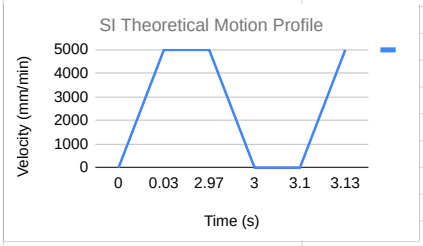
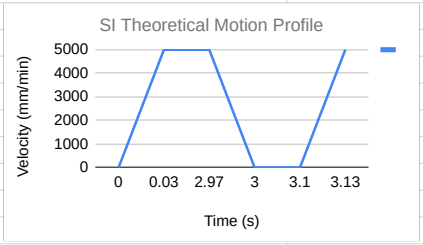
Y Axis



White Paper

Description	SI Value
System Inputs	
Gantry mass (kg)	25
Book cut velocity (mm/min)	5000
Cut time (s)	3
Cut acceleration (m/s^2)	2.78
Dwell (s)	0.1
Motion Profile accel (%)	1.00%
Num Motors (int)	2
Pinion Pitch Diameter (m)	0.045
Calculate Horizontal Load (N)	69.44
Calculate Constant Velocity Motion Distance (m)	0.250
Power (W)	1.04
Peak Linear Velocity (m/s)	0.08
Rev. Distance (m)	0.141
Peak Angular Velocity (rad/s)	3.72
Total Reflected Inertia (kg-m^2)	0.013
Determine Pinion Input Torque	
Rack/Pinion Efficiency	94%
Bearing Friction Constant	0.003
Drive Reduction Ratio	5
Reduction Efficiency (%)	97%
Pinion Pulley Pitch Diameter (m)	0.045
Pinion Pulley Mass (kg)	0
Motor Pulley Pitch Diameter (m)	0.032
Motor Pulley Mass (kg)	0
Cutting forces (N)	150
Belt Drive Inertia (kg-m^2)	0.00E+00
Gearbox Inertia (kg-m^2)	0.000044
ang. acceleration (rad/s^2)	123.46
Net efficiency (%)	91.18%
Cutting torque (Nm)	1.48
Acceleration Torque (Nm)	0.39
Gravity Torque (Nm)	0.00
Pinion Shaft Speed (rev/s)	0.59
Friction Torque (Nm)	0.003
EffectiveTotal Pinion Torque (Nm)	1.933
rms Torque (Nm)	1.460
Peak Torque (Nm)	1.88
Peak Power (W)	6.98
Avg Power (W)	5.69
Calculate Motor Data	
Manufacturer	Sanyo Denki
Model	103H7823-5740
Motor Phase Qty. (int)	1
Motor Rotation/Step (deg)	1.8
Motor Step to Step Accuracy (%)	0.09%
Input Motor Phase Amps (A)	2
Input Drive voltage (V)	48
Motor Volts (low power state) (V)	2.3
Motor Peak Hold Torque (Nm)	2.70
Coil Resistance (ohms)	2.4
Coil Inductance(mH)	9.5

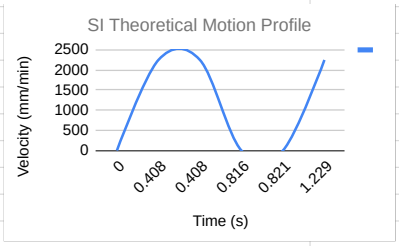
X Axis



White Paper

Description	SI Value
System Inputs	
Gantry mass (kg)	25
Book cut velocity (mm/min)	5000
Cut time (s)	3
Cut acceleration (m/s^2)	2.78
Dwell (s)	0.1
Motion Profile accel (%)	1.00%
Num Motors (int)	1
Pinion Pitch Diameter (m)	0.045
Calculate Horizontal Load (N)	69.44
Calculate Constant Velocity Motion Distance (m)	0.250
Power (W)	2.08
Peak Linear Velocity (m/s)	0.08
Rev. Distance (m)	0.141
Peak Angular Velocity (rad/s)	3.72
Total Reflected Inertia (kg-m^2)	0.013
Determine Pinion Input Torque	
Rack/Pinion Efficiency	94%
Bearing Friction Constant	0.003
Drive Reduction Ratio	5
Reduction Efficiency (%)	97%
Pinion Pulley Pitch Diameter (m)	0.045
Pinion Pulley Mass (kg)	0
Motor Pulley Pitch Diameter (m)	0.032
Motor Pulley Mass (kg)	0
Cutting forces (N)	150
Belt Drive Inertia (kg-m^2)	0.00E+00
Gearbox Inertia (kg-m^2)	0.000013
ang. acceleration (rad/s^2)	123.46
Net efficiency (%)	91.18%
Cutting torque (Nm)	1.48
Acceleration Torque (Nm)	1.56
Gravity Torque (Nm)	0.00
Pinion Shaft Speed (rev/s)	0.59
Total Pinion Torque (Nm)	0.910
Total Pinion Torque (Nm)	4.077
rms Torque (Nm)	2.362
Peak Torque (Nm)	3.95
Peak Power (W)	14.72
Avg Power (W)	9.17
Calculate Motor Data	
Manufacturer	Lichuan
Model	LC60HS112
Motor Phase Qty. (int)	2
Motor Rotation/Step (deg)	1.8
Motor Step to Step Accuracy (%)	0.0009
Input Motor Phase Amps (A)	4
Input Drive voltage (V)	48
Motor Volts (low power state) (V)	2.3
Motor Peak Hold Torque (Nm)	4
Coil Resistance (ohms)	1.56
Coil Inductance(mH)	3.9

Z Axis



White Paper

Description	SI Value
System Inputs	
Gantry mass (kg)	30
Book cut velocity (mm/min)	2250
Cut time (s)	0.816
Cut acceleration (m/s^2)	0.09
Dwell (s)	0.005
Motion Profile accel (%)	50%
Num Motors (int)	1
Leadscrew Max RPM (RPM)	1,500
Leadscrew Minimum Pitch (mm)	5.00
Leadscrew Diameter (mm)	16.00
Leadscrew Length (mm)	300.0
16 mm Leadscrew Actual Pitch (mm)	5.0
Leadscew Starts (int)	1
Leadscrew Lead (mm)	1.27
Peak Leadscrew Velocity (rad/s)	4.70
Leadscrew Inertia (kg-m^2)	0.00004
Total Reflected Inertia (kg-m^2)	0.00100
Determine Leadscrew Input Torque	
Leadscrew Efficiency	94%
Bearing Friction Constant	0.050
Drive Reduction Ratio	1
Reduction Efficiency (%)	100%
Pinion Pulley Pitch Diameter (m)	0
Pinion Pulley Mass (kg)	0
Motor Pulley Pitch Diameter (m)	0
Motor Pulley Mass (kg)	0
Cutting forces (N)	
Belt Drive Inertia (kg-m^2)	0.00E+00
Gearbox Inertia (kg-m^2)	0
ang. acceleration (rad/s^2)	454.72
Net efficiency (%)	0.94
Cutting torque (Nm)	0.00
Acceleration Torque (Nm)	0.46
Gravity Torque (Nm)	0.06
Friction Torque (Nm)	0.10
rms Torque (Nm)	0.466
Peak Torque (Nm)	0.61
Peak Power (W)	0.00
Avg Power (W)	0.00
Calculate Motor Data	
Manufacturer	Sanyo Denki
Model	103H7823-5740
Motor Phase Qty. (int)	2
Motor Rotation/Step (deg)	1.8
Motor Step to Step Accuracy (%)	0.09%
Input Motor Phase Amps (A)	2
Input Drive voltage (V)	48
Motor Volts (low power state) (V)	2.3
Motor Peak Hold Torque (Nm)	2.70
Coil Resistance (ohms)	2.4
Coil Inductance(mH)	9.5

Rotor Inertia (g-cm^2)	840	Rotor Inertia (g-cm^2)	1200	Rotor Inertia (g-cm^2)	840
Motor Wiring Scheme	Parallel	Motor Wiring Scheme	Parallel	Motor Wiring Scheme	Parallel
Motor RPM (rev/min)	178	Motor RPM (rev/min)	178	Motor RPM (rev/min)	1772
Motor Rotation to Linear Travel (mm)	28.3	Motor Rotation to Linear Travel (mm)	28.3	Motor Rotation to Linear Travel (mm)	1.3
System to Rotor Inertia Ratio (int)	0.6 : 1	System to Rotor Inertia Ratio (int)	0 : 1	System to Rotor Inertia Ratio (int)	1.2 : 1
Torque Peak Gearbox input (Nm)	0.39	Torque Peak Gearbox input (Nm)	0.82	Torque Peak Gearbox input (Nm)	0.61
Torque rms Gearbox input (Nm)	0.30	Torque rms Gearbox input (Nm)	0.49	Torque rms Gearbox input (Nm)	0.47
Motor angular velocity (rad/s)	18.61	Motor angular velocity (rad/s)	18.61	Motor angular velocity (rad/s)	4.70
Motor linear acceleration (m/s^2)	13.89	Motor linear acceleration (m/s^2)	13.89	Motor linear acceleration (m/s^2)	0.09
Motor Average power (W)	36	Motor Average power (W)	76	Motor Average power (W)	
Motor RMS power (W)	27	Motor RMS power (W)	44	Motor RMS power (W)	
Motor Resonance Frequency (rev/min)	756	Motor Resonance Frequency (rev/min)	1088	Motor Resonance Frequency (rev/min)	1069
Calculate Drive Parameters		**Calculate Drive Parameters**		**Calculate Drive Parameters**	
Microstep Setting (int)	2	Steps/Rev (int)	2	Steps/Rev (int)	2
Drive Voltage (V)	48	Drive Voltage (V)	48	Drive Voltage (V)	48
Drive Output Current (A)	2	Drive Output Current (A)	2	Drive Output Current (A)	2
Step/Linear mm (int)	11,310	Step/Linear Distance (mm)	11,310	Step/Linear Distance (mm)	3.18E-03
Linear Distance/Step (mm)	0.0000884	Linear Distance/Step (mm)	0.0000884	Linear Distance/Step (mm)	3.15E+02
Positional Error (%/step)	0.13%	Linear Positional Error (%/step)	0.13%	Linear Positional Error (%/step)	
Positional Error/Step Range (mm)	+/- 0.0000885	Linear Positional Error Range (mm)	+/- 0.0000885	Linear Positional Error Range (mm)	
Calculate Power Supply Loads		**Calculate Power Supply Loads**		**Calculate Power Supply Loads**	
Io (A)	0.96	Io (A)	1.47	Io (A)	0.96
Motor Power available (W)	96	Motor Power available (W)	192	Motor Power available (W)	96
Kt (V*s)	1.35	Kt	1.00	Kt	1.35
I peak (A)	1.2	I peak (A)	2.3	I peak (A)	1.4
I rms (A)	1.2	I rms (A)	2.0	I rms (A)	1.3
Vrms_min (V)	28	Vrms_min (V)	22	Vrms_min (V)	10
Total Ideal PSU RMS Power (W)	70	Total Ideal PSU RMS Power (W)	51	Total Ideal PSU RMS Power (W)	14
Total Actual PSU Peak Power (W)	112	Total Actual PSU Peak Power (W)	44	Total Actual PSU Peak Power (W)	19
PSU De-Rate Percent (int)	100%	PSU De-Rate Percent (int)	100%	PSU De-Rate Percent (int)	100%
Total De-Rated PSU Current (A)				8	
Input Test Voltage (V)	48		24		
Motor_Red Radial Velocity (rad/s)	33.34		20.43		
System_Red Radial Velocity (rad/s)	6.67		4.09		
% System Reduction (int)	0.0%		0.0%		
Linear Accel. mm/min^2	5731.18				
Linear Accel. mm/sec^2	95.52				
Calculate Heat		**Calculate Heat**		**Calculate Heat**	
Ambient Temp (deg C)	35	Ambient Temp (deg C)	35	Ambient Temp (deg C)	35
Heat rise Coefficient (W/C)	2.2	Heat rise Coefficient (W/C)	2.2	Heat rise Coefficient (W/C)	2.2
Theta (deg C)	8	Theta (deg C)	14	Theta (deg C)	9
Theta max (deg C)	8	Theta max (deg C)	14	Theta max (deg C)	9
	43		49		44
Controller Inputs		**Controller Inputs**		**Controller Inputs**	