Operating the TCM-3 Tangential Cutting Module

Supplement to the WinCNC Operations Manual

5/19/2015
Laguna Tools

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TANGENTIAL CUTTING MODULE (TCM-3)

OVERVIEW AND WORK FLOW (TCM-3)

The TCM-3 is a processing unit for CNC-machines that is designed to cut various materials such as foils and flocking materials.

Below is a work flow diagram that captures the steps required to execute a program. The following sections outline each step in more detail.

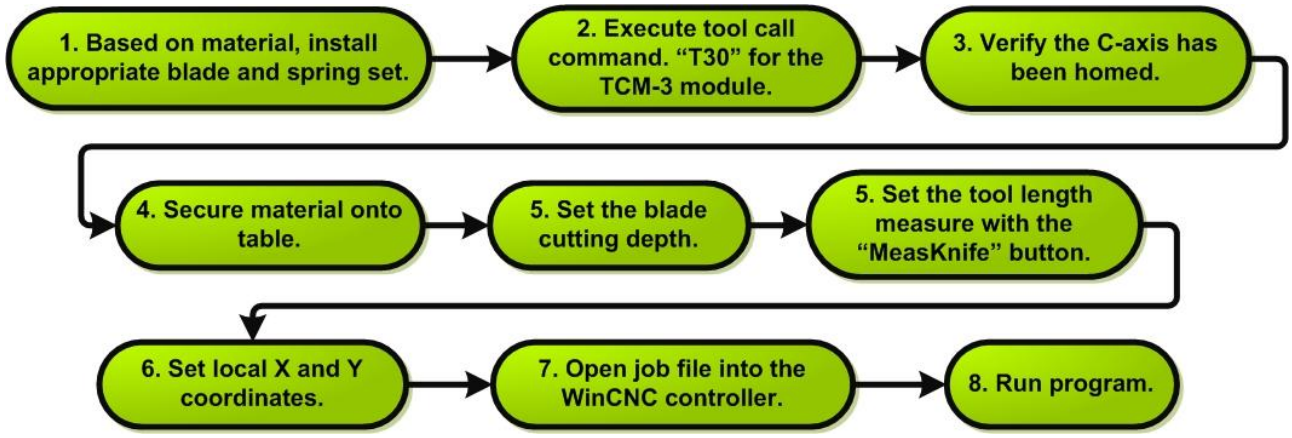

Figure 1. Tangential knife (TCM-3) work flow diagram.

SAMPLE PROJECT : INTRODUCTION

For a sample project, the TCM-3 module and controller will be setup to cut 0.020" styrene.

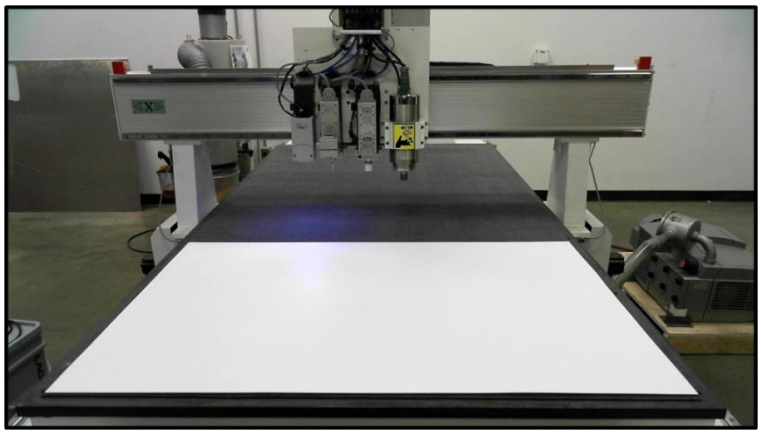

Figure 2. 0.020" styrene sample on a SmartShop MT.

TCM-3 BLADE AND SPRING SELECTION

SPRING OVERVIEW

The type of the spring set determines the coarse adjustment of the pressing force. The fine adjustment will be done by the adjustment wheel that changes the pre-load of the springs.

If the spring set does not have enough pressing force the blade may be forced up away from the material.

Table 1. Available Spring Sets.

Spring Set ID	Pressing Force
S5	5N/500g
S10	10N/1.000g
S18	18N/1.800g
S28	28N/2.800g

Figure 3. Example of available springs.

CHANGING SPRINGS AND FINE ADJUSTMENT

1. Use the adjustment wheel to release spring tension. Remove the four torx (T10) screws and front cover.
2. Using a pick tool, remove and replace springs.
3. Reinstall front cover.
4. Use the fine adjustment wheel set desired pressing force.

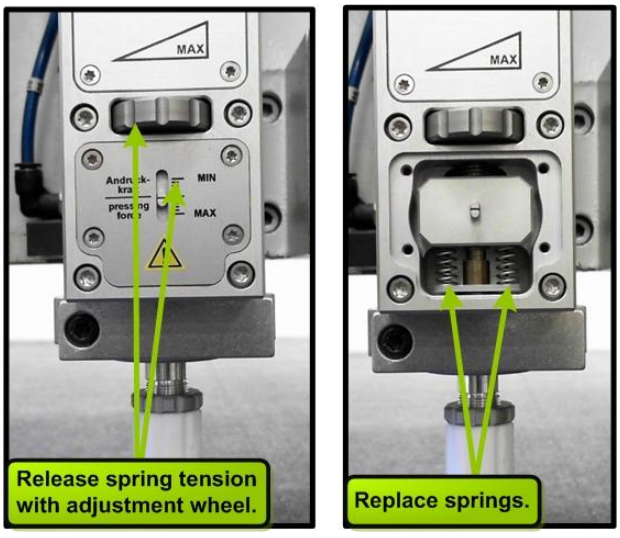

Figure 4. Changing and adjusting springs.

SAMPLE PROJECT : SPRING SELECTION

- The material to be cut is 0.020" thick styrene. The strongest spring set S28 will be used because of the high tensile strength of styrene.

BLADE SELECTION

When selecting a blade it is important to consider material thickness and tensile strength. Different carbide metal blades with a shank diameter of 6mm are available for various cutting applications. The table below presents a selection of the most commonly used blades.

Table 2. Carbide blades.

Blade ID	Cutting Edge	Length of Cutting Edge	Total length	Typical Applications
E12	2	12 mm	25 mm	**Universal blade for various materials such as cardboard, gasket material, foam rubber, cork, useable on both sides**
E18	1	13.5 mm	25 mm	**Universal blade for various materials such as cardboard, gasket material, foam rubber, cork, one-sided blade for fine lines**
E25	1	25 mm	39 mm	**Universal blade for various materials such as cardboard, gasket material, foam rubber, cork, one-sided blade for fine lines**
E28	1	30 mm	45 mm	**Universal blade for various materials such as cardboard, gasket material, foam rubber, cork, one-sided blade for fine lines**
E30	1	2.5 mm	25 mm	**Special blade for TCM module; Wedge blade for normal foils and writings**
E50	1	3.5 mm	25 mm	**Special blade for TCM module; Wedge blade for flock textile foils, felt, cardboard**
E70	1	8 mm	25 mm	**Special blade for TCM module; Wedge blade for textile foils, felt, cardboard, rubber**
E85	1	50 mm	65 mm	**Special blade for EOT module; e.g. for soft polyurethane foam panels**
E87	1	70mm	83mm	**Special blade for EOT module; e.g. for soft polyurethane foam panels**
E92	1	120mm	133mm	**Special blade for EOT module; e.g. for soft polyurethane foam panels**

INSTALLING A BLADE

1. Remove the gliding element.
2. Insert blade with the weldon surface facing the set screw.
3. Torque down the 2.5mm set screw against the weldon surface.
4. Reinstall the gliding element.

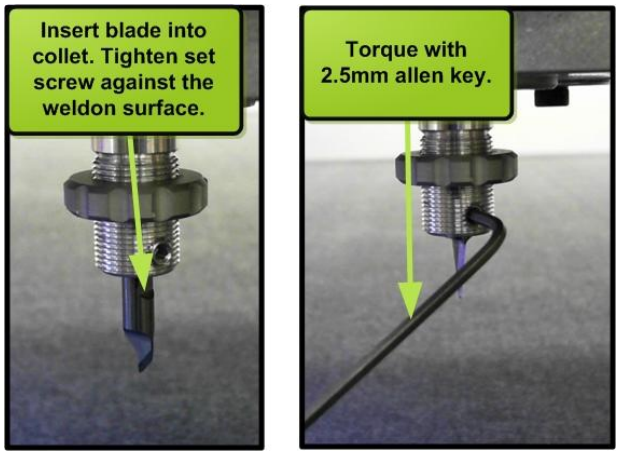

Figure 5. (Right) Changing a blade on the TCM-3 cutting module

SAMPLE PROJECT : BLADE SELECTION

Either the E12 or E50 blades will be sufficient to cut 0.020" styrene. These blades were chosen because of the thickness of the blade's spine as well as a more robust design. Blades like the E70 and E18 will most be damaged due to a thinner spine near the tip of the blade.

Figure 6. Blade examples.

HOMING THE C-AXIS

The C-axis refers to any axis that rotates around the Z-axis, such as the TCM-3 and EOT-2 modules. It is necessary to home the C-axis prior to using the modules. This will ensure blade direction is accurate. If the C-axis is not homed, the blade may be in the incorrect position during a cut, most likely leading to a broken blade.

The C-axis automatically homes when a tool number is called. Depending on the last state the machine was in, one of the two modules will home during the initial homing sequence.

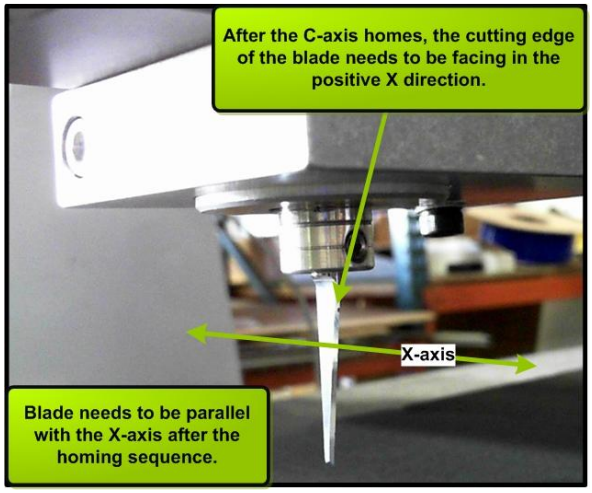

Figure 7. Position of blade after successfully homing the C-axis.

ADJUSTING CUTTING DEPTH

Cutting depth is the length of blade protruding past the nylon gliding element. The gliding element also aids in holding down the material as the blade is dragged through. The TCM-3 module can also be used without the gliding element. In this case, only the tool length offset needs to be set. Skip to the following section.

1. Take a small sample of the material and hold it up behind the blade.
2. Loosen the locking nut and adjust the gliding element until the knife tip is just protruding past the material.
   2.1. Note. This tutorial assumes that the material is to be cut all the way through.
3. Tighten the locking nut and gliding element against each other without affecting the cutting depth.

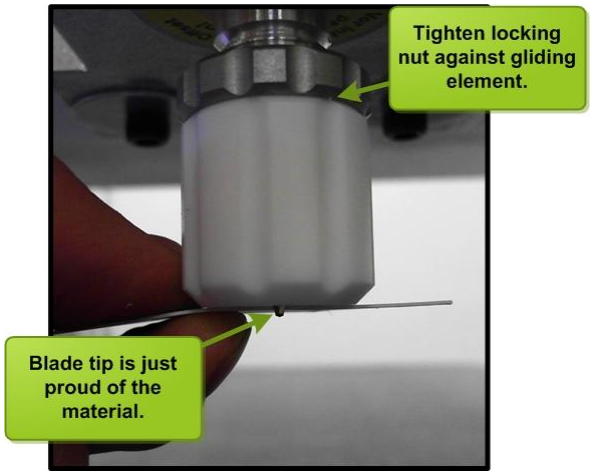

Figure 8. Setting the cutting depth.

4. The cutting depth can be adjusted precisely if the gliding element is mounted. The cutting depth increases 1.0mm per revolution. In practice it´s possible to adjust the depth in increments of 0.05 - 0.1mm.

TCM-3 SETTING KNIFE LENGTH (TOOL LENGTH OFFSET)

The purpose of setting a tool length offset is to store a point in the Z-axis in which the knife will lower to prior to cutting. The buttons "MeasKnife" and "MeasSaw" are used to store this value. When a tool length offset is active there will be a blue next to the corresponding axis. G43 mode will also be active.

SETTING TOOL LENGTH OFFSET

1. Select the TCM-3 tool by executing a tool call command. For the TCM-3 module the tool command is T30. The order of events that follow a tool call are outlined below.
   1.1. The TCM-3 module will extend and all other modules will retract
   1.2. Blue boxes will appear next to the X, Y, and Z axes.
   1.3. The head will shift along the X-axis the corresponding offset.
2. Using the manual jog controls in the winCNC interface slowly lower the knife down into the material. See the figures below for reference.

3. Once the knife has been lowered to the appropriate cutting height. Click "MeasKnife".

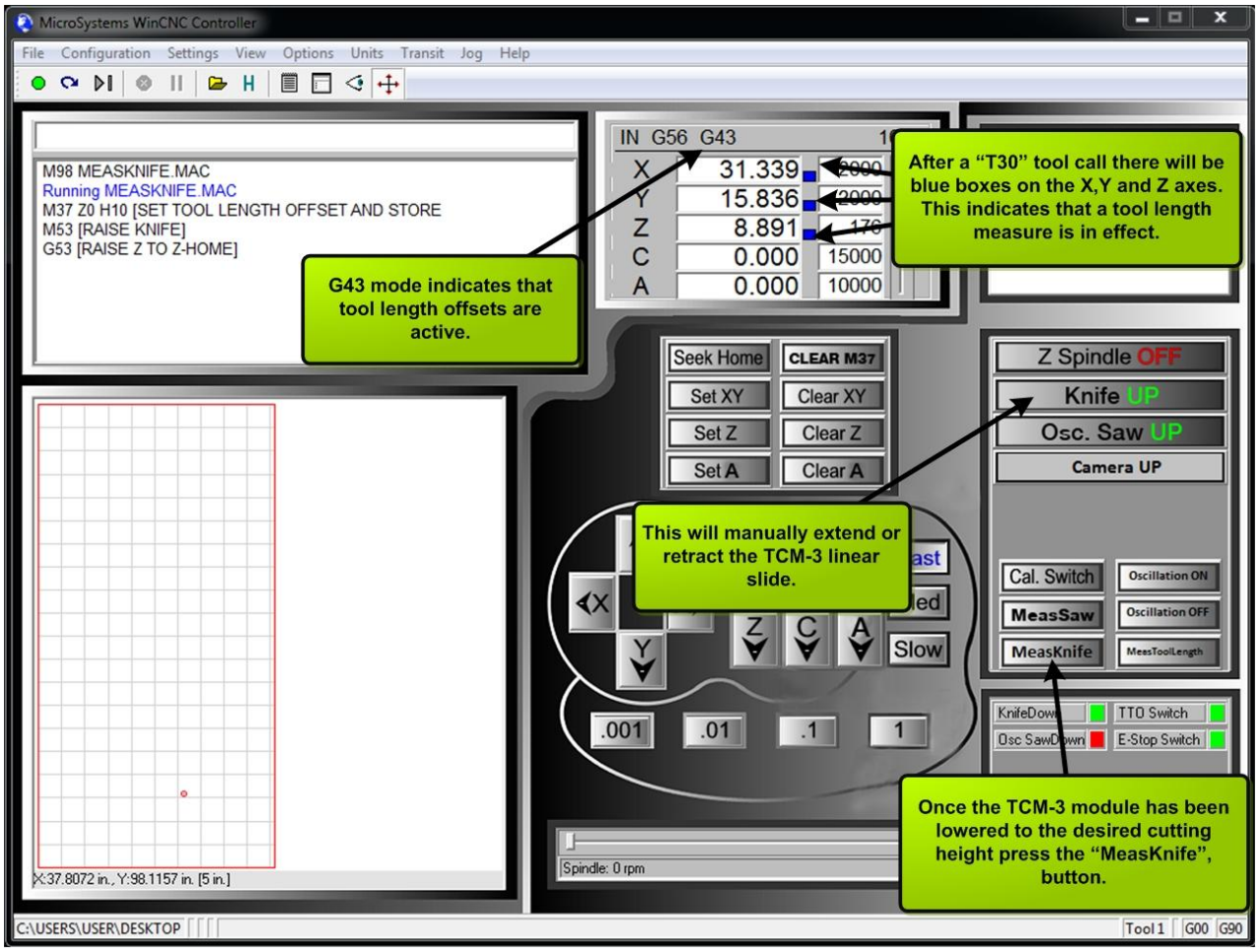

Figure 9. Controller state after a T30 command.

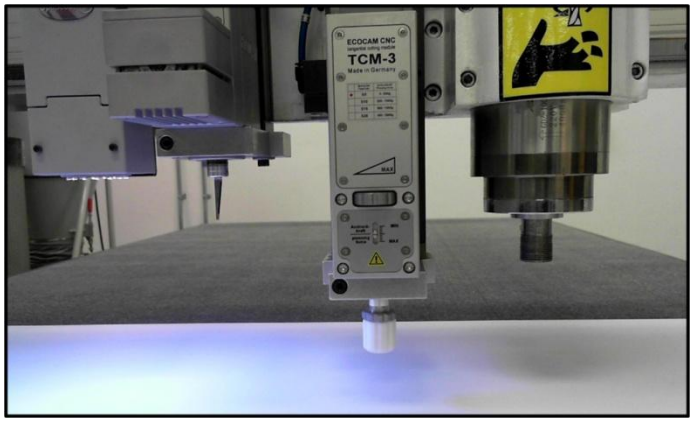

Figure 11. Drag knife extended after T30 command.

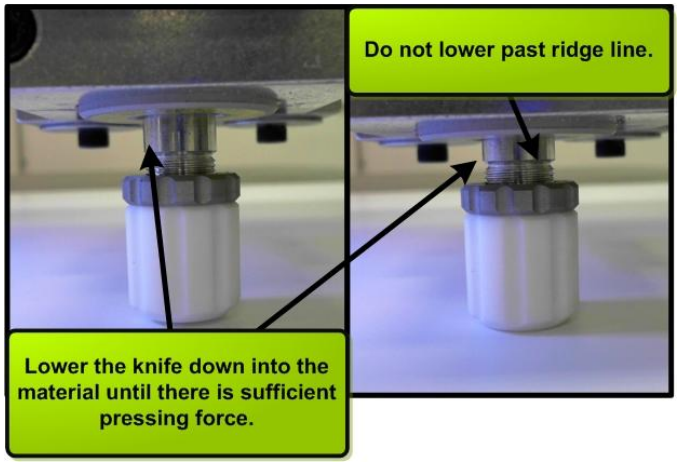

Figure 10. Demonstrating tool length measure process.

4. After pressing the "MeasKnife" button, the linear slide will retract and the tool head will return to the Z-home position.

TCM-3 SETTING WORK COORDINATES

Work coordinates refer to the point in the XY plane that represents the origin of the work piece. Typically the X=0, Y=0 location is the bottom left hand corner of the material. This point is DEPENDENT on where it is declared in the CAD software.

For clarification, the X and Y work coordinates may be referred to by a multitude of names. For instance, work coordinates, XY origin, XY Datum position, local zeros, G54, temporary home, G92, etc., are all synonymous.

STEPS TO SET WORK COORDINATES

1. Manually jog the tool head until the knife point is at the desired XY origin point.
2. Press the "Set XY" button. Green boxes will appear next to the X and Y axes.

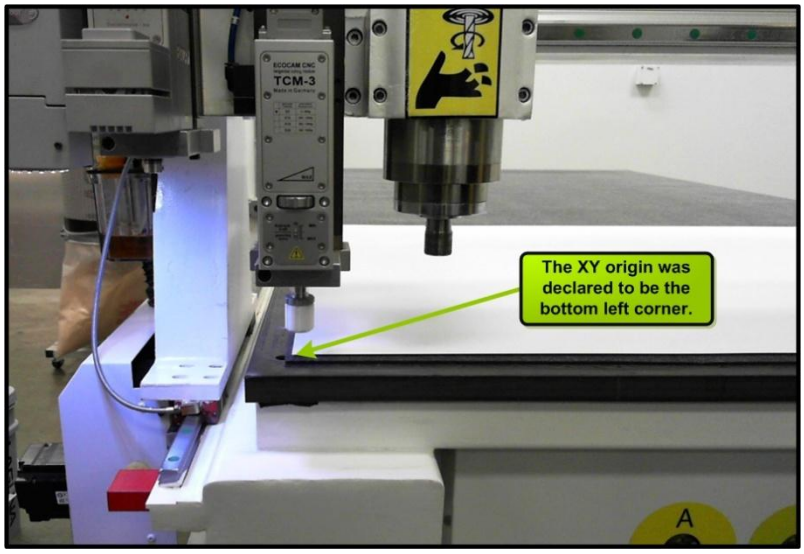

Figure 12. Positioning the cutting module to set local coordinates.

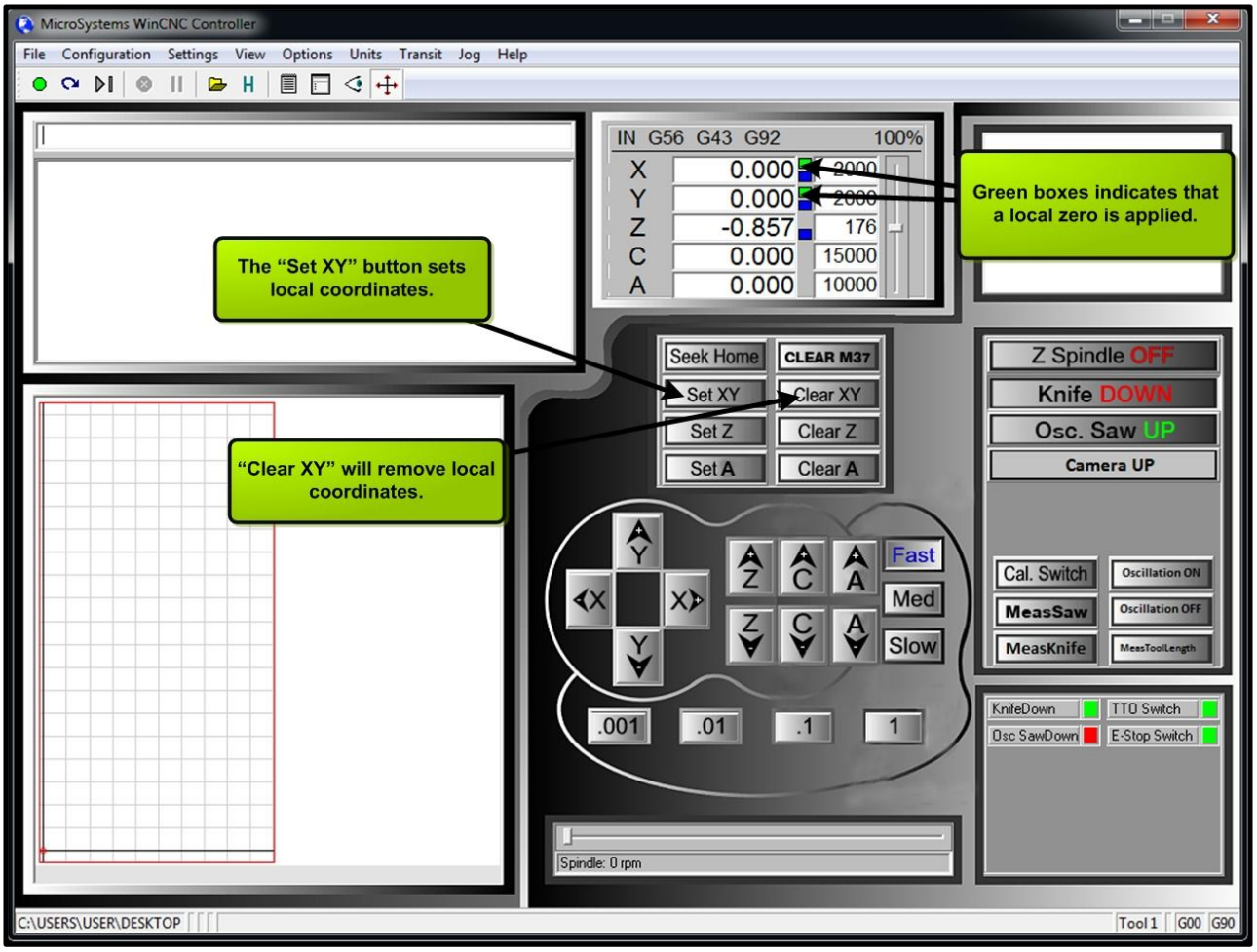

Figure 13. Controller overview of setting and removing local coordinates.

LOADING A PROGRAM AND EXECUTING CODE

Once the previously discussed steps are completed G-code can then be executed. Import a program file using the drop down menu File --> Open. Select the desired file.

The program can be previewed in the viewer window by clicking the View button on the tool bar.

Execute the program by clicking on the green start button or pressing "Enter" on the keyboard. The file path must be in the command line in order for the program to execute.

PRELIMINARY CHECKS

The cutting blades are tungsten carbide, which means they stay sharper longer. But carbide is also brittle, and can break if stress is applied in the wrong place. That is why doing a test cut in the air is an important optional preliminary step to avoid breaking a blade.

Things to look for are

- Positions in the cutpath where the blade makes sharp turns without lifting.
- Cutting edge of the blade not facing the correct direction.
- Cutting speed.

To Execute a cut in the air

- Partially lower the knife so that there is ample clearance for the knife to safely execute the program without crashing into any obstructions.
- Press the "MeasKnife" or "MeasSaw".
- Load program into wincnc. File --> Open, select program. Click on the "view" icon in the tool bar. This will display the cutpath in the viewer window.
- Execute the program.

POST PROCESSOR

The Post Processor will require commands unique to the WinCNC control system. Post processors can be found at the wincnc.net website. See the "CNC swift series with WinCNC Manual" for more details on locating and implementing new post processors.

If using the program Aspire made by Vectric, the post processor is WinCNCKnife.pp.

DRAWING TIPS

When using the tangential cutting modules it is important to be aware of the angles and arcs used in the graphics. In the graphic below there are both acute angles as well as curves.

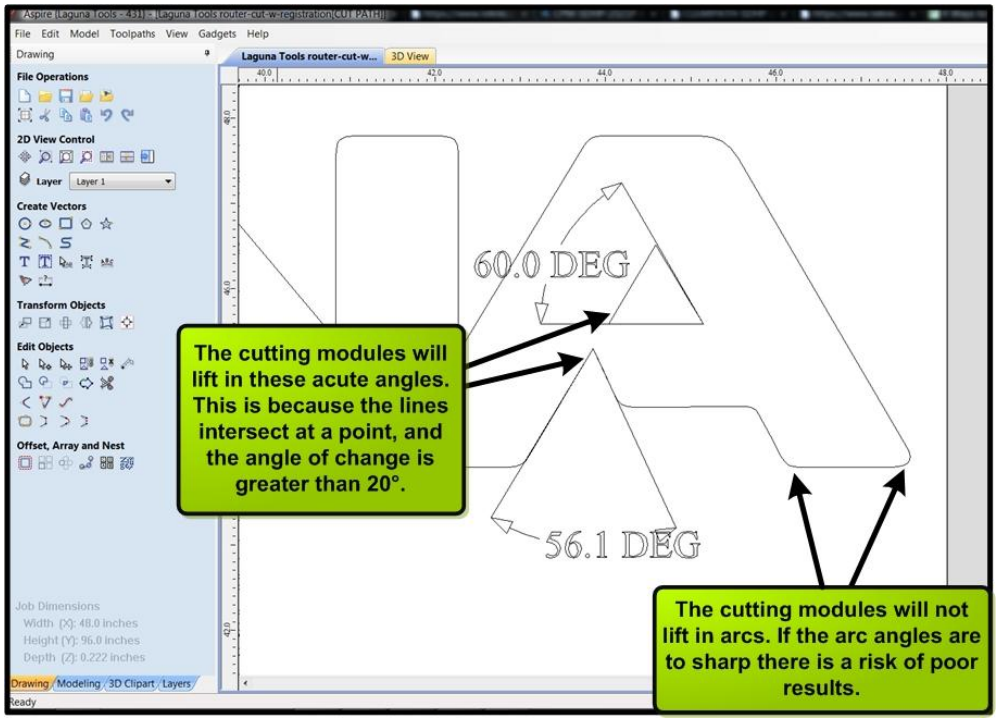

Figure 14. Example graphic highlighting cutting module behavior.

ADVANCED SETTINGS

ADJUSTING LIFT ANGLE

The default lift angle is set at 20°. This means that the tangential module will lift away from the material before rotating in a location where the angle of change is greater than 20°.

- Increasing this value will decrease the number of lifts, but increase the risk of damaging a blade.
- Decreasing this value will increase the number of lifts, but reduce the risk of blade or material damage.

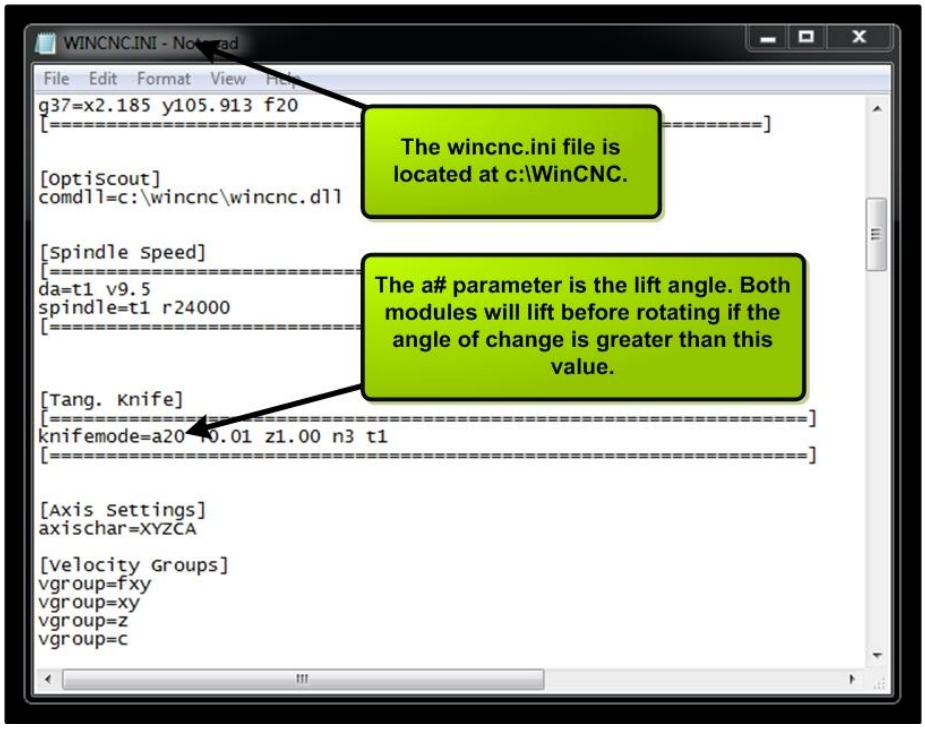

Figure 15. Location of the lift angle parameter.