

Brushless DC-Servomotors

with integrated Encoder

4 Pole Technology

7 / 13 mNm

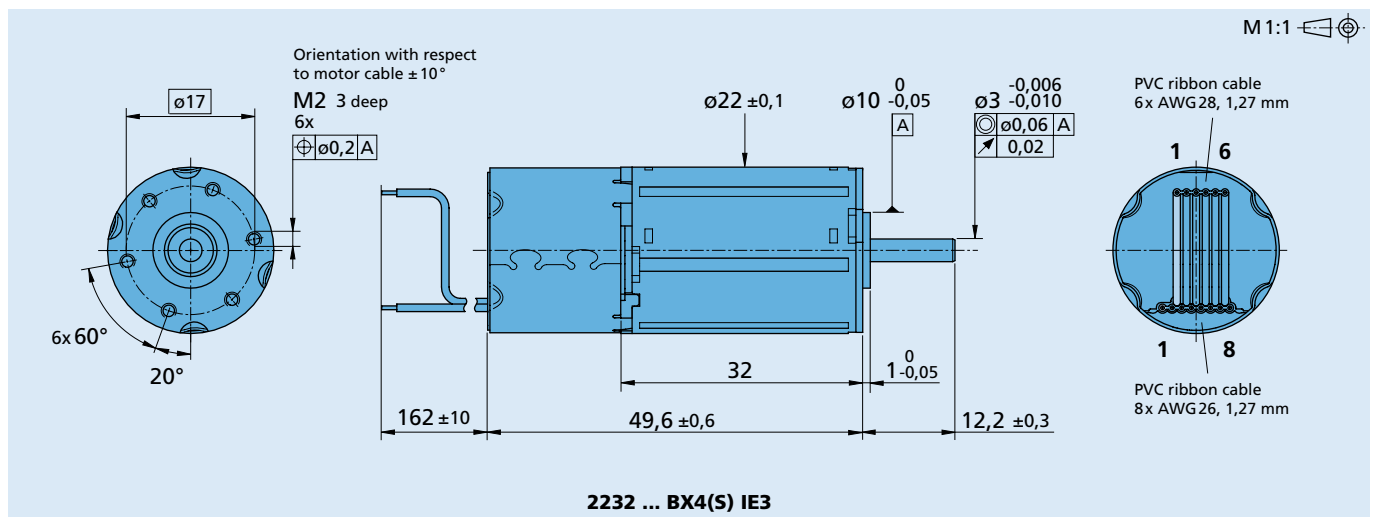
For combination with
Gearheads:
22F

Series 2232 ... BX4 IE3

	2232 S	012 BX4 S	024 BX4 S	012 BX4	024 BX4	IE3
1 Nominal voltage	U _N	12	24	12	24	Volt
2 Terminal resistance, phase-phase	R	3,5	12,4	3,5	12,4	Ω
3 Output power ^{1) 2)}	P _{2 max.}	4,4	4,5	8,8	8,9	W
4 Efficiency	η _{max.}	60,9	61,7	66,9	67,6	%
5 No-load speed	n ₀	13 200	14 000	6 600	7 000	rpm
6 No-load current (with shaft ø 3,0 mm)	I ₀	0,163	0,088	0,112	0,061	A
7 Stall torque	M _H	27,3	29,4	55,7	59,9	mNm
8 Friction torque, static	C ₀	0,6	0,6	0,85	0,85	mNm
9 Friction torque, dynamic	C _v	5,5 · 10 ⁻⁵	5,5 · 10 ⁻⁵	1,5 · 10 ⁻⁴	1,5 · 10 ⁻⁴	mNm/rpm
10 Speed constant	k _n	1 173	616	579	304	rpm/V
11 Back-EMF constant	k _E	0,852	1,623	1,728	3,288	mV/rpm
12 Torque constant	k _M	8,14	15,50	16,50	31,40	mNm/A
13 Current constant	k _I	0,123	0,065	0,061	0,032	A/mNm
14 Slope of n-M curve	Δn/ΔM	504	493	123	120	rpm/mNm
15 Terminal inductance, phase-phase	L	130	470	120	440	μH
16 Mechanical time constant	τ _m	22	22	6,7	6,5	ms
17 Rotor inertia	J	4,2	4,2	5,2	5,2	gcm ²
18 Angular acceleration	α _{max.}	65	70	107	115	· 10 ³ rad/s ²
19 Thermal resistance	R _{th 1} / R _{th 2}	2 / 13		2 / 13		K/W
20 Thermal time constant	τ _{w1} / τ _{w2}	4,1 / 274		4,1 / 283		s
21 Operating temperature range		- 40 ... + 85		- 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		81				g
27 Direction of rotation		electronically reversible				
28 Number of pole pairs		2				
Recommended values - mathematically independent of each other						
29 Speed up to ²⁾	n _{e max.}	16 700	16 700	10 500	10 500	rpm
30 Torque up to ^{1) 2)}	M _{e max.}	7	7	13	13	mNm
31 Current up to ^{1) 2)}	I _{e max.}	0,99	0,52	0,95	0,50	A

¹⁾ at 5 000 rpm

²⁾ thermal resistance R_{th 2} not reduced



Magnetic Encoder		IE3-32	IE3-64	IE3-128	IE3-256	
Lines per revolution	N	32	64	128	256	
Frequency range ¹⁾ , up to	f	15	30	60	120	kHz
Signal output, square wave		2 + 1 Index				channels
Supply voltage	U _{DD Enc}	4,5 ... 5,5				V DC
Current consumption, typical ²⁾	I _{DD Enc}	typ. 16, max. 21				mA
Output current, max. allowable ³⁾	I _{OUT}	4				mA
Index Pulse width ⁴⁾	P ₀	90 ± 45				°e
Phase shift, channel A to B ⁴⁾	Φ	90 ± 45				°e
Signal rise/fall time, max. (C _{LOAD} = 50 pF)	tr/tf	0,1/0,1				µs
Inertia of encoder magnet	J	0,08				gcm ²

¹⁾ speed (rpm) = f (Hz) x 60/N

²⁾ U_{DD Enc} = 5V: with unloaded outputs

³⁾ U_{DD Enc} = 5V: low logic level < 0,4V, high logic level > 4,5V: CMOS- and TTL compatible

⁴⁾ at 5 000 rpm

Features

In this version, the brushless DC servomotors have an encoder with 3 output channels. A permanent magnet on the shaft creates a moving magnetic field which is captured using a single-chip angular sensor and further processed. At the encoder outputs, two 90° phase-shifted rectangular signals are available with up to 256 impulses and an index impulse per motor revolution.

The encoder is available in a variety of different resolutions and is suitable for speed control and positioning applications. The motor and encoder cables are connected via separate ribbon cables.

A detailed instruction manual is included with the product or is available online at www.faulhaber.com

Options

- Connector variants

Encoder:
AWG 28 / PVC ribbon cable (6-conductors), with connector PicoBlade (pitch 1,25 mm)



Motor:
AWG 26 / PVC ribbon cable (8-conductors), with connector MicroFit

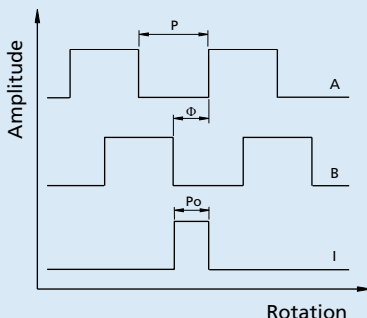


Full product description

- Examples:
2232S024BX4 IE3-256
2232S012BX4S IE3-32

Output signals / Circuit diagram / Connector information

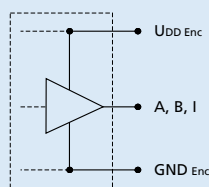
Output signals
with clockwise rotation as seen from the shaft end



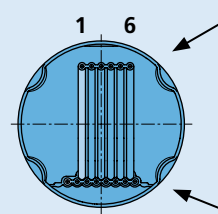
Admissible deviation of phase shift/Index pulse:

$$\Delta\Phi = \left| 90^\circ - \frac{\Phi}{P} * 180^\circ \right| \leq 45^\circ \quad \Delta P_0 = \left| 90^\circ - \frac{P_0}{P} * 180^\circ \right| \leq 45^\circ$$

Output circuit



Connection Encoder



No.	Function
1	n.c.
2	Channel I (Index)
3	GND Enc
4	U _{DD Enc}
5	Channel B
6	Channel A

Connection Motor

No.	Function
1	Phase C
2	Phase B
3	Phase A
4	GND
5	U _{DD} (2,2 ... 18 V DC)
6	Hall sensor C
7	Hall sensor B
8	Hall sensor A

Caution:
Incorrect lead connection will damage the motor electronics!