

Brushless DC-Motors



WE CREATE MOTION

FAULHABER B-Micro

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Product Combinations

			Precision Gearheads																															
			03A	06A	06/1	08/1	08/2	08/3	10/1	12/3	12/4	12/5	15/10	16/7	17/1	20/1R	22F	22/7	23/1	26A	26/1	26/1 R	30/1 S	32A	32ALN	32/3	32/3 R	38A	38/1	38/1 S	38/2	38/2 S		
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2057...B	with integrated Hall Sensors	20 mNm														•																		
2057...BA	for Autoclave Sterilisation	18,7 mNm																		•														
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4221...BXT H	External rotor technology	112 mNm																							•						•	•	•	•

	E2	Encoders - 3 Channel	AES	SC	MC	BR
44/1						
22GPT						
32GPT						
42GPT						
PA2-50						
IE2-1024						
HEDS 5500						
HXM3-64						
IEM3-1024						
IE3-1024						
IE3-1024L						
IEF3-4096						
IEF3-4096L						
IER3-500						
IER3-500L						
IER3-10000						
IER3-10000L						
HEDL 5540						
AESM - 4096						
AES - 4096						
AES - 4096L						
SC 1801 S/P						
SC 1801 F						
SC 2402 P						
SC 2804 S						
SC 5004 P						
SC 5008 S						
MCBL 3002 P						
MCBL 3002 F						
MCBL 3002 S						
MCBL 3003 P						
MCBL 3006 S						
MCBL 3002 PAES						
MCBL 3002 FAES						
MCBL 3002 SAES						
MCBL 3003 PAES						
MCBL 3006 SAES						
MC 5004 P						
MC 5004 P STO						
MC 5005 S						
MC 5010 S						
MBZ						

E2 = Encoders - 2 Channel

AES = Encoders - Absolute

SC = Speed Controller

MC = Motion Controller

BR = Brakes

Brushless DC-Servomotors

Technical Information

General information

The FAULHABER winding:

Originally invented by Dr. Fritz Faulhaber Sr. and patented in 1958, the System FAULHABER coreless (or ironless) progressive, self-supporting, skew-wound rotor winding is at the heart of every FAULHABER DC-Motor. This revolutionary technology changed the industry and created new possibilities for customer application of DC-Motors where the highest power, best dynamic performance, in the smallest possible size and weight are required. Applied in a three phase brushless motor, the winding no longer rotates but rather becomes the basis of a slotless stator. The main benefits of this technology include:

- No cogging torque resulting in smooth positioning and speed control and higher overall efficiency than other brushless motor types
- Extremely high torque and high performance in relation to the size and weight of the motor
- Absolute linear relationship between load to speed, current to torque, and voltage to speed, with a highly sensitive current/torque behaviour
- Extremely low torque ripple

Brushless DC-Motor Types:

Whether it's high torque 4-pole DC-Servomotors, highly efficient flat DC-Micromotors, or compact slotless motors, FAULHABER specializes in getting the most performance out of the smallest package.

Due to their design FAULHABER Brushless DC-Motors are ideal for heavy duty servo applications with frequent overload conditions as well as for continuous duty applications where maximum operational lifetime is required.

FAULHABER high precision 2-pole Brushless DC-Motors are three phase slotless motors that have a wide speed and torque range and are ideal for mid- to high speed applications requiring smooth speed control, high efficiency, and long operational lifetimes.

FAULHABER BHx motors are three phase slotless brushless motors designed for the very highest power to volume ratio and peak efficiency for cool operation even at very high speed. They feature a six phase coil connected for three phase operation which give the motors a significant boost in motor performance with no reduction in efficiency. They are designed for high to very high speed operation. They are available in high speed (BHS) and high torque (BHT) versions to maximize the speed or torque available in a given application.

For highly dynamic servo applications requiring very high torque in the most compact dimensions, the FAULHABER BX4 and BP4 Series 4-pole, DC-Servomotors are ideal. Their robust design with very few parts and no glued components means that they are extremely durable and well suited for challenging ambient conditions such as extreme temperatures and high shock and vibration loads.

The FAULHABER BP4 family of 4-pole slotless brushless motors are ideal for applications requiring the highest peak torque and extremely dynamic motion control.

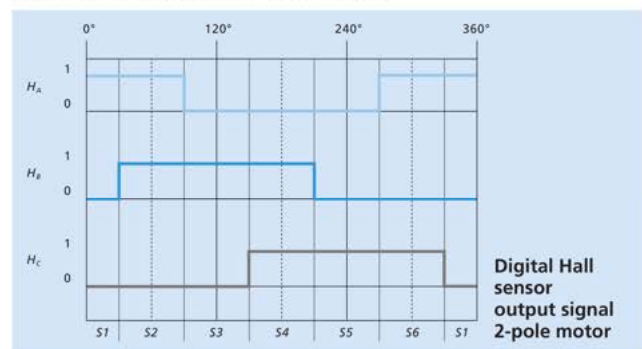
FAULHABER Brushless DC-Flat Motors are 3 phase, slotless, axial flux gap motors with a rotating back iron. They have a much higher efficiency than other flat brushless motors and their rotating back iron provides a high rotor inertia that is ideal for applications requiring low torque ripple and very precise continuous speed control.

The FAULHABER BXT family of flat slotted brushless motors offer the highest possible torque in a very compact design.

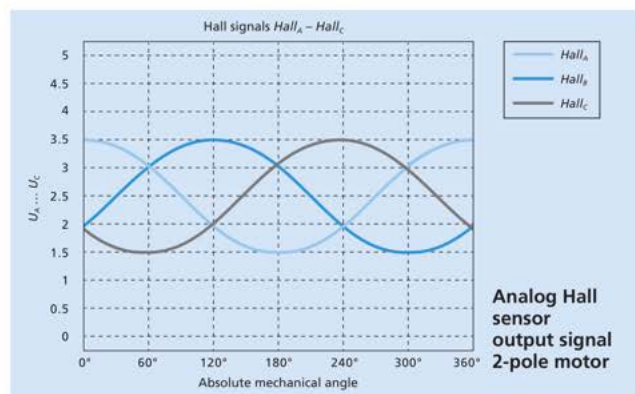
FAULHABER also offers a range of 2-pole Brushless Motors with a cylindrical rotating back iron sometimes referred to as ironless external rotor motors. What sets the FAULHABER Motor apart is the slotless design which eliminates the cogging effect. The high inertia rotor makes these motors ideal for continuous duty applications requiring very precise speed control. These motors also have on-board speed control electronics that can be configured for different speed profiles.

Sensors:

FAULHABER 2-pole or 4-pole DC-Servomotors and Brushless DC-Flat Motors come standard with 3 discrete digital Hall sensors with a 120° phase shift.



As an option, most FAULHABER Brushless DC-Servomotors are available with analog (linear) Hall sensors.



These sensors can replace the need for a high resolution encoder in many applications and provide the basic commutation signal for the Brushless DC-Servomotors in combination with FAULHABER Motion Controllers.

In some cases, for example, the FAULHABER BHx family, discrete sensors are replaced by a commutation PCB which provide the hall signals but can, in some cases, also provide sinusoidal commutation signals.

Magnets:

FAULHABER Brushless DC-Servomotors are designed with a variety of different types of magnets to suit the particular performance of the given motor type or application conditions. These materials include high performance rare earth magnet types such as SmCo and NdFeB.

Service life:

Due to the fact that motor commutation is achieved electronically and not mechanically, the operational lifetime of a FAULHABER Brushless DC-Servomotor depends mainly on the lifetime performance of the motor bearings. FAULHABER uses high precision preloaded ball bearings in all of its Brushless DC-Servomotors 6 mm in diameter and larger. Factors affecting the life of the motor bearings include the static and dynamic axial and radial bearing loads, the ambient thermal conditions, the motor speed, shock and vibrational loads, and the precision of the shaft coupling to the given application. If operated according to the data sheet Brushless DC-Servomotors have an operational lifetime many times that of mechanically commutated (brush) DC-Motors.

Modifications:

FAULHABER specialises in the adaptation of its standard products for customer-specific applications. Available modifications for FAULHABER Brushless DC-Servomotors include:

- Additional voltage types
- Connecting cables (PTFE and PVC) and plugs
- Configurable shaft lengths and second shaft ends
- Modified shaft dimensions and pinion configurations such as flats, gears, pulleys and eccenters
- Extended temperature range
- Vacuum compatibility (e.g. 10^{-5} Pa)
- Modifications for high speed and/or high load applications
- Modifications for high shock & vibration loads
- Autoclavable Motors
- Modifications for motors with tighter than standard electrical or mechanical tolerances

Product Combinations:

FAULHABER offers the industry's largest selection of complementary products tailor made for all of its Brushless DC-Servomotors including:

- Precision gearheads (planetary gearheads, spur gearheads and zero-backlash spur gearheads)
- High resolution Encoders (Incremental and Absolute)
- High Performance Drive Electronics (Speed Controllers, Motion Controllers)
- Integrated drive electronics (Motion and Speed Control)

Brushless DC-Servomotors

Technical Information

Brushless DC-Servomotors

2 Pole Technology

Series 1628 ... B

Values at 22°C and nominal voltage	1628 T
1 Nominal voltage	U_N
2 Terminal resistance, phase-phase	R
3 Efficiency, max.	η_{max}
4 No-load speed	n_o
5 No-load current, typ. (with shaft \varnothing 1,5 mm)	I_o
6 Stall torque	
7 Friction torque	

Notes on technical datasheet

The following values are measured or calculated at nominal voltage, without integrated drive electronics, at an ambient temperature of 22 °C. Not all specifications are given for all motor types and will vary due to the motor technology and type.

Nominal voltage U_N [V]

This is the voltage applied between two winding phases using block commutation. This is the voltage at which the other data sheet parameters are measured or calculated. Depending on the required speed, higher or lower voltage can be applied to the motor within the given limits.

Terminal resistance, phase to phase R [Ω] ± 12 %

Is the resistance between two motor phases without an additional cable. This value will vary with the winding temperature (temperature coefficient: $\alpha_{22} = 0,004 \text{ K}^{-1}$).

Efficiency η_{max} [%]

The maximum ratio between the absorbed electrical power and the obtained mechanical power of the motor.

$$\eta_{max} = \left(1 - \sqrt{\frac{I_o \cdot R}{U_N}}\right)^2$$

No-load speed n_o [min^{-1}] ± 12 %

Describes the motor speed under no-load conditions at steady state and 22 °C ambient temperature. If not otherwise defined the tolerance for the no-load speed is assumed to be ± 12 %.

$$n_o = \frac{U_N - (I_o \cdot R)}{2\pi \cdot k_M}$$

No-load current, typ. I_o [A]

Describes the typical current consumption of the motor without load at an ambient temperature of 22 °C after reaching a steady state condition.

The no-load current is speed and temperature dependent.

Changes in ambient temperature or cooling conditions will influence the value. In addition, modifications to the shaft, bearing, lubrication, and commutation system or combinations with other components such as gearheads or encoders will all result in a change to the no-load current of the motor.

Stall torque M_H [mNm]

The torque developed by the motor at zero speed (locked rotor) and nominal voltage. This value may vary due to the magnet type and temperature and the temperature of the winding.

Starting torque M_A [mNm]

Maximum torque that the motor can produce at room temperature and nominal voltage for a short time during startup. This value can change due to possible current limits in the control electronics.

Both the stall torque M_H and the starting torque M_A can be approximated using the following formula:

$$M_H = M_A = k_M \cdot \frac{U_N}{R} - C_o$$

Friction torque C_o [mNm]

The torque caused by static mechanical friction of the ball bearings and magnetic hysteresis of the stator.

Viscous damping factor C_v [mNm/ min^{-1}]

This factor is made up of the torque due to the viscous friction of the ball bearings as well as the Foucault currents, caused by the cyclical changes in the magnetic field of the stator. These losses are proportional to the speed of the motor.

Speed constant k_n [min^{-1}/V]

The speed variation per Volt applied to the motor terminals at constant load.

$$k_n = \frac{n_o}{U_N - I_o \cdot R} = \frac{1}{k_E}$$

Back-EMF constant k_E [mV/ min^{-1}]

The constant corresponding to the relationship between the induced voltage in the rotor and the speed of rotation.

$$k_E = 2\pi \cdot k_M$$

Torque constant k_M [mNm/A]

The constant corresponding to the relationship between the torque developed by the motor and the current drawn.

Current constant k_I [A/mNm]

Describes the relation of the current in the motor winding and the torque developed at the output shaft.

$$k_I = \frac{1}{k_M}$$

Slope of n-M curve $\Delta n / \Delta M$ [min⁻¹/mNm]

The ratio of the speed variation to the torque variation. The smaller the value, the more powerful the motor.

$$\frac{\Delta n}{\Delta M} = \frac{R}{k_M^2} \cdot \frac{1}{2\pi}$$

Terminal inductance, phase to phase L [μH]

The inductance measured between two phases at 1 kHz.

Mechanical time constant τ_m [ms]

The time required by the motor to reach a speed of 63 % of its final no-load speed, from standstill.

$$\tau_m = \frac{R \cdot J}{k_M^2}$$

Rotor inertia J [gcm²]

The dynamic moment of inertia of the rotor.

Angular acceleration α_{max} [rad/s²]

The acceleration obtained from standstill under no-load conditions and at nominal voltage.

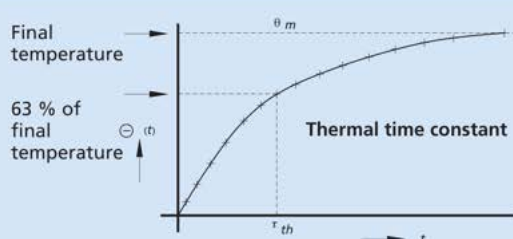
$$\alpha_{max} = \frac{M_H}{J}$$

Thermal resistance R_{th1} ; R_{th2} [K/W]

R_{th1} corresponds to the thermal resistance between the winding and housing. R_{th2} corresponds to the thermal resistance between the housing and the ambient air. R_{th2} can be reduced by enabling exchange of heat between the motor and the ambient air (for example, a thermally coupled mounting configuration, using a heat sink, and/or forced air cooling).

Thermal time constant τ_{w1} ; τ_{w2} [s]

The thermal time constant specifies the time needed for the winding (τ_{w1}) and housing (τ_{w2}) to reach a temperature equal to 63 % of final steady state value.


Operating temperature range [°C]

Indicates the minimum and maximum standard motor operating temperature, as well as the maximum allowable temperature of the standard motor winding.

Shaft bearings

The bearings used for the Brushless DC-Servomotor.

Shaft load max. [N]

The output shaft load at a specified shaft diameter for the primary output shaft. For motors with ball bearings the load and lifetime are in accordance with the values given by the bearing manufacturers. This value does not apply to second, or rear shaft ends.

Shaft play [mm]

The play between the shaft and bearings, including the additional bearing play in the case of ball bearings.

Housing material

The housing material and the surface protection.

Mass [g]

The average mass of the basic motor type.

Direction of rotation

Most motors are designed for clockwise (CW) and counter-clockwise (CCW) operation; the direction of rotation is reversible.

Please note that for motors with integrated electronics, the direction of rotation may not be reversible.

Speed up to n_{max} [min⁻¹]

The maximum recommended motor speed for continuous operation at a given cooling level. This value is based on the recommended operating range for the standard motor bearings and the winding. All higher values have negative effects on the maximum achievable service life of the motor.

Number of pole pairs

Indicates the number of pole pairs of the standard motor.

Hall sensors

Describes the type of motor commutation feedback components in the standard motor.

Magnet material

Describes the basic type of the magnet used in the standard motor.

Brushless DC-Servomotors

Technical Information

Unspecified mechanical tolerances:

Tolerances in accordance with ISO 2768.

≤ 6 = ± 0,1 mm

≤ 30 = ± 0,2 mm

≤ 120 = ± 0,3 mm

The tolerances of non-specified values are available on request.

All mechanical dimensions related to the motor shaft are measured with an axial preload of the shaft toward the motor.

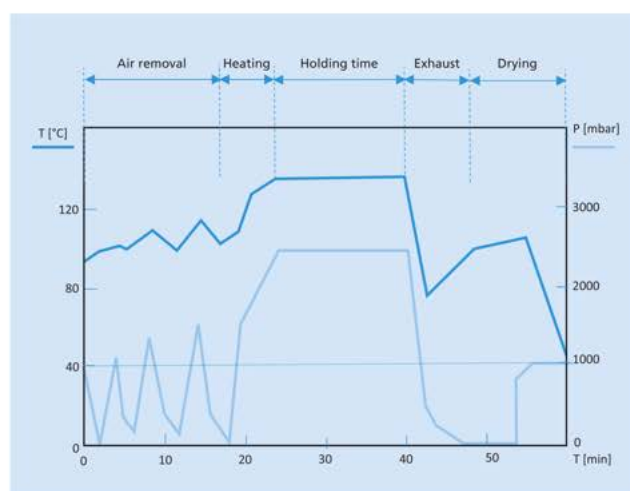
Autoclavable

FAULHABER Brushless DC Motors specified "for Autoclave Sterilisation" have been specifically designed to withstand steam sterilization processes. The sterilization cycle used as reference is the following:

Reference Autoclave Sterilization Cycle:

Sterilizer, Pulse Vacuum Steam Sterilizer

Air Removal Pre Vacuum	ca. 0,9 mbar
Holding Temperature	134 °C
Holding Pressure	2100 mbar
Relative Humidity	100 %
Holding Time	18 minutes
Vacuum Drying	ca. 0,9 mbar



The above mentioned sterilization cycle does not include any preparation activities such as cleaning or disinfection. The typical number of cycles that the brushless DC motor will withstand is indicated in the datasheet. This value could be exceeded if the motor is encapsulated in the final assembly.

Rated values for continuous duty operation

The following values are measured at nominal voltage, without integrated drive electronics, at an ambient temperature of 22 °C.

Rated Torque M_N [mNm]

The maximum continuous duty torque (S1 Operation) at nominal voltage resulting in a steady state temperature not exceeding either the maximum winding temperature and/or operating temperature range of the motor. Additionally the motors are specified either with a 25 % reduction of the R_{th2} value or with an additional mounting condition on a metal flange. Both types of diagram approximate the cooling of the motor given by a typical method of installation. This value can be exceeded if the motor is operated intermittently, for example, in S2 mode and/or if more cooling is applied.

Rated Current (thermal limit) I_N [A]

The typical maximum continuous current at steady state resulting from the rated continuous duty torque. This value includes the effects of a loss of k_M (torque constant) as it relates to the temperature coefficient of the winding, losses due to the effects of the dynamic coefficient of friction which include the Foucault (eddy current) losses, as well as the thermal characteristics of the given magnet material. This value can be exceeded if the motor is operated intermittently, in start/stop mode, in the starting phase and/or if more cooling is used.

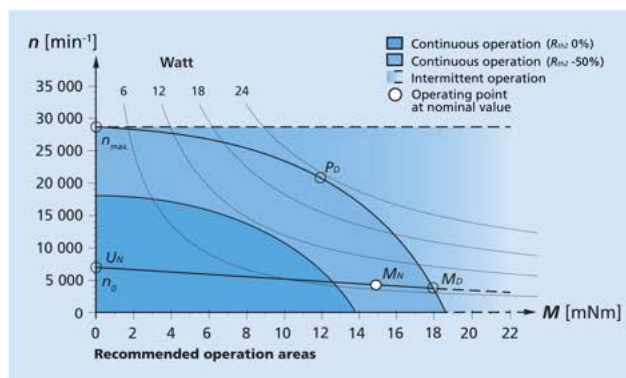
Rated Speed n_N [min⁻¹]

The typical speed at steady state resulting from the application of the given rated torque. This value includes the effects of motor losses on the slope of the n/M curve.

Rated Slope of the n - M curve

An approximation of the slope of the curve at a given rated operating point. This value is derived from the no load speed and the speed under load.

$$\frac{n_0 - n_N}{M_N}$$



Example: Power diagram for rated values at continuous operation.

Explanations on the performance diagram

The performance diagram shows the range of possible operating points of a drive at an ambient temperature of 22 °C and includes both the operation in the thermally insulated and in the cooled state. The possible speed ranges are shown in dependence on the shaft torque.

The sector shown dashed describes potential operating points in which the drive can be engaged in intermittent operation or with increased cooling.

Continuous torque M_D [mNm]

Describes the max. continuous torque in the steady state at nominal voltage and with a thermal reduction of the R_{th2} value by 50 %. The continuous speed decreases linearly vis-à-vis the continuous torque. In the case of slotted flat brushless motors, this point is indicated with the motor mounted on a metal flange and is the same as M_N . The continuous torque is independent of the continuous output power and can be exceeded if the motor is operated intermittently, for example, in S2 operation and/or if more cooling is applied.

Continuous output power P_D [W]

Describes the max. possible output power in continuous operation in steady state with a thermal reduction of the R_{th2} value by 50 %. The value is independent of the continuous torque, responds linearly to the cooling factor and can be exceeded if the motor is operated intermittently, for example, in S2 operation and/or if more cooling is applied.

Brushless DC-Servomotors

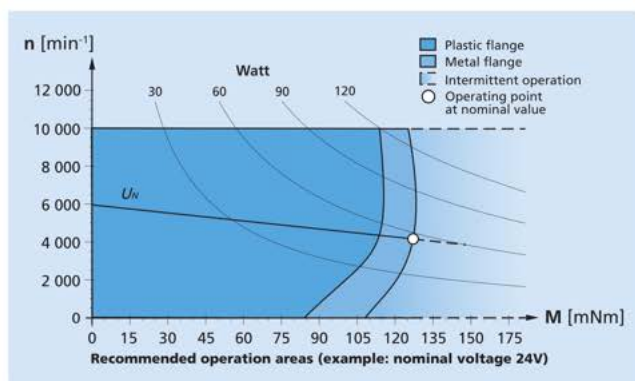
Technical Information

Nominal voltage curve U_N [V]

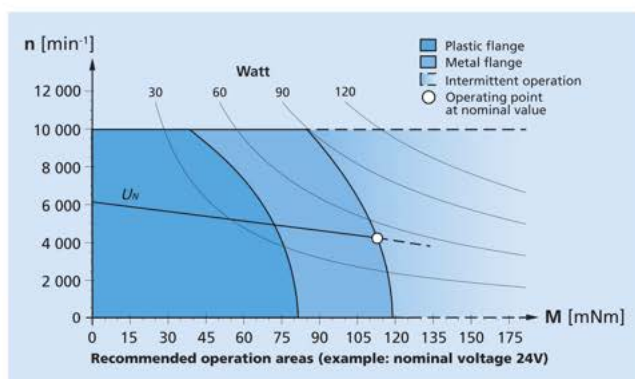
The nominal voltage curve describes the operating points at U_N in the uncooled and cooled state. In steady state, the starting point corresponds to the no-load speed n_0 of the drive. Operating points above this curve can be attained by an increase, operating points below by a reduction of the nominal voltage.

Additional Information for Slotted Brushless Motors

The performance curves for slotted motors with a housing will be significantly different than the diagrams of the motors without a housing. Typically motors without a housing will have a higher performance due to the effects of ambient air flow cooling.



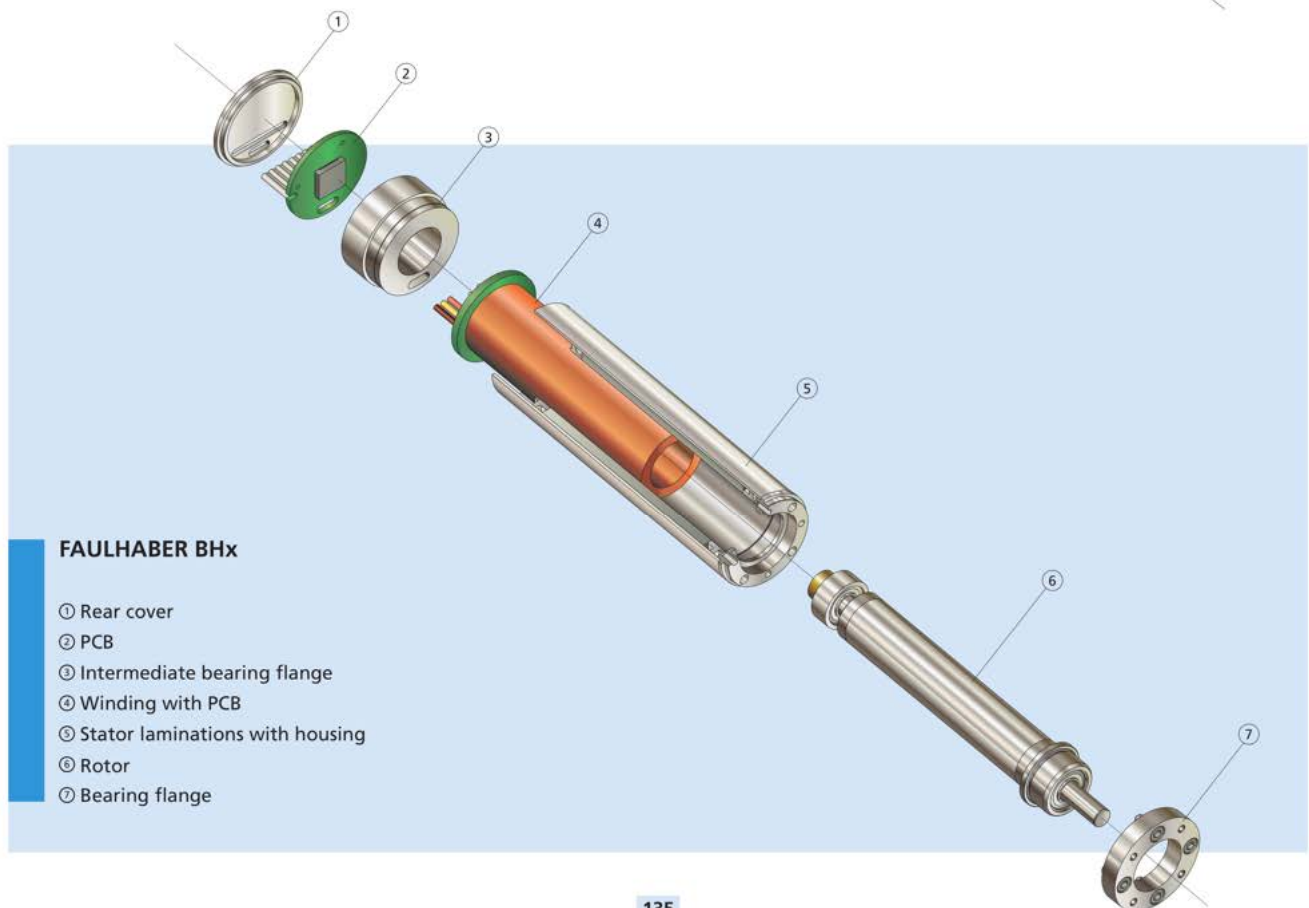
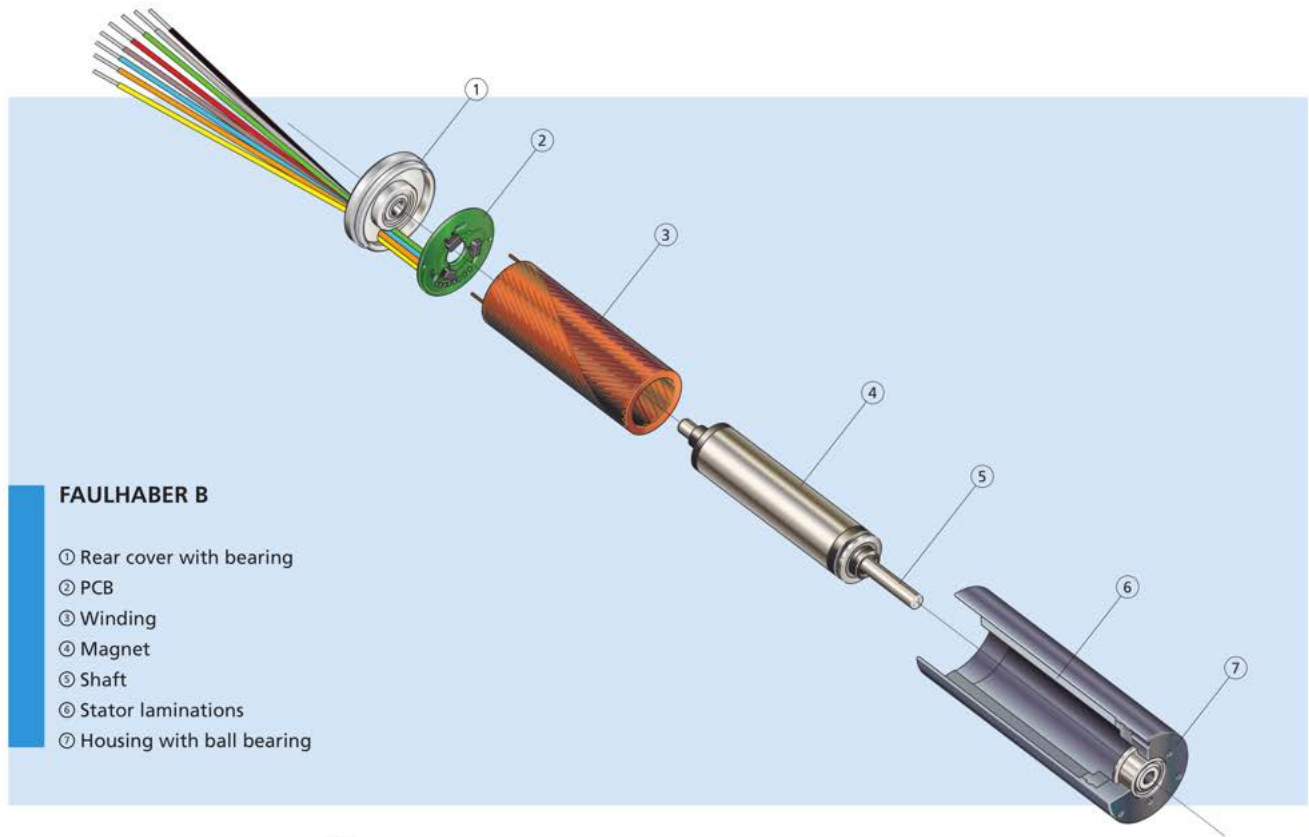
Example: Performance diagram for rated values with continuous operation. (BXT R)



Example: Performance diagram for rated values with continuous operation. (BXT H)

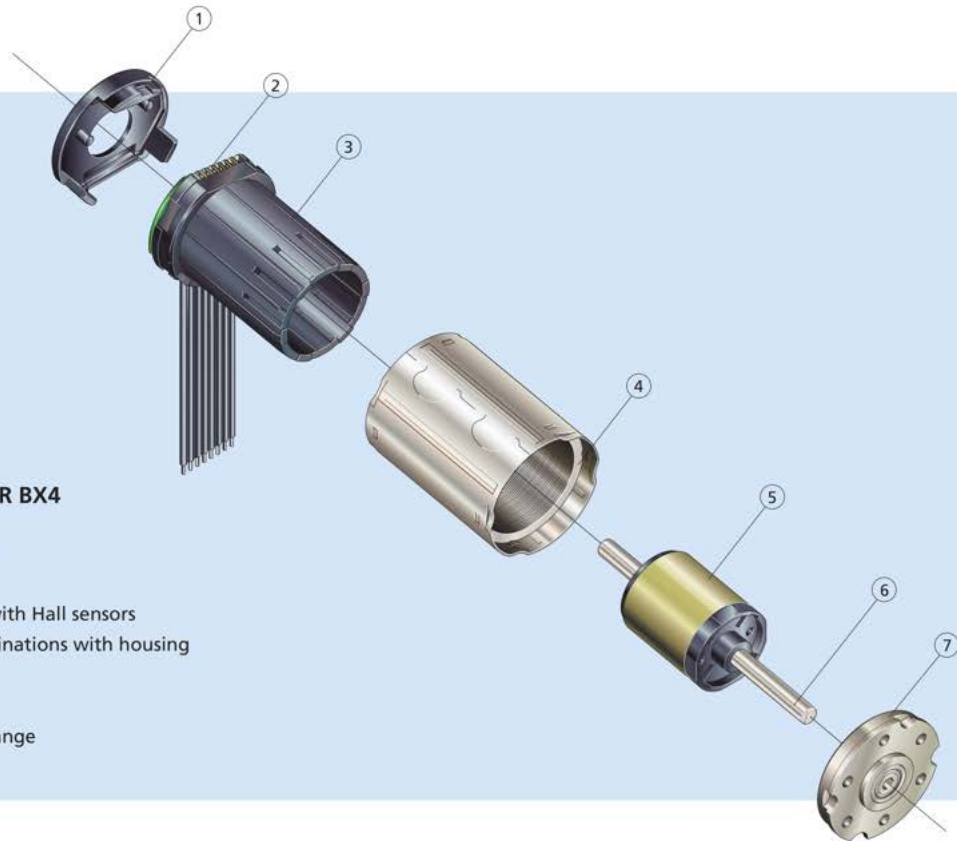
Brushless DC-Servomotors

Basic design



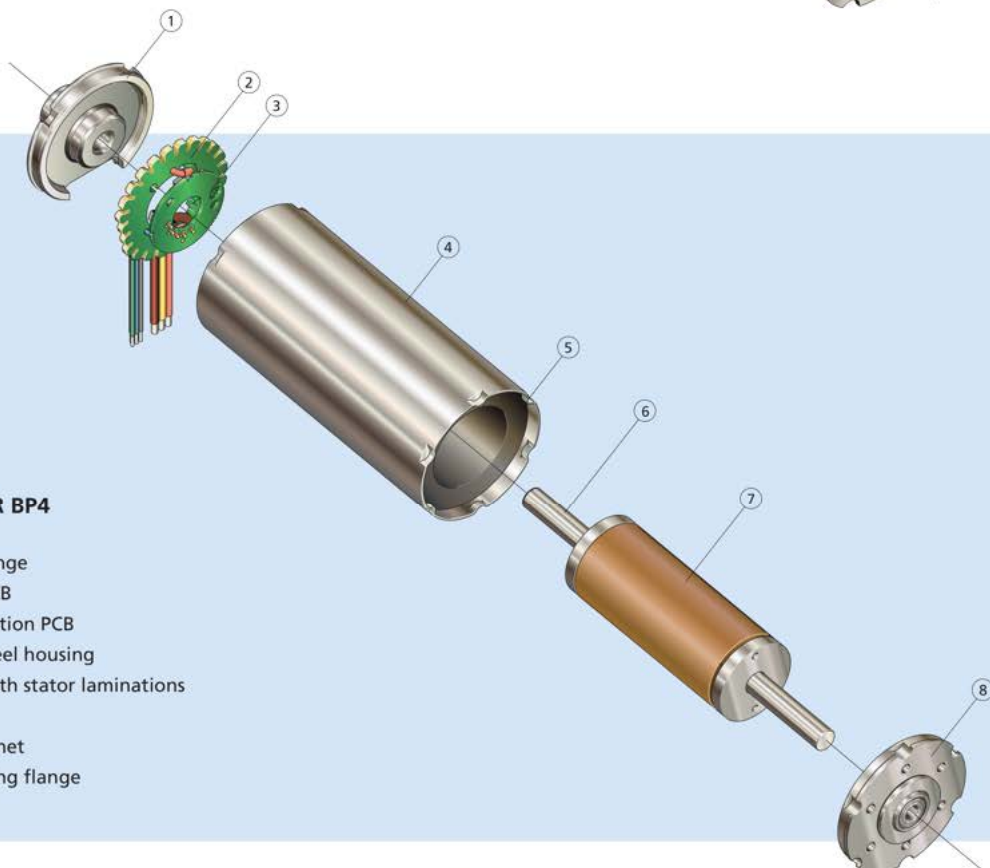
Brushless DC-Servomotors

Basic design



FAULHABER BX4

- ① Rear cover
- ② PCB
- ③ Winding with Hall sensors
- ④ Stator laminations with housing
- ⑤ Magnet
- ⑥ Shaft
- ⑦ Bearing flange

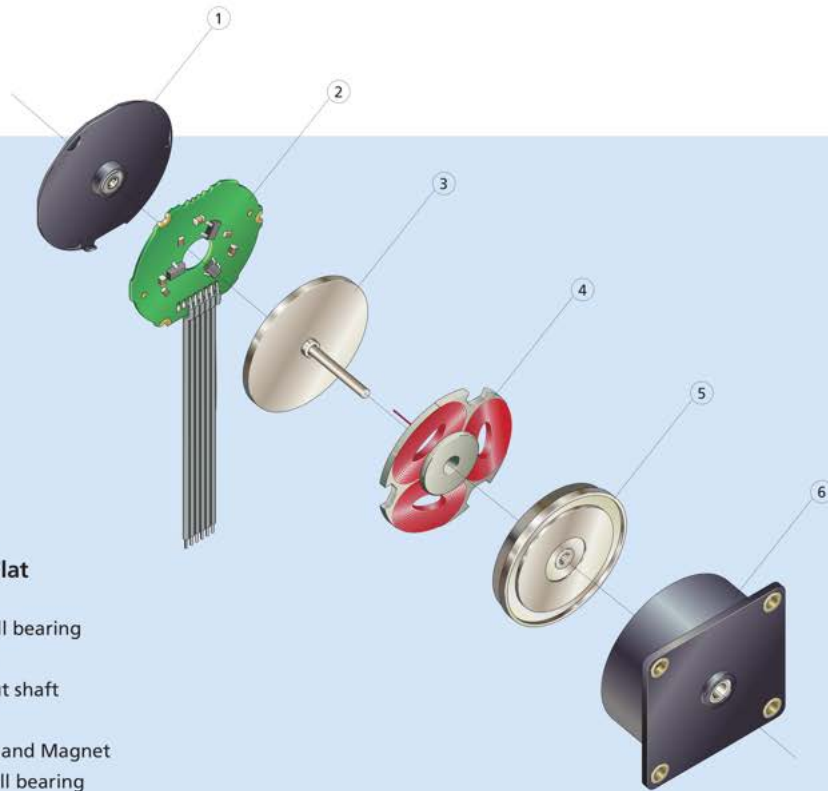


FAULHABER BP4

- ① Bearing flange
- ② Winding PCB
- ③ Hall connection PCB
- ④ Stainless steel housing
- ⑤ Winding with stator laminations
- ⑥ Shaft
- ⑦ 4 Pole magnet
- ⑧ Front bearing flange

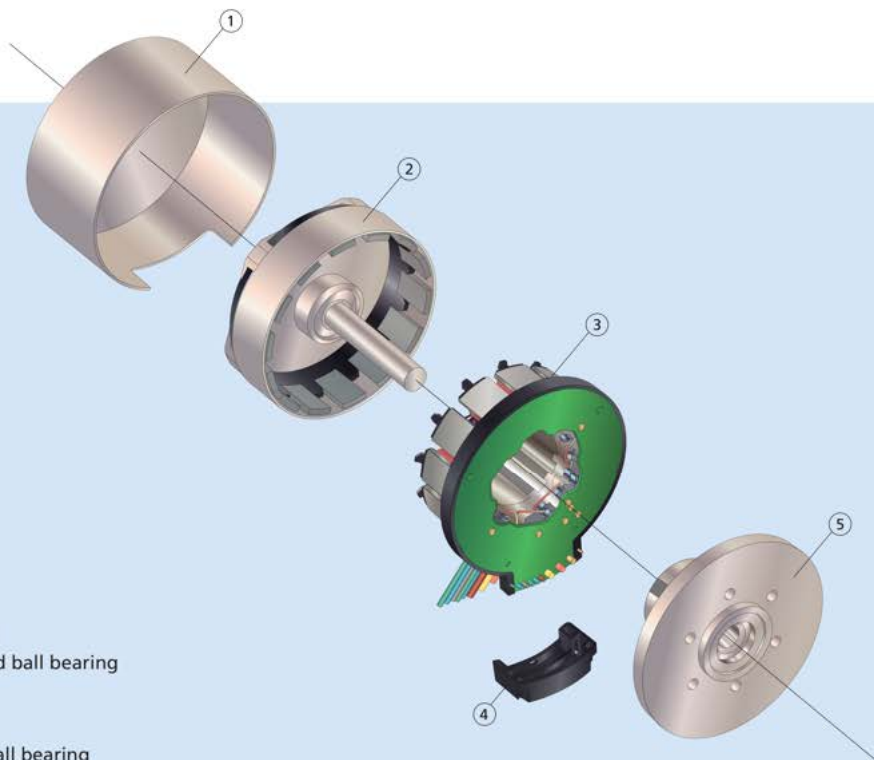
Brushless DC-Flat Motors

Basic design



FAULHABER B-Flat

- ① End cap with ball bearing
- ② Hall Sensor PCB
- ③ Rotor and output shaft
- ④ Stator Winding
- ⑤ Rotor, Back-Iron and Magnet
- ⑥ Housing with ball bearing



FAULHABER BXT

- ① Housing (for BXT H)
- ② Rotor with shaft and ball bearing
- ③ Stator with PCB
- ④ Cover
- ⑤ Front flange with ball bearing

Brushless DC-Servomotors

2 Pole Technology, sensorless

The brushless, sensorless DC-Servomotors can be used even in the most challenging applications where space is extremely limited. After many years of development and experience in microsystem technology, FAULHABER has succeeded in reducing the size of all components and modules to a minimum in order to provide reliable drive functions even with the smallest of dimensions. The brushless DC-Servomotors are sensorless and available with matching, highly compact gearheads for increasing the output torque, and speed controllers. The brushless DC-Servomotors provide a technology basis that can be modified for projects according to the requirements of the individual customer.

Series

0308 ... B

0515 ... B

Key Features

Motor diameter	3 ... 5 mm
Motor length	8 ... 15 mm
Nominal voltage	3 ... 6 V
Speed	up to 96.000 min ⁻¹
Torque	up to 0,13 mNm
Continuous output	up to 0,44 W



Product Code

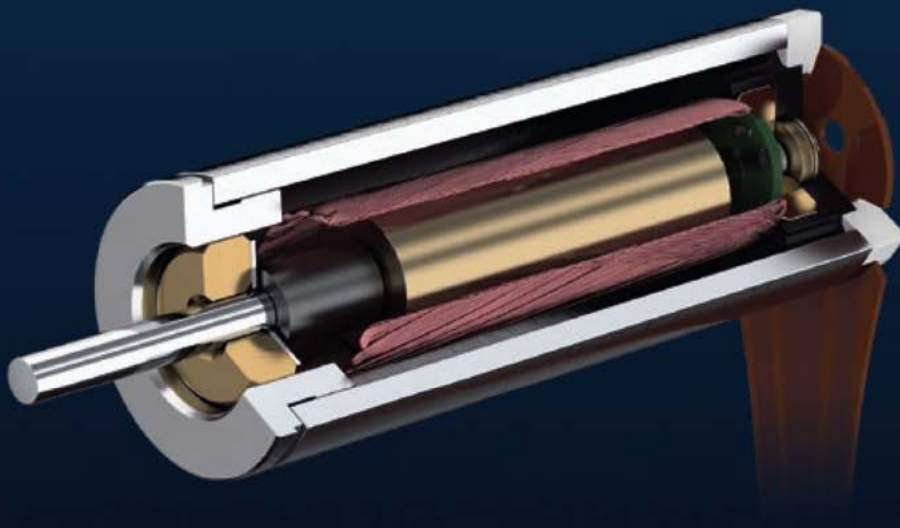
05	Motor diameter [mm]
15	Motor length [mm]
G	Shaft type
006	Nominal voltage [V]
B	Product family

WE CREATE MOTION

FAULHABER B-Micro

Advantages of this series at a glance

- Extremely compact design.
Diameters ranging from 3 mm to 5 mm
- For applications where space is very limited
- 2-pole design with medium to high speeds
- Matching, highly compact gearheads available
- Matching speed controllers available



Brushless DC-Servomotors

2 Pole Technology, sensorless

18 μNm

0,065 W

Series 0308 ... B

Values at 22°C and nominal voltage		0308 H	003 B	
1	Nominal voltage	U_N	3	V
2	Terminal resistance, phase-phase	R	34	Ω
3	Efficiency, max.	η_{max}	20	%
4	No-load speed	n_0	61 000	min^{-1}
5	No-load current, typ. (with shaft \varnothing 0,6 mm)	I_0	0,027	A
6	Stall torque	M_H	0,026	mNm
7	Friction torque, static	C_0	$1,77 \cdot 10^{-3}$	mNm
8	Friction torque, dynamic	C_V	$1,09 \cdot 10^{-7}$	$\text{mNm}/\text{min}^{-1}$
9	Speed constant	k_n	29 800	min^{-1}/V
10	Back-EMF constant	k_E	0,033	$\text{mV}/\text{min}^{-1}$
11	Torque constant	k_M	0,32	mNm/A
12	Current constant	k_I	3,12	A/mNm
13	Slope of n-M curve	$\Delta n/\Delta M$	$3,2 \cdot 10^6$	$\text{min}^{-1}/\text{mNm}$
14	Terminal inductance, phase-phase	L	60	μH
15	Mechanical time constant	τ_m	7	ms
16	Rotor inertia	J	$2 \cdot 10^{-4}$	gcm^2
17	Angular acceleration	α_{max}	1 323	$\cdot 10^3 \text{rad}/\text{s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	60 / 300	K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	0,5 / 45	s
20	Operating temperature range:			
	– motor		-30 ... +60	°C
	– winding, max. permissible		+60	°C
21	Shaft bearings		ruby bearings	
22	Shaft load max.:			
	– with shaft diameter		0,6	mm
	– radial at 3 000 min^{-1} (1 mm from mounting flange)		0,2	N
	– axial at 3 000 min^{-1} (push only)		0,2	N
	– axial at standstill (push only)		2	N
23	Shaft play:			
	– radial	\leq	0,03	mm
	– axial	\leq	0,15	mm
24	Housing material		Nickel alloy	
25	Mass		0,35	g
26	Direction of rotation		electronically reversible	
27	Speed up to	n_{max}	96 000	min^{-1}
28	Number of pole pairs		1	
29	Hall sensors		without	
30	Magnet material		NdFeB	
Rated values for continuous operation				
31	Rated torque	M_N	0,013	mNm
32	Rated current (thermal limit)	I_N	0,056	A
33	Rated speed	n_N	24 820	min^{-1}

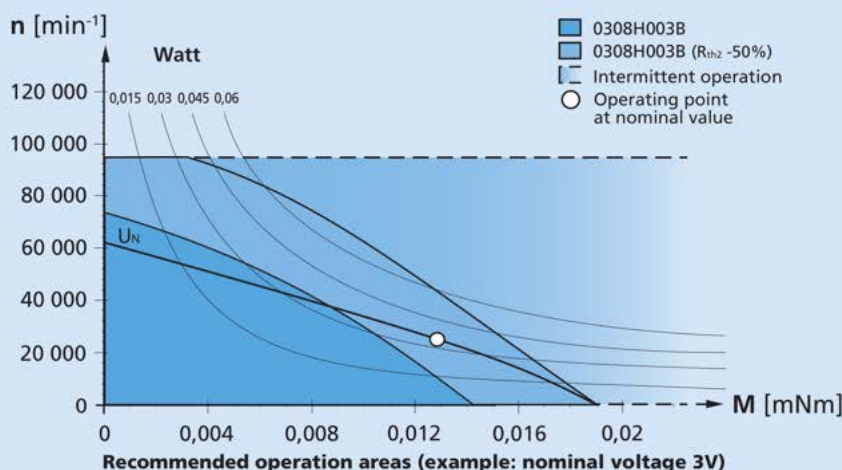
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Brushless DC-Servomotors

2 Pole Technology, sensorless

0,13 mNm

0,44 W

Series 0515 ... B

Values at 22°C and nominal voltage		0515 G	006 B	
1	Nominal voltage	U_N	6	V
2	Terminal resistance, phase-phase	R	16,1	Ω
3	Efficiency, max.	η_{max}	39	%
4	No-load speed	n_0	43 000	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 0,8 mm)	I_0	0,056	A
6	Stall torque	M_H	0,4	mNm
7	Friction torque, static	C_0	0,033	mNm
8	Friction torque, dynamic	C_V	$6,5 \cdot 10^{-7}$	mNm/min ⁻¹
9	Speed constant	k_n	8 282	min ⁻¹ /V
10	Back-EMF constant	k_E	0,121	mV/min ⁻¹
11	Torque constant	k_M	1,15	mNm/A
12	Current constant	k_I	0,867	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	115 600	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	140	μH
15	Mechanical time constant	τ_m	2,4	ms
16	Rotor inertia	J	0,002	gcm ²
17	Angular acceleration	α_{max}	1 983	$\cdot 10^3$ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	21 / 140	K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	1,9 / 89	s
20	Operating temperature range:			
	– motor		-30 ... +80	°C
	– winding, max. permissible		+80	°C
21	Shaft bearings		sintered bearings	
22	Shaft load max.:			
	– with shaft diameter		0,8	mm
	– radial at 3 000 min ⁻¹ (1 mm from mounting flange)		0,2	N
	– axial at 3 000 min ⁻¹ (push only)		0,2	N
	– axial at standstill (push only)		2	N
23	Shaft play:			
	– radial	\leq	0,03	mm
	– axial	\leq	0,15	mm
24	Housing material		steel, nickel plated	
25	Mass		1,6	g
26	Direction of rotation		electronically reversible	
27	Speed up to	n_{max}	77 000	min ⁻¹
28	Number of pole pairs		1	
29	Hall sensors		without	
30	Magnet material		NdFeB	
Rated values for continuous operation				
31	Rated torque	M_N	0,084	mNm
32	Rated current (thermal limit)	I_N	0,127	A
33	Rated speed	n_N	30 880	min ⁻¹

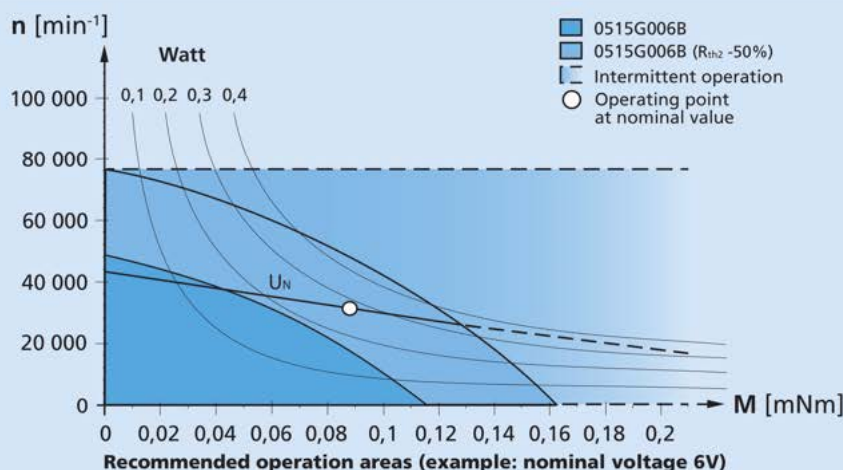
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

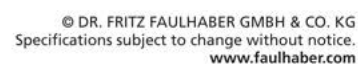
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Scale enlarged



Brushless DC-Servomotors 2 Pole Technology

The original FAULHABER brushless DC servomotors. These ironless slotless motors are built for use in highly challenging areas of application and environmental conditions from the vacuum of space to medical device technology. They are precise, have extremely long operational lifetimes, and are highly reliable. They are available with a wide variety of complementary products such as high resolution encoders and precision gearheads. For maximum integration and reduction of size the standard digital hall sensors in the motors can be replaced with optional analog (linear) hall sensors which can eliminate the need for an encoder in most applications.

Series

0620 ... B	0824 ... B
1028 ... B	1218 ... B
1226 ... B	1628 ... B
2036 ... B	2057 ... B
2057 ... BA	2444 ... B
3056 ... B	3564 ... B
4490 ... B	4490 ... BS

Key Features

Motor diameter	6 ... 44 mm
Motor length	18 ... 90 mm
Nominal voltage	24 ... 48 V
Speed	up to 100.000 min ⁻¹
Torque	up to 217 mNm
Continuous output	up to 282 W



Product Code

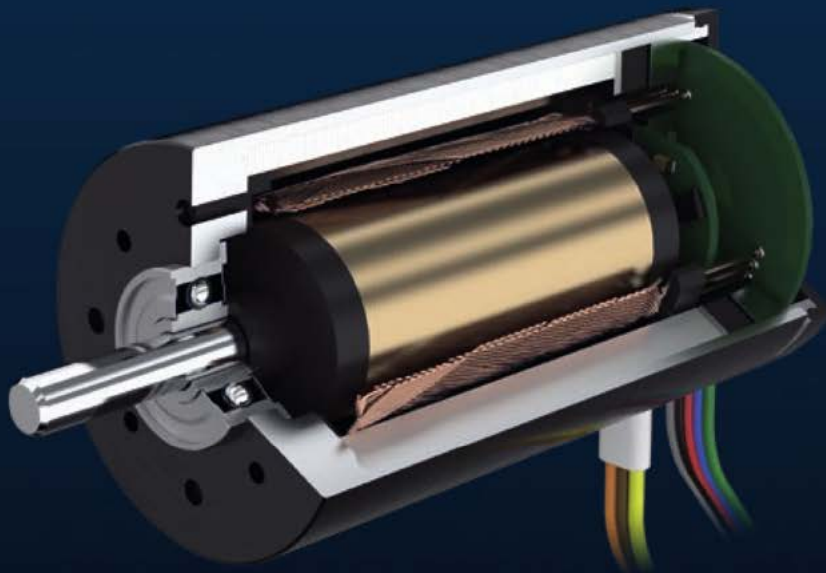
35	Motor diameter [mm]
64	Motor length [mm]
K	Shaft type
024	Nominal voltage [V]
B	Product family

WE CREATE MOTION

FAULHABER B

Advantages of this series at a glance

- High density ironless system FAULHABER winding
- Digital or analog hall sensors available
- Extremely smooth speed control
- Sensitive positioning control



Brushless DC-Servomotors

2 Pole Technology

0,36 mNm

1,7 W

Series 0620 ... B

Values at 22°C and nominal voltage		0620 K	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	8,8	60,2	Ω
3	Efficiency, max.	η_{max}	51	50	%
4	No-load speed	n_0	48 600	37 300	min ⁻¹
5	No-load current, typ. (with shaft ø 1 mm)	I_0	0,056	0,018	A
6	Stall torque	M_H	0,732	0,551	mNm
7	Friction torque, static	C_0	0,011	0,011	mNm
8	Friction torque, dynamic	C_V	1,02·10 ⁻⁶	1,02·10 ⁻⁶	mNm/min ⁻¹
9	Speed constant	k_n	8 761	3 386	min ⁻¹ /V
10	Back-EMF constant	k_E	0,114	0,295	mV/min ⁻¹
11	Torque constant	k_M	1,09	2,82	mNm/A
12	Current constant	k_I	0,917	0,355	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	70 730	72 289	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	28	192	μ H
15	Mechanical time constant	τ_m	7	7,2	ms
16	Rotor inertia	J	0,0095	0,0095	gcm ²
17	Angular acceleration	α_{max}	771	580	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	13,2 / 84,3		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	1,1 / 89		s
20	Operating temperature range:				
	– motor		-20 ... +100		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1		mm
	– radial at 10 000 min ⁻¹ (4 mm from mounting flange)		2		N
	– axial at 10 000 min ⁻¹ (push only)		0,6		N
	– axial at standstill (push only)		10		N
23	Shaft play:				
	– radial	≤	0,012		mm
	– axial	=	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		2,5		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	100 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
Rated values for continuous operation					
31	Rated torque	M_N	0,28	0,3	mNm
32	Rated current (thermal limit)	I_N	0,311	0,122	A
33	Rated speed	n_N	21 820	7 290	min ⁻¹

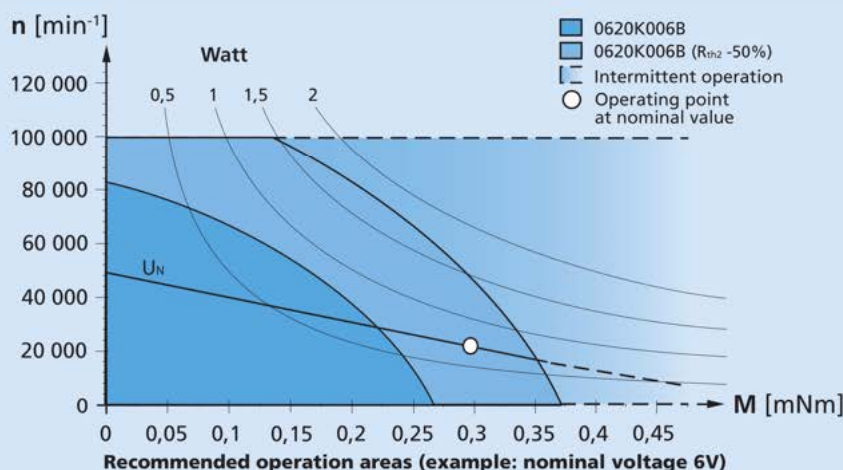
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.





Example product designation: **0620K006B-K2280**

Recommended connector
Molex - ZIF Connector,
No. 52745-0897.

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
06/1	PA2-50 HXM3-64	SC 1801 F SC 2402 P SC 2804 S MCBL 3002 P MCBL 3002 F MCBL 3003 P	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

1,1 mNm

5,8 W

Series 0824 ... B

Values at 22°C and nominal voltage		0824 K	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	2,91	10,7	Ω
3	Efficiency, max.	η_{max}	70	70	%
4	No-load speed	n_0	35 100	37 500	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 1 mm)	I_0	0,055	0,031	A
6	Stall torque	M_H	3,28	3,34	mNm
7	Friction torque, static	C_0	0,021	0,021	mNm
8	Friction torque, dynamic	C_V	$1,89 \cdot 10^{-6}$	$1,89 \cdot 10^{-6}$	mNm/min ⁻¹
9	Speed constant	k_n	5 968	3 183	min ⁻¹ /V
10	Back-EMF constant	k_E	0,168	0,314	mV/min ⁻¹
11	Torque constant	k_M	1,6	3	mNm/A
12	Current constant	k_I	0,625	0,333	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	10 855	11 353	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	30	107	μ H
15	Mechanical time constant	τ_m	2,4	2,5	ms
16	Rotor inertia	J	0,0285	0,0285	gcm ²
17	Angular acceleration	α_{max}	1 561	1 592	$\cdot 10^3$ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	11,2 / 55,2		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	3,5 / 112		s
20	Operating temperature range:				
	– motor		-20 ... +100		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1		mm
	– radial at 10 000 min ⁻¹ (4 mm from mounting flange)		1,5		N
	– axial at 10 000 min ⁻¹ (push only)		0,4		N
	– axial at standstill (push only)		10		N
23	Shaft play:				
	– radial	\leq	0,012		mm
	– axial	$=$	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		5,2		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	90 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
Rated values for continuous operation					
31	Rated torque	M_N	0,89	0,86	mNm
32	Rated current (thermal limit)	I_N	0,66	0,341	A
33	Rated speed	n_N	22 120	24 560	min ⁻¹

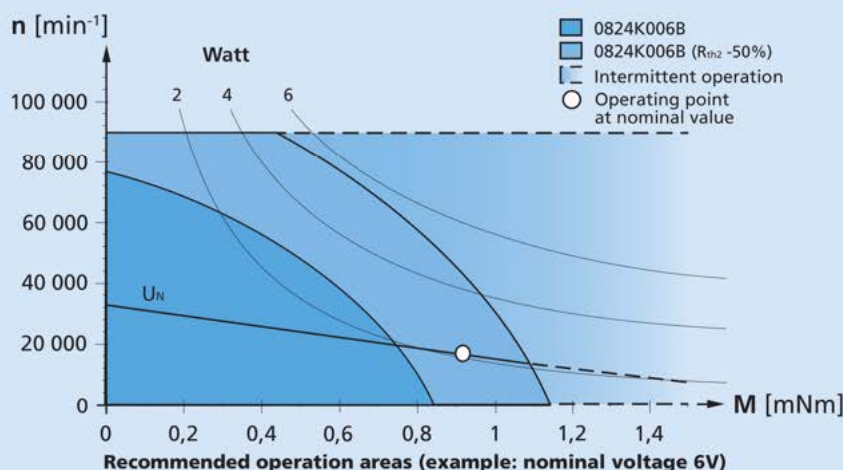
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

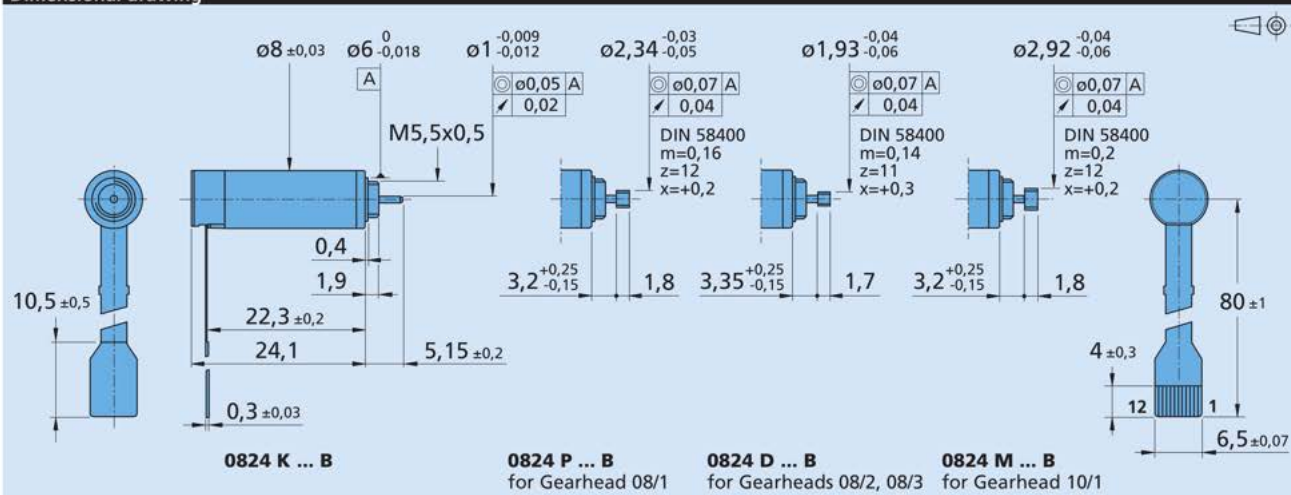
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **0824K006B-K179**

Option	Type	Description	Connection	
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	No.	Function
			1	Phase C
			2	Phase B
			3	Phase A
			4	GND
			5	U _{DD} (+5V)
			6	Hall sensor C
			7	Hall sensor B
			8	Hall sensor A
			9	Hall sensor \overline{B}
			10	Hall sensor \overline{A}
			11	Hall sensor \overline{C}
			12	Reserved
			Standard flexboard	
			12 pole, 0,5 mm pitch	
			Recommended connector	
			Molex - ZIF Connector, No. 52745-1297.	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
08/1 08/2 08/3 10/1	IEM3-1024 AESM-4096	SC 1801 P SC 1801 S SC 2402 P SC 2804 S MCBL 3002 P AES MCBL 3002 F AES MCBL 3003 P AES	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

2,2 mNm

8,7 W

Series 1028 ... B

Values at 22°C and nominal voltage		1028 S	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	1,08	4,37	Ω
3	Efficiency, max.	η_{max}	73	72	%
4	No-load speed	n_0	32 300	33 600	min ⁻¹
5	No-load current, typ. (with shaft ø 1,2 mm)	I_0	0,121	0,065	A
6	Stall torque	M_H	9,72	9,22	mNm
7	Friction torque, static	C_0	0,06	0,06	mNm
8	Friction torque, dynamic	C_V	$4,62 \cdot 10^{-6}$	$4,62 \cdot 10^{-6}$	mNm/min ⁻¹
9	Speed constant	k_n	5 426	2 825	min ⁻¹ /V
10	Back-EMF constant	k_E	0,184	0,354	mV/min ⁻¹
11	Torque constant	k_M	1,76	3,38	mNm/A
12	Current constant	k_I	0,568	0,296	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	3 329	3 653	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	24	87	μH
15	Mechanical time constant	τ_m	1,9	2,1	ms
16	Rotor inertia	J	0,0622	0,0622	gcm ²
17	Angular acceleration	α_{max}	1 803	1 711	$\cdot 10^3 \text{ rad/s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	6,6 / 42,4		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	4,2 / 152		s
20	Operating temperature range:				
	– motor		-20 ... +100		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1,2		mm
	– radial at 10 000 min ⁻¹ (4 mm from mounting flange)		2,5		N
	– axial at 10 000 min ⁻¹ (push only)		1,3		N
	– axial at standstill (push only)		11		N
23	Shaft play:				
	– radial	\leq	0,012		mm
	– axial	$=$	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		9,4		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	79 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
Rated values for continuous operation					
31	Rated torque	M_N	1,68	1,57	mNm
32	Rated current (thermal limit)	I_N	1,16	0,57	A
33	Rated speed	n_N	25 660	26 800	min ⁻¹

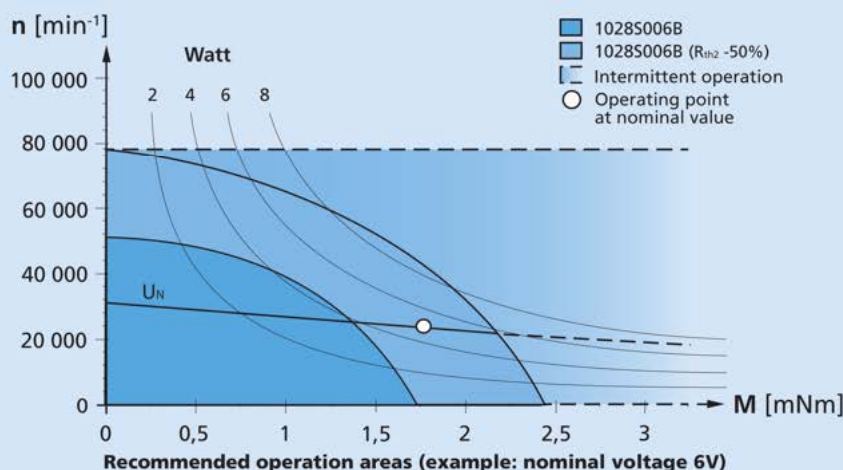
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

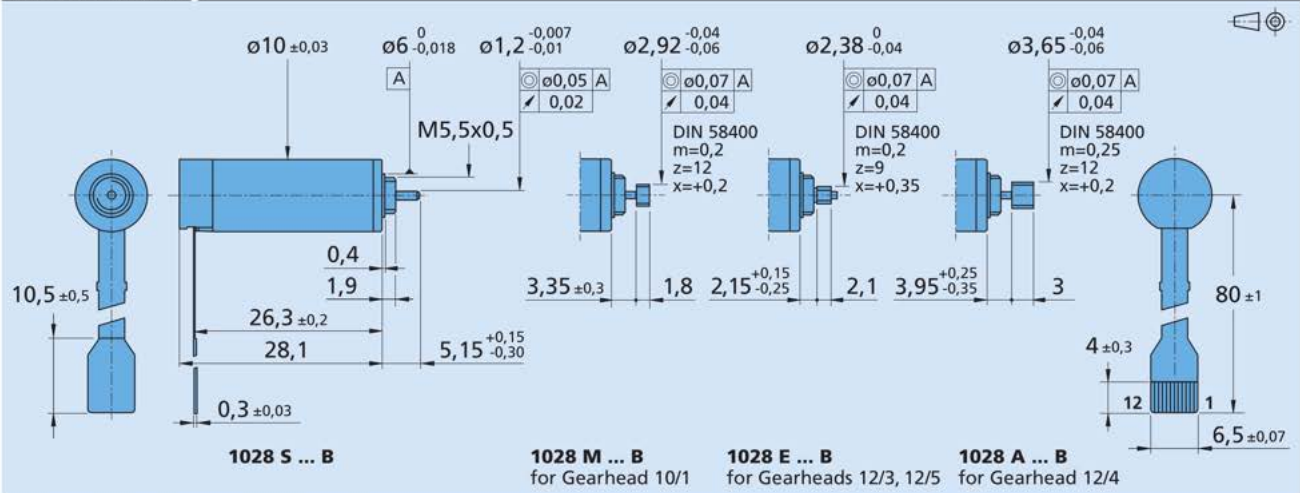
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **1028S006B-K179**

Option	Type	Description	Connection																										
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	<table><tr><th>No.</th><th>Function</th></tr><tr><td>1</td><td>Phase C</td></tr><tr><td>2</td><td>Phase B</td></tr><tr><td>3</td><td>Phase A</td></tr><tr><td>4</td><td>GND</td></tr><tr><td>5</td><td>U_{DD} (+5V)</td></tr><tr><td>6</td><td>Hall sensor C</td></tr><tr><td>7</td><td>Hall sensor B</td></tr><tr><td>8</td><td>Hall sensor A</td></tr><tr><td>9</td><td>Hall sensor B</td></tr><tr><td>10</td><td>Hall sensor A</td></tr><tr><td>11</td><td>Hall sensor C</td></tr><tr><td>12</td><td>Reserved</td></tr></table>	No.	Function	1	Phase C	2	Phase B	3	Phase A	4	GND	5	U _{DD} (+5V)	6	Hall sensor C	7	Hall sensor B	8	Hall sensor A	9	Hall sensor B	10	Hall sensor A	11	Hall sensor C	12	Reserved
No.	Function																												
1	Phase C																												
2	Phase B																												
3	Phase A																												
4	GND																												
5	U _{DD} (+5V)																												
6	Hall sensor C																												
7	Hall sensor B																												
8	Hall sensor A																												
9	Hall sensor B																												
10	Hall sensor A																												
11	Hall sensor C																												
12	Reserved																												
			Standard flexboard 12 pole, 0,5 mm pitch																										
			Recommended connector Molex - ZIF Connector, No. 52745-1297.																										

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
10/1 12/3 12/4 12/5	IEM3-1024 AESM-4096	SC 1801 P SC 1801 S SC 2402 P SC 2804 S MCBL 3002 P AES MCBL 3002 F AES MCBL 3003 P AES	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

1,2 mNm

4,9 W

Series 1218 ... B

Values at 22°C and nominal voltage		1218 S	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	3,14	12	Ω
3	Efficiency, max.	η_{max}	62	62	%
4	No-load speed	n_0	30 500	31 500	min ⁻¹
5	No-load current, typ. (with shaft ø 1,2 mm)	I_0	0,089	0,047	A
6	Stall torque	M_H	3,39	3,44	mNm
7	Friction torque, static	C_0	0,066	0,066	mNm
8	Friction torque, dynamic	C_V	$3,06 \cdot 10^{-6}$	$3,06 \cdot 10^{-6}$	mNm/min ⁻¹
9	Speed constant	k_n	5 276	2 721	min ⁻¹ /V
10	Back-EMF constant	k_E	0,19	0,368	mV/min ⁻¹
11	Torque constant	k_M	1,81	3,51	mNm/A
12	Current constant	k_I	0,553	0,285	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	9 153	9 301	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	35	132	μH
15	Mechanical time constant	τ_m	7,7	7,8	ms
16	Rotor inertia	J	0,08	0,08	gcm ²
17	Angular acceleration	α_{max}	424	431	$\cdot 10^3 \text{rad/s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	10,6 / 48,3		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	2,8 / 169		s
20	Operating temperature range:				
	– motor		-20 ... +100		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1,2		mm
	– radial at 10 000 min ⁻¹ (4 mm from mounting flange)		3,5		N
	– axial at 10 000 min ⁻¹ (push only)		2		N
	– axial at standstill (push only)		11		N
23	Shaft play:				
	– radial	\leq	0,012		mm
	– axial	$=$	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		8,3		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	79 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
Rated values for continuous operation					
31	Rated torque	M_N	0,96	0,95	mNm
32	Rated current (thermal limit)	I_N	0,663	0,34	A
33	Rated speed	n_N	18 280	19 150	min ⁻¹

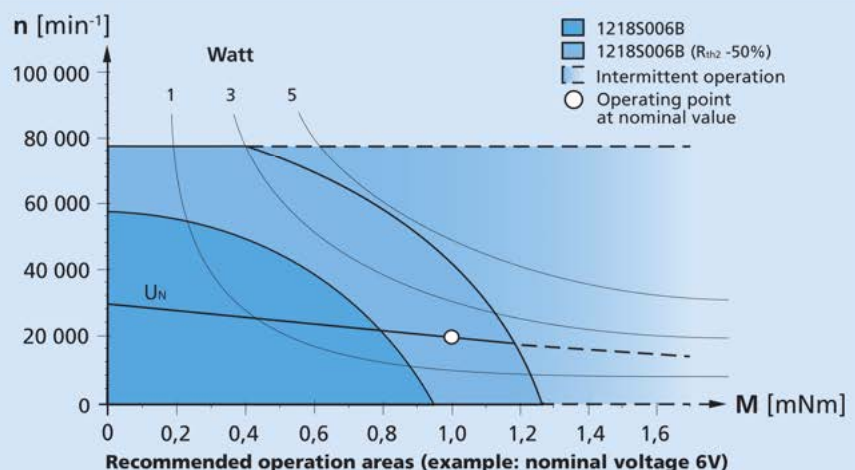
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

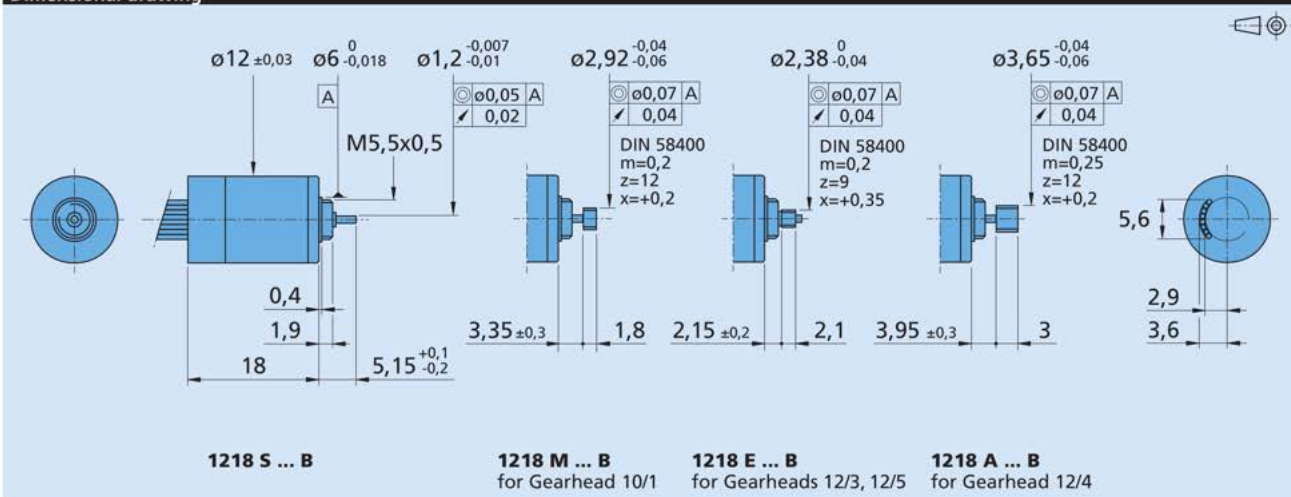
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **1218S006B-K1855**

Option	Type	Description	Connection	
K1855	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Function	Colour
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			8 conductors, AWG 30	
			Length: 80 mm ±3 mm	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
10/1 12/3 12/4 12/5		SC 1801 P SC 1801 S SC 2402 P SC 2804 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MC 5004 P MC 5004 P STO	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

2,6 mNm

9,9 W

Series 1226 ... B

Values at 22°C and nominal voltage	1226 S	006 B	012 B	024 B	
1 Nominal voltage	U_N	6	12	24	V
2 Terminal resistance, phase-phase	R	2,2	5,45	18,1	Ω
3 Efficiency, max.	η_{max}	71	72	72	%
4 No-load speed	n_0	21 000	27 400	29 700	min ⁻¹
5 No-load current, typ. (with shaft \varnothing 1,2 mm)	I_0	0,07	0,054	0,031	A
6 Stall torque	M_H	7,24	8,99	10,2	mNm
7 Friction torque, static	C_0	0,073	0,073	0,073	mNm
8 Friction torque, dynamic	C_V	$5,3 \cdot 10^{-6}$	$5,3 \cdot 10^{-6}$	$5,3 \cdot 10^{-6}$	mNm/min ⁻¹
9 Speed constant	k_n	3 563	2 318	1 237	min ⁻¹ /V
10 Back-EMF constant	k_E	0,281	0,431	0,808	mV/min ⁻¹
11 Torque constant	k_M	2,68	4,12	7,72	mNm/A
12 Current constant	k_I	0,373	0,243	0,13	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	2 925	3 066	2 902	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	36	85	307	μ H
15 Mechanical time constant	τ_m	4,4	4,7	4,6	ms
16 Rotor inertia	J	0,15	0,15	0,15	gcm ²
17 Angular acceleration	α_{max}	499	621	677	$\cdot 10^3$ rad/s ²
18 Thermal resistance	R_{th1} / R_{th2}	7,3 / 36,6			K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	3,2 / 207			s
20 Operating temperature range:					
– motor		-20 ... +100			°C
– winding, max. permissible		+125			°C
21 Shaft bearings		ball bearings, preloaded			
22 Shaft load max.:					
– with shaft diameter		1,2			mm
– radial at 10 000 min ⁻¹ (4 mm from mounting flange)		5			N
– axial at 10 000 min ⁻¹ (push only)		2,5			N
– axial at standstill (push only)		11			N
23 Shaft play:					
– radial	\leq	0,012			mm
– axial	$=$	0			mm
24 Housing material		aluminium, black anodized			
25 Mass		13			g
26 Direction of rotation		electronically reversible			
27 Speed up to	n_{max}	79 000			min ⁻¹
28 Number of pole pairs		1			
29 Hall sensors		digital			
30 Magnet material		NdFeB			
Rated values for continuous operation					
31 Rated torque	M_N	2,13	1,97	1,99	mNm
32 Rated current (thermal limit)	I_N	0,932	0,573	0,311	A
33 Rated speed	n_N	12 480	19 670	22 140	min ⁻¹

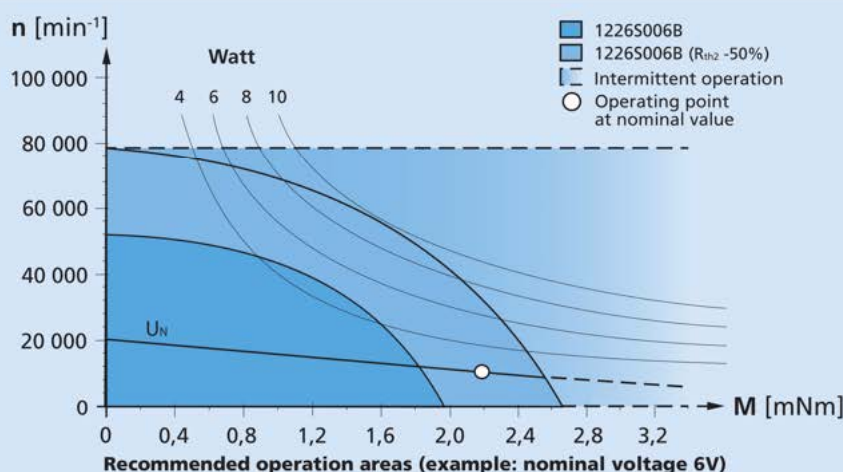
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

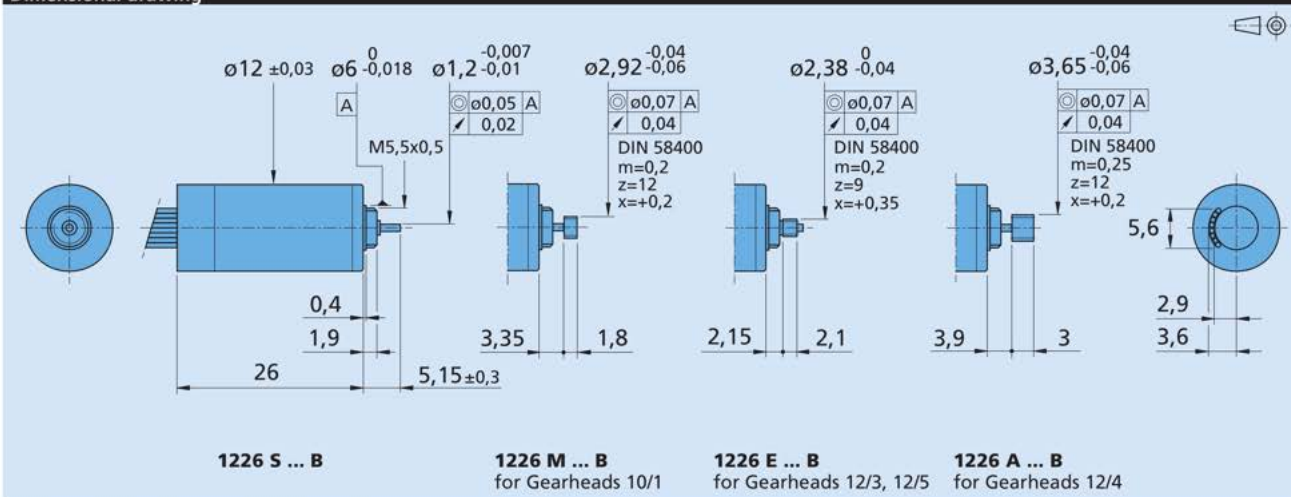
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **1226S006B-K1855**

Option	Type	Description	Connection	
K1855	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Function	Colour
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			8 conductors, AWG 30	
			Length: 80 mm ±3 mm	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
10/1 12/3 12/4 12/5		SC 1801 P SC 1801 S SC 2402 P SC 2804 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MC 5004 P MC 5004 P STO	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

3,3 mNm

17 W

Series 1628 ... B

Values at 22°C and nominal voltage		1628 T	012 B	024 B	
1	Nominal voltage	U_N	12	24	V
2	Terminal resistance, phase-phase	R	4,36	15,2	Ω
3	Efficiency, max.	η_{max}	68	69	%
4	No-load speed	n_0	30 800	31 600	min ⁻¹
5	No-load current, typ. (with shaft ø 1,5 mm)	I_0	0,087	0,045	A
6	Stall torque	M_H	9,79	11	mNm
7	Friction torque, static	C_0	0,148	0,148	mNm
8	Friction torque, dynamic	C_V	5,33·10 ⁻⁶	5,33·10 ⁻⁶	mNm/min ⁻¹
9	Speed constant	k_n	2 645	1 349	min ⁻¹ /V
10	Back-EMF constant	k_E	0,378	0,741	mV/min ⁻¹
11	Torque constant	k_M	3,61	7,08	mNm/A
12	Current constant	k_I	0,277	0,141	A/mNm
13	Slope of n-M curve	$\Delta n/\Delta M$	3 195	2 896	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	134	517	μ H
15	Mechanical time constant	τ_m	18,1	16,4	ms
16	Rotor inertia	J	0,54	0,54	gcm ²
17	Angular acceleration	α_{max}	181	204	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	5,6 / 22,5		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	5,7 / 283		s
20	Operating temperature range:				
	– motor		-30 ... +125		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1,5		mm
	– radial at 3 000 min ⁻¹ (4 mm from mounting flange)		17		N
	– axial at 3 000 min ⁻¹ (push only)		10		N
	– axial at standstill (push only)		20		N
23	Shaft play:				
	– radial	≤	0,015		mm
	– axial	=	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		30		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	70 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		SmCo		
Rated values for continuous operation					
31	Rated torque	M_N	2,62	2,74	mNm
32	Rated current (thermal limit)	I_N	0,829	0,442	A
33	Rated speed	n_N	19 130	20 540	min ⁻¹

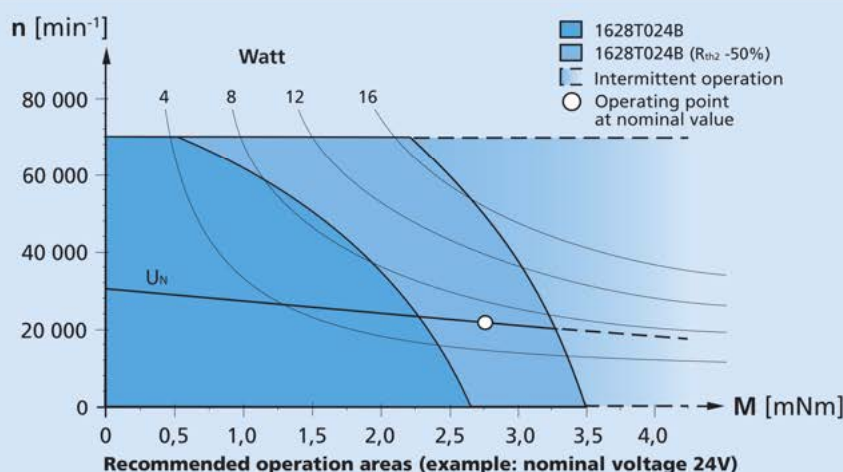
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

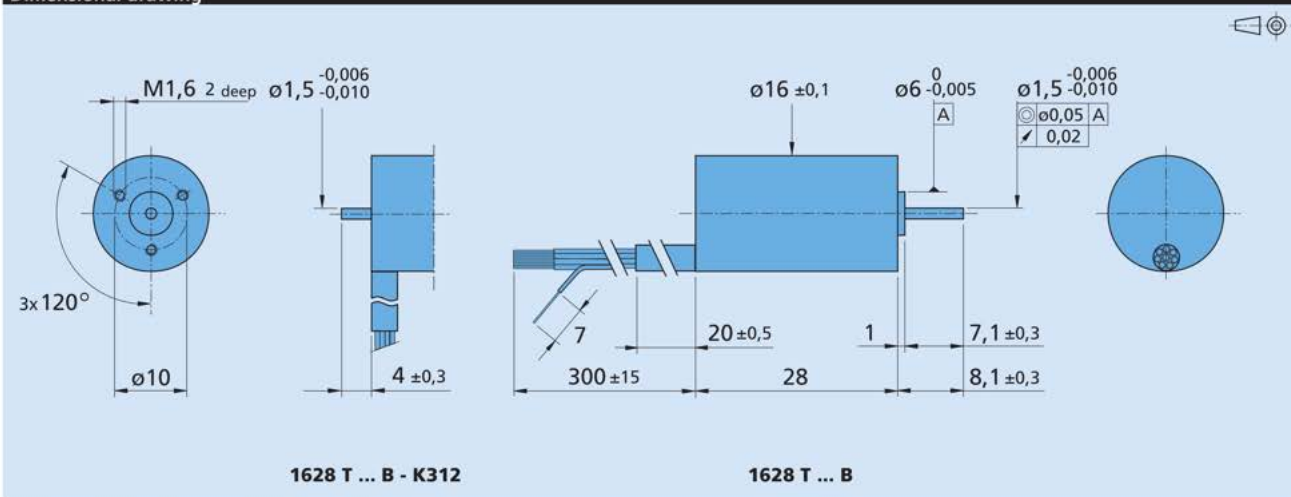
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **1628T012B-K1155**

Option	Type	Description	Connection	
K1155	Controller combination	Analog Hall sensors for combination with Speed Controller SC and Motion Controller MCBL	Function	Colour
K903	Lead wires length	Single lead wires 1000 mm long in PTFE	Phase C	yellow
K313	Encoder combination	Motor with rear end shaft for combination with Encoder IE2	Phase B	orange
K312	Encoder combination	Motor with rear end shaft	Phase A	brown
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			8 conductors, AWG 26	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
15/10 16/7 17/1	IE2-1024	SC 1801 P SC 1801 S SC 2402 P SC 2804 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MC 5004 P MC 5004 P STO	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

7,2 mNm

25 W

Series 2036 ... B

Values at 22°C and nominal voltage	2036 U	012 B	024 B	036 B	048 B	
1 Nominal voltage	U_N	12	24	36	48	V
2 Terminal resistance, phase-phase	R	3,24	13,4	26,4	62,3	Ω
3 Efficiency, max.	η_{max}	71	72	71	69	%
4 No-load speed	n_0	18 800	18 400	20 300	18 500	min ⁻¹
5 No-load current, typ. (with shaft ø 2 mm)	I_0	0,089	0,043	0,033	0,022	A
6 Stall torque	M_H	21,9	21,6	22,4	18,4	mNm
7 Friction torque, static	C_0	0,22	0,22	0,22	0,22	mNm
8 Friction torque, dynamic	C_V	$1,64 \cdot 10^{-5}$	$1,64 \cdot 10^{-5}$	$1,64 \cdot 10^{-5}$	$1,64 \cdot 10^{-5}$	mNm/min ⁻¹
9 Speed constant	k_n	1 602	783	575	396	min ⁻¹ /V
10 Back-EMF constant	k_E	0,624	1,28	1,74	2,52	mV/min ⁻¹
11 Torque constant	k_M	5,96	12,2	16,6	24,1	mNm/A
12 Current constant	k_I	0,168	0,082	0,06	0,042	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	871	860	915	1 024	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	145	613	1 132	2 390	μH
15 Mechanical time constant	τ_m	17,8	17,6	18,7	20,9	ms
16 Rotor inertia	J	1,95	1,95	1,95	1,95	gcm ²
17 Angular acceleration	α_{max}	112	111	115	94	$\cdot 10^3 \text{ rad/s}^2$
18 Thermal resistance	R_{th1} / R_{th2}	4,1 / 16,6				K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	6 / 397				s
20 Operating temperature range:						
– motor		-30 ... +125				°C
– winding, max. permissible		+125				°C
21 Shaft bearings		ball bearings, preloaded				
22 Shaft load max.:						
– with shaft diameter		2				mm
– radial at 3 000 min ⁻¹ (4 mm from mounting flange)		14,5				N
– axial at 3 000 min ⁻¹ (push only)		8				N
– axial at standstill (push only)		30				N
23 Shaft play:						
– radial	\leq	0,015				mm
– axial	$=$	0				mm
24 Housing material		aluminium, black anodized				
25 Mass		56				g
26 Direction of rotation		electronically reversible				
27 Speed up to	n_{max}	55 000				min ⁻¹
28 Number of pole pairs		1				
29 Hall sensors		digital				
30 Magnet material		SmCo				
Rated values for continuous operation						
31 Rated torque	M_N	6,08	6,14	5,87	5,62	mNm
32 Rated current (thermal limit)	I_N	1,14	0,559	0,396	0,26	A
33 Rated speed	n_N	11 430	11 010	12 810	10 450	min ⁻¹

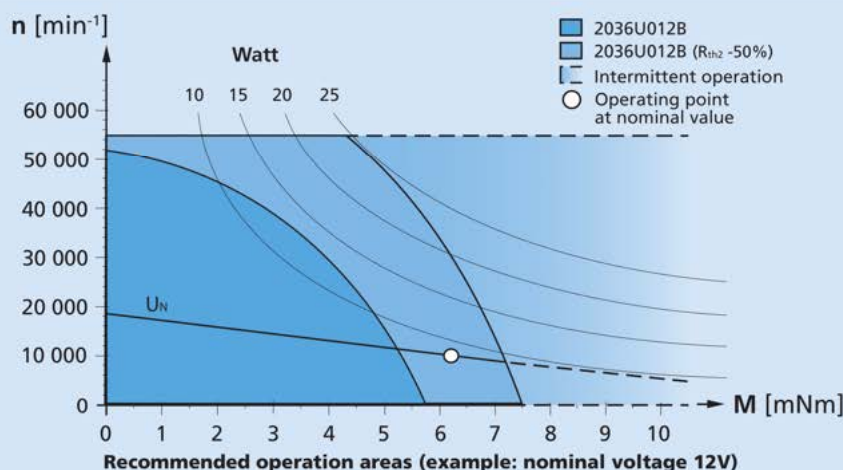
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

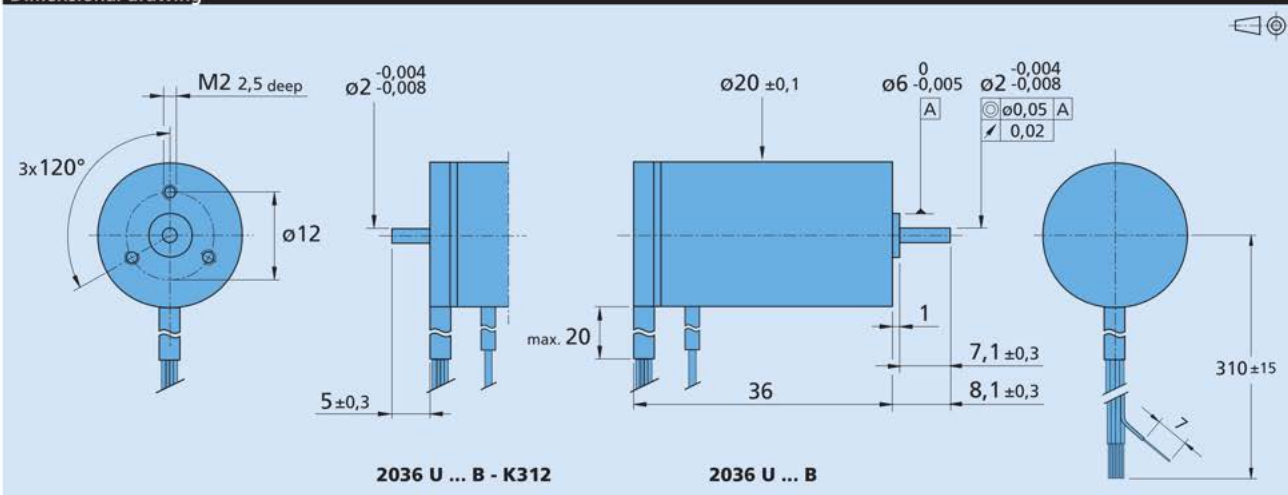
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **2036U012B-K1155**

Option	Type	Description	Connection	
			Function	Colour
K1155	Controller combination	Analog Hall sensors for combination with Speed Controller SC and Motion Controller MCBL	Phase C	yellow
K1026	Sensorless	Motor without Hall sensors	Phase B	orange
K903	Lead wires length	Single lead wires 1000 mm long in PTFE	Phase A	brown
K313	Encoder combination	Motor with rear end shaft for combination with Encoder IE2	GND	black
K312	Encoder combination	Motor with rear end shaft for combination with Encoder HEDS/HEDL/HEDM	U _{DD} (+5V)	red
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			AWG 24: Phase A/B/C	
			AWG 26: Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
20/1R 22GPT	IE2-1024 HEDS 5500 HEDL 5540	SC 1801 P SC 1801 S SC 2402 P SC 2804 S SC 5004 P MCBL 3002 P MCBL 3002 S MCBL 3003 P MC 5004 P MC 5004 P STO MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

20 mNm

68 W

Series 2057 ... B

Values at 22°C and nominal voltage		2057 S	012 B	024 B	
1	Nominal voltage	U_N	12	24	V
2	Terminal resistance, phase-phase	R	0,5	1,32	Ω
3	Efficiency, max.	η_{max}	83	84	%
4	No-load speed	n_0	22 800	26 800	min ⁻¹
5	No-load current, typ. (with shaft ø 3 mm)	I_0	0,2	0,136	A
6	Stall torque	M_H	120	155	mNm
7	Friction torque, static	C_0	0,12	0,12	mNm
8	Friction torque, dynamic	C_V	3,84·10 ⁻⁵	3,84·10 ⁻⁵	mNm/min ⁻¹
9	Speed constant	k_n	1 910	1 118	min ⁻¹ /V
10	Back-EMF constant	k_E	0,524	0,894	mV/min ⁻¹
11	Torque constant	k_M	5	8,54	mNm/A
12	Current constant	k_I	0,2	0,117	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	191	173	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	41	120	μH
15	Mechanical time constant	τ_m	7,9	7,1	ms
16	Rotor inertia	J	4	4	gcm ²
17	Angular acceleration	α_{max}	304	393	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	1,5 / 11,6		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	6,1 / 455		s
20	Operating temperature range:				
	– motor		-30 ... +125		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		3		mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		28		N
	– axial at 3 000 min ⁻¹ (push only)		17		N
	– axial at standstill (push only)		75		N
23	Shaft play:				
	– radial	≤	0,015		mm
	– axial	=	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		95		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	55 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		SmCo		
Rated values for continuous operation					
31	Rated torque	M_N	17	17	mNm
32	Rated current (thermal limit)	I_N	3,52	2,07	A
33	Rated speed	n_N	18 990	23 510	min ⁻¹

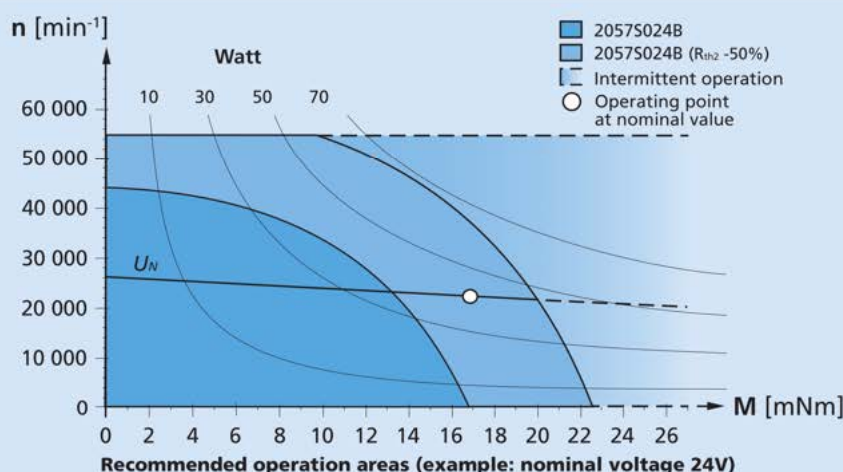
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.





100

Colour
yellow
orange
brown
black
red
grey
blue
green

le

erial PTFE

/B/C

/C, U_{DO}, GNI

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Brushless DC-Servomotors

2 Pole Technology, High Speed for Autoclave Sterilisation

18,7 mNm

91,2 W

Series 2057 ... BA

Values at 22°C and nominal voltage		2057 S	024 BA	
1	Nominal voltage	U_N	24	V
2	Terminal resistance, phase-phase	R	0,427	Ω
3	Efficiency, max.	η_{max}	90	%
4	No-load speed	n_0	44 300	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,178	A
6	Stall torque	M_H	309	mNm
7	Friction torque, static	C_0	0,0559	mNm
8	Friction torque, dynamic	C_V	$1,95 \cdot 10^{-5}$	mNm/min ⁻¹
9	Speed constant	k_n	1 740	min ⁻¹ /V
10	Back-EMF constant	k_E	0,576	mV/min ⁻¹
11	Torque constant	k_M	5,5	mNm/A
12	Current constant	k_I	0,182	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	135	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	36,2	μ H
15	Mechanical time constant	τ_m	4,2	ms
16	Rotor inertia	J	3	gcm ²
17	Angular acceleration	α_{max}	1 030	$\cdot 10^3$ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	1,1 / 15	K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	5 / 630	s
20	Operating temperature range:			
	– motor		-30 ... +140	°C
	– winding, max. permissible		+140	°C
21	Shaft bearings		ball bearings, preloaded	
22	Shaft load max.:			
	– with shaft diameter		3	mm
	– radial at 40 000 min ⁻¹ (5 mm from mounting flange)		22	N
	– axial at 40 000 min ⁻¹ (push only)		12	N
	– axial at standstill (push only)		75	N
23	Shaft play:			
	– radial	\leq	0,05	mm
	– axial	$=$	0	mm
24	Housing material		stainless steel	
25	Mass		100	g
26	Direction of rotation		electronically reversible	
27	Speed up to	n_{max}	65 000	min ⁻¹
28	Number of pole pairs		1	
29	Hall sensors		digital	
30	Magnet material		NdFeB	
Rated values for continuous operation				
31	Rated torque	M_N	13,7	mNm
32	Rated current (thermal limit)	I_N	3	A
33	Rated speed	n_N	43 200	min ⁻¹

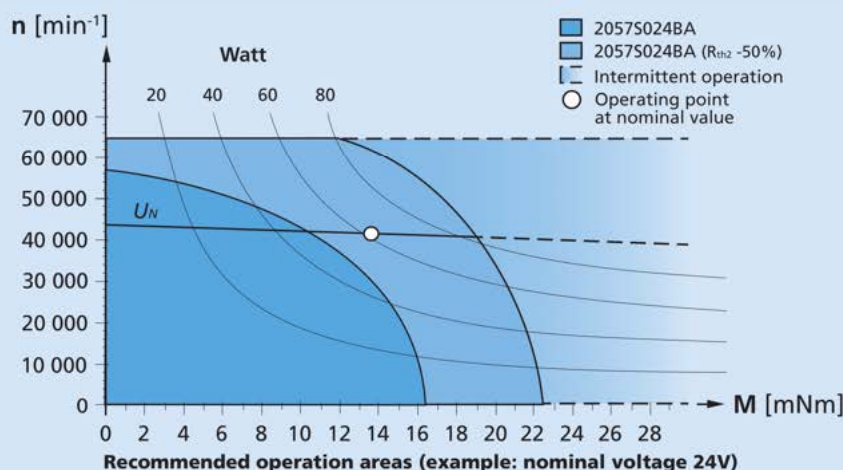
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

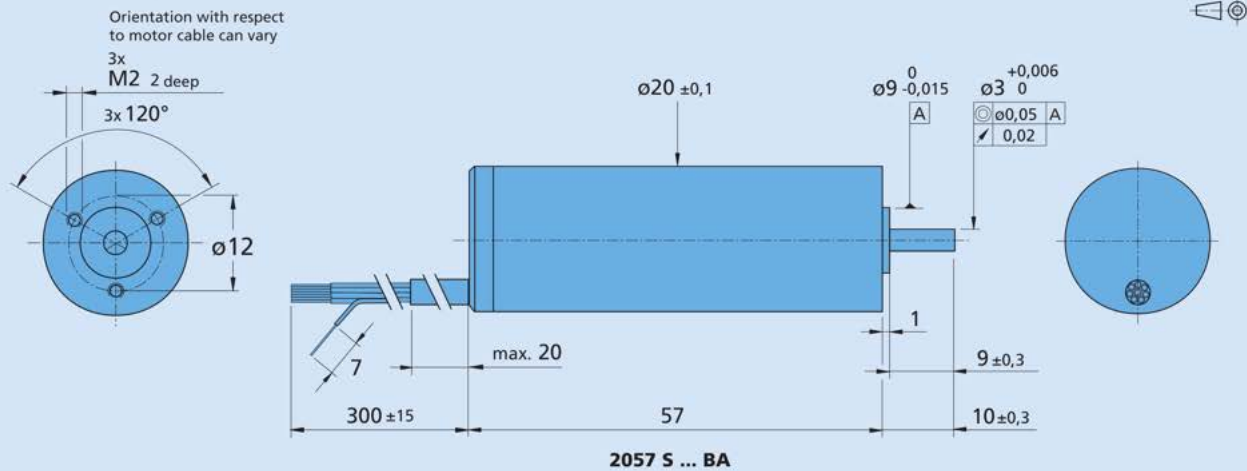
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **2057S024BA-K3825**

Option	Type	Description	Function	Colour	
K3825	Sensor	Sensorless	Phase C	yellow	Standard cable Single wires, material PTFE AWG 24: Phase A/B/C AWG 26: Hall A/B/C, U ₀₀ , GND
			Phase B	orange	
			Phase A	brown	
			GND	black	
			U ₀₀ (+5V)	red	
			Hall sensor C	grey	
			Hall sensor B	blue	
			Hall sensor A	green	

Autoclavable
Sterilisation Process

Reference	Description	
Sterilisation conditions	134°C at 2.1 bar, 100% RH	Contact your sales representative for more detailed information
Holding time	18 minutes	
Number of cycles, typical	1 000	
Number of cycles (sensorless, K3825), typical	1 500	


Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 5004 P SC 5008 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

18 mNm

51 W

Series 2444 ... B

Values at 22°C and nominal voltage		2444 S	024 B	048 B	
1	Nominal voltage	U_N	24	48	V
2	Terminal resistance, phase-phase	R	2	8,54	Ω
3	Efficiency, max.	η_{max}	79	78	%
4	No-load speed	n_0	22 200	21 600	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,159	0,076	A
6	Stall torque	M_H	123	118,5	mNm
7	Friction torque, static	C_0	0,746	0,746	mNm
8	Friction torque, dynamic	C_V	$3,87 \cdot 10^{-5}$	$3,87 \cdot 10^{-5}$	mNm/min ⁻¹
9	Speed constant	k_n	927	450	min ⁻¹ /V
10	Back-EMF constant	k_E	1,08	2,22	mV/min ⁻¹
11	Torque constant	k_M	10,3	21,2	mNm/A
12	Current constant	k_I	0,097	0,047	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	180	181	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	175	740	μ H
15	Mechanical time constant	τ_m	10,8	10,8	ms
16	Rotor inertia	J	5,7	5,7	gcm ²
17	Angular acceleration	α_{max}	216	208	$\cdot 10^3$ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	2,4 / 11,6		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	9,6 / 470		s
20	Operating temperature range:				
	– motor		-30 ... +125		°C
	– winding, max. permissible		+125		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		3		mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		31		N
	– axial at 3 000 min ⁻¹ (push only)		16		N
	– axial at standstill (push only)		57		N
23	Shaft play:				
	– radial	\leq	0,015		mm
	– axial	$=$	0		mm
24	Housing material		aluminium, black anodized		
25	Mass		98		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	45 000		min ⁻¹
28	Number of pole pairs		1		
29	Hall sensors		digital		
30	Magnet material		SmCo		
Rated values for continuous operation					
31	Rated torque	M_N	14,2	14,3	mNm
32	Rated current (thermal limit)	I_N	1,58	0,772	A
33	Rated speed	n_N	18 800	18 100	min ⁻¹

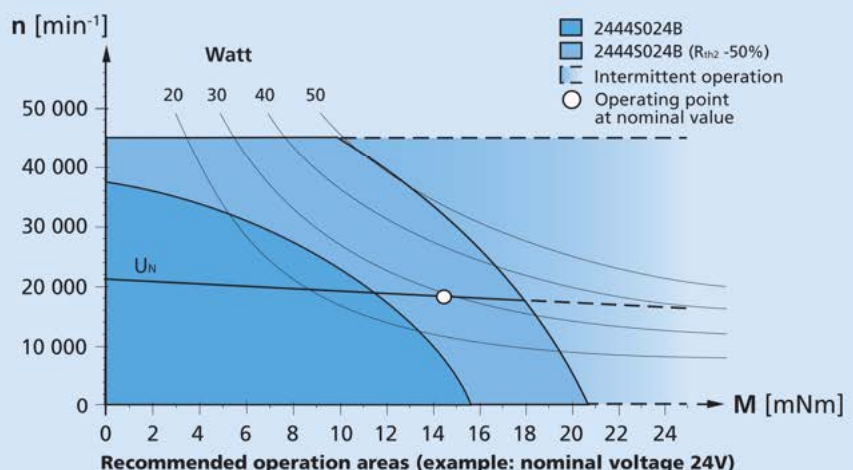
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

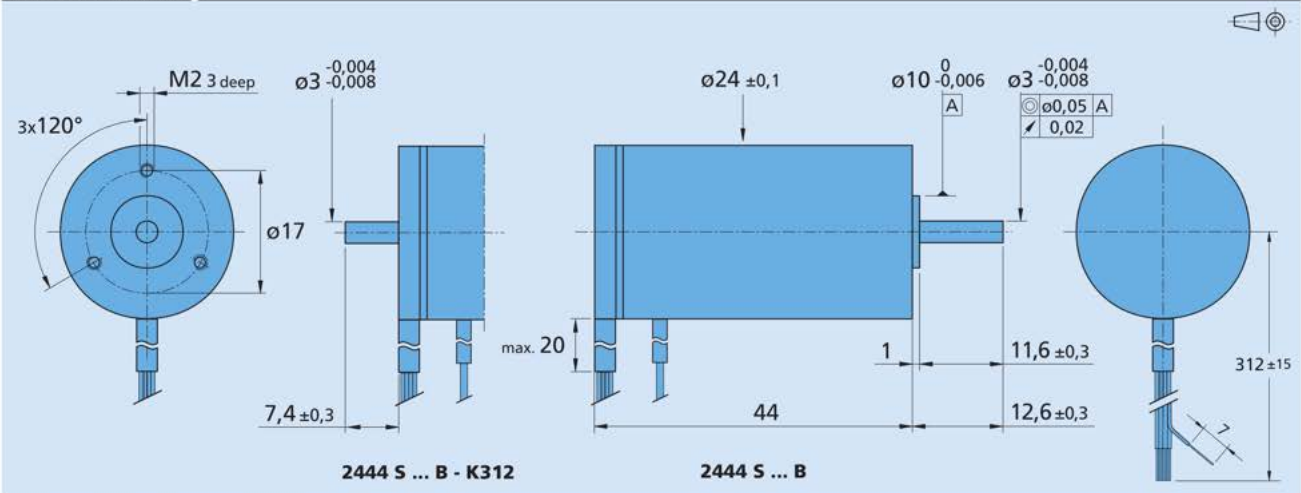
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **2444S024B-K1155**

Option	Type	Description	Connection	
			Function	Colour
K1155	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Phase C	yellow
K1026	Sensorless	Motor without Hall sensors	Phase B	orange
K1555	Lead wires length	Single lead wires 750 mm long in PTFE	Phase A	brown
K903	Lead wires length	Single lead wires 1000 mm long in PTFE	GND	black
K1838	Encoder combination	Motor with rear end shaft for combination with Encoder IE3	U _{DD} (+5V)	red
K313	Encoder combination	Motor with rear end shaft for combination with Encoder IE2	Hall sensor C	grey
K312	Encoder combination	Motor with rear end shaft for combination with Encoder HEDS/HEDL/HEDM	Hall sensor B	blue
K3051	Encoder combination	Motor with rear end shaft for combination with Encoder AES	Hall sensor A	green
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Standard cable Single wires, material PTFE AWG 24: Phase A/B/C AWG 26: Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
22GPT 22/7 23/1 26/1 26/1R 30/1 30/1 S	HEDS 5500 IE3-1024 IE3-1024 L HEDL 5540 AES-4096 AES-4096 L	SC 2402 P SC 2804 S SC 5004 P SC 5008 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MCBL 3006 S MC 5004 P MC 5004 P STO MC 5005 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

33 mNm

71 W

Series 3056 ... B

Values at 22°C and nominal voltage	3056 K	012 B	024 B	036 B	048 B	
1 Nominal voltage	U_N	12	24	36	48	V
2 Terminal resistance, phase-phase	R	1,5	6,4	12,3	23,6	Ω
3 Efficiency, max.	η_{max}	76	77	77	76	%
4 No-load speed	n_0	8 800	8 100	8 900	8 900	min ⁻¹
5 No-load current, typ. (with shaft \varnothing 4 mm)	I_0	0,128	0,057	0,044	0,033	A
6 Stall torque	M_H	102	104	111	103	mNm
7 Friction torque, static	C_0	0,81	0,81	0,81	0,81	mNm
8 Friction torque, dynamic	C_V	$9,5 \cdot 10^{-5}$	$9,5 \cdot 10^{-5}$	$9,5 \cdot 10^{-5}$	$9,5 \cdot 10^{-5}$	mNm/min ⁻¹
9 Speed constant	k_n	742	343	251	188	min ⁻¹ /V
10 Back-EMF constant	k_E	1,35	2,91	3,99	5,32	mV/min ⁻¹
11 Torque constant	k_M	12,9	27,8	38,1	50,8	mNm/A
12 Current constant	k_I	0,078	0,036	0,026	0,02	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	87	79	81	87	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	160	740	1 400	2 600	μ H
15 Mechanical time constant	τ_m	13,6	12,4	12,7	13,7	ms
16 Rotor inertia	J	15	15	15	15	gcm ²
17 Angular acceleration	α_{max}	68	69	74	68	$\cdot 10^3$ rad/s ²
18 Thermal resistance	R_{th1} / R_{th2}	2,2 / 7,9				K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	11,7 / 650				s
20 Operating temperature range:						
– motor		-30 ... +125				°C
– winding, max. permissible		+125				°C
21 Shaft bearings		ball bearings, preloaded				
22 Shaft load max.:						
– with shaft diameter		4				mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		75				N
– axial at 3 000 min ⁻¹ (push only)		18				N
– axial at standstill (push only)		62				N
23 Shaft play:						
– radial	\leq	0,015				mm
– axial	$=$	0				mm
24 Housing material		aluminium, black anodized				
25 Mass		192				g
26 Direction of rotation		electronically reversible				
27 Speed up to	n_{max}	35 000				min ⁻¹
28 Number of pole pairs		1				
29 Hall sensors		digital				
30 Magnet material		SmCo				
Rated values for continuous operation						
31 Rated torque	M_N	28,5	30	29,4	28,3	mNm
32 Rated current (thermal limit)	I_N	2,4	1,17	0,838	0,605	A
33 Rated speed	n_N	5 340	4 820	5 600	5 450	min ⁻¹

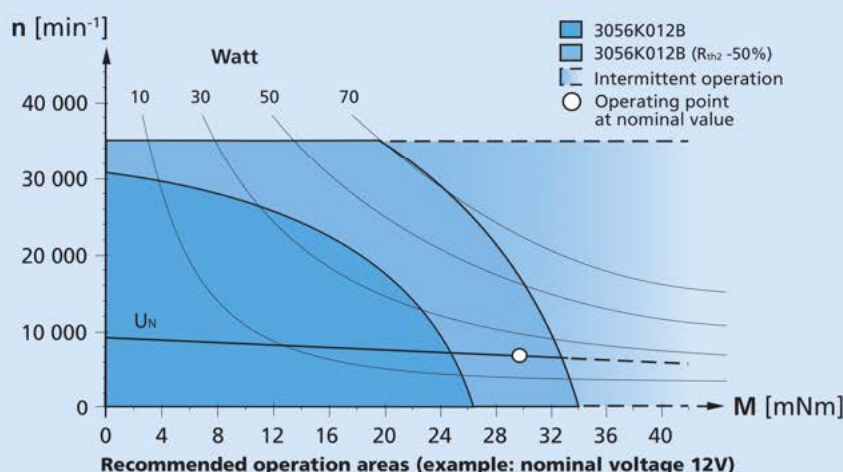
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Technical drawing of the 3056 K ... B - K312 and 3056 K ... B components. The drawing includes three views: a front view, a side view, and a top view. The front view shows a cylindrical component with a diameter of $\varnothing 30 \pm 0,1$ mm and a length of 56 mm. The side view shows a cylindrical component with a diameter of $\varnothing 19$ mm and a length of $14 \pm 0,3$ mm. The top view shows a circular component with a diameter of $\varnothing 19$ mm and a length of $14 \pm 0,3$ mm. The drawing also includes a detail view of the mounting bracket with dimensions 1.4 mm, $12,6 \pm 0,3$ mm, and $14 \pm 0,3$ mm. The drawing is labeled "Scale reduced" and "3056 K ... B - K312" and "3056 K ... B".

Example product designation: **3056K012B-K1155**

Product combination			
Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
30/1	HEDS 5500	SC 2402 P	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.
30/1 S	IE3-1024	SC 2804 S	
32GPT	IE3-1024 L	SC 5004 P	
38/1	HEDL 5540	SC 5008 S	
38/1 S	AES-4096	MCBL 3002 P	
38/2	AES-4096 L	MCBL 3002 S	
38/2 S		MCBL 3003 P	
		MCBL 3006 S	
		MC 5004 P	
		MC 5004 P STO	
		MC 5005 S	

Brushless DC-Servomotors

2 Pole Technology

66 mNm

126 W

Series 3564 ... B

Values at 22°C and nominal voltage	3564 K	012 B	024 B	036 B	048 B	
1 Nominal voltage	U_N	12	24	36	48	V
2 Terminal resistance, phase-phase	R	0,56	1,1	2,61	4,1	Ω
3 Efficiency, max.	η_{max}	82	83	83	83	%
4 No-load speed	n_0	8 300	11 500	11 600	12 800	min ⁻¹
5 No-load current, typ. (with shaft ø 4 mm)	I_0	0,198	0,166	0,112	0,099	A
6 Stall torque	M_H	293	432	408	418	mNm
7 Friction torque, static	C_0	1,2	1,2	1,2	1,2	mNm
8 Friction torque, dynamic	C_V	$1,8 \cdot 10^{-4}$	$1,8 \cdot 10^{-4}$	$1,8 \cdot 10^{-4}$	$1,8 \cdot 10^{-4}$	mNm/min ⁻¹
9 Speed constant	k_n	696	481	323	266	min ⁻¹ /V
10 Back-EMF constant	k_E	1,44	2,08	3,1	3,75	mV/min ⁻¹
11 Torque constant	k_M	13,7	19,9	29,6	35,8	mNm/A
12 Current constant	k_I	0,073	0,05	0,034	0,028	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	28	27	28	31	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	90	190	410	640	μH
15 Mechanical time constant	τ_m	10,4	9,7	10,4	11,1	ms
16 Rotor inertia	J	34,9	34,9	34,9	34,9	gcm ²
17 Angular acceleration	α_{max}	84	124	117	120	$\cdot 10^3 \text{ rad/s}^2$
18 Thermal resistance	R_{th1} / R_{th2}	1,6 / 6,2				K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	15,4 / 820				s
20 Operating temperature range:						
– motor		-30 ... +125				°C
– winding, max. permissible		+125				°C
21 Shaft bearings		ball bearings, preloaded				
22 Shaft load max.:						
– with shaft diameter		4				mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		112				N
– axial at 3 000 min ⁻¹ (push only)		50				N
– axial at standstill (push only)		131				N
23 Shaft play:						
– radial	\leq	0,015				mm
– axial	$=$	0				mm
24 Housing material		aluminium, black anodized				
25 Mass		311				g
26 Direction of rotation		electronically reversible				
27 Speed up to	n_{max}	29 000				min ⁻¹
28 Number of pole pairs		1				
29 Hall sensors		digital				
30 Magnet material		SmCo				
Rated values for continuous operation						
31 Rated torque	M_N	56,2	55,3	53,5	50,4	mNm
32 Rated current (thermal limit)	I_N	4,43	3,04	1,98	1,55	A
33 Rated speed	n_N	6 160	9 620	9 640	10 800	min ⁻¹

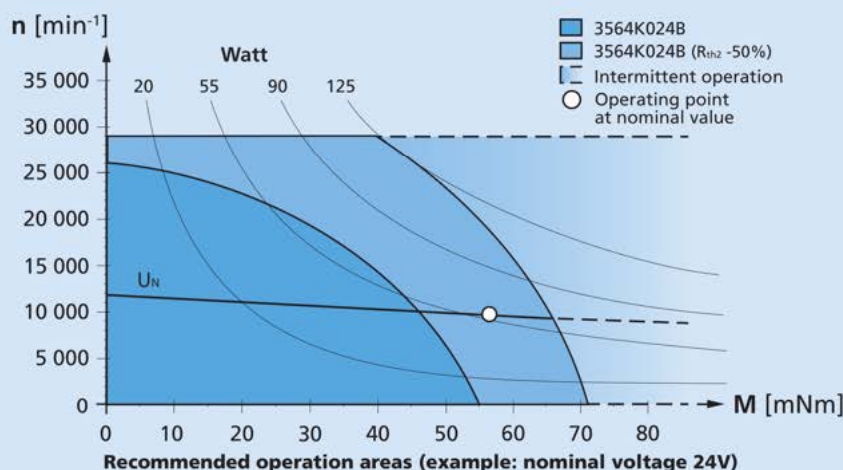
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

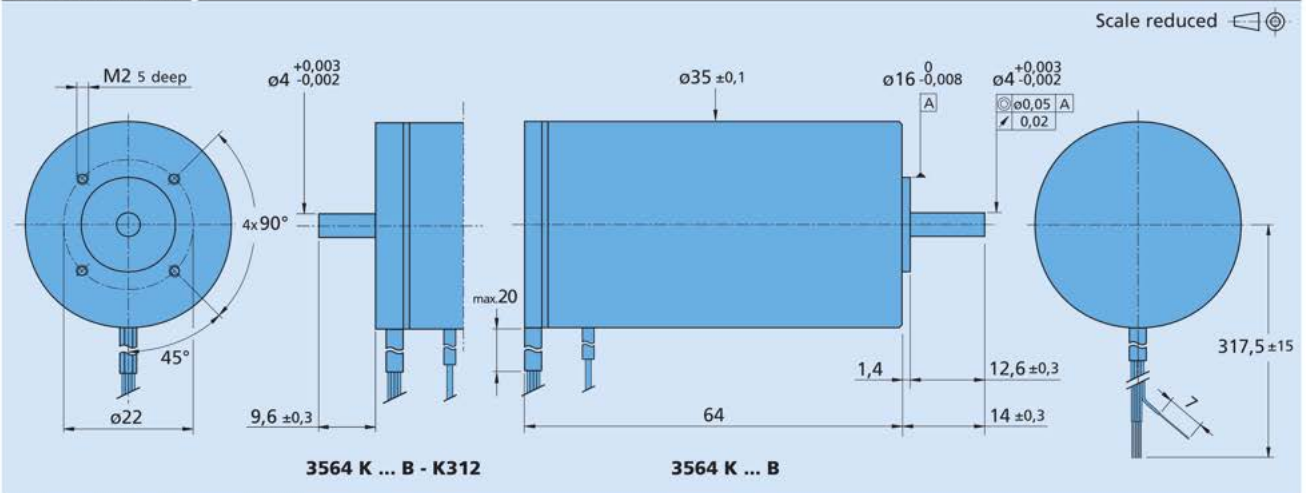
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **3564K012B-K1155**

Option	Type	Description	Connection	
			Function	Colour
K1155	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Phase C	yellow
K1026	Sensorless	Motor without Hall sensors	Phase B	orange
K1838	Encoder combination	Motor with rear end shaft for combination with Encoder IE3	Phase A	brown
K312	Encoder combination	Motor with rear end shaft for combination with Encoder HEDS/HEDL/HEDM	GND	black
K3051	Encoder combination	Motor with rear end shaft for combination with Encoder AES	U _{DD} (+5V)	red
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			AWG 20: Phase A/B/C	
			AWG 26: Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
30/1 30/1 S 32GPT 32/3 32/3R 38A 38/1 38/1 S 38/2 38/2 S 42GPT	HEDS 5500 IE3-1024 IE3-1024 L HEDL 5540 AES-4096 AES-4096 L	SC 2804 S SC 5004 P SC 5008 S MCBL 3003 P MCBL 3006 S MC 5005 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

190 mNm

232 W

Series 4490 ... B

Values at 22°C and nominal voltage		4490 H	024 B	036 B	048 B	
1	Nominal voltage	U_N	24	36	48	V
2	Terminal resistance, phase-phase	R	0,22	0,44	0,7	Ω
3	Efficiency, max.	η_{max}	87	87	87	%
4	No-load speed	n_0	9 700	10 400	10 800	min ⁻¹
5	No-load current, typ. (with shaft ø 6 mm)	I_0	0,527	0,397	0,317	A
6	Stall torque	M_H	2 635	2 760	2 978	mNm
7	Friction torque, static	C_0	4,96	4,96	4,96	mNm
8	Friction torque, dynamic	C_V	$7,72 \cdot 10^{-4}$	$7,72 \cdot 10^{-4}$	$7,72 \cdot 10^{-4}$	mNm/min ⁻¹
9	Speed constant	k_n	395	283	220	min ⁻¹ /V
10	Back-EMF constant	k_E	2,53	3,54	4,56	mV/min ⁻¹
11	Torque constant	k_M	24,2	33,8	43,5	mNm/A
12	Current constant	k_I	0,041	0,03	0,023	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	3,6	3,7	3,5	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	73	142	235	μ H
15	Mechanical time constant	τ_m	4,9	5	4,8	ms
16	Rotor inertia	J	130	130	130	gcm ²
17	Angular acceleration	α_{max}	203	212	229	$\cdot 10^3$ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	0,96 / 3,9			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	23 / 1 222			s
20	Operating temperature range:					
	– motor		-30 ... +125			°C
	– winding, max. permissible		+125			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		6			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		113			N
	– axial at 3 000 min ⁻¹ (push only)		45			N
	– axial at standstill (push only)		135			N
23	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
24	Housing material		aluminium, black anodized			
25	Mass		742			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	18 000			min ⁻¹
28	Number of pole pairs		1			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	148	139	137	mNm
32	Rated current (thermal limit)	I_N	7,45	5,06	3,91	A
33	Rated speed	n_N	9 650	10 470	10 930	min ⁻¹

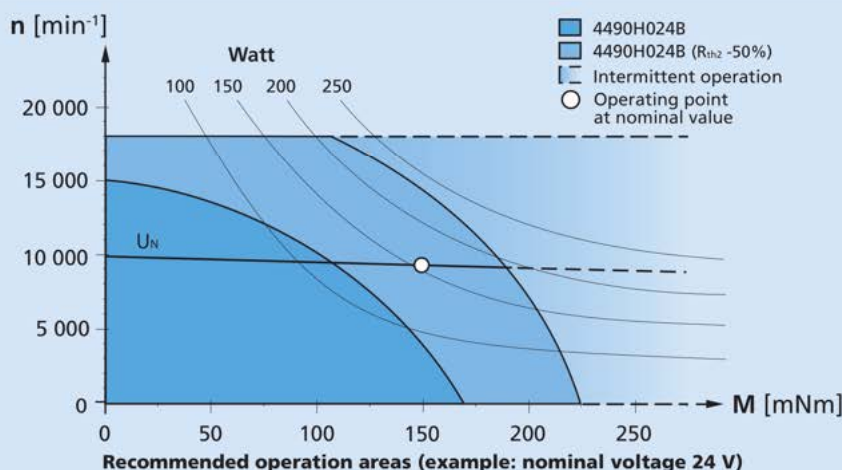
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

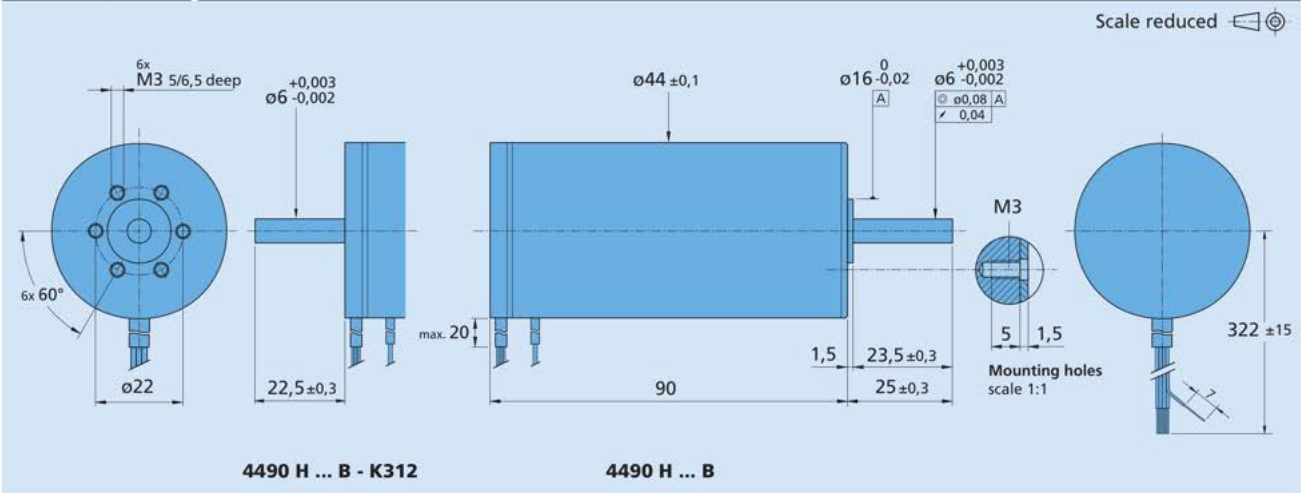
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **4490H024B-K1155**

Option	Type	Description	Connection	
			Function	Colour
K1155	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Phase C	yellow
K1026	Sensorless	Motor without Hall sensors	Phase B	orange
K1838	Encoder combination	Motor with rear end shaft for combination with Encoder IE3	Phase A	brown
K312	Encoder combination	Motor with rear end shaft for combination with Encoder HEDS/HEDL/HEDM	GND	black
K3051	Encoder combination	Motor with rear end shaft for combination with Encoder AES	U _{DD} (+5V)	red
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			AWG 16: Phase A/B/C	
			AWG 26: Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
38A 42GPT 44/1	HEDS 5500 IE3-1024 IE3-1024 L HEDL 5540 AES-4096 AES-4096 L	SC 5004 P SC 5008 S MCBL 3006 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

217 mNm

282 W

Series 4490 ... BS

Values at 22°C and nominal voltage		4490 H	024 BS	036 BS	048 BS	
1	Nominal voltage	U_N	24	36	48	V
2	Terminal resistance, phase-phase	R	0,66	1,31	2,1	Ω
3	Efficiency, max.	η_{max}	87	87	88	%
4	No-load speed	n_0	5 500	5 900	6 100	min ⁻¹
5	No-load current, typ. (with shaft ø 6 mm)	I_0	0,161	0,119	0,094	A
6	Stall torque	M_H	1 523	1 612	1 724	mNm
7	Friction torque, static	C_0	3,86	3,86	3,86	mNm
8	Friction torque, dynamic	C_V	5,2·10 ⁻⁴	5,2·10 ⁻⁴	5,2·10 ⁻⁴	mNm/min ⁻¹
9	Speed constant	k_n	227	162	126	min ⁻¹ /V
10	Back-EMF constant	k_E	4,4	6,16	7,92	mV/min ⁻¹
11	Torque constant	k_M	42	58,8	75,6	mNm/A
12	Current constant	k_I	0,024	0,017	0,013	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	3,6	3,6	3,5	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	219	430	711	μH
15	Mechanical time constant	τ_m	4,9	4,9	4,8	ms
16	Rotor inertia	J	130	130	130	gcm ²
17	Angular acceleration	α_{max}	117	124	133	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	0,96 / 3,9			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	23 / 1 222			s
20	Operating temperature range:					
	– motor		-30 ... +125			°C
	– winding, max. permissible		+125			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		6			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		113			N
	– axial at 3 000 min ⁻¹ (push only)		45			N
	– axial at standstill (push only)		135			N
23	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
24	Housing material		aluminium, black anodized			
25	Mass		742			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	16 000			min ⁻¹
28	Number of pole pairs		1			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	183	181	183	mNm
32	Rated current (thermal limit)	I_N	5,1	3,59	2,83	A
33	Rated speed	n_N	4 940	5 380	5 650	min ⁻¹

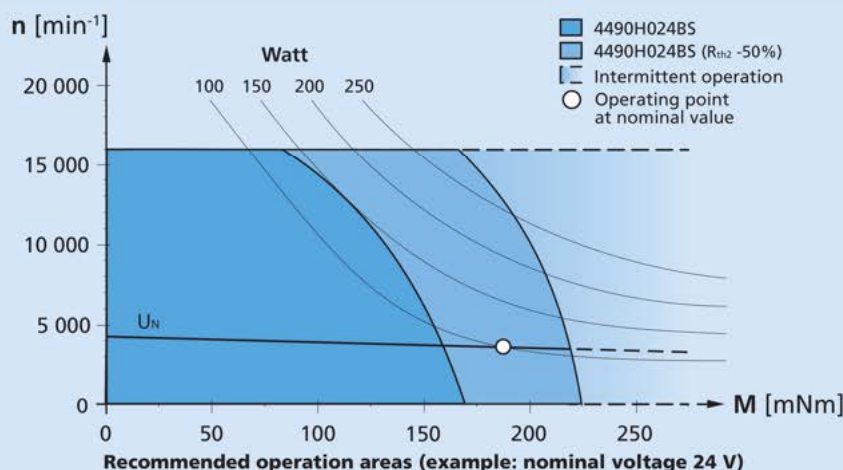
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

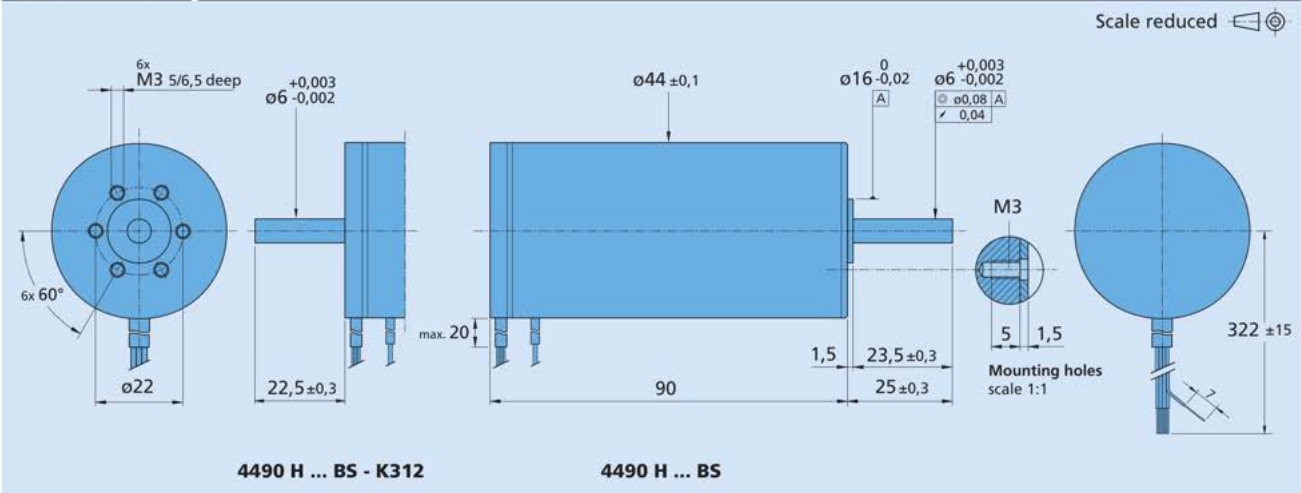
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **4490H024BS-K1155**

Option	Type	Description	Connection	
			Function	Colour
K1155	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL	Phase C	yellow
K1026	Sensorless	Motor without Hall sensors	Phase B	orange
K1838	Encoder combination	Motor with rear end shaft for combination with Encoder IE3	Phase A	brown
K312	Encoder combination	Motor with rear end shaft for combination with Encoder HEDS/HEDL/HEDM	GND	black
K3051	Encoder combination	Motor with rear end shaft for combination with Encoder AES	U _{DD} (+5V)	red
K179	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PTFE	
			AWG 16: Phase A/B/C	
			AWG 26: Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
38A 44/1	HEDS 5500 IE3-1024 IE3-1024 L HEDL 5540 AES-4096 AES-4096 L	SC 5004 P SC 5008 S MCBL 3006 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors 2 Pole Technology

The BHx series uses 2-pole brushless technology based on an innovative and robust design to deliver high power in a compact size. These motors come in 2 distinct versions to support a wide variety of different application needs: the BHT variant is dedicated to high torque for large impulsive cycles, and the BHS model is focused on very high speed for continuous use.

BHx series is capable of driving variable load with minimum speed fluctuation to guarantee smooth behavior at constant speed. Furthermore their low inertia and short response time provide also high dynamics. Those characteristics make BHx series ideal for both-high speed operation and fast accurate positioning, especially in intermittent operation when combined with integrated high resolution encoder. BHx series exhibits low vibration level and low noise to reduce human fatigue and stress inside application environment. Their high efficiency minimizes heat generation and helps to increase comfort when used as handtools.

Series

1645 ... BHS	1660 ... BHS
1660 ... BHT	

Key Features

Motor diameter	16 mm
Motor length	45 ... 60 mm
Nominal voltage	24 ... 48 V
Speed	up to 100.000 min ⁻¹
Torque	up to 18,7 mNm
Continuous output	up to 96 W



Product Code

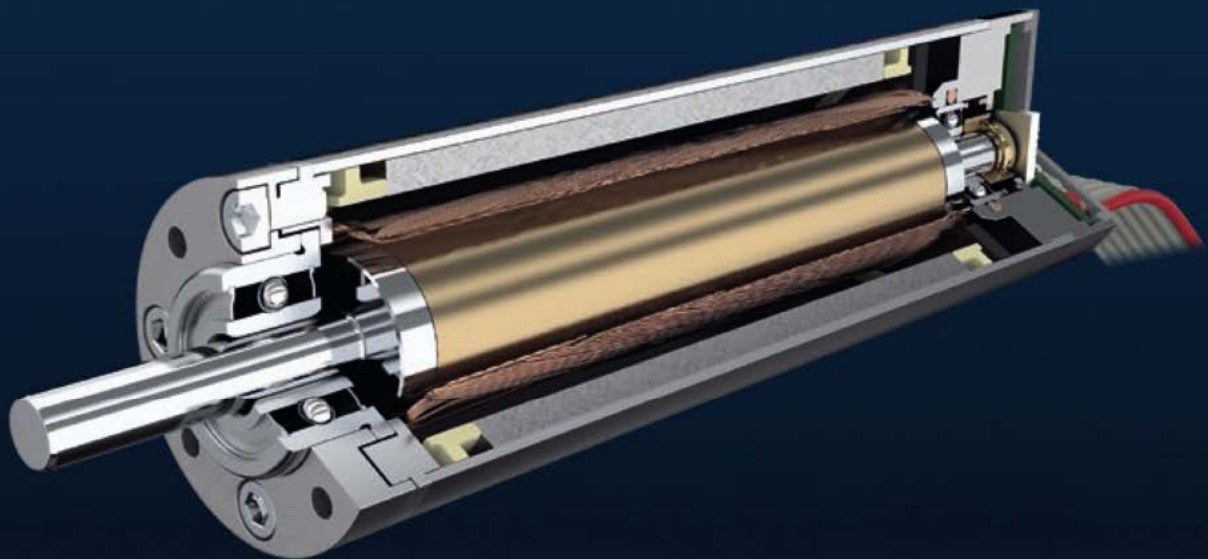
16	Motor diameter [mm]
60	Motor length [mm]
S	Shaft type
024	Nominal voltage [V]
BHT	Product family

WE CREATE MOTION

FAULHABER BHx

Advantages of this series at a glance

- Large power up to 96 W in small diameter
- High speed close to 100'000 min⁻¹ (BHS version)
- Huge impulsive torque > 30 mNm (BHT version)
- Very dynamic and responsive with low inertia
- Low vibration and low noise, suitable for handtools
- Optional integrated encoder



NEW

Brushless DC-Servomotors

2 Pole Technology

8 mNm

58,5 W

Series 1645 ... BHS

Values at 22°C and nominal voltage	1645 S	024 BHS	036 BHS	048 BHS	
1 Nominal voltage	U_N	24	36	48	V
2 Terminal resistance, phase-phase	R	0,684	1,51	2,81	Ω
3 Efficiency, max.	η_{max}	90	90	90	%
4 No-load speed	n_0	62 000	62 900	61 400	min^{-1}
5 No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,0988	0,0674	0,0486	A
6 Stall torque	M_H	137	138	135	mNm
7 Friction torque, static	C_0	0,114	0,114	0,114	mNm
8 Friction torque, dynamic	C_V	$4,49 \cdot 10^{-6}$	$4,49 \cdot 10^{-6}$	$4,49 \cdot 10^{-6}$	$\text{mNm}/\text{min}^{-1}$
9 Speed constant	k_n	2 450	1 650	1 210	min^{-1}/V
10 Back-EMF constant	k_E	0,409	0,606	0,825	$\text{mV}/\text{min}^{-1}$
11 Torque constant	k_M	3,9	5,79	7,88	mNm/A
12 Current constant	k_I	0,256	0,173	0,127	A/mNm
13 Slope of n-M curve	$\Delta n/\Delta M$	429	431	432	$\text{min}^{-1}/\text{mNm}$
14 Terminal inductance, phase-phase	L	46	103	190	μH
15 Mechanical time constant	τ_m	2,6	2,6	2,7	ms
16 Rotor inertia	J	0,59	0,59	0,59	gcm^2
17 Angular acceleration	α_{max}	2 330	2 350	2 300	$\cdot 10^3 \text{rad}/\text{s}^2$
18 Thermal resistance	R_{th1} / R_{th2}	3,1 / 22			K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	6,5 / 580			s
20 Operating temperature range:					
– motor		-30 ... +125			°C
– winding, max. permissible		+125			°C
21 Shaft bearings		ball bearings, preloaded			
22 Shaft load max.:					
– with shaft diameter		3			mm
– radial at 40 000 min^{-1} (5 mm from mounting flange)		18			N
– axial at 40 000 min^{-1} (push only)		9			N
– axial at standstill (push only)		44			N
23 Shaft play:					
– radial	\leq	0,01			mm
– axial	$=$	0			mm
24 Housing material		stainless steel			
25 Mass		58,2			g
26 Direction of rotation		electronically reversible			
27 Speed up to	n_{max}	100 000			min^{-1}
28 Number of pole pairs		1			
29 Hall sensors		digital			
30 Magnet material		NdFeB			
Rated values for continuous operation					
31 Rated torque	M_N	6,09	6,02	6,1	mNm
32 Rated current (thermal limit)	I_N	1,86	1,24	0,924	A
33 Rated speed	n_N	61 300	62 100	60 600	min^{-1}

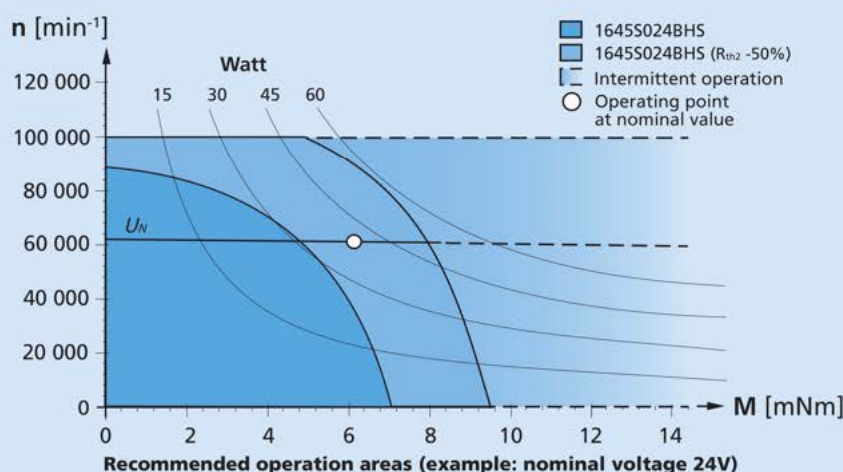
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

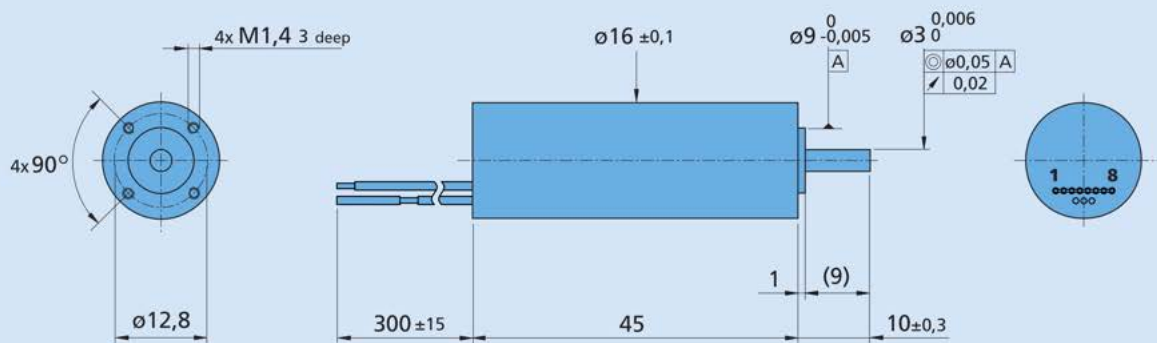
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

1645 S ... BHS
Option, cable and connection information

 Example product designation: **1645S024BHS**

Option	Type	Description	Connection	
			No. Function	Colour
			- Phase C	yellow
			- Phase B	orange
			- Phase A	brown
			1 GND	red
			2 U _{DD} (4,5 ... 5,5V)	grey
			3 Hall sensor C	grey
			4 Hall sensor B	grey
			5 Hall sensor A	grey
			6 Reserved	grey
			7 Reserved	grey
			8 Reserved	grey
Standard cable				
Single wires, material PTFE				
AWG24, Phase A/B/C				
Flat cable, material PVC				
AWG28, Pitch 1,27 mm				
Hall A,B,C, U _{DD} , GND				

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
15/10 17/1 20/1R	IEM3-1024	SC 5004 P SC 5008 S MC 5004 P MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

15,9 mNm

96 W

Series 1660 ... BHS

Values at 22°C and nominal voltage		1660 S	024 BHS	036 BHS	048 BHS	
1	Nominal voltage	U_N	24	36	48	V
2	Terminal resistance, phase-phase	R	0,29	0,51	1,12	Ω
3	Efficiency, max.	η_{max}	92	92	92	%
4	No-load speed	n_0	52 400	60 100	53 600	min ⁻¹
5	No-load current, typ. (with shaft ø 3 mm)	I_0	0,147	0,123	0,076	A
6	Stall torque	M_H	385	442	394	mNm
7	Friction torque, static	C_0	0,16	0,16	0,16	mNm
8	Friction torque, dynamic	C_V	9,43·10 ⁻⁶	9,43·10 ⁻⁶	9,43·10 ⁻⁶	mNm/min ⁻¹
9	Speed constant	k_n	2 038	1 527	1 037	min ⁻¹ /V
10	Back-EMF constant	k_E	0,491	0,655	0,964	mV/min ⁻¹
11	Torque constant	k_M	4,69	6,26	9,21	mNm/A
12	Current constant	k_I	0,21	0,16	0,11	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	127	124	127	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	29	52	112	μH
15	Mechanical time constant	τ_m	1,2	1,2	1,2	ms
16	Rotor inertia	J	0,9	0,9	0,9	gcm ²
17	Angular acceleration	α_{max}	4 278	4 914	4 372	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	2,1 / 18,2			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	6,3 / 638			s
20	Operating temperature range:					
	– motor		-30 ... +125			°C
	– winding, max. permissible		+125			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		3			mm
	– radial at 40 000 min ⁻¹ (5 mm from mounting flange)		19			N
	– axial at 40 000 min ⁻¹ (push only)		9			N
	– axial at standstill (push only)		44			N
23	Shaft play:					
	– radial	≤	0,01			mm
	– axial	=	0			mm
24	Housing material		stainless steel			
25	Mass		78			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	97 000			min ⁻¹
28	Number of pole pairs		1			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	11,6	10,3	11,4	mNm
32	Rated current (thermal limit)	I_N	2,94	1,98	1,48	A
33	Rated speed	n_N	52 370	59 530	53 400	min ⁻¹

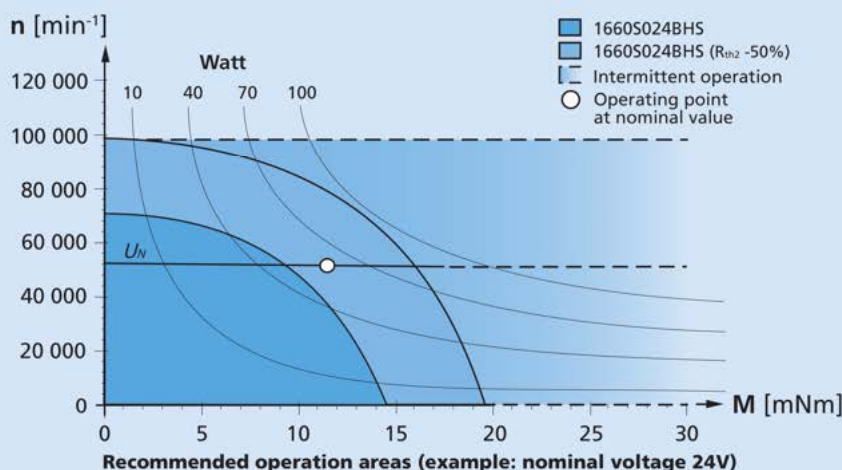
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

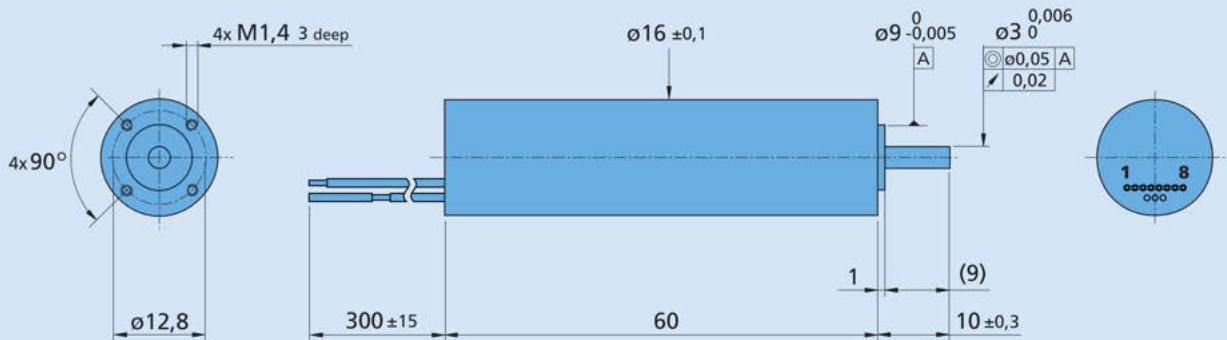
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

1660 S ... BHS
Option, cable and connection information

 Example product designation: **1660S024BHS**

Option	Type	Description	Connection	
			No. Function	Colour
			- Phase C	yellow
			- Phase B	orange
			- Phase A	brown
			1 GND	red
			2 U ₀₀ (4,5 ... 5,5V)	grey
			3 Hall sensor C	grey
			4 Hall sensor B	grey
			5 Hall sensor A	grey
			6 Reserved	grey
			7 Reserved	grey
			8 Reserved	grey
			Standard cable	
			Single wires, material PTFE	
			AWG24, Phase A/B/C	
			Flat cable, material PVC	
			AWG28, Pitch 1,27 mm	
			Hall A,B,C, U ₀₀ , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
15/10 17/1 20/1R	IEM3-1024	SC 5004 P SC 5008 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

2 Pole Technology

18,7 mNm

81 W

Series 1660 ... BHT

Values at 22°C and nominal voltage		1660 S	024 BHT	036 BHT	048 BHT	
1	Nominal voltage	U_N	24	36	48	V
2	Terminal resistance, phase-phase	R	0,49	1,1	1,93	Ω
3	Efficiency, max.	η_{max}	90	90	90	%
4	No-load speed	n_0	34 900	35 200	35 500	min ⁻¹
5	No-load current, typ. (with shaft ø 3 mm)	I_0	0,133	0,09	0,069	A
6	Stall torque	M_H	344	341	343	mNm
7	Friction torque, static	C_0	0,43	0,43	0,43	mNm
8	Friction torque, dynamic	C_V	1,28·10 ⁻⁵	1,28·10 ⁻⁵	1,28·10 ⁻⁵	mNm/min ⁻¹
9	Speed constant	k_n	1 368	918	694	min ⁻¹ /V
10	Back-EMF constant	k_E	0,731	1,09	1,441	mV/min ⁻¹
11	Torque constant	k_M	6,98	10,4	13,7	mNm/A
12	Current constant	k_I	0,143	0,096	0,073	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	95	97	97	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	52	114	203	μH
15	Mechanical time constant	τ_m	1,2	1,2	1,3	ms
16	Rotor inertia	J	1,2	1,2	1,2	gcm ²
17	Angular acceleration	α_{max}	2 796	2 772	2 787	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	2,1 / 18,2			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	6,8 / 631			s
20	Operating temperature range:					
	– motor		-30 ... +125			°C
	– winding, max. permissible		+125			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		3			mm
	– radial at 40 000 min ⁻¹ (5 mm from mounting flange)		19			N
	– axial at 40 000 min ⁻¹ (push only)		9			N
	– axial at standstill (push only)		44			N
23	Shaft play:					
	– radial	≤	0,01			mm
	– axial	=	0			mm
24	Housing material		stainless steel			
25	Mass		78			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	76 000			min ⁻¹
28	Number of pole pairs		1			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	13,9	13,7	13,6	mNm
32	Rated current (thermal limit)	I_N	2,38	1,58	1,18	A
33	Rated speed	n_N	34 490	34 740	35 070	min ⁻¹

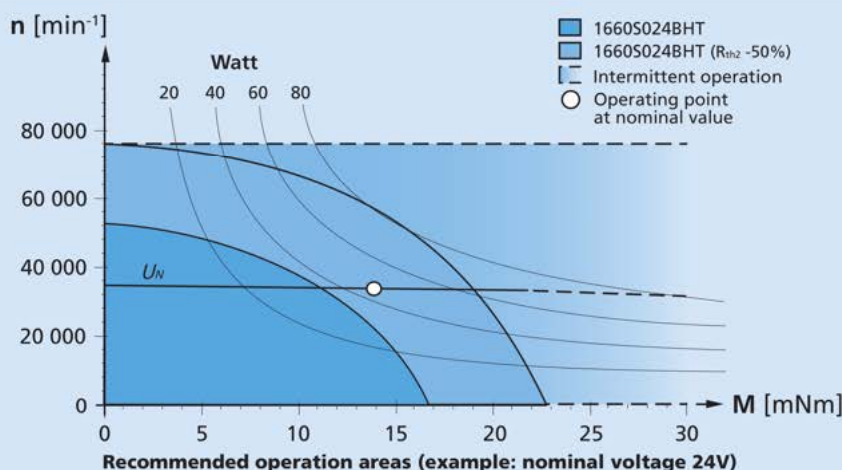
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

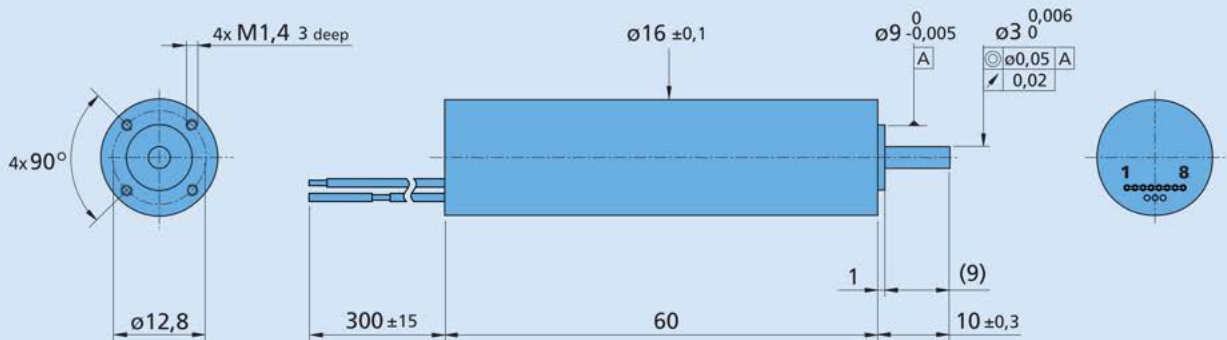
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

1660 S ... BHT
Option, cable and connection information

 Example product designation: **1660S024BHT**

Option	Type	Description	Connection	
			No. Function	Colour
			- Phase C	yellow
			- Phase B	orange
			- Phase A	brown
			1 GND	red
			2 U ₀₀ (4,5 ... 5,5V)	grey
			3 Hall sensor C	grey
			4 Hall sensor B	grey
			5 Hall sensor A	grey
			6 Reserved	grey
			7 Reserved	grey
			8 Reserved	grey
Standard cable				
Single wires, material PTFE				
AWG24, Phase A/B/C				
Flat cable, material PVC				
AWG28, Pitch 1,27 mm				
Hall A,B,C, U ₀₀ , GND				

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
15/10 17/1 20/1R	IEM3-1024	SC 5004 P SC 5008 S MC 5004 P MC 5004 P STO MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors 4 Pole Technology

From dynamic start/stop operation to speed control and high-precision, integrated position control in confined installation spaces – the flexible BX4 modular system can be combined with a wide variety of gearhead and lead screw attachments and offers customised solutions for a broad range of different applications.

The long service life, high torque and an innovative as well as compact design are further outstanding features of this 4-pole product family.

Smooth running, low vibration and low noise mean that these motors can be used in sensitive markets, e.g. medical technology, in addition to market sectors such as automation technology, robotics and machine construction.

Series

2232 ... BX4	2250 ... BX4 S
2250 ... BX4	3242 ... BX4
3268 ... BX4	

Key Features

Motor diameter	22 ... 32 mm
Motor length	32 ... 68 mm
Nominal voltage	6 ... 48 V
Speed	up to 29.000 min ⁻¹
Torque	up to 96 mNm
Continuous output	up to 62 W



22 50 S 024 BX4

Product Code

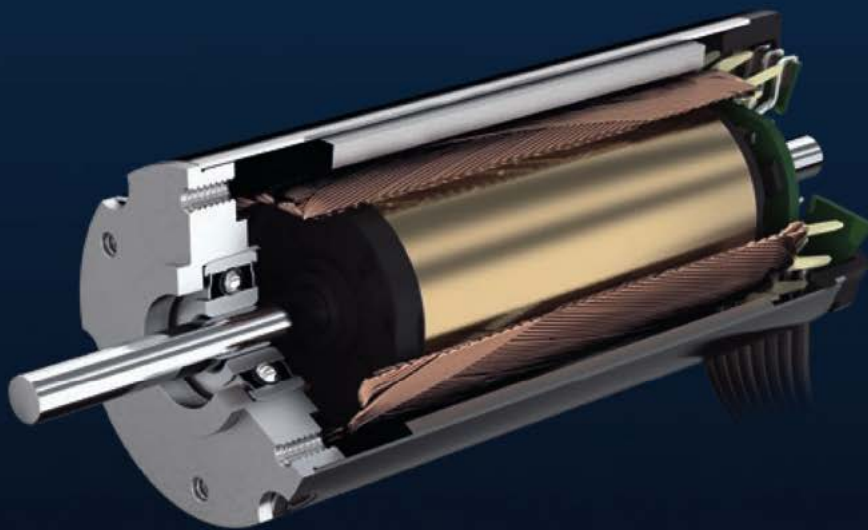
22	Motor diameter [mm]
50	Motor length [mm]
S	Shaft type
024	Nominal voltage [V]
BX4	Product family

WE CREATE MOTION

FAULHABER BX4

Advantages of this series at a glance

- High torque and speed rigidity thanks to 4-pole technology
- Position control in extremely confined installation spaces thanks to optional analogue Hall sensors
- Modular, diameter-compliant mounting concept for high-resolution magnetic and optical encoders
- Versions with integrated Speed or Motion Controllers available
- High reliability and long service life
- Dynamically balanced rotor, quiet running



Brushless DC-Servomotors

4 Pole Technology

18 mNm

23 W

Series 2232 ... BX4

Values at 22°C and nominal voltage	2232 S	006 BX4	012 BX4	015 BX4	018 BX4	024 BX4	
1 Nominal voltage	U_N	6	12	15	18	24	V
2 Terminal resistance, phase-phase	R	0,73	3,5	4,58	7,04	12,5	Ω
3 Efficiency, max.	η_{max}	74	74	74	74	74	%
4 No-load speed	n_0	7 100	6 700	7 100	7 100	7 100	min ⁻¹
5 No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,16	0,072	0,06	0,053	0,039	A
6 Stall torque	M_H	64,7	58,7	64	60,7	61,7	mNm
7 Friction torque, static	C_0	0,46	0,46	0,46	0,46	0,46	mNm
8 Friction torque, dynamic	C_V	$1,1 \cdot 10^{-4}$	$1,1 \cdot 10^{-4}$	$1,1 \cdot 10^{-4}$	$1,1 \cdot 10^{-4}$	$1,1 \cdot 10^{-4}$	mNm/min ⁻¹
9 Speed constant	k_n	1 198	562	480	399	295	min ⁻¹ /V
10 Back-EMF constant	k_E	0,835	1,78	2,08	2,504	3,393	mV/min ⁻¹
11 Torque constant	k_M	7,97	17	19,9	23,9	32,4	mNm/A
12 Current constant	k_I	0,125	0,059	0,05	0,042	0,031	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	110	114	110	118	114	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	25	115	156	225	410	μ H
15 Mechanical time constant	τ_m	5,9	6,1	5,9	6,3	6,1	ms
16 Rotor inertia	J	5,1	5,1	5,1	5,1	5,1	gcm ²
17 Angular acceleration	α_{max}	127	115	125	119	121	$\cdot 10^3$ rad/s ²
18 Thermal resistance	R_{th1} / R_{th2}	3,9 / 18,8					K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	7,9 / 520					s
20 Operating temperature range:							
– motor		-40 ... +100					°C
– winding, max. permissible		+125					°C
21 Shaft bearings		ball bearings, preloaded					
22 Shaft load max.:							
– with shaft diameter		3					mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		20					N
– axial at 3 000 min ⁻¹ (push / pull)		2					N
– axial at standstill (push / pull)		20					N
23 Shaft play:							
– radial	\leq	0,015					mm
– axial	$=$	0					mm
24 Housing material		stainless steel					
25 Mass		65					g
26 Direction of rotation		electronically reversible					
27 Speed up to	n_{max}	29 000					min ⁻¹
28 Number of pole pairs		2					
29 Hall sensors		digital					
30 Magnet material		NdFeB					
Rated values for continuous operation							
31 Rated torque	M_N	14,8	14,7	14,8	14,3	14,6	mNm
32 Rated current (thermal limit)	I_N	2,22	1	0,89	0,72	0,54	A
33 Rated speed	n_N	5 030	4 450	5 040	4 930	4 840	min ⁻¹

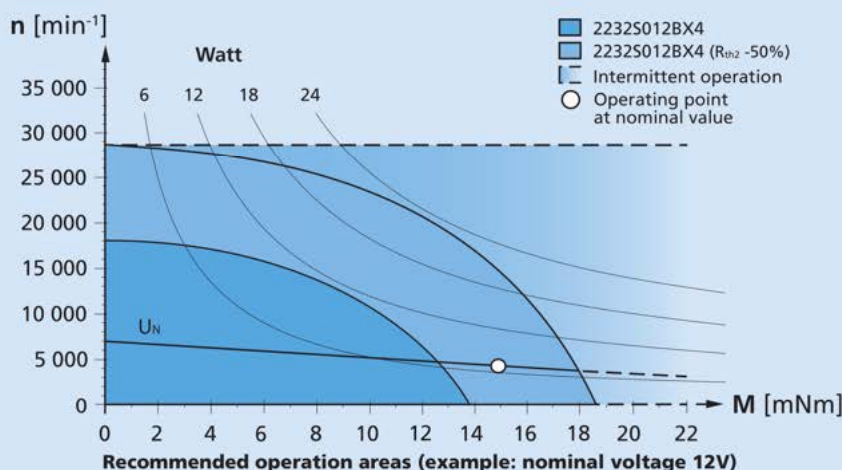
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

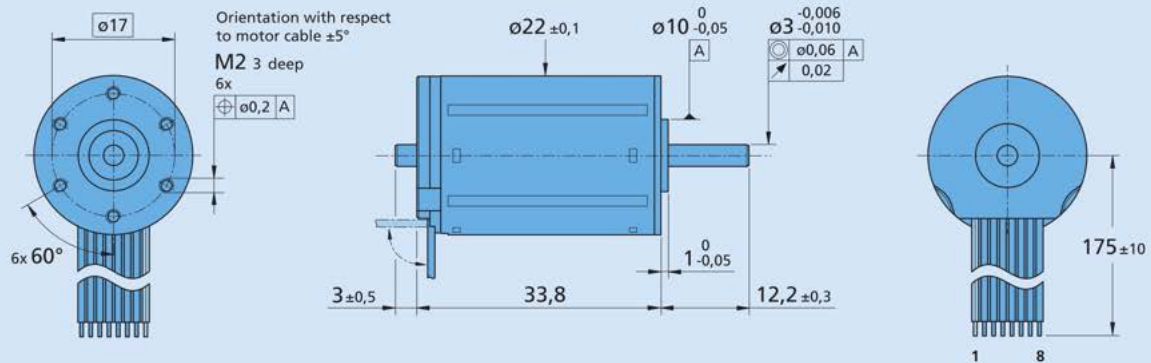
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

2232 S ... BX4
Option, cable and connection information

 Example product designation: **2232S012BX4-3692**

Option	Type	Description	Connection standard		
			No.	Function	Option: 4935/4747
3830	Connector	AWG 26 / PVC ribbon cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	1	Phase C	Phase C yellow
			2	Phase B	Phase B orange
			3	Phase A	Phase A brown
			4	GND	GND black
			5	U _{DD} (+5V)	U _{DD} (+5V) red
			6	Hall sensor C	Hall sensor C grey
			7	Hall sensor B	Hall sensor B blue
			8	Hall sensor A	Hall sensor A green
4935	Single wires	Motor with single wires (PTFE), length 175 mm, AWG26	Standard cable Insulation: PVC 8 conductors, AWG 26 pitch 1,27 mm, wires tinned		
X4935	Single wires	Motor with single wires (PTFE), length 300 mm, AWG26			
Y4935	Single wires	Motor with single wires (PTFE), length 600 mm, AWG26			
4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 175 mm, AWG26			
X4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 300 mm, AWG26			
Y4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 600 mm, AWG26			
Y158	Shaft end	Motor without second shaft end			
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL			

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
22F 22GPT 22/7 26A	IE3-1024 IE3-1024 L IER3-10000 IER3-10000 L AES-4096 AES-4096 L	SC 1801 P SC 1801 S SC 2402 P SC 2804 S SC 5004 P SC 5008 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MCBL 3006 S MCBL 3002 P AES MCBL 3002 S AES MCBL 3003 P AES MCBL 3006 S AES MC 5004 P MC 5004 P STO MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

4 Pole Technology

18 mNm

23 W

Series 2250 ... BX4 S

Values at 22°C and nominal voltage	2250 S	012 BX4 S	018 BX4 S	024 BX4 S	
1 Nominal voltage	U_N	12	18	24	V
2 Terminal resistance, phase-phase	R	1,55	3,17	5,9	Ω
3 Efficiency, max.	η_{max}	71	71	72	%
4 No-load speed	n_0	10 700	11 400	10 900	min ⁻¹
5 No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,188	0,139	0,095	A
6 Stall torque	M_H	82,6	85,8	85,7	mNm
7 Friction torque, static	C_0	0,54	0,54	0,54	mNm
8 Friction torque, dynamic	C_V	$1,3 \cdot 10^{-4}$	$1,3 \cdot 10^{-4}$	$1,3 \cdot 10^{-4}$	mNm/min ⁻¹
9 Speed constant	k_n	890	628	448	min ⁻¹ /V
10 Back-EMF constant	k_E	1,124	1,593	2,231	mV/min ⁻¹
11 Torque constant	k_M	10,7	15,2	21,3	mNm/A
12 Current constant	k_I	0,093	0,066	0,047	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	128	131	124,8	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	64,3	129	250	μ H
15 Mechanical time constant	τ_m	6,9	7	6,7	ms
16 Rotor inertia	J	5,1	5,1	5,1	gcm ²
17 Angular acceleration	α_{max}	162	168	168	$\cdot 10^3$ rad/s ²
18 Thermal resistance	R_{th1} / R_{th2}	3,7 / 15,1			K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	13 / 550			s
20 Operating temperature range:					
– motor		-40 ... +100			°C
– winding, max. permissible		+125			°C
21 Shaft bearings		ball bearings, preloaded			
22 Shaft load max.:					
– with shaft diameter		3			mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		20			N
– axial at 3 000 min ⁻¹ (push / pull)		2			N
– axial at standstill (push / pull)		20			N
23 Shaft play:					
– radial	\leq	0,015			mm
– axial	$=$	0			mm
24 Housing material		stainless steel			
25 Mass		88			g
26 Direction of rotation		electronically reversible			
27 Speed up to	n_{max}	26 000			min ⁻¹
28 Number of pole pairs		2			
29 Hall sensors		digital			
30 Magnet material		NdFeB			
Rated values for continuous operation					
31 Rated torque	M_N	13,6	13	13,7	mNm
32 Rated current (thermal limit)	I_N	1,59	1,09	0,81	A
33 Rated speed	n_N	8 580	9 310	8 720	min ⁻¹

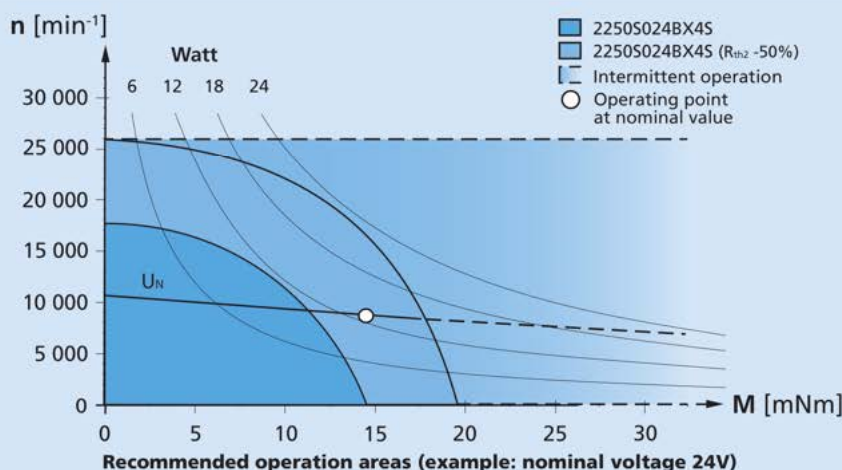
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

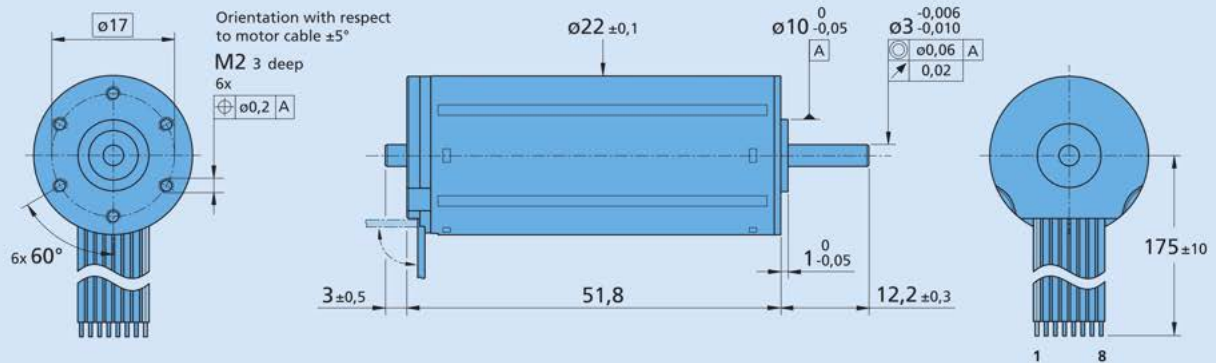
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

2250 S ... BX4 S
Option, cable and connection information

 Example product designation: **2250S024BX4S-3830**

Option	Type	Description	Connection standard		Option: 4935	
			No.	Function	Function	Colour
3830	Connector	AWG 26 / PVC ribbon cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	1	Phase C	Phase C	yellow
			2	Phase B	Phase B	orange
			3	Phase A	Phase A	brown
			4	GND	GND	black
			5	U _{DD} (+5V)	U _{DD} (+5V)	red
4935	Single wires	Motor with single wires (PTFE), length 175 mm, AWG26	6	Hall sensor C	Hall sensor C	grey
X4935	Single wires	Motor with single wires (PTFE), length 300 mm, AWG26	7	Hall sensor B	Hall sensor B	blue
Y4935	Single wires	Motor with single wires (PTFE), length 600 mm, AWG26	8	Hall sensor A	Hall sensor A	green
Y158	Shaft end	Motor without second shaft end	Standard cable Insulation: PVC 8 conductors, AWG 26 pitch 1,27 mm, wires tinned			

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
22F 22/7 26A	IE3-1024 IE3-1024 L IER3-10000 IER3-10000 L AES-4096 AES-4096 L	SC 2402 P SC 2804 S SC 5004 P SC 5008 S MC 5004 P MC 5004 P STO MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

4 Pole Technology

32 mNm

31 W

Series 2250 ... BX4

Values at 22°C and nominal voltage		2250 S	012 BX4	018 BX4	024 BX4	
1	Nominal voltage	U_N	12	18	24	V
2	Terminal resistance, phase-phase	R	1,55	3,17	5,9	Ω
3	Efficiency, max.	η_{max}	76	76	77	%
4	No-load speed	n_0	6 000	6 400	6 200	min ⁻¹
5	No-load current, typ. (with shaft ø 3 mm)	I_0	0,128	0,094	0,066	A
6	Stall torque	M_H	147	152	151	mNm
7	Friction torque, static	C_0	0,8	0,8	0,8	mNm
8	Friction torque, dynamic	C_V	2,6·10 ⁻⁴	2,6·10 ⁻⁴	2,6·10 ⁻⁴	mNm/min ⁻¹
9	Speed constant	k_n	502	354	255	min ⁻¹ /V
10	Back-EMF constant	k_E	1,994	2,825	3,927	mV/min ⁻¹
11	Torque constant	k_M	19	27	37,5	mNm/A
12	Current constant	k_I	0,053	0,037	0,027	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	40,8	41,6	40,3	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	62,8	126	250	μH
15	Mechanical time constant	τ_m	4,3	4,3	4,2	ms
16	Rotor inertia	J	10	10	10	gcm ²
17	Angular acceleration	α_{max}	147	152	151	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	3,5 / 15			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	12 / 660			s
20	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		3			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		20			N
	– axial at 3 000 min ⁻¹ (push / pull)		2			N
	– axial at standstill (push / pull)		20			N
23	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
24	Housing material		stainless steel			
25	Mass		105			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	20 000			min ⁻¹
28	Number of pole pairs		2			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	26,2	25,5	26,2	mNm
32	Rated current (thermal limit)	I_N	1,66	1,15	0,85	A
33	Rated speed	n_N	4 740	5 140	4 870	min ⁻¹

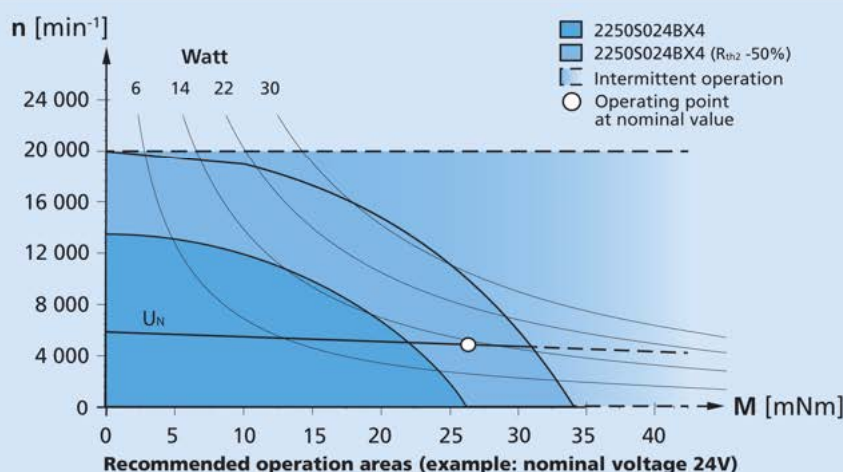
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

Note:

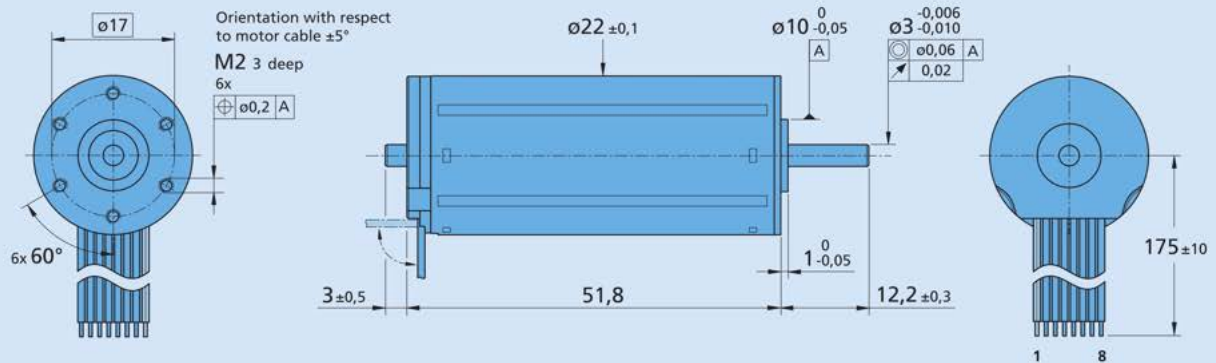
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **2250S024BX4-3692**

Option	Type	Description	Connection standard			Option: 4935/4747	
			No.	Function	Function	Colour	
3830	Connector	AWG 26 / PVC ribbon cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	1	Phase C	Phase C	yellow	
			2	Phase B	Phase B	orange	
			3	Phase A	Phase A	brown	
			4	GND	GND	black	
			5	U _{DD} (+5V)	U _{DD} (+5V)	red	
			6	Hall sensor C	Hall sensor C	grey	
			7	Hall sensor B	Hall sensor B	blue	
			8	Hall sensor A	Hall sensor A	green	
4935	Single wires	Motor with single wires (PTFE), length 175 mm, AWG26	Standard cable Insulation: PVC 8 conductors, AWG 26 pitch 1,27 mm, wires tinned				
X4935	Single wires	Motor with single wires (PTFE), length 300 mm, AWG26					
Y4935	Single wires	Motor with single wires (PTFE), length 600 mm, AWG26					
4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 175 mm, AWG26					
X4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 300 mm, AWG26					
Y4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 600 mm, AWG26					
Y158	Shaft end	Motor without second shaft end					
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL					

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
22F 22GPT 22/7 26A 32GPT	IE3-1024 IE3-1024 L IER3-10000 IER3-10000 L AES-4096 AES-4096 L	SC 2402 P SC 2804 S SC 5004 P SC 5008 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MCBL 3006 S MCBL 3002 P AES MCBL 3002 S AES MCBL 3003 P AES MCBL 3006 S AES MC 5004 P MC 5004 P STO MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

4 Pole Technology

53 mNm

45 W

Series 3242 ... BX4

Values at 22°C and nominal voltage		3242 G	012 BX4	018 BX4	024 BX4	036 BX4	042 BX4	048 BX4		
1	Nominal voltage	U_N	12	18	24	36	42	48	V	
2	Terminal resistance, phase-phase	R	0,92	2,01	3,67	8,96	11,7	15,1	Ω	
3	Efficiency, max.	η_{max}	78	78	78	77	78	78	%	
4	No-load speed	n_0	5 600	5 500	5 600	5 500	5 500	5 500	min ⁻¹	
5	No-load current, typ. (with shaft ø 5 mm)	I_0	0,179	0,117	0,089	0,059	0,05	0,044	A	
6	Stall torque	M_H	268,7	280	269,4	251	262	265	mNm	
7	Friction torque, static	C_0	1,3	1,3	1,3	1,3	1,3	1,3	mNm	
8	Friction torque, dynamic	C_V	4,1·10 ⁻⁴	4,1·10 ⁻⁴	4,1·10 ⁻⁴	4,1·10 ⁻⁴	4,1·10 ⁻⁴	4,1·10 ⁻⁴	mNm/min ⁻¹	
9	Speed constant	k_n	461	304	231	152	130	114	min ⁻¹ /V	
10	Back-EMF constant	k_E	2,168	3,285	4,335	6,571	7,666	8,762	mV/min ⁻¹	
11	Torque constant	k_M	20,7	31,4	41,4	62,8	73,1	83,7	mNm/A	
12	Current constant	k_I	0,048	0,032	0,024	0,016	0,014	0,012	A/mNm	
13	Slope of n-M curve	$\Delta n / \Delta M$	20,5	19,5	20,4	21,7	20,8	20,6	min ⁻¹ /mNm	
14	Terminal inductance, phase-phase	L	60	132	240	529	719	940	μ H	
15	Mechanical time constant	τ_m	6,4	6,1	6,4	6,8	6,5	6,5	ms	
16	Rotor inertia	J	30	30	30	30	30	30	gcm ²	
17	Angular acceleration	α_{max}	90	93,2	90	83,6	87,2	88,3	·10 ³ rad/s ²	
18	Thermal resistance	R_{th1} / R_{th2}	2,3 / 11,6						K/W	
19	Thermal time constant	τ_{w1} / τ_{w2}	13 / 880						s	
20	Operating temperature range:									
	– motor		-40 ... +100						°C	
	– winding, max. permissible		+125						°C	
21	Shaft bearings		ball bearings, preloaded							
22	Shaft load max.:									
	– with shaft diameter		5						mm	
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		50						N	
	– axial at 3 000 min ⁻¹ (push / pull)		5						N	
	– axial at standstill (push / pull)		50						N	
23	Shaft play:									
	– radial		≤ 0,015						mm	
	– axial		= 0						mm	
24	Housing material		stainless steel							
25	Mass		179						g	
26	Direction of rotation		electronically reversible							
27	Speed up to		n_{max} 17 000						min ⁻¹	
28	Number of pole pairs		2							
29	Hall sensors		digital							
30	Magnet material		NdFeB							
Rated values for continuous operation										
31	Rated torque		M_N	41,8	43	41,8	40,7	41,6	41,8	mNm
32	Rated current (thermal limit)		I_N	2,43	1,64	1,21	0,78	0,68	0,6	A
33	Rated speed		n_N	4 600	4 580	4 600	4 480	4 520	4 530	min ⁻¹

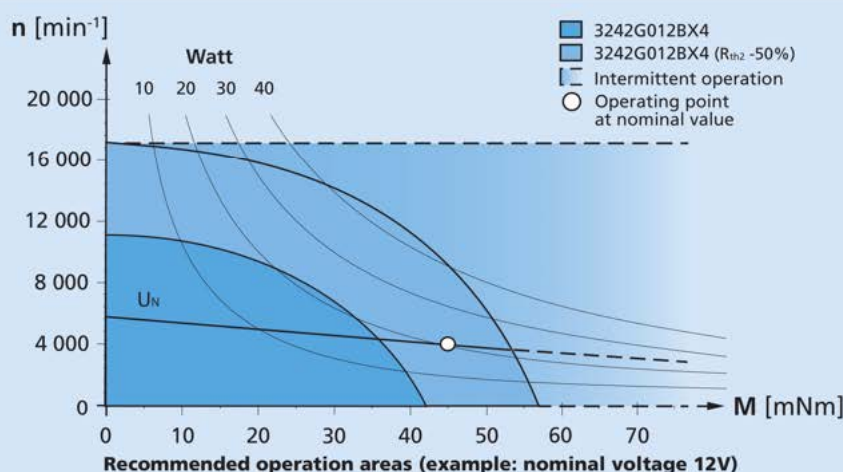
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

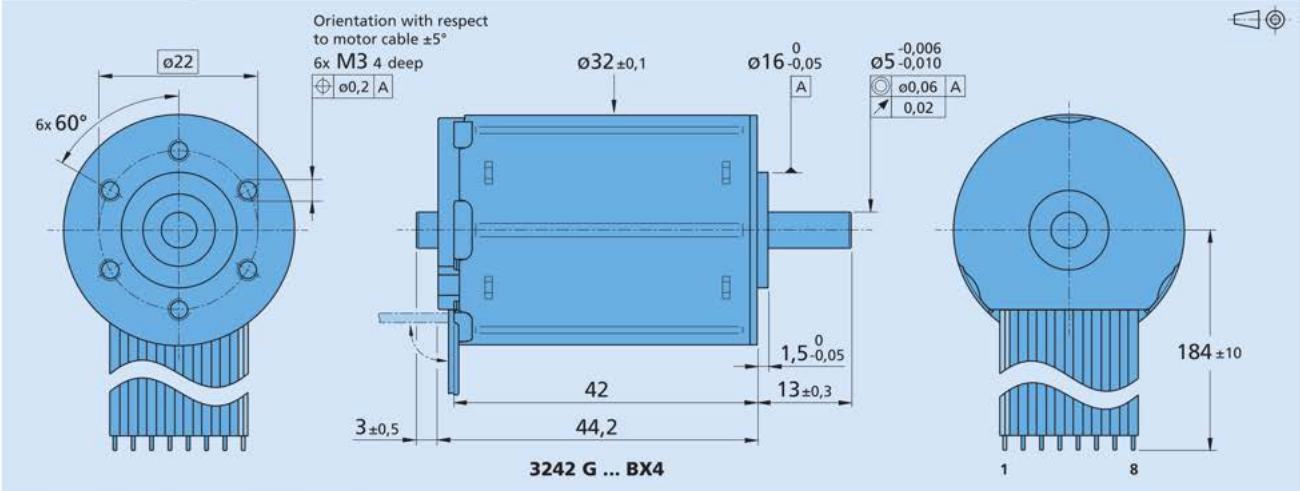
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **3242G012BX4-3692**

Option	Type	Description	Connection standard		
			No.	Function	Option: 4935/4747
3830	Connector	AWG 26 / PVC ribbon cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	1	Phase C	Phase C yellow
			2	Phase B	Phase B orange
			3	Phase A	Phase A brown
			4	GND	GND black
			5	U ₀₀ (+5V)	U ₀₀ (+5V) red
			6	Hall sensor C	Hall sensor C grey
			7	Hall sensor B	Hall sensor B blue
			8	Hall sensor A	Hall sensor A green
4935	Single wires	Motor with single wires (PTFE), length 184 mm, AWG22	Standard cable Insulation: PVC 8 conductors, AWG 24 pitch 2,54 mm, wires tinned		
X4935	Single wires	Motor with single wires (PTFE), length 300 mm, AWG22			
Y4935	Single wires	Motor with single wires (PTFE), length 600 mm, AWG22			
4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 184 mm, AWG22			
X4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 300 mm, AWG22			
Y4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 600 mm, AWG22			
Y158	Shaft end	Motor without second shaft end			
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL			

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
32A 32ALN 32GPT 32/3 32/3R 38A 38/1 38/1 S 38/2 38/2 S 42GPT	IE3-1024 IE3-1024 L IER3-10000 IER3-10000 L AES-4096 AES-4096 L	SC 2402 P SC 2804 S SC 5004 P SC 5008 S MCBL 3002 P MCBL 3002 S MCBL 3003 P MCBL 3006 S MCBL 3002 P AES MCBL 3002 S AES MCBL 3003 P AES MCBL 3006 S AES MC 5004 P MC 5004 P STO MC 5005 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

4 Pole Technology

96 mNm

62 W

Series 3268 ... BX4

Values at 22°C and nominal voltage	3268 G	018 BX4	024 BX4	030 BX4	036 BX4	042 BX4	048 BX4	
1 Nominal voltage	U_N	18	24	30	36	42	48	V
2 Terminal resistance, phase-phase	R	0,92	1,47	2,08	3,23	4,83	6,06	Ω
3 Efficiency, max.	η_{max}	80	81	80	80	80	79	%
4 No-load speed	n_0	5 100	5 500	5 700	5 500	5 300	5 500	min ⁻¹
5 No-load current, typ. (with shaft ø 5 mm)	I_0	0,22	0,183	0,162	0,124	0,101	0,093	A
6 Stall torque	M_H	670	705	742	716	670	678	mNm
7 Friction torque, static	C_0	1,6	1,6	1,6	1,6	1,6	1,6	mNm
8 Friction torque, dynamic	C_V	1,1·10 ⁻³	1,1·10 ⁻³	1,1·10 ⁻³	1,1·10 ⁻³	1,1·10 ⁻³	1,1·10 ⁻³	mNm/min ⁻¹
9 Speed constant	k_n	278	220	185	148	124	111	min ⁻¹ /V
10 Back-EMF constant	k_E	3,595	4,534	5,392	6,741	8,088	8,987	mV/min ⁻¹
11 Torque constant	k_M	34,3	43,5	51,5	64,4	77,2	85,8	mNm/A
12 Current constant	k_I	0,029	0,023	0,019	0,015	0,013	0,012	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	7,45	7,5	7,48	7,44	7,73	7,85	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	67,6	110	152	238	342	423	μH
15 Mechanical time constant	τ_m	4,9	4,9	4,9	4,9	5,1	5,2	ms
16 Rotor inertia	J	63	63	63	63	63	63	gcm ²
17 Angular acceleration	α_{max}	106	112	118	114	106	108	·10 ³ rad/s ²
18 Thermal resistance	R_{th1} / R_{th2}	1,7 / 8,8						K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	16 / 1 080						s
20 Operating temperature range:								
– motor		-40 ... +100						°C
– winding, max. permissible		+125						°C
21 Shaft bearings		ball bearings, preloaded						
22 Shaft load max.:								
– with shaft diameter		5						mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		50						N
– axial at 3 000 min ⁻¹ (push / pull)		5						N
– axial at standstill (push / pull)		50						N
23 Shaft play:								
– radial	≤	0,015						mm
– axial	≈	0						mm
24 Housing material		stainless steel						
25 Mass		290						g
26 Direction of rotation		electronically reversible						
27 Speed up to	n_{max}	12 000						min ⁻¹
28 Number of pole pairs		2						
29 Hall sensors		digital						
30 Magnet material		NdFeB						
Rated values for continuous operation								
31 Rated torque	M_N	74,5	72	69,8	71,9	71,7	70	mNm
32 Rated current (thermal limit)	I_N	2,63	2	1,66	1,36	1,13	1	A
33 Rated speed	n_N	4 550	4 890	5 210	4 950	4 750	4 920	min ⁻¹

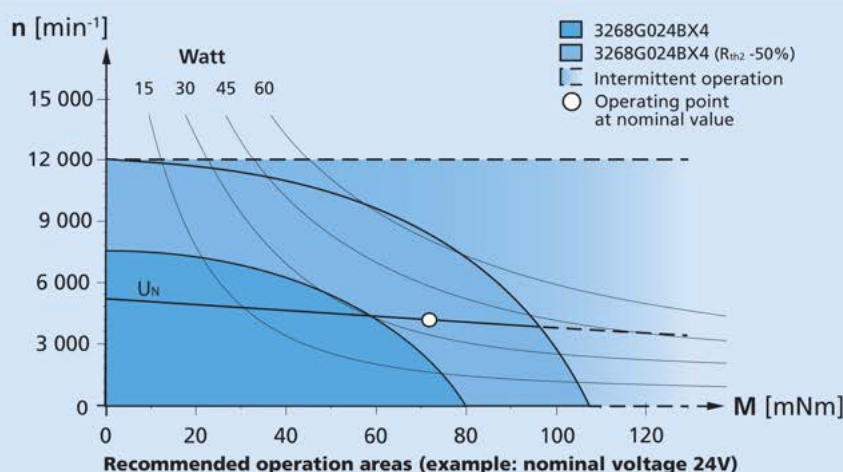
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

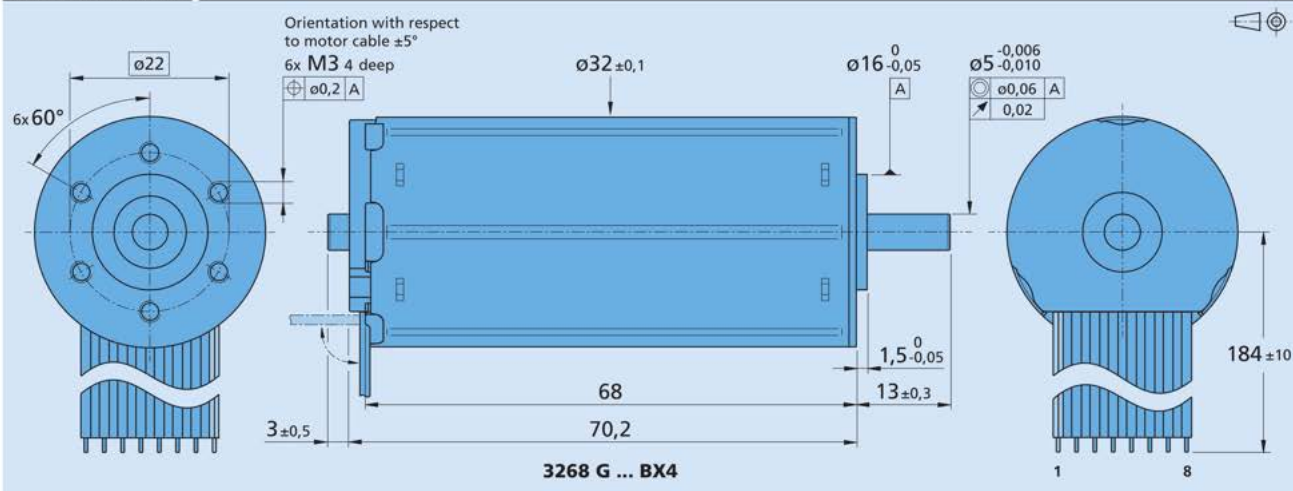
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.


The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **3268G024BX4-3692**

Option	Type	Description	Connection standard		Option: 4935/4747	
			No.	Function	Function	Colour
3830	Connector 	AWG 26 / PVC ribbon cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	1	Phase C	Phase C	yellow
			2	Phase B	Phase B	orange
			3	Phase A	Phase A	brown
			4	GND	GND	black
			5	U _{DD} (+5V)	U _{DD} (+5V)	red
4935	Single wires	Motor with single wires (PTFE), length 184 mm, AWG22	6	Hall sensor C	Hall sensor C	grey
X4935	Single wires	Motor with single wires (PTFE), length 300 mm, AWG22	7	Hall sensor B	Hall sensor B	blue
Y4935	Single wires	Motor with single wires (PTFE), length 600 mm, AWG22	8	Hall sensor A	Hall sensor A	green
4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 184 mm, AWG22	Standard cable Insulation: PVC 8 conductors, AWG 24 pitch 2,54 mm, wires tinned			
X4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 300 mm, AWG22				
Y4747	Temperature range	Up to 150°C, winding max. 150°C, with single wires (PTFE), length 600 mm, AWG22				
Y158	Shaft end	Motor without second shaft end				
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MCBL				

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
32A 32ALN 32GPT 32/3 32/3R 38A 38/1 38/1 S 38/2 38/2 S 42GPT	IE3-1024 IE3-1024 L IER3-10000 IER3-10000 L AES-4096 AES-4096 L	SC 2804 S SC 5004 P SC 5008 S MCBL 3003 P MCBL 3006 S MCBL 3003 P AES MCBL 3006 S AES MC 5004 P MC 5004 P STO MC 5005 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors 4 Pole Technology

The four-pole brushless DC-Servomotors of the BP4 series are characterised by their extremely high torques, despite the compact 22 mm and 32 mm diameter design and low weight. At the heart of the motors lies innovative winding technology that not only allows a very high copper content in the stator, but also has a high electrical and geometric winding symmetry. This minimises losses and maximises efficiency. The BP4 series is overload-resistant and suitable for applications involving high power where the lowest possible total weight and smallest possible installation space are required, and also for dynamic start/stop operation.

Series

2264 ... BP4

3274 ... BP4

Key Features

Motor diameter	22 ... 32 mm
Motor length	64 ... 74 mm
Nominal voltage	12 ... 48 V
Speed	up to 34.500 min ⁻¹
Torque	up to 162 mNm
Continuous output	up to 150 W



Product Code

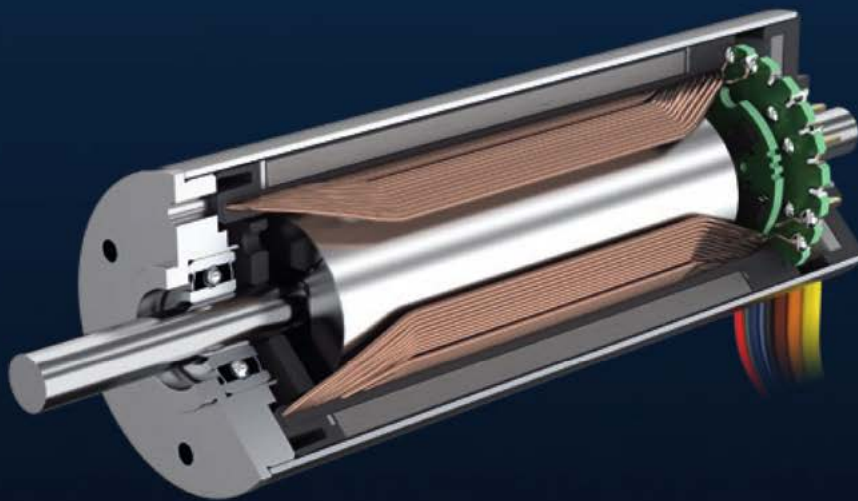
22	Motor diameter [mm]
64	Motor length [mm]
W	Shaft type
024	Nominal voltage [V]
BP4	Product family

WE CREATE MOTION

FAULHABER BP4

Advantages of this series at a glance

- High-power motors with maximum torque
- Continuous output from 133 W to 150 W
- Outstanding ratio of torque to weight and size
- Very high efficiency of up to 91 %
- Fully integrated analogue Hall sensors and matching encoders, gearheads and controllers are available
- For dynamic start/stop operation



Brushless DC-Servomotors

4 Pole Technology

59 mNm

133 W

Series 2264 ... BP4

Values at 22°C and nominal voltage		2264 W	012 BP4	024 BP4	048 BP4	
1	Nominal voltage	U_N	12	24	48	V
2	Terminal resistance, phase-phase	R	0,05	0,22	0,881	Ω
3	Efficiency, max.	η_{max}	91	91	90	%
4	No-load speed	n_0	21 000	21 100	21 100	min ⁻¹
5	No-load current, typ. (with shaft ø 4 mm)	I_0	0,521	0,261	0,13	A
6	Stall torque	M_H	1 311	1 311	1 280	mNm
7	Friction torque, static	C_0	0,41	0,41	0,407	mNm
8	Friction torque, dynamic	C_V	1,15·10 ⁻⁴	1,15·10 ⁻⁴	1,15·10 ⁻⁴	mNm/min ⁻¹
9	Speed constant	k_n	1 618	809	404	min ⁻¹ /V
10	Back-EMF constant	k_E	0,618	1,236	2,48	mV/min ⁻¹
11	Torque constant	k_M	5,9	11,8	23,6	mNm/A
12	Current constant	k_I	0,169	0,085	0,0423	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	14,8	14,8	15,1	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	6	24	91,3	μ H
15	Mechanical time constant	τ_m	1,4	1,4	1,45	ms
16	Rotor inertia	J	9,2	9,2	9,21	gcm ²
17	Angular acceleration	α_{max}	1 424	1 424	1 400	·10 ³ rad/s ²
18	Thermal resistance	R_{th1} / R_{th2}	1,2 / 12			K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	7 / 693			s
20	Operating temperature range:					
	– motor		-40 ... +125			°C
	– winding, max. permissible		+150			°C
21	Shaft bearings		ball bearings, preloaded			
22	Shaft load max.:					
	– with shaft diameter		4			mm
	– radial at 3 000 min ⁻¹ (3 mm from mounting flange)		20			N
	– axial at 3 000 min ⁻¹ (push / pull)		2			N
	– axial at standstill (push / pull)		20			N
23	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
24	Housing material		stainless steel			
25	Mass		140			g
26	Direction of rotation		electronically reversible			
27	Speed up to	n_{max}	34 500			min ⁻¹
28	Number of pole pairs		2			
29	Hall sensors		digital			
30	Magnet material		NdFeB			
Rated values for continuous operation						
31	Rated torque	M_N	59	59	57,9	mNm
32	Rated current (thermal limit)	I_N	11,9	6	2,94	A
33	Rated speed	n_N	20 460	20 490	20 500	min ⁻¹

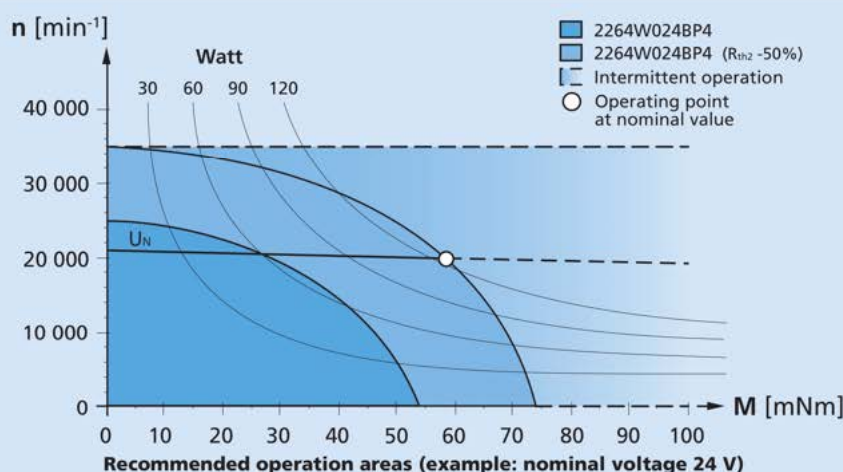
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 50%.

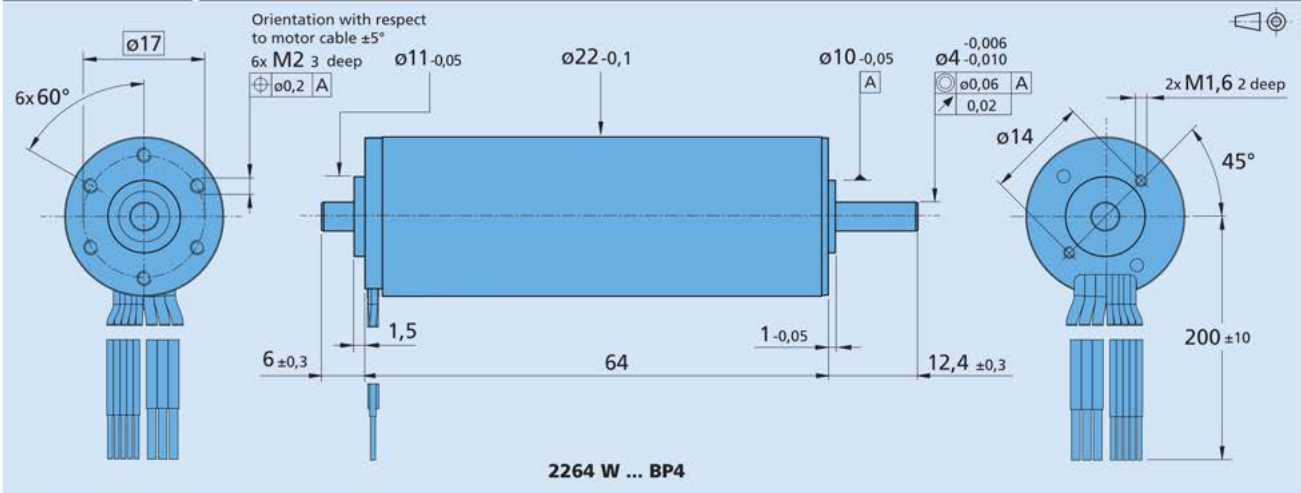
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **2264W024BP4-3692**

Option	Type	Description	Connection	
Y158	Shaft end	Motor without second shaft end	Function	Colour
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MC 5010	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			3 single wires, material PTFE, AWG 20, Phase A/B/C	
			5 single wires, material PTFE, AWG 26, Hall A/B/C, U _{DD} , GND	
			Note	
			With the connection cable the terminal resistance is increased typ. by 0,008 Ω .	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
22GPT 26/1R 32A 32ALN 32GPT 32/3R	IE3-1024 IE3-1024 L IERS3-500 IERS3-500 L IER3-10000 IER3-10000 L AES-4096 L	SC 5008 S MC 5010 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Servomotors

4 Pole Technology

162 mNm

150 W

Series 3274 ... BP4

Values at 22°C and nominal voltage		3274 G	024 BP4	
1	Nominal voltage	U_N	24	V
2	Terminal resistance, phase-phase	R	0,25	Ω
3	Efficiency, max.	η_{max}	89	%
4	No-load speed	n_0	8 700	min ⁻¹
5	No-load current, typ. (with shaft ø 5 mm)	I_0	0,384	A
6	Stall torque	M_H	2 697	mNm
7	Friction torque, static	C_0	2,9	mNm
8	Friction torque, dynamic	C_V	$8,2 \cdot 10^{-4}$	mNm/min ⁻¹
9	Speed constant	k_n	336	min ⁻¹ /V
10	Back-EMF constant	k_E	2,97	mV/min ⁻¹
11	Torque constant	k_M	28,4	mNm/A
12	Current constant	k_I	0,035	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	3	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	60	μH
15	Mechanical time constant	τ_m	1,5	ms
16	Rotor inertia	J	48	gcm ²
17	Angular acceleration	α_{max}	562	$\cdot 10^3 \text{ rad/s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	0,7 / 8	K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	14 / 965	s
20	Operating temperature range:			
	– motor		-40 ... +125	°C
	– winding, max. permissible		+150	°C
21	Shaft bearings		ball bearings, preloaded	
22	Shaft load max.:			
	– with shaft diameter	5		mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)	50		N
	– axial at 3 000 min ⁻¹ (push / pull)	5		N
	– axial at standstill (push / pull)	50		N
23	Shaft play:			
	– radial	\leq	0,015	mm
	– axial	$=$	0	mm
24	Housing material		stainless steel	
25	Mass		320	g
26	Direction of rotation		electronically reversible	
27	Speed up to	n_{max}	16 000	min ⁻¹
28	Number of pole pairs		2	
29	Hall sensors		digital	
30	Magnet material		NdFeB	
Rated values for continuous operation				
31	Rated torque	M_N	162	mNm
32	Rated current (thermal limit)	I_N	6,9	A
33	Rated speed	n_N	8 260	min ⁻¹

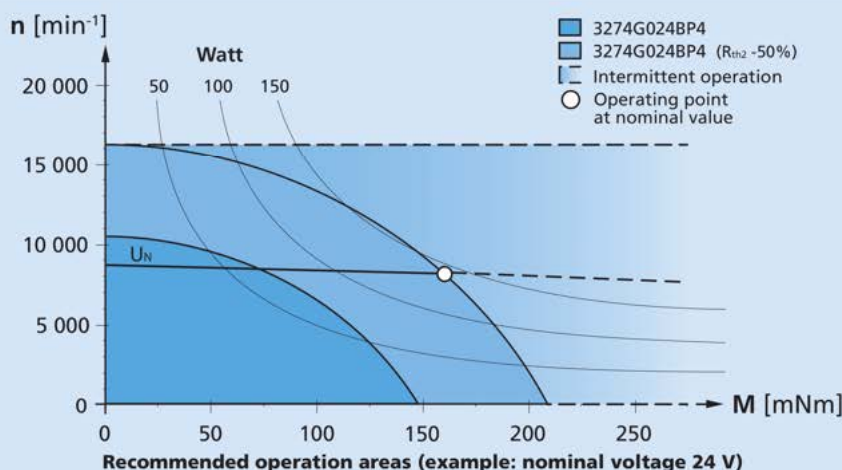
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 50%.

Note:

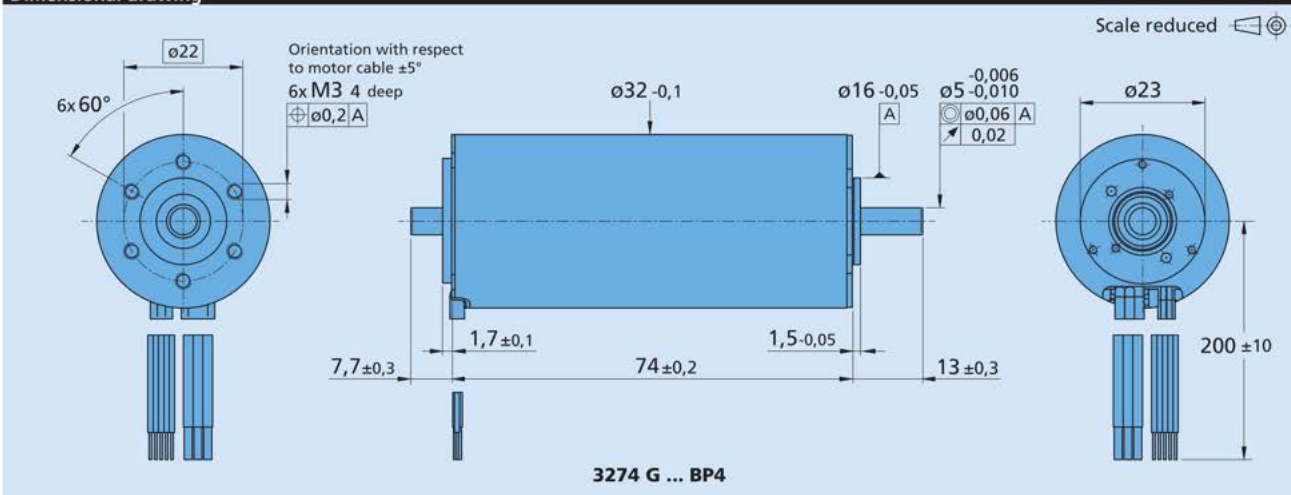
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing



Option, cable and connection information

Example product designation: **3274G024BP4-3692**

Option	Type	Description	Connection	
Y158	Shaft end	Motor without second shaft end	Function	Colour
3692	Controller combination	Analog Hall sensors for combination with Motion Controller MC 5010	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			3 single wires, material FEP, AWG 18, Phase A/B/C	
			5 single wires, material PTFE, AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
32A 32ALN 32GPT 32/3 32/3R 38A 38/1 38/1 S 38/2 38/2 S 42GPT	IE3-1024 IE3-1024 L IERS3-500 IERS3-500 L IER3-10000 IER3-10000 L AES-4096 L	SC 5008 S MC 5010 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Flat Motors and DC-Gearmotors

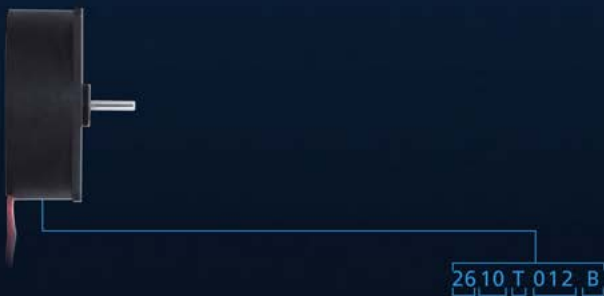
The four-pole brushless DC-Servomotors, which have uniquely flat coil technology with three flat, self-supporting copper windings and are used in the B-Flat series, form the basis for drive systems in applications where space is extremely limited. With their powerful rare-earth magnets, the motors deliver a continuous output of 1.5 W to 9 W and at the same time have only minimal inertia. In combination with the integrated gear-heads in extremely flat design, the motors provide a very compact drive system with increased output torque. Due to the electronic commutation of the drives, the service life is many times longer compared to mechanically commutated motors.

Series

1509 ... B	1515 ... B
2610 ... B	2622 ... B

Key Features

Motor diameter	15 ... 26 mm
Motor length	9 ... 22 mm
Nominal voltage	6 ... 12 V
Speed	up to 40.000 min ⁻¹
Torque	up to 100 mNm
Continuous output	up to 9 W



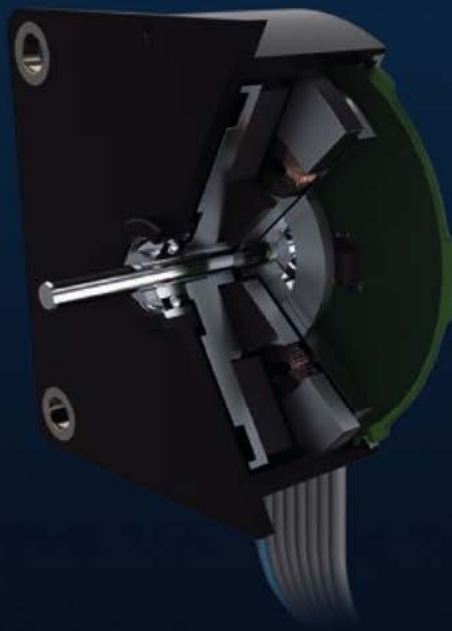
Product Code

26	Motor diameter [mm]
10	Motor length [mm]
T	Shaft type
012	Nominal voltage [V]
B	Product family

FAULHABER B-Flat

Advantages of this series at a glance

- Extremely flat design.
Lengths ranging from 9 mm to 22 mm
- 4-pole design
- Electronic commutation using
three digital Hall sensors
- Integrated spur gearheads
of minimal length with high
gear ratio are available
- Precise speed control



Brushless DC-Flat Motors

4 Pole Technology

0,5 mNm

1,5 W

Series 1509 ... B

Values at 22°C and nominal voltage		1509 T	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	22	92,7	Ω
3	Efficiency, max.	η_{max}	54	53	%
4	No-load speed	n_0	15 000	14 900	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 1,5 mm)	I_0	0,019	0,009	A
6	Stall torque	M_H	0,953	0,904	mNm
7	Friction torque, static	C_0	0,019	0,019	mNm
8	Friction torque, dynamic	C_V	$3,42 \cdot 10^{-6}$	$3,42 \cdot 10^{-6}$	mNm/min ⁻¹
9	Speed constant	k_n	2 682	1 339	min ⁻¹ /V
10	Back-EMF constant	k_E	0,373	0,747	mV/min ⁻¹
11	Torque constant	k_M	3,56	7,13	mNm/A
12	Current constant	k_I	0,281	0,14	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	16 577	17 423	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	570	2 282	μH
15	Mechanical time constant	τ_m	120	126	ms
16	Rotor inertia	J	0,69	0,69	gcm ²
17	Angular acceleration	α_{max}	14	13	$\cdot 10^3 \text{ rad/s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	65 / 45		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	12 / 133		s
20	Operating temperature range:				
	– motor		-25 ... +80		°C
	– winding, max. permissible		+80		°C
21	Shaft bearings		ball bearings, preloaded		
22	Shaft load max.:				
	– with shaft diameter		1,5		mm
	– radial at 3 000 min ⁻¹ (3 mm from mounting flange)		2		N
	– axial at 3 000 min ⁻¹ (push only)		2		N
	– axial at standstill (push only)		15		N
23	Shaft play:				
	– radial	\leq	0,015		mm
	– axial	$=$	0		mm
24	Housing material		plastic		
25	Mass		6,9		g
26	Direction of rotation		electronically reversible		
27	Speed up to	n_{max}	40 000		min ⁻¹
28	Number of pole pairs		2		
29	Hall sensors		digital		
30	Magnet material		NdFeB		
Rated values for continuous operation					
31	Rated torque	M_N	0,45	0,44	mNm
32	Rated current (thermal limit)	I_N	0,147	0,071	A
33	Rated speed	n_N	5 860	5 550	min ⁻¹

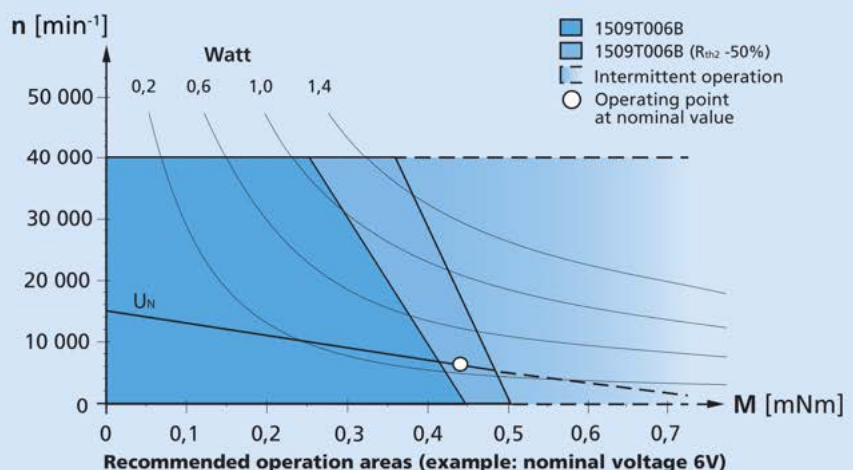
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

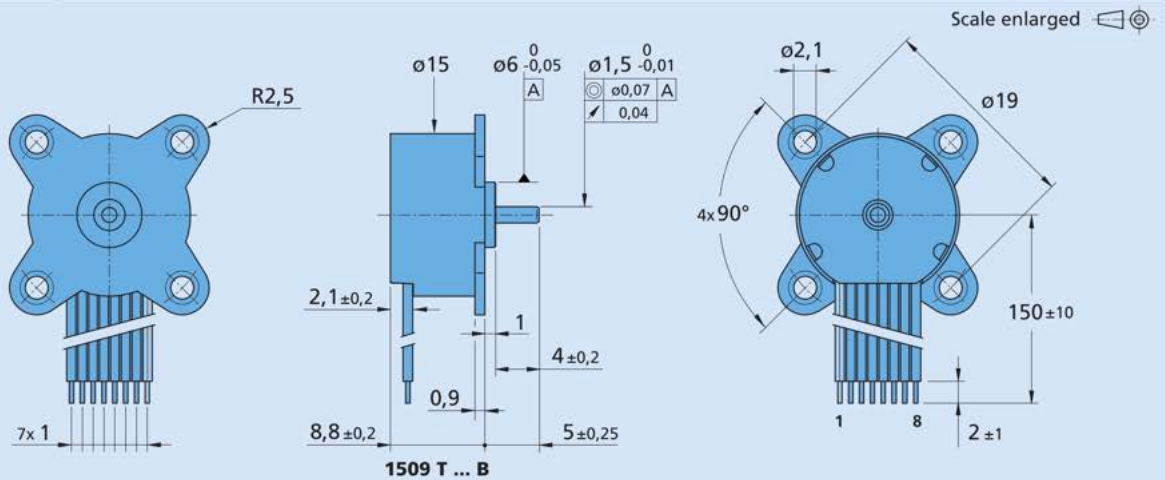
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **1509T006B-X4192**

Option	Type	Description	Connection	
X4192	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	No.	Function
4082	Temperature range	Extended temperature range (-40...+85°C)	1	Phase C
			2	Phase B
			3	Phase A
			4	GND
			5	U _{DD} (+5V)
			6	Hall sensor C
			7	Hall sensor B
			8	Hall sensor A
			Standard cable	
			Insulation: PVC	
			8 conductors, AWG 28	
			pitch 1 mm, wires tinned	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 1801 P SC 1801 S	

Brushless DC-Gearmotors

30 mNm

4 Pole Technology

Series 1515 ... B

Values at 22°C and nominal voltage		1515 U	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	22	92,7	Ω
3	Efficiency, max.	$\eta_{max.}$	54	53	%
4	No-load speed	n_0	15 000	14 900	min^{-1}
5	No-load current, typ.	I_0	0,019	0,009	A
6	Stall torque	M_H	0,953	0,904	mNm
7	Friction torque, static	C_0	0,019	0,019	mNm
8	Friction torque, dynamic	C_v	$3,42 \cdot 10^{-6}$	$3,42 \cdot 10^{-6}$	$\text{mNm}/\text{min}^{-1}$
9	Speed constant	k_n	2 682	1 339	min^{-1}/V
10	Back-EMF constant	k_E	0,373	0,747	$\text{mV}/\text{min}^{-1}$
11	Torque constant	k_M	3,56	7,13	mNm/A
12	Current constant	k_I	0,281	0,14	A/mNm
13	Slope of n-M curve	$\Delta n/\Delta M$	16 577	17 423	$\text{min}^{-1}/\text{mNm}$
14	Terminal inductance, phase-phase	L	570	2 282	μH
15	Mechanical time constant	τ_m	120	126	ms
16	Rotor inertia	J	0,69	0,69	gcm^2
17	Angular acceleration	$\alpha_{max.}$	14	13	$\cdot 10^3 \text{rad}/\text{s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	65 / 45		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	12 / 130		s

Integrated Gearhead

Housing material		plastic	
Geartrain material		metal	
Backlash, at no-load	\leq	4	°
Bearings on output shaft		plastic / brass bearing	
Shaft load max.:			
– radial (5 mm from mounting face)	\leq	1,4	N
– axial	\leq	0,3	N
Shaft press fit force, max.	\leq	5	N
Shaft play:			
– radial (5 mm from mounting face)	\leq	0,08	mm
– axial	\leq	0,25	mm
Operating temperature range		-25 ... +80	°C

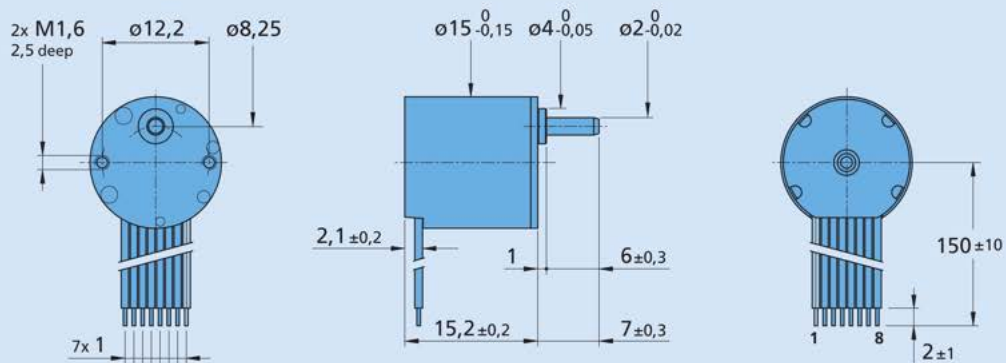
Specifications

reduction ratio (rounded)	output speed up to n_{max} min^{-1}	weight with motor g	output torque		direction of rotation (reversible)	efficiency %
			continuous operation M_{max} mNm	intermittent operation M_{max} mNm		
6 : 1	779	6,9	1,4	3	=	81
13 : 1	372	7,0	2,8	5	≠	73
39 : 1	129	7,2	7,0	10	=	60
112 : 1	45	7,4	19,8	30	≠	59
324 : 1	15	7,7	30,0	50	=	53

Note: output speed at 5000 min^{-1} input speed. Based on motor 1509 ... B.

Dimensional drawing

Scale enlarged 



1515 U ... B

Option, cable and connection information

Example product designation: **1515U006B-4082**

Option	Type	Description	Connection	
4082	Temperature range	Extended temperature range (-40...+85°C)	No.	Function
			1	Phase C
			2	Phase B
			3	Phase A
			4	GND
			5	U _{DD} (+5V)
			6	Hall sensor C
			7	Hall sensor B
			8	Hall sensor A
			Standard cable	
			Insulation: PVC	
			8 conductors, AWG 28	
			pitch 1 mm, wires tinned	

Product Combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 1801 P SC 1801 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless DC-Flat Motors

4 Pole Technology

3,1 mNm

9 W

Series 2610 ... B

Values at 22°C and nominal voltage	2610 T	006 B	012 B	
1 Nominal voltage	U_N	6	12	V
2 Terminal resistance, phase-phase	R	6,97	28,2	Ω
3 Efficiency, max.	η_{max}	79	79	%
4 No-load speed	n_0	6 400	6 400	min ⁻¹
5 No-load current, typ. (with shaft ø 1,5 mm)	I_0	0,01	0,005	A
6 Stall torque	M_H	7,543	7,453	mNm
7 Friction torque, static	C_0	0,035	0,035	mNm
8 Friction torque, dynamic	C_V	$8,85 \cdot 10^{-6}$	$8,85 \cdot 10^{-6}$	mNm/min ⁻¹
9 Speed constant	k_n	1 085	543	min ⁻¹ /V
10 Back-EMF constant	k_E	0,922	1,842	mV/min ⁻¹
11 Torque constant	k_M	8,8	17,6	mNm/A
12 Current constant	k_I	0,114	0,057	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	859	870	min ⁻¹ /mNm
14 Terminal inductance, phase-phase	L	486	1 945	μH
15 Mechanical time constant	τ_m	71	72	ms
16 Rotor inertia	J	7,9	7,9	gcm ²
17 Angular acceleration	α_{max}	9	9	$\cdot 10^3 \text{ rad/s}^2$
18 Thermal resistance	R_{th1} / R_{th2}	33 / 27		K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	23,6 / 222		s
20 Operating temperature range:				
– motor		-25 ... +80		°C
– winding, max. permissible		+80		°C
21 Shaft bearings		ball bearings, preloaded		
22 Shaft load max.:				
– with shaft diameter		1,5		mm
– radial at 3 000 min ⁻¹ (3 mm from mounting flange)		4		N
– axial at 3 000 min ⁻¹ (push only)		3,5		N
– axial at standstill (push only)		17,5		N
23 Shaft play:				
– radial	\leq	0,015		mm
– axial	$=$	0		mm
24 Housing material		plastic		
25 Mass		20,1		g
26 Direction of rotation		electronically reversible		
27 Speed up to	n_{max}	40 000		min ⁻¹
28 Number of pole pairs		2		
29 Hall sensors		digital		
30 Magnet material		NdFeB		
Rated values for continuous operation				
31 Rated torque	M_N	2,87	2,85	mNm
32 Rated current (thermal limit)	I_N	0,356	0,177	A
33 Rated speed	n_N	3 430	3 410	min ⁻¹

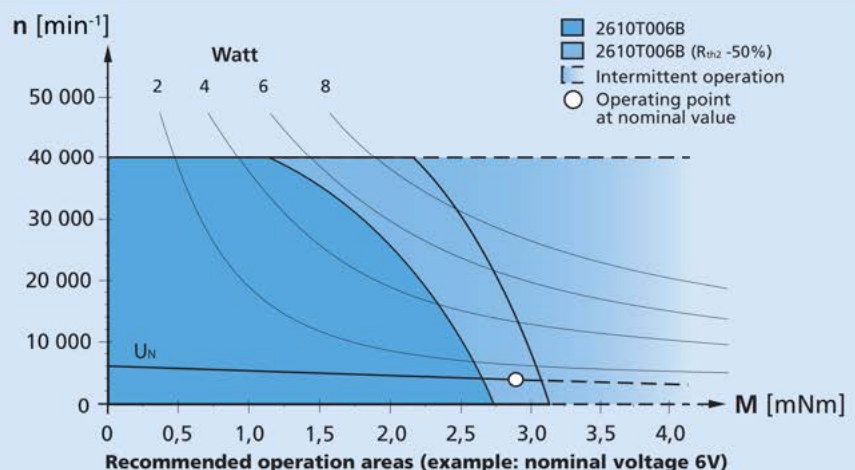
Note: Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The R_{th2} value has been reduced by 25%.

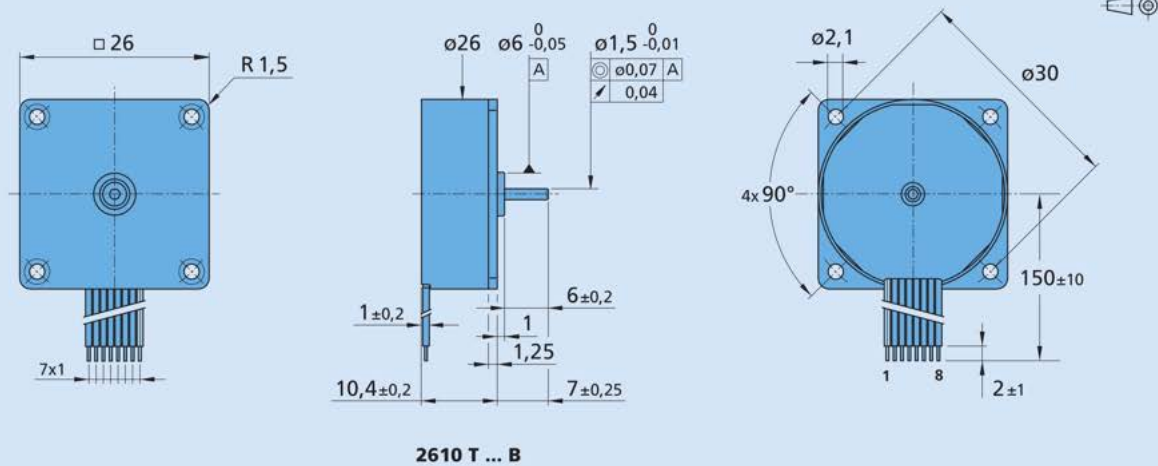
Note:

The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 50% reduced).

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated and thermally coupled condition. Any points of operation above the curve at nominal voltage will require a higher operating voltage. Any points below the nominal voltage curve will require less voltage.



Dimensional drawing

Option, cable and connection information

 Example product designation: **2610T006B-Y4192**

Option	Type	Description	Connection	
Y4192	Bearing lubrication	For vacuum of 10 ⁻⁵ Pa @ 22°C	No.	Function
4082	Temperature range	Extended temperature range (-40...+85°C)	1	Phase C
			2	Phase B
			3	Phase A
			4	GND
			5	U _{DD} (+5V)
			6	Hall sensor C
			7	Hall sensor B
			8	Hall sensor A
			Standard cable	
			Insulation: PVC	
			8 conductors, AWG 28	
			pitch 1 mm, wires tinned	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 1801 P SC 1801 S	

Brushless DC-Gearmotors

100 mNm

4 Pole Technology

Series 2622 ... B

Values at 22°C and nominal voltage		2622 S	006 B	012 B	
1	Nominal voltage	U_N	6	12	V
2	Terminal resistance, phase-phase	R	6,97	28,2	Ω
3	Efficiency, max.	$\eta_{max.}$	79	79	%
4	No-load speed	n_0	6 400	6 400	min ⁻¹
5	No-load current, typ.	I_0	0,01	0,005	A
6	Stall torque	M_H	7,543	7,453	mNm
7	Friction torque, static	C_0	0,035	0,035	mNm
8	Friction torque, dynamic	C_v	$8,85 \cdot 10^{-6}$	$8,85 \cdot 10^{-6}$	mNm/min ⁻¹
9	Speed constant	k_n	1 085	543	min ⁻¹ /V
10	Back-EMF constant	k_E	0,922	1,842	mV/min ⁻¹
11	Torque constant	k_M	8,8	17,6	mNm/A
12	Current constant	k_I	0,114	0,057	A/mNm
13	Slope of n-M curve	$\Delta n / \Delta M$	859	870	min ⁻¹ /mNm
14	Terminal inductance, phase-phase	L	486	1 945	μH
15	Mechanical time constant	τ_m	71	72	ms
16	Rotor inertia	J	7,9	7,9	gcm ²
17	Angular acceleration	$\alpha_{max.}$	9	9	$\cdot 10^3 \text{ rad/s}^2$
18	Thermal resistance	R_{th1} / R_{th2}	33 / 27		K/W
19	Thermal time constant	τ_{w1} / τ_{w2}	23,6 / 222		s

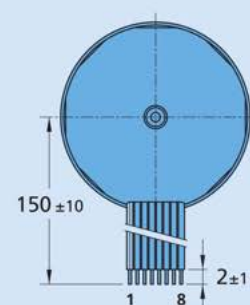
Integrated Gearhead

Housing material		plastic	
Geartrain material		metal	
Backlash, at no-load	\leq	4	°
Bearings on output shaft		ball bearing	
Shaft load max.:			
– radial (5 mm from mounting face)	\leq	15	N
– axial	\leq	5	N
Shaft press fit force, max.	\leq	10	N
Shaft play:			
– radial (5 mm from mounting face)	\leq	0,03	mm
– axial	\leq	0,25	mm
Operating temperature range		-25 ... +80	°C

Specifications

reduction ratio (rounded)	output speed up to n_{max} min ⁻¹	weight with motor g	output torque		direction of rotation (reversible)	efficiency %
			continuous operation M_{max} mNm	intermittent operation M_{max} mNm		
8 : 1	635	25	9	30	=	81
22 : 1	223	26	23	75	≠	73
33 : 1	151	26	30	100	=	60
112 : 1	44	27	93	180	≠	59
207 : 1	24	27	100	180	=	53
361 : 1	14	27	100	180	=	53
814 : 1	6	28	100	180	=	43
1 257 : 1	4	29	100	180	=	43

Note: output speed at 5000 min⁻¹ input speed. Based on motor 2610 ... B.



2622 S ... B

Example product designation: **2622S006B-4082**

Standard cable
Insulation: PVC
8 conductors, AWG 28
pitch 1 mm, wires tinned

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
		SC 1801 P SC 1801 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

Brushless flat motors with External rotor technology

The external rotor motors of the BXT series set new standards: thanks to innovative winding technology and optimum design, the BXT motors deliver a torque of up to 134 mNm. The ratio of torque to weight and size is unmatched. The iron-core motors with 14 high-performance rare earth magnets on the rotor and 12 teeth on the stator are just 14 mm, 16 mm and 21 mm long, making them suitable for applications that require a short drive solution with high torque. Combined with optical and magnetic encoders, gearheads and controls, the result is a compact drive system.

Series

2214 ... BXT R	2214 ... BXT H
3216 ... BXT R	3216 ... BXT H
4221 ... BXT R	4221 ... BXT H

Key Features

Motor diameter	22 ... 42 mm
Motor length	14 ... 21 mm
Nominal voltage	6 ... 48 V
Speed	up to 10.000 min ⁻¹
Torque	up to 134 mNm
Continuous output	up to 100 W



42 21 G 024 BXT R

Product Code

42	Motor diameter [mm]
21	Motor length [mm]
G	Shaft type
024	Nominal voltage [V]
BXT	Product family
R	Open construction

WE CREATE MOTION

FAULHABER BXT

Advantages of this series at a glance

- External rotor motors with very high torque
- Continuous output up to 100 W
- Outstanding ratio of torque to weight and size
- Flat design for space-critical applications. Length range of 14 to 21 mm.
- Matching optical and magnetic encoders, gearheads and controls available
- 14-pole construction



NEW

Brushless DC-Flat Motors

External rotor technology, without housing

10,2 mNm

9 W

Series 2214 ... BXT R

Values at 22°C and nominal voltage		2214 S	006 BXT R	012 BXT R	024 BXT R	
1	Nominal voltage	U_N	6	12	24	V
2	Terminal resistance, phase-phase	R	2,42	6,95	25,9	Ω
3	Efficiency, max.	η_{max}	72	73	70	%
4	No-load speed	n_0	5 740	6 500	6 960	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,062	0,039	0,016	A
6	Starting torque	M_A	23,5	29,1	29,6	mNm
7	Speed constant	k_n	997	561	296	min ⁻¹ /V
8	Back-EMF constant	k_E	1	1,78	3,37	mV/min ⁻¹
9	Torque constant	k_M	9,58	17	32,2	mNm/A
10	Current constant	k_I	0,104	0,0588	0,031	A/mNm
11	Slope of n-M curve	$\Delta n / \Delta M$	252	229	238	min ⁻¹ /mNm
12	Terminal inductance, phase-phase	L	271	884	3 150	μH
13	Mechanical time constant	τ_m	8,7	7,92	8,22	ms
14	Rotor inertia	J	3,3	3,3	3,3	gcm ²
15	Angular acceleration	α_{max}	71,1	88,2	89,7	·10 ³ rad/s ²
16	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
17	Shaft bearings		ball bearings, preloaded			
18	Shaft load max.:					
	– with shaft diameter		3			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		6			N
	– axial at 3 000 min ⁻¹ (push / pull)		2			N
	– axial at standstill (push / pull)		50			N
19	Shaft play:					
	– radial	\leq	0,015			mm
	– axial	$=$	0			mm
20	Mass		25,5			g
21	Direction of rotation		electronically reversible			
22	Speed up to	n_{max}	10 000			min ⁻¹
23	Number of pole pairs		7			
24	Hall sensors		digital			
25	Magnet material		NdFeB			
Rated values for continuous operation						
26	Rated torque	M_N	9,5	10	10,2	mNm
27	Rated current (thermal limit)	I_N	1,18	0,66	0,368	A
28	Rated speed	n_N	1 200	2 590	2 600	min ⁻¹
29	Rated slope of n-M curve	$\Delta n / \Delta M$	478	391	427	min ⁻¹ /mNm

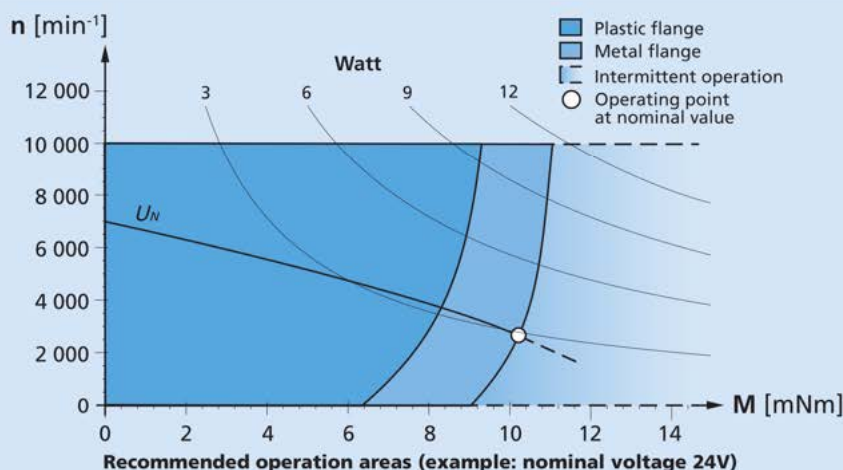
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

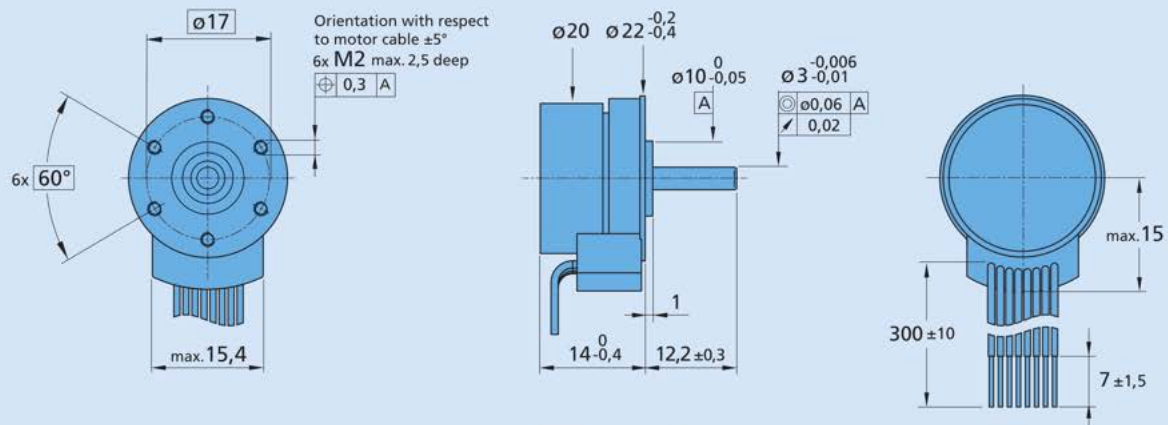
Note:

The display shows the range of possible operation points of the drives at a given ambient temperature of 22°C.


The diagram indicates the recommended speed in relation to the available torque at the output shaft. It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage. Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Dimensional drawing

2214 S ... BXT R
Option, cable and connection information

 Example product designation: **2214S012BXTR-3830**

Option	Type	Description	Connection	
			Function	Colour
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
4337	Gearhead combination	For combination with gearhead 20/1R	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PVC,	
			AWG 26, Phase A/B/C	
			AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
20/1R 22F 22GPT 26/1R		SC 1801 P SC 1801 S SC 2402 P SC 2804 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

NEW

Brushless DC-Flat Motors

External rotor technology, with housing

9,7 mNm

6 W

Series 2214 ... BXT H

Values at 22°C and nominal voltage		2214 S	006 BXT H	012 BXT H	024 BXT H	
1	Nominal voltage	U_N	6	12	24	V
2	Terminal resistance, phase-phase	R	2,42	6,95	25,9	Ω
3	Efficiency, max.	η_{max}	72	74	69	%
4	No-load speed	n_0	5 760	6 500	6 970	min ⁻¹
5	No-load current, typ. (with shaft \varnothing 3 mm)	I_0	0,061	0,04	0,016	A
6	Starting torque	M_A	23,5	29,1	29,6	mNm
7	Speed constant	k_n	997	561	296	min ⁻¹ /V
8	Back-EMF constant	k_E	1	1,78	3,37	mV/min ⁻¹
9	Torque constant	k_M	9,58	17	32,2	mNm/A
10	Current constant	k_I	0,104	0,0588	0,031	A/mNm
11	Slope of n-M curve	$\Delta n / \Delta M$	252	229	238	min ⁻¹ /mNm
12	Terminal inductance, phase-phase	L	271	884	3 150	μ H
13	Mechanical time constant	τ_m	8,7	7,92	8,22	ms
14	Rotor inertia	J	3,3	3,3	3,3	gcm ²
15	Angular acceleration	α_{max}	71,1	88,2	89,7	·10 ³ rad/s ²
16	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
17	Shaft bearings		ball bearings, preloaded			
18	Shaft load max.:					
	– with shaft diameter		3			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		6			N
	– axial at 3 000 min ⁻¹ (push / pull)		2			N
	– axial at standstill (push / pull)		50			N
19	Shaft play:					
	– radial	\leq	0,015			mm
	– axial	$=$	0			mm
20	Mass		28,9			g
21	Direction of rotation		electronically reversible			
22	Speed up to	n_{max}	10 000			min ⁻¹
23	Number of pole pairs		7			
24	Hall sensors		digital			
25	Magnet material		NdFeB			
Rated values for continuous operation						
26	Rated torque	M_N	9,4	9,7	9,7	mNm
27	Rated current (thermal limit)	I_N	1,16	0,653	0,36	A
28	Rated speed	n_N	1 260	2 630	2 710	min ⁻¹
29	Rated slope of n-M curve	$\Delta n / \Delta M$	479	399	439	min ⁻¹ /mNm

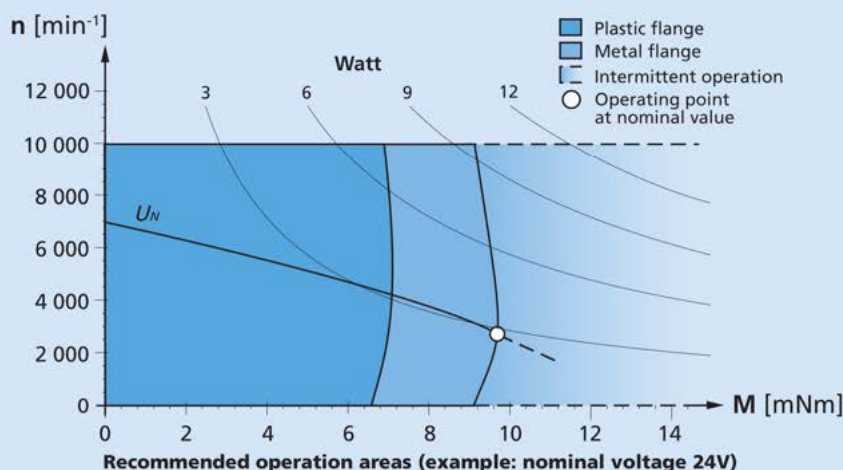
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

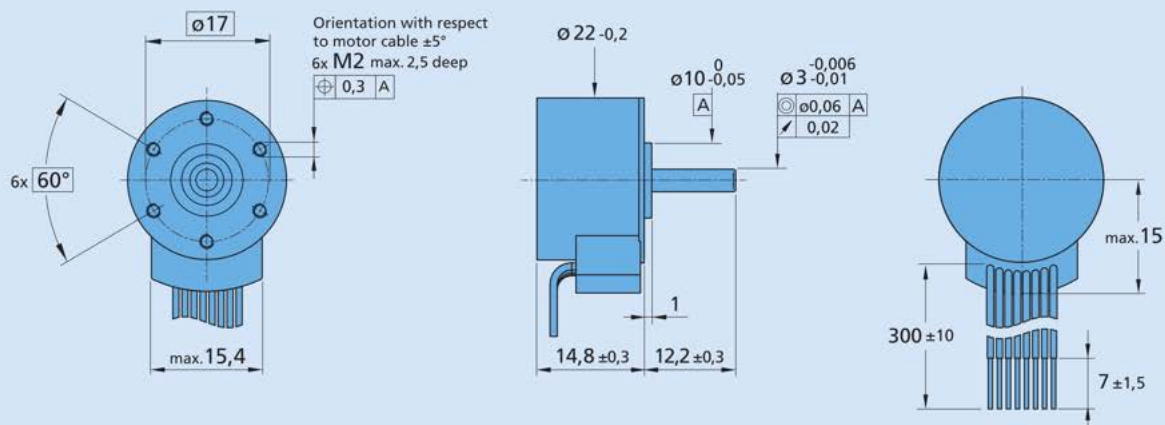
The display shows the range of possible operation points of the drives at a given ambient temperature of 22°C.

The diagram indicates the recommended speed in relation to the available torque at the output shaft. It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage. Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Dimensional drawing



Option, cable and connection information

Example product designation: **2214S012BXT H-3830**

Option	Type	Description	Connection	
			Function	Colour
3830	Connector	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
4337	Gearhead combination	For combination with gearhead 20/1R	Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PVC,	
			AWG 26, Phase A/B/C	
			AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
20/1R 22F 22GPT 26/1R	IE3-1024 IE3-1024 L IEF3-4096 IEF3-4096 L IERS3-500 IERS3-500 L IER3-10000 IER3-10000 L	SC 1801 P SC 1801 S SC 2402 P SC 2804 S MC 5004 P MC 5005 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

NEW

Brushless DC-Flat Motors

External rotor technology, without housing

41 mNm

30 W

Series 3216 ... BXT R

Values at 22°C and nominal voltage		3216 W	009 BXT R	012 BXT R	024 BXT R	
1	Nominal voltage	U_N	9	12	24	V
2	Terminal resistance, phase-phase	R	0,55	0,88	3,26	Ω
3	Efficiency, max.	$\eta_{max.}$	82	83	82	%
4	No-load speed	n_0	6 020	6 240	6 200	min ⁻¹
5	No-load current, typ. (with shaft ø 4 mm)	I_0	0,179	0,129	0,084	A
6	Starting torque	M_A	225	245	263	mNm
7	Speed constant	k_n	691	530	267	min ⁻¹ /V
8	Back-EMF constant	k_E	1,45	1,89	3,75	mV/min ⁻¹
9	Torque constant	k_M	13,8	18	35,8	mNm/A
10	Current constant	k_I	0,0724	0,0555	0,0279	A/mNm
11	Slope of n-M curve	$\Delta n / \Delta M$	27,5	25,9	24,3	min ⁻¹ /mNm
12	Terminal inductance, phase-phase	L	191	331	1 290	μH
13	Mechanical time constant	τ_m	5,28	4,97	4,66	ms
14	Rotor inertia	J	18,3	18,3	18,3	gcm ²
15	Angular acceleration	$\alpha_{max.}$	123	134	144	·10 ³ rad/s ²
16	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
17	Shaft bearings		ball bearings, preloaded			
18	Shaft load max.:					
	– with shaft diameter		4			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		15			N
	– axial at 3 000 min ⁻¹ (push / pull)		3			N
	– axial at standstill (push / pull)		50			N
19	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
20	Mass		57,9			g
21	Direction of rotation		electronically reversible			
22	Speed up to	$n_{max.}$	10 000			min ⁻¹
23	Number of pole pairs		7			
24	Hall sensors		digital			
25	Magnet material		NdFeB			
Rated values for continuous operation						
26	Rated torque	M_N	39,5	40	41	mNm
27	Rated current (thermal limit)	I_N	2,87	2,28	1,17	A
28	Rated speed	n_N	3 320	3 750	4 150	min ⁻¹
29	Rated slope of n-M curve	$\Delta n / \Delta M$	68,4	62,3	50	min ⁻¹ /mNm

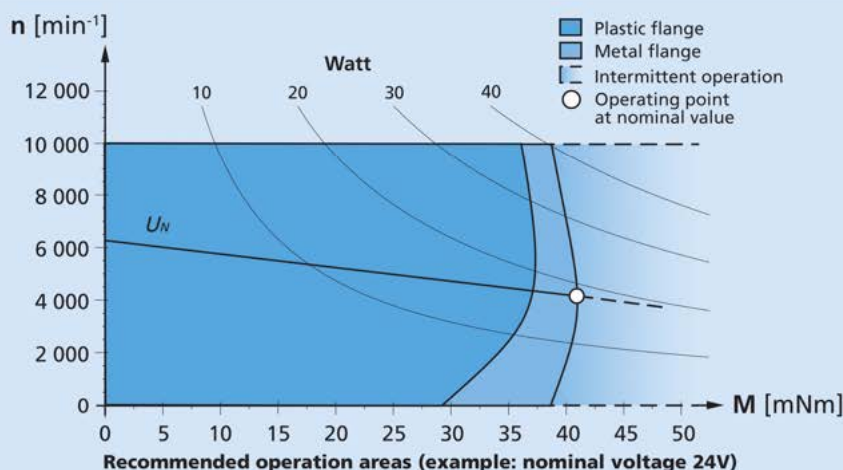
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

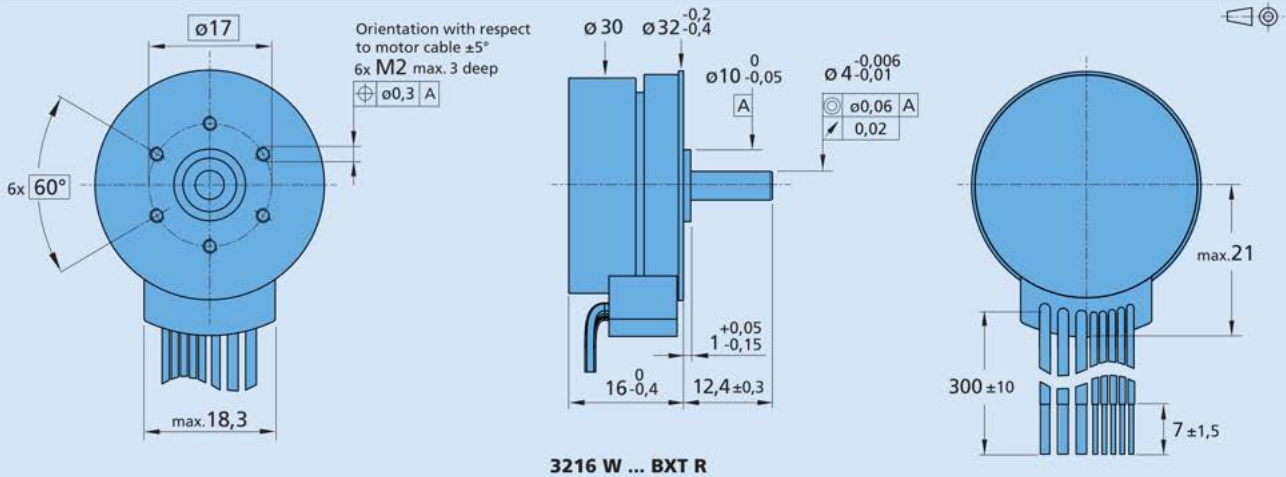
Note:

The display shows the range of possible operation points of the drives at a given ambient temperature of 22°C.


The diagram indicates the recommended speed in relation to the available torque at the output shaft. It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage. Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Dimensional drawing

Option, cable and connection information

 Example product designation: **3216W012BXTR-3830**

Option	Type	Description	Connection	
			Function	Colour
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PVC,	
			AWG 20, Phase A/B/C	
			AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
26A 26/1R 32GPT 32/3R		SC 2402 P SC 2804 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

NEW

Brushless DC-Flat Motors

External rotor technology, with housing

38 mNm

20 W

Series 3216 ... BXT H

Values at 22°C and nominal voltage	3216 W	009 BXT H	012 BXT H	024 BXT H	
1 Nominal voltage	U_N	9	12	24	V
2 Terminal resistance, phase-phase	R	0,55	0,88	3,26	Ω
3 Efficiency, max.	η_{max}	83	84	81	%
4 No-load speed	n_0	6 060	6 230	6 250	min ⁻¹
5 No-load current, typ. (with shaft ø 4 mm)	I_0	0,165	0,126	0,068	A
6 Starting torque	M_A	225	245	263	mNm
7 Speed constant	k_n	691	530	267	min ⁻¹ /V
8 Back-EMF constant	k_E	1,45	1,89	3,75	mV/min ⁻¹
9 Torque constant	k_M	13,8	18	35,8	mNm/A
10 Current constant	k_I	0,0724	0,0555	0,0279	A/mNm
11 Slope of n-M curve	$\Delta n / \Delta M$	27,5	25,9	24,3	min ⁻¹ /mNm
12 Terminal inductance, phase-phase	L	191	331	1 290	μH
13 Mechanical time constant	τ_m	5,28	4,97	4,66	ms
14 Rotor inertia	J	18,3	18,3	18,3	gcm ²
15 Angular acceleration	α_{max}	123	134	144	·10 ³ rad/s ²
16 Operating temperature range:					
– motor		-40 ... +100			°C
– winding, max. permissible		+125			°C
17 Shaft bearings		ball bearings, preloaded			
18 Shaft load max.:					
– with shaft diameter		4			mm
– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		15			N
– axial at 3 000 min ⁻¹ (push / pull)		3			N
– axial at standstill (push / pull)		50			N
19 Shaft play:					
– radial	≤	0,015			mm
– axial	=	0			mm
20 Mass		65,3			g
21 Direction of rotation		electronically reversible			
22 Speed up to	n_{max}	10 000			min ⁻¹
23 Number of pole pairs		7			
24 Hall sensors		digital			
25 Magnet material		NdFeB			
Rated values for continuous operation					
26 Rated torque	M_N	37	38	38	mNm
27 Rated current (thermal limit)	I_N	2,76	2,18	1,1	A
28 Rated speed	n_N	3 400	3 860	4 320	min ⁻¹
29 Rated slope of n-M curve	$\Delta n / \Delta M$	71,9	62,4	50,8	min ⁻¹ /mNm

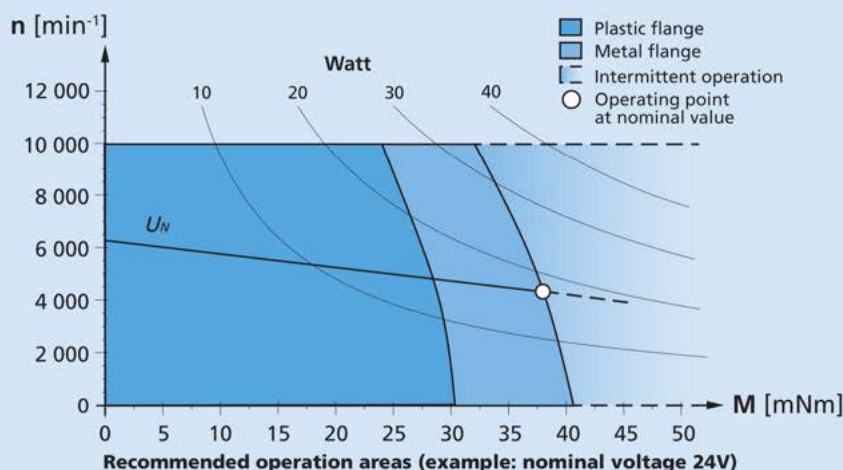
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

The display shows the range of possible operation points of the drives at a given ambient temperature of 22°C.

The diagram indicates the recommended speed in relation to the available torque at the output shaft. It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage. Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Technical drawing of the 3216 W ... BXT H motor terminal box, showing three views: front, side, and top.

Front View (Left):

- Overall diameter: $\varnothing 17$
- 6x $M2$ max. 3 deep
- Orientation with respect to motor cable $\pm 5^\circ$
- 6x 60°
- max. 18.3

Side View (Middle):

- Overall height: $\varnothing 32_{-0.2}^{+0.2}$
- Width: 16.8 ± 0.3
- Internal width: 12.4 ± 0.3
- Internal height: $1_{-0.15}^{+0.05}$
- Internal diameter: $\varnothing 10_{-0.05}^{+0}$
- Internal height: 0.02
- Internal diameter: $\varnothing 4_{-0.01}^{-0.006}$

Top View (Right):

- Overall diameter: $\varnothing 17$
- max. 21
- 300 ± 10
- 7 ± 1.5

3216 W ... BXT H

Example product designation: **3216W012BXTH-3830**

Product combination			
Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
26A 26/1R 32GPT 32/3R	IE3-1024 IE3-1024 L IEF3-4096 IEF3-4096 L IERS3-500 IERS3-500 L IER3-10000 IER3-10000 L	SC 2402 P SC 2804 S MC 5004 P MC 5005 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

NEW

Brushless DC-Flat Motors

External rotor technology, without housing

134 mNm

100 W

Series 4221 ... BXT R

Values at 22°C and nominal voltage		4221 G	018 BXT R	024 BXT R	048 BXT R	
1	Nominal voltage	U_N	18	24	48	V
2	Terminal resistance, phase-phase	R	0,46	0,74	2,6	Ω
3	Efficiency, max.	η_{max}	88	87	88	%
4	No-load speed	n_0	5 670	5 960	6 070	min ⁻¹
5	No-load current, typ. (with shaft ø 5 mm)	I_0	0,181	0,186	0,074	A
6	Starting torque	M_A	1 170	1 220	1 390	mNm
7	Speed constant	k_n	320	253	127	min ⁻¹ /V
8	Back-EMF constant	k_E	3,13	3,95	7,87	mV/min ⁻¹
9	Torque constant	k_M	29,8	37,7	75,2	mNm/A
10	Current constant	k_I	0,0335	0,0265	0,0133	A/mNm
11	Slope of n-M curve	$\Delta n / \Delta M$	4,93	4,97	4,4	min ⁻¹ /mNm
12	Terminal inductance, phase-phase	L	396	664	2 550	μH
13	Mechanical time constant	τ_m	3,56	3,59	3,18	ms
14	Rotor inertia	J	69	69	69	gcm ²
15	Angular acceleration	α_{max}	169	177	201	·10 ³ rad/s ²
16	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
17	Shaft bearings		ball bearings, preloaded			
18	Shaft load max.:					
	– with shaft diameter		5			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		25			N
	– axial at 3 000 min ⁻¹ (push / pull)		4			N
	– axial at standstill (push / pull)		50			N
19	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
20	Mass		127			g
21	Direction of rotation		electronically reversible			
22	Speed up to	n_{max}	10 000			min ⁻¹
23	Number of pole pairs		7			
24	Hall sensors		digital			
25	Magnet material		NdFeB			
Rated values for continuous operation						
26	Rated torque	M_N	122	127	134	mNm
27	Rated current (thermal limit)	I_N	3,6	3,17	1,66	A
28	Rated speed	n_N	3 690	4 180	4 390	min ⁻¹
29	Rated slope of n-M curve	$\Delta n / \Delta M$	16,3	14	12,5	min ⁻¹ /mNm

Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

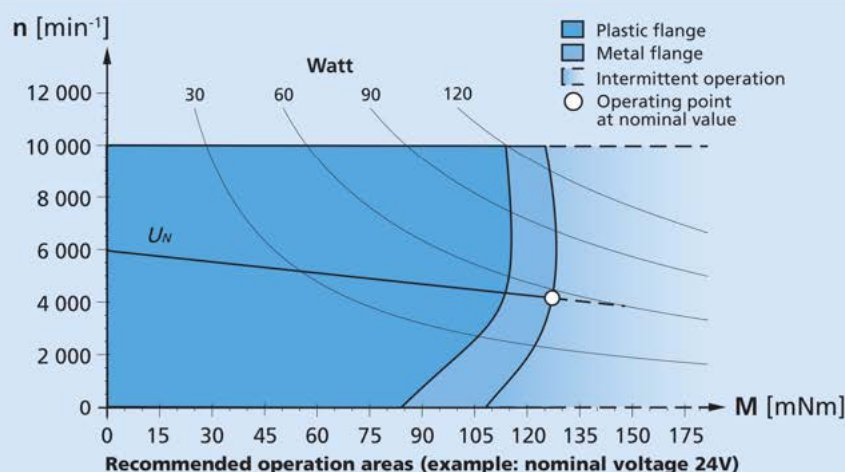
The display shows the range of possible operation points of the drives at a given ambient temperature of 22°C.

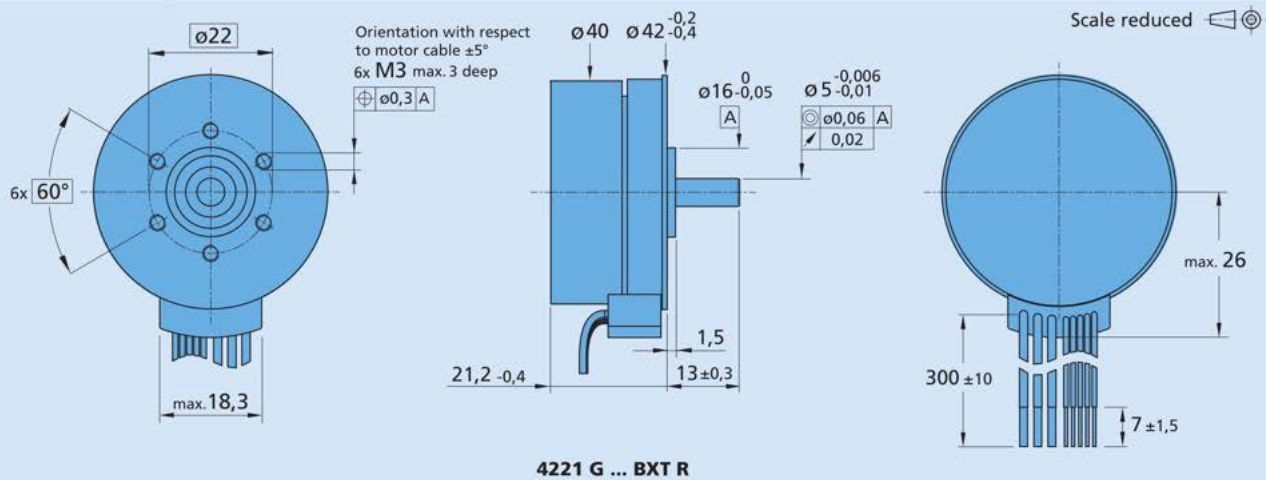
The diagram indicates the recommended speed in relation to the available torque at the output shaft.

It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).


The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage.

Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Dimensional drawing

Option, cable and connection information

 Example product designation: **4221G018BXTR-3830**

Option	Type	Description	Connection	
			Function	Colour
3830		Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PVC,	
			AWG 20, Phase A/B/C	
			AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
32A 38/1 38/1 S 38/2 38/2 S 42GPT		SC 2804 S SC 5004 P SC 5008 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

NEW

Brushless DC-Flat Motors

External rotor technology, with housing

112 mNm

60 W

Series 4221 ... BXT H

Values at 22°C and nominal voltage		4221 G	018 BXT H	024 BXT H	048 BXT H	
1	Nominal voltage	U_N	18	24	48	V
2	Terminal resistance, phase-phase	R	0,46	0,74	2,6	Ω
3	Efficiency, max.	η_{max}	88	87	88	%
4	No-load speed	n_0	5 710	6 040	6 070	min ⁻¹
5	No-load current, typ. (with shaft ø 5 mm)	I_0	0,177	0,139	0,103	A
6	Starting torque	M_A	1 170	1 220	1 390	mNm
7	Speed constant	k_n	320	253	127	min ⁻¹ /V
8	Back-EMF constant	k_E	3,13	3,95	7,87	mV/min ⁻¹
9	Torque constant	k_M	29,8	37,7	75,2	mNm/A
10	Current constant	k_I	0,0335	0,0265	0,0133	A/mNm
11	Slope of n-M curve	$\Delta n / \Delta M$	4,93	4,97	4,4	min ⁻¹ /mNm
12	Terminal inductance, phase-phase	L	396	664	2 550	μH
13	Mechanical time constant	τ_m	3,56	3,59	3,18	ms
14	Rotor inertia	J	69	69	69	gcm ²
15	Angular acceleration	α_{max}	169	177	201	·10 ³ rad/s ²
16	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
17	Shaft bearings		ball bearings, preloaded			
18	Shaft load max.:					
	– with shaft diameter		5			mm
	– radial at 3 000 min ⁻¹ (5 mm from mounting flange)		25			N
	– axial at 3 000 min ⁻¹ (push / pull)		4			N
	– axial at standstill (push / pull)		50			N
19	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
20	Mass		142			g
21	Direction of rotation		electronically reversible			
22	Speed up to	n_{max}	10 000			min ⁻¹
23	Number of pole pairs		7			
24	Hall sensors		digital			
25	Magnet material		NdFeB			
Rated values for continuous operation						
26	Rated torque	M_N	102	112	107	mNm
27	Rated current (thermal limit)	I_N	3,33	2,87	1,39	A
28	Rated speed	n_N	3 980	4 380	4 700	min ⁻¹
29	Rated slope of n-M curve	$\Delta n / \Delta M$	17	14,8	12,8	min ⁻¹ /mNm

Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

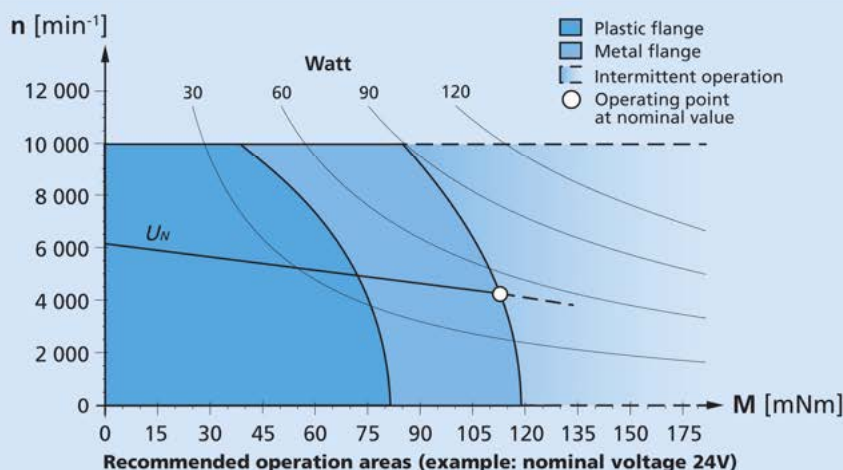
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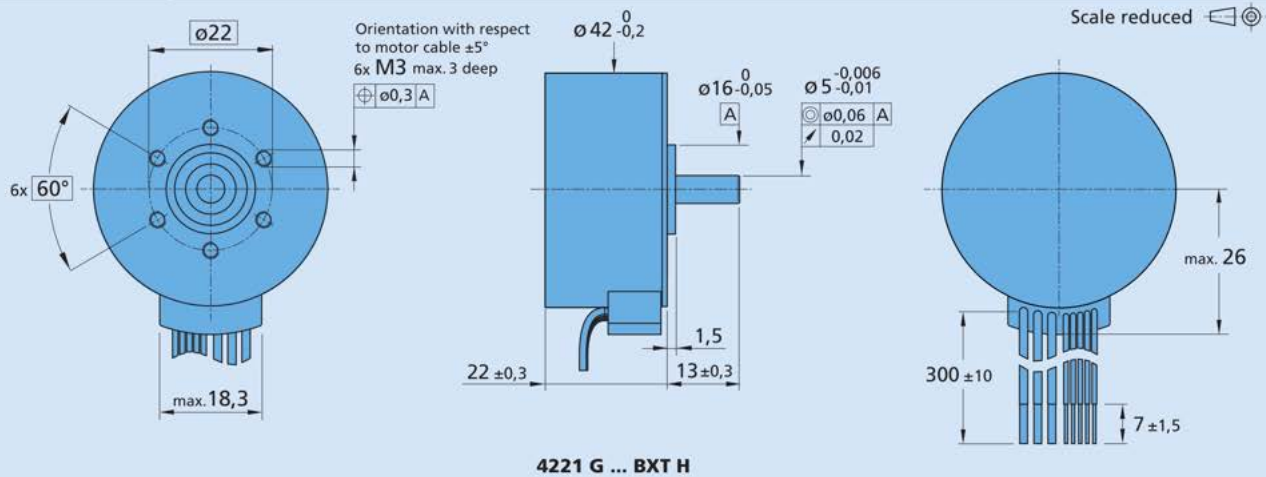
The diagram indicates the recommended speed in relation to the available torque at the output shaft.

It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).


The nominal voltage linear slope describes the maximal achievable operating points at nominal voltage.

Any points of operation above this linear slope will require a supply voltage $U_{mot} > U_N$.



Dimensional drawing

Option, cable and connection information

 Example product designation: **4221G018BXT H-3830**

Option	Type	Description	Connection	
			Function	Colour
3830		Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800	Phase C	yellow
			Phase B	orange
			Phase A	brown
			GND	black
			U _{DD} (+5V)	red
			Hall sensor C	grey
			Hall sensor B	blue
			Hall sensor A	green
			Standard cable	
			Single wires, material PVC, AWG 20, Phase A/B/C	
			AWG 26, Hall A/B/C, U _{DD} , GND	

Product combination

Precision Gearheads / Lead Screws	Encoders	Drive Electronics	Cables / Accessories
32A 38/1 38/1 S 38/2 38/2 S 42GPT	IE3-1024 IE3-1024 L IEF3-4096 IEF3-4096 L IERS3-500 IERS3-500 L IER3-10000 IER3-10000 L	SC 2804 S SC 5004 P SC 5008 S MC 5004 P MC 5005 S	MBZ To view our large range of accessory parts, please refer to the "Accessories" chapter.

Motors with integrated Electronics



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