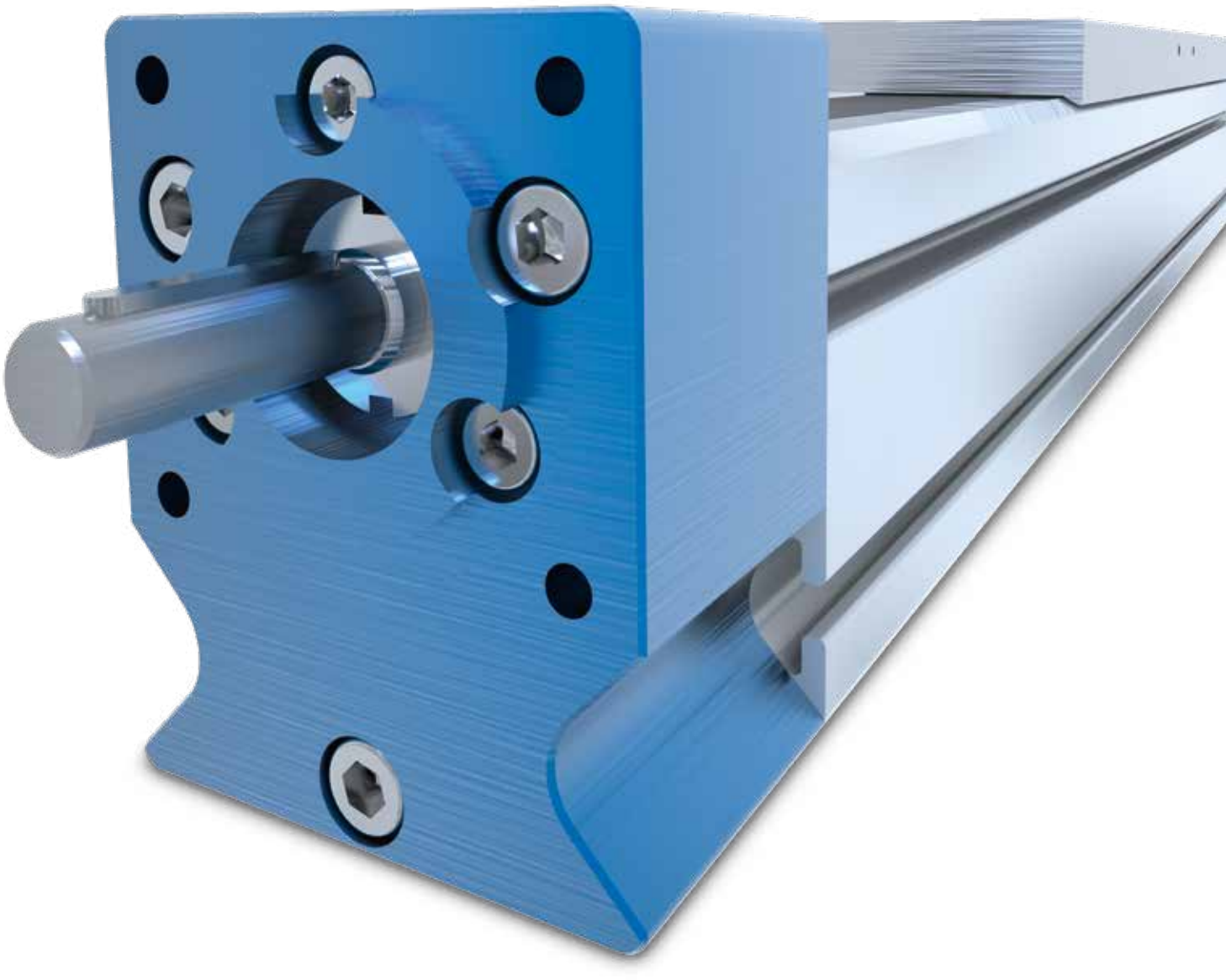
NADELLA ROLLON BY TIMKEN

LINEAR MODULES



SUMMARY

THE SPECIALIST FOR MOTION TECHNOLOGY

NADELLA has developed over time from a supplier of rolling bearings, linear guide components and linear axes into an expert system partner for all areas of motion technology. Wherever innovative ideas, precision and reliability are required, developers and design engineers rely on products from NADELLA. Our customers now include renowned mechanical engineering, plant construction and automation engineering companies in Germany, Europe, Asia and the USA.

FULL SERVICE AND JUST IN TIME

We consider ourselves to be a full-service partner – from development of a product through production and all the way to logistics. Our established network guarantees efficient processes in all areas and throughout the value-added chain – all from a single source. Additionally, express deliveries or fast and inexpensive special treatment of catalogue parts is also possible. This also applies to small and medium quantities.

EXPERIENCE AND KNOW-HOW

Professional operations and application consultation are just a few of our distinguishing characteristics: Our consulting engineers collaborate closely with our customers' experts, actively contributing their specialist expertise, their experience and the technical possibilities. This results in custom solutions that set standards.

MAXIMUM QUALITY AND CERTIFIED ENVIRONMENTAL MANAGEMENT

Maximum quality is our top priority. That is why every process step is accompanied and regularly checked by expert employees. All companies and plants are certified according to DIN EN ISO 9001 or ISO/TS 16949, and their environmental management systems comply with DIN EN ISO 14001. We also have the latest measuring and testing equipment at our disposal to ensure that our high quality standards are met over the long term.

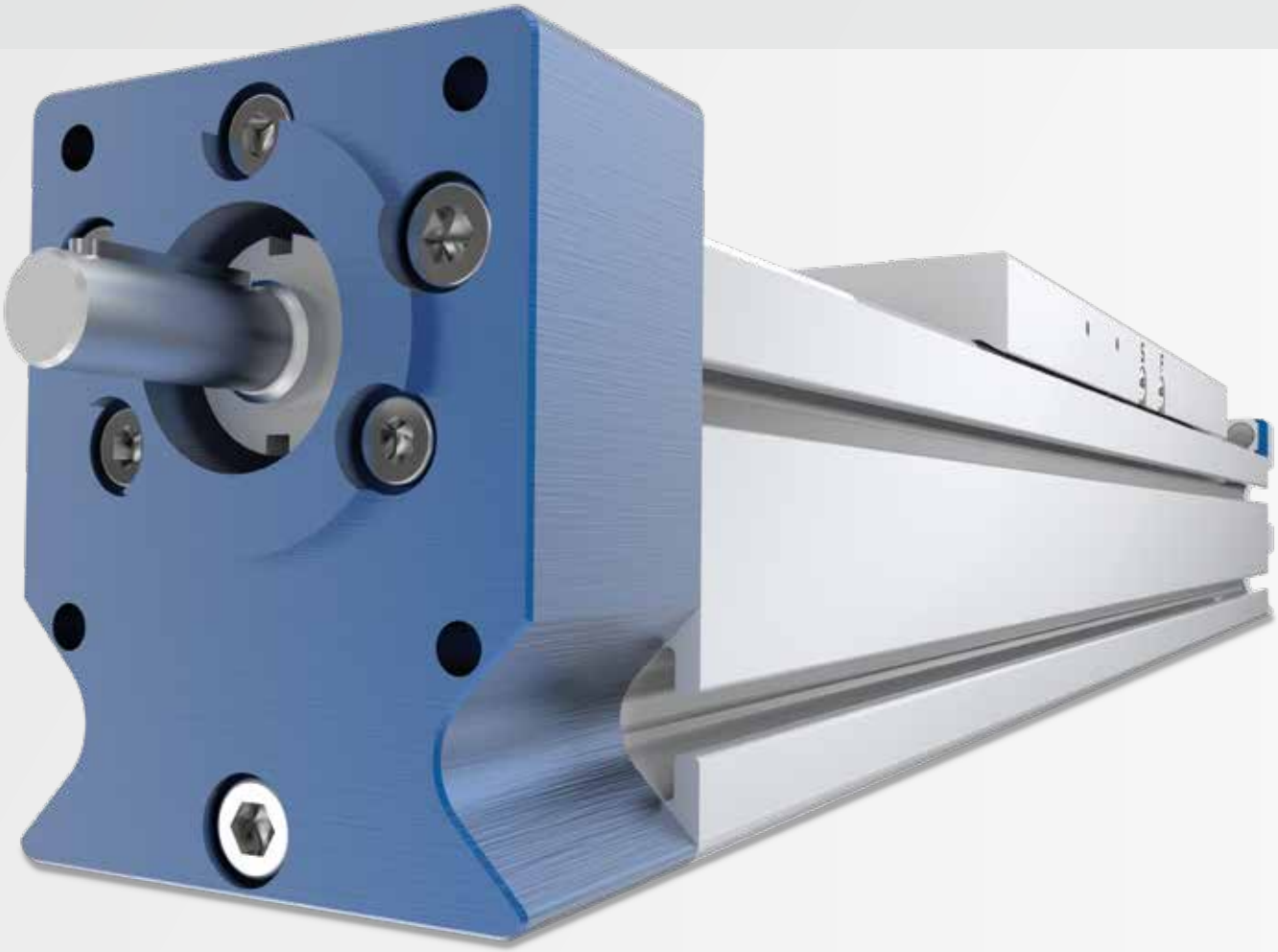
- CAQ system
- 3-D CNC measuring machines
- Force testing
- Radiographic inspection
- Microsection analysis
- Materials testing on metal and plastic

VDMA Mitglied Member

EQ ZERT ISO 9001:2008 ISO 9001 DIN EN ISO 9001 ZERTIFIZIERT zertifiziertes Qualitätsmanagementsystem

EQ ZERT EN ISO 14001 ISO 14001 DIN EN ISO 14001 ZERTIFIZIERT zertifiziertes Umweltmanagementsystem

1



BASIC-LINE
AXNP-S

2

BASIC-LINE AXNP-S
PRODUCT DESCRIPTION

The model range AXNP-S is a further development of our approved AXN / AXNP-Z series with toothed belt drive. The modules have been developed especially for handling and positioning, primarily for precise positioning and vertical applications. If individual module or multiple axis system - various combinations are possible.

DIRT PROTECTION

On the upper side the actuator is completely covered by a cover band which is clipped in the profile so that it prevents dirt particles from penetrating into the module. Wiper brushes integrated in the table plate as well as an overlapping of the table plate over the main profile minimize the gap additionally.

MOTOR CONNECTION

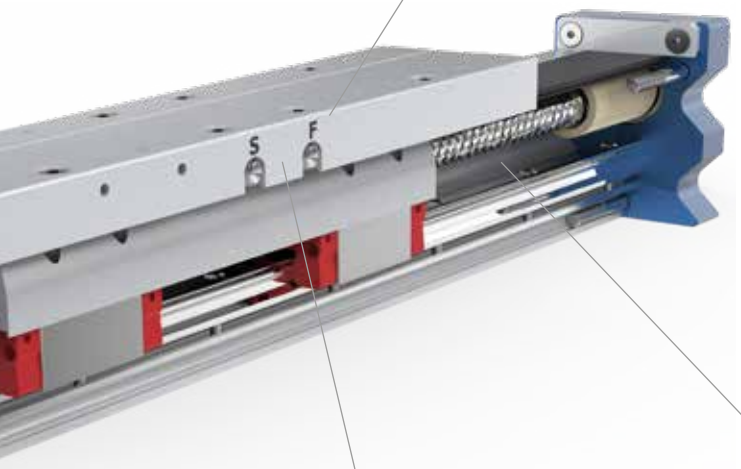
A motor can be mounted through a flange / coupling combination which is availabe for many motor types. If technically possible also special motors can be connected.

RAIL GUIDE

The AXNP-S series is equipped with high-quality ball rail systems. The advantages of these rail guides are long service life, low noise level, high guidance accuracy and high load values. For statically cycling of the guide systems the dynamic load rating is decisive for the dimensioning of the guide systems.

FIXATION OF THE ACTUATOR AND ATTACHEMENTS

By end-to-end slots at the bottom and on either side of the acutator profile a universal installation of the module is possible. Slot nuts that can be swivelled in, fastening strips and connecting plates increase the mounting flexibility. Attachments can simply be screwed through threads in the table plate. Alternatively the Basic-Line can be extended by an additional, non-driven carriage.



SCREW DRIVE

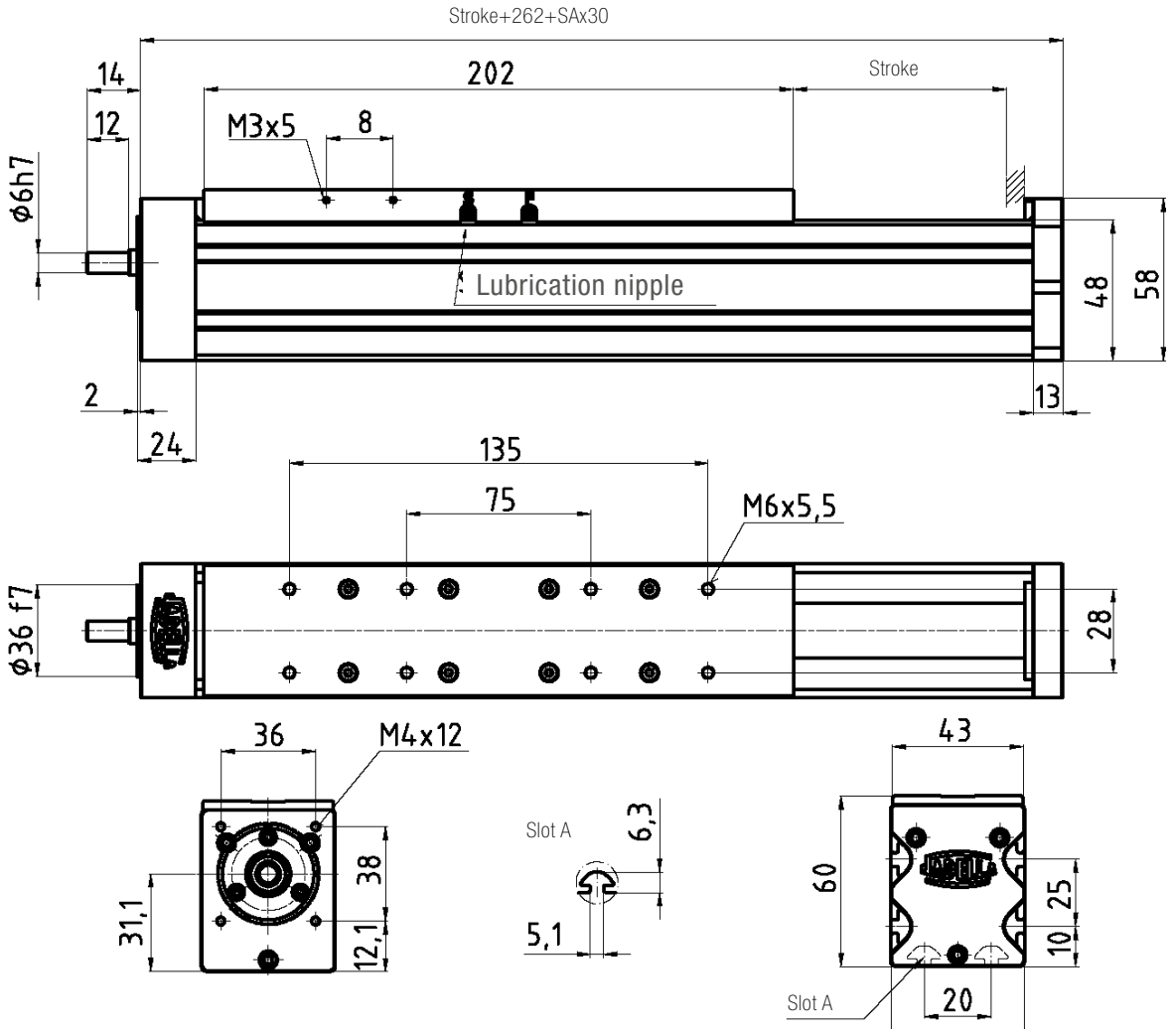
We use standard highly precise whirled ball screw drives. Due to the hard whirling technology a better surface quality can be reached compared to ground spindles. The spindles we use are in the accuracy range of 23 µm / 300 mm (IT5). To support the ball screw drive in case of larger strokes optionally spindle supports are available which prevent oscillations and thus allow higher speeds.

LUBRICATION

The bearings of the linear actuators are lubricated for life. The ball rail system and the ball screw drive can be re-lubricated through separate lubricating nipples at the carriage that are accessible from the outside. Especially in case of a high running performance and / or high acceleration values this is an advantage. For short-stroke use, strokes ≤ ½ length of carriage, please contact our Technical support. We recommend the lubricant Klüber Microlube GL261.

BASIC-LINE AXNP-S
AXNP 45-S

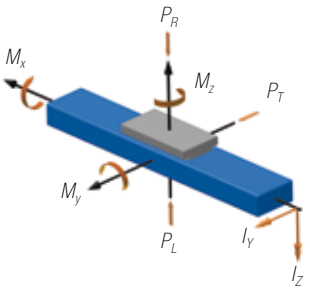
Linear actuator with ball screw drive and rail guide.



Stroke calculation: effective stroke + safety overrun
SA = number of spindle support sets
For motor connection see chapter drive adaption
Lubrication: S = ball screw; F = rail guide

LOADS AND LOAD MOMENTS*

	Rail guide B 9	
Loads (N)	dyn.	stat.
P_R	660	910
P_L	660	910
P_T	660	910
Load moments (Nm)		
M_x	5	6
M_y	20	25
M_z	20	25



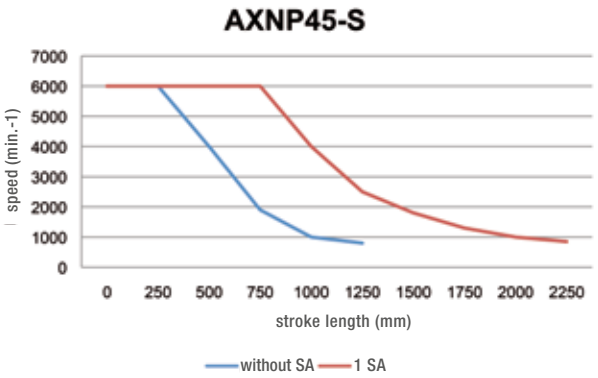
** The dynamic load of the guide system is based on a nominal lifetime of 54000 km*

TECHNICAL DATA

Max. speed	1 m/s
Repeating accuracy	± 0.03 mm
Actuation	Ball screw Ø 12 mm
Max. dynamic working load	3600 N
Pitch	5 / 10 mm
Idle-running torque	0.4 Nm
Moment of inertia	0.11 kgcm²/m
Max. length overall	2 m
Geometrical moment of inertia I_Y	20.3 cm⁴
Geometrical moment of inertia I_Z	21.7 cm⁴

MASS

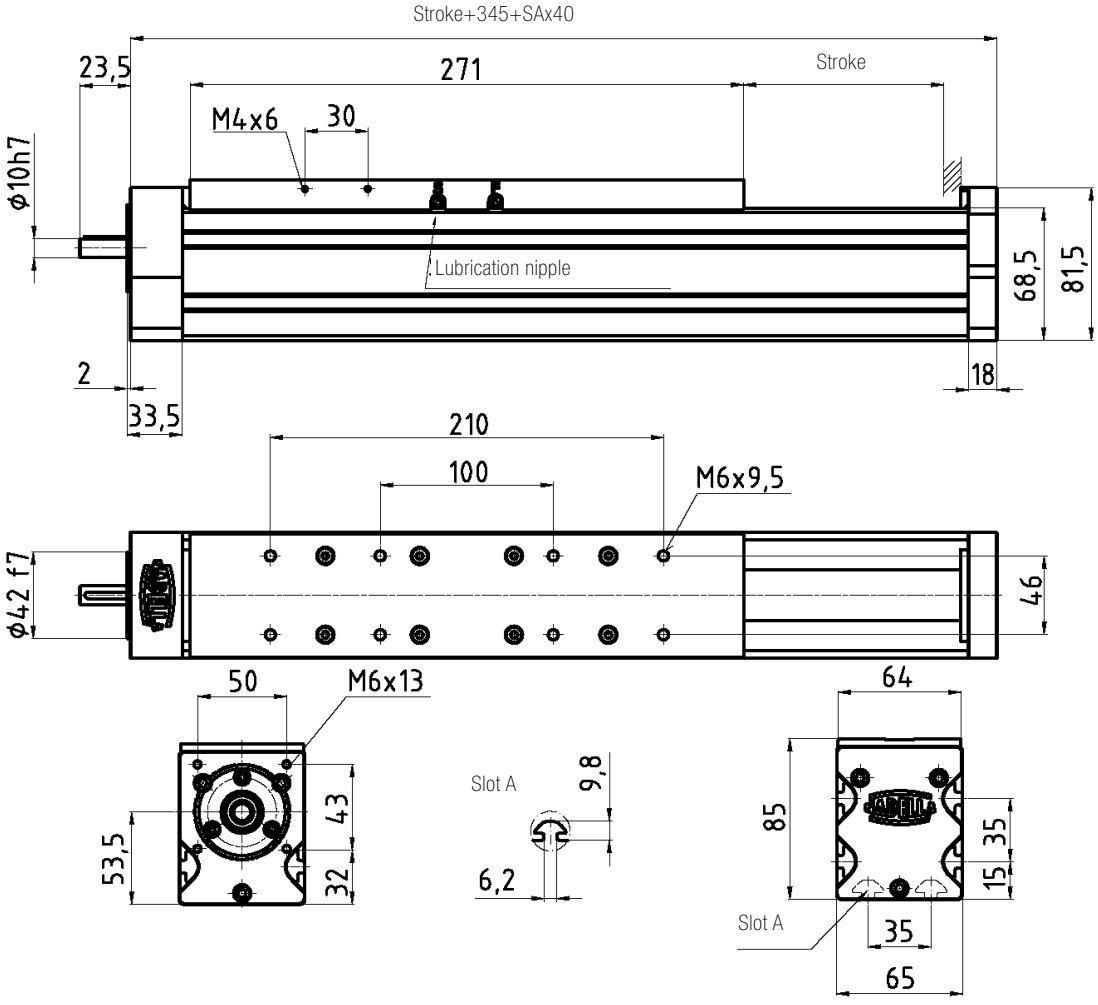
	Rail guide B 9
Basic mass	1.6 kg
Mass per 100 mm stroke	0.4 kg
Slide mass	0.45 kg



SA = 1 set of spindle support

BASIC-LINE AXNP-S
AXNP 65-S

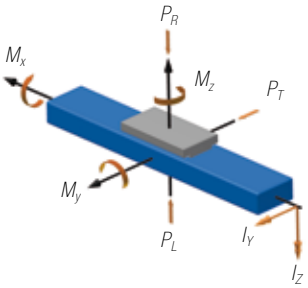
Linear actuator with ball screw drive and rail guide.



Stroke calculation: effective stroke + safety overrun
SA = number of spindle support sets
For motor connection see chapter drive adaption
Lubrication: S = ball screw; F = rail guide

LOADS AND LOAD MOMENTS*

	Rail guide B 15	
Loads (N)	dyn.	stat.
P_R	1400	3900
P_L	1400	3900
P_T	1400	3900
Load moments (Nm)		
M_x	10	30
M_y	65	185
M_z	65	185



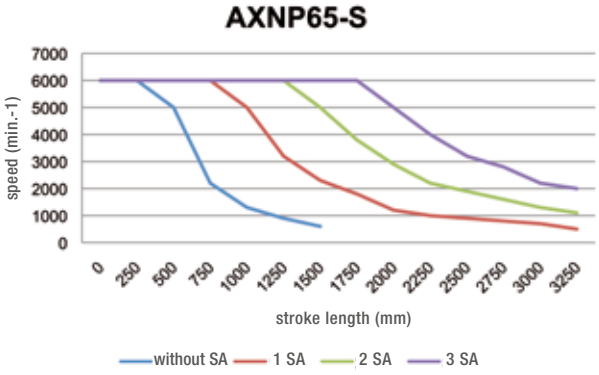
** The dynamic load of the guide system is based on a nominal lifetime of 54000 km*

TECHNICAL DATA

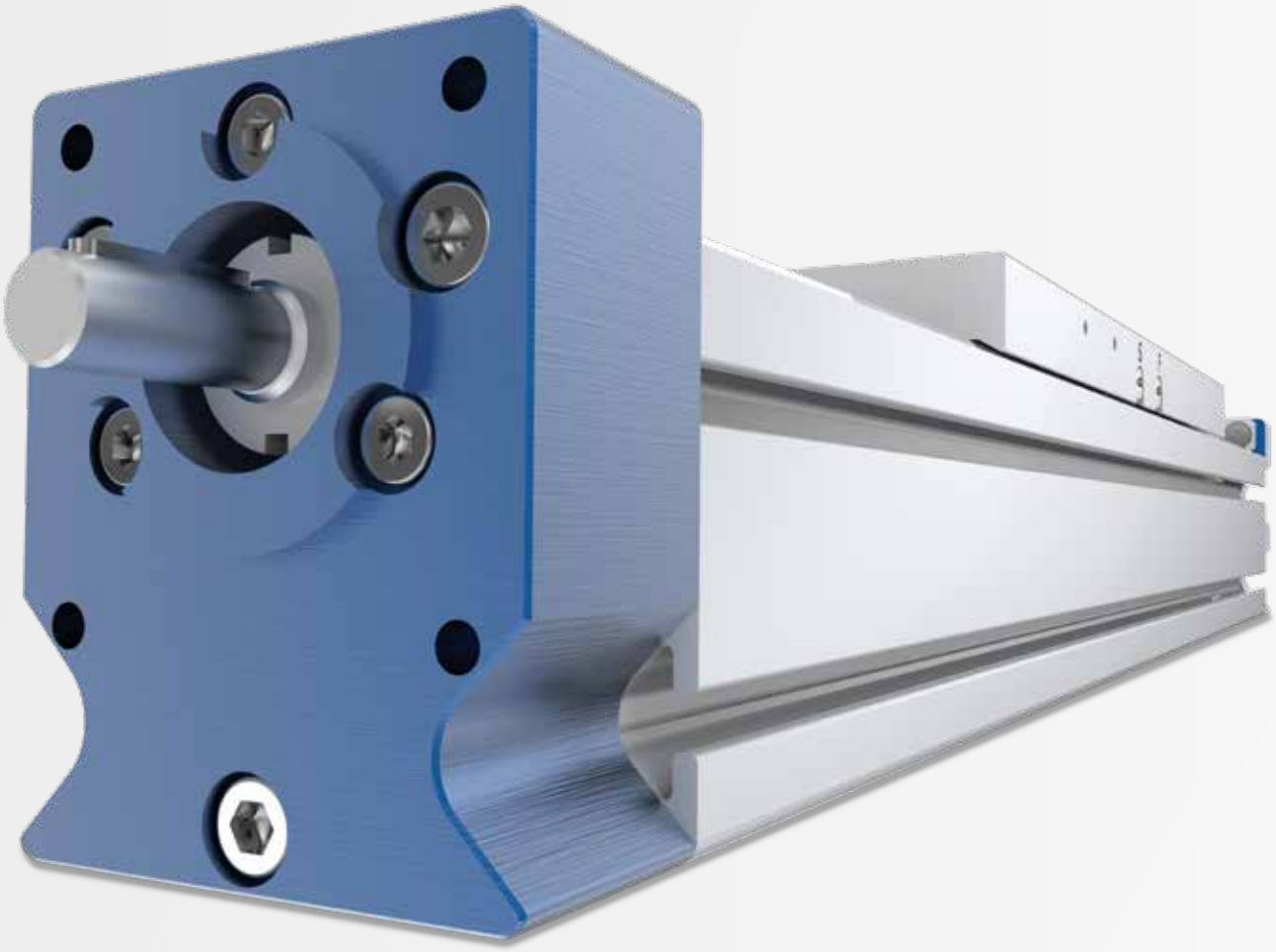
Max. speed	1.6 m/s
Repeating accuracy	± 0.03 mm
Actuation	Ball screw Ø 16 mm
Max. dynamic working load	6500 – 12000 N
Pitch	5 / 10 / 16 mm
Idle-running torque	0.5 Nm
Moment of inertia	0.33 kgcm²/m
Max. length overall	3 m
Geometrical moment of inertia I_Y	76.3 cm⁴
Geometrical moment of inertia I_Z	87.3 cm⁴

MASS

	Rail guide B 15
Basic mass	4.6 kg
Mass per 100 mm stroke	0.8 kg
Slide mass	1.4 kg



SA = 1 set of spindle support



DRIVE ADAPTION / REFERENCE SWITCH

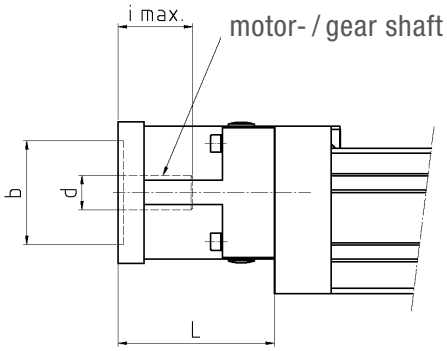
3

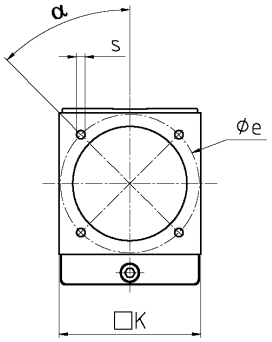
DRIVE ADAPTION
GEAR / MOTOR ADAPTION WITH COUPLING

3.1

Gear / motor adaption through standardized mounting combinations with coupling, coupling bell and adapter flange.

AXNP-S





Example Order Code
AXNP45-S **MK***-B-100-326-00*

AXNP-S

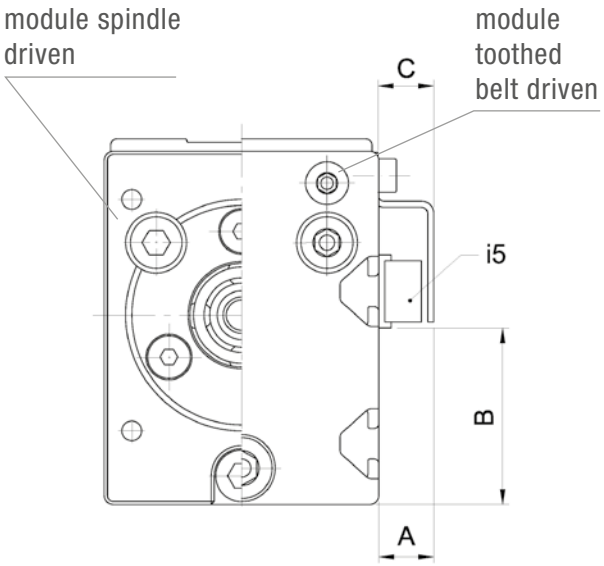
Actuator	Code	Design	e	α	S	b	d	i	K	L
			min. – max.			min. – max.	min. – max.	max.	max.	
AXNP 45-S	I	B5	44 – 53	0°	4 x M5 x 12	35 – 45	4 – 16	34	60	60
	II	B5	50 – 70	45°	4 x M5 x 12	35 – 58	4 – 16	34	60	60
	III	B14	54 – 70	45°	4 x Ø 5.5	35 – 58	4 – 16	34	60	60
AXNP 65-S	I	B5	55 – 95	0°	4 x M6 x 15	48 – 85	8 – 25	40	105	90
	II	B5	60 – 120	45°	4 x M6 x 15	48 – 100	8 – 25	40	105	90
	III	B14	66 – 95	0°	4 x Ø 6.6	48 – 85	8 – 25	40	105	90
	IV	B14	66 – 120	45°	4 x Ø 6.6	48 – 100	8 – 25	40	105	90

END / REFERENCE SWITCH
INDUCTIVE SWITCHES

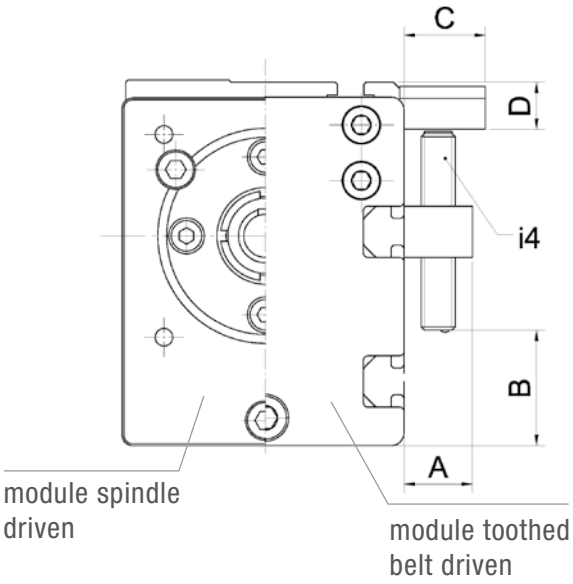
3.2

As an alternative to mechanical switches inductive switches make it possible to monitor positions or to control the end position. They are supplied as set consisting of two switches, lug, fastening units or single initiator. Depending on the application you can order NCC or NOC, break or make contacts. The plug-in connecting lines of the inductive switches are very easy to maintain.

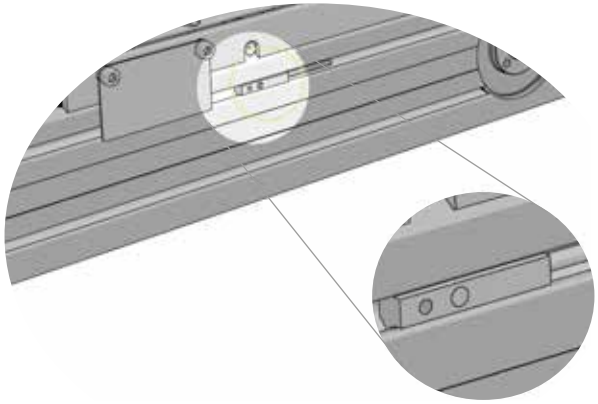
INDUCTIVE PROXIMITY SWITCH AXNP 45-S



INDUCTIVE PROXIMITY SWITCH AXNP 65-S



INDUCTIVE SWITCHES INTEGRATED IN SLOT NUT



These inductive switches are the most compact version of switches. These switches are flush with the surface profile and therefore you will have almost no interfering edge.

	Switch	Mounting dimensions (mm)			
	Type	A	B[1)]	C	D
AXNP 45-S	i5	9	29	9	–
AXNP 65-S	i4	16	27	19	11

[1)] Ca. values depending on switch position without cable connection

TECHNICAL DATA

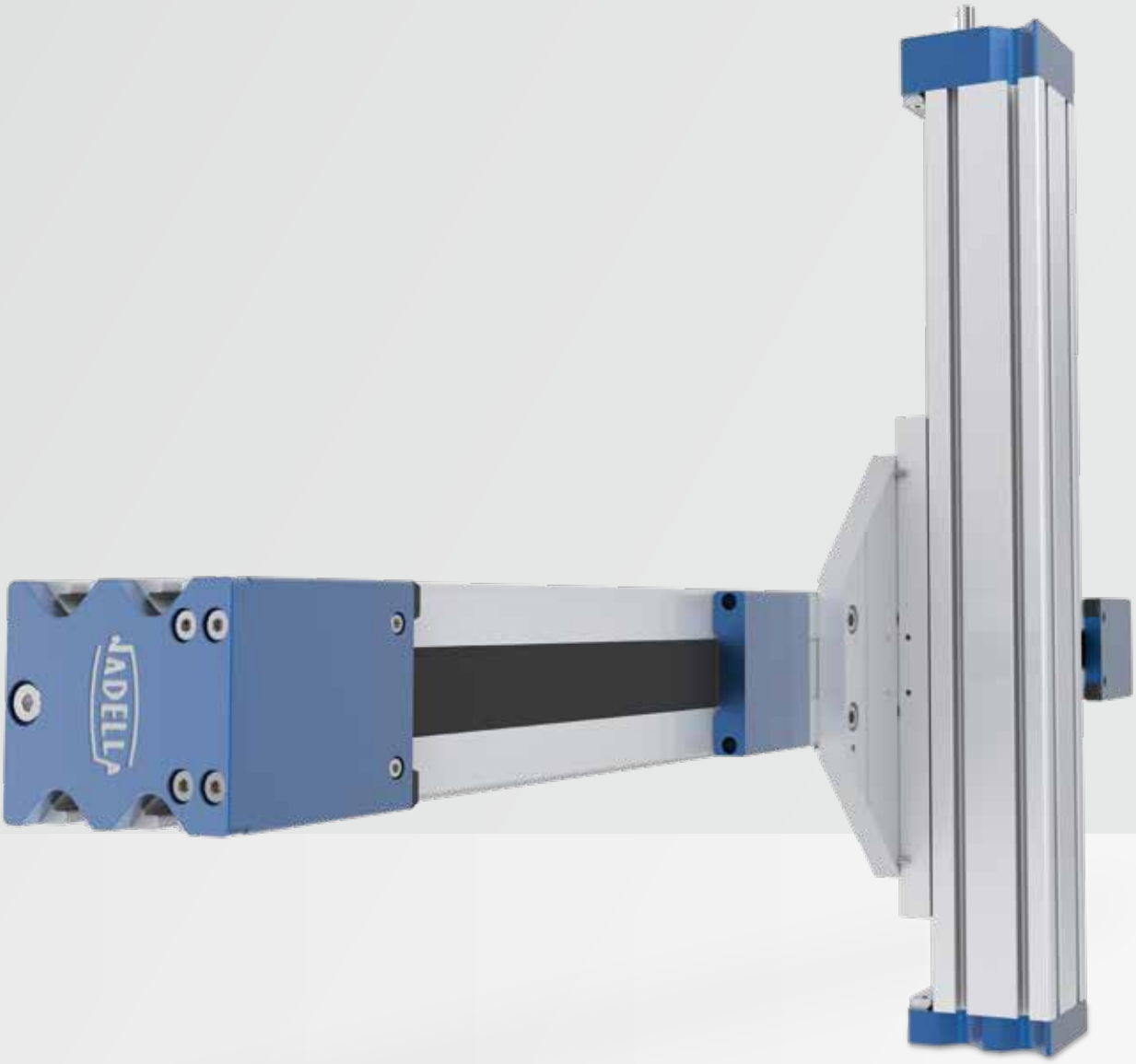
	Connected voltage	max. load current	Switching precision	Cable length[2)]	Protection class
Switch i4 NPN / PNP[3)] opening / closing contact AXNP 65-S	10 … 30 V DC	200 mA	≤ 10 % of sensing distance	5 m	IP 67
Switch i5 NPN / PNP[3)] opening / closing contact AXNP 45-S	10 … 30 V DC	100 mA	≤ 10 % of sensing distance	3 m	IP 67
Switch i6 (integrated in slot nut) PNP opening contact AXNP 65-S	10 … 30 V DC	100 mA	≤ 10 % of sensing distance	2 m	IP 67

[2)] Longer cable length on request (please indicate desired cable length in the order)
[3)] NPN / PNP-NC (normally open) or NPN / PNP-NO (normally closed)

Example Order Code
2pcs. limit witch limit switch NC (normally open),switch cam, fastening elements **i4-NC set complete**

1 limit switch NO (normally closed), fastening elements **i4-NO set single**

NOTES


NADELLA

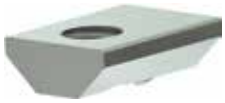
FASTENING AND JOINING ELEMENTS

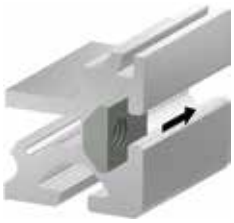
4

FASTENING AND JOINING ELEMENTS
SLOT NUTS

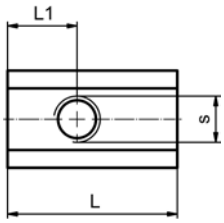
TYPE E (SWIVEL-MOUNTED)
- Standard slot nut
- Can be swivelled in any position
- Fixed by spring ball
- Steel zinc coated

TYPE S (NOT SWIVELLING)
- Slot nut for heavy loads
- Slide-in at end of profile
- Fixation with elastic balls (up to nut slot 8.2)
- Steel zinc coated





TYPE T (DIN – SLOT NUT, NOT SWIVELLING)
- Slot nut for heavy loads
- Installed on demand
- Steel black finished
- Without fixing



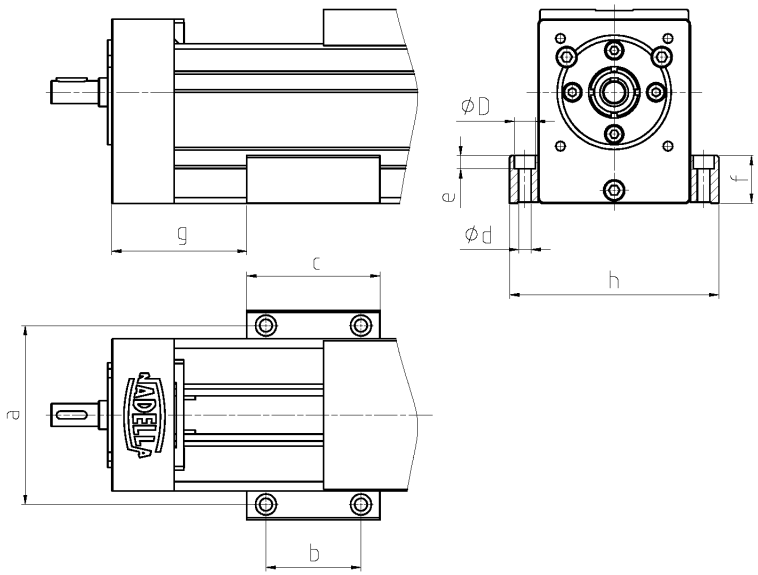
Actuator	Nut slot-	s	Design	L (mm)	L1[1] (mm)	TA (Nm)	max. tensile force (N)
AXNP 45-S	5 St-	M3 M4 M5	E / S	12	3 4 4	1.5	500
AXNP 65-S	6 St-	M4 M5 M6	E / S	17	5 5 5,5	4	1750

[1] Max. values, different dimensions possible
[2] Strength category 10.9 is necessary by using the max. clamping torque

All combinations of actuators and nut slots in the dimension field are possible – Order Example: **AXN 65-Z 6St M5 E**

FASTENING SHOULDER

Easy fixation of actuator by top-side screw connection. For module combinations with fastening shoulder please see chapter „direct connection“.



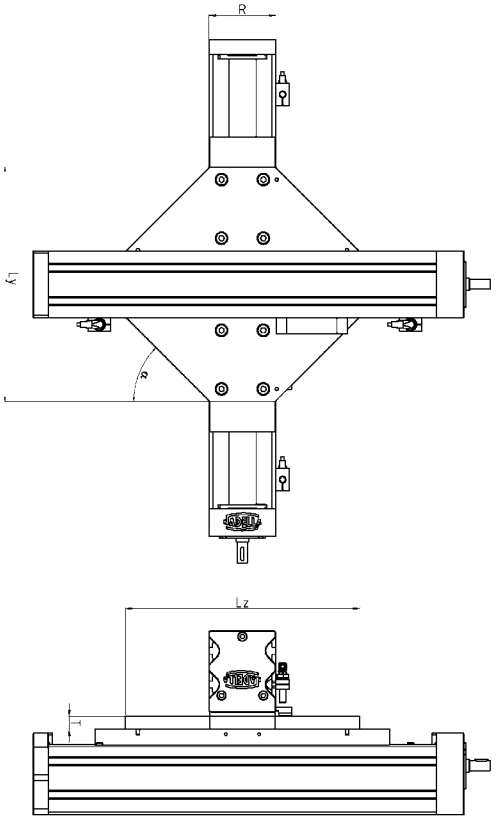
Actuator		a1	a2	b	c	d1	D1	e1	d2	D2	e2	f	g[1]	h
AXNP 45-S	Bfl. Bk4[2] Bfl. B44	60	–	– 28	20 41	5.5	10	5	–	–	–	11	68	74
AXNP 65-S	Bfl. B64 Bfl. Bk6[2] Bfl. B66	80	–	28 – 40	41 20 60	5.5	10	11	–	–	–	17	95	97

[1] For drive belt actuators also depending on drive adapter
[2] Short execution with one countersink

Order Example: **AXN 65-Bfl. B64**

CROSS CONNECTION AXNP-S / AXNP-S

Cross connections by standardized adapter plates for Y-Z axis connections.
Carriage of Z-axis will be connected to the carriage of Y-axis via adapter plate. Advantage: the complete Z-axis profile can be moved.



CROSS CONNECTION SET

	Z-axis	
	AXNP 45-S	AXNP 65-S
AXNP 45-S	SK44	SK64
AXNP 65-S	SK64	SK66

BALL SCREW / BALL SCREW

Y-axis	Z-axis	Ly (mm)	Lz (mm)	R (mm)	T (mm)	α (°)	Cross connection set
AXNP 45-S	AXNP 45-S	155	155	43	12	45	SK44
AXNP 45-S	AXNP 65-S	240	155	64	12	60	SK64
AXNP 65-S	AXNP 65-S	240	240	64	12	45	SK66
AXNP 65-S	AXNP 80-S	280	240	78	15	50	SK86

Example Order Code
SK66

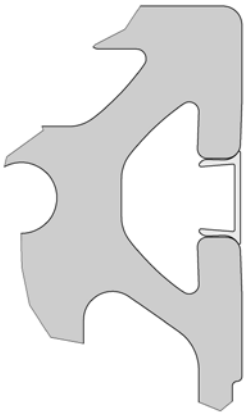
Centre of actuator = centre of carriage plate
Adjustment using cylinder pins or stop angle

COVERS
COVER FOR PROFILE SLOTS AXNP-S

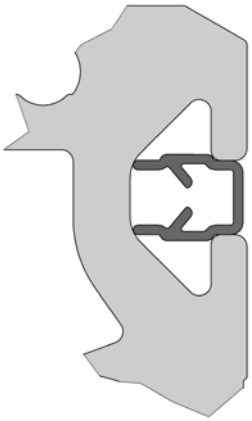
4.4

For any application used in visual range or with increasing dirt, the profile slots can be covered by corresponding covers in aluminium or plastic material. Therefore no dirt particles can enter the t-slots which guarantees good dirt protection for the actuator.

COVER PROFILE AL
Colour: silver-coloured



COVER PROFILE PP
Colour: black



Modul type	Size	Designation	Material
AXNP 45-S	Nut 5	Cover profile 5 PP	Polypropylene black
AXNP 65-S	Nut 6	Cover profile 6 Al Cover profile 6 PP	Silver-coloured Polypropylene black

Example Order Code
profile 8PP


10
20
30
40
Mahr
Nr.055

TECHNICAL INFORMATION

5

TECHNICAL INFORMATION
ACTUATOR SELECTION

DRIVE – TOOTHED BELT DRIVE Z OR SPINDLE DRIVE S

Application	horizontal vertical	-Z -S
Travel length	short* medium* long*	-S -S or -Z -Z
Travel speed	low* medium* high*	-S -S or -Z -Z
Precision	low* high*	-Z -S

GUIDE SELECTION – ROLLER GUIDE LR OR RAIL GUIDE B

Application	horizontal vertical	-LR or -B -LR or -B
Mass	low to medium* medium to high*	-LR or -B -B or parallel guide
Overhanging mass or transverse moment		-B or parallel guide
Dynamic	low to medium* medium to high*	-LR or -B -B

CARRIAGE SIZE – SINGLE / TWIN CARRIAGE OR LONG CARRIAGE

MASS

The mass to be moved should be well fastened on the carriage and not have large overhangs. The centre of gravity of the mass should be approximately in the middle of the carriage mounting surface. Alternatives for longer screw-on surfaces are long standard carriages or double carriages which can also be fitted with larger distances.

OVERHANGING OR WIDE MASSES

If the mass to be moved is very wide or has an overhanging centre of gravity it is recommended to use two parallel actuator units (maybe driven by a connecting shaft).

** The specifications short, medium, long or low, medium, high are to be understood in the ratio 1/3, 2/3 and 3/3 of the technical performance data indicated in the catalogue for respective actuator types and sizes.*

ACTUATOR SIZE AND TYPE

The actuator size is mainly determined by the mass to be moved (weight and volume). This mass should be easy to mount and therefore should have a certain guide size and carriage mounting surface which also is decisive for the actuator size (see product overview in the catalogue).

The second selection criteria for the actuator is the moving dynamic of the mass. The resulting forces (e.g. driving forces, moments, centrifugal forces, etc.) must be absorbed by the toothed belt and by the guide. Based on the synoptical table in the catalogue possible actuator types and sizes can be specified.

To make the right choice the technical data indicated in the catalogue such as admissible loads and load moments should only be used by one third as the combination of forces and moments can significantly affect the lifetime.

Further selection criteria for the actuator type are space requirements and the travel length of the linear actuator. It may be recommendable to replace larger single actuators by smaller parallel actuators and vice-versa. In case of large effective strokes, it may be necessary to use large actuators also for small loads.

The above are only rough guidelines for the selection of an actuator which can also be completely different depending on the application and the existing realities or on the customer‘s personal wishes.

In case of combined actuators such as X-Y systems or X-Y-Z systems a gantry structure with two parallel basic actuators should always be given preference to a boom system with only one basic actuator. For the design of combined systems the actuator on which the mass to be moved will be mounted should always be viewed at first.

We shall be pleased to assist you with the design and selection of the right modules for your application.
Please send us information about your application and technical data. (See also application form at the end of the catalogue)

TECHNICAL INFORMATION
CALCULATION BASIS

GENERAL
All data refer to the respective standard type of the linear module. A special design or temperatures above 80 °C can considerably affect these values.

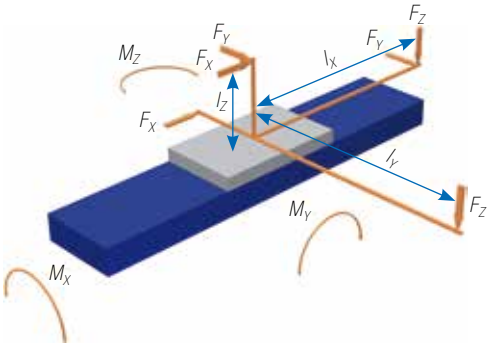
TECHNICAL DATA, LOADS AND LOAD MOMENTS
The values indicated are maximum possible individual sizes. Combined loads (e. g. forces and moments from different directions) reduce these maximum values and can have a negative effect on precision. If linear actuators are not fully supported, in addition a deflection or torsion test may become necessary.

REPEAT ACCURACY
The repeat accuracy defines that under the same conditions within the given tolerances the mechanical linear module will reach again a position already approached before.

STROKE LENGTH
The stroke length indicated in the order code corresponds to the maximum possible travel distance. Accelerating and stopping distances or a possible safety overflow must be taken into consideration for design.

SPEEDS
The theoretical travel speed results from the screw pitch or in case of a toothed belt actuator from the stroke per turn of the pinion, the gear ratio of a possible gear and a motor speed. To determine the actually possible travel speed the specific conditions, the mass to be moved, acceleration, motor output and the admissible drive torque of the selected actuator as well as the efficiency have to be considered.

OPERATING CHARACTERISTICS AND PRODUCTION TOLERANCES
Differences in running performance and noise development with identical units cannot be completely excluded, not even by our high production standard with small production tolerances. Our extruded profiles are manufactured according to DIN EN 12020-2. Especially with reference to straightness and torsion these fixed tolerances mostly are clearly underrun. The exact adjustment of the linear units and / or mounting to precisely machined surfaces increase the guiding accuracy. A possible deflection of partially supported actuators mainly depends on the inherent rigidity, the load, the self-supporting length and the rigidity of the adjacent construction.



DRIVE – TOOTHED BELT DRIVE Z OR SPINDLE DRIVE S

$F_X = m \cdot a$

$F_Y = m \cdot a$

$F_Z = m \cdot (g + a)$

Additional moment loading with an eccentric centre of gravity or lever arm

$M_X = F_Y \cdot l_Z$ or $F_Z \cdot l_Y$

$M_Y = F_X \cdot l_Z$ or $F_Z \cdot l_X$

$M_Z = F_X \cdot l_Y$ or $F_Y \cdot l_X$

F = Load (N)
m = Mass (kg)

a = Acceleration (m/sec²)
g = acceleration of gravity (9.81 m/sec²)

lx, ly, lz = Distance of force application point in direction x, y, z, indicated in m

In most applications there are force combinations. The resulting total forces always must be smaller than the respective admissible values.

DRIVE SIZING (ESTIMATE)

$M_A = M_{Last} + M_{Leer}$

For toothed drive

$$M_{Last} = \frac{F_X \cdot p}{2 \cdot \pi \cdot 1000}$$

For screw drive

$$M_{Last} = \frac{F_X \cdot p}{2 \cdot \pi \cdot \eta \cdot 1000}$$

M_A = Necessary drive torque (Nm)
M_{Last} = Load torque (Nm)
M_{Leer} = Idle torque (Nm) – see data sheets

F_X = Feed force (N)
p = Stroke / revolution (mm) for toothed drive belt
screw pitch (mm) for screw drive

η = For ball screw approx. 0.9

FEED FORCE FOR HORIZONTAL OPERATION

$F_X = m \cdot g \cdot \mu + m \cdot a$

μ = Friction coefficient for rail guide 0.02 for roller guide 0.05

FEED FORCE FOR VERTICAL OPERATION

$F_X = m \cdot (g + a)$

ADMISSIBLE DRIVE TORQUES

The maximum acceleration also depends on the maximum admissible drive torque of the respective actuator. Example: calculation for toothed belt actuator AXN80-Z:

$$M_{Azul} = \text{belt traction} \cdot \text{pinion radius} = \frac{1450N \cdot 180\ mm}{2 \cdot \pi \cdot 1000} = 41.5\ Nm$$

TECHNICAL INFORMATION
ODERING CODE

CODES FOR AXN

ORDERING EXAMPLE

AXN 65 - S HW 14 - LR 35 - 1000 - 1340 - 00

Type designation
AXN ...
AXNP ...

Drive configuration
Z: Belt drive
S: Ball screw
T: Trapezoid thread spindle
O: No drive

Drive configuration
With belt drive

HW:	Hollow shaft
WL (WR):	Driveshaft left (right)
WD:	Driveshaft both sides
KL (KR):	Partially integrated coupling on one side left (right)
PL (PR):	Planetary gear left (right) (please refer page „direct gearbox connection“ for gearbox type)
PLK (PR) = 0:	Without gearbox PLE
MKL (MKR):	Motor flange with coupling left (right)

With spindle drive

W:	Free drive shaft
MK:	Motor flange with coupling

Characteristic of the shaft / coupling

With belt drive
- Diameter of shaft or hollow shaft (HW, WL, WR, WD)
- Diameter of coupling holes (KL,KR, MKL, MKR)
- Gear ratio (PL, PR)
- For type PLK or PRK only the gear ratio is indicated

With spindle drive
Spindle diameter and pitch

Options
This number will be given by NADELLA. It shows special marks or special design which are noted in clear text.

00	No options
01	Spindle support 1SA
02	Spindle support 2SA
03	Spindle support 3SA
04	Spindle support 4SA
10	Cover band
12	Slot covers
13	Covering plate
22	Twin carriage
23	Long carriage
32	Reinforced spindle bearing
33	Double spindle nut
34	Preloaded spindle nut
35	With caged ball technology
66	Pulleys syncronized two modules
76	Exterior parts corrosion resistant
77	Stainless version (NX)
88	Profile with junction
99	According to drawing

More than one option possible

Overall length
(Stroke + length surcharge according to data given in this catalogue)

Stroke

Size of guide system
Subject to catalogue

Reference variable

LR:	Linear guide system
B:	Ball circulating guide according to DIN 645

INFORMATION

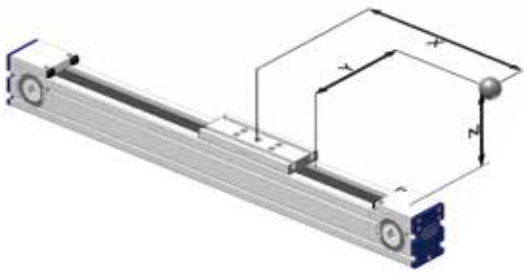
When ordering a version with motor adaptation, please always include the dimension sheets of the motor or gear unit to be mounted.

APPLICATION FORM
PART 1

	Date
Company	Phone
Contact	Fax
Street	eMail
Address	Project designation

APPLICATION PARAMETER

Coordinate	X	Y	Z
Single axis / parallel axis (distance in mm)			
Installation position: horizontal (hor); vertikal (ver) or wall fastening (wa)			
Stroke (mm)			
Effective stroke ≤ ½ carriage length	Yes ☐	No ☐	
Speed v (m/s)			
Acceleration a (m/s²)			
Traverse time (s)			
Cycle time (s)			
Repeating accuracy (± mm)			
Required lifetime (h)			
Actual load (kg)			
External loads (N)			
Center coordinate load X (mm)			
Center coordinate load Y (mm)			
Center coordinate load Z (mm)			
Center coordinate force X (mm)			
Center coordinate force Y (mm)			
Center coordinate force Z (mm)			



INFORMATION For higher loads or charges please send your drawing attached.

APPLICATION FORM
PART 2

5.4

Conditions of use (dust, splash water, abrasive media)
Corrosion resistance
Drive adaption for existing gear

FITTINGS LEFT

Gear ☐ Switch ☐

FITTINGS RIGHT

Gear ☐ Switch ☐

ATTACHMENTS

Connecting shaft for distance (mm) *(please indicate distance of actuators)*		
Planetary gear (Type: ratio) *(e. g.: PLE80 : 8)*	Pieces	Type
Inductive switch (opening / closing contact)	Pieces	Type
Slot nuts	Pieces	Type
Fastening shoulder	Pieces	Type
Cover profile (2m length)	Pieces	Type
Cover plate	Yes ☐	No ☐
Corrosion resistant version	Yes ☐	No ☐

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