Moog Memorymoog
Panoramic Modification

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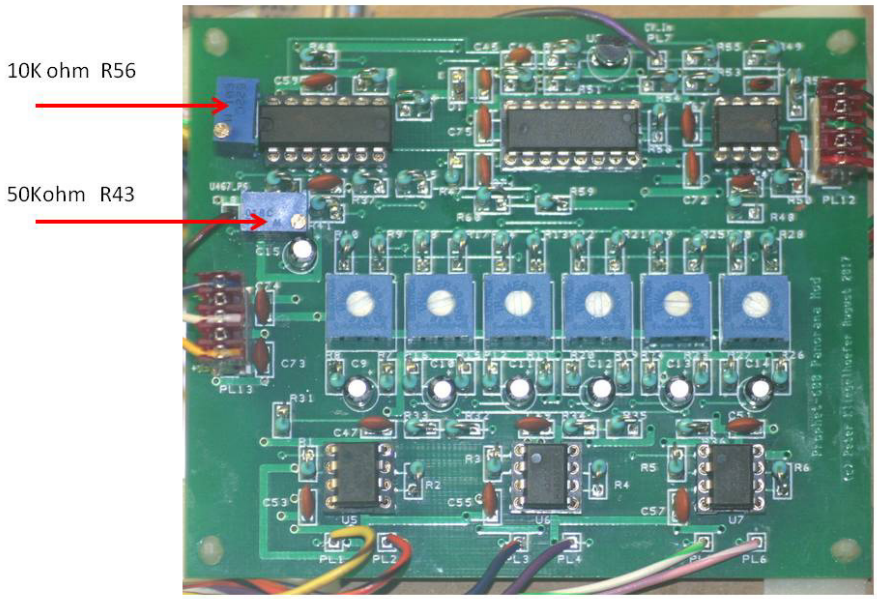
Memorymoog Voice Pan Board Installation

Peter Kliegelhoefer developed a voice panning modification board for the Sequential Prophet 600 synthesizer in 2017. The details of the board were described here: https://www.musikding.de/Prophet-600-Pan-Mod_1

The board takes the outputs of the individual synthesizer voices of a monophonic output, polyphonic synthesizer, directs them into a panning mixer, then through a dual VCA for volume control and then out through a dual buffer as a panned stereo output for the synthesizer voices. He first described the placement of this board into the Sequential Prophet 600 and Korg Polysix synthesizers. The following is a description of how the pan mod board was placed into a Moog Memorymoog Plus.

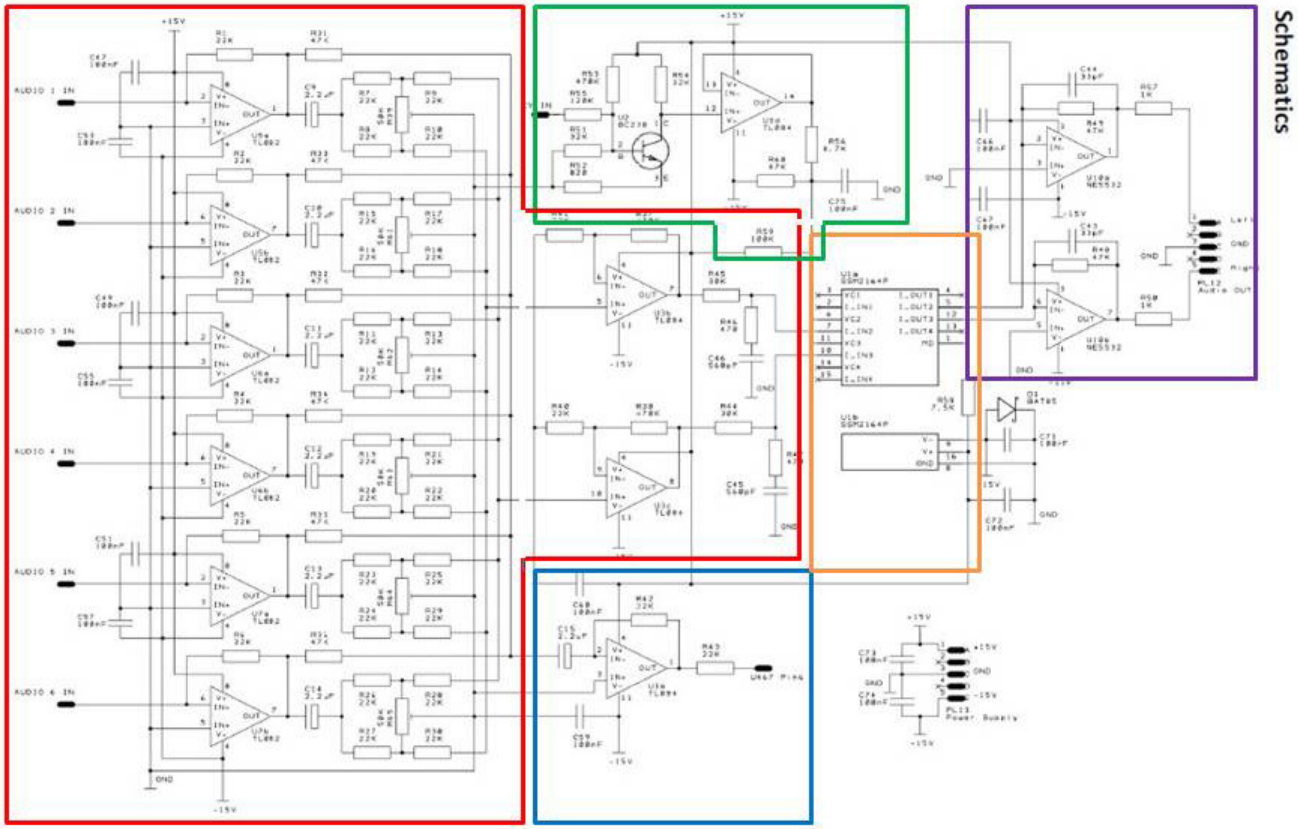
Overview

The Memorymoog is a six voice polyphonic synthesizer and the pan mod board accepts six inputs which can be panned in the stereo field using trim pots in any orientation desired. The pan board incorporates a dual VCA which can be connected to the Memorymoog “Programmable Volume” potentiometer such that control of output volume from the control panel is maintained. However, the “Main Volume” potentiometer is not available to be used for the stereo output as it is simply a single channel rheostat-type resistor/potentiometer. The stock mono output is maintained unchanged as the pan mod board also has a built-in voice summed-mono circuit. This summed mono signal is routed from the pan mod board back to the original trace on the Memorymoog circuit board and continues unchanged to the Master volume output. The main mono output is available simultaneously with the new stereo output. However, the expression pedal volume CV control to the stereo signal is not available. The volume CV pedal input to the mono signal is maintained. No new holes for the stereo output jacks are drilled in the Memorymoog (please, please do not do this). The back panel jack for the “cassette interface remote” is removed and a TRS stereo out jack is put in its place. So the Memorymoog appears totally stock externally. The first step in installation is to understand the functions of the pan mod board. I guess this as good of place as any to state that this is not a project for the inexperienced. A Memorymoog is not one of the easier synthesizers to work on. Let’s just say “it is a complex synth”. I would only do this on a Memorymoog that is already fully restored (recapped, CMOS chips replaced). Also, make sure to back up the patches. Somehow the patch memory became corrupted on mine with all the messing around and I had to reload the patches. The Memorymoog is a touchy beast - but worth all the effort.



Pan Mod Board Function

This is the schematic to the pan mod board:



The circuits outlined in red shows the six inputs, the six panning potentiometers and the dual buffer to the inputs of the dual VCA. The circuit outlined in blue is the sum-to-mono circuit. Its output pin is labeled U467_P6. This is labeled as such because in the original use of the pan mod board, this summed mono signal was sent back to pin 6 of op amp #U467 in the Prophet 600. The circuit outlined in purple is the output buffer where the left and right signals are then sent to the stereo output jack. The chip outlined in orange is the quad VCA chip CoolAudio V2164D (or SSM2164P). As was explained by PeterK, the 2164 chip is a quad VCA but only 2 of the 4 VCAs are used. The 2164 was chosen for the pan mod board because at the time of development, the dual VCA AS3360 (clone of the CEM3360) had not been released so the use of the 2164 was, by necessity, the best choice. Which leads to explanation the circuit outlined in green. The input to this circuit is the CV for the VCAs. In the Memorymoog, this is where the 0-2V CV from the "programmed volume" pot is directed (this will be explained in detail later). The Prophet 600 also used 0-2V for volume CV because both it and the Memorymoog used a CEM3360 for volume attenuation. The CEM3360 is at full volume (zero attenuation) with 2V input and attenuates the signal as the CV moves toward 0V. **The 2164 functions in the opposite way.** The 2164 passes full unattenuated signal with 0V CV input and closes off the signal at 2V input. The circuit outlined in green reverses (not inverts) the CV input so that 2V at the input becomes 0V at the 2164 input and vice versa.

Procedure

The pan mod board was designed for the Prophet 600. I found I had to make a few changes to get it to work with the Memorymoog. I also wanted to make the pan mod look like it belonged in the Memorymoog. I used hookup wire that was the same diameter and resembled the "white striped" hookup wire Moog used. I also used the red colored MTA100 connectors like is used in the Memorymoog to connect power and the stereo output on the pan board so I could easily disconnect the board if I had to work on it (a very wise decision!).

Here is what is needed:

Prophet 600 pan mod kit: https://www.musikding.de/Prophet-600-Pan-Mod_1
All parts, chips and instructions come with the kit. (Not all the parts in the kit are used for the Memorymoog)

Wire used: From Ebay Seller acdcwireandsupply "24 AWG Gauge Stranded Hook Up Wire Kit 5 ft Ea 8 Color w stripe UL1007 300 Volt"

Connectors: Male 5 position x 2 TE Connectivity/AMP part #640456-5
Female 5 position x2 TE Connectivity/AMP part #3-640440-5

TRS Stereo (non-shorting) ¼" jack x1 (Kit comes with 2 mono jacks but PLEASE don't use them and drill holes in a Memorymoog)

220Kohm resistors X 6

Trim pot 10K x1: Bourns 3299W-1-103 or 3296W- 1 -103 (substitute for resistor R56 on pan mod)

Trim pot 50K x1: Bourns 3299W-1-503 or 3296W-1-103 (substitute for resistor R43 on pan mod)

Self adhesive Standoffs x4: I got a bag of these from China, my bag says: *0.18" adhesive PCB stand offs for 1/8" PCB mounting holes. 0.6x0.6 offset base.* These are used to secure the pan board to the Memorymoog's metal base.

"White Nylon cable clamp" ½ inch -- to make the wire loom holders similar to what Moog used in the Memorymoog. Details are explained later. Totally optional but looks nice!

Population of the pan mod board

The pan mod board comes as a kit containing all the necessary components and integrated circuits. Included are single pin terminals that are optional for this application. Full population of the pan mod board is required.

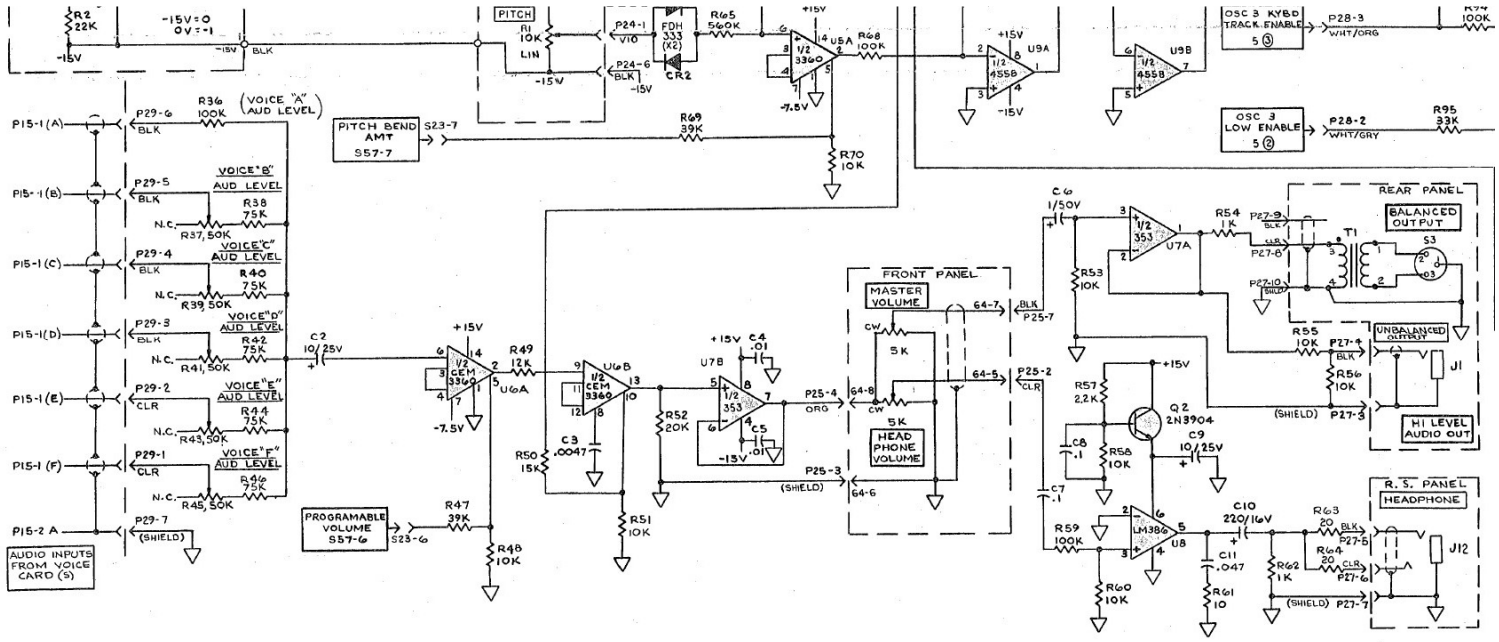
There are three necessary modifications to fit the pan mod board for the Memorymoog as it was originally designed for the Sequential Prophet 600 synthesizer.

1. The Memorymoog requires attenuation of the individual voice signals in order to avoid distortion through the pan mod. A 220Kohm resistor is needed in series with each voice to the input pin (6 x220Kohm resistors)

2. A 50Kohm trim pot is substituted for resistor R43. Pin 6 is the summed mono voice output and the 22kohm (R43) results in a signal that is too attenuated for the Memorymoog. A multiturn trimmer is not necessary but the Bourns 3299W or 3296W fit perfectly in the holes of the pan mod board for R43 (and R56). Snip off one of the end legs of the trim pot as it is used as a simple variable resistor. Setting the summed-mono signal is explained later.

3. A 10Kohm trim pot is substituted for resistor R56. The Bourns 3299W or 3296W fit perfectly in place of R56. This trim pot is able to adjust the CV to the VCA chip input to adjust for exactly 0V when the programmable volume pot is fully open. I found that with R56 (4.7K ohm) in the circuit the CV produced at the VCA input was in negative voltage and caused a crackling distortion in the VCA. By placing the trim pot the CV can be adjusted to 0V and the distortion eliminated.

Here is the schematic of the area of the Memorymoog common analog board of interest:

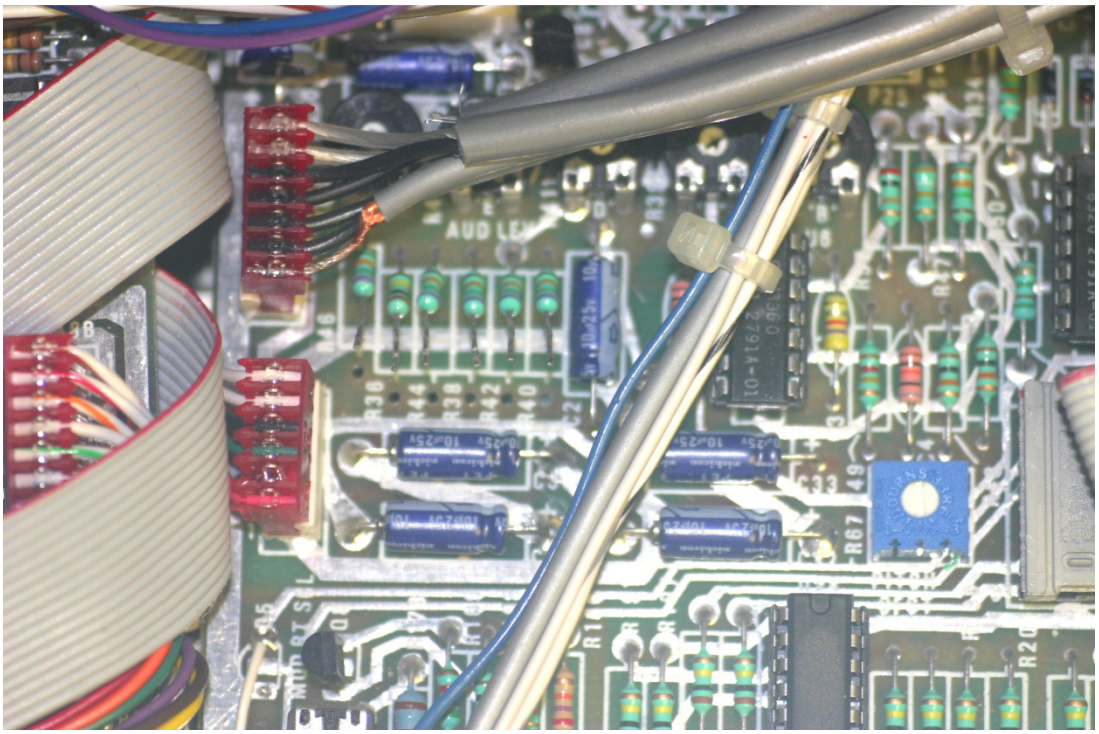


Wires to be soldered on Common Analog board of Memorymoog:

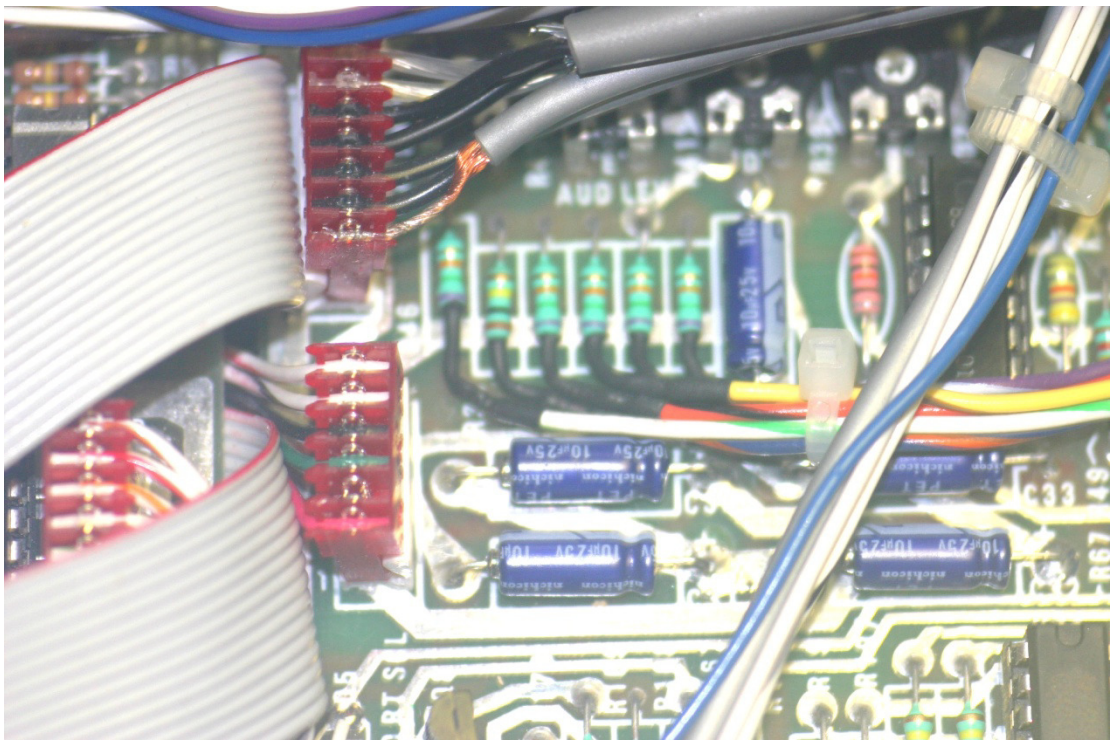
- The six wires to the six synth voices (R36,R38,R40,R42,R44,R46)
- The return mono-summed wire (through R40 hole to trace on underside)
- The CV control wire (to R47)

Desolder the distal ends of resistors R36,R38, R40, R42, R44, R46 and lift them up off the circuit board. This is done by lifting up the common analog board on its hinges and accessing the traces from the underside. The process is made easier by using a piece of wire or long “twist tie” and looping the wire through one of the empty screw holes at the front of the CA board and then looping the other end of the wire around a pot on the front panel which is sitting vertical behind the circuit boards. Use solder wick as access with a desoldering gun is limited. Do not cut the wire leads of the resistors but pull the desoldered ends through the circuit board to the other side. You will want to keep track of which wire is connected to which synth voice so get a piece of paper to write down the connections. The reason will be explained later. Note that the resistors are not “in numerical order” on the circuit board so it is easy to get mixed up. Make a list: Voice 1, resistor R36, wire XX color, etc. Place the common analog board back down to access the component side with the 6 desoldered resistors readied for attaching wires. Solder a different colored striped 24g wire to each resistor. A technical hint for this: Strip just 3mm of the hook up wire (put shrink wrap on the wire first and out of the heat), place flux to the wire with a paint brush and tin the end. Re-flux the tinned wire and also the end of the resistor lead. Get a small puddle of fresh solder on the spatula solder tip, overlap the wire ends for the 3mm and then touch the puddle of solder to the two overlapped wires. The solder will wick up on to the wires and make a small clean solder connection that is smooth and not bulky. The connection can easily be separated if needed if a mistake was made. Solder another colored wire that will be used for the mono-summed signal return using the R40 hole to the trace on the underside.

The six desoldered resistors. The mono-summed return wire is placed back through the R40 hole and soldered underneath.



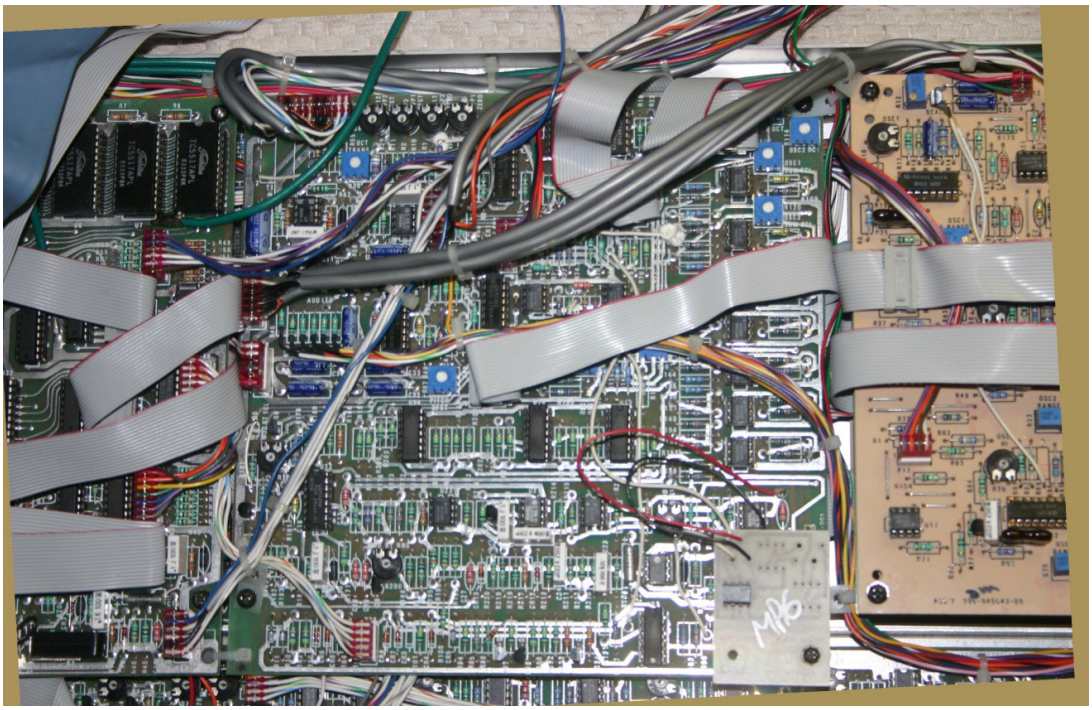
The six wires are attached (the mono-summed wire through R40 is underneath).

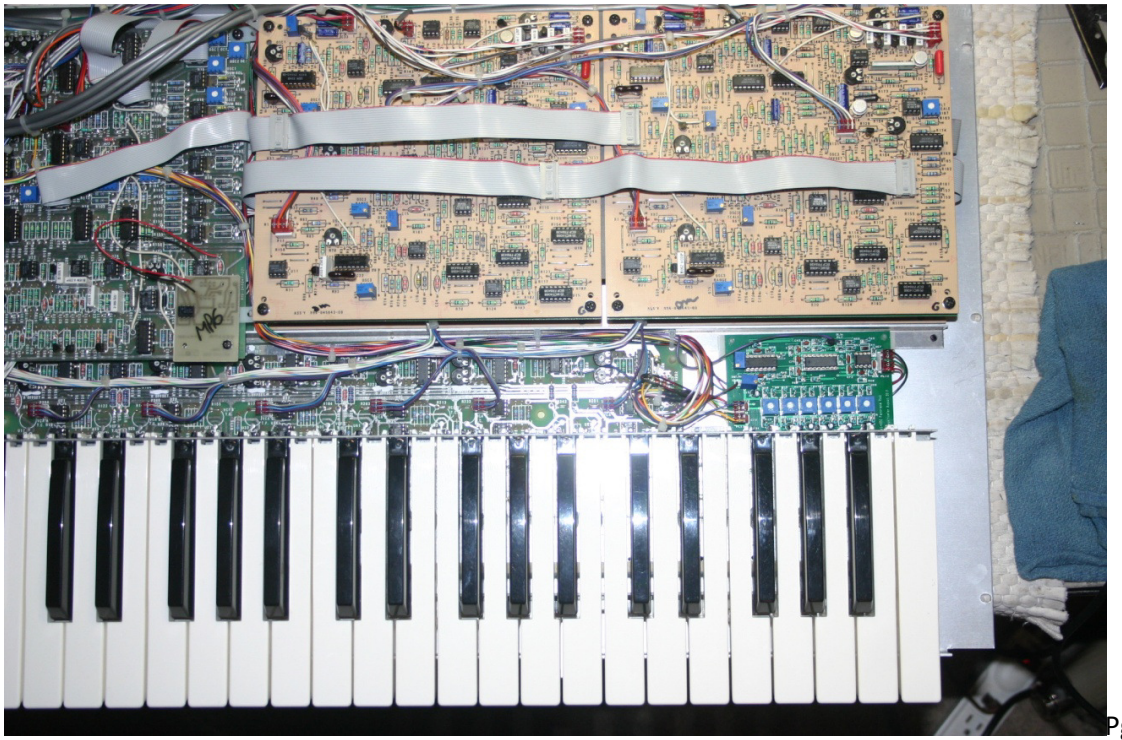


I mounted the pan mod board to the metal base of the Memorymoog just right of the keybed. Leave the wires longer than needed until everything laid out. Use twist ties to keep the wires bundled together until everything is arranged.

The 0-2V CV input to pin 6 on the pan mod board is taken off resistor R47 (programmable volume). The voltage here is 0-2V through the range of the PV pot rotation. Verify with multimeter. Do not disconnect R47, just solder the jumper wire to the distal resistor leg on the component side. You will now have a wire loom of 8 different striped wires. I used twist ties to hold them together temporarily until I got everything lined up, then used small white nylon cable ties like are used in the MM.

Orientation of the 8 wires from the resistors to the pan mod board:

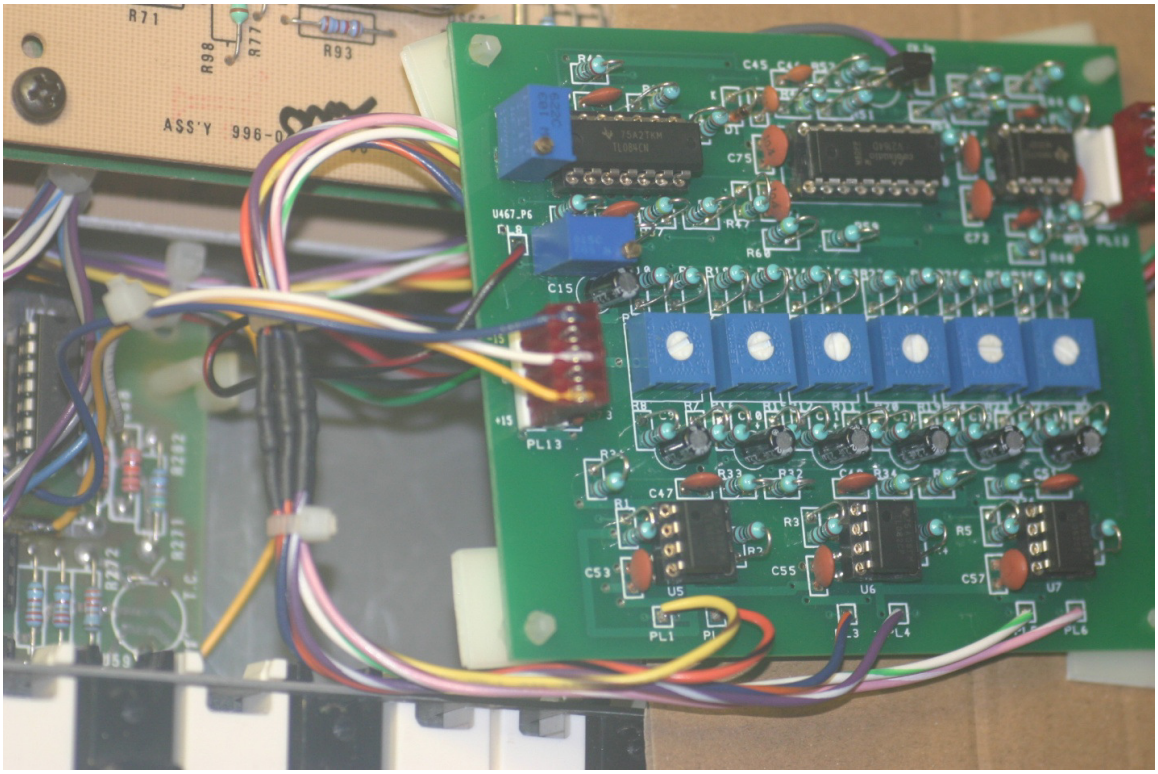




Attaching the wires to the pan mod board

The Memorymoog has several keyboard modes. A patch can be programmed to trigger voices “round robin” or to selectively trigger voice one in priority. In mono (unison) mode, one can select 1,2, or how many voice cards will be triggered together in unison. This has considerations for panned voices. Voice card 1 is best panned center so that when it is selectively triggered first, the voice presents center. I structured the voices as: 1- center, 2- hard right, 3- hard left, 4- center, 5-mid-right, 6-mid-left. This is so that in unison mode, if one voice was desired, it would be centered. Subsequently, 3 voices would cover right, left and center … and so forth for 4 or 6 simultaneous voices. A 220K ohm resistor must be placed in series with each voice wire.

Voice wires with grouped 220K ohm resistors in shrink wrap

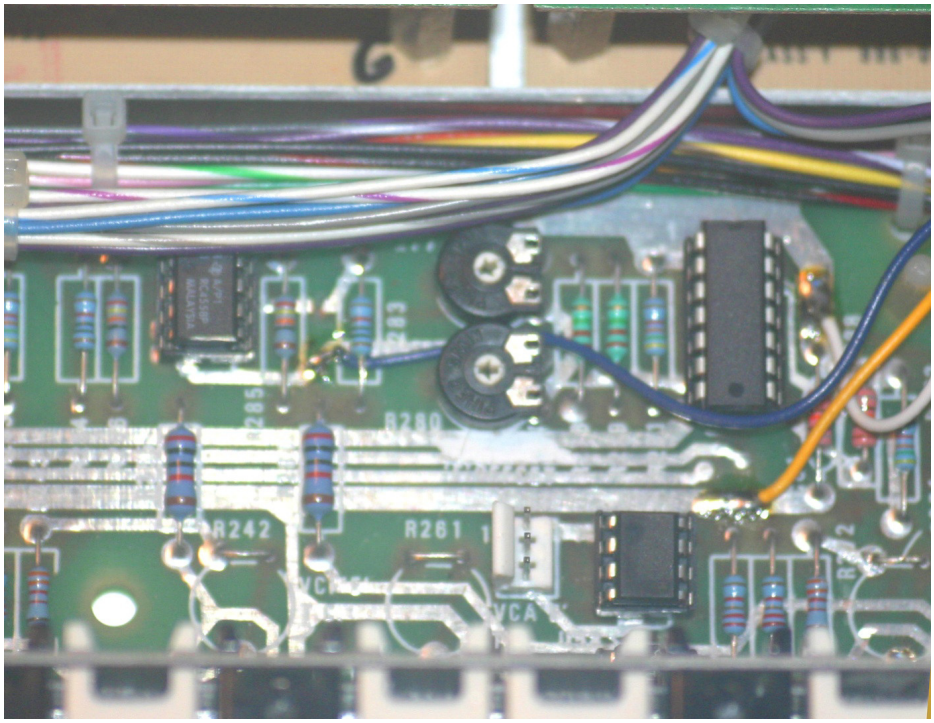


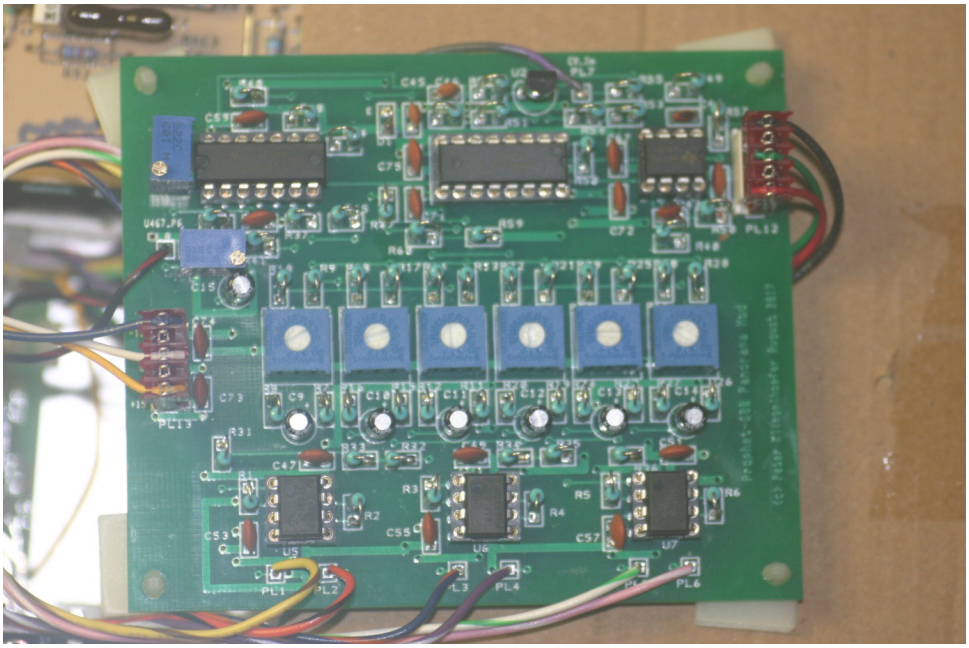
Attaching the Power supply

I wanted to be able to easily disconnect the pan mod board while I was setting everything up so I used five position MTA100 header/connectors for the power input and the output wires to the stereo jack, but using connectors is optional.

The +15/-15 rails and ground are accessed on the right side off of the contour/glide board. There are exposed rails on the component side of the board. Use a multimeter to find and verify the rails.

This picture shows hookup: yellow is +15, blue is -15 and white is ground.

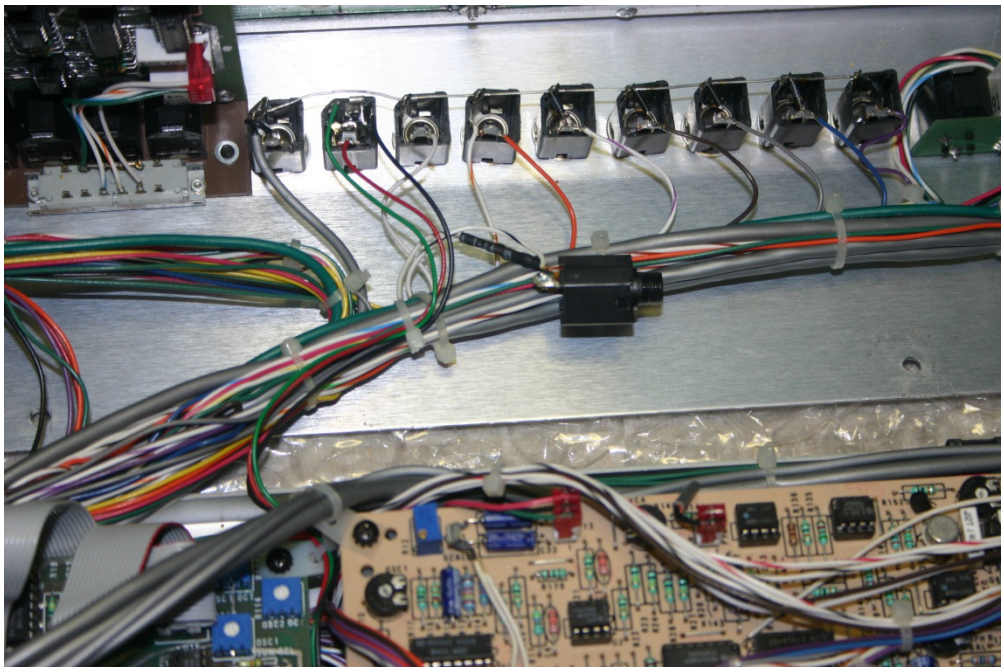


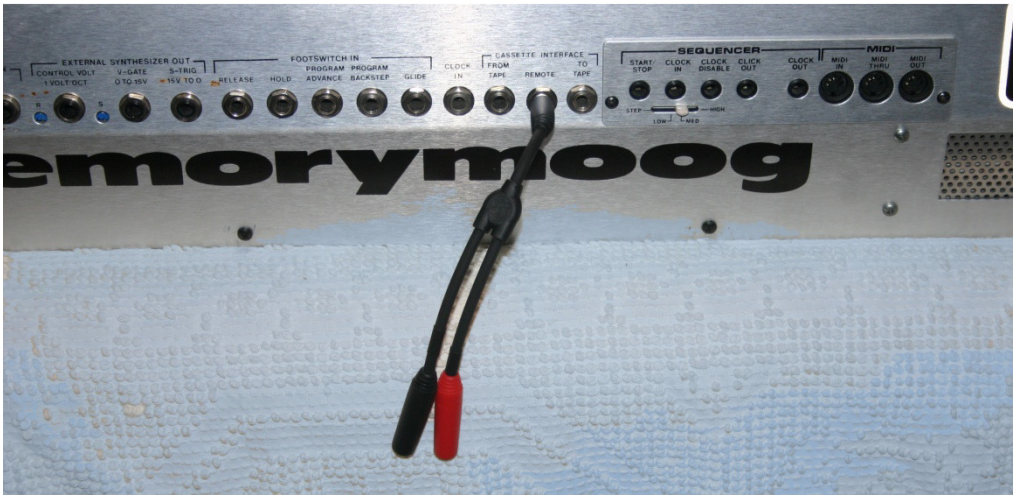


Placement of the stereo out jack

A ¼”TRS stereo (non switching) jack is used. This TRS jack is mounted to the back of the case in place of the “Cassette Interface Remote” jack. The “Remote” jack is not necessary and (conveniently!) is the only jack on the back panel not connected to ground with the buss wire so it can be easily exchanged. PLEASE DO NOT DRILL HOLES IN A MEMORYMOOG CASE TO PLACE OUTPUT JACKS. The Memorymoog is a rare and expensive synthesizer. Use the TRS jack and an adapter. Leave the “Remote” jack attached, wrap in shrink wrap and tape it to the adjacent wire loom. It can be replaced if ever desired.

TRS jack is the second from the left with the red, black and green wires from the pan mod board.





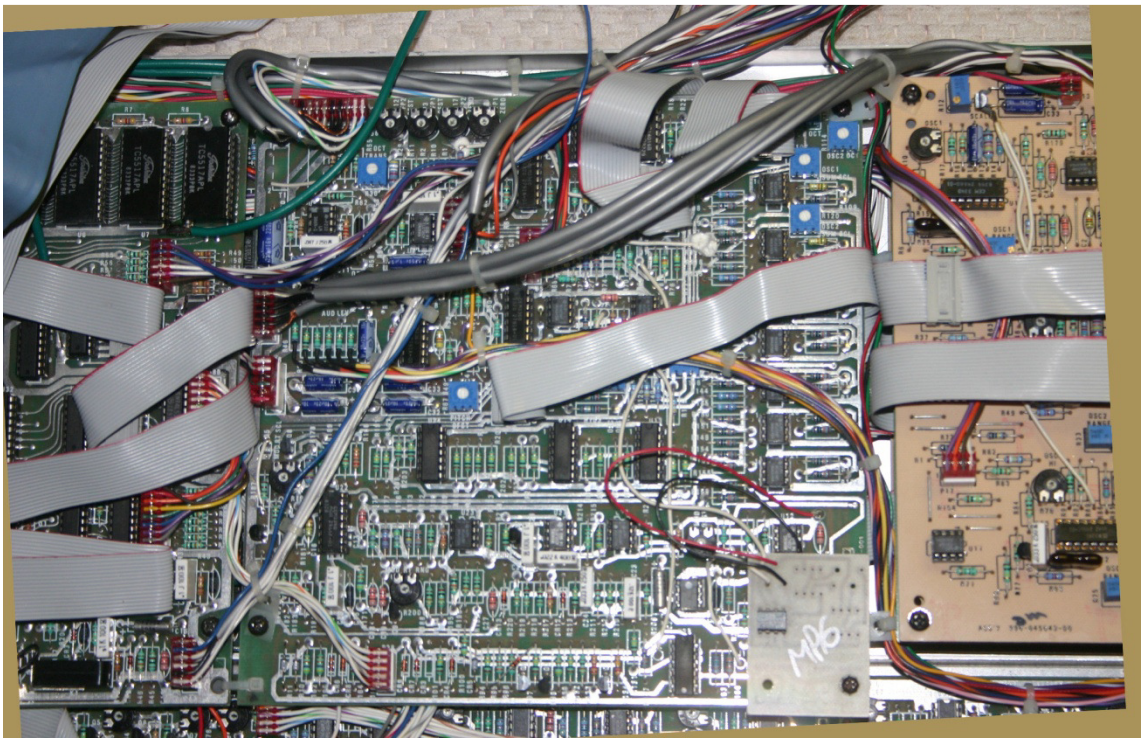
Adjustment of trimpots

Once everything is hooked up, check the 0-2V CV input from the Programmable Volume to the CV input on the pan board. Leave the CV at 2v and measure the voltage at pin 6 (or 11). Adjust trimpot at R56 so voltage is 0V. Turn Programmable Volume pot to minimum. Verify >2V at pin6.

Adjustment of trim pot at R43 is done by ear. As mentioned, using R43 at 22K ohm resulted in a very weak signal back to the common analog board. A straight wire resulted in gross distortion so a 50K trim pot was added to the pan mod board. Set up Memorymoog with all three oscillators to square waves, mixer fully open, filter fully open and no resonance. Basically you want the loudest signal as possible. The "difficulty" in setting the trim pot for return signal volume is that the Memorymoog has saturation by design with the mixer wide open. Play a six note chord and adjust trim pot at R43 to where the signal is the greatest volume and the saturation …. is as much as you want it to be. R43 has no effect on the stereo signal which will have a hotter signal than the mono signal.

Finishing touches:

The wires are now all neatly secured with zip ties. Moog used white nylon "tabs" to secure wire bundles to screws on the circuit boards. These tabs can be replicated by using white nylon "C"- cable clamps (ordered on Ebay from China) and cutting/drilling them to resemble the ones used by Moog.

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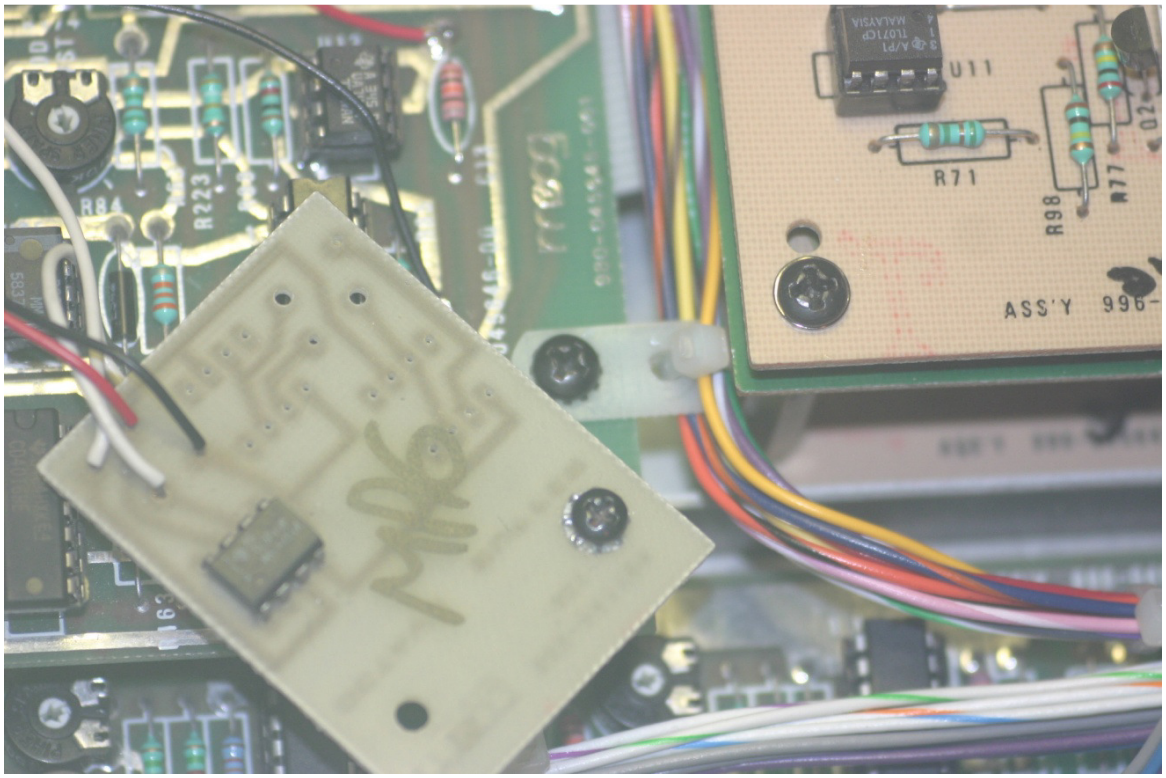
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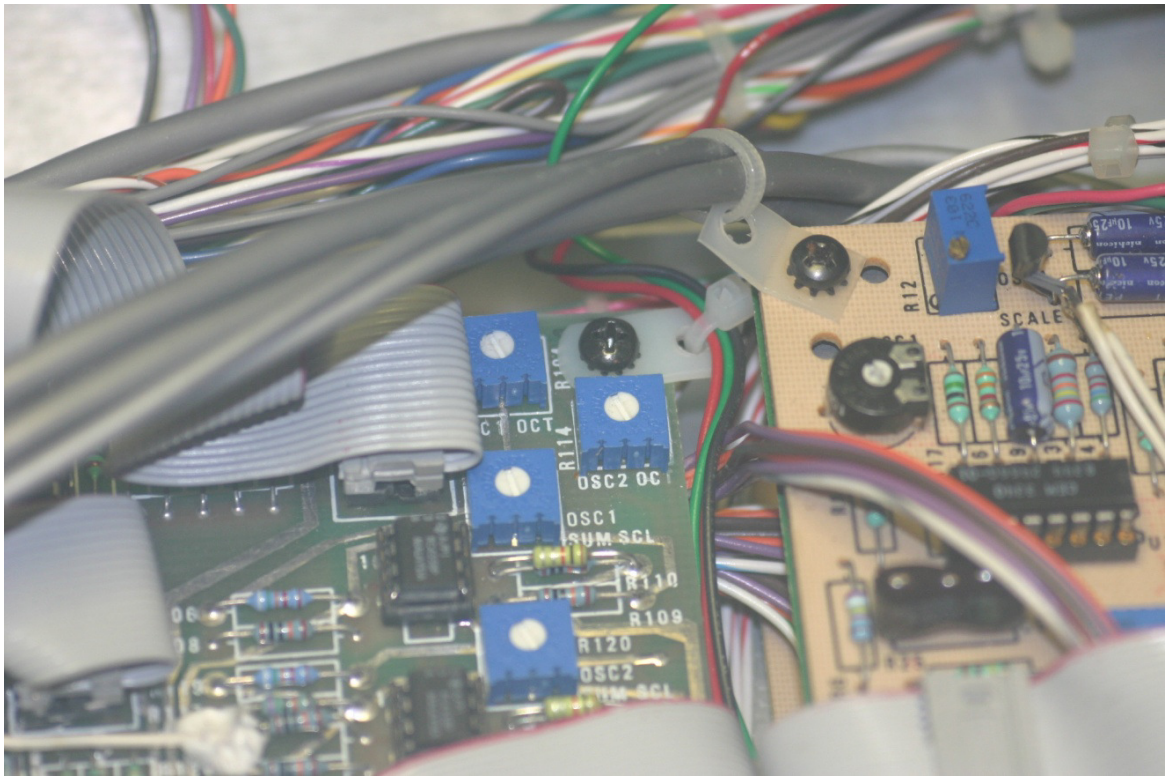
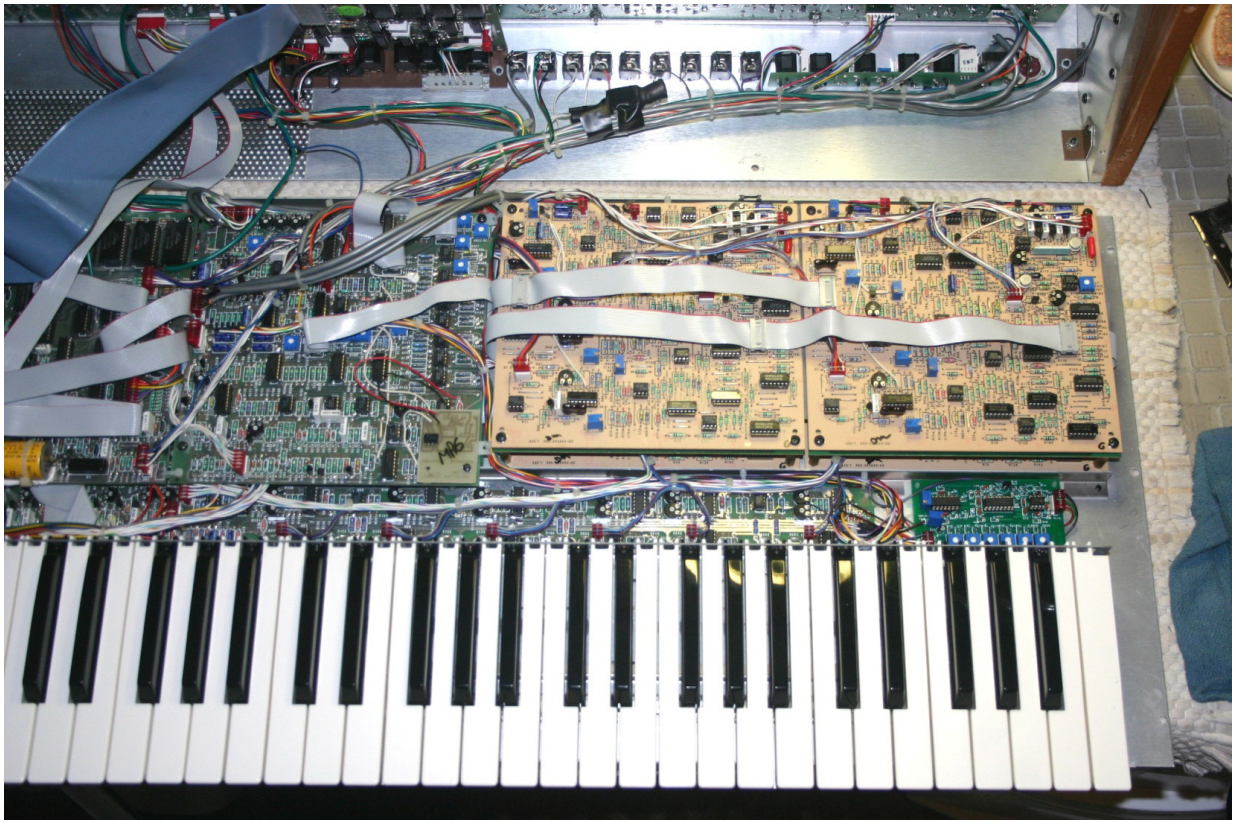


Final routing of the voice and stereo out wires together tucked between circuit boards secured with zip ties.



Conclusion

Placing this pan mod board into the Memorymoog transforms the synthesizer. The Memorymoog is known for being "heavy" and dominating in a mix. Having the voices panned tames the heaviness and congestion of playing multiple voices simultaneously. Since the third oscillator can be used as a "per voice" LFO, the six "LFOs" are free running. Six voices panned in the stereo field with asynchronous LFOs to filter cutoff is a mesmerizing sound. In mono (unison) mode, having 6 voices firing simultaneously panned in the stereo field is … well …. you just need to hear it.