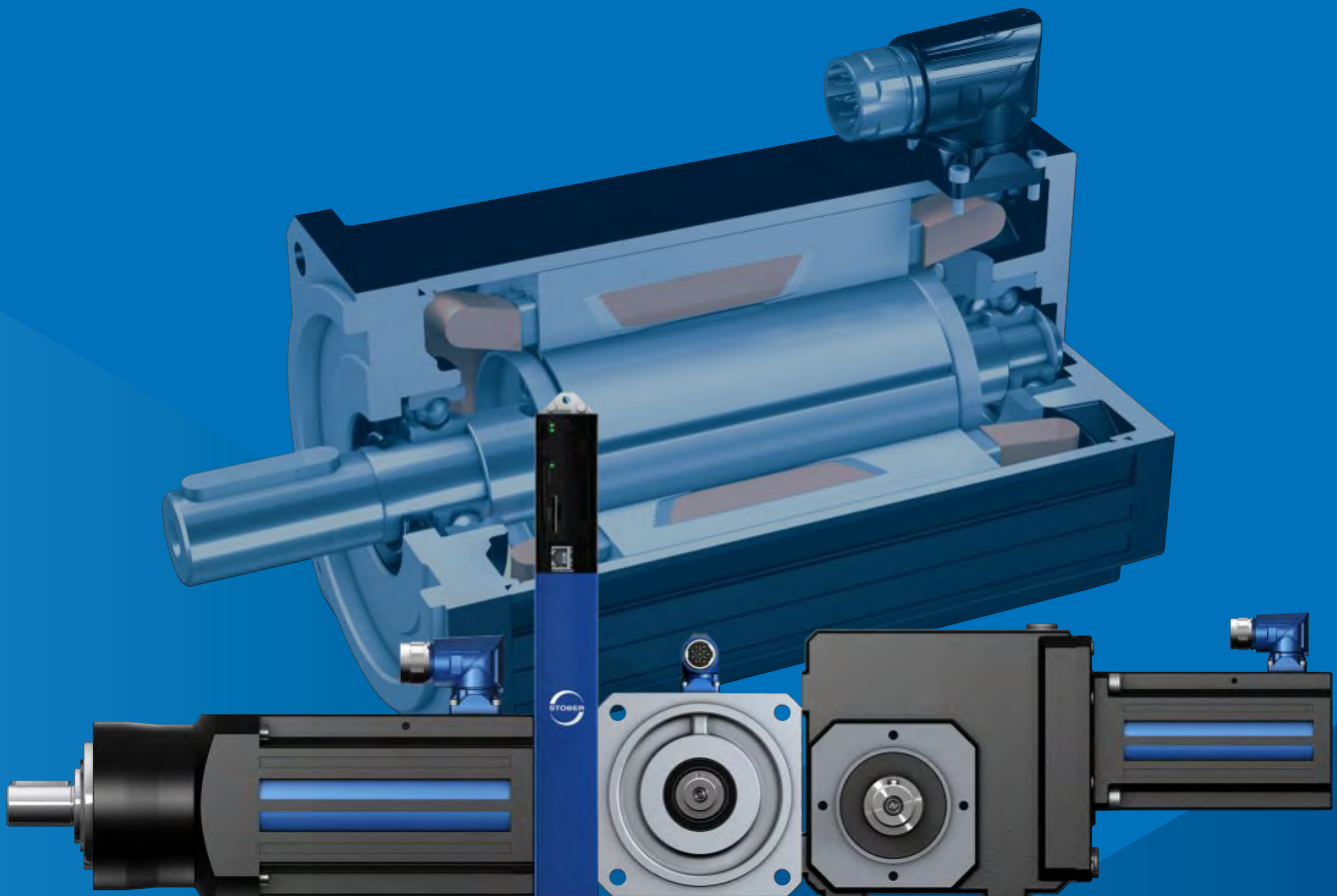


Lean motors

Sensorless drives

IE5 Ultra Premium Efficiency

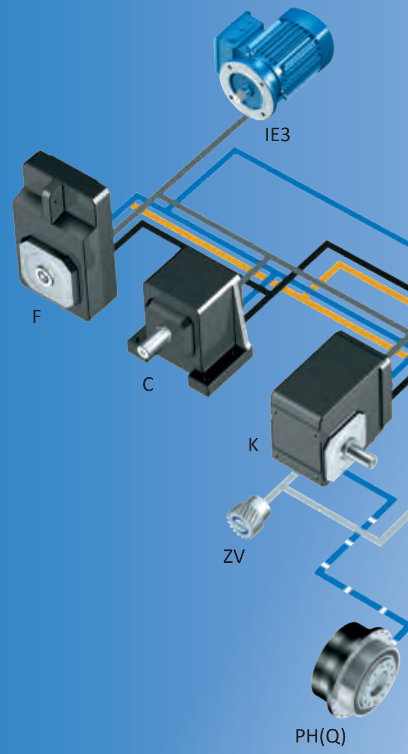
STÖBER

Lean motors

Sensorless drives

One partner. All the possibilities.

STOBER has developed and produced excellent drive technology since 1934 and is active internationally with around 800 employees at 14 locations. STOBER impresses machine manufacturers in wide-ranging industries and markets around the world with tailor-made, highly efficient drive systems for demanding movements.



"Our vision is to be the preferred partner for perfect movement."

- Andreas Thiel, CEO of STÖBER Antriebstechnik.

Lean motors – what you can expect!

In this catalog, we introduce you to the rugged, compact and encoderless STOBER Lean motors. Featuring an IE5 classification and connected with corresponding STOBER SC6 and SI6 drive controllers using a single power cable. They are especially powerful and economical when combined with our precise STOBER servo gear units. It's impossible to be more efficient!

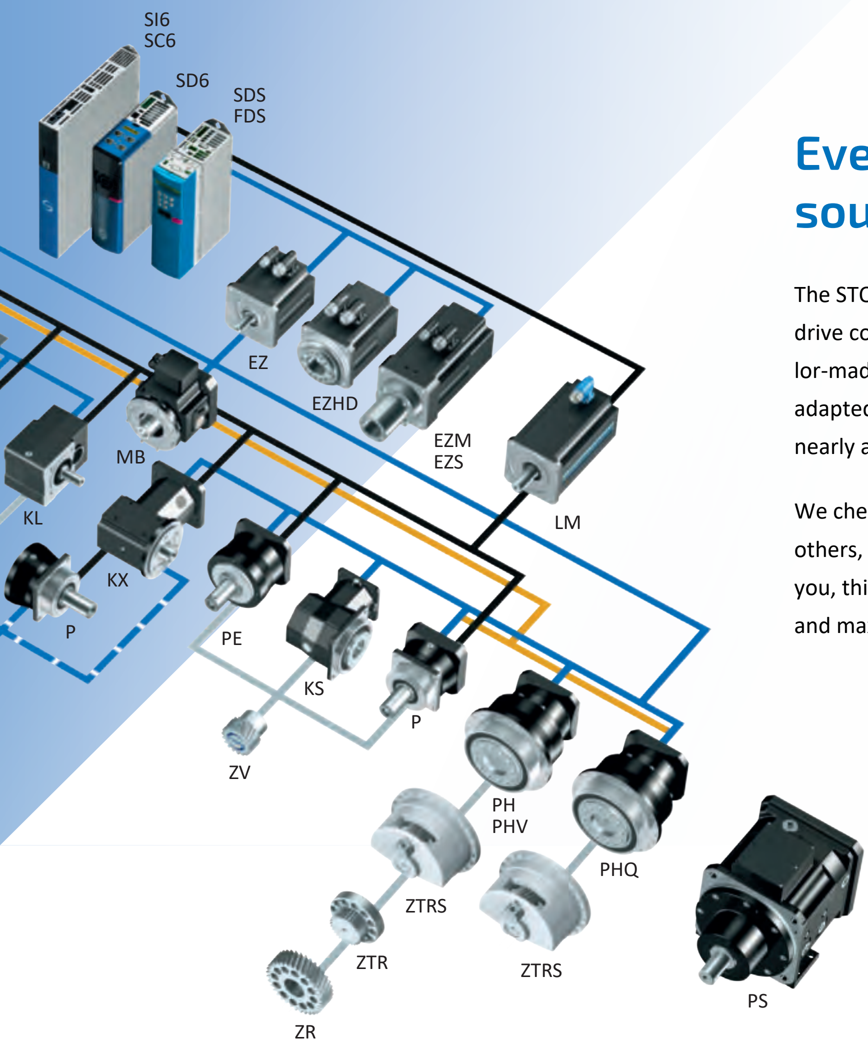
At home in the world of demanding motion

Gear units

Geared motors

Motors

Cables and drive controllers



Everything from a single source.

The STOBER drive system consisting of gear units, motors, cables and drive controllers has a modular design and is freely scalable—for tailor-made, compact and powerful machine concepts. It can be adapted to your individual requirements and combined as needed in nearly all industries and applications areas.

We check every single component and how it works together with others, taking on the responsibility for the complete drive train. For you, this means that one contact partner, certified operating safety and maximum availability are guaranteed.

Need special solutions?

Numerous one-of-a-kind product highlights and project-related adjustments make it possible. With a holistic approach to your specific task, we work together on individualized solutions that are optimally co-ordinated to your requirements. Dedicated and solution-oriented in the support of your visions and projects.

STOBER moves integrally and precisely.

"We put ideas in motion with passion and a great deal of dedication. In the process, we rely on our decades of experience and an exceptionally broad range of products. Our customers benefit from precise, practical system solutions with uncompromising quality and expert individual consultation."

- Patrick Stöber, CEO of STÖBER Antriebstechnik.

STOBER moves as a team and with personality.

As a family-owned company, close relationships are extremely important to us. We build relationships with our employees, customers, and partners based on trust. We put people first.

We advocate for our employees' well-being, see things from our customers' perspectives, and demonstrate personal commitment to our mutual success.

"We have installed gear units, motors and drive controllers from STOBER in nearly all our systems. STOBER supports us in new projects from the first stroke of a pencil in the design phase until commissioning. Our years of cooperation are shaped by openness and honesty and emanate a rather special spirit. The technical consulting, the support—that is real, experienced partnership"

- Jürgen Leicht, Managing Partner of Leicht Stanzautomation.

Working together. Worldwide. Successfully.

With an eye to the future, STOBER is facing the challenges of digitalization and investing in integrated solutions and a strong global production, sales and service presence. STOBER China was founded at the end of 2019. As a result, we are present in more than 40 countries around in the world with eleven subsidiaries and 80 service partners.

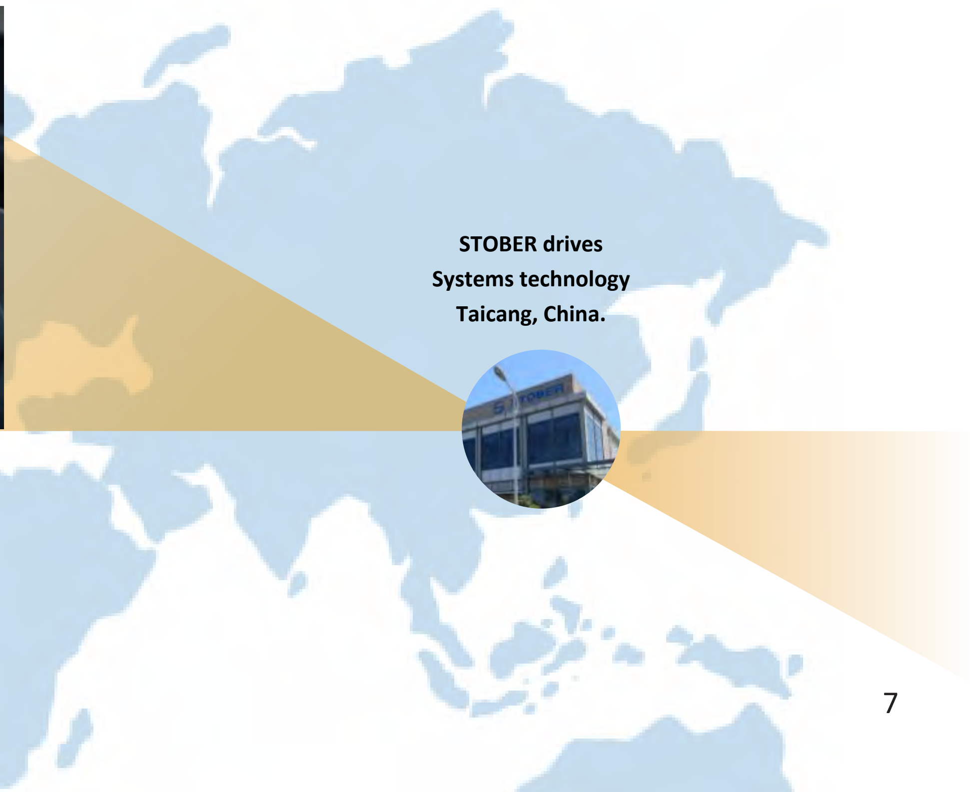


Table of contents

1 Selection tool

1.1 LM Lean motors

Product chapter	**LM**
Chapter number	[▷ 2]

Technical data

M_N	2.25 – 25.7 Nm
M_0	2.43 – 29.8 Nm

An explanation of the formula symbols can be found in the Chapter [▷ 14.1].

Features

Efficiency	★★★★★
Price category	€€€
Key	★☆☆☆☆ good | ★★★★★ excellent € Economy | €€€€€ Premium

Shaft design	
Solid shaft with feather key	✓
Cooling	
Convection cooling	✓
Brake	
Spring-loaded holding brake	✓
Marks and test symbols	
CE	✓
cURus	✓


Product chapter	SC6	SI6
Chapter number	[▶ 3]	[▶ 4]

Technical data

$I_{2N,PU}$	4.5 – 19 A	5 – 50 A
$I_{2N,PU}$	4 – 15 A	4.5 – 40 A
I_{2maxPU}	9.5 – 39.9 A	10.5 – 105 A
I_{2maxPU}	10 – 37.5 A	11.3 – 100 A

An explanation of the formula symbols can be found in the Chapter [▶ 14.1].

Features

Optimal application area		
Number of axes	1 – 4	> 4
Application	Drive based	Controller based
Motor types		
Lean motors	✓	✓
Asynchronous motors	✓	✓
Synchronous servo motors	✓	✓
Torque motors	✓	✓
Encoder interfaces		
EnDat 2.2 digital	✓	✓
Incremental	✓	✓
SSI	✓	✓
Resolver	✓	✓
Pulse/direction signals	✓	✓
EnDat 3 (OCS)	✓	✓
Communication		
EtherCAT	✓	✓
PROFINET	✓	✓
Motor temperature sensor		
PTC thermistor	✓	✓
Safety functions		
STO, SS1: SIL 3, PL e (cat. 4)	(✓)	(✓)
(✓): Safety module required		
Terminals		
Digital inputs	8	8

1 Selection tool

1.2 Drive controllers

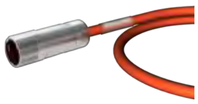
Product chapter	SC6	SI6
Chapter number	[▸ 3]	[▸ 4]

Features

Features		
Multi-axis drive system		✓
Stand-alone	✓	
One Cable Solution (OCS)	✓	✓
Live firmware update	✓	✓
Removable data storage	✓	✓
DC link connection	✓	✓
Applications		
Torque/force mode	✓	✓
Velocity mode	✓	✓
Positioning mode	✓	✓
Interpolating mode	✓	✓
Conformity		
cULus	✓	✓
CE	✓	✓

1 Selection tool

1.3 Connection method



Product chapter	**Cables**
Chapter number	[▸ 5]

Power cables

Design	**Motor plug connector size**
	con.23
speedtec quick lock	✓

Power cores (3 + PE)	**Brake cores**	**Temperature sensor cores**	**Cable ∅**	**Bending radius 1 (min.)**	**Bending radius 2 (min.)**
4 × 1.5 mm^2	2 × 1.0 mm^2	2 × 0.5 mm^2	Max. 12.2 mm	122.0 mm	61.0 mm
4 × 2.5 mm^2	2 × 1.0 mm^2	2 × 1.0 mm^2	Max. 15.0 mm	150.0 mm	75.0 mm

Bending radius: 1 = free to move, 2 = fixed installation

1 Selection tool

1.4 Inline and Offset Geared Motors

Product chapter	P	PE	C	F
Chapter number	[▸ 6]	[▸ 7]	[▸ 8]	[▸ 9]

Technical data

i	3 – 70	3 – 35	2 – 178	4.3 – 274
M_{2acc}	13 – 1840 Nm	13 – 250 Nm	8.7 – 4140 Nm	19 – 1100 Nm
$\Delta\phi_2$	1 – 5 arcmin	8 – 10 arcmin	10 – 20 arcmin	5 – 11 arcmin
η_{get}	95 – 97 %	95 – 97 %	96 – 97 %	96 – 97 %

An explanation of the formula symbols can be found in the Chapter [▸ 14.1].

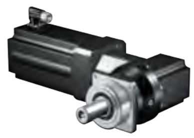
Features

Power density	★★★★☆	★★★☆☆	★☆☆☆☆	★☆☆☆☆
Backlash	★★★★☆	★★★☆☆	★★☆☆☆	★★★☆☆
Price category	€€	€	€	€
Shaft load	★★★★☆	★★☆☆☆	★★☆☆☆	★★★☆☆
Smooth operation	★★★★☆	★★★☆☆	★★★☆☆	★★★☆☆
Torsional stiffness	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆
Mass moment of inertia	★★★★★	★★★★★	★★★★★	★★★★★
Key	★☆☆☆☆ good | ★★★★★ excellent € Economy | €€€€€ Premium			

Shaft design				
Solid shaft with feather key	✓	✓	✓	✓
Solid shaft without feather key	✓		C0 – C5: ✓ Starting at C6: Request	✓
Hollow shaft with keyway				✓
Hollow shaft with shrink ring				✓
Bearing design				
Standard	✓	✓	✓	✓
Axially reinforced	✓			
Radially reinforced	✓			
Maintenance-free	✓	✓	C0 – C5: ✓	✓

1 Selection tool

1.5 Right-angle geared motors

			
Product chapter	**PKX**	**KL**	**K**
Chapter number	[▹ 10]	[▹ 11]	[▹ 12]

Technical data

i	3 – 210	4 – 16	4 – 294
M_{2acc}	13 – 3300 Nm	35 – 60 Nm	17 – 6820 Nm
$\Delta\phi_2$	2 – 8.5 arcmin	16 – 20 arcmin	1.5 – 12 arcmin
η_{get}	94 – 96 %	97 %	94 – 97 %

An explanation of the formula symbols can be found in the Chapter [▹ 14.1].

Features

Power density	★★★★☆	★★☆☆☆	★★☆☆☆
Backlash	★★★★☆	★☆☆☆☆	★★★☆☆
Price category	€€€	€	€€
Shaft load	★★★★☆	★★☆☆☆	★★★☆☆
Smooth operation	★★☆☆☆	★★☆☆☆	★★★☆☆
Torsional stiffness	★★★☆☆	★★☆☆☆	★★☆☆☆
Mass moment of inertia	★★★☆☆	★★★★★	★★★★★
Key	★☆☆☆☆ good | ★★★★★ excellent € Economy | €€€€€ Premium		

Shaft design			
Solid shaft with feather key	✓	✓	✓
Solid shaft without feather key	✓	✓	K1 – K4: ✓ Starting at K5: Request
Solid shaft on both sides		✓	✓
Hollow shaft with keyway		✓	✓
Hollow shaft with shrink ring		✓	✓
Accessories			
Flange		✓	✓
Foot plates		✓	✓
Torque arm bracket			✓
Bearing design			
Standard	✓	✓	✓
Axially reinforced	✓		
Radially reinforced	✓		
Maintenance-free	✓	✓	K1 – K4: ✓

2 LM Lean motors

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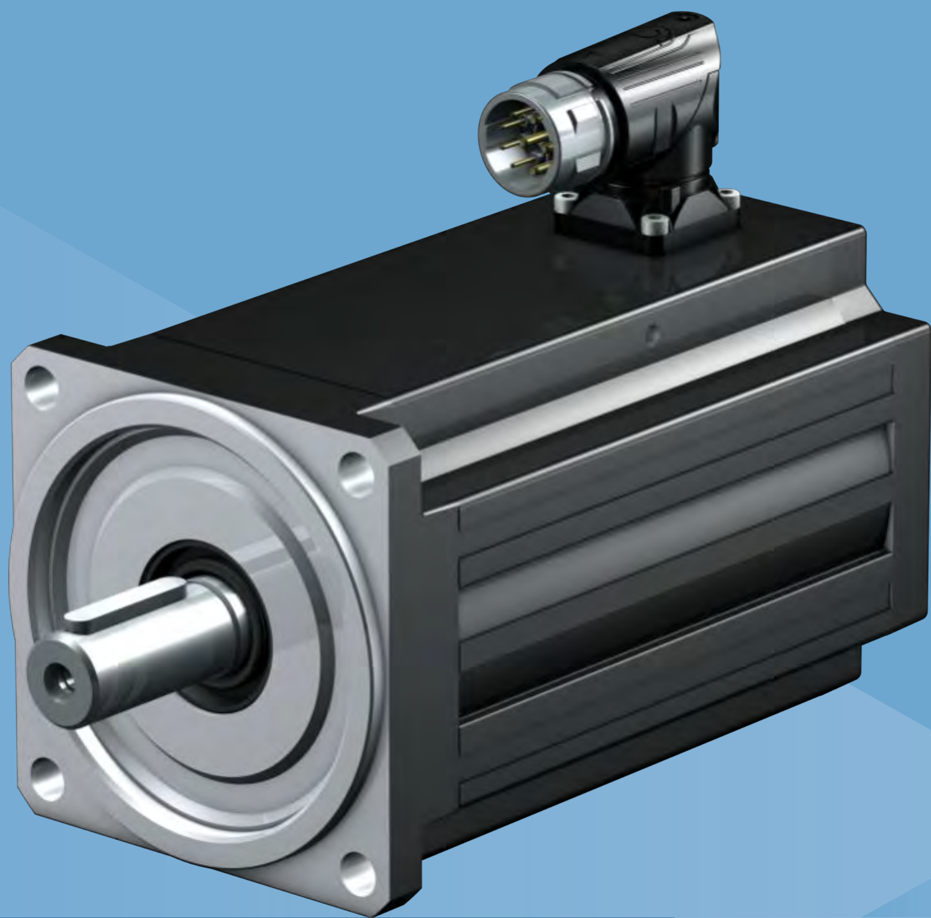


2 Lean motors

LM

2.1 Overview

High-efficiency synchronous motors

Features

Higher energy efficiency than comparable IE4 asynchronous motors	✓
Energy efficiency IE5 in accordance with IEC/TS 60034-30-2	✓
Higher acceleration performance than asynchro-nous motors	✓
Substantially lighter and more compact than comparable asynchronous motors	✓
Rugged thanks to absence of the encoder	✓
Wiring reduced to the power connection cable	✓
Rotating plug connector with quick lock	✓

Technical data

M_N	2.25 – 25.7 Nm
M_0	2.43 – 29.8 Nm

2.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from −15 °C to +40 °C
- Operation on a STOBER drive controller
- DC link voltage U_{ZK} = DC 540 V
- Coating: RAL 9005 Jet black, matte

In addition, the technical data applies to an uninsulated design with the following thermal mounting conditions:

Type	Dimensions of steel mounting flange (thickness x width x height)	Convection surface area Steel mounting flange
LM4, LM5	23 x 210 x 275 mm	0.16 m^2
LM7	28 x 300 x 400 mm	0.3 m^2

Note the differing ambient conditions in Chapter [▶ 2.7.3]

An explanation of the formula symbols can be found in the Chapter [▶ 14.1].

Type	K_{EM} [V/1000 rpm]	n_N [rpm]	M_N [Nm]	I_N [A]	$K_{M,N}$ [Nm/A]	P_N [kW]	η_{mot} [%]	M_0 [Nm]	I_0 [A]	M_R [Nm]	M_{max} <1000 rpm [Nm]	I_{max} <1000 rpm [A]	M_{max} ≥1000 rpm [Nm]	I_{max} ≥1000 rpm [A]	J [kgcm²]	m [kg]
LM401U	110	3000	2.25	1.59	1.42	0.71	85.37	2.43	1.82	0.04	3.77	2.76	4.51	3.31	1.67	4.42
LM402U	120	3000	4.41	2.88	1.53	1.4	87.63	4.50	2.94	0.04	7.84	4.96	9.70	6.16	3.01	6.08
LM403U	120	3000	6.06	3.92	1.55	1.9	90.26	6.19	4.08	0.04	11.5	7.02	12.8	7.85	4.31	7.62
LM503U	135	3000	9.48	5.62	1.69	3.0	92.95	10.1	5.95	0.06	18.3	10.6	20.4	11.8	10.4	10.5
LM505U	135	3000	13.7	7.83	1.75	4.3	94.48	15.5	8.83	0.06	27.2	15.0	32.1	17.8	16.8	15.1
LM704U	145	3000	19.3	10.6	1.81	6.1	95.05	21.3	11.6	0.23	38.8	20.0	41.2	22.3	36.5	20.9
LM706U	140	3000	25.7	14.7	1.75	8.1	95.59	29.8	16.8	0.23	51.5	27.7	61.4	31.7	53.8	28.0

The efficiency η_{mot} was determined based on the standards IEC/TS 60034-30-2 and DIN IEC 60034-2-3.

2.3 Torque/speed curves

Torque/speed curves depend on the nominal speed and/or winding design of the motor and the DC link voltage of the drive controller that is used. The following torque/speed curves apply to the DC link voltage DC 540 V.

At 1000 rpm, the measurement process for detecting the rotor position switches depending on the system, so that the maximum torque of the Lean motor is available as of 1000 rpm.

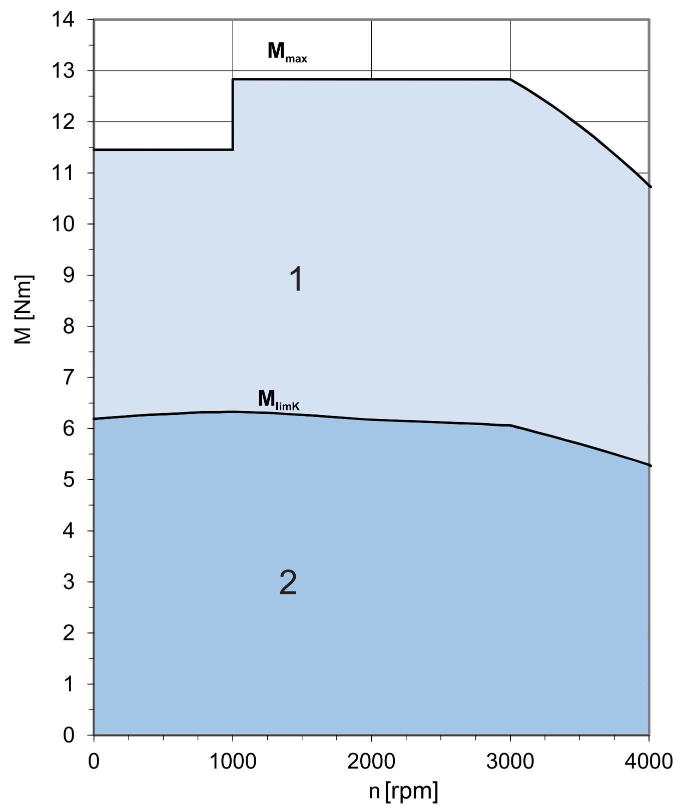
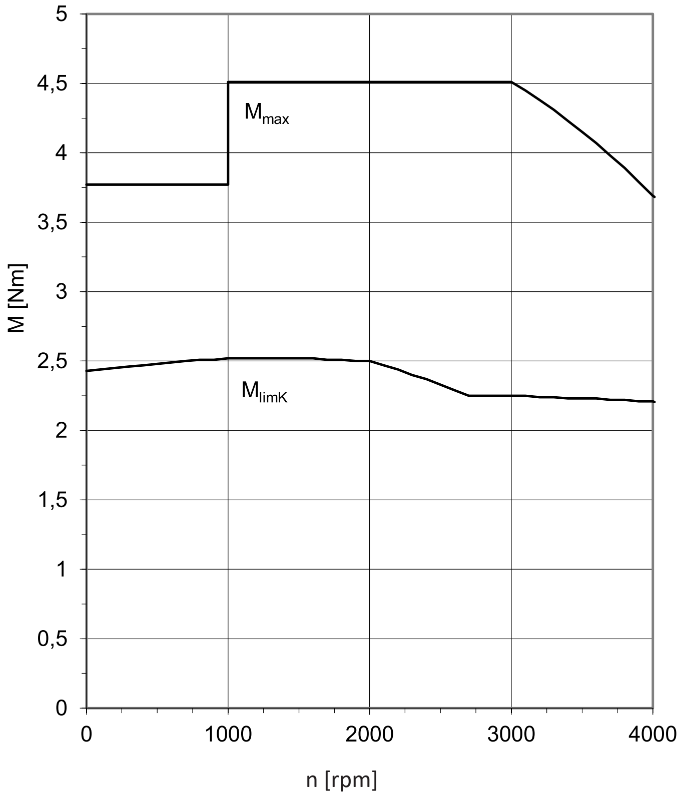


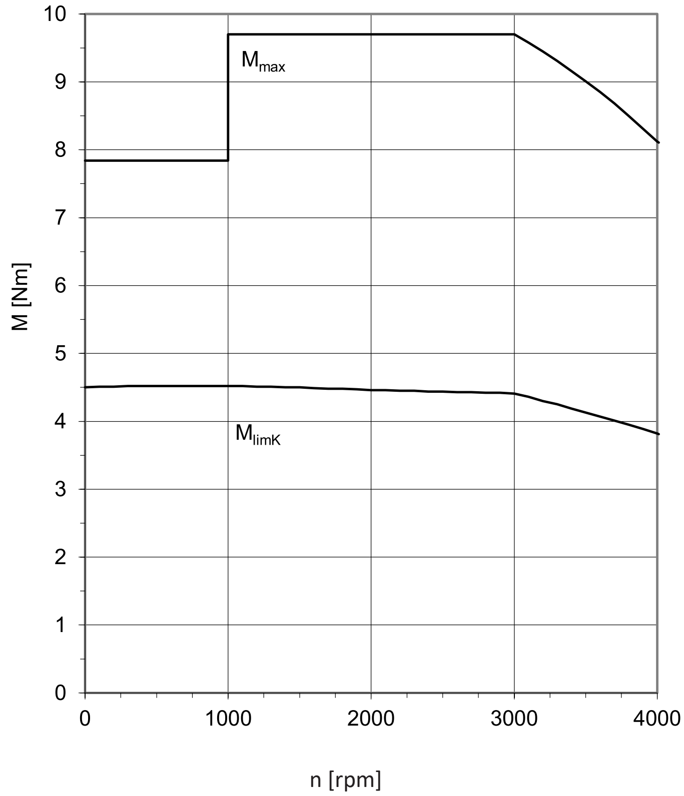
Fig. 1: Explanation of a torque/speed curve

1	Torque range for brief operation (ED_{10} < 100%) with $\Delta\vartheta$ = 100 K
2	Torque range for continuous operation with constant load (S1 mode, ED_{10} = 100%) with $\Delta\vartheta$ = 100 K

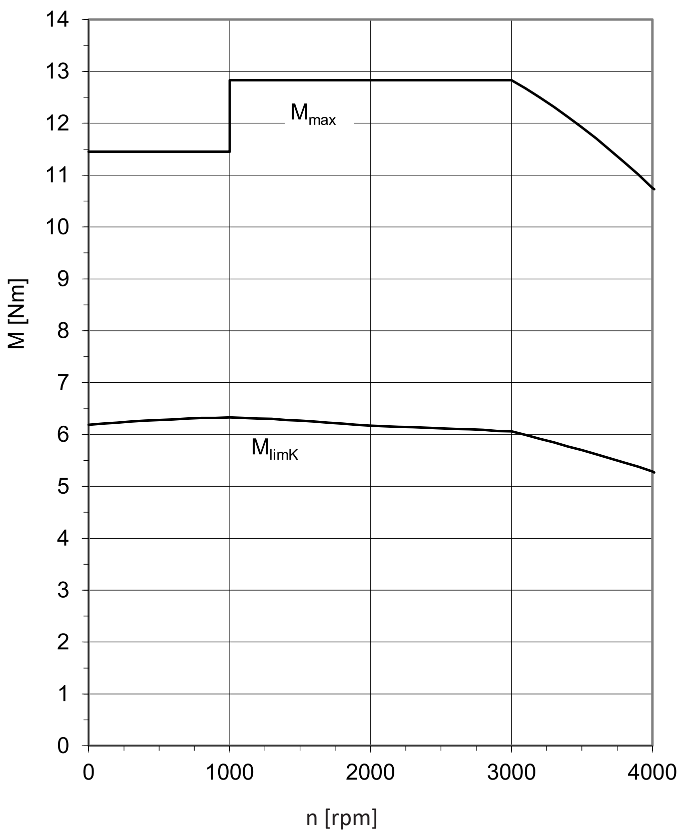
LM401U (n_N=3000 rpm)



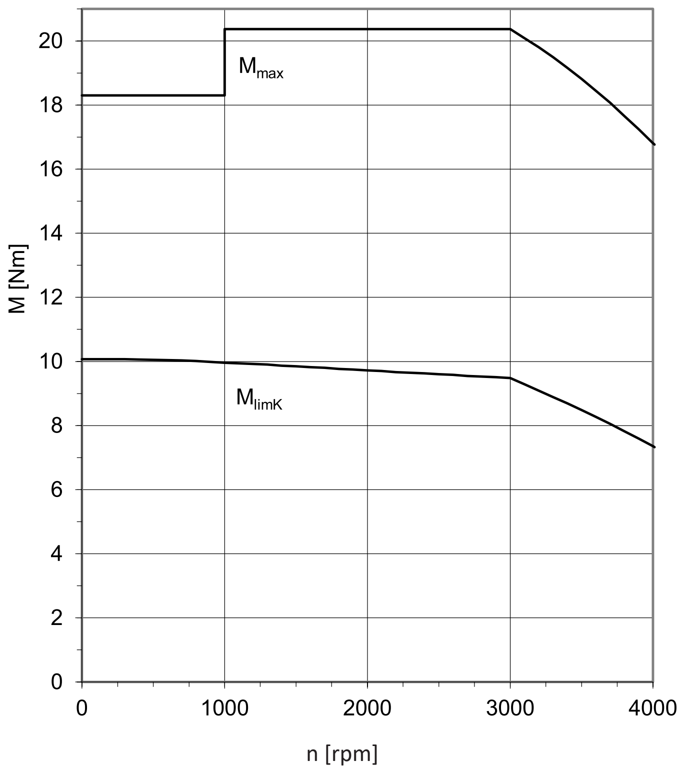
LM402U (n_N=3000 rpm)



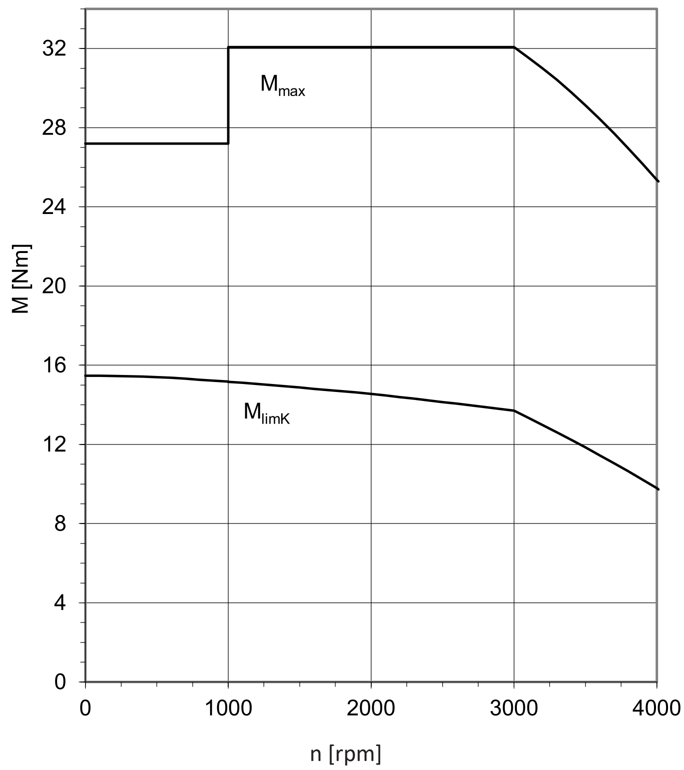
LM403U (n_N=3000 rpm)



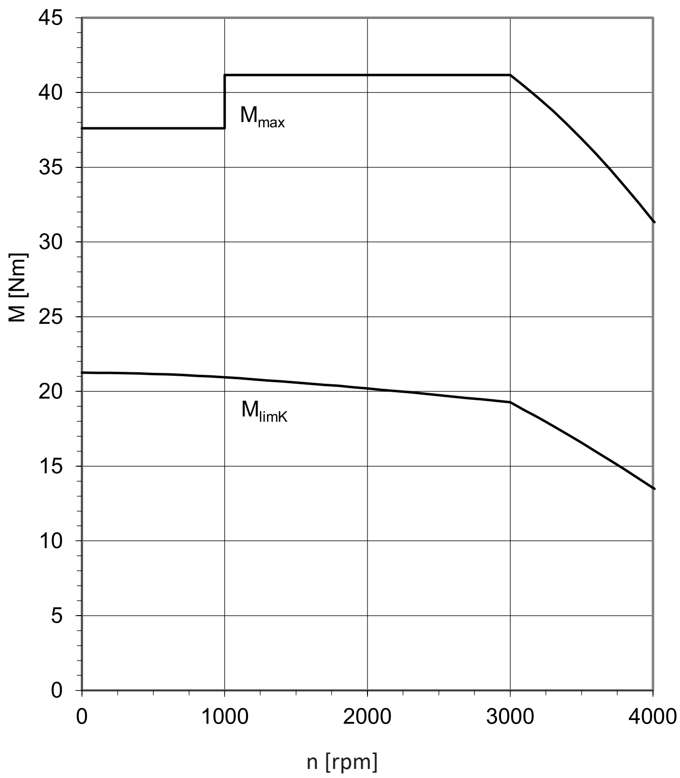
LM503U (n_N=3000 rpm)



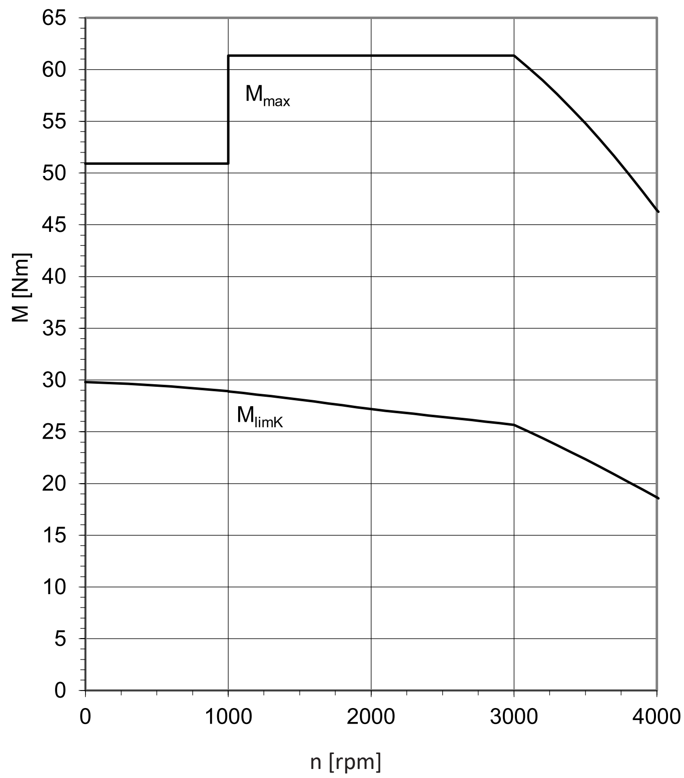
LM505U (n_N=3000 rpm)



LM704U (n_N=3000 rpm)



LM706U (n_N=3000 rpm)



2.4 Dimensional drawings

In this chapter, you can find the dimensions of the motors.

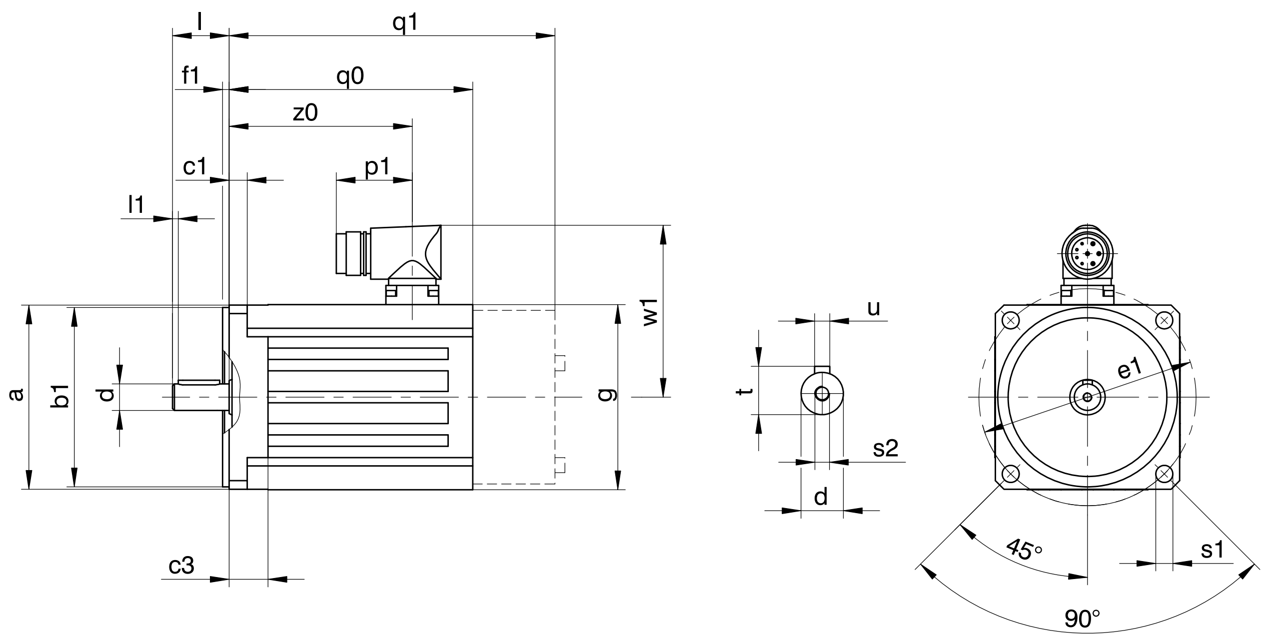
Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50



q0 Applies to motors without brake.

q1 Applies to motors with brake.

Type	□a	∅b1	c1	c3	∅d	∅e1	f1	□g	l	l1	p1	q0	q1	∅s1	s2	t	u	w1	z0
LM401U	98	95_{j6}	9.5	20.5	14_{k6}	115	3.5	98	30	3	40	129.0	172.5	9	M5	16.0	A5×5×22	91	97
LM402U	98	95_{j6}	9.5	20.5	19_{k6}	115	3.5	98	40	3	40	168.0	211.5	9	M6	21.5	A6×6×32	91	136
LM403U	98	95_{j6}	9.5	20.5	19_{k6}	115	3.5	98	40	3	40	199.0	242.5	9	M6	21.5	A6×6×32	91	167
LM503U	115	110_{j6}	10.0	16.0	24_{k6}	130	3.5	115	50	3	40	202.5	250.5	9	M8	27.0	A8×7×40	100	172
LM505U	115	110_{j6}	10.0	16.0	24_{k6}	130	3.5	115	50	3	40	272.5	320.5	9	M8	27.0	A8×7×40	100	242
LM704U	145	130_{j6}	10.0	19.0	24_{k6}	165	3.5	145	50	3	40	255.5	314.5	11	M8	27.0	A8×7×40	115	223
LM706U	145	130_{j6}	10.0	19.0	32_{k6}	165	3.5	145	58	3	40	325.5	384.5	11	M12	35.0	A10×8×50	115	293

2.5 Type designation

Sample code

LM	4	0	1	U	S	AR	O	110

Explanation

Code	Designation	Design
LM	Type	Lean motor
4	Size	4 (example)
0	Generation	0
1	Length	1 (example)
U	Cooling	Convection cooling
S	Design	Standard
AR	Drive controller	SC6
AT		SI6
O	Brake	Without holding brake
F		Spring-loaded holding brake
110	Voltage constant K_{EM}	100 V/1000 rpm (example)

2.6 Product description

2.6.1 General features

Feature	Description
Design	Sensorless synchronous motor with interior permanent magnets
Design	IM B5, IM V1, IM V3 in accordance with EN 60034-7
Protection class	IP56 / IP66 (option)
Thermal class	155 (F) in accordance with EN 60034-1 (155 °C, heating $\Delta\vartheta$ = 100 K)
Surface	Matte black as per RAL 9005
Cooling	IC 410 convection cooling
Bearing	Rolling bearing with lifetime lubrication and non-contact sealing
Sealing	Radial shaft seal rings made of FKM (A side)
Shaft	Shaft with feather key, diameter quality k6
Radial runout	Normal tolerance class in accordance with IEC 60072-1
Concentricity	Normal tolerance class in accordance with IEC 60072-1
Axial runout	Normal tolerance class in accordance with IEC 60072-1
Vibration intensity	A in accordance with EN 60034-14
Noise level	Limit values in accordance with EN 60034-9

Note

Repainting the motor changes its thermal properties. This lowers the performance limit of the motor.

2.6.2 Electrical features

General electrical features of the motor are described in this chapter. Details can be found in the "Selection tables" chapter.

Feature	Description
DC link voltage	DC 540 V (max. 620 V) on STOBER drive controllers
Winding	Three-phase
Circuit	Star, center not led through
Protection class	I (protective grounding) in accordance with EN 61140
Number of pole pairs	3

2.6.3 Ambient conditions

Standard ambient conditions for transport, storage and operation of the motor are described in this chapter. Information about differing ambient conditions can be found in the chapter [▸ 2.7.3].

Feature	Description
Surrounding temperature for transport/storage	−30 °C to +85 °C
Surrounding temperature for operation	−20 °C to +40 °C
Relative humidity	5% to 95%, no condensation
Installation altitude	≤ 1000 m above sea level
Shock load	≤ 50 m/s^2 (5 g), 6 ms in accordance with EN 60068-2-27

Notes

- STOBER Lean motors are not suitable for potentially explosive atmospheres in accordance with (ATEX) Directive 2014/34/EU.
- Secure the power cable close to the motor so that vibrations of the cable do not place impermissible loads on the motor plug connector.
- Note that the braking torques of the holding brake (optional) may be reduced by shock loading.
- Also take into consideration the shock load of the motor due to output units (such as gear units and pumps) which are coupled with the motor.

To prevent damage, protect the motor from the following influences:

- Environments with harmful oils, acids, gases, vapors, dust or radiation
- Extreme temperature fluctuations with high humidity
- Condensation or icing
- Strong UV radiation (e.g. direct sunlight)
- Presence of salt spray
- Shaking, impacts, vibrations and high acceleration
- Sparks or heat

2.6.4 Positioning behavior

Lean motors do not have an encoder installed. Instead, they exhibit anisotropic behavior where the winding inductance depends on the rotor position. The drive controller sends electric signals through the motor windings and calculates the rotor position of the motor based on the received signals. As a result, Lean motors can be used as servo drives in applications for which a positioning accuracy of ± 1° and speed ripple factor ≤ 1% is sufficient. The speed and torque of the Lean motors can be set to any point from a standstill to maximum speed with full torque control.

2.6.5 Possible combinations with drive controllers

The Lean motor can be operated only with STOBER SC6 or SI6 drive controllers. For detailed information about the drive controllers, refer to the corresponding chapter in this catalog.

2.6.6 Temperature sensor

In this chapter, you can find technical data on the temperature sensor installed in STOBER Lean motors for implementing thermal winding protection. To prevent damage to the motor, always monitor the temperature sensor with appropriate devices that will turn off the motor if the maximum permitted winding temperature is exceeded.

You can find information about the electrical connection of the temperature sensor in the "Connection method" chapter.

2.6.6.1 PTC thermistor

The PTC thermistor is installed as a standard temperature sensor in STOBER Lean motors.

The PTC thermistor is a triple thermistor in accordance with DIN 44082 that can be used for monitoring the temperature of each winding phase. The resistance values in the following table and curve refer to a single thermistor in accordance with DIN 44081. These values must be multiplied by 3 for a triple thermistor in accordance with DIN 44082.

Feature	Description
Nominal response temperature ϑ_{NAT}	145 °C ± 5 K
Resistance R −20 °C up to ϑ_{NAT} − 20 K	≤ 250 Ω
Resistance R with ϑ_{NAT} − 5 K	≤ 550 Ω
Resistance R with ϑ_{NAT} + 5 K	≥ 1330 Ω
Resistance R with ϑ_{NAT} + 15 K	≥ 4000 Ω
Operating voltage	≤ DC 7.5 V
Thermal response time	< 5 s
Thermal class	155 (F) in accordance with EN 60034-1 (155 °C, heating Δϑ = 100 K)

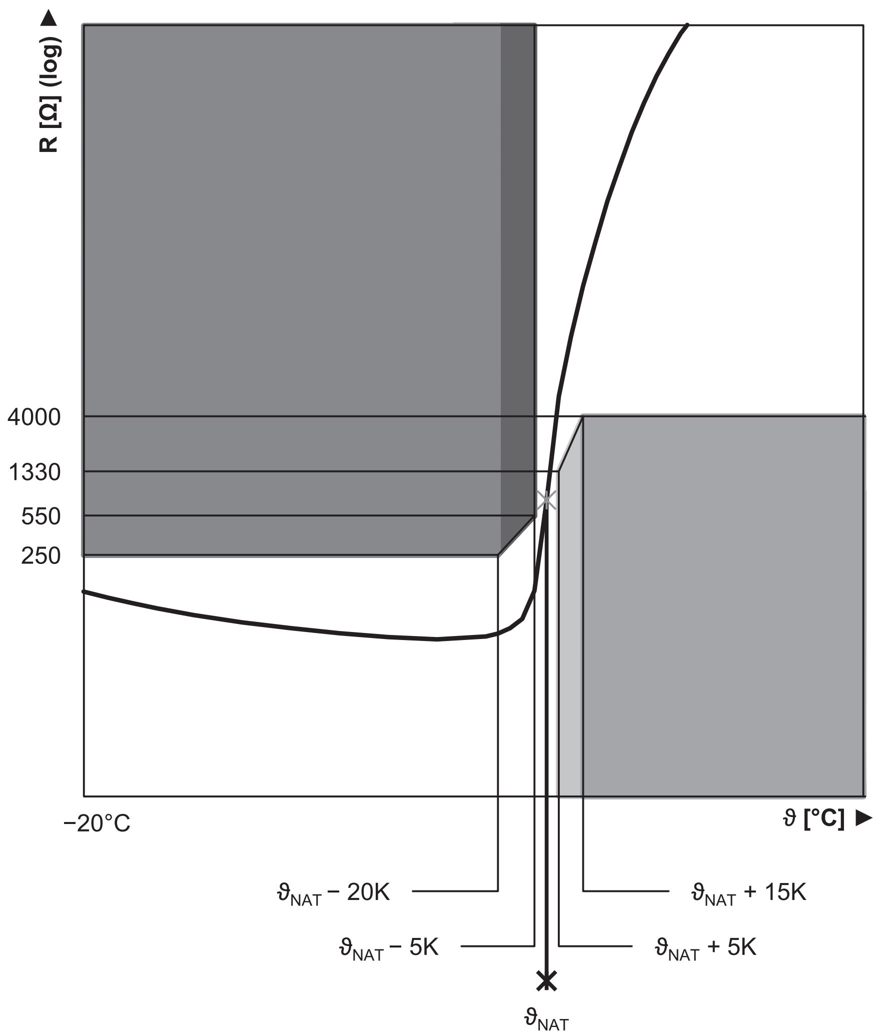


Fig. 2: PTC thermistor curve (single thermistor)

2.6.7 Cooling

A Lean motor is cooled by convection cooling (IC 410 in accordance with EN 60034-6). In this process, the motor heat is dissipated into the ambient air through natural convection and radiation. Here, unimpeded suctioning of the cooling air and escape of the hot air has to be ensured by maintaining sufficient distances to the machine environment.

2.6.8 Holding brake

STOBER Lean motors can be optionally equipped with a spring-loaded holding brake in order to secure the motor shaft when the motor is at a standstill. The holding brake engages automatically if the voltage drops.

Nominal voltage of the spring-loaded holding brake: DC 24 V ± 10%, any polarity.

Observe the following during project configuration:

- The holding brake is designed to keep the motor shaft from moving. Activate braking processes during operation using the corresponding electrical functions of the drive controller. In exceptional circumstances, the holding brake can be used for braking from full speed (following a power failure or when setting up the machine). The maximum permitted work done by friction $W_{B,Rmax/h}$ may not be exceeded.
- Note that the braking torque M_{Bdyn} may initially be up to 50% less when braking from full speed. As a result, the braking effect has a delayed action and braking distances become longer.
- Regularly perform a brake test to ensure the functional safety of the brakes. Details can be found in the documentation of the motor and the drive controller.
- The holding brake of the motor does not offer adequate safety for persons in the hazardous area of gravity-loaded vertical axes. Therefore take additional measures to minimize risk, e.g. by providing a mechanical substructure for maintenance work.
- Take into consideration voltage losses in the connection cables that connect the voltage source to the holding brake connections.
- The holding torque of the brake can be reduced by shock loading. Information about shock loading can be found in the "Ambient conditions" chapter.

Calculation of work done by friction per braking process

$$W_{B,R/B} = \frac{J_{tot} \cdot n^2}{182.4} \cdot \frac{M_{Bdyn}}{M_{Bdyn} \pm M_L}, \ M_{Bdyn} > M_L$$

The sign of M_L is positive if the movement runs vertically upwards or horizontally and it is negative if the movement runs vertically down.

Calculation of the stop time

$$t_{dec} = 2.66 \cdot t_{1B} + \frac{n \cdot J_{tot}}{9.55 \cdot M_{Bdyn}}$$

Switching behavior

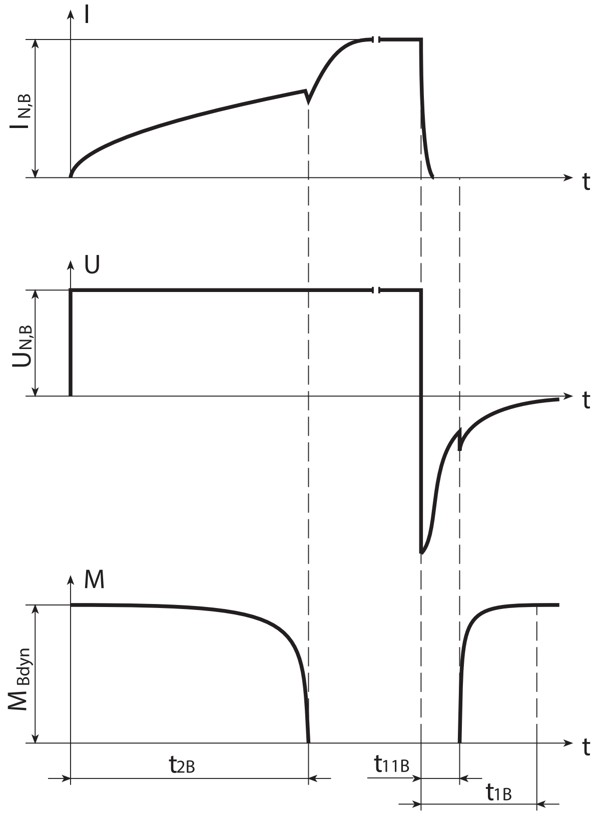


Fig. 3: Holding brake – Switching behavior

Technical data

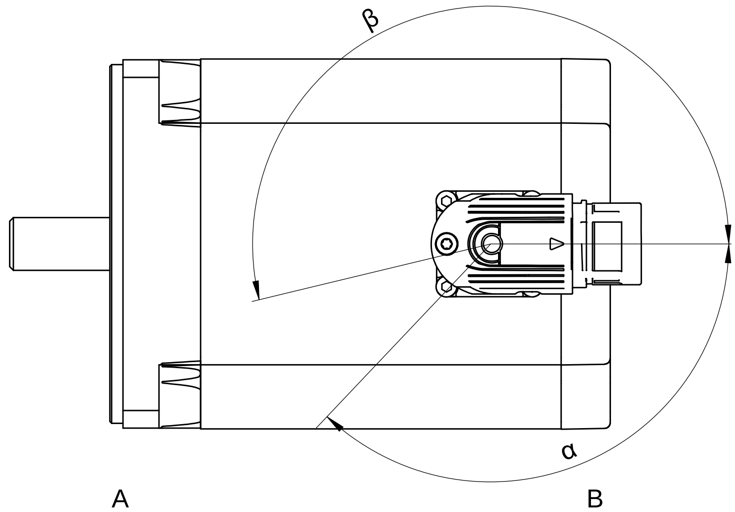
Type	M_{Bstat} [Nm]	M_{Bdyn} [Nm]	$I_{N,B}$ [A]	$W_{B,Rmax/h}$ [kJ/h]	N_{Bstop}	J_{Bstop} [kgcm²]	$W_{B,Rlim}$ [kJ]	t_{2B} [ms]	t_{11B} [ms]	t_{1B} [ms]	$x_{B,N}$ [mm]	ΔJ_B [kgcm²]	Δm_B [kg]
LM401	7.0	6.0	0.90	3.0	428000	3.78	8000	60	18	40	0.2	0.219	1.80
LM402	7.0	6.0	0.90	3.0	250000	6.47	8000	60	18	40	0.2	0.219	1.80
LM403	7.0	6.0	0.90	3.0	178000	9.06	8000	60	18	40	0.2	0.219	1.80
LM503	13	11	0.90	6.0	119000	22.1	13000	80	27	27	0.3	0.686	2.80
LM505	13	11	0.90	6.0	75000	34.9	13000	80	27	27	0.3	0.686	2.80
LM704	31	19	1.9	7.0	53000	76.4	20000	100	50	125	0.2	1.771	4.80
LM706	31	19	1.9	7.0	36000	111	20000	100	50	125	0.2	1.771	4.80

2.6.9 Connection method

2.6.9.1 Plug connectors

Lean motors are equipped with a twistable quick-lock plug connector in the standard version. Details can be found in this chapter.

The figures represent the position of the plug connectors upon delivery.



A	Attachment or output side of the motor	B	Rear side of the motor

Plug connector features

Motor type	Size	Connection	Turning range	
			α	β
LM4 – LM7	con.23	Quick lock	130°	192°

The number in the designation of the plug connector size indicates approximately the external thread diameter of the plug connector in mm (for example con.23 designates a plug connector with an external thread diameter of about 23 mm).

2.6.9.2 Connection of the motor housing to the grounding conductor system

Connect the motor housing to the grounding conductor system of the machine in order to prevent personal injury and faulty triggering of residual current protective devices.

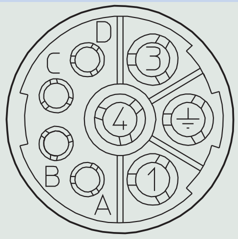
All attachment parts required for the connection of the grounding conductor to the motor housing are delivered with the motor. The grounding screw of the motor is identified with the symbol ⏚ in accordance with IEC 60417-DB. The cross-section of the grounding conductor has to be at least as large as the cross-section of the lines in the power connection.

2.6.9.3 Terminal assignment

The terminal assignment of Lean motors in the standard version is described in this chapter. For more information, refer to the connection plan included in the delivery of every motor.

Power connection

Plug connector size con.23

Connection diagram	Pin	Connection	Color
	1	U phase	black
	3	V phase	blue
	4	W phase	red
	A	Brake +	
	B	Brake –	
	C	Temperature sensor +	
	D	Temperature sensor –	
	⏚	Grounding conductor	green-yellow

2.7 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

2.7.1 Calculation of the operating point

In this chapter, you can find information needed to calculate the operating point.

Check the following conditions for operating points other than the nominal point M_N specified in the selection tables:

$n_{m*} \leq n_N$

$M_{eff*} \leq M_{limK}$

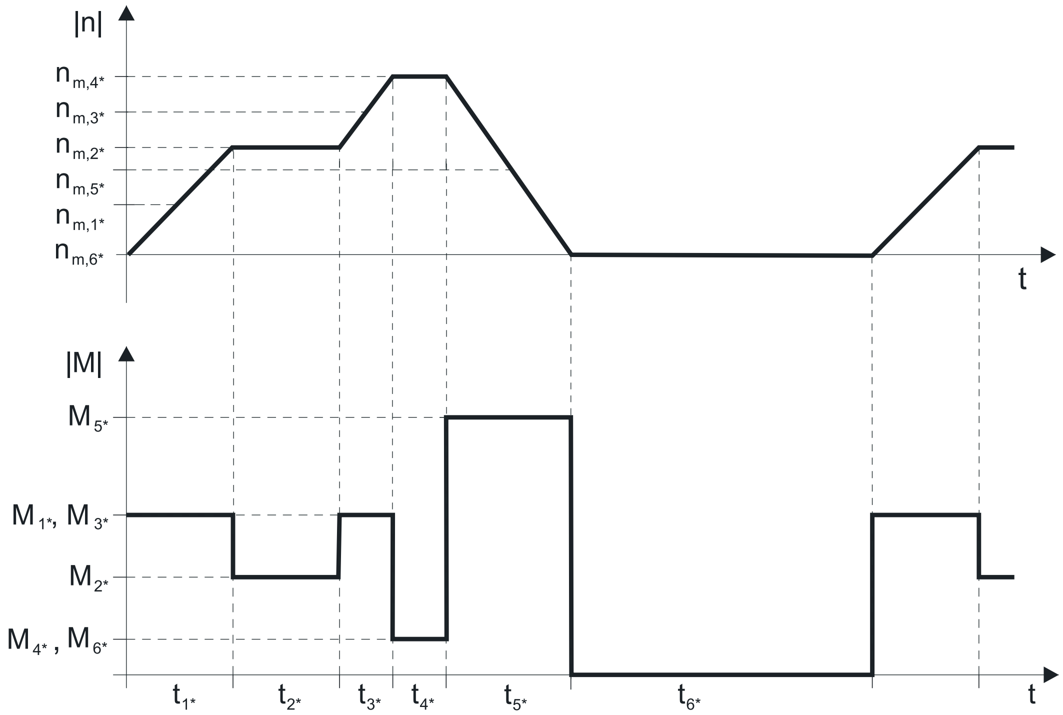
$M_{max*} < M_{max}$

The values for M_N, n_N, M_{max} can be found in the selection tables.

The values for M_{limK} can be found in the torque/speed characteristic curves.

Example of cyclic operation

The following calculations refer to a representation of the power delivered at the motor shaft based on the following example:



Calculation of the actual average input speed

$$n_{m*} = \frac{|n_{m,1*}| \cdot t_{1*} + \ldots + |n_{m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

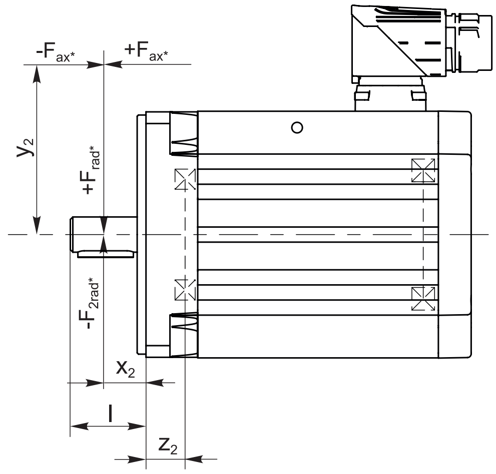
If $t_{1*} + \ldots + t_{5*} \geq 6$ min, determine n_{m*} without the rest phase t_{6*}.

Calculation of the actual effective torque

$$M_{eff*} = \sqrt{\frac{t_{1*} \cdot M_{1*}^{2} + \ldots + t_{n*} \cdot M_{n*}^{2}}{t_{1*} + \ldots + t_{n*}}}$$

2.7.2 Permitted shaft loads

The shaft loads permitted for the Lean motor are defined in this chapter.



Permitted shaft loads

Type	z_2 [mm]	F_{ax100} [N]	F_{rad100} [N]	M_{k100} [Nm]
LM401	19.5	550	1800	62
LM402	19.5	550	1800	71
LM403	19.5	550	1800	71
LM503	19.5	750	2400	107
LM505	19.5	750	2400	107
LM704	24.5	1300	4200	208
LM706	24.5	1300	4200	225

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- A force applied at the center of the output shaft: $x_2 = l / 2$ (shaft dimensions can be found in the chapter Dimensional drawings)
- Output speeds $n_{m*} \leq 100$ rpm ($F_{ax} = F_{ax100}$; $F_{rad} = F_{rad100}$; $M_k = M_{k100}$)

The following applies to output speeds $n_{m*} > 100$ rpm:

$$F_{ax} = \frac{F_{ax100}}{\sqrt[3]{\frac{n_{m*}}{100\ \text{rpm}}}} \qquad F_{rad} = \frac{F_{rad100}}{\sqrt[3]{\frac{n_{m*}}{100\ \text{rpm}}}} \qquad M_k = \frac{M_{k100}}{\sqrt[3]{\frac{n_{m*}}{100\ \text{rpm}}}}$$

The following applies to other force application points:

$$M_{k*} = \frac{2 \cdot F_{ax*} \cdot y_2 + F_{rad*} \cdot (x_2 + z_2)}{1000} \leq M_{k100}$$

$$F_{rad*} \leq F_{rad100}$$

$$F_{ax*} \leq F_{ax100}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

2.7.3 Derating

If you use the motor under ambient conditions that differ from the standard ambient conditions, the nominal torque M_N of the motor is reduced. In this chapter, you can find information for calculating the reduced nominal torque.

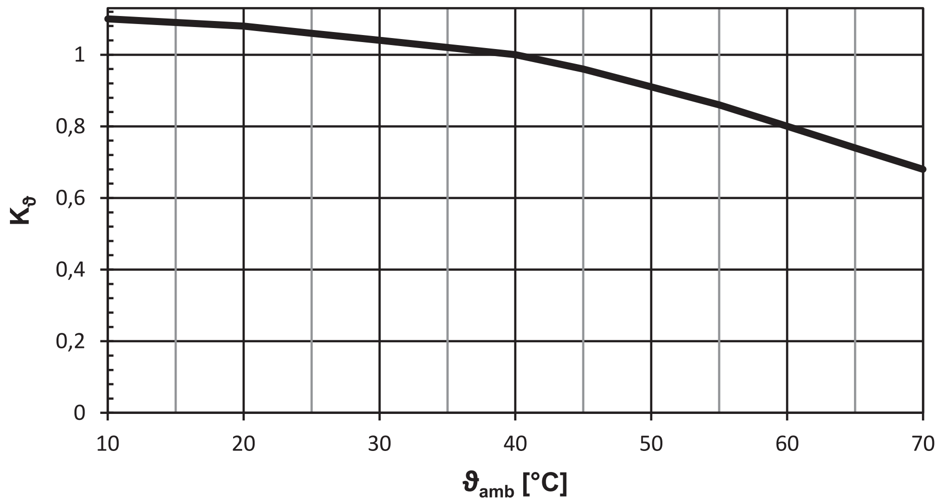


Fig. 4: Derating depending on the surrounding temperature

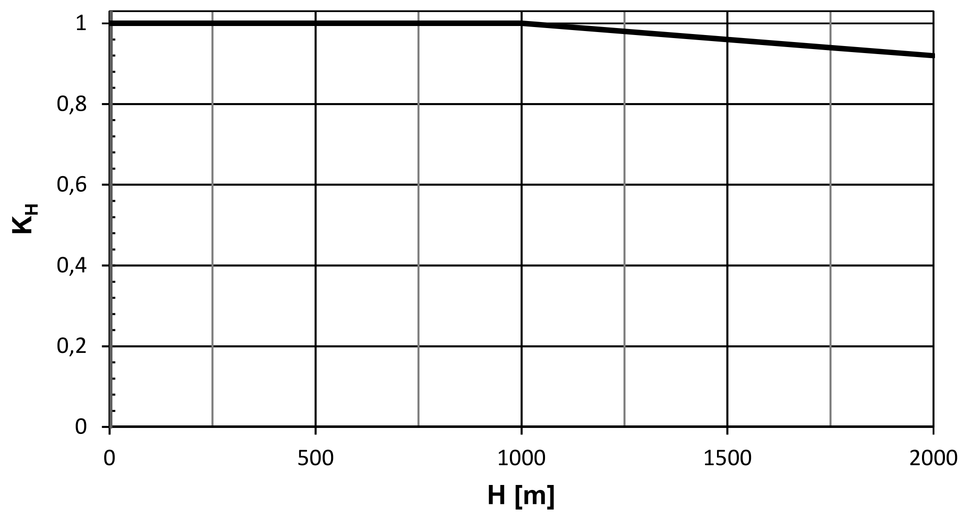


Fig. 5: Derating depending on the installation height

Calculation

If surrounding temperature ϑ_{amb} > 40 °C:

$M_{Nred} = M_N \cdot K_\vartheta$

If installation altitude H > 1000 m above sea level:

$M_{Nred} = M_N \cdot K_H$

If the surrounding temperature ϑ_{amb} > 40 °C and installation altitude H > 1000 m above sea level:

$M_{Nred} = M_N \cdot K_H \cdot K_\vartheta$

2.8 Further information

2.8.1 Directives and standards

STOBER Lean motors meet the requirements of the following directives and standards:

- (Low Voltage) Directive 2014/35/EU
- EN 60034-1:2010 + Cor.:2010
- EN 60034-5:2001 + A1:2007
- EN 60034-6:1993

2.8.2 Identifiers and test symbols

Lean motors have the following marks and test symbols:

CE mark: The product meets the requirements of EU directives.

cURus test symbol "Servo and Stepper Motors – Component"; registered under UL number E488992 with Underwriters Laboratories USA (optional).

2.8.3 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for LM Lean motors	443048_en

3 SC6 drive controllers

Table of contents

3 Drive controllers

SC6

3.1 Overview

Our more compact version for the encoderless Lean motor

Features

- Single or double-axis controller with a nominal output current up to 19 A and 250% overload capacity
- Sensorless position control of STOBER Lean motors
- Control of rotary synchronous servo motors, asynchronous motors and torque motors
- NEW: One Cable Solution EnDat 3
- Electronic motor nameplate via EnDat encoder interfaces
- Integrated EtherCAT or PROFINET communication
- STO safety technology using terminals or STO and SS1 using FSoE (Fail Safe over EtherCAT): SIL 3, PL e (cat. 4)
- Integrated brake control
- Single-ended nominal power consumption on double-axis controllers for operation of motors with different power
- Energy supply through direct power supply
- Flexible DC link connection for multi-axis applications

3.1.1 Features

The compact stand-alone SC6 drive controller allows for sensorless control of Lean motors of the LM series. These motors provide energy efficiency at the performance level of synchronous servo motors. They also guarantee high investment protection, thanks to energy efficiency class IE5 and the corresponding higher efficiency compared to IE4 asynchronous motors. However, the SC6 can also be used in combination with asynchronous motors or synchronous servo motors with encoders (e.g. the EZ series). SC6 is available in three sizes with a nominal output current of up to 19 A: Sizes 0 and 1 as a double-axis controller, size 2 as a single-axis controller.

For use with STOBER Lean motors, the sensorless vector control, specially designed for controlling Lean motors, is available.

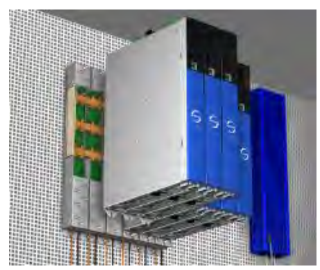
The compact SC6 for Lean motors of the LM series

As small as a paperback

You save valuable space in your control cabinet because, with a width of just 45 mm, this drive controller is the most compact solution on the market. It offers all the features that a designer requires.

Quick DC-Link

The drive controllers have the option of a DC link connection. This technology makes it possible for the regenerative production of energy from one drive to be used as motor energy by another drive. The Quick DC-Link rear structure element has been developed to set up a reliable and efficient rail connection to the DC link connection. This optionally available accessory connects the DC links of the individual drive controllers by means of copper rails that can carry a load of up to 200 A. The rails can be attached without any tools using quick fastening clamps.



Perfectly adapted combinations

SC6 drive controllers can be combined with the STOBER SI6 and SD6 series as needed. For the general energy supply, the drive controllers from the SC6, SI6 and SD6 series are connected to each other using Quick DC-Link modules.

Tailored energy usage

When using double-axis modules, the unused power reserves of one axis can be used for other axes.

Fewer clicks, less wiring

The installation of the drive controller is as easy as you could imagine. There is no difficult wiring. Even if you are connecting the drive controllers in a DC link, the patented Quick DC-Link modules allow for a simple "click" into the standard copper rails as well as the simple installation and connection of the drive controllers.

Safety functions

The safety concept of the drive controller is based on the STO (Safe Torque Off) function. The concept corresponds to SIL 3 according to DIN EN 61800-5-2 and PL e (Cat. 4) according to DIN EN ISO 13849-1. For double-axis controllers, the STO safety function has a two-channel structure that acts upon both axes. For connection to a higher-level safety circuit, different interfaces are available (terminals or FSoE).

Heavy duty

There is an extremely robust design concealed behind the elegant exterior. All components—from the stable, well-shielded sheet steel housing to the motor connectors—far exceed the set values of industry standards. The inside is also anything but small-scale: ample computer capacities, high-quality components, careful workmanship.

3.1.2 Software components

Project configuration and commissioning

The 6th generation of DriveControlSuite project configuration and commissioning software has all the functions for the efficient use of drive controllers in single-axis and multi-axis applications. The program guides you step by step through the complete project configuration and parameterization process using wizards.

Open communication

The Ethernet-based EtherCAT and PROFINET fieldbus systems are available in the drive controller.

Applications

Drive-based motion control is recommended for the decentralized motion control of sophisticated machines.

The drive-based application package from STOBER is the right choice wherever universal and flexible solutions are needed. The Drive Based application provides drive-based motion control for positioning, velocity and torque/force with the PLCopen Motion Control command set. These standard commands have been combined into operating modes for different applications and supplemented with additional functions such as motion block linking, cams and much more. For the command operating mode, all properties of the movements are specified directly by the controller. The properties of the movements in the drive are predefined in the motion block operating mode so that only a start signal is necessary to perform the movement. Linking can be used to define complete motion sequences. There is a separate operating mode available for applications controlled by velocity or torque/force such as pumps, fans or conveyor belts. This also allows for operation without a controller.

In addition, the CiA 402 application is also available, which includes both the controller-based and drive-based operating modes (csp, csv, cst, ip, pp, pv, pt).

3.1.3 Application training

STOBER offers a multi-level training program that is essentially focused on the drive controller.

G6 Basic

Training content: System overview, installation and commissioning of the drive controller. Use of option modules. Parameterization, commissioning and diagnostics using the commissioning software. Remote maintenance. Basics of controller optimization. Configuration of the drive train. Integrated software functions. Software applications. Connection to a higher-level controller. Basics of safety technology. Practical exercises on training topics.

Software used: DriveControlSuite.

G6 Customized

Training content: Special knowledge for regulating, control and safety technology. Electronic cam disk. Practical exercises on training topics.

3.2 Technical data

Technical data for the drive controller can be found in the following chapters.

3.2.1 Type designation

SC	**6**	**A**	**0**	**6**	**2**	**Z**

Tab. 1: Example code for type designation

Code	Designation	Design
SC	Series	ServoCompact
6	Generation	Generation 6
A	Version	
0 – 2	Size	
6	Power output stage	Power output stage within the size
2	Axis controller	Double-axis controller
1		Single-axis controller
Z	Safety technology	SZ6: Without safety technology
R		SR6: STO using terminals
Y		SY6: STO and SS1 using FSoE

Tab. 2: Meaning of the example code

3.2.2 Sizes

Type	ID No.	Size	Axis controller
SC6A062	56690	Size 0	Double-axis controller
SC6A162	56691	Size 1	Double-axis controller
SC6A261	56692	Size 2	Single-axis controller

Tab. 3: Available SC6 types and sizes

SC6 in sizes 0 to 2

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size.

3.2.3 General technical data

The following information applies to all device types.

Device features	
Protection class of the device	IP20
Protection class of the installation space	At least IP54
Protection class	Protection class I in accordance with EN 61140
Radio interference suppression	Integrated line filter in accordance with EN 61800-3, interference emission class C3
Overvoltage category	III in accordance with EN 61800-5-1
Test symbols	

Tab. 4: Device features

Transport and storage conditions	
Storage/ transport temperature	−20 °C to +70 °C Maximum change: 20 K/h
Relative humidity	Maximum relative humidity 85%, non-condensing
Vibration (transport) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²
Fall height for freefall[1] Weight < 100 kg in accordance with EN 61800-2 (or IEC 60721-3-2, class 2M1)	0.25 m

Tab. 5: Transport and storage conditions

Operating conditions	
Surrounding temperature during operation	0 °C to 45 °C with nominal data 45 °C to 55 °C with derating −2.5% / K
Relative humidity	Maximum relative humidity 85%, non-condensing
Installation altitude	0 m to 1000 m above sea level without restrictions 1000 m to 2000 m above sea level with −1.5%/100 m derating
Pollution degree	Pollution degree 2 in accordance with EN 50178
Ventilation	Installed fan
Vibration (operation) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s²

Tab. 6: Operating conditions

Discharge times	
Self-discharge of DC link	15 min

Tab. 7: Discharge times of the DC link circuit

[1] Only valid for components in original packaging

3.2.4 Electrical data

The electrical data of the available SC6 sizes as well as the properties of the brake chopper can be found in the following sections.

Information

For the time span between energizing two devices, note that:

a) Direct, repeat activation of the supply voltage is possible for cyclical power-on/power-off operation.

b) A time span of > 15 minutes must be observed between two energizing processes during continuous, cyclical power-on/power-off operation with increased charging capacity.

Information

The STO safety function is available for safe stopping as an alternative to continuous, cyclical power-on/power-off operation.

An explanation of the symbols used for formulas can be found in Chapter [▷ 14.1].

3.2.4.1 Control unit

Electrical data	All types
U_{1CU}	24 V_{DC}, +20%/−15%
I_{1maxCU}	0.5 A

Tab. 8: Control unit electrical data

3.2.4.2 Power unit: Size 0

Electrical data	SC6A062
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz
f_{2PU}	0 – 700 Hz
U_{2PU}	0 – max. U_{1PU}
$U_{2PU,ZK}$	$\sqrt{2}$ × U_{1PU}
C_{PU}	270 µF
$C_{N,PU}$	1400 µF
C_{maxPU}	1880 µF

Tab. 9: SC6 electrical data, size 0

The charging capacity depends on the time between two energizing processes:

Information

For the maximum charging capacity C_{maxPU}, a time span of ≥ 15 min must be maintained between two energizing processes.

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SC6A062
$f_{PWM,PU}$	4 kHz
$I_{1N,PU}$	10 A
$I_{2N,PU}$	2 × 4.5 A
I_{2maxPU}	210% for 2 s

Tab. 10: SC6 electrical data, size 0, for 4 kHz clock frequency

Electrical data	SC6A062
$f_{PWM,PU}$	8 kHz
$I_{1N,PU}$	8.9 A
$I_{2N,PU}$	2 × 4 A
I_{2maxPU}	250% for 2 s

Tab. 11: SC6 electrical data, size 0, for 8 kHz clock frequency

Electrical data	SC6A062
U_{onCH}	780 – 800 V_{DC}
U_{offCH}	740 – 760 V_{DC}
R_{2minRB}	100 Ω
P_{maxRB}	6.4 kW
P_{effRB}	2.9 kW

Tab. 12: Brake chopper electrical data, size 0

3.2.4.3 Power unit: Size 1

Electrical data	SC6A162
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz
f_{2PU}	0 – 700 Hz
U_{2PU}	0 – max. U_{1PU}
$U_{2PU,ZK}$	$\sqrt{2} \times U_{1PU}$
C_{PU}	940 µF
$C_{N,PU}$	1400 µF
C_{maxPU}	1880 µF

Tab. 13: SC6 electrical data, size 1

The charging capacity depends on the time between two energizing processes:

Information

For the maximum charging capacity C_{maxPU}, a time span of ≥ 15 min must be maintained between two energizing processes.

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SC6A162
$f_{PWM,PU}$	4 kHz
$I_{1N,PU}$	23.2 A
$I_{2N,PU}$	2 × 10 A
I_{2maxPU}	210% for 2 s

Tab. 14: SC6 electrical data, size 1, for 4 kHz clock frequency

Electrical data	SC6A162
$f_{PWM,PU}$	8 kHz
$I_{1N,PU}$	20.9 A
$I_{2N,PU}$	2 × 9 A
I_{2maxPU}	250% for 2 s

Tab. 15: SC6 electrical data, size 1, for 8 kHz clock frequency

Electrical data	SC6A162
U_{onCH}	780 – 800 V_{DC}
U_{offCH}	740 – 760 V_{DC}
R_{2minRB}	47 Ω
P_{maxRB}	13.6 kW
P_{effRB}	6.2 kW

Tab. 16: Brake chopper electrical data, size 1

3.2.4.4 Power unit: Size 2

Electrical data	SC6A261
U_{1PU}	3 × 400 V_{AC}, +32% / −50%, 50/60 Hz; 3 × 480 V_{AC}, +10% / −58%, 50/60 Hz
f_{2PU}	0 – 700 Hz
U_{2PU}	0 – max. U_{1PU}
$U_{2PU,ZK}$	√2 × U_{1PU}
C_{PU}	940 µF
$C_{N,PU}$	1400 µF
C_{maxPU}	1880 µF

Tab. 17: SC6 electrical data, size 2

The charging capacity depends on the time between two energizing processes:

Information

For the maximum charging capacity C_{maxPU}, a time span of ≥ 15 min must be maintained between two energizing processes.

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SC6A261
$f_{PWM,PU}$	4 kHz
$I_{1N,PU}$	22.6 A
$I_{2N,PU}$	19 A
I_{2maxPU}	210% for 2 s

Tab. 18: SC6 electrical data, size 2, for 4 kHz clock frequency

Electrical data	SC6A261
$f_{PWM,PU}$	8 kHz
$I_{1N,PU}$	17.9 A
$I_{2N,PU}$	15 A
I_{2maxPU}	250% for 2 s

Tab. 19: SC6 electrical data, size 2, for 8 kHz clock frequency

Electrical data	SC6A261
U_{onCH}	780 – 800 V_{DC}
U_{offCH}	740 – 760 V_{DC}
R_{2minRB}	47 Ω
P_{maxRB}	13.6 kW
P_{effRB}	6.2 kW

Tab. 20: Brake chopper electrical data, size 2

3.2.4.5 Parallel connection

The charging capacity of the driver controllers can be increased by a parallel connection only if the power grid supply is connected to all drive controllers simultaneously.

3.2.4.6 Single-ended nominal power consumption on double-axis controllers

Operating two motors on one double-axis controller makes it possible to operate one of the motors with a continuous current above the nominal current of the drive controller if the continuous current of the second connected motor is lower than the nominal current of the drive controller. This enables economical combinations of double-axis controllers and motors.

The nominal output current for axis B can be determined using the following formula if the output current for axis A is known:

Example 1

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{3}{5} \qquad \text{where} \qquad 0 \leq I_{2PU(A)} \leq I_{2N,PU}$$

Example 2

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{5}{3} \qquad \text{where} \qquad I_{2N,PU} \leq I_{2PU(A)} \leq 1{,}6 \times I_{2N,PU}$$

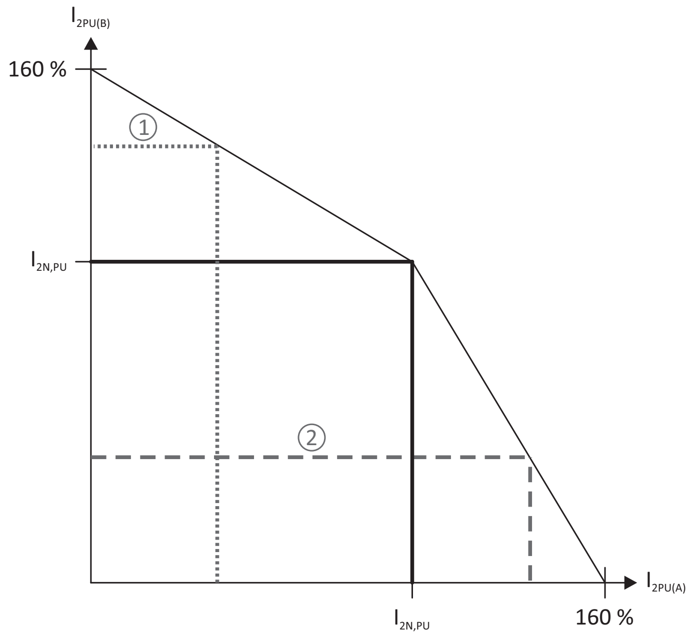


Fig. 1: Asymmetric load on double-axis controllers

Information

Note that the available maximum currents I_{2maxPU} of the axis controllers are also relative to the nominal output current $I_{2N,PU}$ for single-ended nominal power consumption.

3.2.4.7 Power loss data in accordance with EN 61800-9-2

Type	Nominal current $I_{2N,PU}$	Apparent power	Absolute losses $P_{V,CU}$[2]	Operating points[3]								IE class[4]	Comparison[5]
				(0/25)	(0/50)	(0/100)	(50/25)	(50/50)	(50/100)	(90/50)	(90/100)		
				Relative losses									
	[A]	[kVA]	[W]	[%]									
SC6A062	4.5	6.2	Max. 10	1.34	1.49	1.86	1.40	1.63	2.19	1.84	2.77	IE2	
SC6A162	10	13.9	Max. 10	0.76	0.92	1.43	0.81	1.04	1.75	1.22	2.29	IE2	
SC6A261	19	13.2	10	0.77	0.95	1.56	0.82	1.08	1.89	1.25	2.43	IE2	
				Absolute losses P_V									
	[A]	[kVA]	[W]	[W]									[%]
SC6A062	4.5	6.2	Max. 10	83.2	92.5	115.2	86.7	100.8	135.8	113.9	171.7	IE2	36.0
SC6A162	10	13.9	Max. 10	105.5	128.3	198.8	113.1	145.1	243.5	170.1	318.7	IE2	40.8
SC6A261	19	13.2	Max. 10	101.2	125.8	206.1	108.5	142.0	249.5	165.6	320.4	IE2	41.0

Tab. 21: Power loss data of the SC6 drive controller in accordance with EN 61800-9-2

General conditions

The specified losses apply to a drive controller. They apply to both axes together in the case of double-axis controllers.

The loss data applies to drive controllers without any accessories.

The power loss calculation is based on a three-phase supply voltage with 400 V_{AC}/50 Hz.

The calculated data includes a supplement of 10% in accordance with EN 61800-9-2.

The power loss specifications refer to a clock frequency of 4 kHz.

The absolute losses for a power unit that is switched off refer to the 24 V_{DC} power supply of the control electronics.

3.2.5 Derating

When dimensioning the drive controller, observe the derating of the nominal output current as a function of the clock frequency, surrounding temperature and installation altitude. There is no restriction for a surrounding temperature from 0 °C to 45 °C and an installation altitude of 0 m to 1000 m. The details given below apply to values outside these ranges.

3.2.5.1 Effect of the clock frequency

Changing the clock frequency f_{PWM} affects the amount of noise produced by the drive, among other things. However, increasing the clock frequency results in increased losses. During project configuration, define the highest clock frequency and use it to determine the nominal output current $I_{2N,PU}$ for dimensioning the drive controller.

Type	$I_{2N,PU}$ 4 kHz [A]	$I_{2N,PU}$ 8 kHz [A]	$I_{2N,PU}$ 16 kHz [A]
SC6A062	2 × 4.5	2 × 4	2 × 3
SC6A162	2 × 10	2 × 9	2 × 5
SC6A261	19	15	8

Tab. 22: Nominal output current $I_{2N,PU}$ dependent on the clock frequency

[2] Absolute losses for a power unit that is switched off

[3] Operating points for relative motor stator frequency in % and relative torque current in %

[4] IE class in accordance with EN 61800-9-2

[5] Comparison of the losses for the reference related to IE2 in the nominal point (90, 100)

3.2.5.2 Effect of the surrounding temperature

Derating as a function of the surrounding temperature is determined as follows:

- 0 °C to 45 °C: No restrictions (D_T = 100%)
- 45 °C to 55 °C: Derating −2.5%/K

Example

The drive controller needs to be operated at 50 °C.

The derating factor D_T is calculated as follows
D_T= 100% − 5 × 2.5% = 87.5%

3.2.5.3 Effect of the installation altitude

Derating as a function of the installation altitude is determined as follows:

- 0 m to 1000 m: No restriction (D_{IA} = 100%)
- 1000 m to 2000 m: Derating −1.5%/100 m

Example

The drive controller needs to be installed at an altitude of 1500 m above sea level.

The derating factor D_{IA} is calculated as follows:
D_{IA} = 100% − 5 × 1.5% = 92.5%

3.2.5.4 Calculating the derating

Follow these steps for the calculation:

1. Determine the highest clock frequency (f_{PWM}) that will be used during operation and use it to determine the nominal current $I_{2N,PU}$.
2. Determine the derating factors for installation altitude and surrounding temperature.
3. Calculate the reduced nominal current $I_{2N,PU(red)}$ in accordance with the following formula:
   $I_{2N,PU(red)} = I_{2N,PU} \times D_T \times D_{IA}$

Example

A drive controller of type SC6A062 needs to be operated at a clock frequency of 8 kHz at an altitude of 1500 m above sea level and a surrounding temperature of 50 °C.

The nominal current of the SC6A062 at 8 kHz is 4 A per axis. The derating factor D_T is calculated as follows:
D_T = 100% − 5 × 2.5% = 87.5%

The derating factor D_{IA} is calculated as follows:
D_{IA} = 100% − 5 × 1.5% = 92.5%

The output current of importance for the project configuration is:
$I_{2N,PU(red)}$ = 4 A × 0.875 × 0.925 = 3.24 A

3.2.6 Dimensions

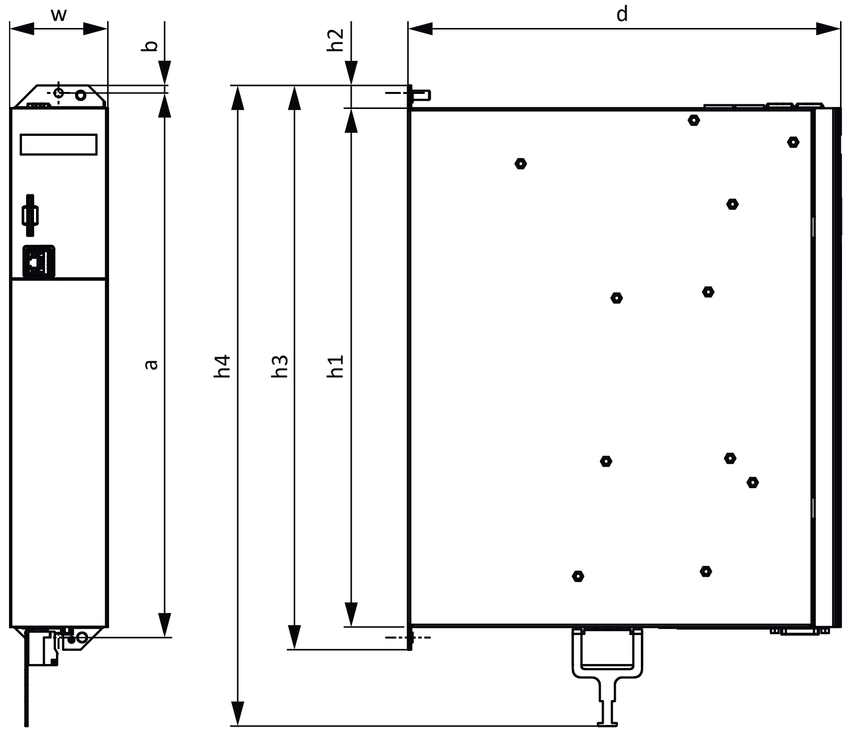


Fig. 2: SC6 dimensional drawing

Dimension			Size 0	Size 1	Size 2
Drive controller	Width	w	45	65	
	Depth	d	265	286	
	Body height	h1	343		
	Fastening clip height	h2	15		
	Height incl. fastening clips	h3	373		
	Total height incl. shield connection	h4	423		
Fastening holes (M5)	Vertical distance	a	360+2		
	Vertical distance to the upper edge	b	5		

Tab. 23: SC6 dimensions [mm]

3.2.7 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
SC6A062	3600	5200
SC6A162	5300	6700
SC6A261	5200	6400

Tab. 24: SC6 weight [g]

3.2.8 Minimum clearances

Drive controller

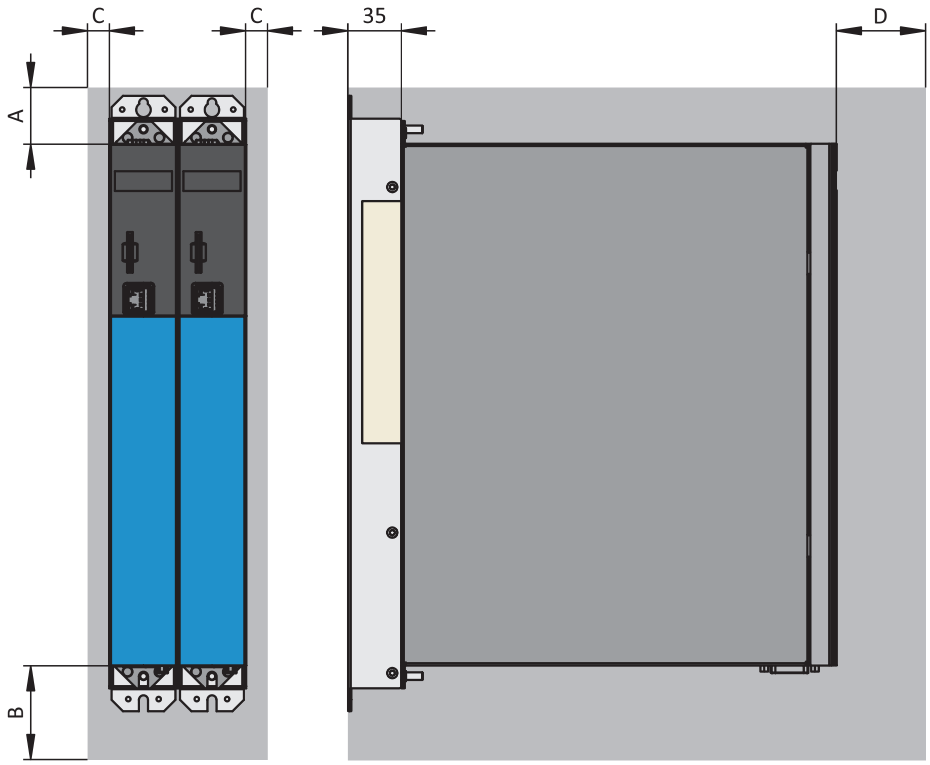


Fig. 3: Minimum clearances

The specified dimensions relate to the outer edges of the drive controller.

Minimum clearance	A (above)	B (below)	C (on the side)	D (in front)
All sizes	100	200	5	50[6]

Tab. 25: Minimum clearances [mm]

Chokes and filters

Avoid installation below drive controllers or supply modules. For installation in a control cabinet, a distance of approximately 100 mm to other neighboring components is recommended. This distance ensures proper heat dissipation for chokes and filters.

Braking resistors

Avoid installation below drive controllers or supply modules. In order for heated air to flow out unimpeded, a minimum clearance of approximately 200 mm must be maintained in relation to neighboring components or walls and approximately 300 mm must be maintained to components above or ceilings.

[6] Minimum clearance to be taken into account for permanent connection of the X9 service interface

3.3 Drive controller/motor combinations

An explanation of the symbols used for formulas can be found in Chapter [▸ 14.1].

LM Lean motor (n_N = 3000 rpm) – SC6

						SC6A062	SC6A162	SC6A261
						$I_{2N,PU}$ [A] ($f_{PWM,PU}$ = 4 kHz)		
	K_{EM} [V/1000 rpm]	M_N [Nm]	I_N [A]	M_0 [Nm]	I_0 [A]	4.5	10	19
						$I_{2N,PU}$ / I_0		
LM401	110	2.25	1.59	2.43	1.82	2.5		
LM402	120	4.41	2.88	4.50	2.94	1.5		
LM403	120	6.06	3.92	6.19	4.08	1.1		
LM503	135	9.48	5.62	10.07	5.95	—	1.7	
LM505	135	13.70	7.83	15.47	8.83	—	1.1	
LM704	145	19.27	10.64	21.26	11.57	—	—	1.6
LM706	140	25.67	14.69	29.80	16.80	—	—	1.1

— Not possible

3.4 Accessories

You can find information about the available accessories in the following chapters.

3.4.1 Safety technology

Information

The drive controller is delivered in the standard design without safety technology (option SZ6). If you want a drive controller with integrated safety technology, you must order it together with the drive controller. The safety modules are an integrated part of the drive controllers and must not be modified.

SZ6 option – Without safety technology

Included in the standard version.

ID No. 56660
Design without safety technology.

SR6 safety module – STO using terminals

ID No. 56661
Optional accessory for the use of the Safe Torque Off safety function (STO) in safety-relevant applications (PL e, SIL 3) in accordance with EN ISO 13849-1 and EN 61800-5-2. Connection to a higher-level safety circuit via terminal X12.

SY6 safety module – STO and SS1 using FSoE

Safety over EtherCAT®

ID No. 56662
Optional accessory for the use of the Safe Torque Off (STO) and Safe Stop 1 (SS1) safety functions in safety-relevant applications (PL e, SIL 3) in accordance with EN ISO 13849-1 and EN 61800-5-2. Connection to the higher-level safety circuit using Fail Safe over EtherCAT (FSoE).

3.4.2 Communication

The drive controller has two interfaces for the fieldbus connection on the top of the device as well as an Ethernet service interface on the front of the device. Cables for the connection are available separately.

EtherCAT or PROFINET fieldbus system

Please specify the desired fieldbus system when placing your purchase order for the base device, since the fieldbus communication is defined using the firmware.

EtherCAT cables

Ethernet patch cable, CAT5e, yellow.
The following designs are available:
ID No. 49313: Length approx. 0.2 m.
ID No. 49314: Length approx. 0.35 m.

PC connecting cables

ID No. 49857
Cable for connecting the X9 service interface to the PC, CAT5e, blue, 5 m.

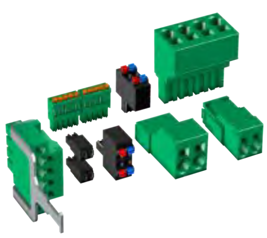
USB 2.0 Ethernet adapter

ID No. 49940
Adapter for connecting Ethernet to a USB port.

3.4.3 Terminal set

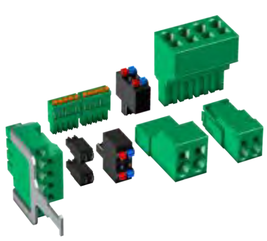
For connection, you need the fitting terminal set for each SC6 drive controller.

Terminal set for drive controller – SZ6 option (without safety technology) or SY6 option (STO and SS1 using FSoE)



The following designs are available:
ID No. 138652
Terminal set for SC6A062Z/Y.
ID No. 138653
Terminal set for SC6A162Z/Y.
ID No. 138654
Terminal set for SC6A261Z/Y.

Terminal set for drive controller – SR6 option (STO via terminals)



The following designs are available:
ID No. 138680
Terminal set for SC6A062R.
ID No. 138681
Terminal set for SC6A162R.
ID No. 138682
Terminal set for SC6A261R.

3.4.4 DC link connection

If you want to connect SC6 drive controllers in the DC link group, you will need Quick DC-Link modules of type DL6B.

You receive the DL6B rear section modules in different designs for a horizontal connection, suitable for the size of the drive controller.

The quick fastening clamps for attaching the copper rails and an insulation connection piece are contained in the scope of delivery. The copper rails are not included in the scope of delivery. These must have a cross-section of 5 x 12 mm. Insulation end sections are available separately.

Quick DC-Link DL6B for drive controller

The following designs are available:
DL6B10
ID No. 56655
Rear section module for size 0 drive controller:
SC6A062
DL6B11
ID No. 56656
Rear section module for size 1 or 2 drive controller:
SC6A162 and SC6A261

Quick DC-Link DL6B insulation end section

ID No. 56659
Insulation end sections for the left and right termination of the group, 2 pcs.

3.4.5 Braking resistor

In addition to drive controllers, STOBER offers the following braking resistors described below in various sizes and performance classes. For the selection, note the minimum permitted braking resistors specified in the technical data of the individual drive controller types.

3.4.5.1 Tubular fixed resistor FZMU, FZZMU

Type	FZMU 400×65	FZZMU 400×65
ID No.	49010	53895
SC6A062	X	—
SC6A162	(X)	X
SC6A261	(X)	X

Tab. 26: Assignment of FZMU, FZZMU braking resistor – SC6 drive controller

X	Recommended
(X)	Possible
—	Not possible

Properties

Specification	FZMU 400×65	FZZMU 400×65
ID No.	49010	53895
Type	Tubular fixed resistor	Tubular fixed resistor
Resistance [Ω]	100	47
Power [W]	600	1200
Therm. time const. τ_{th} [s]	40	40
Pulse power for < 1 s [kW]	18	36
U_{max} [V]	848	848
Weight without packaging [g]	2200	4170
Protection class	IP20	IP20
Test symbols	cURus CE	cURus CE

Tab. 27: FZMU, FZZMU specification

Dimensions

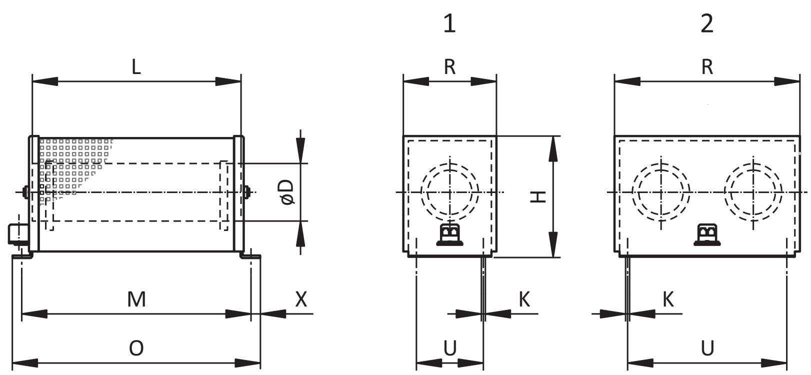


Fig. 4: FZMU (1), FZZMU (2) dimensional drawing

Dimension	FZMU 400×65	FZZMU 400×65
ID No.	49010	53895
L x D	400 × 65	400 × 65
H	120	120
K	6.5 × 12	6.5 × 12
M	430	426
O	485	485
R	92	185
U	64	150
X	10	10

Tab. 28: FZMU, FZZMU dimensions [mm]

3.4.5.2 GVADU, GBADU flat resistor

Type	GVADU 210×20	GBADU 265×30	GBADU 335×30
ID No.	55441	55442	55443
SC6A062	X	X	—
SC6A162	(X)	(X)	X
SC6A261	(X)	(X)	X

Tab. 29: Assignment of GVADU, GBADU braking resistor – SC6 drive controller

X	Recommended
(X)	Possible
—	Not possible

Properties

Specification	GVADU 210×20	GBADU 265×30	GBADU 335×30
ID No.	55441	55442	55443
Type	Flat resistor	Flat resistor	Flat resistor
Resistance [Ω]	100	100	47
Power [W]	150	300	400
Therm. time const. τ_{th} [s]	60	60	60
Pulse power for < 1 s [kW]	3.3	6.6	8.8
U_{max} [V]	848	848	848
Cable design	Radox	FEP	FEP
Cable length [mm]	500	1500	1500
Conductor cross-section [AWG]	18/19 (0.82 mm²)	14/19 (1.9 mm²)	14/19 (1.9 mm²)
Weight without packaging [g]	300	930	1200
Protection class	IP54	IP54	IP54
Test symbols	cULus CE	cULus CE	cULus CE

Tab. 30: GVADU, GBADU specification

Dimensions

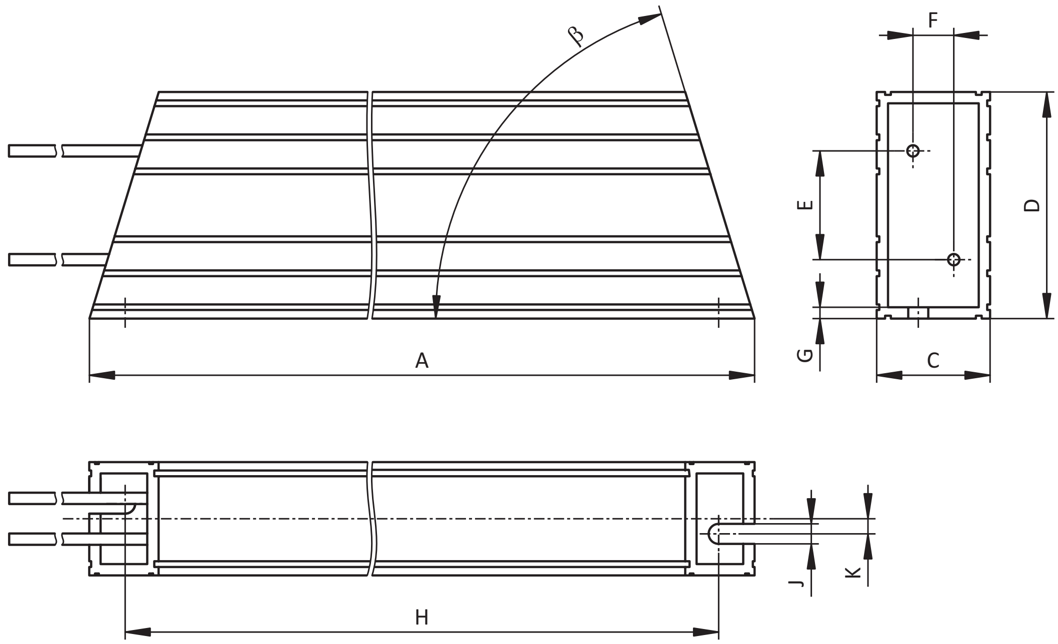


Fig. 5: GVADU, GBADU dimensional drawing

Dimension	GVADU 210×20	GBADU 265×30	GBADU 335×30
ID No.	55441	55442	55443
A	210	265	335
H	192	246	316
C	20	30	30
D	40	60	60
E	18.2	28.8	28.8
F	6.2	10.8	10.8
G	2	3	3
K	2.5	4	4
J	4.3	5.3	5.3
β	65°	73°	73°

Tab. 31: GVADU, GBADU dimensions [mm]

3.5 Further information

3.5.1 Directives and standards

The following European directives and standards are relevant to the drive controllers:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- EN ISO 13849-1:2015
- EN ISO 13849-2:2012
- EN 61800-3:2018
- EN 61800-5-1:2017
- EN 61800-5-2:2017

3.5.2 Symbols, marks and test symbols

Grounding symbol
Grounding symbol in accordance with IEC 60417, symbol 5019.

RoHS lead-free mark
Marking in accordance with RoHS directive 2011-65-EU.

CE mark
Manufacturer's self declaration: The product meets the requirements of EU directives.

UL test symbol
This product is listed by UL for the United States and Canada. Representative samples of this product have been evaluated by UL and meet the requirements of applicable standards.

UL recognized component mark
This component or material is recognized by UL. Representative samples of this product have been evaluated by UL and meet applicable requirements.

3.5.3 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Manual for SC6 drive controllers	442790

4 SI6 Drive controllers

Table of contents

4 Drive controllers

SI6

4.1 Overview

Drive control in a multi-axis drive system

Features

- Single or double-axis controller with a nominal output current up to 50 A and 250% overload capacity
- Supply modules up to 20 kW nominal power
- Sensorless position control of STOBER Lean motors
- Control of rotary synchronous servo motors, asynchronous motors and torque motors
- NEW: One Cable Solution EnDat 3
- Electronic motor nameplate via EnDat encoder interfaces
- Integrated EtherCAT or PROFINET communication
- STO safety technology using terminals or STO and SS1 using FSoE (Fail Safe over EtherCAT): SIL 3, PL e (cat. 4)
- Integrated brake control
- Energy supply over DC link connection
- Single-ended nominal power consumption on double-axis controllers for operation of motors with different power
- Variable feed-in power using supply modules that can be connected in parallel

4.1.1 Features

The completely re-designed STOBER multi-axis drive system consists of the SI6 drive controller and PS6 supply module combination. Matching Quick DC-Link modules handle the energy supply for the networked drive controllers. The SI6 drive controller is available in four sizes as a single or double-axis controller with a nominal output current of up to 50. The PS6 supply module is available in two sizes with a nominal power of 10 kW or 20 kW. As an economically attractive system with a minimized device width, the SI6 opens a new dimension in multi-axis applications.

For use with STOBER Lean motors, the sensorless vector control, specially designed for controlling Lean motors, is available.

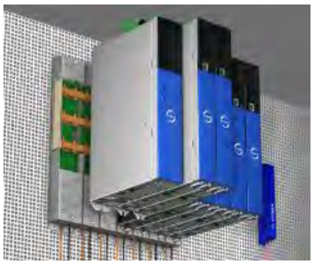
Drive control in multi-axis drive systems with SI6 and PS6

As small as a paperback

You save valuable space in your control cabinet because, with a width of just 45 mm, this drive controller is the most compact solution on the market. It offers all the features that a designer requires.

Dimension capacities precisely

4 axes? 16? Or even 97? A single SI6 drive controller can control up to two axes. Thanks to the multi-axis drive system, the number of motors or axes to be controlled can be scaled without limit. If required, SI6 drive controllers can be combined with stand-alone units from the STOBER SC6 or SD6 series. For the general energy supply, the drive controllers from the SI6, SC6 and SD6 series can be connected to each other using Quick DC-Link modules.



Tailored energy usage

The SI6 drive controllers are connected to a central supply module. There is no need for decentralized supply modules or fuses and cabling for each axis. When using double-axis modules, the unused power reserves of one axis can be used for the second axis. A significant reduction in space and cost!

Fewer clicks, less wiring

Installation is exceptionally simple. No difficult wiring. The patented Quick DC-Link modules allow for a simple “click” into the standard copper rails, as well as the simple installation and connection of the drive controllers.

Safety functions

The safety concept of the drive controller is based on the STO (Safe Torque Off) function. The concept corresponds to SIL 3 according to DIN EN 61800-5-2 and PL e (Cat. 4) according to DIN EN ISO 13849-1. For double-axis controllers, the STO safety function has a two-channel structure that acts upon both axes. For connection to a higher-level safety circuit, different interfaces are available (terminals or FSoE).

Heavy duty

There is an extremely robust design concealed behind the elegant exterior. All components—from the stable, well-shielded sheet steel housing to the motor connectors—far exceed the set values of industry standards. The inside is also anything but small-scale: ample computer capacities, high-quality components, careful workmanship.

4.1.2 Software components

Project configuration and commissioning

The 6th generation of DriveControlSuite project configuration and commissioning software has all the functions for the efficient use of drive controllers in single-axis and multi-axis applications. The program guides you step by step through the complete project configuration and parameterization process using wizards.

Open communication

The Ethernet-based EtherCAT and PROFINET fieldbus systems are available in the drive controller.

Applications

Controller-based motion control is recommended for the central motion control of complex machines.

Using the controller-based operating modes of the CiA 402 application, you can implement applications with synchronized, cyclic set value specification (csp, csv, cst, ip) by a motion controller. In addition, the drive controllers can also independently handle motion tasks, such as referencing and jogging during commissioning.

Drive-based Drive Based and Drive Based Synchronous applications and drive-based operating modes (pp, pv, pt) of the CiA 402 application are also available for torque/force mode, velocity mode or positioning mode.

4.1.3 Application training

STOBER offers a multi-level training program that is essentially focused on the drive controller.

G6 Basic

Training content: System overview, installation and commissioning of the drive controller. Use of option modules. Parameterization, commissioning and diagnostics using the commissioning software. Remote maintenance. Basics of controller optimization. Configuration of the drive train. Integrated software functions. Software applications. Connection to a higher-level controller. Basics of safety technology. Practical exercises on training topics.

Software used: DriveControlSuite.

G6 Customized

Training content: Special knowledge for regulating, control and safety technology. Electronic cam disk. Practical exercises on training topics.

4.2 Technical data

Technical data for the drive controllers, supply modules and accessories can be found in the following chapters.

4.2.1 General technical data

The following specifications apply equally to the SI6 drive controller and the PS6 supply module.

Device features	
Protection class of the device	IP20
Protection class of the installation space	At least IP54
Protection class	Protection class I in accordance with EN 61140
Radio interference suppression	Integrated line filter in accordance with EN 61800-3, interference emission class C3
Overvoltage category	III in accordance with EN 61800-5-1
Test symbols	

Tab. 1: Device features

Transport and storage conditions	
Storage/ transport temperature	−20 °C to +70 °C Maximum change: 20 K/h
Relative humidity	Maximum relative humidity 85%, non-condensing
Vibration (transport) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²
Fall height for freefall[1] Weight < 100 kg in accordance with EN 61800-2 (or IEC 60721-3-2, class 2M1)	0.25 m

Tab. 2: Transport and storage conditions

Operating conditions	
Surrounding temperature during operation	0 °C to 45 °C with nominal data 45 °C to 55 °C with derating −2.5% / K
Relative humidity	Maximum relative humidity 85%, non-condensing
Installation altitude	0 m to 1000 m above sea level without restrictions 1000 m to 2000 m above sea level with −1.5%/100 m derating
Pollution degree	Pollution degree 2 in accordance with EN 50178
Ventilation	Installed fan
Vibration (operation) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s²

Tab. 3: Operating conditions

Discharge times	
Self-discharge of DC link	15 min
DC link circuit fast discharge	Thanks to PS6 supply module in combination with a braking resistor: < 1 min

Tab. 4: Discharge times of the DC link circuit

[1] Only valid for components in original packaging

4.2.2 Supply module

The following section contains specifications for the electrical data, dimensions and weight of the PS6 supply module.

4.2.2.1 Type designation

PS	6	A	2	4

Tab. 5: Example code for supply module type designation

Code	Designation	Design
PS	Series	PowerSupply
6	Generation	Generation 6
A	Version	
2 – 3	Size	
4	Power output stage	

Tab. 6: Meaning of the example code

4.2.2.2 Sizes

Type	ID No.	Size
PS6A24	56650	Size 2
PS6A34	56651	Size 3

Tab. 7: Available PS6 types and sizes

PS6 in sizes 2 and 3

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size.

4.2.2.3 Electrical data

The electrical data of the available PS6 sizes as well as the properties of the brake chopper can be found in the following sections.

Information

The STO safety function is available for safe stopping as an alternative to continuous, cyclical power-on/power-off operation.

An explanation of the symbols used for formulas can be found in Chapter [▶ 14.1].

4.2.2.3.1 Control unit

Electrical data	All types
U_{1CU}	24 V_{DC}, +20%/−15%
I_{1maxCU}	0.5 A

Tab. 8: Control unit electrical data

4.2.2.3.2 Power unit: Size 2

Electrical data	PS6A24
U_{1PU}	3 × 400 V_{AC}, +32%/−50%, 50/60 Hz; 3 × 480 V_{AC}, +10%/−58%, 50/60 Hz
$U_{2PU,ZK}$	$\sqrt{2} \times U_{1PU}$
$P_{N,PU}$	10 kW
$I_{1N,PU}$	25 A
I_{1maxPU}	$I_{1N,PU}$ × 180% for 5 s; $I_{1N,PU}$ × 150% for 30 s
$C_{N,PU}$	5000 µF

Tab. 9: PS6 electrical data, size 2

4.2.2.3.3 Power unit: Size 3

Electrical data	PS6A34
U_{1PU}	3 × 400 V_{AC}, +32%/−50%, 50/60 Hz; 3 × 480 V_{AC}, +10%/−58%, 50/60 Hz
$U_{2PU,ZK}$	$\sqrt{2} \times U_{1PU}$
$P_{N,PU}$	20 kW
$I_{1N,PU}$	50 A
I_{1maxPU}	$I_{1N,PU}$ × 180% for 5 s; $I_{1N,PU}$ × 150% for 30 s
$C_{N,PU}$	10000 µF

Tab. 10: PS6 electrical data, size 3

4.2.2.3.4 Parallel connection

The power and current increase if supply modules are connected in parallel. Take into account that the total is derated by a factor of 0.8 in doing so.

The charging capacity of the supply modules can be increased by a parallel connection only if the power grid supply is connected to all supply modules simultaneously. Increasing the charging capacity also requires derating the total by a factor of 0.8.

The following table shows example combinations for parallel connection.

Electrical data	2 x PS6A24	3 x PS6A24	2 x PS6A34	3 x PS6A34
$P_{N,PU}$	16 kW	24 kW	32 kW	48 kW
$I_{1N,PU}$	40 A	60 A	80 A	120 A
C_{maxPU}	8000 µF	12000 µF	16000 µF	24000 µF

Tab. 11: Electrical data for parallel connection: Example combinations

The following general conditions apply to the parallel connection of several PS6 supply modules:

- Only the same sizes may be connected in parallel.
- You can connect a maximum of 3 PS6A34 in parallel.

4.2.2.3.5 Brake chopper

Electrical data	All types
U_{onCH}	780 – 800 V_{DC}
U_{offCH}	740 – 760 V_{DC}
R_{2minRB}	22 Ω
P_{maxRB}	29.1 kW
P_{effRB}	13.2 kW

Tab. 12: Brake chopper electrical data

4.2.2.3.6 Fast discharge

Fast discharge is activated when no power supply is present for 20 s and the DC link voltage has reduced over this time. For active fast discharge, the DC link is discharged via the brake chopper and the braking resistor. Fast discharge does not take place for constant or increasing DC link voltage as this behavior indicates a second supply module in the DC link group. If the temperature sensor of the braking resistor is active, the fast discharge also remains off.

4.2.2.4 Dimensions

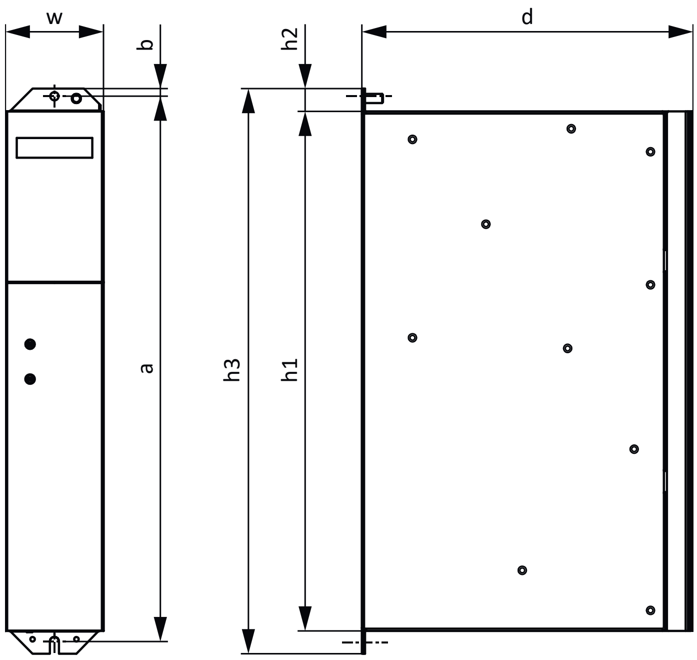


Fig. 1: PS6 dimensional drawing

Dimension			Size 2	Size 3
Supply module	Width	w	45	65
	Depth	d	204	219
	Body height	h1	343	
	Fastening clip height	h2	15	
	Height incl. fastening clips	h3	373	
Fastening holes (M5)	Vertical distance	a	360+2	
	Vertical distance to the upper edge	b	5	

Tab. 13: PS6 dimensions [mm]

4.2.2.5 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
PS6A24	2680	4180
PS6A34	3820	4920

Tab. 14: PS6 weight [g]

4.2.3 Drive controllers

The following chapters contain specifications for the electrical data, dimensions and weight of the drive controller.

4.2.3.1 Type designation

SI	6	A	0	6	1	Z

Tab. 15: Example code for drive controller type designation

Code	Designation	Design
SI	Series	ServoInverter
6	Generation	Generation 6
A	Version	
0 – 3	Size	
6	Power output stage	Power output stage within the size
1	Axis controller	Single-axis controller
2		Double-axis controller
Z	Safety technology	SZ6: Without safety technology
R		SR6: STO using terminals
Y		SY6: STO and SS1 using FSoE

Tab. 16: Meaning of the example code

4.2.3.2 Sizes

Type	ID No.	Size	Axis controller
SI6A061	56645	Size 0	Single-axis controller
SI6A062	56646	Size 0	Double-axis controller
SI6A161	56647	Size 1	Single-axis controller
SI6A162	56648	Size 1	Double-axis controller
SI6A261	56649	Size 2	Single-axis controller
SI6A262	56653	Size 2	Double-axis controller
SI6A361	56654	Size 3	Single-axis controller

Tab. 17: Available SI6 types and sizes

SI6 in sizes 0 to 3

Note that the basic device is delivered without terminals. Suitable terminal sets are available separately for each size.

4.2.3.3 Electrical data

The electrical data of the available SI6 sizes can be found in the following sections.

An explanation of the symbols used for formulas can be found in Chapter [▶ 14.1].

4.2.3.3.1 Control unit

Electrical data	All types
U_{1CU}	24 V_{DC}, +20%/−15%
I_{1maxCU}	0.5 A

Tab. 18: Control unit electrical data

4.2.3.3.2 Power unit: Size 0

Electrical data	SI6A061	SI6A062
U_{1PU}	280 – 800 V_{DC}	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	180 µF	270 µF

Tab. 19: SI6 electrical data, size 0

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SI6A061	SI6A062
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	5 A	2 × 5 A
I_{2maxPU}	210% for 2 s	

Tab. 20: SI6 electrical data, size 0, for 4 kHz clock frequency

Electrical data	SI6A061	SI6A062
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	4.5 A	2 × 4.5 A
I_{2maxPU}	250% for 2 s	

Tab. 21: SI6 electrical data, size 0, for 8 kHz clock frequency

4.2.3.3.3 Power unit: Size 1

Electrical data	SI6A161	SI6A162
U_{1PU}	280 – 800 V_{DC}	
f_{2PU}	0 – 700 Hz	
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	470 µF	940 µF

Tab. 22: SI6 electrical data, size 1

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SI6A161	SI6A162
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	12 A	2 × 12 A
I_{2maxPU}	210% for 2 s	

Tab. 23: SI6 electrical data, size 1, for 4 kHz clock frequency

Electrical data	SI6A161	SI6A162
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	10 A	2 × 10 A
I_{2maxPU}	250% for 2 s	

Tab. 24: SI6 electrical data, size 1, for 8 kHz clock frequency

4.2.3.3.4 Power unit: Size 2

Electrical data	SI6A261	SI6A262
U_{1PU}	$280 – 800\ V_{DC}$	
f_{2PU}	0 – 700 Hz	
U_{2PU}	$0 – \max. \frac{U_{1PU}}{\sqrt{2}}$	
C_{PU}	940 µF	2250 µF

Tab. 25: SI6 electrical data, size 2

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SI6A261	SI6A262
$f_{PWM,PU}$	4 kHz	
$I_{2N,PU}$	22 A	2 × 25 A
I_{2maxPU}	210% for 2 s	

Tab. 26: SI6 electrical data, size 2, for 4 kHz clock frequency

Electrical data	SI6A261	SI6A262
$f_{PWM,PU}$	8 kHz	
$I_{2N,PU}$	20 A	2 × 20 A
I_{2maxPU}	250% for 2 s	

Tab. 27: SI6 electrical data, size 2, for 8 kHz clock frequency

4.2.3.3.5 Power unit: Size 3

Electrical data	SI6A361
U_{1PU}	280 – 800 V_{DC}
f_{2PU}	0 – 700 Hz
U_{2PU}	0 – max. $\frac{U_{1PU}}{\sqrt{2}}$
C_{PU}	2250 µF

Tab. 28: SI6 electrical data, size 3

Nominal currents up to +45 °C (in the control cabinet)

Electrical data	SI6A361
$f_{PWM,PU}$	4 kHz
$I_{2N,PU}$	50 A
I_{2maxPU}	210% for 2 s

Tab. 29: SI6 electrical data, size 3, for 4 kHz clock frequency

Electrical data	SI6A361
$f_{PWM,PU}$	8 kHz
$I_{2N,PU}$	40 A
I_{2maxPU}	250% for 2 s

Tab. 30: SI6 electrical data, size 3, for 8 kHz clock frequency

4.2.3.3.6 Single-ended nominal power consumption on double-axis controllers

Operating two motors on one double-axis controller makes it possible to operate one of the motors with a continuous current above the nominal current of the drive controller if the continuous current of the second connected motor is lower than the nominal current of the drive controller. This enables economical combinations of double-axis controllers and motors.

The nominal output current for axis B can be determined using the following formula if the output current for axis A is known:

Example 1

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{3}{5} \qquad \text{where} \qquad 0 \le I_{2PU(A)} \le I_{2N,PU}$$

Example 2

$$I_{2PU(B)} = I_{2N,PU} - \left(I_{2PU(A)} - I_{2N,PU} \right) \times \frac{5}{3} \qquad \text{where} \qquad I_{2N,PU} \le I_{2PU(A)} \le 1{,}6 \times I_{2N,PU}$$

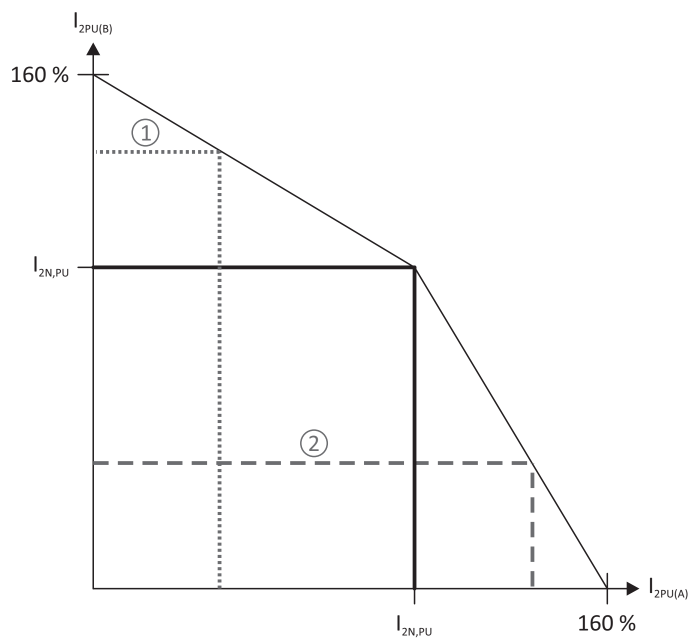


Fig. 2: Asymmetric load on double-axis controllers

Information

Note that the available maximum currents I_{2maxPU} of the axis controllers are also relative to the nominal output current $I_{2N,PU}$ for single-ended nominal power consumption.

4.2.3.3.7 Power loss data in accordance with EN 61800-9-2

Type	Nominal current $I_{2N,PU}$	Apparent power	Absolute losses $P_{V,CU}$[2]	Operating points[3]								IE class[4]	Comparison[5]
				(0/25)	(0/50)	(0/100)	(50/25)	(50/50)	(50/100)	(90/50)	(90/100)		
				Relative losses									
	[A]	[kVA]	[W]	[%]									
SI6A06x	5	3.5	Max. 10	0.71	0.86	1.33	0.76	0.97	1.61	1.13	2.13	IE2	
SI6A16x	12	8.3	Max. 10	0.55	0.71	1.19	0.59	0.80	1.44	0.94	1.87	IE2	
SI6A261	22	16.6	Max. 10	0.55	0.71	1.19	0.59	0.80	1.44	0.94	1.87	IE2	
SI6A262	25	17.3	Max. 10	0.45	0.62	1.12	0.50	0.74	1.47	0.95	2.12	IE2	
SI6A361	50	34.6	Max. 10	0.45	0.62	1.12	0.50	0.74	1.47	0.95	2.12	IE2	
				Absolute losses P_V									
	[A]	[kVA]	[W]	[W]									[%]
SI6A06x	5	3.5	Max. 10	25	30.2	46.5	26.5	33.8	56.5	39.5	74.4	IE2	24.9
SI6A16x	12	8.3	Max. 10	45.7	58.7	98.7	49.1	66.3	119.6	78.1	155.4	IE2	26.7
SI6A261	22	16.6	Max. 10	91.5	117.4	197.3	98.2	132.6	239.2	156.2	310.8	IE2	30.8
SI6A262	25	17.3	Max. 10	77.9	106.5	193.0	87.1	127.9	254.3	163.8	367.6	IE2	36.4
SI6A361	50	34.6	Max. 10	155.8	213.1	386.0	174.3	255.8	508.6	327.6	735.2	IE2	39.5

Tab. 31: Power loss data in accordance with EN 61800-9-2 for one axis of a SI6 drive controller

General conditions

The specified losses apply to an axis of a drive controller and take into account the proportionate losses of the PS6 supply module for that axis.

For a group with a total of x axes, the values are to be multiplied by the number of axis controllers (x), e.g. x = 4 for 1 × PS6 and 2 × SI6A062.

The loss data applies to drive controllers without any accessories.

The power loss calculation is based on a three-phase supply voltage with 400 V_{AC}/50 Hz.

The calculated data includes a supplement of 10% in accordance with EN 61800-9-2.

The power loss specifications refer to a clock frequency of 4 kHz.

The absolute losses for a power unit that is switched off refer to the 24 V_{DC} power supply of the control electronics.

[2] Absolute losses for a power unit that is switched off

[3] Operating points for relative motor stator frequency in % and relative torque current in %

[4] IE class in accordance with EN 61800-9-2

[5] Comparison of the losses for the reference related to IE2 in the nominal point (90, 100)

4.2.3.4 Derating

When dimensioning the drive controller, observe the derating of the nominal output current as a function of the clock frequency, surrounding temperature and installation altitude. There is no restriction for a surrounding temperature from 0 °C to 45 °C and an installation altitude of 0 m to 1000 m. The details given below apply to values outside these ranges.

4.2.3.4.1 Effect of the clock frequency

Changing the clock frequency f_{PWM} affects the amount of noise produced by the drive, among other things. However, increasing the clock frequency results in increased losses. During project configuration, define the highest clock frequency and use it to determine the nominal output current $I_{2N,PU}$ for dimensioning the drive controller.

Type	$I_{2N,PU}$ 4 kHz [A]	$I_{2N,PU}$ 8 kHz [A]	$I_{2N,PU}$ 16 kHz [A]
SI6A061	5	4.5	3.5
SI6A062	2 × 5	2 × 4.5	2 × 3.5
SI6A161	12	10	6
SI6A162	2 × 12	2 × 10	2 × 6
SI6A261	22	20	10
SI6A262	2 × 25	2 × 20	2 × 10
SI6A361	50	40	—

Tab. 32: Nominal output current $I_{2N,PU}$ dependent on the clock frequency

4.2.3.4.2 Effect of the surrounding temperature

Derating as a function of the surrounding temperature is determined as follows:

- 0 °C to 45 °C: No restrictions (D_T = 100%)
- 45 °C to 55 °C: Derating −2.5%/K

Example

The drive controller needs to be operated at 50 °C.

The derating factor D_T is calculated as follows
D_T= 100% − 5 × 2.5% = 87.5%

4.2.3.4.3 Effect of the installation altitude

Derating as a function of the installation altitude is determined as follows:

- 0 m to 1000 m: No restriction (D_{IA} = 100%)
- 1000 m to 2000 m: Derating −1.5%/100 m

Example

The drive controller needs to be installed at an altitude of 1500 m above sea level.

The derating factor D_{IA} is calculated as follows:
D_{IA} = 100% − 5 × 1.5% = 92.5%

4.2.3.4.4 Calculating the derating

Follow these steps for the calculation:

1. Determine the highest clock frequency (f_{PWM}) that will be used during operation and use it to determine the nominal current $I_{2N,PU}$.
2. Determine the derating factors for installation altitude and surrounding temperature.
3. Calculate the reduced nominal current $I_{2N,PU(red)}$ in accordance with the following formula:
   $I_{2N,PU(red)} = I_{2N,PU} \times D_T \times D_{IA}$

Example

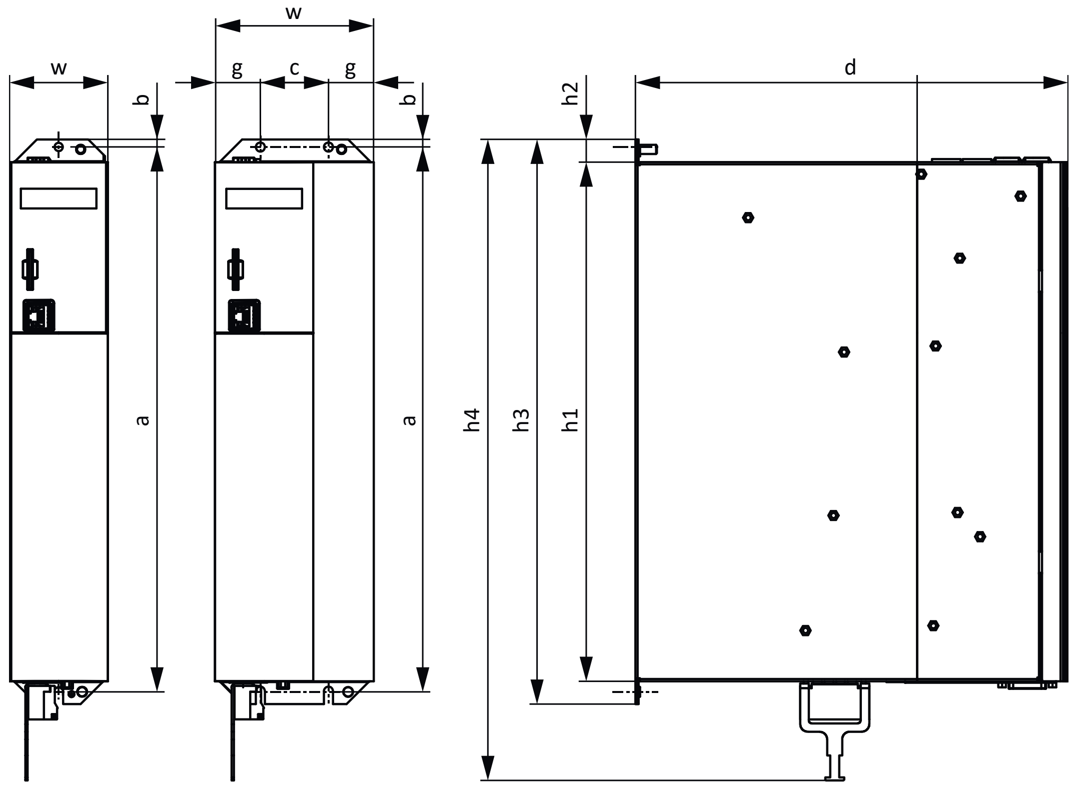
A drive controller of type SI6A061 needs to be operated at a clock frequency of 8 kHz at an altitude of 1500 m above sea level and a surrounding temperature of 50 °C.

The nominal current of the SI6A061 at 8 kHz is 4.5 A. The derating factor D_T is calculated as follows:
D_T = 100% − 5 × 2.5% = 87.5%

The derating factor D_{IA} is calculated as follows:
D_{IA} = 100% − 5 × 1.5% = 92.5%

The output current of importance for the project configuration is:
$I_{2N,PU(red)}$ = 4.5 A × 0.875 × 0.925 = 3.64 A

4.2.3.5 Dimensions



0 – 2 **3**

Fig. 3: SI6 dimensional drawing

Dimension			Size 0	Size 1	Size 2[6]	Size 2[7]	Size 3
Drive controller	Width	w	45	65		105	
	Depth	d	265	286			
	Body height	h1	343				
	Fastening clip height	h2	15				
	Height incl. fastening clips	h3	373				
	Total height incl. shield connection	h4	423				
Fastening holes (M5)	Vertical distance	a	360+2				
	Vertical distance to the upper edge	b	5				
	Horizontal spacing of the fastening holes	c	45				
	Horizontal distance to the side edge	g	30				

Tab. 33: SI6 dimensions [mm]

[6] Single-axis controller
[7] Double-axis controller

4.2.3.6 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
SI6A061	2980	4600
SI6A062	3460	5060
SI6A161	3880	5260
SI6A162	4820	6240
SI6A261	4760	6200
SI6A262	6240	7420
SI6A361	6180	7360

Tab. 34: SI6 weight [g]

4.2.4 DC link connection

The following section contains specifications for the electrical data, dimensions and weight of the DL6B modules Quick DC-Link.

4.2.4.1 General technical data

The following information applies to all Quick DC-Link modules and corresponds to the general technical data for the base device.

Device features	
Protection class of the device	IP20 (if built over with drive controller or supply module)
Protection class	Protection class I in accordance with EN 61140 (if built over with drive controller or supply module)
Protection class of the installation space	At least IP54

Tab. 35: Device features

Transport and storage conditions	
Storage/ transport temperature	−20 °C to +70 °C Maximum change: 20 K/h
Relative humidity	Maximum relative humidity 85%, non-condensing
Vibration (transport) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 3.5 mm 9 Hz ≤ f ≤ 200 Hz: 10 m/s² 200 Hz ≤ f ≤ 500 Hz: 15 m/s²
Fall height for freefall[8] Weight < 100 kg in accordance with EN 61800-2 (or IEC 60721-3-2, class 2M1)	0.25 m

Tab. 36: Transport and storage conditions

Operating conditions	
Surrounding temperature during operation	0 °C to 45 °C with nominal data 45 °C to 55 °C with derating −2.5% / K
Relative humidity	Maximum relative humidity 85%, non-condensing
Installation altitude	0 m to 1000 m above sea level without restrictions 1000 m to 2000 m above sea level with −1.5%/100 m derating
Pollution degree	Pollution degree 2 in accordance with EN 50178
Vibration (operation) in accordance with EN 60068-2-6	5 Hz ≤ f ≤ 9 Hz: 0.35 mm 9 Hz ≤ f ≤ 200 Hz: 1 m/s²

Tab. 37: Operating conditions

[8] Only valid for components in original packaging

4.2.4.2 assignment to DL6B – SI6 and PS6

DL6B is available in the following designs suitable for the individual drive controller types and supply module types:

Type	DL6B10	DL6B11	DL6B12	DL6B20	DL6B21
ID No.	56655	56656	56663	56657	56658
SI6A061	X	–	–	–	–
SI6A062	X	–	–	–	–
SI6A161	–	X	–	–	–
SI6A162	–	X	–	–	–
SI6A261	–	X	–	–	–
SI6A262	–	–	X	–	–
SI6A361	–	–	X	–	–
PS6A24	–	–	–	X	–
PS6A34	–	–	–	–	X

Tab. 38: DL6B assignment to SI6 and PS6

4.2.4.3 Dimensions

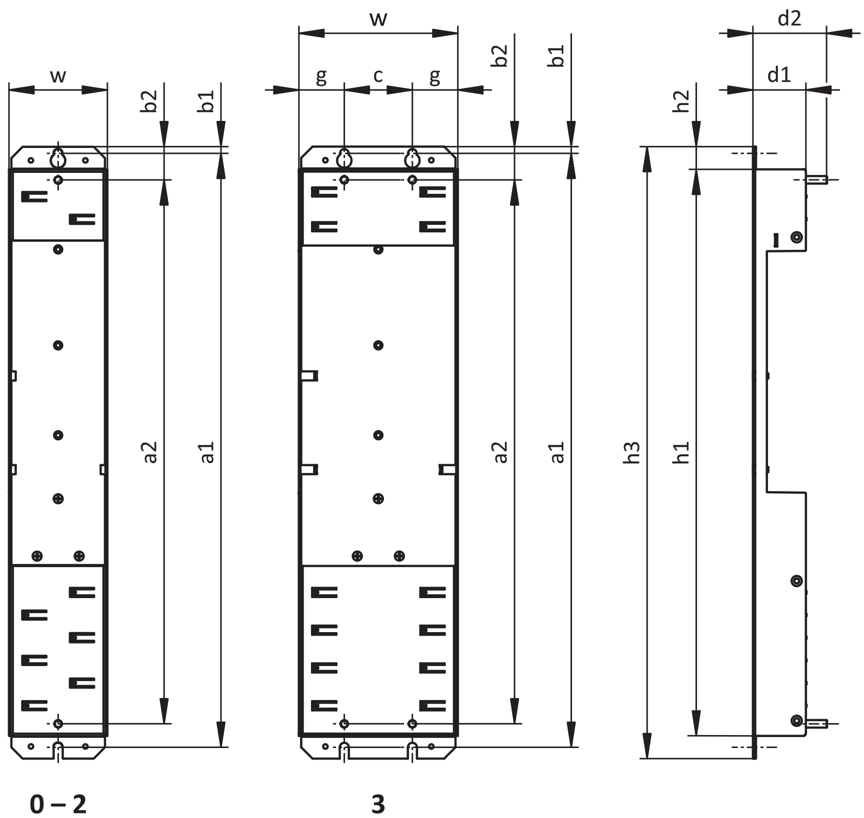


Fig. 4: DL6B dimensional drawing

Dimension			DL6B10 DL6B20	DL6B11 DL6B21	DL6B12
Quick DC-Link	Width	w	45	65	105
	Depth	d1		35	
	Depth incl. attachment bolts	d2		49	
	Height	h1		375	
	Fastening clip height	h2		15	
	Height incl. fastening clips	h3		405	
Fastening holes	Vertical distance (wall mounting)	a1		393+2	
	Vertical distance (module mounting)	a2		360	
	Vertical distance to the up-per edge	b1		4.5	
	Vertical distance to the up-per edge	b2		22	
	Horizontal spacing of the fastening holes	c	—		45
	Horizontal distance to the side edge	g	—		30

Tab. 39: DL6B dimensions [mm]

4.2.4.4 Weight

Type	Weight without packaging [g]	Weight with packaging [g]
DL6B10	440	480
DL6B11	560	600
DL6B12	880	920
DL6B20	480	520
DL6B21	740	780

Tab. 40: DL6B weight [g]

4.2.5 Minimum clearances

Drive controllers and supply modules

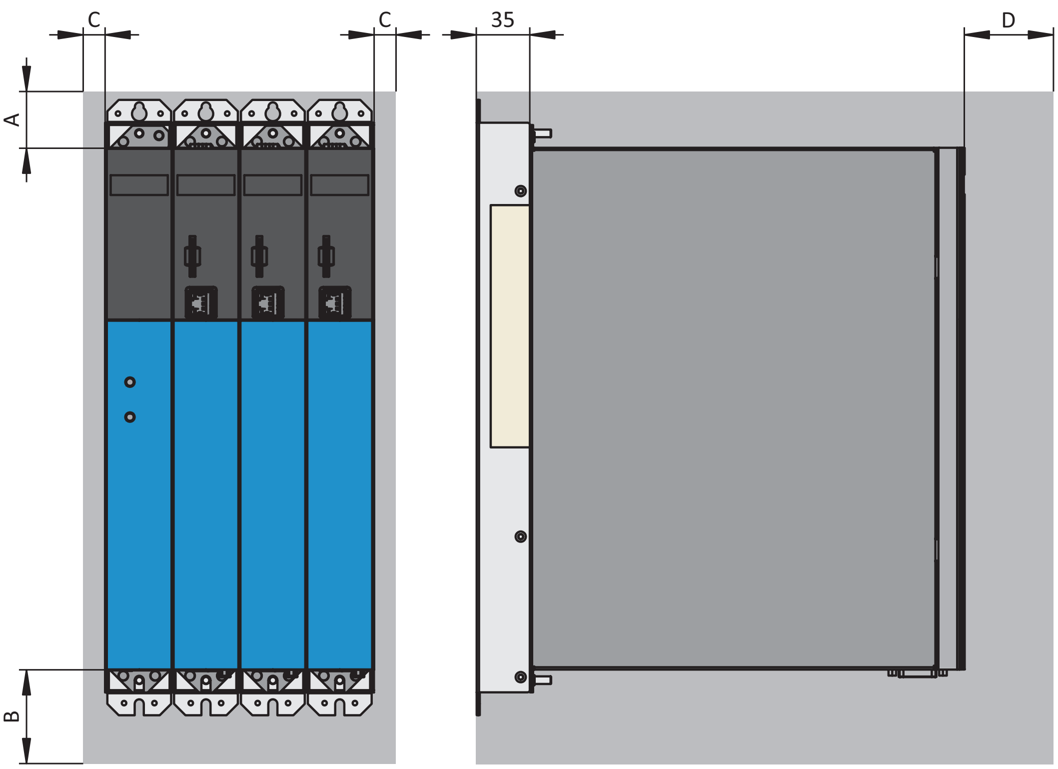


Fig. 5: Minimum clearances

The specified dimensions refer to the outside edges of the drive controller or supply module including the Quick DC-Link rear section module.

Minimum clearance	A (above)	B (below)	C (on the side)	D (in front)
All sizes	100	200	5	50[9]

Tab. 41: Minimum clearances [mm]

Chokes and filters

Avoid installation below drive controllers or supply modules. For installation in a control cabinet, a distance of approximately 100 mm to other neighboring components is recommended. This distance ensures proper heat dissipation for chokes and filters.

Braking resistors

Avoid installation below drive controllers or supply modules. In order for heated air to flow out unimpeded, a minimum clearance of approximately 200 mm must be maintained in relation to neighboring components or walls and approximately 300 mm must be maintained to components above or ceilings.

[9] Minimum clearance to be taken into account for permanent connection of the X9 service interface

4.3 Drive controller/motor combinations

An explanation of the symbols used for formulas can be found in Chapter [▸ 14.1].

LM Lean motor (n_N = 3000 rpm) – SI6

						SI6A061 SI6A062	SI6A161 SI6A162	SI6A261	SI6A262	SI6A361
						$I_{2N,PU}$ [A] ($f_{PWM,PU}$ = 4 kHz)				
	K_{EM} [V/1000 rpm]	M_N [Nm]	I_N [A]	M_0 [Nm]	I_0 [A]	5	12	22	25	50
						$I_{2N,PU}$ / I_0				
LM401	110	2.25	1.59	2.43	1.82	2.7				
LM402	120	4.41	2.88	4.50	2.94	1.7				
LM403	120	6.06	3.92	6.19	4.08	1.2				
LM503	135	9.48	5.62	10.07	5.95	—	2.0			
LM505	135	13.70	7.83	15.47	8.83	—	1.4			
LM704	145	19.27	10.64	21.26	11.57	—		1.9	2.2	
LM706	140	25.67	14.69	29.80	16.80	—	—	1.3	1.5	

— Not possible

4.4 Accessories

You can find information about the available accessories in the following chapters.

4.4.1 Safety technology

Information

The drive controller is delivered in the standard design without safety technology (option SZ6). If you want a drive controller with integrated safety technology, you must order it together with the drive controller. The safety modules are an integrated part of the drive controllers and must not be modified.

SZ6 option – Without safety technology

Included in the standard version.

ID No. 56660
Design without safety technology.

SR6 safety module – STO using terminals

ID No. 56661
Optional accessory for the use of the Safe Torque Off safety function (STO) in safety-relevant applications (PL e, SIL 3) in accordance with EN ISO 13849-1 and EN 61800-5-2. Connection to a higher-level safety circuit via terminal X12.

SY6 safety module – STO and SS1 using FSoE

Safety over EtherCAT

ID No. 56662
Optional accessory for the use of the Safe Torque Off (STO) and Safe Stop 1 (SS1) safety functions in safety-relevant applications (PL e, SIL 3) in accordance with EN ISO 13849-1 and EN 61800-5-2. Connection to the higher-level safety circuit using Fail Safe over EtherCAT (FSoE).

4.4.2 Communication

The drive controller has two interfaces for the fieldbus connection on the top of the device as well as an Ethernet service interface on the front of the device. Cables for the connection are available separately.

EtherCAT or PROFINET fieldbus system

Please specify the desired fieldbus system when placing your purchase order for the base device, since the fieldbus communication is defined using the firmware.

EtherCAT cables

Ethernet patch cable, CAT5e, yellow.
The following designs are available:
ID No. 49313: Length approx. 0.2 m.
ID No. 49314: Length approx. 0.35 m.

PC connecting cables

ID No. 49857
Cable for connecting the X9 service interface to the PC, CAT5e, blue, 5 m.

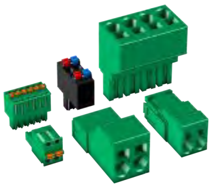
USB 2.0 Ethernet adapter

ID No. 49940
Adapter for connecting Ethernet to a USB port.

4.4.3 Terminal set

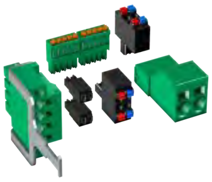
For the connection, you need suitable terminal sets for each PS6 supply module and each SI6 drive controller.

Terminal set for supply module



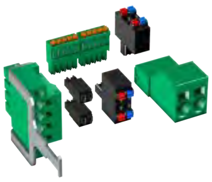
The following designs are available:
ID No. 138660
Terminal set for PS6A24.
ID No. 138661
Terminal set for PS6A34.

Terminal set for drive controller – SZ6 option (without safety technology) or SY6 option (STO and SS1 using FSoE)



The following designs are available:
ID No. 138655
Terminal set for SI6A061Z/Y.
ID No. 138656
Terminal set for SI6A062Z/Y.
ID No. 138657
Terminal set for SI6A161Z/Y.
ID No. 138658
Terminal set for SI6A162Z/Y.
ID No. 138659
Terminal set for SI6A261Z/Y.
ID No. 138662
Terminal set for SI6A262Z/Y.
ID No. 138663
Terminal set for SI6A361Z/Y.

Terminal set for drive controller – SR6 option (STO via terminals)



The following designs are available:
ID No. 138683
Terminal set for SI6A061R.
ID No. 138684
Terminal set for SI6A062R.
ID No. 138685
Terminal set for SI6A161R.
ID No. 138686
Terminal set for SI6A162R.
ID No. 138687
Terminal set for SI6A261R.
ID No. 138688
Terminal set for SI6A262R.
ID No. 138689
Terminal set for SI6A361R.

4.4.4 DC link connection

For the energy supply of the existing networked drive controllers, you need suitable Quick DC-Link modules of type DL6B for each PS6 supply module and each SI6 drive controller.

For the horizontal connection, you receive DL6B rear section modules in various designs, matched to the size of the drive controller or supply module.

The quick fastening clamps for attaching the copper rails and an insulation connection piece are contained in the scope of delivery. The copper rails are not included in the scope of delivery. These must have a cross-section of 5 x 12 mm. Insulation end sections are available separately.

Quick DC-Link DL6B for drive controller

The following designs are available:
DL6B10
ID No. 56655
Rear section module for size 0 drive controller:
SI6A061 and SI6A062
DL6B11
ID No. 56656
Rear section module for size 1 or 2 (single-axis controller) drive controller:
SI6A161, SI6A162 and SI6A261
DL6B12
ID No. 56663
Rear section module for size 2 (double-axis controller) or 3 drive controller:
SI6A262 and SI6A361

Quick DC-Link DL6B for supply module

The following designs are available:
DL6B20
ID No. 56657
Rear section module for size 2 supply module:
PS6A24
DL6B21
ID No. 56658
Rear section module for size 3 supply module:
PS6A34

Quick DC-Link DL6B insulation end section

ID No. 56659
Insulation end sections for the left and right termination of the group, 2 pcs.

4.4.5 Braking resistor

In addition to the supply modules, STOBER offers braking resistors in the various sizes and performance classes described below. For the selection, note the minimum permitted braking resistors specified in the technical data of the supply modules. In the event of a fault, such as a defective brake chopper, the supply module must be disconnected from the power supply.

4.4.5.1 Braking resistor assignment – PS6

Type	KWADQU	FZZMQU	FGFKQU
ID No.	56634	56635	56636
PS6A24	(—)	(X)	X
PS6A34	(—)	(X)	X

Tab. 42: Braking resistor assignment to PS6 supply module

X	Recommended
(X)	Possible
(—)	Useful under certain conditions

4.4.5.2 KWADQU flat resistor

Properties

Specification	KWADQU 420×91
ID No.	56634
Type	Flat resistor with temperature switch (incl. mounting bracket)
Resistance [Ω]	100
Power [W]	600
Thermal time constant τ_{th} [s]	60
Pulse power for < 1 s [kW]	13
U_{max} [V]	848
Cable design	FEP
Cable length [mm]	500
Conductor cross-section [AWG]	14/19 (1.9 mm²)
Weight without packaging [g]	2600
Protection class	IP54
Test symbols	cULus CE

Tab. 43: KWADQU specification

Specification	Temperature switch
Switching capacity	2 A / 24 V_{DC} (DC11)
Nominal response temperature ϑ_{NAT}	180 °C ± 5 K
Type	NC
Cable design	FEP
Cable length [mm]	500
Conductor cross-section [AWG]	22

Tab. 44: Temperature switch specification

Dimensions

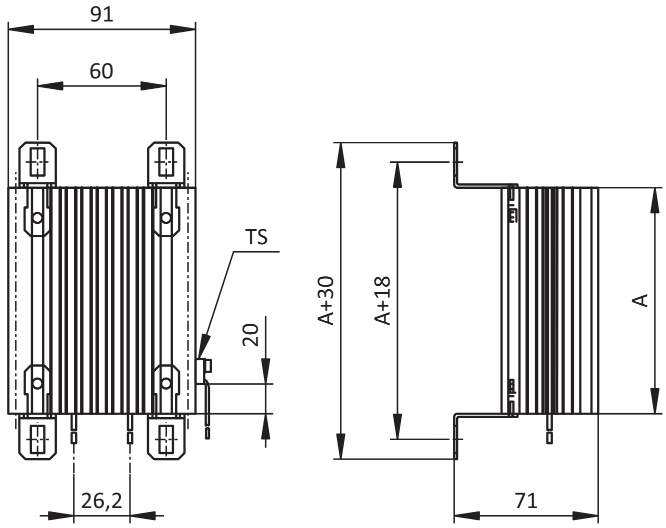


Fig. 6: KWADQU dimensional drawing

Dimension	KWADQU 420×91
A	420

Tab. 45: KWADQU dimensions [mm]

4.4.5.3 FZZMQU tubular fixed resistor

Properties

Specification	FZZMQU 400×65
ID No.	56635
Type	Tubular fixed resistor with temperature switch
Resistance [Ω]	47
Power [W]	1200
Thermal time constant τ_{th} [s]	40
Pulse power for < 1 s [kW]	36
U_{max} [V]	848
Weight without packaging [g]	4200
Protection class	IP20
Test symbols	cURus CE

Tab. 46: FZZMQU specification

Specification	Temperature switch
Switching capacity	2 A / 24 V_{DC} (DC11)
Nominal response temperature ϑ_{NAT}	180 °C ± 5 K
Type	NC
Cable design	FEP
Cable length [mm]	500
Conductor cross-section [AWG]	22

Tab. 47: Temperature switch specification

Dimensions

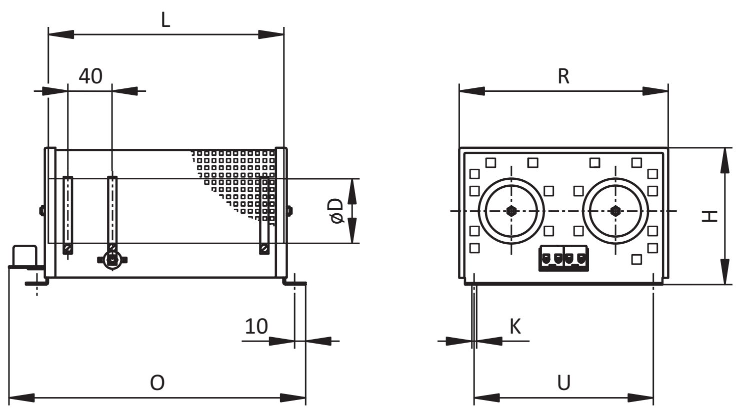


Fig. 7: FZZMQU dimensional drawing

Dimension	FZZMQU 400×65
L × D	400 × 65
H	120
K	6.5 × 12
O	485
R	185
U	150

Tab. 48: FZZMQU dimensions [mm]

4.4.5.4 FGFKQU steel-grid fixed resistor

Properties

Specification	FGFKQU 31005
ID No.	56636
Type	Steel-grid fixed resistor with temperature switch
Resistance [Ω]	22
Power [W]	2500
Thermal time constant τ_{th} [s]	30
Pulse power for < 1 s [kW]	50
U_{max} [V]	848
Weight without packaging [g]	7500
Protection class	IP20
Test symbols	cULus CE

Tab. 49: FGFKQU specification

Specification	Temperature switch
Switching capacity	2 A / 24 V_{DC} (DC11)
Nominal response temperature ϑ_{NAT}	180 °C ± 5 K
Type	NC
Cable design	FEP
Cable length [mm]	500
Conductor cross-section [AWG]	22

Tab. 50: Temperature switch specification

Dimensions

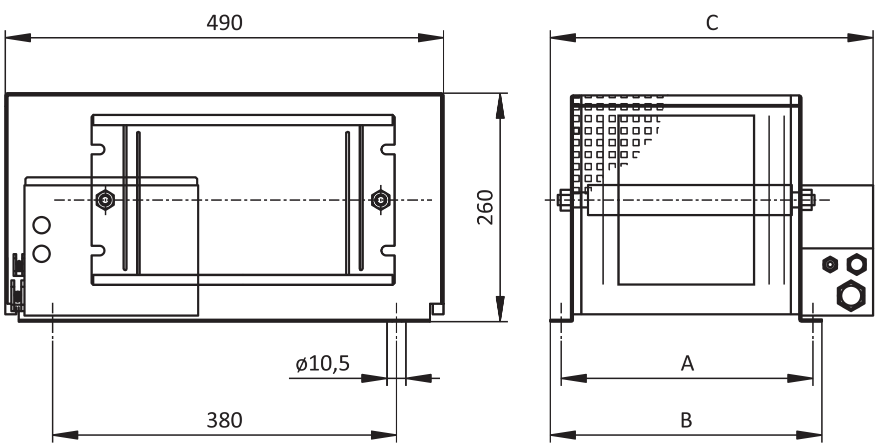


Fig. 8: FGFKQU dimensional drawing

Dimension	FGFKQU 31005
A	270
B	295
C	355

Tab. 51: FGFKQU dimensions [mm]

4.4.6 Choke

Technical specifications for suitable chokes can be found in the following chapters.

4.4.6.1 TEP power choke

Power chokes are used to dampen voltage and current peaks and reduce the load of the power feed-in of the supply modules.

Properties

Specification	**TEP4010-2US00**
ID No.	56528
Phases	3
Thermally allowed continuous current	100 A
Nominal current $I_{N,MF}$	90 A
Absolute loss P_V	103 W
Inductance	0.14 mH
Voltage range	3×400 V_{AC}, +32%/−50% 3×480 V_{AC}, +10%/−58%
Voltage drop U_k	2%
Frequency range	50/60 Hz
Protection class	IP00
Max. surrounding temperature $\vartheta_{amb,max}$	40 °C
Insulation class	B
Connection	Screw terminal
Connection type	Flexible with and without end sleeve
Max. conductor cross-section	6 – 35 mm²
Tightening torque	2.5 Nm
Insulation stripping length	17 mm
Installation	Screws
Directive	EN 61558-2-20
UL Recognized Component (CAN; USA)	Yes
Test symbol, symbol	

Tab. 52: TEP specification

Dimensions

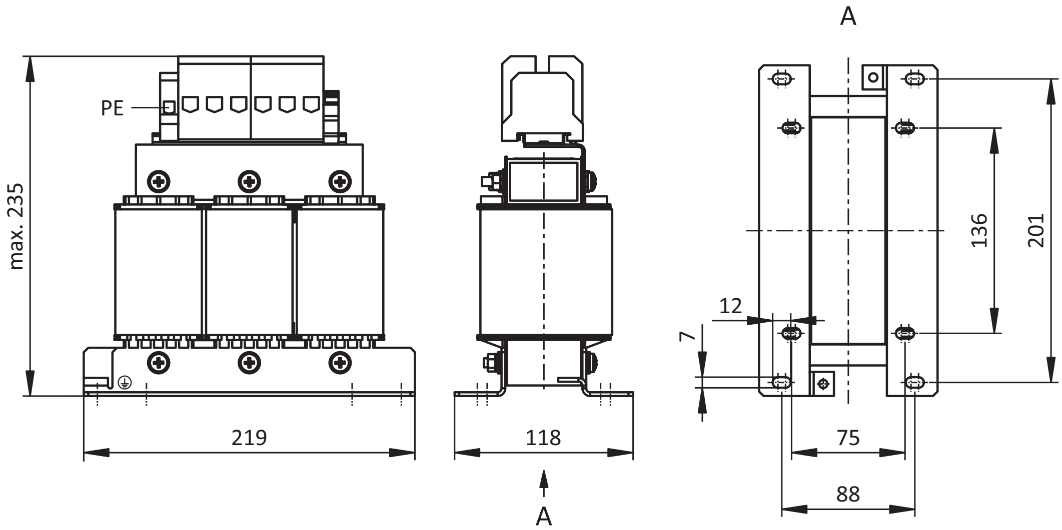


Fig. 9: Power choke dimensional drawing

Dimensions	TEP4010-2US00
Height [mm]	235
Width [mm]	219
Depth [mm]	118
Vertical distance 1 – fastening holes [mm]	201
Vertical distance 2 – Fastening holes [mm]	136
Horizontal distance 1 – fastening holes [mm]	88
Horizontal distance 2 – Fastening holes [mm]	75
Drill holes – Depth [mm]	7
Drill holes – Width [mm]	12
Screw connection – M	M6
Weight without packaging [g]	9900

Tab. 53: TEP dimensions and weight

4.5 Further information

4.5.1 Directives and standards

The following European directives and standards are relevant to the drive controllers:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- EN ISO 13849-1:2015
- EN ISO 13849-2:2012
- EN 61800-3:2018
- EN 61800-5-1:2017
- EN 61800-5-2:2017

4.5.2 Symbols, marks and test symbols

Grounding symbol
Grounding symbol in accordance with IEC 60417, symbol 5019.

RoHS lead-free mark
Marking in accordance with RoHS directive 2011-65-EU.

CE mark
Manufacturer's self declaration: The product meets the requirements of EU directives.

UL test symbol
This product is listed by UL for the United States and Canada. Representative samples of this product have been evaluated by UL and meet the requirements of applicable standards.

UL recognized component mark
This component or material is recognized by UL. Representative samples of this product have been evaluated by UL and meet applicable requirements.

4.5.3 Additional documentation

Additional documentation related to the product can be found at
http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Manual for SI6 drive controllers	442728

5 Connection method

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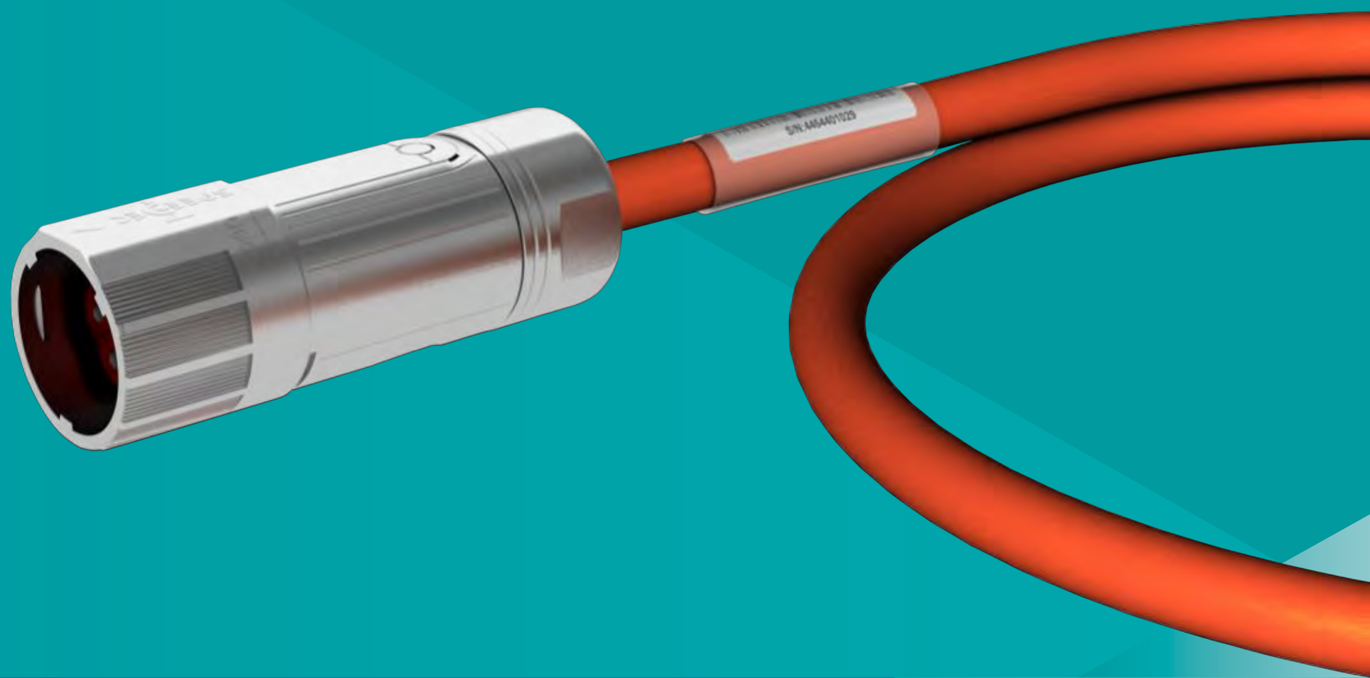


5 Connection method

5.1 Overview

Coordinated connection methods for STOBER drive controllers

Features

- Torsional stress ±30°/m
- Bending resistance
- Oil resistance
- Chemical resistance

A drive controller, cable and motor that are not coordinated with one another can lead to impermissibly high voltage peaks in the drive system, which may cause damage to the motor. The legal requirements of (EMC) Directive 2014/30/EU must also be observed.

Combining STOBER motors, STOBER cables and STOBER drive controllers enables you to comply with these legal requirements.

STOBER offers a range of cables to match. Cables are available in different lengths and are ready-made on both ends.

Using unsuitable connection cables may void any claims made under the warranty.

5.2 Conventions for cables

In the cable connection descriptions, core colors are shortened and used as follows.

Cable colors

BK:	BLACK	PK:	PINK
BN:	BROWN	RD:	RED
BU:	BLUE	VT:	VIOLET
GN:	GREEN	WH:	WHITE
GY:	GRAY	YE:	YELLOW
OG:	ORANGE		

Formatting conventions

Two-colored core:	WHYE	WHITEYELLOW (white and yellow)
Single-colored core:	BK/BN	BLACK/BROWN (black or brown)

5.3 Power cables

STOBER Lean motors of the LM series are equipped with plug connectors as standard.

The cables are available ready-made in the lengths 2.5 m, 5.0 m, 7.5 m, 10.0 m, 12.5 m, 15.0 m, 18.0 m, 20.0 m, 25.0 m, 30.0 m.
Other lengths on request.

5.3.1 Motor assignment

STOBER offers cables with a minimum cross-section for the motors as standard. Depending on the application, however, larger conductor cross-sections may be required. For this reason, take into account the following points in addition for dimensioning the cable:

- Stall current I_0 of the motor
- Permitted current carrying capacity of the conductors
- Cable length
- Terminal specifications of the drive controller
- Connector size of the motor

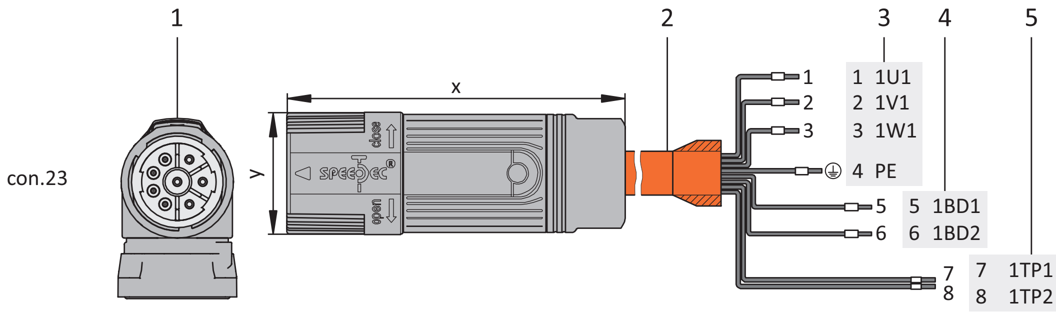
Assignment of LM Lean motors (nN = 3000 rpm)

	K_{EM} V/1000 rpm	Plug connector size	Minimum cross-section mm²
LM401	110	con.23	1.5
LM402	120	con.23	1.5
LM403	120	con.23	1.5
LM503	135	con.23	1.5
LM505	135	con.23	1.5
LM704	145	con.23	2.5
LM706	140	con.23	2.5

Tab. 1: Plug connector size and minimum cross-section, Lean motors

5.3.2 Connection description

Suitable power cables for STOBER Lean motors of the LM series are available in plug connector size con.23 with a speedtec quick lock.



1: Plug connectors

2: STOBER power cable, cable shield

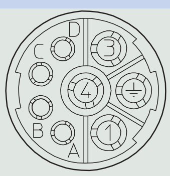
3: Connection to terminal X20, motor

4: Connection of terminal X2/X5, brake

5: Connection to terminal X2, temperature sensor

The maximum cable length of the shielded power cable is 50 m. The use of cables with a length greater than 50 m and up to maximum 100 m must be checked by STOBER for the application.

Power cables – con.23 plug connector

Motor (1)				Cable (2)	Drive controller (3) – (5)		
Motor connection diagram	**Pin**	**Designation**	**Int. motor Core color**	**Core No./ Core color**	**Pin X20**	**Pin X2/X5**	**Pin X2**
	1	1U1	BK	1	1	—	—
	3	1V1	BU	2	2	—	—
	4	1W1	RD	3	3	—	—
	A	1BD1	BK	5	—	5	—
	B	1BD2	BK	6	—	6	—
	C	1TP1	BK	7	—	—	7
	D	1TP2	WH	8	—	—	8
	⏚	PE	GNYE	GNYE	4	—	—
	Housing	Shield	—	—	Shield contact	—	—

Tab. 2: con.23 power cable pin assignment

Length x [mm]	Diameter y [mm]
78	26

Tab. 3: con.23 connector dimensions

5.4 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Connection method manual	443102

6 P planetary geared motors

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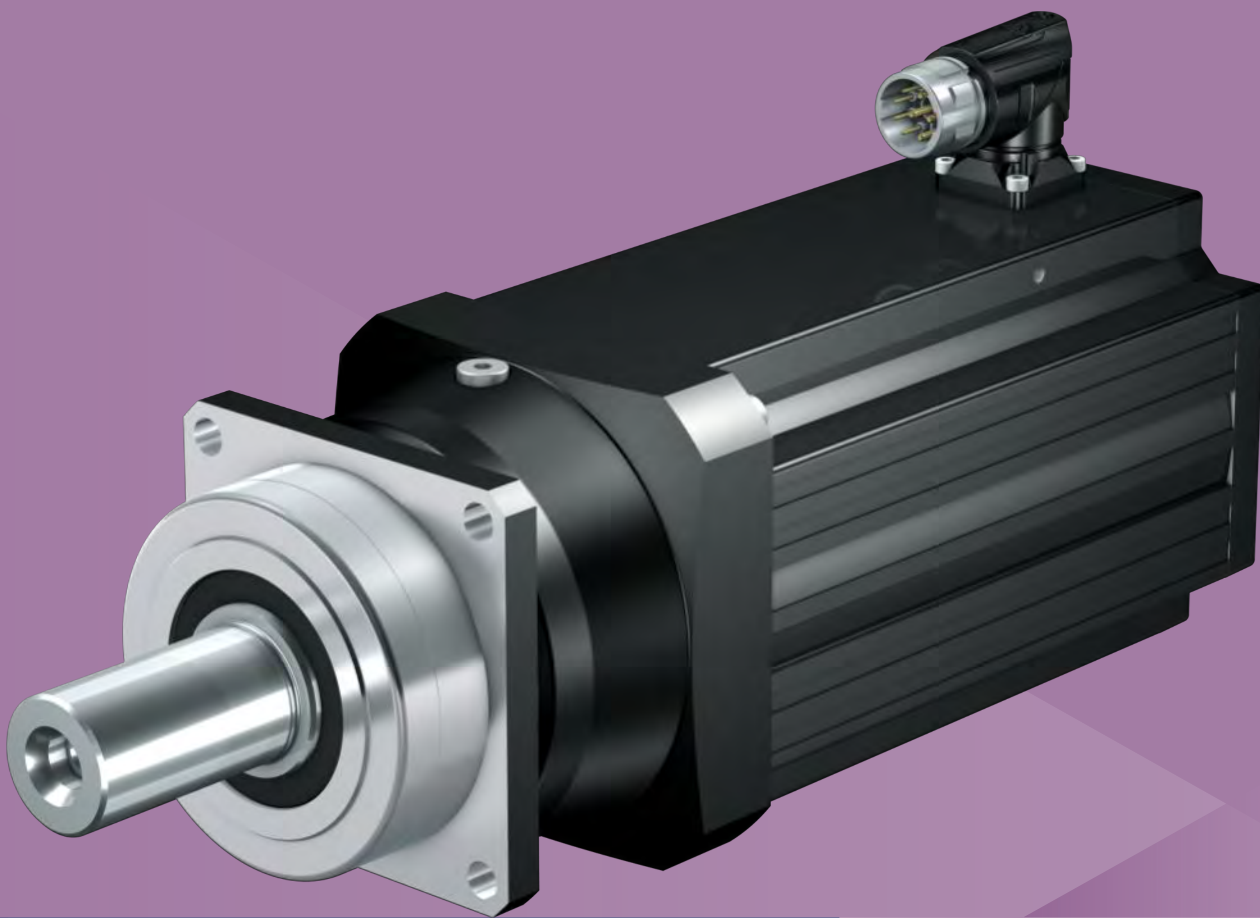


6 Planetary geared motors

P

6.1 Overview

Helical-geared precision planetary geared motors

Features

Power density	★★★★☆
Backlash	★★★★☆
Price category	€€
Shaft load	★★★★☆
Smooth operation	★★★★☆
Torsional stiffness	★★★☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
Any mounting position	✓
Continuous operation without cooling	✓
Reinforced output bearing	✓ (optional)
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	3 – 70
M_{2acc}	13 – 1840 Nm
$\Delta\phi_2$	1 – 5 arcmin
η_{get}	95 – 97 %

6.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors
- M_{2acc}, M_{2accHT}: Solid shaft design without feather key (we generally recommend this shaft design for cyclic operation)

For all other technical data, refer to http://configurator.stoeber.de.

An explanation of the formula symbols can be found in the Chapter [▶ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 66 Nm)																	
300	22	24	1.2	1.3	P331_0100 LM401U	44	44	120	10.00	10/1	5500	8000	1.7	4.0	2.0	4.4	5.9
375	17	19	1.3	2.0	P331_0080 LM401U	35	35	130	8.000	8/1	5000	8000	1.7	4.0	2.0	4.7	5.9
375	34	35	2.6	1.0	P331_0080 LM402U	63	65	130	8.000	8/1	5000	8000	3.0	4.0	2.0	4.7	7.6
429	15	17	1.4	2.6	P331_0070 LM401U	31	31	140	7.000	7/1	5000	8000	1.7	4.0	2.0	5.1	5.9
429	30	31	2.7	1.3	P331_0070 LM402U	66	66	140	7.000	7/1	5000	8000	3.1	4.0	2.0	5.1	7.6
600	11	12	2.1	3.6	P331_0050 LM401U	22	22	150	5.000	5/1	4500	8000	1.7	4.0	2.0	5.5	5.9
600	21	22	4.0	1.8	P331_0050 LM402U	47	47	150	5.000	5/1	4500	8000	3.1	4.0	2.0	5.5	7.6
750	8.7	9.4	2.7	4.5	P331_0040 LM401U	17	17	130	4.000	4/1	4000	8000	1.8	4.0	2.0	5.5	5.9
750	17	17	5.3	2.3	P331_0040 LM402U	38	38	130	4.000	4/1	4000	8000	3.1	4.0	2.0	5.5	7.6
1000	6.5	7.1	5.7	4.0	P331_0030 LM401U	13	13	100	3.000	3/1	3500	7000	2.0	4.0	2.0	5.3	5.9
1000	13	13	11	2.0	P331_0030 LM402U	28	28	100	3.000	3/1	3500	7000	3.3	4.0	2.0	5.3	7.6
P4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																	
60	107	115	1.6	0.95	P432_0500 LM401U	130	140	260	50.00	50/1	5000	8000	1.7	5.0	3.0	12	8.3
75	86	92	2.1	1.0	P432_0400 LM401U	130	130	260	40.00	40/1	5000	8000	1.7	5.0	3.0	12	8.3
86	75	81	1.9	1.4	P432_0350 LM401U	130	140	270	35.00	35/1	4500	8000	1.7	5.0	3.0	12	8.3
94	68	74	2.3	1.3	P432_0320 LM401U	130	130	250	32.00	32/1	4000	8000	1.8	5.0	3.0	9.6	8.3
107	60	65	2.3	1.6	P432_0280 LM401U	120	120	260	28.00	28/1	4500	8000	1.7	5.0	3.0	12	8.3
107	117	120	4.5	0.81	P432_0280 LM402U	130	130	260	28.00	28/1	4500	8000	3.1	5.0	3.0	12	9.9
120	53	58	2.3	1.9	P432_0250 LM401U	110	110	270	25.00	25/1	4500	8000	1.8	5.0	3.0	13	8.3
120	105	107	4.5	0.96	P432_0250 LM402U	130	140	270	25.00	25/1	4500	8000	3.1	5.0	3.0	13	9.9
150	43	46	2.7	2.2	P432_0200 LM401U	86	86	270	20.00	20/1	4000	8000	1.8	5.0	3.0	12	8.3
150	84	86	5.3	1.1	P432_0200 LM402U	130	140	270	20.00	20/1	4000	8000	3.1	5.0	3.0	12	9.9
188	34	37	3.2	2.6	P432_0160 LM401U	69	69	260	16.00	16/1	4000	8000	1.8	5.0	3.0	12	8.3
188	67	68	6.4	1.3	P432_0160 LM402U	130	130	260	16.00	16/1	4000	8000	3.1	5.0	3.0	12	9.9
250	26	28	5.6	2.3	P432_0120 LM401U	51	51	200	12.00	12/1	3500	7000	1.8	5.0	3.0	11	8.3
250	50	51	11	1.2	P432_0120 LM402U	100	100	200	12.00	12/1	3500	7000	3.2	5.0	3.0	11	9.9
300	43	44	1.4	1.4	P431_0100 LM402U	94	94	230	10.00	10/1	4000	8000	3.1	4.0	2.0	9.1	8.6
300	59	60	1.9	1.0	P431_0100 LM403U	120	120	230	10.00	10/1	4000	8000	4.4	4.0	2.0	9.1	10
375	34	35	1.6	2.0	P431_0080 LM402U	75	75	240	8.000	8/1	4000	8000	3.1	4.0	2.0	9.8	8.6
375	47	48	2.2	1.5	P431_0080 LM403U	100	100	240	8.000	8/1	4000	8000	4.4	4.0	2.0	9.8	10
375	74	78	3.4	0.95	P431_0080 LM503U	120	130	240	8.000	8/1	4000	8000	10	4.0	2.0	9.8	13
429	30	31	1.7	2.5	P431_0070 LM402U	66	66	270	7.000	7/1	4000	8000	3.1	4.0	2.0	11	8.6
429	41	42	2.4	1.8	P431_0070 LM403U	87	87	270	7.000	7/1	4000	8000	4.4	4.0	2.0	11	10
429	64	68	3.7	1.2	P431_0070 LM503U	140	140	270	7.000	7/1	4000	8000	10	4.0	2.0	11	13
600	21	22	2.6	3.5	P431_0050 LM402U	47	47	280	5.000	5/1	3700	7000	3.2	4.0	2.0	13	8.6
600	29	30	3.6	2.5	P431_0050 LM403U	62	62	280	5.000	5/1	3700	7000	4.5	4.0	2.0	13	10
600	46	49	5.6	1.6	P431_0050 LM503U	99	99	280	5.000	5/1	3700	7000	11	4.0	2.0	13	13
600	66	75	8.1	1.1	P431_0050 LM505U	140	150	280	5.000	5/1	3700	7000	17	4.0	2.0	13	18
750	17	17	3.4	4.3	P431_0040 LM402U	38	38	240	4.000	4/1	3300	6500	3.4	4.0	2.0	13	8.6
750	24	24	4.7	3.2	P431_0040 LM403U	50	50	240	4.000	4/1	3300	6500	4.7	4.0	2.0	13	10
750	37	39	7.3	2.0	P431_0040 LM503U	79	79	240	4.000	4/1	3300	6500	11	4.0	2.0	13	13
750	53	60	11	1.4	P431_0040 LM505U	120	120	240	4.000	4/1	3300	6500	17	4.0	2.0	13	18
1000	13	13	8.2	3.4	P431_0030 LM402U	28	28	200	3.000	3/1	3000	6000	3.8	4.0	2.0	13	8.6
1000	18	18	11	2.5	P431_0030 LM403U	37	37	200	3.000	3/1	3000	6000	5.1	4.0	2.0	13	10
1000	28	29	18	1.6	P431_0030 LM503U	59	59	200	3.000	3/1	3000	6000	11	4.0	2.0	13	13
1000	40	45	25	1.1	P431_0030 LM505U	93	93	200	3.000	3/1	3000	6000	18	4.0	2.0	13	18
P5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 360 Nm)																	
43	293	299	1.1	0.90	P532_0700 LM402U	350	360	690	70.00	70/1	4200	8000	3.1	4.0	2.0	30	13
54	235	239	1.5	0.94	P532_0560 LM402U	290	290	580	56.00	56/1	4000	8000	3.1	4.0	2.0	25	13
60	209	214	1.4	1.2	P532_0500 LM402U	350	350	700	50.00	50/1	4000	8000	3.1	4.0	2.0	32	13
60	288	294	1.9	0.88	P532_0500 LM403U	350	350	700	50.00	50/1	4000	8000	4.4	4.0	2.0	32	14
75	168	171	2.0	1.2	P532_0400 LM402U	300	300	600	40.00	40/1	4000	8000	3.1	4.0	2.0	31	13

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 360 Nm)																	
75	230	235	2.7	0.88	P532_0400 LM403U	300	300	600	40.00	40/1	4000	8000	4.4	4.0	2.0	31	14
86	147	150	1.6	1.8	P532_0350 LM402U	320	320	700	35.00	35/1	4000	8000	3.1	4.0	2.0	33	13
86	201	206	2.2	1.3	P532_0350 LM403U	350	350	700	35.00	35/1	4000	8000	4.4	4.0	2.0	33	14
86	315	335	3.5	0.84	P532_0350 LM503U	350	350	700	35.00	35/1	4000	8000	10	4.0	2.0	33	17
94	134	137	1.9	1.8	P532_0320 LM402U	290	290	620	32.00	32/1	3500	7000	3.3	4.0	2.0	25	13
94	184	188	2.5	1.3	P532_0320 LM403U	310	360	620	32.00	32/1	3500	7000	4.6	4.0	2.0	25	14
94	288	306	4.0	0.83	P532_0320 LM503U	310	360	620	32.00	32/1	3500	7000	11	4.0	2.0	25	17
107	117	120	2.1	2.0	P532_0280 LM402U	260	260	600	28.00	28/1	4000	8000	3.1	4.0	2.0	32	13
107	161	165	2.8	1.4	P532_0280 LM403U	300	300	600	28.00	28/1	4000	8000	4.4	4.0	2.0	32	14
107	252	268	4.4	0.92	P532_0280 LM503U	300	300	600	28.00	28/1	4000	8000	10	4.0	2.0	32	17
120	105	107	1.9	2.5	P532_0250 LM402U	230	230	710	25.00	25/1	3700	7000	3.2	4.0	2.0	33	13
120	144	147	2.7	1.8	P532_0250 LM403U	300	300	710	25.00	25/1	3700	7000	4.5	4.0	2.0	33	14
120	225	239	4.2	1.2	P532_0250 LM503U	360	360	710	25.00	25/1	3700	7000	11	4.0	2.0	33	17
150	84	86	2.2	3.0	P532_0200 LM402U	180	180	710	20.00	20/1	3500	7000	3.3	4.0	2.0	33	13
150	115	118	3.1	2.2	P532_0200 LM403U	240	240	710	20.00	20/1	3500	7000	4.6	4.0	2.0	33	14
150	180	191	4.8	1.4	P532_0200 LM503U	360	360	710	20.00	20/1	3500	7000	11	4.0	2.0	33	17
150	260	294	7.0	0.96	P532_0200 LM505U	360	360	710	20.00	20/1	3500	7000	17	4.0	2.0	33	22
188	67	68	2.9	3.3	P532_0160 LM402U	150	150	600	16.00	16/1	3500	7000	3.3	4.0	2.0	33	13
188	92	94	3.9	2.4	P532_0160 LM403U	200	200	600	16.00	16/1	3500	7000	4.6	4.0	2.0	33	14
188	144	153	6.1	1.5	P532_0160 LM503U	300	300	600	16.00	16/1	3500	7000	11	4.0	2.0	33	17
188	208	235	8.9	1.1	P532_0160 LM505U	300	300	600	16.00	16/1	3500	7000	17	4.0	2.0	33	22
250	50	51	6.0	2.4	P532_0120 LM402U	110	110	400	12.00	12/1	3000	6000	3.4	4.0	2.0	31	13
250	69	71	8.3	1.7	P532_0120 LM403U	150	150	400	12.00	12/1	3000	6000	4.7	4.0	2.0	31	14
250	108	115	13	1.1	P532_0120 LM503U	200	200	400	12.00	12/1	3000	6000	11	4.0	2.0	31	17
300	92	98	3.5	1.6	P531_0100 LM503U	200	200	580	10.00	10/1	3700	7000	11	3.0	1.0	26	15
300	133	150	5.0	1.1	P531_0100 LM505U	290	290	580	10.00	10/1	3700	7000	17	3.0	1.0	26	19
375	74	78	3.7	2.4	P531_0080 LM503U	160	160	590	8.000	8/1	3700	7000	11	3.0	1.0	25	15
375	106	120	5.3	1.6	P531_0080 LM505U	250	250	590	8.000	8/1	3700	7000	17	3.0	1.0	25	19
375	150	165	7.5	1.2	P531_0080 LM704U	300	300	590	8.000	8/1	3700	7000	37	3.0	1.0	25	25
375	199	231	10	0.88	P531_0080 LM706U	300	300	590	8.000	8/1	3700	7000	54	3.0	1.0	25	32
429	64	68	4.1	2.9	P531_0070 LM503U	140	140	670	7.000	7/1	3700	7000	11	3.0	1.0	31	15
429	93	105	6.0	2.0	P531_0070 LM505U	220	220	670	7.000	7/1	3700	7000	17	3.0	1.0	31	19
429	131	144	8.4	1.4	P531_0070 LM704U	280	280	670	7.000	7/1	3700	7000	37	3.0	1.0	31	25
429	174	202	11	1.1	P531_0070 LM706U	330	380	670	7.000	7/1	3700	7000	54	3.0	1.0	31	32
600	46	49	6.2	4.0	P531_0050 LM503U	99	99	570	5.000	5/1	3500	7000	11	3.0	1.0	35	15
600	66	75	8.9	2.8	P531_0050 LM505U	160	160	570	5.000	5/1	3500	7000	17	3.0	1.0	35	19
600	93	103	13	2.0	P531_0050 LM704U	200	200	700	5.000	5/1	3500	7000	37	3.0	1.0	35	25
600	125	145	17	1.5	P531_0050 LM706U	300	300	700	5.000	5/1	3500	7000	55	3.0	1.0	35	32
750	37	39	8.1	5.0	P531_0040 LM503U	79	79	460	4.000	4/1	3000	6000	12	3.0	1.0	35	15
750	53	60	12	3.5	P531_0040 LM505U	120	120	460	4.000	4/1	3000	6000	18	3.0	1.0	35	19
750	75	82	16	2.5	P531_0040 LM704U	160	160	600	4.000	4/1	3000	6000	38	3.0	1.0	35	25
750	100	116	22	1.8	P531_0040 LM706U	240	240	600	4.000	4/1	3000	6000	55	3.0	1.0	35	32
1000	28	29	20	3.8	P531_0030 LM503U	59	59	340	3.000	3/1	2500	5000	13	3.0	1.0	35	15
1000	40	45	29	2.6	P531_0030 LM505U	93	93	340	3.000	3/1	2500	5000	20	3.0	1.0	35	19
1000	56	62	41	1.9	P531_0030 LM704U	120	120	400	3.000	3/1	2500	5000	39	3.0	1.0	35	25
1000	75	87	54	1.4	P531_0030 LM706U	180	180	400	3.000	3/1	2500	5000	57	3.0	1.0	35	32
P7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 810 Nm)																	
43	630	670	1.4	0.88	P732_0700 LM503U	760	800	1520	70.00	70/1	3700	7000	11	4.0	2.0	60	24
54	504	536	1.7	0.99	P732_0560 LM503U	650	650	1300	56.00	56/1	3700	7000	11	4.0	2.0	57	24
60	450	478	1.7	1.2	P732_0500 LM503U	770	810	1540	50.00	50/1	3700	7000	11	4.0	2.0	63	24
60	651	735	2.4	0.85	P732_0500 LM505U	770	810	1540	50.00	50/1	3700	7000	17	4.0	2.0	63	29
75	360	383	2.3	1.3	P732_0400 LM503U	700	700	1400	40.00	40/1	3700	7000	11	4.0	2.0	63	24
75	521	588	3.3	0.87	P732_0400 LM505U	700	700	1400	40.00	40/1	3700	7000	17	4.0	2.0	63	29
86	315	335	2.0	1.7	P732_0350 LM503U	680	680	1540	35.00	35/1	3700	7000	11	4.0	2.0	64	24
86	456	514	2.9	1.2	P732_0350 LM505U	770	810	1540	35.00	35/1	3700	7000	17	4.0	2.0	64	29
86	641	707	4.1	0.84	P732_0350 LM704U	770	810	1540	35.00	35/1	3700	7000	37	4.0	2.0	64	35
94	288	306	2.4	1.6	P732_0320 LM503U	620	620	1460	32.00	32/1	3000	6000	11	4.0	2.0	57	24
94	416	470	3.5	1.1	P732_0320 LM505U	730	730	1460	32.00	32/1	3000	6000	18	4.0	2.0	57	29
94	586	646	5.0	0.80	P732_0320 LM704U	730	730	1460	32.00	32/1	3000	6000	37	4.0	2.0	57	35
107	252	268	2.3	2.1	P732_0280 LM503U	540	540	1400	28.00	28/1	3700	7000	11	4.0	2.0	64	24
107	364	412	3.3	1.5	P732_0280 LM505U	700	700	1400	28.00	28/1	3700	7000	17	4.0	2.0	64	29
107	513	566	4.6	1.1	P732_0280 LM704U	700	700	1400	28.00	28/1	3700	7000	37	4.0	2.0	64	35
120	225	239	2.6	2.2	P732_0250 LM503U	480	480	1610	25.00	25/1	3500	7000	11	4.0	2.0	64	24
120	325	367	3.7	1.5	P732_0250 LM505U	760	760	1610	25.00	25/1	3500	7000	17	4.0	2.0	64	29
120	458	505	5.3	1.1	P732_0250 LM704U	810	810	1610	25.00	25/1	3500	7000	37	4.0	2.0	64	35

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
P7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 810 Nm)																	
120	610	708	7.0	0.82	P732_0250 LM706U	810	810	1610	25.00	25/1	3500	7000	55	4.0	2.0	64	42
150	180	191	3.2	2.6	P732_0200 LM503U	390	390	1610	20.00	20/1	3000	6000	11	4.0	2.0	64	24
150	260	294	4.6	1.8	P732_0200 LM505U	610	610	1610	20.00	20/1	3000	6000	18	4.0	2.0	64	29
150	366	404	6.4	1.3	P732_0200 LM704U	780	780	1610	20.00	20/1	3000	6000	38	4.0	2.0	64	35
150	488	566	8.5	0.94	P732_0200 LM706U	810	810	1610	20.00	20/1	3000	6000	55	4.0	2.0	64	42
188	144	153	3.6	3.1	P732_0160 LM503U	310	310	1400	16.00	16/1	3000	6000	12	4.0	2.0	65	24
188	208	235	5.2	2.2	P732_0160 LM505U	490	490	1400	16.00	16/1	3000	6000	18	4.0	2.0	65	29
188	293	323	7.3	1.5	P732_0160 LM704U	630	630	1400	16.00	16/1	3000	6000	38	4.0	2.0	65	35
188	390	453	9.8	1.2	P732_0160 LM706U	700	700	1400	16.00	16/1	3000	6000	55	4.0	2.0	65	42
250	108	115	6.3	2.7	P732_0120 LM503U	230	230	1000	12.00	12/1	2500	5000	12	4.0	2.0	62	24
250	156	176	9.2	1.9	P732_0120 LM505U	370	370	1000	12.00	12/1	2500	5000	18	4.0	2.0	62	29
250	220	242	13	1.3	P732_0120 LM704U	470	470	1000	12.00	12/1	2500	5000	38	4.0	2.0	62	35
250	293	340	17	1.0	P732_0120 LM706U	500	500	1000	12.00	12/1	2500	5000	55	4.0	2.0	62	42
300	187	206	4.3	1.5	P731_0100 LM704U	400	400	1150	10.00	10/1	3000	6000	37	3.0	1.0	55	31
300	249	289	5.8	1.1	P731_0100 LM706U	580	580	1150	10.00	10/1	3000	6000	54	3.0	1.0	55	38
375	150	165	4.5	2.3	P731_0080 LM704U	320	320	1340	8.000	8/1	3000	6000	37	3.0	1.0	58	31
375	199	231	6.0	1.8	P731_0080 LM706U	480	480	1340	8.000	8/1	3000	6000	55	3.0	1.0	58	38
429	131	144	4.8	2.9	P731_0070 LM704U	280	280	1560	7.000	7/1	3000	6000	38	3.0	1.0	61	31
429	174	202	6.4	2.2	P731_0070 LM706U	420	420	1560	7.000	7/1	3000	6000	55	3.0	1.0	61	38
600	93	103	7.2	4.1	P731_0050 LM704U	200	200	1120	5.000	5/1	2700	5500	39	3.0	1.0	67	31
600	125	145	9.6	3.1	P731_0050 LM706U	300	300	1120	5.000	5/1	2700	5500	56	3.0	1.0	67	38
750	100	116	13	3.9	P731_0040 LM706U	240	240	900	4.000	4/1	2500	5000	58	3.0	1.0	69	38
1000	56	62	21	4.4	P731_0030 LM704U	120	120	680	3.000	3/1	2200	4000	46	3.0	1.0	68	31
1000	75	87	28	3.3	P731_0030 LM706U	180	180	680	3.000	3/1	2200	4000	63	3.0	1.0	68	38
P8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1840 Nm)																	
43	1281	1414	1.4	0.97	P832_0700 LM704U	1610	1610	3220	70.00	70/1	3000	6000	37	4.0	2.0	164	52
54	1025	1131	1.9	0.98	P832_0560 LM704U	1380	1380	2760	56.00	56/1	3000	6000	38	4.0	2.0	159	52
60	915	1010	1.6	1.4	P832_0500 LM704U	1840	1960	3230	50.00	50/1	3000	6000	37	4.0	2.0	173	52
60	1219	1416	2.1	1.0	P832_0500 LM706U	1840	2000	3230	50.00	50/1	3000	6000	54	4.0	2.0	173	59
75	732	808	2.2	1.4	P832_0400 LM704U	1560	1560	3200	40.00	40/1	3000	6000	37	4.0	2.0	168	52
75	975	1132	3.0	1.0	P832_0400 LM706U	1600	1600	3200	40.00	40/1	3000	6000	55	4.0	2.0	168	59
86	641	707	1.9	2.0	P832_0350 LM704U	1370	1370	3230	35.00	35/1	3000	6000	38	4.0	2.0	176	52
86	854	991	2.6	1.5	P832_0350 LM706U	1840	2000	3230	35.00	35/1	3000	6000	55	4.0	2.0	176	59
94	586	646	2.5	1.7	P832_0320 LM704U	1250	1250	3050	32.00	32/1	2700	5000	40	4.0	2.0	159	52
94	780	906	3.3	1.3	P832_0320 LM706U	1520	1600	3050	32.00	32/1	2700	5000	57	4.0	2.0	159	59
107	513	566	2.7	2.0	P832_0280 LM704U	1100	1100	3200	28.00	28/1	3000	5000	38	4.0	2.0	172	52
107	683	793	3.6	1.5	P832_0280 LM706U	1600	1600	3200	28.00	28/1	3000	5000	55	4.0	2.0	172	59
120	458	505	2.3	2.8	P832_0250 LM704U	980	980	3230	25.00	25/1	2900	5000	39	4.0	2.0	177	52
120	610	708	3.0	2.1	P832_0250 LM706U	1460	1460	3230	25.00	25/1	2900	5000	56	4.0	2.0	177	59
150	366	404	2.6	3.4	P832_0200 LM704U	780	780	3230	20.00	20/1	2700	5000	40	4.0	2.0	177	52
150	488	566	3.4	2.6	P832_0200 LM706U	1170	1170	3230	20.00	20/1	2700	5000	58	4.0	2.0	177	59
188	293	323	3.5	3.4	P832_0160 LM704U	630	630	3200	16.00	16/1	2700	5000	41	4.0	2.0	174	52
188	390	453	4.7	2.6	P832_0160 LM706U	930	930	3200	16.00	16/1	2700	5000	58	4.0	2.0	174	59
250	220	242	5.2	3.6	P832_0120 LM704U	470	470	2400	12.00	12/1	2200	4500	42	4.0	2.0	168	52
250	293	340	6.9	2.7	P832_0120 LM706U	700	700	2400	12.00	12/1	2200	4500	60	4.0	2.0	168	59

6.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

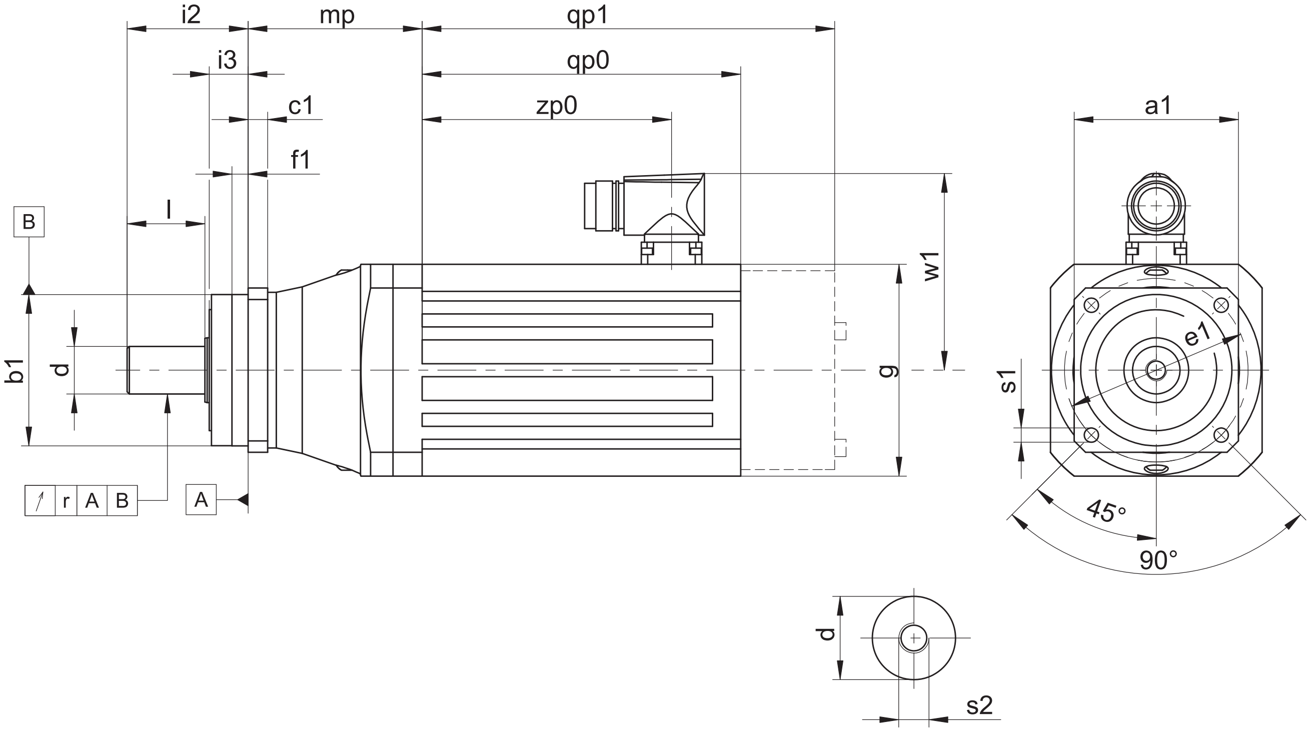
Tolerances

Solid shaft	Tolerance
Fit	ISO k6
Feather keys	DIN 6885-1, high form A
Balancing	With half feather key

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

6.3.1 G shaft design (solid shaft without feather key)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
–	The radial runout specification applies only to the reinforced bearing D.		

Dimensions of gear units

Type	□a1	∅b1	c1	∅d	∅e1	f1	i2	i3	l	r	∅s1	s2
P331	72	60_{h6}	7	16_{k6}	75	7.5	48	18	28	0.025	5.5	M5
P431	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	0.025	6.6	M8
P432	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	0.025	6.6	M8
P531	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	0.030	9.0	M12
P532	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	0.030	9.0	M12
P731	144	130_{h6}	15	40_{k6}	165	3.5	112	27	82	0.035	11.0	M16
P732	144	130_{h6}	15	40_{k6}	165	3.5	112	27	82	0.035	11.0	M16
P832	190	160_{h6}	15	55_{k6}	215	10.0	112	27	82	0.035	13.5	M20

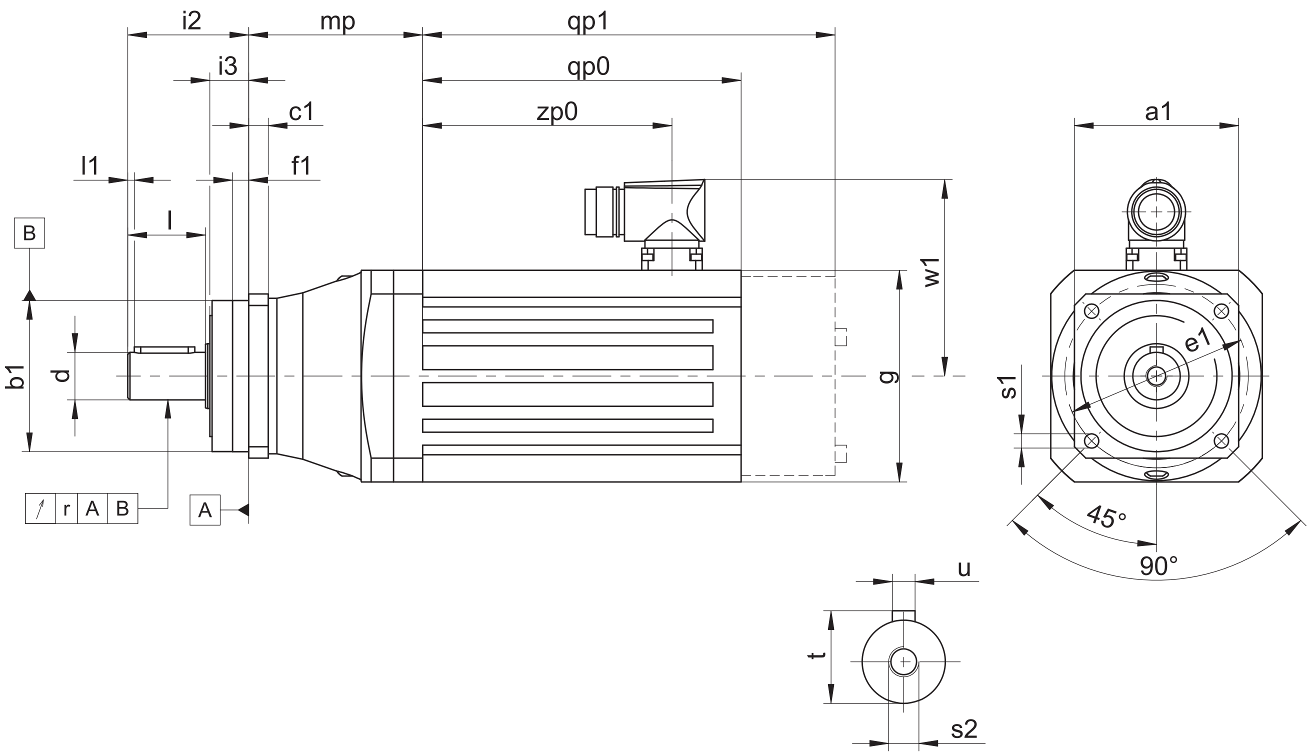
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91.0	76.5
LM402U	98	147.5	191.0	91.0	115.5
LM403U	98	178.5	222.0	91.0	146.5
LM503U	115	186.5	234.5	100.0	156.0
LM505U	115	256.5	304.5	100.0	226.0
LM704U	145	236.5	295.5	115.0	204.0
LM706U	145	306.5	365.5	115.0	274.0

Dimensions of geared motors

Type	LM4	LM5	LM7
	mp	mp	mp
P331	65.0	–	–
P431	80.5	80.0	–
P432	114.0	–	–
P531	–	80.5	83.5
P532	122.5	122.0	–
P731	–	–	100.5
P732	–	148.5	151.5
P832	–	–	192.5

6.3.2 P shaft design (solid shaft with feather key)



qp0	Applies to motors without brake.
–	The radial runout specification applies only to the reinforced bearing D.
qp1	Applies to motors with brake.

Dimensions of gear units

Type	□a1	∅b1	c1	∅d	∅e1	f1	i2	i3	l	l1	r	∅s1	s2	t	u
P331	72	60_{h6}	7	16_{k6}	75	7.5	48	18	28	2	0.025	5.5	M5	18.0	A5×5×22
P431	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	3	0.025	6.6	M8	24.5	A6×6×28
P432	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	3	0.025	6.6	M8	24.5	A6×6×28
P531	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	3	0.030	9.0	M12	35.0	A10×8×50
P532	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	3	0.030	9.0	M12	35.0	A10×8×50
P731	144	130_{h6}	15	40_{k6}	165	3.5	112	27	82	4	0.035	11.0	M16	43.0	A12×8×70
P732	144	130_{h6}	15	40_{k6}	165	3.5	112	27	82	4	0.035	11.0	M16	43.0	A12×8×70
P832	190	160_{h6}	15	55_{k6}	215	10.0	112	27	82	6	0.035	13.5	M20	59.0	A16×10×70

Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91.0	76.5
LM402U	98	147.5	191.0	91.0	115.5
LM403U	98	178.5	222.0	91.0	146.5
LM503U	115	186.5	234.5	100.0	156.0
LM505U	115	256.5	304.5	100.0	226.0
LM704U	145	236.5	295.5	115.0	204.0
LM706U	145	306.5	365.5	115.0	274.0

Dimensions of geared motors

Type	LM4	LM5	LM7
	mp	mp	mp
P331	65.0	–	–
P431	80.5	80.0	–
P432	114.0	–	–
P531	–	80.5	83.5
P532	122.5	122.0	–
P731	–	–	100.5
P732	–	148.5	151.5
P832	–	–	192.5

6.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

P	4	3	1	S	G	S	S	0100	LM403U

Explanation

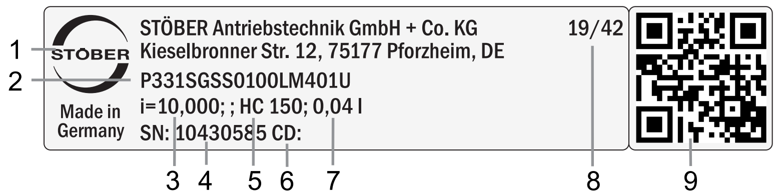
Code	Designation	Design
P	Type	Planetary gear unit
4	Size	4 (example)
3	Generation	Generation 3
1	Stages	Single-stage
2		Two-stage
S	Housing	Standard
G	Shaft	Solid shaft without feather key
P		Solid shaft with feather key
S	Bearing	Standard bearing
D		Axially reinforced bearing (P3 – P9)
Z		Radially reinforced bearing (P3 – P9)[1]
S	Backlash	Standard
R		Reduced
0100	Transmission ratio (i x 10)	i = 10 (example)
LM403U	Motor	LM Lean motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [2]
- Radial shaft seal rings at the output made of NBR or FKM, see the chapter [6.6.3]
- The position of the plug connector, see the chapter [6.5.4]
- For reverse operation of the output shaft from ± 20° to ± 90° and horizontal installation, see the chapter [6.6.4]

6.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Serial number of the gear unit
5	Lubricant specification
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

[1] Not for reduced-backlash option.

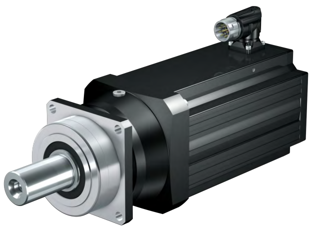
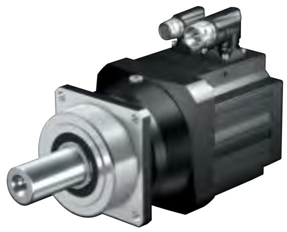
6.4.1.1 Supporting documents

You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

6.5 Product description

6.5.1 Input options

LM Lean motor	EZ synchronous servo motor
	
http://www.stoeber.de/en/PLM	http://www.stoeber.de/en/PEZ

6.5.2 Installation conditions

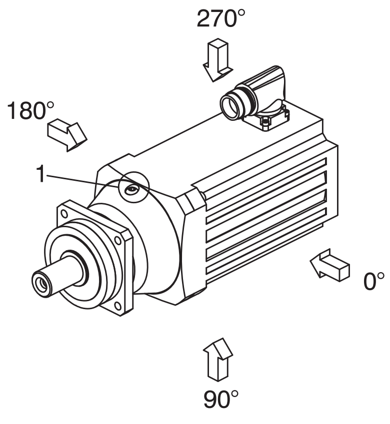
The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 12.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

6.5.3 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate.

You will receive lubricants for use in the food industry upon request.

6.5.4 Position of the plug connector



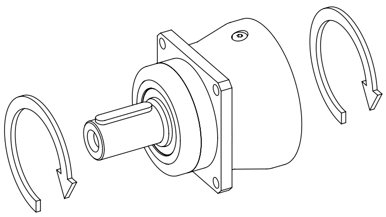
In the standard version, the plug connector is attached in the 270° position (relative to the oil drain plug (1) of the planetary gear unit). Indicate variations for your geared motor in the purchase order.

6.5.5 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 90 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} single-stage	97%
η_{get} two-stage	95%
Protection class:[2]	
Gear unit	IP65
Motor	IP56, optionally IP66

6.5.6 Direction of rotation

The input and output rotate in the same direction.



6.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

6.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

$$n_{1m^*} \leq \frac{n_{1maxDB}}{fB_T}$$

$$n_{1max^*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

$$M_{2acc^*} \leq \frac{M_{2acc}}{fB_{ZB}}$$

$$M_{2NOT^*} \leq M_{2NOT}$$

$$M_{2eq^*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

Refer to the selection tables for the values for n_{1maxDB}, n_{1maxZB}, M_{2acc} (M_{2accHT} for reduced backlash), M_{2NOT}, M_{2N} and S.

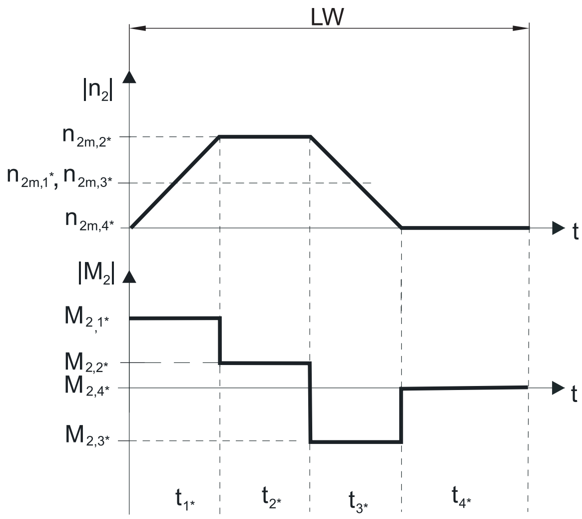
The values for fB_T, fB_{op}, fB_t and fB_{ZB} can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

[2] Observe the protection class of all the components.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m^*} = n_{2m^*} \cdot i$$

$$n_{2m^*} = \frac{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}{t_{1^*} + \ldots + t_{n^*}}$$

If t_{1*} + ... + t_{3*} ≥ 6 min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff^*} = \sqrt{\frac{t_{1^*} \cdot M_{2,1^*}{}^2 + \ldots + t_{n^*} \cdot M_{2,n^*}{}^2}{t_{1^*} + \ldots + t_{n^*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |M_{2,1^*}{}^3| + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |M_{2,n^*}{}^3|}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th}$ ≤ 0 you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

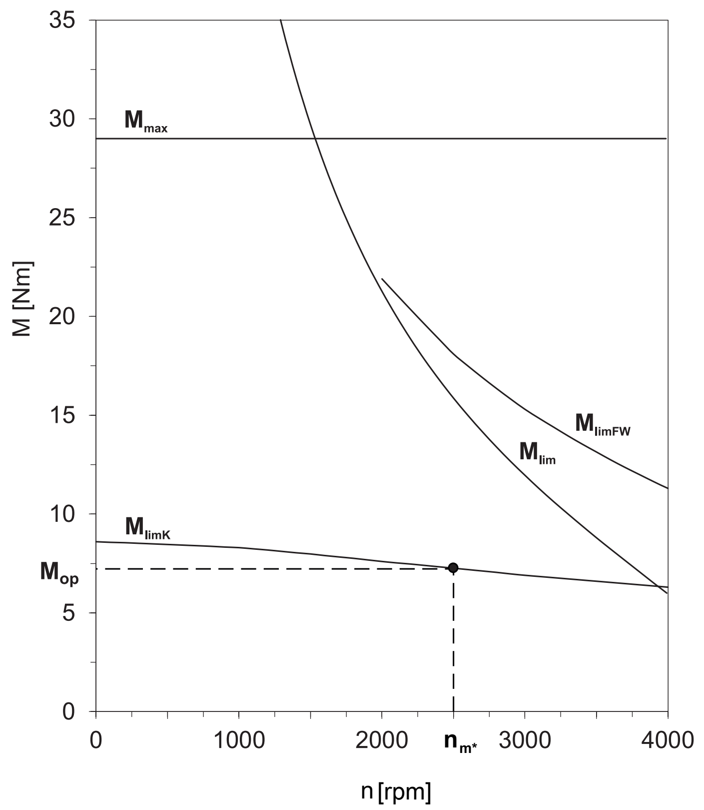
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m^*}}{1000}\right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▷ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.00
Reversing load cyclic operation	1.00

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

6.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 100$ rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

Permitted shaft loads for standard bearing S

Type	z_2	F_{2ax100}	$F_{2rad100}$	$F_{2rad,acc}$	M_{2k100}	$M_{2k,acc}$
	[mm]	[N]	[N]	[N]	[Nm]	[Nm]
P2	17.0	500	1200	1300	34	36
P3	17.5	1000	2500	2500	79	79
P4	18.5	1500	4000	4500	146	164
P5	19.5	2300	6500	7000	315	340
P7	23.0	2900	8500	9000	544	576
P8	24.5	4700	13000	18000	852	1179
P9	33.0	6000	18000	27000	1539	2309

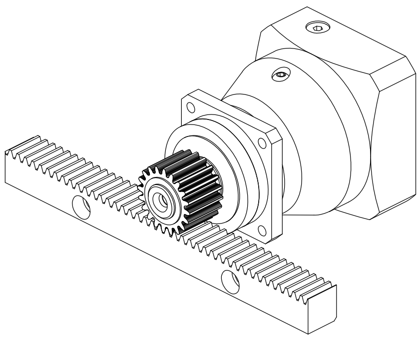


Fig. 1: Recommendation for bearing assignment S (e.g. for straight-cut gearing)

Permitted shaft loads for axially reinforced bearing D

Type	z_2	F_{2ax100}	$F_{2rad100}$	$F_{2rad,acc}$	M_{2k100}	$M_{2k,acc}$
	[mm]	[N]	[N]	[N]	[Nm]	[Nm]
P3	20.0	2500	2750	2750	94	94
P4	22.5	4000	4500	5000	182	203
P5	25.5	6000	7000	8000	382	436
P7	29.0	10000	9500	10000	665	700
P8	32.0	15500	15000	18000	1095	1314
P9	44.0	25000	20000	30000	1930	2895

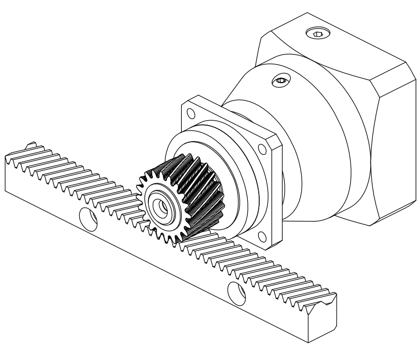


Fig. 2: Recommendation for bearing assignment D (e.g. for helical gearing)

Permitted shaft loads for radially reinforced bearing Z

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P3	17.5	600	3000	3000	95	95
P4	18.5	1000	5000	5000	183	183
P5	19.5	1600	8000	8000	388	388
P7	23.0	2000	10000	10000	640	640
P8	24.5	3600	18000	18000	1179	1179
P9	33.0	5000	27000	35000	2309	2993

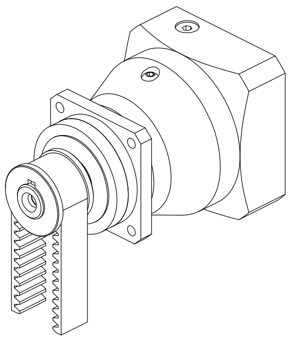


Fig. 3: Recommendation for bearing assignment Z (e.g. for belt drives)

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m^*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

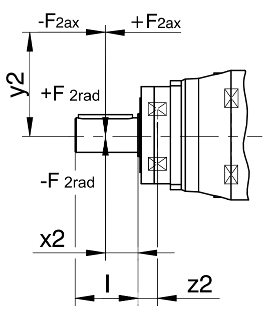


Fig. 4: Force application points

The specified values for $F_{2rad100}$ and $F_{2rad,acc}$ refer to an application of force at the center of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k,acc^*} = \frac{2 \cdot F_{2ax^*} \cdot y_2 + F_{2rad,acc^*} \cdot (x_2 + z_2)}{1000} \leq M_{2k,acc}$$

$$F_{2rad,acc^*} \leq F_{2rad,acc}$$

$$F_{2ax^*} \leq F_{2axN}$$

The values for $F_{2rad,acc}$ and $M_{2k,acc}$ can be found in the table "Permitted shaft loads" in this chapter.

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|M_{2k,acc,1^*}{}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|M_{2k,acc,n^*}{}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}} \le M_{2kN}$$

$$F_{2rad,eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|F_{2rad,acc,1^*}{}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|F_{2rad,acc,n^*}{}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}} \le F_{2radN}$$

The following apply to the bearing service life L_{10h} ($ED_{10} \le 40\%$):

L_{10h} > 10000 h with 1 < M_{2kN}/M_{2k*} < 1.25

L_{10h} > 20000 h with 1.25 < M_{2kN}/M_{2k*} < 1.5

L_{10h} > 30000 h with 1.5 < M_{2kN}/M_{2k*}

For different duty cycles:

$$L_{10h} > L_{10h(ED_{10}=40\%)} \cdot \frac{40\%}{ED_{10}}$$

6.6.3 Recommendation for radial shaft seal rings

For a duty cycle > 60% and higher surrounding temperatures, we recommend radial shaft seal rings made of FKM at the output.

Properties:

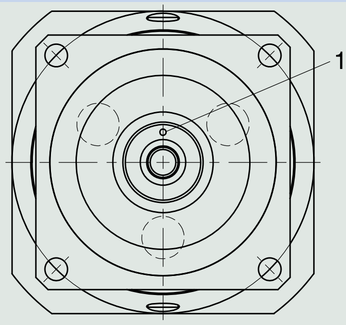
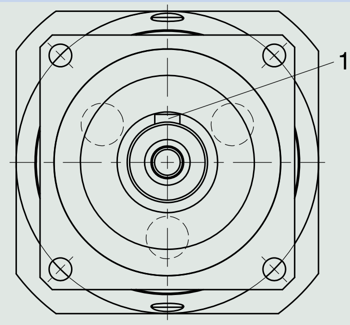
- Excellent temperature resistance
- High chemical stability
- Very good resistance to aging
- Excellent resistance to mineral oils and greases
- For use in the food, beverage and pharmaceutical industries

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

6.6.4 Reverse operation

To ensure lubrication for circulating gearing parts during cyclic reverse operation from ± 20° to ± 90° at the output, pay careful attention to the position of the output shaft for the horizontal mounting of the gear unit, as shown in the diagrams below. The images show the center position of reverse operation. Cyclic reverse operation ≤ ± 20° on request.

Solid shaft without feather key	Solid shaft with feather key
	
1 Position of the mark: top	1 Position of the feather key: top

Notes

- If you use the solid shaft without a feather key (G), you must note the position of the mark during assembly.
- As an alternative, you can use the solid shaft with a feather key (P). In that case, the feather key functions for position orientation. For a backlash-free connection, also use a clamp.

6.7 Additional documentation

Additional documentation related to the product can be found at
http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for P/PE/PH/PHQ/PHV planetary gear units and planetary geared motors	443149_en

7 PE planetary geared motors

Table of contents

7 Planetary geared motors

PE

7.1 Overview

Cost-efficient helical-geared planetary geared motors

Features

Power density	★★★☆☆
Backlash	★★★☆☆
Price category	€
Shaft load	★★☆☆☆
Smooth operation	★★★☆☆
Torsional stiffness	★★★☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
Any mounting position	✓
Non-contact sealing at the input	✓
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	3 – 35
M_{2acc}	13 – 250 Nm
$\Delta\phi_2$	8 – 10 arcmin
η_{get}	95 – 97 %

7.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors

An explanation of the formula symbols can be found in the Chapter [▸ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
PE3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 47 Nm)															
300	22	24	1.7	0.95	PE321_0100 LM401U	44	90	10.00	10/1	4000	7000	1.7	8.0	3.7	5.9
429	15	17	2.6	1.4	PE321_0070 LM401U	31	90	7.000	7/1	4000	7000	1.7	8.0	4.1	5.9
600	11	12	4.1	1.8	PE321_0050 LM401U	22	90	5.000	5/1	3700	7000	1.7	8.0	4.5	5.9
600	21	22	8.0	0.93	PE321_0050 LM402U	47	90	5.000	5/1	3700	7000	3.1	8.0	4.5	7.5
750	8.7	9.4	5.5	2.2	PE321_0040 LM401U	17	85	4.000	4/1	3700	7000	1.8	8.0	4.4	5.9
750	17	17	11	1.1	PE321_0040 LM402U	38	85	4.000	4/1	3700	7000	3.1	8.0	4.4	7.5
1000	6.5	7.1	9.0	2.5	PE321_0030 LM401U	13	64	3.000	3/1	3500	6000	1.9	8.0	3.5	5.9
1000	13	13	18	1.3	PE321_0030 LM402U	28	64	3.000	3/1	3500	6000	3.2	8.0	3.5	7.5
PE4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 100 Nm)															
107	60	65	4.2	0.86	PE422_0280 LM401U	95	190	28.00	28/1	4000	7000	1.7	10.0	13	8.5
120	53	58	4.5	0.97	PE422_0250 LM401U	100	200	25.00	25/1	3700	7000	1.8	10.0	13	8.5
150	43	46	5.0	1.2	PE422_0200 LM401U	86	200	20.00	20/1	3700	7000	1.8	10.0	13	8.5
188	34	37	5.6	1.5	PE422_0160 LM401U	69	190	16.00	16/1	3700	7000	1.8	10.0	13	8.5
300	43	44	1.8	1.1	PE421_0100 LM402U	92	180	10.00	10/1	3600	6000	3.1	8.0	10	8.9
300	59	60	2.4	0.81	PE421_0100 LM403U	92	180	10.00	10/1	3600	6000	4.4	8.0	10	10
429	30	31	2.7	1.6	PE421_0070 LM402U	66	200	7.000	7/1	3600	6000	3.1	8.0	13	8.9
429	41	42	3.7	1.2	PE421_0070 LM403U	87	200	7.000	7/1	3600	6000	4.4	8.0	13	10
600	21	22	4.3	2.1	PE421_0050 LM402U	47	200	5.000	5/1	3400	6000	3.2	8.0	14	8.9
600	29	30	6.0	1.5	PE421_0050 LM403U	62	200	5.000	5/1	3400	6000	4.5	8.0	14	10
600	46	49	9.3	0.97	PE421_0050 LM503U	99	200	5.000	5/1	3400	6000	11	8.0	14	13
750	17	17	5.8	2.6	PE421_0040 LM402U	38	200	4.000	4/1	3400	6000	3.3	8.0	14	8.9
750	24	24	7.9	1.9	PE421_0040 LM403U	50	200	4.000	4/1	3400	6000	4.6	8.0	14	10
750	37	39	12	1.2	PE421_0040 LM503U	79	200	4.000	4/1	3400	6000	11	8.0	14	13
750	53	60	18	0.82	PE421_0040 LM505U	100	200	4.000	4/1	3400	6000	17	8.0	14	18
1000	13	13	10	2.8	PE421_0030 LM402U	28	180	3.000	3/1	3000	5500	3.6	8.0	12	8.9
1000	18	18	14	2.0	PE421_0030 LM403U	37	180	3.000	3/1	3000	5500	4.9	8.0	12	10
1000	28	29	21	1.3	PE421_0030 LM503U	59	180	3.000	3/1	3000	5500	11	8.0	12	13
1000	40	45	31	0.90	PE421_0030 LM505U	90	180	3.000	3/1	3000	5500	17	8.0	12	18
PE5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 250 Nm)															
86	147	150	3.3	0.87	PE522_0350 LM402U	250	500	35.00	35/1	3600	6000	3.1	10.0	33	14
107	117	120	3.7	1.1	PE522_0280 LM402U	240	480	28.00	28/1	3600	6000	3.1	10.0	33	14
120	105	107	4.0	1.2	PE522_0250 LM402U	230	500	25.00	25/1	3400	6000	3.2	10.0	33	14
120	144	147	5.4	0.88	PE522_0250 LM403U	250	500	25.00	25/1	3400	6000	4.5	10.0	33	16
150	84	86	4.4	1.5	PE522_0200 LM402U	180	500	20.00	20/1	3400	6000	3.3	10.0	33	14
150	115	118	6.1	1.1	PE522_0200 LM403U	240	500	20.00	20/1	3400	6000	4.6	10.0	33	16
188	67	68	5.0	1.9	PE522_0160 LM402U	150	480	16.00	16/1	3400	6000	3.4	10.0	33	14
188	92	94	6.8	1.4	PE522_0160 LM403U	200	480	16.00	16/1	3400	6000	4.7	10.0	33	16
188	144	153	11	0.88	PE522_0160 LM503U	240	480	16.00	16/1	3400	6000	11	10.0	33	19
300	92	98	4.8	1.1	PE521_0100 LM503U	200	440	10.00	10/1	3000	5000	11	8.0	27	16
429	64	68	7.3	1.6	PE521_0070 LM503U	140	500	7.000	7/1	2800	5000	11	8.0	32	16
429	93	105	11	1.1	PE521_0070 LM505U	220	500	7.000	7/1	2800	5000	17	8.0	32	21
600	46	49	11	2.2	PE521_0050 LM503U	99	430	5.000	5/1	2600	5000	11	8.0	36	16
600	66	75	16	1.6	PE521_0050 LM505U	160	430	5.000	5/1	2600	5000	17	8.0	36	21
600	93	103	22	1.1	PE521_0050 LM704U	200	500	5.000	5/1	2600	5000	37	8.0	36	27
600	125	145	30	0.83	PE521_0050 LM706U	250	500	5.000	5/1	2600	5000	54	8.0	36	34
750	37	39	14	2.8	PE521_0040 LM503U	79	350	4.000	4/1	2600	5000	11	8.0	37	16
750	53	60	21	1.9	PE521_0040 LM505U	120	350	4.000	4/1	2600	5000	18	8.0	37	21
750	75	82	29	1.4	PE521_0040 LM704U	160	500	4.000	4/1	2600	5000	37	8.0	37	27
750	100	116	39	1.0	PE521_0040 LM706U	240	500	4.000	4/1	2600	5000	55	8.0	37	34
1000	28	29	29	2.6	PE521_0030 LM503U	59	260	3.000	3/1	2500	4500	12	8.0	33	16
1000	40	45	42	1.8	PE521_0030 LM505U	93	260	3.000	3/1	2500	4500	19	8.0	33	21
1000	56	62	60	1.3	PE521_0030 LM704U	120	360	3.000	3/1	2500	4500	38	8.0	33	27
1000	75	87	79	0.96	PE521_0030 LM706U	180	360	3.000	3/1	2500	4500	56	8.0	33	34

7.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

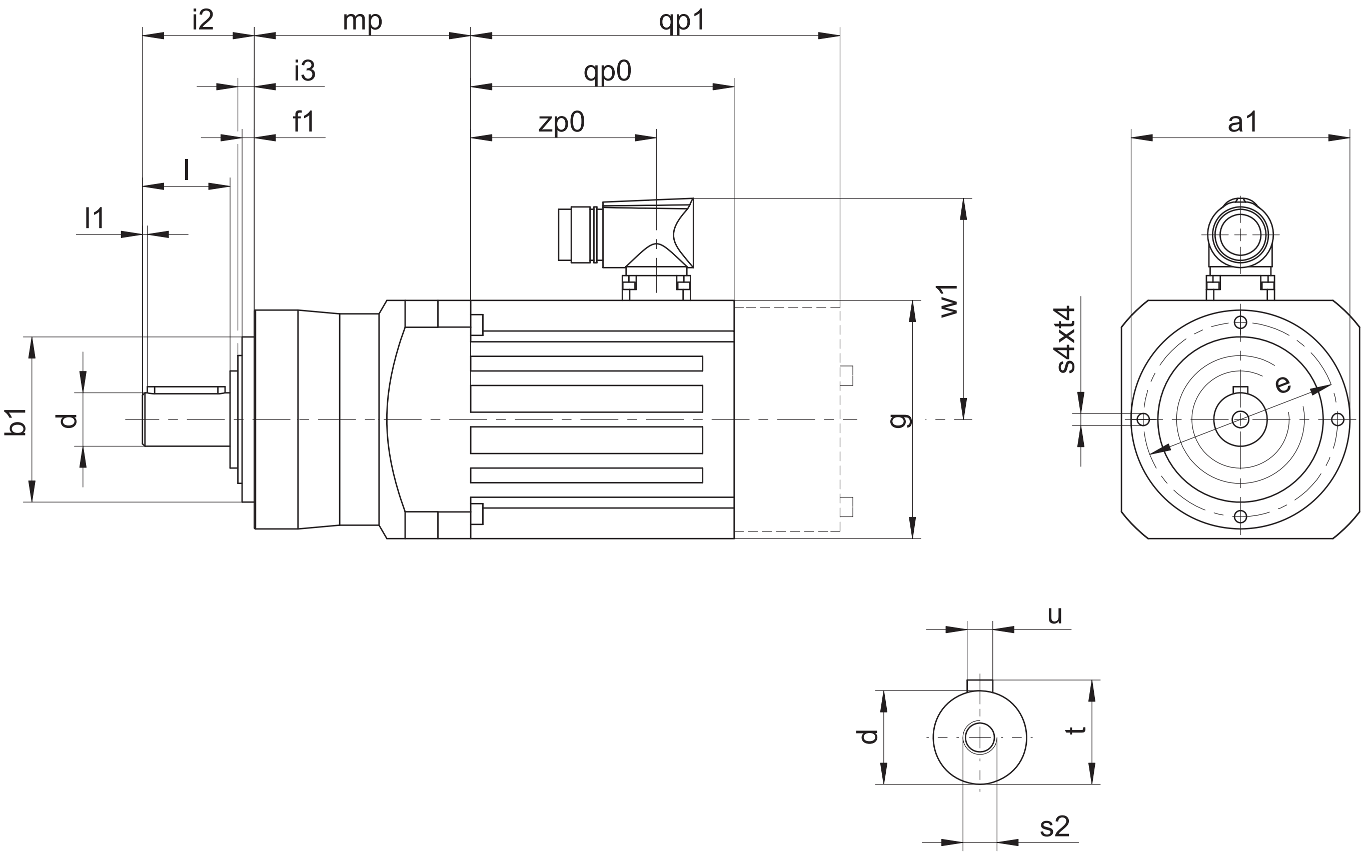
Tolerances

Solid shaft	Tolerance
Fit	ISO k6
Feather keys	DIN 6885-1, high form A
Balancing	With half feather key

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

7.3.1 P shaft design (solid shaft with feather key)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	∅a1	∅b1	∅d	∅e	f1	i2	i3	l	l1	s2	s4	t	t4	u
PE321	70	52_{h6}	16_{k6}	62	5	36	6.0	28	2	M5	M5	18.0	10	A5×5×22
PE421	90	68_{h6}	22_{k6}	80	5	46	6.5	36	2	M8	M6	24.5	12	A6×6×32
PE422	90	68_{h6}	22_{k6}	80	5	46	6.5	36	2	M8	M6	24.5	12	A6×6×32
PE521	120	90_{h6}	32_{k6}	108	6	70	8.0	58	4	M12	M8	35.0	16	A10×8×50
PE522	120	90_{h6}	32_{k6}	108	6	70	8.0	58	4	M12	M8	35.0	16	A10×8×50

Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91	76.5
LM402U	98	147.5	191.0	91	115.5
LM403U	98	178.5	222.0	91	146.5
LM503U	115	186.5	234.5	100	156.0
LM505U	115	256.5	304.5	100	226.0
LM704U	145	236.5	295.5	115	204.0
LM706U	145	306.5	365.5	115	274.0

Dimensions of geared motors

Type	LM4	LM5	LM7
	mp	mp	mp
PE321	89.5	–	–
PE421	95.5	98.0	–
PE422	133.0	–	–
PE521	–	114.0	120.0
PE522	155.5	158.0	–

7.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

PE	4	2	2	S	P	S	S	0120	LM403U

Explanation

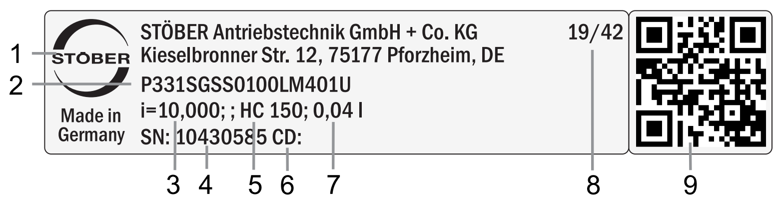
Code	Designation	Design
PE	Type	Planetary gear unit
4	Size	4 (example)
2	Generation	Generation 2
1	Stages	Single-stage
2		Two-stage
S	Housing	Standard
P	Shaft	Solid shaft with feather key
S	Bearing	Standard bearing
S	Backlash	Standard
0120	Transmission ratio (i x 10)	i = 12 (example)
LM403U	Motor	LM Lean motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▷ 2]

7.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Serial number of the gear unit
5	Lubricant specification
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

7.4.1.1 Supporting documents

You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

7.5 Product description

7.5.1 Input options

LM Lean motor

http://www.stoeber.de/en/PELM

EZ synchronous servo motor

http://www.stoeber.de/en/PEEZ

7.5.2 Installation conditions

The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

7.5.3 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate.

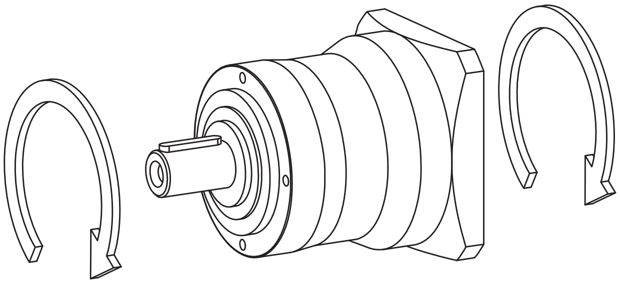
You will receive lubricants for use in the food industry upon request.

7.5.4 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} single-stage	97%
η_{get} two-stage	95%
Protection class:[1]	
Gear unit	IP64
Motor	IP56, optionally IP66

7.5.5 Direction of rotation

The input and output rotate in the same direction.



[1] Observe the protection class of all the components.

7.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

7.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

$$n_{1m*} \leq \frac{n_{1maxDB}}{fB_T}$$

$$n_{1max*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff*} \leq M_{2th}$$

$$M_{2acc*} \leq \frac{M_{2acc}}{fB_{ZB}}$$

$$M_{2NOT*} \leq M_{2NOT}$$

$$M_{2eq*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

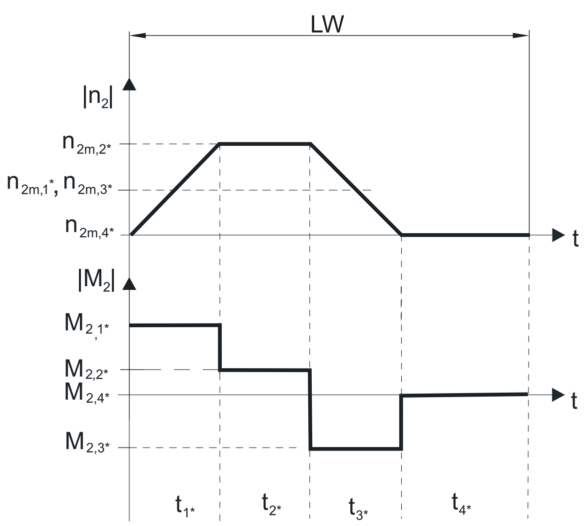
The values for n_{1maxDB}, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S can be found in the selection tables.

The values for fB_T, fB_{op}, fB_t and fB_{ZB} can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m^*} = n_{2m^*} \cdot i$$

$$n_{2m^*} = \frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}{t_{1^*} + \ldots + t_{n^*}}$$

If t_{1^*} + ... + $t_{3^*} \geq 6$ min, calculate n_{2m^*} without the rest phase t_{4^*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff^*} = \sqrt{\frac{t_{1^*} \cdot M_{2,1^*}{}^2 + \ldots + t_{n^*} \cdot M_{2,n^*}{}^2}{t_{1^*} + \ldots + t_{n^*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|M_{2,1^*}{}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|M_{2,n^*}{}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle $ED_{10} > 50\%$ and the actual average input speed n_{1m^*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m^*} accordingly or select another geared motor size.)

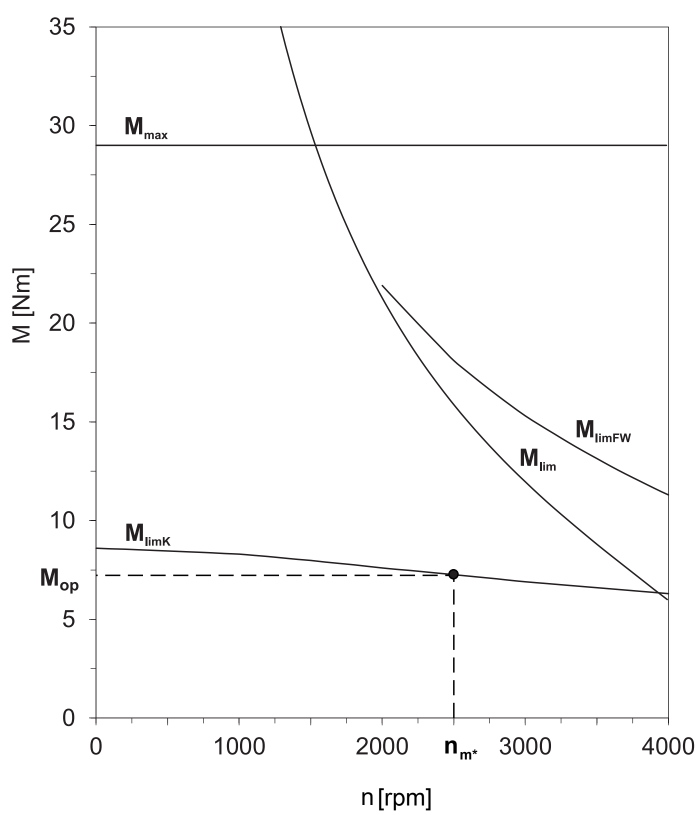
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m^*}}{1000}\right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m^*} can be found in the motor curve of Chapter [▷ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.00
Reversing load cyclic operation	1.00

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

7.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds n_{2m*} ≤ 100 rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

Permitted shaft loads for standard bearing S

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
PE2	8.0	400	800	800	13	13
PE3	11.0	800	1600	1600	40	40
PE4	13.0	1900	2400	2400	73	73
PE5	16.0	4000	4600	4600	206	206

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\ \text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

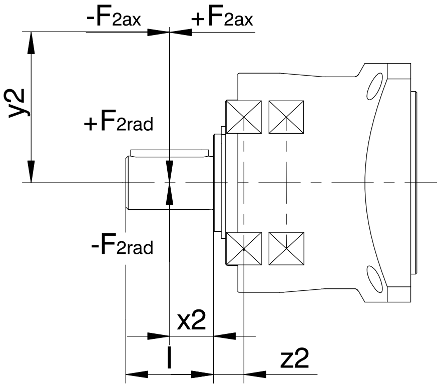


Fig. 1: Force application points

The specified values for $F_{2rad100}$ and $F_{2rad,acc}$ refer to an application of force at the center of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k,acc^*} = \frac{2 \cdot F_{2ax^*} \cdot y_2 + F_{2rad,acc^*} \cdot (x_2 + z_2)}{1000} \leq M_{2k,acc}$$

$$F_{2rad,acc^*} \leq F_{2rad,acc}$$

$$F_{2ax^*} \leq F_{2axN}$$

The values for $F_{2rad,acc}$ and $M_{2k,acc}$ can be found in the table "Permitted shaft loads" in this chapter.

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |M_{2k,acc,1^*}|^3 + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |M_{2k,acc,n^*}|^3}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}} \leq M_{2kN}$$

$$F_{2rad,eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |F_{2rad,acc,1^*}|^3 + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |F_{2rad,acc,n^*}|^3}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}} \leq F_{2radN}$$

The following apply to the bearing service life L_{10h} ($ED_{10} \leq 40\%$):

L_{10h} > 10000 h with 1 < M_{2kN}/M_{2k^*} < 1.25

L_{10h} > 20000 h with 1.25 < M_{2kN}/M_{2k^*} < 1.5

L_{10h} > 30000 h with 1.5 < M_{2kN}/M_{2k^*}

For different duty cycles:

$$L_{10h} > L_{10h(ED_{10}=40\%)} \cdot \frac{40\%}{ED_{10}}$$

7.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

7.7 Additional documentation

Additional documentation related to the product can be found at
http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for PE22 – PE52 planetary gear units and planetary geared motors	443252_en

8 C helical geared motors

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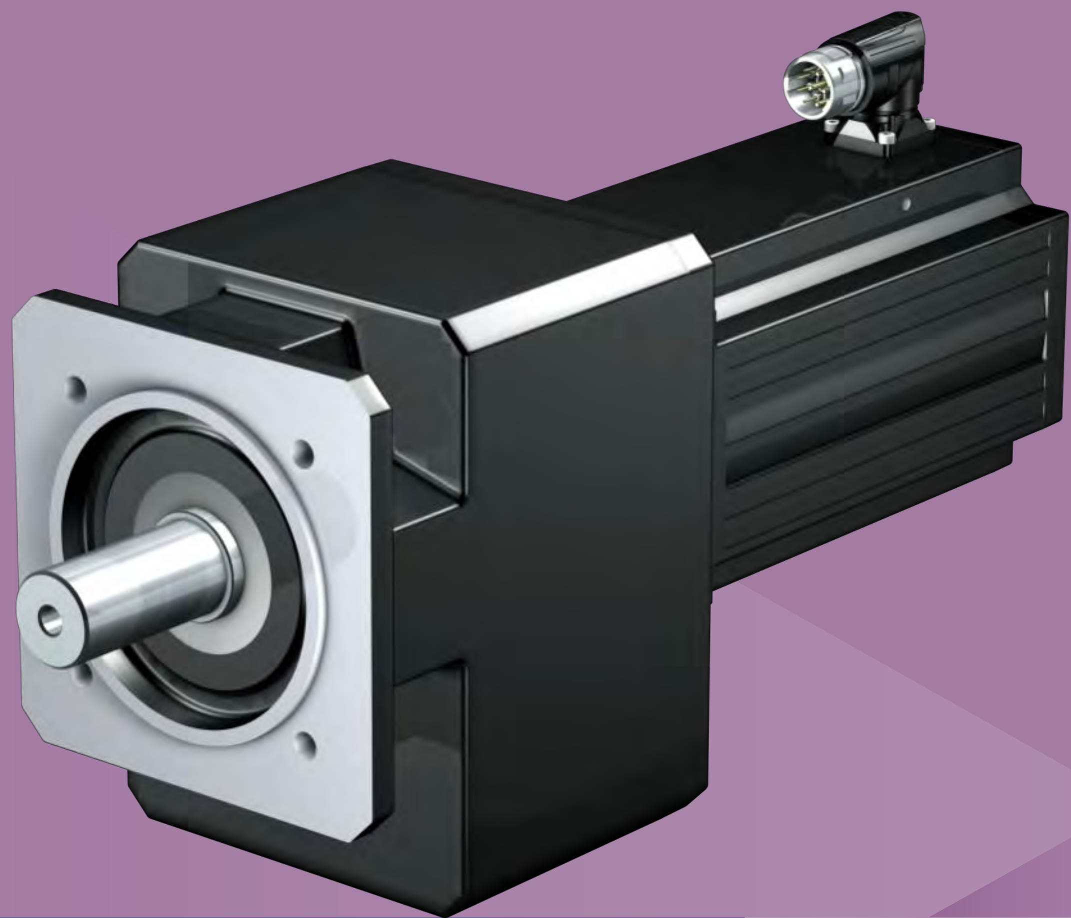


8 Helical geared motors

C

8.1 Overview

Compact helical geared motors

Features

Power density	★☆☆☆☆
Backlash	★★☆☆☆
Price category	€
Shaft load	★★☆☆☆
Smooth operation	★★★☆☆
Torsional stiffness	★★☆☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free (C0 – C5)	✓
FKM seal ring at the input	✓
Reinforced output bearing	✓ (on request)
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	2 – 178
M_{2acc}	8.7 – 4140 Nm
$\Delta\phi_2$	10 – 20 arcmin
η_{get}	96 – 97 %

8.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors
- Weight specification for mounting position EL1, housing design N

For all other technical data, refer to http://configurator.stoeber.de.

An explanation of the formula symbols can be found in the Chapter [▷ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
C0 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 72 Nm)																
120	55	59	3.3	1.1	C002_0250 LM401U	72	120	24.97	899/36	4000	4000	7000	1.7	16	1.6	10
129	51	55	3.2	1.2	C002_0230 LM401U	65	120	23.21	325/14	4000	4000	7000	1.7	16	1.6	10
145	45	49	3.0	1.3	C002_0210 LM401U	72	120	20.71	145/7	4000	4000	7000	1.7	16	1.6	10
171	38	41	2.7	1.6	C002_0175 LM401U	65	120	17.53	3575/204	4000	4000	6500	1.8	16	1.6	10
192	34	37	2.6	1.8	C002_0155 LM401U	68	110	15.64	1595/102	4000	4000	6500	1.8	16	1.6	10
192	67	68	5.1	0.90	C002_0155 LM402U	72	120	15.64	1595/102	4000	4000	6500	3.1	16	1.6	12
213	31	33	2.5	2.0	C002_0140 LM401U	62	100	14.08	169/12	4000	4000	6500	1.8	16	1.6	10
213	60	61	4.8	1.0	C002_0140 LM402U	65	120	14.08	169/12	4000	4000	6500	3.2	16	1.6	12
239	27	30	2.3	2.2	C002_0125 LM401U	55	91	12.57	377/30	4000	4000	6500	1.8	16	1.6	10
239	54	55	4.6	1.1	C002_0125 LM402U	72	120	12.57	377/30	4000	4000	6500	3.2	16	1.6	12
260	25	27	2.3	2.3	C002_0115 LM401U	50	84	11.54	3185/276	3700	3700	6000	1.9	16	1.6	10
260	49	50	4.5	1.2	C002_0115 LM402U	65	120	11.54	3185/276	3700	3700	6000	3.2	16	1.6	12
291	22	24	2.2	2.5	C002_0105 LM401U	45	75	10.30	1421/138	3700	3700	6000	1.9	16	1.6	10
291	44	45	4.4	1.3	C002_0105 LM402U	72	120	10.30	1421/138	3700	3700	6000	3.2	16	1.6	12
291	61	62	6.1	0.93	C002_0105 LM403U	72	120	10.30	1421/138	3700	3700	6000	4.5	16	1.6	14
325	20	22	2.2	2.7	C002_0092 LM401U	40	67	9.228	1495/162	3700	3700	6000	1.9	16	1.6	10
325	39	40	4.3	1.4	C002_0092 LM402U	65	120	9.228	1495/162	3700	3700	6000	3.3	16	1.6	12
325	54	55	5.9	1.0	C002_0092 LM403U	65	120	9.228	1495/162	3700	3700	6000	4.6	16	1.6	14
364	18	19	2.4	2.7	C002_0082 LM401U	36	60	8.235	667/81	3700	3700	6000	1.9	16	1.6	10
364	35	36	4.2	1.5	C002_0082 LM402U	72	120	8.235	667/81	3700	3700	6000	3.3	16	1.6	12
364	48	49	5.8	1.1	C002_0082 LM403U	72	120	8.235	667/81	3700	3700	6000	4.6	16	1.6	14
389	17	18	2.6	2.5	C002_0077 LM401U	34	53	7.714	54/7	4000	4000	7000	1.8	20	1.3	10
389	33	34	5.0	1.3	C002_0077 LM402U	65	110	7.714	54/7	4000	4000	7000	3.1	20	1.3	12
389	45	46	6.8	0.95	C002_0077 LM403U	65	110	7.714	54/7	4000	4000	7000	4.4	20	1.3	14
476	14	15	2.7	2.7	C002_0063 LM401U	28	46	6.300	2035/323	4000	4000	6500	1.8	20	1.3	10
476	27	28	4.8	1.5	C002_0063 LM402U	59	110	6.300	2035/323	4000	4000	6500	3.2	20	1.3	12
476	37	38	6.6	1.1	C002_0063 LM403U	65	110	6.300	2035/323	4000	4000	6500	4.5	20	1.3	14
515	13	14	2.8	2.7	C002_0058 LM401U	25	42	5.824	99/17	4000	4000	6500	1.8	20	1.3	10
515	25	25	4.7	1.6	C002_0058 LM402U	55	110	5.824	99/17	4000	4000	6500	3.2	20	1.3	12
515	34	35	6.5	1.1	C002_0058 LM403U	65	110	5.824	99/17	4000	4000	6500	4.5	20	1.3	14
593	11	12	3.0	2.7	C002_0051 LM401U	22	37	5.063	481/95	4000	4000	6500	1.9	20	1.3	10
593	22	22	4.6	1.7	C002_0051 LM402U	48	110	5.063	481/95	4000	4000	6500	3.2	20	1.3	12
593	30	30	6.4	1.3	C002_0051 LM403U	63	110	5.063	481/95	4000	4000	6500	4.5	20	1.3	14
593	47	49	9.9	0.81	C002_0051 LM503U	65	110	5.063	481/95	4000	4000	6500	11	20	1.3	17
641	10	11	3.1	2.7	C002_0047 LM401U	20	34	4.680	117/25	4000	4000	6500	1.9	20	1.3	10
641	20	20	4.6	1.8	C002_0047 LM402U	44	110	4.680	117/25	4000	4000	6500	3.2	20	1.3	12
641	28	28	6.3	1.3	C002_0047 LM403U	58	110	4.680	117/25	4000	4000	6500	4.5	20	1.3	14
641	43	46	9.8	0.85	C002_0047 LM503U	65	110	4.680	117/25	4000	4000	6500	11	20	1.3	17
723	9.1	9.8	3.3	2.7	C002_0041 LM401U	18	30	4.149	1813/437	3700	3700	6000	1.9	20	1.3	10
723	18	18	4.5	2.0	C002_0041 LM402U	39	110	4.149	1813/437	3700	3700	6000	3.3	20	1.3	12
723	24	25	6.1	1.4	C002_0041 LM403U	52	110	4.149	1813/437	3700	3700	6000	4.6	20	1.3	14
723	38	41	9.6	0.92	C002_0041 LM503U	65	110	4.149	1813/437	3700	3700	6000	11	20	1.3	17
782	8.4	9.0	3.4	2.7	C002_0038 LM401U	17	28	3.835	441/115	3700	3700	6000	1.9	20	1.3	10
782	16	17	4.4	2.1	C002_0038 LM402U	36	110	3.835	441/115	3700	3700	6000	3.3	20	1.3	12
782	23	23	6.1	1.5	C002_0038 LM403U	48	110	3.835	441/115	3700	3700	6000	4.6	20	1.3	14
782	35	37	9.5	0.97	C002_0038 LM503U	65	110	3.835	441/115	3700	3700	6000	11	20	1.3	17
904	7.2	7.8	3.7	2.7	C002_0033 LM401U	15	24	3.318	1702/513	3700	3700	6000	2.0	20	1.3	10
904	14	14	4.3	2.3	C002_0033 LM402U	31	97	3.318	1702/513	3700	3700	6000	3.4	20	1.3	12
904	20	20	5.9	1.7	C002_0033 LM403U	41	97	3.318	1702/513	3700	3700	6000	4.7	20	1.3	14
904	31	32	9.3	1.1	C002_0033 LM503U	62	97	3.318	1702/513	3700	3700	6000	11	20	1.3	17
978	6.7	7.2	3.9	2.7	C002_0031 LM401U	13	22	3.067	46/15	3700	3700	6000	2.0	20	1.3	10
978	13	13	4.3	2.4	C002_0031 LM402U	29	89	3.067	46/15	3700	3700	6000	3.4	20	1.3	12

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
C0 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 72 Nm)																
978	18	18	5.8	1.8	C002_0031 LM403U	38	89	3.067	46/15	3700	3700	6000	4.7	20	1.3	14
978	28	30	9.1	1.1	C002_0031 LM503U	60	89	3.067	46/15	3700	3700	6000	11	20	1.3	17
1083	12	12	4.2	2.6	C002_0028 LM402U	26	81	2.769	36/13	3500	3500	6000	3.4	20	1.3	12
1083	16	17	5.7	1.9	C002_0028 LM403U	34	81	2.769	36/13	3500	3500	6000	4.7	20	1.3	14
1083	25	27	9.0	1.2	C002_0028 LM503U	55	81	2.769	36/13	3500	3500	6000	11	20	1.3	17
1083	37	42	13	0.83	C002_0028 LM505U	58	81	2.769	36/13	3500	3500	6000	17	20	1.3	21
1502	4.4	4.7	4.8	2.7	C002_0020 LM401U	8.7	15	1.997	1480/741	3500	3500	6000	2.4	20	1.3	10
1502	8.5	8.7	4.0	3.2	C002_0020 LM402U	19	58	1.997	1480/741	3500	3500	6000	3.8	20	1.3	12
1502	12	12	5.4	2.3	C002_0020 LM403U	25	58	1.997	1480/741	3500	3500	6000	5.1	20	1.3	14
1502	18	20	8.5	1.5	C002_0020 LM503U	39	58	1.997	1480/741	3500	3500	6000	11	20	1.3	17
1502	27	30	12	1.0	C002_0020 LM505U	47	58	1.997	1480/741	3500	3500	6000	17	20	1.3	21
C1 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																
53	123	133	2.7	0.98	C102_0560 LM401U	140	240	56.36	620/11	4000	4000	6500	1.7	15	3.9	15
60	109	118	2.6	1.1	C102_0500 LM401U	140	240	49.94	899/18	4000	4000	6500	1.7	15	3.9	15
64	102	111	2.5	1.2	C102_0470 LM401U	140	240	46.91	516/11	4000	4000	6500	1.7	15	3.9	15
72	91	98	2.3	1.3	C102_0420 LM401U	140	230	41.57	1247/30	4000	4000	6500	1.7	15	3.9	15
86	77	83	2.2	1.6	C102_0350 LM401U	140	220	35.07	2700/77	4000	4000	6500	1.8	15	3.9	15
97	68	73	2.0	1.8	C102_0310 LM401U	140	190	31.07	435/14	4000	4000	6500	1.8	15	3.9	15
97	133	136	4.0	0.90	C102_0310 LM402U	140	240	31.07	435/14	4000	4000	6500	3.1	15	3.9	17
106	121	124	3.8	0.99	C102_0280 LM402U	140	240	28.36	312/11	4000	4000	6500	3.2	15	3.9	17
119	108	110	3.6	1.1	C102_0250 LM402U	140	240	25.13	377/15	4000	4000	6500	3.2	15	3.9	17
128	51	55	1.8	2.3	C102_0240 LM401U	100	170	23.52	1035/44	4000	4000	6500	1.9	15	3.9	15
128	101	103	3.5	1.2	C102_0240 LM402U	140	240	23.52	1035/44	4000	4000	6500	3.2	15	3.9	17
144	45	49	1.7	2.6	C102_0210 LM401U	91	150	20.84	667/32	4000	4000	6500	1.9	15	3.9	15
144	89	91	3.3	1.3	C102_0210 LM402U	140	240	20.84	667/32	4000	4000	6500	3.2	15	3.9	17
144	123	125	4.5	0.98	C102_0210 LM403U	140	240	20.84	667/32	4000	4000	6500	4.5	15	3.9	19
169	39	42	1.8	2.7	C102_0175 LM401U	78	130	17.73	195/11	3800	3800	6000	2.0	15	3.9	15
169	76	77	3.0	1.6	C102_0175 LM402U	140	240	17.73	195/11	3800	3800	6000	3.3	15	3.9	17
169	104	106	4.1	1.2	C102_0175 LM403U	140	240	17.73	195/11	3800	3800	6000	4.6	15	3.9	19
191	34	37	1.9	2.7	C102_0155 LM401U	69	110	15.71	377/24	3800	3800	6000	2.0	15	3.9	15
191	67	69	2.8	1.8	C102_0155 LM402U	140	240	15.71	377/24	3800	3800	6000	3.3	15	3.9	17
191	92	94	3.9	1.3	C102_0155 LM403U	140	240	15.71	377/24	3800	3800	6000	4.6	15	3.9	19
213	60	61	2.7	2.0	C102_0140 LM402U	130	240	14.06	2010/143	3800	3800	6000	3.4	15	3.9	17
213	83	84	3.7	1.5	C102_0140 LM403U	140	240	14.06	2010/143	3800	3800	6000	4.7	15	3.9	19
213	129	137	5.7	0.93	C102_0140 LM503U	140	240	14.06	2010/143	3800	3800	6000	11	15	3.9	21
241	53	54	2.5	2.2	C102_0125 LM402U	120	240	12.46	1943/156	3800	3800	6000	3.4	15	3.9	17
241	73	75	3.5	1.6	C102_0125 LM403U	140	240	12.46	1943/156	3800	3800	6000	4.7	15	3.9	19
241	115	122	5.4	1.0	C102_0125 LM503U	140	240	12.46	1943/156	3800	3800	6000	11	15	3.9	21
256	26	28	2.2	2.7	C102_0115 LM401U	51	85	11.72	1160/99	3600	3600	6000	2.2	15	3.9	15
256	50	51	2.5	2.3	C102_0115 LM402U	110	240	11.72	1160/99	3600	3600	6000	3.5	15	3.9	17
256	69	70	3.4	1.7	C102_0115 LM403U	140	240	11.72	1160/99	3600	3600	6000	4.8	15	3.9	19
256	108	114	5.4	1.1	C102_0115 LM503U	140	240	11.72	1160/99	3600	3600	6000	11	15	3.9	21
289	23	24	2.3	2.7	C102_0105 LM401U	45	76	10.38	841/81	3600	3600	6000	2.2	15	3.9	15
289	44	45	2.5	2.5	C102_0105 LM402U	98	240	10.38	841/81	3600	3600	6000	3.6	15	3.9	17
289	61	62	3.4	1.8	C102_0105 LM403U	130	240	10.38	841/81	3600	3600	6000	4.9	15	3.9	19
289	95	101	5.3	1.2	C102_0105 LM503U	140	240	10.38	841/81	3600	3600	6000	11	15	3.9	21
322	40	41	2.4	2.7	C102_0093 LM402U	88	240	9.326	3180/341	3600	3600	6000	3.7	15	3.9	17
322	55	56	3.3	2.0	C102_0093 LM403U	120	240	9.326	3180/341	3600	3600	6000	5.0	15	3.9	19
322	86	91	5.2	1.3	C102_0093 LM503U	140	240	9.326	3180/341	3600	3600	6000	11	15	3.9	21
363	35	36	2.4	3.0	C102_0083 LM402U	78	240	8.263	1537/186	3600	3600	6000	3.7	15	3.9	17
363	49	50	3.2	2.1	C102_0083 LM403U	100	240	8.263	1537/186	3600	3600	6000	5.0	15	3.9	19
363	76	81	5.1	1.4	C102_0083 LM503U	140	240	8.263	1537/186	3600	3600	6000	11	15	3.9	21
363	110	124	7.3	0.95	C102_0083 LM505U	140	240	8.263	1537/186	3600	3600	6000	17	15	3.9	26
385	17	18	2.7	2.7	C102_0078 LM401U	34	57	7.796	3243/416	4000	4000	6500	1.9	18	3.1	15
385	33	34	2.8	2.6	C102_0078 LM402U	73	210	7.796	3243/416	4000	4000	6500	3.3	18	3.1	17
385	46	47	3.8	1.9	C102_0078 LM403U	97	210	7.796	3243/416	4000	4000	6500	4.6	18	3.1	19
385	72	76	5.9	1.2	C102_0078 LM503U	130	210	7.796	3243/416	4000	4000	6500	11	18	3.1	21
385	104	117	8.6	0.84	C102_0078 LM505U	130	210	7.796	3243/416	4000	4000	6500	17	18	3.1	26
473	14	15	3.0	2.7	C102_0063 LM401U	28	46	6.338	507/80	3800	3800	6000	2.1	18	3.1	15
473	27	28	2.7	3.0	C102_0063 LM402U	60	180	6.338	507/80	3800	3800	6000	3.4	18	3.1	17
473	37	38	3.7	2.2	C102_0063 LM403U	79	180	6.338	507/80	3800	3800	6000	4.7	18	3.1	19
473	58	62	5.7	1.4	C102_0063 LM503U	130	180	6.338	507/80	3800	3800	6000	11	18	3.1	21
473	84	95	8.3	0.96	C102_0063 LM505U	130	180	6.338	507/80	3800	3800	6000	17	18	3.1	26
511	13	14	3.1	2.7	C102_0059 LM401U	26	43	5.875	47/8	3800	3800	6000	2.1	18	3.1	15

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
C1 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																
511	25	26	2.6	3.1	C102_0059 LM402U	55	170	5.875	47/8	3800	3800	6000	3.4	18	3.1	17
511	35	35	3.6	2.3	C102_0059 LM403U	73	170	5.875	47/8	3800	3800	6000	4.7	18	3.1	19
511	54	57	5.7	1.5	C102_0059 LM503U	120	170	5.875	47/8	3800	3800	6000	11	18	3.1	21
511	78	88	8.2	1.0	C102_0059 LM505U	130	170	5.875	47/8	3800	3800	6000	17	18	3.1	26
597	21	22	2.6	3.5	C102_0050 LM402U	47	150	5.025	201/40	3800	3800	6000	3.5	18	3.1	17
597	30	30	3.5	2.5	C102_0050 LM403U	63	150	5.025	201/40	3800	3800	6000	4.8	18	3.1	19
597	46	49	5.5	1.6	C102_0050 LM503U	99	150	5.025	201/40	3800	3800	6000	11	18	3.1	21
597	67	75	8.0	1.1	C102_0050 LM505U	120	150	5.025	201/40	3800	3800	6000	17	18	3.1	26
644	20	20	2.5	3.7	C102_0047 LM402U	44	140	4.658	3149/676	3800	3800	6000	3.6	18	3.1	17
644	27	28	3.5	2.7	C102_0047 LM403U	58	140	4.658	3149/676	3800	3800	6000	4.9	18	3.1	19
644	43	45	5.4	1.7	C102_0047 LM503U	92	140	4.658	3149/676	3800	3800	6000	11	18	3.1	21
644	62	70	7.9	1.2	C102_0047 LM505U	110	140	4.658	3149/676	3800	3800	6000	17	18	3.1	26
644	87	96	11	0.84	C102_0047 LM704U	130	220	4.658	3149/676	3800	3800	6000	37	18	3.1	32
716	9.1	9.9	3.7	2.7	C102_0042 LM401U	18	30	4.189	377/90	3600	3600	6000	2.4	18	3.1	15
716	18	18	2.5	3.9	C102_0042 LM402U	39	120	4.189	377/90	3600	3600	6000	3.7	18	3.1	17
716	25	25	3.4	2.9	C102_0042 LM403U	52	120	4.189	377/90	3600	3600	6000	5.0	18	3.1	19
716	39	41	5.3	1.8	C102_0042 LM503U	83	120	4.189	377/90	3600	3600	6000	11	18	3.1	21
716	56	63	7.7	1.3	C102_0042 LM505U	98	120	4.189	377/90	3600	3600	6000	17	18	3.1	26
716	78	86	11	0.90	C102_0042 LM704U	130	220	4.189	377/90	3600	3600	6000	37	18	3.1	32
773	8.5	9.2	3.8	2.7	C102_0039 LM401U	17	28	3.883	1363/351	3600	3600	6000	2.4	18	3.1	15
773	17	17	2.5	4.1	C102_0039 LM402U	37	110	3.883	1363/351	3600	3600	6000	3.7	18	3.1	17
773	23	23	3.4	3.0	C102_0039 LM403U	48	110	3.883	1363/351	3600	3600	6000	5.0	18	3.1	19
773	36	38	5.3	1.9	C102_0039 LM503U	77	110	3.883	1363/351	3600	3600	6000	11	18	3.1	21
773	52	58	7.6	1.3	C102_0039 LM505U	90	110	3.883	1363/351	3600	3600	6000	17	18	3.1	26
773	73	80	11	0.95	C102_0039 LM704U	130	220	3.883	1363/351	3600	3600	6000	37	18	3.1	32
900	14	15	2.4	4.6	C102_0033 LM402U	31	97	3.334	2067/620	3600	3600	6000	4.0	18	3.1	17
900	20	20	3.3	3.3	C102_0033 LM403U	41	97	3.334	2067/620	3600	3600	6000	5.3	18	3.1	19
900	31	33	5.2	2.1	C102_0033 LM503U	66	97	3.334	2067/620	3600	3600	6000	11	18	3.1	21
900	44	50	7.4	1.5	C102_0033 LM505U	78	97	3.334	2067/620	3600	3600	6000	18	18	3.1	26
900	62	69	10	1.0	C102_0033 LM704U	120	220	3.334	2067/620	3600	3600	6000	37	18	3.1	32
971	13	13	2.4	4.8	C102_0031 LM402U	29	90	3.091	2491/806	3600	3600	6000	4.0	18	3.1	17
971	18	19	3.3	3.5	C102_0031 LM403U	38	90	3.091	2491/806	3600	3600	6000	5.3	18	3.1	19
971	28	30	5.1	2.2	C102_0031 LM503U	61	90	3.091	2491/806	3600	3600	6000	11	18	3.1	21
971	41	46	7.3	1.5	C102_0031 LM505U	72	90	3.091	2491/806	3600	3600	6000	18	18	3.1	26
971	58	64	10	1.1	C102_0031 LM704U	120	220	3.091	2491/806	3600	3600	6000	37	18	3.1	32
971	77	89	14	0.83	C102_0031 LM706U	120	220	3.091	2491/806	3600	3600	6000	55	18	3.1	39
1162	48	53	10	1.2	C102_0026 LM704U	100	190	2.582	1911/740	3100	3100	5000	38	18	3.1	32
1162	64	75	13	0.93	C102_0026 LM706U	110	190	2.582	1911/740	3100	3100	5000	55	18	3.1	39
1253	45	49	9.9	1.3	C102_0024 LM704U	96	170	2.394	2303/962	3100	3100	5000	38	18	3.1	32
1253	60	69	13	0.98	C102_0024 LM706U	110	170	2.394	2303/962	3100	3100	5000	55	18	3.1	39
1378	13	13	3.4	4.0	C102_0022 LM403U	27	63	2.177	468/215	3100	3100	5000	6.1	18	3.1	19
1378	20	21	5.4	2.5	C102_0022 LM503U	43	63	2.177	468/215	3100	3100	5000	12	18	3.1	21
1378	29	33	7.7	1.8	C102_0022 LM505U	51	63	2.177	468/215	3100	3100	5000	19	18	3.1	26
1378	41	45	9.8	1.4	C102_0022 LM704U	87	160	2.177	468/215	3100	3100	5000	38	18	3.1	32
1378	54	63	13	1.0	C102_0022 LM706U	110	160	2.177	468/215	3100	3100	5000	56	18	3.1	39
1487	12	12	3.6	4.0	C102_0020 LM403U	25	59	2.018	1128/559	3100	3100	5000	6.2	18	3.1	19
1487	19	20	5.6	2.5	C102_0020 LM503U	40	59	2.018	1128/559	3100	3100	5000	12	18	3.1	21
1487	27	30	8.0	1.8	C102_0020 LM505U	47	59	2.018	1128/559	3100	3100	5000	19	18	3.1	26
1487	38	42	9.6	1.5	C102_0020 LM704U	81	150	2.018	1128/559	3100	3100	5000	38	18	3.1	32
1487	50	58	13	1.1	C102_0020 LM706U	100	150	2.018	1128/559	3100	3100	5000	56	18	3.1	39
C2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 230 Nm)																
32	199	215	2.3	1.0	C203_0920 LM401U	230	400	92.40	29939/324	4000	4000	6500	1.7	14	8.3	24
37	173	187	2.1	1.2	C203_0810 LM401U	230	400	80.62	11609/144	4000	4000	6500	1.7	14	8.3	24
43	153	166	2.0	1.3	C202_0700 LM401U	230	310	70.32	7595/108	4000	4000	6500	1.7	14	8.3	19
49	134	145	2.0	1.4	C202_0610 LM401U	220	270	61.35	2945/48	4000	4000	6500	1.7	14	8.3	19
61	211	215	3.3	0.95	C202_0490 LM402U	230	400	49.23	1083/22	4000	4000	6500	3.1	14	8.3	21
64	200	204	3.2	1.0	C202_0470 LM402U	230	400	46.82	2107/45	4000	4000	6500	3.2	14	8.3	21
73	175	178	3.0	1.1	C202_0410 LM402U	230	400	40.85	817/20	4000	4000	6500	3.2	14	8.3	21
85	150	154	2.8	1.3	C202_0350 LM402U	230	400	35.18	1372/39	4000	4000	6500	3.2	14	8.3	21
85	207	211	3.8	0.97	C202_0350 LM403U	230	400	35.18	1372/39	4000	4000	6500	4.5	14	8.3	23
98	131	134	2.6	1.5	C202_0310 LM402U	230	400	30.69	399/13	4000	4000	6500	3.2	14	8.3	21
98	180	184	3.6	1.1	C202_0310 LM403U	230	400	30.69	399/13	4000	4000	6500	4.5	14	8.3	23
106	121	123	2.5	1.7	C202_0280 LM402U	230	400	28.24	4067/144	4000	4000	6500	3.3	14	8.3	21
106	166	170	3.4	1.2	C202_0280 LM403U	230	400	28.24	4067/144	4000	4000	6500	4.6	14	8.3	23

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
C2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 230 Nm)																
122	105	108	2.3	1.9	C202_0250 LM402U	230	400	24.64	1577/64	4000	4000	6500	3.3	14	8.3	21
122	145	148	3.2	1.4	C202_0250 LM403U	230	400	24.64	1577/64	4000	4000	6500	4.6	14	8.3	23
127	101	103	2.3	2.0	C202_0240 LM402U	220	400	23.59	637/27	4000	4000	6500	3.4	14	8.3	21
127	139	142	3.1	1.4	C202_0240 LM403U	230	400	23.59	637/27	4000	4000	6500	4.7	14	8.3	23
127	217	230	4.9	0.92	C202_0240 LM503U	230	400	23.59	637/27	4000	4000	6500	11	14	8.3	25
146	88	90	2.1	2.3	C202_0210 LM402U	190	400	20.58	247/12	4000	4000	6500	3.4	14	8.3	21
146	121	124	2.9	1.7	C202_0210 LM403U	230	400	20.58	247/12	4000	4000	6500	4.7	14	8.3	23
146	189	201	4.6	1.1	C202_0210 LM503U	230	400	20.58	247/12	4000	4000	6500	11	14	8.3	25
171	75	76	2.0	2.7	C202_0175 LM402U	160	400	17.52	3626/207	3700	3700	5500	3.6	14	8.3	21
171	103	105	2.7	1.9	C202_0175 LM403U	220	400	17.52	3626/207	3700	3700	5500	4.9	14	8.3	23
171	161	171	4.2	1.2	C202_0175 LM503U	230	400	17.52	3626/207	3700	3700	5500	11	14	8.3	25
196	65	67	1.8	3.1	C202_0155 LM402U	140	400	15.28	703/46	3700	3700	5500	3.7	14	8.3	21
196	90	92	2.5	2.2	C202_0155 LM403U	190	400	15.28	703/46	3700	3700	5500	5.0	14	8.3	23
196	141	149	4.0	1.4	C202_0155 LM503U	230	400	15.28	703/46	3700	3700	5500	11	14	8.3	25
196	203	229	5.7	0.99	C202_0155 LM505U	230	400	15.28	703/46	3700	3700	5500	17	14	8.3	30
213	60	62	1.8	3.3	C202_0140 LM402U	130	400	14.12	3430/243	3700	3700	5500	3.9	14	8.3	21
213	83	85	2.4	2.4	C202_0140 LM403U	180	400	14.12	3430/243	3700	3700	5500	5.2	14	8.3	23
213	130	138	3.8	1.5	C202_0140 LM503U	230	400	14.12	3430/243	3700	3700	5500	11	14	8.3	25
213	188	212	5.5	1.1	C202_0140 LM505U	230	400	14.12	3430/243	3700	3700	5500	18	14	8.3	30
244	53	54	1.7	3.7	C202_0125 LM402U	120	360	12.32	665/54	3700	3700	5500	3.9	14	8.3	21
244	72	74	2.3	2.7	C202_0125 LM403U	150	360	12.32	665/54	3700	3700	5500	5.2	14	8.3	23
244	113	120	3.6	1.7	C202_0125 LM503U	230	360	12.32	665/54	3700	3700	5500	11	14	8.3	25
244	164	185	5.2	1.2	C202_0125 LM505U	230	360	12.32	665/54	3700	3700	5500	18	14	8.3	30
255	50	51	1.7	3.8	C202_0120 LM402U	110	340	11.76	294/25	3500	3500	5000	4.1	14	8.3	21
255	69	71	2.3	2.8	C202_0120 LM403U	150	340	11.76	294/25	3500	3500	5000	5.4	14	8.3	23
255	108	115	3.6	1.8	C202_0120 LM503U	230	340	11.76	294/25	3500	3500	5000	11	14	8.3	25
255	156	176	5.2	1.2	C202_0120 LM505U	230	340	11.76	294/25	3500	3500	5000	18	14	8.3	30
292	44	45	1.6	4.2	C202_0105 LM402U	97	300	10.26	513/50	3500	3500	5000	4.2	14	8.3	21
292	60	62	2.3	3.1	C202_0105 LM403U	130	300	10.26	513/50	3500	3500	5000	5.5	14	8.3	23
292	94	100	3.5	2.0	C202_0105 LM503U	200	300	10.26	513/50	3500	3500	5000	12	14	8.3	25
292	136	154	5.1	1.4	C202_0105 LM505U	230	300	10.26	513/50	3500	3500	5000	18	14	8.3	30
292	192	212	7.2	0.96	C202_0105 LM704U	230	400	10.26	513/50	3500	3500	5000	38	14	8.3	36
320	175	194	7.0	1.0	C202_0094 LM704U	230	400	9.387	2450/261	3500	3500	5000	38	14	8.3	36
366	153	169	6.9	1.1	C202_0082 LM704U	230	400	8.190	475/58	3500	3500	5000	38	14	8.3	36
385	33	34	2.0	4.0	C202_0078 LM402U	73	220	7.800	39/5	4000	4000	6500	3.5	17	6.0	21
385	46	47	2.7	2.9	C202_0078 LM403U	97	220	7.800	39/5	4000	4000	6500	4.8	17	6.0	23
385	72	76	4.3	1.8	C202_0078 LM503U	150	220	7.800	39/5	4000	4000	6500	11	17	6.0	25
385	104	117	6.2	1.3	C202_0078 LM505U	170	220	7.800	39/5	4000	4000	6500	17	17	6.0	30
385	146	161	8.7	0.91	C202_0078 LM704U	200	350	7.800	39/5	4000	4000	6500	37	17	6.0	36
477	27	27	1.9	4.6	C202_0063 LM402U	59	180	6.295	3330/529	3700	3700	5500	3.8	17	6.0	21
477	37	38	2.6	3.3	C202_0063 LM403U	78	180	6.295	3330/529	3700	3700	5500	5.1	17	6.0	23
477	58	61	4.1	2.1	C202_0063 LM503U	120	180	6.295	3330/529	3700	3700	5500	11	17	6.0	25
477	84	94	6.0	1.5	C202_0063 LM505U	150	180	6.295	3330/529	3700	3700	5500	18	17	6.0	30
477	118	130	8.4	1.0	C202_0063 LM704U	200	350	6.295	3330/529	3700	3700	5500	37	17	6.0	36
518	25	25	1.9	4.8	C202_0058 LM402U	54	170	5.791	666/115	3700	3700	5500	3.8	17	6.0	21
518	34	35	2.6	3.5	C202_0058 LM403U	72	170	5.791	666/115	3700	3700	5500	5.1	17	6.0	23
518	53	57	4.1	2.2	C202_0058 LM503U	110	170	5.791	666/115	3700	3700	5500	11	17	6.0	25
518	77	87	5.9	1.6	C202_0058 LM505U	130	170	5.791	666/115	3700	3700	5500	18	17	6.0	30
518	108	119	8.3	1.1	C202_0058 LM704U	200	350	5.791	666/115	3700	3700	5500	37	17	6.0	36
518	144	167	11	0.83	C202_0058 LM706U	200	350	5.791	666/115	3700	3700	5500	55	17	6.0	43
591	30	30	2.5	3.8	C202_0051 LM403U	63	150	5.072	350/69	3700	3700	5500	5.4	17	6.0	23
591	47	50	4.0	2.5	C202_0051 LM503U	100	150	5.072	350/69	3700	3700	5500	11	17	6.0	25
591	67	76	5.7	1.7	C202_0051 LM505U	120	150	5.072	350/69	3700	3700	5500	18	17	6.0	30
591	95	105	8.1	1.2	C202_0051 LM704U	200	350	5.072	350/69	3700	3700	5500	38	17	6.0	36
591	126	147	11	0.91	C202_0051 LM706U	200	350	5.072	350/69	3700	3700	5500	55	17	6.0	43
643	27	28	2.6	4.0	C202_0047 LM403U	58	140	4.667	14/3	3700	3700	5500	5.4	17	6.0	23
643	43	46	4.0	2.5	C202_0047 LM503U	92	140	4.667	14/3	3700	3700	5500	11	17	6.0	25
643	62	70	5.8	1.8	C202_0047 LM505U	110	140	4.667	14/3	3700	3700	5500	18	17	6.0	30
643	87	96	8.0	1.3	C202_0047 LM704U	190	340	4.667	14/3	3700	3700	5500	38	17	6.0	36
643	116	135	11	0.96	C202_0047 LM706U	200	340	4.667	14/3	3700	3700	5500	55	17	6.0	43
710	25	25	2.7	4.0	C202_0042 LM403U	53	120	4.226	486/115	3500	3500	5000	5.8	17	6.0	23
710	39	41	4.2	2.5	C202_0042 LM503U	84	120	4.226	486/115	3500	3500	5000	12	17	6.0	25
710	56	63	6.1	1.8	C202_0042 LM505U	98	120	4.226	486/115	3500	3500	5000	18	17	6.0	30
710	79	87	7.8	1.4	C202_0042 LM704U	170	310	4.226	486/115	3500	3500	5000	38	17	6.0	36

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
C2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 230 Nm)																
710	105	122	10	1.0	C202_0042 LM706U	200	310	4.226	486/115	3500	3500	5000	55	17	6.0	43
772	23	23	2.8	4.0	C202_0039 LM403U	48	110	3.888	486/125	3500	3500	5000	5.8	17	6.0	23
772	36	38	4.4	2.5	C202_0039 LM503U	77	110	3.888	486/125	3500	3500	5000	12	17	6.0	25
772	52	58	6.4	1.8	C202_0039 LM505U	91	110	3.888	486/125	3500	3500	5000	18	17	6.0	30
772	73	80	7.7	1.4	C202_0039 LM704U	160	280	3.888	486/125	3500	3500	5000	38	17	6.0	36
772	97	112	10	1.1	C202_0039 LM706U	200	280	3.888	486/125	3500	3500	5000	55	17	6.0	43
889	63	70	7.6	1.6	C202_0034 LM704U	130	250	3.373	2250/667	3500	3500	5000	38	17	6.0	36
889	84	98	10	1.2	C202_0034 LM706U	190	250	3.373	2250/667	3500	3500	5000	56	17	6.0	43
967	58	64	7.4	1.7	C202_0031 LM704U	120	230	3.103	90/29	3500	3500	5000	39	17	6.0	36
967	77	90	9.9	1.3	C202_0031 LM706U	180	230	3.103	90/29	3500	3500	5000	56	17	6.0	43
1115	50	55	7.3	1.8	C202_0027 LM704U	110	200	2.690	495/184	3000	3000	4500	39	17	6.0	36
1115	67	78	9.7	1.4	C202_0027 LM706U	160	200	2.690	495/184	3000	3000	4500	57	17	6.0	43
1212	46	51	7.2	1.9	C202_0025 LM704U	99	180	2.475	99/40	3000	3000	4500	39	17	6.0	36
1212	62	72	9.6	1.5	C202_0025 LM706U	140	180	2.475	99/40	3000	3000	4500	57	17	6.0	43
1374	41	45	7.0	2.1	C202_0022 LM704U	87	160	2.184	2160/989	3000	3000	4500	40	17	6.0	36
1374	54	63	9.4	1.6	C202_0022 LM706U	130	160	2.184	2160/989	3000	3000	4500	58	17	6.0	43
1493	38	41	6.9	2.2	C202_0020 LM704U	80	150	2.009	432/215	3000	3000	4500	40	17	6.0	36
1493	50	58	9.2	1.7	C202_0020 LM706U	120	150	2.009	432/215	3000	3000	4500	58	17	6.0	43
C3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 400 Nm)																
22	295	319	1.7	1.2	C303_1370 LM401U	350	700	137.2	59267/432	3800	3800	6000	1.7	13	8.7	29
27	236	255	1.5	1.5	C303_1100 LM401U	350	700	109.6	94705/864	3800	3800	6000	1.8	13	8.7	29
33	198	214	1.4	1.8	C303_0920 LM401U	350	590	91.93	39715/432	3800	3800	6000	1.8	13	8.7	29
37	175	189	1.3	2.0	C303_0810 LM401U	350	520	81.47	1222/15	3800	3800	6000	1.8	13	8.7	29
37	343	350	2.6	1.0	C303_0810 LM402U	400	520	81.47	1222/15	3800	3800	6000	3.1	13	8.7	30
86	322	342	3.7	1.1	C302_0350 LM503U	350	700	35.03	1261/36	3800	3800	6000	11	13	8.7	31
97	285	303	3.5	1.2	C302_0310 LM503U	400	700	31.04	776/25	3800	3800	6000	11	13	8.7	31
107	257	273	3.3	1.4	C302_0280 LM503U	350	700	27.99	2015/72	3800	3800	6000	11	13	8.7	31
121	228	242	3.1	1.5	C302_0250 LM503U	400	670	24.80	124/5	3800	3800	6000	11	13	8.7	31
121	330	372	4.5	1.1	C302_0250 LM505U	400	670	24.80	124/5	3800	3800	6000	17	13	8.7	35
128	216	229	3.1	1.6	C302_0230 LM503U	350	680	23.47	845/36	3800	3800	6000	11	13	8.7	31
144	191	203	2.9	1.8	C302_0210 LM503U	400	610	20.80	104/5	3800	3800	6000	11	13	8.7	31
144	276	312	4.2	1.3	C302_0210 LM505U	400	610	20.80	104/5	3800	3800	6000	17	13	8.7	35
193	291	321	5.4	1.1	C302_0155 LM704U	400	700	15.54	544/35	3500	3500	5500	38	13	8.7	41
214	262	289	5.3	1.2	C302_0140 LM704U	350	700	13.99	2015/144	3500	3500	5500	38	13	8.7	41
242	232	256	5.2	1.3	C302_0125 LM704U	400	700	12.40	62/5	3500	3500	5500	38	13	8.7	41
242	309	358	6.9	0.99	C302_0125 LM706U	400	700	12.40	62/5	3500	3500	5500	55	13	8.7	48
258	217	239	5.1	1.4	C302_0115 LM704U	350	700	11.61	325/28	3200	3200	4800	38	13	8.7	41
258	289	336	6.8	1.0	C302_0115 LM706U	350	700	11.61	325/28	3200	3200	4800	56	13	8.7	48
292	192	212	5.0	1.5	C302_0105 LM704U	400	700	10.29	72/7	3200	3200	4800	38	13	8.7	41
292	256	297	6.7	1.1	C302_0105 LM706U	400	700	10.29	72/7	3200	3200	4800	56	13	8.7	48
322	174	192	4.9	1.6	C302_0093 LM704U	350	680	9.310	3575/384	3200	3200	4800	39	13	8.7	41
322	232	269	6.6	1.2	C302_0093 LM706U	350	680	9.310	3575/384	3200	3200	4800	56	13	8.7	48
364	154	170	4.8	1.7	C302_0083 LM704U	330	600	8.250	33/4	3200	3200	4800	39	13	8.7	41
364	205	238	6.4	1.3	C302_0083 LM706U	400	600	8.250	33/4	3200	3200	4800	56	13	8.7	48
383	72	77	3.4	2.5	C302_0078 LM503U	150	230	7.841	494/63	3800	3800	6000	11	16	7.1	31
383	104	118	4.9	1.8	C302_0078 LM505U	180	230	7.841	494/63	3800	3800	6000	18	16	7.1	35
383	147	162	5.8	1.5	C302_0078 LM704U	310	470	7.841	494/63	3800	3800	6000	37	16	7.1	41
383	195	227	7.7	1.1	C302_0078 LM706U	330	470	7.841	494/63	3800	3800	6000	55	16	7.1	48
475	118	130	5.6	1.7	C302_0063 LM704U	250	430	6.314	221/35	3500	3500	5500	38	16	7.1	41
475	157	183	7.4	1.3	C302_0063 LM706U	330	430	6.314	221/35	3500	3500	5500	55	16	7.1	48
512	110	121	5.5	1.8	C302_0059 LM704U	230	400	5.859	2584/441	3500	3500	5500	38	16	7.1	41
512	146	169	7.4	1.3	C302_0059 LM706U	320	400	5.859	2584/441	3500	3500	5500	55	16	7.1	48
595	94	104	5.4	2.0	C302_0050 LM704U	200	370	5.038	403/80	3500	3500	5500	38	16	7.1	41
595	125	146	7.2	1.5	C302_0050 LM706U	290	370	5.038	403/80	3500	3500	5500	56	16	7.1	48
642	87	96	5.3	2.1	C302_0047 LM704U	190	340	4.675	589/126	3500	3500	5500	38	16	7.1	41
642	116	135	7.1	1.6	C302_0047 LM706U	270	340	4.675	589/126	3500	3500	5500	56	16	7.1	48
718	78	86	5.2	2.3	C302_0042 LM704U	170	300	4.179	117/28	3200	3200	4800	39	16	7.1	41
718	104	121	7.0	1.7	C302_0042 LM706U	240	300	4.179	117/28	3200	3200	4800	56	16	7.1	48
774	72	80	5.2	2.4	C302_0039 LM704U	150	280	3.878	190/49	3200	3200	4800	39	16	7.1	41
774	97	112	6.9	1.8	C302_0039 LM706U	230	280	3.878	190/49	3200	3200	4800	56	16	7.1	48
895	63	69	5.0	2.6	C302_0034 LM704U	130	240	3.352	429/128	3200	3200	4800	40	16	7.1	41
895	83	97	6.7	2.0	C302_0034 LM706U	200	240	3.352	429/128	3200	3200	4800	57	16	7.1	48
965	58	64	5.0	2.7	C302_0031 LM704U	120	230	3.110	1045/336	3200	3200	4800	40	16	7.1	41
965	77	90	6.6	2.1	C302_0031 LM706U	180	230	3.110	1045/336	3200	3200	4800	57	16	7.1	48

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
C4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 600 Nm)																
53	516	548	3.3	1.1	C402_0560 LM503U	550	1040	56.10	9425/168	3500	3500	5500	11	12	22	41
60	462	490	3.1	1.2	C402_0500 LM503U	600	930	50.19	1305/26	3500	3500	5500	11	12	22	41
64	429	456	3.0	1.3	C402_0470 LM503U	550	930	46.67	140/3	3500	3500	5500	11	12	22	41
72	384	408	2.8	1.4	C402_0420 LM503U	600	840	41.75	7056/169	3500	3500	5500	11	12	22	41
86	320	340	2.6	1.7	C402_0350 LM503U	550	790	34.82	975/28	3500	3500	5500	11	12	22	41
86	463	523	3.7	1.2	C402_0350 LM505U	550	790	34.82	975/28	3500	3500	5500	18	12	22	45
96	286	304	2.4	1.9	C402_0310 LM503U	570	710	31.15	405/13	3500	3500	5500	11	12	22	41
96	414	467	3.5	1.3	C402_0310 LM505U	570	710	31.15	405/13	3500	3500	5500	18	12	22	45
120	466	514	4.4	1.2	C402_0250 LM704U	600	1100	24.92	324/13	3500	3500	5500	38	12	22	51
128	437	482	4.3	1.3	C402_0230 LM704U	550	1100	23.36	1495/64	3500	3500	5500	38	12	22	51
144	391	431	4.0	1.4	C402_0210 LM704U	600	1100	20.90	4347/208	3500	3500	5500	38	12	22	51
170	329	363	3.7	1.7	C402_0175 LM704U	550	1100	17.60	845/48	3300	3300	5000	39	12	22	51
170	438	509	4.9	1.3	C402_0175 LM706U	550	1100	17.60	845/48	3300	3300	5000	56	12	22	58
190	294	325	3.5	1.9	C402_0160 LM704U	600	1070	15.75	63/4	3300	3300	5000	39	12	22	51
190	392	455	4.7	1.4	C402_0160 LM706U	600	1070	15.75	63/4	3300	3300	5000	56	12	22	58
214	262	289	3.4	2.0	C402_0140 LM704U	550	1020	13.99	2015/144	3300	3300	5000	40	12	22	51
214	348	404	4.5	1.5	C402_0140 LM706U	550	1020	13.99	2015/144	3300	3300	5000	57	12	22	58
240	234	258	3.4	2.2	C402_0125 LM704U	500	910	12.52	651/52	3300	3300	5000	40	12	22	51
240	312	362	4.5	1.6	C402_0125 LM706U	600	910	12.52	651/52	3300	3300	5000	57	12	22	58
258	217	240	3.3	2.3	C402_0115 LM704U	460	850	11.64	1885/162	2900	2900	4500	41	12	22	51
258	290	336	4.4	1.7	C402_0115 LM706U	550	850	11.64	1885/162	2900	2900	4500	58	12	22	58
288	195	215	3.2	2.5	C402_0105 LM704U	420	760	10.41	406/39	2900	2900	4500	41	12	22	51
288	259	301	4.3	1.9	C402_0105 LM706U	600	760	10.41	406/39	2900	2900	4500	58	12	22	58
384	146	161	4.3	2.2	C402_0078 LM704U	310	450	7.816	2001/256	3500	3500	5500	39	15	17	51
384	195	226	5.7	1.6	C402_0078 LM706U	360	450	7.816	2001/256	3500	3500	5500	56	15	17	58
509	110	121	4.1	2.6	C402_0059 LM704U	240	400	5.891	377/64	3300	3300	5000	40	15	17	51
509	147	170	5.5	2.0	C402_0059 LM706U	320	400	5.891	377/64	3300	3300	5000	57	15	17	58
641	88	97	4.0	3.0	C402_0047 LM704U	190	340	4.682	899/192	3300	3300	5000	41	15	17	51
641	117	135	5.3	2.3	C402_0047 LM706U	270	340	4.682	899/192	3300	3300	5000	58	15	17	58
770	73	80	4.2	3.1	C402_0039 LM704U	160	280	3.894	841/216	2900	2900	4500	42	15	17	51
770	97	113	5.6	2.3	C402_0039 LM706U	230	280	3.894	841/216	2900	2900	4500	60	15	17	58
C5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 920 Nm)																
37	730	776	2.8	1.1	C503_0810 LM503U	920	1330	80.60	19343/240	3400	3400	5000	11	12	23	56
43	643	683	2.7	1.2	C502_0700 LM503U	850	1210	69.97	10075/144	3400	3400	5000	11	12	23	52
48	574	610	2.8	1.2	C502_0620 LM503U	860	1080	62.43	4495/72	3400	3400	5000	11	12	23	52
54	513	545	2.4	1.6	C502_0560 LM503U	850	1120	55.83	335/6	3400	3400	5000	11	12	23	52
54	742	838	3.5	1.1	C502_0560 LM505U	850	1120	55.83	335/6	3400	3400	5000	17	12	23	57
60	458	487	2.3	1.7	C502_0500 LM503U	800	1000	49.82	1943/39	3400	3400	5000	11	12	23	52
60	662	748	3.3	1.2	C502_0500 LM505U	800	1000	49.82	1943/39	3400	3400	5000	17	12	23	57
72	779	860	4.2	1.0	C502_0420 LM704U	920	1600	41.69	667/16	3400	3400	5000	37	12	23	63
86	654	722	3.9	1.2	C502_0350 LM704U	850	1600	35.00	35/1	3400	3400	5000	38	12	23	63
96	584	644	3.7	1.4	C502_0310 LM704U	920	1520	31.23	406/13	3400	3400	5000	38	12	23	63
96	778	903	4.9	1.0	C502_0310 LM706U	920	1520	31.23	406/13	3400	3400	5000	55	12	23	70
107	525	579	3.5	1.5	C502_0280 LM704U	850	1600	28.10	5395/192	3400	3400	5000	39	12	23	63
107	700	812	4.6	1.1	C502_0280 LM706U	850	1600	28.10	5395/192	3400	3400	5000	56	12	23	70
120	469	517	3.3	1.7	C502_0250 LM704U	920	1440	25.07	2407/96	3400	3400	5000	39	12	23	63
120	624	725	4.4	1.3	C502_0250 LM706U	920	1440	25.07	2407/96	3400	3400	5000	56	12	23	70
128	437	482	3.2	1.8	C502_0230 LM704U	850	1490	23.36	1495/64	3400	3400	5000	39	12	23	63
128	582	675	4.2	1.4	C502_0230 LM706U	850	1490	23.36	1495/64	3400	3400	5000	57	12	23	70
144	390	430	3.0	2.1	C502_0210 LM704U	830	1330	20.84	667/32	3400	3400	5000	40	12	23	63
144	519	603	4.0	1.5	C502_0210 LM706U	920	1330	20.84	667/32	3400	3400	5000	57	12	23	70
215	260	287	2.4	3.1	C502_0140 LM704U	560	1010	13.93	195/14	3100	3100	4500	43	12	23	63
215	347	403	3.3	2.3	C502_0140 LM706U	810	1010	13.93	195/14	3100	3100	4500	60	12	23	70
241	232	256	2.6	3.1	C502_0125 LM704U	500	900	12.43	87/7	3100	3100	4500	43	12	23	63
241	309	359	3.4	2.3	C502_0125 LM706U	720	900	12.43	87/7	3100	3100	4500	60	12	23	70
386	145	160	3.7	2.7	C502_0078 LM704U	310	500	7.763	621/80	3400	3400	5000	40	14	21	63
386	193	224	4.9	2.1	C502_0078 LM706U	400	500	7.763	621/80	3400	3400	5000	58	14	21	70
648	87	95	4.2	3.1	C502_0046 LM704U	180	340	4.629	162/35	3100	3100	4500	45	14	21	63
648	115	134	5.6	2.3	C502_0046 LM706U	270	340	4.629	162/35	3100	3100	4500	62	14	21	70
C6 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1650 Nm)																
22	1222	1298	2.4	1.1	C613_1350 LM503U	1380	1720	134.8	15776/117	3200	3200	4500	11	10	74	76
28	961	1021	2.2	1.3	C613_1060 LM503U	1280	1600	106.1	3712/35	3200	3200	4500	11	10	74	76
39	1415	1561	3.3	1.0	C613_0770 LM704U	1650	2560	76.80	8601/112	3200	3200	4500	37	10	74	86
40	687	730	2.6	1.3	C613_0760 LM503U	910	1140	75.81	5307/70	3200	3200	4500	11	10	74	76

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
C6 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1650 Nm)																
47	1169	1290	3.2	1.2	C613_0630 LM704U	1650	2300	63.46	48739/768	3200	3200	4500	37	10	74	86
54	1030	1137	3.2	1.3	C612_0550 LM704U	1380	2600	55.11	496/9	3200	3200	4500	38	10	74	78
61	908	1002	3.0	1.4	C613_0490 LM704U	1550	1940	49.28	31537/640	3200	3200	4500	38	10	74	86
61	1209	1404	4.0	1.1	C613_0490 LM706U	1550	1940	49.28	31537/640	3200	3200	4500	55	10	74	94
66	847	935	2.9	1.5	C612_0450 LM704U	1380	2010	45.33	136/3	3200	3200	4500	39	10	74	78
66	1129	1310	3.9	1.2	C612_0450 LM706U	1380	2010	45.33	136/3	3200	3200	4500	56	10	74	85
76	736	812	2.9	1.7	C612_0390 LM704U	1460	2440	39.40	1891/48	3200	3200	4500	38	10	74	78
76	981	1139	3.8	1.2	C612_0390 LM706U	1460	2440	39.40	1891/48	3200	3200	4500	55	10	74	85
86	652	719	2.5	2.0	C612_0350 LM704U	1380	1720	34.87	1360/39	3200	3200	4500	40	10	74	78
86	868	1008	3.4	1.5	C612_0350 LM706U	1380	1720	34.87	1360/39	3200	3200	4500	57	10	74	85
93	606	668	2.8	1.9	C612_0320 LM704U	1150	1440	32.41	1037/32	3200	3200	4500	39	10	74	78
93	807	937	3.7	1.4	C612_0320 LM706U	1150	1440	32.41	1037/32	3200	3200	4500	56	10	74	85
109	513	566	2.3	2.5	C612_0270 LM704U	1100	1600	27.43	192/7	3200	3200	4500	42	10	74	78
109	683	793	3.1	1.9	C612_0270 LM706U	1280	1600	27.43	192/7	3200	3200	4500	59	10	74	85
120	466	514	2.8	2.1	C612_0250 LM704U	980	1230	24.93	5185/208	3200	3200	4500	40	10	74	78
120	621	721	3.8	1.6	C612_0250 LM706U	980	1230	24.93	5185/208	3200	3200	4500	57	10	74	85
153	366	404	2.7	2.5	C612_0195 LM704U	780	1140	19.61	549/28	3200	3200	4500	42	10	74	78
153	488	567	3.6	1.9	C612_0195 LM706U	910	1140	19.61	549/28	3200	3200	4500	59	10	74	85
C7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 2760 Nm)																
23	2439	2690	3.4	0.81	C713_1320 LM704U	2760	3710	132.4	33887/256	3100	3100	4500	37	10	122	126
30	1826	2015	3.1	1.0	C713_0990 LM704U	2540	3170	99.14	6345/64	3100	3100	4500	37	10	122	126
37	1492	1646	3.0	1.2	C713_0810 LM704U	2260	2820	80.97	20727/256	3100	3100	4500	38	10	122	126
43	1300	1434	2.5	1.5	C712_0700 LM704U	2300	4000	69.55	765/11	3100	3100	4500	39	10	122	113
43	1732	2010	3.3	1.2	C712_0700 LM706U	2300	4000	69.55	765/11	3100	3100	4500	56	10	122	120
53	1062	1172	2.4	1.8	C712_0570 LM704U	1910	2390	56.82	625/11	3100	3100	4500	40	10	122	113
53	1415	1642	3.1	1.4	C712_0570 LM706U	1910	2390	56.82	625/11	3100	3100	4500	57	10	122	120
73	767	846	2.8	1.8	C712_0410 LM704U	1380	1730	41.02	2625/64	3100	3100	4500	40	10	122	113
73	1021	1186	3.7	1.4	C712_0410 LM706U	1380	1730	41.02	2625/64	3100	3100	4500	57	10	122	120
86	655	723	2.3	2.4	C712_0350 LM704U	1400	1960	35.07	2700/77	3100	3100	4500	44	10	122	113
86	873	1014	3.0	1.8	C712_0350 LM706U	1570	1960	35.07	2700/77	3100	3100	4500	61	10	122	120
119	473	522	2.7	2.4	C712_0250 LM704U	1010	1410	25.31	405/16	3100	3100	4500	44	10	122	113
119	630	732	3.5	1.8	C712_0250 LM706U	1130	1410	25.31	405/16	3100	3100	4500	62	10	122	120
C8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 4140 Nm)																
17	3286	3625	2.6	0.97	C813_1780 LM704U	4140	5250	178.4	6956/39	2900	2900	4300	38	10	204	185
22	2549	2813	2.4	1.2	C813_1380 LM704U	3720	4650	138.4	2491/18	2900	2900	4300	38	10	204	185
28	1982	2186	2.3	1.4	C813_1080 LM704U	3370	4210	107.6	4841/45	2900	2900	4300	39	10	204	185
28	2640	3065	3.0	1.1	C813_1080 LM706U	3370	4210	107.6	4841/45	2900	2900	4300	56	10	204	193
33	1673	1846	2.2	1.6	C813_0910 LM704U	2860	3570	90.82	18800/207	2900	2900	4300	39	10	204	185
33	2229	2587	2.9	1.2	C813_0910 LM706U	2860	3570	90.82	18800/207	2900	2900	4300	56	10	204	193
38	1462	1613	2.6	1.4	C813_0790 LM704U	2490	3110	79.34	285619/3600	2900	2900	4300	39	10	204	185
38	1947	2260	3.5	1.1	C813_0790 LM706U	2490	3110	79.34	285619/3600	2900	2900	4300	56	10	204	193

8.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

Tolerances

Axis height in accordance with DIN 747	Tolerance
Up to 50 mm	-0.4 mm
Up to 250 mm	-0.5 mm
Up to 630 mm	-0.6 mm

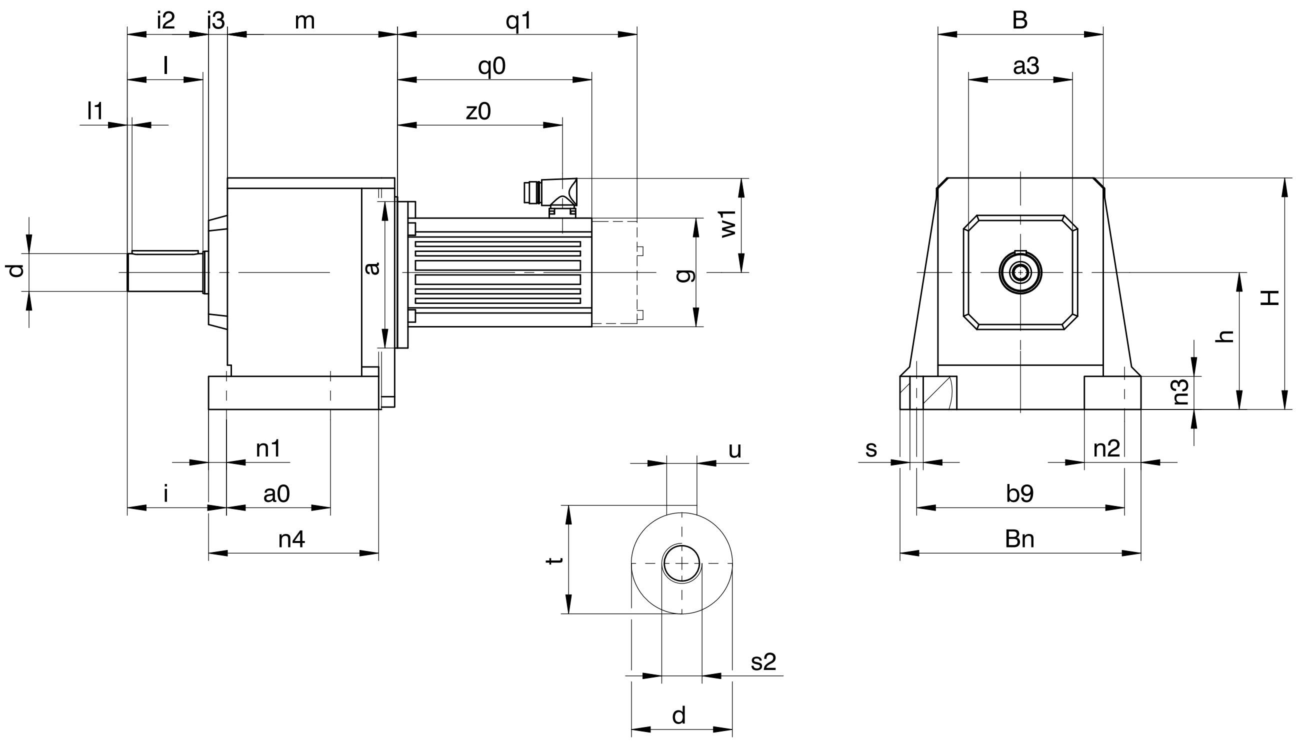
Solid shaft	Tolerance
Shaft ∅ fit ≤ 50 mm	DIN 748-1, ISO k6
Shaft ∅ fit > 50 mm	DIN 748-1, ISO m6
Feather keys	DIN 6885-1, high form A

Flange	Pilot tolerance
Up to 300 mm	ISO j6
Starting at 350 mm	ISO h6

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

8.3.1 Solid shaft design with feather key, N housing design (base)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

C203, C303, C612, C613: Motor adapter and gear unit are sometimes non-coaxial.

Options: C0 – C5 also available with solid shaft without feather key; on request starting at C6.

Dimensions of gear units

Type	a0	a3	b9	B	Bn	∅d	h	H	i	i2	i3	l	l1	n1	n2	n3	n4	∅s	s2	t	u
C0	62	60	110	92	132	20_{k6}	82	144	55	44	13	40	3	11	35	20	95.0	7	M6	22.5	A6×6×32
C1	70	80	150	124	176	25_{k6}	102	177	67	54	15	50	5	13	42	25	117.5	9	M10	28.0	A8×7×40
C2	85	95	170	138	200	30_{k6}	115	195	79	65	21	60	5	14	50	30	134.5	11	M10	33.0	A8×7×50
C3	105	95	185	150	215	30_{k6}	130	215	79	65	20	60	5	14	50	30	153.5	11	M10	33.0	A8×7×50
C4	110	110	220	175	255	40_{k6}	145	245	105	86	20	80	5	19	60	35	180.0	14	M16	43.0	A12×8×70
C5	130	130	245	192	290	40_{k6}	170	290	108	86	21	80	5	22	70	40	197.0	18	M16	43.0	A12×8×70
C6	215	177	245	225	300	50_{k6}	200	315	130	106	47	100	5	25	75	40	265.0	18	M16	53.5	A14×9×90
C7	235	192	300	265	365	60_{m6}	235	375	163	127	58	120	5	25	90	50	285.0	18	M20	64.0	A18×11×100
C8	300	223	340	310	435	70_{m6}	290	450	190	148	70	140	5	29	95	55	360.0	22	M20	74.5	A20×12×125

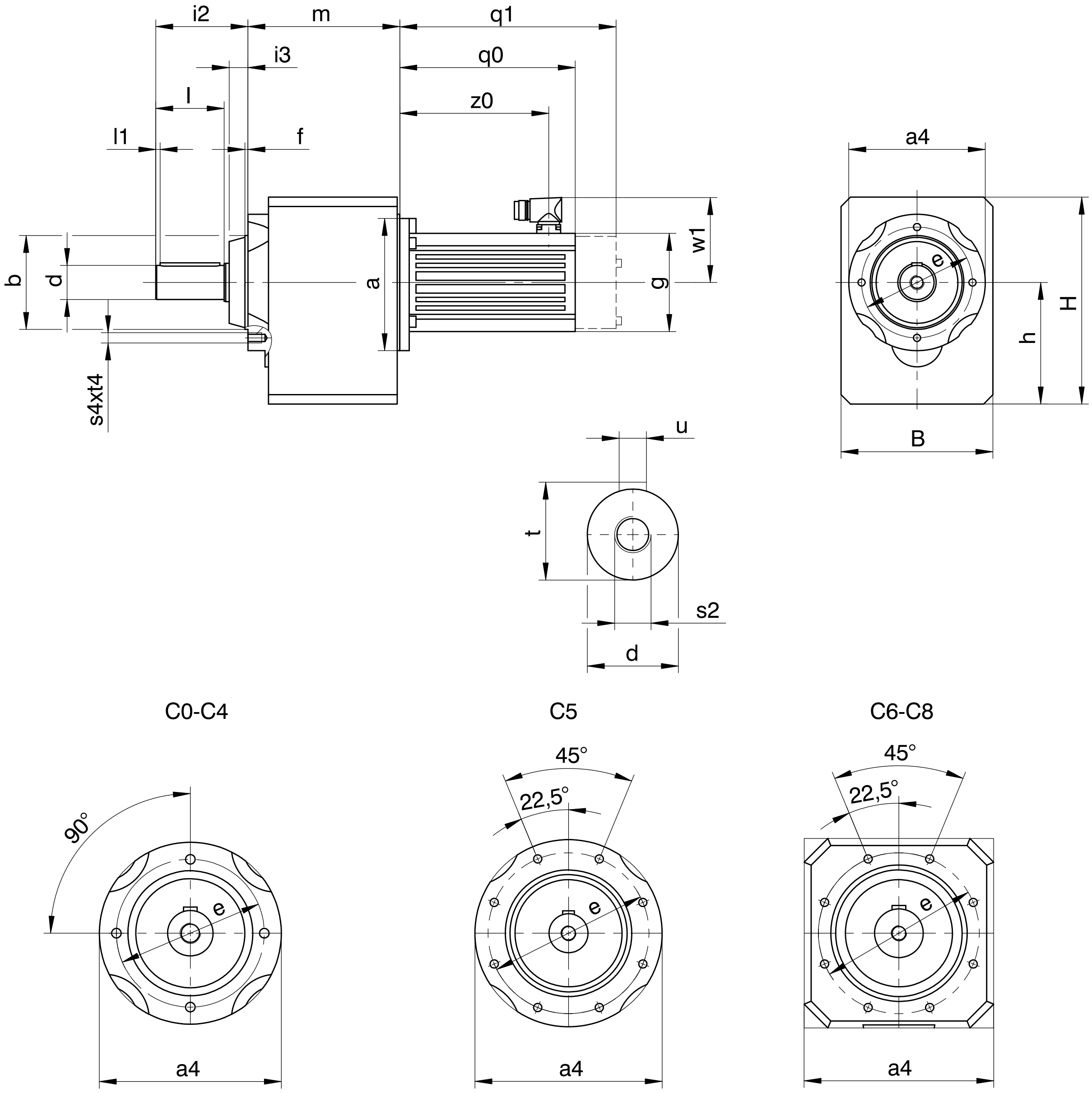
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4		LM5		LM7	
	a	m	a	m	a	m
C002	□98	97.5	□115	101.5	–	–
C102	□98	118.0	□115	122.0	□145	124.0
C202	∅140	129.0	□115	133.0	□145	135.0
C203	∅140	166.0	–	–	–	–
C302	–	–	∅160	152.5	□145	154.5
C303	∅140	185.5	–	–	–	–
C402	–	–	∅160	180.0	□145	182.0
C502	–	–	∅160	200.0	∅200	202.0
C503	–	–	∅160	243.0	–	–
C612	–	–	–	–	∅200	180.0
C613	–	–	∅160	222.0	∅200	242.0
C712	–	–	–	–	∅200	201.0
C713	–	–	–	–	∅200	262.0
C813	–	–	–	–	∅200	296.0

8.3.2 Solid shaft design with feather key, G housing design (pitch circle diameter)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

C203, C303, C612, C613: Motor adapter and gear unit are sometimes non-coaxial.

Options: C0 – C5 also available with solid shaft without feather key; on request starting at C6.

Dimensions of gear units

Type	a4	∅b	B	∅d	∅e	f	h	H	i2	i3	l	l1	s2	s4	t	t4	u
C0	∅87	55_{j6}	97	20_{k6}	75	3.0	79.0	141.0	58	14	40	3	M6	M6	22.5	10	A6×6×32
C1	∅120	80_{j6}	130	25_{k6}	100	3.0	100.0	175.0	71	17	50	5	M10	M6	28.0	13	A8×7×40
C2	∅140	95_{j6}	142	30_{k6}	115	3.0	112.0	192.0	87	22	60	5	M10	M8	33.0	13	A8×7×50
C3	∅140	95_{j6}	154	30_{k6}	115	3.0	127.0	212.0	87	22	60	5	M10	M8	33.0	13	A8×7×50
C4	∅160	110_{j6}	178	40_{k6}	130	3.5	142.5	242.5	108	22	80	5	M16	M10	43.0	16	A12×8×70
C5	∅192	130_{j6}	195	40_{k6}	165	3.5	166.0	286.0	109	23	80	5	M16	M10	43.0	16	A12×8×70
C6	□180	140_{j6}	225	50_{k6}	165	5.0	195.0	310.0	136	30	100	5	M16	M10	53.5	16	A14×9×90
C7	□195	155_{j6}	265	60_{m6}	185	8.0	231.0	371.0	164	37	120	5	M20	M12	64.0	19	A18×11×100
C8	□226	185_{j6}	310	70_{m6}	215	5.0	285.0	445.0	185	37	140	5	M20	M12	74.5	19	A20×12×125

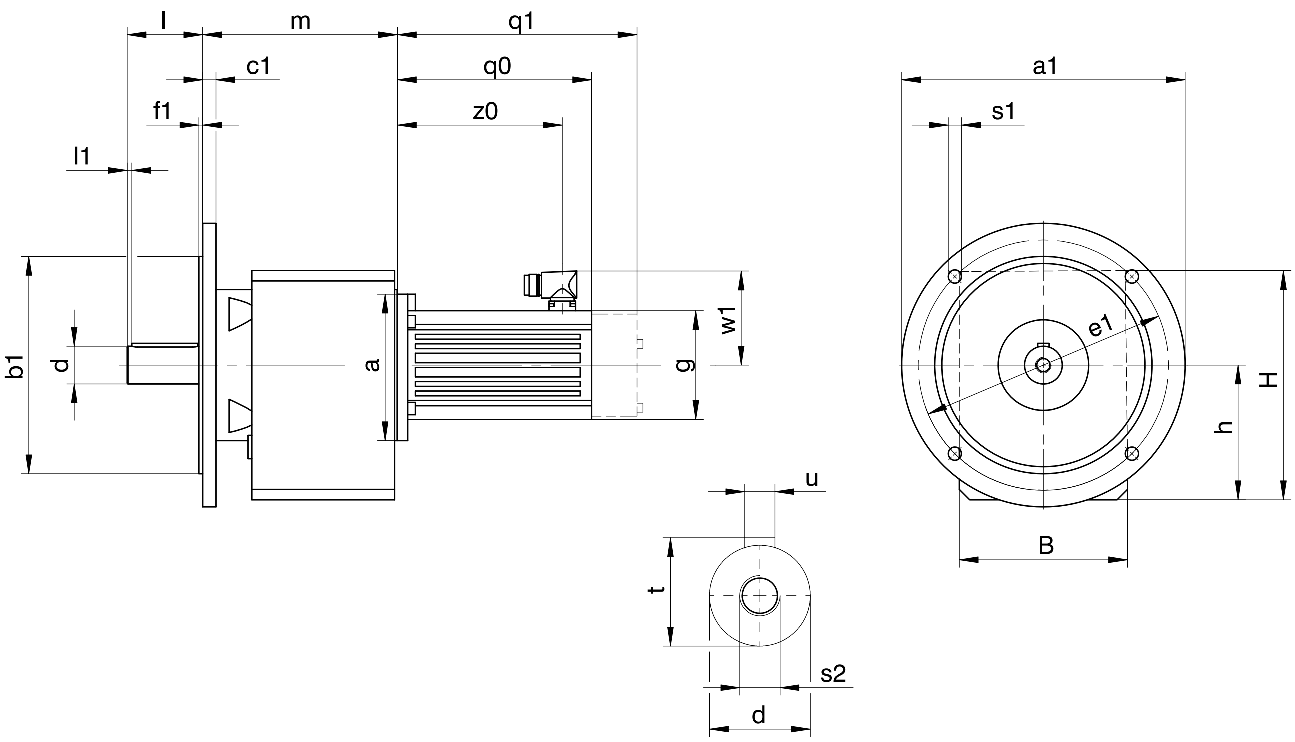
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4		LM5		LM7	
	a	m	a	m	a	m
C002	□98	96	□115	100	–	–
C102	□98	116	□115	120	□145	122
C202	∅140	128	□115	132	□145	134
C203	∅140	165	–	–	–	–
C302	–	–	∅160	151	□145	153
C303	∅140	184	–	–	–	–
C402	–	–	∅160	178	□145	180
C502	–	–	∅160	198	∅200	200
C503	–	–	∅160	241	–	–
C612	–	–	–	–	∅200	197
C613	–	–	∅160	239	∅200	259
C712	–	–	–	–	∅200	222
C713	–	–	–	–	∅200	283
C813	–	–	–	–	∅200	329

8.3.3 Solid shaft design with feather key, F housing design (round flange)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

C203, C303, C612, C613: Motor adapter and gear unit are sometimes non-coaxial.

Options: C0 – C5 also available with solid shaft without feather key; on request starting at C6.

Dimensions of gear units

Type	∅a1	∅b1	B	c1	∅d	∅e1	f1	h	H	l	l1	∅s1	s2	t	u
C0	160	110_{j6}	97	10	20_{k6}	130	3.0	79.0	141.0	40	3	9	M6	22.5	A6×6×32
C1	200	130_{j6}	130	12	25_{k6}	165	3.5	100.0	175.0	50	5	11	M10	28.0	A8×7×40
C2	200	130_{j6}	142	12	30_{k6}	165	3.5	112.0	192.0	60	5	11	M10	33.0	A8×7×50
C3	250	180_{j6}	154	12	30_{k6}	215	4.0	127.0	212.0	60	5	14	M10	33.0	A8×7×50
C4	250	180_{j6}	178	14	40_{k6}	215	4.0	142.5	242.5	80	5	14	M16	43.0	A12×8×70
C5	300	230_{j6}	195	16	40_{k6}	265	4.0	166.0	286.0	80	5	14	M16	43.0	A12×8×70
C6	300	230_{j6}	225	17	50_{k6}	265	4.0	195.0	310.0	100	5	14	M16	53.5	A14×9×90
C7	350	250_{h6}	265	18	60_{m6}	300	5.0	231.0	371.0	120	5	18	M20	64.0	A18×11×100
C8	400	300_{h6}	310	20	70_{m6}	350	5.0	285.0	445.0	140	5	18	M20	74.5	A20×12×125

Dimensions of additional round flanges

Type	∅a1	∅b1	c1	∅e1	f1	∅s1
C0	120	80_{j6}	10	100	3.0	7
C0	140	95_{j6}	10	115	3.0	9
C1	140	95_{j6}	8	115	3.5	9
C1	160	110_{j6}	10	130	3.5	9
C2	160	110_{j6}	10	130	3.5	9
C2	250	180_{j6}	12	215	4.0	14
C3	160	110_{j6}	10	130	3.5	9
C3	200	130_{j6}	12	165	3.5	11
C4	200	130_{j6}	14	165	3.5	11
C4	300	230_{j6}	14	265	4.0	14
C5	250	180_{j6}	14	215	4.0	14
C8	350	250_{h6}	18	300	5.0	18
C8	450	350_{h6}	20	400	5.0	18

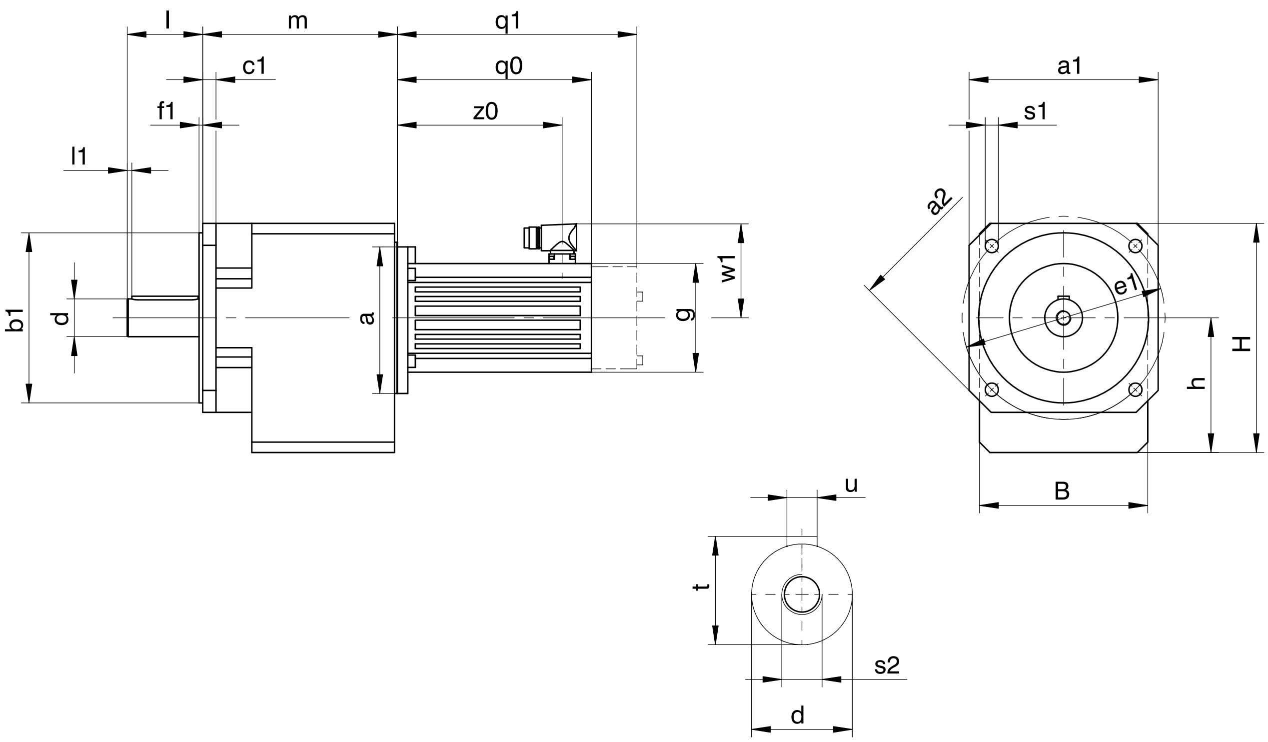
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4		LM5		LM7	
	a	m	a	m	a	m
C002	□98	114	□115	118	–	–
C102	□98	137	□115	141	□145	143
C202	∅140	155	□115	159	□145	161
C203	∅140	192	–	–	–	–
C302	–	–	∅160	178	□145	180
C303	∅140	211	–	–	–	–
C402	–	–	∅160	206	□145	208
C502	–	–	∅160	227	∅200	229
C503	–	–	∅160	270	–	–
C612	–	–	–	–	∅200	233
C613	–	–	∅160	275	∅200	295
C712	–	–	–	–	∅200	266
C713	–	–	–	–	∅200	327
C813	–	–	–	–	∅200	374

8.3.4 Solid shaft design with feather key, Q housing design (square flange)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

C203, C303: Motor adapter and gear unit are sometimes non-coaxial.

Options: C0 – C5 also available with solid shaft without feather key; on request starting at C6.

Dimensions of gear units

Type	□a1	□a2	∅b1	B	c1	∅d	∅e1	f1	h	H	l	l1	∅s1	s2	t	u
C0	124	160	110_{j6}	97	9	20_{k6}	130	3.0	79.0	141.0	40	3	9	M6	22.5	A6×6×32
C1	145	192	130_{j6}	130	11	25_{k6}	165	3.5	100.0	175.0	50	5	11	M10	28.0	A8×7×40
C2	145	192	130_{j6}	142	11	30_{k6}	165	3.5	112.0	192.0	60	5	11	M10	33.0	A8×7×50
C3	200	250	180_{j6}	154	14	30_{k6}	215	4.0	127.0	212.0	60	5	14	M10	33.0	A8×7×50
C4	200	250	180_{j6}	178	14	40_{k6}	215	4.0	142.5	242.5	80	5	14	M16	43.0	A12×8×70

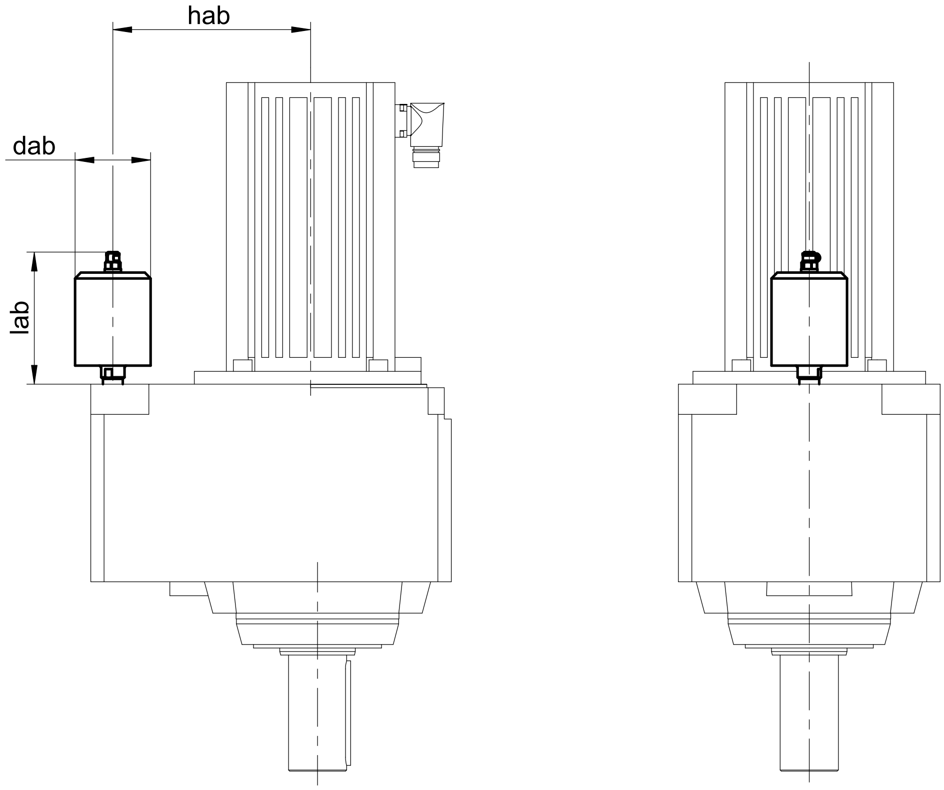
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4		LM5		LM7	
	a	m	a	m	a	m
C002	□98	114	□115	118	–	–
C102	□98	137	□115	141	□145	143
C202	∅140	155	□115	159	□145	161
C203	∅140	192	–	–	–	–
C302	–	–	∅160	178	□145	180
C303	∅140	211	–	–	–	–
C402	–	–	∅160	206	□145	208

8.3.5 Oil expansion tank



Dimensions

Type	LM7		
	dab	hab	lab
C612	65	170	114.5
C712	73	205	129.5

More information can be found in Chapter [▶ 8.6.4]

8.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

C	2	0	2	N	0280	LM403U

Explanation

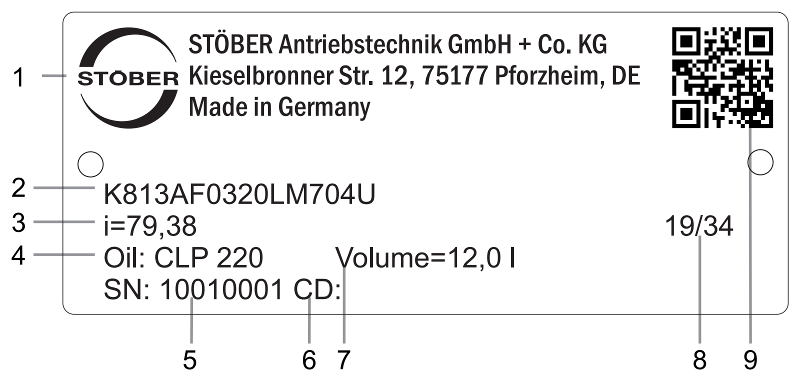
Code	Designation	Design
C	Type	Helical gear unit
2	Size	2 (example)
0	Generation	Generation 0
1		Generation 1
2	Stages	Two-stage
3		Three-stage
G	Housing	Pitch circle diameter
F		Round flange
Q		Square flange
N		Foot
0280	Transmission ratio (i x 10 rounded)	i = 28.24 (example)
LM403U	Motor	LM Lean motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▸ 2]
- The mounting position, see the chapter [▸ 8.5.5]
- The position of the plug connector, see the chapter [▸ 8.5.7]
- Oil expansion tank (recommended for gear units in mounting position EL5), see the chapter [▸ 8.6.4]
- Standard or reinforced output bearing

8.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Lubricant specification
5	Serial number of the gear unit
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

8.4.1.1 Supporting documents

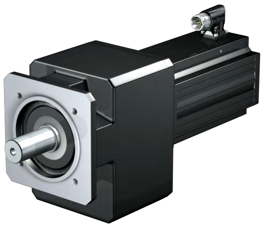
You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

8.5 Product description

8.5.1 Input options

LM Lean motor

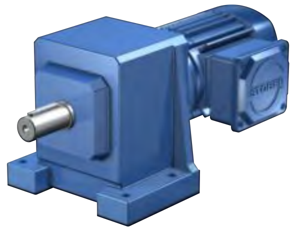


http://www.stoeber.de/en/CLM

EZ synchronous servo motor

http://www.stoeber.de/en/CEZ

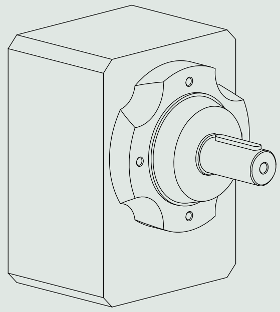
Asynchronous motor



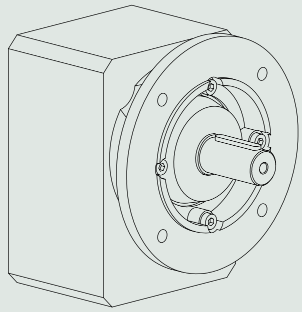
http://www.stoeber.de/en/CIE3D

8.5.2 Housing design

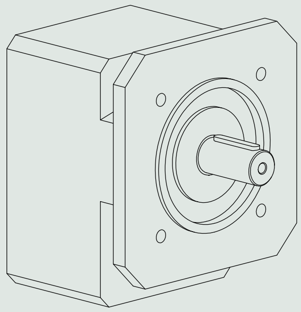
Pitch circle diameter G



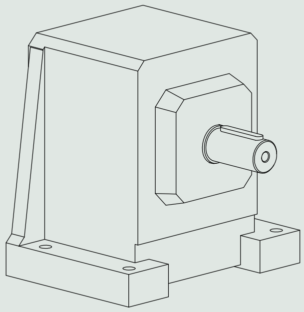
Round flange F



Square flange Q



Foot N



	G	F	Q	N
C0	✓	✓	✓	✓
C1	✓	✓	✓	✓
C2	✓	✓	✓	✓
C3	✓	✓	✓	✓
C4	✓	✓	✓	✓
C5	✓	✓	–	✓
C6	✓	✓	–	✓
C7	✓	✓	–	✓
C8	✓	✓	–	✓
C9	✓	✓	–	✓

8.5.3 Shaft design

Gear units in sizes C0 – C9 come standard with a solid shaft with feather key.

Gear units in sizes C0 – C5 can be ordered with the option of a solid shaft without feather key. Only upon request starting at size C6.

8.5.4 Installation conditions

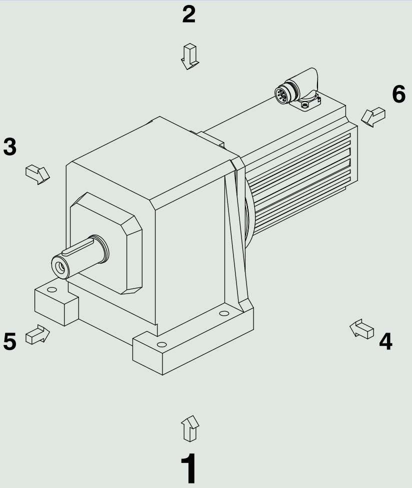
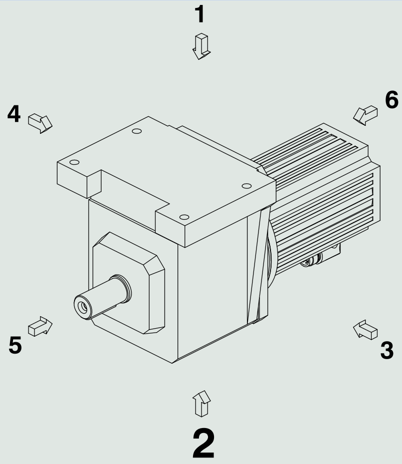
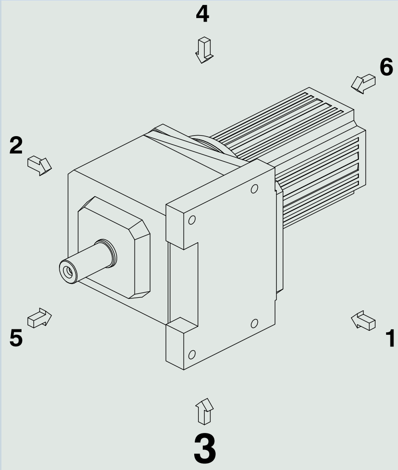
Fastening the gear units on the machine side using the pitch circle diameter

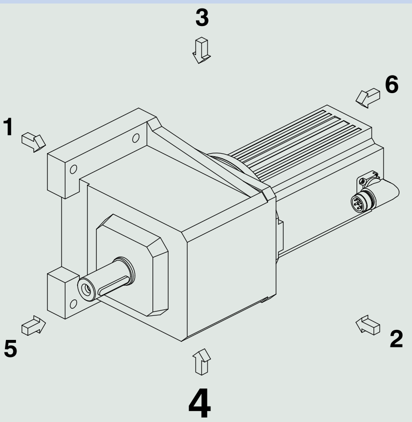
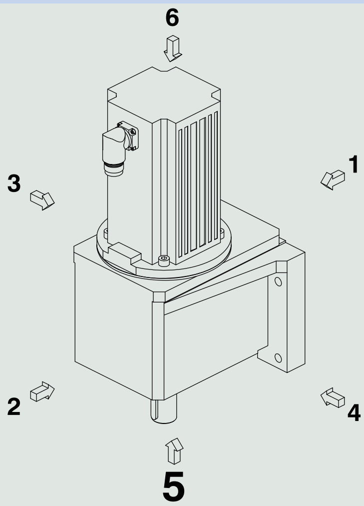
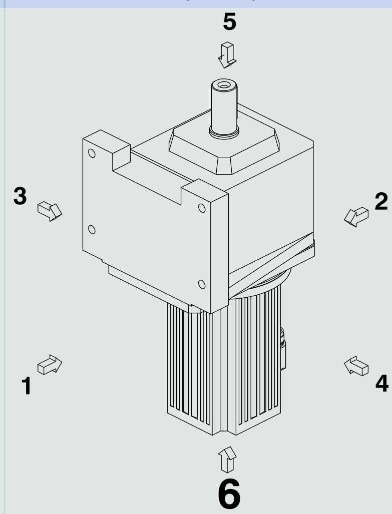
The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

8.5.5 Mounting positions

The following table shows the standard mounting positions.

The numbers identify the gear unit sides. The mounting position is defined by the gear side facing downwards.

EL1 IMB3, IMB5, IMB14, IMB34, IMB35	EL2 IMB8	EL3 IMB7
		

EL4 IMB6	EL5 IMV1, IMV5, IMV18	EL6 IMV3, IMV6, IMV19
		

Since the lubricant filling volume of the gear unit depends on the mounting position, the mounting position must be specified when ordering.

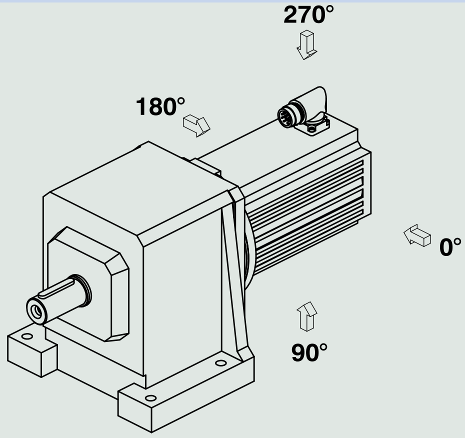
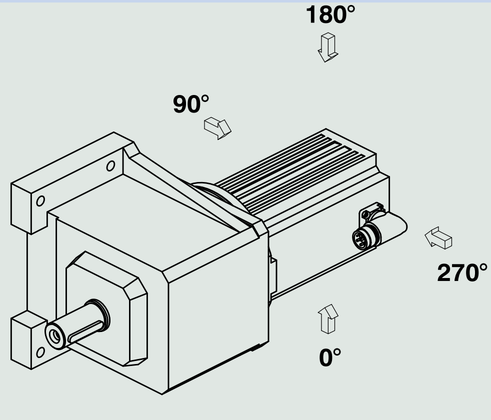
8.5.6 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate. The filling volume and the structure of the gear units depend on the mounting position.

Only install the gear units in the intended mounting position! Reposition the gear units only after consulting STOBER. Otherwise, STOBER assumes no liability for the gear units.

You will receive lubricants for use in the food industry upon request.

8.5.7 Position of the plug connector

Mounting position EL1	Mounting position EL4
Plug connector in 270° position (standard)	Plug connector in 270° position (standard)
	

Indicate variations for your geared motor in the purchase order.

Note that the plug connector position rotates along with the geared motor if the geared motor is in another mounting position.

8.5.8 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} two-stage	97%
η_{get} three-stage	96%
Protection class:[1]	
Gear unit	IP65
Motor	IP56, optionally IP66

8.5.9 Maintenance

The instructions for maintenance can be found in the operating manual, ID 443027_en, at http://www.stoeber.de/en/downloads/. Enter the ID of the documentation in the Search... field.

Ventilation

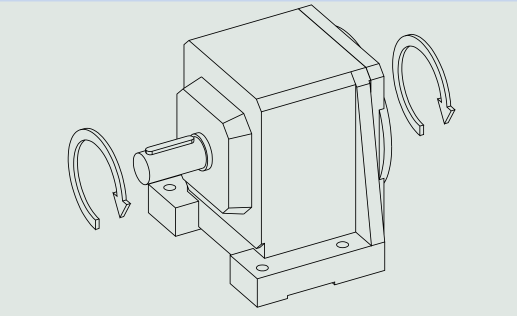
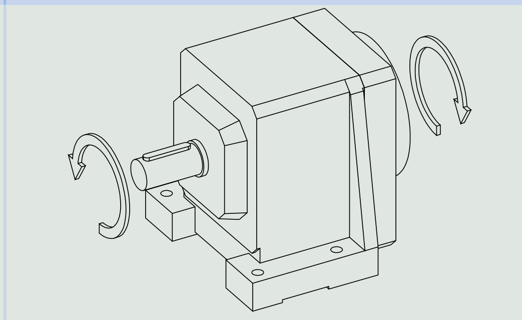
Air release valves are fitted as a standard feature and independently of installation position for gear unit sizes C6 to C9.

For the position and dimensions of the air release valve, refer to the 3D model.

Download the 3D model at http://configurator.stoeber.de.

[1] Observe the protection class of all the components.

8.5.10 Direction of rotation

C002 – C912	C103 – C913
	
The input and output rotate in the same direction.	The input and output rotate in opposite directions.

The pictures show mounting position EL1.

8.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

8.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

For mounting positions EL1, EL2, EL3, EL4:

$$n_{1m^*} \leq \frac{n_{1maxDBEL1,2,3,4}}{fB_T}$$

For mounting positions EL5, EL6:

$$n_{1m^*} \leq \frac{n_{1maxDBEL5,6}}{fB_T}$$

For all mounting positions:

$$n_{1max^*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

$$M_{2acc^*} \leq M_{2acc}$$

$$M_{2NOT^*} \leq M_{2NOT}$$

$$M_{2eq^*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

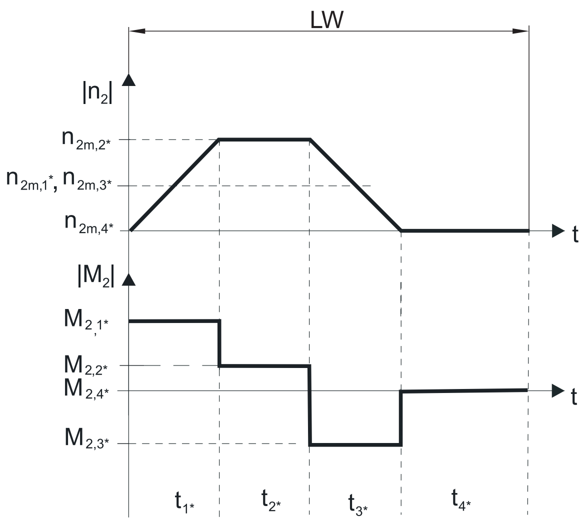
Refer to the selection table for the values for $n_{1maxDBEL1,2,3,4}$ and $n_{1maxDBEL5,6}$, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S.

The values for fB_T, fB_{op} and fB_t can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m*} = n_{2m*} \cdot i$$

$$n_{2m*} = \frac{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If t_{1*} + ... + $t_{3*} \geq 6$ min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff*} = \sqrt{\frac{t_{1*} \cdot M_{2,1*}^{2} + \ldots + t_{n*} \cdot M_{2,n*}^{2}}{t_{1*} + \ldots + t_{n*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |M_{2,1*}^{3}| + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |M_{2,n*}^{3}|}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

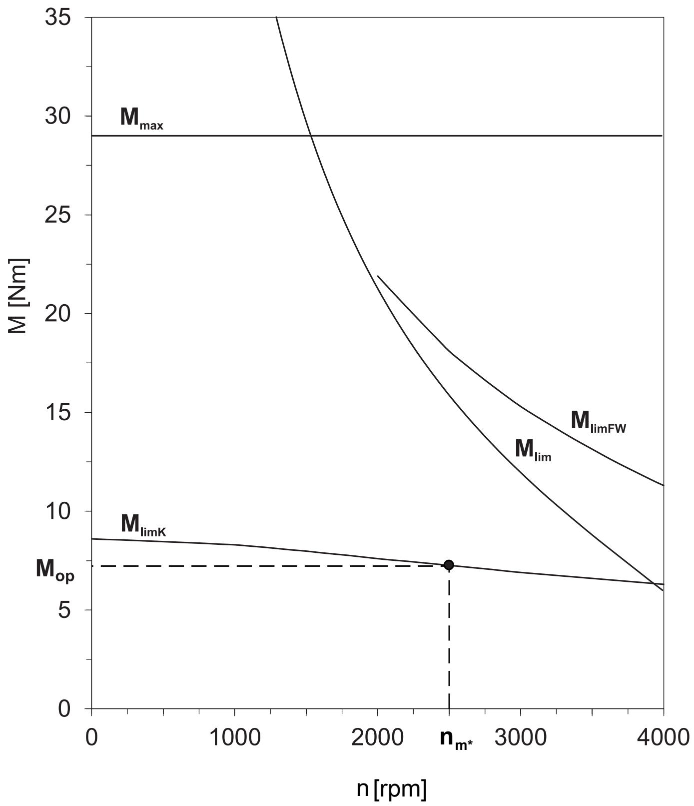
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot athEL \cdot fB_{T} \cdot \left(\frac{n_{1m*}}{1000}\right)^{3}$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▸ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Parameter a_{thEL}

Mounting position	a_{thEL}
EL1, 2, 5, 6	1.0
EL3, 4	1.1

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.25
Reversing load cyclic operation	1.40

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

8.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 20$ rpm ($F_{2axN} = F_{2ax20}$; $F_{2radN} = F_{2rad20}$; $M_{2kN} = M_{2k20}$)
- Only if radial forces on the gear unit are stabilized by its pilots for the pitch circle diameter and flange housing design

Permitted shaft loads

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
C0	20.0	500	1900	1900	80	80
C1	30.0	850	3400	3400	190	190
C2	30.0	1050	4200	4200	260	260
C3	30.0	1400	5650	5650	350	350
C4	35.0	2400	9700	9700	750	750
C5	42.0	3000	11000	11000	900	900
C6	40.0	4000	16000	16000	1500	1500
C7	45.0	5500	22000	22000	2400	2400
C8	50.0	7500	30000	30000	3700	3700
C9	55.0	9500	37000	37000	5200	5200

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds $n_{2m*} > 20$ rpm:

$$F_{2axN} = \frac{F_{2ax20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}}$$

The values for F_{2ax20}, F_{2rad20} and M_{2k20} can be found in the table "Permitted shaft loads" in this chapter.

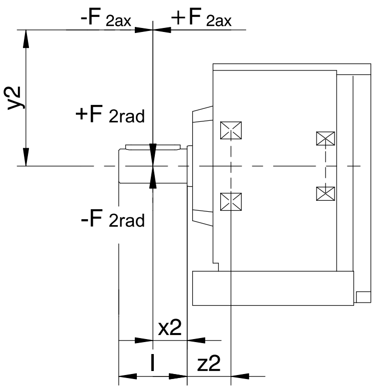


Fig. 1: Force application points

The specified values for F_{2rad20} are based on application of force at the middle of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2rad*} \leq F_{2radN}$$

$$F_{2ax*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

8.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

8.6.4 Oil expansion tank

The gear units have a higher fill level in mounting position EL5. The oil expansion tank prevents oil from escaping out of the gear unit.

Notes

- We recommend using an oil expansion tank in mounting position EL5 (additional cost) for fast running gear units with an input speed n_1 > 1750 rpm and gear ratios i < 20.
- It is not possible to use an oil expansion tank if the plug connector is at 90°!
- The oil expansion tank can only be used with certain sizes; see the chapter [▸ 8.3.5]

8.7 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for C/F/K/S gear units and gear motors	443027_en

9 F offset helical geared motors

Table of contents

9 Offset helical geared motors

F

9.1 Overview

Offset helical geared motors with large axial distances

Features

Power density	★☆☆☆☆
Backlash	★★★☆☆
Price category	€
Shaft load	★★★☆☆
Smooth operation	★★★☆☆
Torsional stiffness	★★☆☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
FKM seal ring at the input	✓
Large axial distances, suitable for confined situations	✓
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	4.3 – 274
M_{2acc}	19 – 1100 Nm
$\Delta\varphi_2$	5 – 11 arcmin
η_{get}	96 – 97 %

9.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors
- Weight specification for mounting position EL1, housing design G

For all other technical data, refer to http://configurator.stoeber.de.

An explanation of the formula symbols can be found in the Chapter [▷ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
F1 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 120 Nm)																	
65	101	109	2.5	1.2	F102_0460 LM401U	120	240	46.43	325/7	4000	4000	7000	1.8	11	6.0	7.7	16
86	76	83	2.4	1.4	F102_0350 LM401U	120	240	35.05	3575/102	4000	4000	6500	1.8	11	6.0	7.7	16
107	61	66	2.3	1.7	F102_0280 LM401U	120	200	28.17	169/6	4000	4000	6500	1.9	11	6.0	7.7	16
130	50	54	2.2	1.9	F102_0230 LM401U	100	170	23.08	3185/138	3700	3700	6000	1.9	11	6.0	7.7	16
130	99	101	4.3	0.97	F102_0230 LM402U	120	240	23.08	3185/138	3700	3700	6000	3.3	11	6.0	7.7	17
163	40	44	2.1	2.2	F102_0185 LM401U	81	130	18.46	1495/81	3700	3700	6000	2.0	11	6.0	7.7	16
163	79	81	4.2	1.1	F102_0185 LM402U	120	240	18.46	1495/81	3700	3700	6000	3.3	11	6.0	7.7	17
163	108	111	5.7	0.82	F102_0185 LM403U	120	240	18.46	1495/81	3700	3700	6000	4.6	11	6.0	7.7	19
221	30	32	2.0	2.7	F102_0135 LM401U	59	99	13.59	231/17	4000	4000	6500	1.9	11	8.0	6.5	16
221	58	59	4.0	1.4	F102_0135 LM402U	110	200	13.59	231/17	4000	4000	6500	3.2	11	8.0	6.5	17
221	80	82	5.4	1.0	F102_0135 LM403U	110	200	13.59	231/17	4000	4000	6500	4.5	11	8.0	6.5	19
275	24	26	2.3	2.7	F102_0110 LM401U	48	79	10.92	273/25	4000	4000	6500	2.0	11	8.0	6.5	16
275	47	48	3.8	1.6	F102_0110 LM402U	100	200	10.92	273/25	4000	4000	6500	3.3	11	8.0	6.5	17
275	64	66	5.2	1.2	F102_0110 LM403U	110	200	10.92	273/25	4000	4000	6500	4.6	11	8.0	6.5	19
335	20	21	2.5	2.7	F102_0089 LM401U	39	65	8.948	1029/115	3700	3700	6000	2.1	11	8.0	6.5	16
335	38	39	3.7	1.8	F102_0089 LM402U	84	200	8.948	1029/115	3700	3700	6000	3.4	11	8.0	6.5	17
335	53	54	5.1	1.3	F102_0089 LM403U	110	200	8.948	1029/115	3700	3700	6000	4.7	11	8.0	6.5	19
335	82	87	7.9	0.84	F102_0089 LM503U	110	200	8.948	1029/115	3700	3700	6000	11	11	8.0	6.5	22
419	16	17	2.8	2.7	F102_0072 LM401U	31	52	7.156	322/45	3700	3700	6000	2.3	11	8.0	6.5	16
419	31	31	3.6	2.1	F102_0072 LM402U	67	200	7.156	322/45	3700	3700	6000	3.6	11	8.0	6.5	17
419	42	43	4.9	1.5	F102_0072 LM403U	89	200	7.156	322/45	3700	3700	6000	4.9	11	8.0	6.5	19
419	66	70	7.6	0.98	F102_0072 LM503U	110	200	7.156	322/45	3700	3700	6000	11	11	8.0	6.5	22
464	28	28	3.5	2.3	F102_0065 LM402U	61	190	6.462	84/13	3500	3500	6000	3.8	11	8.0	6.5	17
464	38	39	4.8	1.6	F102_0065 LM403U	80	190	6.462	84/13	3500	3500	6000	5.1	11	8.0	6.5	19
464	59	63	7.5	1.0	F102_0065 LM503U	110	190	6.462	84/13	3500	3500	6000	11	11	8.0	6.5	22
696	9.4	10	3.6	2.7	F102_0043 LM401U	19	31	4.308	56/13	3500	3500	6000	3.2	11	8.0	6.5	16
696	18	19	3.3	3.0	F102_0043 LM402U	41	130	4.308	56/13	3500	3500	6000	4.5	11	8.0	6.5	17
696	25	26	4.5	2.2	F102_0043 LM403U	54	130	4.308	56/13	3500	3500	6000	5.8	11	8.0	6.5	19
696	40	42	7.0	1.4	F102_0043 LM503U	85	130	4.308	56/13	3500	3500	6000	12	11	8.0	6.5	22
696	57	65	10	0.95	F102_0043 LM505U	100	130	4.308	56/13	3500	3500	6000	18	11	8.0	6.5	26
F2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 270 Nm)																	
27	246	266	2.1	0.98	F202_1130 LM401U	270	480	112.7	1240/11	4000	4000	6500	1.7	11	6.0	18	24
32	205	221	1.9	1.2	F202_0940 LM401U	270	480	93.82	1032/11	4000	4000	6500	1.7	11	6.0	18	24
43	153	165	1.7	1.6	F202_0700 LM401U	270	430	70.13	5400/77	4000	4000	6500	1.8	11	6.0	18	24
53	243	248	3.0	0.99	F202_0570 LM402U	270	480	56.73	624/11	4000	4000	6500	3.2	11	6.0	18	25
64	103	111	1.4	2.3	F202_0470 LM401U	210	340	47.05	1035/22	4000	4000	6500	1.9	11	6.0	18	24
64	201	205	2.7	1.2	F202_0470 LM402U	270	480	47.05	1035/22	4000	4000	6500	3.2	11	6.0	18	25
85	77	84	1.4	2.7	F202_0350 LM401U	160	260	35.46	390/11	3800	3800	6000	2.0	11	6.0	18	24
85	152	155	2.6	1.4	F202_0350 LM402U	270	480	35.46	390/11	3800	3800	6000	3.4	11	6.0	18	25
85	208	213	3.5	1.0	F202_0350 LM403U	270	480	35.46	390/11	3800	3800	6000	4.7	11	6.0	18	27
107	120	123	2.5	1.7	F202_0280 LM402U	260	480	28.11	4020/143	3800	3800	6000	3.5	11	6.0	18	25
107	165	169	3.4	1.2	F202_0280 LM403U	270	480	28.11	4020/143	3800	3800	6000	4.8	11	6.0	18	27
128	51	55	1.7	2.7	F202_0230 LM401U	100	170	23.43	2320/99	3600	3600	6000	2.3	11	6.0	18	24
128	100	102	2.4	1.9	F202_0230 LM402U	220	480	23.43	2320/99	3600	3600	6000	3.7	11	6.0	18	25
128	138	141	3.3	1.4	F202_0230 LM403U	270	480	23.43	2320/99	3600	3600	6000	5.0	11	6.0	18	27
128	215	229	5.1	0.88	F202_0230 LM503U	270	480	23.43	2320/99	3600	3600	6000	11	11	6.0	18	30
161	80	81	2.3	2.2	F202_0185 LM402U	180	480	18.65	6360/341	3600	3600	6000	3.9	11	6.0	18	25
161	110	112	3.2	1.6	F202_0185 LM403U	230	480	18.65	6360/341	3600	3600	6000	5.2	11	6.0	18	27
161	172	182	5.0	1.0	F202_0185 LM503U	270	480	18.65	6360/341	3600	3600	6000	11	11	6.0	18	30
220	30	32	2.2	2.7	F202_0135 LM401U	60	99	13.63	109/8	3800	3800	6000	2.3	11	8.0	16	24
220	58	59	2.2	2.7	F202_0135 LM402U	130	400	13.63	109/8	3800	3800	6000	3.7	11	8.0	16	25
220	80	82	3.0	2.0	F202_0135 LM403U	170	400	13.63	109/8	3800	3800	6000	5.0	11	8.0	16	27

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
F2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 270 Nm)																	
220	125	133	4.7	1.3	F202_0135 LM503U	210	400	13.63	109/8	3800	3800	6000	11	11	8.0	16	30
220	181	204	6.8	0.88	F202_0135 LM505U	210	400	13.63	109/8	3800	3800	6000	17	11	8.0	16	34
278	46	47	2.1	3.2	F202_0110 LM402U	100	310	10.80	7303/676	3800	3800	6000	4.0	11	8.0	16	25
278	64	65	2.9	2.3	F202_0110 LM403U	130	310	10.80	7303/676	3800	3800	6000	5.3	11	8.0	16	27
278	99	106	4.5	1.5	F202_0110 LM503U	210	310	10.80	7303/676	3800	3800	6000	11	11	8.0	16	30
278	144	162	6.5	1.0	F202_0110 LM505U	210	310	10.80	7303/676	3800	3800	6000	18	11	8.0	16	34
333	20	21	2.7	2.7	F202_0090 LM401U	39	66	9.006	3161/351	3600	3600	6000	3.0	11	8.0	16	24
333	39	39	2.0	3.6	F202_0090 LM402U	85	260	9.006	3161/351	3600	3600	6000	4.3	11	8.0	16	25
333	53	54	2.8	2.6	F202_0090 LM403U	110	260	9.006	3161/351	3600	3600	6000	5.6	11	8.0	16	27
333	83	88	4.4	1.7	F202_0090 LM503U	180	260	9.006	3161/351	3600	3600	6000	12	11	8.0	16	30
333	120	135	6.3	1.2	F202_0090 LM505U	210	260	9.006	3161/351	3600	3600	6000	18	11	8.0	16	34
333	168	186	8.9	0.82	F202_0090 LM704U	210	400	9.006	3161/351	3600	3600	6000	38	11	8.0	16	40
419	31	31	2.0	4.2	F202_0072 LM402U	67	210	7.167	5777/806	3600	3600	6000	4.9	11	8.0	16	25
419	42	43	2.7	3.0	F202_0072 LM403U	89	210	7.167	5777/806	3600	3600	6000	6.2	11	8.0	16	27
419	66	70	4.2	1.9	F202_0072 LM503U	140	210	7.167	5777/806	3600	3600	6000	12	11	8.0	16	30
419	95	108	6.1	1.3	F202_0072 LM505U	170	210	7.167	5777/806	3600	3600	6000	19	11	8.0	16	34
419	134	148	8.6	0.96	F202_0072 LM704U	210	400	7.167	5777/806	3600	3600	6000	38	11	8.0	16	40
540	104	114	8.2	1.1	F202_0056 LM704U	210	400	5.552	5341/962	3100	3100	5000	39	11	8.0	16	40
540	138	160	11	0.85	F202_0056 LM706U	210	400	5.552	5341/962	3100	3100	5000	57	11	8.0	16	47
641	28	28	2.6	4.0	F202_0047 LM403U	58	140	4.680	2616/559	3100	3100	5000	8.4	11	8.0	16	27
641	43	46	4.0	2.5	F202_0047 LM503U	92	140	4.680	2616/559	3100	3100	5000	14	11	8.0	16	30
641	62	70	5.8	1.8	F202_0047 LM505U	110	140	4.680	2616/559	3100	3100	5000	21	11	8.0	16	34
641	87	97	8.0	1.3	F202_0047 LM704U	190	340	4.680	2616/559	3100	3100	5000	41	11	8.0	16	40
641	117	135	11	0.96	F202_0047 LM706U	210	340	4.680	2616/559	3100	3100	5000	58	11	8.0	16	47
F3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 450 Nm)																	
16	398	429	1.8	1.0	F303_1850 LM401U	450	800	184.8	29939/162	4000	4000	6500	1.7	11	7.0	22	36
21	307	332	1.6	1.3	F302_1410 LM401U	450	620	140.6	7595/54	4000	4000	6500	1.7	11	6.0	22	31
32	401	409	2.5	1.0	F302_0940 LM402U	450	800	93.64	4214/45	4000	4000	6500	3.2	11	6.0	22	33
43	301	307	2.2	1.3	F302_0700 LM402U	450	800	70.36	2744/39	4000	4000	6500	3.3	11	6.0	22	33
43	414	422	3.0	0.97	F302_0700 LM403U	450	800	70.36	2744/39	4000	4000	6500	4.6	11	6.0	22	35
53	242	247	1.9	1.7	F302_0560 LM402U	450	800	56.49	4067/72	4000	4000	6500	3.4	11	6.0	22	33
53	332	339	2.7	1.2	F302_0560 LM403U	450	800	56.49	4067/72	4000	4000	6500	4.7	11	6.0	22	35
64	202	206	1.8	2.0	F302_0470 LM402U	440	800	47.19	1274/27	4000	4000	6500	3.5	11	6.0	22	33
64	277	283	2.4	1.4	F302_0470 LM403U	450	800	47.19	1274/27	4000	4000	6500	4.8	11	6.0	22	35
86	150	153	1.7	2.4	F302_0350 LM402U	330	800	35.03	7252/207	3700	3700	5500	3.8	11	6.0	22	33
86	206	210	2.3	1.8	F302_0350 LM403U	440	800	35.03	7252/207	3700	3700	5500	5.1	11	6.0	22	35
86	322	342	3.6	1.1	F302_0350 LM503U	450	800	35.03	7252/207	3700	3700	5500	11	11	6.0	22	38
106	121	123	1.6	2.8	F302_0280 LM402U	270	800	28.23	6860/243	3700	3700	5500	4.0	11	6.0	22	33
106	166	170	2.2	2.0	F302_0280 LM403U	350	800	28.23	6860/243	3700	3700	5500	5.3	11	6.0	22	35
106	260	276	3.5	1.3	F302_0280 LM503U	450	800	28.23	6860/243	3700	3700	5500	11	11	6.0	22	38
106	375	424	5.0	0.90	F302_0280 LM505U	450	800	28.23	6860/243	3700	3700	5500	18	11	6.0	22	42
128	101	103	1.6	3.2	F302_0240 LM402U	220	680	23.52	588/25	3500	3500	5000	4.4	11	6.0	22	33
128	138	141	2.2	2.3	F302_0240 LM403U	290	680	23.52	588/25	3500	3500	5000	5.7	11	6.0	22	35
128	216	230	3.4	1.5	F302_0240 LM503U	450	680	23.52	588/25	3500	3500	5000	12	11	6.0	22	38
128	313	353	4.9	1.0	F302_0240 LM505U	450	680	23.52	588/25	3500	3500	5000	18	11	6.0	22	42
160	351	387	6.6	0.84	F302_0190 LM704U	450	800	18.77	4900/261	3500	3500	5000	38	11	6.0	22	48
224	57	58	1.4	4.6	F302_0135 LM402U	130	390	13.38	7696/575	3700	3700	5500	4.3	11	8.0	20	33
224	79	80	2.0	3.3	F302_0135 LM403U	170	390	13.38	7696/575	3700	3700	5500	5.6	11	8.0	20	35
224	123	131	3.1	2.1	F302_0135 LM503U	260	390	13.38	7696/575	3700	3700	5500	12	11	8.0	20	38
224	178	201	4.4	1.5	F302_0135 LM505U	310	390	13.38	7696/575	3700	3700	5500	18	11	8.0	20	42
224	250	276	6.2	1.1	F302_0135 LM704U	350	650	13.38	7696/575	3700	3700	5500	38	11	8.0	20	48
278	63	65	1.9	3.9	F302_0110 LM403U	130	310	10.79	1456/135	3700	3700	5500	6.2	11	8.0	20	35
278	99	105	3.0	2.5	F302_0110 LM503U	210	310	10.79	1456/135	3700	3700	5500	12	11	8.0	20	38
278	143	162	4.3	1.7	F302_0110 LM505U	250	310	10.79	1456/135	3700	3700	5500	19	11	8.0	20	42
278	202	222	6.0	1.2	F302_0110 LM704U	350	650	10.79	1456/135	3700	3700	5500	38	11	8.0	20	48
278	269	312	8.0	0.91	F302_0110 LM706U	350	650	10.79	1456/135	3700	3700	5500	56	11	8.0	20	55
334	53	54	2.0	4.0	F302_0090 LM403U	110	260	8.986	5616/625	3500	3500	5000	6.9	11	8.0	20	35
334	83	88	3.2	2.5	F302_0090 LM503U	180	260	8.986	5616/625	3500	3500	5000	13	11	8.0	20	38
334	119	135	4.6	1.8	F302_0090 LM505U	210	260	8.986	5616/625	3500	3500	5000	19	11	8.0	20	42
334	168	185	5.8	1.4	F302_0090 LM704U	350	650	8.986	5616/625	3500	3500	5000	39	11	8.0	20	48
334	224	260	7.8	1.0	F302_0090 LM706U	350	650	8.986	5616/625	3500	3500	5000	56	11	8.0	20	55
418	134	148	5.6	1.6	F302_0072 LM704U	290	520	7.172	208/29	3500	3500	5000	40	11	8.0	20	48
418	179	207	7.5	1.2	F302_0072 LM706U	350	520	7.172	208/29	3500	3500	5000	58	11	8.0	20	55
524	107	118	5.4	1.9	F302_0057 LM704U	230	420	5.720	143/25	3000	3000	4500	42	11	8.0	20	48

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,3,4 [rpm]	n_{1maxDB} EL5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
F3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 450 Nm)																	
524	142	165	7.2	1.4	F302_0057 LM706U	330	420	5.720	143/25	3000	3000	4500	60	11	8.0	20	55
646	87	96	5.2	2.1	F302_0046 LM704U	190	340	4.644	4992/1075	3000	3000	4500	45	11	8.0	20	48
646	116	134	7.0	1.6	F302_0046 LM706U	270	340	4.644	4992/1075	3000	3000	4500	62	11	8.0	20	55
F4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 700 Nm)																	
11	590	637	1.3	1.2	F403_2740 LM401U	700	1400	274.4	59267/216	3800	3800	6000	1.7	10	6.0	39	44
14	472	509	1.2	1.5	F403_2190 LM401U	700	1400	219.2	94705/432	3800	3800	6000	1.8	10	6.0	39	44
16	395	427	1.1	1.8	F403_1840 LM401U	700	1180	183.9	39715/216	3800	3800	6000	1.8	10	6.0	39	44
43	644	684	2.9	1.1	F402_0700 LM503U	700	1400	70.06	1261/18	3800	3800	6000	11	10	5.0	39	46
54	515	547	2.6	1.4	F402_0560 LM503U	700	1400	55.97	2015/36	3800	3800	6000	11	10	5.0	39	46
64	432	459	2.5	1.5	F402_0470 LM503U	700	1370	46.94	845/18	3800	3800	6000	11	10	5.0	39	46
107	523	577	4.6	1.1	F402_0280 LM704U	700	1400	27.99	2015/72	3500	3500	5500	38	10	5.0	39	56
129	434	479	4.5	1.2	F402_0230 LM704U	700	1400	23.21	325/14	3200	3200	4800	39	10	5.0	39	56
129	578	671	6.0	0.90	F402_0230 LM706U	700	1400	23.21	325/14	3200	3200	4800	56	10	5.0	39	63
161	348	384	4.3	1.4	F402_0185 LM704U	700	1360	18.62	3575/192	3200	3200	4800	40	10	5.0	39	56
161	464	538	5.8	1.0	F402_0185 LM706U	700	1360	18.62	3575/192	3200	3200	4800	57	10	5.0	39	63
221	254	280	4.1	1.7	F402_0135 LM704U	540	930	13.57	5984/441	3500	3500	5500	39	10	7.0	39	56
221	338	392	5.5	1.3	F402_0135 LM706U	550	930	13.57	5984/441	3500	3500	5500	56	10	7.0	39	63
277	202	223	3.9	2.0	F402_0110 LM704U	430	790	10.83	682/63	3500	3500	5500	40	10	7.0	39	56
277	270	313	5.3	1.5	F402_0110 LM706U	550	790	10.83	682/63	3500	3500	5500	57	10	7.0	39	63
334	168	185	3.8	2.3	F402_0090 LM704U	360	650	8.980	440/49	3200	3200	4800	41	10	7.0	39	56
334	224	260	5.1	1.7	F402_0090 LM706U	520	650	8.980	440/49	3200	3200	4800	59	10	7.0	39	63
417	135	149	3.7	2.6	F402_0072 LM704U	290	520	7.202	605/84	3200	3200	4800	43	10	7.0	39	56
417	179	208	4.9	2.0	F402_0072 LM706U	420	520	7.202	605/84	3200	3200	4800	61	10	7.0	39	63
F6 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1100 Nm)																	
27	1032	1096	2.7	1.1	F602_1120 LM503U	1100	2000	112.2	9425/84	3500	3500	5500	11	10	5.0	77	73
32	858	912	2.4	1.3	F602_0930 LM503U	1100	1870	93.33	280/3	3500	3500	5500	11	10	5.0	77	73
43	640	680	2.1	1.7	F602_0700 LM503U	1100	1590	69.64	975/14	3500	3500	5500	11	10	5.0	77	73
43	925	1045	3.0	1.2	F602_0700 LM505U	1100	1590	69.64	975/14	3500	3500	5500	18	10	5.0	77	77
64	873	963	3.5	1.3	F602_0470 LM704U	1100	2000	46.72	1495/32	3500	3500	5500	38	10	5.0	77	83
85	658	726	3.3	1.5	F602_0350 LM704U	1100	2000	35.21	845/24	3300	3300	5000	39	10	5.0	77	83
85	877	1018	4.4	1.1	F602_0350 LM706U	1100	2000	35.21	845/24	3300	3300	5000	57	10	5.0	77	90
107	523	577	3.2	1.8	F602_0280 LM704U	1100	2000	27.99	2015/72	3300	3300	5000	41	10	5.0	77	83
107	697	809	4.3	1.3	F602_0280 LM706U	1100	2000	27.99	2015/72	3300	3300	5000	58	10	5.0	77	90
129	435	480	3.1	2.0	F602_0230 LM704U	930	1690	23.27	1885/81	2900	2900	4500	42	10	5.0	77	83
129	579	673	4.1	1.5	F602_0230 LM706U	1100	1690	23.27	1885/81	2900	2900	4500	59	10	5.0	77	90
220	254	281	2.8	2.9	F602_0135 LM704U	540	920	13.61	871/64	3300	3300	5000	42	10	7.0	73	83
220	339	393	3.8	2.2	F602_0135 LM706U	740	920	13.61	871/64	3300	3300	5000	59	10	7.0	73	90
277	202	223	2.9	3.1	F602_0110 LM704U	430	790	10.82	2077/192	3300	3300	5000	44	10	7.0	73	83
277	269	313	3.9	2.3	F602_0110 LM706U	630	790	10.82	2077/192	3300	3300	5000	62	10	7.0	73	90
334	168	185	3.2	3.1	F602_0090 LM704U	360	650	8.995	1943/216	2900	2900	4500	47	10	7.0	73	83
334	224	260	4.3	2.3	F602_0090 LM706U	520	650	8.995	1943/216	2900	2900	4500	65	10	7.0	73	90

9.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

Tolerances

Axis height in accordance with DIN 747	Tolerance
Up to 50 mm	-0.4 mm
Up to 250 mm	-0.5 mm
Up to 630 mm	-0.6 mm

Solid shaft	Tolerance
Shaft ∅ fit ≤ 50 mm	DIN 748-1, ISO k6
Shaft ∅ fit > 50 mm	DIN 748-1, ISO m6
Feather keys	DIN 6885-1, high form A

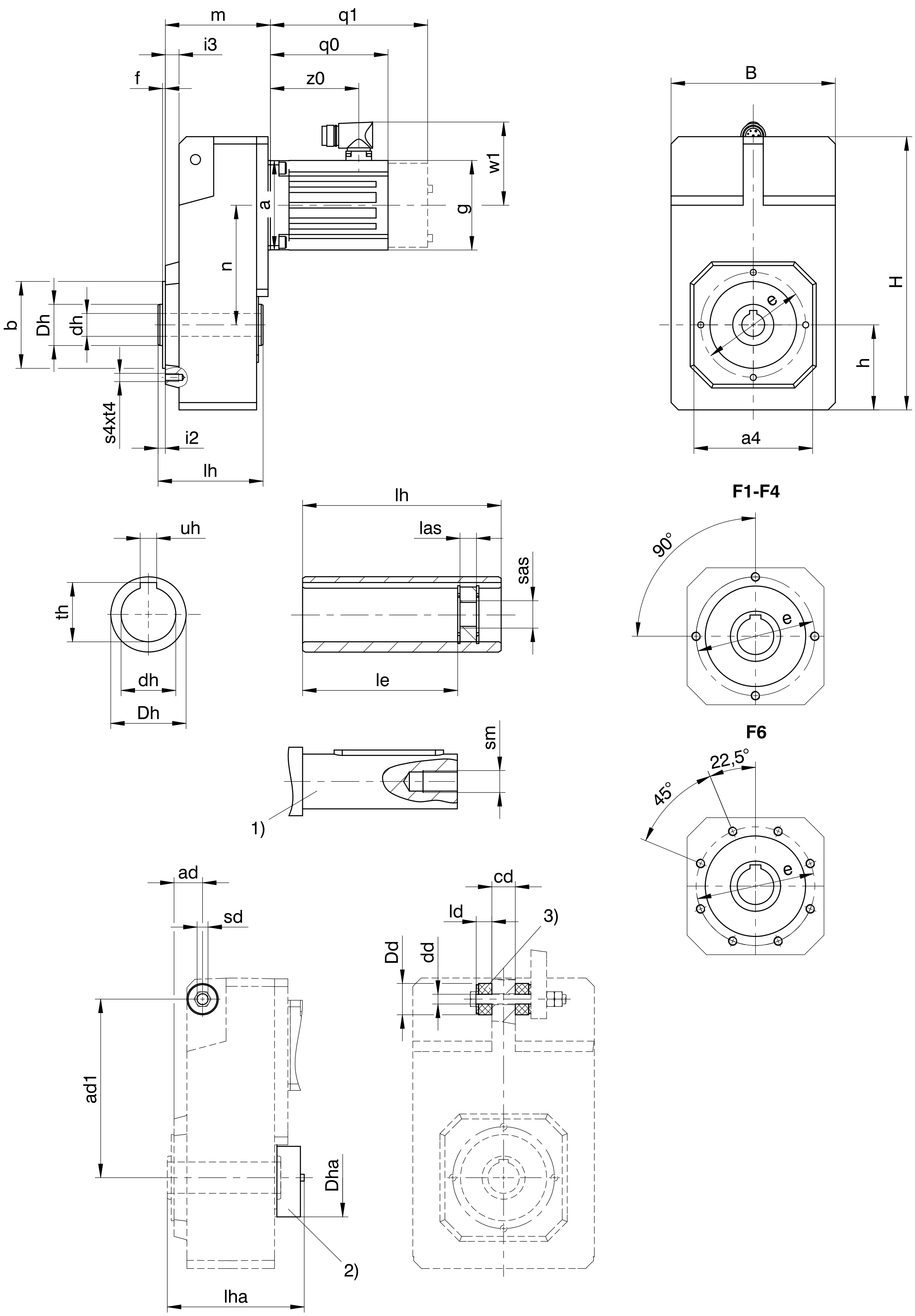
Hollow shaft	Tolerance
Hollow shaft hole fit	ISO H7
Feather keys	DIN 6885-1, high form

Flange	Pilot tolerance
Up to 300 mm	ISO j6
Starting at 350 mm	ISO h6

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

9.3.1 A shaft design (hollow shaft), G housing design (pitch circle diameter)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.	2)	Cover (optional)
3)	Rubber buffer for torque arm bracket (optional). Dimension ∅Dd = outer∅ of the rubber buffer when not tensioned.		

Dimensions of gear units

Type	□a4	ad	ad1	∅b	B	cd	∅dd	∅dh	∅Dd	∅Dh	∅Dha	∅e	f	h	H	i2	i3	ld	le	lh	las	lha	s4	sd	sm	sas	t4	th	uh
F1	100	29.5	150	70_{j6}	145	20	$11.0^{+0,5}$	20^{H7}	30	35	70	85	2.5	74	238.0	6.5	12.5	15	73	95	12	112	M8	M10	M6	M8	13	22.8	6^{JS9}
F2	130	33.0	181	95_{j6}	180	22	$11.0^{+0,5}$	25^{H7}	30	45	82	115	3.0	93	299.0	8.0	15.0	15	92	115	12	130.5	M8	M10	M10	M12	13	28.3	8^{JS9}
F3	150	38.5	205	110_{j6}	206	30	$14.0^{+0,5}$	30^{H7}	37	50	88	130	3.5	106	335.5	8.5	16.5	20	103	130	12	155.5	M10	M12	M10	M12	16	33.3	8^{JS9}
F4	150	38.5	228	110_{j6}	230	30	$14.0^{+0,5}$	40^{H7}	37	55	100	130	3.5	116	370.0	8.5	16.5	20	114	145	12	174.5	M10	M12	M16	M20	16	43.3	12^{JS9}
F6	180	44.5	270	130_{j6}	265	35	$22.0^{+0,5}$	50^{H7}	60	70	115	165	3.5	137	433.0	10.5	20.5	30	143	180	12	192.5	M10	M20	M16	M20	16	53.8	14^{JS9}

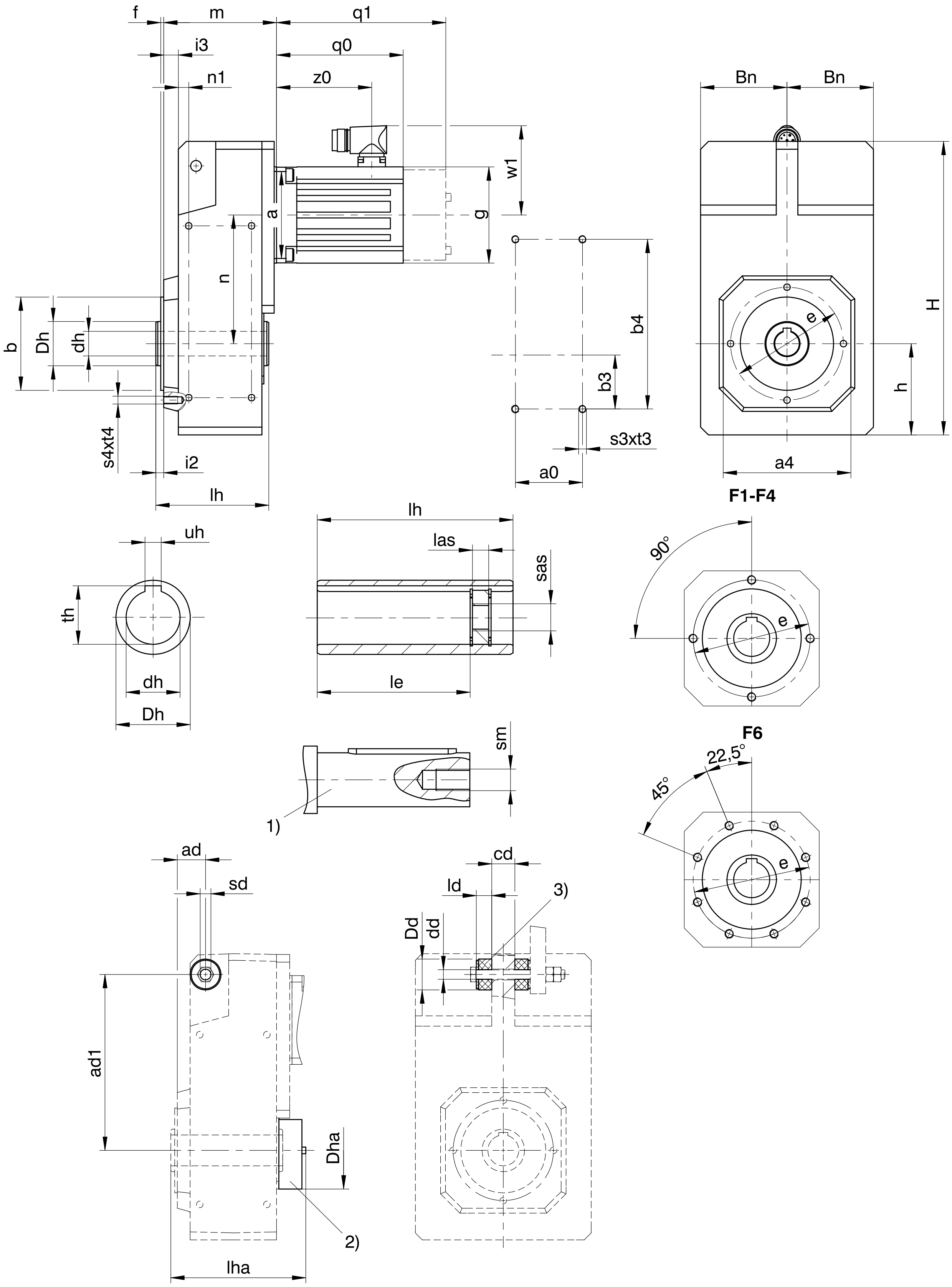
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	97.5	102.0	□115	101.5	102.0	–	–	–
F202	□98	115.0	131.0	□115	119.0	131.0	□145	121.0	131.0
F302	∅140	129.5	149.5	□115	133.5	149.5	□145	135.5	149.5
F303	∅140	166.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	148.5	169.0	□145	150.5	169.0
F403	∅140	181.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	179.5	196.0	□145	181.5	196.0

9.3.2 A shaft design (hollow shaft), GN housing design (pitch circle diameter + side fastening)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.	2)	Cover (optional)
3)	Rubber buffer for torque arm bracket (optional). Dimension ∅Dd = outer∅ of the rubber buffer when not tensioned.		

Dimensions of gear units

Type	a0	□a4	ad	ad1	∅b	b3	b4	Bn	cd	∅dd	∅dh	∅Dd	∅Dh	∅Dha	∅e	f	h	H
F1	50	100	29.5	150	70_{j6}	40	140	71	20	$11.0^{+0,5}$	20^{H7}	30	35	70	85	2.5	74	238.0
F2	64	130	33.0	181	95_{j6}	55	175	88	22	$11.0^{+0,5}$	25^{H7}	30	45	82	115	3.0	93	299.0
F3	72	150	38.5	205	110_{j6}	60	200	102	30	$14.0^{+0,5}$	30^{H7}	37	50	88	130	3.5	106	335.5
F4	87	150	38.5	228	110_{j6}	70	220	114	30	$14.0^{+0,5}$	40^{H7}	37	55	100	130	3.5	116	370.0
F6	108	180	44.5	270	130_{j6}	85	270	131	35	$22.0^{+0,5}$	50^{H7}	60	70	115	165	3.5	137	433.0

Type	i2	i3	ld	le	lh	las	lha	n1	s3	s4	sd	sm	sas	t3	t4	th	uh
F1	6.5	12.5	15	73	95	12	112	10.0	M6	M8	M10	M6	M8	11	13	22.8	6^{JS9}
F2	8.0	15.0	15	92	115	12	130.5	10.5	M8	M8	M10	M10	M12	13	13	28.3	8^{JS9}
F3	8.5	16.5	20	103	130	12	155.5	12.5	M10	M10	M12	M10	M12	16	16	33.3	8^{JS9}
F4	8.5	16.5	20	114	145	12	174.5	12.5	M10	M10	M12	M16	M20	16	16	43.3	12^{JS9}
F6	10.5	20.5	30	143	180	12	192.5	15.5	M12	M10	M20	M16	M20	19	16	53.8	14^{JS9}

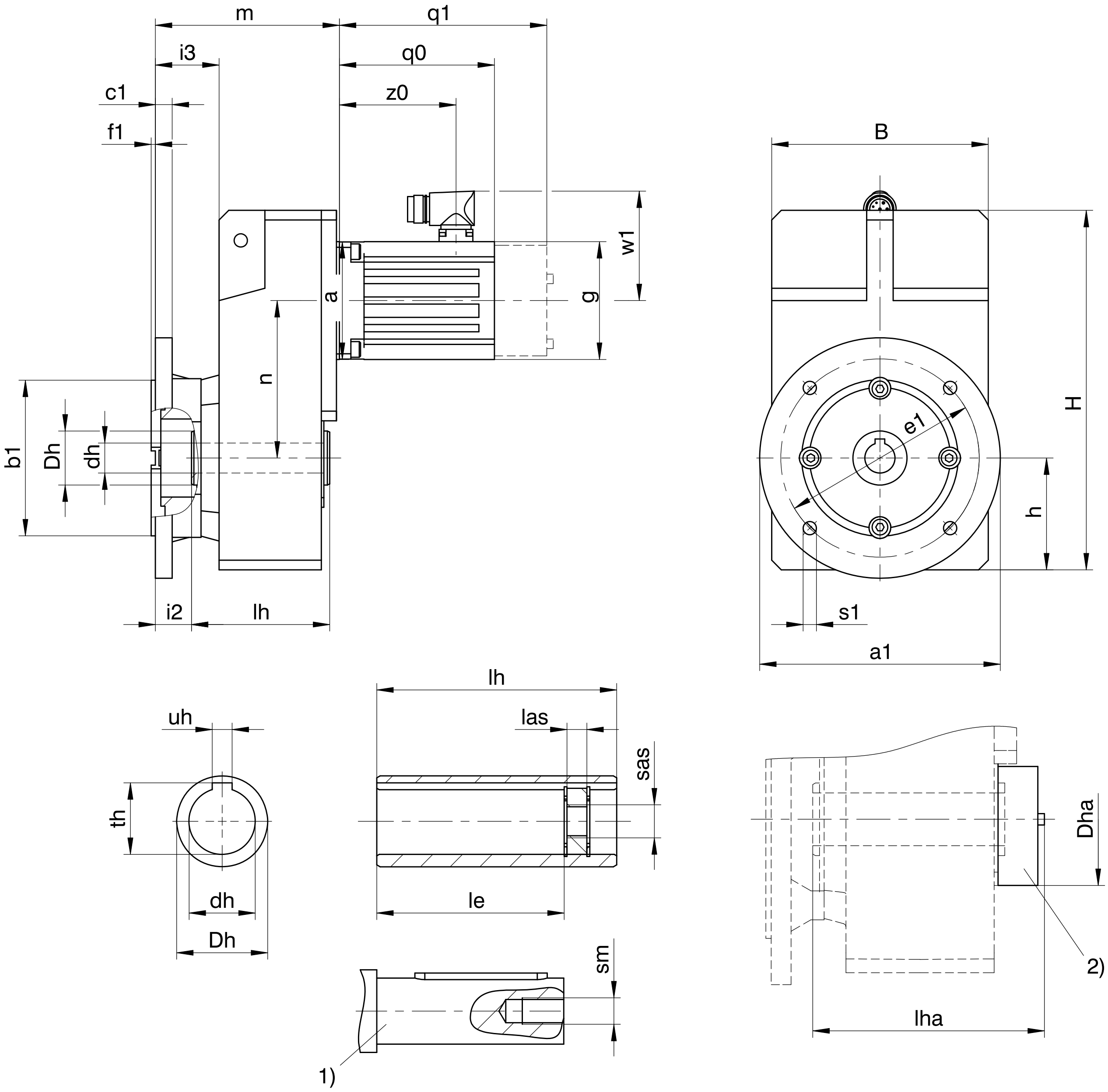
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	97.5	102.0	□115	101.5	102.0	–	–	–
F202	□98	115.0	131.0	□115	119.0	131.0	□145	121.0	131.0
F302	∅140	129.5	149.5	□115	133.5	149.5	□145	135.5	149.5
F303	∅140	166.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	148.5	169.0	□145	150.5	169.0
F403	∅140	181.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	179.5	196.0	□145	181.5	196.0

9.3.3 A shaft design (hollow shaft), F housing design (round flange)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

1) The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.

2) Cover (optional)

Dimensions of gear units

Type	∅a1	∅b1	B	c1	∅dh	∅Dh	∅Dha	∅e1	f1	h	H	i2	i3	le	lh	las	lha	∅s1	sm	sas	th	uh
F1	160	110_{j6}	145	10	20^{H7}	35	70	130	3.5	74	238.0	25.5	44.5	73	95	12	112	9	M6	M8	22.8	6^{JS9}
F2	200	130_{j6}	180	14	25^{H7}	45	82	165	3.5	93	299.0	30.0	53.0	92	115	12	130.5	11	M10	M12	28.3	8^{JS9}
F3	250	180_{j6}	206	15	30^{H7}	50	88	215	4.0	106	335.5	31.5	56.5	103	130	12	155.5	14	M10	M12	33.3	8^{JS9}
F4	250	180_{j6}	230	15	40^{H7}	55	100	215	4.0	116	370.0	31.5	56.5	114	145	12	174.5	14	M16	M20	43.3	12^{JS9}
F6	300	230_{j6}	265	17	50^{H7}	70	115	265	4.0	137	433.0	29.5	60.5	143	180	12	192.5	14	M16	M20	53.8	14^{JS9}

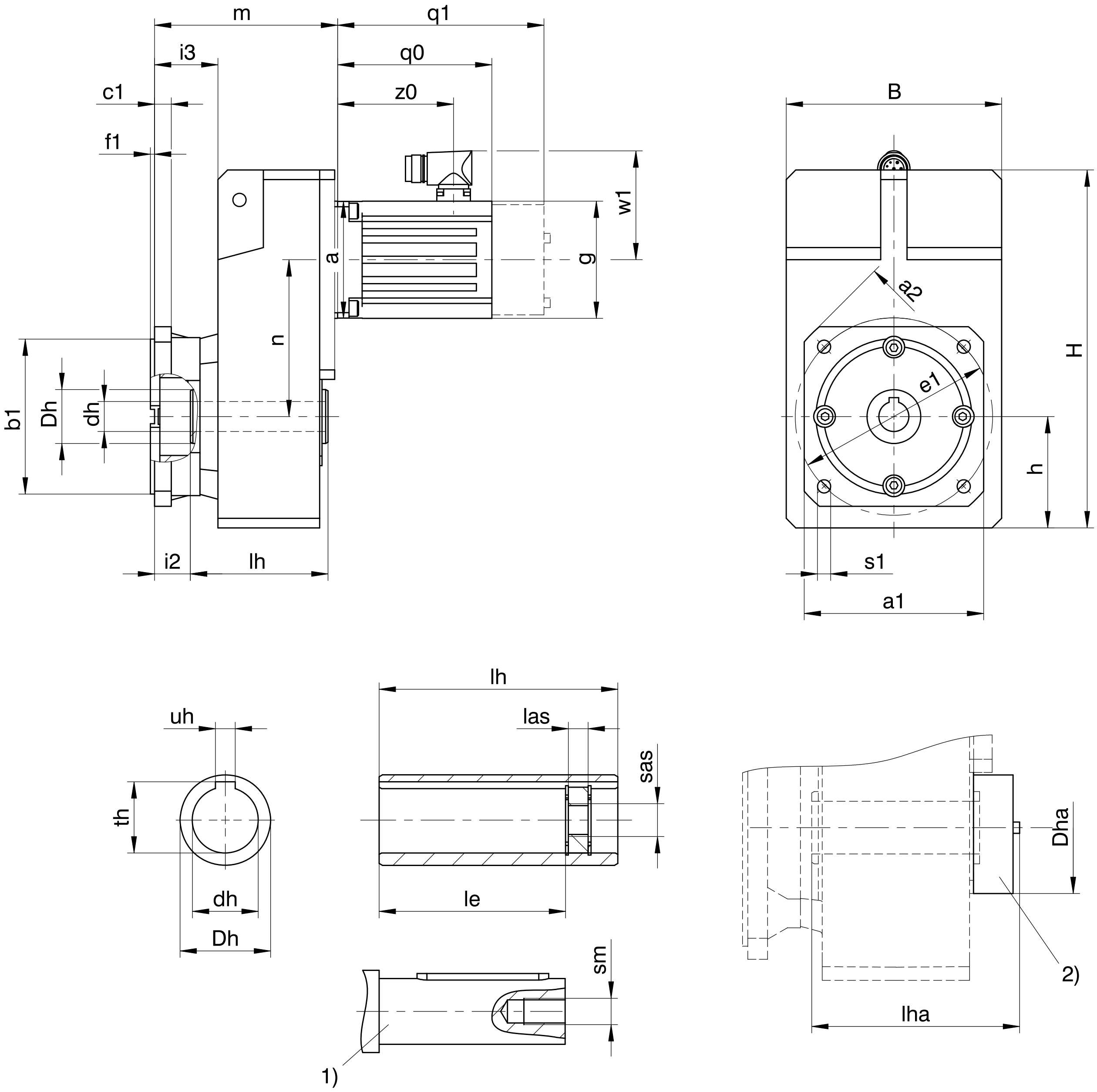
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	∅140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	∅140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	188.5	169.0	□145	190.5	169.0
F403	∅140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	219.5	196.0	□145	221.5	196.0

9.3.4 A shaft design (hollow shaft), Q housing design (square flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.	2)	Cover (optional)

Dimensions of gear units

Type	□a1	□a2	⌀b1	B	c1	⌀dh	⌀Dh	⌀Dha	⌀e1	f1	h	H	i2	i3	le	lh	las	lha	⌀s1	sm	sas	th	uh
F1	125	160	110_{j6}	145	10	20^{H7}	35	70	130	3.5	74	238.0	25.5	44.5	73	95	12	112	9	M6	M8	22.8	6^{JS9}
F2	150	195	130_{j6}	180	14	25^{H7}	45	82	165	3.5	93	299.0	30.0	53.0	92	115	12	130.5	11	M10	M12	28.3	8^{JS9}
F3	200	260	180_{j6}	206	15	30^{H7}	50	88	215	4.0	106	335.5	31.5	56.5	103	130	12	155.5	14	M10	M12	33.3	8^{JS9}
F4	200	260	180_{j6}	230	15	40^{H7}	55	100	215	4.0	116	370.0	31.5	56.5	114	145	12	174.5	14	M16	M20	43.3	12^{JS9}
F6	250	325	230_{j6}	265	17	50^{H7}	70	115	265	4.0	137	433.0	29.5	60.5	143	180	12	192.5	14	M16	M20	53.8	14^{JS9}

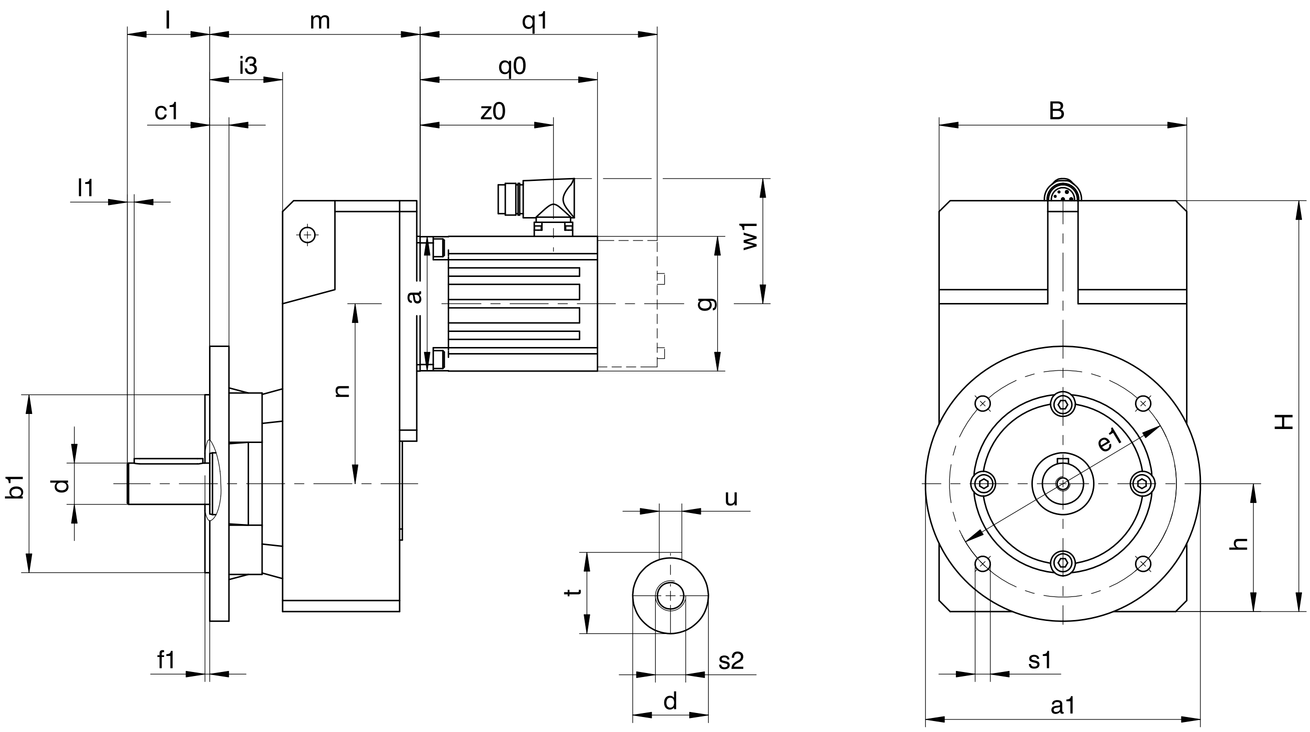
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	⌀140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	⌀140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	⌀160	188.5	169.0	□145	190.5	169.0
F403	⌀140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	⌀160	219.5	196.0	□145	221.5	196.0

9.3.5 V shaft design (solid shaft), F housing design (round flange)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

Dimensions of gear units

Type	∅a1	∅b1	B	c1	∅d	∅e1	f1	h	H	i3	l	l1	∅s1	s2	t	u
F1	160	110_{j6}	145	10	25_{k6}	130	3.5	74	238.0	44.5	50	5	9	M10	28.0	A8×7×40
F2	200	130_{j6}	180	14	30_{k6}	165	3.5	93	299.0	53.0	60	5	11	M10	33.0	A8×7×50
F3	250	180_{j6}	206	15	35_{k6}	215	4.0	106	335.5	56.5	70	5	14	M12	38.0	A10×8×60
F4	250	180_{j6}	230	15	40_{k6}	215	4.0	116	370.0	56.5	80	5	14	M16	43.0	A12×8×70
F6	300	230_{j6}	265	17	50_{k6}	265	4.0	137	433.0	60.5	100	5	14	M16	53.5	A14×9×90

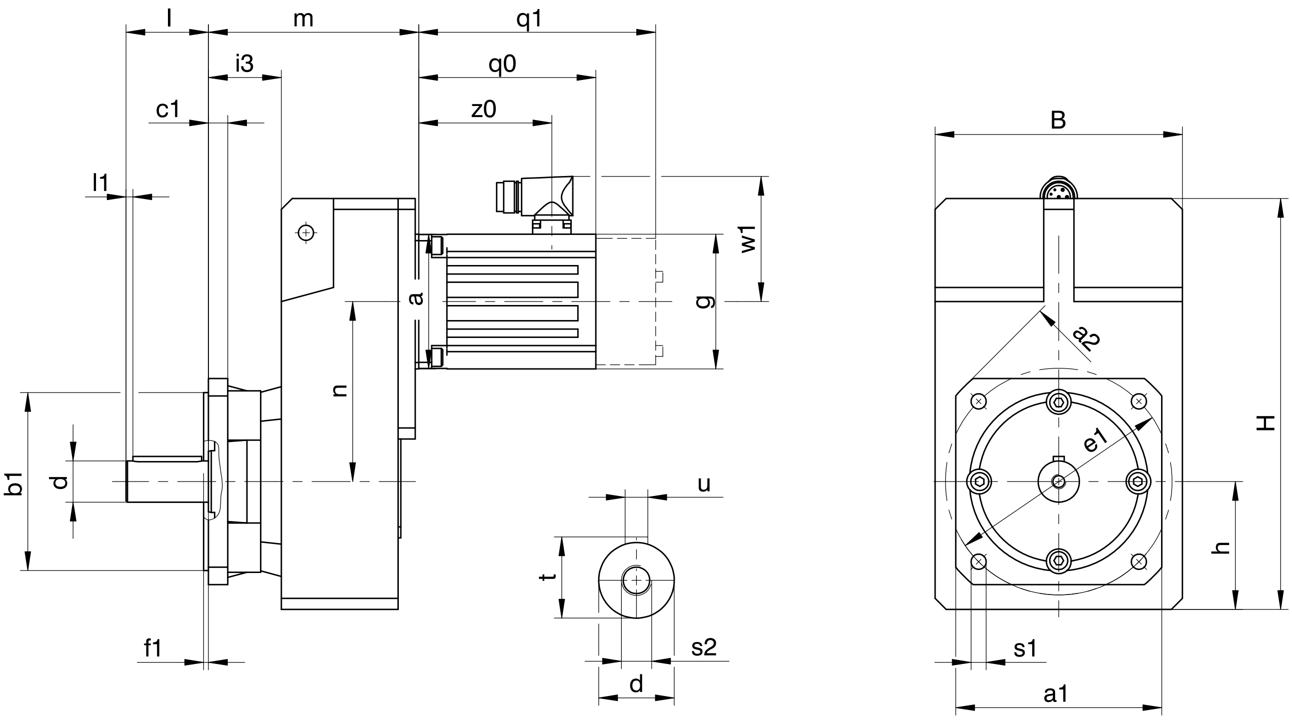
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	∅140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	∅140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	188.5	169.0	□145	190.5	169.0
F403	∅140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	219.5	196.0	□145	221.5	196.0

9.3.6 V shaft design (solid shaft), Q housing design (square flange)



q0 Applies to motors without brake.

q1 Applies to motors with brake.

Dimensions of gear units

Type	□a1	□a2	∅b1	c1	B	∅d	∅e1	f1	h	H	i3	l	l1	∅s1	s2	t	u
F1	125	160	110_{j6}	10	145	25_{k6}	130	3.5	74	238.0	44.5	50	5	9	M10	28.0	A8×7×40
F2	150	195	130_{j6}	14	180	30_{k6}	165	3.5	93	299.0	53.0	60	5	11	M10	33.0	A8×7×50
F3	200	260	180_{j6}	15	206	35_{k6}	215	4.0	106	335.5	56.5	70	5	14	M12	38.0	A10×8×60
F4	200	260	180_{j6}	15	230	40_{k6}	215	4.0	116	370.0	56.5	80	5	14	M16	43.0	A12×8×70
F6	250	325	230_{j6}	17	265	50_{k6}	265	4.0	137	433.0	60.5	100	5	14	M16	53.5	A14×9×90

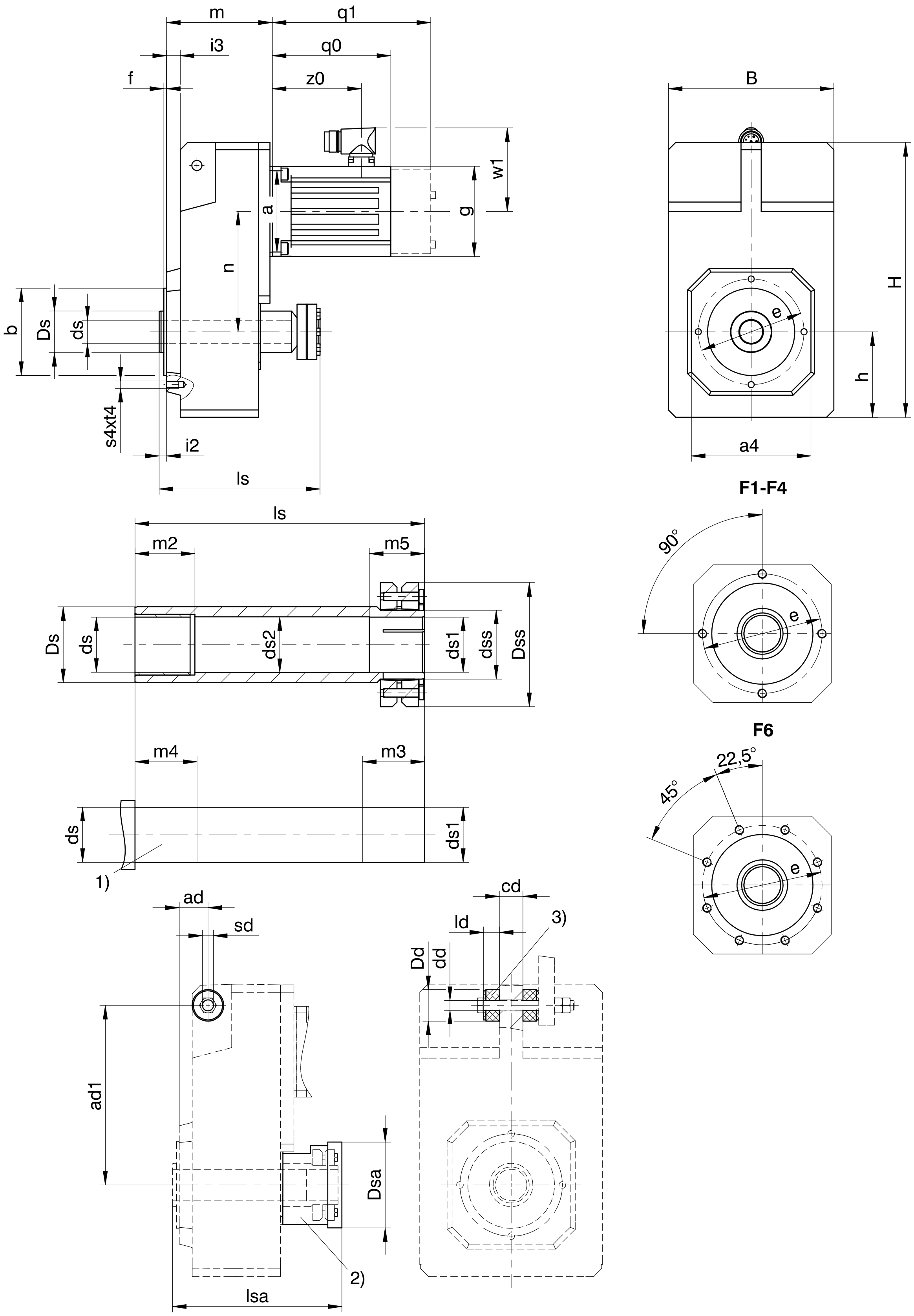
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	∅140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	∅140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	188.5	169.0	□145	190.5	169.0
F403	∅140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	219.5	196.0	□145	221.5	196.0

9.3.7 S shaft design (hollow shaft with shrink disk), G housing design (pitch circle diameter)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)
3)	Rubber buffer for torque arm bracket (optional). Dimension ∅Dd = outer∅ of the rubber buffer when not tensioned.		

Dimensions of gear units

Type	□a4	ad	ad1	∅b	B	cd	∅dd	∅ds	∅ds1	∅ds2	∅dss	∅Dd	∅Ds	∅Dsa	∅Dss	∅e	f	h	H	i2	i3	ld	ls	lsa	m2	m3	m4	m5	s4	sd	t4
F1	100	29.5	150	70_{j6}	145	20	$11.0^{+0,5}$	20_{h9}	20_{h9}^{H7}	20.5	24	30	35	63	50	85	2.5	74	238.0	6.5	12.5	15	146	150	20	31	25	26	M8	M10	13
F2	130	33.0	181	95_{j6}	180	22	$11.0^{+0,5}$	25_{h9}	25_{h9}^{H7}	25.5	30	30	45	73	60	115	3.0	93	299.0	8.0	15.0	15	175	180	20	37	25	32	M8	M10	13
F3	150	38.5	205	110_{j6}	206	30	$14.0^{+0,5}$	30_{h9}	30_{h9}^{H7}	30.5	36	37	50	83	72	130	3.5	106	335.5	8.5	16.5	20	192	196	25	37	30	32	M10	M12	16
F4	150	38.5	228	110_{j6}	230	30	$14.0^{+0,5}$	40_{h9}	40_{h9}^{H7}	40.5	50	37	55	108	90	130	3.5	116	370.0	8.5	16.5	20	210	215	40	45	45	40	M10	M12	16
F6	180	44.5	270	130_{j6}	265	35	$22.0^{+0,5}$	50_{h9}	50_{h9}^{H7}	50.5	62	60	70	128	106	165	3.5	137	433.0	10.5	20.5	30	248	251	40	47	45	42	M10	M20	16

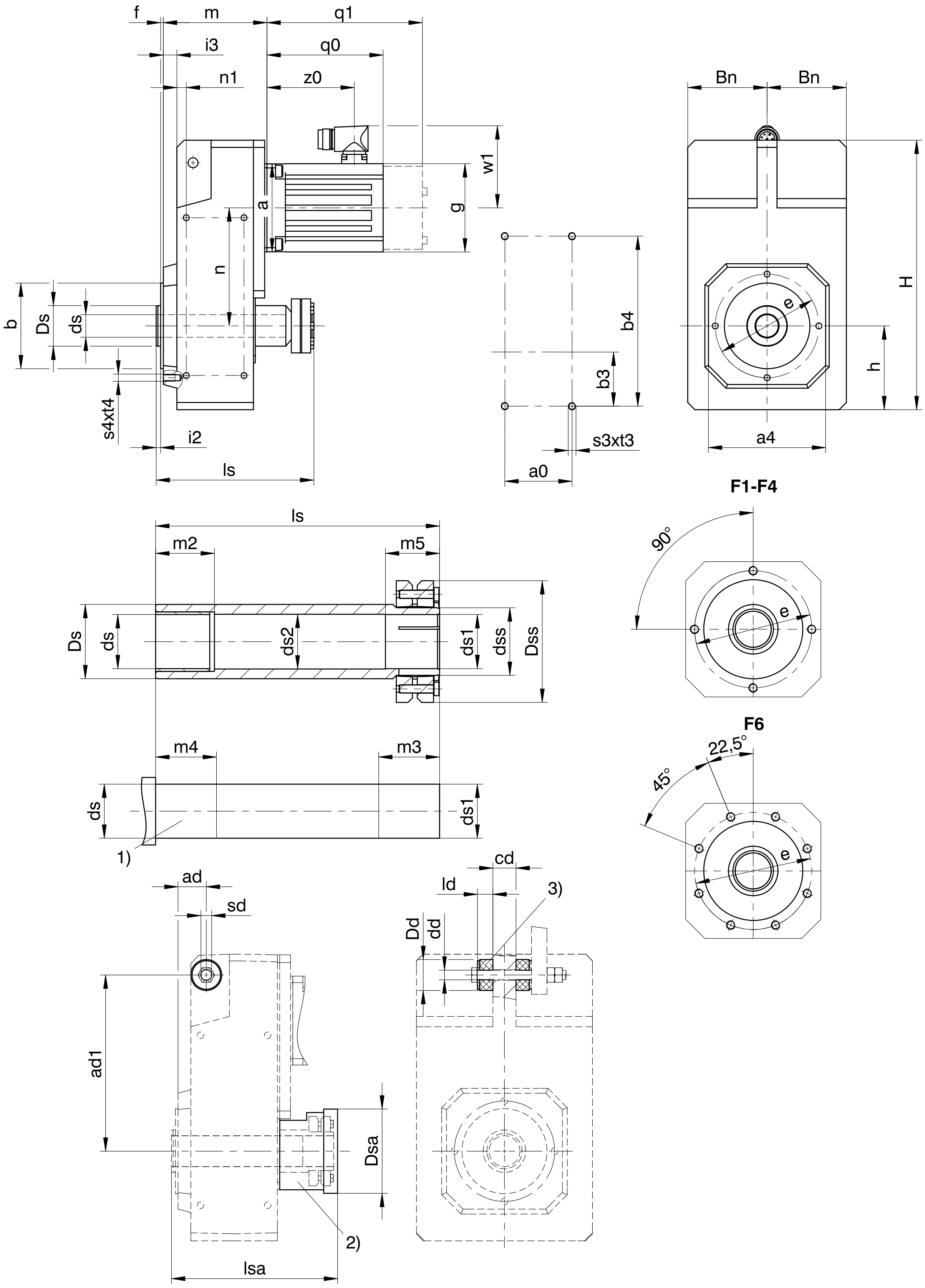
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	97.5	102.0	□115	101.5	102.0	–	–	–
F202	□98	115.0	131.0	□115	119.0	131.0	□145	121.0	131.0
F302	∅140	129.5	149.5	□115	133.5	149.5	□145	135.5	149.5
F303	∅140	166.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	148.5	169.0	□145	150.5	169.0
F403	∅140	181.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	179.5	196.0	□145	181.5	196.0

9.3.8 S shaft design (hollow shaft with shrink disk), GN housing design (pitch circle diameter + side fastening)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)
3)	Rubber buffer for torque arm bracket (optional). Dimension ∅Dd = outer∅ of the rubber buffer when not tensioned.		

Dimensions of gear units

Type	a0	□a4	ad	ad1	∅b	b3	b4	Bn	cd	∅dd	∅ds	∅ds1	∅ds2	∅dss	∅Dd	∅Ds	∅Dsa	∅Dss
F1	50	100	29.5	150	70_{j6}	40	140	71	20	$11.0^{+0,5}$	20_{h9}	20_{h9}^{H7}	20.5	24	30	35	63	50
F2	64	130	33.0	181	95_{j6}	55	175	88	22	$11.0^{+0,5}$	25_{h9}	25_{h9}^{H7}	25.5	30	30	45	73	60
F3	72	150	38.5	205	110_{j6}	60	200	102	30	$14.0^{+0,5}$	30_{h9}	30_{h9}^{H7}	30.5	36	37	50	83	72
F4	87	150	38.5	228	110_{j6}	70	220	114	30	$14.0^{+0,5}$	40_{h9}	40_{h9}^{H7}	40.5	50	37	55	108	90
F6	108	180	44.5	270	130_{j6}	85	270	131	35	$22.0^{+0,5}$	50_{h9}	50_{h9}^{H7}	50.5	62	60	70	128	106

Type	∅e	f	h	H	i2	i3	ld	ls	lsa	n1	m2	m3	m4	m5	s3	s4	sd	t3	t4
F1	85	2.5	74	238.0	6.5	12.5	15	146	150	10	20	31	25	26	M6	M8	M10	11	13
F2	115	3.0	93	299.0	8.0	15.0	15	175	180	10.5	20	37	25	32	M8	M8	M10	13	13
F3	130	3.5	106	335.5	8.5	16.5	20	192	196	12.5	25	37	30	32	M10	M10	M12	16	16
F4	130	3.5	116	370.0	8.5	16.5	20	210	215	12.5	40	45	45	40	M10	M10	M12	16	16
F6	165	3.5	137	433.0	10.5	20.5	30	248	251	15.5	40	47	45	42	M12	M10	M20	19	16

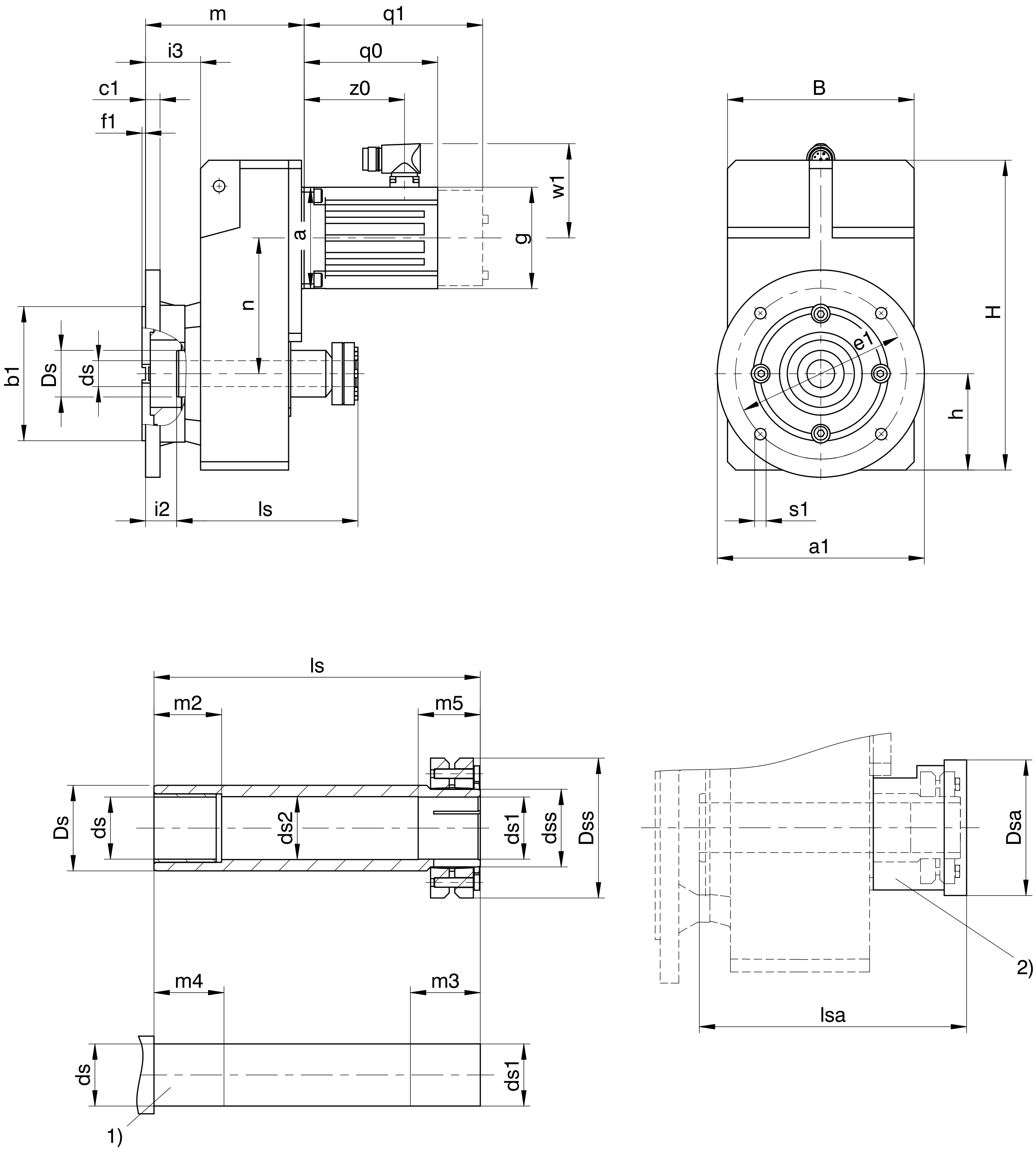
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	97.5	102.0	□115	101.5	102.0	–	–	–
F202	□98	115.0	131.0	□115	119.0	131.0	□145	121.0	131.0
F302	∅140	129.5	149.5	□115	133.5	149.5	□145	135.5	149.5
F303	∅140	166.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	148.5	169.0	□145	150.5	169.0
F403	∅140	181.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	179.5	196.0	□145	181.5	196.0

9.3.9 S shaft design (hollow shaft with shrink disk), F housing design (round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)

Dimensions of gear units

Type	∅a1	∅b1	B	c1	∅ds	∅ds1	∅ds2	∅dss	∅Ds	∅Dsa	∅Dss	∅e1	f1	h	H	i2	i3	ls	lsa	m2	m3	m4	m5	∅s1
F1	160	110_{j6}	145	10	20_{h9}	20_{h9}^{H7}	20.5	24	35	63	50	130	3.5	74	238.0	25.5	44.5	146	150	20	31	25	26	9
F2	200	130_{j6}	180	14	25_{h9}	25_{h9}^{H7}	25.5	30	45	73	60	165	3.5	93	299.0	30.0	53.0	175	180	20	37	25	32	11
F3	250	180_{j6}	206	15	30_{h9}	30_{h9}^{H7}	30.5	36	50	83	72	215	4.0	106	335.5	31.5	56.5	192	196	25	37	30	32	14
F4	250	180_{j6}	230	15	40_{h9}	40_{h9}^{H7}	40.5	50	55	108	90	215	4.0	116	370.0	31.5	56.5	210	215	40	45	45	40	14
F6	300	230_{j6}	265	17	50_{h9}	50_{h9}^{H7}	50.5	62	70	128	106	265	4.0	137	433.0	29.5	60.5	248	251	40	47	45	42	14

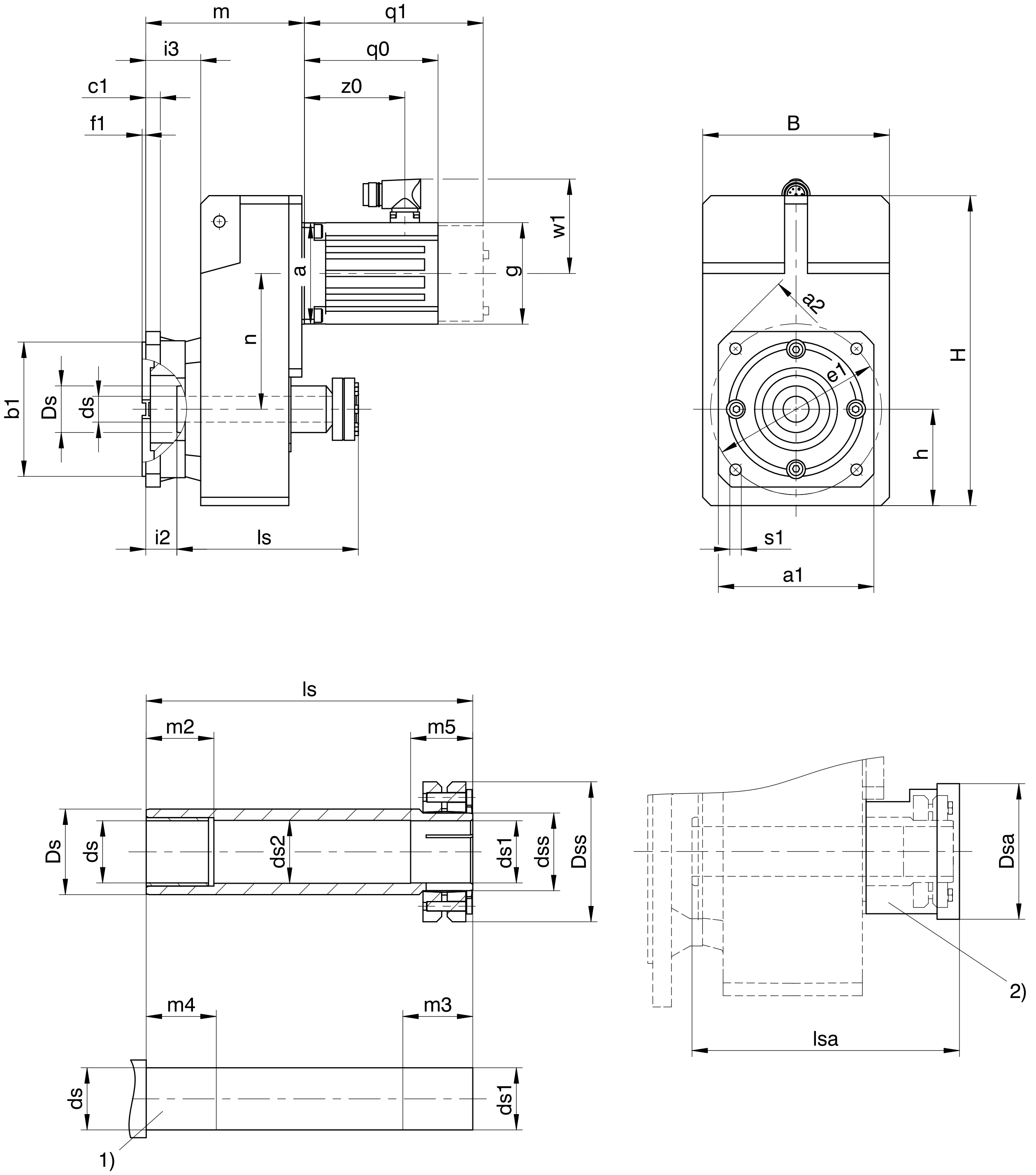
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	∅140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	∅140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	188.5	169.0	□145	190.5	169.0
F403	∅140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	219.5	196.0	□145	221.5	196.0

9.3.10 S shaft design (hollow shaft with shrink disk), Q housing design (square flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)

Dimensions of gear units

Type	□a1	□a2	∅b1	B	c1	∅ds	∅ds1	∅ds2	∅dss	∅Ds	∅Dsa	∅Dss	∅e1	f1	h	H	i2	i3	ls	lsa	m2	m3	m4	m5	∅s1
F1	125	160	110_{j6}	145	10	20_{h9}	20_{h9}^{H7}	20.5	24	35	63	50	130	3.5	74	238.0	25.5	44.5	146	150	20	31	25	26	9
F2	150	195	130_{j6}	180	14	25_{h9}	25_{h9}^{H7}	25.5	30	45	73	60	165	3.5	93	299.0	30.0	53.0	175	180	20	37	25	32	11
F3	200	260	180_{j6}	206	15	30_{h9}	30_{h9}^{H7}	30.5	36	50	83	72	215	4.0	106	335.5	31.5	56.5	192	196	25	37	30	32	14
F4	200	260	180_{j6}	230	15	40_{h9}	40_{h9}^{H7}	40.5	50	55	108	90	215	4.0	116	370.0	31.5	56.5	210	215	40	45	45	40	14
F6	250	325	230_{j6}	265	17	50_{h9}	50_{h9}^{H7}	50.5	62	70	128	106	265	4.0	137	433.0	29.5	60.5	248	251	40	47	45	42	14

Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
F102	□98	129.5	102.0	□115	133.5	102.0	–	–	–
F202	□98	153.0	131.0	□115	157.0	131.0	□145	159.0	131.0
F302	∅140	169.5	149.5	□115	173.5	149.5	□145	175.5	149.5
F303	∅140	206.5	149.5	–	–	–	–	–	–
F402	–	–	–	∅160	188.5	169.0	□145	190.5	169.0
F403	∅140	221.5	169.0	–	–	–	–	–	–
F602	–	–	–	∅160	219.5	196.0	□145	221.5	196.0

9.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

F	2	0	2	A	G	0280	LM403U

Explanation

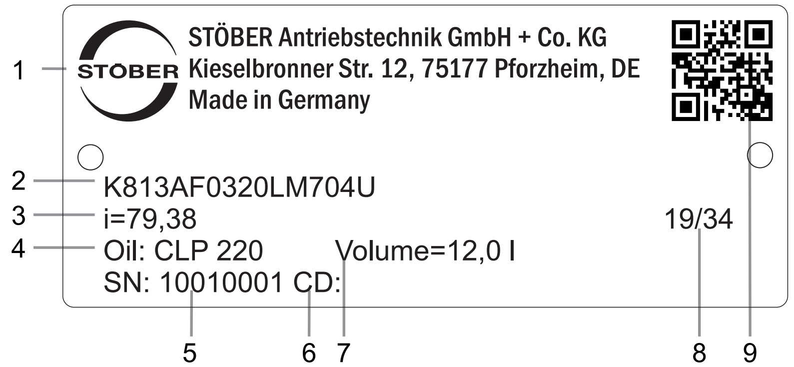
Code	Designation	Design
F	Type	Offset helical gear unit
2	Size	2 (example)
0	Generation	Generation 0
2	Stages	Two-stage
3		Three-stage
A	Shaft	Hollow shaft with keyway
S		Hollow shaft with shrink ring
V		Solid shaft
G	Housing	Pitch circle diameter
F		Round flange
Q		Square flange
GN		Pitch circle diameter + side fastening
0280	Transmission ratio (i x 10 rounded)	i = 28.24 (example)
LM403U	Motor	LM Lean motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▸ 2]
- The mounting position, see the chapter [▸ 9.5.5]
- The position of the plug connector, see the chapter [▸ 9.5.7]

9.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Lubricant specification
5	Serial number of the gear unit
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

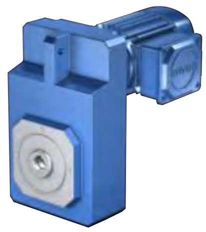
9.4.1.1 Supporting documents

You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

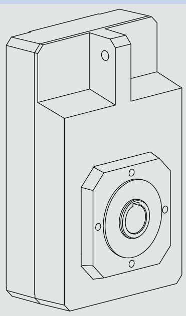
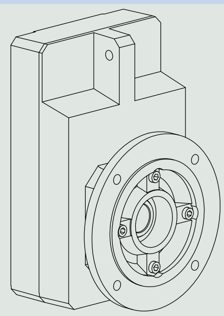
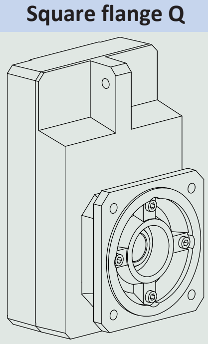
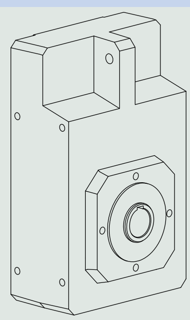
Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

9.5 Product description

9.5.1 Input options

LM Lean motor	EZ synchronous servo motor	Asynchronous motor
		
http://www.stoeber.de/en/FLM	http://www.stoeber.de/en/FEZ	http://www.stoeber.de/en/FIE3D

9.5.2 Housing design

Pitch circle diameter G	Round flange F
	
Square flange Q	**Pitch circle diameter + side fastening GN**
	

	G	F	Q	GN
F1	✓	✓	✓	✓
F2	✓	✓	✓	✓
F3	✓	✓	✓	✓
F4	✓	✓	✓	✓
F6	✓	✓	✓	✓

9.5.3 Combinatorial shaft/housing design

	Housing design				
Shaft design	**Code**	**G**	**F**	**Q**	**GN**
Hollow shaft with keyway	**A**	AG	AF	AQ	AGN
Hollow shaft with shrink ring	**S**	SG	SF	SQ	SGN
Solid shaft	**V**	–	VF	VQ	–

9.5.4 Installation conditions

Hollow shaft

The hollow shaft hole tolerance is ISO H7. The tolerance of the machine shaft must be ISO k6.

Take care to align the machine shaft with the gear unit hollow shaft when attaching the gear unit.

Maximum deviation ≤ 0.03 mm.

For simpler assembly and disassembly of the machine shaft, the hollow shafts are equipped with a spiral groove (as a grease deposit).

A hardened, threaded keeper plate is included in the scope of delivery. You also have the option to order the hollow shaft without a keeper plate.

Hollow shaft with shrink ring

The tolerance of the hollow shaft hole is ISO H7.

The machine shaft must be ISO h9.

Select a material for the machine shaft with a permitted surface pressure of p ≥ 325 N/mm^2.

Possible materials:

- C45E +QT
- 42CrMo4

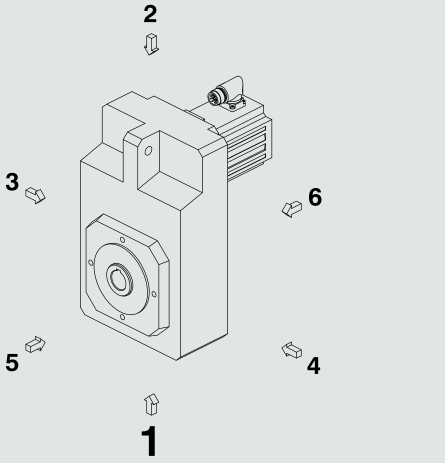
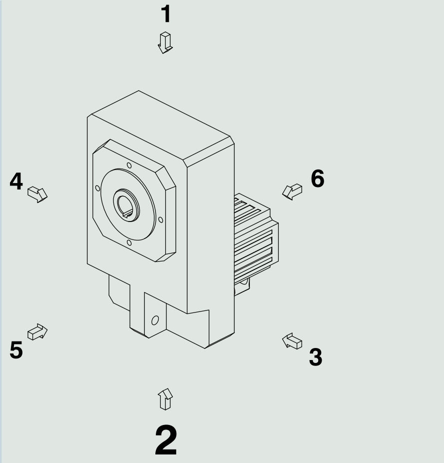
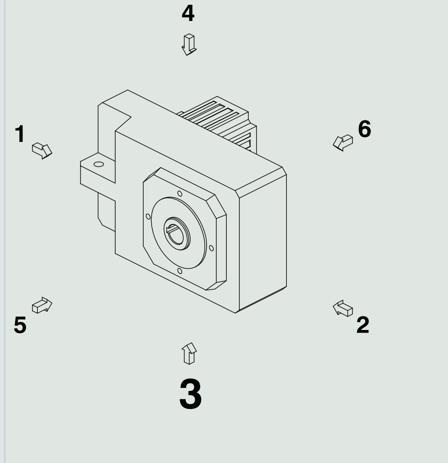
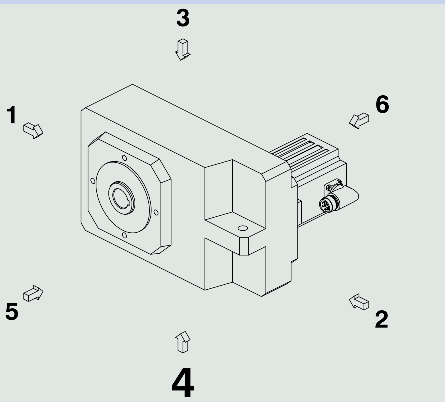
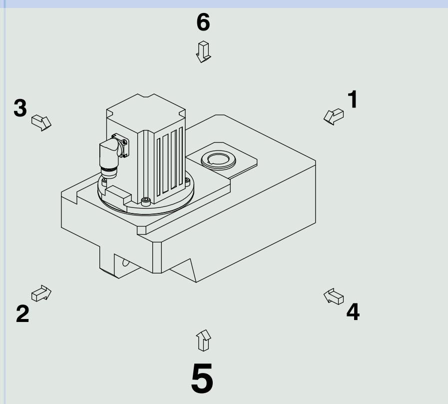
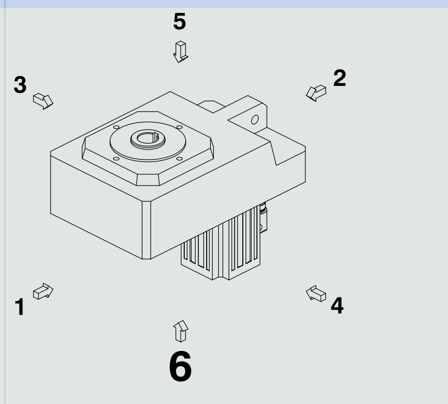
Fastening the gear units on the machine side using the pitch circle diameter

The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

9.5.5 Mounting positions

The following table shows the standard mounting positions.

The numbers identify the gear unit sides. The mounting position is defined by the gear side facing downwards.

EL1	EL2	EL3
		
EL4	**EL5**	**EL6**
		

Since the lubricant filling volume of the gear unit depends on the mounting position, the mounting position must be specified when ordering.

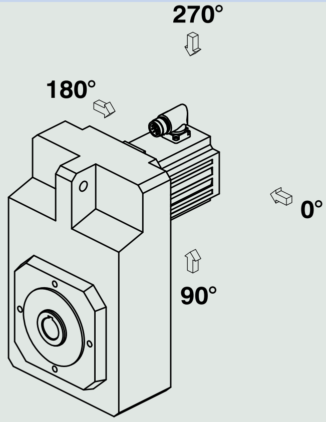
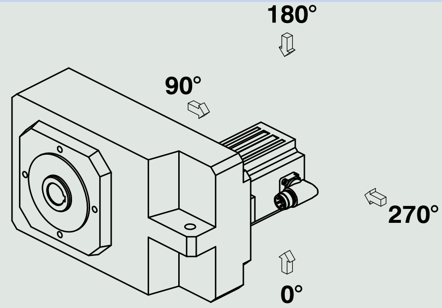
9.5.6 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate. The filling volume and the structure of the gear units depend on the mounting position.

Only install the gear units in the intended mounting position! Reposition the gear units only after consulting STOBER. Otherwise, STOBER assumes no liability for the gear units.

You will receive lubricants for use in the food industry upon request.

9.5.7 Position of the plug connector

Mounting position EL1 Plug connector in 270° position (standard)	Mounting position EL4 Plug connector in 270° position (standard)
	

Indicate variations for your geared motor in the purchase order.

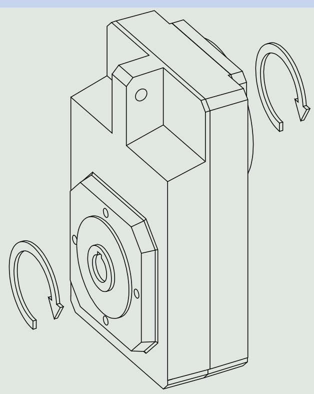
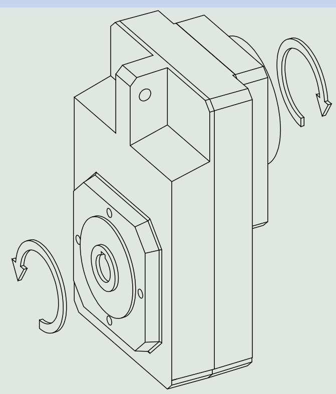
Note that the plug connector position rotates along with the geared motor if the geared motor is in another mounting position.

9.5.8 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency: η_{get} two-stage η_{get} three-stage	 97% 96%
Protection class:[1] Gear unit Motor	 IP65 IP56, optionally IP66

9.5.9 Direction of rotation

Solid shaft (V), hollow shaft with keyway (A), hollow shaft with shrink ring (S)

F102 – F602	F203 – F603
	
The input and output rotate in the same direction.	The input and output rotate in opposite directions.

The pictures show mounting position EL1.

[1] Observe the protection class of all the components.

9.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

9.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

For mounting positions EL1, EL2, EL3, EL4:

$$n_{1m^*} \leq \frac{n_{1maxDBEL1,2,3,4}}{fB_T}$$

For mounting positions EL5, EL6:

$$n_{1m^*} \leq \frac{n_{1maxDBEL5,6}}{fB_T}$$

For all mounting positions:

$$n_{1max^*} \leq \frac{n_{1max\,ZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

$$M_{2acc^*} \leq M_{2acc}$$

$$M_{2NOT^*} \leq M_{2NOT}$$

$$M_{2eq^*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

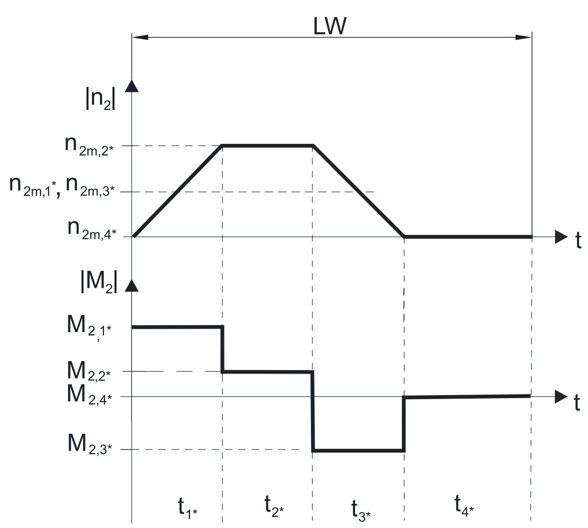
Refer to the selection table for the values for $n_{1maxDBEL1,2,3,4}$ and $n_{1maxDBEL5,6}$, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S.

The values for fB_T, fB_{op} and fB_t can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m*} = n_{2m*} \cdot i$$

$$n_{2m*} = \frac{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If $t_{1*} + \ldots + t_{3*} \geq 6$ min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff*} = \sqrt{\frac{t_{1*} \cdot M_{2,1*}{}^2 + \ldots + t_{n*} \cdot M_{2,n*}{}^2}{t_{1*} + \ldots + t_{n*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |M_{2,1*}{}^3| + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |M_{2,n*}{}^3|}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle $ED_{10} > 50\%$ and the actual average input speed n_{1m*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

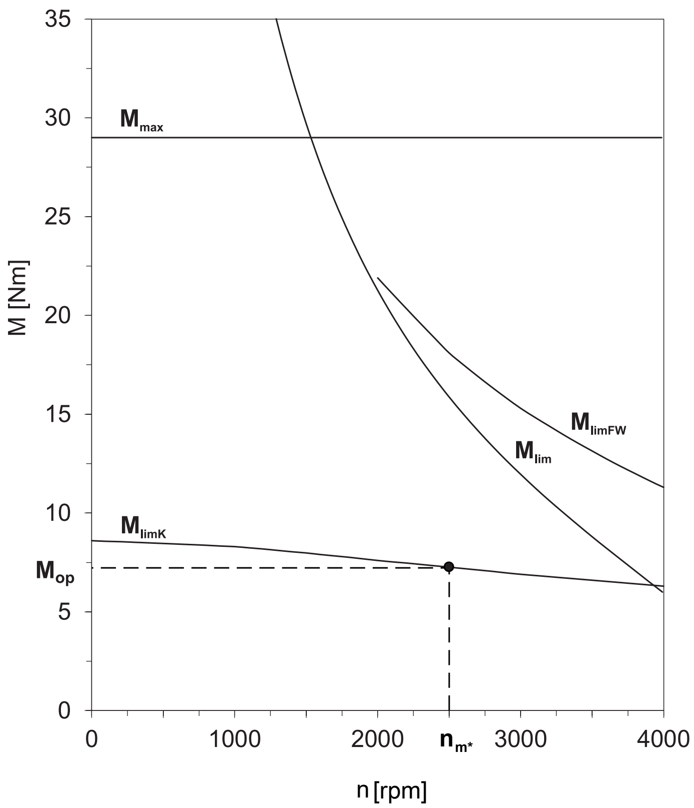
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot athEL \cdot fB_T \cdot \left(\frac{n_{1m*}}{1000}\right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▶ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Parameter a_{thEL}

Mounting position	a_{thEL}
EL1, 2, 5, 6	1.0
EL3, 4	1.1

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.25
Reversing load cyclic operation	1.40

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

9.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 20$ rpm ($F_{2axN} = F_{2ax20}$; $F_{2radN} = F_{2rad20}$; $M_{2kN} = M_{2k20}$)
- Only if radial forces on the gear unit are stabilized by its pilots for the pitch circle diameter and flange housing design

9.6.2.1 V shaft design

Permitted shaft loads for V shaft design (solid shaft)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
F1	35.0	1100	4200	4200	260	260
F2	41.0	1400	5400	5400	400	400
F3	43.0	1900	7500	7500	600	600
F4	44.0	2350	9250	9250	800	800
F6	44.0	3100	12500	12500	1200	1200

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds $n_{2m*} > 20$ rpm:

$$F_{2axN} = \frac{F_{2ax20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}}$$

The values for F_{2ax20}, F_{2rad20} and M_{2k20} can be found in the table "Permitted shaft loads" in this chapter.

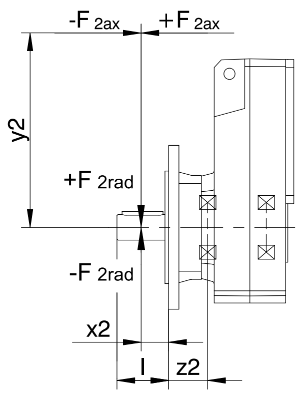


Fig. 1: Force application points for solid shaft

The specified values for F_{2rad20} are based on application of force at the middle of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2rad*} \leq F_{2radN}$$

$$F_{2ax*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

9.6.2.2 A and S shaft design

Permitted shaft loads for A shaft design (hollow shaft with keyway)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
F1	30.0	900	4200	4200	175	175
F2	33.0	1200	5400	5400	250	250
F3	33.0	1350	7500	7500	375	375
F4	39.0	1900	9250	9250	550	550
F6	45.0	2200	12500	12500	800	800

Permitted shaft loads for S shaft design (hollow shaft with shrink ring)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
F1	30.0	900	4200	4200	175	175
F2	33.0	1200	5400	5400	250	250
F3	33.0	1350	7500	7500	375	375
F4	39.0	1900	9250	9250	550	550
F6	45.0	2200	12500	12500	800	800

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 20 rpm:

$$F_{2axN} = \frac{F_{2ax20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}}$$

The values for F_{2ax20}, F_{2rad20} and M_{2k20} can be found in the table "Permitted shaft loads" in this chapter.

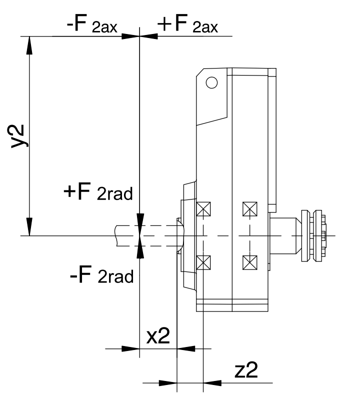


Fig. 2: Force application points for hollow shaft

You can determine the permitted radial forces from the permitted breakdown torque M_{2kN}. The actual radial forces may not exceed the permitted radial forces. The permitted radial forces pertain to the shaft end (x2 = 0).

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2ax*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

9.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

9.7 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for C/F/K/S gear units and gear motors	443027_en

10 PKX right-angle planetary geared motors

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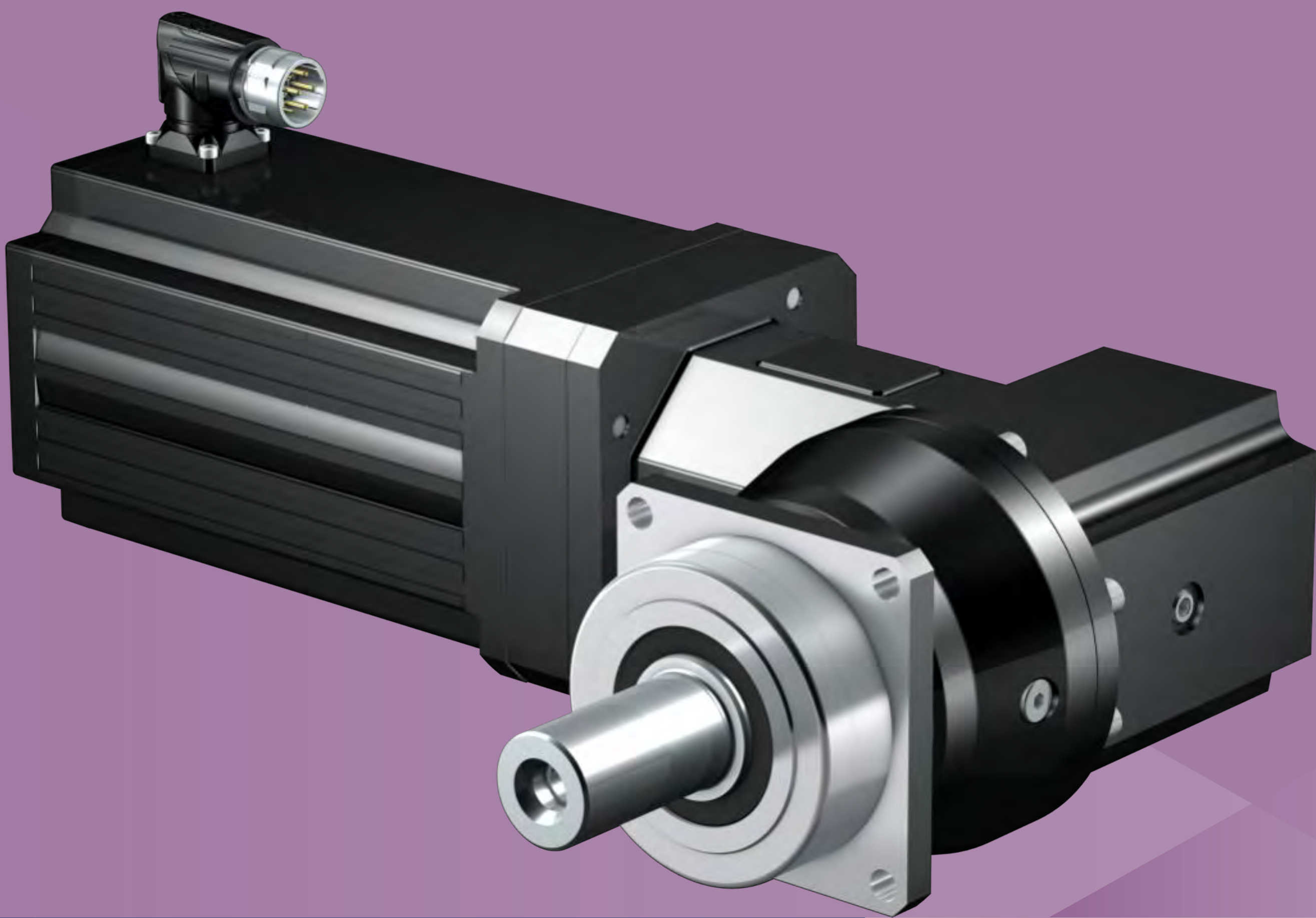


10

Right-angle planetary geared motors

PKX

10.1 Overview

Helical-geared precision right-angle planetary geared motors

Features

Power density	★★★★☆
Backlash	★★★★☆
Price category	€€€
Shaft load	★★★★☆
Smooth operation	★★☆☆☆
Torsional stiffness	★★★☆☆
Mass moment of inertia	★★★☆☆
Helical gearing	✓
Maintenance-free	✓
Small installation space	✓
Continuous operation without cooling	✓
Reinforced output bearing	✓ (optional)
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	3 – 210
M_{2acc}	13 – 3300 Nm
$\Delta\phi_2$	2 – 8.5 arcmin
η_{get}	94 – 96 %

10.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors
- M_{2acc}, M_{2accHT}: Solid shaft design without feather key (we generally recommend this shaft design for cyclic operation)

An explanation of the formula symbols can be found in the Chapter [▶ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
P2KX3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 25 Nm)																		
375	17	19	61	0.93	P231_0040KX301_0020 MF LM401U	25	–	51	8.000	8/1	3500	3000	5500	2.5	8.5	–	1.5	7.4
429	15	16	107	0.90	P231_0070KX301_0010 MF LM401U	23	–	46	7.000	7/1	3000	2500	4500	2.7	7.5	–	1.7	7.4
600	11	12	76	1.3	P231_0050KX301_0010 MF LM401U	22	–	51	5.000	5/1	3000	2500	4500	2.7	8.0	–	1.6	7.4
750	8.6	9.3	61	1.6	P231_0040KX301_0010 MF LM401U	17	–	51	4.000	4/1	3000	2500	4500	2.7	8.5	–	1.5	7.4
750	17	17	120	0.80	P231_0040KX301_0010 MF LM402U	25	–	51	4.000	4/1	3000	2500	4500	4.1	8.5	–	1.5	9.1
P3KX3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 69 Nm)																		
143	45	49	42	1.0	P331_0070KX301_0030 MF LM401U	69	75	140	21.00	21/1	3500	3500	6000	2.4	5.5	3.5	4.2	8.2
150	43	46	68	0.84	P331_0100KX301_0020 MF LM401U	60	60	120	20.00	20/1	3500	3000	5500	2.5	5.0	3.0	4.0	8.2
188	34	37	49	1.2	P331_0080KX301_0020 MF LM401U	63	65	130	16.00	16/1	3500	3000	5500	2.5	5.5	3.5	4.1	8.2
200	32	35	32	1.3	P331_0050KX301_0030 MF LM401U	63	63	130	15.00	15/1	3500	3500	6000	2.4	6.0	4.0	3.8	8.2
214	30	33	38	1.5	P331_0070KX301_0020 MF LM401U	60	60	140	14.00	14/1	3500	3000	5500	2.5	5.5	3.5	4.2	8.2
250	26	28	32	1.3	P331_0040KX301_0030 MF LM401U	50	50	100	12.00	12/1	3500	3500	6000	2.4	6.5	4.5	3.3	8.2
300	21	23	29	2.0	P331_0050KX301_0020 MF LM401U	43	43	130	10.00	10/1	3500	3000	5500	2.5	6.0	4.0	3.8	8.2
300	42	43	57	1.0	P331_0050KX301_0020 MF LM402U	63	63	130	10.00	10/1	3500	3000	5500	3.8	6.0	4.0	3.8	9.9
375	17	19	29	2.0	P331_0040KX301_0020 MF LM401U	34	34	100	8.000	8/1	3500	3000	5500	2.5	6.5	4.5	3.3	8.2
375	34	34	57	1.0	P331_0040KX301_0020 MF LM402U	50	50	100	8.000	8/1	3500	3000	5500	3.8	6.5	4.5	3.3	9.9
429	15	16	37	2.6	P331_0070KX301_0010 MF LM401U	30	30	140	7.000	7/1	3000	2500	4500	2.7	5.5	3.5	4.2	8.2
429	29	30	72	1.3	P331_0070KX301_0010 MF LM402U	65	65	140	7.000	7/1	3000	2500	4500	4.1	5.5	3.5	4.2	9.9
429	41	41	99	0.97	P331_0070KX301_0010 MF LM403U	69	75	140	7.000	7/1	3000	2500	4500	5.4	5.5	3.5	4.2	11
500	13	14	29	2.0	P331_0030KX301_0020 MF LM401U	26	26	77	6.000	6/1	3500	3000	5500	2.5	7.5	5.5	2.4	8.2
500	25	26	57	1.0	P331_0030KX301_0020 MF LM402U	38	38	77	6.000	6/1	3500	3000	5500	3.9	7.5	5.5	2.4	9.9
600	11	12	26	3.7	P331_0050KX301_0010 MF LM401U	22	22	110	5.000	5/1	3000	2500	4500	2.8	6.0	4.0	3.8	8.2
600	21	21	51	1.9	P331_0050KX301_0010 MF LM402U	46	46	110	5.000	5/1	3000	2500	4500	4.1	6.0	4.0	3.8	9.9
600	29	30	71	1.4	P331_0050KX301_0010 MF LM403U	61	61	110	5.000	5/1	3000	2500	4500	5.4	6.0	4.0	3.8	11
750	8.6	9.3	24	3.9	P331_0040KX301_0010 MF LM401U	17	17	91	4.000	4/1	3000	2500	4500	2.8	6.5	4.5	3.3	8.2
750	17	17	48	2.0	P331_0040KX301_0010 MF LM402U	37	37	91	4.000	4/1	3000	2500	4500	4.1	6.5	4.5	3.3	9.9
750	23	24	66	1.5	P331_0040KX301_0010 MF LM403U	49	49	91	4.000	4/1	3000	2500	4500	5.4	6.5	4.5	3.3	11
1000	6.4	7.0	24	3.9	P331_0030KX301_0010 MF LM401U	13	13	68	3.000	3/1	3000	2500	4500	3.0	7.5	5.5	2.4	8.2
1000	13	13	48	2.0	P331_0030KX301_0010 MF LM402U	28	28	68	3.000	3/1	3000	2500	4500	4.3	7.5	5.5	2.4	9.9
1000	17	18	66	1.5	P331_0030KX301_0010 MF LM403U	37	37	68	3.000	3/1	3000	2500	4500	5.6	7.5	5.5	2.4	11
P4KX3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 130 Nm)																		
54	118	127	71	0.81	P432_0280KX301_0020 MF LM401U	130	130	260	56.00	56/1	3500	3000	5500	2.5	5.5	3.5	12	11
60	105	114	60	0.95	P432_0250KX301_0020 MF LM401U	130	140	270	50.00	50/1	3500	3000	5500	2.5	5.5	3.5	12	11
75	84	91	51	1.1	P432_0200KX301_0020 MF LM401U	130	140	270	40.00	40/1	3500	3000	5500	2.5	5.5	3.5	12	11
86	74	80	69	1.4	P432_0350KX301_0010 MF LM401U	130	140	270	35.00	35/1	3000	2500	4500	2.7	5.5	3.5	12	11
94	67	73	43	1.3	P432_0160KX301_0020 MF LM401U	130	130	260	32.00	32/1	3500	3000	5500	2.5	5.5	3.5	11	11
P4KX4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																		
100	64	70	41	1.2	P431_0100KX401_0030 MF LM401U	120	120	230	30.00	30/1	3000	3000	5500	3.1	5.0	3.0	8.4	12
125	52	56	31	1.6	P431_0080KX401_0030 MF LM401U	100	100	240	24.00	24/1	3000	3000	5500	3.1	5.5	3.5	8.5	12
143	45	49	24	2.0	P431_0070KX401_0030 MF LM401U	90	90	270	21.00	21/1	3000	3000	5500	3.1	5.5	3.5	9.2	12
143	88	90	47	1.0	P431_0070KX401_0030 MF LM402U	140	140	270	21.00	21/1	3000	3000	5500	4.5	5.5	3.5	9.2	13
150	43	46	37	1.7	P431_0100KX401_0020 MF LM401U	86	86	230	20.00	20/1	2500	2500	5000	3.3	5.0	3.0	8.4	12
150	84	86	72	0.89	P431_0100KX401_0020 MF LM402U	120	120	230	20.00	20/1	2500	2500	5000	4.6	5.0	3.0	8.4	13
188	34	37	28	2.3	P431_0080KX401_0020 MF LM401U	69	69	240	16.00	16/1	2500	2500	5000	3.3	5.5	3.5	8.5	12
188	67	69	54	1.2	P431_0080KX401_0020 MF LM402U	120	130	240	16.00	16/1	2500	2500	5000	4.7	5.5	3.5	8.5	13
188	93	95	74	0.86	P431_0080KX401_0020 MF LM403U	120	130	240	16.00	16/1	2500	2500	5000	6.0	5.5	3.5	8.5	15
200	32	35	18	2.6	P431_0050KX401_0030 MF LM401U	65	65	260	15.00	15/1	3000	3000	5500	3.1	6.0	4.0	8.6	12
200	63	64	35	1.3	P431_0050KX401_0030 MF LM402U	120	120	260	15.00	15/1	3000	3000	5500	4.5	6.0	4.0	8.6	13
200	87	89	49	0.98	P431_0050KX401_0030 MF LM403U	120	120	260	15.00	15/1	3000	3000	5500	5.8	6.0	4.0	8.6	15
214	30	33	21	3.0	P431_0070KX401_0020 MF LM401U	60	60	270	14.00	14/1	2500	2500	5000	3.3	5.5	3.5	9.2	12
214	59	60	42	1.5	P431_0070KX401_0020 MF LM402U	130	130	270	14.00	14/1	2500	2500	5000	4.7	5.5	3.5	9.2	13
214	81	83	58	1.1	P431_0070KX401_0020 MF LM403U	140	140	270	14.00	14/1	2500	2500	5000	6.0	5.5	3.5	9.2	15

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P4KX4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																		
250	26	28	18	2.6	P431_0040KX401_0030 MF LM401U	52	52	210	12.00	12/1	3000	3000	5500	3.1	6.5	4.5	7.3	12
250	51	52	35	1.3	P431_0040KX401_0030 MF LM402U	97	97	210	12.00	12/1	3000	3000	5500	4.5	6.5	4.5	7.3	13
250	69	71	49	0.98	P431_0040KX401_0030 MF LM403U	97	97	210	12.00	12/1	3000	3000	5500	5.8	6.5	4.5	7.3	15
300	21	23	16	3.9	P431_0050KX401_0020 MF LM401U	43	43	260	10.00	10/1	2500	2500	5000	3.3	6.0	4.0	8.6	12
300	42	43	32	2.0	P431_0050KX401_0020 MF LM402U	93	93	260	10.00	10/1	2500	2500	5000	4.7	6.0	4.0	8.6	13
300	58	59	44	1.5	P431_0050KX401_0020 MF LM403U	120	120	260	10.00	10/1	2500	2500	5000	6.0	6.0	4.0	8.6	15
300	91	96	69	0.94	P431_0050KX401_0020 MF LM503U	120	120	260	10.00	10/1	2500	2500	5000	12	6.0	4.0	8.6	18
375	17	19	16	3.9	P431_0040KX401_0020 MF LM401U	34	34	210	8.000	8/1	2500	2500	5000	3.4	6.5	4.5	7.3	12
375	34	34	32	2.0	P431_0040KX401_0020 MF LM402U	74	74	210	8.000	8/1	2500	2500	5000	4.7	6.5	4.5	7.3	13
375	46	47	44	1.5	P431_0040KX401_0020 MF LM403U	97	97	210	8.000	8/1	2500	2500	5000	6.0	6.5	4.5	7.3	15
375	72	77	69	0.94	P431_0040KX401_0020 MF LM503U	97	97	210	8.000	8/1	2500	2500	5000	12	6.5	4.5	7.3	18
429	15	16	22	4.9	P431_0070KX401_0010 MF LM401U	30	30	270	7.000	7/1	2500	2000	4000	4.1	5.5	3.5	9.2	12
429	29	30	43	2.5	P431_0070KX401_0010 MF LM402U	65	65	270	7.000	7/1	2500	2000	4000	5.5	5.5	3.5	9.2	13
429	41	41	59	1.8	P431_0070KX401_0010 MF LM403U	86	86	270	7.000	7/1	2500	2000	4000	6.8	5.5	3.5	9.2	15
429	63	67	92	1.2	P431_0070KX401_0010 MF LM503U	140	140	270	7.000	7/1	2500	2000	4000	13	5.5	3.5	9.2	18
429	92	103	133	0.81	P431_0070KX401_0010 MF LM505U	140	140	270	7.000	7/1	2500	2000	4000	19	5.5	3.5	9.2	22
500	13	14	17	3.9	P431_0030KX401_0020 MF LM401U	26	26	150	6.000	6/1	2500	2500	5000	3.5	7.5	5.5	5.3	12
500	25	26	32	2.0	P431_0030KX401_0020 MF LM402U	56	56	150	6.000	6/1	2500	2500	5000	4.8	7.5	5.5	5.3	13
500	35	35	45	1.4	P431_0030KX401_0020 MF LM403U	73	73	150	6.000	6/1	2500	2500	5000	6.1	7.5	5.5	5.3	15
500	54	58	70	0.92	P431_0030KX401_0020 MF LM503U	73	73	150	6.000	6/1	2500	2500	5000	12	7.5	5.5	5.3	18
600	21	21	31	3.5	P431_0050KX401_0010 MF LM402U	46	46	260	5.000	5/1	2500	2000	4000	5.6	6.0	4.0	8.6	13
600	29	30	42	2.6	P431_0050KX401_0010 MF LM403U	61	61	260	5.000	5/1	2500	2000	4000	6.9	6.0	4.0	8.6	15
600	45	48	66	1.6	P431_0050KX401_0010 MF LM503U	97	97	260	5.000	5/1	2500	2000	4000	13	6.0	4.0	8.6	18
600	65	74	95	1.1	P431_0050KX401_0010 MF LM505U	120	120	260	5.000	5/1	2500	2000	4000	19	6.0	4.0	8.6	22
600	92	102	134	0.81	P431_0050KX401_0010 MF LM704U	120	120	260	5.000	5/1	2500	2000	4000	39	6.0	4.0	8.6	28
750	17	17	27	4.0	P431_0040KX401_0010 MF LM402U	37	37	210	4.000	4/1	2500	2000	4000	5.7	6.5	4.5	7.3	13
750	23	24	37	2.9	P431_0040KX401_0010 MF LM403U	49	49	210	4.000	4/1	2500	2000	4000	7.0	6.5	4.5	7.3	15
750	36	38	58	1.9	P431_0040KX401_0010 MF LM503U	78	78	210	4.000	4/1	2500	2000	4000	13	6.5	4.5	7.3	18
750	52	59	83	1.3	P431_0040KX401_0010 MF LM505U	97	97	210	4.000	4/1	2500	2000	4000	19	6.5	4.5	7.3	22
750	74	81	117	0.92	P431_0040KX401_0010 MF LM704U	97	97	210	4.000	4/1	2500	2000	4000	39	6.5	4.5	7.3	28
1000	13	13	31	3.5	P431_0030KX401_0010 MF LM402U	28	28	150	3.000	3/1	2500	2000	4000	6.1	7.5	5.5	5.3	13
1000	17	18	43	2.5	P431_0030KX401_0010 MF LM403U	37	37	150	3.000	3/1	2500	2000	4000	7.4	7.5	5.5	5.3	15
1000	27	29	67	1.6	P431_0030KX401_0010 MF LM503U	58	58	150	3.000	3/1	2500	2000	4000	14	7.5	5.5	5.3	18
1000	39	44	97	1.1	P431_0030KX401_0010 MF LM505U	73	73	150	3.000	3/1	2500	2000	4000	20	7.5	5.5	5.3	22
P5KX4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 360 Nm)																		
20	316	341	56	0.85	P532_0500KX401_0030 MF LM401U	350	350	700	150.0	150/1	3000	3000	5500	3.1	4.0	2.0	32	16
21	295	318	72	0.89	P532_0700KX401_0020 MF LM401U	350	360	690	140.0	140/1	2500	2500	5000	3.3	4.0	2.0	30	16
25	253	273	56	0.85	P532_0400KX401_0030 MF LM401U	300	300	600	120.0	120/1	3000	3000	5500	3.1	4.5	2.5	31	16
29	221	239	39	1.2	P532_0350KX401_0030 MF LM401U	350	350	700	105.0	105/1	3000	3000	5500	3.1	4.5	2.5	32	16
30	211	227	50	1.3	P532_0500KX401_0020 MF LM401U	350	350	700	100.0	100/1	2500	2500	5000	3.3	4.0	2.0	32	16
36	177	191	36	1.3	P532_0280KX401_0030 MF LM401U	300	300	600	84.00	84/1	3000	3000	5500	3.1	4.5	2.5	31	16
38	168	182	51	1.3	P532_0400KX401_0020 MF LM401U	300	300	600	80.00	80/1	2500	2500	5000	3.3	4.5	2.5	31	16
40	158	171	29	1.6	P532_0250KX401_0030 MF LM401U	320	320	710	75.00	75/1	3000	3000	5500	3.1	4.5	2.5	31	16
40	309	316	56	0.84	P532_0250KX401_0030 MF LM402U	360	360	710	75.00	75/1	3000	3000	5500	4.5	4.5	2.5	31	18
43	147	159	35	1.8	P532_0350KX401_0020 MF LM401U	300	300	700	70.00	70/1	2500	2500	5000	3.3	4.5	2.5	32	16
43	289	295	69	0.94	P532_0350KX401_0020 MF LM402U	350	350	700	70.00	70/1	2500	2500	5000	4.7	4.5	2.5	32	18
47	135	146	36	1.8	P532_0320KX401_0020 MF LM401U	270	270	620	64.00	64/1	2500	2500	5000	3.4	4.5	2.5	25	16
47	264	269	71	0.91	P532_0320KX401_0020 MF LM402U	310	360	620	64.00	64/1	2500	2500	5000	4.7	4.5	2.5	25	18
50	126	136	24	2.0	P532_0200KX401_0030 MF LM401U	250	250	710	60.00	60/1	3000	3000	5500	3.1	4.5	2.5	31	16
50	248	253	47	1.0	P532_0200KX401_0030 MF LM402U	360	360	710	60.00	60/1	3000	3000	5500	4.5	4.5	2.5	31	18
54	118	127	33	2.0	P532_0280KX401_0020 MF LM401U	240	240	600	56.00	56/1	2500	2500	5000	3.3	4.5	2.5	31	16
54	231	236	64	1.0	P532_0280KX401_0020 MF LM402U	300	300	600	56.00	56/1	2500	2500	5000	4.7	4.5	2.5	31	18
60	105	114	26	2.5	P532_0250KX401_0020 MF LM401U	210	210	710	50.00	50/1	2500	2500	5000	3.3	4.5	2.5	31	16
60	206	211	51	1.3	P532_0250KX401_0020 MF LM402U	360	360	710	50.00	50/1	2500	2500	5000	4.7	4.5	2.5	31	18
60	284	290	70	0.92	P532_0250KX401_0020 MF LM403U	360	360	710	50.00	50/1	2500	2500	5000	6.0	4.5	2.5	31	19
75	84	91	22	3.0	P532_0200KX401_0020 MF LM401U	170	170	710	40.00	40/1	2500	2500	5000	3.4	4.5	2.5	31	16
75	165	168	42	1.5	P532_0200KX401_0020 MF LM402U	360	360	710	40.00	40/1	2500	2500	5000	4.7	4.5	2.5	31	18
75	227	232	58	1.1	P532_0200KX401_0020 MF LM403U	360	360	710	40.00	40/1	2500	2500	5000	6.0	4.5	2.5	31	19
86	74	80	30	3.6	P532_0350KX401_0010 MF LM401U	150	150	700	35.00	35/1	2500	2000	4000	4.1	4.5	2.5	32	16
86	144	147	59	1.8	P532_0350KX401_0010 MF LM402U	320	320	700	35.00	35/1	2500	2000	4000	5.5	4.5	2.5	32	18
86	198	203	81	1.3	P532_0350KX401_0010 MF LM403U	350	350	700	35.00	35/1	2500	2000	4000	6.8	4.5	2.5	32	19
86	310	330	127	0.85	P532_0350KX401_0010 MF LM503U	350	350	700	35.00	35/1	2500	2000	4000	13	4.5	2.5	32	22
94	67	73	20	3.3	P532_0160KX401_0020 MF LM401U	140	140	600	32.00	32/1	2500	2500	5000	3.4	4.5	2.5	29	16

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
P5KX4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 360 Nm)																		
94	132	135	39	1.7	P532_0160KX401_0020 MF LM402U	290	290	600	32.00	32/1	2500	2500	5000	4.7	4.5	2.5	29	18
94	181	185	53	1.2	P532_0160KX401_0020 MF LM403U	300	300	600	32.00	32/1	2500	2500	5000	6.0	4.5	2.5	29	19
P5KX5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 330 Nm)																		
100	64	70	19	2.8	P531_0100KX501_0030 MF LM401U	130	130	580	30.00	30/1	3000	3000	5000	6.5	4.0	2.0	24	17
100	126	129	37	1.4	P531_0100KX501_0030 MF LM402U	280	280	580	30.00	30/1	3000	3000	5000	7.8	4.0	2.0	24	19
100	174	177	51	1.0	P531_0100KX501_0030 MF LM403U	290	290	580	30.00	30/1	3000	3000	5000	9.1	4.0	2.0	24	21
125	52	56	14	3.9	P531_0080KX501_0030 MF LM401U	100	100	590	24.00	24/1	3000	3000	5000	6.5	4.5	2.5	21	17
125	101	103	27	2.0	P531_0080KX501_0030 MF LM402U	220	220	590	24.00	24/1	3000	3000	5000	7.8	4.5	2.5	21	19
125	139	142	37	1.4	P531_0080KX501_0030 MF LM403U	290	290	590	24.00	24/1	3000	3000	5000	9.1	4.5	2.5	21	21
125	217	231	57	0.92	P531_0080KX501_0030 MF LM503U	300	300	590	24.00	24/1	3000	3000	5000	15	4.5	2.5	21	24
143	45	49	11	4.7	P531_0070KX501_0030 MF LM401U	90	90	670	21.00	21/1	3000	3000	5000	6.5	4.5	2.5	25	17
143	88	90	22	2.4	P531_0070KX501_0030 MF LM402U	190	190	670	21.00	21/1	3000	3000	5000	7.8	4.5	2.5	25	19
143	122	124	30	1.7	P531_0070KX501_0030 MF LM403U	260	260	670	21.00	21/1	3000	3000	5000	9.1	4.5	2.5	25	21
143	190	202	48	1.1	P531_0070KX501_0030 MF LM503U	330	380	670	21.00	21/1	3000	3000	5000	15	4.5	2.5	25	24
150	43	46	17	4.2	P531_0100KX501_0020 MF LM401U	86	86	580	20.00	20/1	2500	2500	4500	7.0	4.0	2.0	24	17
150	84	86	33	2.1	P531_0100KX501_0020 MF LM402U	190	190	580	20.00	20/1	2500	2500	4500	8.3	4.0	2.0	24	19
150	116	118	46	1.6	P531_0100KX501_0020 MF LM403U	250	250	580	20.00	20/1	2500	2500	4500	9.6	4.0	2.0	24	21
150	181	192	72	0.99	P531_0100KX501_0020 MF LM503U	290	290	580	20.00	20/1	2500	2500	4500	16	4.0	2.0	24	24
188	67	69	24	3.0	P531_0080KX501_0020 MF LM402U	150	150	590	16.00	16/1	2500	2500	4500	8.3	4.5	2.5	21	19
188	93	95	33	2.2	P531_0080KX501_0020 MF LM403U	200	200	590	16.00	16/1	2500	2500	4500	9.6	4.5	2.5	21	21
188	145	154	52	1.4	P531_0080KX501_0020 MF LM503U	300	300	590	16.00	16/1	2500	2500	4500	16	4.5	2.5	21	24
188	209	236	75	0.96	P531_0080KX501_0020 MF LM505U	300	300	590	16.00	16/1	2500	2500	4500	22	4.5	2.5	21	28
200	63	64	16	3.4	P531_0050KX501_0030 MF LM402U	140	140	640	15.00	15/1	3000	3000	5000	7.9	5.0	3.0	22	19
200	87	89	22	2.4	P531_0050KX501_0030 MF LM403U	180	180	640	15.00	15/1	3000	3000	5000	9.2	5.0	3.0	22	21
200	136	144	34	1.6	P531_0050KX501_0030 MF LM503U	290	290	640	15.00	15/1	3000	3000	5000	15	5.0	3.0	22	24
200	196	222	49	1.1	P531_0050KX501_0030 MF LM505U	310	310	640	15.00	15/1	3000	3000	5000	22	5.0	3.0	22	28
214	59	60	20	3.6	P531_0070KX501_0020 MF LM402U	130	130	670	14.00	14/1	2500	2500	4500	8.4	4.5	2.5	25	19
214	81	83	28	2.6	P531_0070KX501_0020 MF LM403U	170	170	670	14.00	14/1	2500	2500	4500	9.7	4.5	2.5	25	21
214	127	135	43	1.7	P531_0070KX501_0020 MF LM503U	270	270	670	14.00	14/1	2500	2500	4500	16	4.5	2.5	25	24
214	183	207	62	1.1	P531_0070KX501_0020 MF LM505U	330	380	670	14.00	14/1	2500	2500	4500	22	4.5	2.5	25	28
214	258	284	88	0.82	P531_0070KX501_0020 MF LM704U	330	380	670	14.00	14/1	2500	2500	4500	42	4.5	2.5	25	34
250	51	52	16	3.4	P531_0040KX501_0030 MF LM402U	110	110	520	12.00	12/1	3000	3000	5000	7.9	5.5	3.5	18	19
250	69	71	22	2.4	P531_0040KX501_0030 MF LM403U	150	150	520	12.00	12/1	3000	3000	5000	9.2	5.5	3.5	18	21
250	109	115	34	1.6	P531_0040KX501_0030 MF LM503U	230	230	520	12.00	12/1	3000	3000	5000	15	5.5	3.5	18	24
250	157	177	49	1.1	P531_0040KX501_0030 MF LM505U	240	240	520	12.00	12/1	3000	3000	5000	22	5.5	3.5	18	28
300	58	59	20	3.7	P531_0050KX501_0020 MF LM403U	120	120	640	10.00	10/1	2500	2500	4500	9.8	5.0	3.0	22	21
300	91	96	31	2.3	P531_0050KX501_0020 MF LM503U	190	190	640	10.00	10/1	2500	2500	4500	16	5.0	3.0	22	24
300	131	148	44	1.6	P531_0050KX501_0020 MF LM505U	310	310	640	10.00	10/1	2500	2500	4500	22	5.0	3.0	22	28
300	184	203	62	1.2	P531_0050KX501_0020 MF LM704U	310	310	640	10.00	10/1	2500	2500	4500	42	5.0	3.0	22	34
300	245	285	83	0.86	P531_0050KX501_0020 MF LM706U	310	310	640	10.00	10/1	2500	2500	4500	59	5.0	3.0	22	41
375	46	47	20	3.7	P531_0040KX501_0020 MF LM403U	98	98	520	8.000	8/1	2500	2500	4500	9.9	5.5	3.5	18	21
375	72	77	31	2.3	P531_0040KX501_0020 MF LM503U	160	160	520	8.000	8/1	2500	2500	4500	16	5.5	3.5	18	24
375	105	118	44	1.6	P531_0040KX501_0020 MF LM505U	240	240	520	8.000	8/1	2500	2500	4500	22	5.5	3.5	18	28
375	147	163	62	1.2	P531_0040KX501_0020 MF LM704U	240	240	520	8.000	8/1	2500	2500	4500	42	5.5	3.5	18	34
375	196	228	83	0.86	P531_0040KX501_0020 MF LM706U	240	240	520	8.000	8/1	2500	2500	4500	59	5.5	3.5	18	41
429	41	41	27	4.5	P531_0070KX501_0010 MF LM403U	86	86	670	7.000	7/1	2500	2000	3500	12	4.5	2.5	25	21
429	63	67	41	2.9	P531_0070KX501_0010 MF LM503U	140	140	670	7.000	7/1	2500	2000	3500	18	4.5	2.5	25	24
429	92	103	60	2.0	P531_0070KX501_0010 MF LM505U	210	210	670	7.000	7/1	2500	2000	3500	25	4.5	2.5	25	28
429	129	142	84	1.4	P531_0070KX501_0010 MF LM704U	280	280	670	7.000	7/1	2500	2000	3500	44	4.5	2.5	25	34
429	172	199	112	1.1	P531_0070KX501_0010 MF LM706U	330	380	670	7.000	7/1	2500	2000	3500	62	4.5	2.5	25	41
500	25	26	15	4.7	P531_0030KX501_0020 MF LM402U	56	56	390	6.000	6/1	2500	2500	4500	9.0	6.5	4.5	13	19
500	35	35	21	3.5	P531_0030KX501_0020 MF LM403U	74	74	390	6.000	6/1	2500	2500	4500	10	6.5	4.5	13	21
500	54	58	32	2.2	P531_0030KX501_0020 MF LM503U	120	120	390	6.000	6/1	2500	2500	4500	16	6.5	4.5	13	24
500	79	89	47	1.5	P531_0030KX501_0020 MF LM505U	180	180	390	6.000	6/1	2500	2500	4500	23	6.5	4.5	13	28
500	110	122	66	1.1	P531_0030KX501_0020 MF LM704U	180	180	390	6.000	6/1	2500	2500	4500	42	6.5	4.5	13	34
500	147	171	88	0.82	P531_0030KX501_0020 MF LM706U	180	180	390	6.000	6/1	2500	2500	4500	60	6.5	4.5	13	41
600	45	48	30	4.1	P531_0050KX501_0010 MF LM503U	97	97	640	5.000	5/1	2500	2000	3500	19	5.0	3.0	22	24
600	65	74	43	2.8	P531_0050KX501_0010 MF LM505U	150	150	640	5.000	5/1	2500	2000	3500	25	5.0	3.0	22	28
600	92	102	60	2.0	P531_0050KX501_0010 MF LM704U	200	200	640	5.000	5/1	2500	2000	3500	45	5.0	3.0	22	34
600	123	142	80	1.5	P531_0050KX501_0010 MF LM706U	290	290	640	5.000	5/1	2500	2000	3500	62	5.0	3.0	22	41
750	36	38	26	4.7	P531_0040KX501_0010 MF LM503U	78	78	520	4.000	4/1	2500	2000	3500	19	5.5	3.5	18	24
750	52	59	37	3.2	P531_0040KX501_0010 MF LM505U	120	120	520	4.000	4/1	2500	2000	3500	25	5.5	3.5	18	28
750	74	81	52	2.3	P531_0040KX501_0010 MF LM704U	160	160	520	4.000	4/1	2500	2000	3500	45	5.5	3.5	18	34
750	98	114	69	1.7	P531_0040KX501_0010 MF LM706U	230	230	520	4.000	4/1	2500	2000	3500	62	5.5	3.5	18	41

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
P5KX5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 330 Nm)																		
1000	27	29	31	3.9	P531_0030KX501_0010 MF LM503U	58	58	390	3.000	3/1	2500	2000	3500	21	6.5	4.5	13	24
1000	39	44	45	2.7	P531_0030KX501_0010 MF LM505U	92	92	390	3.000	3/1	2500	2000	3500	27	6.5	4.5	13	28
1000	55	61	63	1.9	P531_0030KX501_0010 MF LM704U	120	120	390	3.000	3/1	2500	2000	3500	47	6.5	4.5	13	34
1000	74	85	84	1.4	P531_0030KX501_0010 MF LM706U	180	180	390	3.000	3/1	2500	2000	3500	64	6.5	4.5	13	41
P7KX5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 810 Nm)																		
14	442	478	40	1.3	P732_0700KX501_0030 MF LM401U	760	800	1520	210.0	210/1	3000	3000	5000	6.5	4.0	2.0	59	27
15	421	455	71	1.0	P732_1000KX501_0020 MF LM401U	550	550	1100	200.0	200/1	2500	2500	4500	7.0	4.0	2.0	54	27
20	316	341	29	1.8	P732_0500KX501_0030 MF LM401U	630	630	1540	150.0	150/1	3000	3000	5000	6.5	4.0	2.0	62	27
20	619	632	58	0.91	P732_0500KX501_0030 MF LM402U	770	810	1540	150.0	150/1	3000	3000	5000	7.8	4.0	2.0	62	28
21	295	318	36	2.0	P732_0700KX501_0020 MF LM401U	590	590	1520	140.0	140/1	2500	2500	4500	7.0	4.0	2.0	59	27
21	578	590	71	1.0	P732_0700KX501_0020 MF LM402U	760	800	1520	140.0	140/1	2500	2500	4500	8.3	4.0	2.0	59	28
25	253	273	29	1.8	P732_0400KX501_0030 MF LM401U	510	510	1400	120.0	120/1	3000	3000	5000	6.5	4.5	2.5	62	27
25	495	505	57	0.92	P732_0400KX501_0030 MF LM402U	700	700	1400	120.0	120/1	3000	3000	5000	7.8	4.5	2.5	62	28
29	221	239	22	2.4	P732_0350KX501_0030 MF LM401U	440	440	1540	105.0	105/1	3000	3000	5000	6.5	4.5	2.5	62	27
29	433	442	42	1.2	P732_0350KX501_0030 MF LM402U	770	810	1540	105.0	105/1	3000	3000	5000	7.8	4.5	2.5	62	28
29	595	608	58	0.91	P732_0350KX501_0030 MF LM403U	770	810	1540	105.0	105/1	3000	3000	5000	9.1	4.5	2.5	62	30
30	211	227	27	2.7	P732_0500KX501_0020 MF LM401U	420	420	1540	100.0	100/1	2500	2500	4500	7.0	4.0	2.0	62	27
30	413	421	52	1.4	P732_0500KX501_0020 MF LM402U	770	810	1540	100.0	100/1	2500	2500	4500	8.3	4.0	2.0	62	28
30	567	579	72	1.0	P732_0500KX501_0020 MF LM403U	770	810	1540	100.0	100/1	2500	2500	4500	9.6	4.0	2.0	62	30
36	177	191	17	3.0	P732_0280KX501_0030 MF LM401U	350	350	1400	84.00	84/1	3000	3000	5000	6.5	4.5	2.5	62	27
36	347	354	34	1.6	P732_0280KX501_0030 MF LM402U	700	700	1400	84.00	84/1	3000	3000	5000	7.8	4.5	2.5	62	28
36	476	487	47	1.1	P732_0280KX501_0030 MF LM403U	700	700	1400	84.00	84/1	3000	3000	5000	9.1	4.5	2.5	62	30
38	168	182	26	2.7	P732_0400KX501_0020 MF LM401U	340	340	1400	80.00	80/1	2500	2500	4500	7.0	4.5	2.5	62	27
38	330	337	52	1.4	P732_0400KX501_0020 MF LM402U	700	700	1400	80.00	80/1	2500	2500	4500	8.3	4.5	2.5	62	28
38	454	463	71	1.0	P732_0400KX501_0020 MF LM403U	700	700	1400	80.00	80/1	2500	2500	4500	9.6	4.5	2.5	62	30
40	158	171	17	3.2	P732_0250KX501_0030 MF LM401U	320	320	1610	75.00	75/1	3000	3000	5000	6.5	4.5	2.5	62	27
40	309	316	33	1.6	P732_0250KX501_0030 MF LM402U	680	680	1610	75.00	75/1	3000	3000	5000	7.9	4.5	2.5	62	28
40	425	434	45	1.2	P732_0250KX501_0030 MF LM403U	810	810	1610	75.00	75/1	3000	3000	5000	9.2	4.5	2.5	62	30
43	147	159	19	3.7	P732_0350KX501_0020 MF LM401U	300	300	1540	70.00	70/1	2500	2500	4500	7.0	4.5	2.5	62	27
43	289	295	38	1.9	P732_0350KX501_0020 MF LM402U	640	640	1540	70.00	70/1	2500	2500	4500	8.4	4.5	2.5	62	28
43	397	405	52	1.4	P732_0350KX501_0020 MF LM403U	770	810	1540	70.00	70/1	2500	2500	4500	9.7	4.5	2.5	62	30
43	621	660	82	0.87	P732_0350KX501_0020 MF LM503U	770	810	1540	70.00	70/1	2500	2500	4500	16	4.5	2.5	62	33
47	135	146	20	3.5	P732_0320KX501_0020 MF LM401U	270	270	1460	64.00	64/1	2500	2500	4500	7.2	4.5	2.5	56	27
47	264	269	40	1.8	P732_0320KX501_0020 MF LM402U	580	580	1460	64.00	64/1	2500	2500	4500	8.5	4.5	2.5	56	28
47	363	371	55	1.3	P732_0320KX501_0020 MF LM403U	730	730	1460	64.00	64/1	2500	2500	4500	9.8	4.5	2.5	56	30
47	568	603	86	0.83	P732_0320KX501_0020 MF LM503U	730	730	1460	64.00	64/1	2500	2500	4500	16	4.5	2.5	56	33
50	126	136	14	3.6	P732_0200KX501_0030 MF LM401U	250	250	1610	60.00	60/1	3000	3000	5000	6.6	4.5	2.5	60	27
50	248	253	28	1.9	P732_0200KX501_0030 MF LM402U	540	540	1610	60.00	60/1	3000	3000	5000	7.9	4.5	2.5	60	28
50	340	348	39	1.4	P732_0200KX501_0030 MF LM403U	720	720	1610	60.00	60/1	3000	3000	5000	9.2	4.5	2.5	60	30
50	532	565	61	0.86	P732_0200KX501_0030 MF LM503U	810	810	1610	60.00	60/1	3000	3000	5000	15	4.5	2.5	60	33
54	118	127	16	4.6	P732_0280KX501_0020 MF LM401U	240	240	1400	56.00	56/1	2500	2500	4500	7.1	4.5	2.5	62	27
54	231	236	31	2.3	P732_0280KX501_0020 MF LM402U	510	510	1400	56.00	56/1	2500	2500	4500	8.4	4.5	2.5	62	28
54	318	324	42	1.7	P732_0280KX501_0020 MF LM403U	670	670	1400	56.00	56/1	2500	2500	4500	9.7	4.5	2.5	62	30
54	497	528	66	1.1	P732_0280KX501_0020 MF LM503U	700	700	1400	56.00	56/1	2500	2500	4500	16	4.5	2.5	62	33
60	105	114	15	4.8	P732_0250KX501_0020 MF LM401U	210	210	1610	50.00	50/1	2500	2500	4500	7.1	4.5	2.5	62	27
60	206	211	29	2.4	P732_0250KX501_0020 MF LM402U	450	450	1610	50.00	50/1	2500	2500	4500	8.5	4.5	2.5	62	28
60	284	290	40	1.8	P732_0250KX501_0020 MF LM403U	600	600	1610	50.00	50/1	2500	2500	4500	9.8	4.5	2.5	62	30
60	444	471	63	1.1	P732_0250KX501_0020 MF LM503U	810	810	1610	50.00	50/1	2500	2500	4500	16	4.5	2.5	62	33
75	165	168	26	2.8	P732_0200KX501_0020 MF LM402U	360	360	1610	40.00	40/1	2500	2500	4500	8.6	4.5	2.5	60	28
75	227	232	35	2.0	P732_0200KX501_0020 MF LM403U	480	480	1610	40.00	40/1	2500	2500	4500	9.9	4.5	2.5	60	30
75	355	377	55	1.3	P732_0200KX501_0020 MF LM503U	760	760	1610	40.00	40/1	2500	2500	4500	16	4.5	2.5	60	33
75	513	579	80	0.90	P732_0200KX501_0020 MF LM505U	810	810	1610	40.00	40/1	2500	2500	4500	22	4.5	2.5	60	37
86	144	147	32	3.7	P732_0350KX501_0010 MF LM402U	320	320	1540	35.00	35/1	2500	2000	3500	11	4.5	2.5	62	28
86	198	203	44	2.7	P732_0350KX501_0010 MF LM403U	420	420	1540	35.00	35/1	2500	2000	3500	12	4.5	2.5	62	30
86	310	330	69	1.7	P732_0350KX501_0010 MF LM503U	670	670	1540	35.00	35/1	2500	2000	3500	18	4.5	2.5	62	33
86	449	507	100	1.2	P732_0350KX501_0010 MF LM505U	770	810	1540	35.00	35/1	2500	2000	3500	25	4.5	2.5	62	37
86	631	696	140	0.86	P732_0350KX501_0010 MF LM704U	770	810	1540	35.00	35/1	2500	2000	3500	44	4.5	2.5	62	43
94	132	135	21	3.4	P732_0160KX501_0020 MF LM402U	290	290	1400	32.00	32/1	2500	2500	4500	8.6	4.5	2.5	59	28
94	181	185	29	2.5	P732_0160KX501_0020 MF LM403U	380	380	1400	32.00	32/1	2500	2500	4500	9.9	4.5	2.5	59	30
94	284	302	45	1.6	P732_0160KX501_0020 MF LM503U	610	610	1400	32.00	32/1	2500	2500	4500	16	4.5	2.5	59	33
94	410	463	65	1.1	P732_0160KX501_0020 MF LM505U	700	700	1400	32.00	32/1	2500	2500	4500	22	4.5	2.5	59	37
P7KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 810 Nm)																		
100	272	289	123	1.3	P731_0100KX701_0030 MF LM503U	580	580	1150	30.00	30/1	2100	2100	4000	23	4.0	2.0	52	37
100	393	443	177	0.89	P731_0100KX701_0030 MF LM505U	580	580	1150	30.00	30/1	2100	2100	4000	29	4.0	2.0	52	42

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P7KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 810 Nm)																		
125	217	231	86	1.8	P731_0080KX701_0030 MF LM503U	470	470	1340	24.00	24/1	2100	2100	4000	23	4.5	2.5	53	37
125	314	355	124	1.3	P731_0080KX701_0030 MF LM505U	670	700	1340	24.00	24/1	2100	2100	4000	29	4.5	2.5	53	42
125	442	488	175	0.91	P731_0080KX701_0030 MF LM704U	670	700	1340	24.00	24/1	2100	2100	4000	49	4.5	2.5	53	47
143	190	202	68	2.3	P731_0070KX701_0030 MF LM503U	410	410	1610	21.00	21/1	2100	2100	4000	23	4.5	2.5	54	37
143	275	310	99	1.6	P731_0070KX701_0030 MF LM505U	640	640	1610	21.00	21/1	2100	2100	4000	29	4.5	2.5	54	42
143	387	427	139	1.1	P731_0070KX701_0030 MF LM704U	810	830	1610	21.00	21/1	2100	2100	4000	49	4.5	2.5	54	47
143	515	598	185	0.85	P731_0070KX701_0030 MF LM706U	810	840	1610	21.00	21/1	2100	2100	4000	66	4.5	2.5	54	55
150	181	192	111	1.9	P731_0100KX701_0020 MF LM503U	390	390	1150	20.00	20/1	1800	1800	3500	25	4.0	2.0	52	37
150	262	296	160	1.3	P731_0100KX701_0020 MF LM505U	580	580	1150	20.00	20/1	1800	1800	3500	32	4.0	2.0	52	42
150	368	406	225	0.95	P731_0100KX701_0020 MF LM704U	580	580	1150	20.00	20/1	1800	1800	3500	51	4.0	2.0	52	47
188	145	154	78	2.8	P731_0080KX701_0020 MF LM503U	310	310	1340	16.00	16/1	1800	1800	3500	25	4.5	2.5	53	37
188	209	236	112	1.9	P731_0080KX701_0020 MF LM505U	490	490	1340	16.00	16/1	1800	1800	3500	32	4.5	2.5	53	42
188	295	325	158	1.4	P731_0080KX701_0020 MF LM704U	630	630	1340	16.00	16/1	1800	1800	3500	51	4.5	2.5	53	47
188	392	456	210	1.0	P731_0080KX701_0020 MF LM706U	670	700	1340	16.00	16/1	1800	1800	3500	69	4.5	2.5	53	55
200	136	144	51	3.1	P731_0050KX701_0030 MF LM503U	290	290	1290	15.00	15/1	2100	2100	4000	23	5.0	3.0	52	37
200	196	222	73	2.2	P731_0050KX701_0030 MF LM505U	460	460	1290	15.00	15/1	2100	2100	4000	29	5.0	3.0	52	42
200	276	305	103	1.5	P731_0050KX701_0030 MF LM704U	590	590	1290	15.00	15/1	2100	2100	4000	49	5.0	3.0	52	47
200	368	427	137	1.2	P731_0050KX701_0030 MF LM706U	610	610	1290	15.00	15/1	2100	2100	4000	66	5.0	3.0	52	55
214	127	135	62	3.5	P731_0070KX701_0020 MF LM503U	270	270	1610	14.00	14/1	1800	1800	3500	25	4.5	2.5	54	37
214	183	207	89	2.4	P731_0070KX701_0020 MF LM505U	430	430	1610	14.00	14/1	1800	1800	3500	32	4.5	2.5	54	42
214	258	284	125	1.7	P731_0070KX701_0020 MF LM704U	550	550	1610	14.00	14/1	1800	1800	3500	51	4.5	2.5	54	47
214	343	399	167	1.3	P731_0070KX701_0020 MF LM706U	810	820	1610	14.00	14/1	1800	1800	3500	69	4.5	2.5	54	55
250	109	115	51	3.1	P731_0040KX701_0030 MF LM503U	230	230	1030	12.00	12/1	2100	2100	4000	23	5.5	3.5	47	37
250	157	177	73	2.2	P731_0040KX701_0030 MF LM505U	370	370	1030	12.00	12/1	2100	2100	4000	30	5.5	3.5	47	42
250	221	244	103	1.5	P731_0040KX701_0030 MF LM704U	470	470	1030	12.00	12/1	2100	2100	4000	49	5.5	3.5	47	47
250	294	342	137	1.2	P731_0040KX701_0030 MF LM706U	490	490	1030	12.00	12/1	2100	2100	4000	67	5.5	3.5	47	55
300	91	96	46	4.7	P731_0050KX701_0020 MF LM503U	190	190	1290	10.00	10/1	1800	1800	3500	26	5.0	3.0	52	37
300	131	148	66	3.2	P731_0050KX701_0020 MF LM505U	310	310	1290	10.00	10/1	1800	1800	3500	32	5.0	3.0	52	42
300	184	203	93	2.3	P731_0050KX701_0020 MF LM704U	390	390	1290	10.00	10/1	1800	1800	3500	52	5.0	3.0	52	47
300	245	285	124	1.7	P731_0050KX701_0020 MF LM706U	590	590	1290	10.00	10/1	1800	1800	3500	69	5.0	3.0	52	55
375	72	77	46	4.7	P731_0040KX701_0020 MF LM503U	160	160	1030	8.000	8/1	1800	1800	3500	26	5.5	3.5	47	37
375	105	118	66	3.2	P731_0040KX701_0020 MF LM505U	250	250	1030	8.000	8/1	1800	1800	3500	32	5.5	3.5	47	42
375	147	163	93	2.3	P731_0040KX701_0020 MF LM704U	310	310	1030	8.000	8/1	1800	1800	3500	52	5.5	3.5	47	47
375	196	228	124	1.7	P731_0040KX701_0020 MF LM706U	470	470	1030	8.000	8/1	1800	1800	3500	70	5.5	3.5	47	55
429	92	103	86	4.2	P731_0070KX701_0010 MF LM505U	210	210	1590	7.000	7/1	1800	1600	3000	43	4.5	2.5	54	42
429	129	142	121	3.0	P731_0070KX701_0010 MF LM704U	280	280	1590	7.000	7/1	1800	1600	3000	63	4.5	2.5	54	47
429	172	199	161	2.2	P731_0070KX701_0010 MF LM706U	410	410	1590	7.000	7/1	1800	1600	3000	80	4.5	2.5	54	55
500	54	58	46	4.7	P731_0030KX701_0020 MF LM503U	120	120	770	6.000	6/1	1800	1800	3500	27	6.5	4.5	38	37
500	79	89	66	3.2	P731_0030KX701_0020 MF LM505U	180	180	770	6.000	6/1	1800	1800	3500	34	6.5	4.5	38	42
500	110	122	93	2.3	P731_0030KX701_0020 MF LM704U	240	240	770	6.000	6/1	1800	1800	3500	53	6.5	4.5	38	47
500	147	171	124	1.7	P731_0030KX701_0020 MF LM706U	350	350	770	6.000	6/1	1800	1800	3500	71	6.5	4.5	38	55
600	92	102	86	4.2	P731_0050KX701_0010 MF LM704U	200	200	1130	5.000	5/1	1800	1600	3000	64	5.0	3.0	52	47
600	123	142	115	3.1	P731_0050KX701_0010 MF LM706U	290	290	1130	5.000	5/1	1800	1600	3000	81	5.0	3.0	52	55
750	74	81	78	4.6	P731_0040KX701_0010 MF LM704U	160	160	910	4.000	4/1	1800	1600	3000	65	5.5	3.5	47	47
750	98	114	104	3.5	P731_0040KX701_0010 MF LM706U	230	230	910	4.000	4/1	1800	1600	3000	83	5.5	3.5	47	55
1000	55	61	81	4.4	P731_0030KX701_0010 MF LM704U	120	120	680	3.000	3/1	1800	1600	3000	70	6.5	4.5	38	47
1000	74	85	108	3.3	P731_0030KX701_0010 MF LM706U	180	180	680	3.000	3/1	1800	1600	3000	88	6.5	4.5	38	55
P8KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1840 Nm)																		
20	1331	1413	148	1.1	P832_0500KX701_0030 MF LM503U	1840	2000	3230	150.0	150/1	2100	2100	4000	23	4.0	2.0	172	57
21	1242	1319	215	1.0	P832_0700KX701_0020 MF LM503U	1610	1610	3220	140.0	140/1	1800	1800	3500	25	4.0	2.0	163	57
25	1065	1131	153	1.0	P832_0400KX701_0030 MF LM503U	1600	1600	3200	120.0	120/1	2100	2100	4000	23	4.5	2.5	166	57
29	931	989	104	1.5	P832_0350KX701_0030 MF LM503U	1840	2000	3230	105.0	105/1	2100	2100	4000	23	4.5	2.5	173	57
29	1346	1520	150	1.1	P832_0350KX701_0030 MF LM505U	1840	2000	3230	105.0	105/1	2100	2100	4000	29	4.5	2.5	173	62
30	887	942	134	1.6	P832_0500KX701_0020 MF LM503U	1840	1910	3230	100.0	100/1	1800	1800	3500	25	4.0	2.0	172	57
30	1282	1448	194	1.1	P832_0500KX701_0020 MF LM505U	1840	2000	3230	100.0	100/1	1800	1800	3500	32	4.0	2.0	172	62
36	745	792	107	1.5	P832_0280KX701_0030 MF LM503U	1600	1600	3200	84.00	84/1	2100	2100	4000	23	4.5	2.5	168	57
36	1077	1216	155	1.0	P832_0280KX701_0030 MF LM505U	1600	1600	3200	84.00	84/1	2100	2100	4000	29	4.5	2.5	168	62
38	710	754	138	1.5	P832_0400KX701_0020 MF LM503U	1520	1520	3200	80.00	80/1	1800	1800	3500	25	4.5	2.5	166	57
38	1026	1158	200	1.1	P832_0400KX701_0020 MF LM505U	1600	1600	3200	80.00	80/1	1800	1800	3500	32	4.5	2.5	166	62
40	665	707	81	2.0	P832_0250KX701_0030 MF LM503U	1430	1430	3230	75.00	75/1	2100	2100	4000	23	4.5	2.5	172	57
40	961	1086	117	1.4	P832_0250KX701_0030 MF LM505U	1840	2000	3230	75.00	75/1	2100	2100	4000	29	4.5	2.5	172	62
40	1352	1492	164	0.96	P832_0250KX701_0030 MF LM704U	1840	2000	3230	75.00	75/1	2100	2100	4000	49	4.5	2.5	172	68
43	621	660	94	2.3	P832_0350KX701_0020 MF LM503U	1330	1330	3230	70.00	70/1	1800	1800	3500	25	4.5	2.5	173	57
43	897	1013	136	1.6	P832_0350KX701_0020 MF LM505U	1840	2000	3230	70.00	70/1	1800	1800	3500	32	4.5	2.5	173	62

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P8KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1840 Nm)																		
43	1262	1393	191	1.1	P832_0350KX701_0020 MF LM704U	1840	2000	3230	70.00	70/1	1800	1800	3500	51	4.5	2.5	173	68
47	568	603	104	2.1	P832_0320KX701_0020 MF LM503U	1220	1220	3050	64.00	64/1	1800	1800	3500	26	4.5	2.5	157	57
47	820	926	150	1.4	P832_0320KX701_0020 MF LM505U	1520	1600	3050	64.00	64/1	1800	1800	3500	32	4.5	2.5	157	62
47	1154	1273	211	1.0	P832_0320KX701_0020 MF LM704U	1520	1600	3050	64.00	64/1	1800	1800	3500	52	4.5	2.5	157	68
50	532	565	67	2.3	P832_0200KX701_0030 MF LM503U	1140	1140	3230	60.00	60/1	2100	2100	4000	23	4.5	2.5	169	57
50	769	869	97	1.6	P832_0200KX701_0030 MF LM505U	1800	1800	3230	60.00	60/1	2100	2100	4000	30	4.5	2.5	169	62
50	1082	1194	137	1.2	P832_0200KX701_0030 MF LM704U	1840	2000	3230	60.00	60/1	2100	2100	4000	49	4.5	2.5	169	68
50	1441	1673	182	0.87	P832_0200KX701_0030 MF LM706U	1840	2000	3230	60.00	60/1	2100	2100	4000	67	4.5	2.5	169	75
54	497	528	97	2.2	P832_0280KX701_0020 MF LM503U	1070	1070	3200	56.00	56/1	1800	1800	3500	25	4.5	2.5	168	57
54	718	811	140	1.5	P832_0280KX701_0020 MF LM505U	1600	1600	3200	56.00	56/1	1800	1800	3500	32	4.5	2.5	168	62
54	1010	1114	197	1.1	P832_0280KX701_0020 MF LM704U	1600	1600	3200	56.00	56/1	1800	1800	3500	52	4.5	2.5	168	68
54	1345	1562	262	0.82	P832_0280KX701_0020 MF LM706U	1600	1600	3200	56.00	56/1	1800	1800	3500	69	4.5	2.5	168	75
60	444	471	73	2.9	P832_0250KX701_0020 MF LM503U	950	950	3230	50.00	50/1	1800	1800	3500	26	4.5	2.5	172	57
60	641	724	106	2.0	P832_0250KX701_0020 MF LM505U	1500	1500	3230	50.00	50/1	1800	1800	3500	32	4.5	2.5	172	62
60	902	995	148	1.4	P832_0250KX701_0020 MF LM704U	1840	1930	3230	50.00	50/1	1800	1800	3500	52	4.5	2.5	172	68
60	1201	1394	198	1.1	P832_0250KX701_0020 MF LM706U	1840	2000	3230	50.00	50/1	1800	1800	3500	69	4.5	2.5	172	75
75	355	377	61	3.5	P832_0200KX701_0020 MF LM503U	760	760	3230	40.00	40/1	1800	1800	3500	26	4.5	2.5	169	57
75	513	579	88	2.4	P832_0200KX701_0020 MF LM505U	1200	1200	3230	40.00	40/1	1800	1800	3500	32	4.5	2.5	169	62
75	721	796	124	1.7	P832_0200KX701_0020 MF LM704U	1540	1540	3230	40.00	40/1	1800	1800	3500	52	4.5	2.5	169	68
75	961	1115	165	1.3	P832_0200KX701_0020 MF LM706U	1840	2000	3230	40.00	40/1	1800	1800	3500	70	4.5	2.5	169	75
86	310	330	89	4.1	P832_0350KX701_0010 MF LM503U	670	670	3230	35.00	35/1	1800	1600	3000	37	4.5	2.5	173	57
86	449	507	128	2.8	P832_0350KX701_0010 MF LM505U	1050	1050	3230	35.00	35/1	1800	1600	3000	43	4.5	2.5	173	62
86	631	696	180	2.0	P832_0350KX701_0010 MF LM704U	1350	1350	3230	35.00	35/1	1800	1600	3000	63	4.5	2.5	173	68
86	841	976	240	1.5	P832_0350KX701_0010 MF LM706U	1840	2000	3230	35.00	35/1	1800	1600	3000	80	4.5	2.5	173	75
94	284	302	55	3.9	P832_0160KX701_0020 MF LM503U	610	610	3200	32.00	32/1	1800	1800	3500	26	4.5	2.5	163	57
94	410	463	80	2.7	P832_0160KX701_0020 MF LM505U	960	960	3200	32.00	32/1	1800	1800	3500	33	4.5	2.5	163	62
94	577	637	112	1.9	P832_0160KX701_0020 MF LM704U	1230	1230	3200	32.00	32/1	1800	1800	3500	52	4.5	2.5	163	68
94	769	892	150	1.4	P832_0160KX701_0020 MF LM706U	1600	1600	3200	32.00	32/1	1800	1800	3500	70	4.5	2.5	163	75
100	272	289	51	3.1	P831_0100KX701_0030 MF LM503U	580	580	2580	30.00	30/1	2100	2100	4000	23	4.0	2.0	130	53
100	393	443	73	2.2	P831_0100KX701_0030 MF LM505U	920	920	2580	30.00	30/1	2100	2100	4000	29	4.0	2.0	130	57
100	552	609	103	1.5	P831_0100KX701_0030 MF LM704U	1180	1180	2580	30.00	30/1	2100	2100	4000	49	4.0	2.0	130	63
100	736	854	137	1.2	P831_0100KX701_0030 MF LM706U	1210	1210	2580	30.00	30/1	2100	2100	4000	67	4.0	2.0	130	70
125	217	231	51	3.1	P831_0080KX701_0030 MF LM503U	470	470	2060	24.00	24/1	2100	2100	4000	23	4.5	2.5	128	53
125	314	355	73	2.2	P831_0080KX701_0030 MF LM505U	740	740	2060	24.00	24/1	2100	2100	4000	30	4.5	2.5	128	57
125	442	488	103	1.5	P831_0080KX701_0030 MF LM704U	940	940	2060	24.00	24/1	2100	2100	4000	49	4.5	2.5	128	63
125	589	683	137	1.2	P831_0080KX701_0030 MF LM706U	970	970	2060	24.00	24/1	2100	2100	4000	67	4.5	2.5	128	70
143	190	202	51	3.1	P831_0070KX701_0030 MF LM503U	410	410	1800	21.00	21/1	2100	2100	4000	23	4.5	2.5	125	53
143	275	310	73	2.2	P831_0070KX701_0030 MF LM505U	640	640	1800	21.00	21/1	2100	2100	4000	30	4.5	2.5	125	57
143	387	427	103	1.5	P831_0070KX701_0030 MF LM704U	830	830	1800	21.00	21/1	2100	2100	4000	49	4.5	2.5	125	63
143	515	598	137	1.2	P831_0070KX701_0030 MF LM706U	850	850	1800	21.00	21/1	2100	2100	4000	67	4.5	2.5	125	70
150	181	192	46	4.7	P831_0100KX701_0020 MF LM503U	390	390	2580	20.00	20/1	1800	1800	3500	26	4.0	2.0	130	53
150	262	296	66	3.2	P831_0100KX701_0020 MF LM505U	610	610	2580	20.00	20/1	1800	1800	3500	32	4.0	2.0	130	57
150	368	406	93	2.3	P831_0100KX701_0020 MF LM704U	790	790	2580	20.00	20/1	1800	1800	3500	52	4.0	2.0	130	63
150	491	569	124	1.7	P831_0100KX701_0020 MF LM706U	1170	1170	2580	20.00	20/1	1800	1800	3500	69	4.0	2.0	130	70
188	145	154	46	4.7	P831_0080KX701_0020 MF LM503U	310	310	2060	16.00	16/1	1800	1800	3500	26	4.5	2.5	128	53
188	209	236	66	3.2	P831_0080KX701_0020 MF LM505U	490	490	2060	16.00	16/1	1800	1800	3500	33	4.5	2.5	128	57
188	295	325	93	2.3	P831_0080KX701_0020 MF LM704U	630	630	2060	16.00	16/1	1800	1800	3500	52	4.5	2.5	128	63
188	392	456	124	1.7	P831_0080KX701_0020 MF LM706U	940	940	2060	16.00	16/1	1800	1800	3500	70	4.5	2.5	128	70
200	136	144	51	3.1	P831_0050KX701_0030 MF LM503U	290	290	1290	15.00	15/1	2100	2100	4000	24	5.0	3.0	104	53
200	196	222	73	2.2	P831_0050KX701_0030 MF LM505U	460	460	1290	15.00	15/1	2100	2100	4000	30	5.0	3.0	104	57
200	276	305	103	1.5	P831_0050KX701_0030 MF LM704U	590	590	1290	15.00	15/1	2100	2100	4000	50	5.0	3.0	104	63
200	368	427	137	1.2	P831_0050KX701_0030 MF LM706U	610	610	1290	15.00	15/1	2100	2100	4000	67	5.0	3.0	104	70
214	127	135	46	4.7	P831_0070KX701_0020 MF LM503U	270	270	1800	14.00	14/1	1800	1800	3500	27	4.5	2.5	125	53
214	183	207	66	3.2	P831_0070KX701_0020 MF LM505U	430	430	1800	14.00	14/1	1800	1800	3500	33	4.5	2.5	125	57
214	258	284	93	2.3	P831_0070KX701_0020 MF LM704U	550	550	1800	14.00	14/1	1800	1800	3500	53	4.5	2.5	125	63
214	343	399	124	1.7	P831_0070KX701_0020 MF LM706U	820	820	1800	14.00	14/1	1800	1800	3500	70	4.5	2.5	125	70
250	109	115	51	3.1	P831_0040KX701_0030 MF LM503U	230	230	1030	12.00	12/1	2100	2100	4000	25	5.5	3.5	84	53
250	157	177	73	2.2	P831_0040KX701_0030 MF LM505U	370	370	1030	12.00	12/1	2100	2100	4000	31	5.5	3.5	84	57
250	221	244	103	1.5	P831_0040KX701_0030 MF LM704U	470	470	1030	12.00	12/1	2100	2100	4000	51	5.5	3.5	84	63
250	294	342	137	1.2	P831_0040KX701_0030 MF LM706U	490	490	1030	12.00	12/1	2100	2100	4000	68	5.5	3.5	84	70
300	91	96	46	4.7	P831_0050KX701_0020 MF LM503U	190	190	1290	10.00	10/1	1800	1800	3500	28	5.0	3.0	104	53
300	131	148	66	3.2	P831_0050KX701_0020 MF LM505U	310	310	1290	10.00	10/1	1800	1800	3500	34	5.0	3.0	104	57
300	184	203	93	2.3	P831_0050KX701_0020 MF LM704U	390	390	1290	10.00	10/1	1800	1800	3500	54	5.0	3.0	104	63
300	245	285	124	1.7	P831_0050KX701_0020 MF LM706U	590	590	1290	10.00	10/1	1800	1800	3500	71	5.0	3.0	104	70

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P8KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1840 Nm)																		
375	72	77	46	4.7	P831_0040KX701_0020 MF LM503U	160	160	1030	8.000	8/1	1800	1800	3500	30	5.5	3.5	84	53
375	105	118	66	3.2	P831_0040KX701_0020 MF LM505U	250	250	1030	8.000	8/1	1800	1800	3500	36	5.5	3.5	84	57
375	147	163	93	2.3	P831_0040KX701_0020 MF LM704U	310	310	1030	8.000	8/1	1800	1800	3500	56	5.5	3.5	84	63
375	196	228	124	1.7	P831_0040KX701_0020 MF LM706U	470	470	1030	8.000	8/1	1800	1800	3500	73	5.5	3.5	84	70
429	129	142	78	4.6	P831_0070KX701_0010 MF LM704U	280	280	1590	7.000	7/1	1800	1600	3000	67	4.5	2.5	125	63
429	172	199	104	3.5	P831_0070KX701_0010 MF LM706U	410	410	1590	7.000	7/1	1800	1600	3000	84	4.5	2.5	125	70
500	54	58	46	4.7	P831_0030KX701_0020 MF LM503U	120	120	770	6.000	6/1	1800	1800	3500	36	6.5	4.5	59	53
500	79	89	66	3.2	P831_0030KX701_0020 MF LM505U	180	180	770	6.000	6/1	1800	1800	3500	42	6.5	4.5	59	57
500	110	122	93	2.3	P831_0030KX701_0020 MF LM704U	240	240	770	6.000	6/1	1800	1800	3500	62	6.5	4.5	59	63
500	147	171	124	1.7	P831_0030KX701_0020 MF LM706U	350	350	770	6.000	6/1	1800	1800	3500	79	6.5	4.5	59	70
600	92	102	78	4.6	P831_0050KX701_0010 MF LM704U	200	200	1130	5.000	5/1	1800	1600	3000	72	5.0	3.0	104	63
600	123	142	104	3.5	P831_0050KX701_0010 MF LM706U	290	290	1130	5.000	5/1	1800	1600	3000	89	5.0	3.0	104	70
750	74	81	78	4.6	P831_0040KX701_0010 MF LM704U	160	160	910	4.000	4/1	1800	1600	3000	80	5.5	3.5	84	63
750	98	114	104	3.5	P831_0040KX701_0010 MF LM706U	230	230	910	4.000	4/1	1800	1600	3000	97	5.5	3.5	84	70
1000	55	61	78	4.6	P831_0030KX701_0010 MF LM704U	120	120	680	3.000	3/1	1800	1600	3000	103	6.5	4.5	59	63
1000	74	85	104	3.5	P831_0030KX701_0010 MF LM706U	180	180	680	3.000	3/1	1800	1600	3000	120	6.5	4.5	59	70
P9KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 3300 Nm)																		
14	1863	1979	123	1.3	P932_0700KX701_0030 MF LM503U	3160	–	6310	210.0	210/1	2100	2100	4000	23	4.0	–	369	82
14	2692	3040	178	0.89	P932_0700KX701_0030 MF LM505U	3160	–	6310	210.0	210/1	2100	2100	4000	29	4.0	–	369	87
15	1774	1885	224	0.95	P932_1000KX701_0020 MF LM503U	2200	–	4400	200.0	200/1	1800	1800	3500	26	4.0	–	320	82
20	1331	1413	92	1.7	P932_0500KX701_0030 MF LM503U	2860	–	6400	150.0	150/1	2100	2100	4000	23	4.0	–	393	82
20	1923	2171	132	1.2	P932_0500KX701_0030 MF LM505U	3200	–	6400	150.0	150/1	2100	2100	4000	29	4.0	–	393	87
20	2705	2984	186	0.85	P932_0500KX701_0030 MF LM704U	3200	–	6400	150.0	150/1	2100	2100	4000	49	4.0	–	393	93
21	1242	1319	111	1.9	P932_0700KX701_0020 MF LM503U	2670	–	6310	140.0	140/1	1800	1800	3500	26	4.0	–	369	82
21	1795	2027	161	1.3	P932_0700KX701_0020 MF LM505U	3160	–	6310	140.0	140/1	1800	1800	3500	32	4.0	–	369	87
21	2524	2785	226	0.95	P932_0700KX701_0020 MF LM704U	3160	–	6310	140.0	140/1	1800	1800	3500	52	4.0	–	369	93
25	1065	1131	84	1.9	P932_0400KX701_0030 MF LM503U	2290	–	6000	120.0	120/1	2100	2100	4000	23	4.5	–	384	82
25	1538	1737	121	1.3	P932_0400KX701_0030 MF LM505U	3000	–	6000	120.0	120/1	2100	2100	4000	30	4.5	–	384	87
25	2164	2387	171	0.92	P932_0400KX701_0030 MF LM704U	3000	–	6000	120.0	120/1	2100	2100	4000	49	4.5	–	384	93
29	931	989	62	2.6	P932_0350KX701_0030 MF LM503U	2000	–	6600	105.0	105/1	2100	2100	4000	23	4.5	–	391	82
29	1346	1520	89	1.8	P932_0350KX701_0030 MF LM505U	3150	–	6600	105.0	105/1	2100	2100	4000	30	4.5	–	391	87
29	1893	2089	126	1.3	P932_0350KX701_0030 MF LM704U	3300	–	6600	105.0	105/1	2100	2100	4000	49	4.5	–	391	93
29	2522	2928	168	0.94	P932_0350KX701_0030 MF LM706U	3300	–	6600	105.0	105/1	2100	2100	4000	67	4.5	–	391	100
30	887	942	83	2.6	P932_0500KX701_0020 MF LM503U	1910	–	6400	100.0	100/1	1800	1800	3500	26	4.0	–	393	82
30	1282	1448	120	1.8	P932_0500KX701_0020 MF LM505U	3000	–	6400	100.0	100/1	1800	1800	3500	32	4.0	–	393	87
30	1803	1989	168	1.3	P932_0500KX701_0020 MF LM704U	3200	–	6400	100.0	100/1	1800	1800	3500	52	4.0	–	393	93
30	2402	2789	224	0.96	P932_0500KX701_0020 MF LM706U	3200	–	6400	100.0	100/1	1800	1800	3500	69	4.0	–	393	100
36	745	792	52	3.1	P932_0280KX701_0030 MF LM503U	1600	–	6000	84.00	84/1	2100	2100	4000	23	4.5	–	381	82
36	1077	1216	75	2.1	P932_0280KX701_0030 MF LM505U	2520	–	6000	84.00	84/1	2100	2100	4000	30	4.5	–	381	87
36	1515	1671	105	1.5	P932_0280KX701_0030 MF LM704U	3000	–	6000	84.00	84/1	2100	2100	4000	50	4.5	–	381	93
36	2018	2342	140	1.1	P932_0280KX701_0030 MF LM706U	3000	–	6000	84.00	84/1	2100	2100	4000	67	4.5	–	381	100
38	710	754	76	2.8	P932_0400KX701_0020 MF LM503U	1520	–	6000	80.00	80/1	1800	1800	3500	26	4.5	–	384	82
38	1026	1158	110	2.0	P932_0400KX701_0020 MF LM505U	2400	–	6000	80.00	80/1	1800	1800	3500	32	4.5	–	384	87
38	1443	1592	154	1.4	P932_0400KX701_0020 MF LM704U	3000	–	6000	80.00	80/1	1800	1800	3500	52	4.5	–	384	93
38	1922	2231	206	1.0	P932_0400KX701_0020 MF LM706U	3000	–	6000	80.00	80/1	1800	1800	3500	69	4.5	–	384	100
40	665	707	51	3.1	P932_0250KX701_0030 MF LM503U	1430	–	6580	75.00	75/1	2100	2100	4000	24	4.5	–	381	82
40	961	1086	73	2.2	P932_0250KX701_0030 MF LM505U	2250	–	6580	75.00	75/1	2100	2100	4000	30	4.5	–	381	87
40	1352	1492	103	1.5	P932_0250KX701_0030 MF LM704U	2890	–	6580	75.00	75/1	2100	2100	4000	50	4.5	–	381	93
40	1802	2091	137	1.2	P932_0250KX701_0030 MF LM706U	2970	–	6580	75.00	75/1	2100	2100	4000	67	4.5	–	381	100
43	621	660	56	3.8	P932_0350KX701_0020 MF LM503U	1330	–	6600	70.00	70/1	1800	1800	3500	26	4.5	–	391	82
43	897	1013	81	2.6	P932_0350KX701_0020 MF LM505U	2100	–	6600	70.00	70/1	1800	1800	3500	33	4.5	–	391	87
43	1262	1393	114	1.9	P932_0350KX701_0020 MF LM704U	2700	–	6600	70.00	70/1	1800	1800	3500	53	4.5	–	391	93
43	1681	1952	151	1.4	P932_0350KX701_0020 MF LM706U	3300	–	6600	70.00	70/1	1800	1800	3500	70	4.5	–	391	100
50	532	565	51	3.1	P932_0200KX701_0030 MF LM503U	1140	–	5260	60.00	60/1	2100	2100	4000	25	4.5	–	368	82
50	769	869	73	2.2	P932_0200KX701_0030 MF LM505U	1800	–	5260	60.00	60/1	2100	2100	4000	31	4.5	–	368	87
50	1082	1194	103	1.5	P932_0200KX701_0030 MF LM704U	2310	–	5260	60.00	60/1	2100	2100	4000	51	4.5	–	368	93
50	1441	1673	137	1.2	P932_0200KX701_0030 MF LM706U	2380	–	5260	60.00	60/1	2100	2100	4000	68	4.5	–	368	100
54	497	528	47	4.6	P932_0280KX701_0020 MF LM503U	1070	–	6000	56.00	56/1	1800	1800	3500	27	4.5	–	381	82
54	718	811	67	3.2	P932_0280KX701_0020 MF LM505U	1680	–	6000	56.00	56/1	1800	1800	3500	33	4.5	–	381	87
54	1010	1114	95	2.3	P932_0280KX701_0020 MF LM704U	2160	–	6000	56.00	56/1	1800	1800	3500	53	4.5	–	381	93
54	1345	1562	126	1.7	P932_0280KX701_0020 MF LM706U	3000	–	6000	56.00	56/1	1800	1800	3500	70	4.5	–	381	100
60	444	471	46	4.7	P932_0250KX701_0020 MF LM503U	950	–	6580	50.00	50/1	1800	1800	3500	28	4.5	–	381	82
60	641	724	66	3.2	P932_0250KX701_0020 MF LM505U	1500	–	6580	50.00	50/1	1800	1800	3500	34	4.5	–	381	87
60	902	995	93	2.3	P932_0250KX701_0020 MF LM704U	1930	–	6580	50.00	50/1	1800	1800	3500	54	4.5	–	381	93

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2accHT} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2,5,6 [rpm]	n_{1maxDB} EL3,4 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2red}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P9KX7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 3300 Nm)																		
60	1201	1394	124	1.7	P932_0250KX701_0020 MF LM706U	2870	–	6580	50.00	50/1	1800	1800	3500	71	4.5	–	381	100
75	355	377	46	4.7	P932_0200KX701_0020 MF LM503U	760	–	5260	40.00	40/1	1800	1800	3500	30	4.5	–	368	82
75	513	579	66	3.2	P932_0200KX701_0020 MF LM505U	1200	–	5260	40.00	40/1	1800	1800	3500	36	4.5	–	368	87
75	721	796	93	2.3	P932_0200KX701_0020 MF LM704U	1540	–	5260	40.00	40/1	1800	1800	3500	56	4.5	–	368	93
75	961	1115	124	1.7	P932_0200KX701_0020 MF LM706U	2300	–	5260	40.00	40/1	1800	1800	3500	73	4.5	–	368	100
86	631	696	96	3.8	P932_0350KX701_0010 MF LM704U	1350	–	6600	35.00	35/1	1800	1600	3000	67	4.5	–	391	93
86	841	976	127	2.8	P932_0350KX701_0010 MF LM706U	2010	–	6600	35.00	35/1	1800	1600	3000	84	4.5	–	391	100
94	284	302	46	4.7	P932_0160KX701_0020 MF LM503U	610	–	4210	32.00	32/1	1800	1800	3500	30	4.5	–	348	82
94	410	463	66	3.2	P932_0160KX701_0020 MF LM505U	960	–	4210	32.00	32/1	1800	1800	3500	36	4.5	–	348	87
94	577	637	93	2.3	P932_0160KX701_0020 MF LM704U	1230	–	4210	32.00	32/1	1800	1800	3500	56	4.5	–	348	93
94	769	892	124	1.7	P932_0160KX701_0020 MF LM706U	1840	–	4210	32.00	32/1	1800	1800	3500	73	4.5	–	348	100
107	505	557	80	4.5	P932_0280KX701_0010 MF LM704U	1080	–	6000	28.00	28/1	1800	1600	3000	67	4.5	–	381	93
107	673	781	106	3.4	P932_0280KX701_0010 MF LM706U	1610	–	6000	28.00	28/1	1800	1600	3000	85	4.5	–	381	100
120	451	497	78	4.6	P932_0250KX701_0010 MF LM704U	960	–	5790	25.00	25/1	1800	1600	3000	72	4.5	–	381	93
120	601	697	104	3.5	P932_0250KX701_0010 MF LM706U	1440	–	5790	25.00	25/1	1800	1600	3000	89	4.5	–	381	100
150	361	398	78	4.6	P932_0200KX701_0010 MF LM704U	770	–	4630	20.00	20/1	1800	1600	3000	80	4.5	–	368	93
150	480	558	104	3.5	P932_0200KX701_0010 MF LM706U	1150	–	4630	20.00	20/1	1800	1600	3000	97	4.5	–	368	100
188	289	318	78	4.6	P932_0160KX701_0010 MF LM704U	620	–	3710	16.00	16/1	1800	1600	3000	81	4.5	–	348	93
188	384	446	104	3.5	P932_0160KX701_0010 MF LM706U	920	–	3710	16.00	16/1	1800	1600	3000	98	4.5	–	348	100

10.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

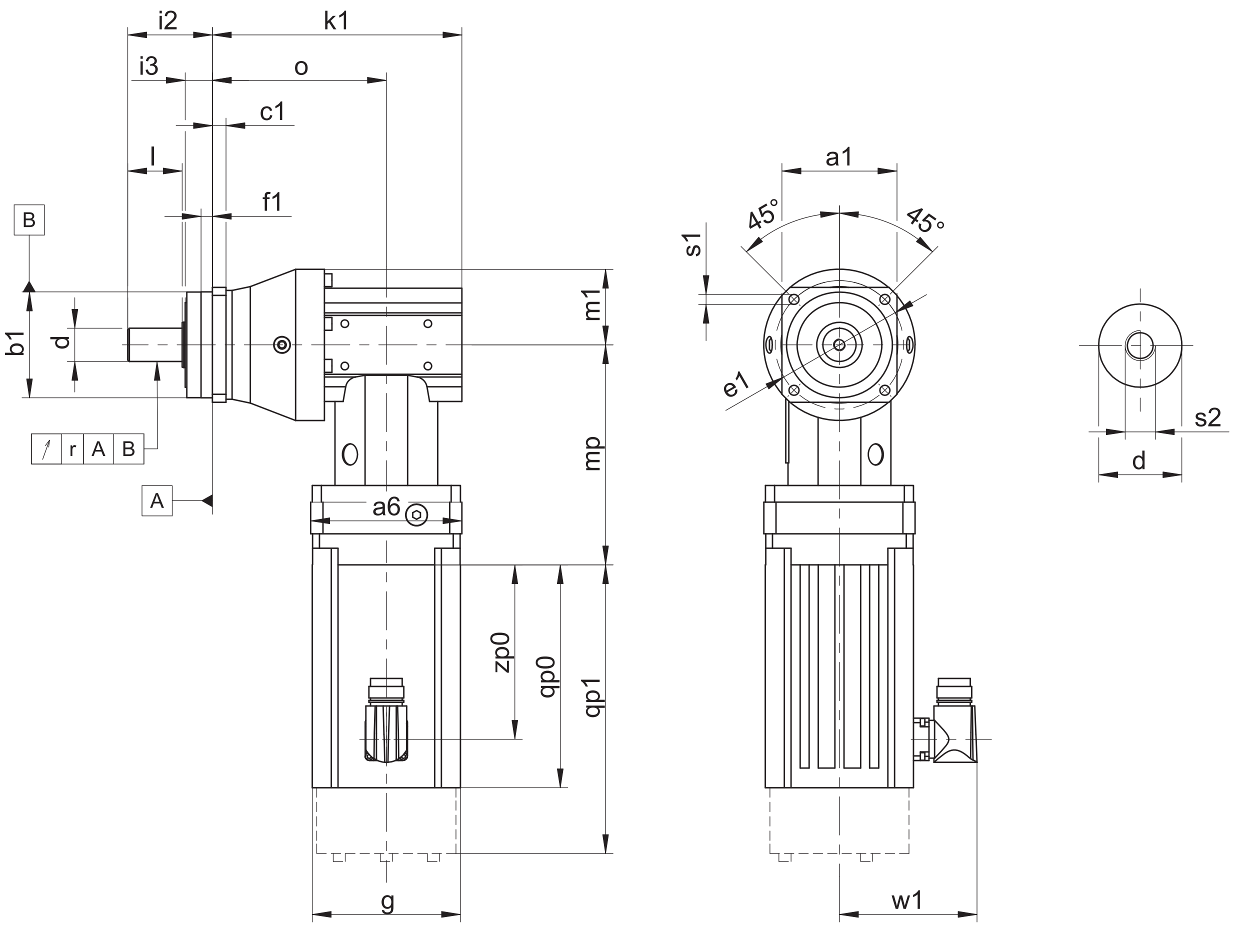
Tolerances

Solid shaft	Tolerance
Fit	ISO k6
Feather keys	DIN 6885-1, high form A
Balancing	With half feather key

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

10.3.1 G shaft design (solid shaft without feather key)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
–	The radial runout specification applies only to the reinforced bearing D.		

Dimensions of gear units

Type	□a1	∅b1	c1	∅d	∅e1	f1	i2	i3	k1	l	m1	o	r	∅s1	s2
P231_KX301_	55	50_{h6}	6	12_{k6}	63	7.0	36	12	124.0	22	31.0	84.0	–	5.5	M4
P331_KX301_	72	60_{h6}	7	16_{k6}	75	7.5	48	18	131.0	28	36.0	91.0	0.025	5.5	M5
P431_KX401_	76	70_{h6}	9	22_{k6}	85	7.5	56	18	165.0	36	49.0	115.0	0.025	6.6	M8
P432_KX301_	76	70_{h6}	9	22_{k6}	85	7.5	56	18	180.0	36	49.0	140.0	0.025	6.6	M8
P531_KX501_	101	90_{h6}	10	32_{k6}	120	15.0	88	28	187.5	58	57.0	128.5	0.030	9.0	M12
P532_KX401_	101	90_{h6}	10	32_{k6}	120	15.0	88	28	207.0	58	57.0	157.0	0.030	9.0	M12
P731_KX701_	144	130_{h6}	15	40_{k6}	165	3.5	112	27	232.5	82	72.0	158.5	0.035	11.0	M16
P732_KX501_	144	130_{h6}	15	40_{k6}	165	3.5	112	27	255.5	82	72.0	196.5	0.035	11.0	M16
P831_KX701_	190	160_{h6}	15	55_{k6}	215	10.0	112	27	267.0	82	95.0	193.0	0.035	13.5	M20
P832_KX701_	190	160_{h6}	15	55_{k6}	215	10.0	112	27	324.5	82	95.0	250.5	0.035	13.5	M20

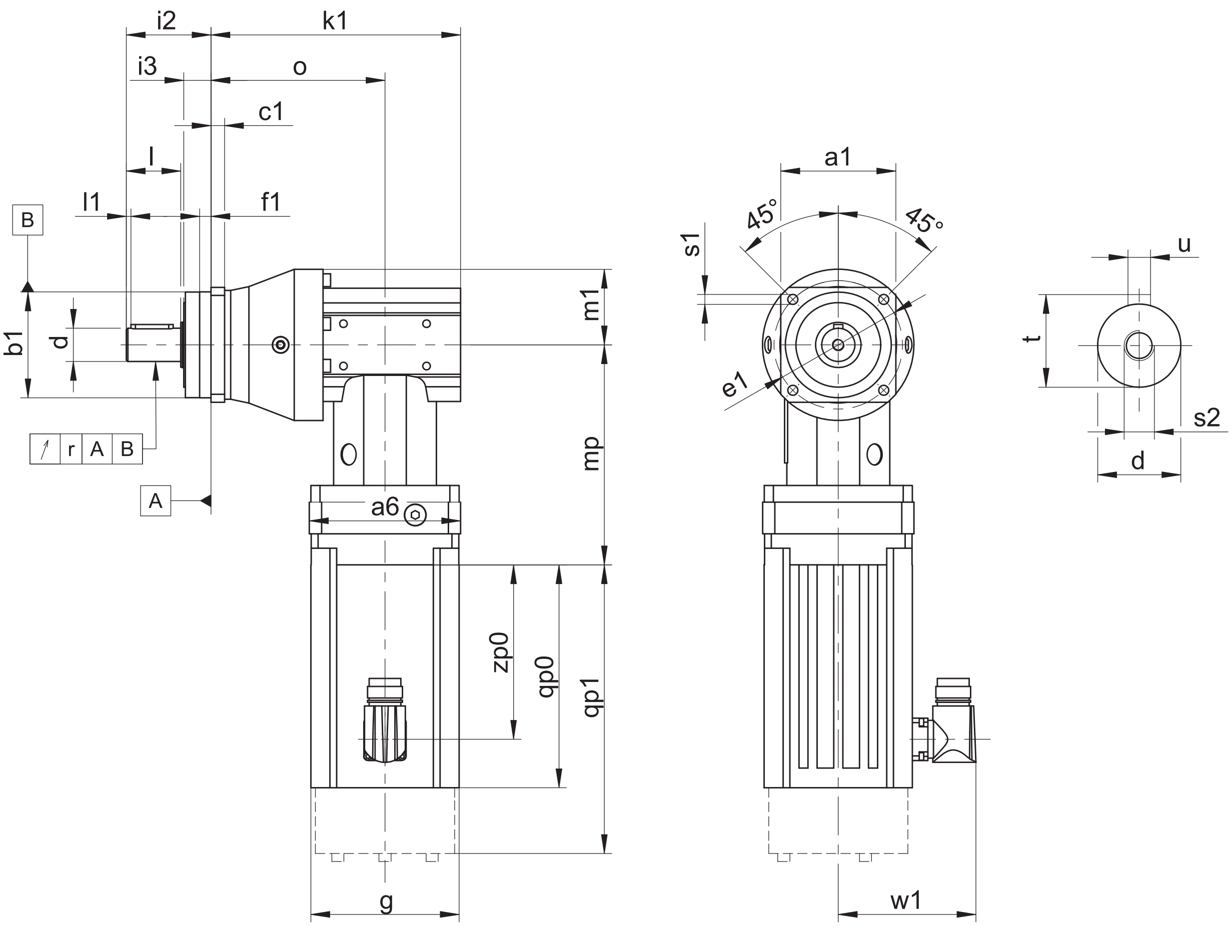
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91	76.5
LM402U	98	147.5	191.0	91	115.5
LM403U	98	178.5	222.0	91	146.5
LM503U	115	186.5	234.5	100	156.0
LM505U	115	256.5	304.5	100	226.0
LM704U	145	236.5	295.5	115	204.0
LM706U	145	306.5	365.5	115	274.0

Dimensions of geared motors

Type	LM4		LM5		LM7	
	□a6	mp	□a6	mp	□a6	mp
P231_KX301_	100	134.0	–	–	–	–
P331_KX301_	100	134.0	–	–	–	–
P431_KX401_	100	145.5	115	150.0	140	153.0
P432_KX301_	100	134.0	–	–	–	–
P531_KX501_	120	176.5	120	172.0	140	183.0
P532_KX401_	100	145.5	115	150.0	–	–
P731_KX701_	–	–	150	214.5	150	217.5
P732_KX501_	120	176.5	120	172.0	140	183.0
P831_KX701_	–	–	150	214.5	150	217.5
P832_KX701_	–	–	150	214.5	150	217.5

10.3.2 P shaft design (solid shaft with feather key)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

– The radial runout specification applies only to the reinforced bearing D.

Dimensions of gear units

Type	□a1	∅b1	c1	∅d	∅e1	f1	i2	i3	k1	l	l1	m1	o	r	∅s1	s2	t	u
P231_KX301_	55	50_{h6}	6	12_{k6}	63	7.0	36	12	124.0	22	2	31.0	84.0	–	5.5	M4	13.5	A4×4×18
P331_KX301_	72	60_{h6}	7	16_{k6}	75	7.5	48	18	131.0	28	2	36.0	91.0	0.025	5.5	M5	18.0	A5×5×22
P431_KX401_	76	70_{h6}	9	22_{k6}	85	7.5	56	18	165.0	36	3	49.0	115.0	0.025	6.6	M8	24.5	A6×6×28
P432_KX301_	76	70_{h6}	9	22_{k6}	85	7.5	56	18	180.0	36	3	49.0	140.0	0.025	6.6	M8	24.5	A6×6×28
P531_KX501_	101	90_{h6}	10	32_{k6}	120	15.0	88	28	187.5	58	3	57.0	128.5	0.030	9.0	M12	35.0	A10×8×50
P532_KX401_	101	90_{h6}	10	32_{k6}	120	15.0	88	28	207.0	58	3	57.0	157.0	0.030	9.0	M12	35.0	A10×8×50
P731_KX701_	144	130_{h6}	15	40_{k6}	165	3.5	112	27	232.5	82	4	72.0	158.5	0.035	11.0	M16	43.0	A12×8×70
P732_KX501_	144	130_{h6}	15	40_{k6}	165	3.5	112	27	255.5	82	4	72.0	196.5	0.035	11.0	M16	43.0	A12×8×70
P831_KX701_	190	160_{h6}	15	55_{k6}	215	10.0	112	27	267.0	82	6	95.0	193.0	0.035	13.5	M20	59.0	A16×10×70
P832_KX701_	190	160_{h6}	15	55_{k6}	215	10.0	112	27	324.5	82	6	95.0	250.5	0.035	13.5	M20	59.0	A16×10×70

Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91	76.5
LM402U	98	147.5	191.0	91	115.5
LM403U	98	178.5	222.0	91	146.5
LM503U	115	186.5	234.5	100	156.0
LM505U	115	256.5	304.5	100	226.0
LM704U	145	236.5	295.5	115	204.0
LM706U	145	306.5	365.5	115	274.0

Dimensions of geared motors

Type	LM4		LM5		LM7	
	□a6	mp	□a6	mp	□a6	mp
P231_KX301_	100	134.0	–	–	–	–
P331_KX301_	100	134.0	–	–	–	–
P431_KX401_	100	145.5	115	150.0	140	153.0
P432_KX301_	100	134.0	–	–	–	–
P531_KX501_	120	176.5	120	172.0	140	183.0
P532_KX401_	100	145.5	115	150.0	–	–
P731_KX701_	–	–	150	214.5	150	217.5
P732_KX501_	120	176.5	120	172.0	140	183.0
P831_KX701_	–	–	150	214.5	150	217.5
P832_KX701_	–	–	150	214.5	150	217.5

10.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

P	7	3	1	S	G	S	S	0050	KX701VF	0030	MF	LM704U

Explanation

Code	Designation	Design
P	Type	Planetary gear unit
7	Size	7 (example)
3	Generation	Generation 3
1	Stages	Single-stage
2		Two-stage
S	Housing	Standard
G	Shaft	Solid shaft without feather key
P		Solid shaft with feather key
S	Bearing	Standard bearing
D		Axially reinforced bearing (P3 – P9)
Z		Radially reinforced bearing (P3 – P9)[1]
S	Backlash	Standard
R		Reduced
0050	Transmission ratio of output (i x 10)	i = 5 (example)
KX701VF	Input	KX7 right-angle geared motor (example)
0030	Transmission ratio of input (i x 10)	i = 3 (example)
MF	Attachment to motor	MF motor adapter
LM704U	Motor	LM Lean motor

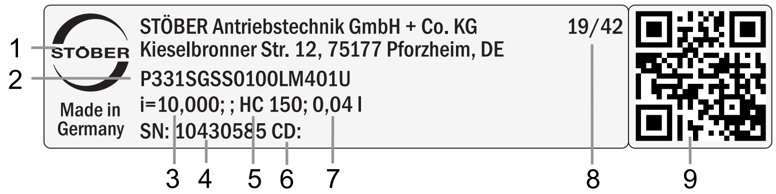
In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▹ 2]
- The mounting position, see the chapter [▹ 10.5.3]
- Radial shaft seal rings at the output made of NBR or FKM, see the chapter [▹ 10.6.3]
- The position of the plug connector, see the chapter [▹ 10.5.5]
- For reverse operation of the output shaft from ± 20° to ± 90° and horizontal installation, see the chapter [▹ 10.6.4]

[1] Not for reduced-backlash option.

10.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Serial number of the gear unit
5	Lubricant specification
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

10.4.1.1 Supporting documents

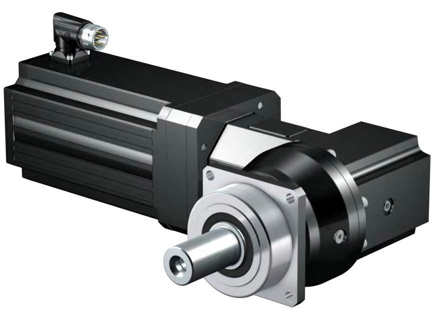
You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

10.5 Product description

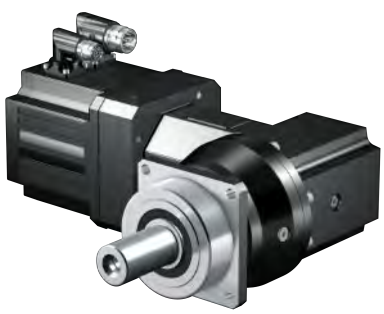
10.5.1 Input options

LM Lean motor



http://www.stoeber.de/en/PKXLM

EZ synchronous servo motor



http://www.stoeber.de/en/PKXEZ

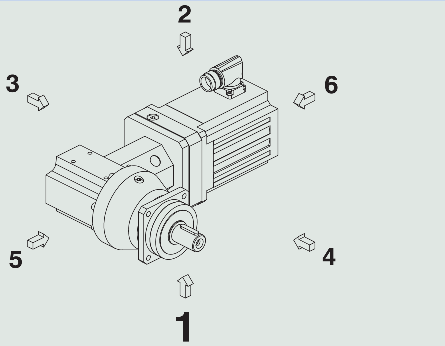
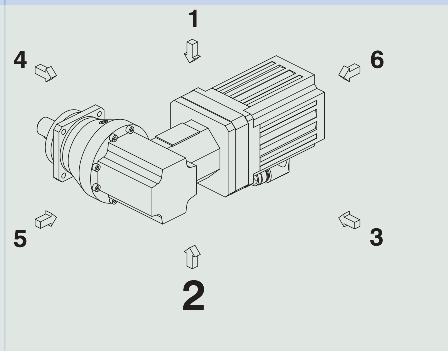
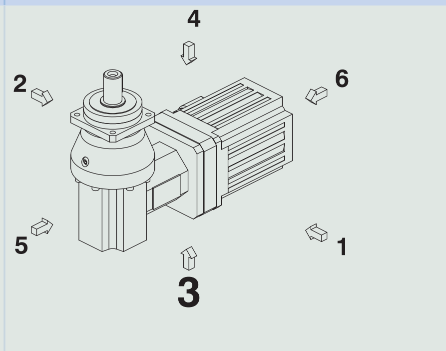
10.5.2 Installation conditions

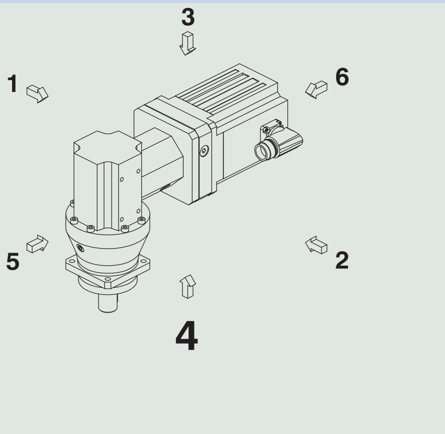
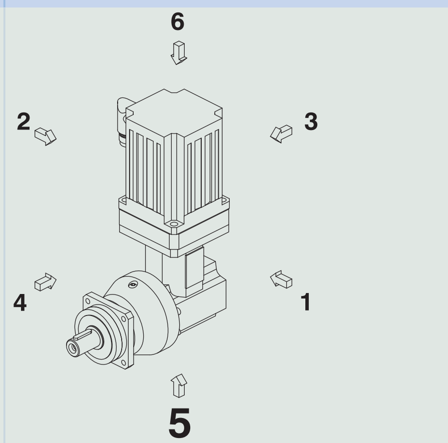
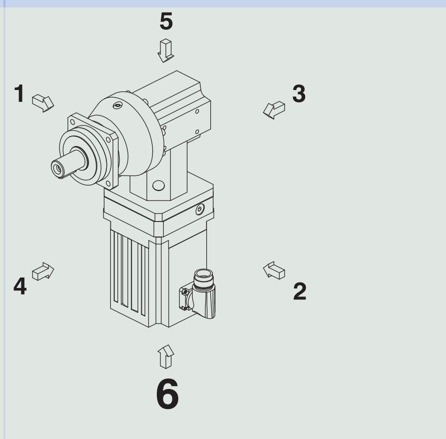
The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 12.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

10.5.3 Mounting positions

The following table shows the standard mounting positions.

The numbers identify the gear unit sides. The mounting position is defined by the gear side facing downwards.

EL1	EL2	EL3
		

EL4	EL5	EL6
		

Since the lubricant filling volume of the gear unit depends on the mounting position, the mounting position must be specified when ordering.

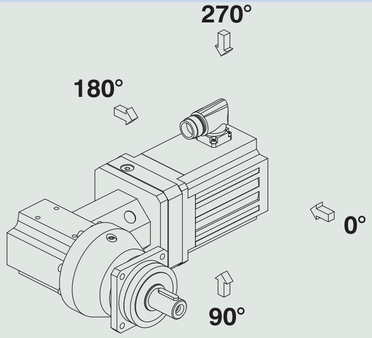
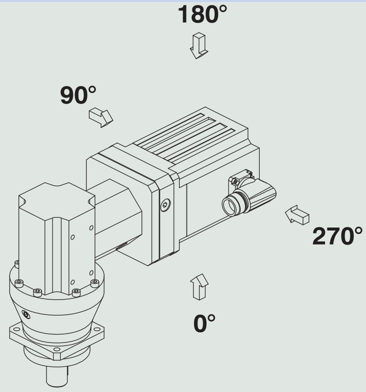
10.5.4 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate. The filling volume and the structure of the gear units depend on the mounting position.

Only install the gear units in the intended mounting position! Reposition the gear units only after consulting STOBER. Otherwise, STOBER assumes no liability for the gear units.

You will receive lubricants for use in the food industry upon request.

10.5.5 Position of the plug connector

Mounting position EL1 Plug connector in 270° position (standard)	**Mounting position EL4** Plug connector in 270° position (standard)
	

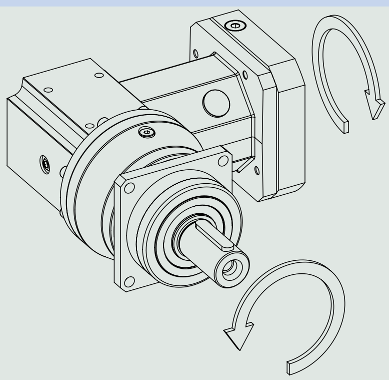
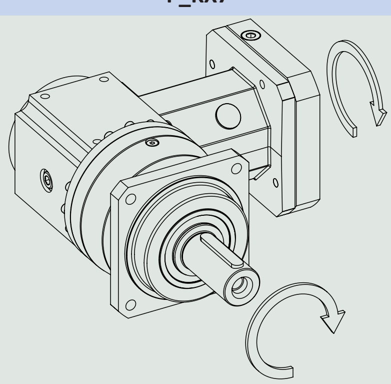
Indicate variations for your geared motor in the purchase order.

Note that the plug connector position rotates along with the geared motor if the geared motor is in another mounting position.

10.5.6 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 90 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} two-stage	96%
η_{get} three-stage	94%
Protection class:[2]	
Gear unit	IP65
Motor	IP56, optionally IP66

10.5.7 Direction of rotation

P_KX3 – P_KX5_	P_KX7
	

The pictures show mounting position EL1.

[2] Observe the protection class of all the components.

10.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

10.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

For mounting positions EL1, EL2, EL5, EL6:

$$n_{1m^*} \leq \frac{n_{1max\,DBEL1,2,5,6}}{fB_T}$$

For mounting positions EL3, EL4:

$$n_{1m^*} \leq \frac{n_{1max\,DBEL3,4}}{fB_T}$$

$$n_{1max^*} \leq \frac{n_{1max\,ZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

$$M_{2acc^*} \leq \frac{M_{2acc}}{fB_{ZB}}$$

$$M_{2NOT^*} \leq M_{2NOT}$$

$$M_{2eq^*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

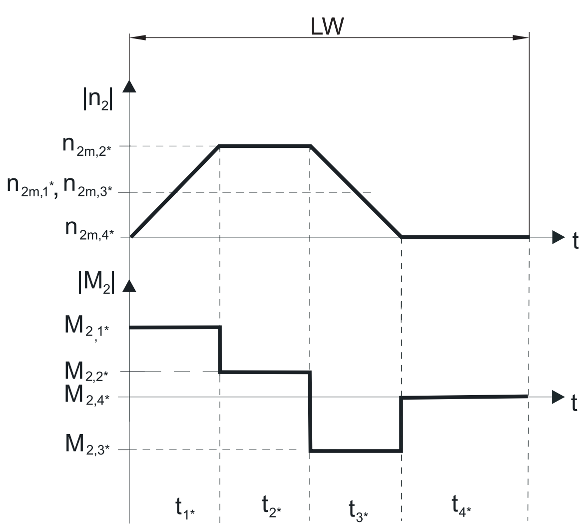
Refer to the selection tables for the values for $n_{1maxDBEL1,2,5,6}$ $n_{1maxDBEL3,4}$, n_{1maxZB}, M_{2acc} (M_{2accHT} for reduced backlash), M_{2NOT}, M_{2N} and S.

The values for fB_T, fB_{op}, fB_t and fB_{ZB} can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m^*} = n_{2m^*} \cdot i$$

$$n_{2m^*} = \frac{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}{t_{1^*} + \ldots + t_{n^*}}$$

If t_{1*} + ... + t_{3*} ≥ 6 min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff^*} = \sqrt{\frac{t_{1^*} \cdot M_{2,1^*}^{\;2} + \ldots + t_{n^*} \cdot M_{2,n^*}^{\;2}}{t_{1^*} + \ldots + t_{n^*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |M_{2,1^*}^{\;3}| + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |M_{2,n^*}^{\;3}|}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th}$ ≤ 0 you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

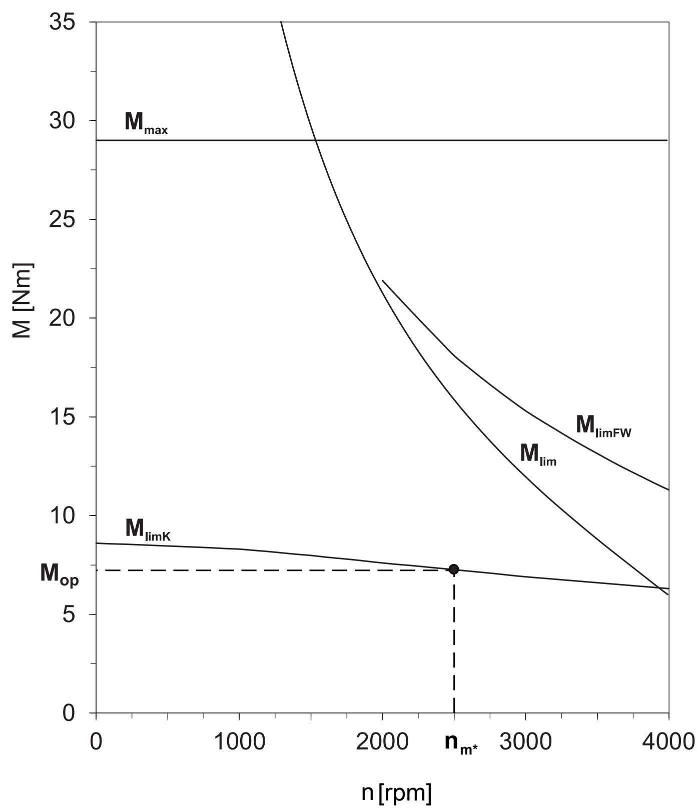
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}9 - \frac{a_{th}}{1000} \cdot athEL \cdot fB_T \cdot \left(\frac{n_{1m^*}}{1000}\right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▸ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Parameter a_{thEL}

Mounting position	a_{thEL}
EL1, 2, 5, 6	1.0
EL3, 4	1.1

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.25
Reversing load cyclic operation	1.40

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

10.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds n_{2m*} ≤ 100 rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

Permitted shaft loads for standard bearing S

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P2	17.0	500	1200	1300	34	36
P3	17.5	1000	2500	2500	79	79
P4	18.5	1500	4000	4500	146	164
P5	19.5	2300	6500	7000	315	340
P7	23.0	2900	8500	9000	544	576
P8	24.5	4700	13000	18000	852	1179
P9	33.0	6000	18000	27000	1539	2309

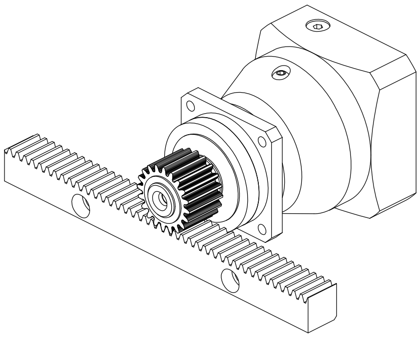


Fig. 1: Recommendation for bearing assignment S (e.g. for straight-cut gearing)

Permitted shaft loads for axially reinforced bearing D

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P3	20.0	2500	2750	2750	94	94
P4	22.5	4000	4500	5000	182	203
P5	25.5	6000	7000	8000	382	436
P7	29.0	10000	9500	10000	665	700
P8	32.0	15500	15000	18000	1095	1314
P9	44.0	25000	20000	30000	1930	2895

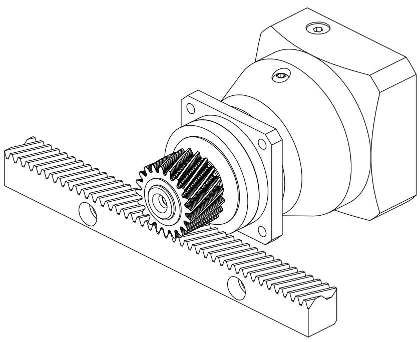


Fig. 2: Recommendation for bearing assignment D (e.g. for helical gearing)

Permitted shaft loads for radially reinforced bearing Z

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P3	17.5	600	3000	3000	95	95
P4	18.5	1000	5000	5000	183	183
P5	19.5	1600	8000	8000	388	388
P7	23.0	2000	10000	10000	640	640
P8	24.5	3600	18000	18000	1179	1179
P9	33.0	5000	27000	35000	2309	2993

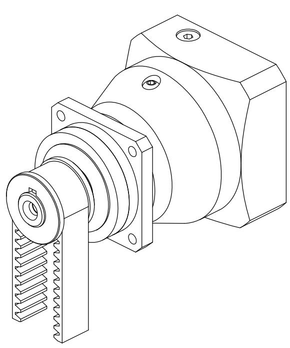


Fig. 3: Recommendation for bearing assignment Z (e.g. for belt drives)

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

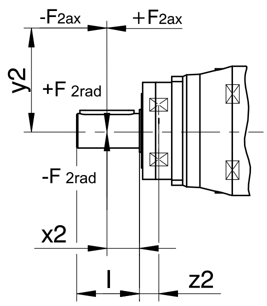


Fig. 4: Force application points

The specified values for $F_{2rad100}$ and $F_{2rad,acc}$ refer to an application of force at the center of the output shaft: x_2 = l/2.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k,acc*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad,acc*} \cdot (x_2 + z_2)}{1000} \leq M_{2k,acc}$$

$$F_{2rad,acc*} \leq F_{2rad,acc}$$

$$F_{2ax*} \leq F_{2axN}$$

The values for $F_{2rad,acc}$ and $M_{2k,acc}$ can be found in the table "Permitted shaft loads" in this chapter.

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq*} = \sqrt[3]{\frac{\left|n_{2m,1*}\right| \cdot t_{1*} \cdot \left|M_{2k,acc,1*}{}^3\right| + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*} \cdot \left|M_{2k,acc,n*}{}^3\right|}{\left|n_{2m,1*}\right| \cdot t_{1*} + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*}}} \leq M_{2kN}$$

$$F_{2rad,eq*} = \sqrt[3]{\frac{\left|n_{2m,1*}\right| \cdot t_{1*} \cdot \left|F_{2rad,acc,1*}{}^3\right| + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*} \cdot \left|F_{2rad,acc,n*}{}^3\right|}{\left|n_{2m,1*}\right| \cdot t_{1*} + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*}}} \leq F_{2radN}$$

The following apply to the bearing service life L_{10h} (ED_{10} ≤ 40%):

L_{10h} > 10000 h with 1 < M_{2kN}/M_{2k*} < 1.25

L_{10h} > 20000 h with 1.25 < M_{2kN}/M_{2k*} < 1.5

L_{10h} > 30000 h with 1.5 < M_{2kN}/M_{2k*}

For different duty cycles:

$$L_{10h} > L_{10h(ED_{10}=40\%)} \cdot \frac{40\%}{ED_{10}}$$

10.6.3 Recommendation for radial shaft seal rings

For a duty cycle > 60% and higher surrounding temperatures, we recommend radial shaft seal rings made of FKM at the output.

Properties:

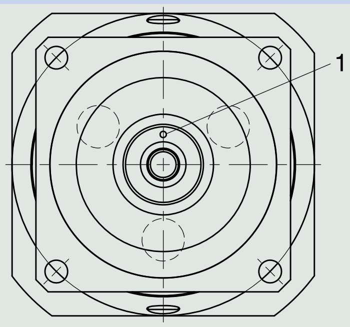
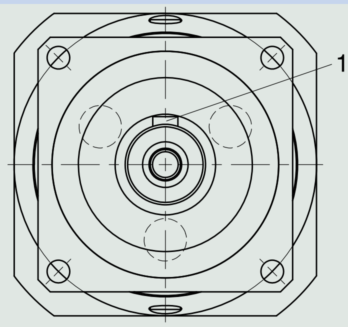
- Excellent temperature resistance
- High chemical stability
- Very good resistance to aging
- Excellent resistance to mineral oils and greases
- For use in the food, beverage and pharmaceutical industries

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

10.6.4 Reverse operation

To ensure lubrication for circulating gearing parts during cyclic reverse operation from ± 20° to ± 90° at the output, pay careful attention to the position of the output shaft for the horizontal mounting of the gear unit, as shown in the diagrams below. The images show the center position of reverse operation. Cyclic reverse operation ≤ ± 20° on request.

Solid shaft without feather key	Solid shaft with feather key
	
1 Position of the mark: top	1 Position of the feather key: top

Notes

- If you use the solid shaft without a feather key (G), you must note the position of the mark during assembly.
- As an alternative, you can use the solid shaft with a feather key (P). In that case, the feather key functions for position orientation. For a backlash-free connection, also use a clamp.

10.7 Additional documentation

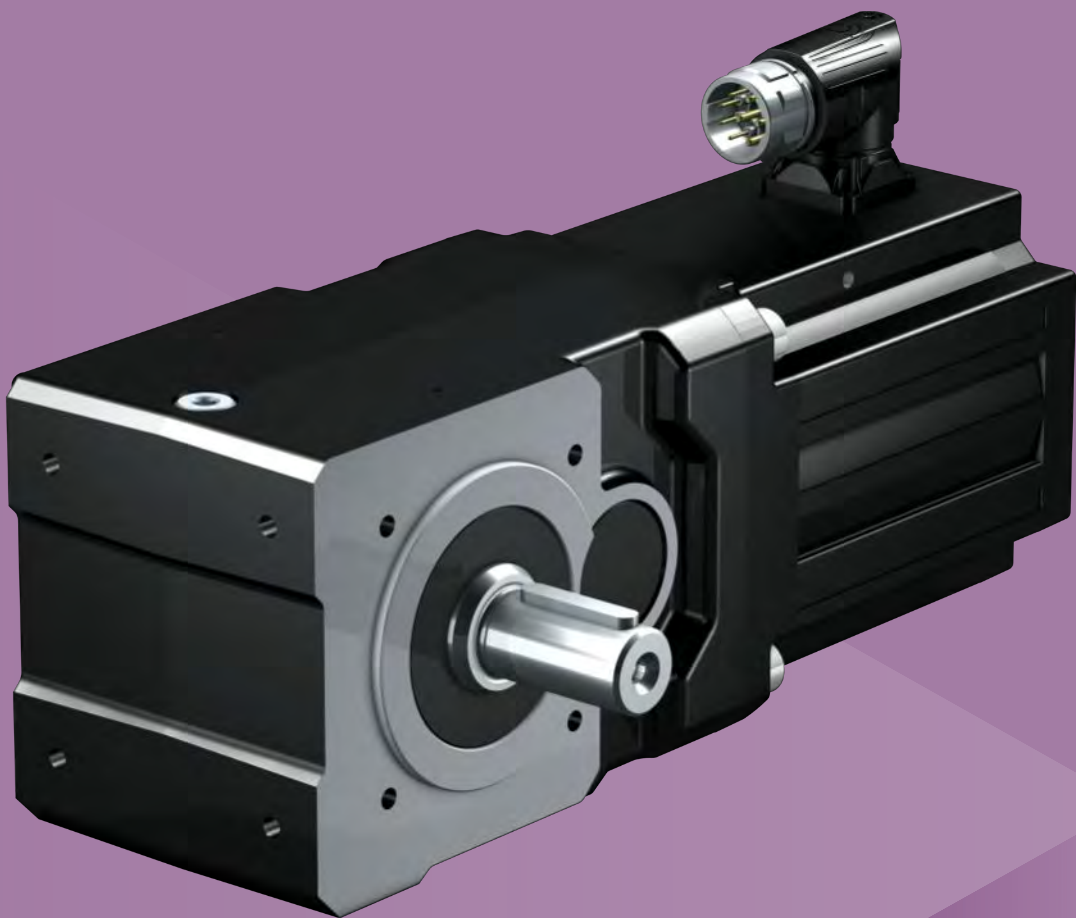
Additional documentation related to the product can be found at http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for KL/KS/PHK/PHKX/PHQK/PK/PKX right-angle servo gear units and right-angle servo geared motors	443150_en

11 KL helical bevel geared motors

Table of contents



11 **Helical bevel geared motors** **KL**

11.1 Overview

Compact helical-geared right-angle geared motors

Features

Power density	★★☆☆☆
Backlash	★☆☆☆☆
Price category	€
Shaft load	★★☆☆☆
Smooth operation	★★☆☆☆
Torsional stiffness	★★☆☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
Any mounting position	✓
Small installation space	✓
FKM seal ring at the input	✓
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	4 – 16
M_{2acc}	35 – 60 Nm
$\Delta\phi_2$	16 – 20 arcmin
η_{get}	97 %

11.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors

An explanation of the formula symbols can be found in the Chapter [▶ 14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
KL2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 60 Nm)															
188	35	38	22	1.4	KL202_0160 LM401U	60	120	16.00	16/1	4000	6000	1.8	16	4.0	12
375	17	19	36	1.4	KL202_0080 LM401U	35	58	8.000	8/1	4000	6000	1.8	20	2.4	12
375	34	35	45	1.2	KL202_0080 LM402U	60	120	8.000	8/1	3500	5000	3.3	16	4.0	14
375	47	48	62	0.84	KL202_0080 LM403U	60	120	8.000	8/1	3500	5000	4.6	16	4.0	15
750	17	17	54	1.6	KL202_0040 LM402U	38	110	4.000	4/1	3500	5000	3.5	20	2.4	14
750	24	24	74	1.2	KL202_0040 LM403U	50	110	4.000	4/1	3500	5000	4.8	20	2.4	15

11.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

Tolerances

Axis height in accordance with DIN 747	Tolerance
Up to 50 mm	-0.4 mm
Up to 250 mm	-0.5 mm
Up to 630 mm	-0.6 mm

Solid shaft	Tolerance
Shaft ∅ fit ≤ 50 mm	DIN 748-1, ISO k6
Shaft ∅ fit > 50 mm	DIN 748-1, ISO m6
Feather keys	DIN 6885-1, high form A

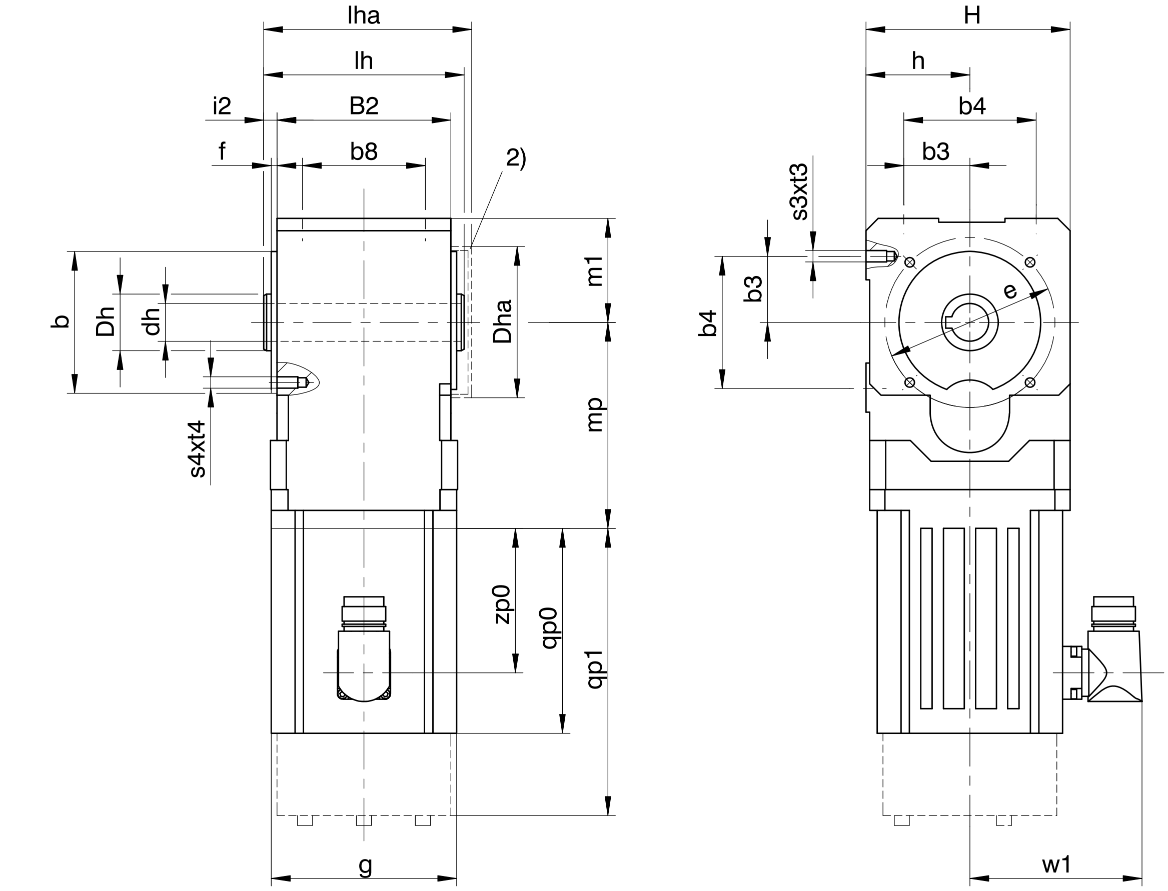
Centering holes in solid shafts in accordance with DIN 332-2, DR shape

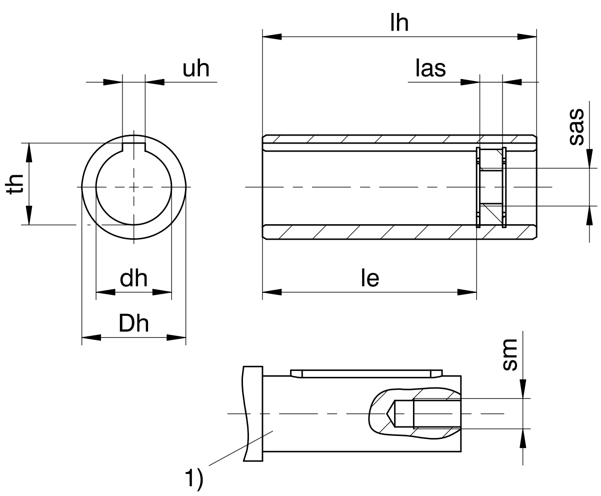
Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

Hollow shaft	Tolerance
Hollow shaft hole fit	ISO G7
Feather keys	DIN 6885-1, high form

Flange	Pilot tolerance
Up to 300 mm	ISO j6
Starting at 350 mm	ISO h6

11.3.1 A shaft design (hollow shaft), G housing design (pitch circle diameter)





qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

1) The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.

2) Cover (optional)

Dimensions of gear units

Type	∅b	b3	b4	b8	B2	∅dh	Dh	Dha	∅e	f	h	H	i2	le	lh	las	lha	m1	s3	s4	sm	sas	t3	t4	th	uh
KL2	75_{j6}	35	70	65	92	20^{H7}	30	80	90	3	55	108	7	79.5	106	12	110	55	M6	M6	M6	M8	13	13	22.8	6^{JS9}

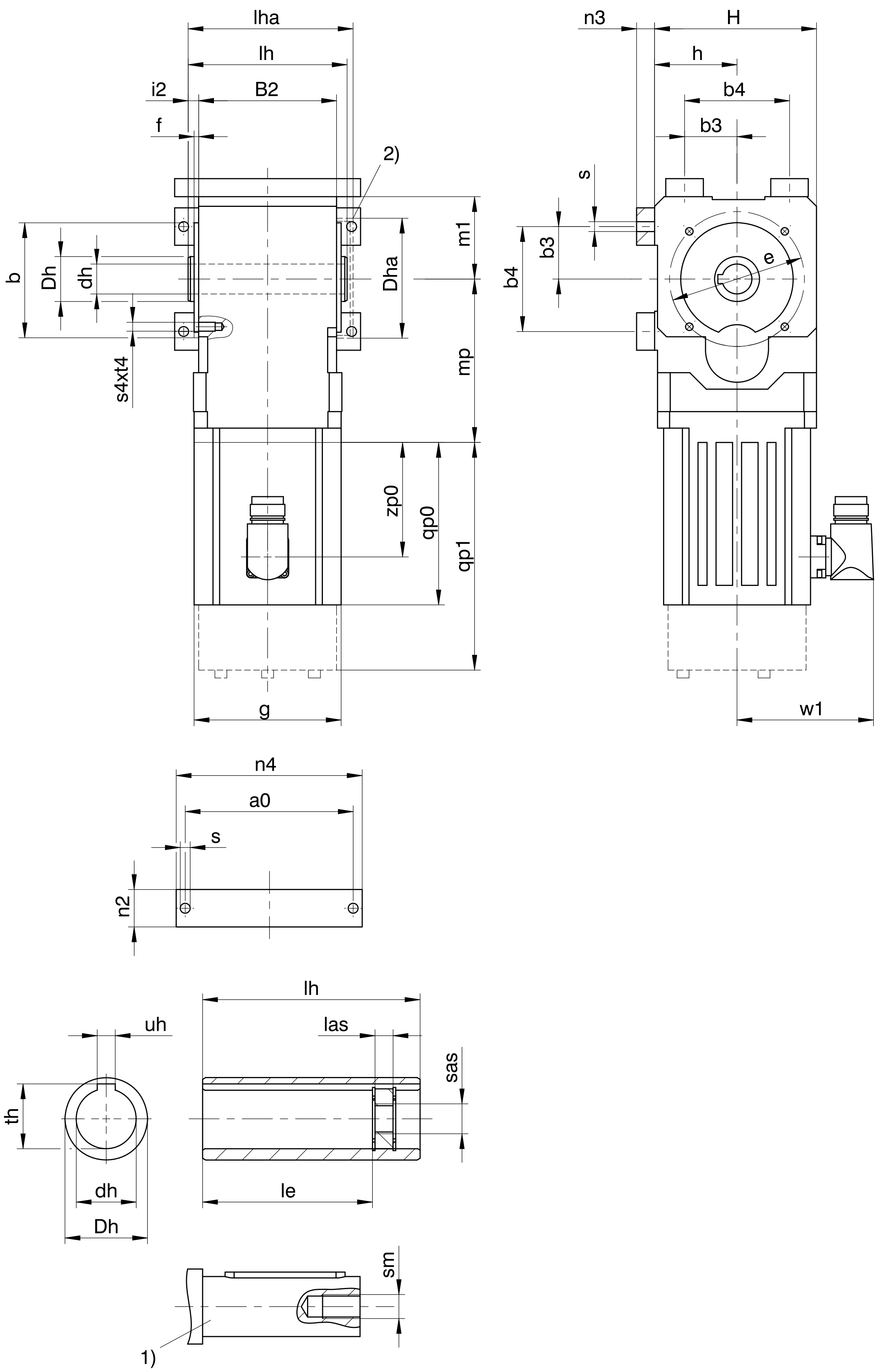
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.2 A shaft design (hollow shaft), NG housing design (base + pitch circle diameter)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.	2)	Cover (optional)

Dimensions of gear units

Type	a0	∅b	b3	b4	B2	∅dh	Dh	Dha	∅e	f	h	H	i2	le	lh	las	lha	m1	n2	n3	n4	∅s	s4	sm	sas	t4	th	uh
KL2	112	75_{j6}	35	70	92	20^{H7}	30	80	90	3	55	108	7	79.5	106	12	110	55	25	12	124	6.6	M6	M6	M8	13	22.8	6^{JS9}

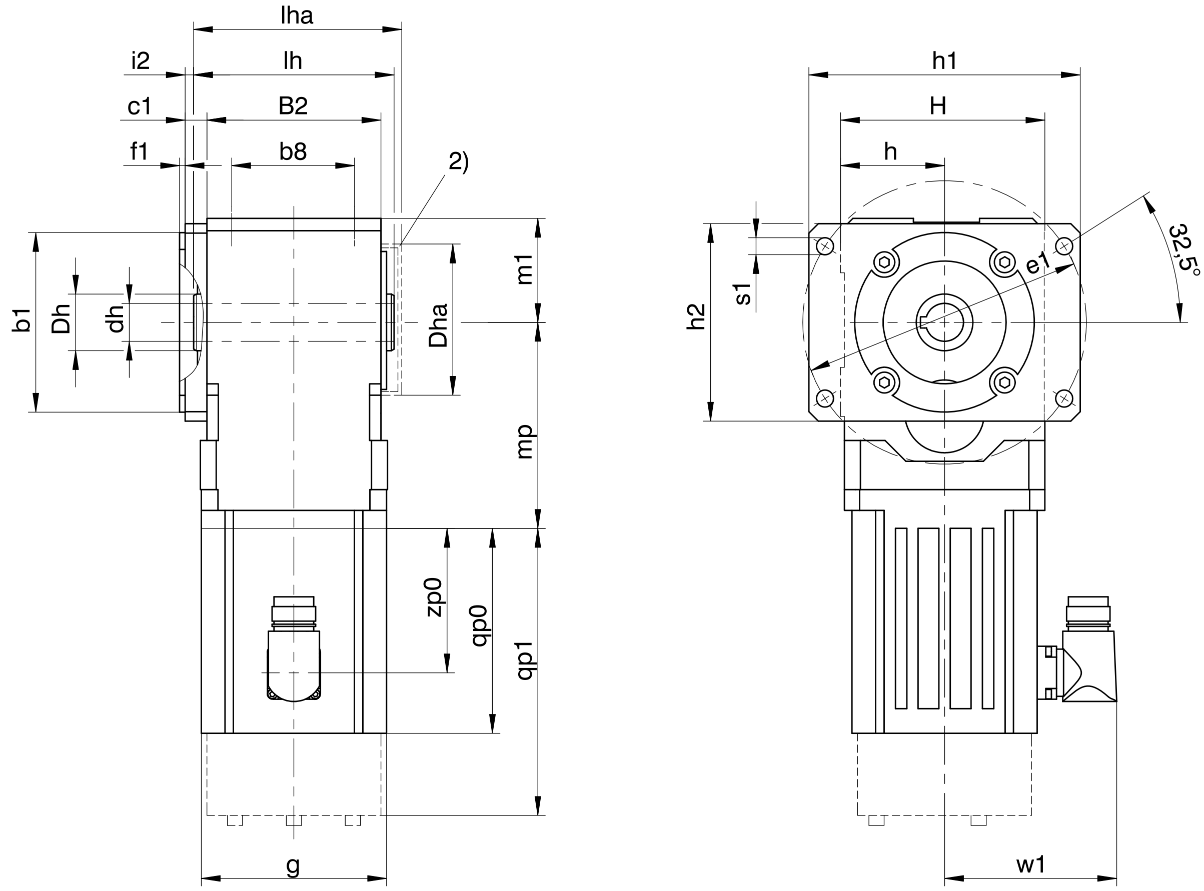
Dimensions of motors

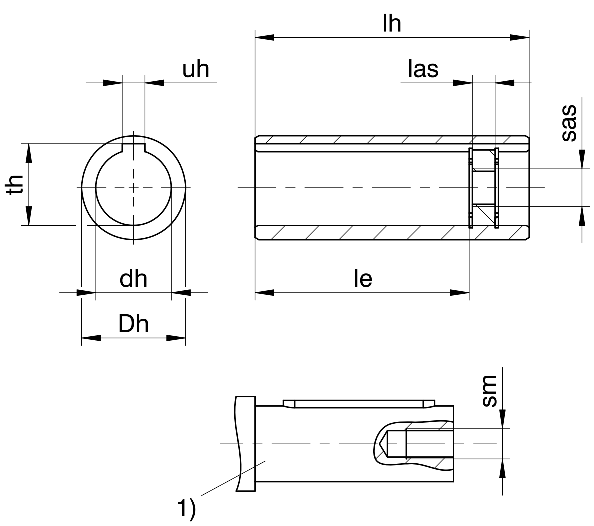
Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.3 A shaft design (hollow shaft), F housing design (flange)





qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.	2)	Cover (optional)

Dimensions of gear units

Type	∅b1	b8	B2	c1	∅dh	Dh	Dha	∅e1	f1	h	h1	h2	H	i2	le	lh	las	lha	m1	∅s1	sm	sas	th	uh
KL2	95_{j6}	65	92	11.5	20^{H7}	30	80	150	3	55	143.5	104.5	108	4.5	79.5	106	12	110	55	9	M6	M8	22.8	6^{JS9}

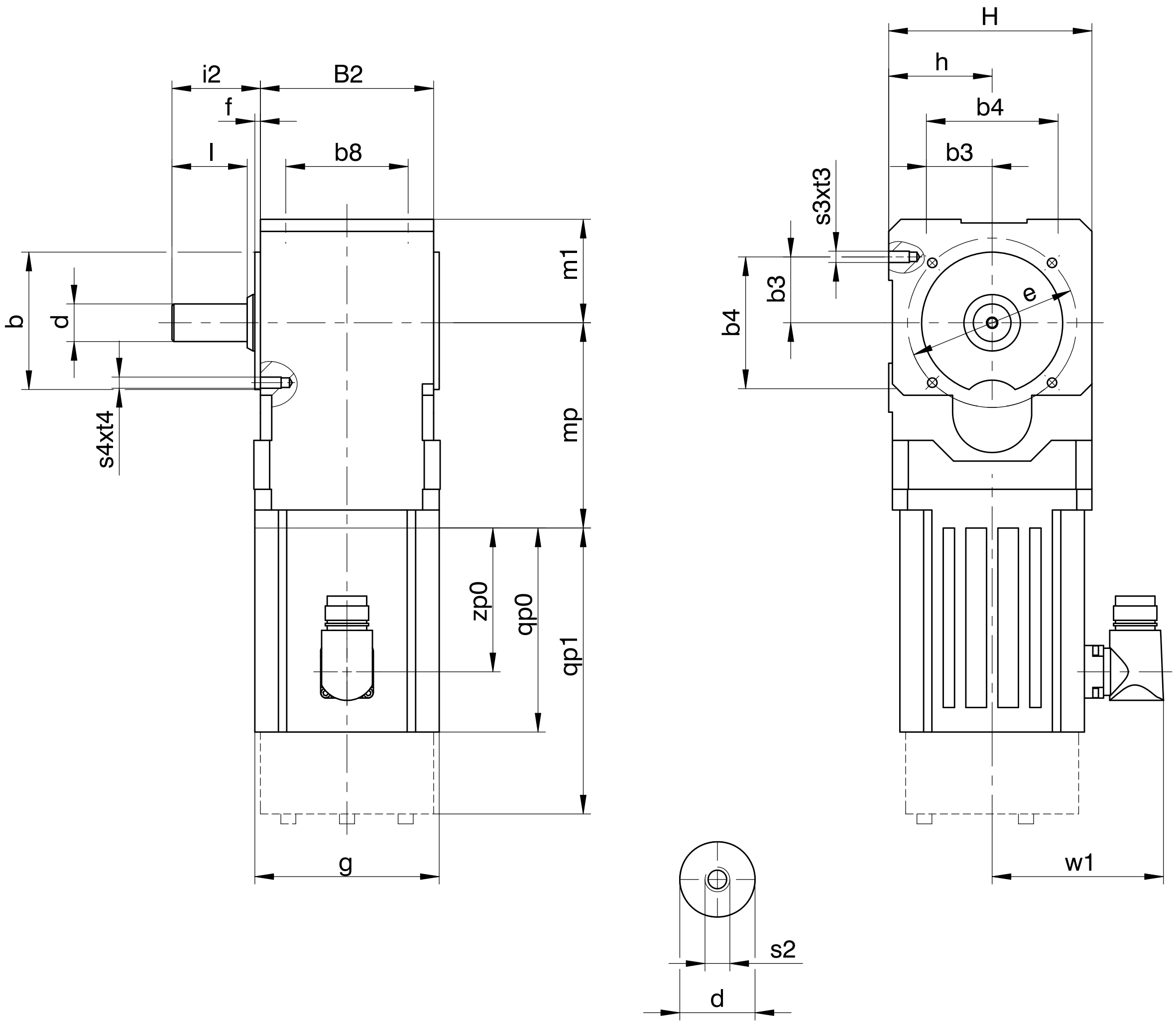
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.4 G shaft design (solid shaft without feather key), G housing design (pitch circle diameter)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	∅b	b3	b4	b8	B2	∅d	∅e	f	h	H	i2	l	m1	s2	s3	s4	t3	t4
KL2	75_{j6}	35	70	65	92	20_{k6}	90	3	55	108	47	40	55	M6	M6	M6	13	13

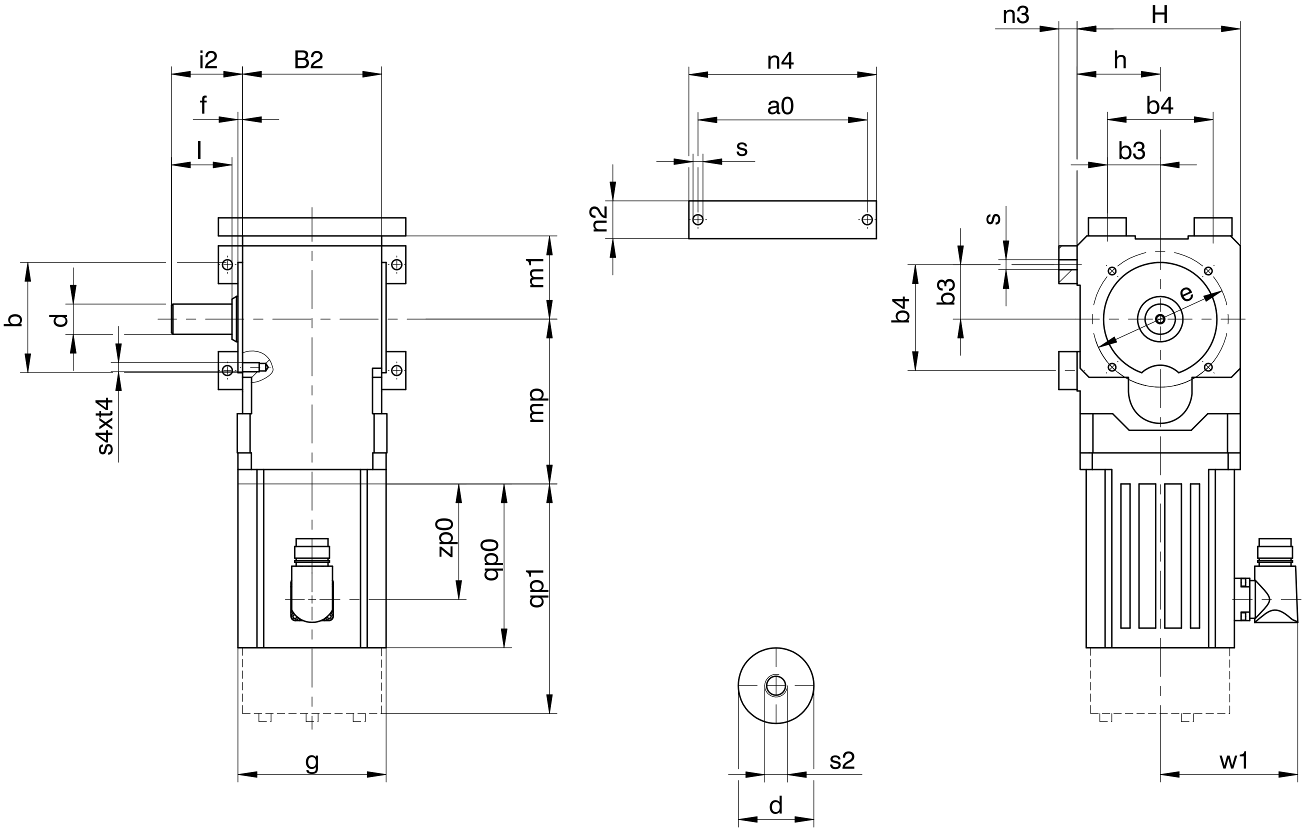
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.5 G shaft design (solid shaft without feather key), NG housing design (base + pitch circle diameter)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	a0	∅b	b3	b4	B2	∅d	∅e	f	h	H	i2	l	m1	n2	n3	n4	∅s	s2	s4	t4
KL2	112	75_{j6}	35	70	92	20_{k6}	90	3	55	108	47	40	55	25	12	124	6.6	M6	M6	13

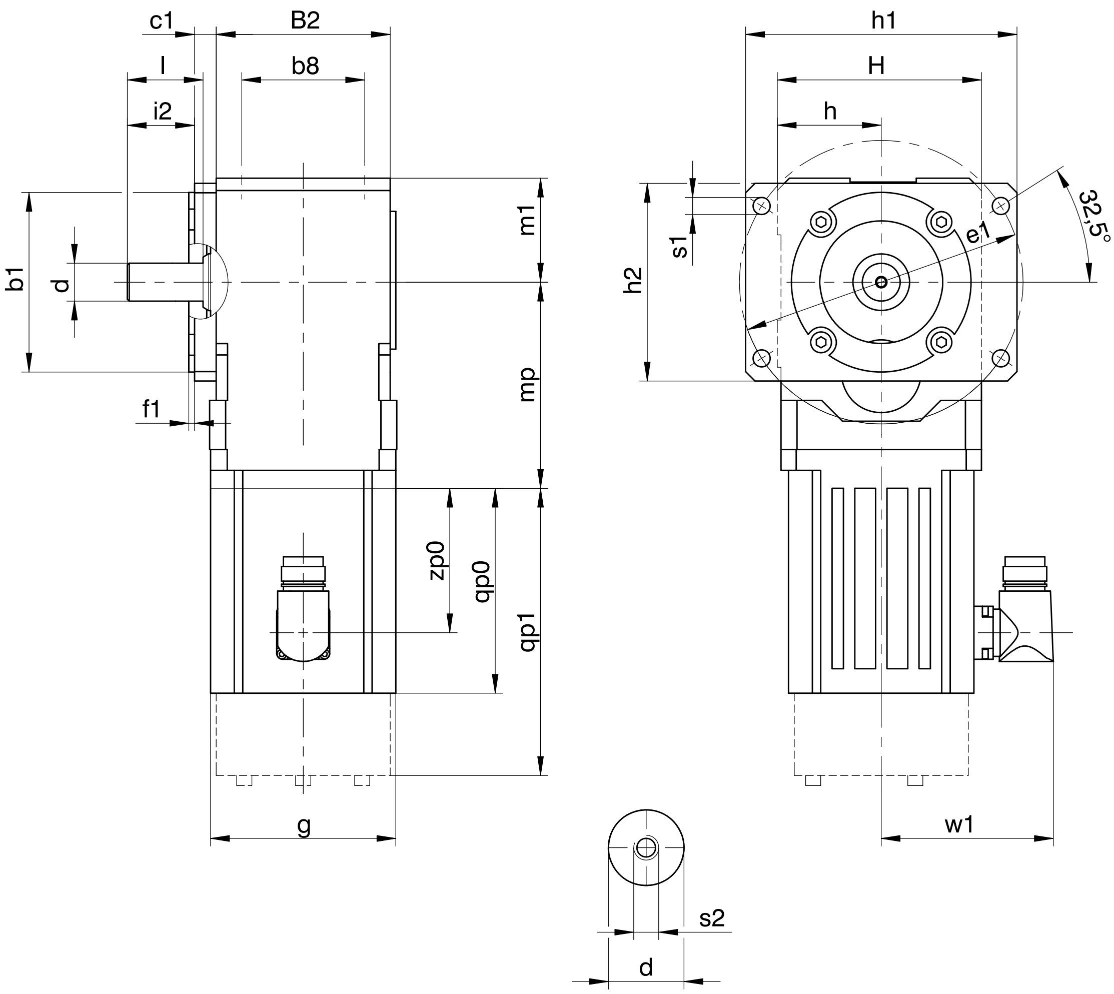
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.6 G shaft design (solid shaft without feather key), F housing design (flange)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	∅b1	b8	B2	c1	∅d	∅e1	f1	h	h1	h2	H	i2	l	m1	∅s1	s2
KL2	95_{j6}	65	92	11.5	20_{k6}	150	3	55	143.5	104.5	108	35.5	40	55	9	M6

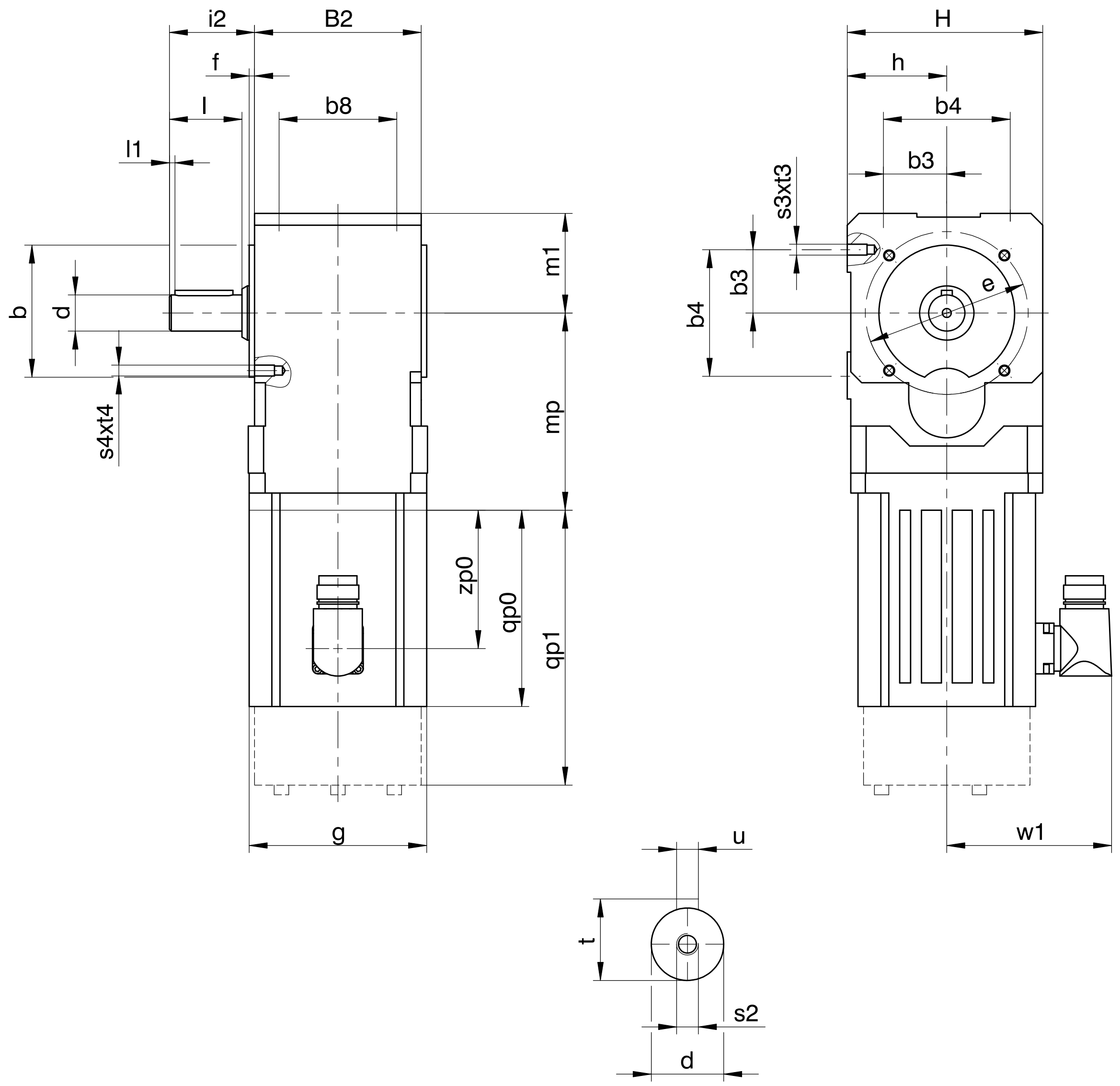
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.7 P shaft design (solid shaft with feather key), G housing design (pitch circle diameter)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	∅b	b3	b4	b8	B2	∅d	∅e	f	h	H	i2	l	l1	m1	s2	s3	s4	t	t3	t4	u
KL2	75_{j6}	35	70	65	92	20_{k6}	90	3	55	108	47	40	3	55	M6	M6	M6	22.5	13	13	A6×6×32

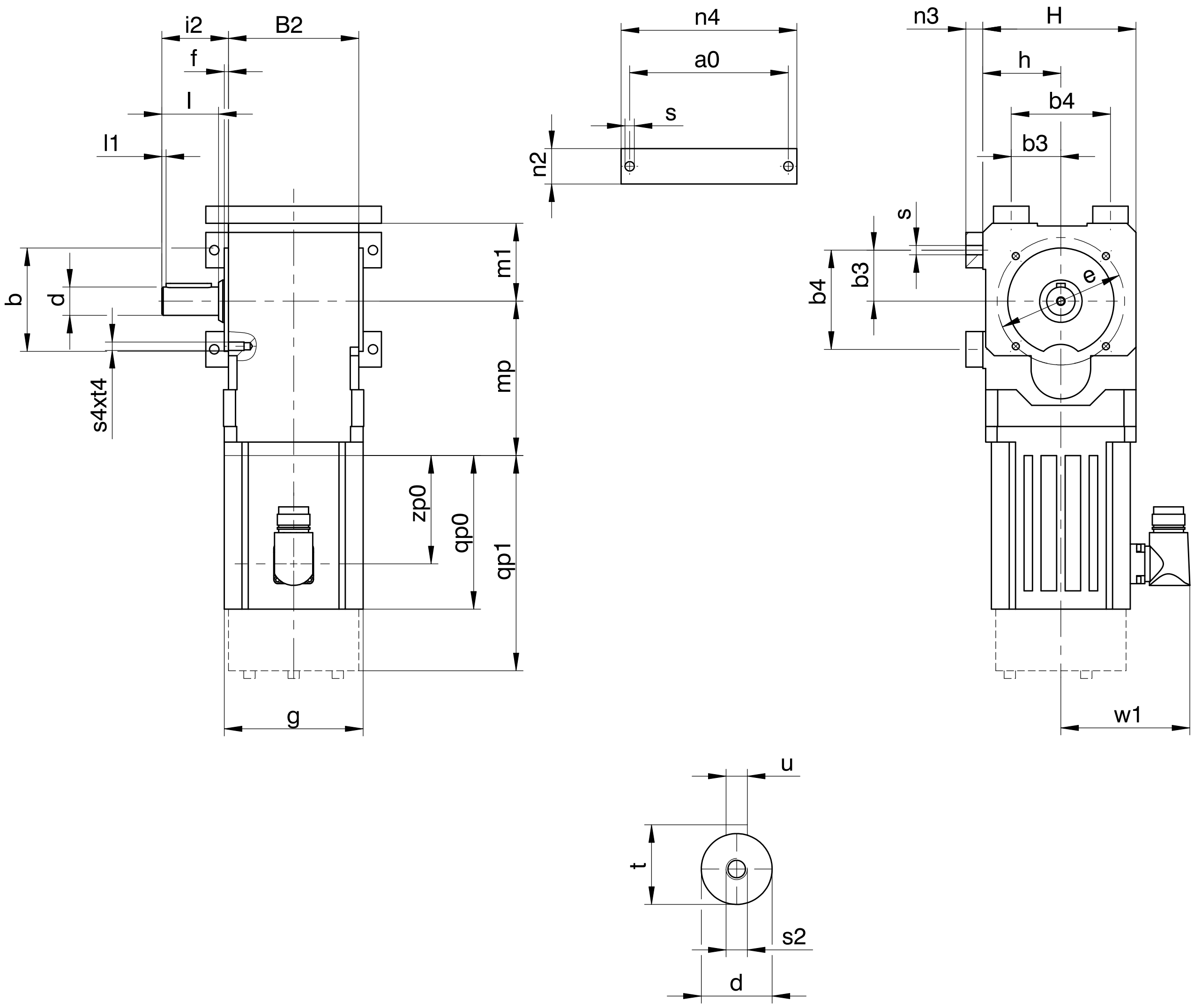
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.8 P shaft design (solid shaft with feather key), NG housing design (base + pitch circle diameter)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	a0	∅b	b3	b4	B2	∅d	∅e	f	h	H	i2	l	l1	m1	n2	n3	n4	∅s	s2	s4	t	t4	u
KL2	112	75_{j6}	35	70	92	20_{k6}	90	3	55	108	47	40	3	55	25	12	124	6.6	M6	M6	22.5	13	A6×6×32

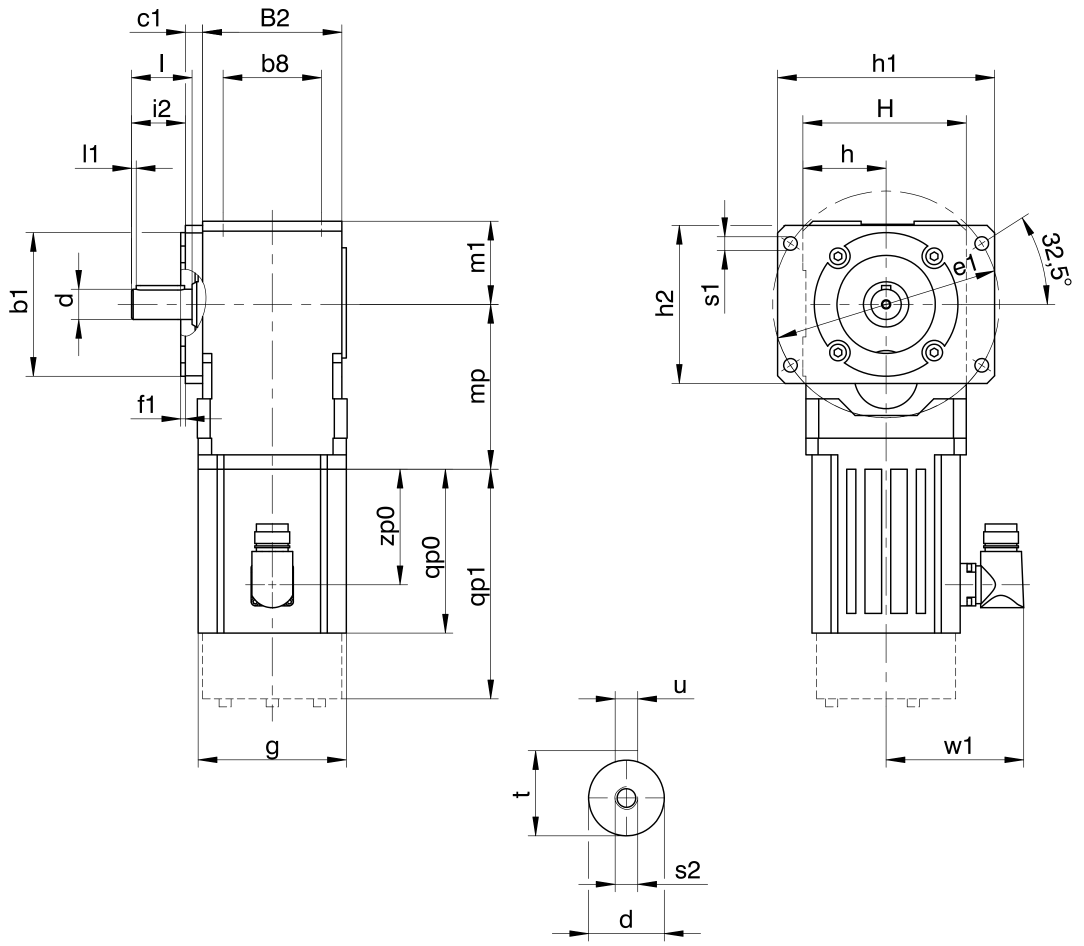
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.9 P shaft design (solid shaft with feather key), F housing design (flange)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	∅b1	b8	B2	c1	∅d	∅e1	f1	h	h1	h2	H	i2	l	l1	m1	∅s1	s2	t	u
KL2	95_{j6}	65	92	11.5	20_{k6}	150	3	55	143.5	104.5	108	35.5	40	3	55	9	M6	22.5	A6×6×32

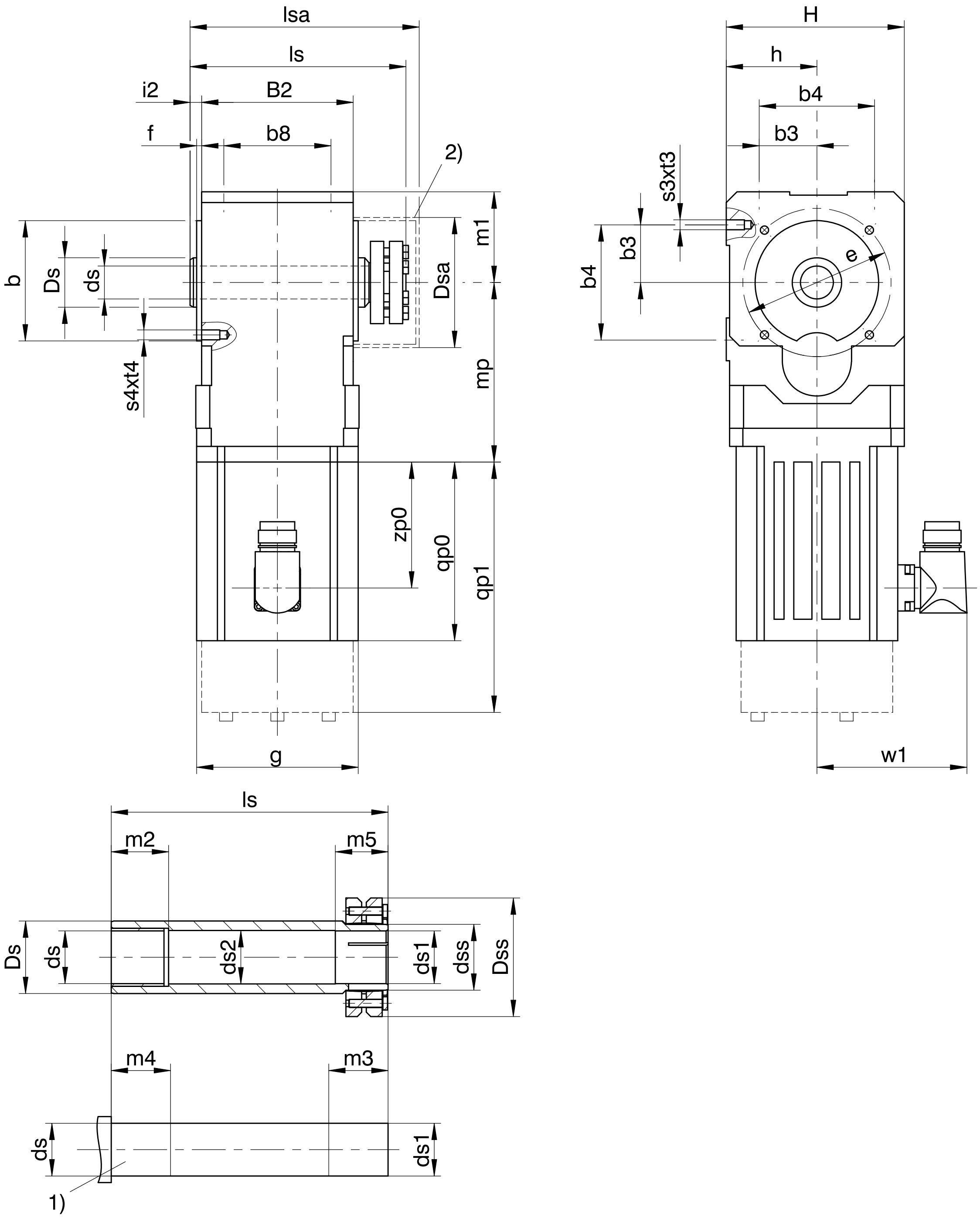
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.10 S shaft design (hollow shaft with shrink disk), G housing design (pitch circle diameter)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)

Dimensions of gear units

Type	Øb	b3	b4	b8	B2	Øds	Øds1	Øds2	Ødss	ØDs	ØDsa	ØDss	Øe	f	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	s3	s4	t3	t4
KL2	75_{j6}	35	70	65	92	20^{H7}	20_{h6}^{H7}	21.5	24	30	79	50	90	3	55	108	7	131	139	55	22	27	31	26	M6	M6	13	13

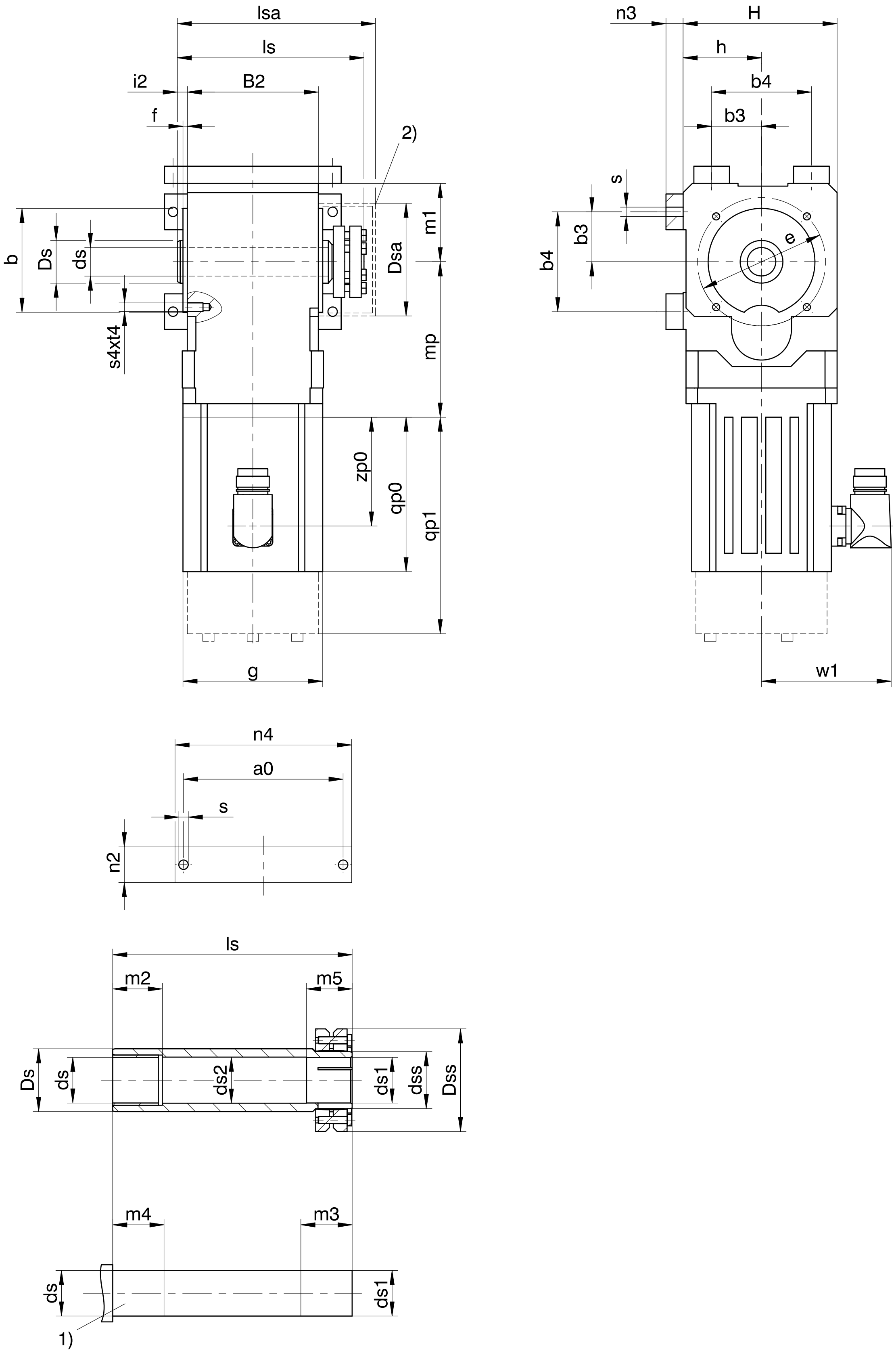
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4 mp
KL202	109

11.3.11 S shaft design (hollow shaft with shrink disk), NG housing design (base + pitch circle diameter)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)

Dimensions of gear units

Type	a0	∅b	b3	b4	B2	∅ds	∅ds1	∅ds2	∅dss	∅Ds	∅Dsa	∅Dss	∅e	f	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	n2	n3	n4	∅s	s4	t4
KL2	112	75_{j6}	35	70	92	20^{H7}	20_{h6}^{H7}	21.5	24	30	79	50	90	3	55	108	7	131	139	55	22	27	31	26	25	12	124	6.6	M6	13

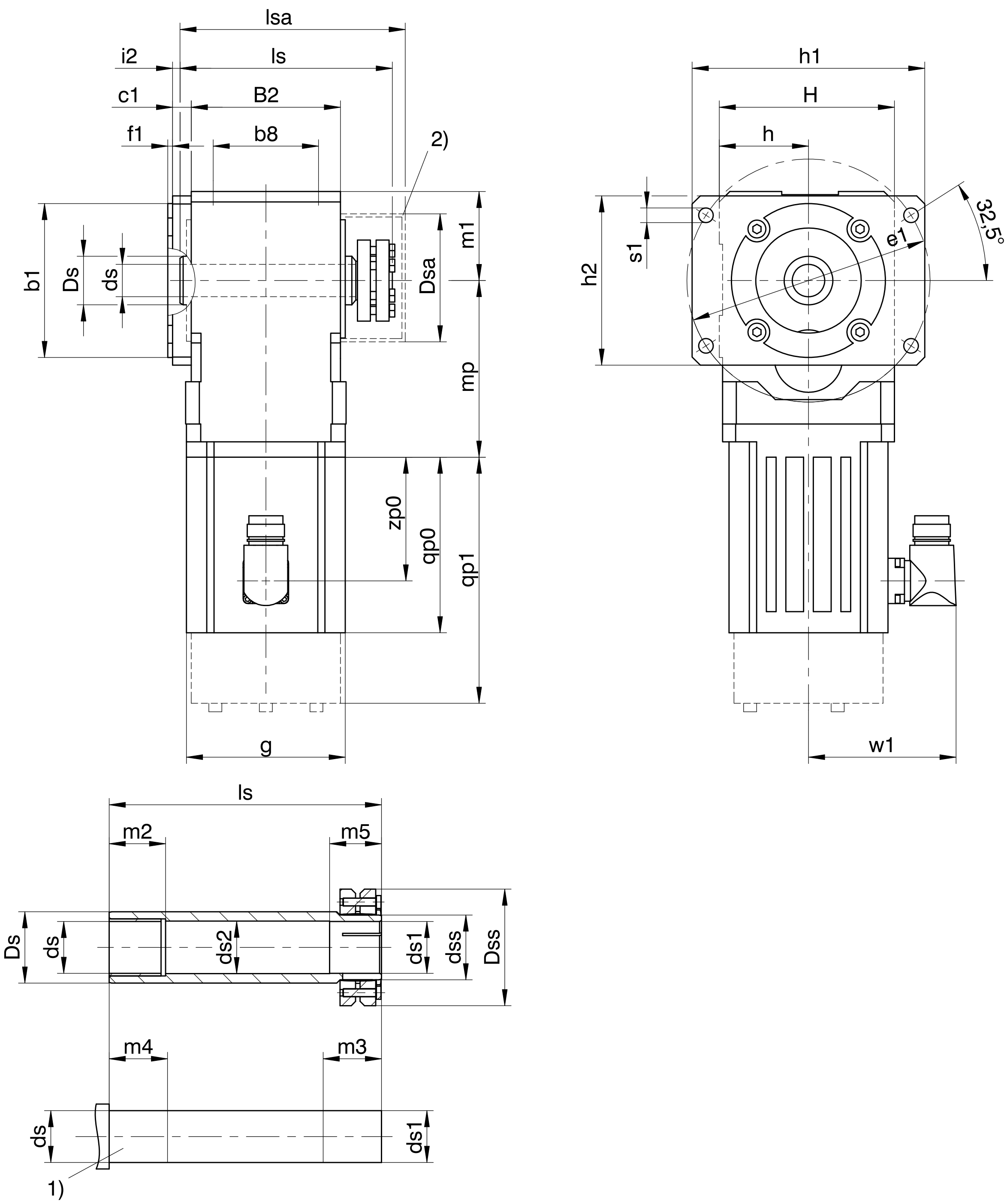
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4
	mp
KL202	109

11.3.12 S shaft design (hollow shaft with shrink disk), F housing design (flange)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.	2)	Cover (optional)

Dimensions of gear units

Type	Øb1	b8	B2	c1	Øds	Øds1	Øds2	Ødss	ØDs	ØDsa	ØDss	Øe1	f1	h	h1	h2	H	i2	ls	lsa	m1	m2	m3	m4	m5	Øs1
KL2	95_{j6}	65	92	11.5	20^{H7}	20_{h6}^{H7}	21.5	24	30	79	50	150	3	55	143.5	104.5	108	4.5	131	139	55	22	27	31	26	9

Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152	91	76.5
LM402U	98	147.5	191	91	115.5
LM403U	98	178.5	222	91	146.5

Dimensions of geared motors

Type	LM4 mp
KL202	109

11.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

KL	2	0	2	P	G	0080	LM401U

Explanation

Code	Designation	Design
KL	Type	Helical bevel gear unit
2	Size	2 (example)
0	Generation	Generation 0
2	Stages	Two-stage
A	Shaft	Hollow shaft with keyway
S		Hollow shaft with shrink ring
G		Solid shaft without feather key
P		Solid shaft with feather key
G	Housing	Pitch circle diameter
F		Flange
NG		Foot + pitch circle diameter
0080	Transmission ratio (i x 10)	i = 8 (example)
LM401U	Motor	LM Lean motor

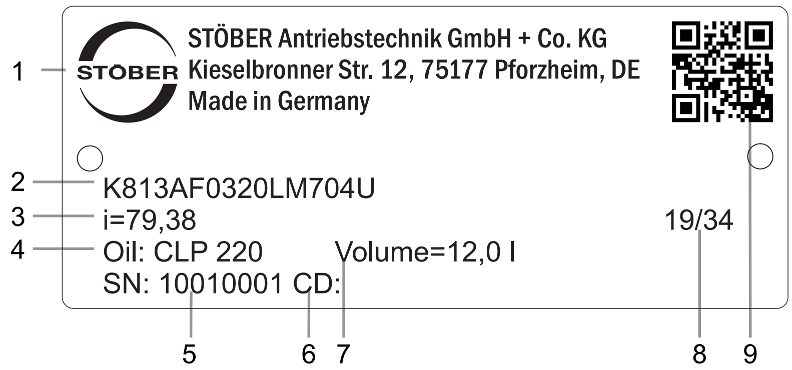
In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▹ 2]
- Attachment of solid shaft: gear unit side 3 or 4; solid shaft on both sides
- Attachment of hollow shaft with keyway: insertion side 3 or 4
- Attachment of hollow shaft with shrink ring: shrink ring on gear unit side 3 or 4
- Attachment of foot plates: gear unit side 1 or 5
- Attachment of flange: gear unit side 3 or 4
- Pitch circle diameter: gear unit side 3 or 4
- The position of the plug connector, see the chapter [▹ 11.5.7]

An explanation of the gear unit sides can be found in the chapter [▹ 11.5.5].

11.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Lubricant specification
5	Serial number of the gear unit
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

11.4.1.1 Supporting documents

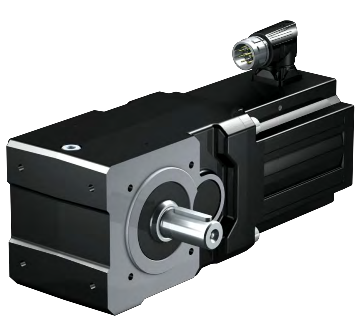
You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

11.5 Product description

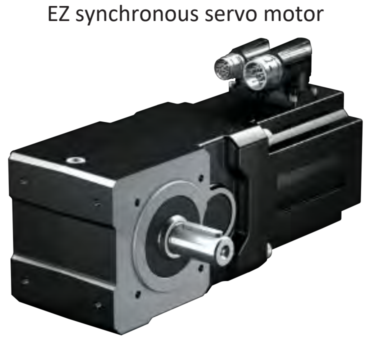
11.5.1 Input options

LM Lean motor



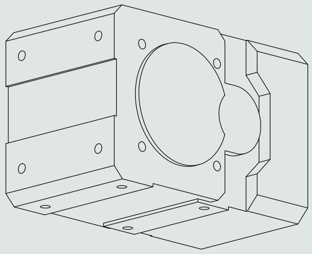
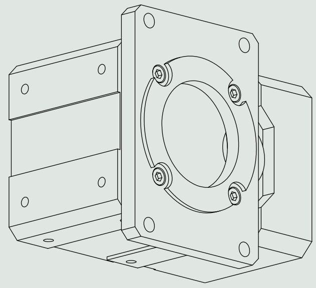
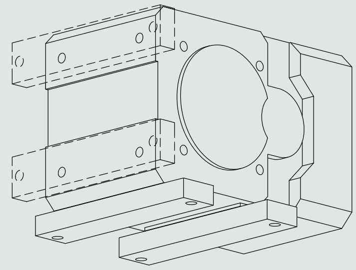
http://www.stoeber.de/en/KLLM

EZ synchronous servo motor



http://www.stoeber.de/en/KLEZ

11.5.2 Housing design

Pitch circle diameter G	Flange F	Foot + pitch circle diameter NG
		

	G	F	NG
KL1	✓	✓	✓
KL2	✓	✓	✓

11.5.3 Combinatorial shaft/housing design

		Housing design		
Shaft design	**Code**	**G**	**F**	**NG**
Hollow shaft with keyway	**A**	AG	AF	ANG
Hollow shaft with shrink ring	**S**	SG	SF	SNG
Solid shaft without feather key	**G**	GG	GF	GNG
Solid shaft with feather key	**P**	PG	PF	PNG

11.5.4 Installation conditions

Hollow shaft

The hollow shaft hole tolerance is ISO H7. The tolerance of the machine shaft must be ISO k6.

Take care to align the machine shaft with the gear unit hollow shaft when attaching the gear unit.

Maximum deviation ≤ 0.03 mm.

For simpler assembly and disassembly of the machine shaft, the hollow shafts are equipped with a spiral groove (as a grease deposit).

A hardened, threaded keeper plate is included in the scope of delivery. You also have the option to order the hollow shaft without a keeper plate.

Hollow shaft with shrink ring

The tolerance of the hollow shaft hole is ISO H7.

The machine shaft must be ISO h9.

Select a material for the machine shaft with a permitted surface pressure of p ≥ 325 N/mm^2.

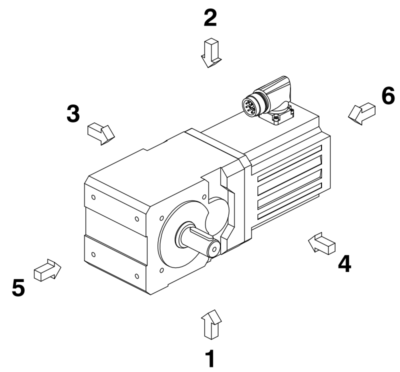
Possible materials:

- C45E +QT
- 42CrMo4

Fastening the gear units on the machine side using the pitch circle diameter

The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

11.5.5 Gear unit sides



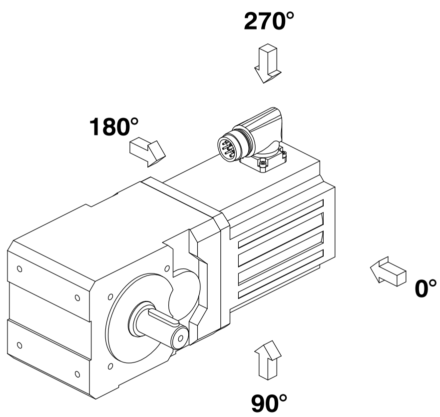
The numbers identify the gear unit sides.

11.5.6 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate.

You will receive lubricants for use in the food industry upon request.

11.5.7 Position of the plug connector



In the standard version, the plug connector is attached in the 270° position.

Indicate variations for your geared motor in the purchase order.

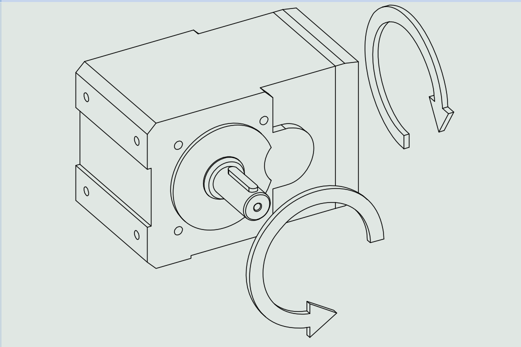
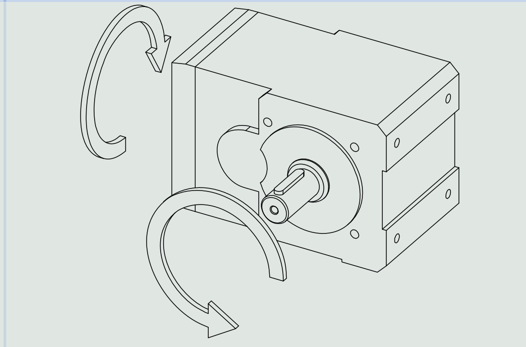
11.5.8 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} two-stage	97%
Protection class:[1]	
Gear unit	IP65
Motor	IP56, optionally IP66

[1] Observe the protection class of all the components.

11.5.9 Direction of rotation

Solid shaft (P and G), solid shaft on both sides (P and G), hollow shaft with keyway (A)

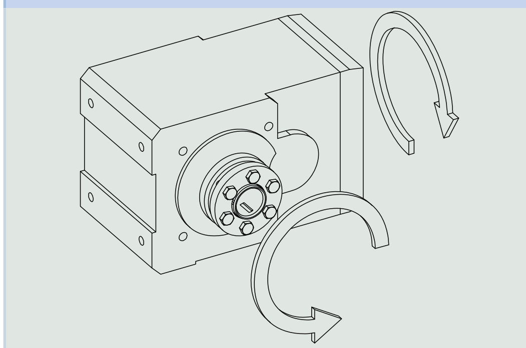
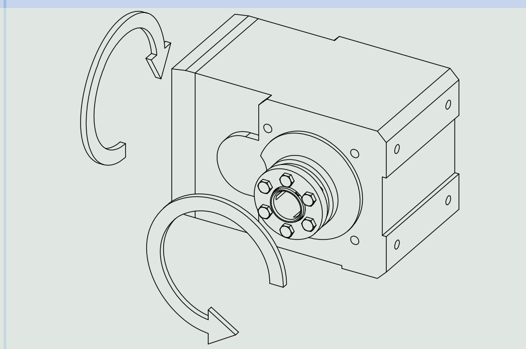
Output side 4	Output side 3
	

The specified directions of rotation also apply to gear units with hollow shaft (A) if the entry side of the machine shaft corresponds to the side of the solid shaft that is shown.

The direction of rotation for the shaft design of a solid shaft on both sides corresponds to the direction of rotation for output side 4.

The pictures show mounting position EL1.

Hollow shaft with shrink ring (S)

Shrink ring side 4	Shrink ring side 3
	

The pictures show mounting position EL1.

11.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

11.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

$$n_{1m^*} \leq \frac{n_{1maxDB}}{fB_T}$$

$$n_{1max^*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

$$M_{2acc^*} \leq \frac{M_{2acc}}{fB_{ZB}}$$

$$M_{2NOT^*} \leq M_{2NOT}$$

$$M_{2eq^*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

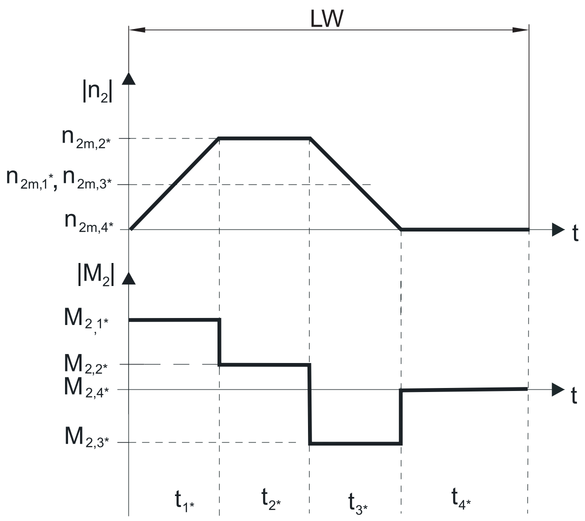
The values for n_{1maxDB}, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S can be found in the selection tables.

The values for fB_T, fB_{op}, fB_t and fB_{ZB} can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m^*} = n_{2m^*} \cdot i$$

$$n_{2m^*} = \frac{|n_{2m,1^*}| \cdot t_{1^*} + ... + |n_{2m,n^*}| \cdot t_{n^*}}{t_{1^*} + ... + t_{n^*}}$$

If t_{1^*} + ... + $t_{3^*} \geq 6$ min, calculate n_{2m^*} without the rest phase t_{4^*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff^*} = \sqrt{\frac{t_{1^*} \cdot M_{2,1^*}{}^2 + ... + t_{n^*} \cdot M_{2,n^*}{}^2}{t_{1^*} + ... + t_{n^*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |M_{2,1^*}{}^3| + ... + |n_{2m,n^*}| \cdot t_{n^*} \cdot |M_{2,n^*}{}^3|}{|n_{2m,1^*}| \cdot t_{1^*} + ... + |n_{2m,n^*}| \cdot t_{n^*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m^*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m^*} accordingly or select another geared motor size.)

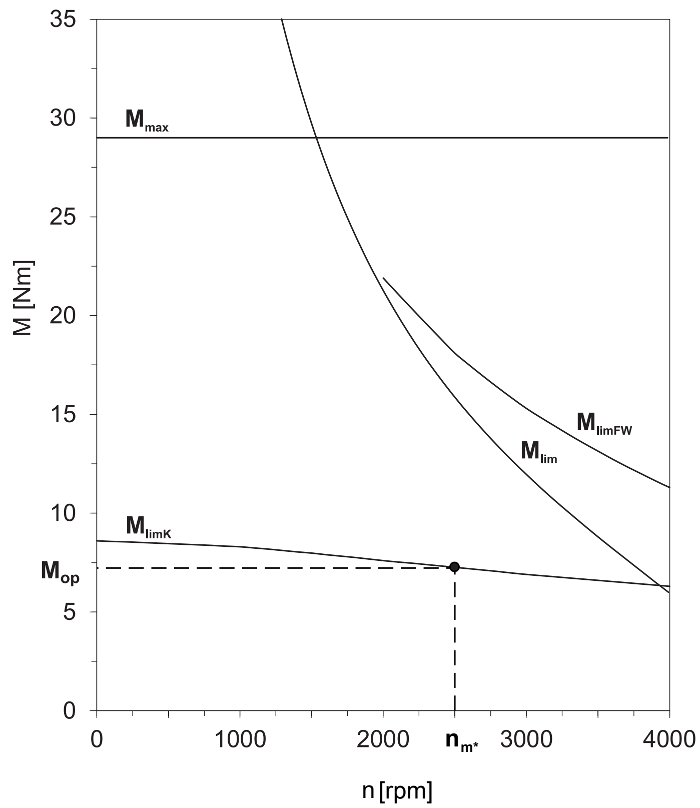
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}9 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m^*}}{1000}\right)^2$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▶ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.25
Reversing load cyclic operation	1.40

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Cyclic operation	fB_{ZB}
≤ 1000 load changes/hour (LW/h)	1.00
> 1000 load changes/hour (LW/h)	1.15

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

11.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m^*} \leq 100$ rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

11.6.2.1 G and P shaft designs

Permitted shaft loads for G and P shaft designs (solid shaft)

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
KL1	20.0	380	1900	1900	68	68
KL2	22.0	560	2800	2800	118	118

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds $n_{2m^*} > 100$ rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m^*}}{100\ \text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

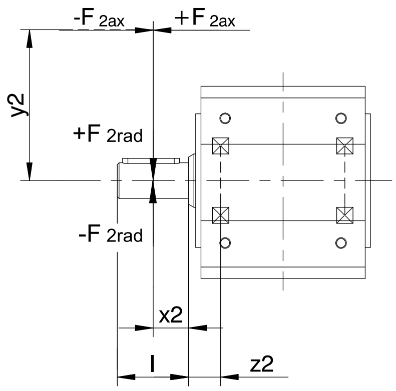


Fig. 1: Force application points for solid shaft

The specified values for $F_{2rad100}$ refer to force application on the center of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k^*} = \frac{2 \cdot F_{2ax^*} \cdot y_2 + F_{2rad^*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2rad^*} \leq F_{2radN}$$

$$F_{2ax^*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

11.6.2.2 A and S shaft design

Permitted shaft loads for A shaft design (hollow shaft with keyway)

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
KL1	18.5	250	1250	1250	43	43
KL2	22.0	560	2800	2800	118	118

Permitted shaft loads for S shaft design (hollow shaft with shrink ring)

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
KL1	18.5	250	1250	1250	43	43
KL2	22.0	560	2800	2800	118	118

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

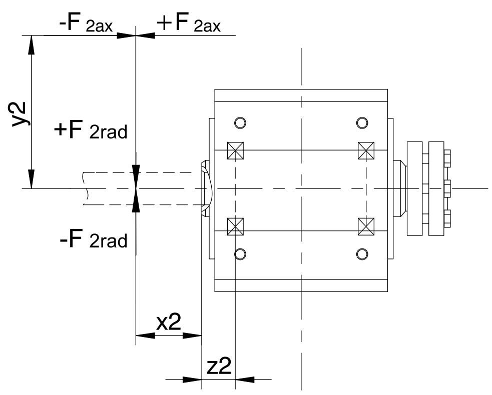


Fig. 2: Force application points for hollow shaft

You can determine the permitted radial forces from the permitted breakdown torque M_{2kN}. The actual radial forces may not exceed the permitted radial forces. The permitted radial forces pertain to the shaft end (x2 = 0).

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \le M_{2kN}$$

$$F_{2ax*} \le F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

11.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

11.7 Additional documentation

Additional documentation related to the product can be found at
http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for KL/KS/PHK/PHKX/PHQK/PK/PKX right-angle servo gear units and right-angle servo geared motors	443150_en

12 K helical bevel geared motors

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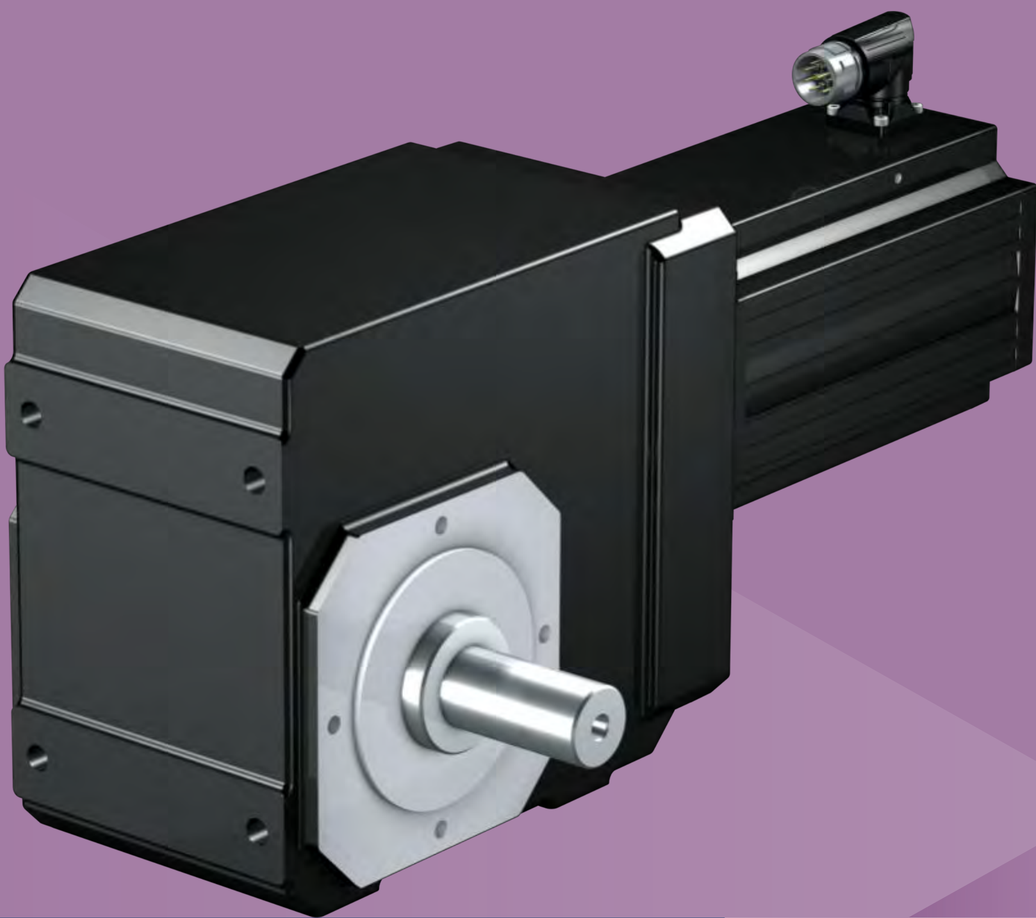


12 Helical bevel geared motors

K

12.1 Overview

Highly rigid helical-geared right-angle geared motor

Features

Power density	★★☆☆☆
Backlash	★★★☆☆
Price category	€€
Shaft load	★★★☆☆
Smooth operation	★★★☆☆
Torsional stiffness	★★☆☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free (K1 – K4)	✓
FKM seal ring at the input	✓
Reinforced output bearing (K5 – K8)	✓ (on request)
Compact and dynamic due to direct motor attachment	✓

Key ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	4 – 294
M_{2acc}	17 – 6820 Nm
$\Delta\phi_2$	1.5 – 12 arcmin
η_{get}	94 – 97 %

12.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors
- Weight specification for mounting position EL1, housing design G

For all other technical data, refer to http://configurator.stoeber.de.

An explanation of the formula symbols can be found in the Chapter [14.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
K1 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																		
64	102	111	13	0.99	K102_0470 LM401U	120	200	46.92	2299/49	4000	4000	7000	1.7	12	6.0	–	6.8	14
85	77	83	11	1.4	K102_0350 LM401U	140	190	35.11	3686/105	4000	4000	7000	1.7	12	6.0	–	6.8	14
89	74	79	16	0.99	K102_0340 LM401U	88	150	33.71	4719/140	4000	4000	7000	1.7	12	6.0	–	6.8	14
107	61	66	11	1.6	K102_0280 LM401U	120	170	28.05	589/21	4000	4000	7000	1.7	12	6.0	–	6.8	14
107	120	122	22	0.83	K102_0280 LM402U	140	240	28.05	589/21	4000	4000	7000	3.1	12	6.0	–	6.8	16
119	55	59	12	1.7	K102_0250 LM401U	110	140	25.22	1261/50	4000	4000	7000	1.7	12	6.0	–	6.8	14
119	108	110	23	0.89	K102_0250 LM402U	120	190	25.22	1261/50	4000	4000	7000	3.1	12	6.0	–	6.8	16
129	51	55	12	1.8	K102_0230 LM401U	100	160	23.27	1140/49	4000	4000	7000	1.8	12	6.0	–	6.8	14
129	100	102	23	0.93	K102_0230 LM402U	140	240	23.27	1140/49	4000	4000	7000	3.1	12	6.0	–	6.8	16
149	44	47	12	2.0	K102_0200 LM401U	88	120	20.15	403/20	4000	4000	7000	1.7	12	6.0	–	6.8	14
149	86	88	23	1.0	K102_0200 LM402U	130	220	20.15	403/20	4000	4000	7000	3.1	12	6.0	–	6.8	16
171	38	41	12	2.2	K102_0175 LM401U	77	130	17.56	2090/119	4000	4000	6000	1.8	12	6.0	–	6.8	14
171	75	77	23	1.1	K102_0175 LM402U	140	240	17.56	2090/119	4000	4000	6000	3.1	12	6.0	–	6.8	16
171	103	105	32	0.82	K102_0175 LM403U	140	240	17.56	2090/119	4000	4000	6000	4.4	12	6.0	–	6.8	17
179	36	39	12	2.3	K102_0165 LM401U	73	110	16.71	117/7	4000	4000	7000	1.8	12	6.0	–	6.8	14
179	71	73	23	1.2	K102_0165 LM402U	130	220	16.71	117/7	4000	4000	7000	3.1	12	6.0	–	6.8	16
179	98	100	32	0.85	K102_0165 LM403U	130	220	16.71	117/7	4000	4000	7000	4.4	12	6.0	–	6.8	17
213	31	33	12	2.6	K102_0140 LM401U	62	100	14.11	494/35	4000	4000	6000	1.9	12	6.0	–	6.8	14
213	60	62	24	1.3	K102_0140 LM402U	130	240	14.11	494/35	4000	4000	6000	3.2	12	6.0	–	6.8	16
213	83	85	33	0.95	K102_0140 LM403U	140	240	14.11	494/35	4000	4000	6000	4.5	12	6.0	–	6.8	17
238	28	30	13	2.7	K102_0125 LM401U	55	92	12.62	429/34	4000	4000	6000	1.8	12	6.0	–	6.8	14
238	54	55	24	1.4	K102_0125 LM402U	120	220	12.62	429/34	4000	4000	6000	3.2	12	6.0	–	6.8	16
238	74	76	33	1.0	K102_0125 LM403U	130	220	12.62	429/34	4000	4000	6000	4.5	12	6.0	–	6.8	17
259	25	27	14	2.7	K102_0115 LM401U	51	84	11.57	266/23	3600	3600	5500	1.9	12	6.0	–	6.8	14
259	49	50	24	1.5	K102_0115 LM402U	110	240	11.57	266/23	3600	3600	5500	3.3	12	6.0	–	6.8	16
259	68	69	33	1.1	K102_0115 LM403U	140	240	11.57	266/23	3600	3600	5500	4.5	12	6.0	–	6.8	17
296	22	24	15	2.7	K102_0100 LM401U	44	74	10.14	507/50	4000	4000	6000	1.9	12	6.0	–	6.8	14
296	43	44	24	1.6	K102_0100 LM402U	95	220	10.14	507/50	4000	4000	6000	3.2	12	6.0	–	6.8	16
296	60	61	33	1.2	K102_0100 LM403U	130	220	10.14	507/50	4000	4000	6000	4.5	12	6.0	–	6.8	17
324	20	22	16	2.7	K102_0092 LM401U	40	67	9.249	1748/189	3600	3600	5500	2.0	12	6.0	–	6.8	14
324	40	40	25	1.7	K102_0092 LM402U	87	240	9.249	1748/189	3600	3600	5500	3.3	12	6.0	–	6.8	16
324	54	56	34	1.3	K102_0092 LM403U	120	240	9.249	1748/189	3600	3600	5500	4.6	12	6.0	–	6.8	17
324	85	90	53	0.80	K102_0092 LM503U	130	240	9.249	1748/189	3600	3600	5500	11	12	6.0	–	6.8	20
361	18	20	17	2.7	K102_0083 LM401U	36	60	8.309	1911/230	3600	3600	5500	2.0	12	6.0	–	6.8	14
361	36	36	25	1.9	K102_0083 LM402U	78	220	8.309	1911/230	3600	3600	5500	3.3	12	6.0	–	6.8	16
361	49	50	34	1.4	K102_0083 LM403U	100	220	8.309	1911/230	3600	3600	5500	4.6	12	6.0	–	6.8	17
361	76	81	53	0.86	K102_0083 LM503U	120	220	8.309	1911/230	3600	3600	5500	11	12	6.0	–	6.8	20
452	15	16	20	2.7	K102_0066 LM401U	29	48	6.644	299/45	3600	3600	5500	2.1	12	6.0	–	6.8	14
452	28	29	25	2.2	K102_0066 LM402U	63	190	6.644	299/45	3600	3600	5500	3.4	12	6.0	–	6.8	16
452	39	40	35	1.6	K102_0066 LM403U	83	190	6.644	299/45	3600	3600	5500	4.7	12	6.0	–	6.8	17
452	61	65	54	1.0	K102_0066 LM503U	120	190	6.644	299/45	3600	3600	5500	11	12	6.0	–	6.8	20
500	26	26	25	2.3	K102_0060 LM402U	56	170	6.000	6/1	3300	3300	5000	3.5	12	6.0	–	6.8	16
500	35	36	35	1.7	K102_0060 LM403U	75	170	6.000	6/1	3300	3300	5000	4.8	12	6.0	–	6.8	17
500	55	59	55	1.1	K102_0060 LM503U	110	170	6.000	6/1	3300	3300	5000	11	12	6.0	–	6.8	20
539	12	13	23	2.7	K102_0056 LM401U	24	40	5.568	1520/273	3300	3300	5000	2.3	12	6.0	–	6.8	14
539	24	24	26	2.4	K102_0056 LM402U	52	160	5.568	1520/273	3300	3300	5000	3.7	12	6.0	–	6.8	16
539	33	33	35	1.8	K102_0056 LM403U	69	160	5.568	1520/273	3300	3300	5000	5.0	12	6.0	–	6.8	17
539	51	54	55	1.1	K102_0056 LM503U	110	160	5.568	1520/273	3300	3300	5000	11	12	6.0	–	6.8	20
750	8.7	9.4	30	2.7	K102_0040 LM401U	17	29	4.000	4/1	3300	3300	5000	2.5	12	6.0	–	6.8	14
750	17	17	26	3.0	K102_0040 LM402U	38	120	4.000	4/1	3300	3300	5000	3.9	12	6.0	–	6.8	16
750	24	24	36	2.2	K102_0040 LM403U	50	120	4.000	4/1	3300	3300	5000	5.2	12	6.0	–	6.8	17

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
K1 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 140 Nm)																		
750	37	39	57	1.4	K102_0040 LM503U	79	120	4.000	4/1	3300	3300	5000	11	12	6.0	–	6.8	20
750	53	60	82	0.97	K102_0040 LM505U	93	120	4.000	4/1	3300	3300	5000	18	12	6.0	–	6.8	25
K2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 220 Nm)																		
33	195	211	8.3	1.0	K203_0910 LM401U	220	400	90.79	46483/512	4000	4000	6500	1.7	10	6.0	2.5	11	25
38	171	185	8.0	1.2	K203_0800 LM401U	220	400	79.62	26273/330	4000	4000	6500	1.7	10	6.0	2.5	11	25
44	147	159	7.7	1.4	K203_0680 LM401U	220	400	68.42	26273/384	4000	4000	6500	1.7	10	6.0	2.5	11	25
45	142	153	7.7	1.4	K203_0660 LM401U	220	400	66.03	46483/704	4000	4000	6500	1.7	10	6.0	2.5	11	25
54	121	131	9.3	1.3	K202_0560 LM401U	190	280	55.54	1333/24	4000	4000	6500	1.7	10	5.0	1.5	11	22
55	117	126	7.3	1.7	K203_0540 LM401U	220	350	54.25	135407/2496	4000	4000	6500	1.8	10	6.0	2.5	11	25
60	107	116	7.1	1.9	K203_0500 LM401U	210	320	49.76	26273/528	4000	4000	6500	1.7	10	6.0	2.5	11	25
60	210	214	14	0.95	K203_0500 LM402U	220	320	49.76	26273/528	4000	4000	6500	3.1	10	6.0	2.5	11	26
65	101	109	7.1	2.0	K202_0460 LM401U	200	260	46.23	1849/40	4000	4000	6500	1.7	10	5.0	1.5	11	22
65	198	202	14	1.0	K202_0460 LM402U	220	400	46.23	1849/40	4000	4000	6500	3.1	10	5.0	1.5	11	23
66	97	105	7.0	2.1	K203_0450 LM401U	190	290	45.22	58609/1296	4000	4000	6500	1.8	10	6.0	2.5	11	25
66	191	195	14	1.0	K203_0450 LM402U	220	290	45.22	58609/1296	4000	4000	6500	3.1	10	6.0	2.5	11	26
74	88	95	12	1.3	K202_0400 LM401U	140	200	40.39	1333/33	4000	4000	6500	1.7	10	5.0	1.5	11	22
76	85	92	6.8	2.3	K203_0390 LM401U	170	250	39.45	135407/3432	4000	4000	6500	1.8	10	6.0	2.5	11	25
76	166	170	13	1.2	K203_0390 LM402U	200	250	39.45	135407/3432	4000	4000	6500	3.1	10	6.0	2.5	11	26
87	75	81	7.7	2.3	K202_0350 LM401U	150	220	34.55	1935/56	4000	4000	6500	1.8	10	5.0	1.5	11	22
87	148	151	14	1.3	K202_0350 LM402U	220	400	34.55	1935/56	4000	4000	6500	3.1	10	5.0	1.5	11	23
87	203	207	19	0.93	K202_0350 LM403U	220	400	34.55	1935/56	4000	4000	6500	4.4	10	5.0	1.5	11	25
89	73	79	8.8	2.0	K202_0340 LM401U	150	190	33.62	1849/55	4000	4000	6500	1.8	10	5.0	1.5	11	22
89	144	147	17	1.1	K202_0340 LM402U	180	310	33.62	1849/55	4000	4000	6500	3.1	10	5.0	1.5	11	23
107	120	122	14	1.5	K202_0280 LM402U	220	400	27.95	559/20	4000	4000	6500	3.2	10	5.0	1.5	11	23
107	164	168	19	1.1	K202_0280 LM403U	220	400	27.95	559/20	4000	4000	6500	4.5	10	5.0	1.5	11	25
119	55	59	9.8	2.3	K202_0250 LM401U	110	160	25.13	1935/77	4000	4000	6500	1.8	10	5.0	1.5	11	22
119	107	110	14	1.6	K202_0250 LM402U	220	400	25.13	1935/77	4000	4000	6500	3.1	10	5.0	1.5	11	23
119	148	151	19	1.2	K202_0250 LM403U	220	400	25.13	1935/77	4000	4000	6500	4.4	10	5.0	1.5	11	25
129	51	55	8.8	2.7	K202_0230 LM401U	100	170	23.18	2967/128	4000	4000	6500	1.9	10	5.0	1.5	11	22
129	99	101	14	1.7	K202_0230 LM402U	220	400	23.18	2967/128	4000	4000	6500	3.2	10	5.0	1.5	11	23
129	136	139	19	1.2	K202_0230 LM403U	220	400	23.18	2967/128	4000	4000	6500	4.5	10	5.0	1.5	11	25
148	87	89	14	1.8	K202_0200 LM402U	190	400	20.33	1118/55	4000	4000	6500	3.2	10	5.0	1.5	11	23
148	119	122	20	1.3	K202_0200 LM403U	220	400	20.33	1118/55	4000	4000	6500	4.5	10	5.0	1.5	11	25
148	187	199	31	0.85	K202_0200 LM503U	220	400	20.33	1118/55	4000	4000	6500	11	10	5.0	1.5	11	28
172	38	41	11	2.7	K202_0175 LM401U	76	130	17.47	559/32	3900	3900	5500	2.0	10	5.0	1.5	11	22
172	75	76	14	2.0	K202_0175 LM402U	160	400	17.47	559/32	3900	3900	5500	3.4	10	5.0	1.5	11	23
172	103	105	20	1.5	K202_0175 LM403U	220	400	17.47	559/32	3900	3900	5500	4.7	10	5.0	1.5	11	25
172	161	171	31	0.94	K202_0175 LM503U	220	400	17.47	559/32	3900	3900	5500	11	10	5.0	1.5	11	28
178	37	40	11	2.7	K202_0170 LM401U	74	120	16.86	2967/176	4000	4000	6500	1.9	10	5.0	1.5	11	22
178	72	74	15	2.1	K202_0170 LM402U	160	400	16.86	2967/176	4000	4000	6500	3.3	10	5.0	1.5	11	23
178	99	101	20	1.5	K202_0170 LM403U	210	400	16.86	2967/176	4000	4000	6500	4.6	10	5.0	1.5	11	25
178	155	165	31	0.96	K202_0170 LM503U	220	400	16.86	2967/176	4000	4000	6500	11	10	5.0	1.5	11	28
217	59	60	15	2.4	K202_0140 LM402U	130	400	13.85	2881/208	3900	3900	5500	3.5	10	5.0	1.5	11	23
217	81	83	20	1.7	K202_0140 LM403U	170	400	13.85	2881/208	3900	3900	5500	4.8	10	5.0	1.5	11	25
217	127	135	32	1.1	K202_0140 LM503U	220	400	13.85	2881/208	3900	3900	5500	11	10	5.0	1.5	11	28
236	28	30	14	2.7	K202_0125 LM401U	56	92	12.71	559/44	3900	3900	5500	2.1	10	5.0	1.5	11	22
236	54	55	15	2.5	K202_0125 LM402U	120	370	12.71	559/44	3900	3900	5500	3.4	10	5.0	1.5	11	23
236	75	76	20	1.8	K202_0125 LM403U	160	370	12.71	559/44	3900	3900	5500	4.7	10	5.0	1.5	11	25
236	117	124	32	1.2	K202_0125 LM503U	220	370	12.71	559/44	3900	3900	5500	11	10	5.0	1.5	11	28
236	169	191	46	0.80	K202_0125 LM505U	220	370	12.71	559/44	3900	3900	5500	17	10	5.0	1.5	11	32
260	25	27	15	2.7	K202_0115 LM401U	51	84	11.55	1247/108	3500	3500	5000	2.3	10	5.0	1.5	11	22
260	49	50	15	2.7	K202_0115 LM402U	110	340	11.55	1247/108	3500	3500	5000	3.7	10	5.0	1.5	11	23
260	68	69	21	1.9	K202_0115 LM403U	140	340	11.55	1247/108	3500	3500	5000	5.0	10	5.0	1.5	11	25
260	106	113	32	1.2	K202_0115 LM503U	220	340	11.55	1247/108	3500	3500	5000	11	10	5.0	1.5	11	28
260	153	173	47	0.86	K202_0115 LM505U	220	340	11.55	1247/108	3500	3500	5000	17	10	5.0	1.5	11	32
298	43	44	15	2.9	K202_0100 LM402U	95	290	10.07	2881/286	3900	3900	5500	3.6	10	5.0	1.5	11	23
298	59	60	21	2.1	K202_0100 LM403U	130	290	10.07	2881/286	3900	3900	5500	4.9	10	5.0	1.5	11	25
298	93	98	33	1.4	K202_0100 LM503U	200	290	10.07	2881/286	3900	3900	5500	11	10	5.0	1.5	11	28
298	134	151	47	0.94	K202_0100 LM505U	220	290	10.07	2881/286	3900	3900	5500	17	10	5.0	1.5	11	32
326	39	40	15	3.1	K202_0092 LM402U	86	270	9.190	2279/248	3500	3500	5000	3.9	10	5.0	1.5	11	23
326	54	55	21	2.3	K202_0092 LM403U	110	270	9.190	2279/248	3500	3500	5000	5.2	10	5.0	1.5	11	25
326	85	90	33	1.4	K202_0092 LM503U	180	270	9.190	2279/248	3500	3500	5000	11	10	5.0	1.5	11	28
326	122	138	47	1.0	K202_0092 LM505U	220	270	9.190	2279/248	3500	3500	5000	18	10	5.0	1.5	11	32
357	18	20	19	2.7	K202_0084 LM401U	37	61	8.397	2494/297	3500	3500	5000	2.4	10	5.0	1.5	11	22

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
K2 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 220 Nm)																		
357	36	37	15	3.3	K202_0084 LM402U	79	240	8.397	2494/297	3500	3500	5000	3.8	10	5.0	1.5	11	23
357	49	50	21	2.4	K202_0084 LM403U	100	240	8.397	2494/297	3500	3500	5000	5.1	10	5.0	1.5	11	25
357	77	82	33	1.5	K202_0084 LM503U	170	240	8.397	2494/297	3500	3500	5000	11	10	5.0	1.5	11	28
357	112	126	48	1.1	K202_0084 LM505U	200	240	8.397	2494/297	3500	3500	5000	18	10	5.0	1.5	11	32
421	133	147	68	0.84	K202_0071 LM704U	210	400	7.118	2107/296	3000	3000	4500	38	10	5.0	1.5	11	38
449	29	29	16	3.8	K202_0067 LM402U	63	190	6.683	2279/341	3500	3500	5000	4.1	10	5.0	1.5	11	23
449	39	40	22	2.8	K202_0067 LM403U	83	190	6.683	2279/341	3500	3500	5000	5.4	10	5.0	1.5	11	25
449	61	65	34	1.8	K202_0067 LM503U	130	190	6.683	2279/341	3500	3500	5000	11	10	5.0	1.5	11	28
449	89	100	49	1.2	K202_0067 LM505U	160	190	6.683	2279/341	3500	3500	5000	18	10	5.0	1.5	11	32
449	125	138	69	0.88	K202_0067 LM704U	210	400	6.683	2279/341	3500	3500	5000	38	10	5.0	1.5	11	38
500	26	26	16	4.1	K202_0060 LM402U	56	180	6.000	6/1	3000	3000	4500	4.7	10	5.0	1.5	11	23
500	35	36	22	3.0	K202_0060 LM403U	75	180	6.000	6/1	3000	3000	4500	6.0	10	5.0	1.5	11	25
500	55	59	34	1.9	K202_0060 LM503U	120	180	6.000	6/1	3000	3000	4500	12	10	5.0	1.5	11	28
500	80	90	49	1.3	K202_0060 LM505U	140	180	6.000	6/1	3000	3000	4500	18	10	5.0	1.5	11	32
500	112	124	69	0.94	K202_0060 LM704U	200	400	6.000	6/1	3000	3000	4500	38	10	5.0	1.5	11	38
579	97	107	70	1.0	K202_0052 LM704U	190	380	5.177	2107/407	3000	3000	4500	38	10	5.0	1.5	11	38
687	26	26	22	3.7	K202_0044 LM403U	54	130	4.364	48/11	3000	3000	4500	6.4	10	5.0	1.5	11	25
687	40	43	35	2.4	K202_0044 LM503U	86	130	4.364	48/11	3000	3000	4500	12	10	5.0	1.5	11	28
687	58	65	51	1.6	K202_0044 LM505U	100	130	4.364	48/11	3000	3000	4500	19	10	5.0	1.5	11	32
687	82	90	71	1.2	K202_0044 LM704U	170	320	4.364	48/11	3000	3000	4500	39	10	5.0	1.5	11	38
687	109	126	95	0.88	K202_0044 LM706U	180	320	4.364	48/11	3000	3000	4500	56	10	5.0	1.5	11	45
750	75	82	72	1.2	K202_0040 LM704U	160	290	4.000	4/1	3000	3000	4500	39	10	5.0	1.5	11	38
750	100	116	95	0.93	K202_0040 LM706U	170	290	4.000	4/1	3000	3000	4500	56	10	5.0	1.5	11	45
K3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 390 Nm)																		
22	293	316	5.8	1.2	K303_1360 LM401U	390	700	136.0	14147/104	3800	3800	6000	1.7	10	5.0	2.5	16	32
27	235	254	5.5	1.5	K303_1090 LM401U	390	700	109.2	167743/1536	3800	3800	6000	1.7	10	5.0	2.5	16	32
33	196	212	5.2	1.8	K303_0910 LM401U	390	590	91.23	26273/288	3800	3800	6000	1.7	10	5.0	2.5	16	32
38	171	185	6.2	1.7	K303_0790 LM401U	340	510	79.42	167743/2112	3800	3800	6000	1.7	10	5.0	2.5	16	32
38	335	342	12	0.85	K303_0790 LM402U	390	510	79.42	167743/2112	3800	3800	6000	3.1	10	5.0	2.5	16	33
43	152	164	8.1	1.4	K302_0690 LM401U	250	310	69.43	6665/96	3800	3800	6000	1.7	10	4.0	1.5	16	27
44	146	157	5.0	2.3	K303_0680 LM401U	290	440	67.73	74777/1104	3800	3800	6000	1.8	10	5.0	2.5	16	32
44	286	291	9.7	1.2	K303_0680 LM402U	350	440	67.73	74777/1104	3800	3800	6000	3.1	10	5.0	2.5	16	33
45	143	154	6.3	1.9	K303_0660 LM401U	290	420	66.35	26273/396	3800	3800	6000	1.8	10	5.0	2.5	16	32
45	280	285	12	0.96	K303_0660 LM402U	340	420	66.35	26273/396	3800	3800	6000	3.1	10	5.0	2.5	16	33
54	238	243	12	1.1	K302_0560 LM402U	320	530	55.71	2451/44	3800	3800	6000	3.1	10	4.0	1.5	16	28
55	117	127	5.7	2.4	K303_0550 LM401U	240	350	54.58	70735/1296	3800	3800	6000	1.8	10	5.0	2.5	16	32
55	230	235	11	1.2	K303_0550 LM402U	280	350	54.58	70735/1296	3800	3800	6000	3.1	10	5.0	2.5	16	33
59	110	119	10	1.4	K302_0500 LM401U	180	220	50.49	6665/132	3800	3800	6000	1.8	10	4.0	1.5	16	27
61	106	114	6.3	2.3	K303_0490 LM401U	210	320	49.26	74777/1518	3800	3800	6000	1.8	10	5.0	2.5	16	32
61	208	212	12	1.2	K303_0490 LM402U	250	320	49.26	74777/1518	3800	3800	6000	3.1	10	5.0	2.5	16	33
65	198	202	8.9	1.7	K302_0460 LM402U	390	690	46.23	1849/40	3800	3800	6000	3.2	10	4.0	1.5	16	28
65	272	278	12	1.3	K302_0460 LM403U	390	690	46.23	1849/40	3800	3800	6000	4.5	10	4.0	1.5	16	30
74	173	177	15	1.1	K302_0410 LM402U	230	380	40.51	4902/121	3800	3800	6000	3.1	10	4.0	1.5	16	28
77	355	377	18	0.97	K303_0390 LM503U	390	690	39.19	34916/891	3800	3800	6000	11	10	5.0	2.5	16	38
84	325	345	18	1.0	K303_0360 LM503U	390	640	35.83	215/6	3800	3800	6000	11	10	5.0	2.5	16	38
86	149	152	8.6	2.2	K302_0350 LM402U	330	700	34.73	903/26	3800	3800	6000	3.3	10	4.0	1.5	16	28
86	204	209	12	1.6	K302_0350 LM403U	390	700	34.73	903/26	3800	3800	6000	4.6	10	4.0	1.5	16	30
86	319	339	18	1.0	K302_0350 LM503U	390	700	34.73	903/26	3800	3800	6000	11	10	4.0	1.5	16	33
89	144	147	11	1.7	K302_0340 LM402U	300	500	33.62	1849/55	3800	3800	6000	3.2	10	4.0	1.5	16	28
89	198	202	16	1.3	K302_0340 LM403U	300	500	33.62	1849/55	3800	3800	6000	4.5	10	4.0	1.5	16	30
92	296	314	18	1.1	K303_0330 LM503U	390	580	32.65	44892/1375	3800	3800	6000	11	10	5.0	2.5	16	38
108	119	122	8.8	2.6	K302_0280 LM402U	260	700	27.88	3569/128	3800	3800	6000	3.4	10	4.0	1.5	16	28
108	164	167	12	1.9	K302_0280 LM403U	350	700	27.88	3569/128	3800	3800	6000	4.7	10	4.0	1.5	16	30
108	256	272	19	1.2	K302_0280 LM503U	390	700	27.88	3569/128	3800	3800	6000	11	10	4.0	1.5	16	33
119	108	110	8.8	2.8	K302_0250 LM402U	240	600	25.26	3612/143	3800	3800	6000	3.3	10	4.0	1.5	16	28
119	148	152	12	2.0	K302_0250 LM403U	310	600	25.26	3612/143	3800	3800	6000	4.6	10	4.0	1.5	16	30
119	232	247	19	1.3	K302_0250 LM503U	390	600	25.26	3612/143	3800	3800	6000	11	10	4.0	1.5	16	33
119	336	379	27	0.89	K302_0250 LM505U	390	600	25.26	3612/143	3800	3800	6000	17	10	4.0	1.5	16	37
129	100	102	8.9	2.9	K302_0230 LM402U	220	650	23.29	559/24	3800	3800	6000	3.5	10	4.0	1.5	16	28
129	137	140	12	2.1	K302_0230 LM403U	290	650	23.29	559/24	3800	3800	6000	4.8	10	4.0	1.5	16	30
129	214	228	19	1.4	K302_0230 LM503U	390	650	23.29	559/24	3800	3800	6000	11	10	4.0	1.5	16	33
129	310	350	28	0.94	K302_0230 LM505U	390	650	23.29	559/24	3800	3800	6000	17	10	4.0	1.5	16	37
148	87	89	9.0	3.2	K302_0200 LM402U	190	510	20.28	3569/176	3800	3800	6000	3.4	10	4.0	1.5	16	28
148	119	122	12	2.3	K302_0200 LM403U	250	510	20.28	3569/176	3800	3800	6000	4.7	10	4.0	1.5	16	30

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
K3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 390 Nm)																		
148	186	198	19	1.5	K302_0200 LM503U	390	510	20.28	3569/176	3800	3800	6000	11	10	4.0	1.5	16	33
148	269	304	28	1.0	K302_0200 LM505U	390	510	20.28	3569/176	3800	3800	6000	17	10	4.0	1.5	16	37
173	74	75	9.1	3.6	K302_0175 LM402U	160	510	17.29	1591/92	3500	3500	5000	3.8	10	4.0	1.5	16	28
173	102	104	13	2.6	K302_0175 LM403U	220	510	17.29	1591/92	3500	3500	5000	5.1	10	4.0	1.5	16	30
173	159	169	20	1.7	K302_0175 LM503U	340	510	17.29	1591/92	3500	3500	5000	11	10	4.0	1.5	16	33
173	230	259	28	1.1	K302_0175 LM505U	390	510	17.29	1591/92	3500	3500	5000	18	10	4.0	1.5	16	37
173	323	357	40	0.82	K302_0175 LM704U	390	700	17.29	1591/92	3500	3500	5000	37	10	4.0	1.5	16	43
177	72	74	9.1	3.6	K302_0170 LM402U	160	470	16.94	559/33	3800	3800	6000	3.6	10	4.0	1.5	16	28
177	100	102	13	2.6	K302_0170 LM403U	210	470	16.94	559/33	3800	3800	6000	4.8	10	4.0	1.5	16	30
177	156	165	20	1.7	K302_0170 LM503U	330	470	16.94	559/33	3800	3800	6000	11	10	4.0	1.5	16	33
177	225	254	28	1.2	K302_0170 LM505U	370	470	16.94	559/33	3800	3800	6000	17	10	4.0	1.5	16	37
177	317	349	40	0.83	K302_0170 LM704U	390	700	16.94	559/33	3800	3800	6000	37	10	4.0	1.5	16	43
215	60	61	9.3	4.1	K302_0140 LM402U	130	410	13.94	1505/108	3500	3500	5000	4.0	10	4.0	1.5	16	28
215	82	84	13	3.0	K302_0140 LM403U	170	410	13.94	1505/108	3500	3500	5000	5.3	10	4.0	1.5	16	30
215	128	136	20	1.9	K302_0140 LM503U	280	410	13.94	1505/108	3500	3500	5000	11	10	4.0	1.5	16	33
215	185	209	29	1.3	K302_0140 LM505U	330	410	13.94	1505/108	3500	3500	5000	18	10	4.0	1.5	16	37
215	260	287	41	0.94	K302_0140 LM704U	390	700	13.94	1505/108	3500	3500	5000	37	10	4.0	1.5	16	43
239	54	55	9.4	4.4	K302_0125 LM402U	120	370	12.58	3182/253	3500	3500	5000	3.9	10	4.0	1.5	16	28
239	74	76	13	3.2	K302_0125 LM403U	160	370	12.58	3182/253	3500	3500	5000	5.2	10	4.0	1.5	16	30
239	116	123	20	2.0	K302_0125 LM503U	250	370	12.58	3182/253	3500	3500	5000	11	10	4.0	1.5	16	33
239	167	189	29	1.4	K302_0125 LM505U	290	370	12.58	3182/253	3500	3500	5000	18	10	4.0	1.5	16	37
239	235	259	41	1.0	K302_0125 LM704U	390	700	12.58	3182/253	3500	3500	5000	37	10	4.0	1.5	16	43
258	50	51	9.4	4.6	K302_0115 LM402U	110	340	11.61	1161/100	3200	3200	4500	4.4	10	4.0	1.5	16	28
258	68	70	13	3.4	K302_0115 LM403U	140	340	11.61	1161/100	3200	3200	4500	5.7	10	4.0	1.5	16	30
258	107	113	20	2.2	K302_0115 LM503U	230	340	11.61	1161/100	3200	3200	4500	12	10	4.0	1.5	16	33
258	154	174	29	1.5	K302_0115 LM505U	270	340	11.61	1161/100	3200	3200	4500	18	10	4.0	1.5	16	37
258	217	239	41	1.1	K302_0115 LM704U	390	700	11.61	1161/100	3200	3200	4500	38	10	4.0	1.5	16	43
296	60	61	13	3.7	K302_0100 LM403U	130	290	10.14	3010/297	3500	3500	5000	5.5	10	4.0	1.5	16	30
296	93	99	20	2.4	K302_0100 LM503U	200	290	10.14	3010/297	3500	3500	5000	12	10	4.0	1.5	16	33
296	135	152	30	1.6	K302_0100 LM505U	240	290	10.14	3010/297	3500	3500	5000	18	10	4.0	1.5	16	37
296	189	209	42	1.2	K302_0100 LM704U	390	700	10.14	3010/297	3500	3500	5000	38	10	4.0	1.5	16	43
296	252	293	55	0.87	K302_0100 LM706U	390	700	10.14	3010/297	3500	3500	5000	55	10	4.0	1.5	16	50
324	173	191	42	1.2	K302_0093 LM704U	370	680	9.267	1075/116	3200	3200	4500	38	10	4.0	1.5	16	43
324	231	268	56	0.93	K302_0093 LM706U	390	680	9.267	1075/116	3200	3200	4500	56	10	4.0	1.5	16	50
355	50	51	14	4.0	K302_0084 LM403U	110	250	8.444	2322/275	3200	3200	4500	5.9	10	4.0	1.5	16	30
355	78	82	22	2.5	K302_0084 LM503U	170	250	8.444	2322/275	3200	3200	4500	12	10	4.0	1.5	16	33
355	112	127	32	1.7	K302_0084 LM505U	200	250	8.444	2322/275	3200	3200	4500	18	10	4.0	1.5	16	37
355	158	174	42	1.3	K302_0084 LM704U	340	610	8.444	2322/275	3200	3200	4500	38	10	4.0	1.5	16	43
355	210	244	56	0.99	K302_0084 LM706U	390	610	8.444	2322/275	3200	3200	4500	55	10	4.0	1.5	16	50
406	138	152	43	1.4	K302_0074 LM704U	300	540	7.391	473/64	2700	2700	4000	39	10	4.0	1.5	16	43
406	184	214	57	1.1	K302_0074 LM706U	380	540	7.391	473/64	2700	2700	4000	56	10	4.0	1.5	16	50
445	126	139	43	1.5	K302_0067 LM704U	270	490	6.740	2150/319	3200	3200	4500	39	10	4.0	1.5	16	43
445	168	195	57	1.1	K302_0067 LM706U	360	490	6.740	2150/319	3200	3200	4500	56	10	4.0	1.5	16	50
500	112	124	43	1.7	K302_0060 LM704U	240	440	6.000	6/1	2700	2700	4000	40	10	4.0	1.5	16	43
500	149	173	58	1.2	K302_0060 LM706U	350	440	6.000	6/1	2700	2700	4000	57	10	4.0	1.5	16	50
558	100	111	44	1.8	K302_0054 LM704U	210	390	5.375	43/8	2700	2700	4000	40	10	4.0	1.5	16	43
558	134	155	58	1.3	K302_0054 LM706U	310	390	5.375	43/8	2700	2700	4000	57	10	4.0	1.5	16	50
687	82	90	45	2.0	K302_0044 LM704U	170	320	4.364	48/11	2700	2700	4000	41	10	4.0	1.5	16	43
687	109	126	59	1.5	K302_0044 LM706U	250	320	4.364	48/11	2700	2700	4000	58	10	4.0	1.5	16	50
750	75	82	45	2.2	K302_0040 LM704U	160	290	4.000	4/1	2700	2700	4000	41	10	4.0	1.5	16	43
750	100	116	60	1.6	K302_0040 LM706U	230	290	4.000	4/1	2700	2700	4000	59	10	4.0	1.5	16	50
K4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 600 Nm)																		
14	469	507	5.8	0.91	K403_2180 LM401U	510	850	218.2	38399/176	3600	3600	5500	1.7	10	5.0	2.5	31	44
17	390	421	4.8	1.3	K403_1810 LM401U	600	990	181.4	14147/78	3600	3600	5500	1.7	10	5.0	2.5	31	44
22	293	316	4.8	1.6	K403_1360 LM401U	590	810	136.1	196037/1440	3600	3600	5500	1.7	10	5.0	2.5	31	44
22	574	586	9.4	0.81	K403_1360 LM402U	600	810	136.1	196037/1440	3600	3600	5500	3.1	10	5.0	2.5	31	46
28	234	253	4.7	1.9	K403_1090 LM401U	470	700	108.8	62651/576	3600	3600	5500	1.8	10	5.0	2.5	31	44
28	459	468	9.3	0.96	K403_1090 LM402U	560	700	108.8	62651/576	3600	3600	5500	3.1	10	5.0	2.5	31	46
33	196	212	4.8	2.1	K403_0910 LM401U	390	590	91.23	26273/288	3600	3600	5500	1.8	10	5.0	2.5	31	44
33	385	392	9.3	1.1	K403_0910 LM402U	470	590	91.23	26273/288	3600	3600	5500	3.1	10	5.0	2.5	31	46
38	170	184	6.0	1.9	K403_0790 LM401U	340	510	79.11	62651/792	3600	3600	5500	1.8	10	5.0	2.5	31	44
38	334	340	12	0.96	K403_0790 LM402U	400	510	79.11	62651/792	3600	3600	5500	3.1	10	5.0	2.5	31	46
45	143	154	6.0	2.1	K403_0660 LM401U	290	420	66.35	26273/396	3600	3600	5500	1.8	10	5.0	2.5	31	44
45	280	285	12	1.1	K403_0660 LM402U	340	420	66.35	26273/396	3600	3600	5500	3.1	10	5.0	2.5	31	46

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
K4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 600 Nm)																		
56	487	517	13	1.1	K403_0540 LM503U	600	950	53.69	38657/720	3600	3600	5500	11	10	5.0	2.5	31	50
61	444	471	13	1.2	K403_0490 LM503U	600	860	48.94	169592/3465	3600	3600	5500	11	10	5.0	2.5	31	50
65	426	452	13	1.3	K402_0460 LM503U	600	990	46.31	602/13	3600	3600	5500	11	10	4.0	1.5	31	46
67	404	429	13	1.3	K403_0450 LM503U	600	790	44.54	1247/28	3600	3600	5500	11	10	5.0	2.5	31	50
77	354	376	13	1.4	K403_0390 LM503U	550	690	39.05	38657/990	3600	3600	5500	11	10	5.0	2.5	31	50
84	324	344	13	1.6	K403_0360 LM503U	510	630	35.72	13717/384	3600	3600	5500	11	10	5.0	2.5	31	50
86	320	340	13	1.6	K402_0350 LM503U	600	810	34.76	4171/120	3600	3600	5500	11	10	4.0	1.5	31	46
86	462	522	19	1.1	K402_0350 LM505U	600	810	34.76	4171/120	3600	3600	5500	17	10	4.0	1.5	31	51
89	310	329	17	1.3	K402_0340 LM503U	470	710	33.68	4816/143	3600	3600	5500	11	10	4.0	1.5	31	46
93	294	312	14	1.6	K403_0320 LM503U	460	570	32.39	2494/77	3600	3600	5500	11	10	5.0	2.5	31	50
108	255	271	14	1.8	K402_0280 LM503U	550	750	27.77	1333/48	3600	3600	5500	11	10	4.0	1.5	31	46
108	369	417	20	1.3	K402_0280 LM505U	600	750	27.77	1333/48	3600	3600	5500	17	10	4.0	1.5	31	51
108	519	573	28	0.89	K402_0280 LM704U	600	1100	27.77	1333/48	3600	3600	5500	37	10	4.0	1.5	31	57
119	232	247	14	1.9	K402_0250 LM503U	470	590	25.28	4171/165	3600	3600	5500	11	10	4.0	1.5	31	46
119	336	379	20	1.3	K402_0250 LM505U	470	590	25.28	4171/165	3600	3600	5500	17	10	4.0	1.5	31	51
119	473	521	28	0.95	K402_0250 LM704U	600	1000	25.28	4171/165	3600	3600	5500	37	10	4.0	1.5	31	57
129	214	228	14	2.0	K402_0230 LM503U	460	680	23.29	559/24	3600	3600	5500	11	10	4.0	1.5	31	46
129	310	350	20	1.4	K402_0230 LM505U	540	680	23.29	559/24	3600	3600	5500	18	10	4.0	1.5	31	51
129	435	480	28	1.0	K402_0230 LM704U	600	1100	23.29	559/24	3600	3600	5500	37	10	4.0	1.5	31	57
149	186	197	14	2.2	K402_0200 LM503U	400	540	20.20	1333/66	3600	3600	5500	11	10	4.0	1.5	31	46
149	268	303	20	1.6	K402_0200 LM505U	430	540	20.20	1333/66	3600	3600	5500	17	10	4.0	1.5	31	51
149	378	417	29	1.1	K402_0200 LM704U	600	1100	20.20	1333/66	3600	3600	5500	37	10	4.0	1.5	31	57
149	503	584	38	0.83	K402_0200 LM706U	600	1100	20.20	1333/66	3600	3600	5500	55	10	4.0	1.5	31	64
172	325	359	29	1.2	K402_0175 LM704U	600	1100	17.41	731/42	3400	3400	5000	38	10	4.0	1.5	31	57
172	433	503	39	0.91	K402_0175 LM706U	600	1100	17.41	731/42	3400	3400	5000	55	10	4.0	1.5	31	64
177	156	165	14	2.5	K402_0170 LM503U	330	490	16.94	559/33	3600	3600	5500	11	10	4.0	1.5	31	46
177	225	254	21	1.7	K402_0170 LM505U	390	490	16.94	559/33	3600	3600	5500	18	10	4.0	1.5	31	51
177	317	349	29	1.2	K402_0170 LM704U	600	1010	16.94	559/33	3600	3600	5500	37	10	4.0	1.5	31	57
177	422	490	39	0.93	K402_0170 LM706U	600	1010	16.94	559/33	3600	3600	5500	55	10	4.0	1.5	31	64
216	260	286	29	1.4	K402_0140 LM704U	550	1010	13.89	1333/96	3400	3400	5000	38	10	4.0	1.5	31	57
216	346	401	39	1.1	K402_0140 LM706U	600	1010	13.89	1333/96	3400	3400	5000	56	10	4.0	1.5	31	64
237	237	261	30	1.5	K402_0125 LM704U	510	870	12.66	2924/231	3400	3400	5000	38	10	4.0	1.5	31	57
237	315	366	40	1.1	K402_0125 LM706U	600	870	12.66	2924/231	3400	3400	5000	55	10	4.0	1.5	31	64
260	215	238	30	1.6	K402_0115 LM704U	460	840	11.52	645/56	3000	3000	4500	39	10	4.0	1.5	31	57
260	287	333	40	1.2	K402_0115 LM706U	600	840	11.52	645/56	3000	3000	4500	56	10	4.0	1.5	31	64
297	189	208	30	1.8	K402_0100 LM704U	400	730	10.10	1333/132	3400	3400	5000	39	10	4.0	1.5	31	57
297	251	292	40	1.3	K402_0100 LM706U	590	730	10.10	1333/132	3400	3400	5000	56	10	4.0	1.5	31	64
325	173	191	30	1.9	K402_0092 LM704U	370	680	9.238	2365/256	3000	3000	4500	40	10	4.0	1.5	31	57
325	230	267	41	1.4	K402_0092 LM706U	540	680	9.238	2365/256	3000	3000	4500	57	10	4.0	1.5	31	64
358	157	173	31	2.0	K402_0084 LM704U	330	610	8.377	645/77	3000	3000	4500	39	10	4.0	1.5	31	57
358	209	242	41	1.5	K402_0084 LM706U	490	610	8.377	645/77	3000	3000	4500	57	10	4.0	1.5	31	64
446	126	139	31	2.3	K402_0067 LM704U	270	490	6.719	215/32	3000	3000	4500	41	10	4.0	1.5	31	57
446	167	194	42	1.7	K402_0067 LM706U	390	490	6.719	215/32	3000	3000	4500	58	10	4.0	1.5	31	64
K5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1000 Nm)																		
32	840	892	15	1.1	K514_0940 LM503U	1000	1620	94.15	338923/3600	3400	3400	5000	11	10	6.0	3.0	50	57
35	759	806	15	1.2	K514_0850 LM503U	1000	1470	85.03	76531/900	3400	3400	5000	11	10	6.0	3.0	50	57
39	703	747	15	1.3	K513_0780 LM503U	1000	1410	77.59	26071/336	3400	3400	5000	11	10	5.0	2.0	50	52
43	635	675	16	1.3	K513_0700 LM503U	980	1280	70.08	841/12	3400	3400	5000	11	10	5.0	2.0	50	52
46	585	621	14	1.5	K513_0650 LM503U	1000	1270	64.54	12586/195	3400	3400	5000	11	10	5.0	2.0	50	52
46	845	955	20	1.1	K513_0650 LM505U	1000	1270	64.54	12586/195	3400	3400	5000	17	10	5.0	2.0	50	57
51	528	561	14	1.7	K513_0580 LM503U	920	1150	58.30	11368/195	3400	3400	5000	11	10	5.0	2.0	50	52
51	764	862	20	1.2	K513_0580 LM505U	920	1150	58.30	11368/195	3400	3400	5000	17	10	5.0	2.0	50	57
62	436	464	13	2.0	K513_0480 LM503U	870	1080	48.16	2697/56	3400	3400	5000	11	10	5.0	2.0	50	52
62	631	712	19	1.4	K513_0480 LM505U	870	1080	48.16	2697/56	3400	3400	5000	18	10	5.0	2.0	50	57
62	887	979	26	1.0	K513_0480 LM704U	1000	1800	48.16	2697/56	3400	3400	5000	37	10	5.0	2.0	50	62
69	394	419	14	2.0	K513_0440 LM503U	780	980	43.50	87/2	3400	3400	5000	11	10	5.0	2.0	50	52
69	570	643	21	1.4	K513_0440 LM505U	780	980	43.50	87/2	3400	3400	5000	18	10	5.0	2.0	50	57
69	801	884	25	1.1	K513_0440 LM704U	1000	1800	43.50	87/2	3400	3400	5000	37	10	5.0	2.0	50	62
78	710	783	24	1.3	K513_0390 LM704U	1000	1800	38.53	2697/70	3400	3400	5000	38	10	5.0	2.0	50	62
86	641	707	24	1.4	K513_0350 LM704U	1000	1780	34.80	174/5	3400	3400	5000	38	10	5.0	2.0	50	62
86	854	991	32	1.1	K513_0350 LM706U	1000	1780	34.80	174/5	3400	3400	5000	55	10	5.0	2.0	50	70
93	595	657	23	1.5	K513_0320 LM704U	1000	1800	32.31	20677/640	3400	3400	5000	38	10	5.0	2.0	50	62
93	793	920	31	1.1	K513_0320 LM706U	1000	1800	32.31	20677/640	3400	3400	5000	56	10	5.0	2.0	50	70
103	538	593	23	1.6	K513_0290 LM704U	1000	1660	29.18	4669/160	3400	3400	5000	38	10	5.0	2.0	50	62

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
K5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1000 Nm)																		
103	716	831	31	1.2	K513_0290 LM706U	1000	1660	29.18	4669/160	3400	3400	5000	56	10	5.0	2.0	50	70
123	449	495	23	1.8	K513_0240 LM704U	960	1620	24.35	11687/480	2800	2800	4200	39	10	5.0	2.0	50	62
123	598	694	31	1.4	K513_0240 LM706U	1000	1620	24.35	11687/480	2800	2800	4200	57	10	5.0	2.0	50	70
136	405	447	23	2.0	K513_0220 LM704U	870	1470	21.99	2639/120	2800	2800	4200	40	10	5.0	2.0	50	62
136	540	627	31	1.5	K513_0220 LM706U	1000	1470	21.99	2639/120	2800	2800	4200	57	10	5.0	2.0	50	70
155	357	393	24	2.1	K513_0195 LM704U	760	1390	19.35	27869/1440	2800	2800	4200	40	10	5.0	2.0	50	62
155	475	551	31	1.6	K513_0195 LM706U	1000	1390	19.35	27869/1440	2800	2800	4200	58	10	5.0	2.0	50	70
172	322	355	24	2.3	K513_0175 LM704U	690	1250	17.48	6293/360	2800	2800	4200	41	10	5.0	2.0	50	62
172	429	498	31	1.7	K513_0175 LM706U	1000	1250	17.48	6293/360	2800	2800	4200	58	10	5.0	2.0	50	70
186	296	327	24	2.4	K513_0160 LM704U	630	1150	16.09	26071/1620	2300	2300	3600	42	10	5.0	2.0	50	62
186	395	458	32	1.8	K513_0160 LM706U	920	1150	16.09	26071/1620	2300	2300	3600	59	10	5.0	2.0	50	70
206	268	295	24	2.6	K513_0145 LM704U	570	1040	14.54	5887/405	2300	2300	3600	42	10	5.0	2.0	50	62
206	357	414	32	1.9	K513_0145 LM706U	830	1040	14.54	5887/405	2300	2300	3600	59	10	5.0	2.0	50	70
K6 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1600 Nm)																		
18	1487	1580	13	0.97	K614_1670 LM503U	1600	2070	166.7	86681/520	3100	3100	4500	11	10	6.0	3.0	83	77
20	1322	1404	12	1.1	K614_1480 LM503U	1600	2170	148.2	4551637/30720	3100	3100	4500	11	10	6.0	3.0	83	77
22	1194	1268	12	1.2	K614_1340 LM503U	1570	1960	133.8	1027789/7680	3100	3100	4500	11	10	6.0	3.0	83	77
24	1099	1167	11	1.3	K614_1230 LM503U	1600	2000	123.2	1261297/10240	3100	3100	4500	11	10	6.0	3.0	83	77
27	992	1054	12	1.3	K614_1110 LM503U	1450	1810	111.3	284809/2560	3100	3100	4500	11	10	6.0	3.0	83	77
31	865	919	15	1.2	K613_0950 LM503U	1290	1630	95.41	293105/3072	3100	3100	4500	11	10	5.0	2.0	83	74
35	781	830	16	1.2	K613_0860 LM503U	1170	1470	86.18	66185/768	3100	3100	4500	11	10	5.0	2.0	83	74
39	690	733	12	1.7	K613_0760 LM503U	1200	1500	76.14	126697/1664	3100	3100	4500	11	10	5.0	2.0	83	74
39	997	1126	18	1.2	K613_0760 LM505U	1200	1500	76.14	126697/1664	3100	3100	4500	18	10	5.0	2.0	83	78
39	1403	1548	21	1.0	K613_0760 LM704U	1600	2900	76.14	126697/1664	3100	3100	4500	37	10	5.0	2.0	83	84
44	623	662	13	1.7	K613_0690 LM503U	1080	1360	68.77	28609/416	3100	3100	4500	11	10	5.0	2.0	83	74
44	901	1017	19	1.2	K613_0690 LM505U	1080	1360	68.77	28609/416	3100	3100	4500	18	10	5.0	2.0	83	78
44	1267	1398	22	1.0	K613_0690 LM704U	1580	2630	68.77	28609/416	3100	3100	4500	37	10	5.0	2.0	83	84
47	1174	1295	19	1.2	K613_0640 LM704U	1600	2900	63.71	130479/2048	3100	3100	4500	38	10	5.0	2.0	83	84
52	1060	1170	19	1.4	K613_0580 LM704U	1600	2800	57.55	29463/512	3100	3100	4500	38	10	5.0	2.0	83	84
63	879	970	19	1.5	K613_0480 LM704U	1600	2290	47.73	39711/832	3100	3100	4500	38	10	5.0	2.0	83	84
63	1171	1360	25	1.2	K613_0480 LM706U	1600	2290	47.73	39711/832	3100	3100	4500	56	10	5.0	2.0	83	91
70	794	876	19	1.7	K613_0430 LM704U	1600	2070	43.11	8967/208	3100	3100	4500	38	10	5.0	2.0	83	84
70	1058	1228	25	1.2	K613_0430 LM706U	1600	2070	43.11	8967/208	3100	3100	4500	56	10	5.0	2.0	83	91
78	706	779	19	1.8	K613_0380 LM704U	1510	2170	38.32	156953/4096	3100	3100	4500	39	10	5.0	2.0	83	84
78	940	1092	26	1.3	K613_0380 LM706U	1600	2170	38.32	156953/4096	3100	3100	4500	56	10	5.0	2.0	83	91
87	638	703	19	1.9	K613_0350 LM704U	1360	1960	34.61	35441/1024	3100	3100	4500	39	10	5.0	2.0	83	84
87	849	986	26	1.4	K613_0350 LM706U	1570	1960	34.61	35441/1024	3100	3100	4500	57	10	5.0	2.0	83	91
94	587	647	19	2.0	K613_0320 LM704U	1250	2000	31.86	130479/4096	3100	3100	4500	40	10	5.0	2.0	83	84
94	782	908	26	1.5	K613_0320 LM706U	1600	2000	31.86	130479/4096	3100	3100	4500	57	10	5.0	2.0	83	91
104	530	585	19	2.2	K613_0290 LM704U	1130	1810	28.77	29463/1024	3100	3100	4500	40	10	5.0	2.0	83	84
104	706	820	26	1.6	K613_0290 LM706U	1450	1810	28.77	29463/1024	3100	3100	4500	58	10	5.0	2.0	83	91
158	350	386	20	2.9	K613_0190 LM704U	750	1360	18.99	17019/896	2600	2600	4000	44	10	5.0	2.0	83	84
158	466	541	26	2.1	K613_0190 LM706U	1090	1360	18.99	17019/896	2600	2600	4000	61	10	5.0	2.0	83	91
175	316	349	20	3.1	K613_0170 LM704U	680	1230	17.16	549/32	2600	2600	4000	45	10	5.0	2.0	83	84
175	421	489	26	2.3	K613_0170 LM706U	980	1230	17.16	549/32	2600	2600	4000	62	10	5.0	2.0	83	91
K7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 2600 Nm)																		
16	1721	1828	11	1.1	K714_1930 LM503U	1940	2420	192.9	320943/1664	2900	2900	4200	11	10	6.0	3.0	126	110
17	1554	1651	12	1.1	K714_1740 LM503U	1750	2190	174.2	72471/416	2900	2900	4200	11	10	6.0	3.0	126	110
20	1353	1438	11	1.3	K714_1520 LM503U	1800	2250	151.7	24273/160	2900	2900	4200	11	10	6.0	3.0	126	110
22	1222	1298	12	1.3	K714_1370 LM503U	1630	2030	137.0	5481/40	2900	2900	4200	11	10	6.0	3.0	126	110
24	2303	2541	16	1.0	K714_1270 LM704U	2600	4520	127.0	520149/4096	2900	2900	4200	37	10	6.0	3.0	126	121
26	2080	2295	15	1.2	K714_1150 LM704U	2600	4090	114.7	117453/1024	2900	2900	4200	37	10	6.0	3.0	126	121
30	1788	1973	14	1.3	K714_0990 LM704U	2600	3820	98.60	1009701/10240	2900	2900	4200	38	10	6.0	3.0	126	121
30	1815	2003	19	1.0	K713_0990 LM704U	2220	3330	98.54	100905/1024	2900	2900	4200	38	10	5.0	2.0	126	112
34	1615	1782	15	1.4	K714_0890 LM704U	2600	3450	89.06	227997/2560	2900	2900	4200	38	10	6.0	3.0	126	121
34	2151	2497	20	1.1	K714_0890 LM706U	2600	3450	89.06	227997/2560	2900	2900	4200	55	10	6.0	3.0	126	128
34	1640	1809	20	1.0	K713_0890 LM704U	2010	3010	89.00	22785/256	2900	2900	4200	38	10	5.0	2.0	126	112
38	1452	1602	14	1.7	K713_0790 LM704U	2600	4800	78.83	20181/256	2900	2900	4200	38	10	5.0	2.0	126	112
38	1935	2246	18	1.2	K713_0790 LM706U	2600	4800	78.83	20181/256	2900	2900	4200	56	10	5.0	2.0	126	119
42	1312	1447	15	1.7	K713_0710 LM704U	2600	4350	71.20	4557/64	2900	2900	4200	38	10	5.0	2.0	126	112
42	1747	2028	19	1.2	K713_0710 LM706U	2600	4350	71.20	4557/64	2900	2900	4200	56	10	5.0	2.0	126	119
46	1195	1318	14	1.9	K713_0650 LM704U	2260	2830	64.85	33201/512	2900	2900	4200	39	10	5.0	2.0	126	112
46	1591	1847	18	1.4	K713_0650 LM706U	2260	2830	64.85	33201/512	2900	2900	4200	56	10	5.0	2.0	126	119
51	1079	1190	15	1.9	K713_0590 LM704U	2040	2550	58.57	7497/128	2900	2900	4200	39	10	5.0	2.0	126	112

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1maxDB} EL1,2 [rpm]	n_{1maxDB} EL3,4,5,6 [rpm]	n_{1maxZB} [rpm]	J_1 [kgcm²]	$\Delta\varphi_2$ [arcmin]	$\Delta\varphi_{2redII}$ [arcmin]	$\Delta\varphi_{2redI}$ [arcmin]	C_2 [Nm/arcmin]	m [kg]
K7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 2600 Nm)																		
51	1437	1669	20	1.4	K713_0590 LM706U	2040	2550	58.57	7497/128	2900	2900	4200	56	10	5.0	2.0	126	119
60	919	1014	15	2.1	K713_0500 LM704U	1940	2420	49.88	166005/3328	2900	2900	4200	40	10	5.0	2.0	126	112
60	1224	1421	20	1.6	K713_0500 LM706U	1940	2420	49.88	166005/3328	2900	2900	4200	58	10	5.0	2.0	126	119
67	830	916	16	2.1	K713_0450 LM704U	1750	2190	45.05	37485/832	2900	2900	4200	40	10	5.0	2.0	126	112
67	1106	1284	21	1.6	K713_0450 LM706U	1750	2190	45.05	37485/832	2900	2900	4200	58	10	5.0	2.0	126	119
76	723	797	15	2.5	K713_0390 LM704U	1540	2250	39.23	2511/64	2900	2900	4200	42	10	5.0	2.0	126	112
76	963	1118	20	1.9	K713_0390 LM706U	1800	2250	39.23	2511/64	2900	2900	4200	60	10	5.0	2.0	126	119
85	653	720	16	2.5	K713_0350 LM704U	1390	2030	35.44	567/16	2900	2900	4200	42	10	5.0	2.0	126	112
85	870	1010	21	1.9	K713_0350 LM706U	1630	2030	35.44	567/16	2900	2900	4200	60	10	5.0	2.0	126	119
K8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 4650 Nm)																		
13	4196	4629	14	0.81	K814_2310 LM704U	4650	6390	231.4	1999333/8640	2800	2800	4000	37	10	6.0	3.0	196	179
16	3479	3839	13	1.0	K814_1920 LM704U	4650	6040	191.9	85963/448	2800	2800	4000	38	10	6.0	3.0	196	179
17	3143	3467	14	1.0	K814_1730 LM704U	4370	5460	173.3	2773/16	2800	2800	4000	38	10	6.0	3.0	196	179
19	2842	3135	13	1.2	K814_1570 LM704U	4300	5380	156.7	601741/3840	2800	2800	4000	38	10	6.0	3.0	196	179
21	2567	2832	14	1.2	K814_1420 LM704U	3890	4860	141.5	135877/960	2800	2800	4000	38	10	6.0	3.0	196	179
24	2300	2538	12	1.4	K814_1270 LM704U	3930	4920	126.9	1461371/11520	2800	2800	4000	38	10	6.0	3.0	196	179
24	3064	3557	17	1.1	K814_1270 LM706U	3930	4920	126.9	1461371/11520	2800	2800	4000	55	10	6.0	3.0	196	186
26	2078	2292	13	1.4	K814_1150 LM704U	3550	4440	114.6	329987/2880	2800	2800	4000	38	10	6.0	3.0	196	179
26	2768	3213	18	1.1	K814_1150 LM706U	3550	4440	114.6	329987/2880	2800	2800	4000	55	10	6.0	3.0	196	186
31	1790	1975	12	1.7	K813_0970 LM704U	3730	6210	97.17	31093/320	2800	2800	4000	39	10	5.0	2.0	196	166
31	2385	2768	16	1.3	K813_0970 LM706U	3730	6210	97.17	31093/320	2800	2800	4000	56	10	5.0	2.0	196	173
34	1617	1784	13	1.7	K813_0880 LM704U	3370	5610	87.76	7021/80	2800	2800	4000	39	10	5.0	2.0	196	166
34	2154	2500	17	1.3	K813_0880 LM706U	3370	5610	87.76	7021/80	2800	2800	4000	57	10	5.0	2.0	196	173
38	1462	1613	14	1.8	K813_0790 LM704U	2630	3290	79.38	45725/576	2800	2800	4000	40	10	5.0	2.0	196	166
38	1948	2262	18	1.4	K813_0790 LM706U	2630	3290	79.38	45725/576	2800	2800	4000	58	10	5.0	2.0	196	173
42	1321	1457	15	1.8	K813_0720 LM704U	2380	2970	71.70	10325/144	2800	2800	4000	40	10	5.0	2.0	196	166
42	1760	2043	19	1.4	K813_0720 LM706U	2380	2970	71.70	10325/144	2800	2800	4000	58	10	5.0	2.0	196	173
61	903	996	14	2.4	K813_0490 LM704U	1930	2690	48.99	5487/112	2800	2800	4000	45	10	5.0	2.0	196	166
61	1202	1396	19	1.8	K813_0490 LM706U	2160	2690	48.99	5487/112	2800	2800	4000	63	10	5.0	2.0	196	173
68	815	899	15	2.4	K813_0440 LM704U	1740	2430	44.25	177/4	2800	2800	4000	46	10	5.0	2.0	196	166
68	1086	1261	20	1.8	K813_0440 LM706U	1950	2430	44.25	177/4	2800	2800	4000	63	10	5.0	2.0	196	173
K9 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 6820 Nm)																		
10	5327	5877	12	0.85	K914_2940 LM704U	6820	8520	293.8	977647/3328	2600	2600	3800	38	10	5.0	–	379	293
12	4479	4942	12	0.97	K914_2470 LM704U	5730	7160	247.0	3288449/13312	2600	2600	3800	38	10	5.0	–	379	293
16	3476	3834	12	1.2	K914_1920 LM704U	5070	6340	191.7	4710481/24576	2600	2600	3800	38	10	5.0	–	379	293
20	2702	2981	12	1.4	K914_1490 LM704U	4600	5750	149.0	9154331/61440	2600	2600	3800	39	10	5.0	–	379	293
20	3599	4178	16	1.1	K914_1490 LM706U	4600	5750	149.0	9154331/61440	2600	2600	3800	56	10	5.0	–	379	300
24	2281	2516	12	1.6	K914_1260 LM704U	3900	4870	125.8	2221925/17664	2600	2600	3800	40	10	5.0	–	379	293
24	3038	3527	15	1.2	K914_1260 LM706U	3900	4870	125.8	2221925/17664	2600	2600	3800	57	10	5.0	–	379	300
32	1700	1876	14	1.7	K914_0940 LM704U	2910	3630	93.78	4177219/44544	2600	2600	3800	41	10	5.0	–	379	293
32	2265	2630	18	1.3	K914_0940 LM706U	2910	3630	93.78	4177219/44544	2600	2600	3800	58	10	5.0	–	379	300

12.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download 3D models of our standard drives at http://configurator.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can also be found at http://configurator.stoeber.de.

Tolerances

Axis height in accordance with DIN 747	Tolerance
Up to 50 mm	-0.4 mm
Up to 250 mm	-0.5 mm
Up to 630 mm	-0.6 mm

Solid shaft	Tolerance
Shaft ∅ fit ≤ 50 mm	DIN 748-1, ISO k6
Shaft ∅ fit > 50 mm	DIN 748-1, ISO m6
Feather keys	DIN 6885-1, high form A

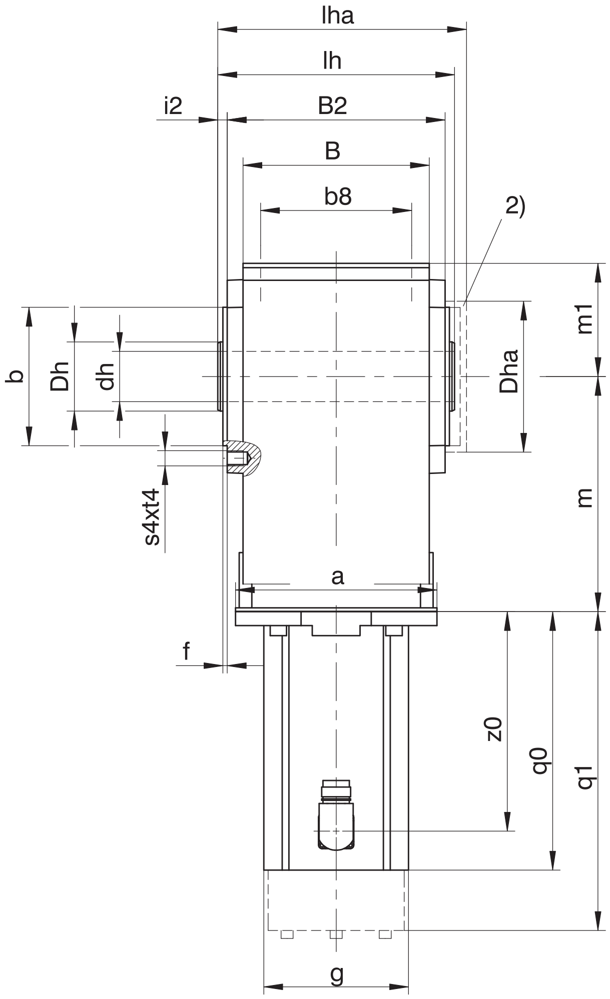
Hollow shaft	Tolerance
Hollow shaft hole fit	ISO H7
Feather keys	DIN 6885-1, high form K1 ∅30: DIN 6885-3, low form

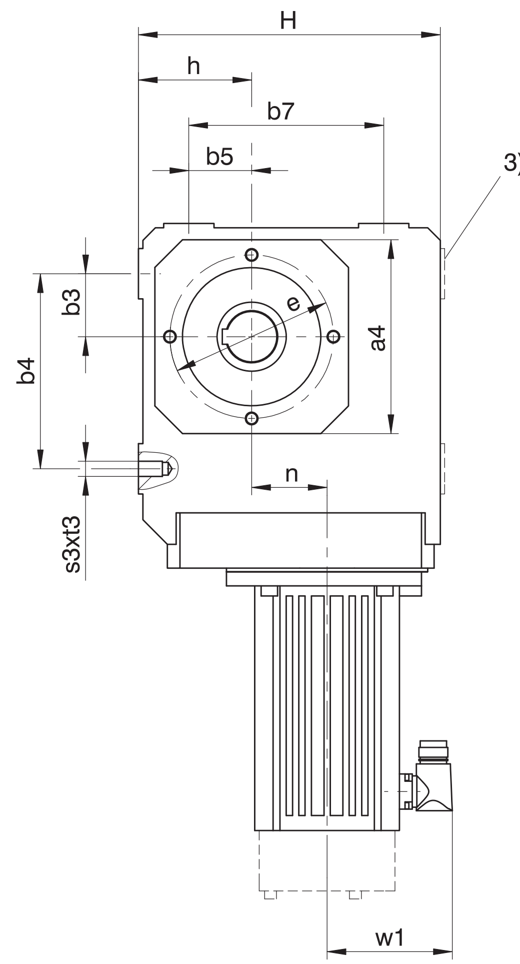
Flange	Pilot tolerance
Up to 300 mm	ISO j6
Starting at 350 mm	ISO h6

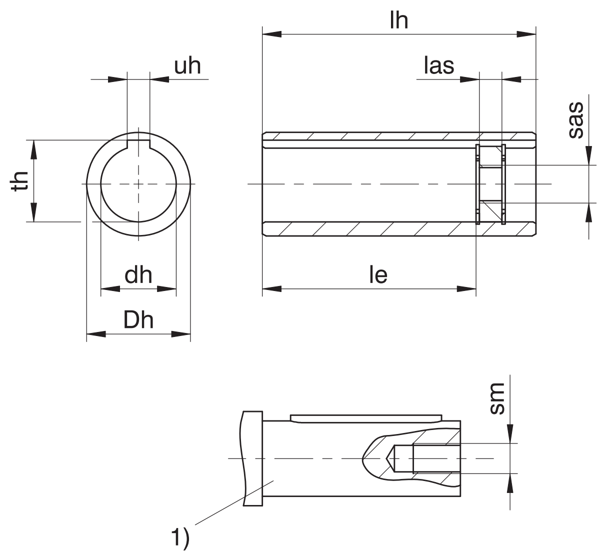
Centering holes in solid shafts in accordance with DIN 332-2, DR shape

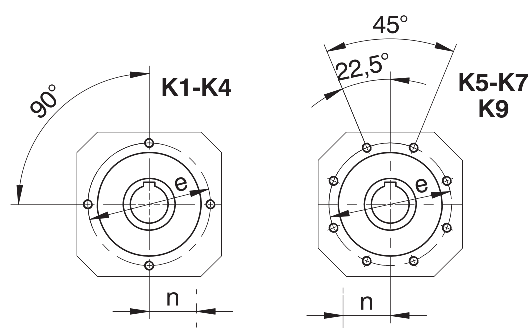
Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

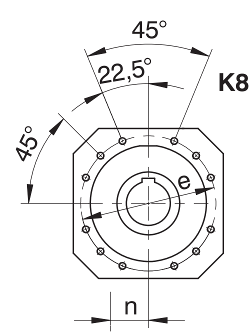
12.3.1 A shaft design (hollow shaft), G housing design (pitch circle diameter)











q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	The length of the machine shaft must be at least 2.2 x Ødh and the length of the feather key must be at least 2 x Ødh.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	□a4	∅b	b3	b4	b5	b7	b8	B	B2	∅dh	∅Dh	Dha	∅e	f	h	H	i2	le	lh	las	lha	m1	s3	s4	sm	sas	t3	t4	th	uh
K1	105	75_{j6}	30	90	30	90	70	90	106	20^{H7}	40	□105	90	3.0	60	160	7.0	98.0	120	12	127.0	60	M8	M8	M6	M8	13	13	22.8	6^{JS9}
K1	105	75_{j6}	30	90	30	90	70	90	106	25^{H7}	40	□105	90	3.0	60	160	7.0	98.0	120	12	127.0	60	M8	M8	M10	M12	13	13	28.3	8^{JS9}
K1	105	75_{j6}	30	90	30	90	70	90	106	30^{H7}	40	□105	90	3.0	60	160	7.0	93.5	120	12	127.0	60	M8	M8	M10	M12	13	13	32.0	8^{JS9}
K2	116	82_{j6}	35	115	35	115	90	115	134	30^{H7}	45	□116	100	3.0	65	190	7.0	121.5	148	12	156.0	65	M10	M8	M10	M12	16	13	33.3	8^{JS9}
K3	132	95_{j6}	40	130	40	130	105	130	146	35^{H7}	50	□132	115	3.0	75	213	7.0	125.0	160	12	168.0	75	M10	M8	M12	M16	16	13	38.3	10^{JS9}
K4	152	110_{j6}	50	155	50	155	120	148	173	40^{H7}	55	□152	130	3.5	90	240	7.5	157.0	188	12	197.5	90	M12	M10	M16	M20	19	16	43.3	12^{JS9}
K5	145	110_{j6}	40	140	100	140	125	160	185	50^{H7}	65	□145	130	3.5	160	260	7.5	164.0	200	12	209.5	100	M16	M10	M16	M20	26	16	53.8	14^{JS9}
K6	180	140_{j6}	50	160	110	160	130	168	200	50^{H7}	70	∅183	165	3.5	190	310	7.5	179.0	215	12	224.5	120	M16	M10	M16	M20	26	16	53.8	14^{JS9}
K7	195	155_{j6}	55	180	125	180	145	190	226	60^{H7}	85	∅205	185	3.5	212	342	8.0	214.0	242	12	252.0	125	M20	M12	M20	M24	33	19	64.4	18^{JS9}
K8	226	185_{j6}	75	240	165	240	185	235	282	70^{H7}	100	∅184	215	4.0	265	410	9.0	263.0	300	20	311.0	145	M24	M12	M20	M24	38	19	74.9	20^{JS9}
K9	280	230_{j6}	95	280	185	280	225	285	330	90^{H7}	120	∅230	265	5.0	315	495	10.0	302.0	350	26	361.0	180	M30	M16	M24	M30	48	26	95.4	25^{JS9}

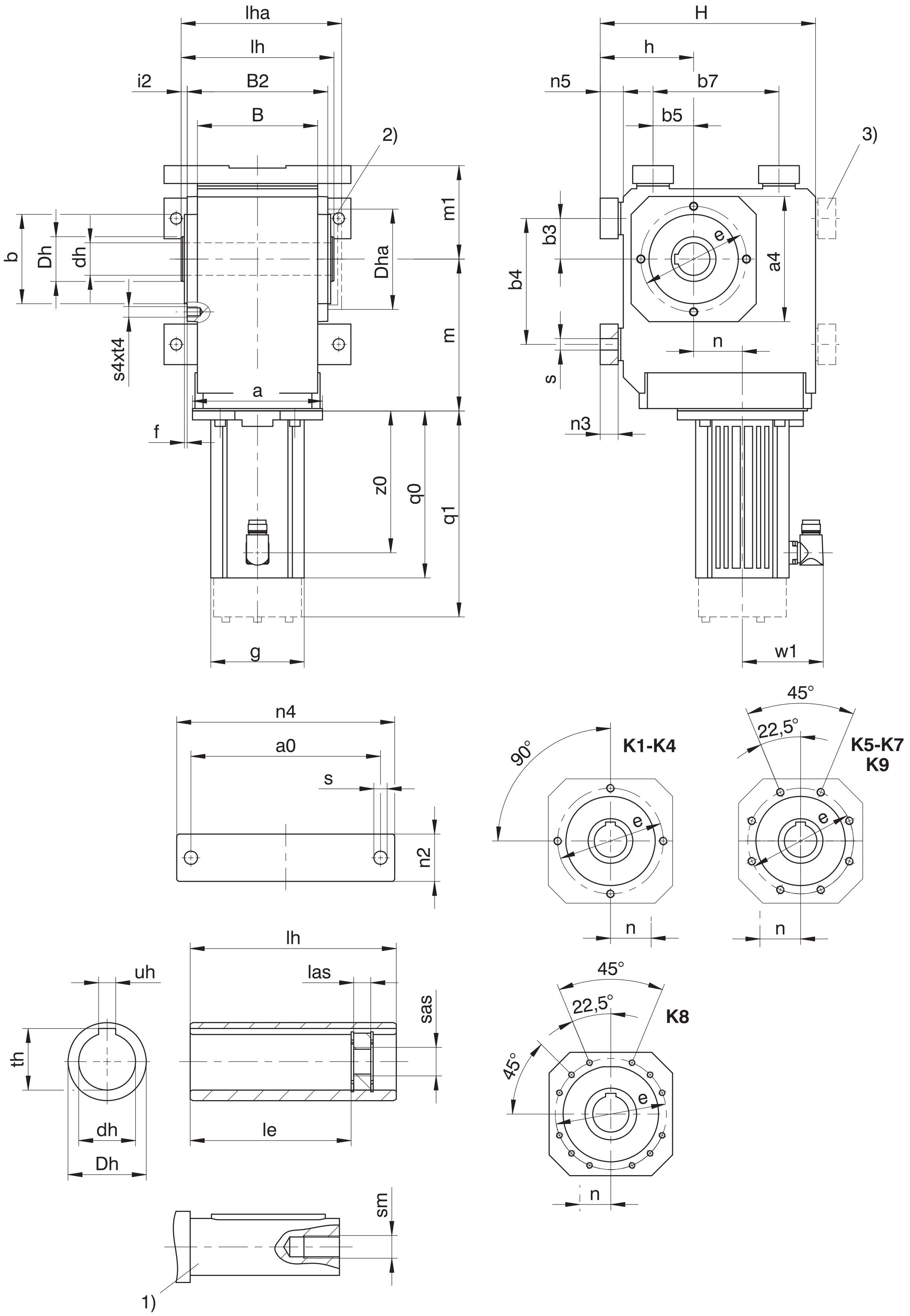
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.2 A shaft design (hollow shaft), NG housing design (base + pitch circle diameter)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	a0	□a4	∅b	b3	b4	b5	b7	B	B2	∅dh	∅Dh	Dha	∅e	f	h	H	i2	le	lh	las	lha	m1	n2	n3	n4	n5	∅s	s4	sm	sas	t4	th	uh
K1	115	105	75_{j6}	30	90	30	90	90	106	20^{H7}	40	□105	90	3.0	75	175	7.0	98.0	120	12	127.0	75	30	13	140	15	9.0	M8	M6	M8	13	22.8	6^{JS9}
K1	115	105	75_{j6}	30	90	30	90	90	106	25^{H7}	40	□105	90	3.0	75	175	7.0	98.0	120	12	127.0	75	30	13	140	15	9.0	M8	M10	M12	13	28.3	8^{JS9}
K1	115	105	75_{j6}	30	90	30	90	90	106	30^{H7}	40	□105	90	3.0	75	175	7.0	93.5	120	12	127.0	75	30	13	140	15	9.0	M8	M10	M12	13	32.0	8^{JS9}
K2	155	116	82_{j6}	35	115	35	115	115	134	30^{H7}	45	□116	100	3.0	88	213	7.0	121.5	148	12	156.0	88	40	20	185	23	11.0	M8	M10	M12	13	33.3	8^{JS9}
K3	170	132	95_{j6}	40	130	40	130	130	146	35^{H7}	50	□132	115	3.0	98	236	7.0	125.0	160	12	168.0	98	45	20	200	23	11.0	M8	M12	M16	13	38.3	10^{JS9}
K4	200	152	110_{j6}	50	155	50	155	148	173	40^{H7}	55	□152	130	3.5	115	265	7.5	157.0	188	12	197.5	115	50	22	230	25	14.0	M10	M16	M20	16	43.3	12^{JS9}
K5	200	145	110_{j6}	40	140	100	140	160	185	50^{H7}	65	□145	130	3.5	190	290	7.5	164.0	200	12	209.5	130	60	27	240	30	18.0	M10	M16	M20	16	53.8	14^{JS9}
K6	210	180	140_{j6}	50	160	110	160	168	200	50^{H7}	70	∅183	165	3.5	220	340	7.5	179.0	215	12	224.5	150	65	27	250	30	18.5	M10	M16	M20	16	53.8	14^{JS9}
K7	241	195	155_{j6}	55	180	125	180	190	226	60^{H7}	85	∅205	185	3.5	250	380	8.0	214.0	242	12	252.0	163	70	35	290	38	23.0	M12	M20	M24	19	64.4	18^{JS9}
K8	300	226	185_{j6}	75	240	165	240	235	282	70^{H7}	100	∅184	215	4.0	310	455	9.0	263.0	300	20	311.0	190	85	41	360	45	27.0	M12	M20	M24	19	74.9	20^{JS9}
K9	360	280	230_{j6}	95	280	185	280	285	330	90^{H7}	120	∅230	265	5.0	365	545	10.0	302.0	350	26	361.0	230	95	46	430	50	31.0	M16	M24	M30	26	95.4	25^{JS9}

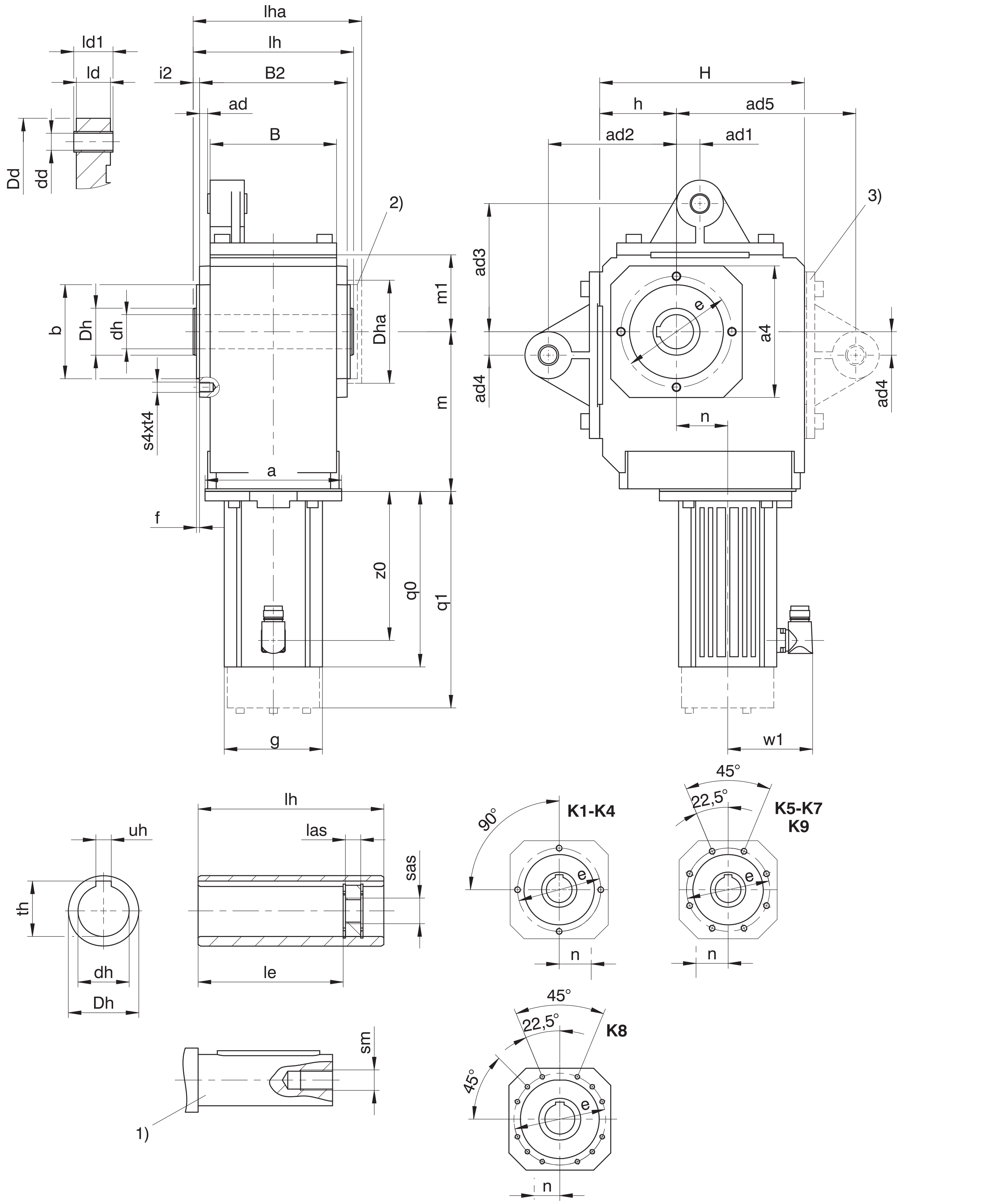
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.3 A shaft design (hollow shaft), GD housing design (pitch circle diameter + torque arm bracket)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

– If you brace the gear units without the factory-adjusted torque arms provided for this purpose, the dimensions for ad2 and ad3 must meet the specified value.

Dimensions of gear units

Type	□a4	ad	ad1	ad2	ad3	ad4	ad5	⌀b	B	B2	⌀dd	⌀dh	⌀Dd	⌀Dh	Dha	⌀e	f
K1	105	6.0	15.0	90	90	15.0	130	75_{j6}	90	106	12^{H9}	20^{H7}	43	40	□105	90	3.0
K1	105	6.0	15.0	90	90	15.0	130	75_{j6}	90	106	12^{H9}	25^{H7}	43	40	□105	90	3.0
K1	105	6.0	15.0	90	90	15.0	130	75_{j6}	90	106	12^{H9}	30^{H7}	43	40	□105	90	3.0
K2	116	6.5	22.5	100	100	22.5	–	82_{j6}	115	134	16^{H9}	30^{H7}	45	45	□116	100	3.0
K3	132	5.0	25.0	120	120	25.0	–	95_{j6}	130	146	16^{H9}	35^{H7}	45	50	□132	115	3.0
K4	152	9.5	27.5	150	150	27.5	–	110_{j6}	148	173	20^{H9}	40^{H7}	55	55	□152	130	3.5
K5	145	9.5	30.0	250	190	30.0	–	110_{j6}	160	185	20^{H9}	50^{H7}	58	65	□145	130	3.5
K6	180	13.0	30.0	250	180	30.0	–	140_{j6}	168	200	20^{H9}	50^{H7}	58	70	⌀183	165	3.5
K7	195	15.0	35.0	300	213	35.0	–	155_{j6}	190	226	20^{H9}	60^{H7}	68	85	⌀205	185	3.5
K8	226	17.0	45.0	350	230	45.0	–	185_{j6}	235	282	24^{H9}	70^{H7}	72	100	⌀184	215	4.0
K9	280	16.0	45.0	450	315	45.0	–	230_{j6}	285	330	24^{H9}	90^{H7}	75	120	⌀230	265	5.0

Dimensions of gear units

Type	h	H	i2	ld	ld1	le	lh	las	lha	m1	s4	sm	sas	t4	th	uh
K1	60	160	7.0	24	28	98.0	120	12	127.0	60	M8	M6	M8	13	22.8	6^{JS9}
K1	60	160	7.0	24	28	98.0	120	12	127.0	60	M8	M10	M12	13	28.3	8^{JS9}
K1	60	160	7.0	24	28	93.5	120	12	127.0	60	M8	M10	M12	13	32.0	8^{JS9}
K2	65	190	7.0	32	38	121.5	148	12	156.0	65	M8	M10	M12	13	33.3	8^{JS9}
K3	75	213	7.0	32	38	125.0	160	12	168.0	75	M8	M12	M16	13	38.3	10^{JS9}
K4	90	240	7.5	40	46	157.0	188	12	197.5	90	M10	M16	M20	16	43.3	12^{JS9}
K5	160	260	7.5	40	46	164.0	200	12	209.5	100	M10	M16	M20	16	53.8	14^{JS9}
K6	190	310	7.5	40	46	179.0	215	12	224.5	120	M10	M16	M20	16	53.8	14^{JS9}
K7	212	342	8.0	64	70	214.0	242	12	252.0	125	M12	M20	M24	19	64.4	18^{JS9}
K8	265	410	9.0	102	115	263.0	300	20	311.0	145	M12	M20	M24	19	74.9	20^{JS9}
K9	315	495	10.0	102	115	302.0	350	26	361.0	180	M16	M24	M30	26	95.4	25^{JS9}

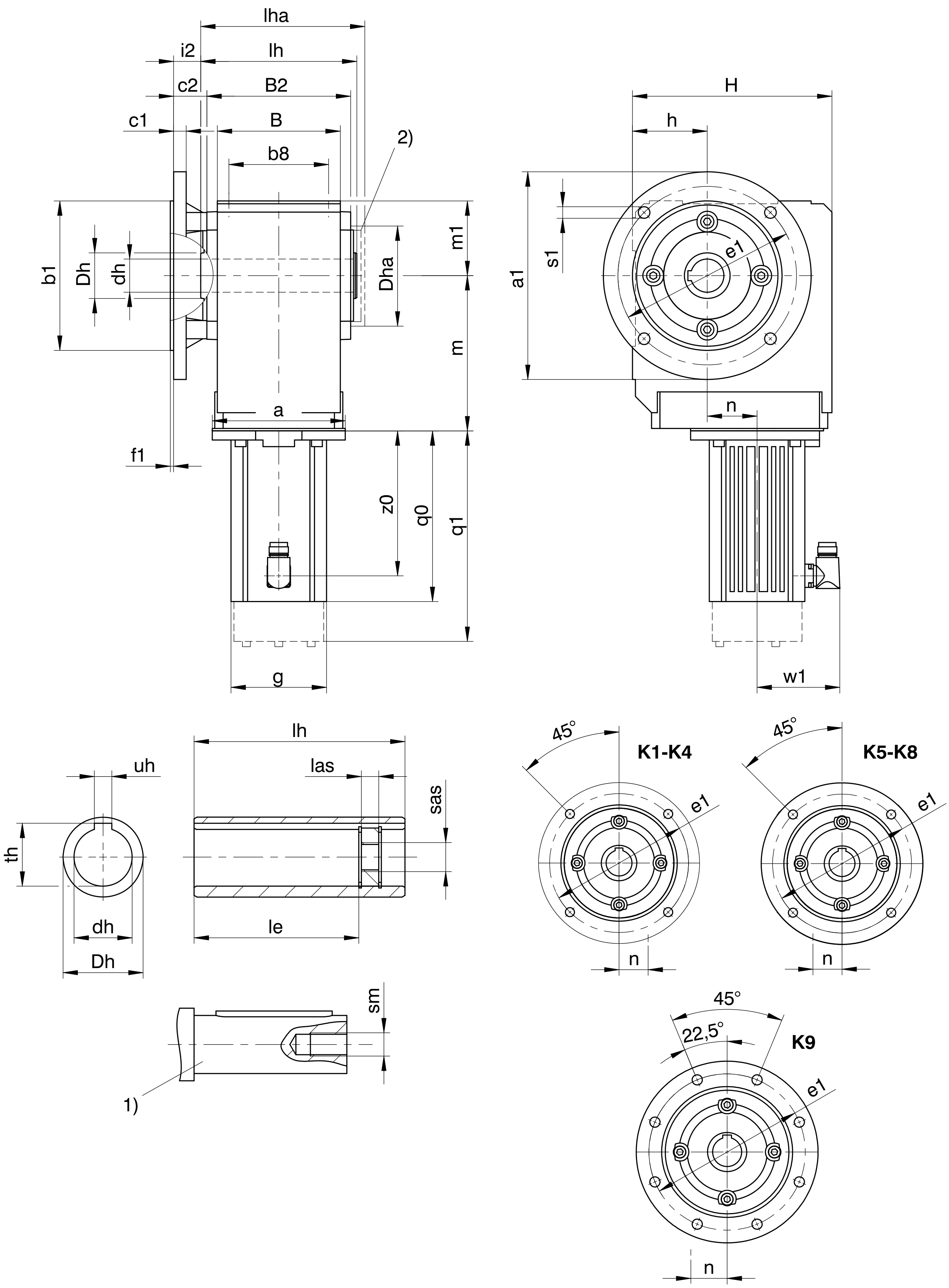
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	⌀140	180	46.0	–	–	–	–	–	–
K302	⌀140	163	52.5	□115	167	52.5	□145	169	52.5
K303	⌀140	200	52.5	⌀160	210	16.0	–	–	–
K402	–	–	–	⌀160	187	60.0	□145	189	60.0
K403	⌀140	220	60.0	⌀160	230	23.0	–	–	–
K513	–	–	–	⌀160	172	15.0	□145	174	15.0
K514	–	–	–	⌀160	215	15.0	–	–	–
K613	–	–	–	⌀160	191	18.0	⌀200	193	18.0
K614	–	–	–	⌀160	234	18.0	–	–	–
K713	–	–	–	–	–	–	⌀200	221	20.0
K714	–	–	–	⌀160	263	20.0	⌀200	283	20.0
K813	–	–	–	–	–	–	⌀200	247	24.0
K814	–	–	–	–	–	–	⌀200	308	24.0
K914	–	–	–	–	–	–	⌀200	353	25.0

12.3.4 A shaft design (hollow shaft), F housing design (round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	The length of the machine shaft must be at least 2.2 x ∅dh and the length of the feather key must be at least 2 x ∅dh.
2)	Cover (optional)		

Dimensions of gear units

Type	∅a1	∅b1	b8	B	B2	c1	c2	∅dh	∅Dh	Dha	∅e1	f1	h	H	i2	le	lh	las	lha	m1	∅s1	sm	sas	th	uh
K1	160	110_{j6}	70	90	106	10	32.0	20^{H7}	40	□105	130	3.5	60	160	25.0	98.0	120	12	127.0	60	9	M6	M8	22.8	6^{JS9}
K1	160	110_{j6}	70	90	106	10	32.0	25^{H7}	40	□105	130	3.5	60	160	25.0	98.0	120	12	127.0	60	9	M10	M12	28.3	8^{JS9}
K1	160	110_{j6}	70	90	106	10	32.0	30^{H7}	40	□105	130	3.5	60	160	25.0	93.5	120	12	127.0	60	9	M10	M12	32.0	8^{JS9}
K2	200	130_{j6}	90	115	134	12	32.0	30^{H7}	45	□116	165	3.5	65	190	25.0	121.5	148	12	156.0	65	11	M10	M12	33.3	8^{JS9}
K3	200	130_{j6}	105	130	146	14	38.0	35^{H7}	50	□132	165	3.5	75	213	31.0	125.0	160	12	168.0	75	11	M12	M16	38.3	10^{JS9}
K4	250	180_{j6}	120	148	173	15	40.0	40^{H7}	55	□152	215	4.0	90	240	32.5	157.0	188	12	197.5	90	14	M16	M20	43.3	12^{JS9}
K5	250	180_{j6}	125	160	185	15	39.5	50^{H7}	65	□145	215	4.0	160	260	32.0	164.0	200	12	209.5	100	14	M16	M20	53.8	14^{JS9}
K6	300	230_{j6}	130	168	200	17	36.0	50^{H7}	70	∅183	265	4.0	190	310	28.5	179.0	215	12	224.5	120	14	M16	M20	53.8	14^{JS9}
K7	350	250_{h6}	145	190	226	18	44.0	60^{H7}	85	∅205	300	5.0	212	342	36.0	214.0	242	12	252.0	125	18	M20	M24	64.4	18^{JS9}
K8	400	300_{h6}	185	235	282	20	45.0	70^{H7}	100	∅184	350	5.0	265	410	36.0	263.0	300	20	311.0	145	18	M20	M24	74.9	20^{JS9}
K9	450	350_{h6}	225	285	330	23	50.0	90^{H7}	120	∅230	400	5.0	315	495	40.0	302.0	350	26	361.0	180	18	M24	M30	95.4	25^{JS9}

Dimensions of additional round flanges

Type	∅a1	∅b1	c1	∅e1	f1	∅s1
K1	140	95_{j6}	10	115	3.0	9
K2	160	110_{j6}	12	130	3.5	9
K3	160	110_{j6}	14	130	3.5	9
K3	250	180_{j6}	14	215	4.0	14
K8	350	250_{h6}	18	300	5.0	18
K8	450	350_{h6}	20	400	5.0	18

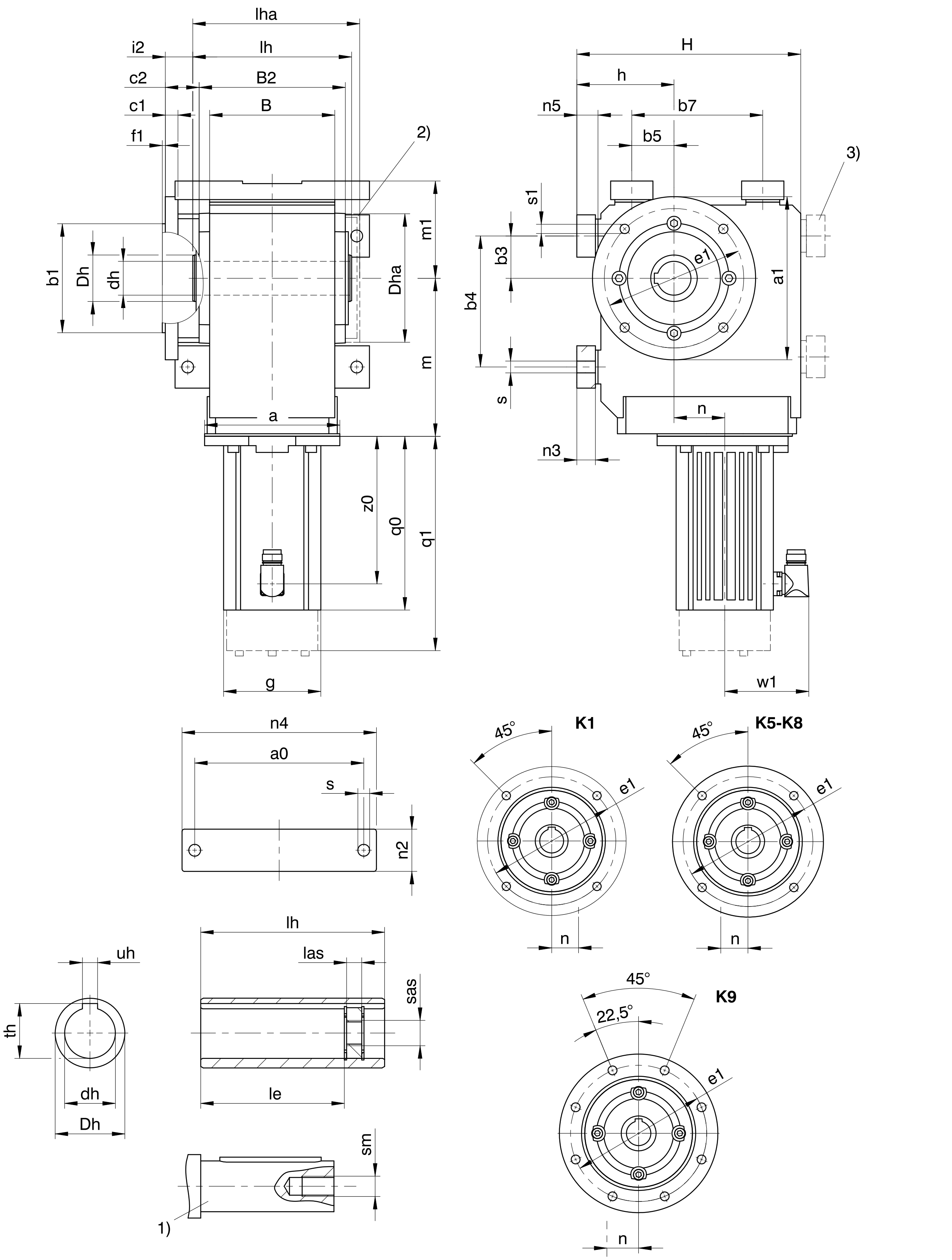
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.5 A shaft design (hollow shaft), NF housing design (base + round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	The length of the machine shaft must be at least 2.2 x Ødh and the length of the feather key must be at least 2 x Ødh.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	a0	∅a1	∅b1	b3	b4	b5	b7	B	B2	c1	c2	∅dh	∅Dh	Dha	∅e1	f1	h
K1	115	160	110_{j6}	30	90	30	90	90	106	10	32.0	20^{H7}	40	□105	130	3.5	75
K1	115	160	110_{j6}	30	90	30	90	90	106	10	32.0	25^{H7}	40	□105	130	3.5	75
K1	115	160	110_{j6}	30	90	30	90	90	106	10	32.0	30^{H7}	40	□105	130	3.5	75
K3	170	160	110_{j6}	40	130	40	130	130	146	14	38.0	35^{H7}	50	□132	130	3.5	98
K5	200	250	180_{j6}	40	140	100	140	160	185	15	39.5	50^{H7}	65	□145	215	4.0	190
K6	210	300	230_{j6}	50	160	110	160	168	200	17	36.0	50^{H7}	70	∅183	265	4.0	220
K7	241	350	250_{h6}	55	180	125	180	190	226	18	44.0	60^{H7}	85	∅205	300	5.0	250
K8	300	400	300_{h6}	75	240	165	240	235	282	20	45.0	70^{H7}	100	∅184	350	5.0	310
K9	360	450	350_{h6}	95	280	185	280	285	330	23	50.0	90^{H7}	120	∅230	400	5.0	365

Dimensions of gear units

Type	H	i2	le	lh	las	lha	m1	n2	n3	n4	n5	∅s	∅s1	sm	sas	th	uh
K1	175	25.0	98.0	120	12	127.0	75	30	13	140	15	9.0	9	M6	M8	22.8	6^{JS9}
K1	175	25.0	98.0	120	12	127.0	75	30	13	140	15	9.0	9	M10	M12	28.3	8^{JS9}
K1	175	25.0	93.5	120	12	127.0	75	30	13	140	15	9.0	9	M10	M12	32.0	8^{JS9}
K3	236	31.0	125.0	160	12	168.0	98	45	20	200	23	11.0	9	M12	M16	38.3	10^{JS9}
K5	290	32.0	164.0	200	12	209.5	130	60	27	240	30	18.0	14	M16	M20	53.8	14^{JS9}
K6	340	28.5	179.0	215	12	224.5	150	65	27	250	30	18.5	14	M16	M20	53.8	14^{JS9}
K7	380	36.0	214.0	242	12	252.0	163	70	35	290	38	23.0	18	M20	M24	64.4	18^{JS9}
K8	455	36.0	263.0	300	20	311.0	190	85	41	360	45	27.0	18	M20	M24	74.9	20^{JS9}
K9	545	40.0	302.0	350	26	361.0	230	95	46	430	50	31.0	18	M24	M30	95.4	25^{JS9}

Dimensions of additional round flanges

Type	∅a1	∅b1	c1	∅e1	f1	∅s1
K1	140	95_{j6}	10	115	3	9
K8	350	250_{h6}	18	300	5	18
K8	450	350_{h6}	20	400	5	18

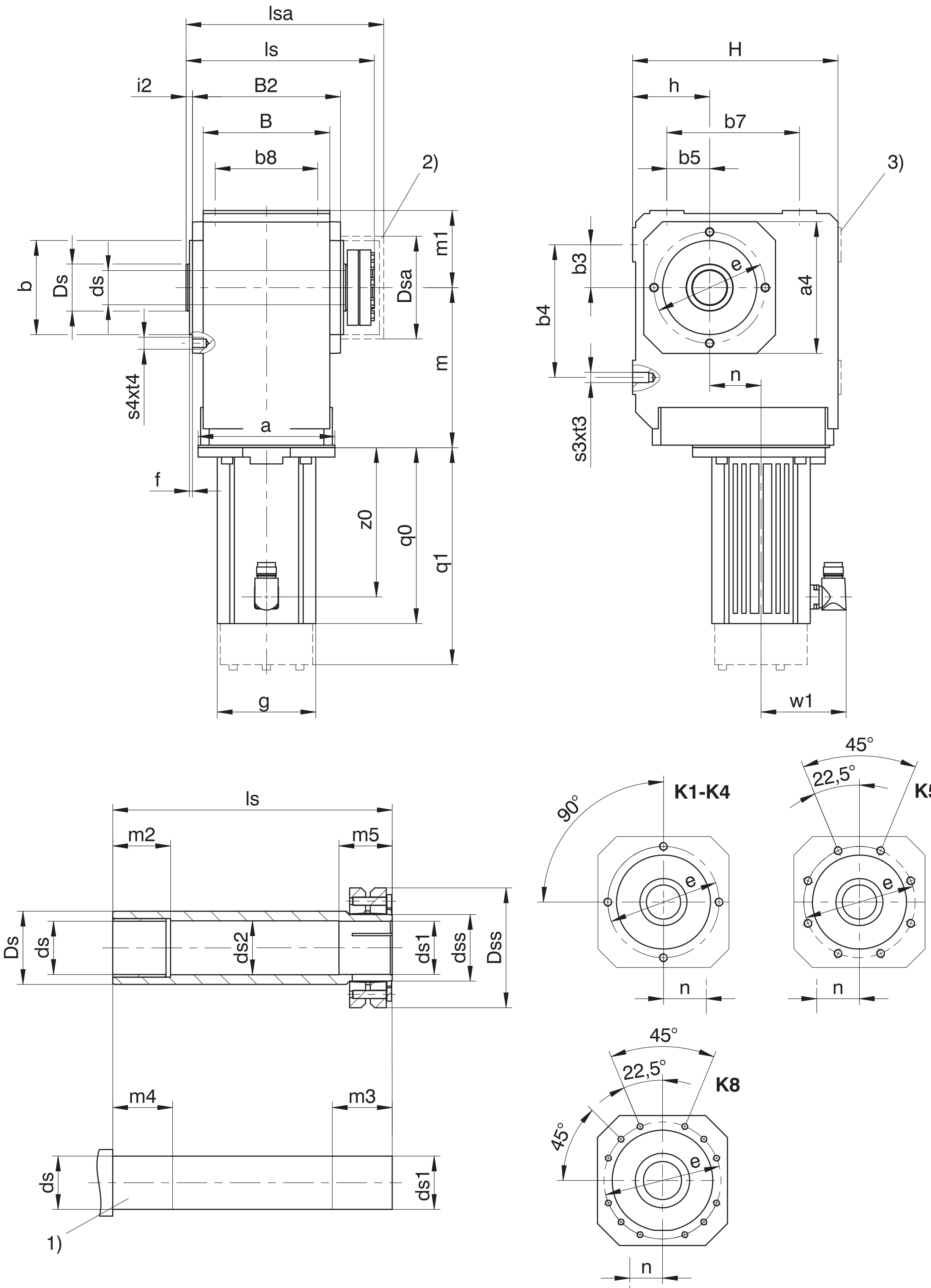
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.6 S shaft design (hollow shaft with shrink disk), G housing design (pitch circle diameter)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	Machine shaft: The dimension ls must meet or exceed the specified value.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	□a4	∅b	b3	b4	b5	b7	b8	B	B2	∅ds	∅ds1	∅ds2	∅dss	∅Ds	∅Dsa	∅Dss	∅e	f	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	s3	s4	t3	t4
K1	105	75_{j6}	30	90	30	90	70	90	106	25_{h9}	25_{h9}^{H7}	25.5	30	40	80.0	60	90	3.0	60	160	7.0	149	163	60	20	34	25	29	M8	M8	13	13
K2	116	82_{j6}	35	115	35	115	90	115	134	30_{h9}	30_{h9}^{H7}	30.5	36	45	88.0	72	100	3.0	65	190	7.0	178	193	65	25	39	30	34	M10	M8	16	13
K3	132	95_{j6}	40	130	40	130	105	130	146	35_{h9}	35_{h9}^{H7}	35.5	44	50	101.0	80	115	3.0	75	213	7.0	190	206	75	30	39	35	34	M10	M8	16	13
K4	152	110_{j6}	50	155	50	155	120	148	173	40_{h9}	40_{h9}^{H7}	40.5	50	55	114.0	88	130	3.5	90	240	7.5	220	243	90	40	39	45	34	M12	M10	19	16
K5	145	110_{j6}	40	140	100	140	125	160	185	50_{h9}	50_{h9}^{H7}	50.5	62	65	116.0	106	130	3.5	160	260	7.5	237	254	100	40	44	45	39	M16	M10	26	16
K6	180	140_{j6}	50	160	110	160	130	168	200	50_{h9}	50_{h9}^{H7}	50.5	62	70	128.0	106	165	3.5	190	310	7.5	254	276	120	40	45	45	40	M16	M10	26	16
K7	195	155_{h6}	55	180	125	180	145	190	226	60_{h6}	60_{h6}^{H7}	62.0	75	85	161.5	138	185	3.5	212	342	8.0	278	314	125	40	45	45	40	M20	M12	33	19
K8	226	185_{h6}	75	240	165	240	185	235	282	70_{h6}	70_{h6}^{H7}	72.0	90	100	193.0	155	215	4.0	265	410	9.0	352	378	145	50	60	60	50	M24	M12	38	19
K9	280	230_{h6}	95	280	185	280	225	285	330	90_{h6}	90_{h6}^{H7}	92.0	120	120	244.0	200	265	5.0	315	495	10.0	418	428	180	60	70	70	60	M30	M16	48	26

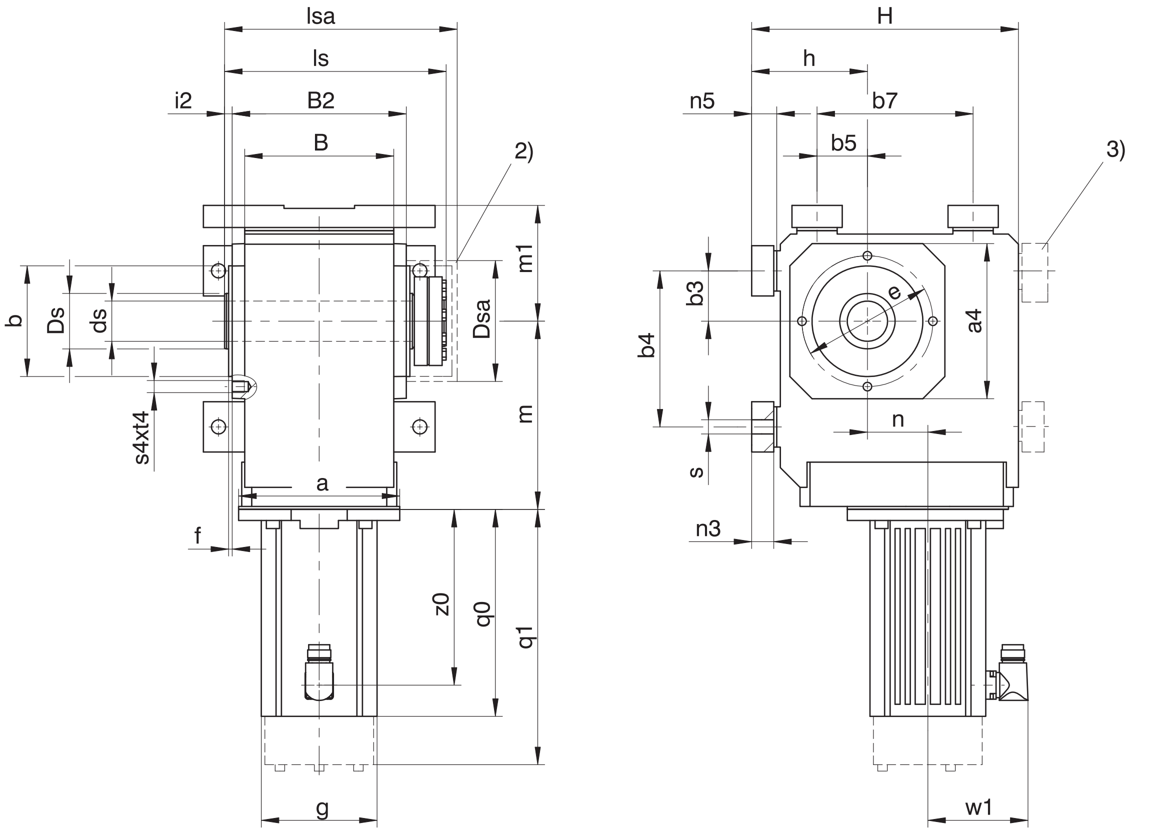
Dimensions of motors

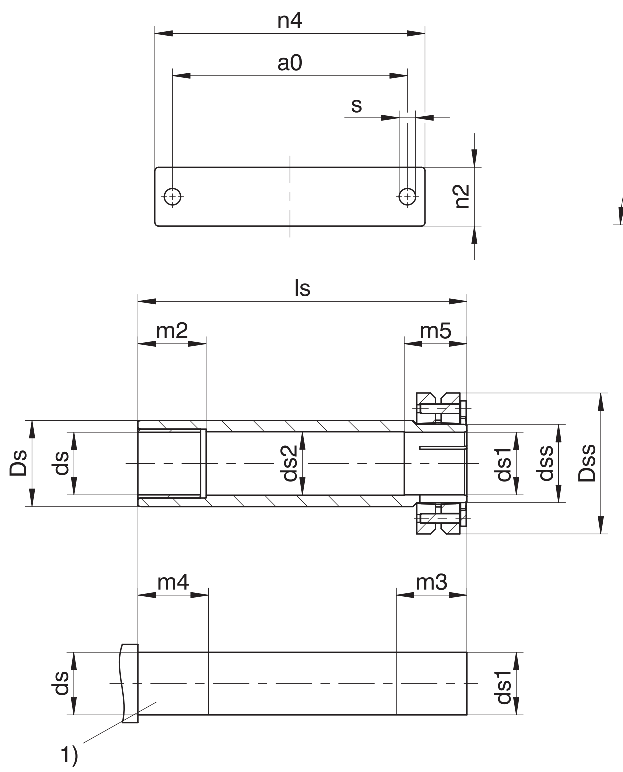
Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

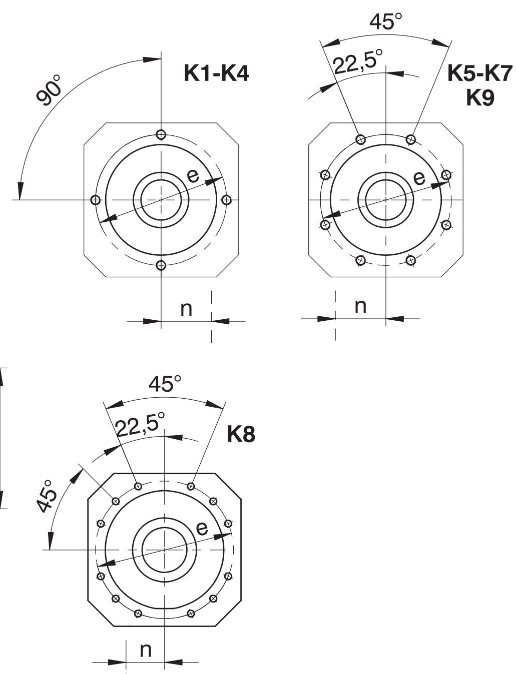
Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.7 S shaft design (hollow shaft with shrink disk), NG housing design (base + pitch circle diameter)







q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	Machine shaft: The dimension ls must meet or exceed the specified value.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	a0	a4	∅b	b3	b4	b5	b7	B	B2	∅ds	∅ds1	∅ds2	∅dss	∅Ds	∅Dsa
K1	115	105	75_{j6}	30	90	30	90	90	106	25_{h9}	25_{h9}^{H7}	25.5	30	40	80
K2	155	116	82_{j6}	35	115	35	115	115	134	30_{h9}	30_{h9}^{H7}	30.5	36	45	88
K3	170	132	95_{j6}	40	130	40	130	130	146	35_{h9}	35_{h9}^{H7}	35.5	44	50	101
K4	200	152	110_{j6}	50	155	50	155	148	173	40_{h9}	40_{h9}^{H7}	40.5	50	55	114
K5	200	145	110_{j6}	40	140	100	140	160	185	50_{h9}	50_{h9}^{H7}	50.5	62	65	116
K6	210	180	140_{j6}	50	160	110	160	168	200	50_{h9}	50_{h9}^{H7}	50.5	62	70	128
K7	241	195	155_{j6}	55	180	125	180	190	226	60_{h6}	60_{h6}^{H7}	62.0	75	85	161.5
K8	300	226	185_{j6}	75	240	165	240	235	282	70_{h6}	70_{h6}^{H7}	72.0	90	100	193
K9	360	280	230_{j6}	95	280	185	280	285	330	90_{h6}	90_{h6}^{H7}	92.0	120	120	244

Dimensions of gear units

Type	∅Dss	∅e	f	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	n2	n3	n4	n5	∅s	s4	t4
K1	60	90	3.0	75	175	7.0	149	163	75	20	34	25	29	30	13	140	15	9.0	M8	13
K2	72	100	3.0	88	213	7.0	178	193	88	25	39	30	34	40	20	185	23	11.0	M8	13
K3	80	115	3.0	98	236	7.0	190	206	98	30	39	35	34	45	20	200	23	11.0	M8	13
K4	88	130	3.5	115	265	7.5	220	243	115	40	39	45	34	50	22	230	25	14.0	M10	16
K5	106	130	3.5	190	290	7.5	237	254	130	40	44	45	39	60	27	240	30	18.0	M10	16
K6	106	165	3.5	220	340	7.5	254	276	150	40	45	45	40	65	27	250	30	18.5	M10	16
K7	138	185	3.5	250	380	8.0	278	314	163	40	45	45	40	70	35	290	38	23.0	M12	19
K8	155	215	4.0	310	455	9.0	352	378	190	50	60	60	50	85	41	360	45	27.0	M12	19
K9	200	265	5.0	365	545	10.0	418	428	230	60	70	70	60	95	46	430	50	31.0	M16	26

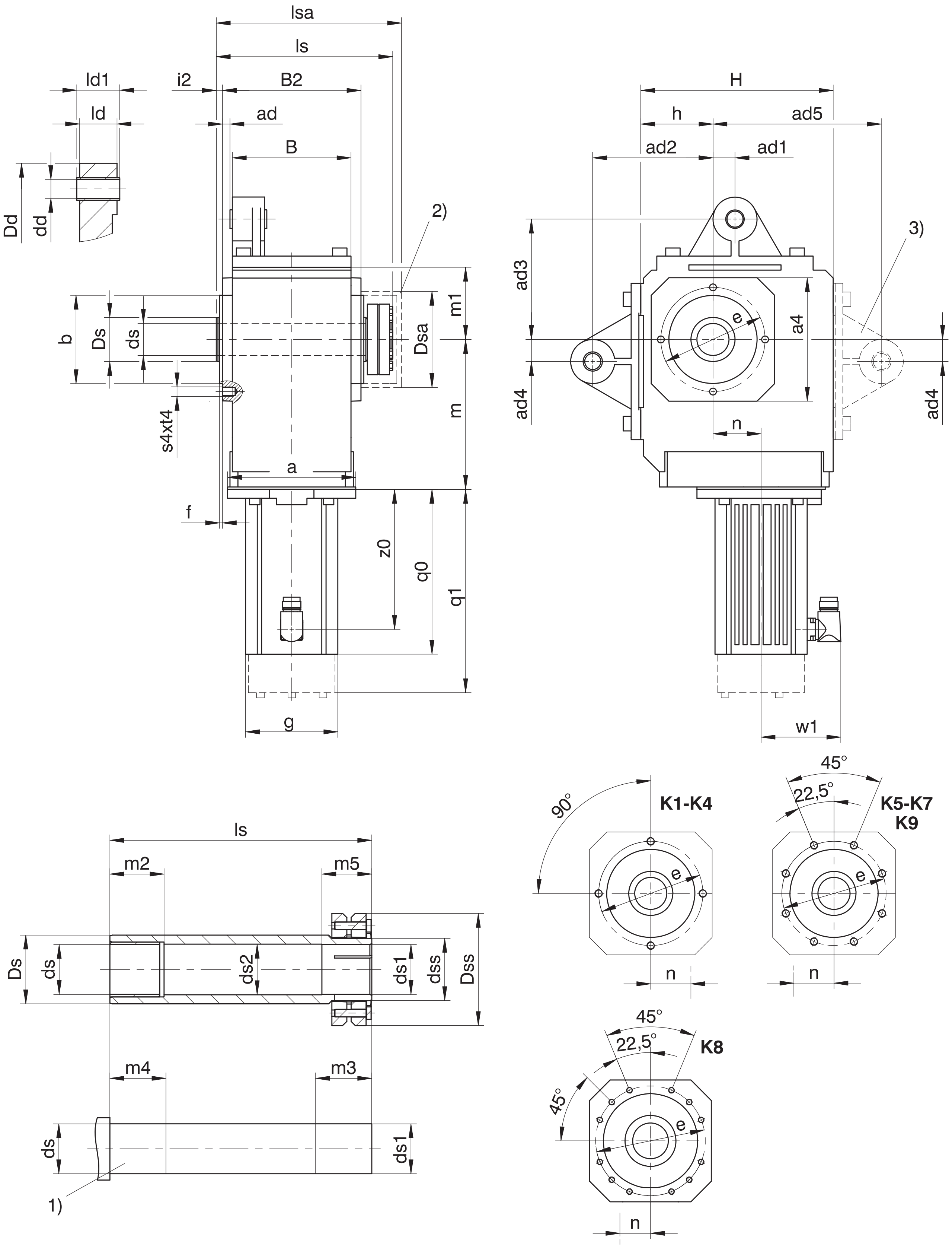
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.8 S shaft design (hollow shaft with shrink disk), GD housing design (pitch circle diameter + torque arm bracket)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	Machine shaft: The dimension ls must meet or exceed the specified value.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)
–	If you brace the gear units without the factory-adjusted torque arms provided for this purpose, the dimensions for ad2 and ad3 must meet the specified value.		

Dimensions of gear units

Type	□a4	ad	ad1	ad2	ad3	ad4	ad5	∅b	B	B2	∅dd	∅ds	∅ds1	∅ds2	∅dss	∅Dd	∅Ds	∅Dsa
K1	105	6.0	15.0	90	90	15.0	130	75_{j6}	90	106	12^{H9}	25_{h9}	25_{h9}^{H7}	25.5	30	43	40	80
K2	116	6.5	22.5	100	100	22.5	–	82_{j6}	115	134	16^{H9}	30_{h9}	30_{h9}^{H7}	30.5	36	45	45	88
K3	132	5.0	25.0	120	120	25.0	–	95_{j6}	130	146	16^{H9}	35_{h9}	35_{h9}^{H7}	35.5	44	45	50	101
K4	152	9.5	27.5	150	150	27.5	–	110_{j6}	148	173	20^{H9}	40_{h9}	40_{h9}^{H7}	40.5	50	55	55	114
K5	145	9.5	30.0	250	190	30.0	–	110_{j6}	160	185	20^{H9}	50_{h9}	50_{h9}^{H7}	50.5	62	58	65	116
K6	180	13.0	30.0	250	180	30.0	–	140_{j6}	168	200	20^{H9}	50_{h9}	50_{h9}^{H7}	50.5	62	58	70	128
K7	195	15.0	35.0	300	213	35.0	–	155_{h6}	190	226	20^{H9}	60_{h6}	60_{h6}^{H7}	62.0	75	68	85	161.5
K8	226	17.0	45.0	350	230	45.0	–	185_{h6}	235	282	24^{H9}	70_{h6}	70_{h6}^{H7}	72.0	90	72	100	193
K9	280	16.0	45.0	450	315	45.0	–	230_{h6}	285	330	24^{H9}	90_{h6}	90_{h6}^{H7}	92.0	120	75	120	244

Dimensions of gear units

Type	∅Dss	∅e	f	h	H	i2	ld	ld1	ls	lsa	m1	m2	m3	m4	m5	s4	t4
K1	60	90	3.0	60	160	7.0	24	28	149	163	60	20	34	25	29	M8	13
K2	72	100	3.0	65	190	7.0	32	38	178	193	65	25	39	30	34	M8	13
K3	80	115	3.0	75	213	7.0	32	38	190	206	75	30	39	35	34	M8	13
K4	88	130	3.5	90	240	7.5	40	46	220	243	90	40	39	45	34	M10	16
K5	106	130	3.5	160	260	7.5	40	46	237	254	100	40	44	45	39	M10	16
K6	106	165	3.5	190	310	7.5	40	46	254	276	120	40	45	45	40	M10	16
K7	138	185	3.5	212	342	8.0	64	70	278	314	125	40	45	45	40	M12	19
K8	155	215	4.0	265	410	9.0	102	115	352	378	145	50	60	60	50	M12	19
K9	200	265	5.0	315	495	10.0	102	115	418	428	180	60	70	70	60	M16	26

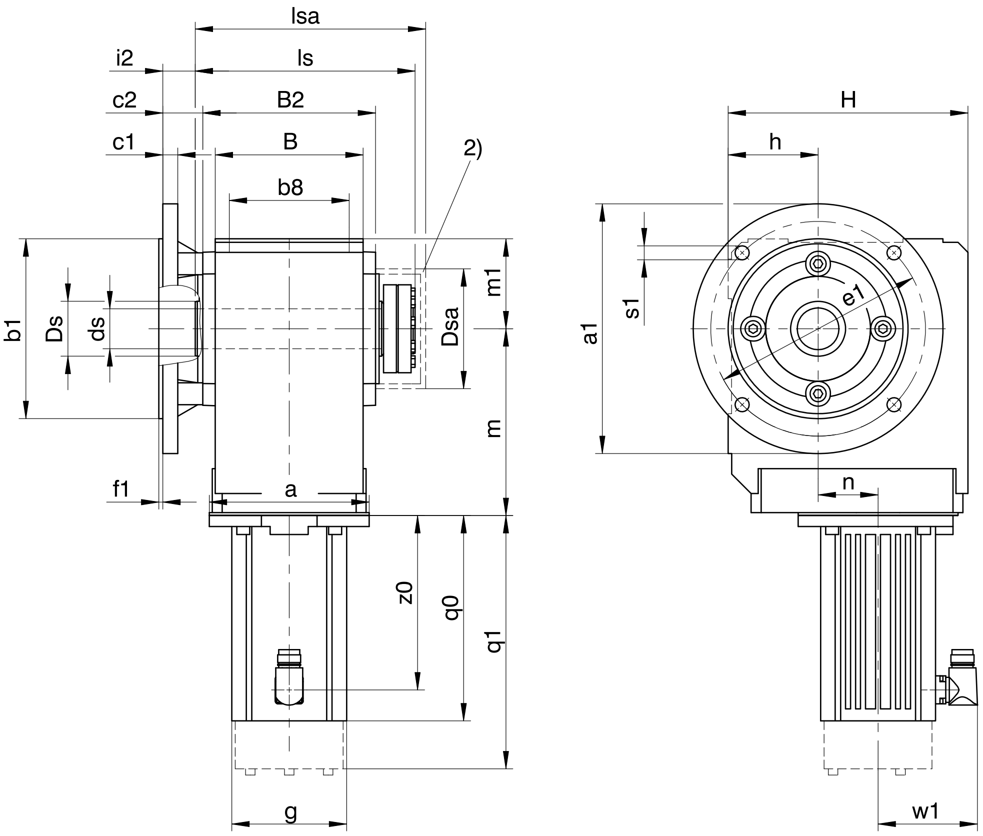
Dimensions of motors

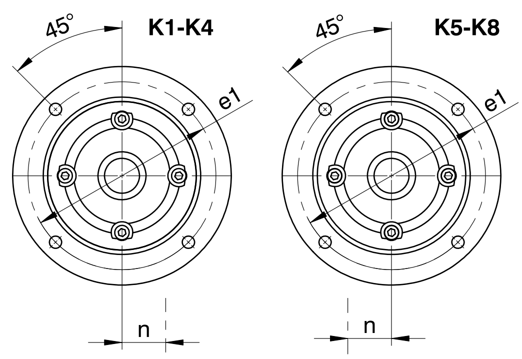
Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

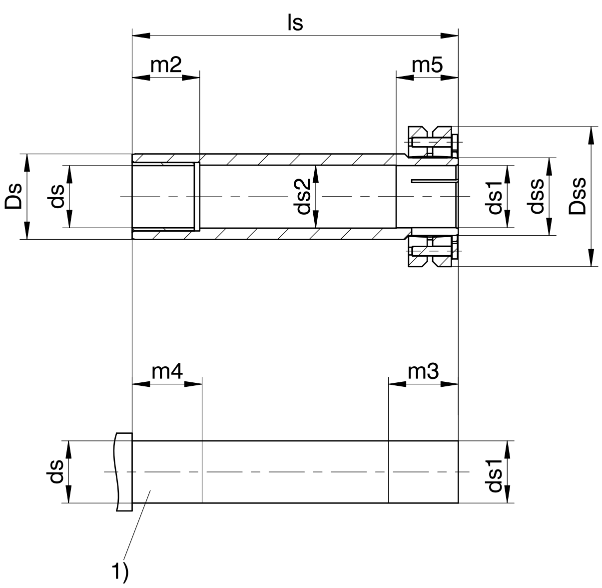
Dimensions of geared motors

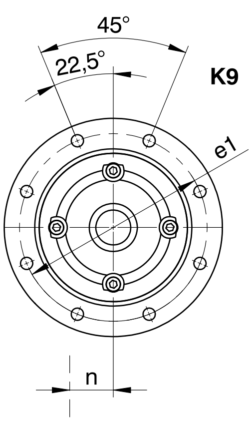
Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.9 S shaft design (hollow shaft with shrink disk), F housing design (round flange)









q0	Applies to motors without brake.
q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.
1)	Machine shaft: The dimension ls must meet or exceed the specified value.
2)	Cover (optional)

Dimensions of gear units

Type	Øa1	Øb1	b8	B	B2	c1	c2	Øds	Øds1	Øds2	Ødss	ØDs	ØDsa	ØDss	Øe1	f1	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	Øs1
K1	160	110_{j6}	70	90	106	10	32.0	25_{h9}	25_{h9}^{H7}	25.5	30	40	80	60	130	3.5	60	160	25.0	149	163	60	20	34	25	29	9
K2	200	130_{j6}	90	115	134	12	32.0	30_{h9}	30_{h9}^{H7}	30.5	36	45	88	72	165	3.5	65	190	25.0	178	193	65	25	39	30	34	11
K3	200	130_{j6}	105	130	146	14	38.0	35_{h9}	35_{h9}^{H7}	35.5	44	50	101	80	165	3.5	75	213	31.0	190	206	75	30	39	35	34	11
K4	250	180_{j6}	120	148	173	15	40.0	40_{h9}	40_{h9}^{H7}	40.5	50	55	114	88	215	4.0	90	240	32.5	220	243	90	40	39	45	34	14
K5	250	180_{j6}	125	160	185	15	39.5	50_{h9}	50_{h9}^{H7}	50.5	62	65	116	106	215	4.0	160	260	32.0	237	254	100	40	44	45	39	14
K6	300	230_{j6}	130	168	200	17	36.0	50_{h9}	50_{h9}^{H7}	50.5	62	70	128	106	265	4.0	190	310	28.5	254	276	120	40	45	45	40	14
K7	350	250_{h6}	145	190	226	18	44.0	60_{h6}	60_{h6}^{H7}	62.0	75	85	161.5	138	300	5.0	212	342	36.0	278	314	125	40	45	45	40	18
K8	400	300_{h6}	185	235	282	20	45.0	70_{h6}	70_{h6}^{H7}	72.0	90	100	193	155	350	5.0	265	410	36.0	352	378	145	50	60	60	50	18
K9	450	350_{h6}	225	285	330	23	50.0	90_{h6}	90_{h6}^{H7}	92.0	120	120	244	200	400	5.0	315	495	40.0	418	428	180	60	70	70	60	18

Dimensions of additional round flanges

Type	Øa1	Øb1	c1	Øe1	f1	Øs1
K1	140	95_{j6}	10	115	3.0	9
K2	160	110_{j6}	12	130	3.5	9
K3	160	110_{j6}	14	130	3.5	9
K3	250	180_{j6}	14	215	4.0	14
K8	350	250_{h6}	18	300	5.0	18
K8	450	350_{h6}	20	400	5.0	18

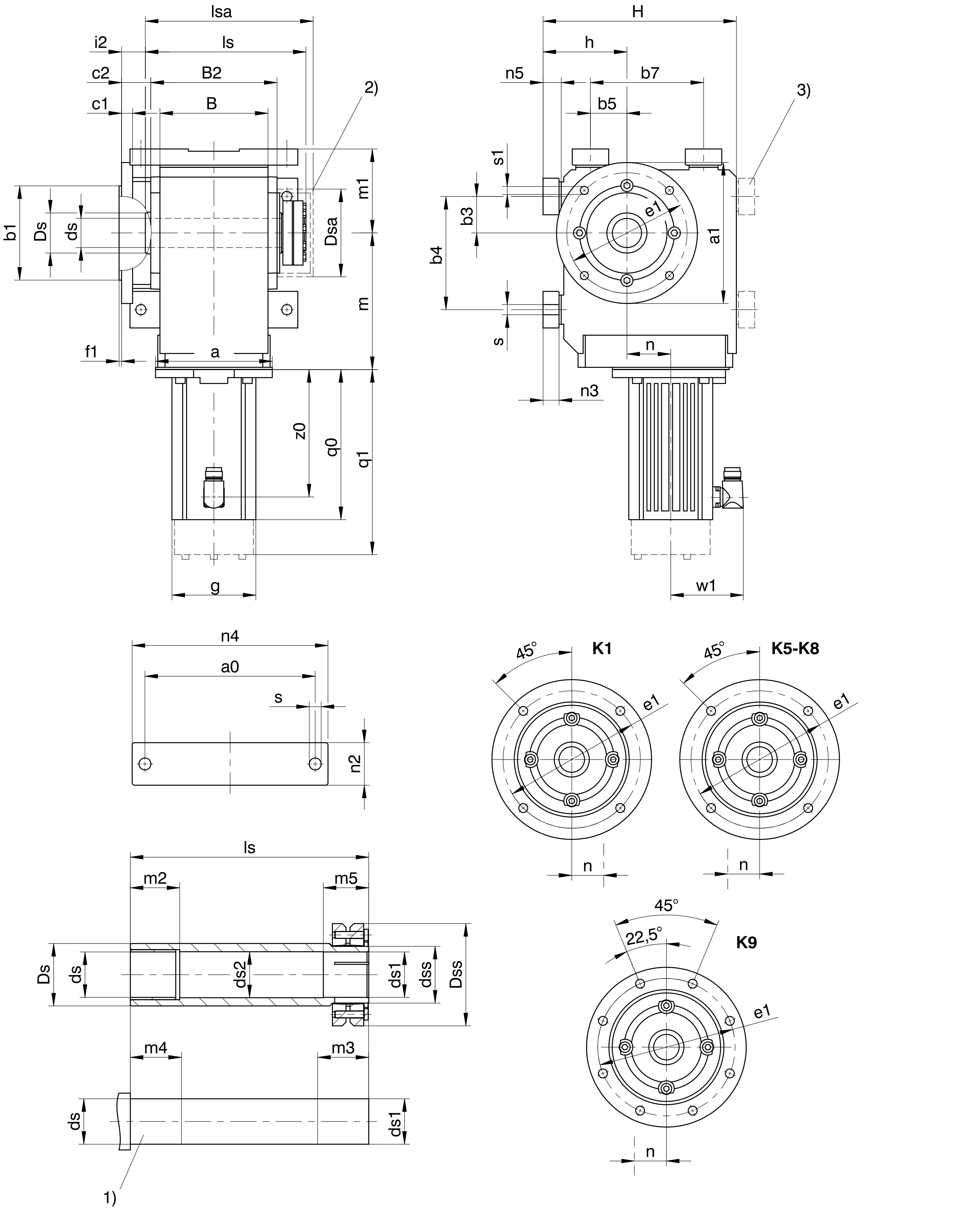
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	Ø140	180	46.0	–	–	–	–	–	–
K302	Ø140	163	52.5	□115	167	52.5	□145	169	52.5
K303	Ø140	200	52.5	Ø160	210	16.0	–	–	–
K402	–	–	–	Ø160	187	60.0	□145	189	60.0
K403	Ø140	220	60.0	Ø160	230	23.0	–	–	–
K513	–	–	–	Ø160	172	15.0	□145	174	15.0
K514	–	–	–	Ø160	215	15.0	–	–	–
K613	–	–	–	Ø160	191	18.0	Ø200	193	18.0
K614	–	–	–	Ø160	234	18.0	–	–	–
K713	–	–	–	–	–	–	Ø200	221	20.0
K714	–	–	–	Ø160	263	20.0	Ø200	283	20.0
K813	–	–	–	–	–	–	Ø200	247	24.0
K814	–	–	–	–	–	–	Ø200	308	24.0
K914	–	–	–	–	–	–	Ø200	353	25.0

12.3.10 S shaft design (hollow shaft with shrink disk), NF housing design (base + round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	1)	Machine shaft: The dimension ls must meet or exceed the specified value.
2)	Cover (optional)	3)	Only for K1 (other sizes on request)

Dimensions of gear units

Type	a0	Øa1	Øb1	b3	b4	b5	b7	B	B2	c1	c2	Øds	Øds1	Øds2	Ødss	ØDs	ØDsa	ØDss
K1	115	160	110_{j6}	30	90	30	90	90	106	10	32.0	25_{h9}	25_{h9}^{H7}	25.5	30	40	80.0	60
K3	170	160	110_{j6}	40	130	40	130	130	146	14	38.0	35_{h9}	35_{h9}^{H7}	35.5	44	50	101.0	80
K5	200	250	180_{j6}	40	140	100	140	160	185	15	39.5	50_{h9}	50_{h9}^{H7}	50.5	62	65	116.0	106
K6	210	300	230_{j6}	50	160	110	160	168	200	17	36.0	50_{h9}	50_{h9}^{H7}	50.5	62	70	128.0	106
K7	241	350	250_{h6}	55	180	125	180	190	226	18	44.0	60_{h6}	60_{h6}^{H7}	62.0	75	85	161.5	138
K8	300	400	300_{h6}	75	240	165	240	235	282	20	45.0	70_{h6}	70_{h6}^{H7}	72.0	90	100	193.0	155
K9	360	450	350_{h6}	95	280	185	280	285	330	23	50.0	90_{h6}	90_{h6}^{H7}	92.0	120	120	244.0	200

Dimensions of gear units

Type	Øe1	f1	h	H	i2	ls	lsa	m1	m2	m3	m4	m5	n2	n3	n4	n5	Øs	Øs1
K1	130	3.5	75	175	25.0	149	163	75	20	34	25	29	30	13	140	15	9.0	9
K3	130	3.5	98	236	31.0	190	206	98	30	39	35	34	45	20	200	23	11.0	9
K5	215	4.0	190	290	32.0	237	254	130	40	44	45	39	60	27	240	30	18.0	14
K6	265	4.0	220	340	28.5	254	276	150	40	45	45	40	65	27	250	30	18.5	14
K7	300	5.0	250	380	36.0	278	314	163	40	45	45	40	70	35	290	38	23.0	18
K8	350	5.0	310	455	36.0	352	378	190	50	60	60	50	85	41	360	45	27.0	18
K9	400	5.0	365	545	40.0	418	428	230	60	70	70	60	95	46	430	50	31.0	18

Dimensions of additional round flanges

Type	Øa1	Øb1	c1	Øe1	f1	Øs1
K1	140	95_{j6}	10	115	3	9
K8	350	250_{h6}	18	300	5	18
K8	450	350_{h6}	20	400	5	18

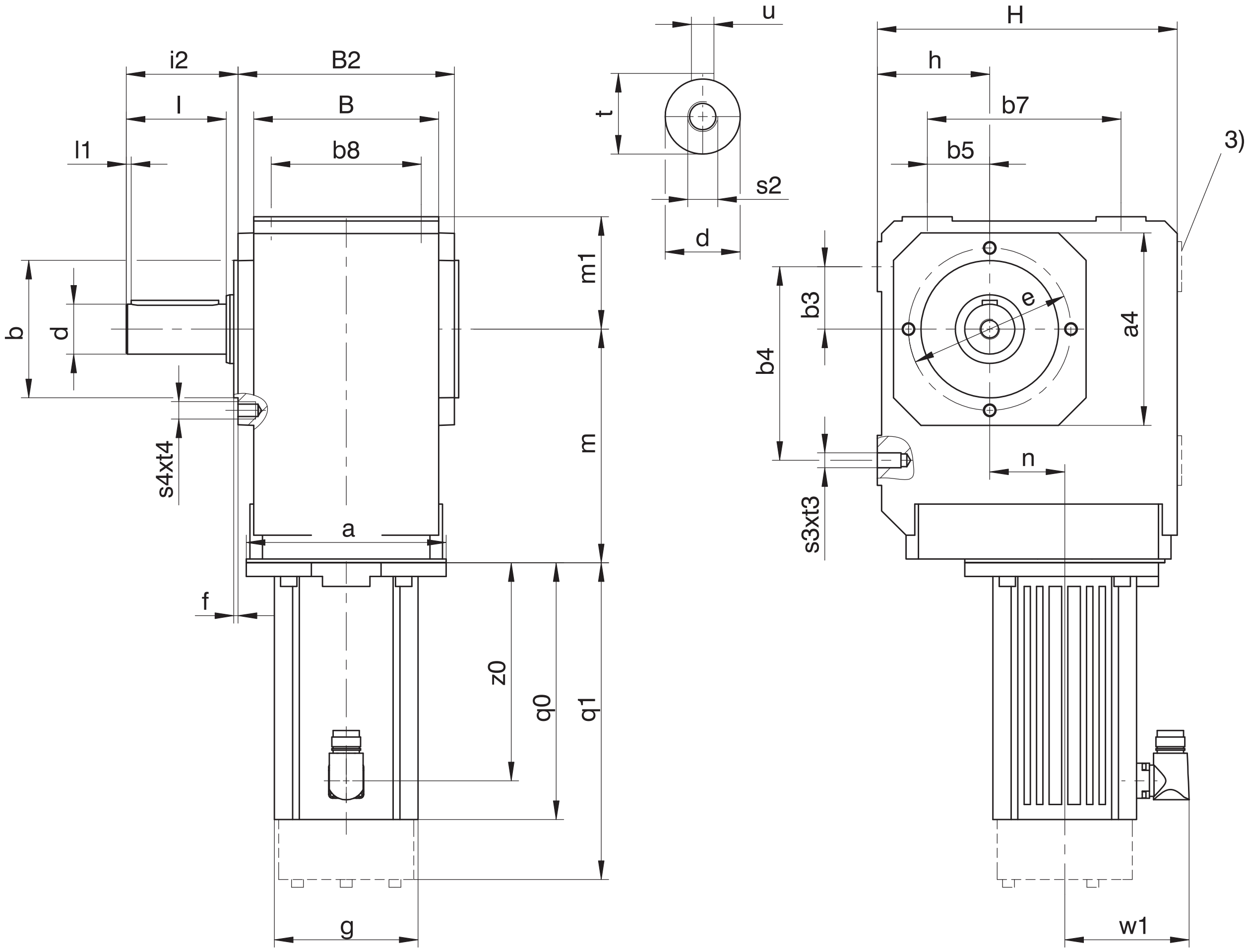
Dimensions of motors

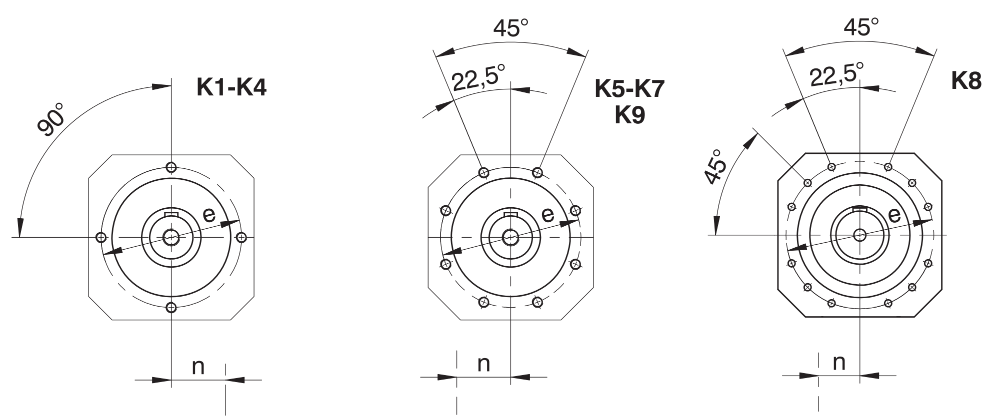
Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.11 A shaft design (solid shaft), G housing design (pitch circle diameter)





q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	3)	Only for K1 (other sizes on request)
–	K1 – K4: solid shaft without feather key available, on request starting at K5.	–	K1 – K9: Solid shaft on both sides available.

Dimensions of gear units

Type	□a4	∅b	b3	b4	b5	b7	b8	B	B2	∅d	∅e	f	h	H	i2	l	l1	m1	s2	s3	s4	t	t3	t4	u
K1	105	75_{j6}	30	90	30	90	70	90	106	25_{k6}	90	3.0	60	160	62.0	50	4	60	M10	M8	M8	28.0	13	13	A8×7×40
K2	116	82_{j6}	35	115	35	115	90	115	134	30_{k6}	100	3.0	65	190	68.0	60	4	65	M10	M10	M8	33.0	16	13	A8×7×50
K3	132	95_{j6}	40	130	40	130	105	130	146	30_{k6}	115	3.0	75	213	69.0	60	4	75	M10	M10	M8	33.0	16	13	A8×7×50
K4	152	110_{j6}	50	155	50	155	120	148	173	40_{k6}	130	3.5	90	240	89.5	80	4	90	M16	M12	M10	43.0	19	16	A12×8×70
K5	145	110_{j6}	40	140	100	140	125	160	185	45_{k6}	130	3.5	160	260	129.5	90	4	100	M16	M16	M10	48.5	26	16	A14×9×80
K6	180	140_{j6}	50	160	110	160	130	168	200	50_{k6}	165	3.5	190	310	136.0	100	4	120	M16	M16	M10	53.5	26	16	A14×9×90
K7	195	155_{j6}	55	180	125	180	145	190	226	60_{m6}	185	3.5	212	342	164.0	120	4	125	M20	M20	M12	64.0	33	19	A18×11×110
K8	226	185_{j6}	75	240	165	240	185	235	282	70_{m6}	215	4.0	265	410	185.0	140	5	145	M20	M24	M12	74.5	38	19	A20×12×125
K9	280	230_{j6}	95	280	185	280	225	285	330	90_{m6}	265	5.0	315	495	220.0	170	8	180	M24	M30	M16	95.0	48	26	A25×14×140

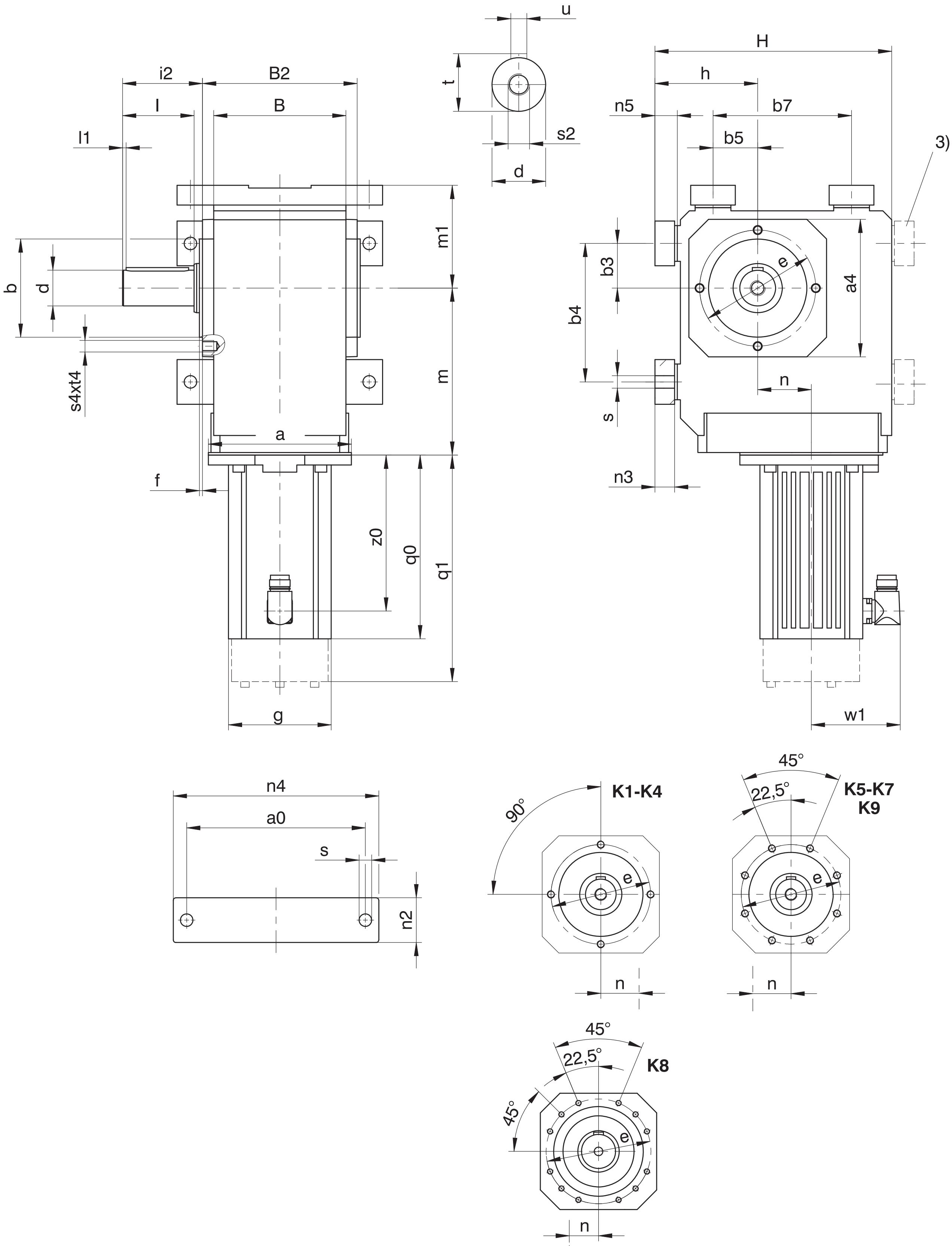
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.12 V shaft design (solid shaft), NG housing design (base + pitch circle diameter)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	3)	Only for K1 (other sizes on request)
–	K1 – K4: solid shaft without feather key available, on request starting at K5.	–	K1 – K10: Solid shaft on both sides available.

Dimensions of gear units

Type	a0	□a4	∅b	b3	b4	b5	b7	B	B2	∅d	∅e	f	h	H	i2	l	l1	m1	n2	n3	n4	n5	∅s	s2	s4	t	t4	u
K1	115	105	75_{j6}	30	90	30	90	90	106	25_{k6}	90	3.0	75	175	62.0	50	4	75	30	13	140	15	9.0	M10	M8	28.0	13	A8×7×40
K2	155	116	82_{j6}	35	115	35	115	115	134	30_{k6}	100	3.0	88	213	68.0	60	4	88	40	20	185	23	11.0	M10	M8	33.0	13	A8×7×50
K3	170	132	95_{j6}	40	130	40	130	130	146	30_{k6}	115	3.0	98	236	69.0	60	4	98	45	20	200	23	11.0	M10	M8	33.0	13	A8×7×50
K4	200	152	110_{j6}	50	155	50	155	148	173	40_{k6}	130	3.5	115	265	89.5	80	4	115	50	22	230	25	14.0	M16	M10	43.0	16	A12×8×70
K5	200	145	110_{j6}	40	140	100	140	160	185	45_{k6}	130	3.5	190	290	129.5	90	4	130	60	27	240	30	18.0	M16	M10	48.5	16	A14×9×80
K6	210	180	140_{j6}	50	160	110	160	168	200	50_{k6}	165	3.5	220	340	136.0	100	4	150	65	27	250	30	18.5	M16	M10	53.5	16	A14×9×90
K7	241	195	155_{j6}	55	180	125	180	190	226	60_{m6}	185	3.5	250	380	164.0	120	4	163	70	35	290	38	23.0	M20	M12	64.0	19	A18×11×110
K8	300	226	185_{j6}	75	240	165	240	235	282	70_{m6}	215	4.0	310	455	185.0	140	5	190	85	41	360	45	27.0	M20	M12	74.5	19	A20×12×125

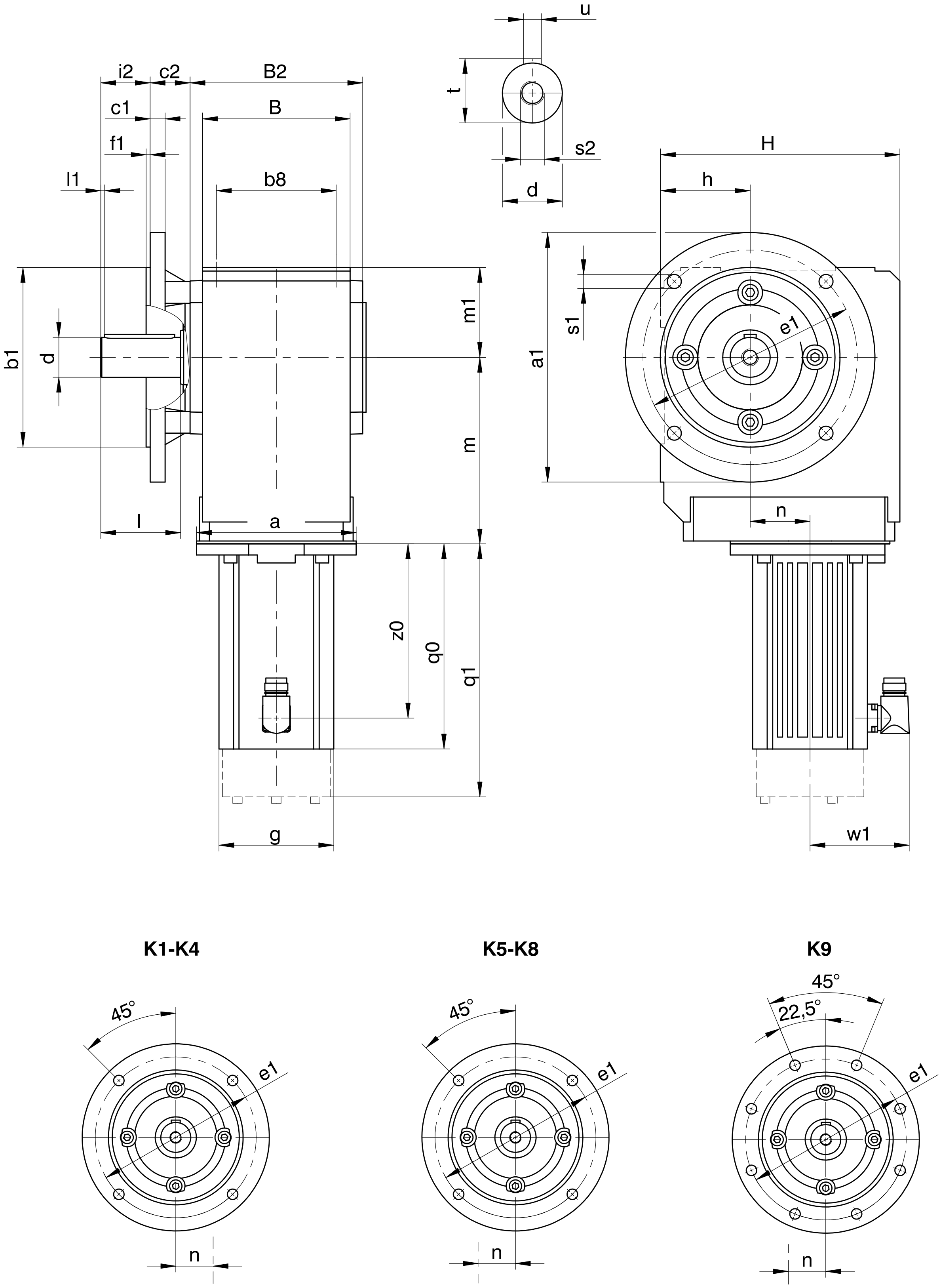
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	∅140	180	46.0	–	–	–	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K402	–	–	–	∅160	187	60.0	□145	189	60.0
K403	∅140	220	60.0	∅160	230	23.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.13 V shaft design (solid shaft), F housing design (round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	–	K1 – K4: solid shaft without feather key available, on request starting at K5.
–	K1 – K9: Solid shaft on both sides available.		

Dimensions of gear units

Type	⌀a1	⌀b1	b8	B	B2	c1	c2	⌀d	⌀e1	f1	h	H	i2	l	l1	m1	⌀s1	s2	t	u
K1	160	110_{j6}	70	90	106	10	32.0	25_{k6}	130	3.5	60	160	30.0	50	4	60	9	M10	28.0	A8×7×40
K2	200	130_{j6}	90	115	134	12	32.0	30_{k6}	165	3.5	65	190	36.0	60	4	65	11	M10	33.0	A8×7×50
K3	200	130_{j6}	105	130	146	14	38.0	30_{k6}	165	3.5	75	213	31.0	60	4	75	11	M10	33.0	A8×7×50
K4	250	180_{j6}	120	148	173	15	40.0	40_{k6}	215	4.0	90	240	49.5	80	4	90	14	M16	43.0	A12×8×70
K5	250	180_{j6}	125	160	185	15	39.5	45_{k6}	215	4.0	160	260	90.0	90	4	100	14	M16	48.5	A14×9×80
K6	300	230_{j6}	130	168	200	17	36.0	50_{k6}	265	4.0	190	310	100.0	100	4	120	14	M16	53.5	A14×9×90
K7	350	250_{h6}	145	190	226	18	44.0	60_{m6}	300	5.0	212	342	120.0	120	4	125	18	M20	64.0	A18×11×110
K8	400	300_{h6}	185	235	282	20	45.0	70_{m6}	350	5.0	265	410	140.0	140	5	145	18	M20	74.5	A20×12×125

Dimensions of additional round flanges

Type	⌀a1	⌀b1	c1	⌀e1	f1	⌀s1
K1	140	95_{j6}	10	115	3.0	9
K2	160	110_{j6}	12	130	3.5	9
K3	160	110_{j6}	14	130	3.5	9
K3	250	180_{j6}	14	215	4.0	14
K8	350	250_{h6}	18	300	5.0	18
K8	450	350_{h6}	20	400	5.0	18

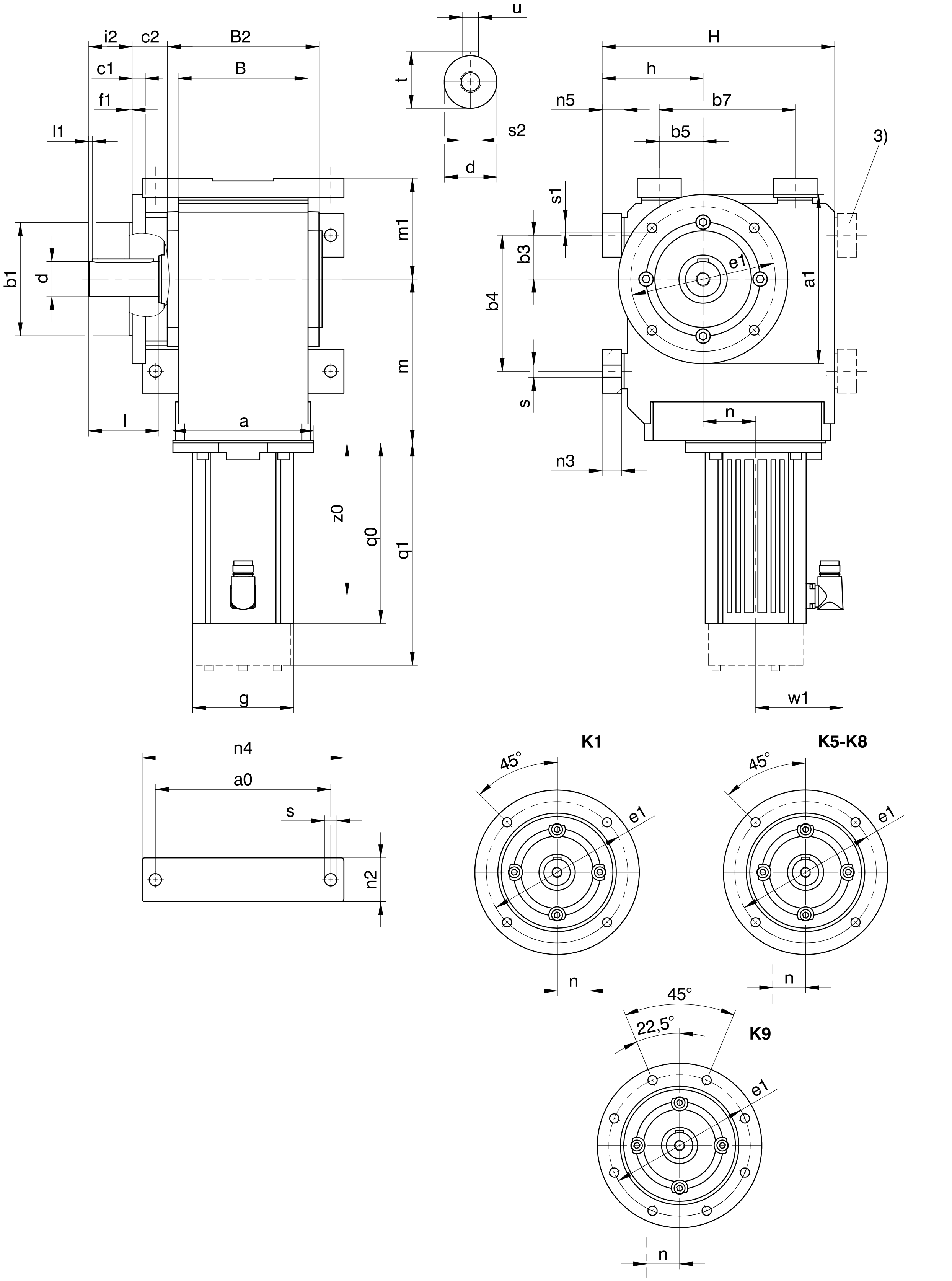
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K202	□98	143	46.0	□115	147	46.0	□145	149	46.0
K203	⌀140	180	46.0	–	–	–	–	–	–
K302	⌀140	163	52.5	□115	167	52.5	□145	169	52.5
K303	⌀140	200	52.5	⌀160	210	16.0	–	–	–
K402	–	–	–	⌀160	187	60.0	□145	189	60.0
K403	⌀140	220	60.0	⌀160	230	23.0	–	–	–
K513	–	–	–	⌀160	172	15.0	□145	174	15.0
K514	–	–	–	⌀160	215	15.0	–	–	–
K613	–	–	–	⌀160	191	18.0	⌀200	193	18.0
K614	–	–	–	⌀160	234	18.0	–	–	–
K713	–	–	–	–	–	–	⌀200	221	20.0
K714	–	–	–	⌀160	263	20.0	⌀200	283	20.0
K813	–	–	–	–	–	–	⌀200	247	24.0
K814	–	–	–	–	–	–	⌀200	308	24.0
K914	–	–	–	–	–	–	⌀200	353	25.0

12.3.14 V shaft design (solid shaft), NF housing design (base + round flange)



q0	Applies to motors without brake.	q1	Applies to motors with brake.
x	Applies to encoders using an optical measuring method.	3)	Only for K1 (other sizes on request)
–	K1 – K4: solid shaft without feather key available, on request starting at K5.	–	K1 – K10: Solid shaft on both sides available.

Dimensions of gear units

Type	a0	∅a1	∅b1	b3	b4	b5	b7	B	B2	c1	c2	∅d	∅e1	f1	h	H	i2	l	l1	m1	n2	n3	n4	n5	∅s	∅s1	s2	t	u
K1	115	160	110_{j6}	30	90	30	90	90	106	10	32.0	25_{k6}	130	3.5	75	175	30.0	50	4	75	30	13	140	15	9.0	9	M10	28.0	A8×7×40
K3	170	160	110_{j6}	40	130	40	130	130	146	14	38.0	30_{k6}	130	3.5	98	236	31.0	60	4	98	45	20	200	23	11.0	9	M10	33.0	A8×7×50
K5	200	250	180_{j6}	40	140	100	140	160	185	15	39.5	45_{k6}	215	4.0	190	290	90.0	90	4	130	60	27	240	30	18.0	14	M16	48.5	A14×9×80
K6	210	300	230_{j6}	50	160	110	160	168	200	17	36.0	50_{k6}	265	4.0	220	340	100.0	100	4	150	65	27	250	30	18.5	14	M16	53.5	A14×9×90
K7	241	350	250_{h6}	55	180	125	180	190	226	18	44.0	60_{m6}	300	5.0	250	380	120.0	120	4	163	70	35	290	38	23.0	18	M20	64.0	A18×11×110
K8	300	400	300_{h6}	75	240	165	240	235	282	20	45.0	70_{m6}	350	5.0	310	455	140.0	140	5	190	85	41	360	45	27.0	18	M20	74.5	A20×12×125

Dimensions of additional round flanges

Type	∅a1	∅b1	c1	∅e1	f1	∅s1
K1	140	95_{j6}	10	115	3	9
K8	350	250_{h6}	18	300	5	18
K8	450	350_{h6}	20	400	5	18

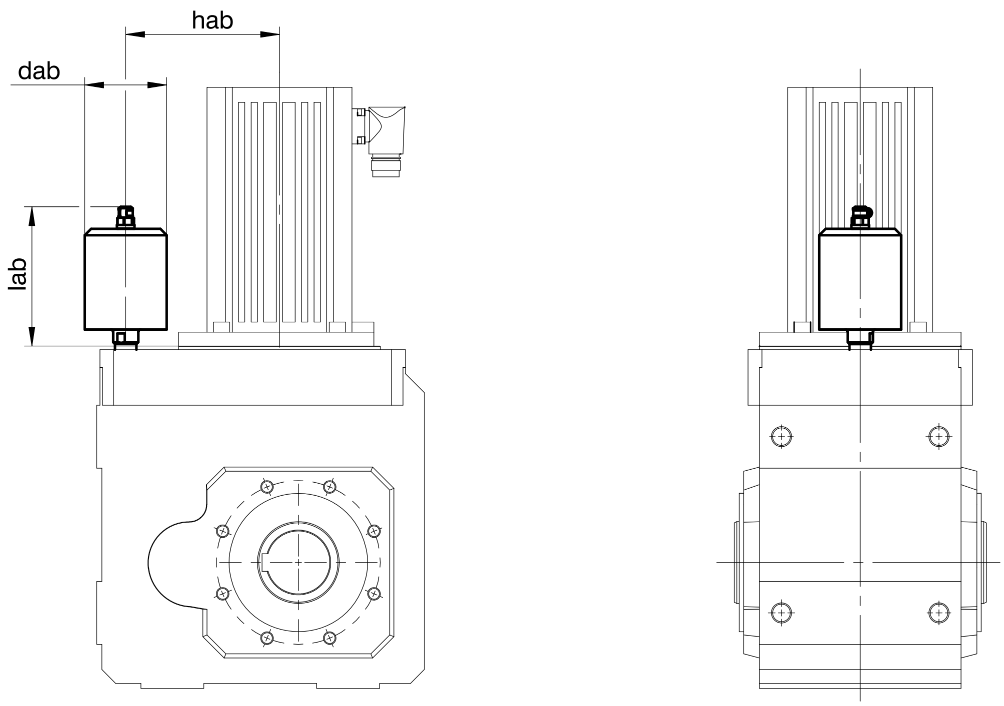
Dimensions of motors

Type	□g	q0	q1	w1	z0
LM401U	98	129.0	172.5	91	97
LM402U	98	168.0	211.5	91	136
LM403U	98	199.0	242.5	91	167
LM503U	115	205.5	253.5	100	175
LM505U	115	275.5	323.5	100	245
LM704U	145	259.5	318.5	115	227
LM706U	145	329.5	388.5	115	297

Dimensions of geared motors

Type	LM4			LM5			LM7		
	a	m	n	a	m	n	a	m	n
K102	□98	124	36.0	□115	128	36.0	–	–	–
K302	∅140	163	52.5	□115	167	52.5	□145	169	52.5
K303	∅140	200	52.5	∅160	210	16.0	–	–	–
K513	–	–	–	∅160	172	15.0	□145	174	15.0
K514	–	–	–	∅160	215	15.0	–	–	–
K613	–	–	–	∅160	191	18.0	∅200	193	18.0
K614	–	–	–	∅160	234	18.0	–	–	–
K713	–	–	–	–	–	–	∅200	221	20.0
K714	–	–	–	∅160	263	20.0	∅200	283	20.0
K813	–	–	–	–	–	–	∅200	247	24.0
K814	–	–	–	–	–	–	∅200	308	24.0
K914	–	–	–	–	–	–	∅200	353	25.0

12.3.15 Oil expansion tank



Dimensions

Type	LM5			LM7		
	dab	hab	lab	dab	hab	lab
K513	65	122.0	113.5	65	122.0	113.5
K613	65	148.5	116.5	65	148.5	116.5
K713	–	–	–	65	170.0	114.5
K813	–	–	–	73	205.0	129.5

More information can be found in Chapter [▶ 12.6.4]

12.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

K	4	0	2	A	G	0280	LM704U

Explanation

Code	Designation	Design
K	Type	Helical bevel gear unit
4	Size	4 (example)
0	Generation	Generation 0
1		Generation 1
2	Stages	Two-stage
3		Three-stage
4		Four-stage
A	Shaft	Hollow shaft with keyway
S		Hollow shaft with shrink ring
V		Solid shaft
G	Housing	Pitch circle diameter
F		Round flange
NG		Foot + pitch circle diameter
NF		Foot + round flange
GD		Pitch circle diameter + torque arm bracket
NGD		Foot + pitch circle diameter + torque arm bracket
0280	Transmission ratio (i x 10 rounded)	i = 28.24 (example)
LM704U	Motor	LM Lean motor

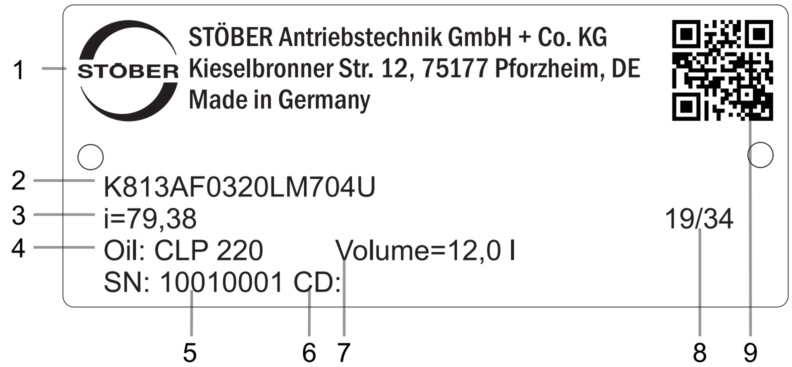
In order to complete the type designation, also specify:

- For a detailed type designation of the motor, see the chapter [▷ 2]
- For the mounting position, see the chapter [▷ 12.5.5]
- Attachment of solid shaft: gear unit side 3 or 4; solid shaft on both sides
- Attachment of hollow shaft with keyway: entry side 3 or 4
- Attachment of hollow shaft with shrink ring: shrink ring on gear unit side 3 or 4
- Attachment of foot plates: gear unit side 1 or 5
- Attachment of flange: gear unit side 3 or 4
- Pitch circle diameter: gear unit side 3 or 4
- Attachment of torque arm bracket: torque arm bracket on gear unit side 1 or 5, eye on gear unit side 3 or 4
- The position of the plug connector, see the chapter [▷ 12.5.7]
- Oil expansion tank (recommended for gear units in mounting position EL5), see the chapter [▷ 12.6.4]
- Backlash: Standard/class II/class I. Backlash class II and class I for an additional charge.
- Standard or reinforced output bearing

An explanation of the gear unit sides can be found in the chapter [▷ 12.5.5].

12.4.1 Nameplate

An example geared motor nameplate is explained in the figure below.



Code	Designation
1	Name of manufacturer
2	Type designation
3	Gear ratio of the gear unit
4	Lubricant specification
5	Serial number of the gear unit
6	Customer-specific data
7	Lubricant fill volume
8	Date of manufacture (year/calendar week)
9	QR code (link to product information)

12.4.1.1 Supporting documents

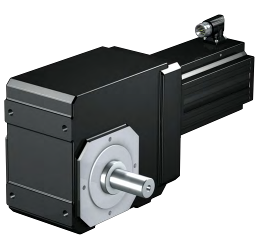
You can view or download supporting documents for the product by reading off the serial number on the nameplate of the product and entering it at the following address online:
https://id.stober.com

Alternatively, you can use a suitable mobile device to scan in the QR code on the nameplate of the product in order to be linked to the supporting documents.

12.5 Product description

12.5.1 Input options

LM Lean motor

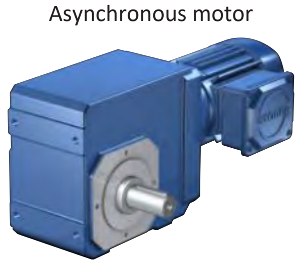


http://www.stoeber.de/en/KLM

EZ synchronous servo motor

http://www.stoeber.de/en/KEZ

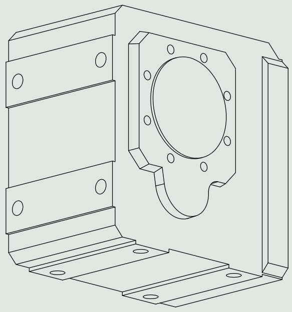
Asynchronous motor



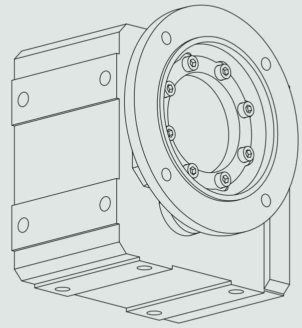
http://www.stoeber.de/en/KIE3D

12.5.2 Housing design

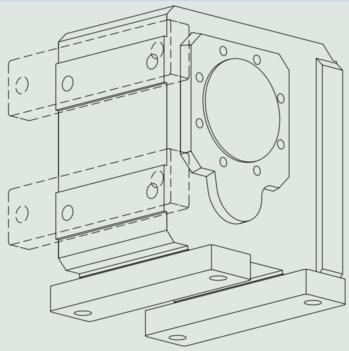
Pitch circle diameter G



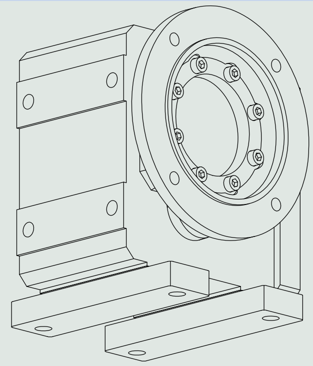
Round flange F



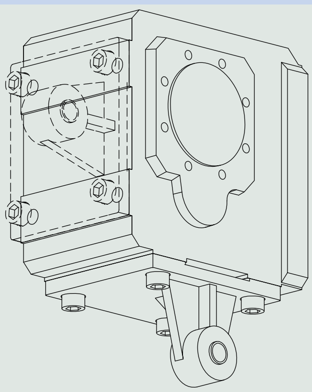
Foot + pitch circle diameter NG



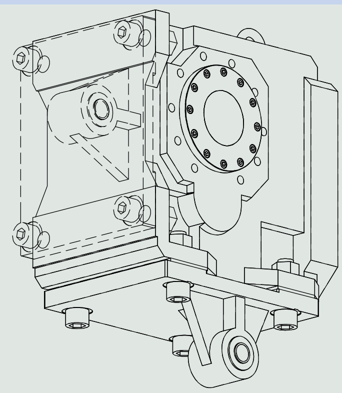
Foot + round flange NF



Pitch circle diameter + torque arm bracket GD



Foot + pitch circle diameter + torque arm bracket NGD



	G	F	NG	NF	GD	NGD
K1	✓	✓	✓	✓	✓	–
K2	✓	✓	✓	–	✓	–
K3	✓	✓	✓	–	✓	–
K4	✓	✓	✓	–	✓	–
K5	✓	✓	✓	✓	✓	–
K6	✓	✓	✓	✓	✓	–
K7	✓	✓	✓	✓	✓	–
K8	✓	✓	✓	✓	✓	–
K9	✓	✓	✓	✓	✓	–
K10	–	–	✓	✓	–	✓

12.5.3 Combinatorial shaft/housing design

	Housing design						
Shaft design	**Code**	**G**	**F**	**NG**	**NF**	**GD**	**NGD**
Hollow shaft with keyway	**A**	AG	AF	ANG	ANF	AGD	ANGD
Hollow shaft with shrink ring	**S**	SG	SF	SNG	SNF	SGD	SNGD
Solid shaft [1)]	**V**	VG	VF	VNG	VNF	–	–

[1)] Gear units in sizes K1 – K10 come with a solid shaft with feather key as standard. Gear units in sizes K1 – K4 can be ordered with the option of a solid shaft without feather key. Only upon request starting at size K5.

12.5.4 Installation conditions

Hollow shaft

The hollow shaft hole tolerance is ISO H7. The tolerance of the machine shaft must be ISO k6.

Take care to align the machine shaft with the gear unit hollow shaft when attaching the gear unit.

Maximum deviation ≤ 0.03 mm.

For simpler assembly and disassembly of the machine shaft, the hollow shafts are equipped with a spiral groove (as a grease deposit).

A hardened, threaded keeper plate is included in the scope of delivery. You also have the option to order the hollow shaft without a keeper plate.

Hollow shaft with shrink ring

The tolerance of the hollow shaft hole is ISO H7.

The machine shaft must be executed as follows:

Gear unit type	Tolerance
K1 to K6	ISO h9
K7 to K10	ISO h6

Select a material for the machine shaft with a permitted surface pressure of $p \geq 325\ N/mm^2$.

Possible materials:

- C45E +QT
- 42CrMo4

Fastening the gear units on the machine side using the pitch circle diameter

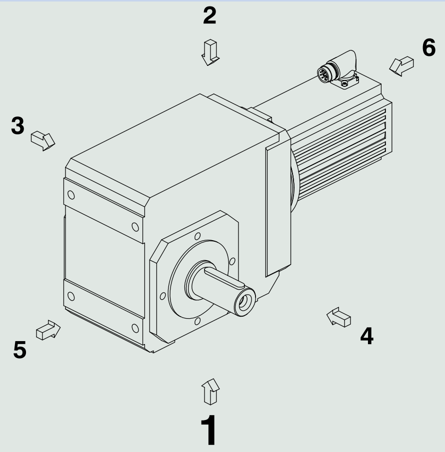
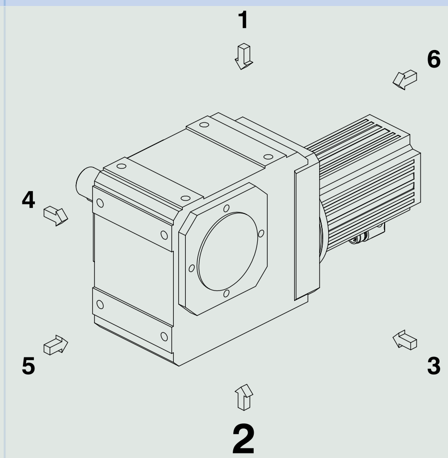
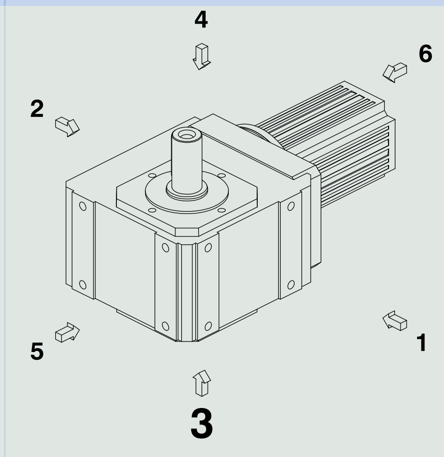
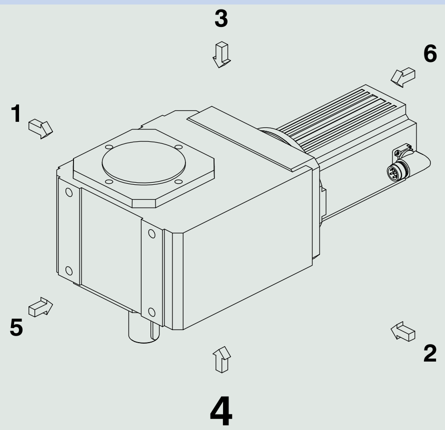
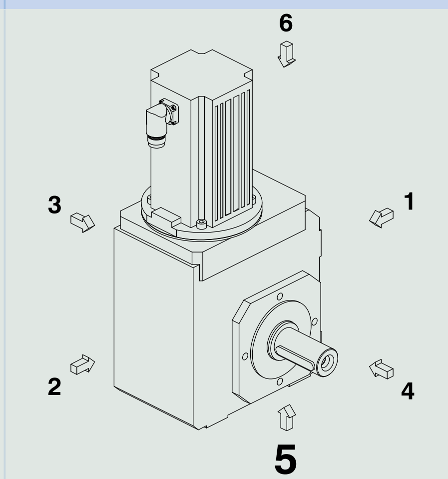
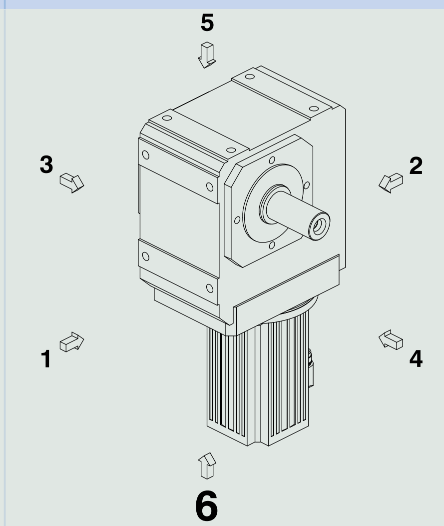
The specified torques and forces only apply when gear units are fastened on the machine side using screws of strength class 10.9. In addition, the gear housings must be adjusted at the pilot. The machine-side fit must be H7.

12.5.5 Mounting positions

The following table shows the standard mounting positions.

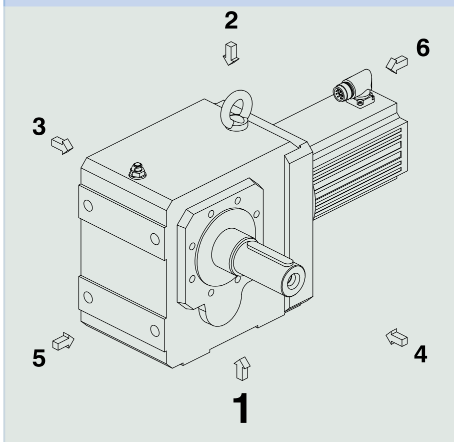
The numbers identify the gear unit sides. The mounting position is defined by the gear side facing downwards.

Mounting positions for gear unit sizes K1 – K4

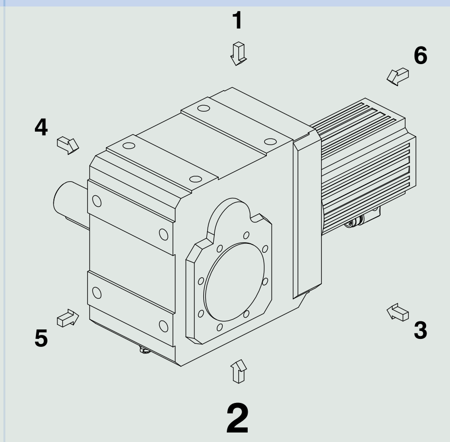
EL1	EL2	EL3
		
EL4	**EL5**	**EL6**
		

Mounting positions for gear unit sizes K5 – K10

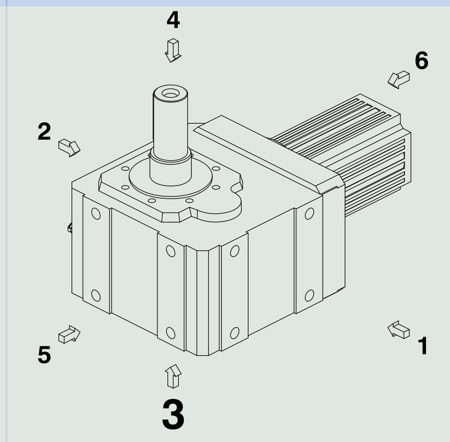
EL1



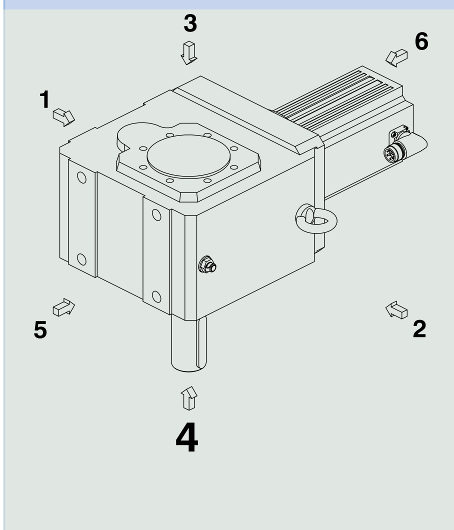
EL2



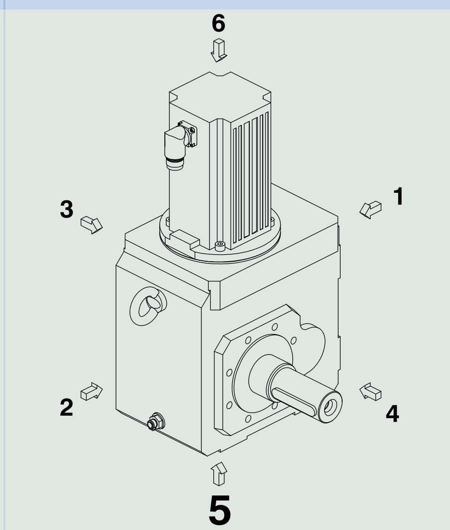
EL3



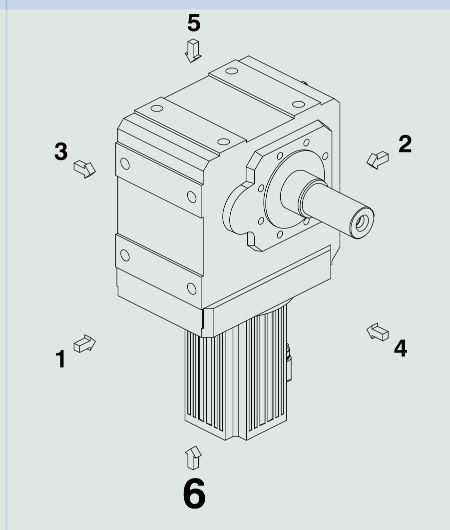
EL4



EL5



EL6



Since the lubricant filling volume of the gear unit depends on the mounting position, the mounting position must be specified when ordering.

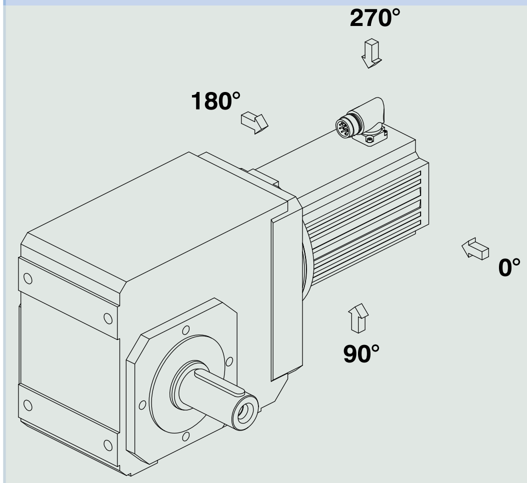
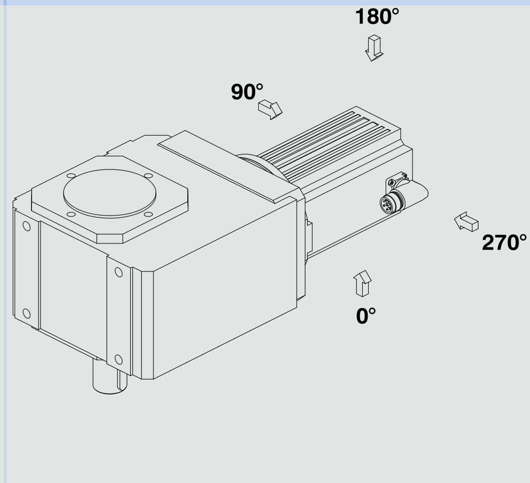
12.5.6 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate. The filling volume and the structure of the gear units depend on the mounting position.

Only install the gear units in the intended mounting position! Reposition the gear units only after consulting STOBER. Otherwise, STOBER assumes no liability for the gear units.

You will receive lubricants for use in the food industry upon request.

12.5.7 Position of the plug connector

<table>
<tr><th>Mounting position EL1
Plug connector in 270° position (standard)</th><th>Mounting position EL4
Plug connector in 270° position (standard)</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Indicate variations for your geared motor in the purchase order.

Note that the plug connector position rotates along with the geared motor if the geared motor is in another mounting position.

12.5.8 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 80 °C
Paint	Black RAL 9005
Explosion-proof design in accordance with (ATEX) Directive 2014/34/EU (optional)	Not available
Efficiency:	
η_{get} two-stage	97%
η_{get} three-stage	96%
η_{get} four-stage	94%
Protection class:[1]	
Gear unit	IP65
Motor	IP56, optionally IP66

12.5.9 Maintenance

The instructions for maintenance can be found in the operating manual, ID 443027_en, at http://www.stoeber.de/en/downloads/. Enter the ID of the documentation in the Search... field.

Ventilation

Air release valves are fitted as a standard feature and independently of installation position for gear unit sizes K5 to K10.

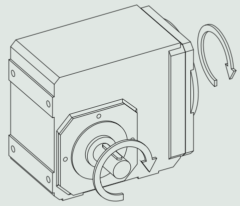
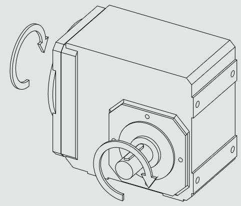
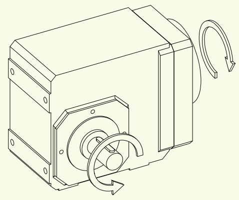
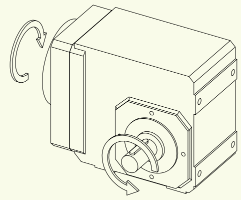
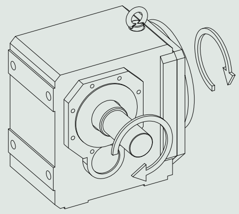
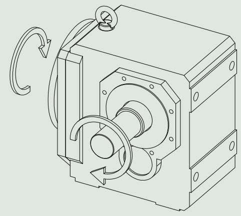
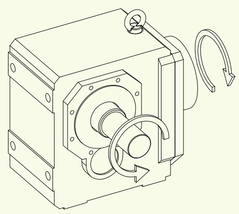
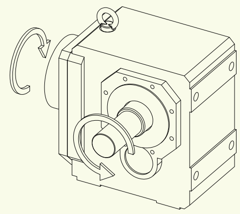
For the position and dimensions of the air release valve, refer to the 3D model.

Download the 3D model at http://configurator.stoeber.de.

[1] Observe the protection class of all the components.

12.5.10 Direction of rotation

Solid shaft (V), solid shaft on both sides (V), hollow shaft with keyway (A)

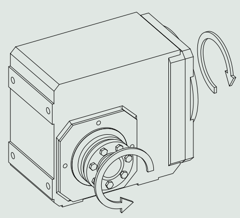
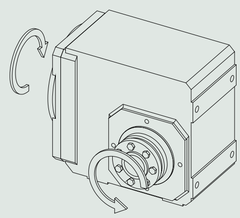
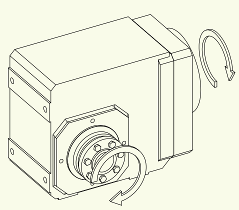
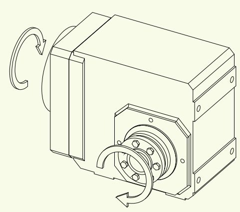
Type	Output side 4	Output side 3
K102 – K402		
K203 – K403		
K513 – K1013		
K514 – K1014		

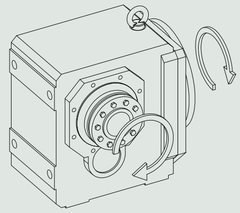
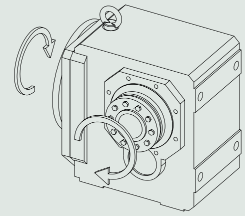
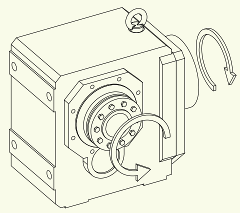
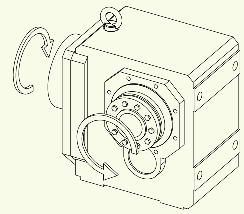
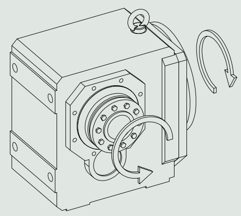
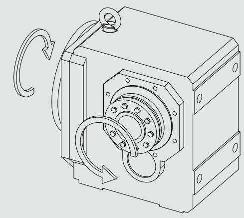
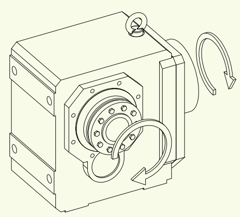
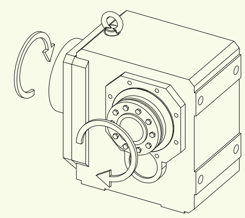
The specified directions of rotation also apply to gear units with hollow shaft (A) if the entry side of the machine shaft corresponds to the side of the solid shaft that is shown.

The direction of rotation for the shaft design of a solid shaft on both sides corresponds to the direction of rotation for output side 4.

The pictures show mounting position EL1.

Hollow shaft with shrink ring (S)

Type	Shrink ring side 4	Shrink ring side 3
K102 – K402		
K203 – K403		

Type	Shrink ring side 4	Shrink ring side 3
K513 – K813		
K514 – K814		
K913 – K1013		
K914 – K1014		

The pictures show mounting position EL1.

12.6 Project configuration

Project your drives using our SERVOsoft designing software. Download SERVOsoft for free at https://www.stoeber.de/en/ServoSoft.

Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

The formula symbols for values actually present in the application are marked with *.

12.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

For continuous operation in mounting positions EL1, EL2:

$$n_{1m*} \leq \frac{n_{1maxDBEL1,2}}{fB_T}$$

For continuous operation in mounting positions EL3, EL4, EL5, EL6:

$$n_{1m*} \leq \frac{n_{1maxDBEL3,4,5,6}}{fB_T}$$

For all mounting positions:

$$n_{1max*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff*} \leq M_{2th}$$

$$M_{2acc*} \leq M_{2acc}$$

$$M_{2NOT*} \leq M_{2NOT}$$

$$M_{2eq*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

Notes

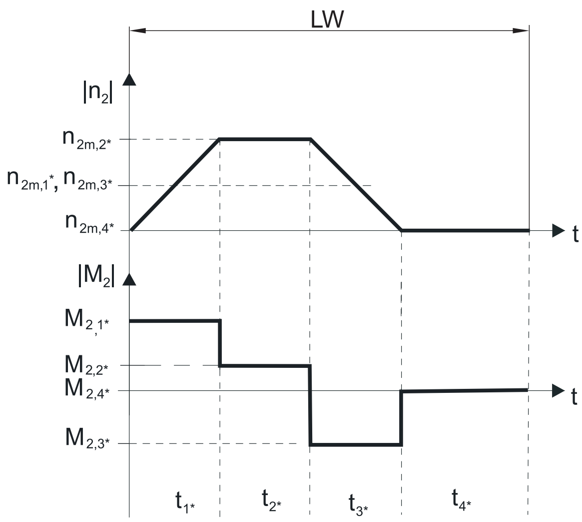
Refer to the selection tables for the values for $n_{1maxDBEL1,2}$ and $n_{1maxDBEL3,4,5,6}$, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S.

The values for fB_T, fB_{op} and fB_t can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m*} = n_{2m*} \cdot i$$

$$n_{2m*} = \frac{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If $t_{1*} + \ldots + t_{3*} \geq 6$ min, calculate n_{2m*} without the rest phase t_{4*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff*} = \sqrt{\frac{t_{1*} \cdot M_{2,1*}^2 + \ldots + t_{n*} \cdot M_{2,n*}^2}{t_{1*} + \ldots + t_{n*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq*} = \sqrt[3]{\frac{|n_{2m,1*}| \cdot t_{1*} \cdot |M_{2,1*}^3| + \ldots + |n_{2m,n*}| \cdot t_{n*} \cdot |M_{2,n*}^3|}{|n_{2m,1*}| \cdot t_{1*} + \ldots + |n_{2m,n*}| \cdot t_{n*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{10} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

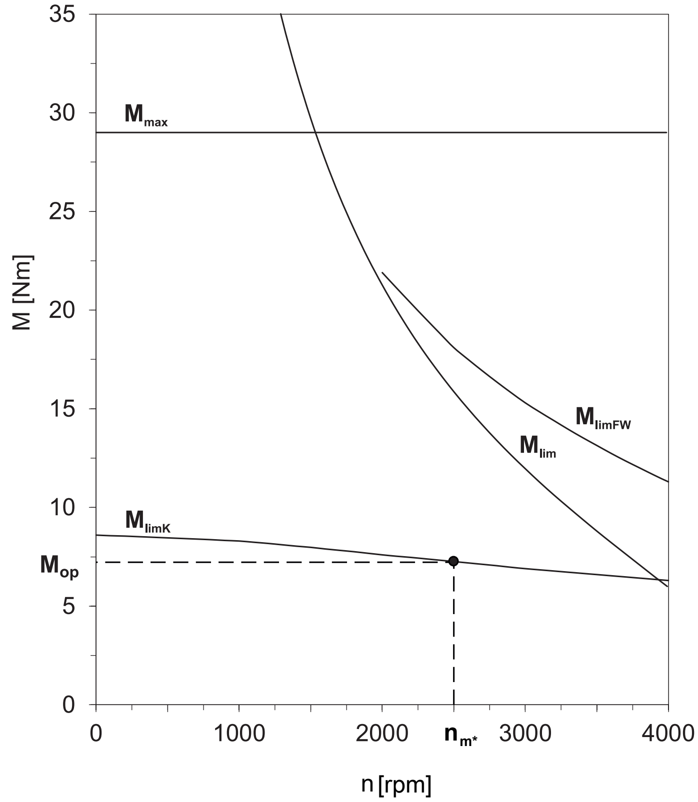
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot athEL \cdot fB_T \cdot \left(\frac{n_{1m*}}{1000}\right)^2$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Parameter a_{thEL}

Mounting position	a_{thEL}
EL1, 2	1.0
EL3, 4, 5, 6	1.1

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.25
Reversing load cyclic operation	1.40

Run time	fB_t
Daily runtime ≤ 8 h	1.00
Daily runtime ≤ 16 h	1.15
Daily runtime ≤ 24 h	1.20

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

12.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds n_{2m*} ≤ 20 rpm ($F_{2axN} = F_{2ax20}$; $F_{2radN} = F_{2rad20}$; $M_{2kN} = M_{2k20}$)
- Only if radial forces on the gear unit are stabilized by its pilots for the pitch circle diameter and flange housing design

12.6.2.1 V shaft design

Permitted shaft loads for V shaft design (solid shaft)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
K1	40.0	1900	5000	5000	360	360
K2	42.0	2100	6000	6000	430	430
K3	45.0	2400	7000	7000	525	525
K4	52.0	3500	11200	11200	1050	1050
K5	72.0	3500	13450	13450	1580	1580
K6	72.0	4000	16000	16000	1960	1960
K7	85.0	5500	22000	22000	3200	3200
K8	60.0	7250	29000	29000	3800	3800
K9	87.0	16500	65000	65000	11200	11200
K10	84.0	25000	80000	80000	15200	15200

Reduced values apply in the case of a V shaft design (solid shaft) in conjunction with an NF housing design (foot + round flange):

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
K10	132.0	25000	64000	64000	15200	15200

For the V solid shaft design on both sides, the values for F_{2rad20} and M_{2k20} must be multiplied by a factor of 0.7.

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 20 rpm:

$$F_{2axN} = \frac{F_{2ax20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}}$$

The values for F_{2ax20}, F_{2rad20} and M_{2k20} can be found in the table "Permitted shaft loads" in this chapter.

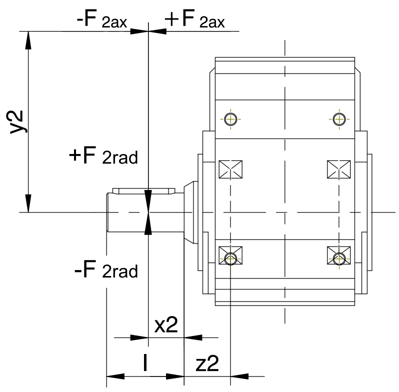


Fig. 1: Force application points for solid shaft

The specified values for F_{2rad20} are based on application of force at the middle of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2rad*} \leq F_{2radN}$$

$$F_{2ax*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

12.6.2.2 A and S shaft design

Permitted shaft loads for A shaft design (hollow shaft with keyway)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
K1	40.0	1900	5000	5000	240	240
K2	42.0	2100	6000	6000	310	310
K3	45.0	2400	7000	7000	380	380
K4	52.0	3500	11200	11200	740	740
K5	39.0	2500	13450	13450	1000	1000
K6	42.0	3000	16000	16000	1300	1300
K7	45.0	4100	22000	22000	2100	2100
K8	50.0	5300	29000	29000	2600	2600
K9	56.0	7000	65000	65000	3600	3600
K10	56.0	9000	80000	80000	5000	5000

Permitted shaft loads for S shaft design (hollow shaft with shrink ring)

Type	z_2 [mm]	F_{2ax20} [N]	F_{2rad20} [N]	$F_{2rad,acc}$ [N]	M_{2k20} [Nm]	$M_{2k,acc}$ [Nm]
K1	40.0	1900	5000	5000	240	240
K2	42.0	2100	6000	6000	310	310
K3	45.0	2400	7000	7000	380	380
K4	52.0	3500	11200	11200	740	740
K5	39.0	2500	13450	13450	1000	1000
K6	42.0	3000	16000	16000	1300	1300
K7	45.0	4100	22000	22000	2100	2100
K8	50.0	5300	29000	29000	2600	2600
K9	56.0	7000	65000	65000	3600	3600
K10	56.0	9000	80000	80000	5000	5000

For other output speeds, download diagrams at http://configurator.stoeber.de.

The following applies to output speeds n_{2m*} > 20 rpm:

$$F_{2axN} = \frac{F_{2ax20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k20}}{\sqrt[3]{\frac{n_{2m*}}{20\ \text{rpm}}}}$$

The values for F_{2ax20}, F_{2rad20} and M_{2k20} can be found in the table "Permitted shaft loads" in this chapter.

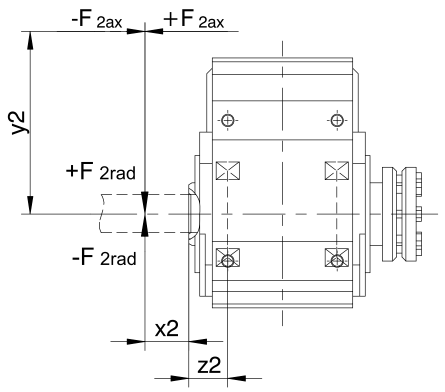


Fig. 2: Force application points for hollow shaft

You can determine the permitted radial forces from the permitted breakdown torque M_{2kN}. The actual radial forces may not exceed the permitted radial forces. The permitted radial forces pertain to the shaft end (x2 = 0).

$$M_{2k*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad*} \cdot (x_2 + z_2)}{1000} \leq M_{2kN}$$

$$F_{2ax*} \leq F_{2axN}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax20}, F_{2rad20} and M_{2k20} by a factor of two.

12.6.3 Radial shaft seal rings

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leaks. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

12.6.4 Oil expansion tank

The gear units have a higher fill level in mounting position EL5. The oil expansion tank prevents oil from escaping out of the gear unit.

Notes

- We recommend using an oil expansion tank in mounting position EL5 (additional cost) for fast running gear units with an input speed n_1 > 1750 rpm and gear ratios i < 20.
- It is not possible to use an oil expansion tank if the plug connector is at 90°!
- The oil expansion tank can only be used with certain sizes; see the chapter [▸ 12.3.15]

12.7 Additional documentation

Additional documentation related to the product can be found at
http://www.stoeber.de/en/downloads/

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for C/F/K/S gear units and gear motors	443027_en

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14 Appendix

Table of contents

14.1 Formula symbols

Symbol	Unit	Explanation
a_{th}	–	Parameter for calculating $K_{mot,th}$
C_2	Nm/ arcmin	Torsional stiffness relative to the gear unit output
C_{maxPU}	F	Maximum charging capacity of the power unit
C_{PU}	F	Self-capacitance of the power unit
ΔJ_B	$kgcm^2$	Additive mass moment of inertia of a motor with brake
Δm_B	kg	Additive weight of a motor with brake
$\Delta\phi_2$	arcmin	Backlash at the output shaft with a blocked input
$\Delta\phi_{2red}$	arcmin	Reduced backlash at the output shaft with a blocked input
$\Delta\vartheta$	K	Temperature difference
D_{IA}	%	Reduction in the nominal current depending on the installation altitude
D_T	%	Reduction in the nominal current depending on the surrounding temperature
ED_{10}	%	Duty cycle based on 10 minutes
η_{get}	%	Efficiency of the gear unit at nominal torque
η_{mot}	%	Efficiency of the motor
F_{2ax*}	N	Actual axial force at the gear unit output
F_{2ax100}	N	Permitted axial force at the gear unit output for $n_{2m*} \leq 100$ rpm (without radial force)
F_{2ax20}	N	Permitted axial force at the gear unit output for $n_{2m*} \leq 20$ rpm (without radial force)
F_{2axN}	N	Permitted nominal axial force at the gear unit output (without radial force)
f_{2PU}	Hz	Output frequency of the power unit
$F_{2rad100}$	N	Permitted radial force at the gear unit output for $n_{2m*} \leq 100$ rpm
F_{2rad20}	N	Permitted radial force on the gear unit output for $n_{2m*} \leq 20$ rpm
$F_{2rad,acc}$	N	Permitted radial acceleration force at the gear unit output
$F_{2rad,acc*}$	N	Radial acceleration force present at the gear unit output
$F_{2rad,acc,1*}$	N	Radial acceleration force present at the gear unit output in the first time period
$F_{2rad,acc,n*}$	N	Radial acceleration force present at the gear unit output in the nth time period
$F_{2rad,eq*}$	N	Actual equivalent force at the gear unit output
F_{2radN}	N	Permitted nominal radial force at the gear unit output
F_{ax}	N	Permitted axial force on the output
F_{ax*}	N	Actual axial force on the output
F_{ax100}	N	Permitted axial force on the output for $n_{m*} \leq 100$ rpm
fB_{op}	–	Operating mode operating factor
fB_t	–	Runtime operating factor
fB_T	–	Temperature operating factor
fB_{ZB}	–	Operating factor for cyclic operation
f_N	Hz	Rotating magnetic field frequency at nominal speed
$f_{PWM,PU}$	Hz	Frequency of the pulse width modulation of the power unit
F_{rad}	N	Permitted radial force on the output
F_{rad*}	N	Actual radial force on the output
F_{rad100}	N	Permitted radial force on the output for $n_{m*} \leq 100$ rpm
H	m	Installation altitude above sea level
i	–	Gear ratio
i_{exact}	–	Mathematically exact gear ratio
I_0	A	Stall current
I_{1maxCU}	A	Maximum input current of the control unit
I_{1maxPU}	A	Maximum input current of the power unit
$I_{1N,PU}$	A	Nominal input current of the power unit
I_{2maxPU}	A	Maximum output current of the power unit
$I_{2N,PU}$	A	Nominal output current of the power unit
$I_{2N,PU(red)}$	A	Reduced nominal output current of the power unit
$I_{2PU(A)}$	A	Output current of the power unit for axis A
$I_{2PU(B)}$	A	Output current of the power unit for axis B

Symbol	Unit	Explanation
I_{max}	A	Maximum current
		Exceeding I_{max} may lead to irreversible damage (demagnetization) of the rotor.
I_N	A	Nominal current
$I_{N,B}$	A	Nominal current of the brake at 20 °C
$I_{N,MF}$	A	Nominal current of the choke or motor filter
J	$kgcm^2$	Mass moment of inertia
J_1	$kgcm^2$	Mass moment of inertia relative to the gear unit input
J_{Bstop}	$kgcm^2$	Reference mass moment of inertia when braking from full speed: $J_{Bstop} = J \times 2$
J_{tot}	$kgcm^2$	Total mass moment of inertia (based on the motor shaft)
K_{EM}	V/1000 rpm	Voltage constant: peak value of the induced voltage between the phases U, V, W of the motor at operating temperature at a speed of 1000 rpm
K_H	–	Derating factor for installation altitude
$K_{M,N}$	Nm/A	Torque constant: ratio of the nominal torque M_N to the nominal current I_N; $K_{M,N} = M_N / I_N$ (tolerance ±10%)
$K_{mot,th}$	–	Factor for determining the thermal limit torque
K_ϑ	–	Derating factor for surrounding temperature
l	mm	Length of the output shaft
L_{10h}	h	Bearing service life
m	kg	Weight (for gear units without lubricant)
M	Nm	Torque
M_0	Nm	Stall torque: The continuous torque the motor is able to deliver at a speed of 10 rpm (tolerance ±5%)
$M_{1*} – M_{6*}$	Nm	Actual torque of the motor in the respective time segment (1 to 6)
$M_{2.0}$	Nm	Stall torque on the gear unit output
M_{2acc}	Nm	Maximum permitted acceleration torque on the gear unit output
M_{2acc*}	Nm	Actual acceleration torque on the gear unit output
$M_{2acc,max}$	Nm	Maximum permitted acceleration torque of a group of geared motors whose size and nominal torque n_{1N} are the same
M_{2accHT}	Nm	Maximum permitted acceleration torque on the gear unit output with reduced backlash
M_{2eff*}	Nm	Actual effective torque on the gear unit output
M_{2eq*}	Nm	Equivalent torque present on the gear unit output
M_{2k*}	Nm	Actual tilting torque on the gear unit output
M_{2k100}	Nm	Permitted tilting torque on the gear unit output for $n_{2m*} \leq 100$ rpm
M_{2k20}	Nm	Permitted tilting torque on the gear unit output for $n_{2m*} \leq 20$ rpm
$M_{2k,acc}$	Nm	Permitted acceleration tilting torque at the gear unit output
$M_{2k,acc*}$	Nm	Acceleration tilting torque present at the gear unit output
$M_{2k,acc,1*}$	Nm	Acceleration tilting torque present at the gear unit output in the first time period
$M_{2k,acc,n*}$	Nm	Acceleration tilting torque present at the gear unit output in the nth time period
$M_{2k,eq*}$	Nm	Actual equivalent tilting torque on the gear unit output
M_{2kN}	Nm	Permitted nominal tilting torque at the gear unit output
M_{2N}	Nm	Nominal torque on the gear unit output (relative to n_{1N})
M_{2NOT}	Nm	Gear unit emergency-off torque on the gear unit output for max. 1000 load changes
M_{2NOT*}	Nm	Actual emergency off torque for the gear unit on the gear unit output
M_{2th}	Nm	Thermal limit torque on the gear unit output
M_{Bdyn}	Nm	Dynamic braking torque at 100 °C (Tolerance +40%, −20%)
M_{Bstat}	Nm	Static braking torque of the motor brake at 100 °C (tolerance +40%, −20%)
M_{eff*}	Nm	Actual effective torque of the motor
M_k	Nm	Permitted tilting torque on the output
M_{k*}	Nm	Actual tilting torque on the output
M_{k100}	Nm	Permitted tilting torque on the output for $n_{m*} \leq 100$ rpm
M_L	Nm	Load torque
M_{lim}	Nm	Torque limit without compensating for field weakening

Symbol	Unit	Explanation
M_{limFW}	Nm	Torque limit with compensation for field weakening (applies to operation on STOBER drive controllers only)
M_{limK}	Nm	Torque limit of the motor with convection cooling
M_{max}	Nm	Maximum torque: the maximum permitted torque the motor is able to deliver over a short period (when accelerating or decelerating) (tolerance ±10%)
M_N	Nm	Nominal torque: the maximum torque of a motor in S1 mode at nominal speed n_N (tolerance ±5%)
M_{n*}	Nm	Actual torque of the motor in the n-th time segment
M_{Nred}	Nm	Reduced nominal torque of the motor
M_{op}	Nm	Torque of motor at the operating point from the motor characteristic curve at n_{1m*}
M_R	Nm	Frictional torque (of the bearings and seals) of a motor at winding temperature $\Delta\vartheta$ = 100 K
n	rpm	Speed
n_{1m*}	rpm	Actual average input speed
n_{1max*}	rpm	Actual maximum input speed
n_{1maxDB}	min^{-1}	Maximum permitted input speed of the gear unit in continuous operation
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL1,2}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL1, EL2
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL1,2,3,4}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL1, EL2, EL3, EL4
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL1,2,5,6}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL1, EL2, EL5, EL6
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL3,4}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL3, EL4
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL3,4,5,6}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL3, EL4, EL5, EL6
		(at surrounding temperature of 20 °C)
$n_{1maxDBEL5,6}$	rpm	Maximum permitted input speed of the gear unit in continuous operation Mounting positions EL5, EL6
		(at surrounding temperature of 20 °C)
n_{1maxZB}	min^{-1}	Maximum permitted input speed of the gear unit in cyclic operation
		(at surrounding temperature of 20 °C)
n_{1N}	rpm	Nominal speed at the gear unit input
n_{2m*}	rpm	Actual average output speed
$n_{2m,1*} - n_{2m,8*}$	rpm	Actual average output speed in the respective time segment (1 to 8)
$n_{2m,n*}$	rpm	Actual average output speed in the n-th time segment
n_{2N}	min^{-1}	Nominal speed at the gear unit output
N_{Bstop}	–	Permitted number of braking processes from full speed (n = 3000 rpm) with J_{Bstop} (M_L = 0). The following applies if the values of n and J_{Bstop} differ: N_{Bstop} = $W_{B,Rlim}$ / $W_{B,R/B}$.
n_{m*}	rpm	Actual average motor speed
$n_{m,1*} - n_{m,6*}$	rpm	Actual average speed of the motor in the respective time segment (1 to 6)
$n_{m,n*}$	rpm	Actual average speed of the motor in the n-th time segment
n_N	rpm	Nominal speed: The speed for which the nominal torque M_N is specified
p	–	Number of pole pairs
P_{effRB}	W	Effective power at the external braking resistor
P_{maxRB}	W	Maximum power at the external braking resistor
P_N	kW	Nominal power: the power the motor is able to deliver long term in S1 mode at the nominal point (tolerance ±5 %)
$P_{N,PU}$	W	Nominal power of the power unit
P_V	W	Power loss
$P_{V,CU}$	W	Power loss of the control unit

Symbol	Unit	Explanation
R_{2minRB}	Ω	Minimum resistance of the external braking resistor
S	–	Service factor: Quotient of the nominal torque from the gear unit and the motor without consideration for thermal limiting performance. Represents a value for the reserve of the geared motor.
ϑ_{amb}	°C	Surrounding temperature
$\vartheta_{amb,max}$	°C	Maximum surrounding temperature
$t_{1*} - t_{8*}$	s	Duration of the respective time segment (1 to 8)
t_{1B}	ms	Linking time: time from when the current is turned off until the nominal braking torque is reached
t_{11B}	ms	Response delay: time from when the current is turned off until the torque increases
t_{2B}	ms	Disengagement time: time from when the current is turned on until the torque begins to drop
t_{dec}	ms	Stop time
t_{n*}	s	Duration of the n-th time segment
ϑ_{NAT}	°C	Nominal response temperature
t	s	Time
τ_{th}	°C	Thermal time constant
U_{1CU}	V	Input voltage of the control unit
U_{1PU}	V	Input voltage of the power unit
U_{2PU}	V	Output voltage of the power unit
$U_{2PU,ZK}$	V	Output voltage of the power unit for the DC link connection (typical values: 400 V_{AC} corresponds to 560 V_{DC}, 480 V_{AC} corresponds to 680 V_{DC})
U_{max}	V	Maximum voltage
$U_{N,B}$	V	Nominal voltage of brake
U_{offCH}	V	Switch-off threshold of the brake chopper
U_{onCH}	V	On limit of the brake chopper
U_{ZK}	V	DC link voltage: characteristic value of a drive controller
$W_{B,R/B}$	J	Work done by friction for braking
$W_{B,Rlim}$	J	Work done by friction until wear limit is reached
$W_{B,Rmax/h}$	J/h	Maximum permitted work done by friction per hour with individual braking
x_2	mm	Distance of the shaft shoulder to the force application point
$x_{B,N}$	mm	Nominal air gap of brake
y_2	mm	Distance of the shaft axis to the axial force application point
z_2	mm	Distance of the shaft shoulder to the middle of the output bearing

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