ALPHA

Unit Collection

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Preface

Originally conceived by the Research And Development department of the IEC as a way to test CUIS connections; the Alpha collection of units has proved to be a trustworthy base in the repertoire of designer's toolboxes. They cover all connection types and allow for the basic control needed to both understand the standard, and perform essential tasks - like splitting or combining transmissions.

The units in this collection were designed with the intention of getting projects off the ground. They provide basic functionality allowing users the basic abilities they need to work with the CUIS design. These are no-frills, milquetoast units designed with essential uses in mind. Batteries are included however, and efforts have been made in the designs to ensure that they are accessible and understandable, with a wide range of functions and control.

You'll likely find other units with similar abilities as those included in this collection, that are better designed with more features; but those will all be improvements. These are the originals.
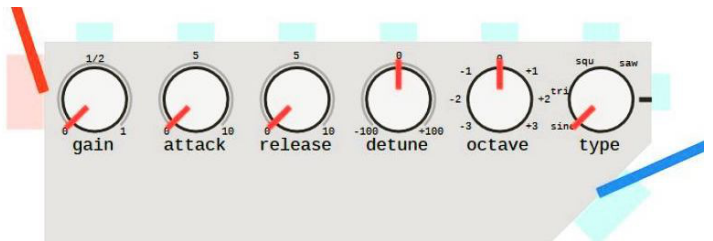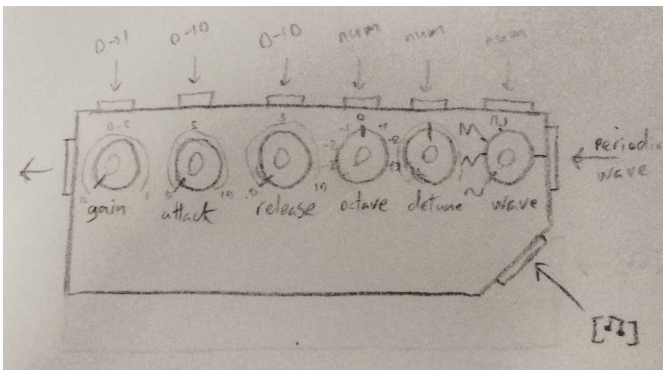
A trip down memory lane; the original designs for these units had a rather more stark feel with a reduced colour palate. As development progressed, the art department managed to get their way and have the units actually look good.

Top-left; the original design for the Basic Synthesizer.
Top-right; an early prototype of the Basic Synthesizer.
Right; the current design for the Basic Synthesizer
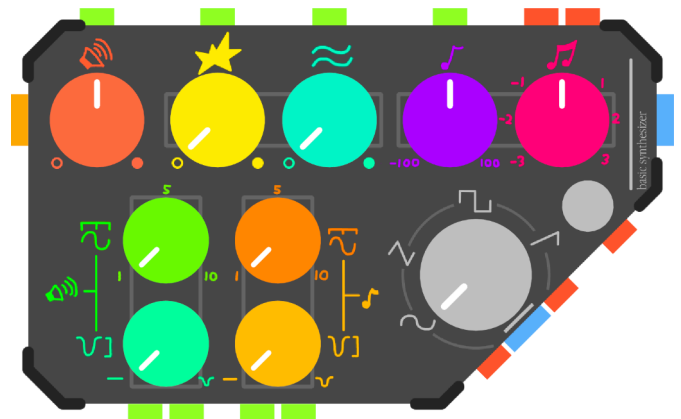
Monitors

Units of this group are used to convert transmissions into human-readable content - or indeed human-listenable content. Though not exhaustive in their ability, they provide a useful glimpse into the digital world.

Amplifier

Similar to any other amplifier; this unit converts audio transmissions into actual sound for a human to hear. Audio connections only contain one stream of audio, so to achieve stereo one needs to deal with the left and right streams separately. There are two audio inputs, for right and left stereo.

The unit has no input amplitude nor panning control; it is intended to be a direct representation of the audio transmission it receives.
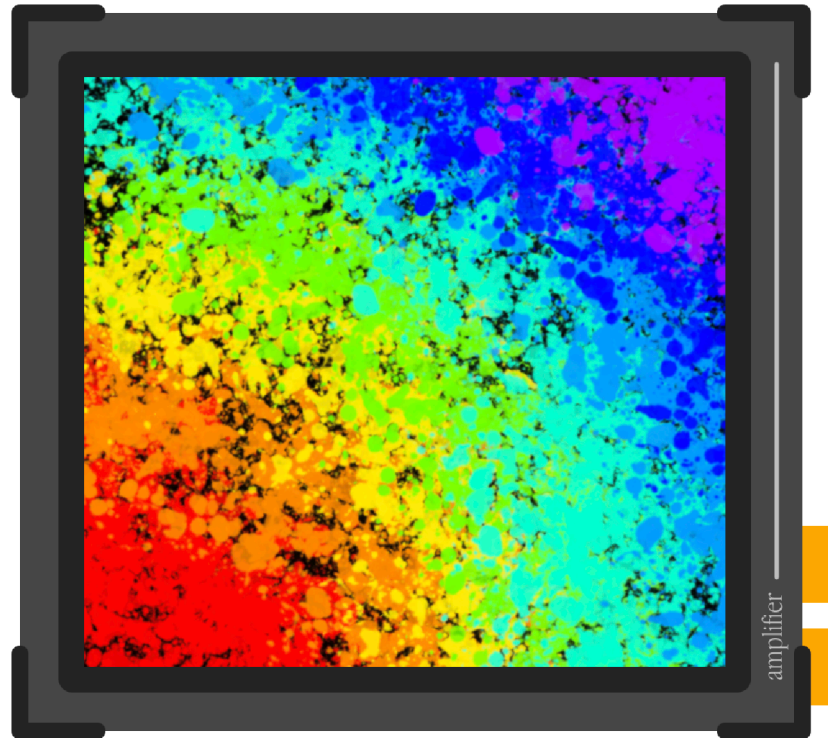
Audio Recorder

As the name suggests, this unit can be used to recored the audio transmissions it receives. Recordings can be paused and restarted, while finished recordings can then be saved. Similar to the Amplifier, this unit has stereo input.

- The four lights across the top of the unit indicate the current state; "Empty", "Recording", "Paused", "Full".

- The central LCD screen will display the current recording time, in hours, minutes and seconds.

- The five buttons on the bottom of the unit control the recording; "Record", "Pause", "Stop", "Save" and "Empty".

For example, in the current state we see in the included diagram; the "Empty" light is lit indicating that this unit has no internal recorded data and is ready to start recording. Pressing the "Record" button will commence the recording lighting the "Recording" light. One can pause and unpause the recording with the "Pause" and "Record" buttons; changing the lights accordingly. Pressing the "Stop" button will halt recording, lighting the "Stopped" button. You will be unable to restart recording from this state. You can now use the "Save" button to save the recording to a file. Pressing the "Empty" button will wipe all recorded data returning the unit to the beginning state.

Audio Scope

Audio transmissions can been see as well as heard. The audio scope unit can be used to plot audio transmission onto a graph to allow for viewing. No synchronizing of audio frequency and framerate is performed; you are simply presented with the audio wave as-is.

This unit provides two interface items; a control for the framerate of the device, between 1 and 30 frames-per-second, and a "freeze" button which will cause the screen to hold on a certain frame of the waveform.
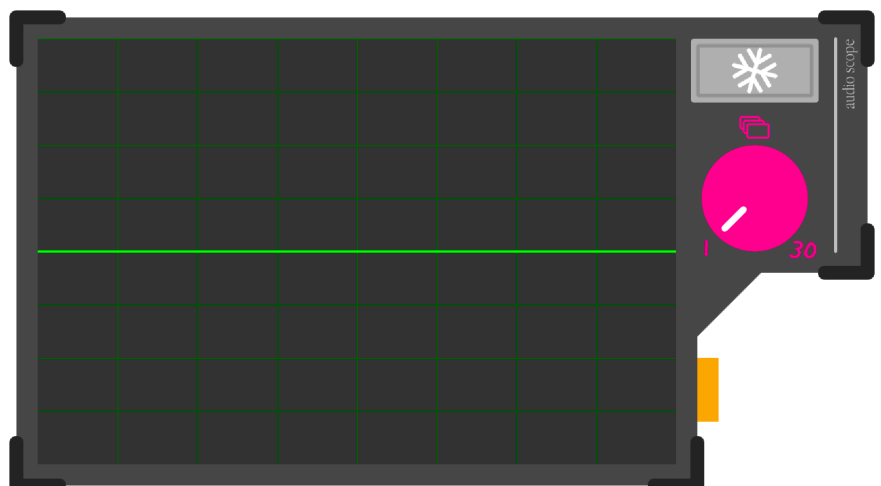
Data Readout

Very simply, this unit is capable of printing out onto its screen, a text-version of whatever data transmission it receives. Typically, this information appears in a JSON format, though some adjustments have been made to the standard parser to incorporate additional data types not covered. The readout has no scrolling functions, nor the ability to control the output in anyway, you are simply presented with the data as-is.
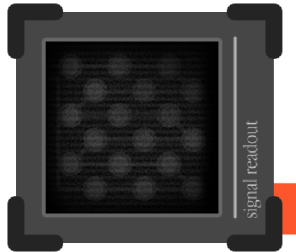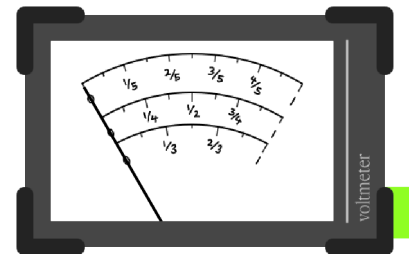
Signal Readout

The simplest of the transmission types also has the simplest of readout's. If the signal is 'active' then the light inside this readout will glow.

Voltage Readout

This unit displays the current value of the incoming voltage transmission. It is limited to a rage of zero to one.

Human Interface Devices

In a fun twist, units of this group do the opposite of those from the previous one. These units are all about converting human actions into transmissions. Similar to their counterparts in the previous section, their abilities are somewhat restricted - not to mention their forms are a little chunky - but they provide essential utility for humans to generate transmissions for a wider system.

Audio In

This unit attaches to your browser's audio-input devices. As such, in creating this unit you may be asked to allow the website to access your microphones. Once allowed, one can use the left and right control buttons to select which of the available inputs to use - the name of the selection appearing on the lower LCD screen.

To the left is a meter visualizing the incoming audio, and to its left is a master control of amplitude, ranging from x0, to x1 to x2 (represented as an empty circle, filled circle and filled square respectively) Finally, the collected audio is produced from the audio connection on the left of the unit.

In addition, above the left and right control buttons, two signal input connection ports are available, allowing the input device to be selected externally.
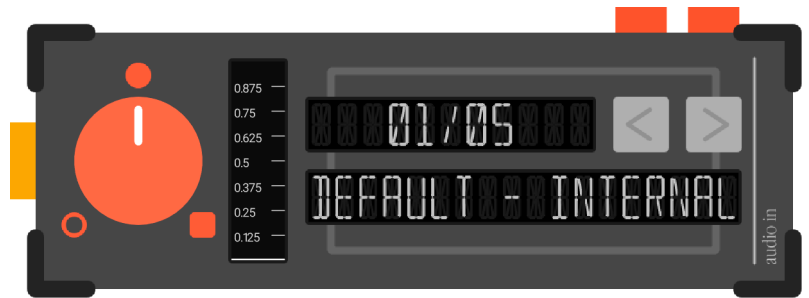
Musical Keyboard

A very familiar sight to many, the musical keyboard is a four octave keyboard. The keyboard is not touch sensitive, though one can control this value using the blue dial on the left side of the unit, which itself can be externally controlled by a voltage transmission, entering the connection underneath. It ranges in value from zero to one (represented as an empty circle and a filled circle respectively) By pressing a key, a data transmission is sent from the data connection on the left, using the "midinumber" data format. Pressing a key will also activate a corresponding signal connection located at the top of the unit, along with a fun red LED which all of us here at the IEC agree looks pretty cool.

Additionally, the signal connections on the button of the unit can be used to activate keys, while the data connection on the right will interpret data transmissions of the "midinumber" data format, pressing the matching key. Therefore, this unit can be used as a translation point between signals and midinumber data transmissions.

Finally, by hovering your mouse over this unit your real typing keyboard will be connected, allowing for musical typing.
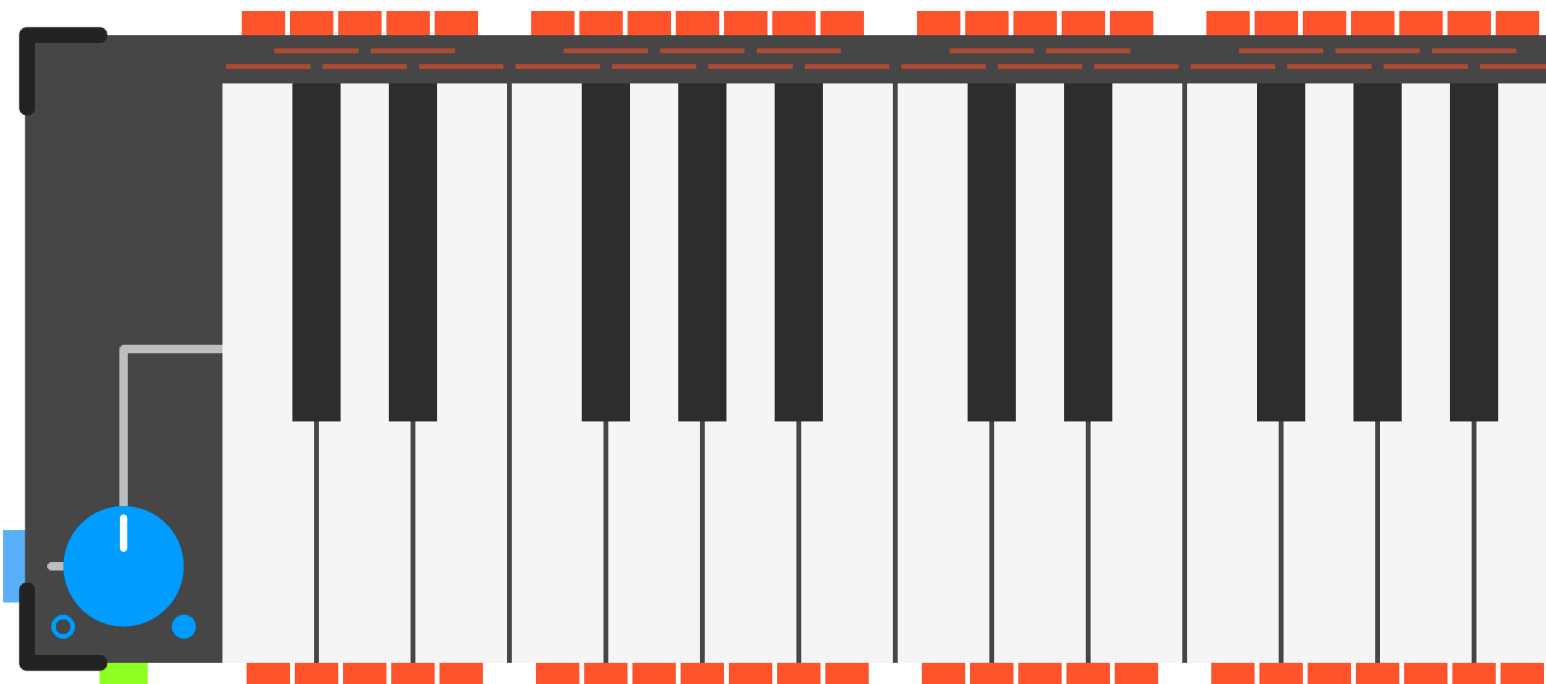
Signal Switch & Voltage Dial

These two simple controls correspond directly to their readout counterparts in the monitors section. The signal switch is a basic switch, producing either an 'active' or 'inactive' signal. The voltage dial produces a voltage value between zero and one (represented as an empty circle and a filled circle respectively)

signal switch

voltage dial

musical keyboard
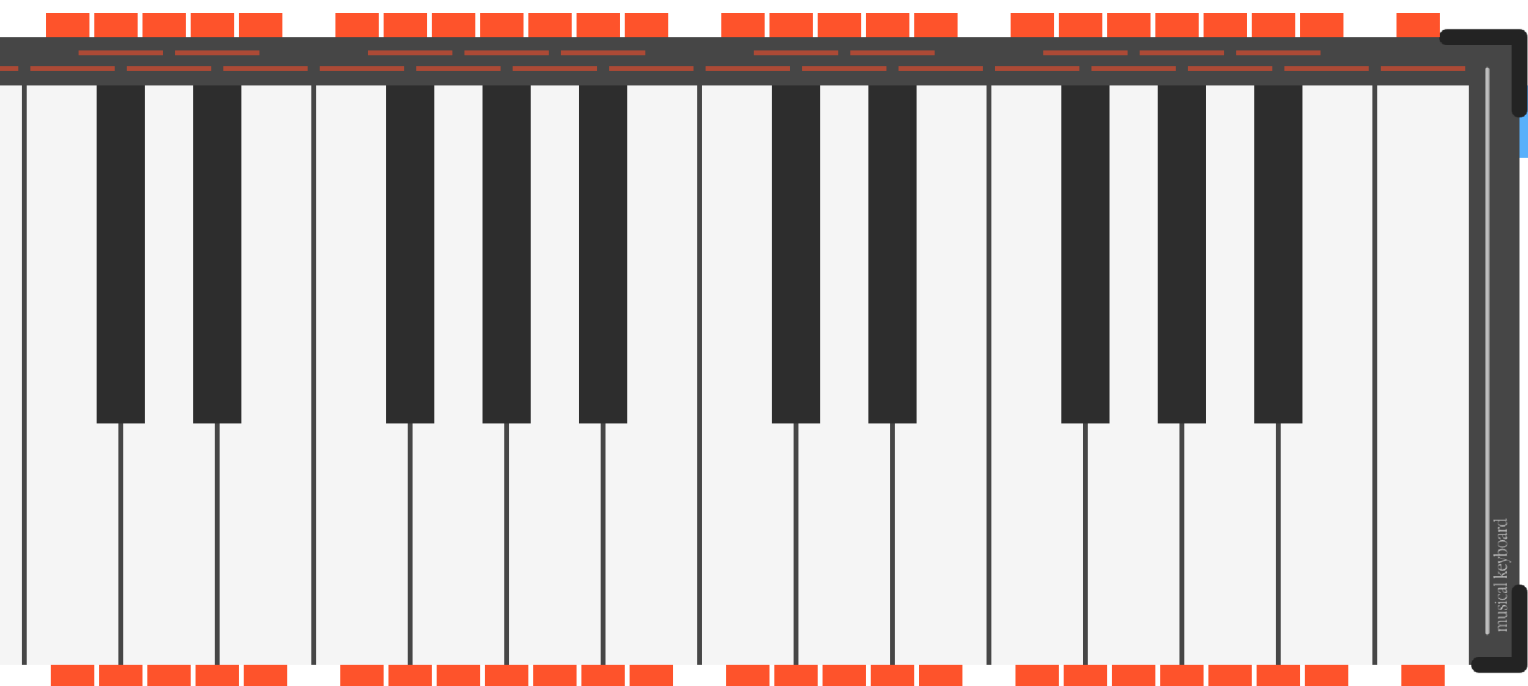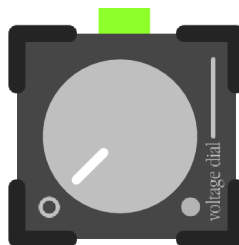
Sequencers

These units are used to generate transmissions in a defined pattern over time. They can be used to add a repeatable timed element to a system - as with the Pulse Generator - or for producing a repeatable pattern of events, that you can use to activate other units.

Pulse Generator

A pulse generator is a unit with a built-in timer which will produce a short repeated Signal transmission. One selects the "pulses-per-minute" value using the upper and lower banks of buttons, with the selected value displayed on the LCD screen in the centre. In the diagram's case, it is set to 120ppm. Left of this screen is 'sync' button, which will reset the generator's timing cycle start point to whenever the button is pushed.

All buttons on this unit have signal connection points which can be used to control it externally. The minimum value is 0.001ppm. The maximum value is 999.999ppm, though higher ppm rates are not recommended due to inaccuracy of the internal clock.
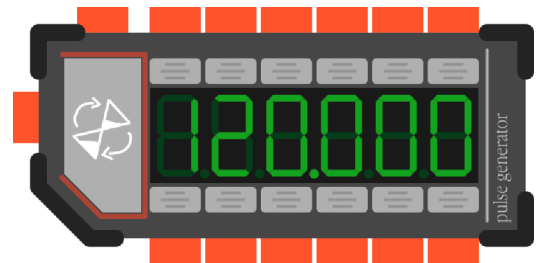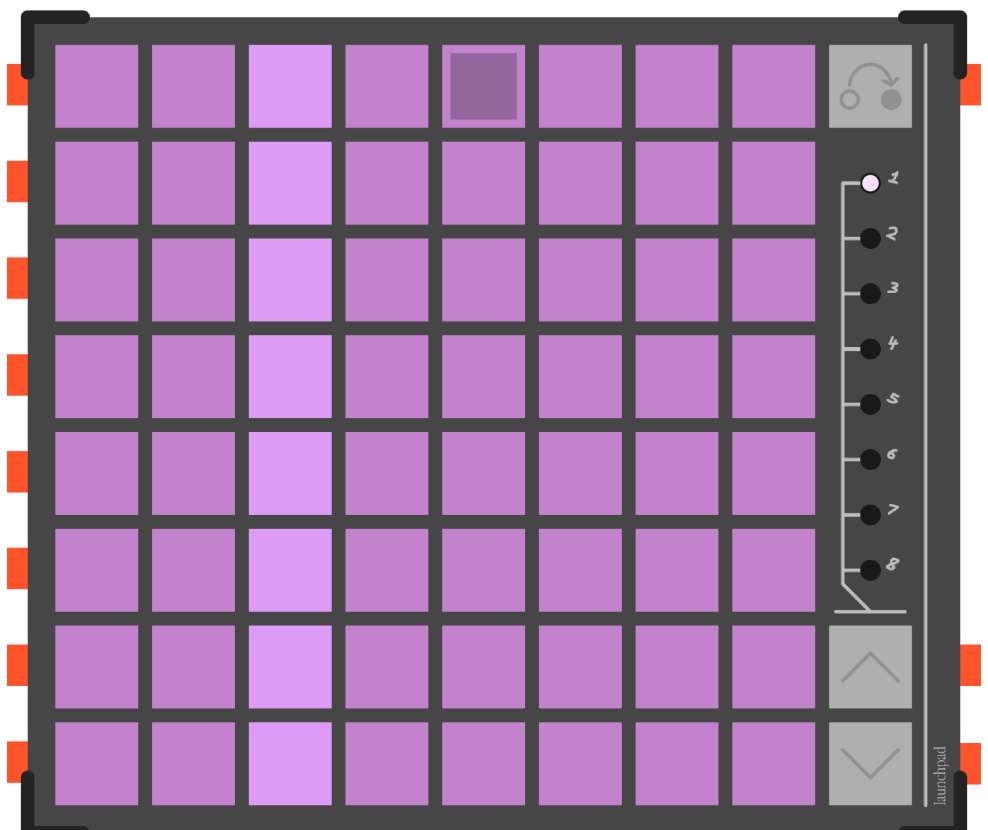
Launchpad

This unit is the first of the two major sequencers of this collection. The Launchpad enables one to design eight patterns of eight channels of signal sequences, each with eight steps.

That's a lot of eights, so let's take it one eight at a time; first take a look at the top right of the unit. Here we can see the "Step" button, and its associated signal connection port to the right. Pressing the button or receiving a signal here perform the same action; advancing the selected column. You'll know which column is selected as all the purple buttons in that column will glow; in the diagram column three is selected. Each time the Step button/connection is activated, the next column to the right is selected, deselecting the previous one until the right-most column is reached. After which, the left-most column will be selected on the next step and the sequence will start all over again.

The eight-by-eight grid of purple buttons can be broken down into eight rows. Each row doesn't effect the others and all act in exactly the same way, so lets just focus on the top row for now. This row of eight purple buttons is the sequence for the signal connection on the left. The purple buttons can be either 'active' or 'inactive', which you can toggle by pressing them. In the diagram, button five is 'active'. When the selected column comes to a button that is 'active' the signal connection will activate. It will deactivate when the column progresses to a button that is 'inactive', or if it progresses to a button that is 'active' it will send an 'inactive' then 'active' signal.

The final eight is related to something called "pages". On the right of the unit you can see a column of eight LEDs with numbers written next to them, below which are control buttons for changing which LED is glowing. As with the step button, there are also associated signal connections to the right of the two buttons. Also, similar to the column; attempting to select a LED above the top-most will cause the bottom-most LED to activate, and vice versa. This is the Page Select mechanism. Each page contains an eight-by-eight grid of button states, thus allowing you to create a pattern on one page, then select a different page to create another pattern on the grid. You can then return to your first pattern by simply re-selecting the page it's on. In the diagram we can see that page one is selected.

Eight Step Sequencer

The other major sequencer, this unit is used for generating patterns of transmissions of the "midinumber" data format.

Similar to the Launchpad, on the top right of the unit sits the "Step" button, and its associated signal connection port to the right. Unlike the Launchpad however, below this button is a direction control switch, allowing one to decide if the unit should progress to the right or left. This switch has signal connection ports to its right which can be used to select its position. As before, stepping off the left or right side of the sequence will cause the selection to jump round to the other side.

The main body of the unit contains eight vertical sections. Each section is a step in the sequence and consists of the same controls which are used to define what musical note information is sent from the data connection on the left of the unit. You can tell where in the sequence the unit is by looking at the rectangular LED at the top of these sections. In this diagram section two is selected.
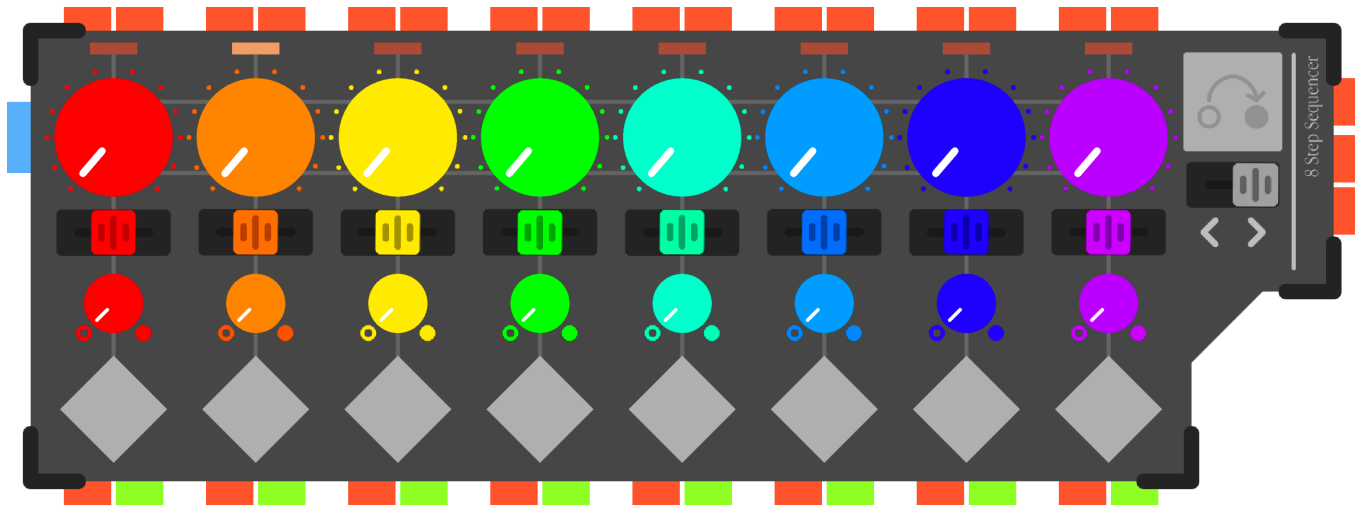
Each section contains the same five elements top to bottom they are;

1. Column LED - this tells you if this section is active

2. Note - a discrete dial allowing you to select one of the twelve notes in an octave

3. Octave - a three position switch with which you select the octave

4. Velocity - a dial to select the velocity of this note

5. Activation - a button which immediately selects this section

Each of the control items in each section have associated connection ports at the top or bottom of the unit. The two signal connection ports at the top decrement and increment the section's note respectively, adjusting the Node dial and Octave switch accordingly. Unlike column selection, decrementing the lowest note does not lead to the highest, nor does incrementing the highest note lead to the lowest. The signal connection at the bottom of the unit activates the Activation button, and the voltage connection point beside it controls the Velocity dial.

Synthesizers

Synthesizers are units that are capable of creating audio transmissions. There are two main forms of synthesizer; those that produce sound mathematically, and those that do so from a stored buffer of values. This collection contains one of each kind.

Audio File Player

This unit takes the stored buffer approach. With it, you can load an audio file and play it back, producing audio transmissions from the audio connections on the left of the unit.

Basic operation is very simple; you press the "load file" button on the top right of the unit, then select which file you would like to use. Once it has loaded, the lower LCD screens will fill with information about this file, namely the current position and the file name respectively. In the larger screen above you will see a waveform representation. Clicking on or dragging around the needle on the waveform will select the starting position, or can be used to skip to a different position in the file during playback. Using the buttons on the bottom left - or their associated signal connections below - one can start or stop playback.
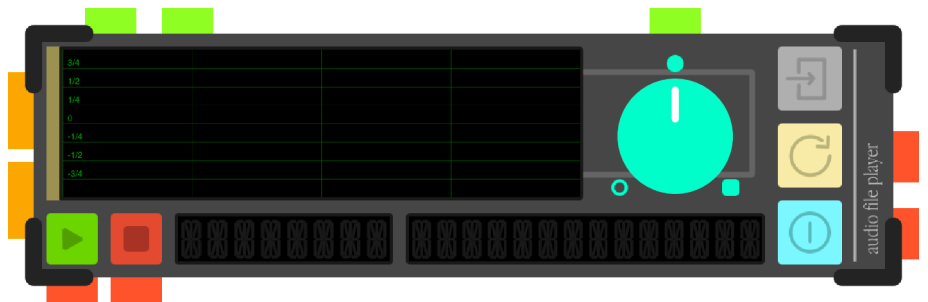
This is basic operation, but there is more to this unit than basic playback of an audio file.

Rate

Notice the dial to the right. This dial can be used to adjust playback rate. The default top position is 1x playback - or normal speed. Counter-clockwise will gradually reduce this to 0x, and clockwise will gradually increase to 2x. This dial can be controlled by the voltage connection port above the dial.

Section

Holding the shift-key down, then click-and-dragging anywhere on the waveform will produce a selected section. When present, the unit will only play audio within this section. You can adjust this section by dragging its sides, or move the whole selection by dragging its body. Double-clicking will remove the section. The section can also be controlled using the two voltage connection ports on the top left of the unit. With this method, setting both the voltages to zero will remove the section.

Looping

Activating the yellow button on the far-right of the unit - which can be done by either pressing it or using the associated signal connection port - engages the unit's looping mode. In this mode playback will continuously loop until told to stop.

Multi-Playback

Activating the blue button on the far-right of the unit - which can also be done by either pressing it or using the associated signal connection port - engages the unit's multi-playback mode. This mode allows you to have more than one stream of the audio file playing at once. Activating this mode, you will notice that the left LCD screen which normally displays the current time, now displays the number of playbacks occurring. Pressing the play button multiple times will start a multiple playback streams. All streams will be stopped when the stop button is pressed.

Basic Synthesizer

Complimentary to the previous unit, this unit produces audio mathematically. Overall, the intention of this unit is to convert data of the midinumber format to produce the appropriate sound. This unit can seem rather daunting thanks to its large number of controls, but rest-assured, its friendlier than you think.

For this unit, there are only really two connections. All other connections and controls are just there to modify and control this core path. The two connections are the audio connection on the very left, and the data connection on the very right. Data messages of the midinumber format are sent in to the right, and their sounds are performed out the left. Midinumber data messages come with a velocity indicating how loud the sound should be. These notes will sound forever until another midinumber data message arrives with the same note selected, but with a velocity of zero.

And that's it, that's the whole unit. Notes in the right, sound out the left. Everything else is frills.

The Frills

There are eleven controls which modify the core path, each with their own connection port for external control. Let's start from the top left.

Gain

The first dial, situated to the top left of the unit, controls the overall volume of the sound produced by the unit. A voltage connection for this dial can be found above.

Attack And Release

The next two dials to the right of the gain dial control the attack and release of any performed note. This translates to meaning the amount of time it takes for a performed note to reach full volume, and how long a stopped note will take to fully stop sounding.

Both dials range from zero to one second, and can be controlled using the voltage connections above each.

Detune And Octave

The final two dials on this top row of controls are responsible for the pitch of performed notes. The left dial is used to detune the notes, slightly modifying their pitch. The second selection dial modifies their octave, ranging from lowering the note by three octaves to raising it by three. Associated voltage and signal connections can be found above both dials.

Modulation

To the lower left of the unit, you can see four dials, vertically grouped together. The left grouping controls Amplitude Modulation while the right controls Pitch Modulation. Both have a similar control scheme Modulation of time period is at the top, ranging from once a second, to ten times a second. Modulation of depth is on the bottom, which ranges from no depth to 100%. Both sets have associated voltage connections at the bottom of the unit.

Waveform

This discrete selection dial is used to determine the waveform that the unit will use for all sounding notes. It is the grey dial located to the right of the machine. There are 5 options to choose from; Sine, Triangle, Square, Sawtooth and the custom user input, which uses the periodic-wave data format (if no connection is made, this option will default to Sine) Each waveform type is represented by a little icon of what the waveform will look like on a graph. Custom user input can be selected by pointing the selection dial at the data connection to the lower right, in which periodic-wave data messages can be received. The surrounding two signal connections are used to step the selection dial clockwise and counter-clockwise.

Panic

This finial button is primarily for emergency purposes. It is the small grey button located to the far right of the unit. Pressing this button will stop all currently sounding notes. As always, the associated signal connection - to the lower right - will perform the same action.
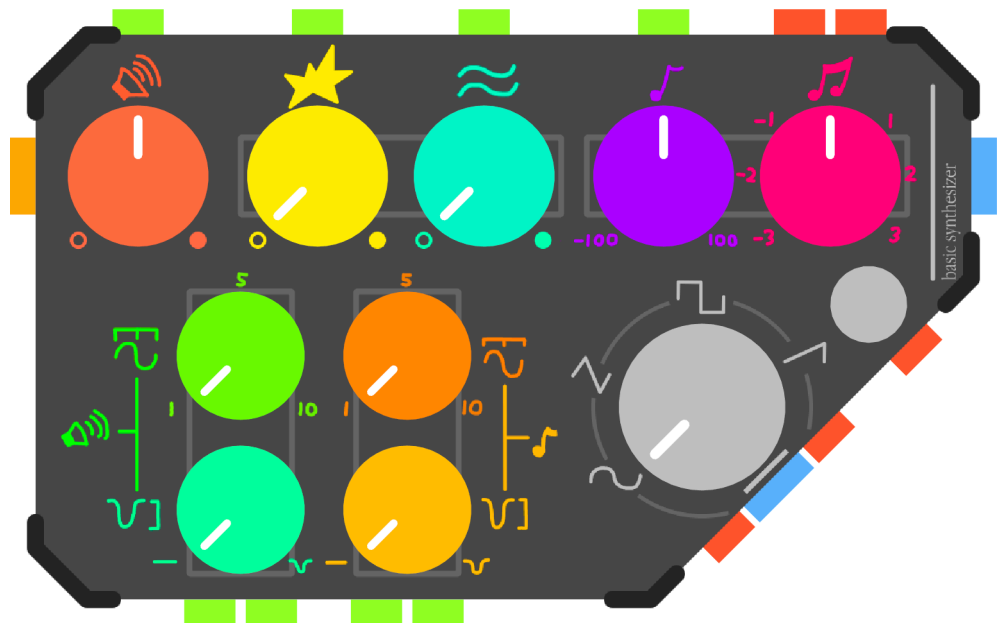
Audio Effect Units

Audio effect units are all about modifying audio transmissions in different ways. There are many many kinds of effect unit possible, but this collection has focused on three of the most common.

Distortion

This unit implements a non-linear distorter, using a curve to apply a wave-shaping distortion to the audio. Beside distortion, it can also be used to add a warm feeling to the sound. Audio transmissions enter using the audio connection on the right, and leave from the audio connection on the left.

The unit has five controls, each with associated connection ports for external control. The lower two dials on the right and left control audio signal gain before entering and after exiting the main distortion circuit within the unit.

The upper left dial controls the distortion amount, changing the steepness of the mathematical curve used in the shaping of the wave. The upper right dial controls the resolution of this curve, ie how many discrete values will be made, which will be subsequently passed to the internal wave-shaping circuitry. Lower values can produce a more digitized effect to higher ones.

Finally, the slider in the centre is used to select the level of oversampling to be used. Oversampling is a technique for creating more samples (up-sampling) before applying the distortion effect to the audio signal.
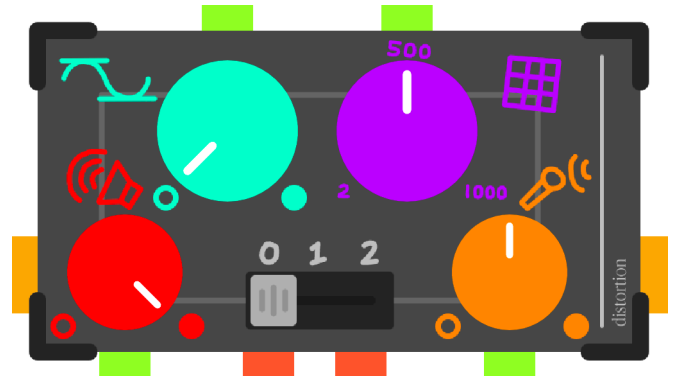
Filter

The simplest of the effect units, this unit can be used to enhance or reduce the amplitude of certain ranges of audio signals; either the low rage, mid range or high range. One can adjust these values using the three dials respectively. Audio transmissions enter using the audio connection on the right, and leave from the audio connection on the left.
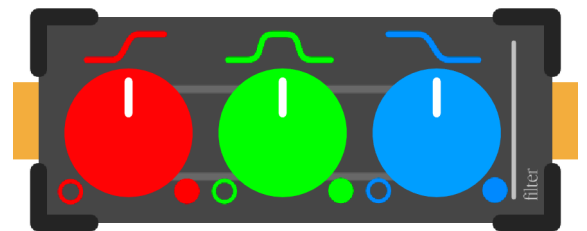
Reverb

Using a convolution processor, this unit can combine incoming audio transmissions with an array of pre-recorded impulse responses to produce a audio signal with the reverb effect. Audio transmissions enter using the audio connection on the right, and leave from the audio connection on the left.

The internal memory contains 38 impulse responses to choose from. One can see which of these are selected with the LCD readout on the left of the unit, and change this section using the up/down buttons in the centre. These buttons can be controlled externally using the signal connection ports on the top and bottom of the unit.

The two dials to the right, control how much of the resulting audio signal is made up of either the convolved audio, or the un-effected audio. Colloquially these are referred to as the "Wet" and "Dry" controls. The right dial being "Wet" control, and the left for controlling "Dry". As usual, below these dials are voltage connection ports which can be used to control these dials externally.
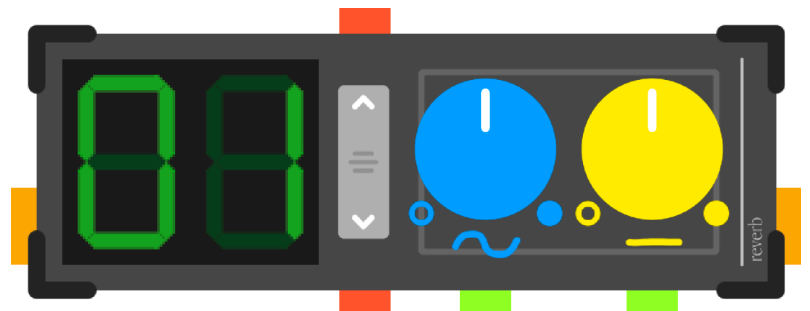
Routing

This section of the collection is all about brining transmissions together, or duplicating them out. The first sub-section contains eight simple combiners and duplicators, which can be used to allow basic manipulation of transmission streams. The second section is dedicated to a multi-track audio mixer, which in itself shows the possibilities for advanced control over multiple transmission streams.

Combiners And Duplicators

Every transmission type comes with its own pair of combiners and duplicators, which as their name suggests can be used to combine two transmission streams into one, or duplicate the transmissions of one stream into two.

All pairs are uniform in their actions, except the Voltage and Audio combiners which come with a "mix" slider, allowing one to select the weighting of the incoming transmissions' effect on the output. Each of these units come with a voltage connection port to allow for external control of this value.
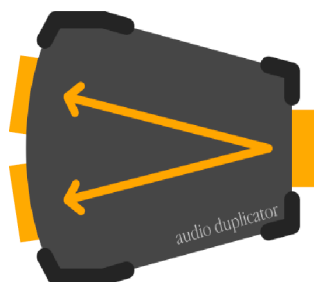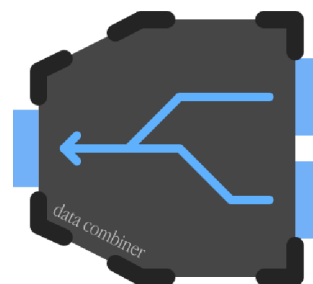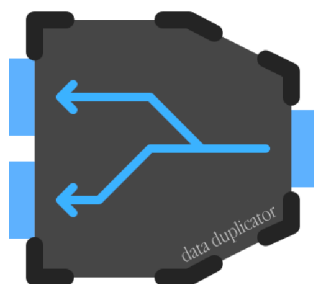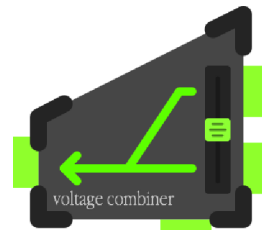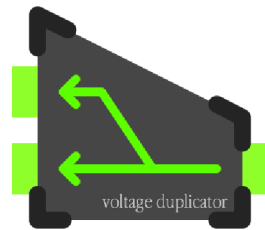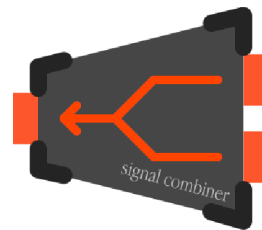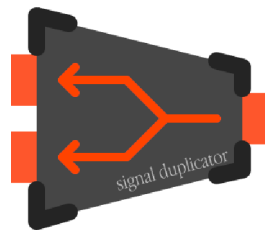
Eight Track Mixer

The Eight Track Mixer can be seen as a more advanced audio combiner unit. It takes eight streams of audio, and mixes combines them together into two output streams. Each of the input streams has its own gain control slider and a left-right panning dial.

Along the bottom of the unit, one can see the input connection ports for the eight audio streams. These streams move up through the unit to have their gains controlled by the eight vertical sliders, which effectively multiply the incoming stream by the value set on the slider. Zero at the bottom, one in the middle and two at the top. After this, the streams move into the eight pan control dials, with which one can control how much of each stream will be sent to either of the two output streams. These values vary from "all to the left" to "all to the right" with a balance of the two in the middle. The mixed audio is produced from the two audio connection nodes at the top of the unit.
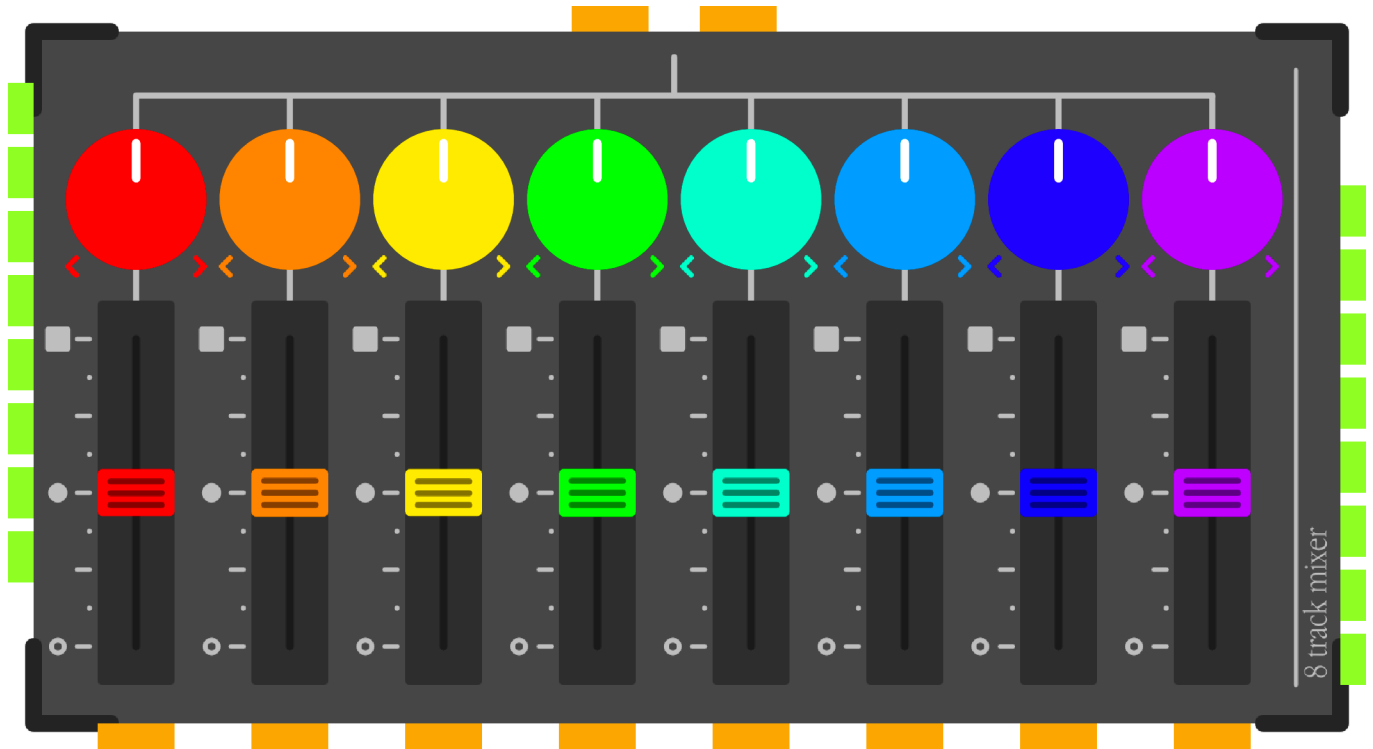
Along the sides, one can find a number of voltage connection ports. These ports can be used to control the values of the gain sliders and panning dials externally. The connections on the left of the unit control the panning dials. The top connection controls the right-most dial, with the next connection port down controlling the next dial to the right, and so on. The right-side connection ports follow a similar pattern, with the top connection port controlling the right-most slider, the next connection port down controlling the next slider to the right, etc.

Tools

No collection would be complete without a small collection of spare parts. This section contains some items that we accidentally ordered too many of, so thought others might find useful.

Ruler

A one meter long metal ruler with markings for every centimeter. Precision designed for by the good people at