

K1DM3 Technical Note

872-LTN1026

Exlar Maximum Motor Torque Calculations

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Maximum Motor Torque= $T_g = J_{Ltot} \alpha + T_L$

Where:

Equivalent moment of inertia= $J_{Ltot} = J_{reducer} + \frac{1}{\epsilon N^2} \left[J_{leadscrew} + \frac{M_1}{\sigma} \left(\frac{P}{2\pi} \right)^2 \right] = 1.67 \times 10^{-4} \text{Kgm}^2$

α –angular acceleration (rad/sec²)=155 rad/sec²

$J_{Ltot} \alpha = 0.026 \text{ Nm}$

$J_{reducer} = 0$

N – reducer ratio=1.0 (no reduction used)

ϵ –efficiency of the reducer=1.0 (none used)

M_1 – mass of components riding on ball screw block (including block)(Kg)=431kg (1/2 of overall mass with an .817m/107m multiplier)

σ –efficiency of the lead screw=0.9

P –lead of roller-screw=0.00254m

$J_{leadscrew} = M_{leadscrew} \frac{r^2}{2} = 5 \times 10^{-5} \text{Kgm}^2$

$M_{leadscrew}$ – mass of leadscrew (Kg)=1.0 Kg

r – radius of leadscrew (m) =0.01m

$T_L = \frac{1}{N} T_F + \frac{1}{N \epsilon} \frac{F P}{\sigma 2\pi} = 0.82 \text{Nm} + 1.71 \text{Nm} = 2.53 \text{ Nm}$

T_F =Torque friction of lead screw = .82 Nm (due to preload to minimize backlash)

F –Force on stage block along axis of travel = 4227 N

T_g Maximum Start Torque =2.53Nm+ 0.026Nm =2.56Nm at 0 RPM

Maximum Speed = 296 RPM

Maximum Start Current: Refer to Exlar Speed vs Torque curves

Type equation here.

2.56N-m/10.2N-m * 21 Amps =5.3 Amps

Stator	GSX40 1B8-04	Units
Continuous Motor Torque	45	lbf-in
Torque Constant (Kt)	6.5	lbf-in/A
Continuous Current Rating	7.7	A
Peak Current Rating	15.4	A
Voltage Constant (Ke)	44.6	Vrms/Krpm
Resistance	1.2	Ohms
Inductance	7.55	mH
Bus Voltage	48	VDC
Speed @ Bus Voltage	400	RPM

Figure 3: Exlar Motor Information

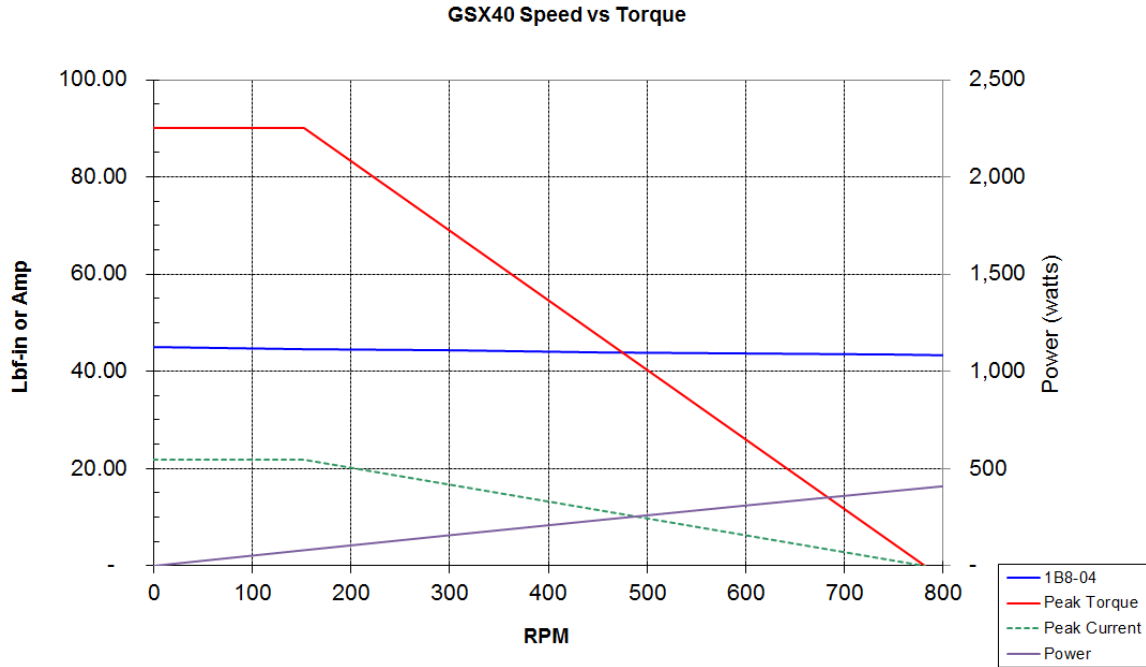


Figure 4: Speed vs Torque