

PAS4•S

Portal axes with ball screw drive

Product manual

V2.02, 07.2010



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.

Table of contents



Important information	2
Table of contents	3
Writing conventions and symbols	7
1 Introduction	9
1.1 Overview of product properties	9
1.1.1 Product family	9
1.1.2 Features and options of the linear axis	9
1.1.3 Characteristics of the linear guide	10
1.1.4 Motor mounting	10
1.2 Product overview	11
1.3 Type code	12
1.4 Declaration of Incorporation	16
2 Before you begin - safety information	17
2.1 Qualification of personnel	17
2.2 Intended use	17
2.3 Hazard categories	18
2.4 Basic information	19
2.5 Standards and terminology	20
3 Technical Data	21
3.1 Ambient conditions	21
3.2 PAS42	22
3.3 PAS43	28
3.4 PAS44	34
3.5 Service life	40
3.6 Positioning accuracy and repeatability	40
3.7 Stroke reserve	40
3.8 Motor	40

4	Installation	41
4.1	Preparing installation	42
4.2	Mechanical installation	42
4.2.1	Standard tightening torques	42
4.2.2	Mounting the linear axis	43
4.2.3	Mounting the contact plate	44
4.2.4	Mounting the sensors	45
4.2.5	Mounting the motor and the gearbox	46
4.2.6	Mounting the payload	49
4.3	Electrical installation	50
4.3.1	Connecting the sensors	50
4.3.2	Motor connection	50
4.4	Checking installation	50
5	Commissioning	51
5.1	Commissioning procedure	52
6	Diagnostics and troubleshooting	53
6.1	Troubleshooting	53
7	Accessories and spare parts	55
7.1	Clamping claws	55
7.2	Slot nuts	56
7.3	Locating dowels	56
7.4	T slot covers	57
7.5	Sensors and additional parts	57
7.5.1	Sensors	57
7.5.2	Sensor extension cable	58
7.5.3	Sensor holder	58
7.5.4	Contact plate	59
7.6	Coupling assemblies	60
7.6.1	Elastomer spiders	60
7.6.2	Clamping hubs	61
7.7	Grease guns	63
7.8	Cover strips	63
7.9	Strip deflection	64
7.10	Cover strip clamp	64
7.11	Magnetic strips	64
7.12	Rubber buffer	65

8	Service, maintenance and disposal	67
8.1	Service address	67
8.2	Checks after collisions	68
8.2.1	Ball screw drive	68
8.2.2	Ball screw bearing	68
8.2.3	Linear guide	68
8.2.4	Elastomer coupling	68
8.3	Replacing parts	70
8.3.1	Replacing a sensor	70
8.3.2	Replacing the motor or the gearbox	70
8.3.3	Replacing the elastomer coupling	72
8.3.4	Replacing the cover strip and the strip deflection	73
8.4	Maintenance	76
8.4.1	Cleaning	76
8.4.2	Lubrication	77
8.4.3	Lubricating the linear guide and the drive elements	78
8.5	Shipping, storage, disposal	79
9	Glossary	81
9.1	Units and conversion tables	81
9.1.1	Length	81
9.1.2	Mass	81
9.1.3	Force	81
9.1.4	Power	81
9.1.5	Rotation	82
9.1.6	Torque	82
9.1.7	Moment of inertia	82
9.1.8	Temperature	82
9.1.9	Conductor cross section	82
9.2	Terms and Abbreviations	83
10	Index	87

Writing conventions and symbols

This manual is valid for PAS4xS standard products. Chapter 1 "Introduction" lists the type code for this product. The type code allows you to identify whether your product is a standard product or a customized version.

The following manuals belong to this product:

- **Product manual of the drive**, describes the technical data, installation, commissioning and the operating modes and functions.
- **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>

Source CAD drawings For easier engineering, CAD drawings and product master data are available for download from the Internet at:

<http://www.schneider-electric.com>

Corrections and suggestions We always try to further optimize our manuals. We welcome your suggestions and corrections.

Please get in touch with us by e-mail:

techcomm@schneider-electric.com.

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.

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 mm² (AWG 14)

Glossary Explanations of special technical terms and abbreviations.

Index List of keywords with references to the corresponding page numbers.

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 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 (cross section axis body 60x60 mm)
- PAS43Sx (cross section axis body 80x80 mm)
- PAS44Sx (cross section axis body 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 ball screw supports
- Easy integration into systems and machines due to axis bodies with T slots
- Different strokes lengths available
- 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 Characteristics of the linear guide

- Recirculating ball bearing guide*
- High acceleration
 - High load capacity
 - High accuracy

1.1.4 Motor mounting

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

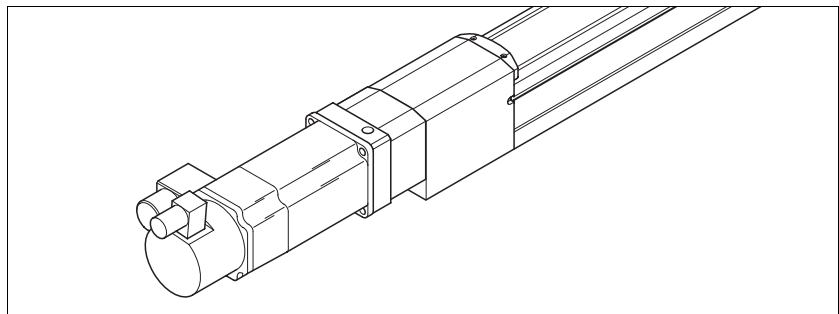


Figure 1.1 Motor mounting straight

1.2 Product overview

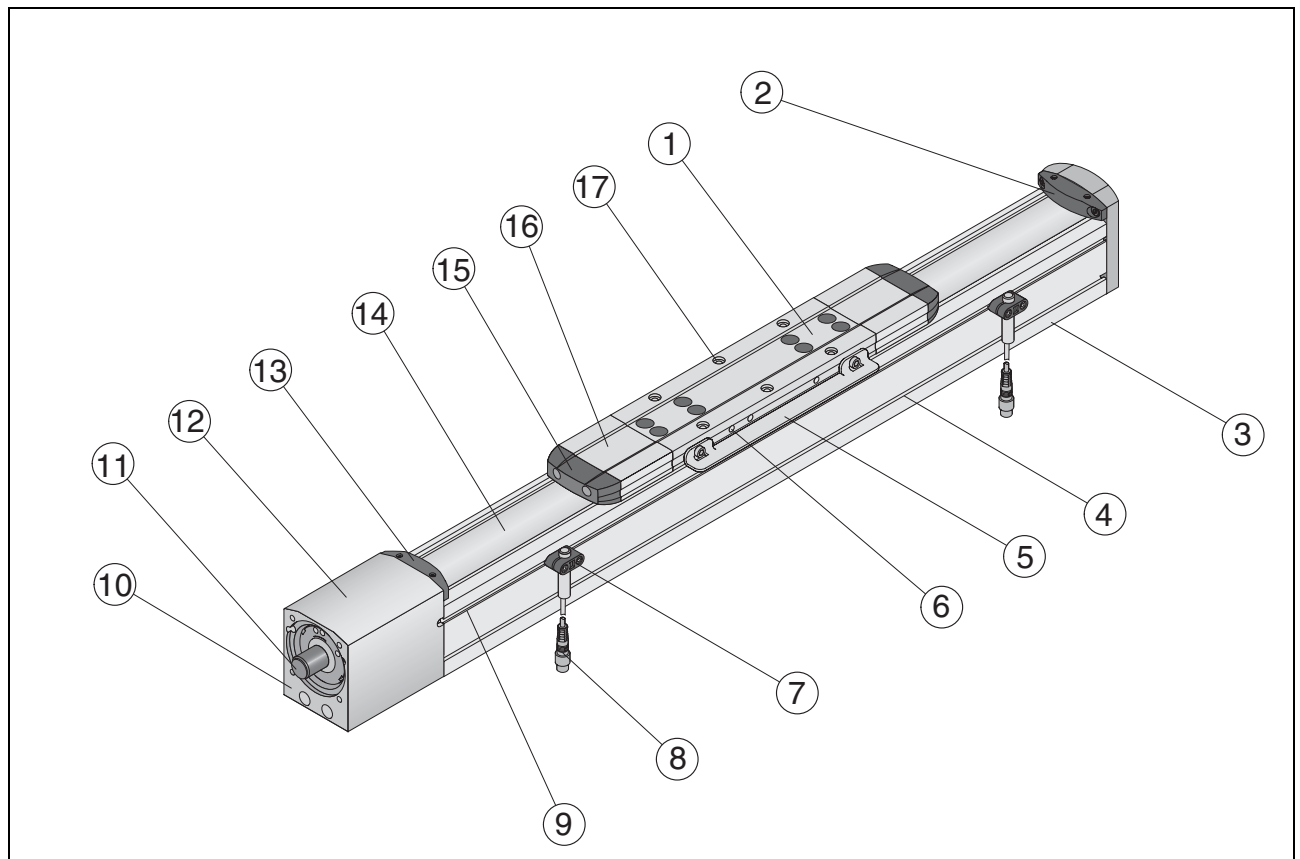


Figure 1.2 Product overview ball screw axis

- (1) Carriage
- (2) End plate with bearing with ball screw drive
- (3) Axis body
- (4) T-slot for fastening the axis body
- (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

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 (cross section axis body) 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 drive A = Support axis (without ball screw drive, linear guide only)	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
Guide type 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 carriage B = Two carriages C = Three carriages	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

Example	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
Motor / gearbox 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; with adaptation material (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
Gearbox interface 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 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 interface	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
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 with spur wheel gear																			
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																			
Mounting direction motor with reference to power connection (with clamping hub mounting screw of adapter plate)	PAS	4	2	S	B	D	1200	C	1	B	A	100	S	/	2	3G	0	V0	3
0 = 0 a'clock																			
3 = 3 a'clock																			
6 = 6 a'clock																			
9 = 9 a'clock																			
X = No motor																			

- 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. Only one carriage is driven. Only the carriage closest to the motor is driven.
- 3) Minimum distance between 2 carriages: see dimensional drawings

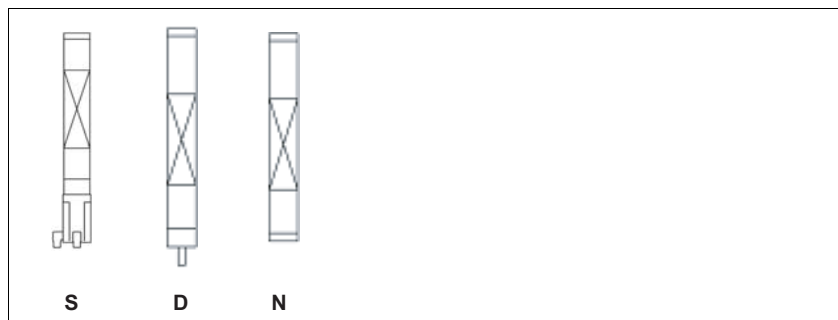


Figure 1.3 Axis drive interface

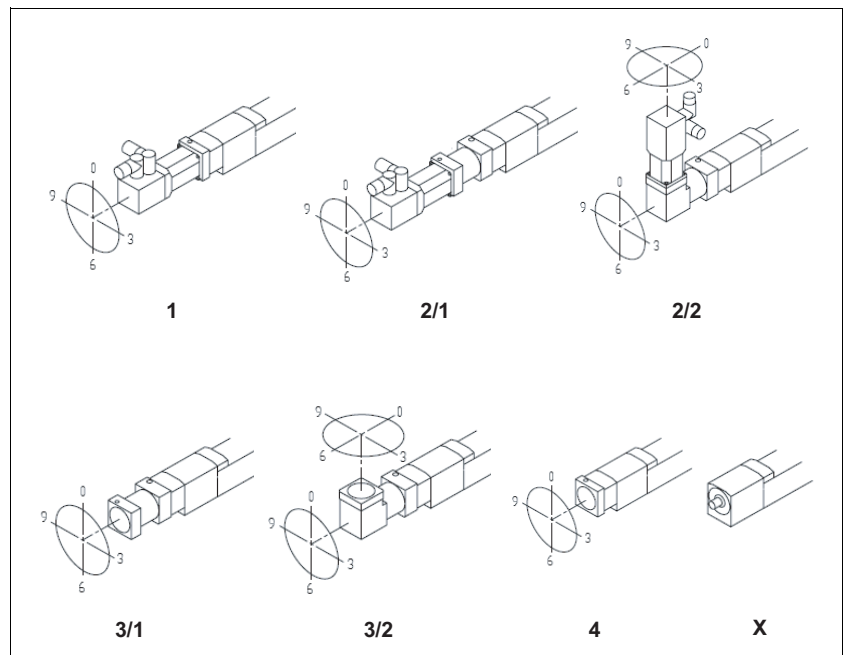




Figure 1.4 Mounting direction motor and gearbox

1.4 Declaration of Incorporation

<u>DECLARATION OF INCORPORATION</u>		 SCHNEIDER ELECTRIC MOTION DEUTSCHLAND GmbH Breslauer Str. 7 77933 Lahr
<p>For partly completed machinery as per Machinery Directive 2006/42/EC</p> <p>We hereby declare that the product listed below in the version distributed by us is partly completed machinery and satisfies the provisions of the Directive by application of the following standards. The relevant technical documentation as per Annex VII, part B, has been compiled. Please observe the safety instructions in our technical documentation.</p>		
Designation:	Portal axis with toothed belt Portal axis with spindle	
Type:	PAS41x, PAS42x, PAS43x, PAS44x	
Product number:	73xx xxxx xxx	
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	
<p>We undertake to transmit, in electronic form, in response to a request by the national authorities relevant information on the partly completed machinery.</p> <p>The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive (2006/42/EC).</p>		
Company stamp:	Schneider Electric Motion Deutschland GmbH Postfach 11 80 • D-77901 Lahr Breslauer Str. 7 • D-77933 Lahr	
Date/Signature:	20 January 2010	
Name/Department:	Wolfgang Brandstätter/Development	

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 linear axis 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).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

CAUTION

CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. **can result** in equipment damage).

2.4 Basic information

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 parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move 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 all 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 and Operation of Adjustable-Speed Drive Systems".

2.5 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 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.

3 Technical Data

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

3.1 Ambient conditions

Ambient temperature during operation

Temperature	[°C]	0 ... +50
-------------	------	-----------

Ambient conditions transportation and storage

The environment during transportation 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 IEC 60721-3-3, class 3K3, no condensation
-------------------	--	--

Installation altitude

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

Degree of protection

Degree of protection		IP 20 ¹⁾
----------------------	--	---------------------

1) Without cover strip IP00.

Vacuum

Operation in vacuum is not permissible.

Lubricants and lubrication

See chapters 8.4.2 "Lubrication" and 8.4.3 "Lubricating the linear guide and the drive elements".

3.2 PAS42

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

Technical data portal axis		PAS42SB					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS15V					
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
Diameter ball screw shaft	[mm]	16					
Backlash of the ball screw drive	[mm]	0.04					
Maximum feed force $F_{x_{max}}^{1)}$	[N]	2980	1560	1540	2980	1560	1540
Maximum speed of rotation of ball screw shaft	[min ⁻¹]	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 $F_{y_{dynmax}}^{1)}$	[N]	4050					
Maximum force $F_{z_{dynmax}}^{1)}$	[N]	4050					
Maximum torque $M_{y_{dynmax}}^{1)}$	[Nm]	304			668		
Maximum torque $M_{z_{dynmax}}^{1)}$	[Nm]	304			668		
Max. torque $M_{x_{dynmax}}^{1)}$	[Nm]	27					
Mass 0 stroke axis	[kg]	6.1 / 5.2			7.8 / 6.9		
Mass per additional carriage (with axis body and ball screw drive)	[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 stroke ⁴⁾	[mm]	1770 / 1870			1590 / 1690		
Minimum stroke ⁵⁾	[mm]	9					
Repeatability ²⁾	[mm]	± 0.02					
Diameter motor shaft	[mm]	6.35 ... 20					
Cross section axis body (W x H)	[mm]	60 x 60					
Axial area moment of inertia (I _x / I _y)	[mm ⁴]	461960 / 598330					
Modulus of elasticity (aluminum) E	[N/mm ²]	72000					
Load rating linear guide C _{stat}	[N]	24200					

Technical data portal axis		PAS42SB					
Load rating linear guide C_{dyn}	[N]	14200					
Load rating ball screw drive C_{stat}	[N]	19900	9100	9200	19900	9100	9200
Load rating ball screw drive C_{dyn}	[N]	14900	7800	7700	14900	7800	7700
Service life 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

Technical data 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	

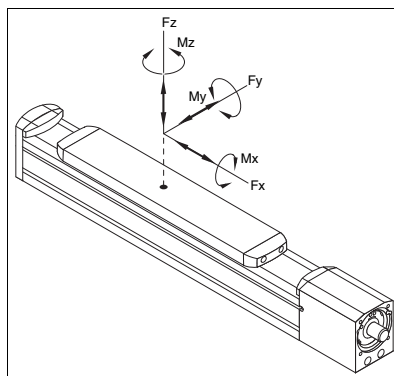
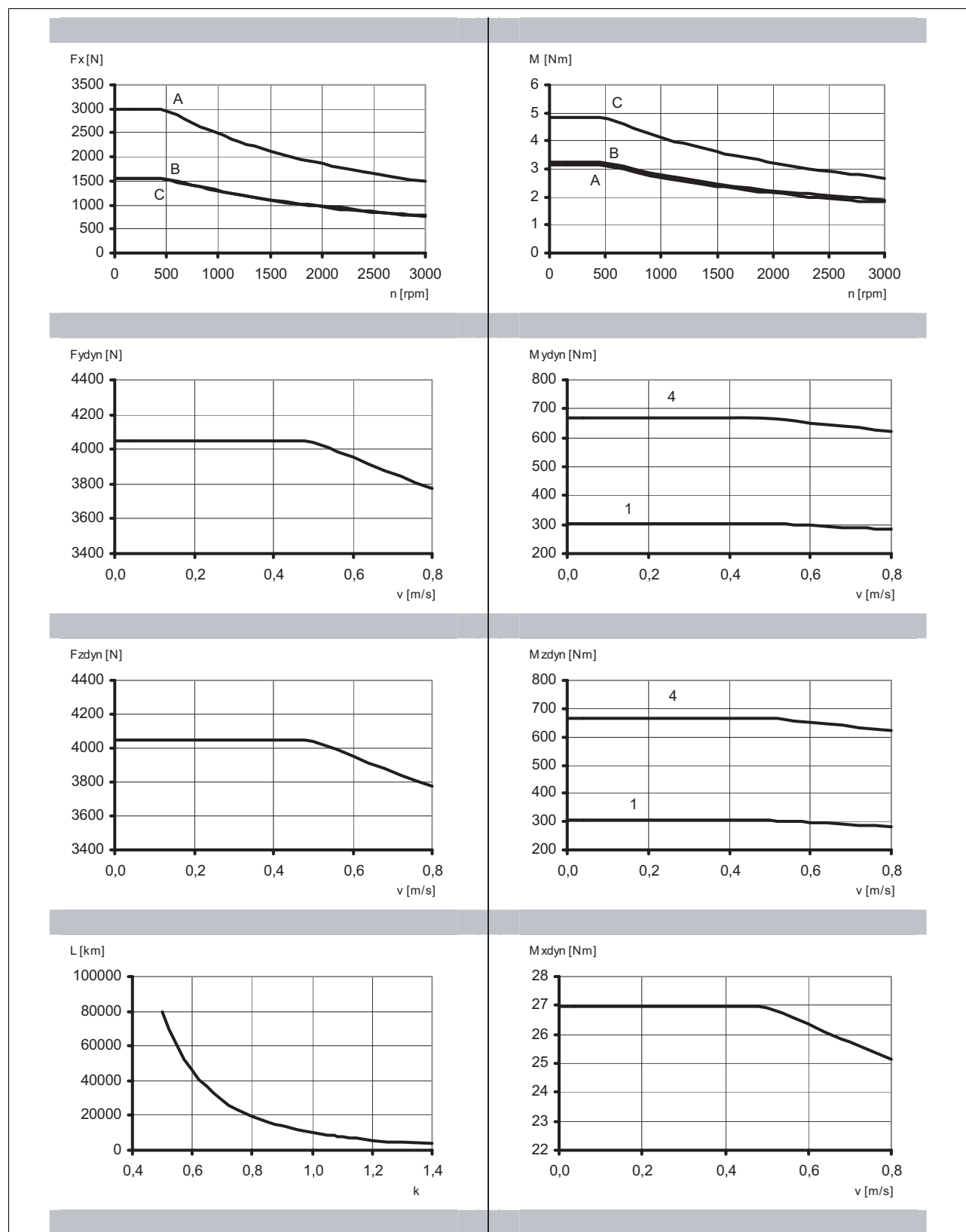


Figure 3.1 Forces and torques

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

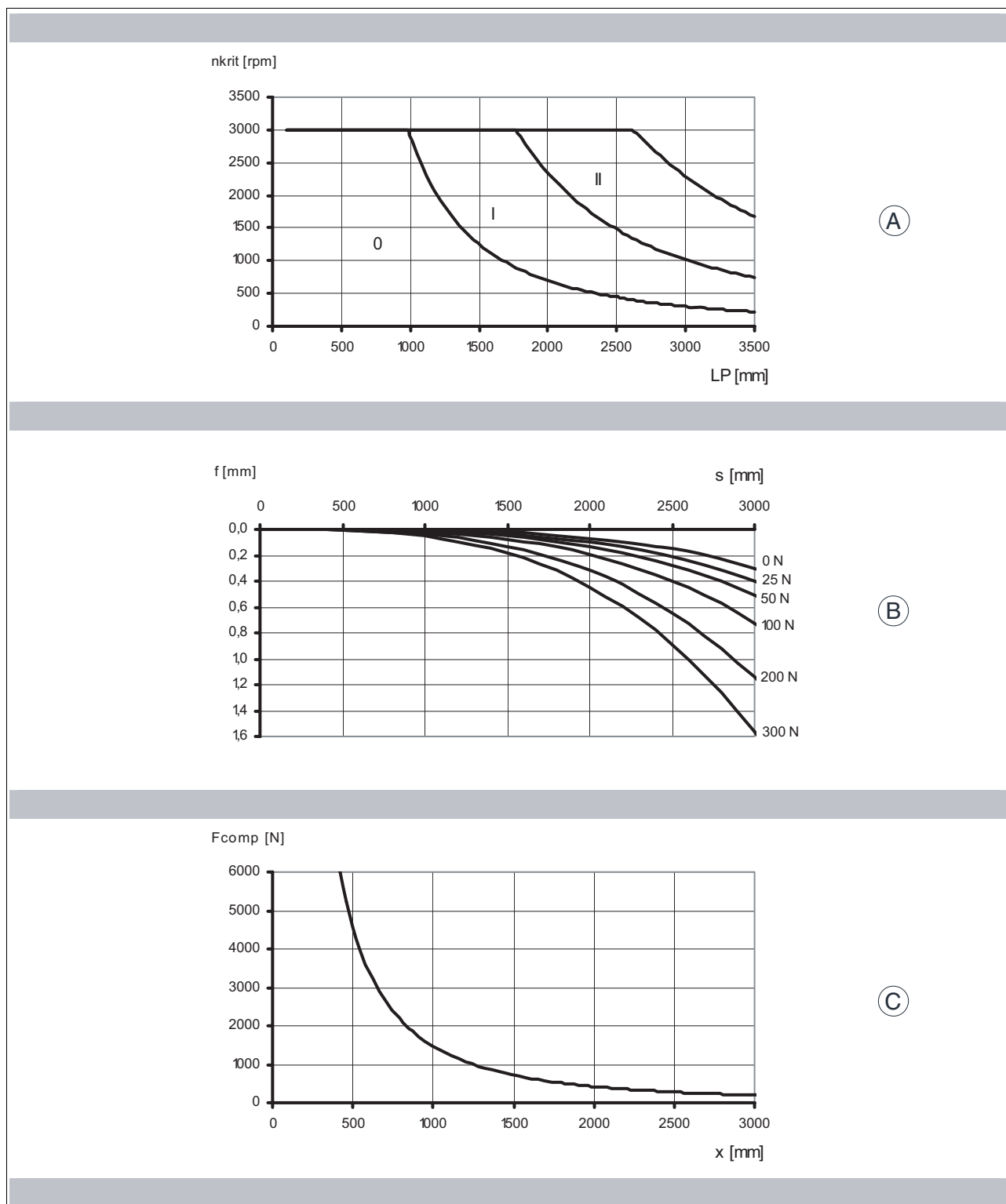


Figure 3.2 Speed of rotation of ball screw, deflection, buckling strength, PAS42SB

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

Dimensional drawings PAS42SB

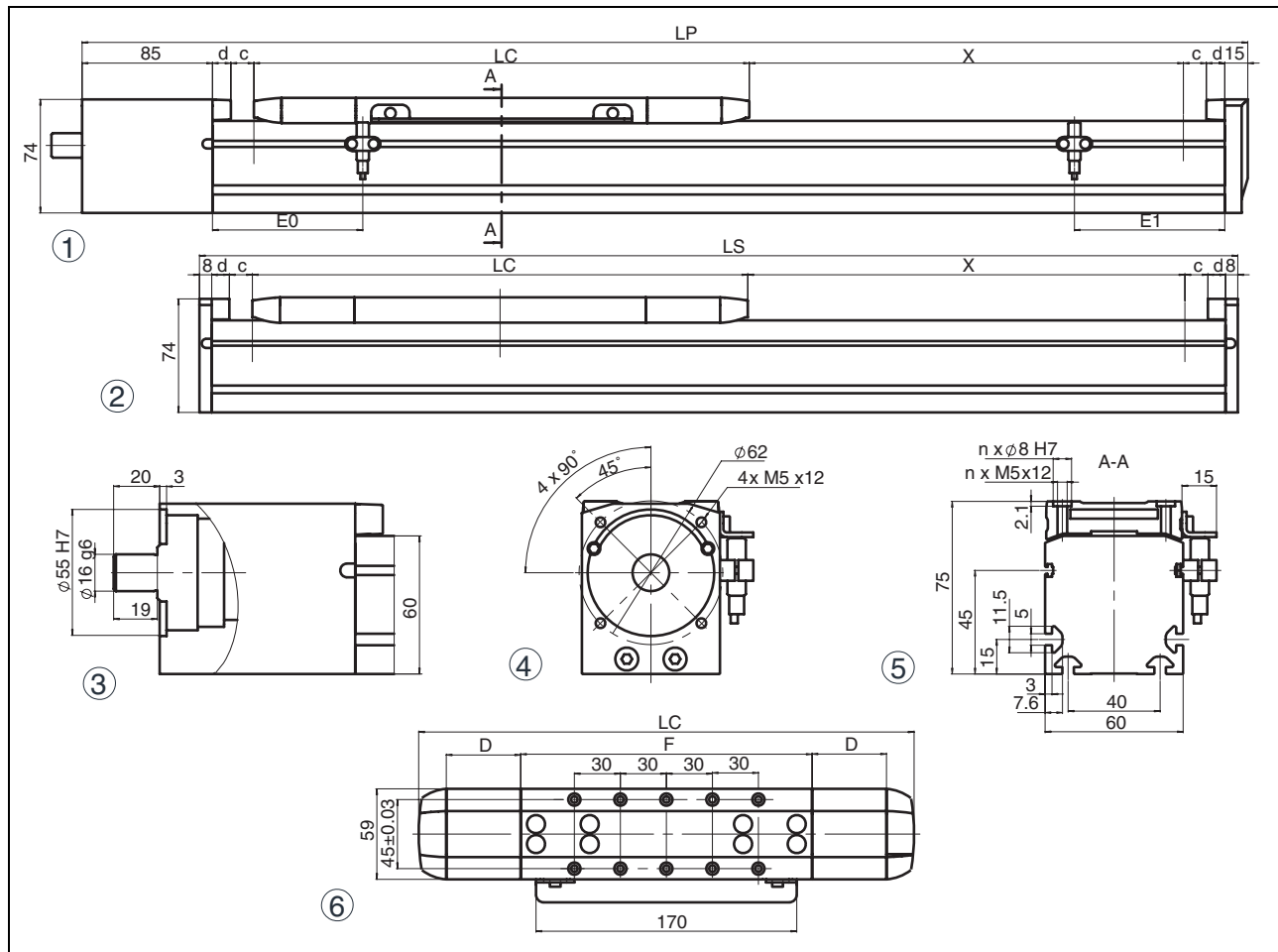


Figure 3.3 Dimensional drawing PAS42SB

- (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)

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 technical data							
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 up to mechanical stop	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.

2) Prepared for locating rings (see Accessories)

3.3 PAS43

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

Technical data portal axis		PAS43SB					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS20					
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
Diameter ball screw shaft	[mm]	20					
Backlash of the ball screw drive	[mm]	0.04					
Maximum feed force $F_{x_{max}}^{1)}$	[N]	3400	2600	1720	3400	2600	1720
Maximum speed of rotation of ball screw shaft	[min ⁻¹]	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 $F_{y_{dynmax}}^{1)}$	[N]	6360					
Maximum force $F_{z_{dynmax}}^{1)}$	[N]	6360					
Maximum torque $M_{y_{dynmax}}^{1)}$	[Nm]	556			1224		
Maximum torque $M_{z_{dynmax}}^{1)}$	[Nm]	556			1224		
Max. torque $M_{x_{dynmax}}^{1)}$	[Nm]	60					
Mass 0 stroke axis	[kg]	12.1 / 10.3			15.4 / 13.6		
Mass per additional carriage (with axis body and ball screw drive)	[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 stroke ⁴⁾	[mm]	3070 / 3190			2860 / 2980		
Minimum stroke ⁵⁾	[mm]	11					
Repeatability ²⁾	[mm]	± 0.02					
Diameter motor shaft	[mm]	9 ... 20					
Cross section axis body (W x H)	[mm]	80 x 80					
Axial area moment of inertia (I _x / I _y)	[mm ⁴]	1480060 / 1851160					
Modulus of elasticity (aluminum) E	[N/mm ²]	72000					
Load rating linear guide C _{stat}	[N]	38400					

Technical data portal axis		PAS43SB					
Load rating linear guide C_{dyn}	[N]	22300					
Load rating ball screw drive C_{stat}	[N]	25300	18400	11600	25300	18400	11600
Load rating ball screw drive C_{dyn}	[N]	17000	13000	8600	17000	13000	8600
Service life 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

Technical data 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	

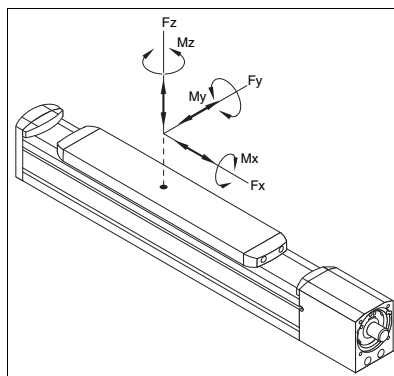
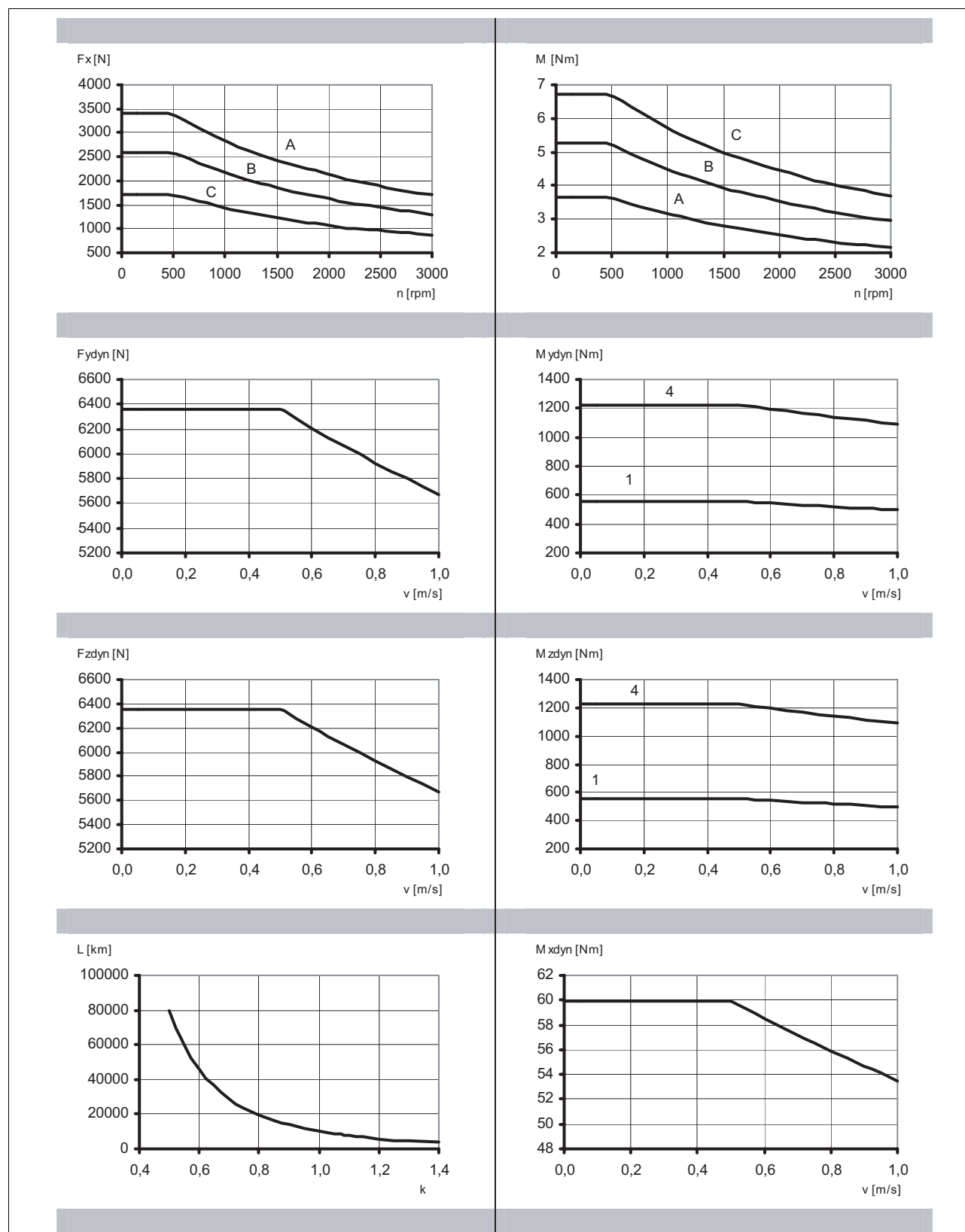


Figure 3.4 Forces and torques

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

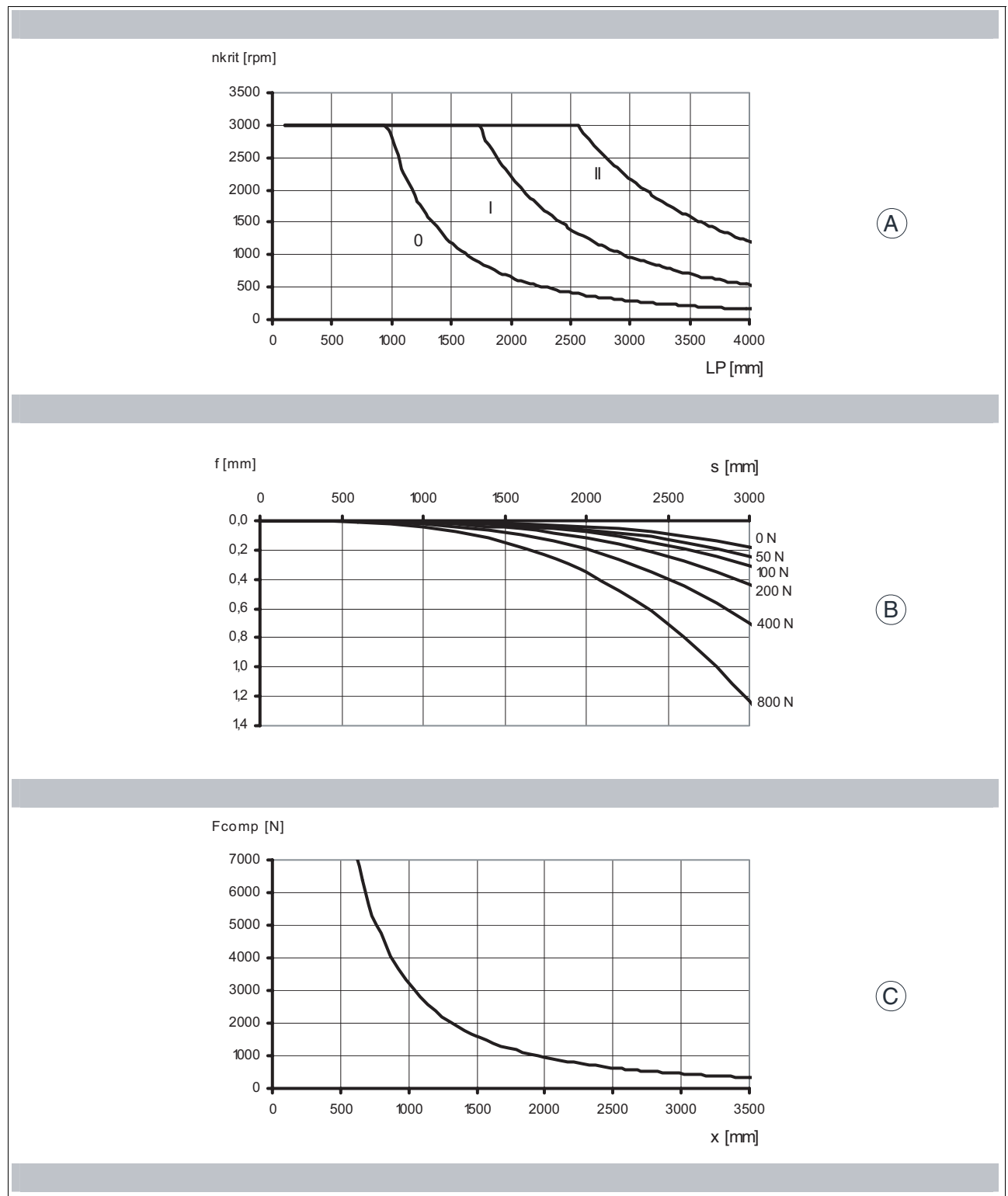


Figure 3.5 Speed of rotation of ball screw, deflection, buckling strength, PAS43SB

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

Dimensional drawings PAS43SB

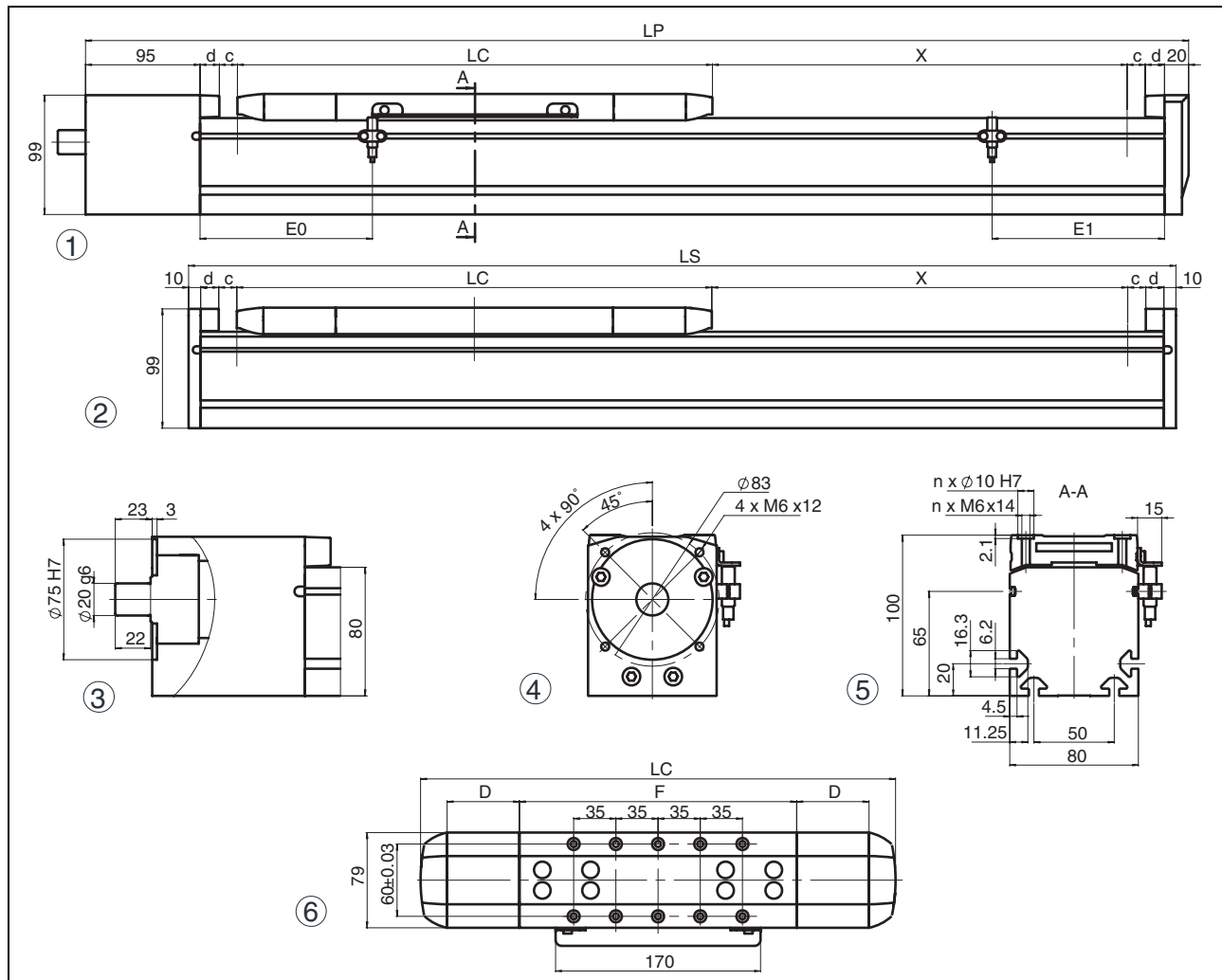


Figure 3.6 Dimensional drawing PAS43SB

- (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)

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 technical data							
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 up to mechanical stop	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.

2) Prepared for locating rings (see Accessories)

3.4 PAS44

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

Technical data portal axis		PAS44SB					
Drive element		Ball screw drive (P7 as per DIN 69051 part 3)					
Guide type		Recirculating ball bearing guide SHS25					
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
Diameter ball screw shaft	[mm]	24					
Backlash of the ball screw drive	[mm]	0.04					
Maximum feed force $F_{x_{max}}^{1)}$	[N]	3700	4520	3000	3700	4520	3000
Maximum speed of rotation of ball screw shaft	[min ⁻¹]	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 $F_{y_{dynmax}}^{1)}$	[N]	9040					
Maximum force $F_{z_{dynmax}}^{1)}$	[N]	9040					
Maximum torque $M_{y_{dynmax}}^{1)}$	[Nm]	935			2155		
Maximum torque $M_{z_{dynmax}}^{1)}$	[Nm]	935			2155		
Max. torque $M_{x_{dynmax}}^{1)}$	[Nm]	89					
Mass 0 stroke axis	[kg]	25.1 / 21.2			32.3 / 28.4		
Mass per additional carriage (with axis body and ball screw drive)	[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 stroke ⁴⁾	[mm]	2940 / 3100			2670 / 2830		
Minimum stroke ⁵⁾	[mm]	13					
Repeatability ²⁾	[mm]	± 0.02					
Diameter motor shaft	[mm]	12 ... 25					
Cross section axis body (W x H)	[mm]	110 x 110					
Axial area moment of inertia (I _x / I _y)	[mm ⁴]	50245408 / 6354770					
Modulus of elasticity (aluminum) E	[N/mm ²]	72000					
Load rating linear guide C _{stat}	[N]	52400					

Technical data portal axis		PAS44SB					
Load rating linear guide C_{dyn}	[N]	31700					
Load rating ball screw drive C_{stat}	[N]	30400	31400	19900	30400	31400	19900
Load rating ball screw drive C_{dyn}	[N]	18500	22600	15000	18500	22600	15000
Service life 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

Technical data 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	

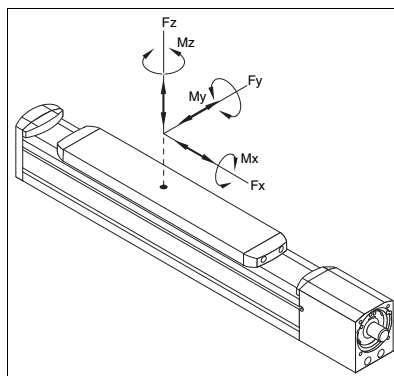
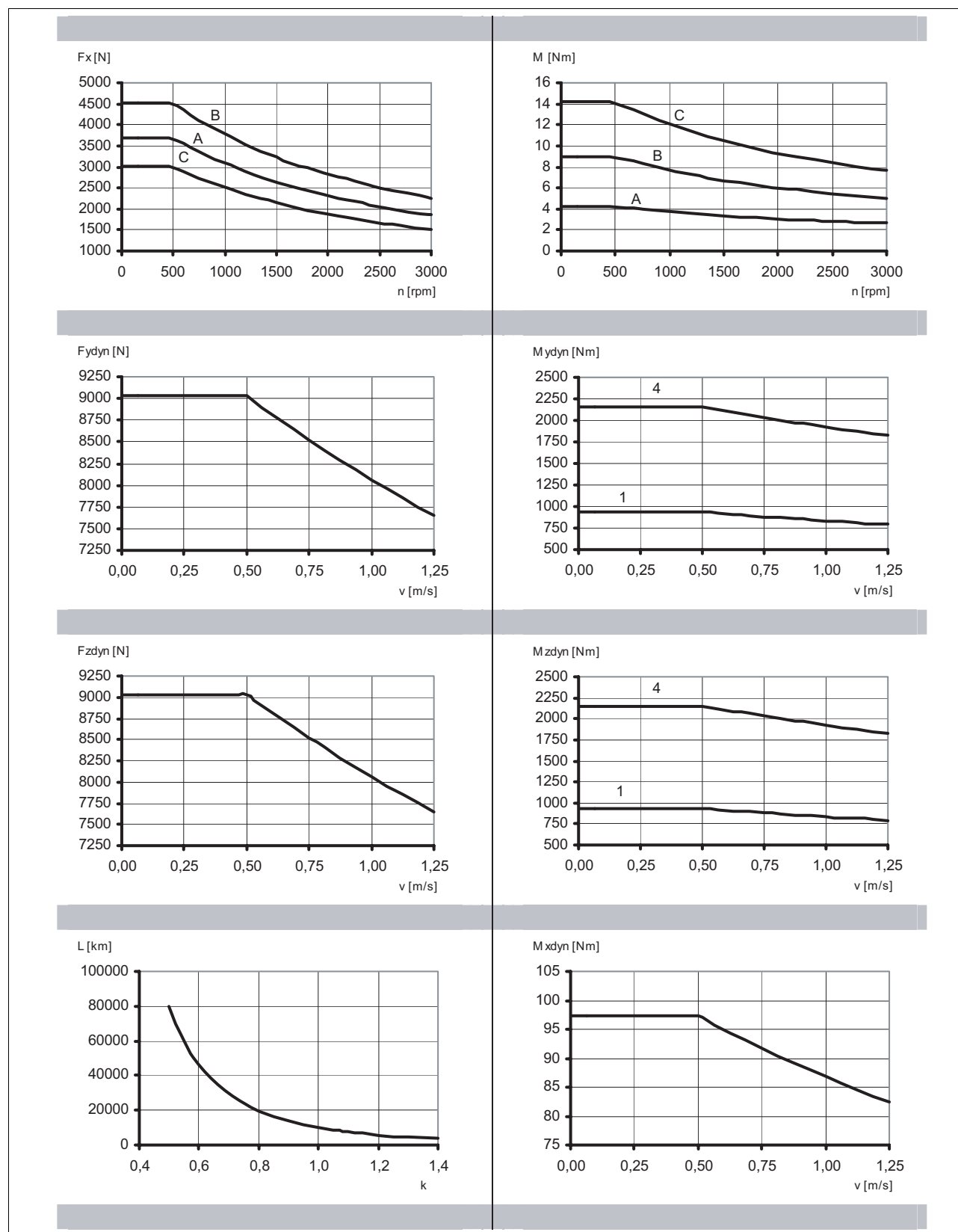


Figure 3.7 Forces and torques

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

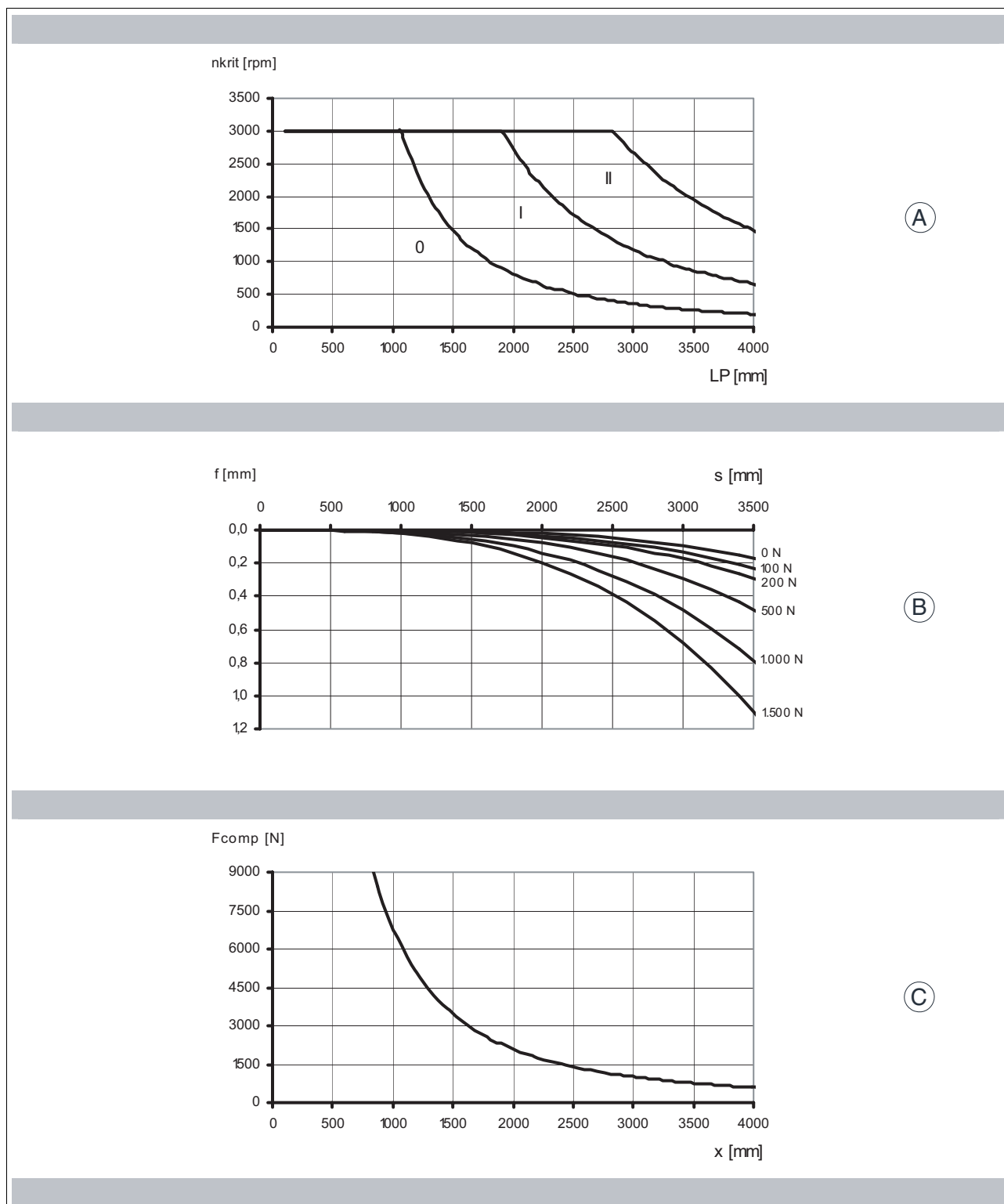


Figure 3.8 Speed of rotation of ball screw, deflection, buckling strength, PAS44SB

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

Dimensional drawings PAS44SB

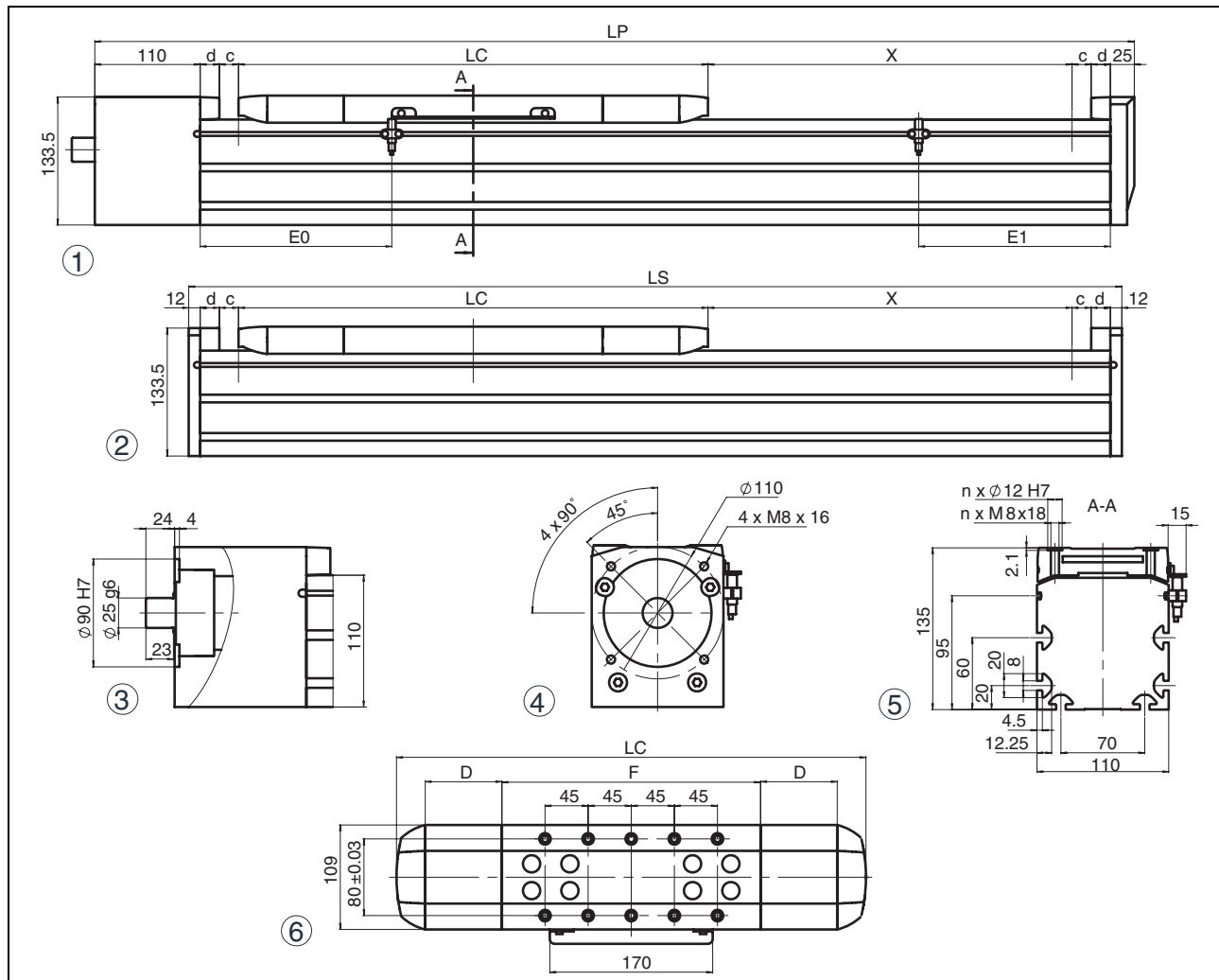


Figure 3.9 Dimensional drawings PAS44SB

- (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 technical data							
Carriage length	LC	[mm]	490	330			760	600		
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 up to mechanical stop	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.

2) Prepared for locating rings (see Accessories)

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 load k .

$$\frac{F_y}{F_{y\max}} + \frac{F_z}{F_{z\max}} + \frac{M_x}{M_{x\max}} + \frac{M_y}{M_{y\max}} + \frac{M_z}{M_{z\max}} = k$$

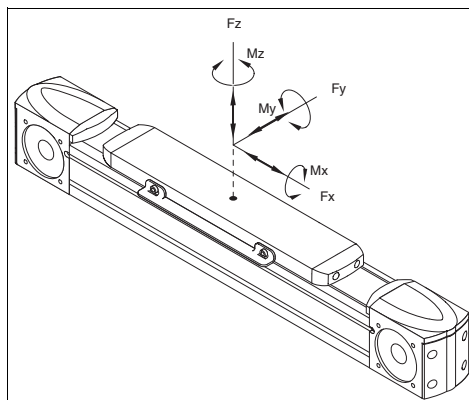


Figure 3.10 Forces and torques

The service life of the axis (in km) can be approximated using the load 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.

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.

4 Installation

WARNING

GREAT MASS OR FALLING PARTS

- Consider the mass of the parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move unexpectedly.

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

WARNING

MOTOR WITHOUT BRAKING EFFECT

If power outage, functions or errors cause the power stage to be switched off, the motor is no longer decelerated in a controlled way and may cause damage.

- 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.

WARNING

HOT SURFACES

The heat sink at the product may heat up to over 100°C (212°F) during operation.

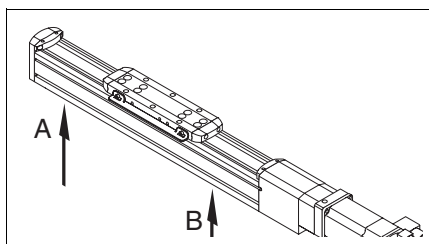
- Avoid contact with the hot heat sink.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.

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

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. They may lead to reduced running accuracy and reduced service life.

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 one fourth 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. Support the motor when lifting the axis.

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 or tilted 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 in mm	Maximum tightening torque in Nm (lb·in)
M3	2.5	1.1 (9.74)
M4	3	2.5 (22.13)
M5	4	5 (44.25)
M6	5	8.5 (75.23)
M8	6	21 (185.87)
M10	8	42 (371.73)
M12	10	70 (619.55)

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:

- If motors with a cross section greater than the cross section of the axis body are used, 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 T slots are used for mounting, the sensor cable cannot be completely routed in the T slots.

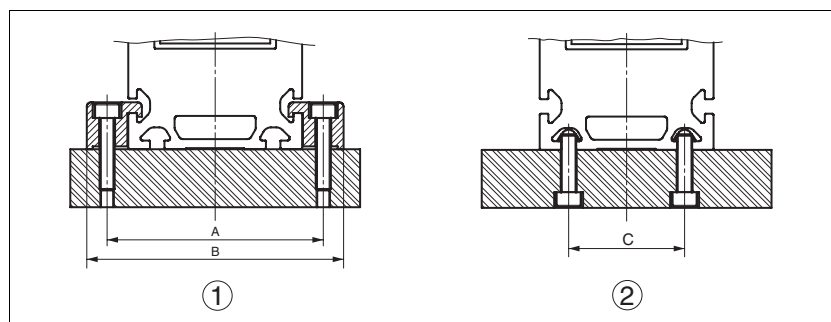


Figure 4.1 Fastening by means of clamping claws (1) and slot nuts from the bottom (2)

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.

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.
- ▶ Start by tightening the fastening screws of the slot nut or clamping claws with a low tightening torque.
- ▶ 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 42.

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.



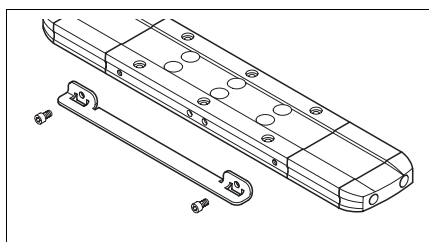
Unless otherwise specified, the standard tightening torques indicated on page 42 apply.

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 hex keys.

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

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 the function to become inoperable.

- 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.



Before mounting

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 drive side end block for inserting the fastening nuts.

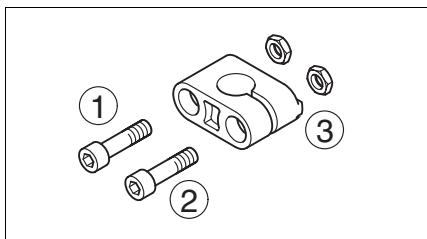
Unless otherwise specified, the standard tightening torques indicated on page 42 apply.

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

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

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

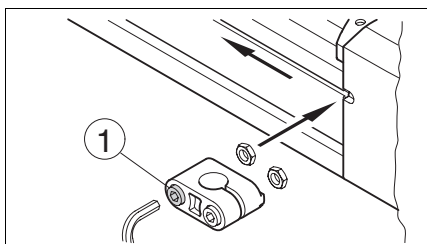
Procedure



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

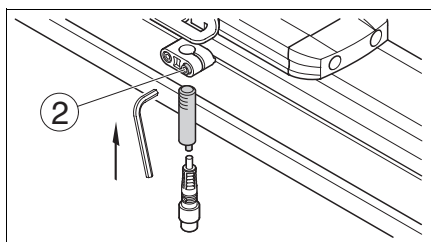
- Screw (1) is used to fasten the sensor holder in the T slot.
- Screw (2) is used to fasten the sensor in the sensor holder.

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 tightening torque of 0.3 (2.66) Nm (lb-in).

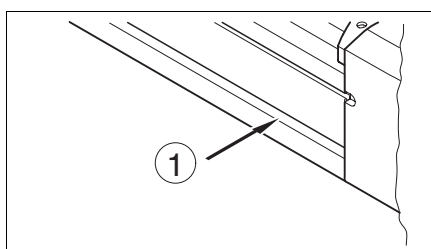
Since the sensor operates inductively, the switching surface must have a specific distance from the contact plate. This so-called "switching distance" amounts to 0.5 ± 0.1 mm.



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

- Route the sensor cable in the T slot.

4.2.5 Mounting the motor and the gearbox

The motor or the gearbox can be mounted in different arrangements (turned in increments of $4 \times 90^\circ$).



Unless otherwise specified, the standard tightening torques indicated on page 42 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] (lb-in)	14 (123.91)	14 (123.91)	35 (309.78)
Mounting dimension	[mm]	13	14	14

Table 4.2 Tightening torques and mounting dimensions clamping hub

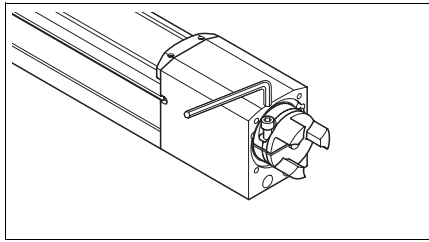
Before mounting

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

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

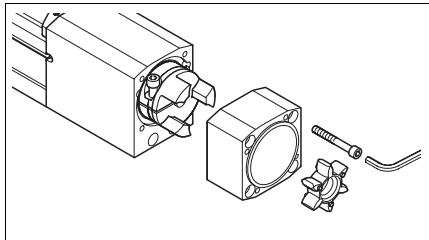
- Clean all parts you will use.
- Check all parts for damage.

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 2 clamping hubs with 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.

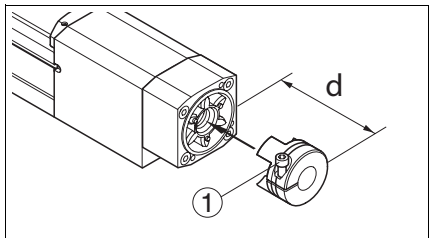


- ▶ Fit the elastomer spider onto the clamping hub.

Slightly greasing the elastomer spider 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.

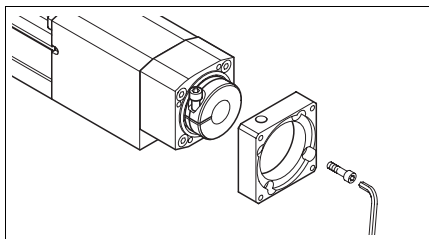
- ▶ Mount the coupling housing with the 4 screws. Verify that the coupling housing has even contact.



- ▶ Fit the second clamping hub.

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

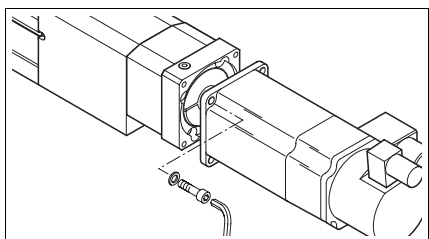
Check the orientation of the clamping screw (1), it should be upwards, if possible. The clamping screw is tightened at a later point in time through the hole in the motor adapter plate.



- ▶ Fit the motor adapter plate with even contact.

Watch out for the position of the hole at the narrow side. The clamping screw of the clamping hub is tightened through this hole.

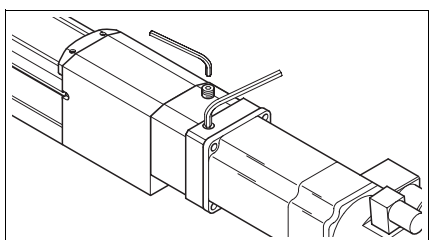
- ▶ Tighten the 4 screws.

Motor mounting only

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

Secure the motor to keep it from falling down.

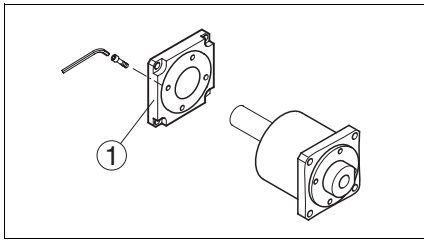
- ▶ Fasten the motor to the motor adapter plate with the 4 screws and washers.



- ▶ Remove the screw plug in the hole at the side of the motor adapter plate.

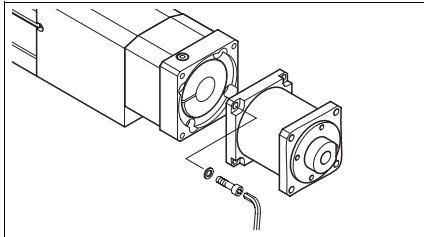
- ▶ Tighten the screw of the clamping hub through the hole with the tightening torque specified in Table 4.2.

- ▶ Close the hole with the screw plug.

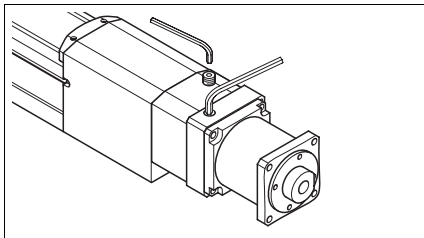
Gearbox mounting only

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.

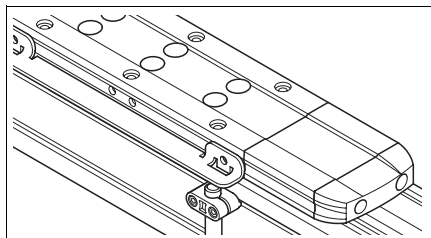


Please refer to the gearbox manual for mounting a motor to the gearbox.

4.2.6 Mounting the payload



Unless otherwise specified, the standard tightening torques indicated on page 42 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

4.3 Electrical installation

4.3.1 Connecting the sensors

The sensors are equipped with an M8 x 1 connector.

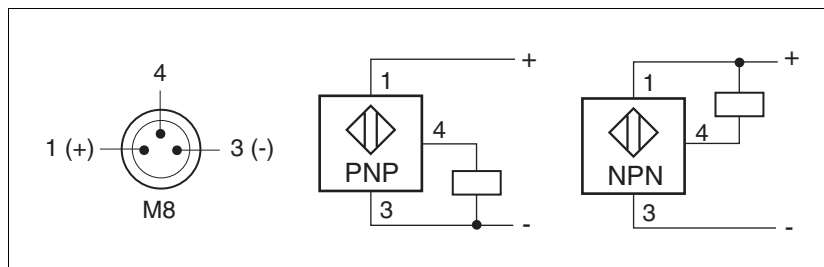


Figure 4.2 Connection assignment sensors

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 fuses?
- Did you isolate all unused cable ends?
- 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?

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 the axis is properly fastened so it cannot come loose even in the case of fast acceleration.
- The carriage of linear axes in vertical or tilted positions may move 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.

5.1 Commissioning procedure



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

- ▶ Verify proper installation, see chapter 4.4 "Checking installation".
- ▶ For commissioning, note the 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.
- ▶ Perform initial tests at reduced velocity. During these tests, verify that the controller responds correctly to the sensors in both directions of movement.
- ▶ Verify that the ambient conditions and actual loads conform to the required and engineering data. See chapter 3.1 "Ambient conditions".

6 Diagnostics and troubleshooting

6.1 Troubleshooting

Problem	Cause	Troubleshooting
Sensor overtraveled	Sensor	Adjust or replace sensors, see page 70
	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 drive.	Speed of rotation too high	Reduce speed of rotation
	Poor lubrication (in the case of noise)	Lubricate, see page 77
	Run-out of the ball screw shaft 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 77
	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

7 Accessories and spare parts



Contact your local sales office if you have questions concerning required spare parts that are not listed.

7.1 Clamping claws

Order data

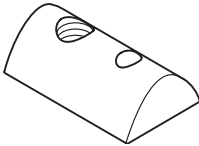
	Description		Order no.
	For mounting the axis body to a mounting surface. Contains 10 piece	For axis ...	
		PAS42	VW33MF10512
		PAS43	VW33MF10613
		PAS44	VW33MF10814

Dimensional drawings

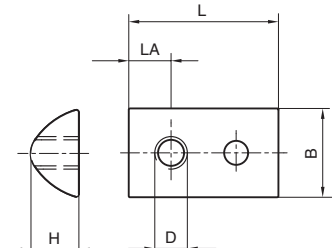
	For axis ...	A	B	B1	B2	D1	D2	H	H1	L	LA1
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
	PAS42	18	19	14	7	10	5.5	16.2	5.4	76	40
	PAS43	18	24	16	8	11	6.6	21.5	6.4	76	40
	PAS44	18	28	20	10	15	9	22	12	76	40

7.2 Slot nuts

Order data

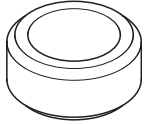
	Description			Order no.
	The slot nuts are inserted into the T-slots of the axis body to fasten the axis or parts of the axis. Contains 10 piece	For axis ...	Slot nut type	
			5 pieces M5	VW33MF010T5N5
		PAS43	6 pieces M6	VW33MF010T6N6
		PAS44	8 pieces M6	VW33MF010T8N6
			8 pieces M8	VW33MF010T8N8

Dimensional drawings

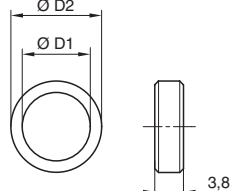
	For axis ...	Slot nut type	B	D	H	L	LA
			mm	mm	mm	mm	mm
	PAS42	5 pieces M5	8	5	4	11.5	4
	PAS43	6 pieces M6	10.6	6	6.4	17	5.5
	PAS44	8 pieces M6	13.8	6	7.3	23	6.5
		8 pieces M8	13.8	8	7.3	23	7.5

7.3 Locating dowels

Order data

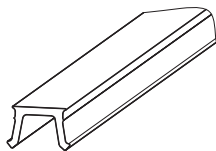
	Description		Order no.
	For precise and reproducible mounting of the payload, the locating dowels are inserted into the holes at the carriage. Contains 20 piece	For axis ...	
		PAS42	VW33MF020LD01
		PAS43	VW33MF020LD02
		PAS44	VW33MF020LD03

Dimensional drawings

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

7.4 T slot covers

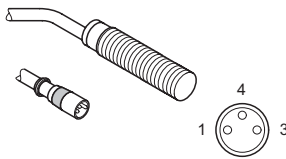
Order data

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

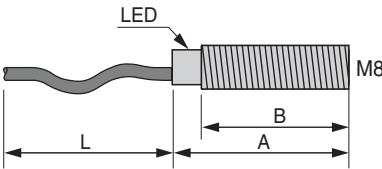
7.5 Sensors and additional parts

7.5.1 Sensors

Order data

	Description		Order no.
	With signal display with 100 mm cable and 3-pin M8 circular plug-in connector. 1 piece	PNP, normally closed contact	XS508B1PBP01M8
		PNP, normally open contact	XS508B1PAP01M8
		NPN, normally closed contact	XS508B1NBP01M8
		NPN, normally open contact	XS508B1NAP01M8

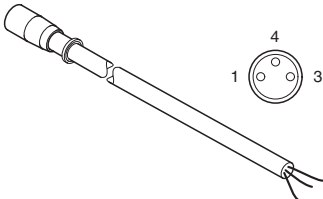
Dimensional drawings

	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.		

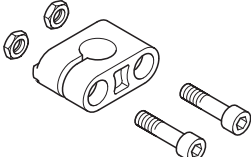
Technical data

Model		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

7.5.2 Sensor extension cable*Order data*

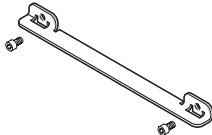
	Description		Order no.
	Suitable for drag chain applications; sensor side end 3-pin M8 circular connector, second cable end open Contains 1 piece	5 m	VW32SBCBGA050
		10 m	VW32SBCBGA100
		20 m	VW32SBCBGA200

7.5.3 Sensor holder*Order data*

	Description	Order no.
	For standard limit switch with 8 mm diameter; movable Contains 10 piece	VW33MF010M8

7.5.4 Contact plate

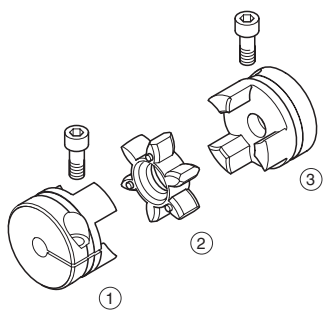
Order data

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

7.6 Coupling assemblies

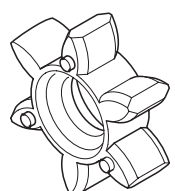


Observe the maximum permissible driving torque of the linear axis. The coupling elements can transmit a greater torque than the linear axis can accept.

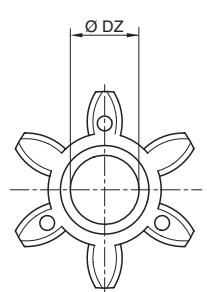
 <p>Coupling assembly (1) Clamping hub (2) Elastomer spider (3) Clamping hub</p>	<p>Coupling assemblies are required to mount motors to axes.</p> <p>A coupling assembly consists of the following components:</p> <ul style="list-style-type: none"> • 2 clamping hubs, one each for ball screw end and motor 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 Contains 1 piece	For axis ...	
		PAS42	SPM3MFR14A034
		PAS43	SPM3MFR20A120
		PAS44	SPM3MFR25A320

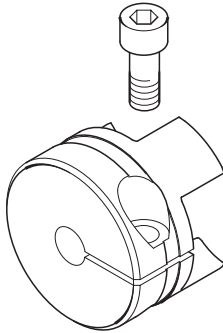
Dimensional drawings

		Shore hardness	Max. torque	Nominal torque	Moment of inertia	Diameter
			M_{max}	M_N	J	DZ
	For axis ...		Nm	Nm	kgcm ²	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

7.6.2 Clamping hubs

Order data

Description			Order no.	
Clamping hub				
Contains 1 piece				
For axis ...	D1 (mm) ¹⁾	M _{max} (Nm)		
	Please inquire for other diameters	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"

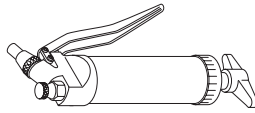
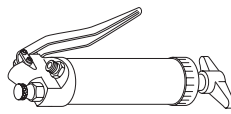
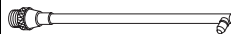
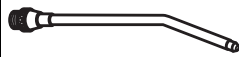
Dimensional drawings

	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 (lb-in)	mm						
	PAS42	0.15	M6	5	14 (123.91)	31	17	8	¹⁾	40	45	14
	PAS43	0.55	M6	5	14 (123.91)	36	20	10	¹⁾	55	57.5	20
	PAS44	1.22	M8	6	35 (309.78)	39	21	9	¹⁾	65	73	25

1) see order data

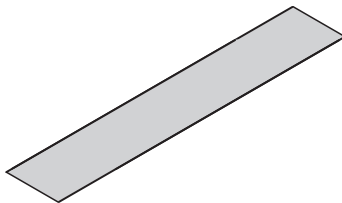
7.7 Grease guns

Order data

Designation	Description	Order no.
Single-hand high-pressure grease gun 	With nozzle for the lubrication of the linear axes with recirculating ball bearing guide. 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 guide. 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

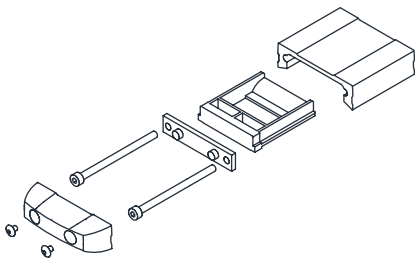
7.8 Cover strips

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

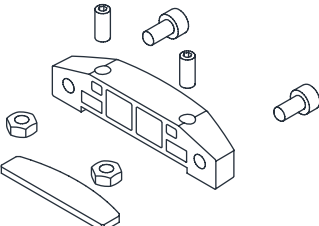
7.9 Strip deflection

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

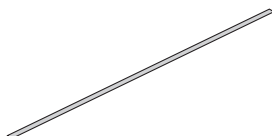
7.10 Cover strip clamp

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

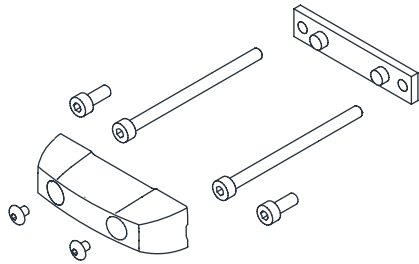
Order data



Description				Order no.
Contains 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

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

8 Service, maintenance and disposal

⚠ WARNING

GREAT MASS OR FALLING PARTS

- Consider the mass of the parts when mounting them. It may be necessary to use a crane.
- Mount the parts in such a way (tightening torque, securing screws) that they cannot come loose even in the case of fast acceleration or continuous vibration.
- Take into consideration that axes installed in vertical or tilted positions may move 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 Checks after collisions

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.

8.2.1 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 8.3.4 "Replacing the cover strip and the strip deflection".



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

8.2.2 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.

8.2.3 Linear guide

The linear guide consists of the guide carriage and the recirculating ball bearing guide.

- ▶ Check the guide carriage for play. If the guide carriage has, the pre-tension has been changed. The pre-tension of the guide carriage can only be adjusted by the manufacture. Note the serial number of the linear axis and contact your local sales office.
- ▶ Perform a visual inspection of the linear guide for damage. To do so, remove the cover strip as described in chapter 8.3.4 "Replacing the cover strip and the strip deflection".
- ▶ Check for irregular noise or vibration. Irregular noise or vibration indicates a deformation in the linear guide. Deformation will cause rapid wear.



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

8.2.4 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 8.3.2 "Replacing the motor or the gearbox".

NOTE: A damaged elastomer coupling must be replaced. See chapter 8.3.3 "Replacing the elastomer coupling" for the procedure.

8.3 Replacing parts

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

To replace the entire axis, install the new axis as per see chapter 4 "Installation".

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

8.3.1 Replacing a sensor

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

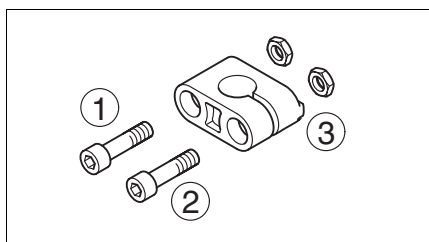


Unless otherwise specified, the standard tightening torques indicated on page 42 apply.

Prerequisites

See chapter 7 "Accessories and spare parts" for suitable spare parts.
You need a set of hex 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 45.

8.3.2 Replacing the motor or the gearbox

⚠ WARNING

UNEXPECTED MOVEMENTS DUE TO DISMOUNTING

Dismounting parts can cause unexpected movements.

- In the case of a linear axis installed in a vertical or tilted position, secure the moving parts to keep them from moving 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.



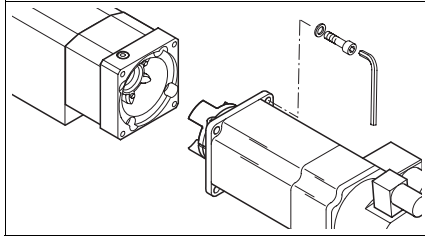
Unless otherwise specified, the standard tightening torques indicated on page 42 apply.

Prerequisites

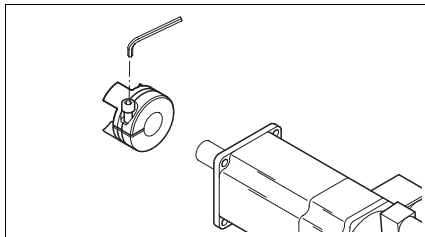
See chapter 7 "Accessories and spare parts" for suitable spare parts.
You need a set of hex keys and a torque wrench with hexagon socket.

NOTE Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

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.

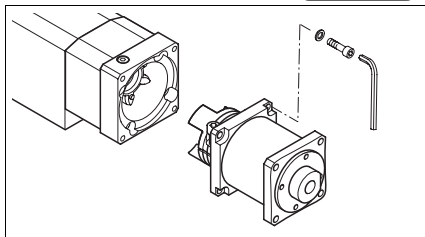


- ▶ Loosen the clamping screw at the clamping hub.
- ▶ Pull the clamping hub off the motor shaft.

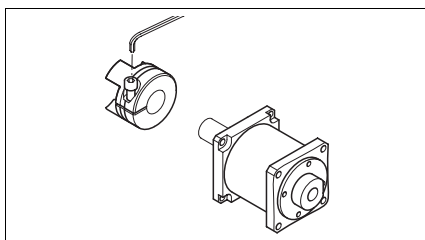
Dismounting, gearbox only



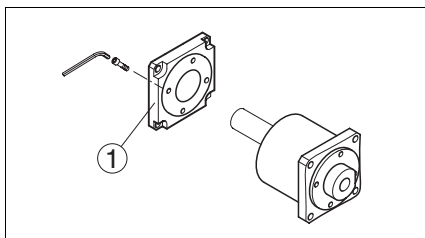
See the gearbox manual for details on removing a motor from the gearbox.



- ▶ 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 46.

NOTE Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.



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

8.3.3 Replacing the elastomer coupling



Unless otherwise specified, the standard tightening torques indicated on page 42 apply.

Prerequisites

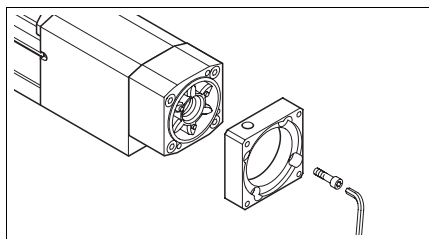
See chapter 7 "Accessories and spare parts" for suitable spare parts.

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

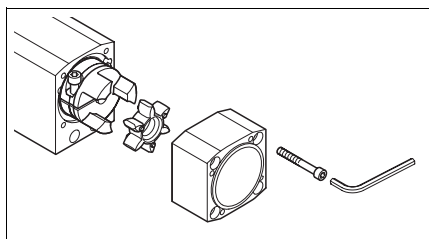
NOTE Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

Procedure

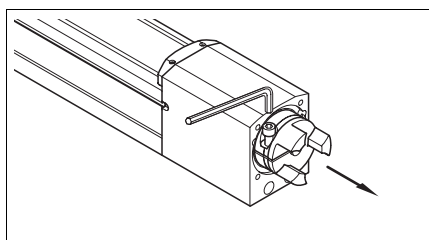
- ▶ Dismount the motor or the gearbox as described in chapter 8.3.2 "Replacing the motor or the gearbox".



- ▶ 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 46.

8.3.4 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 42 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] (lb·in)	0.6 5.31	1.0 8.85	1.5 13.28	3 26.55

Table 8.1 Tightening torques cover strip clamp

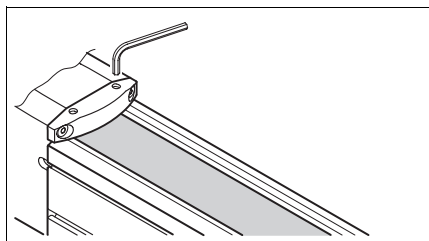
Clamping plate		PAS41	PAS42	PAS43	PAS44
Set screw DIN 913 - 45H		M3 x 10	M4 x 10	M5 x 16	M6 x 20
Wrench size	[mm]	2.5	3	4	5
Tightening torque	[Nm] (lb·in)	0.2 1.77	0.3 2.66	0.4 3.54	0.5 4.43

Table 8.2 Tightening torque 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.

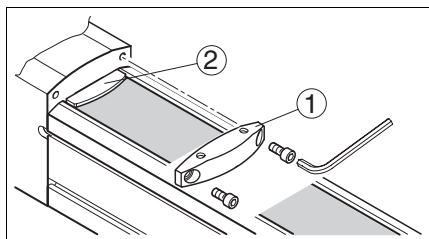
NOTE Do not use ball head hex keys. Excessive torque may cause the ball head to tear off. A torn off ball head is difficult to remove from the screw.

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

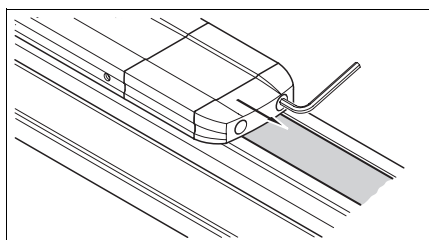


2 set screws at the cover strip clamp fixate the clamping plate below and the cover strip.

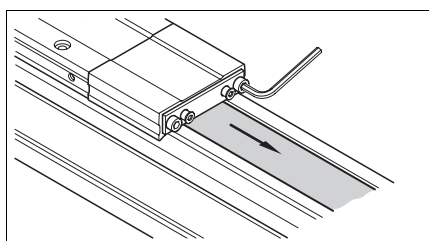
- ▶ Loosen the two set screws.



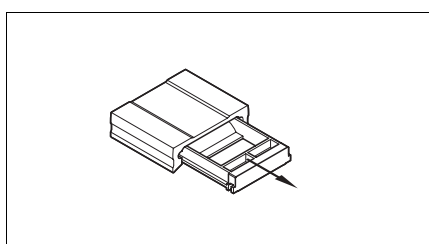
- ▶ Remove the cover strip clamp (1). To do so, loosen the two screws. Keep the screws and the clamping plate (2) from falling down.



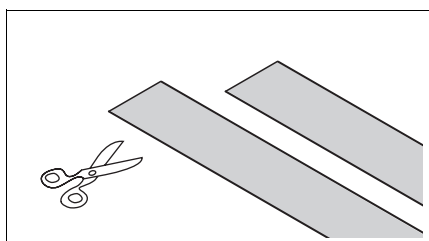
- ▶ Remove the rubber buffer at the strip deflection. To do so, loosen the two screws.



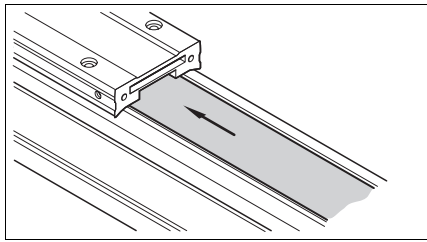
- ▶ Remove the holding plate together with the strip deflection. To do so, loosen the two screws.
- ▶ Pull out the entire cover strip.



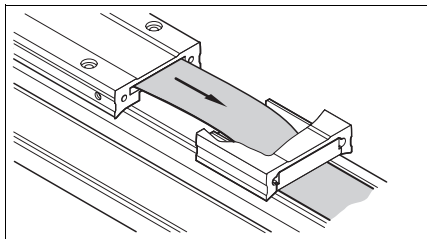
- ▶ Remove the plastic unit from the housing of the strip deflection.
- ▶ Insert the new plastic unit into the housing of the strip deflection.



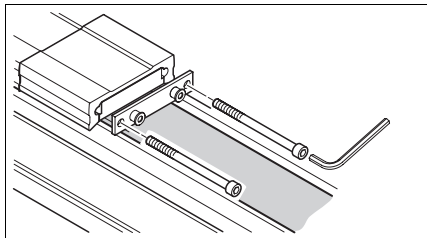
- ▶ Cut the new cover strip to the same length as the old cover strip with the tin snips.



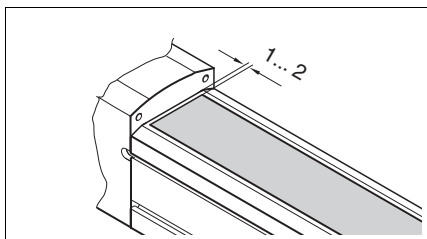
- Guide the new cover strip through the guide channel inside the carriage.



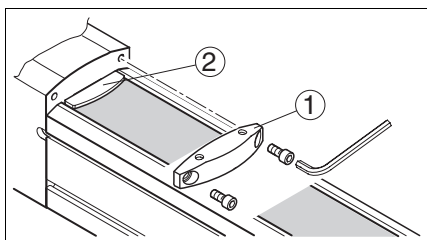
- Guide the new cover strip through the strip deflections.



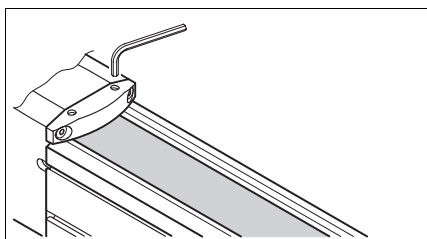
- Place the holding plate for mounting the rubber buffer into position at the strip deflection.
- Screw the strip deflection into place.
When doing so, align the strip deflection and the carriage.



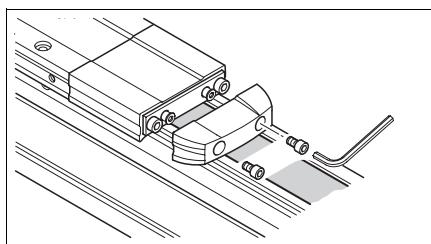
- Place the cover strip over the entire length of the axis body.
Align the cover strip symmetrically. The distance from the two end blocks should amount to 1 ... 2mm.
Verify that the cover strip has even contact with the magnetic strips.



- Fit the clamping plate (2) into place.
- Screw the cover strip clamp (1) into place with the tightening torque specified in Table 8.1.



- Tighten the two set screws for holding the clamping plate with the tightening torque specified in Table 8.2.



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

Test movements

- ▶ Run initial tests at reduced velocity.

8.4 Maintenance

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

- ▶ Include the maintenance intervals in your maintenance schedule.

8.4.1 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 checked 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.

8.4.2 Lubrication

CAUTION

DAMAGE DUE TO INCORRECT LUBRICANT

Incorrect lubricants may damage the product.

- Use the correct type of lubricant (grease, oil) as specified.

Failure to follow these instructions can result in equipment damage.

Lubricant is consumed continuously during operation of the linear axis. The product must be lubricated at regular intervals.

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

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

8.4.3 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

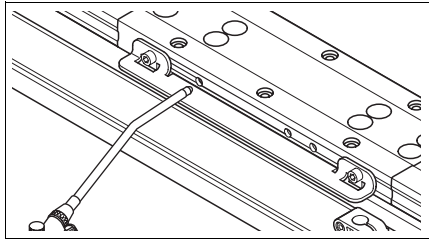
Drive elements • 100 km at a screw pitch of 5 mm
• 200 km at a screw pitch of 10 mm
• 400 km at a screw pitch of 16 mm

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

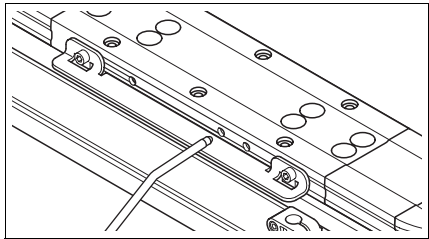
See chapter 7 "Accessories and spare parts" for grease guns, nozzles and lubricants.

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.

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.

8.5 Shipping, storage, disposal

Note the ambient conditions on page 21.

- | | |
|-----------------|---|
| <i>Shipping</i> | The product must be protected against shocks during transportation. If possible, use the original packaging for shipping. |
| <i>Storage</i> | The product may only be stored in spaces where the specified permissible ambient conditions are met.
Protect the product from dust and dirt. |
| <i>Disposal</i> | 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. |

9 Glossary

9.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters [m] to yards [yd]

5 m / 0.9144 = 5.468 yd

9.1.1 Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

9.1.2 Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* 1.942559*10 ⁻³	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ 1.942559*10 ⁻³	-	* 14.5939	* 14593.9
kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

9.1.3 Force

	lb	oz	p	dyne	N
lb	-	* 16	* 453.55358	* 444822.2	* 4.448222
oz	/ 16	-	* 28.349524	* 27801	* 0.27801
p	/ 453.55358	/ 28.349524	-	* 980.7	* 9.807*10 ⁻³
dyne	/ 444822.2	/ 27801	/ 980.7	-	/ 100*10 ³
N	/ 4.448222	/ 0.27801	/ 9.807*10 ⁻³	* 100*10 ³	-

9.1.4 Power

	HP	W
HP	-	* 746
W	/ 746	-

9.1.5 Rotation

	min ⁻¹ (RPM)	rad/s	deg./s
min ⁻¹ (RPM)	-	* $\pi / 30$	* 6
rad/s	* $30 / \pi$	-	* 57.295
deg./s	/ 6	/ 57.295	-

9.1.6 Torque

	lb-in	lb-ft	oz-in	Nm	kp-m	kp-cm	dyne-cm
lb-in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129 \cdot 10^6$
lb-ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558 \cdot 10^6$
oz-in	/ 16	/ 192	-	* $7.0616 \cdot 10^{-3}$	* $720.07 \cdot 10^{-6}$	* $72.007 \cdot 10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616 \cdot 10^{-3}$	-	* 0.101972	* 10.1972	* $10 \cdot 10^6$
kp-m	/ 0.011521	/ 0.138255	/ $720.07 \cdot 10^{-6}$	/ 0.101972	-	* 100	* $98.066 \cdot 10^6$
kp-cm	/ 1.1521	/ 13.8255	/ $72.007 \cdot 10^{-3}$	/ 10.1972	/ 100	-	* $0.9806 \cdot 10^6$
dyne-cm	/ $1.129 \cdot 10^6$	/ $13.558 \cdot 10^6$	/ 70615.5	/ $10 \cdot 10^6$	/ $98.066 \cdot 10^6$	/ $0.9806 \cdot 10^6$	-

9.1.7 Moment of inertia

	lb-in ²	lb-ft ²	kg-m ²	kg-cm ²	kp-cm-s ²	oz-in ²
lb-in ²	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb-ft ²	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg-m ²	* 3417.16	/ 0.04214	-	* $10 \cdot 10^3$	* 10.1972	* 54674
kg-cm ²	* 0.341716	/ 421.4	/ $10 \cdot 10^3$	-	/ 980.665	* 5.46
kp-cm-s ²	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz-in ²	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

9.1.8 Temperature

	°F	°C	K
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

9.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm ²	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm ²	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

9.2 Terms and Abbreviations

	See chapter 2.5 "Standards and terminology" for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.
<i>Axis body</i>	The axis body is an aluminum precision profile.
<i>Ball screw drive</i>	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.
<i>Ball screw pitch</i>	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: <ul style="list-style-type: none"> • High pitch requires high driving torque • High pitch results in high velocity • High pitch causes high inaccuracy
<i>Breakaway torque</i>	The breakaway torque describes the driving torque required to overcome the static friction and that initiates the transition to sliding friction.
<i>Buckling stress</i>	Buckling is the loss of stability of the ball screw when the maximum permissible thrust forces whose line of application is along the axis of the ballscrew axis is exceeded. Excessive buckling stress results in a rapidly increasing deformation and deflection of the ballscrew.
<i>Cantilever axis</i>	In the case of a cantilever axis, the carriage is stationary while the axis body moves. Portal axes work the other way round.
<i>Critical speed of the ball screw shaft</i>	If the critical speed of the ball screw shaft 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 linear axes to increase the critical speed of the ball screw shaft speed and thus the performance data.
<i>DOM</i>	(Date of manufacture). The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. Example: 31.12.09 corresponds to December 31, 2009 31.12.2009 corresponds to December 31, 2009
<i>Degree of protection</i>	The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).
<i>Direction of rotation</i>	Rotation of the motor shaft in a positive or negative direction of rotation. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.
<i>Drive element</i>	The drive element of the linear axis is a ball screw drive.
<i>Error class</i>	Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.
<i>Fatal error</i>	In the case of fatal error, the product is no longer able to control the motor so that the power stage must be immediately disabled.

<i>Fault</i>	Fault is a state that can be caused by an error. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).
<i>Fault reset</i>	A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.
<i>Feed per revolution</i>	The feed per revolution is the distance the carriage covers per motor revolution.
<i>Linear guide</i>	The linear guide consists of the guide carriage and the recirculating ball bearing guide.
<i>Load torque</i>	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.
<i>Modulus of elasticity</i>	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.
<i>Portal axis</i>	In the case of a portal axis, the axis body is stationary while the carriage moves. Cantilever axes work the other way round.
<i>Positioning accuracy</i>	Positioning accuracy is the tolerance between the specified position and actual position.
<i>Recirculating ball bearing</i>	The axis axis body absorbs the forces and torques applied at the carriage via the recirculating ball bearing guide. The recirculating ball bearing guide can absorb high forces and torques.
<i>Repeatability</i>	Repeatability is the accuracy with which it is possible to move to a previous position again under the same conditions.
<i>Running accuracy</i>	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.
<i>Sensor</i>	Inductive proximity switches are used as sensors for limit switches or reference switches. These switches are not a safety function.
<i>Service life</i>	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.
<i>Stiffness</i>	Stiffness is a measure of the ability to move and hold with high position accuracy a part to be positioned even when the load changes.
<i>Stroke reserve</i>	The stroke reserve is the distance between a limit switch and the mechanical stop.
<i>Stroke</i>	Stroke is the maximum travel of the carriage between the switching points of the limit switches.
<i>Support axis</i>	A support axis has linear guides, 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.

Warning If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning is not an error and does not cause a transition of the operating state.

10 Index

10

A

- Abbreviations 83
- Accessories and spare parts 55
- Air humidity 21
- Alignment 44
- Ambient conditions 21
 - Air humidity operation 21
 - Installation altitude 21
 - Operation 21
 - Relative air humidity operation 21
 - Transportation and storage 21
- Axis body 83

B

- Ball screw drive 83
- Ball screw pitch 83
- Before you begin
 - Safety information 17
- Breakaway torque 83
- Buckling stress 83

C

- Cantilever axis 83
- Commissioning 51
 - steps 52
- Connection
 - Motor 50
- Cover strip
 - Replacing 73
- Critical speed of the ball screw 83

D

- Degree of protection 21
- Diagnostics 53
- Disposal 67, 79
- Drive element 83
- Drive elements
 - Lubrication 78

E

- Elastomer coupling 72
- Elastomer coupling, replacing the 72
- Electrical installation 50
- EPLAN Macros 7

F

- Feed per revolution 84

G

Gearbox
 Replacement 70
Glossary 81

H

Hazard categories 18
Humidity 21

I

Installation
 electrical 50
 mechanical 42
Intended use 17
Introduction 9
IP degree of protection 21

L

Linear guide 84
 Lubrication 78
Load torque 84
Lubrication
 Drive elements 78
 Linear guide 78

M

Macros EPLAN 7
Maintenance 67
Manuals
 Source 7
Maximum humidity operation 21
Mechanical installation 42
Modulus of elasticity 84
Motor
 Replacement 70
Mounting
 Contact plate 44
 Customer application 49
 Gearbox 46
 Linear axis 43
 Motor 46
 Sensor 45

O

Operation, ambient temperature 21

P

Portal axis 84
Positioning accuracy 84

Q

Qualification of personnel 17

R

- Recirculating ball bearing 84
- Relative air humidity 21
- Repeatability 84
- Replacement
 - Cover strip 73
 - Gearbox 70
 - Motor 70
 - Sensor 70
 - Strip deflection 73
- Replacing the elastomer coupling 72
- Running accuracy 44, 84

S

- Sensor 84
 - Replacement 70
- Service 67
- Service address 67
- Service life 84
- Shipping 79
- Source
 - EPLAN Macros 7
 - Manuals 7
- Standard tightening torques 42
- Stiffness 84
- Storage 79
 - Ambient conditions 21
- Strip deflection
 - Replacing 73
- Stroke 84
- Stroke reserve 84
- Support axis 84

T

- Technical data 21
- Temperature during operation 21
- Terms 83
- Tightening torques
 - Standard 42
- Transportation
 - Ambient conditions 21
- Troubleshooting 53
- Type code 12

U

- Units and conversion tables 81

V

- Vacuum 21

