TB042 (Rev1) - Determining Maximum Axis Velocity

Overview

The following outlines the maximum velocity of an axis while maintaining the maximum torque.

Method:

$$V_{max} = W_{rpm} * (\text{Metric Pitch})$$

Or

$$V_{max} = \frac{W_{rpm}}{(\text{US Pitch})}$$

<!--[endif]-->

Where:

Metric Pitch = The mm/turn of the screw

US Pitch = The turns/inch of the screw

Vmax = Maximum working velocity (rapid) expected

Wrpm = Working RPM of the motor (Point at which the torque begins to drop.)

Centroid stock Motor:	**Centroid Part Number:**	**Working rpm W_{rpm}**	**Example Metric Calculations:**		**Example US Calculations:**	
			Metric Pitch mm/turn	**Rapid mm/min**	**US Pitch turns/in**	**Rapid in/min**
17 in-lb DC (R)	10439	2300	2.540	5842	10.0	230.
29 in-lb DC (G)	10781	1500	5.08	7620	5.0	300
29 in-lb DC (S)	10104	1500	5.080	7620	5.0	300.
29 in-lb DC (R)	10669	2200	5.080	11176	5.0	440.
40 in-lb DC (S)	10113	1500	5.080	7620	5.0	300.
750 Watt AC (L)	10690	3500	5.080	17780	5.0	700.
1 Kw AC (S)	10555	3200	6.000	19200	4.234	762.
2 Kw AC (S)	10557	2500	8.000	20000	3.175	781.
3 Kw AC (S)	10804	1350	12.000	16200	2.12	636
Examples are for maximum speed using tallest **recommended** pitch.						

Rule: Motor should be running at Wrpm when at expected rapid speed. This rule assures that the motor will produce full torque and accuracy.

Speeds above recommended cause loss of torque, loss of stability, and loss of accuracy. If this speed is too fast (for example 25,000mm/min where 16000 is recommended) then the pulleys should be changed (to 2/3 or 1/ 2) to reduce top speed, or the ball screw should be changed to a lower pitch like 8mm or 6mm.

Just setting the max speed lower in the software does not regain the loss of torque and accuracy.

Obsolete Motors

Centroid stock Motor:	Centroid Part Number:	Working rpm W_{rpm}	Example Metric Calculations:		Example US Calculations:	
			Metric Pitch mm/turn	Rapid mm/min	US Pitch turns/in	Rapid in/min
1 Kw AC (L)-1	10689	3200	5.08	16256	5.0	630
1 Kw AC (L)-2	10689	2200	8.000	17600	3.175	690
2.2 Kw AC (L)-1	10688	3200	5.08	19200	5.0	760
2.2 Kw AC (L)-2	10688	2000	10.000	20000	2.54	780
3 Kw AC (L)	10715	2000	10.000	20000	2.54	780
Examples are for maximum speed using tallest **recommended** pitch.						

DETERMINING MAXIMUM VELOCITY FOR HIGH LINE COUNT ENCODER

Maximum velocity that the Centroid system can control is based on the amount of encoder counts in a second. The limit for the control is 480,000 counts per second. This limit is not reached with a standard Centroid motor with a 2048 line encoder but if using a high line encoder, 4096 lines, the max speed of some motors will be limited. This limit does not apply to the spindle encoder that report velocity only.

Use the equation below to find the max motor speed. The **Encoder Resolution** for the 4096 high line count encoder is 16384 or (4X 4096).

$$Wrpm = \frac{480{,}000 * 60}{Encoder\ Resolution} = 1760\,RPM$$ <!--[endif]-->for high line encoder

This shaft speed is less than the maximum motor speed for all but the 3 Kw (S) motor which cannot spin faster than 1350 RPM.

Maximum Working Velocity with High Line Count Encoder

		Working rpm W_{rpm}	Example Metric Calculations:		Example US Calculations:	
			Metric Pitch mm/turn	Rapid mm/min	US Pitch turns/in	Rapid in/min
		1750	2.540	4445	10.0	175
		1750	5.08	8890	5.0	350
		1750	6.000	10500	4.234	413
		1750	8.000	14000	3.175	551
		1750	12.000	21000	2.12	825
Examples are for maximum speed using tallest **recommended** pitch.						

Document History

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