

HEXAPHON v. 1.4 PCB . Rev. 4. april. 2023

Hexaphonic Witchcraft Synth

<https://ekkoflok.dk/hex.php>

Please read the entire guide before attempting to build the Hexaphon.
Feel free to watch the assembly guide as well:

<https://youtu.be/aX8CBH6oHXs>

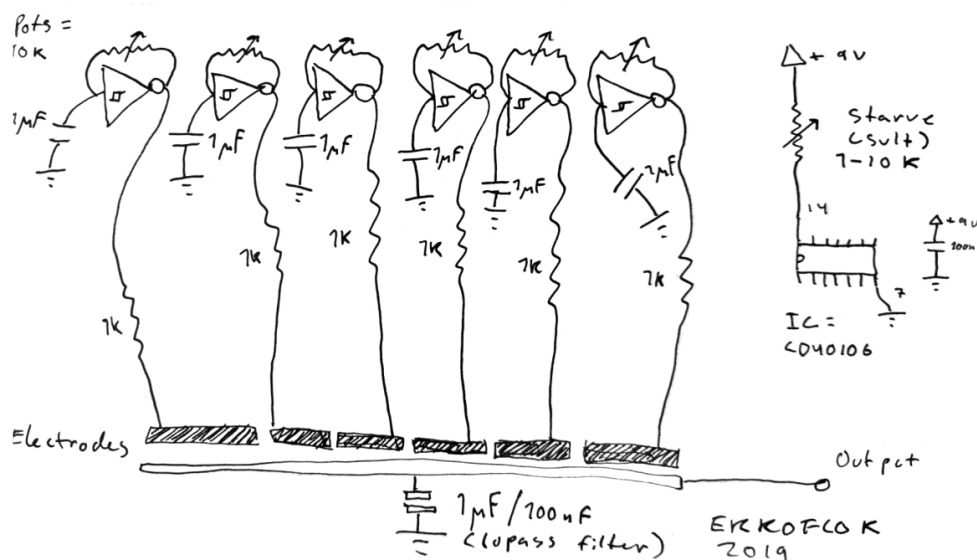


Figure 1: HEX schematic

Introducing the Hexaphon

A synthesizer, a choir of six oscillators joyfully singing along or against each other, producing an output spanning from harmony to cacophony, all by the touch of your skin.

"Hex" is the Greek word for "six" and close to the Danish word "heks", which means "witch". It is about time we throw some witchcraft in our electronics and honour the wise women of the past and the present.

Electronic engineering is in many ways rather conservative, but fortunately there are cracks in the surface - like sticking your fingers inside a circuit or "starving" a circuit to intentionally prevent it from operating predictably. The Hexaphon is such a circuit - you play it by

extending the circuit with your fingertips (or other conductive matter), and force it into chaos by cranking the "starve-control". Let the circuits starve and spare the abundance for the Humans in need.

Like human beings the Hexaphon is a mood swinger of sorts; its mood changes rapidly from harmony to chaos - blindly obeying the orders of the starve control. If the electrodes are the limbs of HEX, the starve-control is the brain - or maybe rather a parasite of sorts, taking control of an otherwise well-behaving instrument. Luckily it seems that the Hexaphon is perfectly happy with returning back to a normal state again after a trip into chaotic territory; thereby reducing the starve-control to a humble way of controlling the timbre - it's not a filter, nor a wave-folder, but it surely does alter the timbre in a non-linear and, most importantly, pleasing manner.

Starving circuits is not a new thing; it has been exploited in fields of circuit bending for ages, and interestingly it is also a well-known trick among guitarists to emulate the sound of a fuzz pedal with a dying battery - by limiting the current flowing from the battery. However it is not something you see on the front panel on the average Behringer synthesizer (yet?!).

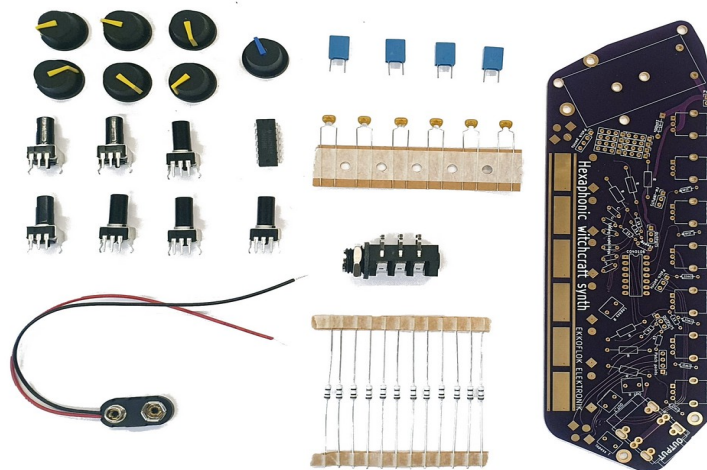


Figure 2: Parts included in the kit

BOM – Bill of Materials

Most of the components have non-critical values - feel free to experiment with the circuit if you feel adventurous!

There is room for more components and provision is made for some "patch points". These are intended for experimenters who might wish to extend the circuit in some way.

- Limiting resistor „r-limit“ – 909r (or 1k) (brown black red) – this one sets the maximum frequency - use a higher value if the oscillator goes into ultra sonic territory
- Resistors „R“ – 909r (or 1k) (red black red)
- Timing capacitors – 1 μ F (105)
- Low pass capacitor – 100nF (224) or 1 μ F (105)
- Output capacitor – 100nF - 1 μ F (105) – the one right next to the jack socket, marked "lopas R"
- Potentiometers – 10k to 100k (larger resistors mean larger range)
- Chip / IC – CD40106BE (Hex inverting Schmitt trigger)
- Battery clip – PP3 9v battery connector, plastic strips or rubber band for fixing
- Knobs
- Jack socket – TRS



Figure 3: Assembled Hexaphon

ASSEMBLY

1. Put in the resistors, designators R
 - Bend the legs, so the resistor fit the hole spacing.
 - The resistors mix (sum) the signals from the oscillators and prevent the oscillators from interfering (unintended).
2. Put in the capacitors, designators C
 - They define the pitch range of the oscillators - higher the capacitance the lower the frequency.
 - There is room for an optional decoupling capacitor marked "bypass" on the pcb, which is usually there to stabilize circuits. In the case of this particular circuit, however, the purpose is to generate

TESTING

1. Attach a 9V-battery - observe the polarity!, turn the first pot (starve control) fully clockwise, connect a jack cable between the audio connector and a powered speaker, a mixer connected to headphones or similar - the output is **not** designed to drive a passive speaker or a pair of headphones directly.
Note that the output is stereo, and thus I recommend using a Y-splitter cable to get each output to a separate speaker.
2. Touch the electrodes and you should hear a sound! If not, check the position of the potentiometers (especially the starve pot). If the
3. Once you have sound, explore the effect of the starve (SULT) potentiometer - it simply limits the amount of current reaching the IC, which in turn affects the sound. It is a technique adapted from circuit bending and thus is not really something you will find information about in the 40106 datasheet. The sounds it produces, however, tend to be quite complex and chaotic.
4. Also please note that electrical shock hazard exists when using a DC adapter connected to mains - use at your own risk. If in doubt, use with battery only.
5. ENJOY!

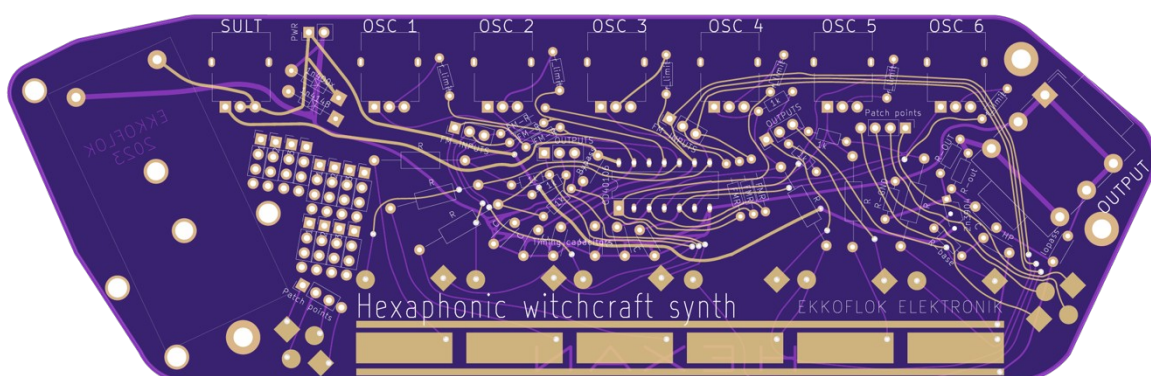


Figure 5: Hexaphon PCB

Troubleshooting FAQ

In case of problems try the following:

Chip gets hot?

- Remove power immediately and check the above guide thoroughly.

There is no sound?

- Is the starve pot turned fully counterclockwise?
- Do the solder joints look OK? (Shiny and like small vulcanos?)
- Take special care with the potentiometer pads.
- Did you remember to solder everything according to Fig.3?
- Are all the pins soldered properly?
- Did you use enough solder for the audio connector?
- Is the battery dead?

If you have any questions, please don't hesitate to contact me at valdemar@ekkoflok.dk. Also, I'd love to hear any sounds you might discover.

I hope you will enjoy your new instrument!

/Ekkoflok 2023