The Eutechnics do-it-yourself TC PSU repair procedure.

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I will list the tools needed, at the very end of this document.

This is the Flextronics Mark 1 version of TC power supply unit. The Mark 2 looks much the same from the outside and very similar inside. They each overheat and fail as a result.

The failures are:-
99.5%; capacitors overheating and failing,
0.5%; some primary failure with black burnt marks and components missing!

We will only consider the 99.5%.
The other 0.5% are usually beyond repair, and must be accepted as 'terminal'… :-(

End view of the Mark 1. The green coloured capacitor seen on the right is a serious culprit for failure - the base near the circuit board is bulging and it is 'leaning'.
There are two capacitors 'behind' the dark blue-grey capacitor seen lying on its side, on the left. Mostly these will have failed.

Basically… nothing good in here.

We must remove the cover.

NOTE, which side is being opened? The same side as the black connectors.

I'll be asking questions later… so be observant here.

Use a sharp-ish knife. I personally wear thin protective gloves, not being a fan of cut fingers.

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Lots of small cuts rather than one

‘I’ll rip it open in one slash!’

swashbuckling style.

Usually a dozen or so will do it. Take your time, it’s only glue.

Try not to cut through the foil in your enthusiasm!

Peel back that edge.

Well done… so far so good.

Flip it over and you should see the next part of the puzzle… this glued seam.

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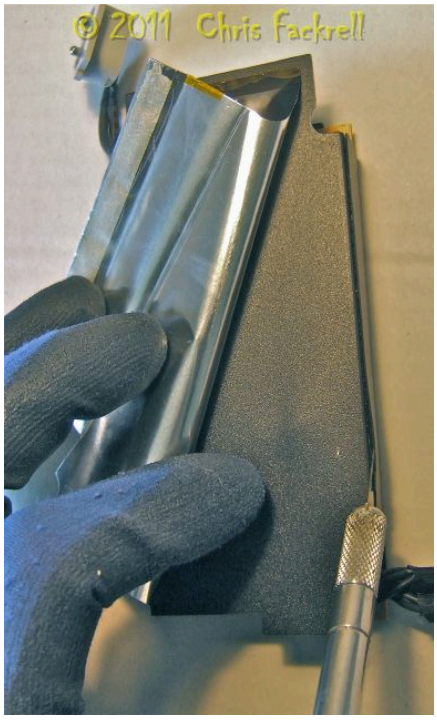

Take the trusty knife and again, gently slice the two parts, apart. The glue is vile here and will happily 'snag' the blade. Gently twisting the blade will help to pry them open.

That was 'trusty' not rusty.

Now take care here.
This is important.

Those two long black tubes are HIGH VOLTAGE CAPACITORS.

It is highly likely that they still contain some of that high voltage. I have measured 180V and that was after it had been unused for a few days.

With a 1000 Ohm 1Watt resistor, bent like in the picture, discharge the capacitor. Make sure to not touch the heat-sink just behind. Only one capacitor needs to be shorted as they are in parallel.

Peel back the black plastic edge. This is the point where the fragility of the plastic will be realised. If the PSU has been *really hot* for months on end, the plastic develops all the physical flexibility and strength of dried pasta sheets, such as might be used in a nice lasagne. It will snap and fracture without much warning, or bending. Gently with a hair-dryer or whizzy heat-gun, get it good and hot (again) and it does become slightly more pliant. Cut away the grey sealant. Cut towards the plastic not the board.

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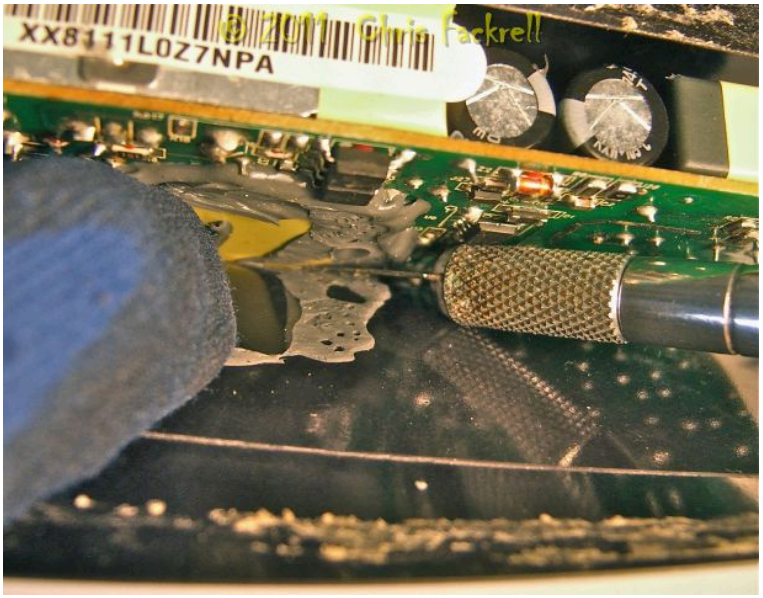
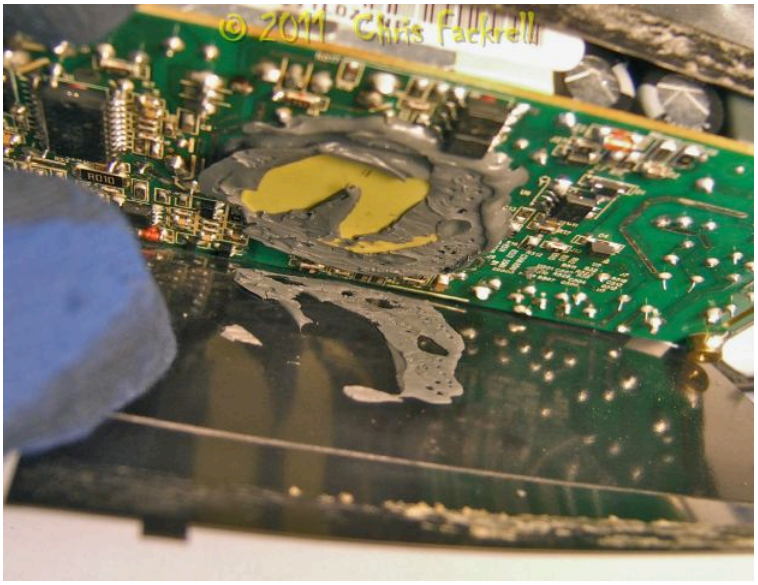
It will take a few slices to get through to the bottom of this lot. Lots of little cuts and very little bending of the plastic.



NOW THE WARNING.

If you did NOT discharge the capacitors, at this point it is highly likely that the blade or handle of the knife will short out some bits sticking through the PCB (Printed Circuit Board - geek speak). You will hear a crack! and see a flash and let me assure you, that will be the end of this PSU! Sadly, sadly, sadly I speak from experience… :-(



Cut gently

and you will eventually release the plastic wrap from the PSU PCB OK?

Having done this bit you will probably understand why I wear those gloves.

To get this far without zapping either yourself or the PSU and to have not broken the plastic into lots of pieces, is quite an achievement.

Well done… shall we proceed?

Take your knife and remove the grey sealant, you know it makes sense.

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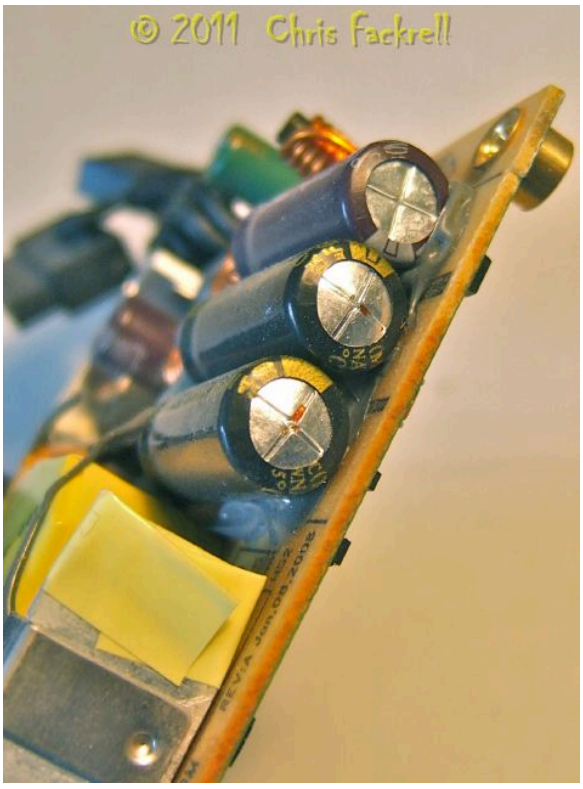
Personally I make sure those capacitors are fully discharged.

I once thought I had discharged the capacitors only to discover I had not.

The 'belt' I received made me throw the circuit board across the room (involuntarily) and caused some nice little burn marks on my fingers.

These comments come from my vast supply of 'experience' and the experience comes from making incorrect assumptions.

If you live long enough through all of your own daft mistakes, you can tell others!



The two bulging capacitors are the ones mentioned at the start. Bulging capacitors are usually dead ones. We will remove these using skill, tenacity and a decent sized soldering iron, along with other implements of circuit board dismantlement.

(I honestly believe this is not a real word - but error checking tells me 'OK')

That horrid little capacitor (top right) is the leaning thing noted at the start. The top is bulging see? I said it was dead… (smug smile).

The other less failure prone capacitor is the top left black-edged beastie. Change all four, failed or not. They have had a hard life and need the comfort of a waste bin to nestle in.

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Let's do some 'getting at things', eh? Those bulging capacitors are all gummed up to the eyeballs with super grey sealant. Cut carefully (and stop if you hit something unforgiving, like a wire).

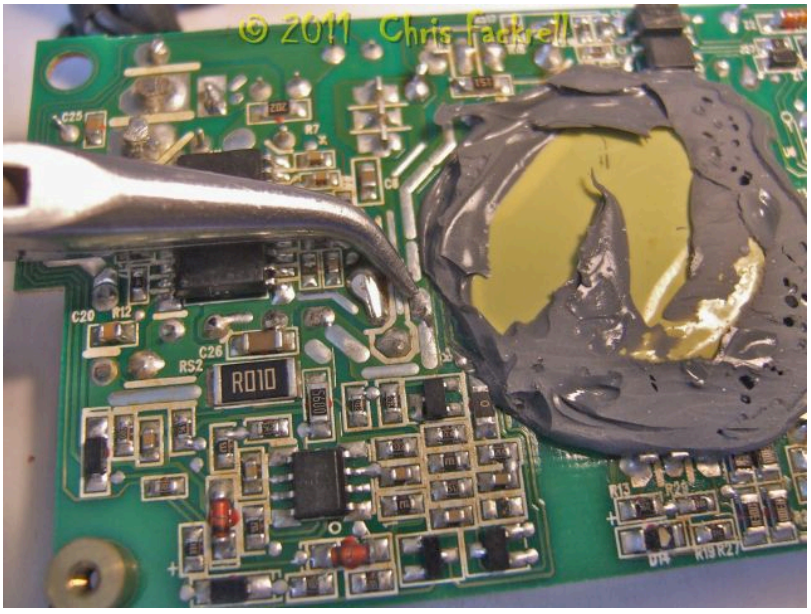
Now the under side of the PCB…

The soldered connections of the two capacitors are along here. The terminal nearest to the yellow centre component

(It's called a transformer [no, not robots in disguise] and is always covered in grey stuff).

Cut it away and pull the bits off with small pliers.

Like this… now melt the solder (add some more if it helps) and remove it with a solder sucker.



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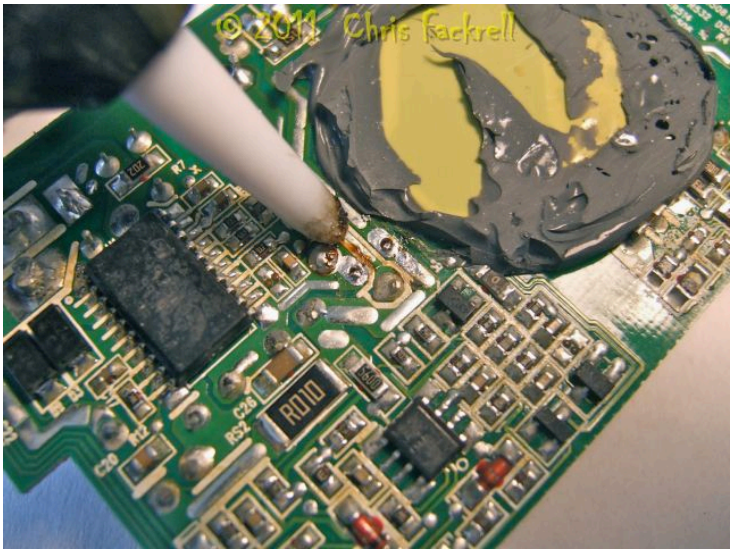
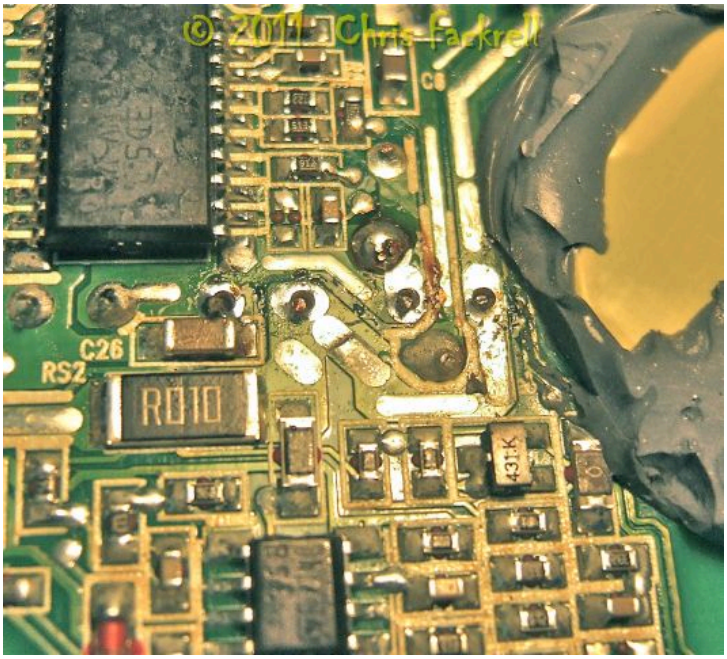
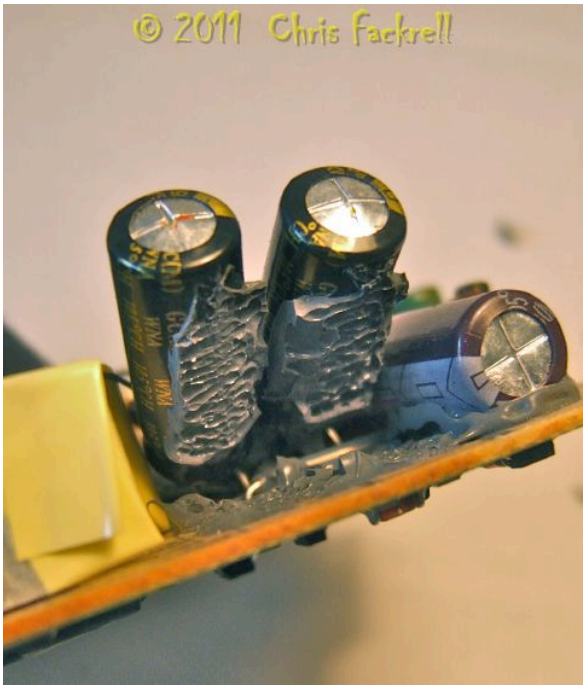


Like this. Do all 4x holes.

As shown here.





Cut the grey stuff away with your not-too-sharp knife. Waggle the two capacitors up and down (they can't touch you for it) and the solder, if any remains, will crack and break free.

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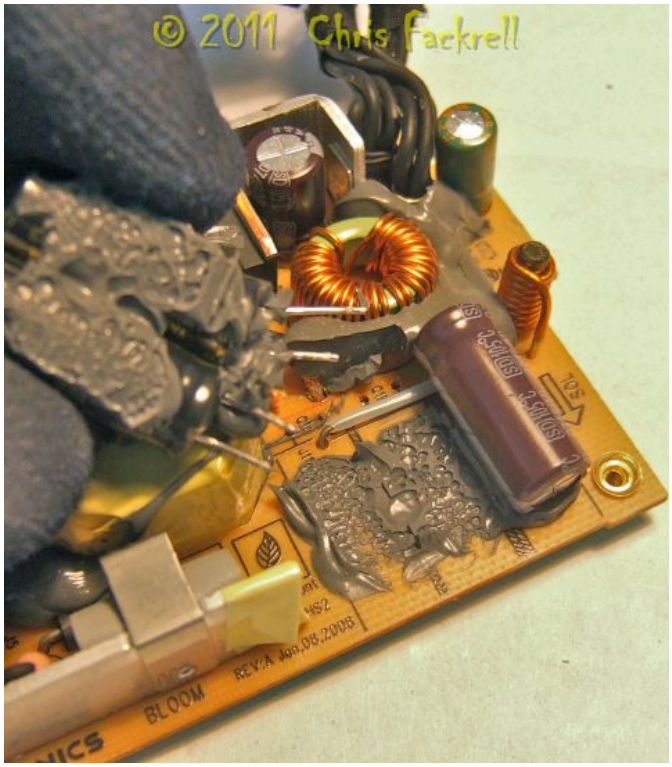
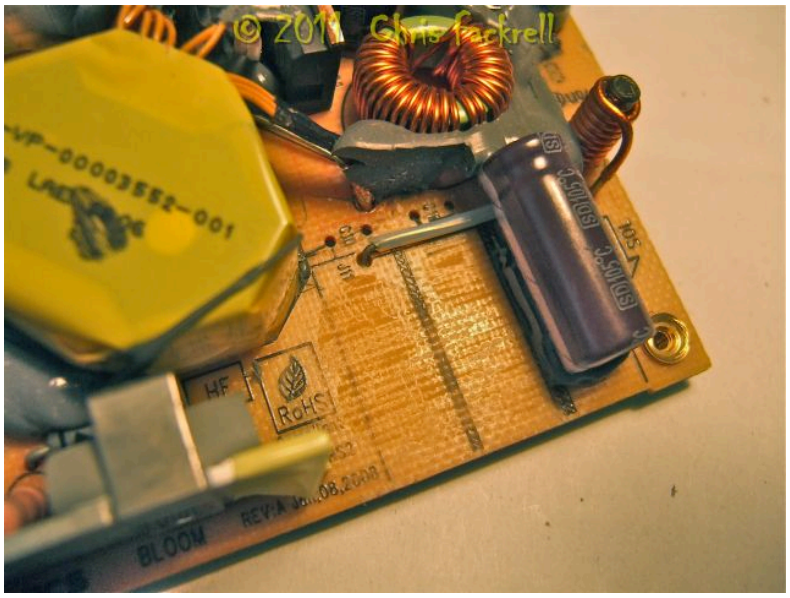
Liberate those capacitors…





… and clean up the PCB.

I do not show the other two ‘end-on’ small capacitors being removed

but they have been.

Clean up the board to give...

Nice clean holes to fit new capacitors.

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These are the new capacitors for the board. The sizes and types (and makes) are quite important.

From the left we have:
2x 1500uF, 6.3V, 105C, 8mm dia x 20mm, electrolytic capacitors,
1x 470 - 860 uF, 16V, 105C, 8mm dia x 12mm, electrolytic capacitor,
1x 470 - 1000uF, 6.3V, 105C, 8mm dia x 12mm, electrolytic capacitor.

Good makes to go for (but not exclusively) are , Rubycon, ELNA, Nichicon, Fuji, Panasonic, Nippon.

Avoid nasty cheapo makes with oddball names like ‘Happy Sun’, ‘SunBurn Capacitors’, - these are made-up names… you know what I mean.

Bend the legs like this.

That stripe down the side denotes the NEGATIVE side. It is important to get this correct. If you get it the OTHER way round and fit it to the board backwards… the ‘phut-factor’ exceeds unity!

(Clever geek talk meaning it ‘fails’ possibly with smoke!)

Bend the legs so the capacitors do not fall out.

I have not shown the two smaller capacitors but the same thing applies. Note the NEGATIVE side of the capacitor and which hole it goes into.

The 20mm long capacitors lie on their sides, just like the ones that came out! :-)

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Now comes the hot molten metal part of the exercise! Hot smokin' solder!

If this is all new to you, fear not. It is all quite easy once you get going; like riding a log or falling off a bike.

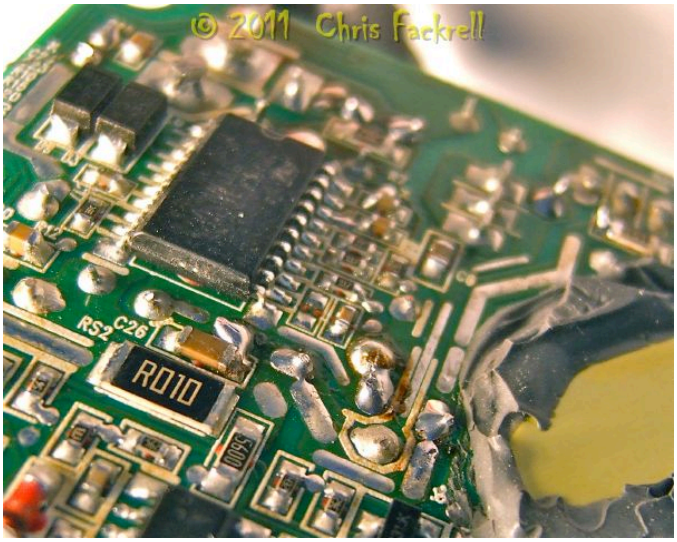
Use decent solder; Lead/Tin is a good mix and works very well, unfortunately the health and safety pixies nowadays are having this stuff BANNED!

Apparently it makes your teeth fall out, or something equally dire.

Silver/Tin is not bad, bloody expensive and melts a bit too hot but makes a nice 'wet' joint.

'Green' solder that is LEAD FREE, unless there is something new recently, I have found to be complete rubbish. It does not 'wet' the joint and smells like a damp hedgehog. Avoid.

TOP PIX: Fit the caps.
SIDE PIX. Clip the legs.



Keep the soldering iron tip clean with a wet cloth. The solder on the tip should be shiny silver and look like mercury (the metal, not the inner most planet). Slightly wetting the joint to be soldered is called 'tinning'. The solder will run to the hottest most molten part. Hold the soldering iron on for a few seconds to make sure the solder flows into the circuit board and up the component leg. Those tough little capacitors can take a few seconds of heat; they will not be damaged. Up to 10 seconds should really be the limit. If the joint is not nice and 'wet' after that, the lead is dirty, or the PCB, or both.

Clean 'em, 'tin' 'em and try again.

When all fitted they look like this.

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At this point the PSU is fixed (hooray!) but not tested (oh). You could just plug it back into the TC and hope all is correct. It may blow things up if you got it wrong - now do you want to risk that? Eh? I thought not.

To test the PSU you must make it work hard into a 'dummy load'. This means some large resistors that take the maximum amount of current at the intended voltage. The PSU is running at full load pushing current through some resistors that get good and hot. While it's doing this, you casually take its pulse (so to speak) to see that the voltages are stable.

The voltages are 5V and 12V and may not read correctly when the PSU is unloaded. A full-load test is the only correct way of doing this. Resistors of low value but high Wattage are needed. This is Ohm's Law stuff and the figures we should use are on the label on the front of the PSU plastic cover (the black brittle thing ~~wrecked~~ seen earlier).

OUTPUTS 5.1V / 3.0A and 12V / 1.2A. Now without too much faffing about, Ohm's Law tells us the resistors needed are 1.7 Ohms and 10 Ohms. The power that each will have to handle again is 15.3 Watts and 14.4 Watts.

Choose resistances that are very slightly HIGHER than shown here and power handling that is very slightly BIGGER than the Watts figures.

I used a 3.3 Ohm 10 Watt wire wound resistor, in parallel with a 3.9 Ohm 10 Watt wire wound, which gave me 1.78 Ohms and 20 Watts. The 12V resistor I used a 10 Ohm, 20 Watts huge finned thing - that looks like a 1950s space ship.

From the top, the wires are:
12V. 0V. 5V.

The central connection will need a soldering iron with a whopping great copper tip that hold lots of heat. Some fiddling little thing, almost regardless of its 'Power Rating' will make little headway again the mass of metal that will suck away the heat quicker than the soldering iron can put more in.

PIX to the right. Load resistors…

12V load at the top, and
2x resistors in parallel to the left for the 5V load.

The lone resistor is my 'discharge the primary capacitors - resistor'. Always to hand…

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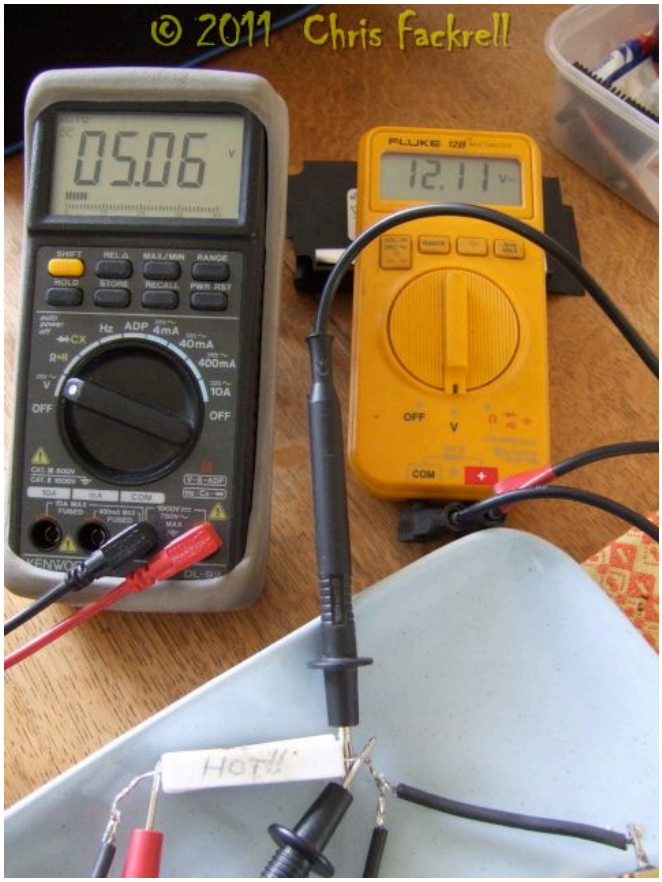

WARNING! Do not touch the PCB when it is powered up! Voltages far higher than 12V are on the surface components and copper tracks.
THEY COULD HURT!
THEY COULD KILL!

Do not be inquisitive and prod around with the meter probes to find out where these voltages are.

I know what I'm doing (in my delusional state - I know everything) and I SLIPPED off a high voltage connection and shorted out the mains input to the board, or something similar. The whip-crack noise and bright flash as the PSU (that I had just fixed) died instantly, will stay with me forever!

I leapt backwards off my seat and whacked my knee against the corner of the desk… the pain was unbelievable. That so much pain could be contained into one knee-cap came as a surprise.

With the PSU loaded, the voltages can now be measured. I show both at the same time but only because I needed two voltmeters for the picture. The values shown are OK. They will always be a fraction % different from the 'spot on' value.

The PSU is fixed!! Dancing in the streets; well a little 'whoop' of joy at least. OK, a smile of satisfaction - British reserve eh?

POWER IT OFF and THEN discharge the main capacitors again, with the trusty resistor. Unsolder the load resistors. Scrub the board clean of bits with an old dry toothbrush.

Re-cover with the plastic and foil. Work out which way it fits - this is important. Use HIGH TEMPERATURE tape to hold things in place and under no circumstances use ordinary sticky tape, or even insulating tape. It will melt and possibly burn. I know it can make a vile smell - I have a friend who was on the receiving end of this 'error' - how we laughed!

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Tools of the trade.

The ones listed first are the bare essentials to do the job. You cannot do the job at all without these.

1. Modelling knife
2. 1 K Ohm 1Watt resistor
3. 25W soldering iron
4. Solder 'wick' (Solder sucker is the 'old school' option)
5. Solder
6. New correct capacitors
7. Small side cutters
8. Cross head screwdriver to remove the PSU in the first place.

These tools make for a better work experience.

9. Multimeter that can measure DC volts.
10. ESR meter to measure the value and performance of the capacitors.
11. High temperature 'KAPTON' or equivalent tape. (The yellow tape in end PIX).
12. An old toothbrush - to brush away bits and old solder flux.
13. Long snipe-nosed pliers (seen in my PIX)
14. Thin polyester protective gloves
15. A decent bright desk light
16. An old tatty tablecloth
17. An ACME anvil… I've ALWAYS wanted one of those! :-)
18. Lots and lots of patience.

By the way, if having read this and you are doubtful about doing it, ask me.
My charges are modest.

See www.fackrell.me.uk

Many thanks and good luck!

Chris Fackrell.