

PCB Fab-In-A-Box

INSTRUCTIONS

Household Items To Gather Up:

- 1) Acetone
- 2) Paper towel
- 3) ScotchBrite® (green pad)
- 4) Tarn-X® cleaner (optional)
- 5) Water tray

TONER TRANSFER PAPER

This specialty paper is coated on the BLUE side with Dextrin, a non-toxic, non-hazardous starch-based product. It is safe to use in all laser printers and photostatic copiers but is NOT intended for inkjet or wax printers! Read the note on the front of the toner transfer paper for full safety details.

- **Which Side To Print:** Print only on the blue side! If you print on the white side of the paper it won't release the toner image and the page will be wasted.

- **Keep The Paper Sealed:**

This paper is dimensionally stable (e.g. lies flat) at 70% RH. If the paper is left exposed to a dry environment (< 50% RH) it will begin to curl which can cause printer jams or result in poor print quality. You will notice that after the paper has been run through your printer it will have a noticeable curl. This is due to the hot fuser rollers removing some of the paper's moisture. It is normal to experience some paper curl after printing but it will not affect the transfer process. This toner transfer paper should not be run through the printer twice since the curl may cause a printer jam. Instead, print to a smaller piece of transfer paper.

- **Economize on Paper Usage:**

This technique will enable you to run very small pieces of transfer paper through any printer device. This is an important trick if using a copier because most require you to use a full-size sheet of paper.

First print your circuit image to a regular sheet of white paper using the manual feed tray. Cut a small piece of the blue transfer paper about 1/2" larger than the size of the printed image and lay it blue-side up, directly over the printed image. Us-

ing an Avery® type of laser-safe label (or any paper tape) secure the "top" edge of the transfer paper to this white paper sheet (eg. the top is the edge that goes into the printer, and print the file image again. If this white paper "carrier" sheet jams the total paper thickness is too great for your printer. To correct this, simply cut out the printed image on the white paper so the transfer paper sits INSIDE the opening and hinge it like a "doggy door". Place the carrier paper into the manual feed tray and print. The image should print perfectly to the small piece of transfer paper.

- **Handling The Paper:**

Handle the paper by the edges if possible and always with dry hands! Try not to get fingerprints over the coated side.

BLANK LAMINATES

There are two parameters for copper laminate boards: 1) Copper Weight: 1/4oz, 1/2oz, 1oz, 2oz, and 2) Total Board Thickness: .032" or .064". (These numbers vary a thousandth or so between vendors.) Our system is geared for the new standard of .032" but with 1/2oz copper foil for very fast etch times. (All production boards are usually 1oz copper.)

- **Cutting To Size:**

These FR-4/G10 fiberglass laminate boards cut very easily with just a conventional paper cutter.

- **Preparing The Copper Surface:**

The ideal way to clean the copper is to use a drop of dish washing soap on the green side of a ScotchBrite® scouring pad with plenty of water. Rinse well then use Tarn-X® cleaner to make the copper as bright and oxidation free as possible. (This is nice but not necessary). NOTE: If during the toner transfer process your toner image becomes damaged you can easily remove the toner image with Acetone and re-clean. However, if you do this, make sure the board is totally dry as well as the paper towel being wet with the Acetone or else moisture will play havoc on liquifying the toner image and make a mess of things!

TONER REACTIVE FOILS (TRF)

The “GreenTRF” is for your circuit image whereas the “WhiteTRF” is optionally applied to your silkscreen-image. If you so elect to add that to your board the dull side of either foil is laid over the toner image, then run through the laminator, allowed it to cool, then peel it back and discard.

The foil pigments of these foils will only stick to the toner image when subjected to heat & pressure from the recommended laminator or a calibrated household iron (see website for this calibration process).

- **Purpose Of The “GreenTRF”:**

Toner is very porous. Without a sealer over the toner image the etchant can easily work into the granular makeup of toner and cause pitting of the copper surface. The job of the green foil is to prevent this from ever happening regardless of the density of the transferred toner image.

- **Purpose Of The “WhiteTRF”:**

For a very professional look to your board you can optionally add a silkscreen layer. Initially the image will of course be black and you may feel this looks just great for a silk-screen image for parts insertion, etc. However, to make the board look like a production piece, the WhiteTRF will give your board a conventional look. If when you apply the WhiteTRF you find some white pigment left behind where it shouldn't be it's due to “surface tension” and is easily removed by laying down strips of 3M® “Temporary” tape and peeling each strip off which will lift off excess white foil.

To apply a foil to either a circuit layout or subsequent silkscreen image, cut a piece of foil about 2” longer than the board, wrap 1” around the leading edge and insert into the laminator. Immediately after the rollers have grabbed the board and foil, drop your fingers down on top of the foil to induce drag over the foil thus preventing wrinkles from forming over the toner image.

PRE-PRINTED IMAGES

The pre-printed “sample” sheet of circuit images included in this kit is a trouble-shooting tool in the event you experience a problem transferring images made from YOUR printer or copier. These images are printed on a known good laser printer with a quality

“branded” toner cartridge. If for example you saw toner particles floating in the water bath after the transfer paper removal step, it would indicate that the problem lies with either the toner density of the printout was not high enough or the laminator not fusing due to low heat and/or pressure. To determine which is at fault, use one of the test images.

If our sample images transfer perfectly, this would confirm proper laminator operation so your focus would then be on your printer's setting. If however, the problem continues even with our images then you know the laminator is the culprit.

- **Printers:**

This paper can only be used with “toner” based printers (laser and photo-static copiers) and can not be used with wax, inkjet or full-color (CMYK) printers. However, you can use any printer to create a “master” on white paper, then use a toner-based copier to duplicate your image to the Toner Transfer Paper.

- **Problem Printers:**

To date we have discovered only the Brother® brand of printers are not compatible with our system. They use a completely different type of toner formulation requiring very high fusing temperatures. Please review the latest info on reported problems with other printers on our website under the Tech Support area.

- **Laser Printer Alternative:**

Many customers who have just an inkjet printer who don't want to purchase a B&W laser printer just to use this product can use any of the low cost B&W “no-frills” copiers by Canon called the “PC” Series. Two older models, PC-150 and PC-160 are out of production so they're inexpensive on the used market. (Search eBay, Amazon, etc.) The newest is the PC-170. To use a copier, you simply print your original artwork from any printer on white paper and run a sheet of the Toner Transfer Paper through the copier. If you go to your local copy house to use their copiers, please review the procedure we have on the website under TECH SUPPORT > Instructions > Printer Setup, reference to “Copiers”).

- **Setting Laser Printer Density & Paper Weight:**

All laser printers have a “toner density” control for the amount of toner being laid down. On some printers the laser printer “density” control may be a bit elusive to locate. If your printer doesn't have an LCD window for making parameter changes, you will then have a “Utility” program that came with the

printer to effect changes. Copiers on the other hand just use the “contrast” control to adjust density of the printout. Don’t confuse Density with Resolution or any other printer modifier. Also, you will want to turn off all “economy mode” settings because you want the most toner you can get out of the printer.

The second parameter you want to set is the Paper Weight. Our transfer paper is a “numbered” paper. It is referred to as 170gsm (grams/square meter). When you get into this parameter area you should see a list of “paper types” (eg. bond, coated, card stock, etc). Look for one that has a range of numbers like “150 to 180gm2” or perhaps “>160”.

- **Laminator vs. Household Iron**

Making boards can be done with either the recommended laminator or a household iron (after it has been calibrated – procedure online) but, there is a performance difference between the two. We highly recommend using the laminator over the iron because it’s just simpler to use and there are no limitations like that of using the iron. Using the iron requires putting your entire body weight over the iron for about 20 seconds. Also, due to the very low pressure being applied (with even your entire body weight over the iron) there is a limit to how fine a line you can reliably transfer – about .012” wide.

- **Best Lamintor Recommendation:**

Only a few laminators on the market provide sufficient heat & pressure to effect perfect transfers to both PCB laminates and for “chemical milling” (etching metals in general). We highly recommend a relatively new Chinese imports on the market marketed by various companies under various names. This type unit is an all metal design, 12” wide featuring a heavy-duty motor drive with an adjustable temperature range up to an astounding 379°F! This is 100°F higher than the standard “brand name” pouch laminator you’d find in any office supply store.

In the USA this laminator goes under the name “Apache AL13P” and available exclusively through Amazon.com. (If this unit had a ‘brand name’ attached to it, it would easily be priced in the \$300~\$350 range!) At the time of this writing, the going price on this gem is only \$89! The only thing it doesn’t have is a thermal fuse to shut down the heaters if it were to malfunction. To that, we suggest you get a inexpensive \$7~\$10 smoke detector

and mount it above the area where you use this unit.

- **Carriers:**

There is never a “carrier” envelope required with the Apache laminator. Doing so will only insulate heat getting to the Toner Transfer Paper and TRF foils reducing the ability to have a perfect transfer.

- **Simple Adjustment:**

There is one simple spring adjustment we recommend doing if you get this unit. The procedure is outlined on our website under the “PRODUCTS menu > Applicator”.

- **Maximum Board Thickness:**

The Apache AL13P can handle boards up to .064” thickness. Please see the instructions outlined under the website’s “PRODUCTS” section > Applicator.

- **Safety Reminder:**

Whenever using a heated device like a laminator you should always be present in the room. If you aren’t in the room with the laminator running, we suggest picking up an inexpensive “Smoke/Fire Detector” and mount it above the laminator. It’s easy to forget the unit is running since it is very quiet and since heated devices are always a potential fire hazard, why not give yourself a bit of advance warning.

- **Transferring Your Toner Image:**

Every software package handles printing a bit differently as to how it prints ‘top’ and ‘bottom’ traces of a board layout so you’ll need to play with this to know how to orient your images. The sample sheet of “test images” (included in the full PCB kit) have been printed in reverse (mirror image) so the text will show up correctly. It’s best to always make a test print to white paper so you can verify orientation before potentially wasting a sheet of the Toner Transfer Paper.

For double-sided PCB’s we have put up on the website three methods. We personally prefer doing one side at a time as it can be a lot faster being that you don’t have to blind-register two opaque pieces of transfer paper and accuracy can be much higher.

Also keep in mind that the very act of transferring a printed image will always reverse the image. Board layout is normally done via “X-Ray” view on-screen where you are looking through the board from the top “component-side”. Most software will not reverse

the BOTTOM image which does render the correct orientation for our process. If your particular software application does not automatically reverse your 'top' side images, you will have to force it to do so. After getting your feet wet with our system, all of this will make much more sense.

MAKING A SINGLE-SIDED PCB

STEP 1:

Clean the copper surface with a drop of dish washing soap on a ScotchBrite® kitchen scrubbing pad, rinse with running tap water and dry with paper towel. Dip the board in Tarn-X® to remove all oxidation from the copper surface. This is not absolutely necessary step but helps to have a high-purity copper surface.

STEP 2:

Trim and lay the printed image into position over the copper and insert into the laminator. The print should not overlap the board. As soon as the rollers grab the board & paper you can let go. When the board exits, reverse the board (head-to-toe) and reinsert it for a second pass to ensure full even heating to every square inch. If using the recommended "Apache" laminator, it has a "REV" (reverse) button you can hold down to shoot the board back through to the front, then let go of the button and run it through again. You can't over do passes through the lamiantor.

STEP 3:

As soon as the board/paper combo exits after the final pass thorough, slip the board into a tray of water right away. Do not let it cool down! We like to have a shallow water tray positioned behind the laminator. After about a minute or two the paper will separate. Slide the slippery paper all over the traces. This will release any residual "Dextrin" (the release agent) that may be hiding between finely spaced traces due to 'surface tension'.

Remove the paper and rinse the board under a hard stream of tap water and pat-dry the board with paper towel. (If any residue is left on the board, it can cause the GreenTRF foil being applied next to be left on the board where it shouldn't be and that will interfere with the etching process later.

STEP 4:

Cut a piece of GreenTRF about 2" longer than the board. Lay the foil, dull-side down over the board with about 1" flipped around the leading edge of the board, (the edge to be inserted into the laminator). Insert into the laminator in one smooth motion until the rollers grab the board. Immediately drop your fingers down over the foil (or pull back on the tail of the foil) to cause high drag over the foil to prevent wrinkles from forming over the toner image. After the board exits bring the board back to the front and re-insert a second time with the same orientation but this time do not touch the GreenTRF! Upon exiting, slip the board back into the water-bath to cool the board, hardening the foil. Now peel the foil 180° back over itself and discard.

STEP 5:

Inspect the green toner image very carefully for any distortions or missing green foil. After you have verified that the image looks perfect, etch in your usual fashion. Check out our website under "Tips & Tricks" to see how to etch extremely fast without even using an etching tank! After etching, wash thoroughly and dry the board. Remove the GreenTRF and black toner with Acetone (or any "hot" solvent) using a fresh, dry paper towel. If using Acetone, it's important that both the board and the paper towel wet with Acetone NOT have any water present as that will reduce the effectiveness of the solvent and will tend to make a smearing mess!

STEP 6:

After etching is done, a silkscreen layer can now be applied directly over the board the same way the circuit image was created but instead of using the GreenTRF, use the WhiteTRF. Many users just leave the black toner as the silkscreen layer as it has good contrast and looks quite good. White of course makes the board look like it was commercially made.

TROUBLE-SHOOTING

There are several trouble-shooting tips on the website if you are having problems making boards. Please see the website or call us if you get stuck on anything with this procedure. The site is constantly being updated with new tips, tricks & techniques and we're available by phone if you don't see an answer to your problem. We are open 9am - 5pm MST (Colorado).

We Want Your Feedback!

Thank you for trying our PCB "Fab-In-A-Box". Please feel free to contact us for anything. We're always "all ears" for comments on how to improve our process or anything else you'd like to share with us.

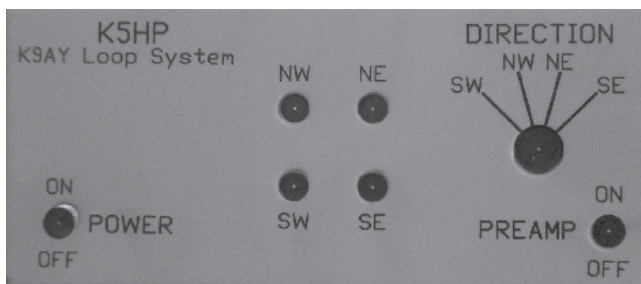
You may have noticed that we included a little "bribe" insert sheet with your order. If you send us high-resolution pictures of what you've done with this product we will compensate you \$20 worth of free supplies of your choosing ... and we'll even pay shipping. What a deal! Details on the website.

NEW! Checkout our latest product called DecalPRO® for making REAL dry-transfer graphics for the outside enclosures of your projects! This new system uses the same transfer paper and laminator for making boards.

All you need are a few inexpensive items and you can then make real, pressure sensitive, dry-transfer graphics that rival expensive 'send out' images and text and do it on the fly with our 8 minute process.

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See our website at "www.DecalProFX.com" to see for yourself everything it can do! There is nothing like it on the market!



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