Prophet-600

Panorama modification

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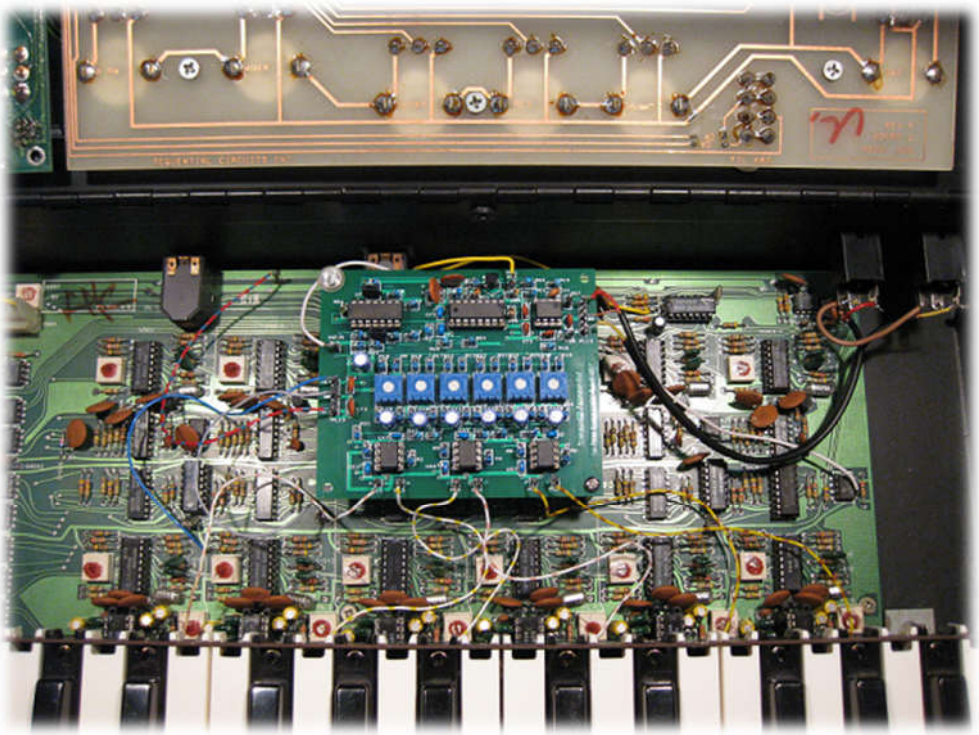
Munich, September 2017



Preface

This little do-it-yourself project was inspired by a feature of the legendary Oberheim OB-X synthesizer, where each of the voices can be freely distributed in the stereo panorama.

A dedicated double layer PCB in through-hole design has been developed to ease the assembly. In comparison with SMD* this approach matches well with the design of the Prophet-600 which is a child of the early 1980's.

The integration of this solution does not require any destructive measures on the original circuitry. It is only suggested to consider two holes at the backside of the cabinet for the two L/R jacks. The Mono signal remains to be unchanged and is independently accessible at its original jack.

Whilst both upgrades are completely independent from each other, this pan mod perfectly complements the ingenious GliGli upgrade, resulting in an attractive performance upgrade of the Prophet-600.

This project mainly addresses e x p e r i e n c e d and s k i l l e d technicians.

The author doesn't take any responsibility for damages of any kind.

Dear internal revenue service: this is a hobbyist project. There is no intent to realize a profit.

And now good luck with everything - have fun!

*SMD: Surface Mounted Devices

Overview

This mod requires following measures:

1. Sourcing of all material
2. Pan mod PCB assembly & Quick test
3. Construction of the filter-IC adaptors
4. Integration of Pan mod PCB and L/R jacks
5. Wiring
6. Have Fun!

Additional Information

This D.I.Y. project was published on the internet portal „amazona.de“. Here you can also find sound examples.

Part 1:

https://www.amazona.de/diy-sequential-prophet-600-panorama-upgrade/

Part 2:

https://www.amazona.de/leser-artikel/sequential-circuits-prophet-600-panorama-modifikation/

There is also an article about the GliGli upgrade:

https://www.amazona.de/test-sequential-prophet-600-gligli-upgrade/

Finally a reference to the internet shop „Das Musikding“.

A complete kit will be available from end of September 2017:

https://www.musikding.de/

Material

An overview of the required material is shown in the annex.

Tools

For a proper construction tools are needed. A temperature controlled soldering iron with a fine copper bit, metal driller and metal file for cabinet machining, and a hot glue gun should belong to the basic equipment of an ambitious technician and hobbyist.

Apart from that a multimeter and an oscilloscope (ideally featuring a test signal for probes; alternatively a separate signal generator) and a short circuit protected power supply with stabilized + / - 15V DC must be on hand.

Prophet-600 Service Manual

It is further recommended to download the Prophet-600 schematics from Internet. Schematics are part of the Service Manual which is freely available from different sources.

Panorama PCB

The PCB is designed for through-hole assembly, making soldering easy.

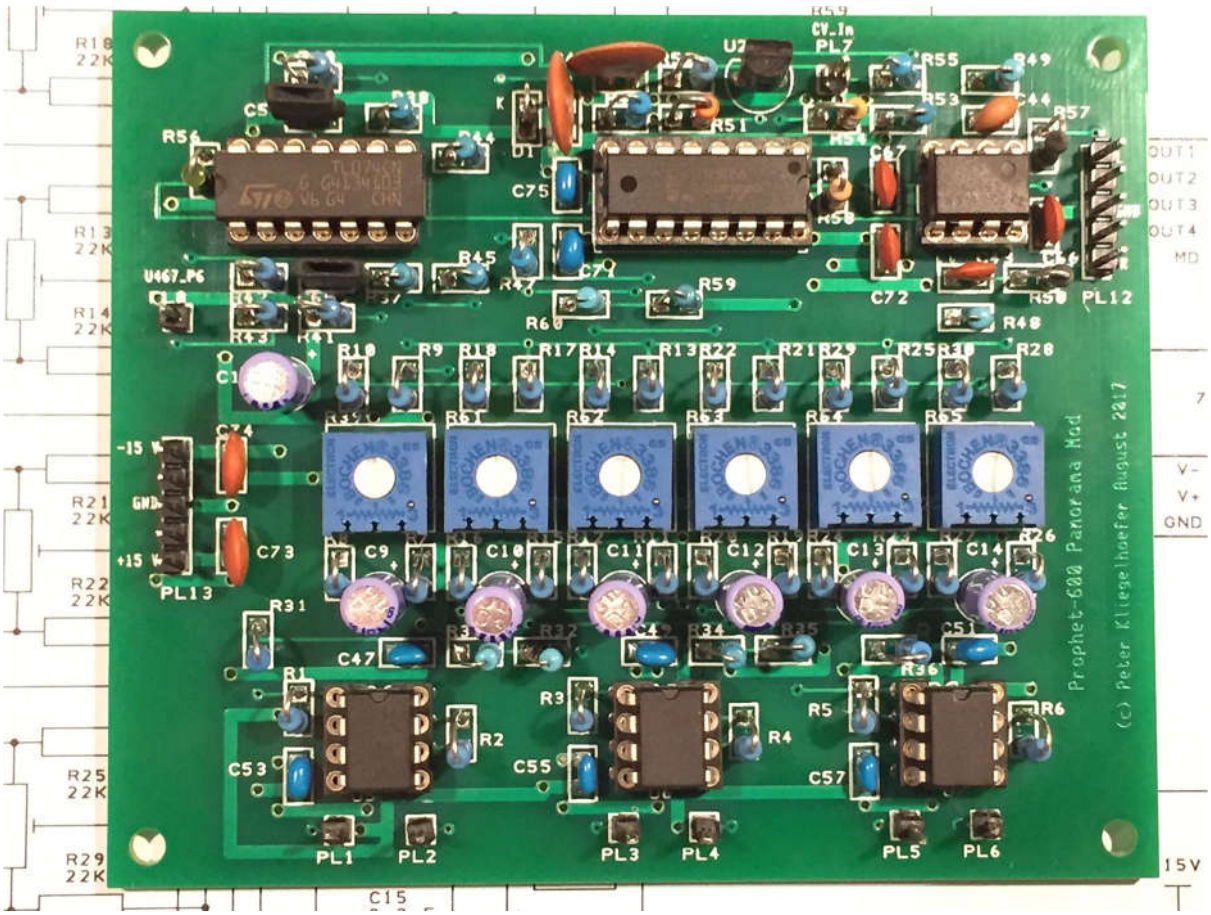
A component diagram can be found in the annex.

It is strongly recommended to use precision sockets for all ICs. This is not costly but makes this application easy to service.

Please put special attention to:

- correct orientation of all ICs (pls. see notch)
- correct connection of the diode (K = cathode)
- correct connection of the universal NPN small signal transistor
- correct connection of the polarized caps (see „+“ marking)
- correct assignment of component values

Following picture gives an idea how the pan mod board should look like.



Hints

It is recommended to only use *quality* components as the audio path is concerned.

Resistors R51 and R54 should be as close as possible to the required value of 32K Ohm. Select the best components if you have a number to choose from.

Do not mix-up values, e.g. 470 (470 Ohm) and 470K (470.000 Ohm). This sometimes also happens to professionals …

For both caps C45 and C46, 470pF can be also used instead of 560pF.

Classic assembly, we start with flat components and work towards the taller ones, finishing with the polarized caps.

We may start with the IC sockets. Pay attention to their orientation. The notch of U3 (TL084) points to the left, notch of U1 (V2164D) and U10 (NE5532) point to the right. The notch of U5~U7 (TL082) point upwards.

The cathode of Schottky diode BAT85 must point upwards (note the “K” marking on the components side).

Universal NPN small signal transistor U2 (BC238) can be any compatible alternative. Please take care of polarity.

Polarized caps (C9~C15) are to be assembled with their positive poles pointing upwards (note the „+“ marking on the components side).

Depending on the mechanical outline of the trim-pots, outer leads may need to be bend into shape *before assembly*. Pay attention to R39 (the trim pot on the most left hand side) where the middle lead may slips into a via instead of the regular pad.

Pins 2 and 4 of both plug strips PL12 and PL13 are not connected.

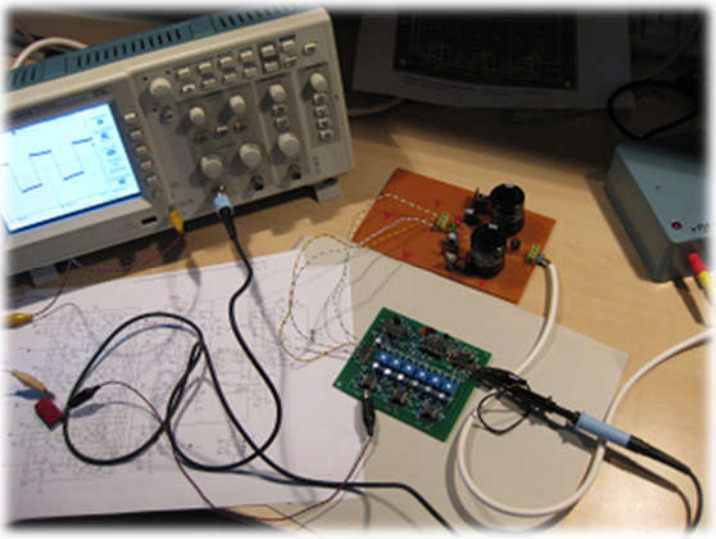
Single pin connectors PL1~PL8 are a bit tricky to assemble but are very useful when it comes to wiring later.

Quick test

When everything is properly assembled, take a magnifying glass and do a check: are all components at the right place, are the solder joints clear and shiny, are there any short circuits or cold solder joints, etc.

If everything is fine, put the ICs into sockets (note the notches), turn all trim-pots into the middle position and connect the +/- 15V DC power supply cables. Do not yet switch on the power supply.

The oscilloscope should provide a simple square wave test signal for probes. This signal is what we are using for our quick test. As voltage level is usually too high for this purpose (e.g. 5Vpp) we attenuate with a 100K Ohm resistor and a non-polarized 0.47uF cap for any DC suppression. Of course a signal generator can be also used when available.



We now supply this signal to PL1, adjust the oscilloscope to 1V / division sensitivity and connect the probe to PL12, connection L or R. If we have a dual channel oscilloscope we can monitor outputs L and R at the same time.

Now we switch on the power supply. **Attention:** if we do see nothing **switch off immediately and try to find the failure**.

If a square wave signal can be seen, vary the corresponding trim-pot to the left and to the right and watch the amplitudes at the L/R outputs. We proceed the same way for all inputs PL1~PL6. When everything is working fine we are more

than half way through.

Filter IC adaptor

Adaptors are needed for the six CEM3372 filter ICs. For our pan mod we only need to separate the audio output at pin14. This pin must not have any connection to the socket on the voiceboard, otherwise the application will not work (but no harm). All other connections are to be “looped through”.

The author tried several adaptor options and identified option 3 as the best in terms of robustness, mechanical size (we are height limited as the filter ICs are partially mounted below the keyboard), and cost.

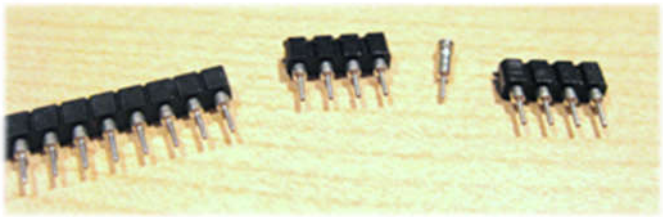
Preparation

Open the synthesizer and remove the keyboard. Make sure you are grounded. Carefully remove all six CEM3372 filter ICs and store them on ESD foam.

Option 1

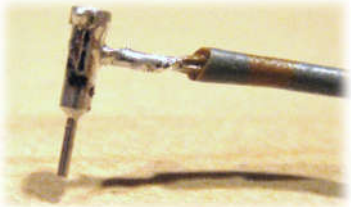
This option was used for the first prototypes. Quick and dirty but it does the job. This may be considered when the synthesizer is rarely moved, if the last cent counts or if there are difficulties to source the connectors described under option 3.

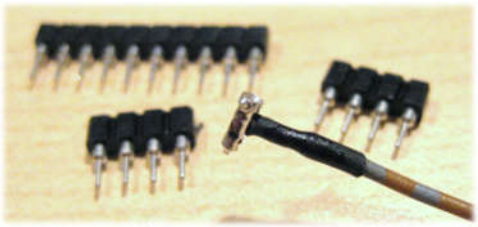
Preparation of standard single in-line connectors. Per IC we need one 9-pole and two 4-pole connectors. In addition to that we need a single bare pole which can be easily extracted from a single line connector row.



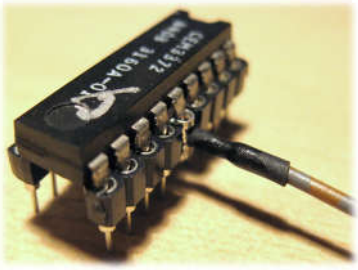
We solder isolated flex wire (length ca. 16cm) to the bare pole and cut the pin below the cup. Some shrink tubing is recommended for isolation. Following

pics show how this construction should look like:





Now everything needs to be assembled. Pin14 is audio-out of the filter IC.



We proceed for each filter IC accordingly. **Attention:** it is highly recommended to additionally isolate the pin14 adaptor from the socket below. Just take a small piece of double layered tape and glue it onto pin14 of the voiceboard socket before you insert the adaptor. Another advantage: the pin14 adaptor hangs a bit lose; tape helps to give this construction a better stability.

Advantage: low cost solution, standard single row connectors easy to obtain from multiple sources.

Disadvantage: Connection of pin14 maybe a bit wobbly. Ensure a snug fit to avoid issues when the synthesizer is being moved (…for the next gig ;-).

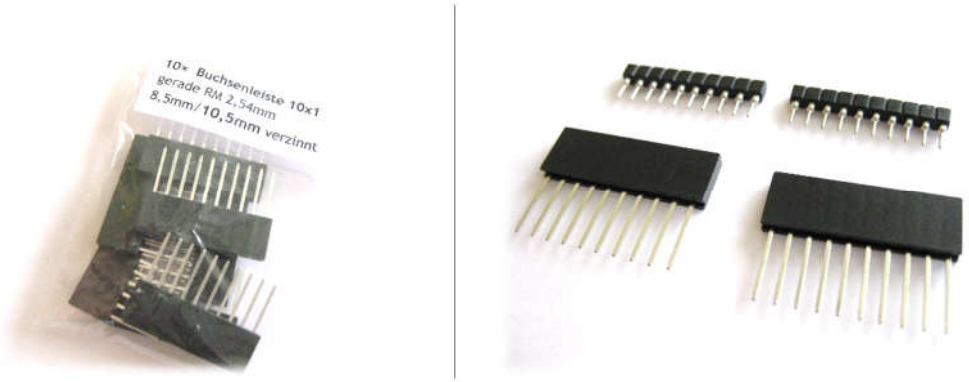
Option 2

Option 1 has the disadvantage that the pin14-adaptor hangs a bit lose. A mechanical more stable solution would be desirable.

This option here makes use of 10-pole long-lead connectors as shown in below pic. I sourced these connectors at a retailer in Germany via e-bay. Cost was

around EUR 2.15 for a pack of ten 10-pin connectors (12 pcs. are needed in total).

Actually we only need 9 contacts per row but I couldn't find such version. There are also e.g. 6-pin connectors or such with more than 10 contacts, but they are of no use for us here.

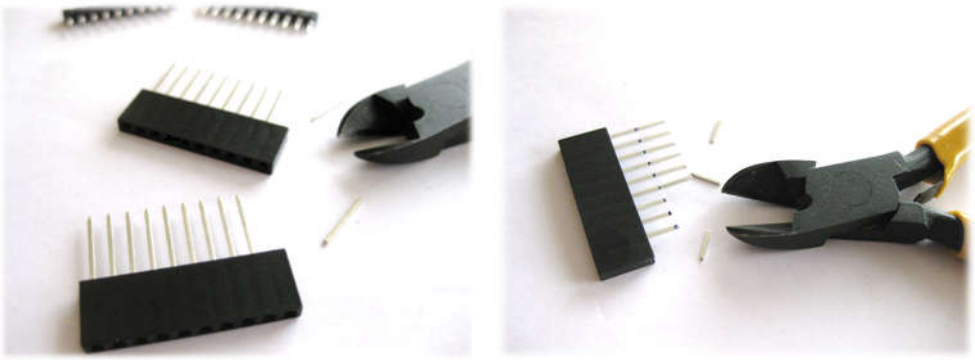


The long leads of the above shown connectors are ideal for solder tails, and they fit very well into the IC sockets on the voiceboard.

Unfortunately, the CEM3372 leads are too thin to ensure a stable fit. We surely will not touch these rare and expensive ICs. Instead, a good compromise might be to additionally use standard IC sockets or single in-line connectors where leads are to be thinly coated with solder to ensure a solid fit.

Therefore we also need standard DIL-18 or DIL-20 precision sockets or standard RM 2.54mm single line connectors which need to be denominated to rows of 9-poles each.

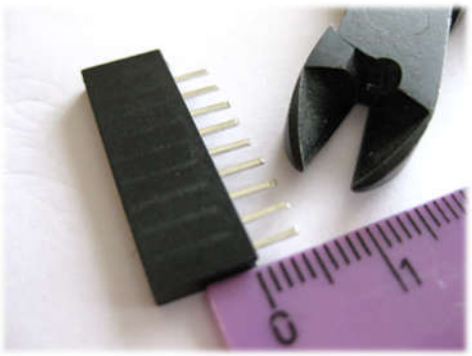
The long-lead connectors need to be prepared first. Two strips are needed per filter IC. Per strip, one outer lead needs to be cut:



Next is to sketch in a line in the middle of the leads and to cut leads as shown in above picture. **However, before you do this please read the below first.**

Per lead there should be a remainder of approx. 4~4.5mm. Not more, as we have to pay special attention to height. But also not much less as we have to ensure a reliable contact in the voiceboard socket.

The strip for the left IC side (pin 1~9) should look as the following:



The strip for the right IC side (pin 10~18) needs to be prepared differently.

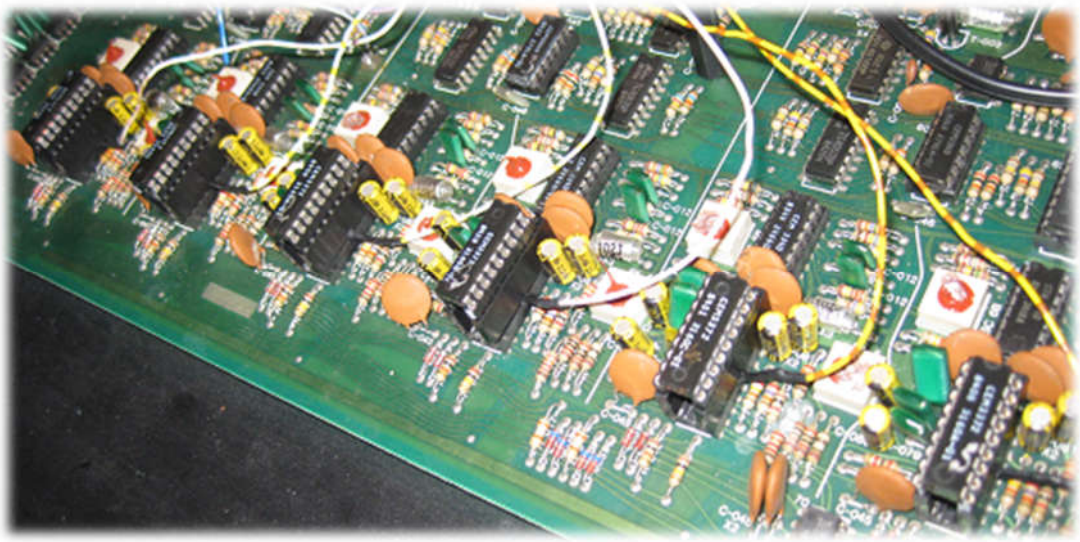
Pin14 for the audio-signal is not to be cut but simply bended to the outside. Now solder an isolated flex wire to this lead and isolate everything with some shrink tubing.

The finished adaptor should now look as the following:

This type of connector does not require additional tape for isolation on the voiceboard socket.

Below picture shows the adaptors inserted on the voiceboard. They need to be flush at the back, means the overhang with the cut leads have to show towards the middle of the voiceboard.

This sandwich now looks as the following: „filter IC on precision socket, with fine solder-coated leads at customized special adaptor, embedded on voiceboard socket". Sounds tasty?



Advantage: Long leads enable comfortable access to pin14

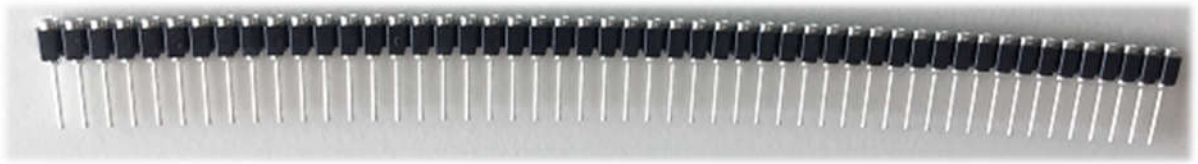
Disadvantage: Limited buying sources, higher effort to prepare the long lead stripes, standard sockets / in-line connector additionally needed, height critical as potential conflict with the keyboard. More costly as it requires additional material.

Option 3

This is the clear favorite from my viewpoint.

After some internet search I found a company in Germany (Fischer Elektronik) who are newly offering single-line precision socket strips with long leads (pole height ca. 11mm, lead length ca. 7mm) an. Part name is **MK31** with a suffix, e.g. „09 Z", where „09" stands for the number of poles (options are 1…50) and „Z" for tin. There are also gold plated „G" versions, but we don't need.

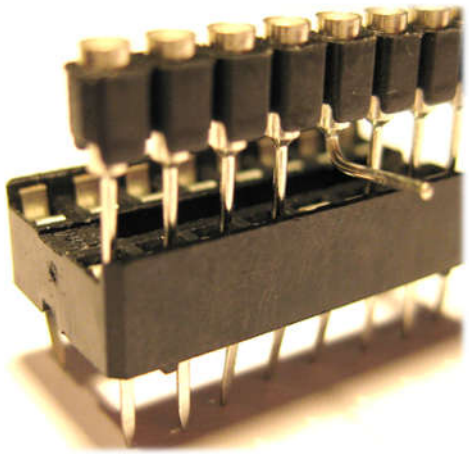
The picture below shows a 50-poles strip.



Depending on the available strip length we may have to prepare pieces with 9-poles each.

For the right IC side we have to carefully bend „pin14“outwardly. The isolated flex wire is to be soldered here, also we use some shrink tubing for isolation.

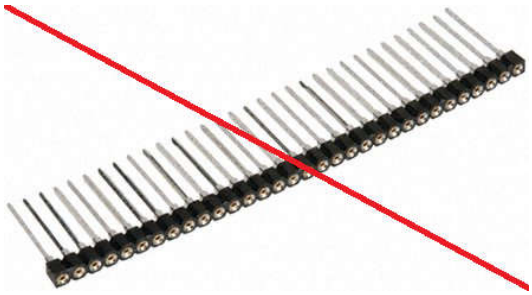
For better illustration please refer to the picture below: the strip is here inserted in same type of socket as it is used on the voiceboard (we ignore the fact that below socket is DIL-16, not DIL-18, it is not relevant here).



Advantage: mechanical and electrical robust solution, low height (=no conflicts with the keyboard), cost/performance ratio.

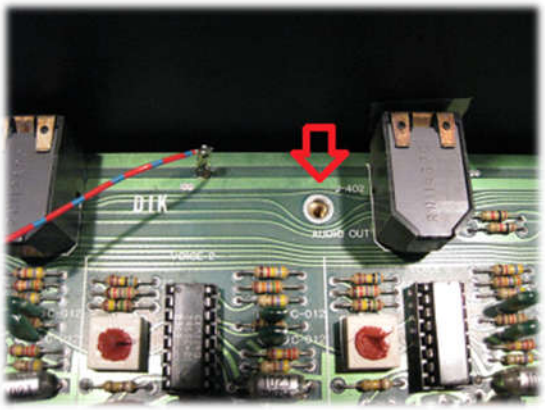
Disadvantage: basically none.

Attention: there are also strips for wire-wrap connection. Leads are also long but too thick and not suited to fit into IC sockets. Do not use, otherwise the voiceboard sockets will be damaged!



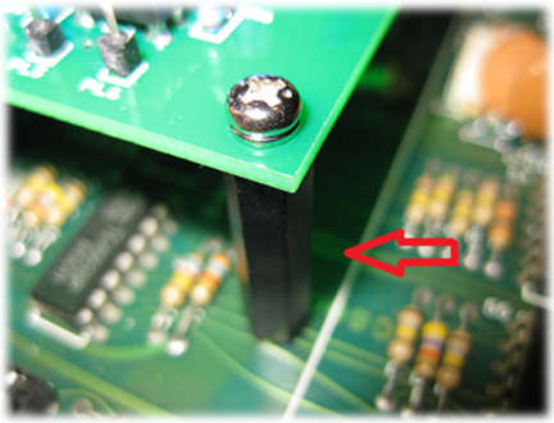
Installation of the PCB

We’re making use of the fact that the voiceboard is fixed at the marked place with a screw. We remove this screw and replace it by an M3 bar spacer as shown below.



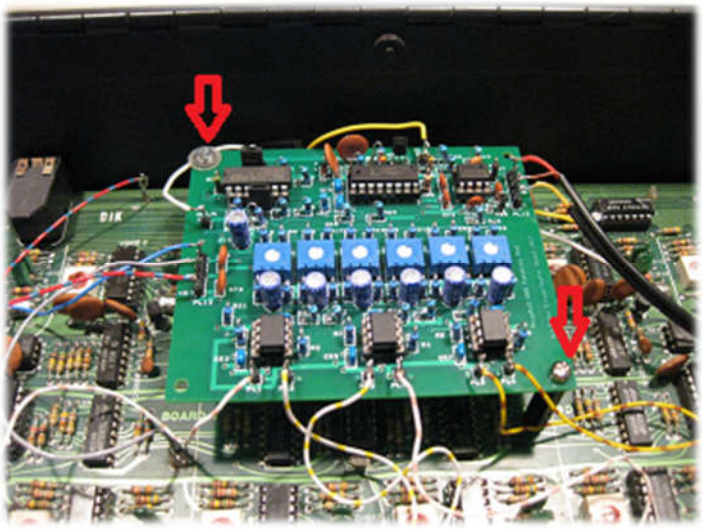
Bar spacer with M3 in- and outside thread, total length ca. 30mm 
(length of outside thread ca. 5mm).

Our PCB is now to be equipped with another bar spacer front right:



Bar spacer with M3 inside thread  ca. 25mm length.

Now we bolt the PCB to the bar spacer at the far end. The front bar spacer lies flat on the voiceboard and can be fixed with some hot glue.

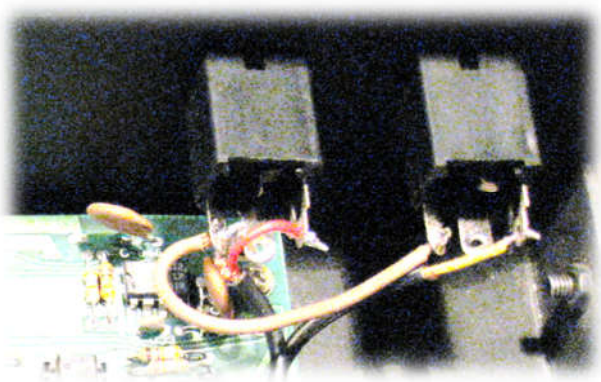


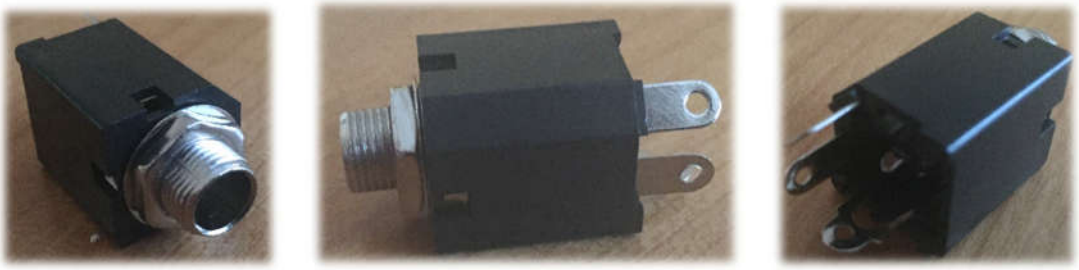
Installation of the L/R jacks

Basically I don’t like irreversible changes of vintage instruments.

However in this particular case intervention is not dramatically and also not so visible therefore reasonable.

Two holes have to be drilled at the rear side of the cabinet for the two 6.3mm Mono jacks. There is a number of different jack types thus we only give some indication here.





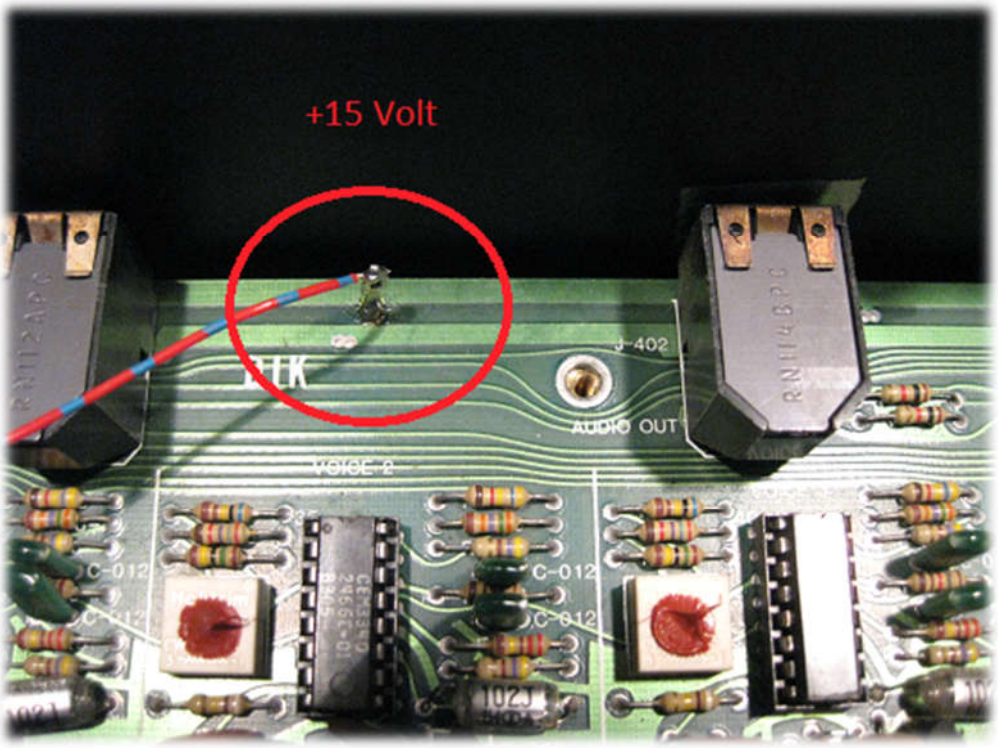
I made very good experience with the jack type shown above.

Wiring

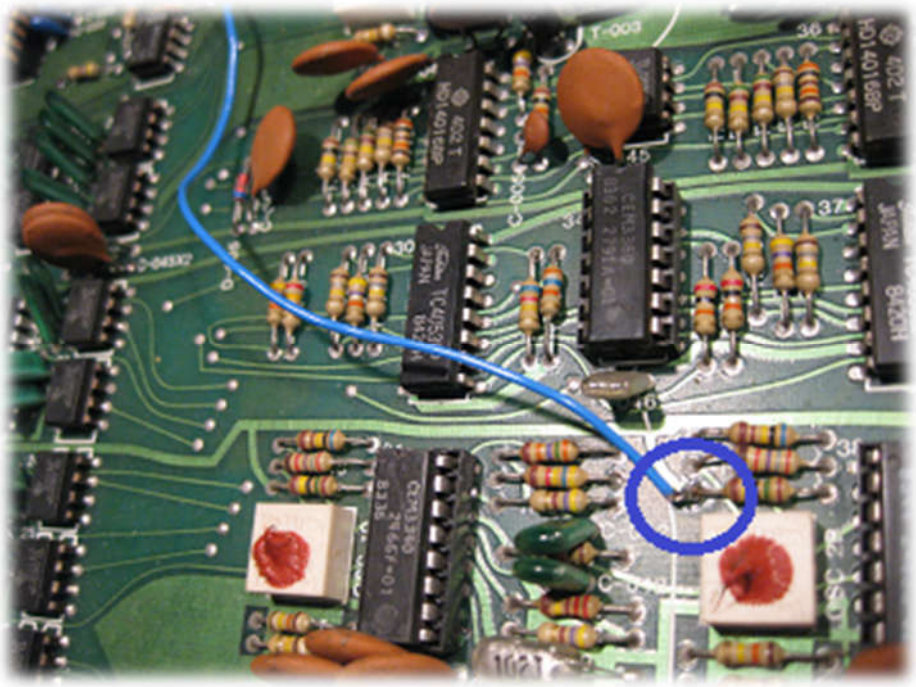
Now everything needs to be properly wired.

We start with the power supply: +15V, -15V and GND is needed. In the following it is shown where to tap these on the voiceboard. You may also want to consult the Prophet 600 schematics to avoid any mistakes.

The marking below shows a spot where there is no solder resist on the trace. Here we tap +15V. We may use a solder terminal to spare the PCB. Care has to be taken to avoid any shorts with neighbor traces. Yes there is solder resist, but you never know…

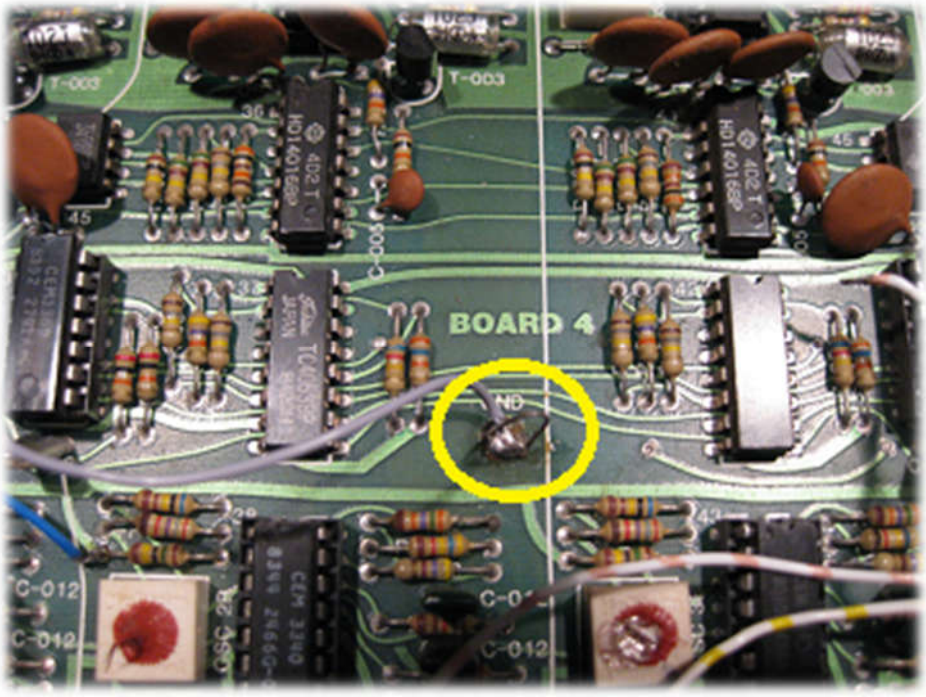


Next is to tap -15V:



Solder an isolated flex wire to the resistor as shown above.

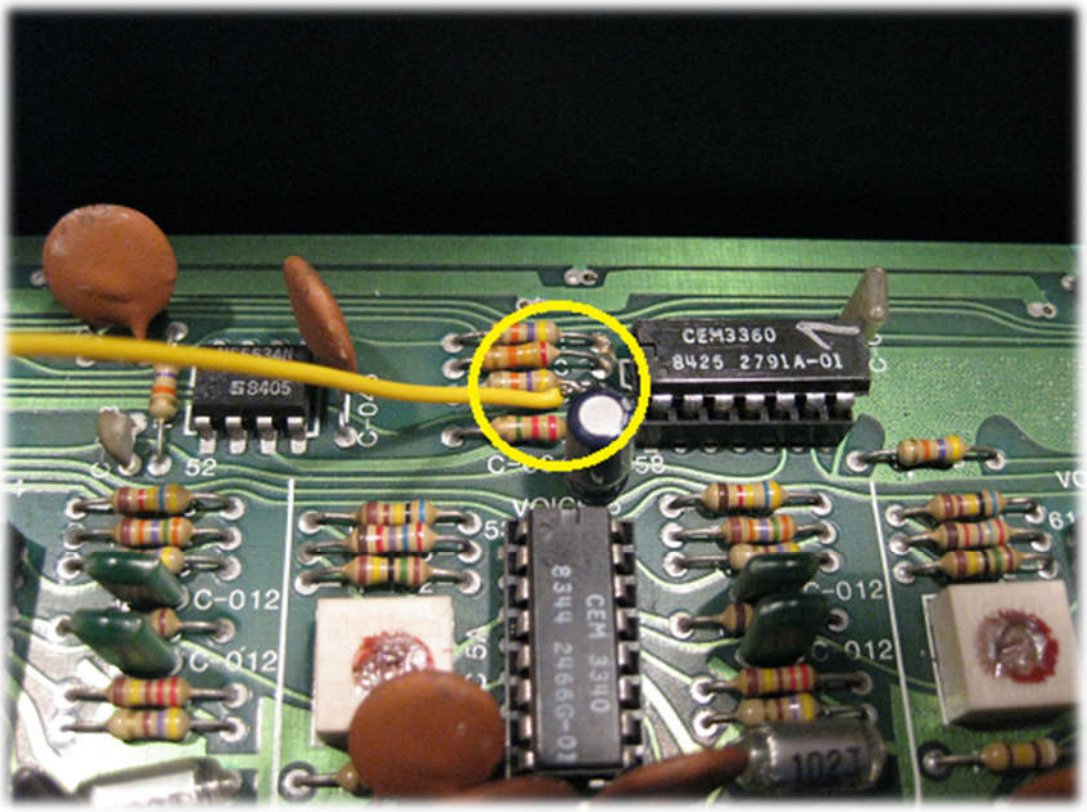
Finally we have to solder another flex wire to GND:



The right place is not difficult to find as there is already a „GND“-marked solder terminal on the voiceboard.

Next is to check with a multimeter or oscilloscope if voltages are correct.
If so, we solder the three wires -15V, GND and +15V to terminal PL13 on the pan mod PCB. Mind the polarity!

What’s next: CV control voltage is needed for manual volume control.

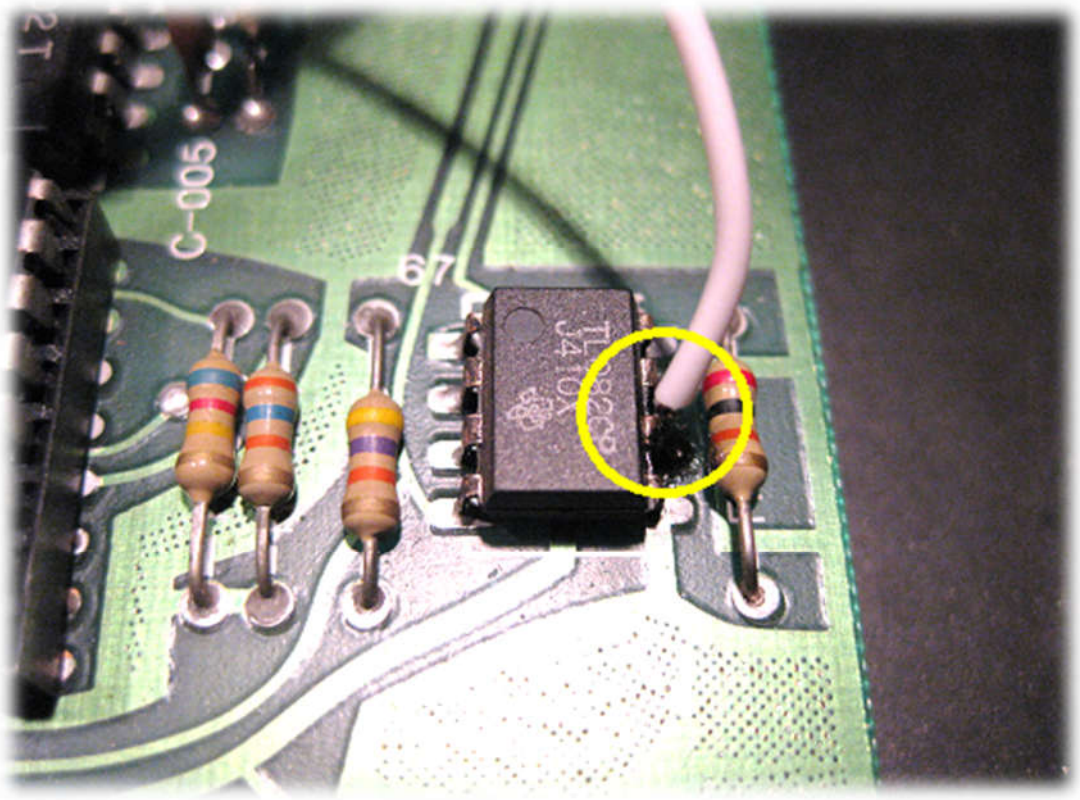


We tap CV at the marked resistor (47K Ohm, third from above, right hand side).

This wire goes to PL7 „CV_IN“ on our Pan Mod PCB.

To ensure proper operation of „auto-tune“, following connection needs to be established.

Carefully solder an isolated flex wire to pin6 of U467 (TL082).

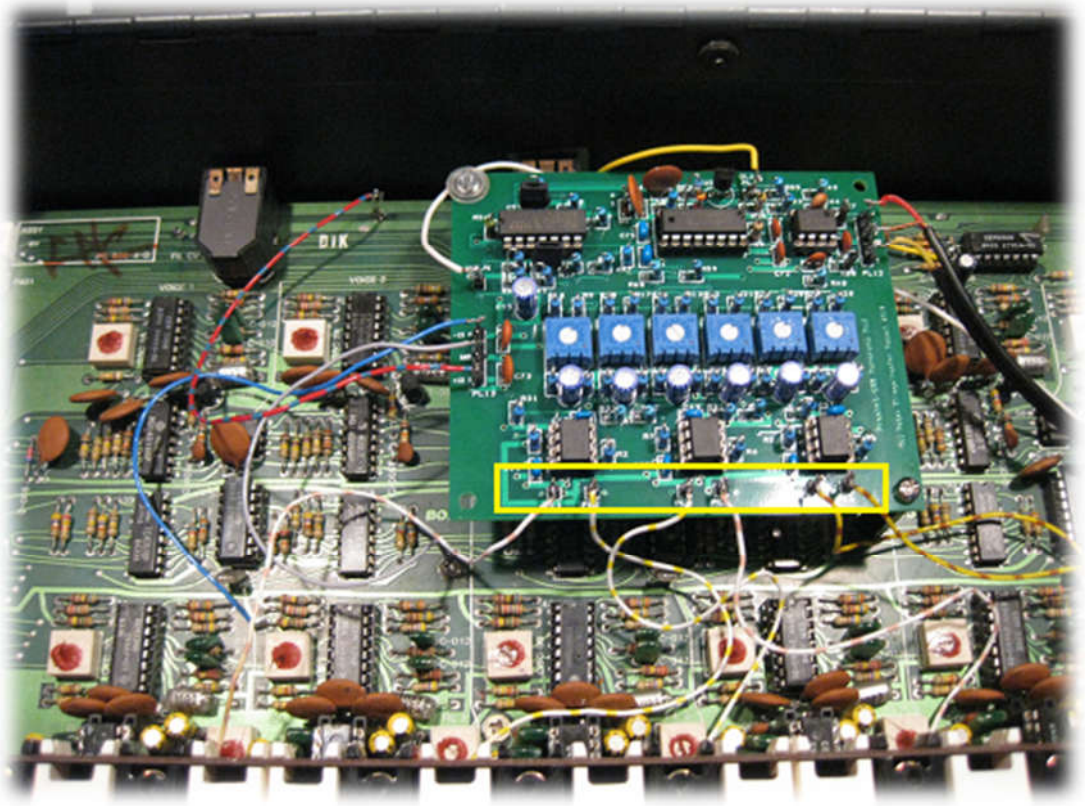


We have to be very careful here as we unfortunately have to directly solder at the IC, and there is also a resistor sitting close to it.

This wire goes to terminal PL8 „U467_Pin6“ on our Pan Mod PCB.

Now it’s time for a coffee break ;-)

Next is to connect the six “Audio Out” wires coming from the filter ICs to terminal pins PL1-6 on the Pan Mod PCB:



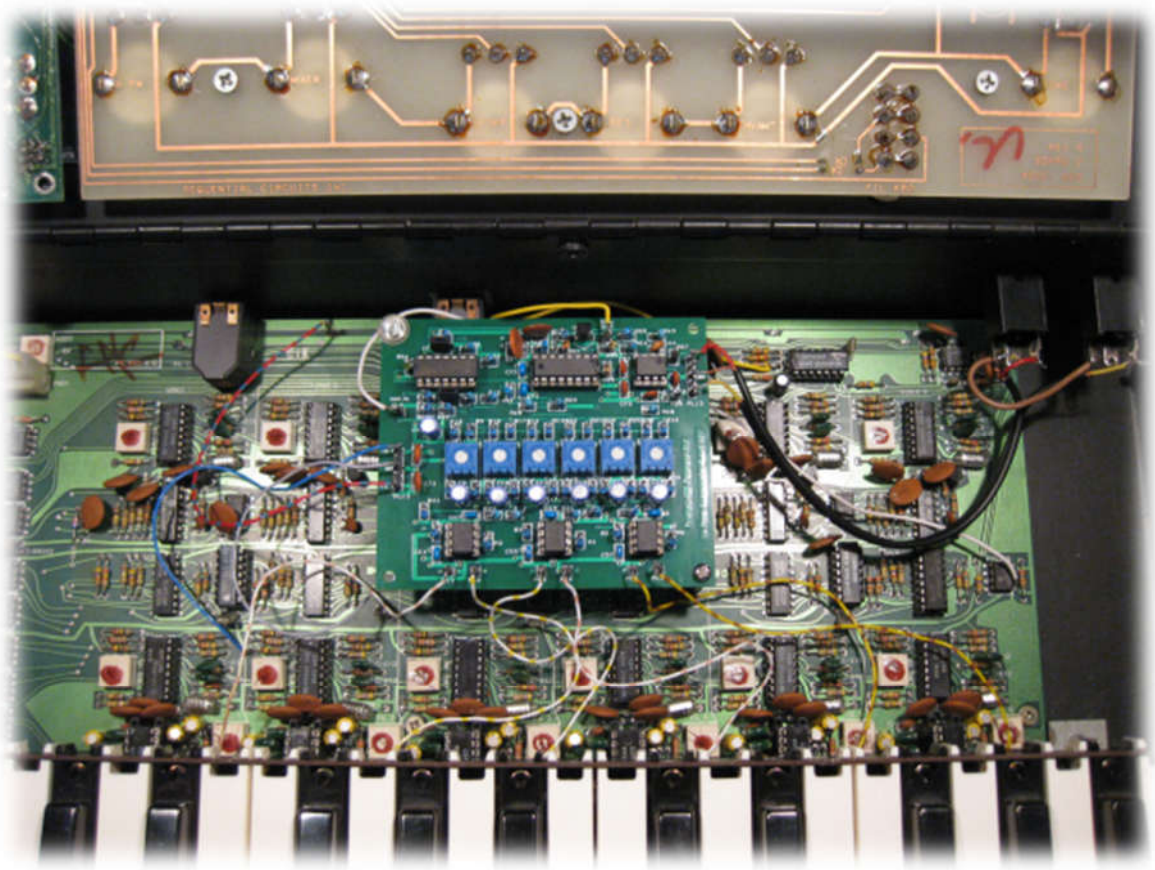
Finally the jacks are to be wired as shown below. Outputs L/R and GND are accessible at terminal PL12 on the Pan Mod PCB. Remember to wire GND to *both* jacks.

Grand finale

Make a careful final check: nothing is semi-fitted, remove solder remainders from the inside of the synth (there are *always* small solder crumbs which can cause shorts…), connect audio and power supply cable, take a deep breath and …only enjoy!

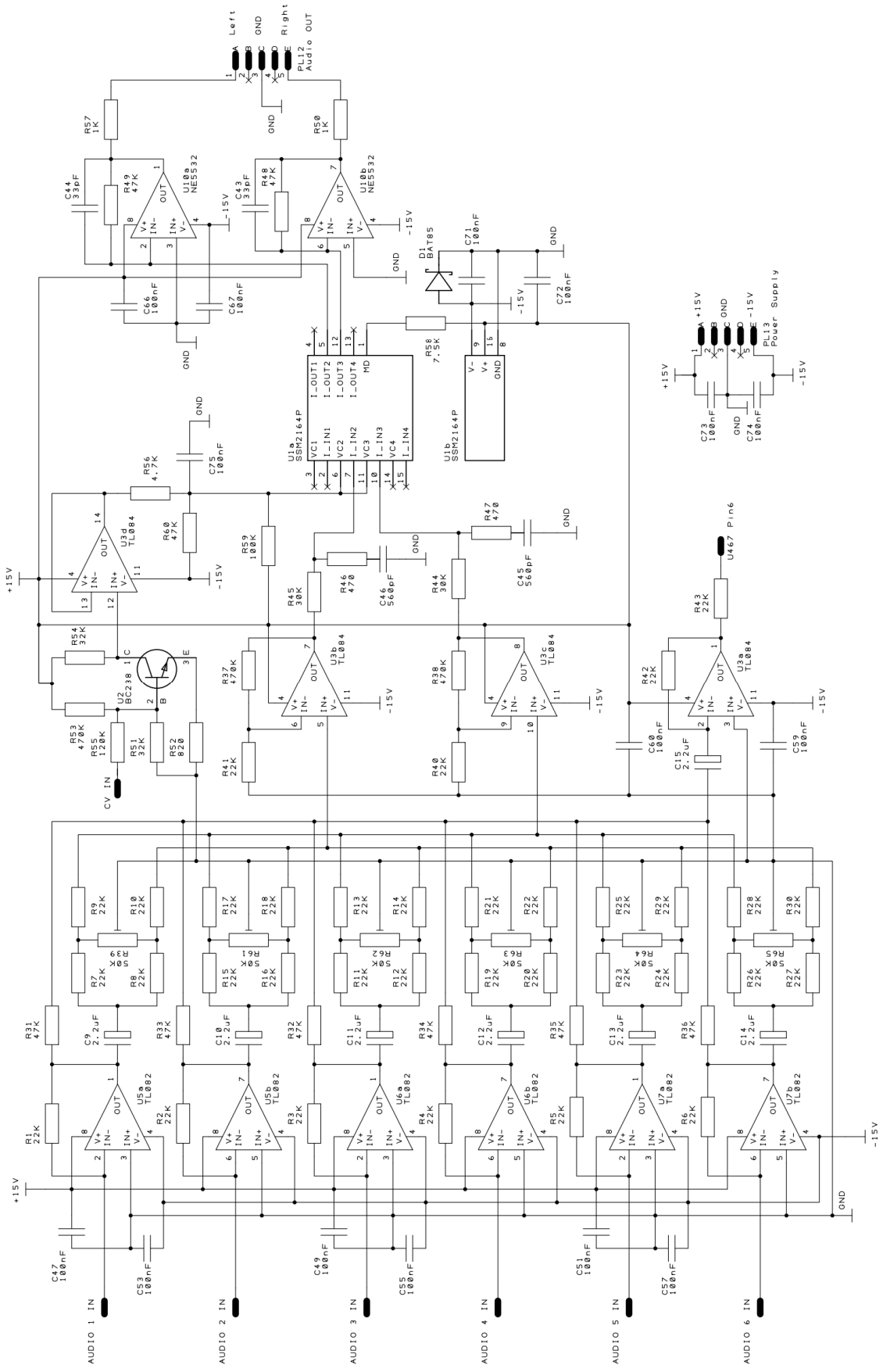
Adjust the blue trim pots to your gusto. According to my experience with the OB-X and now also with this Prophet-600 Pan Mod this job is usually to be done only once. That's why I didn't spend any effort to make the trim pots accessible from the outside.

The output level of the Stereo signal is intentionally a bit higher vs. the Mono signal. The Mono signal is independently available at its original jack.

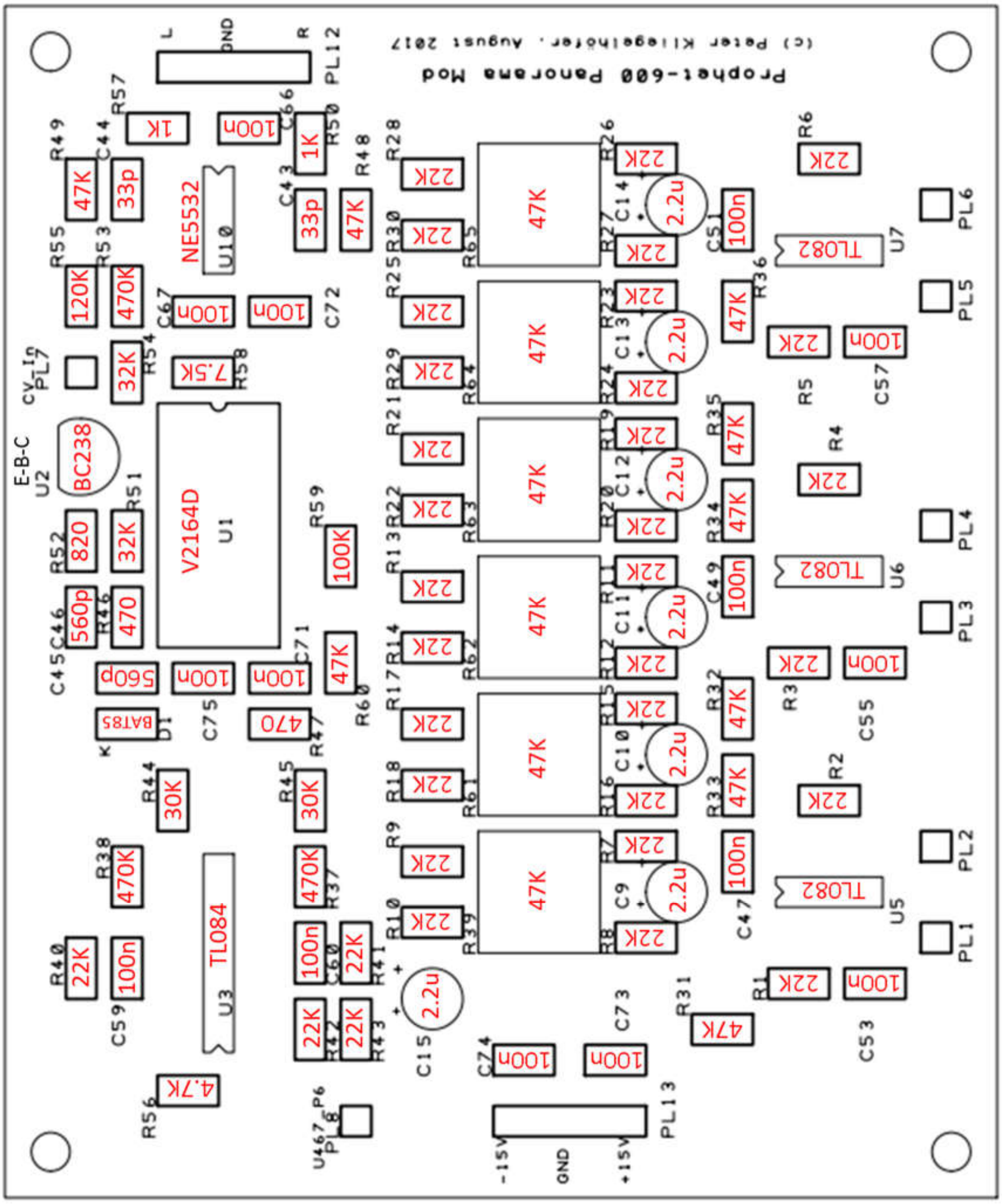


Job done ;-)

Schematics


PL12 Audio OUT
Left
GND
Right
PL13 Power Supply
+15V
-15V
GND
AUDIO 1 IN
AUDIO 2 IN
AUDIO 3 IN
AUDIO 4 IN
AUDIO 5 IN
AUDIO 6 IN
CV IN
U467 Pin6
U10a NE5532
U10b NE5532
U3d TL084
U3b TL084
U3c TL084
U3a TL084
U2 BC238
U1a SSM2164P
U1b SSM2164P
U5a TL082
U5b TL082
U6a TL082
U6b TL082
U7a TL082
U7b TL082
D1 BAT85

Component diagram



Bill of Materials

Component	Value	Amount	Description
PL1-8		8	Terminal, single pin
PL12-13		2	Terminal strip RM2.54, 5-pin
U2	BC238	1	NPN universal small signal transistor, TO92
D1	BAT85	1	Schottky diode, axial
C43-44	33pF	2	Ceramic cap, RM2.54
C47,C49,C51,C55,C57, C59-60,C66-67,C71-75	100nF	15	Unpolarized cap, 50V, RM2.54
C45-46	560pF	2	Ceramic cap, RM2.54
C9-15	2.2uF	7	Polarized cap, 35V, RM2.54
R52	820 Ohm	1	Metal film resistor, 1%, 0.25W, axial
R56	4.7K Ohm	1	Metal film resistor, 1%, 0.25W, axial
R58	7.5K Ohm	1	Metal film resistor, 1%, 0.25W, axial
R1-30,R40-43	22K Ohm	34	Metal film resistor, 1%, 0.25W, axial
R44-45	30K Ohm	2	Metal film resistor, 1%, 0.25W, axial
R51,R54	33K Ohm	2	Metal film resistor, 1%, 0.25W, axial
R50,R57	1K Ohm	2	Metal film resistor, 1%, 0.25W, axial
R31-36,R48-59,R60	47K Ohm	9	Metal film resistor, 1%, 0.25W, axial
R59	100K Ohm	1	Metal film resistor, 1%, 0.25W, axial
R55	120K Ohm	1	Metal film resistor, 1%, 0.25W, axial
R46-47	470 Ohm	1	Metal film resistor, 1%, 0.25W, axial
R37-38,R53	470K Ohm	3	Metal film resistor, 1%, 0.25W, axial
R39,R61-65	47K Ohm	6	Trim potentiometer, linear
U1	V2164D	1	Quad VCA, DIL-16
U3	TL084	1	Quad OPA, DIL-16
U5-U7	TL082	3	Dual OPA, DIL-8
U10	NE5532	1	Dual OPA, , DIL-8
		1	Prophet-600 Panorama Mod PCB
		2	Precision socket DIL-16
		4	Precision socket DIL-8
		2	Mono jack, 6.3mm
		1	Bar spacer, plastic, 30mm total length, M3 in- and outside (5mm length) thread, screw, washer
		1	Bar spacer, plastic, M3 inside thread, 25mm length, screw, washer

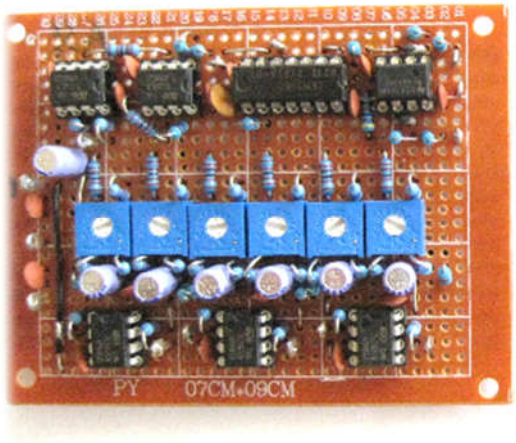
Note: Material for filter IC adaptors according to option.

CoolAudio's V2164D VCA is proven to work in this application. However this application also should work with SSM2164P or any other compatible device from another manufacturer.
Instead of TL084, TL074 or TL064 may be used. Instead of TL082, TL072 may be used.
The transistor type is not critical. Instead of BC238 any other NPN universal small signal transistor may be used. Mind the polarity!
For C45 and C46 also 470pF may be used.

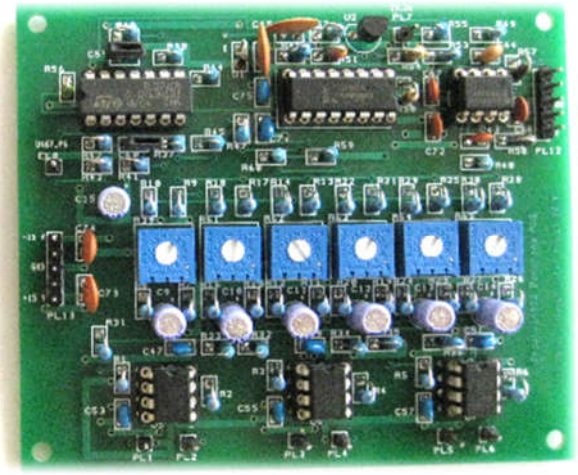
PCB Technical data

Fertigung gemäß IPC-A-600H Klasse 2	
Typ	Einzelleiterplatte
Min. Designstruktur	150 µm
Min. Bohrung	0,3 mm
Basismaterial	FR4 (TG135), 1,6 mm
Lagenanzahl	2
Kupfer Außenlagen	35 µm
Abmessungen	99,06 x 82,55 mm
Oberfläche	HAL bleifrei (HASL-LF)
Viaabdeckung	abgedeckt
Lötstoppmaske	TOP+BOT, grün
Positionsdruck	TOP, weiß
Testmethoden	Elektr.-Test, DRC-Test, AOI

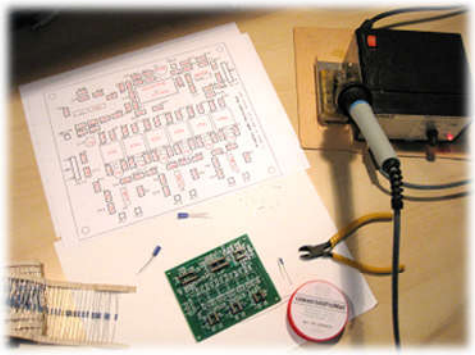
Bonus material



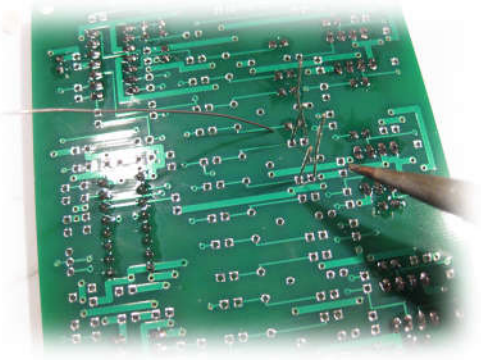
First prototype with CEM3360 VCA…



…and the final board



Let's get it on!



No effort no stereo sound…

Nice company name, huh?