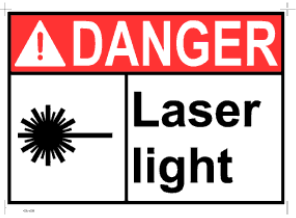
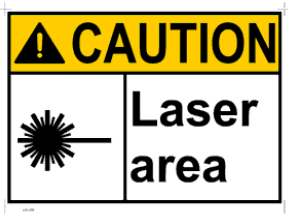
LASER CUTTER

RESOURCE GUIDE





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CONTROL SOFTWARE: LaserCut 5.3

The LaserCut 5.3 Software is installed on the Laptop connected to the Laser Cutter. However, to use the software and/or control the Laser Cutter, the USB Dongle must be plugged into the laptop. The USB Dongle is a software license key only. It does NOT contain any software for the user.

If an educator would like to install the LaserCut 5.3 software on his/her own computer and check out the "USB Dongle," he/she may do so by contacting the site manager. (1st Maker Space technician will guide you through the process at the Laser Cutter Training workshop.)

Files can be created in the LaserCut 5.3 software, as shown in the practice activities, or vector **file** information and raster image information from a variety of programs, such as Adobe Illustrator, Corel Draw, and Adobe Photoshop can be imported create projects that can be cut and/or engraved on the laser cutter. Inkscape can be downloaded for free to create vector files that can be imported into the LaserCut 5.3 software to create an ecp files. The ecp files are downloaded to the laser cutter and can be saved as .MOL files.

What Material will the 30 watt Rabbit Laser Cutter CUT?

- Cardboard
- 1/8 in (3 mm) plywood
- Corex (Political yard signs)
- 1/8 in Acrylic
- Leather & other fabrics
- Paper..

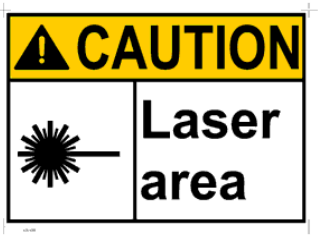
What Material will the Rabbit Laser Cutter ENGRAVE & ETCH?

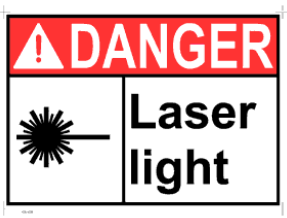
- Most any material except metals, materials that will reflect light or laser, or materials that produce toxic fumes when heated

REMEMBER – SAFETY FIRST!

Get started by completing the Practice Activities!

SAFETY FIRST





The first concern of operating any machine is that the operator and surrounding persons are not in any danger.

Please be safe...!!! Keep all access doors closed during operation. Wear Laser-Safety glasses whenever an access panel is open and the machine is powered. Do not use paper for aligning the laser path. Paper burns and catches fire too easily. Please use a thin wooden plate, plastic sheet, or cardboard, or layered masking tape.

As an owner or operator of the machine, you must ensure that the machine area is properly ventilated. The laser machine works by method of using light energy to obliterate materials in the path of the light beam. The obliterated materials become fumes, gas, and/or micron-sized particles. The fumes, gas, and particles will have a identifiable smell and may be respirable such that they could cause nausea and sickness. Proper ventilation must be observed to ensure no harm to persons in the areas.

If you smell gas (any combustible gas ..such as propane), do not operate the laser machine. The laser light would be more dangerous than an open flame. The condensed light of the laser would be expected to ignite a combustible gas.

Our second concern is that the machine is protected from danger of a damaged device.

Do NOT over-ride any of the safety interlocks! The safety interlocks ensure that the laser will not fire in the situation that could injure an operator or damage the machine. The laser machines may have multiple safety interlocks. The main access panel has a limit switch to detect when the door is opened. The laser machine will complete movements, but the laser will not fire.

The water pump system has a flow detect to ensure water is being pumped through the laser tube. If the flow detector fails, does not detect water pressure then the laser will not fire. Bypassing the flow detector could leave your laser tube vulnerable to damage by overheating without the cooling water.

Do not access the laser tube and electronics panels during operation. The laser tube and electronics panels contain voltages that may be dangerous to a person. The laser power supply generates exceedingly high voltage in order to excite the CO2 gas inside the laser tube. The laser light itself is a radiation that will cause damage to materials in the local area. Direct or indirect exposure is expected to cause extreme acute damage to all materials. With the safety system and sealed enclosure, the laser system is safe and has been tested to NOT harm the operator.

Do not place materials or appendages in the path of the laser light beam. The laser light beam is not as focused until it passes through the focal lens, but is still dangerous enough to cause fire and acute permanent damage to materials which it may contact.

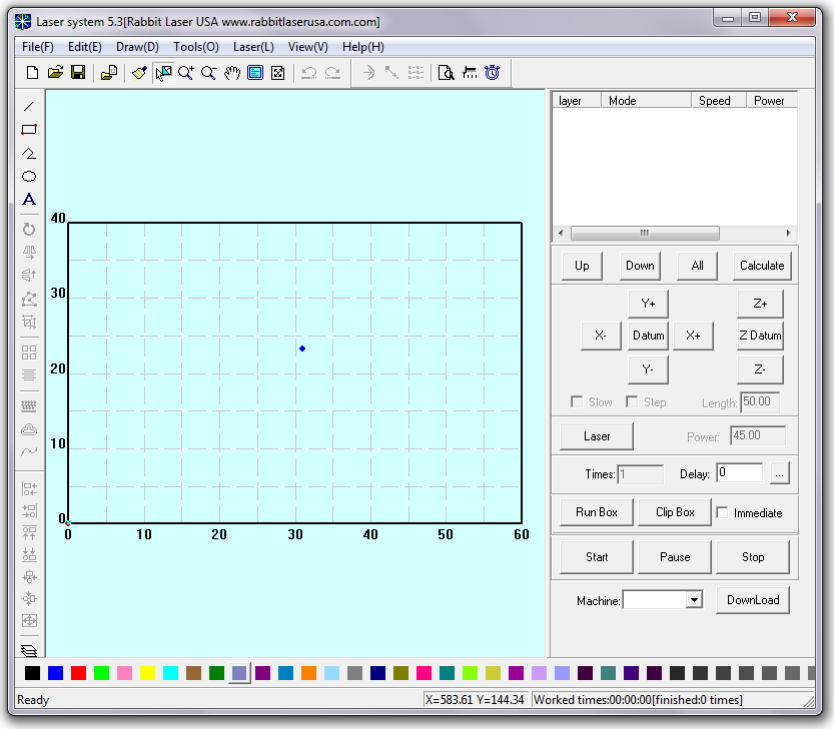
Do not place materials or appendages in the path of the moving axis. Materials placed in the path of the moving axis can cause collisions in which the axis or components of the axis get damaged. Binding or misalignment of the axis and laser path can occur due to collision.

Make sure the axis limit switches are accessible and not obstructed. The machine may be reset and told to go to the home position. During the home routine, the limit switches are required for telling the machines its end of travel. Without the proper operation of the limit switches, the machine will attempt to continue motion and may damage itself.

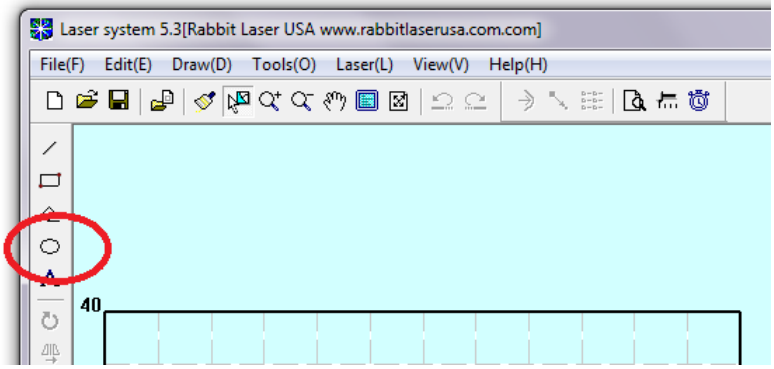
PRACTICE ACTIVITY – First Cut

Working with LaserCut 5.3 to cut a simple circle. Complete the following steps:

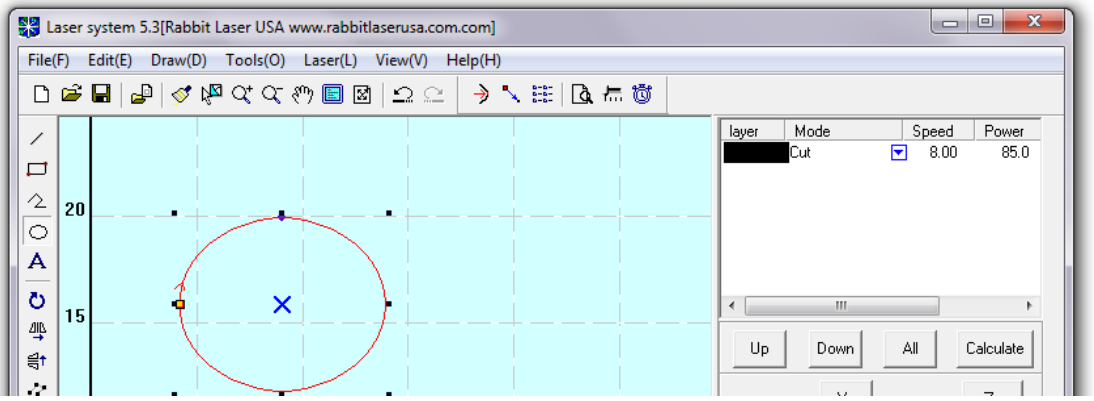
1.) Open The LaserCut 5.3 windows application



2.) Left click the mouse over this image to select the “Ellipse” tool.

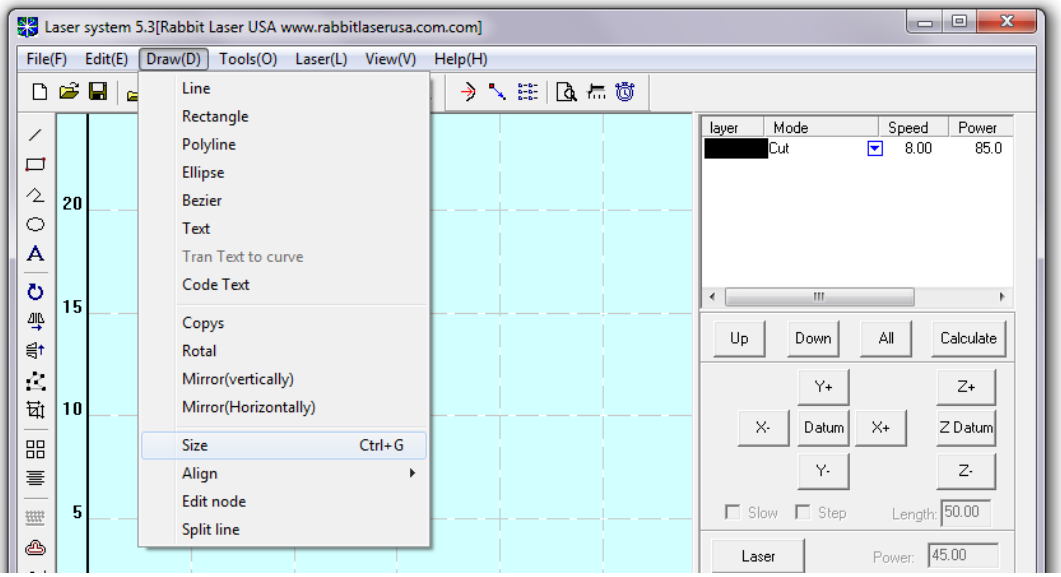


3.) To draw a circle on the work space, click on the work area, drag the mouse to the opposite corner of the circle, then click the left mouse button again.

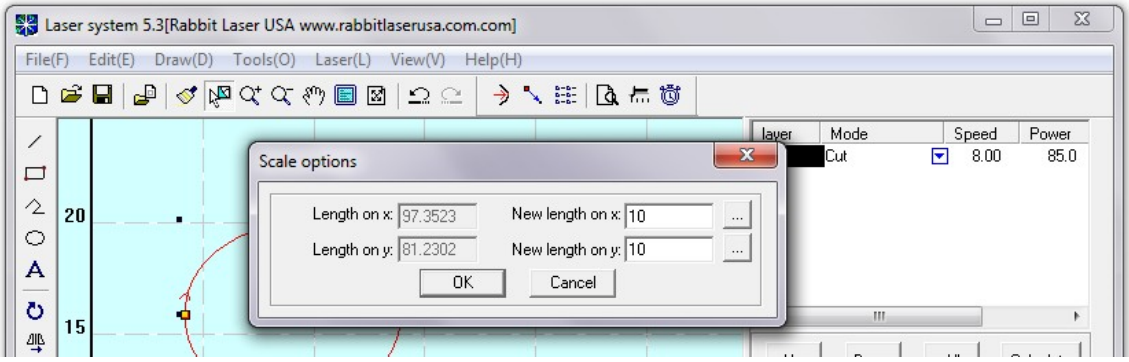


4.) The new circle should be color of red and has the stretchable nodes highlighted to show that the circle is selected.

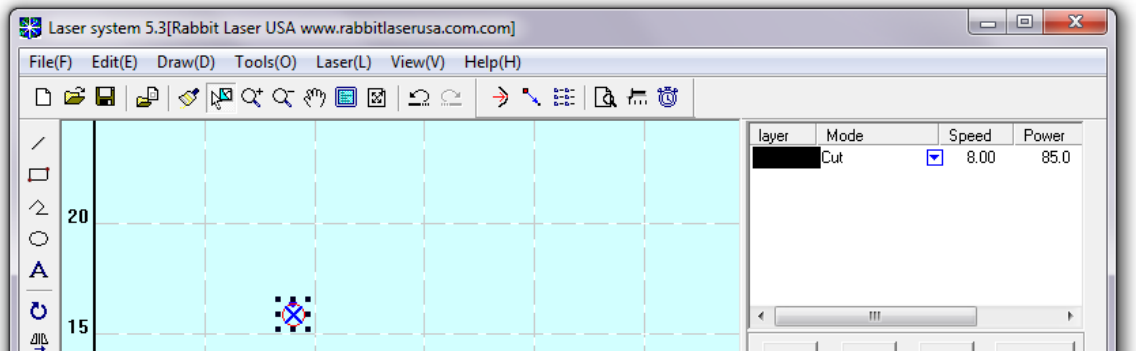
Use the menu command to change the size of the ellipse into a circle. Menu … Draw … Size. The shortcut for this command can be done by holding the **[ctrl]** button and pressing the **[G]** button.



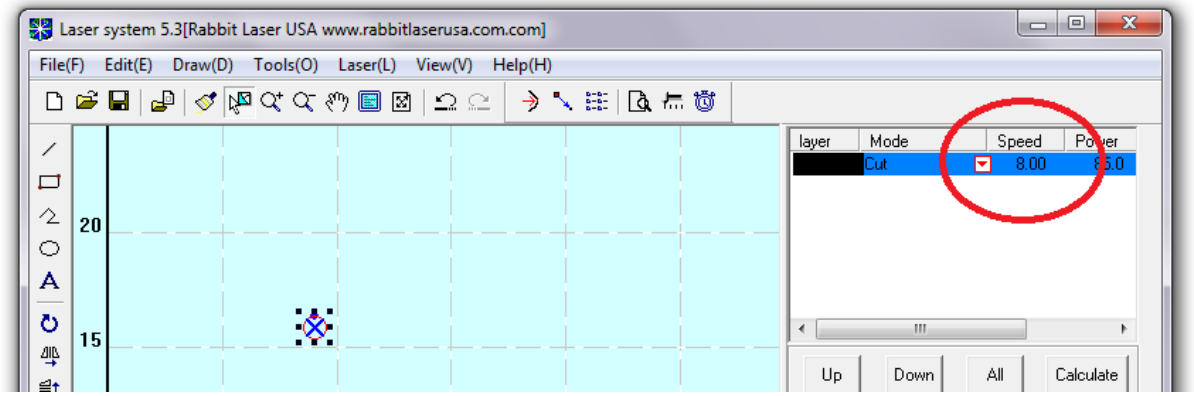
5.) Change the new X and Y values to “10” millimeters.



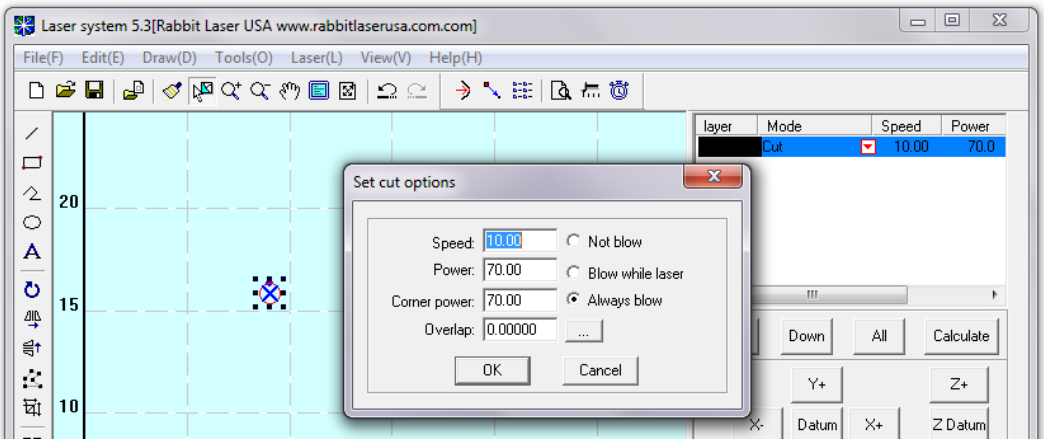
6.) Notice that the ellipse has changed into a circle and now has the exact size that you requested.



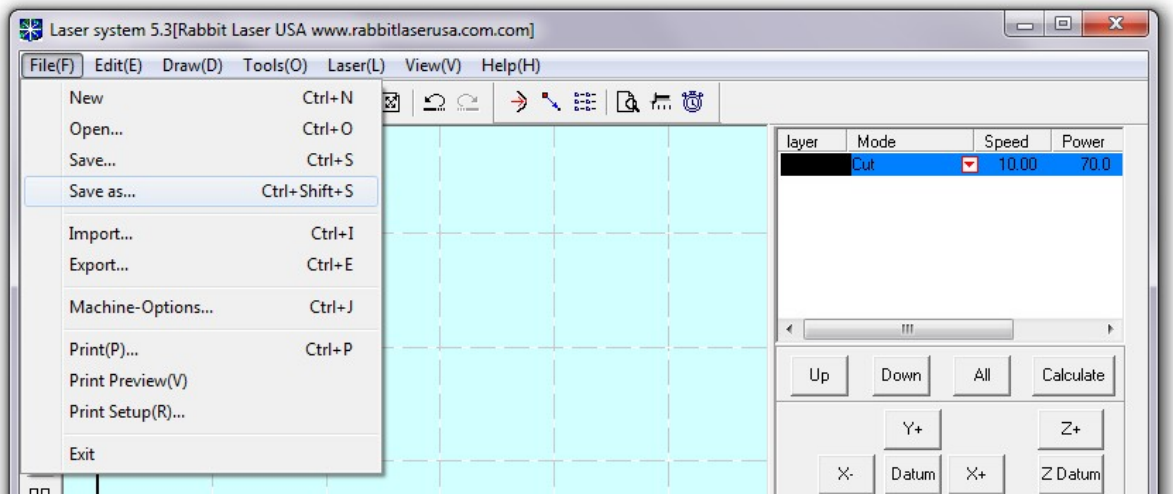
7.) The next step is to change the value of the "Speed" and "Power" settings for the laser to cut the circle. Double-Click over the speed value for the proper color. In this design, we only have one object (the circle) and so we also only have one color layer.

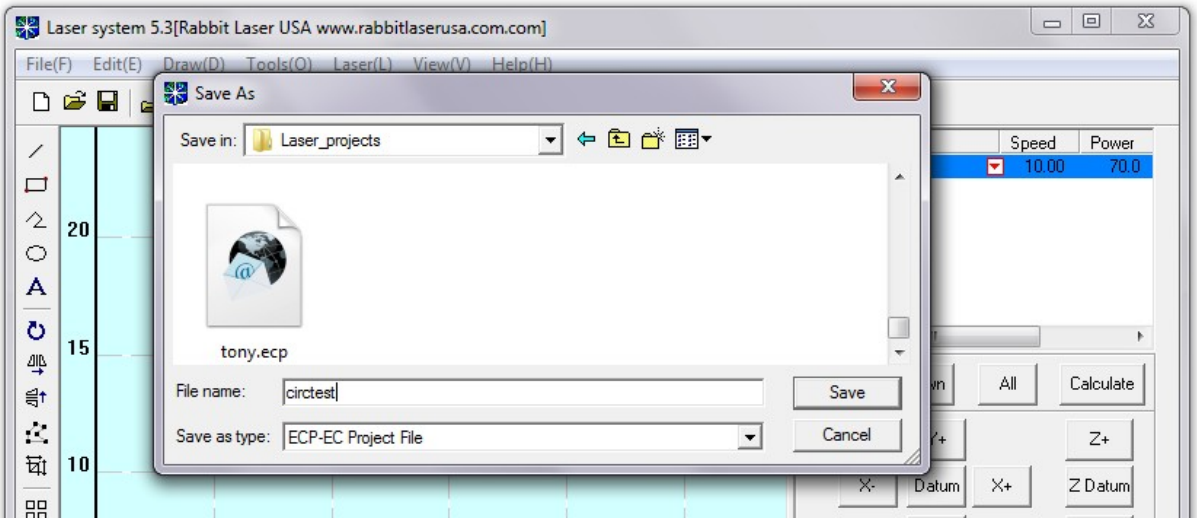


8.) The "Set cut options" dialog window will appear. Change the "Speed" to value of "10". Set the "Power" and
"Corner Power" to values of "70".



9.) Save the project to the computer. Make sure to save a filename that uses numbers and letters only. Do NOT use spaces, underscore, dash or any special characters in the filename.

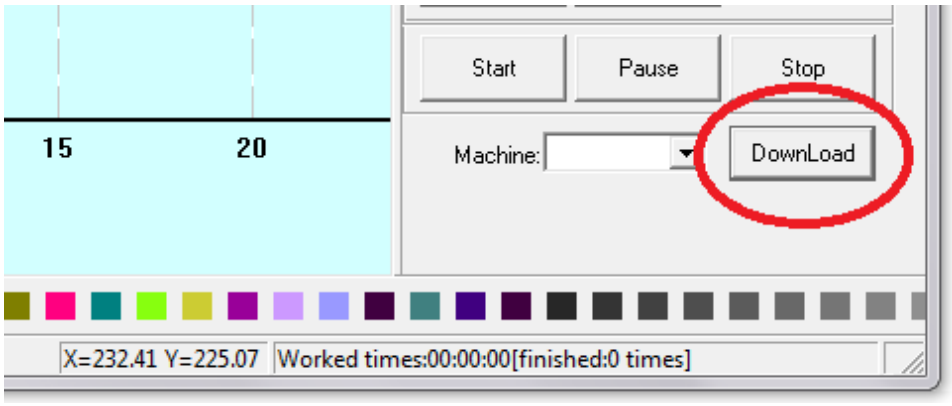


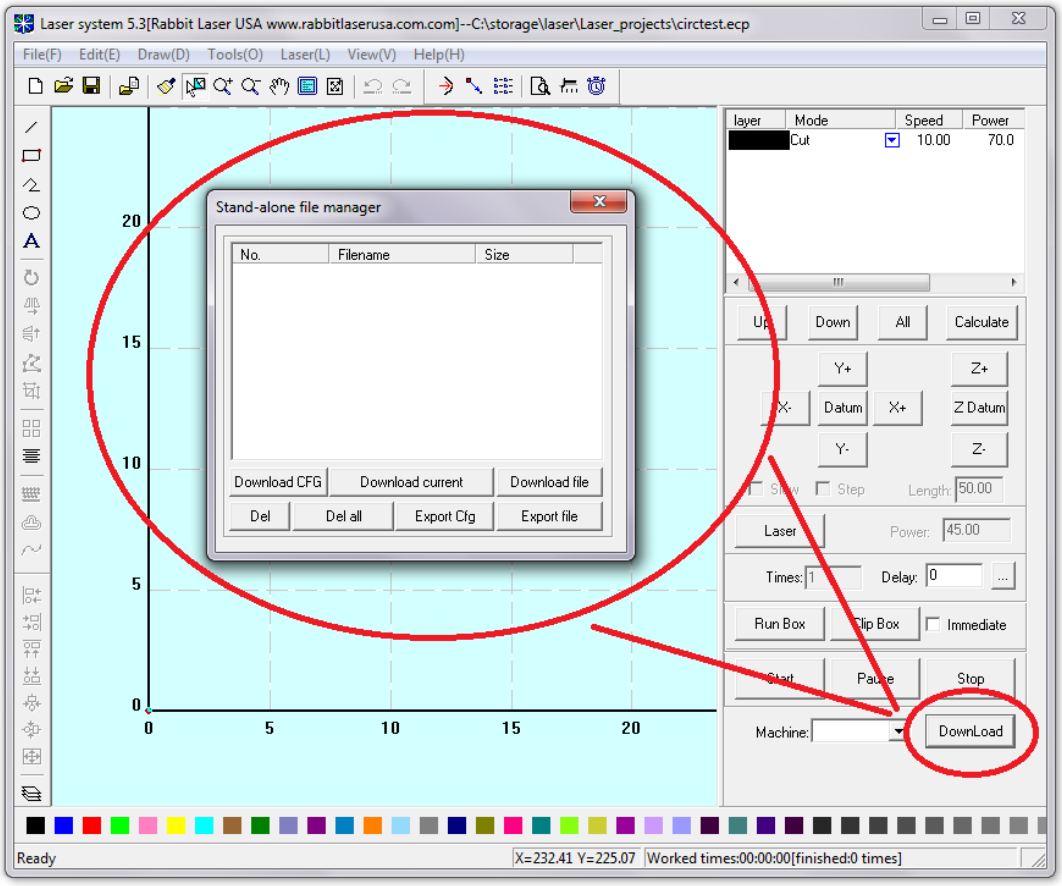


This file has been saved with name of "circtest.ecp". The *.ecp file extension is for this program and does not denote any other software file format.

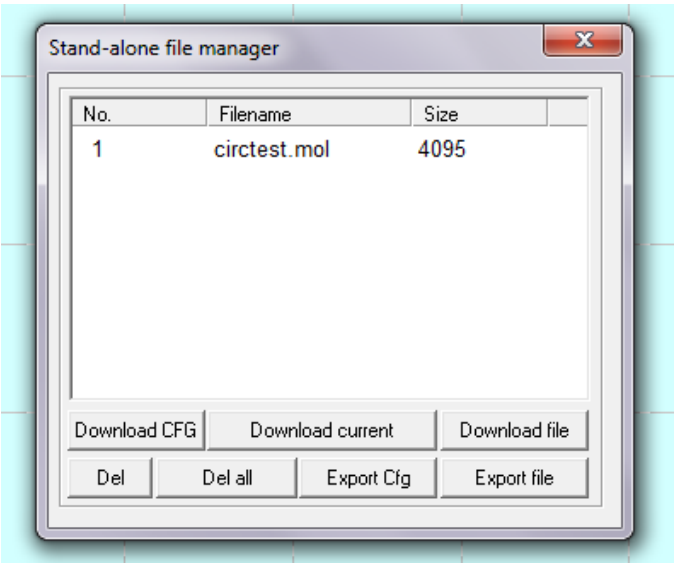
10.)The circle is drawn. The laser settings are made. The design project has been saved to file.
The next step is

"Download" the design into the laser machine. Make sure that the computer is connected to the laser machine by USB cable and that the laser machine is turned on. The computer should already have the drivers loaded.





11.)The “Download” command will start a new connection with the laser machine through the “Stand-alone file manager”. It is a good practice to delete all files in the laser machine and to download only the current design project. Click on the “Del all” button to erase the laser machine memory. Click the “Download current” to load the circtest.ecp from the LaserCut 5.3 software into the laser machine. The compiled file should be read as xx.mol file extension.

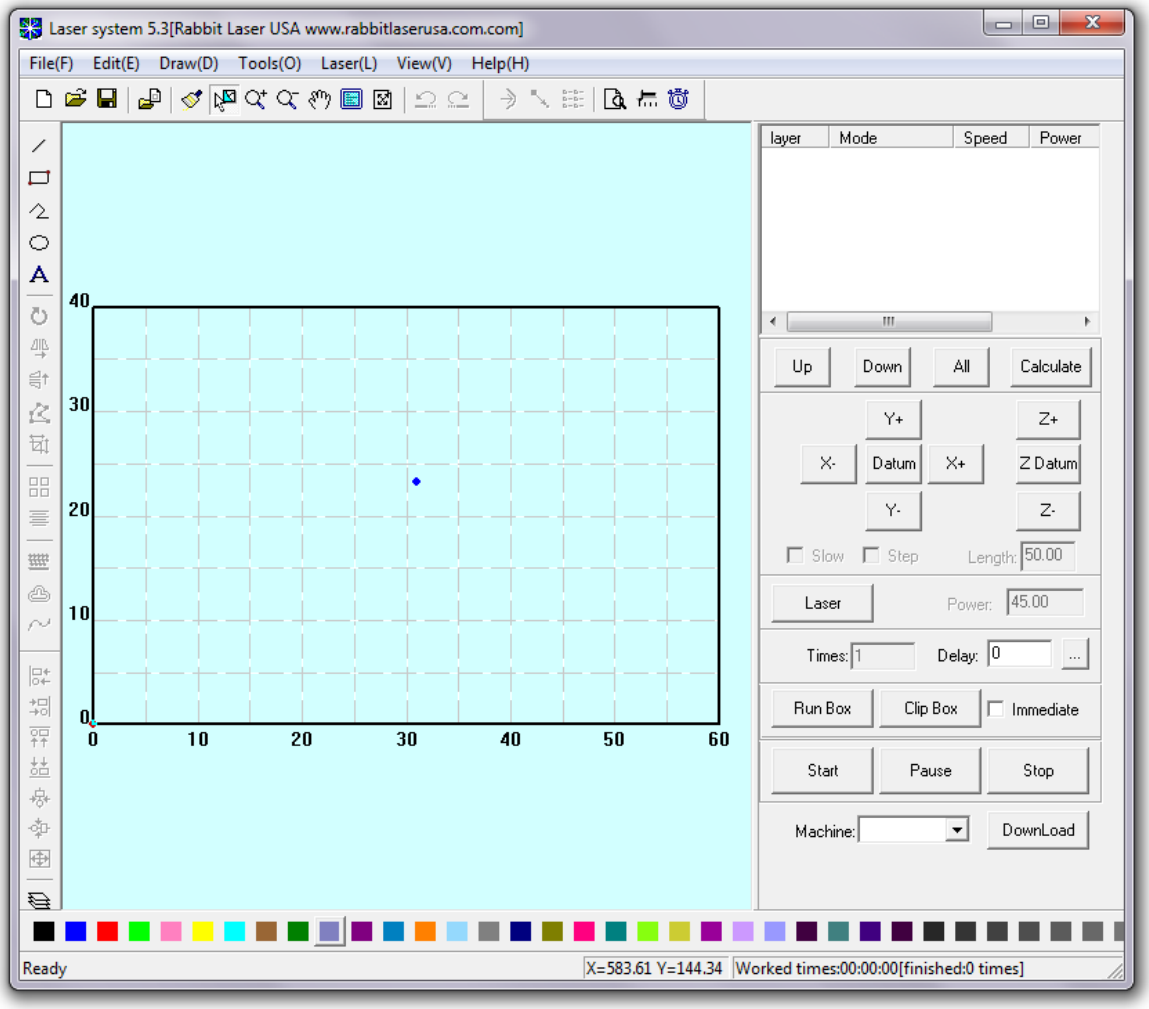


12.)The laser machine should be ready to cut… Please remember to check focus and proper cutting material space.

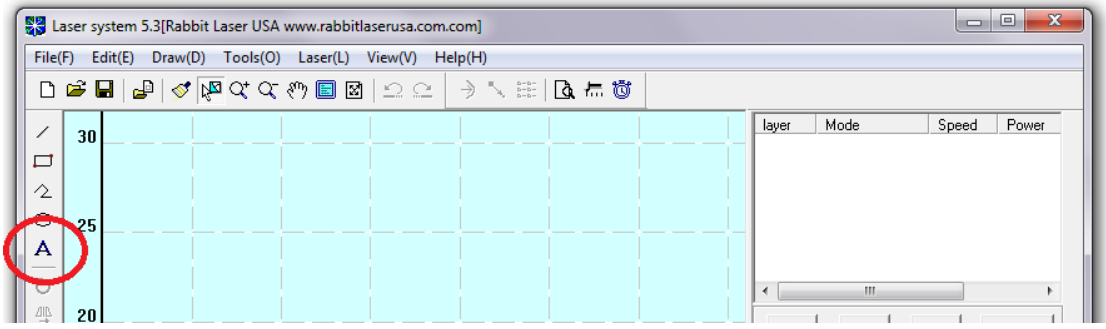
PRACTICE ACTIVITY – First Engrave

Working with LaserCut 5.3 to engrave a name to material such as wood. Complete the following steps:

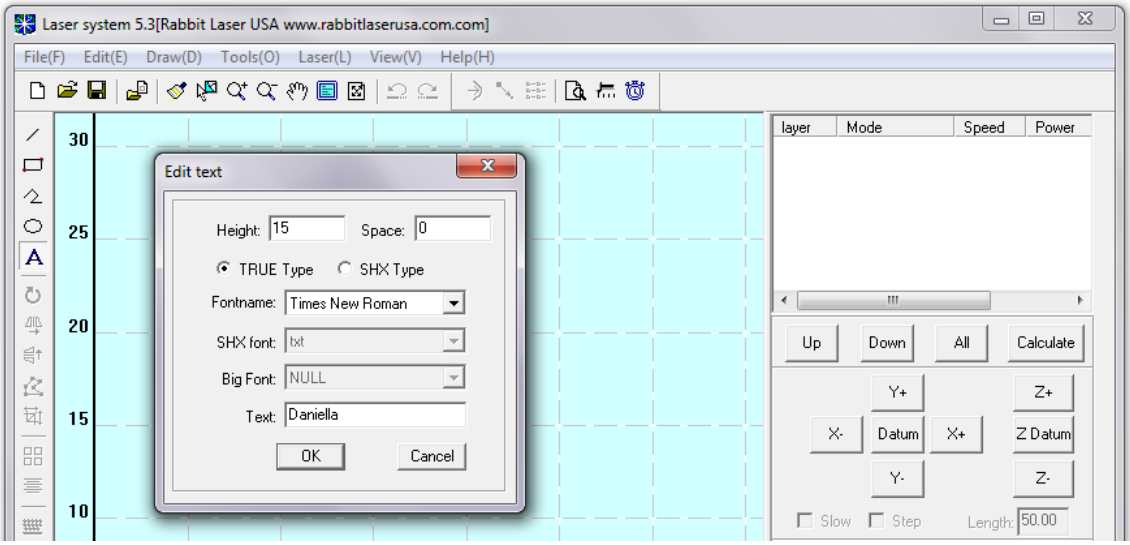
1.) Open The LaserCut 5.3 windows application or use the file menu to start a new project.



2.) Left click the mouse over this image to select the “Text” tool.

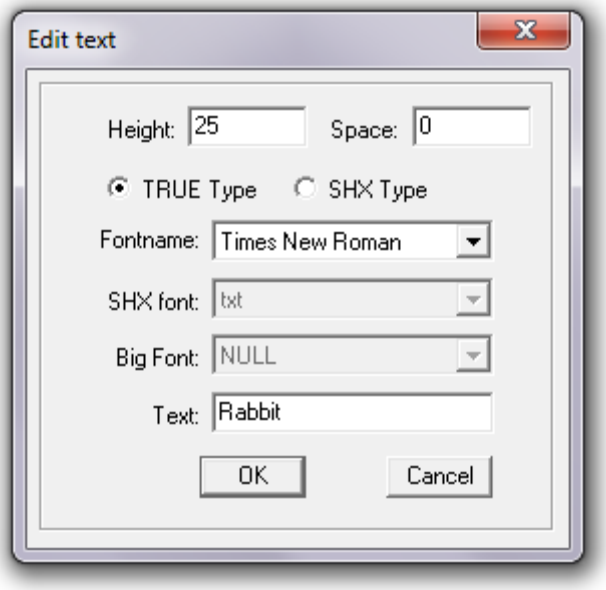


3.) To draw the text on the work space, click (and hold the mouse button down) on the work area, drag the mouse to the opposite corner of the circle, then release the mouse button. The LaserCut 5.3 software will immediately show the “Edit text” dialog window.

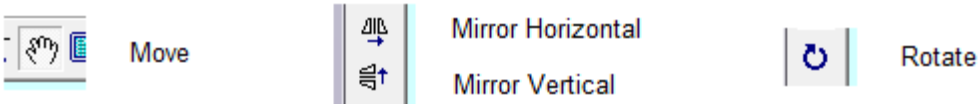


4.) Use the “Edit text” dialog window to select the appropriate text height (measured as font points… not millimeters).

The “Space” value will give more/less space between characters. If selecting a true type font, then the LaserCut 5.3 software can find any font that is installed in the Windows operating system. Type the desired characters in the “Text” area. Special fonts will produce images that correspond to the font character mapping.

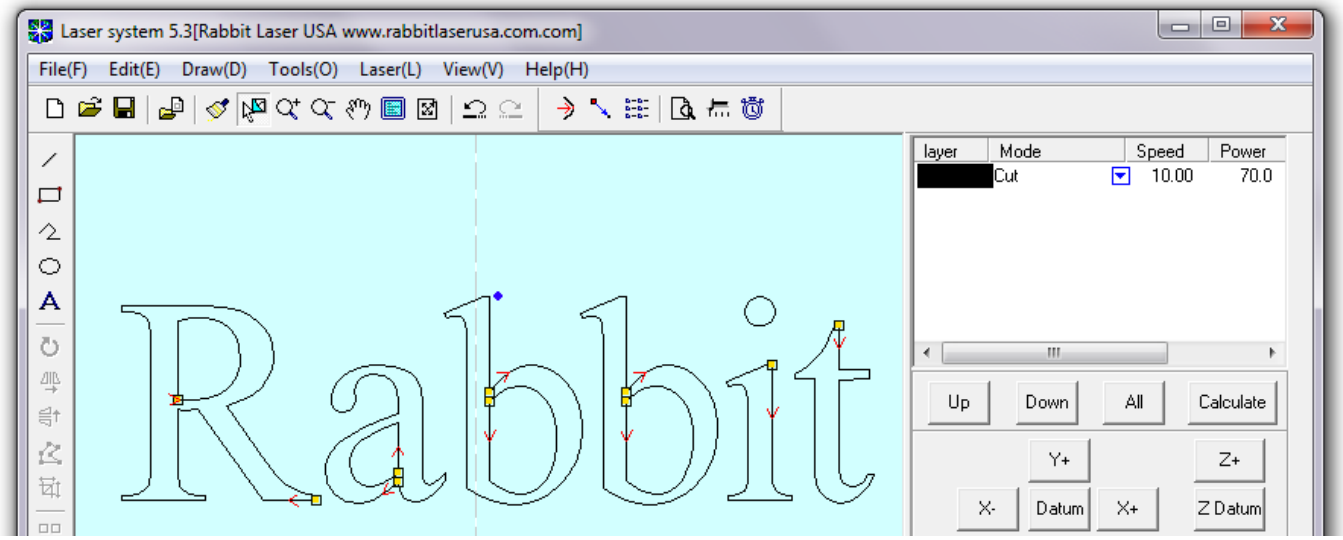


5.) Select “OK’ and the text is placed onto the drawing area. You may need to rotate or move the new text to place it on a specific part of the drawing area. You may want to “mirror” the new text if you need to engrave to the back of a mirror, glass, or clear acrylic.

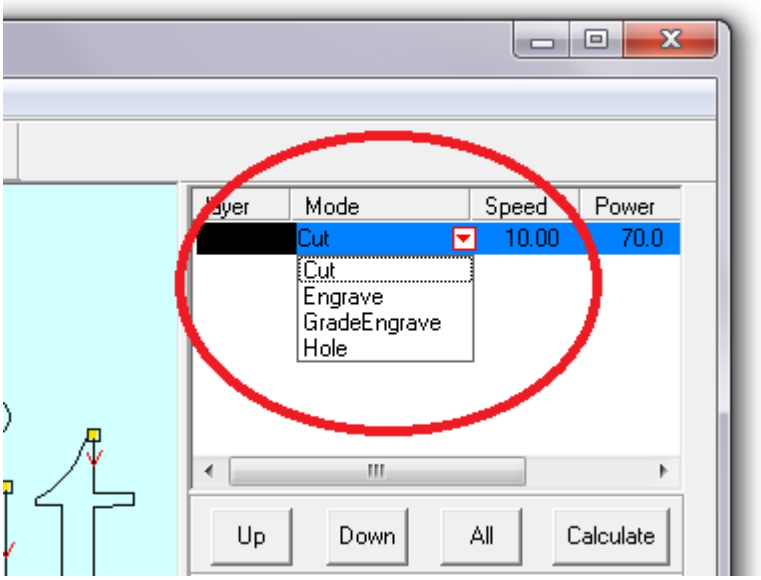


6.) Now that the new text is on the drawing area where we need it, we need to understand more about engraving the text. The text has been converted into a drawing object and no longer has the letter property. The word “Rabbit”

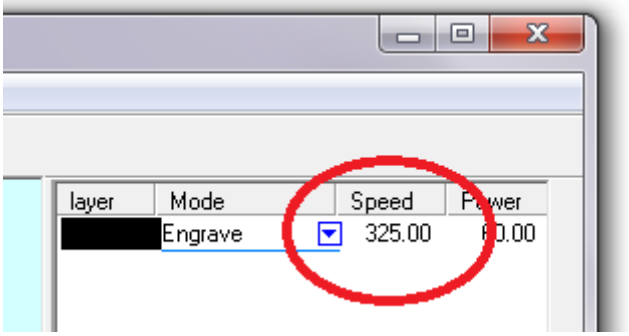
is just a bunch of lines and circle segments. Lasercut 5.3 cannot edit the word “Rabbit”. You would need to delete the drawing objects and go back to step 3.



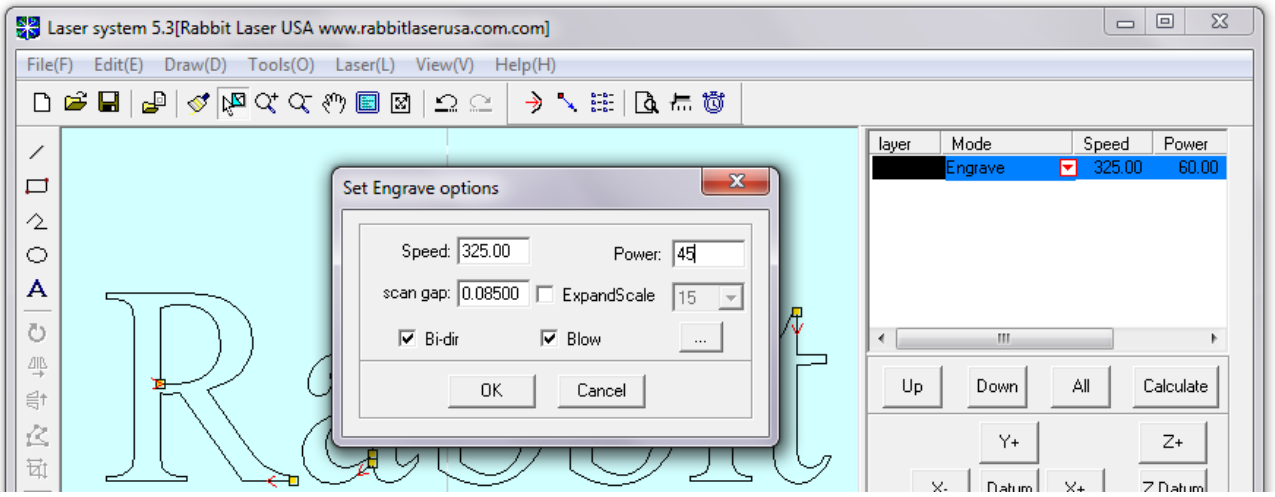
7.) Notice that the “Rabbit” is made of black lines and circle segments. The black color is currently set to a mode of “Cut”. We need to change the mode to “Engrave”. Click the red triangle button next to the black layer. This will cause a small menu to drop. Select the “Engrave” function.



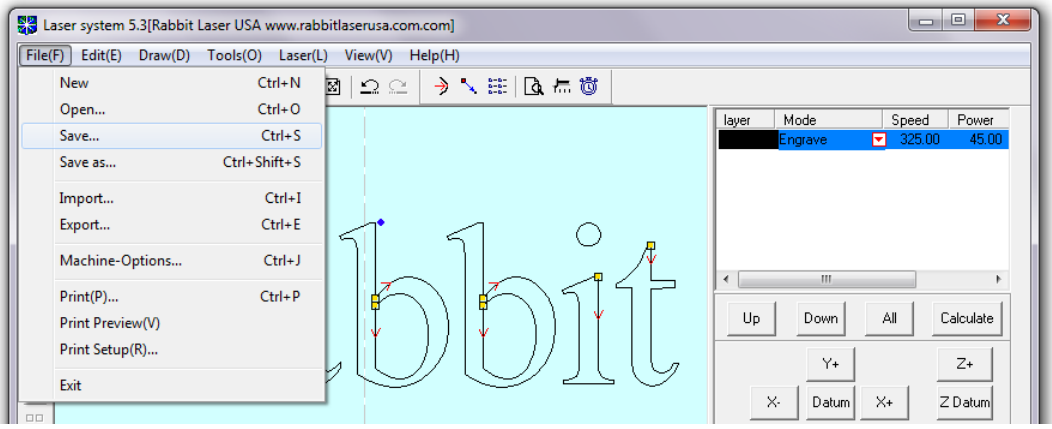
8.) The next step is to change the value of the “Speed” and “Power” settings for the laser to engrave the “Rabbit” object. Double-Click over the speed value for the proper color. In this design, we only have the one color layer of black.

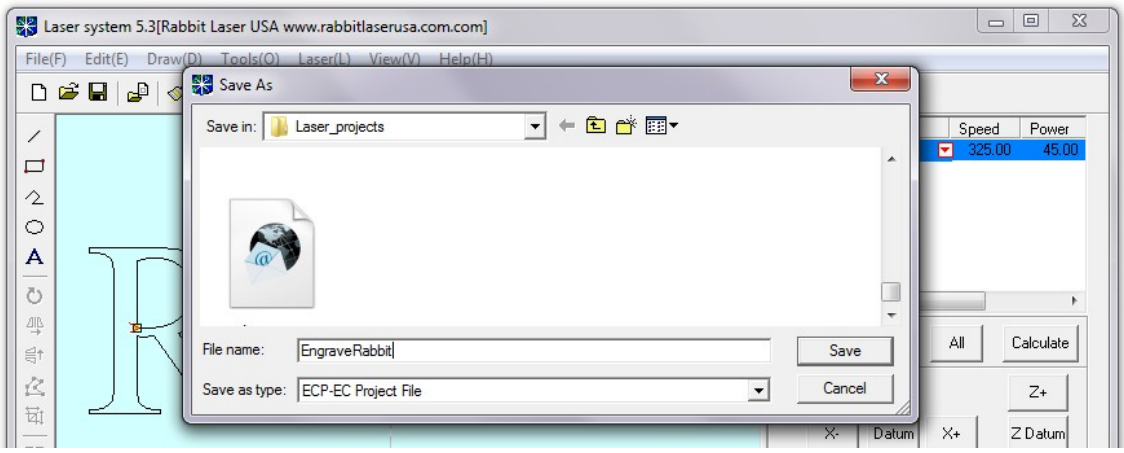


9.) The “Set engrave options” dialog window will appear. Change the “Speed” to value of “325”. Set the “Power” to value of “45”. Set the “Scan gap” to value of 0.085. The scan gap corresponds to a Dots-Per-Inch spacing as the laser machine scans vertically. Equation .. 25.4 / DPI = Scan gap



10.)Save the project to the computer. Make sure to save a filename that uses numbers and letters only. Do NOT use spaces, underscore, dash or any special characters in the filename.

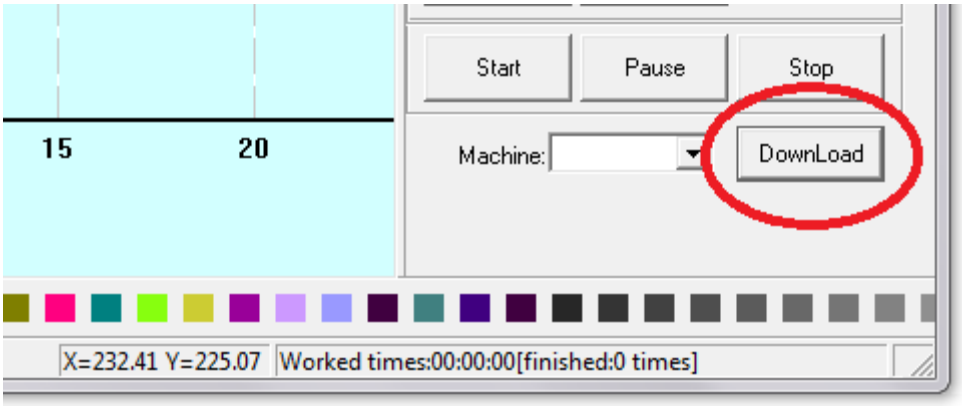


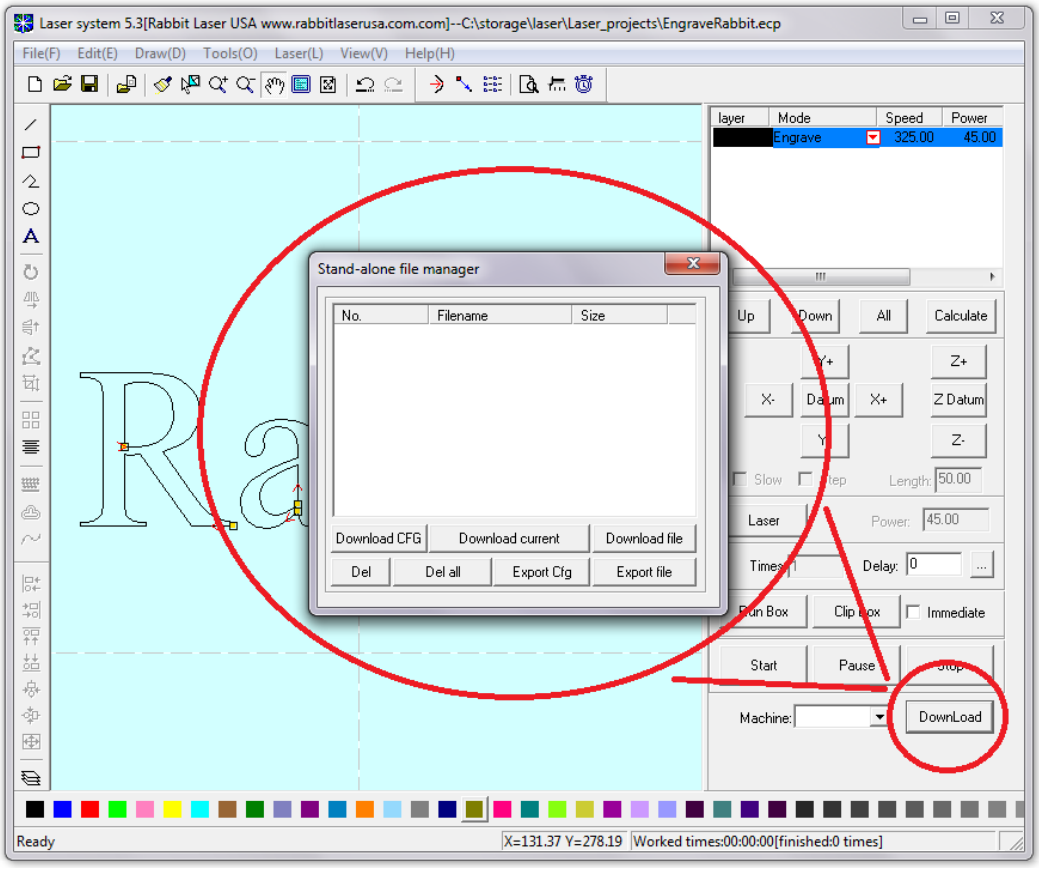


This file has been saved with name of “EngraveRabbit.ecp”. The *.ecp file extension is for this program and does not denote any other software file format.

11.)The circle is drawn. The laser settings are made. The design project has been saved to file. The next step is

"Download" the design into the laser machine. Make sure that the computer is connected to the laser machine by USB cable and that the laser machine is turned on. The computer should already have the drivers loaded.





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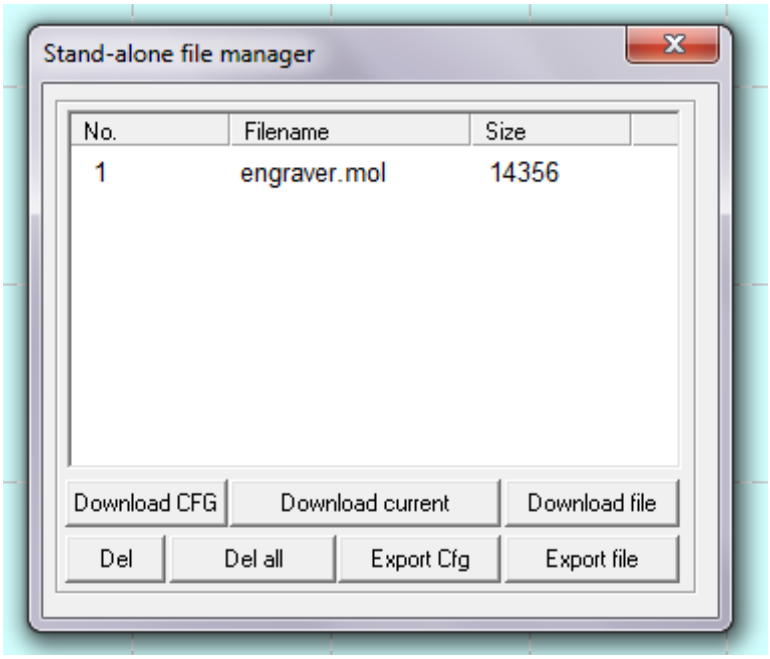
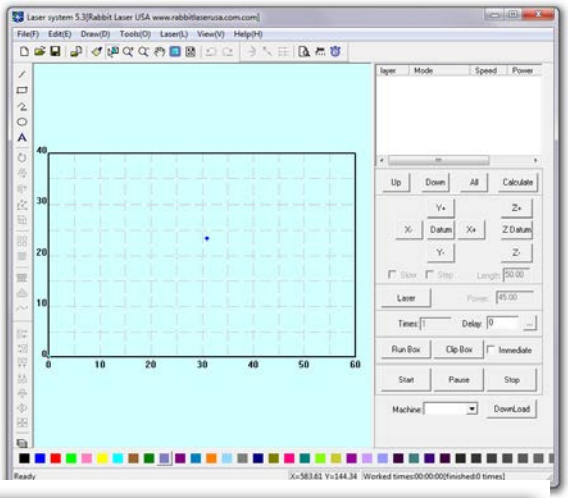


13.)The laser machine should be ready to engrave… Please remember to check focus and proper material space.

GUIDED PRACTICE APPLICATION

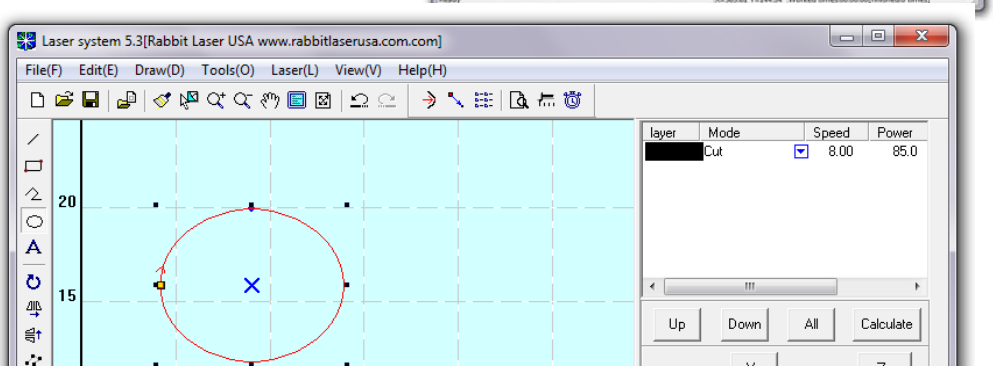
Project: Making a key identification tag.

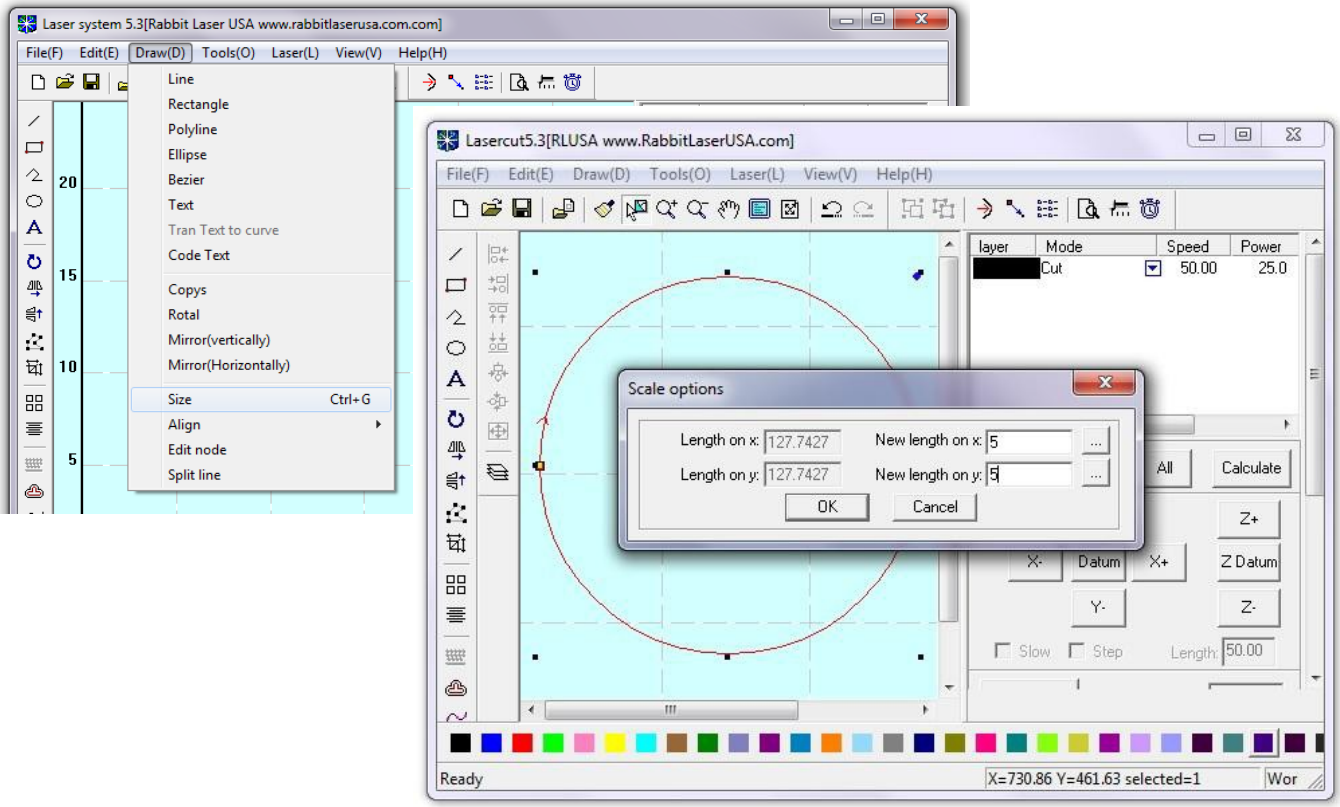


This project can be used to demonstrate some tools and features of the LaserCut application.

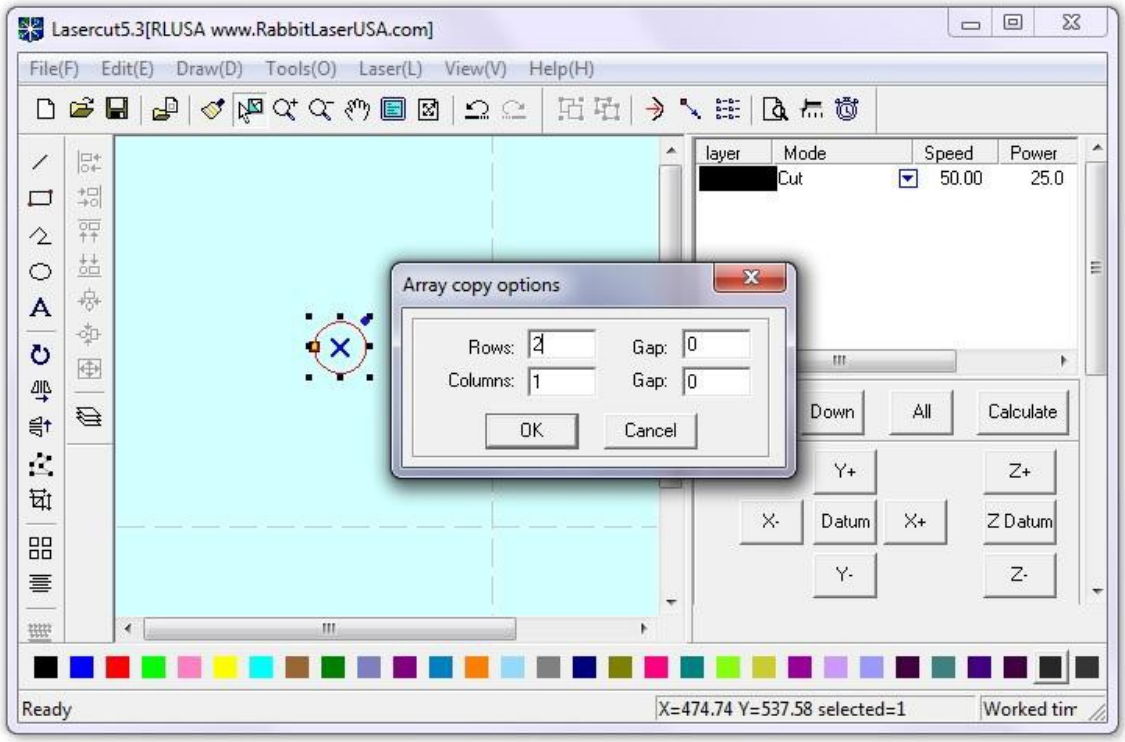
Open the LaserCut 5.3 application. Your LaserCut window will show the working size for the space available inside your laser machine.

Use the “Ellipse” tool to select that we want to draw a ellipse or circle. To draw a circle on the work space, click on the work area, drag the mouse to the opposite corner of the circle, and then click the left mouse button again.

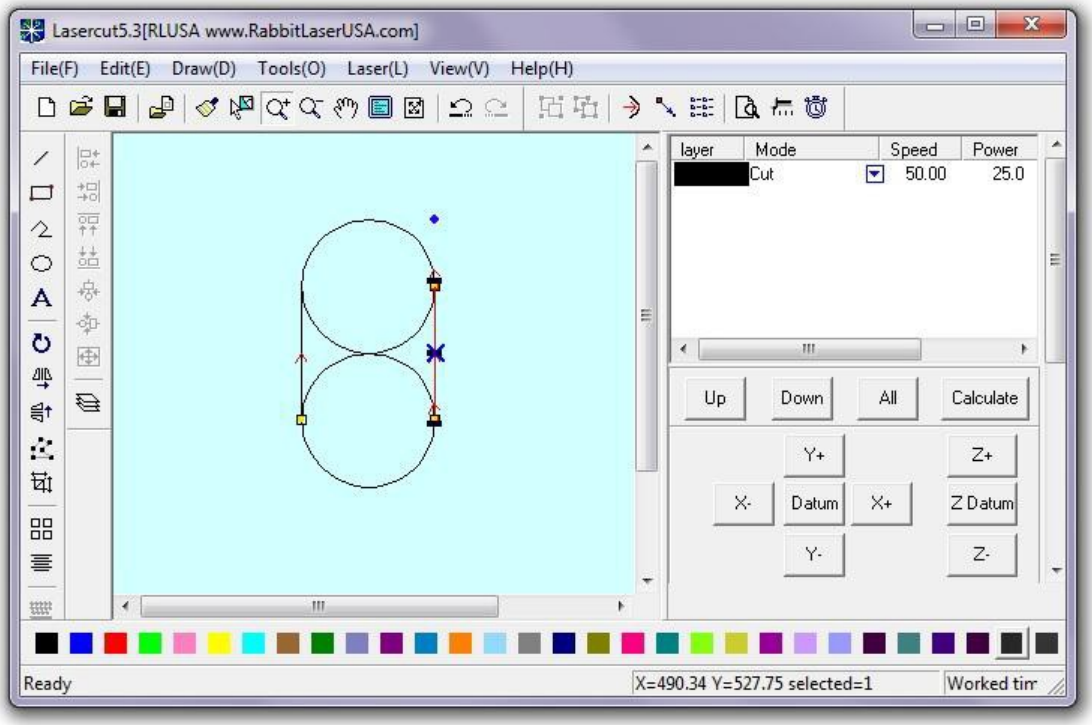




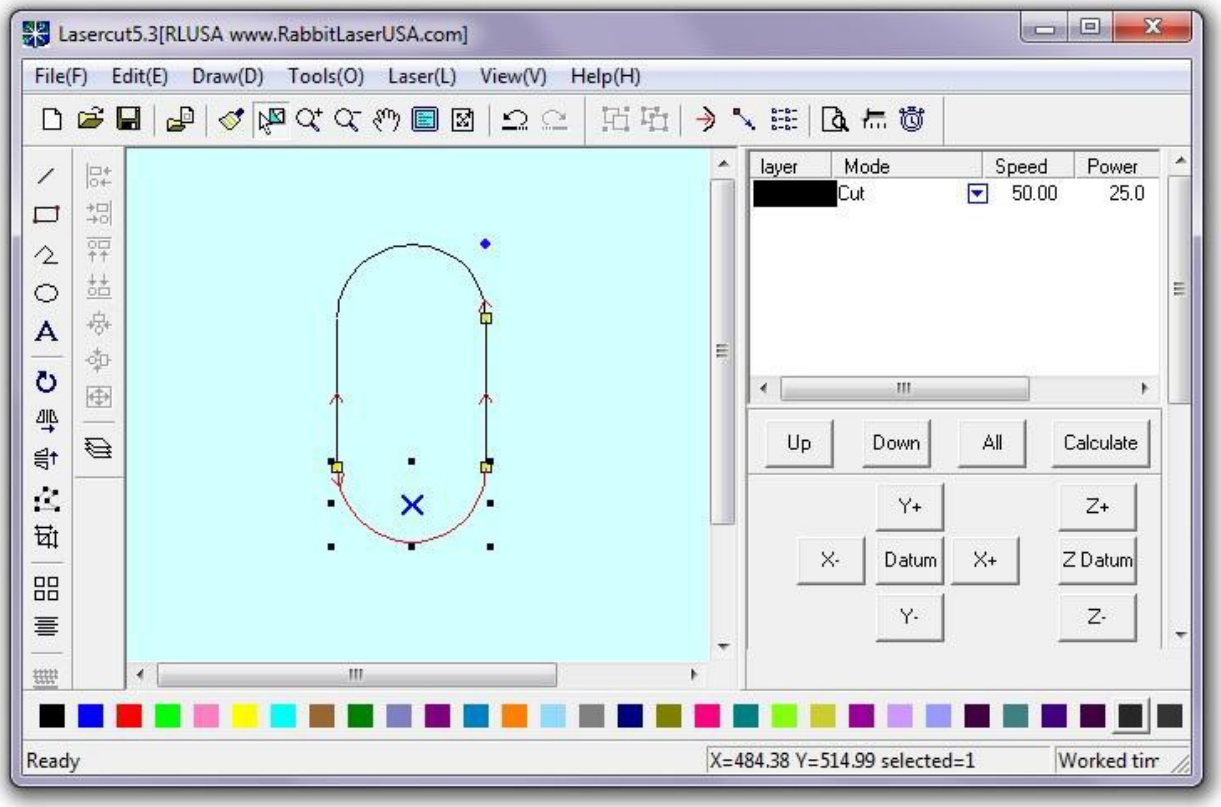
Use the "Draw – Size" menu command to change the size of the circle to 5mm x 5mm.



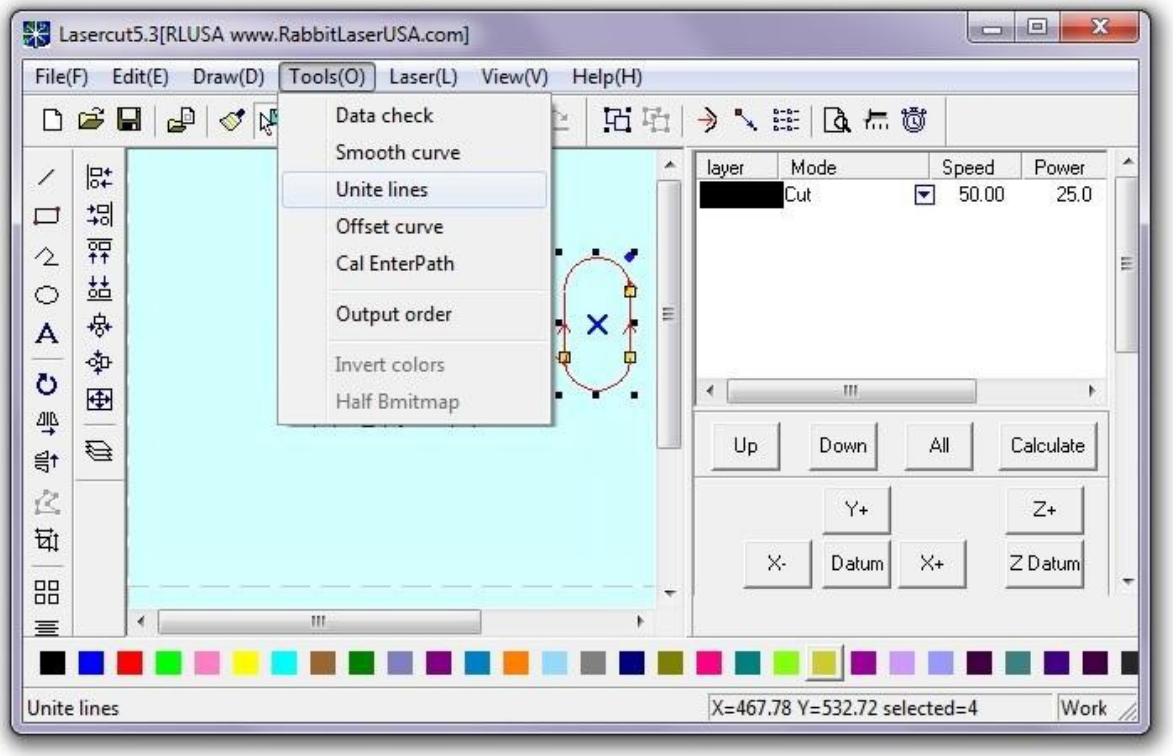
Select the circle. Use the menu command of "Draw – Copies" to create another copy of the circle above the original one. We want to have two (2) circles when we finish this command, so we select to have 2 rows and one column. The "Gap" values are left at "0" because we want the circles to be touching. These two circles will form the slot that our key ring will fit through. A slot allows the key ring to twist more and prevents the metal ring from twist-breaking the plastic/wooden tag.



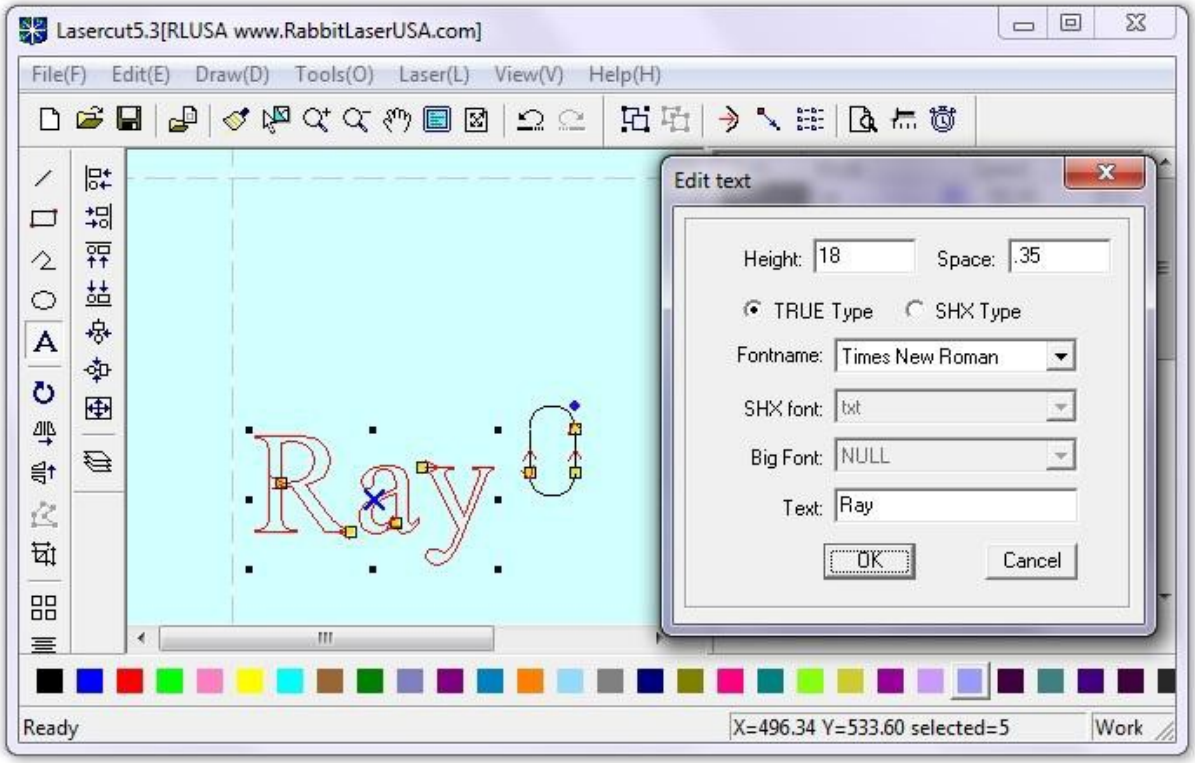
Select the “Draw-Line” tool. Use the snap points to help select the circle start point nodes. Then create the second line by selecting the right set of node points.



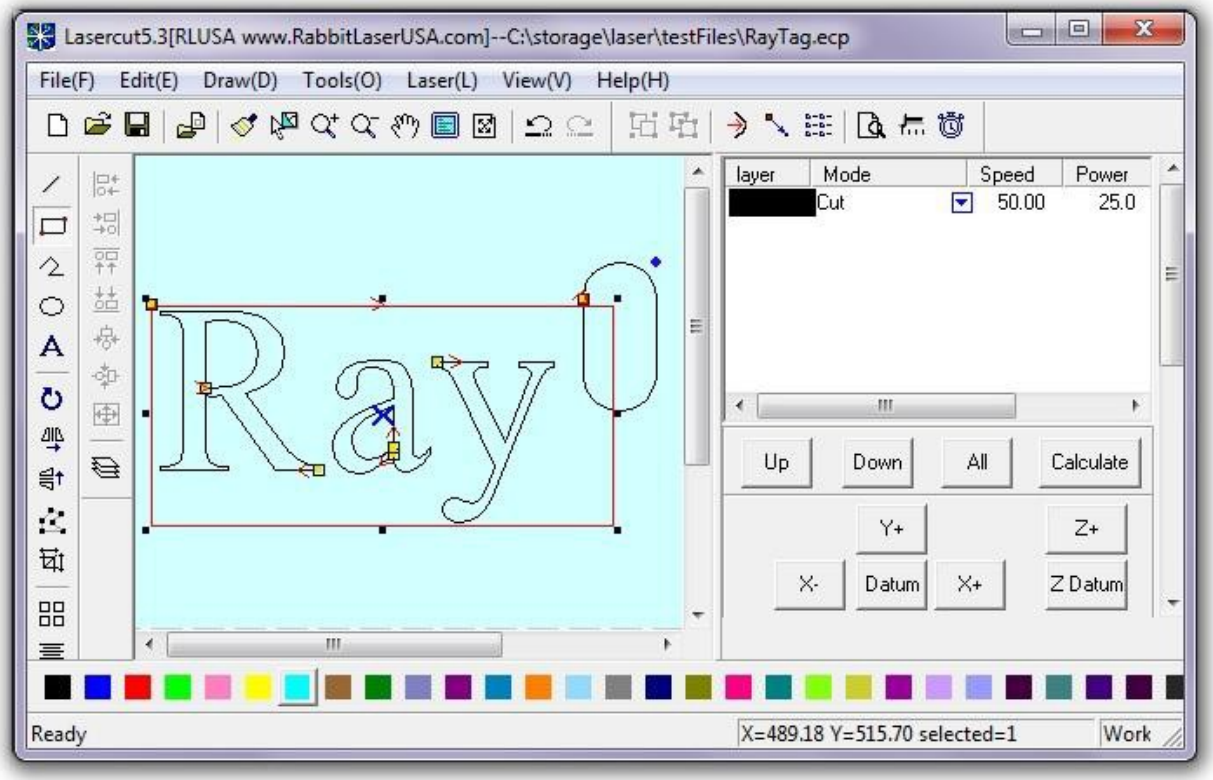
Use the “Draw - Split Line” tool to break the circles apart. Separate the circles at the left and right edges. Once the circles are broken apart, delete the line segments that we do not need.



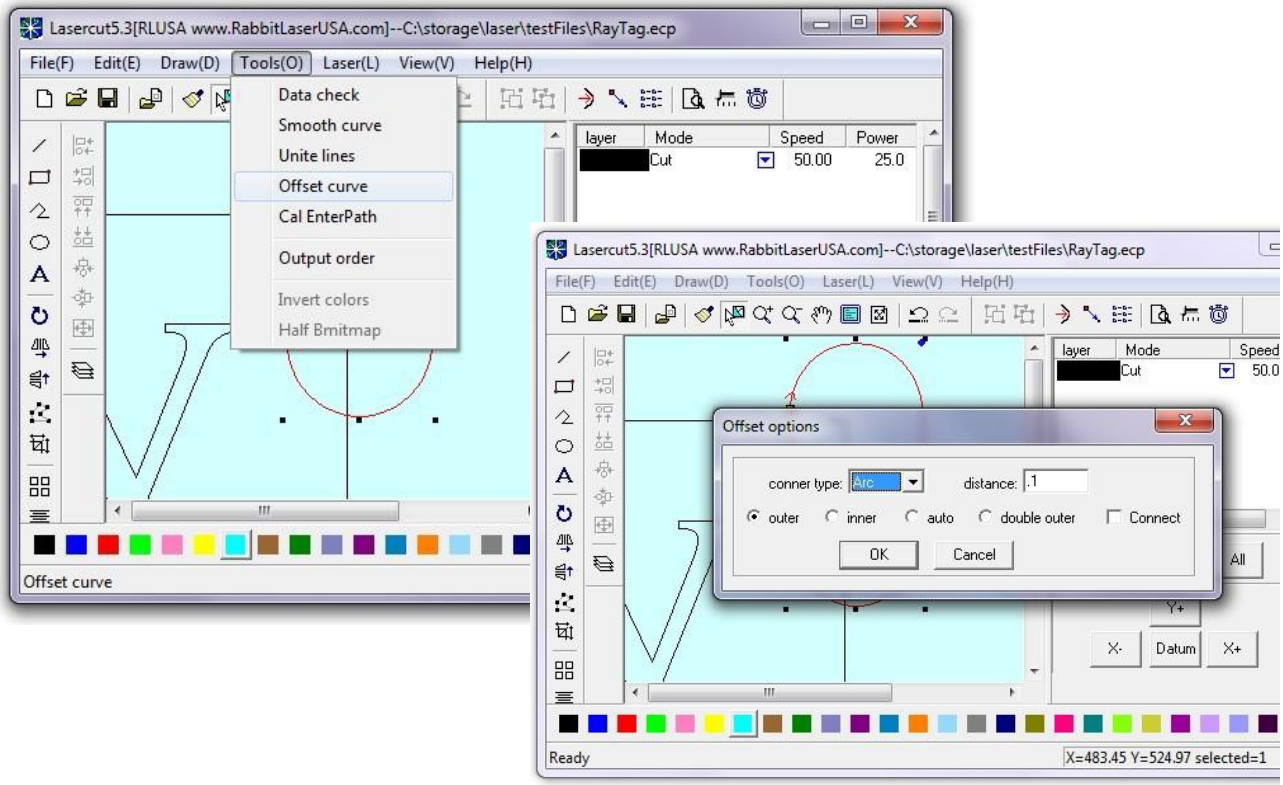
Select all the line segments for the slot. Use the “Unite Lines” command to make these segments into one polyline.



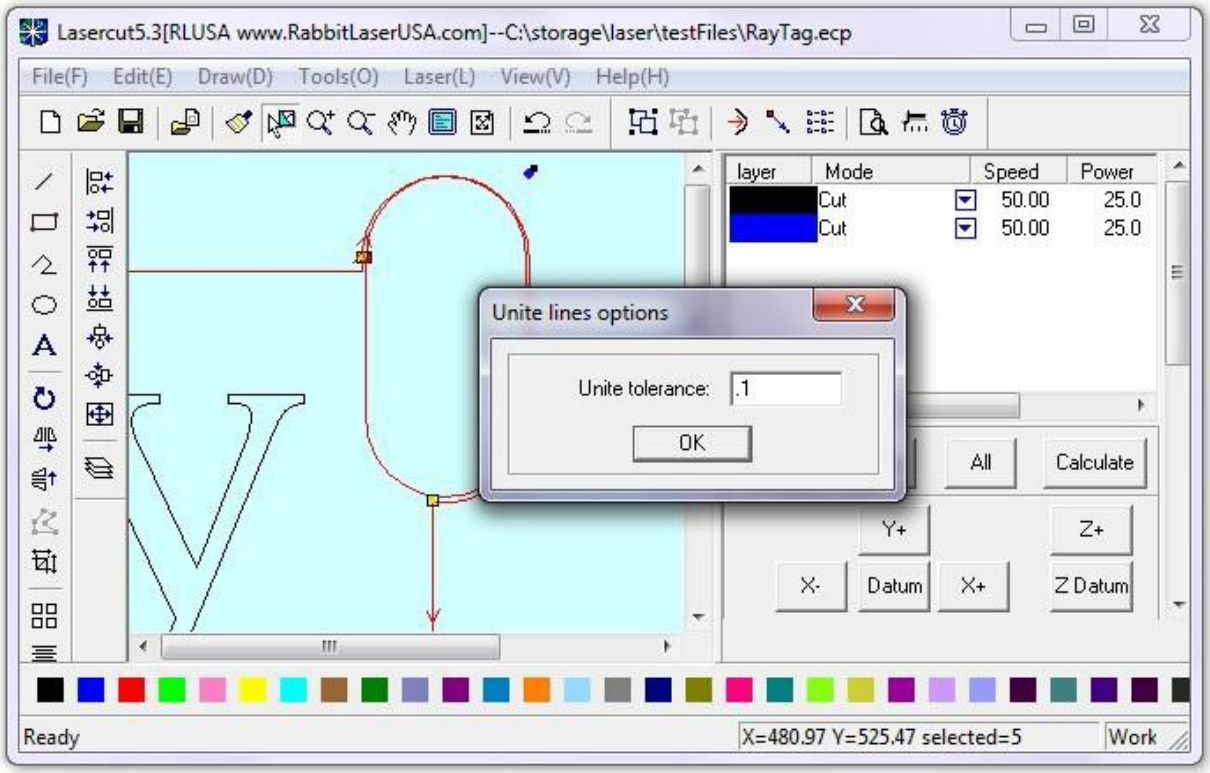
Add the name for the tag.



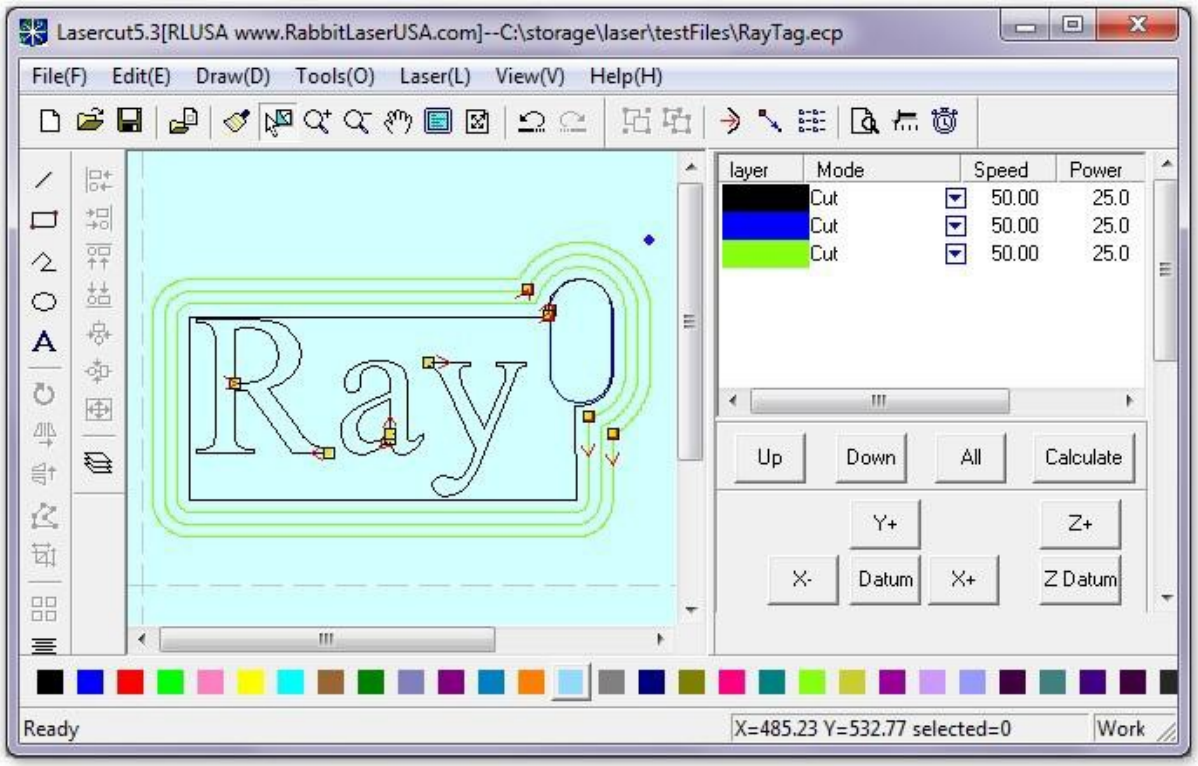
Draw a rectangle around the name. This rectangle will be used as part of a guide for the rest of the project. Make sure the rectangle does not cut off part of the name or leave too much awkward space.



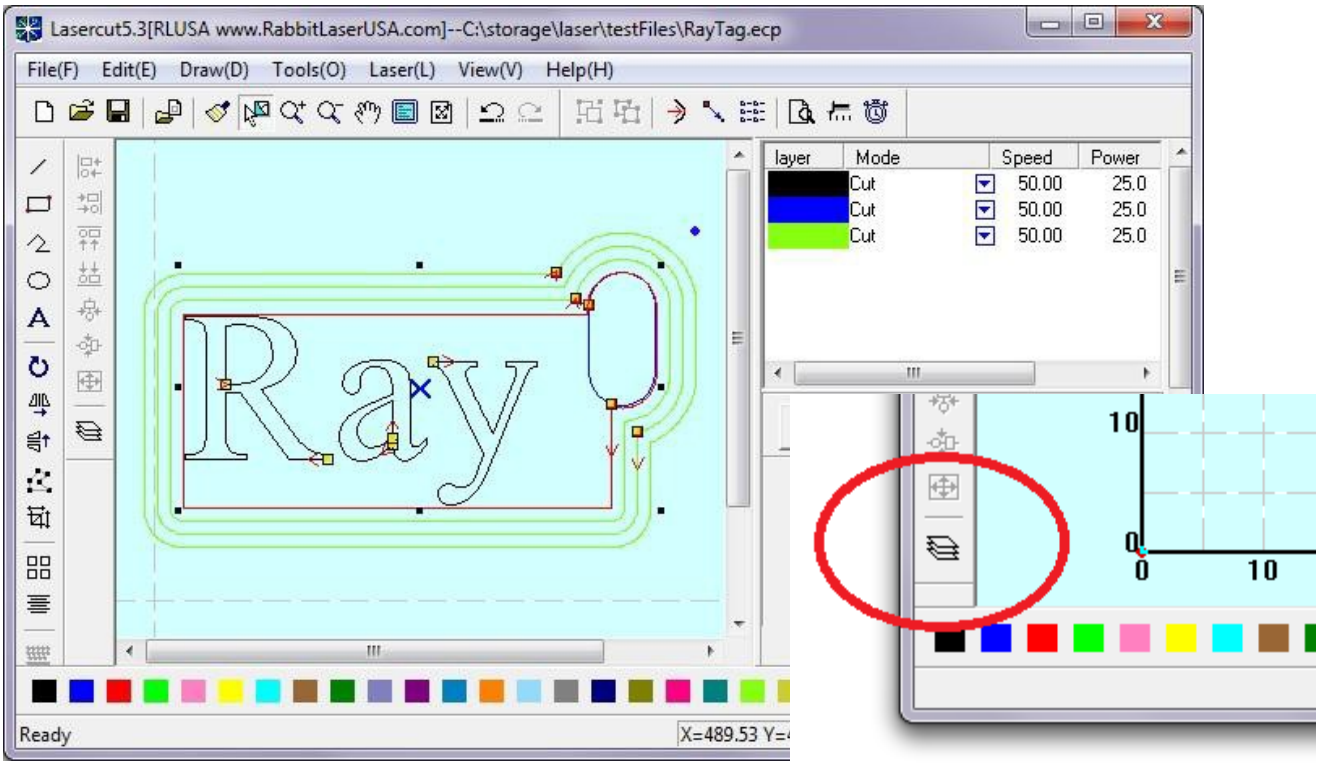
Select the slot shape. Use the “Offset Curve” menu command or the toolbar button to create another slot. Use an offset distance of only 0.1 mm for the new offset distance. The shape that we will create will be an arc on the outside of the existing shape. The new slot will be used as a guide for other parts of the project.



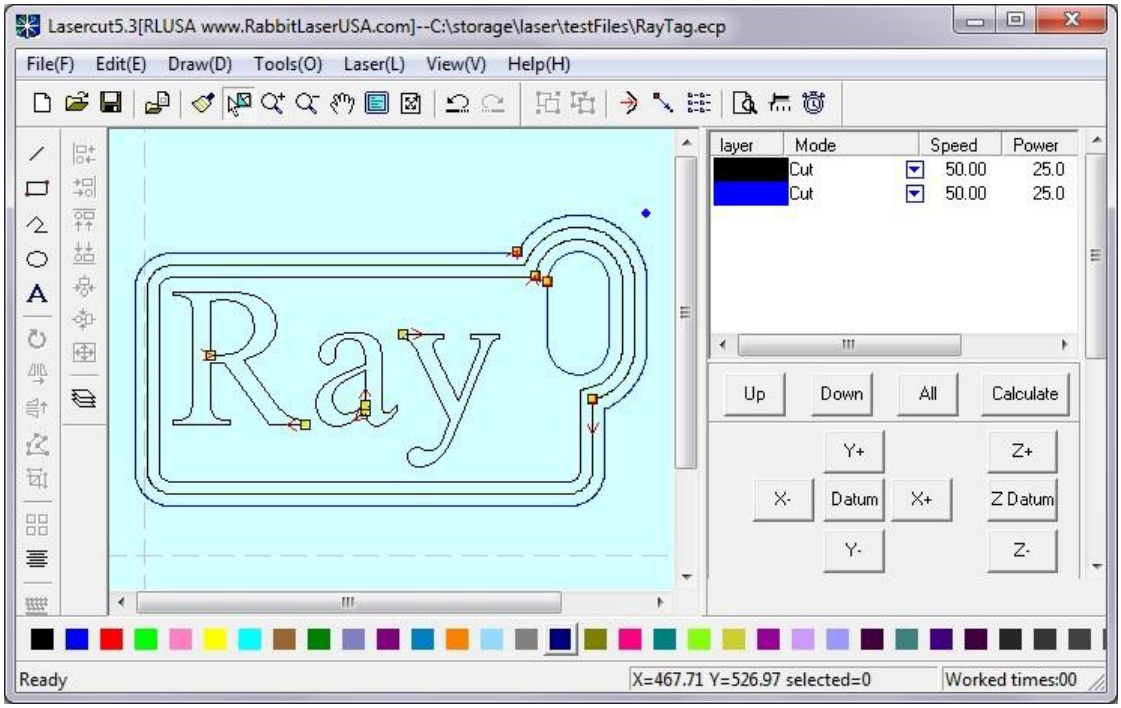
Remember how we used the "Split Line" command. Split the outer slot and the rectangle guide. Use the "Unite Lines" command to make the rectangle and slot into one polygon. This new polygon is our best guide for finishing the tag boundary.



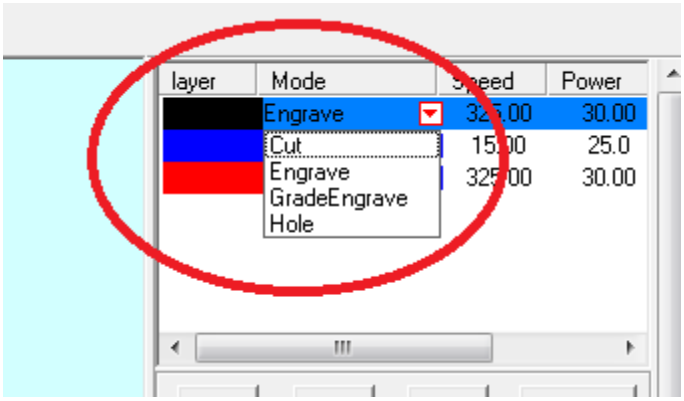
Use the "Offset Curve" menu command or the toolbar button to offset the new guide shape three times. The offset distance should be about 1mm.



The guide object is no longer needed. We can delete this object or make it a new color such that the new color layer can be turned off, locked, frozen, or hidden. I normally choose to hide the guide object in a different color layer. The "Layer Control" button is located at the bottom of the left toolbar.

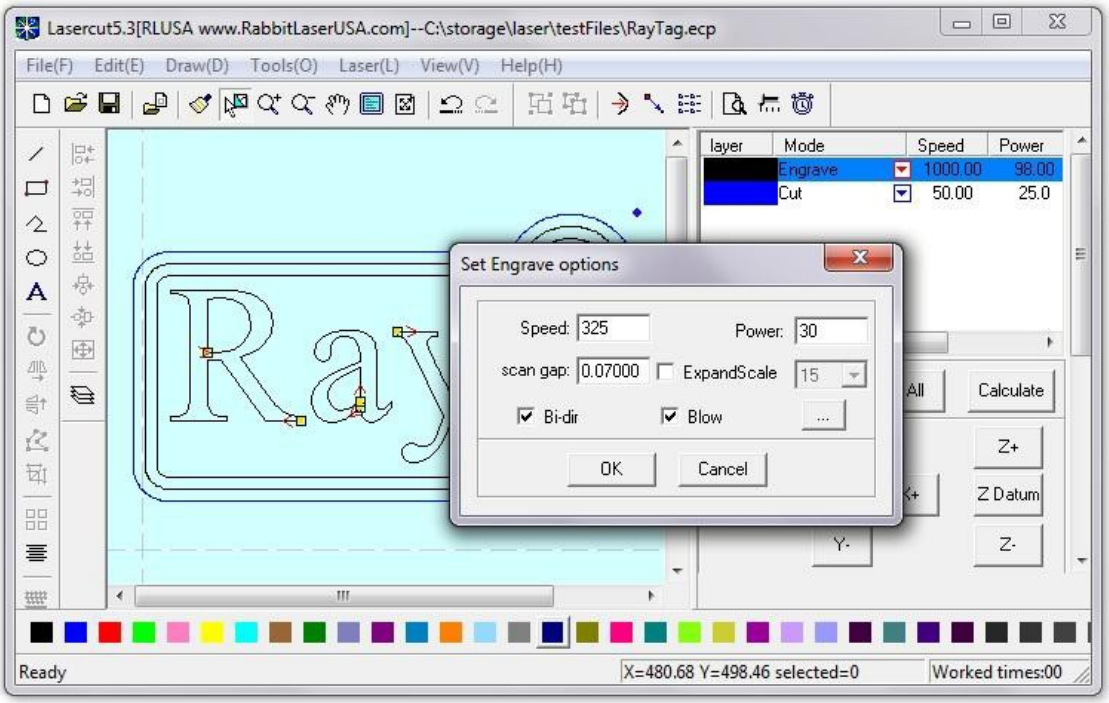


Now the guide shapes are "gone". We need to continue with what the remaining shapes are used for. We know that the slot and outside shape will be cut through the plastic (or whatever material you are using). The name and "beauty ring" will be engraved. It should be easy to select all the shapes and set the color to black. The black color (in this situation) is planned for engraving. Select the slot shape and set that color to blue. Select the outside key-tag shape and set that color to blue. The picture above shows our planned color scheme. Our plan does not yet show the designated function for each color layer.

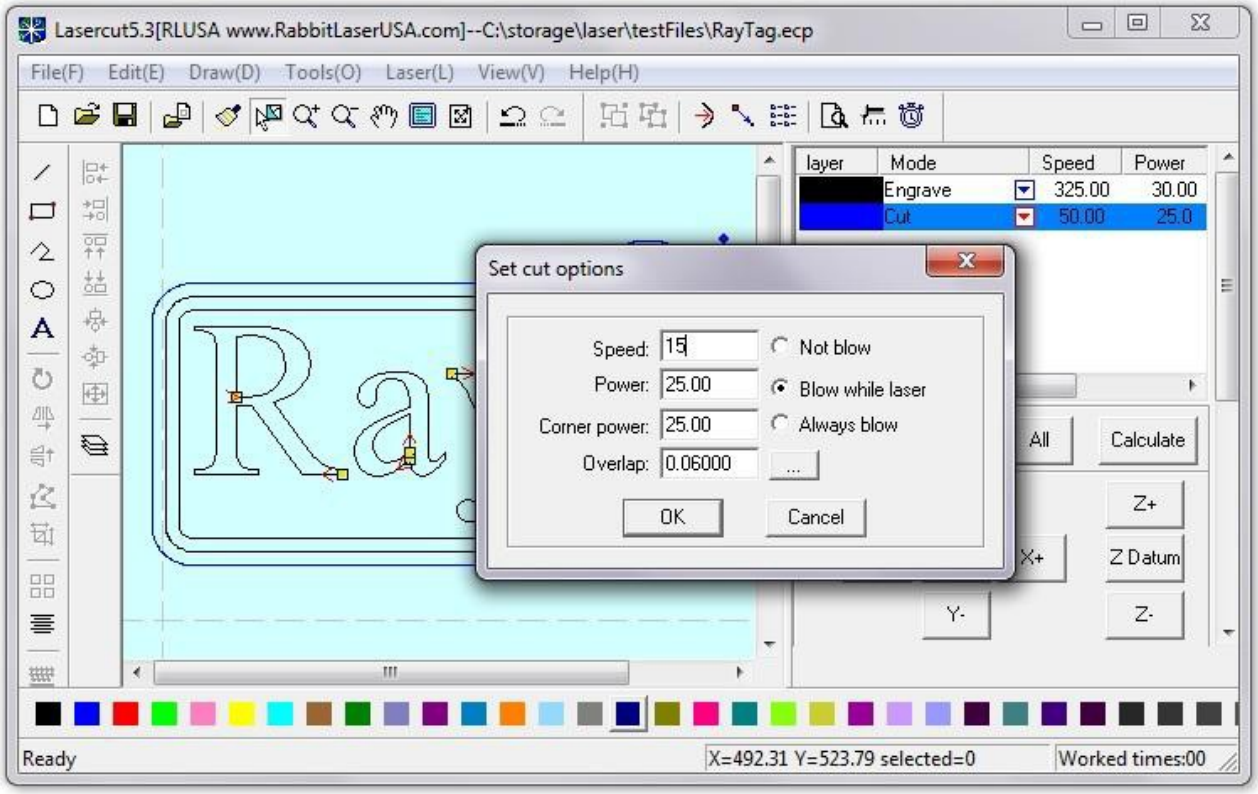


Click on the triangle inside the “Mode” parameter of the black layer. This will expand a small menu of modes that can be used for this layer. You are not required to use any specific color for cutting, engraving…etc. Each project can designate what mode is used on that color layer. For this project, make sure the black layer is used as ENGRAVE by clicking on the “Engrave” option.

Click on the triangle inside the “Mode” parameter of the blue layer. This will expand a small menu of modes that can be
used for this layer. For this project, make sure the blue layer is used as CUT by clicking on the “Cut” option.



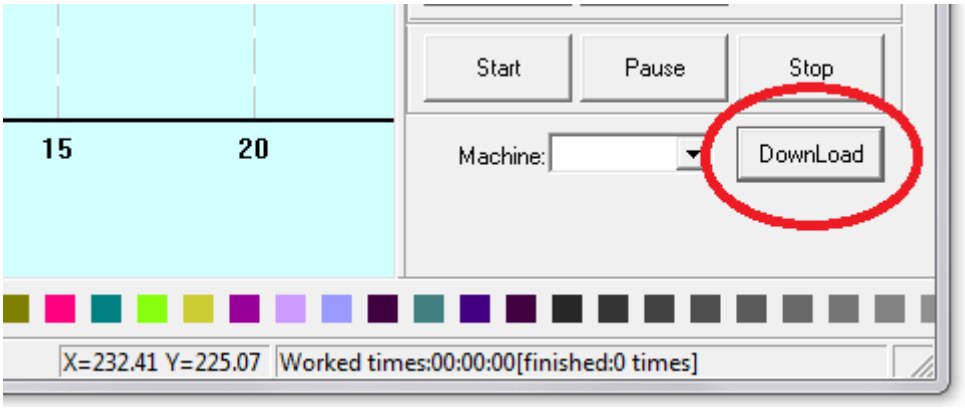
Since the BLACK color layer is set to the “Engrave” function, we need to choose some values for the speed, power, and scan gap. These values will be determined by your laser machine capabilities and the material properties. The picture shows good starting values for the project. Speed:325, Power:30, and ScapGap:0.070



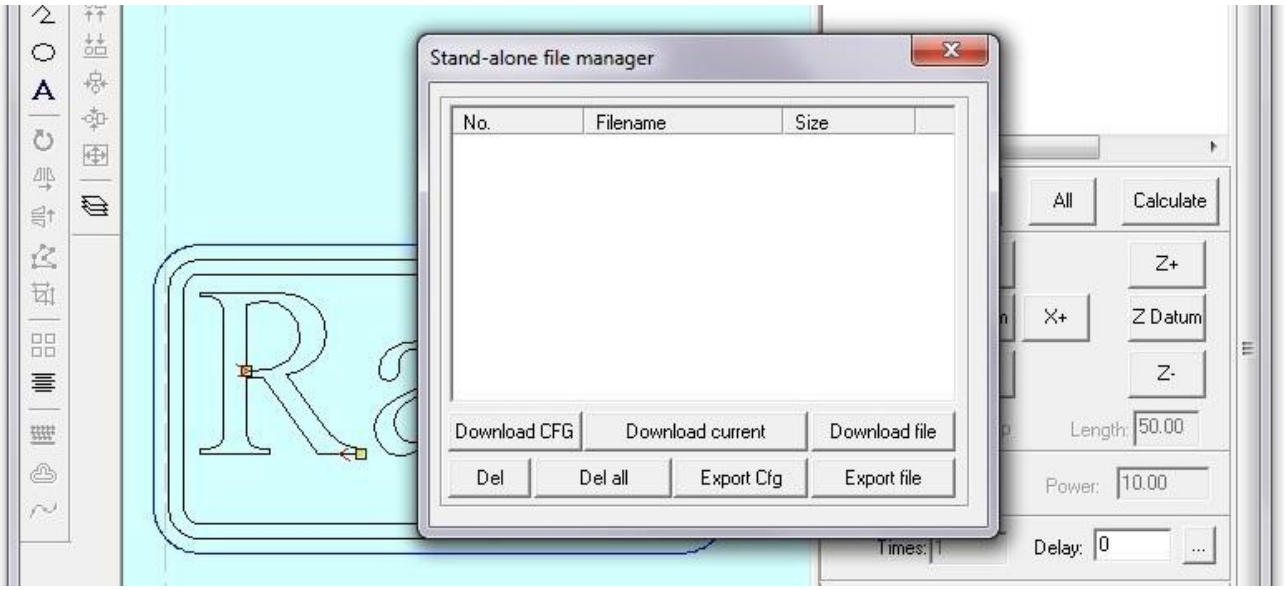
Since the BLUE color layer is set to the "Cut" function, we need to choose some values for the speed, power, and corner power. These values will be determined by your laser machine capabilities and the material properties. The picture shows good starting values for the project. Speed:15, Power:25, and Corner Power:25. The overlap would be used with materials that might have a cut lag while cutting or you are trying to eliminate a laser mark from the start-end cut operation.

Save the project to the computer. Make sure to save a filename that uses numbers and letters only. Do NOT use spaces, underscore, dash or any special characters in the filename.

This file has been saved with name of "RayTag.ecp". The *.ecp file extension is for this program and does not denote any
other software file format.



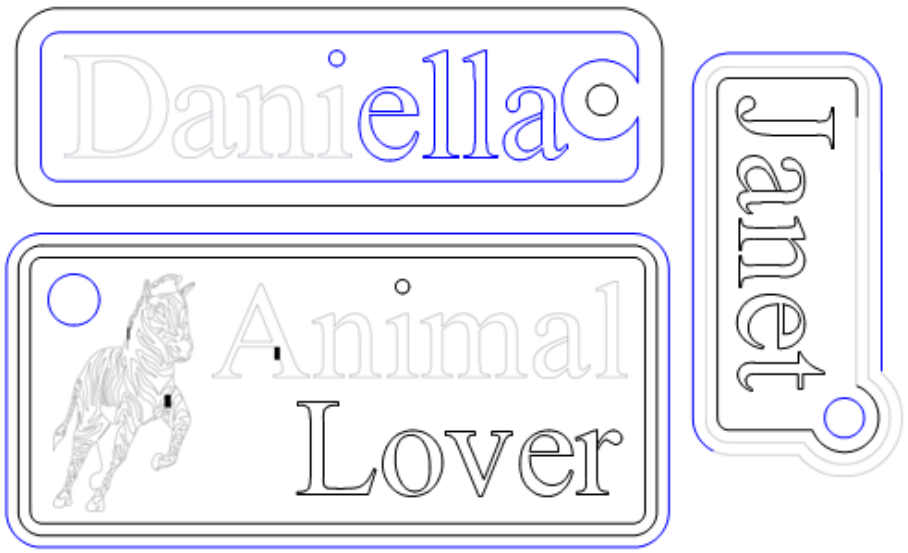
The project is drawn. The laser settings are made. The design project has been saved to file. The next step is "Download" the design into the laser machine. Make sure that the computer is connected to the laser machine by USB cable and that the laser machine is turned on. The computer should already have the drivers loaded.



The “Download” command will start a new connection with the laser machine through the “Stand-alone file manager”. It is a good practice to delete all files in the laser machine and to download only the current design project. Click on the “Del
all” button to erase the laser machine memory. Click the “Download current” to load the circtest.ecp from the LaserCut 5.3
software into the laser machine. The compiled file should be read as xx.mol file extension.

The laser machine should be ready to cut… Please remember to check focus and proper cutting material space.

Now that you have finished your custom tag with this tutorial, try to make a tag with some variations. You could import vector graphics such as DXF, HPGL, NC, Tajima, ... You could also import a JPG, BMP, or other style raster image. Try to
experiment with the engraved areas so that the letters of the name become raised rather than engraved.



More Resources & Tutorials……

Tutorial: Using Inkscape with Laser Cutters
https://youtu.be/pLXl7gwNNvs

Tutorial: 2D – 3D Design with the Laser Cutter!
Use 123D Make to Convert STL files to an .mol files that can be laser cut.
https://youtu.be/JImOkZFOxAQ

Zero-to Maker: Crash Course in Laser Cutting
http://makezine.com/2011/09/01/zero-to-maker-crash-course-in-laser-cutting/

Glossary of Laser Terminology, by Saleh J. Jany BDS MSc. HLD ABLS BLS
http://americanboardoflasersurgery.org/documents/LaserRelatedTerms.pdf

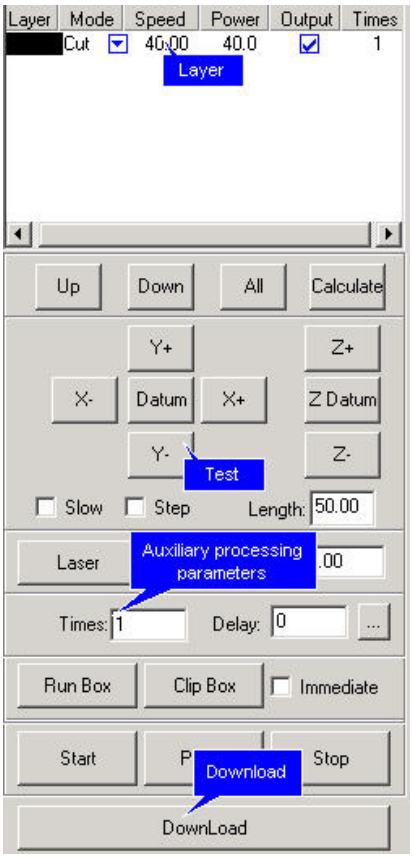
Fun Demo Idea…. Laser Cut Book Cover Project by Makezine
http://makezine.com/projects/make-33/laser-cut-book-covers/

Advanced Settings for Rabbit Laser Cutter:

There are 3 parts in the Laser Cutter interface:

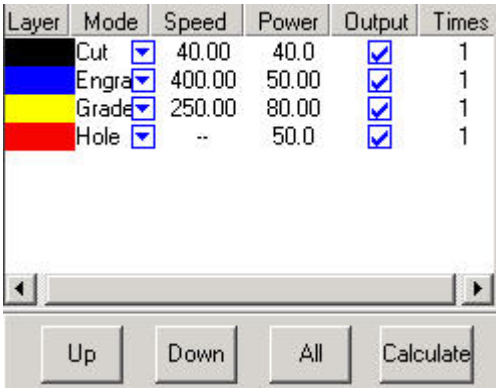
- LAYER
- TEST
- PROCESSING PAREMETERS

1st Maker Space offers a 3 hour workshop to prepare educators to maximize the potential of the Laser Cutter; learn how to adjust settings for various materials and functions.



LAYER

Main interface of “Layer”
Layers management is shown as below:

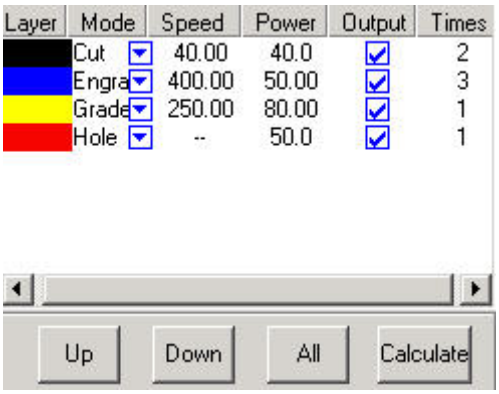


When there are many layers, the processing sequence is from the top down. Select one row and click Up or Down, and the sequence can be changed.

When there are many layers, select one row and click All, and all the processing parameters of the other layers can be set as the layer that has just been selected.

When changed the graphics or parameters, please click Calcul to save the processing parameters in processing file.

In the “Mode” column, work mode can be selected as following.

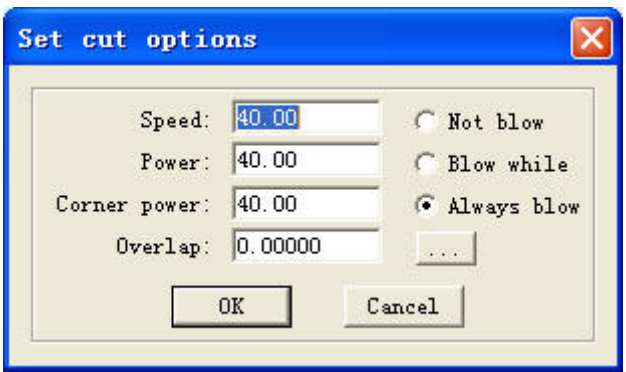


In the “Output” column, you can select that the current layer is output or not.

In the “Times” column, you can input processing times for the current layer.

Interface of “set cut” options

Dblclick the color bar on the “Layer” column, and the dialog box as shown below.



Speed: vector speed on X-Y axis

Power: the laser power when the layer is processed

Corner Power: the laser power when laser head runs on corners

Because when laser head runs on corners, the speed will slow down, if the power is constant, the corners will be cut deeper than others.

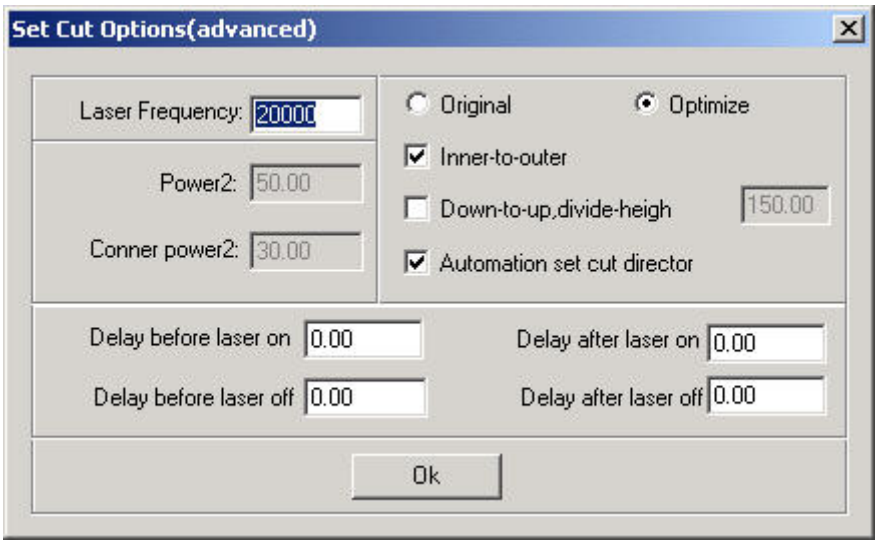
Overlap: When a close graphics can't be cut as it is (close), adjusting this parameter can avoid it. This may be caused by mechanical gaps. The best way to avoid this problem is improve the mechanical precision of the machine.

Not Blow: blowing function is closed.

Blow with Laser: blowing when laser on. Stop blowing when laser off. This function needs hardware support.

Always Blow: blowing when laser head moves and stop blowing when processing procedure finished.

: This is advanced layer options. Click this button.



Laser: This is the PWM frequency.

Original: The machine draws the graph according the route as it is been made.

Optimize: The software will calculate the route to improve processing efficiency. If you select this option, there are 2 options.

Inner-to-outer: cut from inner to outer.

Down-up: cut from down to up according the number of "divide-height".

Automation set cut direction: The software will confirm the direction automatically. If you need to change the direction, please cancel this function.

Power2: laser power of the second laser head. This needs hardware support.

Corner power2: corner power of the second laser head. This needs hardware support. If you need to set output order, "Original" should be selected.

Delay before laser on: delay before laser on.

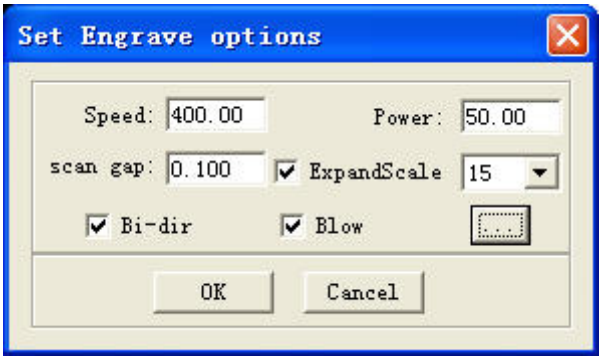
Delay after laser on: delay after laser on.

Delay before laser off: delay before laser off.

Delay after laser off: delay after laser off.

Interface of "set engrave" options

Dblclick the color bar on the "Layer" column, and the dialog box as shown below.



Speed: engraving speed on X-axis.

Power: the laser power when a layer is processed.

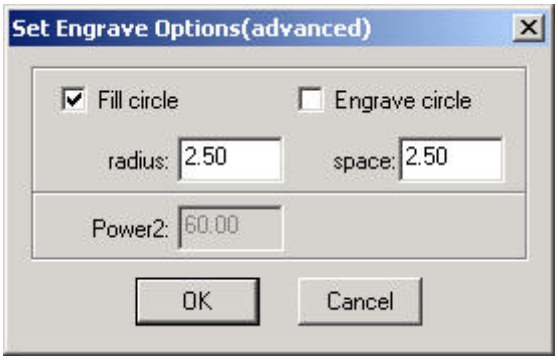
Scan gap: movement distance on Y-axis when engrave a row on X-axis.

Bi-dir: when engraving, laser emit on both negative X-axis and positive X-axis. When cancel this function, laser emit on only one direction.

Blow: blow or not. This function needs hardware support.

Expand scale: when engraving small letters, the width of transverse stroke may be smaller than the actual size. Adjusting this parameter can compensate it.


: This is advanced layer options. Click this button.



Fill circle: select this option, and small circles will fill in the graphics.

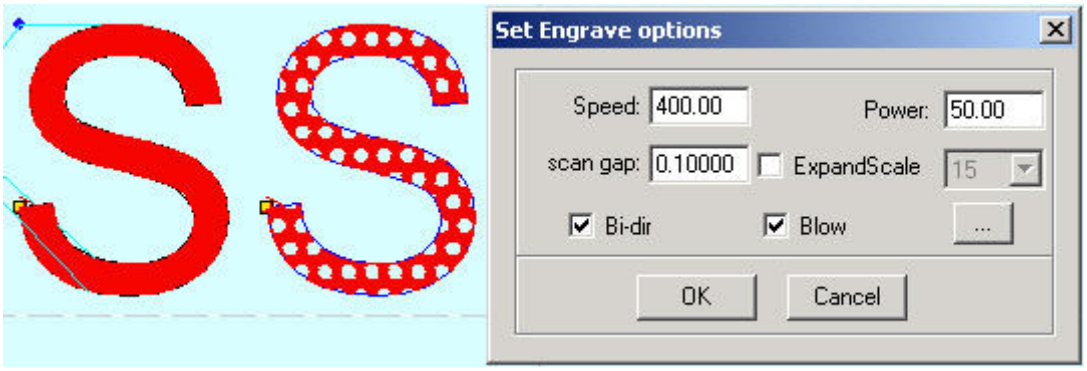
Engrave circle: this option determines the circle will be engraved or not.

Radius: radius of the circle.

Space: space between the circles.

Power2: laser power of the second laser head. This needs hardware support.

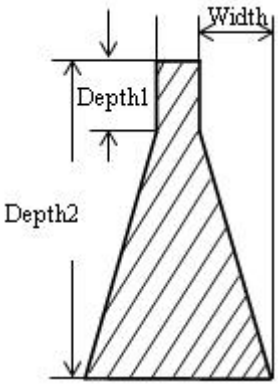
Select this option and small circles will fill in the graphics as following.



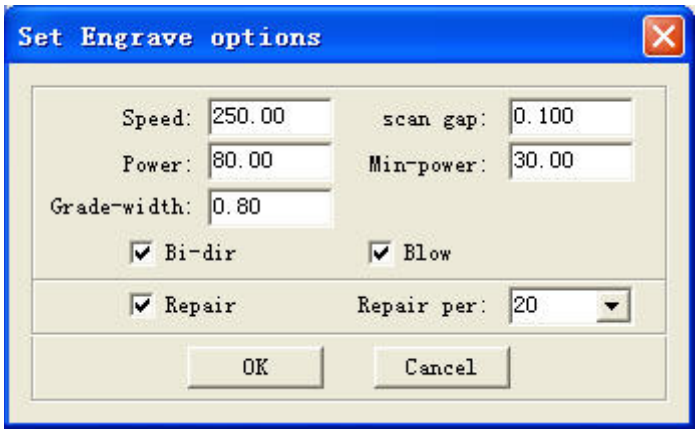
The right “S” is the result of selecting “Fill circle”. You can change the radius and space by inputting different parameters.

5.1.1 Interface of setting grade engrave options

Sketch map of grade engrave as following.



Dblclick the color bar on the “Layer” column, and the dialog box as shown below.



Speed: engraving speed on X-axis.

Scan gap: movement distance on Y-axis when engrave a row on X-axis.

Power: the laser power when a layer is processed. This parameter determines the depth of the slope.

Min-Power: the lowest laser power when grade engraving.

Grade-width: the width of grade.

Bi-dir: when engraving, laser emit on both negative X-axis and positive X-axis. When cancel this function, laser emit on only one direction.

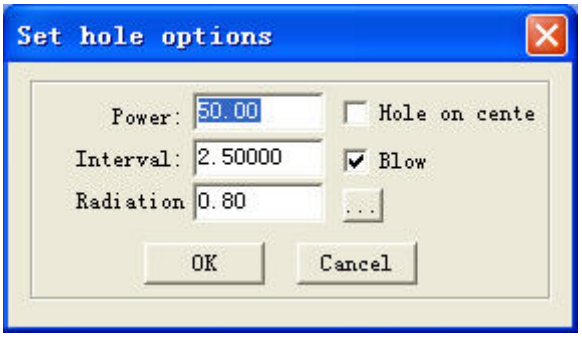
Blow: blow or not. This function needs hardware support.

Repair: select this option and the engraved letters will be clearer.

Repair per: change the parameter will adjust the definition of the engraved letters.

Interface of "setting hole" options

Dblclick the color bar on the "Layer" column, and the dialog box as shown below.



Power: the laser power when a layer is processed.

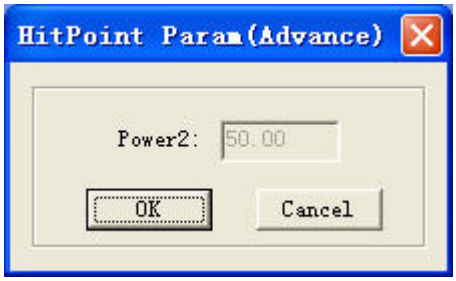
Interval: the space between two adjacent holes.

Radiation time: delay time for a hole. It determines the size of holes.

Hole on center: hole on all the center of the close graphs.

Blow: blow or not. This function needs hardware support.

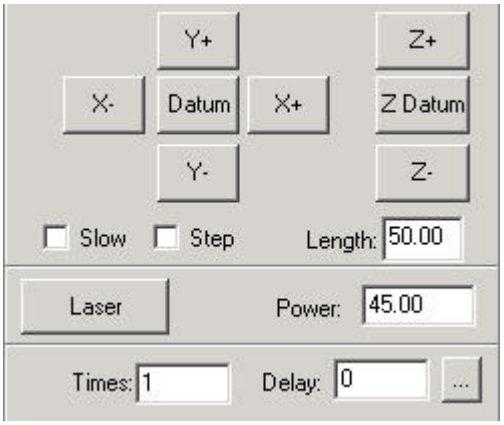
: This is advanced layer options. Click this button.



Power2: laser power of the second laser head. This needs hardware support.

All the defaults are last saved parameters.

TEST



X-, X+, Y+, Y-, Z+, Z-:

Move the axis.

Datum, Z Datum: Click this button and the laser head (or Z) will move to the home point of the machine slowly (the speed is determined by “Datum Speed” that you can change in the Option” dialog box). Then the laser head will move to the origin point quickly (the speed is determined by “Quick Speed” that you can change in the “Option” dialog box). This can eliminate the cumulate error. Generally, the machine should be reset before processing. When run the software, it will be reset automatically (this function can be cancelled as you prefer).

Slow: No use. **Step:** No use.

Length: No use.

Power: It determines the intensity of the laser power supply. The minimum value is 0 and the maximum value is 100.

Laser: Laser on/off.

Auxiliary processing parameters

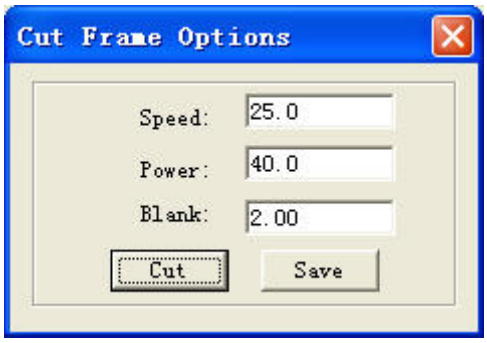
In the following dialog box, some auxiliary processing parameters can be set.

Times and Delay: If input 10 in “Times” and 20 in “Delay”, then press ”Run”, you can get 10 same graphics. And it will stay for 20 seconds after every processing finished. The 20 seconds is for feeding and taking down material. Different time can be set as you need. This function can increase efficiency a lot.

Immediate: If this option is selected, the software will take the position that the laser head is as original point. If this option is not selected, the original point will be the position you set.

Run Box: Click this button, and laser head will move as a rectangle without laser emitting according to the size of the graphics. This function is used for confirming the location of work piece.

Clip Box: Click this button, laser head will move as a rectangle with laser on according to the size of the graphics. This function is also used for confirming the location of work piece. Click this button, and you can see the following dialog box:



Speed: you can choose different speed according to different material. It's better to confirm proper speed through testing.

Power: the laser power when cutting.

Blank: distance between processing graphics and the edge of cutting piece.

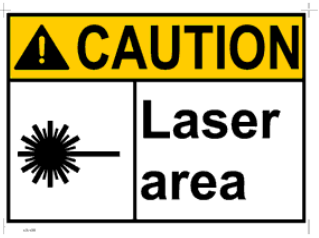
Save: save the parameters for next data.

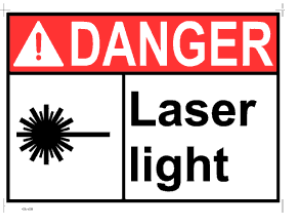
REMEMBER: SAFETY FIRST!!!

Notes:

Record settings that work best for various materials!

Safety





Keep all access doors closed during operation!

Wear Laser-Safety glasses!

Do not use paper for aligning the laser path - Paper burns and catches fire too easily!

Please use a thin wooden plate, plastic sheet, or cardboard, or layered masking tape!

MAKE SURE VENTILATION

IS TURNED ON & WORKING PROPERLY!

Proper ventilation must be observed to ensure no harm to persons in the areas!

If you smell gas (any combustible gas …such as propane), do not operate the laser machine. The laser light would be more dangerous than an open flame. The condensed light of the laser would be expected to ignite a combustible gas!

Do NOT over-ride any of the safety interlocks!

Do NOT bypass Flow Detect on water pump system!

Do not access the laser tube and electronics panels during operation or any time! Call 1st Maker Space!.

Do not place materials or appendages in the path of the laser light beam!

Do not place materials or appendages in the path of the moving axis!

Make sure the axis limit switches are accessible and not obstructed!

Do not be afraid to use the
EMERGENCY STOP
button on the right side of the machine!