

# FEA

## DUAL BAND SMX OPTICAL COMPRESSOR



[www.fealabs.com](http://www.fealabs.com)

## **About the design:**

This design is a direct result of many requests to model the very popular Trace Elliot SMX dual compressor pedal. This optical compressor is the original FEA Dual Band Optical Compressor with the variable Attack, Release and Crossover Frequency controls removed. This compressor does not have the limiter function that the full featured FEA Dual Band compressor has. The crossover frequency, attack and release times are set to the same values as the Trace Elliot SMX dual compressor pedal. The FEA and Trace Elliot compressors have vast differences of internal circuitry and functionality. Disclaimer: There are no claims that the FEA optical compressor sounds or performs like the Trace Elliot dual compressor.

Optical compressors are still preferred over VCA (voltage controlled amplifier) compressors in most recording studios for some instruments. One of those instruments where optical is favored is on the bass guitar for its smooth attack and release characteristics.

Optical compressors use a photocell (photo-resistive cell) and a light source projected onto the photocell to vary the value of resistance inversely proportional to the light intensity. Years ago these were made with a discrete photocell and light source. There are now devices that contain both the photocell and light source in a single package. They are referred to as Vactrols and AOI's (analog optical isolators). The drawbacks of these devices in the past have been with their reaction and recovery times. If the photocell were formulated for a quick reaction to light, the resistance would take a long time to settle back after the light has been removed. The opposite is also true; if the photocell were formulated for a quick recovery after the light has been removed then the reaction to light would be slow. The Silonex Company uses a combination formula for the photocell to overcome these limitations in the AOI that is used in the FEA Dual Band SMX Optical Compressor. This very same AOI is used in some high-end studio compressors for its smooth attack and release qualities. This fast Silonex AOI allows the side-chains in the compressor to accurately control the Attack and Release times of the compression. The purely resistive element in the AOI exhibits less noise and distortion than most designs using a VCA. Most audiophiles preach that only good quality passive components should be in the audio signal path and this is one application that I would have to agree with them. Along with these fantastic Silonex AOI's, the FEA Dual Band SMX Optical Compressor uses 1% metal film resistors, multi-layer metallized polyester film capacitors, hi-fi quality Texas Instrument Excalibur™ operational amplifiers in the signal path.

The dual rail power supply in the FEA Dual Band SMX Optical Compressor is built on an isolated circuit board. The power supply is over filtered two times to assure exceptionally clean power for the signal circuitry. This power supply provides 18Volts (+9V and -9V) to the compressor circuit board to provide plenty of headroom for the signal. The power supply was designed to provide separate power for all of the side-chain control circuitry. This assures that any natural electrical noise that the compressor's side-chain control 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 then color powder coated, the aluminum faceplate is applied and then the entire case is clear epoxy powder coated for protection.

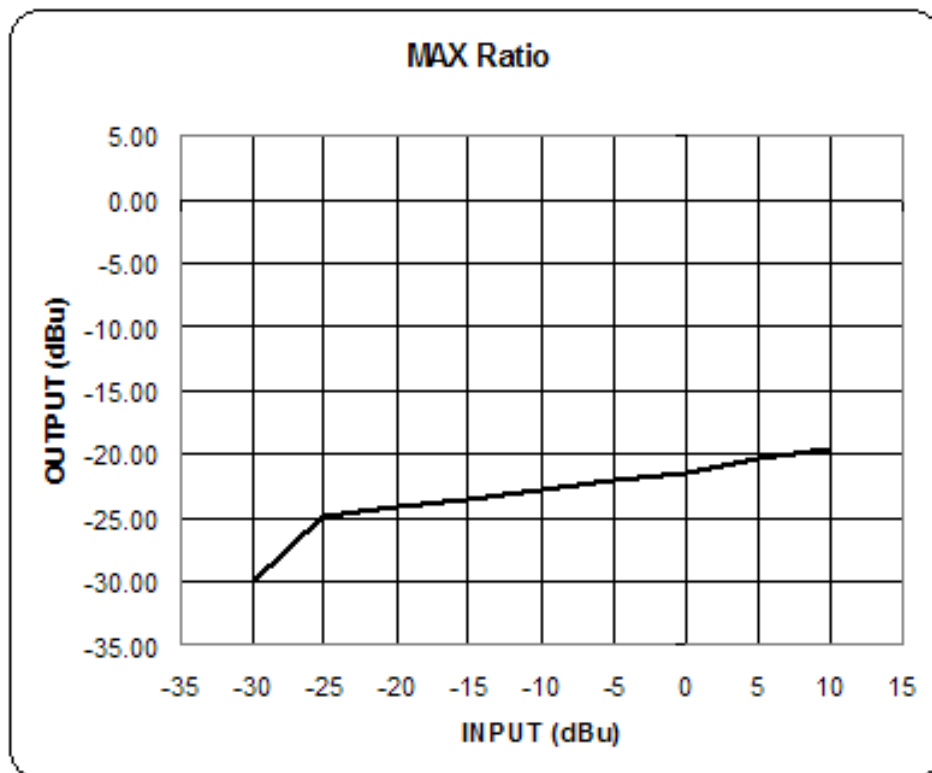
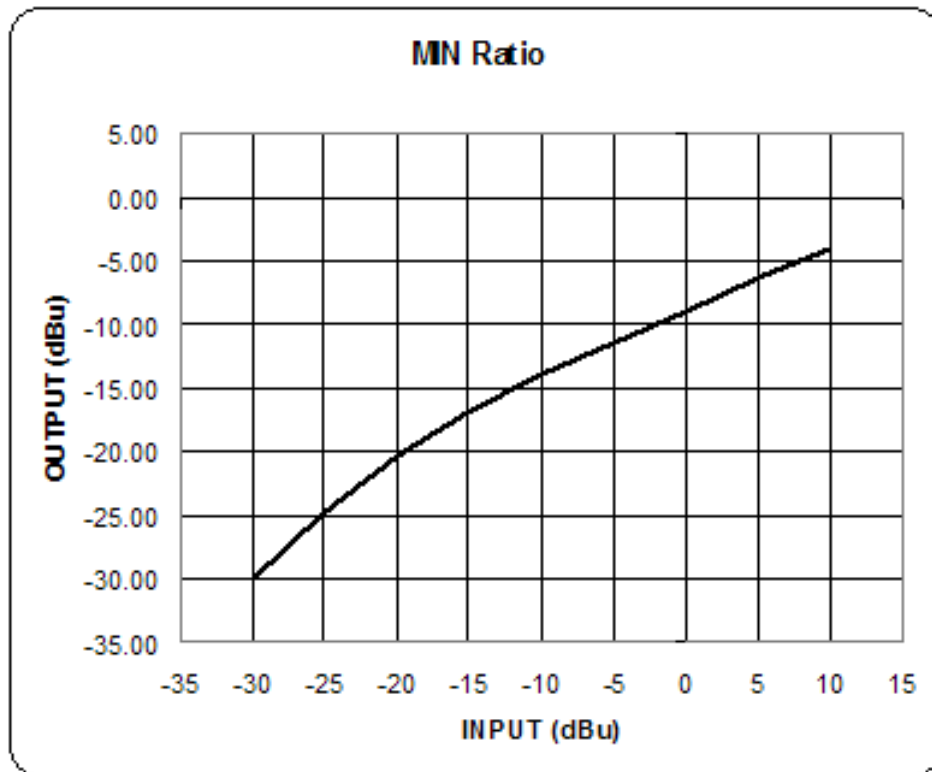
*Frank E. Appleton (FEA)*

## Features:

- Dual optical compressors for separate Low frequency (LO) and High frequency (HI) dynamics control.
- The frequencies above 5KHz are routed around the compressor circuits and are mixed back into the output amplifiers at unity gain to preserve clarity.
- Output GAIN controls for the HI and LO compressors.
- Both bands exhibit soft-knee compression at lower RATIO settings and hard-knee at maximum RATIO settings. The COMP LED indicates when the THRESHOLD has been reached. This LED does not indicate the RELEASE response.
- The compressor side-chains use precision full-wave rectification of the audio signals in the THRESHOLD circuits to improve tracking. This also reduces the possibility of “pumping” with very low frequencies.
- HI BYPASS foot switch. This allows the compressor to only control the Low frequencies (if desired) and to pass the High frequencies to the outputs unaffected. There is a red LED to indicate the HF BYPASS is on. NOTE: With HI BYPASS active the HI GAIN control is inactive.
- ACTIVATE foot switch places the compressor unit in the signal chain or in Direct Bypass mode. In Direct Bypass mode the signal at the input is directly connected to the outputs and does not pass through any electronics.
- The compressors have minimal components in the signal paths to maintain the utmost signal quality. The signal compression is accomplished with only resistive components (Light Dependent Resistors or Photocell). 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 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 9 volt DC power adapter. This allows the signal plenty of headroom from active electronic guitars and aggressive playing techniques (i.e. pop and slap).
- The “switch on” power supply current is less than 1 $\mu$ A (micro amp) on the signal ground at the INPUT 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 Dual-Band SMX Optical Compressor keeps nearly all of the circuit’s generated white noise and transient currents out of the INPUT 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 INPUT jack when not in use to prolong battery life.
- The power and grounds for the signal path circuitry are separated from the side-chain 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.
- HI and LO/FULL output jacks are configured so the outputs of the individual compressors may be routed to different amplifiers or effects. The HI output is useful if you wish to use effects made strictly for guitar and route a clean LO signal to another amplifier or mixer. If only the LO/FULL output jack is used, both the HI and LO signals are mixed together for a composite full range output signal.

## Min and Max RATIO:

Threshold set at -25dB for both tests.



## Technical Specifications:

- Crossover Freq.: 350Hz
- ATTACK: HI 2mS  
LO 22mS
- RELEASE: HI 70mS  
LO 123mS
- RATIO: 2:1 to 7:1
- THRESHOLD: -37dBu to  $\infty$
- Make-up GAIN: 0 to 20dB
- Maximum Input: 7.5dBu
- Maximum Output: 16dBu
- Residual Output Noise: -66dBu from 10Hz-20kHz  
(un-weighted) with no compression and output gains set to maximum. **\*\*This is the absolute worst case noise scenario.\*\***
- Frequency Response: 10Hz – 17KHz +0.5/-3dB  
(100Kohm output load)
- Input Impedance: 1M ohm
- Output Impedance: 1K ohm
- Power adapter noise rejection: 40dBu @ 60Hz  
>90dBu @ 2KHz
- Current Consumption: Approx. 28mA
- Battery Life: Approx. 15 hours continuous use
- Power adapter (optional): 9VDC 2.1mm 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 Dual Band SMX Optical Compressor 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](mailto: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](http://www.fealabs.com)

Email: [info@fealabs.com](mailto:info@fealabs.com)