Ultra High Vacuum Stepper Motors
1.8°, two phase hybrid stepper motors

AML stepper motors are specifically designed for use in UHV environments making them ideally suited for low speed precision in-vacuum manipulation without the use of particle generating motion feed-throughs. The considerable reduction in mechanical complexity, absence of metal to metal sliding surfaces and low outgassing characteristics make these motors especially suitable for sensitive handling applications.

FEATURES

The model D motors are two phase hybrid stepper motors, available in a range of standard sizes and torque ratings. Standard motors provide 200 full steps per revolution, are suitable for use below $1 \times 10^{-10}$ mbar and temperatures between $-65^\circ C$ to $+175^\circ C$. Extended low temperature range (-196°C) versions, radiation hard versions ($1 \times 10^6$ Gy), shaft modifications and hybrid bearings are all available options.

All motors are designed, cleaned, hand assembled and conditioned to UHV standards in an ISO Class 7 cleanroom.

<table>
<thead>
<tr>
<th>Model</th>
<th>Holding Torque mNm</th>
<th>Detent Torque mNm</th>
<th>Rotor Inertia gcm²</th>
<th>Max. Axial Force N</th>
<th>Max. Radial Force (1) N</th>
<th>Mass g</th>
<th>Current Per Phase A</th>
<th>Phase Resistance at 20°C Ω</th>
<th>Phase Inductance mH</th>
</tr>
</thead>
<tbody>
<tr>
<td>D35.1</td>
<td>70</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>15</td>
<td>190</td>
<td>1.0</td>
<td>4.7</td>
<td>3.8</td>
</tr>
<tr>
<td>D42.1</td>
<td>180</td>
<td>8</td>
<td>35</td>
<td>9</td>
<td>15</td>
<td>350</td>
<td>1.0</td>
<td>5.3</td>
<td>6.6</td>
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<tr>
<td>D42.2</td>
<td>360</td>
<td>14</td>
<td>68</td>
<td>9</td>
<td>15</td>
<td>470</td>
<td>1.0</td>
<td>6.8</td>
<td>10.5</td>
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<td>D42.3</td>
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<td>20</td>
<td>102</td>
<td>9</td>
<td>15</td>
<td>610</td>
<td>1.0</td>
<td>8.5</td>
<td>19.5</td>
</tr>
<tr>
<td>D57.1</td>
<td>800</td>
<td>30</td>
<td>300</td>
<td>13</td>
<td>40</td>
<td>700</td>
<td>1.0</td>
<td>10.5</td>
<td>27.0</td>
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Vacuum environment: $<1 \times 10^{-10}$ mbar
Operating temperature: -65°C to +175°C
Temperature sensor: Type 'K' thermocouple standard or PT100 optional
Bakeout temperature: 200°C
Step angle: 1.8°
Step angle tolerance: 5%
Lead length: 1.5m

(1) 20mm from the flange

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The performance shown on these graphs was obtained using an SMD210 drive operating with standard settings for step division.

SMD210 is a switch-mode, bipolar, current-regulating drive with a nominal source of 67volts, optimised for use with vacuum motors. At low speed where step division is active the RSS (root sum of squares) of phase current is set to the nominal current. Over most of the speed range the drive operates in wave mode with nominal set current in only one energised phase.

Different drives will produce different speed / torque curves. Drives capable of producing a total phase current of more than 1A RSS may damage the insulation. Drives with significantly lower source voltages may result in poor high speed performance. Use of the embedded thermocouple is essential for motor protection.
DIMENSIONS

D35.1

1.5m Lead length

4 x Ø3.2 Pumping ports on 28.0 PCD. Both ends.

Leads terminated with 1.5mm crimp sockets
ITT Cannon P/N 192990-0090

M3 thread x 6.5

55±1

D57.1

1.5m Lead length

8 x Ø3.2 Pumping ports on 31.0 PCD. Both ends.

Leads terminated with 1.5mm crimp sockets
ITT Cannon P/N 192990-0090

M3 thread x 10±1

Motor | Length L
---|---
D42.1 | 33
D42.2 | 47
D42.3 | 60

D42.X

1.5m Lead length

8 x Ø3.2 Pumping ports on 31.0 PCD. Both ends.

Leads terminated with 1.5mm crimp sockets
ITT Cannon P/N 192990-0090

M3 thread x 10±1

D42.1 | 33
D42.2 | 47
D42.3 | 60

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**ELECTRICAL CONNECTION**

**ORDERING INFORMATION**

**Bearings**
Standard motors are fitted with open stainless steel bearings lubricated with NyeTorr® 6300 ultra low outgassing UHV grease.

For low duty applications where UHV grease is not permitted specify option ‘H’ hybrid bearings. These have silicon nitride ceramic balls, dry lubricated with Tungsten disulfide.

**Options**
- **H** Hybrid ceramic bearings
- **R** Gamma radiation hardened to $1 \times 10^6$ Gy
- **X** Shaft modification. Please provide a sketch of your requirement
- **C** Cryogenic. Extended operating temperature range. -196°C to +175°C
- **P** PT100 temperature sensor in lieu of thermocouple.

<table>
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<th>Order Code</th>
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<tr>
<td>D35.1</td>
<td>70mNm UHV Stepper Motor</td>
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<td>180mNm UHV Stepper Motor</td>
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<td>D42.2</td>
<td>360mNm UHV Stepper Motor</td>
</tr>
<tr>
<td>D42.3</td>
<td>480mNm UHV Stepper Motor</td>
</tr>
<tr>
<td>D57.1</td>
<td>800mNm UHV Stepper Motor</td>
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**Related products**
- SMD210: Stepper motor drive
- MLF18F: 18-way electrical feedthrough
- MLF18NBL: 3-metre lead, SMD210 to MLF18F

AML pursues a policy of continuous improvement and reserves the right to make detail changes to specifications without consultation. E and OE.