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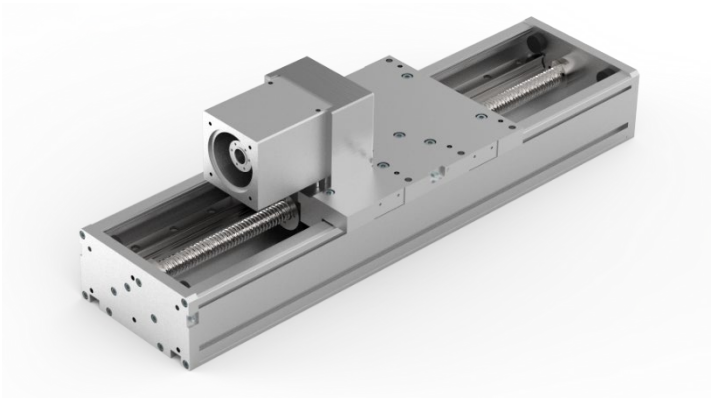

Original Assembly and Maintenance Instructions

Linear unit

HSB-delta®

Type:
Delta 200-SSAM

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1 Safety

These Operating Instructions are an important part of the unit and must always be kept within reach.
The operating instructions must be passed on together with the unit to any third party.

It is important that you contact the manufacturer should there be any part of these Operating Instructions that you do not clearly understand.

1.1 Symbols used

In these Operating Instructions, the following warning symbols and other symbols are used:

DANGER 	Indicates immediate danger. Failure to comply with this instruction risks death or serious injury.
WARNING 	Indicates a danger carrying a medium to high risk. Failure to comply with this instruction may result in death or serious injury.
CAUTION 	Indicates a danger carrying low risk. Failure to comply with this instruction may result in minor or moderate injury or material damage.

☛ Note
Flags tips for the handling and optimum use of the unit.

1.2 Intended use

The mechanical linear unit is solely intended for the purpose of manipulating, positioning, transporting, palletising, loading, unloading, clamping, synchronising, tensioning, testing, measuring, handling and pressing of component parts or tools.

Please take note of the principal fields of application of the linear unit (see Section 4 and Section 3).

In order to guarantee compliance with the law concerning the electromagnetic compatibility of devices (EMC directive), the mechanical linear unit may only be used for industrial applications (in accordance with EN 61000-6-1).

Utilisation of the product for any other purpose would constitute inappropriate use. The manufacturer accepts no liability for any damage resulting from such use. The risk is borne solely by the user.

1.3 General safety

Preconditions for operation

The linear unit must not be put into operation until the machine or line into which it is installed conforms to the following:

- EC/EU directives
- Standards governing the electromagnetic compatibility of machinery

Safe operation

To ensure safe operation, refer to the following documents:

- This operating manual for the linear unit, particularly the technical data
- The operating manual for the line into which it is installed

Decommissioning

Dispose of the product in accordance with the applicable national requirements. Observe the safety data sheets.

1.4 Use in potentially explosive areas

The linear unit is not suitable for use in potentially explosive atmospheres.

1.5 Technical condition of the linear unit

State of the art

The unit conforms to the current state of the art and applicable rules and regulations. The device complies with the EC Machinery Directive and the relevant Harmonised Standards (European standards). Furthermore, the EC Declaration of Incorporation applies.

1.6 Changes to the linear unit

Rebuilding and modifying

There are to be no changes, either structural or safety-related, carried out on the linear unit without the prior written agreement of HSB. We accept no liability for any unauthorised changes carried out on the unit.

The operator may only carry out the maintenance and repair work specified in these Operating Instructions.

Any further work involving the replacement of wearing or substitute parts may only be carried out following consultation with our service technicians and by the service technicians themselves or by HSB.

Never remove or decommission any safety or protection devices.

Follow the assembly instructions supplied by the manufacturer when using special attachment parts.

1.7 Requirements for personnel

Any work involving live parts may only be carried out by trained electricians. This work involves, for example:

- installation of safety limit switches,
- attachment of a drive,
- checking the drive rotation direction.

1.8 Responsibilities of the operator

Preservation of labels	The operator must ensure that any lettering, information signs or labels are fully legible (in particular the serial number) and always observed. Any damaged or illegible information signs and labels must be replaced.
Accident Prevention and Environmental Protection	The applicable regulations for accident prevention and environmental protection must be observed.
Disposal	Dispose of the product according to the relevant national regulations. Refer to the safety data sheets.

2 Warranty

The warranty conditions are specified in the sales documents (delivery and payment conditions). The warranty claim expires if:

- the unit has not been used in accordance with its intended use,
- these Operating Instructions have not been adhered to,
- the unit has been modified without prior authorisation from the manufacturer,
- screws sealed using locking paint have been opened.

The manufacturer is liable only if genuine substitute parts have been used during any maintenance or repair work carried out on the unit.

3 Technical data – standard design

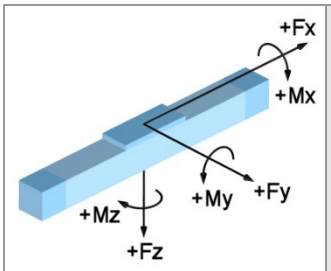
Linear unit Type: Delta	Unit size
	200
	SSAM
Drive element	KGT[2)]
Max. speed [rpm]	3000
Spindle diameter [mm]	25
Spindle pitch [mm]	5 10 25 50
Moment of inertia [kgm²/m]	1.03
max. speed[1)] [m/s]	2.5
max. acceleration [m/s²]	20
Idle torque [Nm]	3.0
Maximum stroke (standard) [mm]	1000
Length of standard long carriage [mm]	300
Repeat accuracy [mm]	±0.03 (KGT)
Operating temperature [°C] (continuous operation)	0 ... 80
Geometrical moment of inertia I_Y [mm⁴]	3889990
Geometrical moment of inertia I_Z [mm⁴]	28139811
Weight (without stroke) [kg]	30
Weight (per 100 mm stroke) [kg]	2.5
Weight of carriage [kg]	18.3
Max. noise emission [dB A] [4)]	75

[1)] Dependent on spindle inclination at max. speed

[2)] Ball screw

[3)] Trapezoidal screw

[4)] The value changes when assembled with other parts of the installation

	**Forces and torques for Delta linear unit with screw drive**							
Type designation	**Dynamic forces [N]**				**Dynamic torques [Nm]**			
	F_X	**F_Y**	**F_Z**	**$-F_Z$**	**M_X**	**M_Y**	**M_Z**	**M_{idle}**
Delta 200-SSAM	6000	5000	8000	5000	3500	4500	3500	2.8

Values in ( ) refer to the long carriage in each case.

M_{idle} = Idle torque ±30 %

The specified forces and torques are the respective maximum values for the single load. The individual values must be reduced for a mixed load or the occurrence of several torques or forces at the same time. If in doubt, please contact Technical Support.

Dynamic load ratings of Delta SSAM linear unit rail guide

(THK and Rex = Rexroth)

Unit size	**Size**	**No. of rails**	**No. of carriages**	**Load rating per carriage C_{dyn} [N]** **THK / Rex**	**Pretension force F_V [N]** **THK / Rex**	**Guiding distance in direction x (lx1) [mm]**	**Guiding distance in direction y (ly) [mm]**
Delta 200	25	2	4	25160 / 28600	1258 / 1820	206	126

Values in ( ) refer to the long carriage in each case.
The load rating and pretensioning values refer to the standard linear guide system.

Dynamic load ratings of Delta linear unit ball screws

Type and unit size	**Nominal Ø in [mm]**	**Pitch in [mm]**	**C_{dyn} [N]**
Delta 200	25	5	23300
		10	22300
		25	32700
		50	14500

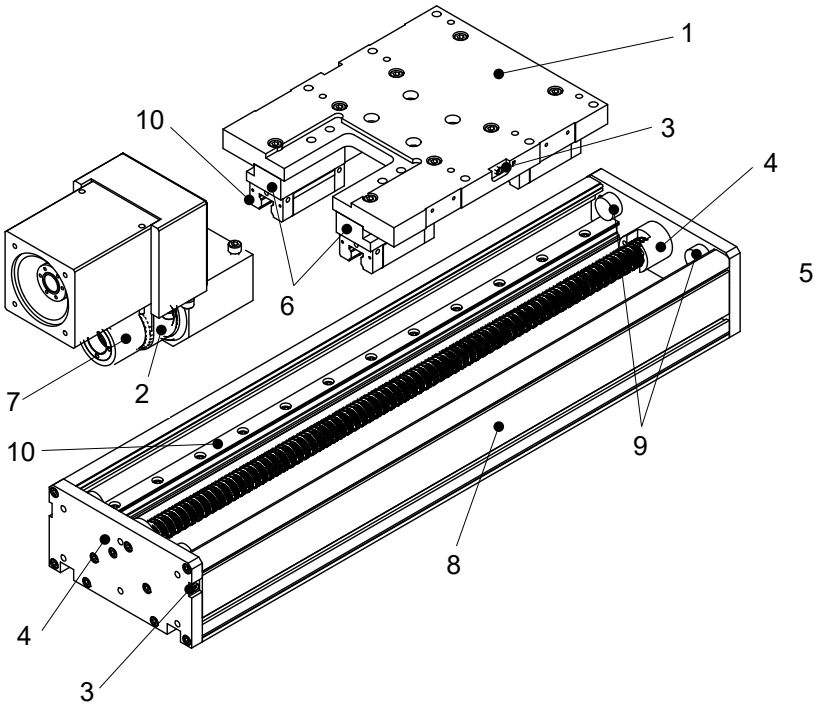
Tightening torques [Nm] for fixing screws							
Fixing screws	**M4**	**M5**	**M6**	**M8**	**M10**	**M12**	The figures given are intended as guides. For shorter insertion depths, the figures must be adjusted accordingly.
DIN912/ISO4762-8.8	2,7	5,4	9,0	22,0	43,0	74,0	
DIN912/ISO4762-10.9	3,0	5,7	9,0	22,0	43,0	74,0	
DIN912/ISO4762-12.9	3,0	5,7	9,0	22,0	43,0	74,0	

	Tightening torques [Nm] for coupling with clamping hub	
Size	**19**	
Coupling diameter [mm]	40	
Screw size	M6	
Tightening torque [Nm]	10	

Tightening torques [Nm] for coupling with clamping ring		
Size	**19**	
Coupling diameter [mm]	40	
Screw size	M4	
Tightening torque [Nm]	2.90	

4 Product description

Linear unit with spindle drive and rail guide



Legend				
	1	Carriage plate	7	Nut attachment
	2	Toothed belt drive	8	Basic profile
	3	Lubrication nipple	9	End stop
	4	Spindle bearing	10	Guiding carriage
	5	Spindle	11	Guide rail
	6	Attachment		

Figure 1: Assemblies of the Delta 200 SSAM linear unit with screw drive

A mechanical linear unit converts rotation into linear motion and thus facilitates fast, safe and accurate movement of loads from one position to another. It consists of a basic aluminium profile, a moveable carriage which is supported by a guide element (linear guide system) and a drive element (ball screw).

The carriage can absorb forces and torques in all directions and is non-positively connected to the guide and drive element via the attachment.

The basic profile is self-supporting up to a certain length and fitted with grooves to keep it in place.

Optionally the linear unit can be fitted with accessories such as inductive or mechanical limit switches and other built-on parts (see Section **6.3**).

The operating area can be flexibly arranged. Several linear units of types Alpha, Beta or Delta can be configured to cover a large area (2 axes) or a spatial arrangement (3 axes).
A plate can be used to connect driven linear units to non-driven linear units of the same type, for example in order to be able to take on large loads.

5 Transport and storage

The mechanical linear unit is a precision instrument. Any heavy impact to this instrument may damage the mechanics and impair its functionality.

CAUTION

Risk of damage by heavy impact or bending!
Only transport an assembled linear unit using transport locks.

In order to avoid any damage to the linear unit when storing or transporting it, the following measures must be taken in order to protect it from jolting or slipping:

- Transport the unit in a sufficiently large container
- Use cushioned packaging

The weight values for the units are listed in Section 3.

The units must be protected against:

- dirt,
- corrosion,
- water
- and an aggressive atmosphere.

6 Assembly and alignment

The linear unit can be mounted as follows:

- With screws in the factory-side threaded holes of the carriage plate
- With mounting brackets
- With screws in the sliding blocks

☛ Mount the linear unit only on a flat surface. Standard parallelism <0.2 mm/1000 mm.

☛ Mounting the linear unit using the threaded rails is recommended for the following situations:
for highly dynamic applications where the linear unit is attached at only 2 attachment points.

6.1 Assembling the linear unit with mounting brackets

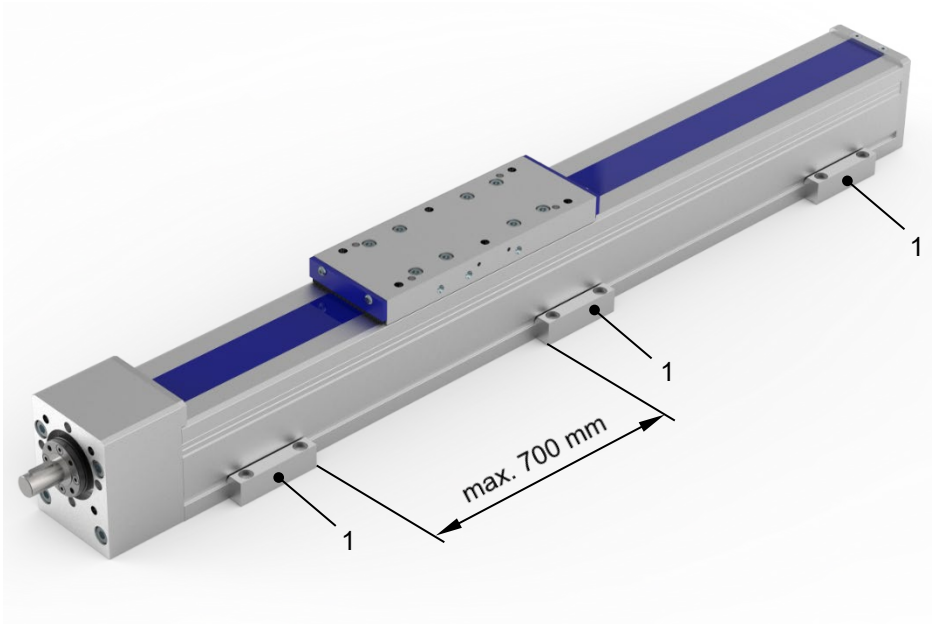


Figure 2: Mounting brackets (1)

☛ The recommended maximum distance between the mounting brackets is 700 mm.

Proceed as follows

1. Loosely fit the mounting brackets (1) into position (Figure 2).
2. Align the linear unit axially.
3. Screw the mounting brackets (1) into place (tightening torques see Section 3).

6.2 Screw linear unit into place from underneath

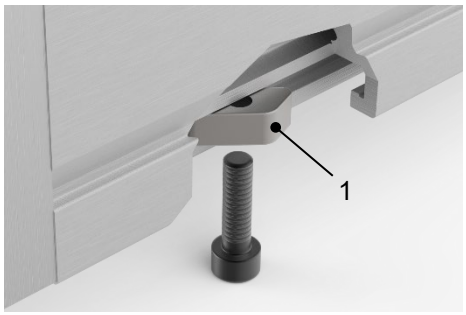


Figure 3: Sliding blocks (1) in the groove on the underside of the basic profile

Secure the linear unit using fastening screws from below using the sliding blocks or the threaded rails in the basic aluminium profile (Figure 3).

Proceed as follows

1. Align the linear unit.
2. Align the sliding blocks (1) / threaded rails.
3. Screw the linear unit into place (tightening torques see Section 3).

6.3 Setting the maximum stroke

DANGER

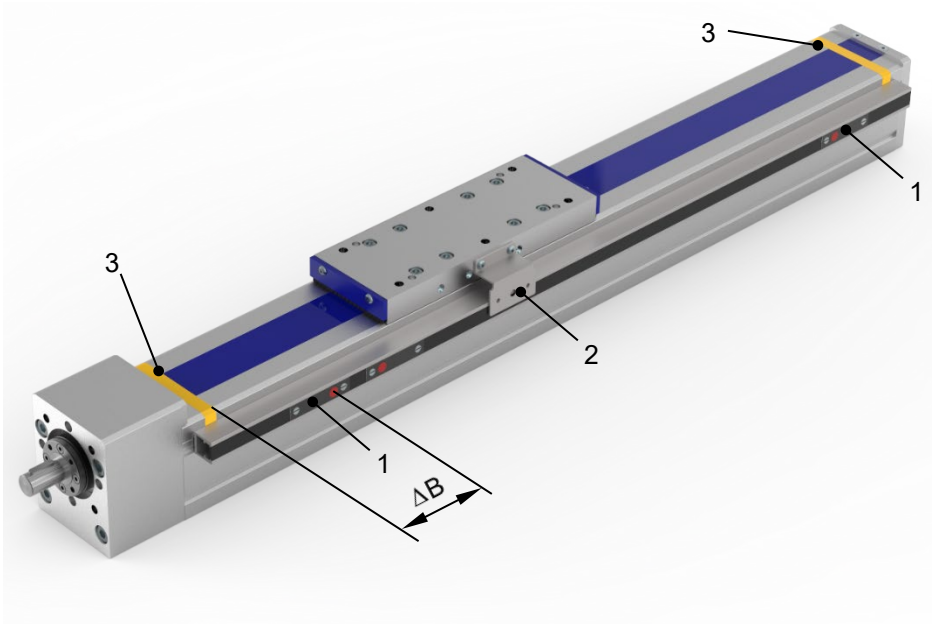
Risk of serious injury from overturning transport devices.
Should the carriage come to a stop beyond the safety area, the transport device mounted on this may break off or overturn. The linear unit can be damaged beyond repair.
Please take note of the specified safety area when setting up the unit and set the limit switches correspondingly.
Electric switches may only be connected by a qualified electrician.

☛ Allow for a sufficient braking distance to ensure that there is enough time to slow down the carriage in the case of an emergency stop.

6.3.1 Adjusting the position of the inductive limit switches

The duty of the inductive limit switches is to shut down the electric drive before the mechanical limit of travel is reached.

The necessary braking distance (Δ B) depends on the speed and deceleration. This braking distance must be less than the distance between the trip point of the limit switch and the actual mechanical limit of travel.



Legend		
	1	Inductive limit switches
	2	Switching cam
	3	Band marking the safety area

Figure 4: Inductive limit switches

CAUTION

The limit switches must trip so that the carriage comes to a stop immediately short of the safety area. At delivery, the safety area is marked with a band (3).

Proceed as follows

1. Switch on the power supply for the limit switches.
2. Loosen the fastening screws for the limit switch.
3. Move the carriage up to the braking position.
4. Move the limit switch (NC) far enough under the switching cam for it to trip and the LED on the sensor to go out.
5. Move the carriage away.
6. Tighten the limit switch fastening screws.
7. Check the correct position of the limit switch: Move the carriage along by hand and check the switch tripping point.
8. Fit the limit switch bar cover.

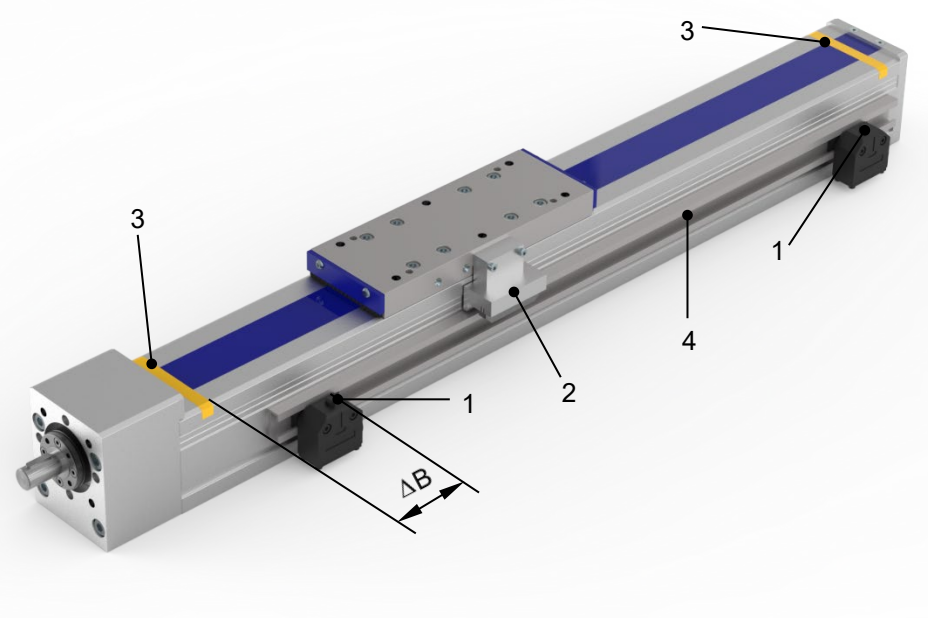
6.3.2 Adjusting the position of the mechanical limit switches

Mechanical safety limit switches (NC) must be used if there is a risk that persons may be endangered unless the electric drive shuts down immediately.

The drive may be started up only once all limit switches are correctly set and are closed.

Mechanical safety limit switches may be combined with inductive limit switches.

External dampers must be fitted as protection against mechanical damage.
The necessary braking distance (Δ B) depends on the speed and deceleration. This braking distance must be less than the distance between the trip point of the limit switch and the actual mechanical limit of travel (Figure 5).



Legend	1	Mechanical limit switches
	2	Switching cam
	3	Band marking the safety area
	4	Retaining plate
	Δ B	Braking distance

Figure 5: Mechanical limit switches

CAUTION

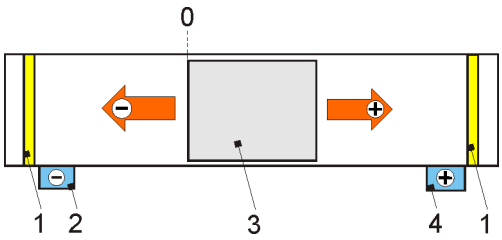
The limit switches must trip so that the carriage comes to a stop immediately short of the safety area. At delivery, the safety area is marked with a band (3).

Proceed as follows

1. Switch on the power supply for the limit switches.
2. Loosen the clamping screw for the retaining plate (Figure 5).
3. Move the carriage up to the safety area.
4. Push the limit switch along until it trips.
5. Tighten the clamping screw on the retaining plate.
6. Check the correct position of the limit switch: Move the carriage along by hand and check the switch tripping point.
   If this leaves insufficient braking distance, repeat the adjustment process.

6.4 Installing the drive

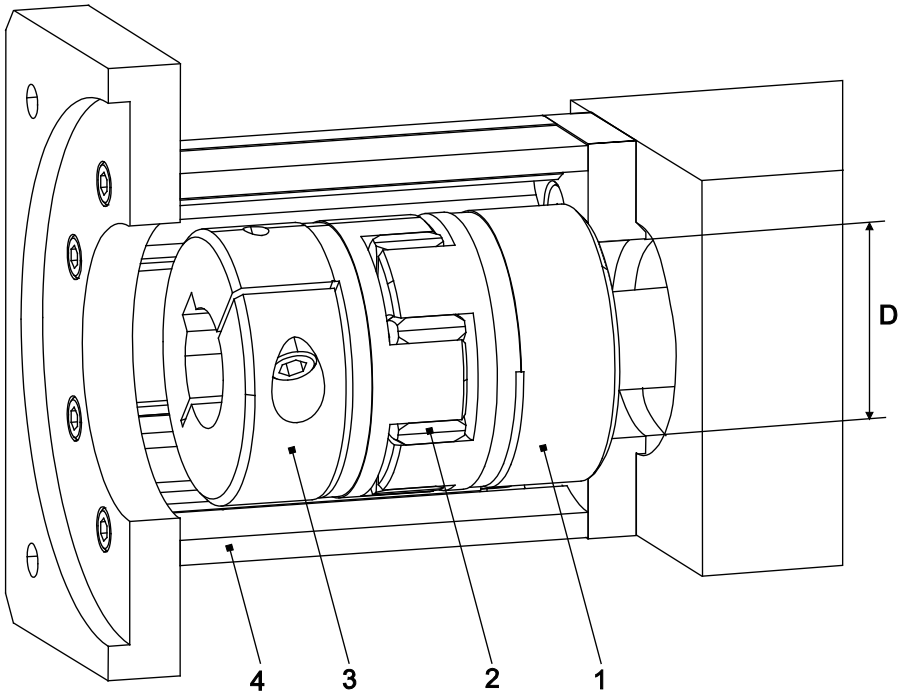
Make sure that the direction of rotation of the external drive corresponds to the direction of rotation of the spindle or the toothed belt, so that the limit switches operate correctly.



Legend				
	1	Safety area	3	Carriage with direction of travel plus and minus from the reference point 0
	2	Limit switch minus direction	4	Limit switch plus direction

Figure 6: Example of direction of travel and limit switch circuits

6.4.1 Installing the motor



Legend				
	1	Coupling half 1	4	Motor mounting
	2	Coupling collar	D	Diameter at motor mounting
	3	Coupling half 2		

Figure 7: Motor mounting with motor coupling at drive journal

Proceed as follows

1. Place the motor and the coupling elements in the mounting position alongside the linear unit.
2. Check the direction of rotation of the motor. It must correspond to the safety limit switches (Figure 6). Change the direction of rotation of the motor if required.
3. If the coupling diameter is smaller than the D measurement at the motor mounting (4), first mount the coupling half 1 (1) (bore flush with the drive shaft) and then the motor mounting (4) (Figure 7).

   If the coupling diameter is larger than the D measurement at the motor mounting (4), first mount the motor mounting (4) and then the coupling half 1 (1) (bore flush with the drive shaft). Tighten the coupling clamping screw using the mounting bore at the motor mounting (4).
4. If necessary, push the coupling collar (2) onto the coupling.
5. Fix the coupling half 2 (3) to the motor journal.
6. Attach the motor to the motor mounting.

Tightening torque [Nm] of clamping screws

Screw	SW	Torque
M6	5	14
M8	6	35
M10	8	65
M12	10	74

7 Commissioning

WARNING

Injury or damage to other installation parts
due to quick linear movements of the transport devices
due to centrifugal load.
Only authorised personnel are permitted to commission the linear unit.

WARNING

Risk of crushing due to incorrect direction of movement of the transport device.
Should the direction of rotation of the drive (motor or gearbox) and the carriage drive (spindle or toothed belt) not correspond, the mounted transport device may travel in the wrong direction.
Only qualified electricians are permitted to carry out any work on the electrical installation or check the direction of rotation.

Checking the unit before commissioning

Before commissioning, the following must be checked:

- whether the holding devices used are consistent with the mass and acceleration information provided by the manufacturer,
- whether the machine or installation in which the linear unit is installed corresponds to the provisions set out by the machinery directive, the harmonised standards, the European standards or the national standards,
- whether the linear unit is correctly mounted,
- whether the inductive and/or mechanical limit switches are correctly connected and functioning properly,
- whether the direction of rotation of the motor shaft and, if applicable, the intermediary gearbox corresponds to the direction of rotation of the spindle or the toothed belt.

If there are faults detected during this inspection, commissioning is not permitted.

Test run

To prevent accidents, collisions and possible errors in the programming, move the linear unit along the stroke several times at such a low speed that it can be stopped in good time in case of an emergency.

The installation can be started up after it has been ensured that there is no risk of a collision when exceeding the maximum stroke.

8 Operation

Risk of damage due to harmful environmental influences!
The linear unit may only be operated under ambient conditions which are permitted by the manufacturer.

Ambient conditions

The linear unit may only be operated within the permitted temperature range of 0 - 80 °C.

Operating the unit in damp, abrasive conditions may result in foreign objects entering components in the linear unit. To prevent this, as part of the integration of the linear unit into the entire plant, measures may need to be taken to prevent foreign bodies from penetrating, e.g. using folding plates, baffle plates, sealing air.

Required inspection

The linear unit must be occasionally checked during operation to see that it is functioning correctly.

The personnel responsible must check the linear unit and the machinery for any visible signs of damage or defects at least once during each shift.

Should there be any changes observed which may compromise safety, it must be switched off immediately.

Emergency stop

The maximum permissible load values must not be exceeded even in an emergency stop situation.

As a rule, the category 1 emergency stop strategy (targeted braking to standstill, then de-energise) is chosen for automation equipment with moving masses. A simple emergency stop strategy is not usually effective, as the masses are still moving and can cause damage.

End position damping

The end stops and stop buffers installed in our linear modules protect the unit at low speed (commissioning). They are definitely not intended to completely protect the unit against damage at high speed and/or with a large mass.

9 Decommissioning

Risk of injury or damage to other installation parts due to falling parts.
Only authorised personnel are permitted to disassemble the linear unit.

1. Separate the machine/installation from the mains supply.
2. Disassemble the drive from the linear unit.
3. Unscrew the linear unit from the machine/installation.

10 Maintenance

- All mounted ball bearings are sealed and maintenance-free.
- Remove excess dust and incidence of dirt from the parts of the linear unit on a regular basis.
- Regularly re-lubricate the screw drive of the linear axes.

10.1 Lubrication

Influencing factors

The following influencing factors are important for an accurate regulation of lubrication intervals:

- Load
- Speed
- Motion sequence
- Operating temperature
- Degree of contamination

Short lubrication intervals

Short lubrication intervals are required for:

- operation under the influence of dust and dampness
- a heavy load
- high speed (up to V_{max})
- short strokes (short-stroke design)

☛ A lubrication stroke should be carried out at least once per shift (8 hours) for a short-stroke design.

Initial lubrication

☛ After commissioning, carry out the initial lubrication. The basic lubrication has already been carried out by the manufacturer.

Refer to the lubrication regulations on the following pages.

Lubrication points on the linear unit

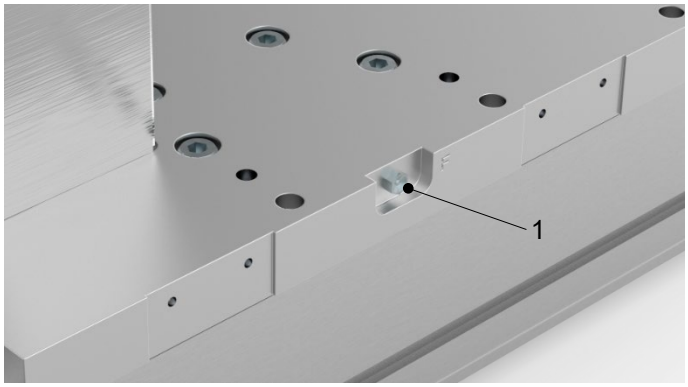


Figure 8: Possible lubrication points “F” (1) on the carriage

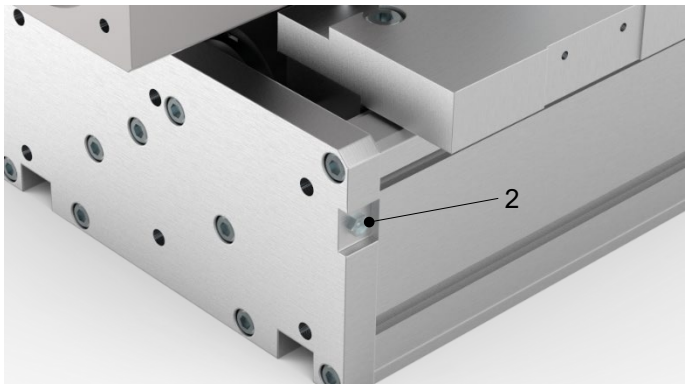


Figure 10: Possible lubrication points “S” (2) for the ball screw

The lubrication points are located on both sides of the linear unit. Use the codes S and F to detect the type of lubrication point.
There is a separate lubrication plan for each lubrication point.

Lubrication point type	Lubrication for ...	Lubricant
S	Spindle	Grease
F	Guide element	Grease

Lubrication method

Whenever possible, the guiding carriage (F) should be lubricated while in motion so that the grease is distributed and no pressure builds up.

To lubricate the ball screw nut, the carriage must be moved to the end position in the direction of the lubrication nipple (S). Now the nut can be lubricated by one of the two lubrication nipples (S) when stationary.

Lubrication plan for lubrication point S (for ball screw)

KGT* type	Lubrication intervals by number of overrollings	Amount of grease [cm³] per ball screw nut	Type of grease
2505	25,000,000	2.60	Grease in accordance with DIN 51825-KP2N-20, e.g. Klüberplex BE 31-102
2510		3.40	☛ If a different type of grease is used, comply with the instructions provided by the lubricant manufacturer. ☛ Grease with a solid lubricant component (e.g. graphite, MoS2) must not be used!
2525		3.10	
2550		4.80	
KGT = ball screw			

Lubrication plan for lubrication point F (for rail guide)

Guiding carriage size	Lubrication interval	Amount of grease [cm³] per guiding carriage	Type of grease
25(L) with ball chain	approx. 5,000 km*	approx. 1.2	Grease in accordance with DIN 51825-KPE1R-20, e.g., Klüberplex BE 31-102 ☛ If a different type of grease is used, comply with the instructions provided by the lubricant manufacturer. ☛ Grease with a solid lubricant component (e.g. graphite, MoS2) must not be used!
25(L) without ball chain	approx. 2,000 km*	approx. 2.8	
** Or at least twice a year. The lubrication interval depends on the ambient conditions and the load. Relubrication "in motion"!*			

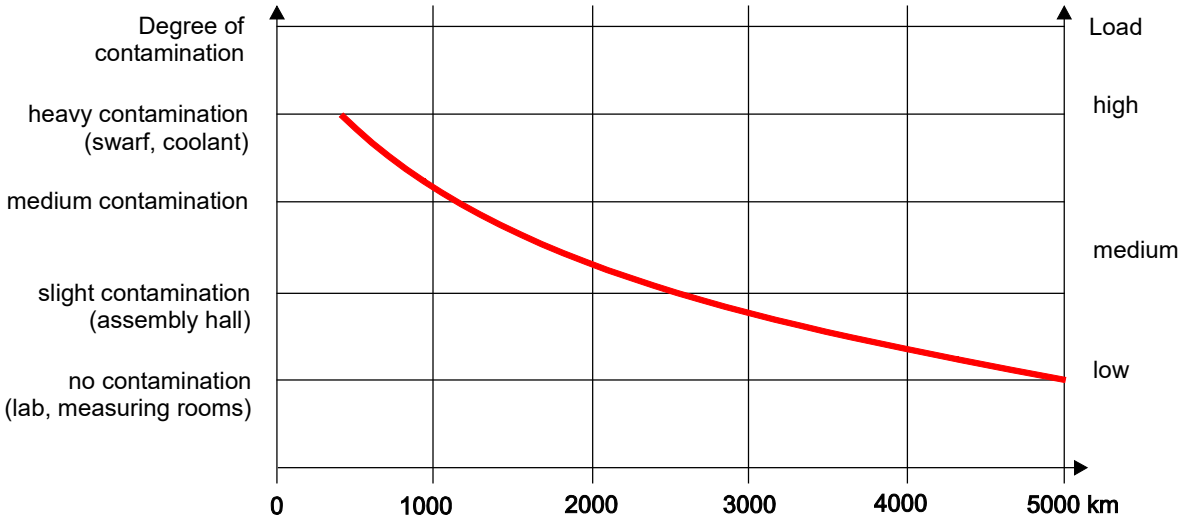


Figure 9: Relubrication intervals for the linear guide system with ball chain

10.2 Your added value in service: Repair and Retrofit

In addition to installation and maintenance, we also offer professional repair and retrofit services for our products. You benefit from our expertise, fast fault diagnosis, and expert repairs – helping to extend the service life of your products and modernize existing systems.

For further information regarding repairs or retrofit solutions, please contact our customer service at service.greifsysteme@de.schunk.com.

We will be happy to advise you.