FwS Ring Modulation
from DACS Ltd

FREQue

two channel ring modulator

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FREQue

Instructions for use and installation

Welcome

At DACS we are very pleased that you have chosen to purchase one of our products. We take a pride in our work and are sure that this FREQue will give you years of exemplary service. If you have any suggestions or comments about this product please call, fax, write or e-mail us with your thoughts. Thank you.

Introduction

Ring Modulation has been around for a long time. Its usefulness was always limited by the high level of breakthrough of the original signals. Some years ago we developed a device which reduced this breakthrough to levels compatible with digital technology. The FwS series of ring modulator based effectors retains the purity of the effect with low noise performance.

With this unit and others in the range you will be able to transform your existing sound generators creating an almost infinite range of unique sounds using your hands and your ears. We're not filled with nostalgia for the 'good old days' but do believe that programming has severe limitations; human creativity and interaction can create a much more flexible and individual musical result than pre-sets.

We have included a number of possible setups and applications for you to try. They are intended as a starting point for your exploration rather than an exhaustive list of possibilities.

If you come up with some particularly good or unusual way of using this FwS device, and are willing to share it with others please send us your ideas and personal/professional details so that we can place them on our web-site and in subsequent editions of our application notes and manuals.

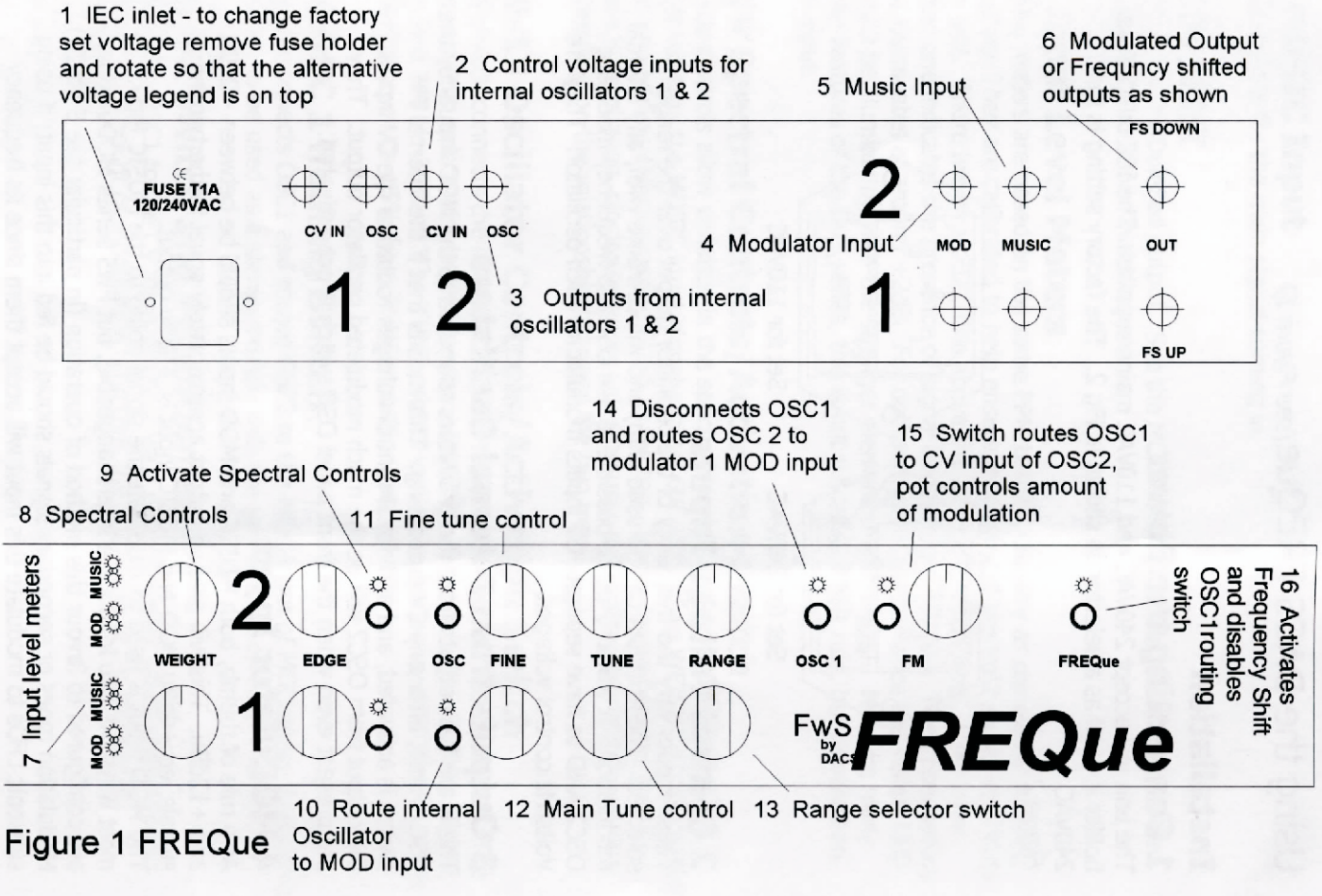


Figure 1 FREQue

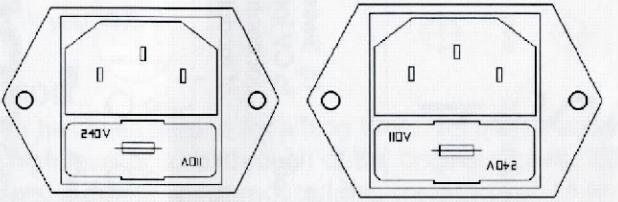
Using the DACS FREQue*(see Figure 1)*

Installation

1 Connecting the Power

The unit will accept 240VAC and 110VAC mains supplies. The IEC inlet's fuse holder is used as a selector as shown in Fig 2. The factory setting is for 240VAC.

Figure 2



Set for 240VAC Set for 110VAC

2 Control Voltage Inputs

These inputs vary the frequency of the oscillator output over the range selected. These inputs can be used with, and will combine with, any internal modulation. It would thus be possible to use OSC1 to frequency modulate OSC2 AND to have separate CV inputs modulating each oscillator. They are Volts/Hz control voltages.

3 Outputs from Internal Oscillators

These are the outputs from the oscillators as routed to the MOD inputs by the OSC switch, after any CV processing. This means that if the internal FM switch is activated, and additional control voltages routed to the CV inputs, the output from OSC2 will be the much modulated oscillator output. They are present even when the front panel OSC switch is not activated.

4 MODulator Input

As a rule of thumb, both MUSIC and MOD inputs should be between +2dBu and +12dBu. This will give an output approximately equal to the two input signals, eg +4dBu MOD and MUSIC input ~ +4dBu output.

The MOD input is used to *modulate* the signal going to the MUSIC input. In most ways the two inputs are interchangeable, but FwS series MODule8ors are configured to favour this method of operation (in particular see 5 below). Modulation tones or secondary signals should be fed into this input; if using subsonic LFOs to modulate this input will accept them since its frequency response is flat down to DC.

5 MUSIC Input

This input is for the main signal coming in.

6 OUTPUT

This is the MODule8ed output. See the MODule8ion Techulation box below for more information on what happens.

7 Input Level Meters

These meters are based on the same PPM ballistic circuitry as our award winning MicAmp. They are calibrated to help ensure that you get the right signal level in to the unit. There are two LEDs, one above the other, for each input. The lower green one indicates the presence of signal above about -40dBu. The upper yellow one illuminates at around +2dB. For optimum sonic performance the yellow LED should be illuminating with the stronger elements in the signal. **NB** Like many other features of the FwS series, this is not a hard and fast rule, but depends on the input.

8/9 Spectral Controls/Activation Switch

These controls allow variation in the spectral content of the MODule8ed output. They work on the MUSIC input signal adding ***OR*** subtracting WEIGHT at the bottom end and adding ***OR*** subtracting EDGE at the top. In the centre détente position there is no change, clockwise adds, anti-clockwise subtracts. Their effect will vary depending on the relationship between the two inputs.

10-13 Oscillator Controls/Activation Switch

The switch connects the internal oscillator to the MOD input of the MODule8. The range switch selects one of five ranges: .1Hz-2Hz, .3Hz-15Hz, 1Hz-200Hz, 15Hz-2 kHz and 500 Hz-16 kHz. The TUNE control varies the frequency over the full range and FINE over ca ±5% from TUNE's position respectively.

14 OSC 1 Routing Switch

This disconnects OSC1 and routes OSC2 to the MOD input of MODule8or 1, allowing the unit to be used as a stereo module with the same effect on each channel.

15 FM Switch and Potentiometer

This route OSC1 to the CV input of OSC2 via a potentiometer which allows you to control the amount of modulation, and thus the amplitude of the sidebands generated.

16 FREQuency Shift switch

This switch activates the Frequency Shift circuitry, and de-activates the OSC1 switch. ***NB For this to work both OSC activation switches must be pushed in.***

The two MUSIC input signals are mixed together then processed. The result is fed to the two main outputs as labelled. The amount of frequency shift is set by the frequency of OSC2. For example if OSC2 was oscillating at 2 Hz, the 2Hz would be added to and subtracted from the frequency components of the combined music inputs and the results would appear at the FS UP and FS DOWN sockets respectively. In effect this process separates the SUM and DIFFERENCE (see below - MODule8ion Techulation) frequencies of the input signals. As with standard ring modulation, when frequencies are shifted down below 0Hz, they rise up again 180° out of phase (see below - MODule8ion Techulation). See the application notes for things to try.

Earthing and Interconnection

The audio 0V and the chassis/mains earth are not linked. If connected directly to a single device, eg a mixing console, for its ins and outs, the unit will not be prone to hum loops. Where it is connected to balanced ins and outs we would recommend connecting the balanced HOT to the tip of the jack and the balanced COLD to the ring, leaving the balanced screen unconnected at the jack end. A balancing upgrade is available for all devices.

MODule8ion Techulation

Ring modulation is theoretically a simple process but can result in very complex and striking results. The mathematics are very straightforward:

Frequencies present in modulated OUTput =
sum of frequencies in input signals + difference between frequencies in input signals

In practice let me offer two examples:

MUSIC and MOD input have a 100Hz sine wave going to them

OUT = (100+100)+(100-100) => 200Hz + 0Hz Thus by sending the same signal to both inputs we add 2nd harmonic distortion to signals, *warming* them up the way valves do.

MUSIC in is 100Hz, MOD in is 75Hz

OUT = (100+75)+(100-75) => 175Hz + 25Hz - Play with the MOD frequency to generate SUPER SUB BASS right down to the floor!!!

Another interesting feature of ring modulation is that negative frequencies re-appear as positive ones 180° out of phase ie MINUS 80Hz is 80Hz but out of phase. This means that if you slide the MOD frequency up against a steady music signal you will get (as well as sounds going up) sounds going down to subsonic and then returning up again...

Specifications for FREQue

Spectral Controls on MUSIC input

Weight	Bass filter (shelving) ±12dB gain from around 80Hz@6dB/8ve
Edge	Treble filter (shelving) ±12dB gain from around 8kHz@6dB/8ve
Switch	Pressed in this activates Spectral Controls

Inputs

Connectors	¼" jack, two pole, TIP input signal, SLEEVE 0V
Levels	Optimum results occur with input levels of +2dBu to +12dBu , maximum input level >+12dBu
Freq Response	Music inputs <20Hz to >35kHz, modulator input DC to >35kHz
Input Impedance	>10k
MOD	Modulation Input - this feeds one side of Ring Mod
MUSIC	Main Input - this feeds the other side of the Ring Modulator.
If input	Spectral Controls are activated they vary the spectrum of this
Breakthrough maximum,	MOD in +10dBm with no MUSIC signal, MOD out <-65dBm typically <-70dBm, same for MUSIC signal with no MOD

Outputs

Connectors	¼" jack, two pole, TIP input signal, SLEEVE 0V
OSC	Oscillator output at ca +12dBu
Levels	For input levels of +4dBu to +12dBu output will be around[2]
+4dBu-	+12dBu, maximum output level around +20dBu
FreqResponse	Flat from DC to a -3dB point at around 65kHz
Signal to noise	-82dB (equivalent to a good mic set to medium gain)

Osc

Fine	Varies around centre frequency by ca 5%
Tune	Varies centre frequency over selected range
Range	Selects from 5 ranges - .1Hz-2Hz, .3Hz-15Hz, 1Hz-200Hz, 15Hz-2kHz, 500Hz-19kHz
CV Inputs	CV Inputs to each oscillator on ¼" jacks, 0-15V, V/Hz characteristics
OSC Outs	Output for both oscillators @ +12dBu

[2] The modulation process involves the interaction of both inputs, and as such it is impossible to predict exact output levels