

## Portabellabz 208p PCBs build notes

The PCBs are tested and error free except a small trace missing on board 2 of the bare tracks revision (see below). In case assistance is needed please refer to the build thread on the Modwiggler forums <https://modwiggler.com/forum/viewtopic.php?f=17&t=194531>  
**I do not offer individual support** for this build, related e-mails or private messages will be ignored but I'll reply as long as I can help on the build thread, thanks for your understanding. Read the FAQ <http://www.portabellabz.be/208pcbfaq.html>

Happy building !

### BOM

The BOM and build instructions are the same as <https://electricmusicstore.com/blogs/build/12614717-stored-program-sound-source-model-208>

The BOM needs in extra

- **2 x 470ohms and 2 x 10k resistors** for the noisy headphones output fix on the motherboard
- **2 x pA726 BOM** <http://www.portabellabz.be/images/pa726/pa726-208.pdf>

Various BOMs and carts exist. I didn't check their content and assume no liability for their accuracy :

- [https://www.samodular.com/wp-content/uploads/2021/04/208p\\_BOM\\_full.pdf](https://www.samodular.com/wp-content/uploads/2021/04/208p_BOM_full.pdf)
- [http://www.portabellabz.be/images/208/Portabellabz\\_208p\\_BOM\\_by\\_AshtrayWasp.xls](http://www.portabellabz.be/images/208/Portabellabz_208p_BOM_by_AshtrayWasp.xls)

Many **rare obsolete expensive parts** can be replaced with modern ones, take a look at <http://www.portabellabz.be/208pcbfaq.html#parts> before ordering those.

The **standoffs** for the 208 panel mounting should be **M3 15mm**, not 17mm, to ease the switches nuts and transfer card mounting.

Some **56 pin edge connectors** with tabs such as the 'Jamma' sold on ebay (ref 56P-3.96S or other) or the Sullins ones might not fit the mother board eyelets.

Some 4016s are source of issues, use **4066** instead of 4016 should help prevent these. In some builds a 4066 for IC2 on card 8 didn't work and a 4016 was needed although a 4066 works in other builds.

Mount **ICs to sockets** to ease troubleshooting, **except the LM380's** on board 12, solder these directly to the board for proper heat sinking with the ground plane.

**Dave Brown's fixes** on <http://modularsynthesis.com/roman/buchla208v2/208spss.htm> for the 208r PCBs errors **do not apply to the 208p**.

The only error that needs a fix on the 208p is the small missing trace on board 2 of the bare tracks PCB revision as mentioned below.

Pics of the cards with **components layout and values** are on <http://www.portabellabz.be/images/208/cards.zip>

### Silkscreen erratum and fix on the early silkscreened boards

**Board 1** : 1M resistor above IC7 is **R16**, not R15

**Board 3** : **R26** is 100k 1 %

**Board 5** : **R17** is SOT, not 6k8 (see below)

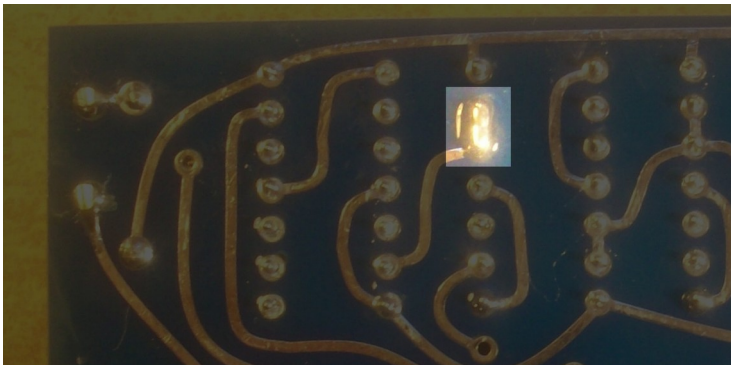
**Board 6** : 100k resistor under IC5 is **R52**, not R43

**Board 11** : 10k 1 % resistor to the right of R31 is **R30**, not R38

**Board 9** : 15k **R7** resistor's right pad is covered by soldermask, gently scratch the soldermask with a flat screwdriver to solder

## Fix on the bare tracks boards

On **board 2**, a small trace is missing between pins 5 and 6 of **IC1**, bridge with solder.



## A few tips...

Solder the **pin headers** to the **mother board** strongly, generously and neatly. Plugging and unplugging the cards causes a lot of stress to them. Too weak solder joints might break and cause bad contacts, this is a common source of issues.

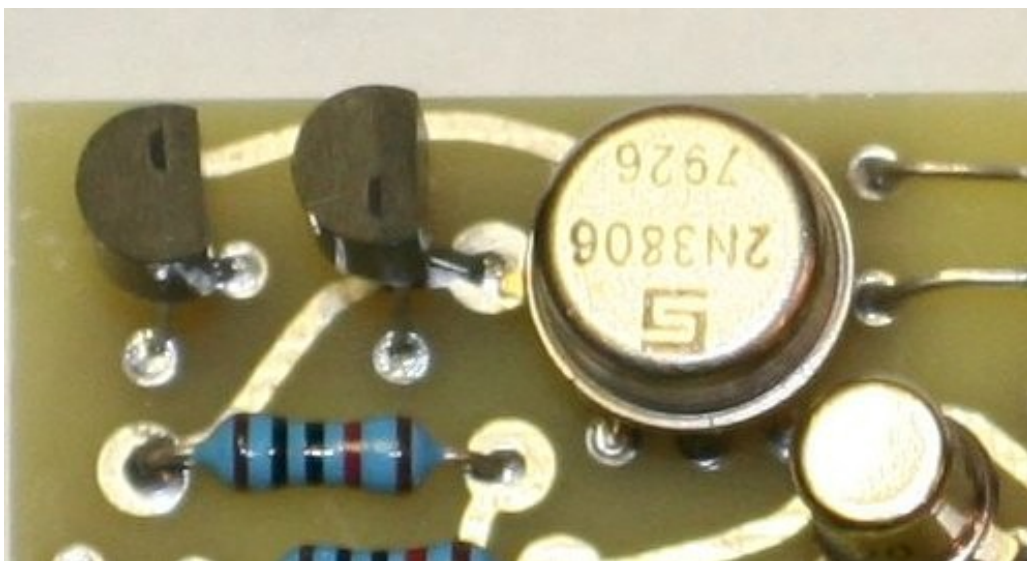
The angles of the banana jacks nuts on the top can interfere with the **placement in the boat**, tighten them so that a flat side points towards the edge.

It's good to add ceramic caps to clear high frequency spurious oscillation, it's not audible but worth doing for perfect operation. Many thanks to Dave Brown who reported this.

- **1nF** across **IC1 pins 12 and 14 on board 3** for the EG waveform
- **100pF** across **IC2 pins 12 and 14 on board 4** for the 'from card' socket
- **100pF** across **IC4 pins 12 and 14 on board 8** for the CO waveform

For **board 5** read the calibration notes below.

If PN3565 are used instead of 2N3565 on **board 6** they should be mounted "upside down" with the rounded side pointing to the outside.



On **board 6 and 7** mount the **pA726** with components leads and avoid pin headers. In many 208s that I repaired bad contacts in headers caused mute or unstable oscillators.

On **board 7**, R3 should be selected on test, a value between 1k8 and 12k, depending on the VT1 vactrol, to set the desired timbre amplitude. The higher R3 value, the more foldings. I find 4-5 folding is good, as shown on [http://modularsynthesis.com/buchla/208/buchla\\_208.htm](http://modularsynthesis.com/buchla/208/buchla_208.htm) but others prefer more foldings. It's up to the builder to select what best suits his needs. If the timbre reaches its maximum before the slider's top, select another vactrol in VT1. If the timbre's effect is heavily reduced in high frequencies, select another VT2.

To clear the slight pitch difference between the **MO and CO keyboard switch** in and out positions, you can replace R4 on **board 6** and R20 on **board 7** formerly 10M with a 6M8 resistor. This affects the oscillators tracking, thus better do it before calibrating it.

**Pots 11 and 18 on the MB** (MO and CO fine tune) should be 50k lin.

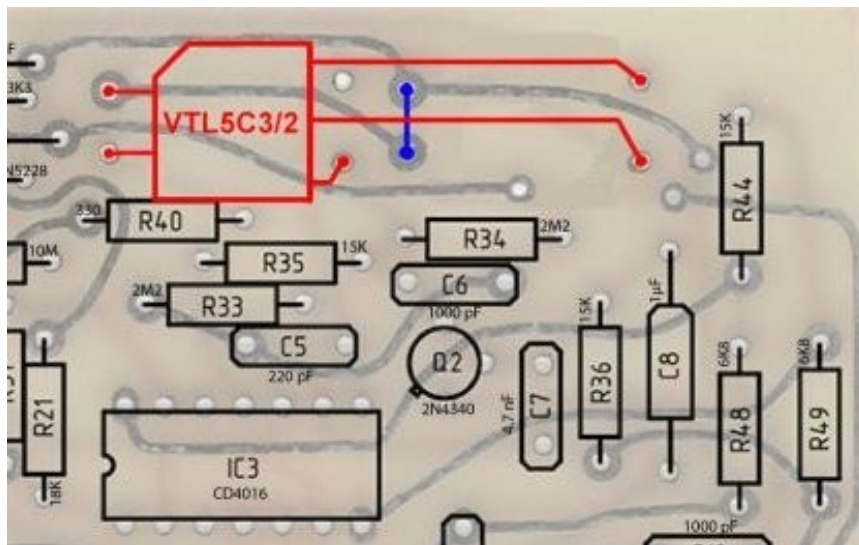
On **board 8** Q1 2N4339 needs selection on test for proper sine waveshape. This can be compensated by adjusting R41's value.

The vactrol should be selected too for a good linearity of the CO waveshape pot course.

It's better to use selected Excelitas VTL5C3/2 **vactrols** (not Xvive VTL5C3/2) on **boards 10 and 11**.

I select these to have the same short decay time in LP mode on each LPG. I find 0.5 sec the max acceptable.

Install them like this and bridge the pads according to the blue line.



Before mounting the panel to the motherboard, check that the 3mm **LEDs** that you'll use fit the panel holes easily. If are hard to push in, gently enlarge by hand the panel holes with a 3mm drill.

Before mounting the **Alps faders**, snip the protruding part of their 4 metal tabs to prevent the risk of short with the PCB traces. Do it with the silkscreened boards too.



**For the bare tracks revision only :** before mounting the **9mm Alpha snap-in pots** to the motherboard, bend the metal tab under the CO fine tune and waveshape pots to prevent the risk of short with the PCB trace under the pot.

## Clearance

Some traces come close to some pads or holes but don't do contact with them, this never was a problem in my builds, anyway I recommend to **solder carefully and neatly** using a good iron with thin solder tip and double check for solder bridges.

## Transfer card

**Before soldering it** to the panel edge connector, insert it thoroughly into the PCB edge connector with the motherboard mounted to the panel, place the panel edge connector and solder a few contacts as a reference.

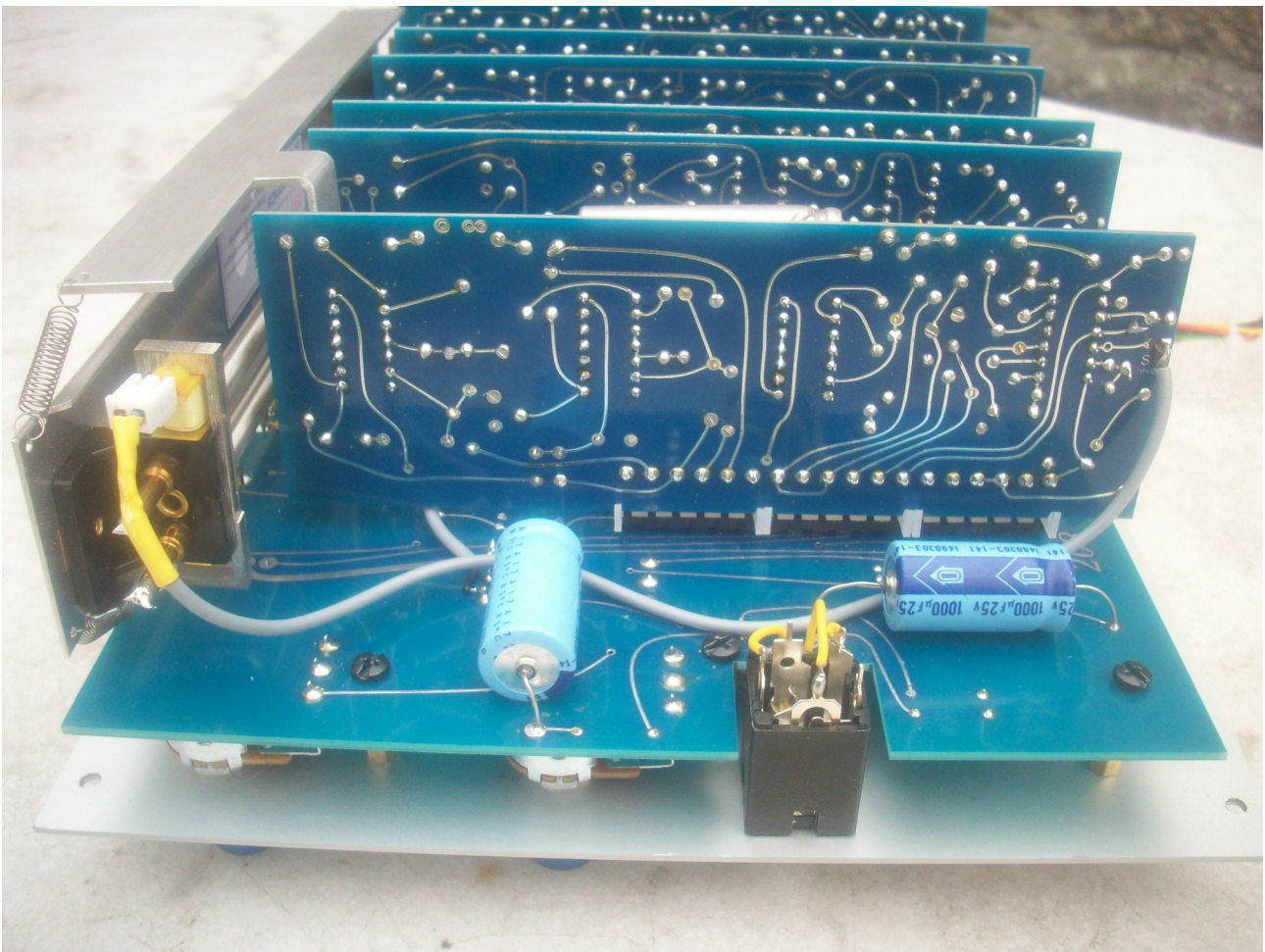
Then remove the panel edge connector and the transfer card and do final soldering.

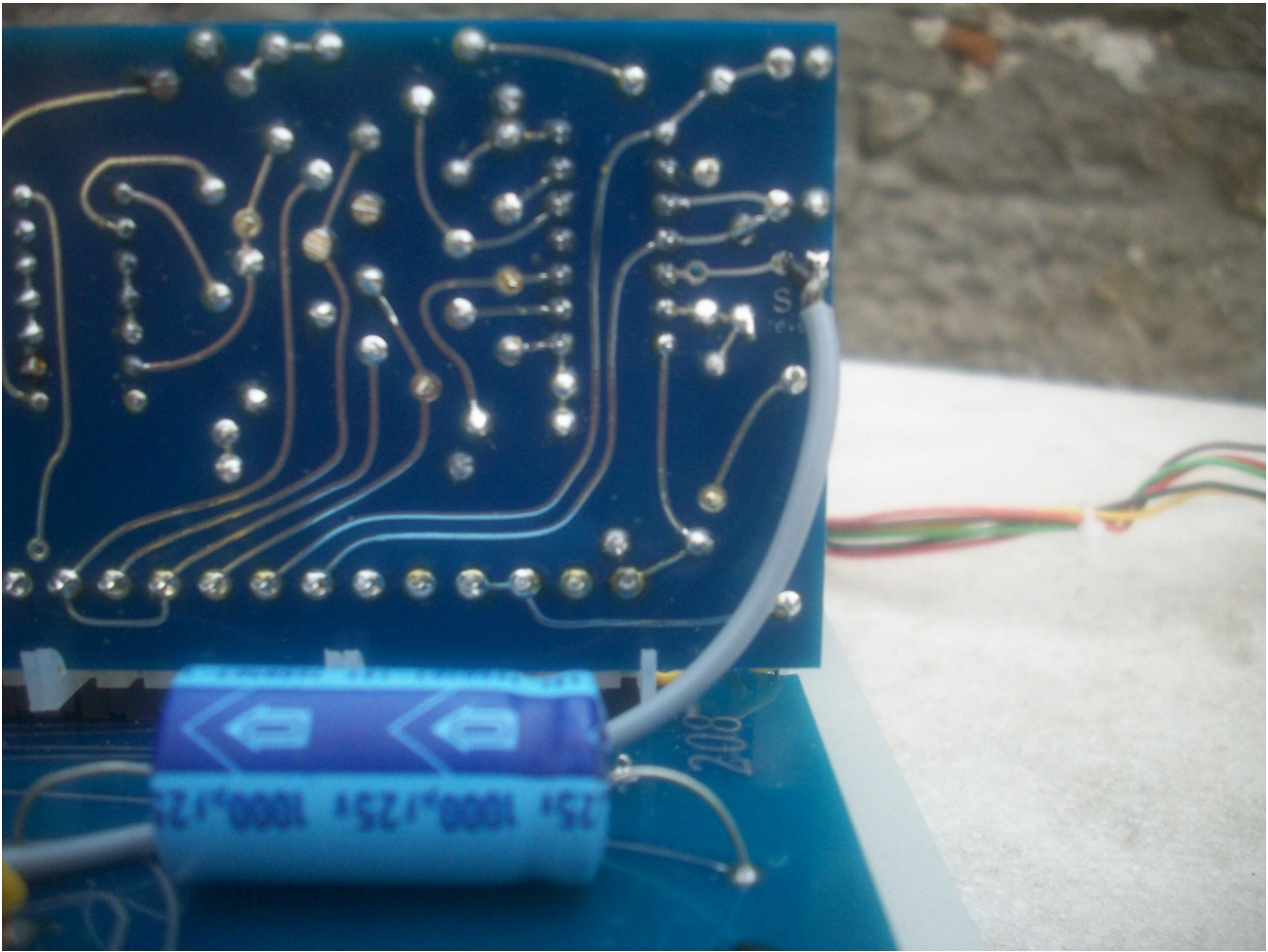
## Reverb

The type is **Accutronics/Belton 1BC2E**, available from <https://www.samodular.com/product/accutronics-reverb-tank-1bc2e/> or <http://www.accutronicsreverb.com> or <http://www.tubeampdoctor.com>

To improve the **reverb mix pot course**, use a log pot, preferably 10k. If a lin pot is already installed, add a resistor of 1/10 of the pot's value (if the pot is 10k, 1k resistor, if 50k, 4k7 resistor etc) between the pot's wiper and CCW terminal to make it log.

Connect the reverb output to card 12 with a **shielded cable**, shielding to "G" pad, signal to "S" pad. The former PCB trace was removed to avoid crosstalk issues. Snip the former reverb black and blue cables to about 15mm from the plug and solder these to the shielded cable, black to shielding (ground), blue to core (signal). Insulate with heatshrink tube.





## **iProgram card**

To use the 208 with an iProgram card :

- interconnect the pins 2 of both rows of the edge connector
  - interconnect the pins 4 of both rows of the edge connector and connect them to noisy ground
- On the silkscreened boards, these connections are already done.

The iProgram card clock connection is on rear/top pin 5 of the card edge connector and on pin 8 of the power connector.

The iProgram card data connection is on rear/top pin 6 of the card edge connector and on pin 9 of the power connector.

## **LEDs**

The LEDs, mostly the pulser's and envelope's ones, can affect the oscillators pitch. This can be attenuated by the addition of series resistors. To add a resistor to the pulser's and envelope's LED, cut the PCB trace between the 2N1711 and Molex connector (there's only one, on the solder side) of boards 3 and 4 and bridge the cut with a resistor.

Depending on the LEDs, select the resistor in order to achieve the best possible compromise between LED brightness and pitch alteration.

To match brightness, the series resistors of the sequencer LEDs should be selected on test and installed afterwards to the back of the MB, do not install R85 to R89 when populating the MB.

Adding 22 $\mu$ F caps between +/-15V and Q ground to the back of the Molex connectors of boards 3, 4, 10, 11 may also help.

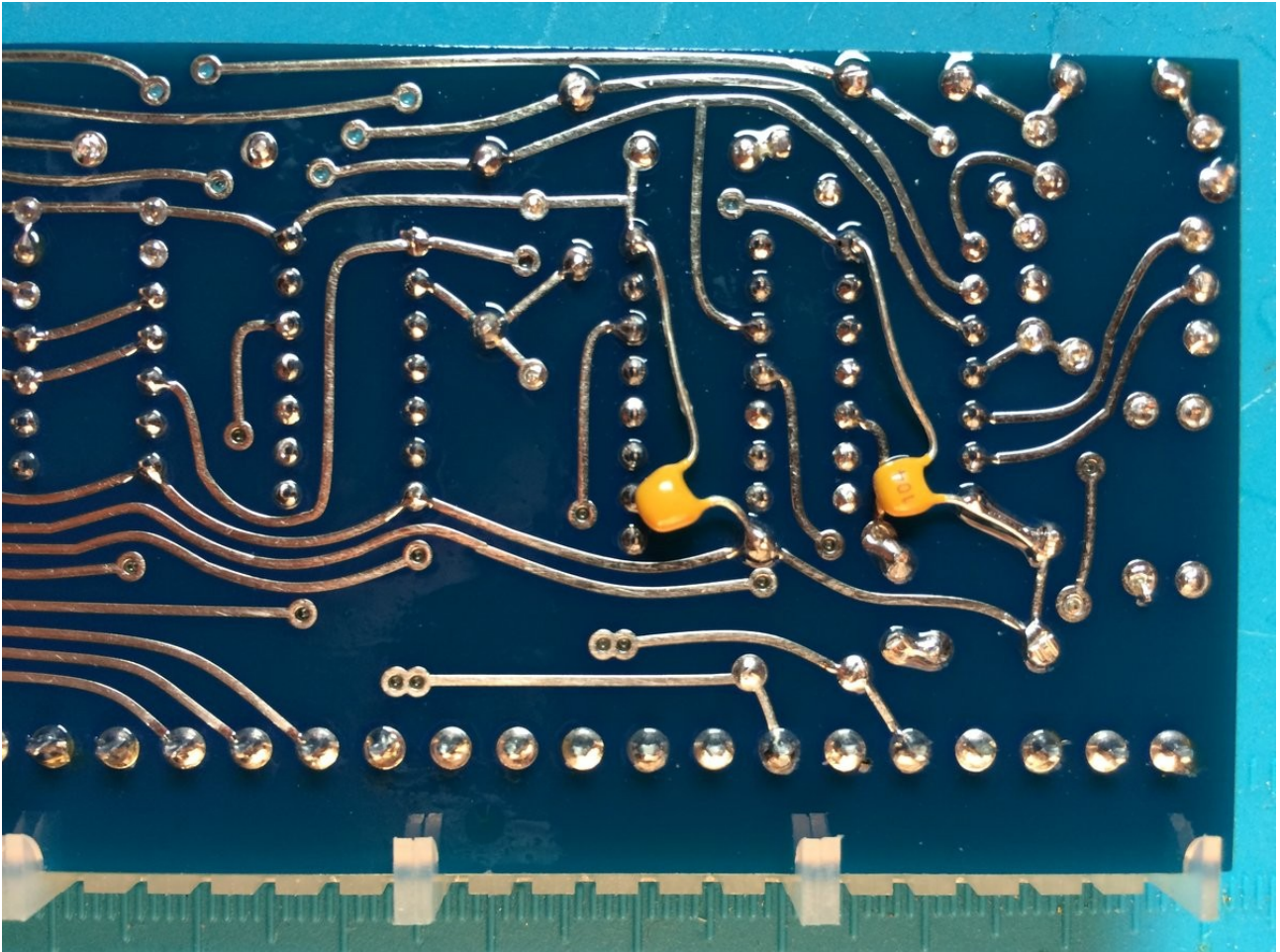
My fav LEDs are Mouser part 604-WP424IDT, flat top and soft brightness.

I cut the track and add a 2k7 resistor between the 2N1711 and Molex pin on boards 3 and 4 and I use 1k resistor for the sequencer LEDs.

## Sequencer

If the sequencer sometimes erratically skips a step, the 4013s on board 1 are probably in cause. Some new ones work fine, others don't. All the NOS ones I tested are ok, V4013D available on ebay works fine.

100nF decoupling caps soldered to the back of IC1 (between pins 7 and 14) and IC9 (between pins 8 and 16) prevent many issues and erratic behaviour of this board. More 100nF caps can be added the same way to the back of the other ICs too if needed.



## Pulser struggles to trig from the keyboard pulse input

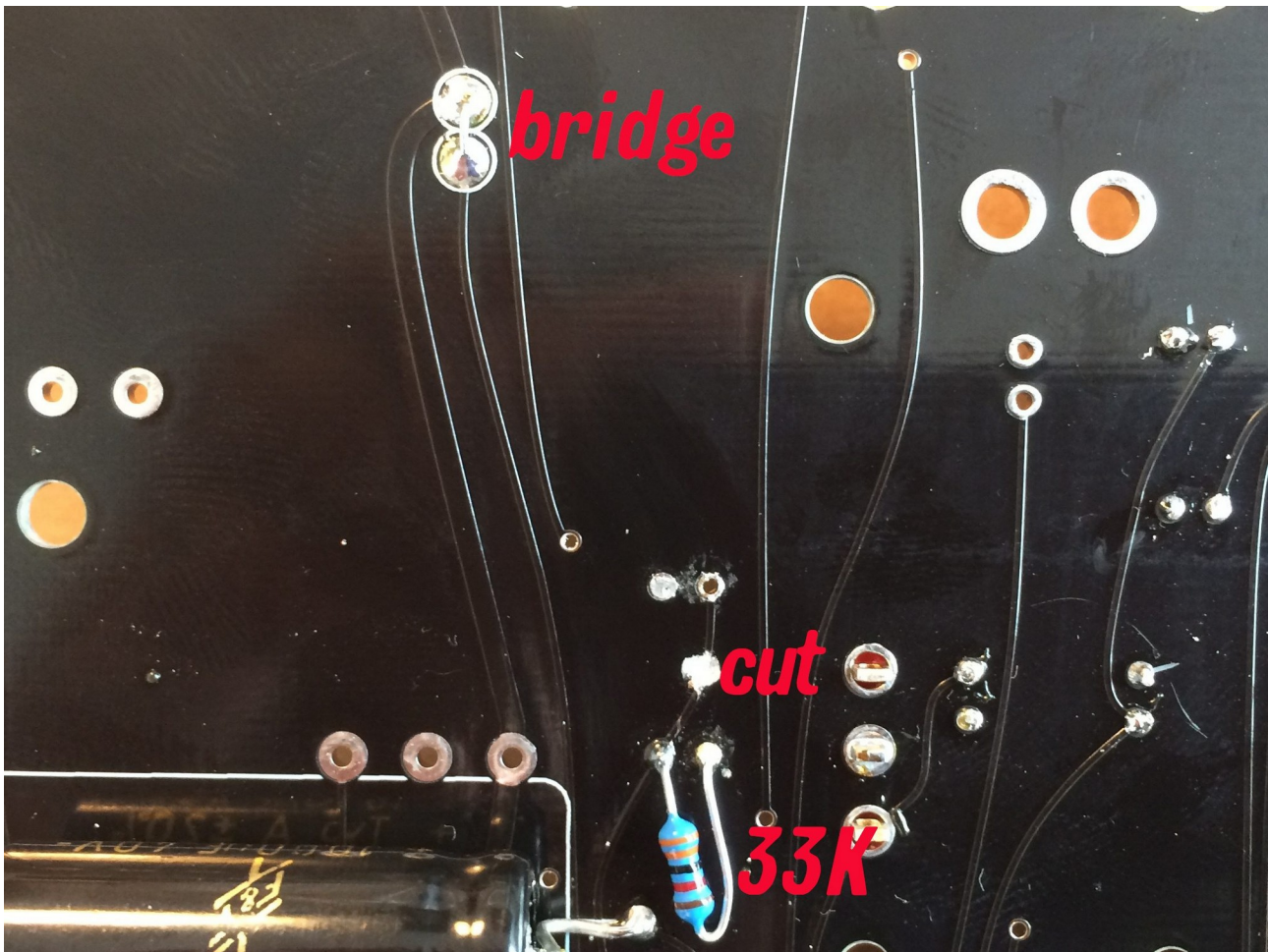
With some controllers the pulser may not trig properly. Add a 680k resistor in parallel to R56 (390k), to reduce its value to 240k. It can be added to the back of the mother board between the pulser mode switch and card 3 pin headers.

## Audio bleed

A slight audio leakage with the level pot to 0 is a common quirk on many 208s and seems to depend on the PSU used. If you can't live with, solder a thick cable between the Q ground on the distro board and the output level pot's ground terminal (the top one) to beef up the ground connection, this should clear it, or at least reduce it to a more than acceptable level.

To clear the MO bleed (many thanks to wiggler Humdanger who suggested this mod) :

- ground the unused reverb trace by bridging the 2 large eyelets near the "mod c.v. out" socket
- don't install R70 33k resistor in its former spot and solder it to the other side of the motherboard between R70 and R71 bottom eyelets
- cut the trace between R70 and R71



## Calibration

Calibration infos are available on Dave Brown's page :  
<http://modularsynthesis.com/roman/buchla208v2/208spss.htm>

Here is some extra.

### Board 5 - Modulator

Vactrols VT1 VT2 VT3 VT4 need selection on test for best performance but this is a PITA and need a lot of vactrols on hand. Dave Brown's Card 5 non-inverting modification is very helpful and highly recommended, it eases selection and adjustment but selection is still required :  
<http://modularsynthesis.com/roman/buchla208v2/208spss.htm>

To select vactrols, if you don't have a good desoldering tool, it's better not to solder them until you find the good ones, make sure they make good contact by bending the legs in the holes, or use tulip sockets pulled out of a machined IC socket for the selection.

Set both MO and CO to high frequency and monitor LPG1 output on a scope, with MO triangle and CO wave, MO modulation switch to AM, LPG to VCA and modulation index fader all the way up. You'd see losanges, if their top are roundish, swap a vactrol or the other and test, adjusting the trimpot.

When you have proper losanges lower the MO frequency and adjust the scope horizontal setting to keep a usable display. If a second smaller losange appears between the former ones at low and very low MO frequency and doubles the MO modulation output frequency, adjust the trimpot until you get regular symmetrical amplitude modulation across the whole MO frequency range. If you can't get it, swap the vactrols.

Changing R17 original value (6k8) may help if the trimpot is off range. Select on test. With Xvive VTL5C3 vactrols and Dave Brown's mod, 18k often works better than 6k8.

A perfect calibration should give a linear AM modulation without waveform "twist" and the AM should be progressive : no AM with the index slider all the way down, full AM with the slider all the way up, ie total signal mute in the down phase and full level in the high phase. If you get full AM before the slider is all the way up (eg at .6 or .8), calibration is wrong.

The difference in the CO output amplitude between AM and FM can be cleared by selecting R29 on test with the index slider set all the way down. The value should be between 18k and 27k. 2 resistors in parallel can be needed to get the exact resistance so that both levels are equal.

## Oscillators tracking

Both MO and CO are able to track on 5 octaves but this needs a fine calibration and subtle selection on test of R5 and R58 on board 6 and R14 and R44 on board 7.

First of all, calibrate both pA726s <http://www.portabellabz.be/images/pa726/pa726-208.pdf>  
In case another  $\mu$ A726 replacement is used, refer to the manufacturer's instructions.

I calibrate the tracking with a 218 but any keyboard or sequencer or midi to CV interface can do the job. To me, proper calibration means all the notes played with the 218 are in tune with MO initial frequency C0 (32.7Hz) and CO initial frequency C1 (65.4Hz). This not an official procedure but my own conclusions after building and calibrating many 208s and other synths. Feel free to adapt this procedure or do otherwise if you like.

Adjust the offset and range trimpots with a frequency counter in a way the frequencies come close to what's written on the panel.  
Then adjust the HF (and LF for the CO) tracking trimpots and the panel "(trim)" ones together, using your ears, a frequency meter or chromatic tuner. The CO frequency is limited to around 2.4KHz by design.

Change the aforementioned resistors if the HF trimpot is off range. A small readjustment of the range trimpot may be needed.  
The goal is to get all octaves in tune. When the octaves are in tune, the notes between will be automatically in tune.

Suggestions for 1.2V/oct. :

Board 6  
R5 : 91k  
R58 : 390k

Board 7  
R14 : 44k (68k added in parallel with 120k)  
R44 : 150k  
R45 : 100k trimpot

Suggestions for 1V/oct :

Board 6  
R5 : 75k  
R58 : 470k

Board 7  
R14 : 39k  
R44 : 180k  
R45 : 100k trimpot

These values are suggestions and might not be ideal in another 208 or with another expo converter, why selection on test is needed for R58 and R44.  
Warm up time and calibration adjustment are needed for each resistor change.



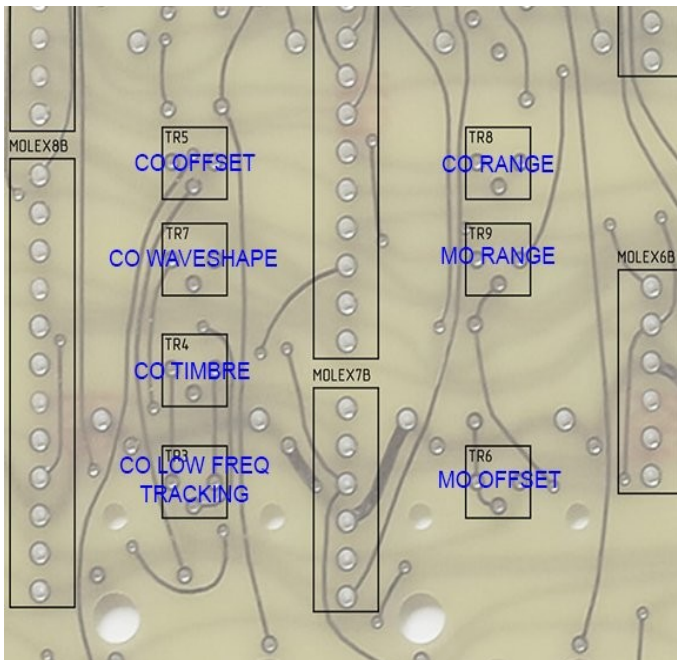
## Board 9 : scaling of the offset control voltage to help maintain stability between the two oscillators of the CO

This may be a tricky part and needs a proper balance between the CO timbre (TR4) and waveshape (TR7) trimpots on the MB and the one on card 9 to avoid wobble and spurious oscillation across the whole CO frequency and timbre range. Some oscillation might occur at specific points of the sliders course, try and adjust the 3 trimpots until you get proper performance, or one you can live with.

### CO timbre

The timbre folding depends on vactrol VT1 on card 7. R3 attenuates the CV making a ground connection, increase its value will increase the number of foldings. There's no official number of foldings, some prefer more foldings, others prefer less, select R3 to best fit your own preference, keeping in mind that this may affect the tracking of both CO oscillators together.

### Trimmers map



Card 5 : MO AM symmetry

Card 6 : MO high frequency tracking

Card 7 : CO high frequency tracking

Card 8 : CO sine

Card 9 : stability between the 2 oscillators of the CO

*Latest update : April 6th 2025*