**DC-Gearmotors**

Precious Metal Commutation with integrated Encoder

### Series 1512...SR...IE2-8

<table>
<thead>
<tr>
<th>Values at 22°C and nominal voltage</th>
<th>1512 U</th>
<th>003 SR</th>
<th>006 SR</th>
<th>012 SR</th>
<th>IE2-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage ( U_n )</td>
<td>3</td>
<td>6</td>
<td>12</td>
<td>Volt</td>
<td></td>
</tr>
<tr>
<td>Terminal resistance ( R )</td>
<td>10,4</td>
<td>50,5</td>
<td>130</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>No-load speed (motor) ( n_0 )</td>
<td>13 400</td>
<td>14 300</td>
<td>15 500</td>
<td>min⁻¹</td>
<td></td>
</tr>
<tr>
<td>Speed constant ( k_n )</td>
<td>4 640</td>
<td>2 480</td>
<td>1 340</td>
<td>min⁻¹/V</td>
<td></td>
</tr>
<tr>
<td>Back-EMF constant ( k_e )</td>
<td>0,216</td>
<td>0,403</td>
<td>0,749</td>
<td>mV/min⁻¹</td>
<td></td>
</tr>
<tr>
<td>Torque constant ( k_M )</td>
<td>2,06</td>
<td>3,84</td>
<td>7,15</td>
<td>mNm/A</td>
<td></td>
</tr>
<tr>
<td>Current constant ( k_i )</td>
<td>0,486</td>
<td>0,260</td>
<td>0,140</td>
<td>A/mNm</td>
<td></td>
</tr>
<tr>
<td>Slope of n-M curve ( \Delta n/\Delta M )</td>
<td>24 700</td>
<td>31 400</td>
<td>24 200</td>
<td>min⁻¹/mNm</td>
<td></td>
</tr>
<tr>
<td>Rotor inductance ( L )</td>
<td>175</td>
<td>720</td>
<td>2 100</td>
<td>µH</td>
<td></td>
</tr>
<tr>
<td>Rotor inertia ( J )</td>
<td>0,09</td>
<td>0,09</td>
<td>0,09</td>
<td>gcm²</td>
<td></td>
</tr>
</tbody>
</table>

**Housing material**
- plastic

**Geartrain material**
- metal

**Backlash, at no-load**
- \( \leq 4 \) °

**Bearings on output shaft**
- plastic / brass bearing

**Shaft load max.**
- radial (5 mm from mounting face) \( \leq 1,4 \) N
- axial \( \leq 1 \) N

**Shaft press fit force, max.**
- \( \leq 15 \) N

**Shaft play:**
- radial (5 mm from mounting face) \( \leq 0,08 \) mm
- axial \( \leq 0,25 \) mm

**Operating temperature range**
- \( 0 \ldots + 70 \) °C

### Specifications

<table>
<thead>
<tr>
<th>reduction ratio (rounded)</th>
<th>output speed up to ( n_{\text{max}} ) min⁻¹</th>
<th>weight with motor ( g )</th>
<th>output torque continuous operation ( M_{\text{max}} ) mNm</th>
<th>output torque intermittent operation ( M_{\text{max}} ) mNm</th>
<th>direction of rotation (reversible)</th>
<th>efficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 : 1</td>
<td>779</td>
<td>6,9</td>
<td>1,4</td>
<td>3</td>
<td>=</td>
<td>81</td>
</tr>
<tr>
<td>13 : 1</td>
<td>372</td>
<td>7,0</td>
<td>2,8</td>
<td>5</td>
<td>≠</td>
<td>73</td>
</tr>
<tr>
<td>39 : 1</td>
<td>129</td>
<td>7,2</td>
<td>7,0</td>
<td>10</td>
<td>≠</td>
<td>60</td>
</tr>
<tr>
<td>112 : 1</td>
<td>45</td>
<td>7,4</td>
<td>19,8</td>
<td>30</td>
<td>≠</td>
<td>59</td>
</tr>
<tr>
<td>324 : 1</td>
<td>15</td>
<td>7,7</td>
<td>30,0</td>
<td>50</td>
<td>=</td>
<td>53</td>
</tr>
</tbody>
</table>

**Note:** output speed at 5000 min⁻¹ input speed. Based on motor 1506 ... SR.

For notes on technical data and lifetime performance refer to "Technical Information".

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Specifications subject to change without notice.

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For combination with Drive Electronics:
- Speed Controller
- Precious Metal Commutation with integrated Encoder

For notes on technical data and lifetime performance refer to "Technical Information".

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Integrated optical Encoder

<table>
<thead>
<tr>
<th>Feature</th>
<th>IE2-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lines per revolution</td>
<td>N</td>
</tr>
<tr>
<td>Signal output, square wave</td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>Ucc</td>
</tr>
<tr>
<td>Current consumption, typical (Ucc = 5 V DC)</td>
<td>Icc</td>
</tr>
<tr>
<td>Output current, max. allowable (at Uout &lt; 1.5V)</td>
<td>Iout</td>
</tr>
<tr>
<td>Pulse width 1)</td>
<td>P</td>
</tr>
<tr>
<td>Phase shift, channel A to B 1)</td>
<td>(\Phi)</td>
</tr>
<tr>
<td>Signal rise/fall time, max. (CLOAD = 50 pF)</td>
<td>tr/tf</td>
</tr>
<tr>
<td>Frequency range 2), up to</td>
<td>f</td>
</tr>
<tr>
<td>Ambient temperature 22°C (tested at 1kHz)</td>
<td></td>
</tr>
<tr>
<td>Velocity (min(^{-1})) = f (Hz) \times 60/N</td>
<td></td>
</tr>
</tbody>
</table>

### 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:

- 1512U003SR 6:1 IE2-8
- 1512U012SR 32:1 IE2-8

### Output signals/Circuit diagram / Connector information

**Output signals**

- Amplitude
- Rotation
- Admissible deviation of phase shift:
  \[\Delta \Phi = 90° - \frac{\Phi}{P} \times 180° \leq 45°\]

**Output circuit**

- An additional external pull-up resistor can be added to improve the rise time. Caution: Iout max. 5 mA must not be exceeded!

**Connector**

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