Estimating the Required Encoder Resolution and Gear Ratio for Driving an Axis with a Ballscrew

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$\mu m := 10^{-6} m$ $\quad$ $rev := 2\pi rad$

What is the maximum rotorary encoder resolution that availible (within reason)?

The maxium rotorary encoder resolution that I have found (in the maxon catalog) is 1000 counts per turn.

With this encoder what is the minimum position resolution that can be resolved with NO gearing of the ball screw?

$pitch := 5 \frac{mm}{rev}$ The pitch of the ballscrew

$counts := 1000 \cdot \frac{1}{rev}$ The actual number of counts per revotion of the encoder

$res_{direct} := \frac{pitch}{counts}$ $\quad res_{direct} = 5\,\mu m$ The minimum position resolution with the encoder connected directly to the ballscrew shaft.

What is the needed to achive the the required position resolution?

$res_{needed} := 0.25\mu m$ The minimum increment that the stage motion should be resolved to.

$ratio_{gear} := \frac{res_{direct}}{res_{needed}}$ $\quad ratio_{gear} = 20$