

E520 Effects

Common controls on the Main Page

All effects are accessed via the Main Page which is divided in five separate areas:

1. Header area – contains the page title and several indicators, including the CPU load percentage, patch name and EEPROM status light (green means EEPROM is up-to-date, red means EEPROM will be updated with parameter changes within a few seconds).
2. Menu area – contains four items which can be selected via the rotary encoder:
 1. Exit – select this item and press the encoder button to leave the Main Page and enter the Top Page which allows access to other menus that control the E520.
 2. Algo – select this item and press the encoder button to select the active effect.
 3. P2 – drops down into the algorithm-specific settings page where you can change parameter routing options.
 4. P3 – drops down into the algorithm-specific patch page where you can load and save patches for the currently selected algorithm.
3. Effect area – where the active effect renders its status
4. VU meters – L/R input and output volume indicators which show real-time signal levels on input and output channels. When the VU meters show red then there is a strong likelihood of clipping distortion.
5. Indicators for Feedback and Mix settings – four small slider widgets that show the current state of the Feedback and Mix controls. When these controls are centered the ‘thumb’ of the widget is a filled circle, otherwise it is an outline. When Feedback controls are centered the amount of feedback is zero. When Mix controls are centered the output will be an equal proportion of wet and dry signal.
6. Buttons – legends and status of the four UI buttons appear in this area. The three left-most buttons are dedicated to effect parameters while the right-most button is always a bypass function that disables the effect and passes audio thru the E520 without modification.

Time Domain Delay Effects

Time domain effects in the E520 are processed without the use of time/frequency transforms and use a buffer rate that provides a good compromise between overhead and latency.

Resampling Mini Delay

Overview

This effect is based on the E580 Resampling Mini Delay and encompasses or extends all of its functions. Stereo inputs are mixed down to a single channel, resampled (ie – the sampling rate may be reduced by a variable amount through a band-limited interpolation process), pass through a delay line with a fixed and variable tap, and are then resampled to two separate outputs. Separate L/R feedback controls allow fine adjustment of recirculation on both the fixed and variable delay. Three mode settings emulate various classical delay characteristics.

CV Inputs

Four CV input parameters are supported:

1. Delay Time – this controls sampling rate over a 1:8 (48kHz-6kHz) range, smoothly varying delay without granular artifacts but introducing considerable FM. The parameter readout shows the time multiplication factor.
2. InMix – The original E580 is a monophonic effect, so on the E520 which is stereo the two inputs are mixed according to this. Full CCW is 100% Left channel, full CW is 100% Right channel and 12:00 position is 50/50 mix. The parameter readout shows percent L & R.
3. Tap Offset – controls the position of the variable delay tap. Range is from 0% to 200% of the fixed tap position. Varying this control in real-time will cause granular cross-fading effects as the delay amount changes. The parameter readout shows offset as a percentage of the fixed tap.
4. Multifunction – varies depending on mode selection:
 1. Clean mode – no functions
 2. Tape mode – controls random delay time variation. Similar to unstable tape speed warble.
 3. BBD mode – reduces SNR by addition of noise.

Buttons

Three button functions are supported:

1. Range – Four delay settings for the fixed tap: 1x, 16x, 256x, 4096x allow delays from 0.196s to ~10min.
2. Mode – Similar to the E580, there are three operating modes:
 1. Clean mode – Basic delay function with no distortion or filtering aside from the normal resampling process.
 2. Tape mode – Emulates old-style tape loop, including saturation distortion, slight peaking and rolloff around 2kHz. The fourth parameter controls tape warble.
 3. BBD mode – Emulates old-style bucket-brigade circuit with rolloff starting around 4kHz. The fourth parameter controls a variable noise floor.

3. Reverse – real-time control that runs the delay line backwards. Note that in this mode there is no new audio input to the delay line and feedback controls don't have any effect.

Readouts

In addition to the parameter readouts there are four indicators:

1. Range – the range button selection
2. Mode – the mode button selection
3. Fixed Delay – the time delay on the fixed tap
4. Tap Offset – the time delay on the variable tap

Feedback

Both feedback knobs are active in this effect.

Tap Tempo

Tap Tempo is active and controls the amount of fixed delay. Use the range button to return to the fixed ranges. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Range setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

This effect has no auxiliary output.

Stereo Clean Delay

Overview

The Stereo Clean Delay is a non-resampling delay (ie – the sampling rate is constant throughout the processing) which always runs at the full 48kHz rate and introduces no interpolation artifacts into the signal while the delay length is stable. This is a true stereo effect in that there are separate delay lines for Left and Right channels but they are processed identically (same delay length, same filtering, etc.). A switchable resonant 4th-order lowpass filter is available in the feedback path if desired. Ping-pong feedback between the two channels may be enabled.

CV Inputs

Three CV input parameters are supported:

1. Delay Length – this controls the length of the delay line. Varying this control in real-time will cause granular cross-fades as the length changes. The parameter readout is in percentage of the full range from 0-99%.
2. Tap Offset – controls the position of the variable delay tap which is mixed 100/100 with the main delay. Range is from 0% to 200% of the Delay Length from parameter #1. Varying this control in real-time will cause granular cross-fading effects as the delay amount changes. The

parameter readout shows offset as a percentage of the Delay Length. When set to 0% this tap is disabled.

3. Filter Cutoff Frequency (when filter enabled) – controls the lowpass filter cutoff frequency. The parameter readout is in kHz from 0-24kHz. When the filter is disabled this parameter is grayed out.
4. Filter Resonance (when filter enabled) – controls the lowpass filter resonance. The parameter readout is in percentage from 0-99% where 0% is no resonance. When the filter is disabled this parameter is grayed out. Be careful – the filter may self-oscillate when this parameter is near 99% and can cause overloads in some situations.

Buttons

Three button functions are supported:

1. Range – Four delay ranges: 1x, 16x, 256x, 4096x allow delays from 0s to ~6min.
2. Swap – swaps the feedback paths of the L & R channels so that audio “ping-pongs” between the two channels.
3. Filt – enables the filters.

Feedback

Feedback is active for this effect.

Readouts

There are four readouts for this effect:

1. Range – 1x thru 4096x
2. Swap – on/off
3. Filter – on/off
4. Time – time delay in seconds

Tap Tempo

Tap Tempo is active and controls the Delay Length. Use the range button or Delay Length parameter to resume knob/button control. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Range setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

This effect has no auxiliary output.

Stereo Resampling Delay

Overview

The Stereo Resampling Delay is resampling delay which allows control of both the delay line length (for granular cross-fade effects) as well as sample rate (for smooth delay changes and FM effects). This is a true stereo effect in that there are separate resamplers and delay lines for Left and Right channels but they are processed identically (same delay length, same filtering, etc.). A switchable resonant 4th-order lowpass filter is available in the feedback path if desired. Ping-pong feedback between the two channels may be enabled.

CV Inputs

Four CV input parameters are supported:

1. Delay Length – this controls the length of the delay line. Varying this control in real-time will cause granular cross-fades as the length changes. The parameter readout is in percentage of the full range.
2. Delay Time - this controls sampling rate over a 1:8 (48kHz-6kHz) range, smoothly varying delay without granular artifacts but introducing considerable FM. The parameter readout shows the time multiplication factor.
3. Filter Cutoff Frequency (when filter enabled) – controls the lowpass filter cutoff frequency. The parameter readout is in kHz from 0-24kHz. When the filter is disabled this parameter is grayed out.
4. Filter Resonance (when filter enabled) – controls the lowpass filter resonance. The parameter readout is in percentage from 0-99% where 0% is no resonance. When the filter is disabled this parameter is grayed out. Be careful – the filter may self-oscillate when this parameter is near 99% and can cause overloads in some situations.

Buttons

Three button functions are supported:

1. Range – Four delay ranges: 1x, 16x, 256x, 4096x allow delays from 0s to ~6min.
2. Swap – swaps the feedback paths of the L & R channels so that audio “ping-pongs” between the two channels.
3. Filt – enables the filters.

Feedback

Feedback is active for this effect.

Readouts

There are four readouts for this effect:

1. Range – 1x thru 4096x

2. Swap – on/off
3. Filter – on/off
4. Time – time delay in seconds

Tap Tempo

Tap Tempo is active and controls the Delay Length. Use the range button or Delay Length parameter to resume knob/button control. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Range setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

This effect has no auxiliary output.

Prime Dual Tap Delay

Overview

The Prime Dual Tap Delay is an emulation of the Lexicon Prime Time rack-mount delay. It is a resampling delay which allows control of both the delay line length (for granular cross-fade effects) as well as sample rate (for smooth delay changes and FM effects). As the original, this is a mono effect in that there is one delay line whose input is an equal mix of Left and Right channels and separate output taps for Left and Right channels with independent delay lengths that are selectable from a pre-determined set which includes delays that have relatively prime ratios. Controllable 4th-order lowpass filters are available in the feedback path if desired. Buffer lengths well beyond that of the original Prime Time effect are available and the two outputs may be mixed down to mono if desired.

CV Inputs

Four CV input parameters are supported:

1. Delay Set A – this controls the length of the A delay line. Varying this control in real-time will cause granular cross-fades as the length changes. The parameter readout is in milliseconds assuming the VCO is in “Cal” mode. There is a limited list of delay values, some of which are “prime” which is indicated above the control.
2. Delay Set B – this controls the length of the B delay line. Varying this control in real-time will cause granular cross-fades as the length changes. The parameter readout is in milliseconds assuming the VCO is in “Cal” mode. There is a limited list of delay values, some of which are “prime” which is indicated above the control.
3. VCO Adj – this varies the sample rate over a 1:2 range. Fully CCW is considered “Calibrated” and an indicator above the control will reflect this. As the control is rotated CW the sample rate is increased by up to 2x and the indicator will show “Uncal” to reflect that the sample rate is not locked down at a precisely known rate. The parameter readout is in percent from 0-99%.

Note – the E520 hardware does not support the full VCO range of the original Prime Time unit, so in the 1x Mult range the VCO Adj control doesn't extend higher than 50%.

4. Rolloff – controls the lowpass filter cutoff frequency. The parameter readout is in kHz from 0.8kHz to 15.0kHz (the full range of the original Prime Time).

Buttons

Three button functions are supported:

1. Delay Mult – Four delay multiplier ranges as in the original Prime Time: 1x, 2x, 4x, 8x. These settings reduce the effective sample rate by the selected amount.
2. Buf Len – three buffer length controls which enable delay settings beyond those of the original Prime Time. The 8k setting is equivalent to the original, while the 64k and 256k setting allow much longer delays.
3. Mix – Allows combining the Left & Right output channels.

Feedback

Feedback is active for this effect.

Readouts

There are four readouts for this effect:

1. Delay Mult – 1x thru 8x
2. Buf Len – 8k thru 256k
3. Mix – L+R (mixed) or L/R (separate)
4. A: – blank or Prime
5. B: - blank or Prime
6. VCO – Cal or Uncal
7. Repeat – Highlighted when in repeat mode (buffer freeze)

Tap Tempo

Tap Tempo is repurposed to enable/disable the Repeat mode. In Repeat mode the audio input is disabled and the buffer recirculates with the previous contents until Repeat is disabled.

Auxiliary Output

This effect has no auxiliary output.

Stereo Reversing Delay

Overview

The Stereo Reversing Delay is a reversing and resampling delay which allows control of both the delay line length (for granular cross-fade effects) as well as sample rate (for smooth delay changes and FM

effects). This is a true stereo effect in that there are separate resamplers and delay lines for Left and Right channels but they are processed identically (same delay length, same filtering, etc.). A switchable resonant 4th-order lowpass filter is available in the feedback path if desired. The unique features are that this delay can be run forward or backwards and it can be “frozen” to keep playing the current delay contents without changing.

CV Inputs

Four CV input parameters are supported:

5. Delay Length – this controls the length of the delay line. Varying this control in real-time will cause granular cross-fades as the length changes. The parameter readout is in percentage of the full range which is fixed at 5.4 seconds.
6. Delay Time - this controls sampling rate over a 1:8 (48kHz-6kHz) range, smoothly varying delay without granular artifacts but introducing considerable FM. The parameter readout shows the time multiplication factor.
7. Filter Cutoff Frequency (when filter enabled) – controls the lowpass filter cutoff frequency. The parameter readout is in kHz from 0-24kHz. When the filter is disabled this parameter is grayed out.
8. Filter Resonance (when filter enabled) – controls the lowpass filter resonance. The parameter readout is in percentage from 0-99% where 0% is no resonance. When the filter is disabled this parameter is grayed out. Be careful – the filter may self-oscillate when this parameter is near 99% and can cause overloads in some situations.

Buttons

Three button functions are supported:

1. Reverse – pressing this button switches the direction of recording in the buffer memory. Sounds already in the buffer will play in the opposite direction and new sounds recorded into memory will go in reverse.
2. Freeze – pressing this button enables/disables Freeze mode, wherein no new sounds are recorded into the memory and the contents of the memory will continue to play out unchanged.
3. Filt – enables the filters.

Feedback

Feedback is active for this effect.

Readouts

There are four readouts for this effect:

1. Reverse – highlighted when in reverse mode.
2. Freeze – highlighted when in freeze mode.
3. Filter – on/off

4. Time – time delay in seconds

Tap Tempo

Tap Tempo is active and controls the delay length. Adjust the Delay Length parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Range setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

This effect has no auxiliary output.

Stereo Flanger Delay

Overview

The Stereo Flanger Delay is short delay which allows smooth control of the delay line length over intervals of 0-100ms which makes it particularly useful for Flanging and Karplus-Strong effects. This is a true stereo effect in that there are separate delay lines for Left and Right channels but they can be processed identically. The unique feature of this algorithm is the inclusion of an 8-stage allpass diffuser at the input with control over mix and length which can be used to “thicken” up the sound prior to flanging. Additional features are that the delay control can be done either in linear time or exponential frequency, and that the output can be set into “flanger mode” which makes comb-filter sounds easier to achieve.

CV Inputs

Four CV input parameters are supported:

1. Diffuse – this is a two-mode control which varies the mix and length of the diffuser. Use button 1 on the right of the display to select control of either the mix or the length – the uncontrolled parameter will be held at its last value (the value is saved during reset / power-cycle). Mix ranges from 0-99% and operates like a wet/dry control. Length readout is displayed as percentage with a maximum of more than 1 second. Current values of both parameters are displayed in a readout near the top of the screen.
2. Delay Time - this controls the delay over a 0-21ms range when in Time mode and a 10Hz-10kHz range when in Frequency mode, smoothly varying delay without granular artifacts but introducing considerable FM. The parameter readout is in percent of maximum but the actual Time or Frequency value is displayed in a readout near the top of the screen.
3. LFO Freq – this controls the frequency of the integrated low-frequency oscillator. The parameter readout varies from 100 sec-1sec/1-11Hz in an exponential curve that provides greater sensitivity in the low frequency range.
4. LFO Depth – this controls the amplitude of the LFO waveform as it is summed with the Delay Time parameter. The parameter readout varies from 0-99%.

Buttons

Three button functions are supported:

1. Diff Sel – toggles between CV1 controlling either the mix or length of the diffuser.
2. T/F Mode – toggles between CV2 controlling delay time in either Time or Frequency mode.
3. Out Mode – toggles between pure delay output and “Flange” output which performs a 100/100 mix of the delay line input and output. Flange mode provides for the deepest comb notches which enhances the sound of the classic effect.

Feedback

Feedback is active for this effect.

Readouts

There are three readouts for this effect:

Time / Freq – displays the delay length as either time or frequency.

DMix – the current value of the Diffuse Mix parameter.

DLen – the current value of the Diffuse Length parameter.

Tap Tempo

Tap Tempo is active and controls the LFO rate. Adjust the LFO rate parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the LFO rate setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

The delay time value (with offset and LFO) is available on the auxiliary output.

Stereo Chowder Delay

Overview

The Stereo Chowder Delay is used to chop/slice incoming audio into “chunks” which are randomly reordered in time with optional reversing and pitch shifting. Various parameters provide control over the chunk size, probability of chopping, reversing and shifting, as well as the time span of reordering. Clean 5ms splices are created between chunks to avoid unpleasant clicking transitions. Tap Tempo is used to set the base time rate.

CV Inputs

Four CV input parameters are supported:

Chop Div – Chop Division controls the size of the chunks. Tap Tempo establishes the duration of a quarter note and the Chop Div parameter scales that from whole notes to 1/64th notes.

Sttr Prb – Stutter Probability controls the probability that a chop/slice operation will occur. At full CCW rotation chopping will never happen. At full CW rotation every chunk will be chopped.

Chop Ord – Chop Order controls how far back in time to go when fetching alternate chunks to insert into the output stream. From full CCW (0%) the range increases up to the limit determined by the Buf Mult button setting. Beyond 50% to full CW the probability that the chunk will be reversed increases from 0 to 100%.

Ptch Prb – Pitch Probability controls the probability that a pitch shift will be applied to any chunk.

Buttons

Three button functions are supported:

Buf Mult – selects one of four possible maximum delays over which the Chop Ord control operates. Range is 4 chunks to 32 chunks.

Stutter – manually forces a repeat of the most recent chunk. Overrides all random operations.

Freeze – toggles Freeze mode where no new audio is recorded in the delay buffer. Chopping still takes place but only on material already in the buffer.

Feedback

There is no feedback and the controls are repurposed in this effect.

Left Feedback – Repeats. Controls the maximum number of repeats randomly applied to any stutter operation. CW from center varies from 1-15 while CCW from center varies from 1-15 and also forces reverse play.

Right Feedback – Pitch Shift. Controls the amount of pitch shift applied to any stutter operation. CW from center is upward shifts while CCW from center is downward shift. Repeated stutters will compound shifts up to one octave and then wrap back to no shift.

Readouts

There are three readouts for this effect:

repeats – displays the number of repeats selected by the Left Feedback.

pitch – displays the pitch shift selected by the Right Feedback.

Flashing Chunk Indicator – a dot in the upper center flashes at the chunk timing rate.

Page 2 Settings

There are 3 additional settings on Pg2

Chl Diverge – Channel Divergence. When set to “Off” the right and left channels will have identical chopping operations applied. When “On” the channels are independently processed and will behave differently depending on the random probability settings.

Ptch Quant – Pitch Quantization. When “Off” the pitch selection on the Right Feedback is unconstrained and can select any pitch shift amount between +/- 800 cents. When “On”, only multiples of 100 cents are allowed.

Sync Phase – Controls the timing phase of the chopping process relative to the Tap Tempo input. Values of -10ms, 0ms and +10ms are allowed and control alignment of the chopping point. Default is -10ms but a value of 0ms will most often ensure that notes are not chopped during their attack.

Tap Tempo

Tap Tempo is active and controls the basic quarter note timing. Adjust the LFO rate parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: Current tempo is always displayed, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active. Tap intervals longer than ~5 seconds cause the tempo calculation to reset. Tempo rate is saved when switching algorithms or powering down. Apply a continuous quarter-note clock (as from a sequencer) to keep the chopping process in sync with the external source.

Auxiliary Output

This effect does not drive the auxiliary output.

Time Domain Shift Effects

Deflector Shield

Overview

The Deflector Shield is a recreation of the original E560 Deflector Shield module. It is a monophonic effect similar to the original Bode frequency shift which applies a variable frequency offset to any input signal. As the original, there are three distinct operating modes, as well as a unique carrier morphing feature that provides unusual output harmonics. Although the input is mono, there are two outputs which allows simultaneous up/down shift as well as true quadrature outputs. Variable feedback is available as well as linear or exponential frequency CV response.

CV Inputs

Three CV input parameters are supported:

1. InMix – The original E560 is a monophonic effect, so on the E520 which is stereo the two inputs are mixed according to this control. Full CCW is 100% Left channel, full CW is 100% Right channel and 12:00 position is 50/50 mix. The parameter readout shows percent L & R.
2. Carrier – this controls the frequency of the internal carrier oscillator which may be varied by +/-5kHz about 0Hz. The parameter readout is in Hz.
3. Morph – the controls morphing of the carrier waveshape. There are 8 different wavetables in the morphing sequence, ranging from a pure sine, triangle, saw, square, random, etc. There is a small waveform display on the UI which shows the current waveshape.

Buttons

Three button functions are supported:

1. Mode – Selects one of three possible operating modes as in the original E560:
 1. Shift – Bode frequency shift. Input signal is shifted in frequency by the carrier amount.
 2. Ring Mod – Ring modulation. Input signal is multiplied by the carrier waveform which results in a more harmonically complex signal than Bode shifting.
 3. Phase – Phase shifting. The internal carrier is disabled and instead the input signal is phase shifted by an amount ranging from 0-360deg as determined by the carrier control parameter.
2. Frq Mode – Selects Exponential or linear response of the carrier frequency to the carrier control parameter.
3. Out Mode – Selects Up/Down or Quadrature output modes.
 1. In Up/Down the two output channels are shifted by opposite amounts as determined by the carrier frequency.
 2. In Quadrature the two outputs shifted by the same amount but are 90deg out of phase with each other

Feedback

Feedback is active for this effect.

Readouts

There are four readouts for this effect:

1. Mode – Shift, Ring Mod, or Phase
2. Frq Mode – Lin or Expo
3. Out Mode – Up/Down or Quadrature
4. LFO BPM – the the Carrier frequency in Beats per Minute.

Page 2 Settings

One additional setting is available on Page 2 to enable or disable quantization of the carrier frequency in integer beats-per-minute.

Tap Tempo

Tap Tempo is active and controls the Carrier rate. Adjust the Carrier parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Carrier setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

The carrier oscillator is available on the auxiliary output.

Stereo Frequency Shifter

Overview

The Stereo Frequency Shifter is similar to the Deflector Shield but is a true stereo effect – the Left and Right channels are completely independent but can be processed with identical parameters. Similar frequency shifts, carrier morphing and modes are available but the output modes are limited to variations of Up and Down shifting. Variable feedback is available as well as linear or exponential frequency CV response.

CV Inputs

Three CV input parameters are supported:

1. L/R Phs – controls the carrier phase offset between the Left and Right channels. Allows creation of stereo effects.
2. Carrier – this controls the frequency of the internal carrier oscillator which ranges from +/- 5kHz. The parameter readout is in kHz.
3. Morph – the controls morphing of the carrier waveshape. There are 8 different wavetables in the morphing sequence, ranging from a pure sine, triangle, saw, square, random, etc. There is a small waveform display on the UI which shows the current waveshape.

Buttons

Three button functions are supported:

1. Mode – Selects one of three possible operating modes as in the original E560:
 1. Shift – Bode frequency shift. Input signal is shifted in frequency by the carrier amount.
 2. Ring Mod – Ring modulation. Input signal is multiplied by the carrier waveform which results in a more harmonically complex signal than Bode shifting.
 3. Phase – Phase shifting. The internal carrier is disabled and instead the input signal is phase shifted by an amount ranging from 0-360deg as determined by the carrier control parameter.
2. Frq Mode – Selects Exponential or linear response of the carrier frequency to the carrier control parameter.
3. Out Mode – Selects Up/Down shift for the Left and Right channels.

Feedback

Feedback is active for this effect.

Readouts

There are three readouts for this effect:

1. Mode – Shift, Ring Mod, or Phase
2. Frq Mode – Lin or Expo
3. Out Mode – Up/Up, Up/Dn, Dn/Up, Dn/Dn
4. LFO BPM – the the Carrier frequency in Beats per Minute.

Page 2 Settings

One additional setting is available on Page 2 to enable or disable quantization of the carrier frequency in integer beats-per-minute.

Tap Tempo

Tap Tempo is active and controls the Carrier rate. Adjust the Carrier parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Carrier setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

The carrier oscillator is available on the auxiliary output.

Stereo Phaser

Overview

The Stereo Phaser is an all-pass phaser with selectable number of all-pass stages and an integrated LFO with variable frequency and depth. It is a true stereo effect – the Left and Right channels are completely independent but are processed with identical parameters. Variable feedback is available as well as selectable LFO waveform and optional phase offset between the Left and Right channels.

CV Inputs

Four CV input parameters are supported:

1. Phase – this adjusts static phase into the all-pass filter stages. The parameter varies from 0-99%.
2. LFO Freq – this controls the frequency of the integrated low-frequency oscillator. The parameter readout varies from 0-11Hz in an exponential curve that provides greater sensitivity in the low frequency range.
3. LFO Depth – this controls the amplitude of the LFO waveform as it is summed with the Phase parameter. The parameter readout varies from 0-99%.
4. LFO Phase – this controls the phase offset between the Left and Right channel LFO values, allowing subtly different sweeps and greater stereo imaging. The parameter readout varies from 0-360deg.

Buttons

Two button functions are supported:

1. Stages – Selects 6, 12, 18 or 24 stages of all-pass processing. 6 stages is gentle and similar to most analog phaser effects. 24 stages results in many more cycles of phase shift and produces a very resonant sound.
2. LFO Wave – Selects Sine or Rectified Sine waveshape for the LFO output.
3. Mode – Selects either “Phaser” or “Allpass” operating modes. In Phaser mode the dry input signal is mixed with the output of the phaser’s allpass filter network to generate the output signal, resulting in a comb filter response at the allpass delay timing. In Allpass mode the raw allpass filter signal is output.

Feedback

Feedback is active for this effect. Use with caution as high values of feedback can cause wild oscillation depending on the settings of other controls.

Readouts

There are two readouts for this effect:

1. Stages – 1, 2, 4, 6, 8, 12, 18, 24
2. LFO Wave – Sine, FWR Sine

Tap Tempo

Tap Tempo is active and controls the LFO rate. Adjust the LFO rate parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the LFO rate setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

The dedicated LFO signal for the Left channel is routed to the Auxiliary output.

Stereo Pitch Shifter

Overview

The Stereo Pitch Shifter is a granular pitch shifter with +/-2 octave range, variable grain size and chaos offset. It is a true stereo effect – the Left and Right channels are completely independent but are processed with identical parameters. Variable feedback is available as well as selectable shift quantization to an equally tempered scale.

CV Inputs

Three CV input parameters are supported:

1. Shift – this controls the amount of pitch shift. Parameter readout range is up to +/-2400 cents, depending on the Range selection.
2. Grain Size – this control varies the size of the cross-fade grains in the shift algorithm. Smaller grains result in a faster modulation rate and introduces a somewhat ring-mod sound. The parameter readout is in percent from 0-99%.
3. Chaos – this control allows a variable amount of random offset in the time position of the cross-fade grains. The effect is subtle but can sometimes reduce the amplitude modulation inherent in the granular pitch shift process.

Buttons

Two button functions are supported:

1. Range – selects one of four different shift ranges for the Shift parameter:
 1. 25 cent – very subtle shifts for fine control of detuning
 2. 100 cent – up to a half-tone shift for more radical detuning
 3. 1200 cent – up to +/-1 octave
 4. 2400 cent – up to +/-2 octaves.
2. Quant – Enables Equal Tempered quantization (100 cent) of the shift parameter.

Feedback

Feedback is active for this effect.

Readouts

There are two readouts for this effect:

1. Range – 25, 100, 1200, 2400
2. Quant – on/off

Tap Tempo

Tap Tempo is not active in this effect.

Auxiliary Output

This effect has no auxiliary output.

Stereo Shimmer Reverb

Overview

The Stereo Shimmer Reverb is a reverb combined with a granular pitch shifter in the feedback path that can be used to introduce a variety of ambient textures. It is a true stereo effect – the Left and Right channels are processed independently but share the same reverb loop so that sounds in one channel will reverberate in the other, but from a different part of the process so that stereo imaging does not

collapse. Variable feedback is available as well as selectable shift amounts to allow for a wide range of moods, dark, chaotic and ethereal. Infinite mode is controlled via the Tap Tempo input and preserves the sound in the reverb by disabling inputs, filters and internal attenuation, extending its duration for hours.

CV Inputs

Four CV input parameters are supported:

1. Rvb Time – this controls the decay time (RT) of the reverb from 0.1 seconds to 10 seconds.
2. Low Cut – this control varies the amount of low-pass cut in the reverb and will reduce the duration of the high frequencies while preserving the low frequencies. The parameter ranges from dB to 14dB.
3. High Cut – this control varies the amount of high-pass cut in the reverb and will reduce the duration of the low frequencies while preserving the high frequencies. The parameter ranges from 1dB to 14dB.
4. Attack – this control varies the amount of initial diffusion applied to the Left and Right channel inputs to the reverb. At low settings the attack is spread out and at high settings it is more sharply defined. The parameter varies from 0 to 99%.

Buttons

Two button functions are supported:

1. Shift L – selects one of 8 different shift amounts for the shimmer feedback in the Left channel:
 1. Oct Up – shifts up an octave. Useful to create an ethereal feel.
 2. 5th up – shifts up a musical 5th interval. Can sound like a chord playing.
 3. Bend up – shifts up 50 cent. Sounds dissonant & chaotic.
 4. Tweak + – shifts up 15 cent. Sounds subtly detuned.
 5. Tweak - - shifts down 15 cent. Subtly detuned.
 6. Bend dn – shifts down 50 cent. Dissonant & chaotic but darker.
 7. 5th dn – shifts down a musical 5th. Orchestral.
 8. Oct dn – shifts down an octave. Dark, imposing.
1. Shift R – selects one of 8 different shift amounts for the shimmer feedback in the Right channel. Uses the same selections as Shift L. Combine different shifts on the two channels for broader textures.

Feedback

Feedback is active for this effect and controls the amount of shift that is re-introduced to the reverb for each channel.

Readouts

There are two readouts for this effect:

1. Shift L – (see list above)
2. Shift R – (see list above)

Page 2 Settings

There is one setting on Page 2

Tweak – controls the amount of shift applied by the “Tweak” setting of the shift amounts.

Tap Tempo

Tap Tempo is repurposed to enable / disable the Infinite mode wherein sounds in the reverb cycle continuously without decaying.

Auxiliary Output

This effect has no auxiliary output.

Stereo Chorus

Overview

The Stereo Chorus is multi-tap chorus with selectable number phases and an integrated LFO with variable frequency and depth. It is a true stereo effect – the Left and Right channels are completely independent but can be processed with identical parameters. Variable feedback is available as well as selectable LFO waveform and optional phase offset between the Left and Right channels.

CV Inputs

Four CV input parameters are supported:

1. Mode Var – depending on the Mode selected via button 1, this controls one of two variables. The parameter varies from 0-99%.
 - A) Offset Mode – a common delay offset for all phases is varied. This can be useful for adding tremolo by modulating the parameter in the 5-10Hz range with an external LFO (or an internal routable LFO). Tap phases are evenly spaced at intervals of $360/N$ where N is the number of phases selected by button 2.
 - B) Phase Mode – the common offset delay is fixed at 35ms and tap phases are spaced at intervals which vary by this parameter.
2. LFO Freq – this controls the frequency of the integrated low-frequency oscillator. The parameter readout varies from 0-11Hz in an exponential curve that provides greater sensitivity in the low frequency range.
3. LFO Depth – this controls the amplitude of the LFO waveform as it is summed with the Phase parameter. The parameter readout varies from 0-99%.

4. LFO Phase – this controls the phase offset between the Left and Right channel LFO values, allowing subtly different sweeps and greater stereo imaging. The parameter readout varies from 0-360deg.

Buttons

Three button functions are supported:

1. Mode – selects either Offset or Phase mode as described above.
2. Phases – Selects 1-4 taps/phases on the delay. 1 phase is a low-complexity chorus similar to early low-cost units. 3 phases is typical for modern chorus effects.
3. LFO Wave – Selects Sine, Rectified Sine or Triangle waveshape for the LFO output.

Feedback

Feedback is active for this effect. Use with caution as high values of feedback can cause wild oscillation depending on the settings of other controls.

Readouts

There are two readouts for this effect:

Stages – 6, 12, 18, 24

LFO Wave – Sine, FWR Sine

Tap Tempo

Tap Tempo is active and controls the LFO rate. Adjust the LFO rate parameter to switch control back to that parameter. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the LFO rate setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

The dedicated LFO signal for the Left channel is routed to the Auxiliary output.

Looping Effects

Stereo Looper

Overview

The Stereo Looper is a time-domain looper with resampling that provides up to 5.8 minutes of looping duration at the full sample rate and approx 45min at the lowest rate. It provides the usual feature set of recording, overdubbing and playback.

CV Inputs

Four CV input parameter is supported:

1. Resample – this controls the resampling rate and varies from 1.0x (full 48kHz sample rate) to 8.0x (6kHz sample rate). Changing this parameter in real time will vary the playback/record speed and affect the pitch of recorded sounds. Lower sample rates allow longer record times but also have reduced bandwidth and may sound dark/dull. Resampling can be quantized to 1.0/2.0/4.0/8.0 for perfect octave pitch shift.
2. Warble – controls random variation of the resample rate to simulate tape warble.
3. Sat/Drive – over first ½ rotation adds gradually more soft saturation. Over second ½ rotation increases drive gain into saturation. Note that drive gain is normalized after the saturation operation to prevent runaway feedback.
4. EQ – over the first ½ rotation gradually reduces lowpass cutoff from 24kHz to ~2kHz. Over second ½ rotation gradually increases highpass cutoff from DC to ~200Hz.

Buttons

Four button functions are supported:

1. Quantize – enables octave quantization of the resample rate.
2. Reverse – reverse direction of overdub or play.
3. Reset – Clears memory and returns the looper mode to Wait.
4. Pause – this temporarily halts the record and/or play process. Pressing again will resume record/play at the same point in the memory.

Feedback

Feedback controls the amount of original signal from the loop is mixed back in during overdub. Set to full CW for perfect preservation of the original. Lower values will cause the loop to fade away with each pass.

Readouts

There are four readouts for this effect:

1. Mode – the current operating mode is displayed in the upper left of the screen.
2. Length / Loop – shows the current record length or loop duration in seconds. Note that this is scaled by the selected Resample rate.
3. A graphic display of loop length and record/play position as a bar graph.

Tap Tempo

Tap Tempo controls the operating mode:

1. Wait – the looper is reset and waiting to start recording with the next press of the Tap button. No audio is passed thru in this mode (wet output is silent).

2. Record – the looper is recording audio into its memory and will continue until it reaches the end of memory, or the next press of the Mode button which will define the loop point, insert a Splice and start the Overdub mode. No audio is passed thru in this mode (wet output is silent).
3. Overdub – all input audio is mixed with the existing contents of the memory according to the Feedback setting. The previous memory contents is simultaneously played thru the wet output with saturation and EQ as selected. Overdub continues recording through the loop point defined by the previous press of the Mode button until the next press of the Tap button at which time it advances to Play mode.
4. Play – memory contents is played but input audio is not recorded. Play continues through the previously defined loop point until the next press of the Mode button at which time it will return to Overdub mode.

Auxiliary Output

This effect has no auxiliary output.

Spectral Effects

Spectral effects are processed in the frequency domain using the Fast Fourier Transform. All spectral effects in the E520 use a 1024 point complex FFT to provide two 512 point real transforms at a rate of 2.7ms which provides a good compromise between time and frequency resolution, while allowing full stereo processing for most effects. Frequency resolution is 512 bins of 48Hz each.

Spectral Crusher

Overview

The Spectral Crusher is a multi-effect which provides a number of unique ways to manipulate sound in the frequency domain. Six different algorithms are available, each of which “crushes” audio in a different way.

CV Inputs

Four CV input parameters are supported:

1. Pitch – This controls a frequency-domain pitch shift by up to +/- 2 octaves. The parameter reads out in cents over the selected range (see below). Quantization to equally tempered half-tone intervals (100 cent steps) is available.
2. Phase Blur – This adds varying amounts of random phase noise to every frequency bin which can decorrelate some of the metallic sounding artifacts that are characteristic of spectral processing.
3. Depends on mode – see description below
4. Depends on mode – see description below.

Buttons

Three button functions are supported:

1. Range – selects one of four different shift ranges for the Shift parameter:
 1. 25 cent – very subtle shifts for fine control of detuning
 2. 100 cent – up to a half-tone shift for more radical detuning
 3. 1200 cent – up to +/-1 octave
 4. 2400 cent – up to +/-2 octaves.
2. Quant – Enables Equal Tempered quantization (100 cent) of the shift parameter.
3. Mode – cycles through operating modes
 1. Pass-thru – Only pitch shifting and phase blur are applied, no additional processing takes place.
 2. Threshold – filters out all bins with loudness that don't fall between the Low and High threshold settings. CV #3 is the low threshold – all bins quieter than this will be dropped. CV #4 is the high threshold – all bins louder than this will be dropped.
 3. Compress – Similar to Threshold mode, except only a low threshold is set and all bins louder than the low threshold will be forced to the target loudness. CV #3 is the low threshold and CV #4 is the target loudness.
 4. Peak-Hold – This algorithm detects the peak loudness in every bin and holds it with exponential decay that's controlled by CV #3. The frequency of the bin will track the actual frequency until the actual loudness falls below the threshold set by CV #4, at which point it will be held.
 5. FrqCrush – The full spectrum is divided into groups and the loudest bin in every group is preserved while all others are dropped. The loudness of the preserved bin is binary quantized. CV #3 controls the size of the groups (powers of 2 from 1 up to 512) while CV #4 controls the loudness quantization (bits from 1-15).
 6. Scintll8 – Random noise modulation is applied to the loudness of every bin. CV #3 controls the amplitude of the noise from 0-99%. CV #4 controls the bandwidth of the noise from 0-99%.

Feedback

Feedback is active for this mode.

Readouts

There are four readouts for this effect:

1. Range – 25, 100, 1200, 2400 cents
1. Quant – on/off

2. Mode – see list above.
3. Freeze – Highlighted when Freeze mode is enabled.

Tap Tempo

Tap Tempo is repurposed to enable/disable Freeze mode. During Freeze the spectrum of the playing sound is held static until Freeze is disabled.

Auxiliary Output

This effect has no auxiliary output.

Spectral Time Machine

Overview

The Spectral Time Machine is a combination of a looper, pitch shifter and time stretcher. A large (5.8 minute) memory records and loops sounds which can be played back continuously or looped with variable speed and pitch. Due to the processing overhead this is a mono effect – Left and Right channels are mixed 50/50 prior to input. Output has pseudo-stereo at some settings of the Phase Blur control.

CV Inputs

Four CV input parameters are supported:

1. Time Factor – This controls the playback speed over a range of +/- 2 x the record speed. Changing speed (or even stopping) does not change pitch. During “Record” mode, the play head may pass up the record head, either forward or backward. When passing forward it will continue playing the previous contents of the memory which may have either silence, or sound from earlier cycles. When passing in reverse it will suddenly shift from old sound to newly recorded sound. During “Overdub” or “Pause” mode, playback is constrained to the loop that was defined when moving from “Record” to “Overdub”.
2. Pitch – This controls a frequency-domain pitch shift by up to +/- 2 octaves. The parameter reads out in cents over the full range of +/-2400 cents. Quantization to equally tempered half-tone intervals (100 cent steps) is available.
3. Phase Blur – This adds varying amounts of random phase noise to every frequency bin which can decorrelate some of the metallic sounding artifacts that are characteristic of spectral processing. Phase blur is applied independently to the Left and Right output channels which results in a wider stereo image at some settings.
4. Spect Fdbk – this allows the spectral output from the play process to be mixed back into the Record buffer.

Buttons

Four button functions are supported:

1. Tap Tempo – Controls the Record process. There are four modes:

1. Wait – the record process is waiting to be started. Press Tap to advance to Record mode.
 2. Record – the buffer is being overwritten with new audio data. Feedback is not enabled at this point and the entire 5.8min buffer can be used for recording. Press Tap to define a loop point, enable feedback and advance to Overdub mode.
 3. Overdub – continues to record, but mixes new input with the current contents of the record buffer and also the spectrally processed output according to the Feedback and Spect Fdbk settings. Press Tap to stop recording and enter Pause mode.
 4. Pause – recording is stopped. Press Tap to return to Overdub mode.
2. Quant – Enables Equal Tempered quantization (100 cent) of the Pitch Shift parameter.
 3. Play – Controls the Play process. There are two Play modes:
 1. Wait – No playback audio. Press the Play button to advance to “Play” mode.
 2. Play – the play process reads out of the buffer at a rate set by the Time Factor parameter. During “Record” mode the entire buffer is available to play so the play head may pass the record head. During “Overdub” or “Pause” modes the play head will be restricted to the loop point established when the record process advanced from “Record” to “Overdub” mode. Press the Play button to stop playback and return the “Wait” mode.
 4. Reset – Resets both the Record and Play modes back to “Wait” without clearing the memory. The play process may still access previously recorded audio in the buffer but the loop point encompasses the entire 5.8min buffer.

Feedback

Feedback parameters for Left and Right control the mixing of input audio with the existing contents of the buffer during “Overdub” mode.

Readouts

A graphic display of loop length and record/play position as a bar graph. The location of the record head is shown above the line and the play head is shown below the line.

Tap Tempo

Tap Tempo controls the record mode.

Auxiliary Output

This effect has no auxiliary output.

Spectral Delay + Pitch

Overview

The Spectral Delay + Pitch is a stereo effect with independent delay and pitch shift applied to the Left and Right channels. Pitch shift quantization to equal tempered half tone intervals is available

independently on each channel and a fixed value phase blur may be applied to both channels simultaneously.

CV Inputs

Four CV input parameters are supported:

1. Delay L – This controls the amount of delay applied to the Left channel. The range is 0 to 1.96 seconds.
2. Pitch L – This controls frequency-domain pitch shift by up to +/- 2 octaves for the Left channel. The parameter reads out in cents over the full range of +/-2400 cents. Quantization to equally tempered half-tone intervals (100 cent steps) is available.
3. Delay R – This controls the amount of delay applied to the Right channel. The range is 0 to 1.96 seconds.
4. Pitch R – This controls frequency-domain pitch shift by up to +/- 2 octaves for the Right channel. The parameter reads out in cents over the full range of +/-2400 cents. Quantization to equally tempered half-tone intervals (100 cent steps) is available.

Buttons

Three button functions are supported:

1. Quant L – Enables Equal Tempered quantization (100 cent) of the Left channel shift parameter.
2. Quant R – Enables Equal Tempered quantization (100 cent) of the Right channel shift parameter.
3. Blur – Enables / Disables fixed value phase blur for both channels.

Feedback

Feedback is active for this mode.

Readouts

There are three readouts for this effect:

1. Quant L – on/off
2. Quant R – on/off
3. Blur - on/off.

Tap Tempo

Tap Tempo is disabled in this effect.

Auxiliary Output

This effect has no auxiliary output.

Spectral Delay

Overview

The Spectral Delay is a stereo effect which delays each spectral bin by different amounts. Several modes are provided to vary the bin delays in different ways. Left and Right channels have independently controlled delay parameters.

CV Inputs

Four CV input parameters are supported but their function varies depending on the operating mode so see below for details:

1. Left channel mode-dependent parameter 1.
2. Left channel mode-dependent parameter 2.
1. Right channel mode-dependent parameter 1.
2. Right channel mode-dependent parameter 2.

Buttons

Three button functions are supported:

1. Range L – Selects maximum delay range for the Left channel. Ranges vary between 0.17 sec up to 5.46 sec.
1. Range R – Selects maximum delay range for the Right channel. Ranges vary between 0.17 sec up to 5.46 sec.
2. Mode – selects one of three possible algorithms for varying the bin delays:
 1. Pivot / Tilt – This creates a piecewise-linear response curve with control of the slope and center frequency. Parameter #1 “Pivot” controls the the center frequency and ranges from 0 - 24kHz, while parameter #2 controls the slope of the response and ranges from [fixme].
 2. Sinusoid – The creates a sinusoidal response curve with control of period and gain. Parameter #1 controls the period of the sinusoid from 375 Hz to 24kHz, while parameter #2 controls the amplitude of the sine wave and ranges from -1.0 to +1.0
 3. Random – This creates a pseudo-random delay across all bins with varying seed and gain. Parameter #1 selects the seed from among 128 possible to keep the per-bin random delays stable while the parameter is not changed. Parameter #2 controls the amplitude of the random values and ranges from -1.0 to +1.0.

Feedback

Feedback is active for this mode.

Readouts

There are five readouts for this effect:

1. Range L – 0.17s thru 5.46s
2. Range R – 0.17s thru 5.46s
3. Mode – see list above.
4. Delay vs Frequency plot for Left channel
5. Delay vs Frequency plot for Right channel

Tap Tempo

Tap Tempo is active and controls the maximum delay range of both channels. Use the range buttons to return to the fixed ranges. Tap Tempo status is shown in the upper left of the effect area: No indicator means tap tempo is inactive, “...” means that some taps are detected and the algorithm is acquiring the tempo, while “TT” signifies that tempo is active and overrides the Range setting. Tap intervals longer than ~5 seconds cause the tempo calculation to reset.

Auxiliary Output

This effect has no auxiliary output.

Spectral Vocoder

Overview

The Spectral Vocoder is a mono effect which superimposes the amplitude response of one signal (the Modulator, in the Left channel) upon another signal (the Carrier, in the Right channel) which can (among other things) be used to create “talking instruments” when speech is used as the Modulator signal. Various amplitude and frequency manipulations are provided to improve or distort the intelligibility of the resulting sounds, including gain adjustments, compression, enhanced sibilance (“S” sounds) and frequency resolution reduction.

CV Inputs

Four CV input parameters are supported:

1. Gain – this adjusts the sensitivity of the detector on the Modulator signal. The parameter ranges from 0 – 100 with higher values indicating greater sensitivity.
2. Tilt – this parameter provides a coarse equalization and ranges from 0.99 to -0.99. Fully CCW (0.99) the low frequency response is emphasized and at fully CW (-0.99) the high frequency response is emphasized. In the center the overall response is flat with frequency.
1. Sibilance – this controls the amount of high-frequency noise injected into the Carrier signal. The parameter ranges from 0-99% and increasing it adds more noise which can enhance overall intelligibility by emphasizing “S” sounds in speech.
2. Bands – this controls the frequency resolution of the algorithm. The parameter ranges from 8 to 512 and at lower settings will muddle the intelligibility of the resulting sound.

Buttons

Two button functions are supported:

1. Compress – this applies a nonlinear response to the Modulator gain calculation and can be used to improve intelligibility of vocoded speech.
2. Invert – this does a spectral inversion of the Modulator signal, pivoting around 6kHz. It makes speech completely unintelligible.

Feedback

Feedback is active for this mode.

Readouts

There are Two readouts for this effect:

1. Compress - on/off
2. Invert - on/off

Tap Tempo

Tap Tempo is disabled in this effect.

Auxiliary Output

This effect has no auxiliary output.

Spectral Drone

Overview

The Spectral Drone is a stereo effect which is patterned on the Michael Norris Spectral Dronemaker plugin. It takes any audio as input, samples the sounds at controllable intervals and interpolates between the samples.

CV Inputs

Four CV input parameters are supported but their function varies depending on the operating mode so see below for details:

Length – This varies from 0.01 second to 10 seconds and controls the nominal length of the sampling interval. Shorter lengths track the incoming sound more accurately, longer lengths lead to slowly changing sounds.

Phase Blur – This controls the amount of phase blur added to the output. At full CCW no blur is added, while at full CW the maximum is added. Increasing blur will change from wavy to bubbly to glassy sounding output.

Left Pitch – A variable amount of pitch shift can be added to the left channel audio prior to the sampling process. Range is -1200 cents to +1200 cents and is nonlinear to provide more fine tuning for small shifts.

Right Pitch – same as Left Pitch but for the right channel.

Buttons

Three button functions are supported:

Peak – When On, instead of taking the amplitude of the audio at the sampling instant, the peak value over the previous interval is used. This can make the output louder but also results in less dynamic sounds.

Variance – controls the amount of variation in the sampling length between the FFT bins. Off means no variation and all frequencies are sampled at the same rate. 40% and 100% settings allow increasing randomness.

Grid – When on, all frequencies are quantized to the center of the nearest FFT bin. Can make the sounds more mechanical and buzzy.

Feedback

Feedback is active for this mode. When either feedback is in the negative (left of center) range then Ping mode is on for that channel. Ping mode changes the way frequencies are sampled and can result in interesting discontinuities in the tones.

Readouts

There are two readouts for this effect:

Left and Right Ping mode status is shown above the parameter widgets.

Page 2 Settings

There is one Page 2 setting which enables quantization of the pitch shifts to 100cent intervals.

Tap Tempo

Tap Tempo is active and synchronizes the sampling interval. Each tap will force an immediate sample operation and can be used to keep the drone time aligned with an external source.

Auxiliary Output

This effect has no auxiliary output.

Miscellaneous Effects

Miscellaneous Effects are neither Time or Spectral in nature but still modify audio.

Envelope-Wah

This is a classic Auto-Wah effect consisting of an envelope follower combined with resonant lowpass filters.

CV Inputs

Four CV input parameters are supported:

1. Gain – this adjusts the sensitivity of the detector on the Left channel signal. The parameter ranges from 0 – 5.5x with higher values indicating greater sensitivity.
2. Offset – this is a voltage offset added to the detected signal after gain is applied. Use it to adjust the baseline value when no signal is present such that the desired “off” filtering is applied.
3. Lag – this adjusts the response of a lag filter that smooths the detected envelope. 0% (full CCW) applies no filtering while 99% (full CW) freezes the signal.
4. Resonance – this controls the resonance peak of the audio lowpass filter. Use it to enhance the formant of the ‘wah-wah’ effect to make the baby cry harder.

Buttons

Three button functions are supported:

1. Detector – selects one of five different detection algorithms:
 - I. Precision – closely follows the envelope without much ripple but has some lag on the attack. Probably the best choice for ‘wah-wah’ effects.
 - II. Crunchy – similar to Precision, but has a very fast attack.
 - III. Sinusoid – tracks signals with sinusoidal waveforms very accurately, but not so accurate for more complex waveforms.
 - IV. Average – tracks the average power of signals but requires a lot of lag filtering to smooth out ripple.
 - V. Peak – very accurate peak tracking but also requires a lot of lag filtering to remove ripple.
2. Sensitivity – Low or High. Low is normal and High applies 20dB of signal boost on the detected envelope. Useful when dealing with weak signals.
3. Invert – Changes the sense of the final detected output. “Wah-Wah” is normal positive sense. “Yo-Yo” inverts and makes the filter sweep in the opposite direction.

Feedback

Feedback is active for this mode.

Readouts

There are no readouts for this effect.

Tap Tempo

Tap Tempo is disabled in this effect.

Auxiliary Output

The detected / scaled / offset / inverted envelope as applied to the filter is available on the Auxiliary output.

Utility Effects

Utility effects are those which don't modify audio signals - instead they analyze inputs and present the results to the user via the display, or as signals on the audio and auxiliary outputs.

Scope

Overview

The Scope utility effect is a multi-purpose signal analyzer which comprises five different analysis modes:

1. Time mode – essentially an oscilloscope with control over triggering, vertical gain and horizontal timebase.
2. X-Y mode – a 2D plotting utility that can be used to generate Lissajous graphs of the Left vs Right channels.
3. Freq mode – a spectrum analyzer with variable frequency span.
4. VU mode – a level meter which functions similarly to industry-standard VU meters.
5. Tune mode – a frequency meter accurate to 0.1Hz which includes quantization and tuning error readouts for standard Equal Tempered tuning.

Left and Right input channels are processed separately and modes may be selected independently on each.

CV Inputs

Four CV input parameters are supported. Parameters 1 & 2 are assigned to the Left channel readout and parameters 3 & 4 are assigned to the Right channel readout. The functions vary depending on mode:

1. Time mode – Two parameters are used: a Vertical parameter controls the amplitude of the displayed signal in and a Horizontal parameter controls the time base. The maximum amplitude is 7V/division which covers the full input range of the audio signal and the minimum amplitude is 0.05V/division. Horizontal resolution varies from 170.7ms/division down to 1.3ms/division which is one pixel per sample at the native 48kHz rate.
2. X-Y mode – the same two parameters as Time mode. Note that the time base control now affects the duration of the Lissajous trace. Longer time base means the trace captures a longer duration signal, but also loses resolution so plots may appear “spikier”.
5. Freq mode – only one parameter is used to control the span of the frequency plot. Three spans are available: 3kHz/division, 6kHz/division, and 12kHz/division. The vertical axis has a fixed scale of 20dB/division.

6. VU mode – no parameters are used for this mode. The meter is scaled such that the +3dB limit represents the full 14Vpp input range for a sine waveform. The 0dB tic is the nominal 10Vpp level of a Synthesis Technology oscillator. Note that like a normal analog VU meter, this level meter is sensitive to wave shape, so a 10Vpp square wave will peg the meter even though it doesn't actually saturate the codec input.
7. Tune mode – One parameter is used for this mode which allows setting the frequency of the A1 note to 440.0Hz +/-50 cents. The frequency estimation process requires about 10ms to settle to an accurate measurement (usually about +/-0.1Hz) and will present tuning error on a scale of +/-50cents. A caveat: for some complex waveforms the estimate may be off by one or more octaves, but the quantized note on the scale and relative cents error estimate will still be correct.

Buttons

Three button functions are supported:

1. L Mode - Selects operating mode for the Left channel.
2. R Mode - Selects operating mode for the Right channel.
3. Trigger – selects the trigger mode for both channels in Time or X-Y modes.
 1. Auto – the sweep is initiated when the input signal rises through 0V, or after an internal timer expires. This ensures that even in the absence of a true trigger you'll still see a sweep.
 2. Ext – the sweep is initiated only when a rising edge is seen on the SYNC input jack, or the Tap Tempo button is pressed.

Feedback

Feedback is not active for this mode.

Readouts

There are two readout areas for this effect – basically two small screens in which the signals are plotted and/or results summarized.

Tap Tempo

Tap Tempo is used for external triggering.

Auxiliary Output

This effect has no auxiliary output.

Revision History

V0.1 – Oct 10, 2019: Initial release

V0.2 – Nov 4, 2019: Updates for new functionality. Added Main Page P2, P3, Clean Delay Tap offset, Scope mode.

V0.3 – Nov 22, 2019: Updates for new effects and functionality. Added Flanger, Chorus, Tap LFO setting, Auto-Wah.

V0.4 – Dec 2, 2019: Updates for new aux outputs on freq shift and flanger. Updates to Looper UI.

V0.5 – Dec 6, 2019: Updated for new Time Machine UI.

V0.6 – Dec 31, 2019: Updated for new Stereo Chowder Delay.

V0.7 – Jan 10, 2020: Updated for new Spectral Drone, added frequency shift BPM, Shimmer RT and filter unit displays.