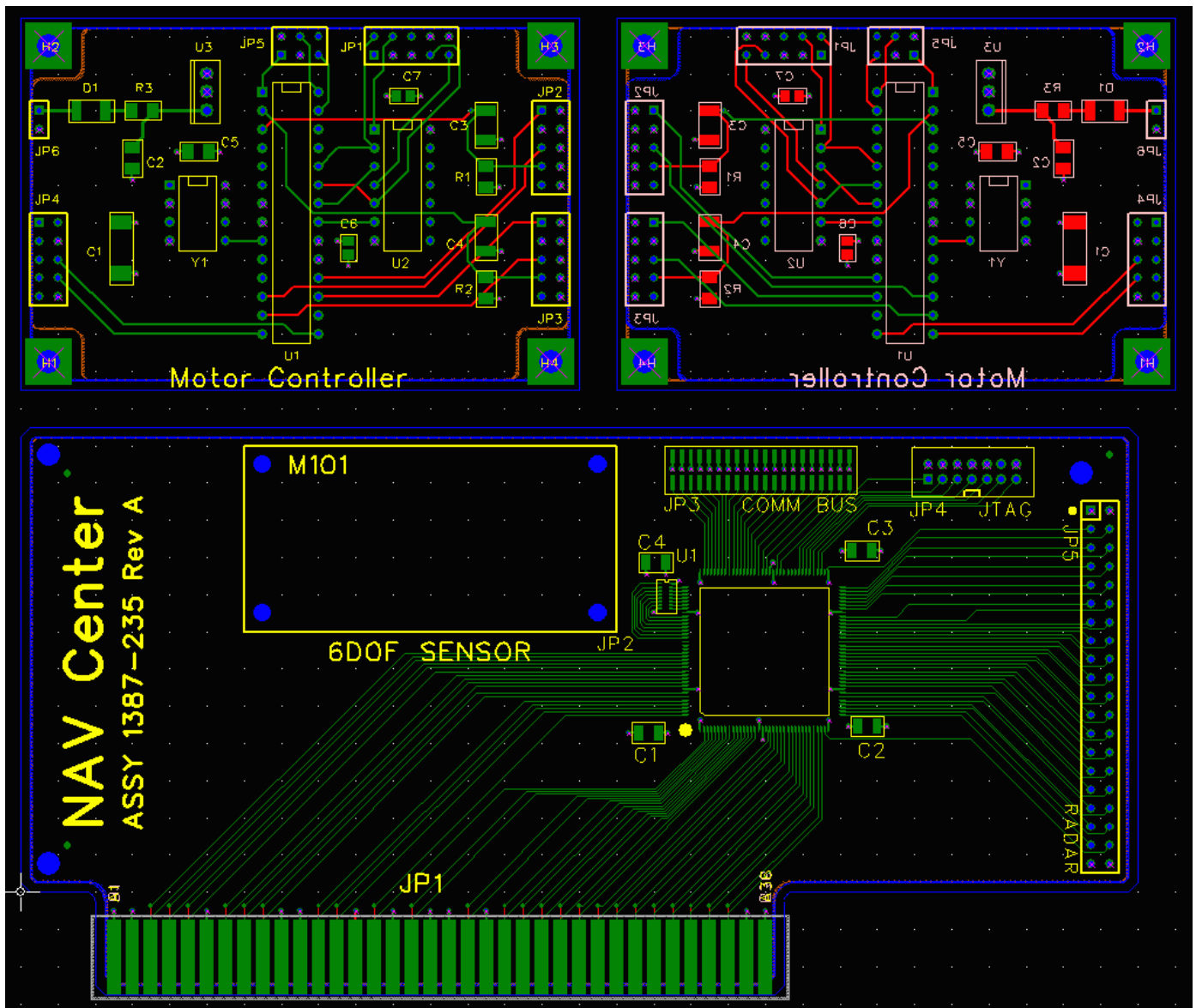


# Version 1.20





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## Introduction

**FpcRef** is a panelization cosmetic preprocessor implemented as a Win2K/XP console (command line) application. It can replace component reference designation strings on both sides of the board with text and/or mirror (rotate) the layout about the Y axis. The default behavior, as in earlier versions of this application, is to only replace all reference designations but option switches have been added suppress reference replacement and enable mirroring.

The reference designation replacement is done by adding text strings that duplicate each reference, as it currently exists, and hiding the real references by setting both the height and stroke width to zero. The original reference designation values, though invisible, are otherwise unchanged.

The mirroring option actually rotates the entire layout about the Y axis as if the layout had been turned over and place face down. The geometry of all features is mirrored and layer order of all objects is inverted

Each .fpc file processed results in a new file being created with, depending on which options are enabled, "\_ref", "\_mir" or "\_refm" appended to the file name. The original file is unchanged. For example, by default, *demo.fpc* produces *demo\_ref.fpc* with only the references changed. If mirroring is also enabled, the new file is named *demo\_refm*. If only mirroring is enabled, the output file is named *demo\_mir*.

Note: text should only consist of normally printable characters (code 0x20 - 0x7e). Characters outside this range may cause text location errors when mirrored and, if location critical, could require touch up.

Ex:

```
D:\Code\FpcRef\RefTest>fpcref "text test" demo          ← file test text.fpc is quoted

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File "text test.fpc" loaded, 758 lines read.
File "text test_ref.fpc" created
34 Component RefRes strings hidden by "Height/Stroke" method
in "text test_ref.fpc"

File "demo.fpc" loaded, 1168 lines read.
File "demo_ref.fpc" created
25 Component RefRes strings hidden by "Height/Stroke" method
in "demo_ref.fpc"

Done.
2 files loaded.
2 files created

Elapsed time: 0.113 Sec
```

## **Installation and Setup**

*FpcRef* is distributed as a set of files in a zip archive that includes the executable, the user guide and a selection of example files.

To install *FpcRef*, extract the file **FpcRef.exe** to any handy directory such as C:\Program Files\FpcRef or C:\Program Files\FreePCB\bin\.

If the path to **FpcRef.exe** is not already included in the environment **PATH** variable, it should be added.

For those unfamiliar with setting environment variables, assume for example that **FpcRef.exe** is installed in the C:\Program Files\FreePCB\bin directory:

- Open the **System Properties** form by
  - Right clicking on **My Computer** and clicking on **Properties**.or
  - Open the **Control Panel**.
  - Open the **System** tool.
- Click the **Advanced** tab and open the **Environment Variables**.
- Scroll the variable list down to and highlight the **path=** entry and click **EDIT**.
- Click in the value field to clear the highlight.
- Scroll to the end of the field and add **;C:\Program Files\FreePCB\bin** to the existing value.
- Click **OK** to exit the edit window.
- Click **OK** to save and exit the Environment Variables window.
- Click **OK** to exit System Properties.



## **Operation**

FpcRef is a command line application. To use it, open a command shell (Start→Run→Cmd) and change the working directory to where the FreePCB file(s) are located.

## **Command Line Syntax**

The command line syntax was designed for simple yet flexible operation. The full syntax consists of the program name followed by optional switches and one or more file names:

```
C:> fpcref [switches] [path1]name1[.ext1] [[path2]name2[.ext2]] ...
```

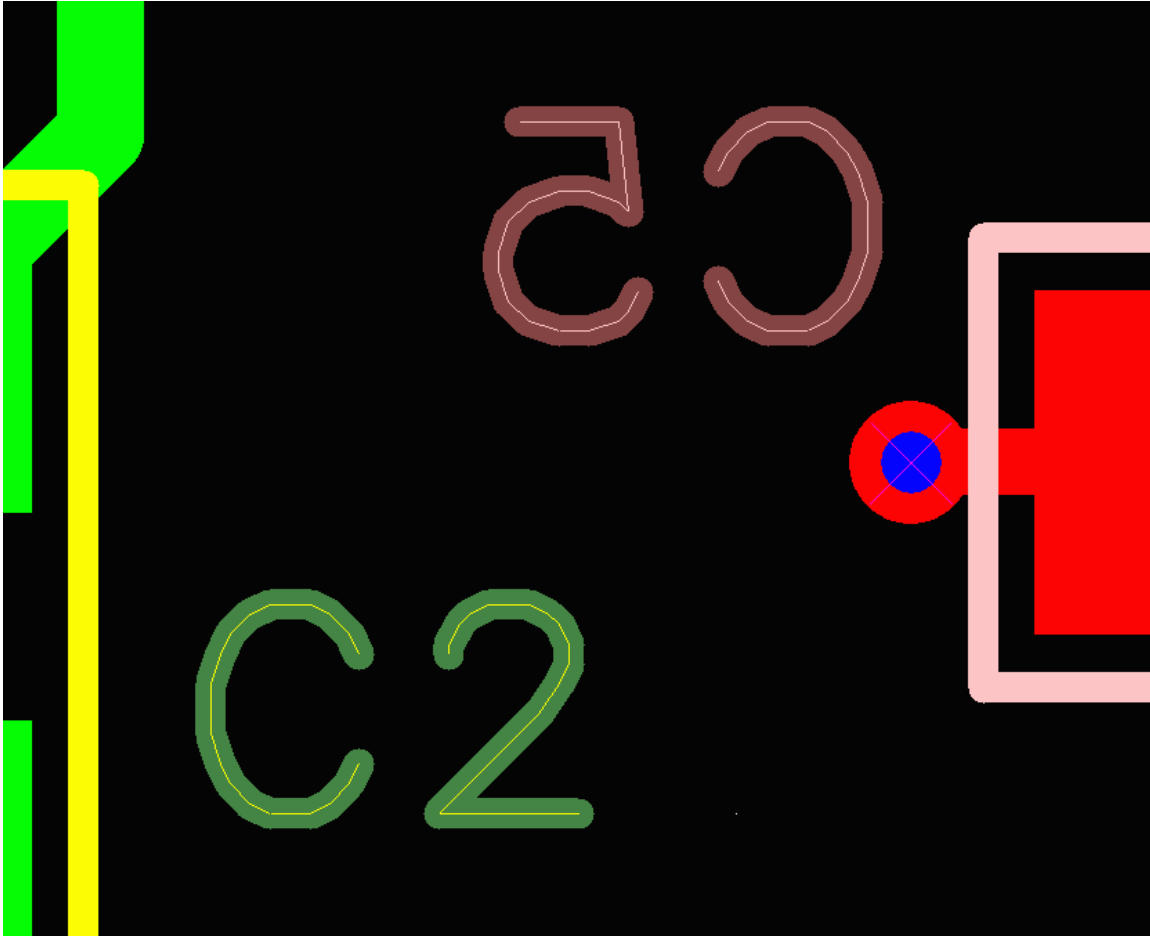
The number of files that may be processed is limited only by the DOS command line length. If the file name includes an extension, as determined by the presence of a period character, the name will be used as entered; if no extension is found, the extension **.FPC** will be append. If the name includes any spaces, it must be enclosed within double quotes ("). The optional command line switches are not case sensitive.

## **Available Switches**

- |          |   |
|----------|---|
| -D       | Enable <b><i>Debug</i></b> mode.                                      |
| -H or -? | Display a short switch and usage <b><i>Help</i></b> summary and quit. |
| -M       | Mirror the layout about the Y axis.                                   |
| -S       | Skip reference designation replacement.                               |
| -V       | Enable the <b><i>Visibility</i></b> method for hiding RefDes strings. |

### **-D : Debug Mode**

Change operation to debug mode for text position verification. In this mode, the new text is placed on the *inner\_1* and *inner\_2* signal layers instead of the top and bottom silkscreens and the original reference designation text remains visible but has its stroke width set to zero. Note that debug is only effective during ref text replacement, if the **-S** switch is used to bypass this process, debug mode is ignored.



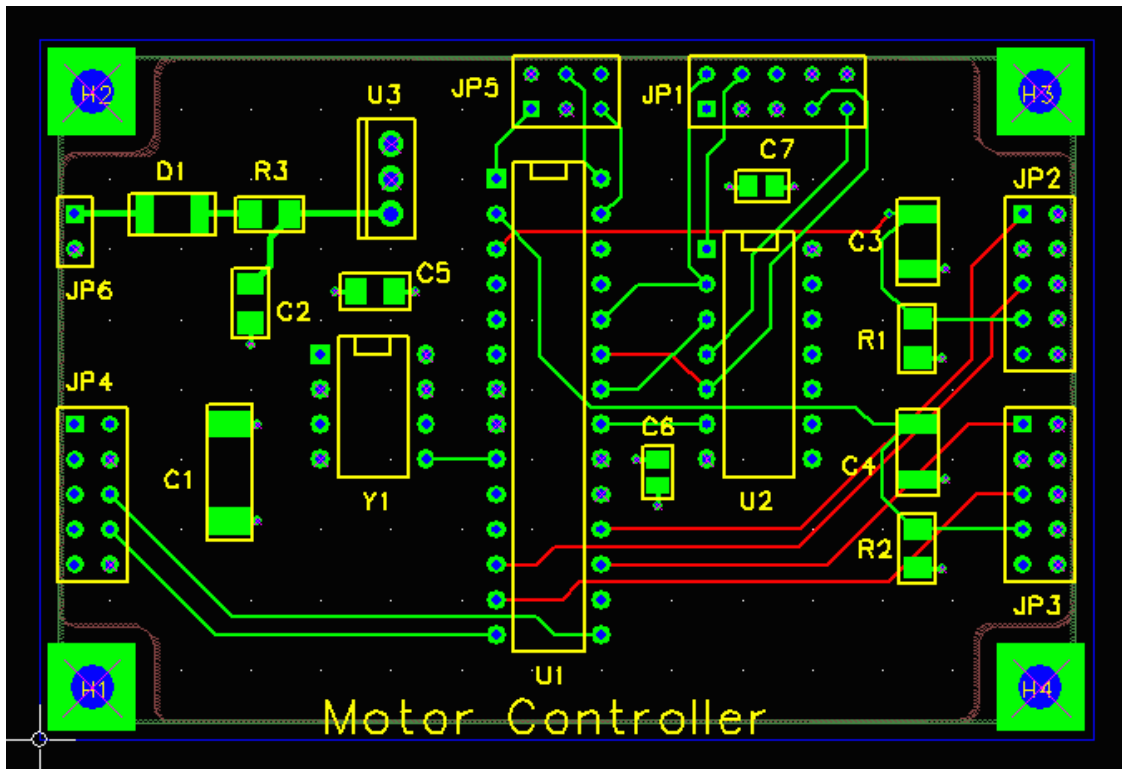
Debug mode will only function with files that have four or more signal layer. The *inner\_1* and *inner\_2* layers must both be present, if not, debug mode is disabled for that file.

### **-H or -? : Help**

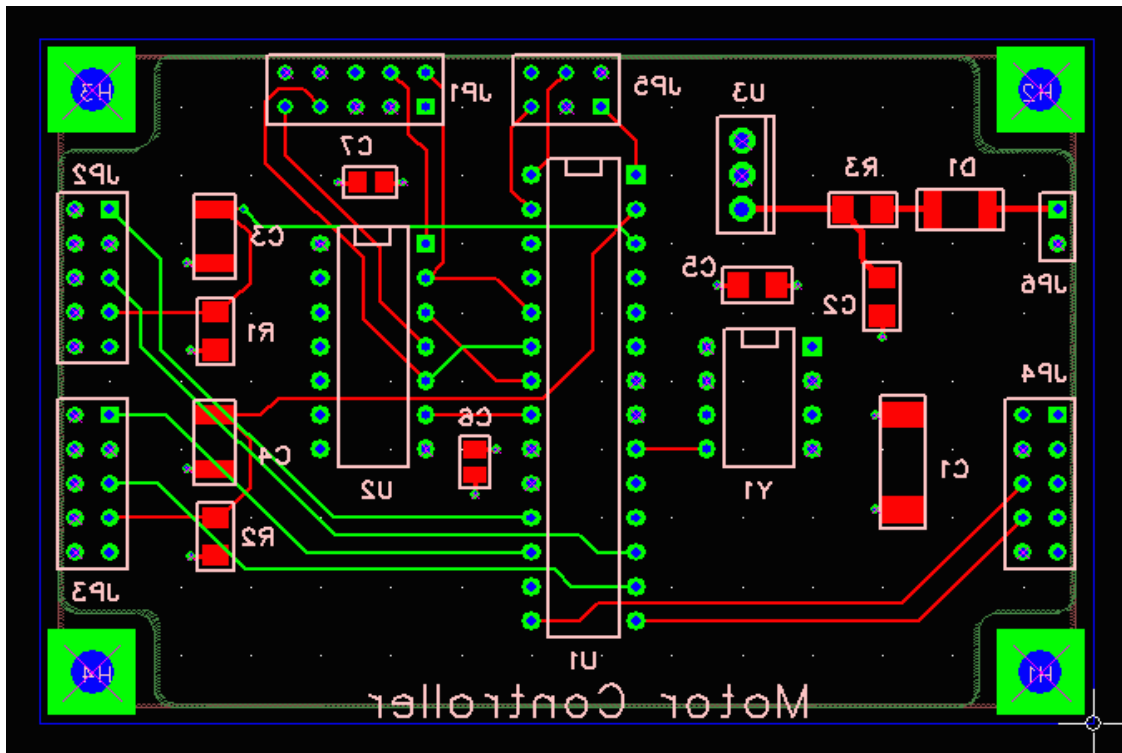
Display a short help screen and terminate.

### -M: Mirror layout

With mirroring enabled, the layout is rotated around the Y axis. All parts are flipped to the opposite side and the layer assignments for all copper, silkscreen and solder mask cutout objects are inverted.



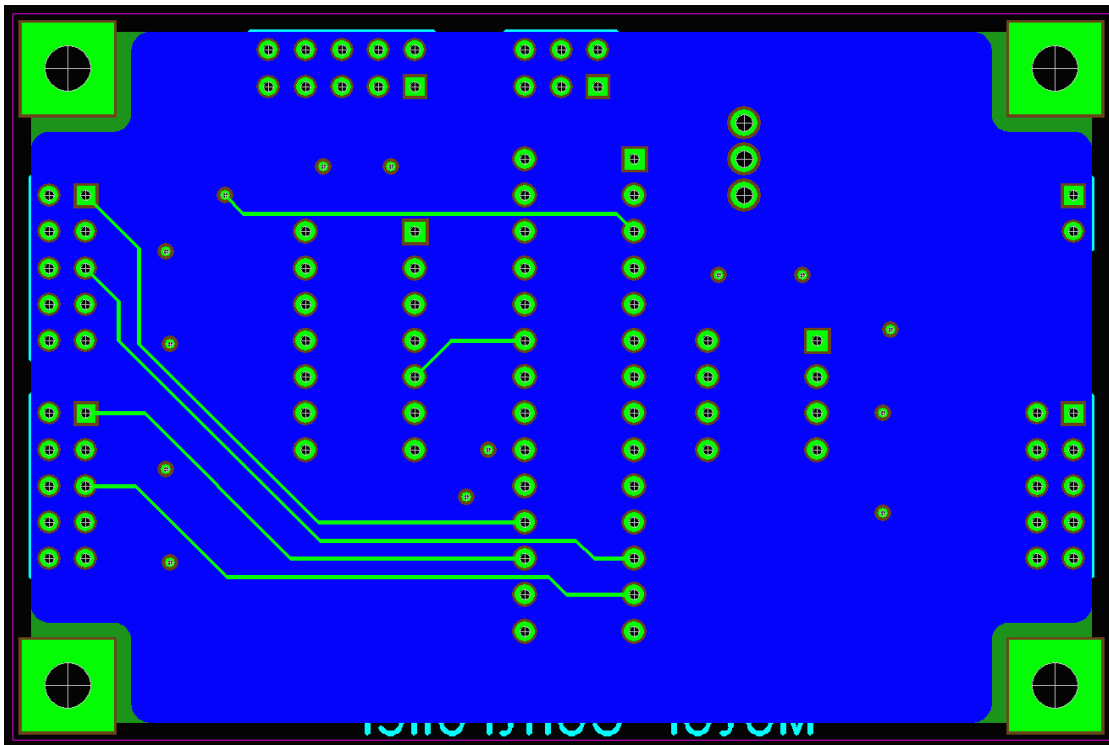
*motor\_1.fpc*



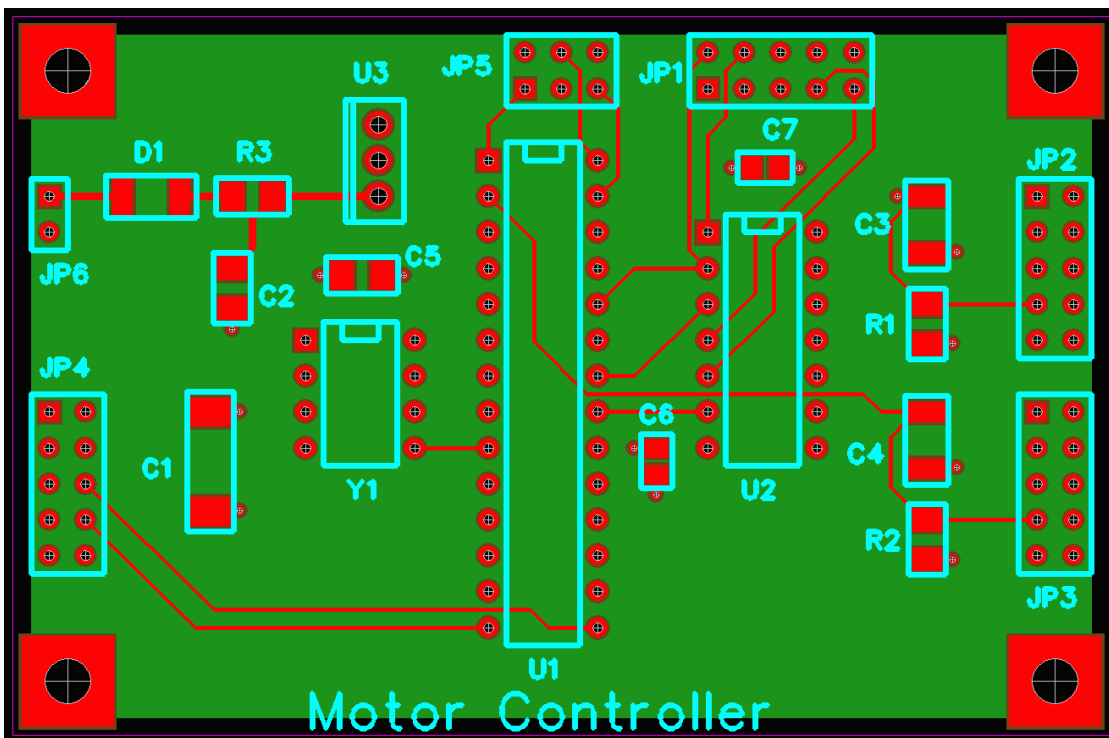
*motor\_1\_refm.fpc*

If you would like to continue editing the layout, it can be returned to the first quadrant by using **Tools→Move Origin** to place the origin back into the lower left corner.

Top and bottom views of the Gerber data generated from *motor\_1\_refm* :



*Top side view*



*Bottom side view*

In **FreePCB**, all copper areas are clockwise. That is, independent of the order defined, the finished polygons have their edges and vertexes ordered in a clockwise fashion and any included cutouts are ordered counterclockwise. Although reverse ordered polys do not seem to cause any problems in FreePCB with connectivity or Gerber generation, mirrored copper polys are reordered to maintain this standard convention. All other polygons, outlines, mask cutouts and footprint polys, can exist as CW or CCW and so they are not reordered when mirrored.

### **-S : Skip RefDes Replacement**

This switch disables the reference designation replacement and debug processes.

### **-V : Enable the Visibility Method**

By default, *FpcRef* hides the existing reference designation strings by setting both the height and stroke width to zero. This is referred to as the *Height/Stroke* method. In newer versions of *FreePCB*, reference designations have a visibility control flag that can be used to hide the text. With the *Visibility* method enabled, files created by these newer *FreePCB* versions will use the reference designation visibility flag to hide the existing designations.

Sad note: until version 1.355, *FreePCB* failed to honor the visibility flags during **Paste Group From File** operation and made all imported designation visible. If you are using a version of *FreePCB* older than 1.355, continue to use the default *Height/Stroke* method for proper operation.

## Panelization

**FreePCB** has, for some time, had the capability to easily panelize a single layout with its Gerber generator. But combining two or more layouts for panelization, with any layout tool, including **FreePCB**, presents problems with part reference and net name duplication. This is normally solved by reassigning the part references and by either merging or renaming conflicting net.

For panelizing, we don't need to worry about net names but we do care about the part reference changes. **FpcRef** solves this dilemma by creating a copy of the layout where the part references are duplicated as silkscreen text objects and hiding the real references. The modified layout can then be combined with other layouts and any reference changes will not be visible either in the layout or the resulting Gerber files.

## Tutorial

As an exercise, we'll walk through the steps necessary to create a simple combined layout.

The starting layout does not need to be modified but any imported layouts do. So the first step is to select which layouts *will* be imported and create modified versions with **FpcRef**. In this exercise, we will be importing two versions of the motor\_1 layout, *motor\_1.fpc*, one normal and mirrored.

Use **FpcRef** to create the normal view *motor\_1\_ref.fpc* :

```
D:\PCBs\FpcRef Demo> fpcref motor_1

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Ver 1.20R (c)2007-09 Bruce Parham

File "motor_1.fpc" loaded, 1312 lines read.

File "motor_1_ref.fpc" created,

25 Component RefRes strings hidden by "Height/Stroke" method
in "motor_1_ref.fpc".

Done.

1 file loaded.

1 file created.

Elapsed time: 0.062 Sec
```

And the mirrored view *motor\_1\_refm* :

```
D:\Code\Demo_FpcRef> fpcref -m motor_1

FpcRef - A FreePCB Post Layout RefDes Converter
Ver 1.20R (c)2007-09 Bruce Parham

File "motor_1.fpc" loaded, 1332 lines read.

File "motor_1_refm.fpc" created,

25 Component RefRes strings hidden by "Height/Stroke" method
and layout mirrored in "motor_1_refm.fpc".

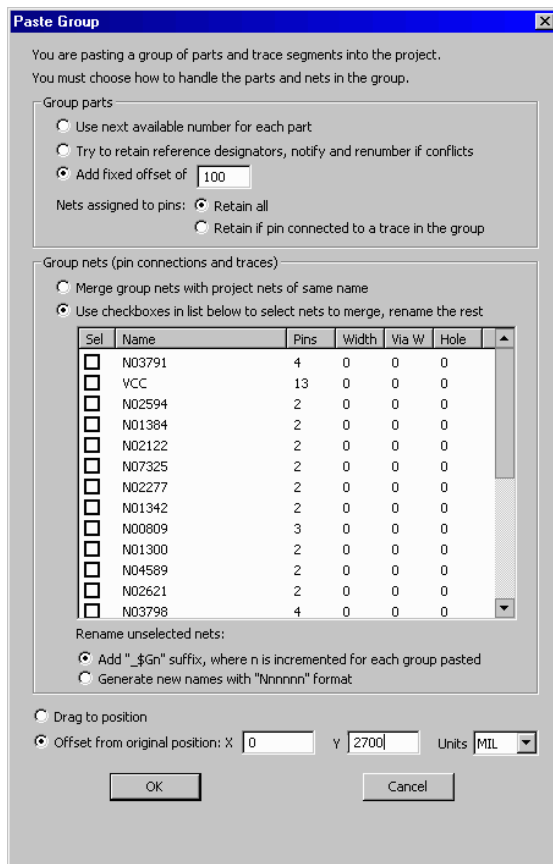
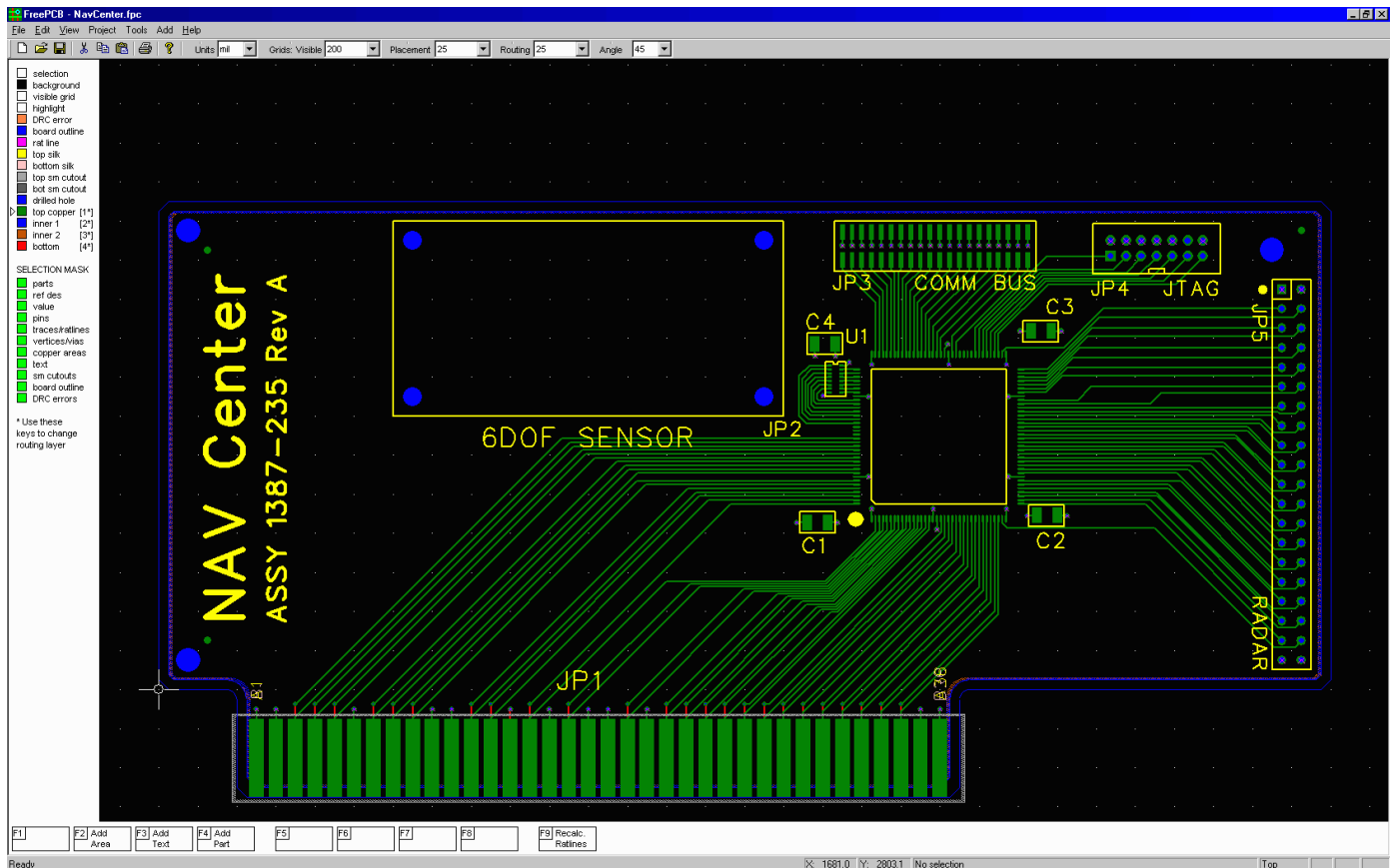
Done.

1 file loaded.

1 mirrored file created.

Elapsed time: 0.015 Sec
```

Next, open the starting layout, *NavCenter.fpc* in this case, in **FreePCB**.



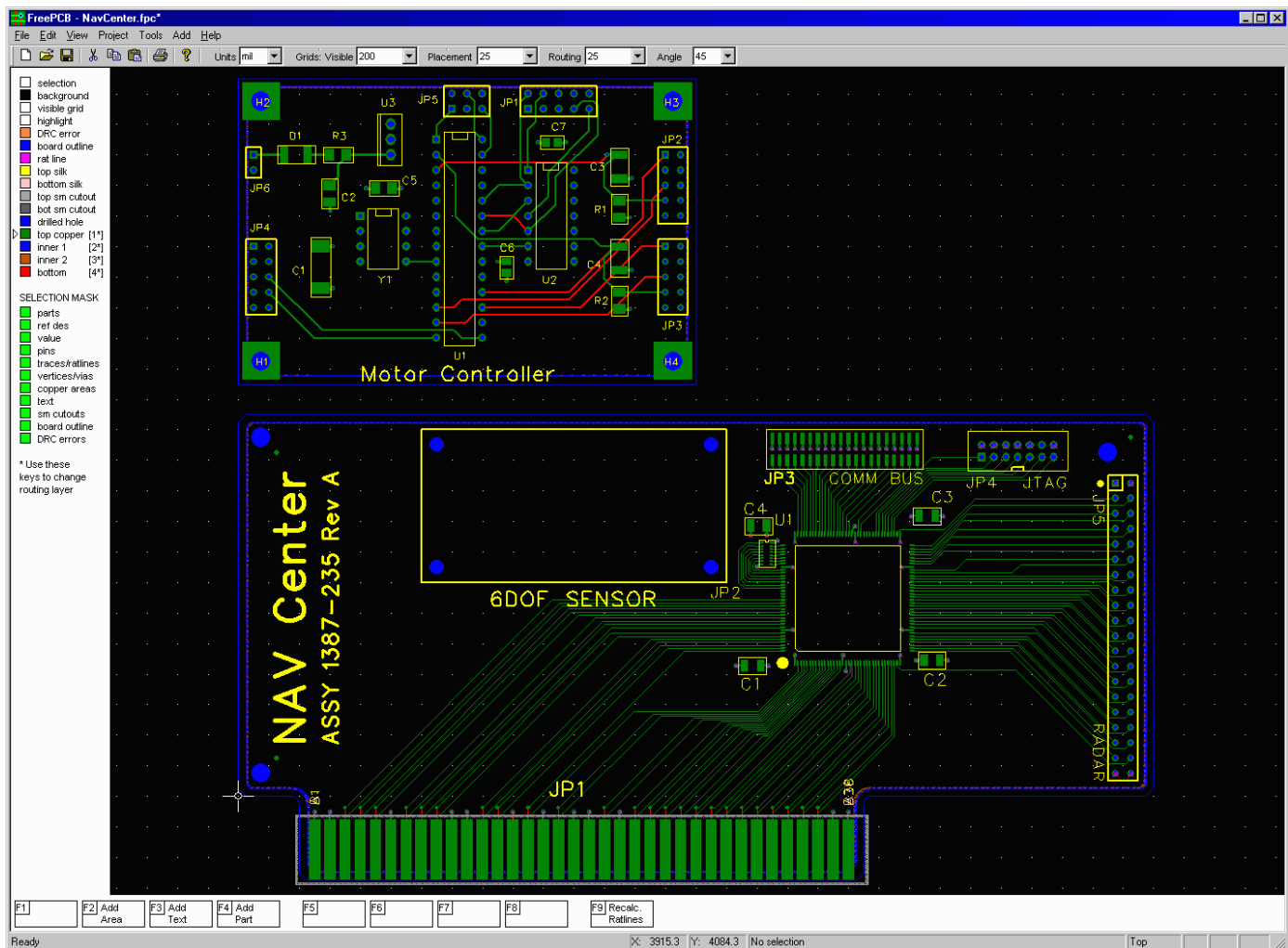
Once the layout is opened, click on **Edit→Paste Group From File...** and select the file *motor\_1\_ref.fpc* to open the **Paste Group** form.

In the **Group Parts** section, click on Add fixed offset and enter a large offset like 100.

In the **Group Nets** section, make sure Use Checkboxes... and Add "\_Gn" suffix are selected and that no nets are checked or select the Generate new names option. (This step is not strictly necessary but, if nets are allowed to merge, the layout can become cluttered with ratlines.)

Finally, select Offset from original position, enter a Y offset of 2700 mils and click **OK**. (The offset function refers the position of the origin of the imported layout relative to the origin of the current layout.)

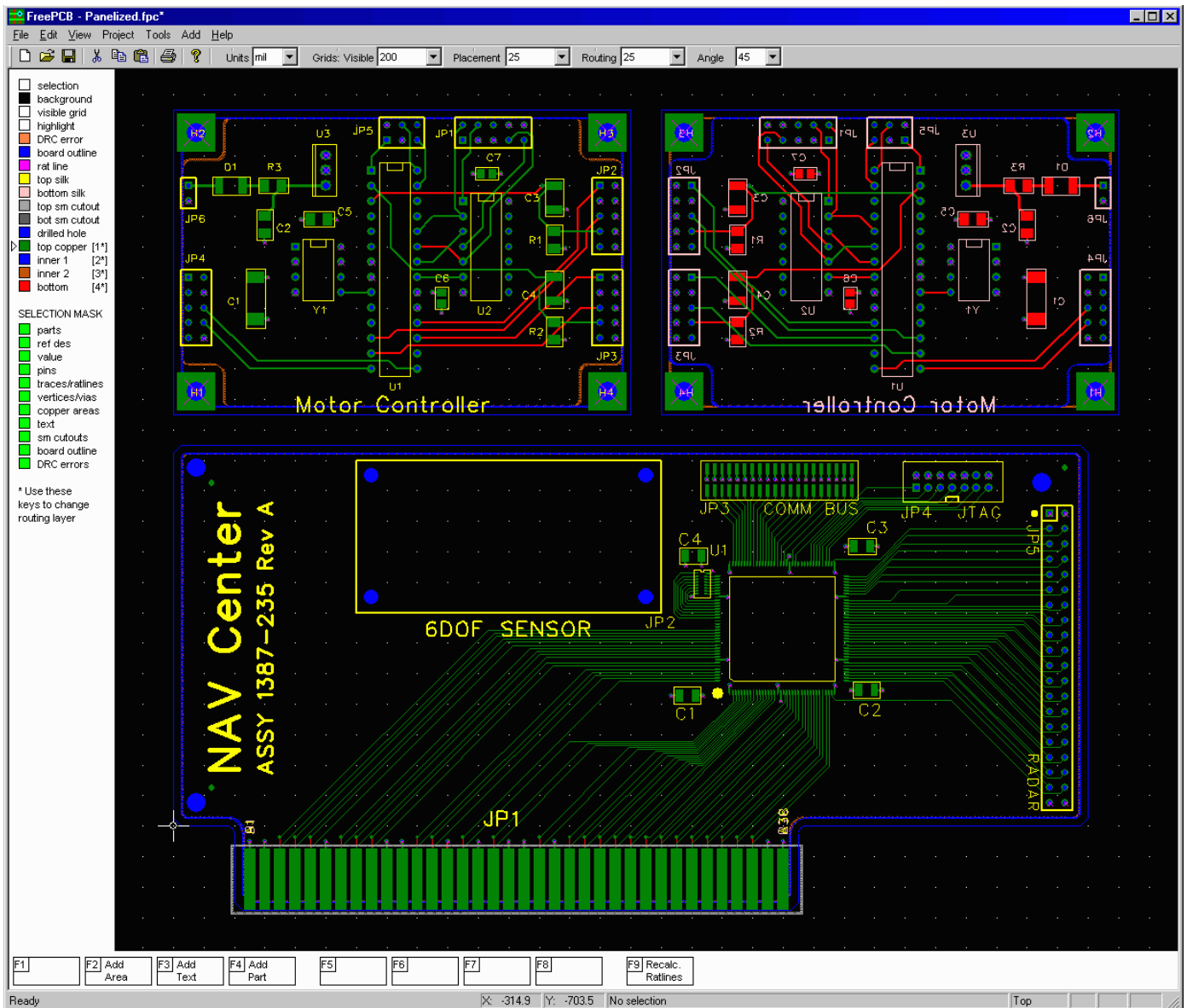
Click outside of the layout to unselect the newly imported items.



The layout as it appears after the first import operation.



To finish the layout, as outlined above, import the mirrored layout *motor\_1\_refm* but with a parts offset of 200 and an XY offset of 6200 by 2700 mils. Note that the X offset must be increased by the width of the imported layout because, in the mirrored layout, the origin is located at the lower right corner.



Save the finished layout to a new file using **File**→**Save As** and the combined layout is done.

## Revision History

Ver	Date	Comment
1.000	15 Aug 07	Initial release to FreePCB forum.
1.01	16 Aug 07	Fixed bug in debug mode on boards with less than 4 layers. Changed version number to 2 decimal place value.
1.02	19 Nov 07	Updated to FPC V1.339.
1.10	3 Aug 08	Updated to FPC V1.344. Added millisecond resolution elapsed time indicator. Made "Height/Stroke" visibility method the default. Added real User Guide.
1.20	8 Mar 09	Added -M Mirror Layout option. Added -S option to skip refdes conversion.