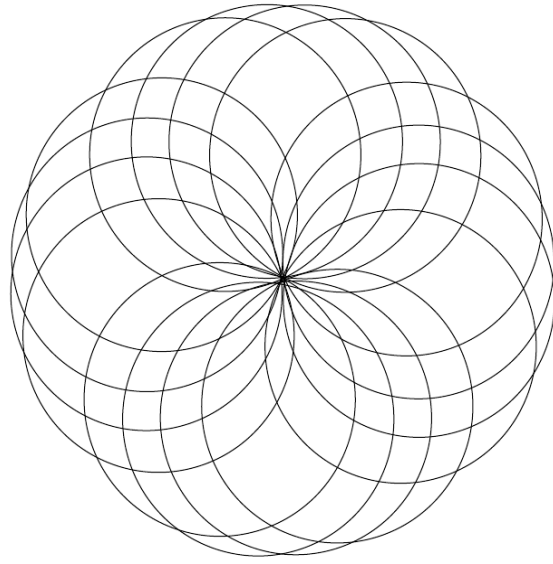




Ornamental Turner's Handy Book

Version 1.4
August 2026

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Startup Checklists

Rose Engine

1. Center the headstock.
2. **Rosettes** - Ensure the rosettes are:
 - a. The ones you want,
 - b. Phased correctly (and held in place using a pin on the MDF Rose Engine), and
 - c. Held against the phaser/ multiplier drive gear with a collet.
 - d. Also, ensure you add a drop or two of thin oil to the rosette.
3. **Object You're Turning** - Set the object in the chuck or collet and ensure:
 - a. The object is aligned,
 - b. The object is being held securely,
 - c. The chuck or collet is secured to the adapter, &
 - d. The spindle adapter is being held securely in place with a draw bar.
4. **Rubbers** - Ensure the rubber is:
 - a. The desired shape and style,
 - b. Aligned with the rosette, &
 - c. If using two rosettes, ensure the projection of each rubber is correct.
5. **Amplitude Adjuster** - Ensure the amplitude adjuster:
 - a. Has the amplitude % set,
 - b. Has the arms vertically aligned,
 - c. Is using the correct shape and style of rubber to follow the rosette, &
 - d. Any unused lever arms are locked in place so that they do not interfere with the movement.
6. **Cross Slide**
 - a. Align the cross slide relative to the spindle as desired for your art. Usually this is parallel, but an angled cut may be desired.
 - b. Ensure there is sufficient movement on the cross slide for the needed work in both directions (X & Z).
 - c. Ensure the slide is held securely to the bed.
 - d. Ensure the cutter will not cut into the collet / chuck.

Re-check that everything is locked down, especially the:

1. Draw bar for work holding,
2. Chuck or collet to the adapter,
3. Object in the chuck/collet,
4. Slide (i.e., mag switches), &
5. Tool holder in QCTP.

Overhead Drive

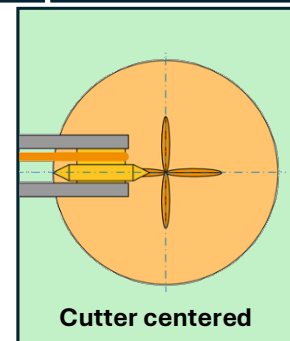
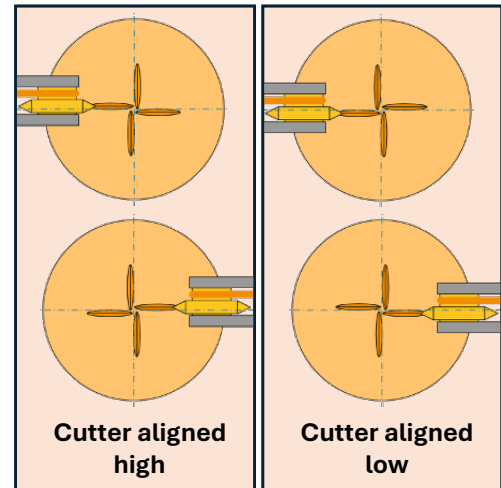
1. Adjust the cables to be vertical for both X and Z axes,
2. Ensure the cables are not too slack, nor too taut, &
3. Set the speed for the cutter
 - a. Running too fast will burn certain woods, especially on the end grain.
 - b. This is especially critical when using an ECF.

Cutting Frame

1. **Rod Cutters:** When using these for cutting frames, ensure the cutter is:
 - a. The one desired with the correct edge angle (e.g., 60°, 90°, 120°, etc.) & edge shape,

Startup Checklists

- b. Sharp,
 - c. At the desired projection for the needed diameter of swing,
 - d. Held in the correct rotational position, &
 - e. Held securely.
2. Set the UCF's rotation.
 - a. Usually, this is 0° from horizontal, but it could be different if desired, &
 - b. Ensure the rotation is in the correct direction.
3. Align the cutter vertically (unless desired to be otherwise). The pictures to the right may be helpful.
4. Ensure the cutting frame is held securely in the QCTP.
5. Ensure the cutter is being turned in the correct direction. If not, reverse the overhead drive cables.



Drilling Spindle

1. **Cutters:** Ensure the cutter is:
 - a. The one desired with the correct edge angle (e.g., 60°, 90°, 120°, etc.) & edge shape,
 - b. Sharp, &
 - c. Held securely in the collet.
2. Align the cutter vertically (as noted above for the cutting frame; unless desired to be otherwise).
3. Ensure the drilling spindle is held securely in the QCTP.
4. Ensure the cutter is being turned in the correct direction. If not, reverse the overhead drive.

Vacuum

Set the vacuum inlet so that:

1. It does not interfere with movement of the slide.
2. Is best able to collect most of the dust coming off the cutter.

Lighting

Set the lights so that:

1. They do not interfere with movement of the slide,
2. They provide for maximum visibility of the cutting activity, &
3. They do not shine up into the operator's eyes.

Eccentric Cutting Frame

1. **Cutters:** Ensure the cutter is:
 - a. The one desired:
 - i. Edge angle (e.g., 60°, 90°, 120°, etc.) &
 - ii. Edge shape,
 - b. Sharp,
 - c. Held in the correct rotational position, &
 - d. Held securely.
2. Ensure the rotational radius for the ECF is correct.
3. Ensure the ECF is balanced.
4. Ensure vertical alignment is correct.
5. If holding the ECF in a drilling spindle, see also the notes for the drilling spindle.
6. Ensure the cutter is being turned in the correct direction. If not, reverse the overhead drive.

Spherical Slide

1. Set the spherical slide so that the swing achieves the desired profile.
2. Ensure that the swing path is not encumbered by other objects.
3. Ensure the spherical slide is held securely to the bed.

Curvilinear Slide

1. Align the curvilinear slide to be parallel to the spindle, unless you want an angled cut.
2. Ensure there is sufficient movement on the curvilinear slide for the needed work (both X & Z axes).
3. Ensure the curvilinear slide is held securely to the bed.
4. **Template** – Ensure the template is:
 - a. The correct one,
 - b. Aligned correctly relative to the object, &
 - c. Securely held in place.
5. **Template Follower** - Ensure the template follower is:
 - a. The correct size and shape,
 - b. Held securely in place, &
 - c. Securely engaged with the template during the entire movement distance using either the weights or a spring

Threading

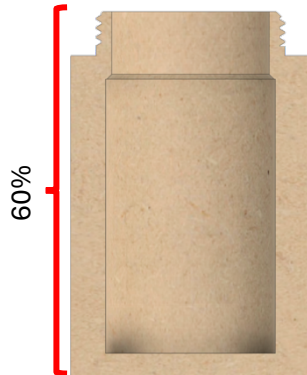
Threading

John Swanson's book, *Turning Threaded Boxes* is the best reference for this activity.



16 threads / inch (TPI) is the recommended pitch. Experienced turners have cited this as good for most woods.

For 60° threads, the threads are 0.040" wide, 0.054" tall.



The division between a box's base and lid as advocated by John is shown to the left.

The recommended approach is to thread the lid 1st and then thread the base. This allows the lid to be used to ensure the threading is proper on the base.

Another recommendation is to turn a set of blocks with the same internal and external threads. These blocks can then be used to hold the mated parts whilst finishing the ends. This is particularly useful if the pieces are held by a tenon in a collet chuck.

Threaded Box's Base

The base for the threaded box is shown to the right with annotations.

Hand-chased threads need a relief here. For threads cut with a jig or using a cutter held in a drilling spindle, you do not need such a relief, except for space for the nose of the cutter.

Width of relief should equal width of one thread (Thread Pitch width)

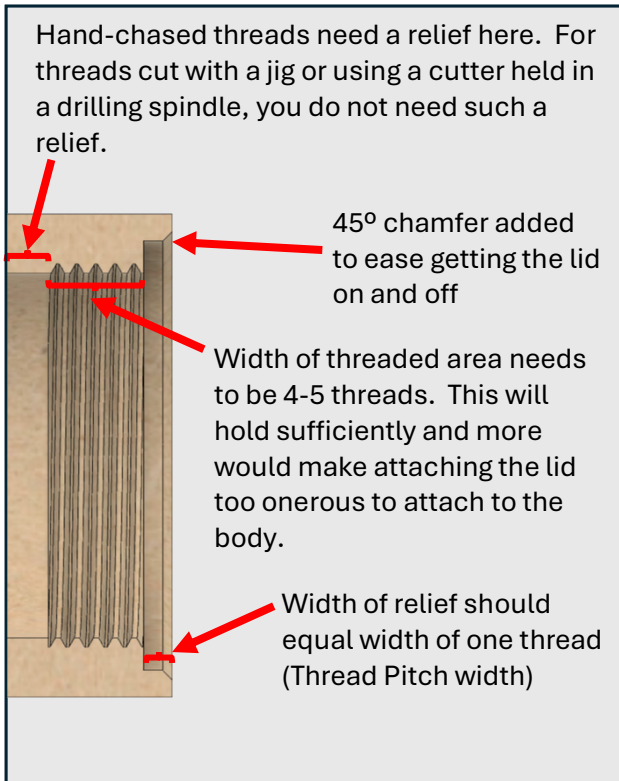
45° chamfer added to ease getting the lid on and off

Starting diameter for this tenon is 0.060" greater than the internal diameter of the lid.

Width of threaded area needs to be 3-4 threads. This will hold sufficiently and more would make attaching the lid too onerous to attach to the body. Width needs to be greater for fragile woods like burls. Consider 1/8" to 1/4".

for the nose of the cutter.

Threaded Box's Lid



The lid for the threaded box is shown to the left with annotations.

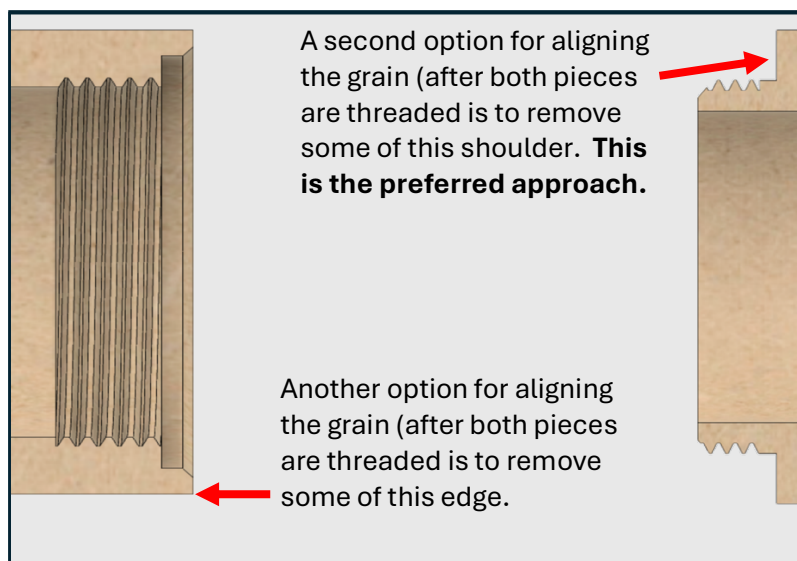
Aligning the Grain on the Box

To align the grain on the box's lid with the base, there are two options. Both are quite powerful, so be careful when using them.

For a box with threads at 16 TPI, the amount to remove to rotate one vs. the other 10° is

$$\frac{10^\circ}{360^\circ} \cdot \frac{1}{16} = 0.0017"$$

So, it is best to remove any amount very slowly!



Formulas

Formulas

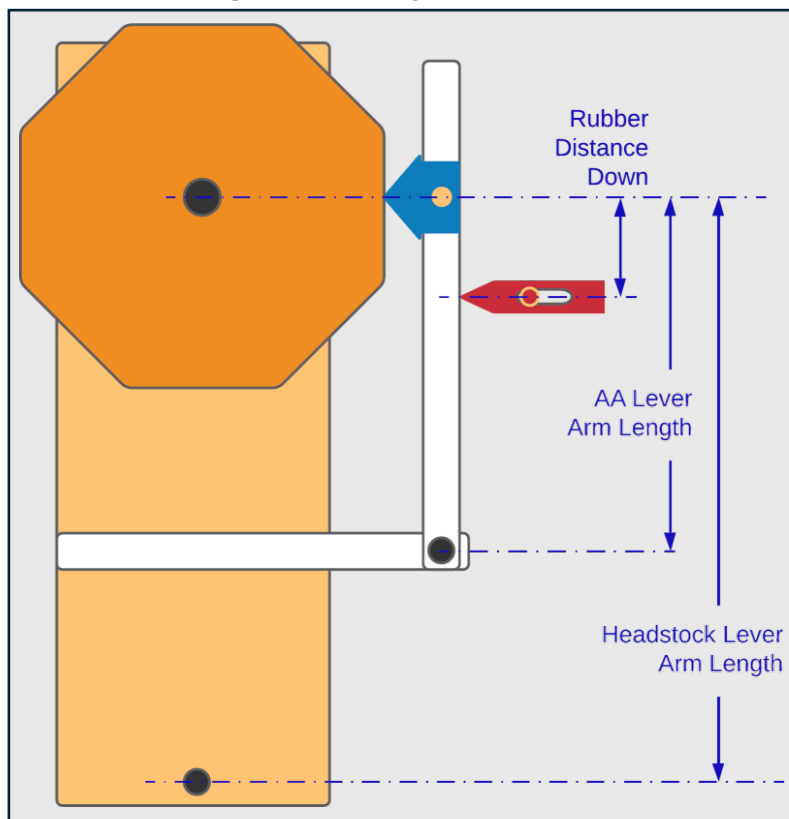
1 mm = 0.03937"

Metric Leadscrews

Pitch	Starts	Inches / Rev
1 mm	1	0.0394
	2	0.0787
	3	0.1181
	4	0.1575
3 mm	1	0.1181
	2	0.2362
	3	0.3543
	4	0.4724
5 mm	1	0.1969
	2	0.3937
	3	0.5906
	4	0.7874

Pitch	Starts	Inches / Rev
2 mm	1	0.0787
	2	0.1575
	3	0.2362
	4	0.3150
4 mm	1	0.1575
	2	0.3150
	3	0.4724
	4	0.6299
6 mm	1	0.2362
	2	0.4724
	3	0.7087
	4	0.9449

Vertical Amplitude Adjuster



HLAL = Headstock Lever arm Length

AALAL = AA Lever Arm Length

RDD = Rubber Distance Down

$$AA\% = \frac{HLAL \cdot (AALAL - RDD)}{AALAL \cdot (HLAL - RDD)} \cdot 100\%$$

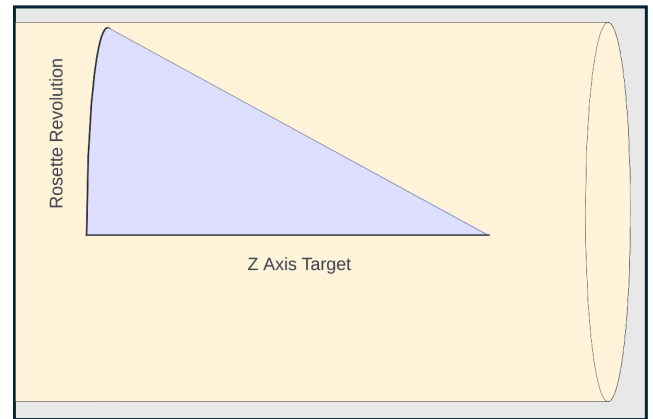
$$RDD = \frac{HLAL \cdot AALAL \cdot (1 - AA\%)}{HLAL \cdot (AALAL \cdot AA\%)}$$

UCF Rotation Angle Calculation

These calculations are used when cutting along the perimeter of a cylinder with the rosette rotating at a different speed from the spindle. The UCF will need to be aligned so that the axis of its rotation is in the valley of the rosette's lowest dip. This will ensure the design is not blurred out.

For this calculation,

- The cutter is moved a distance along the Z axis
- Whilst the rosette rotates a certain number of degrees.



The angle for rotating the UCF is calculated using these formulas:

$$\text{Cylinder circumference} = \pi \cdot \text{Final Diameter}$$

$$\text{Rosette Rev. Dist.} = \text{Cyl circumference} \cdot \left(\frac{\text{Rosette Rev.}^\circ}{360^\circ} \right)$$

$$\text{UCF Rotation}^\circ = \tan^{-1} \left(\frac{\text{Rosette Revolution Distance}}{\text{Z Axis Target}} \right)$$

ELFOS

ELFOS

Preferences

Tab	Notes	
Axes with Stepper Motor Drives		
All Axes (General)	• Microsteps = 32 • Steps/360 = 200	• Polarity = High
Spindle	• Gear Ratio = 9	
Motor 3	If using a Rosette Phaser/Multiplier • Radial with Gear Ratio = 9	Otherwise • Radial - ensure gear ratio is correct • Linear - ensure Distance/360 & ensure leadscrew direction are correct
Motor 4	• Radial - ensure gear ratio is correct	• Linear - ensure Distance/360 & ensure leadscrew direction are correct
X Axis & Z Axis	These are device dependent: • Distance/360 (per device) • Leadscrew direction	When using the Rose function, • Max speed to 1,000-2,000 • Acceleration to 50,000
Other		
Limits	• Ensure limit pins match settings • Ensure type (NC or NO) is correct • Ensure eStop pin matches settings	• Generally, Stop Spindle with Axis is checked.
More	• Aux pin needs to be set if using this function	• Keep steppers enabled should be on if using DM542T drivers
Returns	• Generally, MaxSpd = 15,000	

Main

Set max speed on axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

Index

Be sure Synchro matches what you want to do:

- OFF (dark green) = index Spindle & M3 axis separately. This can be used to achieve the same functionality as the worm screw on a division plate.
- ON (light green) = index Spindle & M3 axis at the same time

Sync

Set max speed for selected axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

Be sure Synchro matches what you want to do:

- OFF (brown) = Synchronize Spindle with selected second axis (X, M3, or M4) using selected settings.
It should be OFF for threading.
- ON (light green) = Synchronize Spindle & M3 (using the set sync percentage) with selected second axis (X or M4) using selected settings.

CCW and CW indexing options use settings for Index setting #1.

Calculations for Sync

$$\text{StepOver} = \frac{\text{Distance Moved}}{\text{Revolutions}}$$

$$\text{Spindle Rate} = \frac{\text{Microsteps}}{\text{Rev}} \times \frac{\text{Spindle Rev}}{\text{Motor Rev}}$$

$$\text{Max Speed} = \frac{\text{Max Pulses}}{\text{sec}} \times \frac{60 \text{ sec}}{\text{min}}$$

$$\text{RPM} = \frac{\text{Max Speed}}{\text{Spindle Rate}} \times \frac{\text{Speed\%}}{100\%}$$

$$\text{Time Required} = \frac{\text{Revolutions Required}}{\text{RPM}}$$

Threading Calculations for Sync

Index Page	Sync Page
<i>Divisions = # of starts desired</i>	$\text{Distance} = \frac{4}{\text{TPI}}$
	$\text{Revolutions} = \frac{\text{Distance} \cdot \text{TPI}}{\text{Starts}}$

MultiSync

Set max speed for all axes except the Spindle (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

Calculations for MultiSync

$$StepOver = \frac{Distance\ Moved}{\left(\frac{Spindle\ Rotation^\circ}{360^\circ}\right)}$$

$$Spindle\ Rate = \frac{Microsteps}{Rev} \times \frac{Spindle\ Rev}{Motor\ Rev}$$

$$Max\ Speed = \frac{Max\ Pulses}{sec} \times \frac{60\ sec}{min}$$

$$RPM = \frac{Max\ Speed}{Spindle\ Rate} \times \frac{Speed\%}{100\%}$$

$$Time\ Required = \frac{Revolutions\ Required}{RPM}$$

Recip

Set max speed for selected axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

Be sure Synchro matches what you want to do:

- OFF (dark blue) = Synchronize Spindle with selected second axis (X, Z, M3, or M4) using selected settings.
- ON (light green) = Synchronize Spindle & M3 (using the set sync percentage) with selected second axis (X, Z, or M4) using selected settings.

CCW and CW indexing options use settings for Index setting #1.

⇐ and ⇒ indexing options use settings for the Move screen, using the #1 setting for selected axis.

Basket Weave Calculations for Recip

Index Page	Move Page
$Divisions = Waves \cdot Cuts\ per\ Wave \cdot 2$	$Z\ Axis\ Distance = \frac{Axis\ Amplitude}{Cuts\ per\ Wave}$
Recip Page	Cutter Data
$Axis\ Amplitude = \frac{Diameter \cdot \pi}{2 \cdot Waves}$	$Depth\ of\ Cut = \frac{Distance}{\tan\left(\frac{Cutter\ Angle}{2}\right)}$

Greek Key

Set max speed for selected axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

Rose

Set max speed for selected axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

200 is the recommended starting speed. If the pattern does not turn out as expected, try running at a slower speed.

CCW and CW indexing options use settings for Index setting #1.

⇐ and ⇒ indexing options use settings for the Move screen, using the #1 setting for selected axis.

Program

Set max speed for selected axis (right side) to 15,000 and speed slider at 100%. This allows for the spindle speed slider to set the speed for all axes.

ELFOS User Manual

The ELFOS User Manual is available at the MDF Rose Engine 2.0 Library (<https://mdfre2.colvintools.com/>).

Rose Engine Butler

Rose Engine Butler

Rose Engine Butler runs on LinuxCNC. The library is at www.RoseEngineButler.com.

The commands often used are:

Action Keys

Cmd	Comments
F1	Toggle eStop
F2	Toggle Power
F3	Manual Control
F5	MDI
R	Run (Gcode) program
T	Step
Cntrl Home	Home all joints
Cntrl Space	Clear notifications

Common Gcode Commands

The LinuxCNC "G-code" Quick Reference is available from the Rose Engine Butler Library. Many commands are shown below in capital letters; LinuxCNC does not care if capital letters or lower case is used.

Spindle

Sp0 Spindle

Sp1 Rosette Phaser/Multiplier

Cmd	Comments
M3 Ss \$n	Start spindle n at speed s in a clockwise (+) direction. This single command equates to these two separate commands: Ss \$0 M3 [\$n] There are some maximum speeds set in the system configuration; however, these are sometimes able to be overridden by using a gcode instead of the user panel. The user is cautioned to ensure the selected settings are correct. \$0 = Sp0 (the primary spindle) \$1 = Sp1 (the rosette phaser / multiplier) \$-1= both spindles
M4 Ss \$n	Start the spindle n at speed s in a counterclockwise (-) direction. This single command equates to these two separate commands: Ss \$n M4 [\$n] As noted for M3, the user may be able to override the speed limits imposed by the user panel.

Cmd	Comments
M5 \$n	Stop spindle n. If no spindle is specified, then all running spindles are stopped.
Ss \$n	Set the speed to s for spindle n.
M19 Rr Qq [Pp] [\$n]	Orient (i.e., index) the spindle. The values to enter are: - r = degrees to rotate - q = Number of seconds to wait. 60 is a good number. - p = Direction to rotate. Direction to rotate to position. This is optional, and if not specified, 0 is defaulted. 0 - rotate for smallest angular movement (default) 1 - always rotate clockwise (same as M3 direction) 2 - always rotate counterclockwise (same as M4 direction) - n = Spindle to index (0 or 1). This is optional. It is wise to run the G97 command before this one to ensure the speed is not too high. For example, to set the spindle speed for indexing at 2 rpm, before indexing 10° in a clockwise (+) manner, the command would be: <pre>G97 S2 M19 R10 Q60 P1</pre>

Linear Axes (X, Z, U, V, W)

Cmd	Comments
G1 ad Fs	Move axis a distance d at a feed rate (speed) of s. For example, move the X axis 1.1" in towards the operator (+ direction) at 10 inches/minute, enter <pre>G1 X1.1 F10</pre> For example, move the X axis 1.1" in away from the operator (- direction) at 10 inches/minute, enter <pre>G1 X-1.1 F10</pre>

Rotary Axes (A, B, C)

Cmd	Comments
G1 ad Fs	Move axis a distance d at a feed rate (speed) of s. For example, move the B axis 1.1" in towards the operator (+ direction) at 10 inches/minute, enter <pre>G1 X1.1 F10</pre> For example, move the B axis 10° in the - direction at 15 degrees/minute, enter <pre>G1 B-10 F15</pre>

Additions or Changes?

If you have any additions or changes, please send them to:

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