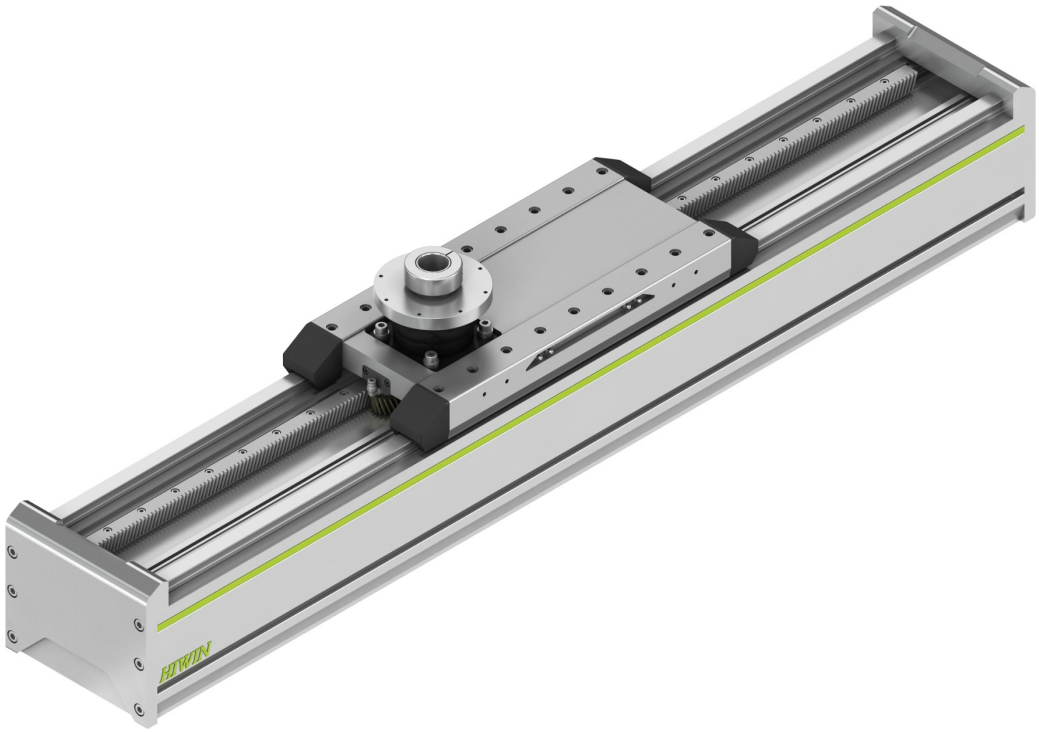

Valid from serial no. HSN 000 000 000 1

Assembly instructions

Rack and pinion axis HB-R, HC-R

HBR_HCR-01-1-EN-2504

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Imprint

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Contents

1 General

1.1 About these assembly instructions

These assembly instructions are intended for planners, developers and operators of systems who plan and install the named products as machine elements. It is also addressed to the persons who carry out the following work in connection with the named axes:

- Transport
- Assembly
- Electrical connection including connection to the higher-level control system
- Integration into a safety system
- Retrofitting or upgrading
- Setup
- Commissioning
- Operation
- Cleaning
- Maintenance
- Troubleshooting
- Decommissioning, disassembly and disposal

1.1.1 Requirements

We assume that

- The operating personnel have been instructed in the safe operation of the named products and have read and understood these assembly instructions in full
- Maintenance personnel maintain and repair the products in such a way that they present no danger to persons, the environment or property

1.1.2 Availability

These assembly instructions must always be available to all persons working with or on the named products. The assembly instructions are also available at hiwin.de.

1.2 Presentation and layout conventions used in these assembly instructions

1.2.1 Instructions

Instructions are provided in sequential order and identified with a triangle symbol.
The results of the actions are accompanied by a tick symbol.

Example:

- ▶ Instruction 1
- ▶ Instruction 2
- ✓ Result

1.2.2 Lists

Lists are identified through the use of bullet points.

Example:

The products must not be operated:

- Outdoors
- In areas where there is a risk of explosion
- …

1.2.3 Presentation of safety notices

Safety notices are always indicated by a signal word and sometimes with a hazard-specific symbol (see section 1.2.4 Symbols used).

The following signal words/hazard levels are used:

⚠ **Danger!** Immediate danger!

Non-compliance with the safety notices will result in severe or fatal injury!

⚠ **Warning**! Potentially dangerous situation!

Non-compliance with the safety notices could result in severe or fatal injury!

⚠ **Attention!** Potentially dangerous situation!

Non-compliance with the safety notices could result in moderately severe or minor injury!

Caution! Potentially dangerous situation!

Non-compliance with the safety notices could result in damage to property or the environment!

1.2.4 Symbols used

The following symbols are used in these assembly instructions and on the products:

Warning and prohibition signs			
	Warning of dangerous electrical voltage!		Warning of risk of hearing damage!
	Warning of cutting injuries!		Warning of crushing risk!
	Environmentally hazardous substance!		Warning of danger from suspended loads!

Mandatory signs			
	Wear safety gloves!		Wear hearing protection!
	Wear protective goggles!		Release prior to work!

1.2.5 Notes

Note:
Notes describe general advice and recommendations.

1.3 Warranty and liability

The manufacturer's “General Terms and Conditions of Sale and Delivery” apply.

1.4 Manufacturer information

Address	HIWIN GmbH Brücklesbünd 1 77654 Offenburg
Telephone	+49 (0) 781 / 9 32 78 - 0
Technical customer service team	+49 (0) 781 / 9 32 78 - 77
Fax	+49 (0) 781 / 9 32 78 - 90
Technical customer service team fax	+49 (0) 781 / 9 32 78 - 97
E-Mail	support@hiwin.de
Internet	hiwin.de

1.5 Product monitoring

Please inform HIWIN GmbH, as manufacturer of the named products, about:

- Accidents
- Possible sources of danger on the products
- Any unclear information in these assembly instructions

2 Basic safety notices

⚠ **Warning**!

> This chapter is for the safety of everyone who works with, assembles, installs, operates, maintains or disassembles the named products. Failure to comply with the following notes could be dangerous!

2.1 Proper use

The linear axes combine the guide and the drive to create a compact unit. They are used for the exact positioning in time and place of fixed loads within an automated system. All the linear axes may only be used as described for the intended purpose:

- Performance limits are given for each size of the named products (see “Linear axes and axis systems HX” catalogue). These performance limits must not be exceeded during operation.
- The products must not be used in potentially explosive atmospheres.
- The products must not be operated in a vacuum.
- The products may only be used and operated indoors.
- In the event of vertical mounting, a suitable clamping or braking device must be provided to be able to prevent unintentional lowering of the load.
- The products are used as part of an overall system, therefore personal safety must be ensured via the concept of the overall system.
- The assembly instructions and the maintenance and servicing instructions must be complied to ensure the intended use of the products.
- Any other use of the products is considered improper use.

The linear axes are supplied as a system (guide, drive). That is why the entire documentation of the system must be observed. Depending on the linear axis type, the accompanying documentation may vary.

Requirements for ambient conditions

Ambient conditions during operation:	+5 to +40 °C
Relative humidity during operation:	according to IEC 60721-3-3, class 3K22, non-condensing
Climatic ambient conditions for transport and storage:	Ambient temperature: –20 to +50 °C, non-condensing

Note:

Prevent condensation from forming to avoid corrosion of the axis.

2.2 Reasonably foreseeable misuse

The named products must not be operated:

- Outdoors
- In areas where there is a risk of explosion

2.3 Conversions or modifications

Conversions or modifications to the named products are not permitted! For special requirements, please contact HIWIN GmbH.

2.4 Residual risks

No residual hazards emanate from the named products during normal operation, as they are used as part of the overall system and personal safety is to be ensured by the operator via the overall system. Dangers that may arise during maintenance and servicing are specified in the respective chapters.

2.5 Requirements for personnel

Only authorised persons may carry out work on the products! They must be familiar with the safety equipment and regulations before they start work (see following table).

Activity	Qualifications
Normal operation	Instructed personnel
Cleaning	Instructed personnel
Maintenance	Qualified personnel of the operator or manufacturer
Servicing	Qualified personnel of the operator or manufacturer
Transport	Instructed personnel
Assembly	Instructed qualified personnel
Disassembly	Instructed qualified personnel

2.6 Safety equipment

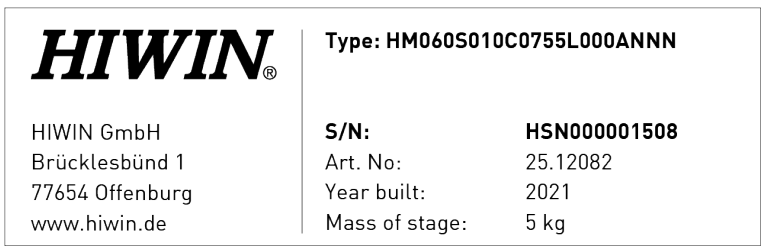
Table 2.1: Personal protective equipment

Operating phase	Personal protective equipment
Normal operation	Staying around the named products is not permitted during normal operation. When staying in the vicinity of the products, the following personal protective equipment is necessary, depending on the travel speed: ○ Safety shoes ○ Hearing protection if necessary
All other operating phases (Cleaning, maintenance, servicing, retrofitting, troubleshooting, repair)	The following personal protective equipment is required for all other phases of operation of the named products: ○ Safety shoes ○ If necessary, protective gloves and goggles ○ Hearing protection if necessary ○ If necessary, hairnet

2.7 Labelling on the products

The labels shown below can be found on the products.

Fig. 2.1: Example of a type plate



3 Description of the linear axes

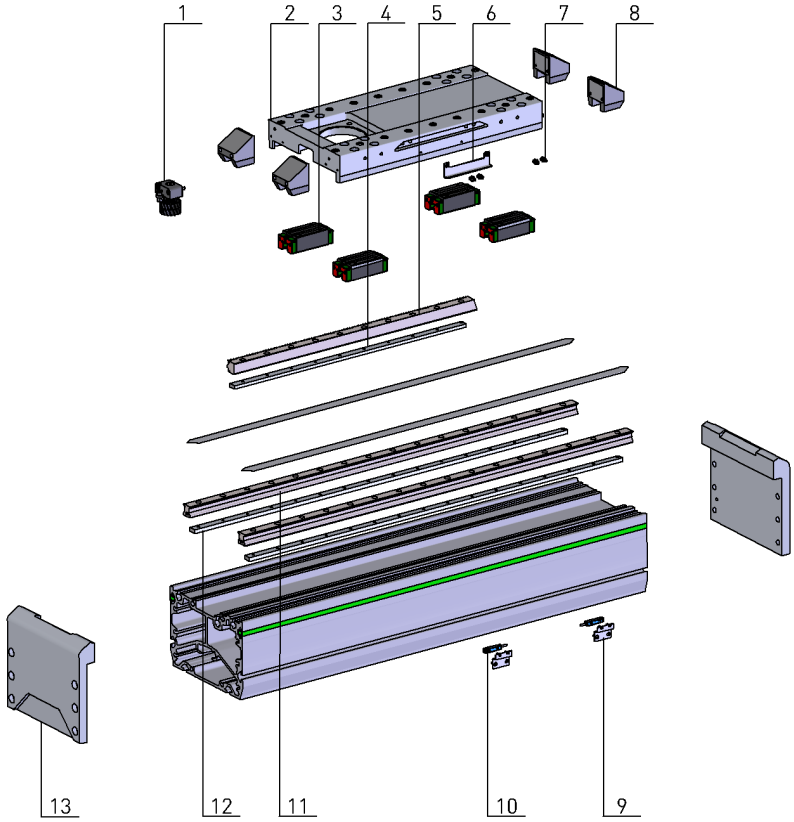
3.1 Bridge axis HB-R

3.1.1 Application

The bridge axes with rack and pinion drive are bendable positioning modules with an integrated double guide. They are particularly suitable for applications that require a high feed force and high positioning accuracy.

3.1.2 Main components

Fig. 3.1: Main components of the linear axis HB-R

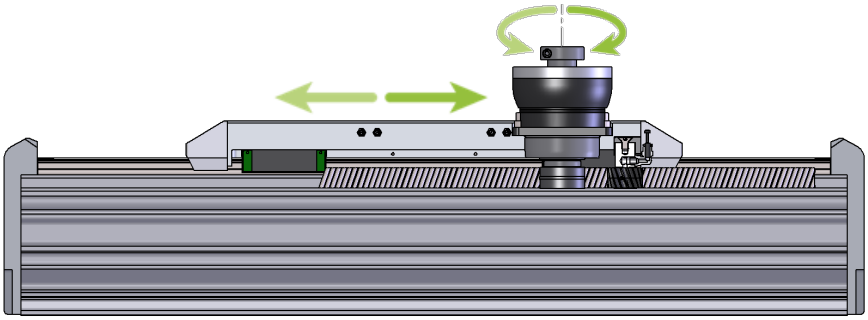


1	Lubrication pinion	8	Stop buffer
2	Carriage	9	Limit switch holder
3	Block	10	Limit switch
4	Threaded strip	11	Profile rail
5	Toothed rack	12	Threaded strip
6	Damping element	13	End plate
7	Grease nipple		

3.1.3 Application function

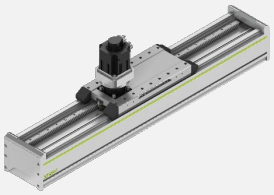
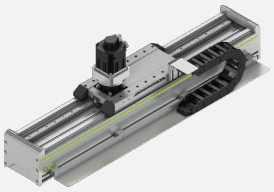
At linear axes with a rack and pinion drive, the drive and the guide are combined in a compact unit. The forces and torques from the load to be moved are transmitted into the linear guideway via the carriages. This additionally ensures precise guidance of the linear movement with four blocks per carriage. The actual movement occurs via a rack and pinion drive, whose rack is actuated by an electric motor via a drive pinion. The rack and pinion drive converts the rotary movement of the motor into a linear movement of the carriage.

Fig. 3.2: Functional principle of the bridge axis HB-R



3.1.4 Order code

Number		1	2	3	4	5	6	7	
Order code		HB	250	R	223	N	1234	S	
1	HB	HIWIN bridge axis							
2	250	Size (profile width): 250: 250 mm							
3	R	Drive type: R: Rack and pinion drive							
4	223	Module, number of teeth: 223: Module 2, number of teeth 23							
5	N	Cover strip: N: Without							
6	1234	Stroke length [mm]							
7	S	Carriage length: S: Short							

Number		8	9	10	11	12	13
Continued Order code		A	N	N	R	HW28	G3503
8	**A**	Limit switch [2]: N: Without A: 2 × NC contact, 300 mm cable, plug B: 2 × NO contact, 300 mm cable, plug C: 2 × NC contact, 5 m open cable end D: 2 × NO contact, 5 m open cable end					
9	**N**	Rack: N: Standard rack					
10	**N**	Distance measuring system: N: Without A: MAGIC, analogue, 1 VSS sin/cos D: MAGIC, digital, TTL 5V					
11	**R**	Drive interface [1]: S: Straight, without energy chain D: Straight, with energy chain			 		
12	**HW28**	Flange type motor					
13	**G3503**	Gearbox					

[1] If no drive interface is selected, the order code ends after this digit.
[2] Additional reference switches on request.

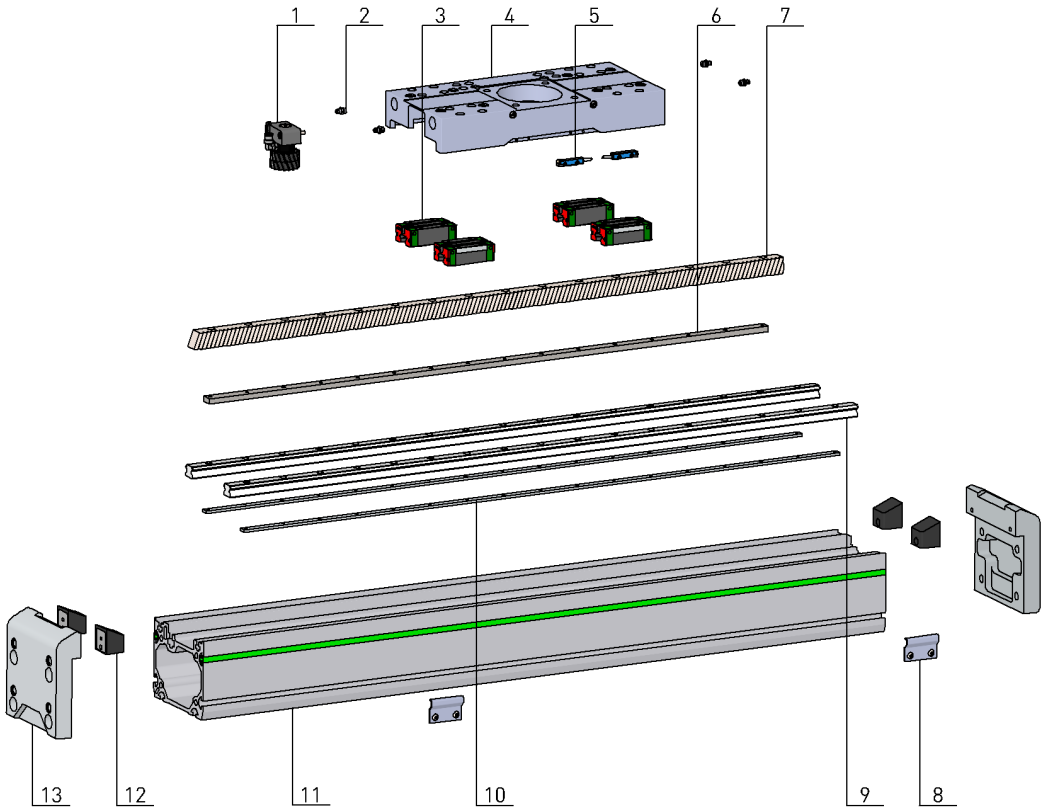
3.2 Cantilever axis HC-R

3.2.1 Application

The cantilever axes with rack and pinion drive are bendable positioning systems with an integrated double guide. They are particularly suitable for applications that require a high feed force and high positioning accuracy.

3.2.2 Main components

Fig. 3.3: Main components of the cantilever axis HC-R

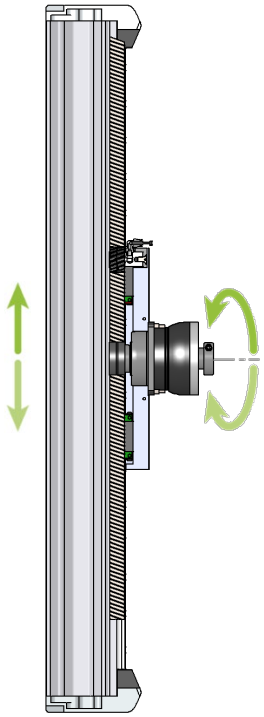


1	Lubrication pinion	8	Damping element
2	Grease nipple	9	Profile rail
3	Block	10	Threaded strip
4	Drive block	11	Axis profile
5	Limit switch	12	Stop buffer
6	Threaded strip	13	End plate
7	Toothed rack		

3.2.3 Application function

The cantilever axis HC-R is a linear axis in which the drive block is stationary, while the lightweight cantilever moves. The two linear guideways with two blocks each ensure that forces and torques are safely transferred from the cantilever to the drive block. The actual movement occurs via a rack and pinion drive, whose rack is actuated by an electric motor via a drive pinion. The rack and pinion drive converts the rotary movement of the motor into a linear movement of the cantilever.

Fig. 3.4: Functional principle of the cantilever axis HC-R



3.2.4 Order code

Number		1	2	3	4	5	6	7
Order code		HC	150	R	223	N	1234	S
1	HC	HIWIN cantilever axis						
2	150	Size (profile width): 150: 150 mm						
3	R	Drive type: R: Rack and pinion drive						
4	223	Module, number of teeth: 223: Module 2, number of teeth 23						
5	N	Cover strip: N: Without						
6	1234	Stroke length [mm]						
7	S	Carriage length: S: Short						

Number		8	9	10	11	12	13
Continued Order code		A	N	N	S	HW28	G3503
8	**A**	Limit switches: N: Without A: 2 × NC contact, 100 mm cable, plug B: 2 × NO contact, 100 mm cable, plug C: 2 × NC contact, 4 m open cable end D: 2 × NO contact, 5 m open cable end					
9	**N**	Clamping and braking element: N: Without C: With 1 pneumatic clamping element [2)] B: With 1 pneumatic Clamping and brake element D: With 2 pneumatic clamping elements [2)] E: With 2 pneumatic Clamping and brake element					
10	**N**	Distance measuring system: N: Without A: MAGIC, analogue, 1 VSS sin/cos D: MAGIC, digital, TTL 5 V					
11	**S**	Drive interface [1)]: S: Straight					
12	**HW28**	Flange type motors					
13	**G3503**	Gearbox					

[1)] If no drive interface is selected, the order code ends after this digit.

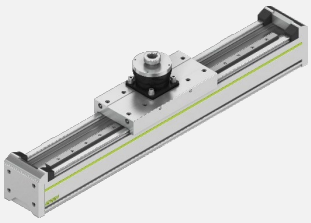
[2)] The clamping element may only be used when the axis is at a standstill and not as a brake. The clamping element option is no longer available for new projects.

4 Options of the linear axes

4.1 Stroke length

The stroke lengths of the linear axes can be selected in millimetre increments. The maximum stroke length depending on the series and size is listed in Table 4.1.

Table 4.1: Maximum stroke length

	Axis	Maximum stroke (mm)
Bridge axis 	**HB250R**	5,150
Cantilever axis 	**HC150R**	2,000

Please note that the maximum possible stroke is reduced with the following options:

- Energy chain

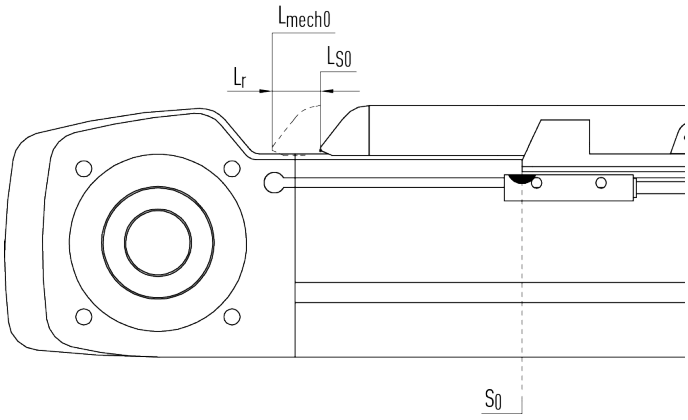
4.1.1 Reserve stroke

Caution! Possible damage to the linear axis!

▶ The mechanical end position must not be approached during operation!

Reserve stroke L_r corresponds to the distance that can be travelled in addition to the stroke on both sides of the end positions (stroke 0, stroke max.) before the carriage reaches the mechanical end position (mechanical 0) at the built-in stop buffers. The reserve stroke for each axis size can be found in the “Linear axes and axis systems HX” catalogue.

Fig. 4.1: Illustration of reserve stroke using the example of a linear axis



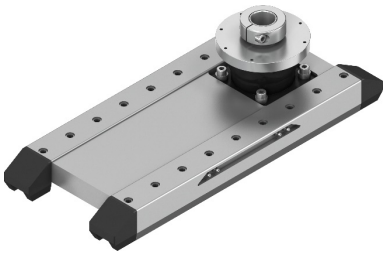
L_{mech0} Carriage position at mechanical 0 (rubber buffer stop)
L_{S0} Carriage position at stroke 0 (sensor switching point)
S_0 Position of the carriage at stroke 0 (sensor switching point)

4.2 Carriage length

Carriage type S is provided as standard for the rack and pinion axes.

The carriages have fastening threads for mounting the payload. These have additional counter bores to allow for insertion of centring sleeves.

Fig. 4.2: Carriage with fastening threads

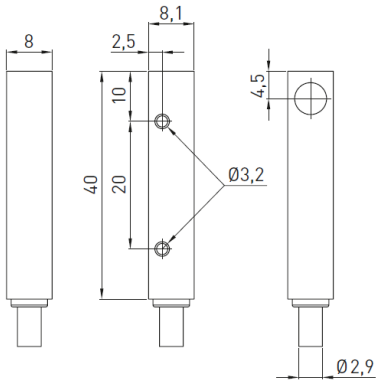


4.3 Limit switch

With linear axes, two inductive limit switches indicate the end positions of the travel distance. The limit switch cables can either be routed directly to the interface or laid laterally in the mounting groove. The limit switches are available as NC or NO contacts and optionally with open cable end or with plug.

4.3.1 Dimensions

Fig. 4.3: Limit switch dimensions



4.3.2 Specifications

Table 4.2: General features of the limit switches

Order code	A	B	C	D
Article number				
HC-R	25-000786	25-0002766	25-000787	25-000788
HB-R	80073805	80073846	80073857	80073860
Output function	NC contact	NO contact	NC contact	NO contact
Connection type HC-R	100mm cable with M8 plug		4m cable [2] Open cable end	5m cable [2] Open cable end
HB-R	300mm cable with M8 plug		5m cable [2] Open cable end	5m cable [2] Open cable end
Connection	3-pin		3-wire	
Type	Cuboid			
Dimensions (W × H × D)	8 × 8 × 40 mm			
Max. switching distance	2 mm			
Secured switching distance	1.62 mm			
Switching distance to be set	1 mm			
Switching sequence	2,000 Hz			
Switching output	PNP			
Electrical type	DC 3-wire			
Protection class	IP67, IP68 [1]			

[1] According to EN 60529

[2] Not energy chain compatible. If the limit switch cables are installed in an energy chain, separately available extension cables can be used, see the “Linear axes and linear axis systems” catalogue

Table 4.3: Mechanics/Electrics of the limit switches

Order code	A	B	C	D
Power supply	10 to 30 VDC			
Residual ripple	≤ 10% [1]			
Voltage drop	≤ 2 V [2]			
Current consumption	≤ 10 mA [3]			
Ready delay	≤ 100 ms			
Hysteresis	5 to 15%			
Reproducibility	≤ 2 % [4]			
Temperature drift	±10%			
EMC	According to EN 60947-5-2			
Continuous current I_a	≤ 200 mA			
Cable material	PVC			
Short-circuit protection	Yes			
Reverse polarity protection	Yes			
Switch-on pulse suppression	Yes			
Shock and vibration resistance	30 g, 11 ms/10 to 55 Hz, 1 mm			
Ambient temperature during operation	-25 °C to +75 °C			
Housing material	Plastic, VISTAL®			
Material, active surface	Plastic, VISTAL®			
UL file no. (certificate)	NRKH.E348498			

[1] From U_v
[2] At I_a max.
[3] Without load
[4] At constant voltage and temperature

4.4 Clamping and braking element

⚠ **Attention!**

Failure to do so may result in serious injury. Injuries and malfunctions can occur in particular due to

- Improperly installed pneumatic lines
- Malfunction of the pneumatic supply, e. g. due to pressure fluctuations
- Damaged or loosened pneumatic lines

4.4.1 Clamping element LKPS (HC150R)

⚠ **Attention!** Danger of injury and damage to property!

Improper use of the clamping element can result in damage to property and personal injury.

- Only use the clamping element when the axis is stationary!
- Do not use as a braking element or emergency brake!

The clamping element may only be used for static holding of a position.

- If there is no air pressure (air pressure: 0 bar), the clamping element clamps with spring force. The clamping profiles are pressed against the guide rail via a spring energy accumulator (clamps with spring force).
- If the air pressure is between 5.5 and 6.5 bar, free travel is possible. The air pressure keeps the clamping profiles apart (release with air pressure).

Fig. 4.4: Clamping element closed (0 bar)

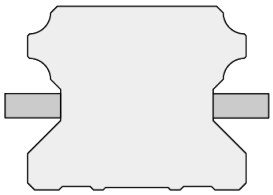
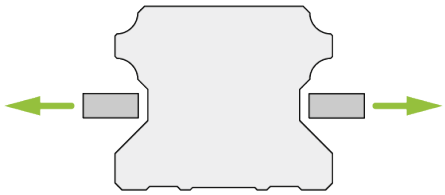


Fig. 4.5: Clamping element open (5.5 to 6.5 bar)



According to EN ISO 13849-1, the clamping element is considered a safety-relevant component of control systems and, as a proven component, can be used in category B or 1 control systems without any further control-related measures.

Table 4.4: Clamping element specifications

Features	Linear axis
	HC150R
Manufacturer	Zimmer Group
Type	LKPS2001AS2
Static holding force, axial	650 N
Air connection	M5
Pressure min. (opening pressure)	5.5 bar
Pressure max.	6.5 bar
Clamping cycles	Up to 5 million
Braking cycles	Not allowed
Plug-in connection for hose	6 mm
Actuation	Pneumatic
Air quality	Oiled air according to ISO 8573-1, class 4 Filter size 25 µm, the air filter must be kept clean

4.4.2 Clamping and braking element LBPS (HC150R)

⚠ **Attention!** Danger of injury and damage to property!

Improper use of the braking element can result in damage to property and personal injury.

- Observe the maximum number of dynamic braking cycles according to the data sheet!
- Calculation of the stopping distance according to the manufacturer's specifications!

The braking element may be used for static holding of a position as well as for dynamic braking cycles.

- If there is no air pressure (air pressure: 0 bar), the braking element clamps with spring force. The clamping profiles are pressed against the guide rail via a spring energy accumulator (clamps with spring force).
- If the air pressure is between 5.5 and 6.5 bar, free travel is possible. The air pressure keeps the clamping profiles apart (release with air pressure).

Fig. 4.6: Braking element closed (0 bar)

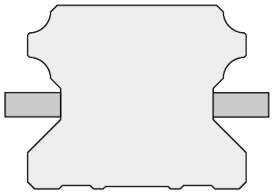
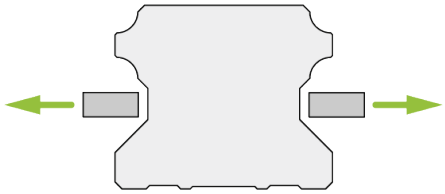


Fig. 4.7: Braking element open (5.5 to 6.5 bar)



According to EN ISO 13849-1, the braking element is a safety-related part of control systems and can be used as a proven component in category B or 1 control systems without any further control measures.

Table 4.5: Braking element specifications

Features	Linear axis
	HC150R
Manufacturer	Zimmer Group
Type	LBPS2001AS2
Static holding force, axial	650 N
Air connection	M5
Pressure min. (opening pressure)	5.5 bar
Pressure max.	6.5 bar
Clamping cycles	Up to 5 million
Braking cycles	Up to 500
Plug-in connection for hose	6 mm
Actuation	Pneumatic
Air quality	Oiled air according to ISO 8573-1, class 4 Filter size 25 µm, the air filter must be kept clean

Calculation of the stopping distance for vertical installation [1)]

[1)] Source: Zimmer Group

Vertical application accelerates the system via the earth's gravity until the braking element is triggered and the braking process begins.

- Speed at the beginning of the braking process V_{brake}:
  $V_{Brems} = v_0 + g \times (t_R + t_A) = 2\frac{m}{s} + 9{,}81\ \frac{m}{s^2} \times (0{,}06\ s + 0{,}01\ s) = 2{,}69\frac{m}{s}$
- Braking distance S_B:
  $$S_B = \frac{m \times v_{Brems}^2}{2 \times \left(F \times A \times \frac{\mu_G}{\mu_H}\right) - m \times g)} = \frac{50\ kg \times \left(2{,}69\frac{m}{s}\right)^2}{2 \times \left(\left(3.100\ N\ \times 1 \times \frac{0{,}06}{0{,}1}\right) - 50\ kg \times 9{,}81\frac{m}{s^2}\right)}$$
  $$= 0{,}132\ m$$
- Reaction path and response path S_R:
  $$S_R = v_0 \times (t_r + t_A) + \frac{1}{2} \times g \times (t_R + t_A)^2$$
  $$= 2\frac{m}{s} \times (0{,}06\ s + 0{,}01\ s) + \frac{1}{2} \times 9{,}81\frac{m}{s^2} \times (0{,}06\ s + 0{,}01\ s)^2$$
  $$= 0{,}164$$
- Stopping distance S_H:
  $S_H = S_B + S_R = 0{,}132\ m + 0{,}164\ m = 0{,}296\ m$

4.5 Meassurement system

If the accuracy of the linear axis, which is provided by the drive element and the encoder signal of the servo drive, is insufficient for an application, positioning and repeat accuracy can be enhanced through the use of a distance measuring system. The housing of the encoder is electrically shielded, the output is either an analogue or digital signal.
The HIWIN-MAGIC distance measuring system consists of the encoder (Fig. 4.8) and the magnetic tape (Fig. 4.9) as the dimensional standard. Assembly is done at the factory.

Fig. 4.8: MAGIC encoder

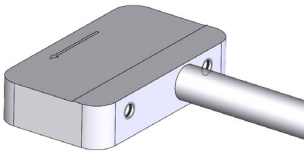


Fig. 4.9: MAGIC magnetic tape

Note:

The tape of the magnetic distance measuring systems must not be exposed to strong magnetic fields (keep it away from permanent magnets!). Strong vibrations (e.g. a blow with a hammer) can also damage the magnetisation of the measuring tape. The system is not suitable for environments with magnetic dust (e.g. graphite dust). These can falsify the measuring signal or damage the distance measuring system.

4.5.1 Technical data of the MAGIC distance measuring system

Table 4.6: Electrical and mechanical properties of the MAGIC encoder

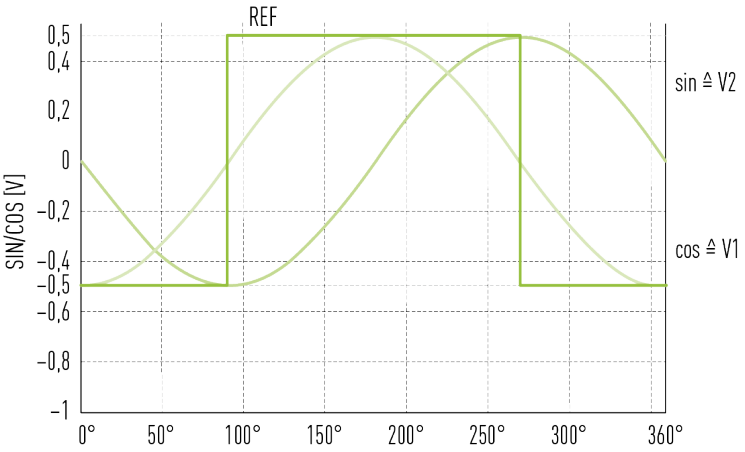
Order code	A	D
Type	1 V_{SS} (analogue)	TTL (digital)
Article	8-08-0530	8-08-0531
Electrical properties		
Output signal specification	sin/cos, 1 V_{SS} (0.85 V_{SS} – 1.2 V_{SS})	Quadrature signals acc. to RS422
Resolution	Infinite, signal period 1 mm	1 µm
Repeatability bidirectional	0.003 mm	0.002 mm
Absolute precision	±20 µm/m	
Reference signal [1)]	Periodic index impulse at a distance of 1 mm	
Phase angle	90° ±0.1° el	90°
DC component	2.5 V ±0.3 V	–
Distortion factor	Type < 0,1%	–
Operating voltage	5 V ± 5%	
Power consumption	Type 35 mA, max. 70 mA	Type 70 mA, max. 120 mA
Max. measurement speed	10 m/s	5 m/s
EMC class	3, according to IEC 801	
Mechanical properties		
Housing material	Aluminium alloy, stainless steel sensor base	
Encoder dimensions	L × W × H: 38 mm × 22 mm × 8 mm	
Standard cable length	1,000 mm	
Min. bending radius cable	40 mm	
Protection class	IP67	
Operating temperature	0 °C to +50 °C	
Encoder weight	50 g	

[1)] Can be used e.g. with reference switch

4.5.2 Formats and outputs of the distance measuring system MAGIC (analogue)

Signal format sine/cosine 1 V_{SS} output: The electrical signals after the differential input of the downstream electronic components. The HIWIN MAGIC-PG interface sine/cosine 1 V_{SS} is strictly based on the Siemens specification. The period length of the sine output signal is 1 mm. The period length of the reference signal is 1 mm.

Fig. 4.10: Electrical signals after the difference input of the subsequent electronics (analogue version)

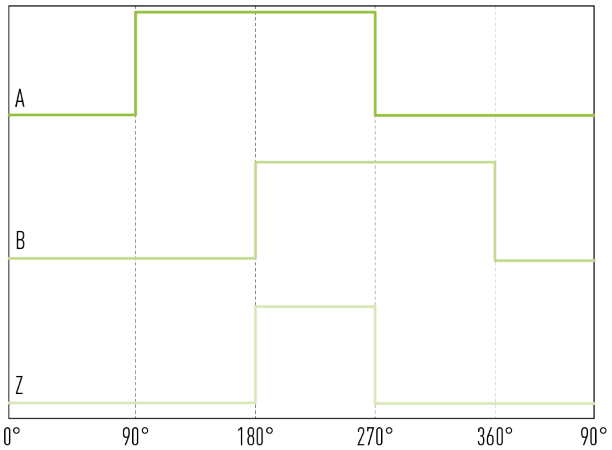


Output signals within one scale period (1,000 µm) in degrees (360°=1,000µm)

4.5.3 Formats and outputs of the distance measuring system MAGIC (digital)

Digital TTL output: The signals to the A and B channels are phase-shifted by 90° (according to the RS-422 specifications conforming to DIN 66259). Output signals: A, $\bar{A}$, B, $\bar{B}$ and Z, $\bar{Z}$.

Fig. 4.11: Signals of the MAGIC encoder (TTL version)



A A signal

B B signal

Z Z signal (reference switch)

For more information, see the “HIWIN MAGIC distance measuring system” assembly instructions.

4.6 Drive interface

The rack and pinion axes are equipped with a gearbox as standard. The gearbox, as an integral part of the drive adaptation, is firmly connected to the centre of the carriage on the bridge axis HB-R and firmly connected to the centre of the drive block on the cantilever axis HC-R. Depending on the motor, the scope of delivery includes a suitable motor gear adapter plate for connecting the motor.

Fig. 4.12: Drive interfaces of the bridge axis HB-R

S D

S: Straight, without energy chain

D: Straight, with energy chain

Fig. 4.13: Drive interfaces of the cantilever axis HC-R

S

S: Straight

4.7 Energy chain

The bridge axes HB-R can optionally be supplied with generously dimensioned energy chains to ensure that additional cables are transported safely. They are extremely compact and save space when attached to the axis. The alignment of the energy chain depends on the selected drive interface (see section 4.6). The energy chain type and specification can be found in Table 4.7. Linear axes with an energy chain are optimised for horizontal installation. Linear axes with an energy chain for vertical application are available on request.

Table 4.7: Specification of energy chain

Axis type	Manufacturer's reference [1)]	Inner cross section W × H [mm]	Bending radius [mm]
HB250R	2600.07.100.0	75 × 35	100
HC150R	Not available		

[1)] Manufacturer: igus GmbH

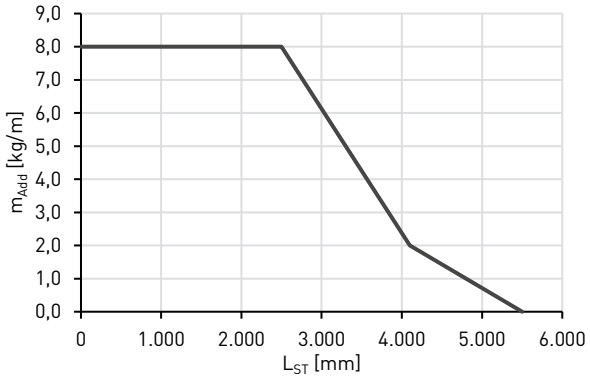
The upper run is self-supporting but there is a surface for the lower run that supports the energy chain as it unrolls. To prevent the cables and hoses from riding over each other, there is a partition in every second link. The connecting pieces are of a rigid design. Strain relief combs are fitted at both ends so that the cables and hoses can be secured with cable ties. To ensure

that the energy chains are handled correctly, and that the cables and hoses are installed and secured properly, please observe the assembly instructions from the energy chain manufacturer.

General notes:

- For details of suitable motor and signal cables, please refer to the operating manual from the motor manufacturer.
- Observe the minimum bending radii (industrial standard 8 × D) specified for the cables and hoses, and the associated service life that is to be anticipated.
- In the case of shielded cables, make sure the shields are resistant to bending.
- Low-friction and abrasion-resistant cable/hose sheaths should be used.
- To prevent cables and hoses with different outer sheaths from bonding, separate them with partitions.
- Ensure twist-free installation of cables and hoses.
- Leave enough spare room (10 to 20%, at least 1 mm) all the way around the cables and hoses, and allow for the lateral expansion that occurs when hoses are pressurised.
- Make sure that the weight is distributed evenly/symmetrically. Ideally, heavy cables and hoses should be positioned at the outer edges.
- Provide strain relief for cables and hoses at both ends so that they are located in the neutral zone when the energy chain is in the extended position and can move freely within its radius.
- In the case of high acceleration values or if the cables have a wide variety of diameters, use additional partitions where applicable. Partitions are available as a separate item, see the “Linear axes and linear axis systems” catalogue
- Observe the maximum permissible additional load mA_{dd} as a result of cables and hoses depending on the stroke L_{ST}.

Fig. 4.14: Maximum permissible additional load m_{Add} depending on the stroke L_{ST}, series 2600 (source: igus)



5 Transport and setup

5.1 Delivery

5.1.1 Delivery condition

The linear axes are delivered fully assembled and functionally tested.

5.1.2 Scope of delivery

The scope of delivery varies depending on the model, accessories and options ordered.

5.2 Transport to the installation location

⚠ **Warning**! Danger from suspended loads or falling parts!

Lifting heavy loads can cause damage to health.

- Assembly and maintenance of the linear axes only by qualified personnel!
- Take the mass of the parts into account during transport. Use suitable lifting gear!
- Comply with the applicable industrial safety regulations for handling suspended loads.
- Lift linear axes only at specified support points!
- Secure machines and machine parts against tipping over!

⚠ **Attention!** Risk of impact and crushing!

If the axes are moved/driven manually, injuries can be caused by moving axes and attachments (energy chains, attachments installed by customer).

- Observe applicable industrial safety regulations!
- Transport to the installation site only by qualified personnel!

Caution! Possible damage to the linear axis!

The linear axis can be damaged by mechanical stress.

- Lift linear axes only at specified support points! (See section 5.5)!
- For longer linear axes, ensure the centre sections have additional protection!
- Ensure that the linear axes do not bend, as this will permanently affect the precision!
- Do not transport any additional loads on the linear axis during transport!
- Provide additional support for heavy attachments!

The linear axes are precision products and must be handled with care. Impacts and shocks can damage the axes. Reduced running accuracy and a reduced service life could be the result. Transport the product packed as close as possible to the installation site. Only remove the packaging once there.

5.3 Installation location requirements

5.3.1 Environmental conditions

Ambient conditions during operation:	+5 to +40 °C
Relative humidity during operation:	according to IEC 60721-3-3, class 3K22, non-condensing
Climatic ambient conditions for transport and storage:	Ambient temperature: –20 to +50 °C, non-condensing

5.3.2 Safety equipment to be provided by the operator

Possible safety equipment/measures:

- Personal protective equipment according to UVV (accident prevention regulation)
- Electrosensitive protective equipment
- Mechanical safety equipment

5.4 Storage

- Store the linear axes in the transport packaging.
- Alternative: Select packaging in which the linear axes are secured against slipping, damage and vibration.
- Store the linear axes only in dry, frost-free rooms.
- Clean and protect used linear axes before storage.

5.5 Unpacking and setup

Caution! Danger to health and the environment!

Contact with lubricants can cause irritation, poisoning and allergic reactions as well as damage to the environment.

- Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.
- Dispose of substances appropriately.

Note:

The linear axes may only be set up and operated indoors.

- Remove the packaging.
- Lift the linear axis for transport at specified support points A and B (see Fig. 5.1, Fig. 5.2 and Fig. 5.3). The distance of points A and B from the end of the axis should be one quarter of the total length of the axis.
- Do not lift the linear axis by attachments. During transport, provide additional support for heavy attachments such as the drive.
- Dispose of the packaging in an environmentally friendly manner.

Fig. 5.1: Support points A and B for lifting and transporting

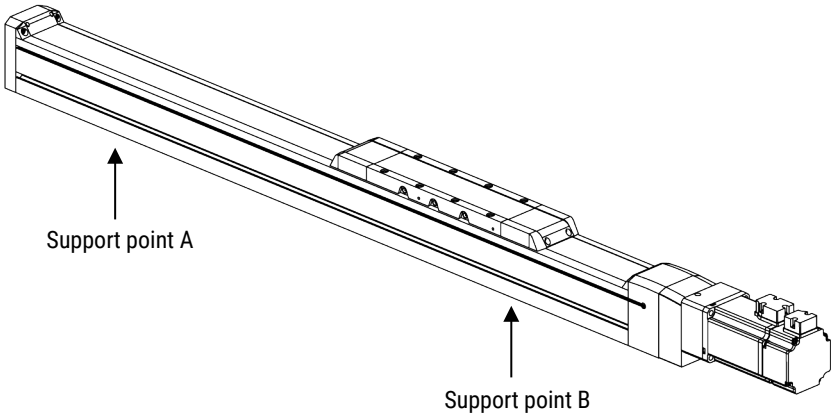


Fig. 5.2: Correct position of the support points

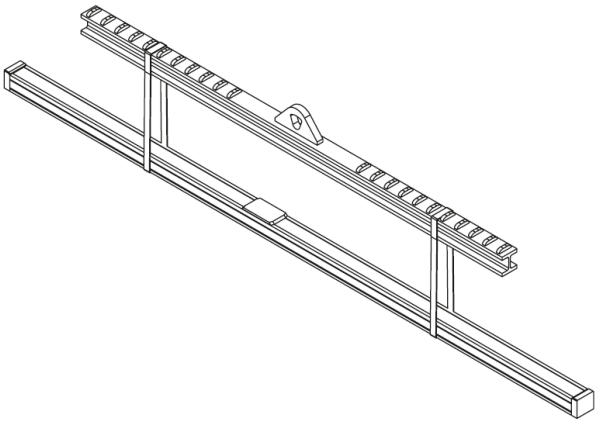
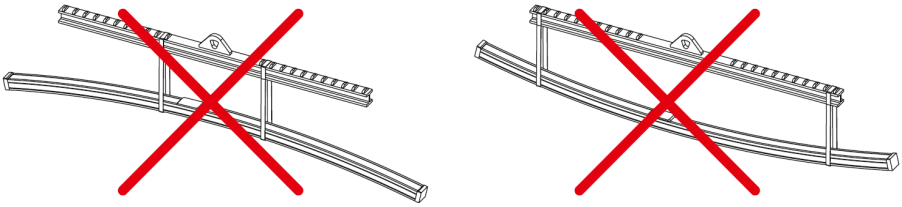


Fig. 5.3: Incorrect position of the support points



6 Assembly and connection

⚠ **Warning**! Risk of impact and crushing!

Injuries may occur due to automatic or manual movement of the carriage.

- A safety guard must be provided for the operation of the linear axes!
- Commissioning, set-up and troubleshooting only by qualified personnel!

⚠ **Warning**! Risk of impact and crushing!

Unintentional movements of the driven elements of the linear axes can cause injuries.

- Construction of the control system according to DIN EN 12100. No start-up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!

⚠ **Attention!** Danger of hearing damage!

The linear axes can generate noise above 70 dB(A) at high speeds.

- For fast running linear axes with a noise development above 70 dB(A), ear protection must be worn!
- Linear axes with energy chain and chain support can generate noise up to 94db(A) depending on load and speed. Noise reduction tape is available as an accessory.

⚠ **Attention!** Danger from suspended loads or falling parts!

- Assembly and maintenance of the linear axes only by qualified personnel!
- Take the mass of the parts into account during transport. Use suitable lifting gear!
- Comply with the applicable industrial safety regulations for handling suspended loads.
- Lift linear axes only at specified support points!
- Secure machines and machine parts against tipping over!
- Attach the linear axes according to the assembly instructions!
- When linear axes are arranged vertically, secure the carriage when stationary!

⚠ **Attention!** Danger of impacts and crushing due to imposed load becoming detached!

If the fastener is fastened incorrectly or fails, injuries can be caused by falling or flying parts.

- Carry out assembly in such a way that parts do not come loose even in the event of strong acceleration or continuous vibrations!
- Attach the payload in accordance with the assembly instructions!

⚠ **Attention!** Risk of impact and crushing!

If the axes are moved by the motor, injuries can be caused by moving axes and attachments (energy chains, attachments installed by customer).

- A safety guard must be provided for the operation of the linear axes!
- When linear axes are arranged vertically, secure the carriage when stationary!

⚠ **Attention!** Danger of electric shock or burns from contact with live parts!

Contact with live parts can cause injuries.
If the customer installs cables incorrectly, the constant motion inside the energy chain can cause chafing and expose the electrical contact points.

- Construction of the control system according to DIN EN 12100. No start-up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!
- Only qualified personnel may install cabling!
- Work on electrical installations only by qualified personnel!

Caution! Danger to health and the environment!

Contact with lubricants can cause irritation, poisoning and allergic reactions as well as damage to the environment.

- Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.
- Dispose of substances appropriately.

6.1 Mounting the bridge axis HB-R

The linear axis can be installed in any position. It must be mounted on the axis profile of the axis. The axes can be fastened to the mounting surface with clamping profiles (lateral grooves) or with T nuts (bottom grooves). Please note that depending on the installation position, the weight of the linear axis acts as an additional load and that the actually acting forces and torques must be below the permissible values (see "Linear axes and axis systems HX" catalogue).

Note:

Depending on the linear axis, the axis profile is manufactured as an extruded precision profile according to EN 12020-2 or EN 755-9.

Note:

If increased running accuracy is required, the axis must be aligned and fastened to an accurate reference edge.

Note:

The screws must be secured against unintentional loosening.

6.1.1 Maximum support distance of the linear axes HB-R

In the case of linear axes with long stroke lengths and high payloads, an impermissibly high deflection of the axis beam can occur depending on the mounting. To avoid this, the axis beam should be supported several times and mounted stably on a flat surface. The maximum permissible support distance L as a function of the acting force can be determined from the following diagrams.

Fig. 6.1: Horizontal lying axis position

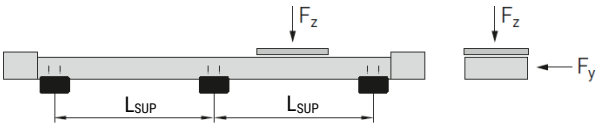


Fig. 6.2: Horizontal standing axis position

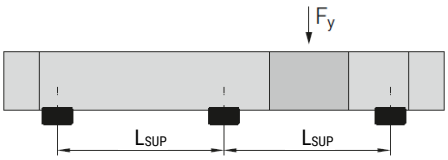


Fig. 6.3: HB-R: Maximum support distance L_{SUP} as a function of force F_z

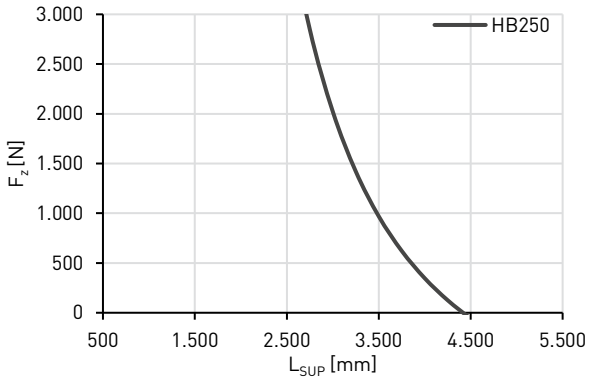
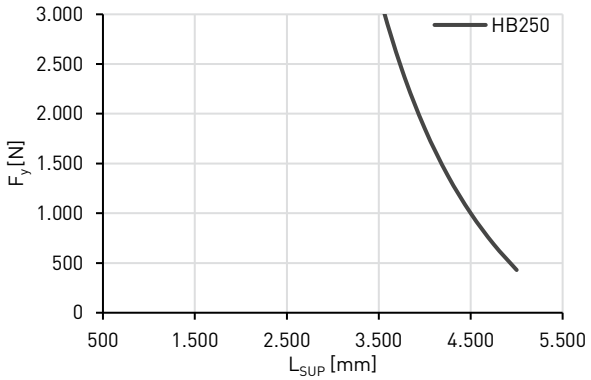


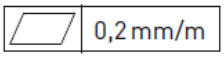
Fig. 6.4: HB-R: Maximum support distance L_{SUP} as a function of force F_y



6.1.2 Accuracy requirements for the mounting surface

When mounting the linear axis, ensure that the axis profile is mounted on a level surface and that the mounting points are aligned with each other to ensure that the required level of evenness is achieved.

Accuracy requirement for the mounting surface:



6.1.3 Mounting with T nuts – linear axis HB-R

The T nut to be used for each axis size can be found in Table 6.1. The T nuts must be arranged according to Fig. 6.5 or Fig. 6.7. The required number of T nuts depends on the external load. To calculate the required number, the load values listed in Table 6.1 must be taken into account. The minimum number of T nuts specified in Table 6.1 must not be undercut. The T nuts must be positioned in groups at mounting points, as shown in Fig. 6.6and Fig. 6.7. It is important to ensure that there is at least one mounting point at each end of the axis and each mounting point is capable of safely transmitting the external load. The number and spacing of the additional mounting points should be chosen according to the load situation. Distances L_{NX} listed in Table 6.1 are only reference values.

- Drill the mounting holes in the mounting surface.
- Clean the mounting surface.
- Swivel the T nuts into the lower groove of the linear axis.
- Position the linear axis on the mounting surface.
- Pre-assemble the T nut with the screws with low screw tightening torque.
- Tighten the screws in a criss-cross fashion, taking into account the screw tightening torques.

✓ The linear axis is mounted.

Fig. 6.5: Hole distance for mounting the bridge axis HB-R

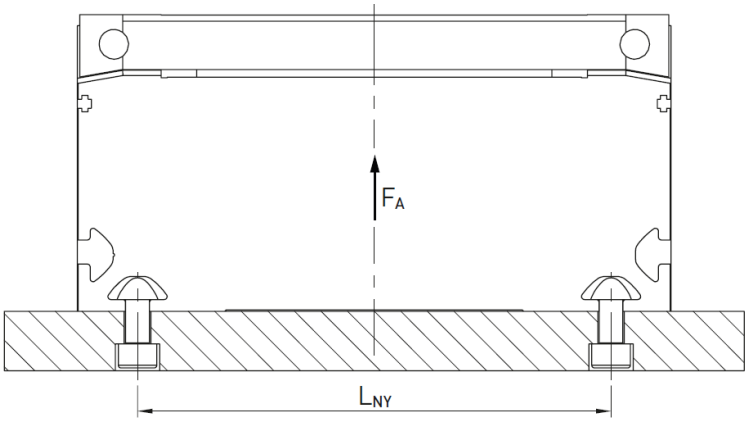


Fig. 6.6: Permissible axial operating force in tensile direction per T nut ($F_{A\_per.}$)

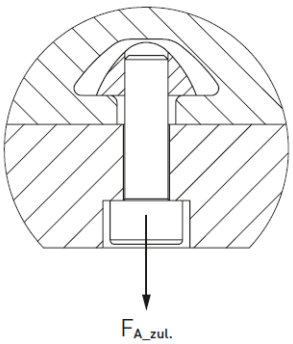


Fig. 6.7: Mounting with T nuts – HB-R

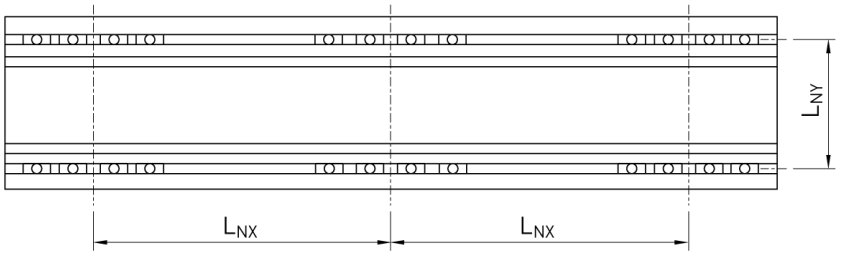


Table 6.1: Mounting with T nuts

Linear axis	Minimum number of T nuts	L_{NY} [mm]	Recommended distance L_{NX} [mm]	Thread size	Screw tightening torque [Nm]	$F_{A\_per.}$ [1] [N]	Article number T nuts (10 pcs)
HB250R	16	150	1,000	M8	34	6,000	80114686
HB250R	16	150	1,000	M10	46	7,000	80114691

[1] Permissible axial operating force in tensile direction per T nut.

6.1.4 Mounting with clamping profiles – linear axis HB-R

The clamping profiles must always be fitted in pairs (on the left and right of the axis profile) (see Fig. 6.9). The required number of clamping profiles depends on the external load. To calculate the required number, the load values listed in Table 6.2 must be taken into account. The minimum number of clamping profiles specified in Table 6.2 must not be undercut. It is important to ensure that there is at least one mounting point at each end of the axis and each mounting point is capable of safely transmitting the external load. The number and spacing of the additional mounting points should be chosen according to the load situation. Distances L_{SX} listed in Table 6.2 are only reference values.

- Drill the mounting holes in the mounting surface.
- Clean the mounting surface.
- Position the linear axis on the mounting surface.
- Swivel the clamping profile into the lateral groove.
- Pre-assemble the clamping profile with the screws with low screw tightening torque.
- Tighten the screws in a criss-cross fashion at each mounting point, taking into account the screw tightening torques. When doing so, observe the sequence of the mounting points: Tighten either from the outside inwards or from one side to the other to avoid stress.

✓ The linear axis is mounted.

Fig. 6.8: Hole distance for mounting – HB-R

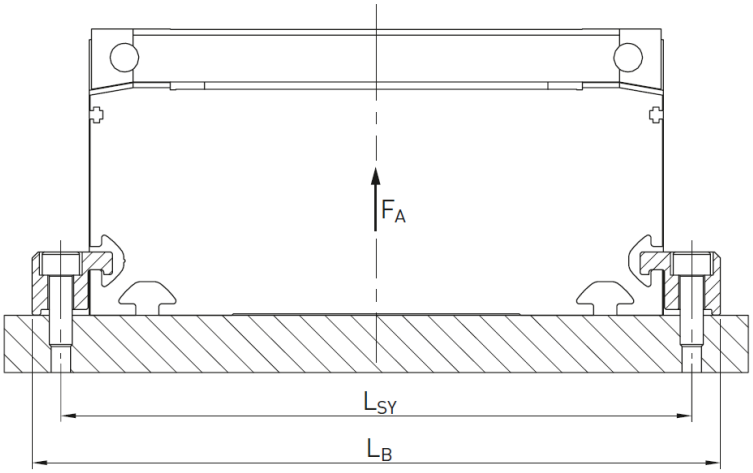


Fig. 6.9: Mounting with clamping profiles – HB-R

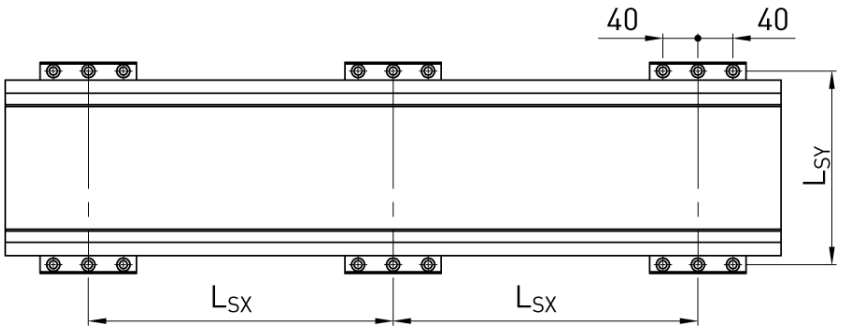


Table 6.2: Mounting with clamping profiles

Linear axis	Minimum number of clamping profiles	L_{SY} [mm]	L_B [mm]	Recommended distance L_{SX} [mm]	Thread size	Screw tightening torque [Nm]	$F_{A\_per.}$ [1] [N]	Article number clamping profiles (4 pcs)
HB250R	8	283	321	1,000	M10	33.0	7,000	80113432

[1] Permissible axial operating force in tensile direction per pair of clamping profiles

6.2 Mounting the cantilever axis HC-R

The cantilever axis HC-R is mounted to the front of the drive block on a suitable mounting surface. The number of screws and the thread sizes are predefined (see Table 6.3). Please note that depending on the installation position, the weight of the linear axis acts as an additional load and that the actually acting forces and torques must be below the permissible values (see “Linear axes and axis systems HX” catalogue).

Note:

Depending on the axis type, the axis profile is manufactured as an extruded precision profile according to EN 12020-2 or EN 755-9.

Note:

The screws must be secured against unintentional loosening.

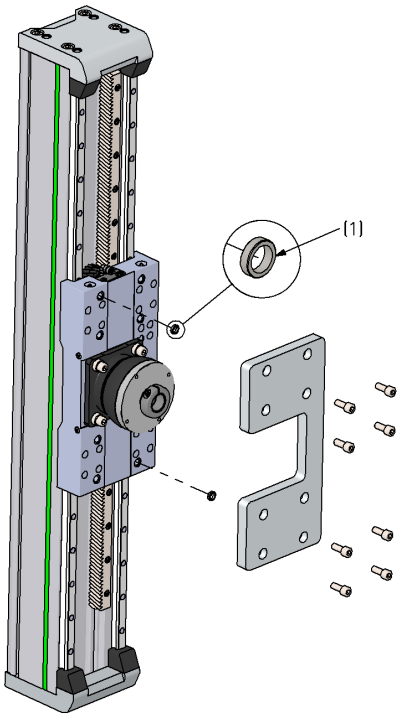
- Drill the mounting holes in the mounting surface.
- Clean the mounting surfaces.
- Position the two centring sleeves [1] diagonally opposite each other on the side of the drive block.
- Position the linear axis on the mounting surface.
- Tighten the mounting bolts in a criss-cross fashion to the specified tightening torque.

✓ The cantilever axis is mounted.

Table 6.3: Mounting the cantilever axis

Linear axis	Thread size × depth	Counter bore depth for centring sleeve [mm]	Counter bore diameter for centring sleeve [mm]	Number of mounting bolts	Article number centring sleeve [1], 10 pcs
HC150R	M10 × 18	2.0	Ø15 H7	8	25-000513

Fig. 6.10: Mounting the cantilever axis HC-R



Note:

Alternatively, the cantilever axes can also be mounted on the axis profile with T nuts or clamping profiles. The right mounting materials can be found at hiwin.de.

6.3 Mounting the payload

The distances of the threaded holes for mounting the payload can be found in the “Linear axes and axis systems HX” catalogue. Additional counter bores allow for insertion of centring rings. HIWIN recommends arranging two centring rings diagonally opposite each other. For axes with more than one carriage, only equipping one carriage at a time with centring sleeves is recommended to avoid stress.

- Clean the mounting surfaces on the carriage.
- Clean the mounting surface of the payload.
- If necessary, use centring sleeves [1].
- Position the payload on the carriage (HB-R) or the end plate (HC-R) of the linear axis.
- Tighten the mounting bolts in a criss-cross fashion.
- Check if the load moves freely throughout the entire stroke.
- Secure the screws.
- ✓ The payload is mounted.

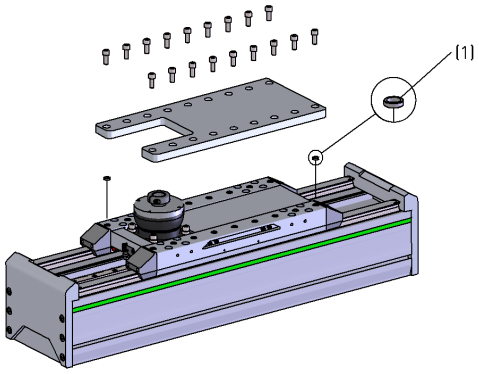
Accuracy requirement for the mounting surface of the payload.

Table 6.4: Mounting the payload

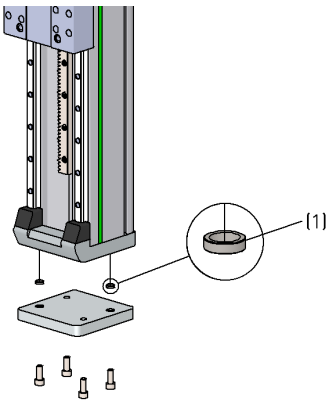
Linear axis	Thread size × depth	Counter bore depth for centring sleeve [mm]	Counter bore diameter for centring sleeve [mm]	Article number centring sleeve [1], 10 pcs
HB250R	M10 × 20	2.0	Ø15 H7	25-000513
HC150R	M10 × 18	2.0	Ø15 H7	25-000513

Fig. 6.11: Mounting the payload

HB-R



HC-R



6.4 Mounting and setting the limit switches – bridge axis HB-R

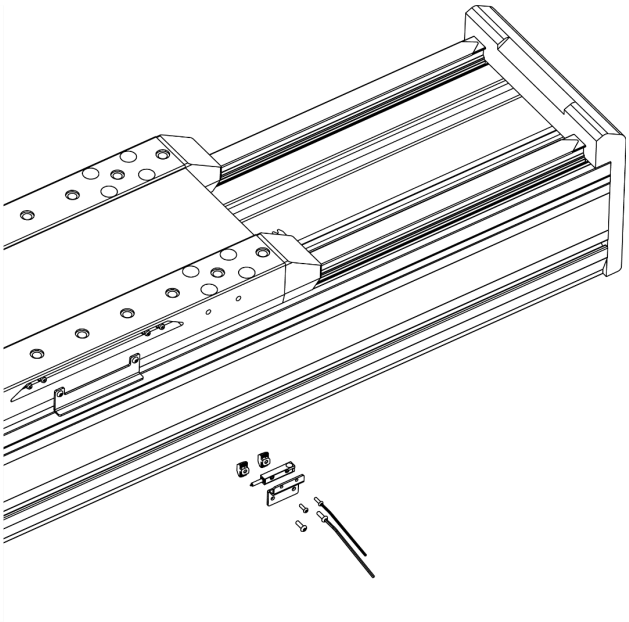
6.4.1 Mounting the limit switches

The limit switches are optionally available as NC or NO contacts. The limit switch can be mounted directly in the limit switch groove using the enclosed screws and hammerhead nuts.

- If necessary, remove the green strip from the upper groove.
- Initially connect the limit switch to the mounting plate.
- Align the limit switch horizontally to the upper edge of the mounting plate.
- Mount the limit switch using the M3 screws, screw tightening torque $\leq$ 1.5 Nm.
- Insert the M4 screw through the holes in the mounting plate and tighten the hammerhead nuts a few threads.
- Turn the hammerhead nut to insert it through the opening of the upper groove.
- Gradually tighten the M4 screws one after the other. The hammerhead nuts turn into position. Screw tightening torque $\leq$ 3 Nm.

✓ The limit switches have been mounted.

Fig. 6.12: Mounting of limit switch:



6.4.2 Mounting the damping element

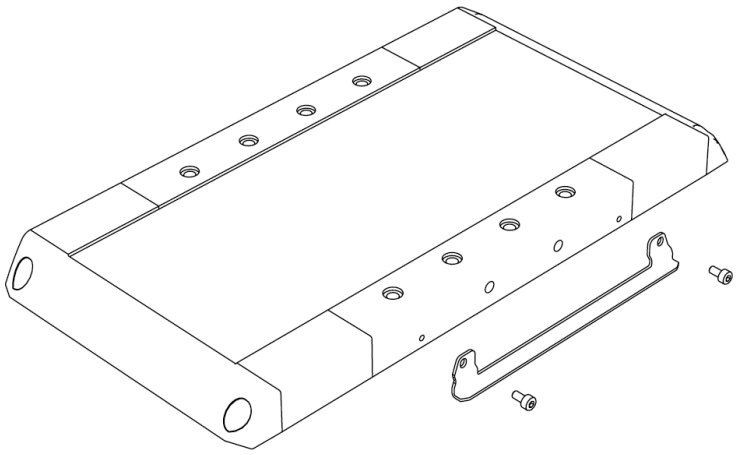
The damping element actuates the limit switches at the two end positions of the carriage (at stroke 0 and max. stroke) and must be mounted on the same side as the limit switches.

- Place the damping element on the carriage.
- Screw the damping element slightly to the carriage using the enclosed screws.
- Align the damping element parallel to the lower edge of the carriage.
- ✓ The damping element is pre-assembled.

Table 6.5: Damping element

Linear axis	Article number damping element
HB250R	80073712

Fig. 6.13: Mounting damping element



6.4.3 Setting the switching distance

The limit switches are inductive units and require a defined switching distance between limit switch and damping element.

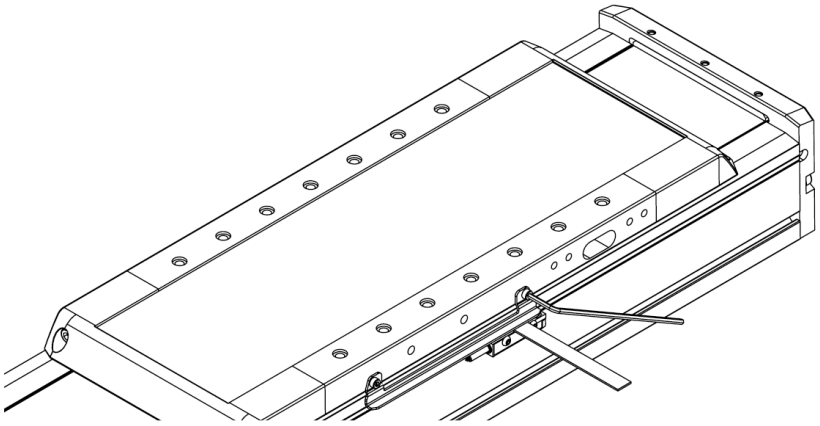
Switching distance	1 mm
Screw tightening torque	1 Nm

- Move the carriage until the damping element is above a limit switch. Align the damping element using a feeler gauge to ensure that the switching distance is maintained. Make sure that the damping element remains aligned parallel to the lower edge of the carriage.
- Tighten the screws of the damping element to the predefined screw tightening torque.
- If a second limit switch is installed: Move the carriage until the damping element is positioned above the second limit switch and use a feeler gauge to check whether the switching distance is maintained. Correct, if necessary, until the switching distance is maintained for both limit switches.
- ✓ The switching distance has been set.

Note

Check that the limit switch is functioning correctly before commissioning with a limit switch test box or by controlled travel to the end positions.

Fig. 6.14: Setting the switching distance with a feeler gauge and tightening the bolts



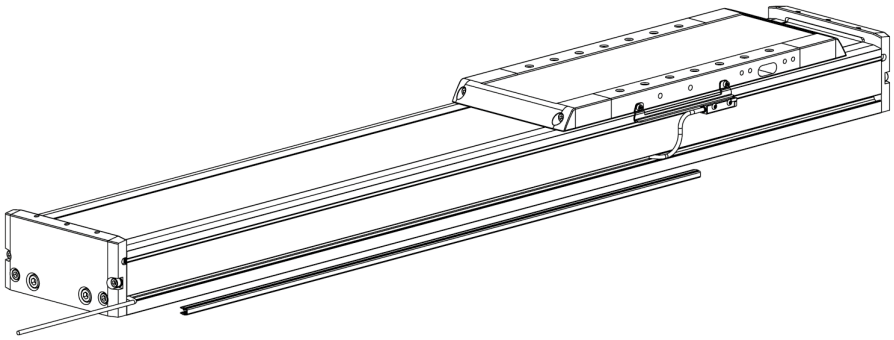
6.4.4 Installing the limit switch cables

If necessary, install the limit switch cable in the lower groove. The cable can be protected by the groove cover there. The groove cover is available as a separate item.

Table 6.6: : Groove cover

Linear axis	Groove type	Article number groove cover [1], 5 pcs
HB250R	Size 10	80114653

Fig. 6.15: Mounting of limit switch: Installing the cables, using the groove cover



6.5 Mounting and setting the limit switches – cantilever axis HC-R

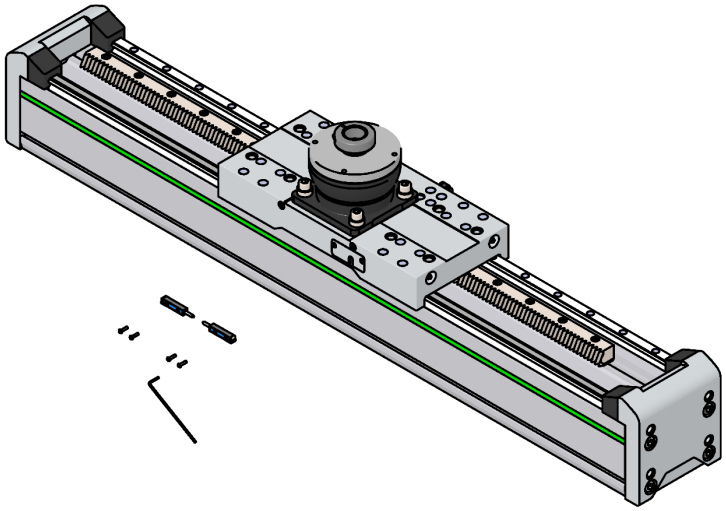
6.5.1 Mounting the limit switches

The limit switches are available either as normally closed or normally open contacts. The limit switch can be mounted directly on the drive block using the enclosed screws.

- Attach the limit switches to the drive block.
- Screw the limit switches slightly to the drive block housing using the enclosed screws.
- Push the limit switches gently against the reference edge of the drive block.
- Tighten the screws. Screw tightening torque = 0.5 Nm.

✓ The limit switches have been mounted.

Fig. 6.16: Mounting of limit switch



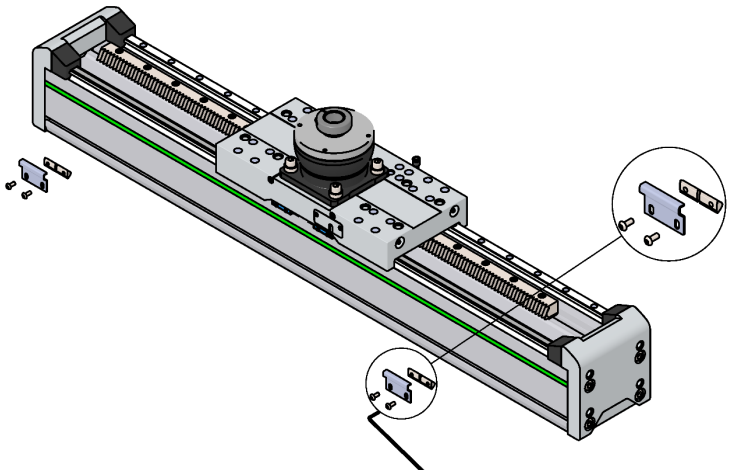
6.5.2 Mounting the damping elements

The damping elements actuate the limit switches at the two end positions of the axis (at stroke 0 and max. stroke) and must be mounted on the same side as the limit switches.

- If necessary, remove the green strip from the upper groove.
- Swivel two T nuts into the upper groove.
- Attach the damping elements using both screws. Leave the two screws unfastened for the time being.
- Slide the damping elements to the desired position.

✓ The damping elements are pre-assembled.

Fig. 6.17: Mounting damping element



6.5.3 Setting the switching distance

The limit switches are inductive units and require a defined switching distance between limit switch and damping element.

- Move the drive block until a limit switch is positioned above a damping element. Using a feeler gauge, align the damping element to produce the following switching distance:

Table 6.7: Setting the switching distance

Switching distance	1 mm
Screw tightening torque	1 Nm

Make sure that the damping element remains aligned parallel to the upper edge of the axis.

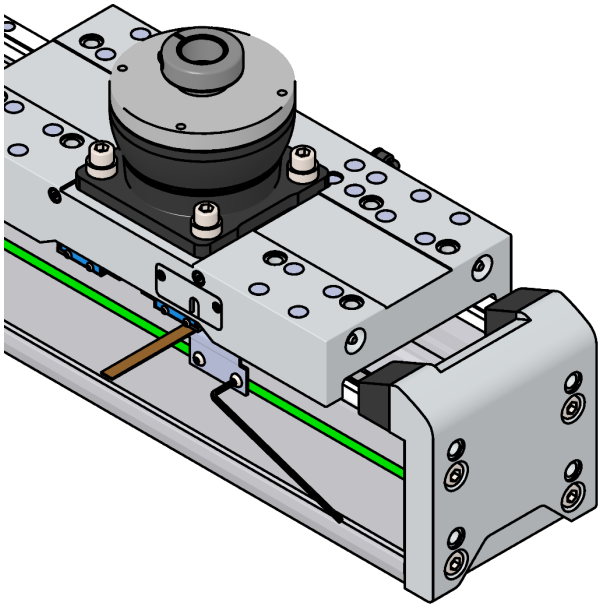
- Tighten the screws of the damping element to the predefined screw tightening torque.
- Move the drive block housing until the second limit switch is located above the second damping element, and repeat the process on this side.

Note

Check that the limit switch is functioning correctly before commissioning with a limit switch test box or by controlled travel to the end positions.

✓ The switching distance has been set.

Fig. 6.18: Setting the switching distance with a feeler gauge and tightening the bolts



6.6 Mounting the drive adaptation

The linear axes HB-R and HC-R are always supplied with a gearbox ex works. The motor is mounted by the customer as described below.

- Clean the mounting surface on the gearbox and the motor gear adapter plate GM.
- Attach the motor gear adapter plate GM to the gearbox and align it in the centre of the gearbox flange.
- Tighten the screws [1] of the motor gear adapter plate to the screw tightening torque T1.
- Clean the clamping connection on the gearbox using a lint-free cloth. The contact surface to the gear shaft must be free of grease.
- Remove the lateral plug [3] of the motor gear adapter plate GM.
- Turn the clamping hub on the gearbox until the clamping bolt can be reached via the mounting hole of the motor gear adapter plate GM.
- Make a note of the screw tightening torque T3 of the clamping connection that is lasered on at the front for later mounting.
- Clean the mounting surface on the motor using a lint-free cloth.
- Place the motor flat on the motor gear adapter plate GM. Insert the motor shaft into the clamping connection of the gearbox.
- If necessary, secure the screws with thread locker.
- Tighten the screws [2] in a criss-cross fashion to the maximum screw tightening torque T2 according to the information provided by the motor manufacturer.
- Tighten the screw of the clamping connection on the gearbox to the maximum screw tightening torque T3.
- Press the plug as far as possible into the motor gear adapter plate.

✓ The drive adaptation is mounted.

Fig. 6.19: Mounting the drive adaptation

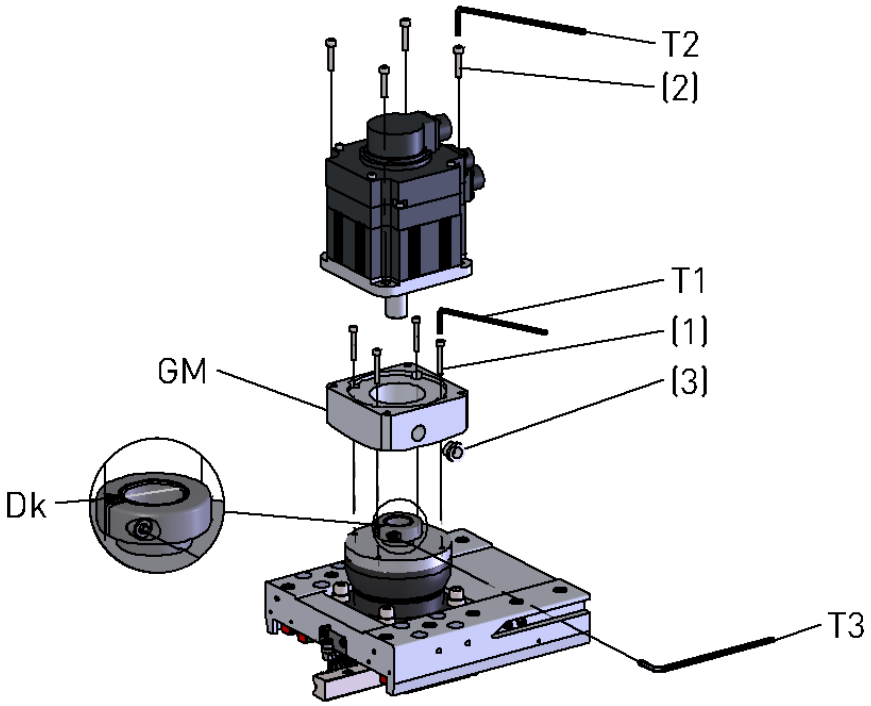


Table 6.8: Screw tightening torques

Linear axis	Gearbox type [1)]	Clamping hub diameter Dk [mm]	Screw [1] size / quantity	T1 [Nm]	T2 [Nm]	T3 [Nm]
HB250R, HC150R	NPR35-H	28	M5 / 4	7.6	According to the information provided by the motor manufacturer	14
	NPR35-K	38	M6 / 7	13.2		79

[1)] Manufacturer: Wittenstein alpha GmbH

6.7 Mounting the tape for reduction of noise emissions from the energy chain

The tape reduces the noise emission of the energy chain.

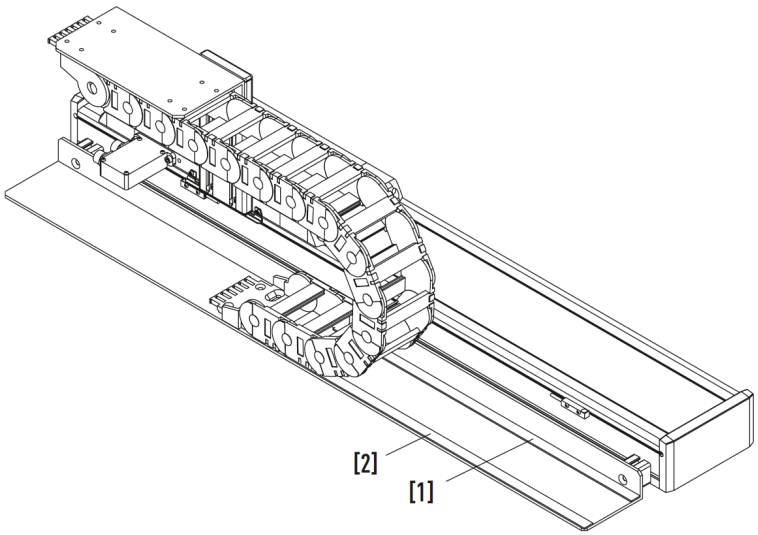
- Slide the carriage by hand to the mechanical end position so that the energy chain rests on the energy chain support to the maximum extent.
- Shorten the noise reduction tape until it corresponds to the maximum support length of the energy chain. Two tapes of the same length are required for each energy chain.
- Slide the carriage by hand to the other end position so that the lower section of the energy chain is lifted as far as possible from the energy chain support.
- Clean the energy chain support so that it is free of dirt, dust and grease.
- Attach the 1st tape **[1]** flush with the corner of the energy chain support.
- Attach the 2nd tape **[2]** flush with the outer edge of the support bracket.
- Move the carriage and make sure that the energy chain runs on the tapes over its entire travel distance.

✓ The noise reduction tape has been mounted.

Table 6.9: : Tape for reduction of noise emissions

Linear axis	Article number noise reduction tape, roll 10 m each
HB250R	25-002485

Fig. 6.20: Linear axis with mounted noise reduction tape



6.8 Electrical connection

⚠ **Danger!** Danger due to electrical voltage!

If the motor is not properly earthed, there is a risk of electric shock.

- Make sure that the linear axes are properly earthed via the PE rail in the switch cabinet before connecting the electrical power supply!

⚠ **Danger!** Danger due to electrical voltage!

Electrical currents can also flow when the motor is not moving.

- Make sure that the linear axes are disconnected from the power supply before disconnecting the electrical connections of the motors!
- After disconnecting the servo drive from the power supply, wait at least 5 minutes before touching live parts or loosening connections!
- To be on the safe side, measure the voltage in the intermediate circuit of the servo drive. Wait until it has dropped below 40 V!
- Work on electrical installations only by qualified personnel!

6.8.1 Limit switch connection

The pin assignment of the limit switch plug for variant A and B can be seen in Fig. 6.22. For variant C and D with open cable end, connect the wires according to Fig. 6.21.

Fig. 6.21: Wiring diagram

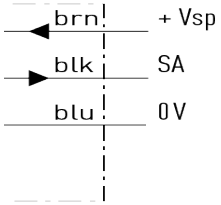
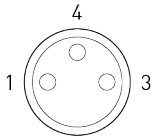


Fig. 6.22: Pin assignment: Limit switch plug



Pin assignment:
1: Brown (+ Vsp)
3: Blue (0 V)
4: Black (switching output)

Note:

Since the sensor is operated with a low voltage, it alone does not normally pose a risk of injury or death.

Note:

Do not operate the sensor with a voltage other than the specified voltage, otherwise it may be destroyed!

6.8.2 External distance measuring system connection

The HIWIN-MAGIC distance measuring system is laterally integrated into the carriage of the linear axis ex works. The cable length is 1 m with open cable end.

Fig. 6.23: MAGIC distance measuring system – linear axes HB-R

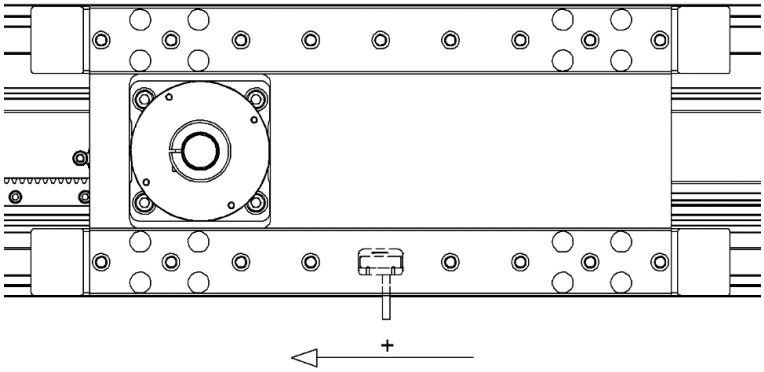
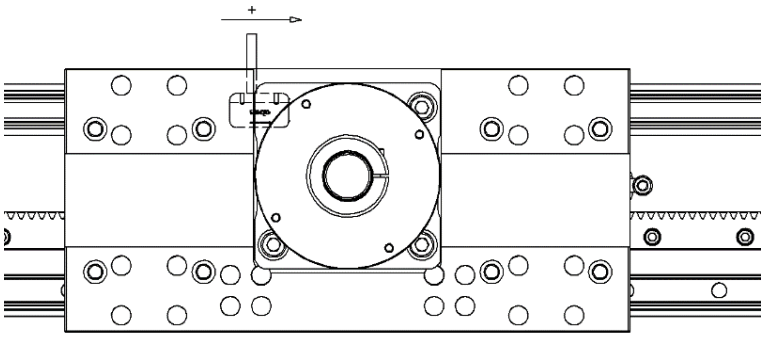


Fig. 6.24: MAGIC distance measuring system – linear axis HB-R



If the encoder is connected according to Fig. 6.24, the counting direction (with moving encoder) results according to the definitions in Fig. 6.25.

If you wish to have a positive counting direction in the opposite direction, when connecting to the electronic evaluation system, you must switch “A” with “B and “Ā” with “$\bar{B}$”.

Fig. 6.25: Detail view, positive direction of travel of MAGIC encoder

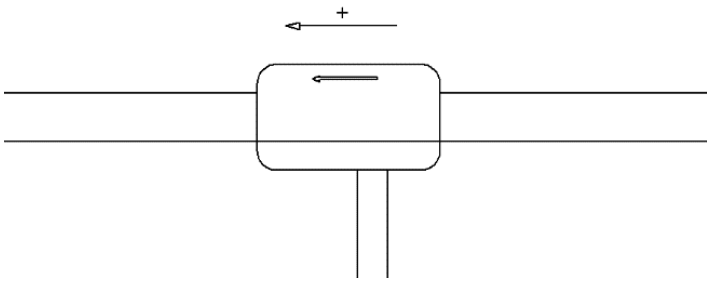


Table 6.10: Cable and plug assignments

Colour of encoder cable	Signal
Brown	Power supply 5 V
White	GND / 0 V
Green	V1+ / A
Yellow	V1- / Ā
Blue	V2+ / B
Red	V2- / $\bar{B}$
Violet	Ref+ / Z
Grey	Ref- / $\bar{Z}$
	Shielding

For more information, see the “HIWIN MAGIC distance measuring system” assembly instructions.

6.8.3 Motor connection

Note:

Notes on the connection options of the motor can be found in the instruction manual of the motor used!

6.8.4 Servo drive connection

Note:

Notes on the connection options of the servo drive can be found in the instruction manual of the servo drive used!

6.9 Pneumatic connection

The linear axis HC-R can optionally be equipped with pneumatic clamping or braking elements (see order code 3.2.4 Order code). The pneumatic connection for the clamping or braking element is located on the side of the drive block (see Fig. 6.26 and Fig. 6.27).

The connection for the hose has an outer diameter of 6 mm.

Fig. 6.26: Position of the pneumatic connection, 1x clamping or braking element, order code C and B

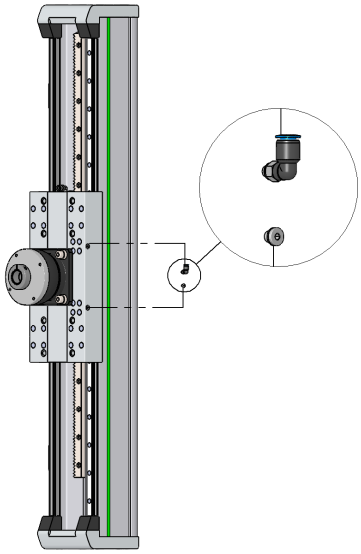


Fig. 6.27: Position of the pneumatic connection, 2x clamping or braking element, order code D and E

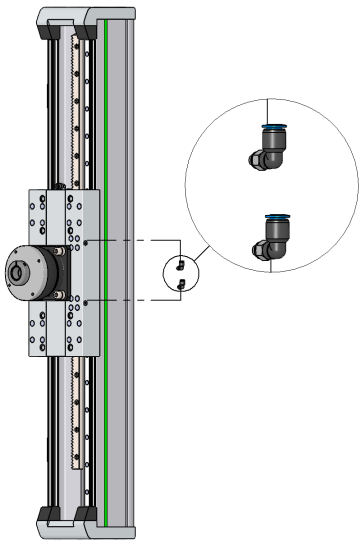


Table 6.11: General features of the pneumatic connection

Structural design	Push-pull principle
Nominal tightening torque	1.33 Nm
Hose connection	Outer diameter: 6 mm
Nominal size	2 mm

7 Maintenance and cleaning

⚠ **Warning**! Risk of impact and crushing!

Injuries can occur if the carriage is moved or accidentally started up.

- When linear axes are arranged vertically, secure the carriage when stationary!
- Construction of the control system according to DIN EN 12100: No start up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!

⚠ **Warning**! Danger of injury and damage to property!

Unauthorised work on the unit may cause injury and invalidate the warranty.

- Assembly and maintenance of the system only by qualified personnel!

⚠ **Attention!** Danger of crushing due to tilting of the axes!

- Secure machine and machine parts against tipping over!

⚠ **Attention!** Danger of impacts and crushing due to the axis falling down or the payload coming loose! Danger due to high loads!

- Use suitable lifting gear!
- Attach the linear axes according to the assembly instructions!
- Attach the payload in accordance with the assembly instructions!

⚠ **Attention!** Risk of impact and crushing!

If the axes are moved/driven manually, injuries can be caused by moving axes and attachments (energy chains, attachments installed by customer).

- Observe applicable industrial safety regulations!
- Transport to the installation site only by qualified personnel!

⚠ **Attention!** Danger of electric shock or burns from contact with live parts!

Contact with live parts can cause injuries. If the customer installs cables incorrectly, the constant motion inside the energy chain can cause chafing and expose the electrical contact points.

- Construction of the control system according to DIN EN 12100. No start-up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!
- Only qualified personnel may install cabling!
- Work on electrical installations only by qualified personnel!

⚠ **Attention!** Danger to health and the environment!

Contact with lubricants can cause irritation, poisoning and allergic reactions as well as damage to the environment.

- Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.
- Dispose of substances appropriately.

Caution! Damage due to incorrect lubricant!

Using the wrong lubricant can cause damage to property or environmental pollution.

- Use the correct type of lubricant (grease, oil) according to the specifications in these assembly instructions!

For maintenance work:

- Secure the linear axis against unauthorised switching on.
- Disconnect the linear axis from the power supply.
- Secure the linear axis against unauthorised restart.

Note:

Compliance with the maintenance intervals for cleaning and lubrication is essential.

- Include the maintenance intervals in your maintenance schedule.

7.1 Lubrication

Operation of the linear axis continuously consumes lubricant. The product must be relubricated regularly. Note that the lubricant may leak out of the lubrication system in small quantities.

The following factors influence the lubrication intervals:

- Dust and dirt
- Operating temperatures
- Loads
- Vibration stress
- Permanently short positioning paths
- Speeds

Note:

Insufficient lubrication or the wrong lubricant increase wear and reduce the service life!

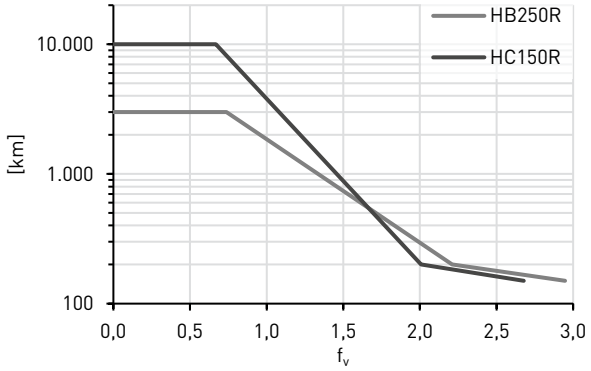
7.1.1 Lubricating the linear guideway

Part of the linear axis is a linear guideway with blocks that are provided with initial lubrication ex works. Grease nipples are located on the carriage for relubricating the linear guideway.

Table 7.1: Relubrication quantity [cm³] per block

Linear axis	Block type	Number of blocks	Lubricant	Relubrication quantity [cm³]
HB250R	CGH25HA	4	HIWIN G04	1.0
HC150R	QHH20CA	4	HIWIN G04	0.5

Fig. 7.1: Relubrication interval [km] depending on the load



fv Load comparison factor according to the “Linear axes and linear axis systems” catalogue, chapter “Calculation basis”

Table 7.2: Lubricant for linear guideway

Grease type	Area of application	Unit of measure	Article number
Hiwin G04	Linear guideway	Cartridge 400g	20-000345

7.1.2 Lubrication process for the linear guideway

Note:
Only use lubricants according to DIN 51825, KP2K, consistency class NGLI2!

Note:
Make sure that only lubricants without solid lubricant content (e. g. graphite or MoS_2) are used!

Note:
If the linear axes are installed vertically, to the side or with the profile rail facing upwards, the relubrication quantities must be increased by approx. 50%.

Note:
In case of special operating conditions (contamination, short stroke, type of installation), the lubrication intervals must be adapted to the application.

Lubricating the linear guideway:

- Move the carriage to any position.
- Position the nozzle of the grease gun at a right angle to a lateral lubrication point.
- Press the nozzle against the grease nipple with manual force.
- Operate the grease gun until the required relubrication quantities have been reached.
- Repeat the process for all the lubrication points.

✓ The linear guideway is lubricated.

Fig. 7.2: Lubricating the bridge axis HB-R

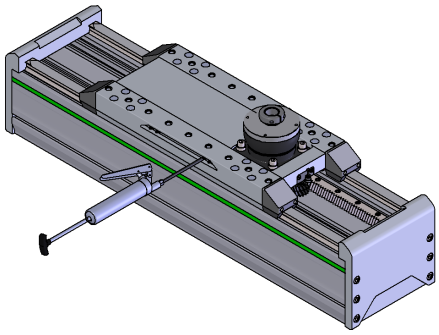
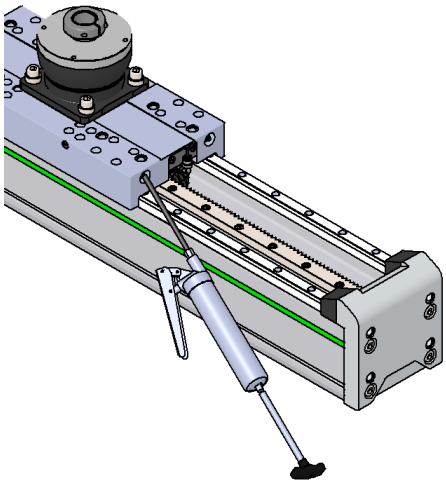


Fig. 7.3: Lubricating the cantilever axis HC-R



7.1.3 Lubricating the toothed rack

Part of the linear axis is a toothed rack with drive pinion that is provided with initial lubrication ex works. The toothed rack is relubricated continuously via the lubrication pinion mounted on the carriage. The grease requirement for relubrication depends on the maximum travel speed of the linear axis. A hose connection piece is located on the lubrication pinion as standard.

Table 7.3: Grease requirement

Max. travel speed [m/s]	Grease requirement [cm^3/24h]
Up to 0.5	0.30
Up to 1.0	0.40
Up to 2.0	0.55
Up to 3.0	0.70

Due to the high feed forces that can occur with a toothed rack and pinion drive, the open gearing must be lubricated under all circumstances. The polyurethane foam lubrication pinion is supplied with a preset quantity of grease via a lubricator or a central lubrication system (lubricant pump). The open-cell polyurethane foam ensures an optimum supply of lubricant. The material stores the lubricant and releases it again in very small quantities. This ensures continuous lubrication and prevents wear caused by insufficient lubrication. In addition to supplying lubricant, the lubrication pinion also cleans the open gearing.

Table 7.4: Lubricant for toothed rack

Grease type	Area of application	Unit of measure	Article number
Grease for toothed rack	Toothed rack	Cartridge 400g	80076723

7.2 Cleaning the linear axis

The linear axes must be checked regularly and cleaned from the outside.

Observe the following points when cleaning:

- Do not use compressed air.
- The surface is anodised and only resistant to alkaline cleaning agents under certain conditions. Only neutral cleaning agents may be used for cleaning.
- Remove coarse particles from the surface regularly. A moistened, soft and lint-free cleaning cloth is ideal for this purpose.

7.3 Replacing the lubrication pinion

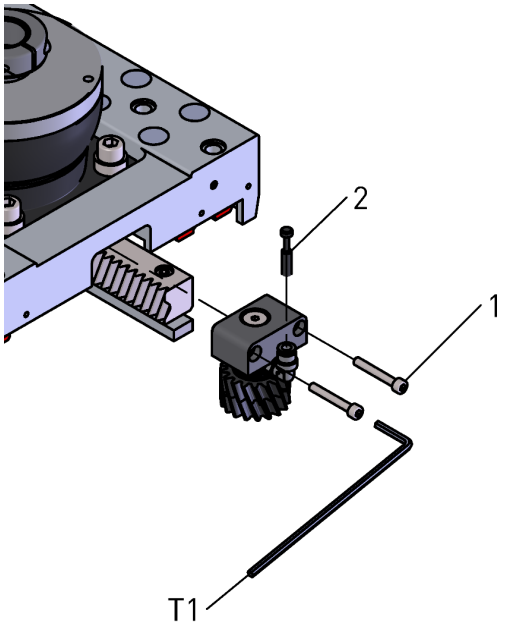
Visually inspect the lubrication pinion every 6 months and replace the lubricating gear every 3 years. The lubrication pinion set is supplied with the mounting material.

- ▶ Move the carriage to any position.
- ▶ Secure the carriage against unintentional travel.
- ▶ Loosen the 2 cylinder screws and pull the lubrication pinion out of the carriage.
- ▶ Clean the mounting surface of the carriage.
- ▶ Coat the flanks of the lubrication pinion completely with the toothed rack grease prior to installation.
- ▶ Insert the new lubrication pinion into the carriage and tighten the mounting bolts [1] to the stipulated screw tightening torque T1.
- ▶ Remove the dummy plugs [2]
- ✓ The new lubrication pinion is mounted!

Table 7.5: Lubrication pinion

Suitable for linear axis	T1 [Nm]	Article number	Description
HB250R, HC150R	5.0	80074421	BG lubrication pinion H-R

Fig. 7.4 : Replacing the lubrication pinion



8 Faults

Possible faults on the linear axis and their remedies can be found in Table 8.1.

In the event of faults in the motor or the servo drive, refer to the instruction manual for the motor or the servo drive for the meaning of the fault and notes on how to remedy it.

⚠ **Attention!** Risk of impact and crushing!

If the axes are moved by the motor, injuries can be caused by moving axes and attachments (energy chains, attachments installed by customer).

- A safety guard must be provided for the operation of the linear axes!
- When linear axes are arranged vertically, secure the carriage when stationary!

⚠ **Attention!** Danger of electric shock or burns from contact with live parts!

Contact with live parts can cause injuries.
If the customer installs cables incorrectly, the constant motion inside the energy chain can cause chafing and expose the electrical contact points.

- Construction of the control system according to DIN EN 12100. No start up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!
- Only qualified personnel may install cabling!
- Work on electrical installations only by qualified personnel!

Table 8.1: Fault table

Fault	Possible cause	Remedy
Carriage does not move	Gearbox or drive pinion is blocked	Check the gearbox or drive pinion for correct assembly. Send axis to HIWIN GmbH for repair
	Load too high	Reduce load or acceleration of the drive if necessary
Carriage exhibits backlash and positions inaccurately	Backlash in the guides or drive elements after a collision or due to extreme external influences (impacts, load peaks, etc.)	Send axis to HIWIN GmbH for repair
Programmed absolute position changes	Clamping connection on the gearbox slips	Check the torques of the clamping bolts on the clamping elements and, if necessary, adjust them; check the maximum drive torque applied and, if necessary, reduce it
No limit switch function	Switching distance too large	Readjust the switching distance and set correctly
	Limit switch defective or cable break	Replace limit switch
	Signal does not arrive at the control system	Check the supply line to the control system
Noise development and vibrations at high speed	Speed is too high.	Reduce speed
	Tension in the system	Install the axis so it is free of tension, check the evenness of the supporting surface and the attached load
	Incorrect settings on the drive controller	Re-tune and adapt controller settings to the application conditions

Fault	Possible cause	Remedy
Noise development of the guides	Lack of lubricant	Relubrication
	Damage to the guides, for example due to extreme impact loads on the carriage or extreme contamination	Send axis to HIWIN GmbH for repair
Motor load increases, control system switches off due to overload	Tension in the system or lack of lubricant	Install the axis so it is free of tension, check the evenness of the supporting surface and the attached load. Relubricate axis
	Axis and guides are heavily contaminated	Clean axis, ensure free movement of guide and drive elements

9 Disassembly

⚠ **Danger!** Danger due to electrical voltage!

Dangerous currents may flow before and during assembly, disassembly and repair work.

- Work may only be carried out by qualified electricians when the device is de-energised!
- Before working, disconnect the linear axes from the power supply and secure them against being switched on again!

⚠ **Warning**! Risk of impact and crushing!

Injuries can occur if the carriage is moved or accidentally started up.

- When linear axes are arranged vertically, secure the carriage when stationary!
- Construction of the control system according to DIN EN 12100: No start up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!

⚠ **Warning**! Danger of crushing due to traversing carriage!

Risk of injury due to crushing and damage to the linear axes due to movement of the traversing carriage due to gravity, as the axes do not have a brake by default.

- Ensure that the carriage is secured against unintentional movement when stationary!

⚠ **Warning**! Danger of cutting!

The cover strip can cause cuts during assembly or disassembly.

- Commissioning and set-up only by qualified personnel with appropriate protective equipment (gloves, goggles)!

⚠ **Warning**! Danger from suspended loads or falling parts!

Lifting heavy loads can cause damage to health.

- Assembly and maintenance of the linear axes only by qualified personnel!
- Take the mass of the parts into account during transport. Use suitable lifting gear!
- Comply with the applicable industrial safety regulations for handling suspended loads.
- Lift linear axes only at specified support points!
- Secure machines and machine parts against tipping over!

⚠ **Attention!** Risk of impact and crushing!

If the axes are moved/driven manually, injuries can be caused by moving axes and attachments (energy chains, attachments installed by customer).

- Observe applicable industrial safety regulations!
- Transport to the installation site only by qualified personnel!

⚠ **Attention!** Danger of electric shock or burns from contact with live parts!

Contact with live parts can cause injuries.
If the customer installs cables incorrectly, the constant motion inside the energy chain can cause chafing and expose the electrical contact points.

- Construction of the control system according to DIN EN 12100. No start up after:
  - Application, return of energy!
  - Correction of a fault!
  - Machine stop!
- Only qualified personnel may install cabling!
- Work on electrical installations only by qualified personnel!

⚠ **Attention!** Danger of crushing due to tilting of the axes!

- Secure machine and machine parts against tipping over!

Caution! Danger to health and the environment!

Contact with lubricants can cause irritation, poisoning and allergic reactions as well as damage to the environment.

- Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.
- Dispose of substances appropriately.

Disassembly steps:

- Disconnect the linear axis from the electric system.
- Unscrew the moving load.
- Protect the moving parts (e.g. carriage) from unintentional movement.
- Unscrew the linear axis.

✓ The linear axis is disassembled.

10 Disposal

⚠ **Attention!** Danger to health and the environment!

Contact with lubricants can cause irritation, poisoning and allergic reactions as well as damage to the environment.

- Only use suitable media that are not dangerous for humans. Observe the manufacturer's safety data sheets.
- Dispose of substances appropriately.

Table 10.1: Disposal

Liquids	
Lubricants	Dispose of as hazardous waste in an environmentally-safe manner
Soiled cleaning cloths	Dispose of as hazardous waste in an environmentally-safe manner
Linear axis	
Cabling, electrical components	Dispose of as electrical waste
Plastic components (e.g. energy chain)	Sort by type before disposal
Components made of steel (e.g. profile rail)	Sort by type before disposal
Aluminium components (e.g. profile, synchronous shaft)	Sort by type before disposal

11 Installation certificate

In terms of EC Machinery Directive 2006/42/EC, Appendix II 1. B for incomplete machines

The manufacturer: HIWIN GmbH, Brücklesbünd 1, 77654 Offenburg, Germany

Documentation department: HIWIN GmbH, Brücklesbünd 1, 77654 Offenburg, Germany

Description and identification of the incomplete machine:

Product:	Bridge axis HB-R and cantilever axis HC-R
Type:	HB250R, HC150R from 2024
Year of manufacture:	

We hereby declare that the machine satisfies the following fundamental provisions of the Machinery Directive 2006/42/EC:

1.1.3, 1.1.5, 1.3.3, 1.3.4, 1.3.7, 1.3.9, 1.5.1, 1.5.8, 1.5.9, 1.6.2, 1.5.5, 1.1.2, 1.3.2, 1.5.4

We also declare that the specialist technical documents have been produced in accordance with appendix VII, part B.
We expressly declare that the incomplete machine satisfies all of the applicable provisions of the following EC directives.

2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility (EMC)
2011/65/EU	RoHS Directive on the restriction of hazardous substances

Reference of the harmonised standards applied in accordance with Article 7(2)

EN ISO 13732-1:2008	Ergonomics of the thermal environment – Evaluation methods for human responses to contact with surfaces - Part 1: Hot surfaces
EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

The manufacturer or its agents undertake to provide the specialist documents on the incomplete machine to authorised organisations in the individual member states upon request.

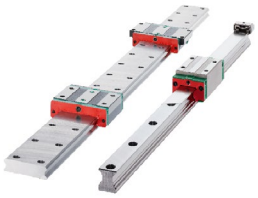
Commercial copyrights remain unaffected.

Important note! The incomplete machinery may not be put into operation until it has been ascertained that the machinery into which this incomplete machinery is to be incorporated is in conformity with this Directive.

Offenburg, August 2024

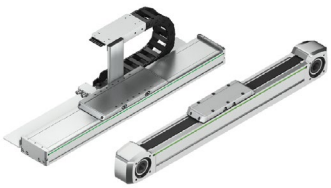
Werner Mäurer, Management

We live motion.

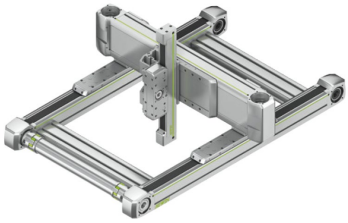


Linear guideway

Ballscrews



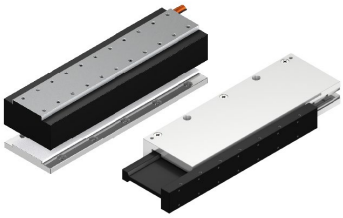
Linear axes



Linear axis systems

Torque motors

Robot



Linear motors

Rotary tables

Servo drives and servo motors

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