

**NEW**

# Brushless DC-Servomotors

6 / 12 mNm

with magnetic Encoders  
Electronic Commutation

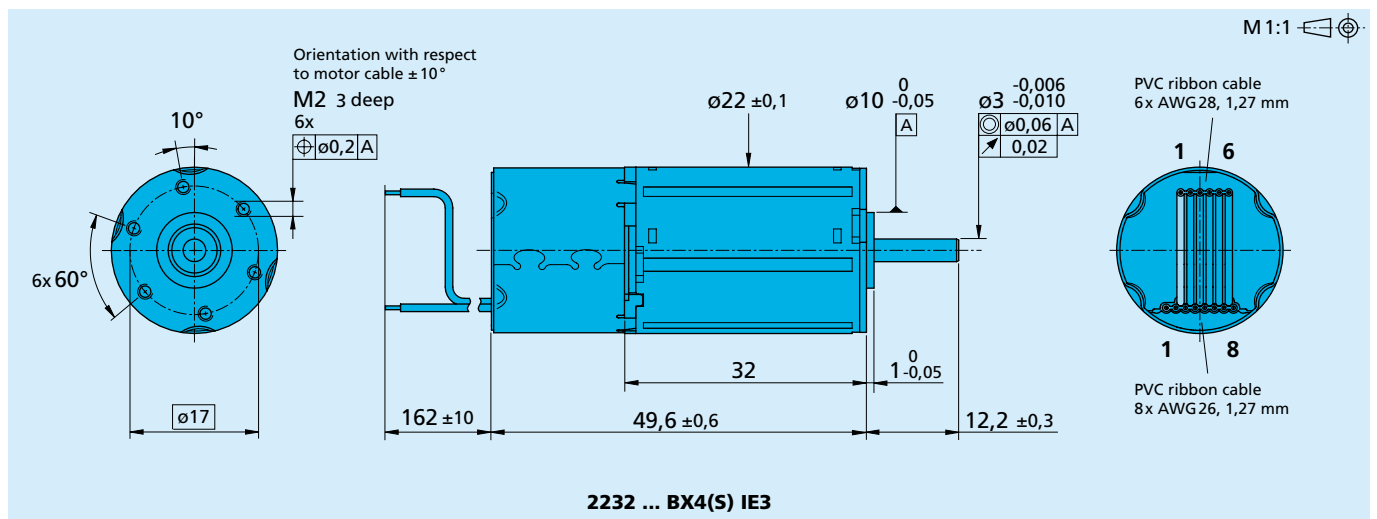
For combination with  
Gearheads:  
22F

## Series 2232 ... BX4 IE3

	2232 S	012 BX4 S	024 BX4 S	012 BX4	024 BX4	IE3
1 Nominal voltage	U <sub>N</sub>	12	24	12	24	Volt
2 Terminal resistance, phase-phase	R	3,5	12,4	3,5	12,4	Ω
3 Output power <sup>1) 2)</sup>	P <sub>2 max.</sub>	3,4	3,4	6,5	6,6	W
4 Efficiency	η <sub>max.</sub>	60,9	61,7	66,9	67,6	%
5 No-load speed	n <sub>0</sub>	13 180	13 980	6 600	7 000	rpm
6 No-load current (with shaft ø 3,0 mm)	I <sub>0</sub>	0,163	0,088	0,112	0,061	A
7 Stall torque	M <sub>H</sub>	27,3	29,4	55,7	59,9	mNm
8 Friction torque, static	C <sub>0</sub>	0,6	0,6	0,85	0,85	mNm
9 Friction torque, dynamic	C <sub>v</sub>	5,5 · 10 <sup>-5</sup>	5,5 · 10 <sup>-5</sup>	1,5 · 10 <sup>-4</sup>	1,5 · 10 <sup>-4</sup>	mNm/rpm
10 Speed constant	k <sub>n</sub>	1 174	616	579	304	rpm/V
11 Back-EMF constant	k <sub>E</sub>	0,852	1,623	1,728	3,288	mV/rpm
12 Torque constant	k <sub>M</sub>	8,14	15,50	16,50	31,40	mNm/A
13 Current constant	k <sub>I</sub>	0,123	0,065	0,061	0,032	A/mNm
14 Slope of n-M curve	Δn/ΔM	505	493	123	120	rpm/mNm
15 Terminal inductance, phase-phase	L	130	470	120	440	μH
16 Mechanical time constant	τ <sub>m</sub>	22	22	7	7	ms
17 Rotor inertia	J	4,2	4,2	5,2	5,2	gcm <sup>2</sup>
18 Angular acceleration	α <sub>max.</sub>	65	70	107	115	· 10 <sup>3</sup> rad/s <sup>2</sup>
19 Thermal resistance	R <sub>th 1</sub> / R <sub>th 2</sub>	2 / 17		2 / 17		K/W
20 Thermal time constant	τ <sub>w1</sub> / τ <sub>w2</sub>	4 / 510		4 / 527		s
21 Operating temperature range		- 40 ... + 85		- 40 ... + 100		°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		76				g
27 Direction of rotation		electronically reversible				
28 Number of pole pairs		2				
<b>Recommended values - mathematically independent of each other</b>						
29 Speed up to <sup>2)</sup>	n <sub>e max.</sub>	14 100	14 100	10 400	10 400	rpm
30 Torque up to <sup>1) 2)</sup>	M <sub>e max.</sub>	6	6	12	12	mNm
31 Current up to <sup>1) 2)</sup>	I <sub>e max.</sub>	0,85	0,45	0,90	0,48	A

<sup>1)</sup> at 5 000 rpm

<sup>2)</sup> thermal resistance R<sub>th 2</sub> not reduced



Magnetic Encoder		IE3-32	IE3-64	IE3-128	IE3-256		
Lines per revolution	N	32	64	128	256		
Frequency range <sup>1)</sup> , up to	f	15	30	60	120		kHz
Signal output, square wave		2+1 index					channels
Supply voltage	U <sub>DD Enc</sub>	4,5 ... 5,5					V DC
Current consumption, typical <sup>2)</sup>	I <sub>DD Enc</sub>	typ. 16, max. 21					mA
Output current, max. allowable <sup>3)</sup>	I <sub>OUT</sub>	4					mA
Pulse width <sup>4)</sup>	P	180 ± 45					°e
Index Pulse width <sup>4)</sup>	P <sub>0</sub>	90 ± 45					°e
Phase shift, channel A to B <sup>4)</sup>	Φ	90 ± 45					°e
Signal rise/fall time, max. (C <sub>LOAD</sub> = 50 pF)	tr/tf	0,1/0,1					µs
Inertia of encoder magnet	J	0,08					gcm <sup>2</sup>

<sup>1)</sup> velocity (rpm) = f (Hz) x 60/N

<sup>2)</sup> U<sub>DD Enc</sub> = 5V: with unloaded outputs

<sup>3)</sup> U<sub>DD Enc</sub> = 5V: low logic level < 0,4V, high logic level > 4,5V: CMOS- and TTL compatible

<sup>4)</sup> 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 with various impulse figures and is suitable for the monitoring and regulation of the speed and direction of rotation and for positioning the drive shaft. The motor and encoder are connected via separate ribbon cables.

A detailed instruction manual for installation and operation is enclosed.

## Options

- connector variants

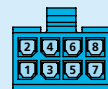
### Encoder:

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



## Order information

- Ordering examples:

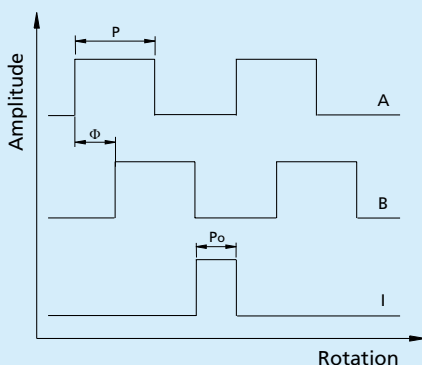
2232S024BX4 IE3-256

2232S012BX4S IE3-32

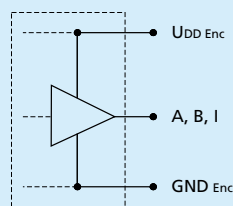
## Output signals / Circuit diagram / Connector information

### Output signals

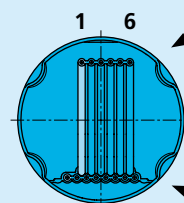
with clockwise rotation as seen from the shaft end



### Output circuit



### Connection Encoder



#### No. Function

1	n.c.
2	Channel I (Index)
3	GND Enc
4	U <sub>DD Enc</sub>
5	Channel B
6	Channel A

### Connection Motor

#### No. Function

1	Phase C
2	Phase B
3	Phase A
4	GND
5	U <sub>DD</sub> (2,2 ... 18V DC)
6	Hall sensor C
7	Hall sensor B
8	Hall sensor A

### Caution:

Incorrect lead connection will damage the motor electronics!