Dual Digital Build Manual

Introduction

This document is meant to aid you in assembling your Dual Digital Oscillator (DDO from now on).

Some instructions may be a bit basic for advanced builders but I hope they are of use for the less experienced builders.

A note for advanced builders

I understand that you just want to get started but please read the section matching resistors before starting any assembly.

Tools you'll need

Solderingstation,

Multimeter (preferably 4digit digital)

Small cutting pliers,

Screwdrivers

Hacksaw(if making brackets for the panel)

Powerdrill + 3mm drill (if making brackets for the panel)

Ruler (if making brackets for the panel)

Fine marker (if making brackets for the panel)

A steady CV voltage source, Ie a midi-cv interface.

Making brackets

If you are building the euro panel and need to make your own brackets, this is how I usually do.

I use L-shaped extruded aluminum, I cut them using a hacksaw into the correct length.

After that, use the guide below to place the holes. Make sure you don't rescale the page, or the measurements will be wrong!

If you want to double check the hole placement, lay the panel on top of the bracket, and see that the inner holes match. Then lay the PCB on top and see that the outer holes line up.

Resistor matching

There are a few 100k resistors that need to be matched in pairs. Each pair does not need to be exactly 100k, it is only important that both resistor in each pair have the same value. In other words two resistors with the value 99.6k is a valid pair, as is a pair with the values 100.1k

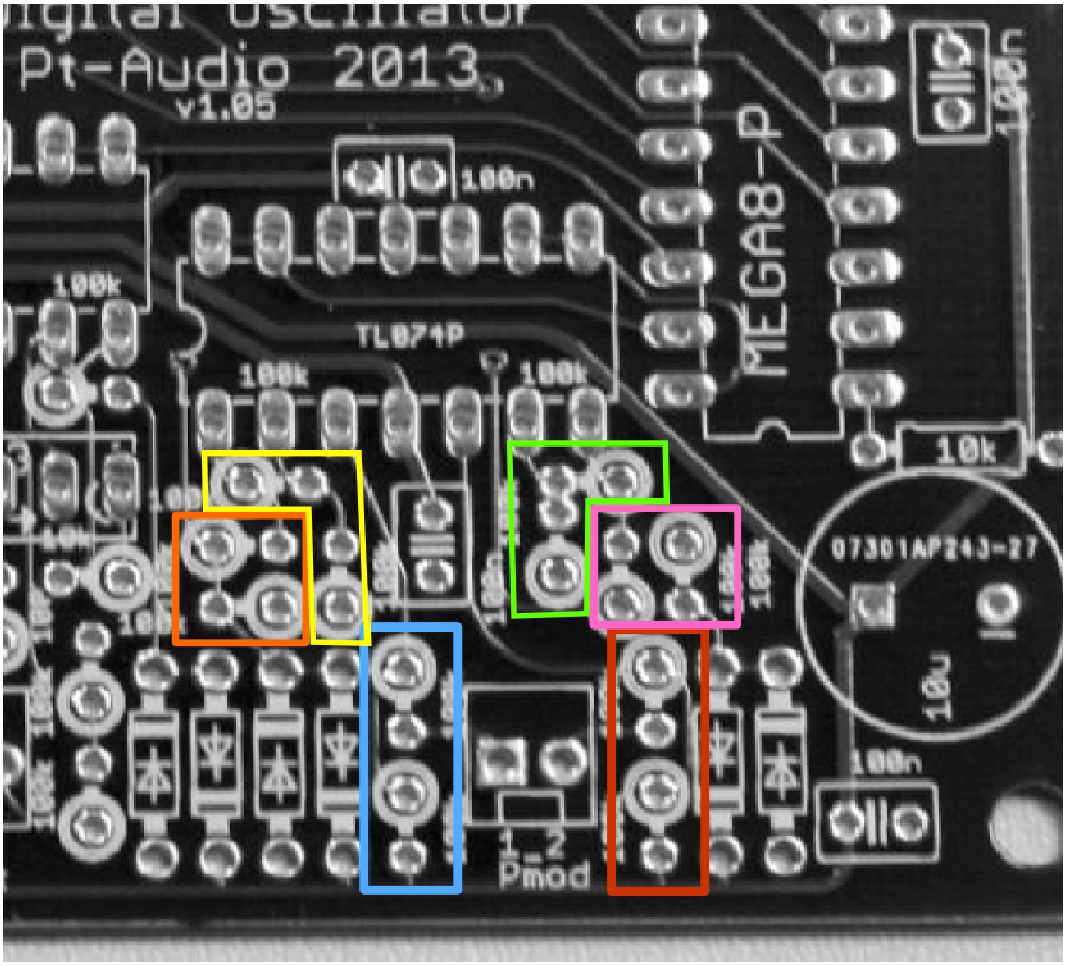
This matching affects the V/octave tracking of the P-mod inputs, do it properly and you will get good tracking on this input as well.

You will need 6 pairs.

Matching is done easiest by using a digital multimeter.

Remember that resistors are affected by heat, so make sure you are not touching the resistors with your hands when measuring. I usually lay out the resistors in front of me on a piece of paper and after each measurement I note down the value next to the resistor on the paper.

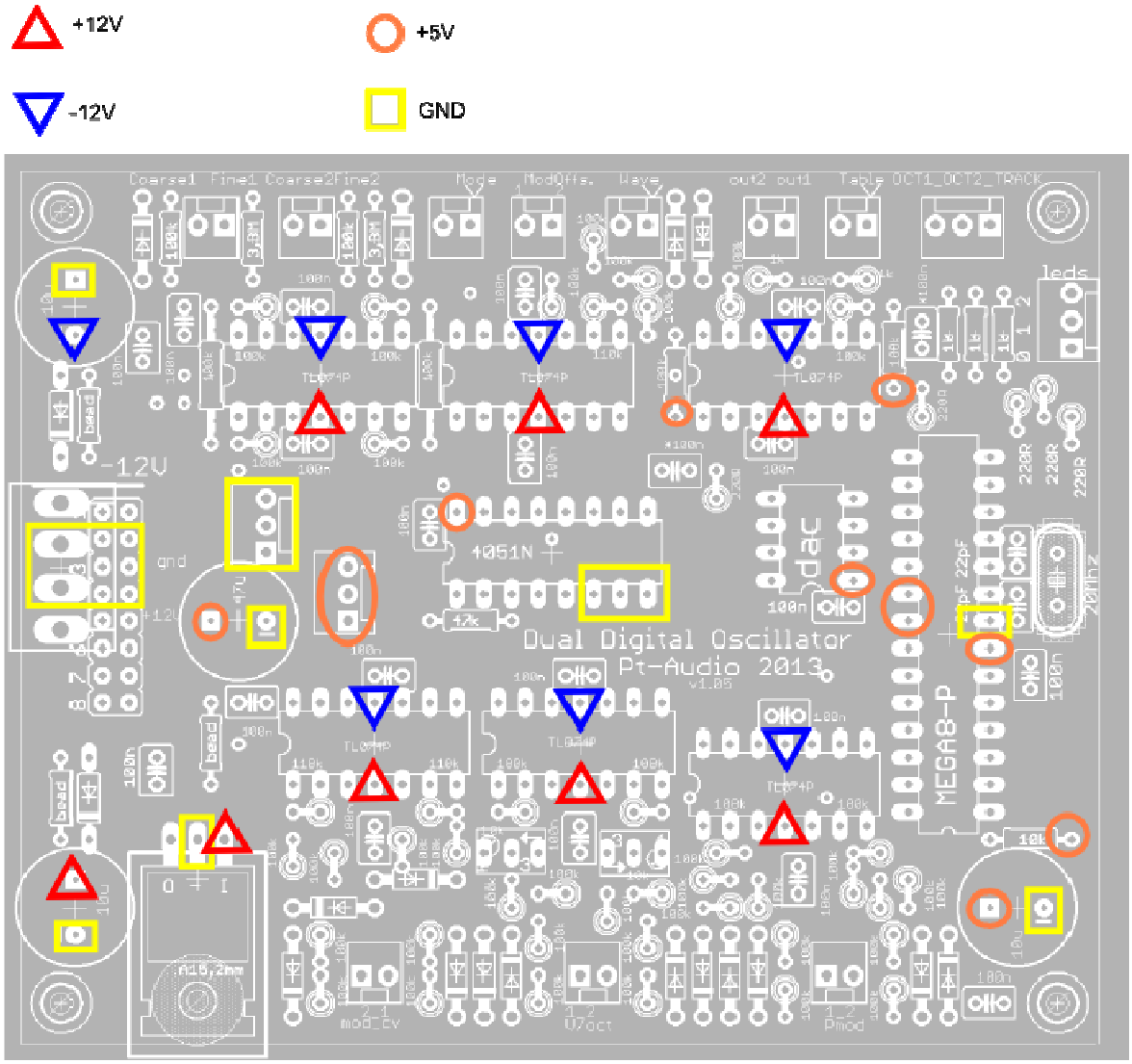
The matched resistors are the ones marked in the image below.



Soldering the PCB

First, start by checking your PCB for manufacturing errors.

The image below show the points to check and how they relate.



- Check ground continuity,

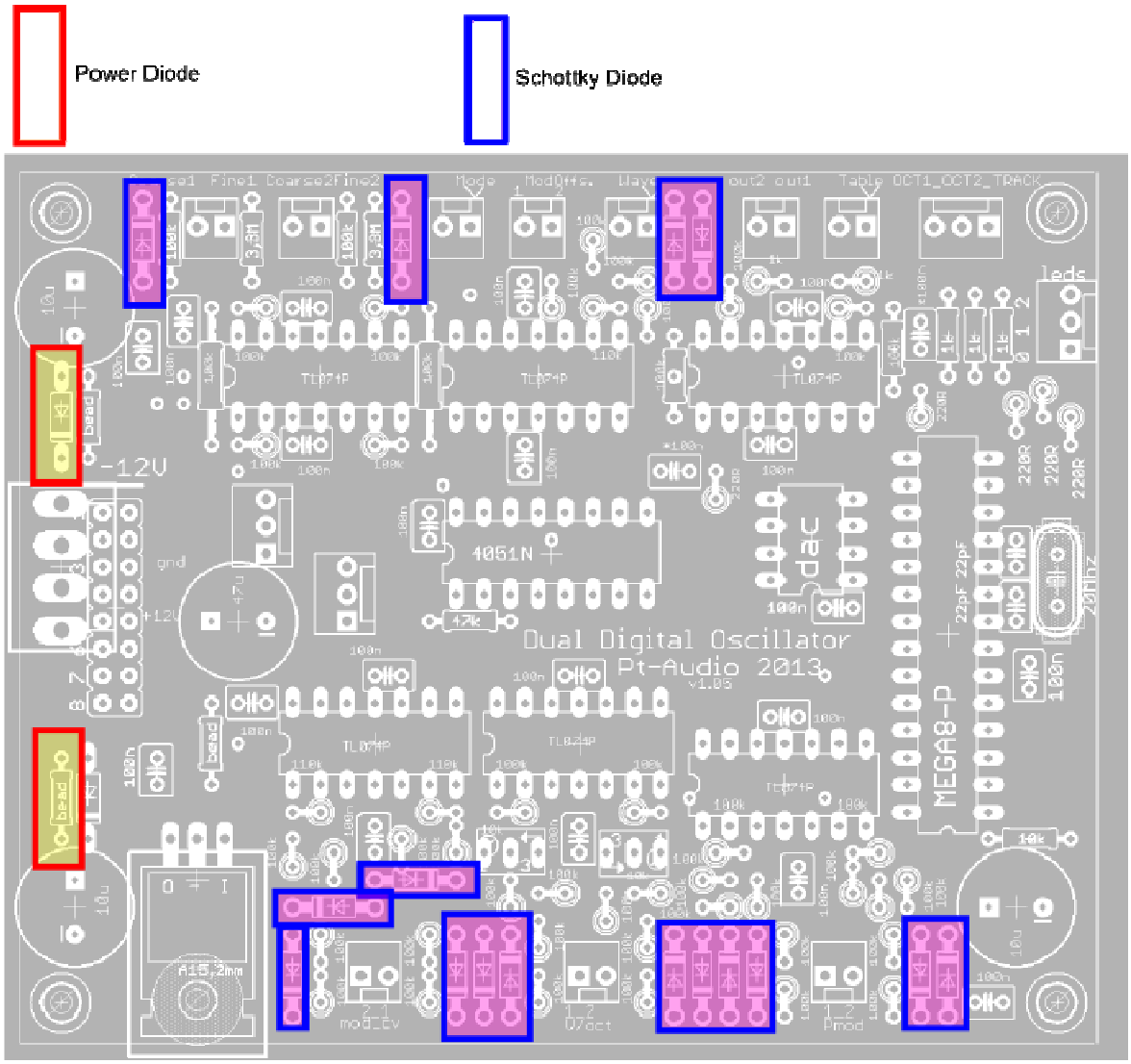
- Check for shorts between ground and all three power rails (+12/ -12 /+5)

- Check for shorts between power rails.

If all checks out ok, time to start placing components. This is the order I usually place them in.

Remember to take a break from time to time.

- Start by placing the two power diodes, double check their polarity. **Do not confuse these with the schottky diodes!** The power diodes are the ones next to the power connector and are parallel with a ferrite bead. If in doubt check the image below.



- 16 Schottky diodes, again double check their polarity.

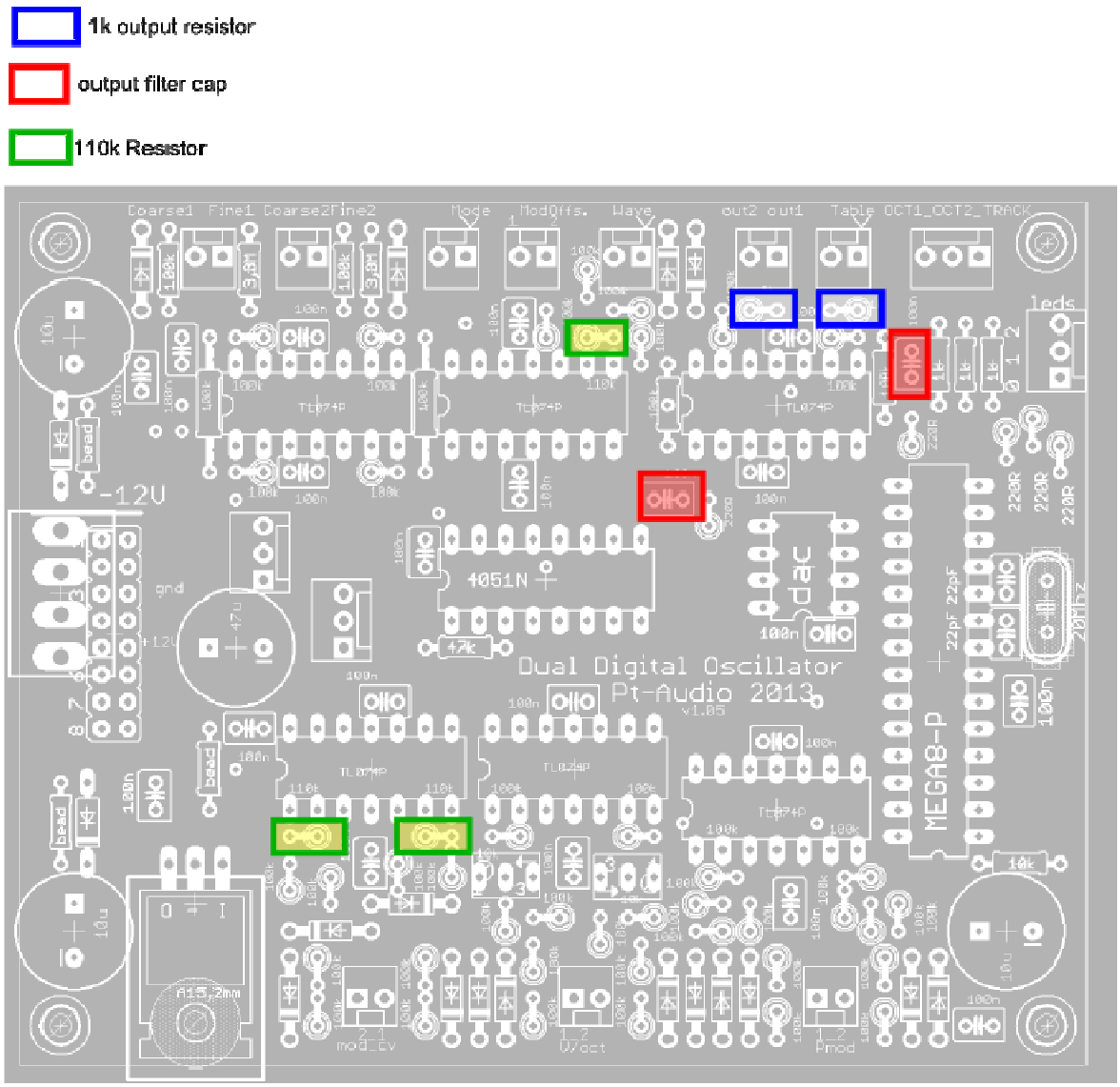
- 3 Ferrite beads. (Marked Bead)

- IC sockets, note their notch.

- all the horizontal resistors

- All the MTA headers. **Note that these should be placed outwards!**

There are a few resistors that are hard to read on the PCB, the image below should help you with these. (Mainly the 110k and 1k resistors)



- All vertical 110k Resistors

- 1k resistors.

- The matched 100k Resistors (see separate section and image above)

- Trimpots

- output filter poly caps. **Note that these are marked as *100n on the PCB**

(You can use 100nF caps as well, it will give you a much more mellow tone, If you can't decide, cut off two pins of a IC socket and you can use that to change the filter cap)

- decoupling ceramic caps

- 220R resistors

- remaining 100k resistors

- Voltage regulator

- Crystal timing caps

- Crystal, (crystals are heat sensitive, you may use a small clamp as heatsink while soldering.)

- Electrolytic caps (take care of their polarity)

-Power connector

Now take a break.

Powerless check
Now before powering up the board, check your soldered board for shorts once more.

Check between all three power lines and ground.

If no shorts are found, it is time to power up the board and check some voltages.

First power up and voltage check
Connect the pcb to your power supply (that should be turned off) double check the polarity of the power connector in both ends.

Power up the PSU, should there be popping, sparks or smoke turn off the psu asap!

If the power up goes ok time to check the voltages.

- +12V (you will lose some voltage over the power diode, +11.6V is ok)
- -12V (again, some voltage loss due to power diode, -11.6V is ok)
- +5V should be 5V or a tad more, ie 5.03V

If all voltages check ok, great, have a short break and then continue with the panel wiring.

Wiring the panel

This section is written for assembling the pt-audio Euro panel, but the concept should be possible to apply on alternative layouts and/or formats as well.

If you are using brackets for you pcb, test that they fit before wiring up the panel.

Start by checking your pots and switches, it is so much better to do before you fasten them or solder anything.

-Checking pots,

-Checking switches

-checking jacks

-checking the leds

After checking the panel components, place and fasten them, also fasten the standoffs.

If in doubt of how to wire, I attached a image in the end of this manual of how I wired my panel.

- Start by wiring the grounds. Remember that leds are bipolar.
- Then wire the +5V
- Then wire the CV inputs that are attenuated by a pot
    - Pitch mod 1 & 2,
    - Mod CV 1 & 2,
    - Wave
- Now wire the pot wiper for all the pots in a good color.
- Continue with the V/Oct CV inputs and the outputs
- Then wire the switches
- Then wire the leds,

Now fasten the brackets to the standoffs, and then the PCB to the bracket using small standoffs.

Now for each connector on the PCB, place a female MAT100 header, and then measure how much wire you need. Don’t wire too tight, you need to be able to lift of the connectors so give it a little slack. Double check that you place the wires in the correct input.

Now, take a short break.

Power up test2

- Place the 6 opamps on the PCB, check their orientation.
- Check that all connectors are connected.
- Turn all potentiometers to their leftmost position.

Now connect the module to your PSU (that should be switched off)

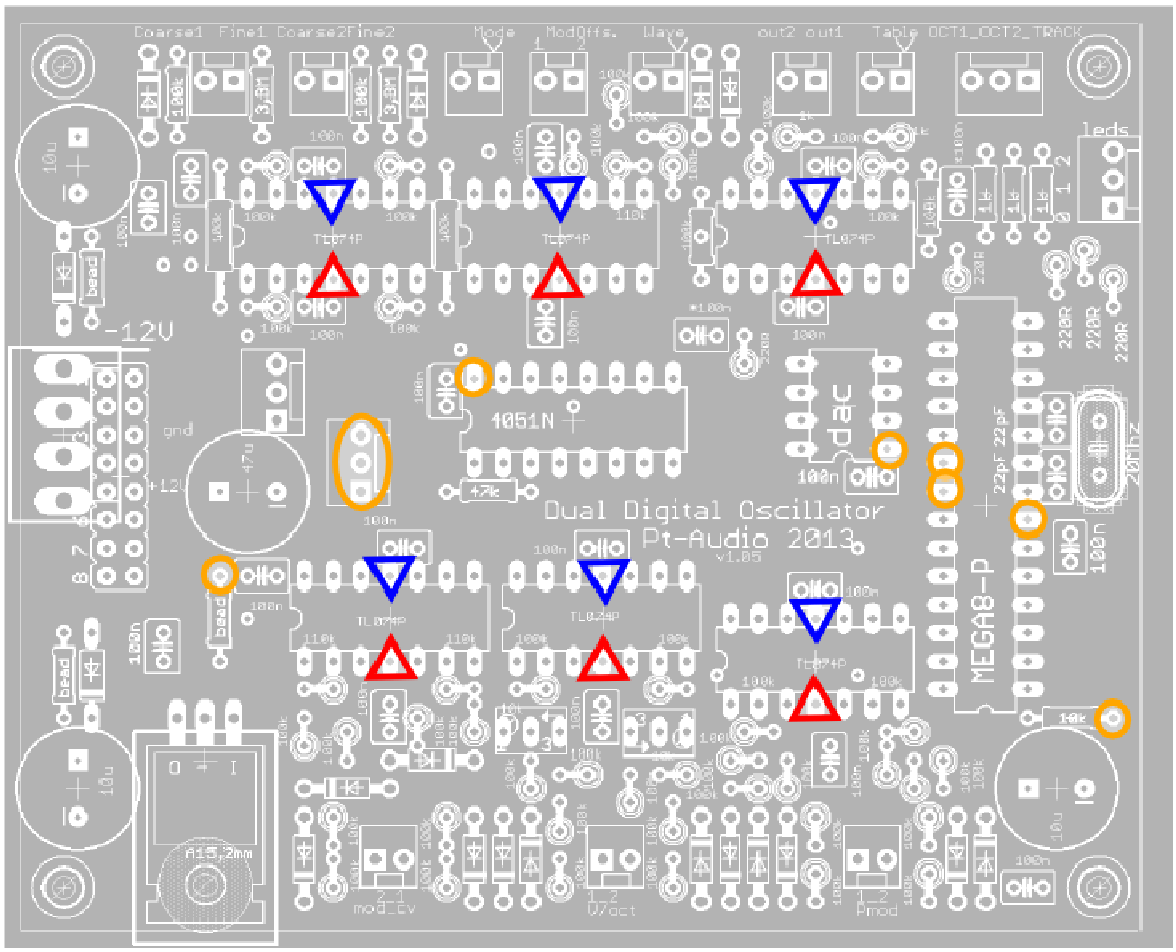
Turn on the PSU,

- check that no magic smoke appears.
- After a few seconds, gently touch the Voltage regulator to feel if it is hot. It should not be.
- Then gently touch each of the opamps, neither should get hot.
- Check the voltage on the pins marked below, they should be stable.
  (due to the voltage drop from the power diodes your 12V will be a bit less.)

+5V

-12V

+12 V



If all went well it is time to trim the V/Octave trimmers.

Trimming the V/Oct inputs

Starting with Osc 1.

- Apply a 1V CV signal to the V/Octave 1 input. (The leftmost jack)
- Measure with your multimeter the input voltage
- Measure the voltage on pin 25 of the AtMega socket, adjust the trimmer so that it reads the same as the input voltage.
- Now increase the input voltage to 2V and adjust the trimmer if needed so pin25 reads the same as the input.
- Repeat the process for 4V input as well. This should be enough for 5 octaves of tracking.
- When done, repeat the process for the second channel, and pin 26 of the AtMega socket.

Note, The V/Octave inputs are designed for the range 0V to +5V. any voltage outside of this range will be clipped by the protection diodes. So don't try to calibrate these inputs outside this range.

After calibration, turn off the PSU and let any remaining voltages drain for a few minutes. After that, unplug the module and insert the three remaining IC's

the multiplexer, the DAC and the AtMega

Once again, check their orientations.

Finally, make sure your PSU is turned off, connect the module to your PSU, and turn it on.

Turn the mode potentiometer from min to max and then back to min. This should light up the leds representing the binary form of mode 0(off, off, off) to 7(on, on,on)

If it does, time for the final check and fine tuning.

Final check and fine tuning.

Make sure all potentiometers are in minimum position and the mode selected is mode zero = all leds are turned off.

Connect the leftmost output to your mixer, or to what you usually connect your module to hear it's outputs. You should hear a sine wave, but in rather low pitch.

The controls.

Starting with the left side of the panel, Osc1.

Coarse

Turn the leftmost coarse potentiometer towards its maximum, the pitch of the oscillator should now rise. If the pitch rises as it should, all is fine, turn it back again.

Fine

Now try the fine control, this should also raise the pitch, but not as much as it is only a finer adjustment.

Mod.offs
Turn up the mod offset, this will increase the amount of modulation from osc2 to osc1s phase and sounds similar to FM. It should make the sound brighter and also harsh if you go too far. At its maximum it will be close to white noise. (Good for snares, hihats and what not) Turn it down when done. The timbre generated depends on the pitch ratios of osc 1 and osc2, try different combinations and hear their effect.

Note, the effect of the modulation depends on the selected Mode, but it usually increase the effect of the selected mode.

CV inputs
We have already tried the v/octave inputs, now we need to test the others.

The p-mod is bipolar, and accepts signals that can be both positive and negative. As long as they are between -5V and +5V, ie a LFO, but also a negative envelope is fine.

p.mod (pith mod)
Connect a bipolar LFO to the p-mod CV input.

Turn up the p.mod knob a bit and the pitch of the oscillator should now go up and down with the voltage of the LFO. (Should you not have a LFO, a envelope can serve the same purpose)

If you matched the resistors when soldering, this CV input track 1V/Octave quite good.

Note, that if no cable is plugged into the input, the pot will work as a pitch offset.

Wave
I usually test this by connecting my mod wheel to the Wave CV input but using a envelope is fine as well. Without anything connected, the wave potentiometer does nothing.

Connect an envelope generator to the Wave CV input. Set it to a slow attack, slow decay/release and with no sustain. Set the potentiometer to 9 o’ clock, Now trigger the envelope and listen to the sound of waves being scanned. Depending on the setting of the Table potentiometer, one of four wavetables are scanned with 8 waves per table.

Note, the wave control controls the selected Wave for both Osc1 and osc2.

Mod.CV
Set a envelope to a fast attack, a medium decay/release and no sustain. Plug it into the mod CV input. Set the mod CV potentiometer to 9 o’ clock and trigger the envelope.

You should hear the phase modulation amount following the envelope voltage.

Switch oct.
The Oct switch lower the pitch of osc1 one octave.

Note, Osc2 is by standard one octave lower than osc1

Osc2

Osc 2 have the same controls as Osc1 and they should be tested in the same manner as for osc1.

There are however a few differences.

- Osc2 is by default one octave lower than osc1.
- Osc2 can be switched down 8 octaves, not just one by it’s osc switch.
- Osc2 is by default linked to osc1s V/oct input. You will however get best tracking for both oscillators if you unlink them, and apply the same CV to both V/Oct inputs.
- The Table potentiometer does control the selected Wavetable for both osc1 and 2.

Troubleshooting

Controls not behaving as expected:

- Check your wiring, you may have confused the outputs, the fine/coarse knobs, or you may have some bad solder joint.

Module is silent, no controls do anything.

- Power down asap, check for shorts, feel if IC's a hot, check IC orientation. Remove IC's and start checking voltages.

Example patches

Coming ;-)

Mods

Cooming ;-)

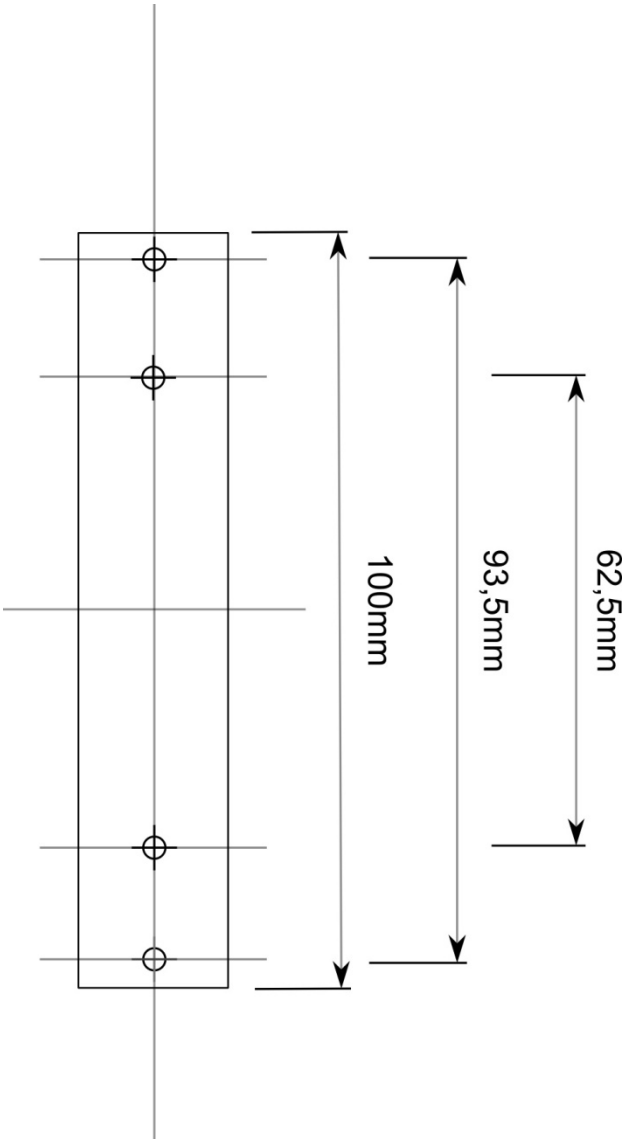
Bracket template

The easiest way to make brackets for the panel is it to cut two pieces of aluminum bars to the same length as the PCB.

Draw a line along the middle of the aluminum, Then place the PCB on top of the bracket, center it on the line, and draw the outlines of the mounting holes.

Now, the tricky part to draw the holes of the panel so they are placed on the middle of the bracket. The drawing below should make it a bit easier.

After placing the holes it is just a matter of double checking and then drilling.



Images

Panel Wireing