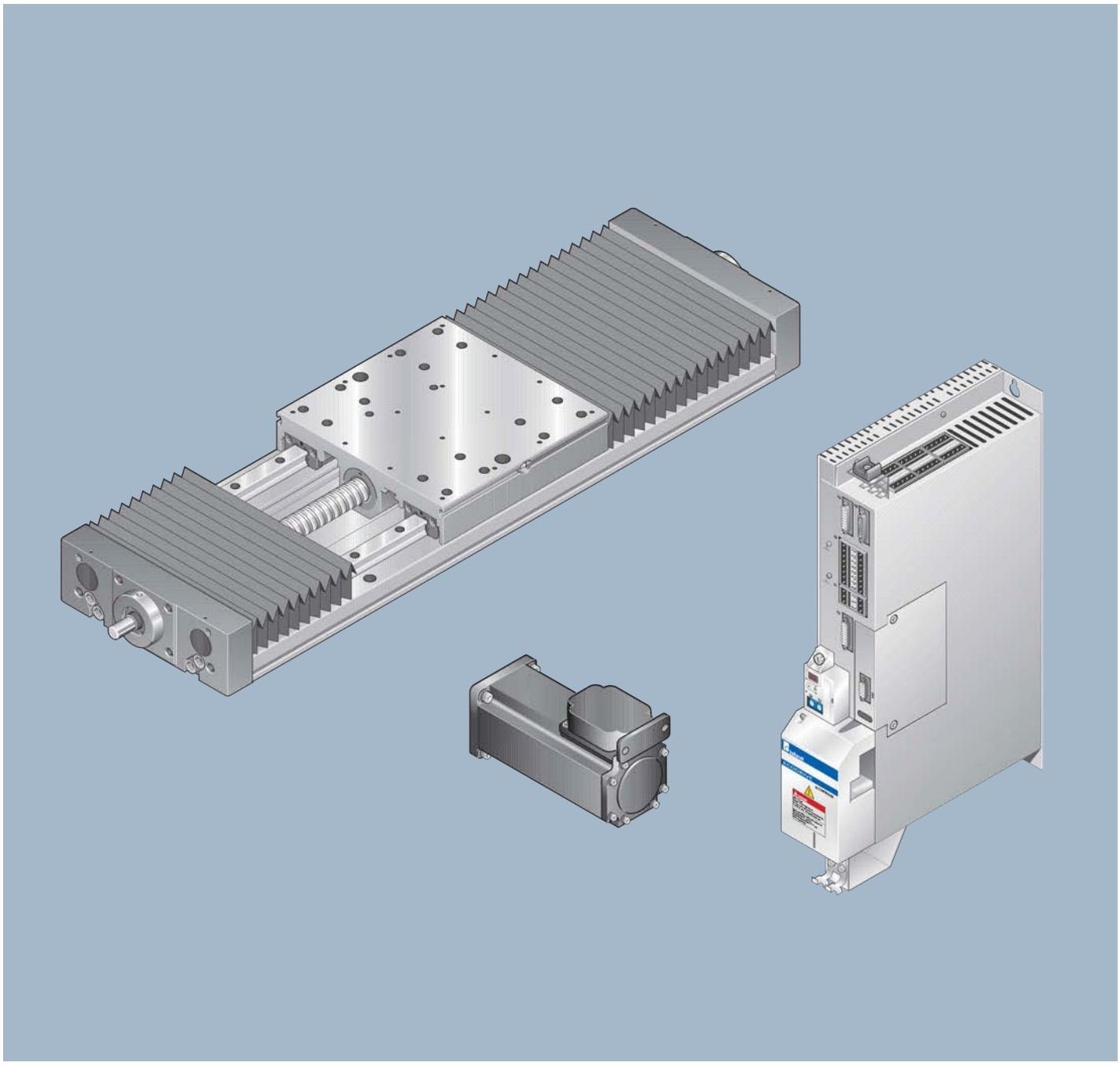
The Drive & Control Company

Rexroth
Bosch Group

Ball Rail Tables TKK



Rexroth Linear Motion Technology

Ball Rail Systems	Standard Ball Rail Systems	
	Super Ball Rail Systems	
	Ball Rail Systems with Aluminum Runner Blocks	
	High Speed Ball Rail Systems	
	Corrosion Resistant Ball Rail Systems	
	Wide Ball Rail Systems	
	Ball Rail Systems with Integrated Measuring System	
	Braking and Clamping Units for Ball Rail Systems	
	Gear Racks for Ball Rail Systems	
	Miniature Ball Rail Systems	
	eLINE Ball Rail Systems	
	Cam Roller Guides	
Roller Rail Systems	Standard Roller Rail Systems	
	Wide Roller Rail Systems	
	Heavy Duty Roller Rail Systems	
	Roller Rail Systems with Integrated Measuring System	
	Braking and Clamping Units for Roller Rail Systems	
	Gear Racks for Roller Rail Systems	
Linear Bushings and Shafts	Linear Bushings, Linear Sets	
	Shafts, Shaft Support Rails, Shaft Support Blocks	
	Ball Transfer Units	
	Traditional Engineering Components	
Screw Drives		
Linear Motion Systems	Linear Motion Slides	– Ball Screw Drive – Toothed Belt Drive
	Linear Modules	– Ball Screw Drive – Toothed Belt Drive – Rack and Pinion Drive – Pneumatic Drive – Linear Motor
	Compact Modules	– Ball Screw Drive – Toothed Belt Drive – Linear Motor
	Multi-Axis Motion Systems CMS	
	Precision Modules	– Ball Screw Drive
	Ball Rail Tables	– Ball Screw Drive – Linear Motor
	Controllers, Motors, Electrical Accessories	
	Linear Actuators	

A Single Solution for Many Applications

The Applications

– Driving

– Transporting

– Positioning

up to 2,860mm

Load capacity C up to 132,500 N
Longitudinal moment M_L up to 18,100 Nm
Torsional moment M_t up to 19,800 Nm

up to 2500 kg

up to 96 m/min

Repeatability up to	0.005 mm
Postioning accuracy up to	0.01 mm
Linear guiding accuracy to within	0.007 mm

AC servo drive or stepping motor
with mount, coupling or side drive with
timing belt (plus control unit)

Mechanical and proximity switches

Combination option provided by connectors

T-nuts etc.

Moment of friction measurement
Lead deviation
Sequence accuracy
Positioning accuracy
Combination option provided by connectors

The Solution

Rexroth Ball Rail Tables TKK

Product Overview

Rexroth Ball Rail Tables are precision, ready-to-mount components with high performance characteristics and compact dimensions.

Practical combination options and the modular construction principle make a wide range of economical applications possible.

Rapid delivery is a matter of course.

Structure

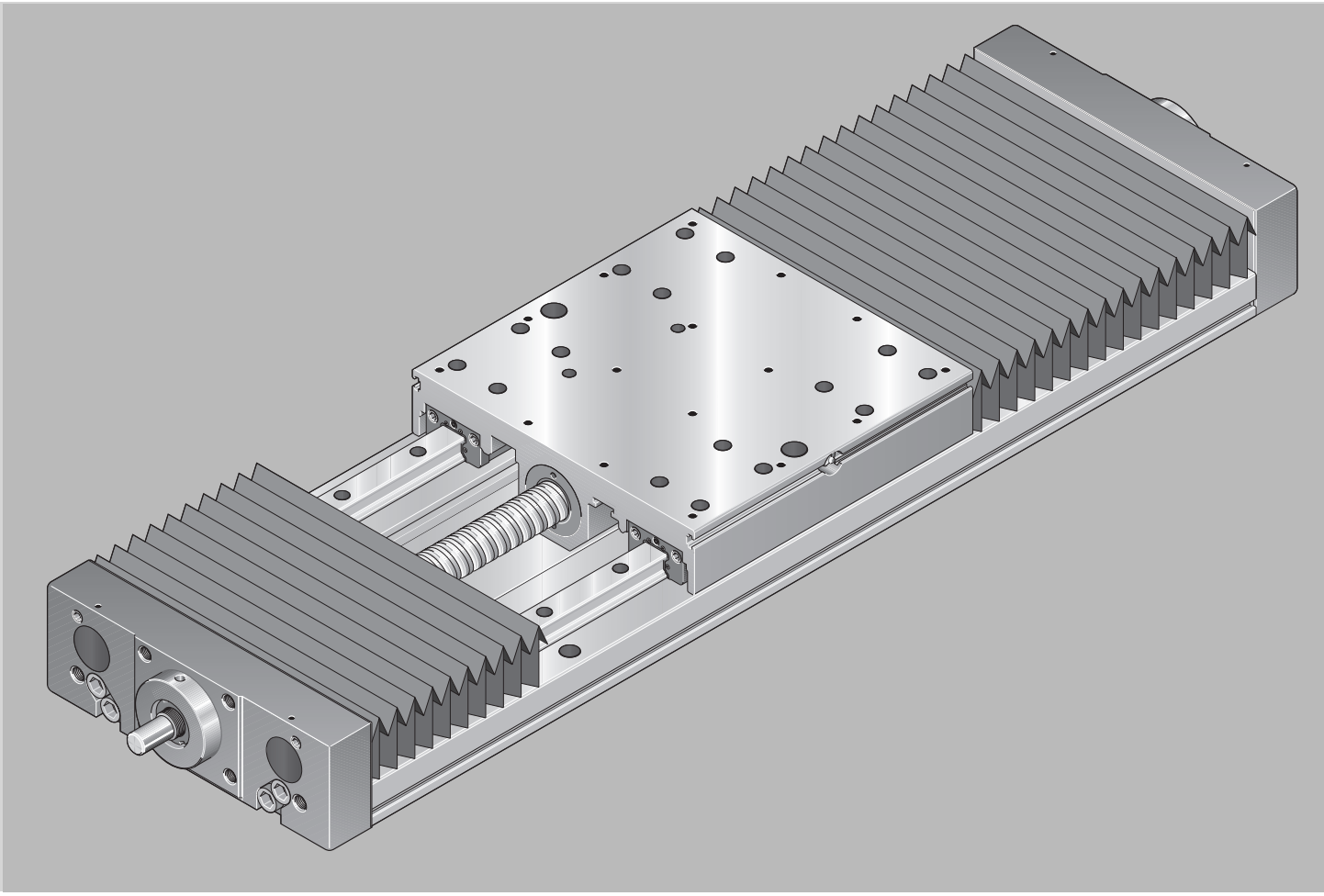
– Base plate made from precision machined aluminum or steel profile with reference edge in finely graduated length increments
- Guideway: Two Ball Rail Systems with four long runner blocks per carriage
- Precision Ball Screw Assemblies to tolerance class 7 with zero backlash nut systems
- Aluminum fixed bearing end-plates with two-row preloaded angular contact ball bearing
- Floating bearing end-plates with double floating bearing system
- Carriage made of machined aluminum or steel profiles in various lengths

Accessories

– Bellows
- Internal glass scale
- Internal or external mechanical switch
- Internal or external proximity switch
- Socket with mating plug for the switches
- Aluminum profile cable duct
- Side drive with timing belt or motor mount and coupling for attachment of the motor
- Maintenance-free digital AC servomotors with integrated brake and attached feedback

Drive controllers and control systems

For mounting and maintenance please refer to “Instructions for Ball Rail Tables TKK”
RDEFI 82 571



Features

Rapid assembly provided by machined reference edge on the base plate.

Switches adjustable over the full length of travel. Can be mounted either internally, protected by the bellows, or externally, in freely accessible positions.

Inexpensive maintenance of the four runner blocks and the precision ball screw assembly. Lubrication via one central lubrication point. A lube port is readily accessible on each side of the carriage.(Suitable for grease lubrication only)

Protection of integrated components provided by high-quality, oil and moisture resistant welded bellows.

No loss of load capacity due to rigid table design, reference edge for runner blocks, parallel drilled nut mounting.

Increased load-bearing capacity generally permits the use of a smaller Ball Rail Table.

Oil and temperature resistant bellows mounting provided by mechanical clamping of the last folds.

High speeds over long distances are possible by using the combination of Ball Rail Systems, and Ball Screws which offer large diameters and leads, and double floating bearing systems.

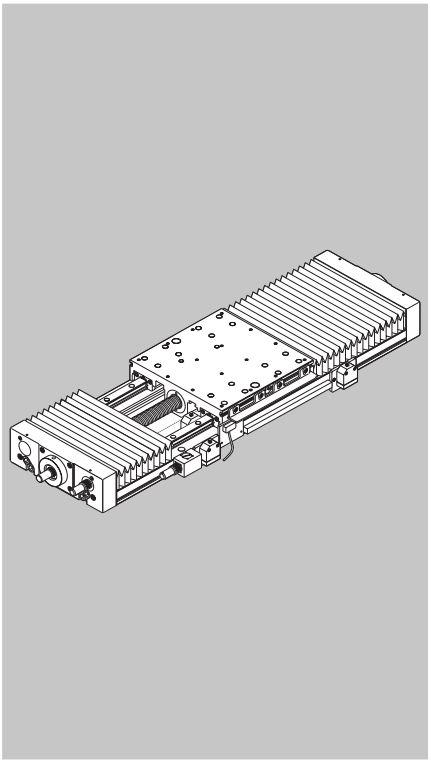
Product Overview

Motor preselection in accordance with controllers and control systems

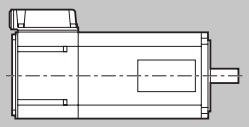
A choice can be made between several different motor/controller combinations to achieve the most cost-efficient solution for each application.

The motor/controller combination must always be considered when sizing the drive.

For more detailed information on motors and control systems, please refer to catalog RE 82 701 “Controllers, Motors, Electrical Accessories”.

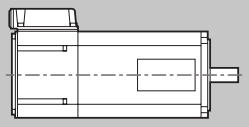


Digital AC servomotors



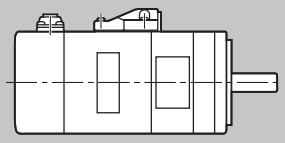
MKD

MHD



MKD

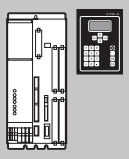
MiniDrive



MMD 082A

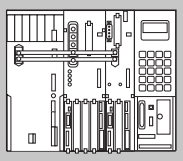
DKC

Digital controller
The low-cost solution for single-axis and multi-axis systems



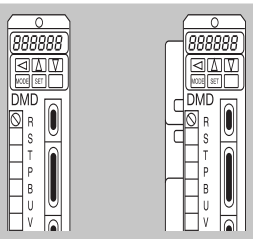
DKS

Digital positioning module and DLC controls
The universal solution for one axis



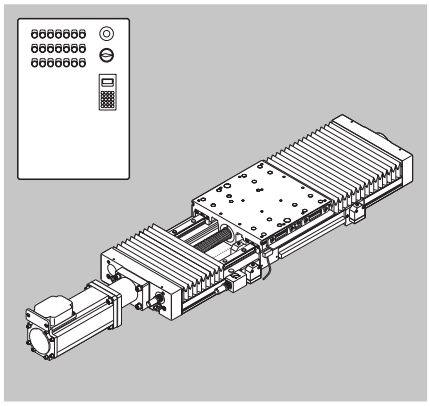
DDS

Digital controllers and CLM analog positioning module
The convenient solution for multi-axis systems



DMD **Digital controller**

WD3 **Power output section**
for control cabinet installation



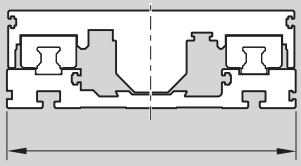
Ball Rail Tables can be supplied complete with motor, controller and control system.

Product Overview

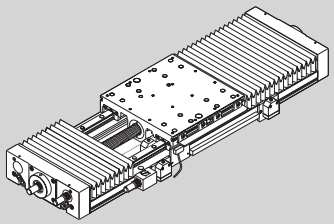
Type designation

The Ball Rail Tables are designated according to **type** and **size.**

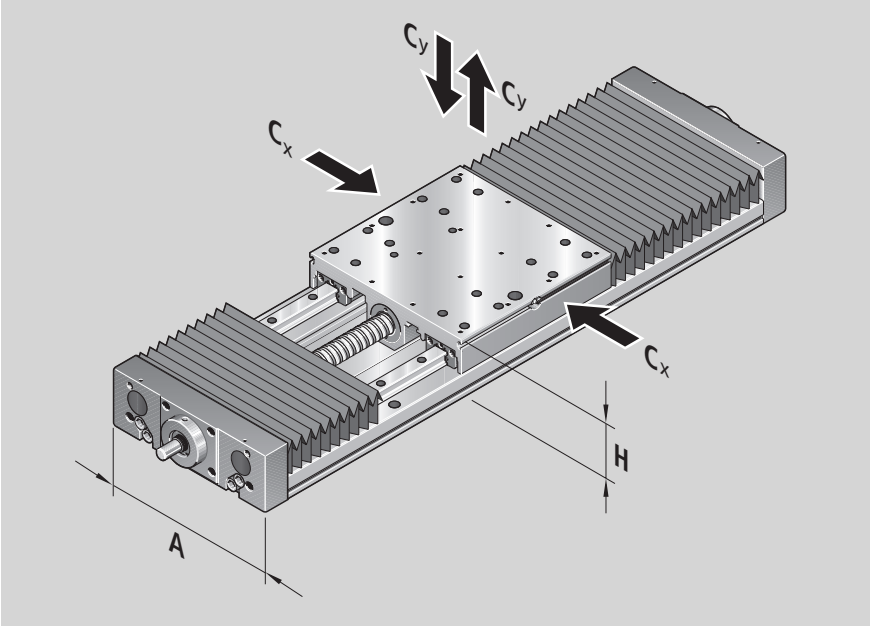
Types also cover the equivalent designs without drive systems.

Ball Rail Table (example) =			Type			Size		
			T	**K**	**K**	**20**	**225**	**Al**
System	=	Ball Rail Table (T)						
Guideway	=	Ball Rail System (K)						
Drive unit	=	Ball Screw Drive (K)						
Dimensions of guideway	=							
Frame dimensions	=							
Material	= Aluminum Steel							

Sizes

	Type	Guideway	Drive unit	Ball Rail Table	
Ball Rail Tables	**TKK**	**Ball Rail Sy-**	 **without drive unit**  **Ball Screw Drive**		

Overview of Ball Rail Tables with permissible loads



Suitable loads

(recommended values on the basis of past experience)

As far as the desired service life is con-cerned, loads of up to approximately 20% of the dynamic load and moment values (C, M_t, M_L) have proven acceptable.

With a side load above 8% C, it should be taken into account when considering the service life that only one rail is secured laterally.

Higher side loads are only taken up by the runner blocks on the secured rail.

In addition, the following values may not be exceeded:

- maximum permissible drive torque
- maximum permissible loads
- maximum permissible speeds

(For more details, see “Technical Data")

Ball Rail Table	Dimensions A x H (mm)	- dyn. load capacity C_x (N) C_y (N)
TKK 15 - 155 Al	155 x 60	**19 500**
TKK 20 - 225 Al	225 x 75	**64 300**
TKK 20 - 225 St		
TKK 20 - 225 Al	225 x 105	
TKK 30 - 325 Al	325 x 90	**100 000**
TKK 30 - 325 St		
TKK 30 - 325 Al	325 x 120	
TKK 35 - 455 Al	455 x 120	**132 500**

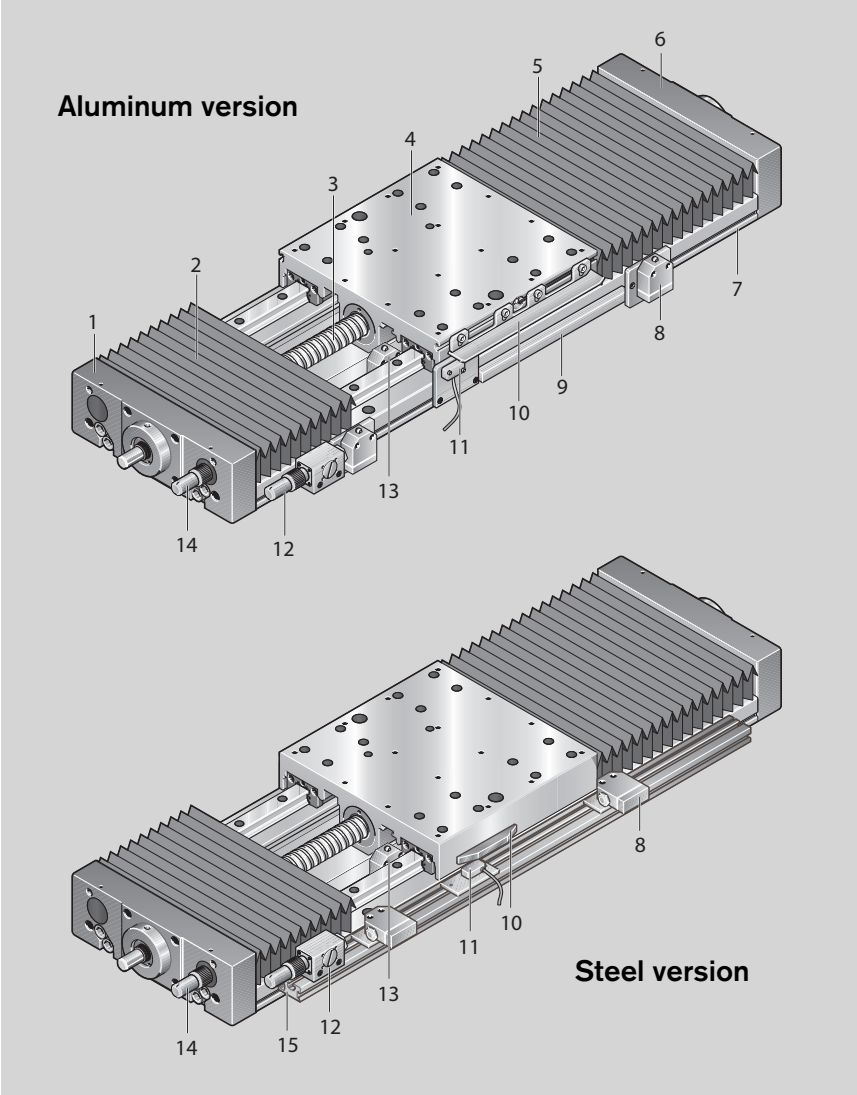
Product Overview

Structure

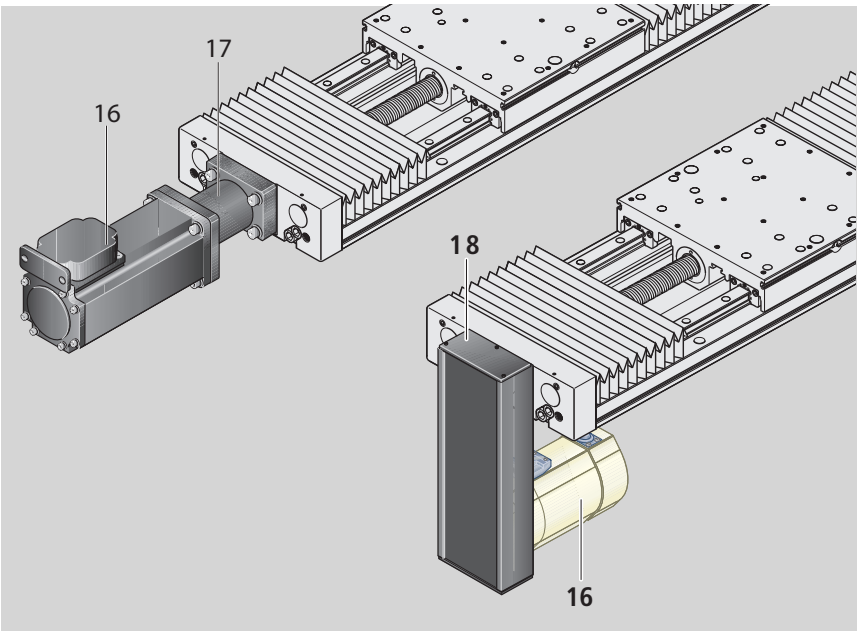
1 Fixed bearing end-plate
2 and 5 Bellows, two-part
3 Precision ball screw assembly with zero backlash nut
4 Carriage with 4 long runner blocks
6 Floating bearing end-plate
7 Base plate

Accessories

8 Mechanical switch, external
9 Cable duct
10 Switching cam
11 Proximity switch, external
12 Socket/plug for external switches
13 Mechanical and proximity switches, internal
14 Socket/plug for internal switches
15 Profiled support



16 Motor
17 Motor mount and coupling
18 Timing belt with side drive



Motor attachment with mount and coupling

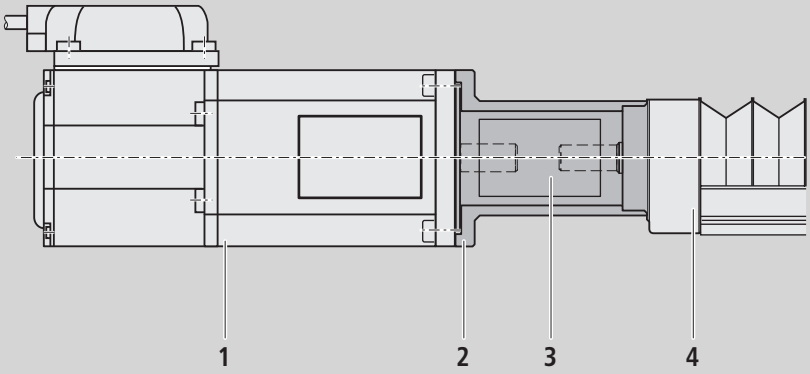
A motor can be attached using a mount and coupling to all Ball Rail Tables.

The motor mount serves both to attach the motor to the Ball Rail Table and as an enclosed housing for the coupling.

The coupling transmits the motor torque to the Ball Rail Table drive shaft without radial force or stress.

Our standard couplings compensate for the thermal expansion of the system.

If other makes of couplings are used, their thermal expansion must be taken into account.



1 Motor
2 Motor mount
3 Coupling
4 Ball Rail Table

Motor attachment via side drive with timing belt

In all Ball Rail Tables the motor can be attached using a side drive with timing belt.

This results in a shorter overall length compared to a motor attachment using motor mount and coupling.

The compact, enclosed housing acts as a belt guard and secures the motor.

Different gear ratios are available:

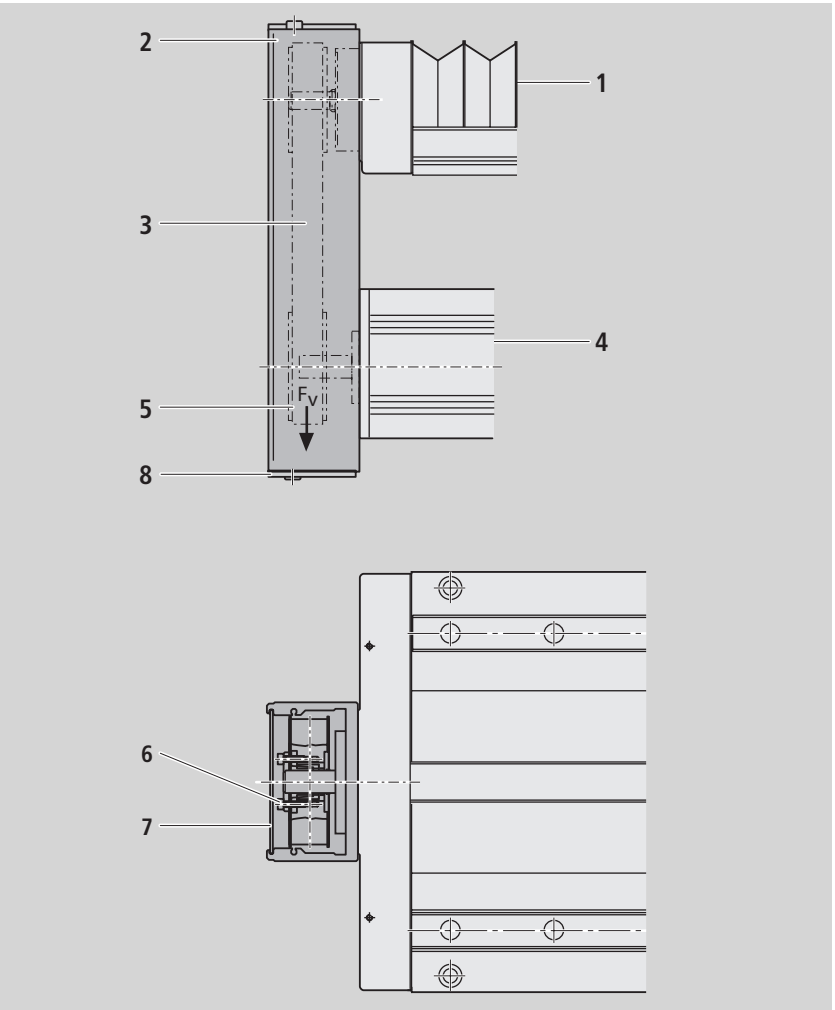
i = 1

i = 1.5

i = 2

The side drive with timing belt can be mounted in four directions:

– bottom, top (RV05 and RV06)
– left, right (RV01 to RV04)



1 Ball Rail Table
2 Anodized aluminum frame
3 Toothed belt
4 AC servomotor
5 Pretensioning of the toothed belt: Apply pretensioning force F_v to the motor (F_v will be indicated on delivery)
6 Belt pulleys attached using clamping fixtures
7 Cover plate
8 Cover

Mounting Accuracy

General notes on mounting

The Aluminum Ball Rail Tables can be mounted from above or below.

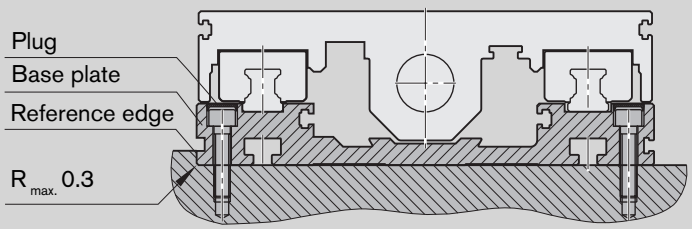
The Steel Ball Rail Tables can only be mounted by bolting from above. In both versions, a reference edge is built into the base plate to help align the unit.

The mounting hole plugs are included with the unit.

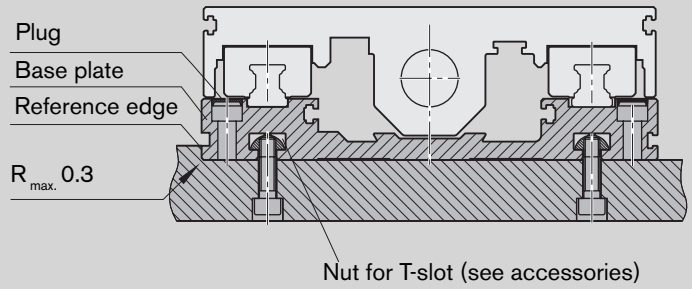
For connection dimensions, see the relevant dimension drawings.

Aluminum Ball Rail Tables

Mounting from above

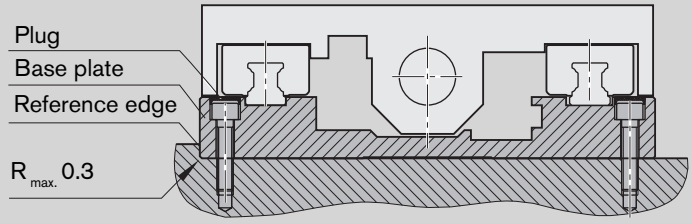


Mounting from below



Steel Ball Rail Tables

Mounting from above

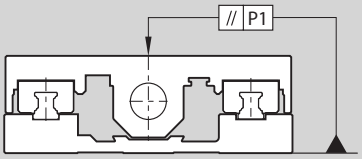


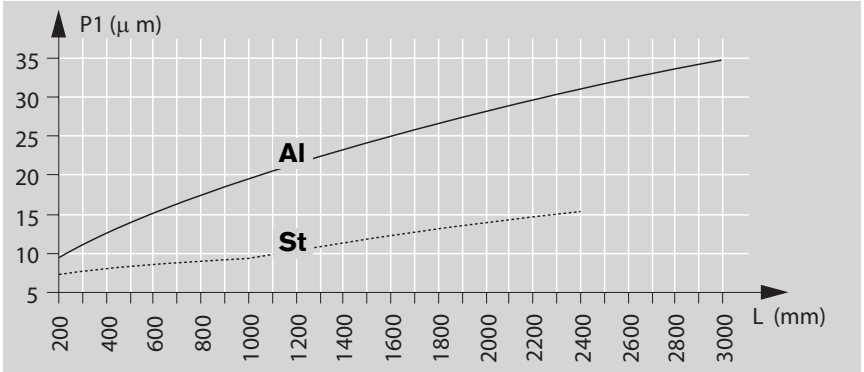
Accuracy

All accuracy data apply to the unit when screwed down and assume an ideal flat mounting surface. Irregularities in the mounting surface are not taken into account in the values given below.

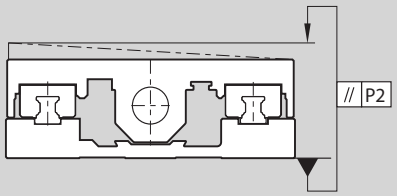
Accuracy P1

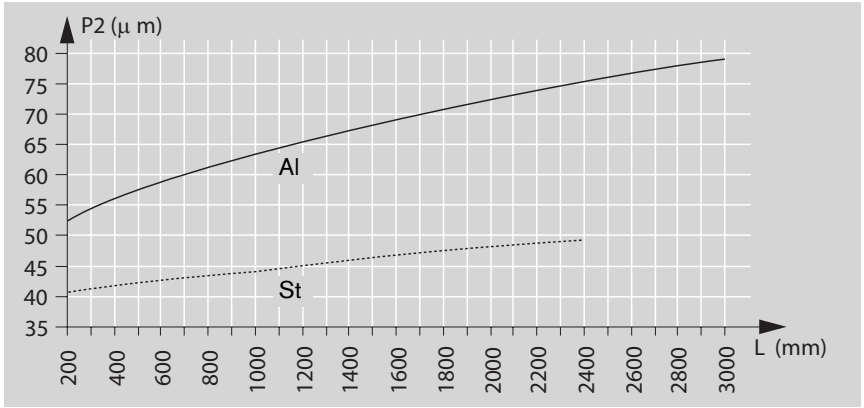
Measured in the center of the carriage



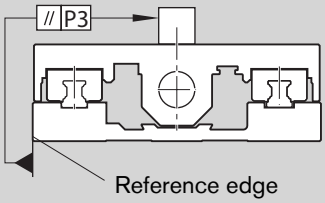


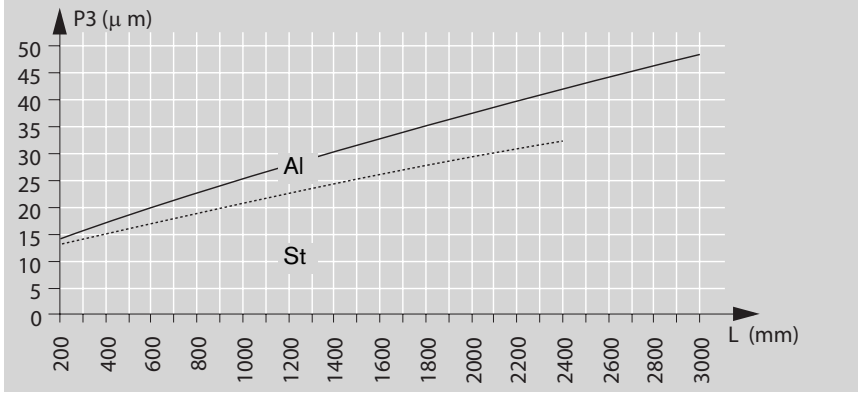
Accuracy P2



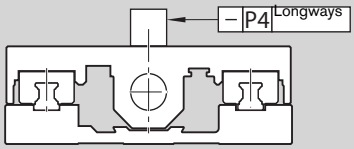


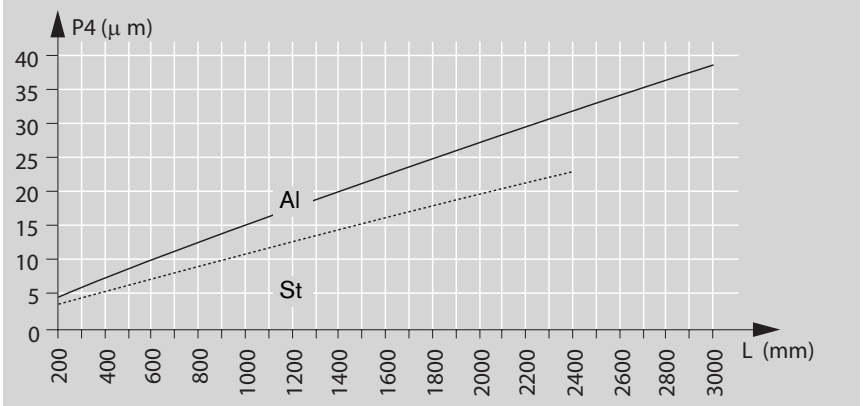
Accuracy P3





Accuracy P4





Technical Data

General system data

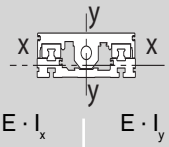
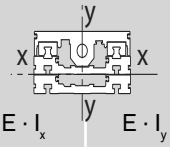
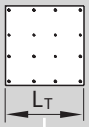
Ball Rail Table	Ball Screw	Dynamic load capacity C			Dynamic moments M_t	Dynamic moments M_L		Maximum loads F_V	Maximum loads F_H	
	d_0 x P	Guideway (N)	Ball screw (N)	Fixed bearing (N)	(Nm)	(Nm)	(Nm)	(N)		
						L_1 = 150	L_1 = 220			
TKK 15-155 Al	without	25300	–	–	1330	1160	2050	24000	6000	
	16 x 10		9600	17000						
	16 x 16		9300							
	20 x 5		14300							
	20 x 20		13300							
						L_1 = 220	L_1 = 320			
TKK 20-225 Al TKK 20-225 St	without	79200 Al only	–	–	6340	5150	9110	79200	19800	
	20 x 5		14300	17000						
	20 x 20		13300							
	25 x 5		15900	18800						
	25 x 10		15700							
	25 x 25		14700							
						L_1 = 320	L_1 = 450			
TKK 30-325Al TKK 30-325 St	without	129960	–	–	14940	11890	20330	123200	30800	
	32 x 5		21600	26000						
	32 x 10		31700							
	32 x 20		19700							
	32 x 32		19500							
						L_1 = 450				
TKK 35-455Al	without	180600	–	–	27090	24740		163200	40800	
	40 x 5		29100	29000						
	40 x 10		50000							
	40 x 20		37900							
	40 x 40		37000							

Notes on dynamic load capacities and moments

The dynamic load capacities and moments of the guideway are based on 100,000 m travel.

However, a travel of just 50,000 m is often taken as a basis. If this is the case, for comparison purposes:

Multiply values C, M_t and M_L from the table by 1.26. Load ratings for the precision ball screw assembly comply with DIN 69051.

E · I values				Carriage mass m_b		Weight L = Length in mm m_b = Moved mass			
									
(·10^8 Ncm²)	(·10^8 Ncm²)	(·10^8 Ncm²)	(·10^8 Ncm²)	(kg)	(kg)	(kg)		(kg)	
				L_T = 150	L_T = 220				
3.07	62.17	–	–	2.3	3	(1) (2)	0.010 · L + m_b - 0.3 0.0124 · L + m_b + 2		
				L_T = 220	L_T = 320				
TKK 20-225 Al									
5.13	196.59	25.27	355.95	7	9	(1) (2)	0.015 · L + m_b - 0.4 0.018 · L + m_b + 3	(1) (2)	0.026 · L + m_b - 0.4 0.029 · L + m_b + 3
TKK 20-225 St									
9.88	577.03	–	–	13	18	(1) (2)	0.040 · L + m_b - 0.4 0.043 · L + m_b + 3		
				L_T = 320	L_T = 450				
TKK 30-325 Al									
9.92	664.00	45.69	1156.91	17	23	(1) (2)	0.029 · L + m_b - 1 0.035 · L + m_b + 5	(1) (2)	0.048 · L + m_b - 1 0.054 · L + m_b + 5
TKK 30-325 St									
17.27	1826.96	–	–	33.5	45.4	(1) (2)	0.070 · L + m_b - 1 0.076 · L + m_b + 5		
				L_T = 450					
34.71	2554.23	–	–	41		(1) (2)	0.056 · L + m_b - 2.5 0.066 · L + m_b + 12		

E = Modulus of elasticity
I = Planar moment of inertia
L_T = Carriage length

(1) = without ball screw drive and end-plates
(2) = with ball screw drive and end-plates

Weight data does not include motor and switch attachments.

Technical Data

Permissible speed

Ball Rail Table	Permissible speed v_{per} (m/min)
without drive without bellows	180 m/min*)
without drive with bellows	100 m/min
with drive with bellows	see graphs
with drive without bellows	$f \cdot v_{per}$ v_{per}: see graphs f: see table

*) Speeds up to 300 m/min are possible, but service life is limited by increased wear of the plastic components in the ball rail systems.
Tests have shown distances of 50 to $100 \cdot 10^5$ m without failure.

Example: for TKK 30-325 Al with ball screw drive 32 x 32 but without bellows, with L = 1980 mm

Permissible speed:

$v_{per} = f \cdot v = 0.89 \cdot 57$ m/min

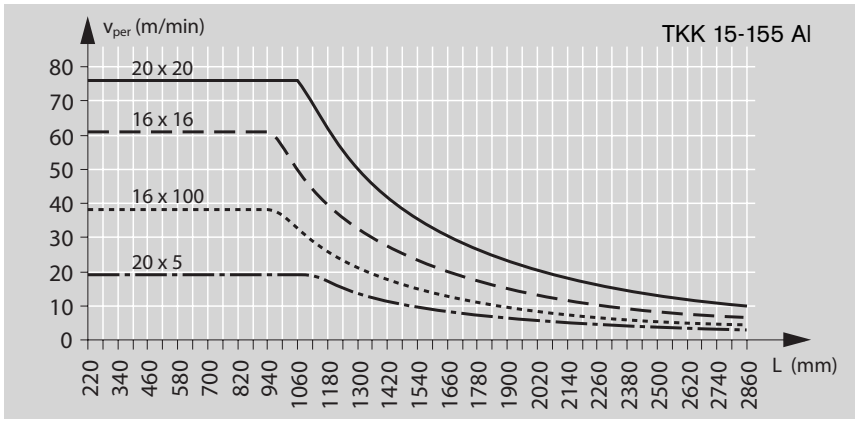
$v_{per} = 50.73$ m/min

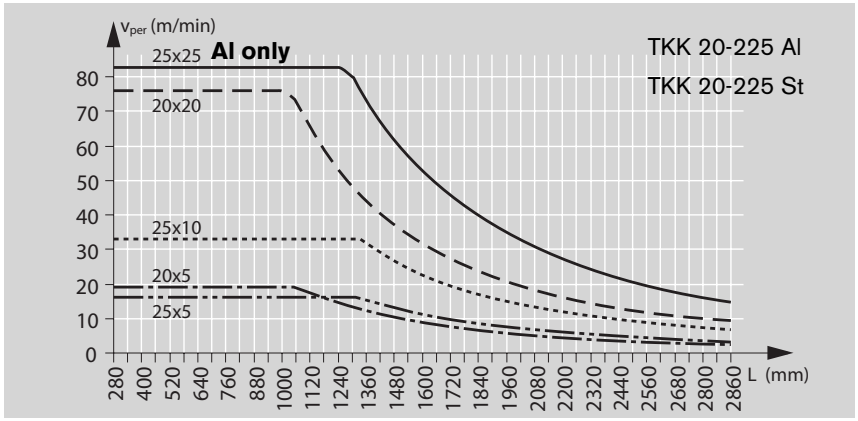
(where and $v = 57$ m/min from graph
$f = 0.89$ from table)

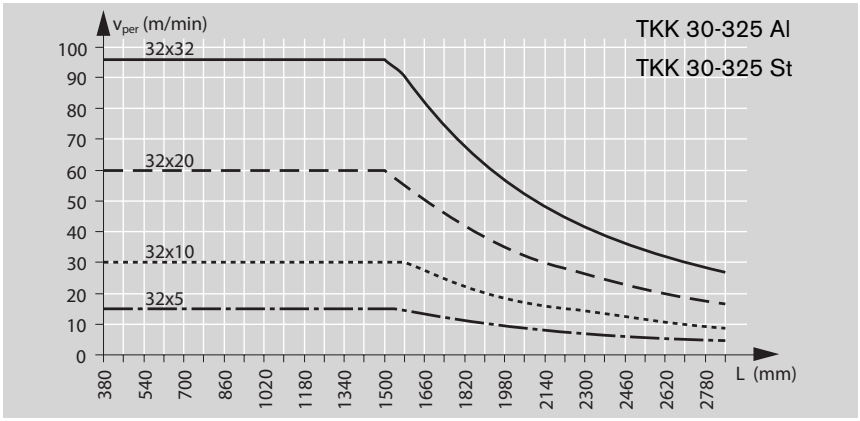
Reduction factor f for version with ball screw drive without bellows

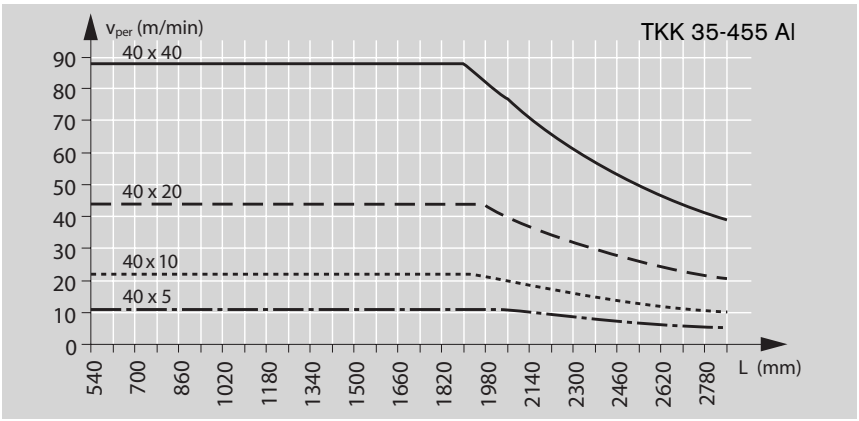
Table	Ball screw diam.	L (mm)	f
TKK 15-155	16	≤ 820	1.0
		≥ 820	0.83
	20	≤ 940	1.0
		≥ 940	0.83
TKK 20-225	20	≤ 940	1.0
		≥ 940	0.87
	25	≤ 1180	1.0
		≥ 1180	0.87
TKK 30-325	32	≤ 1580	1.0
		≥ 1580	0.89
TKK 35-455	40	≤ 1900	1.0
		≥ 1900	0.91

⚠ **When selecting the motor, take account of the permissible speed of the Ball Rail Table or the selected ball screw drive.**









Permissible drive torque, Fixed bearing end

For motor attachment via motor mount and coupling.

⚠ **For the permissible torque with a motor attached using side drive with timing belt, see “Timing belt side drive, Floating bearing end”.**

The values of M_{per} shown apply under the following conditions:

- Horizontal operation
- Ball screw drive journal without keyway
- No radial load on the ball screw drive journal
- Ball rail table with polyurethane bellows

⚠ **Take account of the rated torque of the coupling used!**

Ball screw journal with keyway

Due to notch effect and the reduction of the effective diameter, observe the following maximum values for the drive torque!

Ball Rail Table	M_{per} (Nm)
15-155	4.5
20-225	4.5 (Ball screw dia. 20) 11 (Ball screw dia. 25)
30-325	18
35-455	76

⚠ **When comparing the graph and table, the lower of the two values applies in each case!**

Example:

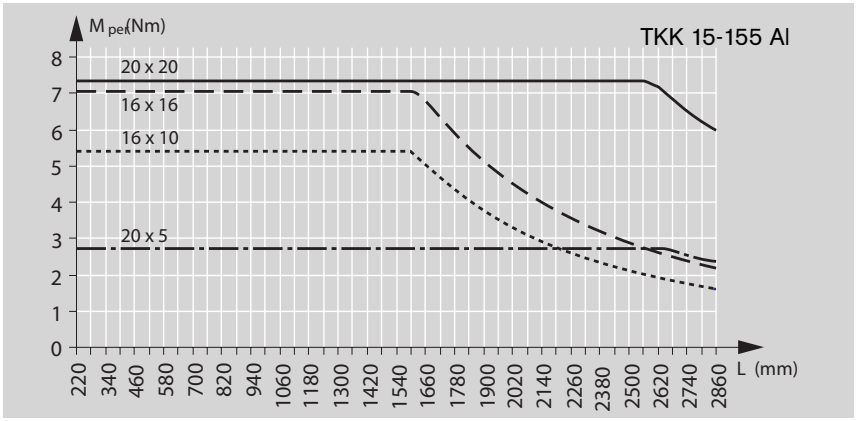
TKK 15-155, ball screw 20x5, length 1060 mm.

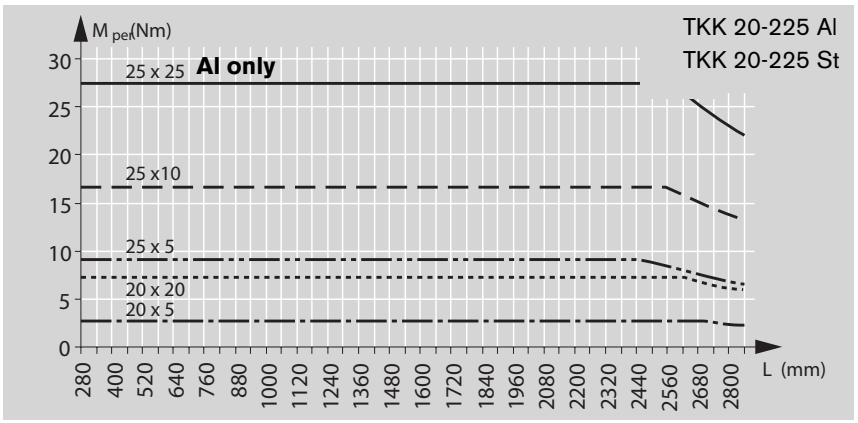
Drive torque M_{per} from graph:

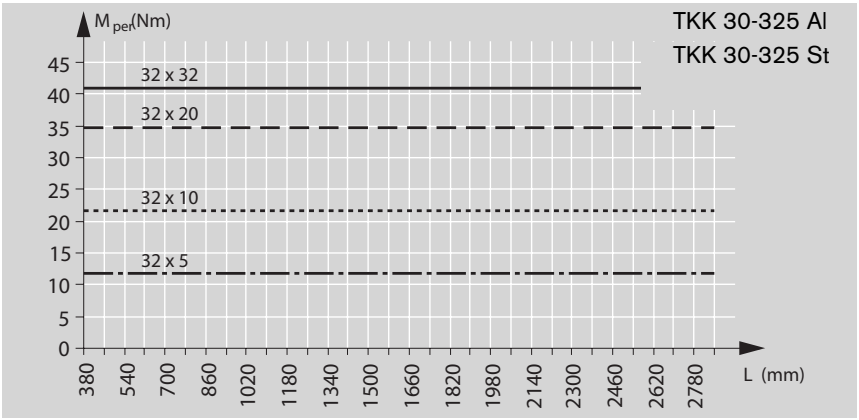
~ 2.7 Nm

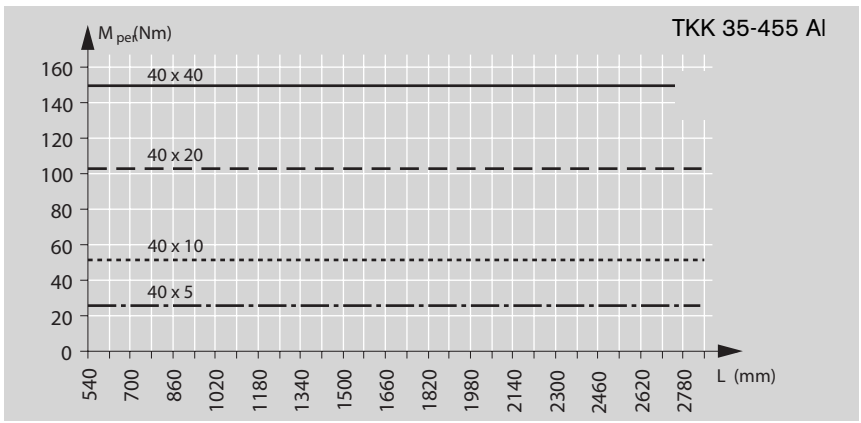
Maximum permissible drive torque as per table: 4.5 Nm

Drive torque for sizing: 2.7 Nm









Technical Data

Drive data of the side drive with timing belt,
Floating bearing end for motor attachment via side drive with timing belt

Motor type		MKD 41B, MMD 082A					MHD 71A					
Overall dimensions (mm)		51 x 88					66 x 116					
Friction moment M_{RRv} (Nm)		0.4					0.45					
		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at		Permissible torque up to length L = … at (1)			Reduced mass moment of inertia at		
Reduction i = …			i = 1	i = 1.5	i = 1	i = 1.5		i = 1	i = 2	i = 1	i = 2	
Belt type			16 AT5	16 AT5	16 AT5	16 AT5		25 AT5	25 AT5	25 AT5	25 AT5	
Ball Rail Table	Ball screw d_0 x P	L (mm)	M_{Rv} (Nm)	M_{Rv} (Nm)	J_{Rv} (10^{-6} kgm²)	J_{Rv} (10^{-6} kgm²)	L (mm)	M_{Rv} (Nm)	M_{Rv} (Nm)	J_{Rv} (10^{-6} kgm²)	J_{Rv} (10^{-6} kgm²)	
TKK 15-15	16 x10	1180	9.6	6.4	260	91	1060	11.6	5.8	1420	230	
	16 x16	1420	9.6	6.4			1300	11.6	5.8			
	20 x 5	1420	9.6	6.4			1420	10.0	5.0			
	20 x 20	2260	9.6	6.4			1540	19.6	9.8			
TKK 20-225	20 x 5	1480	9.6	6.4	270	94	1480	10.0	5.0	1420	230	
	20 x 20	2200	9.6	6.4			1600	19.6	9.8			
	25 x 5	2320	9.6	6.4			1960	14.0	7.0			
	25 x 10	2860	9.6	6.4			2320	19.6	9.8			
	25 x 25	2860	9.6	6.4			2860	19.6	9.8			
TKK 30-325	32 x 5						2860	19.0	9.5	1440	240	
	32 x 10						2860	19.0	9.5			
	32 x 20						2860	19.0	9.5			
	32 x 32						2860	19.0	9.5			
TKK 35-455	40 x 5											
	40 x 10											
	40 x 20											
	40 x 40											

M_{Rv} … Permissible system torque with side drive with timing belt on the motor journal (motor torque not taken into account)
M_{RRv} … Friction moment, side drive with timing belt on the motor journal
J_{Rv} … Reduced mass moment of inertia, side drive with timing belt
i … Reduction, side drive with timing belt
(1) … Please ask if you wish to know the permissible torque for longer lengths

Technical data AC servomotors

Motor	MKD 41B-144	MMD 082A	MHD 71A-061	MKD 71B-061	
Maximum effective rotary speed n_M (1/min)	↯	↯	↯	↯	
Rated torque M_{MN} (Nm)	2.7	2.4	3.5	8	
Maximum torque M_{Mmax} (Nm)	↯	↯	↯	↯	
Mass moment of inertia $J_M + J_{Br}$ (10^{-6} kgm²)	170 + 16	133 + 8	440 + 72	870 + 38	
Braking torque M_{Br} (Nm)	2.2	2.4	5	5	
Load with brake m_{Br} (kg)	4.65	3.7	6.6	9.42	

	MKD 71B, MHD 71B							MKD 90B, MHD 90B				
	66 x 116							90 x 160				
	0.5							0.6				
	Permissible torque up to length L = … at [1]				Reduced mass moment of inertia at			Permissible torque up to length L = … at [1]			Reduced mass moment of inertia at	
		i = 1		i = 2	i = 1		i = 2		i = 1	i = 2	i = 1	i = 2
		25 AT5	32 AT5	32 AT5	25 AT5	32 AT5	32 AT5		50 AT10	50 AT10	50 AT10	50 AT10
	L (mm)	M_{Rv} (Nm)	M_{Rv} (Nm)	M_{Rv} (Nm)	J_{Rv} (10^{-6} kgm²)	J_{Rv}	J_{Rv}	L (mm)	M_{Rv} (Nm)	M_{Rv} (Nm)	J_{Rv} (10^{-6} kgm²)	J_{Rv}
	2860	19.0		9.5	1440		280					
	2860	19.0		13.0								
	2860	19.0		13.0								
	2860	19.0		13.0								
	2860		26.0	13.0		1680	290	2860	26.0	13.0	7860	1280
	2860		26.0	13.0				2860	52.0	26.0		
	2860		26.0	13.0				2860	67.0	33.5		
	2860		26.0	13.0				2860	67.0	33.5		

	MHD 71B-061	MKD 90B-047	MHD 90B-047
	⚡	⚡	⚡
	8	12	12
	⚡	⚡	⚡
	870 + 72	4300 + 360	4300 + 360
	5	11	11
	9.4	15.1	14.6

⚡ **refer to catalog “Controllers, Motors, Electrical Accessories” RE 82 701**

For the motor data of stepping motors, see the section on “Motors”

Calculation Bases

Formulas

Nominal service life

Nominal service life in meters:

$$L_{10} = \left(\frac{C}{F_m}\right)^3 \cdot 10^5$$

Nominal service life in hours:

$$L_{10h} = \frac{L10}{60 \cdot v}$$

L_{10} = Nominal service life in meters (m)
L_{10h} = Nominal service life in hours (h)
C = Dynamic load capacity (N)
F_m = Mean equivalent dynamic load (N)
v = Speed (m/min) (from “Permissible speed” graph)

Friction moment

for motor attachment using motor mount and coupling

$$M_R = M_{RS}$$

for motor attachment using side drive with timing belt

$$M_R = \frac{M_{RS}}{i} + M_{RRv}$$

M_R = Friction moment at the drive journal (Nm)
M_{RS} = Friction moment, system (Nm)
M_{RRv} = Friction moment, side drive with timing belt at motor journal (Nm)
i = Reduction

Constants k_1, k_2, k_3

Moment of friction of system at motor journal M_R

d_0 = Nominal diameter ball screw drive (mm)
P = Lead ball screw drive (mm)

Ball Rail Table	Ball screw $d_0 \times P$ (mm)	Constants k_1 short carriage	Constants k_1 long carriage	Constants k_2	Constants k_3	Moment of friction M_{RS} (Nm) for 2% preload of guideway	Moment of friction M_{RS} (Nm) for 8% preload of guideway
TKK 15-155	16 x 10	10.5	12.3	0.039	2.53	0.56	0.58
	16 x 16	19.6	24.2	0.039	6.48	0.58	0.61
	20 x 5	13.6	14.1	0.100	0.63	0.64	0.65
	20 x 20	35.5	42.5	0.100	10.13	0.72	0.75
TKK 20-225 Al	20 x 5	16.6	17.9	0.100	0.63	0.66	0.68
	20 x 20	83.1	103.3	0.100	10.13	0.82	0.90
	25 x 5	35.4	36.6	0.256	0.63	0.82	0.84
	25 x 10	48.7	53.7	0.256	2.53	0.88	0.92
	25 x 25	139.3	170.9	0.235	15.83	1.08	1.17
TKK 20-225 St	20 x 5	20.4	23.5	0.100	0.63	0.66	0.68
	20 x 20	143.9	194.5	0.100	10.13	0.82	0.90
	25 x 5	39.2	42.3	0.256	0.63	0.82	0.84
	25 x 10	63.9	76.5	0.256	2.53	0.88	0.92
TKK 30-325 Al	32 x 5	110.0	113.8	0.712	0.63	1.10	1.12
	32 x 10	142.3	157.5	0.712	2.53	1.29	1.32
	32 x 20	265.3	326.1	0.667	10.13	1.21	1.27
	32 x 32	534.0	689.6	0.667	25.94	1.36	1.46
TKK 30-325 St	32 x 5	120.5	128.0	0.712	0.63	1.10	1.12
	32 x 10	184.1	214.3	0.712	2.53	1.29	1.32
	32 x 20	432.5	553.0	0.667	10.13	1.21	1.27
	32 x 32	962.0	1270.6	0.667	25.94	1.36	1.46
TKK 35-455	40 x 5	319.2		1.783	0.63	1.66	1.68
	40 x 10	368.2		1.607	2.53	2.32	2.35
	40 x 20	679.7		1.607	10.13	2.24	2.29
	40 x 40	1926.0		1.607	40.53	2.59	2.69

Mass moment of inertia

for handling:

$6 \cdot J_M \geq J_{fr}$

for processing:

$1.5 \cdot J_M \geq J_{fr}$

J_{fr} = External mass moment of inertia (kgm²)

J_M = Mass moment of inertia of motor (kgm²)

for motor attachment using motor mount and coupling

$$J_{fr} = J_S + J_K + J_{Br}$$

$$J_S = (k_1 + k_2 \cdot L + k_3 \cdot m_{fr}) \cdot 10^{-6}$$

$$J_{tot} = J_{fr} + J_M = J_S + J_K + J_{Br} + J_M$$

for motor attachment using side drive with timing belt

$$J_{fr} = \frac{J_S}{i^2} + J_{Rv} + J_{Br}$$

$$J_S = (k_1 + k_2 \cdot L + k_3 \cdot m_{fr}) \cdot 10^{-6}$$

$$J_{tot} = J_{fr} + J_M = \frac{J_S}{i^2} + J_{Rv} + J_M + J_{Br}$$

J_{tot} = Total mass moment of inertia (kgm²)

J_{fr} = External mass moment of inertia (kgm²)

J_S = Mass moment of inertia of system with additional load (kgm²)

J_K = Mass moment of inertia of coupling (kgm²)

J_{Br} = Mass moment of inertia, motor brake (kgm²)

J_M = Mass moment of inertia of motor (kgm²)

J_{Rv} = Reduced mass moment of inertia, side drive with timing belt at motor journal (kgm²)

m_{fr} = External load (kg)

L = Length of Ball Rail Table (mm)

i = Reduction

k_1, k_2, k_3 = Constants, see “Constants” table

Rotary speed

If a geared motor is fitted, the moment of inertia of the gears and the gear transmission ratios must be taken into account.

$$n_1 = \frac{i \cdot v \cdot 1000}{P}$$

$$n_1 < n_{Mmax}$$

$$v \leq v_{per}$$

v = Speed (m/min)

n_1 = Speed at motor journal (1/min)

n_{Mmax} = Maximum effective rotary speed of motor (1/min)

P = Ball screw lead (mm)

i = Reduction

v_{per} = Permissible speed (see “Technical Data”) (m/min)

Coupling Data

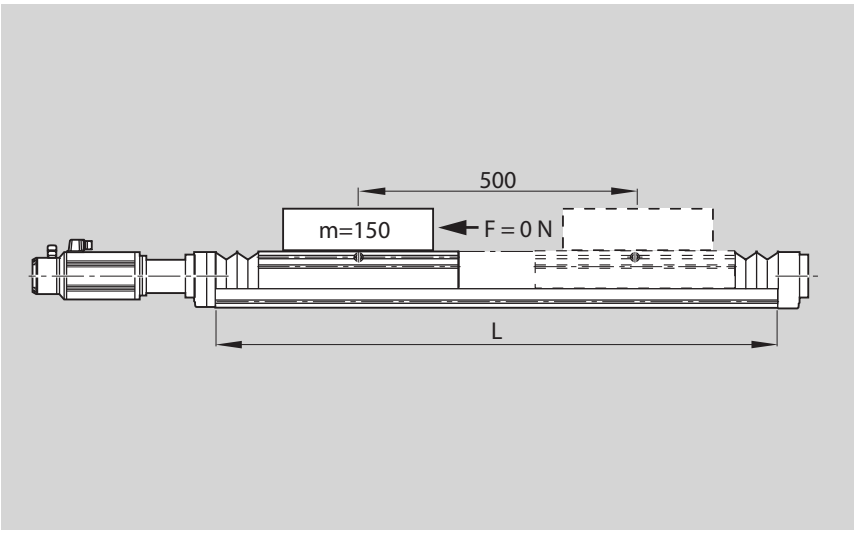
Couplings with data as given in the table are used for Ball Rail Tables TKK... with standard servomotors.

Ball Rail Table	Rated torque of coupling M_K (Nm)	Mass moment of inertia J_K (km²)	Coupling mass (kg)
TKK 15-155	19	$57 \cdot 10^{-6}$	0.26
TKK 20-225	19	$57 \cdot 10^{-6}$	0.26
	50	$200 \cdot 10^{-6}$	0.7
TKK 30-325	50	$200 \cdot 10^{-6}$	0.7
TKK 35-455	98	$390 \cdot 10^{-6}$	0.9

Calculation Bases

When sizing the drive, always take the motor/controller combination into consideration as the motor type and performance data (e.g. max. effective speed and maximum torque) depend on the controller or control system used.

(See also "Product Overview, Motor pre-selection in accordance with controllers and control systems").



Starting data

A mass of 150 kg is to be moved 500 mm at a maximum velocity of 40 m/min.

The following unit is selected on the basis of its technical data and mounting dimensions:

Ball rail table TKK 30-325 Al

- L_T = 320 mm
- 2% preload
- with bellows cover
- with size 71 AC servomotor, connected via motor mount and coupling

Length estimate

Excess travel	= 2 · P = 2 · 32 mm = 64 mm
Max. travel	= $Stroke_{effective}$ + 2 · excess travel
	= 500 mm + 2 · 64 mm
	= 628 m
Length L:	for max. travel = 628 mm from Data Sheet TKK 30-325 Al L = 1100 mm

Selection of the ball screw drive

See "Technical Data" section for graphs.

General recommendation:

Wherever possible, always select the smallest lead.

According to the graph for "Permissible speed", the permissible ball screw drives for v = 40 m/min and L = 1100 mm are:

ball screw 32 x 20 and ball screw 32 x 32

Selected ball screw drive (smaller lead)

ball screw 32 x 20

with a maximum permissible drive torque of 35 Nm as per "Permissible drive torque" graph for L = 1100 mm

Calculation

Length **L**

Excess travel	= 2 · P = 2 · 20 mm = 40 mm
Max. travel	= $Stroke_{effective}$ + 2 · excess travel
	= 500 mm + 2 · 40 mm
	= 580 mm
L	= 1020 mm for max. travel of 580 mm (582 mm) from Data Sheet TKK 30-325 Al

Friction moment M_R

M_R	= M_{RS} (see "Technical Data")
M_R	= 1.21 Nm

Mass moment of inertia

$J_S = (k_1 + k_2 \cdot L + k_3 \cdot m_{fr}) \cdot 10^{-6}$ kgm² (k_1, k_2, k_3 see "Constants")

$= (265.3 + 0.667 \cdot 1020 \text{ mm} + 10.13 \cdot 150 \text{ kg}) \cdot 10^{-6}$ kgm²

$= 2465 \cdot 10^{-6}$ kgm²

$J_K = 200 \cdot 10^{-6}$ kgm² (see "Technical Data")

$J_{Br} = 38 \cdot 10^{-6}$ kgm² (see "Motor Data")

$J_{fr} = J_S + J_K + J_{Br} = (2465 + 200 + 38) \cdot 10^{-6}$ kgm² $= 2703 \cdot 10^{-6}$ kgm

for handling:

$$Ja_M > \frac{J_{fr}}{6} = \frac{2703}{6}$$

$J_M > 450 \cdot 10^{-6}$ kgm²

Rotary speed n at v = 40 m/min

$$n_1 = \frac{i \cdot v \cdot 1000}{P} = \frac{1 \cdot 40 \text{ m/min} \cdot 1000}{20 \text{ mm}} = 2000 \text{ min}^{-1} < n_{Mmax}$$

$v = 40$ m/min

Result

Ball rail table	TKK 30-325 Al
Length	L = 1020 mm
Ball screw drive:	
Diameter	32 mm;
Lead	20 mm;
Carriage length:	L_T = 320 mm;
Preload:	2%

Motor attached using motor mount and coupling

Motor with:
- maximum effective speed $n_{Mmax} > 2000$ min⁻¹
- mass moment of inertia $J_M > 450 \cdot 10^{-6}$ kgm²
- maximum drive torque $M_{per} < 35$ Nm

Take account of coupling torque M_K and friction moment M_R
($M_K = 50$ Nm; $M_R = 1.21$ Nm)

These conditions are met by all AC servomotors permitted in selection table TKK 30-325 Al.

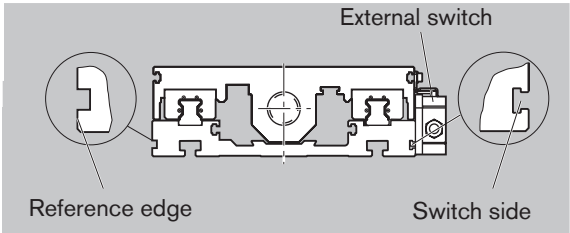
The exact motor selection will depend on:

- the criteria from the "Motor Selection" overview
- recalculating the drive system with the performance data from catalog "Controllers, Motors, Electrical Accessories" RE 82 701.

TKK 15-155 Al Options Table

Part number 1460-205-00, (....) mm — See dimensions table for length

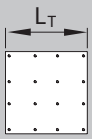
Type (....)

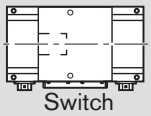
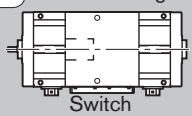
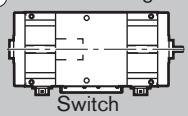
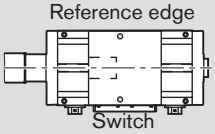
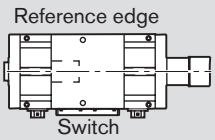
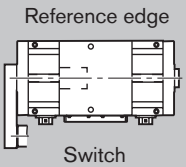
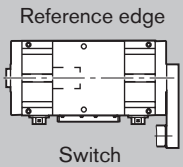
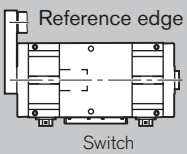
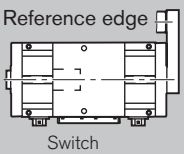
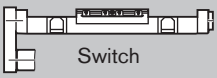
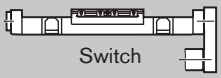


Guide-way = (..)

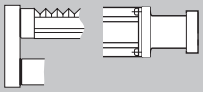
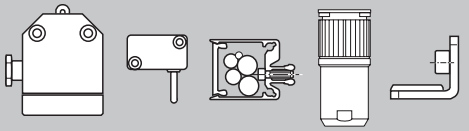
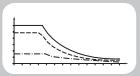
Drive unit = (..)

Carriage = (..)



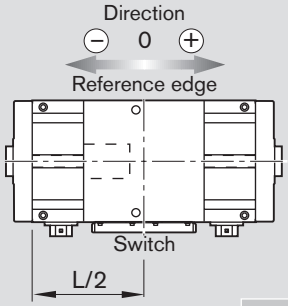
	Dimension drawing no. for motor attachment	Base plate		Ball screw journal	Ball screw drive				Carriage length L_T			
		flat	high	keyway	16 x 10	16 x 16	20 x 5	20 x 20	150 mm Preload 2%	150 mm Preload 8%	220 mm Preload 2%	220 mm Preload 8%
without drive unit (without end-plates)												
(OA01) 		(01)			(00)				(01)	(02)	(03)	(04)
without motor mount and motor												
(OF01) Reference edge 		(01)		dia 10 (fixed bearing end)	(01)	(07)	(13)	(19)	(01)	(02)	(03)	(04)
(OF04) Reference edge 				dia 10 keyway (fixed brg.)	(01)	(07)	(13)	(19)				
with motor mount and coupling, with or without motor												
(MF01) 	14.26.05	(01)		dia 10 (fixed bearing end)	(01)	(07)	(13)	(19)	(01)	(02)	(03)	(04)
(MF02) 												
with side drive with timing belt, with or without motor												
(RV01) 	14.26.75	(01)		dia 11 floating bearing end)	(03)	(09)			(01)	(02)	(03)	(04)
(RV02) 												
(RV03) 	14.26.90			dia 14 (floating bearing end)			(15)	(21)	(01)	(02)	(03)	(04)
(RV04) 												
(RV05) 	14.26.55											
(RV06) 	14.26.70											

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

	Motor attachment = ..	**Motor = ..**	**Cover = ..**	Position measuring system = ..	1st switch = ..-. ± ….. mm 2nd switch = ..-. ± ….. mm 3rd switch = ..-. ± ….. mm Cable duct = .. - . …. mm Socket-plug = .. Switching cam = ..	Documentation = ..
						

	i =	Mounting direction as per diagram			Motor type		Polyurethane bellows without	Polyurethane bellows with	Glass scale without	Glass scale with	Standard report	Special report
		OA01	00		without	00	00	upon request	00	upon request	03	02 Friction moment
		OF01-OF04	00			00						
	1	MF01-MF02	02		without	00						03 Lead deviation
					MKD 41B	10						
			06		without	00						
					MMD 082A	60						
	1	RV01-RV04	41		without	00						
		RV05-RV06	42									
	1.5	RV01-RV04	43		MKD 41B	10						
		RV05-RV06	44									
	1	RV01-RV04	29		without	00						04 Sequence accuracy
		RV05-RV06	30									
	2	RV01-RV04	31		MHD71A-061	61						
		RV05-RV06	32									
	1	RV01-RV04	53		without	00						
		RV05-RV06	54									
	1.5	RV01-RV04	55		MMD 082A	60						
		RV05-RV06	56									
	1	RV01-RV04	45		without	00						
		RV05-RV06	46									
	1.5	RV01-RV04	47		MKD 41B	10						
		RV05-RV06	48									
	1	RV01-RV04	37		without	00						05 Positioning accuracy
		RV05-RV06	38									
	2	RV01-RV04	39		MHD71A-061	61						
		RV05-RV06	40									
	1	RV01-RV04	49		without	00						
		RV05-RV06	50									
	1.5	RV01-RV04	51		MMD 082A	60						
		RV05-RV06	52									

without switch
without cable duct 00



External switching cam
16

External switch

PNP NC	11 -A ±….
PNP NO	13 -A ±….
Mechanical	15 -A ±….

Switch type
Pos. and direction
Switch activation point in mm

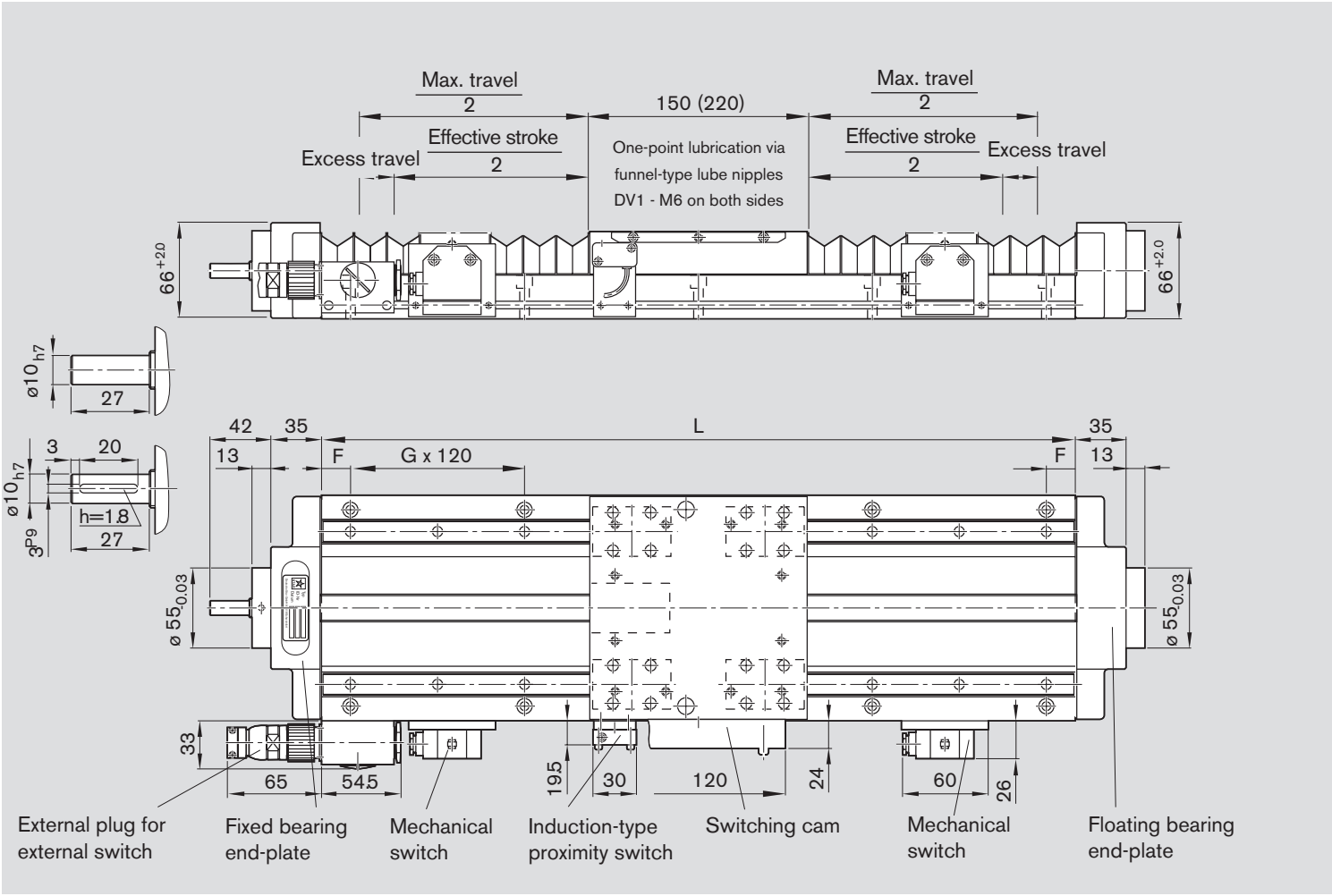
External socket-plug (loose)
17

Cable duct (loose)

Cable duct	20 - X….

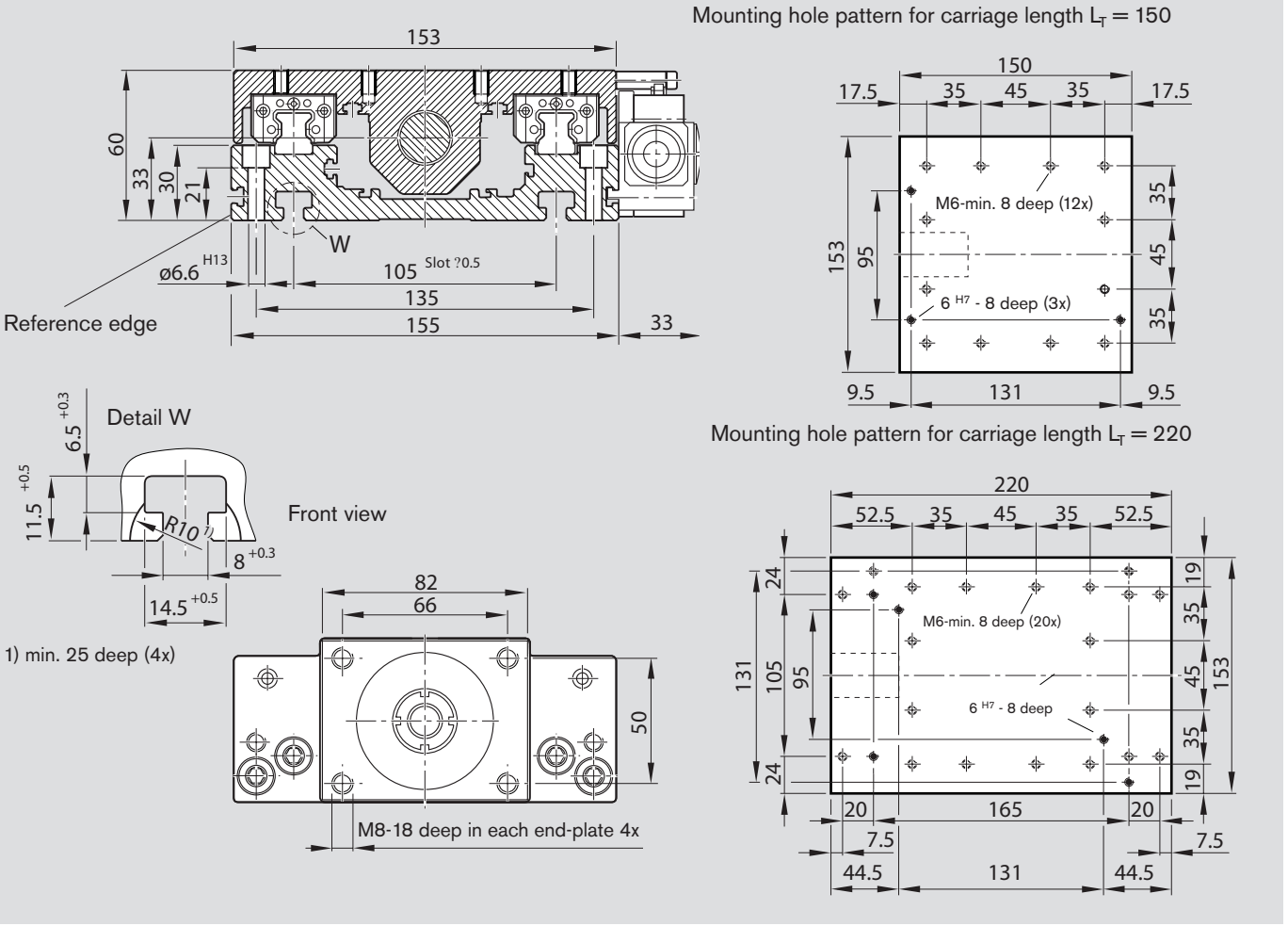
Type
Length in mm

TKK 15-155 Al Dimension Drawings



Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	150*	220*	150*	220*
220	50 - 1 x 120 - 50	-	-	60	-
280	20 - 2 x 120 - 20	68	-	120	-
340	50 - 2 x 120 - 50	117	59	180	110
400	20 - 3 x 120 - 20	166	109	240	170
460	50 - 3 x 120 - 50	216	158	300	230
520	20 - 4 x 120 - 20	265	207	360	290
580	50 - 4 x 120 - 50	315	257	420	350
640	20 - 5 x 120 - 20	364	306	480	410
700	50 - 5 x 120 - 50	414	356	540	470
760	20 - 6 x 120 - 20	463	405	600	530
820	50 - 6 x 120 - 50	512	454	660	590
880	20 - 7 x 120 - 20	562	504	720	650
940	50 - 7 x 120 - 50	611	553	780	710
1000	20 - 8 x 120 - 20	661	603	840	770
1060	50 - 8 x 120 - 50	710	652	900	830
1120	20 - 9 x 120 - 20	759	702	960	890
1180	50 - 9 x 120 - 50	809	751	1020	950
1240	20 - 10 x 120 - 20	858	800	1080	1010
1300	50 - 10 x 120 - 50	908	850	1140	1070
1360	20 - 11 x 120 - 20	957	899	1200	1130
1420	50 - 11 x 120 - 50	1007	949	1260	1190
1480	20 - 12 x 120 - 20	1056	998	1320	1250
1540	50 - 12 x 120 - 50	1105	1048	1380	1310

Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	150*	220*	150*	220*
1600	20 - 13 x 120 - 20	1155	1097	1440	1370
1660	50 - 13 x 120 - 50	1204	1146	1500	1430
1720	20 - 14 x 120 - 20	1254	1196	1560	1490
1780	50 - 14 x 120 - 50	1303	1245	1620	1550
1840	20 - 15 x 120 - 20	1353	1295	1680	1610
1900	50 - 15 x 120 - 50	1402	1344	1740	1670
1960	20 - 16 x 120 - 20	1451	1394	1800	1730
2020	50 - 16 x 120 - 50	1501	1443	1860	1790
2080	20 - 17 x 120 - 20	1550	1492	1920	1850
2140	50 - 17 x 120 - 50	1600	1542	1980	1910
2200	20 - 18 x 120 - 20	1649	1591	2040	1970
2260	50 - 18 x 120 - 50	1699	1641	2100	2030
2320	20 - 19 x 120 - 20	1748	1690	2160	2090
2380	50 - 19 x 120 - 50	1797	1739	2220	2150
2440	20 - 20 x 120 - 20	1847	1789	2280	2210
2500	50 - 20 x 120 - 50	1896	1838	2340	2270
2560	20 - 21 x 120 - 20	1946	1888	2400	2330
2620	50 - 21 x 120 - 50	1995	1937	2460	2390
2680	20 - 22 x 120 - 20	2045	1987	2520	2450
2740	50 - 22 x 120 - 50	2094	2036	2580	2510
2800	20 - 23 x 120 - 20	2143	2085	2640	2570
2860	50 - 23 x 120 - 50	2193	2135	2700	2630



Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as guideline value for the braking distance.
In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 20 mm:
Excess travel (braking distance) ≈ 40 mm

Recommended standard configuration:

– 2 mechanical switches

– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical	60
	mechanical - proximity	45
	proximity - proximity	12.5

Maximum switch activation point

The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

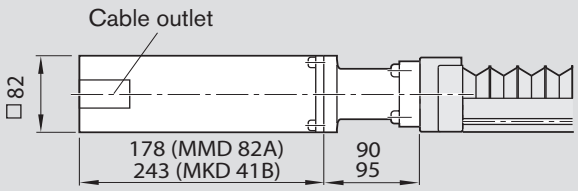
Maximum switch activation point = 0.5 · max. travel - excess travel

TKK 15-155 Al Dimension Drawings

Motor attachment with motor mount and coupling

14.26.05

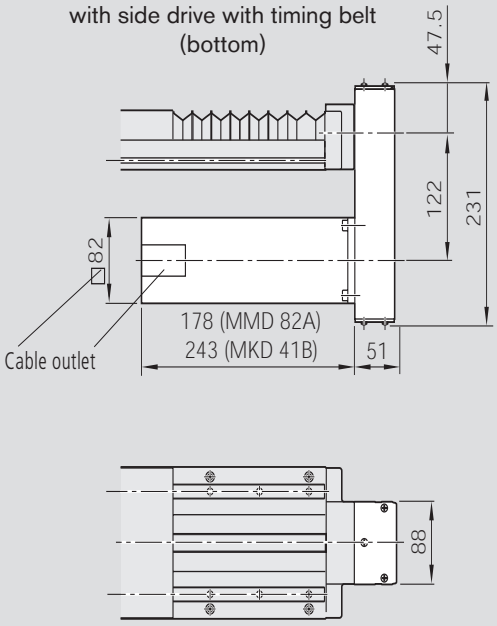
Types MF01 and MF02
Motor MKD 41B or MMD 082A
with motor mount and coupling



Motor attachment for side drive with timing belt

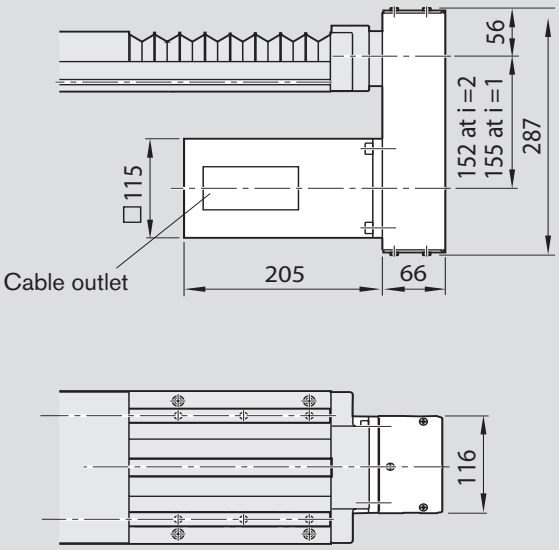
14.26.55

Types RV05 and RV06
Motor MKD 41B or MMD 082A
with side drive with timing belt
(bottom)



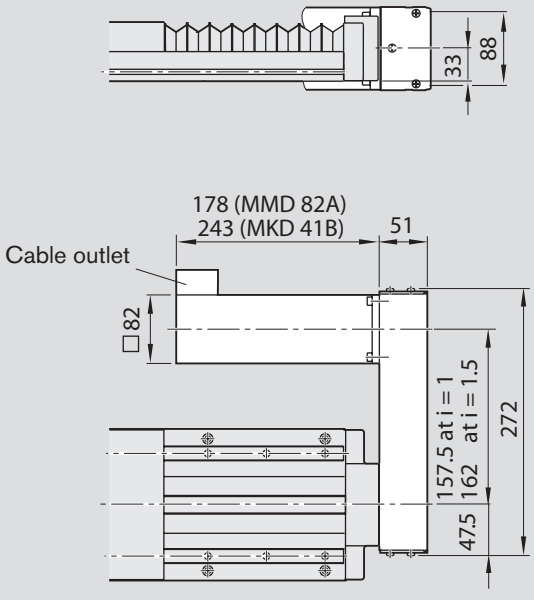
14.26.70

Types RV05 to RV06
Motor MHD 71A with side drive with timing belt
(bottom)



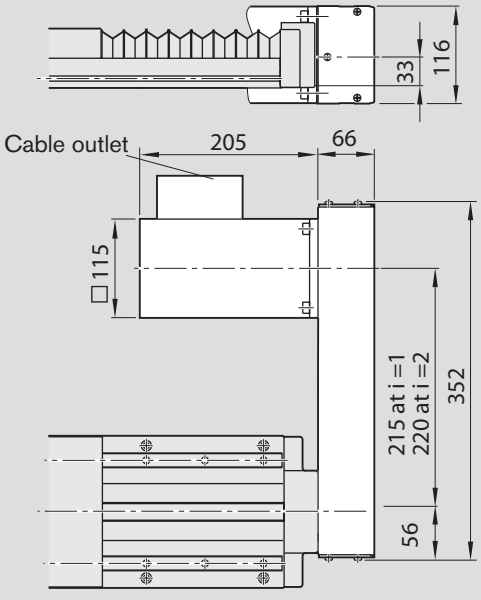
14.26.75

Types RV01 to RV04
Motor MKD 41B or MMD 082A
with side drive with timing belt (side)



14.26.90

Types RV01 to RV04
Motor MHD 71A with side drive with timing belt
(side)



For motor dimensions see "Motors"

Note for multi-axis units
(e.g. cross-tables)

For multi-axis units with motor attachment via side drive with timing belt, the motor may project into the working area of adjacent axes. Check for any interference contours.

TKK 20-225 Al Options Table

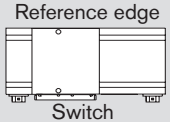
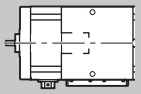
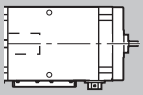
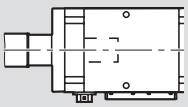
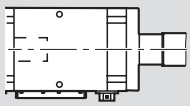
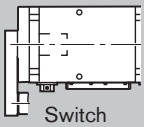
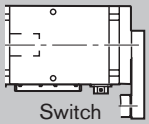
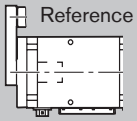
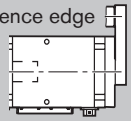
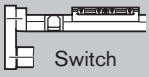
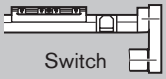
Part number 1460-305-00, (....) mm — Type (....)

See dimensions table for length

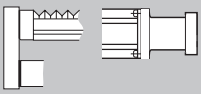
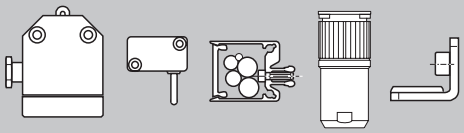
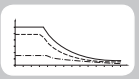
Guide-way = (..)

Drive unit = (..)

Carriage = (..)

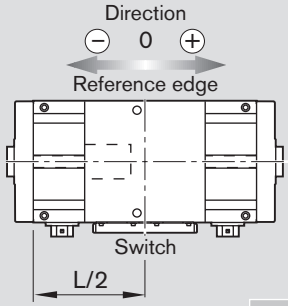
Reference edge / Switch	Dimension drawing	Base plate: flat	Base plate: high	Ball screw journal / keyway	Ball screw drive: 20 x 5	Ball screw drive: 20 x 20	Ball screw drive: 25 x 5	Ball screw drive: 25 x 10	Ball screw drive: 25 x 25	Carriage length L_T: 220 mm Preload 2%	Carriage length L_T: 220 mm Preload 8%	Carriage length L_T: 320 mm Preload 2%	Carriage length L_T: 320 mm Preload 8%
without drive unit (without end-plates)													
OA01 		01	11				00			01	02	03	04
without motor mount and motor													
OF01 Reference edge  Switch		01	11	dia 10 (fixed bearing end)	01	07				01	02	03	04
				dia 10 keyway (fixed bearing)	04	10							
				dia 14 (fixed bearing end)			13	19					
				dia 14 keyway (fixed bearing)			16	22					
				dia 14 (fixed bearing end)					25	05	06	07	08
				dia 14 keyway (fixed bearing)					28				
OF04 Reference edge  Switch													
with motor mount and coupling, with or without motor													
MF01 Reference edge  Switch	14.26.05	01	11	dia 10 (fixed bearing end)	01	07				01	02	03	04
				dia 14 (fixed bearing end)			13	19		01	02	03	04
									25	05	06	07	08
MF02 Reference edge  Switch													
with side drive with timing belt, with or without motor													
RV01 Reference edge  Switch	14.26.75 14.26.90	01	11	dia 14 (floating bearing end)	03	09	15	21		01	02	03	04
									27	05	06	07	08
RV02 Reference edge  Switch													
RV03 Reference edge  Switch													
RV04 Reference edge  Switch													
RV05  Switch	14.26.55 14.26.70												
RV06  Switch													

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

	Motor attachment = ..	Motor = ..	Cover = ..	Position measuring system = ..	1st switch = ..-. ± ….. mm 2nd switch = ..-. ± ….. mm 3rd switch = ..-. ± ….. mm Cable duct = .. - . …. mm Socket-plug = .. Switching cam = ..	Documentation = ..
						

i =	Mounting direction as per diagram			Motor type		Polyurethane bellows without	Polyurethane bellows with	Glass scale without	Glass scale with	Standard report	Special report
	OA01	00		without	00	00	upon request	00	upon request	03	02 Friction moment
	OF01-OF04	00		without	00						
1	MF01-MF02	02		without MSK 040C	86 87						03 Lead deviation
		08		without VRDM 397	37 38						
				without VRDM 3910	39 40						
		09		without VRDM 3913	41 42						
		10		without MSM 040B	74 75						
		12		without MSK 050C	88 89						
1	MF01-MF02	04		without MSK 040C	86 87	00	01	00	upon request	03	04 Sequence accuracy
		11		without MSM 040B	74 75						
		13		without MSK 050C	88 89						
1	RV01-RV04	45		without	86						
	RV05-RV06	46									
1.5	RV01-RV04	47		MSK 040C	87						
	RV05-RV06	48									
1	RV01-RV04	49		without	74						
	RV05-RV06	50									
1.5	RV01-RV04	51		MSM 040B	75						05 Positioning accuracy
	RV05-RV06	52									
1	RV01-RV04	53		without	88						
	RV05-RV06	55									
2	RV01-RV04	54		MSK 050C	89						
	RV05-RV06	56									

without switch
without cable duct 00



Internal switching cam 07

Internal switch

PNP NC	01 -I ±….
PNP NO	03 -I ±….
Mechanical	05 -I ±….

Switch type
Pos. and direction
Switch activation point in mm

External switching cam 16

External switch

PNP NC	11- A ±….
PNP NO	13- A ±….
Mechanical	15- A ±….

Switch type
Pos. and direction
Switch activation point in mm

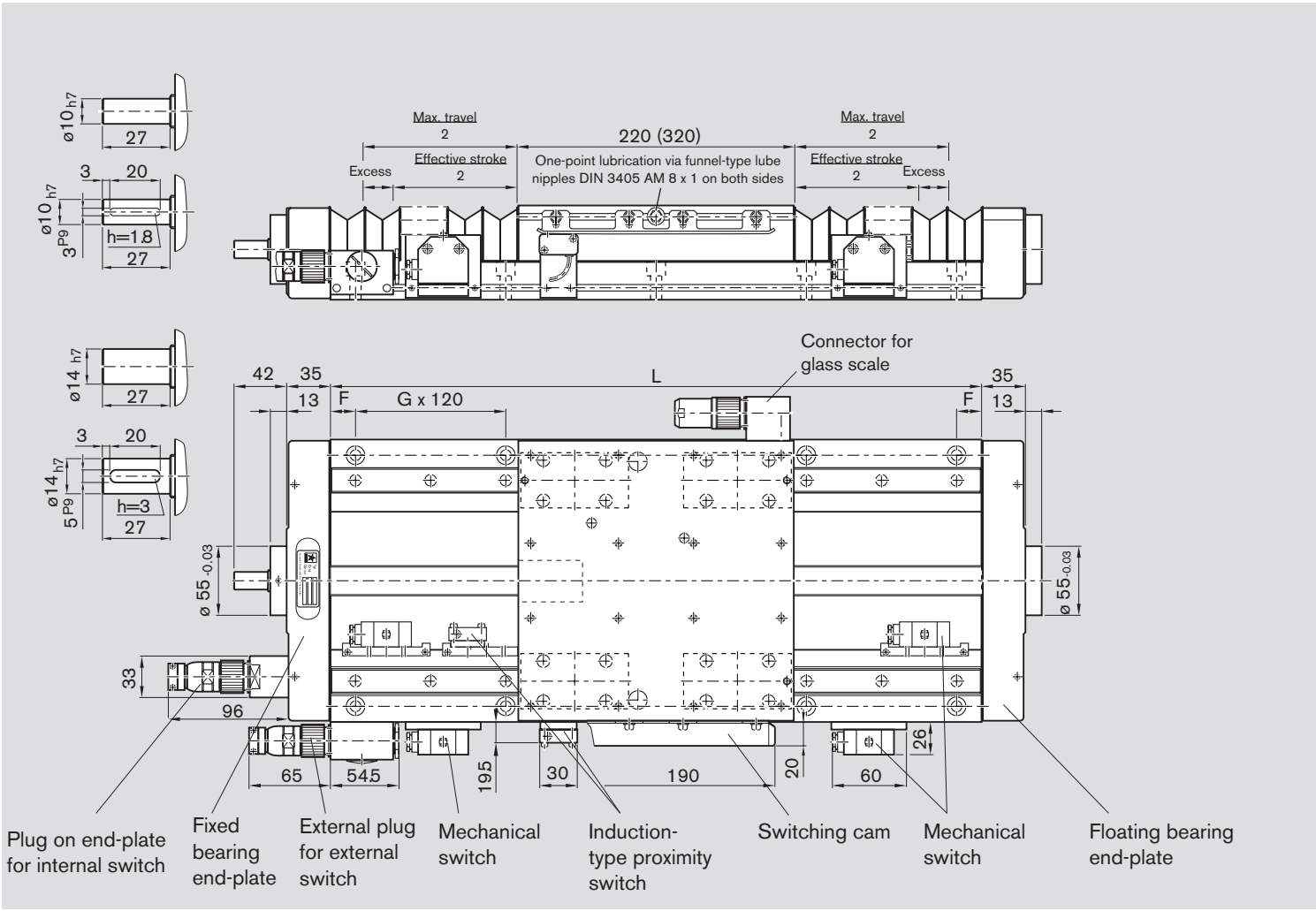
External socket-plug (loose) 17

Cable duct (loose)

Cable duct	20 - X….

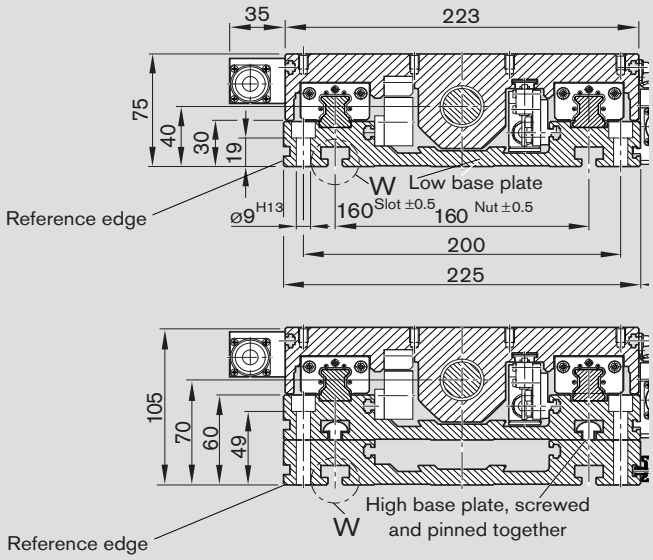
Type
Length in mm

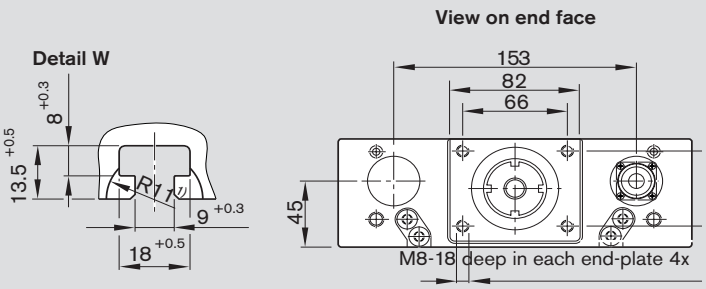
TKK 20-225 Al Dimension Drawings



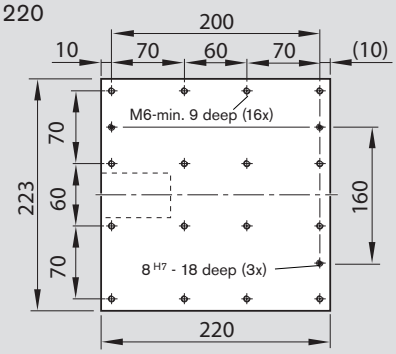
Length	Counterbored mounting hole spacing	Max. travel for carriage length* with bellows		w/o bellows	
L (mm)	F - G x 120 - F	220*	320*	220*	320*
340	50 - 2 x 120 - 50	70	-	110	-
400	20 - 3 x 120 - 20	122	34	170	70
460	50 - 3 x 120 - 50	174	86	230	130
520	20 - 4 x 120 - 20	226	138	290	190
580	50 - 4 x 120 - 50	278	190	350	250
640	20 - 5 x 120 - 20	330	242	410	310
700	50 - 5 x 120 - 50	382	294	470	370
760	20 - 6 x 120 - 20	434	346	530	430
820	50 - 6 x 120 - 50	486	398	590	490
880	20 - 7 x 120 - 20	538	450	650	550
940	50 - 7 x 120 - 50	590	502	710	610
1000	20 - 8 x 120 - 20	642	554	770	670
1060	50 - 8 x 120 - 50	694	606	830	730
1120	20 - 9 x 120 - 20	746	658	890	790
1180	50 - 9 x 120 - 50	798	710	950	850
1240	20 - 10 x 120 - 20	850	762	1010	910
1300	0 - 10 x 120 - 50	902	814	1070	970
1360	20 - 11 x 120 - 20	954	866	1130	1030
1420	50 - 11 x 120 - 50	1006	918	1190	1090
1480	20 - 12 x 120 - 20	1058	970	1250	1150
1540	50 - 12 x 120 - 50	1110	1022	1310	1210
1600	20 - 13 x 120 - 20	1162	1074	1370	1270

Length	Counterbored mounting hole spacing	Max. travel for carriage length* with bellows		w/o bellows	
L (mm)	F - G x 120 - F	220*	320*	220*	320*
1660	50 - 13 x 120 - 50	1214	1126	1430	1330
1720	20 - 14 x 120 - 20	1266	1178	1490	1390
1780	50 - 14 x 120 - 50	1318	1230	1550	1450
1840	20 - 15 x 120 - 20	1370	1282	1610	1510
1900	50 - 15 x 120 - 50	1422	1334	1670	1570
1960	20 - 16 x 120 - 20	1474	1386	1730	1630
2020	50 - 16 x 120 - 50	1526	1438	1790	1690
2080	20 - 17 x 120 - 20	1578	1490	1850	1750
2140	50 - 17 x 120 - 50	1630	1542	1910	1810
2200	20 - 18 x 120 - 20	1682	1594	1970	1870
2260	50 - 18 x 120 - 50	1734	1646	2030	1930
2320	20 - 19 x 120 - 20	1786	1698	2090	1990
2380	50 - 19 x 120 - 50	1838	1750	2150	2050
2440	20 - 20 x 120 - 20	1890	1802	2210	2110
2500	50 - 20 x 120 - 50	1942	1854	2270	2170
2560	20 - 21 x 120 - 20	1994	1906	2330	2230
2620	50 - 21 x 120 - 50	2046	1958	2390	2290
2680	20 - 22 x 120 - 20	2098	2010	2450	2350
2740	50 - 22 x 120 - 50	2150	2062	2510	2410
2800	20 - 23 x 120 - 20	2202	2114	2570	2470
2860	50 - 23 x 120 - 50	2254	2166	2630	2530

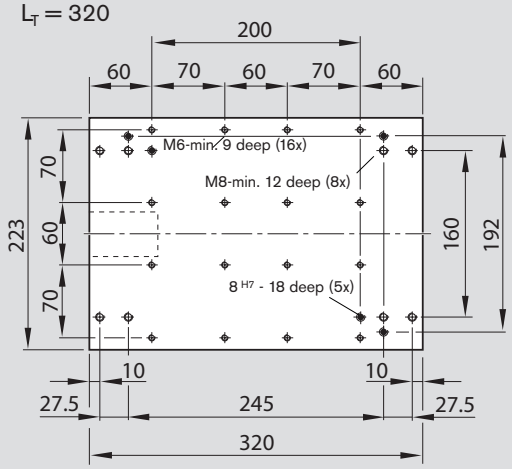




Mounting hole pattern for carriage length
$L_T = 220$



Mounting hole pattern for carriage length
$L_T = 320$



1) 27 deep (4x)
2) Ball nut

Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 25 mm:
Excess travel (braking distance) ≈ 50 mm

Recommended standard configuration:

– 2 mechanical switches

– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical mechanical - proximity proximity - proximity	60 45 12.5
internal	mechanical - mechanical mechanical - proximity proximity - proximity	70 50 25

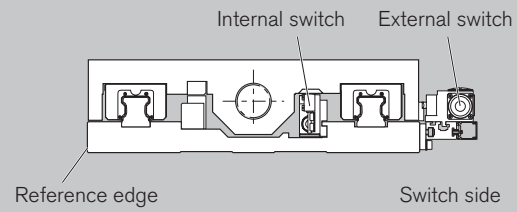
Maximum switch activation point

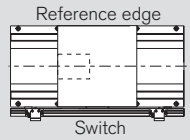
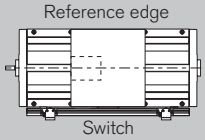
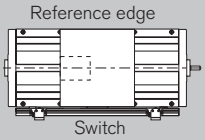
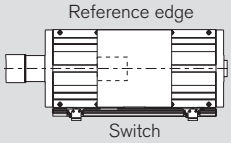
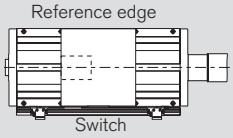
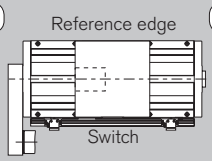
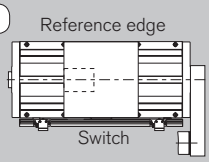
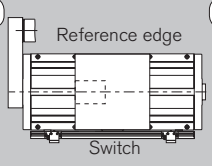
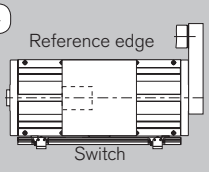
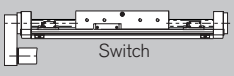
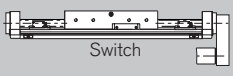
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

Maximum switch activation point = 0.5 · max. travel - excess travel

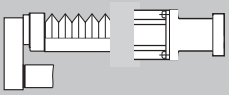
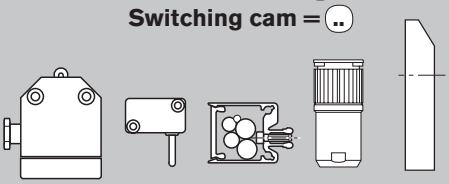
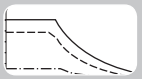
TKK 20-225 St Options Table

Part number 1460-300-00, (....) mm — **Type (....)** — **See dimensions table for**



	Dimension drawing no. for motor attachment	Guide-way =(..)	Drive unit =(..)				Carriage =(..)				
		Base plate	Ball screw journal	Ball screw drive			Table length L_T				
			keyway	20 x 5	20 x 20	25 x 5	25 x 10	220 mm Preload 2%	220 mm Preload 8%	320 mm Preload 2%	320 mm Preload 8%
without drive unit (without end-plates)											
(OA01) 		(01)		(00)				(01)	(02)	(03)	(04)
without motor mount and motor											
(OF01)  (OF04) 		(01)	dia 10 (fixed bearing end)	(01)	(07)			(01)	(02)	(03)	(04)
			dia 10 keyway (fixed bearing end)	(04)	(10)						
			dia 14 (fixed bearing end)			(13)	(19)				
			dia 14 keyway (fixed bearing end)			(16)	(22)				
with motor mount and coupling, with or without motor											
(MF01) 	14.36.05 14.36.20	(01)	dia 10 (fixed bearing end)	(01)	(07)			(01)	(02)	(03)	(04)
(MF02) 			dia 14 (fixed bearing end)			(13)	(19)	(01)	(02)	(03)	(04)
with side drive with timing belt, with or without motor											
(RV01)  (RV02) 	14.36.75	(01)	dia 14 (floating bearing end)	(03)	(09)	(15)	(21)	(01)	(02)	(03)	(04)
(RV03)  (RV04) 	14.36.90										
(RV05)  (RV06) 	14.36.55 14.36.70										

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

	Motor attachment = ..	Motor = ..	Cover = ..	Position measuring system = ..	1st switch = ..-. ± ….. mm 2nd switch = ..-. ± ….. mm 3rd switch = ..-. ± ….. mm Cable duct = .. - . …. mm Socket-plug = .. Switching cam = ..	Documentation = ..
						

i =	Mounting direction as per diagram			Motor type		Polyurethane bellows without	Polyurethane bellows with	Glass scale without	Glass scale with	Standard report	Special report
	OA01	00		without	00	00	upon request	00	upon request	01	02 Friction moment
	OF01-OF04	00		without	00	00	01				03 Lead deviation
1	MF01-MF02	10		without	00						
				MMD 082A	60						
		02		without	00						
		04		MKD 41B	10						
1	MF01-MF02	06		without	00						
				MKD 71B-061	11						
				MHD 71B-061	62						04 Sequence accuracy
		11		without	00						
				MMD 082A	60						
1	RV01-RV04	37		without	00						
	RV05-RV06	38									
2	RV01-RV04	39		MHD 71A-061	61						
	RV05-RV06	40									
1	RV01-RV04	45		without	00						
	RV05-RV06	46									
1.5	RV01-RV04	47		MKD 41B	10						
	RV05-RV06	48									05 Positioning accuracy
1	RV01-RV04	49		without	00						
	RV05-RV06	50									
1.5	RV01-RV04	51		MMD 082A	60						
	RV05-RV06	52									

without switch
without cable duct 00

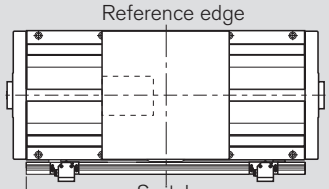
Internal switch

PNP NC	01 -I ±…..
PNP NO	03 -I ±…..
Mechanical	05 -I ±…..

Switch type
Pos. and direction
Switch activation point in mm

Socket-plug on end-plate Switch- 07

Direction
– 0 +
Reference edge



Switch
L/2

External switch

PNP NC	11 -A ±….
PNP NO	13 -A ±….
Mechanical	15 -A ±….

Switch type
Pos. and direction
Switch activation point in mm

External switching cam with profiled support 26

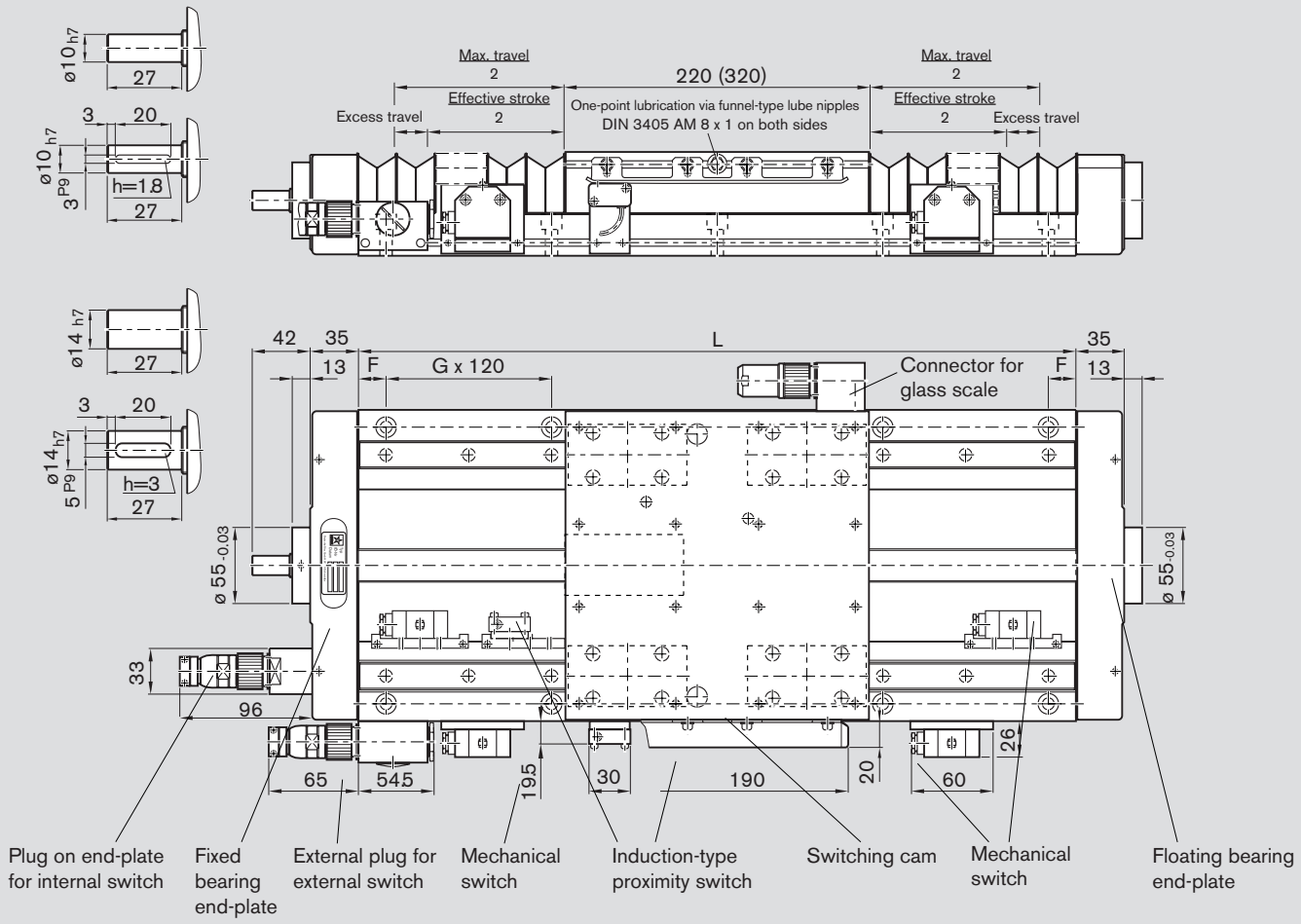
External socket-plug (loose) 17

Cable duct (loose)

Cable duct	20 - X….

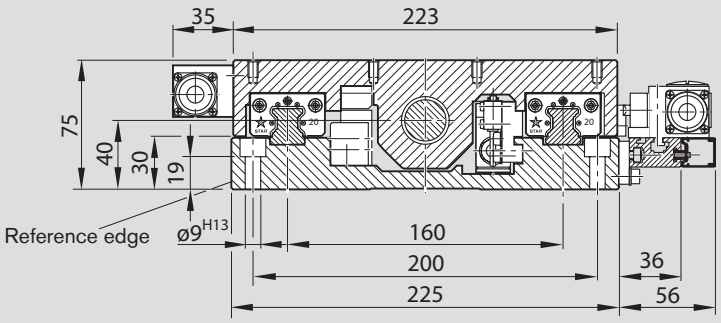
Type
Length in mm

TKK 20-225 St Dimension Drawings

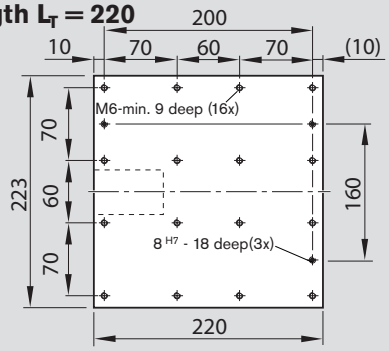


Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	220*	320*	220*	320*
340	50 - 2 x 120 - 50	70	-	110	-
400	20 - 3 x 120 - 20	122	34	170	70
460	50 - 3 x 120 - 50	174	86	230	130
520	20 - 4 x 120 - 20	226	138	290	190
580	50 - 4 x 120 - 50	278	190	350	250
640	20 - 5 x 120 - 20	330	242	410	310
700	50 - 5 x 120 - 50	382	294	470	370
760	20 - 6 x 120 - 20	434	346	530	430
820	50 - 6 x 120 - 50	486	398	590	490
880	20 - 7 x 120 - 20	538	450	650	550
940	50 - 7 x 120 - 50	590	502	710	610
1000	20 - 8 x 120 - 20	642	554	770	670
1060	50 - 8 x 120 - 50	694	606	830	730
1120	20 - 9 x 120 - 20	746	658	890	790
1180	50 - 9 x 120 - 50	798	710	950	850
1240	20 - 10 x 120 - 20	850	762	1010	910
1300	0 - 10 x 120 - 50	902	814	1070	970
1360	20 - 11 x 120 - 20	954	866	1130	1030
1420	50 - 11 x 120 - 50	1006	918	1190	1090
1480	20 - 12 x 120 - 20	1058	970	1250	1150
1540	50 - 12 x 120 - 50	1110	1022	1310	1210
1600	20 - 13 x 120 - 20	1162	1074	1370	1270

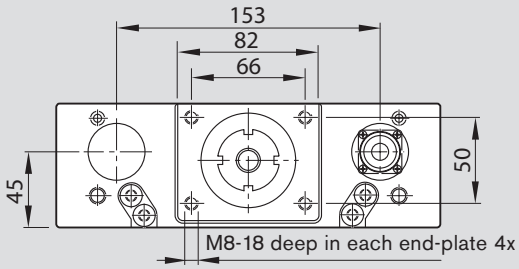
Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	220*	320*	220*	320*
1660	50 - 13 x 120 - 50	1214	1126	1430	1330
1720	20 - 14 x 120 - 20	1266	1178	1490	1390
1780	50 - 14 x 120 - 50	1318	1230	1550	1450
1840	20 - 15 x 120 - 20	1370	1282	1610	1510
1900	50 - 15 x 120 - 50	1422	1334	1670	1570
1960	20 - 16 x 120 - 20	1474	1386	1730	1630
2020	50 - 16 x 120 - 50	1526	1438	1790	1690
2080	20 - 17 x 120 - 20	1578	1490	1850	1750
2140	50 - 17 x 120 - 50	1630	1542	1910	1810
2200	20 - 18 x 120 - 20	1682	1594	1970	1870
2260	50 - 18 x 120 - 50	1734	1646	2030	1930
2320	20 - 19 x 120 - 20	1786	1698	2090	1990
2380	50 - 19 x 120 - 50	1838	1750	2150	2050



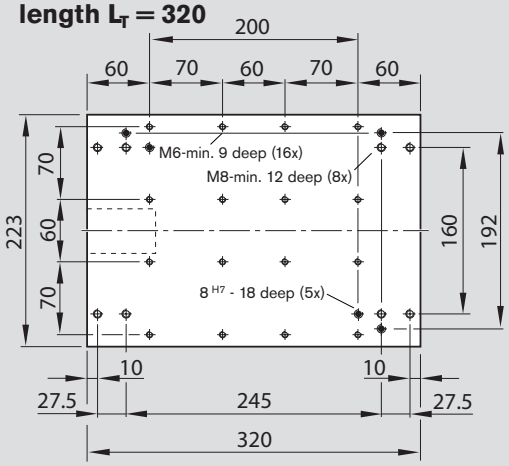
Mounting hole pattern for carriage length $L_T = 220$



Front view



Mounting hole pattern for carriage length $L_T = 320$



Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 25 mm:
Excess travel (braking distance) ≈ 50 mm

Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical	60
	mechanical - proximity	45
	proximity - proximity	12.5
internal	mechanical - mechanical	70
	mechanical - proximity	50
	proximity - proximity	25

Maximum switch activation point

The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

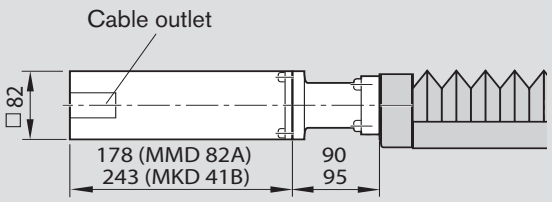
Maximum switch activation point = 0.5 · max. travel - excess travel

TKK 20-225 Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

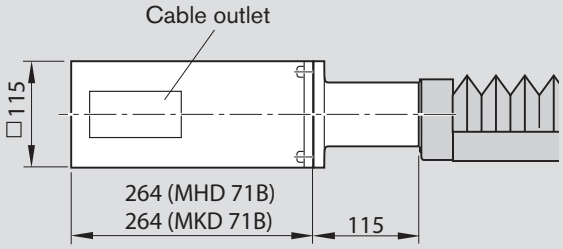
14.36.05

Types MF01 and MF02
Motor MKD 41B or MMD 82A
with motor mount and coupling



14.36.20

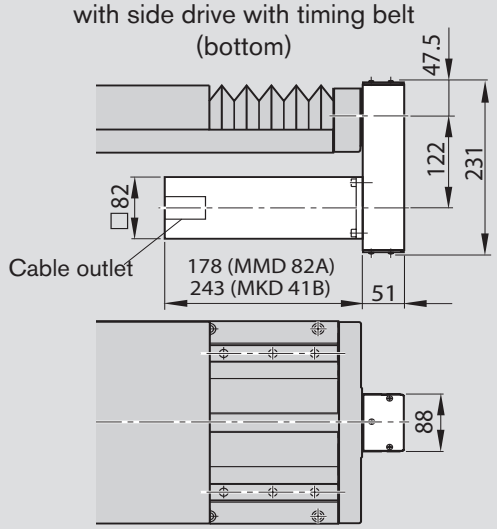
Types MF01 and MF02
Motor MKD 71B or MHD71B
with motor mount and coupling



Motor attachment for side drive with timing belt

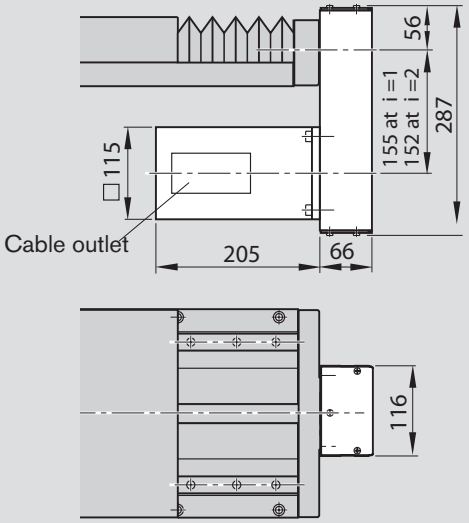
14.36.55

Types RV05 to RV06
Motor MKD 41B or MMD 82A
with side drive with timing belt
(bottom)



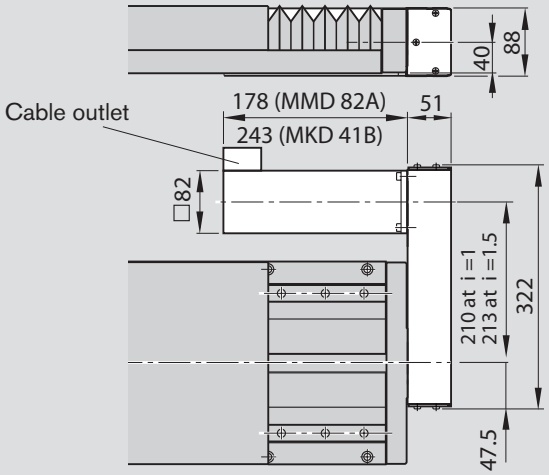
14.36.70

Types RV05 to RV06
Motor MHD 71A with side drive with timing belt (bottom)



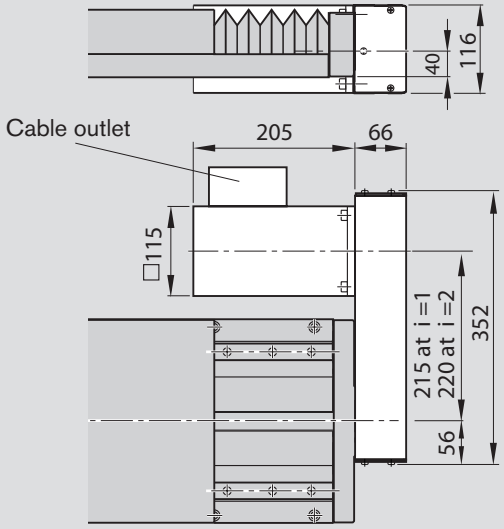
14.36.75

Types RV01 to RV04
Motor MKD 41B or MMD 82A
with side drive with timing belt (side)



14.36.90

Types RV01 to RV04
Motor MHD 71A with side drive with timing belt (side)



Note for steel version

In version RV01 and RV02 with externally mounted switches:
no switches may be mounted in the motor area!

For motor dimensions see “Motors”

Note for multi-axis units

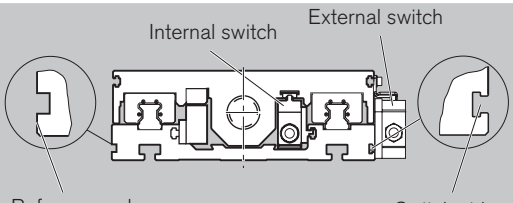
(e.g. cross-tables)

For multi-axis units with motor attachment via side drive with timing belt, the motor may project into the working area of adjacent axes.
Check for any interference contours!

TKK 30-325 AI Options Table

Part number 1460-405-00, (....) mm — **Type (....)**

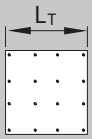
See dimensions table for length

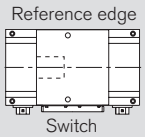
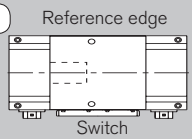
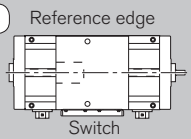
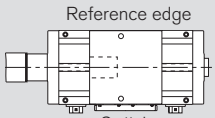
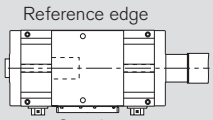
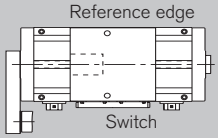
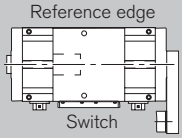
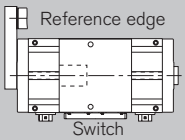
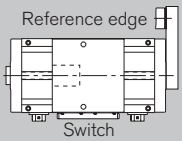
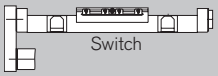
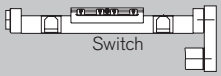


Guide-way = (..)

Drive unit = (..)

Carriage = (..)

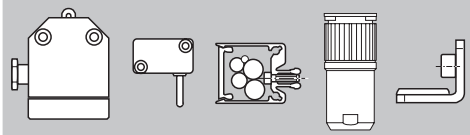


	Dimension drawing no. for motor attachment	Base plate		Ball screw journal	Ball screw drive				Carriage length L_T			
									320 mm		450 mm	
									Preload		Preload	
		flat	high	keyway	32 x 5	32 x 10	32 x 20	32 x 32	2%	8%	2%	8%
without drive unit (without end-plates)												
OA01 		01	11		00				05	06	07	08
without motor mount and motor												
OF01  OF04 		01	11	dia 16 (fixed bearing end)	07	13	19	25	05	06	07	08
				dia 16 keyway (fixed brg.)	10	16	22	28				
with motor mount and coupling, with or without motor												
MF01 	14.46.20	01	11	dia 16 (fixed bearing end)	07	13	19	25	05	06	07	08
MF02 												
with side drive with timing belt, with or without motor												
RV01  RV02 	14.46.90	01	11	dia 19 (floating bearing end)	09	15	21	27	05	06	07	08
RV03  RV04 												
RV05  RV06 	14.46.70											

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

	Motor attachment = ..	**Motor = ..**	**Cover = ..**	**Position measuring system = ..**	**1st switch = ..-. ± ….. mm** **2nd switch = ..-. ± ….. mm** **3rd switch = ..-. ± ….. mm** **Cable duct = .. - . …. mm** **Socket-plug = ..** **Switching cam = ..**	**Documentation = ..**

i =	Mounting direction as per diagram			Motor type		Polyurethane bellows: without	Polyurethane bellows: with	Glass scale: without	Glass scale: with	Standard report	Special report
	OA01	00		without	00	00	upon request	00	upon request	01	02 Friction moment
	OF01-OF04	00			00						
1	MF01-MF02	06		without	00	00	01				03 Lead deviation
				MKD 71B-061	11						
				MHD 71B-061	62						
1	RV01-RV04	69		without	00						04 Sequence accuracy
	RV05-RV06	70									
2	RV01-RV04	71		MHD 71B-061	62						
	RV05-RV06	72									
1	RV01-RV04	73		without	00						05 Positioning accuracy
	RV05-RV06	74		MKD 71B-061	11						
2	RV01-RV04	75									
	RV05-RV06	76		MHD 71B-061	62						



without switch
without cable duct 00

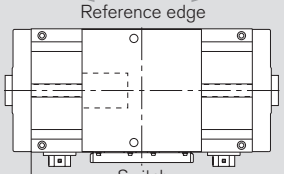
Internal switch

PNP NC	01 -I ±…..
PNP NO	03 -I ±…..
Mechanical	05 -I ±…..

Switch type
Pos. and direction
Switch activation point in mm

Socket-plug on end-plate Switch- 07

Direction
− 0 +
Reference edge



Switch
L/2

External switch

PNP NC	11 -A ±….
PNP NO	13 -A ±….
Mechanical	15 -A ±….

Switch type
Pos. and direction
Switch activation point in mm

External switching cam 16

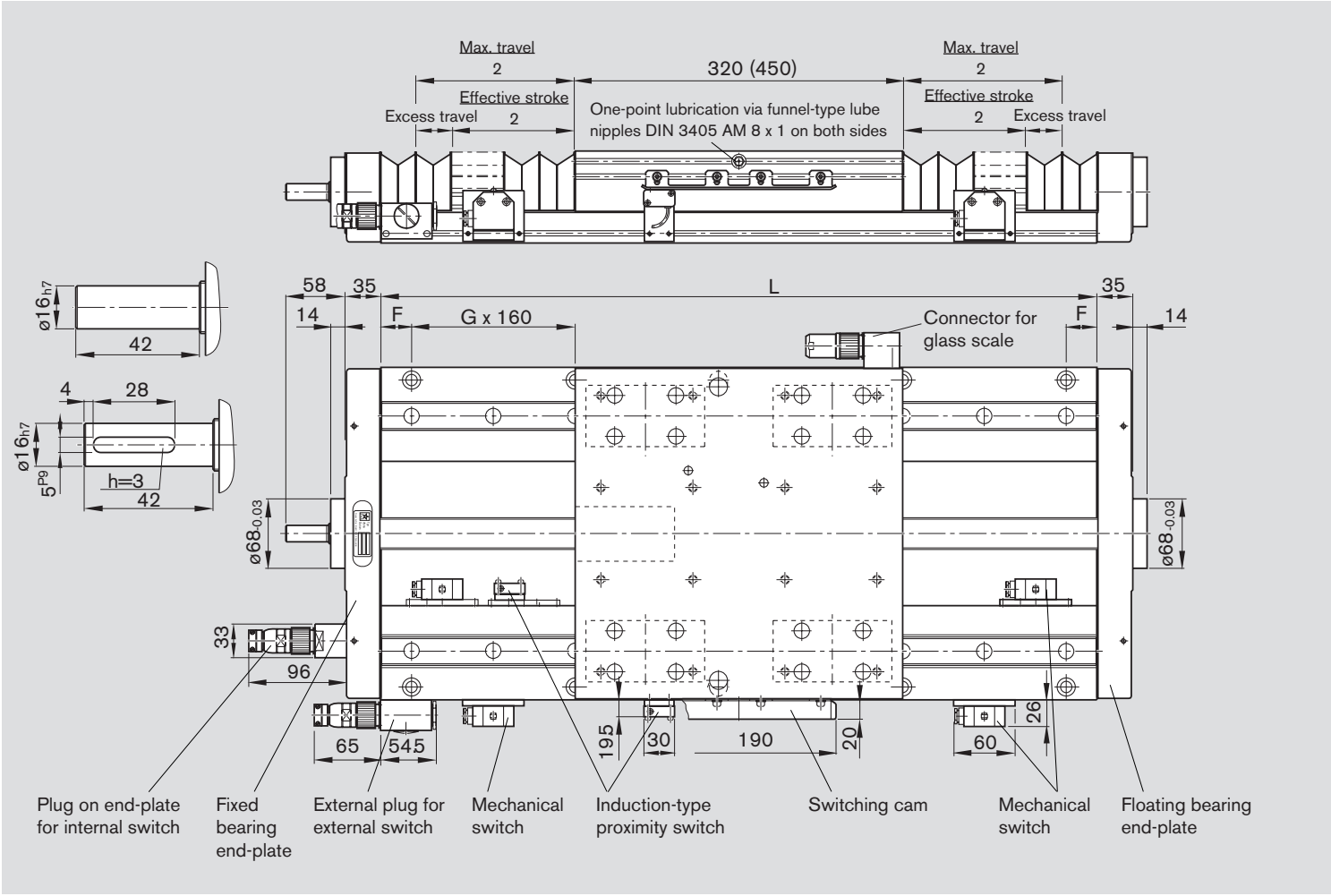
External socket-plug (loose) 17

Cable duct (loose)

Cable duct	20 - X….

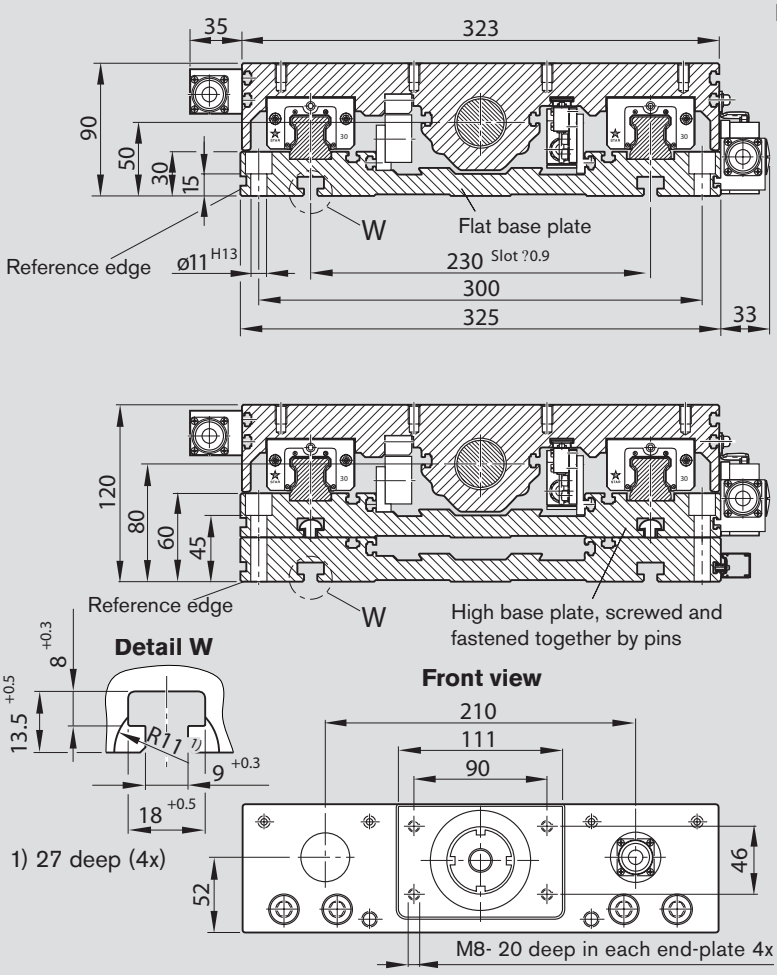
Type
Length in mm

TKK 30-325 Al Dimension Drawings

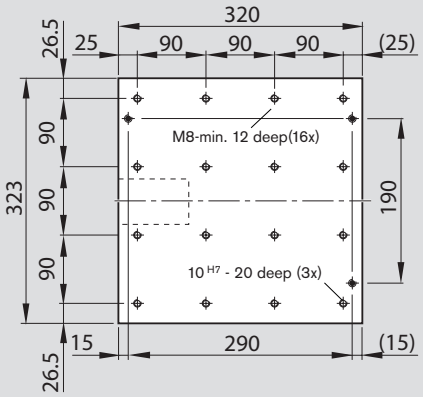


Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	320*	450*	320*	450*
460	70 - 2 x 160 - 70	-	-	130	-
540	30 - 3 x 160 - 30	154	-	210	-
620	70 - 3 x 160 - 70	225	109	290	160
700	30 - 4 x 160 - 30	297	180	370	240
780	70 - 4 x 160 - 70	368	251	450	320
860	30 - 5 x 160 - 30	439	322	530	400
940	70 - 5 x 160 - 70	510	394	610	480
1020	30 - 6 x 160 - 30	582	465	690	560
1100	70 - 6 x 160 - 70	653	536	770	640
1180	30 - 7 x 160 - 30	724	604	850	720
1260	70 - 7 x 160 - 70	795	679	930	800
1340	30 - 8 x 160 - 30	866	750	1010	880
1420	70 - 8 x 160 - 70	938	821	1090	960
1500	30 - 9 x 160 - 30	1009	892	1170	1040
1580	70 - 9 x 160 - 70	1080	963	1250	1120
1660	30 - 10 x 160 - 30	1151	1035	1330	1200

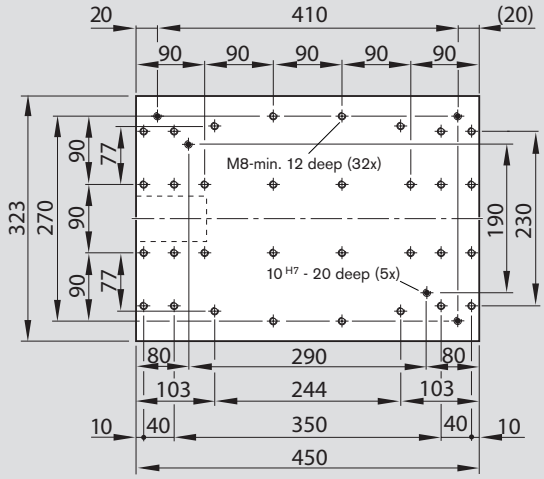
Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	320*	450*	320*	450*
1740	70 - 10 x 160 - 70	1223	1106	1410	1280
1820	30 - 11 x 160 - 30	1294	1177	1490	1360
1900	70 - 11 x 160 - 70	1365	1248	1570	1440
1980	30 - 12 x 160 - 30	1436	1320	1650	1520
2060	70 - 12 x 160 - 70	1507	1391	1730	1600
2140	30 - 13 x 160 - 30	1579	1462	1810	1680
2220	70 - 13 x 160 - 70	1650	1533	1890	1760
2300	30 - 14 x 160 - 30	1721	1605	1970	1840
2380	70 - 14 x 160 - 70	1792	1676	2050	1920
2460	30 - 15 x 160 - 30	1864	1747	2130	2000
2540	70 - 15 x 160 - 70	1935	1818	2210	2080
2620	30 - 16 x 160 - 30	2006	1889	2290	2160
2700	70 - 16 x 160 - 70	2077	1961	2370	2240
2780	30 - 17 x 160 - 30	2148	2032	2450	2320
2860	70 - 17 x 160 - 70	2220	2103	2530	2400



Mounting hole pattern for carriage length $L_T = 320$



Mounting hole pattern for carriage length $L_T = 450$



Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as
guideline value for the braking distance.
In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 32 mm:
Excess travel (braking distance) ≈ 64 mm

Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical	60
	mechanical - proximity	45
	proximity - proximity	12.5
internal	mechanical - mechanical	70
	mechanical - proximity	50
	proximity - proximity	25

Maximum switch activation point

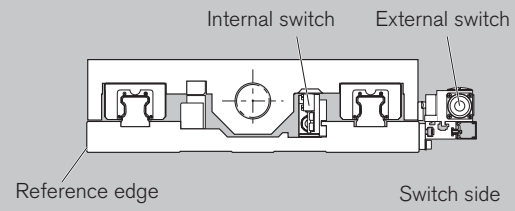
The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

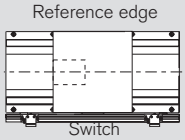
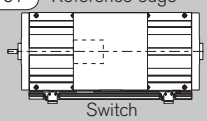
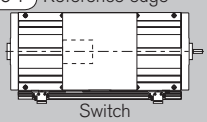
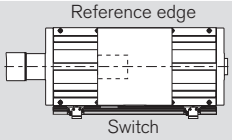
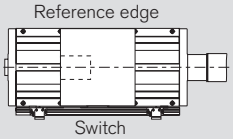
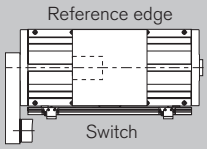
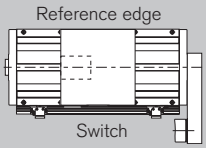
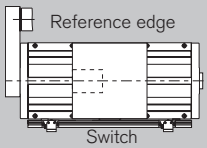
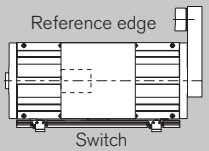
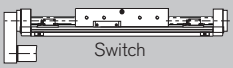
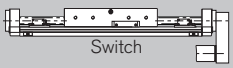
Maximum switch activation point = 0.5 · max. travel - excess travel

TKK 30-325 St Options Table

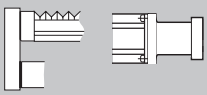
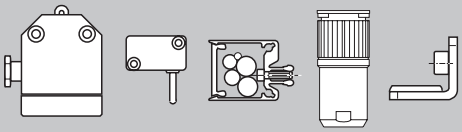
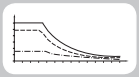
Part number 1460-400-00, (....) mm — **Type (....)**

See dimensions table for length

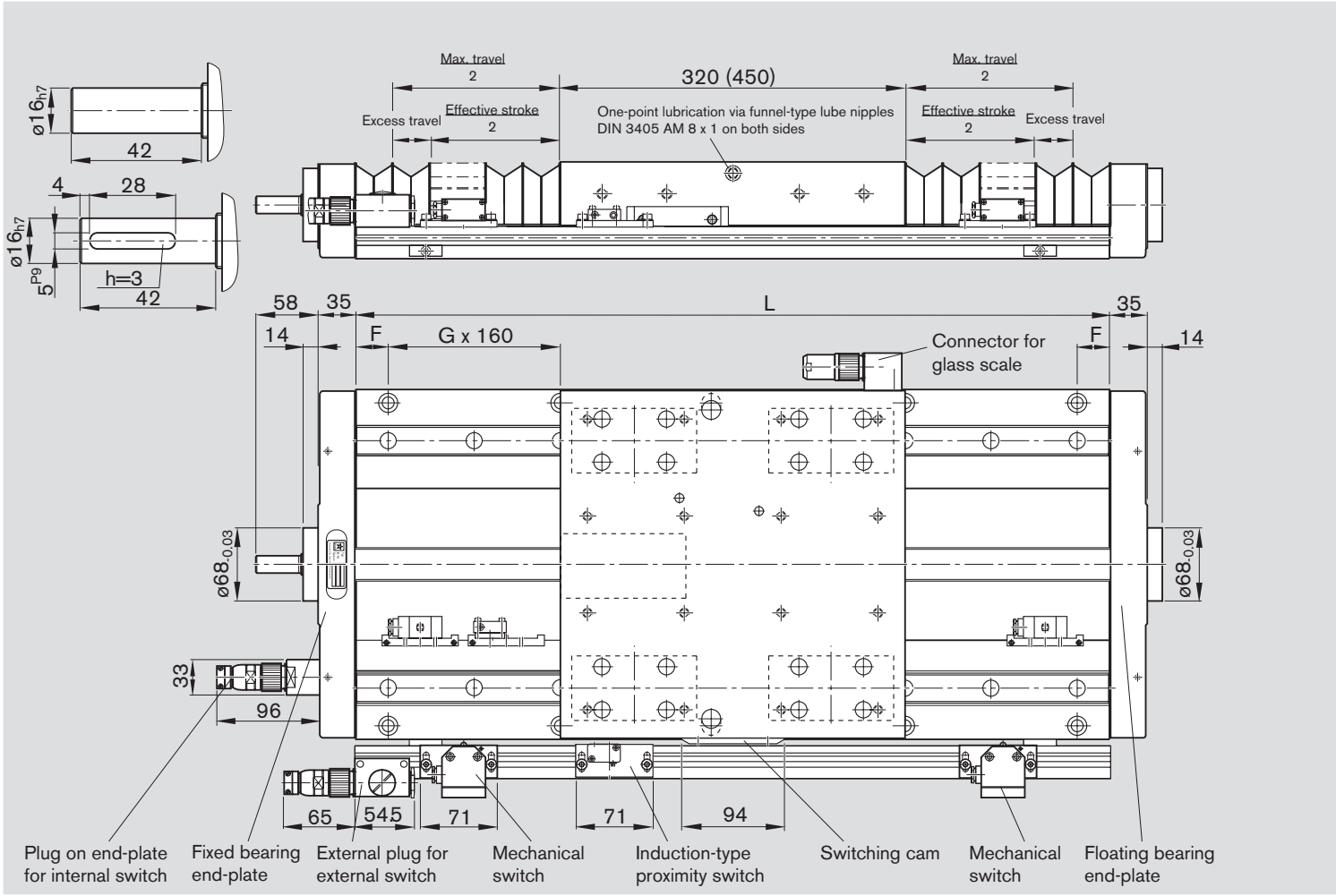


	Dimension drawing no. for motor attachment	Guide-way =(..) Base plate flat	Drive unit =(..) Ball screw journal keyway	Ball screw drive 32 x 5	32 x 10	32 x 20	32 x 32	Carriage =(..) Carriage length L_T 320 mm Preload 2%	320 mm Preload 8%	450 mm Preload 2%	450 mm Preload 8%
without drive unit (without end-plates) OA01 		(01)		(00)				(05)	(06)	(07)	(08)
without motor mount and motor OF01  OF04 		(01)	dia 16 (fixed bearing end)	(07)	(13)	(19)	(25)	(05)	(06)	(07)	(08)
			dia 16 keyway (fixed brg.)	(10)	(16)	(22)	(28)				
with motor mount and coupling, with or without motor MF01  MF02 	14.46.20	(01)	dia 16 (fixed bearing end)	(07)	(13)	(19)	(25)	(05)	(06)	(07)	(08)
with side drive with timing belt, with or without motor RV01  RV02 	14.46.90	(01)	dia 19 (floating bearing end)	(09)	(15)	(21)	(27)	(05)	(06)	(07)	(08)
RV03  RV04 											
RV05  RV06 	14.46.70										

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

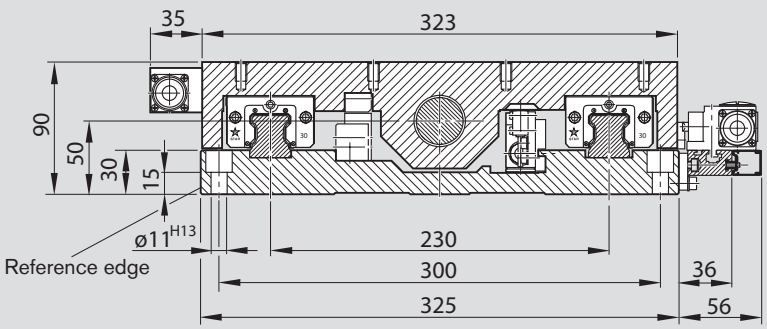
	Motor attachment = (..)		Motor = (..)		Cover = (..)		Position measuring system = (..)		1st switch = (..-. ± ….) mm 2nd switch = (..-. ± ….) mm 3rd switch = (..-. ± ….) mm Cable duct = (.. - . ….) mm Socket-plug = (..) Switching cam = (..)	Documentation = (..)	
											
i =	Mounting direction as per diagram			Motor type		Polyurethane bellows: without	Polyurethane bellows: with	Glass scale: without	Glass scale: with		Standard report	Special report
	OA01	00		without	00	00	upon request	00	upon request	without switch without cable duct 00	01	02 Friction moment
	OF01-OF04	00		without	00					Internal switch: PNP NC 01 -I ±….. / PNP NO 03 -I ±….. / Mechanical 05 -I ±….. Switch type, Pos. and direction, Switch activation point in mm		
1	MF01-MF02	06		without	00					Socket-plug on end-plate Switching cam 07		03 Lead deviation
				MKD 71B-061	11					Direction – 0 + Reference edge; Switch; L/2		
				MHD 71B-061	62							
1	RV01-RV04	69		without	00					External switching cam with profiled support 26		04 Sequence accuracy
	RV05-RV06	70								External switch: PNP NC 11 -A ±…. / PNP NO 13 -A ±…. / Mechanical 15 -A ±…. Switch type, Pos. and direction, Switch activation point in mm		
2	RV01-RV04	71		MHD 71B-061	62					External socket-plug (loose) 17		
	RV05-RV06	72										
1	RV01-RV04	73		without	00					Cable duct (loose): Cable duct 20 - X.... Type, Length in mm		05 Positioning accuracy
	RV05-RV06	74		MKD 71B-061	11							
2	RV01-RV04	75										
	RV05-RV06	76		MHD 71B-061	62							

TKK 30-325 St Dimension Drawings

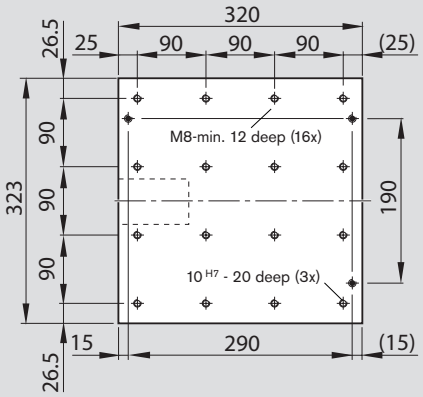


Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	320*	450*	320*	450*
460	70 - 2 x 160 - 70	-	-	130	-
540	30 - 3 x 160 - 30	154	-	210	-
620	70 - 3 x 160 - 70	225	109	290	160
700	30 - 4 x 160 - 30	297	180	370	240
780	70 - 4 x 160 - 70	368	251	450	320
860	30 - 5 x 160 - 30	439	322	530	400
940	70 - 5 x 160 - 70	510	394	610	480
1020	30 - 6 x 160 - 30	582	465	690	560
1100	70 - 6 x 160 - 70	653	536	770	640
1180	30 - 7 x 160 - 30	724	604	850	720
1260	70 - 7 x 160 - 70	795	679	930	800
1340	30 - 8 x 160 - 30	866	750	1010	880
1420	70 - 8 x 160 - 70	938	821	1090	960
1500	30 - 9 x 160 - 30	1009	892	1170	1040
1580	70 - 9 x 160 - 70	1080	963	1250	1120
1660	30 - 10 x 160 - 30	1151	1035	1330	1200

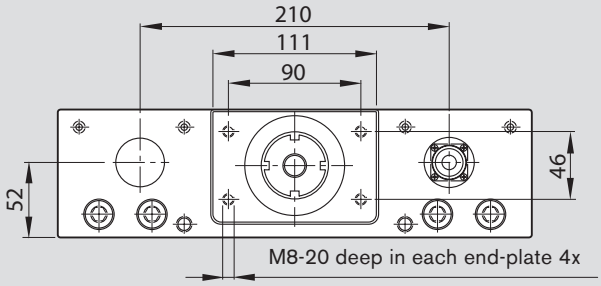
Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	320*	450*	320*	450*
1740	70 - 10 x 160 - 70	1223	1106	1410	1280
1820	30 - 11 x 160 - 30	1294	1177	1490	1360
1900	70 - 11 x 160 - 70	1365	1248	1570	1440
1980	30 - 12 x 160 - 30	1436	1320	1650	1520
2060	70 - 12 x 160 - 70	1507	1391	1730	1600
2140	30 - 13 x 160 - 30	1579	1462	1810	1680
2220	70 - 13 x 160 - 70	1650	1533	1890	1760
2300	30 - 14 x 160 - 30	1721	1605	1970	1840
2380	70 - 14 x 160 - 70	1792	1676	2050	1920



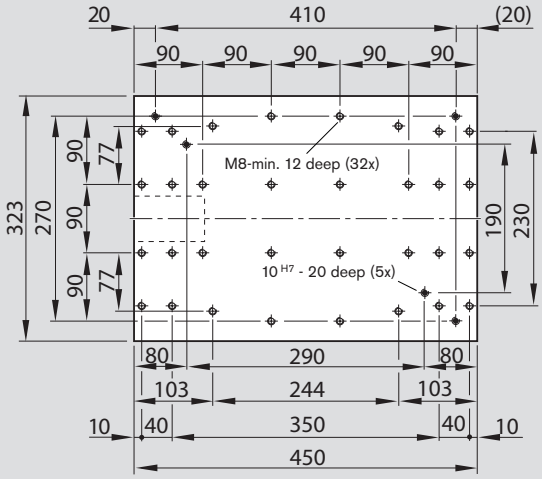
Mounting hole pattern for carriage length $L_T = 320$



Front view



Mounting hole pattern for carriage length $L_T = 450$



Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as guideline value for the braking distance.
In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 32 mm:
Excess travel (braking distance) ≈ 64 mm

Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical	62
	mechanical - proximity	49
	proximity - proximity	35
internal	mechanical - mechanical	70
	mechanical - proximity	50
	proximity - proximity	25

Maximum switch activation point

The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

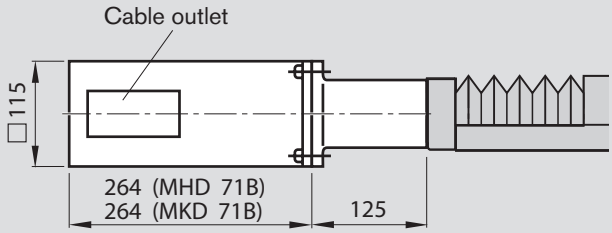
Maximum switch activation point = 0.5 · max. travel - excess travel

TKK 30-325 Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

14.46.20

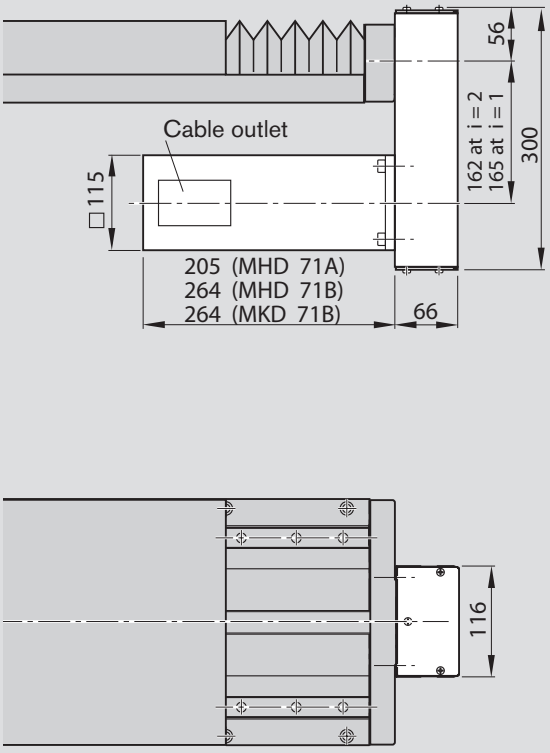
Types MF01 and MF02
Motor MKD 71B or MHD 71B
with motor mount and coupling



Motor attachment for side drive with timing belt

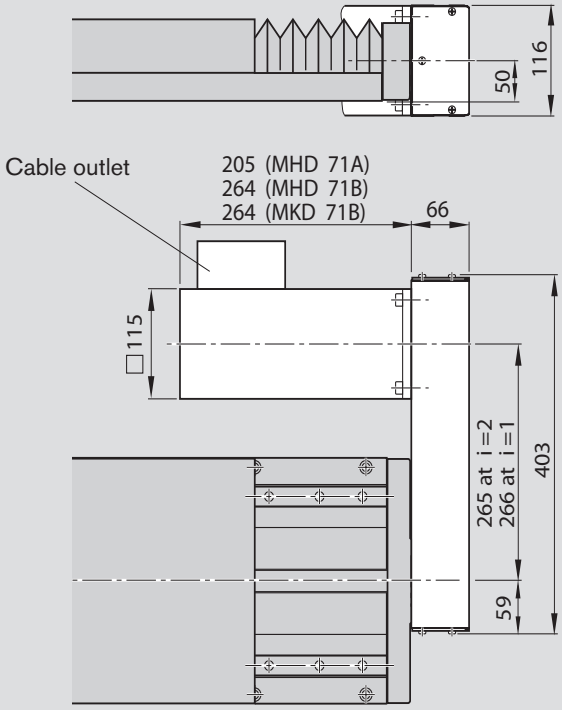
14.46.70

Types RV05 to RV06
Motor MKD 71B, MHD 71A or MHD 71B
with side drive with timing belt (bottom)



14.46.90

Types RV01 to RV04
Motor MKD 71B, MHD 71A or MHD 71B
with side drive with timing belt (side)



Note for steel version

In version RV01 and RV02 with externally mounted switches:
no switches may be mounted in the motor area!

Note for multi-axis units

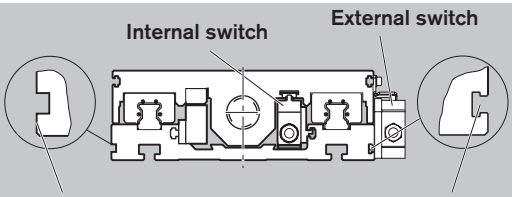
(e.g. cross-tables)

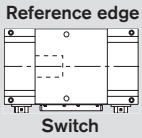
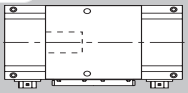
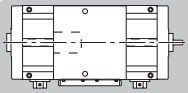
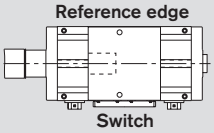
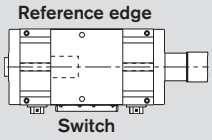
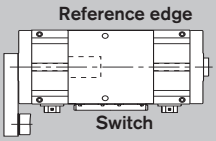
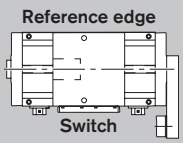
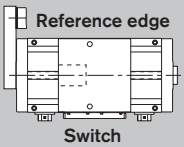
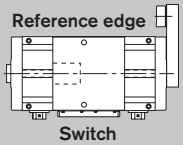
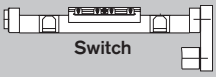
For multi-axis units with motor attachment via side drive with timing belt, the motor may project into the working area of adjacent axes. Check for any interference contours!

For motor dimensions see “Motors”

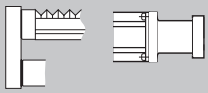
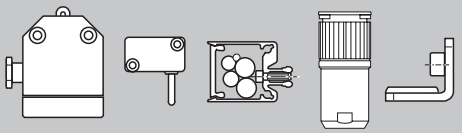
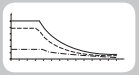
TKK 35-455 Al Options Table

Part number 1460-505-00, ... mm — **Type** .... — See dimensions table for length



	Dimension drawing no. for motor attachment	Guide-way = ..	Drive unit = ..	Carriage = ..							
		Base plate	Ball screw journal	Ball screw drive				Carriage length L_T			
		flat	keyway	40 x 5	40 x 10	40 x 20	40 x 40	450 mm Preload 2%	450 mm Preload 8%		
without drive unit (without end-plates)											
OA01 		01		00				05	06		
without motor mount and motor											
OF01 		01	dia 25 (fixed bearing end)	25	31	37	43	05	06		
OF04 			dia 25 keyway (fixed brg.)	28	34	40	46				
with motor mount and coupling, with or without motor											
MF01 	14.56.20	01	dia 25 (fixed bearing end)	25	31	37	43	05	06		
MF02 											
with side drive with timing belt, with or without motor											
RV01 	14.56.80	01	dia 24 (floating bearing end)	27	33	39	45	05	06		
RV02 											
RV03 	14.56.90										
RV04 											
RV05 	14.56.60										
RV06 	14.56.70										

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

	Motor attachment = ..		Motor = ..		Cover = ..	Position measuring system = ..	1st switch = ..-. ± ….. mm 2nd switch = ..-. ± ….. mm 3rd switch = ..-. ± ….. mm Cable duct = .. - . …. mm Socket-plug = .. Switching cam = ..	Documentation = ..
								

i =	Mounting direction as per diagram			Motor type		Polyurethane bellows: without	Polyurethane bellows: with	Glass scale: without	Glass scale: with	Standard report	Special report
	OA01	00		without	00	00	upon request	00	upon request	01	02 Friction moment
	OF01-OF04	00		without	00	00	01				
1	MF01-MF02	08		without	00						03 Lead deviation
				MKD 90B-047	13						
				MKD 90B-047	63						
1	RV01-RV04	49		without	00						04 Sequence accuracy
	RV05-RV06	50		MKD 71B-061	11						
2	RV01-RV04	51									
	RV05-RV06	52		MHD 71B-061	62						
1	RV01-RV04	53		without	00						05 Positioning accuracy
	RV05-RV06	54		MKD 90B-047	13						
2	RV01-RV04	55									
	RV05-RV06	56		MHD 90B-047	63						

without switch
without cable duct 00

Internal switch
PNP NC 01 -I ±…..
PNP NO 03 -I ±…..
Mechanical 05 -I ±…..
Switch type
Pos. and direction
Switch activation point in mm

Socket-plug on end-plate Switching cam 07

Direction
− 0 +
Reference edge
Switch
L/2

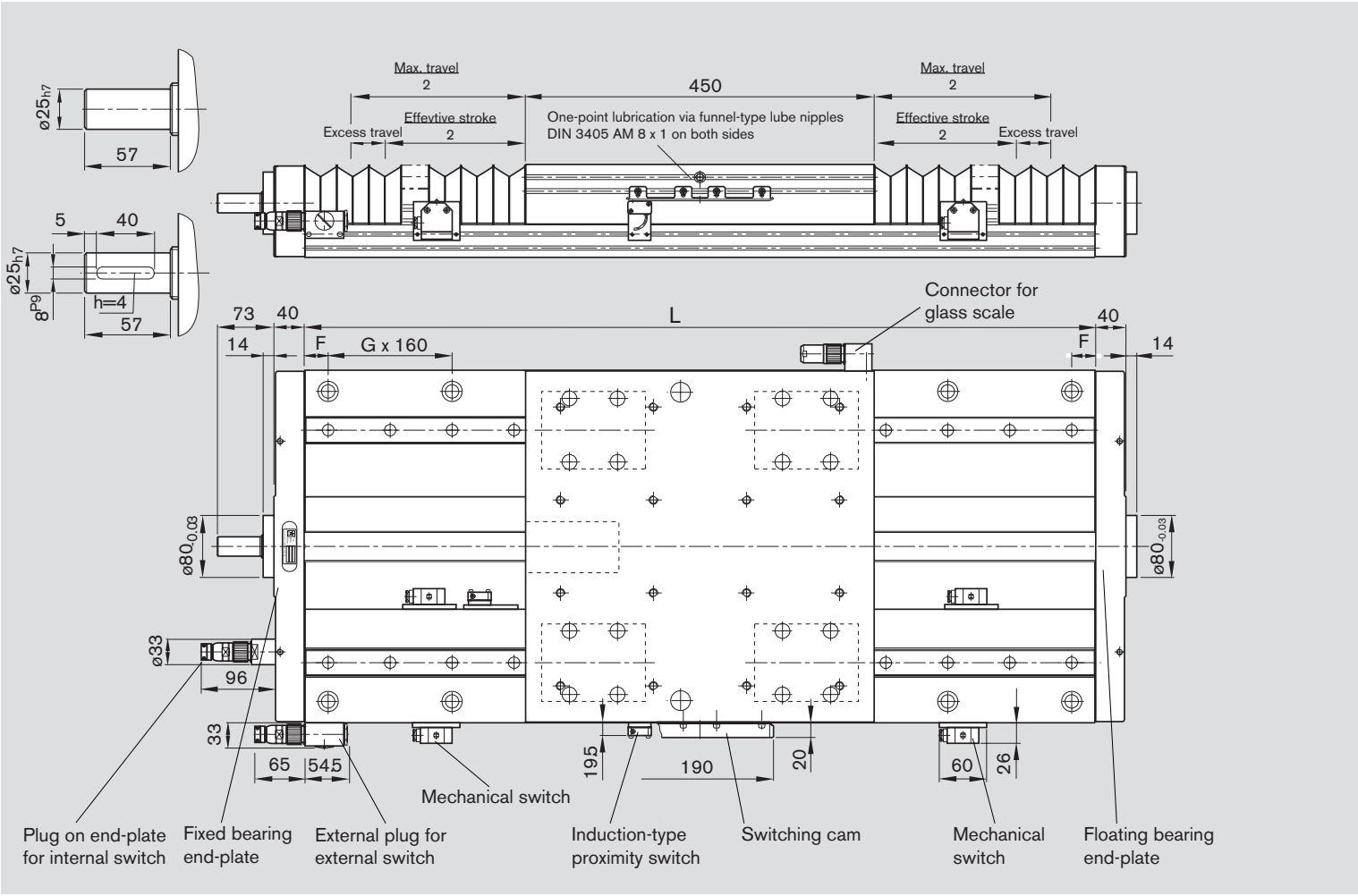
External switching cam 16

External switch
PNP NC 11 -A ±….
PNP NO 13 -A ±….
Mechanical 15 -A ±….
Switch type
Pos. and direction
Switch activation point in mm

External socket-plug (loose) 17

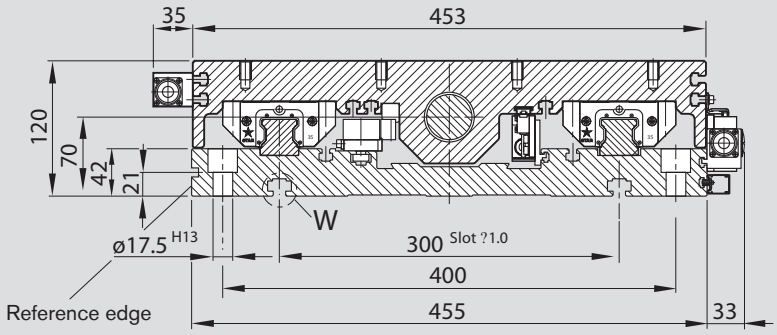
Cable duct (loose)
Cable duct 20 - X....
Type
Length in mm

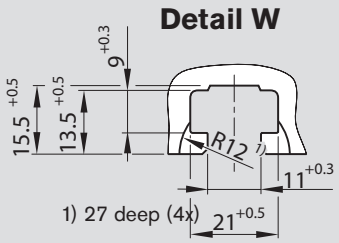
TKK 35-455 Al Dimension Drawings

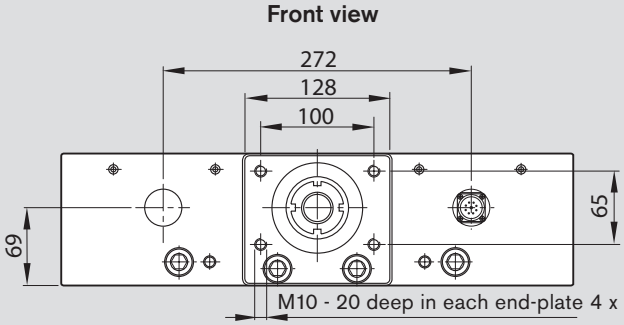


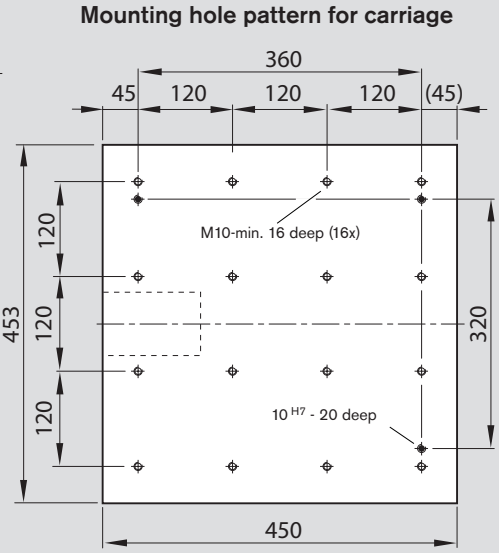
Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	450*		450*	
620	70 - 3 x 160 - 70	110		160	
700	30 - 4 x 160 - 30	183		240	
780	70 - 4 x 160 - 70	256		320	
860	30 - 5 x 160 - 30	328		400	
940	70 - 5 x 160 - 70	401		480	
1020	30 - 6 x 160 - 30	474		560	
1100	70 - 6 x 160 - 70	546		640	
1180	30 - 7 x 160 - 30	619		720	
1260	70 - 7 x 160 - 70	692		800	
1340	30 - 8 x 160 - 30	746		880	
1420	70 - 8 x 160 - 70	837		960	
1500	30 - 9 x 160 - 30	910		1040	
1580	70 - 9 x 160 - 70	982		1120	
1660	30 - 10 x 160 - 30	1055		1200	
1740	70 - 10 x 160 - 70	1127		1200	

Length	Counterbored mounting hole spacing	Max. travel for carriage length*			
		with bellows		without bellows	
L (mm)	F - G x 120 - F	450*		450*	
1820	30 - 11 x 160 - 30	1200		1360	
1900	70 - 11 x 160 - 70	1273		1440	
1980	30 - 12 x 160 - 30	1345		1520	
2060	70 - 12 x 160 - 70	1418		1600	
2140	30 - 13 x 160 - 30	1491		1680	
2220	70 - 13 x 160 - 70	1563		1760	
2300	30 - 14 x 160 - 30	1636		1840	
2380	70 - 14 x 160 - 70	1709		1920	
2460	30 - 15 x 160 - 30	1781		2000	
2540	70 - 15 x 160 - 70	1854		2080	
2620	30 - 16 x 160 - 30	1927		2160	
2700	70 - 16 x 160 - 70	1999		2240	
2780	30 - 17 x 160 - 30	2072		2320	
2860	70 - 17 x 160 - 70	2144		2400	









Effective stroke

For safe operation, the excess travel must be longer than the braking distance. The acceleration travel can be taken as guideline value for the braking distance. In most cases, 2x the ball screw lead (P) will be sufficient.

Example for P = 40 mm:
Excess travel (braking distance)
≈ 80 mm

Recommended standard configuration:
– 2 mechanical switches
– 1 proximity switch

Effective stroke = max. travel - 2 · excess travel

Distance between switch activation points of two switches

Switch position	For switch combination	Min. spacing (mm)
external	mechanical - mechanical	60
	mechanical - proximity	45
	proximity - proximity	12.5
internal	mechanical - mechanical	70
	mechanical - proximity	50
	proximity - proximity	25

Maximum switch activation point

The switch activation point characterizes the position of the center of the carriage after travel. The zero point is at L/2.

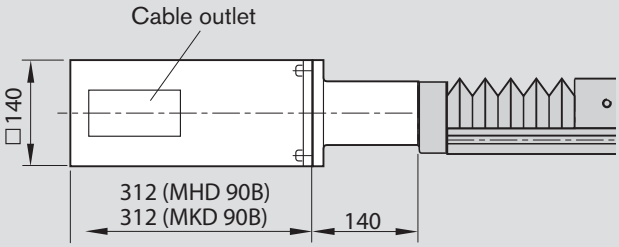
Maximum switch activation point = 0.5 · max. travel - excess travel

TKK 35-455 Al Dimension Drawings, Motor Attachment

Motor attachment with motor mount and coupling

14.56.20

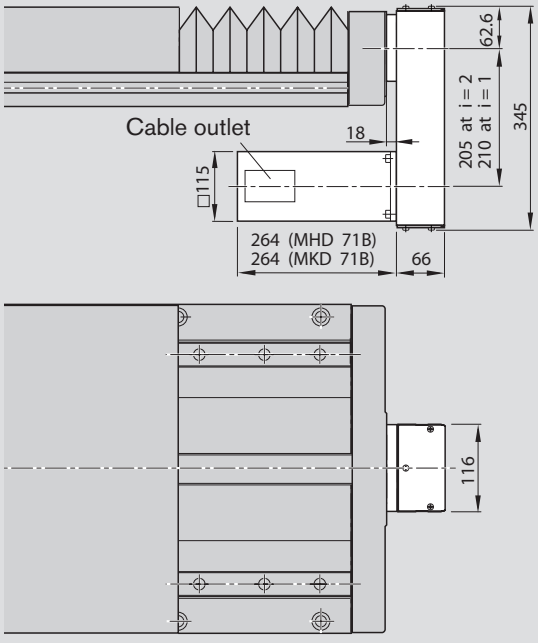
Types MF01 and MF02
Motor MKD 90B or MHD 90B
with motor mount and coupling



Motor attachment for side drive with timing belt

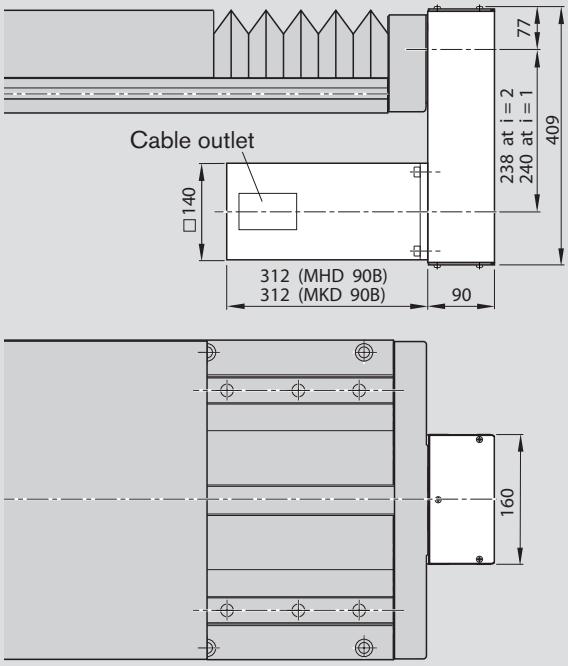
14.56.60

Types RV05 and RV06
Motor MKD 71B or MHD 71B
with side drive with timing belt (bottom)



14.56.70

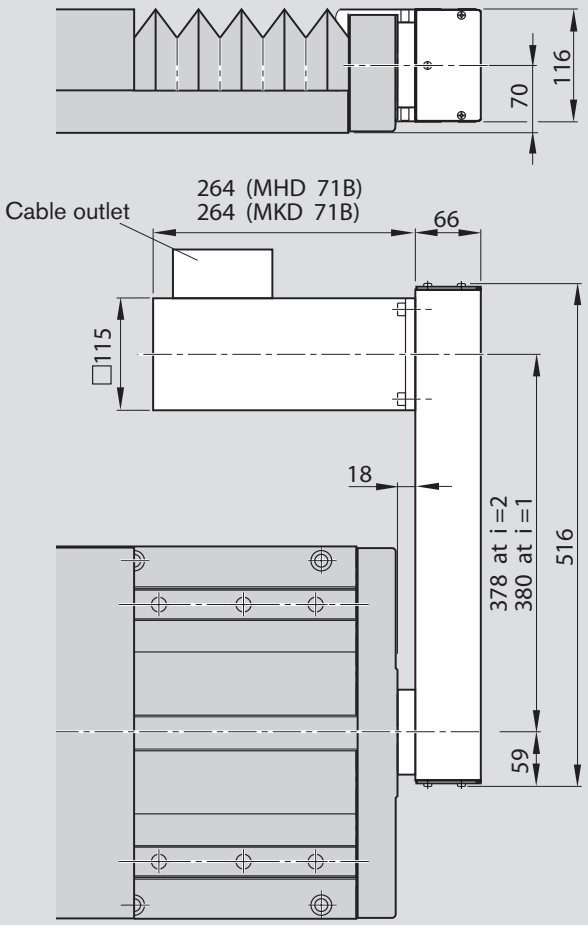
Types RV05 and RV06
Motor MKD 90B or MHD 90B
with side drive with timing belt (bottom)



Motor attachment for side drive with timing belt

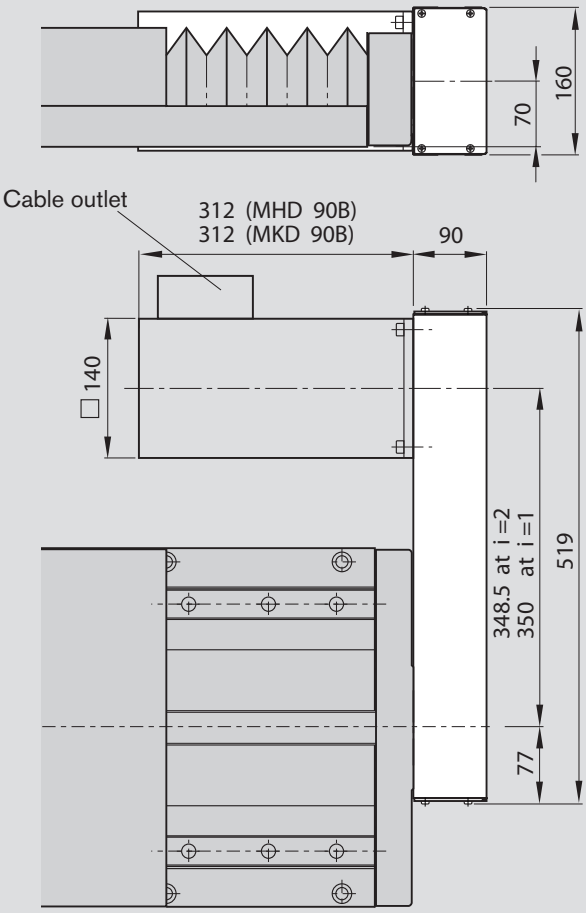
14.56.80

Types RV01 and RV04
Motor MKD 71B or MHD 71B
with side drive with timing belt (side)



14.56.90

Types RV01 and RV04
Motor MKD 90B or MHD 90B
with side drive with timing belt (side)



Note for multi-axis units

(e.g. cross-tables)

For multi-axis units with motor attachment via side drive with timing belt, the motor may project into the working area of adjacent axes. Check for any interference contours!

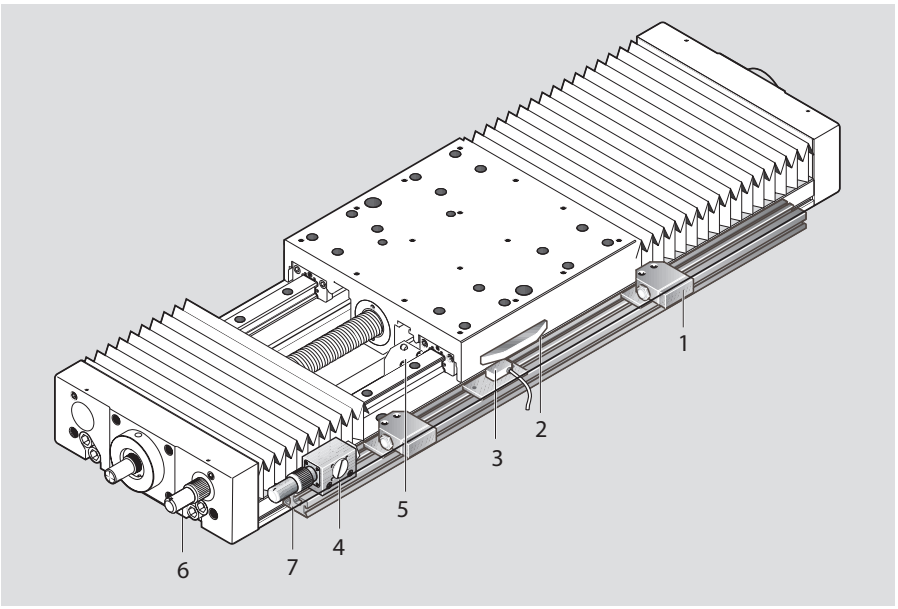
For motor dimensions see “Motors”

Switch Mounting Arrangements

Overview of the switching system

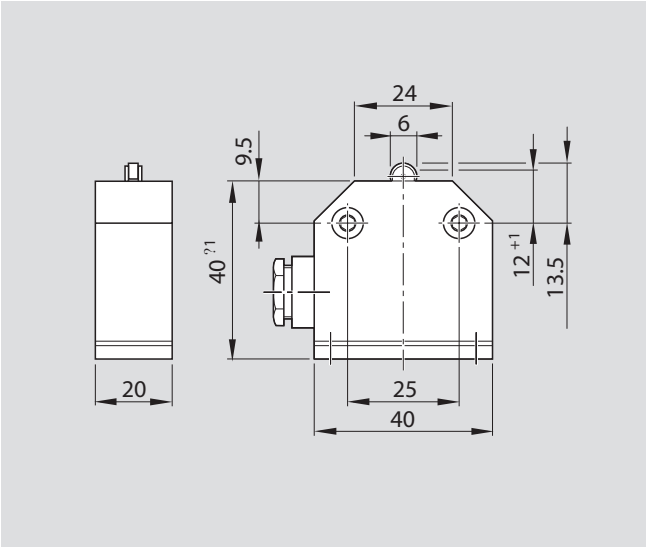
Accessories:

1 Mechanical switch, external
2 Switching cam
3 Proximity switch, external
4 Socket/plug for external switches
5 Mechanical and proximity switches, internal
6 Socket/plug for internal switches
7 Profiled support



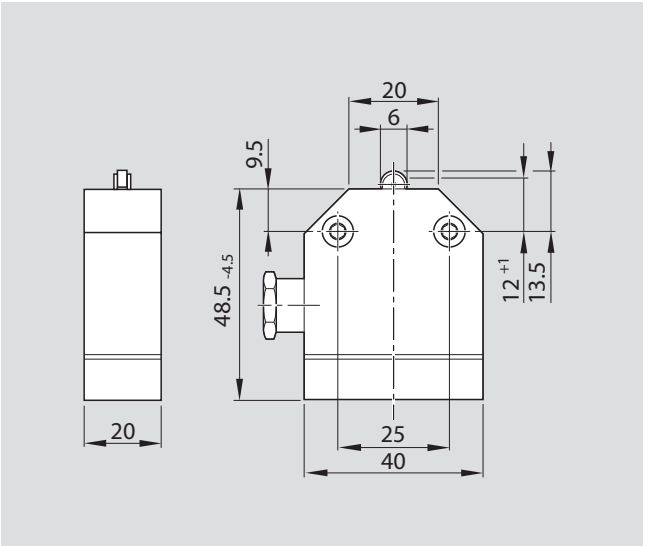
Internal mechanical switch

Reproducibility	= ± 0.05 mm
Permissible ambient temperature	= -5°C to +80°C
Enclosure	= DIN 40050 IP 67
Contact time	= < 2 ms
Insulation	= group C to VDE 0110
Rated voltage	= 250 V AC
Continuous current	= 5 A
Switching capacity at 220 V, 40-60 Hz	= cosφ = 0.8 at 2 A
Contact resistance when new	= < 240 mý
Connection	= screw connection
Contact system	= single-pole changeover
Switch system	= snap-action

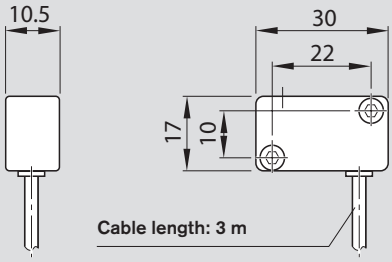


External mechanical switch

Reproducibility	= ± 0.05 mm
Permissible ambient temperature	= -5°C to +80°C
Enclosure	= DIN 40050 IP 67
Contact time	= < 2 ms
Insulation	= group C to VDE 0110
Rated voltage	= 250 V AC
Continuous current	= 5 A
Switching capacity at 220 V, 40-60 Hz	= cosφ = 0.8 at 2 A
Contact resistance when new	= < 240 mý
Connection	= screw connection
Contact system	= single-pole changeover
Switch system	= snap-action

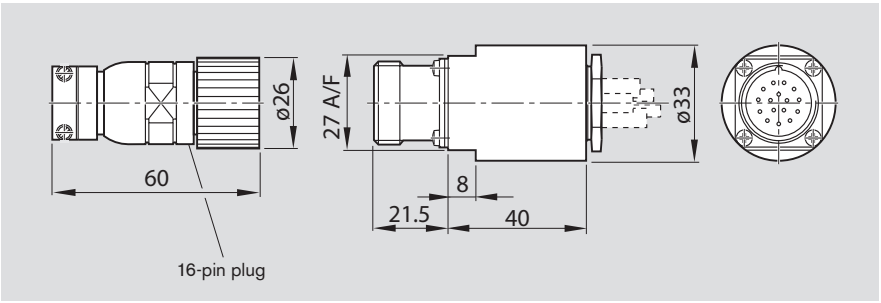


Induction-type proximity switch internal and external	
Miniature circuit-breakers with potted cable (3 x 0.14 mm² Unitronic),	
Housing form	= NO
Minisensor	= Form A DIN 41635
Voltage	= 10 to 30 V DC
Residual ripple	= 10 %
Load	= 200 mA
No-load current	= 20 mA
Switching frequency	= max. 1500 Hz
Temperature-related shift in make point	= ≤4 µm/°C
Output signal steepness	= ≥ 1V/µs
Repeatability of make point to EN 50008	= ≤0.1 mm



End-plate-mounted socket and plug for internal switches

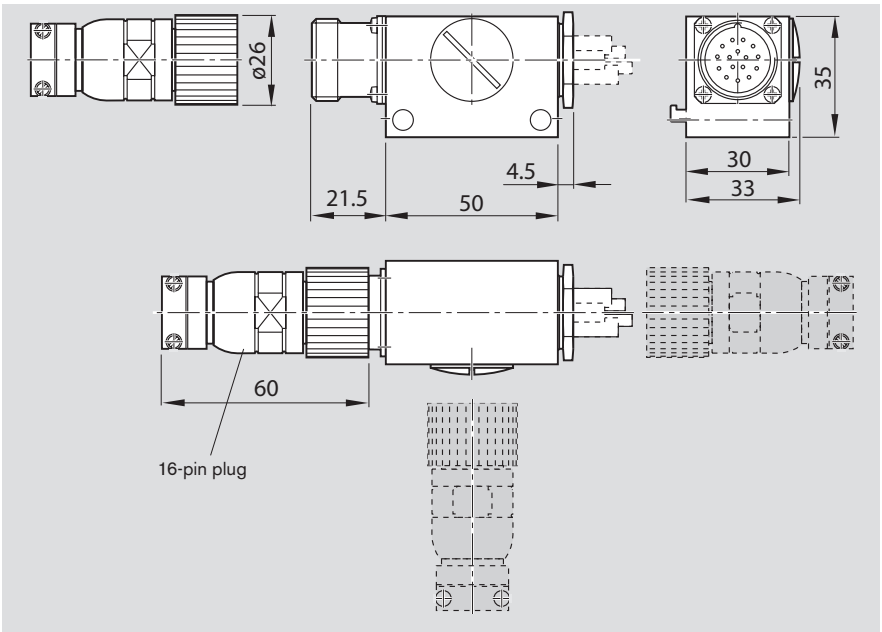
- Socket and plug each have 16 pins.
- Socket and switch are prewired.
- A plug is provided.



Externally mounted socket and plug for external switches

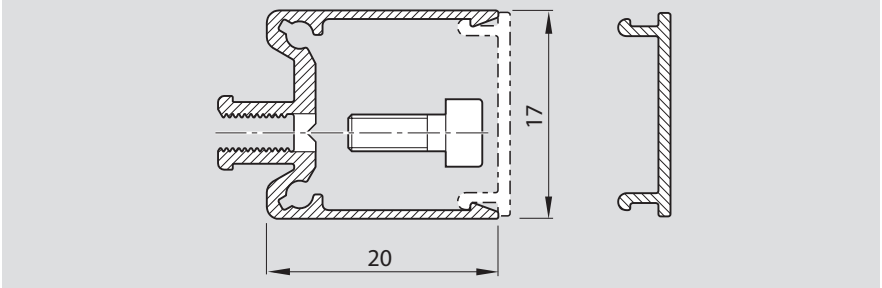
- Socket and plug each have 16 pins.
- Socket and switch are not prewired. The switch activation points can thus be optimized during start-up.
- A plug is provided.

The plug can be mounted in three directions (see diagram).



Cable duct

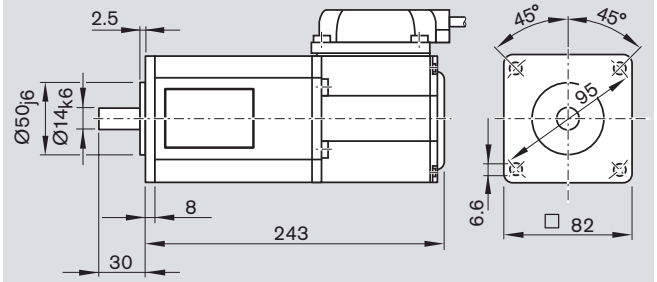
- The cable duct holds a maximum of two cables for mechanical switches and three cables for proximity switches.
- The duct is fixed by clipping to the T-slot on the table and is secured by tightening the fixing screws.
- The fixing screws and cable grommets are supplied with the duct.



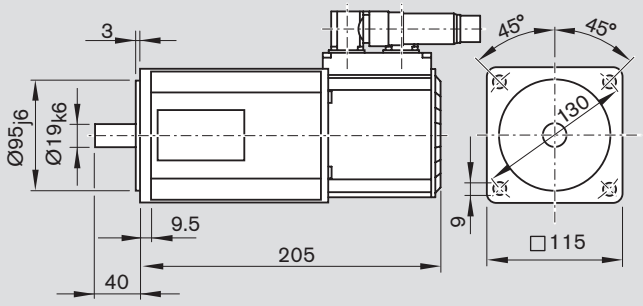
Motors

Dimensions of AC Servomotors

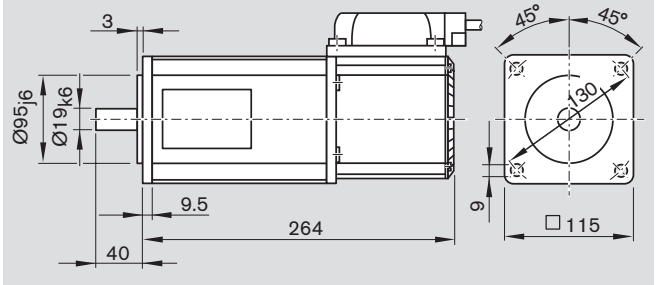
MKD 41B-144 KG1 Part number 8611-010-03



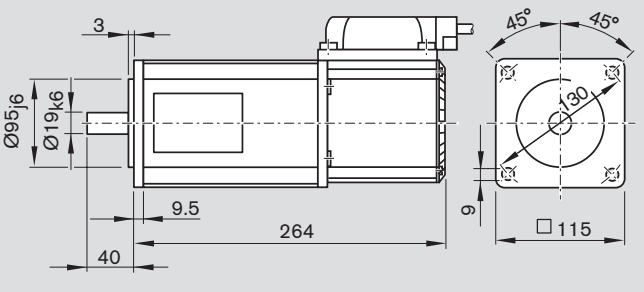
MHD 71A-061-NG1-UN Part number 8611-061-03



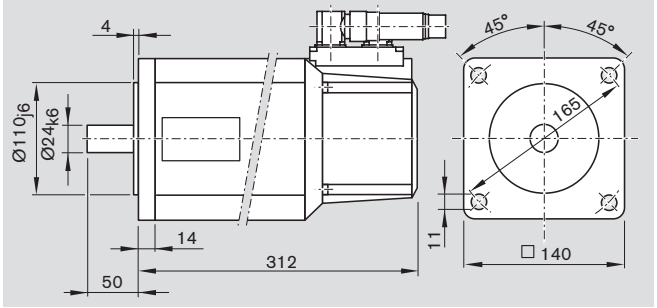
MHD 71B-061-NG1-UN Part number 8611-062-03



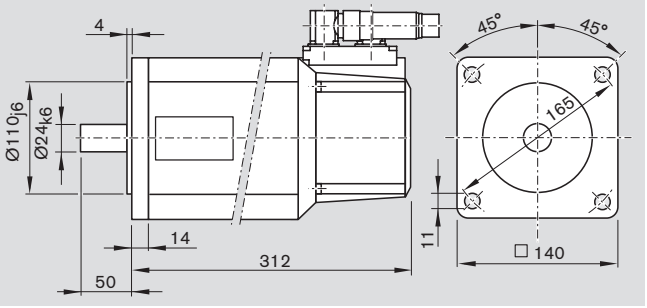
MKD 71B-N-061 KG1 Part number 8611-011-03



MHD 90B-047-NG1-UN Part number 8611-063-03



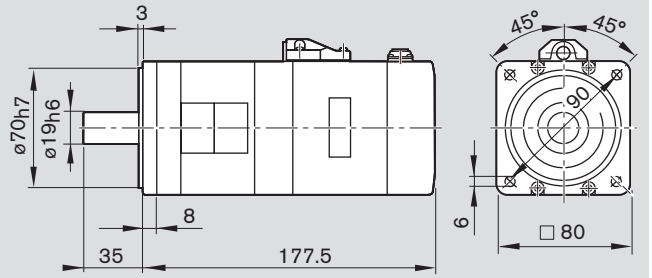
MKD 90B-047 KG1 Part number 8611-013-03



For the data of the AC servomotors, see “Motor Data” and catalog “Controllers, Motors, Electrical Accessories” RE 82 701.

Dimensions of MiniDrive

MMD 082A-030-EG1-CN Part number 8611-060-03



The motors can be supplied as complete units with control system. For further details on the motors and controllers, see catalog **RE 82 701.** Drawings to different scales.

Accessories

Documentation

Standard report

Option 01

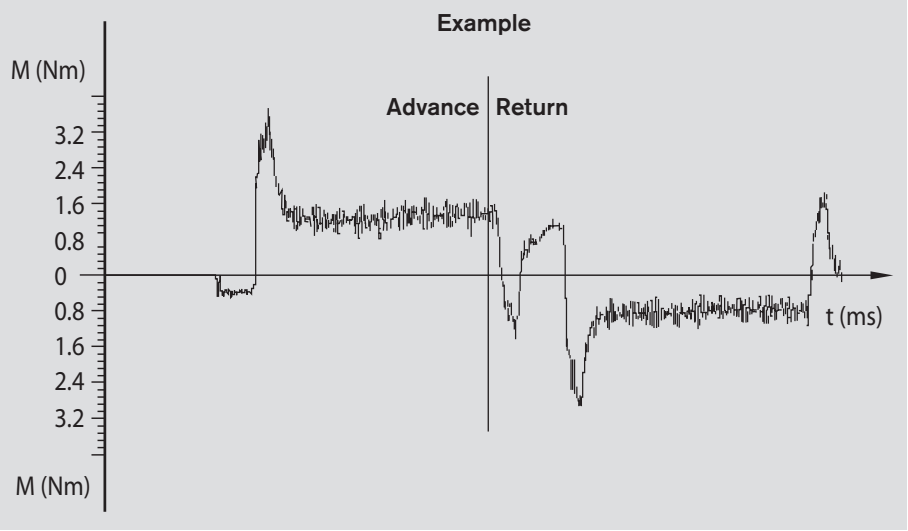
The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances.

Checks listed in the standard report:
- functional checks of mechanical components
- functional checks of electrical components
- design is in accordance with order confirmation

Moment of friction measurement of the complete system

Option 02

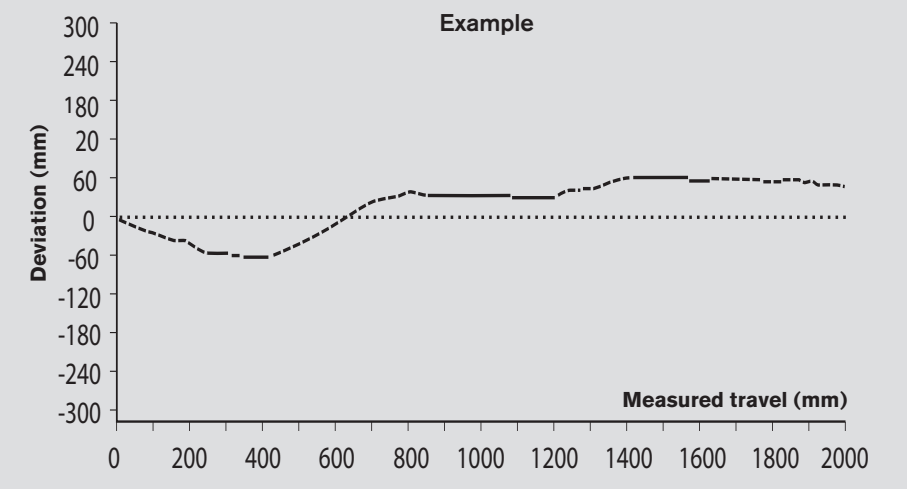
The moment of friction is measured over the entire travel range.



Lead deviation of ball screw

Option 03

In addition to the graph (see diagram), a measurement report in table form is provided.



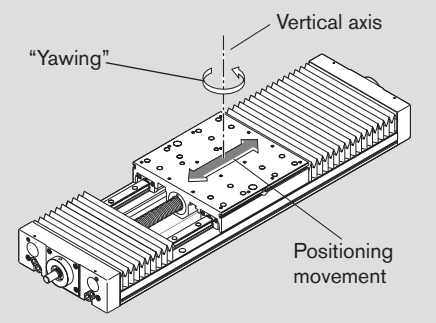
Sequence accuracy

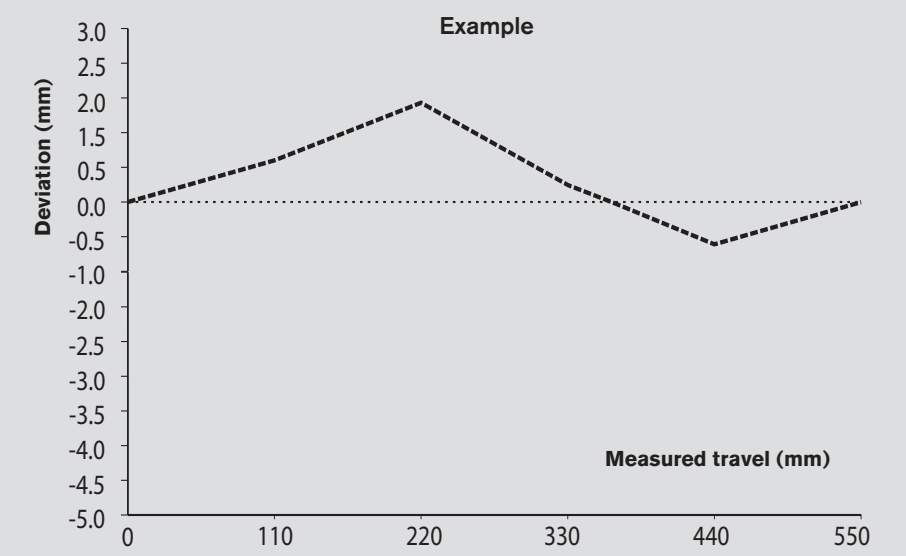
Option 04

Several measuring points are passed during the total travel.
The following deviations are permitted:

Yawing

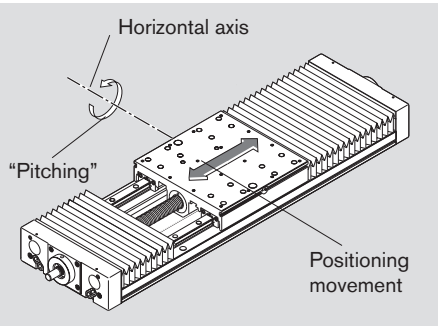
Yawing is angular deviation about the vertical axis. This angular deviation is converted to a linear deviation in mm on the basis of a standard length and is plotted on the graph.

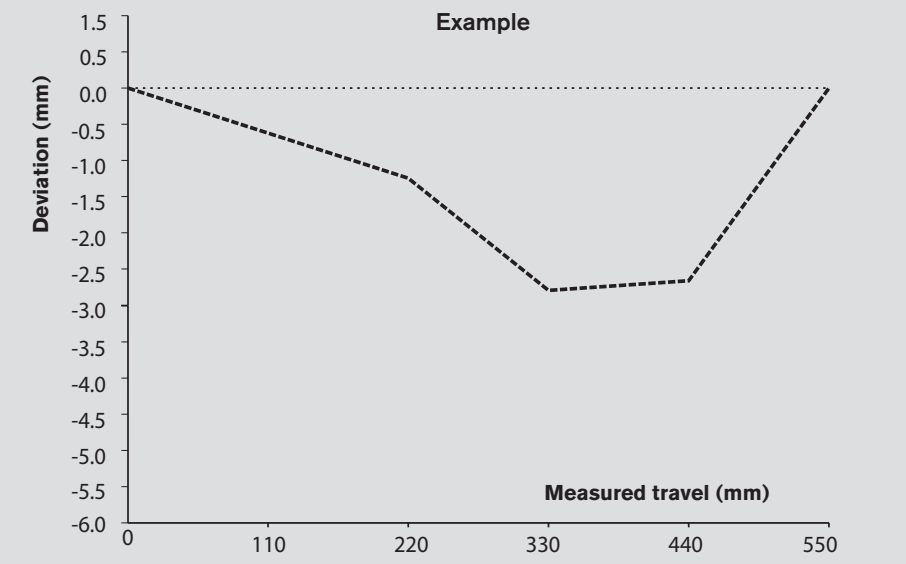




Pitching

Pitching means angular deviation about the horizontal axis. This angular deviation is converted into a linear deviation in mm on the basis of a standard length and is plotted on thgraph.





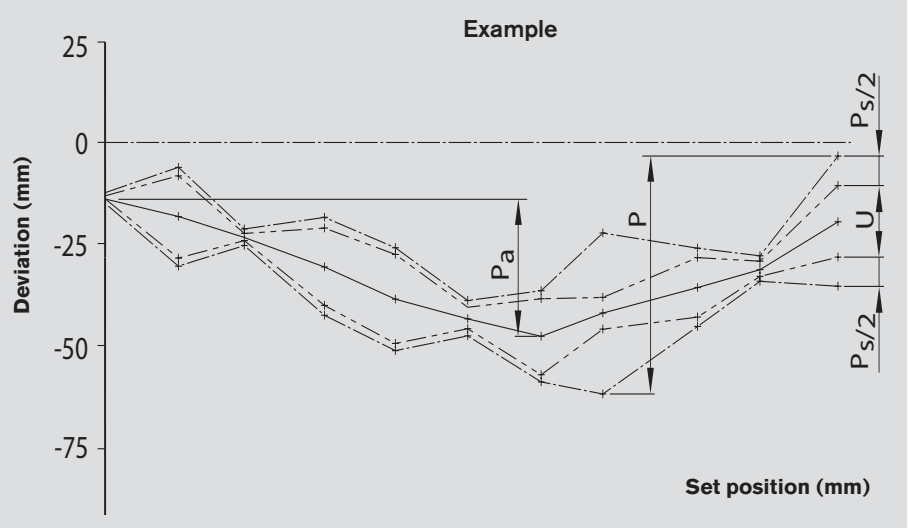
In addition to graphical representation (see illustrations), a measurement report is supplied in table form.

Accessories

Documentation

Positioning accuracy to VDI/DGQ 3441 Option 05

Measurement points are selected at irregular intervals along the travel. This enables even periodical deviations to be detected during positioning. Each measurement point is approached several times from both sides. This will give the following parameters.



Positioning accuracy P

The positioning accuracy corresponds to the total deviation. It encompasses all the systematic and random deviations during positioning.

The positioning accuracy takes the following characteristic values into consideration:

- positioning deviation
- reversal range
- position variation range

Positioning deviation P_a

The positioning deviation corresponds to the maximum difference arising in the mean values of all the measurement points. It describes systematic deviations.

Reversal range U

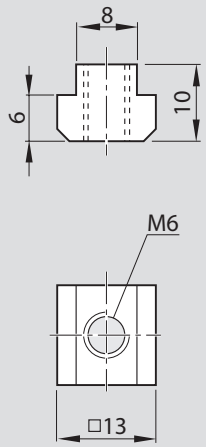
The reversal range corresponds to the difference in mean values of the two approach directions.The reversal range is determined at every measurement point. It describes systematic deviations.

Position variation range P_S

The position variation range describes the effects of random deviations. It is determined at every measurement point.

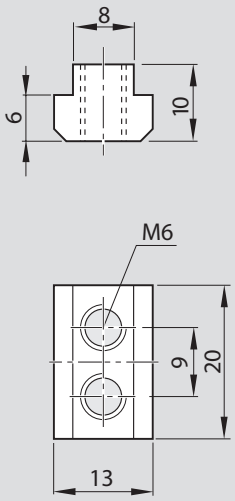
Mounting accessories

TKK 15-155 Al



Part number
8447-001-01

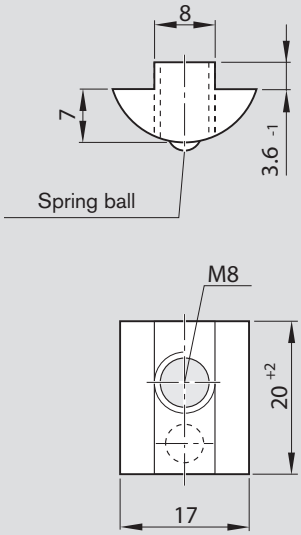
T-nut



Part number
0391-750-03

T-nut

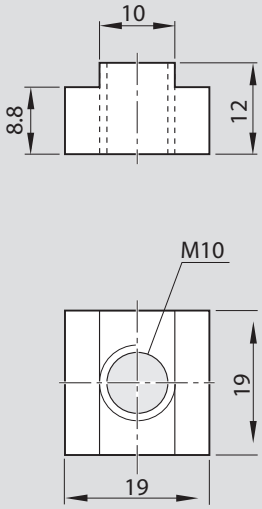
TKK 20-225 Al
TKK 30-325 Al



Part number
8447-010-02

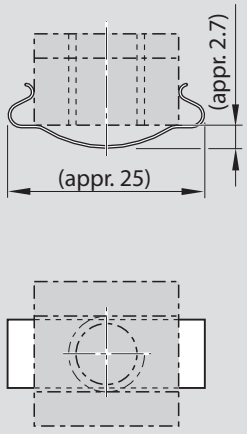
T-nut

TKK 35-455 Al



Part number
8447-006-01

T-nut

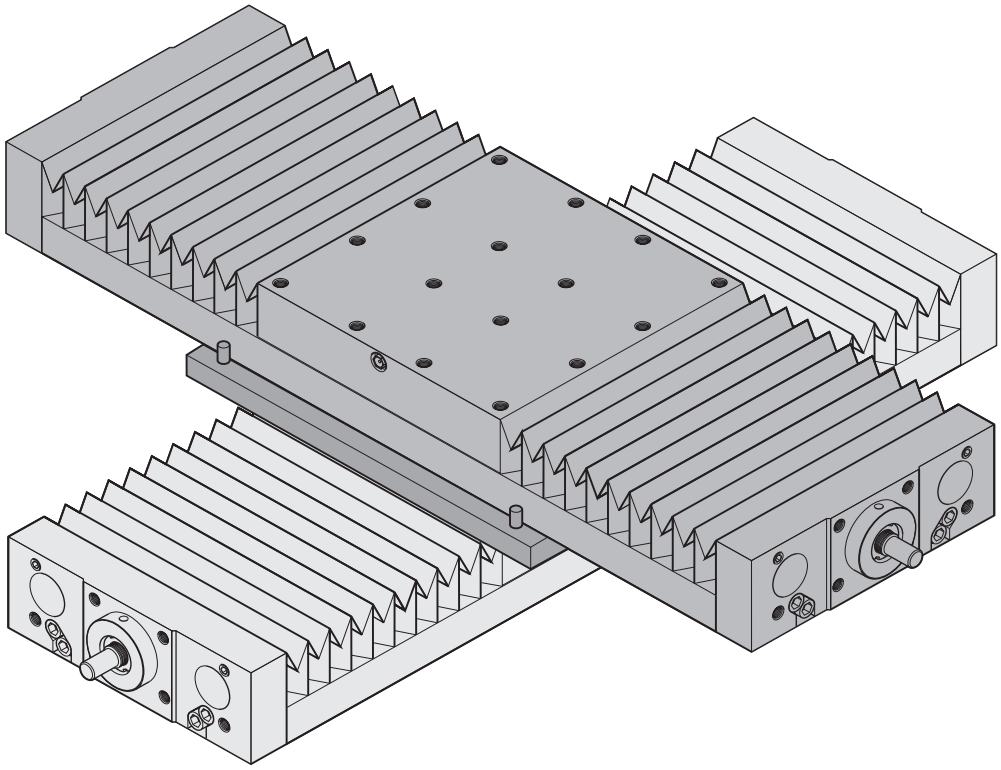


Part number
8454-030-49

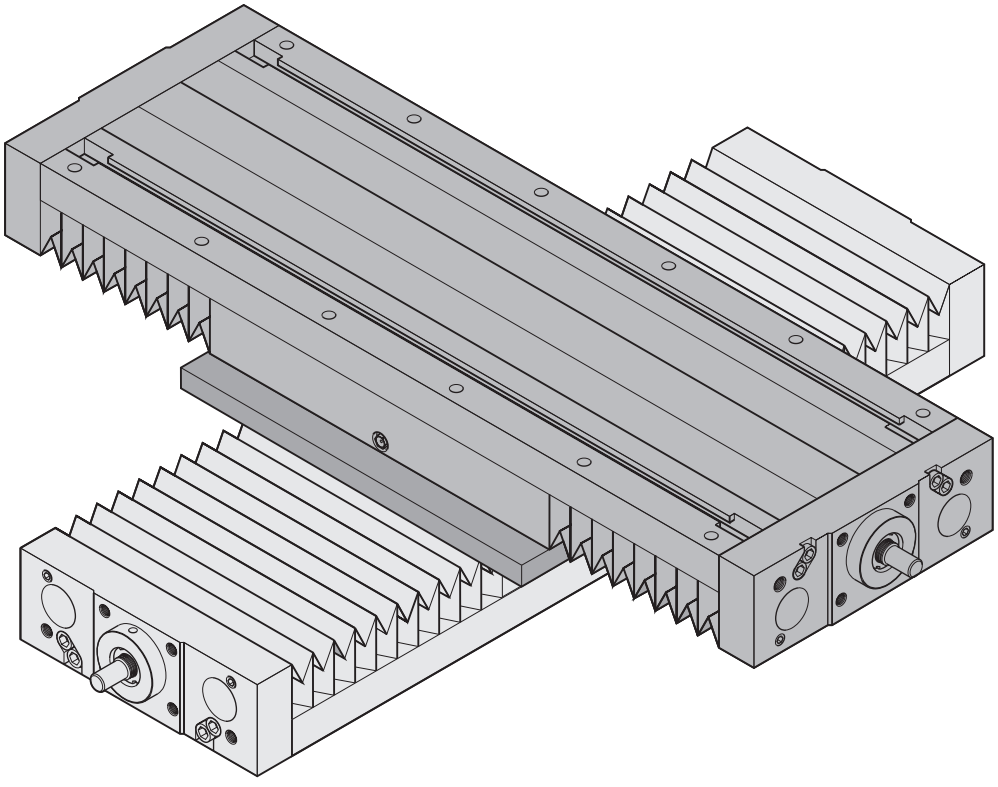
Fixing spring for
T-nut 8447-006-01

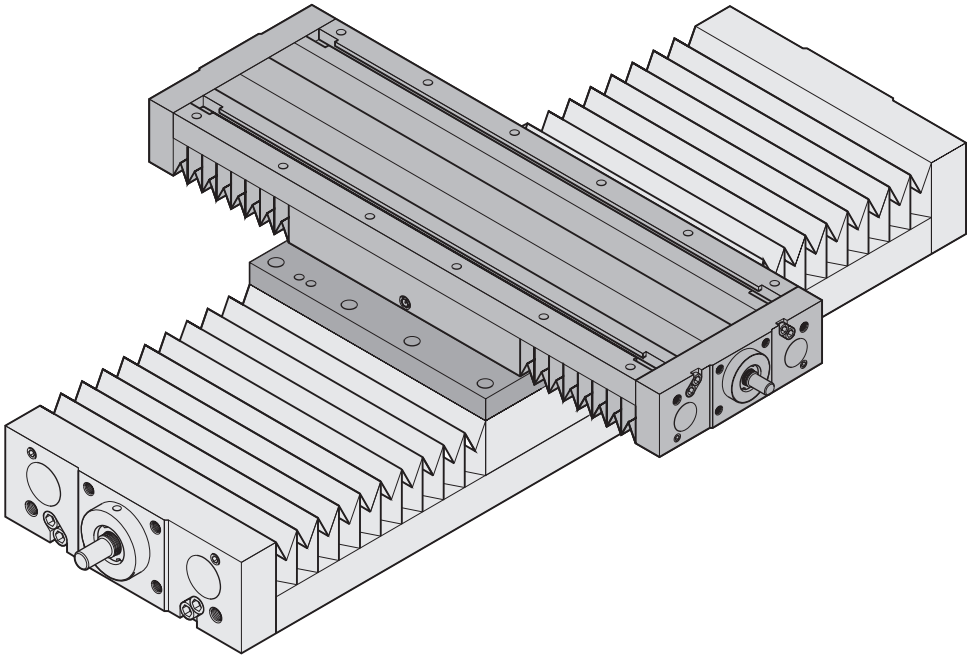
Connection System

Rexroth cross plates are used for simple construction of X-Y units. They are supplied as complete assemblies with all screws, pins and T-nuts necessary for joining the two axes together.

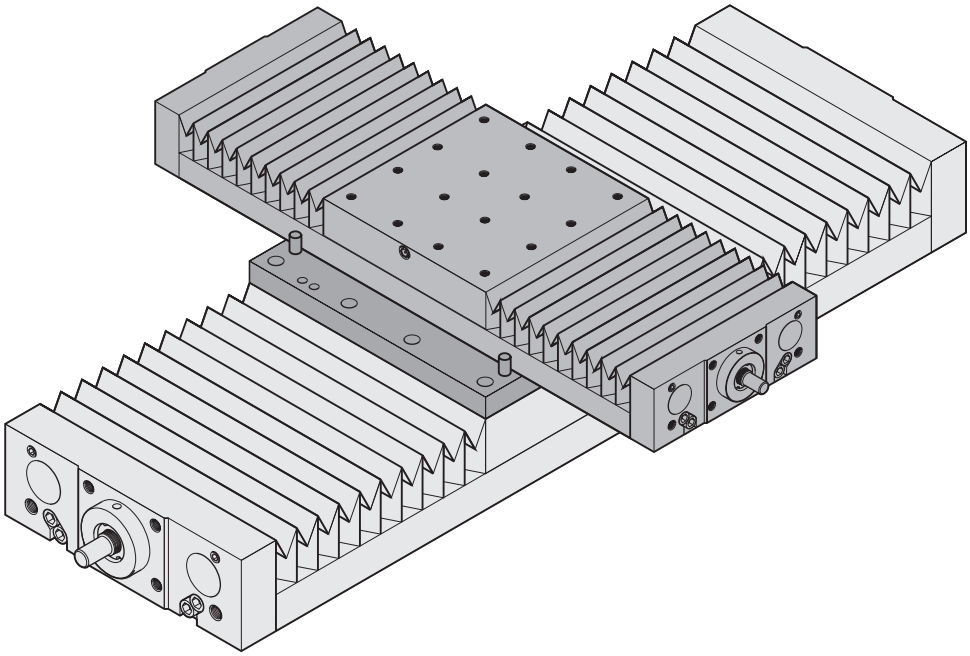


The connection system is designed so that ball rail tables of both identical ...





... and next largest or smallest sizes can be combined.



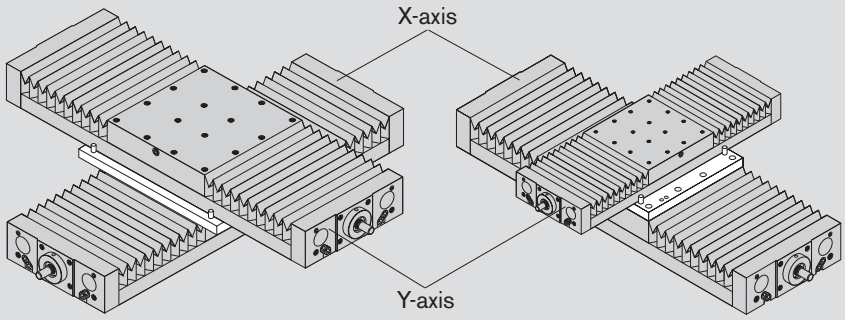
Connection System

General

In a two-axis unit, the accuracies of the individual axes and of the cross plate are added, together with the elastic deformation of the Y-axis (not fully supported). However, this deformation can be significantly reduced by the use of the high base plate.
The perpendicularities described in the graphs are calculated maximum values and describe the angular relation of the two axes to each other.

They are attained by simple joining and fixing together using existing or predrilled pin-holes, without requiring alignment. More precise perpendicularities can be produced by aligning the Y-axis and drilling the predrilled pin-holes in the cross plate.
The P4 accuracies of the individual axes must be added to the specified angularity.

Assemblies for connection of base plate to carriage

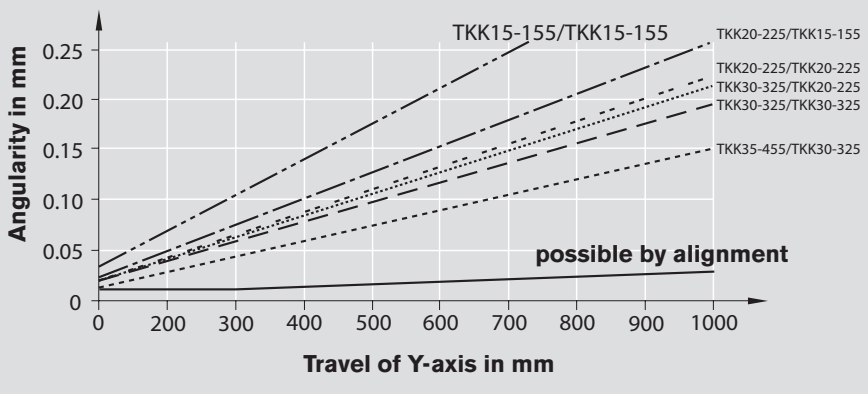


Part numbers of cross plate assemblies

Comprising: cross plate with all fixings required to join the two axes.

X-axis	Y-axis		
	TKK 15-155	TKK 20-225	TKK 30-325
TKK 15-155	0391-200-11		
TKK 20-225	0391-200-13	0391-200-15	
TKK 30-325		0391-200-17	0391-200-19
TKK 35-455			0391-200-21

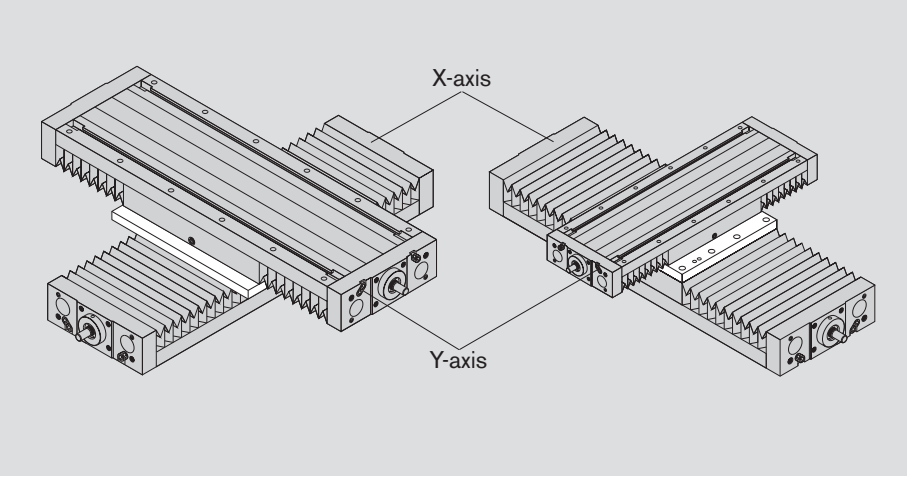
Perpendicularity of the two axes



Note

Fully assembled cross plates and combinations of steel ball rail tables available on request.
In the case of motor attachment via side drive with timing belt, the motor may project into the working area of adjacent axes. Check interference edges.

Assemblies for connection of carriage to carriage



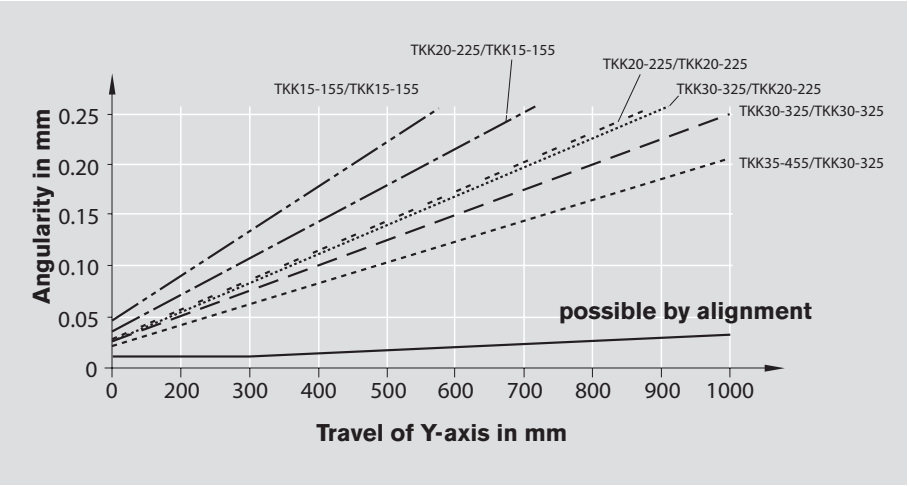
Part numbers of cross plate assemblies

Comprising: cross plate with all fixings required to join the two axes.

X-axis	Y-axis		
	TKK 15-155 with $L_T = 220$	**TKK 20-225** with $L_T = 320$	**TKK 30-325** with $L_T = 450$
TKK 15-155	0391-200-12		
TKK 20-225	0391-200-14	0391-200-16	
TKK 30-325		0391-200-18	0391-200-20
TKK 35-455			0391-200-22

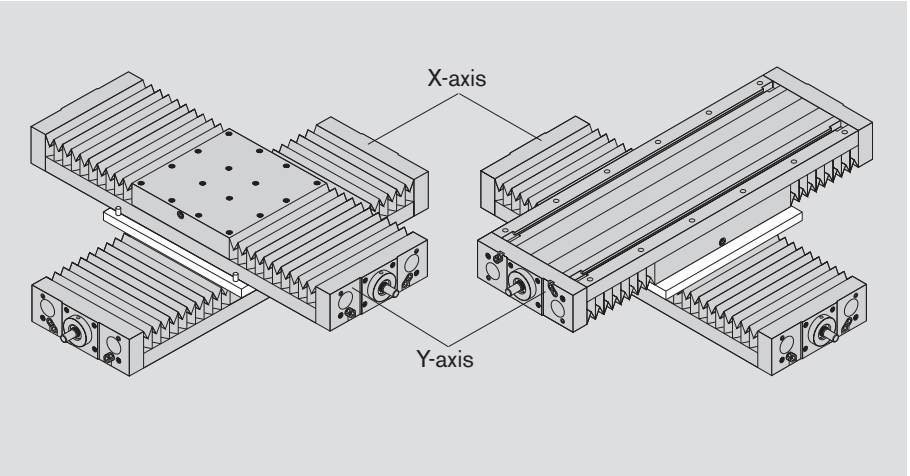
L_T = Carriage length

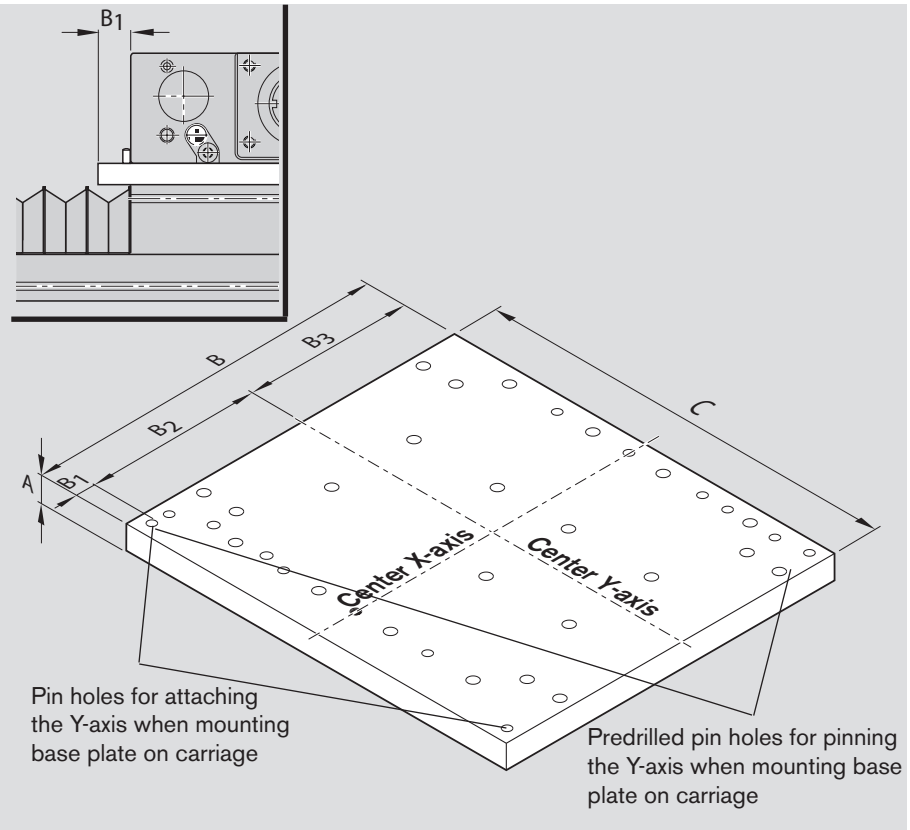
Perpendicularity of the two axes



Connection System

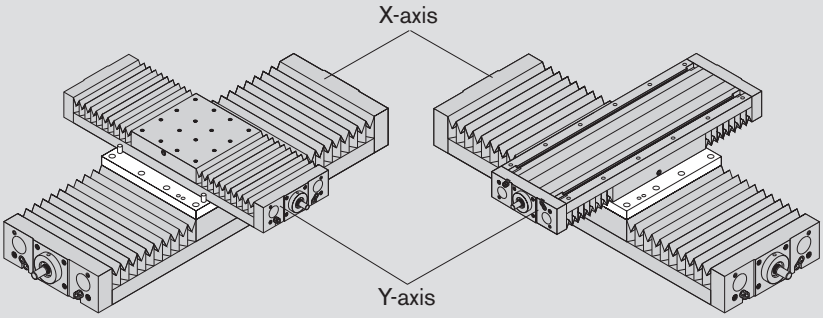
Dimensions of the cross plates when connecting ball rail tables of the same size

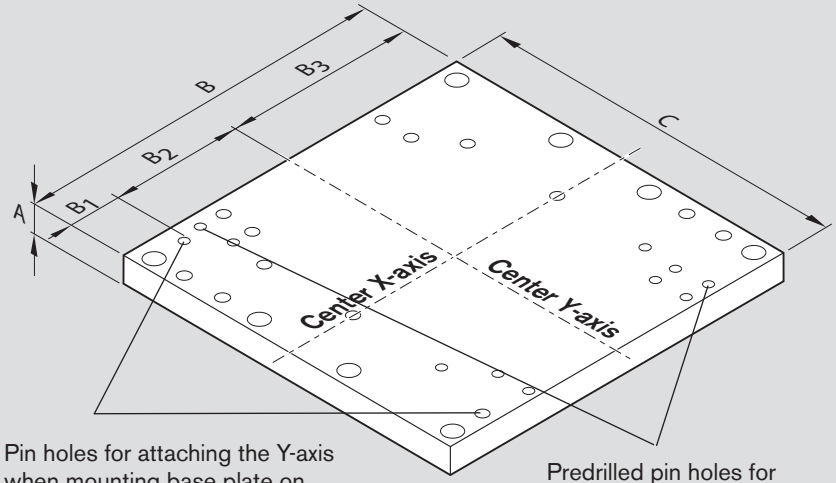




Part number of assembly	(mm) A	B	C	B_1	B_2	B_3
0391-200-11 0391-200-12	18	165	220	11	77.5	76.5
0391-200-15 0391-200-16	18	240	320	16	112.5	111.5
0391-200-19 0391-200-20	25	340	450	16	162.5	161.5

Dimensions of the cross plates when connecting ball rail tables of adjacent sizes





Pin holes for attaching the Y-axis when mounting base plate on carriage

Predrilled pin holes for pinning the Y-axis when mounting base plate on

Part number of assembly	(mm) A	B	C	B_1	B_2	B_3
0391-200-13 0391-200-14	18	220	220	32.5	77.5	110
0391-200-17 0391-200-18	18	320	320	47.5	112.5	160
0391-200-21 0391-200-22	25	400	450	37.5	162.5	200

Inquiry/Order Form

Bosch Rexroth Corporation
14001 South Lakes Drive
Charlotte, NC 28273

Telephone 800/438-5983
Telefax 704/583-4338

Bosch Rexroth – Ball Rail® Tables

Order example

TKK 20-225 St 1460-300-00, 1660 mm			ball rail table, length L = 1660 mm
Type	=	RV04	with side drive with timing belt, mounted as in diagram RV04
Guideway	=	01	base plate, flat
Drive unit	=	09	ball screw 20 x 20 (drive via floating bearing journal, dia 14)
Carriage	=	01	one carriage 220 mm long, preload 2 %
Motor attachment	=	39	with side drive with timing belt with MHD 71A, i = 2
Motor	=	61	with motor MHD 71A
Cover	=	01	polyurethane bellows
Position measuring system	=	00	without glass scale
1st switch	=	15-A + 500 mm	mechanical switch, external, switch activation point + 500 mm
2nd switch	=	11-A ± 0 mm	PNP NC, external, switch activation point ± 0 mm
3rd switch	=	15-A – 500 mm	mechanical switch, external, switch activation point – 500 mm
Cable duct	=	20-X 1500 mm	cable duct 1500 mm long (loose)
Socket-plug	=	17	external socket-plug for switches (loose)
Switching cam	=	26	with external switching cam (for switch activation)
Documentation	=	01	with standard report

To be completed by customer: Inquiry ☐ / Order ☐

TKK ..... _____ - _____ - _____ , Length _____ mm

Type ..... ☐☐☐☐

Guideway ..... ☐☐

Drive unit ..... ☐☐

Carriage ..... ☐☐

Motor attachment ..... ☐☐

Motor ..... ☐☐

Cover ..... ☐☐

Position measuring system ..... ☐☐

1st switch ..... ☐☐ - ☐ ○ ☐☐☐☐ mm

2nd switch ..... ☐☐ - ☐ ○ ☐☐☐☐ mm

3rd switch ..... ☐☐ - ☐ ○ ☐☐☐☐ mm

Cable duct ..... ☐☐ - ☐ ☐☐☐☐ mm

Socket-plug ..... ☐☐

Switching cam ..... ☐☐

Documentation ..... ☐☐

Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

Quantity: _____ pcs, _____ per month, _____ per year, per order, or _____

Comments:

From: ***OEM*** ***User*** ***Distributor***

Company: _____ **Contact:** _____

Address: _____ **Department:** _____

_____ **Phone:** _____ **Fax:** _____

Notes

Notes

The Drive & Control Company

Rexroth
Bosch Group

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Linear Motion and
Assembly Technologies
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