KNK Force Print and Cut (PNC) Calibration Using Sure Cuts a Lot

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If You're New to SCAL

If you've not yet set up your Force to cut from Sure Cuts a Lot, please watch the following video by Darrel Farris:

https://www.youtube.com/watch?v=ZcJj5l7TY34

What is a PNC Calibration?

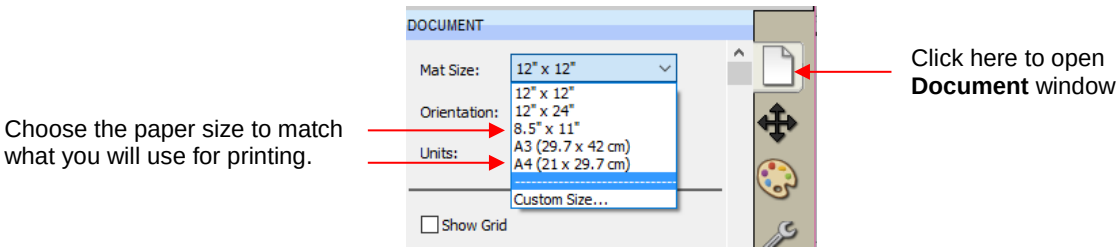
- In order to get precise PNC results, you must tweak the camera calibration. This is nothing more than determining how far away the camera is located relative to the tip of the blade. Because the camera is manually installed, the distance from the center of the camera to the tip of the blade will vary some from one Force to the next. Also, you will want to use the same blade holder with all of your PNC applications, as the distance might change with slight differences in the holders.
- The distance is measured in an X direction and in a Y direction where X is how far right the center of the camera is located relative to the blade tip. Then Y is how far forward the center of the camera is located relative to the blade tip. Later in this tutorial, the location for entering these numbers will be shown.
- The calibration process involves performing and repeating a PNC to see how much you need to adjust the **X** and **Y** values in order to get perfect results. And you SHOULD be able to get perfect PNC's! :)

What You Need for Calibrating

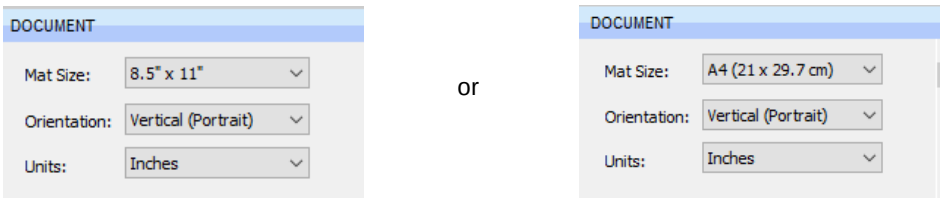
- You need to be well rested! You don't want to start learning the PNC process when you are tired, stressed, or in a hurry. Mastering a PNC comes when you have the time to repeat it about 4 times in a row. At that point, you will not only have repeated the process enough times to feel very comfortable with the order of the steps, but you'll have your calibration perfected and then be ready to do future PNC's quickly and with ease.
- Next, you will need the following items:
  - ◊ Sure Cuts A Lot
  - ◊ Printer
  - ◊ Blade holder
  - ◊ Copy/printer paper in either Letter size (8.5" x 11") or A4 (21 x 29.7 cm)
  - ◊ Calibration File (available here: http://cutterpunk.com/files/knk/BasicShapes.zip)
- ***Important!*** In order to facilitate the calibration proces, please follow all instructions exactly. Later, after calibration, you can change up methods, such as paper orientation and mat sizing, as desired.

Preparing the Calibration File

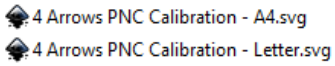
(1) It is strongly recommended that you set the dimensions to match the paper size you'll be using for the calibration. Working closer to the origin of the Force reduces unnecessary movement that can introduce factors which may affect accuracy. In the **Document** window, open the **Mat Size** drop down menu and select either 8.5" x 11" or A4 (21 x 29.7cm):



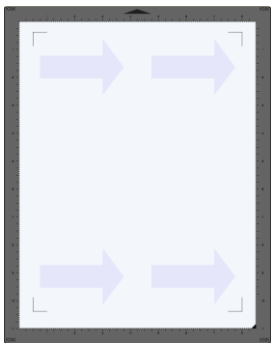
(2) Next change the mat orientation, if needed, so that you are working in **Portrait** mode. Again, after calibrating you can work in **Landscape** mode if you prefer. However, in order to use the diagram for adjusting calibration settings, it is very important to use **Portrait**. Your settings should now look like this:



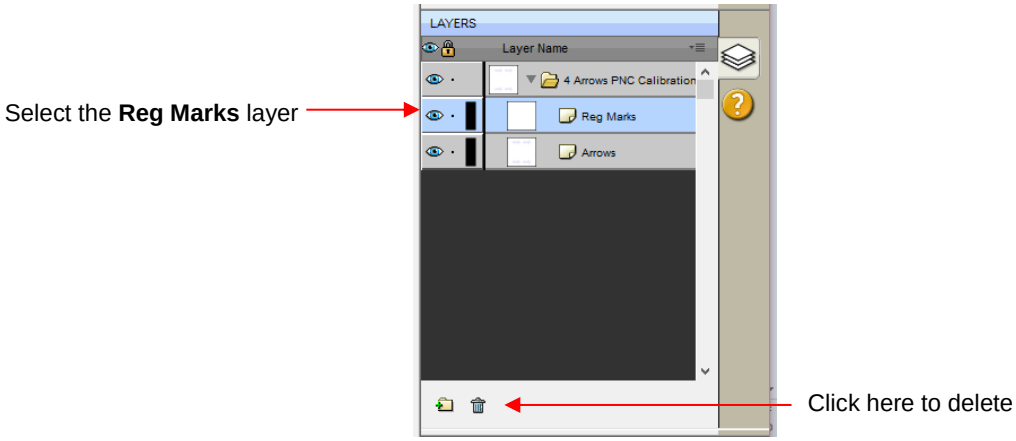
(3) Inside the **Basic Shapes** folder from the downloaded zip file, you will find the following two files interspersed with the other files:



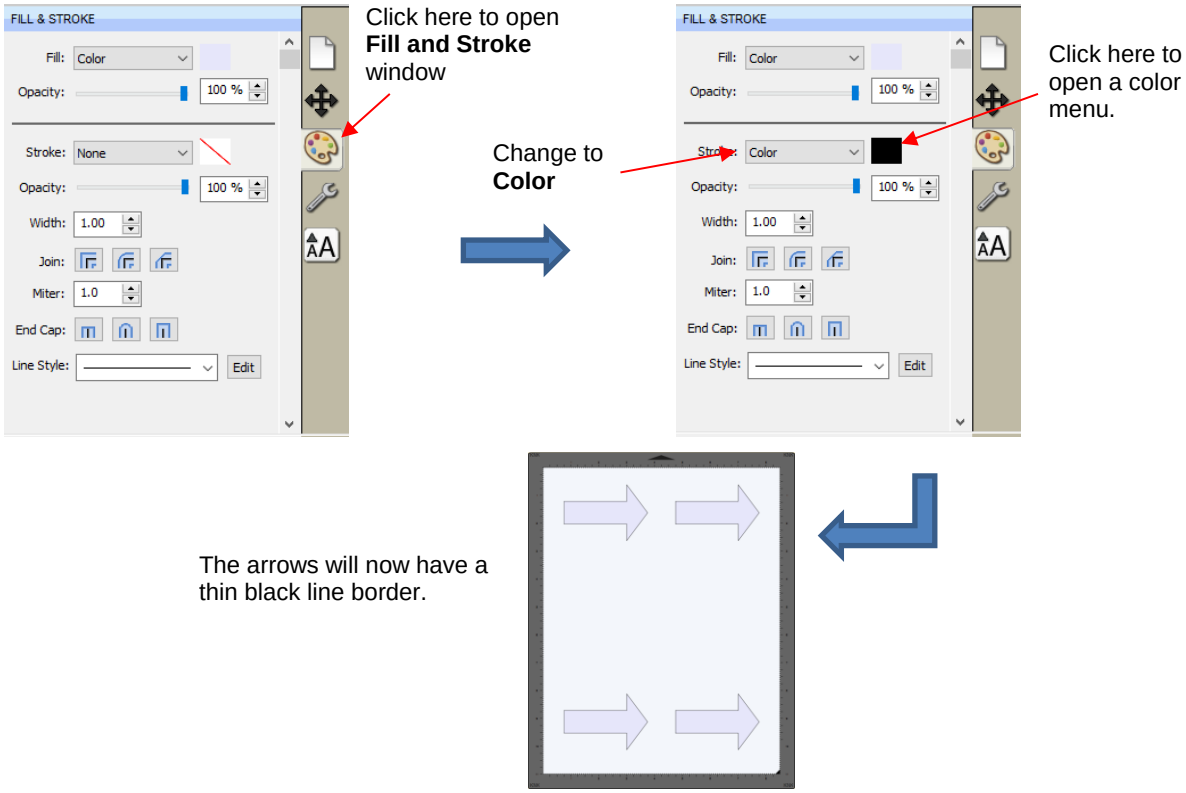
(4) Use **File>Import** to open whichever one matches the printer paper you're using, i.e. A4 or Letter. Move the imported shapes so they are roughly centered in the document area:



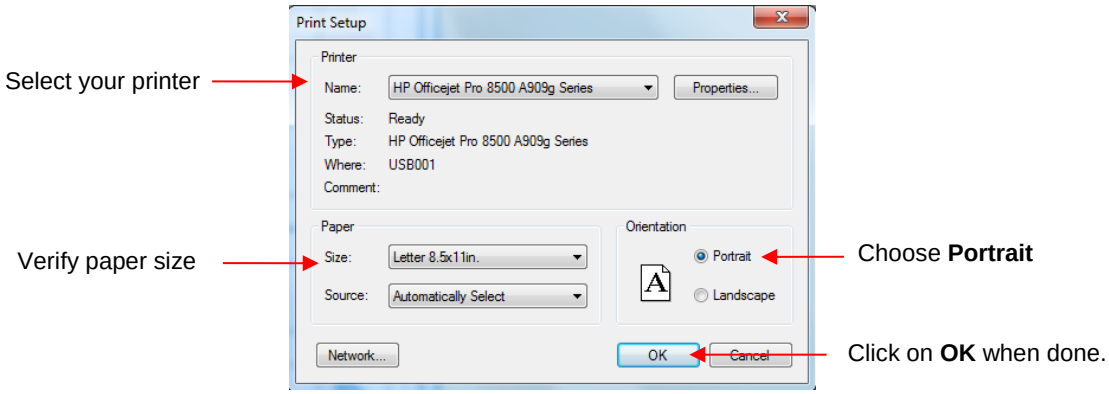
(5) Because this calibration file was created for calibrating in C3, it contains a registration mark layer not needed in SCAL. On the **Layers Bar**, select the **Reg Marks** layer and delete it:



(6) It is also recommended that the arrows be outlined for printing. Select that layer and click on the **Fill and Stroke** icon. Change the **Stroke** from **None** to **Color** and then click on the box to the right of that to open a color selection menu.



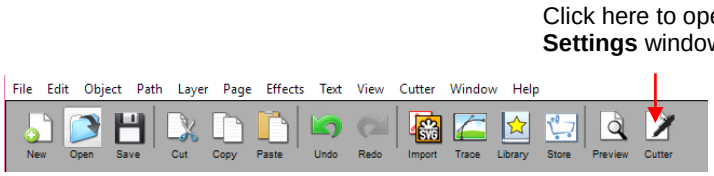
(7) Go to **File>Print Setup**, select the printer you plan to use, paper size, and **Orientation**:



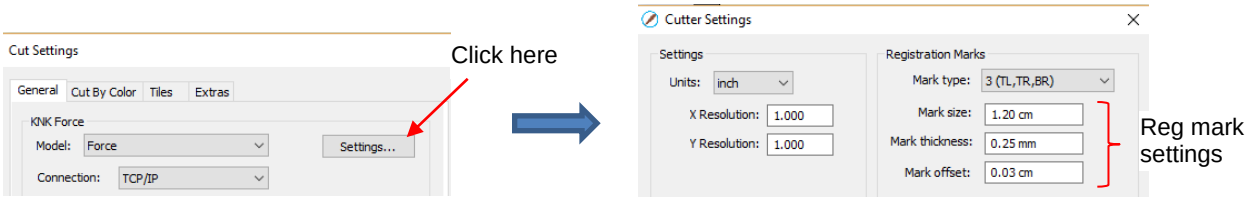
(8) Do NOT use **File>Print** at this point because the reg mark settings still need to be adjusted. This will be done in the next section.

Entering Settings and Printing

(1) Click on the **Cutter** icon to open the cut window:

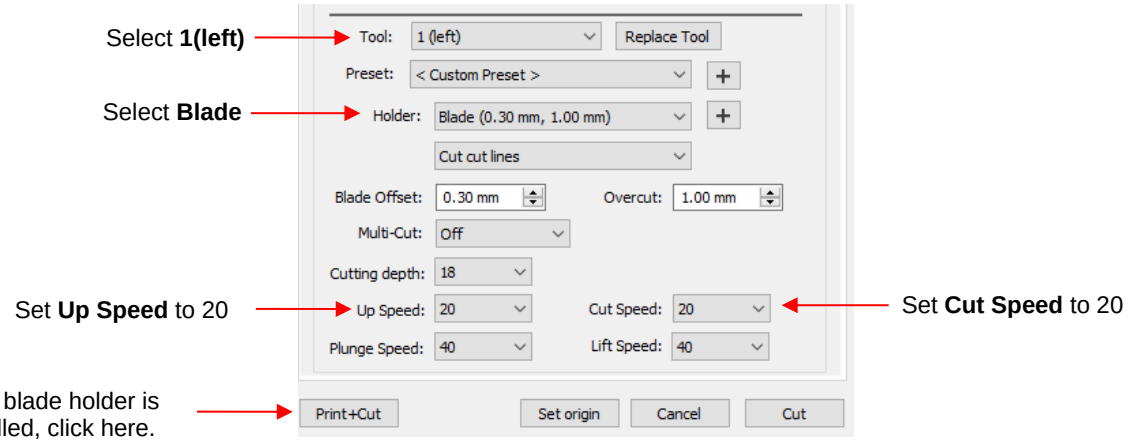


(2) Click on the **Settings** button to open the **Cutter Settings** windows:



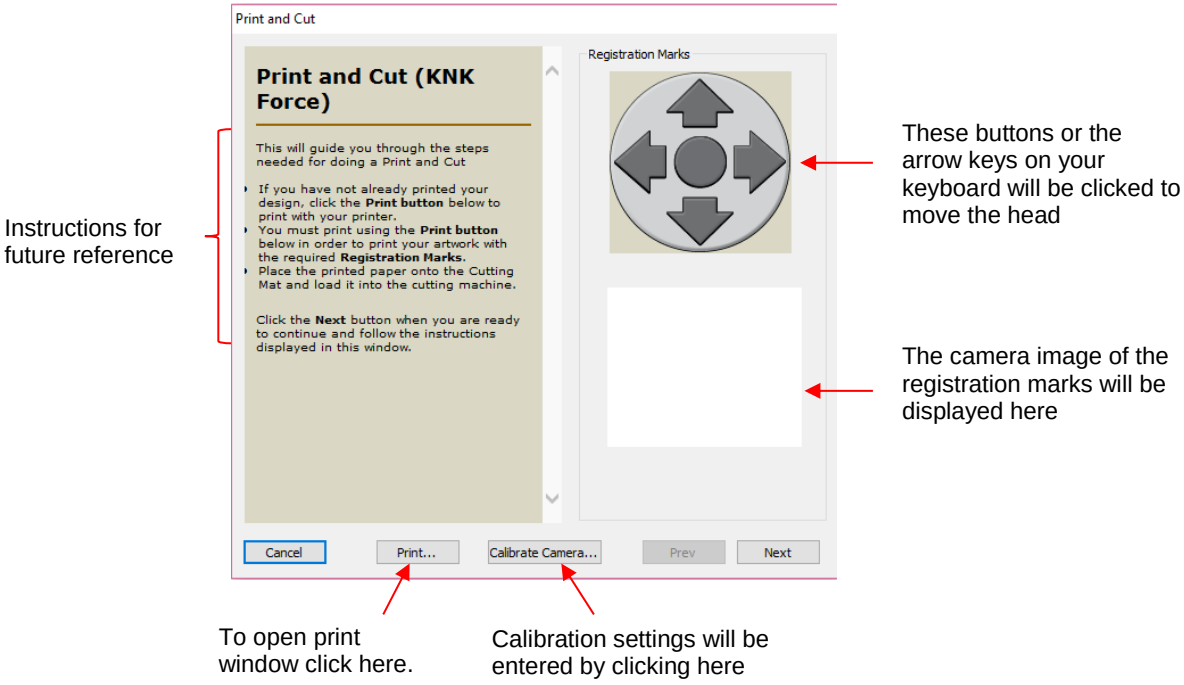
(3) You can modify the settings for the reg mark size, line thickness and offset from the image to be cut. The latter one, **Mark offset**, should be changed from the current setting to 0.03 cm so that the reg marks will be as close as possible to the printed image. This isn't an absolute requirement but it does allow more of the page to be used for your project. Once the settings have been changed, click on **Save** at the bottom of that window.

(4) Under **Tool**, select **1(left)** and enter the following settings. Use whatever **Cutting Depth** works best for cutting your printer paper. **Important:** Keep the **Up Speed** and **Cut Speed** low, as shown:

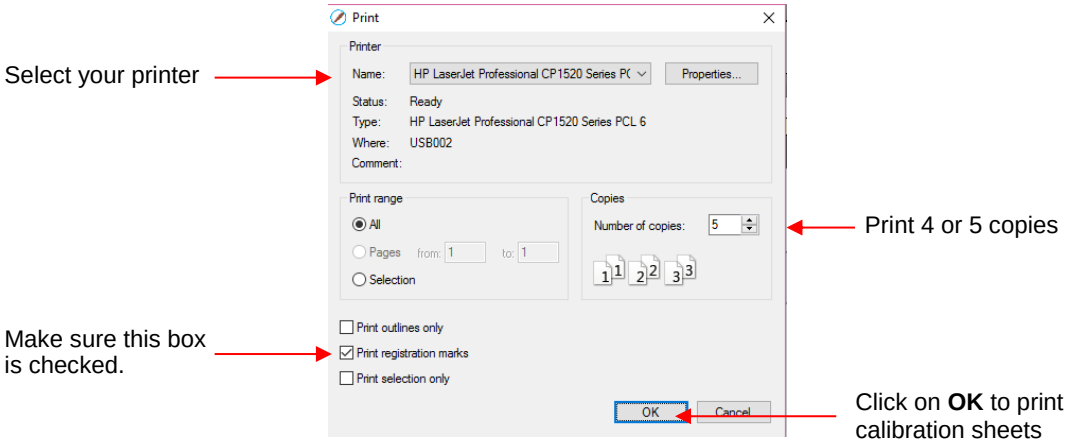


(5) Load the blade holder onto the left side using **Replace Tool.** Then click on **Print+Cut.**

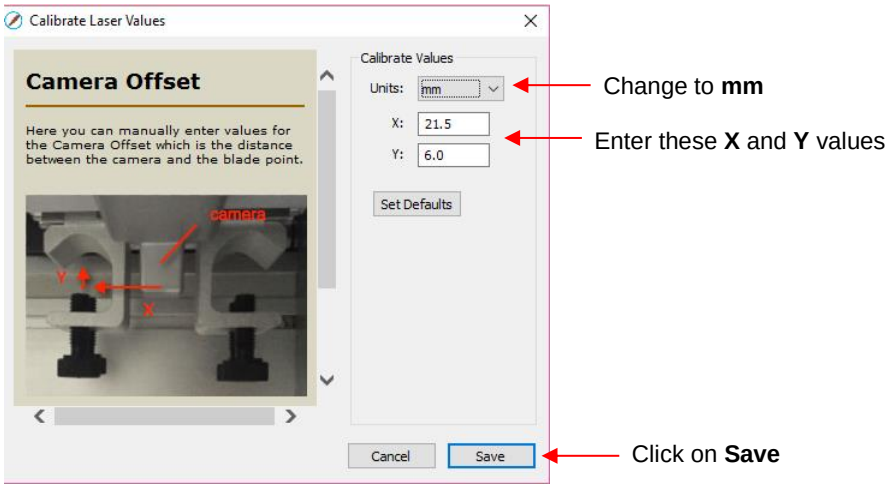
(6) The following **Print and Cut** window will open.



(7) To print the arrows with the registration marks, click on **Print:**



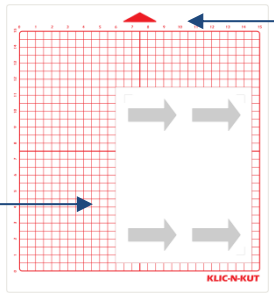
(8) After printing, click on the **Calibrate Camera** button. It is highly recommended that the calibration numbers be entered and adjusted in mm. So, change the **Units** and then enter the **X** and **Y** shown:



Setting the Registration Marks and Cutting

The general process is to have the blade holder near each mark and then the camera sends a photo to the screen for tweaking the alignment. If you make the effort, at the start, to have the blade holder centered over the corner of the upper left printed registration mark, it makes the rest of the process go much faster. Also, do not have a bright light shining onto the printout as it can wash out the printed registration marks and make it more difficult to do the alignment.

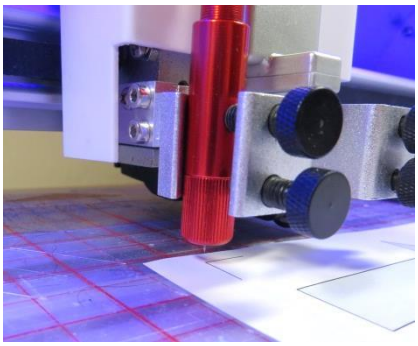
(1) Place the printout onto the mat and align with the grid. As you are facing the Force, the printout should be on the mat in a portrait orientation with the arrow pointing towards the right end cap. It's important to have the printout fairly straight so that the camera will be able to move within a set distance of the target. The same goes for inserting the mat into the Force- align as straight as possible, using the horizontal grooves on the Force itself.



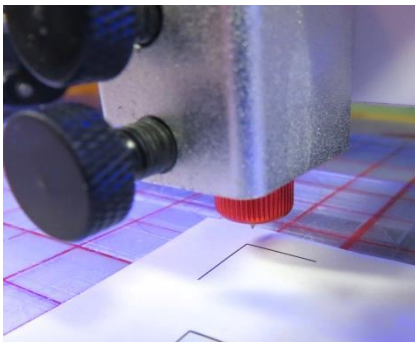
2. Insert the mat into the Force with this triangle pointing away from you.

1. Place the printout onto the mat with the arrows pointing to the right.

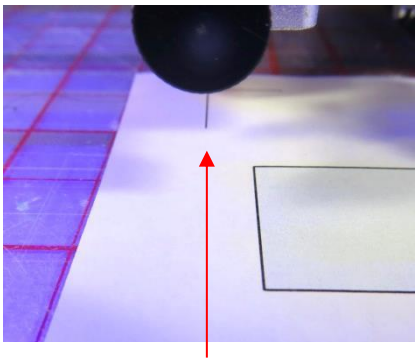
(2) Click on **Next** and the head will move towards the upper left registration mark. You will then either click the onscreen direction buttons or use the arrow keys on your keyboard to move the tip of the blade approximately over the corner of that registration mark. Note that smaller increments can be made by holding the **Shift** key while moving. Here are some photos take at different angles:



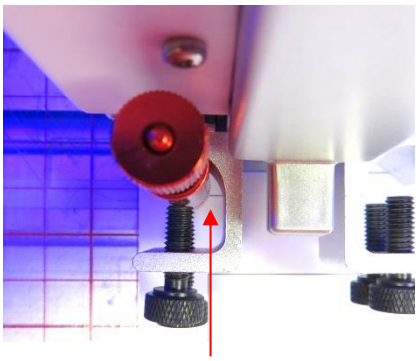
Close up from the left side



Close up from the right side



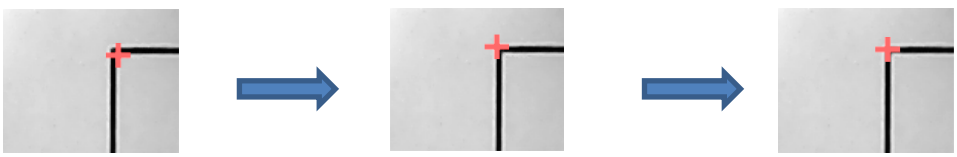
Close up face on to the front screw. Note how the vertical line of the reg mark is centered with the screw.



Close up take from above the blade holder. Note how the horizontal line of the reg mark is centered with the middle of the blade holder

(3) Hint: Another method that I use is to put the printout onto the mat after after the head has moved to the first registration mark. Works great!

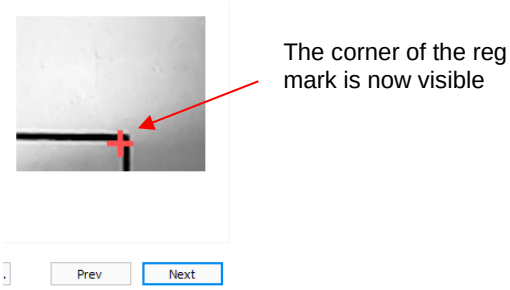
(4) Once you have the blade tip approximately over the corner, click on **Continue**. The camera will then move into place and send an image. On your computer (or smart device) screen, click on the corner of the reg mark and the red "**+**" will jump to that location. Then use either the on screen buttons or the arrow keys on your keyboard to perfectly align the center of the red "**+**" with the corner of the reg mark:



(5) Once the red "+" is centered as shown in the far right screenshot, then click on **Next**. The head will move to the next reg mark and the process is repeated. You do not necessarily have to check that the blade tip is over the second and third marks before having those images sent. It should be very close.

(6) If you cannot see the corner of a reg mark in any of the projected camera images, note which direction the camera needs to move and then click on **Prev** at the bottom. In the following example, which occurred at the top right registration mark, you can tell that the camera needs to move down, as only the top line of the reg mark is visible:

(7) After clicking on **Prev**, you will be taken back to the prior screen. Move only one or two increments in the directions needed and click on **Next**. It doesn't take very many clicks to move a significant distance relative to the size of the magnified image projected by the camera. For example, in this case above, only one click of the down arrow resulted in the needed change:



(8) The reg mark is now clearly seen and the red "+" can be moved to the corner of that reg mark. Once aligned, click on **Next**.

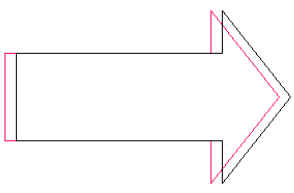
(9) Once you've completed all three, the head will return home to correct the blade direction and then will proceed to cut out the shapes.

Adjusting the X and Y Camera Offsets

(1) After the print and cut is completed, examine how the cut lines were made relative to the printed lines. If the offset is large enough, use a metric ruler to measure. If the offset is very small, then just estimating will be fine as you refine your calibration.

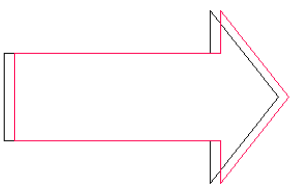
(2) In the following diagram, the red lines represent the cut lines and the black lines represent the printed lines. Use this diagram to determine whether your **Offset** values need to raised or lowered:

If the red cut line is left of the black print line, then increase the value of X.



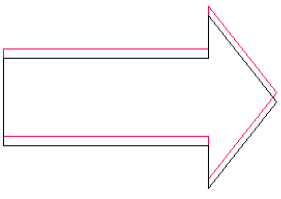
Red cut line is 1mm left of the black line: increase X from 21.5 to 22.5

If the red cut line is right of the black print line, then decrease the value of X.



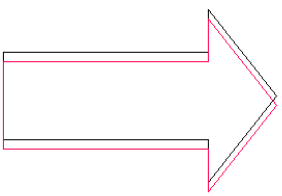
Red cut line is 1mm right of the black line: decrease X from 21.5 to 20.5

If the red cut line is above the black print line, then increase the value of Y.



Red cut line is above the black line: increase Y from 6.0 to 7.0

If the red cut line is below the black print line, then decrease the value of Y.



Red cut line is below the black line: decrease Y from 6.0 to 5.0.

(3) Go back to the calibration window (**Cutte**r>**Print + Cut**>**Calibrate Camera**). Modify the **X** and **Y Camera Offset** settings. Again, switch to mm before entering new numbers. Start with at least 1 mm adjustments (like shown above). Click on **Apply Changes** before leaving this window.

(4) It's a good idea to keep track of prior values so that you'll know which direction to change for subsequent calibration tests. Remember that you should expect to get perfect results, so keep adjusting those **X** and **Y** values until you get there. After adjusting by 1 mm, you should then adjust by 0.5 mm. Then even smaller. Once you are adjusting by 0.1 mm, you should be able to achieve the optimum settings. If you are still off by "just a hair" in one direction or the other, then adjust by a final 0.05 mm.

(5) During the testing, you may find that one side is aligned but the other is not. For example, the cut line may be perfectly aligned with the print line on the lower side of the arrow but a little above the arrow along the upper side. Adjust the calibration based on the side that is off.

(6) If you find that one or two arrows are perfect but the others are off:

- ◊ Check the **CS** and **US** settings. Too high of a speed can cause inaccuracies.
- ◊ Make sure the pinch wheels are still centered under the grey rectangles.
- ◊ Make sure the bottom of the mat, the pinch wheels, and the grit shafts are clean.
- ◊ Make sure nothing is interfering with the smooth traveling of the mat. This can include mat guides and support boxes in the back of the cutter.
- ◊ Make sure the blade isn't cutting too deeply into the mat. Lower the **CD**, if necessary.

(7) Once you have your calibration completed, write down these final **X** and **Y offsets**.