Product Description

Outstanding features

Rexroth Precision Modules are precise, ready-to-install linear motion systems that combine high performance with compact dimensions.
Rexroth offers favorable price/performance ratios and fast delivery.

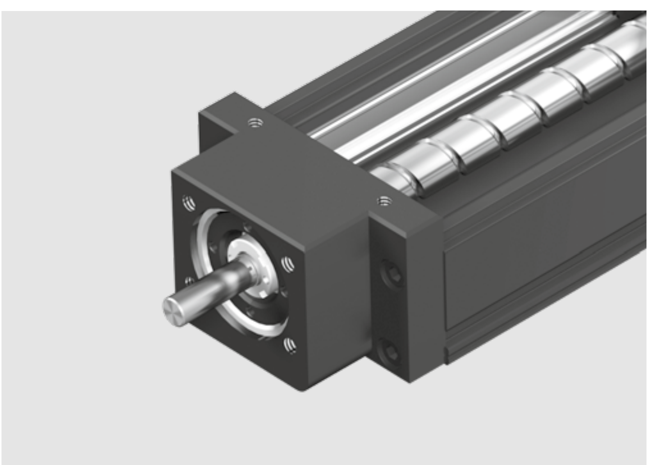
Structural design
- Extremely compact and rigid precision steel profile (frame) with reference edge and integrated Rexroth guideway geometry
- Precision ball screw drive in tolerance grade 7 with zero-backlash nut system
- Aluminum fixed bearing end block with preloaded ball bearings and ball screw journal
- Floating bearing end block with double ball bearings
- One or two steel carriages, standard length or long, for PSK without cover or with cover plate
- One aluminum carriage, standard length or long, for PSK with sealing strip

Attachments
- Maintenance-free digital AC servo drives with integrated brake and attached feedback, or stepping motors
- Motor mount and coupling or timing belt side drive for motor attachment
- Adjustable switches over the entire travel range
- Aluminum profile cable duct

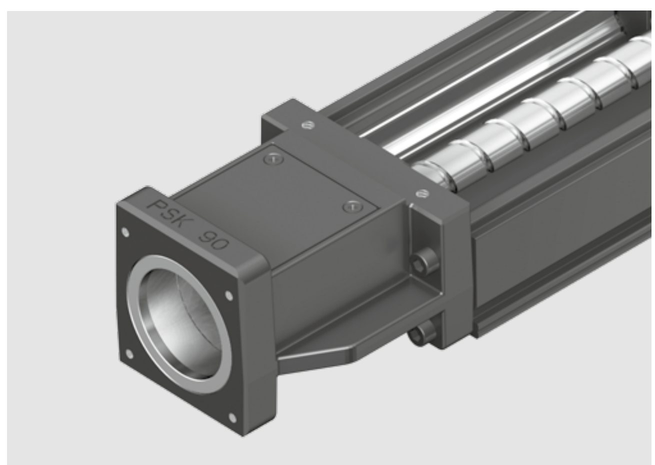
Drive controllers and control systems

Further highlights

- Extremely stiff and precise miniature drive unit
- Optimal travel performance, high load capacities, high precision and high rigidity due to integrated Rexroth Ball Rail System
- High positioning accuracy and repeatability due to Precision Ball Screw Assembly with zero-backlash nut system
- Repeatability up to 0.005 mm
  Positioning accuracy up to 0.01 mm
  Guidance accuracy up to 0.005 mm
- High travel speeds combined with high precision due to Ball Rail Systems, large screw diameters and leads, and double floating bearing
- Rapid mounting and easy axis alignment thanks to machined reference edge on the frame
- Precise alignment and secure mounting of attachments thanks to tapped bores and pin holes in the carriage
- Easy motor attachment via locating feature and fastening threads
- Low-cost maintenance provided by one-point lubrication (grease) for Ball Rail System and Precision Ball Screw Assembly
- Precision Modules in standard lengths for fast delivery



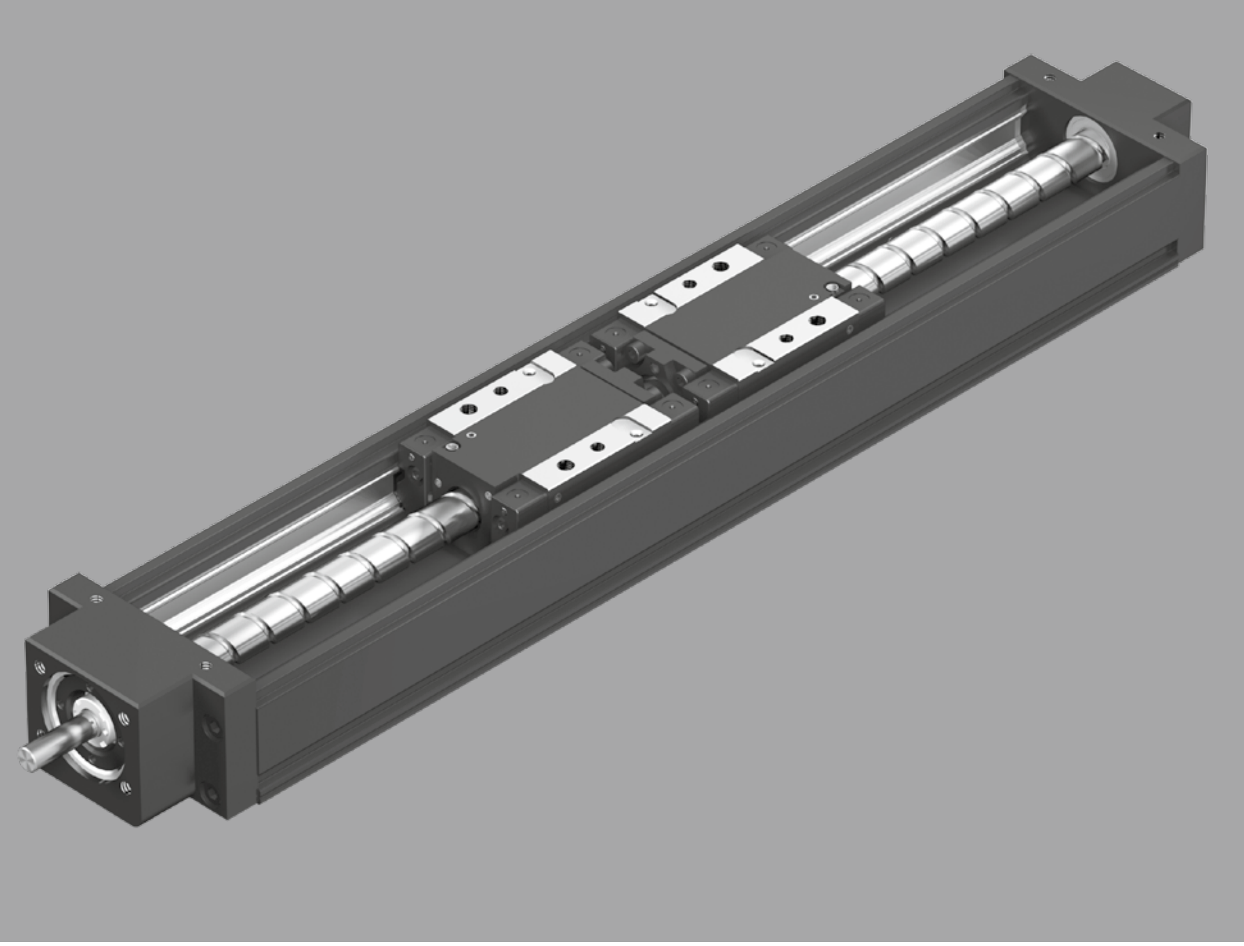
Fixed bearing end block with ball screw journal

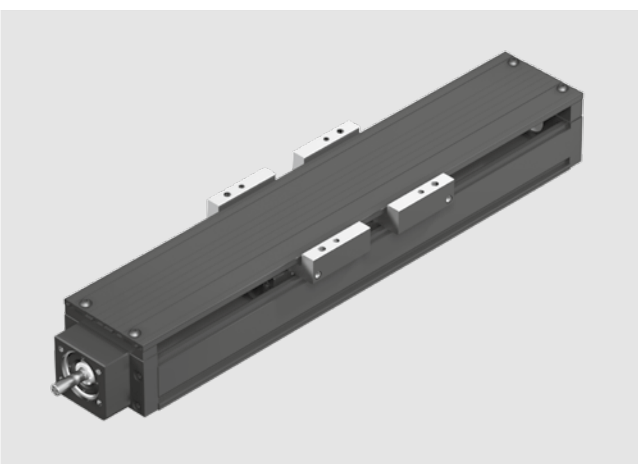


Fixed bearing end block with integrated motor mount

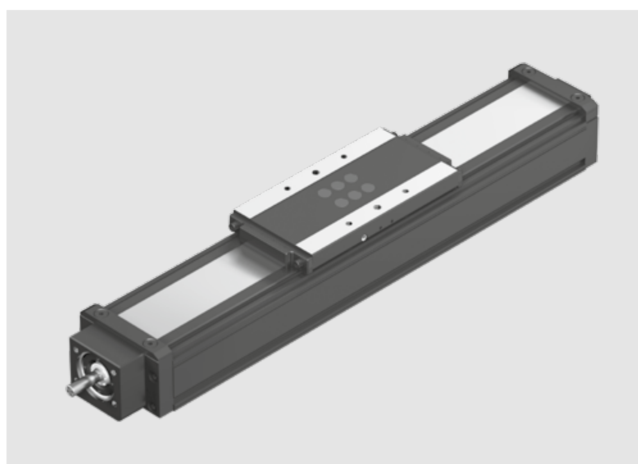
For mounting, maintenance and start-up, see “Instructions for Precision Modules PSK.”

PSK without cover





Internal elements protected by cover plate
One or two steel carriages, standard length or long



Internal elements protected by stainless steel sealing strip
Aluminum carriage, standard length or long

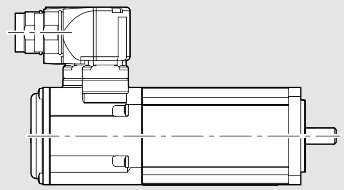
Product Overview

Motor selection

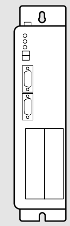
Based on drive controllers and control system

A choice can be made between several different motor/controller combinations to achieve the most cost-efficient solution for each customer application.
When sizing the drive, always consider the motor-controller combination.
For more information about motors and control systems, see the following Rexroth catalog:
– IndraDrive for Linear Motion Systems

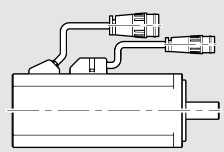
Digital AC servo motors MSK



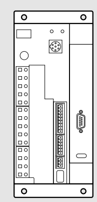
Digital controllers IndraDrive



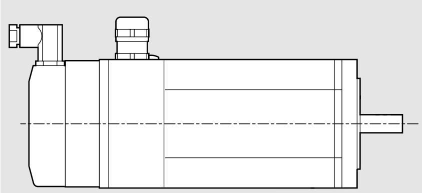
Digital AC servo motors MSM



Digital controllers ECODRIVE Cs

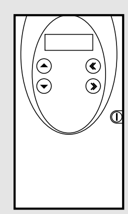


3-phase stepping motors VRDM

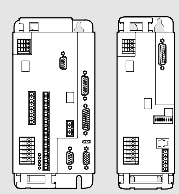


Power electronics

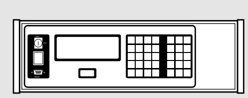
SD326
SD328



Twin Line



Profi Step control unit

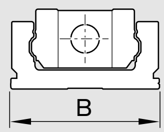


Precision Modules PSK can be supplied complete with motor, drive and control unit.

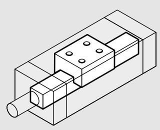
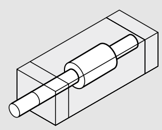
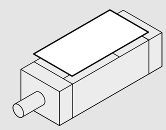
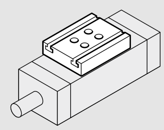
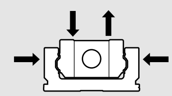
Product Overview

Type designation (size)

Precision Modules are designated according to type and size.
Types also cover the equivalent designs without drive systems.

Description		Type			Size
	Example: Precision Module	**P**	**S**	**K**	**60**
System	Precision Module **(P)**				
Guideway	Integrated Ball Rail System **(S)**				
Drive unit	Precision Ball Screw Assembly **(K)**				
Frame size 	Approx. width of frame (mm) Example: B = 60 mm				

Overview of types with load capacities

Type	System	Guideway	Drive unit 1)	Size	Cover	Carriage (carr.)	Number	Load capacities C (N)
								
PSK	Precision Module	Rail System	Precision Ball Screw Assembly	**PSK 40**	Without / cover plate	Standard	1 carr.	3 065
							2 carr.	4 980
				PSK 50	Without / cover plate	Standard	1 carr.	7 300
							2 carr.	11 850
					Sealing strip	Standard	1 carr.	7 300
						Long	1 carr.	11 850
				PSK 60	Without / cover plate	Standard	1 carr.	7 300
							2 carr.	11 850
						Long	1 carr.	9 000
							2 carr.	14 620
					Sealing strip	Standard	1 carr.	9 000
						Long	1 carr.	14 620
				PSK 90	Without / cover plate	Standard	1 carr.	21 300
							2 carr.	34 600
						Long	1 carr.	27 500
							2 carr.	44 670
					Sealing strip	Standard	1 carr.	21 300
						Long	1 carr.	34 600

1) All Precision Modules can also be supplied without drive unit.

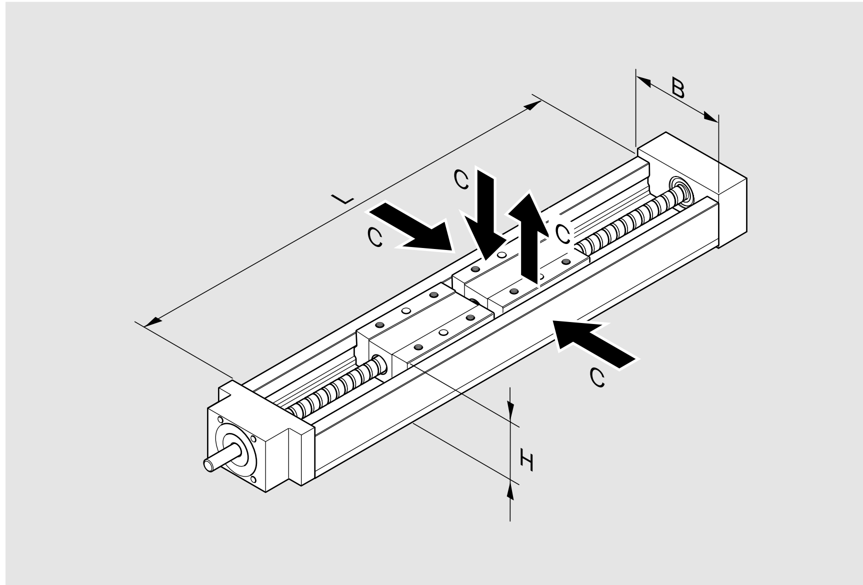
Permissible loads

Suitable loads (recommended values)
With respect to the desired service life, loads up to about 20% of the characteristic dynamic values (**C, M_t, M_L**) have proved acceptable.

At the same time, the following may not be exceeded:
- maximum permissible loads
- permissible drive torque
- permissible travel speed

For permissible values, see the “Technical Data” section.

Dimensions



Standard lengths L

Precision Module		PSK 40	PSK 50	PSK 60	PSK 90
B	(mm)	40	50	60	86
H	(mm)	20	26	33	46
L	(mm)	100	100	150	340
		150	150	200	440
		200	200	250	540
		250	250	300	640
		300	300	400	740
		350	350	500	840
			400	600	940
			450	700	
			500	800	
			550	900	
			600	940	

Structural Design

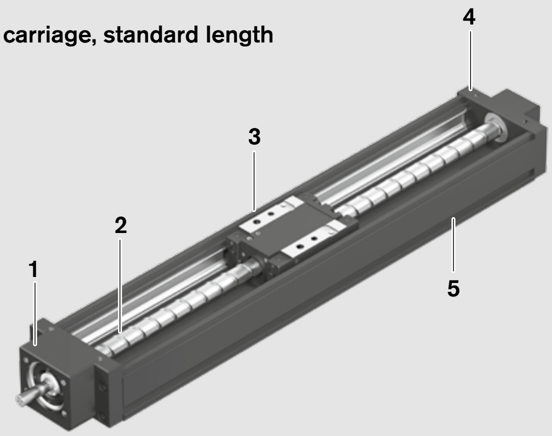
PSK without cover

1 Fixed bearing end block
2 Ball screw with zero-backlash cylindrical single nut
3 One or two steel carriages, standard length or long
4 Floating bearing end block
5 Frame with reference edge and integrated guideway geometry

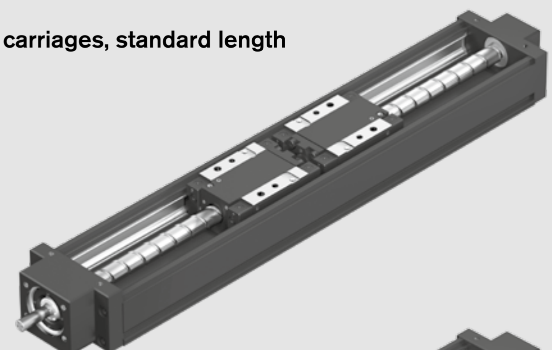
PSK with cover plate

6 Cover plate
7 One or two carriages, standard length or long
8 Carriage plate, aluminum
9 Carriage, steel

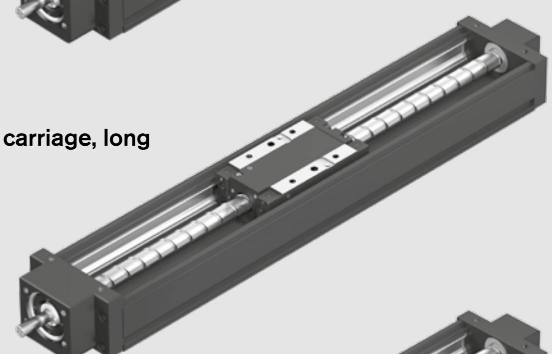
1 carriage, standard length



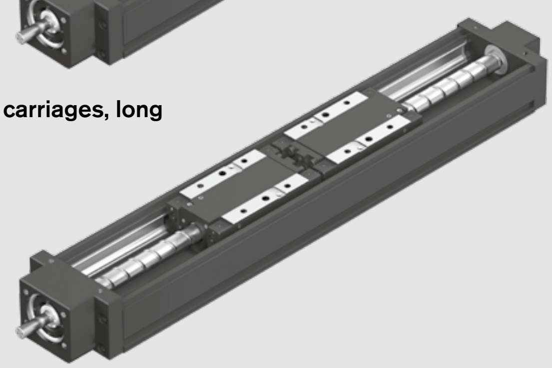
2 carriages, standard length



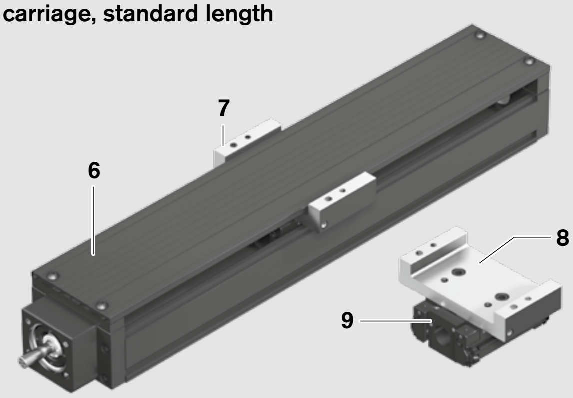
1 carriage, long



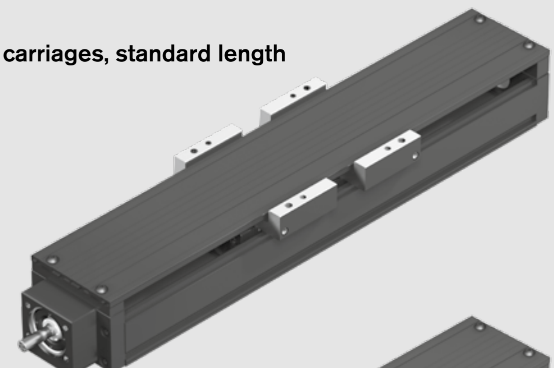
2 carriages, long



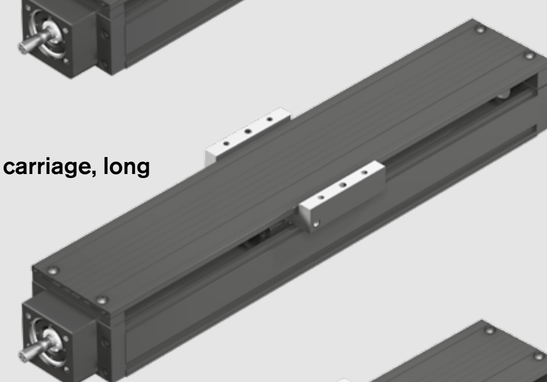
1 carriage, standard length



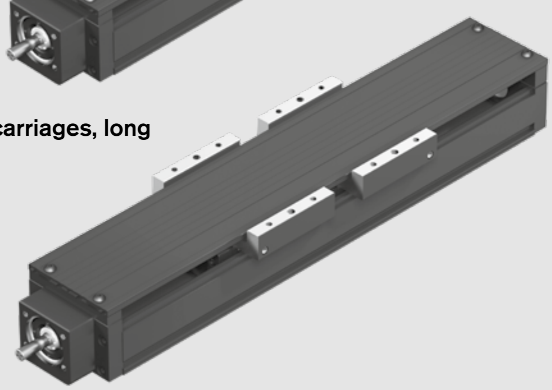
2 carriages, standard length



1 carriage, long



2 carriages, long



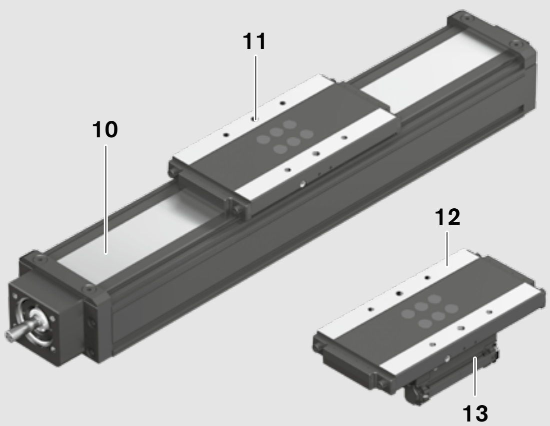
PSK with sealing strip

10 Sealing strip, stainless steel
11 One carriage, standard length or long
12 Carriage plate, aluminum
13 Carriage, aluminum

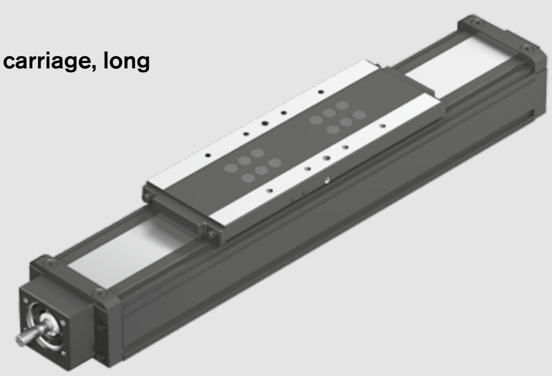
Attachments for all PSK modules

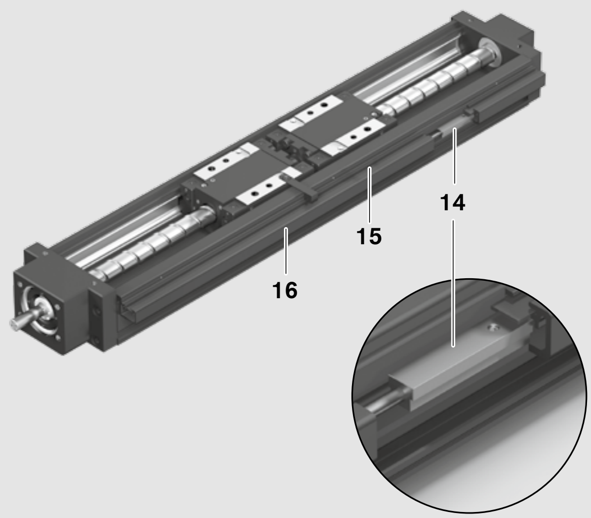
14 Switches
15 Cable duct
16 Switching cam

1 carriage, standard length



1 carriage, long



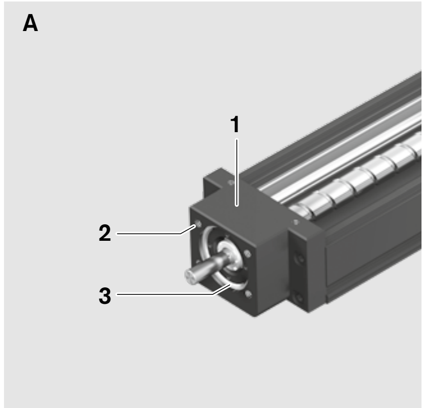


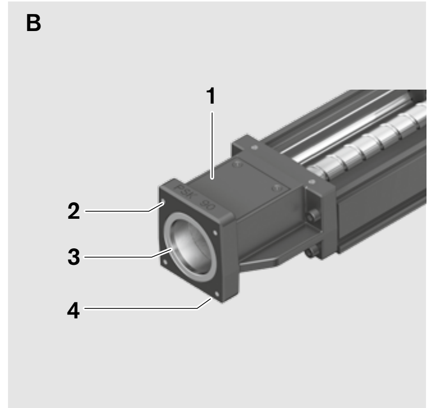
Structural Design

Fixed bearing end block

Version with ball screw journal (A)
1 End block with preloaded bearing
2 Tapped mounting hole
3 Centering feature

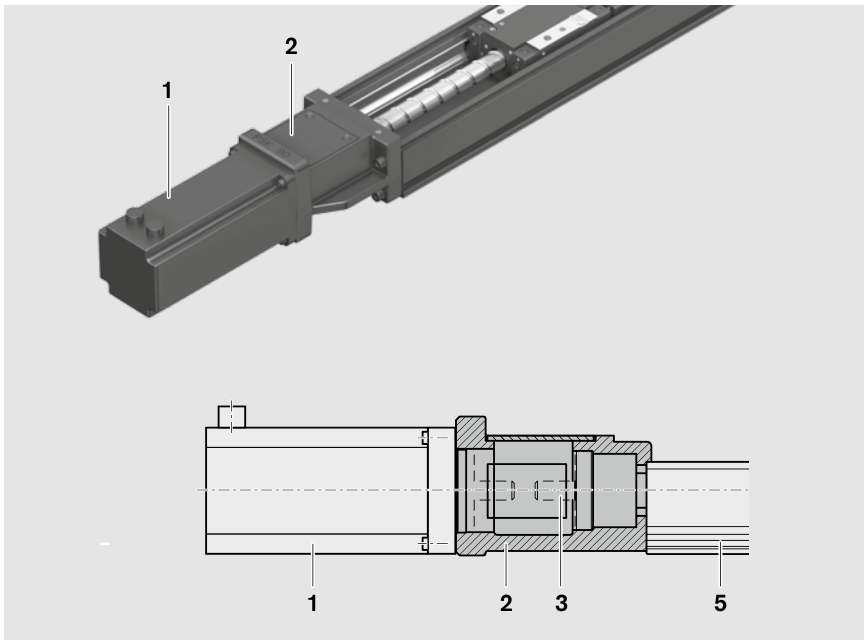
Version with integrated motor mount (B)
1 End block with integrated motor mount and preloaded bearing
2 Tapped mounting hole
3 Centering feature
4 Flange for motor attachment



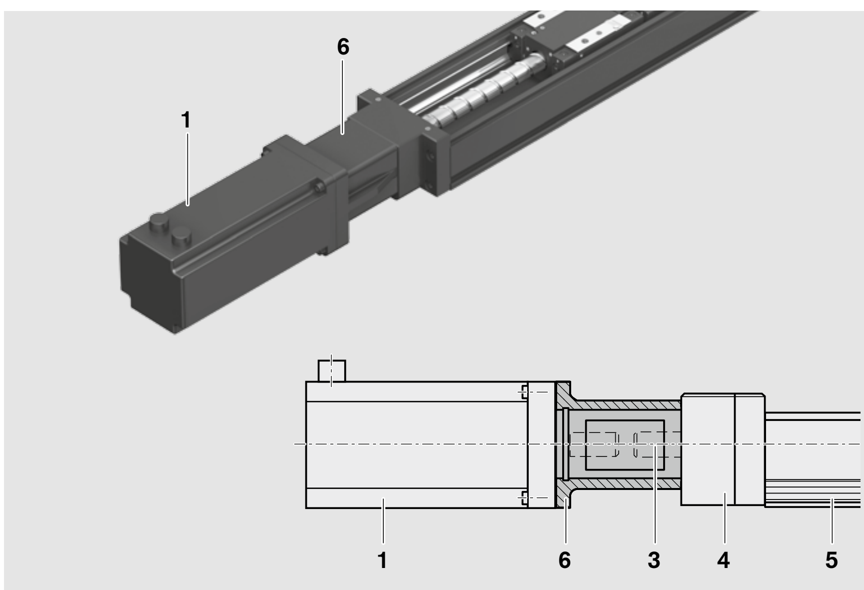


Motor attachment

Motor attachment with motor mount and coupling
A motor can be attached to all Precision Modules by means of a motor mount and coupling.
The motor mount serves to fasten the motor to the Precision Module and acts as a closed housing for the coupling.
The coupling transmits the motor drive torque free of distortive stresses to the Precision Module's ball screw journal.



Fixed bearing end block with integrated motor mount and coupling
1 Motor
2 Fixed bearing end block with integrated motor mount
3 Coupling
5 Precision module



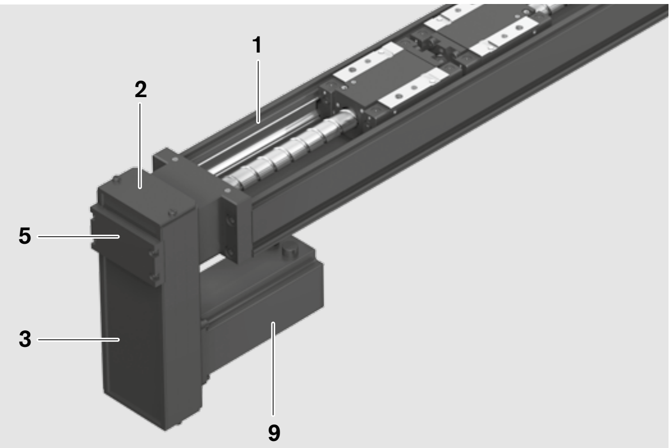
Fixed bearing end block with attached motor mount and coupling
1 Motor
3 Coupling
4 Fixed bearing end block
5 Precision module
6 Motor mount

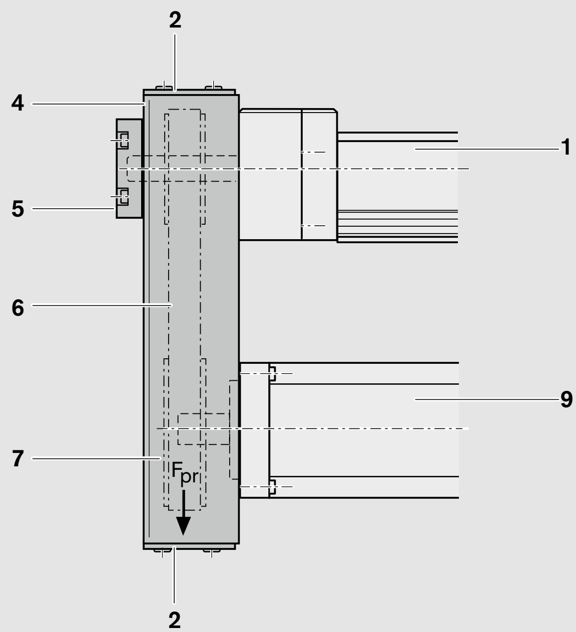
Motor attachment with timing belt side drive
On Precision Modules PSK 60 and PSK 90 the motor (9) can be attached via a side drive with timing belt.
This makes the overall length shorter than when attaching the motor with a motor mount and coupling.
The compact, closed housing protects the belt and secures the motor.

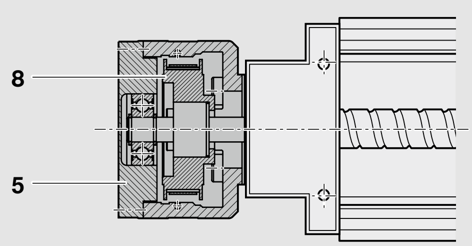
The following gear ratios are available:
i = 1 : 1
i = 1 : 1.5

The timing belt side drive can be mounted in four different directions:
– top, bottom
– left, right

1 Precision module
2 End cover
3 Cover plate
4 Drawn, anodized aluminum profile
5 Ball screw journal with support bearing
6 Toothed belt
7 Pre-tensioning of the toothed belt: Apply pretensioning force F_{pr} to motor (F_{pr} will be indicated on delivery)
8 Belt pulleys
9 AC servo motor







Technical Data

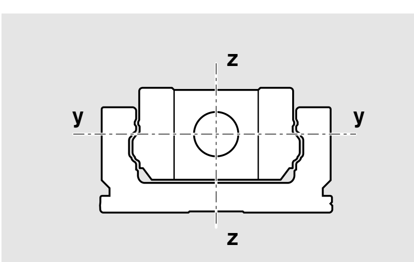
Dynamic characteristics

Precision Module	Type of cover	Carriage (carr.)		Guideway			Ball screw		Fixed bearing
			Number	Dynamic load capacity C (N)	Dynamic load moments M_t (Nm)	M_L (Nm)	Size d_0 x P	Dynamic load capacity C (N)	Dynamic load capacity C (N)
PSK 40	W/o and w/plate	Standard	1 carr.	3 065	43.1	14.8	6 x 1	900	820
			2 carr.	4 980	70.0	2.49 x l_m	6 x 2	890	820
PSK 50	W/o and w/plate	Standard	1 carr.	7 300	150.0	35	8 x 2.5	2 200	1 600
			2 carr.	11 850	244.0	5.93 x l_m	8 x 2.5	2 200	1 600
	Strip	Standard	1 carr.	7 300	150.0	35	8 x 2.5	2 200	1 600
		Long	1 carr.	11 850	244.0	356	8 x 2.5	2 200	1 600
PSK 60	W/o and w/plate	Standard	1 carr.	7 300	170.0	35	12 x 2	2 240	4 000
			2 carr.	11 850	276.0	5.93 x l_m	12 x 2	2 240	4 000
		Long	1 carr.	9 000	210.0	60	12 x 5	3 800	4 000
			2 carr.	14 620	341.0	7.31 x l_m	12 x 5	3 800	4 000
	Strip	Standard	1 carr.	9 000	210.0	60	12 x 10	2 500	4 000
		Long	1 carr.	14 620	341.0	541	12 x 10	2 500	4 000
PSK 90	W/o and w/plate	Standard	1 carr.	21 300	710.0	150	16 x 5	12 300	13 400
			2 carr.	34 600	1153.0	17.3 x l_m	16 x 5	12 300	13 400
		Long	1 carr.	27 500	910.0	270	16 x 10	9 600	13 400
			2 carr.	44 670	1478.0	22.34 x l_m	16 x 10	9 600	13 400
	Strip	Standard	1 carr.	21 300	710.0	150	16 x 16	6 300	13 400
		Long	1 carr.	34 600	1153.0	1557	16 x 16	6 300	13 400

l_m = center-to-center distance between carriages (mm)
d_0 = screw diameter (mm)
P = screw lead (mm)
carr. = carriage(s) (mm)
m_{ca} = moved mass of system (kg)

General technical data

Precision Module	Planar moment of inertia I_y (cm⁴)	I_z (cm⁴)	Minimum center-to-center distance $l_{m\ min}$ Standard carr. (mm)	Long carr. (mm)	Mass of the linear motion system m_s (kg): Without cover, without drive	Without cover, with drive	With cover plate	With sealing strip
PSK 40	0.892	6.65	50	–	$0.0026 \cdot L + m_{ca}$	$0.0028 \cdot L + 0.075 + m_{ca}$	$0.0030 \cdot L + 0.089 + m_{ca}$	–
PSK 50	1.690	13.50	60	–	$0.0035 \cdot L + m_{ca}$	$0.0038 \cdot L + 0.179 + m_{ca}$	$0.0041 \cdot L + 0.204 + m_{ca}$	$0.0042 \cdot L + 0.208 + m_{ca}$
PSK 60	5.380	34.48	60	75	$0.0062 \cdot L + m_{ca}$	$0.0069 \cdot L + 0.254 + m_{ca}$	$0.0072 \cdot L + 0.281 + m_{ca}$	$0.0073 \cdot L + 0.272 + m_{ca}$
PSK 90	22.340	145.80	90	110	$0.0125 \cdot L + m_{ca}$	$0.0138 \cdot L + 0.638 + m_{ca}$	$0.0146 \cdot L + 0.726 + m_{ca}$	$0.0147 \cdot L + 0.736 + m_{ca}$



Mass
Mass calculation without motor and switches.
Mass formula:
Mass factor (kg/mm) · length L (mm) + mass of all parts of fixed length (kg) + moved mass of system m_{ca} (kg)

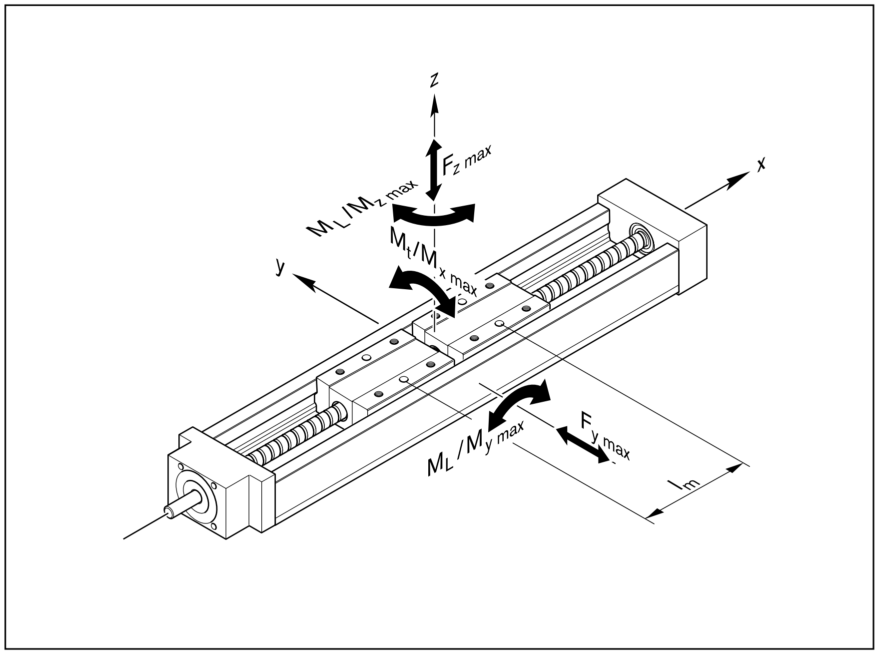
Modulus of elasticity E

E = 210,000 N/mm²

Note on dynamic load capacities and moments
Determination of the dynamic load capacities and moments is based on a travel life of 100,000 m.
Often only 50,000 m are actually stipulated.
For comparison: Multiply values **C, M_t and M_L** from the table by 1.26.

Maximum permissible loads
The maximum permissible forces ($F_{y\,max}$, $F_{z\,max}$) and moments ($M_{x\,max}$, $M_{y\,max}$, $M_{z\,max}$) are equal to half the dynamic characteristics (**C, M_t, M_L**).

Suitable loads (recommended values)
With respect to the desired service life, loads up to about 20% of the characteristic dynamic values (**C, M_t, M_L**) have proved acceptable.
At the same time, the following may not be exceeded:
– maximum permissible loads
– permissible drive torque
– permissible travel speed



l_m = center-to-center distance between carriages (mm)

Moved mass of system m_{ca}

Precision Module	Carriage	Moved mass of system m_{ca} (kg) Without cover, without drive		Without cover, with drive		With cover plate		With sealing strip
		1 carr.	2 carr.	1 carr.	2 carr.	1 carr.	2 carr.	1 carr.
PSK 40	Standard	0.08	0.17	0.09	0.18	0.14	0.28	–
PSK 50	Standard	0.20	0.40	0.22	0.42	0.29	0.56	0.20
	Long	–	–	–	–	–	–	0.37
PSK 60	Standard	0.25	0.49	0.27	0.52	0.38	0.73	0.33
	Long	0.34	0.69	0.37	0.71	0.51	1.00	0.58
PSK 90	Standard	0.77	1.54	0.85	1.62	1.09	2.10	0.80
	Long	1.04	2.08	1.11	2.15	1.43	2.79	1.40

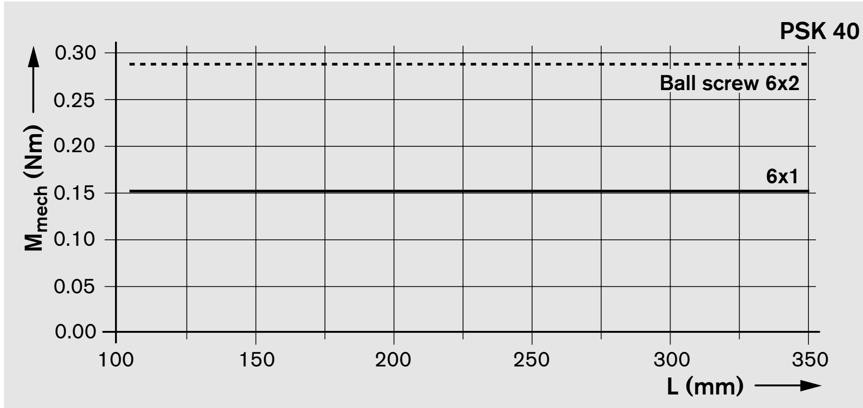
carr. = carriage(s) (mm)

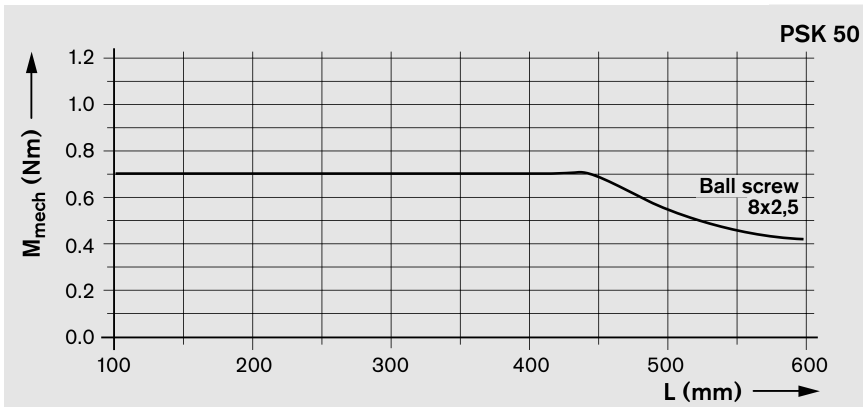
Technical Data

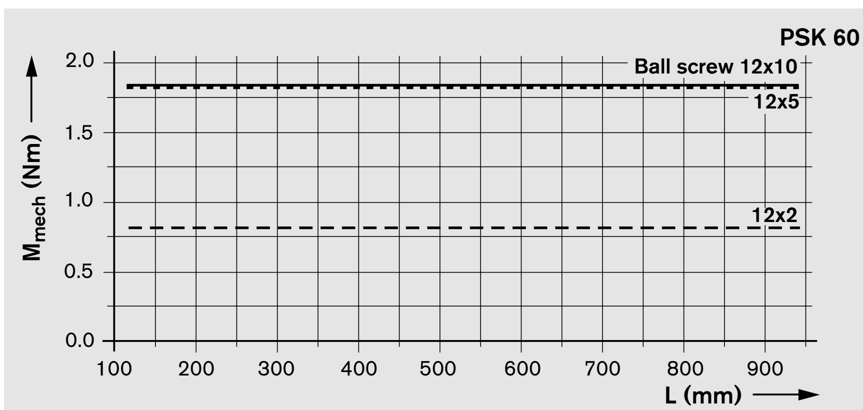
Maximum permissible drive torque for mechanical system M_{mech}

The values shown for M_{mech} are applicable under the following conditions:
- Horizontal operation
- Ball screw journal without keyway
- No radial load on ball screw shaft

Consider the rated torque of the coupling used!

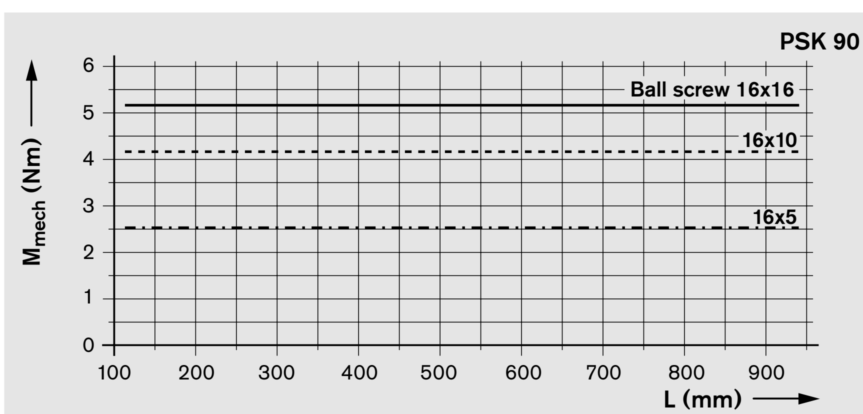






Ball screw journal with keyway
For PSK 90:
If a keyway is used, when comparing the chart against the table, the lower of the two values will always apply!

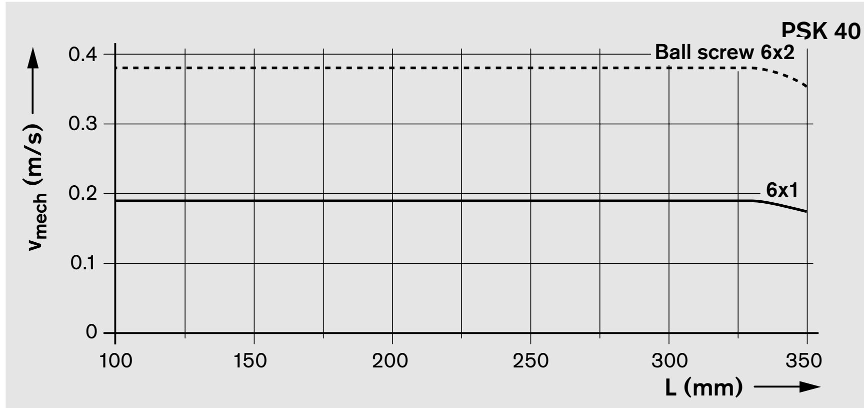
Precision Module	M_{mech} (Nm)
PSK 90	3.2

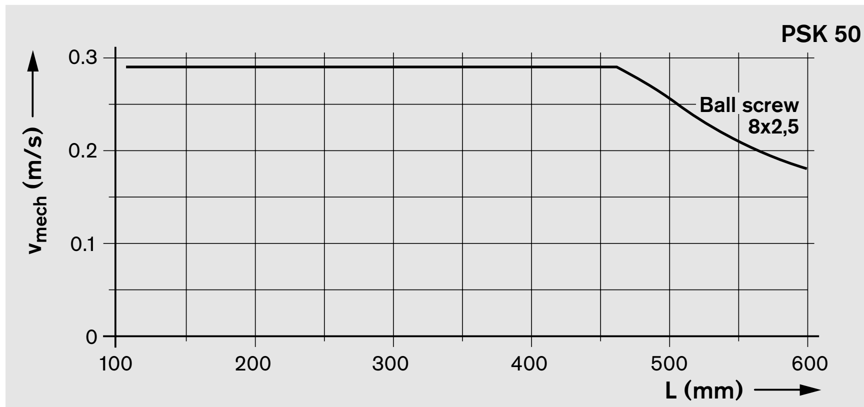


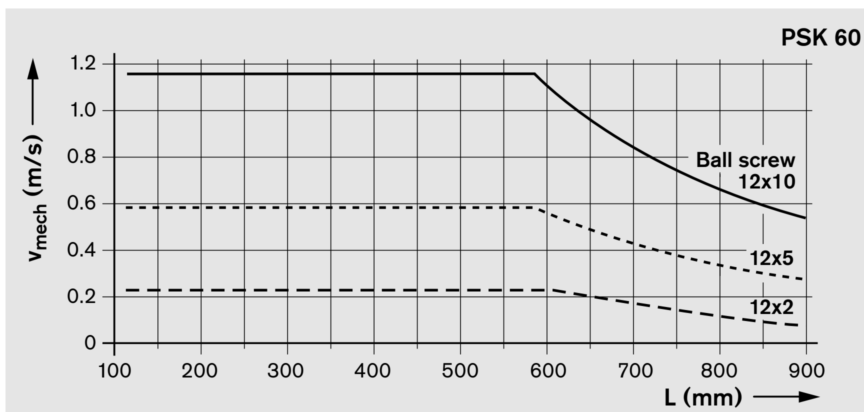
M_{mech}	=	maximum permissible drive torque for mechanical system	(N)
L	=	PSK length	(mm)
Ball screw	=	ball screw size: d_0 x P	
d_0	=	screw diameter	(mm)
P	=	lead	(mm)

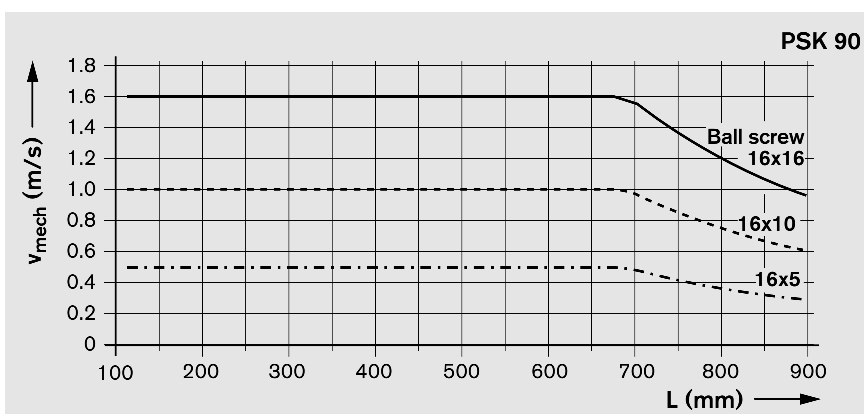
Maximum permissible linear speed of mechanical system v_{mech}

Consider the motor speed!









v_{mech}	=	maximum permissible linear speed of mechanical system	(m/s)
L	=	PSK length	(mm)
Ball screw	=	ball screw size: d_0 x P	
d_0	=	screw diameter	(mm)
P	=	lead	(mm)

Technical Data

Drive data of timing belt side drive, fixed bearing end for motor attachment via timing belt side drive

Motor type		MSM 030B / MSM 030C / MSK 030C					MSM 040B / MSK 040C				
Frictional torque M_{Rsd} (Nm)		0.35					0.4				
		Permissible torque up to length L = ... at			Reduced mass moment of inertia at		Permissible torque up to length L = ... at			Reduced mass moment of inertia at	
Gear ratio			i = 1	i = 1.5	i = 1	i = 1.5		i = 1	i = 1.5	i = 1	i = 1.5
Precision Module	Ball screw size d_0 x P	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)	L (mm)	M_{sd} (Nm)	M_{sd} (Nm)	J_{sd} (10^{-6} kgm²)	J_{sd} (10^{-6} kgm²)
PSK 60	12 x 2	940	0.80	0.50	45.6	17.7	–	–	–	–	–
	12 x 5	940	1.60	1.10	45.6	17.7	–	–	–	–	–
	12 x 10	940	1.60	1.10	45.6	17.7	–	–	–	–	–
PSK 90	16 x 5	940	2.40	1.60	40.0	14.0	940	2.40	1.60	234	98.9
	16 x 10	940	2.50	1.70	40.0	14.0	940	3.90	2.60	234	98.9
	16 x 16	940	2.50	1.70	40.0	14.0	940	4.80	3.20	234	98.9

M_{Rsd} = frictional torque of timing belt side drive at motor journal (Nm)
M_{sd} = maximum permissible drive torque of the timing belt side drive (Nm); consider the maximum torque of the motor M_{max}
J_{sd} = mass moment of inertia of timing belt side drive (kgm²)
i = timing belt side drive reduction

d_0 = screw diameter (mm)
P = screw lead (mm)

Frictional torque of the linear motion system M_{Rs}

Precision Module	Ball screw size d_0 x P	Frictional torque of the linear motion system M_{Rs} (Nm) for carriage version – Without cover or with cover plate, 1 carr. or 2 carr.		With sealing strip, 1 carr. or 2 carr.	
		Standard	Long	Standard	Long
PSK 40	6 x 1	0.033	–	–	–
	6 x 2	0.034	–	–	–
PSK 50	8 x 2.5	0.10	–	0.10	0.11
PSK 60	12 x 2	0.12	0.12	0.12	0.13
	12 x 5	0.13	0.14	0.14	0.15
	12 x 10	0.15	0.16	0.16	0.18
PSK 90	16 x 5	0.30	0.31	0.30	0.31
	16 x 10	0.30	0.33	0.32	0.35
	16 x 16	0.31	0.37	0.34	0.39

carr. = carriage(s) (mm)
d_0 = screw diameter (mm)
P = screw lead (mm)

Mass moment of inertia of the linear motion system J_s referred to the drive journal

$$J_s = (k_{J\,fix} + k_{J\,var} \cdot L) \cdot 10^{-6}$$

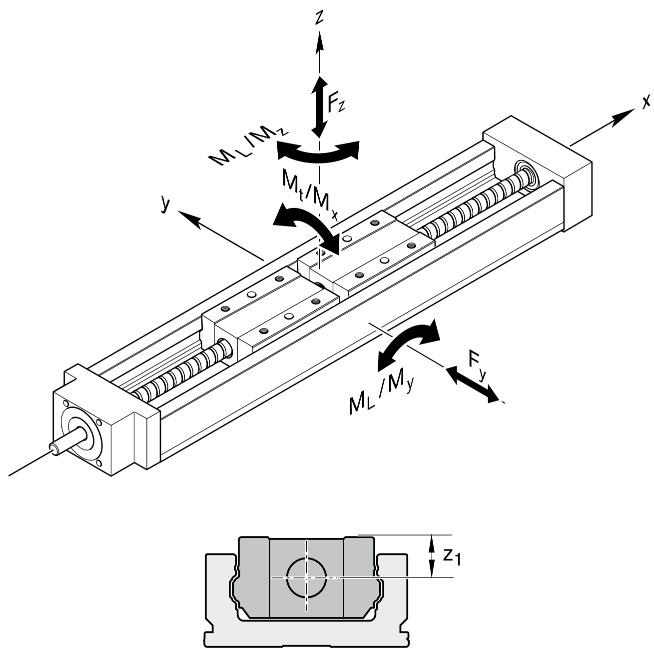
J_s = mass moment of inertia of linear motion system (without external load) (kgm^2)
$k_{J\,fix}$ = constant for fixed-length portion of mass moment of inertia ($10^6\ kgm^2$)
$k_{J\,m}$ = constant for mass-specific portion of mass moment of inertia ($10^6\ kgm^2$)
$k_{J\,var}$ = constant for variable-length portion of mass moment of inertia (10^9 kgm)
L = length (mm)

Precision Module	Ball screw size d_0 x P	Carriage	$k_{J\,fix}$ Without cover 1 carr.	Without cover 2 carr.	Cover plate 1 carr.	Cover plate 2 carr.	Sealing strip 1 carr.	$k_{J\,var}$	$k_{J\,m}$
PSK 40	6 x 1	Standard	0.115	0.117	0.116	0.120	–	0.002	0.025
	6 x 2	Standard	0.122	0.131	0.127	0.141	–	0.002	0.101
PSK 50	8 x 2,5	Standard	0.533	0.565	0.544	0.587	0.530	0.004	0.158
		Long	–	–	–	–	0.557		
PSK 60	12 x 2	Standard	0.999	1.024	1.010	1.045	1.005	0.013	0.101
		Long	1.009	1.043	1.023	1.073	1.030		
	12 x 5	Standard	1.130	1.289	1.200	1.422	1.168	0.011	0.633
		Long	1.194	1.409	1.282	1.593	1.327		
	12 x 10	Standard	1.643	2.277	1.922	2.808	1.795	0.011	2.533
		Long	1.897	2.758	2.251	3.492	2.492		
PSK 90	16 x 5	Standard	4.216	4.703	4.368	5.007	4.184	0.031	0.633
		Long	4.216	4.703	4.368	5.007	4.184		
	16 x 10	Standard	5.831	7.781	6.439	8.997	5.704	0.031	2.533
		Long	6.489	9.124	7.300	10.745	7.224		
	16 x 16	Standard	9.213	14.207	10.770	17.319	8.889	0.034	6.485
		Long	10.899	17.643	12.974	21.793	12.780		

Coupling data

Precision Module	for motor attachment	Coupling data Rated torque M_{cN} (Nm)	Mass moment of inertia J_c ($10^{-6}\ kgm^2$)	Weight m_c (kg)
PSK 40	MSM 020B	0.70	0.12	0.015
PSK 50	MSM 020B	1.90	2.10	0.040
	MSM 030B	3.70	7.00	0.075
	MSK 030C	3.70	7.00	0.075
	VRDM 368	3.70	7.00	0.075
PSK 60	MSM 030B	3.70	7.00	0.075
	MSK 030C	1.90	2.10	0.040
	VRDM 368	5.50	20.00	0.040
PSK 90	MSM 030C	10.00	35.00	0.170
	MSM 040B	9.00	60.00	0.260
	MSK 030C	10.00	35.00	0.170
	MSK 040C	9.00	60.00	0.260
	VRDM 3910	9.00	60.00	0.260
	VRDM 397	9.00	60.00	0.260

Technical Data, Calculations



Combined equivalent load on bearing of the linear guide

(1) $$F_{comb} = |F_y| + |F_z| + C \cdot \frac{|M_x|}{M_t} + C \cdot \frac{|M_y|}{M_L} + C \cdot \frac{|M_z|}{M_L}$$

F_{comb}	=	combined equivalent load on bearing	(N)
F_y	=	force in y-direction	(N)
F_z	=	force in z-direction	(N)
M_x	=	torsional moment (about the x-axis)	(Nm)
M_y	=	torsional moment (about the y-axis)	(Nm)
M_z	=	torsional moment (about the z-axis)	(Nm)
C	=	dynamic load capacity	(N)
M_t	=	dynamic torsional moment load capacity	(Nm)
M_L	=	dynamic longitudinal moment load capacity	(Nm)

	z_1 (mm)		
	Without cover	**Cover plate**	**Sealing strip**
PSK 40	11	23	–
PSK 50	13	27	27
PSK 60	17	32	32
PSK 90	22	44	44

z_1 = distance between guideway centerline and top edge of carriage (mm)

Nominal life

Nominal life of the guideway in meters:

(2) $$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^5 \text{ m}$$

Nominal life of the guideway in hours:

(3) $$L_h = \frac{L}{3600 \cdot v_m}$$

Frictional torque

Frictional torque for motor attachment via motor mount and coupling:

(4) $$M_R = M_{Rs}$$

Frictional torque for motor attachment via timing belt side drive:

(5) $$M_R = \frac{M_{Rs}}{i} + M_{R\,sd}$$

Mass moment of inertia

for motor attachment via motor mount and coupling:

(6) $$J_{ex} = J_s + J_t + J_c$$

for motor attachment via timing belt side drive:

(7) $$J_{ex} = \frac{J_s + J_t}{i^2} + J_{sd}$$

Translatory mass moment of inertia of external load referred to the drive journal

(8) $$J_t = m_{ex} \cdot k_{Jm} \cdot 10^{-6}$$

C	=	dynamic load capacity	(N)
F_{comb}	=	combined equivalent load on bearing	(N)
i	=	timing belt side drive reduction	(–)
J_c	=	mass moment of inertia, coupling	(kgm^2)
J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_s	=	mass moment of inertia of linear motion system (without external load)	(kgm^2)
J_t	=	translatory mass moment of inertia of external load referred to the drive journal	(kgm^2)
k_{Jm}	=	constant for mass-specific portion of mass moment of inertia	(10^6 m^2)
L	=	nominal life	(m)
L_h	=	nominal life	(h)
m_{ex}	=	moved external load	(kg)
M_R	=	frictional torque at motor journal	(Nm)
$M_{R\,sd}$	=	frictional torque of timing belt side drive	(Nm)
M_{Rs}	=	frictional torque of linear motion system	(Nm)
v_m	=	average speed	(m/s)

Technical Data, Calculations

Mass moment of inertia of the drive train referred to the motor journal

$$J_{dc} = J_{ex} + J_{br} \tag{8}$$

Mass moment of inertia ratio

$$V = \frac{J_{dc}}{J_m} \tag{9}$$

Application area	V
Handling	≤ 6.0
Machining	≤ 1.5

Total mass moment of inertia referred to the motor journal

$$J_{tot} = J_{dc} + J_m \tag{10}$$

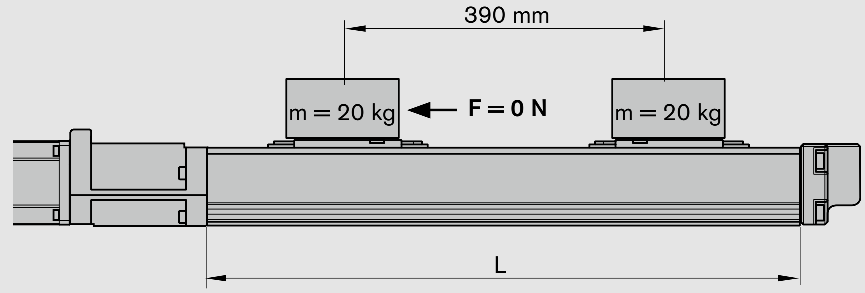
Maximum permissible rotary speed for mechanical system

$$n_{mech} = \frac{v_{mech} \cdot i \cdot 1000 \cdot 60}{P} \tag{11}$$

Condition:
$n_{mech} < n_{m\,max}$

i = timing belt side drive reduction (–)
J_{br} = mass moment of inertia, motor brake (kgm^2)
J_{dc} = mass moment of inertia, drive train (kgm^2)
J_{ex} = mass moment of inertia of mechanical system (kgm^2)
J_m = mass moment of inertia, motor (kgm^2)
J_{tot} = total mass moment of inertia (kgm^2)
$n_{m\,max}$ = maximum permissible rotary speed of motor with controller (min^{-1})
n_{mech} = maximum permissible rotary speed of mechanical system (min^{-1})
P = screw lead (mm)
V = ratio of mass moments of inertia of drive train and motor (–)
v_{mech} = maximum permissible linear speed of mechanical system (m/s)

Calculation example



Given data

A mass of 20 kg is to be moved 390 mm at a maximum travel speed of 0.6 m/s.

Module selected based on the technical data and the connection dimensions:

- PSK 90 without cover and with a standard length steel carriage; motor attachment via integrated motor mount and coupling
- Motor type MSK 030C

When sizing the drive, the motor-controller combination must always be considered, as the motor type and performance data (e.g. maximum useful speed and maximum torque) will depend on the controller or control system used.

Estimation of the PSK module length L

Excess travel = 2 · P = 2 · 16 mm = 32 mm
(in accordance with the formula given in "PSK 90 Components and Ordering Data")

Selection of ball screw:
As a general rule:
Always choose the lowest lead (resolution, braking distance, length).

Permissible ball screws according to the "Permissible travel speed" chart at
v_{mech} = 0.6 m/s: Ball screw 16x10 and 16x16;
Ball screw selected:
Ball screw 16x10 with v_{mech} = 1 m/s
M_{mech} = 4.1 Nm with ball screw 16x10
(according to the chart "Maximum permissible drive torque")

Calculation of PSK length L

Excess travel = 2 · P = 2 · 10 mm = 20 mm
Length L = (effective stroke + 2 · excess travel) + 100 mm =
(390 mm + 2 · 20 mm) + 100 mm = 530 mm
Selected: Standard length L = 540 mm;
hole spacing in frame: 70 mm / 4 · 100 mm / 70 mm

Frictional torque M_R

$M_R = M_{Rs}$
M_R = 0.30 Nm (see "Technical Data")

Calculation example (continued)

Mass moment of inertia of mechanical system:

$J_{ex} = J_s + J_t + J_c$

$J_s = (k_{J\,fix} + k_{J\,var} \cdot L)$
$= (5.831 + 0.031 \cdot 540\text{ mm}) \cdot 10^{-6}$
$= 22.57 \cdot 10^{-6}\text{ kgm}^2$ (see “Technical Data”)

$J_t = m_{ex} \cdot k_{J\,m} \cdot 10^{-6}$
$= 20\text{ kg} \cdot 2.533 \cdot 10^{-6}\text{ kgm}^2$
$= 50.66 \cdot 10^{-6}\text{ kgm}^2$ (see “Technical Data”)

$J_c = 60 \cdot 10^{-6}\text{ kgm}^2$ (see “Technical Data”)
$J_{ex} = (22.57 + 50.66 + 60) \cdot 10^{-6}\text{ kgm}^2$
$= 133.23 \cdot 10^{-6}\text{ kgm}^2$

$J_{dc} = J_{ex} + J_{br}$
$J_{br} = 7.0 \cdot 10^{-6}\text{ kgm}^2$ (see “Motors”)
$J_{dc} = (133.23 + 7.0) \cdot 10^{-6}\text{ kgm}^2$
$= 140.23 \cdot 10^{-6}\text{ kgm}^2$

Mass moment of inertia for handling ($V \leq 6$):

$$V = \frac{J_{dc}}{J_m} \leq 6$$

$$V = \frac{140.23 \cdot 10^{-6}\text{ kgm}^2}{30 \cdot 10^{-6}\text{ kgm}^2} = 4.67 < 6$$

Rotary speed n:

$$n_{mech} = \frac{v \cdot i \cdot 1000 \cdot 60}{10} = \frac{0.6\text{ m/s} \cdot 1 \cdot 1000 \cdot 60}{10\text{ mm}} = 3600\text{ min}^{-1}$$

Result

Precision Module PSK 90 without cover and with one standard-length steel carriage; Motor MSK 030C, attached via integrated mount and coupling:

Standard length	L	=	540 mm;
Hole spacing in frame:			70 mm / 40 · 100 mm / 70 mm
Ball screw 16 x 10 with	v_{mech}	=	1 m/s > 0.6 m/s
	M_{mech}	=	4.1 Nm
Frictional torque	M_R	=	0.30 Nm
Motor MSK 030C:			
Mass moment of inertia	J_m	=	$30 \cdot 10^{-6}\text{ kgm}^2$; $V = 4.67 < 6$
Rotary speed	$n_{m\,max}$	=	$9000\text{ min}^{-1} > 3600\text{ min}^{-1}$
Torque	M_{max}	=	4.0 Nm < 4.1 Nm

For final motor selection, the drive and performance data must be recalculated as specified in the Rexroth catalog “Control Systems, Electrical Accessories, ...”

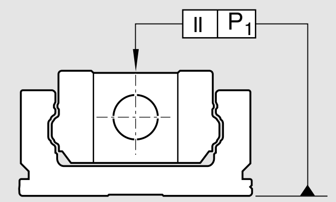
Accuracy

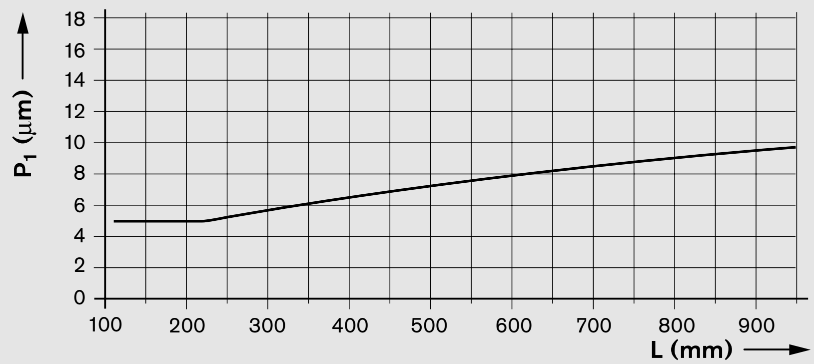
General note

All accuracy figures apply to the module when screwed down and assume an ideally flat mounting base. The values given do not take account of any shape deviations in the mounting base surface.

Accuracy P_1

Measured at the carriage center





Accuracy P_3