

# Flat DC-Micromotors

## Precious Metal Commutation with integrated Encoder

0,4 mNm  
0,8 W

### Series 1506 ... SR IE2-8

Values at 22°C and nominal voltage		1506 N	003 SR	006 SR	012 SR	IE2-8
1 Nominal voltage	$U_N$		3	6	12	V
2 Terminal resistance	$R$		10,4	50,5	130	$\Omega$
3 Efficiency, max.	$\eta_{max}$		68	66	70	%
4 No-load speed	$n_0$		13 400	14 300	15 500	min <sup>-1</sup>
5 No-load current, typ. (with shaft $\varnothing$ 0,8 mm)	$I_0$		0,01	0,005	0,003	A
6 Stall torque	$M_H$		0,54	0,46	0,64	mNm
7 Friction torque	$M_R$		0,02	0,02	0,02	mNm
8 Speed constant	$k_n$		4 640	2 480	1 340	min <sup>-1</sup> /V
9 Back-EMF constant	$k_E$		0,216	0,403	0,749	mV/min <sup>-1</sup>
10 Torque constant	$k_M$		2,06	3,84	7,15	mNm/A
11 Current constant	$k_I$		0,486	0,26	0,14	A/mNm
12 Slope of n-M curve	$\Delta n / \Delta M$		24 700	31 400	24 200	min <sup>-1</sup> /mNm
13 Rotor inductance	$L$		175	720	2 100	$\mu$ H
14 Mechanical time constant	$\tau_m$		24	30	23	ms
15 Rotor inertia	$J$		0,09	0,09	0,09	gcm <sup>2</sup>
16 Angular acceleration	$\alpha_{max}$		58	50	71	$\cdot 10^3$ rad/s <sup>2</sup>
17 Thermal resistance	$R_{th1} / R_{th2}$	36 / 61				K/W
18 Thermal time constant	$\tau_{w1} / \tau_{w2}$	5,4 / 190				s
19 Operating temperature range:						
– motor		+0 ... +70				°C
– winding, max. permissible		+70				°C
20 Shaft bearings		sintered bearings				
21 Shaft load max.:						
– with shaft diameter		0,8				mm
– radial at 3 000 min <sup>-1</sup> (3 mm from bearing)		0,5				N
– axial at 3 000 min <sup>-1</sup>		0,1				N
– axial at standstill		10				N
22 Shaft play:						
– radial	$\leq$	0,03				mm
– axial	$\leq$	0,2				mm
23 Housing material		plastic				
24 Mass		7,1				g
25 Direction of rotation		clockwise, viewed from the front face				
26 Speed up to	$n_{max}$	16 000				min <sup>-1</sup>
27 Number of pole pairs		2				
28 Magnet material		NdFeB				
<b>Rated values for continuous operation</b>						
29 Rated torque	$M_N$		0,37	0,29	0,4	mNm
30 Rated current (thermal limit)	$I_N$		0,2	0,086	0,063	A
31 Rated speed	$n_N$		2 500	2 500	2 530	min <sup>-1</sup>

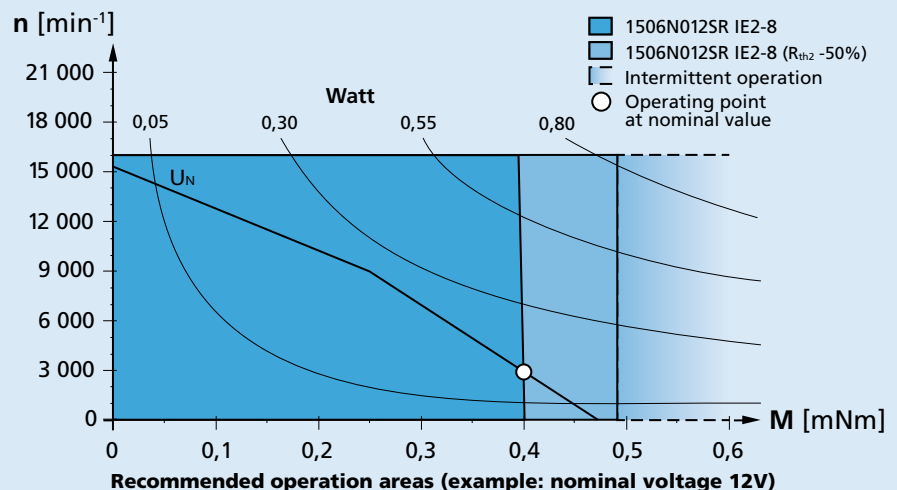
**Note:** Rated values are calculated with nominal voltage and at a 22°C ambient temperature. The  $R_{th2}$  value has been reduced by 0%.

**Note:**

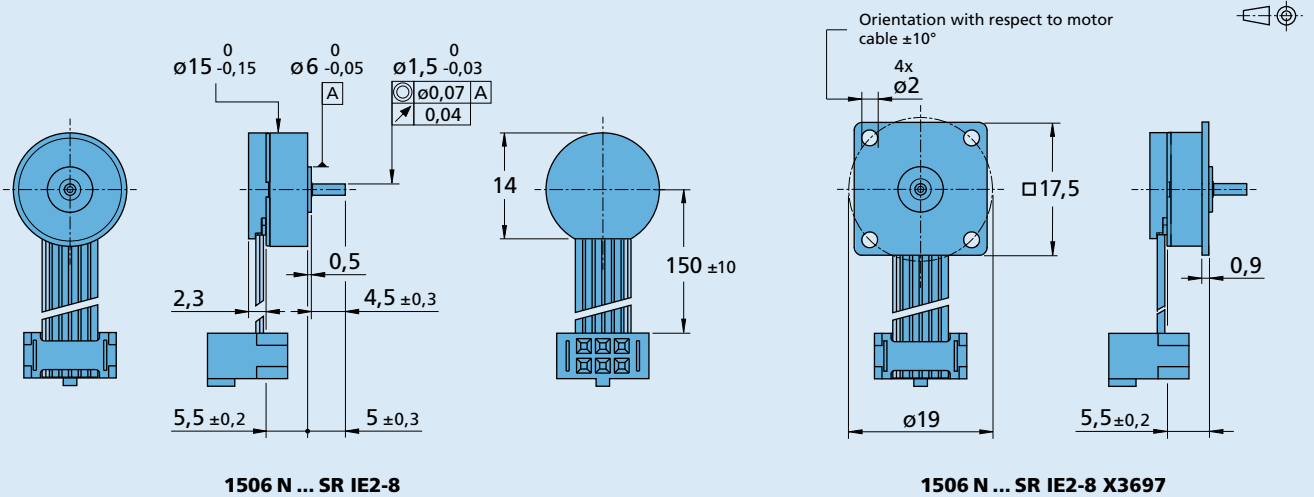
The diagram indicates the recommended speed in relation to the available torque at the output shaft for a given ambient temperature of 22°C.

The diagram shows the motor in a completely insulated as well as thermally coupled condition ( $R_{th2}$  50% 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.



### Dimensional drawing



### Integrated optical Encoder

	IE2-8		
Lines per revolution	<i>N</i>	8	
Signal output, square wave		2	Channel
Supply voltage	$U_{DD}$	3,2 ... 5,5	V DC
Current consumption, typical ( $U_{DD} = 5V$ DC)	$I_{DD}$	typ. 8, max. 15	mA
Output current, max. allowable (at $U_{out} < 1,5V$ )	$I_{OUT}$	5	mA
Pulse width <sup>1)</sup>	<i>P</i>	180 ± 45	°e
Phase shift, channel A to B <sup>1)</sup>	$\Phi$	90 ± 45	°e
Signal rise/fall time, max. ( $C_{LOAD} = 50$ pF)	<i>tr/tf</i>	2,5/0,3	µs
Frequency range <sup>2)</sup> , up to	<i>f</i>	4,5	kHz

<sup>1)</sup> Ambient temperature 22°C (tested at 1kHz)

<sup>2)</sup> Velocity (min<sup>-1</sup>) = f (Hz) x 60/N

### Features

In this version, the DC-Micromotors have an optical encoder with two output channels. A code wheel on the shaft is optically captured and further processed. At the encoder outputs, two 90° phase-shifted rectangular signals are available with 8 impulses per motor revolution.

The encoder is suitable for the monitoring and regulation of the speed and direction of rotation and for positioning the drive shaft.

The supply voltage for the encoder and the DC-Micromotor as well as the two channel output signals are interfaced through a ribbon cable with connector.

### Full product description

■ Examples:

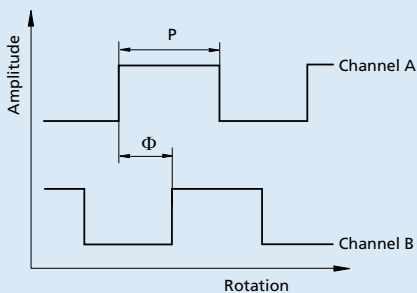
1506N003SR IE2-8

1506N012SR IE2-8

### Output signals / Circuit diagram / Connector information

#### Output signals

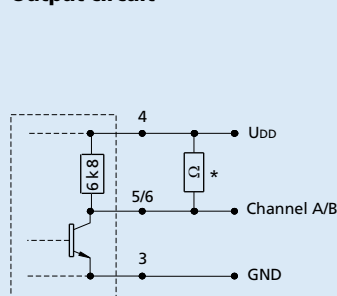
with clockwise rotation as seen from the shaft end



Admissible deviation of phase shift:

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

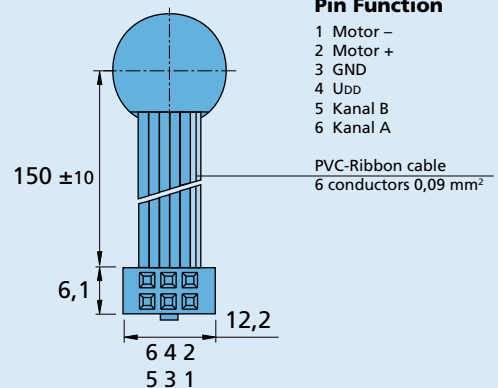
#### Output circuit



\* An additional external pull-up resistor can be added to improve the rise time. Caution:  $I_{OUT}$  max. 5 mA must not be exceeded!

#### Pin Function

- 1 Motor -
- 2 Motor +
- 3 GND
- 4  $U_{DD}$
- 5 Kanal B
- 6 Kanal A



#### Connector

EN 60603-13 / DIN-41651.  
grid 2,54 mm