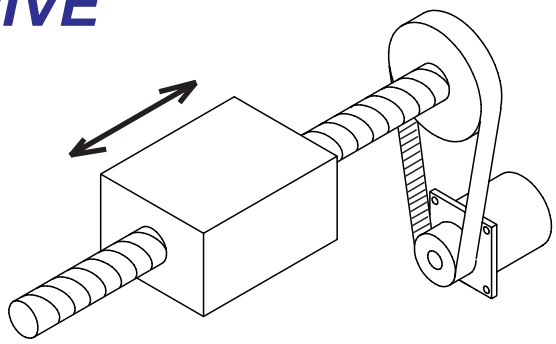
SCREW DRIVE

MAIN ADVANTAGES

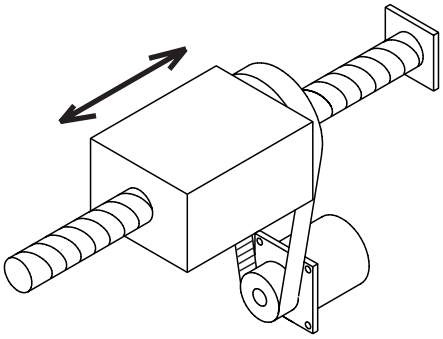
High precision (ballscrews)
High effiiciency (ballscrews)
High thrust
High mechanical advantage

MAIN DISADVANTAGES

High cost (ballscrews)
High screw inertia
Dirt may clog thread
Load may backdrive motor



Fixed motor (Rotating screw)



Fixed screw (Rotating nut)

Fill in the boxes and return to us. We will size a suitable stepper motor and drive for you!

Screw Pitch Small screw pitches will produce very fine resolution. However, small screw pitches will limit top speed of the load. Load inertia is greatly reduced by a small screw pitch ($J \alpha p^2$).

Screw Diameter Larger screw diameters will exert greater thrust and can be supplied with greater pitch. However, larger screw diameter increases the inertia the motor must rotate ($J \alpha d^4$). Also, if the screw is very long and is mounted horizontally, gravity will make it sag at rest. Whipping may occur at high speeds. This can be helped by tensioning a screw.

Screw Length Inertia of the screw is directly proportional to screw length ($J \alpha l$). Check manufacturer's specifications to make sure screw does not sag at rest or whip at high speeds.

Screw Type Ballscrews are best but can be expensive. Their efficiency is usually over 95%. ACME thread screws are a lot cheaper but have lower efficiency of around 50 to 60%

Load Mass This is the mass that the screw must move. Screws are capable of driving very large loads. Inertia seen by the motor is directly proportional to load mass.

Drive Method There are two ways of configuring a screw. The most common is to fix the motor and rotate the screw, moving the load. This is good but often, most of the motor's energy is used in accelerating the high inertia of the screw (particularly with very long screws). This can be prevented by fixing the screw and rotating the nut (and the motor). The inertia is much lower but now the motor must be also moved, dragging the electrical cables with it.

Gear Reduction Sometimes it is necessary to use gearing with a screw to reduce inertia or amplify torque. This may be done using low cost timing belts and pulleys or a precision gearhead that mounts onto the motor. High ratio reduction will help torque but will limit speed. Gearing reduces load and screw inertia by the square of the ratio of the reducer ($J \alpha 1/n^2$). Planetary gearheads and pulleys have high efficiency but worm drive gearboxes have very poor efficiency.

External Load External forces on the load must be taken into consideration. These may be friction, gravity (if motion is vertical) or cutting forces on a cutting machine. Sometimes these can be measured on an existing machine. On a new machine, you will just have to estimate these forces or try to calculate them.

Resolution Resolution is the smallest amount of linear movement that corresponds to one motor step. It will depend on screw pitch and gearing. What is the minimum accuracy increment of motion your machine needs to do? This is not necessarily the same as accuracy which is also affected by backlash and quality of your screw and gearing.

Top Speed What is the maximum linear top speed required? Be careful as specifying a very high top speed will result in a costly system. On many machines, the top speed occurs during rapid traverse when there are no cutting forces involved.

Ramp Time This is stepper motor terminology for acceleration and deceleration time. These are usually linear although some controllers can provide "S" profile ramping to reduce shock on components. Very fast acceleration times will require large and expensive motors and drives. Motor torque is directly proportional to acceleration rate.

Duty Cycle Duty cycle (expressed as %) is the proportion of time the motor is running compared to total time. In most machines, the motor will run for a short period and rest for a while before starting the next cycle. The duty cycle is (run time)/(run time + rest time).

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