

Frequency Modulation, signal input and depth control scaled in V/octave.

Length Modulation, signal input and depth control scaled in V/octave.

Input Amplifier, exponential gain applied to convolution and bucket brigade delay.

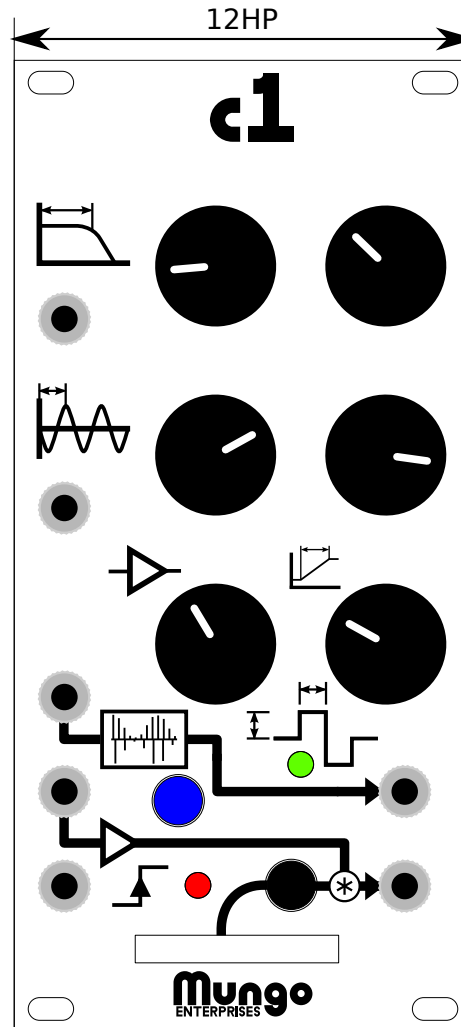
● Alternate, sampling bit depth from 8 to 20 bits.

Sampling Input, audio input for sampling channel.

Convolution Input, audio input for convolution channel.

Clock Input, frequency tracking input.

Mode Button, changes sampler mode when pressed. Holding in zoom (+) selects interpolated output. Neutral zoom selects automatic variable rate sampling. Holding out zoom (-) selects fixed rate sampling, pressing a second time toggles ● alternate knob modes.



Frequency Offset, added to modulation sets the frequency of the sample rate conversion and convolution.

Length Offset, added to modulation sets the length of convolution or number of steps in bucket brigade delay.

Slew Limiter, variable slew rate applied to the linear frequency and length. Exponentially scaled.

● Alternate, sampling frequency.

Sampler Output, full range DC coupled output.

Convolution Output, inverted full range DC coupled output.

Function Button, swaps between bucket brigade delay ○ and realtime convolution of both channels ●. Loads waveform from SD card if present. Holding in zoom (+) when pressing button enables interpolation on output.

SD Card, reads 16bit mono .wav files off FAT formatted SD cards from W0.WAV to WF.WAV in sequence. Sample rate insensitive, maximum length 49,000 samples.

Power, -12V 25mA
+12V 160mA operating

Frequency Modulation, signal input and depth control scaled in V/octave.

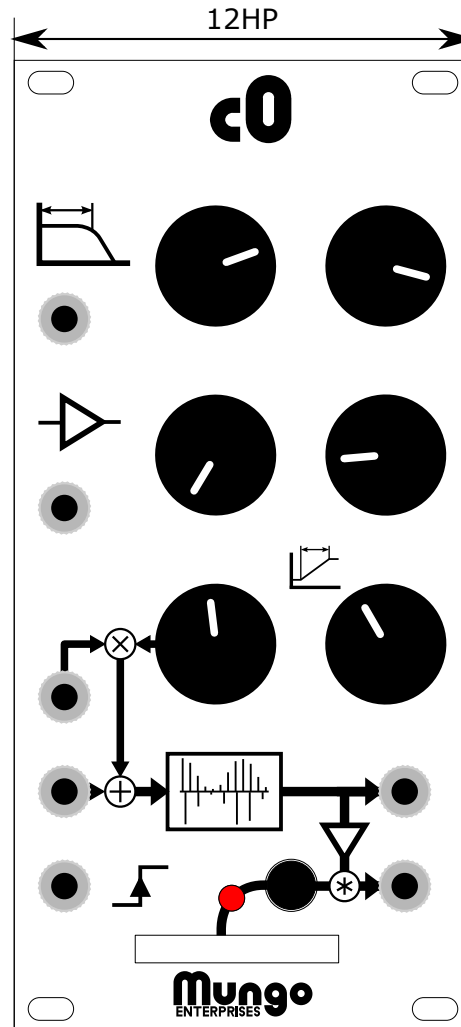
Amplitude Modulation, signal input and depth control for exponential amplifier. Will provide gain to both the modulated signal and the source.

Input Amplifier, bipolar gain control of input amplitude.

Signal Inputs, full range DC coupled inputs. When the zoom control is held in (+) during loading a limited DC cut filter will be applied to the inputs.

Clock Input, frequency tracking input.

Load Button, loads a waveform into the convolution kernel from the SD card, holding the zoom control in (+) while loading will enable interpolation. Holding the button while no SD card is installed will adjust delay time up/down alternately.



SD Card, reads 16bit mono .wav files off FAT formatted SD cards from W0.WAV to W9.WAV in sequence. Sample rate insensitive, maximum length 12,000 samples.

Frequency Offset, added to modulation sets the frequency of the sample rate conversion and convolution.

Amplitude Offset, added to modulation sets the exponential gain applied to the convolution.

Slew Limiter, variable slew rate applied to the linear frequency. Exponentially scaled.

Signal Output, full range DC coupled output from the sample rate convertor.

Convolution Output, full range DC coupled output with gain and convolution applied.

Power, ±12V 25mA
+5V 250mA operating

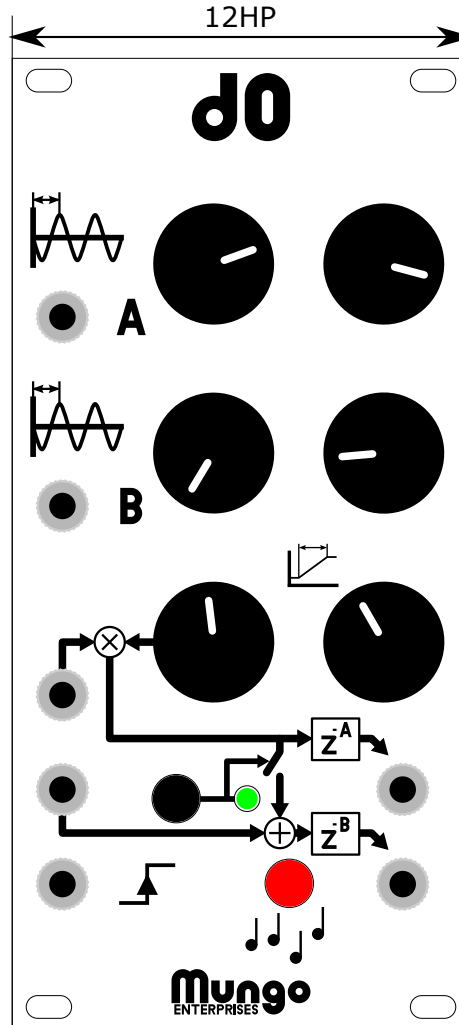
Delay Modulation, independent to each channel, signal input and depth control scaled in V/octave.

Input Amplifier, bipolar gain control of channel A.

Signal Inputs, full range DC coupled inputs.

Sum Button, adds channel A into channel B predelay. Holding zoom +/- while pressing this button enables a DC cut filter on the inputs.

Clock Input, frequency tracking input applied to both channels. Delay times remain a fixed multiple of the clock period.



Delay Offset, independent to each channel, added to the modulation and midi note value. Exponentially scaled. Ranges from 0.2 ms to over 2 s.

Slew Limiter, variable slew rate applied to the delay time of both channels independently. Exponentially scaled.

Signal Outputs, full range DC coupled outputs.

Tune Button, generates a C₄ reference square wave on both outputs. Feeding back this to the A input calibrates the delay transit time for tuned feedback. Holding zoom +/- while pressing this button sets the delay time of both channels to track midi note data.

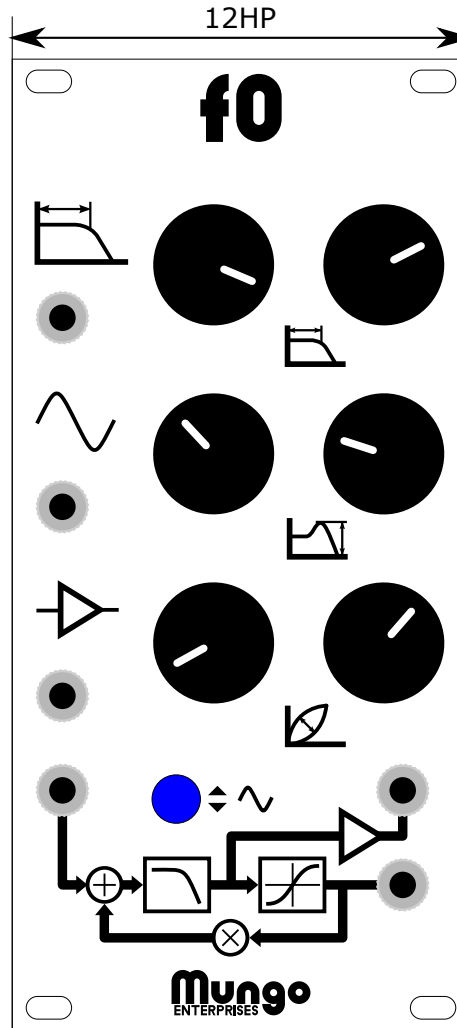
Frequency Modulation, signal input and depth control scaled in V/octave.

Assignable Modulation, signal input and depth control. Can modulate any of the 3 continuous controls to the right by selecting top/middle/bottom with zoom +/- when pressing the function button.

VCA Input, signal input and depth control for exponential amplifier. Will provide gain to both the modulated signal and the source.

Source Input, signal to be filtered.

Function Button, swaps between 12 and 24 dB/octave slope of the filter core.



Frequency Offset, added to modulation and midi note value sets the cutoff frequency of the low pass filter. Scaling is exponential V/octave for both the offset and modulation sources.

Resonance Offset, added to modulation sets the gain of the feedback path in the filter. With appropriate curve amounts and total loop gain the filter will self oscillate.

Curve Offset, added to modulation sets the gain about zero of the curve/distortion component in the signal path. Positive values produce gain and an overdrive distortion type transfer function, while negative values reduce gain and produce inverse (crossover) distortion.

VCA Output, output signal of filter amplified by exponential amplifier.

Direct Output, of filter and curve functions in series.

Depth Modulation, signal input and depth control linearly scaled in volts per second of delay/offset time.

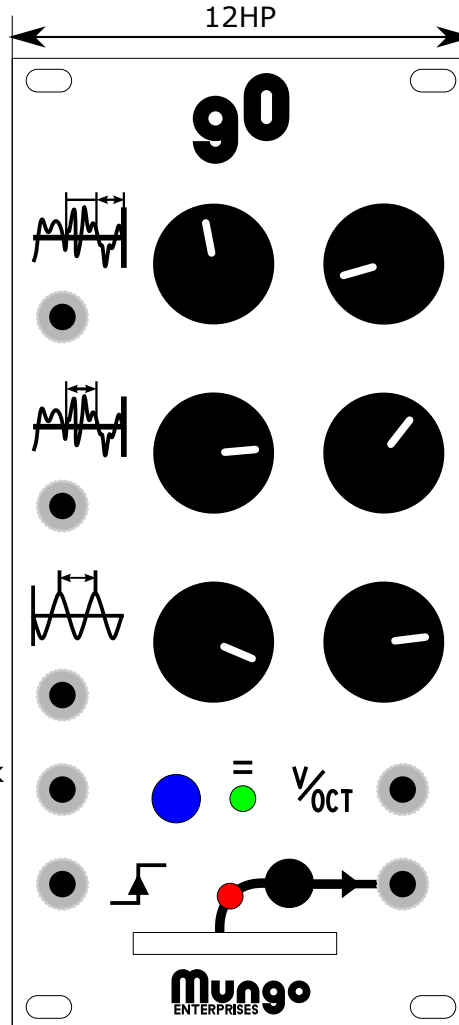
Width Modulation, signal input and depth control linearly scaled in volts per second of audio window.

Frequency Modulation, signal input and depth control scaled in V/octave.

Input, trimmed 1V/octave input during waveform playback otherwise used for input of live audio.

Reset Input, positive going edge triggers reset of waveform playback. High level holds grain or recording in live input modes.

Function Button, swaps between live modes or loads waveform from SD card if present.



Depth Offset, added to modulation sets the offset of the audio window ratiometrically to the remaining buffer within the full waveform.

Width Offset, added to modulation sets the width of the audio window ratiometrically to the full size of waveform.

Frequency Offset, added to fixed and variable modulation and midi note value sets the frequency of the sawtooth core oscillator.

Tracking Button, enables correction of output pitch, hold when pressing the function button to latch setting.

Tracking Output, output signal in V/octave estimating the frequency of the input waveform.

Audio Output, output signal of modulated audio.

SD Card, reads 16bit mono .wav files off FAT formatted SD cards from W0.WAV to W9.WAV in sequence. Sample rate insensitive, maximum length 500,000 samples.

Power, ±12V 25mA
+5V 125mA operating

Live Mode, the function button swaps between the two live modes when an SD card is not installed.

While the LED is lit the hold mode is enabled, it samples the current grain at a positive going edge on the reset input and continues to play this until a negative going edge ignoring any changes to the window depth or width while held. Note, the buffer will overflow if the hold is maintained for many seconds and the grain will glitch as it jumps to the new data.

Swapping to the record pause mode (LED unlit), holding the reset input high will disable filling the buffer. This can be used to sample live sounds for manipulation as all functions operate as normal, but while paused all incoming sound will be lost.

Playback Mode, the function button cycles through the wave files stored on the SD card if inserted. Once a file is loaded the card can be removed and the sound will remain in memory until the function button is pressed again to change mode or load another sound.

Files named W0.WAV to W9.WAV stored in the root directory of the card will be loaded in sequence one at a time. They must be 16 bit mono wave files in the .wav format, the sample rate is ignored and up to 500,000 samples can be loaded into the buffer for realtime manipulation.

Interpolation, holding in zoom (+ or -) when loading a waveform or changing modes will enable interpolation of the output audio.

Grain size, has a strong effect on the resultant sounds, adjusting the window size dramatically changes the result.



Window Size in Samples

Dozens or less, maintains only tonal information window size can create strong formants.

Hundreds, microsound fragments that are hard to identify their source.

Thousands, sample fragments where the source is clear but rhythmically devoid.

Tens of thousands, sampling maintaining the rhythmic context of the source material.

Modulation, signal input and depth control modulating the gain of channel 1.

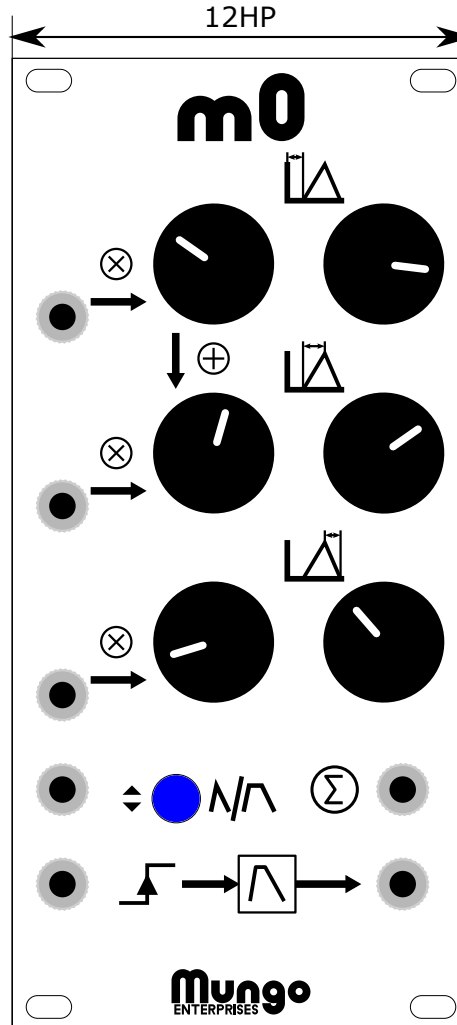
Channel 1, signal input and inverting gain/attenuation.

Channel 2, signal input and inverting gain/attenuation.

Channel 3, trimmed unity input.

Gate Input, positive going edge triggers envelope.

Function Button, swaps between attack-decay or attack-release modes of the envelope. Selecting zoom +/- when pressing the button assigns the envelope to the modulation or channel 2 depth respectively.



Delay Time, period between trigger and attack of envelope scaled exponentially.

Attack Rate, rate at which envelope approaches full scale, scaled exponentially.

Decay/Release Rate, rate at which envelope approaches zero, scaled exponentially.

Sum Output, output signal of all channels summed.

Envelope Output, direct envelope output, 0-10V unipolar.

Width Modulation, signal input and depth control scaled in linear amplitude.

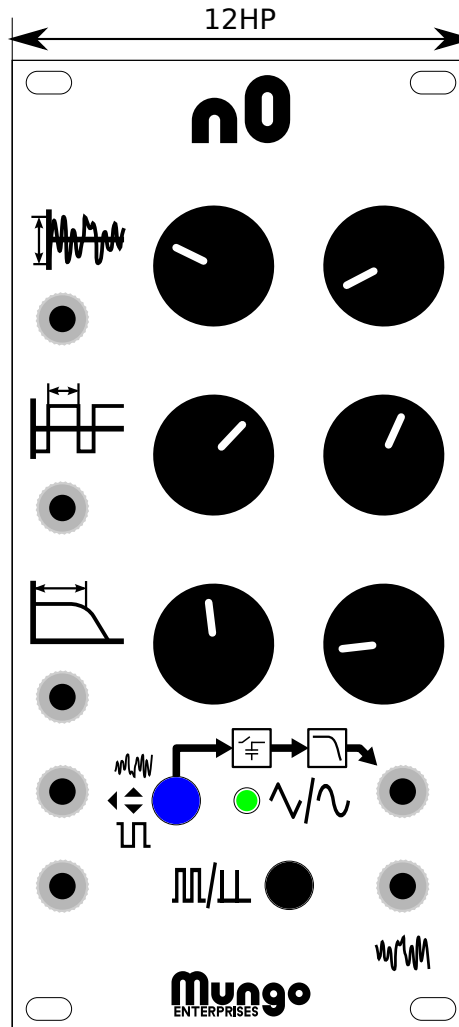
Frequency Modulation, signal input and depth control scaled in V/octave.

Filter Modulation, signal input and depth control scaled in V/octave.

Function Button, swaps between applying the slew limiter or low pass filter to the sampled signal. Selecting zoom +/- when pressing the button selects the source as noise/signal in/oscillator for sampling.

Signal Input, full range DC coupled input, functions as a 1V/octave input when sampling noise/oscillator.

Reset Input, positive going edge triggers reset of oscillator, or sampling if oscillator is stopped.



Width Offset, added to the modulation sets the peak amplitude of the noise signal, maintaining a constant signal power.

Frequency Offset, added to the modulation sets the frequency of the oscillator triggering the sampling. Range includes completely stopped.

Filter Offset, added to the modulation and oscillator frequency, sets the frequency cutoff of the low pass filter and slew limiter functions. Range includes infinite hold.

Sampled Output, DC coupled output trimmed for offset and gain.

Noise Output, unprocessed output from noise source.
Alternate Mode: noise, random gates
sampling, trigger pulse/gate
oscillator, phase shifted (width control)

Sampling Button, swaps between sample & hold and track & hold functions and triggers a sample immediately. Selecting zoom +/- when pressing the button enables midi tracking of the oscillator and filter.

Power, $\pm 12V$ 25mA
 $+5V$ 125mA operating

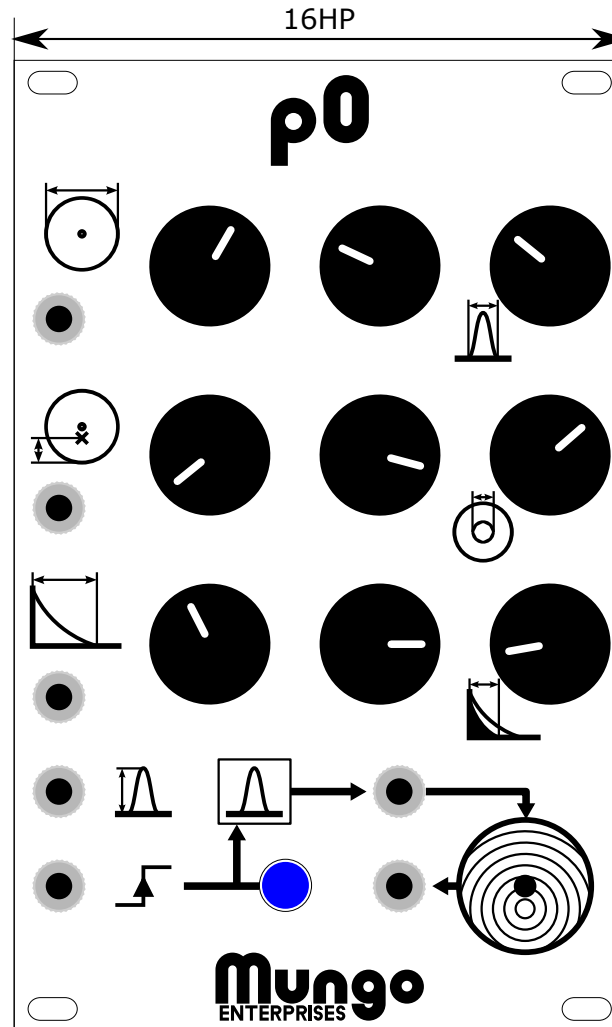
Size, modulation input, depth, and offset control scaled in V/octave. Continuously variable.

Location of strike, modulation input, depth, and offset control used at trigger. Ratiometric of size.

Decay, modulation input, depth, and offset control used at trigger. Exponentially scaled.

Velocity, offset from nominal +/- 5V range.

Trigger Input, positive going edge trigger.



Strike Softness, filter of the impulse.

Central Size, damping area, ratiometric to full size.

Central Decay, decay in central region.

Impulse Output, full amplitude trigger signal.

Final Output, synthesised output.

Trigger Button, manually triggers a strike. Holding + zoom while pressing latches maximum velocity, holding - zoom silences the entire model.

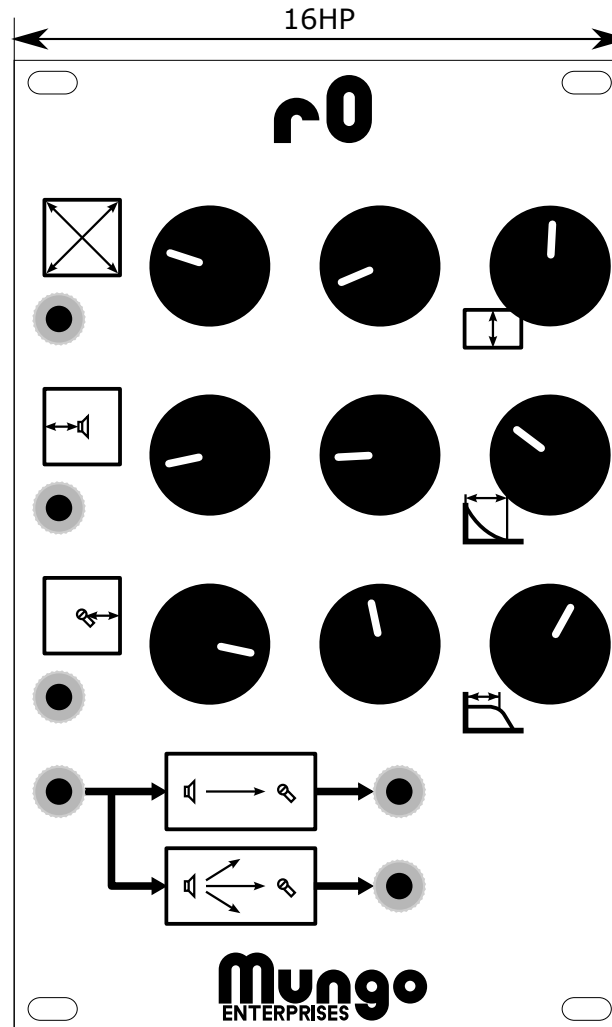
Power, ±12V 25mA
+5V 125mA operating

Size, modulation input, depth, and offset control exponentially scaled. Size of the entire sound stage.

Location of source, modulation input, depth, and offset control. Ratiometric of size from front to back.

Location of pickup, modulation input, depth, and offset control. Ratiometric of source location to back.

Audio input, DC coupled, +/- 10V range.



Width, ratio of width to depth of sound stage. Scaled exponentially.

Decay, exponentially scaled, maintains constant power at output.

Reflection filter, highpass or lowpass filter applied to each reflection of sound.

Direct Output, dry delayed signal without reverb.

Full Output, output including all reflections.

Start, sets the position at start of playback, ratiometrically scaled with the waveform.

Gate Input, positive going edge triggers sampler start and negative going edge triggers the end of looping.

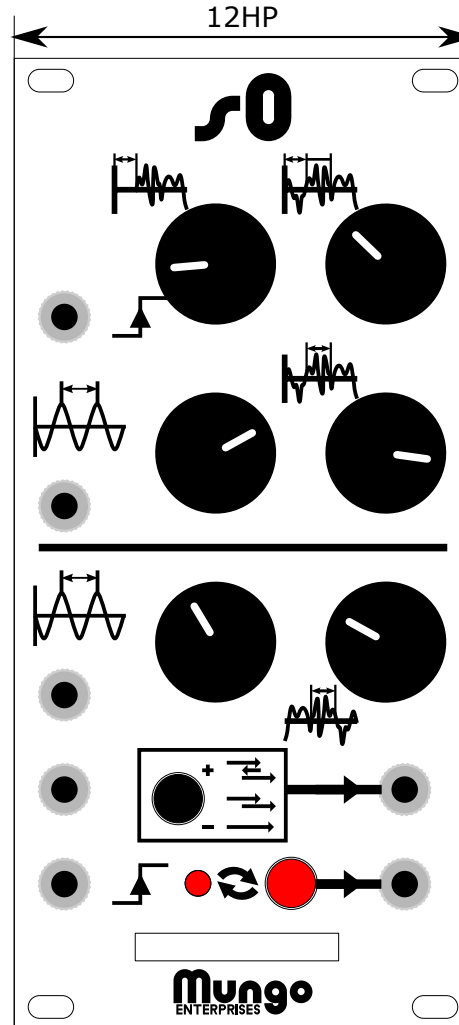
Sampler Frequency, signal input and sampler playback frequency control scaled in V/octave.

Granular Frequency, signal input and looper playback frequency control scaled in V/octave.

Input, audio input for recording to looper buffer.

Reset Input, positive going edge triggers reset and synchronisation of looper playback. 0.01Hz to 2.5kHz

Load Button, swaps between the two loaded loops. When zooming in loads from the SD card to the sampler. When zooming out loads the looper buffer not in use from the SD card or if no card present from the audio input.



Loop Start, sets the position for the start of looping, ratiometrically scaled with the waveform.

Loop Width, sets the position for the end of looping, ratiometrically scaled with the waveform and added to the loop start position.

Granular Width, exponentially scaled, sets the size of the grains used for pitch shifting. Extreme small settings disable pitch shifting and interpolation.

Trigger Button, triggers sampler and sets looping mode as reversing/looping/single shot when zoom control is held at +/0/- respectively.

Sampler Output, output signal of the sampler.

Looper Output, output signal of the looper.

SD Card, reads 16bit mono .wav files off FAT formatted SD cards from S0.WAV to S9.WAV in sequence. Sample rate insensitive, maximum length 500,000 samples.

Power, ±12V 25mA
+5V 150mA operating

Looper Phase Locked Loop, (PLL) the reset input of the looper triggers a PLL to lock onto the incoming period of the positive going edges of the signal. Each positive going edge triggers the start of a new period with the PLL adjusting its frequency to maintain synchronisation.

Live Recording, pressing the load button while the zoom control is held in the out (-) position and no SD card is present will load audio from the input to the waiting buffer during the next period.

File Loading, pressing the load button while the zoom control is held in the in (+) position will load the next file from the SD card to the waiting buffer. They must be 16 bit mono wave files in the .wav format, the sample rate is ignored and up to 200,000 samples can be loaded into each buffer for playback. Files named S0.WAV to S9.WAV stored in the root directory of the card will be loaded in sequence one at a time, overwriting any sound present in the waiting buffer.

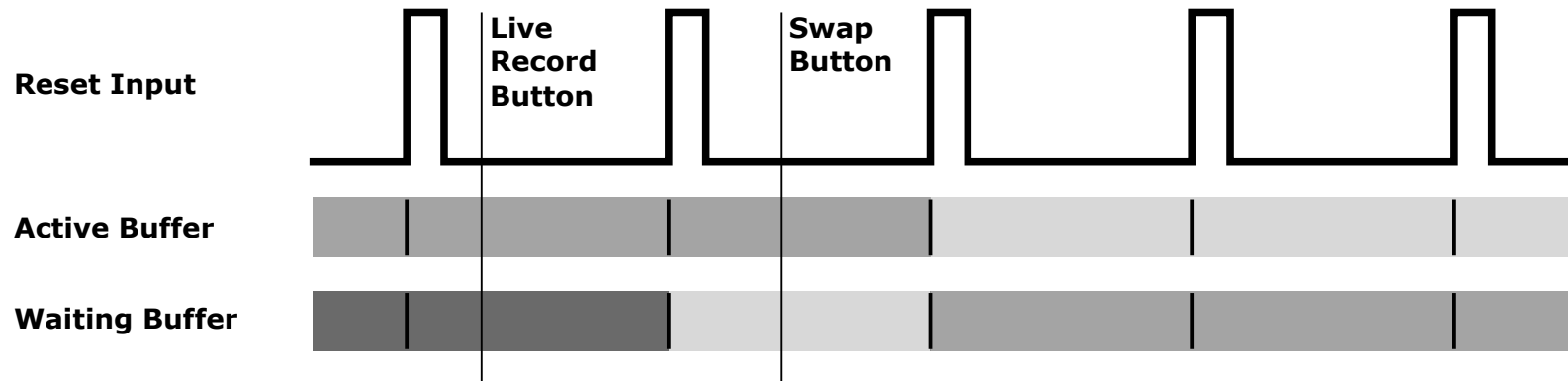
Buffer Swap, pressing the load button when the zoom control is in the neutral position will queue the active and waiting buffers to be swapped at the next positive going edge of the reset input. The waiting buffer is retained until either new data is loaded to it or power is removed.

Sampler, the sampler data is loaded from the SD card by holding zoom in (+) while pressing the load button. Total memory available for the sampler is 500,000 samples less the two equally sized buffers of the looper. They must be in 16 bit mono wave files in the .wav format, the sample rate is ignored. Files named S0.WAV to S9.WAV stored in the root directory will be loaded in sequence one at a time, overwriting any data present in the memory.

Sampler Looping Modes, the 3 different looping modes are selected by the position of the zoom control when the trigger button is pressed. When the zoom is held out/neutral/in they are:

- No looping, play from start to end at positive going edge of gate.
- 0 Looping in a single direction only. Held until gate goes low.
- + Looping in alternate directions. Held until gate goes low.

The start and loop start locations are both proportional to the file length and can play forwards or backwards through the file. Similarly the loop width is proportional to the file length but is also offset from the loop start location forwards or backwards. Even when looping is disabled the sampler will still play to the start and end positions of the loop on the way through to the end.



Base Frequency Modulation, signal input and depth control scaled in V/octave.

Filter Width Modulation, signal input and depth control scaled in V/octave.

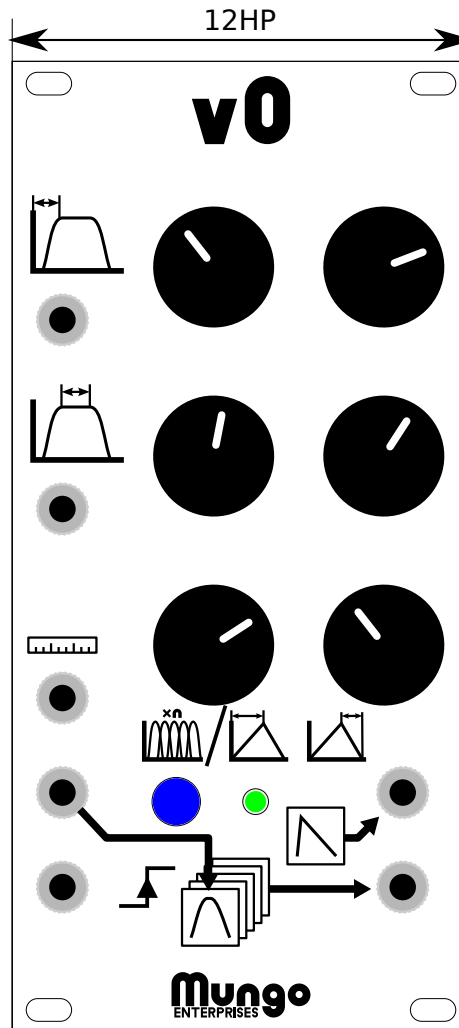
Filter Band Count, number of channels vocoded in the range of the filter. Attack time of the envelope follower in bandpass mode. Exponentially scaled from 1-64 bands.

Analysis Input, or input for envelope follower.

Synthesis Input, or input for bandpass filter.

Hold Input, holds output of analysis sections while high.

Mode Button, selects vocoding or bandpass filter mode. Press zoom +/- when switching modes to enable midi tracking of the base frequency. Alternate: selecting zoom +/- when switching modes assigns the width modulation to width/decay/band count.



Base Frequency, added to modulation sets the lower frequency of the bandpass filter bank. Exponentially scaled.

Filter Width, added to modulation sets the width of the bandpass region of the filter bank. Exponentially scaled.

Decay Time, variable decay of the analysis or envelope follower. Exponentially scaled.

Envelope Output, envelope of highpassed remainder of vocoding analysis for voicing analysis. In bandpass mode, the envelope of the analysis input.

Filter Output, synthesised output of vocoder or output of bandpass filter.

Frequency Modulation, signal input and depth control scaled in V/octave.

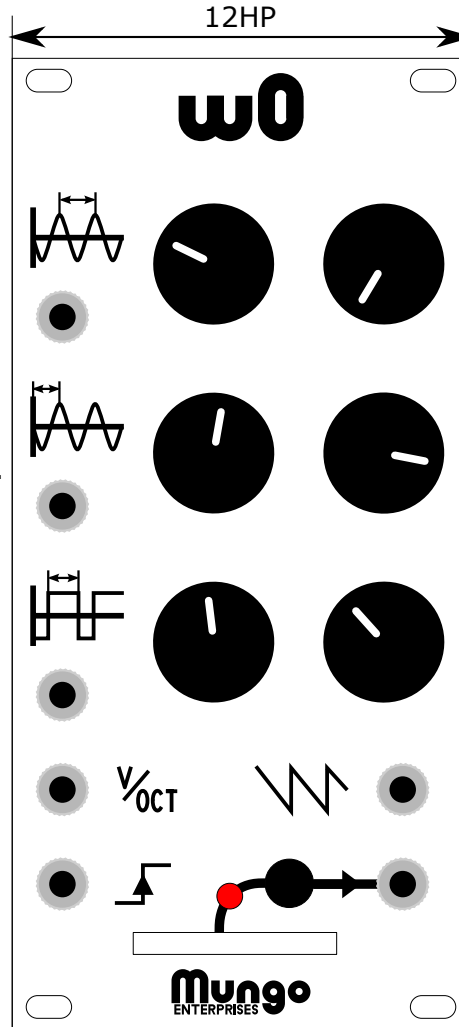
Phase Modulation, signal input and depth control scaled in V/degree. Will provide gain and limited to ± 360 degrees.

Symmetry Modulation, signal input and depth control

Frequency Input, trimmed 1V/octave input.

Reset Input, positive going edge triggers reset of sawtooth core oscillator.

Function Button, swaps between builtin waveforms or loads arbitrary waveform from SD card.



Frequency Offset, added to fixed and variable modulation and midi note value sets the frequency of the sawtooth core oscillator.

Phase Offset, added to modulation sets the phase offset of both outputs to the sawtooth core oscillator.

Symmetry Offset, added to modulation sets the symmetry of the sawtooth and square waveforms. Sawtooth waveform is swept from negative sawtooth through triangle to positive sawtooth. Sets the duty cycle of the square waveform.

Sawtooth Output, output signal of variable symmetry sawtooth waveform.

Arbitrary Output, alternates between builtin waveforms of sine and square, or sine and arbitrary waveform. Phase and frequency locked to sawtooth output.

SD Card, reads 16bit mono .wav files off FAT formatted SD cards from W0.WAV to W9.WAV in sequence. Sample rate insensitive, maximum length 4,000 samples.

Power, $\pm 12V$ 25mA
 $+5V$ 125mA operating

Power, the modules all follow the standard 16pin power connector allocating one of the bussing signals to midi.

WARNING, the midi is 3.3V logic and should not be connected anything other than the optional midi kit.

Modules draw the majority of their current from the 5V rail.

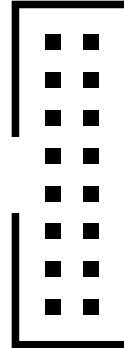
Zoom, the modules support dynamic zoom of the knobs controlled by an external switch. This can be bussed between multiple modules by linking only the zoom pin. Shorting the zoom pin to ground zooms out, while shorting to the supplied 3.3V will zoom in.

The optional zoom kit includes a 3-way momentary switch mounted on a 2HP panel to allow easy control of zoom.

A single pole momentary switch between zoom and ground provides a single level of zoom control.

If zoom is not desired, place a jumper between the zoom pin and ground to operate the knobs over their full range.

Pin 1



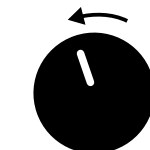
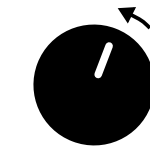
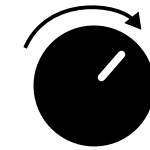
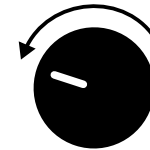
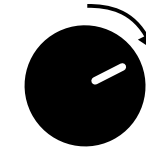
-12V
GND
GND
GND
+12V
+5V
MIDI

■ MIDI
■ ■ GND
■ ■ ZOOM
■ ■ 3.3V

Knob

Zoom Switch

Value/Range



Revisions, rereleased modules are identifiable by inclusion of a DIP switch on the rear. The revised modules have changes as noted below:

d0	No functional changes or options.	Power , +12V 80mA, -12V 25mA
g0	Tracking output and button are removed. Scaling of grain width is exponential, DIP switch A enables original proportional linear scaling.	Power , +12V 80mA, -12V 25mA
n0	Expanded range of noise distributions 4x. Lower output changes mode with input source. DIP switch A enables original unprocessed noise output.	Power , +12V 80mA, -12V 25mA
p0	Additional models selected by DIP switches, A increases dispersion, B balances volume of components.	Power , +12V 125mA, -12V 25mA
v0	Modulation assignable to width/decay/band count. DIP switch A disables width modulation destination routing, B disables midi tracking in routing mode.	Power , +12V 100mA, -12V 25mA
w0	Configurable width of phase modulation. DIP switch A increases range.	Power , +12V 70mA, -12V 25mA

The zoom header no longer includes a MIDI connection. A MIDI adaptor is available that plugs directly into the bus board and connects through the 16 way power cable. Each module ships with a power cable that isolates the midi bus connection.

- ■ **GND**
- ■ **ZOOM**
- ■ **3.3V**