THANKS FOR CHOOSING ONE OF OUR KITS!

This manual has been written taking into account the common issues that we often find people experience in our workshops. The order in which the components are placed on the board is meant to make assembly as easy as possible.

Some steps are not obvious, so even if you're an experienced DIYer please read the steps thoroughly before starting.
If this is your first project, please read this article before you start assembling the kit:
www.befaco.org/howto/

You will be soldering both boards at the same time. Keeping them in the panel together might help you through the build.
Check last pages of the Build for PCB pics to help you identify components.

HAVE FUN!

DIODES

Solder the diodes **observing their polarity**. The black or white line on the diode must match with the white line on the diode symbol on the PCB silkscreen. All the 1N4148 Are facing bottom and the 1N5817 up.

From D1 to D16 are mounted on top of the Voltage reference ICs, **make sure that those are flat and parallel with the pcb**, This will be important later.

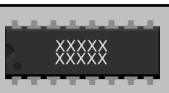
Qty	Value	Name on PCB
18	1N4148	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18
2	1N5817 (black)	D19, D20

FERRITE

To solder the two ferrite beads use a recycled resistor leg passed through each ferrite and proceed as if it were a resistor. Ferrite beads don't have polarity.

Qty	Name on PCB
2	F1, F2

IC SOCKETS



Place the sockets (taking care to orientate them properly – the notch should match the image on the silkscreen) and solder them into their correct positions.

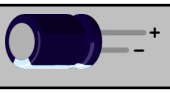
Qty	Value	Name on PCB
2	DIL8	IC5, IC6,

CAPACITORS

Identifying capacitors can be quite tricky. Codes stated are indicative, please take a look at this guide for help identifying capacitors: http://www.wikihow.com/Read-a-Capacitor

Qty	Value	Code	Name on PCB
6	100nf	104	C4, C5, C7, C8, C11, C12
2	10pF	10	C1, C3
2	1nF	102	C2, C6

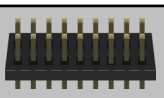
ELECTROLYTIC CAPACITORS



Values are written on the side of the capacitor. Mind their polarity (The long leg of the capacitor is the positive (+)).

Qty	Value	Code	Name on PCB
2	10uF	10uF	C9, C10

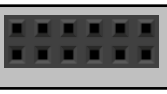
PIN HEADERS



Place and solder the Pin Headers on the silkscreen side of the main board (It is the shorter pins that you are soldering). Double check they all are perfectly straight.

Qty	PINs	Name on PCB
2	2x3	SV1, SV2

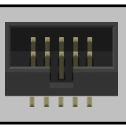
SOCKET CONNECTORS



Place the socket connectors on the control board over the silkscreen markings at positions and solder. Double check they all are perfectly straight.

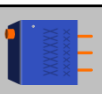
Qty	PINs	Name on PCB
2	2x3	SV100, SV101

POWER CONNECTOR



Solder the power connector at “POWER” ensuring it is facing out from the edge of the PCB.

TRIMMERS



Solder the 10k trimmers at IN_GAIN, SEMITONE, OCTAVE, OFFSET_10, OFSET_-5_5 with the screw facing out from the edge of the PCB.

ICs

Place the ICs in their respective sockets taking note of their orientation – the notch or dot on the top of the IC must match that of the socket and silkscreen.

Qty	Value	Name on PCB
2	LF412	IC5, IC6

Now it's a good moment to split the boards apart.
Please save the small rectangle piece for a late Step.

SPACERs

Secure the spacer onto the CONTROL PCB (through the hole with silver outline) with the main body of the spacer on the component side, and the nut on the mechanical side.

You're nearly at the end, but the next part is critical and takes a good bit of concentration. If you're feeling a bit strained, a break would definitely help. Reply to those unread messages or prove someone wrong in Internet, for example. Mechanical parts are really delicate and will need your full attention.

FRONT PANEL COMPONENTS MOUNTING TIPS:

Now we will proceed to mount mechanical parts to panel. This part of the assembly is CRITICAL. Please take your time and read the following instructions carefully.

These components must **NOT** be soldered until they are placed on the PCB and fully attached to the front panel!!!

There are two reasons for this:

> The height of the panel components are not all the same. Because of this, if not attached properly before soldering, they will not stay properly seated against the panel. This might cause mechanical stress reducing their life expectancy and in the worst case cause them to break.
> The second reason is that it is very difficult to align the components to the holes if the panel is not positioned prior to soldering.

ROTARY SWITCHES

First of all **check** the Rotary switches, both are 12 pins but one has **11 positions and the other 12, please identify the correct**.
Solder the rotary switches on marked places, Double check they all are **perfectly straight**.

Qty	Type	Name on PCB
1	Rotary Switch **11P** 2C	OCTAVES
1	Rotary Switch **12P** 2C	SEMITONES

TOOGLE SWITCH

Place the toggle switch in the place marked as RANGE. **Don't solder them yet!**

MINI-JACKS

Place the mini-jacks on the PCB ensuring they are on the side with the silkscreen. **Don't solder them until the front panel is in place with all nuts screwed to it.** This way it's easier to solder them in the right position. Keep in mind that the front panel holes are quite narrow and it is almost impossible to place it with all the components already soldered.

LED

Place the LEDs onto main PCB minding its polarity, but don't solder them until the front panel is in place. This is the only way to solder them the right position.

Qty	Type	Name on PCB
2	LED red 2mm	LED1, LED2

BANANAS

Screw the Banana connectors to the panel. **DON'T SOLDER THEM UNTIL TEST THE MODULE!**

Qty	Type	Name on PCB
1	**Red** Banana 2mm	T_OUT
1	**Black** Banana 2mm	GND

FRONT PANEL

Attach the front panel adjusting the parts one by one if necessary until it fits. At this point a pair of fine tweezers can be helpful.

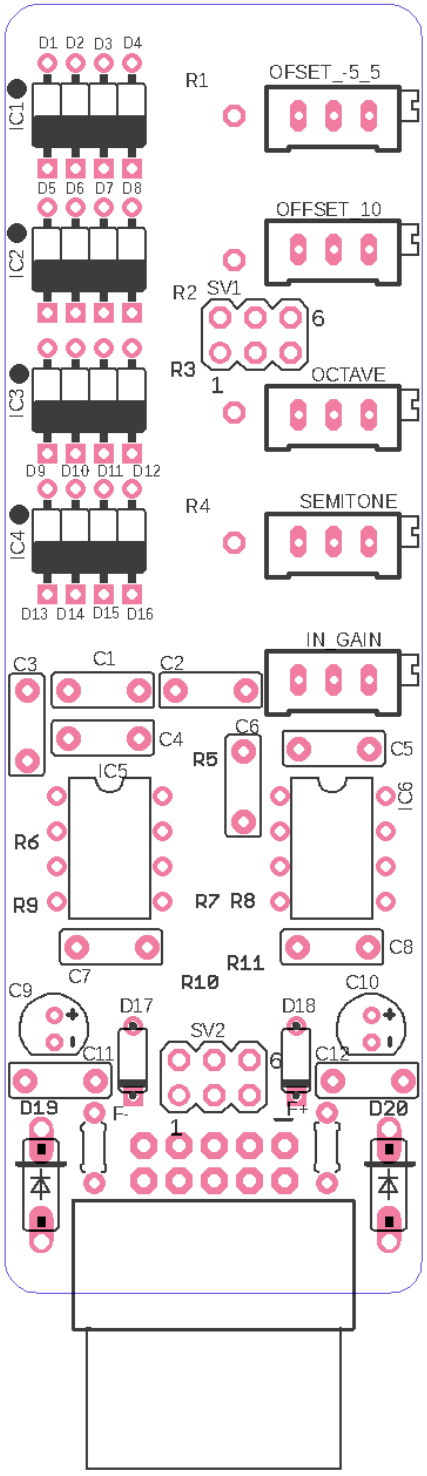
To Finish:
- Screw in the parts in this order: **A) Mini-jacks B) Switch** - Ensuring all of the above parts are flush with the panel and both PCB and panel are perfectly parallel. Then you can **finally solder them!**
- Fit the **LEDs** on the panel hole and solder them.

FIRST TEST

Make a fast Test to the module:

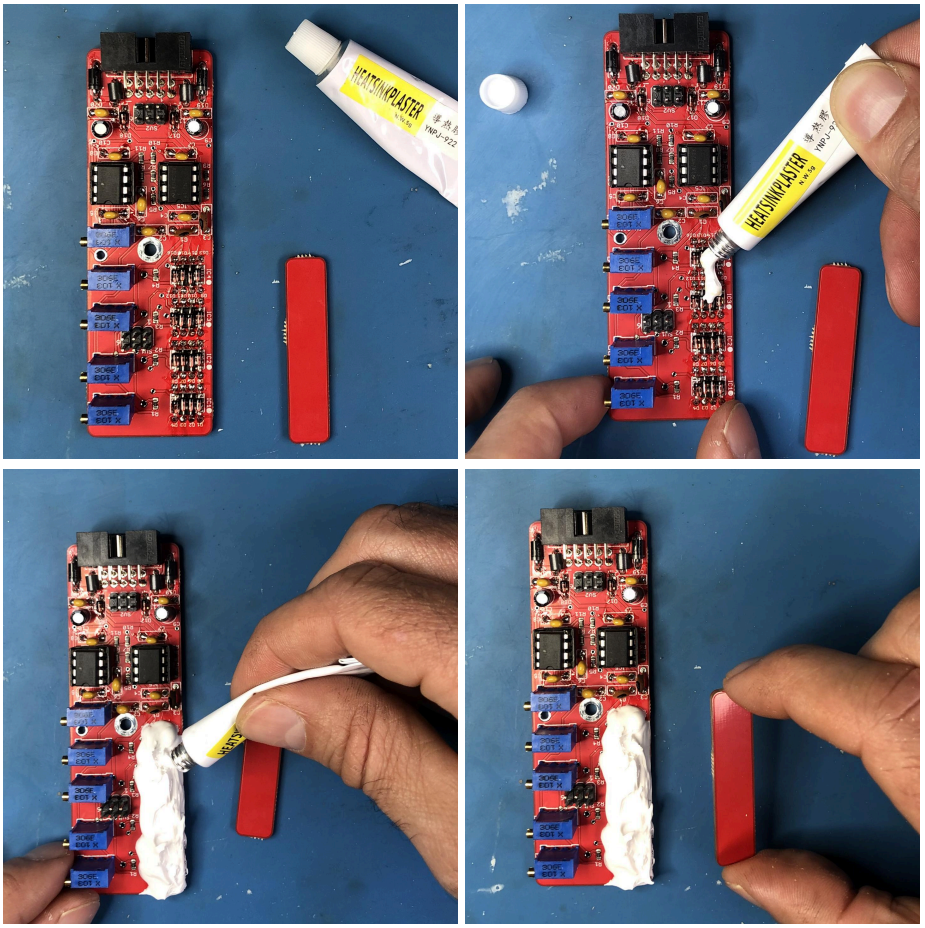
- Connect the power ribbon cable: The red wire (-12V) on the power ribbon cable corresponds to pin number one on the male power connector. The number one pin is indicated with a small triangle on the male power connector and a white line on the main PCB. A white or black line (or "-12v") marked on your power bus normally indicates the corresponding pin.

- Test the Out is sending a DC voltage and this changes with the switches, also test if the input is add to the DC signal.

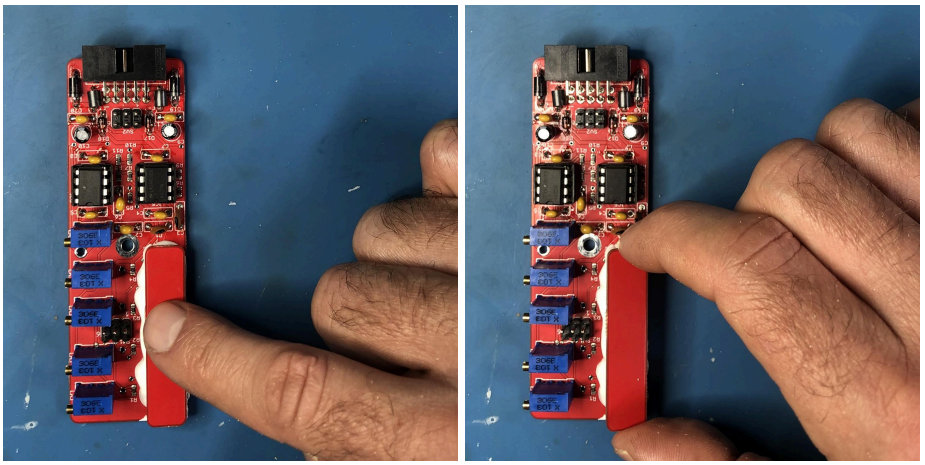

D1 D2 D3 D4
IC1
D5 D6 D7 D8
IC2
IC3
D9 D10 D11 D12
IC4
D13 D14 D15 D16
R1
OFSET_-5_5
OFFSET_10
R2 SV1
6
R3
1
OCTAVE
R4
SEMITONE
IN_GAIN
C3
C1
C2
C4
C6
R5
C5
IC5
IC6
R6
R9
R7 R8
C7
C8
R10
R11
C9
D17
SV2
D18
C10
C11
C12
D19
D20
F-
F+
1

THERMAL GLUE

- Place the thermal glue over the diodes above IC1, IC2, IC3, IC4., **make sure this covers all the Diodes and ICs**, the exceed of glue can be removed later so don't be scrooge.

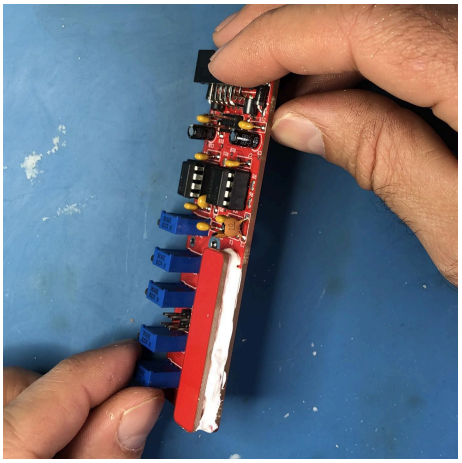


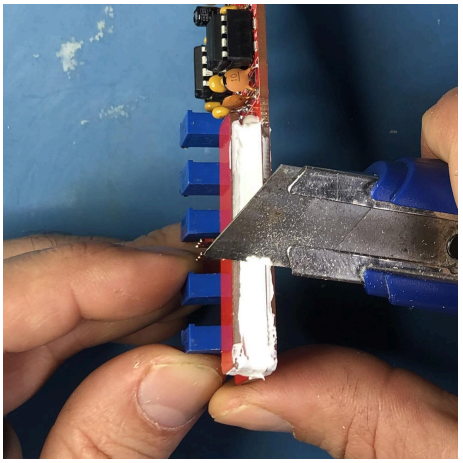
- Then place the Rectangle piece of PCB above the glue pressing gently.



- Keep the board apart and wait till glue is hard, this takes hours.

- Once the glue is hard and dry, you can cut the exces that gets out of the PCB.





FINAL ASSEMBLY AND TEST

- Solder the Bananas, the legs of the bananas are too long, trim them before attach the PCBs.

- Connect the **main PCB** to the **control PCB** using the pin headers and by threading the M3 screw through the main PCB and securing them to the spacer. The main PCB should be orientated so that the component side is facing towards the front panel.

- Put the knobs on the potentiometers and the red cap on the switch.

- Test the module and proced the to the calibration, all detailed procedure is explained on the next pages.

- **Enjoy the module!**

CALIBRATION PROCEDURE

You will need:

- Decent multimeter. One with a minimum of 4 Digits is ok although 5½ digits are advisable for accurate calibration.
- Small flat screwdriver.
- Eurorack power supply.
- Voltage generator. Any Module or CV source able to generate a stable DC voltage between 5 and 10 volts will do the job.

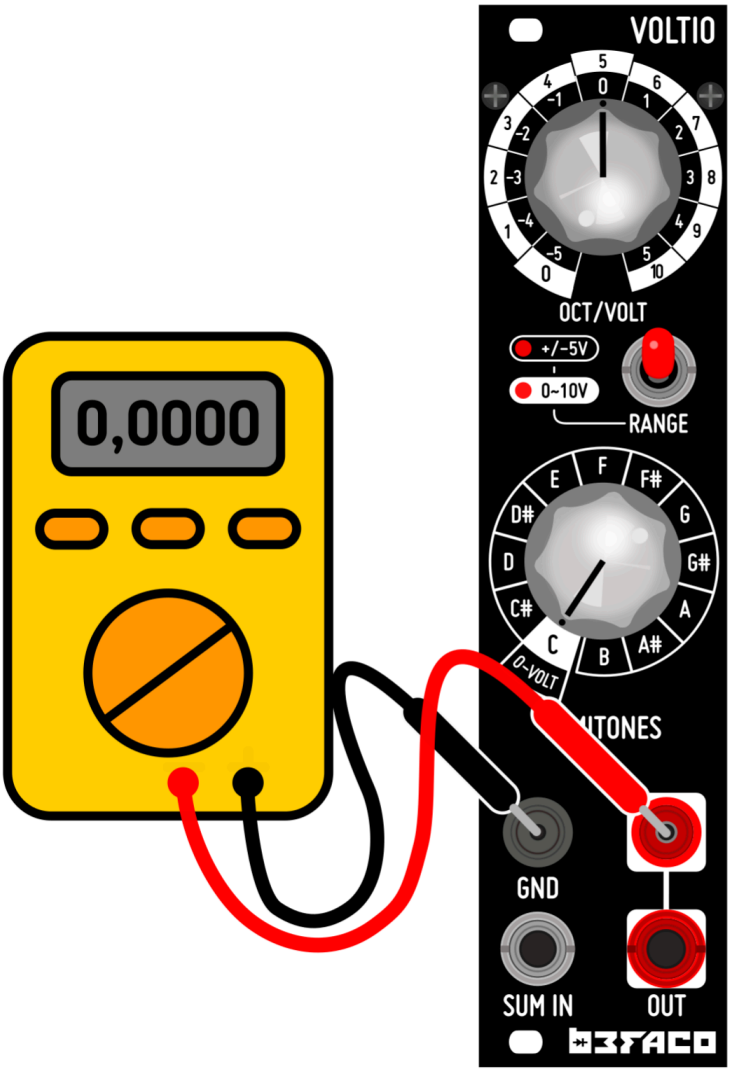
Before calibration, connect the module to the power supply, turn it on, and let it warm up for a minimum of 15 minutes.

Most of this procedure can be done with the multimeter probes connected to the two 2mm banana plugs of the front panel.

The error margin for all readings is +/-1 milivolt (+/-0.001 Volt)

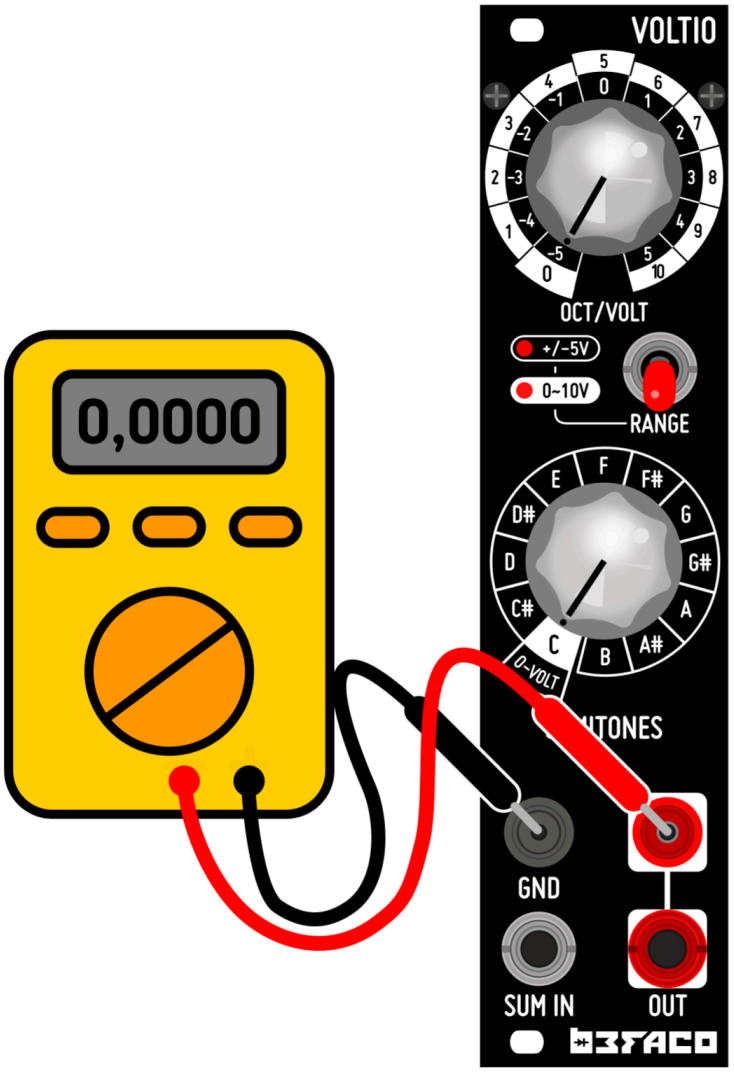
STEP 1: Calibration of the offset deviation of the -5/+5 range.

- 1. Set the *OCTAVE SWITCH* at 5/0 position (12 o'clock)
- Set the *SEMITONE SWITCH* at C position (7 o'clock)
- Set the *RANGE SWITCH* on the TOP position (-5/+5)
- Adjust the *-5/5 OFFSET TRIMMER* to 0,000* Volts measured at the OUT



STEP 2: Offset deviation calibration for the 0/10 range.

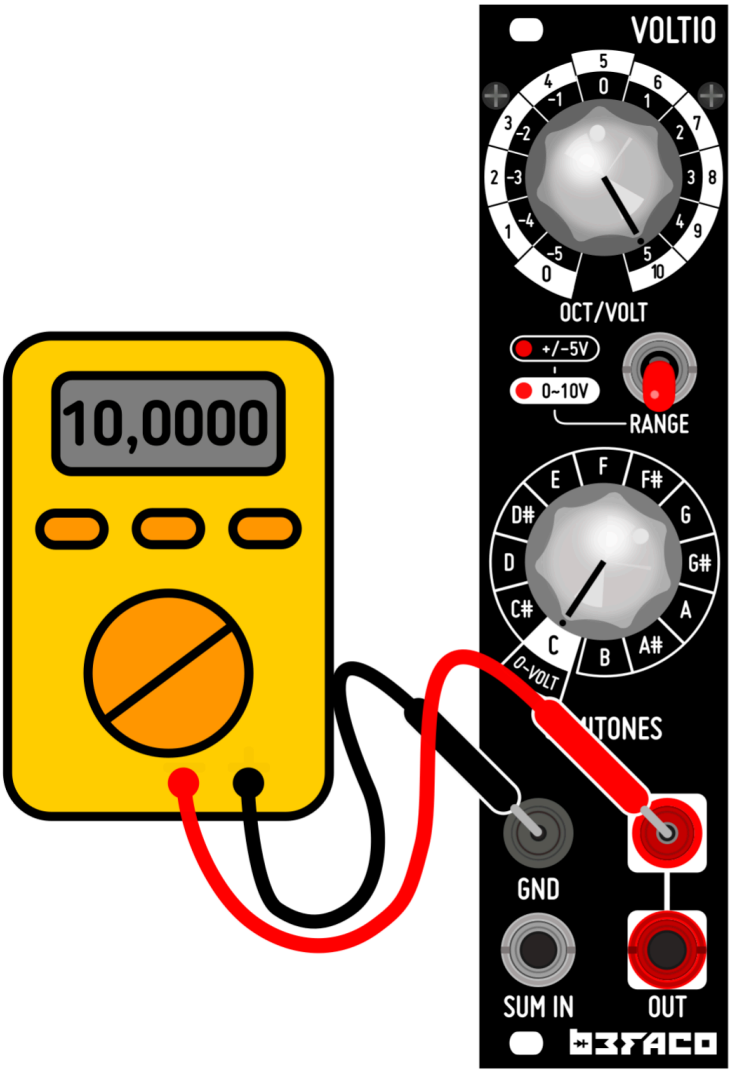
- 1. Set the *OCTAVE SWITCH* at 0/-5 position (7 o'clock)
- Set the *RANGE SWITCH* on BOTOM position (0~10)
- Adjust the *0/10 OFFSET TRIMMER* to 0,000* Volts measured at OUT



STEP 3: *OCTAVE SWITCH* Calibration.

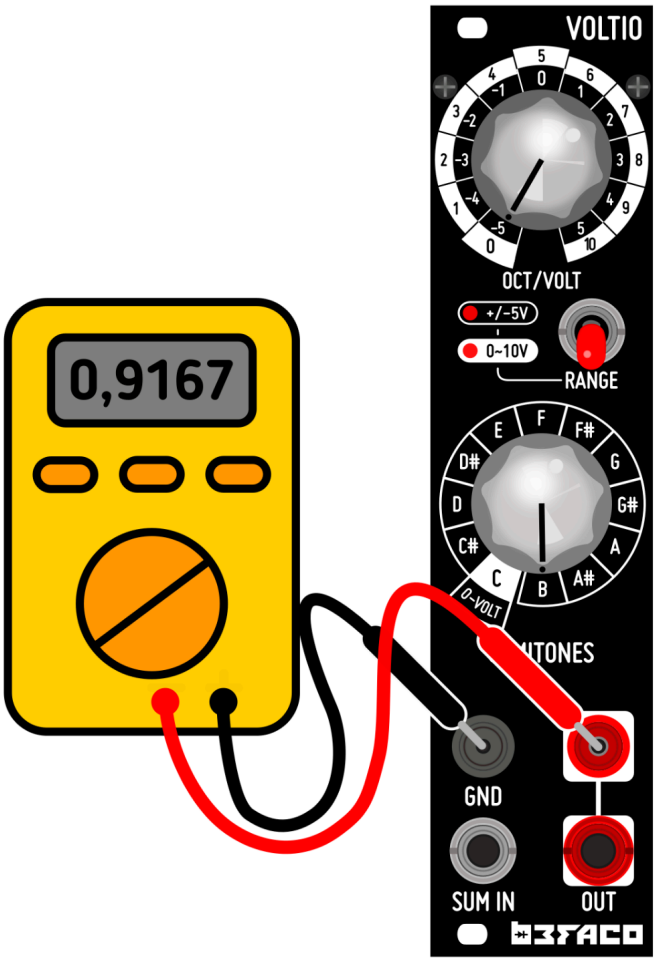
- Set the *OCTAVE SWITCH* at 10/+5 (5 o'clock)
- Adjust the *OCTAVE TRIMER* for 10,000* Volts measured at the OUT
- Check if all switch steps generate exact volts within the +/-1mV error margin.

It is possible to gain some extra accuracy by repeating steps 1 to step 3.

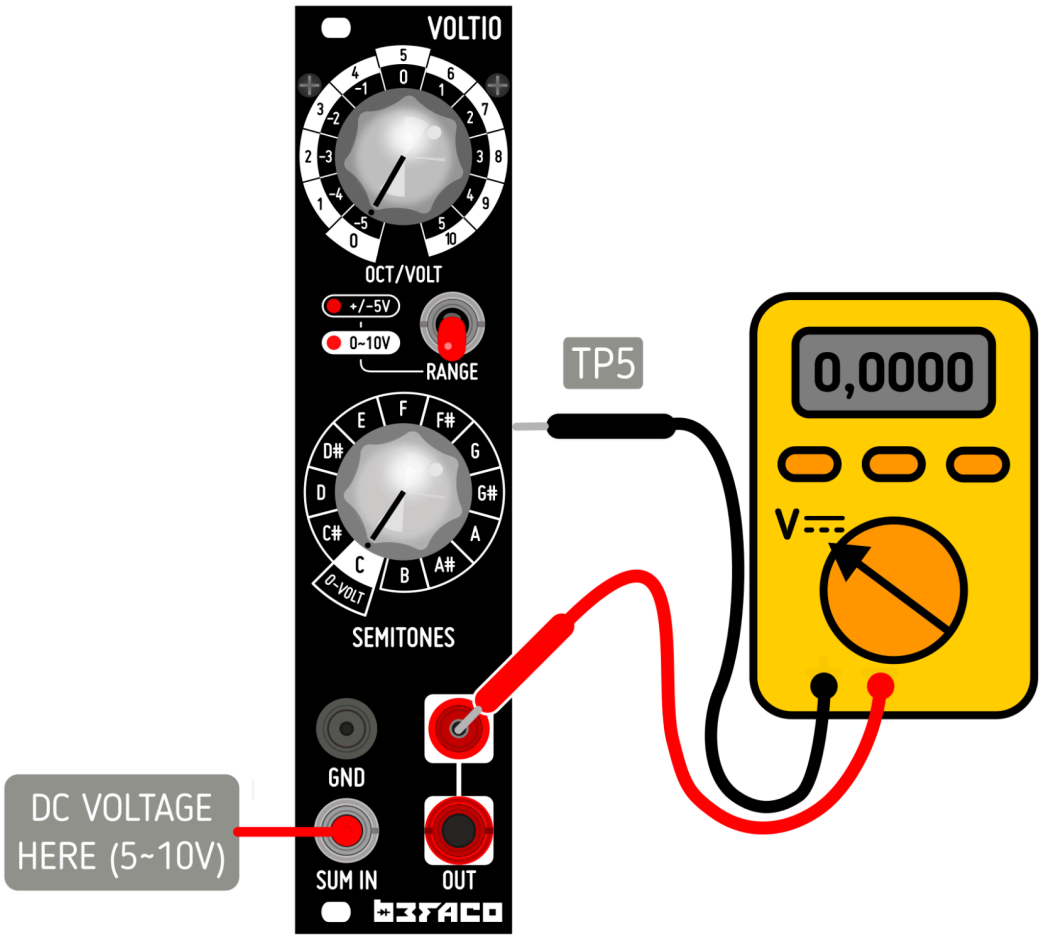


STEP 4: *SEMITONES SWITCH* Calibration.

- Set the *OCTAVE SWITCH* at 0/-5 (7 o'clock)
- Set the *SEMITONE SWITCH* at B (6 o'clock)
- Adjust the *SMTONE TRIMMER* for 0,9167 Volts at OUT
- Following the next table, check if all steps of the switch generate exact values within the +/-1mV error margin.



STEP	VOLTS
C	0,0000
C#	0,0833
D	0,1667
D#	0,2500
E	0,3333
F	0,4167
F#	0,5000
G	0,5833
G#	0,6667
A	0,7500
A#	0,8333
B	0,9167

STEP 5: *SUM IN* accuracy calibration.

- Enter some external voltage at the IN. Any voltage from 5 to 10 Volts will be okay because we just need to measure the difference between input and output.
- Set the *SEMITONE SWITCH* at C position (7 o'clock)
- Disconnect the multimeter's ground probe (The black one) and place it on *TP5 which is located* at the bottom of the module.
- Adjust the *CV IN TRIMMER* for 0.0000 Volts measured between OUT and *TP5*.