Oakley Sound Systems

5U Oakley Modular Series

EFG & EFG-Deluxe
Envelope Follower & Gate Extractor

PCB Issue 6

User Manual

V6.0.0

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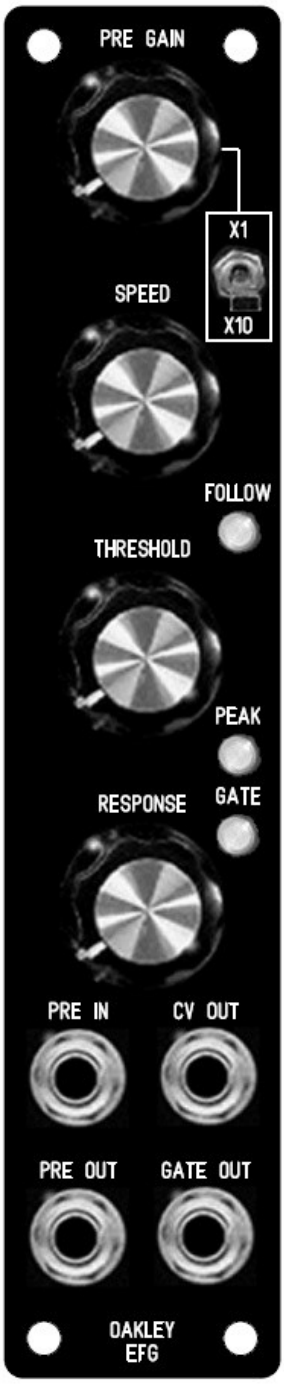
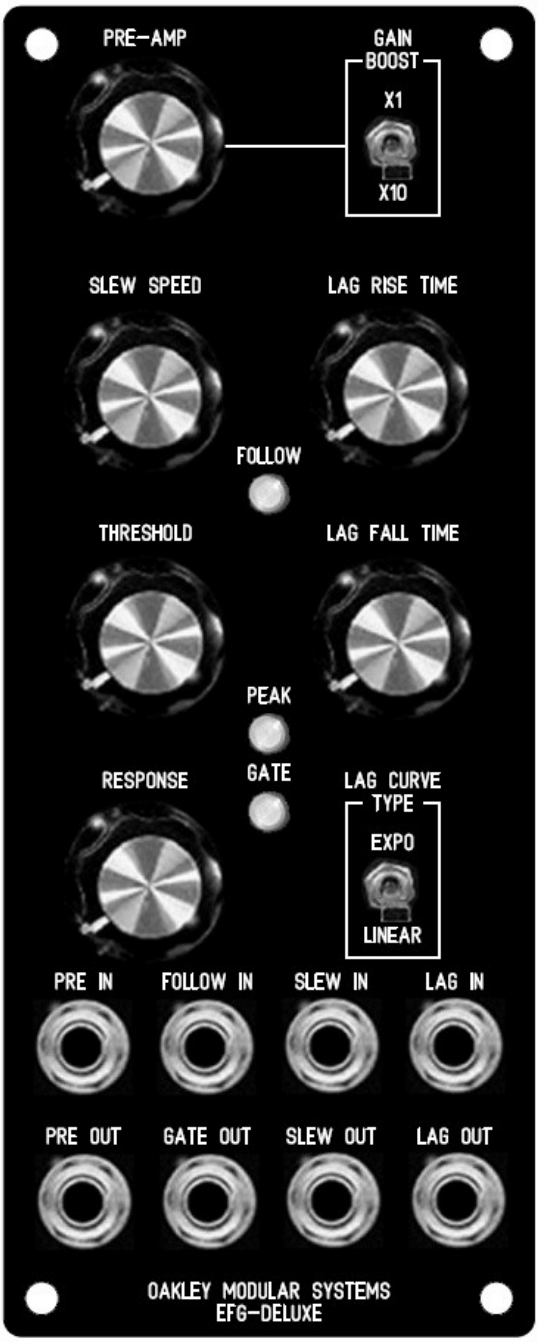


The suggested front panel design for the standard EFG in a single width MOTM format.



The suggested panel design for the EFG-Deluxe module in the 2U wide MOTM format

Introduction

This is the User Manual for the issue 6 EFG and EFG-Deluxe modules from Oakley Sound.

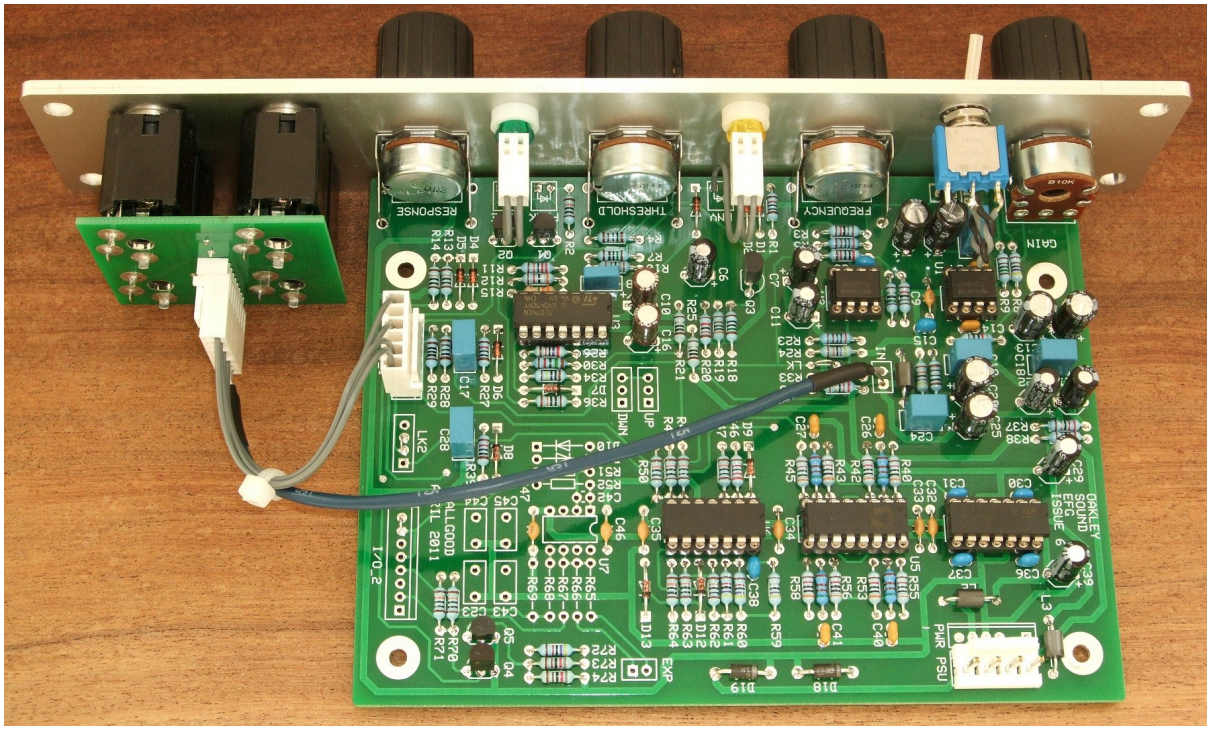
This document contains an overview of the operation of the unit.

For the Builder's Guide, which contains a full parts list for the components needed to populate the board and gives details on how to wire up the module in either of its guises, please visit the main project webpage at:

http://www.oakleysound.com/follower.htm

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

For general information on how to build our modules, including circuit board population, mounting front panel components and making up board interconnects please see our generic Construction Guide at the project webpage or http://www.oakleysound.com/construct.pdf.



This is the prototype of the issue 6 standard EFG module behind a natural finish 1U wide Schaeffer panel. This version doesn't have a peak LED fitted but this would normally be found above the green gate LED.

The Oakley EFG and EFG-Deluxe Module

The Oakley EFG is one of our most popular and long lived modules. And now with the issue 6 design I've given it a bit of a makeover.

An envelope follower takes an audio input and converts it into a control voltage. This control voltage will rise and fall with the overall volume of the input signal. The louder the input, the bigger the output of envelope follower. The Oakley issue 6 EFG has a fully variable speed CV output thanks to its internal four stage slew generator. Set to fast the CV output will respond very quickly to incoming audio and is therefore suitable for tracking fast moving cymbal and hi-hat patterns. Set it more slowly and it is more useful in processing overall audio volume. By using the CV output to control VCAs and VCFs it is very easy to create synchronised patterns that keep in perfect time with a drum machine or other musical input.

Another feature of the Oakley EFG, is the provision of a gate extractor. This part analyses the peaks in the music and creates a gate type signal in time with these peaks. This can be used to trigger envelope generators in time with an external drum loop or click track. Two rotary controls, threshold and response, enable you to get clean gate signals from all sorts of input material.

The Oakley EFG comes with a wide range three stage input pre-amplifier. This allows guitars and other unbalanced external instruments to be processed simply. You can use this output for driving other modules.

The double width deluxe version of the module utilises a built-in Little-Lag module. Unlike earlier versions, issue 6 of the EFG main circuit board contains all the circuitry required, thus this version of the EFG-Deluxe does not feature a separate Little-Lag PCB. In the standard EFG the parts pertaining to the Little-Lag circuit are simply omitted from the circuit board.

And finally the EFG, in either guise, has three LEDs. One showing input overload, one for gate status, and one for a visual indication of the slewed CV output.

Power (+/-15V) is provided to the board either by our standard Oakley 4-way header or Synthesizers.com header. Current draw is around +50mA and -40mA.

The module in a little more detail

The EFG consists of four or five separate sections, the pre-amplifier, the absolute value circuit, the slew generator, the gate extractor and for the EFG-Deluxe, the lag generator.

1. The Pre-amplifier

This is a three stage op-amp based amplifier circuit with a very wide range of gain. The first two stages are controlled with the gain pot. This varies the gain from 0.4 to 129 (or -8dB to +42dB). The third and final stage's gain is controlled by a simple switch and it can be either 1 or 10. Thus the maximum gain of the whole pre-amplifier with the gain pot turned full up and the gain switch to x10 is 1293 (+62dB). This is a very large gain and it should be used with care. It should also be noted that any noise present on the input signal will also be amplified too.

Maximum output voltage from the 'pre out' socket will be around +/-12V. At levels above this the sound will become distorted. However, this does not cause any damage to the module and may be used to create a desired musical effect.

The pre-amplifier is AC coupled so it will not pass DC nor slow moving control voltages.

2. The Absolute Value Circuit

In the EFG this is hard wired to the output of the pre-amplifier. In the EFG-Deluxe this section has its own input socket, 'follow in', which is normalised to the output of the pre-amplifier.

The job of the absolute value circuit is to produce a positive voltage that is equal to the absolute value of the input voltage. This is sometimes called a rectifier or precision rectifier circuit. For example, an input voltage of +2V will produce an output of +2V, while an input voltage of -3V will produce an output of +3V. In other words the output of this circuit is always positive.

The peak LED lights up when the output of the absolute value circuit exceeds 10V. Once this is lit it tells the user that the absolute value circuit is nearing its maximum output. Once at its maximum output the circuit can no longer follow the input voltage correctly.

The user of the module cannot directly tap the output of the absolute value circuit. Instead it passes on directly to the gate extractor, the slew and lag generators.

3. The Slew Generator

This is basically a four pole low pass filter whose cut off frequency is controlled by the 'slew speed' pot on the front panel. In the EFG the slew generator is internally connected to the output of the absolute value circuit. In the EFG-Deluxe it has its own input socket, 'slew in' which is normalised to the absolute value circuit's output. The output of the slew generator is found at the 'CV out' on the EFG or the 'slew out' on the EFG-Deluxe.

The slew generator acts to slow the changes seen on its input. Essentially averaging the input signal to a more slowly moving one. The rapidly changing output of the absolute value circuit can thus be slowed down to a voltage that follows the average value of the input. In this way a signal that is proportional to the volume of the original input signal can be created.

There is no right value for the speed of the slew generator. The best setting will depend on the material it has to process. And it is up to you, the user of the EFG, to set the speed to give you the best sounding results. Fast moving input signals will need the slew generator set to fast to be able to keep up with the input. However, too fast and you'll pick up the fluttering of the input waveform itself. There's usually a sweet spot for any particular input signal.

With the EFG-Deluxe the slew generator can be used as an audio filter and a slew (or lag) generator for CVs. The cut-off frequency of the slew generator varies from 0.8Hz to about 3.6kHz.

The output of the slew generator is also presented visually in the form of the 'follow' LED. The brightness of this LED is in proportion to the output voltage.

4. The Gate Extractor

The gate extractor has two control pots, 'threshold' and 'response'. The gate extractor looks at a special processed version of the absolute value circuit's output. The output of the gate extractor is found at the 'gate out' socket. It is 0V when inactive and 7.5V when activated. To activate the gate output the absolute value circuit's output signal must exceed the level set by the 'threshold' pot. Any change in the input signal's volume will produce a corresponding change in the absolute value circuit's output. If the threshold is set correctly then this will be detected by the gate extractor and the gate output will respond accordingly.

The 'response' pot is actually a form of hysteresis control. When turned up this forces the gate extractor to stay high longer than it would normally do. This gives us a cleaner falling edge to our gates and reduces false triggering as the input signal naturally decays.

The gate LED lights when the gate is activated.

5. The Lag Generator

This part is found on the EFG-Deluxe only. This is a very useful part of the module which can introduce a natural 'smoothness' to the absolute value circuit's bumpy output. However, since it has its own input socket you can also process externally produced CVs and waveforms. It doesn't just have the usual 'slew time' pot that the slew generator possesses, but two separate 'up' and 'down' controls. The 'up' control will affect the speed at which the output rises. The 'down' control affects the speed at which it falls.

Much like the slew generator there is no perfect setting for all types of input material. You will need to play around with both the pots to get the best quality CV out from your chosen input material. It's probably best to start out with both pots set to their fastest, ie. at zero, and then slowly increase the 'down' pot first. Increasing the 'up' time then smooths things out but will often reduce the sensitivity. Again experimentation is the key.

If you feed the lag generator with a *gate* signal the module becomes an effective AR envelope generator.

You have a choice of linear or 'exponential' output slopes, controlled by a simple switch. The exponential output allows for lag times from around 2mS to around 10 seconds. In this mode the output moves quickly at first then slows to reach the final value. You get a more natural effect when using this mode. However, because of unwanted voltage offsets the unit is not sufficiently accurate to use for portamento applications in 'expo' mode.

In linear mode, the output rises or falls in a straight line. It is classified in volts per second, as opposed to just time. The amount of time it takes depends on the front panel pots' positions AND the voltage change on the input. Generally, for small changes in voltage the linear output will appear to move quicker than its 'log' equivalent. The linear mode is very accurate and can be used to create linear portamento.

Final Comments

I hope you enjoy using the Oakley EFG module.

If you have any problems with the module, an excellent source of support is the Oakley Sound Forum at Muffwiggler.com. Paul Darlow and I are on this group, as well as many other users and builders of Oakley modules.

If you have a comment about this user manual, or have a found a mistake in it, then please do let me know.

Last but not least, can I say a big thank you to all of you who helped and inspired me. Thanks especially to all those nice people on the Synth-diy and Analogue Heaven mailing lists and those at Muffwiggler.com.

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