

I/O-section consists of four 3,5mm mono jacks labeled 1, 2, 3 and 4. The jacks are used to feed signals in and out of the 4060. The jacks are wired to the patch board as follows: 8 patch points labeled GND are connected to power supply ground, and are the common signal ground to all jacks. Sections labeled 1, 2, 3 and 4, each consisting of 8 patch points are wired to the corresponding jacks.

Please note! When nothing is patched to the patch points, no signals are connected to the jacks. So, the first thing you might want to do is connect a point in DIVIDER to section 1, 2, 3 or 4 with a jumper wire. Now you have a square wave signal present at the corresponding jack. You can, and should, try any component in place of the jumper wire, and patch multiple signals to the same jack with different components to mix them together in various ways.

The signal conductors of the jacks are doubled as **touch contacts** in the front panel. Each touch contact is connected to the jack above. You can use the touch contacts in different ways such as: (1) connecting signals to the jacks from other touch contacts with your fingers, (2) touching the contacts with component legs or jumper wires from the patch board before deciding which one you want to connect, (3) touching the contacts with the tip of a patch cable connected to another module.

PWR-section is what makes the CD4060 chip behave in a more interesting way. Dialing down the CURRENT knob limits the amount of electrical current provided for the chip, as would happen with a **weak battery**. When the current is not adequate, the efforts made by the chip - oscillating and dividing - start to show. Add components to the patch board and you can hear how they load the circuit, each in a different way. If the device halts, dial the CURRENT up or remove the last component.

Operating voltages of the module are available in - and +. The voltages are + and - 4,4 volts, resulting in a maximum signal swing of 8,8 volts peak to peak. The limited, i.e. starved, voltage is available in ST+. You can use ST+ as a kind of a general output of the device's inner workings.

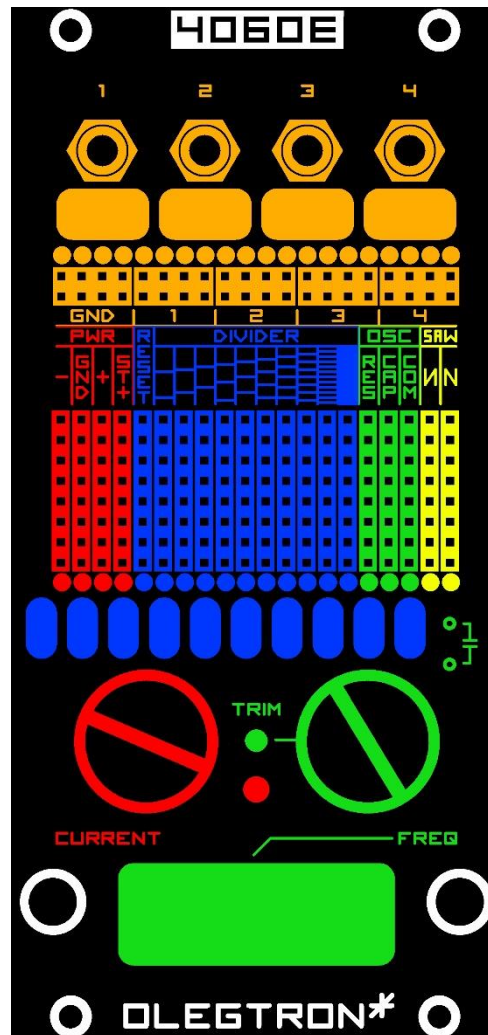
In the middle of + and - there is a row of power supply / signal ground.

There are 180 ohm resistors in series with both the negative and positive power supply, so the system never gets full power. This means you cannot get an absolute clean signal from the box. On the positive side the resistor makes it safe to plug components around the patch board. It is advisable however to **check capacitor polarity and voltage rating** before patching to **PWR-section**.

SAW-section integrates the popular "7-bit saw" module of the original 4060. It's now buffered and inverted, though. The SAW section takes 7 of the highest DIVIDER frequencies and converts them into a rising sawtooth wave, and it's mirror image. The waveforms are far from ideal, but provide a different timbre/good starting point for an LFO. When you patch components to the patch board, the SAW-waveforms will change.

Olegtron 4060E, the Eurorack sibling to Olegtron 4060 MK2, is a module anti-theoretic by nature, but you might still want to eyeball this paper through. If things don't work out, try again! Please share your findings and ask for help at www.olegtron.com/forum

Olegtron 4060 is a simple device - more of a design concept. It's based on the datasheet example circuit of CD4060, a CMOS logic chip from the lovely 4000-series.



OSC-section gives you access to the base frequency oscillator that sets the **pitch** and **tempo** of the whole system. The frequency is adjusted by turning the FREQ knob. By adjusting TRIM with a small screwdriver you can set the upper limit of the FREQ potentiometer. When you turn TRIM up, the oscillation will stop at maximum FREQ values, but there'll be interesting behavior at the threshold!

You can also use external components to control the frequency: If you want to **speed up** the oscillator, patch a **resistor**, such as the provided LDR, between RES(istor) and COM(mon). If you want to **slow down** the oscillator, patch a **capacitor** between CAP(acitor) and COM. The metal sockets next to the knob double the CAP and COM, so you can patch a capacitor there for more permanent slowing.

Below the knobs there is a special touch contact area, where OSC: RES and COM are exposed for touching with fingers. Since skin conducts electricity, touching the contacts will change the frequency of the main oscillator.

You can also **output** signals from the OSC patch points when you need high pitched sounds. The waveforms in OSC section are also different if you need a change of timbre. Since we are in the center of the action here the OSC patch points are quite sensitive. So, if the oscillation stops, try patching with another component to avoid loading the oscillator.

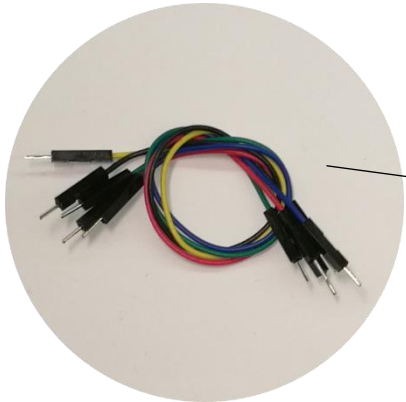
Since the OSC section is so delicate and vulnerable, you can feed **external signals** into the patch points to sync/override the internal oscillator. You can also patch signals from 4060E itself for some internal modulation. Start with a small capacitor from DIVIDER to RES.

DIVIDER-section provides the nominal **outputs** of the CD4060 chip. But worry not! In case of Olegtron, the outputs can be used **as inputs** too, sensitivity depending on the setting of CURRENT and the components used. This is also a good area to start plugging components to alter the sound.

In divider there are 10 divisions derived from the oscillator base frequency. In audio range the outputs are perceived as different octaves of square wave signal. In low frequency range the signals at the outputs appear as voltages changing state between high and low, each output at half the tempo compared to the previous. Please note that for some reason there is a one octave gap missing before the lowest three DIVIDER outputs. This is a feature of the CD4060 chip.

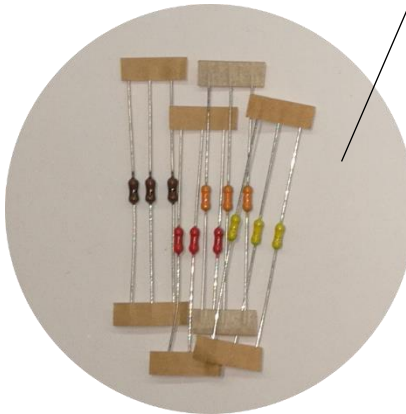
The 10 DIVIDER frequencies are also available in the touch contacts below the patch board. You can use the touch contacts with other touch contacts as described in the I/O-section paragraph.

When you input a positive signal to RESET input, it will reset all DIVIDER outputs to low state and stop the oscillator. When the input signal goes back to low, oscillation starts again, and the divider begins to count. If you want the RESET to just reset the outputs, but keep things running, patch it with a small capacitor! The sensitivity of the RESET input is dependent on the CURRENT knob. You can also try patching to it with a diode or other components.



This page will go through some features of the basic electronics component set provided with your Olegtron 4060. There's not much electronics theory here, rather just thoughts of how the components could be utilized. All possibilities are not covered here - it's all about experimenting! If something does not work, try something else!

Jumper wires are normally used in electronics prototyping. They are flexible conductors covered with isolator and equipped with pins in the ends. The main idea of a conductor is that it lets electric current flow through theoretically freely. The isolator protects the conductors from touching each other and potentially causing problems. They are handy for sure, but when it comes to using with Olegtron 4060 they are a bit dull. Also short circuiting two patch points with a jumper wire might halt the whole device, which is a bit of a nuisance. There's a whole world of components out there, so why not use them!



Resistors are a lot more interesting. Their function is somewhere between conductor and isolator. They let electrons flow, but at slower rate. This property is called resistance, and it's unit is ohm, Ω . The less resistance there is, the more freely electric current flows through. Resistors' values are usually hundreds, thousands (kilo-ohm, $k\Omega$) or millions (mega-ohm, $M\Omega$). The value is color coded to the body of the resistor with a set of stripes. The resistors in Olegtron 4060's component set are further color coded with spray paint to make patching easier. Below is a list of the resistors provided:

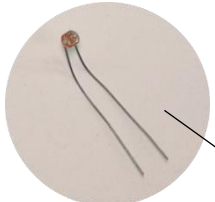
Brown	1 $k\Omega$	brown-black-black-brown-brown
Red	10 $k\Omega$	brown-black-black-red-brown
Orange	100 $k\Omega$	brown-black-black-orange-brown
Yellow	1 $M\Omega$	brown-black-black-yellow-brown

Resistors are quite handy in patching your 4060. When patching to I/O with a **resistor** you can limit the current, i.e. strength of the signal, going in and out of the device. A good approach is to start with a larger resistor, and if there is not enough effect, change it to a smaller one.

You can also use resistors to connect different patch points together without short circuiting them. When you connect two DIVIDER patch points together with a resistor, they start to kind of compete with each one, and that will affect the whole system.

You can also mix several signals together by patching them to the TRS jack with resistors. Use different resistors for different weight in the mix. Resistors can be used in other ways too, such as forming voltage dividers, or in passive filters. More at the forum!

LDR, Light Dependent Resistor is a very useful component. Like the name suggests, it's resistance changes depending on light. If the component is in complete darkness, the resistance is some megaohms, and in bright light only some kilo-ohms. Patch the LDR between OSC: RES and COM for **frequency control** or between PWR: + and ST+ for **current control**. Or between DIVIDER patch points etc.



Capacitors are components, which have the ability to store electric energy. This property is called capacitance, and it's unit is Farad, F. Usually capacitor values are fractions of a Farad ranging from trillionth (picofarad, pF), to billionth (nanofarad, nF) and millionth (microfarad, μF). The capacitors provided with Olegtron 4060 can be roughly divided in two: small and large value. Small capacitors are also spray painted for ease of use:

Red = 1nF, orange = 10nF, yellow = 100nF and green = 1 μF .

The small capacitors can be used to control the frequency of the oscillation: you can patch a capacitor between OSC: CAP and COM to slow down the whole device. If you want to slow the device down more permanently, you can use the small sockets next to FREQ potentiometer. You can also connect a capacitor from the DIVIDER to OSC section for some internal frequency modulation.

The small capacitors work fine in general patching, but the larger ones have more effect. The usual effect you get from the large capacitors is a sweep, which originates in the charging and discharging of the component. You can achieve sweeps by connecting two DIVIDER patch points together, but also by connecting the other leg to PWR-section.

If you connect a large capacitor between PWR - and +, you can filter out some harshness from the system. You can also use the capacitor with POWER switches: when you cut the power, the capacitor discharges and causes a kind of a decaying sound.

Diodes are semiconductors that let current flow only to one direction. When you patch a diode between two DIVIDER patch points, they will start to compete, but only to one direction. Diodes have a threshold voltage at which they start to conduct. This means, that they will behave differently depending on CURRENT. Diodes can also be used to mix signals, a bit like with resistors.

Transistors are another group of semiconductors. They can be thought of as electrical switches, which let current through only when they receive a control current. In the provided BC547 and BC548 transistors the control input (base) is the center leg.

LEDs, a.k.a. Light Emitting Diodes, are a special group of diodes: they shine light when conducting. This is really handy when patching 4060: you will see the LED blinking, and you can simultaneously hear the difference in sound. LEDs like normal diodes have a threshold voltage, much higher though, and different depending on the color. So different LEDs start to conduct at different voltages. Some of the LEDs have multiple legs internally connected to different colors, so there's a lot of functionality in one shiny little package.

And that's only for starters! Get some more components and try them out! When you find something interesting or have a question to ask, please go to www.olegtron.com/forum

