

ORBITAL 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 0.1% Resistors) 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.

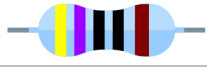
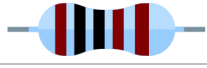


















---- WARNING ----

PRECISION RESISTORS (0.1%)

The following resistors needs to be at least 0.1% resistors.
The layout can accept both SMD 0805 (or smaller) or through-hole 1/4W (or 1/6W) resistors.
Depending on the components you have, assemble one or the other.

Qty	Value	Reference designator
8	100k 0.1% 0805	R1B1, R2B1, R3B1, R4B1, R5B1, R6B1, R7B1, R8B1
8	100k 0.1% TH 1/4W	R1A1, R2A1, R3A1, R4A1, R5A1, R6A1, R7A1, R8A1

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STANDARD RESISTORS (1%)				
Qty	Value	Color	Code	Reference designator
2	470		Yellow, violet, black, black, brown	R11, R13
9	1k		Brown, black, black, brown, brown	R10, R45, R46, R47, R48, R49, R50, R51, R52
1	1.5k		Brown, green, black, brown, brown	R28
1	1.8k		Brown, grey, black, brown, brown	R19
1	5.6k		Green, blue, black, brown, brown	R16
1	10k		Brown, black, black, red, brown	R22
1	15k		Brown, green, black, red, brown	R40
3	22k		Red, red, black, red, brown	R5, R20, R24
1	24k		Red, yellow, black, red, brown	R15
2	47k		Yellow, purple, black, red, brown	R18, R21
4	91k		White, brown, black, red, brown	R30, R32, R35, R38
12	100k		Brown, black, black, orange, brown	R1, R2, R3, R17, R25, R33, R36, R39, R41, R42, R43, R44
2	150k		Brown, green, black, orange, brown	R8, R23
2	180k		Brown, grey, black, orange, brown	R26, R27
1	200k		Red, black, black, orange, brown	R4
1	220k		Red, red, black, orange, brown	R9
4	240k		Red, yellow, black, orange, brown	R29, R31, R34, R37
1	1M		Brown, black, black, yellow, brown	R7
2	1.5M		Brown, green, black, yellow, brown	R6, R12
1	10M		Brown, black, black, green, brown	R14

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DIODES

Diodes are **Polarized!**

The black or white line on the diode must match the white line on the diode symbol on the Silkscreen.

Qty	Value	Reference designator
2	1N5818	D1, D2
4	1N4148	D3, D4, D5, D6

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

VOLTAGE REGULATORS

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	LM78L05	U9
1	LM79L05	U10

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

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INTEGRATED CIRCUIT SOCKETS

ICs are oriented and so are sockets. Solder the sockets first, take care of orientation: the notch or dot on one end of the IC should match the silkscreen.

Don't place the ICs on the sockets yet. This will be done at the end step of this build.

Qty	Value	Reference designator
2	DIP 14	U2, U4
1	DIP 8	U3
1	DIP 16	U5

CAPACITORS

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

Qty	Value	Code	Reference designator
2	10p	10	C19, C20
1	200p	201	C16
1	1n	102	C12
4	10n	103	C1, C6, C7, C17
11	100n	104	C4, C5, C8, C9, C10, C11, C13, C14, C15, C21, C22

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	Code	Voltage	Reference designator
2	10uF	10uF	≥ 25 V	C2, C3
1	1uF	1uF	≥ 25 V	C18

TRIMMERS

Solder the trimmers with the screw facing out from the edge of the PCB.

The pins under RV5 should be cut really short to prevent them from touching the top of RV7 during assembly.

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

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POWER CONNECTOR

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

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 three PCBs.

Put Board B and the rotary switch board aside.

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

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INTEGRATED CIRCUITS

ICs are oriented, take care of orientation: the notch or dot on one end of the IC should match the silkscreen. **Before** putting the ICs, **ground yourself** (you can touch the metal on your kitchen sink faucet).

Qty	Value	Reference designator
1	TL074	U2
1	CD4013	U4
1	TL072	U3
1	AS3340 or CEM3340	U5

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
2	1x06 Female Pin Header	J30, J31
2	1x06 Male Pin Header	J20, J21
1	1x09 Female Pin Header	J33
1	1x09 Male Pin Header	J23
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 !

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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 on 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.**

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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 !

