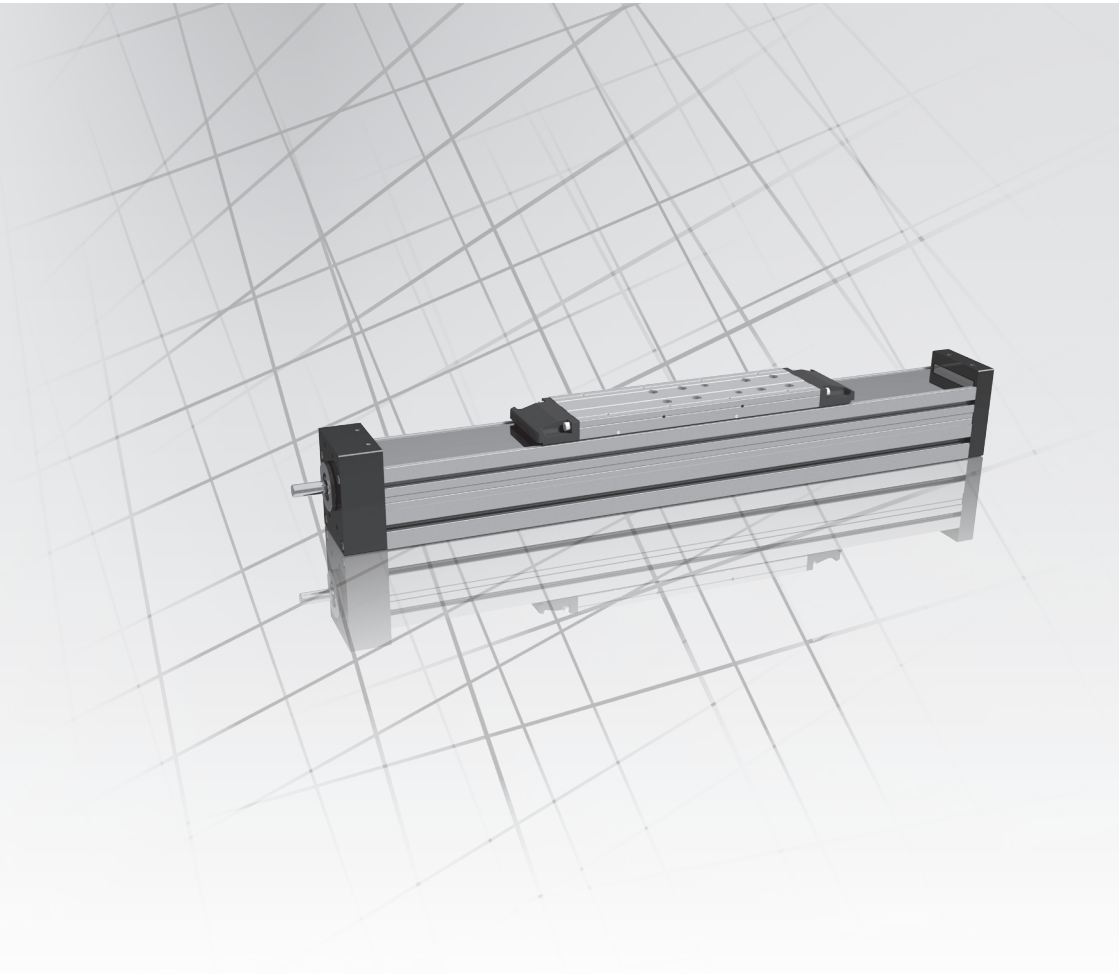
LINE TECH



LINEAR MODULES WITH BALL SCREW

ASSEMBLY AND MAINTENANCE INSTRUCTIONS

(ENGLISH)

SWISS MADE LINEAR TECHNOLOGY

Contents

These instructions contain standard illustrations, so representations may deviate from the original. The scope of delivery for special designs, options or technical changes may differ from the explanations described here. We reserve the right to make changes for the purposes of technical improvement.

Despite taking great care when creating these assembly and maintenance instructions, printing errors cannot be excluded. We are grateful for any information alerting us to errors or poorly formulated/represented information in this document.

Date of creation: 11/2020 MS/RB

1. General

Warranty:
LINE TECH AG warrants compliance with the specifications expressly agreed upon in the confirmation and in general the execution of the order with the due care customary in the industry. The warranty covers the function of the Linear Module and includes all defects that are demonstrably due to manufacturing or material defects.

Warranty period:
The warranty period (factory warranty) is twelve months from the date of delivery according to the general terms and conditions of sale and delivery, provided a longer period has not been agreed upon.

Warranty exclusion:
Excluded from the warranty are defects and faults for which LINE TECH AG is not responsible, such as natural wear, force majeure, improper handling, interventions on the part of the customer or third parties, excessive and improper use, unsuitable operating equipment, extreme environmental conditions and non-compliance with assembly, operating and maintenance instructions. Any warranty claims shall expire in such cases.

LINE TECH AG is only liable for customer damages that are directly related to the breach of contractual obligations and that have been caused by LINE TECH AG due to gross negligence. The liability for slight negligence on the part of LINE TECH AG or for actions of auxiliary persons commissioned by LINE TECH AG is excluded to the legally permitted extent. In no case is LINE TECH AG liable for direct or indirect consequential damages or third party damages. The exclusion or limitation of liability of LINE TECH AG also apply for the personal liability of its employees, workers, representatives and vicarious agents.

2. Use in Accordance with the Regulations

LINE TECH Linear Modules with ball screw (BSD) are particularly well-suited for applications with larger strokes and high travel speeds due to their structural features. The Linear Module with ball screw (incomplete machine in the sense of the Machinery Directive 2006/42/EC) is intended to be installed in machines and is used exclusively to move, precisely position and transport lightweight to medium-weight loads.

Linear Modules with ball screws (BSD) can be installed in any position (horizontal, vertical or overhead). All relevant technical safety and accident prevention regulations, including DIN EN ISO 12100 (machine safety), as well as all documentation enclosed with the product, such as instructions, etc., must be observed when installing the incomplete machine in a complete machine.

The linear unit with ball screw may only be used in accordance with the intended use provided by LINE TECH AG. Any other use beyond this is considered improper. The manufacturer is not liable for any personal injury and/or property damage that results from said improper use. The risk is borne solely by the user. The assembly and maintenance instructions prescribed by the manufacturer must be observed to ensure use in accordance with the regulations. Only qualified specialist personnel may carry out the commissioning, assembly, maintenance and repair work.

In general, LINE TECH Linear Modules are intended for linear movement as occurs during positioning, processing, transporting, palletising, loading, unloading, clamping, tensioning, testing, measuring, handling and manipulating workpieces or tools. In the process, the type-specific load data from the respective catalogue documents or supplementary technical calculations from LINE TECH are to be taken into consideration.

3. Use Not in Accordance with the Regulations

Use in application areas with special operating conditions, such as in the presence of moisture, dirt, dust (fibre glass and wood), aggressive atmospheres, potentially explosive environments, extreme climatic conditions and/or extreme temperature fluctuations, short-stroke and others are not consider proper and intended use. For special solutions, please contact LINE TECH AG.

4. Declaration of incorporation

Declaration of incorporation
within the meaning of the EC Machinery Directive 2006/42/EC, annex II B

The manufacturer

Line Tech AG
Europastrasse 19
8152 Glattbrugg

hereby declares that for the incomplete machine

Designation: Linear Module with ball screw (LM)
Material number: according to the nameplate LINE TECH AG

these basic requirements of the Machinery Directive 2006/42/EC have been applied and complied with:

- 1.1.2 Principles for the integration of safety
- 1.1.3 Materials and products
- 1.1.5 Machine design with respect to handling
- 1.3.2 Risk of breakage during operation
- 1.3.3 Risks from falling or ejected objects
- 1.3.4 Risks from surfaces, edges and corners
- 1.3.7 Risks from moving parts
- 1.3.9 Risk of uncontrolled movements
- 1.5.1 Electrical power supply
- 1.5.2 Static electricity
- 1.5.4 Assembly error
- 1.5.5 Extreme temperature
- 1.5.6 Fire
- 1.5.8 Noise
- 1.5.13 Emission of hazardous materials and substances
- 1.6.1 Maintenance of the incomplete machine
- 1.7.2 Warning of residual risks

Furthermore, it is stated that the specific technical documentation has been prepared according to annex VII part B. These will be transmitted to market surveillance authorities in the form of paper documents/in electronic form upon request.

Compliance with the provisions of additional EU guidelines, standards or specifications:

- EN ISO 12100:2010 Safety of Machinery - General Principles for Design - Risk assessment and risk reduction

The incomplete machine may then first be put into operation once it has been determined that the machine in which the incomplete machine is to be installed meets the provisions of the EC Machinery Directive 2006/42/EC, if relevant under this guideline.

The following person is authorised to compile the relevant technical documentation:

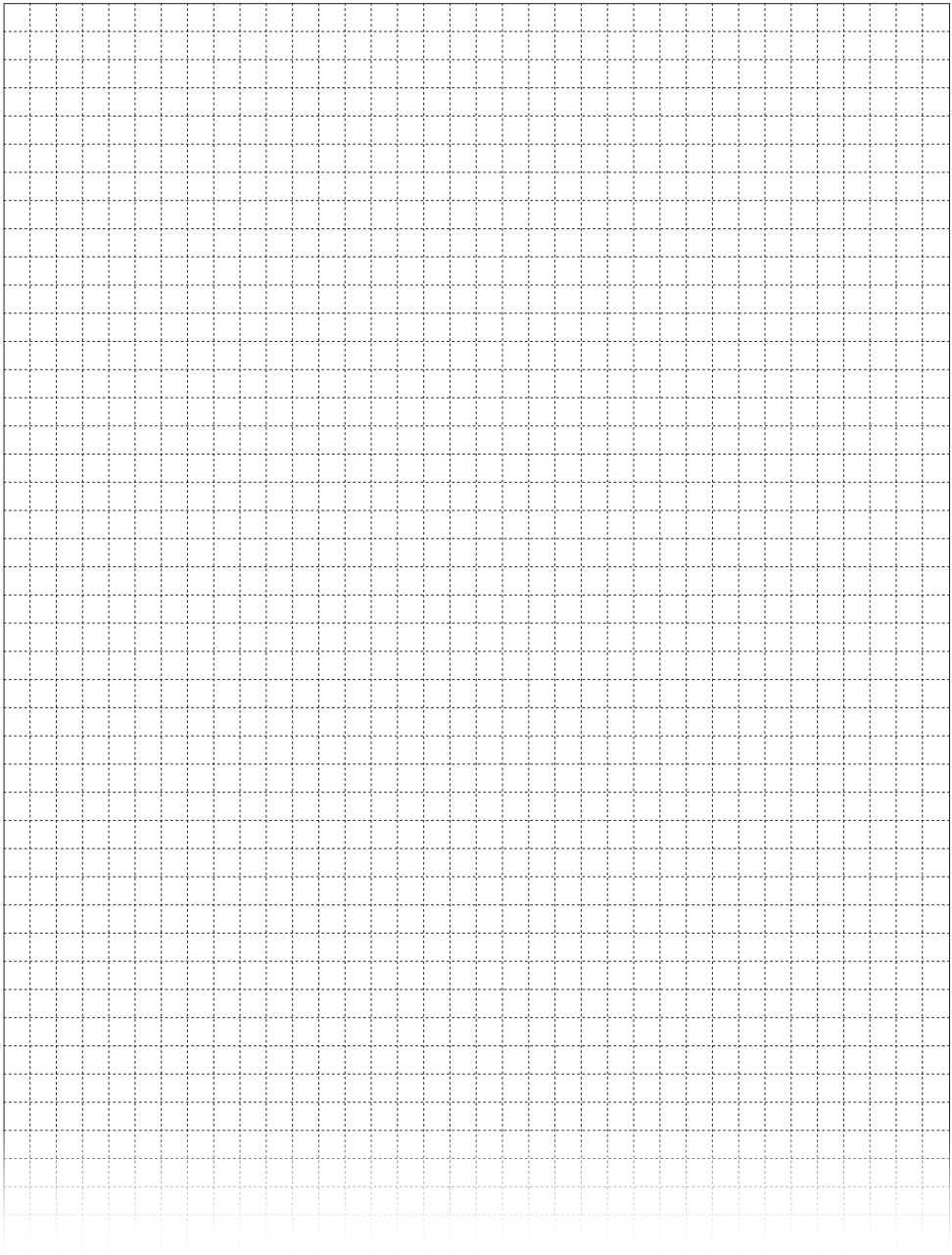
Name: Rolf Bünzli
Address: Europastrasse 19, CH-8152 Glattbrugg

Glattbrugg, 05 Nov. 2020

Michael Schilbach
Technical Sales Manager

Rolf Bünzli
Head of Quality Management

Notes



5. Safety, References, Symbols

5.1 Safety Instructions

The following safety and hazard instructions are for your personal protection, the protection of third parties and the protection of the Linear Module. They must therefore be observed.

The following pictograms are used in these assembly and maintenance instructions as safety and hazard instructions:

DANGER
Indicates an imminent danger. Failure to observe this notice may result in death or serious injury.

WARNING
Indicates a potential hazardous situation. If this information is ignored, it could result in property damage or physical injury.

CAUTION
Indicates a possible hazard. Ignoring this information may result in injuries, such as cuts and crushing, etc. Make sure any sources of hazards are secured.

CAUTION
Indicates a possible hazard. Ignoring this information may lead to eye injuries. Wear protective goggles.

CAUTION
Indicates a possible hazard. De-energise the module. Secure the power supply from unintentional or unauthorised commissioning.

CAUTION
Indicates a possible hazard. Ignoring this information may lead to skin burns. Avoid skin contact and wear protective gloves.

Note
Indicates general information and work recommendations.

5.2 Identification of references

References are made to repeated or further information as follows:
→ 2.1 Reference to section 2.1 → □ 5.1.1 Reference to image 5.1.1 (image 1 in section 5.1)

5.3 Symbols


Commissioning


Assembly

Travel speed


Securing with adhesive
(Observe the safety data sheet)


Maintenance


RPM


Tightening torque

Screw


Thermometer


Excerpt from the LINE TECH AG product catalogue

6. Transport

6.1 Transport, packaging and storage

The mechanics of Linear Modules can be damaged from heavy impacts and bending, which can greatly impair its function. Axes with a length of more than 700 mm must always be supported during transport. In order to avoid transport damage, LINE TECH AG Linear Modules are sufficiently packaged and protected against slipping and vibrations.

For storage, the Linear Module should be placed in a well-padded sturdy crate and sufficiently protected against moisture, dirt and aggressive atmosphere.

6.2 Scope of delivery

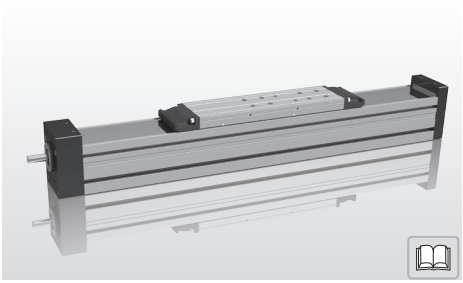
The scope of delivery of the product includes:

- Linear Module according to the order confirmation
- Assembly and maintenance instructions
- Additional and special accessories according to the order

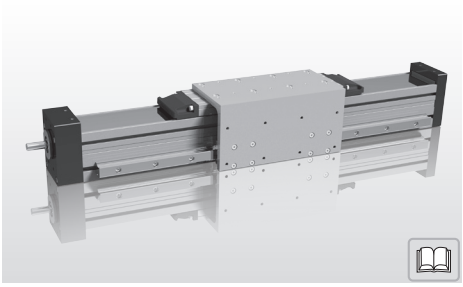
7. Linear Module (LM) with ball screw (BSD)

7.1 Product overview

LM...R...N
Linear Module with ball screw



LM...R...L/R
Linear Module with ball screw and lateral support rail left/right



LINE TECH Linear Modules with ball screw are of modular conception, ready-to-install linear systems with drive. Sealed guide elements in all sizes are employed. Guides and drive are protected from external factors (such as dirt and chippings) by a steel strip / the toothed belt. The base profile is made of aluminium alloy and manufactured with the extrusion process.

Additional limit switches fitted on the outside, in conjunction with motors and a controller, ensure correct positioning of the carriage and provide protection against overrun.

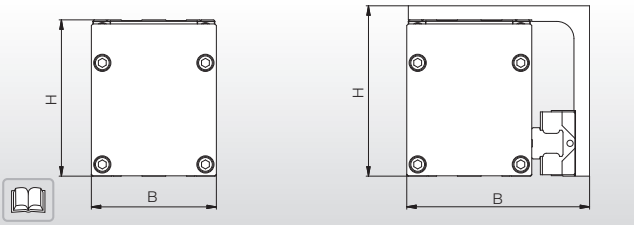
The selected design provides for a high level of performance with compact dimensions.

Design

– Compact aluminium base profile

– Ready-to-install Linear Modules in any lengths

– Carriages made of aluminium



Linear Module	Dimensions	Load ratings	
Type	W x H [mm]	C_0 [kN]	C [kN]
LM3…N	60 x 85	35.0	18.0
LM3…L/R	98 x 94	70.0	36.0
LM4…N	80 x 100	59.9	34.2
LM4...L/R	117 x 109	119.9	68.4
LM5...N	110 x 129	85.0	49.6
LM5...L/R	155 x 141	170.0	99.2

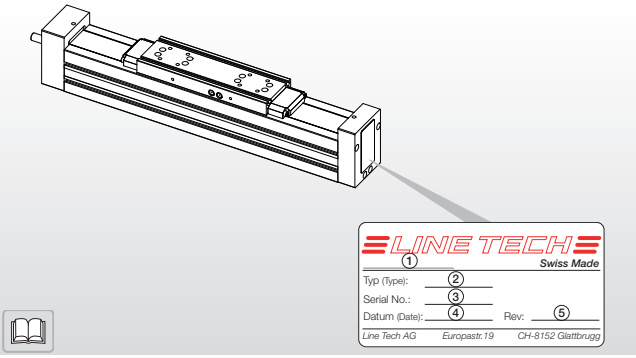
Linear Modules can be installed and assembled by qualified personnel using these assembly and maintenance instructions.

The units must not be opened under any circumstances. If a unit is opened, safe operation can no longer be guaranteed!

7.2 Nameplate “Ordering of spare parts and accessories”

The following information is to be taken from the nameplate in order to get a clear identification of the unit. This information is to be given to the manufacturer immediately if there are problems with the Linear Module:

1. Name of the unit
2. Type designation
3. Serial number
4. Date of production (calendar week/year)
5. Date of repair (If available)



7.3 Tightening torques for screws

Screws of the strength class 8.8 are used by default. If other screws are used, these are specially labelled.

The tightening torques recommended by LINE TECH AG are defined in the table below.

Tightening torque $M_{A\ max.}$ [Nm] — Friction factor for screws μ = 0.120

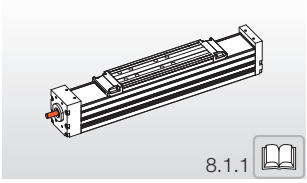
Screw according to	Material class	Thread size								
		M2	M2.5	M3	M4	M5	M6	M8	M10	M12
ISO 4762	8.8	0.36	0.73	1.27	3.00	5.90	10.10	24.60	48.00	84.00
ISO 4762	12.9	0.60	1.23	2.14	5.10	10.00	17.40	42.20	83.00	144.00
ISO 7380-1	10.9	0.25	0.50	0.90	2.00	4.00	7.20	12.00	23.00	58.00

8. Design and assembly of Linear Modules with ball screw

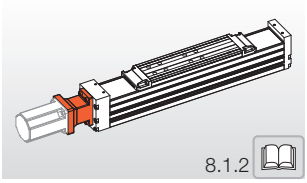
8.1 Assembly design versions with different motor mountings

LINE TECH Linear Modules with ball screw can be delivered in various design versions and with different prepared motor mountings → 13
Dimensions for Linear Modules LM3, LM4 and LM5 → 9.1-9.6

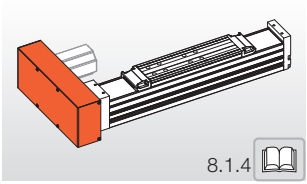
Assembly stage 01
Free spindle end



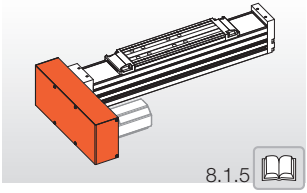
Assembly stage 02
With coupling and intermediate flange



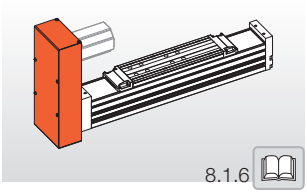
Assembly stage 04
Set up for lateral motor mounting right



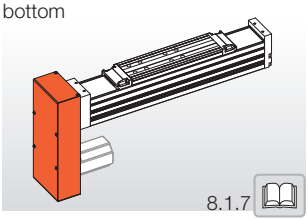
Assembly stage 05
Set up for lateral motor mounting left



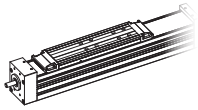
Assembly stage 06
Set up for lateral motor mounting top



Assembly stage 07
Set up for lateral motor mounting bottom



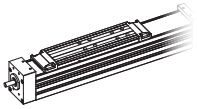
8.2 Technical data for ball screw (BSD)



LM	BSD	Axial load rating		Positioning accuracy	Repeating accuracy	Accelera-tion	Axial play		Idle torque
Size	d x p	C_0	C_{dyn}			a_{max}	Type	Axial play	
	[mm]	[N]	[N]	[µm/mm]	[mm]	[m/s²]		[mm]	[Nm]
LM3…R…	16 x 5	4551	4327	52/300	< 0.01 1)	10.0	R	< 0.02	0.030
							V	—	0.100
	16 x 10	4551	4327	52/300	< 0.01 1)	10.0	R	< 0.02	0.060
							V	—	0.200
	16 x 16	4551	4327	52/300	< 0.01 1)	10.0	R	< 0.02	0.120
							V	—	0.320
LM4…R…	20 x 5	5705	4912	52/300	< 0.01 1)	10.0	R	< 0.02	0.050
							V	—	0.120
	20 x 20	5705	4912	52/300	< 0.01 1)	10.0	R	< 0.02	0.200
							V	—	0.400
LM5…R…	32 x 5	11538	8947	52/300	< 0.01 1)	10.0	R	< 0.02	0.080
							V	—	0.200
	32 x 10	11538	8947	52/300	< 0.01 1)	10.0	R	< 0.02	0.160
							V	—	0.400
	32 x 32	11538	8947	52/300	< 0.01 1)	10.0	R	< 0.02	0.600
							V	—	1,200

d x p = screw diameter x thread pitch
1) backlash not factored in
R = reduced play
V = preloaded

8.3 General technical details for Linear Modules



LM	Movement speed		Moments of inertia (Z, Y)		Stroke max.	Cover	Feed and friction force	Moved mass
Type	v_{max} [m/s]	v_{max} [m/s]	I_Y [cm⁴]	I_Z [cm⁴]	[mm]		F_V [N]	m_b [kg]
LM3...R...N	5.0	2)	64.5	81.7	2000	without	20.00	1.410
						with	30.00	
LM3...R...L/R	5.0	2)	64.8	81.9	2000	without	40.00	2.515
						with	50.00	
LM4...R...N	5.0	2)	106.5	152.7	3000	without	25.00	2.500
						with	35.00	
LM4...R...L/R	5.0	2)	107.6	153.4	3000	without	50.00	4.225
						with	60.00	
LM5...R...N	5.0	2)	432.7	594.0	3000	without	30.00	5.330
						with	40.00	
LM5...R...L/R	5.0	2)	434.6	595.3	3000	without	60.00	8.820
						with	70.00	

2) for spindle drive, dependent on rotational speed characteristics, spindle length and corresponding critical rotational speed

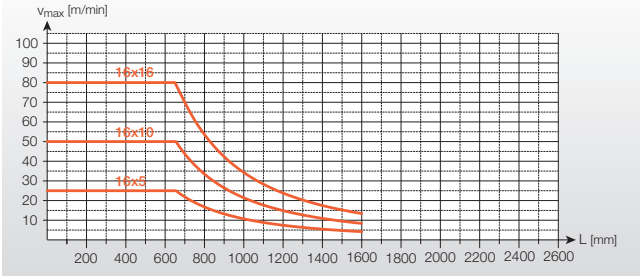
8.4 Permissible speeds

For ball screw drive, note the rotational speed characteristics, spindle length and relevant critical rotational speed as well as engine speed

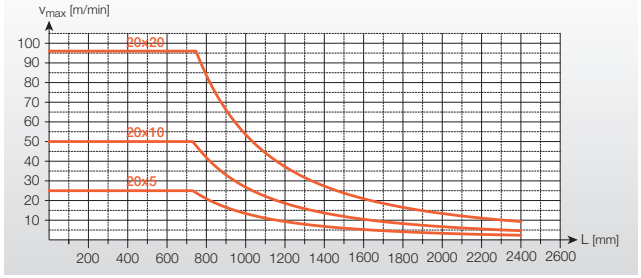
Legend:

1) Greater accuracy on request
L = overall length of the Linear Module

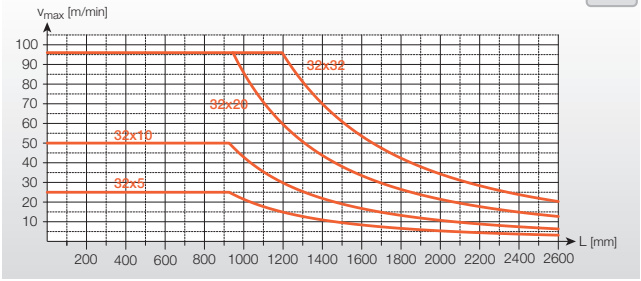
... for Linear Module LM3...R... with ball screw ø 16 x ... 1)



... for Linear Module LM4...R... with ball screw ø 20 x ... 1)



... for Linear Module LM5...R... with ball screw ø 32 x ... 1)

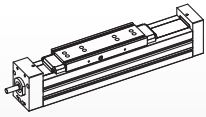


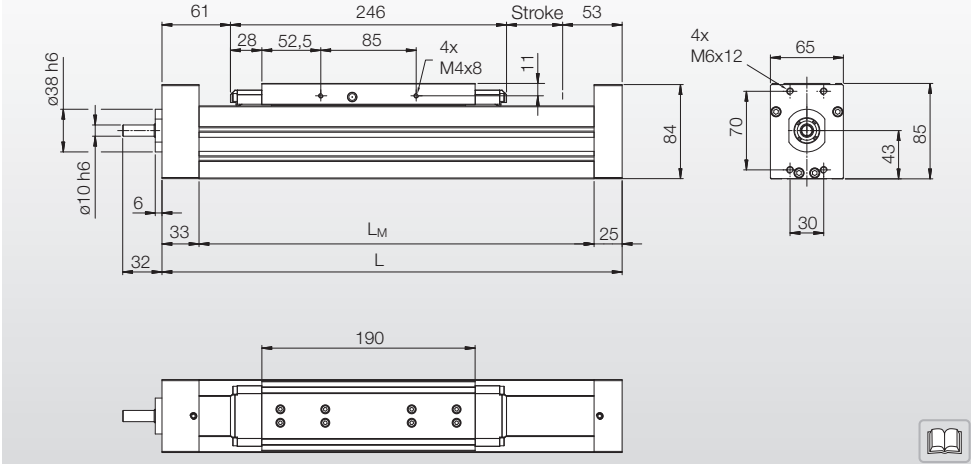
9. Dimensions, exploded views and parts lists

9.1 Dimensions of Linear Module LM3...BR...N

with ball screw, with cover

CAD data is available from www.linetech.ch





Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM3...BR...N	Stroke + 360	L – 58	L + 22	L – 22	4.60 kg + 0.65 kg/100 mm stroke

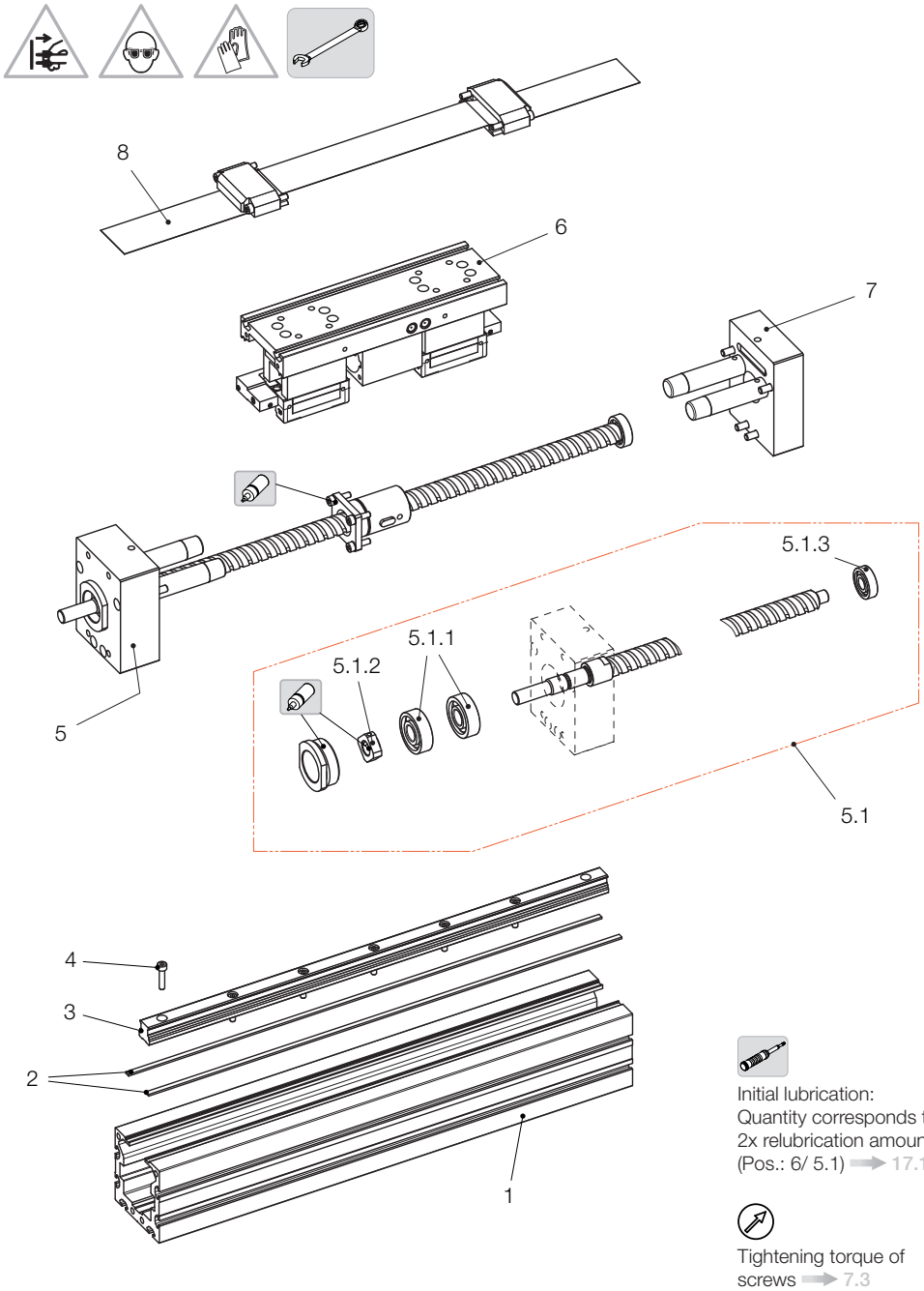
9.1.1 Parts list for exploded view

→ □ 9.1.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	-
5	End plate with ball screw	10	-
5.1	Complete ball screw	11	-
5.1.1	Angular contact ball bearings	12	-
5.1.2	Lock nut	13	-
5.1.3	Floating bearing	14	-

9.1.2 Setup and assembly of the Linear Module (exploded view)



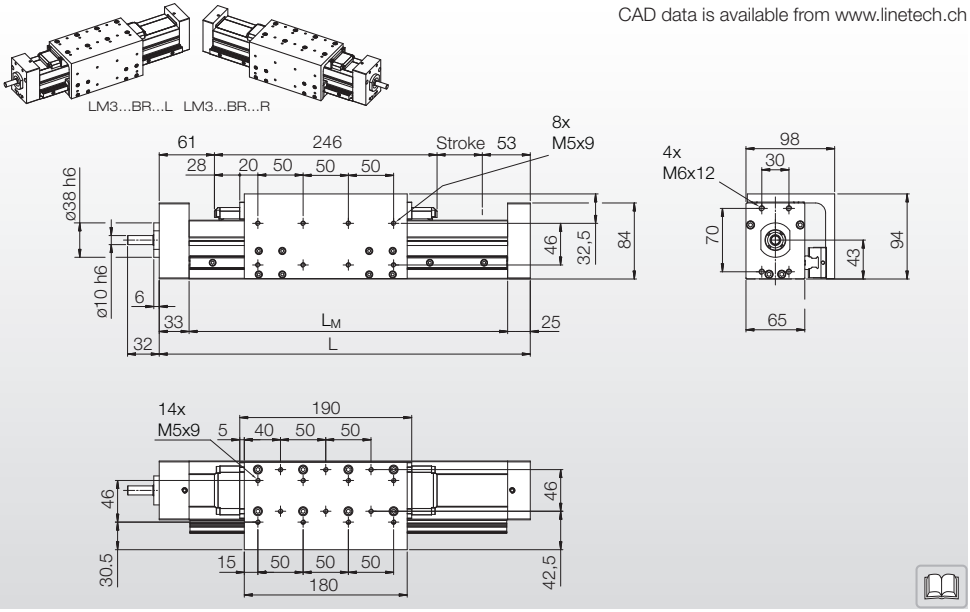
Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

9.2 Dimensions of Linear Module LM3...BR...L/R

with ball screw and lateral support rail left/right, with cover

CAD data is available from www.linetech.ch



Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM3...BR...L/R	Stroke + 360	L – 58	L + 22	L – 22	6.11 kg + 0.78 kg/100 mm stroke

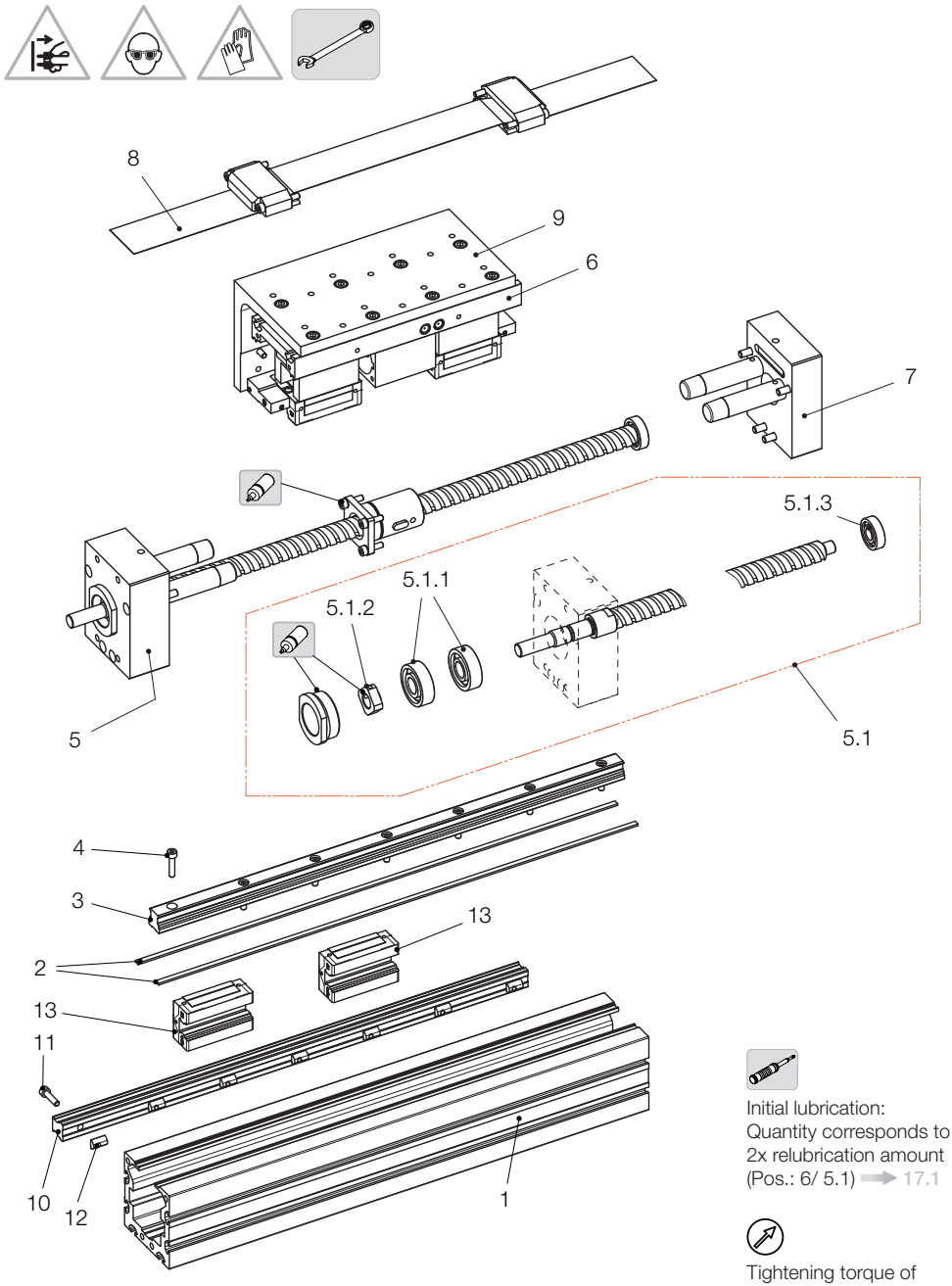
9.2.1 Parts list for exploded view

→ □ 9.2.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	Angle for the support rail
5	End plate with ball screw	10	Support rail
5.1	Complete ball screw	11	Screw to the support rail
5.1.1	Angular contact ball bearings	12	Sliding block to the support rail
5.1.2	Lock nut	13	Runner block to the support rail
5.1.3	Floating bearing	14	-

9.2.2 Setup and assembly of the Linear Module (exploded view)



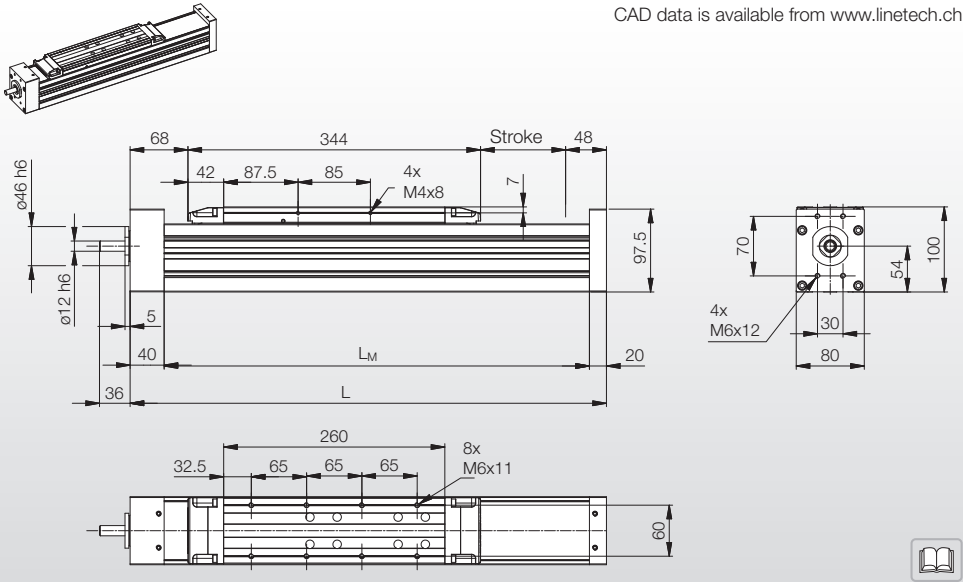
Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

9.3 Dimensions of Linear Module LM4...BR...N

with ball screw, with cover

CAD data is available from www.linetech.ch



Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM4...BR...N	Stroke + 460	L – 60	L + 30	L – 22	7.8 kg + 0.95 kg/100 mm stroke

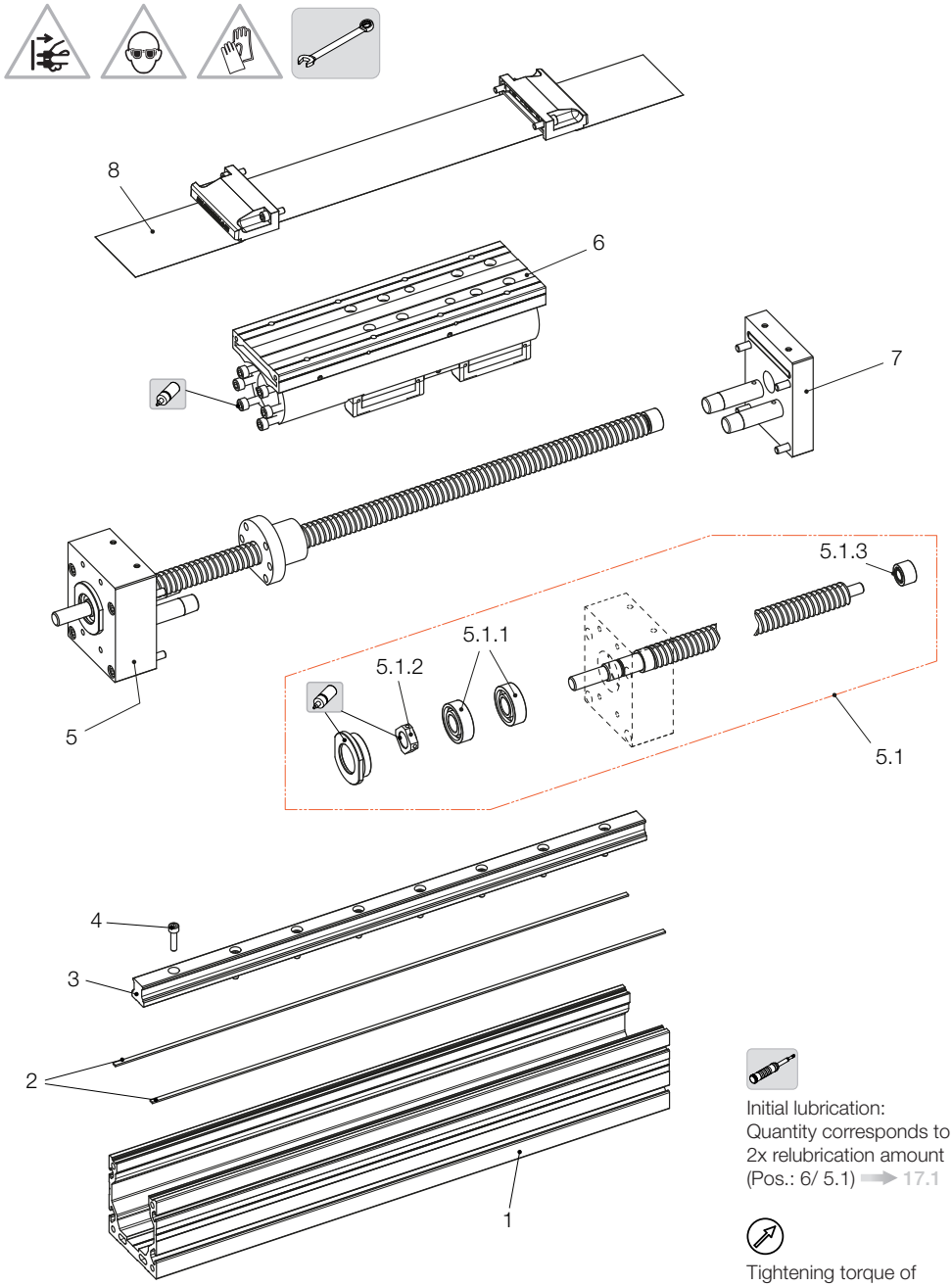
9.3.1 Parts list for exploded view

→ 9.3.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	-
5	End plate with ball screw	10	-
5.1	Complete ball screw	11	-
5.1.1	Angular contact ball bearings	12	-
5.1.2	Lock nut	13	-
5.1.3	Floating bearing	14	-

9.3.2 Setup and assembly of the Linear Module (exploded view)



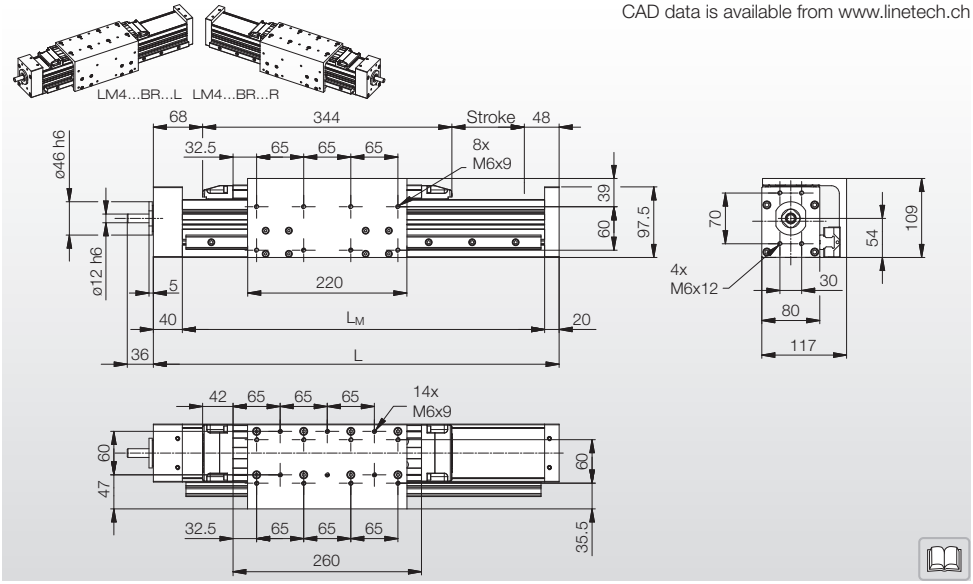
Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

9.4 Dimensions of Linear Module LM4...BR...L/R

with ball screw and lateral support rail left/right, with cover

CAD data is available from www.linetech.ch



Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM4...BR...L/R	Stroke + 460	L – 60	L + 30	L – 22	10.46 kg + 1.18 kg/100 mm stroke

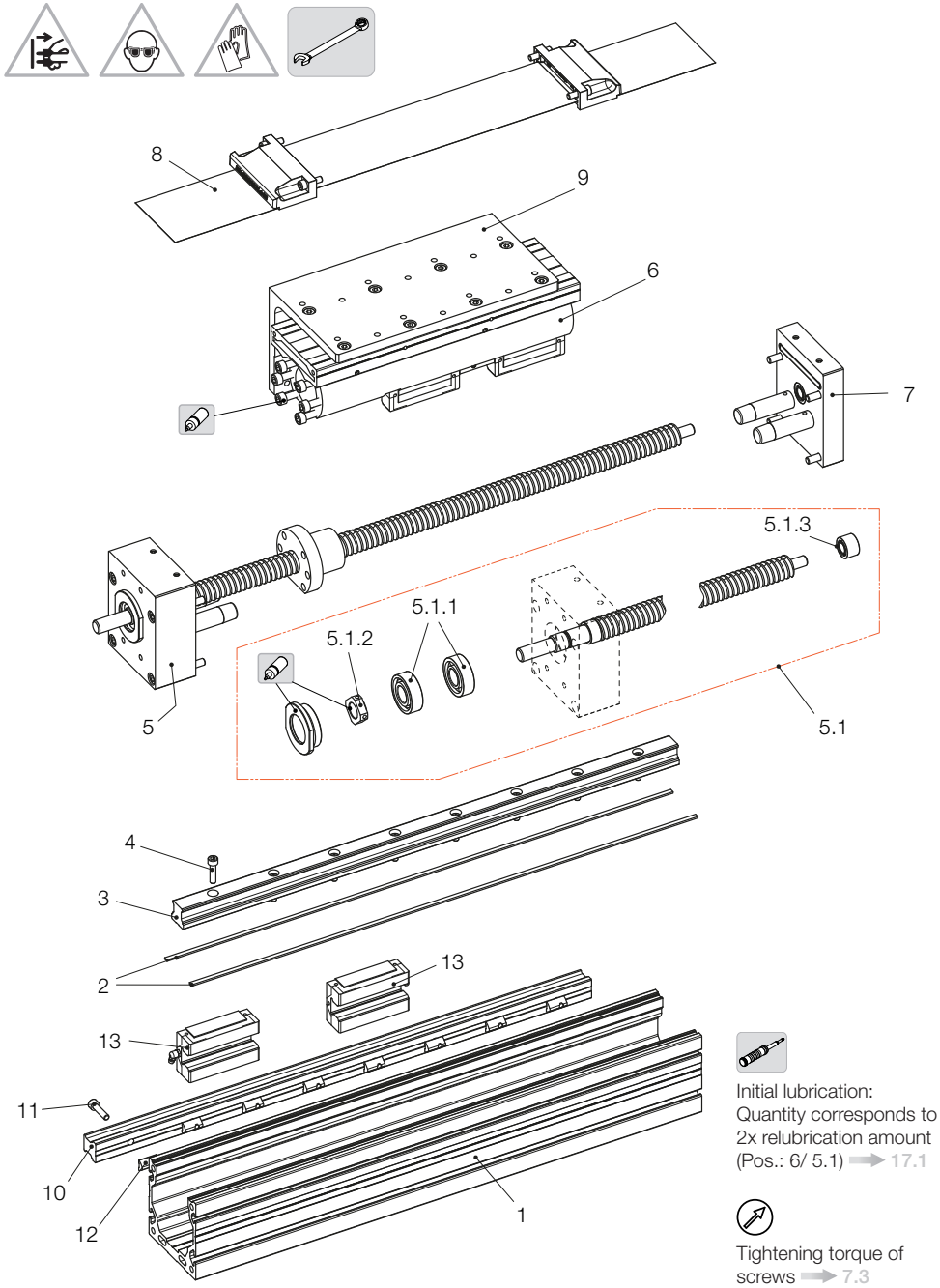
9.4.1 Parts list for exploded view

→ 9.4.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	Angle for the support rail
5	End plate with ball screw	10	Support rail
5.1	Complete ball screw	11	Screw to the support rail
5.1.1	Angular contact ball bearings	12	Sliding block to the support rail
5.1.2	Lock nut	13	Runner block to the support rail
5.1.3	Floating bearing	14	-

9.4.2 Setup and assembly of the Linear Module (exploded view)



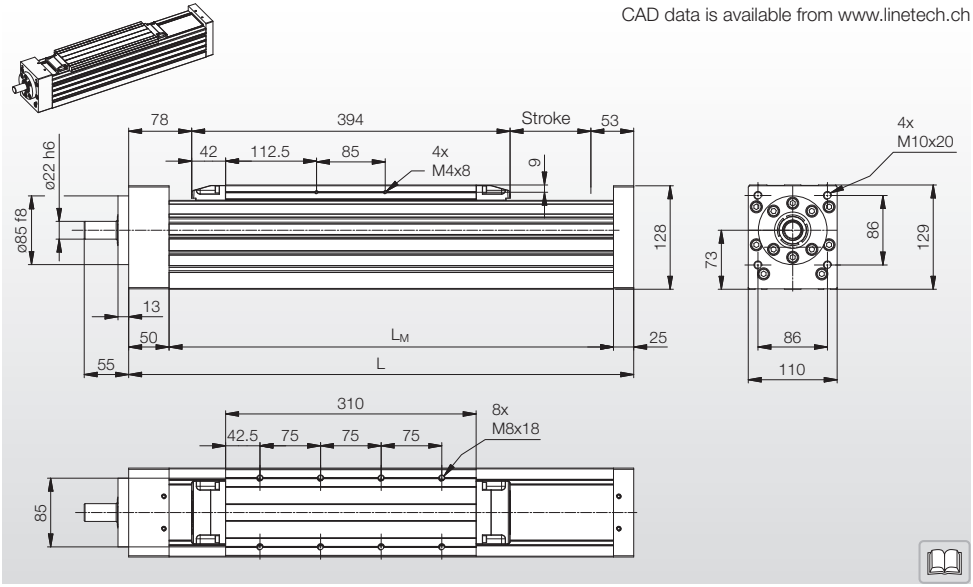
Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

9.5 Dimensions of Linear Module LM5...BR...N

with ball screw, with cover

CAD data is available from www.linetech.ch



Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM5...BR...N	Stroke + 525	L – 75	L + 50	L – 44	16.8 kg + 1.9 kg/100 mm stroke

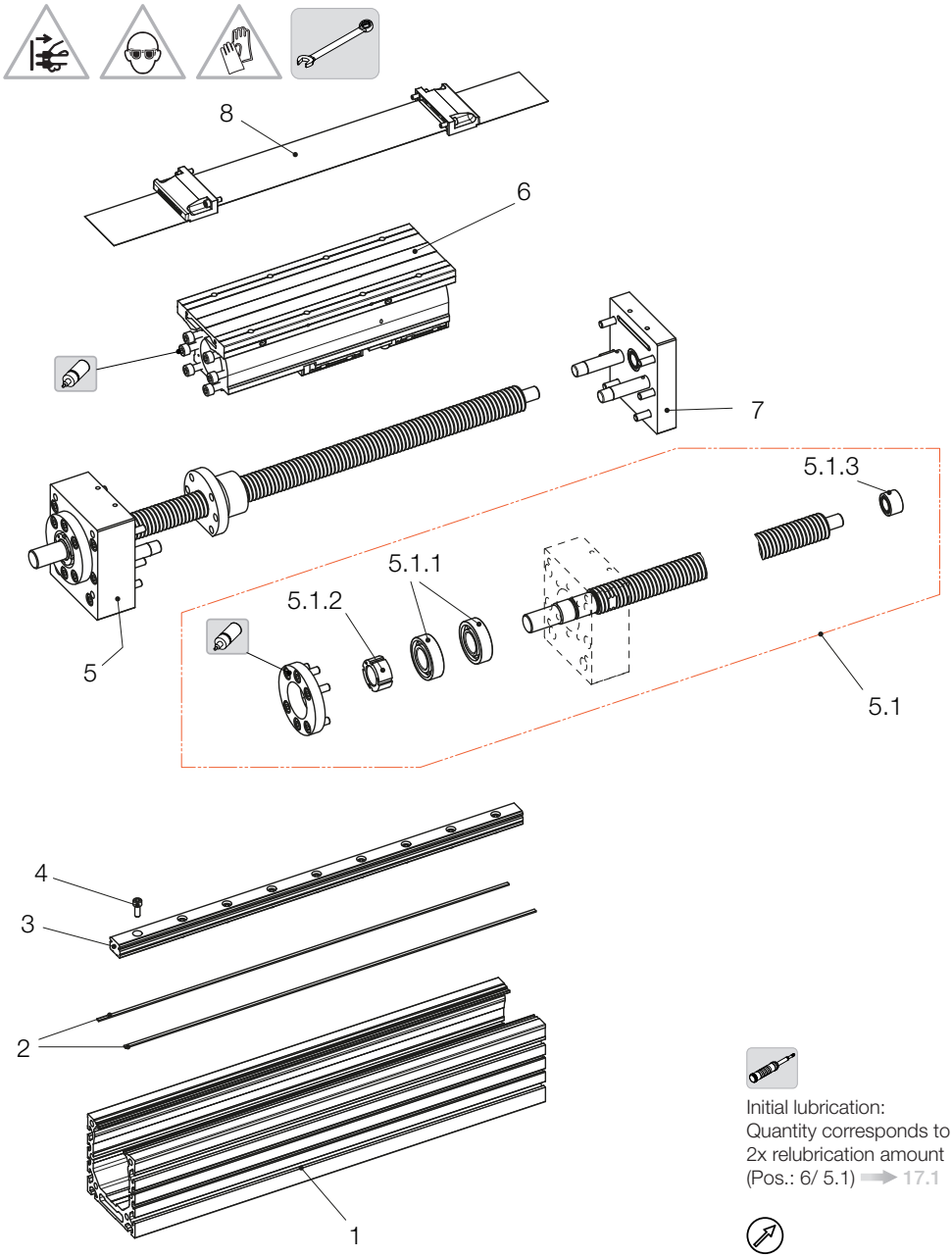
9.5.1 Parts list for exploded view

→ □ 9.5.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	-
5	End plate with ball screw	10	-
5.1	Complete ball screw	11	-
5.1.1	Angular contact ball bearings	12	-
5.1.2	Lock nut	13	-
5.1.3	Floating bearing	14	-

9.5.2 Setup and assembly of the Linear Module (exploded view)



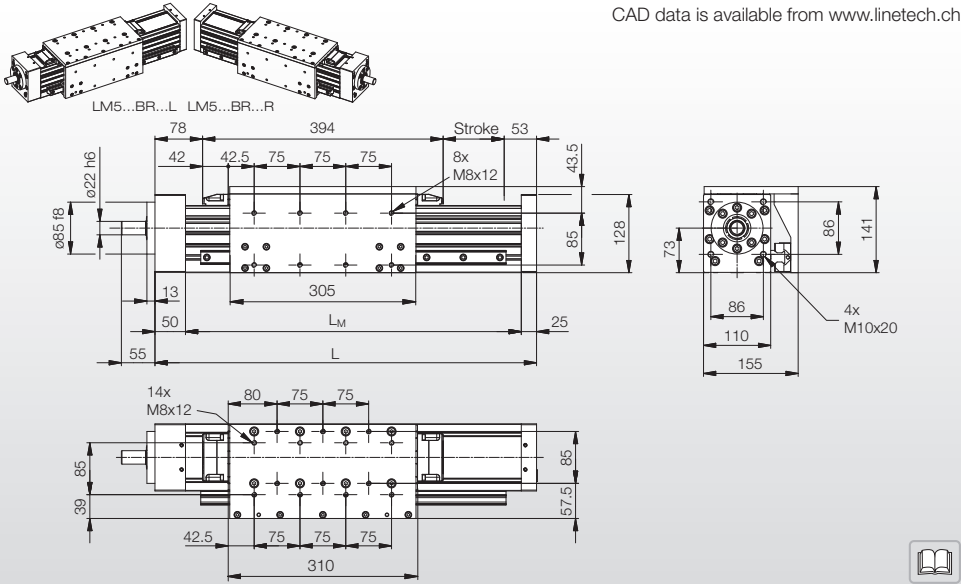
Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

9.6 Dimensions of Linear Module LM5...BR...L/R

with ball screw and lateral support rail left/right, with cover

CAD data is available from www.linetech.ch



Nominal size	Dimensions				
Designation	L [mm]	L_M [mm]	Spindle length [mm]	Length of protective ribbon [mm]	Weight [kg]
LM5...BR...L/R	Stroke + 525	L – 75	L + 50	L – 44	21.75 kg + 2.21 kg/100 mm stroke

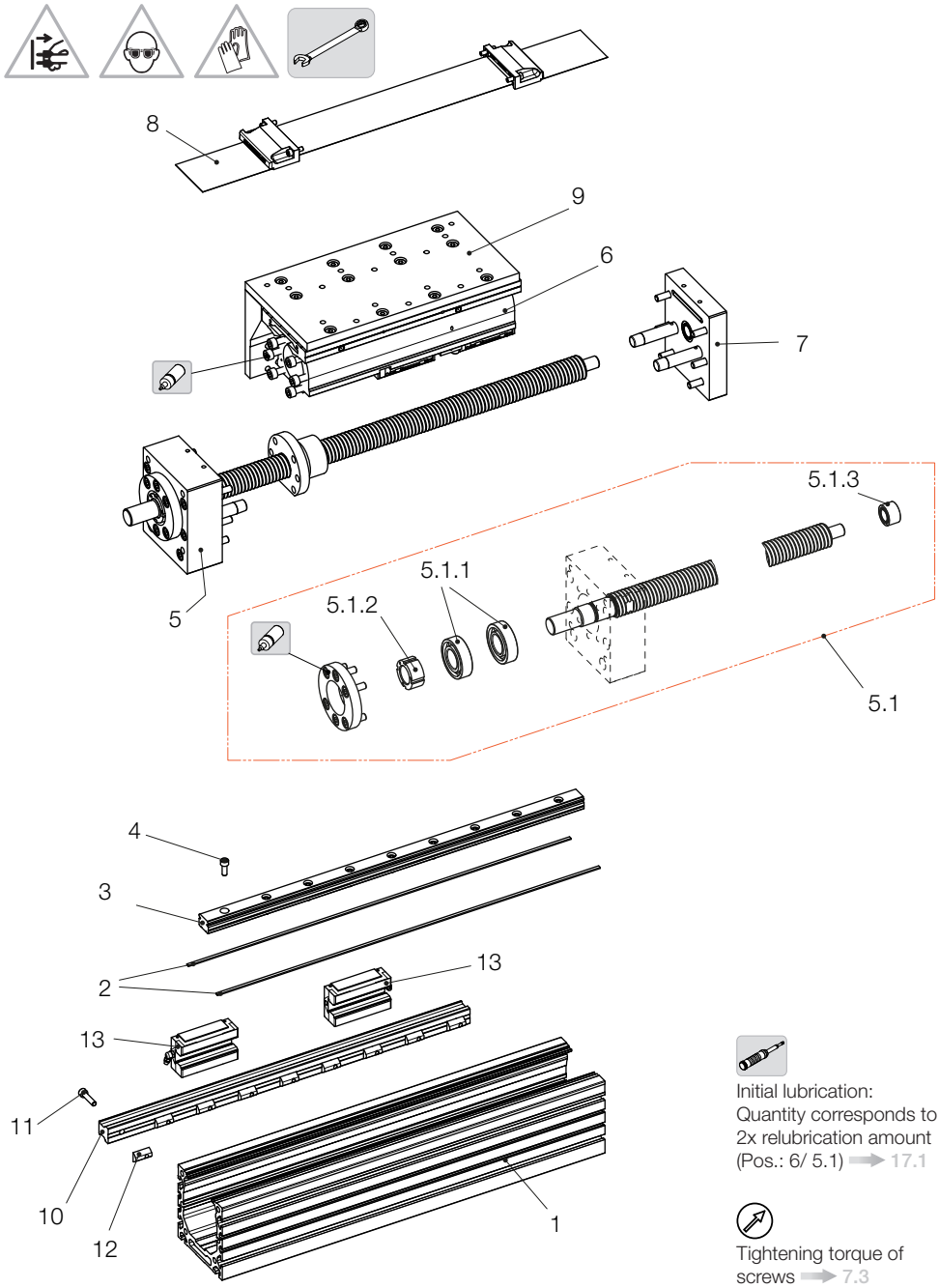
9.6.1 Parts list for exploded view

→ □ 9.6.2

Assembly of attachments according to the corresponding chapters → 11 / 12 / 13
LINE TECH recommends ordering the superordinate assemblies
Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Base profile	6	Carriage
2	Magnetic tape	7	End plate opposite the drive side
3	Linear rail	8	Cover with belt deflector
4	Screw on linear rail	9	Angle for the support rail
5	End plate with ball screw	10	Support rail
5.1	Complete ball screw	11	Screw to the support rail
5.1.1	Angular contact ball bearings	12	Sliding block to the support rail
5.1.2	Lock nut	13	Runner block to the support rail
5.1.3	Floating bearing	14	-

9.6.2 Setup and assembly of the Linear Module (exploded view)



Initial lubrication:
Quantity corresponds to 2x relubrication amount (Pos.: 6/ 5.1) → 17.1

Tightening torque of screws → 7.3

10. Deflection of Linear Modules (LM) with ball screw (BSD)

10.1 Permissible deflection

Permissible deflection with ball screw

Linear Modules may be assembled self-supporting. However, the deflection must be noted in the process, as this limits the possible load.

If the maximum permissible deflection is exceeded, the Linear Modules must be additionally supported.

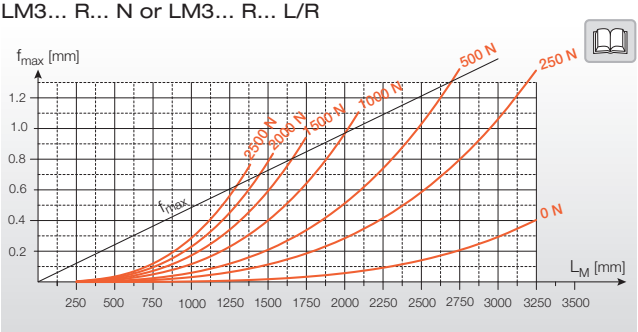
The maximum permissible deflection is limited by the maximum deflection angle of 5'. If this value is exceed without support, it will affect the service life.

If increased demands are made on system accuracy we recommend supporting the Linear Modules along their entire length.

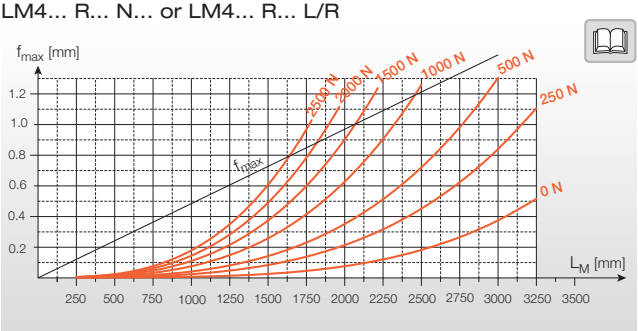
The following diagrams apply for:

– fixed clamping
  (40–50 mm per side)
– 3–4 screws per side
– fixed substructure

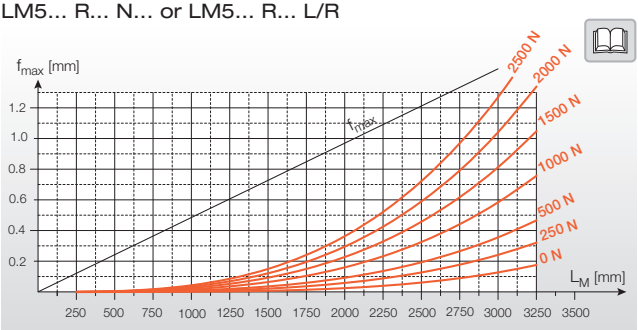
LM3... R... N or LM3... R... L/R



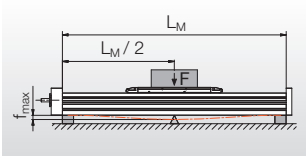
LM4... R... N... or LM4... R... L/R



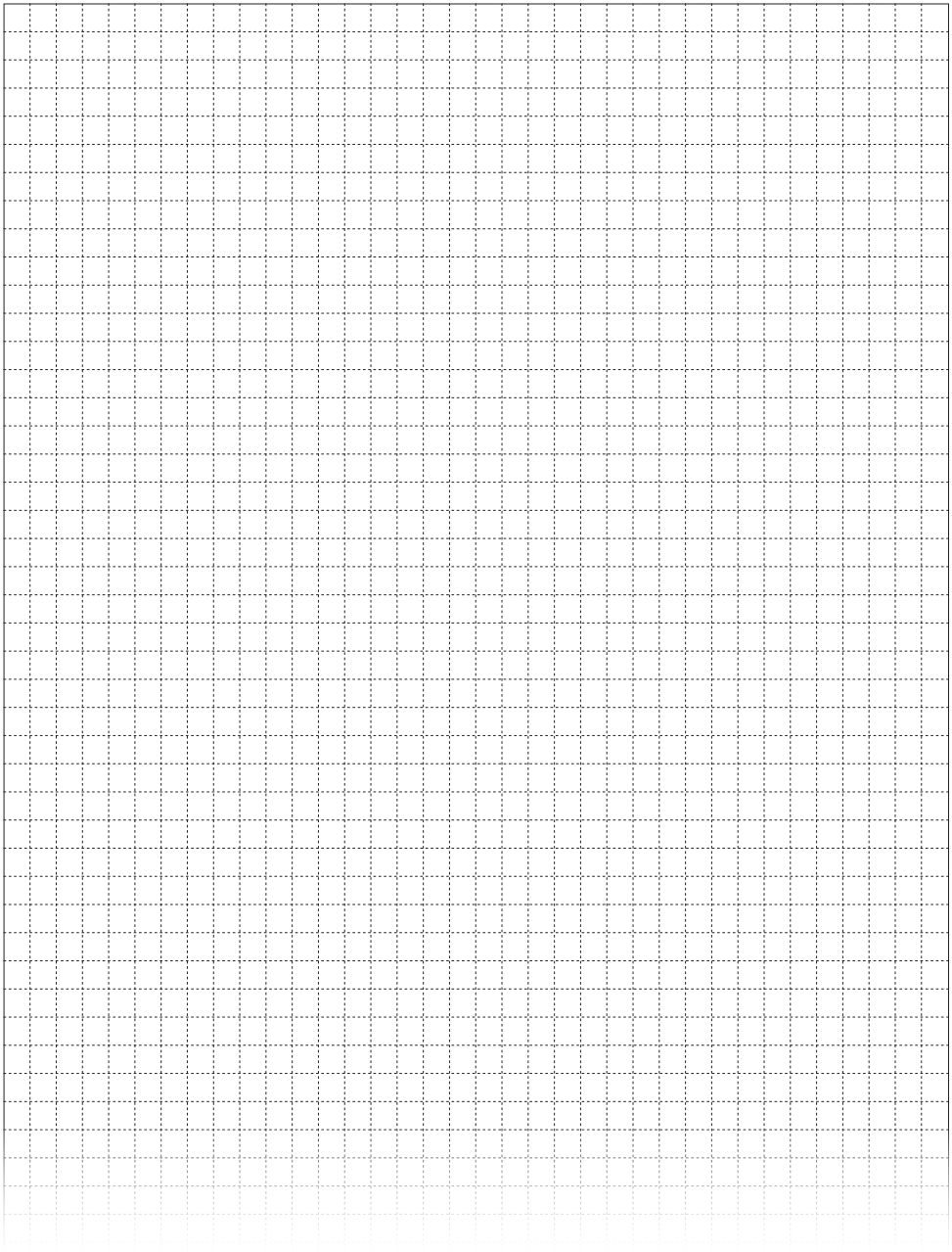
LM5... R... N... or LM5... R... L/R



Installation position:
– horizontal



Notes

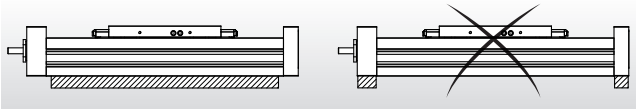


11. Fastening accessories

11.1 Securing the Linear Module with clamps

Caution: The end plates may not be used as supporting elements. Only attach and support the Linear Modules on the base profile, not on the end plates.

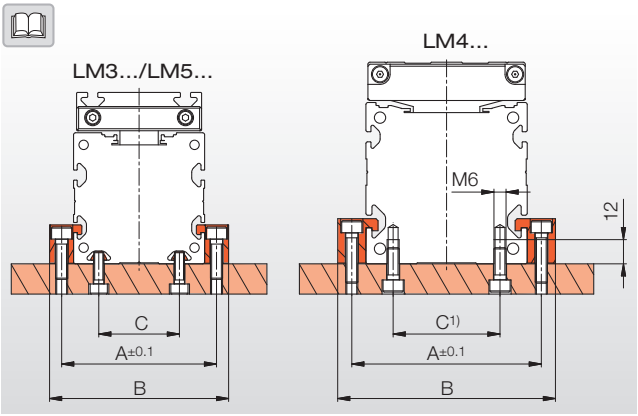
The aluminium base profile is the main supporting body of the unit. This must be supported across the entire length if possible.



The Linear Modules are secured with clamps or sliding blocks.

Nominal size	Dimensions [mm]		
	A	B	C
LM3...	76.8	88.8	40
LM4...	94.0	108.0	53[1)]
LM5...	132.0	150.0	85

The screws are to be secured with Loctite. For the recommended tightening torques M_A, see → 7.3

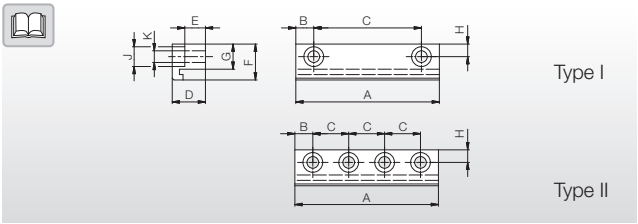


1) possible for size LM4 with planning by LINE TECH during production.

Mounting options

Recommended number of clamps:
- 4 clamps per metre (type I)
- 3 clamps per metre (type II)

The clamps pursuant to the following table can be purchased from LINE TECH AG.

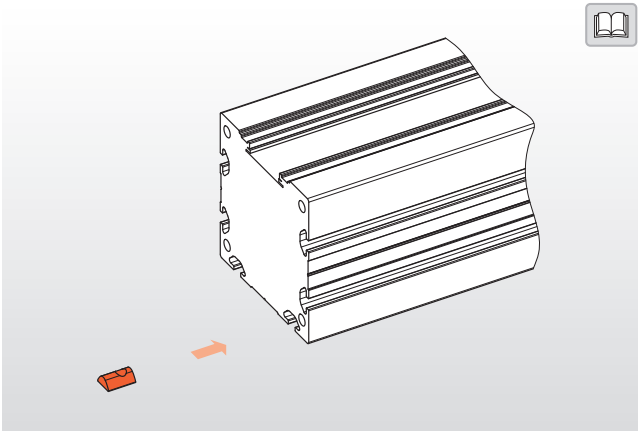


Nominal size	Type	Dimensions [mm] A	B	C	D	E	F	G	H	J	K	Weight [kg]	Item no.
LM3...	I	80	10	.....	19.0	12.0	16	11.9	6	ø11	ø6.5	.....	.....
	II			20								0.118	P-54376/1
LM4...	I	80	10	60	22.0	15.0	20	14.0	7	ø11	ø6.5	0.195	M-40023/1
	II			.....								.....	.....
LM5...	I	108	19	70	25.7	16.7	28	20.0	9	ø15	ø9.0	0.412	M-50158/1
	II			.....								.....	.....

11.2 Securing the Linear Module with sliding blocks

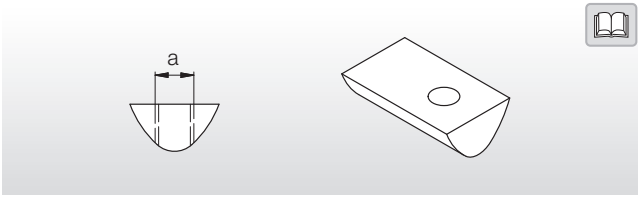
Caution:

Sliding blocks having the relevant groove width can be used to mount add-on parts to the base profile.



Sliding block types NS5 and NS8 can be used in line with the groove width.
Size, material and connection thread as per the following order system (e.g. NS6 St M5) must be defined as the order number.

The available types are listed opposite. The sliding blocks pursuant to the following table can be purchased from LINE TECH AG.



Dimensions [mm]		Material
Groove width	a (thread)	
5	M3 / M4 / M5	Steel / stainless steel
6	M4 / M5 / M6	Steel / stainless steel
8	M4 / M5 / M6 / M8	Steel / stainless steel

Order designation for sliding blocks

Example: NS6 St M5

NS	6	St	M5

Sliding block NS

Groove width
5
6
8

Thread size (Mass “a”)
M3 / M4 / M5 / M6 / M8

Material
St = Steel
stainless = stainless

12. Limit switch

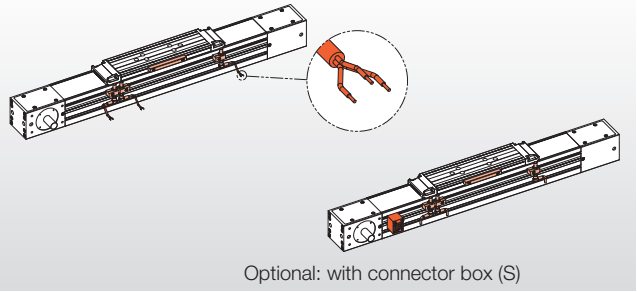
12.1 Attachment / assembly / plug connection

Limit switch preparation

Limit switches are supplied as standard without connector box with 2 metre long cables (order code N); a connector box with completed cabling is available as an option (order code S).

Limit switch mating connectors and cables are not included in the delivery, but can be ordered ready-made from LINE TECH AG.

Standard: without connector box (N), with connector cable (L = 2m)



Optional: with connector box (S)

12.2 Limit switches / reference switch mounting overview

Limit switch

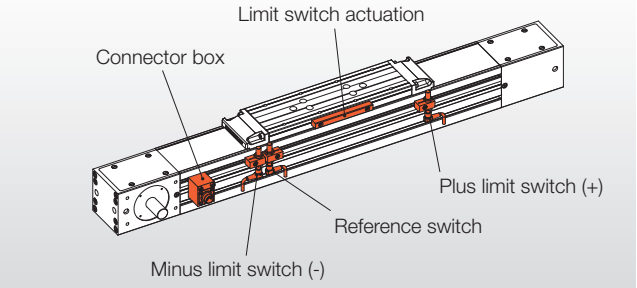
The limit switches are used in conjunction with a control unit to limit the stroke (prevent overrunning of the carriage) and to define the reference position.

At the factory the plus and minus limit switches are preset to a nominal stroke of 0 to +5 mm

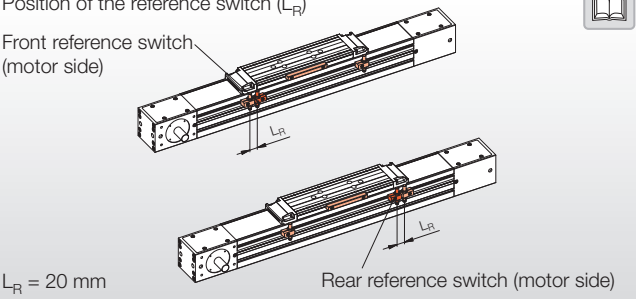
LINE TECH employs the following standard inductive limit switches:
- PNP normally closed
Supply: 10…30 V DC
Current consumption off-load: < 10 mA
Load mx. 200 mA

On request the following non standard limit switches are available:
– PNP normally open (PNP-NO)
– NPN normally closed (NPN-NC)
– NPN normally open (NPN-NO)
– Reed switches
– Mechanical switches

Limit switches / reference switch mounting overview



Position of the reference switch (L_R)

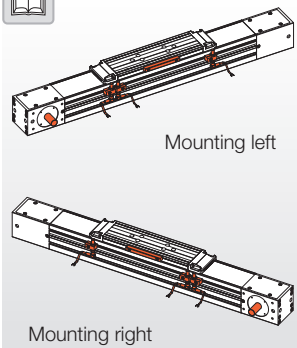


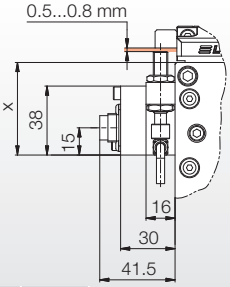
L_R = 20 mm

Fitting position of limit switches

The installation position of the limit switches. is evident from the following images. The reference point can be assigned to the positive (+) or the negative limit switch (-).

Special applications often require a separate reference point switch to be mounted between the positive and negative limit switches. The limit switch closest to the motor mounting (limit switch controller interface) is known as the forward limit switch.



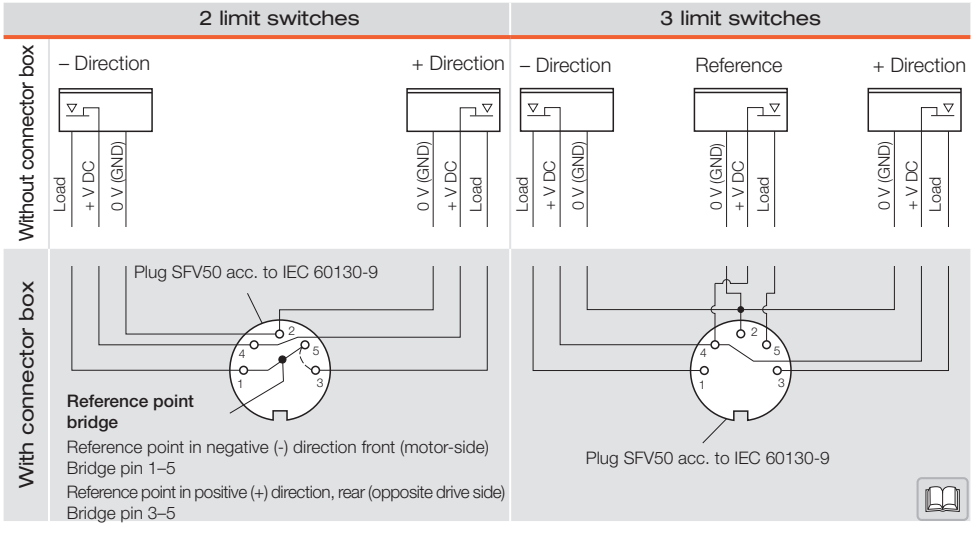


Size	x [mm]
LM3	55
LM4	51
LM5	59

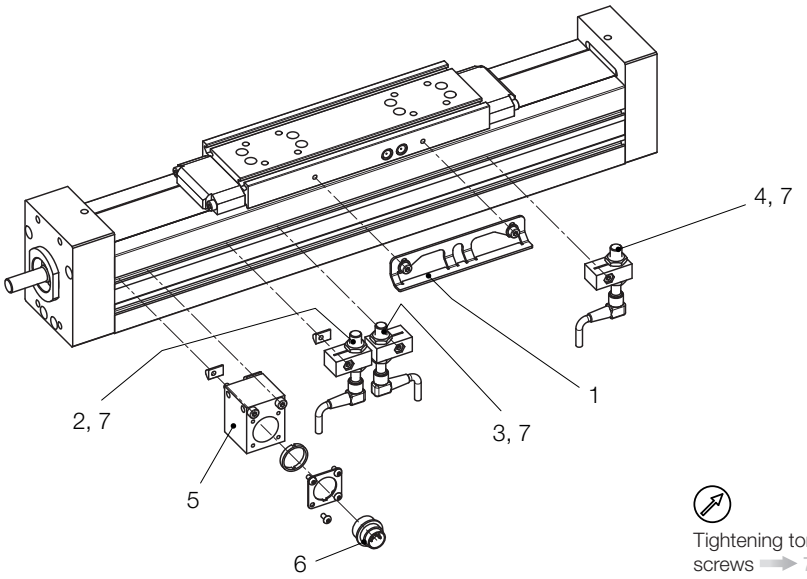
The plug pin assignment when using a connector box is shown in the diagram below.

The individual pins are assigned as follows:
Pin 1 = negative (-) direction (load)
Pin 2 = 0 V (GND)
Pin 3 = Positive (+) direction (load)
Pin 4 = +10…30 V DC
Pin 5 = Reference (load)

Colour code key for the diagrams below:
Load = black
+V DC = brown
0 V (GND) = blue



12.2.1 Limit switch mounting (exploded view)



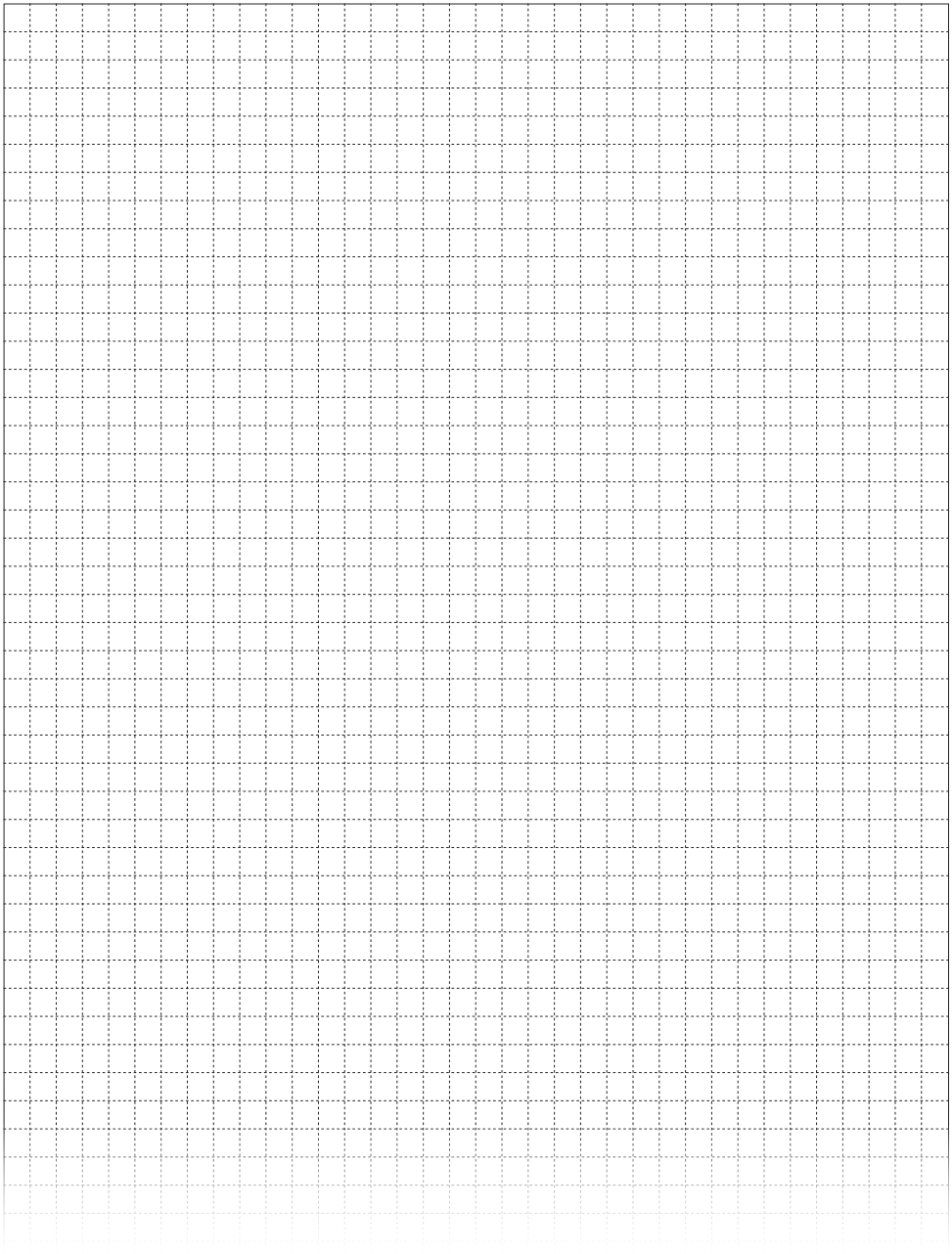
Tightening torque of screws → 7.3

12.2.2 Parts list for exploded view → □ 12.2.1

Ordering spare parts and accessories requires the information from the nameplate → 7.2

Position	Designation	Position	Designation
1	Limit switch actuation	5	Connector box
2	Minus limit switch (-)	6	Plug (including nut)
3	Reference switch	7	Limit switch cable (3-pole)
4	Plus limit switch (+)	8	-

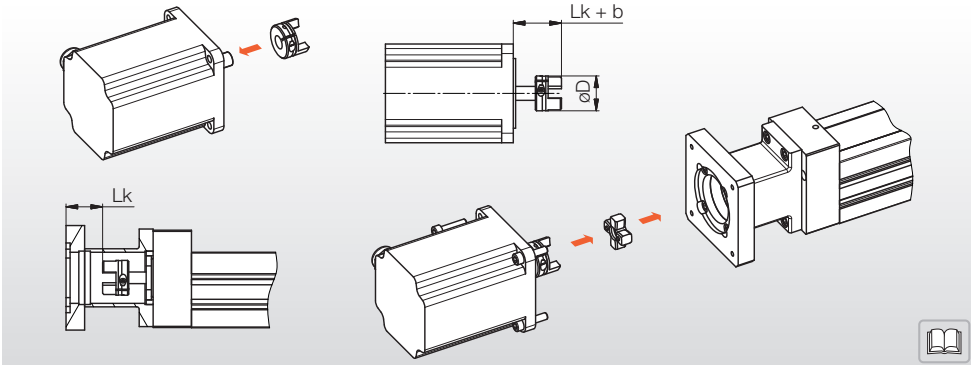
Notes



13. Motor mounting

13.1 Straight, with ball screw

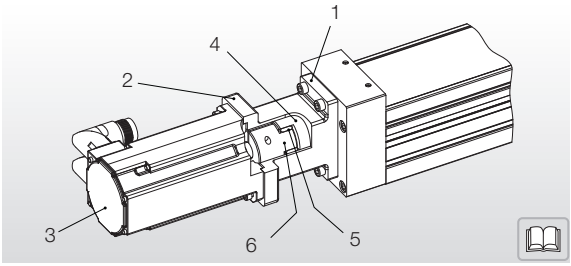
Note the motor manufacturer's operating instructions prior to mounting a motor



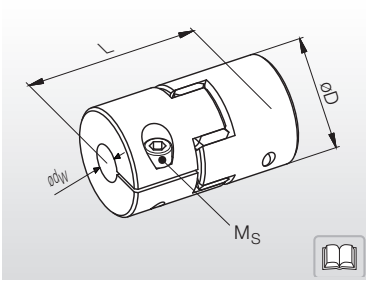
1) Measure the spacing of the Lk on the unit
2) Attach the clamping hub to the motor mounting in the spacing Lk + b. Tightening torque of the clamping screw → 13.1.2
3) Attach the preassembled motor with gear ring to the unit

13.1.1 Motor attachments and parts list, straight with ball screw

Position	Designation
1	Intermediate flange
2	Motor plate
3	Motor
4	"LM" clamping hub
5	Sprocket
6	"Motor" clamping hub



13.1.2 Tightening torque of the clamping screws

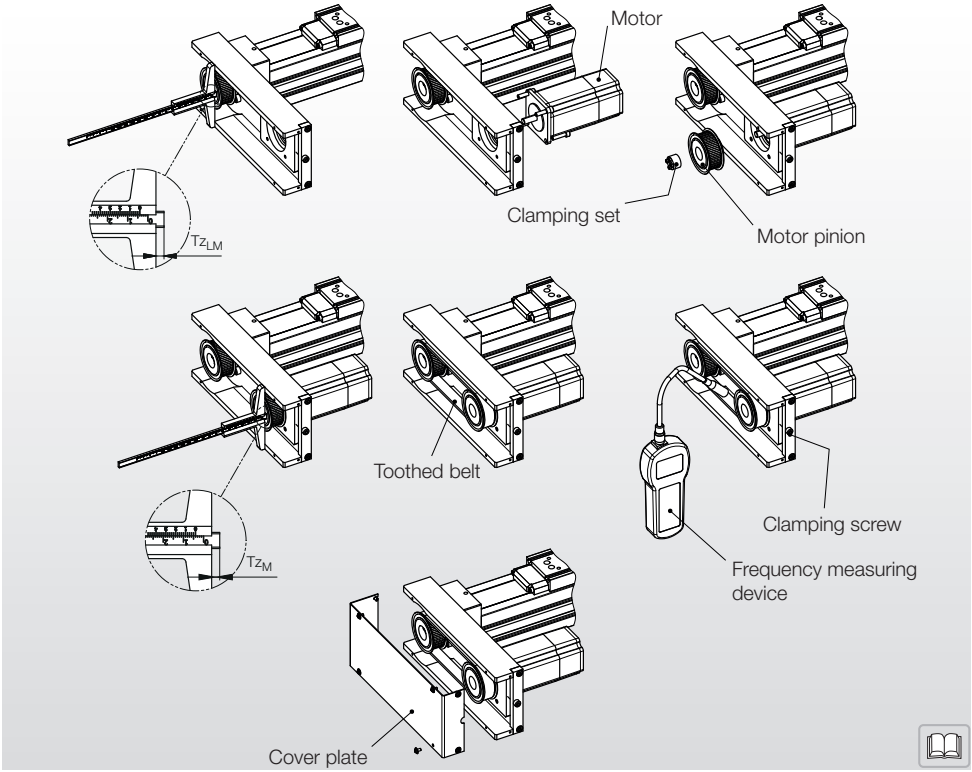


Tightening torque of the clamping screws

Size	Dimensions [mm]				Tightening torque of the clamping screw [Nm]		Drive torque [Nm]	
	L	øD	b	ød	Type	M_S	T_N	T_{max}
14	35	30	10	≤16	ISO 4762	1.34	6.3	25
19	66	40	12	≤20	ISO 4762	10.10	17.0	34
19	66	40	12	≤20	ISO 7380	7.20	17.0	34
24	78	55	14	≤28	ISO 4762	10.10	40.0	120

13.2 Lateral, with ball screw

Note the motor manufacturer's operating instructions prior to mounting a motor



1) Measure the mounting depth of the mounted pinion Tz_{LM} at the unit.

2) Mount the motor on the belt drive housing with the corresponding screws.
Ensure that the screws are tightened so that the motor and the motor plate can still be moved easily.

3) Mount the pinion on the motor side using a clamping set (tightening torques of the clamping screws → 13.2.1) in the same mounting depth ($Tz_{LM} = Tz_M$).

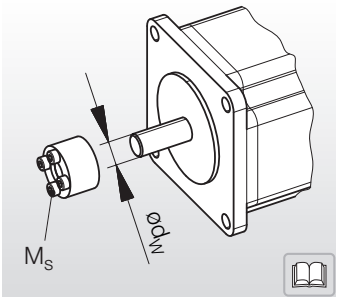
4) Insert the toothed belt and tighten using the clamping screw.
The toothed belt tension is checked using a frequency measuring device. The adjustment frequency "f" can be determined according to the calculation → 13.3.
Please also note the operating instructions of the frequency measuring device used.

5) Tighten the screws of the motor mounting according to the tightening torques → 7.3 .

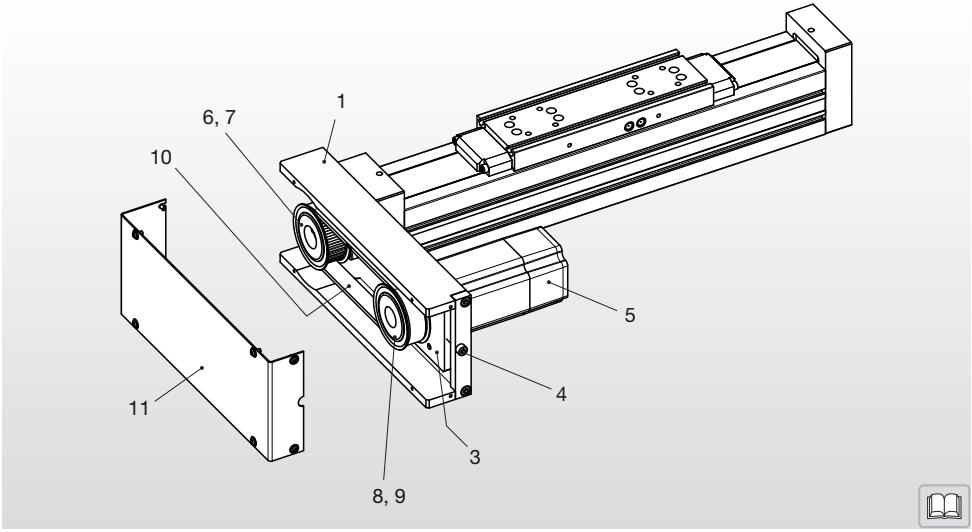
6) Mount the cover plate.

13.2.1 Tightening torque of the clamping screws

Tightening torque of the clamping screws		
Motor shaft $ød_W$ [mm]	Type ISO 4762	Tightening torque M_S [Nm]
ø5…ø12	M2.5 x 10	1.20
ø14, ø15	M3 x 16	2.10
ø16…ø19	M4 x 20	4.90
ø20, ø22	M5 x 20	10.00
ø24…ø32	M6 x 24	17.00



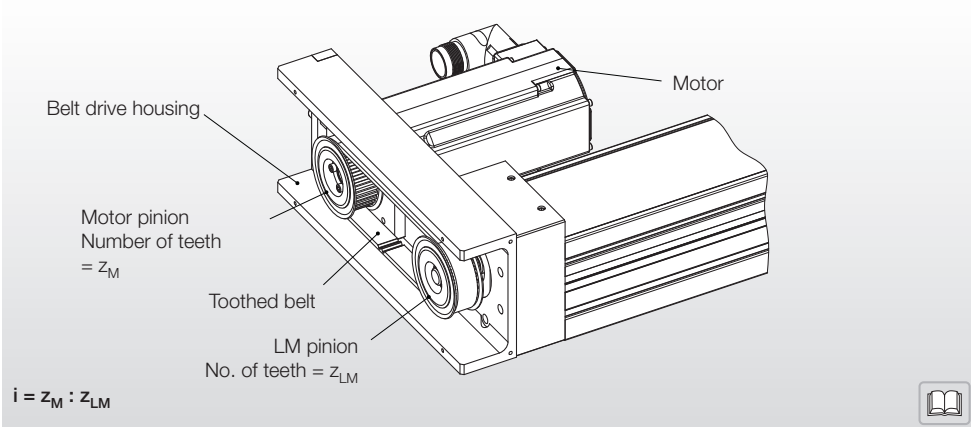
13.2.2 Motor attachments and parts list, lateral with ball screw



Position	Designation	Position	Designation
1	Belt drive housing	7	Linear Module clamping set
2	Belt clamping plate	8	Motor pinion
3	Motor plate	9	Motor clamping set
4	Clamping screw	10	Toothed belt
5	Motor	11	Cover plate
6	Linear Module pinion		

13.3 Calculation of the preload frequency

ß = Wrap angle [°]
b = Belt width [mm]
E = Axle base [mm]
E_{eff} = Effective axle base [mm]
f = Preload frequency of the belt [Hz]
F_U = Circumferential force [N]
F_{Uzul} = Permissible preload force [N]
F_V = Preload force [N]
L_F = Free span length [m]
L_R = Belt length [mm]
M_M = Motor torque [Nm]
m_{spec} = Specific toothed belt weight [kg/m]
n_M = Engine speed [rpm]
P = Power in [kW]
t = Division [mm]
v_M = Speed of the motor pinion [m/s]
z_M = Number of teeth of the motor [-]
z_{LM} = Number of teeth of the Linear Module [-]



$i = z_M : z_{LM}$

Nominal size	Reduction i	Axle base E [mm]	No. of teeth z_M	No. of teeth z_{LM}	Belt data Length L_R [mm]	Belt data Width b [mm]	Division t [mm]	Spec. Weight m_{spec} [kg/m]	Max. permissible preload force F_{Vzul} [N]
	1:1	132.5	32	32	425	15.0	5.0	0.065	330
LM3...	1:1.5	135.0	32	48	475	15.0	5.0	0.065	330
	1:2	133.5	24	48	450	15.0	5.0	0.065	330
	1:1	132.5	32	32	425	15.0	5.0	0.065	330
LM4...	1:1.5	135.0	32	48	475	15.0	5.0	0.065	330
	1:2	133.5	24	48	450	15.0	5.0	0.065	330
	1:1	167.5	48	32	575	15.0	5.0	0.065	330
LM5...	1:1.5	174.5	32	48	550	15.0	5.0	0.065	330
	1:2	172.5	27	48	550	15.0	5.0	0.065	330

1) Wrap angle ß

$$ß = 2 \cdot \arccos \cdot \left[\frac{t \cdot (z_{LM} - z_M)}{2 \cdot \pi \cdot E} \right] [°]$$

2) Effective axle base E_{eff}

$$E_{eff} = \frac{1}{4} \cdot \left[L_R - \frac{t}{2} \cdot (z_{LM} + Z_M) + \sqrt{\left[L_R - \frac{t}{2} \cdot (z_{LM} + z_M) \right]^2 - 2 \cdot \left[\frac{t}{\pi} \cdot (z_{LM} - z_M) \right]^2} \right] [mm]$$

3) Power P

$$P = \frac{M_M \cdot n_M}{9.55 \cdot 10^3} \text{ kW}$$

4) Speed of the motor pinion v_M

$$v_M = \frac{n_M \cdot z_M \cdot t}{60 \cdot 10^3} [m/s]$$

5) Circumferential force F_U

$$F_U = \frac{P \cdot 10^3}{v_M} [m/s]$$

6) Review F_U

$$F_U \leq F_{Uzul}$$

7) Preload force F_V

$$F_V = F_U \cdot \sin \frac{ß}{2} \cdot 0.61 [N]$$

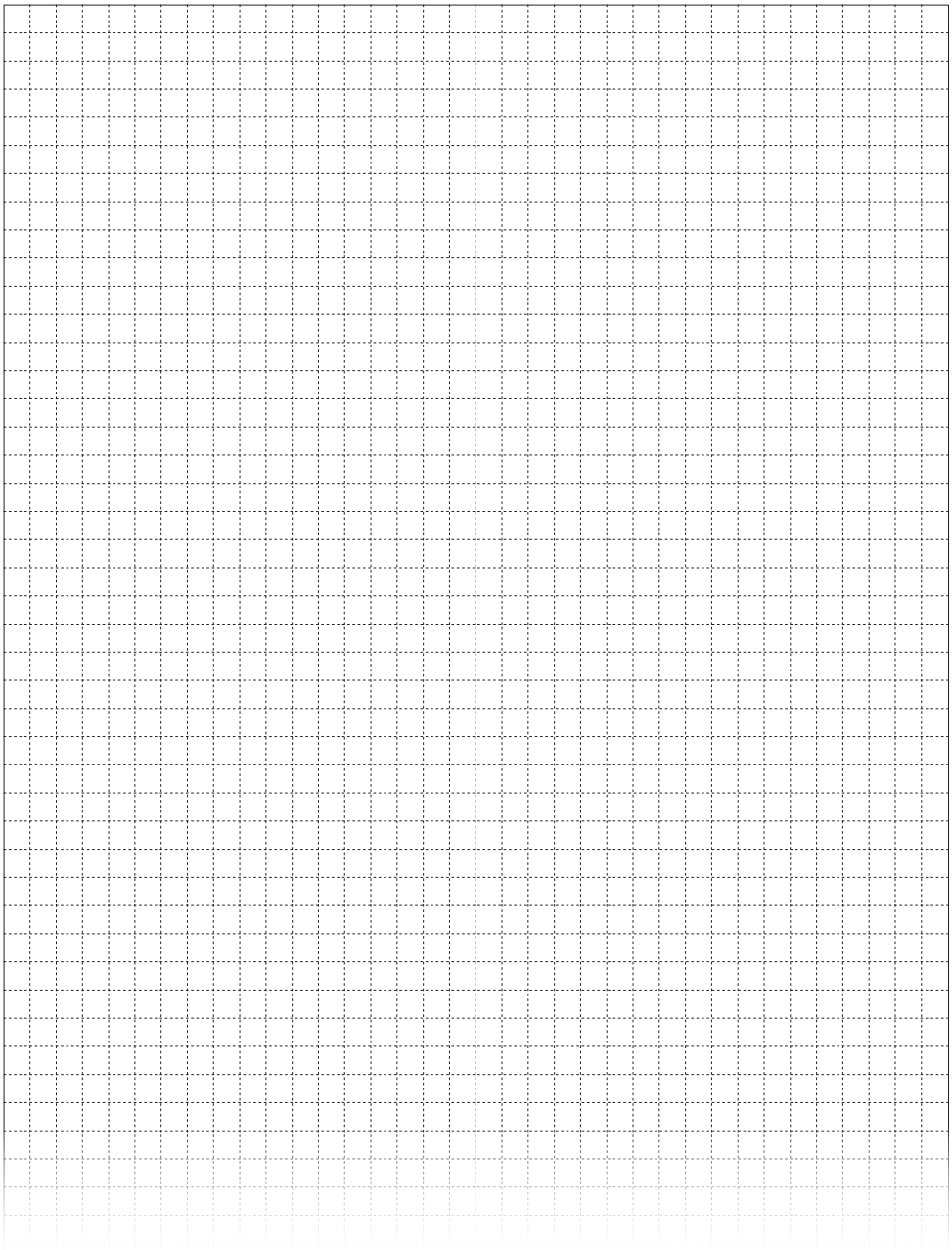
8) Free span length L_F

$$L_F = \sqrt{Eeff^2 - \frac{(z_{LM} - z_M)^2}{4}} / 1000 [m]$$

9) Preload frequency of the belt f

$$f = \sqrt{\frac{F_U}{4 \cdot m \cdot L_F^2}} [Hz] \text{ -0 \% / +10 \%}$$

Notes



14. Commissioning

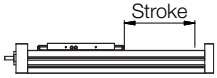
14.1 Operating conditions

Contact LINE TECH AG prior to commissioning for application areas with special operating conditions, such as in the presence of moisture, dirt, dust (fibre glass and wood), aggressive atmospheres, extreme climatic conditions and/or extreme temperature fluctuations, short-stroke and others.

Before commissioning the unit, check that the mounting means of the installed axis match the manufacturer's specifications with respect to the mass and acceleration and that they are secured.

Normal operating conditions		
Ambient temperature	5°C... 80°C	°C
Movement speed	≤ m/s	v
Rotational speed of the ball screw		
Load		

Minimal stroke

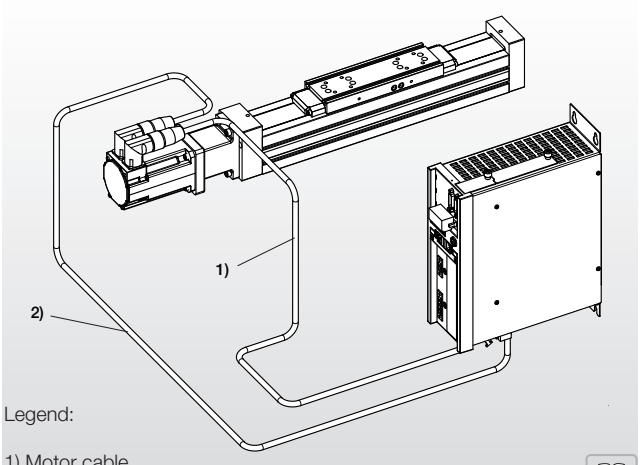


Type	Minimal stroke
LM3	≥ 45 mm
LM4	≥ 55 mm
LM5	≥ 65 mm

14.2 Electrically connect the LM

Observe the safety regulations when working on electrical systems! The AC/DC supply must be connected by a qualified electrician.

Install the power cables and signal cables so that they are spatially separated! Do not install the product near devices that generate strong electromagnetic fields. This could impair the function. Observe the documentation of the controller used.



Legend:

1) Motor cable
2) Signal cable

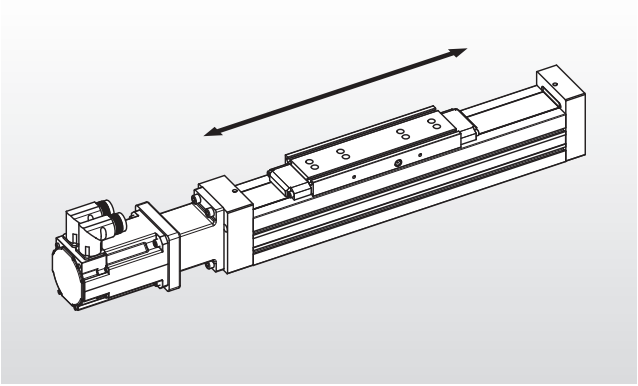
Check the EMERGENCY OFF switch prior to the first test run! Note the technical data about the Linear Modules with ball screw 8.2 - 8.4

Carry out a trial run only in the installed state combined with linear guides.

Check the internal protective equipment.

Check all screw connections to ensure they are tight.

Carry out the entire stroke at a low speed.
Check the setting and function of the limit switch 12.2



15. Operation

The Linear Module with ball screw may only be used in accordance with the intended use provided by LINE TECH AG 2

The Linear Module with ball screw may only be operated under operating conditions that are approved by the manufacturer 14.1

The Linear Module with ball screw must be checked for externally visible damage and defects. Externally attached mounting means, electrical cables and plug connections must be visually checked to ensure they are in a flawless condition.

If changes occur that put the safety of people and systems at risk, these are to be taken out of operation immediately.

16. Decommissioning

Disconnect the machine/system from the mains supply. To secure the machine from being switched on again without authorisation, actuate the emergency stop and attach the warning sign “Machine/system disconnected from mains supply”.

Remove the drive from the unit.

Unscrew the linear unit from the machine/system

17. Maintenance - Service - Upkeep

17.1 Lubricant Quantities, Lubrication Points, Lubrication Interval

The Linear Modules may only be lubricated with grease.

The initial greasing is performed by LINE TECH AG. The bearings used are usually maintenance-free and do not have to be re-lubricated under normal conditions.

The Linear Modules may only be lubricated with grease. LINE TECH AG recommends MICROLUBE GBU-Y 131 as a standard grease. If using other greases (other brands), the compatibility with the standard grease must be checked first. Observe the safety data sheet.

In the event of special operating conditions, inquire about the lubricant quantities. Values and information about lubricant quantities can be found in the adjacent table, corresponding to use under normal operating conditions

There are grease nipples on both sides of the carriage parts. It is sufficient if the amount of grease is pressed in from one side only.

Type	BSD d x P (mm)	Grease	Grease relubrication		
			Ball screw	Runner blocks (cm^3)	
			(cm^3)	Grease point 1)	Grease point 2)
LM3	16 x 5	Klüber Microlube GBU-Y 131	0.60	3.50	1.75 (per carriage)
	16 x 10		0.85		
	16 x 16		1.15		
LM4	20 x 5		0.90	3.50	1.75 (per carriage)
	20 x 20		2.30		
LM5	32 x 5		2.10	4.40	2.20 (per carriage)
	32 x 10		2.95		
	32 x 32		5.15		

Depending on which value is reached first, the linear guides and the ball screw are to be relubricated according to the adjacent table

Type	BSD d x P (mm)	Operating interval (h)	Time interval (months)	Running interval (km)
LM3	16 x 5	500	3 - 6	250
	16 x 10			500
	16 x 16			800
LM4	20 x 5	500	3 - 6	250
	20 x 20			1 000
LM5	32 x 5	500	3 - 6	250
	32 x 10			500
	32 x 32			1 600

Various grease nipples exist on the Linear Modules.

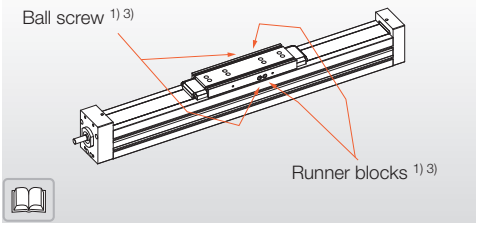
1) Grease nipple according to DIN 3405; The carriage positions for the purposes of lubrication are independent of the stroke.

2) Grease nipple according to DIN 71412; The carriage positions for the purposes of lubrication are independent of the stroke.

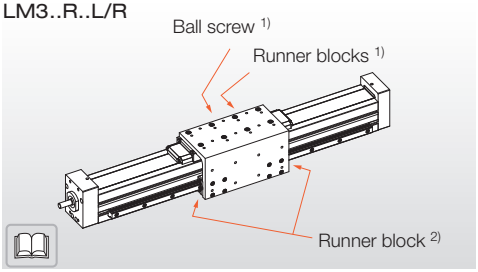
3) Lubrication is possible either from the left or right.

For pressing in the lubricant, we recommend the grease gun with the item number: ZPE.GREASEGUN-03
Procedure:
- Lubricate the table part(s)
- Calculate the amount of grease per stroke when lubricating with a hand press
- After the lubrication, remove the excess grease with a clean cloth.

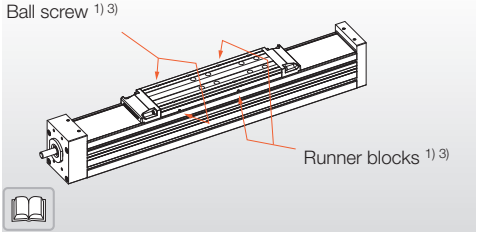
LM3..R..N



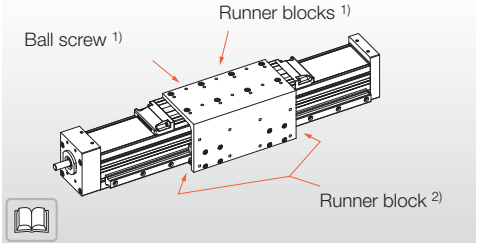
LM3..R..L/R



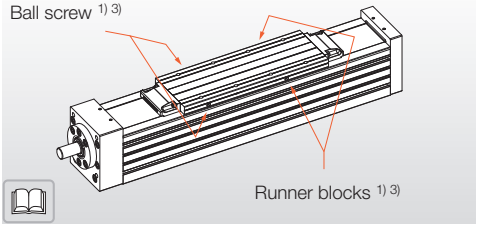
LM4..R..N



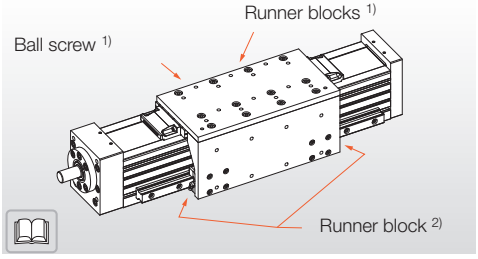
LM4..R..L/R



LM5..R..N



LM5..R..L/R



LINE TECH®

Linear movements are the backbone of modern, industrial production systems. LINE TECH AG has been involved in linear technology solutions for more than 20 years. A comprehensive range of components as well as linear and positioning systems, combined with the specialist expertise of our employees, is the stand-out benefit of LINE TECH AG.

Matured services, from engineering to design, in conjunction with flexible production, complement the product offering, thereby offering customers a high level of benefit.

In-house products

In-house products from LINE TECH are modular, ready-to-install linear axles:

- Linear Modules
- Bridge Modules
- Compact Units
- Positioning Units

Systems / Assemblies

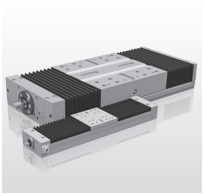
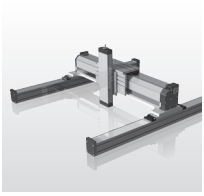
Our engineering team develops tailor-made solutions in accordance with customer requirements.

Components

Trade products complement the product offering with linear guides, drives and components:

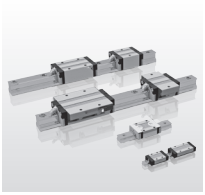
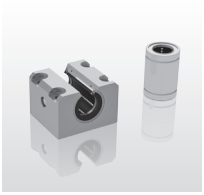
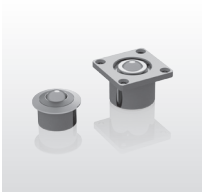
- Linear guides
- Ball screws
- Roller linear guides
- Ball bushings and shafts
- Ball casters
- Extensive range of accessories
- Megatorque motors
- Linear motors







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