# Pentax to RS274X Converter

Introduction

In Japan, the Asahi-Pentax company produces a photoplotter called the LPP. This photoplotter is in many ways similar to the ones manufactured by Gerber Scientific and Cymbolic Sciences but accepts a data format that is quite unique.

The input to the Pentax phototplotter (called Pentax from this point on) appears to be Gerber data but may not contain conventional draw and flash apertures at all.

Instead one sees only a single D-code (or no D-code specified) and only draw commands.
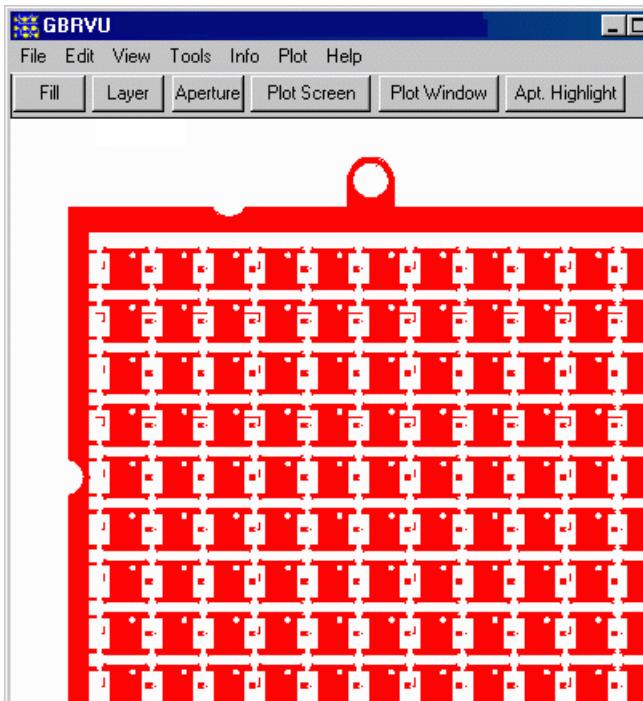
This is what the designer expects to see.

It turns out that the draws represent the edges of polygons and that the Pentax photoplotter knows how to close the polygon and fill it.

To further complicate matters, a polygon that is enclosed by another polygon has the opposite polarity.

Conventional photoplotters and CAM systems do not "understand" the Pentax rules and hence display only the outlines of the polygons - not what the designer expects his mask to look like.
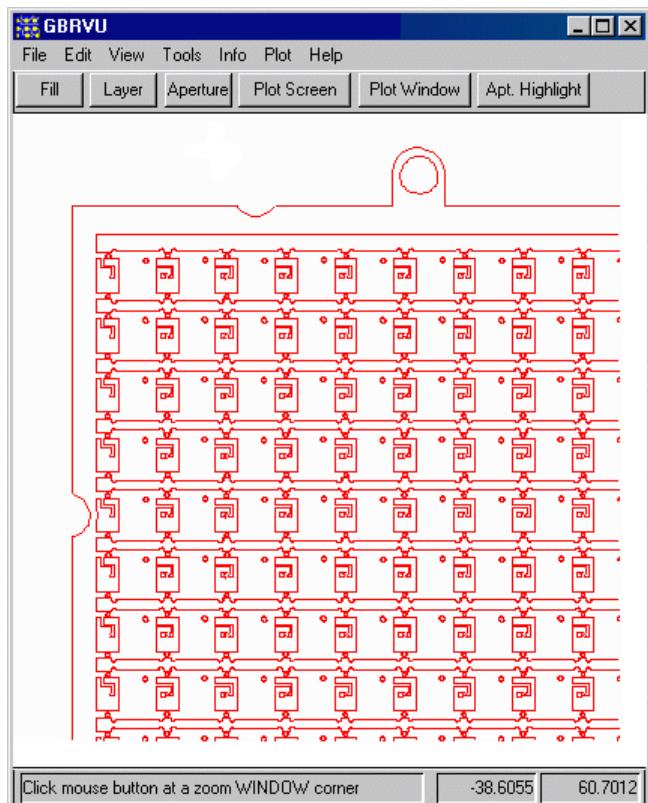
What Pentax data looks like to a standard plotter.
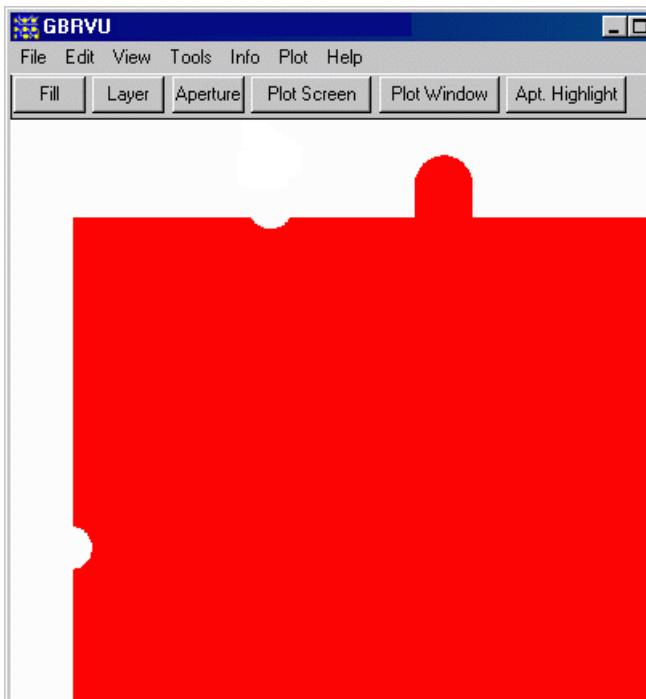
Here is what you will get if you cannot deal with automatically generating the polarity reversals.

Mixed Pentax Data

To further complicate matters, we have encountered Pentax data that also includes conventional draws and flashes in the same file.

In this case, one or more D-codes represents the polygonal Pentax data and the other D-codes are conventional draws and flashes.

As far as we can determine, the Pentax data should be processed first. Then the conventional commands should be imaged.

In the screen shot ar right, you can see conventional draws and flashes and outline areas which are Pentax data.
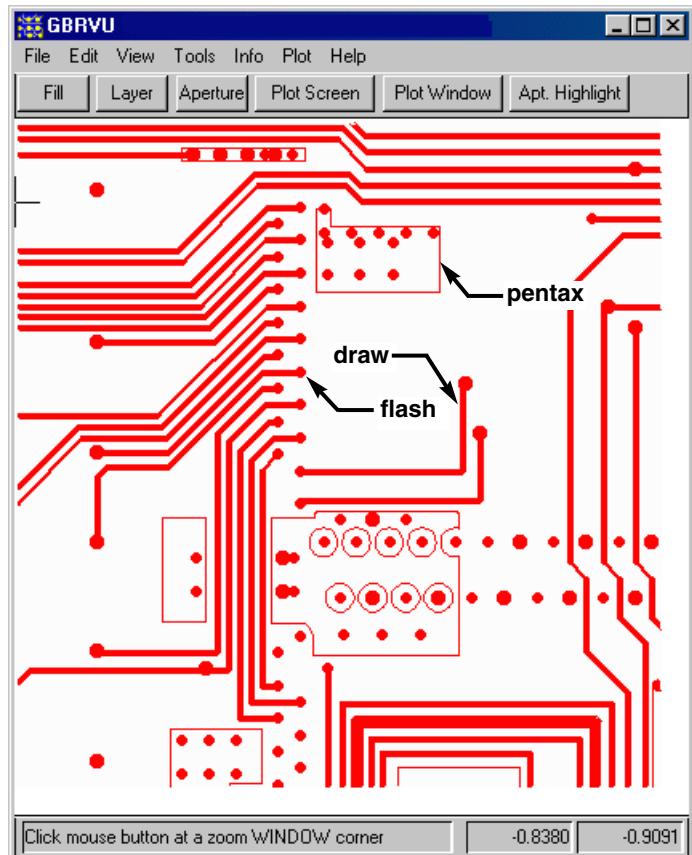
Problems Associated with Converting Pentax to Gerber

Lines are not Linked

There is no requirement that the lines that form a polygon be continuous or otherwise grouped. Hence any tool that is to convert this data must have a way to sort out the lines into boundaries.

Lines Need Not Touch

The endpoints of lines forming a boundary need not touch. It is not clear how much gap or overlap is allowed but some is definitely allowed.

Polygon Polarity Depends on Surroundings

A polygon's polarity (whether it is dark or clear) depends on whether it is already surrounded by another polygon. Each new level of embedded polygon reverses the field.

Mixed Pentax and Conventional Commands

One encounters files that have a d-code that should be dealt with as a polygon and other d-codes that are used normally as draws and flashes.

The Conversion Approach

1. Read in the Pentax data.

2. Assign one or more D-codes as Pentax.

3. Collect all the draws on the Pentax D-code and form boundaries.

4. Output the boundaries to a de-embedding and boolean routine. The dembedding routine will determine the polarity hierarchy and the boolean will operate on them.

5. Output a "clean" RS274X file that can be run through a standard photoplotter (uses G36/G37 for polygons...)

Running the Conversion from Pentax to RS274X

Load the Pentax File

Loading a Pentax file is the same as loading a Gerber file. Select the file. It may be neccessary to build the aperture list and to enter parameters such as format, units, circular interpolation etc... Once you have the Pentax file on screen you can check it's overall dimensions to insure that the format and units are correct.

Review the Apertures

Use the **File | Aperture** selection to open the aperture list. If there is only one D-code defined you should set it equal to Round with diameter of 0.0.

If there are multiple apertures you should determine which one represents the Pentax data. One easy way to do this is to use the **Info | Highlight** apertures function to highlight each aperture on screen until the one that defines the polygons is highlighted.

It is important in a file where there are multiple apertures to set the d-codes that represent Pentax data = Round 0.

This is the only way the program knows to treat these apertures as polygons and the rest of the apertures as conventional Gerber commands.
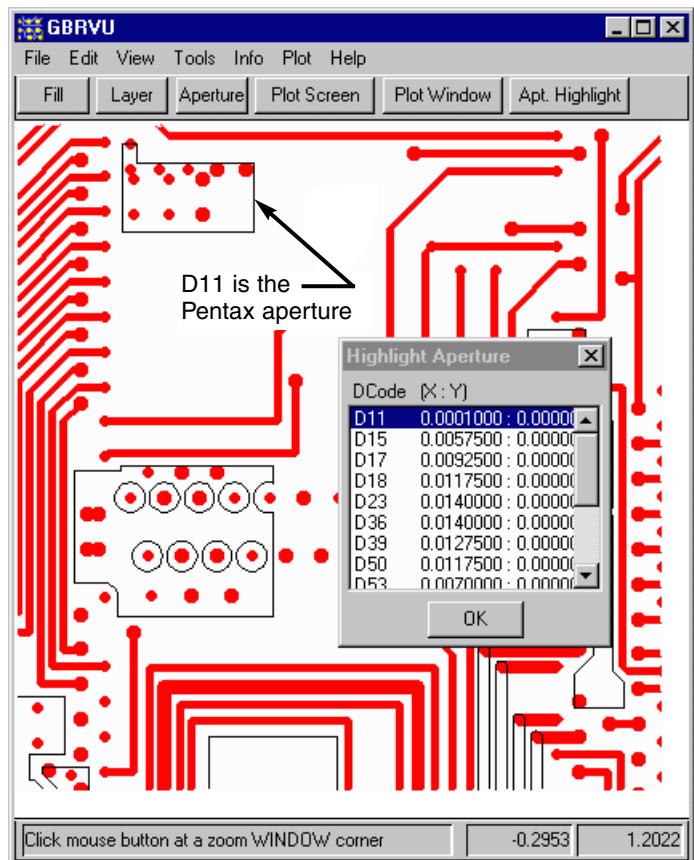
Use the Export Function

Use the **File | Export** selection to open the Export dialog box. From this box you will be able to control conversion from Pentax to RS274X.
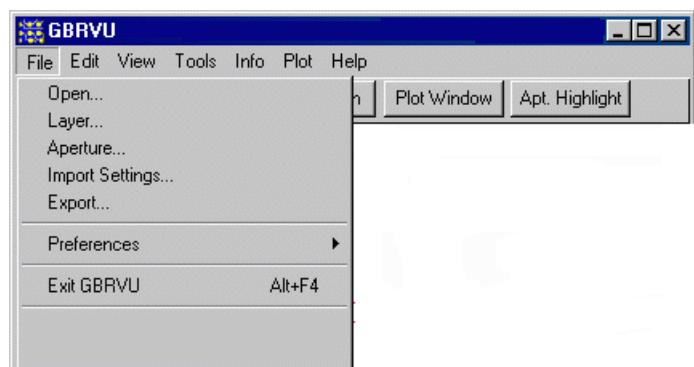
Configuring the Export to 274X

The Export RS274X dialog controls how the input data is converted.

Output File Name - select the directory and filename of the new RS274X file.

Output Mode

Standard - no processing is done on the input file. The output file is RS274X and all settings and aperture definitions are embedded into the header.

Link Zero Width Draws Only - Any draw made with a zero width aperture will be treated as an edge of a boundary - it will be linked together with other draws to form closed boundaries. These will be output in RS274X as G36/G37 polygons.

Treat as Pentax Data - The same linking as above - once the polygons are linked a second module will determine how they are ordered (for polarity).

Misc

Pass Error Data Out - if checked, any draws in the input data that cannot be joined into a closed boundary will appear in the output file.

Error D-Code - any draw errors will be output using this D-code. (this makes it easy to identify all output data that is considered an error.)

Link Settings

Max Search Radius - the linker first tries to find endpoints that match exactly. If none is found it increases the distance it will search for a free endpoint. The max search radius defines how large this distance can be. It is always set in the same units as your input file (either mm or inches.)
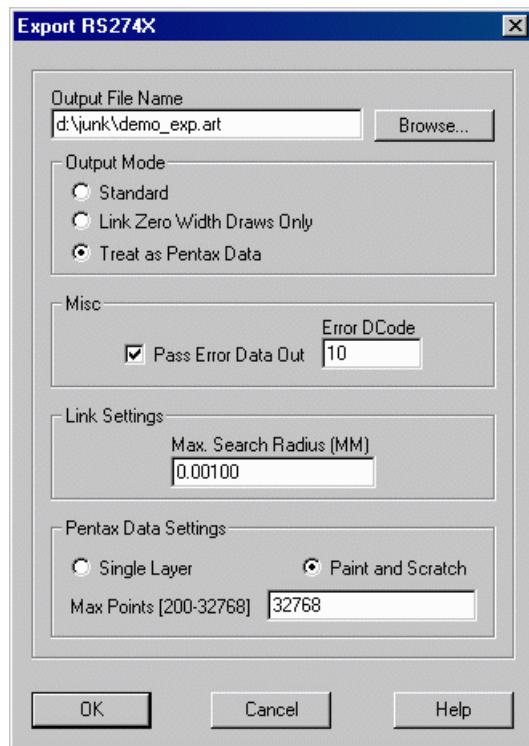
Pentax Data Settings

Single Layer - all data in the output file is on a single layer. The boolean module creates complex polygons using cutlines to deal with the clear regions.

Paint and Scratch - Multiple internal layers are created using LPD and LPC commands.**Max Points** - the maximum number of vertices in a polygon. Should a polygon exceed this number then the program will break it into two or more polygons as needed.