

Brushless DC-Servomotors

with integrated Speed Controller

4 Pole Technology

16 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_o | 6 600 | 7 000 | rpm |
| 6 No-load current (with shaft \varnothing 3,0 mm) | I_o | 0,112 | 0,061 | A |
| 7 Stall torque | M_H | 55,7 | 59,9 | mNm |
| 8 Friction torque, static | C_o | 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_{th1} / R_{th2} | 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 / 16 | 12 / 13 | mNm |
| 31 Current up to ^{1) 2)} | $I_{e \text{ max.}}$ | 1 / 1,4 | 0,5 / 0,8 | A |

¹⁾ at 5 000 rpm

²⁾ thermal resistance R_{th2} not reduced / thermal resistance R_{th2} by 55% reduced

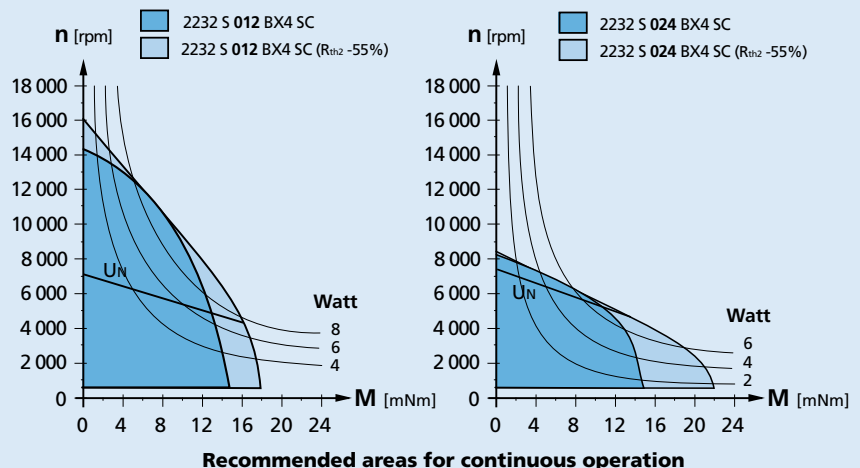
Note:

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

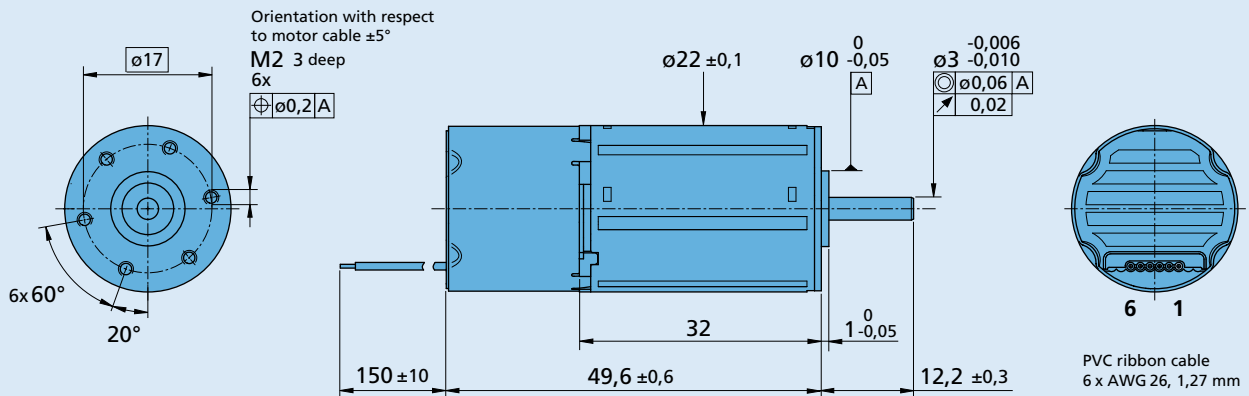
The diagram shows the motor in a completely insulated as well as thermally coupled condition (R_{th2} 55% reduced).

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 with other parameter settings.

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



Dimensional drawing



2232 S ... BX4 SC

| 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} | | 1,4 | A |
| Max. peak output current ¹⁾ | I_{max} | | 2,8 | A |
| Total standby current at U_N | I_{el} | 0,020 | | A |
| Speed range: | | | | |
| – standard » Hall sensors (digital) | | 400 ... 50 000 ²⁾ | | rpm |
| – optional » Hall sensors (analog) | | 50 ... 50 000 ²⁾ | | rpm |
| Scanning range | | 500 | | μs |

¹⁾ at 22°C ambient temperature and max. 60°C motor temperature at the nominal voltage of motor and electronics

²⁾ speed depend on 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 | $U_{in} = 0 \dots 10V \mid > 10V \dots U_p$ » 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": | | |
| – digital 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

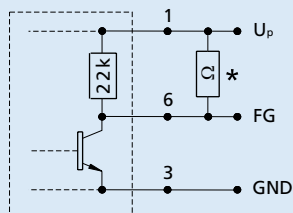
In this variant, the brushless DC servomotors have an integrated Speed Controller. The motor is commutated using Hall sensors integrated into the motor. Speed control is via a PI regulator.

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.

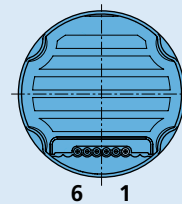
Circuit diagram/Connection information

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_{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
- Analog Hall sensors (Option no.: 3692)



Accessories

- Programming board (Part No.: 6501.00088)

Full product description

- Example:
 2232S024BX4 SC