The HepcoMotion® SDM range has been based on the popular SBD range of belt driven linear actuators but incorporates a ballscrew into the design. This allows for improved stiffness and precision.

Units are supplied in increments of 60mm (SDM20-80) and 80mm (SDM30-100) up to 2800mm in one piece. Longer units are available on request. The nominal stroke length is calculated with the carriage up against the internal buffers. In practice a clearance should be provided to allow for overrun.

SDM units with a high lead ballscrew drive and cleanroom versions will be available shortly. Please contact Hepco for more details.

The main dimensions of the standard length SDM unit are shown below.

### SDM - Screw Driven Module

<table>
<thead>
<tr>
<th>SDM Unit</th>
<th>Pitch</th>
<th>A</th>
<th>B</th>
<th>C1</th>
<th>C2</th>
<th>D</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
<th>G</th>
<th>Hxl</th>
<th>J</th>
<th>K</th>
<th>L1 (min)</th>
<th>L2 Nominal stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDM 20-80</td>
<td>Ø16x5/10/16</td>
<td>54</td>
<td>52</td>
<td>51.5</td>
<td>58</td>
<td>140</td>
<td>185</td>
<td>218</td>
<td>23</td>
<td>12</td>
<td>M5x12</td>
<td>103.5</td>
<td>85</td>
<td>530</td>
<td>L1-294</td>
</tr>
<tr>
<td>SDM 30-100</td>
<td>Ø20x5</td>
<td>69</td>
<td>60</td>
<td>65</td>
<td>76</td>
<td>180</td>
<td>235</td>
<td>268</td>
<td>24.5</td>
<td>12</td>
<td>M5x12</td>
<td>123.5</td>
<td>105</td>
<td>530</td>
<td>L1-322</td>
</tr>
<tr>
<td></td>
<td>Ø20x20</td>
<td>69</td>
<td>60</td>
<td>65</td>
<td>76</td>
<td>180</td>
<td>235</td>
<td>268</td>
<td>24.5</td>
<td>12</td>
<td>M5x12</td>
<td>123.5</td>
<td>105</td>
<td>540</td>
<td>L1-332</td>
</tr>
</tbody>
</table>

### Note

1. Diameters Q and W relate to a recess 2mm deep

(All dimensions in mm)
SDM units are available with a long carriage option. This version has two LBG bearing blocks in the carriage and has much improved load capacity. The main dimensions of the standard long carriage SDM units are shown below. For further information please contact Hepco’s technical department.

![SDM Unit Diagram](image)

<table>
<thead>
<tr>
<th>SDM Unit</th>
<th>Pitch</th>
<th>A</th>
<th>B</th>
<th>C1</th>
<th>C2</th>
<th>D1</th>
<th>D2</th>
<th>E1</th>
<th>E2</th>
<th>F</th>
<th>G</th>
<th>Hxl</th>
<th>J</th>
<th>K</th>
<th>L1 (min)</th>
<th>L2 Nominal Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDM 20-80</td>
<td>Ø16x5/10/16</td>
<td>54</td>
<td>52</td>
<td>51.5</td>
<td>58</td>
<td>196</td>
<td>26</td>
<td>235</td>
<td>275</td>
<td>308</td>
<td>23</td>
<td>12</td>
<td>M5x12</td>
<td>103.5</td>
<td>85</td>
<td>540</td>
</tr>
<tr>
<td>SDM 30-100</td>
<td>Ø20x5</td>
<td>69</td>
<td>60</td>
<td>65</td>
<td>76</td>
<td>260</td>
<td>46</td>
<td>295</td>
<td>340</td>
<td>373</td>
<td>24.5</td>
<td>12</td>
<td>M5x12</td>
<td>123.5</td>
<td>105</td>
<td>530</td>
</tr>
<tr>
<td></td>
<td>Ø20x20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90</td>
<td>540</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SDM Unit</th>
<th>Pitch</th>
<th>L3 (min)</th>
<th>L4 (min)</th>
<th>M</th>
<th>N1</th>
<th>N2</th>
<th>O</th>
<th>P</th>
<th>Q † H7</th>
<th>R1</th>
<th>R2</th>
<th>S</th>
<th>TxU</th>
<th>V</th>
<th>W †</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDM 20-80</td>
<td>Ø16x5/10/16</td>
<td>10</td>
<td>45</td>
<td>80</td>
<td>91.5</td>
<td>52</td>
<td>25</td>
<td>10</td>
<td>44.5</td>
<td>20</td>
<td>3</td>
<td>17</td>
<td>M6x9.5</td>
<td>30</td>
<td>-</td>
<td>20</td>
<td>40</td>
<td>10</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>SDM 30-100</td>
<td>Ø20x5</td>
<td>20</td>
<td>21</td>
<td>100</td>
<td>112</td>
<td>62.5</td>
<td>30</td>
<td>15</td>
<td>50</td>
<td>25</td>
<td>5</td>
<td>17</td>
<td>M8x9.5</td>
<td>45</td>
<td>43</td>
<td>30</td>
<td>40</td>
<td>10</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Ø20x20</td>
<td>20</td>
<td>31</td>
<td>100</td>
<td>112</td>
<td>62.5</td>
<td>30</td>
<td>15</td>
<td>50</td>
<td>25</td>
<td>5</td>
<td>17</td>
<td>M8x9.5</td>
<td>45</td>
<td>43</td>
<td>30</td>
<td>40</td>
<td>10</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

(All dimensions in mm)

Note:
1. Diameters Q and W relate to a recess 2mm deep.
Re-lubrication of the ball guide carriage blocks and the ballscrew is via the access points in the side of the beam, and closed off with a threaded plug. The lubrication interval depends on length of stroke, speed and duty, but should be no longer than 500km linear travel.

The positions of the lubrication holes for both standard and long carriage arrangements are detailed below.

Lubricant must be applied to all lubrication points on the SDM unit. Use lithium soap based grease NLGI consistency No 2 or similar. For further details please contact Hepco’s technical department.

<table>
<thead>
<tr>
<th>SDM Unit</th>
<th>Ballscrew Pitch</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Y5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDM20-80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>Ø16x05</td>
<td>150</td>
<td>172</td>
<td>-</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Ø16x10</td>
<td></td>
<td>179.5</td>
<td></td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Ø16x16</td>
<td></td>
<td>175</td>
<td>-</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Long Carriage</td>
<td>Ø16x5/10</td>
<td>150</td>
<td>264.5</td>
<td>186.5</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Ø16x16</td>
<td></td>
<td>266.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDM30-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>Ø20x5</td>
<td>150</td>
<td>213.5</td>
<td>-</td>
<td>43.5</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Ø20x20</td>
<td></td>
<td>221</td>
<td>-</td>
<td>43.5</td>
<td>50</td>
</tr>
<tr>
<td>Long Carriage</td>
<td>Ø20x5</td>
<td>150</td>
<td>309</td>
<td>258</td>
<td>43.5</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Ø20x20</td>
<td></td>
<td>316.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
System Life Calculation

The system life of a SDM unit will be dependent on many factors. These include the life of the LBG linear ball guide, which supports the moving load applied to the carriage, and the ballscrew which provides the driving force. In many applications the limiting factor will be the linear ball guide, and this life can be calculated in the section below. In some applications where the SDM is providing a high driving force, then the life of the ballscrew should also be considered.

LBG Linear Ball Guide life

The table shows the maximum carriage loading, and the calculation below determines the system life.

To determine system life, first calculate the load factor \( LF \) using the equation below.

\[
LF = \frac{L_1}{L_{1\text{max}}} + \frac{L_2}{L_{2\text{max}}} + \frac{M_s}{M_{s\text{max}}} + \frac{M_v}{M_{v\text{max}}} = \leq 0.2
\]

The life of the system is then calculated using the equation below:

\[
\text{System Life (km)} = 50 \times \left( \frac{1}{LF \times f_v} \right)^3
\]

Note: \( f_v \) is the variable load factor which takes account of speed and vibration/impact conditions. A value of 2 is appropriate for typical SDM applications, but consult Hepco’s technical department for specific advice.

Ballscrew Life

The table below shows details of the ballscrew static and dynamic capacities, and the maximum driving force that can be applied by the SDM unit for a linear travel of 10000km.

<table>
<thead>
<tr>
<th>SDM Unit</th>
<th>Ballscrew Diameter x pitch</th>
<th>Ballscrew Nut Capacity</th>
<th>Maximum driving force @ 10000 km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Static Coa</td>
<td>Dynamic Ca</td>
<td></td>
</tr>
<tr>
<td>SDM20-80</td>
<td>16 x 5</td>
<td>17900N</td>
<td>7800N</td>
</tr>
<tr>
<td></td>
<td>16 x 10</td>
<td>12490N</td>
<td>7210N</td>
</tr>
<tr>
<td></td>
<td>16 x 16</td>
<td>12800N</td>
<td>6500N</td>
</tr>
<tr>
<td>SDM30-100</td>
<td>20 x 5</td>
<td>23800N</td>
<td>11300N</td>
</tr>
<tr>
<td></td>
<td>20 x 20</td>
<td>21400N</td>
<td>9800N</td>
</tr>
</tbody>
</table>

For more further details on ballscrew life please refer to the BSP catalogue, available at [www.HepcoMotion.com/bspdatauk](http://www.HepcoMotion.com/bspdatauk) or contact Hepco’s technical department.
Calculations & Performance

Drive Data & Calculations

The linear force which can be generated by a SDM unit is determined by the torque applied (τ in Nm), the force coefficient (Cf) and composite drag (Dc) of the SDM unit.

\[
\text{Linear Force (N)} = \text{Cf} \times 7^2 \times \text{Dc}
\]

The above equation gives the linear force developed by a typical system in typical conditions, but there will be some variation. It is recommended to select motors which have significantly more than the minimum torque, to ensure performance and reliability.

Beam Deflection Calculations & Data

The deflection of a SDM unit under load follows conventional beam calculations. For example, the deflection of a SDM unit L [mm] long, simply supported at the ends and subject to a central load F [N] is:

\[
\text{Deflection (mm)} = \frac{F \times L^3}{48 \times E \times I}
\]

Where E is the young’s modulus of aluminium alloy (= 7x10^4 N/mm²) and I is the second moment of area of the SDM beam section (see table).

Example: In the case of a simply supported SDM 20-80 beam 2000mm between supports, and subject to a central load of 150N, the deflection at the centre of the span will be 0.25mm.

SDM Unit Weights

The weight of a SDM unit is calculated using the formula in the table below, where L is the beam length in m. This data will allow the calculation of the mass of the moving parts.
**Calculations & Performance**

**Screw Critical Speed**

For any SDM unit, there is a critical speed of rotation beyond which the screw is susceptible to large amplitude vibration and deflection due to ‘whip’. The speed at which this becomes possible depends upon the maximum length of the screw between the support bearing and the nut, and the length of the screw. It is important that operating speeds are below this critical speed. In all cases the ballscrew should not operate at speeds in excess of 3000rpm. The curves shown include a safety factor of 20% on speed.

![Graph showing allowable linear speed vs. SDM beam length for different ball screw sizes](image)

**Screw Buckling Load**

The maximum axial load on the screw can be limited by buckling of the screw, where systems are long or thrust loads are high. The curves shown include a safety factor of 100%.

For long systems, where the loading on the screw (which is fixed at the drive end and floats axially at the other end) is high, then it may be possible to arrange the principle load to put the screw in tension.

![Graph showing allowable thrust force vs. SDM beam length for different ball screw sizes](image)
**Ancillary Components**

**Limit Switch Assembly**
(Includes switch, brackets and fixings)

- **Mechanical**
  - SBD20-80-V3SWA-M
  - SBD30-100-V3SWA-M

- **Inductive**
  - SBD20-80-V3SWA-I
  - SBD30-100-V3SWA-I

**T-Slot Cover**
(Supplied fitted in each of the T-slots)

- 1-242-1016

**T-Nuts**

- M4: 1-242-1029
- M5: 1-242-1030
- M6: 1-242-1001
- M8: 1-242-1002

**Motor Connection Kits**
(These include the flange tube, coupling components and all fasteners required)

Hepco will make flanges to fit any motor type on request, standard kits are available to fit a wide range of motors and gearboxes. Please contact Hepco’s technical department for further advice and information.

**Ordering Details**

**SDM - Product Range**

Size of unit: Choose **20-80** or **30-100**

Beam Length. Beam lengths are available in increments of 60mm for SDM 20-80 and increments of 80mm for SDM 30-100.

Ball screw size and pitch: Choose from **16x5**, **16x10** or **16x16** for SDM 20-80 and **20x5** or **20x20** for SDM 30-100.

Long Carriage option with twin LBG bearing blocks: **B2**

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