

# Brushless DC-Servomotors

sensorless, with optional Hall Sensors  
SMARTSHELL® Technology

## 6,5 mNm

For combination with  
Gearheads:  
20/1, 22/2, 22/5, 22/7, 23/1, 26/1(S), 30/1(S), 38/3  
Drive Electronics:  
Speed Controller

### Series 2232 ... BSL

	2232 S	006 BSL	012 BSL	024 BSL	048 BSL	
1 Nominal voltage	$U_N$	6	12	24	48	Volt
2 Terminal resistance, phase-phase	R	1,11	4,33	14,46	41,20	$\Omega$
3 Output power <sup>1)</sup>	$P_{2 \text{ max.}}$	13	14	14	13	W
4 Efficiency	$\eta_{\text{ max.}}$	61	61	62	62	%
5 No-load speed	$n_o$	15 600	15 600	17 100	20 950	rpm
6 No-load current (with shaft $\varnothing$ 3,0 mm)	$I_o$	0,294	0,146	0,085	0,060	A
7 Stall torque	$M_H$	18	19	21	24	mNm
8 Friction torque, static	$C_o$	0,389	0,389	0,389	0,389	mNm
9 Friction torque, dynamic	$C_v$	$4,05 \cdot 10^{-5}$	$4,05 \cdot 10^{-5}$	$4,05 \cdot 10^{-5}$	$4,05 \cdot 10^{-5}$	mNm/rpm
10 Speed constant	$k_n$	2 752	1 370	751	460	rpm/V
11 Back-EMF constant	$k_E$	0,363	0,730	1,331	2,175	mV/rpm
12 Torque constant	$k_M$	3,47	6,97	12,71	20,77	mNm/A
13 Current constant	$k_i$	0,288	0,143	0,079	0,048	A/mNm
14 Slope of n-M curve	$\Delta n / \Delta M$	880	851	855	912	rpm/mNm
15 Terminal inductance, phase-phase	L	38	153	509	1 337	$\mu\text{H}$
16 Mechanical time constant	$\tau_m$	17	17	17	18	ms
17 Rotor inertia	J	1,92	1,92	1,92	1,92	$\text{gcm}^2$
18 Angular acceleration	$\alpha_{\text{ max.}}$	96	99	108	124	$10^3 \text{ rad/s}^2$
19 Thermal resistance	$R_{\text{th} 1} / R_{\text{th} 2}$	3,56 / 17,2				K/W
20 Thermal time constant	$\tau_{w1} / \tau_{w2}$	3 / 645				s
21 Operating temperature range		- 30 ... +125				$^{\circ}\text{C}$
22 Shaft bearings		ball bearings, preloaded				
23 Shaft load max.:						
- radial at 3 000/20 000 rpm (6 mm from mounting flange)		28 / 24	for series 2232 S ... B ..			N
- radial at 3 000/20 000 rpm (4,5 mm from mounting flange)		29 / 25	for series 2232 U ... B ..			N
- axial at 3 000/20 000 rpm (push-on only)		21 / 16				N
- axial at standstill (push-on only)		45				N
24 Shaft play:						
- radial	$\leq$	0,015				mm
- axial	$=$	0				mm
25 Housing material		mounting face in aluminium, housing in plastic				
26 Weight		60				g
27 Direction of rotation		electronically reversible				
<b>Recommended values - mathematically independent of each other</b>						
28 Speed up to <sup>2)</sup>	$n_{e \text{ max.}}$	39 000	39 000	39 000	39 000	rpm
29 Torque up to <sup>1) 2)</sup>	$M_{e \text{ max.}}$	6,3	6,5	6,5	6,2	mNm
30 Current up to <sup>1) 2)</sup>	$I_{e \text{ max.}}$	2,17	1,10	0,60	0,36	A

<sup>1)</sup> at 20 000 rpm

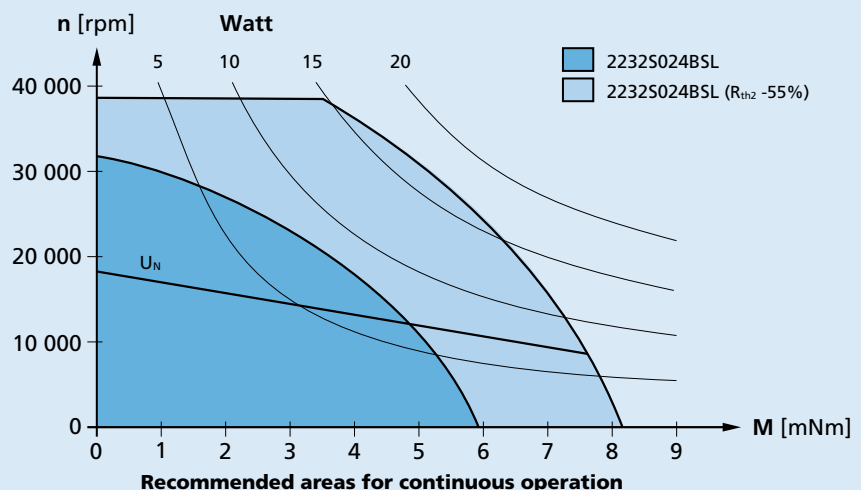
<sup>2)</sup> thermal resistance  $R_{\text{th} 2}$  by 55% reduced

#### 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 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.



**Options**

Motors with digital sensors:  
**2232 S ... BDS, 2232 U ... BDS**

Motors with analog sensors:  
**2232 S ... BAS, 2232 U ... BAS**

**2232 S ... BSL sensorless**

Orientation with respect to cable  $\pm 5^\circ$

**Cable**  
 Single wires, material PTFE  
 Length 300 mm  $\pm$  15 mm  
 3 conductors, AWG 24

**2232 S ... BSL**  
 for combination with:  
 Gearheads 22/7, 23/1, 26/1(S), 30/1(S), 38/3  
 Drive Electronics Speed Controller

Function	Colour
Phase A	brown
Phase B	orange
Phase C	yellow

**2232 U ... BSL sensorless**

Orientation with respect to cable  $\pm 5^\circ$

**Cable**  
 Single wires, material PTFE  
 Length 300 mm  $\pm$  15 mm  
 3 conductors, AWG 24

**2232 U ... BSL**  
 for combination with:  
 Gearheads 20/1, 22/2, 22/5  
 Drive Electronics Speed Controller

Function	Colour
Phase A	brown
Phase B	orange
Phase C	yellow

**2232 S ... BAS, 2232 S ... BDS, 2232 U ... BAS, 2232 U ... BDS with Hall sensors**

Inertia of Magnet disc  
 $J = 0,025 \text{ gcm}^2$

**Cable**  
 Single wires, material PTFE  
 Length 300 mm  $\pm$  15 mm  
 3 conductors, AWG 24  
 5 conductors, AWG 26

Function	Colour
Phase A	brown
Phase B	orange
Phase C	yellow
Hall sensor A	green
Hall sensor B	blue
Hall sensor C	grey
+5V - Logical supply	red
GND - Logical	black

**2232 S ... BDS**  
 for combination with:  
 Drive Electronics Speed Controller

**2232 U ... BDS**  
 for combination with:  
 Drive Electronics Speed Controller

**2232 S ... BAS**  
 for combination with:  
 Drive Electronics Motion Controllers

**2232 U ... BAS**  
 for combination with:  
 Drive Electronics Motion Controllers