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MODULAR SYNTHESIZERS

OSCAR
DSF

Oscar DSF User Manual

Oscar DSF is a complex, stereo Voltage Controlled Oscillator, based on the mathematics of Discrete Summation Formulae.

The Discrete Summation Formula used in Oscar DSF produces sounds rich in harmonics (or 'partials') in a similar way to FM. The mathematics of Discrete Summ… oh, let's just call them DSFs from now on…

The mathematics of DSFs is more complex than FM, but the way that you, the user, get the sounds you want is usually simpler.

Oscar DSF can sound like a traditional oscillator, and it can make the usual clangs and tings associated with FM oscillators. It can handle fat bass sounds, or evolving ambient drones.

Oscar DSF has two complete DSF based complex oscillators, controlled by the same basic pitch CV, but with a pitch offset control which can detune one oscillator up to ±1 octave.

The output of the each oscillator passes through another complex FM stage, which acts like a wave folder, so that's what we call it. Technically, it's actually an FM operator with the carrier frequency set to zero. It sounds great, whatever you call it.

The final piece of the signal chain is a simple VCA, allowing Oscar DSF to be used as a stand alone synth voice (probably with the addition of an envelope generator, or some other source of modulation).

1. Installation

Be sure to turn off rack power before starting installation. Please observe precautions for static sensitive devices when handling the module.

AlphaPro uses a 16-pin Doepfer standard power cable. Please take care to ensure that the cable is fitted the correct way round.

If using the supplied power cable, the plastic lug on the top of the cable connector should fit into the slot in the plastic shroud around the PCB connector.

2. Operation

1.0 FRONT PANEL CONTROLS

To keep Oscar DSF as small as possible, each of the three larger front panel knobs has two functions. You select which group of functions you want to control using the OSC/FOLDER switch. With the switch in the OSC position, the knobs control the main functions of the oscillators as shown by the white lettering. Switching to FOLDER illuminates the red LED in the centre of the panel, and the knobs now control the wave folder, the VCA and the oscillator detune, shown in red lettering (see later).

Obviously, if you set a knob position in OSC mode, then switch to FOLDER and change that same knob, when you switch back to OSC there needs to by a way to re-synchronise the knob position with the OSC function.

Oscar DSF uses the 'catch' method to do this. Simply turn the knob until it 'catches' the old value and you are back in control of that parameter.

1.1 OSCILLATOR BASICS

It's worth just taking a few moments to explain how Oscar DSF produces sounds.

The oscillators can be thought of as a combination of FM and additive synthesis.

In additive synthesis, sine waves of different frequencies and amplitudes are added together to produce complex waveforms. If the sine waves are a whole multiples of the base note – or 'fundamental' – then they are usually called harmonics. If they are not related simply to the fundamental, then they are often called partials. We'll stick to calling everything a partial, for simplicity.

In theory, additive synthesis can produce any continuous wave shape that exists, however the user controls all those individual sine waves can be a bit cumbersome.

In contrast, FM produces complex waveforms by using a modulating wave (traditionally a sine wave) to change the frequency of another wave (also, traditionally, a sine wave). Unsurprisingly, these two waves are called the modulator and the carrier. You build up complex sounds by having several of these modulators and carriers, in various arrangements. Knowing how to arrange them, and what carriers and modulators to use, requires a lot of knowledge and a good deal of experimentation.

Oscar DSF uses a carrier and modulator, but they are combined in a much more complex way than FM synthesis, producing a rich spectrum of partials. Importantly, the number and amplitude of the partials can be controlled with a single knob. Similarly, the spread of the partials – how their frequencies relate to the fundamental – can be controlled with another knob.

1.2 OSCILLATOR CONTROLS

PARTIALS:
The Partials knob controls the number and amplitude of the partials produced by the oscillator. Fully anti-clockwise produces no partials. You just get the fundamental – a sine wave.

Turning the knob clockwise increases the number of partials, and each partial increases in amplitude, so the sound gets richer and richer as more partials are added,

MOD RATIO:
The MOD RATIO knob – along with the MOD MODE switch (see below) controls the ratio between the frequency of the carrier (the fundamental) and the modulator. In other words, this knob controls how the partials relate to the fundamental.
Turn the knob fully anti-clockwise and both carrier and modulator will be the same frequency. This gives you a sawtooth waveform (remember to turn up the PARTIALS control). Turning PARTIALS to full gives you a sort of hyper-saw with a sharp rising edge and a curved slope. Very buzzy!

MOD MODE:
The MOD MODE switch controls how the MOD RATIO knob works.

Switch to F (for FREE) there are no constraints on the modulation frequency as you turn up the MOD RATIO control.

Switch to R (for RATIONAL) and the MOD RATIO control produces whole number ratios, with half steps in between. So from fully anti-clockwise you get 1 : 1, 1 : 1.5, 1 : 2, 1 : 2.5 and so on. With these low, whole numbers, and careful setting of the PARTIALS control, you can get waveforms that sound like square waves, triangle waves etc. They may not look like these on an oscilloscope, as the partial phases are different, but it all sounds the same to your ears.

The half steps are more dissonant, but still – of course – related to the fundamental.

Switch the MOD MODE switch to I (for Irrational) and the partials are mathematically arranged have no relationship to the fundamental at all. This can produce classic FM clangs and tings, as well as a whole host of other interesting sounds.

PITCH

From the factory, Oscar DSF is calibrated to be 'in tune' based on the Arturia (and others) 'standard' of 0V being a C, however there are two ways to change this.

The PITCH knob controls overall tuning of the module. There is a centre detent for 'in tune' and the control gives you just over a fifth in each direction.

In FOLDER mode, this control becomes the detune for the second oscillator (see below).

TUNE

The TUNE switch performs two functions. When you turn TUNE on, the module will output A440 – irrespective of any other settings – so you can tune other oscillators to this module.

However, when you switch TUNE off, the module samples whatever CV you have plugged into the left-most V/O input (ensure that the attenuator is turned fully clockwise).

This CV will now correspond to A440, allowing you to 'auto-tune' to any CV. Perhaps your keyboard or sequencer pitch CV is being processed by another module that produces a small voltage offset, or you want to transpose to another key, or your set-up uses a different or arbitrary CV. Just set the CV you want to be A440 and Oscar DSF will autotune to that CV.

Note that, if you have the PITCH knob offset from zero, then Oscar DSF will jump to this offset pitch when you come out of tune mode.

OCTAVE
The OCTAVE switch allows the pitch of the oscillators to be offset by an octave each way.

1.3 FOLDER

With the OSC/FOLDER switch set to FOLDER, the three main front panel knobs have different functions. A red LED in the centre of the front panel lights up to remind you that you are accessing the red knob functions.

INITIAL GAIN
The INITIAL GAIN knob controls the static gain of the built in VCA. On power up – assuming the OSC/FOLDER switch is set to OSC – this is set to unity gain, effectively bypassing the VCA.

Reducing the INITIAL GAIN results in the output VCA being controlled by the PAR CV input.

DETUNE

The DETUNE knob controls the tuning of the second oscillator. The range of detune available is just over an octave, though the control is non-linear, making it easier to set small detunes for rich stereo effects.

FOLD

The FOLD knob, unsurprisingly, controls the wave folder. As the knob is turned clockwise, more of the waveform is folded back on itself. However, the Oscar DSF wave folder is not a simple 'hard' fold. Instead, the output of the oscillator folds along a sine curve. This kind of folder produces more harmonics related to the fundamental of the waveform, so with the Mod Mode set to Rational, it enriches the partials produced by the oscillator. In Irrational mode, the folder will 'fill in' the gaps in the spectrum. In both modes, this tends to increase in the richness of the waveform without some of the harshness that other wave folders exhibit.

1.4 INPUTS AND OUTPUT

OUT R and OUT L
The first Oscar DSF oscillator is output on OUT L, the second on OUT R.

VPO
The VPO (Volt Per Octave) inputs control the pitch of both oscillators. The two inputs are summed and each has an attenuator. It's important that the input you are using for true Volt Per Octave has its corresponding attenuator fully clockwise for accurate pitch tracking. It's common to use one input for pitch and the other for vibrato (with appropriate attenuation).

PAR CV
The PAR CV input (with attenuator) allows CV control of the PARTIALS parameter, as described in the OSCILLATOR section above. PAR CV is bipolar, adding and subtracting from the value set by the PARTIALS knob – so for full range with negative PAR CVs you need to turn up the PARTIALS knob.

FOLD CV
The FOLD CV input (with attenuator) allows CV control of the amount of wave folding applied to the oscillator outputs. As with the PAR CV, this input is bipolar, adding and subtracting form the FOLD knob value.

PAN CV
The PAN CV (with attenuator) implements a stereo pan of the two outputs.

3. Specifications

Width: 10HP

POWER CONSUMPTION

+12v: 200mA
-12v: 50mA
+5v: 0mA

Inputs:
VPO CV [Zero attenuation]: Volt per Octave
PAR CV Right [Zero attenuation]: 0V - 5V
FOLD CV [Zero attenuation]: 0V - 5V
PAN CV [Zero attenuation]: ±5V

Outputs:
Dual/Stereo: ±5V nominal, ±12V max

Important Safety Instructions

Correct disposal of this product:

This symbol indicates that this product must not be disposed of with household waste according to WEEE Directive (2012/19/EU) and your national law. This product should be taken to a collection centre licensed for the recycling of waste electrical and electronic equipment (EEE).

We may change the specifications and operation of our products at any time during their development and production, so we do not guarantee that the information given in this document is accurate or complete.