Winnows

Dual VC Resonator

User Manual

Revision 26/04/24

Thank you for purchasing this dual channel resonant bandpass filter module from Laine. We hope you enjoy working with it.

Operation

Winnows is a creative tool for resonant tone shaping with plenty of possibilities for source modulation. It can be employed subtly as a wide, dual bandpass filter through to a more dramatic narrow, ringing or booming resonant feedback effect unit.

Each channel filters and boosts around a central resonant cutoff frequency, with the remaining signal damped by low pass filters. The audio chain can be routed to give a wide or steep bandpass filter response using the channel Pole Routing Switch. The amount of out of band rejection around the centre frequency range is dictated by the switch position, which toggles the number of filter poles the input signal passes through. The more poles passed, the steeper the cutoff slopes. With steep slopes the sound of the resonance core begins to dominate.

Each channel begins to self-oscillate with a decaying envelope with the resonance control at around 85%. Increasing the control to maximum resonance produces stable self-oscillation producing a 10VPP sine wave signal at the outputs. Mixing channels can create filtering that has the characteristic of speech, known as vowel filtering. This is most pronouced when channels are fed similar but inverted frequency CV signals, which emulate the mouth with the top and bottom lip moving up and downwards.

Much of the overall tone and character of Winnows is set with the damping control. This adjusts the cutoff frequency of two low pass filters at different stages in the channel circuitry, one is after the first bandpass filter and resonance core, the second damping LFP comes after the second bandpass filter. The frequency control of the damping is entirely separate from the bandpass filters. Lower damping settings combined with higher bandpass frequencies produce a pleasing wooden and muted timbre.

Channels

Winnows is a dual channel device with identical circuitry per channel. Channel one is controlled by the left set of controls and top row of jack inputs. Channel two is controlled by the right hand set of controls and lower row of jack inputs.

Control Voltage (CV) Inputs

Bandpass centre frequency (Freq), Resonance (Res) and Damping cutoff (Damp) are CV controllable. 0-8v signals are expected, however the CV inputs use rectified circuitry so will accept but ignore incoming negative signals. The inputs will soft clip incoming CV around 10V.

Frequency Control

A central resonant frequency (pitch) of the bandpass filter is adjusted by a horizontal slide potentiometer. The frequency range from left to right spans from around 30Hz to 3.5 KHz. When used in combination with the Frequency CV Input, sliding the fader to the left will give more control of the range over to the CV input signal. Higher CV values result in a higher central frequency of the bandpass filter poles.

Pole Routing Switch

Each channel can be switched between two routing options that strongly alter the character of the filters. One has a wide frequency range and shallow rolloff from the central frequency and the other has a narrow frequency range with a steep rolloff either side.

Wide Routing

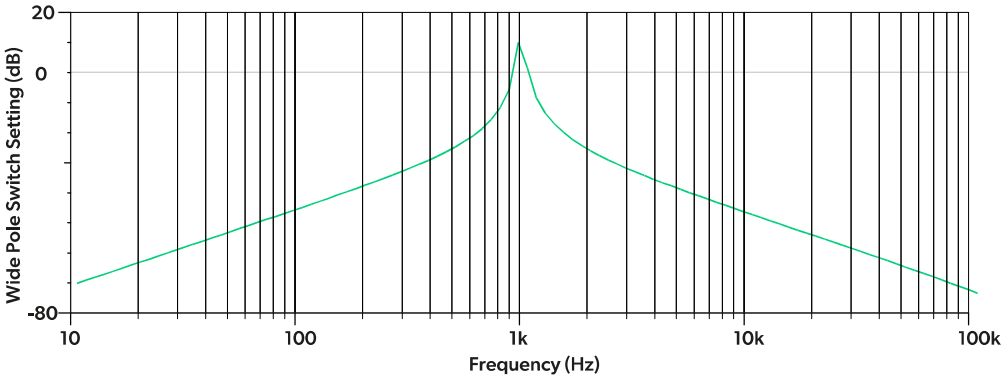
Switch in the lower position
2-Pole BP + 3-Pole Resonance damped by 1-Pole LP

Steep Routing

Switch in the upper position
Wide response into 2-Pole BP + 2-Pole Resonance damped by 1-Pole LP

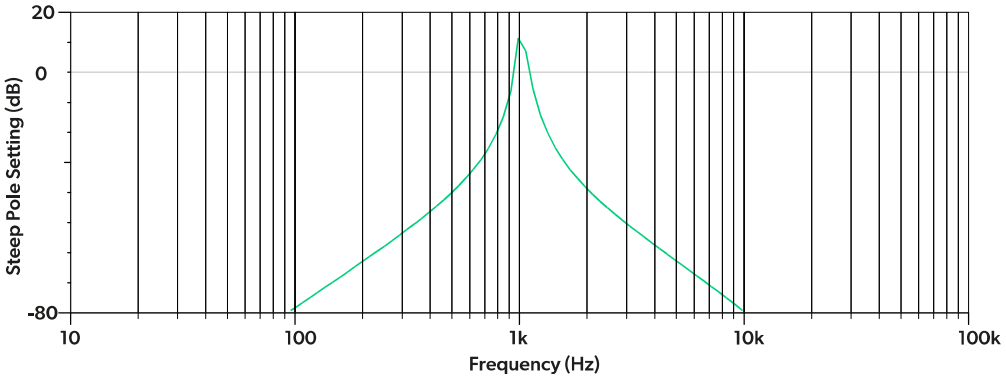
Wide Response with High Resonance

The signal is routed through a bandpass filter, resonator core and damping LPF



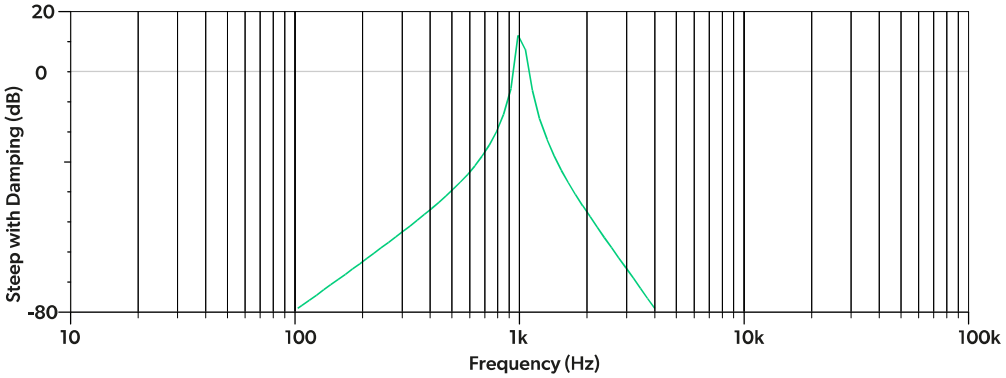
Steep Response with High Resonance

The wide output is routed through a second chain of bandpass filter, resonator core and damping LPF



Steep Response with High Resonance and Damping

The rolloff of the steep response is further increased on the upper side of the central frequency with the damping control. Both Bandpass and Damping LPF are set to 1KHz



Resonance

The resonance (also known as Q or quality factor) sets the gain around the central frequency. It's amount can be adjusted by the larger round channel potentiometer, with the highest resonance occuring at the fully clock-wise position. Self-oscillation with around a one second decay envelope will occur near the 85% mark. This level of resonance useful for creating percussion sounds. At its highest setting the resonance core performs stable self-oscillation, producing a 10VPP sine wave at the outputs. During self oscillation the channel responds to incoming CV in the same manner as audio inputs, so can be 'played' as if it were an oscillator voice.

Resonance CV signals work slightly differently to the frequency and damping CV, with smaller voltages producing greater resonance boosts. Higher settings will also give more control of the resonance amount over to the CV input signal (if it it used).

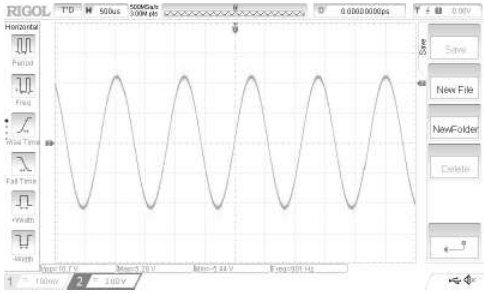
Damping

Damping for each channel is controlled by the smaller round potentiometer. It can remove any harshness from the signal, soften the tone of the input as well as being used a modulation effect.

Turning the knob anti-clockwise gives more control over to CV, with CV inputs expecting 0-8V. At the fully anti-clockwise setting Lower CV signals result in greater damping due to a lower cutoff frequency. 8V CV and above will result in no damping being applied. CV inputs are clipped at 10V.

The damping cutoff is independant to the bandpass filters and It comprises a gentle, single pole low pass filter with a 6dB per octave rolloff slope.The lower cutoff point for damping is around 300Hz so some of the input signal will still pass through when fully damped. There is no resonance built into the damping filter circuitry.

Oscilloscope plot of the sine wave output at full resonance settings



Audio Inputs

Audio inputs expect +-10VPP and begin clipping over 10V. The inputs are AC coupled.

Audio Outputs

The output level will greatly depend on the input and amount of resonance applied. Low resonance settings with a wide routing will result in outputs being quieter than the input and may need amplifiying externally. High resonance settings may clip when combined with the input signal and may need trimming before and after in the signal path.

Specifications

- Intellijel 1U format
- Width 24HP
- Depth 34mm

- Power requirements
~85mA +12V
~85mA -12V

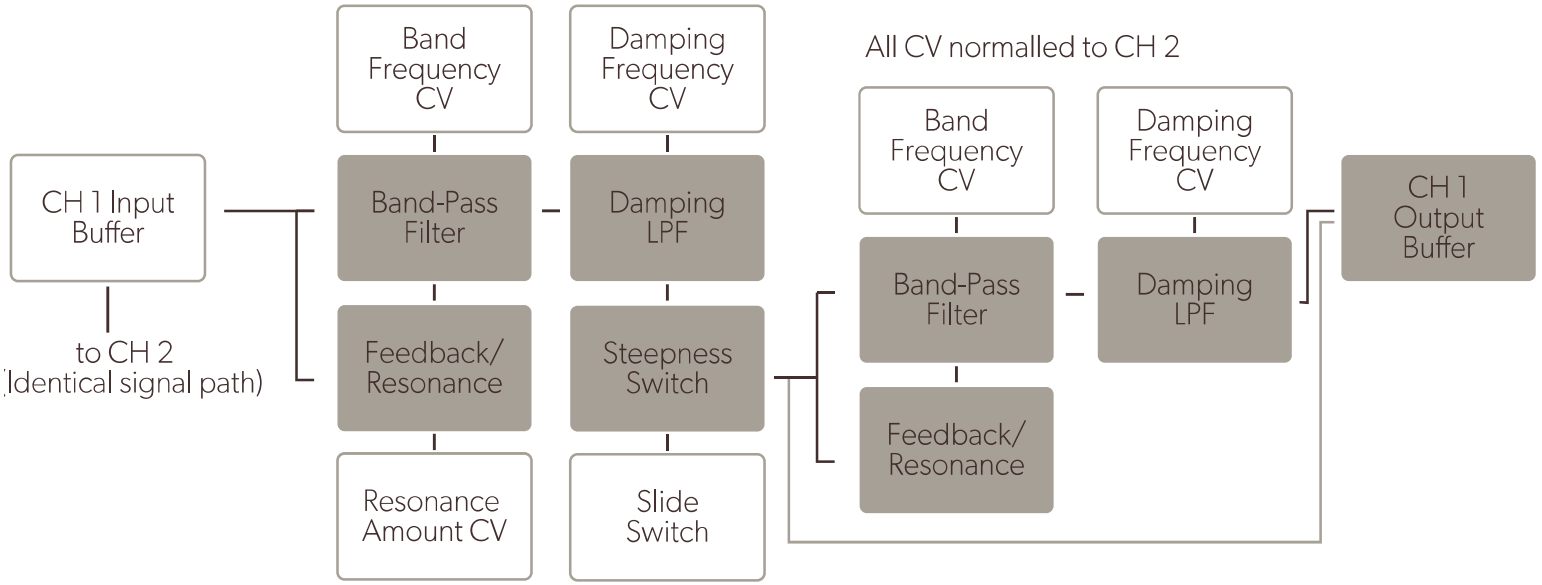
- Control voltage range
0-8V

- Impedance
Input 100K
Output 1K

- Weight
120 grams

- Printed Circuit Board
FR-4 TG155 ENIG,
Lead free solder
Sn96.5%, Ag3.0%, Cu0.5%

Signal Flow Diagram



Tuning Range and Central Frequency

At factory the frequency range of each channel is set to span 30Hz to 3.5 KHz. This was chosen to be the best sounding range for combining resonance and damping with a variety of CV signals. The frequency range of each channel can be extended at the upper and lower boundaries using the Freq Scale trimmer pot. This can be fine tuned with the Freq Offset trimmer.

To match channels by ear or spectrum analyser, remove all CV and audio inputs and set both channels to wide routing. Set the resonance to full and damping to minimum. Move the frequency slider to the right and measure the frequency of the sine wave at the output. Now measure at low frequencies with the slider fully left. Adjust the frequency scale to taste. Repeat this with the second channel and fine tune to match with the Freq Offset trimmer.

Trimming Resonance

Resonance for each channel can be adjusted and matched using the Res Scale trimmer.
This fine tunes the point at which self oscillation occurs when using the controls. It also trims the resonance gain at the maximum setting. Adjusting this trimmer will also have a small effect on the Freq Offset trimming.

Normalisation

The CV and audio inputs of channel 1 are normalled to the inputs of channel 2. Patching into channel 2 breaks the normalisation.

Temperature Compensation

Winnows uses VCA based filter cores without temperature compensation. Channels are matched at factory but some temperature drift of the tuned central frequency is to be expected.

Filter Core

The filter cores are based on state variable filters with SSI2164 VCAs. Integrator opamps are OPA1679.

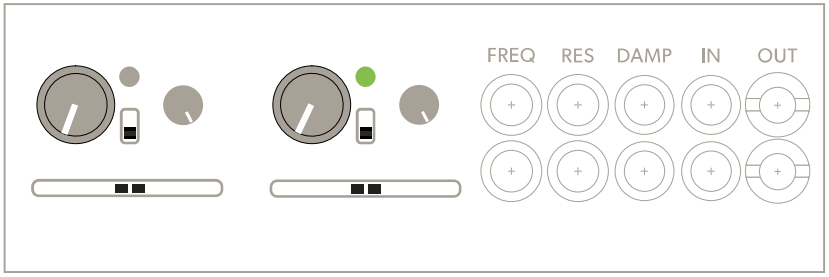
Integrator Capacitors

All integrator capacitors are surface mount MLCC. The tolerance is 1% with C0G or NP0 dialectric

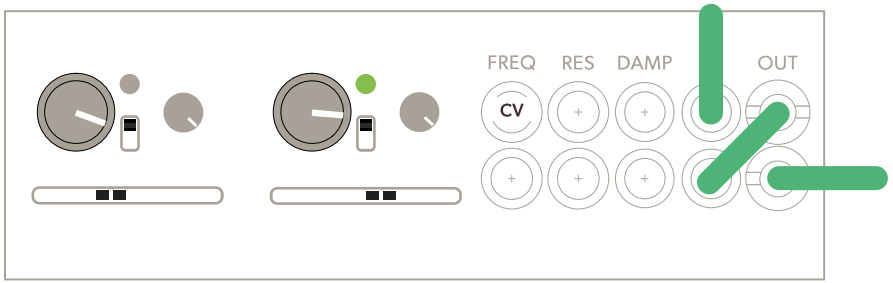
Patch Ideas

Here are some patch starting points for getting to know Winnows.

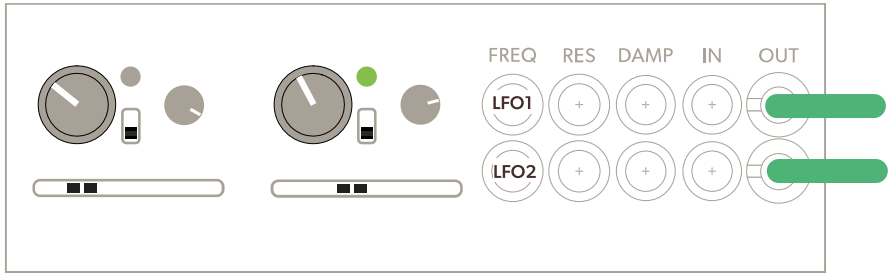
Factory reset



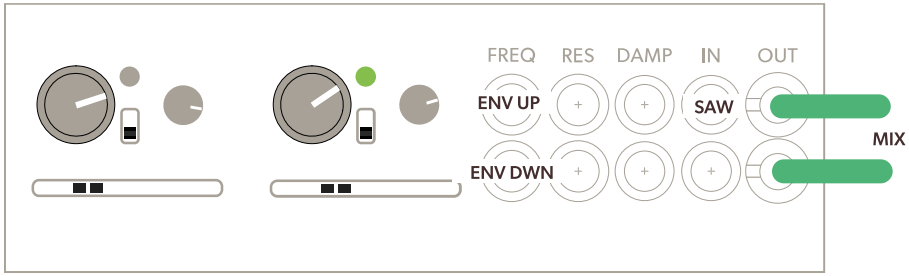
Patching channels in series



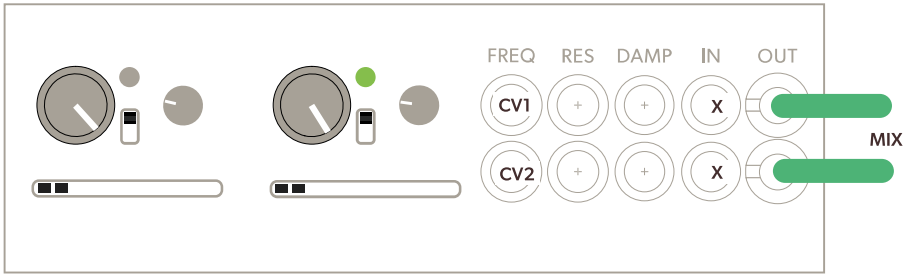
Gentle bandpass filters for pads and instruments



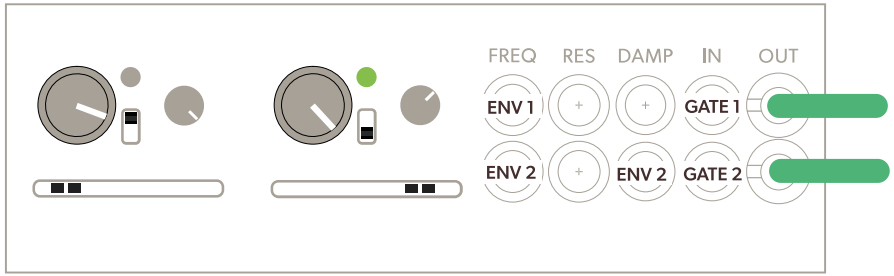
Vowel filter



Drone machine using self oscillation



Percussion source with low and high voice



Protect your Ears
Caution must be shown with high resonance settings, especially in combination with higher central frequencies. Always patch with low mixer volume levels, and use hearing protection wherever possible.

Standards Compliance
This device complies with international EMC and Safety Standards when installed in a fully compliant rack. It has been assembled and tested in the United Kingdom.

CE
EU Low Voltage directive (LVD) 2014/35/EU, EU Electromagnetic Compatibility directive (EMC) 2014/30/EU. The Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment Directive (RoHS2) 2011/65/EU.

FCC
This device complies with Part 15 of FCC rules. Operation
is subject to the following two conditions:

(1) this device may not cause harmful interference, (2) this device must accept any interference received, including interference that may cause undesired operation.

Electromagnetic Compatibility
BS EN 55032:2015, Class B. BS EN 55035:2017.

Electrical Safety
BS EN 62368-1:2014 + A11:2017, EN 62368-1:2014 + A11:2017, CSA CAN/CSA-C22.2 NO. 62368-1 2nd Ed, 2014.

Environmental Temperature
Operating: +1 to 30°C.
Storage: -20 to 50°C.

Warranty
Laine warrants this product to be free of defects in materials or construction for a period of one year from the date of purchase (proof of purchase or invoice is required.)

Defects resulting from incorrect power supply voltages over or under 12V, abuse of the product, removing knobs, changing face plates, or any other causes determined by Laine to be the fault of the user are not covered by this warranty, and normal service charges will apply. During the warranty period, any defective products will be repaired or replaced, at the discretion of Laine, on a return-to-Laine basis with the customer paying the shipping cost to Laine.

Laine implies and accepts no responsibility for harm to person or apparatus caused through the operation of this product.

Product Support Contact
Please contact **jack@laine.uk** with any questions, return requests and comments.

www.laine.uk
Instagram @laine.modular