RS240

FREQUENCY SHIFTER

INTRODUCTION

A frequency shifter is a highly specialised module capable of shifting the spectrum of a signal by a fixed amount. This is very different from a pitch-shifter and other effects such as ring modulation or frequency modulation. (See appendix 5.)

The RS240 allows you to shift the frequency linearly within a number of ranges, the widest of which shifts the signal by approximately ±5kHz at its maximum setting. You can use manual and voltage controls (or a combination of the two) to achieve the desired effects. Upwardly shifted and downwardly shifted signals are available simultaneously, both as independent signals, and as a user-defined mix of the two.

This module also allows you to shift the frequency exponentially, which will produce a number of conventional - and less conventional - pitch shifting effects.

IN USE

The RS240 offers two front panel frequency shift controls. These are the large pitch control knob in the centre of the panel, and the scale selector that determines both the maximum amount of shift, and whether this shift is linear (i.e adding an amount to the frequency of the incoming signal) or exponential (multiplying by a factor the frequency of the incoming signal). There are also three CV inputs that allow you to control the amount of pitch shift using external voltage sources.

CV1, CV2, CV3

Each of these accepts CVs in the range ±10V. However, the maximum range of the three summed sockets is also ±10V, so you cannot apply +10V to each of the three inputs and expect a frequency shift proportional to +30V.

Pitch Control Knob

You can shift the frequency of the incoming signal between the maximum and minimum ranges shown. The internal CV generated by the knob is equivalent to ±5V (i.e. a 10V range in total) applied to any of the CV1, CV2 or CV3 inputs.

Note: If you apply CVs to CV1, CV2 or CV3 while the pitch control knob is offset from its zero position, the amount of pitch shift will be determined by the sum of the external CVs plus the internal CV generated by the knob.

SCALE

The scale switch has six positions, as follows:

- Zero

  None of the pitch shifting mechanisms have any affect upon the signal.

- EXP

  The input frequency is multiplied by a factor to create the upward shifted signal, and divided by the same factor to create the downward shifted signal. The maximum amount of shift is approximately ±2kHz.

  To understand this better let's assume that, for an input signal of some arbitrary frequency, and with the SCALE switch set to EXP, a CV of +1V applied to any of the CV inputs shifts the 'B' signal upward by one octave (i.e. double the frequency). An applied CV of +2V will therefore shift the signal upward by two octaves (i.e. multiplying it by a factor of 4) and so on… At the same time, +1V will halve the frequency of the 'A' signal (down one octave), while +2V will quarter it (down two octaves) and so on…

  Of course, this is only one (very specific) example, and you should experiment to find other ways in which the EXP setting can create interestingeffects.

- 5, 50, 500, 5k

  The input frequency is shifted upward by an arithmetic amount to create the B signal, and downward by the same amount to create the A signal. The maximum amount of shift is approximately ±5Hz, ±50Hz, ±500Hz, and ±5kHz respectively.

  To understand this better let's assume that, for an input signal of some arbitrary frequency, and with the SCALE switch set to "5k", a CV of +1V applied to any of the CV inputs shifts the 'B' signal upward by 1kHz. An applied CV of +2V will therefore shift the signal upward by 2kHz and so on… which is a far cry from the harmonically meaningful relationship described for the EXP setting, above. At the same time, +1V will subtract 1kHz from the frequency of the 'A' signal, while +2V will subtract 2kHz and so on…

  Again, this is only one (very specific) example, and you should experiment to find ways in which you can use each of these ranges to create interestingeffects.

Note: You may wonder what happens when the A signal drops below 0Hz. In this case, the frequency "wraps round" and the output is a positive frequency with inverted phase. The following table should make this clear:

Input (Hz)	*Shift (Hz)*	*Output (Hz)*
100	*-50*	*50 +ve phase*
100	*-60*	*40 +ve phase*
100	*-70*	*30 +ve phase*
100	*-80*	*20 +ve phase*
100	*-90*	*10 +ve phase*
100	*-100*	*0*
100	*-110*	*10 -ve phase*
100	*-120*	*20 -ve phase*

… and so on

Zero Adjust

You should use this to calibrate the RS240 each time you change the SCALE setting. To do so, set the Pitch Control knob to Linear "0" (the 12 o'clock position) make sure that there are no CVs applied to CV1, CV2 or CV3, and then rotate the ZERO ADJUST until the associated LED stops blinking. This shows that there is no shift in the A or B signals, and that the RANGE is correctly centred.

Audio Signal Inputs/Outputs and the Mix control

The RS240 offers one signal input and five signal outputs, as follows. The amplitude of the output is approximately equal to that of the input.

- SIGNAL INPUT

  This conforms to standard RS Integrator specifications, and accepts audio signals of maximum amplitude ±10V. Signals in a frequency range of approximately 30Hz to 16kHz are accepted for frequency shifting.

- OUT A

  The output carries the downward shifted signal.

- OUT B

  The output carries the upward shifted signal.

- MIX OUT (X3)

  These three outputs each carry both of the signals produced by the RS240: the downward shifted ('A') signal, and the downward shifted ('B') signal. You may control the relative proportions of these signals using the associated MIXTURE A/B knob.

Squelch

When the input signal drops below the threshold, a noise gate cuts off the output, thus minimising unwanted noise and artefacts generated from background noise. (The term squelch is an early radio industry term for a noise gate.)

- Squelch threshold

  You may set the threshold between 0dB (at which point all signals are rejected) and -60dB (which gates the output only when the very quietest signals are received at the input).

- Squelch on/off

  You may disable the gate by setting this switch to OFF.