		3					5					10				
m_{ex}	(kg)	2	5	8	11	14	6	14	22	30	38	20	40	60	80	100
t_a	(ms)	85	110	135	160	185	145	205	255	315	375	230	300	370	445	510
s_a	(mm)	210	270	335	400	465	300	420	525	645	760	230	300	370	445	510
a	(m/s^2)	60	46	37	31	27	28	20	16	13	11	8.6	6.6	5.4	4.5	3.9
v_{dc}	(m/s)	5					4.1					2				
*	(mm)	± 0.1														

MSM 041B, HCS01.1E-W0013, 230 V

i		5					10						
m_{ex}	(kg)	2	4	6	8	10	10	15	20	25	30	35	40
t_a	(ms)	29	36	43	49	55	42	53	61	69	78	86	95
s_a	(mm)	30	37	43	49	55	21	27	31	35	40	43	48
a	(m/s^2)	68	55	47	40.8	36.2	23	19	16	14.5	12.8	11.5	10.5
v_{dc}	(m/s)	2					1						
*	(mm)	± 0.1											

Vertical operation (frame stationary, carriage travels)

MSK 040C, HCS02.1E-W0028, 3 x 400 V

i		3				5					10				
m_{ex}	(kg)	1	2	3	4	2	6	10	14	18	5	10	15	20	25
t_a	(ms)	80	95	110	125	65	95	125	160	215	105	135	165	208	285
s_a	(mm)	200	230	270	313	105	155	215	275	360	105	135	165	208	285
a	(m/s^2)	63	54	46	40	54	37	27	21	16	19.5	15	12	9.6	7
v_{dc}	(m/s)	5				3.4					2				
*	(mm)	± 0.1													

MSK 050C, HCS02.1E-W0028/W0054, 3 x 400 V

i		3					5					10				
m_{ex}	(kg)	2	5	8	11	14	5	10	15	20	25	10	20	30	40	50
t_a	(ms)	85	115	155	195	230	150	205	265	342	436	235	340	500	400	740
s_a	(mm)	215	290	380	465	570	310	420	540	700	895	235	340	500	200	370
a	(m/s^2)	58	43	33	26	22	27	20	15.5	12	9.4	8.5	5.9	4	2.5	1.35
v_{dc}	(m/s)	5					4.1					2			1	
*	(mm)	± 0.1														

MKR 25-110

Drive data without motor (i = 1)

Belt pulley drive diameter	92.2 mm
Travel speed with sealing strip v_{mech}	Up to 5 m/s
Mass moment of inertia J_s (short carriage)	(77.05 + L (mm) · 0.0123) · 10^{-4} kgm^2
Mass moment of inertia J_s (long carriage)	(146.35 + L (mm) · 0.0123) · 10^{-4} kgm^2

Horizontal operation

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		3				5						10				
m_{ex}	(kg)	3	5	7	9	8	16	24	32	40	50	20	60	100	140	180
t_a	(ms)	85	95	105	115	120	155	190	215	250	300	175	260	350	435	520
s_a	(mm)	210	235	260	285	275	350	420	480	555	665	210	310	420	520	626
a	(m/s^2)	59	53	48	44	37	29	24	21	18	15	13.5	9.2	6.9	5.5	4.6
v_{dc}	(m/s)	5				4.5						2.4				
*	(mm)	± 0.1														

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

i		3						5						10					
m_{ex}	(kg)	4	8	12	16	20	24	10	20	40	60	80	100	20	60	100	140	180	200
t_a	(ms)	150	170	185	210	230	240	275	310	380	340	390	440	476	555	615	690	770	800
s_a	(mm)	380	430	465	520	570	600	550	615	760	505	585	660	476	555	615	690	770	800
a	(m/s^2)	33	29	27	24	22	21	14.5	13	10.5	8.9	7.7	6.8	4.2	3.6	3.25	2.9	2.6	2.5
v_{dc}	(m/s)	5						4			3			2					
*	(mm)	± 0.1																	

Vertical operation (frame stationary, carriage travels)

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		3				5						10						
m_{ex}	(kg)	3	5	7	9	6	10	18	26	34	40	20	30	40	50	60	80	100
t_a	(ms)	85	100	110	125	120	140	190	423	205	250	210	260	320	410	520	370	835
s_a	(mm)	215	245	275	310	266	315	420	545	310	375	250	310	385	490	625	185	420
a	(m/s^2)	58	51	45	40	38	32	24	18.5	14.5	12	11.5	9.3	7.5	5.9	4.6	2.7	1.2
v_{dc}	(m/s)	5				4.5				3		2.4					1	
*	(mm)	± 0.1																

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

i		3					5						10				
m_{ex}	(kg)	4	8	12	16	20	6	10	18	26	34	40	20	40	60	80	100
t_a	(ms)	160	180	210	240	265	210	220	265	310	366	417	280	375	540	870	1800
s_a	(mm)	390	445	520	595	655	310	330	395	465	550	625	140	190	270	435	910
a	(m/s^2)	32	28	24	21	19	14.5	13.6	11.4	9.7	8.2	7.2	3.56	2.66	1.85	1.15	0.55
v_{dc}	(m/s)	5					4.5		3				1				
*	(mm)	± 0.1															

a = acceleration (m/s^2)
i = gear reduction (-)
m_{ex} = mass (kg)
s_a = acceleration travel (mm)
t_a = acceleration time (ms)
v_{dc} = travel speed (m/s)
* = reproducibility (mm)

MSK = servo motor
MSM = servo motor
VRDM = stepping motor
HCS = digital controller

Linear Modules MKR

Performance Data

MKR 35-165

Drive data without motor (i = 1)

Belt pulley drive diameter	140.05 mm
Travel speed v_{mech}	Up to 5 m/s
Mass moment of inertia J_s	$(743 + L \cdot 0.07797) \cdot 10^{-4}$ kgm²

Horizontal operation

MSK 076C, HCS02.1E-W0070, 3 x 400 V

i		**6**						**12**					
m_{ex}	(kg)	10	20	40	60	80	100	50	100	200	300	400	500
t_a	(ms)	125	145	175	210	245	280	138	165	225	285	265	333
s_a	(mm)	250	285	350	420	490	560	138	165	225	285	200	250
a	(m/s²)	32	28	22.5	19	16	14	14.5	12	8.9	7	5.8	4.5
v_{dc}	(m/s)	4						2				1.5	
*	(mm)	± 0.1											

Vertical operation

MSK 076C, HCS02.1E-W0070, 3 x 400 V

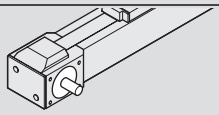
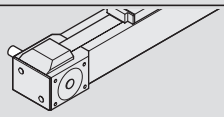
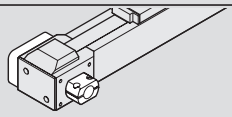
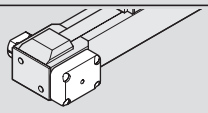
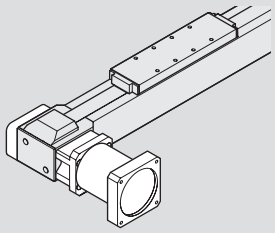
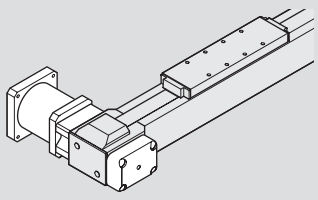
i		**6**					**12**					
m_{ex}	(kg)	10	20	40	60	80	20	40	80	120	160	200
t_a	(ms)	135	160	210	290	360	190	220	300	200	270	375
s_a	(mm)	265	315	420	570	730	280	335	450	148	200	280
a	(m/s²)	30	25.5	19	14	11	16	13.5	10	7.6	5.6	4
v_{dc}	(m/s)	4					1.5					
*	(mm)	± 0.1										

a = acceleration (m/s²)
i = gear reduction (-)
m_{ex} = mass (kg)
s_a = acceleration travel (mm)
t_a = acceleration time (ms)
v_{dc} = travel speed (m/s)
* = reproducibility (mm)

MSK = servo motor
MSM = servo motor
VRDM = stepping motor
HCS = digital controller

Linear Modules MKR

Linear Modules MKR 12-40 Components and Ordering Data

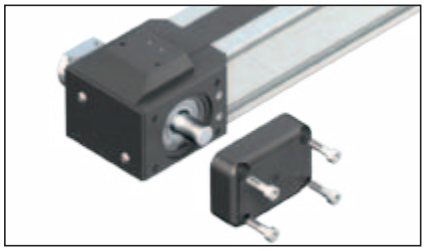
Part number, length R1140 660 00, ... mm	Version[1]		Guideway	Drive unit	Drive journal	Carriage L_{ca} = 135 mm	
With drive unit (MA)	MA01		01	Journal at right	01	01	
	MA02		01	Journal at left	02		
	MA05		01	Hollow shaft at right	05		
	MA06		01	Hollow shaft at left	06		
With gear reducer (MG)	MG10		01	Gear reducer at right	11		
	MG11		01	Gear reducer at left	12		

1) Without drive unit: see MKK 12-40 ☞ 36-37

L_{ca} = carriage length

Ordering example: see “Inquiry/Order”

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



Drive journal

Versions MA05, MA06, MG10 and MG11 also offer a drive journal, which can be accessed by removing the screws and the cover.

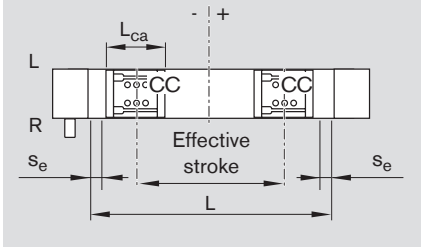
Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit [2] with gear reducer	for motor	without Brake	with Brake	without	with Sealing strip [3]		Standard report	Measurement report
–	00	–	00		00	01	Without switches 00 Proximity switch PNP NC 36-.±.... Switching cam 18 PNP NO 38-.±.... Cable duct 25 Switch type / Mounting side (R/L) / Direction of travel / Switching distance Socket-plug 28 Magnetic field sensor with cable Reed sensor 51 Cable duct 25 Hall sensor PNP NC 52 Socket-plug 28 Magnetic field sensor with connector Reed sensor 58 Hall sensor PNP NC 59	01	02 Friction moment 05 Positioning accuracy
–	00	–	00						
–	00	–	00						
–	00	–	00						
i = 5	13	MSM 031B	106	107					
i = 10	14								
i = 5	15	MSM 031C	108	109					
i = 10	16								
i = 5	11	MSK 030	84	85					
i = 10	12								

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

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 10\ \text{mm} + L_{ca}$$

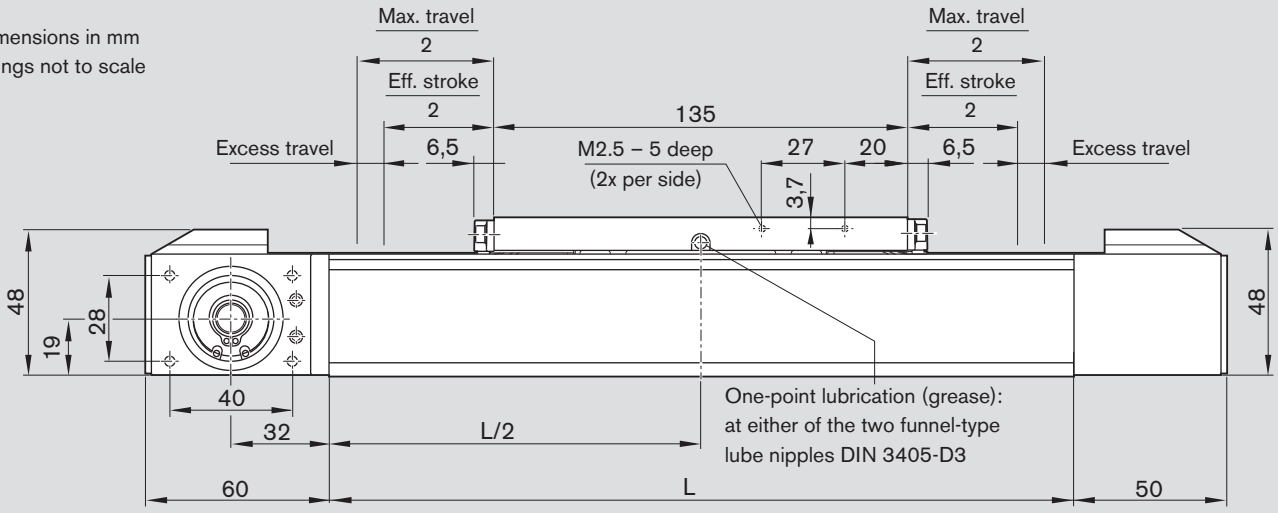
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.

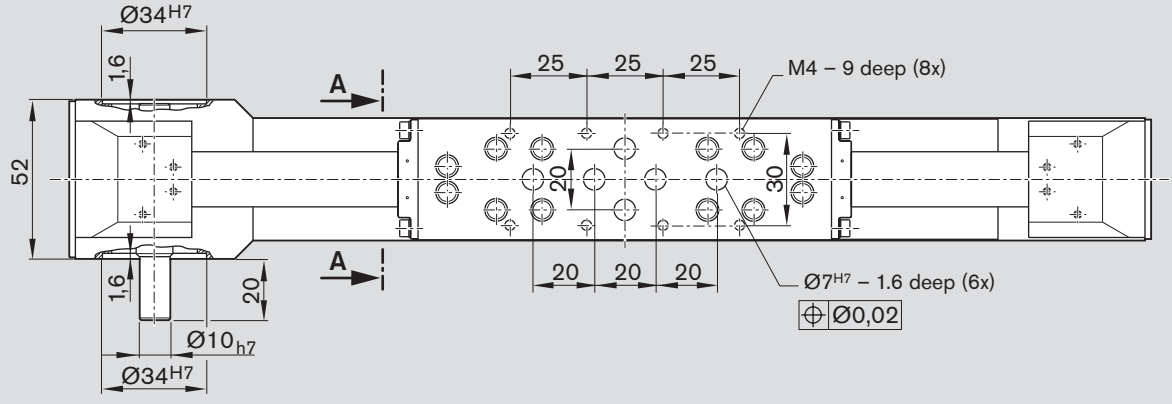


Linear Modules MKR

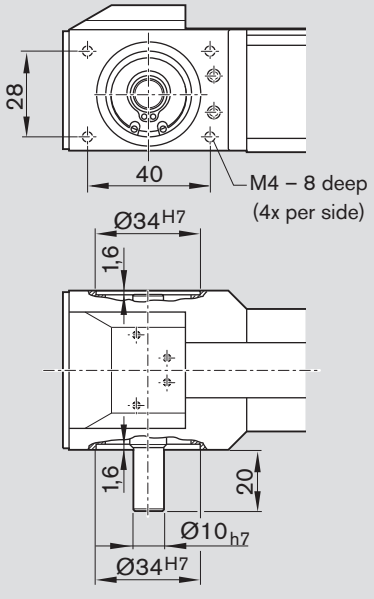
Linear Modules MKR 12-40 Dimensions

All dimensions in mm
Drawings not to scale

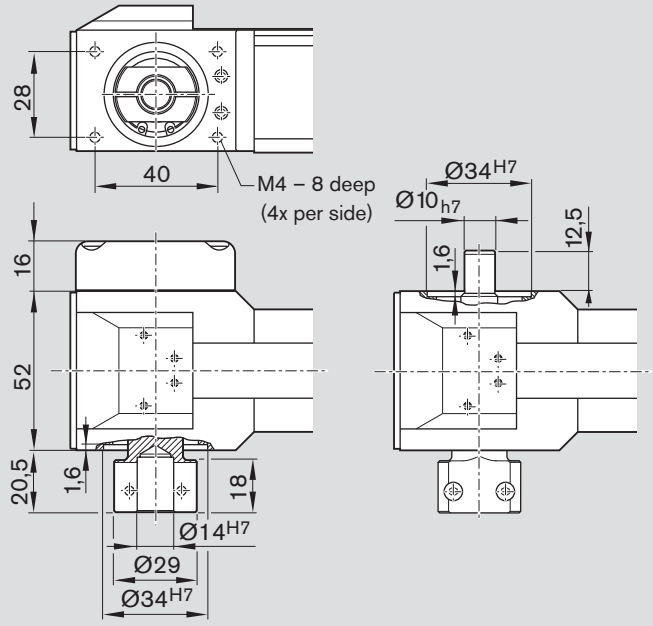




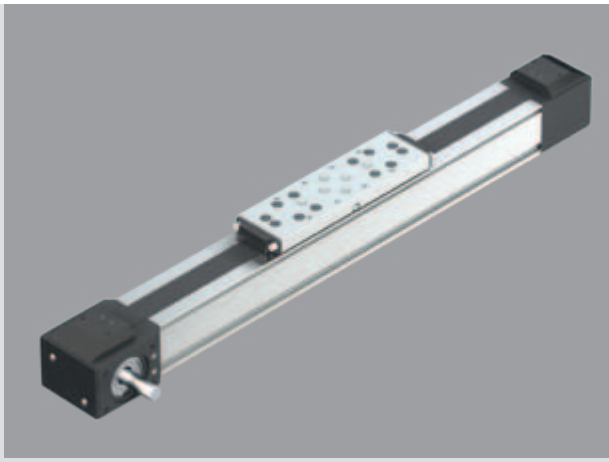
MA01, MA02

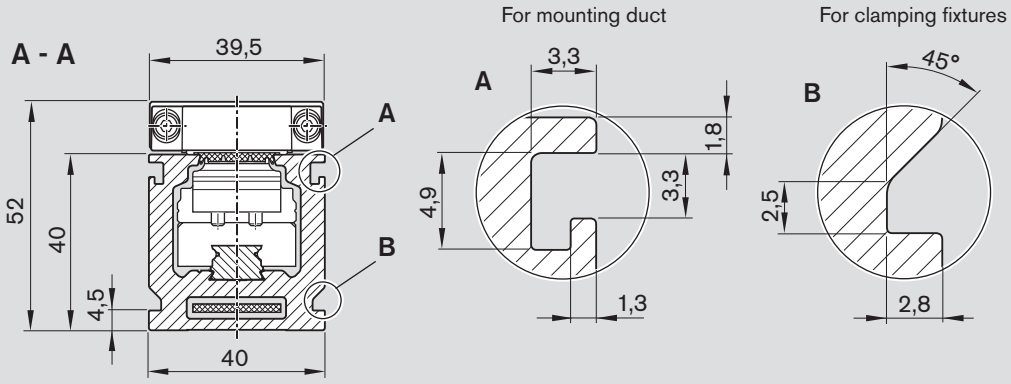


MA05, MA06

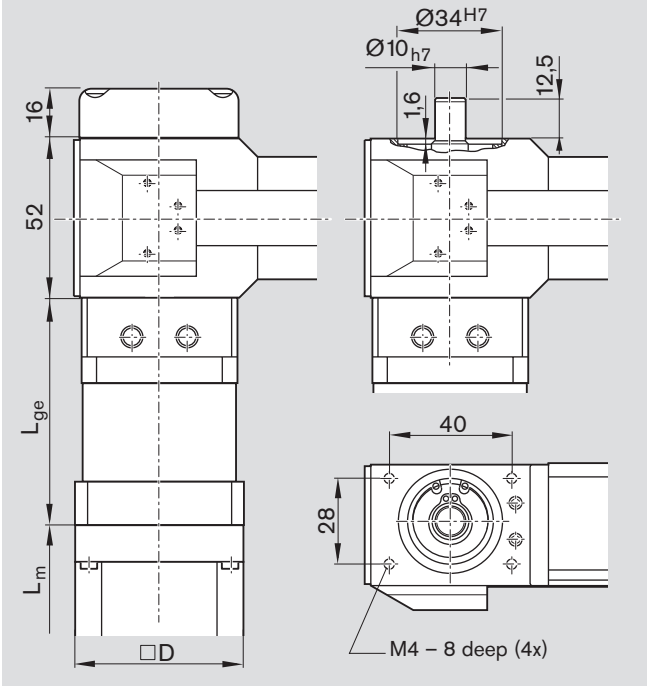


A second journal can be accessed by removing the cover.





MG10, MG11

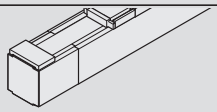
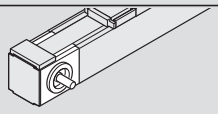
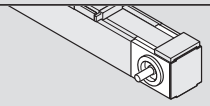
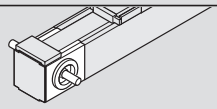
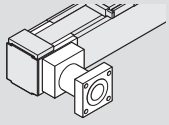
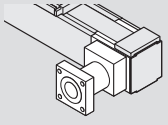


Version	Motor	Dimensions (mm)			
		D	L_{ge}	L_m without brake	L_m with brake
MG10, MG11	MSM 031B	60	101	79.0	115.5
	MSM 031C	60	111	98.5	135.0
	MSK 030C	54	91	188.0	213.0

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

Linear Modules MKR

Linear Modules MKR 15-65 Components and Ordering Data

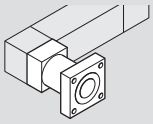
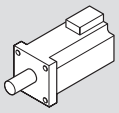
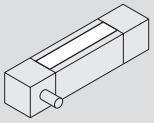
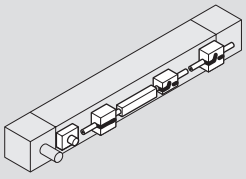
Version		Guideway	Drive unit: Drive journal	Drive unit: Reduction i = 1 1)	Drive unit: Reduction i = 1 2)	Drive unit: Reduction i = 3	Drive unit: Reduction i = 7	Drive unit: MSM 041B Reduction i = 3	Carriage L_{ca} = 190 mm
Without drive unit	OA01 	02	–	00					01
With drive unit (MA), without gear reducer i = 1	MA01 	01	Right	01	03	–	–	–	01
	MA02 	01	Left	01	03	–	–	–	01
	MA03 	01	On both sides	02	04	–	–	–	01
With gear reducer (MG)	MG01  MG02 	01	Gear reducer with socket	–	–	10	11	15	01

Ordering example: see “Inquiry/Order”

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

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

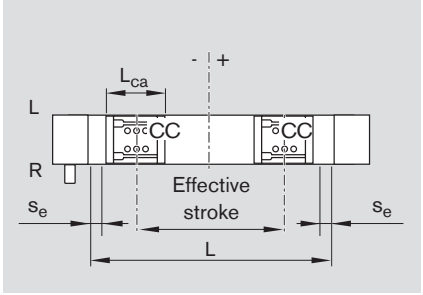
L_{ca} = carriage length

Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Reduction i =	Attachment kit [3]	for motor		without Brake	with Brake	without Sealing strip [4]	with Sealing strip [4]		Standard report	Measurement report
–	00	–		00		00	01 without side sealing	**Without switch and cable duct** 00	01	02 Friction moment
–	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		
–	00	–		–				**Cable duct (loose)** – Length 20, ... mm		05 Positioning accuracy
–	00	–		–				**External socket/ plug (loose)** 17		
i = 3	06	**MSK 030C**	84	85			02 with side sealing	**Switching cam at one end** 16		
i = 7										
i = 3	01	**MSK 040C**	86	87				**Switching cam at both ends** 26		
i = 7										
i = 3	04	**MSM 041B**	110	111						
i = 7	05	**MSM 031C**	108	109						
i = 3	03	**VRDM 397**	37	38						
i = 7		**VRDM 3910**	39	40						

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 40\ \text{mm} + L_{ca}$$

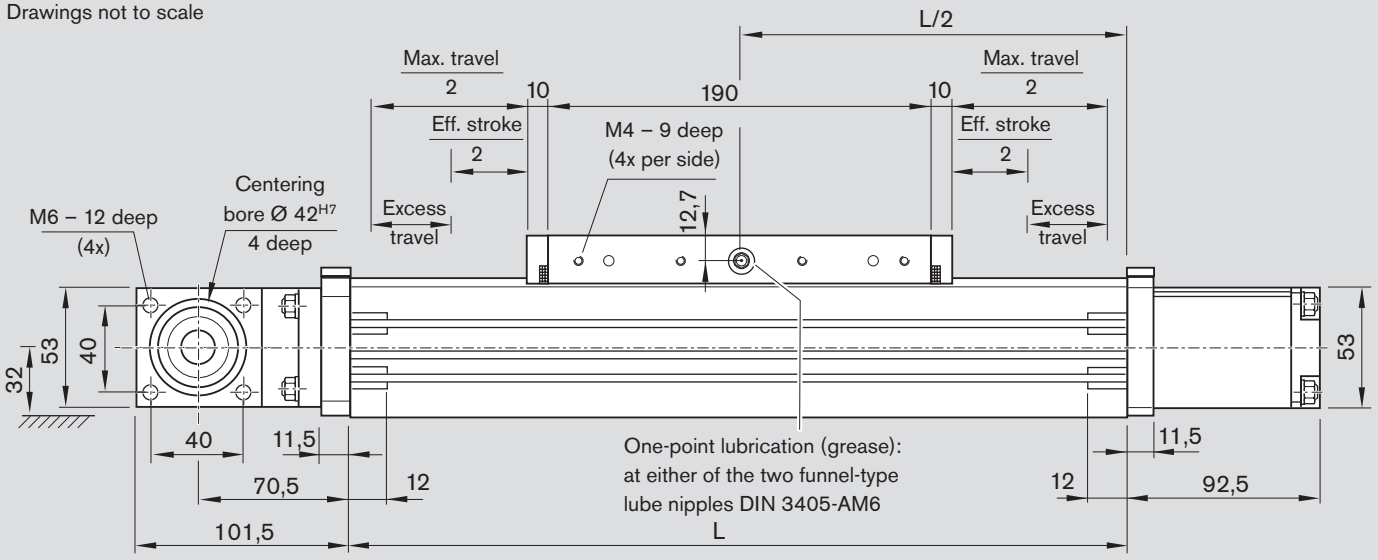
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.

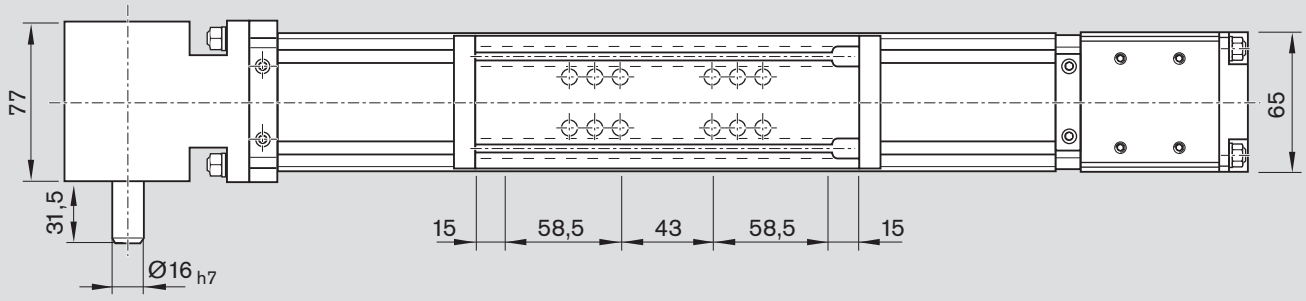


Linear Modules MKR

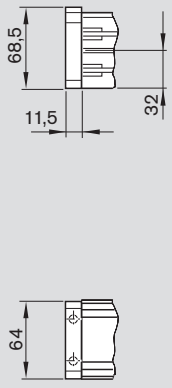
Linear Modules MKR 15-65 Dimensions

All dimensions in mm
Drawings not to scale

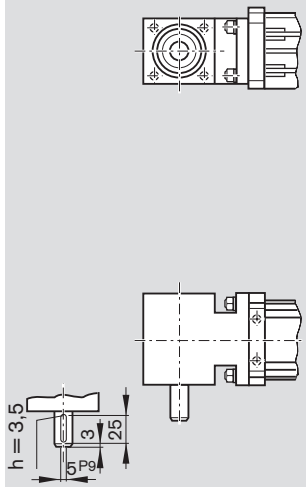




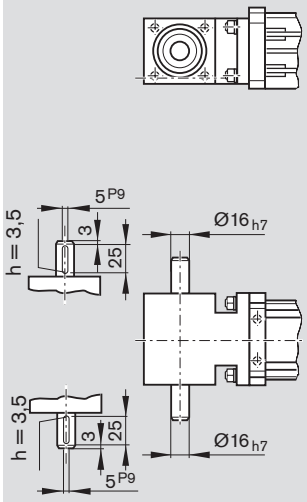
OA01



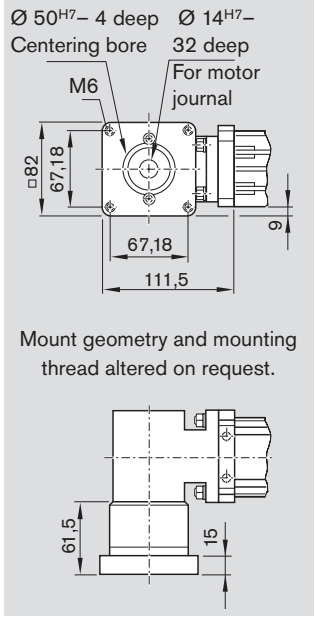
MA01, MA02



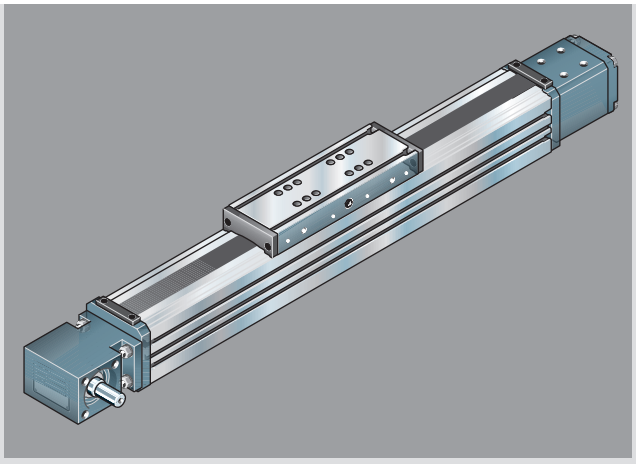
MA03

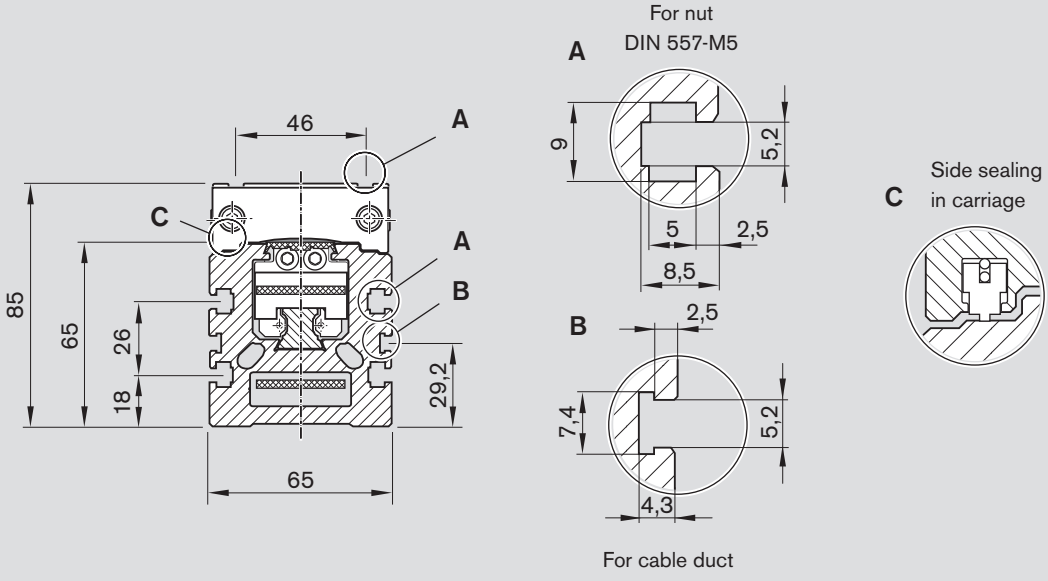


MG01, MG02

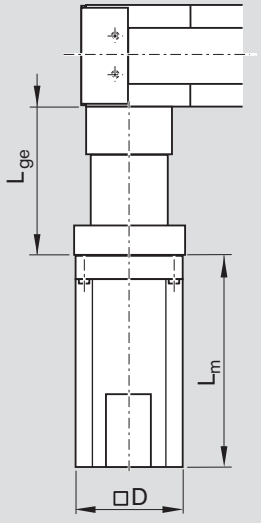


Mount geometry and mounting thread altered on request.





MG01, MG02

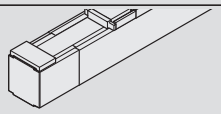
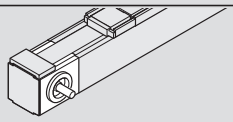
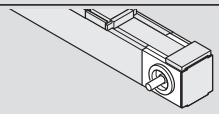
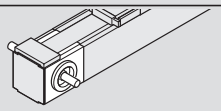
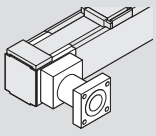
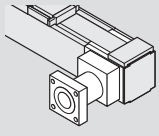
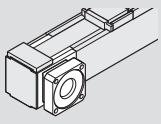
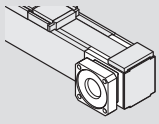


Motor	Dimensions (mm)			
	D	L_{ge}	L_m without brake	L_m with brake
MSK 030C	54.0	61.5	188.0	213.0
MSK 040C	82.0	61.5	185.5	215.5
MSM 031C	60.0	61.5	98.5	135.0
MSM 041B	80.0	61.5	112.0	149.0
VRDM 397	57.2	61.5	110.0	156.5
VRDM 3910	85.0	61.5	140.0	186.5

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

Linear Modules MKR

Linear Modules MKR 20-80 Components and Ordering Data

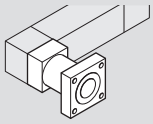
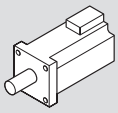
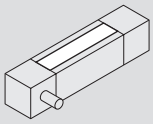
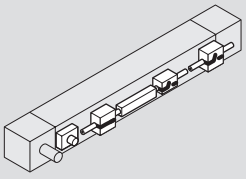
Part number, length R1140 160 10, ... mm Version		Guideway	Drive unit Drive journal	Reduction i = 1 [1]	i = 1 [2]	i = 3	i = 5	i = 10	Carriage L_{ca} = 190 mm with T-slot	with thr.	L_{ca} = 260 mm with T-slot	with thr.
Without drive unit	OA01 	02	Without	50					01	02	11	12
With drive unit (MA), without gear reducer i = 1	MA01 	01	Journal at right	01	03	–						
	MA02 	01	Journal at left	01	03	–						
	MA03 	01	Journal on both sides	02	04	–						
With gear (MG), external gear reducer	MG01  MG02 	01	Gear reducer at right / at left	–	–	10						
			Gear reducer at right / at left	–	–	11 Gear reducer with second journal						
With gear (MG), integrated LPB gear reducer	MG03  MG04 	01	Gear reducer at right / at left	–	–	20						

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length
thr. = thread

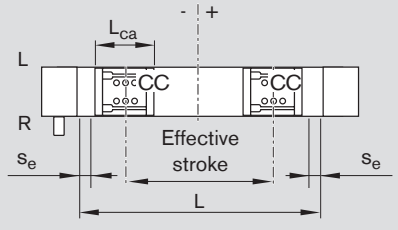
1) Without keyway
2) With keyway
3) Attachment kit also available without motor (when ordering: enter “00” for motor)
4) Stepping motors on request
5) Steel sealing strip, permissible up to L = 3500 mm

Motor attachment			Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
									
Reduction i =	Attachment kit[3] with gear reducer	for motor[4]	without	with Brake	without	with Sealing strip[5]		Standard report	Measurement report
–	00	–	00				**Without switch and cable duct** 00		
–	00	–	00				**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm		
–	00	–	00			10 without sealing lip	**Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	00	–	00						02 Friction moment
i = 3	01						**Cable duct (loose)** – Length 20, ... mm		
i = 5	10	**MSK 040C**	86	87	00			01	
i = 10	20								
i = 3	02						**External socket/ plug (loose)** 17		05 Positioning accuracy
i = 5	11	**MSM 041B**	110	111					
i = 10	21								
i = 3	04						**External switching cam** 16		
i = 5	14	**MSK 050C**	88	89					
i = 10	24								
i = 3	50								
i = 5	55	**MSK 040C**	86	87		15 with sealing lip			
i = 10	60								
i = 3	51								
i = 5	56	**MSM 041B**	110	111					
i = 10	61								
i = 3	54								
i = 5	58	**MSK 050C**	88	89					
i = 10	63								

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 20\ \text{mm} + L_{ca}$$

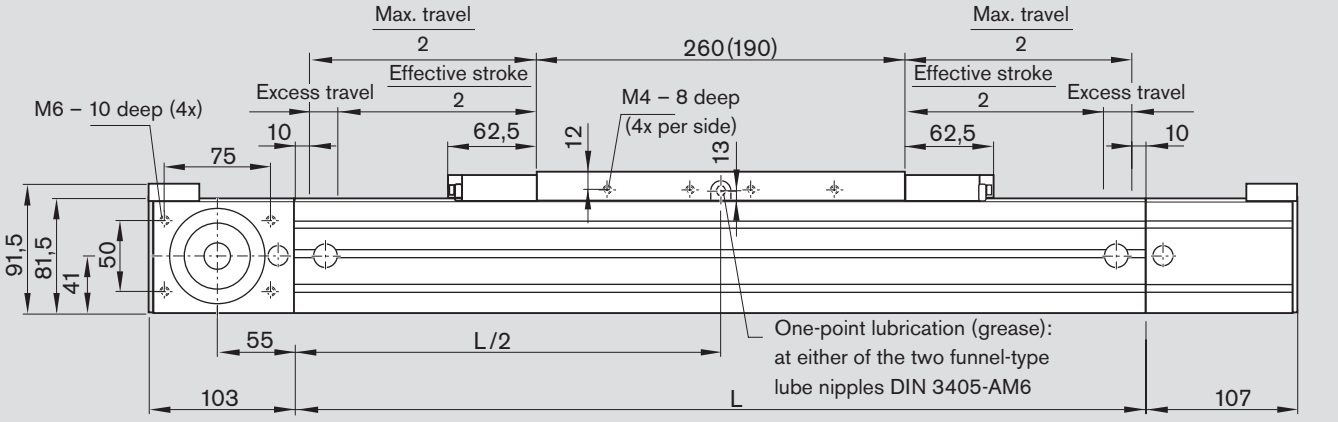
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.

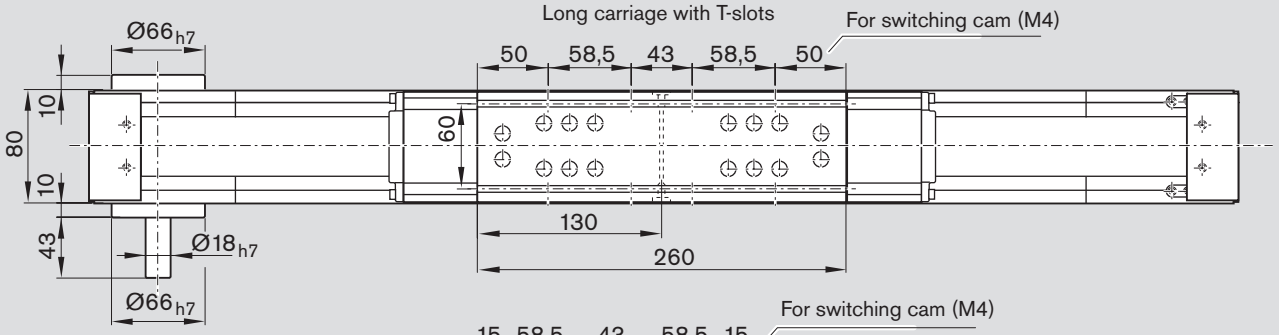


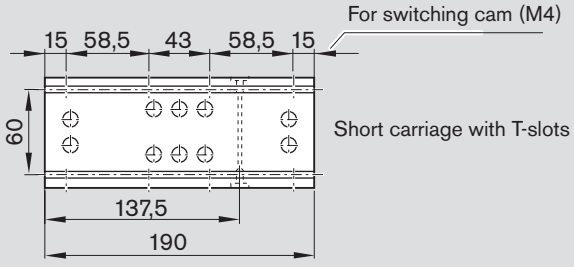
Linear Modules MKR

Linear Modules MKR 20-80 Dimensions

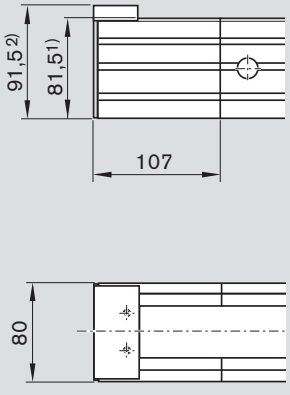
All dimensions in mm
Drawings not to scale





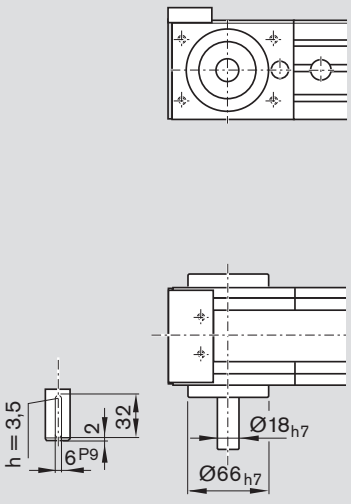


OA01

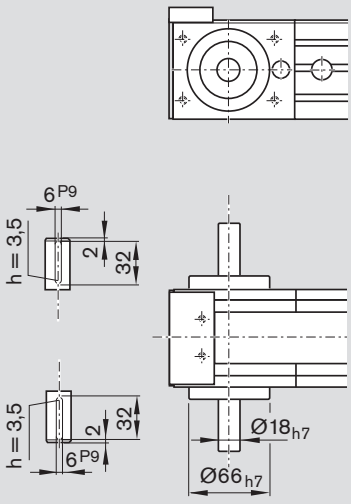


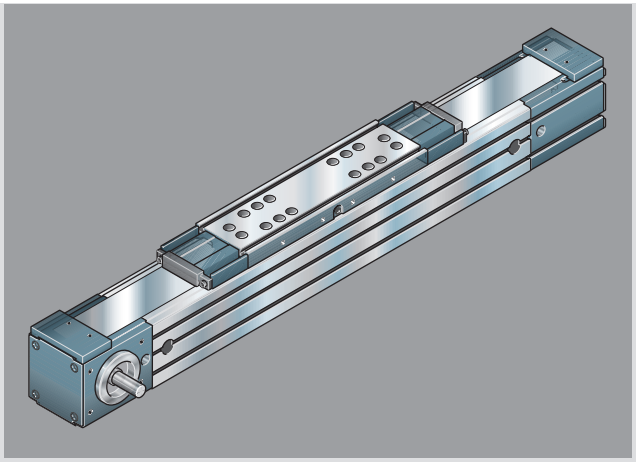
1) Without sealing strip
2) With sealing strip

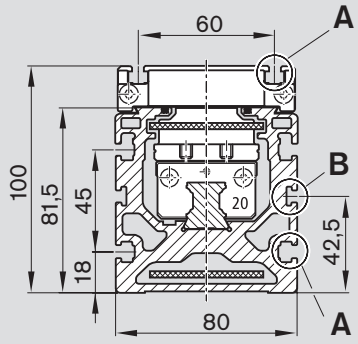
MA01, MA02

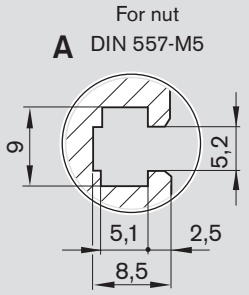


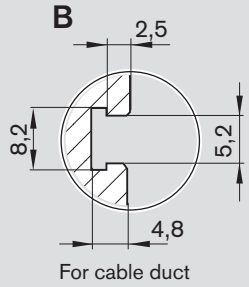
MA03



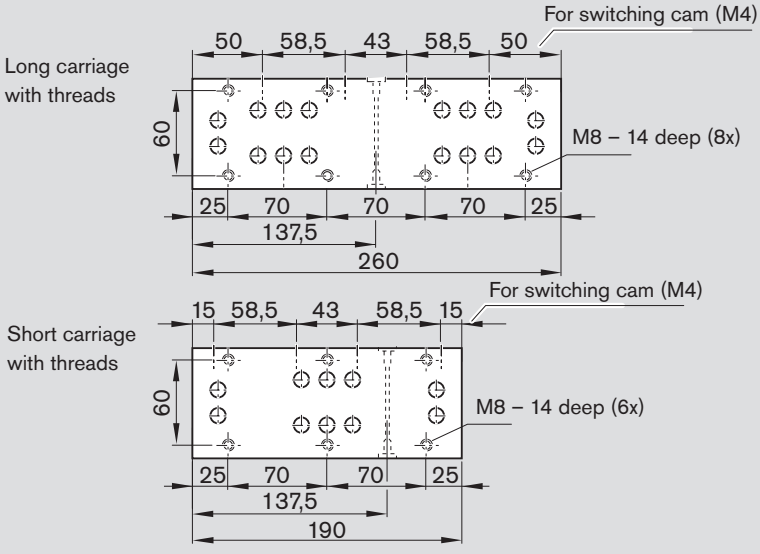




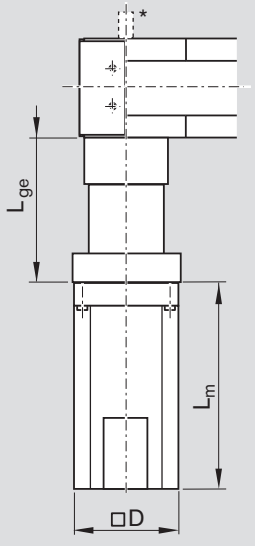




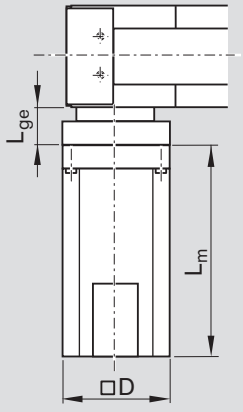




MG01*, MG02*



MG03, MG04



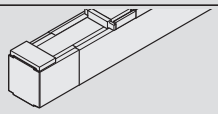
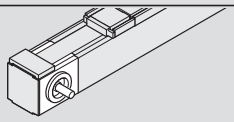
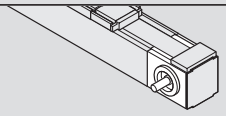
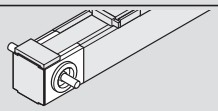
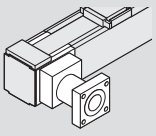
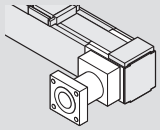
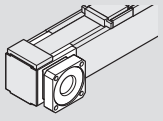
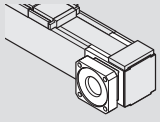
Motor	Dimensions (mm)				
	Gear unit		Motor		
	L_{ge} MG01 MG02	L_{ge} MG03 MG04	D	L_m without brake	L_m with brake
MSK 040C	135	41	82	185.5	215.5
MSK 050C	145	51	98	203.0	233.0
MSM 041B	140	46	80	112.0	149.0

* For drive unit Option 11: second journal Ø18 x 43

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

Linear Modules MKR

Linear Modules MKR 25-110 Components and Ordering Data

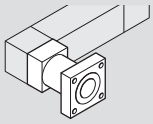
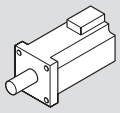
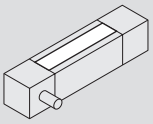
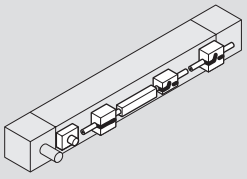
Part number, length R1140 260 10, ... mm Version		Guideway	Drive unit Drive journal	Reduction i = 1 [1]	i = 1 [2]	i = 3	i = 5	i = 10	Carriage L_{ca} = 210 mm with T-slot	with thr.	L_{ca} = 305 mm with T-slot	with thr.
Without drive unit	OA01 	02	Without	50					01	02	11	12
With drive unit (MA), without gear reducer i = 1	MA01 	01	Journal at right	01	03	–						
	MA02 	01	Journal at left	01	03	–						
	MA03 	01	Journal on both sides	02	04	–						
With gear (MG), external gear reducer	MG01  MG02 	01	Gear reducer at right / at left	–	–	10						
			Gear reducer at right / at left	–	–	11 Gear reducer with second journal						
With gear (MG), integrated LPB gear reducer	MG03  MG04 	01	Gear reducer at right / at left	–	–	20						

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length
thr. = thread

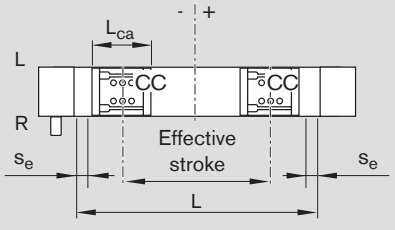
1) Without keyway
2) With keyway
3) Attachment kit also available without motor (when ordering: enter “00” for motor)
4) Stepping motors on request
5) Steel sealing strip, permissible up to L = 3500 mm
6) Motor without brake

Motor attachment				Motor		Cover		Switches / Cable duct / Socket-plug	Documentation	
										
Reduction i =	Attachment kit[3] with gear reducer	for motor[4]		without	with	without	with		Standard report	Measurement report
				Brake		Sealing strip[5]				
–	00	–		00			10 without sealing lip	**Without switch and cable duct** 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 **Cable duct (loose)** – Length 20, ... mm **External socket/ plug (loose)** 17 **Switching cam at one end** 16 **Switching cam at both ends** 26	01	02 Friction moment 05 Positioning accuracy
–	00	–		00						
–	00	–		00						
–	00	–		00						
i = 3	06	**MSK 060C**		90	91	00				
i = 5	16									
i = 10	26									
i = 3	02	**MSK 076C**		92	93					
i = 5	11									
i = 10	21									
i = 3	05	**MSK 060C**		90	91		15 with sealing lip			
i = 5	15									
i = 10	25									
i = 3	04	**MSK 076C**		92	93					
i = 5	14									
i = 10	24									

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 20 \text{ mm} + L_{ca}$$

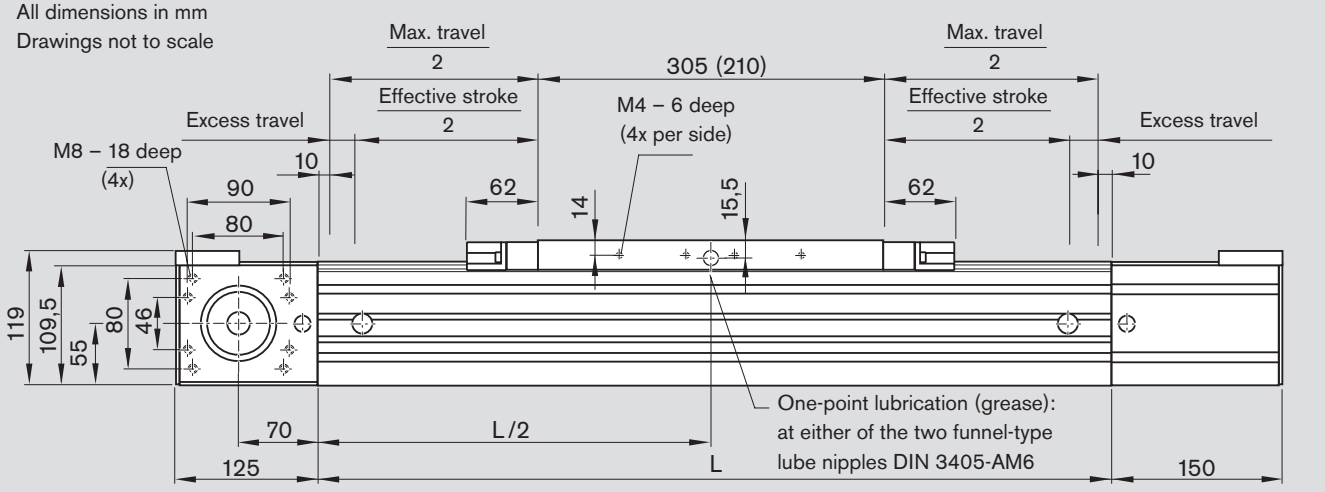
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.

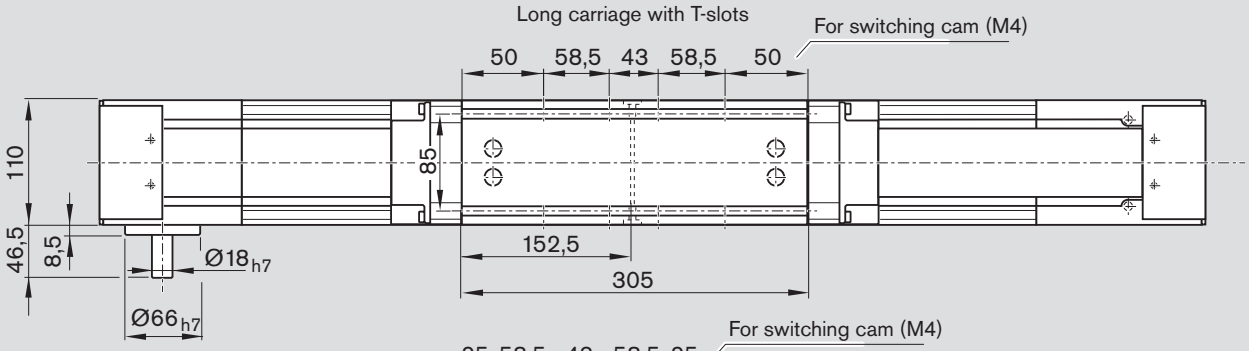


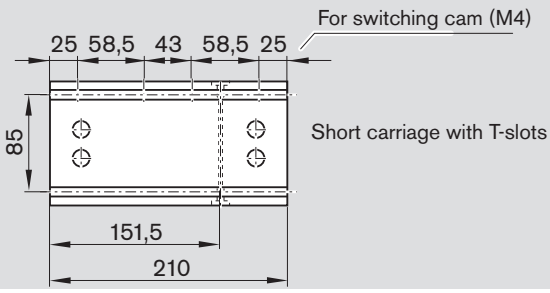
Linear Modules MKR

Linear Modules MKR 25-110 Dimensions

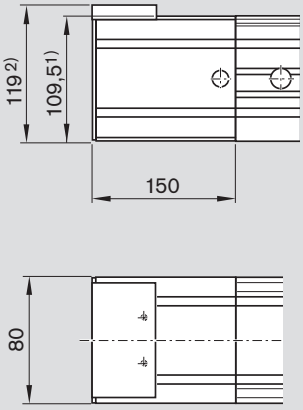
All dimensions in mm
Drawings not to scale





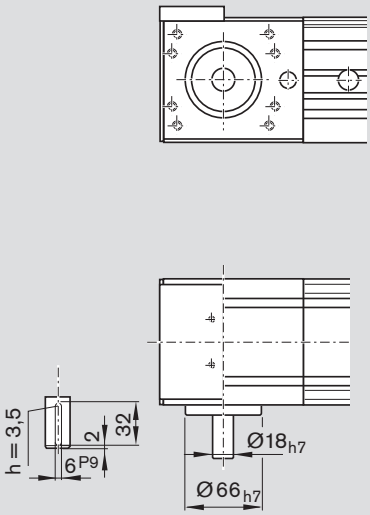


OA01

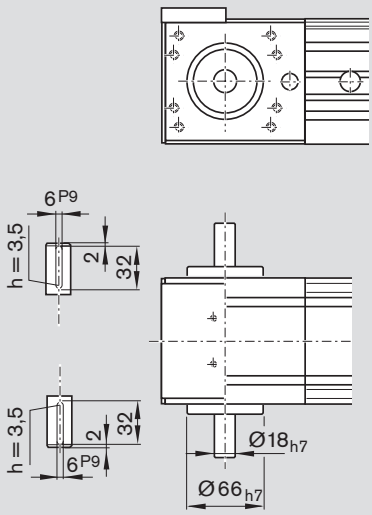


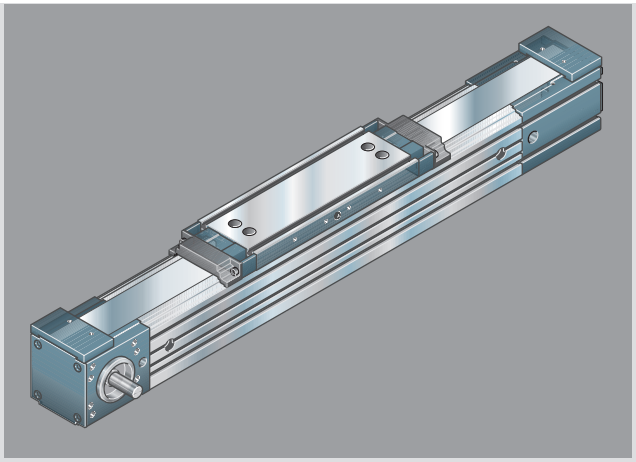
1) Without sealing strip
2) With sealing strip

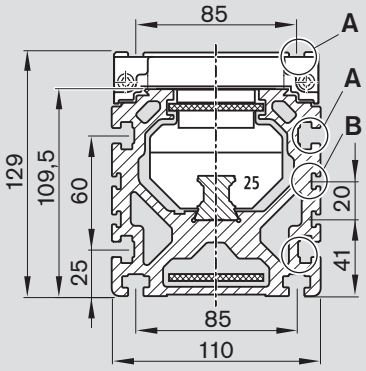
MA01, MA02



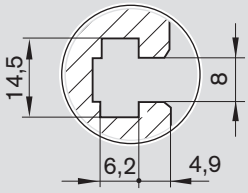
MA03







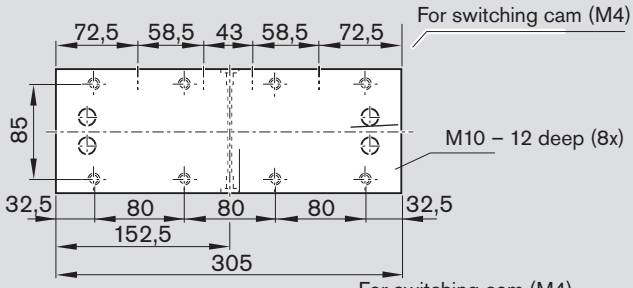
For nut
A DIN 508-M6



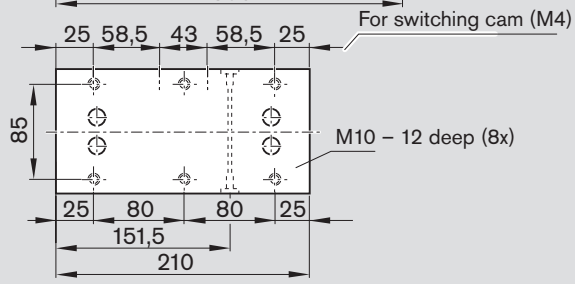


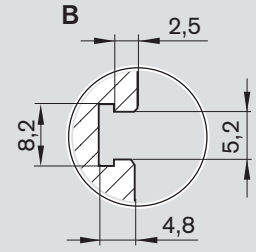
Side sealing
in carriage

Long carriage
with threads



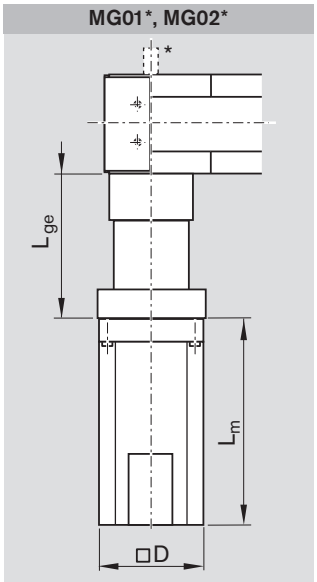
Short carriage
with threads



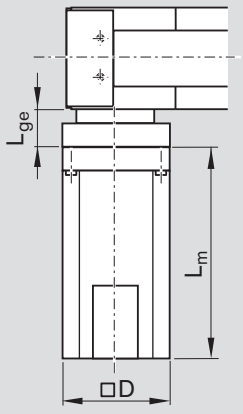


For cable duct

MG01*, MG02*



MG03, MG04



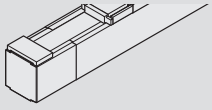
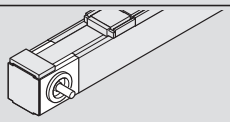
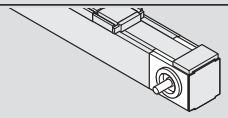
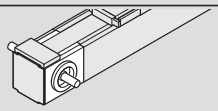
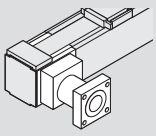
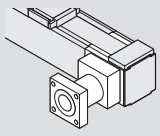
Motor	Dimensions (mm)				
	Gear unit		Motor		
	MG01 MG02	L_{ge} MG03 MG04	D	L_m without brake	L_m with brake
MSK 060C	162	50	116	226.0	259.0
MSK 076C	172	60	140	292.5	292.5

* For drive unit Option 11: second journal Ø18 x 43

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

Linear Modules MKR

Linear Modules MKR 35-165 Components and Ordering Data

Part number, length R1140 360 00, ... mm Version		Guideway	Drive unit Drive journal	Reduction i = 1 [1]	i = 1 [2]	i = 6	i = 12	Carriage L_{ca} = 400 mm	
Without drive unit	OA01 	01		50				05	
With drive unit (MA), without gear reducer i = 1	MA01 	01	Right	01	03	–	–		
	MA02 	01	Left	01	03	–	–		
	MA03 	01	On both sides	02	04	–	–		
With gear (MG), external gear reducer	MG01  MG02 	01	Gear reducer with socket	–	–	10	11		

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length

1) Without keyway
2) With keyway

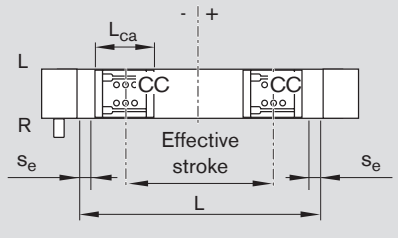
Motor attachment			Motor		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit [3]	for motor	without Brake	with Brake		Standard report	Measurement report
–	00	–	00		**Without switch and cable duct** 00	01	02 Friction moment 05 Positioning accuracy
–	00	–	00		**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm **Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	00	–	00				
–	00	–	00				
i = 6	01	**MSK 076C**	92	93	**Cable duct (loose)** – Length 20, ... mm		
					External socket/plug (loose) 17		
					Switching cam at one end 16		
i = 12	02	**MSK 076C**	92	93	**Switching cam at both ends** 26		

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

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 40\ \text{mm} + L_{ca}$$

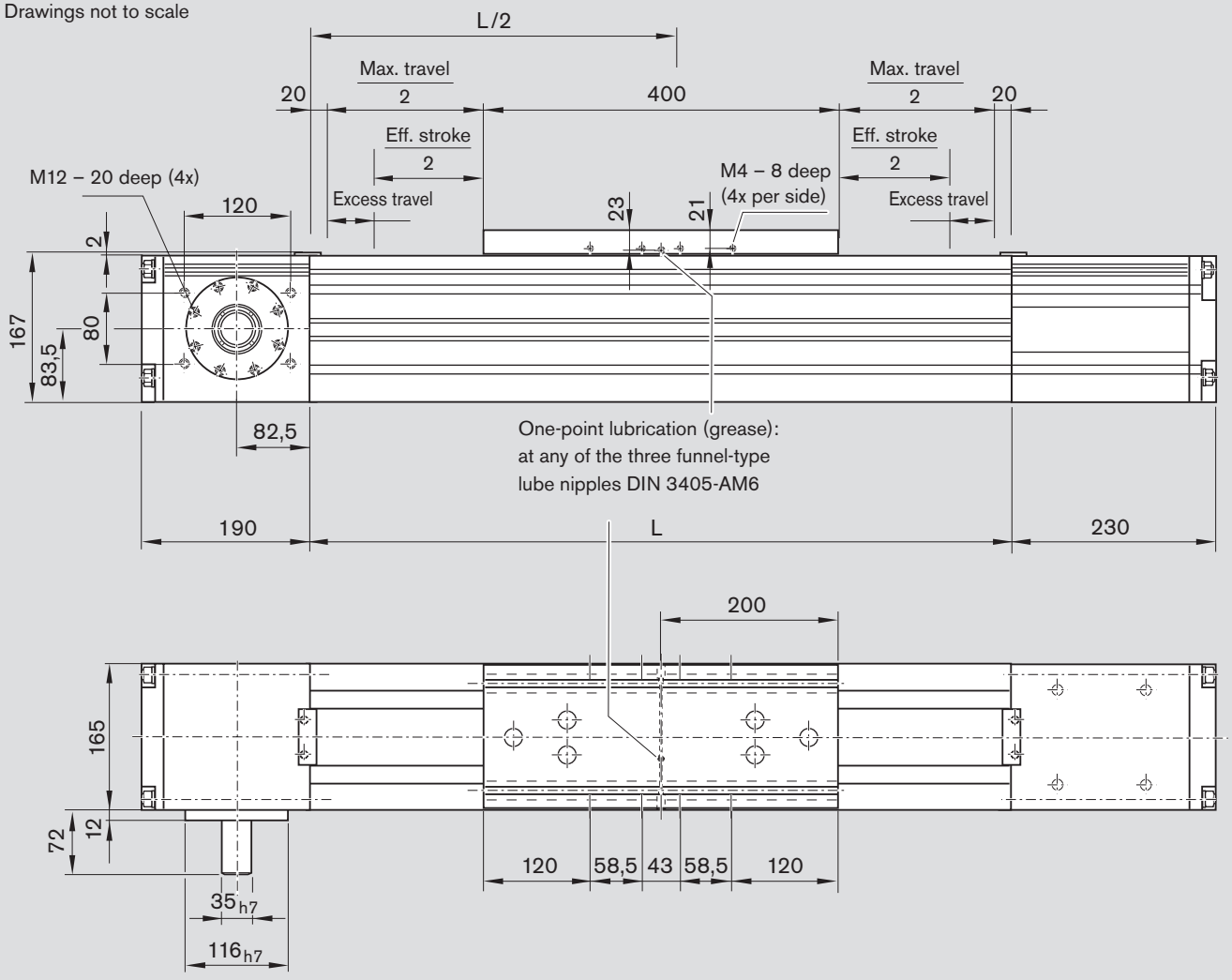
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.



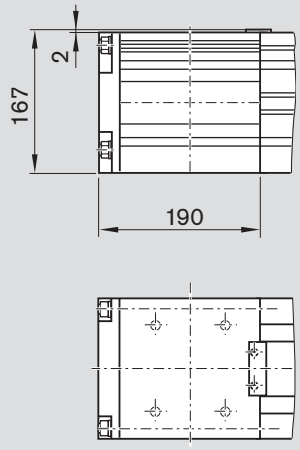
Linear Modules MKR

Linear Modules MKR 35-165 Dimensions

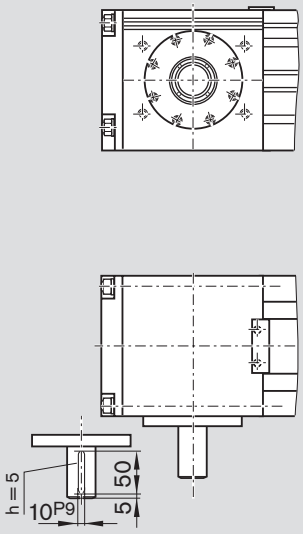
All dimensions in mm
Drawings not to scale



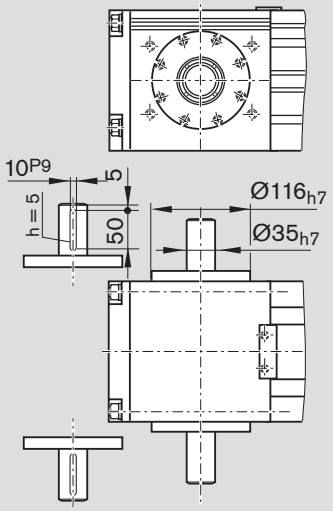
OA01

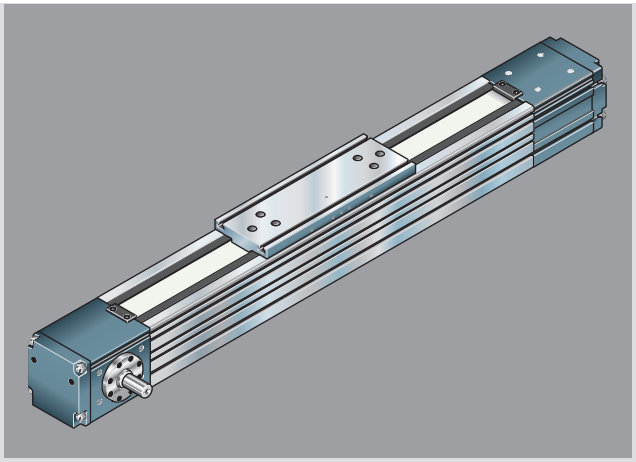


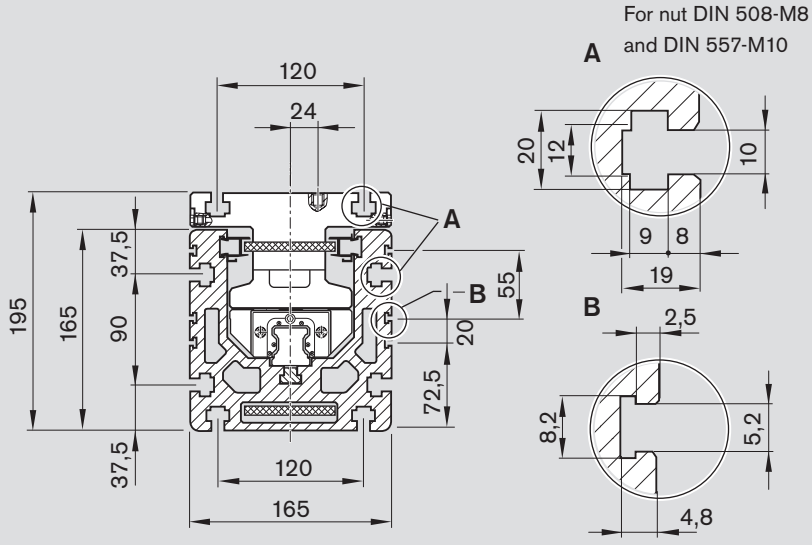
MA01, MA02



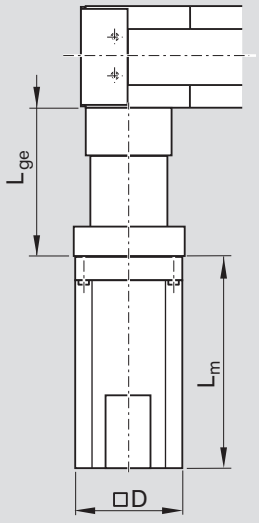
MA03







MG01, MG02



Motor	Dimensions (mm)				
	Gear unit		Motor		
		L_{ge}	D		L_m
	i = 6	i = 12		without brake	with brake
MSK 076C	35	78	140.0	292.5	292.5

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

Linear Modules MLR

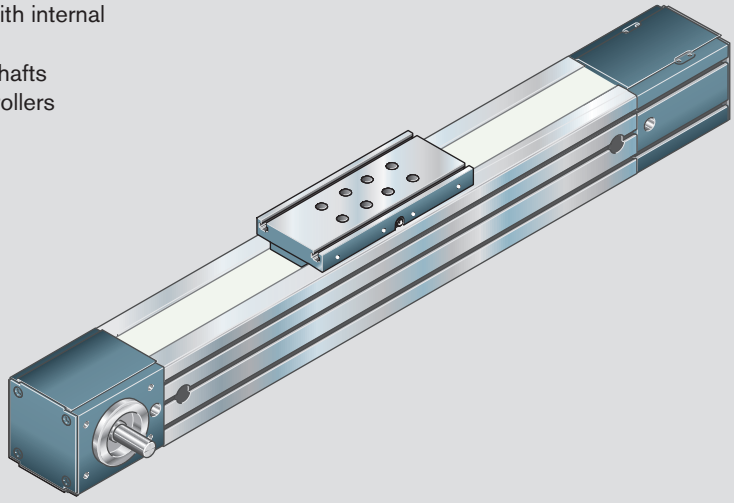
Product Description

Characteristic features

MLR...: Linear Modules with Cam Roller Guide and Toothed Belt Drive for high-speed applications (up to 10 m/s)

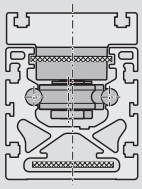
⚠ **Linear Modules with Cam Roller Guide to be lubricated with oil only!**

The MLR... Linear Modules comprise:
- a compact, anodized aluminum profile frame
- the integrated Rexroth Cam Roller Guide system with internal cam rollers
- cam rollers, clearance-free adjusted via eccentric shafts
- a carriage with one-point oil lubrication for all cam rollers
- the pre-tensioned toothed belt
- mountable switches
- an AC servo motor with control units
- gear unit
- a cover provided by the toothed belt



For mounting and maintenance, see the relevant Instructions.

MLR



Linear Module with Cam Roller Guide and Toothed Belt Drive
The special design of the integrated zero-clearance Rexroth Cam Roller Guide makes it ideal for very high speeds (up to 10 m/s).

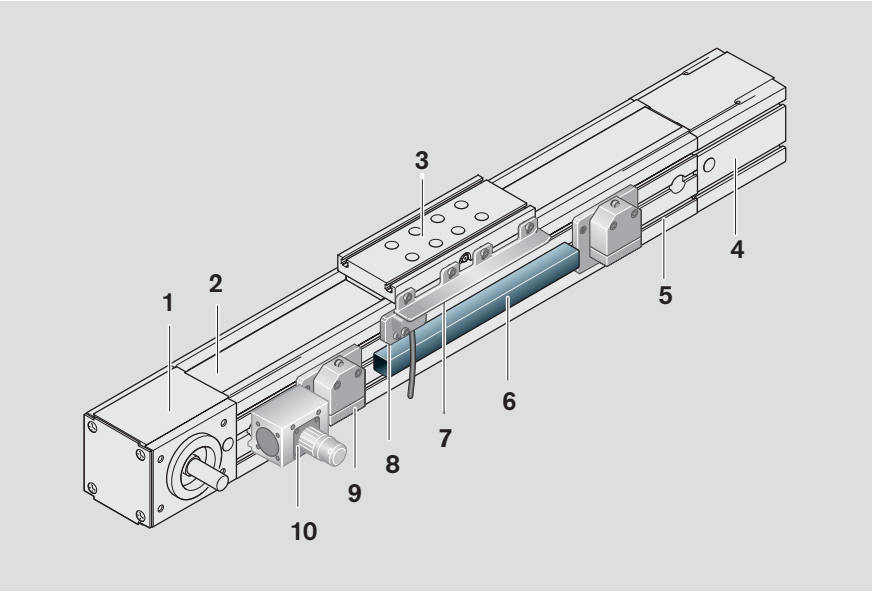
Structural Design

Structural design

1 Drive end enclosure
2 Toothed belt
3 Carriage with runner blocks
4 Idler (non-drive) end enclosure
5 Frame

Attachments:

6 Cable duct
7 Switching cam
8 Proximity switch
9 Mechanical switch
10 Socket-plug



Versions

MA01 and MA02

With drive unit (MA) without gear reducer (i = 1), journal for motor attachment right or left.

MA03

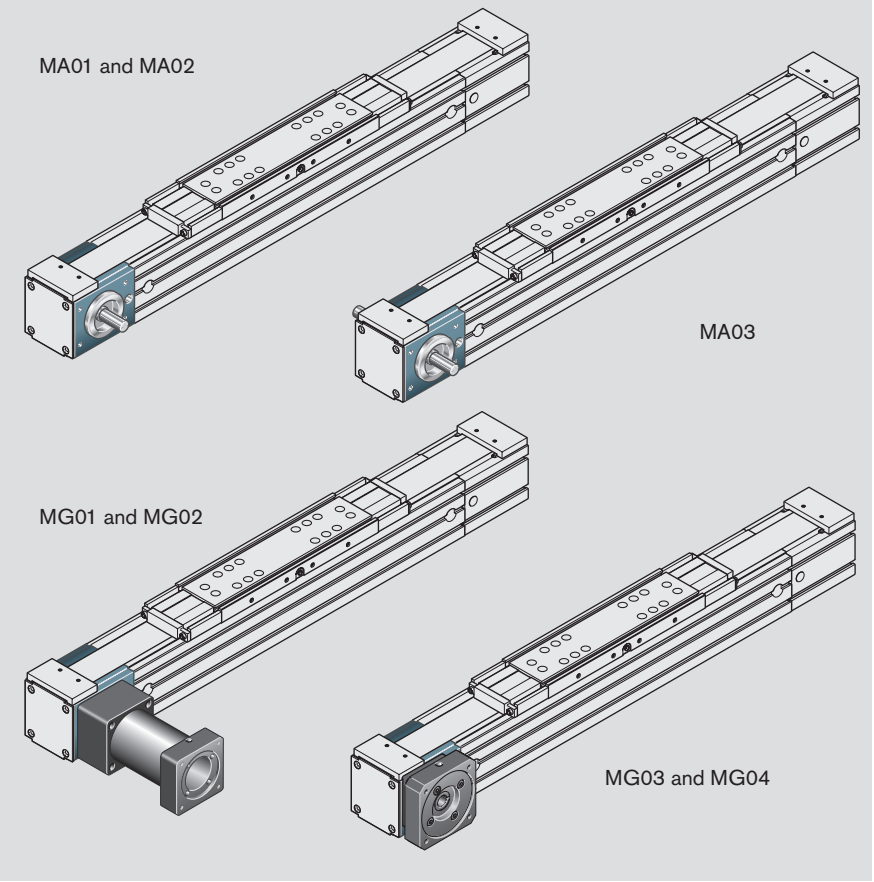
As MA01 and MA02, journal for motor attachment on both sides.

MG01 and MG02

With gear reducer, motor attachment via motor mount and socket.

MG03 and MG04

With integrated gear reducer, motor attachment via motor mount and socket.

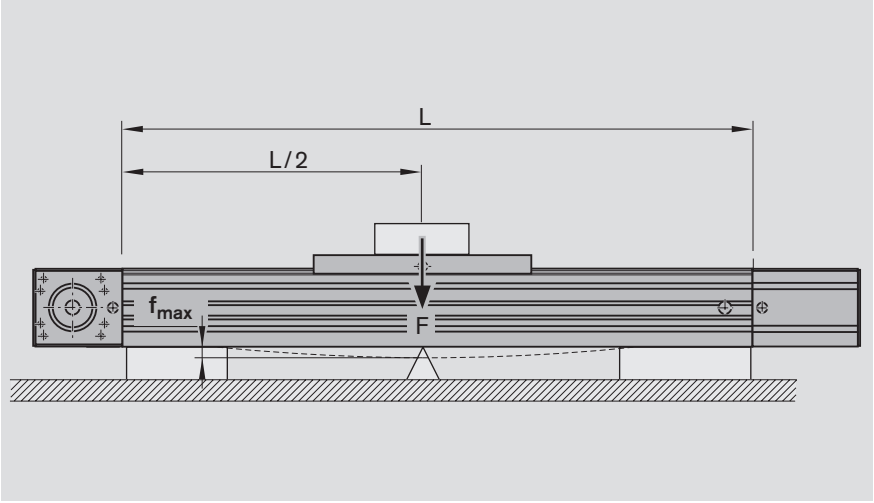


Linear Modules MLR

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

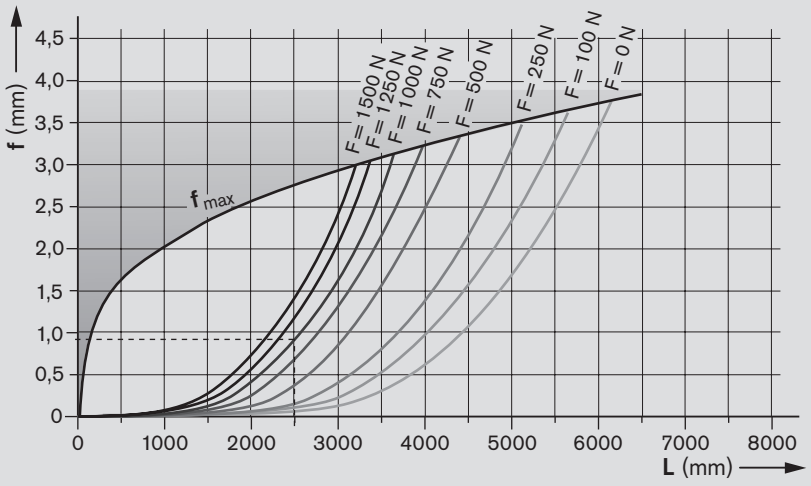
Linear Module MLR 10-80:
L = 3000 mm
F = 500 N
From chart 10-80:
f = 0.9 mm
f_{max} = 3.4 mm

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

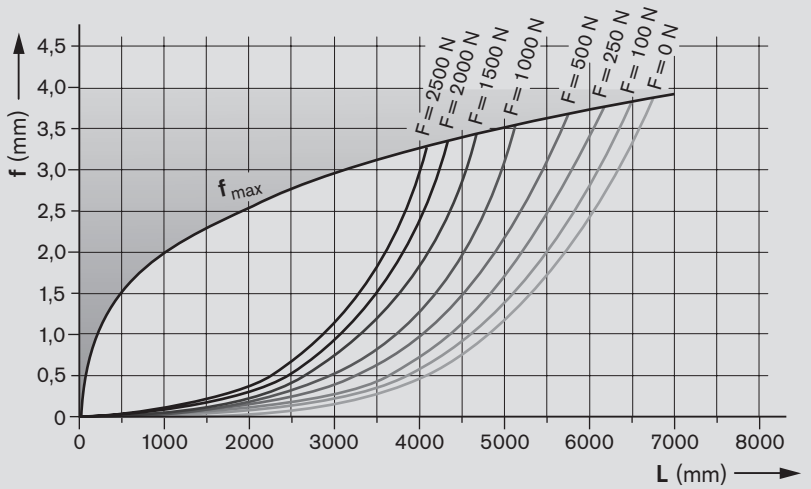
The graphs apply under the following conditions:

- Both ends firmly fixed (200 to 250 mm per end)
- 6 to 8 screws per side
- Solid mounting base

MLR 10-80



MLR 10-110



Linear Modules MLR

Technical Data

General technical data

	Carriage length	Dynamic load capacities*)		Dynamic load moments*)		Maximum permissible loads				Moved mass	Minimum length	Maximum length	Planar moment of inertia	
						Forces		Moments						
		C_x (N)	C_y (N)	M_t (Nm)	M_L (Nm)	$F_{x\,max}$ (N)	$F_{y\,max}$ (N)	$M_{t\,max}$ (Nm)	$M_{l\,max}$ (Nm)	(kg)	L_{min} (mm)	L_{max} (mm)	I_x (cm^4)	I_y (cm^4)
MLR 10-80	190	17 150	10 050	226	316	2500	1500	35	158	1.7	480	10000	128	201
MLR 10-110	305	31 000	18 200	629	1121	8000	4800	49	302	3.3	605	10000	479	692

*) Dynamic load capacities and load moments for nominal life calculation

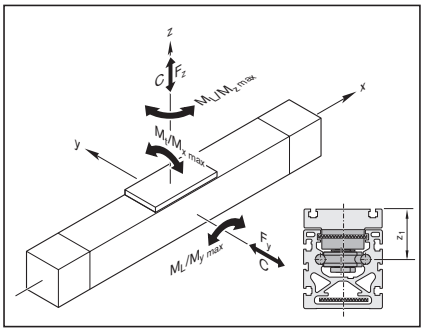
Note on dynamic load capacities and moments

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.

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
MLR 10-80	50
MLR 10-110	55



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:

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

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 in meters	(m)
L_h	=	nominal life in hours	(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)

Drive data

	Gear reducer ratio i	Maximum drive torque M_a (Nm)	Lead constant (mm/rev)	Belt data: Belt type	Width (mm)	Tooth pitch (mm)	Max. belt drive transmission force (N)	Belt elasticity limit (N)	Specific spring rate c_{spec} (N)
MLR 10-80	1	32.0	205.00	AT 5	50	5	980	3500	$0.875 \cdot 10^6$
	1 with keyway	27.0	205.00						
	3	10.7	68.33						
	5	6.4	41.00						
	10	3.2	20.50						
MLR 10-110	1	80.0	290.00	AT 10	50	10	1740	7500	$2.12 \cdot 10^6$
	1 with keyway	27.0	290.00						
	3	26.7	96.66						
	5	16.0	58.00						
	10	8.0	29.00						

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.

Weight

Weight calculation does not include motor or switch attachments.
Weight formula:
Weight factor (kg/mm) · length L (mm) + weight of all parts of fixed length (carriage, end blocks, etc.) (kg)

	Carriage length (mm)	Drive units	Weight (kg)
MLR 10-80	190	Without drive unit	0.0089 · L + 4.4
		Drive i = 1	0.0089 · L + 4.9
		With LP gear reducer	0.0089 · L + 8.3
MLR 10-110	305	Without drive unit	0.0141 · L + 9.7
		Drive i = 1	0.0141 · L + 10.1
		With LP gear reducer	0.0141 · L + 16.9

Linear Modules MLR

Performance Data

MLR 10-80

Drive data without motor (i = 1)

Belt pulley drive diameter	65.27 mm
Travel speed v_{mech}	Up to 10 m/s
Mass moment of inertia J_s (short carriage)	$(21.1 + L\ (mm) \cdot 0.00379) \cdot 10^{-4}$ kgm²
Mass moment of inertia J_s (long carriage)	$(29.7 + L\ (mm) \cdot 0.00379) \cdot 10^{-4}$ kgm²

Horizontal operation

MSK 040C, HCS02.1E-W0028, 3 x 400 V

i		3				5					10				
m_{ex}	(kg)	1	2	3	4	4	6	10	14	18	10	20	40	60	80
t_a	(ms)	77	89	100	110	75	85	105	130	155	110	145	210	280	364
s_a	(mm)	190	220	250	278	120	145	180	220	263	110	145	210	280	364
a	(m/s^2)	65	56	50	45	47	40	32	26	22	18	13.5	9.4	7	5.5
v_{dc}	(m/s)	5				3.4					2				
*	(mm)	± 0.1													

MSK 050C, HCS02.1E-W0028/W0054, 3 x 400 V

i		3					5					10				
m_{ex}	(kg)	2	5	8	11	14	6	14	22	30	38	20	40	60	80	100
t_a	(ms)	85	110	135	160	185	145	205	255	315	375	230	300	370	445	510
s_a	(mm)	210	270	335	400	465	300	420	525	645	760	230	300	370	445	510
a	(m/s^2)	60	46	37	31	27	28	20	16	13	11	8.6	6.6	5.4	4.5	3.9
v_{dc}	(m/s)	5					4.1					2				
*	(mm)	± 0.1														

MSM 041B, HCS01.1E-W0013, 230 V

i		5					10						
m_{ex}	(kg)	2	4	6	8	10	10	15	20	25	30	35	40
t_a	(ms)	29	36	43	49	55	42	53	61	69	78	86	95
s_a	(mm)	30	37	43	49	55	21	27	31	35	40	43	48
a	(m/s^2)	68	55	47	40.8	36.2	23	19	16	14.5	12.8	11.5	10.5
v_{dc}	(m/s)	2					1						
*	(mm)	± 0.1											

Vertical operation (frame stationary, carriage travels)

MSK 040C, HCS02.1E-W0028, 3 x 400 V

i		3				5					10				
m_{ex}	(kg)	1	2	3	4	2	6	10	14	18	5	10	15	20	25
t_a	(ms)	80	95	110	125	65	95	125	160	215	105	135	165	208	285
s_a	(mm)	200	230	270	313	105	155	215	275	360	105	135	165	208	285
a	(m/s^2)	63	54	46	40	54	37	27	21	16	19.5	15	12	9.6	7
v_{dc}	(m/s)	5				3.4					2				
*	(mm)	± 0.1													

MSK 050C, HCS02.1E-W0028/W0054, 3 x 400 V

i		3					5					10				
m_{ex}	(kg)	2	5	8	11	14	5	10	15	20	25	10	20	30	40	50
t_a	(ms)	85	115	155	195	230	150	205	265	342	436	235	340	500	400	740
s_a	(mm)	215	290	380	465	570	310	420	540	700	895	235	340	500	200	370
a	(m/s^2)	58	43	33	26	22	27	20	15.5	12	9.4	8.5	5.9	4	2.5	1.35
v_{dc}	(m/s)	5					4.1					2			1	
*	(mm)	± 0.1														

MLR 10-110

Drive data without motor (i = 1)

Belt pulley drive diameter	92.2 mm
Travel speed v_{mech}	Up to 10 m/s
Mass moment of inertia J_s (short carriage)	(77.05 + L (mm) · 0.0123) · 10^{-4} kgm^2
Mass moment of inertia J_s (long carriage)	(146.35 + L (mm) · 0.0123) · 10^{-4} kgm^2

Horizontal operation

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		3				5						10				
m_{ex}	(kg)	3	5	7	9	8	16	24	32	40	50	20	60	100	140	180
t_a	(ms)	85	95	105	115	120	155	190	215	250	300	175	260	350	435	520
s_a	(mm)	210	235	260	285	275	350	420	480	555	665	210	310	420	520	626
a	(m/s^2)	59	53	48	44	37	29	24	21	18	15	13.5	9.2	6.9	5.5	4.6
v_{dc}	(m/s)	5				4.5						2.4				
*	(mm)	± 0.1														

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

i		3						5						10					
m_{ex}	(kg)	4	8	12	16	20	24	10	20	40	60	80	100	20	60	100	140	180	200
t_a	(ms)	150	170	185	210	230	240	275	310	380	340	390	440	476	555	615	690	770	800
s_a	(mm)	380	430	465	520	570	600	550	615	760	505	585	660	476	555	615	690	770	800
a	(m/s^2)	33	29	27	24	22	21	14.5	13	10.5	8.9	7.7	6.8	4.2	3.6	3.25	2.9	2.6	2.5
v_{dc}	(m/s)	5						4			3			2					
*	(mm)	± 0.1																	

Vertical operation (frame stationary, carriage travels)

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		3				5						10						
m_{ex}	(kg)	3	5	7	9	6	10	18	26	34	40	20	30	40	50	60	80	100
t_a	(ms)	85	100	110	125	120	140	190	423	205	250	210	260	320	410	520	370	835
s_a	(mm)	215	245	275	310	266	315	420	545	310	375	250	310	385	490	625	185	420
a	(m/s^2)	58	51	45	40	38	32	24	18.5	14.5	12	11.5	9.3	7.5	5.9	4.6	2.7	1.2
v_{dc}	(m/s)	5				4.5				3		2.4					1	
*	(mm)	± 0.1																

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

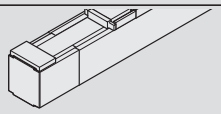
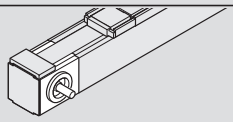
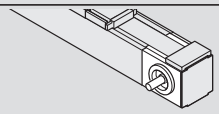
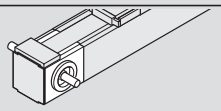
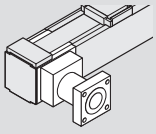
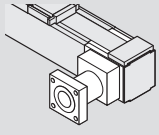
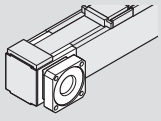
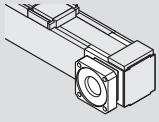
i		3					5						10				
m_{ex}	(kg)	4	8	12	16	20	6	10	18	26	34	40	20	40	60	80	100
t_a	(ms)	160	180	210	240	265	210	220	265	310	366	417	280	375	540	870	1800
s_a	(mm)	390	445	520	595	655	310	330	395	465	550	625	140	190	270	435	910
a	(m/s^2)	32	28	24	21	19	14.5	13.6	11.4	9.7	8.2	7.2	3.56	2.66	1.85	1.15	0.55
v_{dc}	(m/s)	5					4.5		3				1				
*	(mm)	± 0.1															

a = acceleration (m/s^2)
i = gear reduction (-)
m_{ex} = mass (kg)
s_a = acceleration travel (mm)
t_a = acceleration time (ms)
v_{dc} = travel speed (m/s)
* = reproducibility (mm)

MSK = servo motor
MSM = servo motor
VRDM = stepping motor
HCS = digital controller

Linear Modules MLR

Linear Modules MLR 10-80 Components and Ordering Data

Part number, length R1148 160 10, ... mm Version		Guideway	Drive unit Drive journal	Reduction i = 1 [1]	i = 1 [2]	i = 3	i = 5	i = 10	Carriage L_{ca} = 190 mm with T-slot
Without drive unit	OA01 	02	Without	50					01
With drive unit (MA), without gear reducer i = 1	MA01 	01	Journal at right	01	03	–			
	MA02 	01	Journal at left	01	03	–			
	MA03 	01	Journal on both sides	02	04	–			
With gear (MG), external gear reducer	MG01  MG02 	01	Gear reducer at right / at left	–	–	10			
			Gear reducer at right / at left	–	–	11 Gear reducer with second journal			
With gear (MG), integrated LPB gear reducer	MG03  MG04 	01	Gear reducer at right / at left	–	–	20			

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length

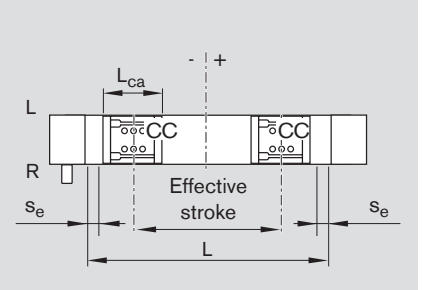
1) Without keyway
2) With keyway
3) Attachment kit also available without motor (when ordering: enter “00” for motor)
4) Stepping motors on request

Motor attachment			Motor		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit[3] with gear reducer	for motor[4]	without Brake	with Brake		Standard report	Measurement report
–	00	–	00		**Without switch and cable duct** 00		
–	00	–	00		**Switches:** – PNP NC 11- . ± ... mm – PNP NO 13- . ± ... mm – Mechanical 15- . ± ... mm		
–	00	–	00		**Ordering data:** Switch type Mounting side (R/L) Direction of travel Switching distance		
–	00	–	00				02 Friction moment
i = 3	01	MSK 040C	86	87	**Cable duct (loose)** – Length 20, ... mm	01	
i = 5	10						
i = 10	20						
i = 3	02	MSM 041B	110	111	**External socket/plug (loose)** 17		05 Positioning accuracy
i = 5	11						
i = 10	21						
i = 3	04	MSK 050C	88	89	**External switching cam** 16		
i = 5	14						
i = 10	24						
i = 3	50	MSK 040C	86	87			
i = 5	55						
i = 10	60						
i = 3	51	MSM 041B	110	111			
i = 5	56						
i = 10	61						
i = 3	54	MSK 050C	88	89			
i = 5	58						
i = 10	63						

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 100\ \text{mm} + L_{ca}$$

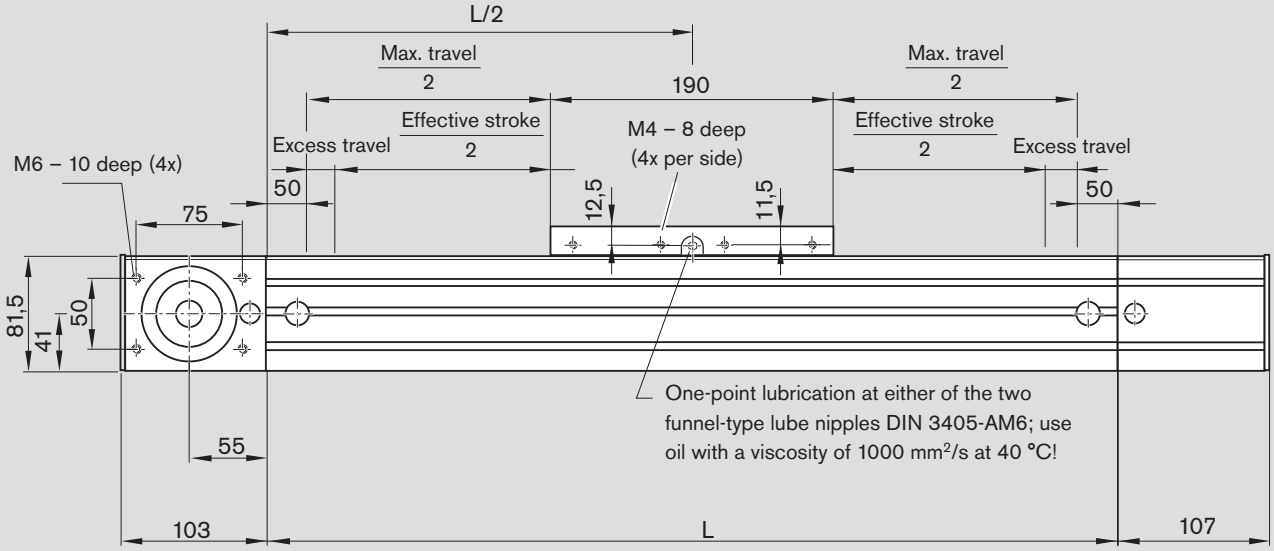
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.

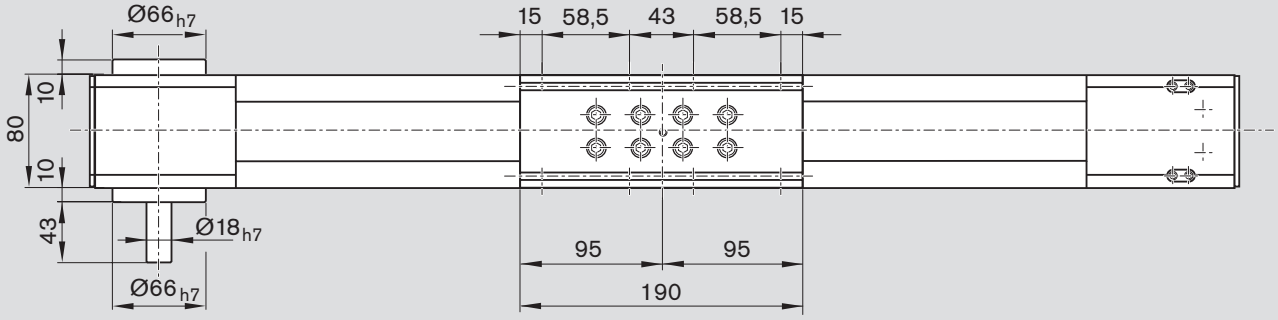


Linear Modules MLR

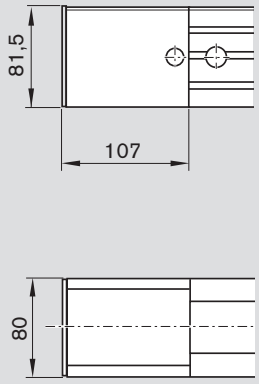
Linear Modules MLR 10-80 Dimensions

All dimensions in mm
Drawings not to scale

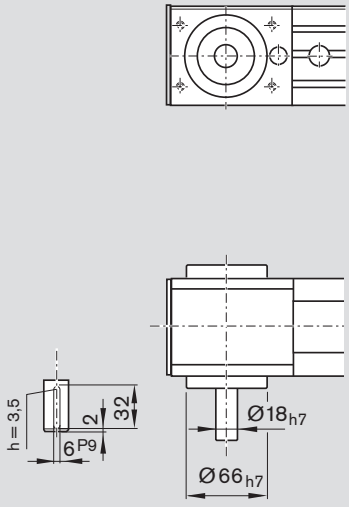




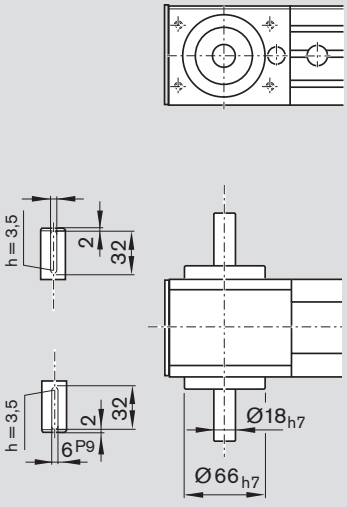
OA01

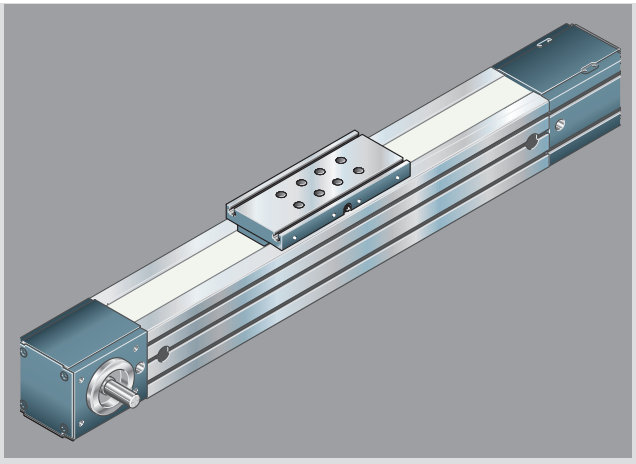


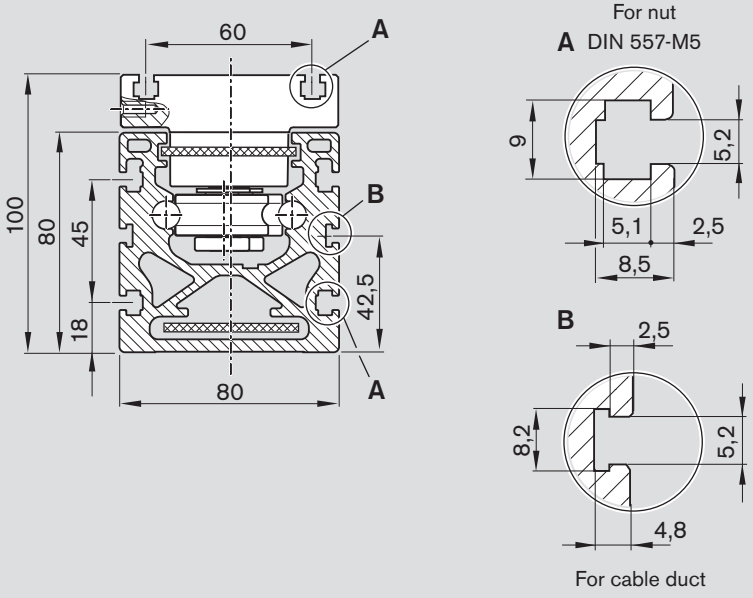
MA01, MA02



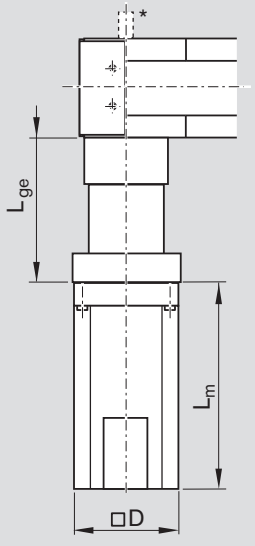
MA03



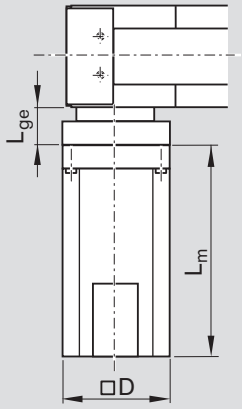




MG01*, MG02*



MG03, MG04



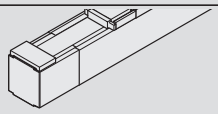
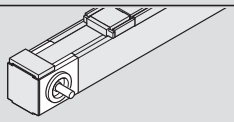
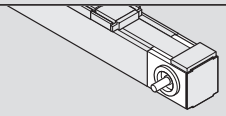
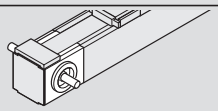
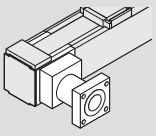
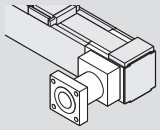
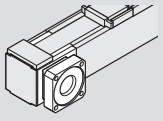
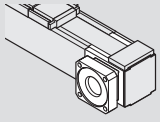
Motor	Dimensions (mm)				
	Gear unit		Motor		
	MG01 MG02	L_{ge} MG03 MG04	D	without brake	L_m with brake
MSK 040C	135	41	82	185.5	215.5
MSK 050C	145	51	98	203.0	233.0
MSM 041B	140	46	80	112.0	149.0

* For drive unit Option 11: second journal Ø18 x 43

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

Linear Modules MLR

Linear Modules MLR 10-110 Components and Ordering Data

Part number, length R1148 260 10, ... mm Version		Guideway	Drive unit Drive journal	Reduction i = 1 [1]	i = 1 [2]	i = 3	i = 5	i = 10	Carriage L_{ca} = 305 mm with T-slot	
Without drive unit	OA01 	02	Without	50					05	
With drive unit (MA), without gear reducer i = 1	MA01 	01	Journal at right	01	03	–				
	MA02 	01	Journal at left	01	03	–				
	MA03 	01	Journal on both sides	02	04	–				
With gear (MG), external gear reducer	MG01  MG02 	01	Gear reducer at right / at left	–	–	10				
			Gear reducer at right / at left	–	–	11 Gear reducer with second journal				
With gear (MG), integrated LPB gear reducer	MG03  MG04 	01	Gear reducer at right / at left	–	–	20				

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length

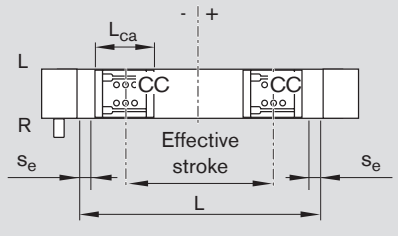
1) Without keyway
2) With keyway
3) Attachment kit also available without motor (when ordering: enter “00” for motor)
4) Stepping motors on request

Motor attachment				Motor		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit[3] with gear reducer	for motor[4]		without Brake	with Brake		Standard report	Measurement report
–	00	–		00		**Without switch and cable duct** 00	01	02 Friction moment 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		
–	00	–		00				
–	00	–		00				
i = 3	06	MSK 060C		90	91	**Cable duct (loose)** – Length 20, ... mm		
i = 5	16							
i = 10	26							
i = 3	02	MSK 076C		92	93	**External socket/plug (loose)** 17		
i = 5	11							
i = 10	21							
i = 3	05	MSK 060C		90	91	**Switching cam at one end** 16		
i = 5	15							
i = 10	25							
i = 3	04	MSK 076C		92	93	**Switching cam at both ends** 26		
i = 5	14							
i = 10	24							

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 70 \text{ mm} + L_{ca}$$

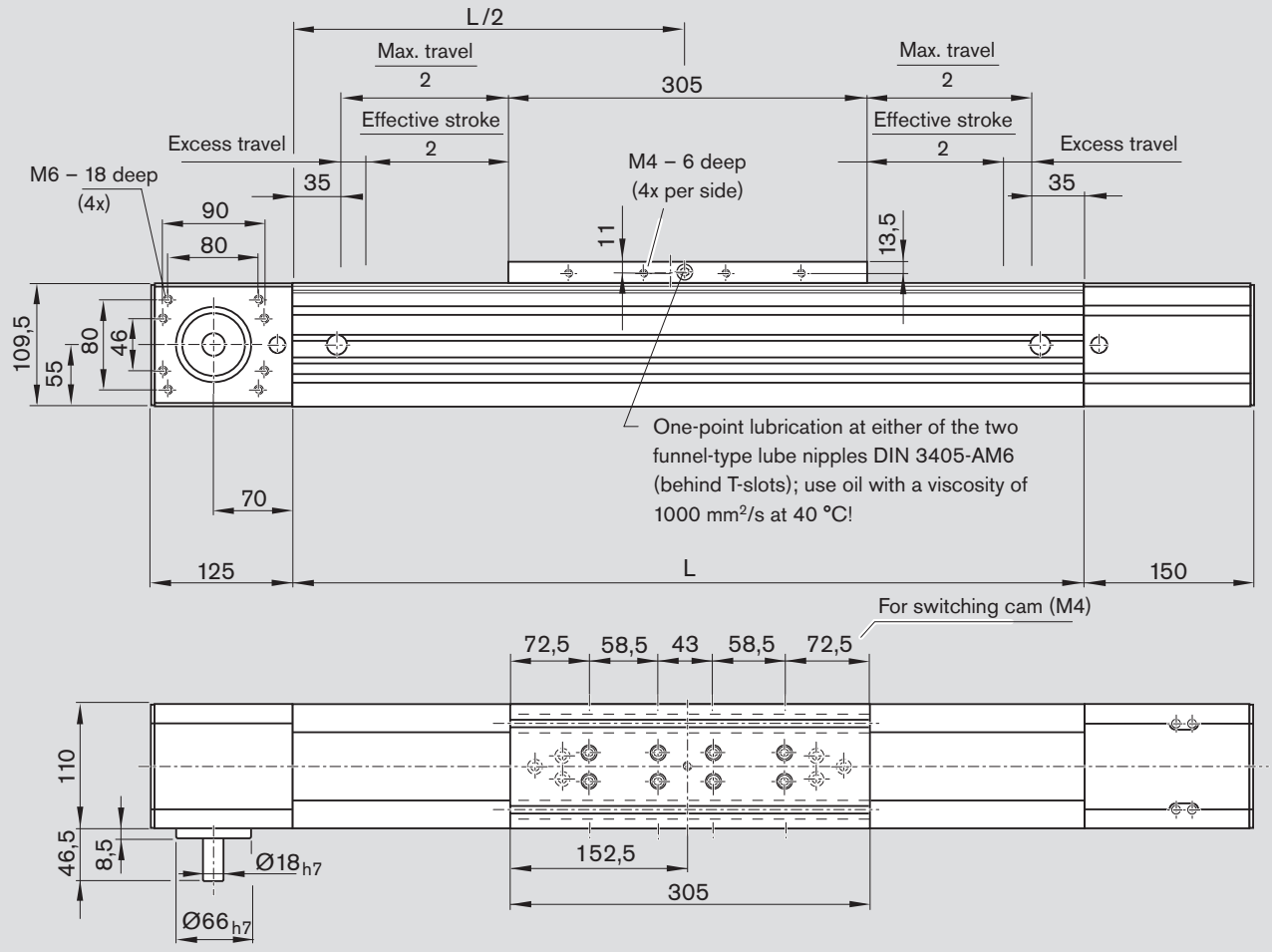
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.



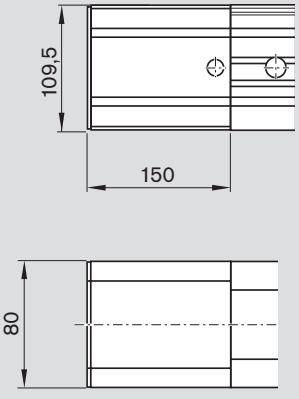
Linear Modules MLR

Linear Modules MLR 10-110 Dimensions

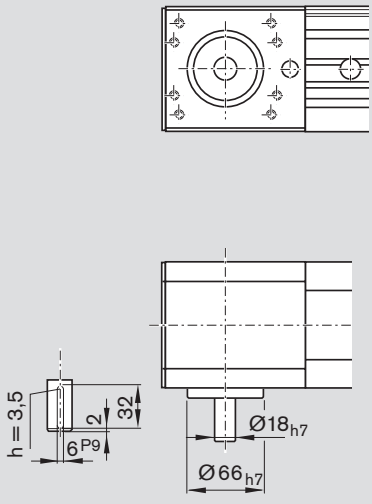
All dimensions in mm
Drawings not to scale



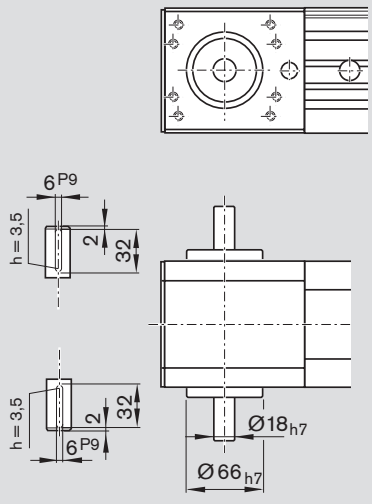
OA01

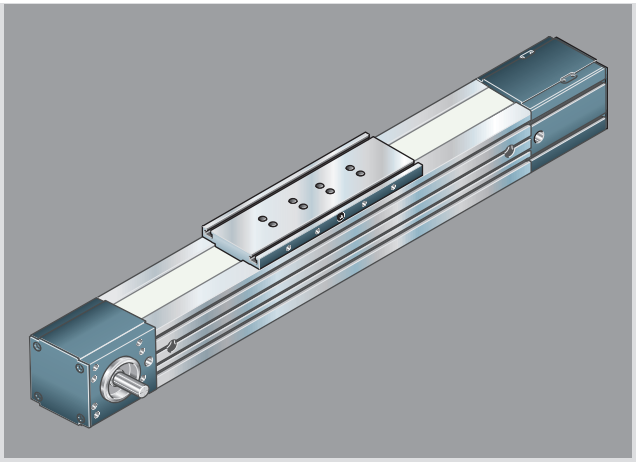


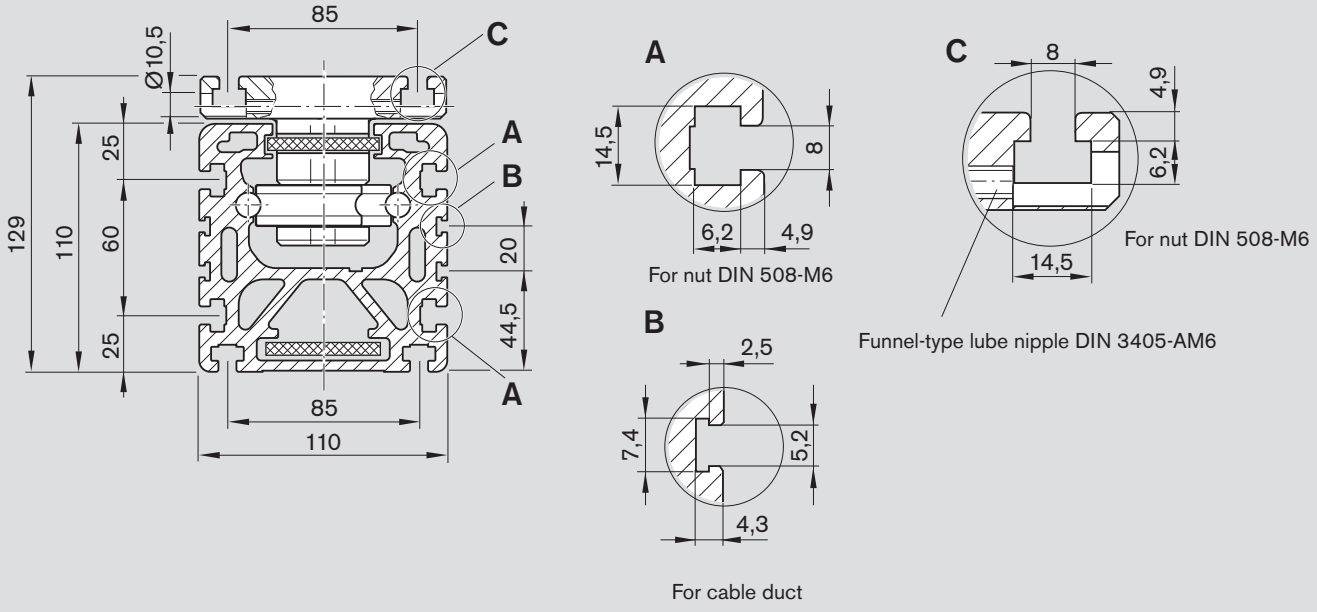
MA01, MA02



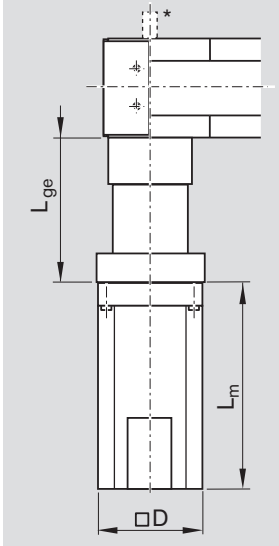
MA03



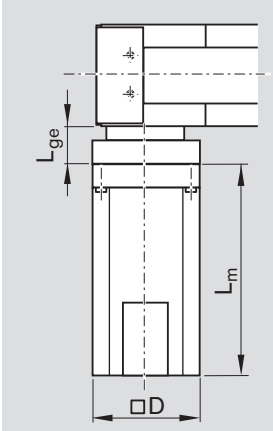




MG01*, MG02*



MG03, MG04



Motor	Dimensions (mm)				
	Gear unit		Motor		
	MG01 MG02	L_{ge} MG03 MG04	D	without brake	L_m with brake
MSK 060C	162	50	116	226.0	259.0
MSK 076C	172	60	140	292.5	292.5

* For drive unit Option 11: second journal Ø18 x 43

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

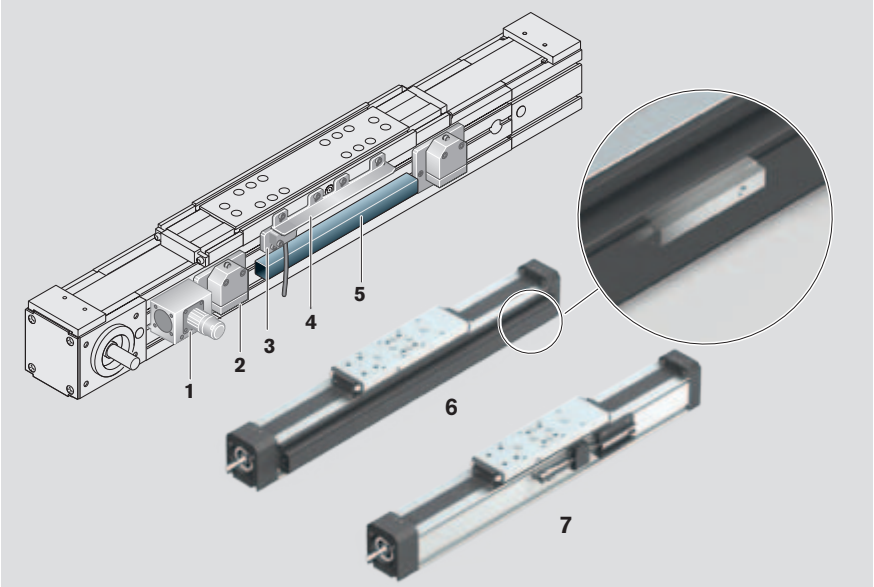
Switching System MKK, MKR, MLR

Overview of Switching System

Overview of the switching system

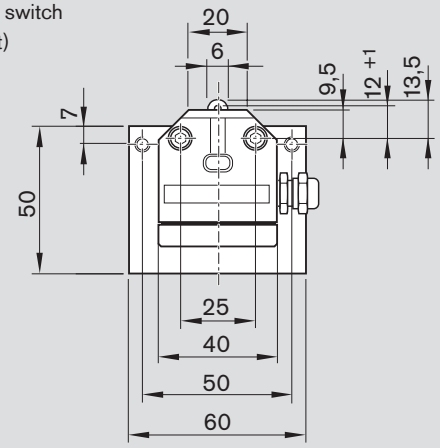
1 Socket and plug
2 Mechanical switch (with mounting accessories)
3 Proximity switch (with mounting accessories)
4 Switching cam
5 Cable duct (aluminum alloy)

6 Magnetic field sensor with mounting duct (MKK/MKR 12-40)
7 Magnetic field sensor with connector and sensor mount (MKK/MKR 12-40)



Mechanical switch (technical data)	
Repeatability	± 0.05 mm
Permissible ambient temperature	–5 °C to +80 °C
Protection class	DIN 40050 IP 67
Bounce time	< 2 ms
Insulation class	Group C as per VDE 0110
Rated voltage	250 V AC
Continuous current	5 A
Switching capacity at 220 V, 40–60 Hz	cosφ = 0.8 at 2 A
Contact resistance when new	< 240 mΩ
Connection type	Screw connector
Contact system	Single-pole changeover
Switching system	Snap-action
B_{10d} as per EN ISO 13849-1	1 000 000 switching cycles

Mechanical switch (with mount)

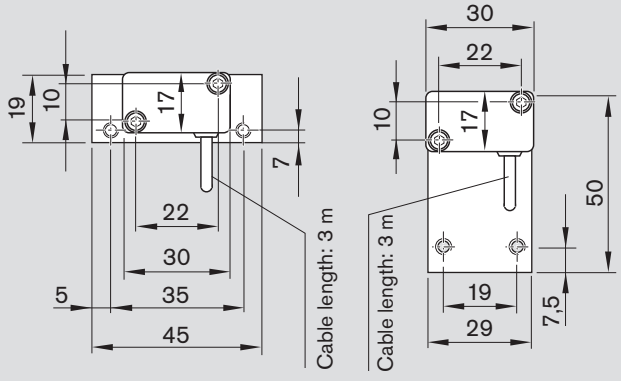


Further connection dimensions ☞ 112-113

Proximity switch with potted cable (3 x 0.14 mm² Unitronic) Technical data	
Housing form	NO
Minisensor	Form A DIN 41635
Operating voltage	10 ... 30 V DC
Residual ripple	≤ 10%
Load	200 mA
No-load current	≤ 20 mA
Switching frequency	max. 1500 Hz
Temperature-related shift in make point	≤ 4 µm/K
Output signal steepness	≥ 1V/µs
Repeatability of make point per EN 50008	≤ 0.1 mm
Cable length	3 m
$MTTF_d$ as per EN ISO 13849-1	30 – 100 years

Proximity switch (with mount) for frame sizes -40, -65, -80, -165

Proximity switch (with mount) for frame size -110



Further connection dimensions ☞ 112-113

Switch Mounting Arrangements MKK/MKR 12-40

Switch mounting arrangements for magnetic field sensors with mounting duct

1 Switch (magnetic field sensor) with potted cable
2 Cable
3 Mounting/cable duct

The switch activator is a magnet integrated in the carriage (no switching cam necessary).
The switch activation points can be positioned anywhere along the stroke.

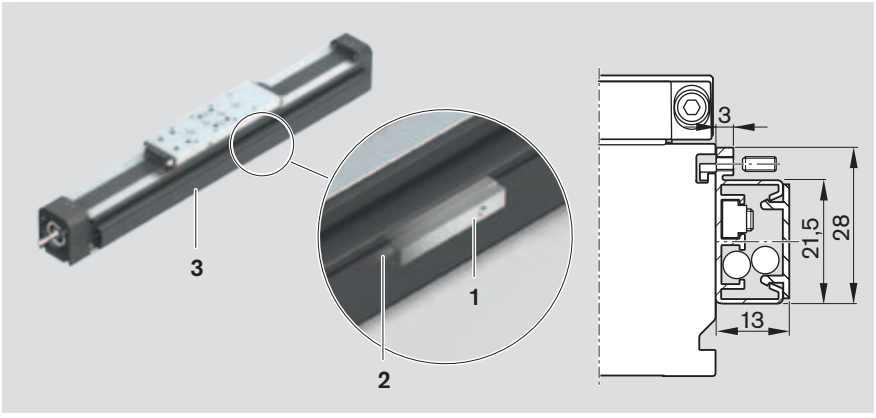
Version

– Hall sensor (PNP NC) or
– Reed sensor (changeover)

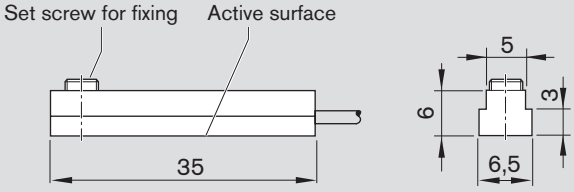
For technical data, see “Magnetic field sensor” on the next page.

Notes for mounting

The magnetic field sensors are pushed into the top T-slot in the cable duct and fixed with set screws. The cables are routed along the side of the T-slot.
For details regarding mounting and switch activation points, see mounting instructions. Sensors may only be mounted on one side (left or right) of the Linear Module and should not be installed until the Linear Module has been screwed down on its base.



Magnetic field sensor with potted cable



Switch mounting arrangements for magnetic field sensor with connector and sensor mount

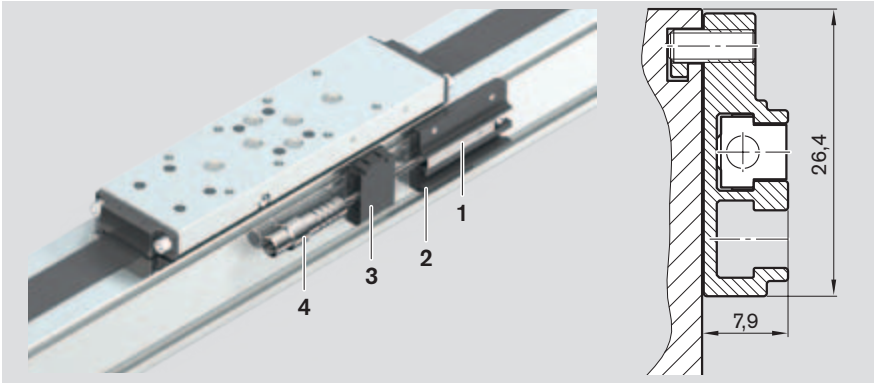
Sensor mounting kit

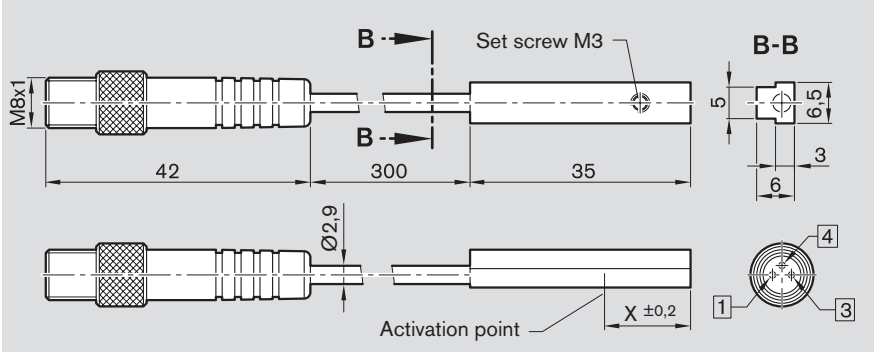
1 Sensor (Hall or Reed)
2 Sensor mount incl. set screws (loose) and square nut
3 Cable holder (3 pcs) incl. set screw (loose)
4 Plug

The switch activator is a magnet integrated in the carriage (no switching cam necessary).
The switch activation points can be positioned anywhere along the stroke.

Notes for mounting

Sensors may only be mounted on one side (left or right) of the Linear Module and should not be installed until the Linear Module has been screwed down on its base.
For a description of the mounting procedure and determination of the switch activation points, see the mounting instructions for Linear Modules.





Dimension X: Hall sensor = 13.65 mm, Reed sensor = 9 mm

Switching System MKK, MKR, MLR

Switch Mounting Arrangements MKK/MKR 12-40

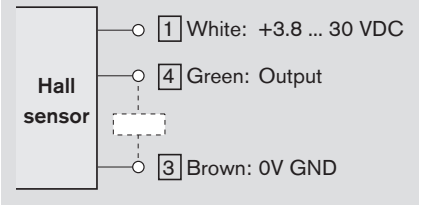
Magnetic field sensor

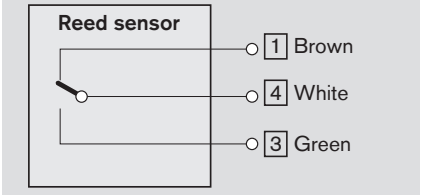
Technical data

Hall sensor	
Contact type	PNP NC
Operating voltage	3.8–30 V DC
Current consumption	max. 10 mA
Output current	max. 20 mA
Cable length	2 m /10 m
Protection class	IP 66
Short-circuit protection	No
Max. travel speed	2 m/s
$MTTF_d$	10 years
Part number	**Cable length**
R3476 010 03	2 m
R3476 017 03	10 m

Reed sensor	
Contact type	Changeover
Switching voltage	max. 100 V DC
Switching current	max. 0.5 mA
Cable length	2 m /10 m
Protection class	IP 66
Max. travel speed	2 m/s
Switching points	2
$MTTF_d$	10 years
Part number	**Cable length**
R3476 009 03	2 m
R3476 015 03	10 m

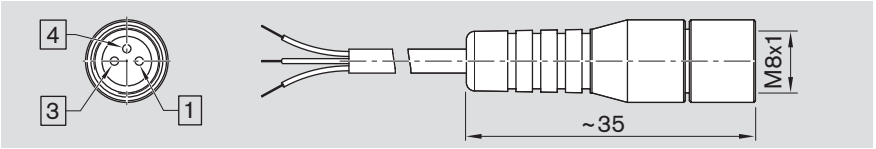
Pin assignment





Extension cable for sensor (Hall / Reed) with connector

The extension cable (approx. 5 m) is supplied complete with a female connector M8x1 for connection to the sensor.



Extension cable					
Part number	**Connector contact**	**1**	**3**	**4**	**Protection class**
R3476 025 03	to core	brown	blue	black	IP 66 when connected

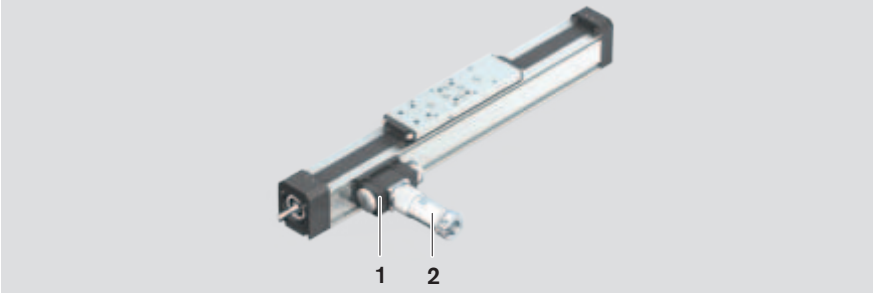
Socket-plug MKK/MKR 12-40

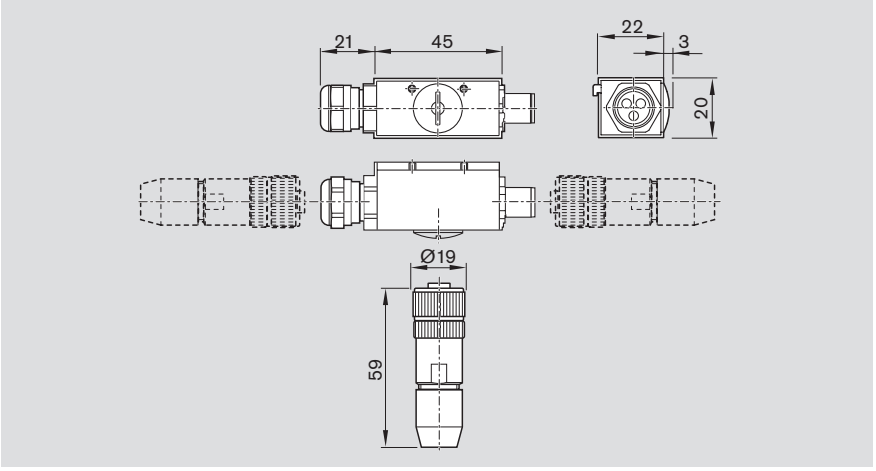
1 Socket
2 Plug

Notes
The socket and plug have 16 pins.
The socket and plug are not pre-wired.

Since the mounting arrangements allow shifting of the switches, the switch activation points can be optimized during start-up.
The plug can be mounted in three directions.

Part number
R1175 601 02



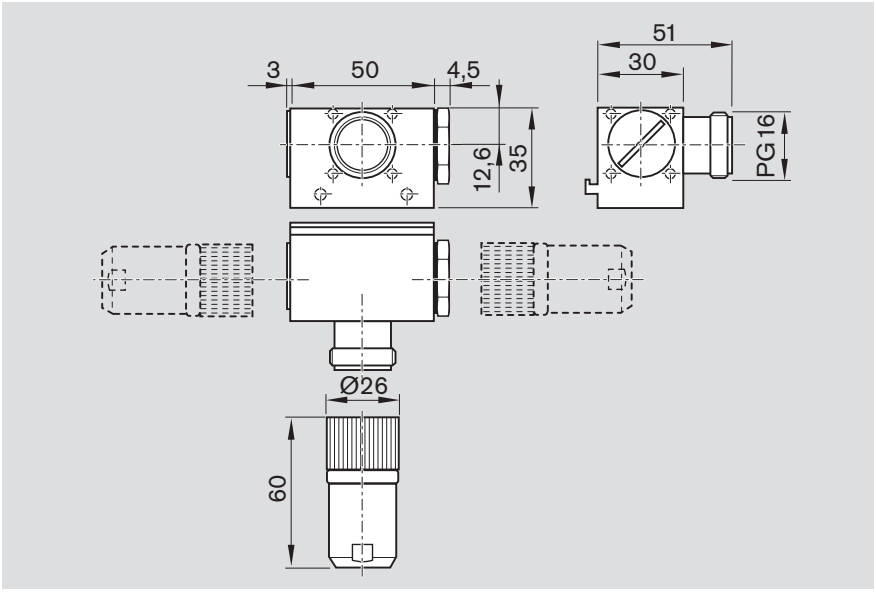


Switch Mounting Arrangements MKK/MKR/MLR 15-65 to 35-165

Socket-plug

- Attach the socket at the end with the most switches. (See example on next page.)

The socket and switch are not pre-wired. The switch activation points can thus be optimized during start-up. A plug is provided.
The plug can be mounted in three directions (see diagram).



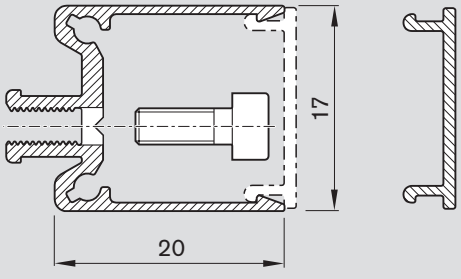
Ordering the switches and accessories

Item		Frame size				
		-40	-65	-80	-110	-165
1	Socket-plug	R1175 601 02	R1175 001 53			
2	Mechanical switch with accessories		R1175 001 51			
	Mechanical switch alone		R3453 040 16			
3	Proximity switch					
	– Accessories without switch	R1175 001 52	R1175 001 52	R1175 001 52	R1175 201 52	R1175 001 52
	– PNP NC	R3453 040 01	R3453 040 01			
	– NPN NC	R3453 040 02	R3453 040 02			
	– PNP NO	R3453 040 03	R3453 040 03			
	– NPN NO	R3453 040 04	R3453 040 04			
4	Switching cam	R1175 001 50	R1175 001 50			
5	Cable duct	R0396 620 18	R0396 620 17			

Cable duct

- The cable duct is fastened in the T-slots on the side of the frame. Fastening screws widen the profile and give the cable duct a secure hold.

For the slot position, see “Components and Ordering Data” tables and “Dimensions”. The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches. Fastening screws and cable grommets are included.

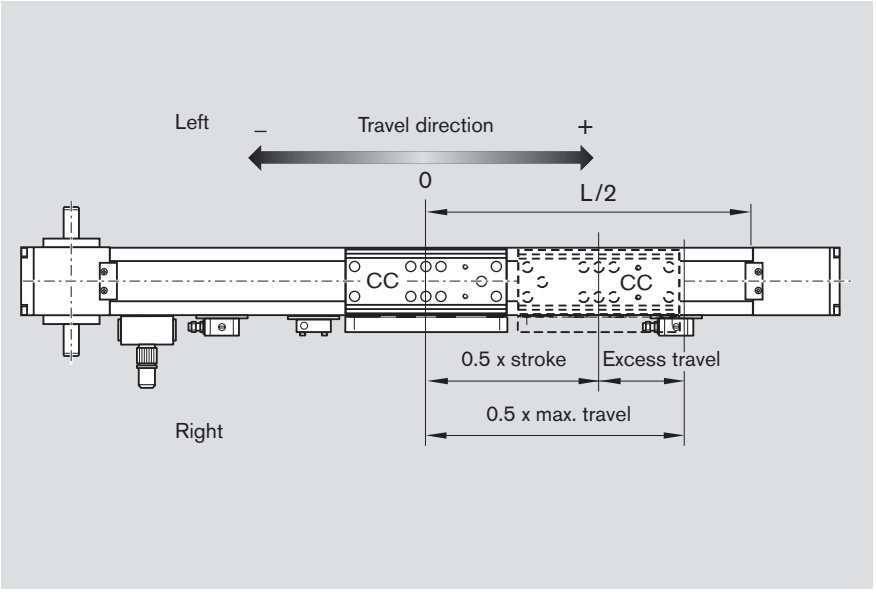


Switching System MKK, MKR, MLR

Mounting Examples for Mechanical/Proximity Switches

Determining the switch activation points

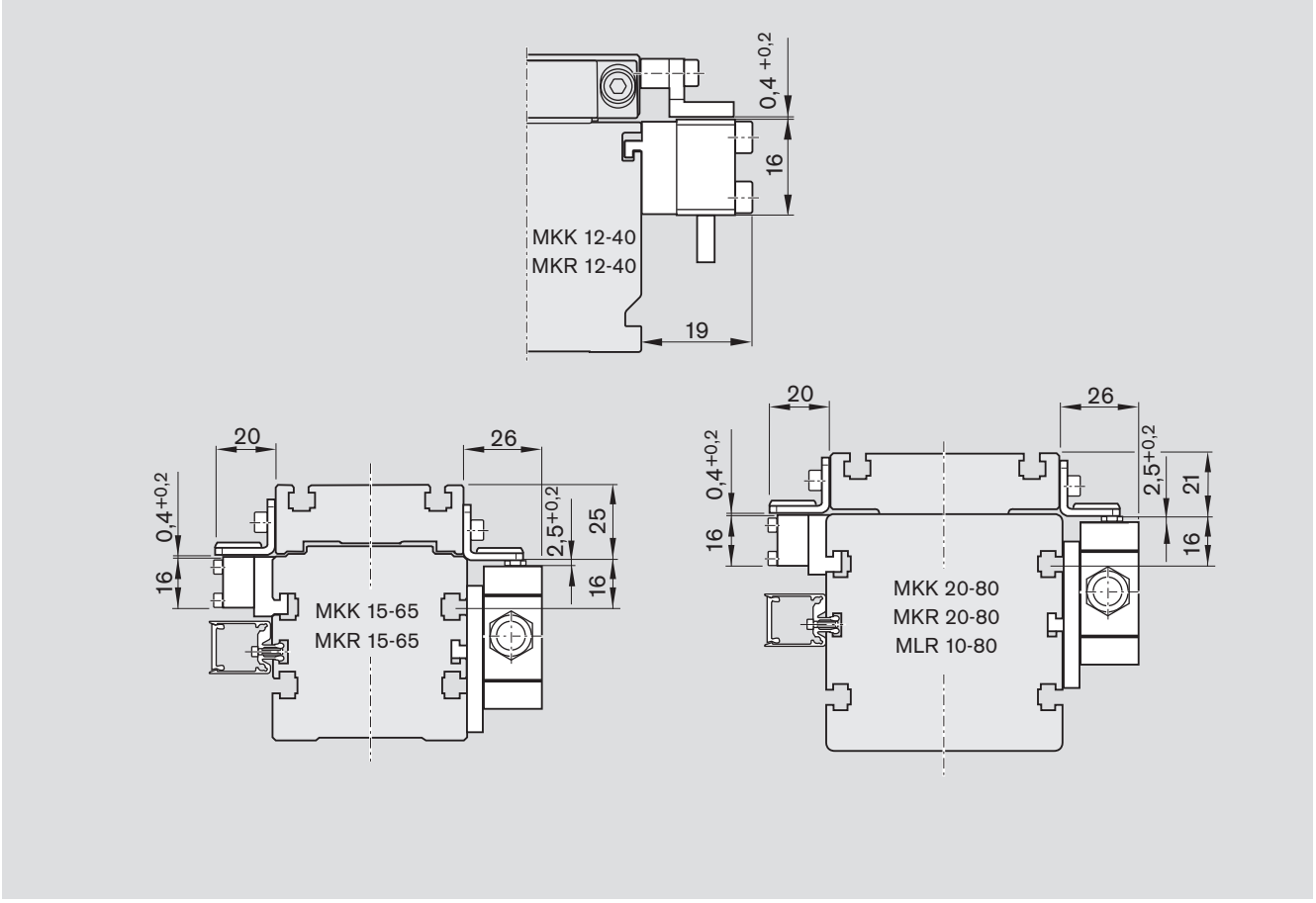
Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).
Example for a mechanical limit switch (provided the zero point is at L/2):
Maximum switching distance =
= 0.5 x (max. travel) – excess travel
= 0.5 x stroke
For safe operation of the Linear Module, the excess travel must be longer than the braking distance.
For MKR... and MLR...:
The acceleration travel s_a can be taken as a guideline value for the braking distance.
For MKK...:
In most cases the recommended limit for excess travel (braking path) is:
Excess travel = 2 x screw lead P

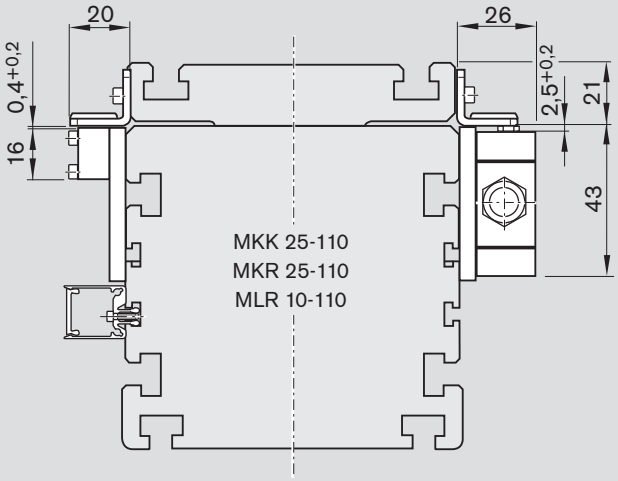


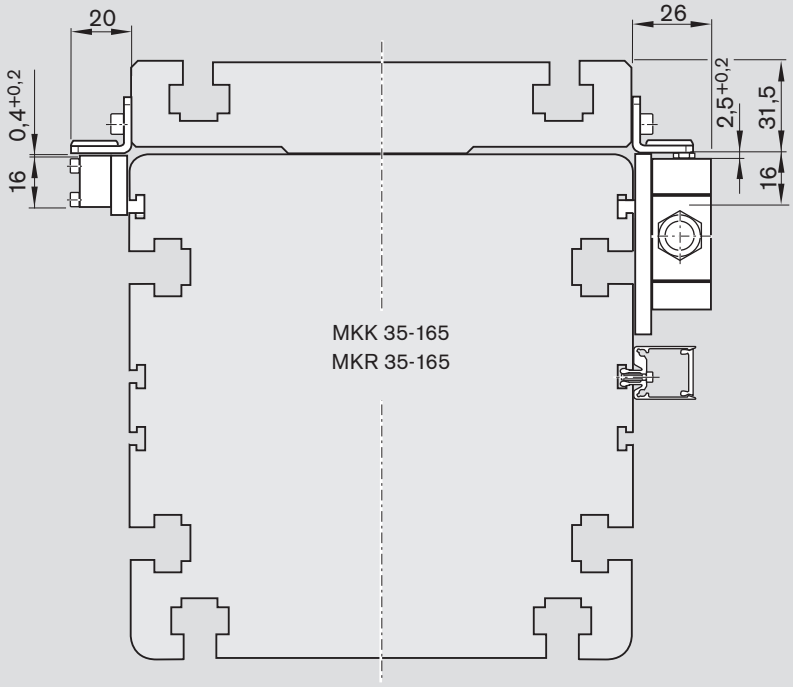
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch
Slide the mounting plates with switches into the slot and fix with two set screws.

Take note of the minimum switching distance (determined by the mounting accessories):

mechanical-mechanical	=	60 mm
mechanical-proximity	=	45 mm
proximity-proximity	=	28 mm




20
26
0,4+0,2
16
2,5+0,2
21
43
MKK 25-110
MKR 25-110
MLR 10-110


20
26
0,4+0,2
16
2,5+0,2
31,5
16
MKK 35-165
MKR 35-165

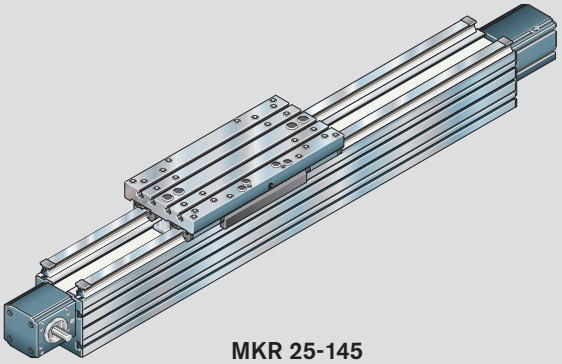
Linear Modules MKR 25-145

Product Description

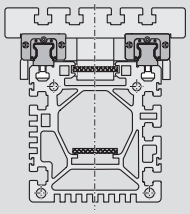
Characteristic features

MKR 25-145: Linear Module with two Ball Rail Systems for high load moment capacity and Toothed Belt Drive for high speeds

The Linear Module MKR 25-145 comprises:
- an anodized aluminum profile frame of high inherent rigidity
- two Rexroth Ball Rail Systems with sealing strips
- a profiled aluminum carriage with four long runner blocks
- a planetary gear integrated in the drive pulley
- with or without gear reducer for attachment of the motor
- an AC servo motor (other motor types on request)
- mountable switches
- control units



MKR 25-145



For mounting, maintenance and start-up, see the relevant Instructions.

Technical Data

General technical data

	Carriage length	Dynamic load capacity	Dynamic load moment		Moved mass	Minimum length	Maximum length	Planar moment of inertia	
		C	M_L	M_t		L_{min}	L_{max}	I_x	I_y
	(mm)	(N)	(Nm)	(Nm)	(kg)	(mm)	(mm)	(cm^4)	(cm^4)
MKR 25-145	400	98 700	5 700	14 600	10,6	760 *	6 000	2 790	1 955

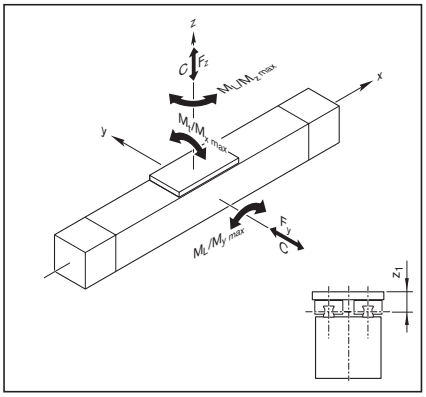
	Maximum permissible loads			
	Forces		Moments	
	$F_{x\,max}$ (N)	$F_{y\,max}$ (N)	$M_{t\,max}$ (Nm)	$M_{l\,max}$ (Nm)
MKR 25-145	49 350	49 350	2 850	7 300

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

*) for a theoretical stroke of 100 mm

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.



Z_1 = 50.5 mm
(application point of the effective force)

Drive data

	Gear reducer ratio i	Maximum drive torque M_a	Lead constant	Pulley drive diameter	Belt data					
					Belt type	Width	Tooth pitch	Max. belt drive transmission force	Belt elasticity limit	Specific spring rate
		(Nm)	(mm/rev)	(mm)		(mm)	(mm)	(N)	(N)	(N)
MKR 25-145	1	80.0	290.00	92.2	AT 10	50	10	1740	7500	$2.12 \cdot 10^6$
	1*)	27.0	290.00							
	3	26.6	96.66							
	5	16.0	58.00							
	10	8.0	29.00							

*) With keyway

Combined equivalent load on bearing of the linear guide

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

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:

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

C	=	dynamic load capacity	(N)
L	=	nominal life in meters	(m)
L_h	=	nominal life in hours	(h)
F_{comb}	=	combined equivalent load on bearing	(N)
v	=	travel speed	(m/min)

Mass of the linear system

Weight calculation does not include motor or switch attachments.
Formula:
Weight factor (kg/mm) · length L (mm) + weight of all parts of fixed length (carriage, end blocks, etc.) (kg)

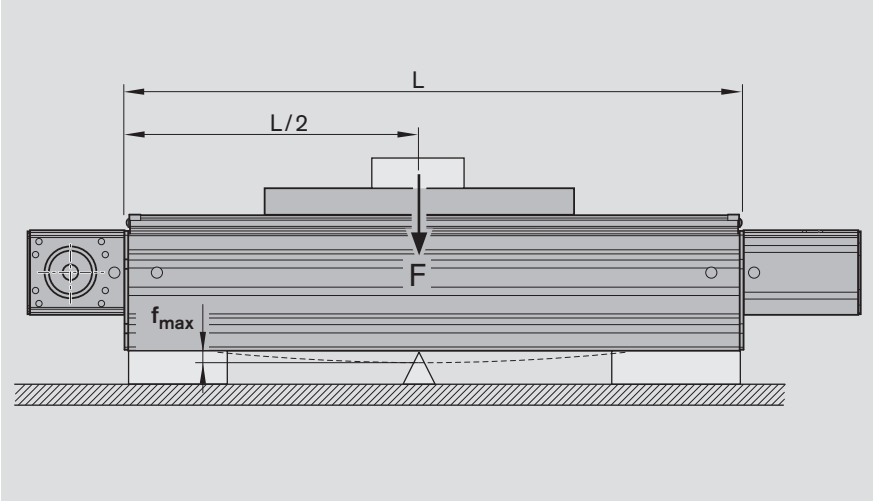
	Carriage length (mm)	Drive unit	Weight (kg)
MKR 25-145	400	Without drive unit	0.0306 · L + 17.4
		Drive i =1	0.0306 · L + 17.7
		With gear reducer	0.0306 · L + 24.6

Linear Modules MKR 25-145

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.

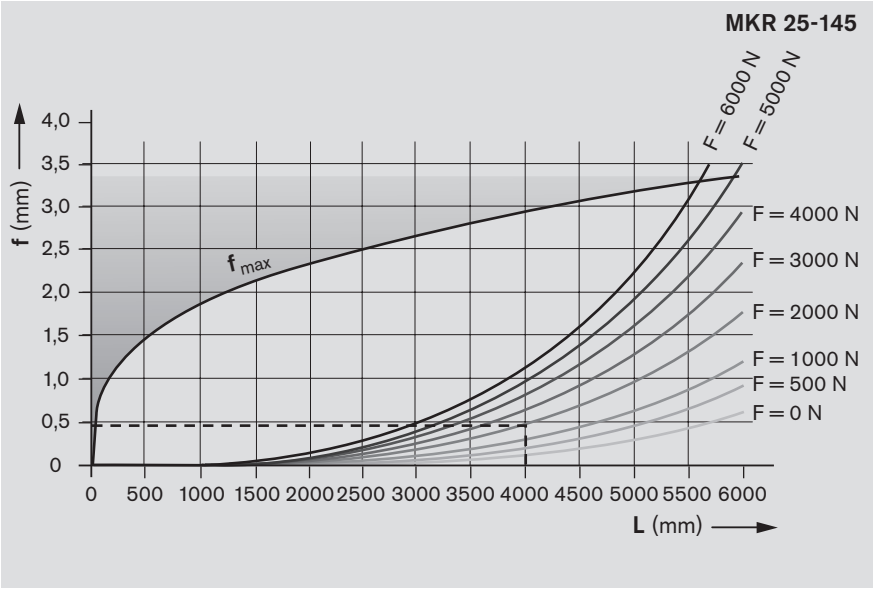
⚠ **f_{max} must not be exceeded!**

Example

Linear Module MKR 25-145:
L = 4000 mm
F = 2000 N
From chart:
f = 0.47 mm
f_{max} = 2.9 mm

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

The chart is valid for:
- Both ends firmly fixed (approx. 350 mm per end)
- 6 to 8 screws per side
- Solid mounting base



Performance Data

The tables contain performance data examples for gear-motor-controller combinations. They are intended as a rough guide for selection. The precise performance data must be calculated for each application case.
For more information on motors, controllers and control systems, please refer to the catalogs “IndraDrive Cs” and “IndraDrive C for Linear Motion Systems.” These figures do not include any assessment of the effective torque of the motor-controller combination.

Drive data without motor (i = 1)

Belt pulley drive diameter	92.2 mm
Max. linear speed	Up to 5 m/s
Belt type	AT 10, 50 mm wide, steel reinforced
Mass moment of inertia	(250 + L (mm) · 0.0123) · 10^{-4} kgm²

Horizontal operation

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		**5**						**10**					
m_{ex}	(kg)	4	12	20	28	36	46	15	55	95	135	175	
t_a	(ms)	120	155	190	215	250	300	175	260	350	435	520	
s_a	(mm)	275	350	420	480	555	665	210	310	420	520	626	
a	(m/s^2)	37	29	24	21	18	15	13.5	9.2	6.9	5.5	4.6	
v_{dc}	(m/s)	4.5						2.4					
*	(mm)	± 0.1											

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

i		**3**					**5**						**10**					
m_{ex}	(kg)	4	8	12	16	20	6	16	36	56	76	96	15	55	95	135	175	195
t_a	(ms)	170	185	210	230	240	275	310	380	340	390	440	476	555	615	690	770	800
s_a	(mm)	430	465	520	570	600	550	615	760	505	585	660	476	555	615	690	770	800
a	(m/s^2)	29	27	24	22	21	14.5	13	10.5	8.9	7.7	6.8	4.2	3.6	3.25	2.9	2.6	2.5
v_{dc}	(m/s)						4			3			2					
*	(mm)	± 0.1																

Vertical operation (frame stationary, carriage travels)

MSK 060C, HCS02.1E-W0054, 3 x 400 V

i		**5**					**10**						
m_{ex}	(kg)	6	12	20	30	36	15	25	35	45	55	75	95
t_a	(ms)	140	190	423	205	250	210	260	320	410	520	370	835
s_a	(mm)	315	420	545	310	375	250	310	385	490	625	185	420
a	(m/s^2)	32	24	18.5	14.5	12	11.5	9.3	7.5	5.9	4.6	2.7	1.2
v_{dc}	(m/s)				3		2.4					1	
*	(mm)	± 0.1											

MSK 076 C, HCS02.1E-W0054, 3 x 400 V

i		**3**				**5**					**10**				
m_{ex}	(kg)	4	8	12	16	6	12	22	30	36	15	35	55	75	95
t_a	(ms)	180	210	240	265	220	265	310	366	417	280	375	540	870	1800
s_a	(mm)	445	520	595	655	330	395	465	550	625	140	190	270	435	910
a	(m/s^2)	28	24	21	19	13.6	11.4	9.7	8.2	7.2	3.56	2.66	1.85	1.15	0.55
v_{dc}	(m/s)						3				1				
*	(mm)	± 0.1													

a = acceleration (m/s^2)
i = gear reduction (-)
m_{ex} = mass (kg)
s_a = acceleration travel (mm)
t_a = acceleration time (ms)
v_{dc} = travel speed (m/s)
* = reproducibility (mm)

MSK = servo motor
HCS = digital controller

Linear Modules MKR 25-145

Linear Modules MKR 25-145 Components and Ordering Data

Part number, length R1146 200 10, ... mm			Guideway	Drive unit					Carriage	
Version	Slots for cable duct, left (L)	Slots for cable duct, right (R)		Drive journal	Reduction i = 1 1)	1 2)	3	5	10	L_{ca} = 400 mm	
W/o drive unit (OA)	OA01		01	Without 50	–					10	
With drive unit (MA), without gear reducer i = 1	MA01	MA11	01	Right	01	03	–			05	
	MA02	MA12	01	Left	01	03	–				
	MA03	MA13	01	On both sides	02	04	–				
With external gear reducer (MG)	MG01	MG03	01	Gear unit	–	–	10			05	
	MG02	MG04		With 2nd journal	–	–	11			05	
With integrated LPB gear reducer (MG)	MG05	MG07	01	Integrated gear unit	–	–	20			05	
	MG06	MG08									

Ordering example: see “Inquiry/Order”

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

L_{ca} = carriage length

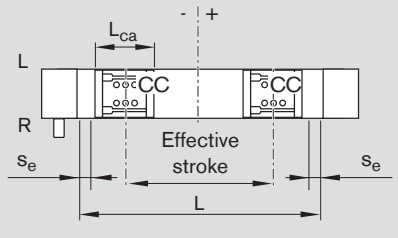
1) Without keyway
2) With keyway
3) Attachment kit also available without motor (when ordering: enter “00” for motor)

Motor attachment			Motor		Switches / Cable duct / Socket-plug	Documentation	
Reduction i =	Attachment kit[3] with gear reducer	for motor	without Brake	with Brake		Standard report	Measurement report
–	00	–	00		**Without switch and cable duct** 00	01	02 Friction moment 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		
–	00	–					
–	00	–			**Cable duct (loose)** – Length 20, ... mm		
i = 3	06	**MSK 060C**	90	91	**External socket/plug (loose)** 17		
i = 5	16						
i = 10	26						
i = 3	02	**MSK 076C**	92	93	**External switching cam** 16		
i = 5	11						
i = 10	21						
i = 3	05	**MSK 060C**	90	91			
i = 5	15						
i = 10	25						
i = 3	04	**MSK 076C**	92	93			
i = 5	14						
i = 10	24						

Length L

$$L = (\text{effective stroke} + 2 \cdot \text{excess travel } s_e) + 40 \text{ mm} + L_{ca}$$

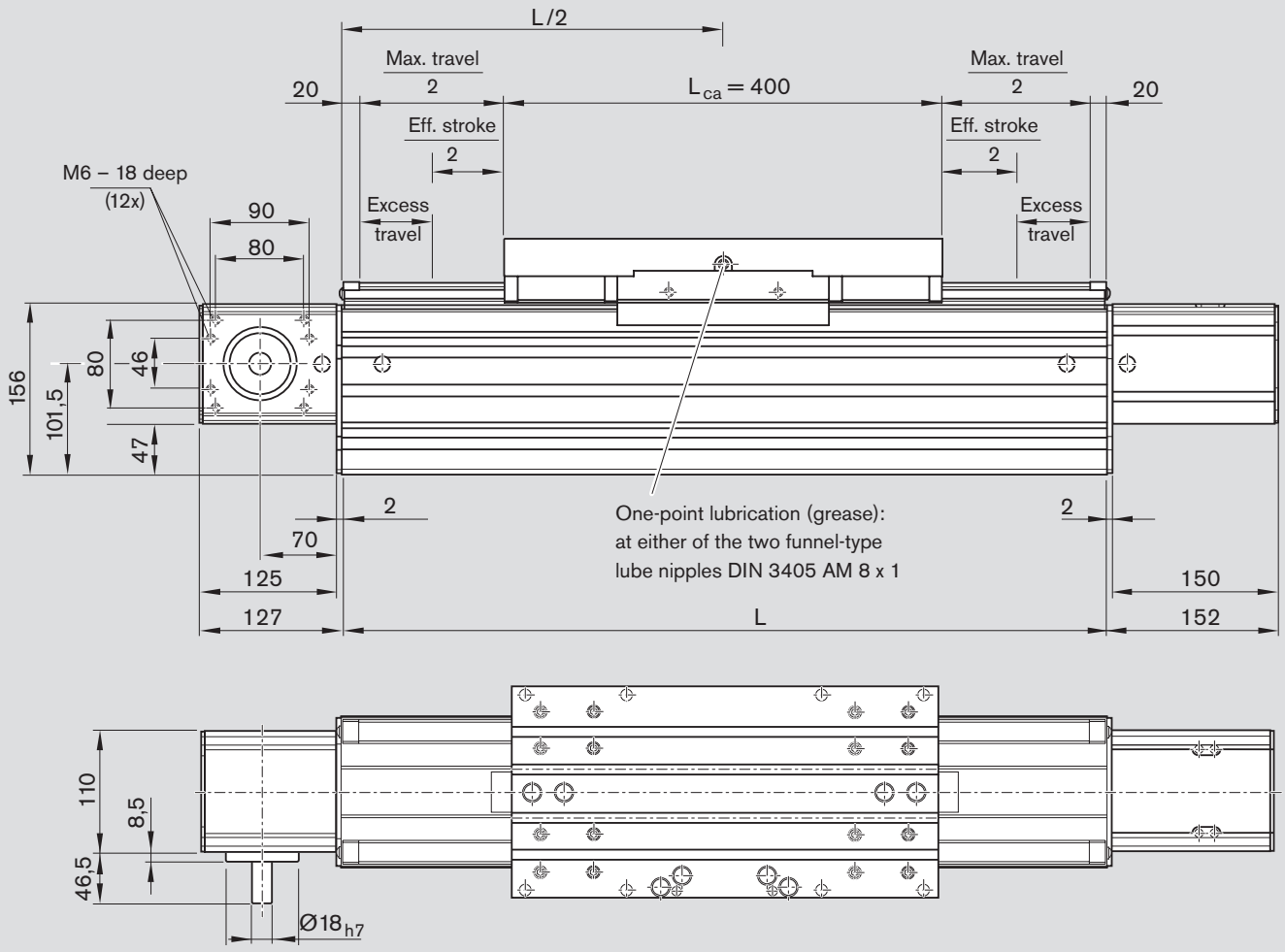
Effective stroke = maximum travel of carriage center (CC) between the outermost switch activation points.
The excess travel s_e must be longer than the braking distance. The acceleration travel can be taken as a guideline value for the braking distance.



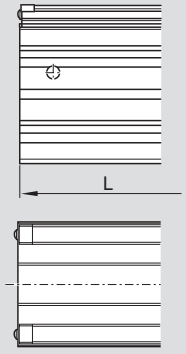
Linear Modules MKR 25-145

Linear Modules MKR 25-145 Dimensions

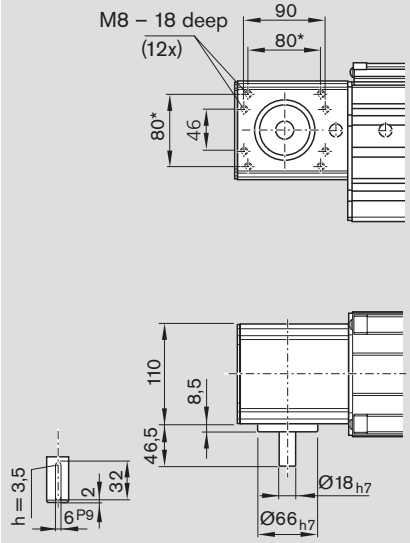
All dimensions in mm
Drawings not to scale



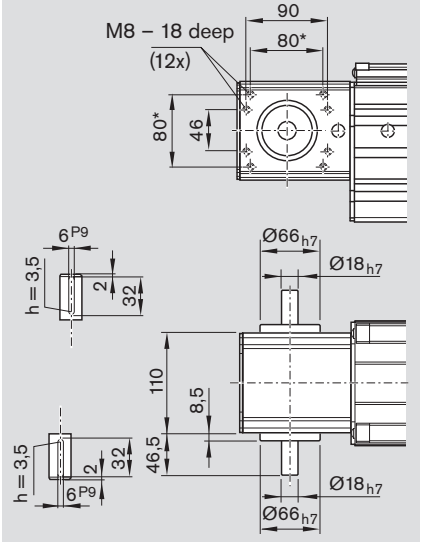
OA01

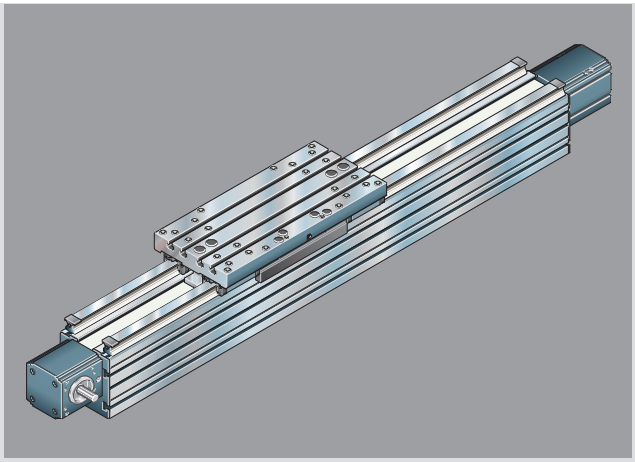


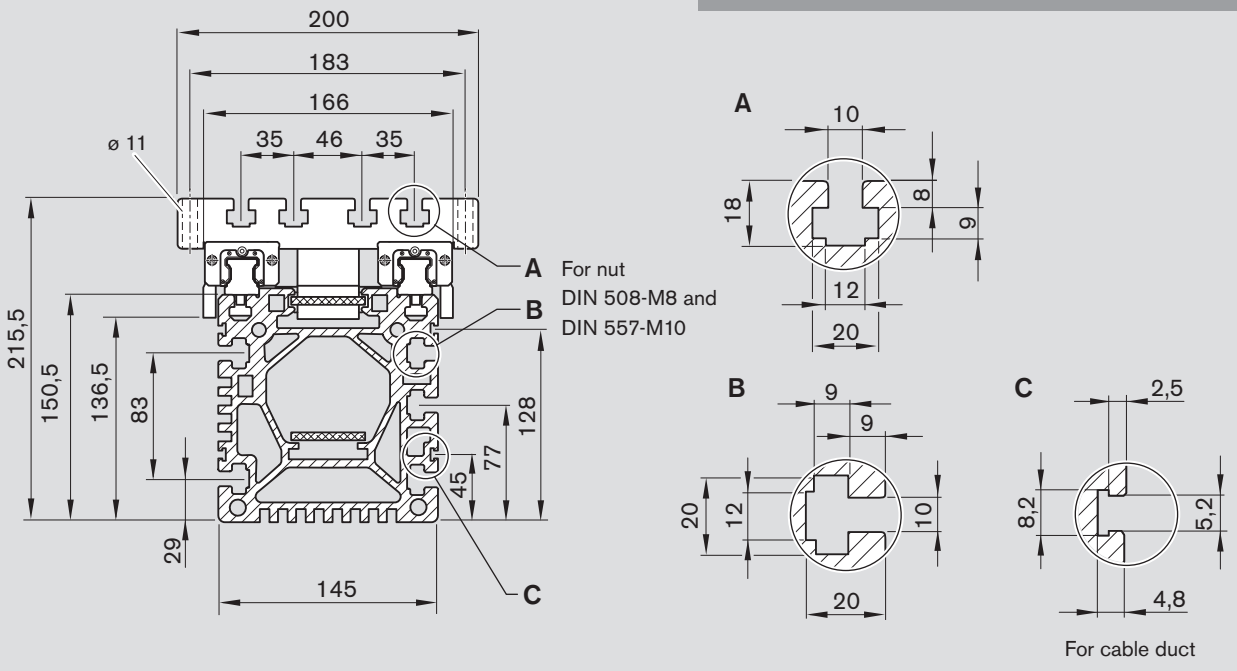
MA01, MA02, MA11, MA12



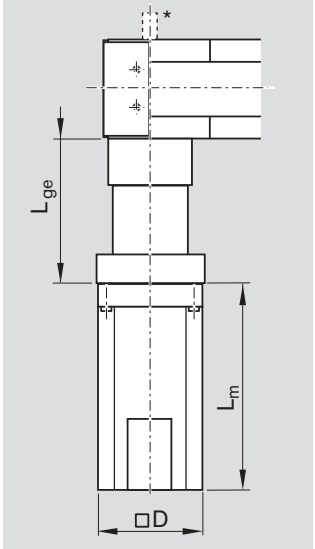
MA03, MA13



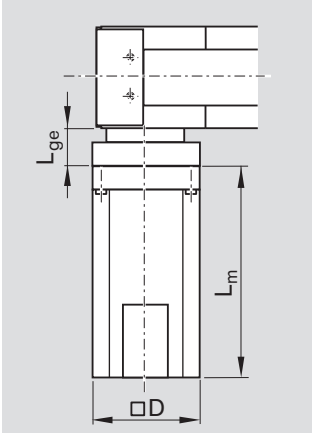




MG01* - MG04*



MG05 - MG08



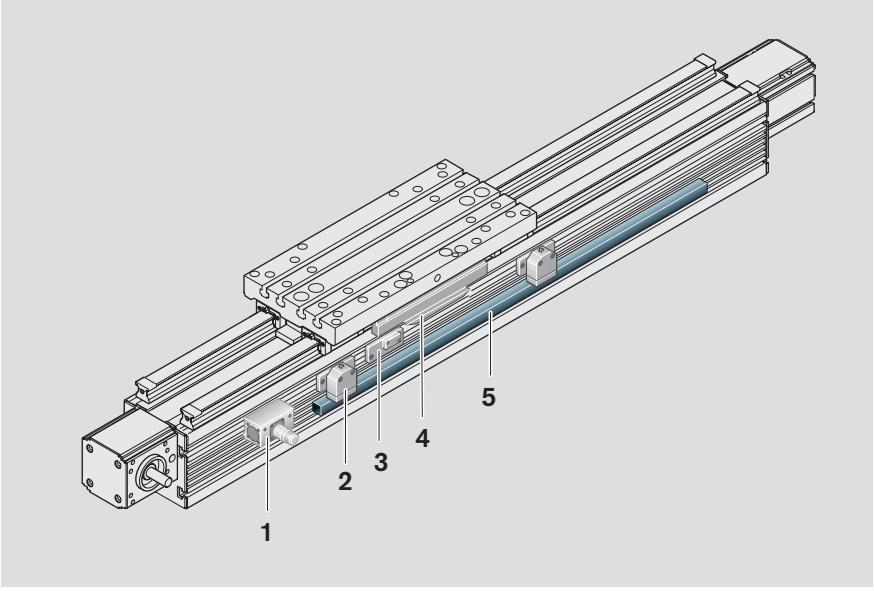
Motor	Dimensions (mm)				
	Gear unit		Motor		
	L_{ge}		D		L_m
	MG01 - MG04	MG05 - MG08		without brake	with brake
MSK 060C	162	50	116	226.0	259.0
MSK 076C	172	60	140	292.5	292.5

* For drive unit Option 11: second journal Ø18 x 43

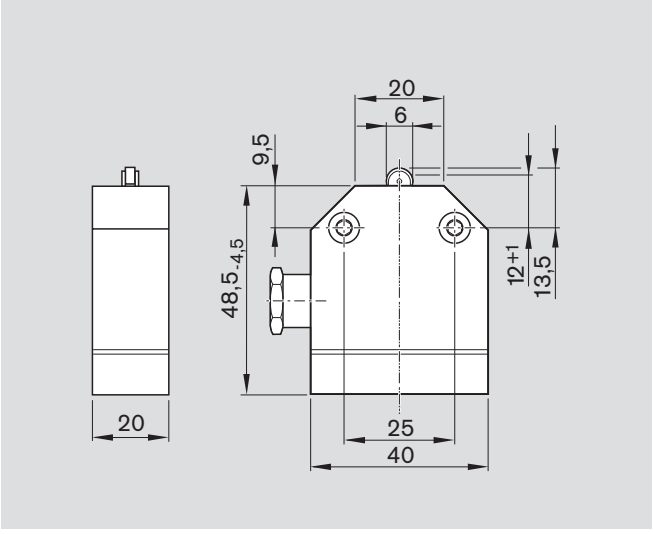
Switching System MKR 25-145

Overview of the switching system MKR 25-145

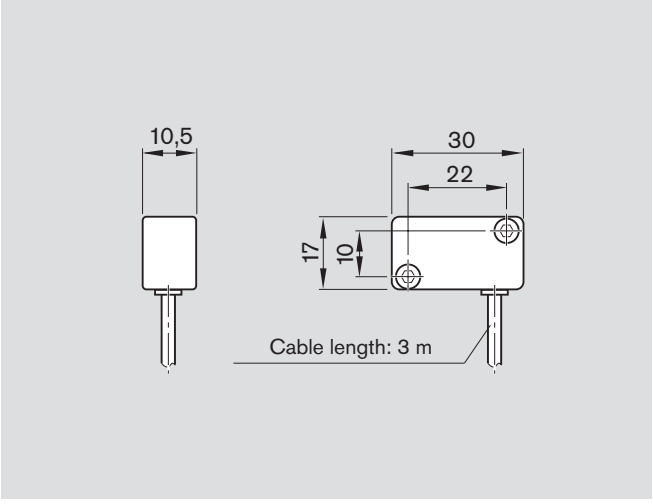
1 Socket with plug
2 Mechanical switch (with mounting accessories)
3 Proximity switch (with mounting accessories)
4 Switching cam
5 Cable duct (aluminum alloy)



Mechanical switch (technical data)	
Repeatability	± 0.05 mm
Permissible ambient temperature	–5 °C to +80 °C
Protection class	DIN 40050 IP 67
Bounce time	< 2 ms
Insulation class	Group C as per VDE 0110
Rated voltage	250 V AC
Continuous current	5 A
Switching capacity at 220 V, 40–60 Hz	cosφ = 0.8 at 2 A
Contact resistance when new	< 240 mΩ
Connection type	Screw connector
Contact system	Single-pole changeover
Switching system	Snap-action
B_{10d} as per EN ISO 13849-1	1 000 000 switching cycles



Proximity switch (technical data) Miniature circuit-breaker with potted cable (3 x 0.14 mm² Unitronic)	
Housing form	NO
Minisensor	Form A DIN 41635
Operating voltage	10 ... 30 V DC
Residual ripple	≤ 10%
Load	200 mA
No-load current	≤ 20 mA
Switching frequency	max. 1500 Hz
Temperature-related shift in make point	≤ 4 µm/K
Output signal steepness	≥ 1 V/µs
Repeatability of make point per EN 50008	≤ 0.1 mm
$MTTF_d$ as per EN ISO 13849-1	30 – 100 years

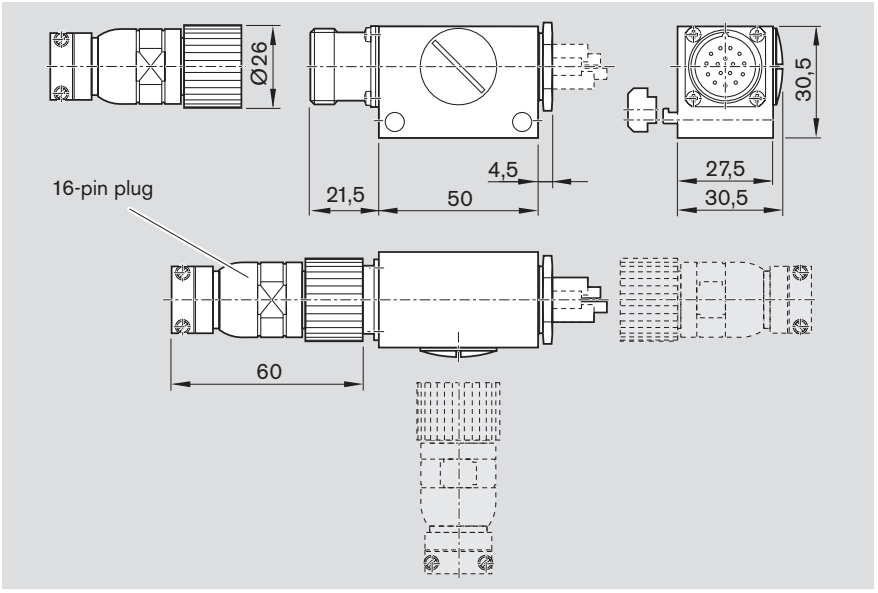


Socket and plug

- Attach the socket at the end with the most switches.

The socket and plug have 16 pins.
The socket and switch are not pre-wired. The switch activation points can thus be optimized during start-up. A plug is provided.

The plug can be mounted in three directions (see diagram).

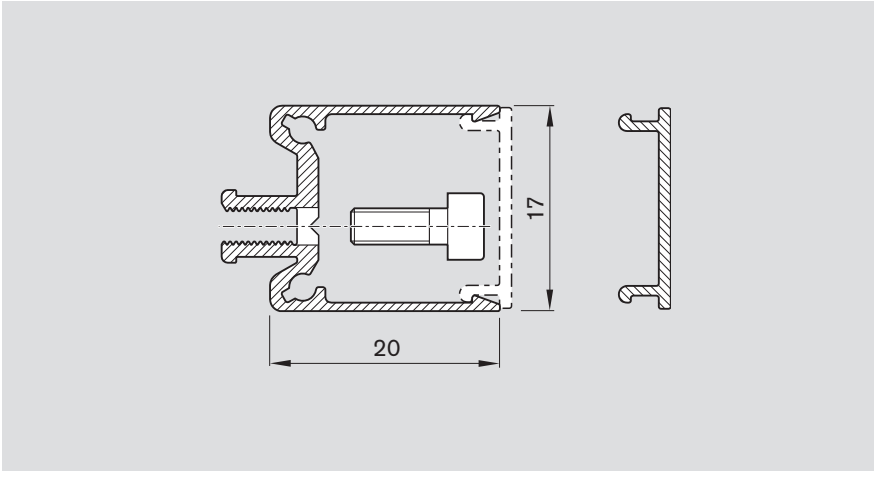


Cable duct

- The cable duct is fastened in the T-slots on the side of the frame. Fastening screws widen the profile and give the cable duct a secure hold.

For the slot position, see “Components and Ordering Data” tables and “Dimensions”.
The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches.

Fastening screws and cable grommets are included.



Ordering the switches and accessories

Item		Frame size -145
1	Socket-plug	R1175 001 53
2	Mechanical switch with accessories	R1175 201 51
	Mechanical switch alone	R3453 040 16
3	Proximity switch	
	– Accessories without switch	R1175 201 50
	– PNP NC	R3453 040 01
	– NPN NC	R3453 040 02
	– PNP NO	R3453 040 03
	– NPN NO	R3453 040 04
4	Switching cam	R1175 001 50
5	Cable duct	R0396 620 17

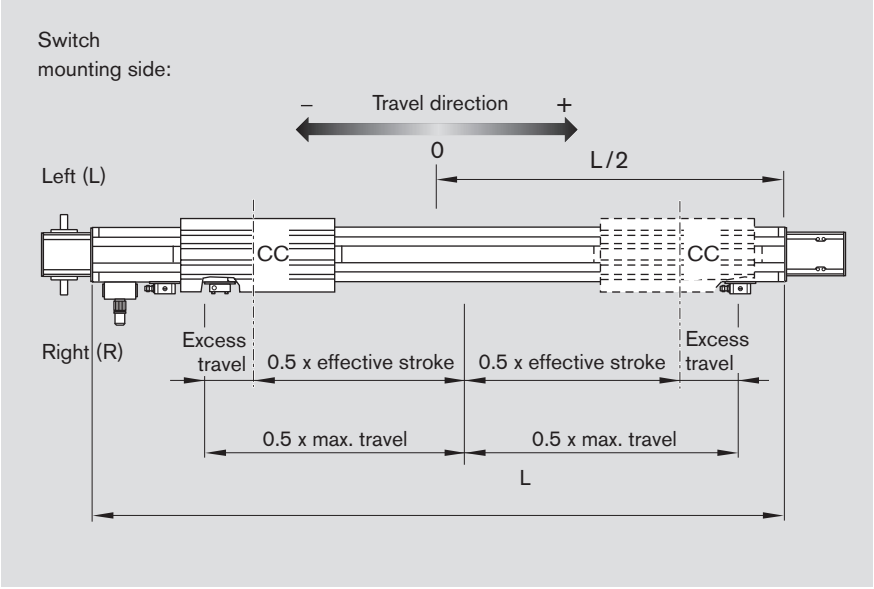
Switching System MKR 25-145

Switch mounting arrangements MKR 25-145

Mechanical and proximity switches
Switching distance: The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).

Mounting example
Example for a mechanical limit switch (provided the zero point is at L/2):
Maximum switching distance =
= 0.5 x (max. travel) – excess travel
= 0.5 x effective stroke

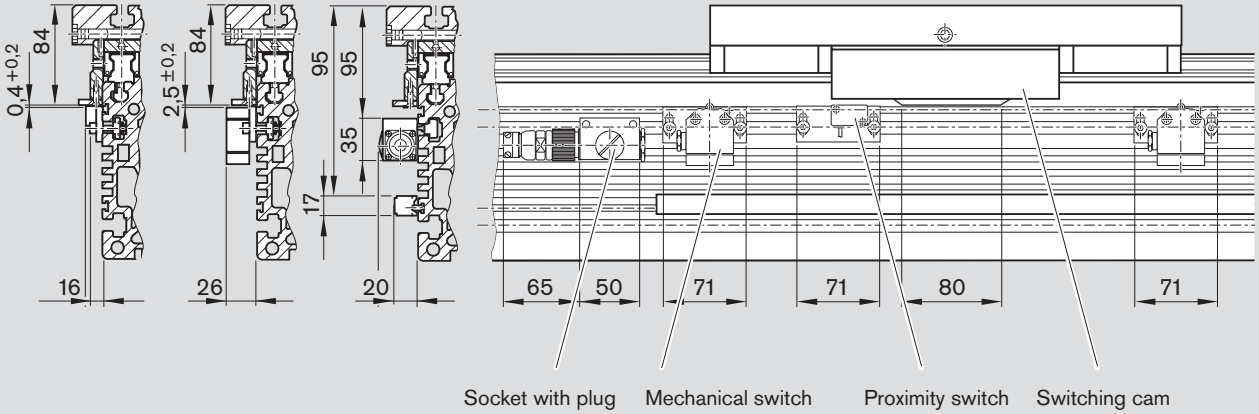
For safe operation of the Linear Module, the excess travel must be longer than the braking distance.
Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch
Slide the mounting plates with switches into the slot and fix with two socket head cap screws.



Take note of the minimum switching distance (determined by the mounting plates):

mechanical-mechanical	= 62 mm
mechanical-proximity	= 49 mm
proximity-proximity	= 35 mm

The switches and socket-plug are mounted in the upper T-slots of the frame and activated by a switching cam on the carriage.



Robotic Erector System for Linear Modules/Linear Modules

General Product Description

In the past, machine manufacturers themselves have had to devise, design and fabricate systems to install or mount and connect linear modules with precision ball screw assemblies or toothed belt drives.

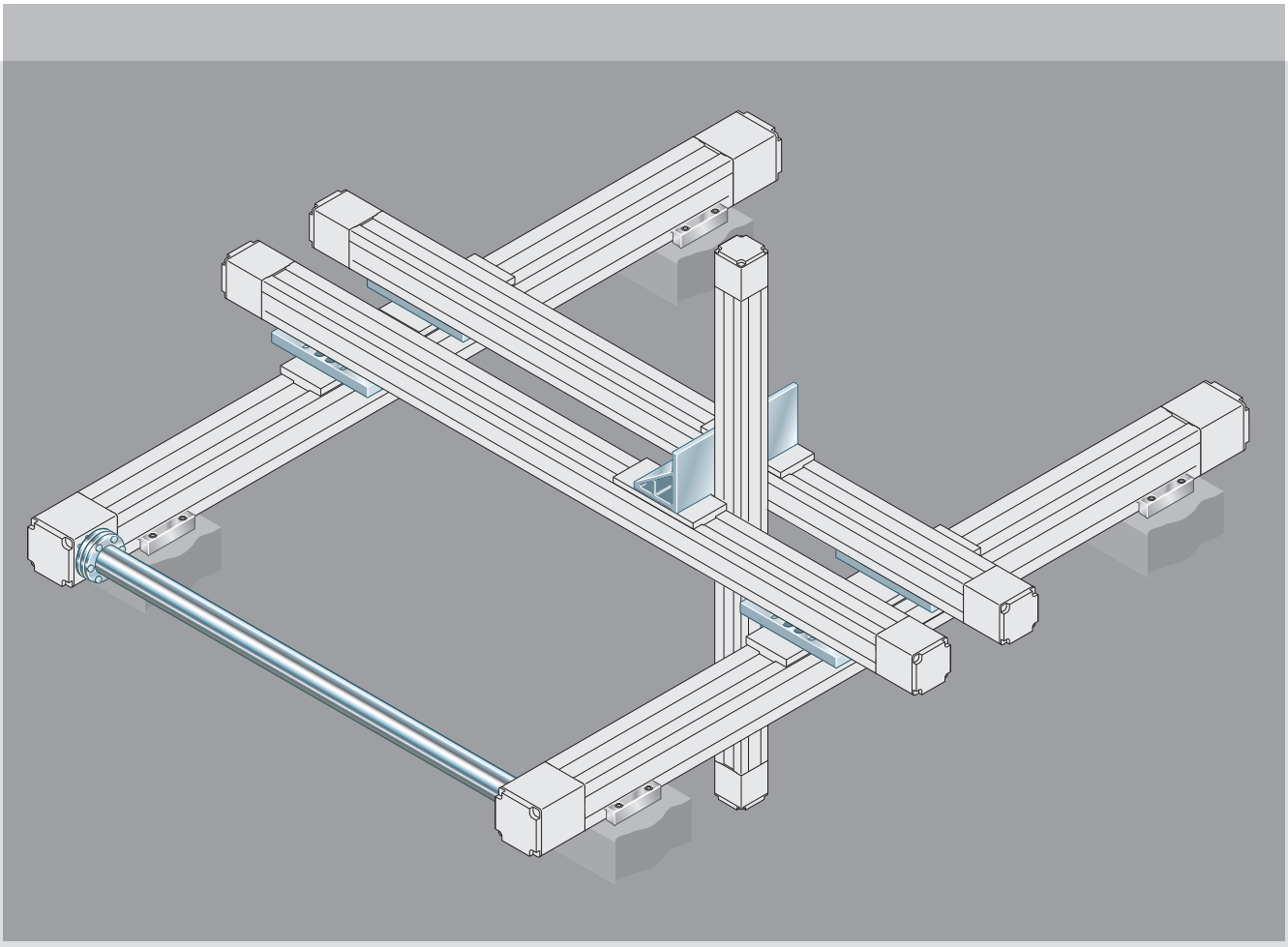
The Robotic Erector System for linear modules facilitates these tasks and brings savings for the user, since the system comprises mass-produced standardized components.

As a result, users can respond flexibly to the varied requirements and uses of linear motion technology.

The system offers various possibilities to construct two or three axes from Linear Modules and connectors.

The basic elements (plates and brackets) have been designed to allow modules to be connected to other modules of the same size or one size larger or smaller. Connecting shafts meet the high requirements for parallel operation of two linear modules with toothed belt drive.

The range also includes purpose-designed mounting accessories. The linear modules and the connecting elements combine to form the Robotic Erector System.

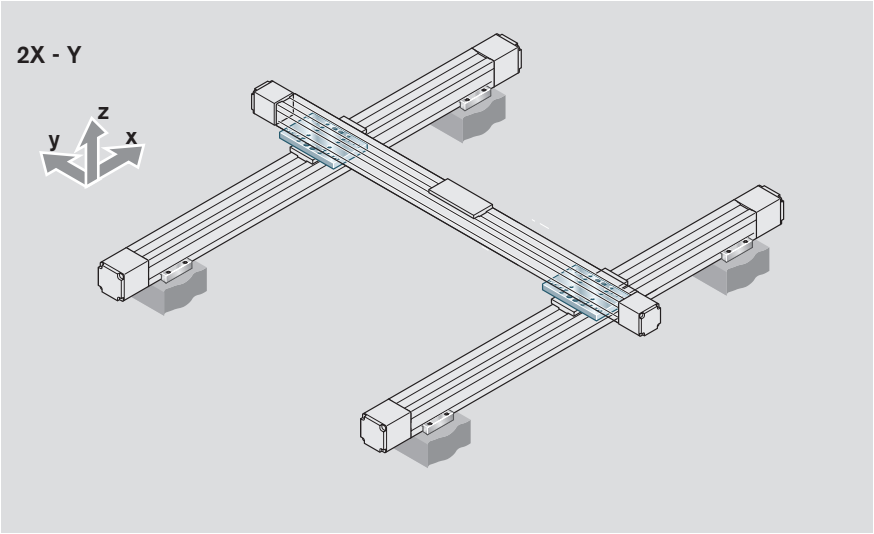


Robotic Erector System for Linear Modules/Linear Modules

Configuration Options

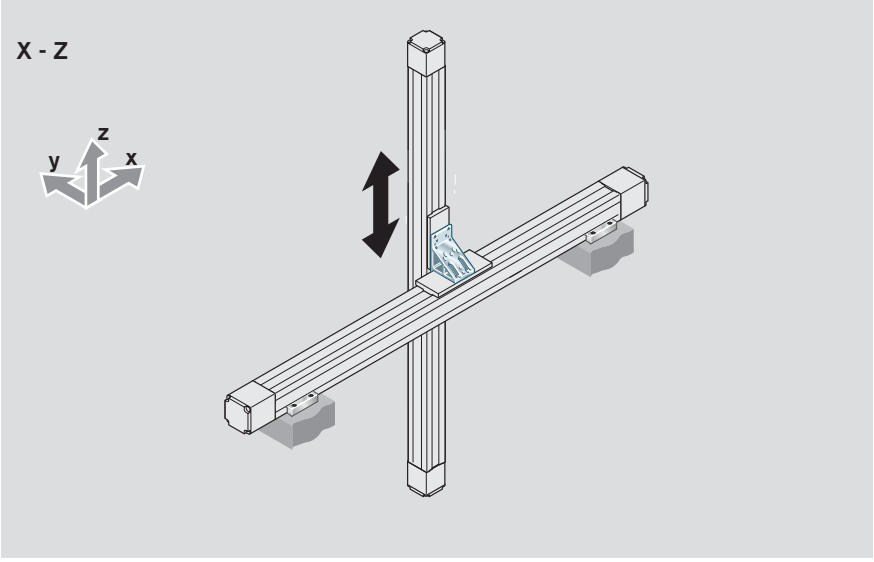
2 axes

Connectors:
2 connection plates



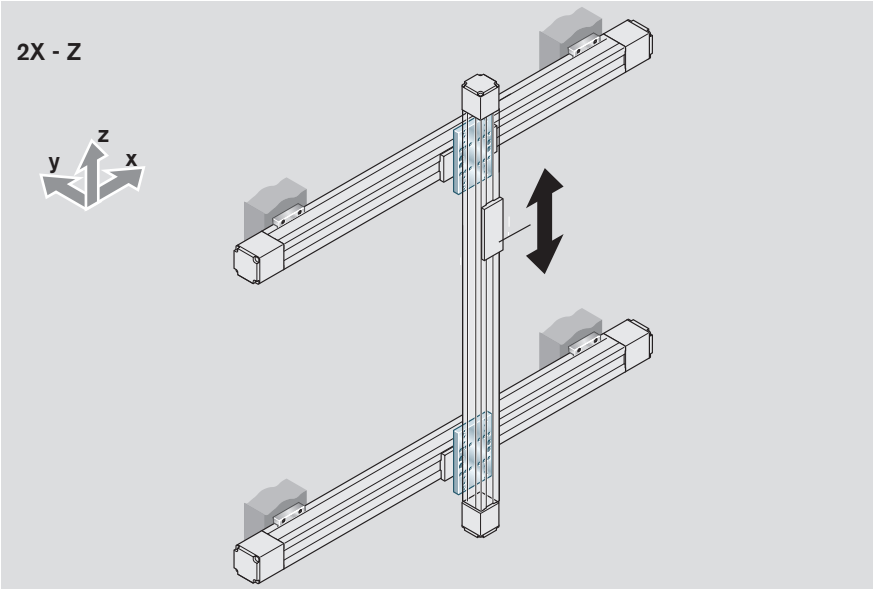
Linear module traverses in the Z-axis.

Connectors:
1 connection bracket



Carriage traverses in the Z-axis.

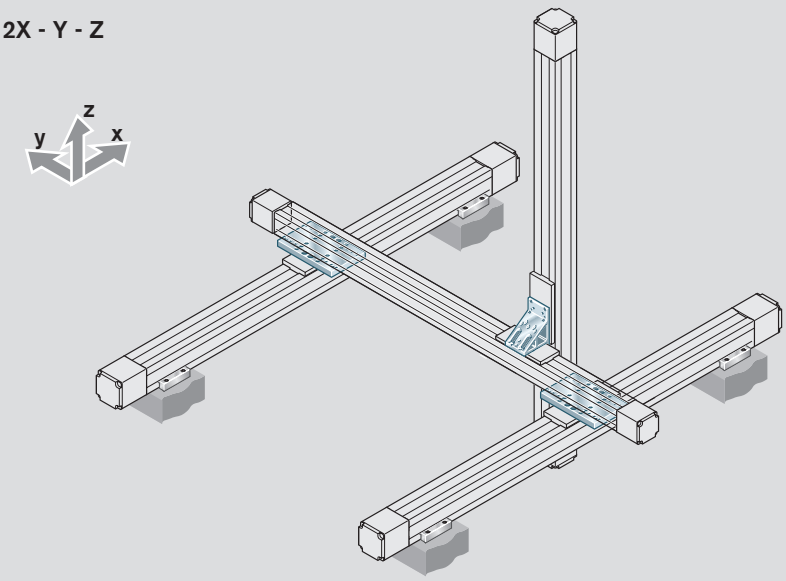
Connectors:
2 connection plates



3 axes

Connectors:
- 2 connection plates
- 1 connection bracket

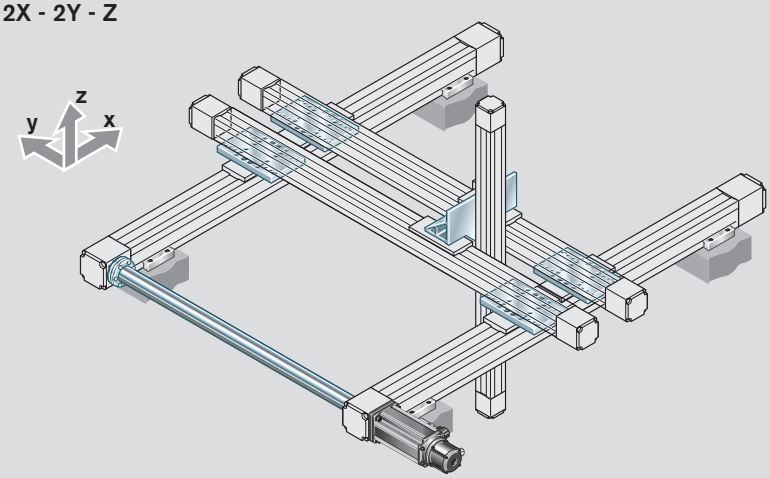
2X - Y - Z



- Torque support for the Y-axis
- Parallel drive, external motor

Connectors:
4 connection plates
1 angle bracket for 3 linear modules
1 connecting shaft

2X - 2Y - Z



Robotic Erector System for Linear Modules/Linear Modules

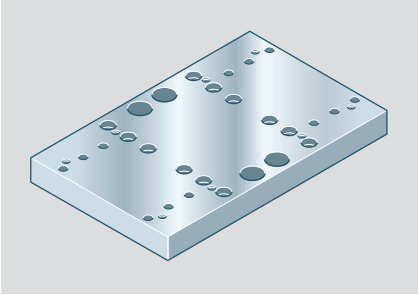
Connection Elements

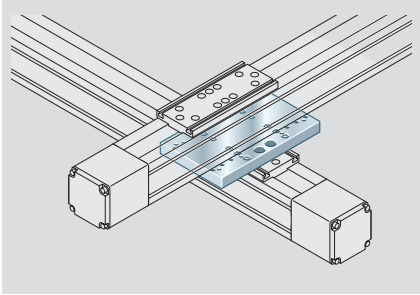
The connectors are mass-produced from a high-strength but lightweight aluminum alloy material that minimizes additional weight and the cost of a system. The connecting shafts are made of steel.

Carriages with T-slots are required to mount the plates and connection brackets.

Plates

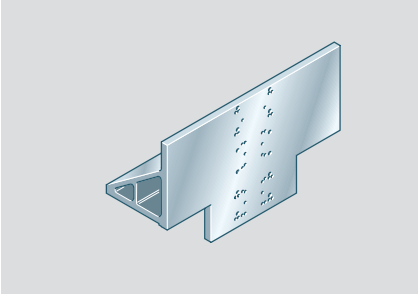
Connection plate
- right-angled joint between two linear modules
- frame to carriage mounting
- aluminum alloy

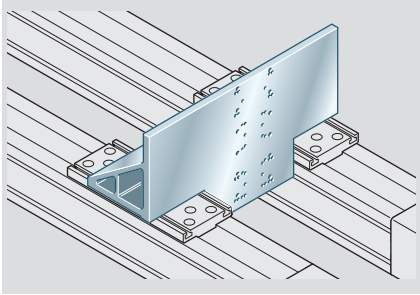




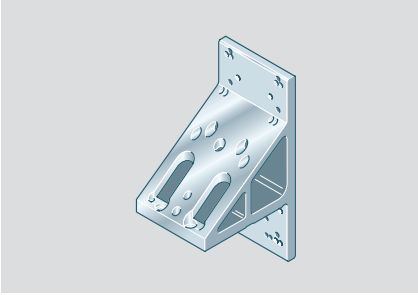
Connection brackets

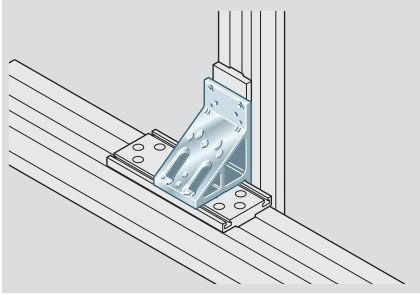
Angle bracket to connect 3 linear modules
- parallel connection between two linear modules
- mounting to carriages
- mounting of Z axes possible
- strengthened by additional ribs





Angle bracket to connect 2 linear modules
- right-angled joint between two linear modules
- carriage to carriage mounting
- carriage to frame mounting
- mounts directly to carriages

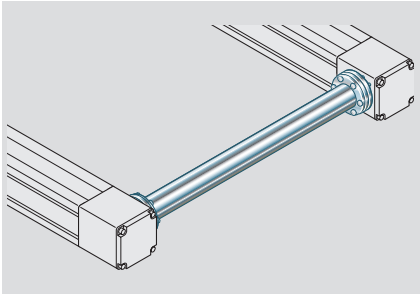




Connecting Shafts

- parallel drive for linear modules
- connecting shafts
  - high rigidity
  - high precision

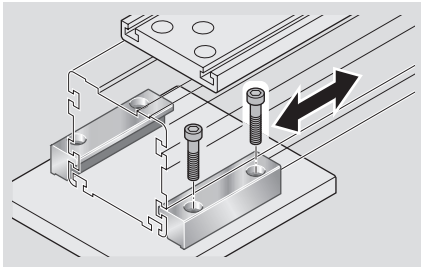


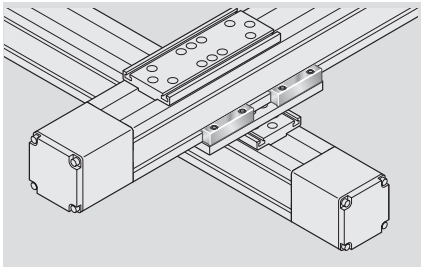


For dimension drawings of the individual connectors, see “Dimensions...”.

Easy mounting to adjacent structures or connection plate by means of clamping fixtures

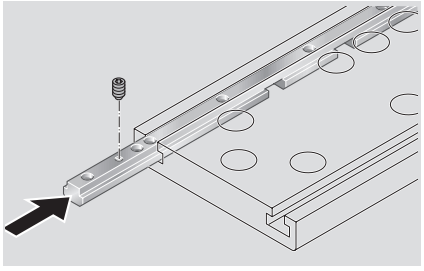
- Simply screw down linear modules.
- Clamping fixtures engage in the T-slots of the frame.
- Equalizes tolerances in longitudinal and transverse direction.

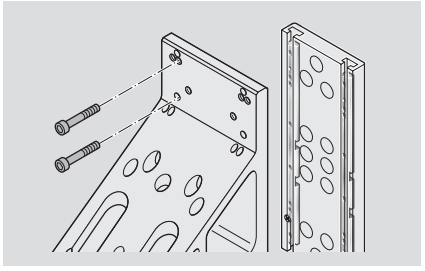




Anchor strips permit rapid and easy assembly using T-slots

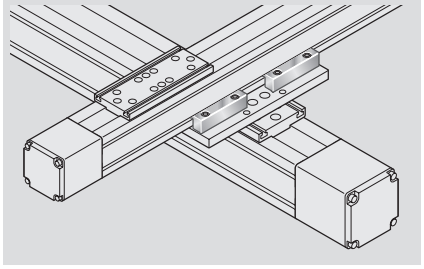
- Insert and adjust the anchor strip.
- Fix in place with set screws, if necessary (i.e., if in vertical position).
- Assemble structure.

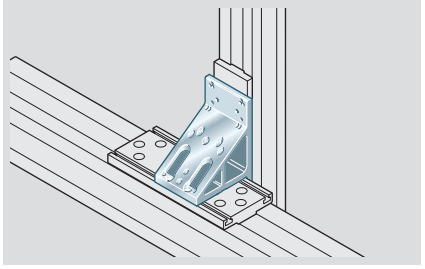


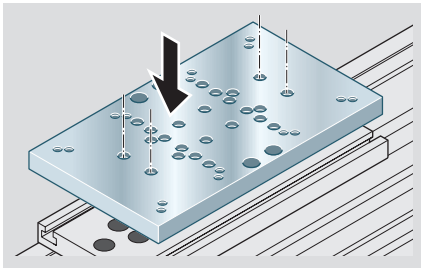


Connection of identical/different module sizes

– MK. 35-165	MK.	35-165
	MK.	25-110
	MLR	10 110
	MK.	25-145
– MK. 25-110 – MLR 10 110	MK.	25-110
	MLR	10 110
	MK.	20 80
	MLR	10 80
	MK.	25-145
–MK. 15-65	MK.	15-65
	MK.	20 80
	MLR	10 80



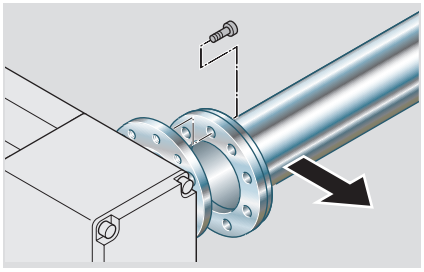




With types MKR and MLR, allows removal of the toothed belt without dismantling the plates or angle brackets.

Mounting/removal of connecting shafts to/from installed linear modules

- Easy adjustment for synchronous parallel operation, as connecting shafts can be turned steplessly into any position.



Robotic Erector System for Linear Modules/Linear Modules

Erecting Robotic Structures

Mounting of Linear Modules with Rexroth mounting components

Connection of Linear Module		to Linear Module
MKK 35-165 MKR 35-165	>	MKK 35-165 MKR 35-165

Identification system for part numbers
Example:

Connection plate
R0391 210 03

Part number of individual component

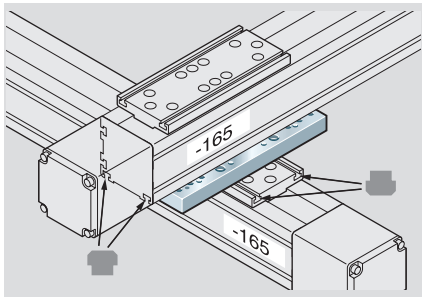
Part number of the complete assembly kit including mounting accessories (in this case: including anchor strips and screws as per DIN)

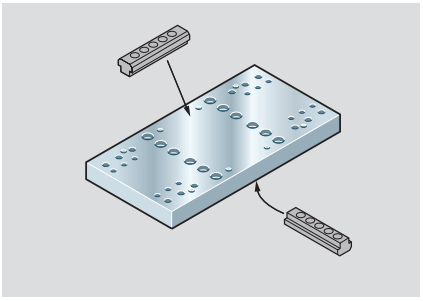
Complete assembly kit: R0391 200 00

Connection plate R0391 210 03

Complete assembly kit: R0391 200 00

Mounting using threaded anchor strips.

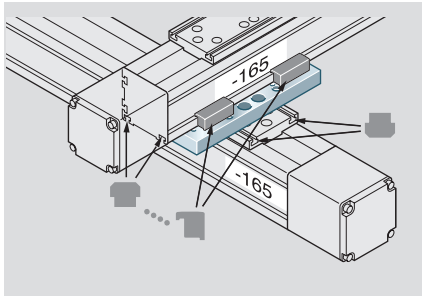


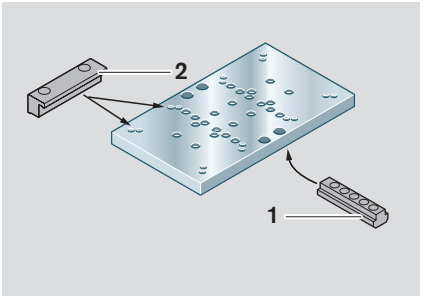


Connection plate R0391 210 62

Complete assembly kit: R0391 200 50

Anchor strips (1) fixable with set screws.
Mounting using clamping fixtures (2).



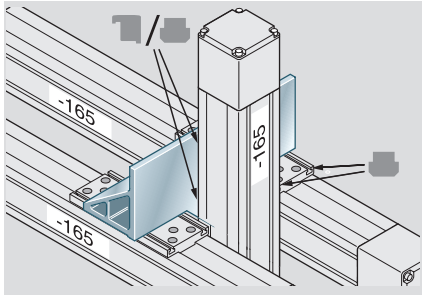


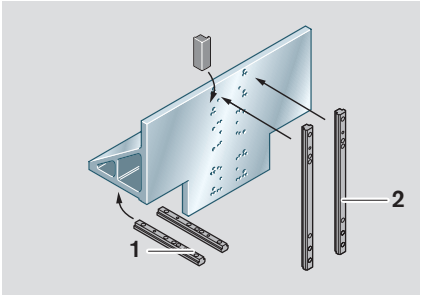
Angle bracket R0391 150 02

– on carriage with anchor strips
Complete assembly kit: R0391 100 65

Anchor strips (1) + (2) fixable with set screws.

– on frame with clamping fixtures
Complete assembly kit: R0391 100 66

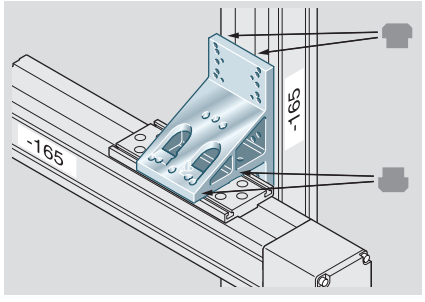


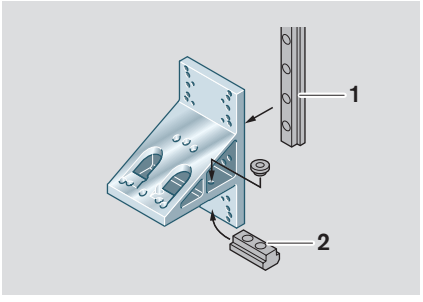


Angle bracket R0391 150 01

Complete assembly kit: R0391 100 50

Anchor strips (1) + T-nuts (2) fixable with set screws.





Symbols used

Anchor strip or T-nut

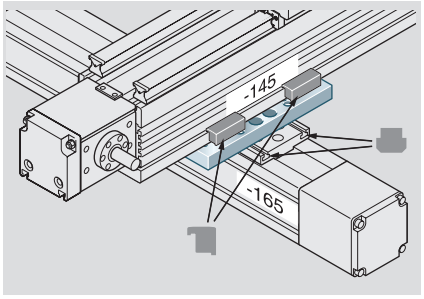
Clamping fixture

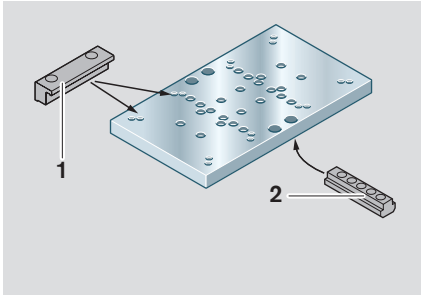
Connection of Linear Module		to Linear Module
MKK 35-165 MKR 35-165	>	MKK 25-145 MKR 25-145

Connection plate R0391 210 62

Complete assembly kit: R0391 200 51

- Mounting using clamping fixtures (1).
- Mounting using threaded anchor strips (2).



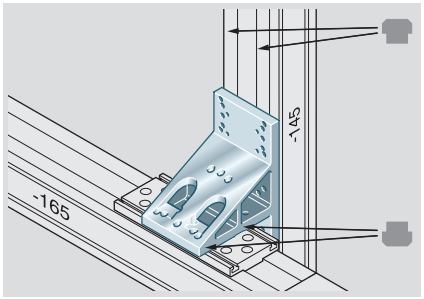


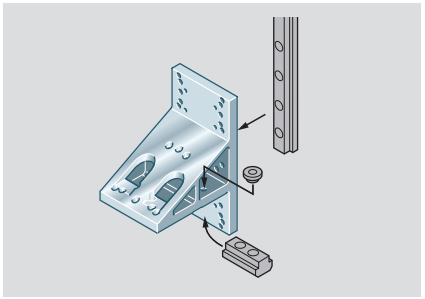
Angle bracket R0391 150 01

Complete assembly kit: R0391 100 51

- Anchor strips (1) + T-nuts (2) fixable with set screws.

Note
For precise details of the Rexroth mounting accessories, see “Mounting Accessories” and “Mounting”.





Robotic Erector System for Linear Modules/Linear Modules

Erecting Robotic Structures

Mounting of Linear Modules with Rexroth mounting components

Connection of Linear Module		to Linear Module
MKK 35-165 MKR 35-165	>	MKK 25-110 MKR 25-110 MLR 10 110

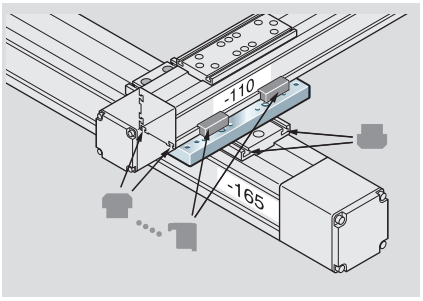
Connection plate R0391 210 03

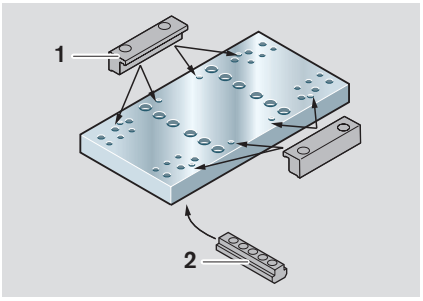
Complete assembly kit: R0391 200 01

Mounting using clamping fixtures (1).

Complete assembly kit: R0391 200 02

Mounting using threaded anchor strips (2).



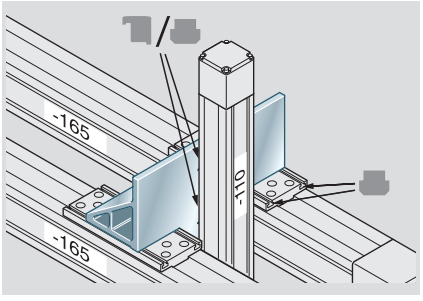


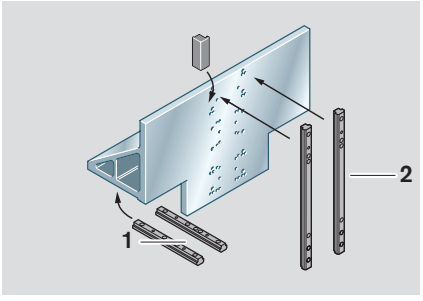
Angle bracket R0391 150 02

– **on carriage with anchor strips**
Complete assembly kit: R0391 100 67

Anchor strips (1) + (2) fixable.

– **on frame with clamping fixtures**
Complete assembly kit: R0391 100 68

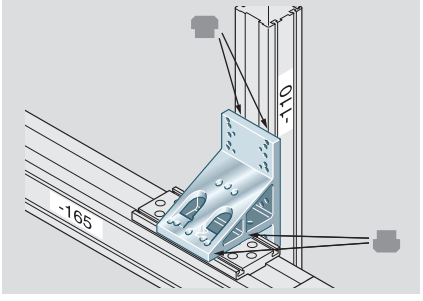


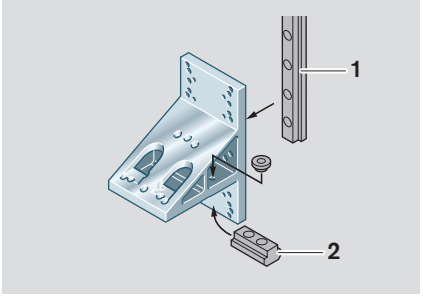


Angle bracket R0391 150 01

Complete assembly kit: R0391 100 52

Anchor strips (1) + T-nuts (2) fixable with set screws.





Symbols used

Anchor strip or T-nut

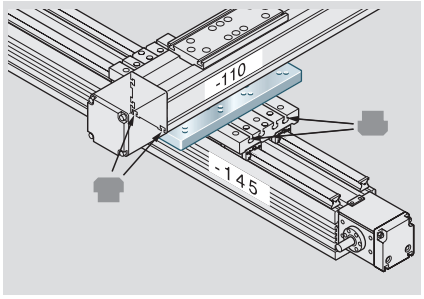
Clamping fixture

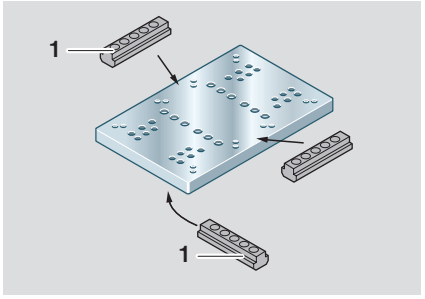
Connection of Linear Module		to Linear Module
MKR 25-145 MKZ 25-145	>	MKK 25-110 MKR 25-110 MLR 10 110

Connection plate R0391 210 61

Complete assembly kit: R0391 200 55

Mounting using threaded anchor strips (1).



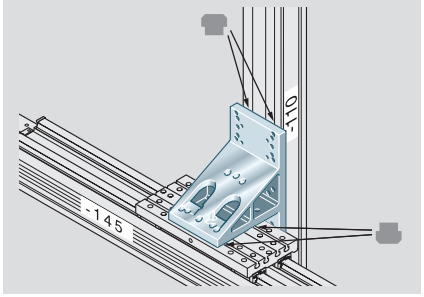


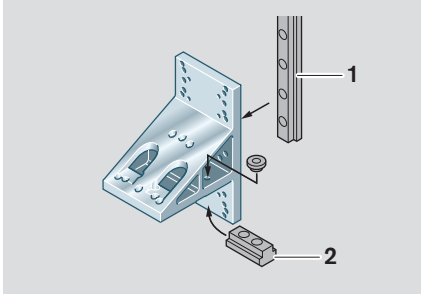
Angle bracket R0391 150 01

– **on carriage with anchor strips**

Complete assembly kit: R0391 100 52

Anchor strips (1) + T-nuts (2) fixable with set screws.





Note
For precise details of the Rexroth mounting accessories, see “Mounting Accessories” and “Mounting”.

Robotic Erector System for Linear Modules/Linear Modules

Erecting Robotic Structures

Mounting of Linear Modules with Rexroth mounting components

Identification system for part numbers (example):

Connection plate
R0391 210 03

Part number of individual component

Complete assembly kit: R0391 200 00

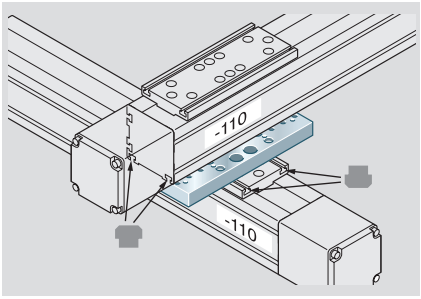
Part number of the complete assembly kit including mounting accessories (in this case: including anchor strips and screws as per DIN)

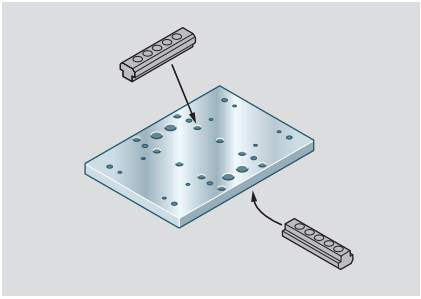
Connection of Linear Module		to Linear Module
MKK 25-110	>	MKK 25-110
MKR 25-110		MKR 25-110
MLR 10-110		MLR 10-110

Connection plate R0391 210 02

Complete assembly kit: R0391 200 03

Mounting using threaded anchor strips.





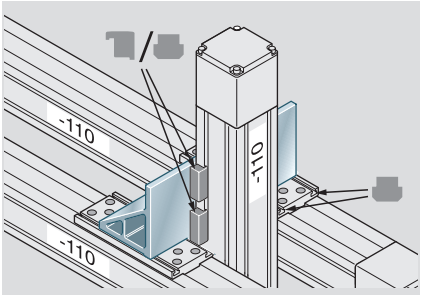
Angle bracket R0391 140 11

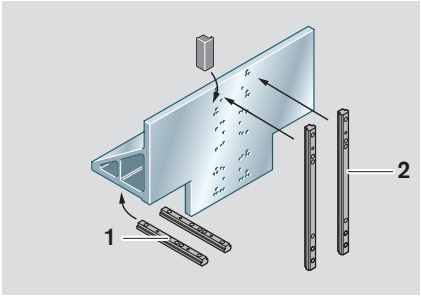
– on carriage with anchor strips
Complete assembly kit: R0391 100 69

Anchor strips (1) + (2) fixable.

– on frame with clamping fixtures
Complete assembly kit: R0391 100 70

Anchor strips (1) fixable.

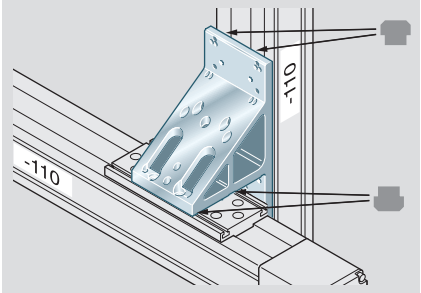


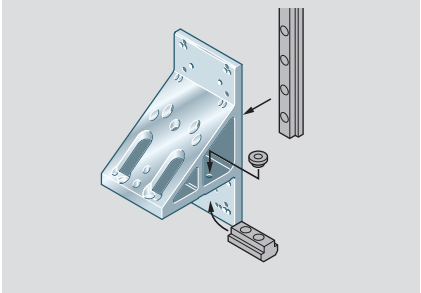


Angle bracket R0391 140 08

– on carriage with anchor strips
Complete assembly kit: R0391 100 53

Anchor strips (1) + T-nuts (2) fixable with set screws.





Symbols used

Anchor strip or T-nut

Clamping fixture

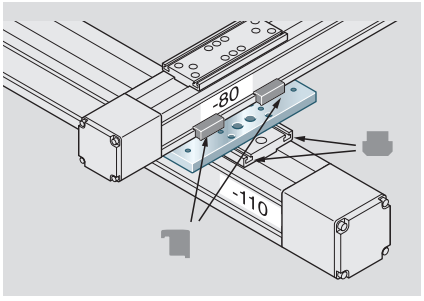
Connection of Linear Module		to Linear Module
MKK 25-110	>	MKK 20 80
MKR 25-110		MKR 25-80
MLR 10-110		MLR 10-80

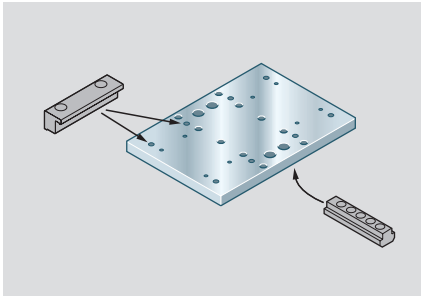
Connection plate R0391 210 02

Complete assembly kit: R0391 200 04

Mounting using clamping fixtures (1).

Mounting using threaded anchor strips (2).





Angle bracket R0391 140 11

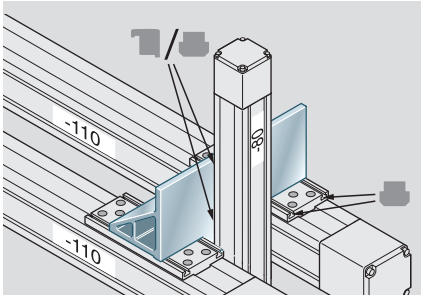
Mounting for frame size -80:
– on carriage with anchor strips

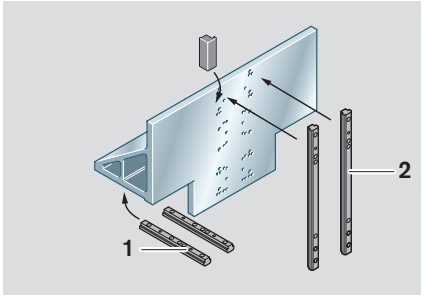
Complete assembly kit: R0391 100 71

Anchor strips (1) + (2) fixable.
– on frame with clamping fixtures

Complete assembly kit: R0391 100 72

Anchor strips (2) fixable.

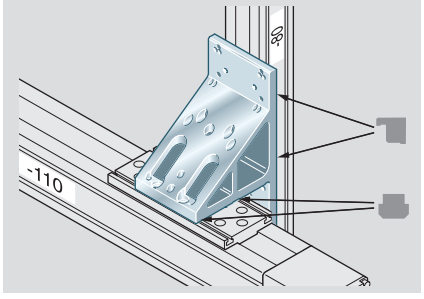


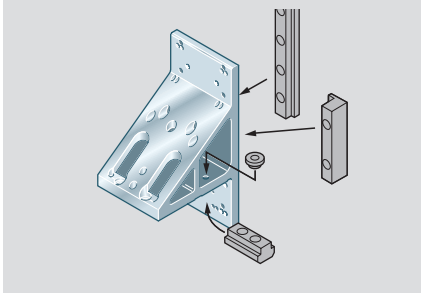


Angle bracket R0391 140 08

Mounting for frame size -80:
– on carriage with anchor strips
Complete assembly kit: R0391 100 54

Anchor strips (1) fixable.
– on frame with clamping fixtures
Complete assembly kit: R0391 100 55





Note
For precise details of the Rexroth mounting accessories, see “Mounting Accessories” and “Mounting”.

Robotic Erector System for Linear Modules/Linear Modules

Identification System for Part Numbers

Identification system for part numbers (example):

Connection plate R0391 210 03

Part number of individual component

Complete assembly kit: R0391 200 00

Part number of the complete assembly kit including mounting accessories (in this case: including anchor strips and screws as per DIN)

Connection plate R0391 210 58

Complete assembly kit: R0391 200 56

- Mounting using clamping fixtures (1).
- Mounting using threaded anchor strips (2).

Angle bracket R0391 140 08

– **Z axis (size -65) with anchor strips on carriage**

Complete assembly kit: R0391 100 58

- Anchor strips (1) + T-nuts (2) fixable with set screws.

– **Z axis (size -80) with anchor strips on carriage**

Complete assembly kit: R0391 100 59

- Anchor strips (1) + T-nuts (2) fixable with set screws.

– **Z axis on frame with clamping fixtures (size -65 and -80)**

Complete assembly kit: R0391 100 60

- Z axis mounted using anchor strips (1) and fixable with set screws.

Connection plate R0391 210 57

Complete assembly kit: R0391 200 57

- Mounting using clamping fixtures (1).
- Mounting using threaded anchor strips (2).

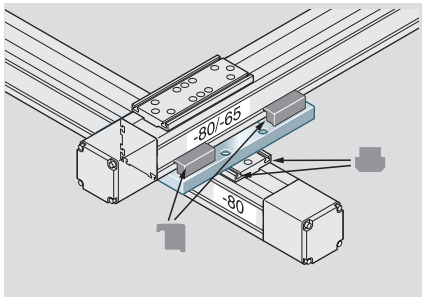
Symbols used

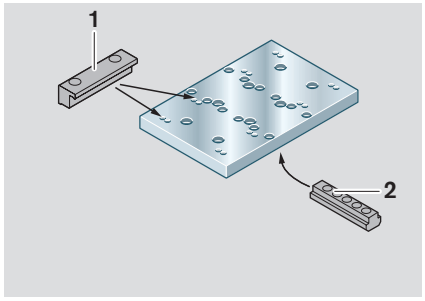
- Anchor strip or T-nut
- Clamping fixture

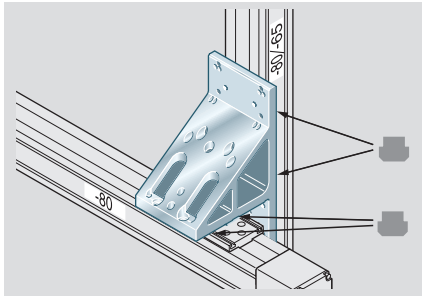
Note

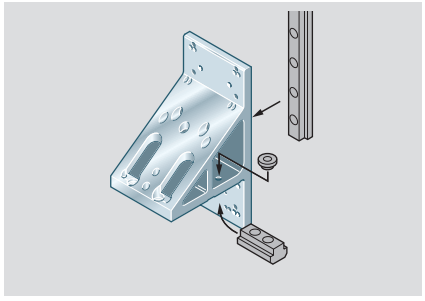
For precise details of the Rexroth mounting accessories, see “Mounting Accessories” and “Mounting”.

Connection of Linear Module		to Linear Module
MKK 20-80 MKR 20-80 MLR 10-80	>	MKK 20-80 MKR 20-80 MLR 10-80 MKK 15-65 MKR 15-65 MKP 15-65

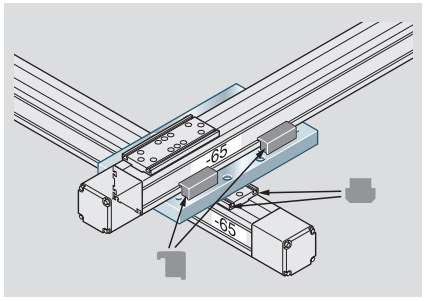


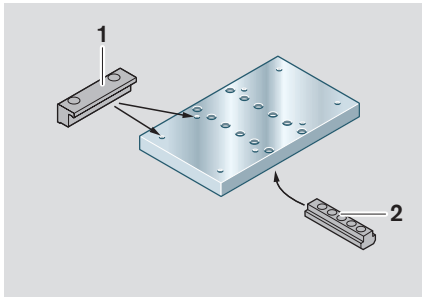






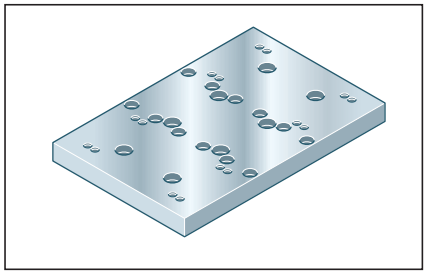
Connection of Linear Module		to Linear Module
MKK 15-65 MKR 15-65 MKP 15-65	>	MKK 15-65 MKR 15-65 MKP 15-65

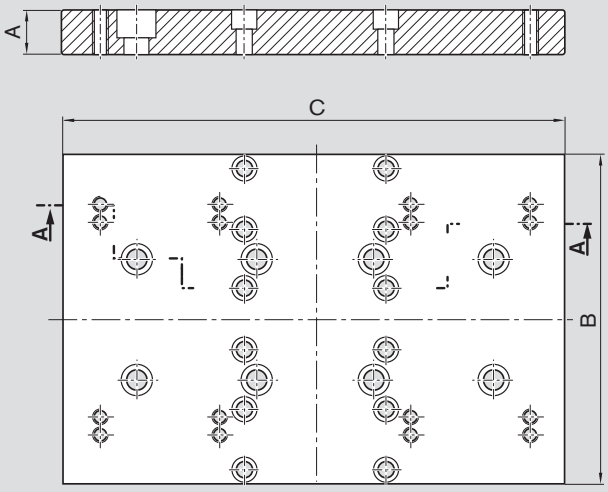




Connection plates

for connection of linear modules
Aluminum alloy, anodized





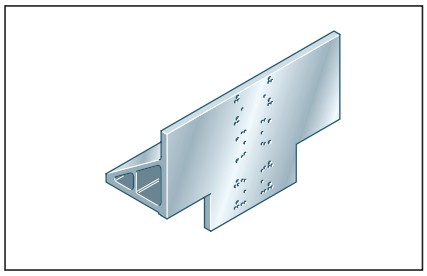
Section A – A

Frame size	Part number	Dimensions			Weight
		A (mm)	B (mm)	C (mm)	(kg)
-65 / -65	R0391 210 57	18	115	196	1.20
-80 / -65	R0391 210 58	18	138	210	1.45
-110/ -80	R0391 210 02	18	138	220	1.50
-110/ -165	R0391 210 03	25	163	320	3.50
-145/ -110	R0391 210 61	25	230	360	5.60
-145/ -165	R0391 210 62	25	240	410	6.70

Robotic Erector System for Linear Modules/Linear Modules

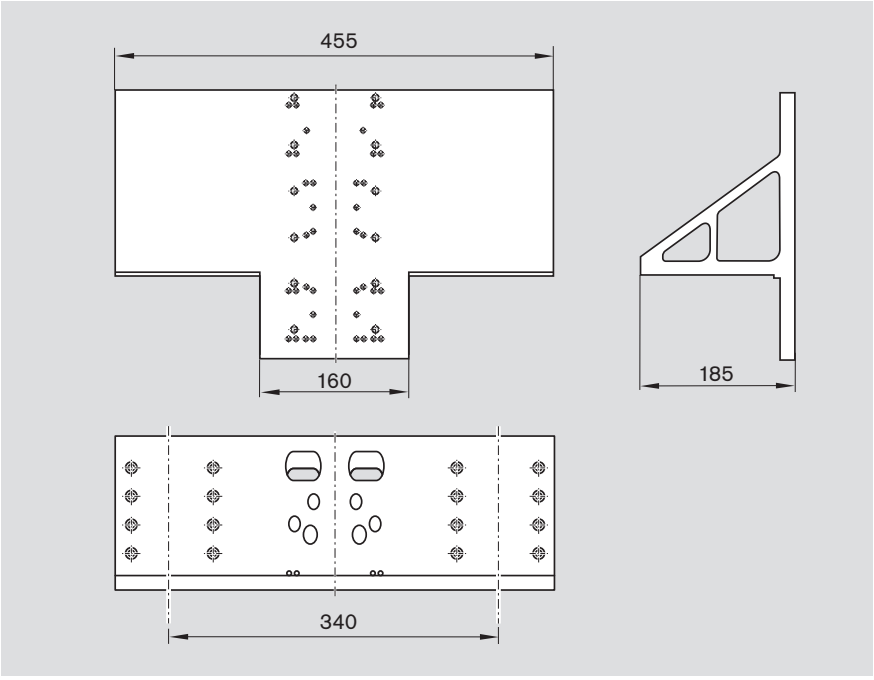
Angle Brackets

Dimensions



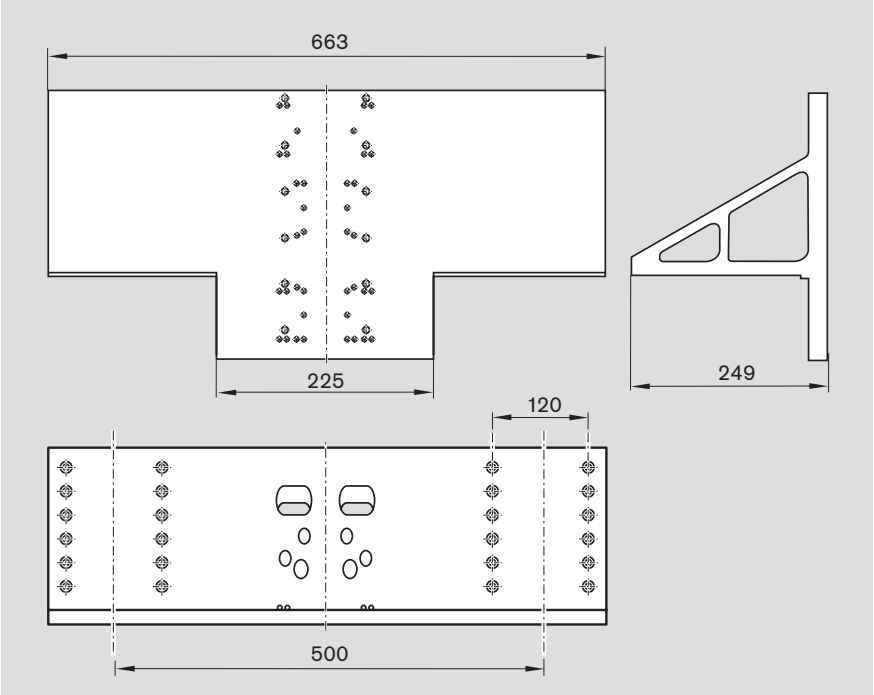
Angle bracket R0391 140 11

for connecting 3 linear modules with frame sizes -110 and -80
Fabricated aluminum alloy



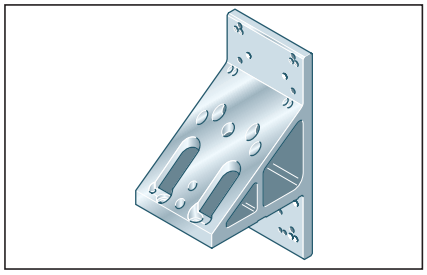
Angle bracket R0391 150 02

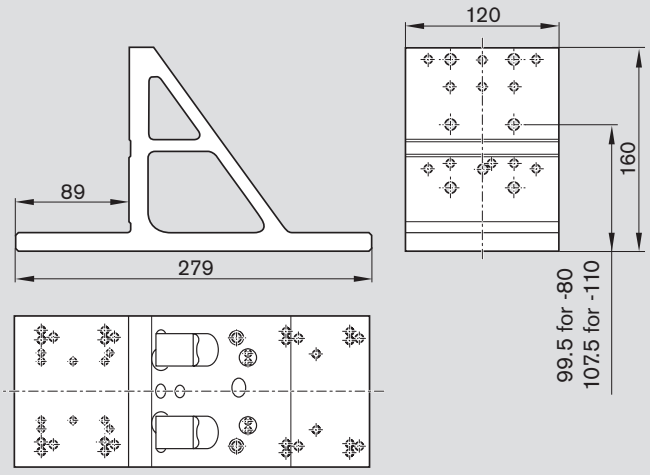
for connecting 3 linear modules with frame sizes 2x -165 and 1x -110 or 2x -165 and 1x -165
Fabricated aluminum alloy



Angle bracket
R0391 140 08

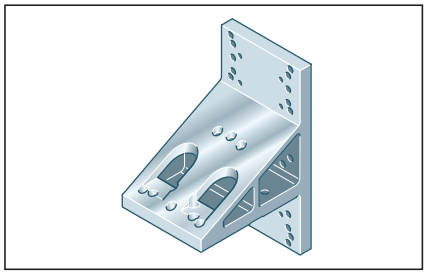
for all linear modules with frame sizes
-110, -80 and -65
Fabricated aluminum alloy, anodized
Weight approx. 2.5 kg

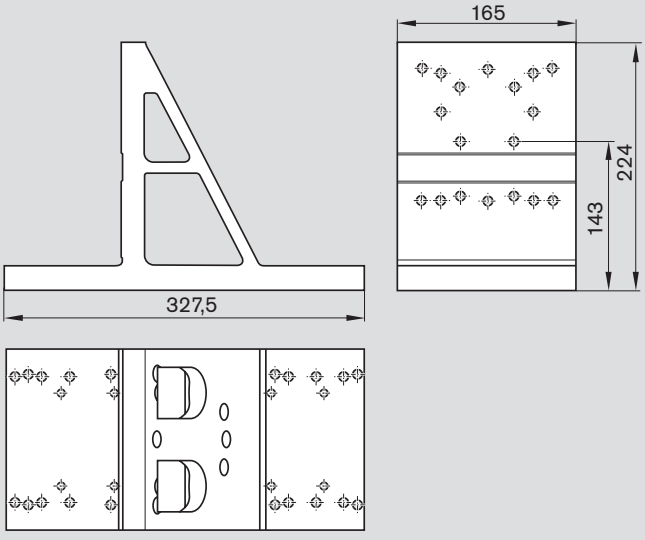




Angle bracket
R0391 150 01

for all linear modules with frame sizes
-165, -145 and -110
Fabricated aluminum alloy, anodized
Weight approx. 5.8 kg





Robotic Erector System for Linear Modules/Linear Modules

Connecting Shafts

Steel connecting shafts with disk-pack coupling
(shaft 1, 2)
- Compensation of misalignments
- Backlash-free and torsionally stiff
- Bridge large distances between axes
- Dynamically balanced as per VDI 2060

Connecting shafts with flexible membrane coupling
(shaft 3 - 6)
- Compensation of misalignments
- Backlash-free and torsionally stiff
- Bridge large distances between axes
- Clamping hub (mounting and dismounting without shifting aligned axes)
- Dynamically balanced as per VDI 2060

Ordering
Please state the part number and length L_{cs} when ordering.
Alternative design subject to same technical data.

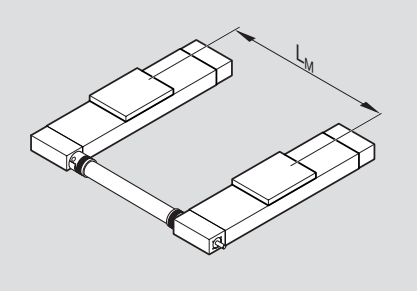
Notes on horizontal mounting orientation (version for vertical mounting orientation on request)
Alternative design subject to same technical data.

⚠ **Install guards to protect against contact with rotating parts during operation!**
Comply with the equipment safety rules and machine safety regulations at all times!

Calculation of length L_{cs} for i = 1:

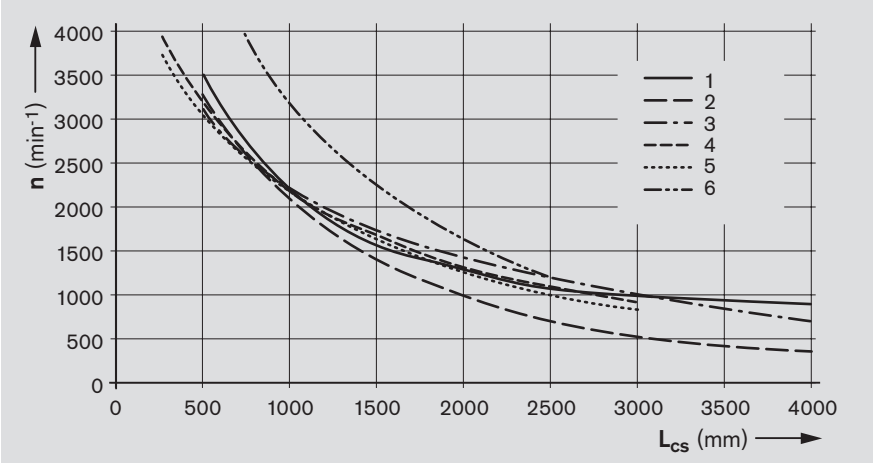
Shaft	Frame size	Length L_{cs} (mm)
1	-165	L_M – 220 mm
2	-110	L_M – 140 mm
	-80	L_M – 120 mm
3	-110	L_M – 155 mm
4	-80	L_M – 144 mm
5	-65	L_M – 105 mm
6	-40	L_M – 55 mm

L_{cs} = overall length of the connecting shaft (mm)
L_M = center-to-center distance between linear modules (mm)



Critical speed as a function of overall length

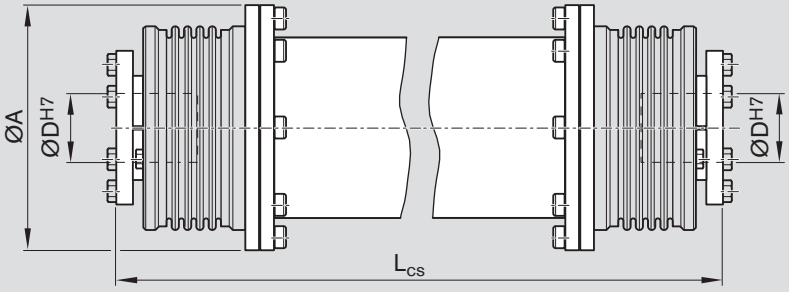
n = rotary speed (min^{-1})
L_{cs} = overall length of the connecting shaft (mm)



Dimensions



Steel connecting shafts (disk-pack coupling)



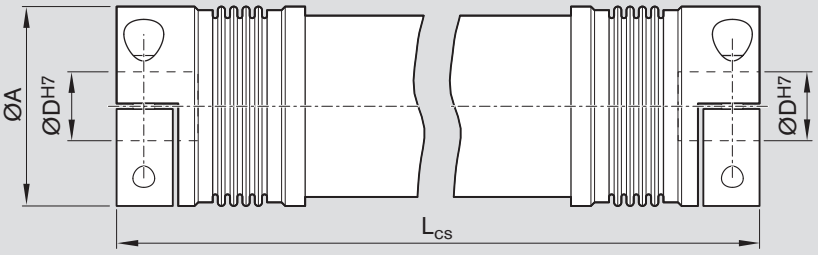
Dimensions and part numbers

Shaft	Frame size	Part number	Dimensions			Torque	Weight	Flexibility		Mass moment of inertia
			A (mm)	D (mm)	$L_{cs\ max}$ (mm)	(Nm)	(kg)	Δk_a (mm)	Δk_w (°)	(10^{-6} kgm²)
1	**-165**	R0391 510 11	147	35	4 000	400	7 + 13.5 kg/m	2.6	1	23300 + 20.6 · L_{cs}
2	**-80, -110**	R0391 510 12	110	18	4 000	100	3 + 4.6 kg/m	1.8	1	3300 + 4.4 · L_{cs}

Δk_a = axial flexibility (mm)
Δk_w = angular flexibility (°)



Connecting shafts (membrane coupling)



Dimensions and part numbers

Shaft	Frame size	Part number	Dimensions			Torque	Weight	Mass moment of inertia
			A (mm)	D (mm)	$L_{cs\ max}$ (mm)	(Nm)	(kg)	(10^{-6} kgm²)
3	**-110**	R0391 510 13	81	18	4 000	150	3.3 + 1.5 kg/m	9700 + 0.14 · L_{cs}
4	**-80**	R0391 510 14	66	18	3 000	60	1.2 + 1.3 kg/m	1130 + 0.13 · L_{cs}
5	**-65**	R0391 510 15	60	16	3 000	25	0.7 + 1.1 kg/m	570 + 0.07 · L_{cs}
6	**-40**	R0391 510 21	32	10	1 500	25	0.12 + 0.3 kg/m	23 + 0.075 · L_{cs}

Robotic Erector System for Linear Modules/Linear Modules

Mounting and Fastening Elements

General Notes

When mounting and securing connection components, do not exceed the maximum tightening torques for screws as indicated in the following table.

Mounting accessories

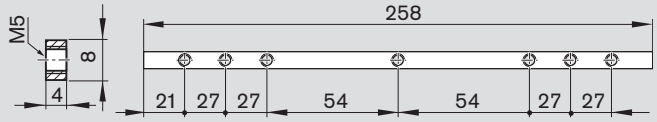
Tightening torques for fastening screws

8.8	M4	M5	M6	M8	M10	M12
(Nm)	2.7	5.5	9.5	23	46	80

Threaded anchor strips

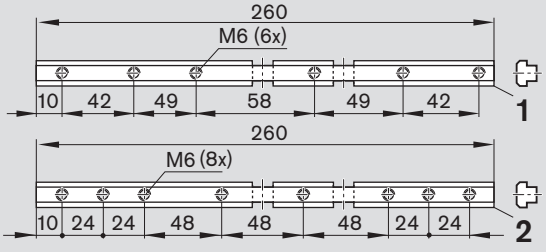
Steel, black finished
All anchor strips can be fixed in place for vertical installation.

Frame size -80



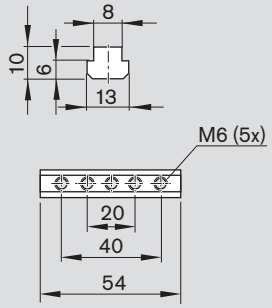
Part number
R0391 710 03

Frame size -110



Part number
(1): R0391 710 01
(2): R0391 710 00
Profiles as per DIN 508

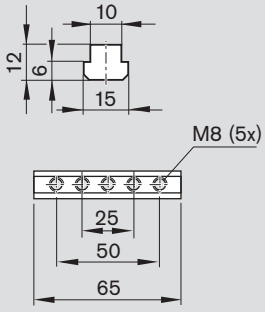
Frame size -110



Part number
R0391 710 06

Profile as per DIN 508

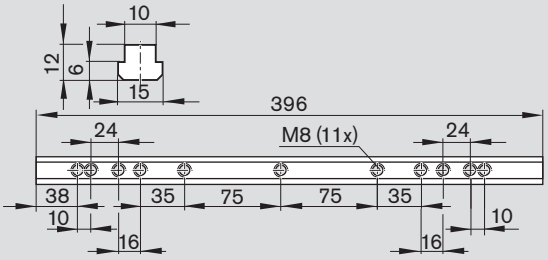
Frame size -145 and -165



Part number
R0391 710 05

Profile as per DIN 508

Frame size -165



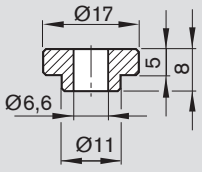
Part number
R0391 710 04

Profile as per DIN 508

Reducers

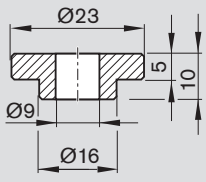
Aluminum alloy, black anodized

Frame size -110



Part number
R0391 750 14

Frame size -165



Part number
R0391 750 15

Linear Modules

Mounting

General Notes

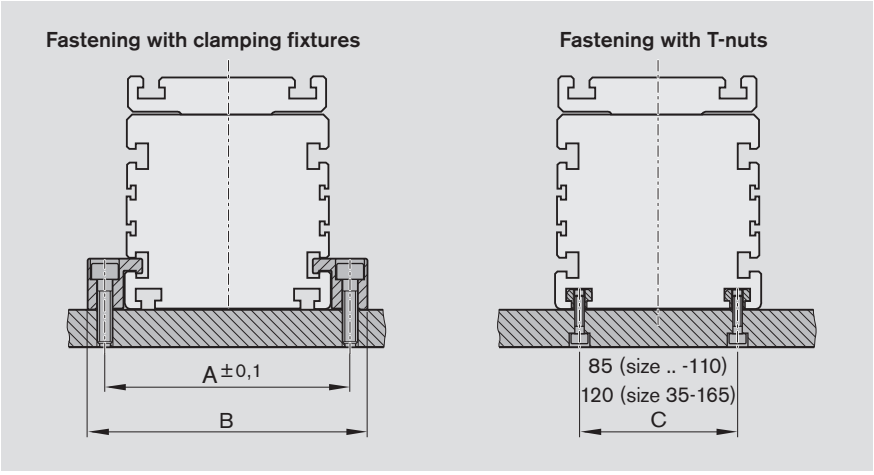
The linear modules are mounted using various mounting components:
- Clamping fixtures
- T-nuts for frame size -110 and up
- Square nuts
- Spring nuts
- Screws for T-slots as per DIN 787 (not shown).

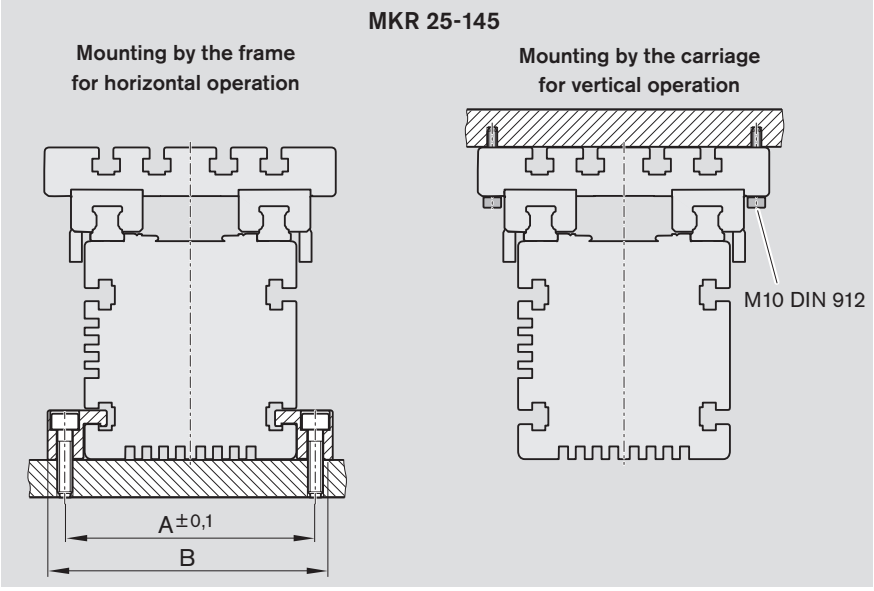
Length dependent on base.

When mounting Linear Modules, please note the maximum tightening torques listed in the table.

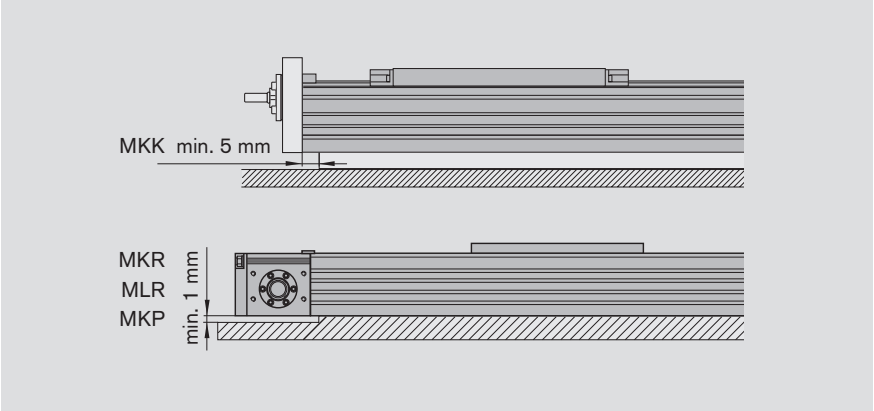
Size	A (mm)	B (mm)
15-65	81	95
20-80/10-80	96	110
25-110/10-110	132	150
35-165	192	218
25-145	172	198

See “Robotic Erector System for Linear Modules” for additional mounting accessories for connecting linear modules.





⚠ **Do not mount or support the Linear Module by the end block, end enclosure or end plate!**
The frame is the main load-bearing part!



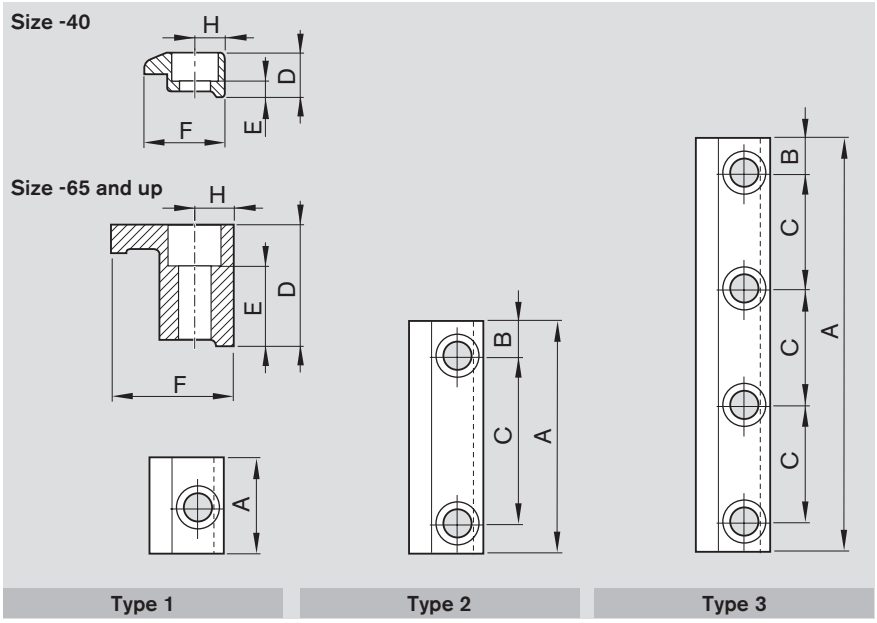
Tightening torques of the fastening screws
at friction factor 0.125
Strength class 8.8

8.8	M4	M5	M6	M8	M10	M12
(Nm)	2.7	5.5	9.5	23	46	80

Clamping fixtures

Recommended number of clamping fixtures for Miniature Linear Modules -40:
- Type 1: 6 pieces per side/m
- Type 2: 4 pieces per side/m
- Type 3: 3 pieces per side/m

Recommended number of clamping fixtures for Linear Modules -65 and up:
- Type 2: 3 per meter and side

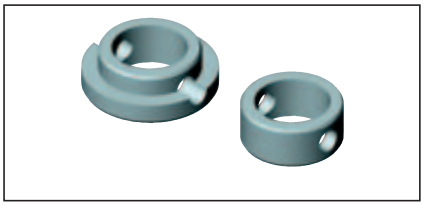


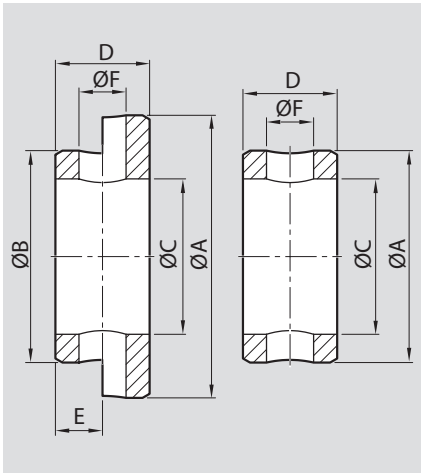
Size	Countersink ISO 4762 for	Type	Number of holes N	Dimensions (mm) A	B	C	D	E	F	H	Part number
12-40	M5	1	1	22	–	–	10.0	4.8	15	6.5	R1419 010 01
		2	2	57	8.5	40					R1419 010 43
		3	4	77	8.5	20					R1419 010 44
15-65	M6	2	2	78	14	50	20.0	11.5	20	7	R1175 190 24
20-80/10-80	M6			78	14	50	20.0	11.5	20	7	R1175 190 24
25-110/ 10-110	M8			108	19	70	27.5	16.5	29	9	R1175 290 26
35-165	M10			163	29	105	40.5	27.0	41	13	R1175 390 14
25-145	M10			163	29	105	32.0	18.5	41	13	R1175 290 44

Centering rings

The centering ring serves as a positioning aid. It creates a positive-locking connection with good reproducibility.

Material: steel (corrosion-resistant)





Module	Centering ring size	Part number	Dimensions (mm) A k6	B k6	C ±0.1	D -0.2	E +0.2	ØF
MKK 12-40	**7**	R0396 605 43	7	–	5.5	3	–	1.6
MKR 12-40	**7-5**	R0396 605 47	7	5	3.4	3	1.5	1.6
	9-7	R0396 605 49	9	7	5.5	3.5	1.5	1.6
	12-7	R0396 605 77	12	7	5.5	3.5	1.5	1.6

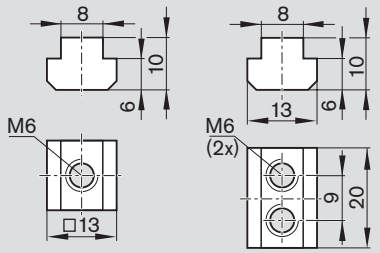
Linear Modules

Mounting

T-nuts

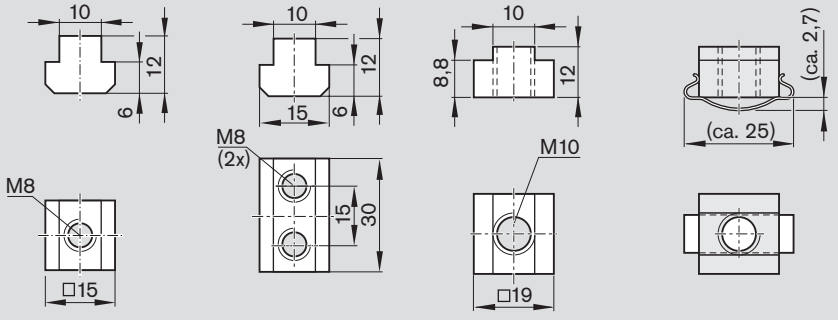
See “Robotic Erector System for Linear Modules”
for additional mounting accessories for connecting linear modules.

Size 25-110
Size 10-110



Part number	Part number
R3447 001 01	R0391 750 03 Profile as per DIN 508

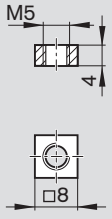
Size 35-165
MKR 25-145



Part number	Part number	Part number	Part number
M6: R3447 003 01 M8: R3447 002 01	R0391 750 04 Profile as per DIN 508	R3447 006 01 T-nut	R3454 030 49 Fixing spring for T-nut R3447 006-01

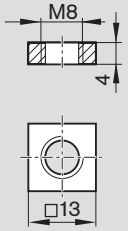
Square nuts

Size 15-65;
20-80; 10-80



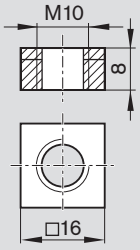
Part number
R3442 001 00 per DIN 557

Size 25-110
Size 10-110



Part number
R3442 003 01 per DIN 562

Size 35-165

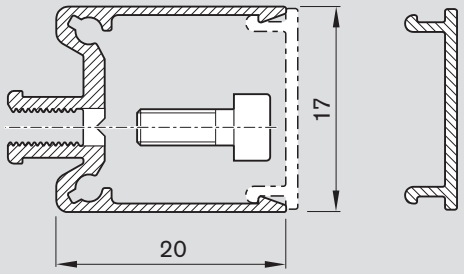


Part number
R3442 002 00 per DIN 557

Cable duct

- The cable duct is fastened in the T-slots on the side of the frame. Fastening screws widen the profile and give the cable duct a secure hold.

For the slot position, see “Components and Ordering Data” tables and “Dimensions”. The cable duct will accommodate up to two cables for mechanical switches and three cables for proximity switches. Fastening screws and cable grommets are included.



Linear Modules

Documentation

Standard report

Option 01

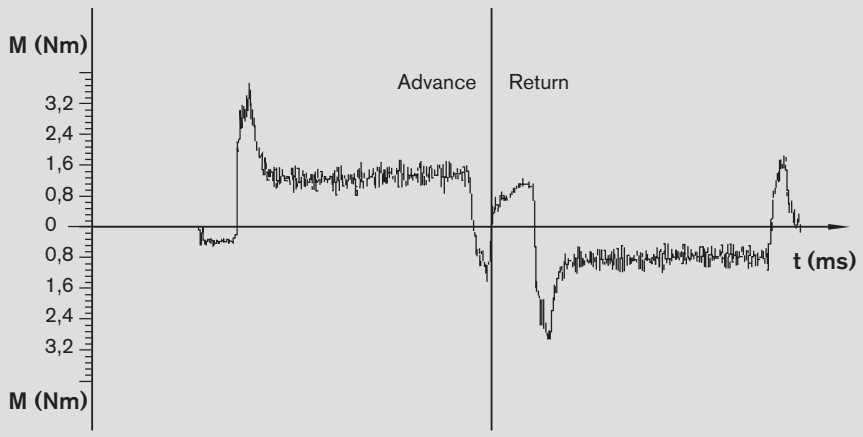
The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- functional checks of mechanical components
- functional checks of electrical components
- design is in accordance with order confirmation

Frictional moment of complete system

Option 02
The moment of friction is measured over the entire travel range.

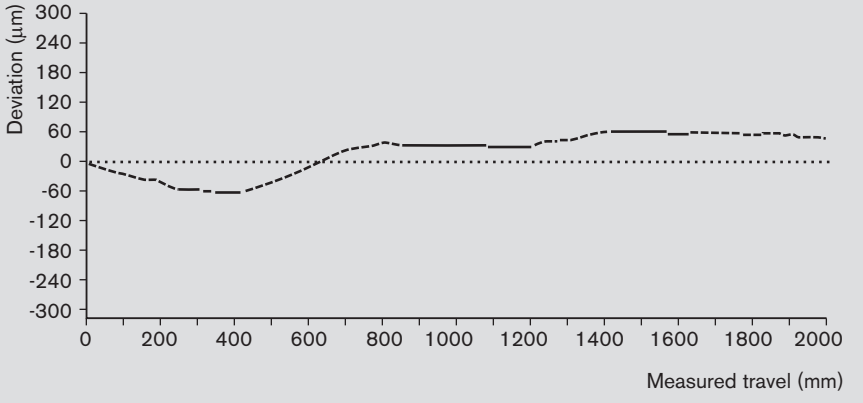
Example



Lead deviation of ball screw for Linear Modules MKK

Option 03
In addition to graphical representation (see illustration), a measurement report is supplied in table form.

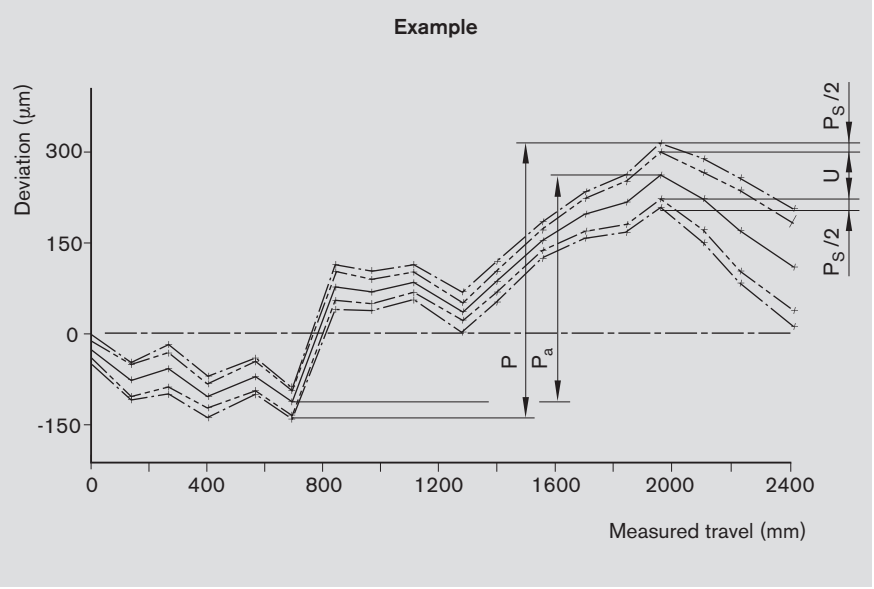
Example



Positioning accuracy

per VDI/DGQ 3441
Option 05

Measurement points are selected at irregular intervals along the travel range. This enables even periodical deviations to be detected during positioning. Each measurement point is approached several times from both sides. This gives the following parameters.



Positioning accuracy P

The positioning accuracy corresponds to the total deviation.
It encompasses all the systematic and random deviations during positioning.

The positioning accuracy takes the following characteristic values into consideration:
- Position deviation
- Reversal range
- Position variation range

Position deviation P_a

The position deviation corresponds to the maximum difference arising in the mean values of all the measurement points.
It describes systematic deviations.

Reversal range U

The reversal range corresponds to the difference in mean values of the two approach directions.
The reversal range is determined at every measurement point.
It describes systematic deviations.

Position variation range P_S

The position variation range describes the effects of random deviations.
It is determined at every measurement point.

Motors

Servo Motors

Notes
All MSK/MSM servo motors have an absolute multiturn encoder.
The motors can be supplied complete with controller and control systems. please refer to the Rexroth catalogs “IndraDrive Cs” and “IndraDrive C for Linear Motion Systems.”

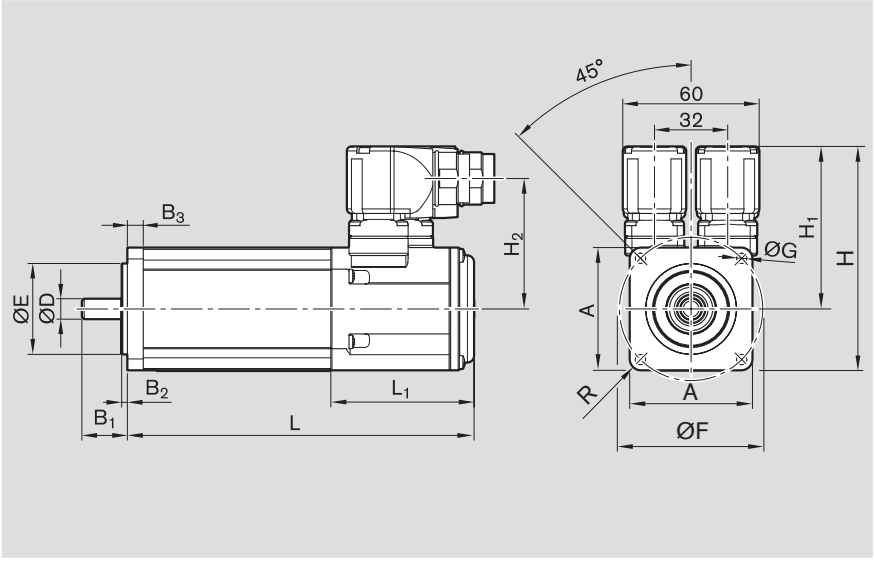
AC Servo Motors MSK

SAFETY ON BOARD



Motor data

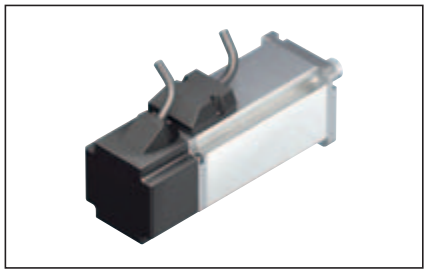
Description		Unit	MSK 030C	MSK 040C	MSK 050C	MSK 060C	MSK 076C
Maximum rotary speed	n_{max}	(min^{-1})	9000	7500	5700	5200	4500
Maximum permissible torque	M_{max}	(Nm)	4	8.1	15	24	43.5
Motor mass moment of inertia	J_m	(10^{-6} kgm^2)	30	140	330	800	4300
Mass without brake	m_m	(kg)	2.1	3.6	5.4	8.4	13.8
Brake							
Brake holding torque	M_{br}	(Nm)	1.0	4.0	5.0	10.0	11.0
Brake mass moment of inertia	J_{br}	(10^{-6} kgm^2)	7	23	107	55	360
Mass of brake	m_{br}	(kg)	0.25	0.32	0.7	0.45	1.1



Dimensions

	Dimensions (mm) A	B_1	B_2	B_3	ØD k6	ØE j6	ØF	ØG	H	H_1	H_2	L without brake	L with brake	L_1	R
MSK 030C	54	20	2.5	7.0	9	40	63	4.5	98.5	71.5	57.4	188.0	213.0	–	R5
MSK 040C	82	30	2.5	8.0	14	50	95	6.6	124.5	83.5	69.0	185.5	215.5	42.5	R8
MSK 050C	98	40	3.0	9.0	19	95	115	9.0	134.5	85.5	71.0	203.0	233.0	55.5	R8
MSK 060C	116	50	3.0	9.5	24	95	130	9.0	156.0	98.0	84.0	226.0	259.0	48.0	R9
MSK 076C	140	50	4.0	14.0	24	110	165	11.0	180.0	110.0	95.6	292.5	292.5	79.0	R12

AC Servo Motors MSM

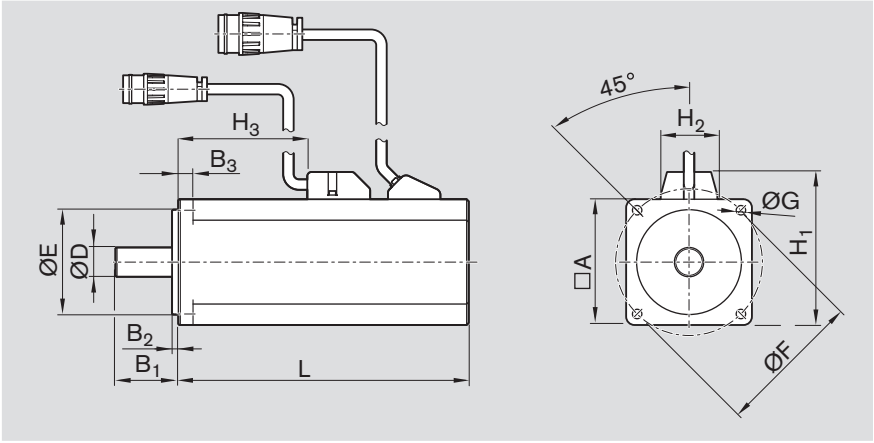


Motor data

Description		Unit	MSM 019B	MSM 031B	MSM 031C	MSM 041B
Maximum rotary speed	n_{max}	(min^{-1})	3000	3000	3000	3000
Maximum permissible torque	M_{max}	(Nm)	0.95	1.91	3.80	7.10
Rated torque	M_N	(Nm)	0.32	0.64	1.30	2.40
Motor mass moment of inertia	J_m	(10^{-6} kgm^2)	5.1	14.0	26.0	87.0
Mass without brake	m_m	(kg)	0.47	0.82	1.20	2.30
Brake						
Brake holding torque	M_{br}	(Nm)	0.29	1.27	1.27	2.45
Brake mass moment of inertia	J_{br}	(10^{-6} kgm^2)	0.2	1.8	1.8	7.5
Mass of brake	m_{br}	(kg)	0.21	0.48	0.50	0.80

Versions and part numbers

	Part numbers	Version		
		Without brake	With brake	Option code
MSM 019B	R3471 104 03	X		MSM 019B-0300-NN-M0-CH0
	R3471 105 03		X	MSM 019B-0300-NN-M0-CH1
MSM 031B	R3471 106 03	X		MSM 031B-0300-NN-M0-CH0
	R3471 107 03		X	MSM 031B-0300-NN-M0-CH1
MSM 031C	R3471 108 03	X		MSM 031C-0300-NN-M0-CH0
	R3471 109 03		X	MSM 031C-0300-NN-M0-CH1
MSM 041B	R3471 110 03	X		MSM 041B-0300-NN-M0-CH0
	R3471 111 03		X	MSM 041B-0300-NN-M0-CH1



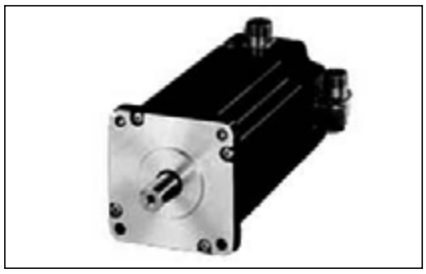
Dimensions

	Dimensions (mm)												
	A	B_1	B_2	B_3	ØD h6	ØE h7	ØF	ØG	H_1	H_2	H_3	L without brake	L with brake
MSM 019B	38	25	3	6	8	30	45	3.5	51	27	40.8	92.0	122.0
MSM 031B	60	30	3	7	11	50	70	4.5	73	27	34.0	79.0	115.5
MSM 031C	60	30	3	7	14	50	70	4.5	73	27	61.5	98.5	135.0
MSM 041B	80	35	3	8	19	70	90	6.0	93	27	76.0	112.0	149.0

Motors

3-phase Stepping Motors

3-phase Stepping Motors VRDM

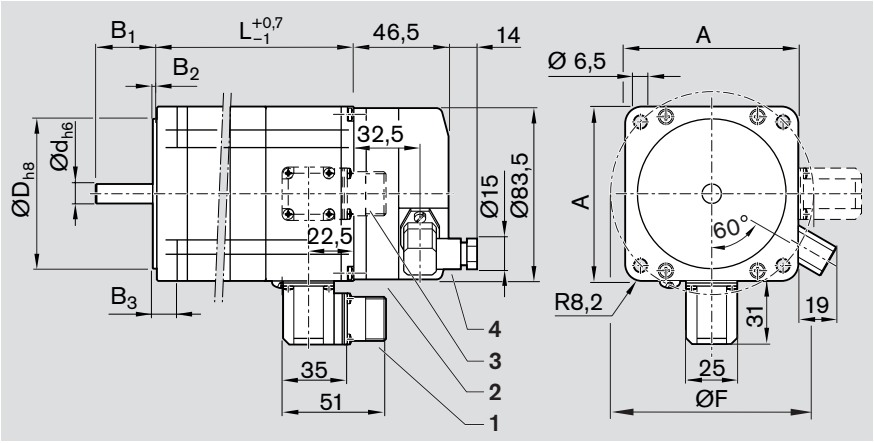


Note
All VRDM motors are equipped with an encoder.

Motor data

Description		Unit	VRDM 397	VRDM 3910	VRDM 3913
Maximum permissible torque	M_{max}	(Nm)	2.00	4.00	6.00
Rotor moment of inertia w/o brake	J_m	(10^{-6} kgm^2)	1.1×10^{-4}	2.2×10^{-4}	3.3×10^{-4}
Motor holding torque	M_m	(Nm)	2.26	4.52	6.78
Mass without brake	m_m	(kg)	2.5	3.1	4.2
Step count	z	(–)	200 / 400 / 500 / 1000 / 2000 / 4000 / 5000 / 10000		
Stepping angle per step	α	(°)	1.8 / 0.9 / 0.72 / 0.36 / 0.18 / 0.09 / 0.072 / 0.036		
Encoder resolution			1000 increments/revolution		
Brake					
Brake holding torque	M_{br}	(Nm)	6		
Brake mass moment of inertia	J_{br}	(10^{-6} kgm^2)	0.2×10^{-4}		
Mass of brake	m_{br}	(kg)	1.5		

1 Motor connector
2 Brake
3 Encoder connector
4 Brake connector



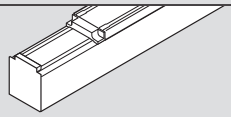
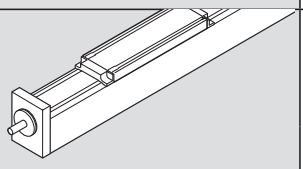
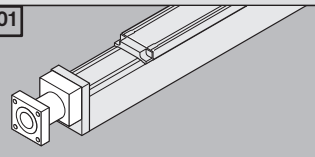
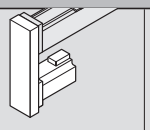
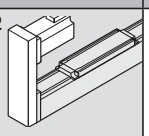
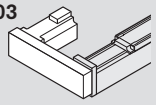
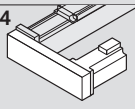
Dimensions

	Dimensions (mm) A	B_1	B_2	B_3	Ød	ØD	ØF	ØG	L without brake	L with brake
VRDM 397	85	30	2	10	12_{h6}	60_{h8}	99	6.5	110.0	156.5
VRDM 3910	85	30	2	10	12_{h6}	60_{h8}	99	6.5	140.0	186.5
VRDM 3913	85	30	2	10	14_{h6}	60_{h8}	99	6.5	170.0	216.5

Inquiry/Order

Selection and Ordering Example using the Components and Ordering Data Table

Linear Modules MKK 25-110

Part number, length R1160 260 10, ... mm	Version	Guideway	Drive unit: Screw journal	Drive unit: Ball screw size d_0 x P				Carriage: L_{ca} = 310 mm		
				32x5	32x10	32x20	32x32	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

= Selected option to be entered into the "Inquiry/Order Form" at the end of this catalog

= Highlighting of the selection area after deciding on the specific version

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

Odering Data Option		Description
Linear Module and size	MKK 25-110	Linear Module MKK (with ball rail system [K] and ball screw drive [K]),
Part number, length	R1160 260 10, 1030 mm	size 25-110, length 1030 mm
Version	MF01	Linear Module with motor mount and motor, mounted as shown in diagram MF01
Guideway	01	Ball Rail System
Drive unit	03	Ball screw, size 32 x 20 (d_0 x P)
Carriage	01	Carriage with length L_{ca} = 310 mm, without screw support SPU
Motor attachment	02	Attachment kit with motor mount for motor MSK 076C
Motor	92	Motor MSK 076C without brake
Cover	20	Steel sealing strip, without side sealing
1st switch	15 - R + 250 mm	Mechanical switch, switch activation point: Right + 250 mm (limit switch)
2nd switch	11 - R – 150 mm	PNP NC, switch activation point: Right – 150 mm (positioning switch)
3rd switch	15 - R – 250 mm	Mechanical switch, switch activation point: Right – 250 mm (limit switch)
Cable duct	20, 1000 mm	Cable duct, loose, length 1000 mm
Socket-plug	17	Socket-plug on switch side
Switching cam	16	Switching cam for switch activation
Documentation	03	Measurement report: lead deviation of ball screw

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 **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 **Cable duct (loose)** – Length 20, ... mm **External socket/ plug (loose)** 17 **External switching cam** 16	01	02 Friction moment 03 Lead deviation 05 Positioning accuracy
–	00	–	00						
–	03	MSK 060C	90	91					
–	02	MSK 076C	92	93					
i = 1	23	MSK 060C	90	91		21 with side sealing			
i = 2	24	MSK 060C	90	91					

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

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

Determining the switch activation point

The switch activation point is determined by the following factors:

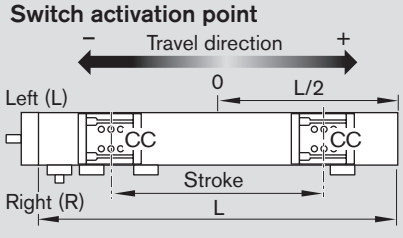
- Mounting side:
  Switches may be mounted on the left (L) or right (R) side of the module.
- Direction of travel:
  Switches may be mounted on the minus (–) or plus (+) side of zero.
- Switching distance:
  The switching distance is the distance between the carriage center (CC) and the zero point (0) when a switch is activated (given in mm).

Refer to the section on “Switch Mounting Arrangements” for more information on switch types and switch mounting.

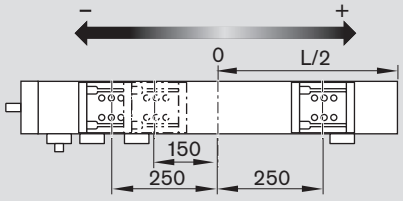
Example
Effective stroke = 500 mm
Limit switches:
Switch position for 1st switch = + 250 mm
Switch position for 3rd switch = – 250 mm
Positioning switch:
Switch position for 2nd switch = – 150 mm

Length L
For length calculations, see “Components and Ordering Data” for the respective Linear Modules.

Switch activation point



Switch activation point example



Inquiry/Order

Inquiry/Order Form

Bosch Rexroth AG
Linear Motion and Assembly Technologies
97419 Schweinfurt
Germany

Telephone + 49 9721 937-0
Telefax + 49 9721 937-350 (direct)

Rexroth – Linear Module

Ordering example

Ordering Data			Description
Linear Module MKK 25-110			Module designation
Part number: R1160 260 10, 1310 mm			MKK 25-110, length = 1310 mm
Version	=	MF01	With motor mount and motor, as shown in diagram MF01
Guideway	=	01	Ball Rail System
Drive unit	=	03	Ball screw, size 32 x 20 (d_0 x P)
Carriage	=	01	Carriage with length L_{ca} = 310 mm, without screw support SPU
Motor attachment	=	02	Attachment kit with motor mount for motor MSK 076C
Motor	=	92	Motor MSK 076C without brake
Cover	=	20	Steel sealing strip, without side sealing
1st switch	=	15-R + 390 mm	Mechanical switch, switch activation point: right + 390 mm
2nd switch	=	11-R – 290 mm	PNP NC, switch activation point: right – 290 mm
3rd switch	=	15-R – 390 mm	Mechanical switch, switch activation point: right – 390 mm
Cable duct	=	20, 1200 mm	Cable duct, loose, length 1200 mm
Socket-plug	=	17	Socket-plug on switch side
Switching cam	=	16	With switching cam for switch activation
Documentation	=	03	Lead deviation report for ball screw

To be completed by customer: Inquiry ☐ / Order ☐

Linear Module _____

Part number: R_____ _____ _____**, length** _____**mm**

Version = ☐☐☐☐
Guideway = ☐☐
Drive unit = ☐☐
Carriage = ☐☐
Motor attachment = ☐☐
Motor = ☐☐
Cover = ☐☐
1st switch = ☐☐ - ☐ + ☐☐☐☐ **mm**
2nd switch = ☐☐ - ☐ ± ☐☐☐☐ **mm**
3rd switch = ☐☐ - ☐ – ☐☐☐☐ **mm**
Cable duct = ☐☐ , ☐☐☐☐ **mm**
Socket-plug = ☐☐
Switching cam = ☐☐
Documentation = ☐☐

Single parts:
Robotic Erector System
(Part number): R_____ _____ _____
R_____ _____ _____
R_____ _____ _____
R_____ _____ _____

Quantity **Order of:** ____ **pcs,** _____ **per month,** _____ **per year, per order, or** _____
Comments:

Sender
Company: _____ **Name:** _____

Address: _____ **Department:** _____

_____ **Telephone:** _____

_____ **Telefax:** _____

Rexroth
Bosch Group

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Subject to technical modifications

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