FEA

2 Channel Mixer

www.fealabs.com

About the design:

The 2 Channel Mixer was designed to compliment and expand upon the output features of the FEA Dual Band Optical Compressors. The FEA Dual Band Optical Compressor is an ideal crossover unit for bi-amplifying a guitar signal due to the compressors separate LO and HI outputs (Bi-amplifying is the method of sending low frequencies to one amplifier and high frequencies to another amplifier). The FEA 2 Channel Mixer allows the two outputs of the FEA Dual Band Optical Compressor to be utilized in unique ways and then remixed for a single amplifier. With the use of the Dual Band Optical Compressor and the 2 Channel Mixer the LO and HI signal paths are available for separate FX processors. For example, a chorus FX pedal could be placed in the HI frequency signal path from the compressor to the FEA mixer. This one scenario would keep the lowest frequencies dry and un-effected while adding chorus to the higher frequencies. Having both the LO and HI signals available in this manner allows for the musician to create his or her own signature sounds.

The phase for channel two can be continually adjusted from 0 to 180 degrees. Because some FX pedals invert their output signals an adjustment was necessary to realign the signal or to change the phase of the signal on channel two to reduce a cancellation effect. Due to some players using multiple FX boxes at different times during a performance an adjustable phase control was necessary. This phase adjustment can be applied just enough to minimize a cancellation effect between the two mixer channels when recombined for the output. A phase inverter switch would have been cumbersome because it would need to be constantly toggled on and off depending upon the FX box currently active.

There is a BOOST foot switch for instantly increasing the gain. The boost gain is adjustable from 3dB to 10dB and can be applied to CH1, CH2 or both via the rotary selector. There is a jumper on the back of the circuit board that enables gradual high frequency attenuation to the boost circuit. This filter helps to keep the white noise (hiss) from other pedals from becoming overbearing while the BOOST is active.

There is an output amplifier selector to choose between the BJT (Bipolar Junction Transistor) output of the operational amplifier or a discrete class A JFET (Junction Field Effect Transistor) amplifier output. The JFET amplifier has been carefully designed to minimize signal distortions.

There are clipping indicators for the two inputs and the output. This is to show when the signal is too hot and is approaching distortion. This feature works just like the clipping LED's found on the lager professional mixing consoles.

The FEA 2 Channel Mixer uses 1% metal film resistors, multi-layer metallized polyester film capacitors, hi-fi quality operational amplifiers in the signal path. These are the very same op-amps that are used in some very high-end studio mixing consoles.

The dual rail power supply in the 2 Channel Mixer is built on an isolated circuit board. The power supply can be powered with 9 to 25V DC and is over filtered two times to assure exceptionally clean power for the signal circuitry. This power supply provides 18Volts (+9V and -9V) to the mixer circuit board to provide plenty of headroom for the signal. The power supply was designed to provide separate power for the signal clipping monitoring circuitry. This assures that any natural electrical noise that the mixer's clipping monitoring circuitry generates will not bleed into the signal circuitry. I have not seen this approach to power distribution in any of the other manufacturer's guitar effects. Is it overkill? Maybe…but I feel that it is absolutely crucial to eliminate every bit of noise where possible.

The case is a standard Hammond aluminum enclosure. I have tried some of the copies with my prototypes but did not like their quality for a final product. After the Hammond case is machined and sanded it is treated with Aluminum Chromate for corrosion resistance. This is one of the same treatments that the United States military specify for their aluminum panels. The enclosure is then color powder coated, the aluminum faceplate is applied and then the entire case is clear epoxy powder coated for protection.

Frank E. Appleton (FEA)

Features:

- Input GAIN control on both mixer channels can be adjusted from -5dB to +12dB.

- Channel 2 has an adjustable PHASE control to correct for signal inversion from some FX pedals. This is to help minimize frequency peaks and notches when mixed with channel 1 having a similar harmonic structure.

- Channel 2 has a footswitch to enable or disable the channel. Channel 1 cannot be disabled and is always active.

- The BOOST amplifier is activated by the BOOST footswitch. The BOOST amplifier can be set to either channel or both via the rotary selection switch.

- The jumper on the back of the circuit board enables a low pass filter in the BOOST circuit at 15KHz to help minimize white noise (hiss) while BOOST is activated.

- Output amplifier type is selected via a rotary selection switch. There are two output amplifier topologies available in the 2 Channel Mixer. The first type is the BJT, "class AB" output of the op-amp. This amplifier is usually considered the most accurate and has a clean and sterile sound. The second type is a discrete JFET "class A" amplifier. Some prefer this type of amplifier for its sonic character resembling tube amplification.

- There are three clipping monitoring circuits for detecting excessive signal levels. The clipping monitors will light before the signal actually clips and the monitor for channel 2 is always active, even if the channel is disabled by the footswitch. ***NOTE: If a clipping LED illuminates then the gain should be reduced for the affected channel or output.***

- The 2 Channel Mixer has minimal components in the signal paths to maintain the utmost signal quality. All resistors in the circuit are low noise 1% metal film type. The signal coupling capacitors are tight tolerance, quiet, multi-layer and metallized polyester film type. The operational amplifiers used in the signal path are JFET input, low-noise, low-distortion "hi-fi quality" devices.

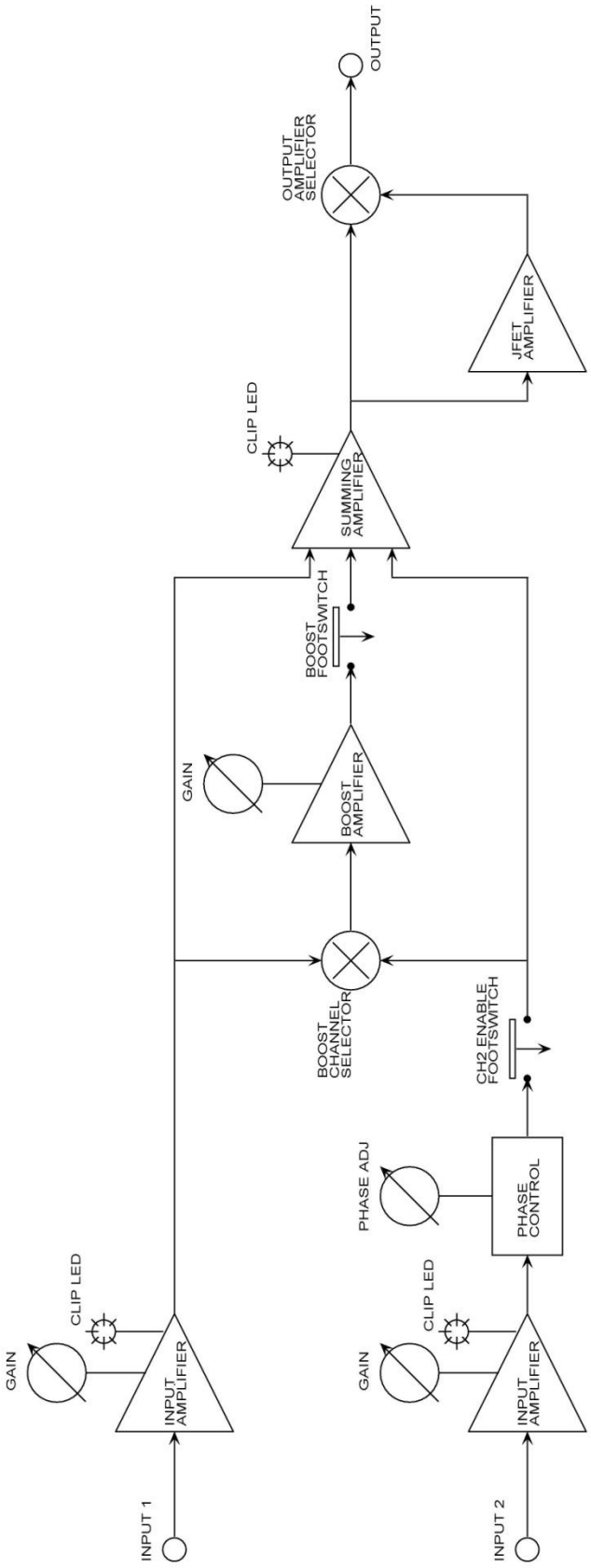
- The power supplies onboard voltage charge pump allows the circuitry to operate at 18volts (+9 and –9 volt rails) from a single 9-volt battery or AC power adapter of 9 volts or greater. This allows the signal plenty of headroom from active electronic guitars and aggressive playing techniques (i.e. pop and slap).

- This pedal is unique in which the OUTPUT jack is used for turning the power ON when a plug is inserted in lieu of the more common INPUT jack switch.

- The onboard power supply can accommodate power adapter voltages up to 25 volts DC with protection from reversed polarity. The "switch on" power supply current is less than 1µA (micro amp) on the signal ground at the OUTPUT jack. This is approximately 45,000 times (-93dB) less than the commonly used method of connecting the battery's negative terminal to ground via the sleeve of the plug inserted into the INPUT jack. The "switch on" sensing method used in the FEA 2 Channel Mixer keeps nearly all of the circuit's generated white noise and transient currents out of the OUTPUT stage signal ground. Extreme measures have been taken to keep the power and signal paths as clean as possible. ***NOTE: Unplug the cord from the OUTPUT jack when not in use to prolong battery life.***

- The power and grounds for the signal path circuitry are separated from the clipping monitors circuit power and grounds to protect the audio signal from spurious noise. The power for the signal amplifiers is exceptionally clean, filtered twice for each rail and all filter stages are oversized.

Mixer Block Diagram:



Technical Specifications:

- **Channel GAIN:** -5 to +12dB
- **Boost GAIN:** +3 to +10dB
- **Boost LP filter:** -3dB @ 15KHz (with jumper)
- **Maximum Input:** 17.5dBu
- **Maximum Output:** 14.5dBu
- **Residual Output Noise:** -60dBu from 20Hz-20kHz (un-weighted) with both gain controls set to maximum. **This is the absolute worst case noise scenario.**
- **Frequency Response:** 5Hz – 20KHz +/-3dB (100Kohm output load)
- **Total Harmonic Distortion:** Op-Amp output: <0.005% @ 1KHz JFET output: <0.01% @ 1KHz
- **Input Impedance:** 800K ohm
- **Output Impedance:** 1K ohm
- **Power adapter noise rejection:** 40dBu @ 60Hz >90dBu @ 2KHz
- **Current Consumption:** Approx. 15mA
- **Battery Life:** Approx. 30 hours continuous use
- **Power adapter (optional):** 9VDC 2.1mm Barrel Connector with negative center pin

Battery Replacement:

Remove the four screws on the bottom cover to access the battery compartment. If storing the unit for long periods of time the battery should be removed to prevent corrosion of the battery snap. Be sure to place the battery wires along the side of the battery in the battery pocket and use care while replacing the bottom cover.

Warranty:

The FEA 2 Channel Mixer is fully covered for a period of 5 (five) years and the foot switches are covered for 1 (one) year against defects in material and workmanship. Abuse and neglect are not covered under the warranty. The customer will be responsible for shipping cost to and from FEA Labs for repairs. Contact me before attempting to ship a unit for repair at: info@fealabs.com.

All repairs made outside of the warranty period will be very reasonable (usually only the cost of the parts)… your satisfaction is priority one.

Contact FEA Labs at:

Website: www.fealabs.com

Email: info@fealabs.com