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## SAFE AND ECONOMICAL STEPS TO PRODUCING A 'PCB'

*The following is a guide to making simple circuits using Vero products, tanks and consumables.*

### HEALTH & SAFETY

Even though our range of PCB Chemistry is very low in hazardous contents, but their nature all PCB chemicals will be hazardous to some extent - e.g. corrosive; irritant etc.

This means you should ALWAYS wear protective clothing, gloves and goggles and ALWAYS refer to full Health and Safety data sheets before mixing or using.

**It is recommended that when using machinery, a R.C.D. Adaptor is fitted to your power supply.**

### 1. PREPARING THE ARTWORK

Firstly design the required circuit. The best option is to design the circuit on a computer and print or plot a 1:1 artwork onto a translucent or transparent film. Ideally print the artwork via a Laser printer onto [Laser film](#), (13-2009), or on an Inkjet Printer with [Premium film](#) (13-2010). If the software allows print a mirror image of the circuit as this will ensure the black areas of the artwork will be in contact to the PCB's Photoresist during UV exposure. If the circuit is to be designed manually then lay a piece of translucent drafting film over a grid (both supplied in an RA60 drafting pack. From the circuit diagram sketch the 1:1 circuit out onto drafting film in blue crayon or blue pen. Then rub down the Seno dry transfer over the sketch using an artwork spatula or similar Any blue lines left on the drafting film will be lost during exposure and will not be reproduced on the PCB laminate.

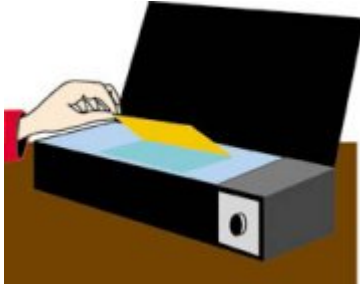


### 2. DEVELOPING THE IMAGE

Place the board to be developed in a board holder and immerse in the developing tank. This along with the quality of the artwork and UV unit is the most critical part of PCB production. It is very important to ensure the board is not over-developed. The developed image can look good, but over-developing can cause a reduction in the thickness of the resist, which could then break down at the etching stage. A 20 : 1 dilution with water for Developer [13-2001](#)



### 3. EXPOSING THE PCB FOTOBOARD OR FPC-16



Select a suitable size of our Fotoboard. If necessary cut a piece using a suitable shear such as our 12 inch shears [13-3005](#). In UV safe or low light environment remove the protective black plastic from the Fotoboard to reveal the photoresist. Position the artwork in contact with the photosensitive side of the Fotoboard and place both in an exposure unit ([13-3001](#) & [13-3002](#)), artwork down. Having closed the lid set the unit's integral timer to the correct time (the small unit illustrated (Diagram 2) will require a 3 minute time) and the exposure will automatically commence. & [13-2002](#). These Developers with the modern photoresist used on Fotoboard, can be used at room temperature without heating. When developing, remove and wash after 15—30 seconds. If the developed image is not clean and sharp it may need a little more time in the developer, if so immerse into the developer for a few more seconds and then wash immediately again.



### 4. SPRAY WASHING

Use the wash facility of your process immediately after the board is removed from the Developer.

### 5. ETCHING

The developed and washed board is then placed into the Etching Tank. If you are using Bubble Etch Tank our parts [13-3003](#) (single) or [13-3004](#) (triple) tank systems, the board is placed in the lid / basket holder and immersed into the etchant, with the lid on the Air Pump is turned on and at normal etching temperature of 45 °C for Ferric etching should take approximately 5 minutes. For very fine detail, the board should be turned upside-down halfway through the etching cycle (always spray wash the board before handling). Never lift the lid off the etching tank with the air pump still turned on. When etching is completed, spray wash as before.





## 6. RESIST STRIPPING

The PCB will now consist of an etched circuit still covered in the photoresist. This can be removed with the [13-2012](#) resist strip applicator or better still with a [13-3003](#) Universal Tank with resist strip solution, at 45°C - 50°C. As before the lid/board holder is raised at any time to examine the board. The photoresist should be stripped off in approximately 2-3 minutes. Once the photoresist has been stripped from the circuit the board holder and board are then washed.

## 7. SCRUB CLEANING

The board is then thoroughly dried and mechanically scrubbed with a [13-2008](#) Surface Preparation Silica. This will ensure that the copper circuit is perfectly clean by removing any oxidation, passivation or chlorides left by the water as well as any other impurities. After scrubbing, any small particles left by the silica block should be wiped off with a clean dry tissue.



## 8. TIN PLATING

Before the clean board has had a chance to oxidise again it should be immersed in a [13-3003](#) universal tank containing immerse tin solution ([13-2006](#) & [13-2007](#)) for 7-15 minutes. Once immersed in the solution this unique tin which operates at low temperature will begin to work immediately and plate a very smooth surface of small molecules of tin onto the copper circuit. This will stop the copper from oxidising and will also act as a solder flux. For best results when you remove the board from the tin solution immerse immediately in cold water then rinse thoroughly in hot and wipe dry with a paper towel.



## TECHNICAL TIPS

### CIRCUIT DESIGN

- Align all your components with the sketch to make sure they fit.
- Ensure your tracks are wide enough to carry the required current.
- Design your circuits, so that all your common components e.g. resistors / capacitors are next to each other. This will greatly speed assembly time
- Always make sure your circuit is as small as is practically possible.

### ARTWORK PREPARATION

- Photocopies of existing circuits layouts can be made. Photocopy them onto [13-2009](#) or [13-2010](#) but not OHP film. Check to see if the artwork is dense. The black areas should appear black and opaque, not grey, when it is held up to the light. If not, touch up the artwork with UV opaque pens or rub down transfers . Better still print an original directly from a laser or ink jet printer onto the appropriate films.
- Finally always remember quality artworks will give quality boards.

### PCB LAMINATE SELECTION

- Always use pre-sensitised laminates, not etch resist pens / transfers on uncoated boards. This provides false economies as it is time consuming to do, modifications are difficult, only simple circuits can be made and a mistake found after etching means the whole layout has to be done again.
- For accurate and safe cutting of laminates, we recommend use of one of our purpose built shears such as the [13-3005](#) desk top shears. Hacksaws, band-saws etc. produce harmful dust and splinters and accuracy is difficult. Buying larger sheets and cutting them yourself is more economical and you get to keep the off-cut !

### EXPOSURE

- Only remove the black protective film when ready to expose the board.
- Exposure times for our UV Units [13-3001](#) and [13-3002](#) should be 3 to 2.5 minutes respectively. Generally under-exposure makes it difficult to develop off the unwanted areas or photoresist and over-exposure causes undercutting and thinning of tracks and pads, as does poor contact between artwork and photoresist layer.

## DEVELOPING THE IMAGE

- Do not use Sodium Hydroxide in a tray - It is very caustic and causes severe burns in crystal form and has to be mixed fresh each time. For hand development use our safe [13-2011](#) Seno Normal Developer applicator – Sodium Hydroxide free, room temperature working develops 50 / 70 eurocards and when empty can be thrown away with normal refuse.
- For frequent use or batches of boards use one of our temperature controlled tanks with our sodium hydroxide free developers, in powder and for best results use our liquid concentrate – available on request. Both developers have a good tank life. Do not make a solution that is too strong.
- If resist is not totally removed during the developing, observe the following: (a) Your exposure time is too short - increase time by 25%, if still poor- check (b) and (c). (b) Your developer is getting exhausted -Increase developing time or replenish developer. (c) Developer is too cold - check temperature - it should be 18°C minimum.
- Resist is totally removed by the developer: (a) The boards has been grossly over-exposed or artwork was not opaque enough. (b) Developer is too strong - dilute to suit. (c) Developer is too hot - do not exceed 23°C.
- N.B. If the board has been developed properly, you will find that if you put it in the etchant for 10 seconds, then remove and spray wash it, the copper to be etched away will be a dull pink. If however there are any shiny spots or areas other than that of your image then these will be areas of photoresist which have not developed away. If this is the case, put the board back in the developer for 30 seconds, remove and spray wash it then return board to the etchant. Repeat if necessary.

## ETCHING THE BOARD

Ferric Chloride is the most widely used etchant, because it is cheap, has long tank life and etches quickly and efficiently. It's one drawback is that it is messy and stains, however if you wear protective clothing and ensure any spillage is wiped away immediately with a damp cloth you should have no problems. Ferric Chloride Stain Remover can be used for removing stains from clothes, tanks, etc.

- The alternatives to ferric is our fine etch crystals ([13-2005](#)), which are as safe as ferric and when in solution are very clean. The problem with Fine Etch is:- (a) Longer etching times (b) Short tank life (2 - 3 weeks), which can make it expensive if used infrequently. (c) Higher etching temperature, 50°C
- If the resist breaks down in the etchant:- (a) The board has been over-developed - Reduce developing time (b) Etchant is too hot - check temperature Optimum 40 - 45°C ( maximum 55°C) for Ferric

- If the pads and tracks are badly defined and etching time is long: (a) Etchant needs changing - Done when time exceeds 20 minutes (b) Resist has not been totally removed during developing - Return board to developer for 30 seconds then wash and return to etchant. If results are still bad, board is a failure and you must refer to Exposure and Developing tips for your next board.

## **IMMERSION TINNING**

- You could just leave resist on, but tinning gives following advantages: (a) You will give a professional finish to your board. (b) The tinning will greatly improve the solderability of the board. (c) The tin will protect the copper from oxidation.
- For good tinning (a) Make sure the copper surface is thoroughly clean (b) Avoid solution contamination (c) Carefully follow rinsing instructions (d) Tin looks very thin - change solution.

## **DRILLING**

- Never use a normal pillar drill - it is inaccurate, tedious and too slow.
- Always use a precision high speed (15,000-20,000 minimum r.p.m.) drill
- Use a purpose built PCB Drill Stand and not a general 'hobby' drill stand. A PCB drill stand will improve accuracy and prevent drill wander and breakages.
- Always use tungsten carbide drill bits. At approximately one third of the price MM reground tungsten carbide drill bits offer excellent savings.