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

http://www.portabellabz.be/images/208/208p_BOM_full.pdf
https://docs.google.com/spreadsheets/d/1cnEczMHioVaDfC6PTv5P8Z8ZCVCr_DOI8-_9SIc18J8/edit?gid=1202872178#gid=1202872178

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 must be **M3 15mm**.

Builders reported that some **56 pin edge connectors** such as the ‘Jamma’ ones sold on ebay (ref 56P-3.96S or other) or the Sullins ones have pads slightly too large for the motherboard eyelets.
The LW-N28A2G ones with thin lugs available from ebay or Samodular fit and are needed for the Portabellabz expansion cards and Hub.

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

Prefer a **CD4016** over a CD4066 on **card 8**, a CD4066 might upset the CO sine wave.

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.
The **LM380’s** can be also mounted to sockets if a **heat sink** is put on each one.

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

My preferred 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.

Vactrols

Any vactrol can be used anywhere as long as it’s properly selected.
These are more likely to be suitable :
- MEMS on board 5
- Xvive VTL5C3 on board 7 and 8
- Excelitas VTL5C3/2 on boards 10 and 11

The brand is less important than a proper selection on test, which is essential, details below.

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

Build tips

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

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.

Solder carefully and neatly using a good iron with **thin solder** tip and double check for solder bridges.

Solder the transfer card to the panel 56 pin edge connector and install it in the end, when the mother board is mounted.

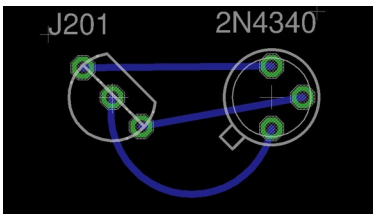
The angles of the banana jacks nuts on the top can interfere with the **placement in the boat**, tighten them so that a flat side points towards the edge.

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

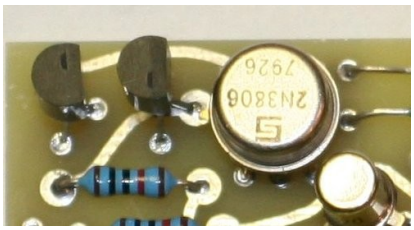
For **board 5** read the calibration notes below.

If **J201** are used instead of 2N4339, 2N4340 and 2N4341 on **boards 6, 7, 10, 11** they must be mounted this way :



Some J201's in Q1 on **board 7** may cause MO bleed into the CO or upset tracking adjustment, if this occurs, replace by another one.

If **PN3565** are used instead of 2N3565 on **board 6** they must be mounted with the rounded side pointing to the outside :



On **boards 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 but others prefer more foldings. It's up to the builder to select what best suits his needs. If the

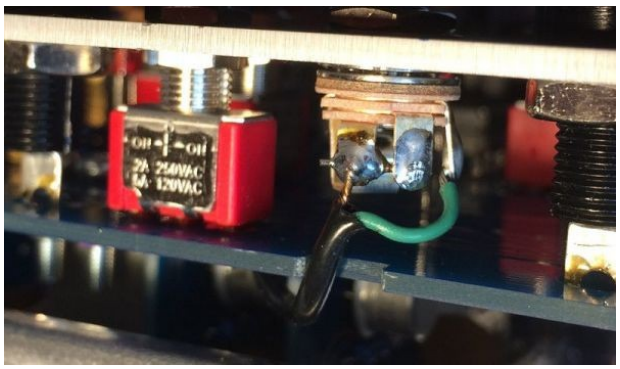
timbre reaches its maximum before the slider's top, select another vactrol in VT1.
If the timbre's effect is heavily reduced in high frequencies, select another VT2.
To clear the slight pitch difference between the **MO and CO keyboard switch** in and out positions, you can replace R4 on **board 6** and R20 on **board 7** formerly 10M with a 6M8 resistor. This affects the oscillators tracking, thus better do it before calibrating it.

The course of the **CO waveshape** pot depends on R30 on **board 7**, reduce its former 15k value if the max is reached before fully CW.

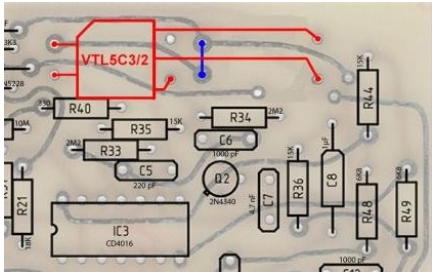
On **board 8** Q1 2N4339 needs selection on test for proper sine waveshape. This can be compensated for by adjusting R41's value.
The SMP4339 works very well here and no selection is needed with this one, it's good to use this adapter https://www.portabellabz.be/adapt.html#sot
The vactrol must be selected too for a good linearity of the CO waveshape pot course. If the max added waveshape is reached with the pot at mid-course, decrease R30's value.

On **board 9** the LM301's can cause distortion and background noise in the CO. If this occurs, replace them, IC7 is the most critical.

Connect the preamp input normalled tinijax socket to **board 10** with a **shielded cable**, core between the board's 'pin1' pad and socket's tip, shielding between the board's 'pin2' pad and socket's ring and normalling pad so that when no plug is inserted the tip is grounded. Make sure the cable doesn't touch the reverb springs.

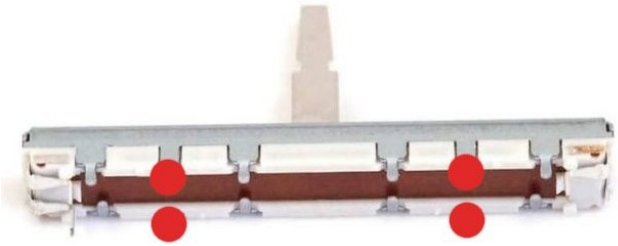


Single vactrols work too but matching is easier with selected Excelitas VTL5C3/2 **vactrols** (not Xvive VTL5C3/2) on **boards 10 and 11**.
I select these to have the same short decay time in LP mode on each LPG. I find 0.5 sec the max acceptable.
Install them like this and bridge the pads according to the blue line. Don't bridge if you use single vactrols.



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.



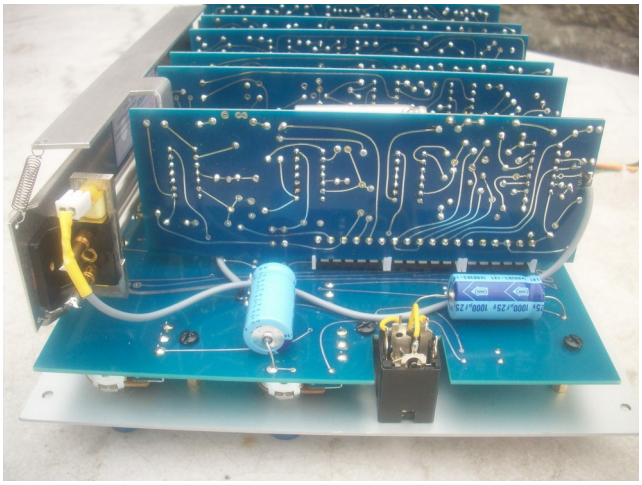
Reverb

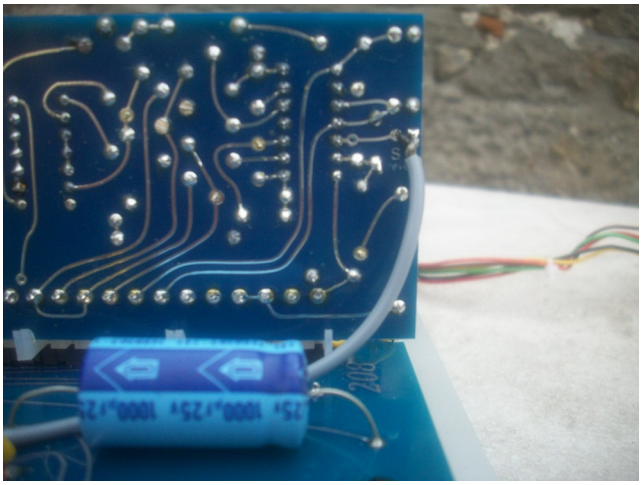
The type is **Accutronics/Belton 1BC2E**, available from
https://www.samodular.com/product/accutronics-reverb-tank-1bc2e/ or
http://www.accutronicsreverb.com or http://www.tubeampdoctor.com

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.

Mount the **reverb frame** to the mother board with 2 screws and self-locking nuts.

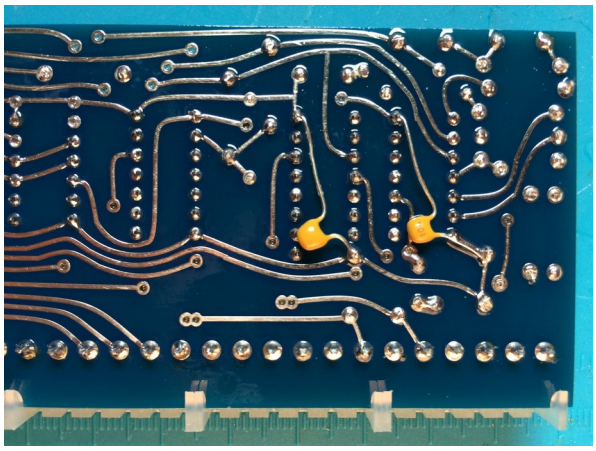
Connect the reverb output to card 12 with a **shielded cable**, shielding to "G" pad, signal to "S" pad. The former PCB trace was removed to avoid crosstalk issues. Snip the former reverb black and blue cables to about 15mm from the plug and solder these to the shielded cable, black to shielding (ground),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





Sequencer

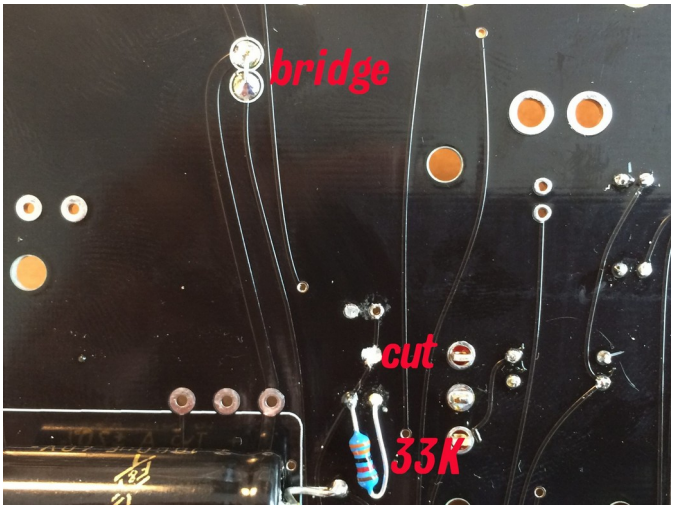
If the sequencer sometimes erraticaly skips a step, the 4013s on board 1 are probably in cause. Some new ones work fine, others don't. All the NOS ones I tested are ok, V4013D available on ebay works fine.
100nF decoupling caps soldered to the back of IC1 (between pins 7 and 14) and IC9 (between pins 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.



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 groud 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



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.

iProgram Card & Program Manager Card

To use the 208p with the legacy BEMI 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.

The 208p is not compatible as is with the BUSA Program Manager Card and iProgram Card with a later firmware because those need a +10V enable signal on contact 10 of the bottom row of the edge connector instead of the sequencer 5th stage out.
More details at the end of https://buchla.com/guides/208C_addendum.pdf

Calibration

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

Here is some extra.

Board 5 - Modulator

Select vactrols VT1 VT2 VT3 VT4 on test (most MEMS ones are ok in the first place), if you don’t have a good desoldering tool, it's better not to solder them untill you find the good ones, make sure they make good contact by bending the legs in the holes. You can also install temporarily tulip sockets pulled out of a machined IC socket for the selection and remove them when selection is done to solder the vactrols directly to the board.
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.

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.
Adjust the value of R17 (6k8) if the trimpot is off range.

Adjust the value of R23 (22k) to have the same AM amplitude with the index slider all the way up and all the way down.

The panel MO silkscreen shows a positive ramp but its actual effect is a negative ramp. Dave Brown details a modification to invert it if desired.
http://modularsynthesis.com/roman/buchla208v2/208spss.htm

Select R29 on test with the index slider all the way down to have the same CO output amplitude with the mode select switch set to AM and FM. The value should be between 18k and 27k.
You can use 2 resistors in parallel to get the exact resistance. I install a 33k resistor and add one in parallel selected on test.

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 µA726 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

Sugestions for 1V/oct :

Board 6
R5 : 75k
R58 : 470k

Board 7
R14 : 39k
R44 : 180k

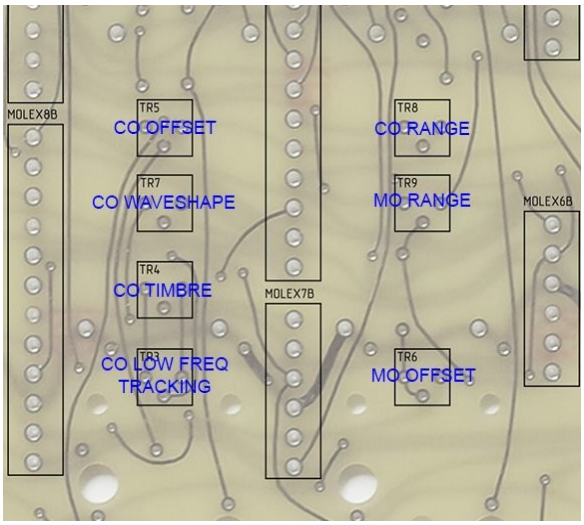
These values are suggestions and might not be ideal in another 208 or with another expo converter, why selection on test is needed for R58 and R44.
Warm up time and calibration adjustment are needed for each resistor change.

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,
Wobbling when the frequency is lower than 55Hz and 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.

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

Most recent update : September 5th 2026