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FAULHABER

Brushless DC-Motors
Technical Information



WE CREATE MOTION

EN

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.

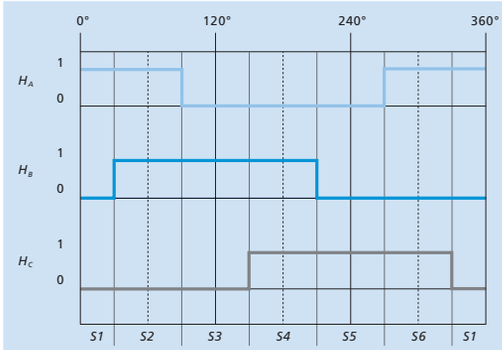
The FAULHABER BP4 family of 4-pole slotless brushless motors are ideal for applications requiring the highest peak torque and extremely dynamic motion control.

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.

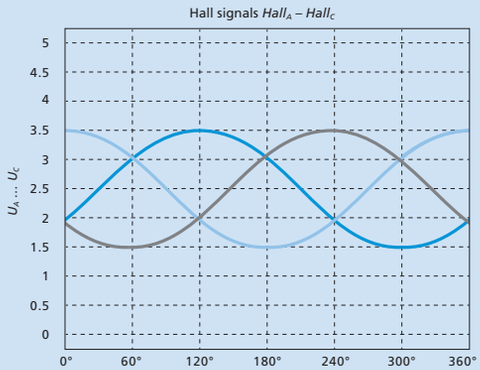


Digital Hall sensor output signal 2-pole motor

Brushless DC-Servomotors

Technical Information

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



Analog Hall sensor output signal 2-pole motor

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 FAUHABER 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.

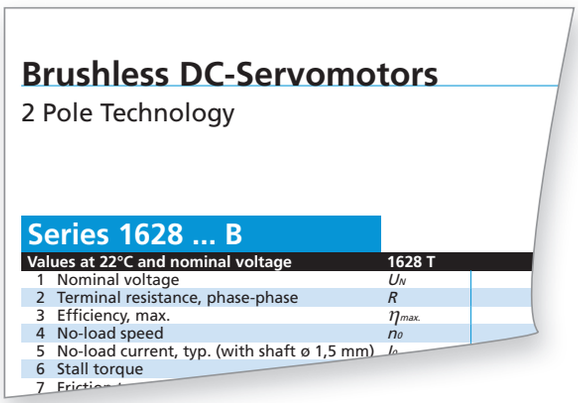
Service life:
Due to the fact that motor commutation is achieved electronically and not mechanically, the operational lifetime of a FAULHABER Brushless DC-Servomotor depends mainly on the lifetime performance of the motor bearings. FAULHABER uses high precision preloaded ball bearings in all of its Brushless 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
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.	$\eta_{max.}$
4	No-load speed	n_0
5	No-load current, typ. (with shaft ø 1,5 mm)	I_o
6	Stall torque	
7	Friction	

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: $\alpha_{22} = 0{,}004\ K^{-1}$).

Efficiency $\eta_{max.}$ [%]
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.

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

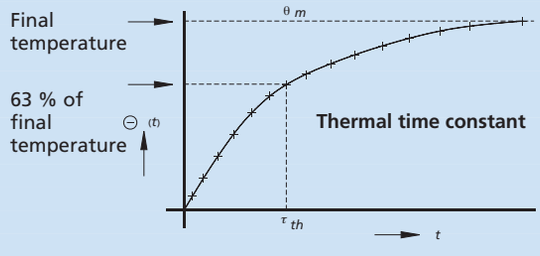
Rotor inertia J [gcm^2]
The dynamic moment of inertia of the rotor.

Angular acceleration $\alpha_{max.}$ [rad/s^2]
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.

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.

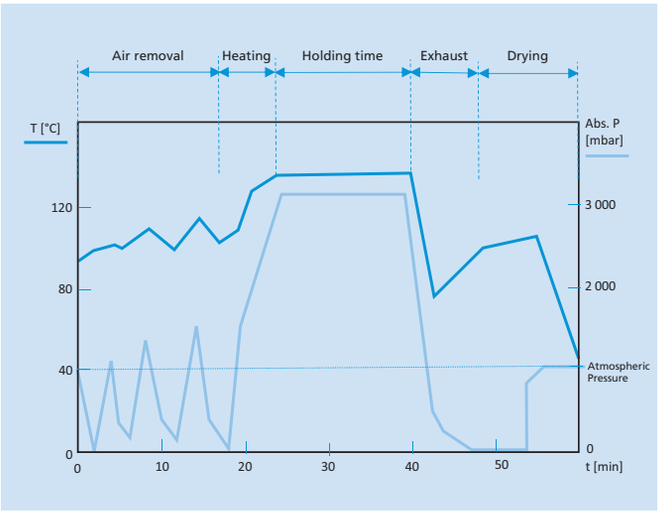
All mechanical dimensions related to the motor shaft are measured with an axial preload of the shaft toward the motor.

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 Sterlizer

Air removal	Fractioned pre-vacuum air removal
Holding Temperature	134 °C
Holding Pressure	ca. 3 100 mbar abs.
Relative Humidity	100 %
Holding Time	18 minutes
Drying	Post-vacuum drying



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.

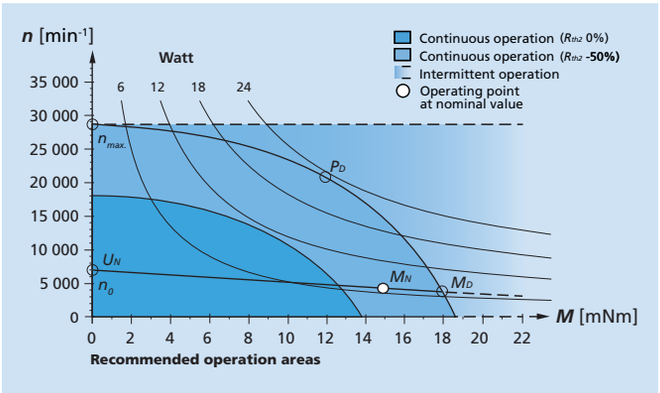
Rated Torque M_N [mNm]
The maximum continuous duty torque (S1 Operation) at nominal voltage resulting in a steady state temperature not exceeding either the maximum winding temperature and/or operating temperature range of the motor. Additionally the motors are specified either with a 25 % reduction 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.

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



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.

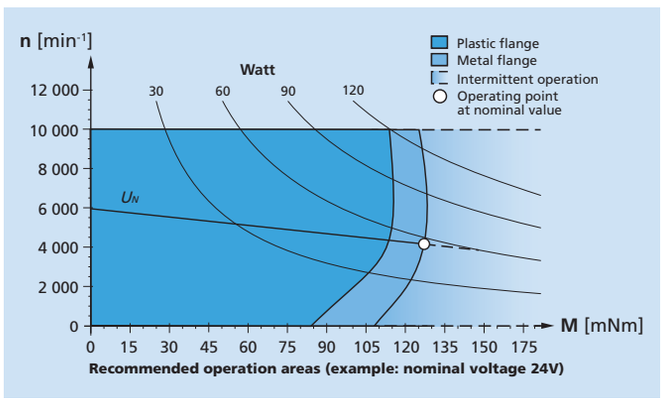
The sector shown dashed describes potential operating points in which the drive can be engaged in intermittent operation or with increased cooling.

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.

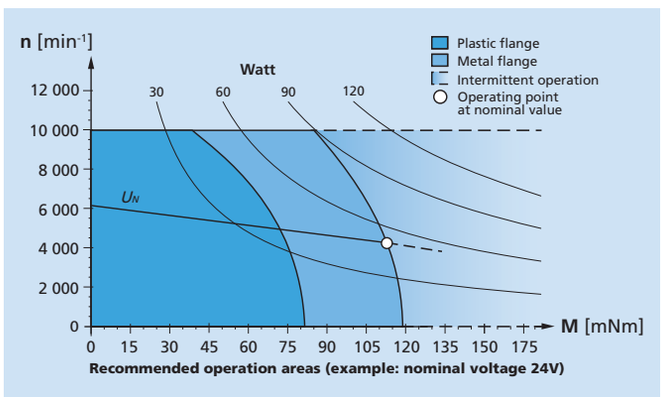
Continuous output power P_D [W]
Describes the max. possible output power in continuous operation in steady state with a thermal reduction of the R_{th2} value by 50 %. The value is independent of the continuous torque, responds linearly to the cooling factor and can be exceeded if the motor is operated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

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 housing. Typically motors without a housing will have a higher performance due to the effects of ambient air flow cooling.



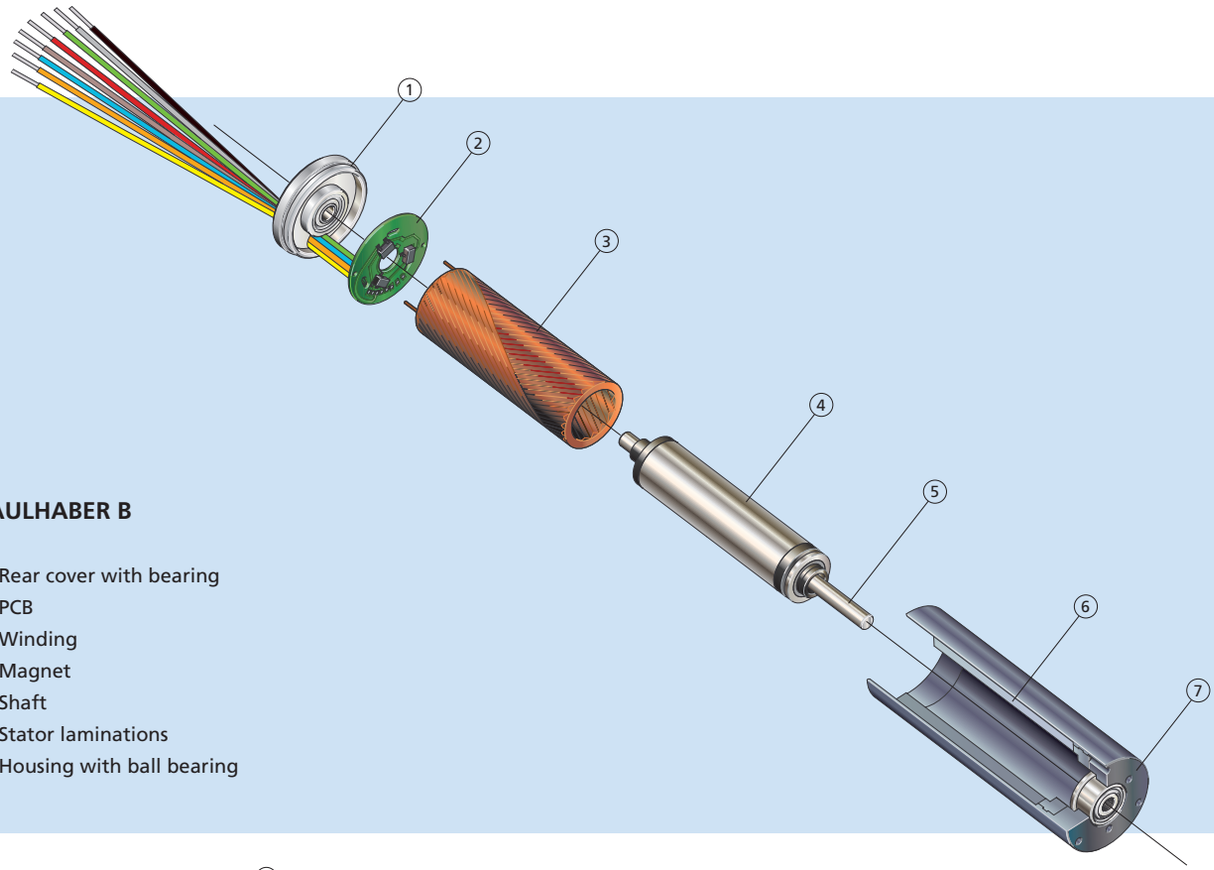
Example: Performance diagram for rated values with continuous operation. (BXT R)



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

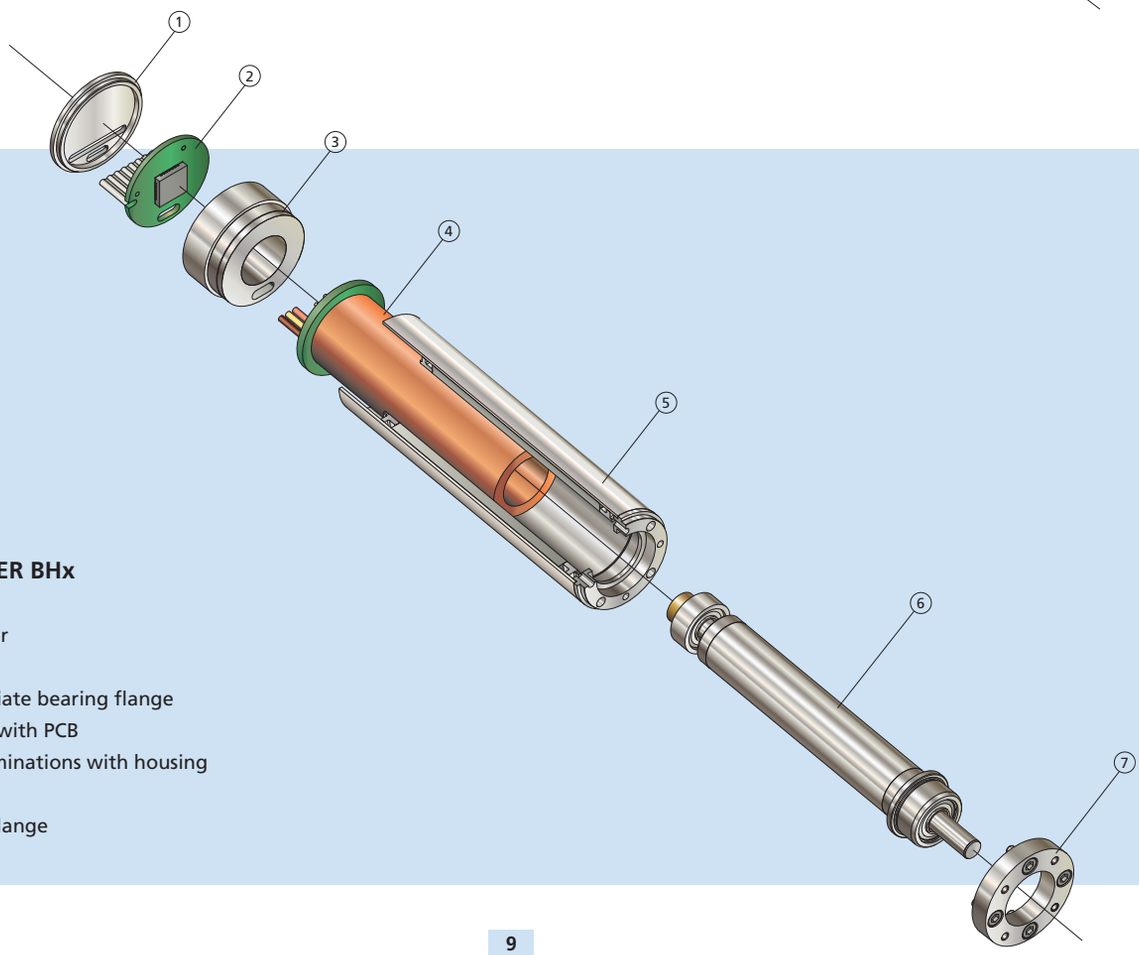
Brushless DC-Servomotors

Basic design



FAULHABER B

① Rear cover with bearing
② PCB
③ Winding
④ Magnet
⑤ Shaft
⑥ Stator laminations
⑦ Housing with ball bearing

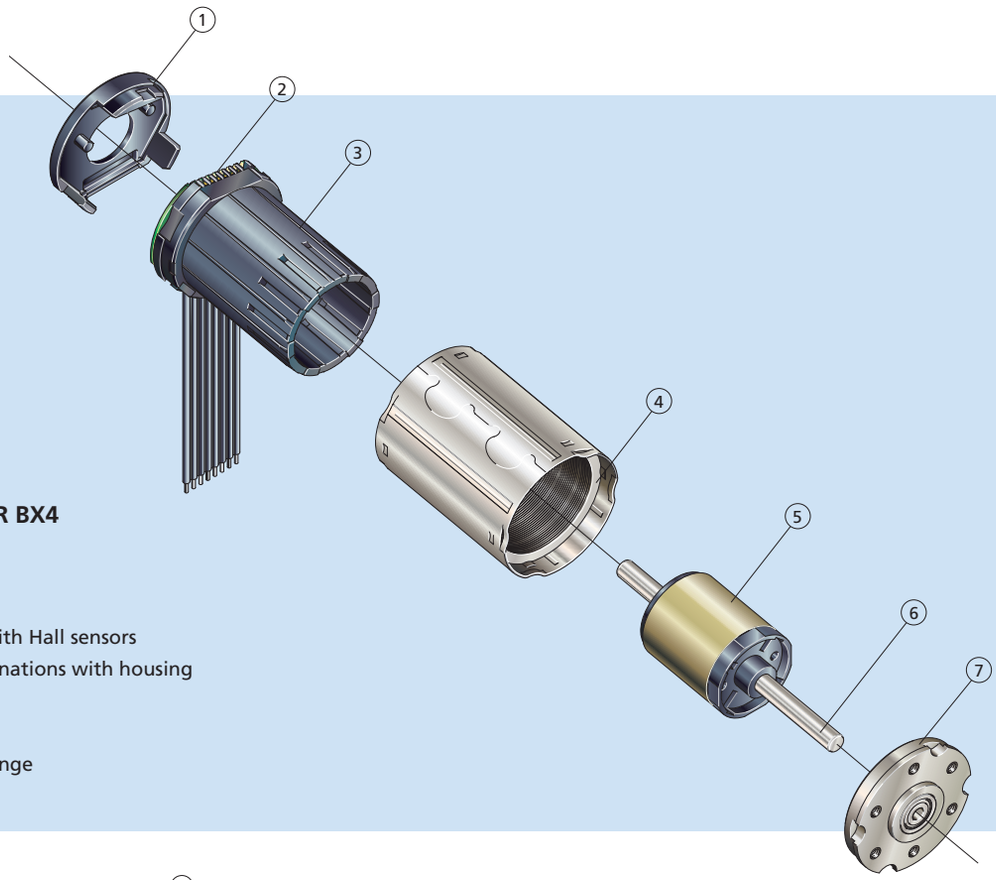


FAULHABER BHx

① Rear cover
② PCB
③ Intermediate bearing flange
④ Winding with PCB
⑤ Stator laminations with housing
⑥ Rotor
⑦ Bearing flange

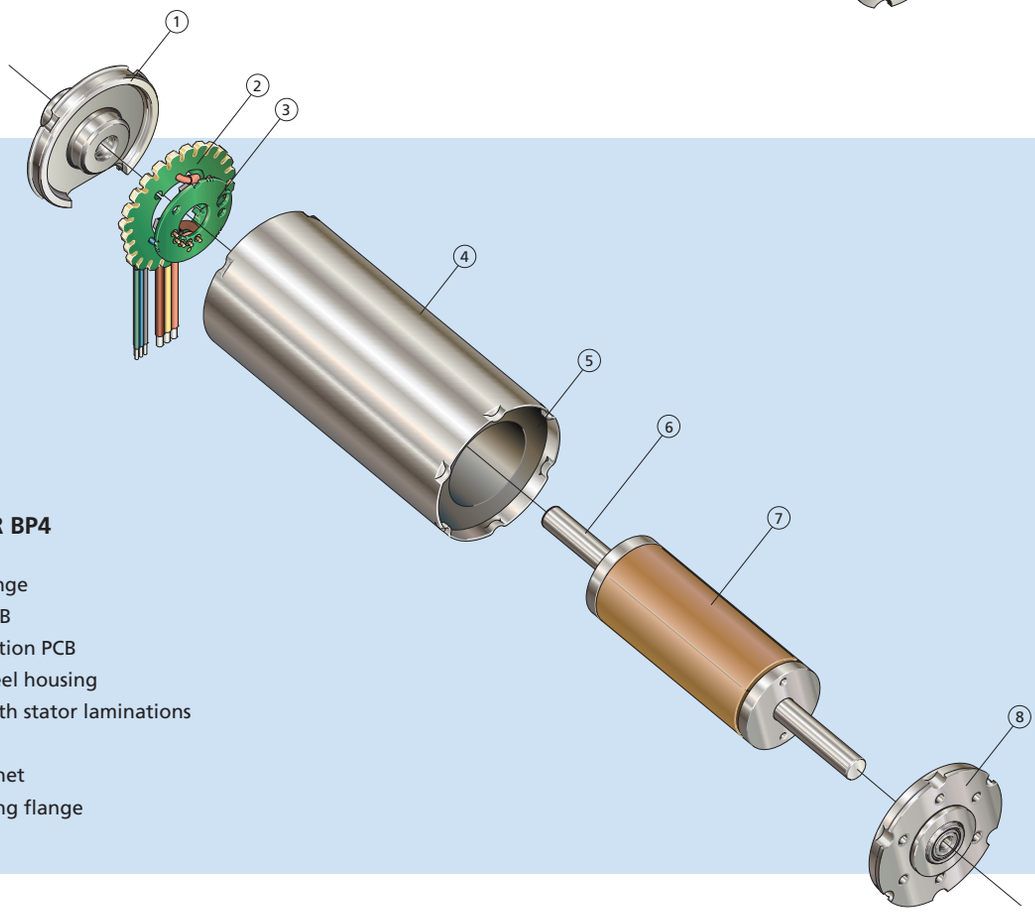
Brushless DC-Servomotors

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

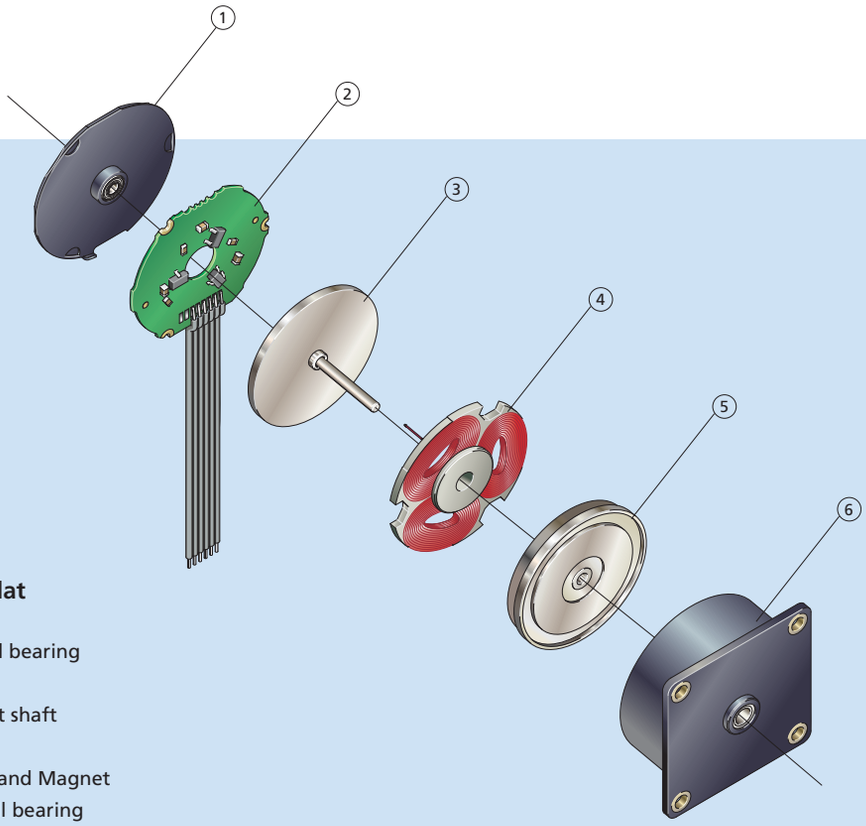


FAULHABER BP4

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

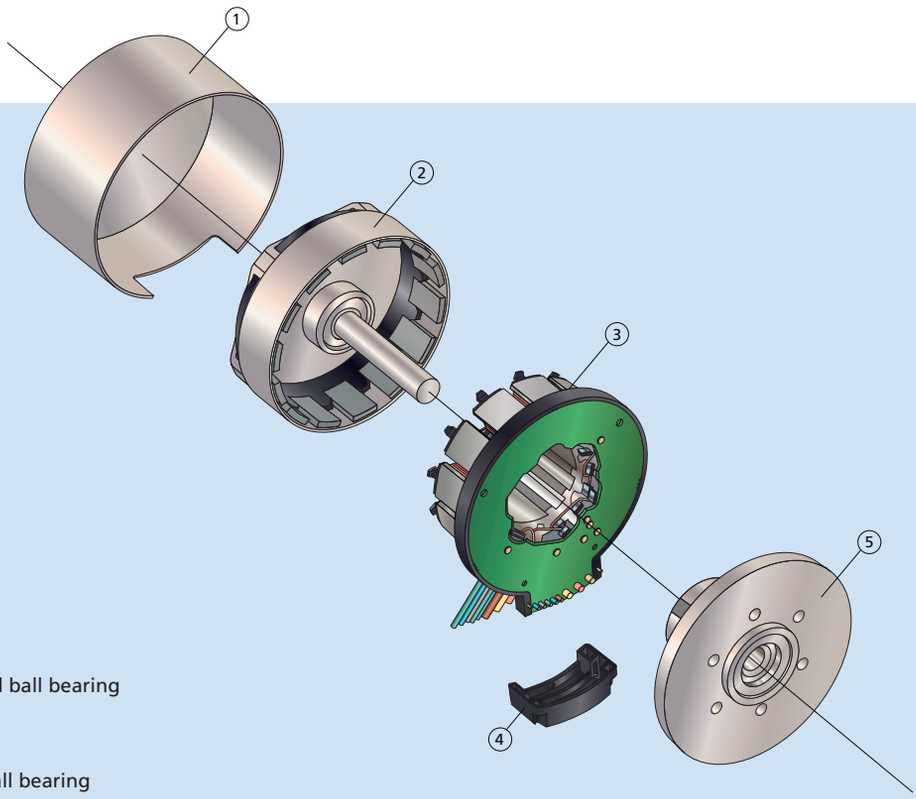
Brushless DC-Flat Motors

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



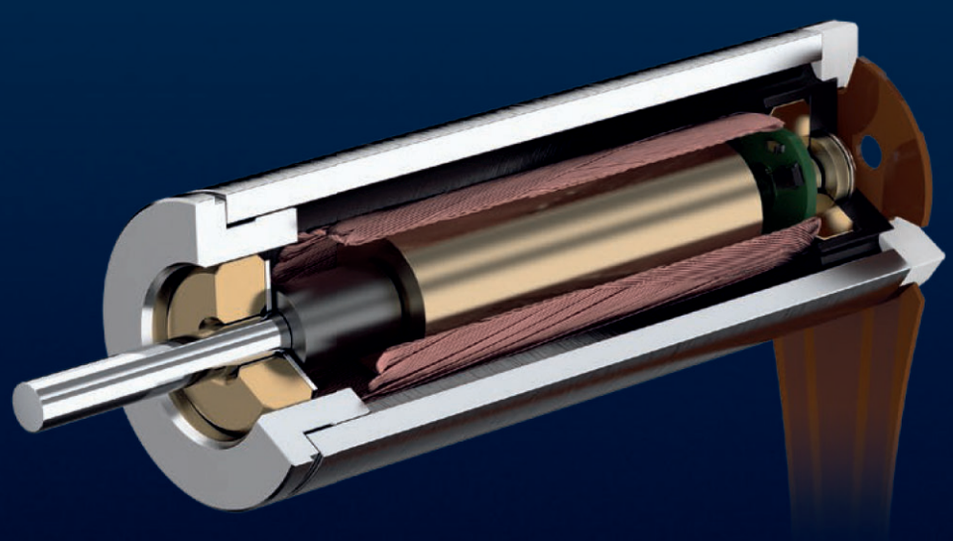
Product Code

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

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

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

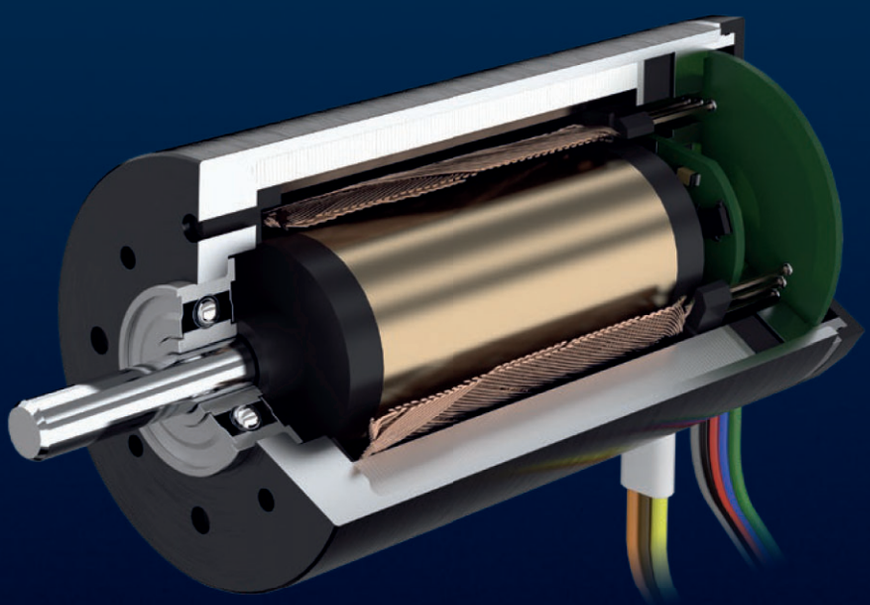
35	Motor diameter [mm]
64	Motor length [mm]
K	Shaft type
024	Nominal voltage [V]
B	Product family

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

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.

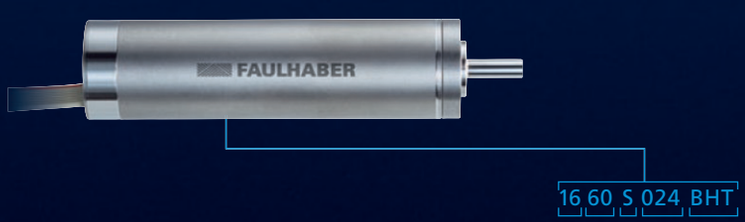
BHx series is capable of driving variable load with minimum speed fluctuation to guarantee smooth behavior at constant speed. Furthermore their low inertia and short response time provide also high dynamics. Those characteristics make BHx series ideal for both-high speed operation and fast accurate positioning, 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



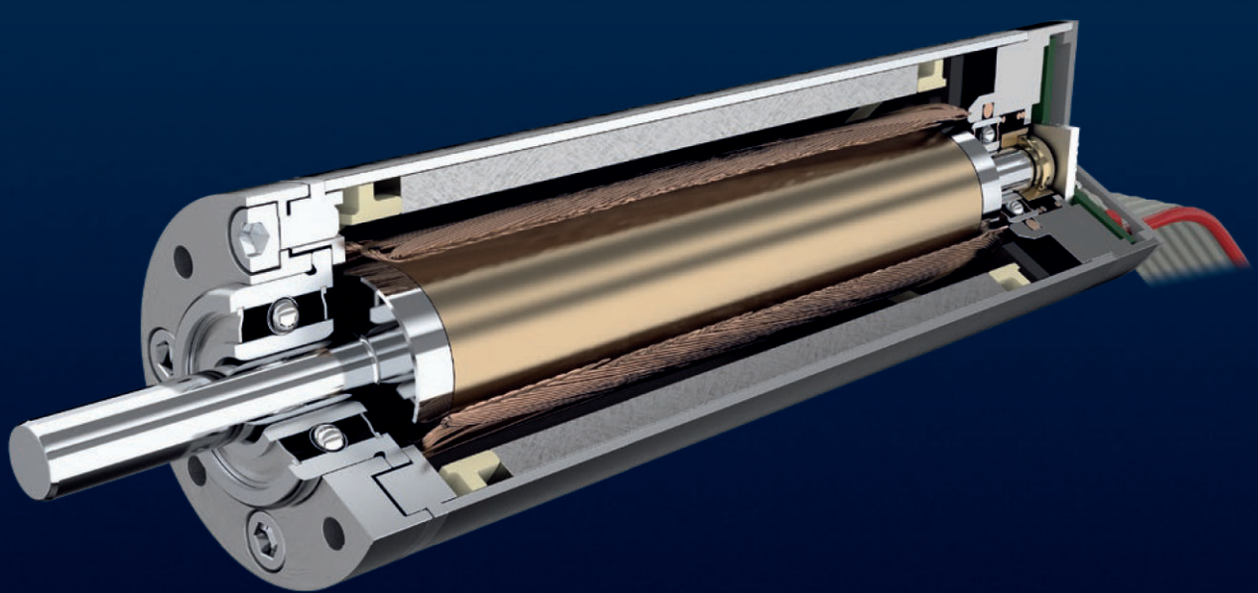
Product Code

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

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



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 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.

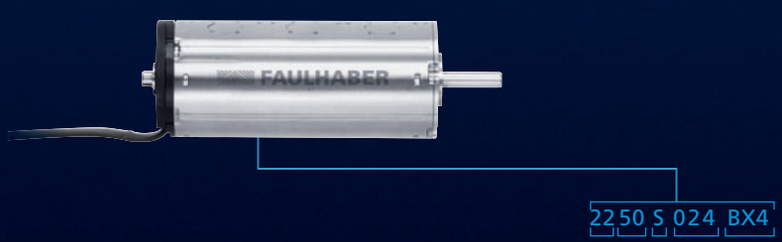
Smooth running, low vibration and low noise mean that these motors can be used in sensitive markets, e.g. medical technology, in addition to market sectors such as automation technology, robotics and machine construction.

Series

2232 … BX4	2250 … BX4
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



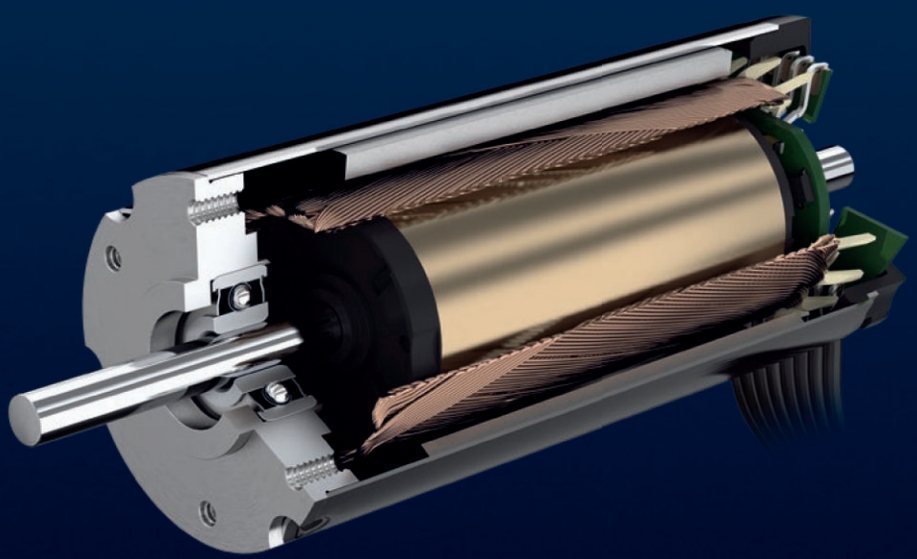
Product Code

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

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

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

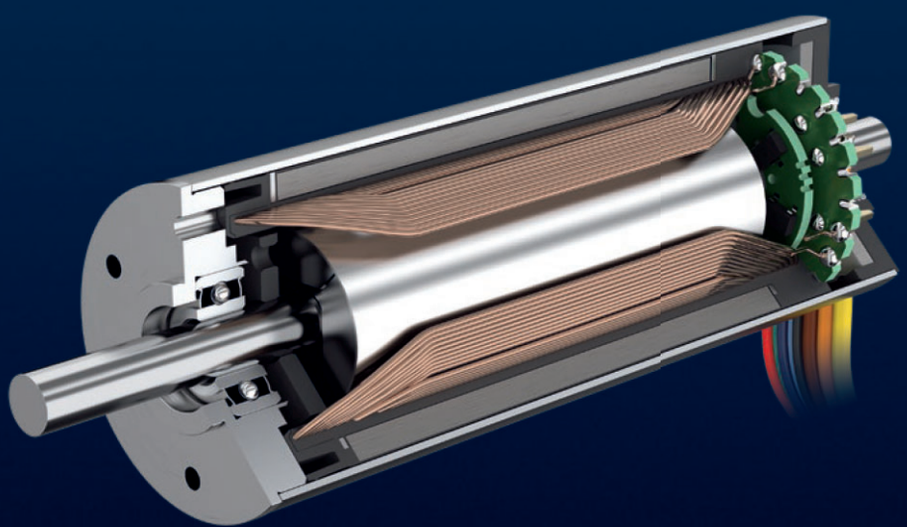
22	Motor diameter [mm]
64	Motor length [mm]
W	Shaft type
024	Nominal voltage [V]
BP4	Product family

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-Flat Motors and DC-Gearmotors

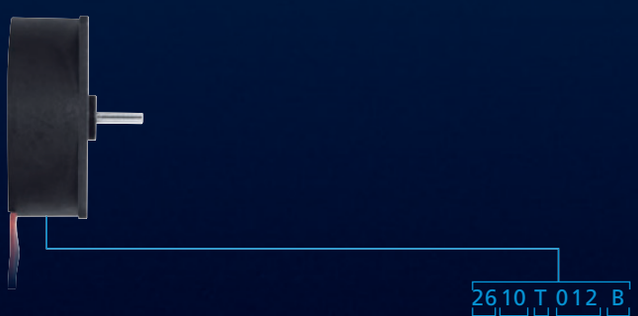
The four-pole brushless DC-Servomotors, which have uniquely flat coil technology with three flat, self-supporting copper windings and are used in the B-Flat series, form the basis for drive systems in applications where space is extremely limited. With their powerful rare-earth magnets, the motors deliver a continuous output of 1.5 W to 9 W and at the same time have only minimal inertia. In combination with the integrated gearheads 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



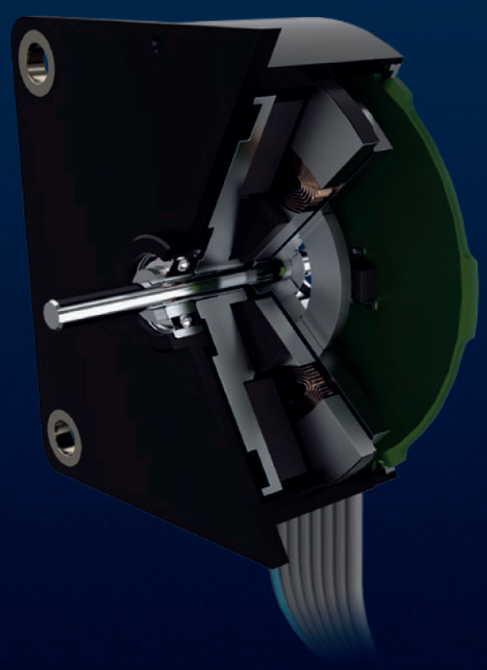
Product Code

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 flat motors with External rotor technology

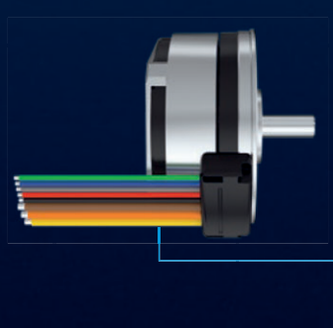
The external rotor motors of the BXT series set new standards: thanks to innovative winding technology and optimum design, the BXT motors deliver a torque of up to 134 mNm. The ratio of torque to weight and size is unmatched. The iron-core motors with 14 high-performance rare earth magnets on the rotor 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



Product Code

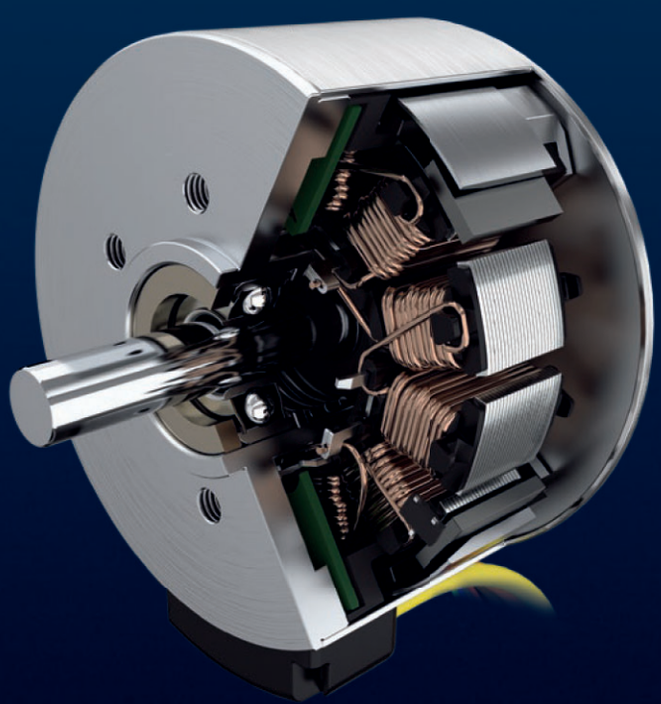
42	Motor diameter [mm]
21	Motor length [mm]
G	Shaft type
024	Nominal voltage [V]
BXT	Product family
R	Open construction

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



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