Yamaha SY99 LCD Display Upgrade Procedure

Author

Derek Cook, December 2012

The Display Upgrade is based on original research and work undertaken by EX5_Etc, which he kindly posted under the FM forum on EX5Tech (see **Links** Section).

Purpose of Document

It's a well known fact that the Liquid Crystal Display (LCD) backlight used in the Yamaha SY77/TG77/SY99 series will progressively get dimmer and dimmer over time. I have just acquired my SY99, and it exhibited this failing.

This document covers replacing the SY99 LCD with a "cool blue" LCD (white text on a blue background) that was the subject of the EX5Tech thread listed in the **Links** section of this document.

The EW50340BMW display used in the original work by EX5_Etc, is no longer available, so this guide has been written for the Newhaven display type ***NHD-24064WG-ATMI-VZ#***, which is a more recent alternative, and which was selected as it is one of the slimmer options on the market.

The disassembly and assembly took about two hours each way (although I was taking my time, taking pictures and writing notes); replacing the display took about two hours with the modifications required to the SY99, so you need to allow about six-eight hours for the job in total.

The Newhaven display is very similar to the EW50340BMW, but with the following differences that need to be accounted for in the upgrade:

- The required supply voltage for the LED backlight is 3V, with 3.5V quoted as the maximum. If 5V from the SY99 is used, the display is too bright, and there is probably a risk of long term damage to the display as you are over driving it.
- The SY99 contrast circuit requires adaptation to get the contrast voltage required by the display in the correct range.

So, it's a little more wok than the original upgrade, but nothing terribly complicated.

At the same time as doing this upgrade, I also needed to repair a sticky black key on the keybed, and to fit replacement batteries, using battery holders instead of soldered batteries. I also upgraded my TG77 display as well. So I have written guides for these activities as well.

Disclaimer

Whilst I have taken care in preparing this guide, and whilst the upgrade worked fine on my SY99, I cannot be held responsible for any damage that you could do to your machine or injury to yourself and/or others as a result of you following these notes; either on your own account or by any error or omission in this guide. You do this upgrade entirely at your own risk!

Please bear in mind that during a production run of any manufactured item, a manufacturer can make changes, and I can't guarantee that all SY99 machines are identical, as I only have the one. So care is needed in checking that the steps advised are appropriate for your machine, as it might be different to mine.

Pre-Requisites

First of all, make sure that you're comfortable with the concept of completely dismantling your beloved SY99, including cutting wires and unsoldering a resistor on one of the synth's circuit boards.

Keyboards are usually dismantled from the "bottom up", so the LCD will be the last item you get to after undoing what seems like hundreds of screws, unplugging many cables, removing five circuit boards, other bits and pieces and the keyboard assembly itself! And of course disassembly is the easy part; you need to get it all back together again (hopefully with no screws left over) and in working order!

You also need to be proficient in soldering, or know somebody who is and who can help you.

You will need the following tools to do this job:

- Posidrive and Jewelers' screwdrivers;
- Wire cutters;
- Some small fine nose pliers also come in handy;
- Soldering iron and solder;
- A desoldering pump, or solder removal wick;
- An anti-static wrist strap is recommended;
- Voltmeter.

You will need the new LCD panel itself and the parts identified in the **Parts** Section at the back of this document.

You need to ensure that you take anti-static precautions whilst the synth is open. If you don't have an anti-static wrist strap, then ensure that you regularly earth yourself on a metal object, such as a radiator to prevent the build up of any static charge.

Electric Shock Hazard Warning

Be very aware that in opening the keyboard, and if it is powered whilst it is open, there will be exposed mains voltages on the power supply board and thus a risk of electric shock. Obviously, the synth only needs to be powered up for short periods whilst it is disassembled. If you keep your hands well away from the power supply board when the case is open and the synth is powered, then the odds of you getting an electric shock will be very small.

If you are in any doubt regarding your ability to work safely with a potential exposed mains voltage hazard, then you should refer this job to a competent electronics technician.

Procedure

Step 1 – Backup your Data

As you are doing a lot of internal disassembly, as a precaution you should ensure that all of your important user data (Voices, Waves, etc.) is backed up to floppy disk, or via MIDI to computer.

Step 2 – Find a Good Work Area

You'll be working on this for a while, so find somewhere comfortable and where there's plenty of light. My kitchen was the best place for this in my house. Note the towels under the keyboard to protect the fascia.

References in this document to "top" and "bottom", "left" and "right", refer to you looking at the keyboard in this orientation of the base upwards and the back panel towards you.

Before placing the keyboard in this position, don't forget to remove the volume knobs from the volume sliders. They come off quite easily, as they are just a push fit.

Whilst on the subject of avoiding scratches, the next step is very important!

Step 3 – Remove Cat from Work Area

An EX5Tech pre-requisite in the guides we write, and a very important step if you wish to avoid being "scrammed"! And of course, cat hair is terrible for static, and it gets everywhere[1]!

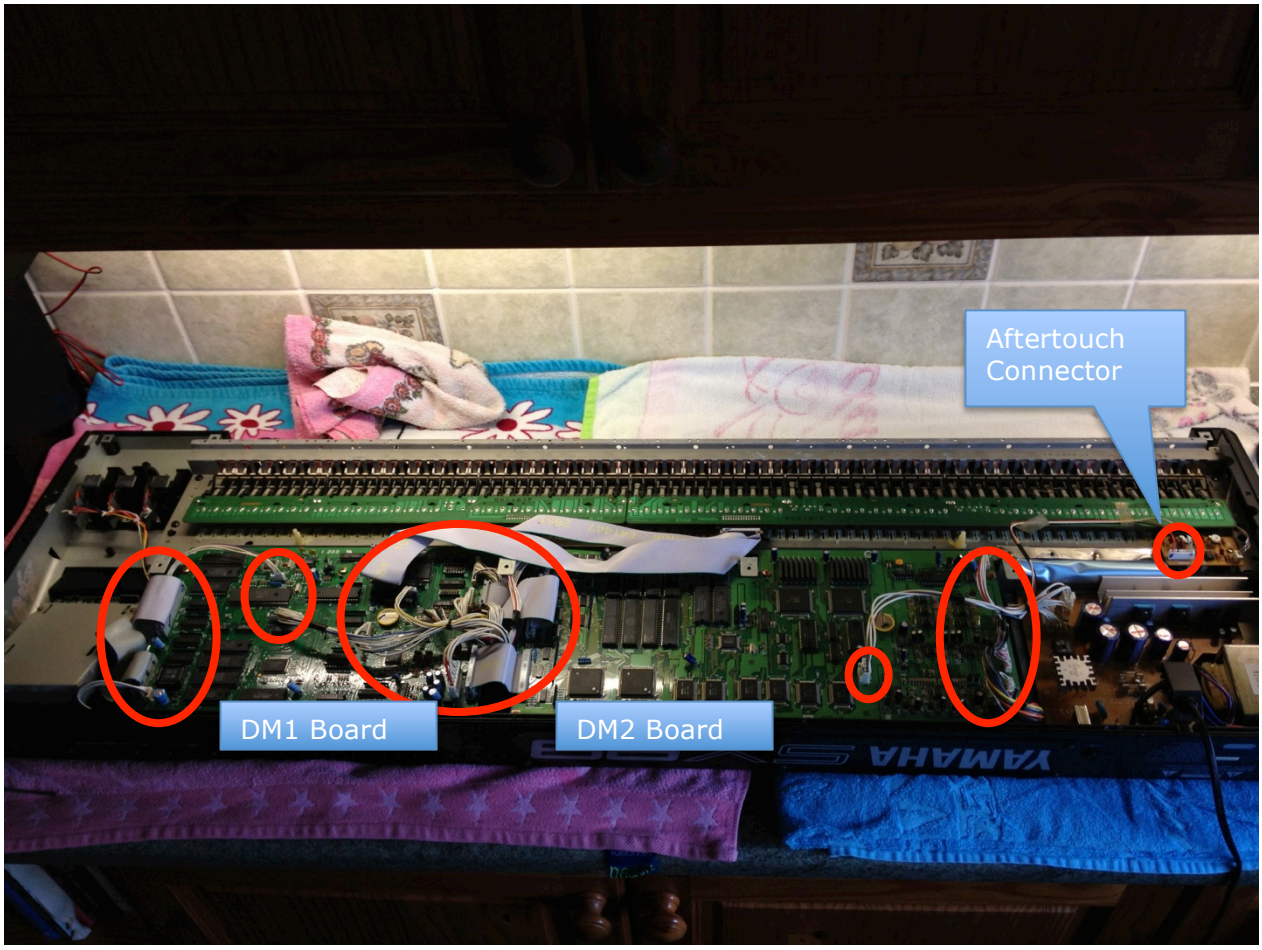
[1] Synth Trivia: If you're in the market for an OSCAR monosynth, look out for one where the innards contain cigarette ash and cat hair; as these were supposedly hand built by chain smoking, cat loving Chris Huggett, the main man behind the Oxford Synthesiser Company.

Step 4 – Remove Bottom Plate

The first big step is to undo all the screws on the bottom plate (including the four rubber feet). The plastic end cheeks can be left in place.

As there are only a few different types of screws, I didn't worry about making diagrams as to where they came from, but I kept the external screws in one bowl, and the internal screws in another to make it easier to sort them out later.

With the bottom cover removed you can see that there are two main boards, DM1 and DM2, with quite a few connectors going between them. All of these connectors need to be removed. Fortunately, all of them have different numbers of pins, and thus their associated plugs cannot be connected in the wrong place. So I didn't worry about labeling the leads with the numbers of the Printed Circuit Board (PCB) connectors that they go to. Don't forget the Aftertouch connector on the keyboard, as well as the ribbon cable from DM1 to the two connectors on the keyboard.



Step 5 – Remove Main Boards

Remove all the identified connectors and unscrew and remove the boards. Each board is held by six screws, three at the front and three at the back.

Removing the boards reveals screening material, which also needs to be removed. The black plastic under the DM2 board is easily removed, just note how it slots in the frame at the front of the keyboard.

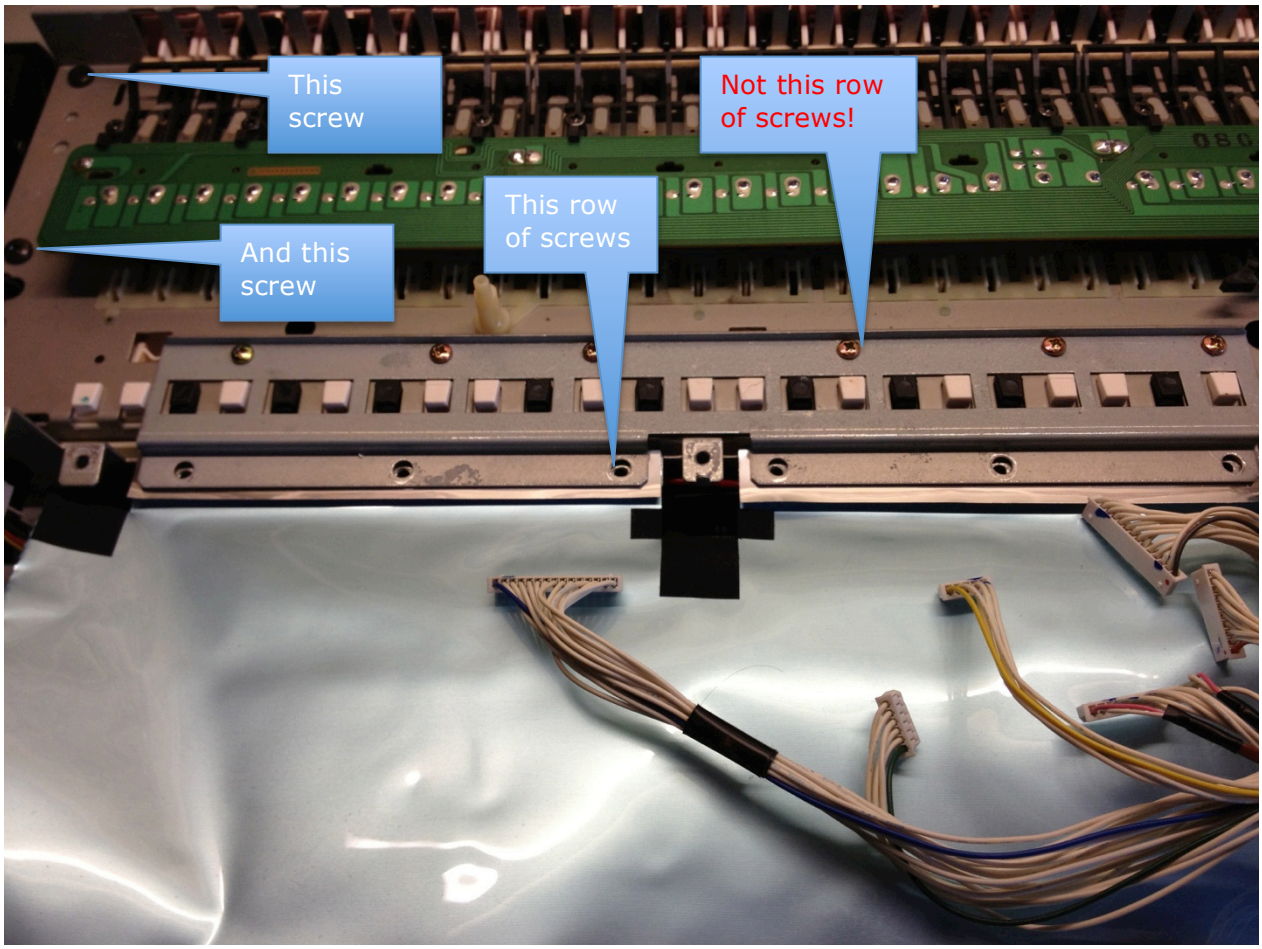
The silver sheets will now be loose at the back of the synth (they are secured by the PCB screws), but are secured under the keybed, which now needs to be removed.

Step 6 – Remove the Keybed

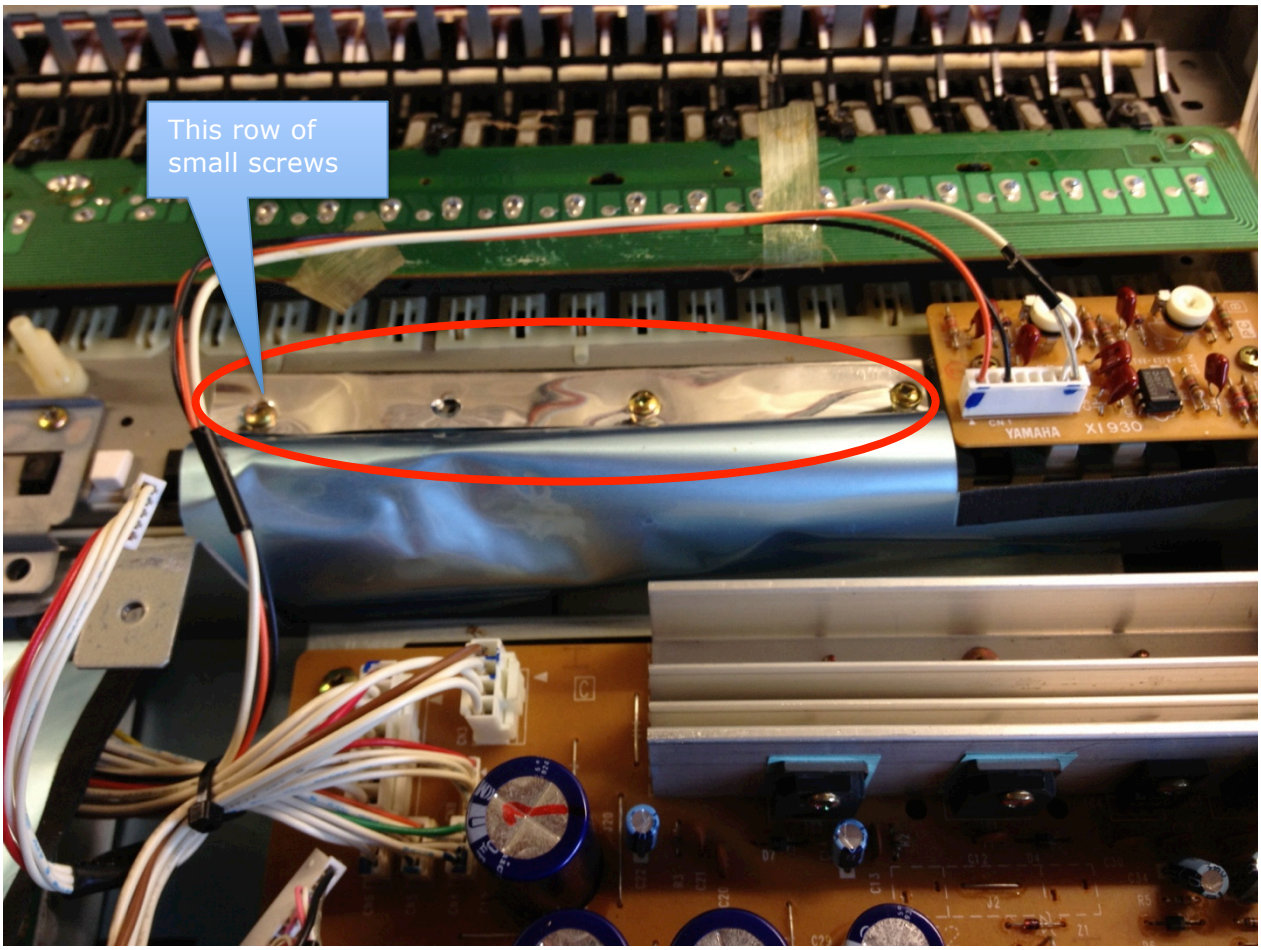
You need to remove the two end screws either side of the keybed. Note that these screws are different to all the other internal ones; they are black with a coarser self tapping thread.

Undo all the screws connecting the rear of the keybed to the metal bracket.

Note that that it is the row of larger screws, closer to you, that are removed, the smaller ones holding the flat metal strip to the keybed can be left alone. When doing these jobs part of the process is learning what not to take off!



There are also some small screws on the screening by the PSU that need to be removed.



With all the screws undone, gently lift the keyboard out, moving it away from you towards the front and up a little, taking care to ensure that you don't foul anything. Pay particular attention to the Aftertouch ribbon connector to your right, as it's easy to catch it on the case.

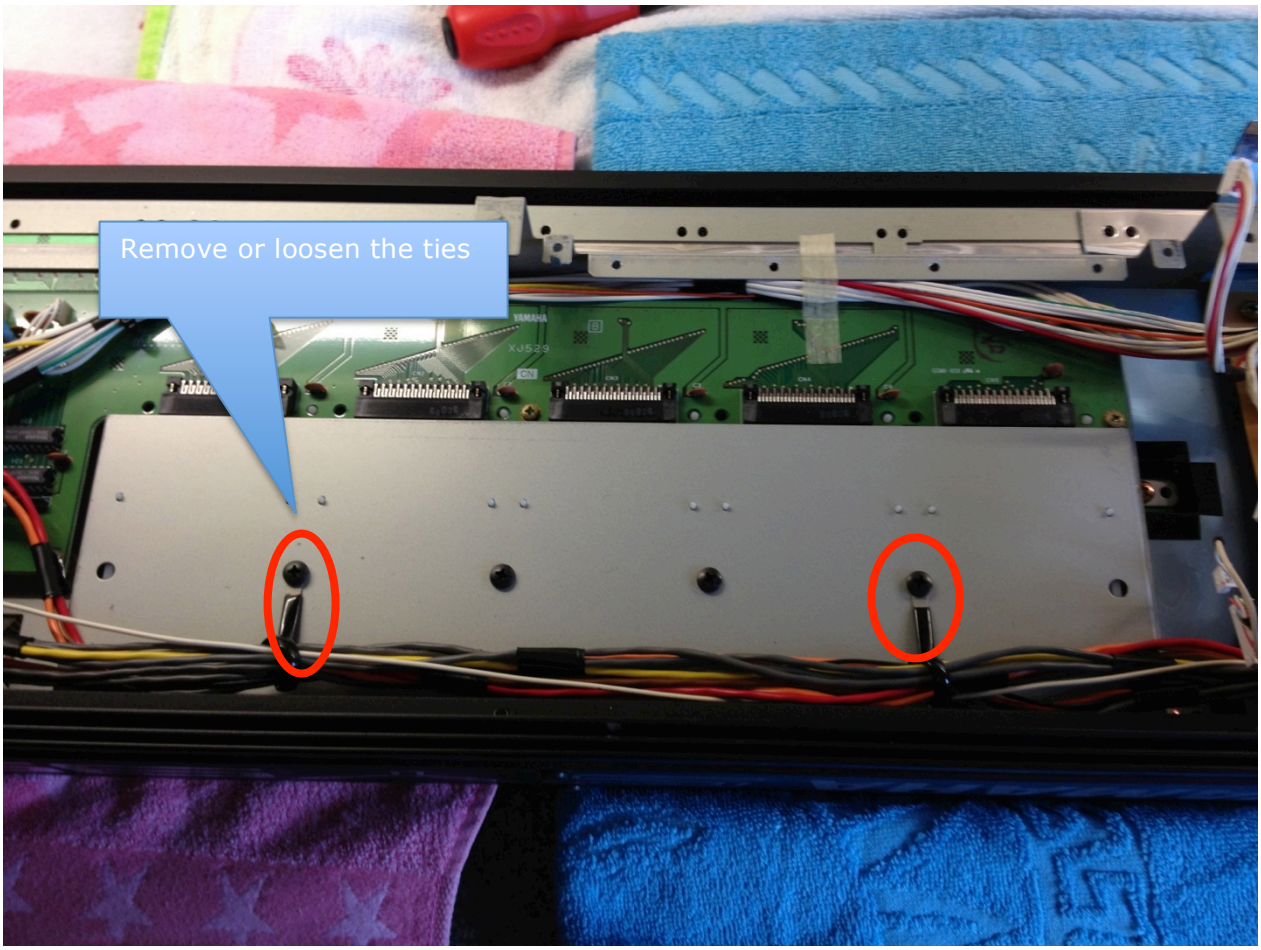
With the keyboard removed, the screening can now be removed, which will reveal the next layer!

Step 7 – Remove the Sample RAM Board and Housing

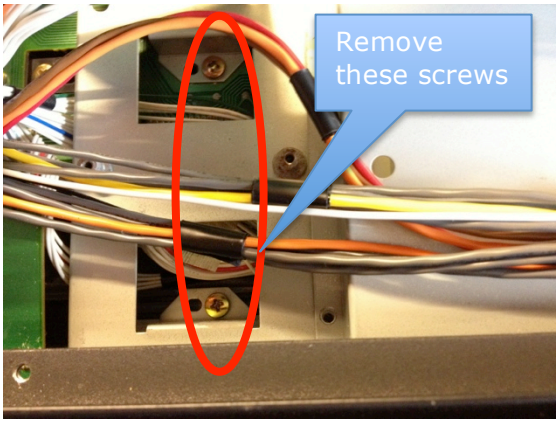
If you have any Sample RAM expansions installed, remove them first and store them safely.

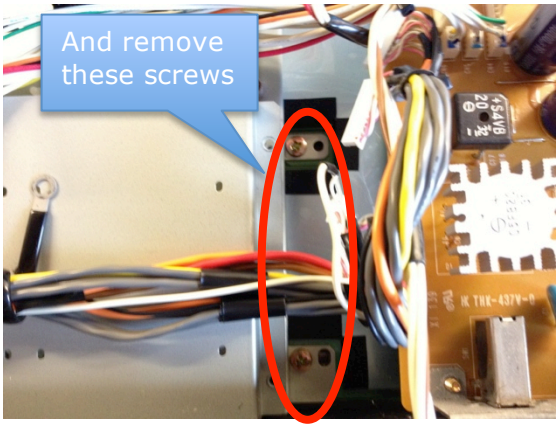
Remove the Sample RAM board, unclipping the connector for the ribbon cable that goes to the DM2 card and the Expansion Cartridge slots. The connectors on the right of the card are soldered in place, so just move this card so that it is out of the way of the expansion housing.

Undo the two black screws on the top that have cable retaining clips on them, or just open out the clips to allow the wires to be loose.



Undo the screws holding the sample RAM chassis. There are two recessed screws either side of the chassis.





You'll need to slide and angle the housing to remove it. I also found that in my synth, the rear of the housing was catching on the screening foil underneath it, so it wouldn't move out easily until I had freed it.

Step 8 – Remove the Data/Waveform Cartridge Board

There are three screws to remove: One either side, and one accessible via the hole in the middle of the board. The board has a ground lead connected to the chassis. This doesn't need to be removed, just place the board to one side out of the way of the switch board.

Step 9 Remove the Floppy Drive

This needs removing as you need to access the board underneath it. There are three screws to remove: one either side and one on the rear frame.

Step 10 – Remove X1138 IO Board

This needs removing so you can access the wires going from the PSU to CN33, which provide a 5V feed for the voltage inverter. We will need to cut these wires to provide the voltage for the LED backlight of the new display. It also removes the power to the existing LCD backlight inverter, which will no longer be needed, so you will no longer hear its annoying whine!

The card is held by several screws on the outside of the rear panel, by the connectors, so unscrew them all.

Whilst you are at it, remove the Red/Black lead from CN34, which provides the backlight power.

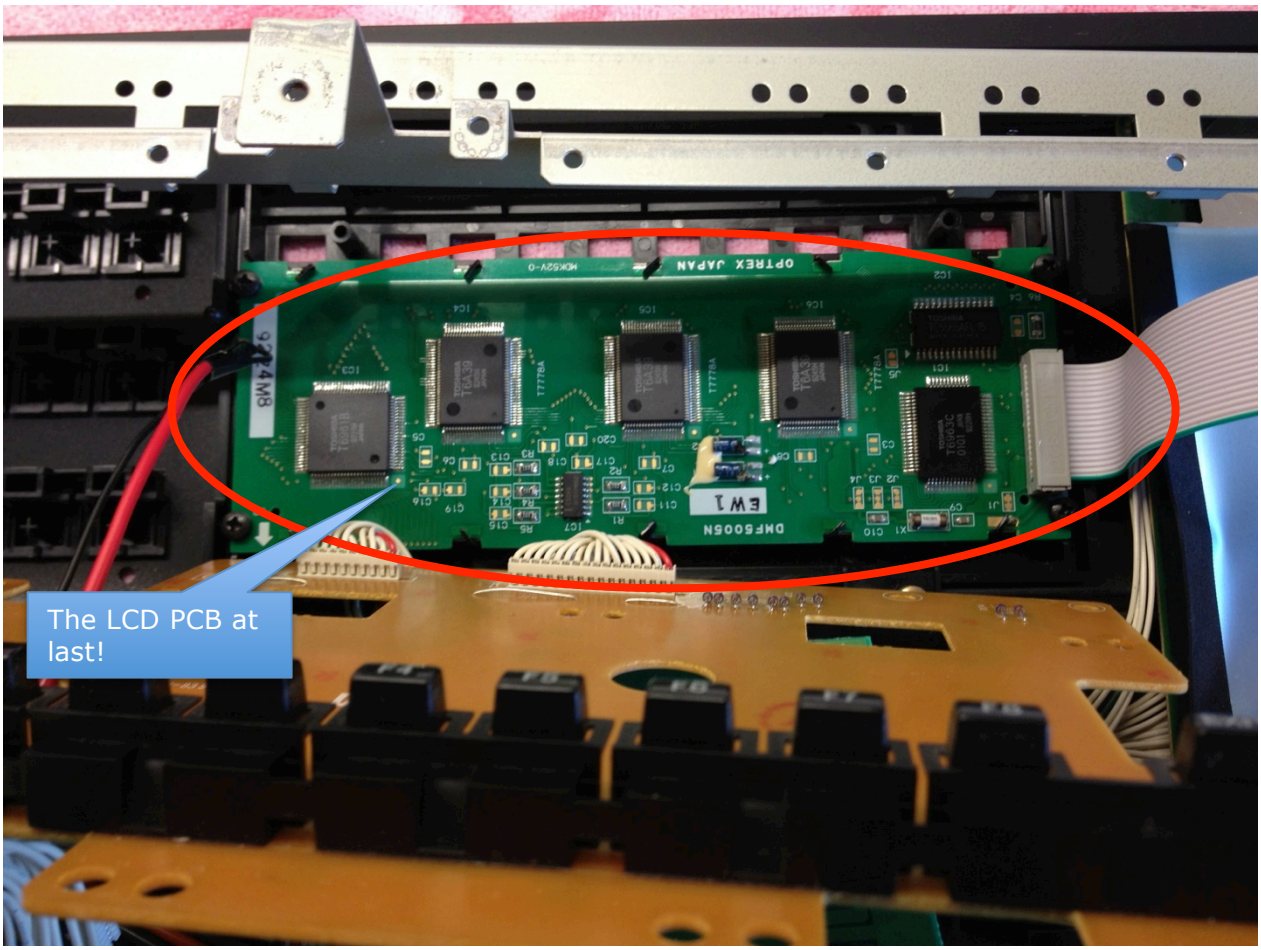
The other leads are soldered directly to the card, but you don't need to remove the card completely; you just need to be able to turn it over.

Step 11 – Remove the Switch Board

As well as the screws directly securing the card, the metal frame above the board needs to be unscrewed and lifted to allow this board to be removed.

I didn't remove this board completely and just rested it against the back panel. This saved removing even more wires.

We've now, at last, reached the LCD display, which is secured by four small screws, one in each corner! Simply undo them to remove the display, feeding the Power lead for the display through the circular hole in the switch board.


The LCD PCB at last!

Step 12 – Have a Cup of Coffee, Tea, or a Stiff Drink!

Pat yourself on your back (or get somebody else to do that for you, if you're not too dexterous)!

You've done well to get this far, although of course, with the contents of the synth strewn everywhere, there's no going back now!

Step 13 – Preparing the "Cool Blue" Display

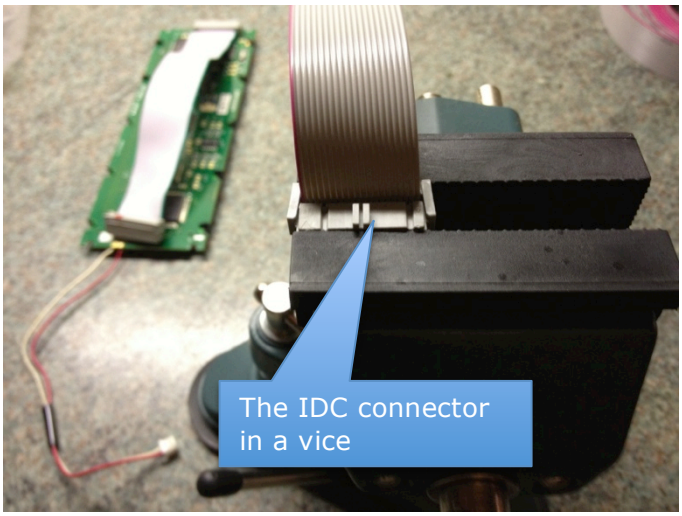
The display comes without a connector for the ribbon cable. So solder the right angled header that you have acquired to do the job. I forgot to take a picture of this, but the connector goes on the component side of the card, like the directly soldered connector on the display that you have just removed. If you put it on the front, the display won't fit in, so just ensure that it's on the right side before you solder the connector onto the board!

I also cut the supplied power leads, which are a little short, and soldered two new ones that are long enough to reach the left side of the synth, as we need to provide a supply voltage at 3V for the LED backlight. You'll see how I do this later.

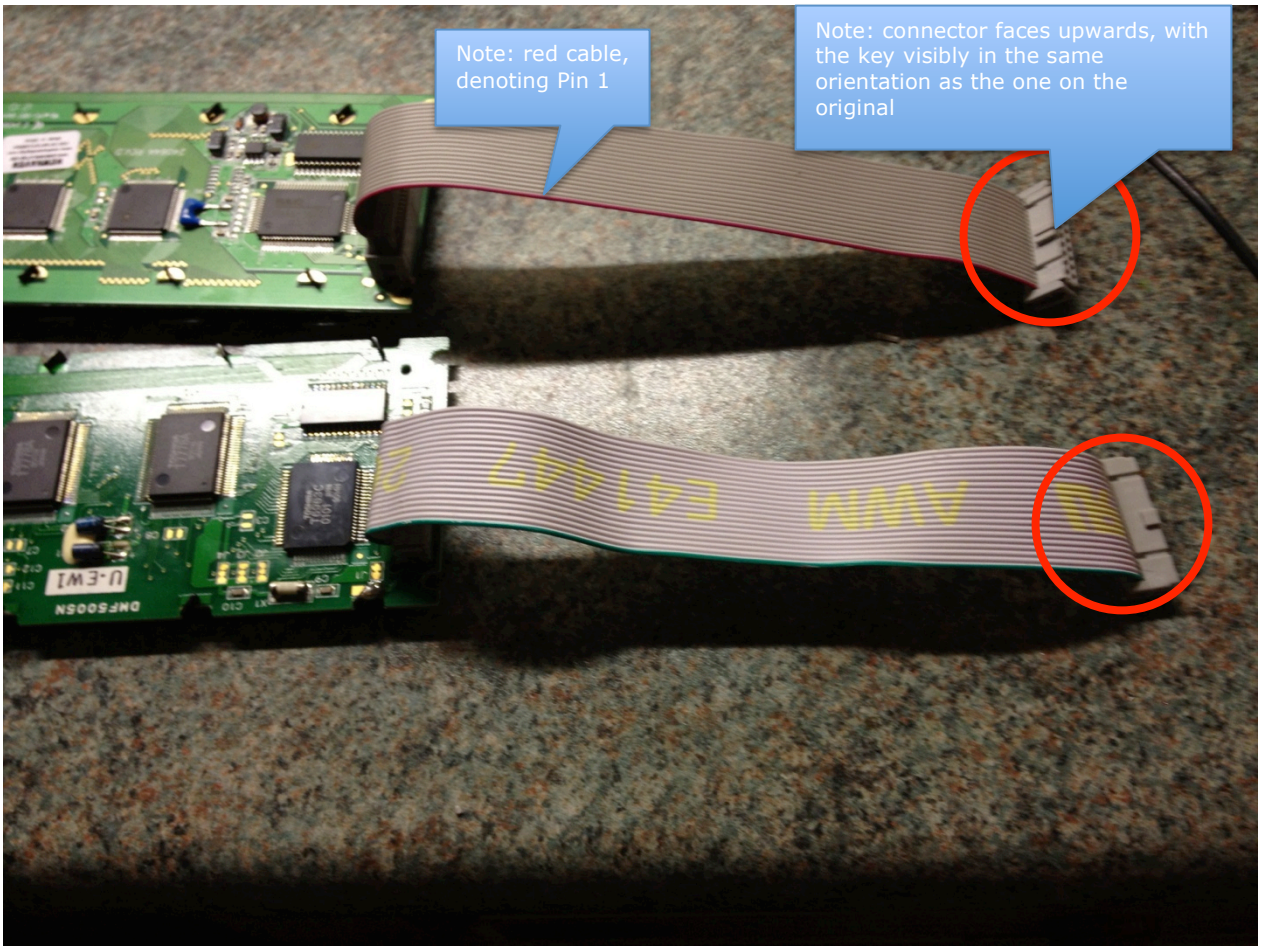
Step 14 – Make the Ribbon Cable

Whilst a special tool is usually recommended for attaching the IDC connectors to the ribbon, I find that you can get away with squeezing the connectors in a small vice if you're careful; you just need to make sure that you don't short circuit several cores in the cable, which can happen if you have the cable misaligned. So, I always check the cable for continuity pin by pin after completing it. I also check adjacent pins to ensure there is no unwanted continuity (i.e. short circuited cables).

Tighten and untighten the vice as you apply the pressure to attach both connectors to the ribbon cable.

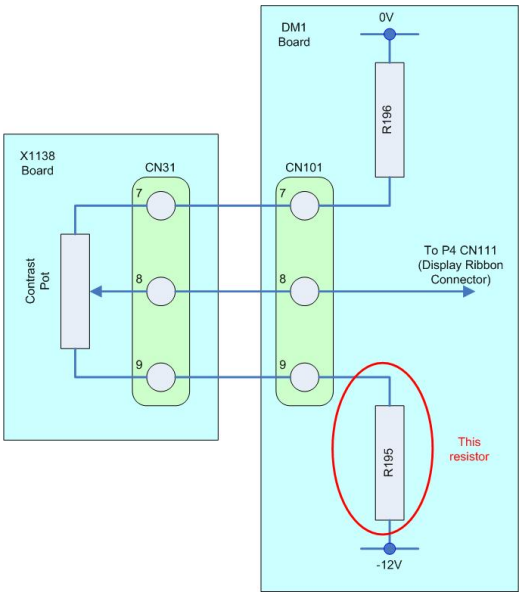


Note that you need to get the orientation of the plugs on the cable correct, to match the connector keys either end. Use the existing display (in the foreground in the picture below) to get this right.



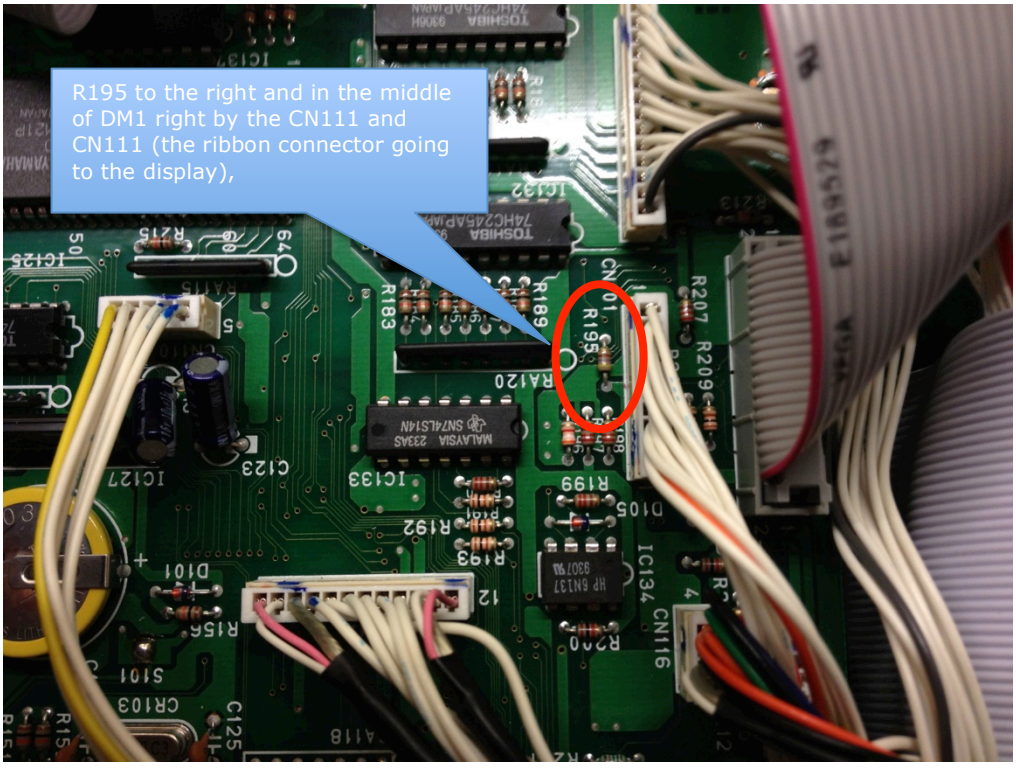
Step 15 – Replace Resistor R195

The following diagram shows a simplified view of the contrast circuit, highlighting Resistor R195, which needs replacing.

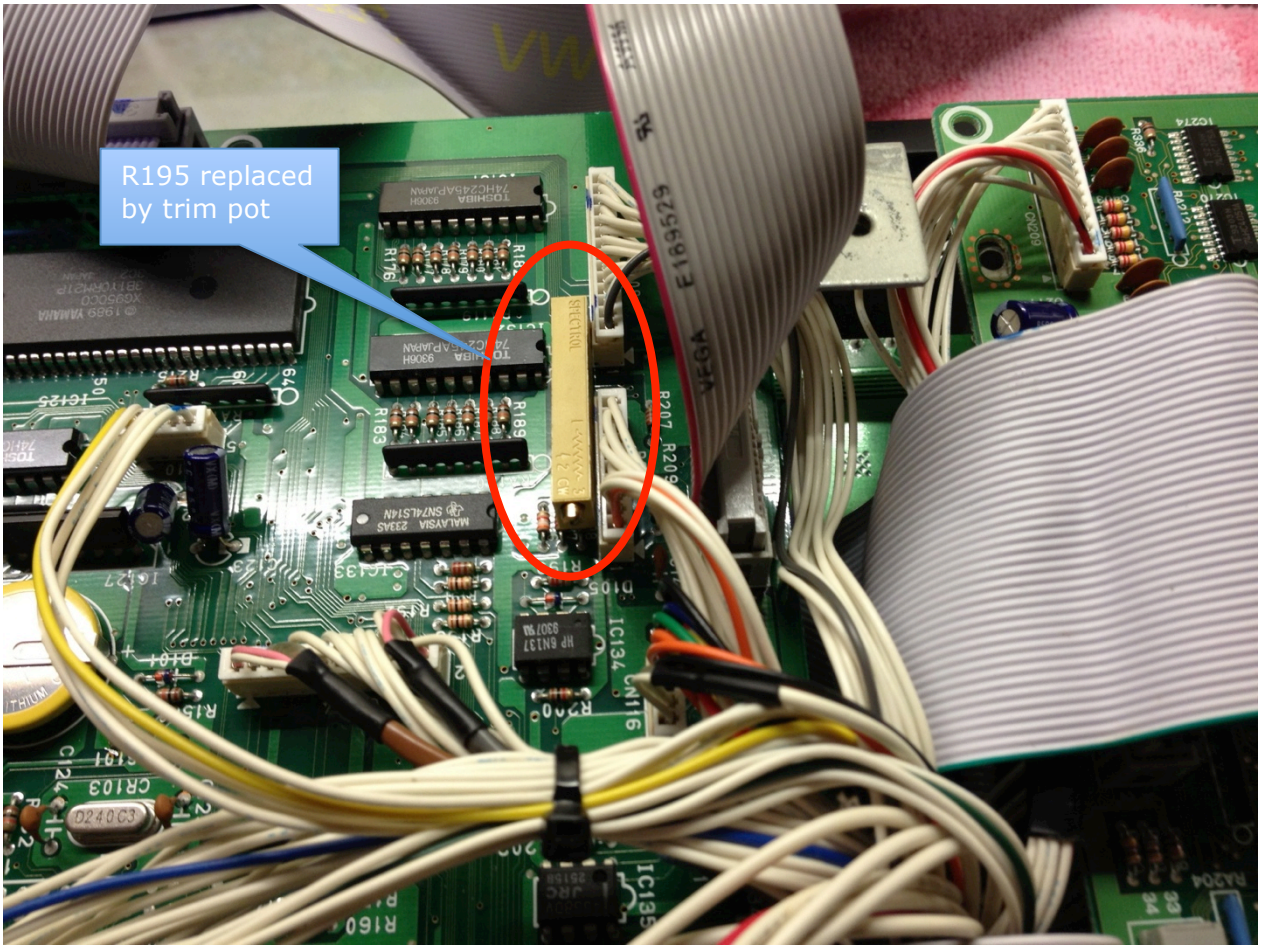


If the resistor is not replaced, your display will look very washed out like this.

R195 can be found close to CN101 on the DM1 card, right by the cluster of connectors on the right hand side of the board. Desolder and remove this resistor.



Rather than try different resistor values (and so need a whole load of resistors!), I elected to use a multi-turn trimmer (variable resistor) with a value of 10K. I snipped the 3rd leg off and formed the other two to fit the lead spacing of R195.



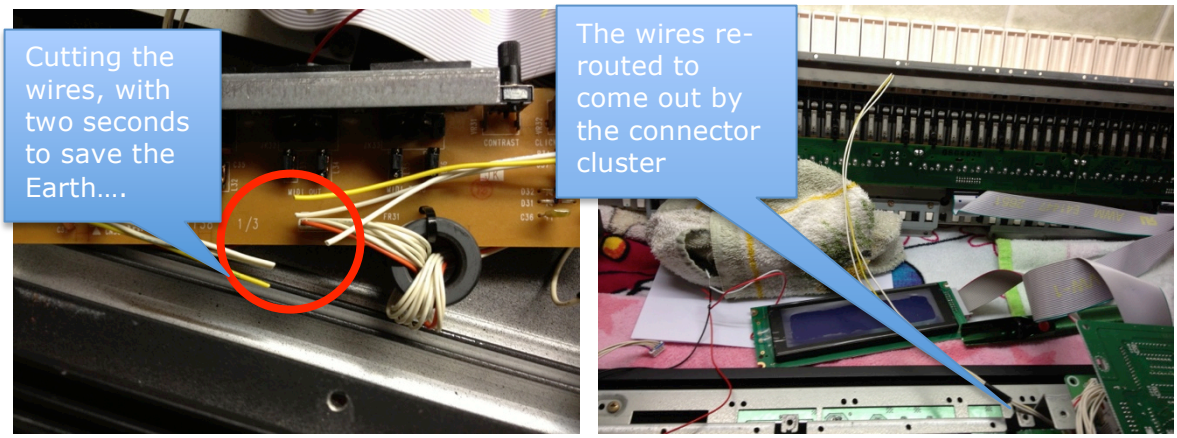
Step 16 – Provide 3V Power for the LED Backlight

As mentioned previously, you need a power source for the LED backlight in the new display, and the inverter circuit on the X1138 is now redundant.

So cut the wires running from the PSU to CN33 on the X1138 board. In the picture below, you'll note I haven't cut the wires too close to the connectors, just in case I needed to reconnect for some reason.

The yellow wire is the 5V supply, and any one of the two white wires can be used to provide the 0V connection.

Re-route the liberated wires so that they come out in the cluster of wires between the DM1 and DM2 boards.

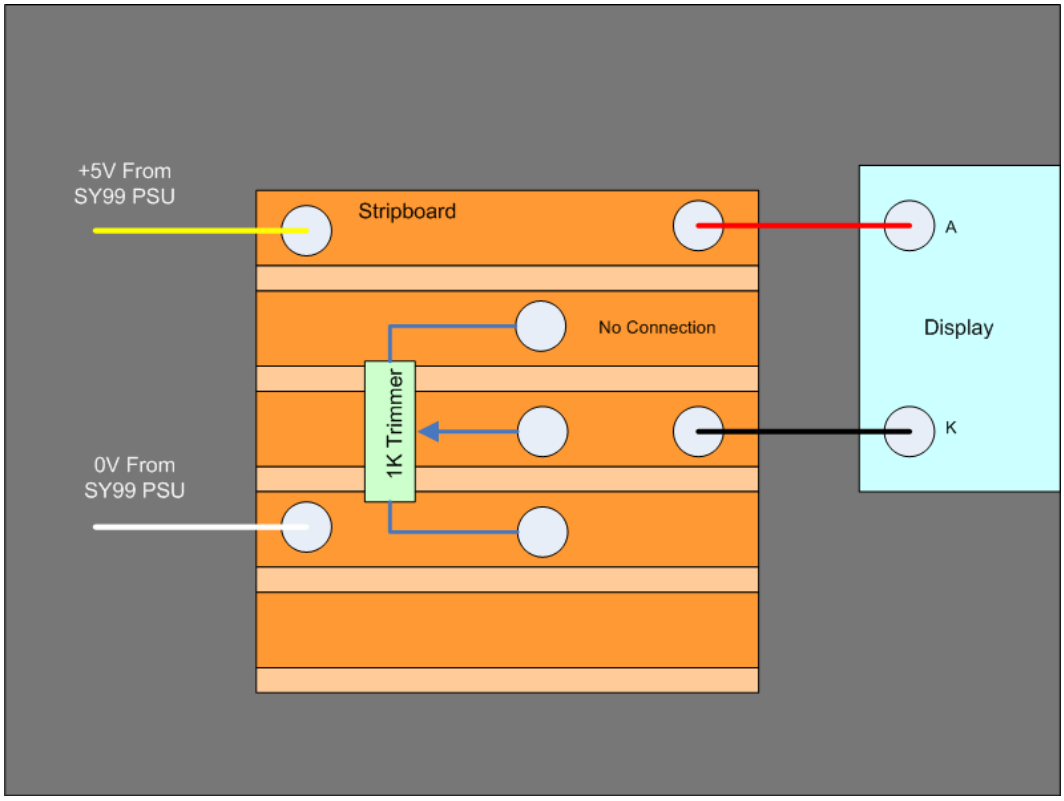


As mentioned, earlier, this 5V supply is outside the quoted range of the new Display's LED backlight, so we need to simply drop some voltage. This is done by putting a resistor in series with the negative line of the supply. Again, I elected to use a 1K trimmer rather than experimenting to find the right value.

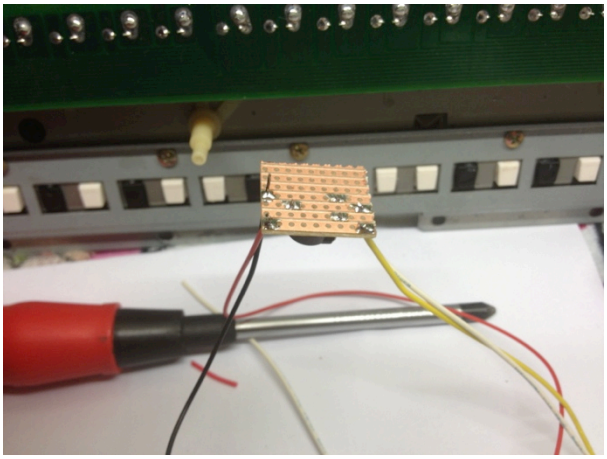
As this is a new addition and not a replacement of an existing component, you need to find a way of holding it and connecting the wires.

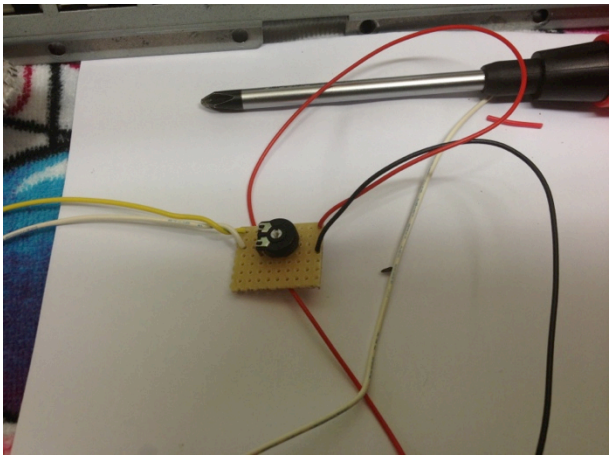
I elected to use a piece of Veroboard (SRBP Stripboard), cut into a square which is large enough to hold the trimmer, but small enough to fit in a convenient space on the DM1 board

The following diagram, shows my very simple circuit.

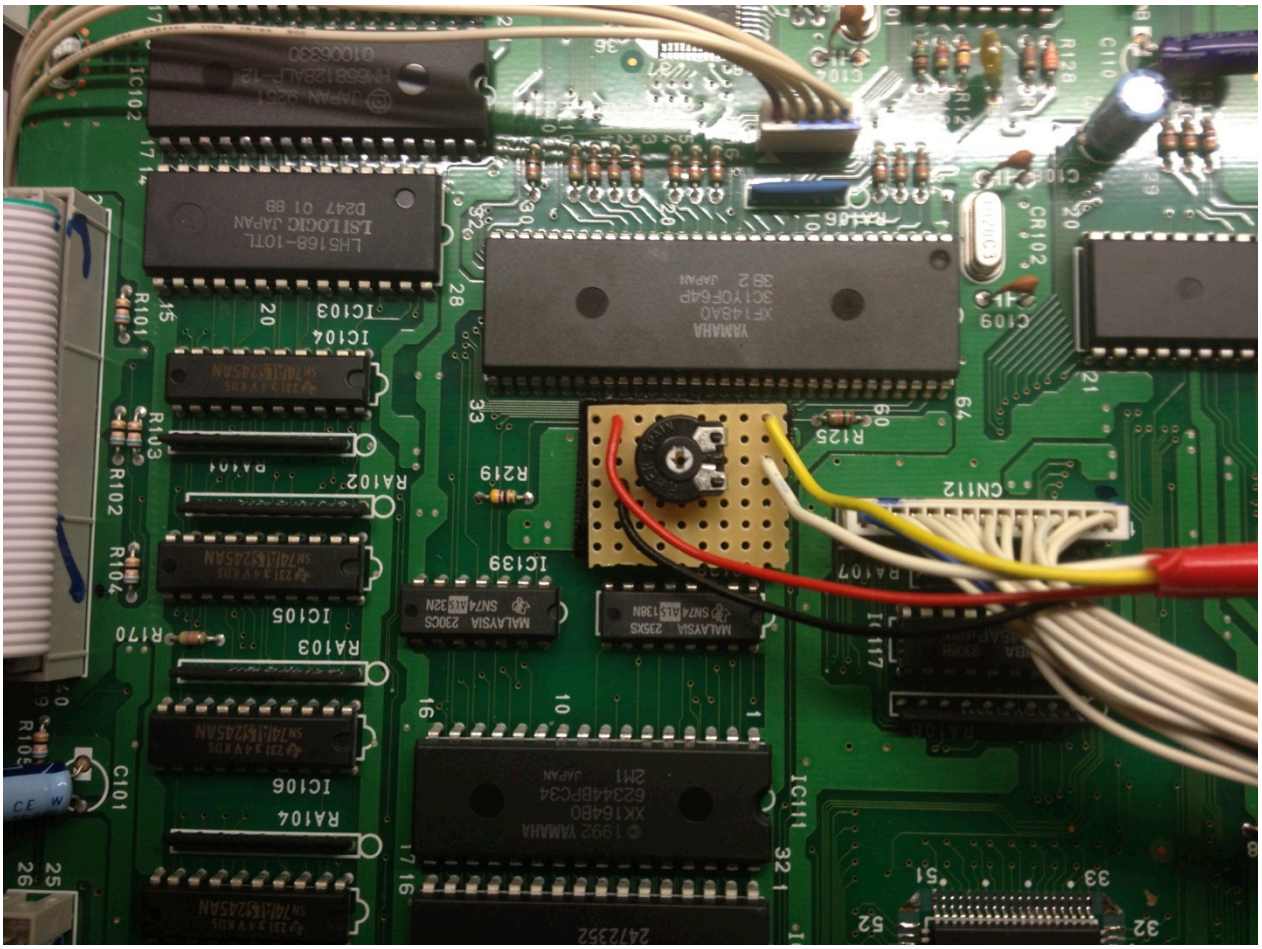


This is what the circuit looks like whilst under construction and testing.





And this is where I placed it on the DM1 board (over to the left, not far from the edge of the board), using some sticky Velcro pads. I placed it here, as I wanted it in an accessible location so that I could adjust it in future if needed without having to disassemble everything!



Step 17 – Try It Out

I like to get things working incrementally, and certainly didn't want to put everything back together until I knew that the display was working. You also need to set the display backlight up to your tastes, and this is quite difficult with the display in situ!

I guess a better way of doing this is to make a small PCB with the Pots on, drill the SY99 and have them accessible from the case, but once setup, I'm not envisioning the need to keep adjusting the pots, so inside was good enough for me.

So I put all the boards back in, using A4 paper to insulate boards that were lying on each other, plugged all the connectors in, and ran the synth to see if I had a display, and more importantly sounds!

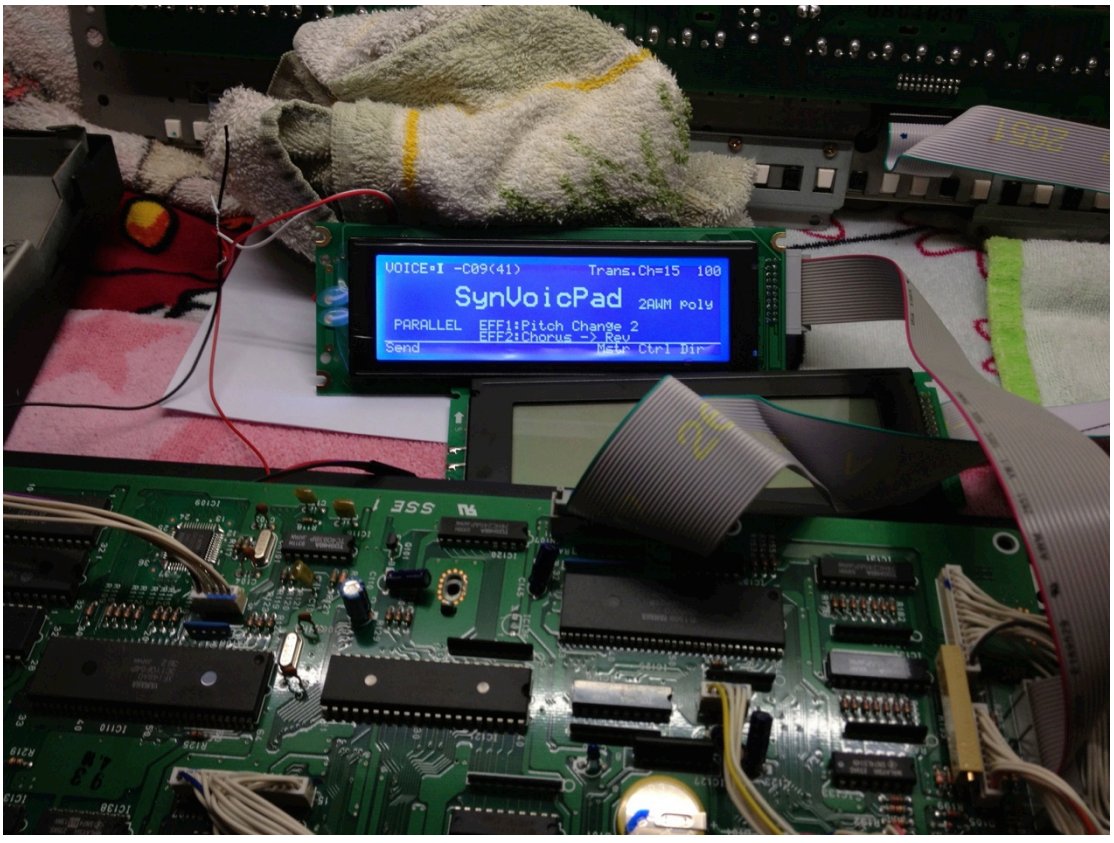
CAUTION: When running the synth like this, keep your hands well clear of the PSU!

Step 18 – Adjust the Trimmers

Check that the voltage drop across the used terminals of the trimmer on the Veroboard is 2V or greater (so the voltage drop across the LED backlight is 3V or less), and adjust if required.

With the rear panel contrast knob in a central position, adjust the trimmer that replaced R195 until you get a contrast level that you like.

The following picture shows everything working before worrying about final assembly…



Following adjustment, I measured the following resistance values.

- Contrast Trimmer – 2K4
- LED Supply Trimmer – 78R

Step 19 – Reassemble Keyboard

So easy to say it, but assembly is "simply" the reverse of disassembly, taking care that all the connectors go back in the right place! So follow this guide in reverse!

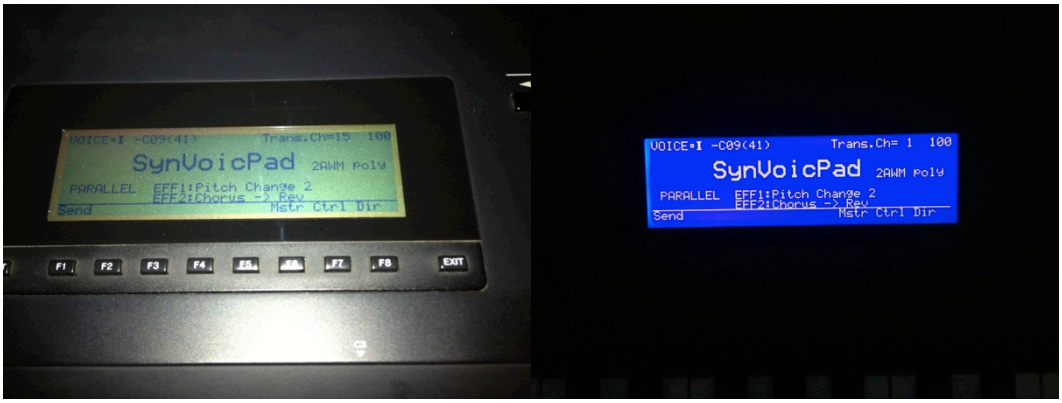
Don't forget to take the protective foil off of the new display before final fitting! And ensure there is no dust or debris from the work in the display screen cover (you don't want to find this out after assembling everything!).

The end result of all this is a "cool blue" alternative look to your SY99!

Conclusion

By the end of this, hopefully you now have an upgraded "cool blue display" and you can now see the SY99 data displayed on the screen again!

So here is the "before" and "after" side by side (noting that the camera flash acts as a temporary backlight on the original!). It's hard work, and a lot of disassembly and reassembly, but the results speak for themselves.



And hopefully, you had no screws left over!

Acknowledgements

Huge thanks go to EX5_Etc for posting the information regarding his original "cool blue" display upgrade on the SY99, which prompted me to do the same for my SY77 in 2008, and now my TG77 and SY99 in 2012. This guide is based on his original work.

The following Yamaha Forum Members have, via discussion on Yamaha Forums, contributed information that helped me to achieve this upgrade:

- Accordeosynther
- Synthjoe
- Kaffimusic

The "Cat on Keyboard" shot is courtesy of my EX5Tech colleague, Jim Attfield. The observant of you will notice that the keyboard in this instance was not an SY99.

Parts List

The following table provides a list of parts that I used in this project. For the trimmers, the choice of type is not critical. The trimmers listed are not the exact same ones I had to hand, but are similar in style to what I had, so give you an idea of what to go for. I used RS Components as a supplier, as they are happy to deal with private individuals and are very prompt in their service. I ordered the components one evening, and had them via standard post the next day, which is astounding given that I live in darkest (and wettish) Wales!

Part	Description	Supplier	Link
NHD-24064WG-ATMI-VZ#	NewHaven 240 x 64 STN-BL	Mouser Electronics	http://uk.mouser.com/
289-9896	10 Way Ribbon Cable[2]	RS	http://uk.rs-online.com/web/
192-7473	20 Way IDC Socket	RS	http://uk.rs-online.com/web/
674-1265	20 Way IDC Header R/A	RS	http://uk.rs-online.com/web/
434-217	SRBP Strip Board (Veroboard)	RS	http://uk.rs-online.com/web/
186-053	10K Trimmer	RS	http://uk.rs-online.com/web/
743-2369	1K Trimmer	RS	http://uk.rs-online.com/web/

[2] This is for a 5M reel, which is far more than needed for the upgrade, but it comes in handy for other things. Maplin Electronics sell 20 way ribbon cable that can be ordered to length, and of course can split in half. Or you can rob an old PC for its ribbon cable, or try a PC supplier/repairer for a suitable cable.

Links

The EX5Tech thread that inspired this upgrade:

http://www.ex5tech.com/ex5ubb_cgi/ultimatebb.cgi?ubb=get_topic&f=21&t=000075

And of course, EX5Tech in general:

http://www.ex5tech.com

The Yamaha UK forums also provide a very good forum for all things Yamaha (and more), which is a good resource for the Yamaha SY series, and there has been a lot of activity recently about doing these upgrades on the SY77, TG77 and SY99.

http://www.yamahaforums.co.uk/

Finally, a bit of blatant self promotion(!):

My website for my Java based x.factory librarians, available for the EX5, AN1x, FS1R, DX7/DX7II and Motif synthesizers and, of course, the SY77, TG77 and SY99!

http://www.xfactory-librarians.co.uk/

My Pink Floyd Tribute Band, Pure Floyd

http://www.purefloyd.co.uk/

My Celtic/Ambient/Progressive project, Carreg Ddu

http://www.carregddu.co.uk/

And my progressive/classic rock influenced project, Echoes

http://www.echoes-music.co.uk/