Rotary to Linear Conversion

Linear motion systems driven by rotating electric motors commonly employ one of three rotary-to-linear conversion systems: **ballscrew, belt drive, or Acme screw.**

Leadscrews

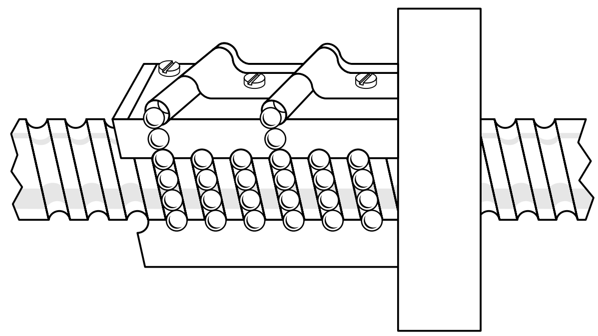
Screw-drive mechanisms, whether Acme screw or ballscrew provide high thrust (to thousands of pounds), but are often limited by critical speed, maximum recirculation speed of ball nut circuits, or sliding friction of Acme nut systems.

Ballscrew

The majority of linear motion applications convert motor torque to linear thrust using ballscrews due to their ability to convert more than 90% of the motor's torque to thrust. As seen below the ballnut uses one or more circuits of recirculating steel balls which roll between the nut and ballscrew threads. Ballscrews provide an effective solution when the application requires:

- High efficiency - low friction
- High duty cycle (> 50%)
- Long life - low wear

Ballscrew

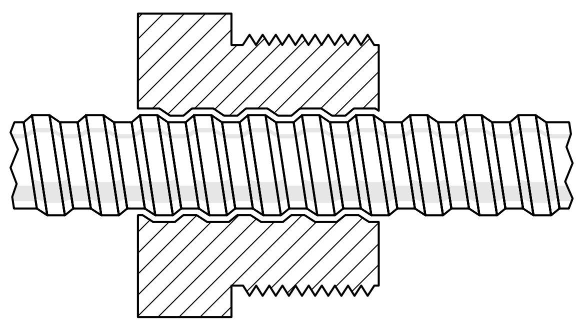


Acme Screw

The Acme Screw uses a plastic or bronze solid nut that slides along the threads of the screw, much like an ordinary nut and bolt. Since there are no rolling elements between the nut and the leadscrew, Acme screws yield only 30-50% of the motor's energy to driving the load. The remaining energy is lost to friction and dissipated as heat. This heat generation limits the duty cycle to less than 50%. A great benefit of the Acme screw is its ability to hold a vertical load in a power-off situation (refer to the Backdrive specifications for acme screw actuators). The Acme screw is a good choice for applications requiring:

- Low speeds
- Low duty cycles (50%)
- The ability to hold position while motor power is off

Acme Screw



Timing Belt

Belt Drive systems offer many of the benefits of ballscrews, yet have fewer moving parts, and do not have the critical speed limits of leadscrew-driven systems. They generally provide more linear motion from the same motor movement, resulting in higher travel speeds with minimal component wear. In contrast, this design results in lower repeatability and accuracy. Thrust capability is also smaller compared to screw-drive systems due to the tensile strength limitation of the transport belt.

The general configuration can be seen in the figure. A toothed belt passes around a pulley in each end of the actuator and is attached to the carriage to pull it back and forth along the length of travel. The carriage is supported by a linear bearing system to provide load carrying capacity. The neoprene belt is reinforced with steel tensile elements to provide strength and minimize belt stretch. Timing belt systems are a good solution for applications requiring:

- High speeds
- Low thrusts
- High efficiency
- High duty cycle

Belt Drive