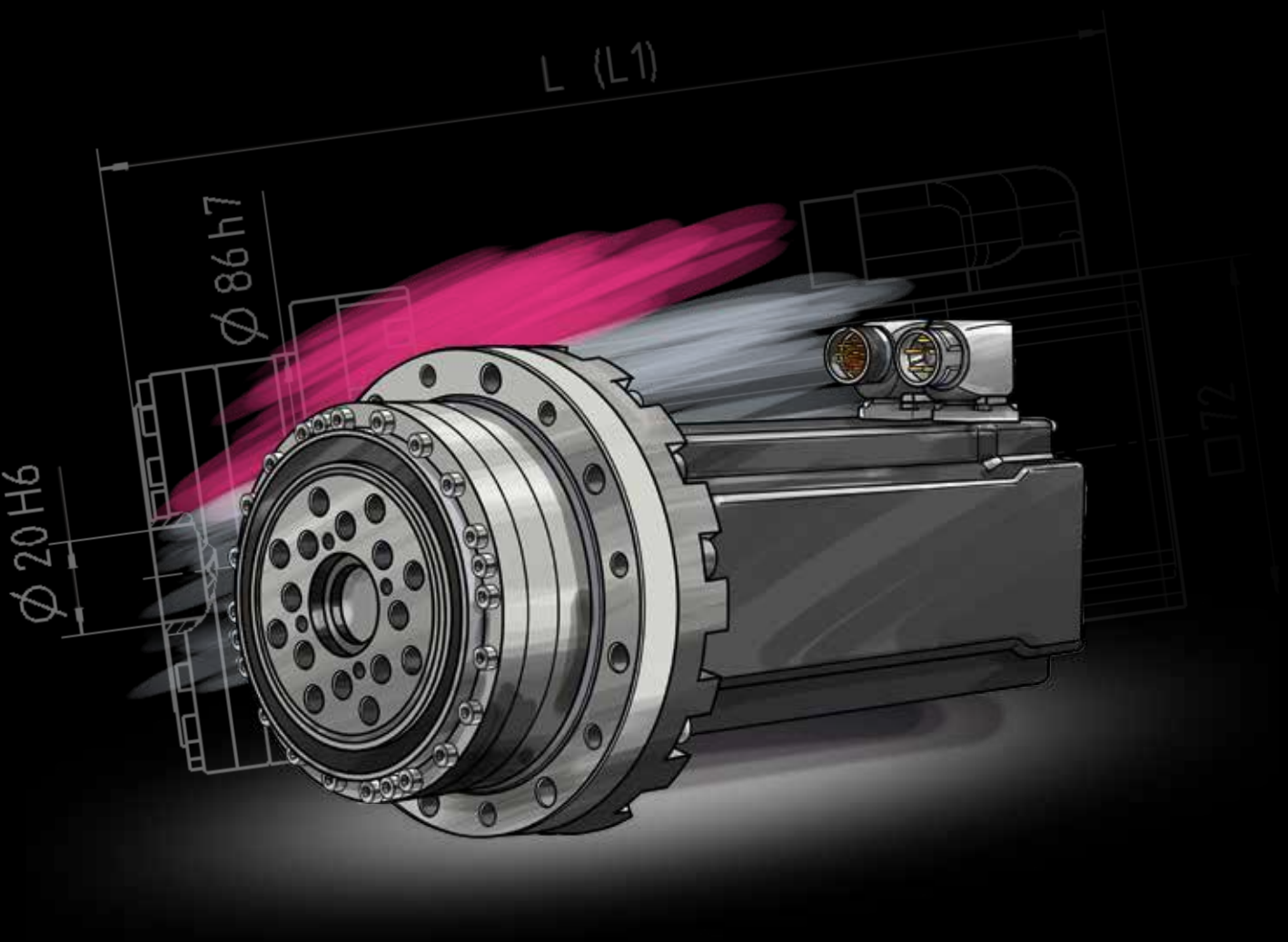
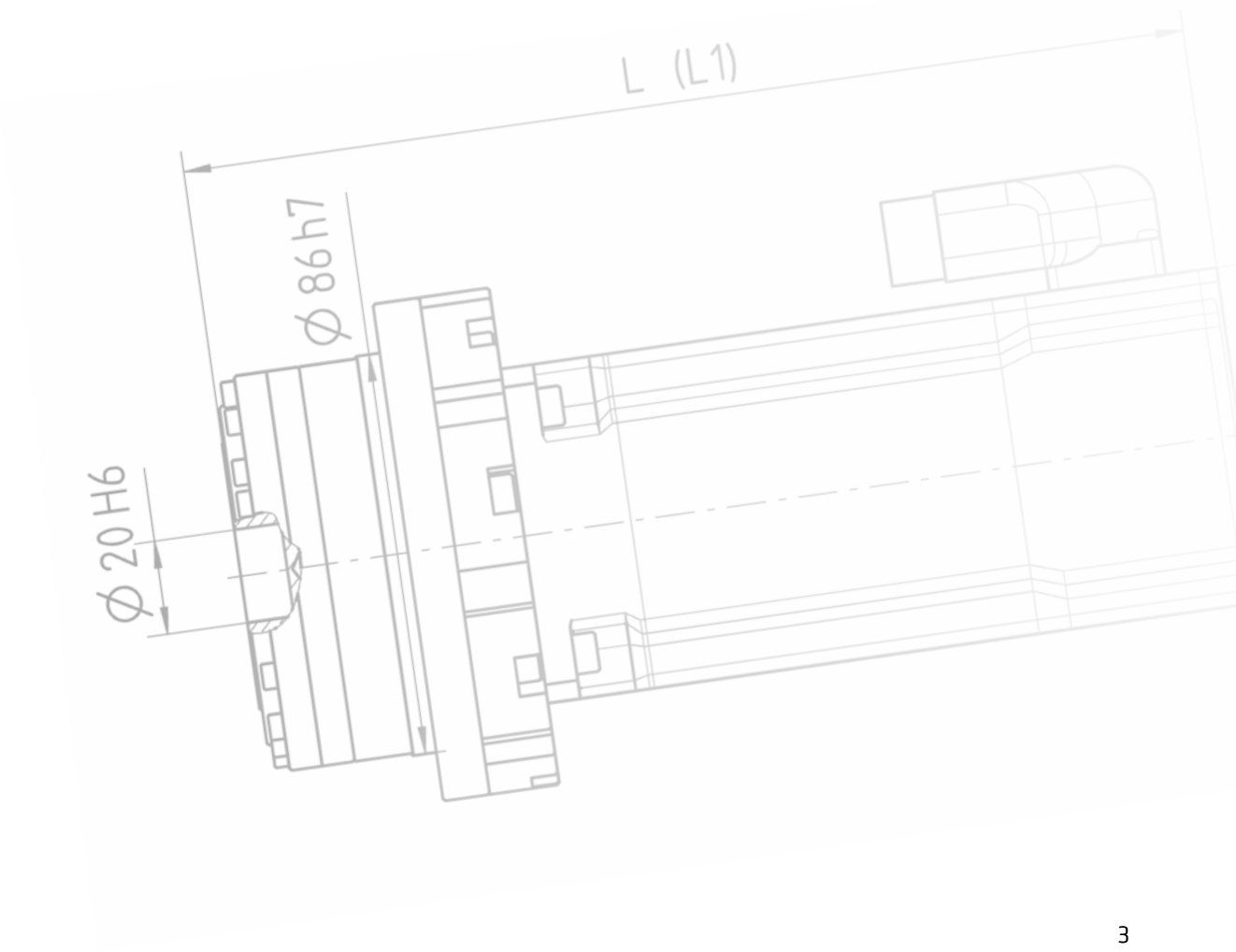
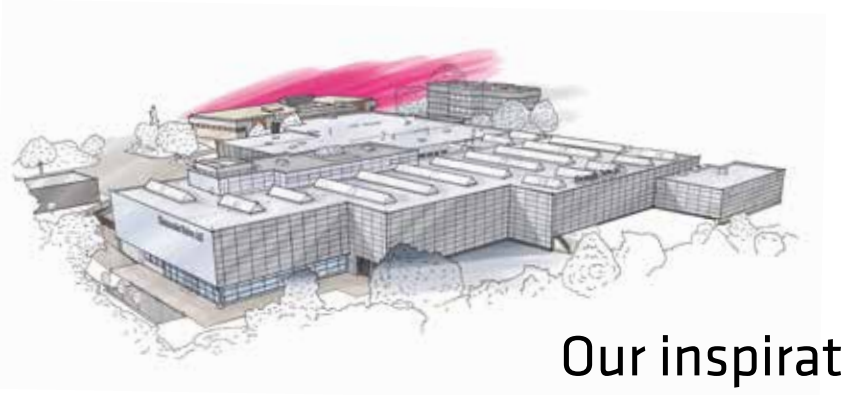
Servo Actuators BDA

Harmonic Drive AG



Content





Our inspiration

Your business drives us. For every individual set of requirements, we have an equally diverse range of solutions: four out of every five products that leave our company are special versions, developed, designed, and produced to customer specifications – from space saving component sets to customised special drives. Harmonic Drive® Precision Drive Technology based on the strain wave gear principle can be found in machine tools, and of course also in robotics, the aerospace industry, and numerous other key industries.

Our headquarters are in Limburg an der Lahn, Germany, but our marketplace is the entire world. Since the company was founded in 1970, Harmonic Drive AG has grown from a small distribution company to a leading international solution provider with production capability for drive technology – with a parent company in Japan and a sister company in the USA, employees in more than 20 locations worldwide, and a product range of over 23,000 items.

Each product reflects our extensive expertise – and also the conviction that successful innovations are not made for the market, but are created by the market. We are your reliable partner when it comes to developing solutions together that ideally meet your needs – as a result Harmonic Drive AG has been creating pioneering products for nearly half a century.

Find out for yourself: share your next challenge with us and find out how your business can become a driving force for innovation.


Harmonic Drive AG

Far beyond the horizon

Our highly developed drive solutions can be found all over the world – and even above it: gears from Harmonic Drive AG ensure that the "Opportunity" space probe is still operating reliably more than 13 years after its precise landing on the surface of Mars.

Whether it's a red or blue planet: gears, actuators and systems from Harmonic Drive AG are used wherever the highest demands are placed on quality and reliability. It is no wonder that our pioneering mechatronic products are used today in a wide range of key industries.

Thanks to local sites worldwide and close cooperation with our parent company in Japan and our sister company in the USA, we ensure that you can benefit from customised Harmonic Drive® Solutions around the globe – we are there where you need us, crossing national borders and time zones with ease, and facing tricky challenges with enthusiasm.

We successfully meet the requirements of our customers from a wide range of industries. The driving force behind our success is creativity and customer focus: more than 80% of our solutions are developments that we have designed and produced ourselves for specific purposes – from applications in optical machines in India to communications engineering in South Africa.

Let us know what you need: we are sure to have the ideal solution for your requirements.

Maybe you will think of us the next time you travel the globe in a plane from the Airbus range, where high precision Harmonic Drive® Gears for aviation help ensure that you have a safe flight and put the world at your feet.

Highest dynamics and economical design

The BDA Series Servo Actuator consists of a synchronous servo motor and a precision gearbox. The series offers maximum torque between 9.8 Nm and 647 Nm and is available in seven sizes.

Flexibility in gear selection

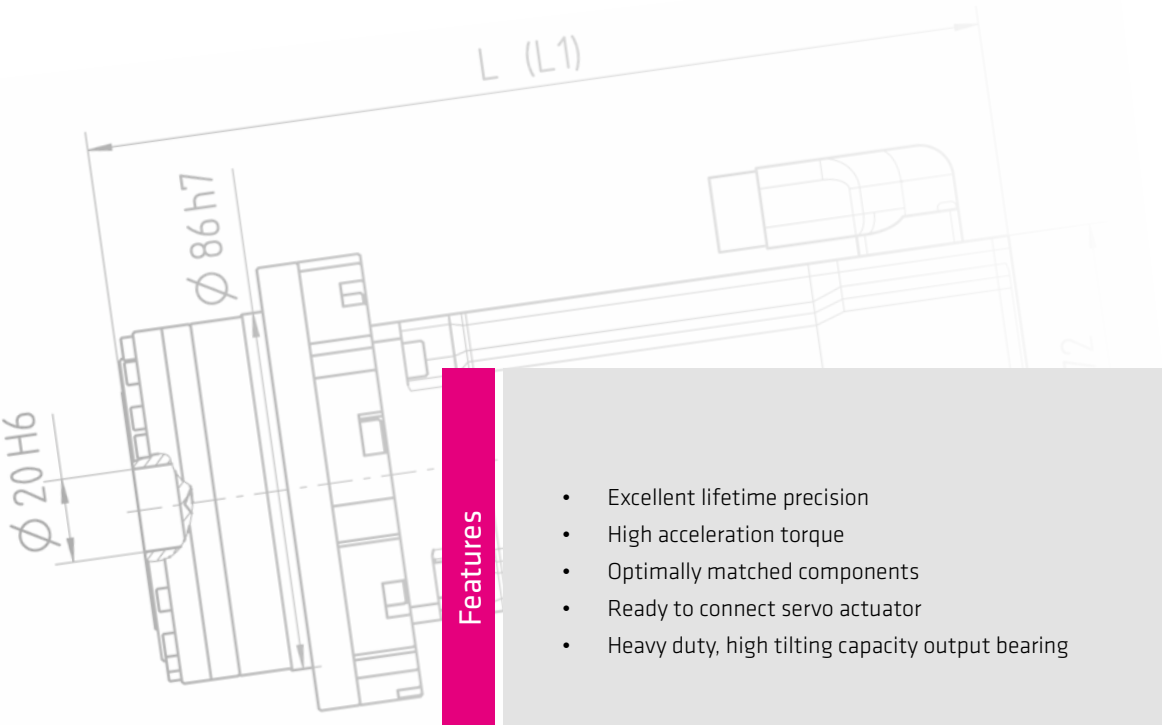
Harmonic Drive ® Servo Actuators are the perfect combination of highly dynamic, compact motors, precise Harmonic Drive® Component Sets and highly stable output bearings for receiving high loads.

To adapt to specific applications, the BDA Series offers a selection of zero backlash strain wave gears or low backlash planetary gears. The high tilting capacity output bearing allows the direct attachment of high payloads without the need for further support, thus allowing a simple and space saving construction.

Multiple combination possibilities

The BDA Series offers numerous possible combinations of motor windings, motor feedback systems, brakes and connectors. The connectors are rotatable and the electrical connection can have multiple positions.

The flexibility in its configuration allows compatibility with almost all servo motors on the market. With the servo controller of the YukoDrive® Series, specially adapted to the needs of the Harmonic Drive® Servo Actuators, a pre-configured gear system is available from a single source, specifically tailor made for your application.



Features

- Excellent lifetime precision
- High acceleration torque
- Optimally matched components
- Ready to connect servo actuator
- Heavy duty, high tilting capacity output bearing

Optimised for your applications:

- Best positioning and highest synchronisation
- Short cycle times
- Low configuration effort
- Easy integration
- Simple, direct load connection

Customer Benefits

BDA

Ordering code

Table 10.1

Series	Size Version	Ratio			Gear type	Motor winding	Connector configuration	Motor feedback	Brake
BDA	14A	50	100		HFUC	BL	Y1	ROO MGH	B
	17A	50	100			AS			
	20A	50	100	160		AU			
	25A	50	100	160		AV			
	32A	50	100	160		AW	L1		
	40A	50	100	160		AW			
BDA	11A	21	37		HPG	BM	Y1	ROO MGH	B
	14A	21	33			AS			
	20A	21	33			AW	L1		
	32A	21	33			AW			

Ordering code

BDA	-	20A	-	100	-	HFUC	-	AU	-	Y1	-	MGH	-	B

Table 10.2

Ratio Gear type		
Ordering code	Ratio	Gear type
HPG	21	HPG Planetary gear
	33	
	37	
HFUC	50	HFUC-2UH Unit
	100	
	160	

Table 10.3

Motor winding		
Size Version	Ordering code	Maximum DC bus voltage
11A	BM	325 VDC
14A	BL	
14A	AS	565 VDC
17A	AS	
20A	AU	
	AW	
25A	AV	
32A	AW	
40A	AW	

Table 10.4

Connector configuration			
Ordering code	Motor feedback	Motor	Motor feedback
Y1	ROO MGH	9 pin (ytec®)	12 pin (ytec®)
L1	ROO	8 pin (M23)	12 pin (M23)
	MGH	8 pin (M23)	17 pin (M23)

Table 10.5

Motor feedback		
Ordering code	Type	Protocol
ROO	Resolver	–
MGH	Multi-turn absolute	HIPERFACE®

Combinations

Table 11.1

Size / Version		BDA									
		11A	14A		17A	20A		25A	32A		40A
Ratio	21	●	●	-	-	●	-	-	●	-	-
	33	-	●	-	-	●	-	-	●	-	-
	37	●	-	-	-	-	-	-	-	-	-
	50	-	-	●	●	-	●	●	-	●	●
	100	-	-	●	●	-	●	●	-	●	●
	160	-	-	-	-		●	●	-	●	●
Gear type	HFUC	-	-	●	●	-	●	●	-	●	●
	HPG	●	●	-	-	●	-	-	●	-	-
Motor winding	BL	-	-	●	-	-	-	-	-	-	-
	BM	●	-	-	-	-	-	-	-	-	-
	AS	-	●	-	●	-	-	-	-	-	-
	AU	-	-	-	-	-	●	-	-	-	-
	AV	-	-	-	-	-	-	●	-		-
	AW	-	-	-	-	●	-	-	●	●	●
Connector configuration	Y1	●	●	●	●	-	●	●	-	-	-
	L1	-	-	-	-	●	-	-	●	●	●
Motor feedback	ROO	●	●	●	●	●	●	●	●	●	●
	MGH	●	●	●	●	●	●	●	●	●	●
Brake	B	●	●	●	●	●	●	●	●	●	●

● available ○ on request – not available

Technical data

Table 12.1

	Symbol [Unit]	BDA-11A		BDA-14A	
Motor feedback		ROO / MGH		ROO / MGH	
Gear type		HPG-11		HPG-14	
Ratio	i [ ]	21	37	21	33
Maximum output torque	T_{max} [Nm]	9.8	9.8	23	23
Maximum output speed	n_{max} [rpm]	381	216	286	182
Continuous stall torque	T_0 [Nm]	6.0	6.0	15	15
Moment of inertia					
- with resolver ROO without brake	J_{out} [kgm²]	0.003	0.009	0.038	0.094
- with resolver ROO with brake	J_{out} [kgm²]	0.004	0.013	0.041	0.102
- with encoder MGH without brake	J_{out} [kgm²]	0.003	0.009	0.038	0.094
- with encoder MGH with brake	J_{out} [kgm²]	0.004	0.013	0.041	0.102
Brake holding torque	T_{Br} [Nm]	9.8	9.8	23	23
Weight without brake	m [kg]	1.2		3.9	
Weight with brake	m [kg]	1.4		4.3	
Transmission accuracy	[arcmin]	< 5		< 4	
Lost Motion	[arcmin]	≤ 3		≤ 1	
Torsional stiffness	K_3 [· 10³ Nm/rad]	2.2		4.7	
Ambient operating temperature	[°C]	0 ... 40		0 ... 40	
Output bearing					
Dynamic radial load	$F_{R\,dyn\,(max)}$ [N]	440	520	720	830
Dynamic axial load	$F_{A\,dyn\,(max)}$ [N]	660	780	1080	1240
Dynamic tilting moment	$M_{dyn\,(max)}$ [Nm]	9.5		32.3	

Table 12.2

	Symbol [Unit]	BDA-20A		BDA-32A	
Motor feedback		ROO / MGH		ROO / MGH	
Gear type		HPG-20		HPG-32	
Ratio	i [ ]	21	33	21	33
Maximum output torque	T_{max} [Nm]	100	100	300	300
Maximum output speed	n_{max} [rpm]	238	152	190	121
Continuous stall torque	T_0 [Nm]	55	60	170	200
Moment of inertia					
- with resolver ROO without brake	J_{out} [kgm²]	0.112	0.276	0.394	0.973
- with resolver ROO with brake	J_{out} [kgm²]	0.141	0.347	0.444	1.095
- with encoder MGH without brake	J_{out} [kgm²]	0.112	0.276	0.394	0.973
- with encoder MGH with brake	J_{out} [kgm²]	0.141	0.347	0.444	1.095
Brake holding torque	T_{Br} [Nm]	100	100	246	300
Weight without brake	m [kg]	7.8		14.6	
Weight with brake	m [kg]	8.7		15.6	
Transmission accuracy	[arcmin]	< 4		< 4	
Lost Motion	[arcmin]	≤ 1		≤ 1	
Torsional stiffness	K_3 [· 10³ Nm/rad]	18.5		74.1	
Ambient operating temperature	[°C]	0 ... 40		0 ... 40	
Output bearing					
Dynamic radial load	$F_{R\,dyn\,(max)}$ [N]	1510	1730	2920	3340
Dynamic axial load	$F_{A\,dyn\,(max)}$ [N]	2250	2580	4360	4990
Dynamic tilting moment	$M_{dyn\,(max)}$ [Nm]	183		452	

Illustration 13.1

BDA-11A-HPG [mm]

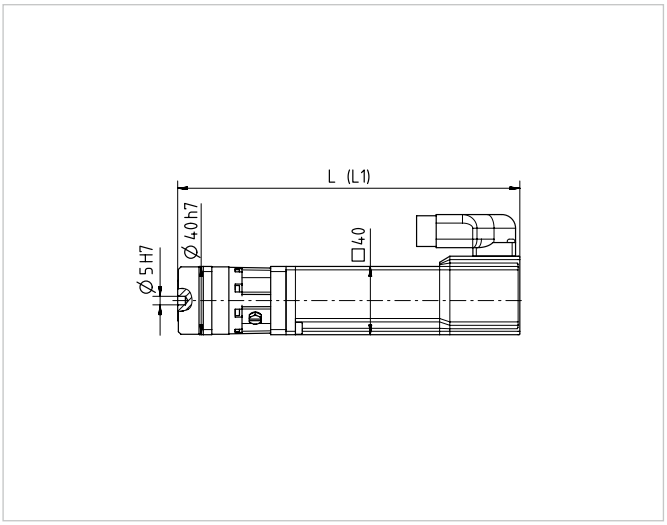


Illustration 13.2

BDA-14A-HPG [mm]

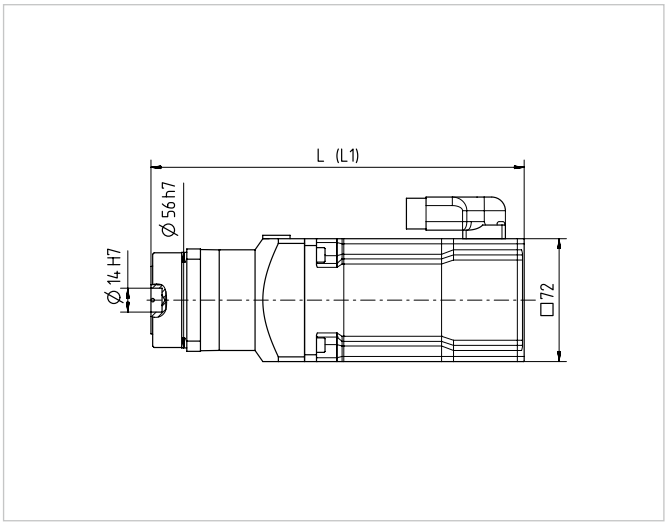


Table 13.3

	Symbol [Unit]	BDA-11A	BDA-14A
Gear type		HPG	HPG
Motor feedback		ROO / MGH	ROO / MGH
Length (without brake)	L [mm]	201	219
Length (with brake)	L1 [mm]	233	258

Illustration 13.4

BDA-20A-HPG [mm]

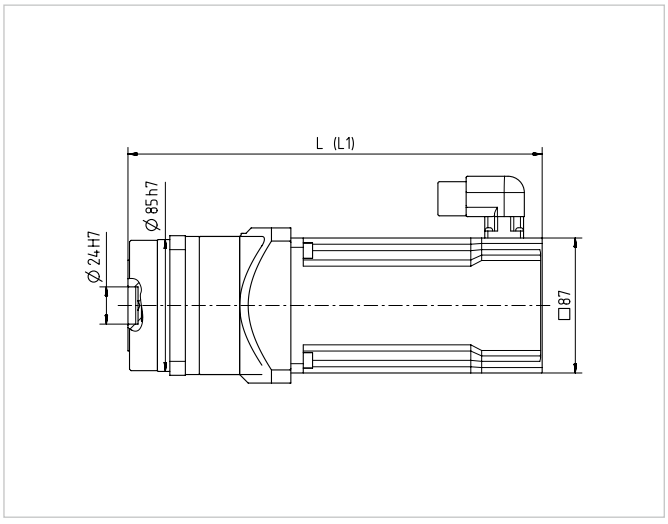


Illustration 13.5

BDA-32A-HPG [mm]

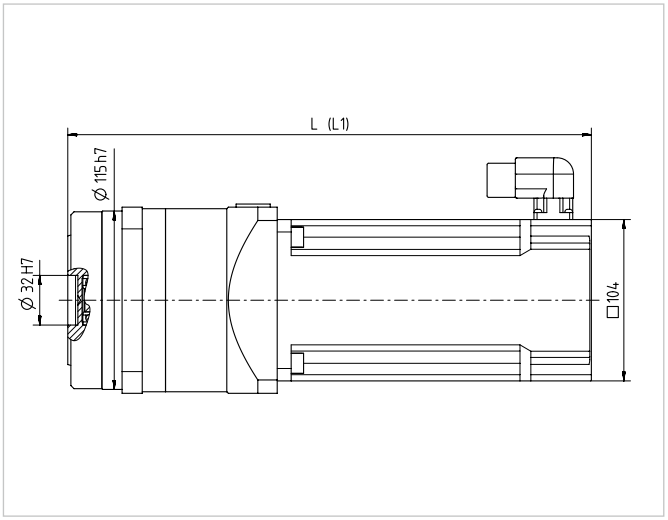


Table 13.6

	Symbol [Unit]	BDA-20A	BDA-32A
Gear type		HPG	HPG
Motor feedback		ROO / MGH	ROO / MGH
Length (without brake)	L [mm]	267	338
Length (with brake)	L1 [mm]	315	387

Technical data

Table 14.1

	Symbol [Unit]	BDA-14A		BDA-17A	
Motor feedback		ROO / MGH		ROO / MGH	
Gear type		HFUC-14		HFUC-17	
Ratio	i [ ]	50	100	50	100
Maximum output torque	T_{max} [Nm]	18	28	34	54
Maximum output speed	n_{max} [rpm]	160	80	146	73
Continuous stall torque	T_0 [Nm]	6.9	11	26	39
Moment of inertia					
- with resolver ROO without brake	J_{out} [kgm²]	0.026	0.105	0.129	0.515
- with resolver ROO with brake	J_{out} [kgm²]	0.032	0.128	0.135	0.538
- with encoder MGH without brake	J_{out} [kgm²]	0.026	0.105	0.129	0.515
- with encoder MGH with brake	J_{out} [kgm²]	0.032	0.128	0.135	0.538
Brake holding torque	T_{Br} [Nm]	18	28	34	54
Weight without brake	m [kg]	1.5		2.5	
Weight with brake	m [kg]	1.72		2.7	
Transmission accuracy	[arcmin]	< 2		< 1.5	
Lost Motion	[arcmin]	< 1		< 1	
Torsional stiffness	K_3 [· 10³ Nm/rad]	5.7	7.1	13	16
Ambient operating temperature	[°C]	0 ... 40		0 ... 40	
Output bearing					
Dynamic radial load	$F_{R\,dyn\,(max)}$ [N]	1928		2148	
Dynamic axial load	$F_{A\,dyn\,(max)}$ [N]	2878		3207	
Dynamic tilting moment	$M_{dyn\,(max)}$ [Nm]	41		64	

Table 14.2

	Symbol [Unit]	BDA-20A			BDA-25A		
Motor feedback		ROO / MGH			ROO / MGH		
Gear type		HFUC-20			HFUC-25		
Ratio	i [ ]	50	100	160	50	100	160
Maximum output torque	T_{max} [Nm]	56	82	92	98	157	176
Maximum output speed	n_{max} [rpm]	120	60	38	112	56	35
Continuous stall torque	T_0 [Nm]	34	49	49	55	108	108
Moment of inertia							
- with resolver ROO without brake	J_{out} [kgm²]	0.19	0.76	1.94	0.39	1.54	3.95
- with resolver ROO with brake	J_{out} [kgm²]	0.21	0.84	2.15	0.41	1.62	4.15
- with encoder MGH without brake	J_{out} [kgm²]	0.19	0.76	1.94	0.39	1.54	3.95
- with encoder MGH with brake	J_{out} [kgm²]	0.21	0.84	2.15	0.41	1.62	4.15
Brake holding torque	T_{Br} [Nm]	56	82	92	90	157	176
Weight without brake	m [kg]	3.0			4.2		
Weight with brake	m [kg]	3.4			4.6		
Transmission accuracy	[arcmin]	< 1.5			< 1.5		
Lost Motion	[arcmin]	< 1			< 1		
Torsional stiffness	K_3 [· 10³ Nm/rad]	23	29		44	57	
Ambient operating temperature	[°C]	0 ... 40			0 ... 40		
Output bearing							
Dynamic radial load	$F_{R\,dyn\,(max)}$ [N]	2354			8600		
Dynamic axial load	$F_{A\,dyn\,(max)}$ [N]	3511			15800		
Dynamic tilting moment	$M_{dyn\,(max)}$ [Nm]	91			156		

Illustration 15.1 BDA-14A-HFUC [mm]

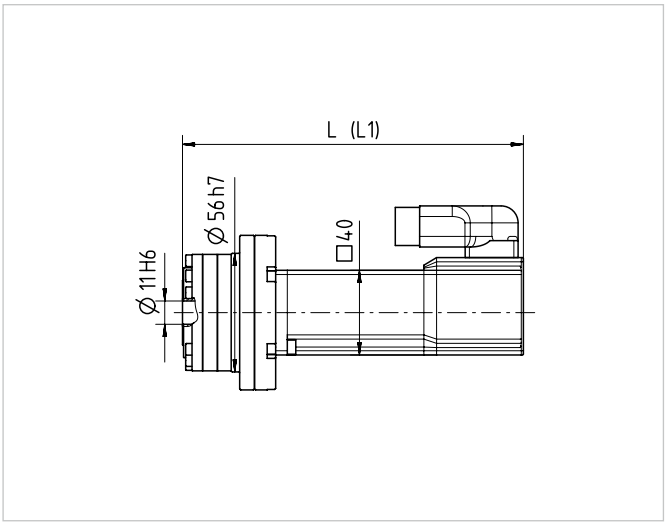


Illustration 15.2 BDA-17A-HFUC [mm]

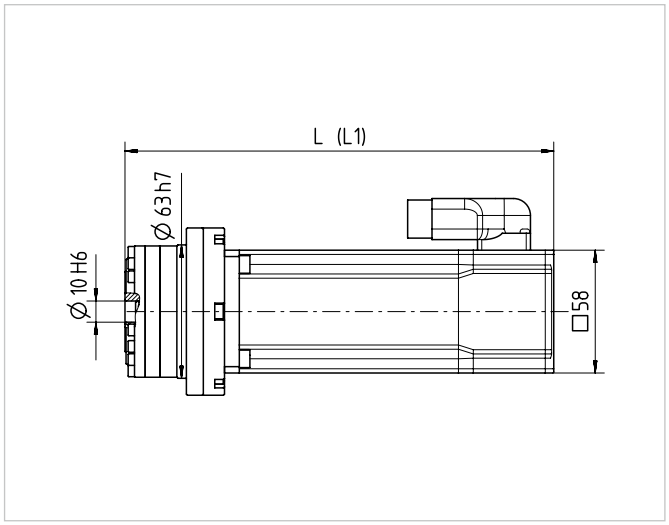


Table 15.3

	Symbol [Unit]	BDA-14A	BDA-17A
Gear type		HFUC	HFUC
Motor feedback		ROO / MGH	ROO / MGH
Length (without brake)	L [mm]	161	196
Length (with brake)	L1 [mm]	193	237

Illustration 15.4 BDA-20A-HFUC [mm]

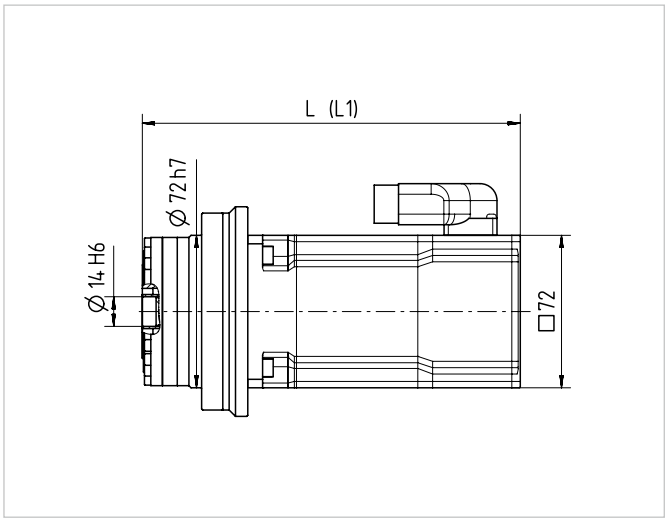


Illustration 15.5 BDA-25A-HFUC [mm]

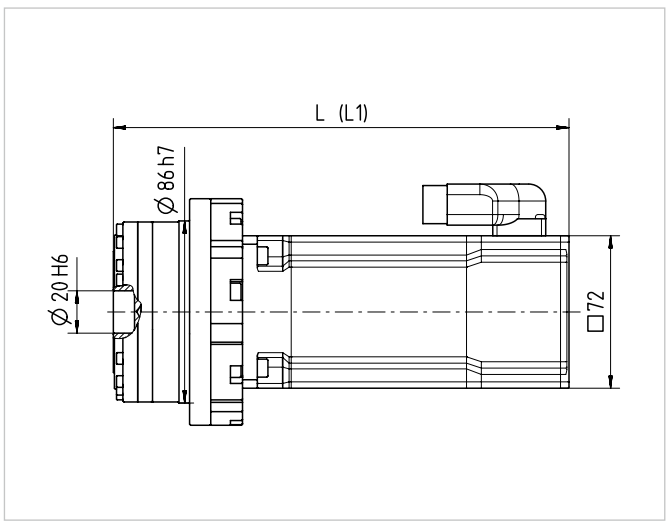


Table 15.6

	Symbol [Unit]	BDA-20A	BDA-25A
Gear type		HFUC	HFUC
Motor feedback		ROO / MGH	ROO / MGH
Length (without brake)	L [mm]	172	208
Length (with brake)	L1 [mm]	218	255

Technical data

Table 16.1

	Symbol [Unit]	BDA-32A			BDA-40A		
Motor feedback		ROO / MGH			ROO / MGH		
Gear type		HFUC-32			HFUC-40		
Ratio	i [ ]	50	100	160	50	100	160
Maximum output torque	T_{max} [Nm]	216	333	372	402	568	647
Maximum output speed	n_{max} [rpm]	96	48	30	80	40	25
Continuous stall torque	T_0 [Nm]	108	216	216	196	372	451
Moment of inertia							
- with resolver ROO without brake	J_{out} [kgm^2]	1.23	4.91	12.6	3.63	14.5	37.2
- with resolver ROO with brake	J_{out} [kgm^2]	1.39	5.56	14.2	3.91	15.6	40.0
- with encoder MGH without brake	J_{out} [kgm^2]	1.23	4.91	12.6	3.63	14.5	37.2
- with encoder MGH with brake	J_{out} [kgm^2]	1.39	5.56	14.2	3.91	15.6	40.0
Brake holding torque	T_{Br} [Nm]	216	333	372	402	568	647
Weight without brake	m [kg]	7.6			13.4		
Weight with brake	m [kg]	8.5			14.4		
Transmission accuracy	[arcmin]	< 1.5			< 1.5		
Lost Motion	[arcmin]	< 1			< 1		
Torsional stiffness	K_3 [$\cdot 10^3$ Nm/rad]	98	120		180	230	
Ambient operating temperature	[°C]	0 ... 40			0 ... 40		
Output bearing							
Dynamic radial load	$F_{R\,dyn\,(max)}$ [N]	6101			8652		
Dynamic axial load	$F_{A\,dyn\,(max)}$ [N]	7926			11242		
Dynamic tilting moment	$M_{dyn\,(max)}$ [Nm]	313			450		

Illustration 17.1 BDA-32A-HFUC [mm]

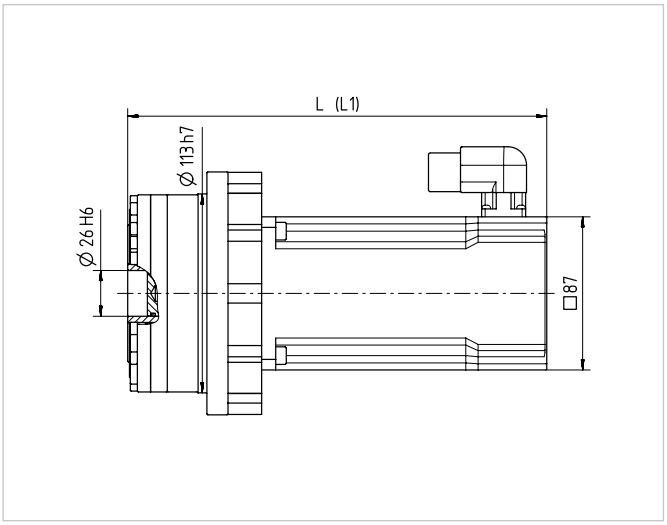


Illustration 17.2 BDA-40A-HFUC [mm]

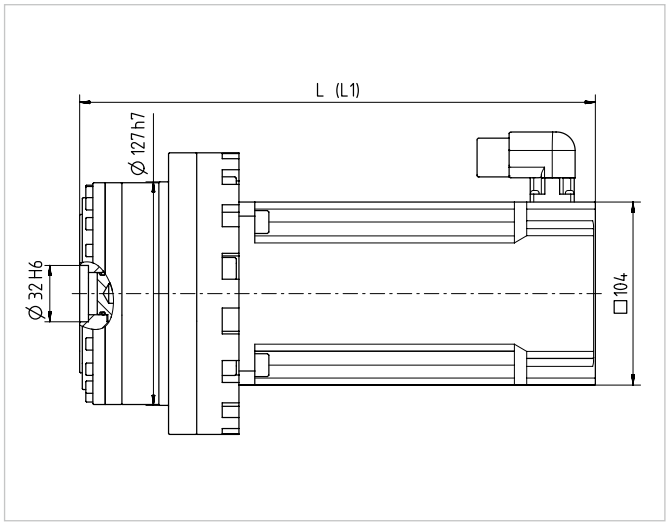


Table 17.3

	Symbol [Unit]	BDA-32A	BDA-40A
Gear type		HFUC	HFUC
Motor feedback		ROO / MGH	ROO / MGH
Length (without brake)	L [mm]	230	284
Length (with brake)	L1 [mm]	286	342

Motor feedback

Encoder

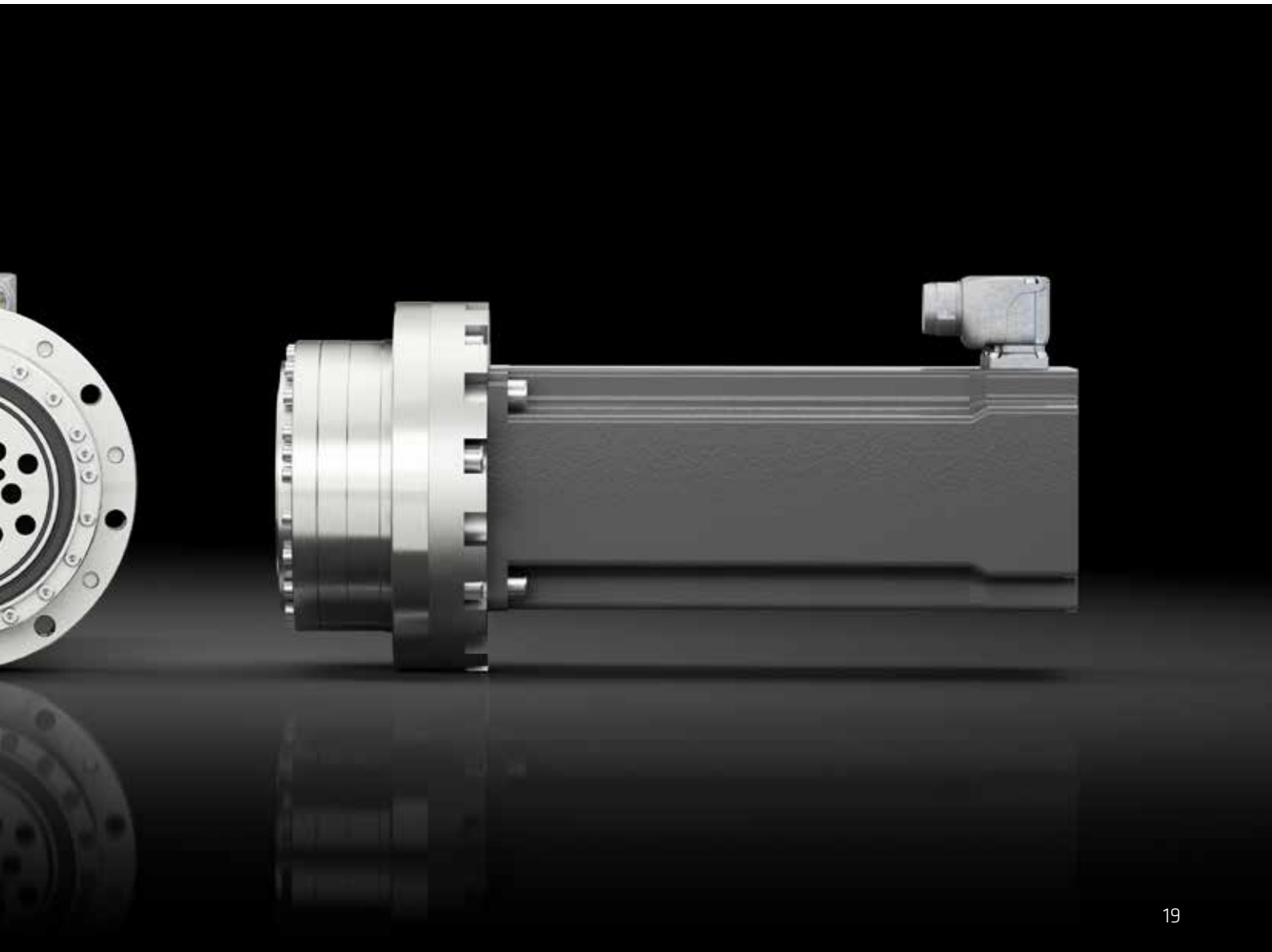
Table 18.1

Type	Multi-turn absolute
Ordering code	MGH
Manufacturer designation	SKM36
Protocol	HIPERFACE®
Power supply	7 ... 12 VDC
Incremental signal	1 V_{ss}
Signal form	sinusoidal
Resolution	128
Absolute position value/revolution	4096 (12 bit)
Revolutions	4096 (12 bit) Mechanical multi-turn

Resolver

Table 19.1

Type	Resolver
Ordering code	R00
Power supply	7 VAC
Input frequency	5 ... 10 kHz
Current dissipation	< 50 mA
Number of pole pairs	1
Transformation ratio	0,5 ±10 %



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