



## 7.0 - MAKING A PEN FIXTURE FOR ENGRAVING PENS

**Material required: Acrylic, 9 by 9 by 1/4"**

**Difficulty Level: Advanced**

Engraving wood (or painted metal) pens is a task particularly well suited for laser engraving. It's quick and easy – *if* you have a fixture that accurately positions the pens on your engraving table. For this job, we'll design and make a fixture that we'll use later for engraving some pens. The finished pen fixture is shown in Figure 7-1.



Figure 7-1 Finished Pen Fixture

### 7.1 Fixture Job Plan

Here's our plan for making the pen fixture:

- We'll use a 1/4 thick piece of acrylic material measuring 9 by 9 inches.
- The finished fixture will have a single column of pen locations, or stations.
- GravoStyle5 lets us design on layers. This is conceptually the same as doing design work on different pages of a book, with one difference. The difference is that GravoStyle5 lets us view all the layers together (one on top of another), or, we can view the layers one at a time. We'll place this pen fixture on a second layer and we'll later use the top layer for the names we want to engrave on the pens.
- We'll start by designing the top-left station. It will have a six-inch long by 1/8<sup>th</sup> inch high slot that we'll cut out of the

#### **POWER TIP**

*We're using acrylic material because we need a thick piece and we have to cut slots out of it. Cutting through thick material is a challenge, but acrylic is one of the easiest materials to laser cut. To make it easier yet, GravoStyle 5 Laser working with a Gravograph laser engraver lets you setup the job to cut a little at a time in multiple passes, automatically focusing the laser beam deeper after each pass.*



material. This slot will provide the vertical position for a pen; the pen will rest in the slot.

- We'll design a ruler scale to aid in locating the pen side-to-side in the slot.
- We'll use GravoStyle5's duplication tools to repeat the top-left station (slot and ruler scale) to an array of one across by six down with a vertical pitch of one inch between the slots.
- We'll assign different colors for the three types of laser engraving we'll have to do for this fixture. The three are raster (for the numbers on the ruler scale), vector lines (for the ruler lines) and vector cuts (for cutting the slots out of the material.
- Finally, we'll send our template job to the table for engraving and cutting.

**LOOK FURTHER**

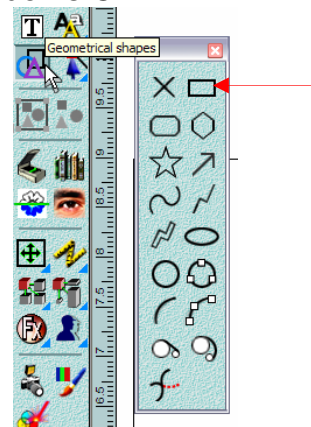
*When we use layers, we do our work on one layer at a time, although we can switch from layer to layer. We'll call the layer that's enabled for design the "active layer" at that time. GravoStyle5 sends the design of the active layer only to the table when we engrave. This feature is very powerful for using templates that can be seen on-screen, but not engraved, for locating our design work. When we engrave pens, the design of our pen fixture on a then inactive layer will be our on-screen template – usefully in view, but not engraved.*

## 7.2 Designing the Slot

Start a New job with dimensions of 9" by 9". The default border is Ok.

Open the fly-out toolbar of the "Geometrical Shapes" tool icon (Figure 7.2). Select the rectangle tool. Click and drag a short distance anywhere on the material and press the **F2** key (with the left mouse button still depressed).

Release the mouse button when the dialog opens. We will enter precise dimensions for the rectangle (our slot) as well as a precise location. Figure 7-3 shows this dialog box with the dimensions to be entered.



**Figure 7-2  
Geometrical Shapes  
Fly-Out Toolbar**



We are specifying the rectangle (slot) to be 6 inches wide by 0.125 inches high. We are locating the center left edge of the slot 8" from the bottom (Y-zero position) which is 1" from the top. Click "OK" to accept these values and we'll see the finished slot (Figure 7-4). Press the shortcut key combination Ctl+8 to view in Wire mode.

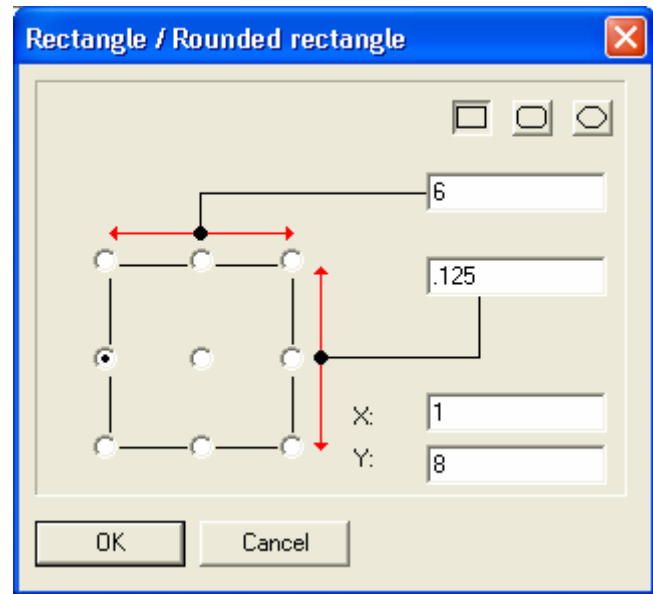


Figure 7-3 Designing the Slot

To return to Select mode, either click the Select arrow or press the Space-bar on the keyboard.

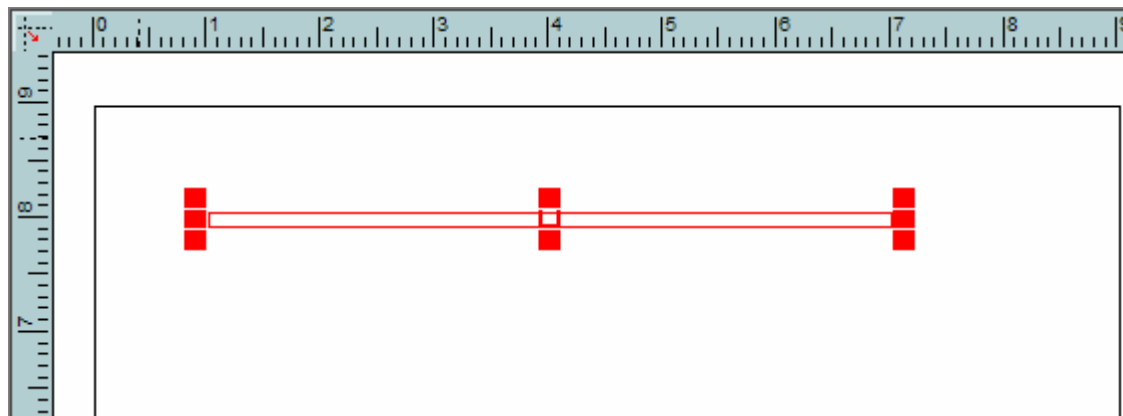


Figure 7-4 Finished Slot

**TIP**

*Why a slot height of only 1/8<sup>th</sup> inch? 1/4 inch would make it a little easier to position pens, but it would make text positioning more difficult.*

*The reason: as the slot becomes wider, the body of the pen sinks deeper into the slot, but the pen's clip cannot drop below the top surface of the fixture. As the pen lowers relative to the clip's location, the clip is forced to rotate up and may get too close to the desired engrave area.*



### 7.3 Designing the Ruler

GravoStyle5 has a powerful tool that lets us design scales and rulers. It's located in the "Special Tools" fly-out toolbar (Figure 7-5). Click on this tool to start the Dials & Scales wizard.

In the first dialog window (Figure 7-6), we'll select a linear scale. We'll enter an X value of 1.000 for the origin and a Y value of 7.500. This will position the scale just under the first slot. The origin is the starting

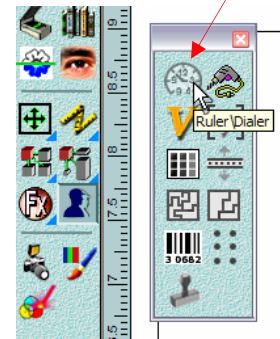


Figure 7.5 RulerDial Tool

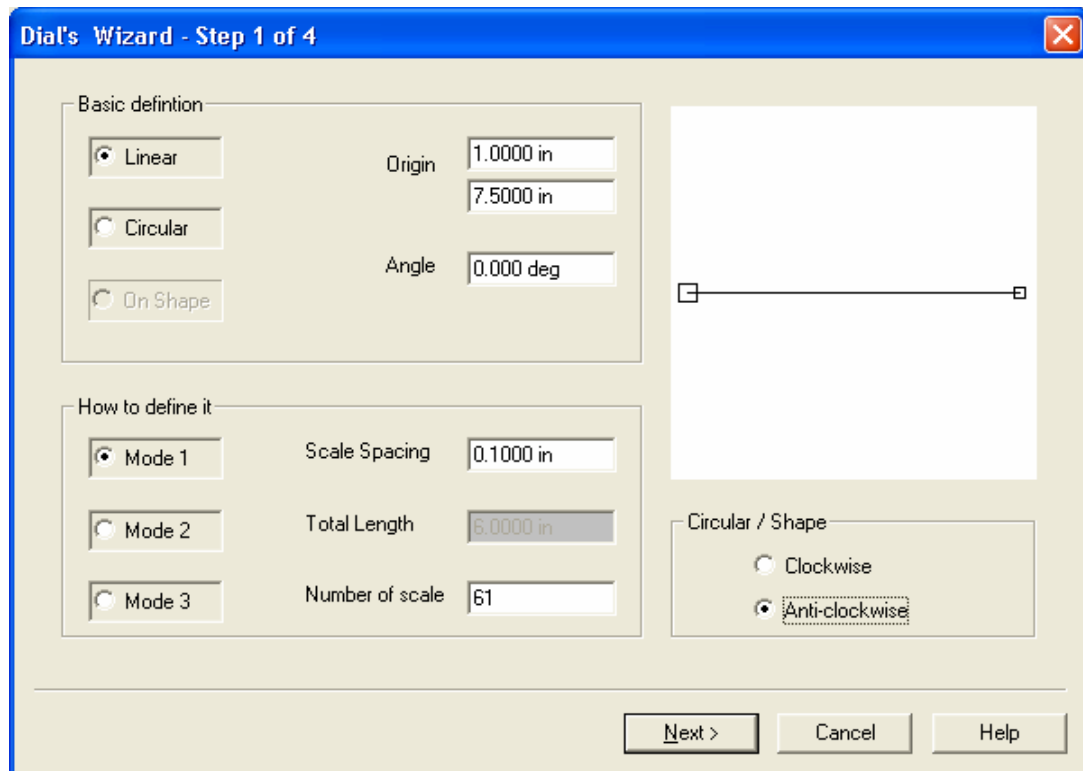


Figure 7-6 Ruler Design Window 1

point (left end) of the spine of the scale.) We'll leave the default angle at zero. We'll select the first of three scaling modes and enter a .1 inch distance between the scale's tick lines and a total number of 61 ticks. (6 inches at 10 ticks to the inch plus the "0" tick.)



The scale so far is depicted in the area at the right of the dialog window. The tick marks aren't shown because we haven't yet specified their size.

Notice that the line depicting the scale's spine has a small square at its left end and a larger square at its right end. The larger square represents the scale's

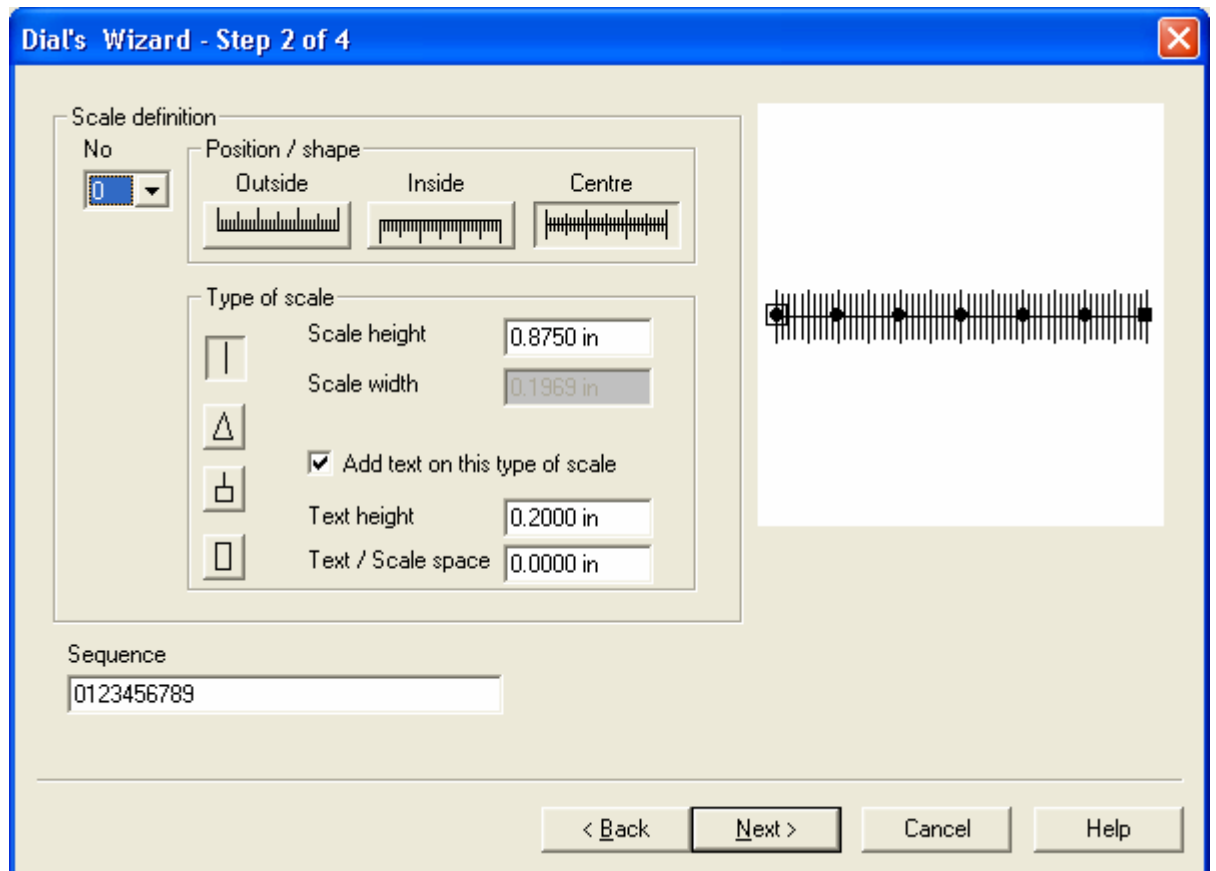


Figure 7-7 Ruler Design Window 2

starting point; in this case it would read from right to left, which isn't what we want. We'll select "**Counterclockwise**" and the sense of the scale will reverse to what we want, reading from left to right.

We'll click on the "**Next**" button and move on to step 2 (Figure 7-7).

In this window we'll have to define our scale as a repeating sequence of ticks. There are ten of them in the sequence. We define the first sequence only and the program automatically repeats it as required. We begin counting at zero. Our sequence starts with a long line for the beginning, or "0" tick. Ticks 1, 2, 3



and 4 will be shorter ones. We'll make the fifth one (at ½ inch) the same length as the "0" tick. Ticks 6,7,8 and 9 will be the same size as ticks 1,2, 3 and 4.

We have to type in the sequence in the bottom-left area of the dialog window as "0123456789". A drop-down list at the top-left lets us select the ticks in the sequence one-at-a-time and we can then enter our design values for each one.

In Figure 7-7 we're designing the "0" tick mark. (It'll also be the tick that shows up in the 1, 2, 3, 4,5 and 6 inch locations.) From top to bottom:

- We've selected a setting labeled "Centre" that centers the tick mark on the horizontal spine of the scale. (We'll also use this same position for all the others.)
- We've specified a "Stroke Height" (tick mark height) of 0.875 inches. We'll use the same value for tick number 5 and we'll specify 0.750 for all the other ticks
- We've checked the box that places a number (text) to this tick mark and we've specified a text height of 0.200 inches.
- We've specified "0" distance between the spine of the scale and the text.
- As we specify each tick mark in the sequence, the picture of the scale in the dialog window will update.

The following table summarizes the settings for each tick in the sequence:

Tick No.	0	1	2	3	4	5	6	7	8	9
Position	Center	Center	Center	Center	Center	Center	Center	Center	Center	Center
Stroke Height	0.875	0.750	0.750	0.750	0.750	0.875	0.750	0.750	0.750	0.750
Text Height	0.200	---	---	---	---	---	---	---	---	---
Distance between text and spine	0	---	---	---	---	---	---	---	---	---



We'll click "**Next**" after entering these settings and proceed to the third dialog window (Figure 7-8). We'll accept all of the defaults, including the Arial font, except for the "Tool Path" color. We'll change this to red, but we'll leave the font color black. Why? It's because we can expect that the lines will be vectors and the text will be raster fills. Vector lines and raster fills require different colors (and hence, power & speed) settings.

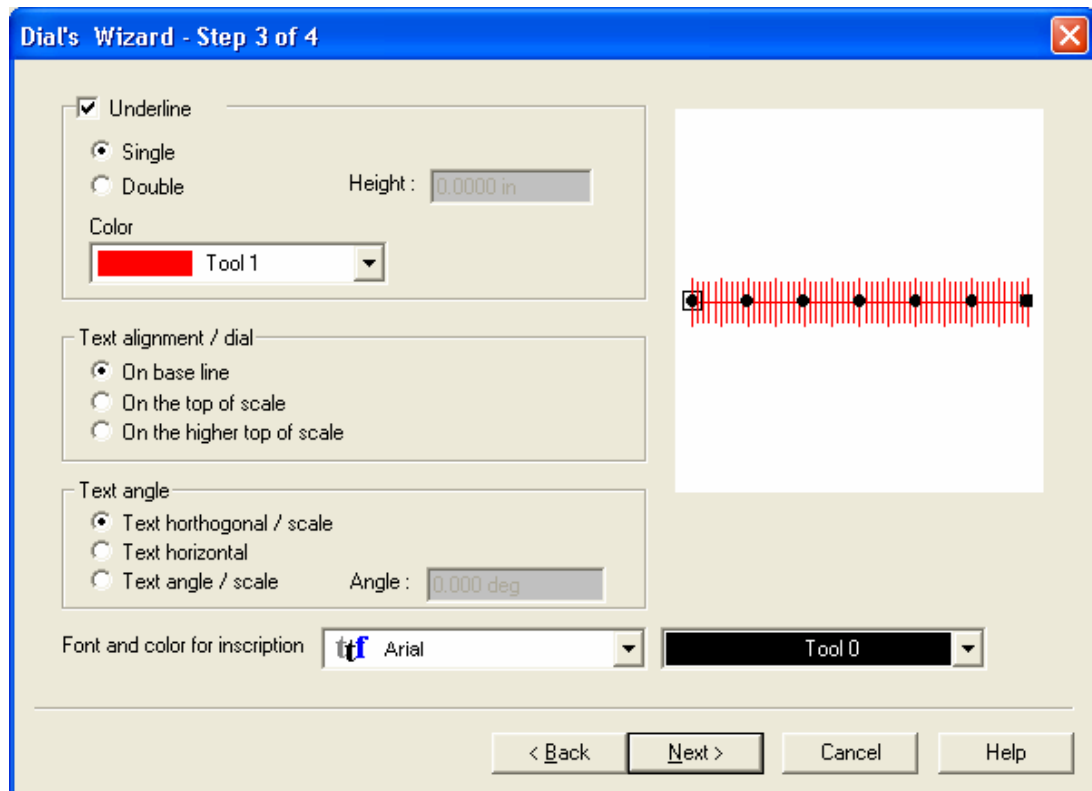


Figure 7-8 Ruler Design Window 3

We'll click on "**Next**" and proceed to window 4, the last one (Figure 7-9). Here we'll specify:

- That GravoStyle5 will automatically number the tick marks.
- That we'll start with number "1" to line up with the top ruler on the laser.
- That we'll number in steps of one.
- That we'll delete trailing zeros.



We *won't* tell GravoStyle5 to number each stroke. If we did, the program would

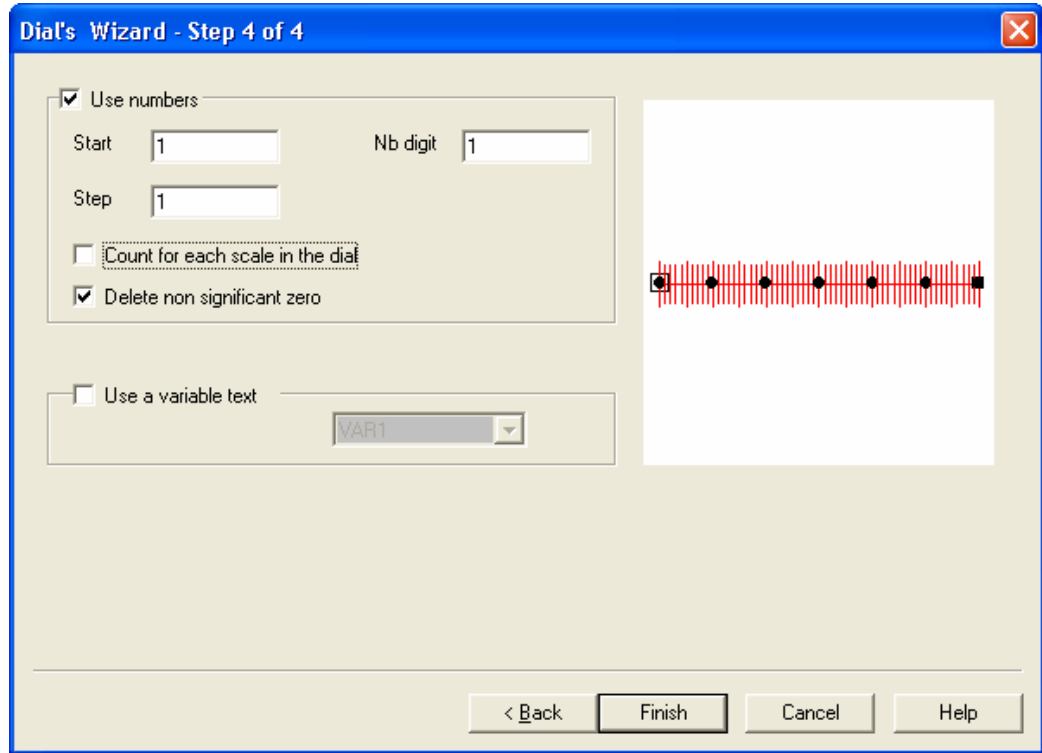


Figure 7-9 Ruler Design Window 4

call the number at the one inch mark “10” instead of (1).

We'll now click on the “Finish” button and our ruler design will appear on-screen positioned (Figure 7-10).



Figure 7-10 Finished Ruler Design

### 7.4 Setting Fixture Colors

**LOOK FURTHER**

*We can also use the “Rulers\Dials” tool to design round scales and dials. The procedure is very much the same; we need only select “circular” instead of “linear” in the first dialog window.*



The fixture requires three different modes of laser engraving:

- 1) Raster – for the rulers' numbers.
- 2) Vector Engrave – for the rulers' ticks
- 3) Vector Cut Through – for the slots.

We'll differentiate between them by using a different color for each and applying different power and speed settings to each.

We can see that the scales' numbers and the slots are black and that the ruler lines are red. We'll open the "Laser Colors" window where we'll change the color of all the slots to, say, green by selecting the slot and double-clicking on the green color bar in the window. Now we'll make the following settings:

- 1) Black (the numbers' color) is already set for raster fill engraving. We'll leave it that way.
- 2) We'll set red (the ruler lines color) to vector engraving.
- 3) We'll set green, the color of the slots) to vector engraving as well.

At this point our settings are done and the "Laser colors" window and the fixture stations will look like Figure 7-11. We can now close the "Laser Colors" window.

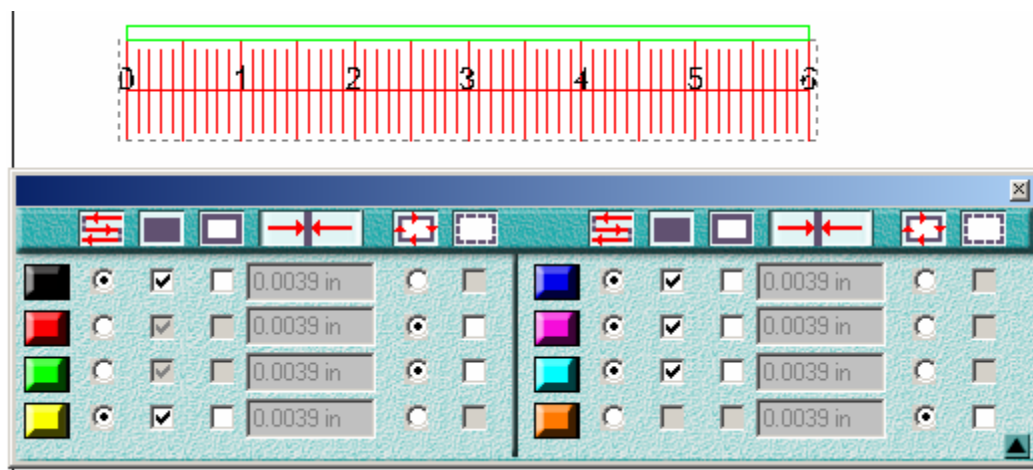


Figure 7-11 Laser Colors



## 7.5 Replicating Fixture Station 1

The design of station 1 is now complete. Our next step is to replicate it in an

**TIP**

*If you're engraving a job that includes making cutouts in the material, the material may shift in position after a piece falls out. Make it a practice to always make these cuts after all other engraving has been completed.*

*Remember – all raster engraving is done before any vector engraving and raster engraving is done in the order of color (that is, the order in which the colors are shown in the “Laser Colors” dialog window. The order of vector engraving is not dependent on color. Vectors are cut in the order in which they are created.*

*If you're not sure, select the vector objects to be cut last, open the “alignment tools” fly-out menu and click on the tool labeled “bring to front”. (This makes sense if you picture that an object drawn last will be on top of, and therefore in front of, all other objects.)*

array of one across and six down. To do this we need use only one tool.

- Let's click on the “Zoom on Material” icon on the top toolbar. The screen will show the entire plate with station 1 at the top.
- Select the ruler and the slot by dragging a box around them with the mouse cursor.
- Open the “Duplication Tools” fly-out toolbar (Figure 7-12).

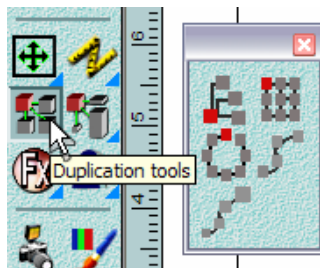


Figure 7-12  
Duplication Tools

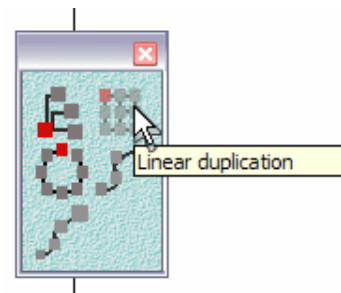


Figure 7-13  
Linear Duplication Tool

**LOOK FURTHER**

*Other tools in the Duplication toolbar let you duplicate in a circular pattern, duplicate along a curve or duplicate freehand with a single mouse click*



- Click on the “Linear Duplication” tool in the fly-out toolbar (Figure 7-13)
- A dialog box will open, and we’ll enter the numbers “1” for Columns and 6 for Rows and then click “OK” (Figure 7-14).

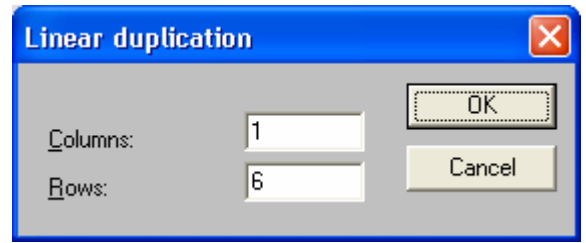


Figure 7-14 Linear Duplication Dialog

- The cursor will change by showing a symbol at its lower right. The symbol will be an arrow-headed cross with six small rectangles above it. Start dragging anywhere and press the **F2** key while the mouse button is still depressed.
- A dialog box will pop up. It has three tabs. The first tab, Columns/Rows, uses the 1 column and 6 rows we already entered in Figure 7-15.

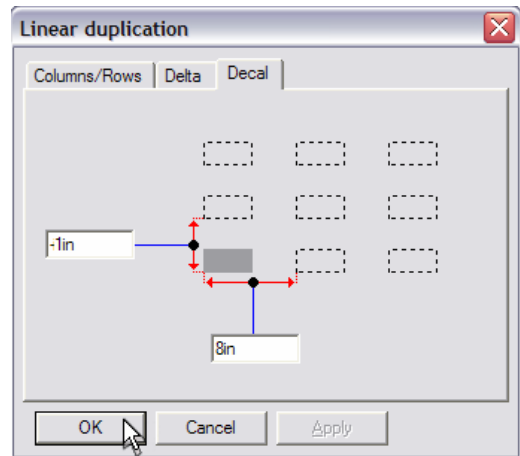


Figure 7-15 Linear Duplication F2 Dialog Box, Tab 3

- Click on the right-most tab (Decal = Repeat). The page that pops up will let us enter the vertical and horizontal pitch between station duplicates. We’ll enter -1.000 (down direction) and 0 respectively (Figure 7-16)
- Finally, Click on “OK” to accept these settings. The screen redraws and our finished fixture appears. Our design is done.

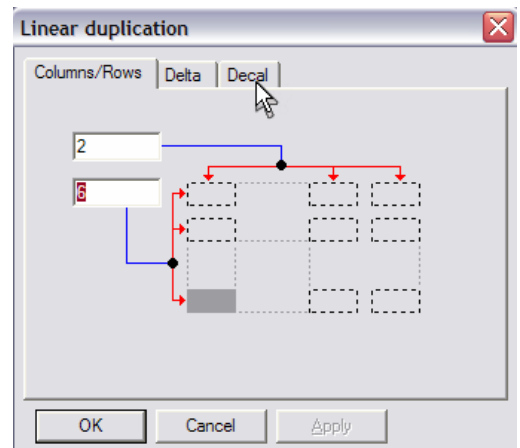


Figure 7-16 Linear Duplication F2 Dialog Box, Tab 1

### 7.6 Move Fixture to a New Layer

We’ll now cut & paste our fixture to a second layer and leave a new top layer for doing our pen design work.



***Make sure that you save your fixture job file before proceeding!***

Figure 7-17 shows the bottom-left portion of GravoStyle5's screen. This area is where we add or delete design layers. We do this by clicking the "+" key to add



**Figure 7-17 layers**

a layer and by clicking the "-" key to delete the current layer. Each layer has its own tab that we can rename by double-clicking on the tab.

At the right is a check box. If we click in it all layers are visible, but only the active one can be edited or engraved. Uncheck this box.

We'll now add a new layer by clicking on the "+" key. We'll click on its tab – it's the right one – to make it the active layer, and we'll see that the fixture is no longer visible.

Double-click on the new layer's tab, select the default name by dragging the mouse cursor over it and type in a new name, say, "**Fixture**". Click anywhere inside the design area to apply the change.

Now we'll move the fixture to the new layer.

- Switch back to the first layer. The fixture is again visible.
- Select the entire fixture by dragging a box around it with the mouse cursor or by pressing hotkey **Ctl-L**.
- Click on the "Edit" menu and select "Cut". The fixture disappears.
- Click on the new layers tab ("Fixture") to make it active.
- Click on the "Edit" menu and select paste. The fixture reappears in its "Fixture" tab.

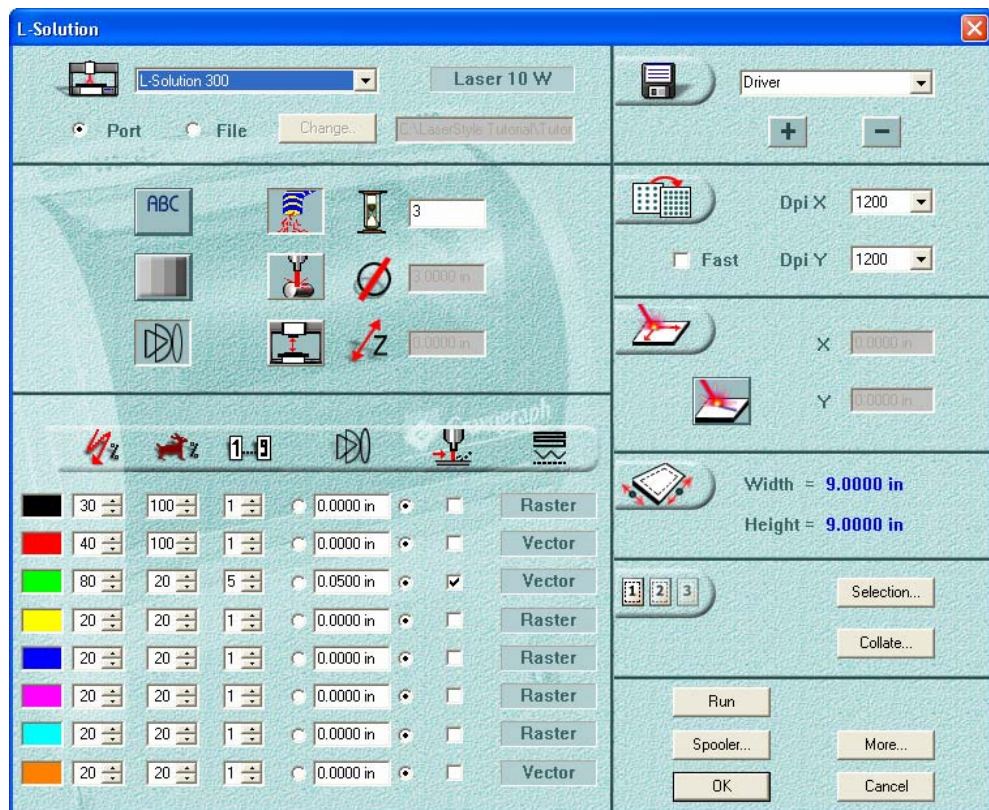


### 7.7 Lasering the Fixture

Click on the “Lasering” tool in the top toolbar. GravoStyle5s’ internal laser machine driver window will appear. When we finish making our settings in this window, it will look like figure 7-18.

Our settings are as follows for a typical 60W laser:

- We’ll use 1200 dpi for this job. This high a resolution isn’t needed for the raster or for the ruler lines, but it applies more laser muscle to the slot cutouts.
- We’ll set black at 70 power and 100 speed for the ruler numbers.




**Figure 7-18 Laser Driver Window**

- We’ll set red at 40 power and 100 speed for the ruler lines.
- We’ll set green at 90 power and 10 speed for the slot cutouts. We’ll also set “4” in the third settings column, whose heading is an icon having the



numbers 1 – 9. The significance of this heading is that we can here set this color to be engraved in more than one pass. For the slots, we'll use a setting of four passes.

- The fourth column gives us the power to have a Gravograph New Hermes laser machine automatically refocus the beam deeper into the material before or after each pass. We've set the green color to refocus 0.0500 inches **after** each pass. This helps maintain a tightly focused beam through the material thickness and concentrates the beam's cutting power where we need it. There are round selection buttons (called radio buttons)  immediately before and after the window where the refocusing value is entered. If the button before the value is selected, the beam is refocused before each pass. If the button after the value is selected, the beam refocuses after each pass. We've selected *after*.

We're finished. We just have to click on the “**Run**” button and the job is sent to

### **IMPORTANT!**

***Always use our honeycomb table or pin table option or plain spacers or to elevate the workpiece. If you don't, the laser beam will reflect off the surface of the table and back to the underside of the workpiece. The workpiece may be ruined and the table will have some residue of melted or burned material.***

the laser engraving machine. We'll then click on “**Cancel**” after the job is sent and save our file with these settings included in the job file.

## **7.8 What We've Learned**

By designing and engraving this job, we've learned:

- How to use layers in our designs.
- How to use the Geometrical Shapes toolbar.
- How to use the Duplication Tools Pallet.
- How to design scales and rulers.
- How to design and engrave cutouts in materials.
- How to engrave in multiple passes.