ORBITAL SMD V1 – ASSEMBLY GUIDE

This document will help you to build your module without any trouble! We will give you the order in which the components should be placed on the boards to make your life easier during assembly.

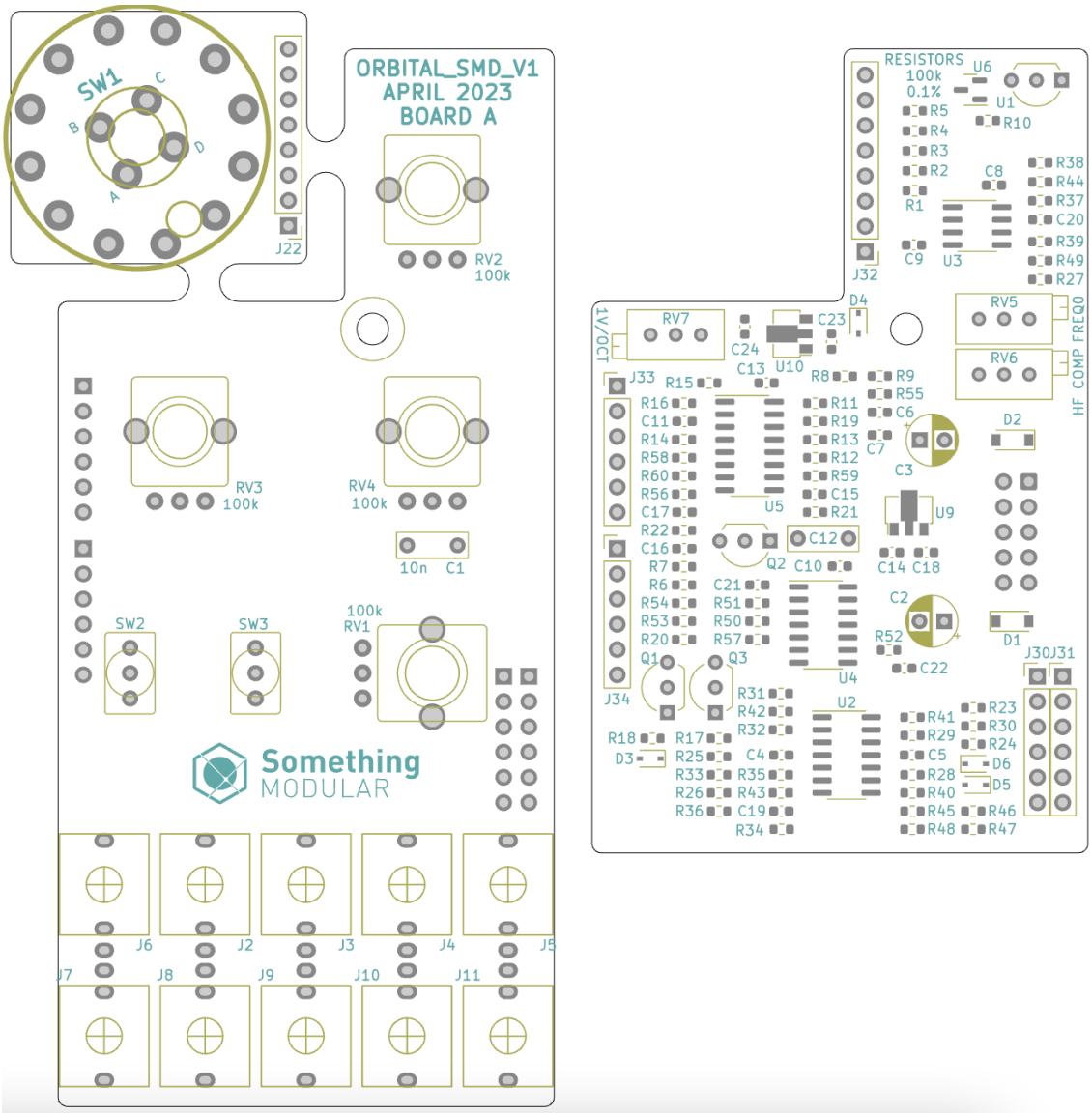
If you want more information about how to build Eurorack modules and what tools you should have, go check our DIY electronics advice on our website: **somethingmodular.fr**

We also made an **online interactive BOM** so you can check components placement.

And again:

THANKS YOU FOR CHOOSING OUR KIT!! YOU'RE AWESOME!!

Now let's build this module, your module!



---- WARNING ----

This module was design to achieve an **accurate frequency tracking**.

Specific components (such as LM4040**A**IZ-5.0) and a **calibration procedure** are required to do so. You will find them in the lists below.

If you don't have those components and want to use standard ones, the ORBITAL will still give you good results and be playable but **be aware** that this might reduce the performance of the frequency tracking.

---- WARNING ----

Let's start by working on board B :

CAPACITORS

For best performance, use Silver Mica type capacitors.

Qty	Value	Code	Reference designator
1	1n	102	C12

TRANSISTORS

Be sure they are orientated correctly. TO-92 packages have a flat side and a curve side that must match the silkscreen outline on the PCB.

Qty	Value	Reference designator
2	2N3904	Q1, Q3
1	2N3906	Q2

ELECTROLYTIC CAPACITORS

Electrolytic Capacitors are **Polarized!**
Mind the polarity : the long leg is the positive lead, negative lead is denoted by a white line.

Qty	Value	Package	Voltage	Reference designator
2	10µF	D5.0 * P2.0	≥ 25 V	C2, C3

VOLTAGE REFERENCES

This component generates a 5V reference that is important for the accurate tracking of the octave switch.
We do recommend using **LM4040AIZ-5.0** which has a precision of 0.1% but other less precise version such as LM4040BIZ-5.0 (0.2%) will do fine.

Be sure they are orientated correctly. TO-92 packages have a flat side and a curve side that must match the silkscreen outline on the PCB.

Qty	Value	Reference designator
1	LM4040AIZ-5.0	U1

TRIMMERS

Solder the trimmers with the screw facing out from the edge of the PCB. Choose 3296X type.

Qty	Value	Reference designator
1	10k	RV7
1	20k	RV6
1	100k	RV5

POWER CONNECTOR

This component should be soldered on the back of the PCB. Mind pin 1.

Congratulation, You have just completed the first part of the job.

Now put Board B aside and let's work on Board A :

CAPACITORS

C12 is the timing capacitor. We do recommend using **silver mica** type capacitors for stability purpose.

Qty	Value	Code	Reference designator
1	10n	103	C1

ROTARY SWITCH

The front panel was specifically design for the Alpha rotary switches: **SR2612F-0112** or **SR2612F-0206**.

You can use other switches, please note that you may have to enlarge the front panel hole to fit other brand switches. The switches must be **non-Shorting** type (break-before-make) with at least 6 positions.

If you are using SR2612F-0112, don't forget to put the locking washer to restrict the switch to only 6 positions. Mind the position of the pin "A".

Qty	Value	Reference designator
1	SR2612F-0112	SW1

You can now separate the switch from board A.

READ THIS BEFORE SOLDERING ANYTHING:

Install potentiometers, mini-jacks and switches onto board A **without soldering**. Now place the front panel, secure few components (top potentiometer and bottom jacks for example). Check for any mechanical stress on components, PCB or panel. If there is none then you can solder.

Remember to do this little routine every time you put front panel components, soldering without putting all the components first, you may have a hard time aligning the components to the panel holes.

3.5mm Jack Sockets

Qty	Value	Reference designator
10	PJ301M-12	J2, J3, J4, J5, J6, J7, J8, J9, J10, J11

Potentiometers - ALPHA 9MM POTS

Qty	Value	Reference designator
4	100k linear	RV1, RV2, RV3, RV4

TOGGLE SWITCHES

Qty	Value	Reference designator
2	2MS1T1B1M2QES	SW2, SW3

Unscrew the few components tied to the front panel, put the front panel aside.

FEMALE AND MALE PIN HEADERS

Put every couple of pin headers inside each other. Place the female pin headers on the back side of board A and the male pin headers on the front side of board B.
Secure the spacer between board A and B. **Solder** both female and male pin headers.

Solder the **short pins side** of the 1x08 Male Pin Header at the **back** of the rotary switch PCB.

Qty	Value	Reference designator
4	1x06 Female Pin Header	J30, J31, J33, J34
4	1x06 Male Pin Header	J20, J21, J23, J24
1	1x08 Male Pin Header	J22 (should be soldered on the other side of the footprint)

Install the Rotary switch PCB inside the dedicated 1x08 pin header holes in Board B.

Put back the panel as you did before. Now you can secure all jacks, toggle switches and pots nuts.

Finally, secure the rotary-switch screw. You can now solder the 1x08 pin header on Board B.

Once you are done. Put the potentiometer and rotary-switch knobs on.

CONGRATULATION, you've just finished building your new module !

FIRST POWER UP TEST :

Before powering up your module, use a multimeter to check that there is no short between +12V, -12V and Ground rails.

Now you can power up your module: Connect the power ribbon cable (the red wire on the power ribbon cable corresponds to -12V) and **Enjoy!**

CALIBRATION PROCEDURE :

For the calibration of the 3340 chip, you will need the following tools :

- An accurate 1V/Oct source;
- An oscilloscope (or any other way to measure a frequency).

Before you start calibrating, let the ORBITAL warm up for few minutes.

This Design has 3 trimmer to calibrate :

- RV7 (1V/OCT) : set the voltage tracking so that a change of 1V in CV will cause a change of exactly one octave in frequency.
- RV6 (HF COMP) : set the compensation at high octaves for better tracking.
- RV5 (FREQ0) : set the initial frequency (all pots CCW) of the VCO.

Tracking Calibration Steps :

1. Turn the HF COMP (RV6) trimmer fully clock-wise until clicks are heard. You may have to make multiple turns to make sure it is fully "OFF".
2. Set the octave switch on 32'.
3. Use your 1V/Oct source to adjust the output frequency to approximately 100Hz. Use the table right under to take note of that frequency, it will be called **X**. Calculate 2 times X.

X									
2*X									
Y									
Y – 2*X									

4. With your 1V/Oct source, go one **octave up (add exactly one volt)**, take note of that new frequency, called **Y**. Calculate Y – 2*X.
5. **Adjust the RV7 trimmer** and repeat steps 3 and 4 as many times as needed to get **Y – 2*X** as close as you can to 0. (Within 0.1Hz is a good tracking).
6. With your 1V/Oct source, go one or two more octave up, and check again the tracking of the VCO. Once you are done and happy with the result, **don't touch the RV7 Trimmer anymore.**
7. Go a few octaves up to around 1000Hz, in this range, the note should be flat compared to what you should have based on the lower octaves. Adjust RV6 (HF COMP) counter-clockwise until the frequency goes up.
8. The oscillator **tracking** is now calibrated.

Initial Frequency Calibration Steps :

1. Turn all the potentiometers fully counter-clockwise.
2. Do not connect anything in the V/Oct, Lin FM, Exp FM jacks.
3. Set the octave switch on 8'.
4. Adjust RV5 (FREQ0) until your VCO has the desired frequency. you can choose it obviously but I would recommend, in this setup, to calibrate your VCO to C2 (65,41Hz) or C3 (130,81Hz).
5. The **initial Frequency** of your Oscillator is now calibrated.

YOU'RE READY TO ROLL ! ENJOY YOUR NEW MODULE !