The Elektor Formant system by haraldswerk.de x Erica Synths

General build guidelines – READ FIRST

Since Erica Synths originated as a company that originally developed DIY kits for Eurorack modular synthesizers, we want to keep the spirit of DIY synths alive and besides our mki x es.EDU DIY series we occasionally develop other DIY projects. This time, we went full in. We saw a demo of the Elektor Formant synthesizer by Lookmomnocomputer and set out to develop a contemporary, DIY-friendly and extended version of the synthesizer. When researching the project, we came across haraldswerk.de by the amazing engineer Harald Antes who adapted most of the Elektor Formant modules for use with a standard Eurorack power supply and improved schematics for contemporary components. Harald kindly collaborated on this project and not only licensed his schematics but also agreed to keep an eye on a build thread on Modwiggler to support builders with advice. We developed an extended system with a custom MIDI interface to replace the original keyboard controller and added several modules that were not in the original system, but now considerably expand versatility of the system. We kept the unique internal wiring of the modules so the system can also be played without patching, exactly as described in the original Elektor Formant manuals.

Our Elektor Formant system consists of:
SEQ – a sequencer (new module, not found in the original system)

3 x VCO

12 dB/Oct VCF

24 dB/Oct VCF

RFM - formant filter module

FX module (new module, based on DSP found on Erica Synths FX modules)

COM – an updated Output module with a 6.3mm stereo output and dedicated headphones output

INTERFACE module – MIDI-CV module based on our custom MIDI-CV board

EF/RING – envelope follower and ringmodulator module

NOISE – module that integrates white and coloured noise and random voltage generators

DIVIDER – frequency divider module to generate custom waveforms and suboctaves from incoming audio signal

WAVEPROC – waveshaper, based on original schematics

2 x VCA

PHASER, based on Erica Synths Black K-Phaser, an 8-stage optical phaser

2 x MIXER

DISPATCH – buffered gate and CV multiple

LFO

2 x VC LFO

2 x ADSR

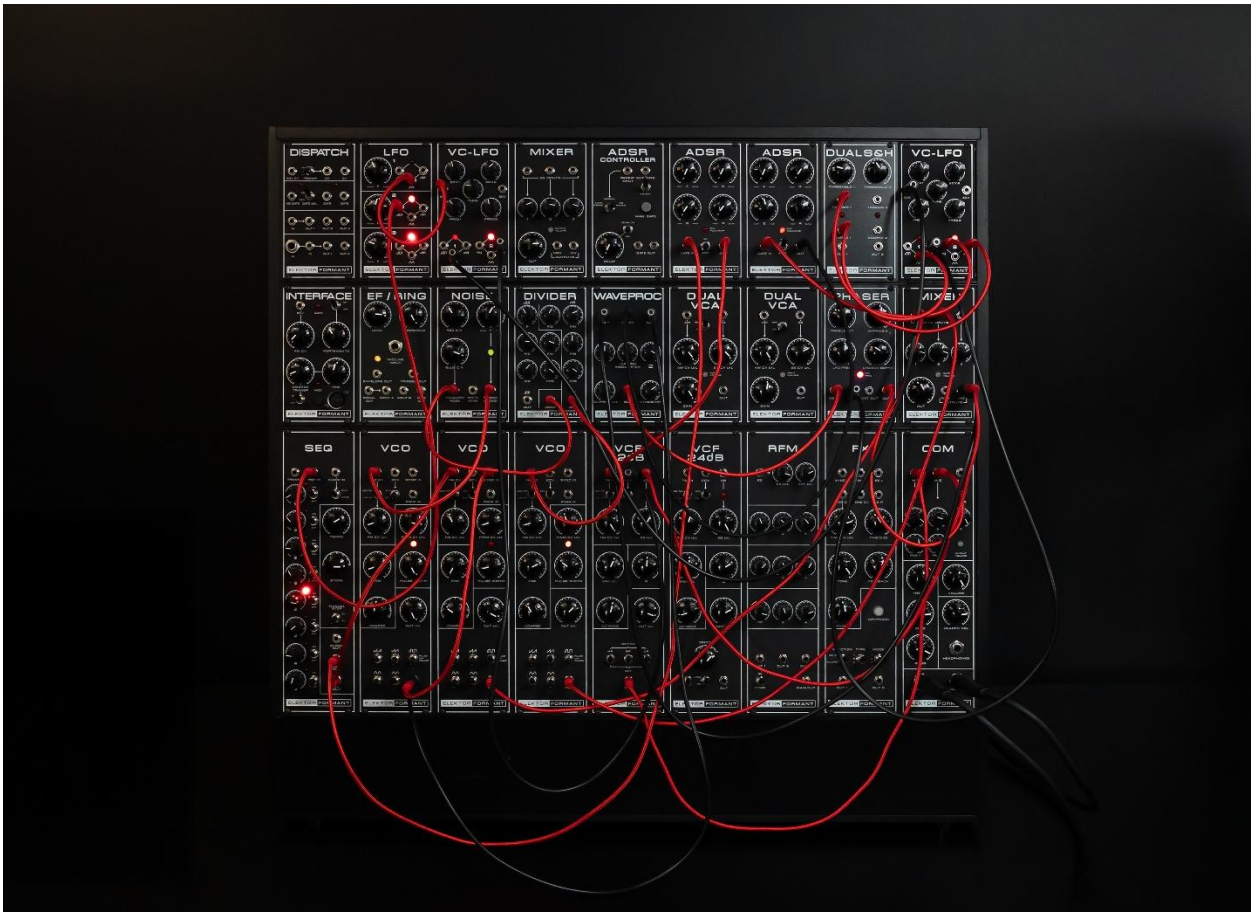
ADSR CONTROLLER

DUAL S&H

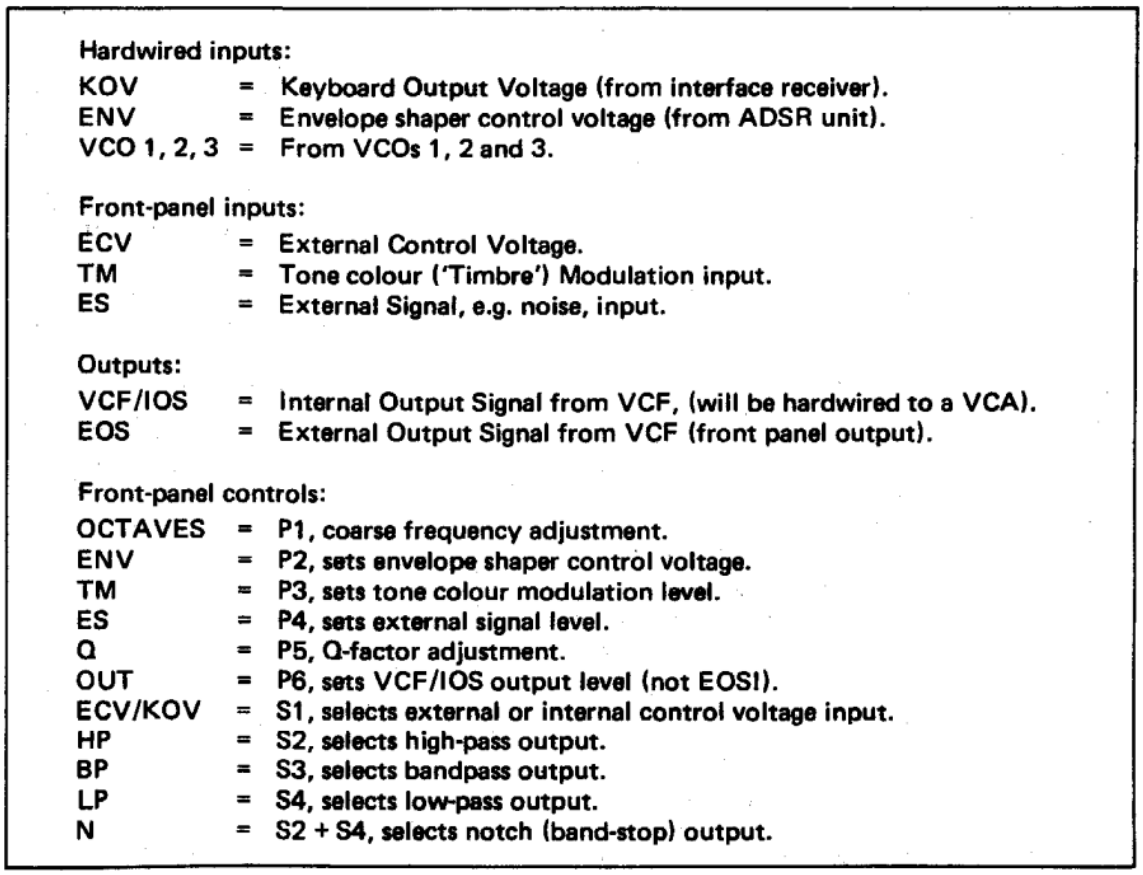
PSU distribution board and external 12V@3.3A PSU

Enclosure with rails and threaded inserts

Theis gives you a monster system with 27 modules capable of original Elektor Formant sounds and much more, a valuable addition to any studio.



The Elektor Formant system uses quite distinct **labeling on the front panels,** which sometimes may not be obvious. Here's an example of the labeling for the 12dB/Oct VCF, the same logic applies to all modules.



Hardwired inputs:

KOV	=	Keyboard Output Voltage (from interface receiver).
ENV	=	Envelope shaper control voltage (from ADSR unit).
VCO 1, 2, 3	=	From VCOs 1, 2 and 3.

Front-panel inputs:

ECV	=	External Control Voltage.
TM	=	Tone colour ('Timbre') Modulation input.
ES	=	External Signal, e.g. noise, input.

Outputs:

VCF/IOS	=	Internal Output Signal from VCF, (will be hardwired to a VCA).
EOS	=	External Output Signal from VCF (front panel output).

Front-panel controls:

OCTAVES	=	P1, coarse frequency adjustment.
ENV	=	P2, sets envelope shaper control voltage.
TM	=	P3, sets tone colour modulation level.
ES	=	P4, sets external signal level.
Q	=	P5, Q-factor adjustment.
OUT	=	P6, sets VCF/IOS output level (not EOSI).
ECV/KOV	=	S1, selects external or internal control voltage input.
HP	=	S2, selects high-pass output.
BP	=	S3, selects bandpass output.
LP	=	S4, selects low-pass output.
N	=	S2 + S4, selects notch (band-stop) output.

Elektor Formant DIY kits

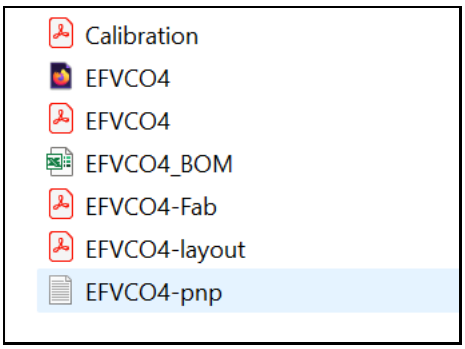
The system comes in two versions – the **Full kit** that includes all components to complete the system and the **Partial kit** that includes the enclosure, PSU, PCBs, panels, potentiometers, switches, jack sockets and custom parts to complete the modules, so the builder needs to source the generally available components – semiconductors and passive components available at most retailers. We do not make much profit on components, therefore, unless you have extensive stock of electronic components in your workshop, we highly recommend going for the Full kit.

All modules are designed to be DIY friendly – they are just 35 mm deep, do not require wiring (except original wiring between modules) but since most modules are quite complex, the system is intended for **advanced DIYers** who have extensive experience in DIY electronics and **have all necessary tools (multimeter, oscilloscope) for calibration and troubleshooting**. All modules were built and tested here at Erica Synths, in the 24-hour soldering marathon at This Museum is Not Obsolete and by Harald. They all work great, there are no issues with PCBs, BOMs or components. **We cannot provide support with this project, and builders have to rely on their**

experience and/or information on the build thread on Modwiggler. Also, all kits are professionally assembled and double-checked, so in case some components are missing, they most probably were lost during the build process and the **DIYer has to stock these themselves.** In case you do not feel qualified to build this system yourself, but you still want it, please, contact some trusted builders on the Modwiggler forum.

Preparation

All modules come with a similar set of assembly files. Download the .zip file from www.ericasynths.lv, unzip it, and you will find folders with assembly files; a folder for each module. The folder and file name are represented on the PCB and in the example of the VCO module, it reads as follows: EFVCO4, where EF (Elektor Formant) VCO (name of the module) 4 (version of the PCB).



1. The **Calibration** instructions contain also optional mods and error correction instructions.
2. Next one is the **web app – an interactive BOM** file where you can easily find the placement of components and mark populated ones – we highly recommend using it.
3. The EFVCO4 .pdf contains the **schematics** of the module.
4. The Excel file is a **regular BOM**.
5. The EFVCO4-Fab is a **component placement file** where you can see both sides of the PCB with populated components, both designators and values. **On some modules values may differ from ones stated on the PCB, please, follow this document!!!**
6. EFVCO4-layout and EFVCO4-pnp are optional, they have nothing to do with assembly of the module.

Before starting assembly, we strongly recommend printing out Calibration instructions, Schematics and Component placement files – this will prevent you from making mistakes during assembly

Assembly process.

Before assembly, we recommend sorting **all potentiometers and switches** according to the BOM of each module.

Most of the assembly is straight-forward and similar to any other DIY kit, but there are a few components that require specific attention. Some modules (VCO, VCF, VCA, S&H, EF/RING and COM) use some **ICs, in SIOC (SMT) cases. Solder these first before proceeding with THT components.** Jack sockets and potentiometers are the main support of the panel of the module and they are 10 mm tall. Once you have completed populating a PCB on the component side, turn it around and populate **jack sockets and potentiometers**. Then install the panel, fix it with a few jack socket and potentiometer nuts and make sure it fits well.

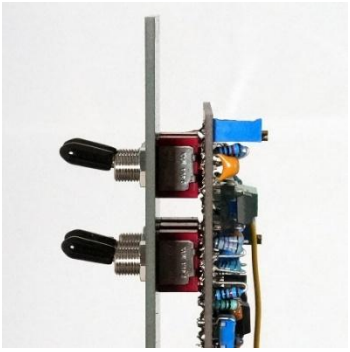
Pay close attention to the **polarity of the electrolytic capacitors**! A notch on the silkscreen indicates the **negative pin of the capacitor**.

Follow the silkscreen for **transistor and diode orientation**!

Follow the silkscreen when installing the 2x8 pin **connector for the power supply ribbon cable**! A notch on the silkscreen indicates pin 1 of the power connector. The pin 1 on the connector is marked by a triangle on the enclosure.

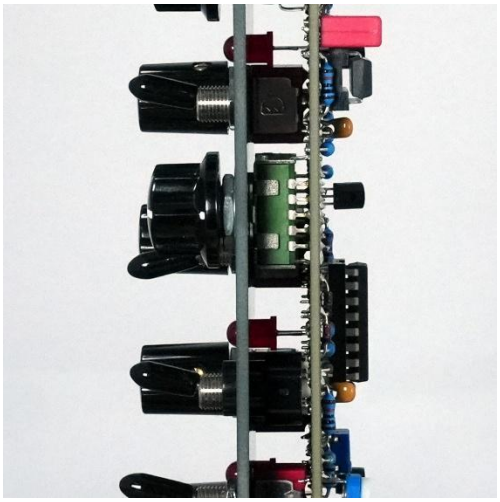
Many modules have **toggle switches** and they are ~ 9mm tall. To populate them correctly and prevent bending the PCB or panel when the nut is tightened, follow the steps below:

1. Install and solder jack sockets and potentiometers. Remove all nuts from the switches.
2. Remove the panel and install the toggle switches, **but do not solder them, yet!** Some are 2 position switches, some are 3 position switches – make sure you install correct ones (you may refer to the silkscreen on the panel), because switches are notoriously difficult to remove once they are soldered. **NB! The ADSR Controller has an ON-ON-ON** switch – do not mistake it for the ON-OFF-ON switch. There's a small ON-ON-ON engraving on the side of the switch and you may also use a multimeter to check the pinout of the switch.
3. Now install the front panel and fix it with a few jack socket and potentiometer nuts.
4. Use one nut to tighten each switch. Make sure the switch is tightened to the panel.
5. Now you can solder the switch and complete assembly of the panel – install all nuts on the jack sockets and potentiometers and install the knobs and black silicone covers on the toggle switch levers.
6. A module with properly installed toggle switches has to look like this:



The Sequencer module has 7-position and the 24 dB/Oct VCF has 4-position green **rotary switches**. Their assembly is similar to that of the toggle switches.

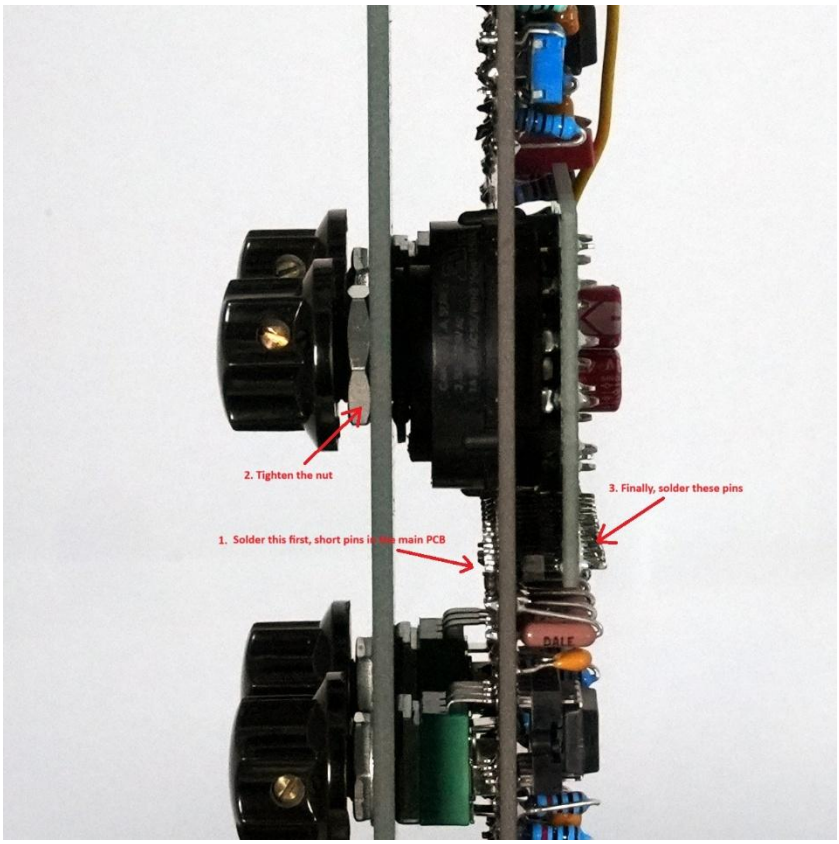
1. Install and solder jack sockets and potentiometers. Remove the nut and washer from the switch and use pliers to snap off the stopper lag on top of the switch.
2. Remove the panel from the module and install the rotary switch, **but do not solder it, yet!**
3. Install the front panel and fix it with a few jack socket and potentiometer nuts.
4. Now put a washer on the switch and tighten it with a nut. Make sure the switch is tightened to the panel. The leads of the switch will be barely visible on the opposite side of the PCB because the switch is just 7 mm tall, but don't worry, the connection will be secured when switch is soldered.
5. Now solder the switch and complete the assembly of the panel – install all nuts on the jack sockets and potentiometers and install the knobs.
6. A module with properly installed rotary switches has to look like this:



The VCO module has a **9 position rotary switch** that comes with **a small connector PCB**. To install it, follow the instructions below.

1. Install and solder jack sockets and potentiometers. Cut the shaft of the rotary switch so it measures ~12 mm tall.
2. Remove the nut, washer and a position detent washer from the switch and use pliers to snap off the stopper lag on top of the switch.
3. Install the switch in a small connector PCB, make sure the switch is properly aligned and vertical and solder all pins of the switch.
4. Now insert the one-row 14-pin male connector in the relevant spot on the PCB on the component side so that the shorter pins go through the PCB and solder it from the potentiometer/jack socket side.

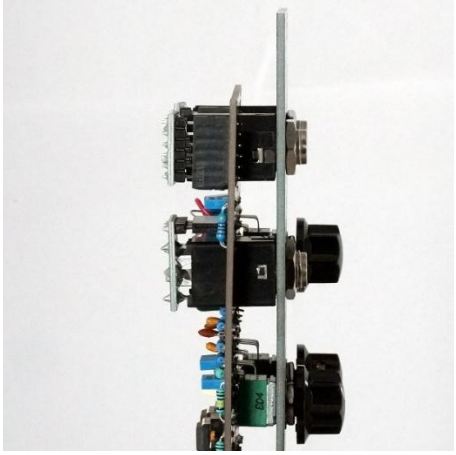
5. Install the panel and fix it with a few nuts on the jack sockets and potentiometers, especially around area of the rotary switch.
6. Place the position detent washer on 9th position and rotate the switch to make sure it rotates by 9 positions. If it does, install the switch so that the small connector PCB goes on the 14-pin connector. **Do not solder, yet!**
7. Put the washer and nut on the panel side and tighten the switch so it touches the front panel.
8. Now you can solder the 14-pin connector on the small connector board.
9. A module with properly installed toggle switches has to look like this:



Some modules (COM, DISPATCH and EF/RING) have **6.3 mm jack sockets**. In order to make assembly easier, we developed small PCBs for jack sockets that are connected to the main PCB via a one-row six-pin connector. Assemble them in the following order:

1. Solder a one-row 6-pin female connector on the main PCB on the component side.
2. Install the 6.3 mm jack socket on the small PCB. Align it with the silkscreen and make sure the jack socket is fully inserted into the PCB and is perfectly vertical. Solder the pins of the jack socket.

3. Solder a one-row 6-pin male connector on the small PCB. The connector should face the same direction as the jack socket.
4. Once the front panel of the module is installed, insert the jack socket into the relevant hole in the front panel and make sure the male connector on the small PCB is connected to the female one on the main PCB.
5. Tighten the jack socket hex nut to fix it in place. When completed, the jack socket assembly should look like this:

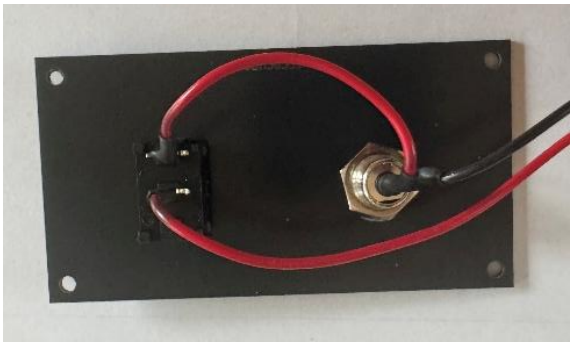


The ADSR CONTROLLER, INTERFACE and FX modules have **pushbuttons**. Make sure the notch of each pushbutton matches the notch on the silkscreen. One of the pushbuttons is illuminated (it has six pins) – it goes on the FX module.

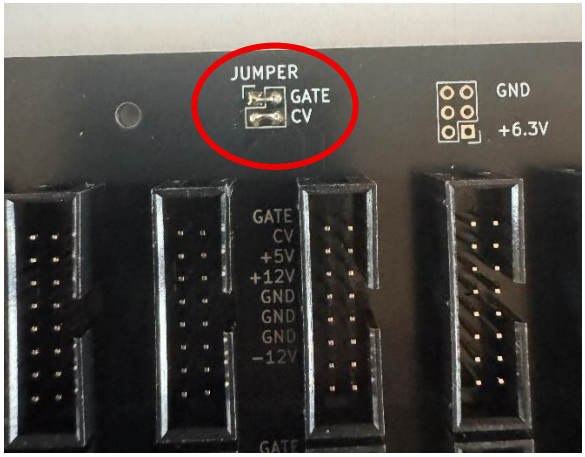
Assemble the enclosure!

The enclosure is made of 12 mm plywood and has cut-out guides to make assembly easier. The only tool you will need is a screwdriver.

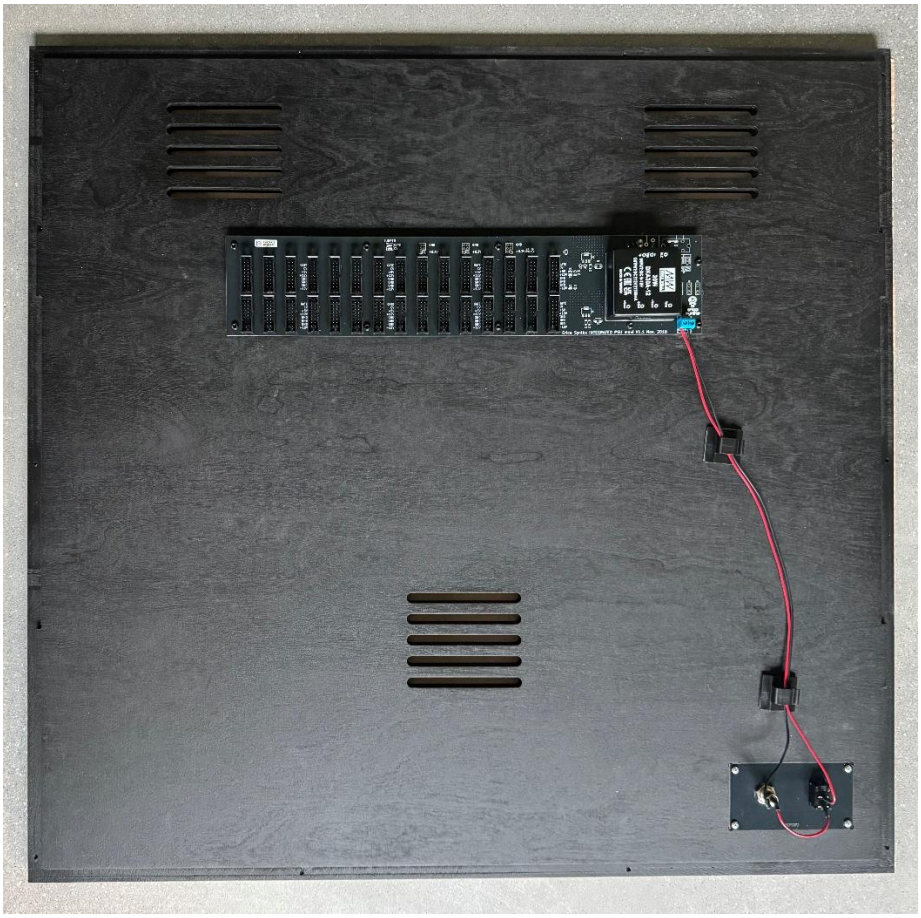
1. Start with the back panel and PSU connections! Locate the small PCB and install the switch and DC socket. Connect them as shown in the photo below! Use heatshrink tubes to insulate connections.



2. Install two jumper wires for GATE and CV bus on the power distribution board.



3. Install the power distribution board. There are pre-drilled holes in the middle of the back panel for easier installation - use 5 mm plastic spacers and shorter screws supplied with the case to fix the power distribution board in place.
4. Now, connect the power distribution board to the switch board. Mind the polarity of the connection – it is critical!



5. Once completed, power it up and make sure you measure +12V and -12V on the relevant rails. Set the back panel aside – it will be useful for testing the modules in build process.
6. **Next, follow the instructions below (and the attachment) to assemble the rest of enclosure!**
7. Connect the side panels with the top and bottom panels. One side of the t**op panel is slightly angled** – make sure it aligns with the angle of the front surface of the enclosure. Tighten the connections with screws.
8. Then install the front panel on the bottom part of the enclosure. Same as for the top panel **- one side of the panel is slightly angled** – this side is the top side and the angled edge has to face inwards.
9. Insert the threaded inserts in the rails and use M5 screws to fix the rails in place. Rails do not have threads on the sides, but because aluminum is a softer material than the screws, they will find a way. Start with the bottom rail, then proceed with the next one. You may want to use the front panels of the modules as guides to align the rails during installation.
10. Once all modules are calibrated, you can install them into the enclosure. Once all modules are installed you need to perform the **internal wiring**. Follow the picture in the attachment to interconnect the modules (red wires are audio path, green ones – CV and Gate signal). Please note that **you need to connect the signal wire only**, because the GND connection is done via the power distribution board. Same goes for the CV and GATE connections – we use a Eurorack standard power distribution board and 16-thread ribbon cables that ensure the connections mentioned above.
11. Installation of the back panel with the power distribution board is a bit tricky – first, you need to connect all modules to the power distribution board and then close the case and fix the back panel via screws supplied with the enclosure kit.

Once again – because of the complexity of the modules - we **cannot provide support for this project and builders have to rely on their experience and/or information on the build thread on Modwiggler.**

In case you do not feel qualified to build this system yourself but still want it, please contact some trusted builders on the Modwiggler forum.

Good luck with building the system! Enjoy!

Harald Antes, Elektor Magazine and Erica Synths team.

Special thanks to Matthias Gams for documenting his build process and pointing to some nuances in documentation.