PAS4•S

Portal axes with ball screw drive
Product manual

V2.01, 07.2009

MNA1MLSDM00EN, V2.01, 07.2009

BERGER LAHR

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Important information

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries.
For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

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Writing conventions and symbols

Work steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

- ■ Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

Bulleted lists

The items in bulleted lists are sorted alphanumerically or by priority. Bulleted lists are structured as follows:

- Item 1 of bulleted list
- Item 2 of bulleted list
  - – Subitem for 2
  - – Subitem for 2
- Item 3 of bulleted list

Making work easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

SI units

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

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1 Introduction

1.1 Overview of product properties

The ball screw axes are based on specially developed and particularly torsion-resistant aluminum profiles. They excel with the their ability to position heavy loads at changing torques with high feed forces and high accuracy.

1.1.1 Product family

The linear axes product family consists of the following sizes:

- PAS42Sx (axis body cross section 60x60 mm)
- PAS43Sx (axis body cross section 80x80 mm)
- PAS44Sx (axis body cross section 110x110 mm)

The sizes differ in terms of outer dimensions, drive data, payload capacities and maximum stroke.

1.1.2 Features and options of the linear axis

The linear axis excels with the following features and options:

- High positioning accuracy even at great ballscrew lengths due to several moving screw supports
- Simple integration into systems and machines due to axis bodies with slots
- Stroke length available precise to the millimeter
- Mounting thread with counterbores for locating dowels at the carriage for reproducible mounting of the payload
- Grease nipples at the side of the carriage for external lubrication
- Distribution of the payload to up to 3 carriages
- Optional cover strip
- Motor mounting via compact coupling system
- Sensors adjustable in T slots

1.1.3 Features of the linear guide

Recirculating ball bearing guide

- High acceleration
- High load capacity
- High accuracy
- Suitable for high torques
- Optimum absorption of forces by the axis body

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1.1.4 Motor mounting

The motor or the gearbox are coupled by means of a preloaded elatomer coupling.

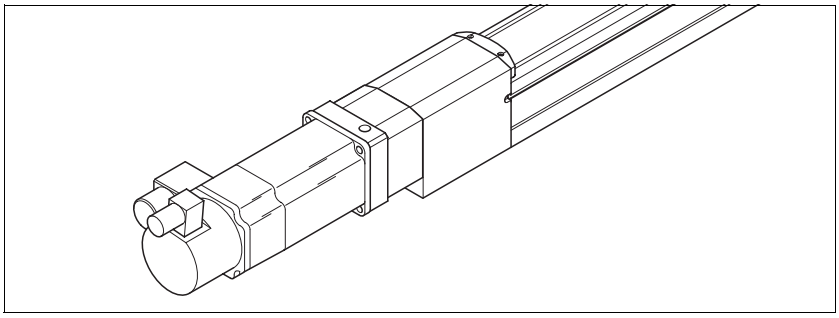

Figure 1.1 Motor mounting straight

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1.2 Product overview

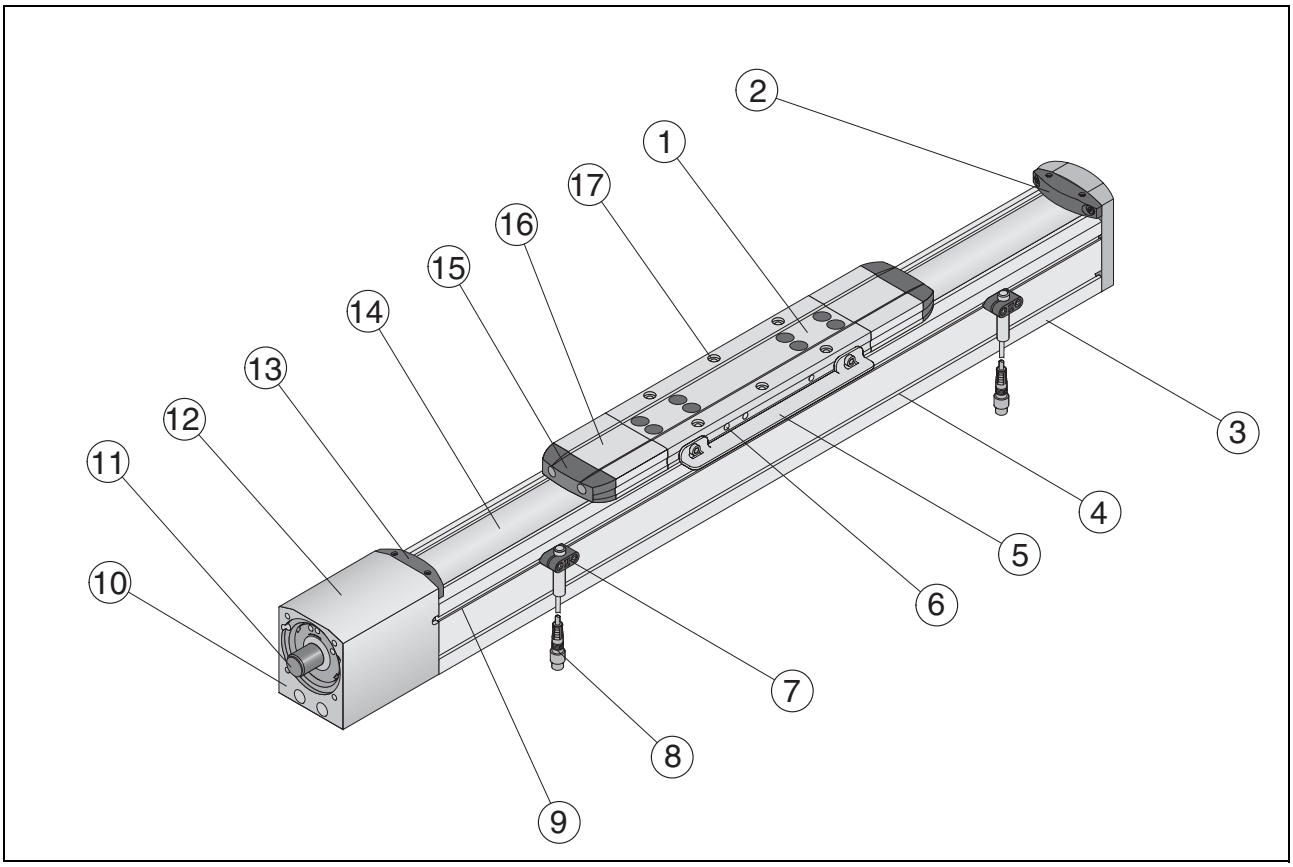

Figure 1.2 Product overview ball screw axis

(1) Carriage
(2) End plate with ball screw shaft bearing
(3) Axis body
(4) T slot for mounting the linear axis
(5) Contact plate sensor
(6) Grease nipples, 3
(7) Sensor holder
(8) Sensor with cable and connector
(9) T-slot for fastening the sensor holder
(10) Flange for motor mounting
(11) Shaft extension
(12) Drive block
(13) Clamp fastener for cover strip
(14) Cover strip
(15) Rubber buffer
(16) Strip deflection
(17) Thread for fastening the payload

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1.3 Type code

Example	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Product PAS = Portal axis	**PAS**	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Product family 4 = Basic line	PAS	**4**	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Size (axis body cross section) 2 = 60; (60 x 60 mm) 3 = 80; (80 x 80 mm) 4 = 110; (110 x 110 mm)	PAS	4	**2**	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Carriage drive element S = Ball screw A = Support axis (without ball screw, only linear guide)	PAS	4	2	**S**	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Type of guide B = Recirculating ball bearing guide	PAS	4	2	S	**B**	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Feed per revolution B = 5 mm (size 2, 3, 4) D = 10 mm (size 2, 3, 4) F = 16 mm (size 2) G = 20 mm (size 3) H = 25 mm (size 4) N = Support axis	PAS	4	2	S	B	**D**	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Stroke xxxx = in mm (maximum stroke per size see Technical Data)	PAS	4	2	S	B	D	**1200**	C	1	B	A	100	S	/	2	3G	0	V0	3
Limit switches [1] A = 2 x PNP sensors as normally closed contacts, not wired C = 2 x PNP sensors as normally open contacts, not wired E = 2 x NPN sensors as normally closed contacts, not wired G = 2 x NPN sensors as normally open contacts, not wired N = No sensors, no contact plate	PAS	4	2	S	B	D	1200	**C**	1	B	A	100	S	/	2	3G	0	V0	3
Carriage 1 = Type 1 4 = Type 4	PAS	4	2	S	B	D	1200	C	**1**	B	A	100	S	/	2	3G	0	V0	3
Options B = With cover strip / without ball screw support C = With cover strip / one ball screw support D = Without cover strip / one ball screw support E = With cover strip / two ball screw supports F = Without cover strip / without ball screw support D = Without cover strip / without ball screw support	PAS	4	2	S	B	D	1200	C	1	**B**	A	100	S	/	2	3G	0	V0	3
Number of carriages [2] A = One B = Two (on request) C = Three (on request)	PAS	4	2	S	B	D	1200	C	1	B	**A**	100	S	/	2	3G	0	V0	3

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Example	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Distance between carriages [3] Up to 999 = in mm (xxx = with a single carriage)	PAS	4	2	S	B	D	1200	C	1	B	A	**100**	S	/	2	3G	0	V0	3
Axis drive interface See Figure 1.3 S = With motor mounting or motor adapter mounting D = With shaft extension N = Support axis	PAS	4	2	S	B	D	1200	C	1	B	A	100	**S**	/	2	3G	0	V0	3
Gearbox / motor interface 1 = With motor, without gearbox (select motor type) 2 = With motor, with gearbox (select motor/gearbox type) 3 = Without motor, with gearbox (select motor/gearbox type) 4 = Without motor, without gearbox (select motor/gearbox type) X = Without motor, without gearbox (without select motor/gearbox selection)	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	**2**	3G	0	V0	3
Gearboxes 0G = Planetary gear - PLE 40 1G = Planetary gear - PLE 60 3G = Planetary gear - PLE 80 5G = Planetary gear - PLE 120 0A = Planetary gear - WPLE 40 1A = Planetary gear - WPLE 60 3A = Planetary gear - WPLE 80 5A = Planetary gear - WPLE 120 7G = Planetary gear - PLS 70 8G = Planetary gear - PLS 90 9G = Planetary gear - PLS 115 YY = Third-party gearbox without mounting by Schneider Electric (gearbox drawing required) ZZ = Third-party gearbox with mounting by Schneider Electric (gearbox must be provided) XX = No gearbox	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	**3G**	0	V0	3
Mounting direction gearbox (with clamping hub mounting screw of adapter plate) 0 = 0 a'clock 3 = 3 a'clock 6 = 6 a'clock 9 = 9 a'clock X = No gearbox	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	**0**	V0	3

Example	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Motor / gearbox interface V6 = Stepper motors BRS 364 / BRS 366 V8 = Stepper motors BRS 368 V9 = Stepper motors BRS 397 / BRS 39A V0 = Stepper motors BRS 39B V1 = Stepper motors BRS 3AC / BRS 3AD I6 = ILS..571; ILS..572 with stepper motor I7 = ILS..573 with stepper motor I9 = ILS..851; ILS..852 with stepper motor I8 = ILS..853 with stepper motor E7 = DC brushless ILExx66 S6 = Servo motors SER 36• / BRH 057 S9 = Servo motors SER 39• / BRH 085 S1 = Servo motors SER 311• / BRH 110 A6 = ILA..57 with servo motors H5 = Servo motors BSH 055• H7 = Servo motors BSH 0701 / BSH 0702 / BMH 0701 / BMH 0702 H8 = Servo motors BSH 0703 / BMH 0703 H1 = Servo motors BSH 1001 / BSH 1002 / BSH 1003; BMH 1001 / BMH 1002 / BMH 1003 H4 = Servo motors BSH 1004 H2 = Servo motors BSH 1401 / BSH 1402 / BSH 1403 / BSH 1404 / BMH 1401 / BMH 1402 / BMH 1403 YY = Third-party motor without mounting by Schneider Electric (motor drawing required) ZZ = Third-party motor with mounting by Schneider Electric (motor drawing required; motor must be provided) XX = No motor	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Mounting direction motor with reference to power connection (with clamping hub mounting screw of adapter plate) 0 = 0 a'clock 3 = 3 a'clock 6 = 6 a'clock 9 = 9 a'clock X = No motor	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	**3**

1) With 100 mm cable with connector at one end, other versions and extension cables as accessories
2) Only carriages of the same type are possible.
3) Minimum distance between 2 carriages: see dimensional drawings

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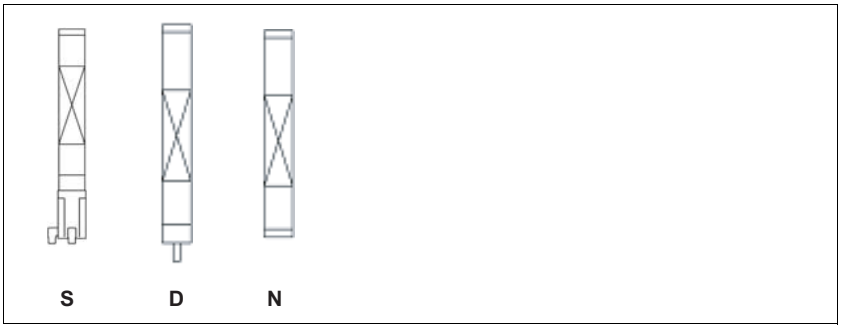

Figure 1.3 Axis drive interface

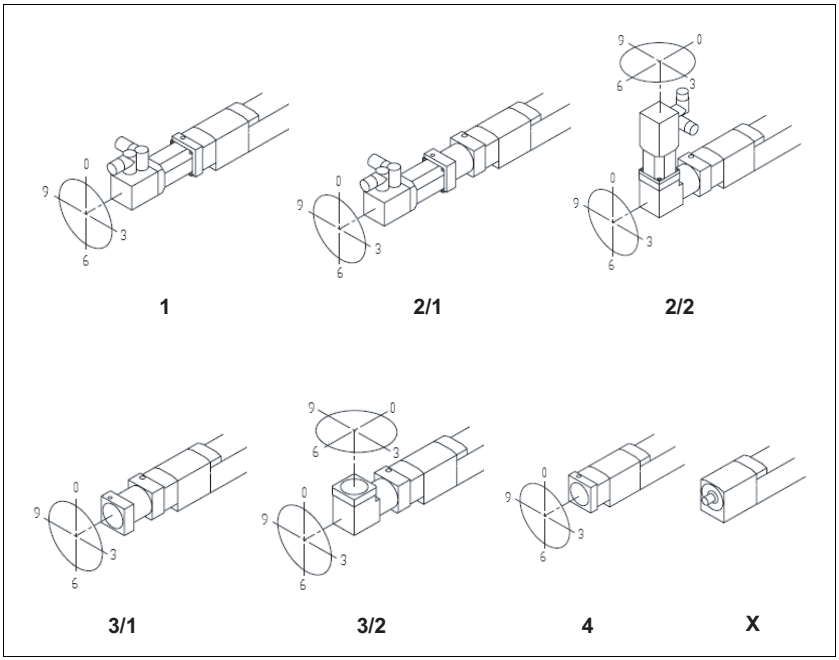

Figure 1.4 Mounting direction motor and gearbox

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1.4 Documentation and literature references

The following manuals belong to this product:

- **Product manual**, describes the technical data, installation, commissioning and the replacement of parts.
- **Motor manual**, describes the technical characteristics of the motors, including correct installation and commissioning.

Source manuals

The latest versions of the manuals can be downloaded from the Internet at:

http://www.schneider-electric.com

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1.5 Manufacturer's Declaration

MANUFACTURER'S DECLARATION

Schneider Electric

according to EC Directive on Machinery 98/37/EG

We hereby declare that the following product:

Designation:	Portal axis with toothed belt Portal axis with spindle
Type:	PAS41x, PAS42x, PAS43x, PAS44x
Product number:	73xx xxxx xxx

in the version delivered is intended for installation in a machine. Commissioning is prohibited unless the machine meets the regulations according to the EC directives. Please observe the safety instructions in our technical documentation.

Applied harmonized standards, especially	EN ISO 12100-1:2003-11 Safety of machinery basic concepts, principles for design Part 1: Basic terminology, methodology EN ISO 12100-2:2003-11 Safety of machinery basic concepts, principles for design Part 2: Technical principles and specifications
Applied national standards and technical specifications, especially	Product documentation

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Date/Signature: 30 July 2009

Name/Department: Wolfgang Brandstätter/Development

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2 Before you begin - safety information

2.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

2.2 Intended use

This product is a portal axis with mounted motor and intended for industrial use according to this manual.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).

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2.3 Basic information

⚠ WARNING

GREAT MASS OR FALLING PARTS

- Consider the mass of the axis when mounting it. It may be necessary to use a crane.
- Mount the axis in such a way (tightening torque, securing screws) that the axis and mounted parts cannot come loose even in the case of fast acceleration or continuous vibration.
- Note that vertically installed linear axes may lower unexpectedly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are EMERGENCY STOP, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe the accident prevention regulations and local safety guidelines. [1)]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation for Construction and Operation of Adjustable-Speed Drive Systems.

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2.4 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61800-7 series: "Adjustable speed electrical power drive systems - Part 7-1: Generic interface and use of profiles for power drive systems - Interface definition"
- IEC 61158 series: "Industrial communication networks - Fieldbus specifications"
- IEC 61784 series: "Industrial communication networks - Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

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3 Technical Data

See chapter 9 "Glossary" for definitions and explanations of terms see chapter.

3.1 Ambient conditions

Ambient temperature during operation

Temperature	[°C]	0 ... +50

Ambient conditions transportation and storage

The environment during transport and storage must be dry and free from dust. The maximum vibration and shock load must be within the specified limits.

Temperature	[°C]	-25 ... +70

Relative humidity

The following relative humidity is permissible during operation:

Relative humidity		As per IEC60721-3-3, class 3K3, non-condensing

Installation altitude

Installation altitude above mean sea level for linear axis without motor	[m]	<1500

Vacuum

Operation in vacuum is not permissible.

3.2 PAS42•

Value pairs with / without cover strip are separated by "/".

Characteristics portal axis		**PAS42SB**					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS15V					
Typical payload	[kg]	25					
Carriage type		Type 1			Type 4		
Carriage length	[mm]	323 / 226			503 / 406		
Ball screw pitch	[mm]	5	10	16	5	10	16
Ball screw shaft diameter	[mm]	16					
Axial backlash ball screw	[mm]	0.04					
Maximum feed force Fx_{max} [1)]	[N]	2980	1560	1540	2980	1560	1540
Maximum speed of rotation of ball screw	[rpm]	3000					
Maximum velocity [2)]	[m/s]	0.25	0.50	0.80	0.25	0.50	0.80
Maximum acceleration [2)]	[m/s^2]	10					
Maximum driving torque M_{max} [1)]	[Nm]	3.2	3.3	4.9	3.2	3.3	4.9
Breakaway torque 0 stroke axis [3)]	[Nm]	0.53	0.56	0.59	0.53	0.56	0.59
Breakaway torque per additional carriage [3)]	[Nm]	0.03	0.06	0.09	0.03	0.06	0.09
Moment of inertia 0 stroke axis	[$kgcm^2$]	1.21 / 1.16	1.24 / 1.19	1.3/ 1.24	1.29 / 1.25	1.33 / 1.28	1.41 / 1.35
Moment of inertia per additional carriage [3)]	[$kgcm^2$]	0.16 / 0.11	0.19 / 0.14	0.25 / 0.19	0.24 / 0.2	0.28 / 0.23	0.36 / 0.3
Moment of inertia per 1 m of stroke	[$kgcm^2/m$]	0.35	0.45	0.50	0.35	0.45	0.50
Moment of inertia per 1 kg of payload	[$kgcm^2/kg$]	0.006	0.025	0.065	0.006	0.025	0.065
Maximum force Fy_{dynmax} [1)]	[N]	4050					
Maximum force Fz_{dynmax} [1)]	[N]	4050					
Maximum torque My_{dynmax} [1)]	[Nm]	304			668		
Maximum torque Mz_{dynmax} [1)]	[Nm]	304			668		
Max. torque Mx_{dynmax} [1)]	[Nm]	27					
Mass 0 stroke axis	[kg]	6.1 / 5.2			7.8 / 6.9		
Mass per additional carriage (including axis body and ball screw)	[kg]	3.7 / 2.9			5.5 / 4.6		
Mass per 1 m of stroke	[kg/m]	6.9					
Moving mass carriage	[kg]	1.5 / 1.3			2.0 / 1.8		
Maximum working stroke [4)]	[mm]	1770 / 1870			1590 / 1690		
Minimum stroke [5)]	[mm]	9					
Repeatability [2)]	[mm]	± 0.02					
Diameter motor shaft	[mm]	6.35 ... 20					
Axis body cross section (W x H)	[mm]	60 x 60					
Axial area moment of inertia (Ix / Iy)	[mm^4]	461960 / 598330					
Modulus of elasticity (aluminum) E	[N/mm^2]	72000					

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Characteristics portal axis		PAS42SB					
Maximum ambient temperature	[°C]	0 ... +50					
Load ratings linear guide (C_{stat} / C_{dyn})	[N]	24200 / 14200					
Load ratings ball screw drive (C_{stat} / C_{dyn})	[N]	19900 / 14900	9100 / 7800	9200 / 7700	19900 / 14900	9100 / 7800	9200 / 7700
Service life reference magnitude 6)	[km]	10000					

1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)
2) Load- and stroke-dependent
3) The carriage closest to the motor is driven.
4) Please inquire for greater stroke
5) Minimum stroke required for lubrication of the linear guide
6) Forces and torques relate to the service life reference magnitude

Characteristics support axis		PAS42AB	
Carriage type		Type 1	Type 4
Breakaway force 0 stroke axis	[N]	30	
Breakaway force per additional carriage	[N]	30	
Mass 0 stroke axis	[kg]	4.4 / 3.5	6.1 / 5.2
For further data (if applicable) see:		PAS42SB	

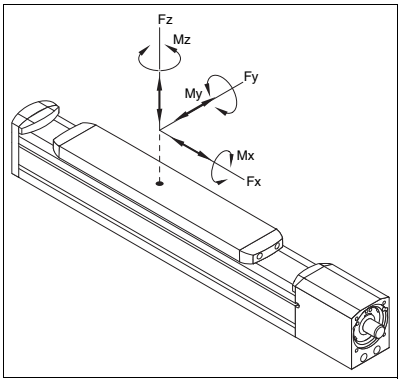
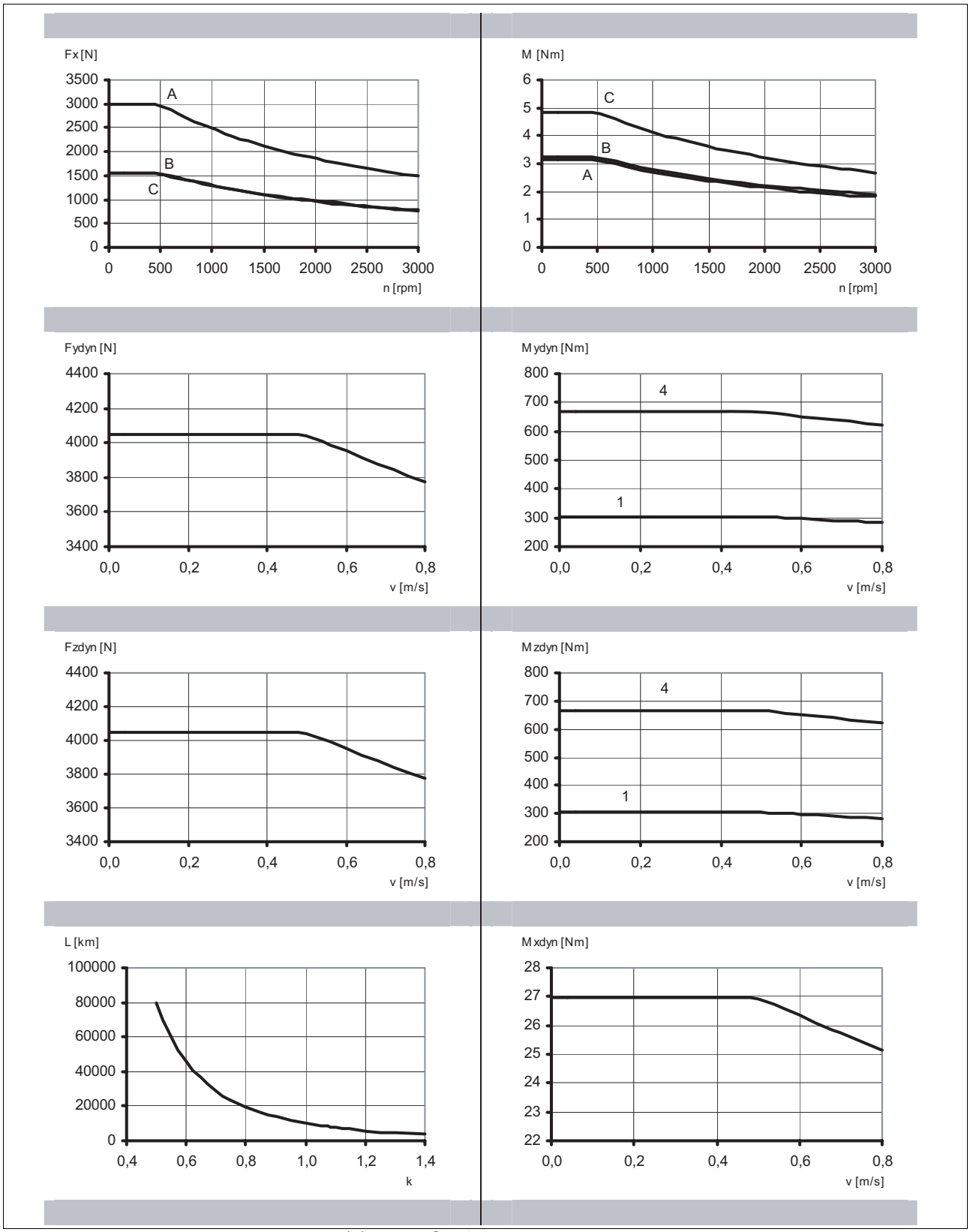


Figure 3.1 Forces and torques

Characteristic curves PAS42SB



(1) Carriage type 1
(4) Carriage type 4
(A,B,C) Ball screw pitch A = 5 mm, B = 10 mm, C = 16 mm

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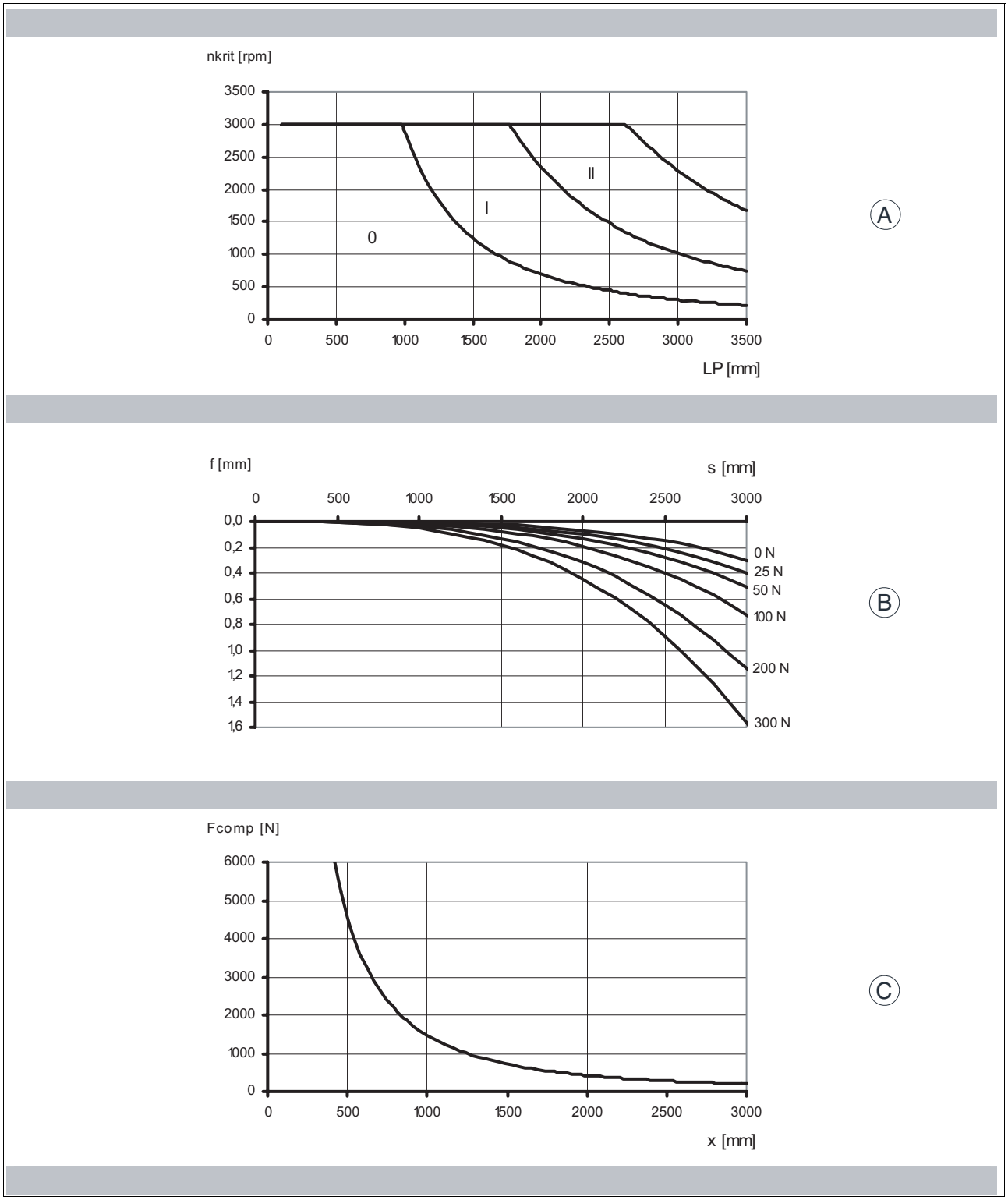

Figure 3.2 Speed of rotation of ball screw, deflection, buckling strength, PAS42SB

(A) Speed of rotation of ball screw
(0,I,II) Without, 1 or 2 ball screw supports
(B) Deflection
(C) Buckling strength

Dimensional drawings PAS42SB

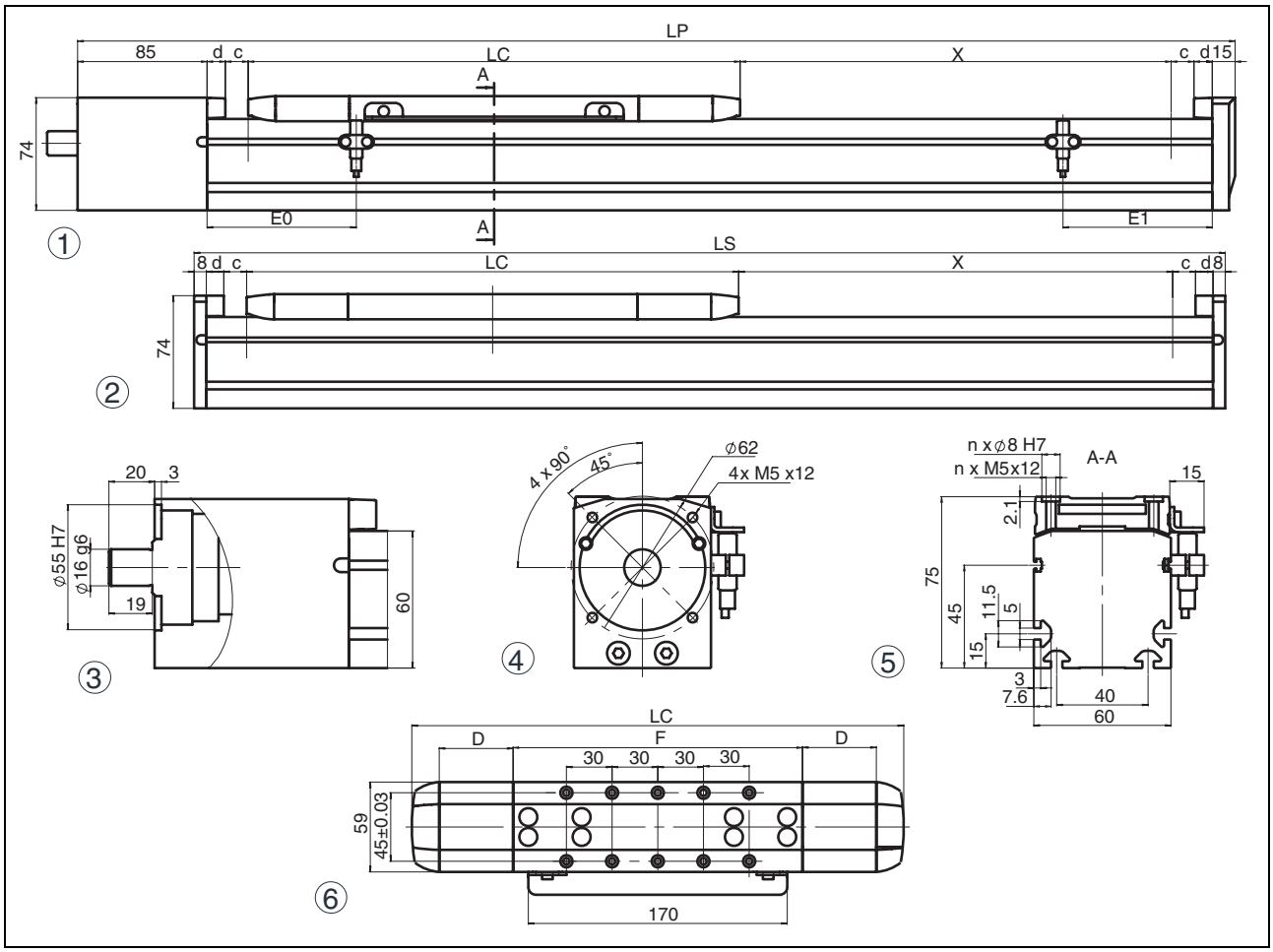

Figure 3.3 Dimensional drawing PAS42SB

(1) Portal axis
(2) Support axis
(3) Shaft extension
(4) Drive block
(5) Section of axis
(6) Carriage type 1 (type 4 has more tapped holes for mounting)

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Carriage type			**Type 1**				**Type 4**			
Cover strip			Yes	No			Yes	No		
Number of ball screw supports			0, 1 or 2	0	1	2	0, 1 or 2	0	1	2
Total length of portal axis [1]	LP	[mm]	466 + X	369 + X	399 + X	429 + X	646 + X	549 + X	579 + X	609 + X
Total length of support axis	LS	[mm]	382 + X	285 + X	315 + X	345 + X	562 + X	465 + X	495 + X	525 + X
Stroke	X	[mm]	See characteristics							
Carriage length	LC	[mm]	323	226			503	406		
Profile length of carriage	F	[mm]	190				370			
Number of tapped holes for mounting [2]	n		10				22			
Distance between tapped holes		[mm]	30 ±0.03				30 ±0.03			
Limit switch position at drive end	E0	[mm]	98	50	65	80	98	50	65	80
Limit switch position opposite drive end	E1	[mm]	98	50	65	80	278	230	245	260
Stroke reserve to mechanical stop [3]	c	[mm]	10				10			
Length of cover strip clamp	d	[mm]	11.5				11.5			
Deflection of cover strip	D	[mm]	48.5	-			48.5	-		
Minimum distance between 2 carriages		[mm]	90	35			90	35		

1) In the case of axes with more than one carriage, you must add the carriage length (LC) and the distance between the carriages for each additional carriage. More than 1 carriage on request.
2) Prepared for locating rings (see Accessories)
3) The stroke reserve must be increased depending on the application factors load, acceleration and velocity. The displacement distances must be taken into account in terms of the total length.

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3.3 PAS43•

Value pairs with / without cover strip are separated by "/".

Characteristics portal axis		**PAS43SB**					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS20					
Typical payload	[kg]	60					
Carriage type		Type 1			Type 4		
Carriage length	[mm]	394 / 274			604 / 484		
Ball screw pitch	[mm]	5	10	20	5	10	20
Ball screw shaft diameter	[mm]	20					
Axial backlash ball screw	[mm]	0.04					
Maximum feed force Fx_{max} [1)]	[N]	3400	2600	1720	3400	2600	1720
Maximum speed of rotation of ball screw	[rpm]	3000					
Maximum velocity [2)]	[m/s]	0.25	0.50	1.00	0.25	0.50	1.00
Maximum acceleration [2)]	[m/s^2]	10					
Maximum driving torque M_{max} [1)]	[Nm]	3.7	5.3	6.8	3.7	5.3	6.8
Breakaway torque 0 stroke axis [3)]	[Nm]	0.7	0.7	0.8	0.7	0.7	0.8
Breakaway torque per additional carriage [3)]	[Nm]	0.04	0.08	0.15	0.04	0.08	0.15
Moment of inertia 0 stroke axis	[$kgcm^2$]	2.76 / 2.62	2.82 / 2.67	3.05 / 2.87	2.99 / 2.86	3.07 / 2.93	3.36 / 3.19
Moment of inertia per additional carriage [3)]	[$kgcm^2$]	0.46 / 0.32	0.52 / 0.37	0.75 / 0.57	0.69 / 0.56	0.77 / 0.63	1.06 / 0.89
Moment of inertia per 1 m of stroke	[$kgcm^2/m$]	0.95	1.10	1.15	0.95	1.10	1.15
Moment of inertia per 1 kg of payload	[$kgcm^2/kg$]	0.006	0.025	0.101	0.006	0.025	0.101
Maximum force Fy_{dynmax} [1)]	[N]	6360					
Maximum force Fz_{dynmax} [1)]	[N]	6360					
Maximum torque My_{dynmax} [1)]	[Nm]	556			1224		
Maximum torque Mz_{dynmax} [1)]	[Nm]	556			1224		
Max. torque Mx_{dynmax} [1)]	[Nm]	60					
Mass 0 stroke axis	[kg]	12.1 / 10.3			15.4 / 13.6		
Mass per additional carriage (including axis body and ball screw)	[kg]	7.7 / 5.9			11.0 / 9.2		
Mass per 1 m of stroke	[kg/m]	11.70					
Moving mass carriage	[kg]	3.0 / 2.6			3.9 / 3.5		
Maximum working stroke [4)]	[mm]	3070 / 3190			2860 / 2980		
Minimum stroke [5)]	[mm]	11					
Repeatability [2)]	[mm]	± 0.02					
Diameter motor shaft	[mm]	9 ... 20					
Axis body cross section (W x H)	[mm]	80 x 80					
Axial area moment of inertia (Ix / Iy)	[mm^4]	1480060 / 1851160					
Modulus of elasticity (aluminum) E	[N/mm^2]	72000					

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Characteristics portal axis		PAS43SB					
Maximum ambient temperature	[°C]	0 ... +50					
Load ratings linear guide (C_{stat} / C_{dyn})	[N]	38400 / 22300					
Load ratings ball screw drive (C_{stat} / C_{dyn})	[N]	25300 / 17000	18400 / 13000	11600 / 8600	25300 / 17000	18400 / 13000	11600 / 8600
Service life reference magnitude 6)	[km]	10000					

1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)
2) Load- and stroke-dependent
3) The carriage closest to the motor is driven.
4) Please inquire for greater stroke
5) Minimum stroke required for lubrication of the linear guide
6) Forces and torques relate to the service life reference magnitude

Characteristics support axis		PAS43AB	
Carriage type		Type 1	Type 4
Breakaway force 0 stroke axis	[N]	40	
Breakaway force per additional carriage	[N]	40	
Mass 0 stroke axis	[kg]	9.1 / 7.3	12.4 / 10.6
For further data (if applicable) see:		PAS43SB	

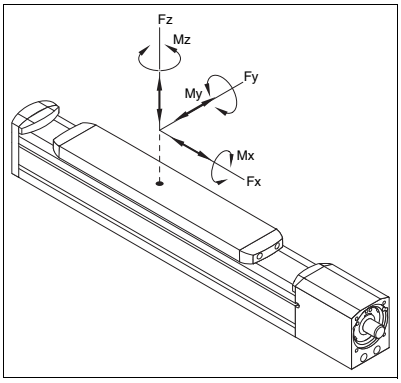
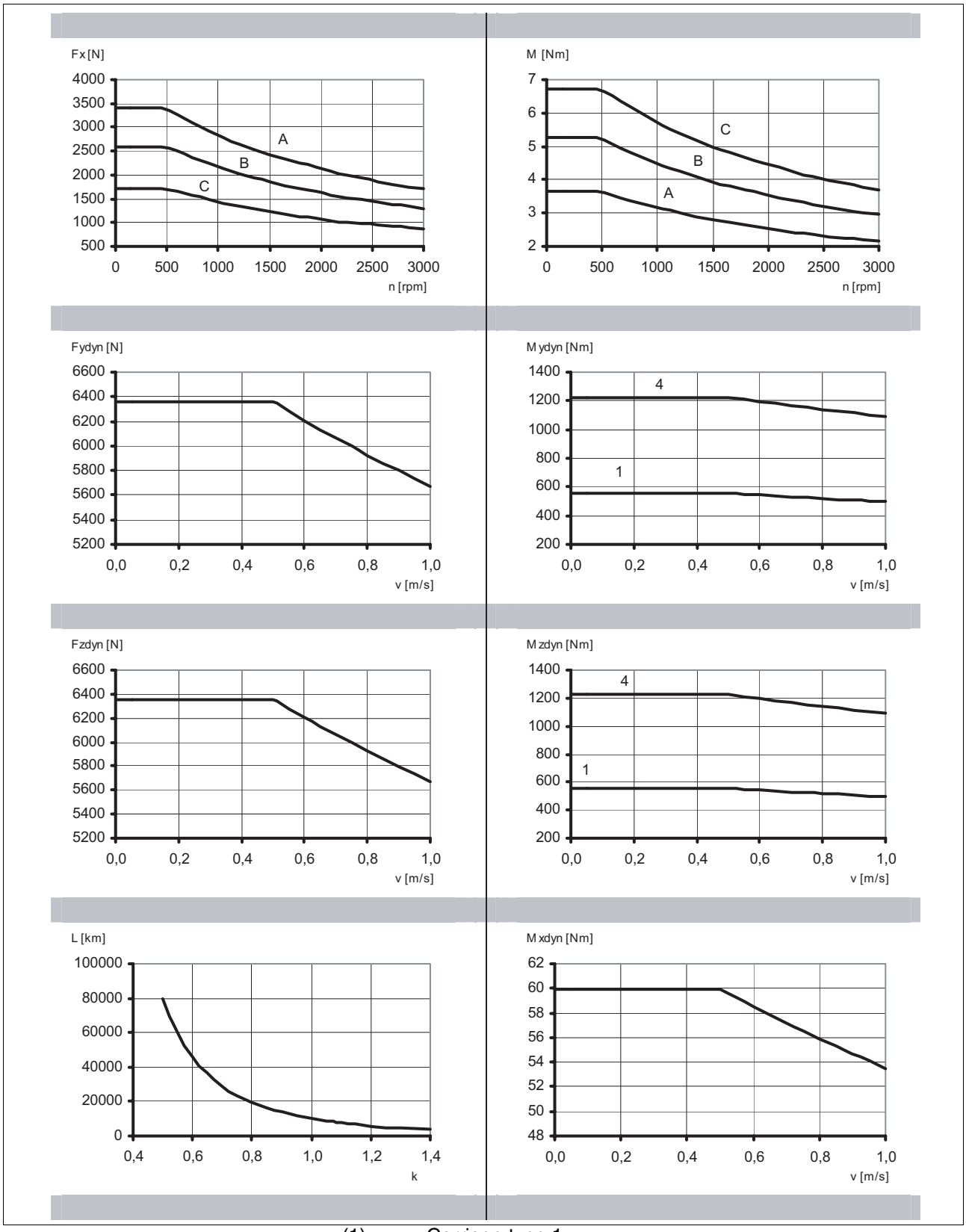


Figure 3.4 Forces and torques

Characteristic curves PAS43SB



(1) Carriage type 1
(4) Carriage type 4
(A,B,C) Ball screw pitch A = 5 mm, B = 10 mm, C = 20 mm

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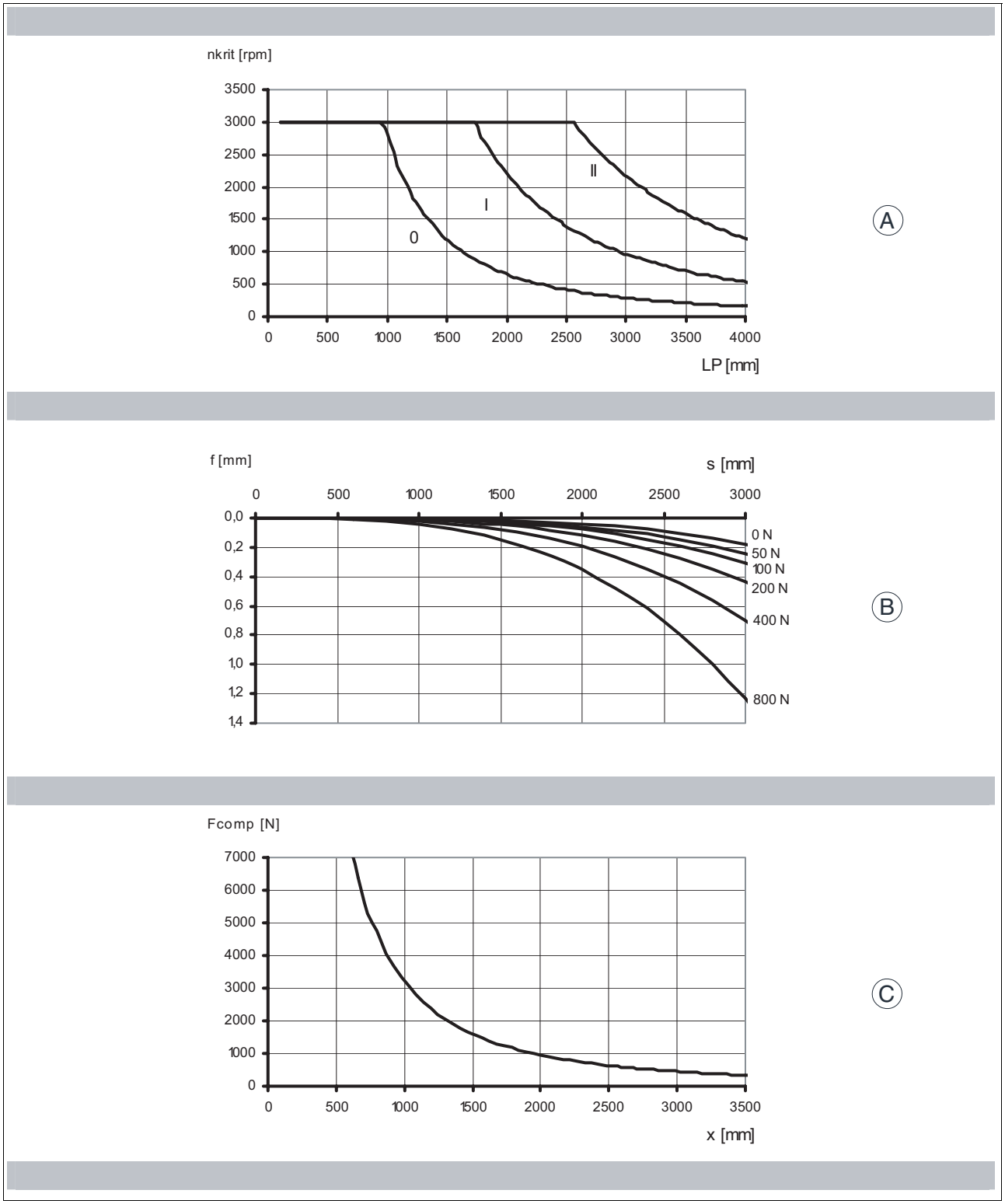

Figure 3.5 Speed of rotation of ball screw, deflection, buckling strength, PAS43SB

(A) Speed of rotation of ball screw
(0,I,II) Without, 1 or 2 ball screw supports
(B) Deflection
(C) Buckling strength

Dimensional drawings PAS43SB

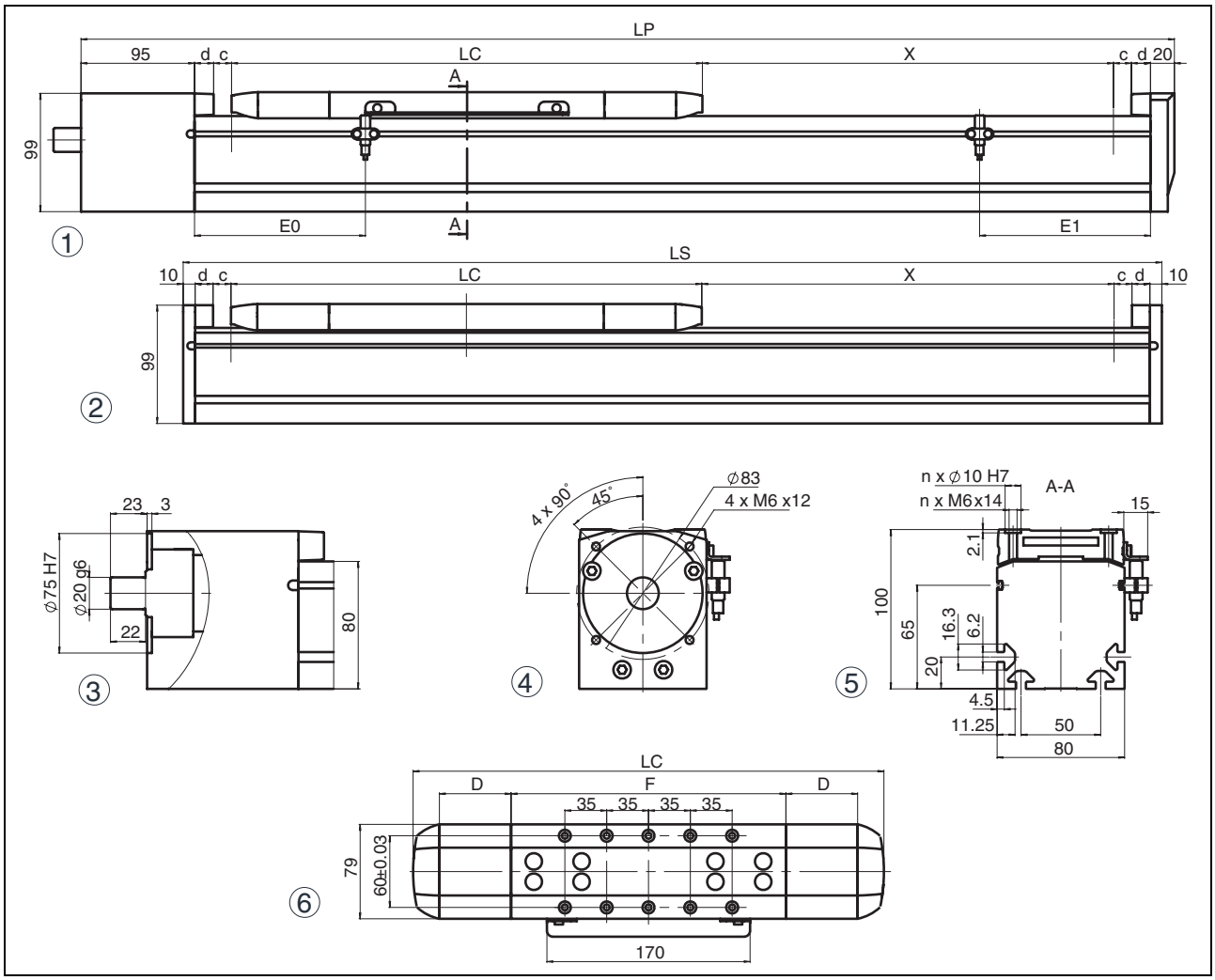

Figure 3.6 Dimensional drawing PAS43SB

(1) Portal axis
(2) Support axis
(3) Shaft extension
(4) Drive block
(5) Section of axis
(6) Carriage type 1 (type 4 has more tapped holes for mounting)

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Carriage type			**Type 1**				**Type 4**			
Cover strip			Yes	No			Yes	No		
Number of ball screw supports			0, 1 or 2	0	1	2	0, 1 or 2	0	1	2
Total length of portal axis [1]	LP	[mm]	569 + X	449 + X	489 + X	529 + X	779 + X	659 + X	699 + X	739 + X
Total length of support axis	LS	[mm]	474 + X	354 + X	394 + X	434 + X	684 + X	564 + X	604 + X	644 + X
Stroke	X	[mm]	See characteristics							
Carriage length	LC	[mm]	394	274			604	484		
Profile length of carriage	F	[mm]	230				440			
Number of tapped holes for mounting [2]	n		10				22			
Distance between tapped holes		[mm]	35 ±0.03				35 ±0.03			
Limit switch position at drive end	E0	[mm]	143	83	103	123	143	83	103	123
Limit switch position opposite drive end	E1	[mm]	143	83	103	123	353	293	313	333
Stroke reserve to mechanical stop [3]	c	[mm]	15				15			
Length of cover strip clamp	d	[mm]	15				15			
Deflection of cover strip	D	[mm]	60	-			60	-		
Minimum distance between 2 carriages		[mm]	90	35			90	35		

1) In the case of axes with more than one carriage, you must add the carriage length (LC) and the distance between the carriages for each additional carriage. More than 1 carriage on request.
2) Prepared for locating rings (see Accessories)
3) The stroke reserve must be increased depending on the application factors load, acceleration and velocity. The displacement distances must be taken into account in terms of the total length.

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3.4 PAS44•

Value pairs with / without cover strip are separated by "/".

Characteristics portal axis		**PAS44SB**					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS25					
Typical payload	[kg]	100					
Carriage type		Type 1			Type 4		
Carriage length	[mm]	490 / 330			760 / 600		
Ball screw pitch	[mm]	5	10	25	5	10	25
Ball screw shaft diameter	[mm]	24					
Axial backlash ball screw	[mm]	0.04					
Maximum feed force Fx_{max} [1)]	[N]	3700	4520	3000	3700	4520	3000
Maximum speed of rotation of ball screw	[rpm]	3000					
Maximum velocity [2)]	[m/s]	0.25	0.5	1.25	0.25	0.5	1.25
Maximum acceleration [2)]	[m/s^2]	10					
Maximum driving torque M_{max} [1)]	[Nm]	4.3	9.0	14.3	4.3	9.0	14.3
Breakaway torque 0 stroke axis [3)]	[Nm]	1.05	1.09	1.23	1.05	1.09	1.23
Breakaway torque per additional carriage [3)]	[Nm]	0.05	0.09	0.23	0.05	0.09	0.23
Moment of inertia 0 stroke axis	[$kgcm^2$]	6.86 / 6.47	6.97 / 6.57	7.75 / 7.23	7.51 / 7.13	7.66 / 7.26	8.72 / 8.2
Moment of inertia per additional carriage [3)]	[$kgcm^2$]	1.21 / 0.82	1.32 / 0.92	2.1 / 1.58	1.86 / 1.48	2.01 / 1.61	3.07 / 2.55
Moment of inertia per 1 m of stroke	[$kgcm^2/m$]	2.00	2.30	2.40	2.00	2.30	2.40
Moment of inertia per 1 kg of payload	[$kgcm^2/kg$]	0.006	0.025	0.158	0.006	0.025	0.158
Maximum force Fy_{dynmax} [1)]	[N]	9040					
Maximum force Fz_{dynmax} [1)]	[N]	9040					
Maximum torque My_{dynmax} [1)]	[Nm]	935			2155		
Maximum torque Mz_{dynmax} [1)]	[Nm]	935			2155		
Max. torque Mx_{dynmax} [1)]	[Nm]	89					
Mass 0 stroke axis	[kg]	25.1 / 21.2			32.3 / 28.4		
Mass per additional carriage (including axis body and ball screw)	[kg]	15.2 / 11.3			22.4 / 18.5		
Mass per 1 m of stroke	[kg/m]	19.00					
Moving mass carriage	[kg]	5.9 / 5.0			8.0 / 7.1		
Maximum working stroke [4)]	[mm]	2940 / 3100			2670 / 2830		
Minimum stroke [5)]	[mm]	13					
Repeatability [2)]	[mm]	± 0.02					
Diameter motor shaft	[mm]	12 ... 25					
Axis body cross section (W x H)	[mm]	110 x 110					
Axial area moment of inertia (Ix / Iy)	[mm^4]	50245408 / 6354770					
Modulus of elasticity (aluminum) E	[N/mm^2]	72000					

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Characteristics portal axis		PAS44SB					
Maximum ambient temperature	[°C]	0 ... +50					
Load ratings linear guide (C_{stat} / C_{dyn})	[N]	52400 / 31700					
Load ratings ball screw drive (C_{stat} / C_{dyn})	[N]	30400 / 18500	31400 / 22600	19900 / 15000	30400 / 18500	31400 / 22600	19900 / 15000
Service life reference magnitude 6)	[km]	10000					

1) The maximum permissible dynamic forces and torques decrease at increasing velocities (see characteristic curves)
2) Load- and stroke-dependent
3) The carriage closest to the motor is driven.
4) Please inquire for greater stroke
5) Minimum stroke required for lubrication of the linear guide
6) Forces and torques relate to the service life reference magnitude

Characteristics support axis		PAS44AB	
Carriage type		Type 1	Type 4
Breakaway force 0 stroke axis	[N]	50	
Breakaway force per additional carriage	[N]	50	
Mass 0 stroke axis	[kg]	18.7 / 14.8	25.9 / 22.0
For further data (if applicable) see:		PAS44SB	

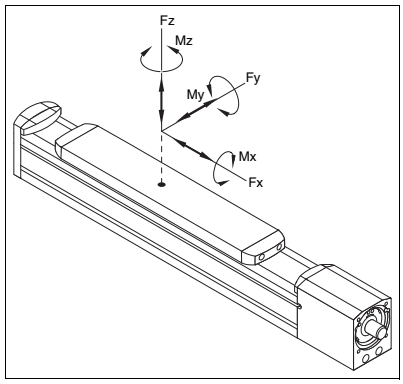
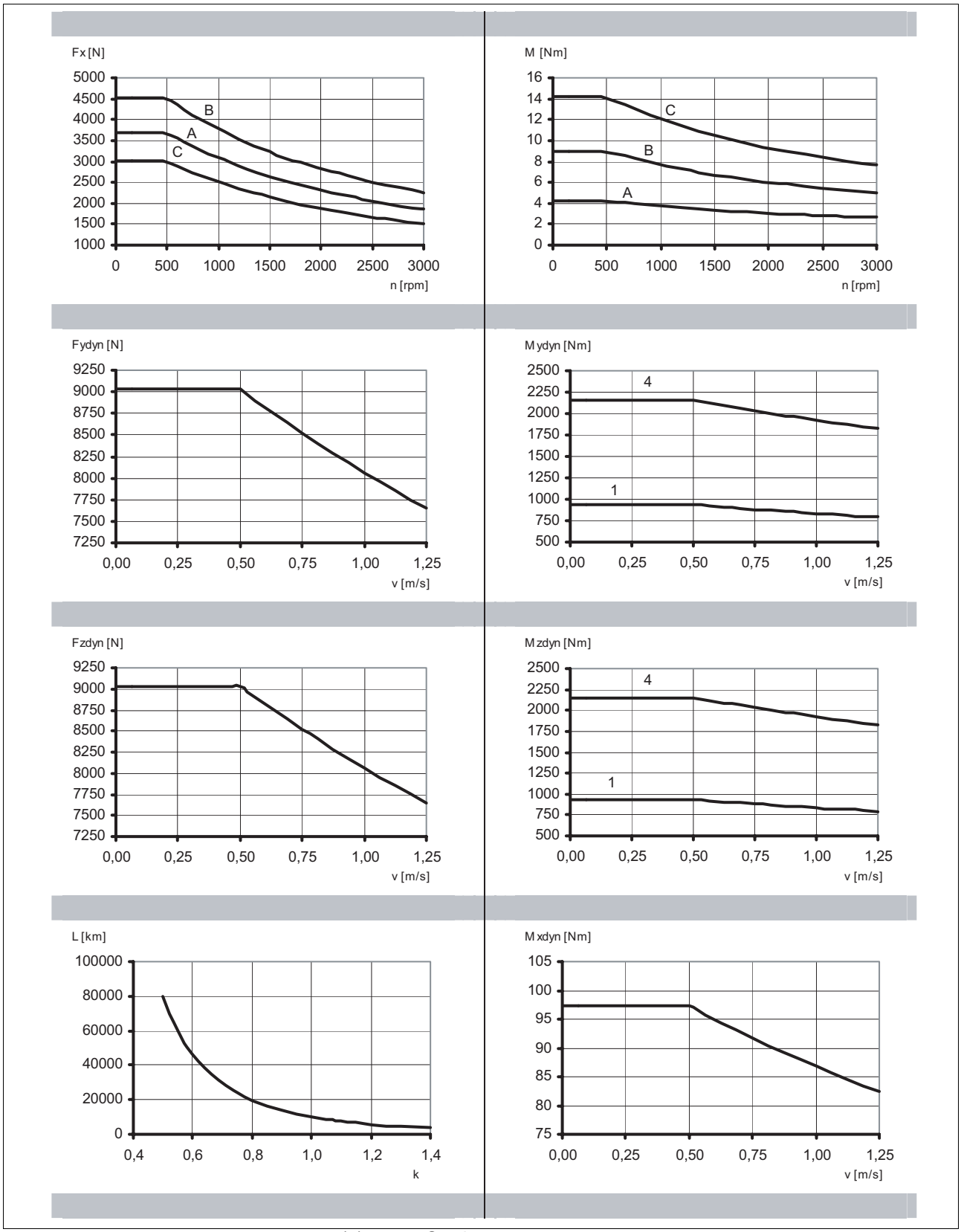


Figure 3.7 Forces and torques

Characteristic curves PAS44SB



(1) Carriage type 1
(4) Carriage type 4
(A,B,C) Ball screw pitch A = 5 mm, B = 10 mm, C = 20 mm

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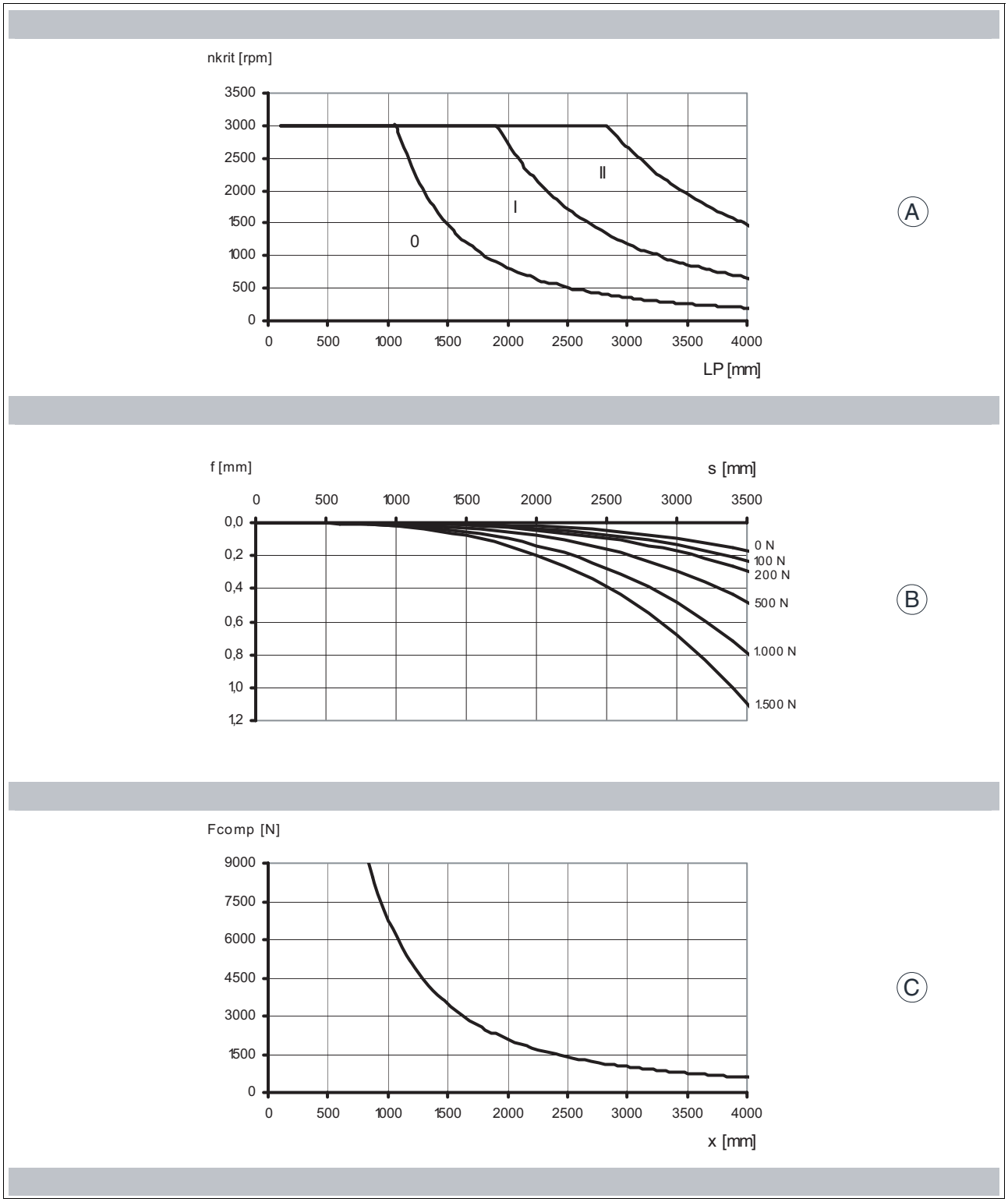

Figure 3.8 Speed of rotation of ball screw, deflection, buckling strength, PAS44SB

(A) Speed of rotation of ball screw
(0,I,II) Without, 1 or 2 ball screw supports
(B) Deflection
(C) Buckling strength

Dimensional drawings PAS44SB

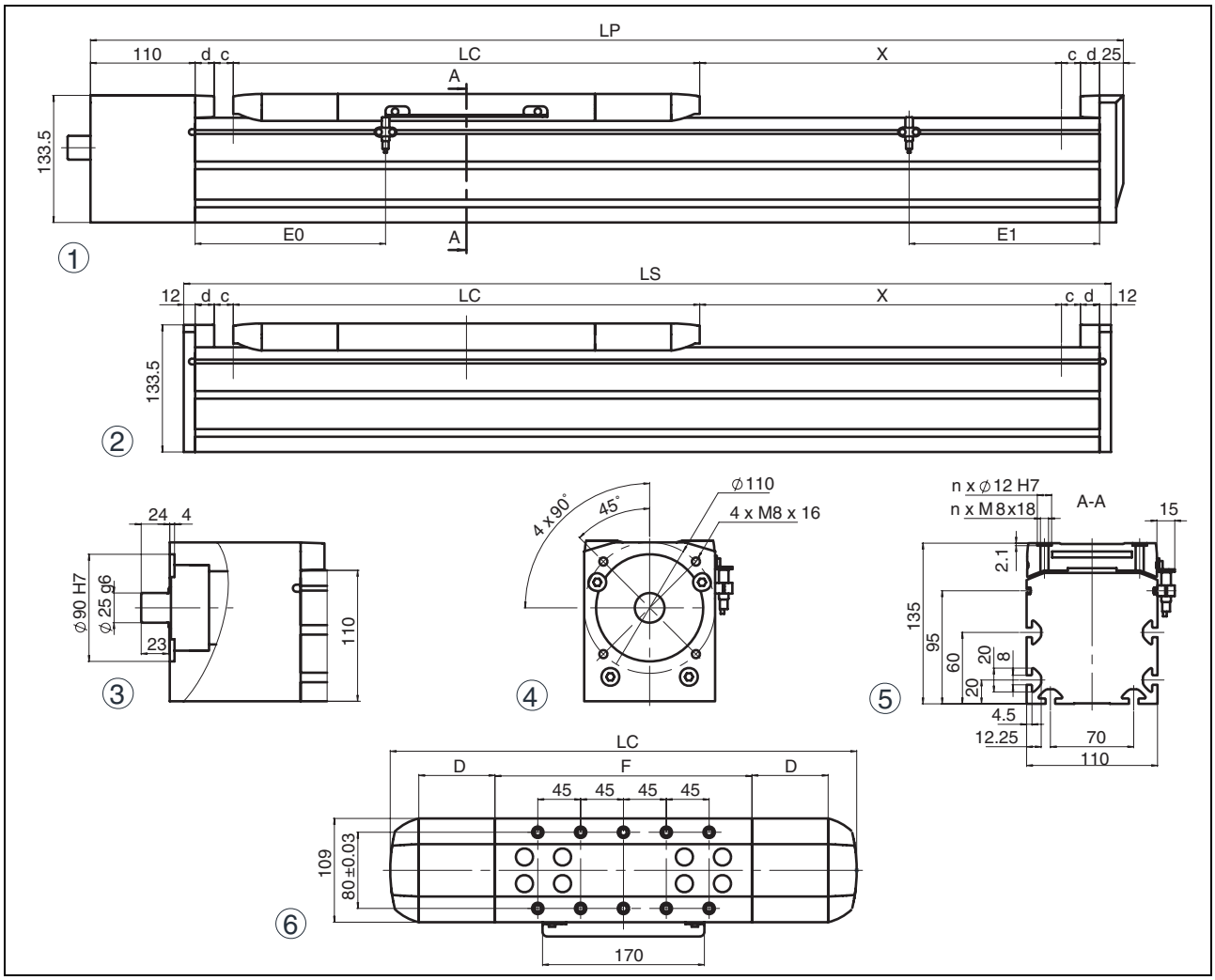

Figure 3.9 Dimensional drawings PAS44SB

(1) Portal axis
(2) Support axis
(3) Shaft extension
(4) Drive block
(5) Section of axis
(6) Carriage type 1 (type 4 has more tapped holes for mounting)

Carriage type			**Type 1**				**Type 4**			
Cover strip			Yes	No			Yes	No		
Number of ball screw supports			0, 1 or 2	0	1	2	0, 1 or 2	0	1	2
Total length of portal axis [1)]	LP	[mm]	705 + X	545 + X	595 + X	645 + X	975 + X	815 + X	865 + X	915 + X
Total length of support axis	LS	[mm]	594 + X	434 + X	484 + X	534 + X	864 + X	704 + X	754 + X	804 + X
Stroke	X	[mm]	See characteristics							
Carriage length	LC	[mm]	490	330			760	600		

Carriage type			**Type 1**				**Type 4**			
Profile length of carriage	F	[mm]	270				540			
Number of tapped holes for mounting [2)]	n		10				22			
Distance between tapped holes		[mm]	45 ±0.03				45 ±0.03			
Limit switch position at drive end	E0	[mm]	200	120	145	170	200	120	145	170
Limit switch position opposite drive end	E1	[mm]	200	120	145	170	470	390	415	440
Stroke reserve to mechanical stop [3)]	c	[mm]	20				20			
Length of cover strip clamp	d	[mm]	20				20			
Deflection of cover strip	D	[mm]	80	-			80	-		
Minimum distance between 2 carriages		[mm]	90	40			90	40		

1) In the case of axes with more than one carriage, you must add the carriage length (LC) and the distance between the carriages for each additional carriage. More than 1 carriage on request.
2) Prepared for locating rings (see Accessories)
3) The stroke reserve must be increased depending on the application factors load, acceleration and velocity. The displacement distances must be taken into account in terms of the total length.

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3.5 Service life

The service life of the product is a function of the mean forces and torques that act in the system. If multiple forces and torques act simultaneously, use the following formula to calculate the loading factor k.

$$\frac{Fy}{Fymax} + \frac{Fz}{Fzmax} + \frac{Mx}{Mymax} + \frac{My}{Mymax} + \frac{Mz}{Mzmax} = k$$

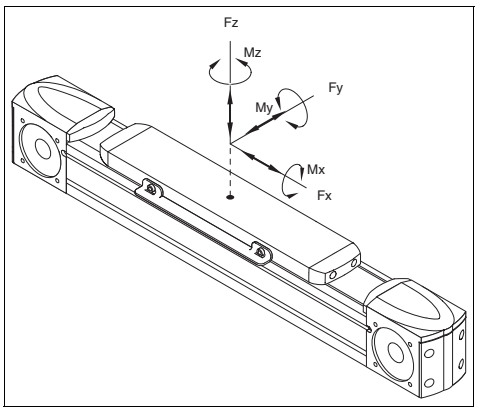

Figure 3.10 Forces and torques

The service life of the axis (in km) can be approximated using the loading factor and the service life - load characteristic curve.

The application-specific load values appear in the numerator.

The numerator contains the maximum permissible forces and torques. These forces and torques decrease at increasing velocities, see characteristic curves in chapter 3.

3.6 Positioning accuracy and repeatability

Positioning accuracy and repeatability depend on temperature, load and velocity changes as well as the accuracy of the ball screw drive and the accuracy of the switching points of the sensors.

At steady temperature, speed and load, the repeatability amounts to ± 0.02 mm.

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3.7 Stroke reserve

Stroke reserve	PAS42	PAS43	PAS44
[mm]	10	15	20

Table 3.1 Distance between limit switch and mechanical stop

3.8 Motor

See the motor manual for details on the motor.

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4 Installation

⚠ WARNING

GREAT MASS OR FALLING PARTS

- Consider the mass of the axis when mounting it. It may be necessary to use a crane.
- Mount the axis in such a way (tightening torque, securing screws) that the axis and mounted parts cannot come loose even in the case of fast acceleration or continuous vibration.
- Note that vertically installed linear axes may lower unexpectedly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

MOTOR WITHOUT BRAKING EFFECT

If power outage and faults cause the power stage to be switched off, the motor is no longer stopped by the brake and may increase its speed even more until it reaches a mechanical stop.

- Verify the mechanical situation.
- If necessary, use a cushioned mechanical stop or a suitable holding brake.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ CAUTION

HOT SURFACES

Depending on the operation, the surface may heat up to more than 100°C (212°F).

- Do not allow contact with the hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.
- Check the temperature during test runs.

Failure to follow these instructions can result in injury or equipment damage.

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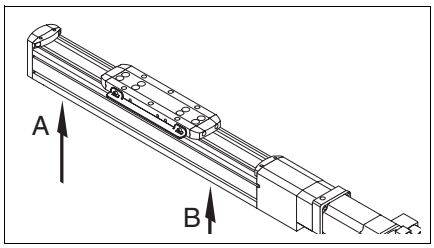
4.1 Preparing installation

The linear axis is a precision product and must be handled with care. Shocks and impacts may damage the guides and the ball screw drive. This may cause inaccuracies and even premature failure.

Transport the product in its packaging as close as possible to the installation site. Do not remove the packaging until the product is at the installation site.



The linear axis may only be lifted at points A and B (see figure). The distance between the end block and point A and between the end block and point B should be ¼ of the total length of the linear axis. If an axis with a mounted motor is lifted, points A and B are to be moved to balance the load. The motor must not be used to lift the load. However, support the motor when lifting the axis.

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4.2 Mechanical installation

Accessibility for servicing When mounting the linear axis, the motor and the sensors, keep in mind that they may have to be accessed for servicing.

Mounting position The linear axis can be installed in any position.

If a linear axis with a mounted motor is mounted in a vertical position, the motor should be at the top. This way, the ball screw is under tension and there is no buckling stress.

4.2.1 Standard tightening torques

Special tightening torques are applicable for mounting sensors and elastomer couplings; these tightening torques are listed in the appropriate chapters.

The following, generally applicable tightening torques apply to mounting the payload and fastening slot nuts, clamping claws, motor and contact plate with hex socket screws.

Thread	Wrench size [mm]	$M_{Amax.}$[Nm]
M3	2.5	1.1
M4	3	2.5
M5	4	5
M6	5	8.5
M8	6	21
M10	8	42
M12	10	70

Table 4.1 Standard tightening torques for screws, ISO 4762 - 8.8

4.2.2 Mounting the linear axis

Only mount the linear axis using the T slots at the axis body. To do so, use clamping claws (lateral fastening) or slot nuts (bottom or lateral fastening).

A selection of suitable clamping claws and slot nuts can be found in chapter 7 "Accessories and spare parts".

Note the following:

- When using motors with a cross section greater than the cross section than the axis body, the axis must be supported or the mounting surface must be cut out as required.
- The end blocks protrude beyond the axis body at the ends. The end blocks must not be the only parts supported by the mounting surface.
- If the lateral slots are used for mounting, the sensor cable cannot be completely routed in the slots.

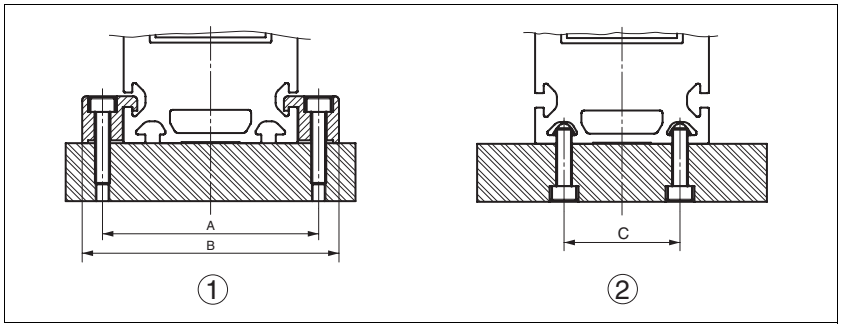

Figure 4.1 Fastening by means of clamping claws (1) and slot nuts from the bottom (2)

Tapped hole distance		**PAS42**	**PAS43**	**PAS44**
A	[mm]	74	96	130
B	[mm]	88	112	150
C	[mm]	40	50	70

Maximum distance [1)]		**PAS42**	**PAS43**	**PAS44**
Clamping claws	[mm]	600	800	1000
Slot nuts	[mm]	600	800	1000

1) Recommended values per side at medium loads

The greater the load or the demands on the running accuracy, the shorter the distance between the slot nuts or the clamping claws must be.

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Alignment for running accuracy

Due to the manufacturing process of the extruded profiles, a linear axis has a certain tolerance in terms in straightness and twist. The deviations are generally well within the specifications of EN 12020-2 in the case of the product.

Perform the following lateral alignment procedure for running accuracy.

- The mounting surface must be machined smooth and flat.
- ▶ First, slightly tighten the screws of the slot nuts or the clamping claws.
- ▶ Provide a reference plane alongside the linear axis.
- ▶ Place a dial gauge onto the carriage.
- ▶ Move the carriage and record the deviation with reference to the reference plane over the entire stroke.
- ▶ Correct the deviations by lateral alignment of the linear axis and by tightening the screws appropriately. Observe the standard tightening torques 47.

4.2.3 Mounting the contact plate

A contact plate must be mounted to the carriage for the inductive sensors. Fastening threads are located at both sides of the carriage.

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

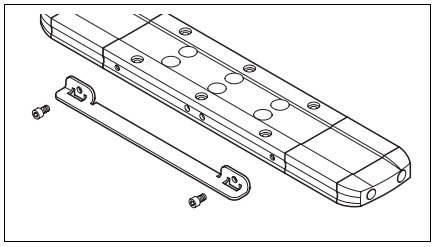
Before mounting

See chapter 7 "Accessories and spare parts", subchapter 7.5 "Sensors and additional parts" for suitable contact plates.

You need a set of Allen keys.

- ▶ Clean all parts you will use.
- ▶ Check all parts for damage; repair damages.

Procedure



- ▶ For mounting, select the side of the carriage that will be easily accessible for service.
- ▶ Screw the contact plate to the carriage with M4 screws.
- ▶ Align the contact plate in parallel with the carriage so as to have the same switching distance on both sides.

4.2.4 Mounting the sensors

⚠ WARNING

LOSS OF CONTROL

If unsuitable sensors are installed, ground faults or line interruptions will be detected as an On state and will cause a failure of the protection function.

- If possible, use normally closed contacts as limit switches so that a wire break can be signaled as an error.

Failure to follow these instructions can result in death, serious injury or equipment damage.

A sensor is mounted to the axis body by means of a sensor holder. The axis body provides a T slot for the sensor holder. This T slot has a cutout at the end block for inserting the fastening nuts.

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

Before mounting

See chapter 7 "Accessories and spare parts" for suitable sensors.

You need a set of Allen keys and a feeler gauge.

▶ Clean all parts you will use.

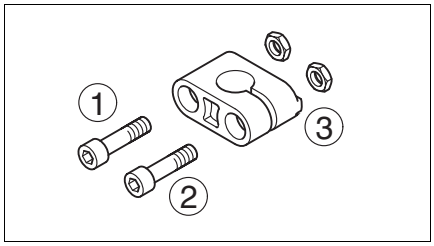
▶ Check all parts for damage; repair damages.

▶ Check the sensor for correct type and function.

▶ Verify that your controller and your interface are suitable for the sensor.

▶ See the dimensional drawings in chapter 3 "Technical Data" for information on the sensor position..

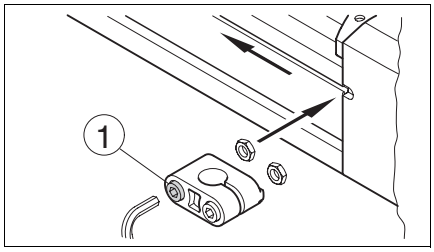
Procedure



2 M3 hex socket screw with hex nuts are located at the sensor.

- Screw (1) is used to fasten the sensor holder in the slot.
- Screw (2) is used to fasten the sensor in the sensor holder.

In addition, the sensor holder features cams (3) at both sides to keep the sensor from turning in the T slot.



▶ Slide each nut into the T slot at the cutout.

▶ Place the the sensor holder with the two screws into position. Leave the two screws loose at first.

▶ Slide the sensor holder to the desired position and tighten screw (1) with a torque of 0.3 Nm.

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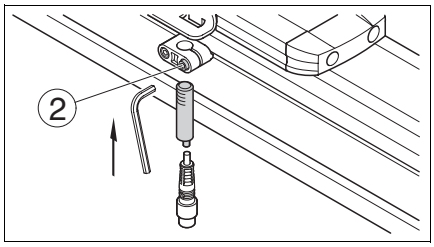
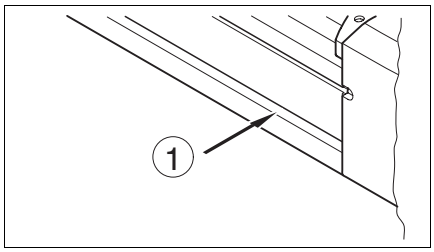
Since the sensor operates inductively, the switching surface must have a specific distance from the contact plate. This so-called "switching distance" amounts to 0.5 ±0.1 mm.



- ▶ Move the carriage until the contact plate is above the sensor holder.
- ▶ Slide the sensor through the sensor holder opening until the switching distance has been reached.

  Measure the distance using a feeler gauge.
- ▶ Tighten screw (2).
- ▶ Finally, check the switching distance with the feeler gauge.



The slot (1) can hold up to 3 sensor cables. Suitable slot covers are available on request.

- ▶ Route the sensor cable in the slot.

4.2.5 Mounting the motor or the gearbox

The motor or the gearbox are coupled by means of a preloaded elatomer coupling.

The motor or the gearbox can be mounted in different arrangements (turned in increments of 4 x 90°).

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

Special tightening torques

Clamping hub		**PAS42**	**PAS43**	**PAS44**
Screw ISO 4762 - 10.9		M6 x 16	M6 x 20	M8 x 25
Wrench size	[mm]	5	5	6
Tightening torque	[Nm]	14	14	35
Mounting dimension	[mm]	13	14	14

Table 4.2 Tightening torques and mounting dimensions clamping hub

Before mounting

See chapter 7 "Accessories and spare parts" for suitable elastomer couplings (elastomer spiders, clamping hubs).

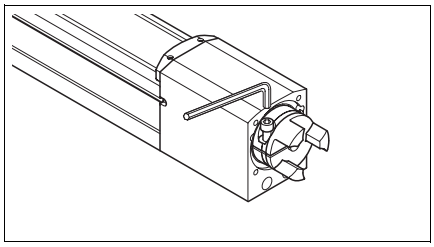
You need a set of Allen keys and a torque wrench with hexagon socket.

- ▶ Clean all parts you will use.
- ▶ Check all parts for damage; repair damages.

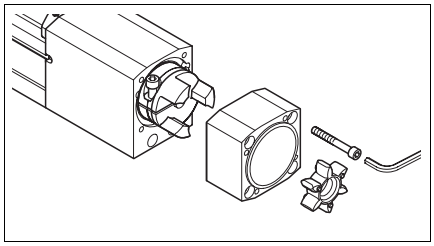
NOTE: Polluted or damaged parts may cause run-out which has an adverse effect on the service life of the elastomer coupling and the linear axis.

Mounting the elastomer coupling

The elastomer coupling has two clamping hubs which may have different holes.



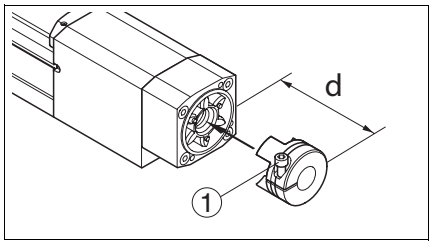
- ▶ Slide the matching clamping hub onto the shaft extension of the linear axis all the way to the stop.
- ▶ Tighten the clamping screw at the clamping hub with the tightening torque specified in Table 4.2.



- ▶ Fit the elastomer spider onto the clamping hub.

  Slightly greasing the ring gear or the hub facilitates the fitting process. Use only mineral oil based lubricants without additives or silicon based lubricants.

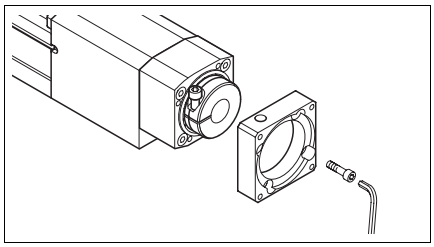
  NOTE: If the elastomer spider can be fitted too easily (without preloading), it must be replaced.
- ▶ Mount the coupling housing with the 4 screws. Verify that the coupling housing has even contact.



- ▶ Fit the second clamping hub.

  Note the installation dimension d measured to the collar, as per Table 4.2.

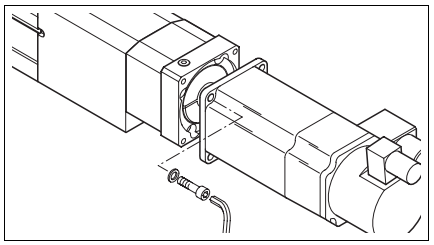
  Check the orientation of the clamping screw (1), preferably upwards. The clamping screw is tightened at a later point in time through the hole in the motor adapter plate.



- ▶ Fit the motor adapter plate with even contact.

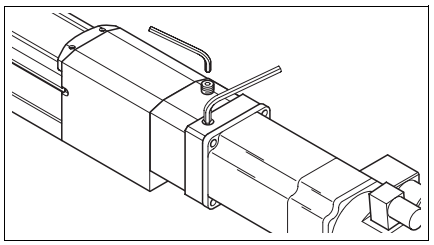
  Verify correct position of the hole at the side so that you can tighten the clamping hub screw through the hole.
- ▶ Tighten the 4 screws.

Motor mounting only



- ▶ Place the motor onto the motor adapter plate with even contact.

  Secure the motor to keep it from falling down.
- ▶ Fasten the motor to the motor adapter plate with the 4 screws and washers.



- ▶ Remove the screw plug in the hole at the side of the motor adapter plate.
- ▶ Tighten the screw of the clamping hub through the hole with the tightening torque specified in Table 4.2.
- ▶ Close the hole with the screw plug.

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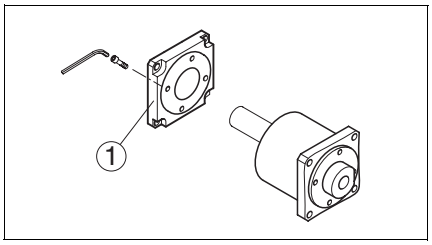
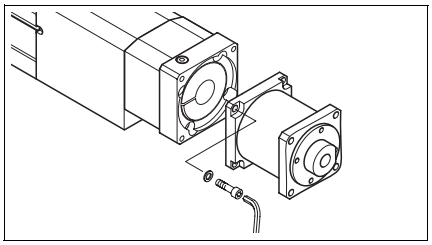
Gearbox mounting only



A flange plate (1) is required if the gearbox does not have its own flange.

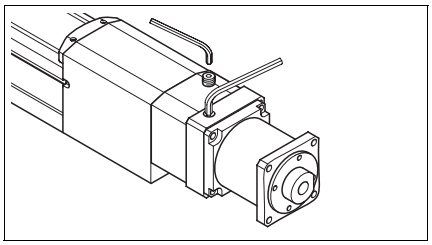
- ▶ Mount the flange plate to the gearbox with the 4 screws.

  Verify that the flange plate has even contact.



- ▶ Place the gearbox onto the motor adapted plate with even contact.

  Secure the gearbox to keep it from falling down.
- ▶ If the gearbox has a parallel keyway, align the keyway and the slot of the clamping hub.
- ▶ Fasten the gearbox with the 4 screws and washers.

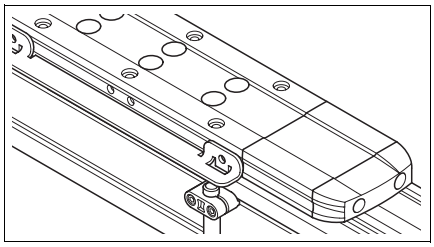


- ▶ Remove the screw plug in the hole at the side of the motor adapter plate.
- ▶ Tighten the screw of the clamping hub through the hole with the tightening torque specified in Table 4.2.
- ▶ Close the hole with the screw plug.

Please refer to the gearbox manual for mounting a motor to the gearbox.

4.2.6 Mounting the payload

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.



Carriage

Mounting threads on the carriage allow you to fasten the payload.

For reproducible mounting of the payload, each thread is provided with a counterbore for a locating dowel. See chapter 7 "Accessories and spare parts" for suitable locating dowels.

Carriage		**PAS42**	**PAS43**	**PAS44**
Thread	[mm]	M5	M6	M8
Depth	[mm]	10	12	16
Diameter counterbore for locating dowel	[mm]	8	10	12

Table 4.3 Carriage

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4.3 Electrical installation

4.3.1 Connecting the sensors

The sensors are equipped with an M8 x 1 connector.

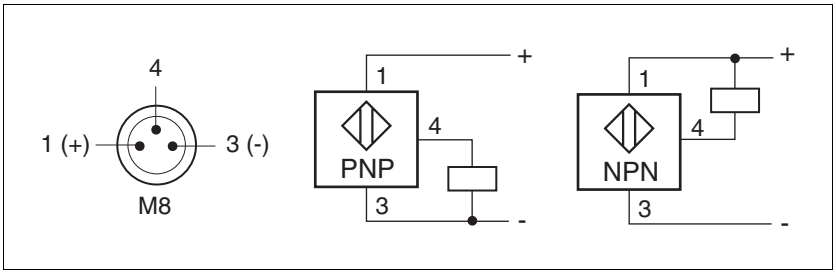

Figure 4.2 Connection assignment sensors

Pin	Description	Color
1	PELV supply voltage (+)	BN (brown)
3	PELV supply voltage (-)	BU (blue)
4	Output	BK (black)

The cable length is 100 mm. Extension cables are available in various lengths as accessories, see chapter 7 "Accessories and spare parts".

4.3.2 Motor connection

See the motor manual for details on connecting the motor.

4.4 Checking installation

Verify that you have correctly installed the product after having performed the above steps.

- ▶ Verify correct mounting and cabling of the product. In particular, check the mains connection and the 24V connection.

Check the following:

- ▶ Did you connect all protective ground conductors?
- ▶ Do you use correct fueses?
- ▶ Are any live cable ends exposed?
- ▶ Did you properly install and connect all cables and connectors?
- ▶ Did you properly install the sensors?
- ▶ Do the sensors function as required?
- ▶ Is it possible to freely move the carriage with the contact plate for the sensors along the entire travel length?

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5 Commissioning

⚠ WARNING

UNEXPECTED MOVEMENT

When the axis is operated for the first time, there is a risk of unexpected movements caused by possible wiring errors or unsuitable parameters.

- Verify that that the axis is properly fastened so it cannot come loose even in the case of fast acceleration.
- Note that vertically installed linear axes may lower unexpectedly.
- Verify that a functioning button for EMERGENCY STOP is within reach.
- Verify that the system is free and ready for the movement before switching it on.
- Run initial tests at reduced velocity.

Failure to follow these instructions can result in death, serious injury or equipment damage.

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5.1 Commissioning procedure

You must also re-commission an already configured product if you want to use it under changed operating conditions.

- ▶ For commissioning, note all information provided in the manual of the motor used and the manual of the drive used.
- ▶ Verify that the actual loads conform to the required and engineering data prior to operating the product.
- ▶ Verify the function of the sensors. The integrated LED must indicate the switching state correctly.
- ▶ Check the distance between the sensors and the mechanical stops. The movement must be stopped by the sensors before the carriage reaches a mechanical stop.
- ▶ Verify that the sensors are positioned in such a way that the movement of the carriage is stopped in both directions by a sensor.
- ▶ Perform initial tests at reduced velocity. During these tests, verify that the controller responds correctly to the sensors in both directions of movement.
- ▶ Perform a full test under realistic conditions.

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6 Diagnostics and troubleshooting

6.1 Troubleshooting

Problem	Cause	Troubleshooting
Sensor overtraveled	Sensor	Adjust or replace sensors, see page 61
	Controller	Check controller
Motor load increases, controller switches off because of overload.	Guides and/or ball screw drive under mechanical tension or excessive friction caused by poor lubrication.	Contact service
Noise and vibrations at high speed of rotation of the ball screw	Speed of rotation of ball screw too high	Reduce speed of rotation of ball screw
	Poor lubrication (in the case of noise)	Lubricate, see page 83
	Run-out of the screw caused by impact or shock	The ball screw must be replaced. Contact service
Running inaccuracy and noise of the guides	Poor lubrication	Lubricate, see page 83
	Damage to the guides, for example by shock or impact on the carriage	Replace guides, contact service
Carriage has backlash and positions inaccurately	Backlash in ball screw drive or guides after a collision or poor lubrication	Contact service

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6.2 Inspection

Components of the linear axis may be damaged or destroyed as a result of a collision.

- ▶ After a collision, inspect the drive elements, the linear guide and the elastomer coupling for damage according to the instructions in the following chapters.

6.2.1 Ball screw drive

- ▶ Check the linear axis for unusual noise and vibrations.
- ▶ Perform a visual inspection of the ball screw drive for damage. To do so, remove the cover strip as described in chapter 6.3.4 "Replacing the cover strip (and the strip deflection)".

A damaged ball screw drive must be replaced. Contact your local sales office.

6.2.2 Ball screw bearing

- ▶ Check the linear axis for unusual noise and vibrations.

A damaged ball screw bearing must be replaced. Contact your local sales office.

6.2.3 Linear guide

The linear guide consists of the guide carriage and the profile rail.

- ▶ Perform a visual inspection of the linear guide for damage. To do so, remove the cover strip as described in chapter 6.3.4 "Replacing the cover strip (and the strip deflection)".

A damaged linear guide must be replaced. Contact your local sales office.

6.2.4 Elastomer coupling

- ▶ Perform a visual inspection of the elastomer coupling for damage. To do so, remove the motor or the gearbox as described in chapter 6.3.2 "Replacing the motor or the gearbox".

NOTE: A damaged elastomer coupling must be replaced. See chapter 6.3.2 "Replacing the motor or the gearbox" for the procedure.

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6.3 Replacing parts

Only replace the parts described. All other parts may only be replaced by technicians trained by the manufacturer.

Carry out a complete installation for replacing the entire axis as per see chapter 4 "Installation".

Adjust and check the linear axis as per chapter 5 "Commissioning" after replacing parts.

6.3.1 Replacing a sensor

You can replace a sensor without changing the position of the sensor holder.

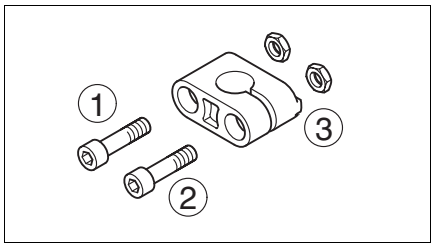
Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

Prerequisites

See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of Allen keys and a feeler gauge.

Procedure



- ▶ Loosen the M3 screw (2) at the slotted side of the sensor holder until the sensor to be replaced can be pulled out from below.
- ▶ Mount the new sensor as described on page 50.

6.3.2 Replacing the motor or the gearbox

⚠ WARNING

GREAT MASS OR FALLING PARTS

- In the case of a vertically installed linear axis, secure the moving parts to keep them from falling down.
- Mount the product in such a way (tightening torque, securing screws) that the axis and mounted parts cannot come loose even in the case of fast acceleration or continuous vibration.
- Note that vertically installed linear axes may lower unexpectedly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The motor or the gearbox are coupled by means of a preloaded elastomer coupling.

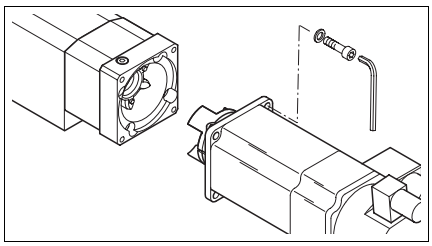
Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

Prerequisites

See chapter 7 "Accessories and spare parts" for suitable spare parts.

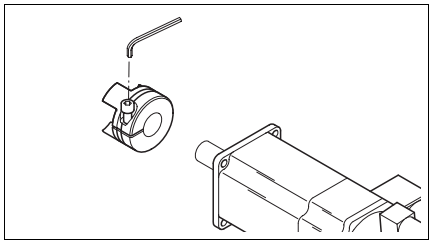
You need a set of Allen keys and a torque wrench with hexagon socket.

Dismounting, motor only



- ▶ Secure the motor to keep it from falling down.
- ▶ Remove the 4 screws and washers at the motor.
- ▶ Pull the motor and the clamping hub off of the motor adapter plate.

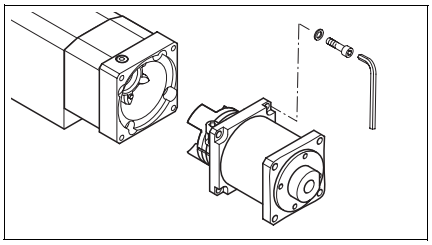
  This requires a greater force of up to 450 N.



- ▶ Loosen the clamping screw at the clamping hub.
- ▶ Pull the clamping hub off the motor shaft.

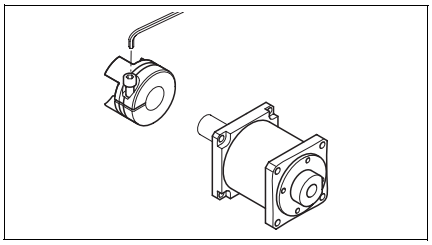
Dismounting, gearbox only

See the gearbox manual for details on removing a motor from the gearbox.

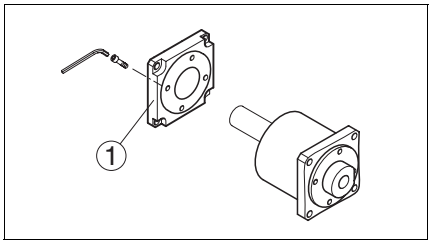


- ▶ Remove the 4 screws and washers at the gearbox flange.
- ▶ Pull the gearbox and the clamping hub off of the motor adapter plate.

  This requires a greater force of up to 450 N.



- ▶ Loosen the clamping screw at the clamping hub.
- ▶ Pull the clamping hub off the gearbox shaft.



If the gearbox does not have its own flange, the flange plate (1) must be dismounted.

- ▶ Remove the 4 screws at the flange plate.
- ▶ Remove the flange plate.

Mounting

- ▶ Mount the motor or the gearbox as described on page 51.

NOTE: If the new motor or the new gearbox has shaft dimensions different from the old motor or gearbox, you must use a suitable new elastomer coupling. See the next chapter for details on replacing an elastomer coupling.

Please refer to the gearbox manual for mounting a motor to the gearbox.

6.3.3 Replacing the elastomer coupling

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

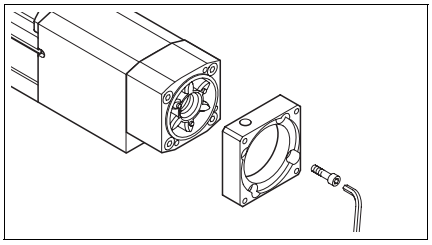
Prerequisites

See chapter 7 "Accessories and spare parts" for suitable spare parts.

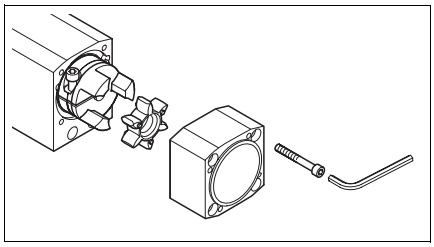
You need a set of Allen keys and a torque wrench with hexagon socket.

Procedure

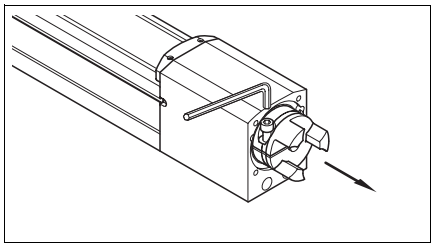
- ▶ Dismount the motor or the gearbox as described in chapter 6.3.2 "Replacing the motor or the gearbox".



- ▶ Remove the 4 screws at the motor adapter plate.
- ▶ Remove the motor adapter plate.



- ▶ Dismount the coupling housing with the 4 screws.
- ▶ Pull the elastomer spider off of the clamping hub.



- ▶ Loosen the clamping screw at the clamping hub.
- ▶ Pull the clamping hub off the shaft extension of the linear axis.

- ▶ Mount the elastomer coupling as well as the motor or the gearbox as described on page 51.

6.3.4 Replacing the cover strip (and the strip deflection)

⚠ WARNING

SHARP EDGES

The cover strip has sharp edges. When the cover strip is cut to length, the edges may be particularly sharp.

- Wear protective gloves.

Failure to follow these instructions can result in death, serious injury or equipment damage.

When the cover strip is worn, it is recommended that the two strip deflections be replaced at the same time (deflection unit with brush).

Unless otherwise specified, the standard tightening torques indicated on page 47 apply.

Special tightening torques

Cover strip clamp		PAS41	PAS42	PAS43	PAS44
Screw ISO 4762 - 8.8		M3 x 8	M4 x 8	M5 x 10	M6 x 14
Wrench size	[mm]	2.5	3	4	5
Tightening torque	[Nm]	0.6	1.0	1.5	3

Table 6.1 Tightening torques cover strip clamp

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Clamping plate		PAS41	PAS42	PAS43	PAS44
Set screw DIN 913 - 45H		M3 x 10	M4 x 10	M5 x 16	M6 x 20
Wrench size	[mm]	2.5	3	4	5
Tightening torque	[Nm]	0.2	0.3	0.4	0.5

Table 6.2 Tightening torques clamping plate

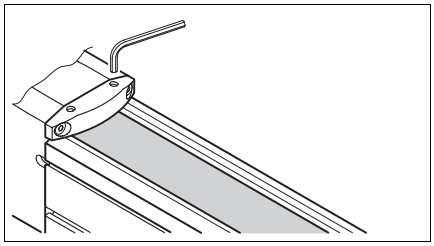
Prerequisites

See chapter 7 "Accessories and spare parts" for suitable spare parts.

You need a set of Allen keys and a torque wrench with hexagon socket and a pair of tin snips.

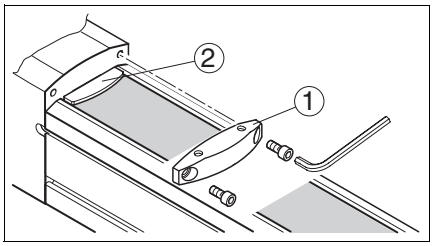
Procedure

Carry out the following steps on both ends of the carriage / linear axis.



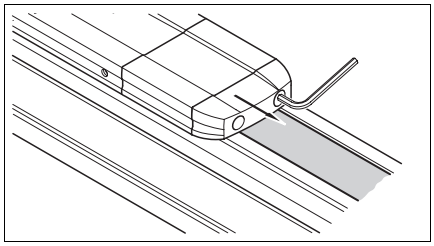
2 set screws at the cover strip clamp fixate the clamping plate below and the cover strip.

▶ Loosen the two set screws.

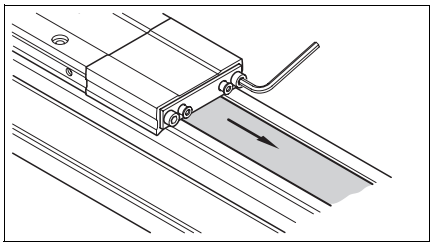


▶ Remove the cover strip clamp (1). To do so, loosen the two screws.

Keep the screws and the clamping plate (2) from falling down.

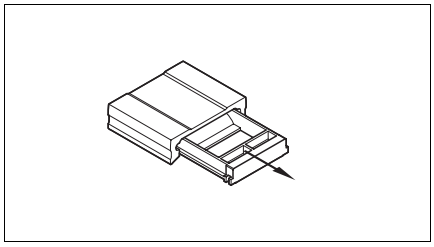


▶ Remove the rubber buffer at the strip deflection. To do so, loosen the two screws.



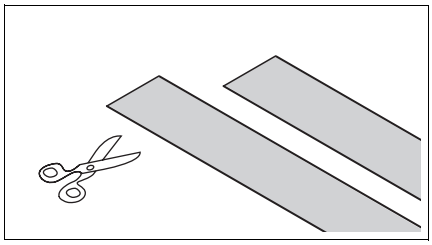
▶ Remove the holding plate together with the strip deflection. To do so, loosen the two screws.

▶ Pull out the entire cover strip.

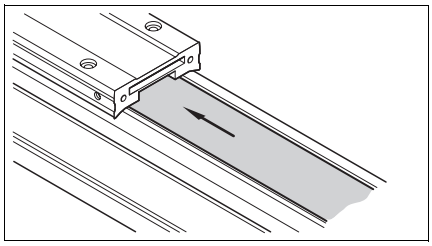


▶ Remove the plastic unit from the housing of the strip deflection.

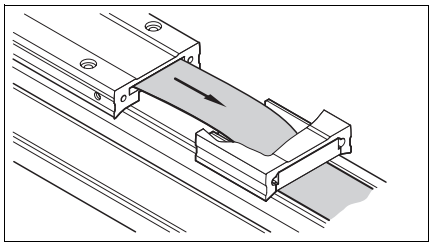
▶ Insert the new plastic unit into the housing of the strip deflection.



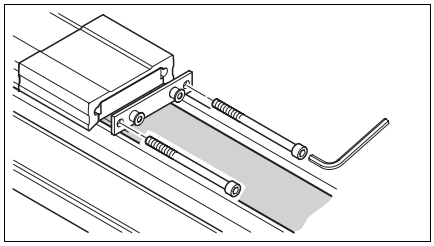
▶ Cut the new cover strip to the same length as the old cover strip with the tin snips.



▶ Guide the new cover strip through the guide channel inside the carriage.



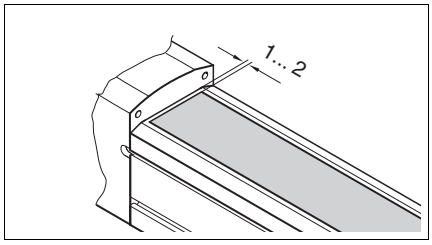
▶ Guide the new cover strip through the strip deflections.



▶ Place the holding plate for mounting the rubber buffer into position at the strip deflection.

▶ Screw the strip deflection into place.

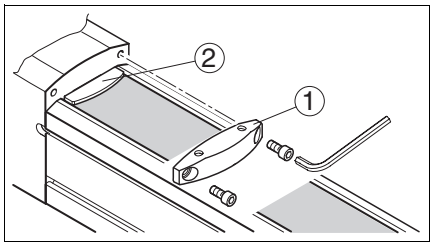
When doing so, align the strip deflection and the carriage.



▶ Place the cover strip over the entire length of the axis body.

Align the cover strip symmetrically so that the distance to the two end blocks amounts to 1 ... 2 mm.

Verify that the cover strip has even contact with the magnetic strips.



▶ Fit the clamping plate (2) into place.

▶ Screw the cover strip clamp (1) into place with the tightening torque specified in Table 6.1.

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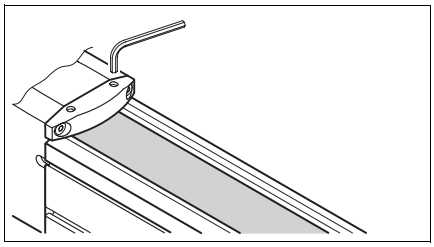
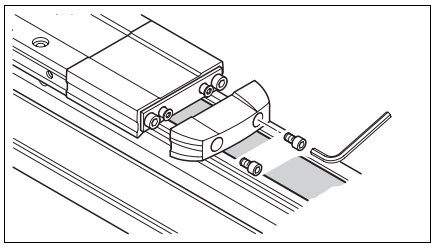


▶ Tighten the two set screws for holding the clamping plate with the tightening torque specified in Table 6.2.



▶ Mount the rubber buffer with the two screws and the washers.

Test movements

▶ Run initial tests at reduced velocity.

Verify proper function of the cover strip.

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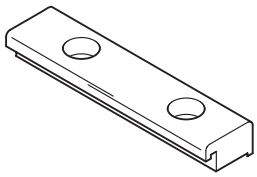
7 Accessories and spare parts

Contact your local sales office if order numbers are missing or if you have questions.

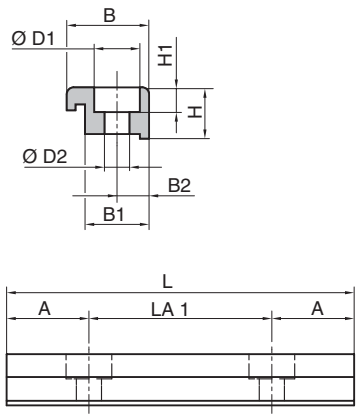
7.1 Clamping claws

Order data



Description		Order no.
For mounting the linear axes to a mounting surface. 10 piece	**For axis** ...	
	PAS42	**VW33MF10512**
	PAS43	**VW33MF10613**
	PAS44	**VW33MF10814**

Dimensional drawings



For axis ...	A	B	B1	B2	D1	D2	H	H1	L	LA1
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
PAS42	18	19	14	7	10	5.5	16.2	5.4	76	40
PAS43	18	24	16	8	11	6.6	21.5	6.4	76	40
PAS44	18	28	20	10	15	9	22	12	76	40

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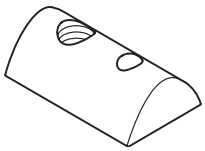
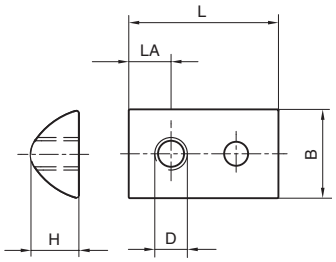
7.2 Slot nuts

Order data

	Description			Order no.
	The slot nuts are inserted into the T-slots of the axis body to fasten the axis or parts of the axis. 10 piece	**For axis** ...	**Slot nut type**	
		PAS42	5 pieces M5	**VW33MF010T5N5**
		PAS43	6 pieces M6	**VW33MF010T6N6**
		PAS44	8 pieces M6	**VW33MF010T8N6**
			8 pieces M8	**VW33MF010T8N8**

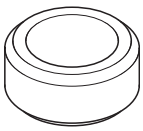
Dimensional drawings



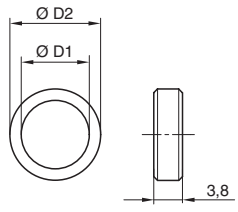
For axis ...	**Slot nut type**	**B**	**D**	**H**	**L**	**LA**
		mm	mm	mm	mm	mm
PAS42	5 pieces M5	8	5	4	11.5	4
PAS43	6 pieces M6	10.6	6	6.4	17	5.5
PAS44	8 pieces M6	13.8	6	7.3	23	6.5
	8 pieces M8	13.8	8	7.3	23	7.5

7.3 Locating dowels

Order data

	Description		Order no.
	For precise and reproducible mounting of the payload, the locating dowels are inserted into the holes at the carriage. 20 piece	**For axis**	
		PAS42	**VW33MF020LD01**
		PAS43	**VW33MF020LD02**
		PAS44	**VW33MF020LD03**

Dimensional drawings



For axis ...	**D1**	**D2**
	mm	mm
PAS42	5.5	8 h6
PAS43	6.6	10 h6
PAS44	9	12 h6

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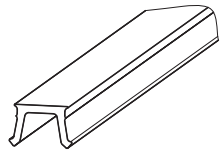
7.4 T slot covers

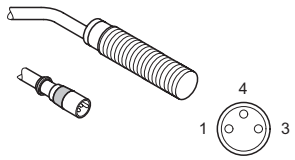
Order data

	Description			Order no.
	Length 2 m	**For axis** ...	**T slot size**	
	5 piece	PAS42	5	**VW33MC05B05**
		PAS43	6	**VW33MC05A06**
		PAS44	8	**VW33MC05A08**

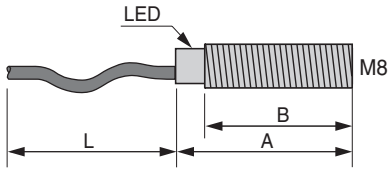
7.5 Sensors and additional parts

7.5.1 Sensors

Order data

	Description		Order no.
	With signal state indicator, 100 mm cable and 3-pin M8 circular connector, suitable for all axes 1 piece	PNP, normally closed contact	**XS508B1PBP01M8**
		PNP, normally open contact	**XS508B1PAP01M8**
		NPN, normally closed contact	**XS508B1NBP01M8**
		NPN, normally open contact	**XS508B1NAP01M8**

Dimensional drawings



Total length	Thread length	Cable length
A	**B**	**L**
[mm]	[mm]	[mm]
33	25	100
See chapter 4.3.1 "Connecting the sensors" for the connection assignment.		

Technical data

Design		Cylindrical thread M8 x 1
Approvals		CE
Electrical connection (PUR cable with M8 connector)	[m]	0.10
Nominal switching distance S_n(in the case of steel)	[mm]	1.5
Hysteresis		1 to 15% of the real switching distance
Degree of protection as per IEC 60529		IP67
Temperature (storage)	[°C]	-40 ... +85
Temperature (operation)	[°C]	-25 ... +70
Housing material		Nickel-plated brass
Cable material		PUR, 3 x 0.12 mm^2, length 10 cm
Function indicator output		Yellow LED
Function indicator supply voltage		No
Supply voltage (PELV)	[V_{dc}]	12 ... 24 with reverse polarity protection
Supply voltage (including residual ripple)	[V_{dc}]	10 ... 36
Switching current (overload and short-circuit protection)	[mA]	< 200
Voltage drop, output conducting	[V]	< 2
No-load current	[mA]	< 10
Maximum switching frequency	[Hz]	5000
Switch-on time	[ms]	< 0.1
Switch-off time	[ms]	< 0.1

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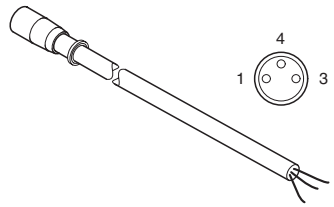
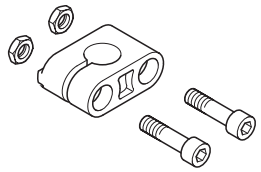
7.5.2 Sensor extension cable

Order data

	Description		Order no.
	Suitable for drag chain applications; sensor side end 3-pin M8 circular connector, second cable end open 1 piece	5 m	**VW32SBCBGA050**
		10 m	**VW32SBCBGA100**
		20 m	**VW32SBCBGA200**

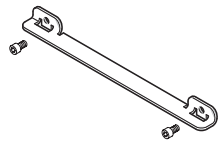
7.5.3 Sensor holder

Order data

	Description	Order no.
	For standard limit switch with 8 mm diameter; movable; suitable for all axes 10 piece	**VW33MF010M8**

7.5.4 Contact plate

Order data

	Description	Order no.
	For mounting to the carriage of the axis Content 1 contact plate 2 screws	**VW33MASP1**

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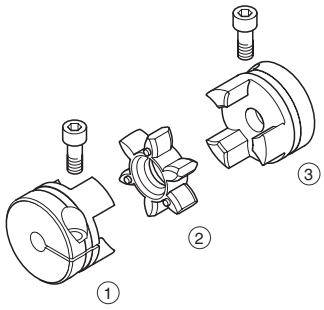
7.6 Coupling assemblies

spb can transmit a greater torque than the linear axis can accept.



Coupling assembly

(1) Clamping hub

(2) Elastomer spider

(3) Clamping hub

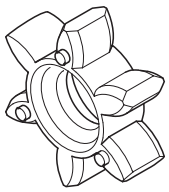
Coupling assemblies are required to mount motors to axes.

A coupling assembly consists of the following components:

- 2 clamping hubs, one each for ball screw end and motor end
- 1 elastomer spider, as a decoupling element between the hubs
- 2 screws

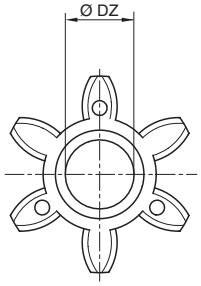
7.6.1 Elastomer spiders

Order data



Description		Order no.
Decoupling element between the hubs 1 piece	**For axis** ...	
	PAS42	**SPM3MFR14A034**
	PAS43	**SPM3MFR20A120**
	PAS44	**SPM3MFR25A320**

Dimensional drawings



For axis ...	Shore hardness	Maximum torque M_{max} Nm	Nominal torque M_N Nm	Moment of inertia J kgcm²	Diameter DZ mm
PAS42	98 Sh A	34	17	0.013	14
PAS43	98 Sh A	120	60	0.067	20
PAS44	98 Sh A	320	160	0.15	25

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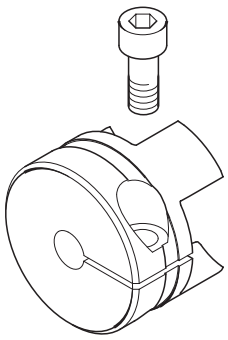
7.6.2 Clamping hubs

Order data



Description			Order no.
Clamping hub 1 piece			
For axis ...	**D1 (mm)** [1] Please inquire for other diameters	**M_{max} (Nm)** Maximum torque that can be transmitted	
PAS42	6.35	32.5	**SPM3MFCC06A07**
	8	35	**SPM3MFCC08A07**
	9	36	**SPM3MFCC09A07**
	10	41	**SPM3MFCC10A07**
	11	45	**SPM3MFCC11A07**
	12	50	**SPM3MFCC12A07**
	14	53	**SPM3MFCC14A07**
	16 [2]	55	**SPM3MFCC16A07**
	19	58	**SPM3MFCC19A07**
	20	60	**SPM3MFCC20A07**
PAS43	12	49	**SPM3MFCC12A08**
	14	54	**SPM3MFCC14A08**
	19	75	**SPM3MFCC19A08**
	20 [2]	76	**SPM3MFCC20A08**
	22	78	**SPM3MFCC22A08**
	24	85	**SPM3MFCC24A08**
	25	98	**SPM3MFCC25A08**
PAS44	12	108	**SPM3MFCC12A09**
	14	111	**SPM3MFCC14A09**
	19	128	**SPM3MFCC19A09**
	20	138	**SPM3MFCC20A09**
	22	154	**SPM3MFCC22A09**
	24	158	**SPM3MFCC24A09**
	25 [2]	160	**SPM3MFCC25A09**

1) See dimensional drawings
2) Clamping hub with diameter for ball screw shaft extension, see dimensional drawings ball screw axis in chapter 3 "Technical Data"

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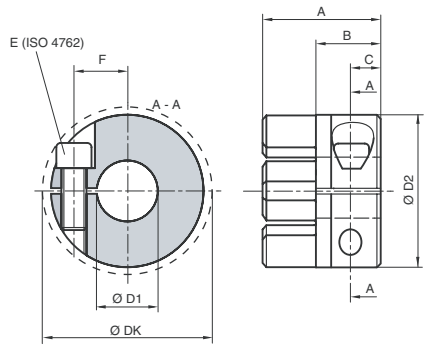
Dimensional drawings



For axis ...	Moment of inertia	Screw ISO 4762	Wrench size	Tightening torque	Hub length	Bore depth H7	Distance between centers	Inside diameter		Outside diameter	
	J	**E**			**A**	B	C	**D1**	**D2**	**DK**	**F**
	kgcm^2		mm	Nm	mm						
PAS42	0.15	M6	5	14	31	17	8	1)	40	45	14
PAS43	0.55	M6	5	14	36	20	10	1)	55	57.5	20
PAS44	1.22	M8	6	35	39	21	9	1)	65	73	25

1) See order data

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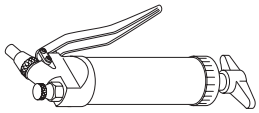
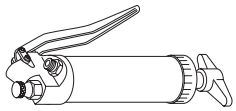
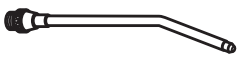
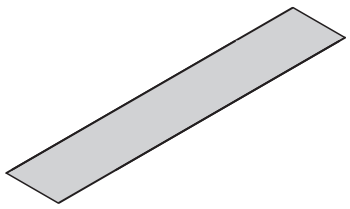
7.7 Grease guns

Order data

Designation	Description	Order no.
Single-hand high-pressure grease gun 	With nozzle for lubricating the linear axes with Recirculating ball bearing guides. Suitable nozzle type D. Volume: 120 cm^3; delivery volume: 0.5 cm^3/stroke	**VW33MAP01**
Single-hand high-pressure oil gun 	With nozzle for the lubrication of the linear axes with roller. Suitable nozzle type D. Volume: 120 cm^3; delivery volume: 0.5 cm^3/stroke	**VW33MAP02**
Nozzle type D6 90° 	For grease nipple type D6; nipple 90°, Ø 6 mm; length 20 mm; with M4 pointed nozzle 90° lateral	**VW33MAT01**
Nozzle type D6 20° 	For grease nipple type D6; nipple 20°, Ø 6 mm; length 20 mm; with M4 pointed nozzle 20° angled	**VW33MAT02**

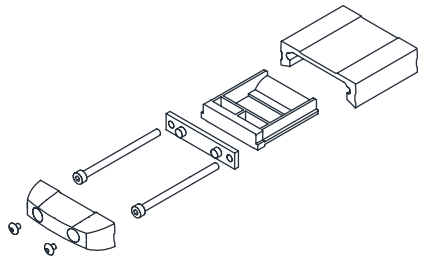
7.8 Cover strips

Order data

	Description				Order no.
	For axis ...	**Width (mm)**	**Height (mm)**	**Length (m)**	
	PAS42	36	0.15	3	**SPM3MAC36L030**
				6	**SPM3MAC36L060**
	PAS43	45	0.15	3	**SPM3MAC45L030**
				6	**SPM3MAC45L060**
	PAS44	65	0.15	3	**SPM3MAC65L030**
				6	**SPM3MAC65L060**

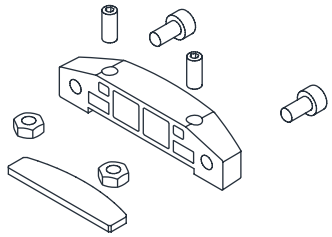
7.9 Strip deflection

Order data

	Description		Order no.
	Kit with 1 strip deflection 1 deflection unit with brush 1 holding plate 1 rubber buffers 4 screws	**For axis** ...	
		PAS42	**SPM3MAC2D0042**
		PAS43	**SPM3MAC3D0043**
		PAS44	**SPM3MAC4D0044**

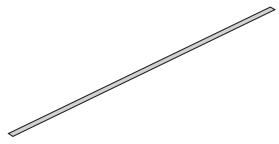
7.10 Cover strip clamp

Order data

	Description		Order no.
	Kit with 1 belt deflection 1 clamping plate 2 screws 2 set screws 2 nuts	**For axis** ...	
		PAS42	**SPM3MAC1F042**
		PAS43	**SPM3MAC1F043**
		PAS44	**SPM3MAC1F044**

7.11 Magnetic strips

Order data

	Description				Order no.
	2 piece				
	For axis ...	Width (mm)	Height (mm)	**Length (m)**	
	PAS42	4.0	1	1.5	**SPM3MAW1S415**
				3	**SPM3MAW1S430**
				6	**SPM3MAW1S460**
	PAS43 / PAS44	6.0	1	1.5	**SPM3MAW1S615**
				3	**SPM3MAW1S630**
				6	**SPM3MAW1S660**

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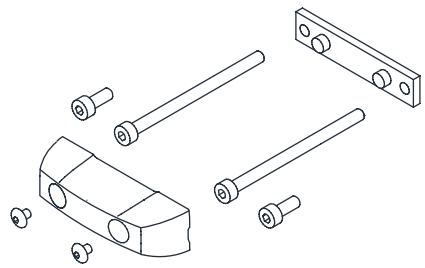
7.12 Rubber buffer

Order data

	Description		Order no.
	Kit with 2 rubber buffers 2 holding plates 12 screws	**For axis** ...	
		PAS42	**SPM3MAC2B042**
		PAS43	**SPM3MAC3B043**
		PAS44	**SPM3MAC4B044**

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8 Service, maintenance and disposal

⚠ DANGER

ELECTRIC SHOCK

High voltages at the motor connection may occur unexpectedly.

- Verify that no voltage is present (this includes the DC bus) prior to taking up work on the drive system.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

GREAT MASS OR FALLING PARTS

- Consider the mass of the axis when mounting it. It may be necessary to use a crane.
- Mount the axis in such a way (tightening torque, securing screws) that the axis and mounted parts cannot come loose even in the case of fast acceleration or continuous vibration.
- Note that vertically installed linear axes may lower unexpectedly.

Failure to follow these instructions can result in death, serious injury or equipment damage.

8.1 Service address

If you cannot resolve an error yourself please contact your sales office. Have the following details available:

- Nameplate (type, identification number, serial number, DOM, ...)
- Type of error (such as LED flash code or error number)
- Previous and concomitant circumstances
- Your own assumptions concerning the cause of the error

Also include this information if you return the product for inspection or repair.

If you have any questions please contact your sales office. Your sales office staff will be happy to give you the name of a customer service office in your area.

http://www.schneider-electric.com

8.2 Maintenance

The maintenance intervals for cleaning and lubrication must be adhered to.

- ▶ Include the maintenance intervals in your maintenance schedule.

8.2.1 Cleaning

Due to its design, the product is not susceptible to the ingress of contaminants and external objects. The guide is located inside the axis body and it is covered.

The product must be inspected and cleaned at regular intervals.

- ▶ Do not use compressed air for cleaning.
- ▶ Remove large particles and dirt from the surface at regular intervals.
- ▶ The anodized surface only has a limited resistance to alkaline cleaning agents. Therefore, use only neutral cleaning agents for cleaning.
- ▶ Use only damp, soft and lint-free cleaning cloths to wipe the surface.

Cover strip

The cover strip is teflon-coated. The friction causes abrasion on the cover strip.

- ▶ Remove abrasion products at regular intervals.

8.2.2 Lubrication

CAUTION

DAMAGE DUE TO WRONG LUBRICANT

Wrong lubricants may damage the product.

- Use the correct type of lubricant (grease, oil) as required by the linear guide of the linear axis.
- Note the type code.

Failure to follow these instructions can result in equipment damage.

Lubricant is used continuously during operation of the linear axis. Therefore, regular relubrication is mandatory.

The lubrication system is not completely tight. Therefore, small amounts of lubricants may escape after relubrication.

Insufficient lubrication or incorrect lubricants increase wear and reduce the service life. The following factors influence the lubrication intervals:

- Dust and dirt particles
- High operating temperatures
- Heavy loads
- Heavy vibration
- Permanent short-distance positioning
- High speed of rotation of ball screw

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8.2.3 Lubricating the linear guide and the drive elements

The ball screw axis is lubricated with grease from an internal reservoir. The reservoir is factory-prefilled. The carriage features 3 grease nipples at each side for relubrication.

- The outer grease nipples are used to lubricate the linear guide.
- The inner grease nipples are used to fill the drive element (ball screw drive).

The lubrication interval depends on the load, the velocity, the cycle time and the ambient conditions. The following recommended values apply to lubrication intervals:

Linear guide

- 5000 km operational performance

Size	Lubricant	Relubrication volume	Strokes
PAS42	Microlube GL 261	0.3 cm^3	1/4
PAS43	Microlube GL 261	0.6 cm^3	1 1/4
PAS44	Microlube GL 261	1.0 cm^3	2

Drive elements

- 100 km at a screw pitch of 5 mm
- 200 km at a screw pitch of 10 mm
- 400 km at a screw pitch of 16 mm

Size	Lubricant	Relubrication volume	Strokes
PAS42	Microlube GL 261	1.5 cm^3	3
PAS43	Microlube GL 261	3.5 cm^3	7
PAS44	Microlube GL 261	4.5 cm^3	9

See chapter 7 "Accessories and spare parts" for grease guns, nozzles and lubricants.

Notes on greasing

When applying the lubricant, you must not exceed a maximum flow rate. Therefore, the minimum injection time of 3 seconds per grease gun stroke must be adhered to.

The carriage must be moved between strokes of the grease gun to allow the grease to distribute evenly in the lubricant reservoirs.

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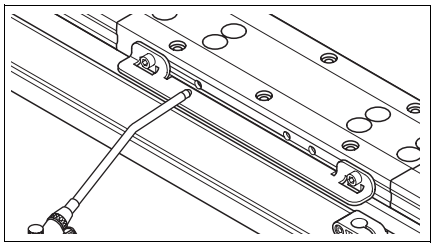
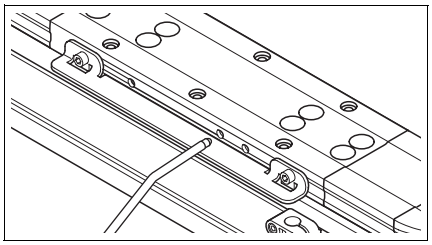
Procedure



Lubricating the linear guide

▶ Inject the correct type and volume of grease into the two outer grease nipples at one side of the carriage.



Lubricating the drive element

▶ Inject the correct type and volume of grease into the center grease nipple at one side of the carriage.

8.3 Shipping, storage, disposal

Note the ambient conditions on page 23.

Shipping The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage The product may only be stored in spaces where the specified permissible ambient conditions for room temperature and humidity are met. Protect the product from dust and dirt.

Disposal The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations.

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9 Glossary

9.1 Terms and Abbreviations

Axis body — The axis body is a high-strength, torsion-resistant aluminum precision profile.

Ball screw drive — The ball screw drive converts a rotary movement into a linear movement. It consists of a ball screw, a ball nut with the ball recirculating elements and the bearing balls. A ball screw drive has a very high efficiency. It allows for high-precision, stiff feed movements and generates high feed forces at high positioning accuracy and repeatability.

Ball screw pitch — The pitch of the ball screw shaft relates to the distance covered by the carriage per revolution of the ball screw. The greater the pitch the higher the maximum velocity.

The following applies to the ball screw pitch:

- High pitch requires high driving torque
- High pitch results in high velocity
- High pitch causes high inaccuracy
- High pitch implies little self-locking

Breakaway torque — The breakaway torque describes the driving torque required to overcome the static friction and that initiates the transition to sliding friction.

Buckling load — Buckling is the loss of stability of the spindles when the max. permissible feed forces whose line of application is along the spindle axis are exceeded. Exceeding the buckling load is expressed by a quickly increasing change in the shape of the spindle with a deviation to the side.

Cantilever axis — In the case of a cantilever axis, the carriage is stationary while the axis body moves. Portal axes work the other way round.

Critical speed of the ball screw — If the critical speed of the ball screw is exceeded, deflection of the ball screw and resonance will occur. This will seriously affect the service life of the ball screw drive. Ball screw supports are installed in longer ball screw axes to increase the critical screw speed and thus the performance data.

Drive element — The drive element of the linear axis is a ball screw drive.

Feed per revolution — The feed per revolution is the distance the carriage covers per motor revolution.

Linear guide — The linear guide consists of the guide carriage and the profile rail.

Load torque — The permissible load torques are calculated based on the service life of the carriage guide. If the load torque exceeds the specified values, the service life of the axis will be reduced.

Modulus of elasticity — The modulus of elasticity is used to describe the tendency of a material to deform along an axis when opposing forces are applied along this axis; it is the ratio of tensile strain and tensile stress. The higher the value, the stiffer the material.

Mounting position — The linear axes can be installed in any desired position. However, all external forces and torques must be within the ranges of permissible values.

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Portal axis Generic term for driven axes and support axes. In the case of a portal axis, the axis body is stationary while the carriage moves. Cantilever axes work the other way round.

Positioning accuracy Positioning accuracy is the tolerance between the specified position and actual position.

Repeatability Repeatability is the accuracy with which it is possible to move to a previous position again under the same conditions.

Running accuracy Due to the manufacturing process, the extruded aluminium profiles have a certain tolerance in terms in straightness and twist. The tolerances are specified in EN 12020-2. To reach the desired running accuracy, the linear axis must be mounted on a precision-machined surface.

Self-locking The product is not self-locking. This means that motors with a holding brake, a separate holding brake or suitable weight compensation for the linear axis must be used, particularly so if axes are vertically mounted.

Sensor Inductive proximity switches are used as sensors for limit switches or reference switches. These switches are not a safety function.

Service life The service life is the distance in kilometers before the first signs of material fatigue can be seen on the guides, the drive elements and the bearings. Service life specifications (kilometers covered) relate to the nominal values specified in the data sheet. If the nominal values are exceeded, the service life decreases accordingly.

Stiffness The stiffness shows information on the capacity of part that is to be positioned to move and stop at the correct position, even under load variations.

Stroke reserve The stroke reserve is the distance between a limit switch and the mechanical stop.

Stroke Stroke is the maximum travel of the carriage between the switching points of the limit switches.

Support axis A support axis has a linear guide, but no drive elements. A support axis carries loads that are applied asymmetrically to the carriage and improves the stability and service life of the system.

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