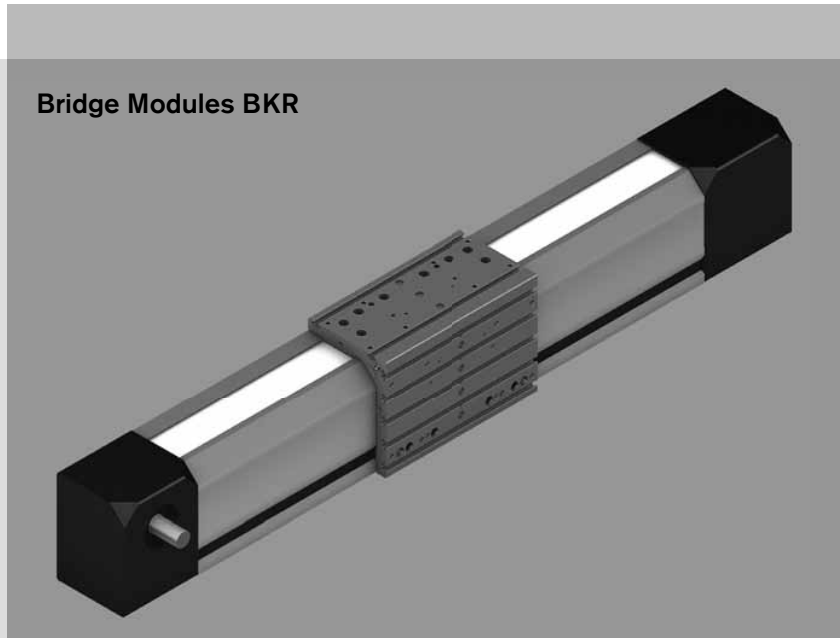


Bridge Modules with Toothed Belt Drive BKR

Product Overview

Bridge Modules are ready-to-install precision linear motion systems for high-performance applications. They can be supplied in any desired length. Excellent price/performance ratio and fast delivery.

Bridge Modules BKR



Structural design

- Highly rigid precision-extruded aluminum profile with two integrated Ball Rail Systems
- Idler (non-driven) end enclosure with integrated belt-tensioning system
- Torsionally stiff angled aluminum carriage with T-slots and threaded holes offering multiple mounting possibilities
- Driven by a pre-tensioned, steel reinforced toothed belt

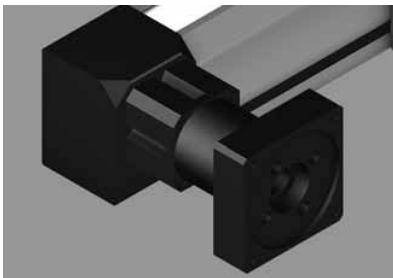
Attachments

- Maintenance-free digital AC servo drives with integrated brake and feedback
- Gear reducer type LP
- Switches
- Socket with mating plug for switches
- Cable duct made of profiled aluminum

Other distinguishing features

- Optimal travel performance, high load capacities and high rigidity due to two zero-clearance Ball Rail Systems arranged at a 90° angle to each other
- High travel speeds combined with high precision and smooth running over long travel ranges
- Polyurethane seals and guides for the toothed belt in the aluminum profile
- Internal components protected by two polyurethane sealing strips
- Precise alignment and secure mounting (positive-locking) of attachments thanks to camoLINE technology in the carriage
- Adjustable switches over the entire travel range.
- Easy motor attachment via locating feature and fastening threads
- Low-cost maintenance provided by one-point lubrication (grease) of the ball rail systems from either side
- Pulley ball bearings are lubricated for life

BKR 15-115 in preparation



Gear reducer

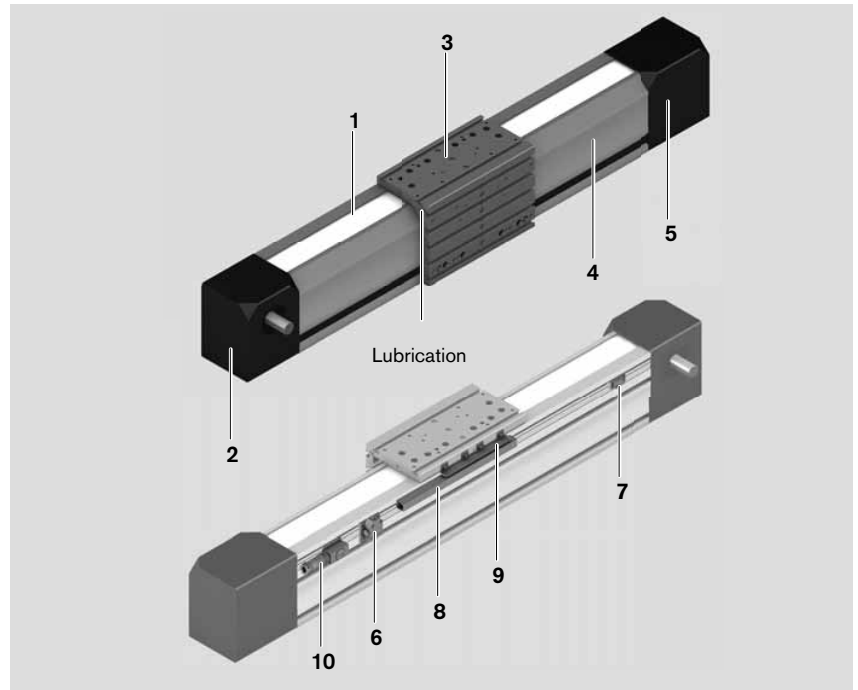
Different gear ratios allow optimum matching of the external load and the motor's inertia.

Structural Design

- 1 Toothed belt
- 2 Drive end enclosure
- 3 Carriage
- 4 Aluminum extrusion
- 5 Idler (non-driven) end enclosure

Attachments:

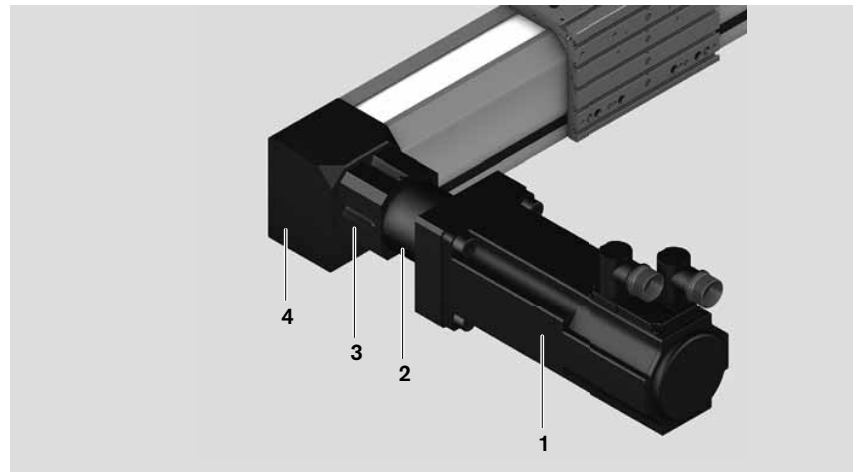
- 6 Mechanical switch
- 7 Proximity switch
- 8 Cable duct
- 9 Switching cam
- 10 Socket/plug



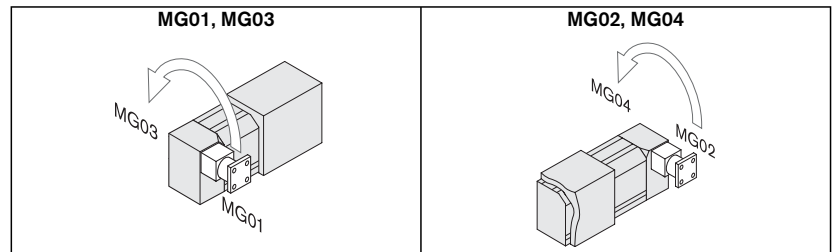
Structural design of the gear reducer

For all BKR Bridge Modules, a planetary gearbox can be installed via a flange. The flange serves as a mounting point for the gearbox to the Bridge Module. This direct connection eliminates the need for a coupling, thereby minimizing torsional deflection. Different gear ratios are available:
 $i = 3, 5, 10$

- 1 Servo motor
- 2 Gear reducer
- 3 Flange
- 4 Drive end enclosure



Direct motor attachment with gear reducer



Bridge Modules with Toothed Belt Drive BKR

Technical Data

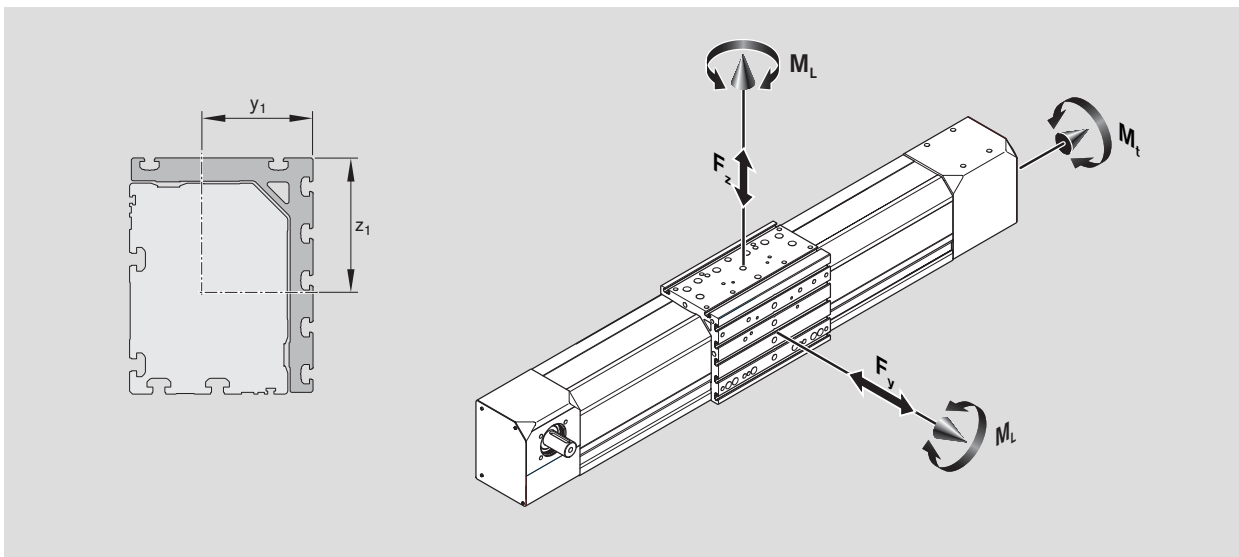
Load capacities and moments

Size	Belt type	Dynamic load capacity C Guideway (N)	Dynamic load moments (Nm)		Planar moment of inertia (cm ⁴)		Maximum length L _{max} (mm)	Moved mass of system m _{ac} (kg)	Specific spring constant c _{spec} (N/mm · m)	Dimensions (mm)	
			Torsional load moment M _t	Longitudinal load moment M _L	I _y	I _z				y ₁	z ₁
BKR 15-115	AT 10	21900	850	1260	1050	760	5800	4.75	2.12 · 10 ⁶	88.1	104.2
BKR 20-135	AT 10	56200	2960	4130	1960	1380	5800	7.48	2.97 · 10 ⁶	99.0	125.6

Toothed belt stretch $\Delta_L = (F \cdot L) / c_{spec}$

Maximum permissible loads

Size	Maximum permissible forces (N)		Maximum permissible moments (Nm)	
	F _{y max}	F _{z max}	M _{t max}	M _{L max}
BKR 15-115	15700	15700	610	770
BKR 20-135	26100	26100	1370	1690



Note on dynamic load capacities and moments

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

Acceptable loads (recommended from experience)

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

At the same time, the following may not be exceeded:

- maximum permissible loads,
- permissible drive torque,
- permissible travel speed.

The nominal life and the combined equivalent load on the bearing must be checked.

Modulus of elasticity E

= 70,000 N/mm²

Mass of the linear motion system m_s

Calculation without motor and switches

Weight factor (kg/mm) · length L (mm) + weight of all parts of fixed length (carriage, drive end, idler end, etc. (kg) + additional mass (kg))

Size		Weight (kg)	Additional mass of gear reducer	
$i = 1$	BKR 15-115	$0.01962 \cdot L + 13.26$	–	–
$i = 1$	BKR 20-135	$0.02771 \cdot L + 21.58$	–	–
$i = 3, 5, 10$	BKR 15-115	$0.01962 \cdot L + 13.26$	LP90	4.0
$i = 3, 5, 10$	BKR 20-135	$0.02771 \cdot L + 23.99$	LP120	8.6

Accuracy

The accuracy of the extrusion profile used for the frame is 1.0 mm per meter.

Length

Size	Length of Bridge Module (mm)
BKR 15-115	$L = \text{stroke (mm)} + 2 \cdot \text{excess travel (mm)} + 300 \text{ (mm)}$
BKR 20-135	$L = \text{stroke (mm)} + 2 \cdot \text{excess travel (mm)} + 340 \text{ (mm)}$

Drive data

Size	Drive type	Gear reducer ratio i	Maximum perm. drive torque M_{mech} (Nm)	Lead constant u (mm/rev)	Belt type	Width b (mm)	Tooth pitch T (mm)	Max. belt drive transmission force F (N)	Belt elasticity limit F_{perm} (N)
BKR 15-115	$i=1$	1	75	260.0	AT 10	50	10	1740	7500
	Gear reducer LP90	3	25	86.6					
		5	15	52.0					
		10	7.5	26.0					
BKR 20-135	$i=1$	1	150.6	340.0	AT 10	70	10	2783	11900
	Gear reducer LP120	3	50.2	113.3					
		5	30.1	68.0					
		10	15.0	34.0					

Drive data without motor ($i = 1$)

Size	Drive unit diameter (mm)	Lead constant u (mm/rev)	Travel speed v_{mech} (m/s)	Belt type	Reduced mass moment of inertia J_s (kgm ²)
BKR 15-115	82.76	260.0	up to 5	AT 10, width 50	$(170.4 + L \text{ (mm)}) \cdot 0.009931 \cdot 10^{-4} \text{ (kgm}^2\text{)}$
BKR 20-135	108.23	340.0	up to 5	AT 10, width 70	$(416.9 + L \text{ (mm)}) \cdot 0.02384 \cdot 10^{-4} \text{ (kgm}^2\text{)}$

Frictional torque

Size	Motor	Gear reducer type	Gear ratio i	Frictional torque of system M_{RS} (Nm)	Frictional torque of gear reducer M_{Rge} (Nm)
BKR 15-115	MSK 076C-450	Gear reducer LP90	3, 5, 10	4.12	0.38
	MSK 060C-600	Gear reducer LP90		4.12	0.38
BKR 20-135	MSK 076C-450	Gear reducer LP120		5.31	0.80

Bridge Modules with Toothed Belt Drive BKR

Technical Data

BKR 15-115

Performance data of gear reducer LP90

Performance values for horizontal operation with servo motor MSK 060C-600 and IndraDrive controller¹⁾

Connection voltage: 3 x 400 V

Gear reducer ratio	i = 3					i = 5					i = 10				
	Mass (kg)	2	4	6	8	10	5	10	15	20	25	20	40	60	80
Acceleration time t (ms)	78	86	94	102	109	123	142	161	179	198	188	228	268	309	349
Acceleration distance s (mm)	196	215	235	254	273	308	355	402	448	495	244	297	349	401	453
Acceleration a (m/s ²)	63.7	58.0	53.3	49.2	45.8	40.6	35.2	31.1	27.9	25.3	40.6	35.2	31.1	27.9	25.3
Travel speed v _{mech} (m/s)	5.00					5.00					2.60				
Repeatability ± (mm)	0.1														

Performance data of gear reducer LP90

Performance values for horizontal operation with servo motor MSK 076C-0450 and IndraDrive controller¹⁾

Connection voltage: 3 x 400 V

Gear reducer ratio	i = 3					i = 5					i = 10				
	Mass (kg)	3	6	9	12	15	15	30	45	60	75	40	80	120	160
Acceleration time t (ms)	152	163	175	186	197	221	251	288	322	355	389	436	482	528	572
Acceleration distance s (mm)	381	409	436	464	492	331	382	432	482	533	292	327	361	396	431
Acceleration a (m/s ²)	32.8	30.6	28.7	26.9	25.4	13.6	11.8	10.4	9.3	8.4	3.9	3.4	3.1	2.8	2.6
Travel speed v _{mech} (m/s)	5.00					3.00					1.50				
Repeatability ± (mm)	0.1														

BKR 20-135

Performance data of gear reducer LP120

Performance values for horizontal operation with servo motor MSK 076C-0450 and IndraDrive controller¹⁾

Connection voltage: 3 x 400 V

Gear reducer ratio	i = 3					i = 5					i = 10				
	Mass (kg)	6	14	22	30	38	10	30	50	90	130	100	150	200	250
Acceleration time t (ms)	112	134	156	179	201	111	141	172	373	471	22.4	26.	301	339	377
Acceleration distance s (mm)	280	335	391	446	499	177	226	275	233	294	17.9	210	240	271	301
Acceleration a (m/s ²)	44.7	37.3	32.0	28.0	24.9	28.9	22.7	18.6	13.7	10.9	7.1	6.1	5.3	4.7	4.2
Travel speed v _{mech} (m/s)	5.0					3.2					1.6				
Repeatability ± (mm)	0.1														

1) For additional information, refer to the catalogs "Controllers, Motors, Electrical Accessories, Servo motors" and "DSC, ECODRIVE Cs".

The tables contain performance data examples for different gearbox-motor-controller combinations. They are intended to serve as a guide for selection; exact values must be calculated based on individual cases.

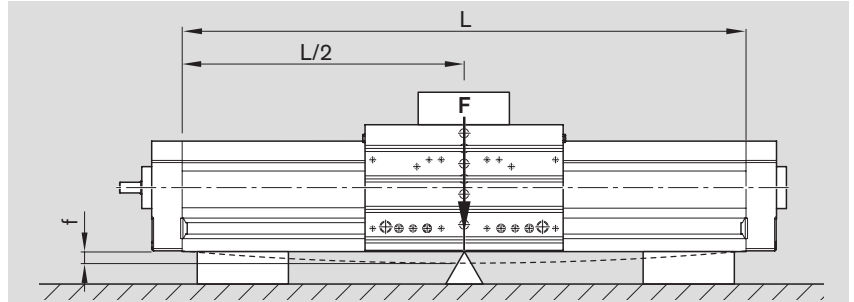
Please check whether the selected combination is a permissible one (load capacities, moments, maximum speeds, motor data, etc.)!

Deflection

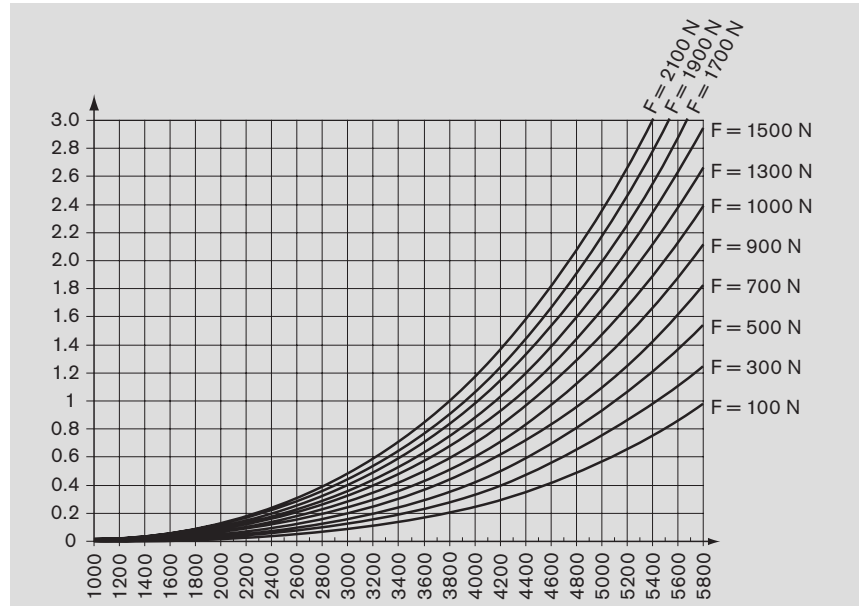
A particular feature of Bridge Modules is that they can be installed as cantilevered axes.

Deflection must, however, be taken into consideration, because it limits the possible load.

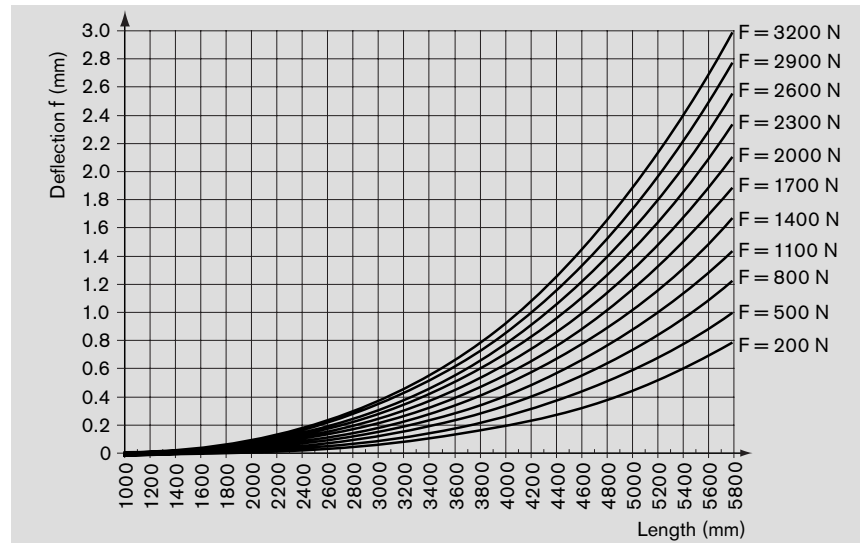
If high system dynamics are required, supports must be provided every 300 to 600 mm.



BKR 15-115



BKR 20-135



Bridge Modules with Toothed Belt Drive BKR

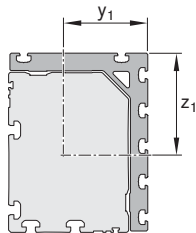
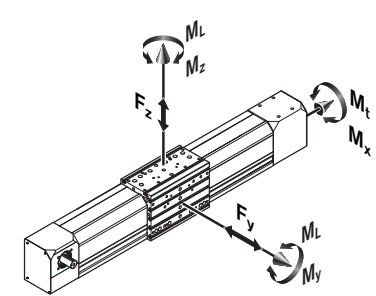
Calculations

Calculation principles

Combined equivalent load on bearing of the linear guide

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

BKR size	Dimensions (mm)	
	y ₁	z ₁
15-115	88.1	104.2
20-135	99.0	125.6

- C = dynamic load capacity (N)
- F_{comb} = combined equivalent load on bearing (N)
- F_y = force in y-direction (N)
- F_z = force in z-direction (N)
- i = gear ratio
- L = nominal life in meters (m)
- L_h = nominal life in hours (h)
- M_L = dynamic longitudinal moment load capacity (Nm)
- M_R = frictional torque at motor journal (Nm)
- M_{RS} = frictional torque of the system (Nm)
- M_{Rge} = frictional torque of gear reducer (Nm)
- M_t = dynamic torsional moment load capacity (Nm)
- M_x = torsional moment (about the x-axis) (Nm)
- M_y = torsional moment (about the y-axis) (Nm)
- M_z = torsional moment (about the z-axis) (Nm)
- v_m = average speed (m/s)
- y₁, z₁ = application point of the effective force (mm)

Nominal life

Nominal life of the guideway in meters:

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

Nominal life of the guideway in hours:

$$L_h = \frac{L}{3600 \cdot v_m}$$

Frictional torque

for motor attachment via motor mount and coupling:

$$M_R = M_{RS}$$

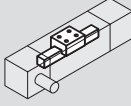
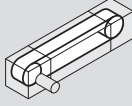
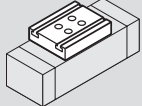
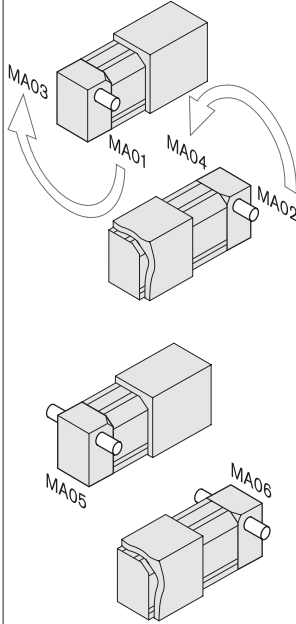
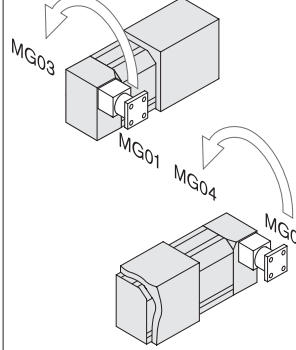
for motor attachment via gear reducer:

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

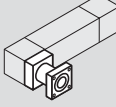
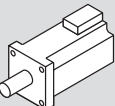
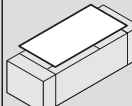
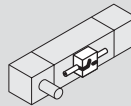
Notes

Bridge Modules with Toothed Belt Drive BKR

BKR 15-115 Components and Ordering Data

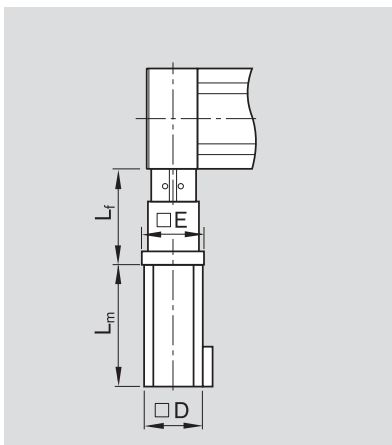
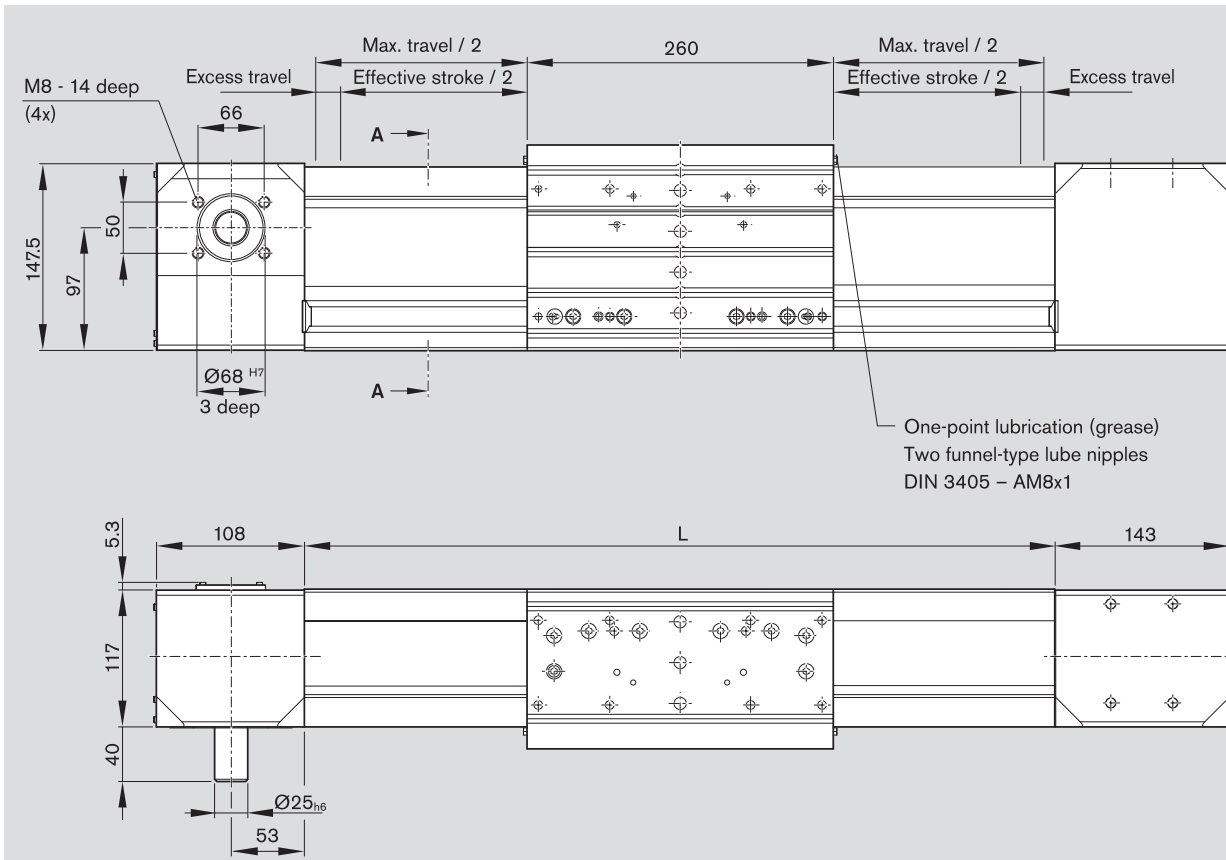
Part number, length R0324 400 00, ... mm	Type	Guideway 	Drive unit 		Carriage 	
			Shaft without keyway i = 1	Gear reducer i = 5, 10	One carriage	
with drive 	MA01	01	01		01	
	MA02		02			
	MA03		03			
	MA04					
	MA05					
	MA06					
with gear reducer LP90 	MG01 MG02	01		10	01	
	MG03 MG04			11		

1) Attachment kit also available without motor (when ordering: enter "00" for motor)

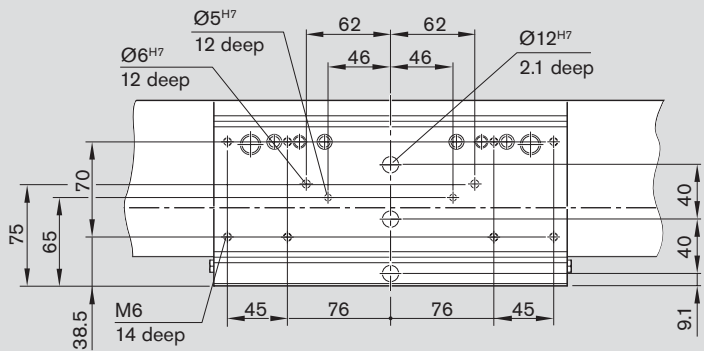
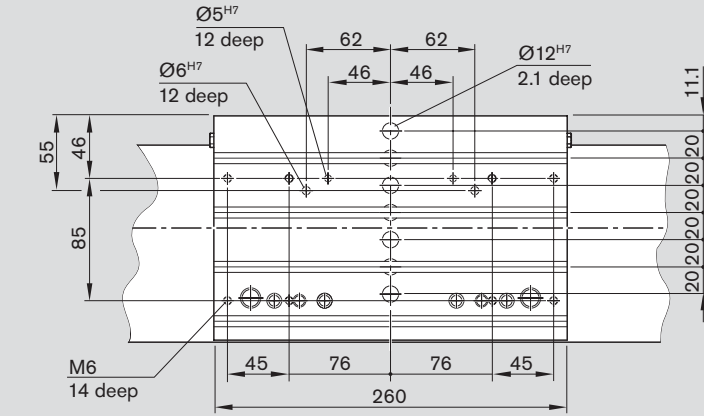
	Motor attachment ¹⁾			Motor		Cover		Switches Switching cam, socket, plug, cable duct			Documentation			
	 Gear reducer i = 3 i = 5 i = 10			 Motor type without brake with brake		 Gap seal made of PU tape w/o with					Standard report	Measure- ment report		
				without	00			Without switch Without cable duct 00						
						01	02	Proximity/mechanical switches					02 Frictional torque	
								PNP NC	11	One switching cam 16 Two switching cams 26	Socket/ plug 17	01		
								PNP NO	13					
								Mechanical switch	15					
								Cable duct Length = L 20					05 Positioning accuracy	
	40	41	42	MSK 060C	90	91								
	20	21	22	MSK 076C	92	93								
	40	41	42	MSK 060C	90	91								
	20	21	22	MSK 076C	92	93								

Bridge Modules with Toothed Belt Drive BKR

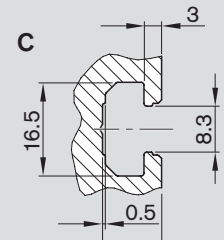
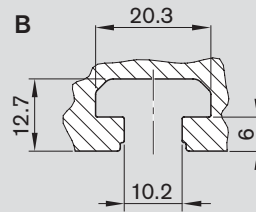
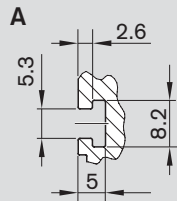
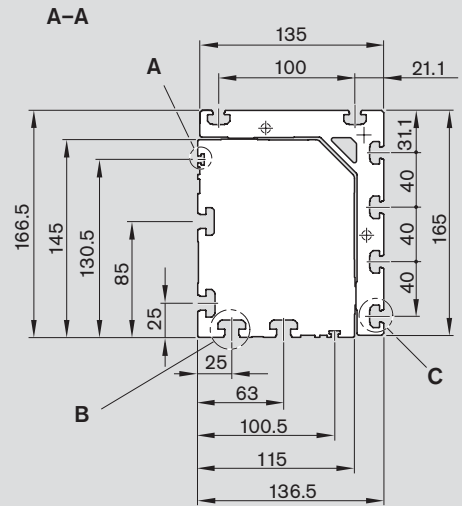
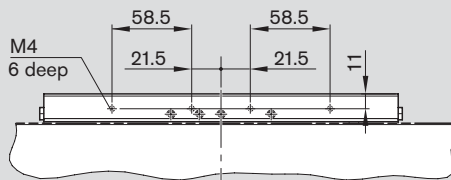
BKR 15-115 Components and Ordering Data



Motor	Gear reducer	Dimensions (mm)				
		D	E	L_r	without brake	with brake
MSK 060C	LP90	116	120	157	226.0	259.0
MSK 076C		140	140		292.5	292.5

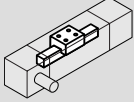
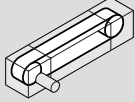
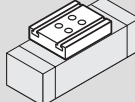
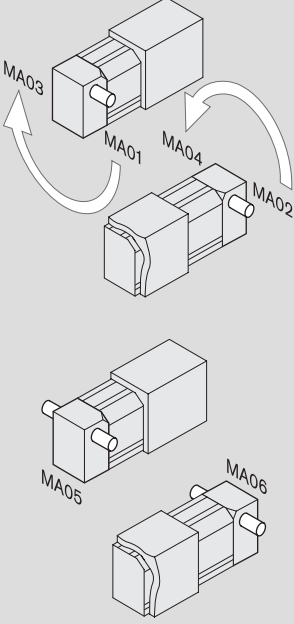
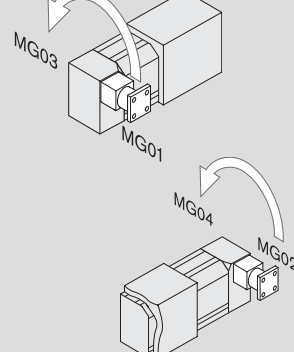


Mounting hole pattern for switching cam



Bridge Modules with Toothed Belt Drive BKR

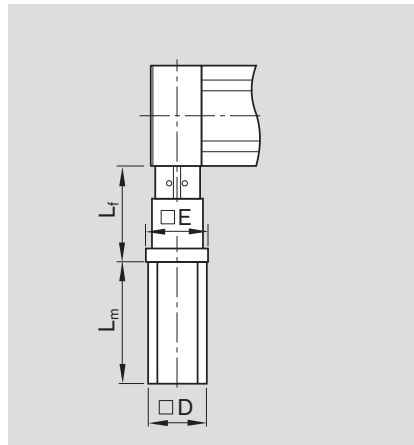
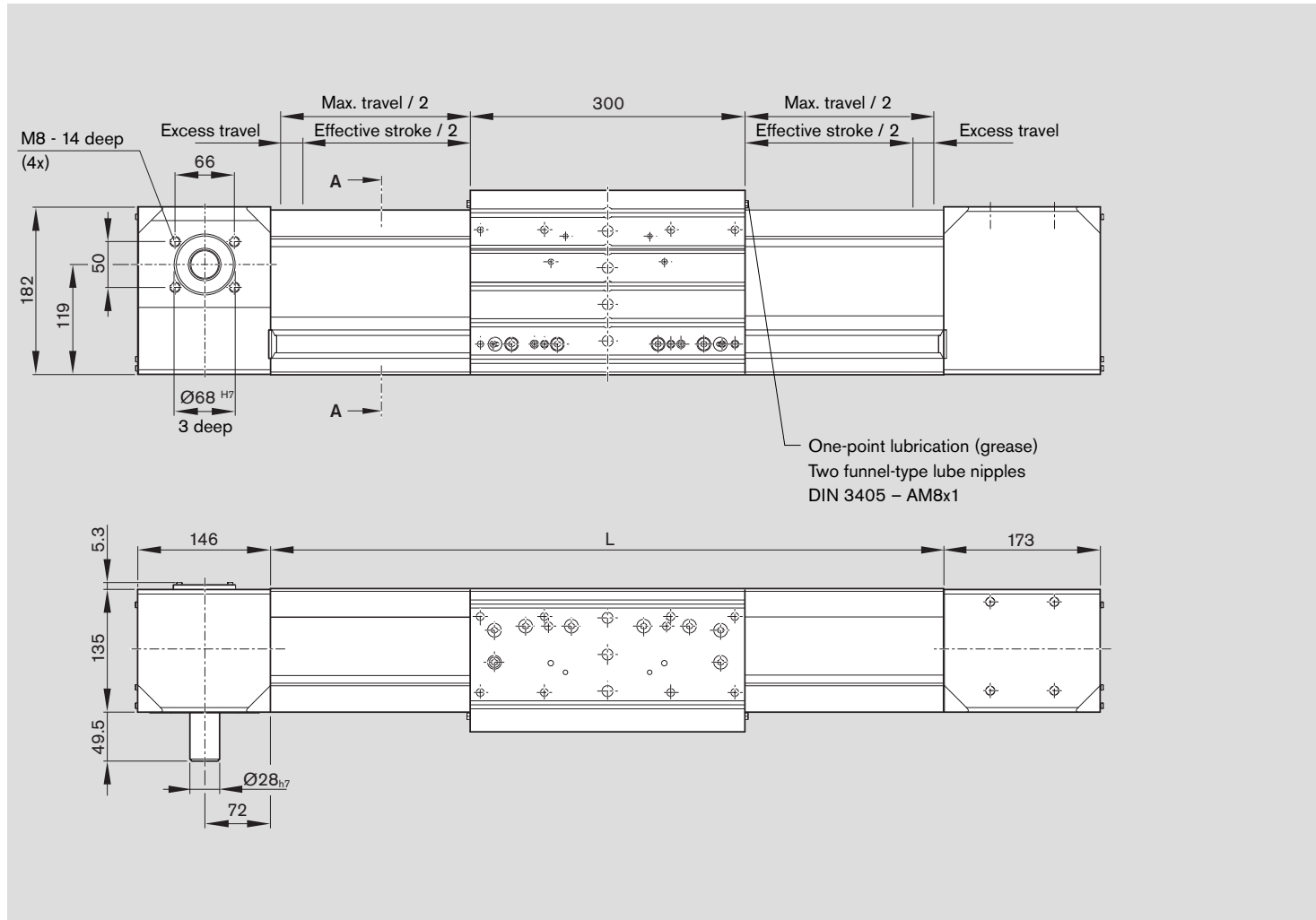
BKR 20-135 Components and Ordering Data

Part number, length R0324 500 00, ... mm	Type	Guideway 	Drive unit 		Carriage 	
			Shaft without keyway i = 1	Gear reducer i = 3, 5, 10	One carriage	
with drive 	MA01	01	01		01	
	MA02					
	MA03		02			
	MA04		03			
	MA05					
	MA06					
with gear reducer LP120 	MG01 MG02	01	10		01	
	MG03 MG04					

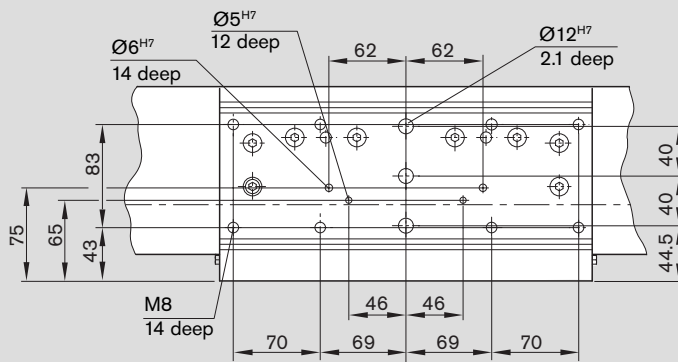
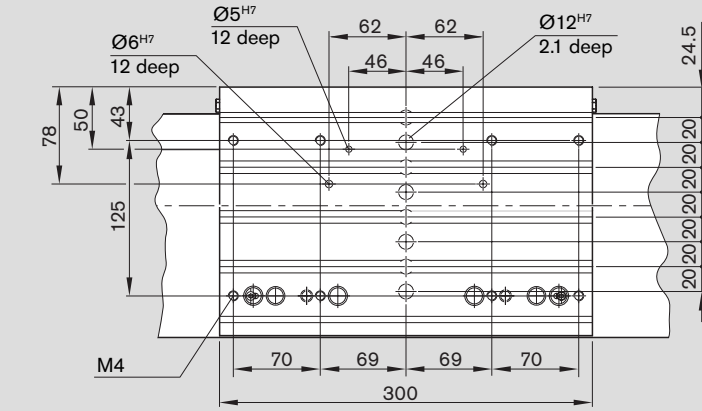
1) Attachment kit also available without motor (when ordering: enter "00" for motor)

Bridge Modules with Toothed Belt Drive BKR

BKR 20-135 Dimensions



Motor	Gear reducer	Dimensions (mm)				
		D	E	L _f	L _m without brake	L _m with brake
MSK 076C	LP120	140	140	165	216.5	292.5



Mounting hole pattern for switching cam

