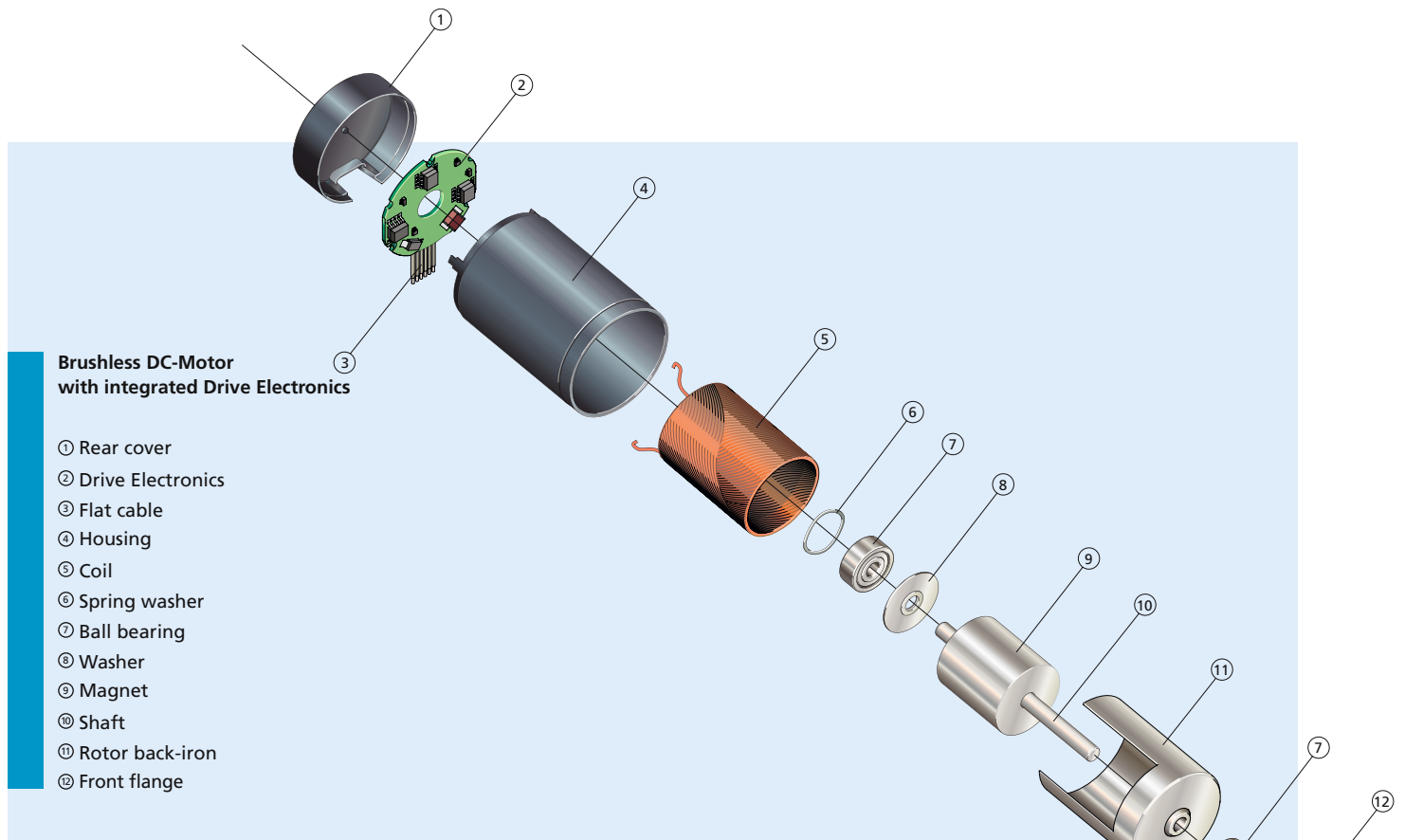


Brushless DC-Motors with integrated Drive Electronics



Features

These new brushless DC-Motors with integrated drive electronics combine the advantages of the System FAULHABER® skew wound coil technology with the lifetime benefits of electronic commutation. The motors are based on a three-phase ironless coil, a bipolar rare-earth permanent magnet and sensorless electronic commutation.

To define the position of the rotor in relation to the rotating field of the coil, the back-EMF is measured and processed. The position detection of the rotor is sensorless. The design features the basic linear characteristics over a wide speed range and the absence of cogging torque just like the traditional brush commutated DC-Motors in the FAULHABER program. The rotating magnet and iron flux path avoid iron losses and results in higher efficiency.

Benefits

- System FAULHABER®, ironless stator coil
- High reliability and operational lifetime
- Wide range of linear torque / speed performance
- Programmable motor characteristics
- No sparking
- No cogging
- Dynamically balanced rotor
- Integrated electronics
- Simple design

Product Code



31	Motor diameter [mm]
53	Motor length [mm]
K	Shaft type
012	Nominal voltage [V]
BRC	Type of commutation (brushless), with integrated electronics

31 53 K 012 BRC

Brushless DC-Motors

with integrated Drive Electronics

1,8 mNm

Series 1525 ... BRC

	1525 U	009 BRC	012 BRC	015 BRC	
Nominal voltage	U_N	9	12	15	Volt
No-load speed	n_o	16 300	15 800	15 500	rpm
No-load current (with shaft \varnothing 2,0 mm)	I_o	0,047	0,037	0,033	A
Starting torque	M_A	3,9	4,1	4,1	mNm
Torque constant	k_M	5,12	7,06	8,95	mNm/A
Slope of n-M curve	$\Delta n/\Delta M$	2 540	2 260	2 270	rpm/mNm
Rotor inertia	J	2,2	2,2	2,2	gcm ²
Operating temperature range		- 25 ... + 85			°C
Shaft bearings		ball bearings, preloaded			
Shaft load max.:					
- shaft diameter		2,0			mm
- radial at 3 000 rpm (3 mm from mounting face)		8			N
- axial at 3 000 rpm		0,8			N
- axial at standstill		10			N
Shaft play:					
- radial	$I \leq$	0,015			mm
- axial	II	0			mm
Housing material		mounting face in aluminium, housing in plastic			
Weight		16			g
Direction of rotation		reversible			

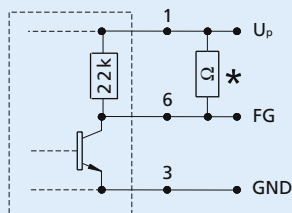
Recommended values - mathematically independent of each other

		1 000 - 16 000			
Speed range	n_e				rpm
Torque up to ¹⁾	$M_{e \max.}$	1,7	1,8	1,8	mNm
Current up to (thermal limits) ¹⁾	$I_{e \max.}$	0,40	0,31	0,25	A

¹⁾ Specification applies to $U_{nsoll} = 10$ V

Electronic

Supply voltage	U_p	min. 4 ... max. 18	V DC
Current	$I_{\max.}$	15	mA



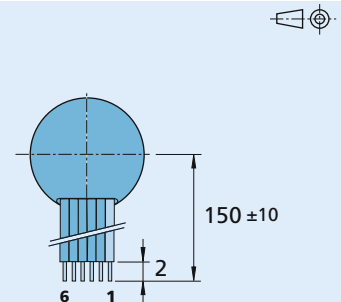
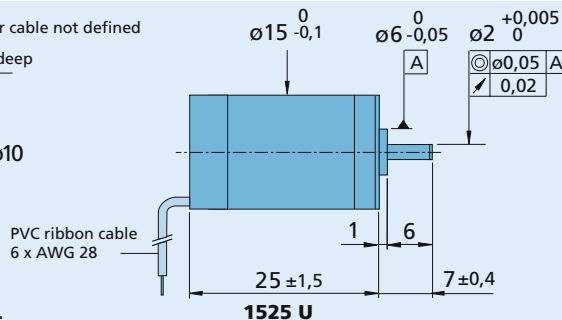
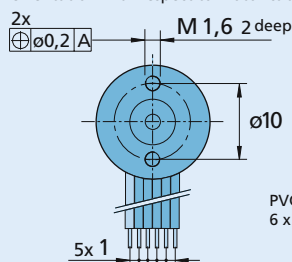
Circuit diagram

* An additional external pull-up resistor can be added to improve the rise time.

Caution:

$I_{out \max.}$ 15 mA must not be exceeded!

Orientation with respect to motor cable not defined



Cable connection

No.	Function	
1 (red)	U_p : electronic supply	4 V DC - 18 V DC
2	U_{mot} : coil supply	1,7 V DC - 18 V DC
3	GND : ground	
4	U_{nsoll} : Speed command	0 - 10 V DC > 10 V DC - max. U_p not defined
5	DIR : direction of rotation	on ground or $U < 0,5$ V = CCW, $U > 3$ V = CW
6	FG : frequency output	(max. U_p , $I_{\max.}$ 15 mA) 3 lines per revolution

Caution:

Incorrect lead connection will damage the motor electronics!

Brushless DC-Motors

with integrated Drive Electronics

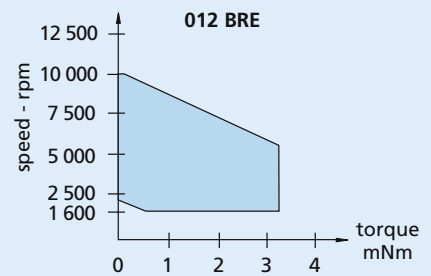
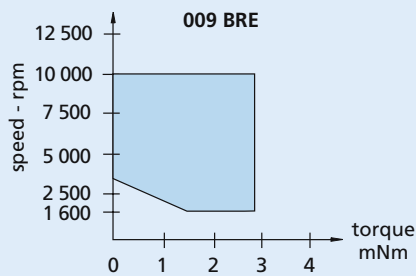
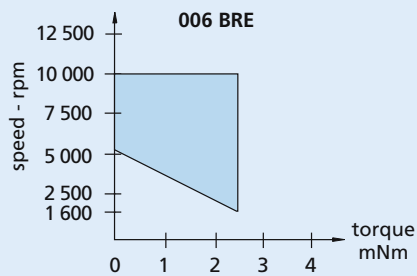
3,2 mNm

Series 1935 ... BRE

	1935 S	006 BRE	009 BRE	012 BRE	
Nominal voltage ¹⁾	U _N	6	9	12	Volt
No-load speed	n ₀	7 400	7 650	7 400	rpm
No-load current (with shaft ø 3,0 mm)	I ₀	0,050	0,035	0,027	A
Starting torque	M _A	2,9	4,0	4,4	mNm
Torque constant	k _M	6,32	9,74	13,70	mNm/A
Slope of n-M curve	Δn/ΔM	1 470	1 140	1 110	rpm/mNm
Rotor inertia	J	8,1	8,1	8,1	gcm ²
Operating temperature range		0 ... + 70			°C
Shaft bearings		ball bearings, preloaded			
Shaft load max.:					
– shaft diameter		3			mm
– radial at 3 000 rpm (3 mm from mounting face)		10			N
– axial at 3 000 rpm		1			N
– axial at standstill		150			N
Shaft play:					
– radial	⊥	0,015			mm
– axial	∥	0			mm
Housing material		mounting face in aluminium, housing in plastic			
Weight		33			g
Direction of rotation		not reversible - clockwise rotation, viewed from the front face			
¹⁾ The supply voltage range for the integrated electronics is:		min. 4,5 ... max. 16			V DC

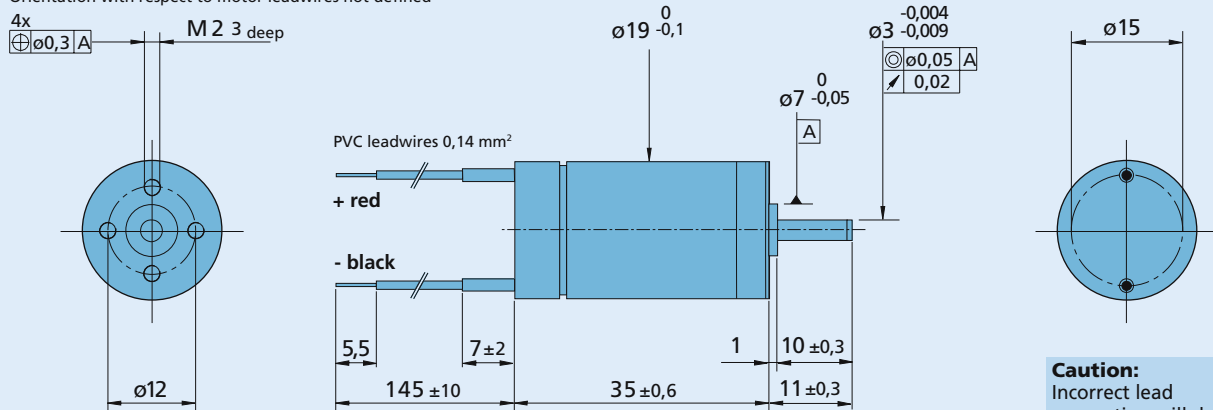
Recommended values - mathematically independent of each other

Speed range	n _e	1 600 – 10 000			rpm
Torque up to	M _{e max.}	2,4	2,9	3,2	mNm
Current up to (thermal limits)	I _{e max.}	0,50	0,40	0,33	A



Recommended speed - torque range

Orientation with respect to motor leadwires not defined



1935 S

Caution:
Incorrect lead connection will damage the motor electronics!

Brushless DC-Motors

with integrated Drive Electronics

28 mNm

Series 3153 ... BRC

	3153 K	009 BRC	012 BRC	024 BRC	
Nominal voltage	U_N	9	12	24	Volt
No-load speed	n_o	5 200	5 200	5 200	rpm
No-load current (with shaft \varnothing 4,0 mm)	I_o	0,142	0,107	0,057	A
Starting torque	M_A	42	50	50	mNm
Torque constant	k_M	16,22	21,80	43,59	mNm/A
Slope of n-M curve	$\Delta n/\Delta M$	45,8	42,9	41,4	rpm/mNm
Rotor inertia	J	118	118	118	gcm ²
Operating temperature range		- 25 ... + 85			°C
Shaft bearings		ball bearings, preloaded			
Shaft load max.:					
- shaft diameter		4,0			mm
- radial at 3 000 rpm (3 mm from mounting face)		30			N
- axial at 3 000 rpm		5			N
- axial at standstill		50			N
Shaft play:					
- radial	\perp	0,015			mm
- axial	\parallel	0			mm
Housing material		mounting face in aluminium, housing in plastic			
Weight		155			g
Direction of rotation		reversible			

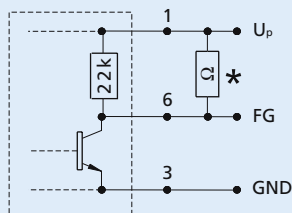
Recommended values - mathematically independent of each other

Speed range	n_e		1 000 – 6 500		rpm
Torque up to ¹⁾	$M_{e \max.}$	27	28	28	mNm
Current up to (thermal limits) ¹⁾	$I_{e \max.}$	1,90	1,46	0,75	A

¹⁾ Specification applies to $U_{nsoll} = 10$ V

Electronic

Supply voltage	U_p	min. 5 ... max. 30		V DC
Current	$I_{\max.}$	25		mA

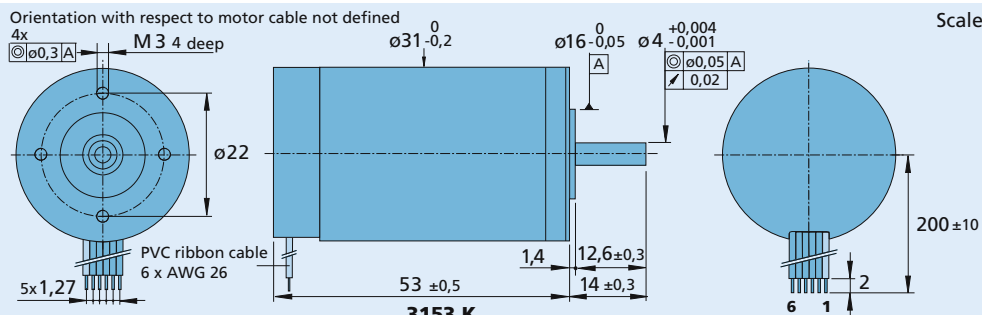


Circuit diagram

* An additional external pull-up resistor can be added to improve the rise time.

Caution:

$I_{OUT \max.}$ 15 mA must not be exceeded!



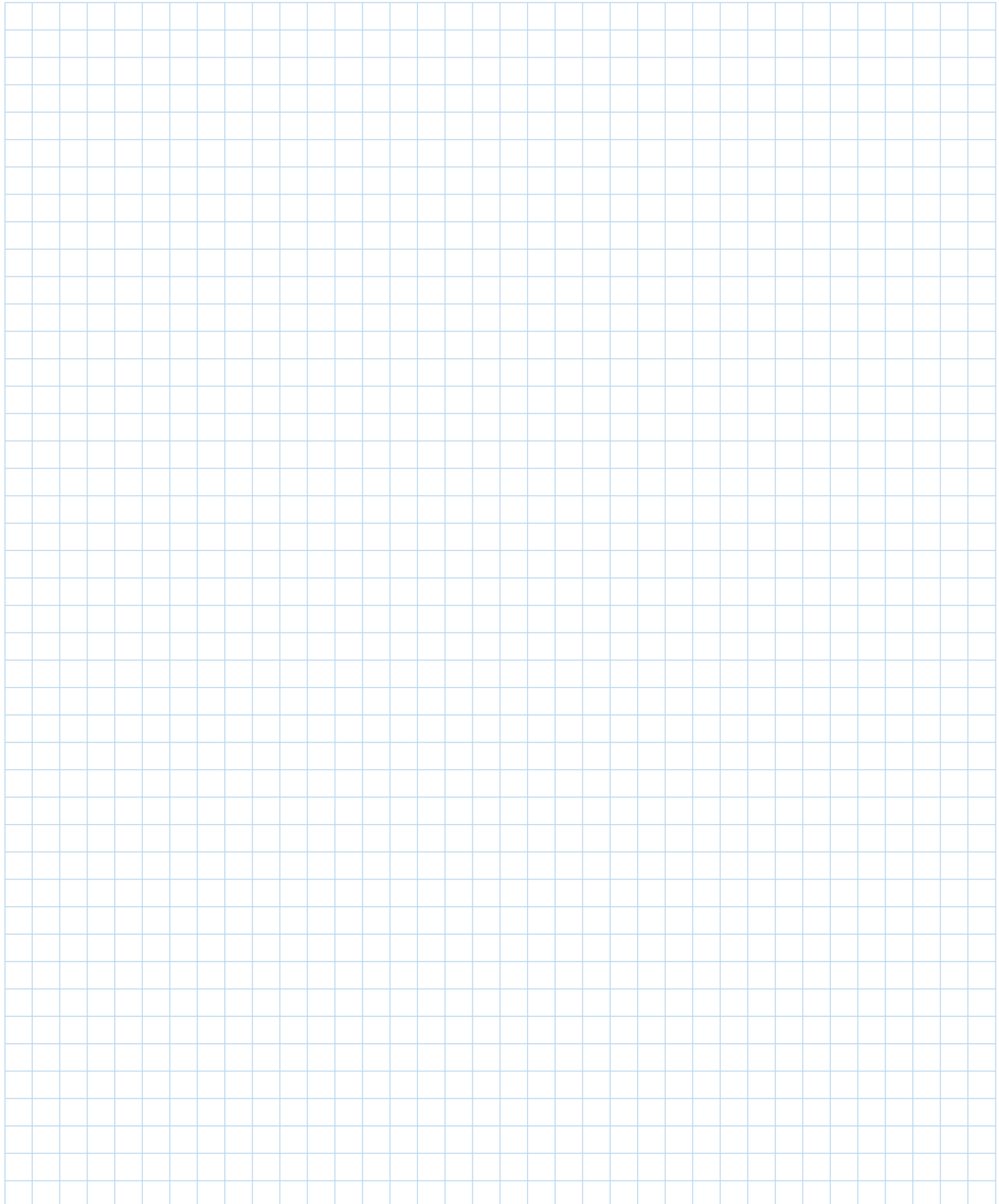
Cable connection

No.	Function	
1 (red)	U_p : electronic supply	5 V DC - 30 V DC
2	U_{mot} : coil supply	0 V DC up to 2 · U_N (max. 30 V DC)
3	GND : ground	
4	U_{rsoll} : Speed command	0 - 10 V DC > 10 V DC - max. U_p not defined
5	DIR : direction of rotation	on ground or $U < 0,5$ V = CCW, $U > 3$ V = CW
6	FG : frequency output	(max. U_p , $I_{\max.}$ 15 mA) 3 lines per revolution

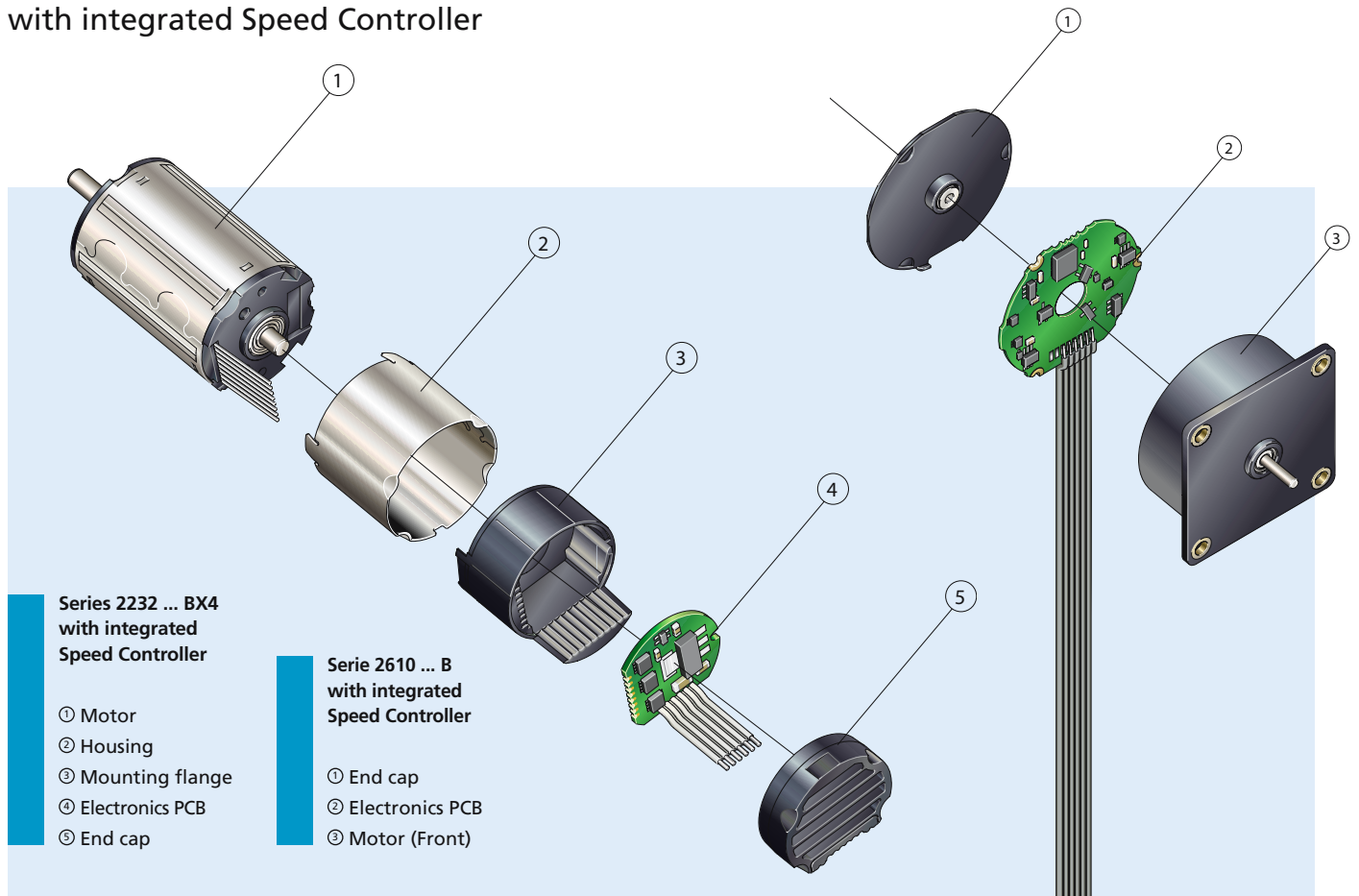
Caution:

Incorrect lead connection will damage the motor electronics!

Notes



Brushless DC-Motors with integrated Speed Controller



**Series 2232 ... BX4
with integrated
Speed Controller**

- ① Motor
- ② Housing
- ③ Mounting flange
- ④ Electronics PCB
- ⑤ End cap

**Serie 2610 ... B
with integrated
Speed Controller**

- ① End cap
- ② Electronics PCB
- ③ Motor (Front)

Brushless
DC-Motors

Features

These new brushless DC motors combine the advantages of a slotless brushless motor with dedicated, high precision, speed control electronics.

Speed control is achieved using the on board PI controller with an external command voltage. The drives are protected from overload with the integrated current limiting.

The control parameters of the drive electronics can be modified to fit the application using our optional programming adapter and the easy to use FAULHABER Motion Manager software.

Many drives are also available in a simple 2 wire configuration for ease of integration or replacement of standard DC motors in some applications.

Benefits

- Integrated drive electronics
- Extremely compact
- Very robust construction
- Easy to use
- Integrated current limiting
- Control parameters can be tuned to the application

Product Code



32_68_G_024_BX4_SC

32	Motor diameter [mm]
68	Motor length [mm]
G	Shaft type
024	Nominal Voltage [V]
BX4	Type of commutation (electronic)
SC	Integrated Speed Controller

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

7 mNm

For combination with
Gearheads:
22F, 22/7, 26A

Series 2232 ... BX4 S SC

	2232 S	012 BX4 S	024 BX4 S	SC
1 Nominal voltage	U_N	12	24	Volt
2 Terminal resistance, phase-phase	R	3,5	12,4	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	4,4	4,5	W
4 Efficiency	$\eta_{\text{ max.}}$	60,9	61,7	%
5 No-load speed	n_0	13 200	14 000	rpm
6 No-load current (with shaft \varnothing 3,0 mm)	I_0	0,163	0,088	A
7 Stall torque	M_H	27,3	29,4	mNm
8 Friction torque, static	C_0	0,6	0,6	mNm
9 Friction torque, dynamic	C_v	$5,5 \cdot 10^{-5}$	$5,5 \cdot 10^{-5}$	mNm/rpm
10 Speed constant	k_n	1 173	616	rpm/V
11 Back-EMF constant	k_E	0,852	1,623	mV/rpm
12 Torque constant	k_M	8,14	15,50	mNm/A
13 Current constant	k_I	0,123	0,065	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	504	493	rpm/mNm
15 Terminal inductance, phase-phase	L	130	470	μH
16 Mechanical time constant	τ_m	22	22	ms
17 Rotor inertia	J	4,2	4,2	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	65	70	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{\text{th } 1} / R_{\text{th } 2}$	2 / 13		K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	4,1 / 274		s
21 Operating temperature range		- 40 ... + 85		$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded		
23 Shaft load max.:				
– radial at 3 000 rpm (4 mm from mounting flange)		20		N
– axial at 3 000 rpm		2		N
– axial at standstill		20		N
24 Shaft play:				
– radial	\leq	0,015		mm
– axial	\equiv	0		mm
25 Housing material		stainless steel		
26 Weight		77		g
27 Direction of rotation		electronically reversible		
28 Number of pole pairs		2		

Recommended values - mathematically independent of each other

29 Speed up to	$n_{e \text{ max.}}$	22 500	17 000	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$	7	7	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$	0,99	0,52	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance $R_{\text{th } 2}$ not reduced

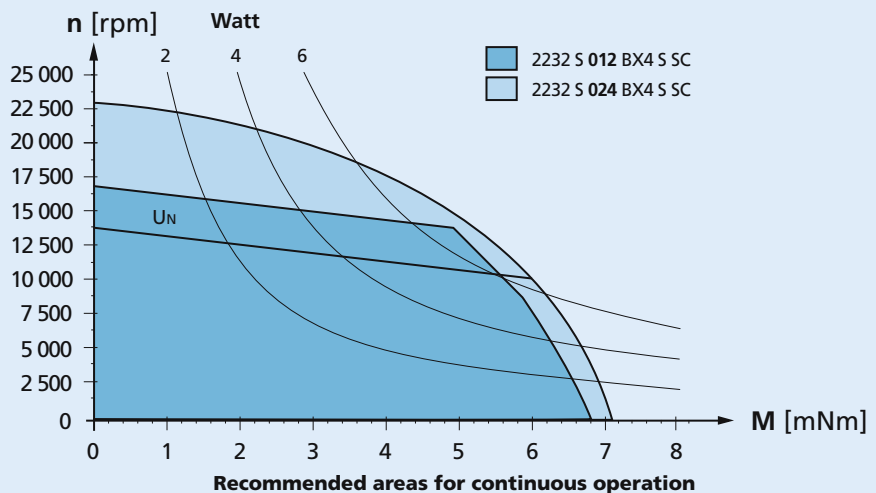
Note:

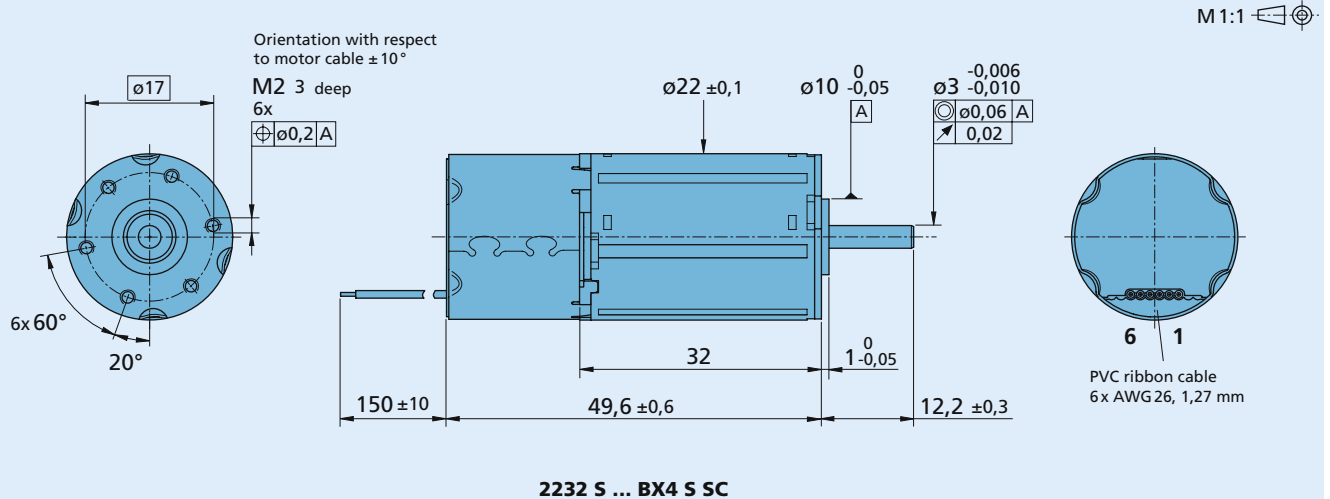
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated condition.

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use with other parameter settings.

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated 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


Speed Controller		012 BX4 S	024 BX4 S	SC
Power supply electronic	U_p	5 ... 28		V DC
Power supply motor	U_{mot}	6 ... 28		V DC
PWM switching frequency	f_{PWM}	96		kHz
Efficiency	η	95		%
Max. continuous output current ¹⁾	I_{dauer}	1	0,5	A
Max. peak output current	I_{max}	2	1	A
Total standby current	I_{el}	0,020		A
Speed range electronic		400 ... 50 000 ²⁾		rpm
Scanning range		500		μs

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

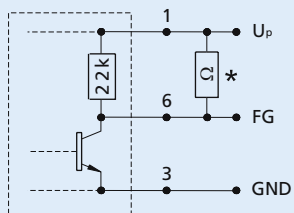
Connection information		012 BX4 S	024 BX4 S	SC
Connection 1 "U_P":	power supply electronic	U_p		
Connection 2 "U_{mot}":	power supply electronic coil	U_{mot}		
Connection 3 "GND":	ground	ground		
Connection 4 "U_{nsoll}":				
- analog input	input voltage	$U_{\text{in}} = 0 \dots 10 \text{ V} \mid > 10 \text{ V} \dots U_p \gg$ set speed value not defined		
	input resistance	$R_{\text{in}} \geq 5 \text{ k}\Omega$		
	set speed value	per 1 V	2 000	2 000 rpm
		$U_{\text{in}} < 0,15 \text{ V} \gg$ motor stops		
		$U_{\text{in}} > 0,3 \text{ V} \gg$ motor starts		
Connection 5 "DIR":				
- analog input	direction of rotation	to ground or level $< 0,5 \text{ V} \gg$ counterclockwise		
		open or level $> 3 \text{ V} \gg$ clockwise		
	input resistance	$R_{\text{in}} \geq 10 \text{ k}\Omega$		
Connection 6 "FG":				
- digital output	frequency output	max. U_p ; $I_{\text{max}} = 15 \text{ mA}$; open collector with 22 k Ω pull-up resistor		
		6 lines per revolution		

Features

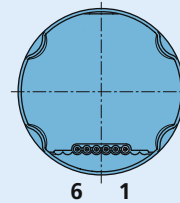
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

Circuit diagram / Connection information
Output circuit


* An additional external pull-up resistor can be added to improve the rise time.
Caution: I_{out} max. 15 mA must not be exceeded!

Cable connection

Connection
No. Function

1	U_p
2	U_{mot}
3	GND
4	Unsell
5	DIR
6	FG

Caution:

Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
AWG 26 / PVC ribbon cable
with connector Micro-Fit


Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
2232S024BX4S SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

13 mNm

For combination with
Gearheads:
22F, 22/7, 26A

Series 2232 ... BX4 SC

	2232 S	012 BX4	024 BX4	SC
1 Nominal voltage	U_N	12	24	Volt
2 Terminal resistance, phase-phase	R	3,5	12,4	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	8,8	8,9	W
4 Efficiency	$\eta_{\text{ max.}}$	66,9	67,6	%
5 No-load speed	n_0	6 600	7 000	rpm
6 No-load current (with shaft \varnothing 3,0 mm)	I_0	0,112	0,061	A
7 Stall torque	M_H	55,7	59,9	mNm
8 Friction torque, static	C_0	0,85	0,85	mNm
9 Friction torque, dynamic	C_v	$1,5 \cdot 10^{-4}$	$1,5 \cdot 10^{-4}$	mNm/rpm
10 Speed constant	k_n	579	304	rpm/V
11 Back-EMF constant	k_E	1,728	3,288	mV/rpm
12 Torque constant	k_M	16,50	31,40	mNm/A
13 Current constant	k_I	0,061	0,032	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	123	120	rpm/mNm
15 Terminal inductance, phase-phase	L	120	440	μH
16 Mechanical time constant	τ_m	6,7	6,5	ms
17 Rotor inertia	J	5,2	5,2	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	107	115	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{\text{th } 1} / R_{\text{th } 2}$	2 / 13		K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	4,1 / 283		s
21 Operating temperature range		- 40 ... +85		$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded		
23 Shaft load max.:				
- radial at 3 000 rpm (4 mm from mounting flange)		20		N
- axial at 3 000 rpm		2		N
- axial at standstill		20		N
24 Shaft play:				
- radial	\leq	0,015		mm
- axial	\equiv	0		mm
25 Housing material		stainless steel		
26 Weight		77		g
27 Direction of rotation		electronically reversible		
28 Number of pole pairs		2		
Recommended values - mathematically independent of each other				
29 Speed up to	$n_{e \text{ max.}}$	14 500	8 500	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$	13	13	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$	0,95	0,50	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance $R_{\text{th } 2}$ not reduced

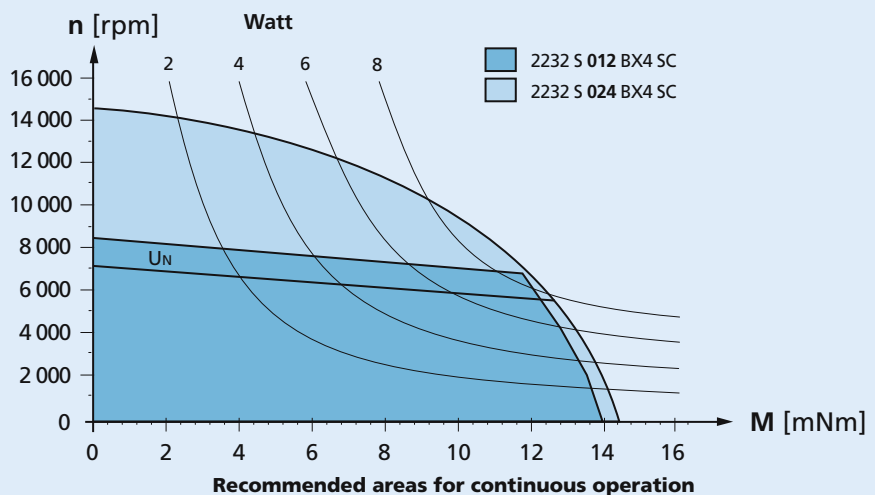
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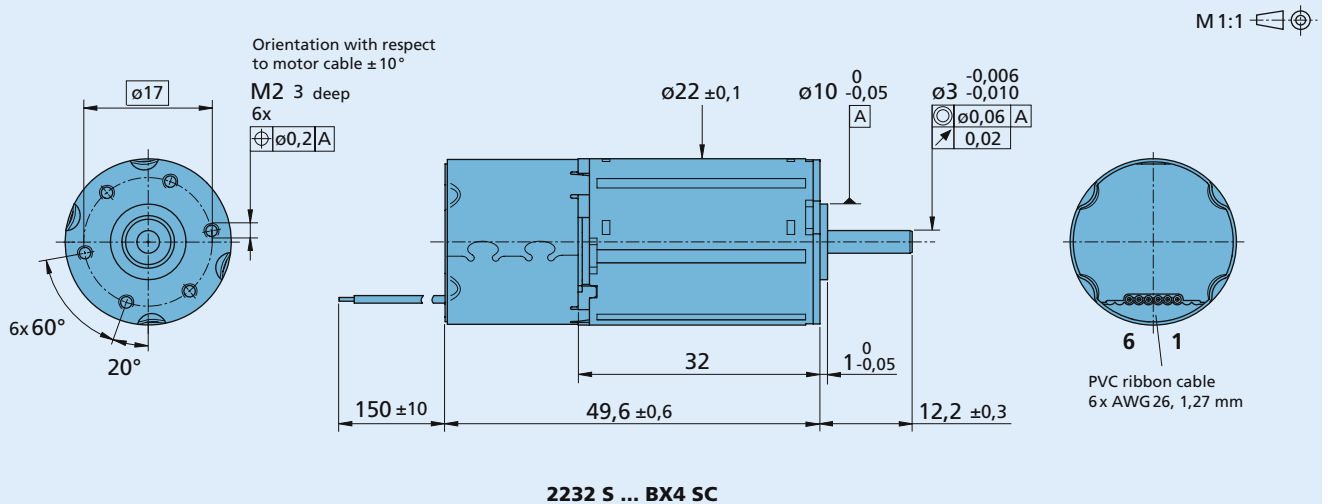
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The diagram shows the motor in a completely insulated condition.

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use with other parameter settings.

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated 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


Speed Controller		012 BX4	024 BX4	SC
Power supply electronic	U_p	5 ... 28		V DC
Power supply motor	U_{mot}	6 ... 28		V DC
PWM switching frequency	f_{PWM}	96		kHz
Efficiency	η	95		%
Max. continuous output current ¹⁾	I_{dauer}	1	0,5	A
Max. peak output current	I_{max}	2	1	A
Total standby current	I_{el}	0,020		A
Speed range electronic		400 ... 50 000 ²⁾		rpm
Scanning range		500		μ s

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

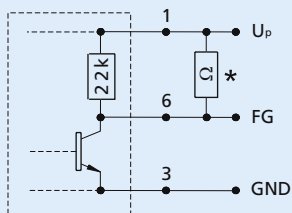
Connection information		012 BX4	024 BX4	SC
Connection 1 "U_P":	power supply electronic	U_p		
Connection 2 "U_{mot}":	power supply electronic coil	U_{mot}		
Connection 3 "GND":	ground	ground		
Connection 4 "U_{nsoll}":				
- analog input	input voltage	$U_{in} = 0 \dots 10V \mid > 10V \dots U_p \gg$ set speed value not defined		
	input resistance	$R_{in} \geq 5k\Omega$		
	set speed value	per 1V	1 000	1 000 rpm
		$U_{in} < 0,15V \gg$ motor stops		
		$U_{in} > 0,3V \gg$ motor starts		
Connection 5 "DIR":				
- analog input	direction of rotation	to ground or level < 0,5V » counterclockwise		
		open or level > 3V » clockwise		
	input resistance	$R_{in} \geq 10k\Omega$		
Connection 6 "FG":				
- digital output	frequency output	max. U_p ; $I_{max} = 15 mA$; open collector with 22k Ω pull-up resistor		
		6 lines per revolution		

Features

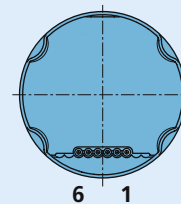
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

Circuit diagram/Connection information
Output circuit


* An additional external pull-up resistor can be added to improve the rise time.
 Caution: I_{out} max. 15 mA must not be exceeded!

Cable connection

Connection

No.	Function
1	U_P
2	U_{mot}
3	GND
4	U_{soll}
5	DIR
6	FG

Caution:
 Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
 AWG 26 / PVC ribbon cable with connector Micro-Fit


Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
 2232S024BX4 SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

15 mNm

For combination with
Gearheads:
22F, 22/7, 26A

Series 2250 ... BX4 S SC

	2250 S	024 BX4 S	SC
1 Nominal voltage	U_N	24	Volt
2 Terminal resistance, phase-phase	R	5,9	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	10,3	W
4 Efficiency	$\eta_{\text{ max.}}$	70,4	%
5 No-load speed	n_0	10 500	rpm
6 No-load current (with shaft \varnothing 3,0 mm)	I_0	0,105	A
7 Stall torque	M_H	84,7	mNm
8 Friction torque, static	C_0	0,75	mNm
9 Friction torque, dynamic	C_v	$1,4 \cdot 10^{-4}$	mNm/rpm
10 Speed constant	k_n	451	rpm/V
11 Back-EMF constant	k_E	2,218	mV/rpm
12 Torque constant	k_M	21,1	mNm/A
13 Current constant	k_I	0,047	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	125,6	rpm/mNm
15 Terminal inductance, phase-phase	L	250	μH
16 Mechanical time constant	τ_m	6,97	ms
17 Rotor inertia	J	5,3	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	160	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{\text{th } 1} / R_{\text{th } 2}$	1,2 / 10,5	K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	4,2 / 332	s
21 Operating temperature range		- 40 ... +85	$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded	
23 Shaft load max.:			
– radial at 3 000 rpm (4 mm from mounting flange)		20	N
– axial at 3 000 rpm		2	N
– axial at standstill		20	N
24 Shaft play:			
– radial	\leq	0,015	mm
– axial	\equiv	0	mm
25 Housing material		stainless steel	
26 Weight		97	g
27 Direction of rotation		electronically reversible	
28 Number of pole pairs		2	
Recommended values - mathematically independent of each other			
29 Speed up to	$n_{e \text{ max.}}$	12 500	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$	15	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$	0,84	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance $R_{\text{th } 2}$ not reduced

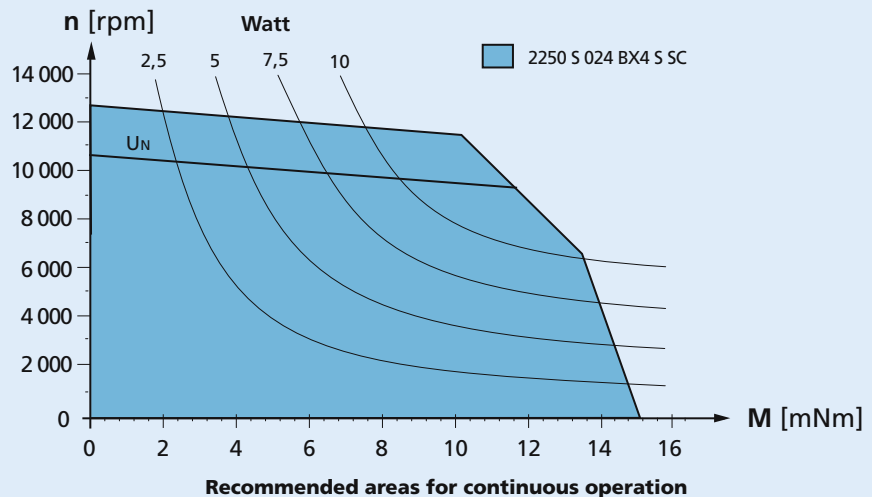
Note:

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


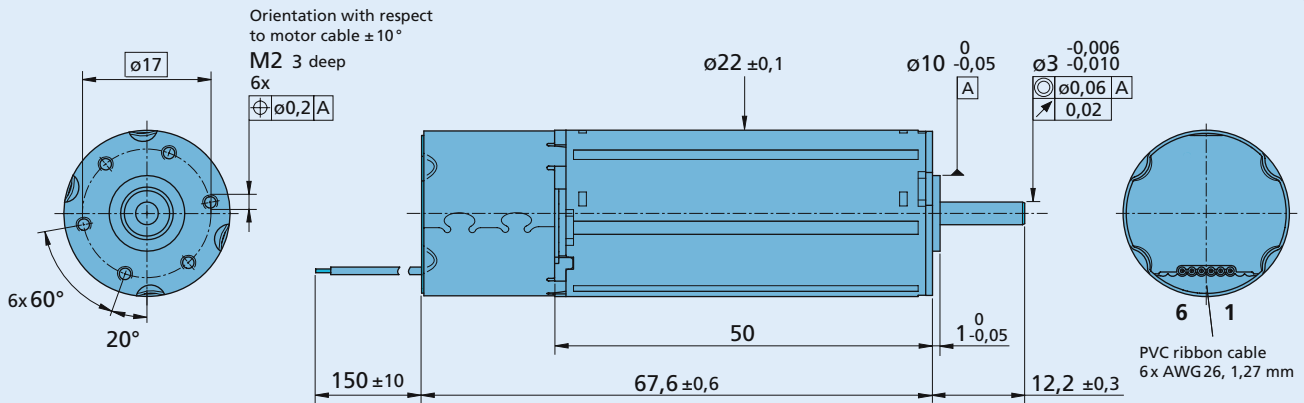
The diagram shows the motor in a completely insulated condition.

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use with other parameter settings.

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated condition. Any points 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

 M 1:1 

2250 S ... BX4S SC

Speed Controller		024 BX4 S	SC
Power supply electronic	U_p	5 ... 28	V DC
Power supply motor	U_{mot}	6 ... 28	V DC
PWM switching frequency	f_{PWM}	96	kHz
Efficiency	η	95	%
Max. continuous output current ¹⁾	I_{dauer}	0,8	A
Max. peak output current	I_{max}	1,6	A
Total standby current	I_{el}	0,020	A
Speed range electronic		400 ... 50 000 ²⁾	rpm
Scanning range		500	μ s

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

Connection information		024 BX4 S	SC
Connection 1 "U _P ":	power supply electronic	U_p	
Connection 2 "U _{mot} ":	power supply electronic coil	U_{mot}	
Connection 3 "GND":	ground	ground	
Connection 4 "U _{nsoll} ":			
- analog input	input voltage	$U_{in} = 0 \dots 10V \mid > 10V \dots U_p$ » set speed value not defined	
	input resistance	$R_{in} \geq 5k\Omega$	
	set speed value	per 1V, 2 000	rpm
		$U_{in} < 0,15V$ » motor stops	
		$U_{in} > 0,3V$ » motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level $< 0,5V$ » counterclockwise	
	input resistance	open or level $> 3V$ » clockwise	
		$R_{in} \geq 10k\Omega$	
Connection 6 "FG":			
- digital output	frequency output	max. U_p ; $I_{max} = 15$ mA; open collector with 22 k Ω pull-up resistor	
		6 lines per revolution	

Features

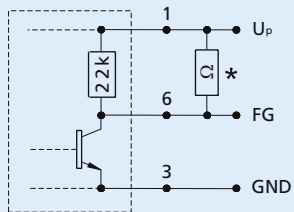
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

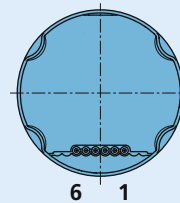
Circuit diagram/Connection information

Output circuit



* An additional external pull-up resistor can be added to improve the rise time.
Caution: $I_{out\ max.}$ 15 mA must not be exceeded!

Cable connection



Connection

No.	Function
1	U _P
2	U _{mot}
3	GND
4	U _{nsoll}
5	DIR
6	FG

Caution:
Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
AWG 26 / PVC ribbon cable with connector Micro-Fit



Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
2250S024BX4S SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

25 mNm

For combination with
Gearheads:
22F, 22/7, 26A

Series 2250 ... BX4 SC

	2250 S	024 BX4	SC
1 Nominal voltage	U _N	24	Volt
2 Terminal resistance, phase-phase	R	5,9	Ω
3 Output power ¹⁾	P _{2 max.}	17,3	W
4 Efficiency	η _{max.}	75,0	%
5 No-load speed	n ₀	6 000	rpm
6 No-load current (with shaft ø 3,0 mm)	I ₀	0,072	A
7 Stall torque	M _H	149,0	mNm
8 Friction torque, static	C ₀	1,2	mNm
9 Friction torque, dynamic	C _v	2,4 · 10 ⁻⁴	mNm/rpm
10 Speed constant	k _n	259	rpm/V
11 Back-EMF constant	k _E	3,860	mV/rpm
12 Torque constant	k _M	36,9	mNm/A
13 Current constant	k _I	0,027	A/mNm
14 Slope of n-M curve	Δn/ΔM	41,4	rpm/mNm
15 Terminal inductance, phase-phase	L	240	μH
16 Mechanical time constant	τ _m	4,30	ms
17 Rotor inertia	J	10	gcm ²
18 Angular acceleration	α _{max.}	149	· 10 ³ rad/s ²
19 Thermal resistance	R _{th 1} / R _{th 2}	1,2 / 10,5	K/W
20 Thermal time constant	τ _{w1} / τ _{w2}	4,2 / 424	s
21 Operating temperature range		- 40 ... +85	°C
22 Shaft bearings		ball bearings, preloaded	
23 Shaft load max.:			
- radial at 3 000 rpm (4 mm from mounting flange)	20		N
- axial at 3 000 rpm	2		N
- axial at standstill	20		N
24 Shaft play:			
- radial	≤	0,015	mm
- axial	≡	0	mm
25 Housing material		stainless steel	
26 Weight		117	g
27 Direction of rotation		electronically reversible	
28 Number of pole pairs		2	
Recommended values - mathematically independent of each other			
29 Speed up to	n _{e max.}	7 200	rpm
30 Torque up to ^{1) 2)}	M _{e max.}	25	mNm
31 Current up to ^{1) 2)}	I _{e max.}	0,79	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance R_{th 2} not reduced

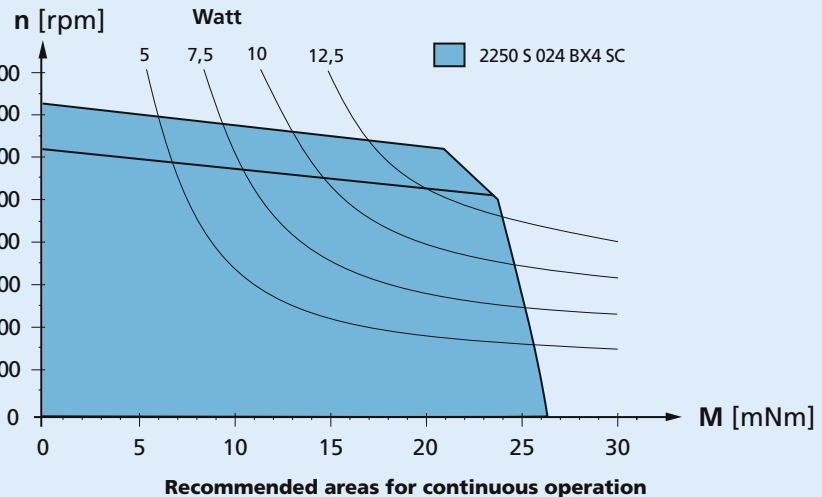
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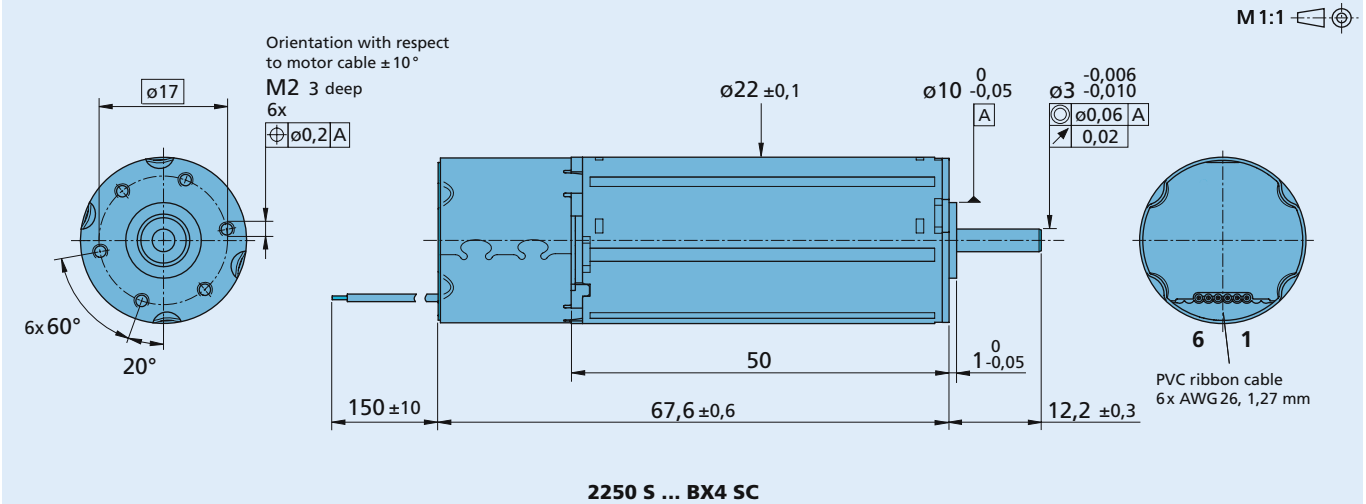
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated condition.

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use with other parameter settings.

The nominal voltage (U_N) curve shows the operating point at nominal voltage in the insulated 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


Speed Controller		024 BX4	SC
Power supply electronic	U_p	5 ... 28	V DC
Power supply motor	U_{mot}	6 ... 28	V DC
PWM switching frequency	f_{PWM}	96	kHz
Efficiency	η	95	%
Max. continuous output current ¹⁾	I_{dauer}	0,8	A
Max. peak output current	I_{max}	1,6	A
Total standby current	I_{el}	0,020	A
Speed range electronic		400 ... 50 000 ²⁾	rpm
Scanning range		500	μs

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

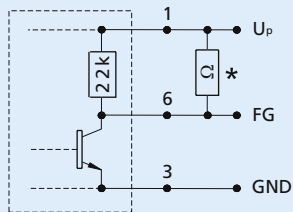
Connection information		024 BX4	SC
Connection 1 "U _P ":	power supply electronic	U_p	
Connection 2 "U _{mot} ":	power supply electronic coil	U_{mot}	
Connection 3 "GND":	ground	ground	
Connection 4 "U _{nsoll} ":			
- analog input	input voltage	$U_{in} = 0 \dots 10V \mid > 10V \dots U_p$ » set speed value not defined	
	input resistance	$R_{in} \geq 5k\Omega$	
	set speed value	per 1V, 1 000	rpm
		$U_{in} < 0,15V$ » motor stops	
		$U_{in} > 0,3V$ » motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level $< 0,5V$ » counterclockwise	
		open or level $> 3V$ » clockwise	
	input resistance	$R_{in} \geq 10k\Omega$	
Connection 6 "FG":			
- digital output	frequency output	max. U_p ; $I_{max} = 15 \text{ mA}$; open collector with 22k Ω pull-up resistor	
		6 lines per revolution	

Features

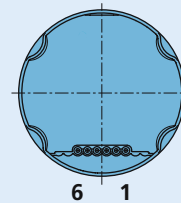
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

Circuit diagram/Connection information
Output circuit


* An additional external pull-up resistor can be added to improve the rise time.
 Caution: I_{out} max. 15 mA must not be exceeded!

Cable connection

Connection

No.	Function
1	U _P
2	U _{mot}
3	GND
4	U _{nsoll}
5	DIR
6	FG

Caution:
 Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
 AWG 26 / PVC ribbon cable with connector Micro-Fit


Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
 2250S024BX4 SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

54 mNm

For combination with

Gearheads:

30/1, 32A, 32/3, 32/3 S, 38/1, 38/1 S, 38/2, 38/2 S

Series 3242 ... BX4 SC

	3242 G	012 BX4	024 BX4	SC
1 Nominal voltage	U_N	12	24	Volt
2 Terminal resistance, phase-phase	R	0,89	3,6	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	21,2	21,1	W
4 Efficiency	$\eta_{\text{ max.}}$	77,4	77,3	%
5 No-load speed	n_o	5 500	5 500	rpm
6 No-load current	I_o	0,206	0,103	A
7 Stall torque	M_H	83	83	mNm
8 Friction torque, static	C_o	1,3	1,3	mNm
9 Friction torque, dynamic	C_v	$5,2 \cdot 10^{-4}$	$5,2 \cdot 10^{-4}$	mNm/rpm
10 Speed constant	k_n	455	227	rpm/V
11 Back-EMF constant	k_E	2,199	4,409	mV/rpm
12 Torque constant	k_M	21,0	42,1	mNm/A
13 Current constant	k_I	0,0476	0,0238	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	19,3	19,4	rpm/mNm
15 Terminal inductance, phase-phase	L	60	240	μH
16 Mechanical time constant	τ_m	6,1	6,1	ms
17 Rotor inertia	J	30	30	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	28	28	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{th 1} / R_{th 2}$	1,6 / 12,4		K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	9 / 810		s
21 Operating temperature range		- 40 ... +100		$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded		
23 Shaft load max.:				
- radial at 3 000 rpm (4,5 mm from mounting flange)		50		N
- axial at 3 000 rpm		5		N
- axial at standstill		50		N
24 Shaft play:				
- radial	\leq	0,015		mm
- axial	\equiv	0		mm
25 Housing material		stainless steel		
26 Weight		192		g
27 Direction of rotation		electronically reversible		
28 Number of pole pairs		2		

Recommended values - mathematically independent of each other

29 Speed up to	$n_{e \text{ max.}}$	14 000	6 000	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$	32 / 36	32 / 54	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$	1,90 / 2,00	0,95 / 1,55	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance $R_{th 2}$ not reduced / thermal resistance $R_{th 2}$ by 55% reduced

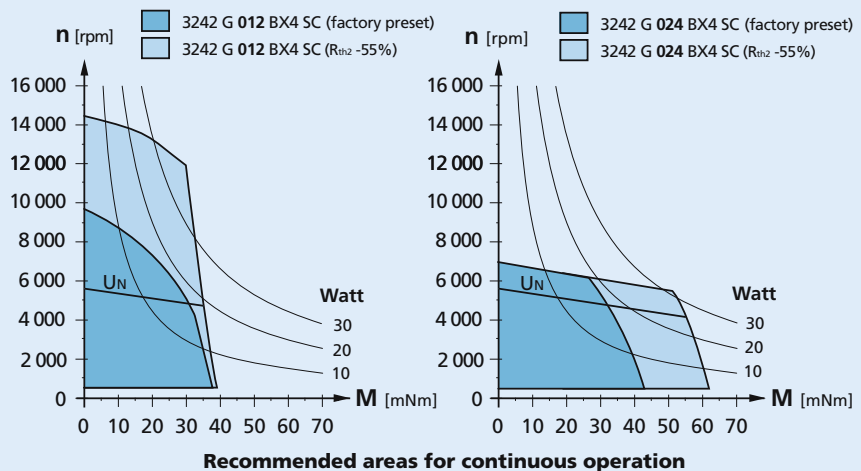
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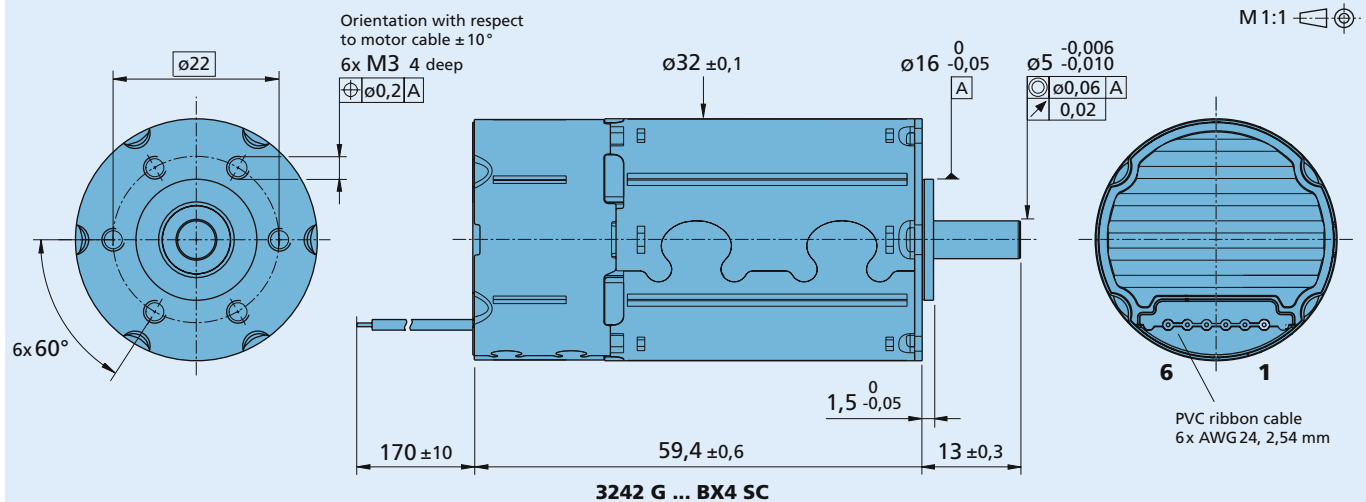
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ($R_{th 2}$ 55% reduced).

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use at higher continuous current.

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


Speed Controller		012 BX4	024 BX4	SC
Power supply electronic	U_P	5 ... 30		V DC
Power supply motor	U_{mot}	5 ... 30		V DC
PWM switching frequency	f_{PWM}	96		kHz
Efficiency	η	95		%
Max. continuous output current ¹⁾	I_{dauer}	2		A
Max. peak output current	I_{max}	4		A
Total standby current at U_N	I_{el}		17	10
				mA
Speed range, electronics		400 ... 50 000 ²⁾		rpm
Scanning rate		500		μ s

¹⁾ at 22°C ambient temperature

²⁾ speed is dependent on the motor operating voltage

Connection information

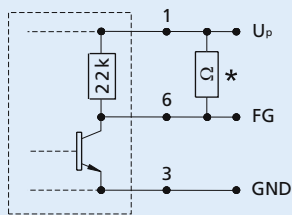
Connection 1 "U_P":	power supply electronic	U_P	
Connection 2 "U_{mot}":	power supply electronic coil	U_{mot}	
Connection 3 "GND":	ground	ground	
Connection 4 "U_{nsoll}":			
- analog input	input voltage	$U_{in} = 0 \dots 10V \mid > 10V \dots U_P \gg$ set speed value not defined	
	input resistance	$R_{in} \geq 8,9k\Omega$	
	set speed value	per 1V, 1 000	rpm
		$U_{in} < 0,15V \gg$ motor stops	
		$U_{in} > 0,3V \gg$ motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level < 0,5V » counterclockwise	
		open or level > 3V » clockwise	
	input resistance	$R_{in} \geq 10k\Omega$	
Connection 6 "FG":			
- digital output	frequency output	max. U_P ; $I_{max} = 15$ mA; open collector with 22 k Ω pull-up resistor	
		6 lines per revolution	

Features

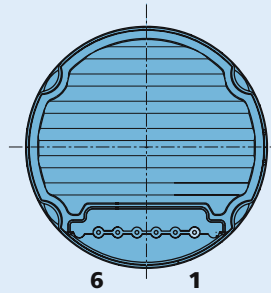
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

Circuit diagram/Connection information
Output circuit


* An additional external pull-up resistor can be added to improve the rise time.
 Caution: I_{out} max. 15 mA must not be exceeded!

Cable connection

Connection

No.	Function
1	U_p
2	U_{mot}
3	GND
4	U_{soll}
5	DIR
6	FG

Caution:

Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
 AWG 24 / PVC ribbon cable
 with connector Micro-Fit


Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Examples:
 3242G012BX4 SC
 3242G024BX4 SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

50 mNm

For combination with
Gearheads:
30/1, 32A, 32/3, 32/3 S, 38/1, 38/1 S, 38/2, 38/2 S

Series 3242 ... BX4 SCDC

	3242 G	012 BX4	024 BX4	SCDC
1 Nominal voltage	U_N	12	24	Volt
2 Terminal resistance, phase-phase	R	0,89	3,6	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	21,2	21,1	W
4 Efficiency	$\eta_{\text{ max.}}$	77,4	77,3	%
5 No-load speed	n_0	5 300	5 400	rpm
6 No-load current	I_0	0,199	0,101	A
7 Stall torque	M_H	83	83	mNm
8 Friction torque, static	C_0	1,3	1,3	mNm
9 Friction torque, dynamic	C_v	$5,2 \cdot 10^{-4}$	$5,2 \cdot 10^{-4}$	mNm/rpm
10 Speed constant	k_n	455	227	rpm/V
11 Back-EMF constant	k_E	2,199	4,409	mV/rpm
12 Torque constant	k_M	21,0	42,1	mNm/A
13 Current constant	k_I	0,0476	0,0238	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	19,3	19,4	rpm/mNm
15 Terminal inductance, phase-phase	L	60	240	μH
16 Mechanical time constant	τ_m	6,1	6,1	ms
17 Rotor inertia	J	30	30	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	28	28	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{\text{th } 1} / R_{\text{th } 2}$	1,6 / 12,4		K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	9 / 810		s
21 Operating temperature range		- 40 ... +85		$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded		
23 Shaft load max.:				
- radial at 3 000 rpm (4,5 mm from mounting flange)		50		N
- axial at 3 000 rpm		5		N
- axial at standstill		50		N
24 Shaft play:				
- radial	\leq	0,015		mm
- axial	\equiv	0		mm
25 Housing material		stainless steel		
26 Weight		189		g
27 Direction of rotation		electronically reversible		
28 Number of pole pairs		2		
Recommended values - mathematically independent of each other				
29 Speed up to	$n_{\text{e max.}}$	12 000	6 000	rpm
30 Torque up to ^{1) 2)}	$M_{\text{e max.}}$	27 / 29	28 / 50	mNm
31 Current up to ^{1) 2)}	$I_{\text{e max.}}$	1,60 / 1,60	0,82 / 1,40	A

¹⁾ at 5000 rpm

²⁾ thermal resistance $R_{\text{th } 2}$ not reduced / thermal resistance $R_{\text{th } 2}$ by 55% reduced

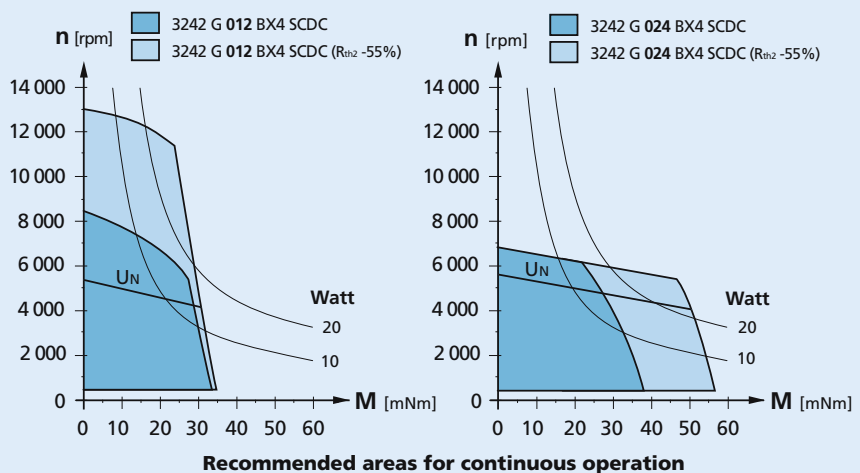
Note:

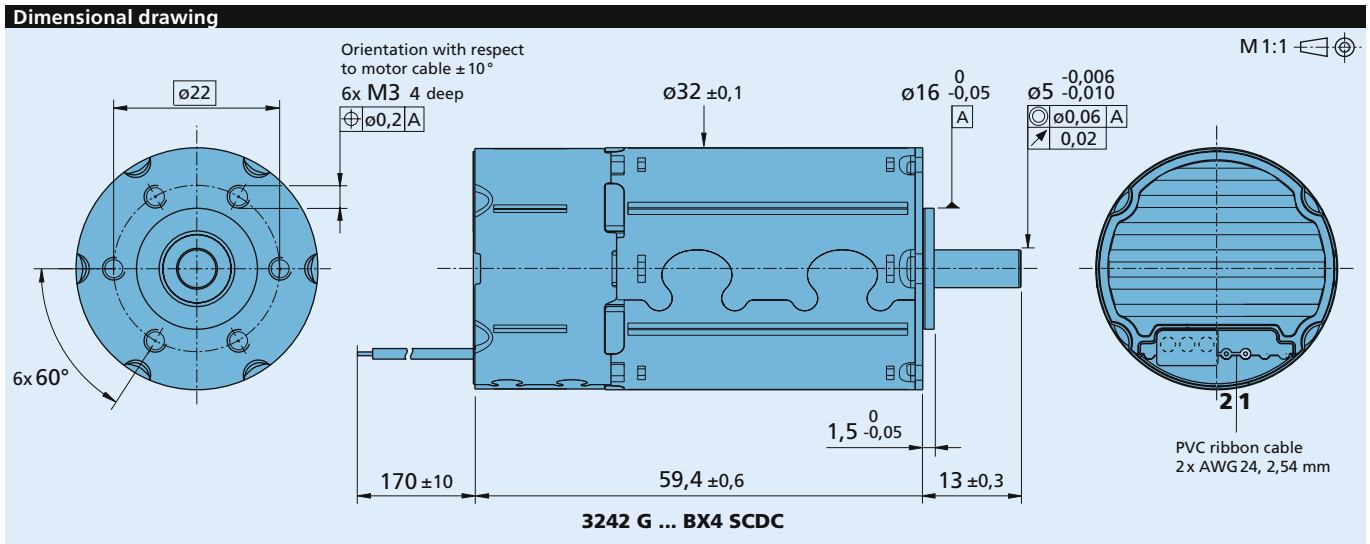
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ($R_{\text{th } 2}$ 55% reduced).

The motor is factory pre-configured to perform at the recommended continuous current. Non-standard configurations are only possible upon request from the manufacturer.

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.





Speed Controller		012 BX4	024 BX4	SCDC
Power supply electronic	U_p	6,5 ... 30		V DC
Power supply motor	U_{mot}	6,5 ... 30		V DC
PWM switching frequency	f_{PWM}	96		kHz
Efficiency	η	95		%
Max. continuous output current ¹⁾	I_{dauer}	1,6		A
Max. peak output current	I_{max}	4		A
Total standby current at U_N	I_{el}	17	10	mA
Speed range, electronics		400 ... 50 000 ²⁾		rpm
Scanning rate		500		μs

¹⁾ at 22°C ambient temperature

²⁾ speed is dependent on the motor operating voltage

Connection information

Connection 1 "Mot +": positive power supply

Connection 2 "Mot -": negative power supply

Features

In this version, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using the integrated digital hall sensors. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

The direction of rotation is dependent on the polarity of the voltage.

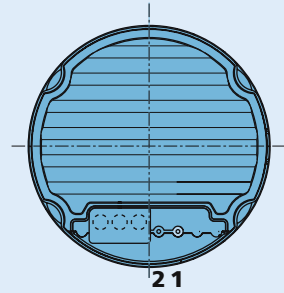
Full product description

■ Examples:

3242G012BX4 SCDC
3242G024BX4 SCDC

Connection information
Options

- Connector variants (Option no. 4140)
 AWG 24 / PVC ribbon cable
 with connector Micro-Fit
 connector pin assignment:


Cable connection

Connection

No.	Function
1	Mot +
2	Mot -

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

73 mNm

For combination with

Gearheads:

30/1, 32A, 32/3, 32/3 S, 38/1, 38/1 S, 38/2, 38/2 S

Series 3268 ... BX4 SC

	3268 G		024 BX4	SC
1 Nominal voltage	U_N		24	Volt
2 Terminal resistance, phase-phase	R		1,45	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$		32,7	W
4 Efficiency	$\eta_{\text{ max.}}$		79,5	%
5 No-load speed	n_0		5 500	rpm
6 No-load current	I_0		0,215	A
7 Stall torque	M_H		137	mNm
8 Friction torque, static	C_0		1,7	mNm
9 Friction torque, dynamic	C_v		$1,3 \cdot 10^{-3}$	mNm/rpm
10 Speed constant	k_n		220	rpm/V
11 Back-EMF constant	k_E		4,555	mV/rpm
12 Torque constant	k_M		43,5	mNm/A
13 Current constant	k_I		0,0230	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$		7,3	rpm/mNm
15 Terminal inductance, phase-phase	L		110	μH
16 Mechanical time constant	τ_m		4,6	ms
17 Rotor inertia	J		60	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$		23	$\cdot 10^3 \text{rad/s}^2$
19 Thermal resistance	$R_{\text{th } 1} / R_{\text{th } 2}$	1,9 / 9,6		K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	17 / 1 060		s
21 Operating temperature range		- 40 ... + 100		$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded		
23 Shaft load max.:				
– radial at 3 000 rpm (4,5 mm from mounting flange)		50		N
– axial at 3 000 rpm		5		N
– axial at standstill		50		N
24 Shaft play:				
– radial	\leq	0,015		mm
– axial	\equiv	0		mm
25 Housing material		stainless steel		
26 Weight		305		g
27 Direction of rotation		electronically reversible		
28 Number of pole pairs		2		
Recommended values - mathematically independent of each other				
29 Speed up to	$n_{e \text{ max.}}$		7 000	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$		47 / 73	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$		1,41 / 2,00	A

¹⁾ at $U_{\text{soil}} = 10\text{V}$

²⁾ thermal resistance $R_{\text{th } 2}$ not reduced / thermal resistance $R_{\text{th } 2}$ by 55% reduced

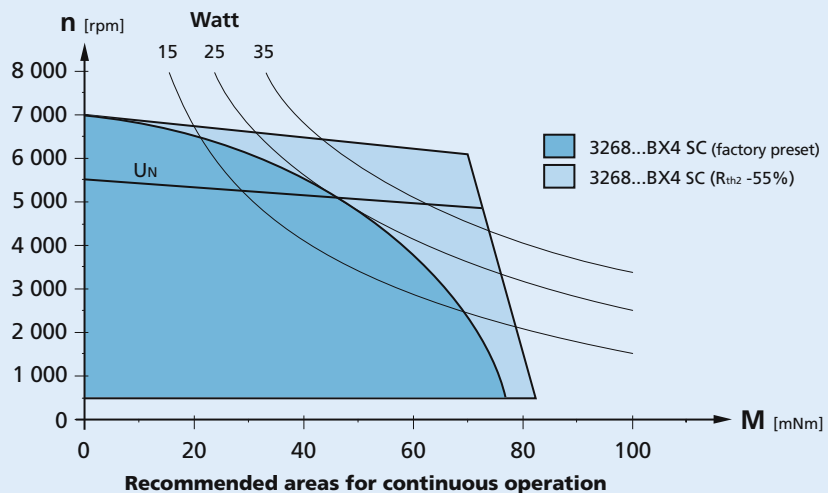
Note:

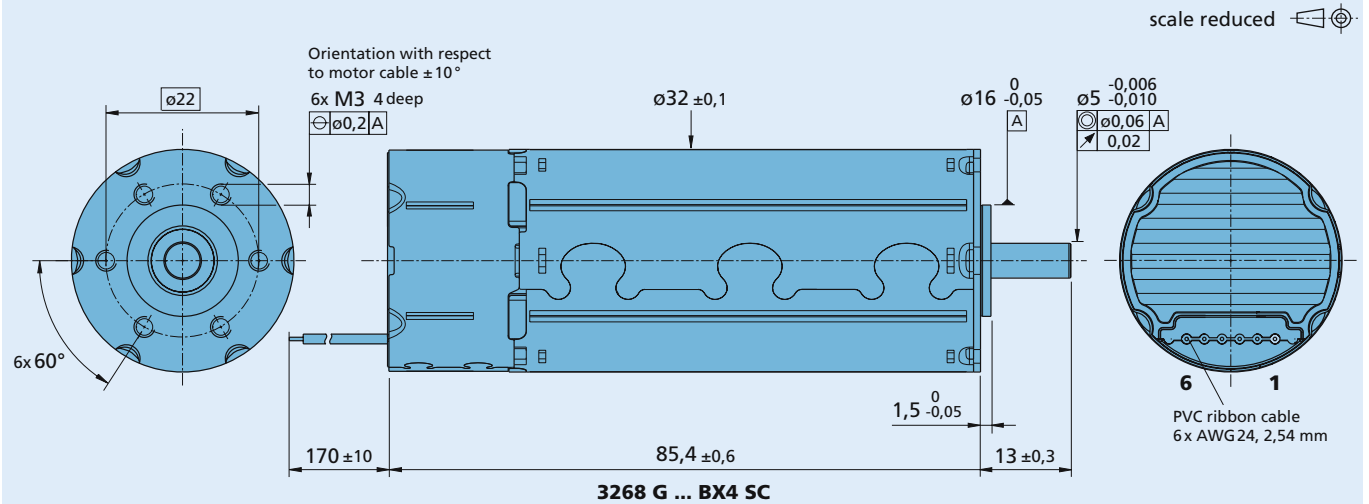
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ($R_{\text{th } 2}$ 55% reduced).

The motor is factory pre-configured to a continuous current for the thermally insulated condition. The controller must be reconfigured with the easy to use Motion Manager Software for use at higher continuous current.

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


Speed Controller		024 BX4	SC
Power supply electronic	U_p	5 ... 30	V DC
Power supply motor	U_{mot}	5 ... 30	V DC
PWM switching frequency	f_{PWM}	96	kHz
Efficiency	η	95	%
Max. continuous output current ¹⁾	I_{dauer}	2	A
Max. peak output current	I_{max}	4	A
Total standby current at U_N	I_{el}	10	mA
Speed range, electronics		400 ... 50 000 ²⁾	rpm
Scanning rate		500	μ s

¹⁾ at 22°C ambient temperature

²⁾ speed is dependent on the motor operating voltage

Connection 1 "U_P":	power supply electronic	U_p	
Connection 2 "U_{mot}":	power supply electronic coil	U_{mot}	
Connection 3 "GND":	ground	ground	
Connection 4 "U_{nsoll}":			
- analog input	input voltage	$U_{in} = 0 \dots 10 \text{ V} \mid > 10 \text{ V} \dots U_p \gg$ set speed value not defined	
	input resistance	$R_{in} \geq 8,9 \text{ k}\Omega$	
	set speed value	per 1 V, 1 000	rpm
		$U_{in} < 0,15 \text{ V} \gg$ motor stops	
		$U_{in} > 0,3 \text{ V} \gg$ motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level $< 0,5 \text{ V} \gg$ counterclockwise	
		open or level $> 3 \text{ V} \gg$ clockwise	
	input resistance	$R_{in} \geq 10 \text{ k}\Omega$	
Connection 6 "FG":			
- digital output	frequency output	max. U_p ; $I_{max} = 15 \text{ mA}$; open collector with 22 k Ω pull-up resistor	
		6 lines per revolution	

Features

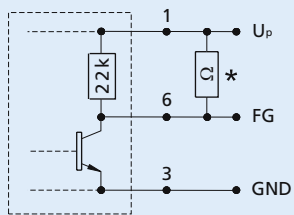
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use. The following parameters can be changed: current limit and regulator parameters.

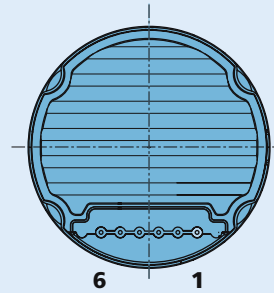
Circuit diagram/Connection information

Output circuit



* An additional external pull-up resistor can be added to improve the rise time.
Caution: I_{out} max. 15 mA must not be exceeded!

Cable connection



Connection

No.	Function
1	U_p
2	U_{mot}
3	GND
4	U_{soll}
5	DIR
6	FG

Caution:
Incorrect lead connection will damage the motor electronics!

Options

- Connector variant (Option no.: 3809)
AWG 24 / PVC ribbon cable
with connector Micro-Fit

Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
3268G024BX4 SC

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

58 mNm

For combination with
Gearheads:
30/1, 32A, 32/3, 32/3 S, 38/1, 38/1 S, 38/2, 38/2 S

Series 3268 ... BX4 SCDC

	3268 G	024 BX4	SCDC
1 Nominal voltage	U_N	24	Volt
2 Terminal resistance, phase-phase	R	1,45	Ω
3 Output power ¹⁾	$P_{2 \text{ max.}}$	32,7	W
4 Efficiency	$\eta_{\text{ max.}}$	79,5	%
5 No-load speed	n_0	5 300	rpm
6 No-load current	I_0	0,210	A
7 Stall torque	M_H	137	mNm
8 Friction torque, static	C_0	1,7	mNm
9 Friction torque, dynamic	C_v	$1,3 \cdot 10^{-3}$	mNm/rpm
10 Speed constant	k_n	220	rpm/V
11 Back-EMF constant	k_E	4,555	mV/rpm
12 Torque constant	k_M	43,5	mNm/A
13 Current constant	k_I	0,0230	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	7,3	rpm/mNm
15 Terminal inductance, phase-phase	L	110	μH
16 Mechanical time constant	τ_m	4,6	ms
17 Rotor inertia	J	60	gcm^2
18 Angular acceleration	$\alpha_{\text{ max.}}$	23	$\cdot 10^3 \text{ rad/s}^2$
19 Thermal resistance	$R_{th 1} / R_{th 2}$	1,9 / 9,6	K/W
20 Thermal time constant	τ_{w1} / τ_{w2}	17 / 1 060	s
21 Operating temperature range		- 40 ... +85	$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded	
23 Shaft load max.:			
- radial at 3 000 rpm (4,5 mm from mounting flange)	50		N
- axial at 3 000 rpm	5		N
- axial at standstill	50		N
24 Shaft play:			
- radial	\leq	0,015	mm
- axial	\equiv	0	mm
25 Housing material		stainless steel	
26 Weight		305	g
27 Direction of rotation		electronically reversible	
28 Number of pole pairs		2	
Recommended values - mathematically independent of each other			
29 Speed up to	$n_{e \text{ max.}}$	6 500	rpm
30 Torque up to ^{1) 2)}	$M_{e \text{ max.}}$	37 / 58	mNm
31 Current up to ^{1) 2)}	$I_{e \text{ max.}}$	1,11 / 1,60	A

¹⁾ at 5000 rpm

²⁾ thermal resistance $R_{th 2}$ not reduced / thermal resistance $R_{th 2}$ by 55% reduced

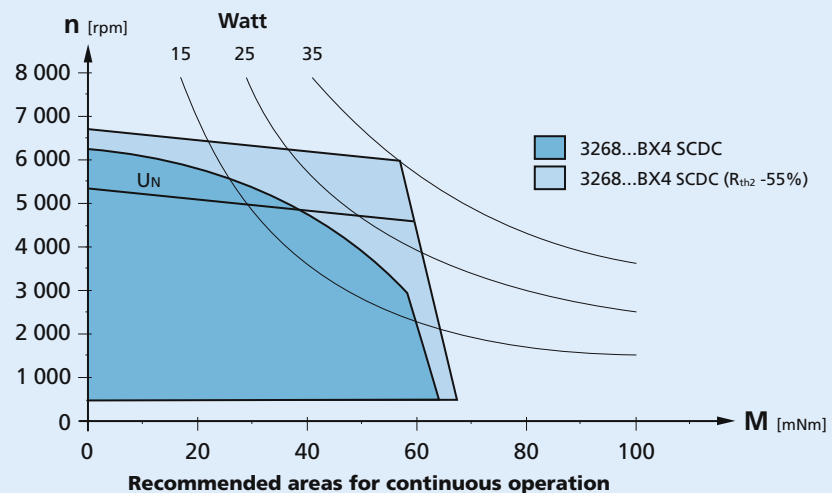
Note:

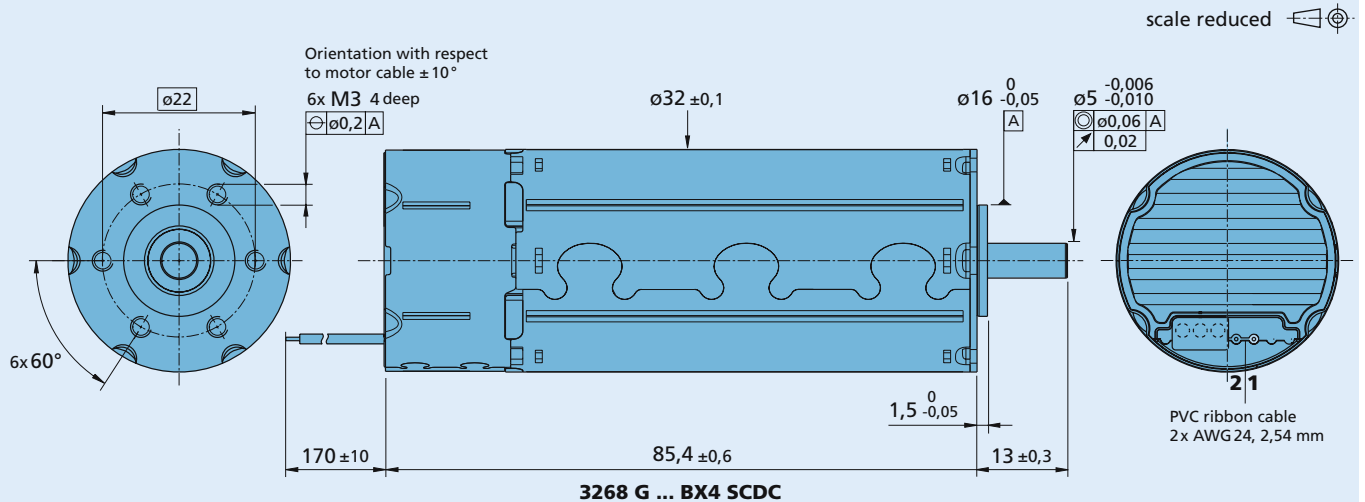
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ($R_{th 2}$ 55% reduced).

The motor is factory pre-configured to perform at the recommended continuous current. Non-standard configurations are only possible upon request from the manufacturer.

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


Speed Controller		024 BX4	SCDC
Power supply electronic	U_p	6,5 ... 30	V DC
Power supply motor	U_{mot}	6,5 ... 30	V DC
PWM switching frequency	f_{PWM}	96	kHz
Efficiency	η	95	%
Max. continuous output current ¹⁾	I_{dauer}	1,6	A
Max. peak output current	I_{max}	4	A
Total standby current at U_N	I_{el}	10	mA
Speed range, electronics		400 ... 50 000 ²⁾	rpm
Scanning rate		500	μs

¹⁾ at 22°C ambient temperature

²⁾ speed is dependent on the motor operating voltage

Connection information

Connection 1 "Mot +": positive power supply

Connection 2 "Mot -": negative power supply

Features

In this version, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using the integrated digital hall sensors. Speed control is via a PI regulator.

The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

The direction of rotation is dependent on the polarity of the voltage.

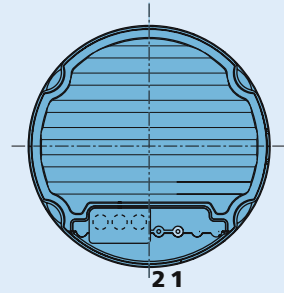
Full product description

■ Examples:

3268G024BX4 SCDC

Connection information
Options

- Connector variants (Option no. 4140)
 AWG 24 / PVC ribbon cable
 with connector Micro-Fit
 connector pin assignment:


Cable connection

Connection

No.	Function
1	Mot +
2	Mot -

Brushless Flat DC-Micromotors with integrated Speed Controller

3,7 mNm

Series 2610 ... B SC

	2610 T	006 B	012 B	SC
1 Nominal voltage	U _N	6	12	Volt
2 Terminal resistance, phase-phase	R	7,0	28,2	Ω
3 Output power ¹⁾	P _{2 max.}	1,92	1,91	W
4 Efficiency	η _{max.}	78	78	%
5 No-load speed	n ₀	6 200	6 200	rpm
6 No-load current	I ₀	0,012	0,006	A
7 Stall torque	M _H	7,73	7,68	mNm
8 Friction torque, static	C ₀	0,025	0,025	mNm
9 Friction torque, dynamic	C _v	1,35 · 10 ⁻⁵	1,35 · 10 ⁻⁵	mNm/rpm
10 Speed constant	k _n	1 055	528	rpm/V
11 Back-EMF constant	k _E	0,948	1,895	mV/rpm
12 Torque constant	k _M	9,05	18,1	mNm/A
13 Current constant	k _I	0,111	0,055	A/mNm
14 Slope of n-M curve	Δn/ΔM	816	822	rpm/mNm
15 Terminal inductance, phase-phase	L	480	1 940	μH
16 Mechanical time constant	τ _m	69	70	ms
17 Rotor inertia	J	8,1	8,1	gcm ²
18 Angular acceleration	α _{max.}	9,5	9,5	· 10 ³ rad/s ²
19 Thermal resistance	R _{th 1} / R _{th 2}	33 / 27		K/W
20 Thermal time constant	τ _{w1} / τ _{w2}	20 / 230		s
21 Operating temperature range		-25 ... +80		°C
22 Shaft bearings		ball bearing, preloaded		
23 Shaft load max.:				
– radial at 3 000/7 000 rpm (3 mm from mounting flange)		4,0 / 3,5		N
– axial at 3 000/7 000 rpm (push-on only)		3,5 / 3,4		N
– axial at standstill (push-on only)		17,5		N
24 Shaft play:				
– radial	≤	0,015		mm
– axial	≡	0		mm
25 Housing material		plastic		
26 Weight		20,1		g
27 Direction of rotation		electronically reversible		

Recommended values - mathematically independent of each other

28 Speed up to	n _{e max.}	7 000	7 000	rpm
29 Torque up to ^{1) 2)}	M _{e max.}	3,14 / 3,72	3,13 / 3,70	mNm
30 Current up to ^{1) 2)}	I _{e max.}	0,403 / 0,475	0,201 / 0,236	A

¹⁾ at 5 000 rpm

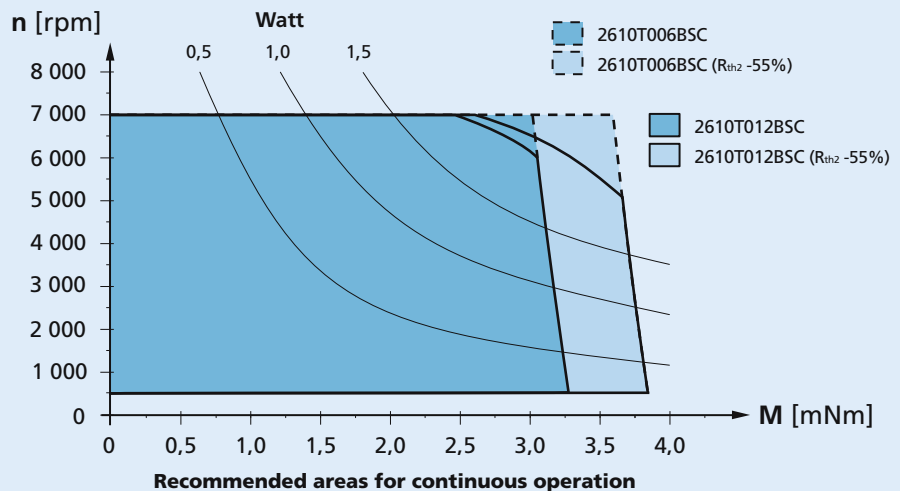
²⁾ thermal resistance R_{th 2} not reduced / thermal resistance R_{th 2} by 55% reduced

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_{th 2} 55% reduced).

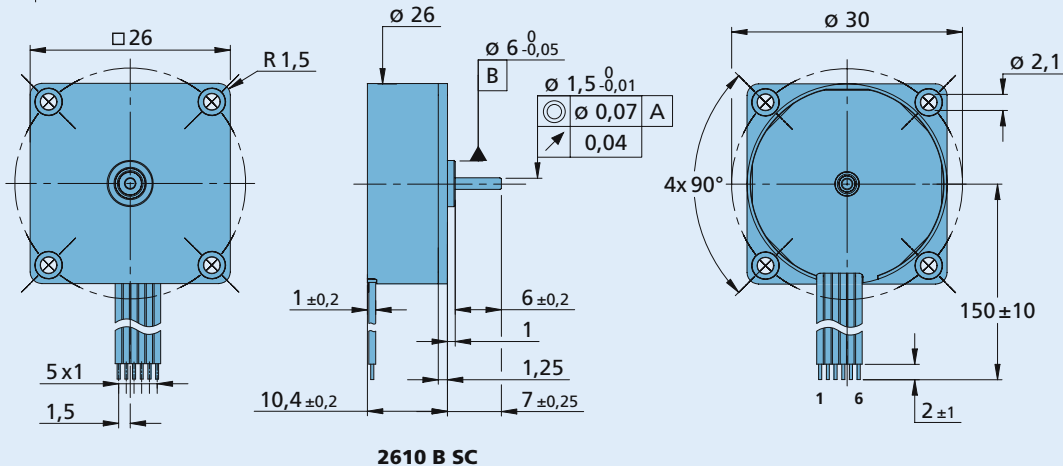
The area of the curve is defined by the maximum allowable supply voltage of the integrated speed controller as well as the control performance characteristics.



Recommended areas for continuous operation

2610 T ... B SC

M1:1


2610 B SC
Option

- connector variants AWG 28 / PVC ribbon cable with connector Picoblade
- connector pin assignment:


Connection

No.	Function
1	Up
2	U _{mot}
3	GND
4	Unsoll
5	DIR
6	FG

Speed Controller	006 B	012 B	SC
PWM switching frequency	96	96	kHz
Efficiency	95	95	%
Max. continuous output current ¹⁾	0,8	0,8	A
Max. peak output current	1,6	1,6	A
Total standby current	0,020		A
Speed range electronic	500 ... 60 000 ²⁾		rpm
Scanning range	500		µs

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

Connection information	006 B	012 B	SC
Connection 1 "U_P": power supply electronic	U _P = 4 ... 18 V		
Connection 2 "U_{mot}": power supply electronic coil	U _{mot} = 1,7 ... 18 V		
Connection 3 "GND": ground	ground		
Connection 4 "Unsoll":			
- analog input	input voltage	U _{in} = 0 ... 10 V (max. U _P)	
	input resistance	R _{in} ≥ 8 kΩ	
	set speed value	per 1 V 1 000	1 000 rpm
		U _{in} < 0,15 V » motor stops	
		U _{in} > 0,3 V » motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level < 0,5 V » counterclockwise	
		open or level > 3 V » clockwise (max. U _P)	
	input resistance	R _{in} ≥ 10 kΩ	
Connection 6 "FG":			
- digital output	frequency output	with max. U _P » I _{max} = 15 mA; open collector with 22 kΩ pull-up resistor	
		6 lines per revolution	

Features

In this variant, the brushless DC-Micromotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator. The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use.

The following parameters can be changed: current limit and regulator parameters.

Full product description

- Examples:

2610T006B SC

2610T012B SC

Brushless DC-Gearmotors

with integrated Speed Controller

100 mNm

Series 2622 ... B SC

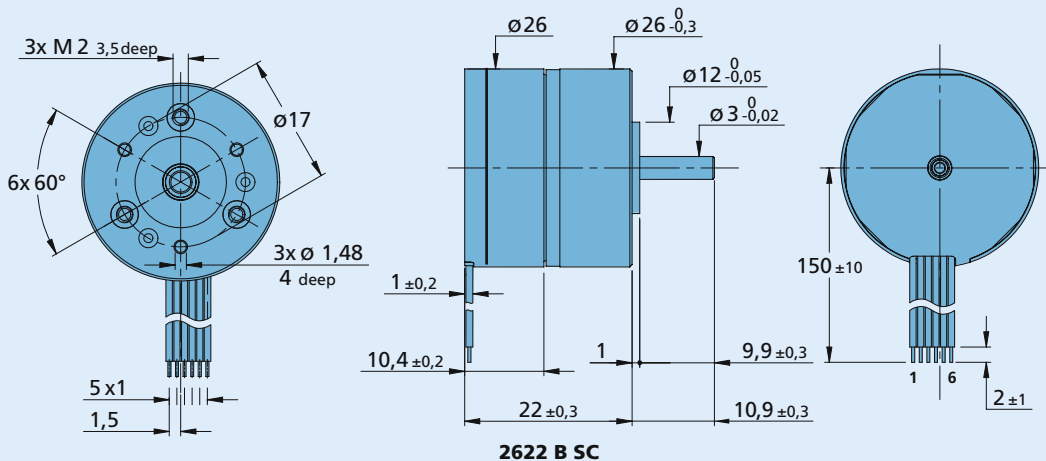
	2622 S	006 B	012 B	SC
1 Nominal voltage	U _N	6	12	Volt
2 Terminal resistance, phase-phase	R	7,0	28,2	Ω
3 Output power	P _{2 max.}	1,92	1,91	W
4 Efficiency	η _{max.}	78	78	%
5 No-load speed	n ₀	6 200	6 200	rpm
6 No-load current	I ₀	0,012	0,006	A
7 Stall torque	M _H	7,73	7,68	mNm
8 Friction torque, static	C ₀	0,025	0,025	mNm
9 Friction torque, dynamic	C _v	1,35 · 10 ⁻⁵	1,35 · 10 ⁻⁵	mNm/rpm
10 Speed constant	k _n	1 055	528	rpm/V
11 Back-EMF constant	k _E	0,948	1,895	mV/rpm
12 Torque constant	k _M	9,05	18,1	mNm/A
13 Current constant	k _I	0,111	0,055	A/mNm
14 Slope of n-M curve	Δn/ΔM	816	822	rpm/mNm
15 Terminal inductance, phase-phase	L	480	1 940	μH
16 Mechanical time constant	τ _m	69	70	ms
17 Rotor inertia	J	8,1	8,1	gcm ²
18 Angular acceleration	α _{max.}	9,5	9,5	· 10 ³ rad/s ²
19 Thermal resistance	R _{th 1} / R _{th 2}	33 / 27		K/W
20 Thermal time constant	τ _{w1} / τ _{w2}	20 / 230		s

Integrated Gearhead

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

Specifications

reduction ratio (rounded)	output speed up to n _{max} rpm	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

2622 S ... B SC
 M1:1

Option

- connector variants AWG 28 / PVC ribbon cable with connector Picoblade
- connector pin assignment:


Connection

No.	Function
1	Up
2	U _{mot}
3	GND
4	Unsoll
5	DIR
6	FG

Speed Controller	006 B	012 B	SC
PWM switching frequency	96	96	kHz
Efficiency	95	95	%
Max. continuous output current ¹⁾	0,8	0,8	A
Max. peak output current	1,6	1,6	A
Total standby current	0,020		A
Speed range electronic	500 ... 60 000 ²⁾		rpm
Scanning range	500		µs

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature respectively

²⁾ speed depend on motor operating voltage

Connection information	006 B	012 B	SC
Connection 1 "U_P": power supply electronic	U _P = 4 ... 18 V		
Connection 2 "U_{mot}": power supply electronic coil	U _{mot} = 1,7 ... 18 V		
Connection 3 "GND": ground	ground		
Connection 4 "U_{nsoll}":			
- analog input	input voltage	U _{in} = 0 ... 10V (max. U _P)	
	input resistance	R _{in} ≥ 8 kΩ	
	set speed value	per 1V 1 000	1 000 rpm
		U _{in} < 0,15V » motor stops	
		U _{in} > 0,3V » motor starts	
Connection 5 "DIR":			
- analog input	direction of rotation	to ground or level < 0,5V » counterclockwise	
		open or level > 3V » clockwise (max. U _P)	
	input resistance	R _{in} ≥ 10 kΩ	
Connection 6 "FG":			
- digital output	frequency output	with max. U _P » I _{max} = 15 mA; open collector with 22 kΩ pull-up resistor	
		6 lines per revolution	

Features

In this variant, the brushless DC-Micromotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator. The Speed Controller has a current limiting device which limits the maximum motor current if the thermal load is too high. Twice the continuous current is possible over a short time.

Using the "FAULHABER Motion Manager" software, the customer can modify the Speed Controller to special conditions of use.

The following parameters can be changed: current limit and regulator parameters.

Full product description

- Examples:

2622S006B SC

2622S012B SC