FAULHABER

FAULHABER BXT

NEW

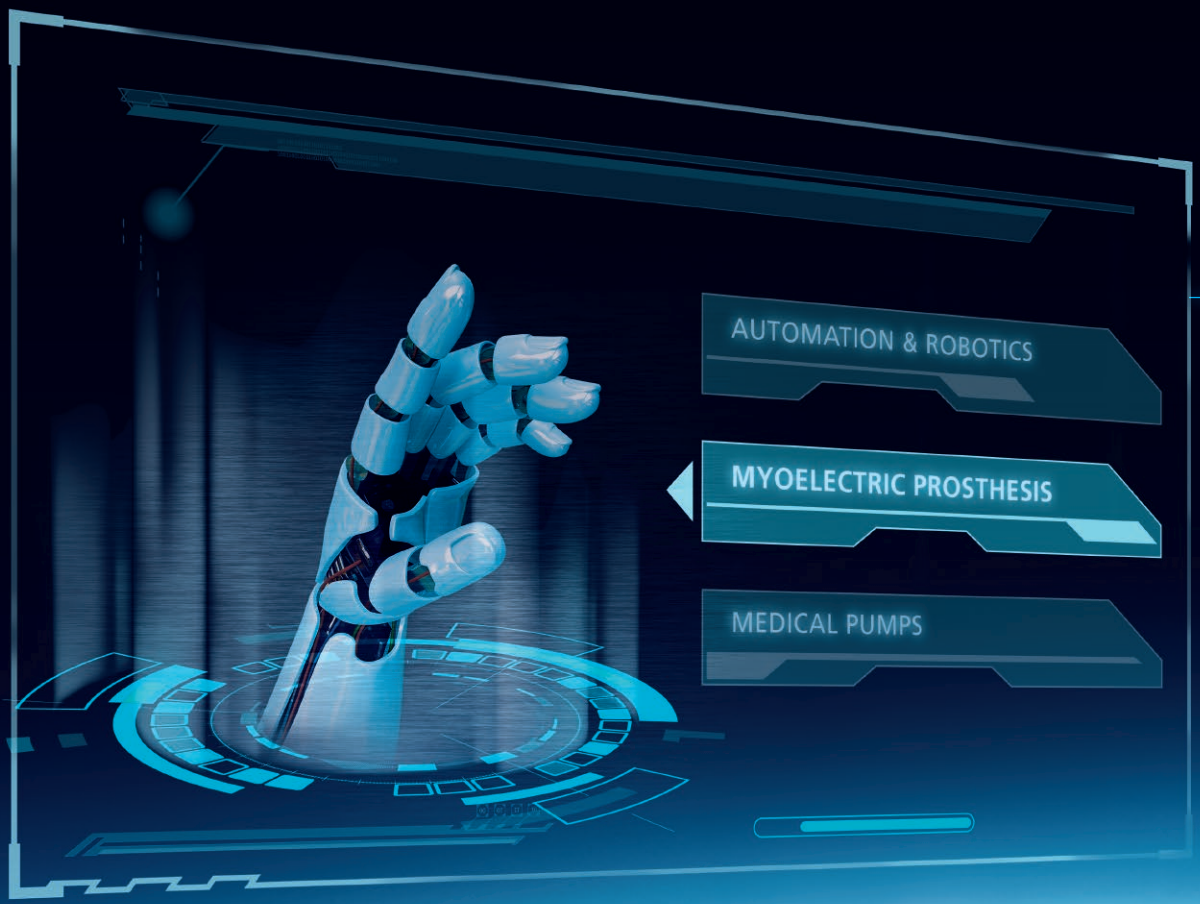
Power in new dimensions

WE CREATE MOTION

EN

FAULHABER BXT

Today, you don't find visionary designs in Hollywood, but rather in the development departments of innovative companies. Requirements for drives are changing – particularly when high-torque motors are required that are as short as possible in the axial direction due to limited installation space, it is often difficult to find a suitable solution.
With the innovative BXT motor family, FAULHABER extends the limits of what is possible for such requirements.



FAULHABER

More power in a very small space

From robotics to prosthetics and even in the medical and laboratory technology: this requirement arises frequently. In terms of making compact yet still extremely high-torque motors, the design of the motor winding and its production are critical. This is where FAULHABER comes in, who has developed the new FAULHABER BXT motor family on the basis of traditional external-rotor motors. As the motors are only 14 mm, 16 mm and 21 mm short in the axial direction, they are easy to accommodate in applications that offer little space.

The three sizes can solve many different drive challenges. For a forearm prosthesis, for example, the small motor can be used for the hand and the mid-sized one for the elbow. Other possible applications for the small compact drives are robot grippers, industrial automation, humanoid robots and even bio-robotics.

The motors also have other impressive characteristics such as good synchronisation properties, which is advantageous for dialysis machines and medical pumps, for example. Thanks to the high copper filling factor and the design of the pole shoes, the magnetic field is strong and the cogging torque very small. The efficiency of the motors significantly exceeds that of comparable motors of this size and design.

The motors are available with or without housing. The unhoused BXT R models are particularly recommended for speed-controlled applications in which high powers are transformed, as the heat is optimally dissipated in the unhoused versions. The housed version BXT H is particularly recommended for positioning applications, as it can be combined with a wide variety of optical and magnetic encoders.

Brushless flat motors with External rotor technology

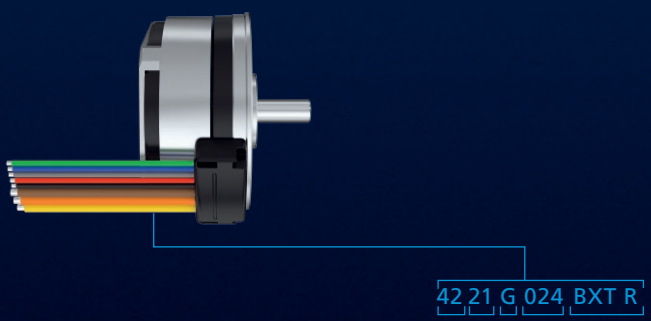
The external rotor motors of the BXT series set new standards: thanks to innovative winding technology and optimum design, the BXT motors deliver a torque of up to 134 mNm. The ratio of torque to weight and size is unmatched. The iron-core motors with 14 high-performance rare earth magnets on the rotor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

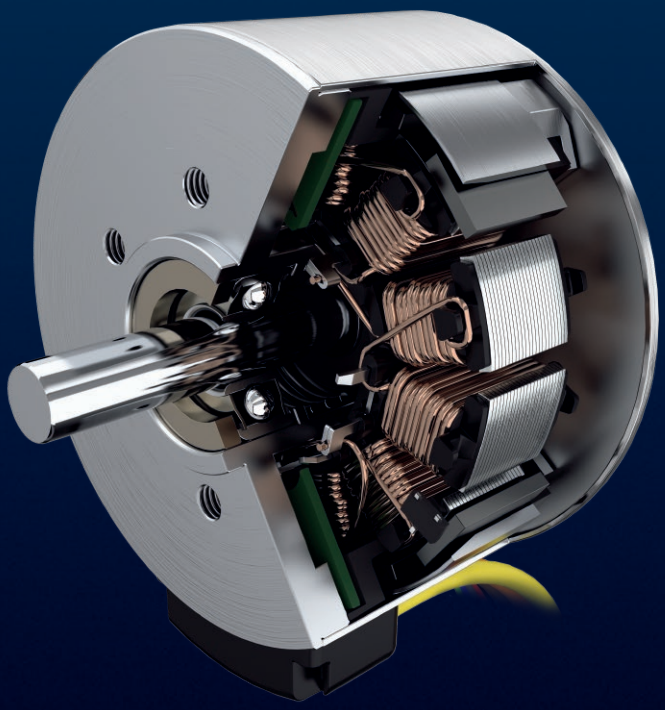
WE CREATE MOTION

FAULHABER

FAULHABER BXT

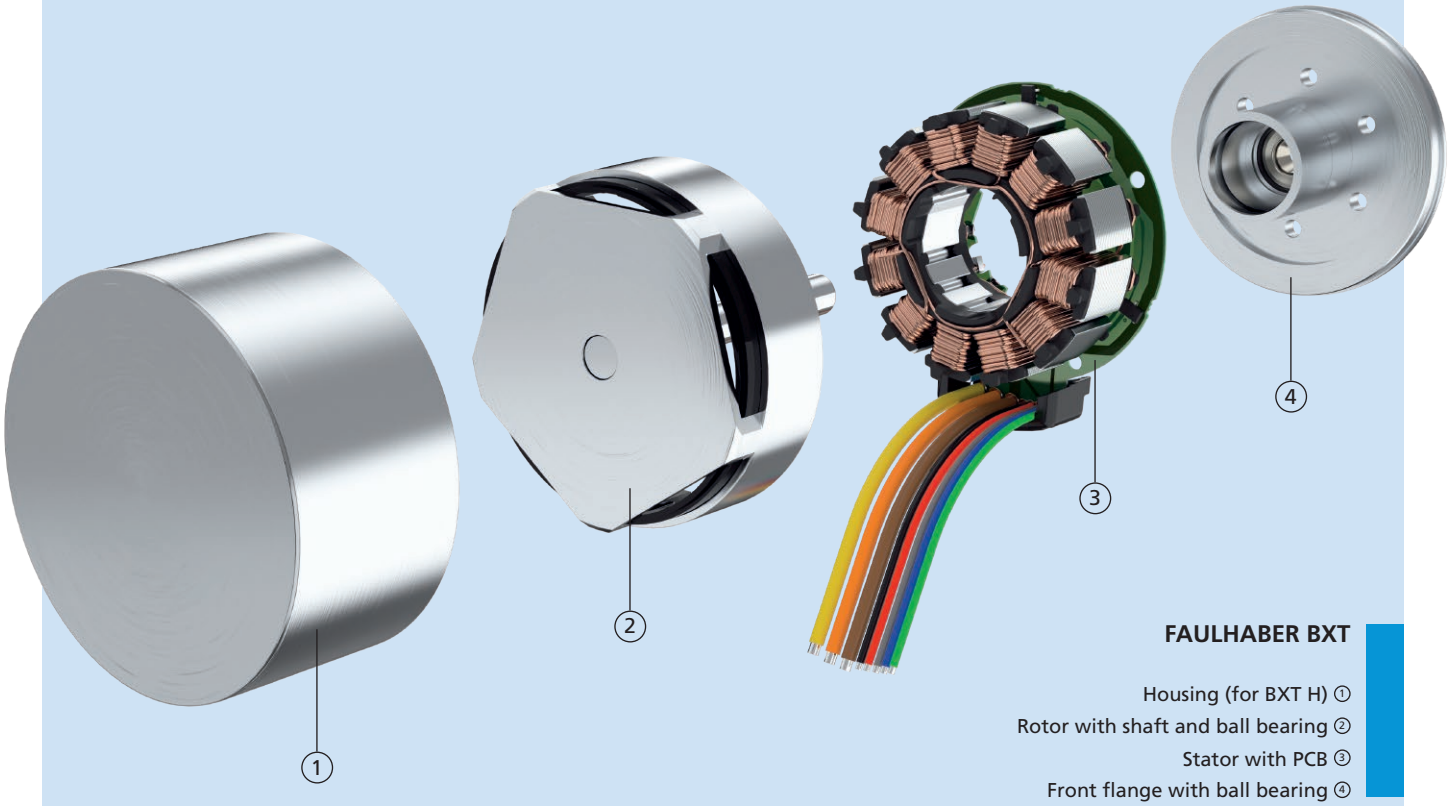
Advantages of this series at a glance

- 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



Brushless Flat DC-Servomotors

Technical Information



FAULHABER BXT

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

General Information

The FAULHABER BXT motors are ideally suited for applications with low to medium speed that require a high torque in short design, high efficiency and long service life.

Versions

The FAULHABER BXT brushless flat DC-servomotors are available in versions with and without housing. The unhoused BXT R models are particularly recommended for speed-controlled applications in which high powers are transformed, as the heat is optimally dissipated. The housed version BXT H is particularly recommended for positioning applications, as it can be combined with a wide variety of optical and magnetic encoders.
The housings of the BXT H serve as protection against touching as well as dirt, are diameter-compliant and thus just as compact as the unhoused BXT R motors.

Note

With the unhoused BXT R motors, the rotor turns freely. The BXT R motors may only be operated in a suitable environment. Dirt and humidity could penetrate the motor and reduce the service life.
If hair or clothing become caught in the rotor, there is a risk of injury.

An innovative winding technology is used with the iron-core BXT motors that enables an exceptionally high copper fill factor of the stators. Torques far above the what is typical for this drive class are thereby achieved.

The main advantages of the BXT motors are:

- Power in new dimensions: extremely high torque in relation to the size and weight of the motor
- The design enables the construction of compact motors for space-critical applications
- Very good synchronisation properties thanks to the multipole basic design

Unlike motors with an ironless, self-supporting FAULHABER winding, motors with an iron-core winding have a cogging torque. Through the targeted design of the pole shoes, the cogging torque of the BXT motors is, however, reduced to a minimum. The adjustment of the operating points of the iron-core motors is dependent on the control, since the motors do not have a linear relationship of load to speed due to inductance.

Sensors

FAULHABER BXT DC-servomotors are equipped standard with 3 digital Hall sensors with a phase shift of 120°. Due to the motors' high number of poles with 14 individual magnets, seven electrical commutation cycles occur within a motor revolution.

Service life

Due to the fact that motor commutation is achieved electronically and not mechanically, the service life of a FAULHABER brushless DC-servomotor depends mainly on the service life of the motor bearings. FAULHABER uses high-precision, pre-loaded ball bearings in each of its brushless DC-servomotors with diameters of 6 mm and up. Factors affecting the life of the motor bearings include the static and dynamic axial and radial bearing loads, the ambient thermal conditions, the speed, vibrational and shock loads, and the precision of the shaft coupling to the given application. If brushless DC-servomotors are operated according to the data sheet, their service life exceeds that of mechanically commutated (brushed) DC motors many times over.

Product combinations

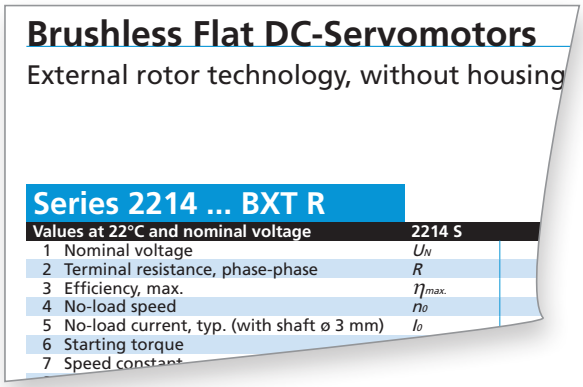
FAULHABER offers the industry's largest selection of complementary products tailor-made for all of its brushless flat DC-servomotors. FAULHABER BXT DC-servomotors are available with:

- Precision gearheads (planetary gearheads)
- High resolution encoders (incremental encoders)
- Powerful Drive Electronics (Speed Controller, Motion Controller)

Modifications

FAULHABER specialises in the adaptation of its standard products for customer-specific applications. The following options are available for the FAULHABER BXT brushless flat DC-servomotor:

- 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


Brushless Flat DC-Servomotors
External rotor technology, without housing

Series 2214 ... BXT R

Values at 22°C and nominal voltage		2214 S
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 3 mm)	I_0
6	Starting torque	
7	Speed constant	

Notes on technical data sheet

The following values are measured or calculated at nominal voltage and an ambient temperature of 22°C.

Nominal voltage U_N [V]
This voltage is applied between two motor phases. This is the voltage at which other data sheet parameters are measured or calculated. Depending on the required speed, higher or lower voltage at the motor can be applied 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.

$$\eta_{max.} = \left(1 - \sqrt{\frac{I_0 \cdot R}{U_N}}\right)^2$$

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, and lubrication or combinations with other components such as gearheads or encoders will all result in a change to the no-load current of the motor.

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.

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

Speed constant k_n [min^{-1}/V]
The speed variation per Volt applied to the motor terminals at constant load.

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

Generator voltage constant k_E [mV/min^{-1}]
The constant corresponding to the relationship between the induced voltage in the rotor and the speed of rotation.

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

Slope of the n/M characteristic curve $\Delta n/\Delta M$ [min^{-1}/mNm]
The calculated ratio of the speed change to torque change at room temperature and ideal control. 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 a sinusoidal measurement frequency of 1 kHz.

Mechanical start 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 moment of inertia of the rotor.

Angular acceleration $\alpha_{max.}$ [rad/s²]
The acceleration obtained from standstill under no-load conditions and at nominal voltage.

$$\alpha_{max.} = \frac{M_A}{J}$$

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 bearing
The bearings used for the brushless DC-motors.

Shaft load, max. permissible [N]
Max. permissible shaft load of the output shaft with specified shaft diameter. The values for load and service life of motors with ball bearings are based on manufacturer specifications.

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 specified by the external control electronics.

Speed up to $n_{max.}$ [min⁻¹]
The maximum recommended speed for continuous operation. This value is based on the recommended operating range of the standard motor bearing and of the winding. All higher values have a negative impact 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.

Rated values for continuous duty operation

The following values are measured at nominal voltage, on an aluminium flange (Ø 70 mm x 3 mm) and at an ambient temperature of 22 °C at the recommended operating point.

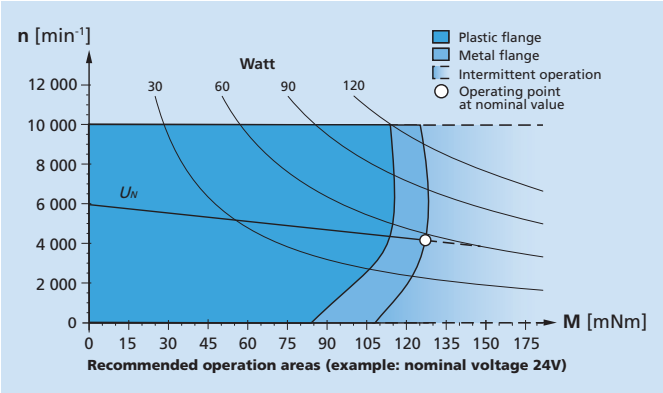
Rated torque M_N [mNm]
Maximum continuous torque (S1 mode) at nominal voltage at which in the steady state condition the temperature does not exceed the maximum permissible winding temperature and/or the operating temperature range of the motor. Motor mounted on an aluminium flange (Ø 70 mm x 3 mm), which approximates the amount of cooling available in a typical mounting configuration of the motor. 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 limits) I_N [A]
The typical maximum continuous current at steady state resulting from the rated continuous duty torque. This value takes into account the influence of heating. This applies to a lower torque constant k_M and the increased resistance of the winding. Furthermore, the losses from the effects of the dynamic coefficient of friction – including the eddy current losses – are taken into consideration. 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.

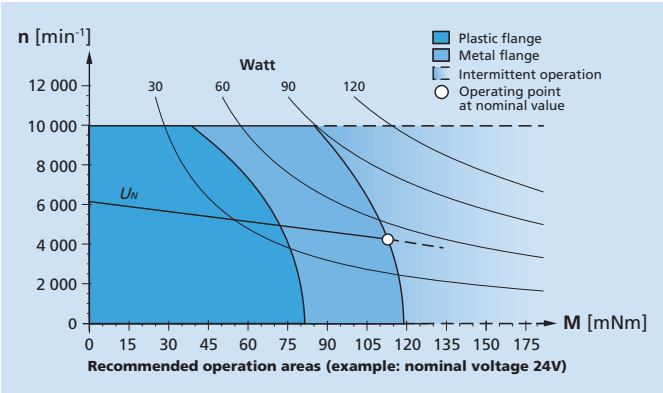
Rated speed n_N [min⁻¹]
Typical rated speed in the steady state condition which is determined from the given rated torque. This value takes into account the effects that motor losses have on the slope of the n/M characteristic curve.

Nominal slope of the n/M characteristic curve [min-1/mNm]
An approximation of the current slope at the specified rated values. This value is derived from the torque and speed values when idling with respect to the rated values.

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



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



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

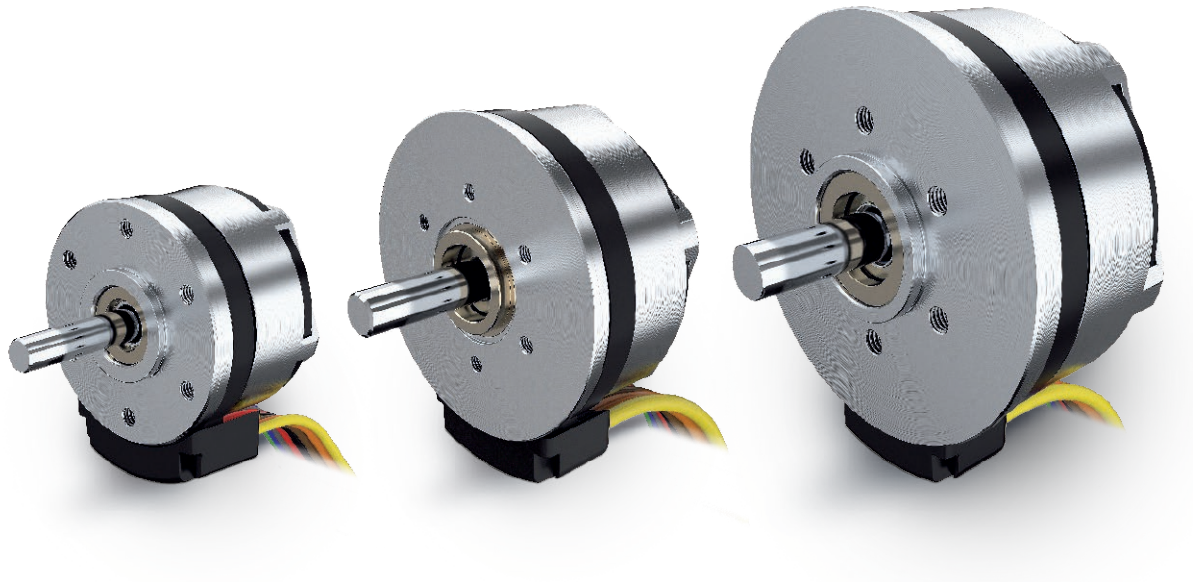
Explanations on the performance diagram

The performance diagrams show the range of possible measured operating points of a drive at an ambient temperature of 22°C and include both the operation on the plastic as well as aluminium flange. 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. The characteristics of the performance diagram of the housed (BXT H) and unhoused (BXT R) series are different. As the speed increases, the cooling factor improves for the open series (BXT R), which results in an increased torque. As the speed increases further, this effect is dampened by the different speed-dependent components of the friction.

Continuous torque M_D [mNm]
Describes the max. recommended continuous torque in the steady state condition at nominal voltage and operation on an aluminium flange. 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 P_D [W]
Describes the max. possible output power in continuous operation in steady state condition with operation on an aluminium flange. The value is independent of the continuous torque and can be exceeded if the motor is operated intermittently, for example, in S2 operation and/or if more cooling is applied.

Nominal voltage characteristic curve U_N [V]
The nominal voltage curve describes the operating points at U_N. 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 this curve by a reduction of the nominal voltage.



Brushless Flat DC-Servomotors

NEW

FAULHABER

Brushless Flat DC-Servomotors

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.	$\eta_{max.}$		72	73	70	%
4 No-load speed	n_0		5 740	6 500	6 960	min⁻¹
5 No-load current, typ. (with shaft ø 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 Slope of n-M curve	$\Delta n/\Delta M$		252	229	238	min⁻¹/mNm
10 Terminal inductance, phase-phase	L		271	884	3 150	µH
11 Mechanical time constant	τ_m		8,7	7,92	8,22	ms
12 Rotor inertia	J		3,3	3,3	3,3	gcm²
13 Angular acceleration	$\alpha_{max.}$		71,1	88,2	89,7	·10³rad/s²
14 Operating temperature range:						
– motor		-40 ... +100				°C
– winding, max. permissible		+125				°C
15 Shaft bearings		ball bearings, preloaded				
16 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
17 Shaft play:						
– radial	≤	0,015				mm
– axial	=	0				mm
18 Mass		25,5				g
19 Direction of rotation		electronically reversible				
20 Speed up to	$n_{max.}$	10 000				min⁻¹
21 Number of pole pairs		7				
22 Hall sensors		digital				
23 Magnet material		NdFeB				
Rated values for continuous operation						
24 Rated torque	M_N		9,5	10	10,2	mNm
25 Rated current (thermal limit)	I_N		1,18	0,66	0,368	A
26 Rated speed	n_N		1 200	2 590	2 600	min⁻¹
27 Rated slope of n-M curve	$\Delta n/\Delta M$		478	391	427	min⁻¹/mNm

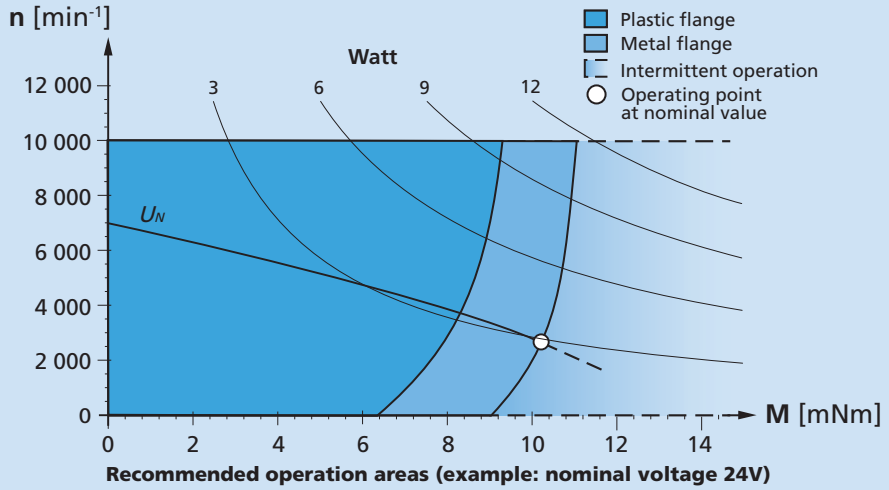
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

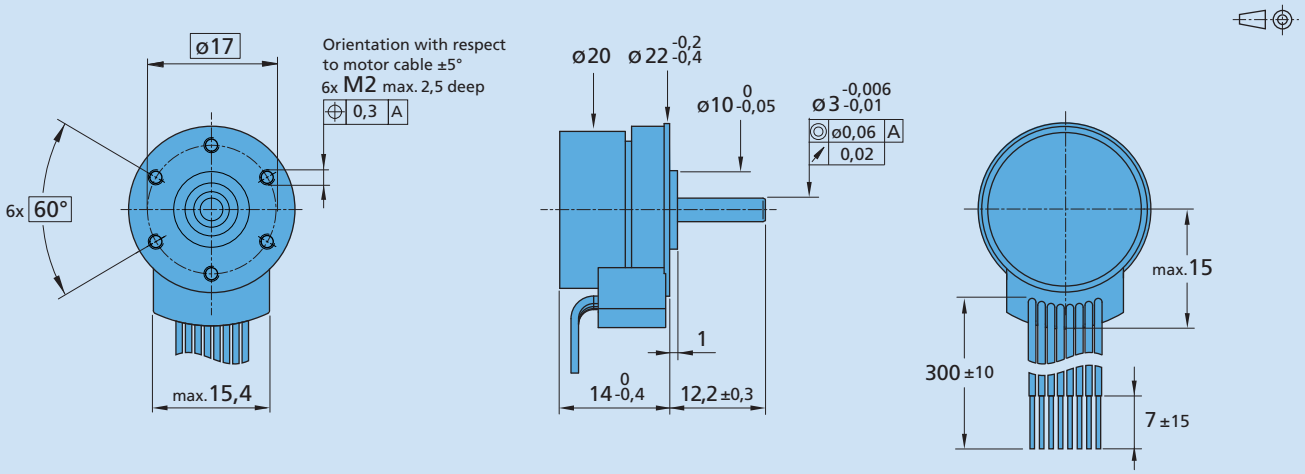
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



2214 S ... BXT R

Option, cable and connection information

Example product designation: **2214S012BXTH-3830**

Option	Type	Description
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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 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
22F 26/1 R		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.

PRELIMINARY

FAULHABER

Brushless Flat DC-Servomotors

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.	$\eta_{max.}$		72	74	69	%
4 No-load speed	n_0		5 760	6 500	6 970	min⁻¹
5 No-load current, typ. (with shaft ø 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 Slope of n-M curve	$\Delta n/\Delta M$		252	229	238	min⁻¹/mNm
10 Terminal inductance, phase-phase	L		271	884	3 150	µH
11 Mechanical time constant	τ_m		8,7	7,92	8,22	ms
12 Rotor inertia	J		3,3	3,3	3,3	gcm²
13 Angular acceleration	$\alpha_{max.}$		71,1	88,2	89,7	·10³rad/s²
14 Operating temperature range:						
– motor		-40 ... +100				°C
– winding, max. permissible		+125				°C
15 Shaft bearings		ball bearings, preloaded				
16 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
17 Shaft play:						
– radial	≤	0,015				mm
– axial	=	0				mm
18 Mass		28,9				g
19 Direction of rotation		electronically reversible				
20 Speed up to	$n_{max.}$	10 000				min⁻¹
21 Number of pole pairs		7				
22 Hall sensors		digital				
23 Magnet material		NdFeB				
Rated values for continuous operation						
24 Rated torque	M_N		9,4	9,7	9,7	mNm
25 Rated current (thermal limit)	I_N		1,16	0,653	0,36	A
26 Rated speed	n_N		1 260	2 630	2 710	min⁻¹
27 Rated slope of n-M curve	$\Delta n/\Delta M$		479	399	439	min⁻¹/mNm

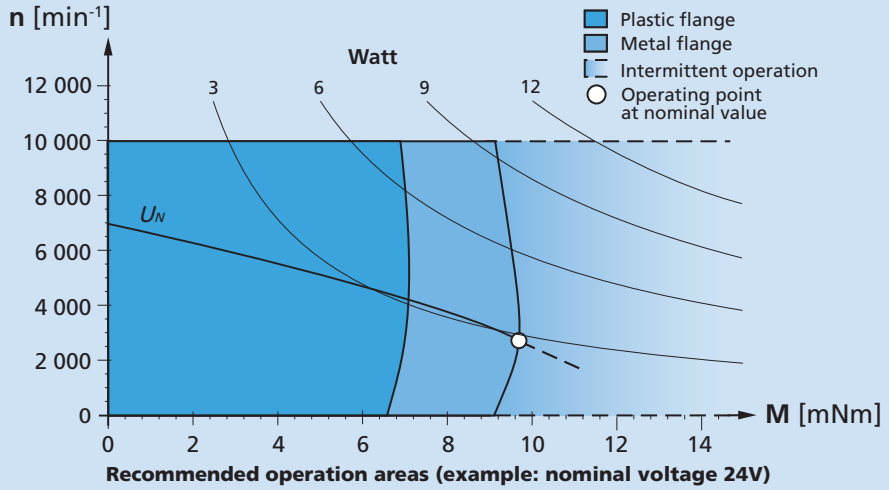
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

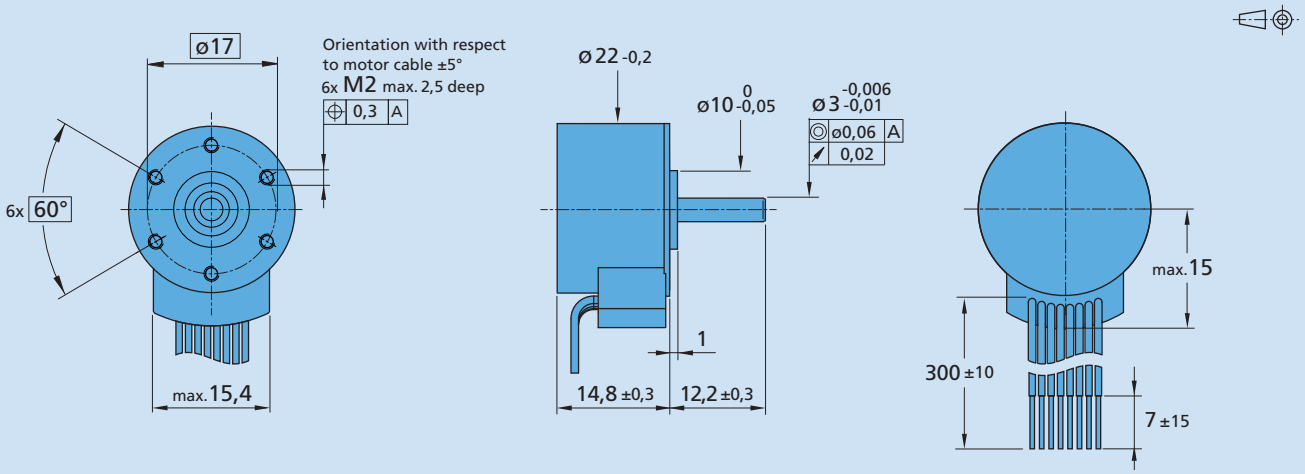
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



2214 S ... BXT H

Option, cable and connection information

Example product designation: **2214S012BXTH-3830**

Option	Type	Description
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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 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
22F 26/1 R	IE3-1024 IE3-1024 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

FAULHABER

Brushless Flat DC-Servomotors 41 mNm

External rotor technology, without housing 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	Slope of n-M curve	$\Delta n/\Delta M$	27,5	25,9	24,3	min⁻¹/mNm
10	Terminal inductance, phase-phase	L	191	331	1 290	µH
11	Mechanical time constant	τ_m	5,28	4,97	4,66	ms
12	Rotor inertia	J	18,3	18,3	18,3	gcm²
13	Angular acceleration	$\alpha_{max.}$	123	134	144	·10³rad/s²
14	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
15	Shaft bearings		ball bearings, preloaded			
16	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
17	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
18	Mass		57,9			g
19	Direction of rotation		electronically reversible			
20	Speed up to	$n_{max.}$	10 000			min⁻¹
21	Number of pole pairs		7			
22	Hall sensors		digital			
23	Magnet material		NdFeB			
Rated values for continuous operation						
24	Rated torque	M_N	39,5	40	41	mNm
25	Rated current (thermal limit)	I_N	2,87	2,28	1,17	A
26	Rated speed	n_N	3 320	3 750	4 150	min⁻¹
27	Rated slope of n-M curve	$\Delta n/\Delta M$	68,4	62,3	50	min⁻¹/mNm

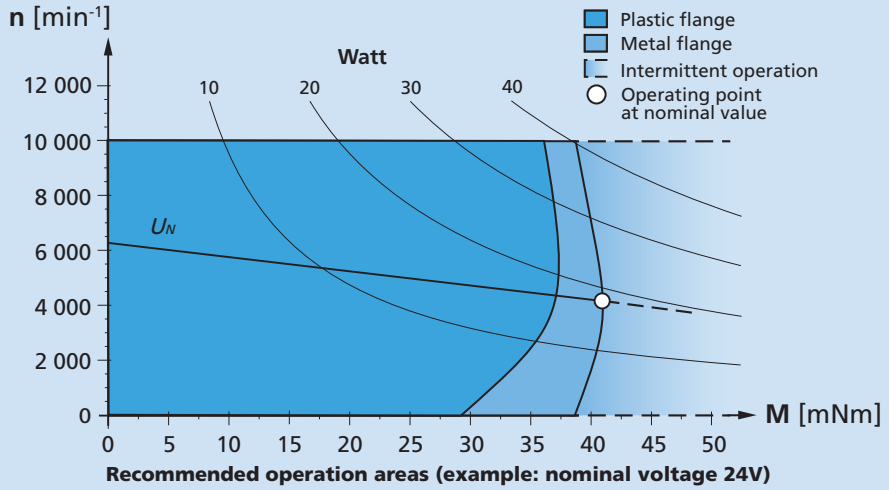
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

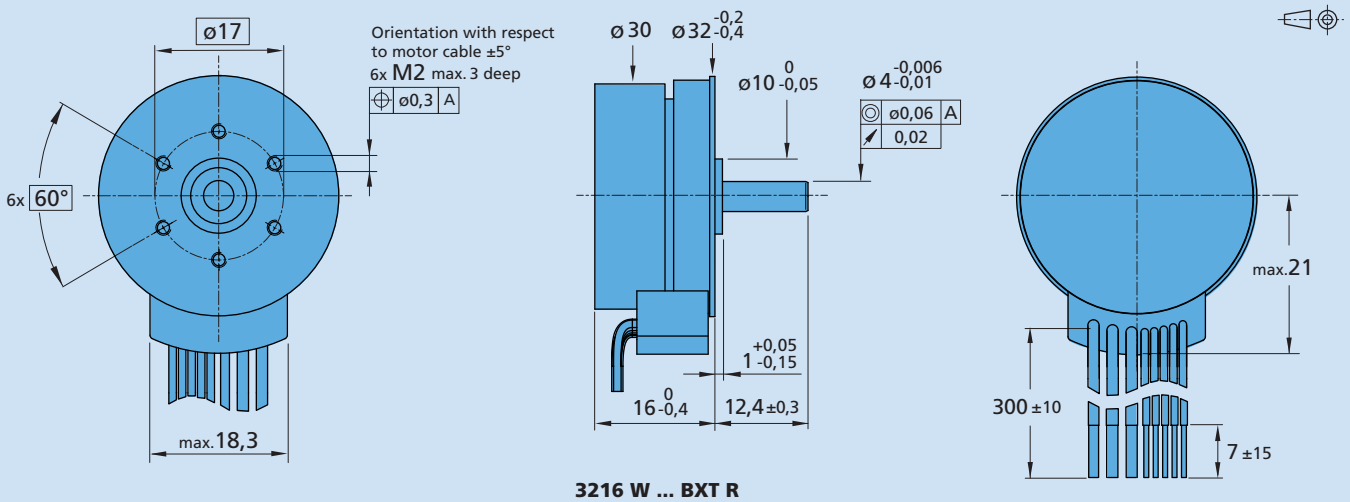
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



3216 W ... BXT R

Option, cable and connection information

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

Option	Type	Description
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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
26/1 R 32/3 R		SC 2402 P SC 2804 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

PRELIMINARY

FAULHABER

Brushless Flat DC-Servomotors

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.	$\eta_{max.}$	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	Slope of n-M curve	$\Delta n/\Delta M$	27,5	25,9	24,3	min⁻¹/mNm
10	Terminal inductance, phase-phase	L	191	331	1 290	µH
11	Mechanical time constant	τ_m	5,28	4,97	4,66	ms
12	Rotor inertia	J	18,3	18,3	18,3	gcm²
13	Angular acceleration	$\alpha_{max.}$	123	134	144	·10³rad/s²
14	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
15	Shaft bearings		ball bearings, preloaded			
16	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
17	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
18	Mass		65,3			g
19	Direction of rotation		electronically reversible			
20	Speed up to	$n_{max.}$	10 000			min⁻¹
21	Number of pole pairs		7			
22	Hall sensors		digital			
23	Magnet material		NdFeB			

Rated values for continuous operation						
24	Rated torque	M_N	37	38	38	mNm
25	Rated current (thermal limit)	I_N	2,76	2,18	1,1	A
26	Rated speed	n_N	3 400	3 860	4 320	min⁻¹
27	Rated slope of n-M curve	$\Delta n/\Delta M$	71,9	62,4	50,8	min⁻¹/mNm

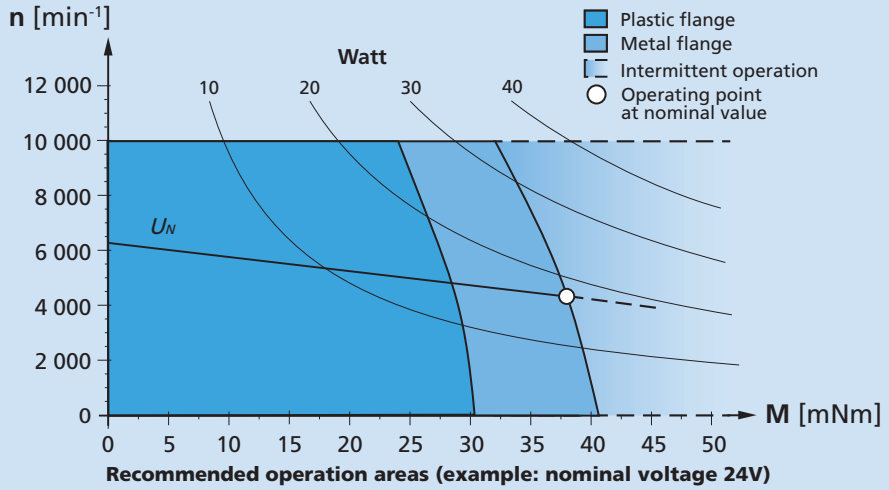
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

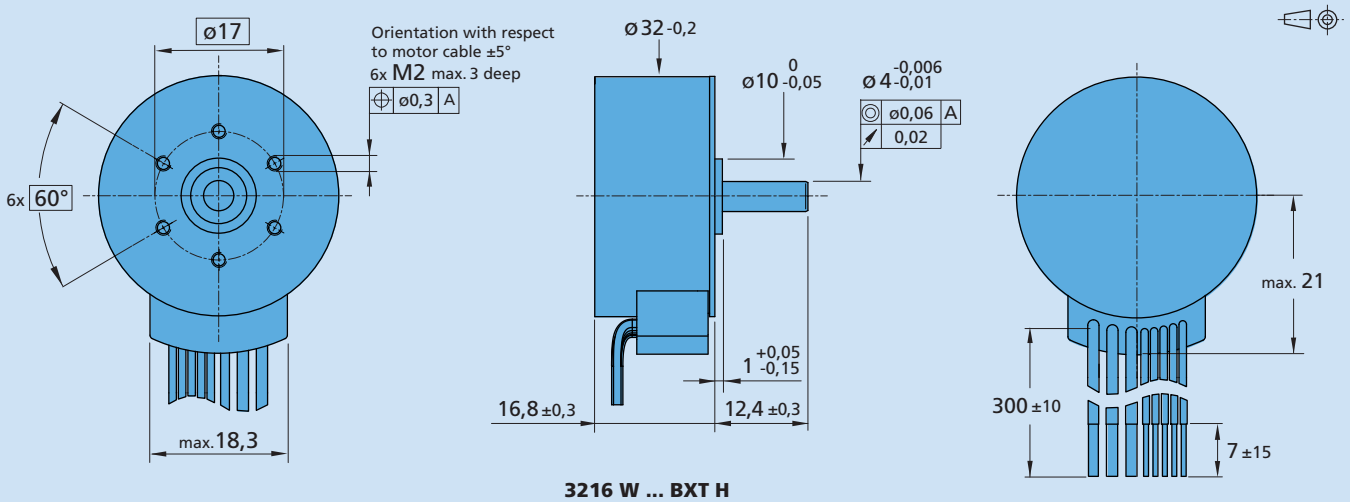
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



3216 W ... BXT H

Option, cable and connection information

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

Option	Type	Description
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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
26/1 R 32/3 R	IE3-1024 IE3-1024 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

FAULHABER

Brushless Flat DC-Servomotors

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.	$\eta_{max.}$	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	Slope of n-M curve	$\Delta n/\Delta M$	4,93	4,97	4,4	min⁻¹/mNm
10	Terminal inductance, phase-phase	L	396	664	2 550	µH
11	Mechanical time constant	τ_m	3,56	3,59	3,18	ms
12	Rotor inertia	J	69	69	69	gcm²
13	Angular acceleration	$\alpha_{max.}$	169	177	201	·10³rad/s²
14	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
15	Shaft bearings		ball bearings, preloaded			
16	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
17	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
18	Mass		127			g
19	Direction of rotation		electronically reversible			
20	Speed up to	$n_{max.}$	10 000			min⁻¹
21	Number of pole pairs		7			
22	Hall sensors		digital			
23	Magnet material		NdFeB			
Rated values for continuous operation						
24	Rated torque	M_N	122	127	134	mNm
25	Rated current (thermal limit)	I_N	3,6	3,17	1,66	A
26	Rated speed	n_N	3 690	4 180	4 390	min⁻¹
27	Rated slope of n-M curve	$\Delta n/\Delta M$	16,3	14	12,5	min⁻¹/mNm

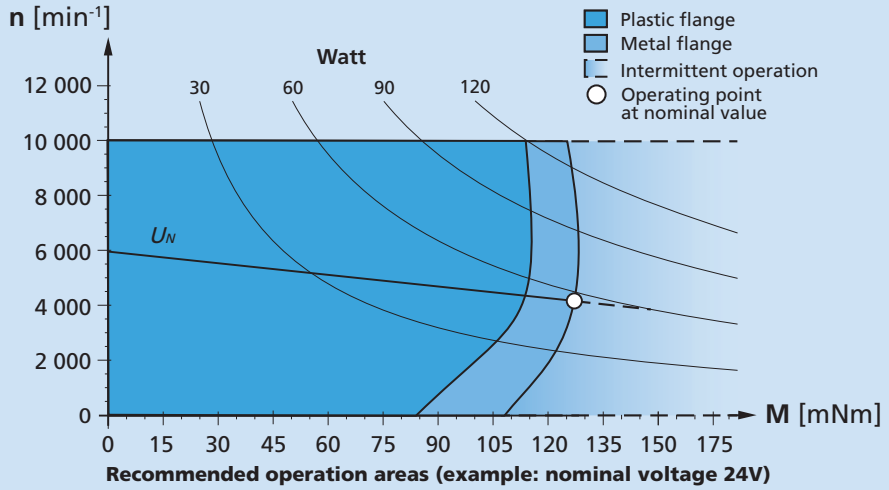
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

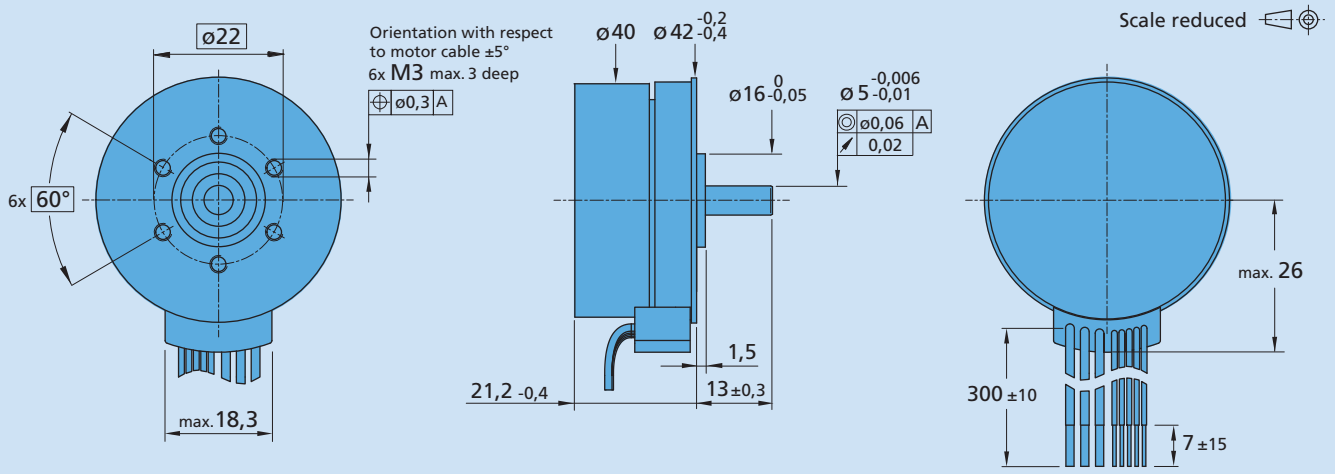
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



4221 G ... BXT R

Option, cable and connection information

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

Option	Type	Description
3830	Connector 	Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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 S 38/2 S		SC 2804 S SC 5004 P SC 5008 S	To view our large range of accessory parts, please refer to the "Accessories" chapter.

PRELIMINARY

FAULHABER

Brushless Flat DC-Servomotors 112 mNm

External rotor technology, with housing 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.	$\eta_{max.}$	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	Slope of n-M curve	$\Delta n/\Delta M$	4,93	4,97	4,4	min⁻¹/mNm
10	Terminal inductance, phase-phase	L	396	664	2 550	µH
11	Mechanical time constant	τ_m	3,56	3,59	3,18	ms
12	Rotor inertia	J	69	69	69	gcm²
13	Angular acceleration	$\alpha_{max.}$	169	177	201	·10³rad/s²
14	Operating temperature range:					
	– motor		-40 ... +100			°C
	– winding, max. permissible		+125			°C
15	Shaft bearings		ball bearings, preloaded			
16	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
17	Shaft play:					
	– radial	≤	0,015			mm
	– axial	=	0			mm
18	Mass		142			g
19	Direction of rotation		electronically reversible			
20	Speed up to	$n_{max.}$	10 000			min⁻¹
21	Number of pole pairs		7			
22	Hall sensors		digital			
23	Magnet material		NdFeB			
Rated values for continuous operation						
24	Rated torque	M_N	102	112	107	mNm
25	Rated current (thermal limit)	I_N	3,33	2,87	1,39	A
26	Rated speed	n_N	3 980	4 380	4 700	min⁻¹
27	Rated slope of n-M curve	$\Delta n/\Delta M$	17	14,8	12,8	min⁻¹/mNm

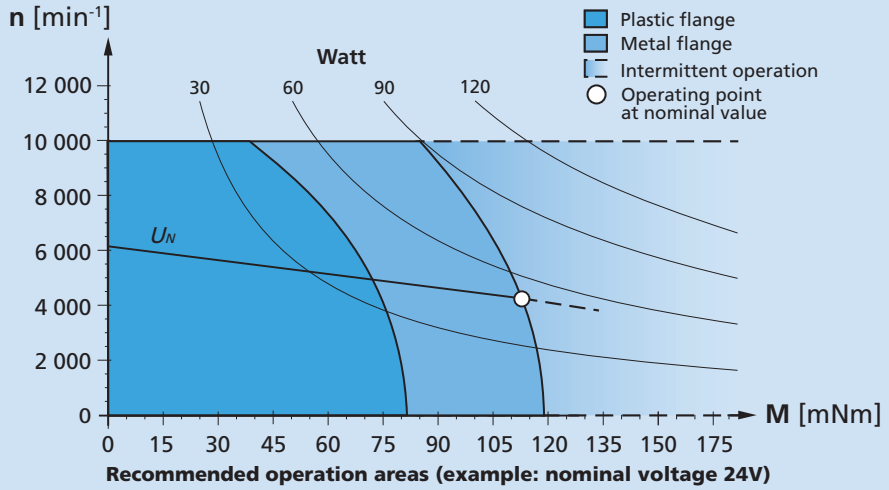
Note: Rated values are measured at nominal voltage and 22°C ambient temperature.

Note:

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

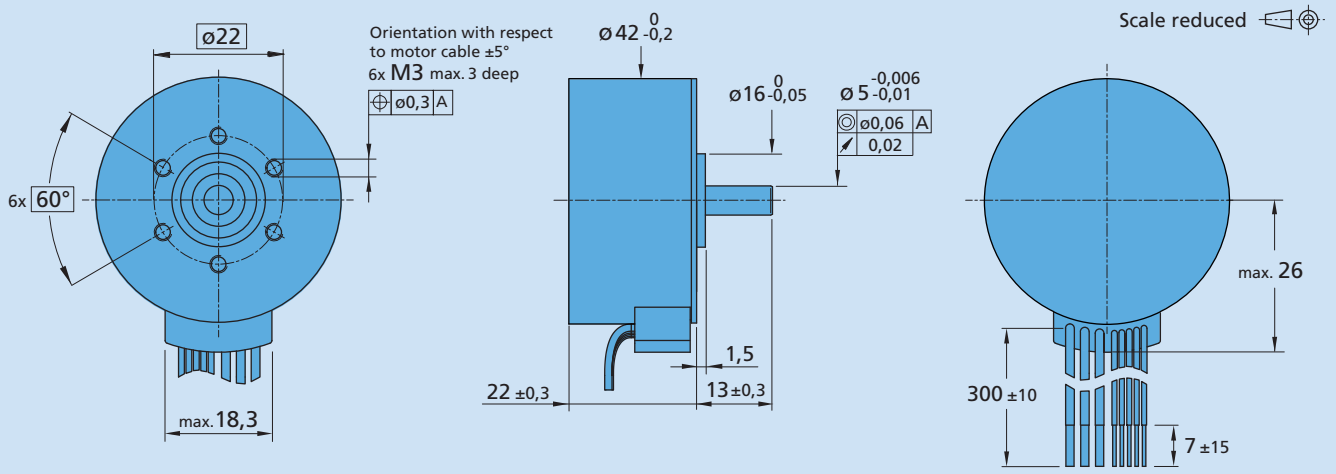
The diagram indicates the recommended speed in relation to the available torque at the output shaft.
It includes the assembly on a plastic- as well as on a metal flange (assembly method: IM B 5).

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 $U_{mot} > U_N$.



Recommended operation areas (example: nominal voltage 24V)

Dimensional drawing



4221 G ... BXT H

Option, cable and connection information

Example product designation: **4221G018BXTH-3830**

Option	Type	Description
3830		Standard cable with connector MOLEX Microfit 3.0, 43025-0800, recommended mating connector 43020-0800

Connection

Function	Colour
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 S 38/2 S	IE3-1024 IE3-1024 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	To view our large range of accessory parts, please refer to the "Accessories" chapter.

FAULHABER

More information

faulhaber.com

faulhaber.com/facebook

faulhaber.com/youtubeEN

faulhaber.com/linkedin

faulhaber.com/instagram

Your local contact

DFF_BXT-MINICAT_11-2018_EN_600

FAULHABER GROUP