# Toothed belt axes ELGC-TB-KF







#### Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide

#### Key features

#### At a glance



- Optimal installation space to working space ratio
- Protected against external influences by internal guide
- Compact, integrated coupling, easy to service
- Unique assembly system
- Compact double bearing integrated in the axis to save space
- Stainless steel cover strip kept in place with magnetic strips
- Easy to clean and less susceptible to contamination

#### Compact

Optimum dimensions thanks to the integrated compact coupling and a very short slide

#### Flexible

Adapterless combination of ELGC and EGSC using the innovative "one size down" assembly system

#### Integrated

Simple position sensing with proximity switch SMT-8M and integrated positioning magnet

#### Protected

The cover strip and optional vacuum connection protect against particle emissions and atmospheric pollution

#### Modular and flexible with motor, motor mounting kit and servo drive

Motor Servo motor



Stepper motor



Servo drive Servo drive



Motor controller for stepper motor



### Motor mounting kit

Axial kit



Parallel kit



#### Simplicity in one unit

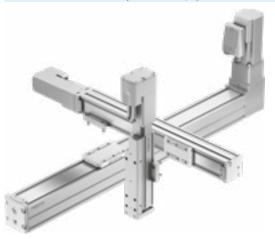
This product is also available as a product unit as part of the Simplified Motion Series:



- · The Simplified Motion Series combines the simplicity of pneumatics with the benefits of electric automation. The perfect solution for all users who are looking for an electric alternative for very simple movement and positioning tasks, but don't want the commissioning process for traditional electric drive systems that can often be quite complex.
- Simplified functionality for simple movements between two end positions
- A variety of movements with different mechanical systems
- · Integrated products eliminate the need for a control cabinet
- · Quick and easy commissioning without software or special expertise
- Digital I/O and IO-Link integrated as standard

### Key features

#### From individual axis to complete handling system



- The toothed belt and spindle axes ELGC and mini slide EGSC form a scalable modular system for compact automation
- The shared platform architecture creates a consistent range with matching interfaces. A large number of systems can be realised entirely without adapter plates
- Powerful drive and guide components ensure a long service life, as well as excellent load capacity and reliability
- The uniform and universal range of accessories reduces warehousing and design costs
- Two position sensing functions can be selected:
  - With magneto-resistive proximity switches (detection via integrated magnets)
  - With inductive proximity switches (detection via switch lug)

#### The products for the handling system

Spindle axis ELGC-BS









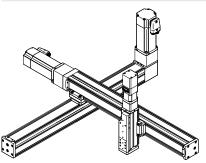
Mini slide EGSC



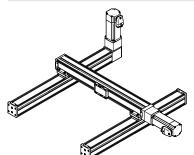
#### Typical handling systems

For applications where compact dimensions are essential, the axes ELGC can be combined into very space-saving handling systems that are suitable for assembly systems, test and inspection systems, small parts handling, the electronics industry and desktop applications. The very compact linear axes ELGC, mini slide EGSC and electric cylinder EPCC offer an optimal ratio between installation space and working space. They feature a common system approach and platform architecture and the connections are largely adapterless.

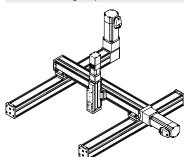
#### Cantilever system



#### Planar surface gantry



#### 3-dimensional gantry

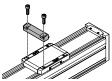


#### Key features

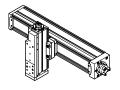
# Matrix showing combinations between axis ELGC/ELGS-TB, ELGC/ELGS-BS, mini slide EGSC/EGSS-BS, electric cylinder EPCC/EPCS-BS and guide axis ELFC Mounting options with profile mounting and via angle kit

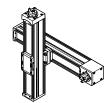
		Assembly axis ELGC-BS/-TB; ELFC; EGSC-BS; EPCC-BS; ELGS-BS/-TB; EGSS-BS, EPCS-BS					
	Size	25	32	45	60		
ELGC-BS/-TB; ELFC;	32	•	-	-	-		
	45	-	•	-	-		
ELGS-BS/-TB	60	-	-	•	-		
	80	-	-	_			

#### With profile mounting EAHF-L2-...-P-D...



• Mounting option: base axis with one-size-down assembly axis



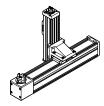


#### With angle kit EHAA-D-L2-...-AP



 Mounting option: base axis rotated through 90° with one-size-down assembly axis





# Matrix showing combinations between axis ELGC/ELGS-TB, ELGC/ELGS-BS, mini slide EGSC/EGSS-BS, electric cylinder EPCC/EPCS-BS and guide axis ELFC Assembly options with adapter kit or direct mounting

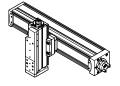
				BS/-TB; ELF S, EPCS-BS		; EPCC-BS;
	Size	25	32	45	60	80
Base axis	32			-	-	-
ELGC-BS/-TB; ELFC;	45	-	ı		-	-
ELGS-BS/-TB	60	-	-			_
	80	-	-	-	ı	

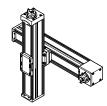
			is EGSC-BS; E	GSS-BS	
	Size	25	32	45	60
Base axis	25	•	-	-	-
EGSC-BS;	32	-	•	-	-
EGSS-BS	45	-	-		-
	60	-	-	-	•

#### With adapter kit EHAA-D-L2

- Mounting option: base axis with the same size assembly axis
- Mounting option: base axis with height adjustment for one-size-down assembly axis
- When motors are mounted using parallel kits, this may lead to interfering contours. In this case, the adapter plate is required for height compensation

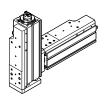






#### With direct mounting

Mounting option: base axis with the same size assembly axis

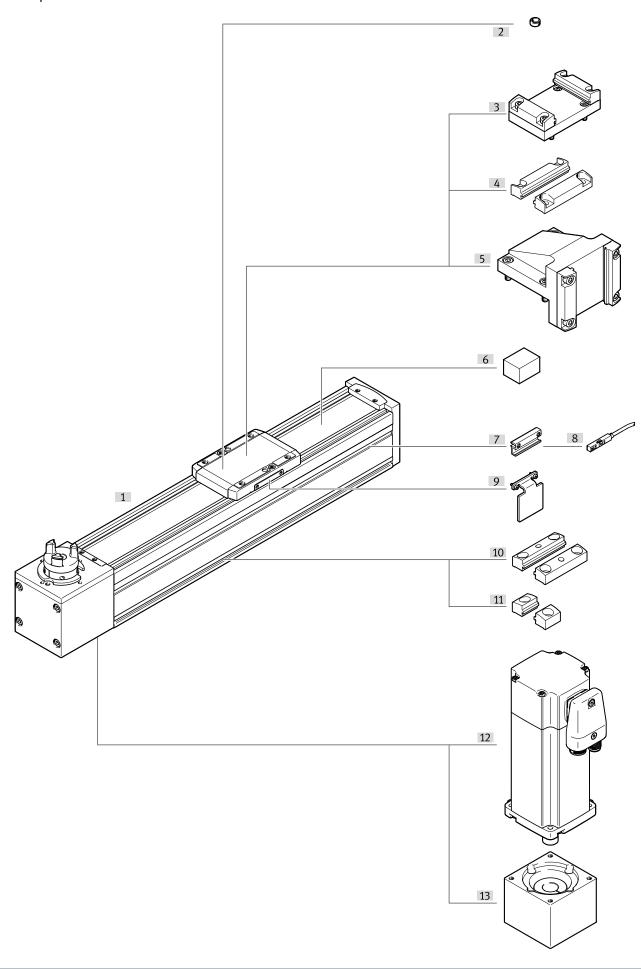


# Type codes

001	Series
ELGC	Gantry axis
002	Drive system
ТВ	Toothed belt
003	Guide
KF	Recirculating ball bearing guide
<b>KF</b>	Recirculating ball bearing guide Size
004	Size

Stroke	
200	
300	
500	
600	
800	
1000	
1200	
1500	
1800	
2000	
	300 500 600 800 1000 1200 1500 1800

# Peripherals overview



# Peripherals overview

Acces	sories		
	Туре	Description	→ Page/Internet
[1]	Toothed belt axis ELGCTB-KF	Electric drive	8
[2]	Centring pin/sleeve ZBS/ZBH	For centring loads and attachments on the slide	26
[3]	Adapter kit EHAA-D-L2	<ul> <li>For axis/axis mounting with adapter plate</li> <li>Mounting option: base axis with same size or one-size-down assembly axis (→ page 4)</li> <li>When motors are mounted using parallel kits, this may lead to interfering contours. In this case, the adapter plate is required for height compensation (download CAD data → www.festo.com)</li> </ul>	23
[4]	Profile mounting EAHF-L2P-D	<ul> <li>For axis/axis mounting without adapter plate</li> <li>Mounting option: base axis with one-size-down assembly axis (→ page 4)</li> </ul>	22
[5]	Angle kit EHAA-D-L2AP	For mounting one-size-down vertical axes (assembly axes) on base axes with mounting position "slide at top" (→ page 4)	24
[6]	Clamping element EADT-S-L5-32	Tool for retensioning the cover strip	26
[7]	Sensor bracket EAPM-L2-SH	For mounting the proximity switches on the axis. The proximity switches can only be mounted using the sensor bracket	25
[8]	Proximity switches SIES-8M	Inductive proximity switches, for T-slot	26
	Proximity switches SMT-8M	Magnetic proximity switches, for T-slot	26
[9]	Switch lug EAPM-L2SHS	For sensing the slide position in conjunction with inductive proximity sensors SIES-8M	25
[10]	Profile mounting EAHF-L2P	For mounting the axis on the side of the profile. The profile mounting can be fixed in place on the mounting surface using the drill hole in the centre	21
[11]	Profile mounting EAHF-L2P-S	For mounting the axis on the side of the profile	20
[12]	Motor EMME-AS, EMMS-ST	Motors specially matched to the axis	19
[13]	Axial kit EAMM-A	For axial motor mounting	19

#### Sealing air connection



Air is exchanged between the interior of the cylinder and the environment via a sealing air connection. This prevents negative pressure or excess pressure arising in the interior of the cylinder.

Additional functions of the connection:

- Application of slight negative pressure prevents emission of particles
- Application of slight excess pressure prevents atmospheric pollution Suitable push-in fittings  $\rightarrow$  page 26

# Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide

### Data sheet



g-

Size

45 ... 80



Stroke length 200 ... 2000 mm



www.festo.com



General technical data					
Size		45	60	80	
Design		Electromechanical axis with toothed belt			
Guide		Recirculating ball bearing guide			
Mounting position		Any			
Working stroke	[mm]	200, 300, 500, 600, 800, 1000, 1200,	200, 300, 500, 600, 800, 1000, 1200,	200, 300, 500, 600, 800, 1000, 1200,	
		1500	1500, 1800, 2000	1500, 1800, 2000	
Max. feed force F <sub>x</sub>	[N]	75	120	250	
Max. no-load torque <sup>1)</sup>	[Nm]	0.075	0.194	0.413	
Max. no-load resistance to shifting <sup>1)</sup>	[N]	7.8	15.6	24.7	
Max. driving torque	[Nm]	0.716	1.49	4.178	
Max. speed	[m/s]	1.2	1.5	1.5	
Max. acceleration	[m/s <sup>2</sup> ]	15			
Repetition accuracy	[mm]	±0.1			
Position sensing		Magneto-resistive, inductive			

<sup>1)</sup> At 0.2 m/s

Operating and environmental condit	ions	
Ambient temperature <sup>1)</sup>	[°C]	0+50
Degree of protection		IP40
Duty cycle	[%]	100
Maintenance interval		Life-time lubrication

<sup>1)</sup> Note operating range of proximity switches

Weight [g]			
Size	45	60	80
Basic weight with 0 mm stroke <sup>1)</sup>	760	1775	3500
Additional weight per 10 mm stroke	23	43	73
Moving mass	169	482	901

<sup>1)</sup> Including slide

Toothed belt				
Size		45	60	80
Indexing	[mm]	2	3	3
Elongation <sup>1)</sup>	[%]	0.187	0.124	0.200
Effective diameter	[mm]	19.1	24.83	33.42
Feed constant	[mm/rev]	60	78	105

<sup>1)</sup> At max. feed force

Mass moment of inertia				
Size		45	60	80
Jo	[kg mm <sup>2</sup> ]	18.62	88.04	291.2
J <sub>H</sub> per metre stroke	[kg mm <sup>2</sup> /m]	2.81	8.51	19.27
J <sub>L</sub> per kg payload	[kg mm <sup>2</sup> /kg]	91.19	154.11	279.3

The mass moment of inertia  $J_A$  of the entire axis is calculated as follows:

 $J_A = J_O + J_H x$  working stroke [m] +  $J_L x$  m<sub>payload</sub> [kg]

#### Homing

Homing can be carried out in two ways:

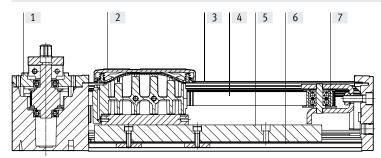
- Against a fixed stop
- Using a reference switch

The following values must be observed:

Size		45	60	80	
Max. impact energy	[J]	0.5x10 <sup>-3</sup>	1x10 <sup>-3</sup>	2x10 <sup>-3</sup>	
At max. homing speed	[m/s]	0.01	·	•	

#### Materials

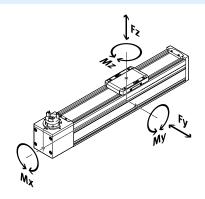
Sectional view



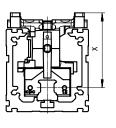
Axis		
[1]	Drive cover	Painted die-cast aluminium
[2]	Slide	Die-cast aluminium
[3]	Cover strip	High-alloy stainless steel
[4]	Toothed belt	Polychloroprene with glass cord and nylon coating
[5]	Guide	Steel
[6]	Profile	Anodised wrought aluminium alloy
[7]	Guide pulley	Aluminium
	Note on materials	RoHS-compliant
		Contains paint-wetting impairment substances

#### Characteristic load values

The indicated forces and torques refer to the centre of the guide. The point of application of force is the point where the centre of the guide and the longitudinal centre of the slide intersect. These values must not be exceeded during dynamic operation. Special attention must be paid to the deceleration phase.



Distance from the slide surface to the centre of the guide



Max. permissible forces and torques on the slide (strength limits)							
Size		45	60	80			
Fy <sub>max</sub> .	[N]	300	600	900			
Fz <sub>max</sub> .	[N]	600	1800	2700			
Mx <sub>max</sub> .	[Nm]	5.5	29.1	59.8			
My <sub>max.</sub>	[Nm]	4.7	31.8	56.2			
Mz <sub>max</sub> .	[Nm]	4.7	31.8	56.2			

Distance from the slide surface to the centre of the guide							
Size		45	60	80			
Dimension x	[mm]	42.8	54.6	72.5			

Max. permissible forces and torques for the bearing calculation, for a service life of 5000 km or 5 x 10 <sup>6</sup> cycles							
Size		45	60	80			
Fy <sub>max.</sub>	[N]	880	3641	5543			
Fz <sub>max</sub> .	[N]	880	3641	5543			
Mx <sub>max</sub> .	[Nm]	5.5	29.1	59.8			
My <sub>max</sub> .	[Nm]	4.7	31.8	56.2			
Mz <sub>max</sub> .	[Nm]	4.7	31.8	56.2			



For a guide system to have a service life of 5000 km, the load comparison factor must have a value of  $fv \le 1$ , based on the maximum permissible forces and torques for a service life of 5000 km.

This formula can be used to calculate a guide value.

The engineering software "PositioningDrives" is available

for more precise calculations → www.festo.com/x/electric-motion-sizing

If the axis is subjected to two or more of the indicated forces and torques simultaneously, the following equation must be satisfied in addition to the indicated maximum loads:

Calculating the load comparison factor:

$$f_{v} = \frac{|F_{y1}|}{F_{y2}} + \frac{|F_{z1}|}{F_{z2}} + \frac{|M_{x1}|}{M_{x2}} + \frac{|M_{y1}|}{M_{y2}} + \frac{|M_{z1}|}{M_{z2}} \le 1$$

 $F_1/M_1 = dynamic value$ 

 $F_2/M_2 = maximum value$ 

#### Calculating the service life

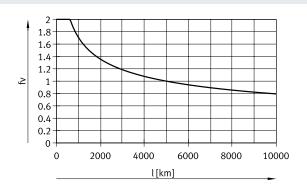
The service life of the guide depends on the load. To be able to make a statement as to the service life of the guide, the graph below plots the load comparison factor fv against the service life.

These values are only theoretical. You must consult your local Festo contact for a load comparison factor fv greater than 1.

#### Load comparison factor f<sub>v</sub> as a function of service life l

#### Example:

A user wants to move an x kg load. Using the formula ( $\rightarrow$  page 10) gives a value of 1.5 for the load comparison factor  $f_v$ . According to the graph, the guide would have a service life of approx. 1500 km. Reducing the acceleration reduces the Mz and My values. A load comparison factor  $f_v$  of 1 now gives a service life of 5000 km.



#### Comparison of the characteristic load values for 5000 km with dynamic forces and torques of recirculating ball bearing guides

The characteristic load values of the bearing guides are standardised to ISO and JIS using dynamic and static forces and torques. These forces and torques are based on an expected service life of the guide system of 100 km according to ISO or 50 km according to JIS.

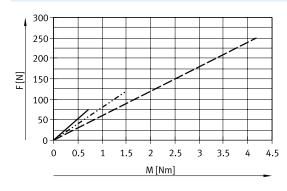
As the characteristic load values are dependent on the service life, the maximum permissible forces and torques for a 5000 km service life cannot be compared with the dynamic forces and torques of bearing guides to ISO/JIS.

To make it easier to compare the guide capacity of linear axes ELGC with bearing guides, the table below lists the theoretically permissible forces and torques for a calculated service life of 100 km. This corresponds to the dynamic forces and torques to ISO.

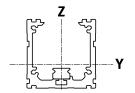
These 100 km values have been calculated mathematically and are only to be used for comparing with dynamic forces and torques to ISO. The drives must not be loaded with these characteristic values as this could damage the axes.

Max. permissible forces and torques for a theoretical service life of 100 km (from a guide perspective only)							
Size		45	60	80			
Fy <sub>max</sub> .	[N]	3240	13400	20400			
Fz <sub>max</sub> .	[N]	3240	13400	20400			
Mx <sub>max</sub> .	[Nm]	20	107	220			
My <sub>max.</sub>	[Nm]	17	117	207			
Mz <sub>max</sub> .	[Nm]	17	117	207			

#### Feed force F as a function of input torque M



#### Second moment of area



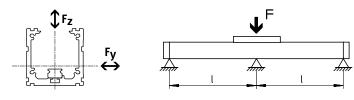
Size		45	60	80
ly	[mm <sup>4</sup> ]	140x10 <sup>3</sup>	441x10 <sup>3</sup>	1.37x10 <sup>6</sup>
Iz	[mm <sup>4</sup> ]	170x10 <sup>3</sup>	542x10 <sup>3</sup>	1.66x10 <sup>6</sup>

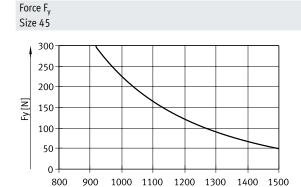
#### Maximum permissible support spacing L (without profile mounting) as a function of force F

In order to limit deflection in the case of large strokes, the axis may need to be supported.

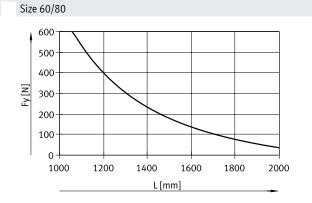
The following graphs can be used to determine the maximum permissible support spacing I as a function of force F acting on the axis.

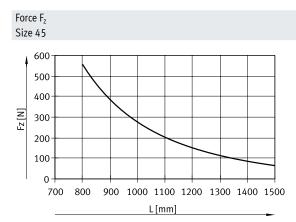
The deflection is f = 0.5 mm.

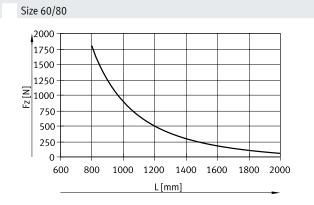




L[mm]







#### Recommended deflection limits

Adherence to the following deflection limits is recommended so as not to impair the functionality of the axes. Greater deformation can result in increased friction, greater wear and reduced service life.

Size		Static deflection (stationary load)
45 80	0.05% of the axis length, max. 0.5 mm	0.1% of the axis length

								Downl	oad CAD data →	www.festo.com
E B 3	D2	H2 H2	L2	A → pag	L6	77	B. D3		View B	H13 H13 H13
	<u>Н</u>	7 H8						[1] = Se push	us stroke length aling air connect n-in fittings → pa d position zero s	age 26
Size	B1	B2	B3	B4	<b>I</b>	2 <sup>1)</sup> Ø	D3	D4	H1	H2
1										
45	45	42.6	22.5	6.1	16	5.3	-	G1/8	54	22
45 60	45 60	42.6 57.1	22.5	6.1			– M4	G1/8 G1/8	54 72	22 29.5
					3:	6.3				
60	60	57.1	30	6.1	3:	5.3	M4	G1/8	72	29.5
60 80 Size	60 80	57.1 77.1	30 40	6.1	3: 3:	5.3	M4 M6	G1/8 G1/8	72 96	29.5 39.5
60 80 Size 45 60	60 80 H3 49 65.5	57.1 77.1 H4	30 40 H5 0.5 0.5	6.1 6.1 H6 12.5 19.5	33 33 1	5.3 1.4 1.4 17	M4 M6 H8 - 48	G1/8 G1/8 H11 42.8 54.6	72 96 H12 45 60	29.5 39.5 H13 18.5 32.5
60 80 Size	60 80 H3	57.1 77.1 H4	30 40 H5	6.1 6.1 H6	33 33 1	5.3 1.4 1.4 1.4	M4 M6 H8	G1/8 G1/8 H11	72 96 H12	29.5 39.5 H13
60 80 Size 45 60	60 80 H3 49 65.5	57.1 77.1 H4 49.6 66.1	30 40 H5 0.5 0.5	6.1 6.1 H6 12.5 19.5	33 33 1	5.3 1.4 1.4 17	M4 M6 H8 - 48	G1/8 G1/8 H11 42.8 54.6	72 96 H12 45 60	29.5 39.5 H13 18.5 32.5
60 80 Size 45 60 80	60 80 H3 49 65.5 85.5	57.1 77.1 H4 49.6 66.1 88.1	30 40 H5 0.5 0.5 0.5	6.1 6.1 H6 12.5 19.5 20 L4 <sup>2)</sup> min.	3: 3: 1	6.3 1.4 1.4 1.75 7 L6	M4 M6 H8 - 48 65	G1/8 G1/8 H11 42.8 54.6 72.5	72 96 H12 45 60 80	29.5 39.5 H13 18.5 32.5 41.5
60 80 Size 45 60 80	60 80 H3 49 65.5 85.5	57.1 77.1 H4 49.6 66.1 88.1	30 40 H5 0.5 0.5 0.5	6.1 6.1 H6 12.5 19.5 20	33: 34: 14: 55:	5.3 1.4 1.4 17 	M4 M6 H8 - 48 65	G1/8 G1/8 H11 42.8 54.6 72.5	72 96 H12 45 60 80	29.5 39.5 H13 18.5 32.5 41.5

Coupling diameter or interference diameter of locking screw
 Includes a stroke reserve of approx. 3 mm

6.1

6.1

38.5

47.5

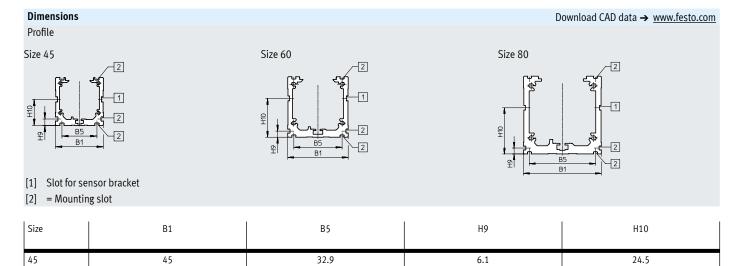
# Data sheet

60

80

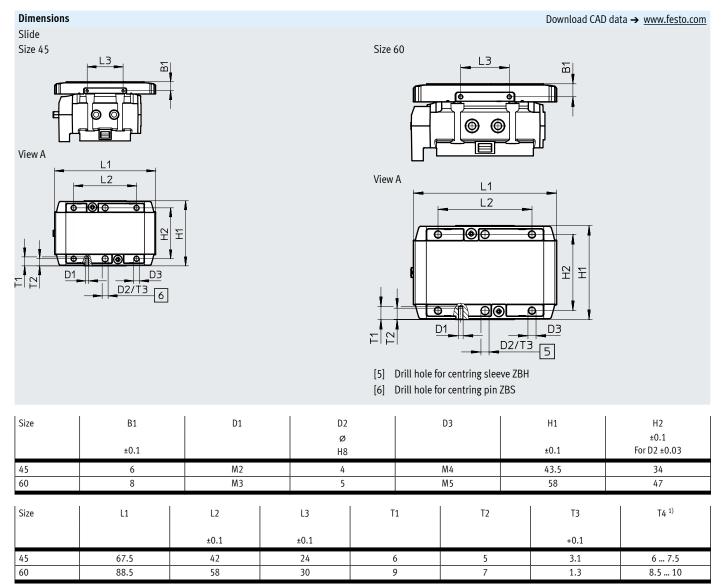
60

80



47.9

67.9



<sup>1)</sup> Recommended screw-in depth

#### Dimensions Download CAD data → www.festo.com Slide Size 80 View A L1 L2 **®**(0) का 모모 lacktriangle\_D3 D1\_ D2/T3 5 [5] Drill hole for centring sleeve ZBH Size В1 D1 D2 D3 Н1 ±0.1 ±0.1 ±0.1 For D2 ±0.03 Н8 80 11 M4 M6 78 63 T4 1) Size L1 L2 L3 T1 T2 T3 ±0.1 ±0.1 +0.1

106

73

36

12

9

1.6

11 ... 14

80

<sup>1)</sup> Recommended screw-in depth

# Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide $% \left( 1\right) =\left( 1\right) \left( 1\right)$

# Data sheet

Ordering data				
-	Size	Stroke [mm]	Part no.	Туре
	45	200	8062768	ELGC-TB-KF-45-200
		300	8062769	ELGC-TB-KF-45-300
		500	8062770	ELGC-TB-KF-45-500
		600	8062771	ELGC-TB-KF-45-600
		800	8062772	ELGC-TB-KF-45-800
		1000	8062773	ELGC-TB-KF-45-1000
		1200	8062774	ELGC-TB-KF-45-1200
		1500	8062775	ELGC-TB-KF-45-1500
	60	200	8062776	ELGC-TB-KF-60-200
		300	8062777	ELGC-TB-KF-60-300
		500	8062778	ELGC-TB-KF-60-500
		600	8062779	ELGC-TB-KF-60-600
		800	8062780	ELGC-TB-KF-60-800
		1000	8062781	ELGC-TB-KF-60-1000
		1200	8062782	ELGC-TB-KF-60-1200
		1500	8062783	ELGC-TB-KF-60-1500
		1800	8062784	ELGC-TB-KF-60-1800
		2000	8062785	ELGC-TB-KF-60-2000
	80	200	8062786	ELGC-TB-KF-80-200
		300	8062787	ELGC-TB-KF-80-300
		500	8062788	ELGC-TB-KF-80-500
		600	8062789	ELGC-TB-KF-80-600
		800	8062790	ELGC-TB-KF-80-800
		1000	8062791	ELGC-TB-KF-80-1000
		1200	8062792	ELGC-TB-KF-80-1200
		1500	8062793	ELGC-TB-KF-80-1500
		1800	8062794	ELGC-TB-KF-80-1800
		2000	8062795	ELGC-TB-KF-80-2000



#### Note

Depending on the combination of motor and drive, it may not be possible to reach the maximum feed force of the drive.

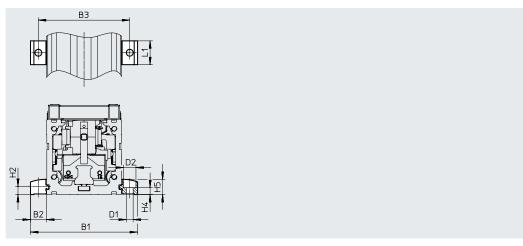
* Kits for third-party motors → Internet: eamm-a  ** Kit	Permissible axis/motor combinations wi	th axial kit			Data sheets → Internet: eamm-a
Type Part no. Type  ELGC-TB-KF-45  With servo motor  EMME-AS-40	Motor <sup>1)</sup>	Axial kit			
ELGC-TB-KF-45  With servo motor  EMME-AS-40			TI PE	<ul> <li>Kits for third-party motors → Internet: eamm-a</li> </ul>	
With servo motor           EMME-AS-60         4595742         EAMM-A-V32-40P           EMME-AS-60         4608750         EAMM-A-V32-60P           EMME-AS-60         4608750         EAMM-A-V32-60P           With stepper motor         With stepper motor           EMMS-ST-42         4281142         EAMM-A-V32-42A           EMMS-ST-57         4597016         EAMM-A-V32-57A           EIGCTB-KF-60         With servo motor           With servo motor         EMME-AS-60         4133487           EAMM-A-T42-60P         EMME-AS-60         4133487           EMME-AS-80         4623788         EAMM-A-T42-80P           EMME-AS-80         4623788         EAMM-A-T42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-A-T42-87A           EIGC-TB-KF-80         With stepper motor         EMMS-ST-87         4610008         EAMM-A-T42-87A           EIGC-TB-KF-80         4824833         EAMM-A-T46-60P         EMME-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P         EMME-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P         EMME-AS-8	Туре	Part no.	Туре		
EMME-AS-40         4595742         EAMM-A-V32-40P           EMMT-AS-60         4608750         EAMM-A-V32-60P           EMME-AS-60         4608750         EAMM-A-V32-60P           EMME-SF-60         4281142         EAMM-A-V32-42A           EMMS-ST-57         4597016         EAMM-A-V32-57A           EIGCTB-KF-60           With servo motor           EMMT-AS-60         4133487         EAMM-AT42-60P           EMMT-AS-80         4623788         EAMM-AT42-80P           EMME-AS-80         4623788         EAMM-AT42-80P           EMME-ST-57         4327034         EAMM-AT42-87A           EMMS-ST-87         4610008         EAMM-AT42-87A           EIGCTB-KF-80           With stepor motor           EMME-AS-60         4824833         EAMM-AT46-60P           EMME-AS-60         4824833         EAMM-AT46-60P           EMME-AS-60         4624170         EAMM-AT46-80P           EMME-AS-80         4624170         EAMM-AT46-60P           EMME-AS-80         4624227         EAMM-AT46-100A           EMME-AS-100	ELGC-TB-KF-45				
EMMT-AS-60         4608750         EAMM-A-V32-60P           EMME-AS-60         4608750         EAMM-A-V32-60P           With stepper motor         EMMS-ST-57         4281142         EAMM-A-V32-42A           EMMS-ST-57         4597016         EAMM-A-V32-57A           EIGC-TB-KF-60           With servo motor         With servo motor           EMMT-AS-60         4133487         EAMM-A-T42-60P           EMME-AS-60         4633788         EAMM-A-T42-80P           EMME-AS-80         4623788         EAMM-A-T42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-A-T42-57A           EMMS-ST-87         4610008         EAMM-A-T42-87A           EIGC-TB-KF-80         With servo motor           EMMS-ST-87         4824833         EAMM-A-T46-60P           EIMM-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-80         4624170         EAMM-A-T46-60P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-100         4624272         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A <tr< td=""><td>With servo motor</td><td></td><td></td><td></td><td></td></tr<>	With servo motor				
EMME-AS-60         4608750         EAMM-A-V32-60P           With stepper motor         EMMS-ST-42         4281142         EAMM-A-V32-42A           EMMS-ST-57         4597016         EAMM-A-V32-57A           ELGCTB-KF-60         ELGCTB-KF-60           With servo motor         EMMT-AS-60         4133487         EAMM-A-T42-60P           EMMT-AS-60         4133487         EAMM-A-T42-60P         EMMT-AS-80           EMME-AS-80         4623788         EAMM-A-T42-80P         EMME-AS-80           With stepper motor         EMMS-ST-57         4327034         EAMM-A-T42-57A         EMMS-ST-87         4610008         EAMM-A-T42-87A         EMMS-ST-87         4610008         EAMM-A-T42-87A         EMMS-ST-60         4824833         EAMM-A-T46-60P         EMMT-AS-60         4824833         EAMM-A-T46-60P         EMMT-AS-80         4624170         EAMM-A-T46-80P         EMMT-AS-80         4624170         EAMM-A-T46-80P         EMME-AS-80         462427         EAMM-A-T46-100A         EMME-AS-100         462427         EAMM-A-T46-100A         EMME-AS-100         4624227         EAMM-A-T46-100A         With stepper motor	EMME-AS-40	4595742	EAMM-A-V32-40P		
With stepper motor           EMMS-ST-42         4281142         EAMM-A V32-42A           EMMS-ST-57         4597016         EAMM-A V32-57A           EIGC-TB-KF-60           With servo motor           EMMT-AS-60         4133487         EAMM-AT42-60P           EMME-AS-60         4133487         EAMM-AT42-60P           EMME-AS-80         4623788         EAMM-AT42-80P           EMME-AS-80         4623788         EAMM-AT42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-AT42-57A           EMMS-ST-87         4610008         EAMM-AT42-87A           EIGC-TB-KF-80         EMMS-ST-60         4824833         EAMM-AT42-87A           EMMT-AS-60         4824833         EAMM-AT46-60P           EMME-AS-60         4824833         EAMM-AT46-60P           EMMT-AS-80         4624170         EAMM-AT46-80P           EMMT-AS-80         4624170         EAMM-AT46-100A           EMME-AS-100         4624227         EAMM-AT46-100A           With stepper motor	EMMT-AS-60	4608750	EAMM-A-V32-60P		
EMMS-5T-42         4281142         EAMM-A-V32-42A           EMMS-5T-57         4597016         EAMM-A-V32-57A           ELGC-TB-KF-60           With servo motor           EMMT-AS-60         4133487         EAMM-A-T42-60P           EMME-AS-60         4433487         EAMM-A-T42-80P           EMME-AS-80         4623788         EAMM-A-T42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-A-T42-87A           EMMS-ST-87         4610008         EAMM-A-T42-87A           ELGC-TB-KF-80         With servo motor           EMMT-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         EAMM-A-T46-100A	EMME-AS-60	4608750	EAMM-A-V32-60P		
EMMS-ST-57         4597016         EAMM-A-V32-57A           EIGC-TB-KF-60           With serve motor           EMMT-AS-60         4133487         EAMM-AT42-60P           EMME-AS-60         4623788         EAMM-AT42-80P           EMME-AS-80         4623788         EAMM-AT42-80P           EMMS-ST-57         4327034         EAMM-AT42-57A           EMMS-ST-87         4610008         EAMM-AT42-87A           EIGC-TB-KF-80           With serve motor           EMMT-AS-60         4824833         EAMM-AT46-60P           EMME-AS-60         4824833         EAMM-AT46-60P           EMME-AS-80         4624170         EAMM-AT46-80P           EMMT-AS-100         462427         EAMM-AT46-100A           EMME-AS-100         4624227         EAMM-AT46-100A           With stepper motor	With stepper motor				
ELGC-TB-KF-60 With servo motor EMMT-AS-60	EMMS-ST-42	4281142	EAMM-A-V32-42A		
With servo motor           EMMT-AS-60         4133487         EAMM-AT42-60P           EMME-AS-60         4133487         EAMM-AT42-60P           EMMT-AS-80         4623788         EAMM-AT42-80P           EMME-AS-80         4623788         EAMM-AT42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-AT42-57A           EMMS-ST-87         4610008         EAMM-AT42-87A           EIGC-TB-KF-80         With servo motor           With servo motor         EMMF-AS-60         4824833         EAMM-AT46-60P           EMME-AS-60         4824833         EAMM-AT46-60P           EMME-AS-80         4624170         EAMM-AT46-80P           EMMF-AS-80         4624170         EAMM-AT46-80P           EMMF-AS-100         462427         EAMM-AT46-100A           EMME-AS-100         462427         EAMM-AT46-100A           With stepper motor         EAMM-AT46-100A	EMMS-ST-57	4597016	EAMM-A-V32-57A		
EMMT-AS-60         4133487         EAMM-A-T42-60P           EMME-AS-60         4133487         EAMM-A-T42-60P           EMMT-AS-80         4623788         EAMM-A-T42-80P           EMME-AS-80         4623788         EAMM-A-T42-80P           With stepper motor         EMMS-ST-57         4327034         EAMM-A-T42-57A           EMMS-ST-87         4610008         EAMM-A-T42-87A           EIGC-TB-KF-80           With serve motor           EMMT-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor	ELGC-TB-KF-60				
EMME-AS-60 4133487 EAMM-AT42-60P  EMMT-AS-80 4623788 EAMM-AT42-80P  EMME-AS-80 4623788 EAMM-AT42-80P  With stepper motor  EMMS-ST-57 4327034 EAMM-AT42-57A  EMMS-ST-87 4610008 EAMM-A-T42-87A  ELGC-TB-KF-80  With serve motor  EMMT-AS-60 4824833 EAMM-A-T46-60P  EMME-AS-60 4824833 EAMM-A-T46-60P  EMMT-AS-80 4624170 EAMM-A-T46-80P  EMME-AS-80 462427 EAMM-A-T46-100A  With stepper motor	With servo motor				
EMMT-AS-80 4623788 EAMM-A-T42-80P  EMME-AS-80 4623788 EAMM-A-T42-80P  With stepper motor  EMMS-ST-57 4327034 EAMM-A-T42-57A  EMMS-ST-87 4610008 EAMM-A-T42-87A  ELGC-TB-KF-80  With servo motor  EMMT-AS-60 4824833 EAMM-A-T46-60P  EMME-AS-60 4824833 EAMM-A-T46-60P  EMMT-AS-80 4624170 EAMM-A-T46-80P  EMME-AS-80 4624170 EAMM-A-T46-80P  EMMT-AS-100 4624227 EAMM-A-T46-100A  With stepper motor	EMMT-AS-60	4133487	EAMM-A-T42-60P		
EMME-AS-80       4623788       EAMM-AT42-80P         With stepper motor       EMMS-ST-57       4327034       EAMM-AT42-57A         EMMS-ST-87       4610008       EAMM-AT42-87A         ELGC-TB-KF-80         With servo motor         EMMT-AS-60       4824833       EAMM-AT46-60P         EMME-AS-60       4824833       EAMM-AT46-60P         EMMT-AS-80       4624170       EAMM-AT46-80P         EMME-AS-80       4624170       EAMM-AT46-80P         EMMT-AS-100       4624227       EAMM-AT46-100A         EMME-AS-100       4624227       EAMM-AT46-100A         With stepper motor       With stepper motor	EMME-AS-60	4133487	EAMM-A-T42-60P		
With stepper motor  EMMS-ST-57	EMMT-AS-80	4623788	EAMM-A-T42-80P		
EMMS-ST-57 4327034 EAMM-A-T42-57A  EMMS-ST-87 4610008 EAMM-A-T42-87A  ELGC-TB-KF-80  With servo motor  EMMT-AS-60 4824833 EAMM-A-T46-60P  EMME-AS-60 4824833 EAMM-A-T46-60P  EMMT-AS-80 4624170 EAMM-A-T46-80P  EMME-AS-80 4624170 EAMM-A-T46-80P  EMMT-AS-80 462427 EAMM-A-T46-100A  With stepper motor	EMME-AS-80	4623788	EAMM-A-T42-80P		
EMMS-ST-87 4610008 EAMM-A-T42-87A  ELGC-TB-KF-80  With servo motor  EMMT-AS-60 4824833 EAMM-A-T46-60P  EMME-AS-60 4824833 EAMM-A-T46-60P  EMMT-AS-80 4624170 EAMM-A-T46-80P  EMME-AS-80 4624170 EAMM-A-T46-80P  EMMT-AS-80 462427 EAMM-A-T46-100A  EMMT-AS-100 4624227 EAMM-A-T46-100A  With stepper motor	With stepper motor	•			
ELGC-TB-KF-80 With servo motor  EMMT-AS-60	EMMS-ST-57	4327034	EAMM-A-T42-57A		
With servo motor           EMMT-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         With stepper motor	EMMS-ST-87	4610008	EAMM-A-T42-87A		
With servo motor           EMMT-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         With stepper motor	FIGCTP VE 90				·
EMMT-AS-60         4824833         EAMM-A-T46-60P           EMME-AS-60         4824833         EAMM-A-T46-60P           EMMT-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         With stepper motor		-			
EMME-AS-60       4824833       EAMM-A-T46-60P         EMMT-AS-80       4624170       EAMM-A-T46-80P         EMME-AS-80       4624170       EAMM-A-T46-80P         EMMT-AS-100       4624227       EAMM-A-T46-100A         EMME-AS-100       4624227       EAMM-A-T46-100A         With stepper motor       With stepper motor		4824833	FAMM-A-T46-60P		
EMMT-AS-80         4624170         EAMM-A-T46-80P           EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         With stepper motor         A624227					
EMME-AS-80         4624170         EAMM-A-T46-80P           EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor         With stepper motor					
EMMT-AS-100         4624227         EAMM-A-T46-100A           EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor					
EMME-AS-100         4624227         EAMM-A-T46-100A           With stepper motor					
With stepper motor					
		7027227	LIMM-A-140-100A		
FMM5-51-87 4048//1 FAMM-A-146-8/A	EMMS-ST-87	4048771	EAMM-A-T46-87A		

<sup>1)</sup> The input torque must not exceed the max. permissible transferable torque of the axial kit.

### Profile mounting EAHF-L2-...-P-S

Material: Anodised wrought aluminium alloy RoHS-compliant • For mounting the axis on the side of the profile





Dimensions and ordering data									
For size	B1	B2	В3	D1	D2	H2			
				Ø	Ø				
				H13	H13				
45	70.6	12.8	58	5.5	10	6.1			
60	85.6	12.8	73	5.5	10	6.1			
80	105.6	12.8	93	5.5	10	6.1			

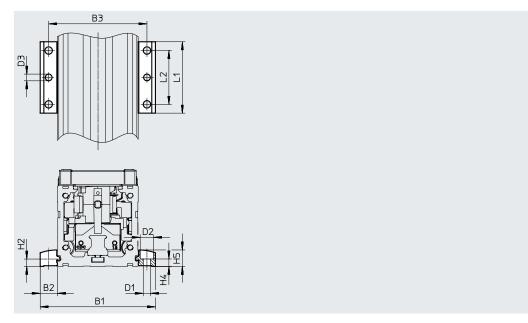
For size	H4 ±0.1	Н5	L1	Weight [g]	Part no.	Туре
45	5.5	12.2	19	6	5184133	EAHF-L2-45-P-S
60	5.5	12.2	19	6	5184133	EAHF-L2-45-P-S
80	5.5	12.2	19	6	5184133	EAHF-L2-45-P-S

#### Profile mounting EAHF-L2-...-P

Material: Anodised wrought aluminium alloy RoHS-compliant • For mounting the axis on the side of the profile.

The profile mounting can be attached to the mounting surface using the drill hole in the centre.





Dimensions and ord	Dimensions and ordering data												
For size	B1	B2	В3	D1	D2	D3	H2						
				Ø	Ø	ø							
				H13	H13								
45	70.6	12.8	58	5.5	10	5	6.1						
60	85.6	12.8	73	5.5	10	5	6.1						
80	105.6	12.8	93	5.5	10	5	6.1						

For size	H4	H5	L1	L2	Weight [g]	Part no.	Туре
	±0.1						
45	5.5	12.2	53	40	35	4835728	EAHF-L2-45-P
60	5.5	12.2	53	40	35	4835728	EAHF-L2-45-P
80	5.5	12.2	53	40	35	4835728	EAHF-L2-45-P

# Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide

### Accessories

#### Profile mounting EAHF-L2-...-P-D...

Material:

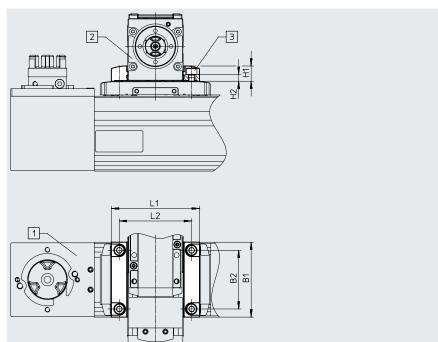
Anodised wrought aluminium alloy RoHS-compliant

- For axis/axis mounting without adapter plate
- Mounting option: base axis with one-size-down assembly axis (→ page 4)

[1] Base axis[2] Assembly axis

Combination matrix					
		[2] Assembly axis ELGC-	BS/-TB; ELFC; EGSC-BS		
	Size	32	45	60	
[1] Base axis	45	4759748	-	-	
ELGC-BS/-TB, ELFC	60	-	4759739	-	
	80	_	_	4759726	





Dimensions and ordering	ng data			
For combination	B1	B2	D1	H1
(size)				
4 5/32	45	34	M4	9
6 0/45	60	47	M5	12.2
8 0/60	78	63	M6	12.2

For combination (size)	H2 ±0.1	L1	L2	Weight [g]	Part no.	Туре
4 5/32	3.7	51.4	42	24	4759748	EAHF-L2-25-P-D2
6 0/45	5.5	70.6	58	56	4759739	EAHF-L2-45-P-D3
8 0/60	4.5	85.6	73	77	4759726	EAHF-L2-45-P-D4

RoHS-compliant

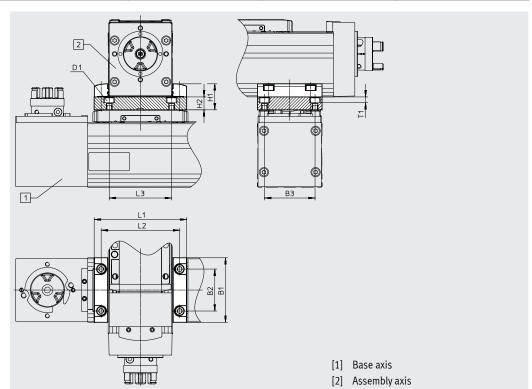
#### Adapter kit EHAA-D-L2

Material: Anodised wrought aluminium alloy

- For axis/axis mounting with adapter plate
- Mounting option: base axis with same size or one-size-down assembly axis
   (→ page 4)
- When motors are mounted using parallel kits, this may lead to interfering contours. In this case, the adapter plate is required for height compensation (download CAD data → www.festo.com)

Combination matrix					
		[2] Assembly axis ELGC-BS/-T	B; ELFC; EGSC-BS		
	Size	32	45	60	80
[1] Base axis	45	8066714		-	-
ELGC-BS/-TB; ELFC	60	-	8066715		-
	80	-	-	8066716	





For combination	B1	B3	D1	H1	H2	L1	L2	L3	T1	Weight	Part no.	Туре
(size)		±0.05								[g]		
4 5/32	45	34	M4	19	10	51.4	42	42	5.4	136	8066714	EHAA-D-L2-45-L2-45
6 0/45	60	47	M5	24.2	12	70.6	58	58	5.4	205	8066715	EHAA-D-L2-60-L2-60
8 0/60	78	63	M6	24.2	12	85.6	73	73	6.4	315	8066716	EHAA-D-L2-80-L2-80

For combination	B1	B2	В3	D1	H1	H2	L1	L2	L3	T1	Weight	Part no.	Туре
(size)			±0.05								[g]		
4 5/45	45	32	34	M4	22.2	10	71	58	42	5.4	136	8066714	EHAA-D-L2-45-L2-45
6 0/60	60	39	47	M5	24.2	12	86	73	58	5.4	205	8066715	EHAA-D-L2-60-L2-60
8 0/80	78	63	63	M6	24.2	12	106	93	73	6.4	315	8066716	EHAA-D-L2-80-L2-80

# Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide

# Accessories

#### Angle kit EHAA-D-L2-...-AP

Material:

Anodised wrought aluminium alloy

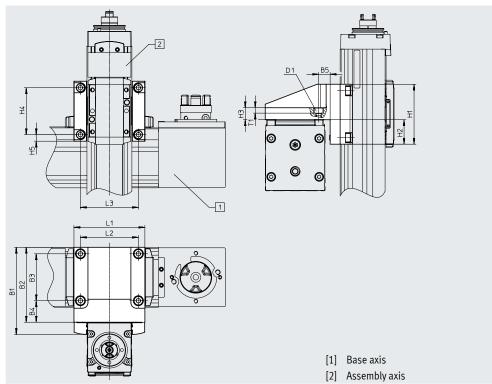
RoHS-compliant

• For mounting one-size-down vertical axes (assembly axes) on base axes with mounting position "slide at top"

(→ page 4)

Combination matrix				
		[2] Assembly axis ELGC-BS/-TB; ELFC; EG	SSC-BS	
	Size	32	45	60
[1] Base axis	45	8066718	-	-
ELGC-BS/-TB; ELFC	60	-	8066719	-
	80	-	-	8066720





Dimensions and order	ring data									
For combination (size)	B1	B2	B3	B4	B5	D1	H1	H2	H3	H4
4 5/32	69	60	34	20.5	11.5	M4	45	17.5	10	34
6 0/45	87.2	75	47	21.5	21.5	M5	60	24.5	12	47
8 0/60	107.2	95	63	23.5	23.5	M6	78	33.5	12	63

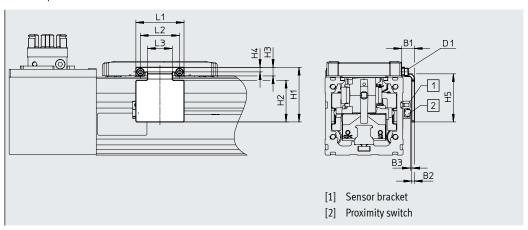
For combination (size)	Н5	L1	L2	L3	T1	Weight [g]	Part no.	Туре
4 5/32	5.5	52	42	42	5.4	222	8066718	EHAA-D-L2-45-L2-32-AP
6 0/45	6.5	71	58	58	5.4	433	8066719	EHAA-D-L2-60-L2-45-AP
8 0/60	7.5	86	73	73	6.4	768	8066720	EHAA-D-L2-80-L2-60-AP

#### Switch lug EAPM-L2-SLS

For sensing using inductive proximity switches SIES-8M

Material: Galvanised steel RoHS-compliant





Dimensions and ord	lering data							
For size	B1	B2	В3	D1	H1	H2	Н3	H4
					±0.2			
45	9.4	2	1.2±0.31	M2	37	28	5.5	3.3
60	9.7	2	1.3±0.31	M3	42	32	6.6	3.5
80	9.5	2	1.1±0.32	M4	53.5	42	8.3	4.5

For size	H5 ±0.2	L1 ±0.2	L2 ±0.15	L3	Weight [g]	Part no.	Туре
45	33	30	24	14	18	8067260	EAPM-L2-45-SLS
60	37	37	30	19	27	8067261	EAPM-L2-60-SLS
80	47	44.6	36	23.4	42	8067262	EAPM-L2-80-SLS

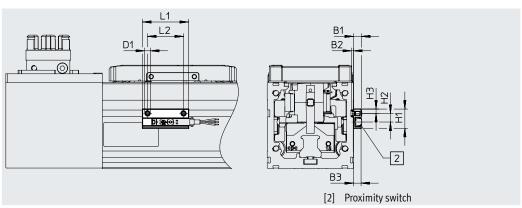
#### Sensor bracket EAPM-L2-SH

Material:

Anodised wrought aluminium alloy

RoHS-compliant





Dimensions and ordering data								
For size	B1	B2	D1	H1	H2			
45, 60, 80	5.5	1.3	M4	13.4	6			

For	size	Н3	L1	L2	Weight [g]	Part no.	Туре
45,	60,80	3	32	25	4	4759852	EAPM-L2-SH

# Toothed belt axes ELGC-TB-KF, with recirculating ball bearing guide $% \left( 1\right) =\left( 1\right) \left( 1\right)$

# Accessories

Ordering data							
	For size	Description	Pa	art no.	Туре	PU <sup>1)</sup>	
Centring pin ZBS	centring sleeve ZBH						
	45	For slide	50	62959	ZBS-4	10	
	60		18	89652	ZBH-5		
	80		1	86717	ZBH-7		
Clamping elemer	nt EADT						
	45	Tool for retensioning the cover strip	86	065818	EADT-S-L5-32	1	
	60,80		8	058451	EADT-S-L5-70		
Push-in fitting							
	45, 60, 80	For sealing air connection	1	86266	QSM-G1/8-4-I	10	
			1:	86267	QSM-G1/8-6-I		
9							

					186267	QSM-G1/8-6-I
Packaging unit						<del>:</del>
rdering data	– Proximity switches for T-slot, inductive					Data sheets → Internet: si
Ū	Type of mounting	Switching	Electrical connection	Cable length	Part no.	Туре
		output		[m]		
I/O contact						
	Inserted in the slot from above, flush with	PNP	Cable, 3-wire	7.5	551386	SIES-8M-PS-24V-K-7,5-OE
180	the cylinder profile		Plug M8x1, 3-pin	0.3	551387	SIES-8M-PS-24V-K-0,3-M8D
		NPN	Cable, 3-wire	7.5	551396	SIES-8M-NS-24V-K-7,5-OE
			Plug M8x1, 3-pin	0.3	551397	SIES-8M-NS-24V-K-0,3-M8D
I/C contact						
	Inserted in the slot from above, flush with	PNP	Cable, 3-wire	7.5	551391	SIES-8M-PO-24V-K-7,5-OE
<b>S</b>	the cylinder profile		Plug M8x1, 3-pin	0.3	551392	SIES-8M-PO-24V-K-0,3-M8D
		NPN	Cable, 3-wire	7.5	551401	SIES-8M-NO-24V-K-7,5-OE
			Plug M8x1, 3-pin	0.3	551402	SIES-8M-NO-24V-K-0,3-M8D
	Type of mounting	Switching output	Electrical connection	Cable length [m]	Part no.	Туре
N/O contact				. ,		
1/0 contact	Insertable in the slot from above,	PNP	Cable, 3-wire	2.5	574335	SMT-8M-A-PS-24V-E-2,5-0E
	flush with the cylinder profile,		Plug M8x1, 3-pin	0.3	574334	SMT-8M-A-PS-24V-E-0,3-M8D
<b>*****</b> *******************************	short design					
N/C contact						
	Insertable in the slot from above,	PNP	Cable, 3-wire	7.5	574340	SMT-8M-A-PO-24V-E-7,5-0E
	flush with the cylinder profile,					
<u>"</u>	short design				:	
Ordering data	– Connecting cables					Data sheets → Internet: nel
	Electrical connection, left	Electrical	connection, right	Cable length	Part no.	Туре
				[m]		
2	Straight socket, M8x1, 3-pin	Cable, ope	en end, 3-wire	2.5	541333	NEBU-M8G3-K-2.5-LE3
			•	5	541334	NEBU-M8G3-K-5-LE3
<i>D</i>	Angled socket, M8x1, 3-pin	Cable, ope	en end, 3-wire	2.5	541338	NEBU-M8W3-K-2.5-LE3
				5	541341	NEBU-M8W3-K-5-LE3