Linear Motion Drives
(comparative analysis)
Linear Motion Drives
(comparative analysis)
Linear Motion Drives
(comparative analysis)

**Linear Motion Drive** is a linear positioning system consisting of the electro-magnetic actuator (rotary or linear), linear guide (bearing) and transmission mechanism (if applicable).

In the following analysis **Linear Drives** are compared on the basis of their inherent “linear open loop” accuracy. Even though a linear resolver may be employed in the motor, “linear open loop” accuracy will still be determined by the manufacturing and installation tolerances.

Linear brushless motors with magnetic resolvers like NSK Megatrust and THK Servo Guide Type HRS are used for comparison.

For improved linear accuracy a linear position transducer (glass or metal encoder) can be used with any above linear technologies.
Conditions for Comparison

- **IntelliDrives**
  - pitch error 0.0004”/12”
  - cyclic error 0.0008” (2 phase)
  - 0.0004” (with error correction)

- **Precision ballscrew**
  - lead accuracy 0.0001”/1” - does not include accuracy of the rotary motors/encoders

- **Commercial ballscrew**
  - lead accuracy 0.003”/1’ - does not include accuracy of the rotary motors/encoders

- **Acme lead screw**
  - lead accuracy 0.0006”/1” - does not include accuracy of the rotary motors/encoders

- **Belt Drive**
  - accuracy 0.001”/1” - does not include accuracy of the rotary motors/encoders

- **Linear brushless motor**
  - 0.002”/36” + 0.0004”
  - (50 mkm/1m + 10 mkm)
$$$
\text{Relative Cost Comparison} $$$

- IntelLiDrives: 1.0
- Belt Drive: 1.4
- Leadscrew Drive: 1.8
- Commercial Ballscrew: 2.2
- Precision Ballscrew: 2.4
- Linear Brushless Motors: 3.4

Linear Motion in its Simplest Form™
Repeatability

Linear Motion in its Simplest Form™
Accuracy (travel 12")

- IntelLiDrives (error correction)
- Linear Brushless Motors
- Precision Ballscrew
- IntelLiDrives (2 phase)
- Commercial Ballscrew
- Leadscrew Drive
- Belt Drive

mils

Linear Motion in its Simplest Form™
Accuracy (travel 36")

mils

IntelLiDrives (error correction)
IntelLiDrive (2 phase)
Linear Brushless Motors
Precision Ballscrew
Commercial Ballscrew
Leadscrew Drive
Belt Drive

Linear Motion in its Simplest Form™
# IntelLiDrives and High Lead Ball Screws

<table>
<thead>
<tr>
<th>parameter</th>
<th>IntelLiDrive</th>
<th>SHL Ball screw 40 mm lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>cumulative pitch error</td>
<td>0.0004”/12” (10 mkm/300mm)</td>
<td>accumulated ref. lead error Ec</td>
</tr>
<tr>
<td>cyclic error</td>
<td>0.0008” (20 mkm)</td>
<td>variation €c 20 mkm</td>
</tr>
<tr>
<td></td>
<td>0.0004” (10 mkm)</td>
<td>variation € $2\pi$ 8 mkm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>motor full step error (3% full step) 6 mkm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>motor microstep error (5% full step) 10 mkm</td>
</tr>
<tr>
<td>total accuracy</td>
<td>30 mkm</td>
<td>20 mkm</td>
</tr>
<tr>
<td>hysteresis</td>
<td>0.0004” (10 mkm)</td>
<td>axial play 10 mkm</td>
</tr>
</tbody>
</table>
IntelliDrives

http://www.IntelliDrives.com

Linear Motion in its Simplest Form™