HYBRID LINEAR ACTUATORS
High Performance Stepper Motor Linear Actuators
COMPANY
Helix is a global supplier to the Medical Device, Life Science, Security, Semiconductor, Aerospace, Electromechanical and Defense industries. Helix leads the linear motion industry by manufacturing the highest quality linear actuation solutions in the world. We focus entirely on manufacturing electromechanical actuation systems that help our customer be more productive and profitable. Our execution of innovative product designs solves real problems for our customers and builds a foundation for long term success.

CULTURE
Our culture is based on a team of smart, happy and competitive professionals focused on manufacturing innovative products centered on delivering precise electromechanical linear motion solutions. We are in the people business, as well as the product business. People make and sell our products and a team of smart, happy and competitive people make a company healthy.

OPERATIONS
Our company is built to deliver high-quality products and engineering support to solve the most demanding linear motion applications in any industry. We deliver components and subsystem solutions to high volume OEMs and custom machine builders to help secure their success.

HISTORY
Helix was founded in 2011 to manufacture high-quality lead screws for the growing electromechanical actuation industry. Helix’s rapid growth has included the addition of linear actuator solutions to deliver integrated and turnkey solutions.

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Helix hybrid stepper motor actuators feature heavy duty ball bearings to maximize their thrust. Helix lead screws are securely laser welded into the motor’s rotor to minimize backlash and provide years of dependable life. Bipolar for more power and unipolar windings are available, both providing quiet and smooth operation with your drive. Helix can also provide a high performance drive for your application. Optional accessories available are connectors, wire harnesses, encoders and custom lead nuts.

### HYBRID STEPPER MOTOR ACTUATOR ORDERING GUIDE

<table>
<thead>
<tr>
<th>Series</th>
<th>Model</th>
<th>Motor Length</th>
<th>Actuator Style</th>
<th>Lead Screw</th>
<th>Nut Style</th>
<th>Lead Screw Length</th>
<th>Lead Screw Precision</th>
<th>Bearing Support</th>
<th>Encoder</th>
<th>Encoder Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMA</td>
<td>8</td>
<td>S</td>
<td>Single Stack Motor</td>
<td>8</td>
<td>P1</td>
<td>0.0003” / Inch</td>
<td>M1 Universal Mount Single Bearing</td>
<td>E200</td>
<td>200 CPR</td>
<td>A</td>
</tr>
<tr>
<td>SMA</td>
<td>11</td>
<td>D</td>
<td>Double Stack Motor</td>
<td>8</td>
<td>P1</td>
<td>0.0003” / Inch</td>
<td>M1 Universal Mount Single Bearing</td>
<td>E500</td>
<td>500 CPR</td>
<td>A</td>
</tr>
<tr>
<td>SMA</td>
<td>14</td>
<td>E</td>
<td>Floating Screw</td>
<td>8</td>
<td>P2</td>
<td>0.0001” / Inch</td>
<td>F1 Flanged Mount Single Bearing</td>
<td>E1000</td>
<td>1000 CPR</td>
<td>B</td>
</tr>
<tr>
<td>SMA</td>
<td>23</td>
<td>T</td>
<td>Triple Stack Motor</td>
<td>8</td>
<td>P2</td>
<td>0.0001” / Inch</td>
<td>F1 Flanged Mount Single Bearing</td>
<td>E2000</td>
<td>2000 CPR</td>
<td>B</td>
</tr>
</tbody>
</table>

**FINAL PART NAME:** SMA - 8 - 012-025NFA - 8 - P1 - M1 - E200 - A

### ENCODER POSITION DIAGRAM

#### NEMA Size 8
- Position A
- Position B

#### NEMA Sizes 11, 14, 17, 23
- Position A
- Position B

### THE HELIX ADVANTAGE

- **The Broader Selection of Linear Stepper Actuators**
- Thousands of combinations of lead screws and lead screw nuts in stock
- No compromises of design and efficiency

- **Helix Linear Stepper Motors Are Precision Manufactured**
  - Peak performance
  - Equipped with deep groove ball bearings
  - Maximum thrust loads
  - Long life
  - Optional encoders and wiring harness are available

- **Proprietary Laser Welding Process**
  - Ensures strong bond between screw and motor
  - Precision alignment
  - Eliminates need for costly support bearing and coupling
  - Provides maximum system stiffness

- **Lead Screws Are PTFE Coated in an In-house Computer Controlled Environment**
  - Uniform coating
  - Long lasting, smooth operating life
  - Ensures prompt delivery and total quality control
  - Nuts are injection molded using the latest technology and materials

- **Rapid prototyping services, custom design actuators or a complete linear system.**

If there is a need for a custom motor, motor harness, lead or diameter, special coating, different materials or a custom nut configuration, please contact Helix for more information.
SMA - 8
Size 8 - Hybrid Linear Actuator (1.8° Step Angle)

**MOTOR CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring</td>
<td>Bipolar</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>5 VDC</td>
</tr>
<tr>
<td>Current / Phase</td>
<td>0.39 A</td>
</tr>
<tr>
<td>Resistance / Phase</td>
<td>20.4 Ω</td>
</tr>
<tr>
<td>Inductance / Phase</td>
<td>5.0 mH</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>2.4 W</td>
</tr>
<tr>
<td>Temperature Rise</td>
<td>135° F</td>
</tr>
<tr>
<td>Weight</td>
<td>1.5 oz (43g)</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>20 M Ω</td>
</tr>
</tbody>
</table>

**SPEED CHARTS**

*Note: Speed charts are based on using bi-polar motors with chopper drives at 100% duty cycle. Chopper drive curves were created using full steps on a 5 volt motor and a 40v power supply.*

**AVAILABLE LEAD SCREWS**

| Screw Diameter | Lead Diameter / Lead Code | Travel Per Step |
|                |                         |                |
| 0.125"         | 0.0120" 012-012          | 0.00006000"    |
| 0.125"         | 0.0240" 012-024          | 0.00012000"    |
| 4.00mm         | 1.00mm 016-039           | 0.006mm        |
| 4.00mm         | 2.00mm 016-078           | 0.010mm        |

More sizes available - See Page 16

**WIRING DIAGRAM**

**EZZE-MOUNTS™ - UNIVERSAL MOUNT**

**EZZE-MOUNTS™ - FLANGED**

**ATA - ANTI-BACKLASH THREADED NUT**

**AFA - ANTI-BACKLASH FLANGED NUT**

**NTA - STANDARD THREADED NUT**

**NFA - STANDARD FLANGED NUT**
SMA - 11
Size 11 - Hybrid Linear Actuator (1.8° Step Angle)

**MOTOR CHARACTERISTICS**

- **Operating Voltage**: 5 VDC
- **Current / Phase**: 6.42 A
- **Resistance / Phase**: 11.8 Ω
- **Inductance / Phase**: 6.7 mH
- **Power Consumption**: 4.2 W
- **Temperature Rise**: 135° F
- **Weight**: 4.2 oz (119g)
- **Insulation Resistance**: 20 MΩ

**SPEED CHARTS**

<table>
<thead>
<tr>
<th>Force vs. Speed (RPMs)</th>
<th>Force vs. Linear Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed (RPMs)</td>
<td>Force (lbs)</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
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<td>10</td>
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<td>15</td>
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<tr>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

**AVAILABLE LEAD SCREWS**

<table>
<thead>
<tr>
<th>Screw Diameter</th>
<th>Lead</th>
<th>Diameter / Lead Code</th>
<th>Travel Per Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1875&quot;</td>
<td>0.050&quot;</td>
<td>018-050</td>
<td>0.00025&quot;</td>
</tr>
<tr>
<td>0.1875&quot;</td>
<td>0.100&quot;</td>
<td>018-100</td>
<td>0.00050&quot;</td>
</tr>
<tr>
<td>0.1875&quot;</td>
<td>0.200&quot;</td>
<td>018-200</td>
<td>0.00050&quot;</td>
</tr>
<tr>
<td>0.1875&quot;</td>
<td>0.400&quot;</td>
<td>018-400</td>
<td>0.002&quot;</td>
</tr>
</tbody>
</table>

**WIRING DIAGRAM**

- **Bi-Polar (4 Leads)**

**NTA - STANDARD THREADED NUT**

**NFA - STANDARD FLANGED NUT**

**ATA - ANTI-BACKLASH THREADED NUT**

**AFA - ANTI-BACKLASH FLANGED NUT**

**EZZE-MOUNTS™ - UNIVERSAL MOUNT**

**EZZE-MOUNTS™ - FLANGED**

**ROTATING SCREW / TRANSLATING NUT**

**END VIEW**

Note: Speed charts are based on using bi-polar motors with chopper drives at 100% duty cycle. Chopper drive curves were created using full steps on a 5 volt motor and a 40v power supply.
HYBRID LINEAR ACTUATOR

**SMA - 14**

Size 14 - Hybrid Linear Actuator
(1.8° Step Angle)

**MOTOR CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring</td>
<td>Bipolar</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>5 VDC</td>
</tr>
<tr>
<td>Current / Phase</td>
<td>0.57 A</td>
</tr>
<tr>
<td>Resistance / Phase</td>
<td>8.8 Ω</td>
</tr>
<tr>
<td>Inductance / Phase</td>
<td>13 mH</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>5.7 W</td>
</tr>
<tr>
<td>Temperature Rise</td>
<td>135 °F</td>
</tr>
<tr>
<td>Weight</td>
<td>5.7 oz (162g)</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>20 MΩ</td>
</tr>
</tbody>
</table>

**SPEED CHARTS**

**ROTATING SCREW / TRANSLATING NUT**

- **Force vs. Speed (RPMs)**
  - Force vs. Linear Velocity
  - Speed vs. RPMs
  - Recommended Load Limit

**END VIEW**

- **Section A-A**
  - Mounting Surface
  - Section A-A

- **E22-0.033**
  - A4M2
  - DEEP 3.5 MN
  - AWG26 UL 1007
  - 1.38"
  - 0.250" Lead
  - 0.0310" Diameter

**AVAILABLE LEAD SCREWS**

<table>
<thead>
<tr>
<th>Screw Diameter</th>
<th>Lead Diameter</th>
<th>Travel Per Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.250&quot;</td>
<td>0.0310&quot;</td>
<td>0.00016&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.0630&quot;</td>
<td>0.00032&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.1250&quot;</td>
<td>0.00063&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.2500&quot;</td>
<td>0.00125&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.5000&quot;</td>
<td>0.00250&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.7500&quot;</td>
<td>0.00375&quot;</td>
</tr>
</tbody>
</table>

More sizes available - See Page 16

**WIRING DIAGRAM**

- **Bi-Polar (4 Leads)**
  - BLK
  - GRN
  - RED
  - BLU

**NTA - STANDARD THREADED NUT**

- THD 9/16" - 18 UNF

**NFA - STANDARD FLANGED NUT**

- THD 9/16" - 18 UNF

**ATA - ANTI-BACKLASH THREADED NUT**

- THD 9/16" - 18 UNF

**AFA - ANTI-BACKLASH FLANGED NUT**

- THD 9/16" - 18 UNF

**RTA - RADIAL ANTI-BACKLASH THREADED NUT**

- THD 9/16" - 18 UNF

**RFA - RADIAL ANTI-BACKLASH FLANGED NUT**

- THD 9/16" - 18 UNF

**EZZE-MOUNTS™ - UNIVERSAL MOUNT**

- EZM-4004

**EZZE-MOUNTS™ - FLANGED**

- EZF-4004

**More sizes available - See Page 16**

**Note:** Speed charts are based on using bipolar motors with chopper drives at 100% duty cycle. Chopper drive curves were created using full steps on a 5 volt motor and a 40v power supply.

The specifications and data in this publication are believed to be accurate and reliable. However, it is the responsibility of the product users to determine the suitability of these products for a specific application. When defective products will be replaced without charge (promptly returned). Accuracy is assumed beyond such replacement.
SMA - 17
Size 17 - Hybrid Linear Actuator (1.8° Step Angle)

**MOTOR CHARACTERISTICS**

- **Wiring**: Bipolar
- **Operating Voltage**: 2.1 VDC
- **Current / Phase**: 1.7A
- **Resistance / Phase**: 1.2 ohms
- **Inductance / Phase**: 1.8 mH
- **Power Consumption**: 7 W
- **Temperature Rise**: 135° F
- **Weight**: 8.5 oz (241g)
- **Insulation Resistance**: 20 MΩ

**SPEED CHARTS**

Without bearing support

Shown with Flanged EZZE-Mount™

**AVAILABLE LEAD SCREWS**

<table>
<thead>
<tr>
<th>Screw Diameter</th>
<th>Lead Diameter</th>
<th>Lead Code</th>
<th>Travel Per Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.250&quot;</td>
<td>0.0310&quot;</td>
<td>025-031</td>
<td>0.00016&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.0630&quot;</td>
<td>025-063</td>
<td>0.00032&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.1250&quot;</td>
<td>025-125</td>
<td>0.00063&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.2500&quot;</td>
<td>025-250</td>
<td>0.00125&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.5000&quot;</td>
<td>025-500</td>
<td>0.00250&quot;</td>
</tr>
<tr>
<td>0.250&quot;</td>
<td>0.7500&quot;</td>
<td>025-750</td>
<td>0.00375&quot;</td>
</tr>
</tbody>
</table>

More sizes available - See Page 16

**WIRING DIAGRAM**

**NTA - STANDARD THREADED NUT**

**NFA - STANDARD FLANGED NUT**

**ATA - ANTI-BACKLASH THREADED NUT**

**AFA - ANTI-BACKLASH FLANGED NUT**

**RTA - RADIAL ANTI-BACKLASH THREADED NUT**

**RFA - RADIAL ANTI-BACKLASH FLANGED NUT**

**EZZE-MOUNTS™ - UNIVERSAL MOUNT**

**EZZE-MOUNTS™ - FLANGED**

Note: Speed charts are based on using bi-polar motors with chopper drives at 100% duty cycle. Chopper drive curves were created using full steps on a 5 volt motor and a 40v power supply.

The specifications and data in this publication are believed to be accurate and reliable. However, it is the responsibility of the product user to determine the suitability of such products for a specific application. Mteil-direct products will be replaced without charge (prorally prorated), in addition to a prorated refund of any replacement.

23200 Commerce Park Road | Beachwood, OH 44122 USA | 216-485-2232 or 1-855-435-4958 | email: sales@helixlinear.com
SMA - 23
Size 23 - Hybrid Linear Actuator (1.8° Step Angle)

**MOTOR CHARACTERISTICS**
- **Wiring**: Bipolar
- **Operating Voltage**: 2.5 VDC
- **Current / Phase**: 2.5A
- **Resistance / Phase**: 1 ohms
- **Inductance / Phase**: 2.2 mH
- **Power Consumption**: 13 W
- **Temperature Rise**: 135° F
- **Weight**: 18 oz (511g)
- **Insulation Resistance**: 20 MΩ

**SPEED CHARTS**

**ROTATING SCREW / TRANSLATING NUT**

**END VIEW**

**AVAILABLE LEAD SCREWS**

<table>
<thead>
<tr>
<th>Screw Diameter</th>
<th>Lead Diameter / Lead Code</th>
<th>Travel Per Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.375&quot;</td>
<td>0.0630&quot;</td>
<td>037-063</td>
</tr>
<tr>
<td>0.375&quot;</td>
<td>0.1000&quot;</td>
<td>037-100</td>
</tr>
<tr>
<td>0.375&quot;</td>
<td>0.1670&quot;</td>
<td>037-107</td>
</tr>
<tr>
<td>0.375&quot;</td>
<td>0.2500&quot;</td>
<td>037-250</td>
</tr>
<tr>
<td>0.375&quot;</td>
<td>0.5000&quot;</td>
<td>037-500</td>
</tr>
<tr>
<td>0.375&quot;</td>
<td>1.0000&quot;</td>
<td>037-999</td>
</tr>
</tbody>
</table>

More sizes available - See Page 16

**WIRING DIAGRAM**

**NTA - STANDARD THREADED NUT**

**NFA - STANDARD FLANGED NUT**

**ATA - ANTI-BACKLASH THREADED NUT**

**AFA - ANTI-BACKLASH FLANGED NUT**

**RTA - RADIAL ANTI-BACKLASH THREADED NUT**

**RFA - RADIAL ANTI-BACKLASH FLANGED NUT**

**EZZE-MOUNTS™ - UNIVERSAL MOUNT**

**EZZE-MOUNTS™ - FLANGED**

**Note**: Speed charts are based on using bi-polar motors with chopper drives at 100% duty cycle. Chopper drive curves were created using full steps on a 5 volt motor and a 40V power supply.

The specifications and data in this publication are believed to be accurate and reliable. However, it is the responsibility of the product user to determine the suitability of Helix products for a specific application. While defective products will be replaced without charge (promptly returned, excluding liability assumed beyond such replacement).

The lead screw data in this publication is not intended for use in a motor control system, and is based on Helix’s current understanding of the lead screw technology. Helix makes no representations or warranties regarding the operation of any motor control system that utilizes the lead screw data in this publication.
### LEAD SCREW SPECIFICATIONS

#### INCH LEAD SCREWS*

<table>
<thead>
<tr>
<th>Material</th>
<th>300 Series Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Coatings</td>
<td>PTFE - For use with Acetal nuts</td>
</tr>
<tr>
<td>Ceramic Coating - for use with bronze nuts</td>
<td></td>
</tr>
<tr>
<td>FNC - For use with bronze or acetal nuts</td>
<td></td>
</tr>
</tbody>
</table>

#### LEAD SCREW NUT

<table>
<thead>
<tr>
<th>Standard Material</th>
<th>Helix Precision Acetal (externally Lubricated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Performance Material</td>
<td>Helix Precision Thermoplastic (externally Lubricated)</td>
</tr>
</tbody>
</table>

| Extreme Strength Material | Helix Bronze |

#### Standard Lead Accuracy [in/ft (μm/300 mm)]

- 0.010 (250)

#### Precision Lead Accuracy [in/ft (μm/300 mm)]

- 0.003 (75)

#### Straightness [in/ft (μm/300 mm)]

- 0.005 (125)

### LEAD SCREW SPECIFICATIONS - CONTINUED

#### METRIC LEAD SCREWS*

<table>
<thead>
<tr>
<th>Material</th>
<th>300 Series Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Coatings</td>
<td>PTFE - For use with Acetal nuts</td>
</tr>
<tr>
<td>Ceramic Coating - for use with bronze nuts</td>
<td></td>
</tr>
<tr>
<td>FNC - For use with bronze or acetal nuts</td>
<td></td>
</tr>
</tbody>
</table>

#### LEAD SCREW NUT

<table>
<thead>
<tr>
<th>Standard Material</th>
<th>Helix Precision Acetal (externally Lubricated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Performance Material</td>
<td>Helix Precision Thermoplastic (externally Lubricated)</td>
</tr>
</tbody>
</table>

| Extreme Strength Material | Helix Bronze |

#### Standard Lead Accuracy [mm/rev (μm/300 mm)]

- 0.010 (250)

#### Precision Lead Accuracy [mm/rev (μm/300 mm)]

- 0.003 (75)

#### Straightness [mm/rev (μm/300 mm)]

- 0.005 (125)

### END MACHINING FOR LEAD SCREWS*

#### Standard Edge Break

![Standard Edge Break Diagram](image)

#### Turned Journal

![Turned Journal Diagram](image)

#### Ground Journal

![Ground Journal Diagram](image)

#### Snap Ring Groove

![Snap Ring Groove Diagram](image)

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*More sizes available - Contact Helix for more information

*Visit helixlinear.com for end machining templates.
The custom solutions team at Helix is focused on delivering custom actuation systems.

Our services include:
- Design support
- Prototyping / 3D printing
- Testing and qualification
- Production assembly and integration

Customized Linear Slides
- Hybrid stepper motors and servo motors
- Motor mount
- Integrated profile rail
- Flags & switches
- Custom lead screw nut
- PTFE coated screw

Customized Linear Actuators
- Hybrid stepper motors and servo motors
- Integrated profile rail
- Bearing supports for screw
- Customized carriage block
- PTFE coated screw
- Custom molded anti-backlash nut

Helix bearing supports can be easily added to a hybrid linear actuator to support the end of the lead screw. Adding a Helix EZZE-Mount™ helps extend the life of your linear actuator by eliminating radial deflection and vibration.

Also Available in Double Bearing Options
- Flanged Double Bearing EZZE-Mount™
- Universal Double Bearing EZZE-Mount™

Stainless Steel and Anodized Aluminum EZZE-Mounts™
**MOTOR / ELECTRICAL SPECIFICATIONS**

**MOTOR**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>SMA - 8</th>
<th>SMA - 11</th>
<th>SMA - 14</th>
<th>SMA - 17</th>
<th>SMA - 23</th>
</tr>
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<tbody>
<tr>
<td>Frame Size</td>
<td>NEMA 8</td>
<td>NEMA 11</td>
<td>NEMA 14</td>
<td>NEMA 17</td>
<td>NEMA 23</td>
</tr>
<tr>
<td>Step Size (*)</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Max. Axial Load (3)</td>
<td>10 (46)</td>
<td>20 (89)</td>
<td>50 (222)</td>
<td>75 (334)</td>
<td>200 (890)</td>
</tr>
<tr>
<td>Max. Radial Play [in @ lbs (mm @ N)]</td>
<td>0.001 @ 1 (0.03 @ 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Play [in @ lbs (mm @ N)]</td>
<td>0.002 @ 2 (0.05 @ 9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentricity of Mounting Pilot to Shaft [in (mm)]</td>
<td>0.003 (0.08) TIR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perpendicularity of Shaft to Mounting Face [in (mm)]</td>
<td>0.003 (0.08) TIR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Case Temperature [ °F (°C)]</td>
<td>140 (60)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature [ °F (°C)]</td>
<td>-4 to 122 (-20 to 50)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Humidity (non-condensing) [%]</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnet Wire Insulation</td>
<td>Class B 130 °C (266 °F)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>100 Mohm @ 500 VDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>500 VAC for 1 minute</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ASSEMBLY**

| Max. Backlash with Standard Nut [in (mm)] | 0.010 (0.25) |
| Max. Backlash with Helix Anti-Backlash Nut [in (mm)] | 0 |
| Runout [in/ft (mm/300 mm)] | 0.007 (0.18) |
| Operating Temperature [ °F (°C)] | 15 to 125 (-10 to 50) |

**ENCODER DIMENSIONS**

<table>
<thead>
<tr>
<th>NEMA Size 8</th>
<th>NEMA Sizes 11, 14, 17, 23</th>
</tr>
</thead>
</table>

**GLOSSARY AND DEFINITIONS**

**Detent or Residual Torque**
The torque required to rotate the motor’s output shaft with no current applied to the windings.

**Drives**
Term depicting the external electrical components to run a Stepper Motor System. This will include power supplies logic sequencers, switching components and usually a variable frequency pulse source to determine the step rate.

**Dynamic Torque**
The torque generated by the motor at a given step rate. Dynamic torque can be represented by pull-in torque or pull-out torque.

**Holding Torque**
The torque required to rotate the motor’s output shaft while the windings are energized with a steady state D.C. current.

**Inertia**
The measure of a body’s resistance to acceleration or deceleration. Typically used in reference to the inertia of the load to be moved by a motor or the inertia of a motor’s rotor.

**Linear Step Increment**
The linear travel movement generated by the lead screw with each single step of the rotor.

**Maximum Temperature Rise**
Allowable increase in motor temperature by design. Motor temperature rise is caused by the internal power dissipation of the motor as a function of load. This power dissipation is the sum total from I^2R (copper loss), iron (core) loss, and friction. The final motor temperature is the sum of the temperature rise and ambient temperature.

**Pulse Rate**
The number of pulses per second (pps) applied to the windings of the motor. The pulse rate is equivalent to the motor step rate.

**Pulses Per Second (PPS)**
The number of steps that the motor takes in one second (sometimes called “steps per second”). This is determined by the frequency of pulses produced by the motor drive.

**Ramping**
A drive technique to accelerate a given load from a low step rate, to a given maximum step rate and then to decelerate to the initial step rate without the loss of steps.

**Single Step Response**
Time required for the motor to make one complete step.

**Step**
The angular rotation produced by the rotor each time the motor receives a pulse. For linear actuators a step translates to a specific linear distance.

**Step Angle**
The rotation of the rotor caused by each step, measured in degrees.

**Steps Per Revolution**
The total number of steps required for the rotor to rotate 360°.

**Torque**
The sum of the frictional load torque and inertial torque.

**Pull Out Torque**
The maximum torque the motor can deliver once the motor is running at constant speed. Since there is no change in speed there is no inertial torque. Also, the kinetic energy stored in the rotor and load interia help to increase the pull of the torque.

**Pull In Torque**
The torque required to accelerate the rotor inertia and any rigidly attached external load up to speed plus whatever friction torque must be overcome. Pull-in torque, therefore, is always less than pull-out torque.

**Torque to Inertia Ratio**
Holding torque divided by rotor inertion.
The specifications and data in this publication are believed to be accurate and reliable. However, it is the responsibility of the product user to determine the suitability of Helix products for a specific application. While defective products will be replaced without charge if promptly returned, no liability is assumed beyond such replacement.

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HELIX QUALITY EVOLUTION

Developed Manufacturing Systems
Quality Systems and Accreditations
Supply Chain Approval Process
State of the Art Management Systems
APQP Launch Protocols
System and Process Protocols
Engineering Analysis and Predictive Tools
Reliability Engineering and Testing
Custom Engineered and Built Test Instrumentation
Design and Test for Fault Tolerance and Prognostics
Certification Testing

QUALITY - CONTINUED

HIGH TECH QUALITY EXPERIENCE

When you select Helix Linear Technologies as a supplier, you can be assured that your product will be designed and tested to rigorous product planning. Pre-design activity includes understanding of customer requirements applied to predictive models, engineering calculations and linear modeling through prototype development, stereo-lithography samples of form, fit, and function that verify design criteria.

VALIDATION AND VERIFICATION

Through years of rigorous development, Helix has proven its designs and manufacturing processes against the most stringent standards and specifications. Design and process verification and validation tools are employed throughout the product life cycle.

CERTIFICATIONS

Helix serves many customers in the Aerospace and Medical device markets and has complied with common Quality System Requirements.

ITAR

Helix is registered with the Department of State For International Traffic In Arms Compliance.

The Department of State is responsible for the export and temporary import of defense articles and services governed by 22 U.S.C. 2778 of the Arms Export Control Act.

INVESTIGATION CAPABILITY

Roundness Measurement - Critical to quality, characteristics such as roundness are monitored throughout the screw manufacturing process.

Lead Accuracy Measurement - Precise lead accuracy measurement systems are utilized to validate process to conform to Helix internal specifications and customer requirements.

QUALITY TOOLS:

• Design for Six Sigma manufacturing
• D.O.E. (Design of Experiments)
• APQP (Advanced Product Quality Planning)
• DFMEA, PFMEA
• FEA (Finite Element Analysis)
• DVP&R (Design Verification Plan & Report)
• Reliability testing
• Process validation to 21 CFR Part 82 (Medical Device)

TESTING

Efficiency Measurement - Helix Engineering has designed test machines to measure and validate screw assembly efficiency.

Torque Measurement - Preloaded lead screw assemblies are evaluated to determine compliance with engineering specifications utilizing a dynamic torque testing machine.

FUNCTIONAL TESTING

Helix test systems and engineered testing processes perform analysis and verification of life, durability, and performance. The functional testing defines operating limits in specifications and helps set defined targets in product launch process and assurance plans.

The engineered testing provides predictive tools, generates data for prognostics, and validates performance wear models. Life tests help determine performance in multiple operating conditions as well. Helix offers proof testing for customers developing new systems and actuators to help accelerate product release dates.
LINEAR MOTION APPLICATIONS
High Quality, Precision Linear Motion Solutions

LIFE SCIENCES

- Pipeting automation
- Syringe pumps
- Microscopes
- MRI scanners
- CT scanners
- Radiographic machines
- In-vitro diagnostics
- Genomics
- Blood gas chemistry

PRINTING & BINDING

- “Z” axis actuators
- Multi-axis gantries
- 3D printing
- Automation / Material handling
- Additive manufacturing (AD)
- Large format sign printing
- Digital offset printing process
- Folding and sealing equipment
- Thermal CTP systems

SECURITY - MILITARY

- Automated door locking systems
- Pan-tilt-zoom cameras
- Automated gates
- Tactical automated security cameras
- Missile fin actuation
- Tank sighting systems
- Drones and UAVs
- Torpedo fin actuation
- Guided munitions

SEMICONDUCTOR

- Burnishing stages
- Stacking systems
- Vision inspection machines
- X, Y, Z gantries
- Wafer elevators / Wafer handling
- Acoustic microscopes
- Ultrasonic imaging
- Tuning coils
- Vacuum chamber doors

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