SOLDERBOX

Semi-modular workstation

INTRODUCTION

A modular synthesizer embodies creativity on many different levels. Not only does it let you create sound and music, the instrument itself can also be created and infinitely modified by yourself.

Solderbox is heavily inspired by Jakob Haq's Haqrack; which contains many modules made and even designed by himself.

In this age of effortless AI-generated stuff Solderbox is a meticulously handcrafted instrument with its own distinct personality, designed to bring you countless hours of fun hands-on creative exploration and sound design.

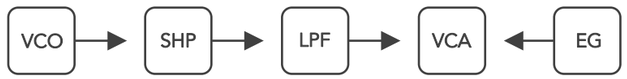
SEMI-MODULAR

So what's a semi-modular? Two things make Solderbox semi-modular: the modules are pre-configured, and some of the modules are normalized.

This basically means that the modules at your disposal have already been compiled into a coherent instrument, and there are some internal wired connections already pre-made ("normalized") so you can use the instrument without having to patch cables yourself.

NORMALIZED CONNECTIONS

The normalized connections in Solderbox are as follows:



- Oscillator 1 (VCO) feeds into the SHAPERS module
- The shapers feed into the LPF (lowpass filter section)
- The filter output is sent to the VCA output module (amplifier)
- The envelope generator (EG) is also sent into the VCA
- MIDI notes are sent to the VCO frequency (when the internal sequencer is not used)
- MIDI triggers are sent to the EG GATE (when the internal sequencer is not used)

Using these pre-wired connections, you can already dial in some interesting sounds using the synth's knobs without having to plug any wires into the patchbay.

An internally normalized connection can be overruled/broken by plugging a cable into its corresponding ***input*** patchpoint. Plugging something into a normalised ***output*** patchpoint does not break the internal connection, but just adds an extra connection to it.

WIRING YOUR OWN PATCHES

By dragging wires from an input to an output (or vice versa) you can wire your own patches. Output patchpoints (which send out a voltage signal) have a light background, the input patchpoints (which accept voltage signals) are on a dark background.

It is not possible to connect two inputs or two outputs. But anything else goes. There is no wrong way to patch wires. Although not all wirings will give you usable results, you can't damage or break anything by making unconventional connections.

Remove a cable by picking up one of its jacks and releasing it away from the patchpoint.

Cable colors are determined by the color of the module where you start dragging the wire. If want to change the color of the cable, simply double-tap on one of its patchpoints to cycle through all available colors.

STACKABLE CABLES

You can plug multiple cables into each output. Simply long-press on an output patchpoint that is already in use to add additional cables to it. For example if you want to send the same EG OUT signal to multiple modules you can do so using this stacking mechanism.

1. VCO (OSCILLATOR) MODULE

Solderbox has two oscillators. Each can be addressed individually, and VCO 2 can be used as a FM modulator for VCO 1.

When the supersaw oscillator (SUP) is selected in VCO 1, the FM knob functions as a detune knob instead - affecting the spread of its 7 sawtooths.

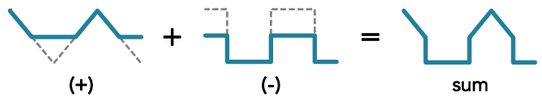
VCO 1 CV is normalized to VCO 2 CV. So when nothing is plugged into VCO 2 CV, it will receive the same input CV as VCO 1.

The output of VCO 2 is not patched into anything by default. You'll need to wire it up yourself if you want to hear it, or mix it with VCO 1 using the utility module.

2. WAVESURGEON MODULE

The wavesurgeon combines two rectifiers with attenuverters and allows you to split one or two waveforms (sounds or LFOs) into positive and negative halves. You can then use the attenuverters to flip or fade these independently and optionally recombine them into a completely new waveform.

So this modules allows you to generate waveshapes that would otherwise be impossible to generate.



The wave that is fed into ***surgeon in (+)*** will have its negative part removed. The wave going into ***surgeon in (-)*** will have its positive part removed.

If nothing is wired into (-) then the input for (+) will be used for both halves.

3. SHAPERS MODULE

The shapers module applies one of various different waveshapers to the signal. When modulating the shaping amount, the knob sets the maximum distortion level, and all modulation happens between 0 and the knob's setting.

4. NOISE & RANDOM MODULE

The noise knob selects the character of the noise output, seamlessly fading between:

BROWN NOISE > WHITE NOISE > SAMPLE & HOLD NOISE > CRACKLE

There are two separate random value generators (***random I*** and ***random II***). Random values are positive values between 0 and the rand knob's setting.

New random values are generated when a gate signal is sent into ***random trig***, or when the EG module is triggered.

If you want to generate smaller values, set the rand knob to a low setting. If you need the full range between 0 and 1, set the rand knob to the max setting.

5. LPF (LOW PASS FILTER) MODULE

The LPF removes high frequency content from the audio signal. The steepness of the filter can be selected using the 6dB, 12dB, 18dB and 24dB settings. The ***drive*** knob lets you dial in a bit of filter distortion for extra grunge.

Cutoff setting, resonance level and envelope modulation can all be modulated using the patchbay.

When modulating cutoff, resonance and/or env mod, their respective knobs determine the centerpoint of the modulation. So all modulation can go around (above and below) the knobs' settings. Note that this is different from most other modulations, where a knob determines the maximum setting instead.

6. LFO 1+2

These are two individual LFO modules. You can choose to have them run freely (not synced to the current tempo) or have either LFO 1 or LFO 1+2 synchronized to the tempo.

The ***1 x 2 out*** patchpoint sends out the amplitude modulated combination of both LFOs to serve as a slightly more unpredictable modulation source.

7. EG (ENVELOPE GENERATOR) MODULE

Our EG module follows a typical west-coast setup, including a ***rise*** (attack), ***fall*** (release) and optional ***sustain*** mode.

The ***rise*** and ***fall*** settings determine the time it takes to go from 0 to 1, and back to 0. The ***curve*** setting alters the character of the slopes from steep, exponential to linear and slow.

When ***loop*** is enabled the EG will be triggered repeatedly every time a cycle is finished, turning the envelope into an LFO with a very tweakable shape.

The ***cycle loop*** patchpoint sends out a gate trigger signal whenever the EG cycle is finished (regardless of whether ***loop*** is enabled or not). You can use this, for example, to generate new random values for the next cycle.

8. UTILITY

Utility modules tend to be the least exciting - but also most intensively used modules in any modular setup. The Solderbox utility module contains three inputs (each with their own attenuverter).

The input signals can be multiplied (for doing things like signal scaling, or creating AM/ringmod sounds) or summed (for mixing signals together).

In 1 also has a ***slew*** control, which applies an exponential slew rate limiter to the input signal.

Out 1 sends out the slewed and attenuverted signal from ***in 1***.

If nothing is plugged into ***in 1*** it sends out a constant voltage between -1 and 1, which can be controlled using the ***att 1*** knob. You can use this to send out constant voltages to other inputs, or to add offsets to inputs 2 and 3.

9. PULSEQUENCER (+QUANTIZER)

A generative melody generator. See the detailed section on the other page for an explanation of the sequencer algorithm.

The quantizer is a sub-module which quantizes any signal into a melodic scale. By default it is wired into the sequencer, buy you can use the quantizer separately by patching a signal into the ***quant in*** point. Using the quantizer overrides the sequencer's melodic output.

10. VCA

The amplifier controls how much of the generated signal is audible. By setting the ***eg/on*** switch to "on", all of the signal will be sent out unattenuated. This is what you could call a drone mode, because it will result in a constant sound.

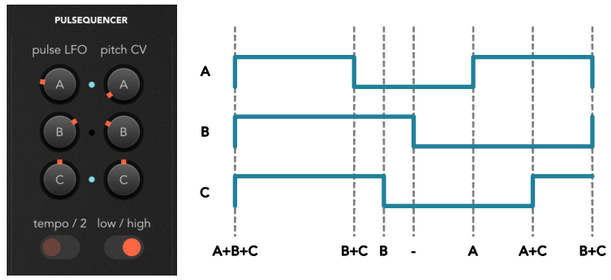
If you set the switch to "eg", the CV patched into vca eg will determine how much of the audio will be let through. Typically you patch the output of the EG module into this patch point (this connection is internally normalized, so we've already done that for you).

12. ENTROPY

This is a hybrid between a cheap digital delay and a bitcrusher. It will delay the left and the right sides of the stereo output separately.

The delay lines are then processed using an 8 bit memory processor, causing each subsequent echo to devolve further into crunchy, noisy digital artifacts.

PULSEQUENCER



The pulsequencer is a generative module, which creates repeating complex melodies using nothing but three simple square LFOs which are synced to the current tempo.

Each of the LFOs has a rate (speed) and a pitch CV (voltage when the wave is “up”). As square waves do, these LFOs constantly bounce up and down between 0v (down) and their pitch voltage setting (up).

So how does it generate a melody? The algorithm is quite simple:

- All three LFOs are constantly running in parallel, going up and down
- Whenever any of the LFOs changes value (i.e. goes up or down) a trigger is generated
- If none of the LFOs are currently “up”, the trigger is discarded (becomes a “rest”)
- Otherwise, all voltages of the LFOs that are currently “up” are summed together
- This means there are 8 possible combinations: rest, A, B, C, A+B, A+C, B+C and A+B+C
- The summed voltage is sent to the quantizer to be transformed into the 7 different note frequencies

These combinations of up to 7 different notes and their timing can be changed by setting the pulse and pitch settings for the three LFOs, resulting in millions of different patterns using only these basic controls.

The ***tempo/2*** applies a tempo divider to the LFOs, making them all run half as fast to generate slower patterns. The ***low/high*** switch adds a higher base frequency to all the pitch CVs, which generates patterns using higher pitched notes.

Mutation
If a signal is fed into the ***mutate in*** patchpoint (e.g. by wiring one of the random outputs or an LFO into it) there is a chance for each trigger to have its output voltage to be altered. If the mutate signal is high, the chance of a mutation is also higher.

So if you’re sending a random signal into the mutate patchpoint, you can increase or decrease the chance of a mutation using the ***rand*** knob. Alternatively, if you’re using an LFO with the mutate patchpoint, the chance of a mutation goes up and down with the LFO’s wave.

OTHER GENERATIVE TECHNIQUES

Solderbox was designed to be very versatile when it comes to exploring generative techniques. So there are several other methods for making patches that create their own sound, and which do not require MIDI input, besides using the Pulsequencer.

Drone mode
By setting the ***eg/on*** switch in the VCA to “on” you create a constant output of the whatever is sent to the VCA. This is the easiest starting point for creating a drone. You can then apply LFOs to the filter and other modulatable parameters to create a complex drone sound.

Looping envelope
You can set the EG to loop mode, causing the envelope to retrigger indefinitely. Since the EG is normalized internally to the VCA, you will hear a retriggering note right away. Remember that random values are also (re)generated whenever the EG triggers, so you can use the random outputs to change the sound up in every EG cycle.

Let an LFO trigger the EG
You can feed an LFO output into the eg gate to let it trigger a sound whenever the LFO goes “up”. If you use a S&H LFO you never know when it will go across the threshold, but you can sync it to tempo to make sure it will always be in a rhythmic pattern.

INSTABILITY ENGINE

Solderbox has a built-in “instability engine”, which mimics the subtle behavior of analog fluctuations in electronic circuits, leaky signals, crosstalk between components and other unpredictable elements.

The result is a synthesizer that behaves less digital and more like a living organism with an analog soul.

USING SOLDERBOX AS A PLUGIN INSTRUMENT

The optimal, and most versatile, way to run Solderbox, is to load it into a plugin host app so you can conrol it with MIDI and combine it with other plugins.

Solderbox runs as an Auv3 (Audio Unit version 3) plugin, in both instrument and audio effect slots.

When loaded as an instrument it will respond to MIDI input and parameter automation (letting you control knobs using an external controller).

Triggering MIDI notes

When the Solderbox instrument plugin receives a MIDI note, three things happen:

- The EG module is triggered, but only if nothing is wired into ***eg gate***
- The note value is sent to the ***vco 1 cv*** input, if nothing is plugged in yet
- The sequencer is transposed up or down from middle-c (C4/notenum 60)

To reset sequencer transpose to 0 again, either send midinote C4 to the instrument, or doube-tap or drag the ***transpose*** indicator in sequencer

You can use the ***trigger*** button to simulate MIDI notes when you don’t have MIDI input available so you can audition patches.

MONOPHONIC AND POLYPHONIC MODE

For each patch you can optionally enable a 3-voice polyphonic mode so you can play 3 voice chords using MIDI. Note that the sequencer will only work on the first voice. Polyphonic mode requires more CPU power.

USING SOLDERBOX IN AN EFFECT SLOT

When using Solderbox in a plugin host app and loading it as an effect plugin, you can send audio through it and process it in several interesting ways.

In this mode the second oscillator is replaced with an external audio input; giving you access to any sound the host sends through the plugin.

It also automatically serves as the FM modulator, letting you modulate oscillator 1 with the external audio signal.

You can modulate the input level of the external audio input using its respective patchpoint.

The input mode of the external audio can be switched between L+R, L, R and 1V/octave. In the latter mode the input is scaled to a pitch CV signal that is compatible with the 1V/octave signal of various other software modular environments.

You can do creative things with the external audio signal, beside just processing it as an audio signal. You could use it to triggers notes (gate), use the input signal as an LFO or use it to send (communication) signals between different audio plugins.

THE PATCHBAY

Vco 1 cv	in	Receives a voltage which is converted into a note frequency for osc 1
Vco 2 cv	in	Receives a voltage which is converted into a note frequency (osc 2)
Fm amt	in	FM amount, scaled between 0 and the FM knob’s current setting
Osc 1	out	The audio signal generated by vco 1
Osc 2	out	The audio signal generated by vco 2

Surgeon in (+)	in	Input for audio or LFO signal to be processed by the positive half of the wavesplitter
Surgeon in (-)	in	Input for the negative part of the wavesplitter
Out (+)	out	The rectified and attenuverted audio signal from the positive side of the wave splitter
Out (-)	out	The rectified and attenuverted audio signal from the negative side of the wave splitter
Sum out	out	The new hybrid signal created by recombining the positive and negative sides of the wavesplitter

Shaper in	in	Takes an audio signal to be distorted using the selected waveshaper
Shaper amt	in	CV input signal for modulating the waveshaping amount. Scaled between 0 and the amount knob’s setting
Shaper out	out	Outputs the waveshaped audio signal
Noise level	in	Input signal for modulating the level of the noise generator.
Noise out	out	Audio output of the noise generator

Filter in	in	Input for the audio signal to be filtered
Cutoff cv	in	Modulation signal for the cutoff frequency
Reso cv	in	Modulation input for the resonance amount
Env mod cv	in	Modulation input for the amount of envelope modulation
Filter out	out	Audio output for the filtered audio

Lfo 1 rate	in	Input for modulating the speed (rate) of LFO 1
Lfo 2 rate	in	Input for modulating the speed (rate) of LFO 2
Lfo 1 out	out	Bipolar output signal of LFO 1
Lfo 2 out	out	Bipolar output signal of LFO 2
1 x 2 out	out	CV output signal of the amplitude modulated combination of LFO 1 and LFO 2 (bipolar)

Eg gate	in	Gate input for triggering the Envelope Generator
Rise time	in	Input for modulating the rise time of the EG
Fall time	in	Input for modulating the fall time of the EG
Cycle loop	out	Sends out a gate signal as soon as the envelope’s fall segment has finished and the EG either cycles or goes to idle/silent
Eg out	out	The CV signal containing the envelope level. Typically used to modulate another parameter or shaping the VCA output

In 1	in	Input 1 of the utility section (can be audio or CV)
In 2	in	Input 2 of the utility section (can be audio or CV)
In 3	in	Input 3 of the utility section (can be audio or CV)
Out 1	out	The individual output for input 1, with the attenuverter and slew rate limiter applied to it. If no wire is plugged into “in 1” it will send out a constant voltage between -1 and 1.
Mix out	out	The summed (mixed) or multiplied output of all used input channels

Quant in	in	A voltage to be quantized to the currently selected note scale (using this input will override note output of the sequencer)
Mutate in	in	CV input for controlling the % chance of a mutation in the sequencer output
Quant out	out	Outputs the quantized signal of either the sequencer or the “quant in” input Typically patched into “vco 1 cv” when using the sequencer
Unquant out	out	Unquantized output of the sequencer, using this signal will result in atonal frequencies
Trig out	out	Gate trigger signal when the sequencer sounds out a new note. Typically patched into “EG gate” when using the sequencer

Vca in	in	Input for the audio signal to be amplified and be sent out to the output of Solderbox
Vca eg	in	The envelope CV signal to be applied to the audio signal sent into the VCA. Typically this will be “EG out”
Random trig	in	Gate trigger input for generating new random values
Random I	out	Random voltage between 0 and the rand knob’s setting. This is a constant signal until a new valiue is generated
Random II	out	A second random voltage between 0 and rand knob’s setting

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