WASP SYNTHESISERS LIMITED

Introduction

You are now the proud owner of one of the most remarkable synthesizers currently available. The Gnat has been designed to provide all the features that are to be found on an electronic music synthesizer, but at a fraction of the cost. Don't let the apparent simplicity of the control panel fool you: every control is vital to the overall performance of the instrument, and many of the control knobs serve several roles.

It is a simple matter to get sounds out of the Gnat; however, to get the best out of this synthesizer, it is important to understand exactly how the controls relate to the final sound produced. It is for this reason that you should study this manual carefully: for many, the Gnat will be your first synthesizer, and, unless you are familiar with the various terms and the possibilities that the Gnat offers, you will not be getting the most out of your new instrument. Those who have used a synthesizer before should also study this manual, as the Gnat offers several interesting features that may not immediately be apparent.

Section I – Setting Up

The Touch-Sensitive Keyboard

It is important to set up the sensitivity of the keyboard to your own requirements. Even though the keyboard may be set correctly for one person, this does not mean that it will suit you.

To set the sensitivity of the keyboard, a small trim control is provided (12). This is located just to the left of the monitor speaker, and can be adjusted with the aid of a small screwdriver until the feel is right, i.e. so that the notes will sound only when touched. If the sensitivity is set too high, notes will sound even when you aren't touching the keyboard. If it is set too low, you will either have to press the keys hard to get a sound, or else no sound will be heard at all.

Your Gnat is now 'set up' to play, so you might as well "have a go" before getting stuck into the mysteries of the synthesizer, and what you can do with this amazing instrument.

Section II – What is a Synthesizer?

You have purchased a Gnat electronic music synthesizer, but what exactly is a synthesizer? The term has been somewhat corrupted over the years, but, essentially, a synthesizer is a device that is used to construct a sound from basic elements. In order to understand how a synthesizer works, and what it does, it is first important to grasp fully what "sound" is.

The Three Elements of Sound

Sound is the sensation that we experience when our ears respond to changes in air pressure. These changes themselves are also referred to as sound. When an instrument such as a piano is played, the air particles around it are compressed and expanded by the sound board of the instrument: these compressions and rarefactions are transmitted through the air and sensed by our ears. The brain then converts the signals received from the ear and perceives the sound of a piano. If you look at figure 2, you can see how the movement of the arms (or prongs) of a tuning fork sets up these vibrations of air particles.

Sound has three elements: Pitch, Timbre, and Loudness. In due course, we shall see how these elements relate to the three fundamental "building blocks" of the synthesizer, namely the oscillator, the filter, and the amplifier.

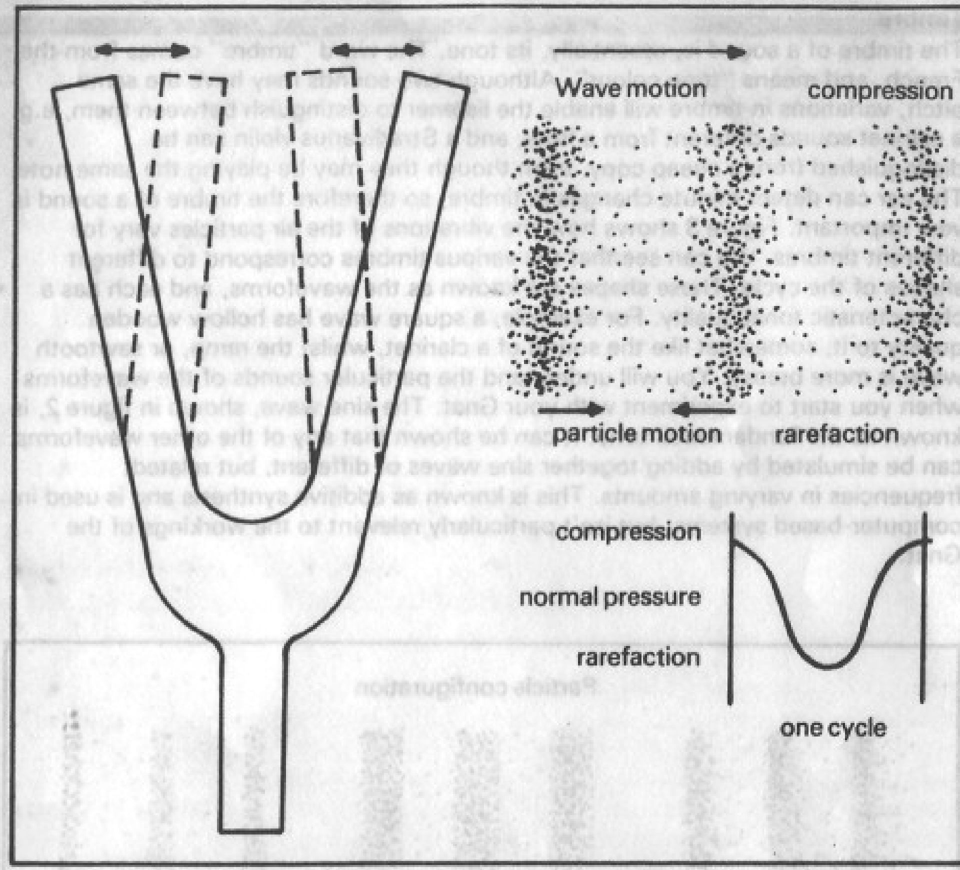


Figure 2: Production of sound waves by a tuning fork

Pitch

In figure 2, we can see that the compressions and rarefactions (expansions) of the air particles occur at regular intervals, each of these intervals being known as a cycle. Let us imagine that our tuning fork is an A-440 type; that is to say, when it vibrates, it does so 440 times every second. Consequently, there will be 440 complete cycles or compression and expansion of the air particles in one second. This is known as the frequency and it is measured in cycles per second, or Hertz (Hz). A note of this frequency is, by our standards, designated an 'A' in musical terms, hence the fork is an A-440. Now, our ears can only detect frequencies over a certain range, known as the audio spectrum. Most people can hear frequencies between 20 Hz and 18,000 Hz; however, these figures do vary from person to person. To give you an idea of the frequency range produced by certain instruments, consider a grand piano, which generates frequencies from around 27 Hz to 4,200 Hz. A guitar generates from 80 to 1,000 Hz, whilst a tenor voice would cover from 140 Hz to 500 Hz. This frequency of a note is known as the pitch.

Timbre

The timbre of a sound is, essentially, its tone. The word "timbre" comes from the French, and means "tone colour". Although two sounds may have the same pitch, variations in timbre will enable the listener to distinguish between them, e.g. a clarinet sounds different from a flute, and a Stradivarius violin can be distinguished from a cheap copy, even though they may be playing the same note. The ear can detect minute changes in timbre, so therefore the timbre of a sound is very important. Figure 3 shows how the vibrations of the air particles vary for different timbres. We can see that the various timbres correspond to different shapes of the cycle. These shapes are known as the waveforms, and each has a characteristic tonal quality. For example, a square wave has hollow wooden quality to it, somewhat like the sound of a clarinet, whilst the ramp, or sawtooth wave is more brassy. You will understand the particular sounds of the waveforms when you start to experiment with your Gnat. The sine wave, shown in figure 2, is known as the fundamental tone. It can be shown that any of the other waveforms can be simulated by adding together sine waves of different, but related, frequencies in varying amounts. This is known as additive synthesis and is used in computer-based systems, but isn't particularly relevant to the workings of the Gnat.

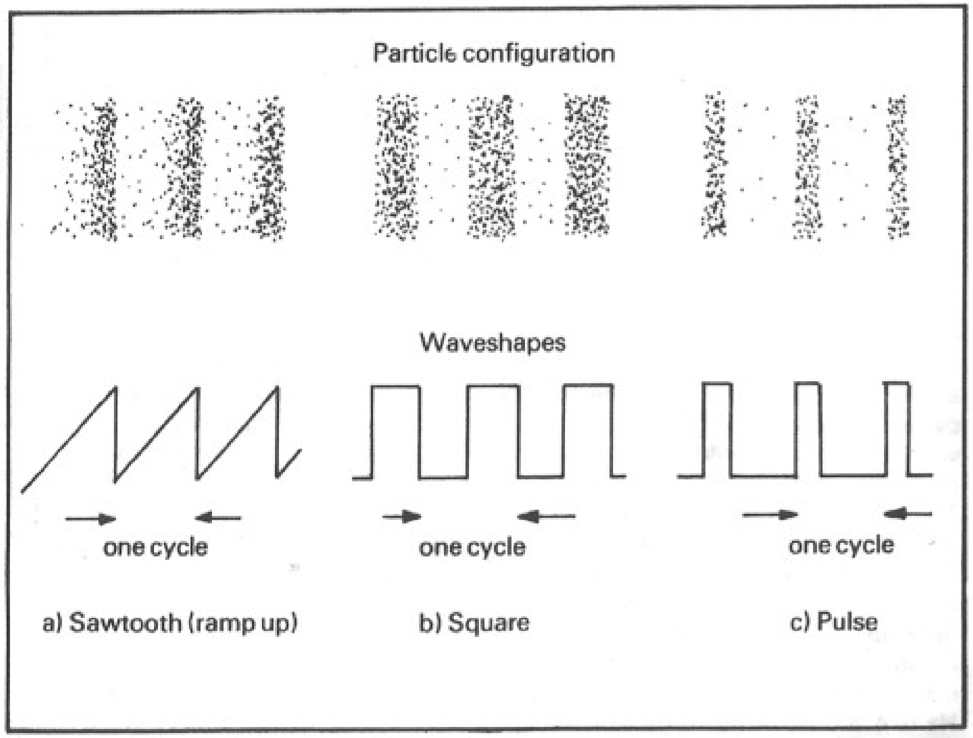


Figure 3: Air particle movement and corresponding waveshapes

Loudness

The loudness of a note is directly dependent on the amount the air is compressed and rarefied by the medium producing the sound, i.e. a sound from, say a kettle drum is going to cause a considerable effect on the density of the air particles because such an instrument is physically large and capable of compressing and expanding a large volume of air particles. Whereas a violin, with a relatively small body/sound board, is unable to reach an equivalent loudness. It is also important to consider that the ear perceives different frequencies to be of varying loudness, i.e. a high-frequency note will generally seem louder than a low note. Also, a sound rich in harmonics will seem louder than a fundamental sine wave, even though they may both have similar amplitudes.

We now understand how the pitch, timbre, and loudness of the sound corresponds to the vibrations of the air particles. The synthesizer generates sound indirectly—it produces changes in electronic currents, as opposed to air pressure—but the concepts of pitch, timbre, and loudness still apply when creating a sound with a synthesizer, and it will help you to get the most out of your Gnat if you think along these lines.

Sound Changes With Time

If you consider the sound produced by almost any musical instrument, you will be aware that these parameters vary during the course of the note.

i) Loudness and Time: All sounds have what is known as a contour, or envelope, i.e. they have a start, from which their loudness goes from nothing to a particular level. This level will probably change during the course of the sound, and there will eventually come a point at which the loudness decreases and the sound ends. So the sound produced by playing a note on a piano would have an envelope that started fairly abruptly as the hammer hit the strings, which would die away gradually as long as the note was held, and would then fall away abruptly as the key was released and the dampers deadened the strings. The contour, or envelope, shapes the loudness of the note (figure 4).

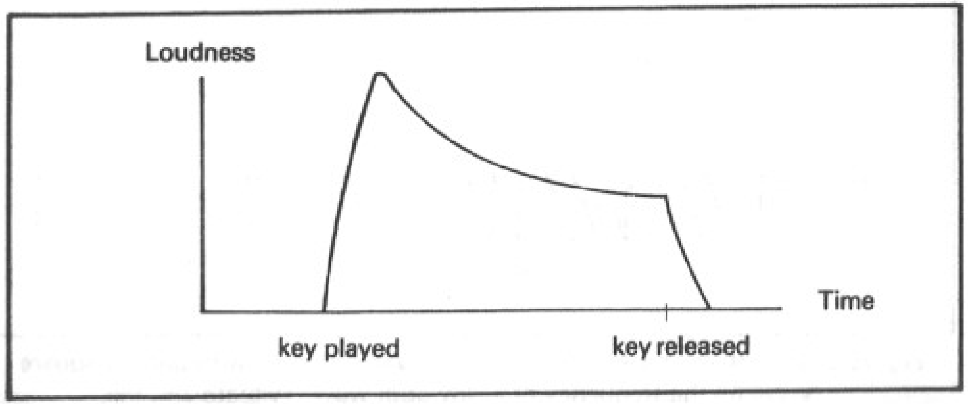


Figure 4: Typical loudness contour of an acoustic piano

ii) Timbre and Time: The tone of most sounds changes during the course of the note. This is quite a complex phenomenon to illustrate, but we'll continue with the piano as our example. You can detect that the timbre of a note is much brighter when the key is struck; as the note dies away, the higher frequency elements of the sound tend to die away, and the timbre becomes more mellow. In actual fact, the changes in timbre are far more complex than this, and it is these timbral variations that have plagued electronic instrument manufacturers over the years, such that there is no electronic instrument capable of accurately simulating an accoustic grand piano.

iii) Pitch and Time: With most musical instruments, the pitch remains relatively constant for the duration of the note. However, a small periodic low-frequency variation in pitch will produce the effect known as "vibrato" if the low-frequency waveform is a sine, or triangle wave, or "trill" if a square wave is used (see figure 5).

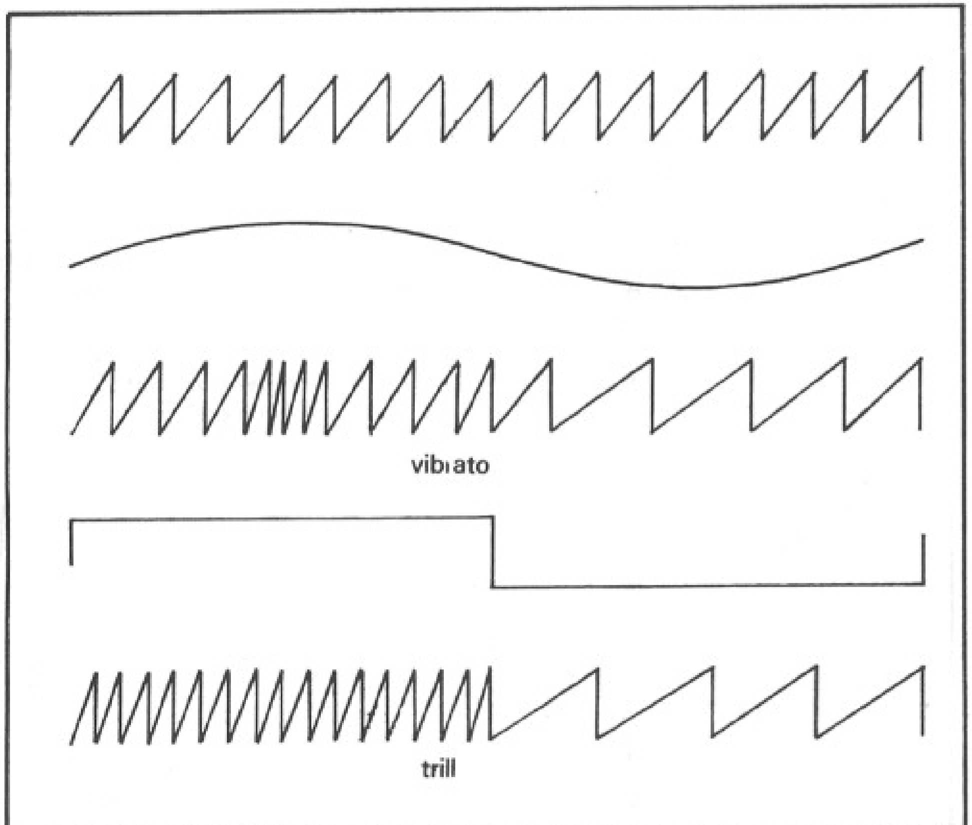


Figure 5: The effect of a low frequency sine wave and a low frequency square wave on the frequency of a sawtooth wave—vibrato and trill.

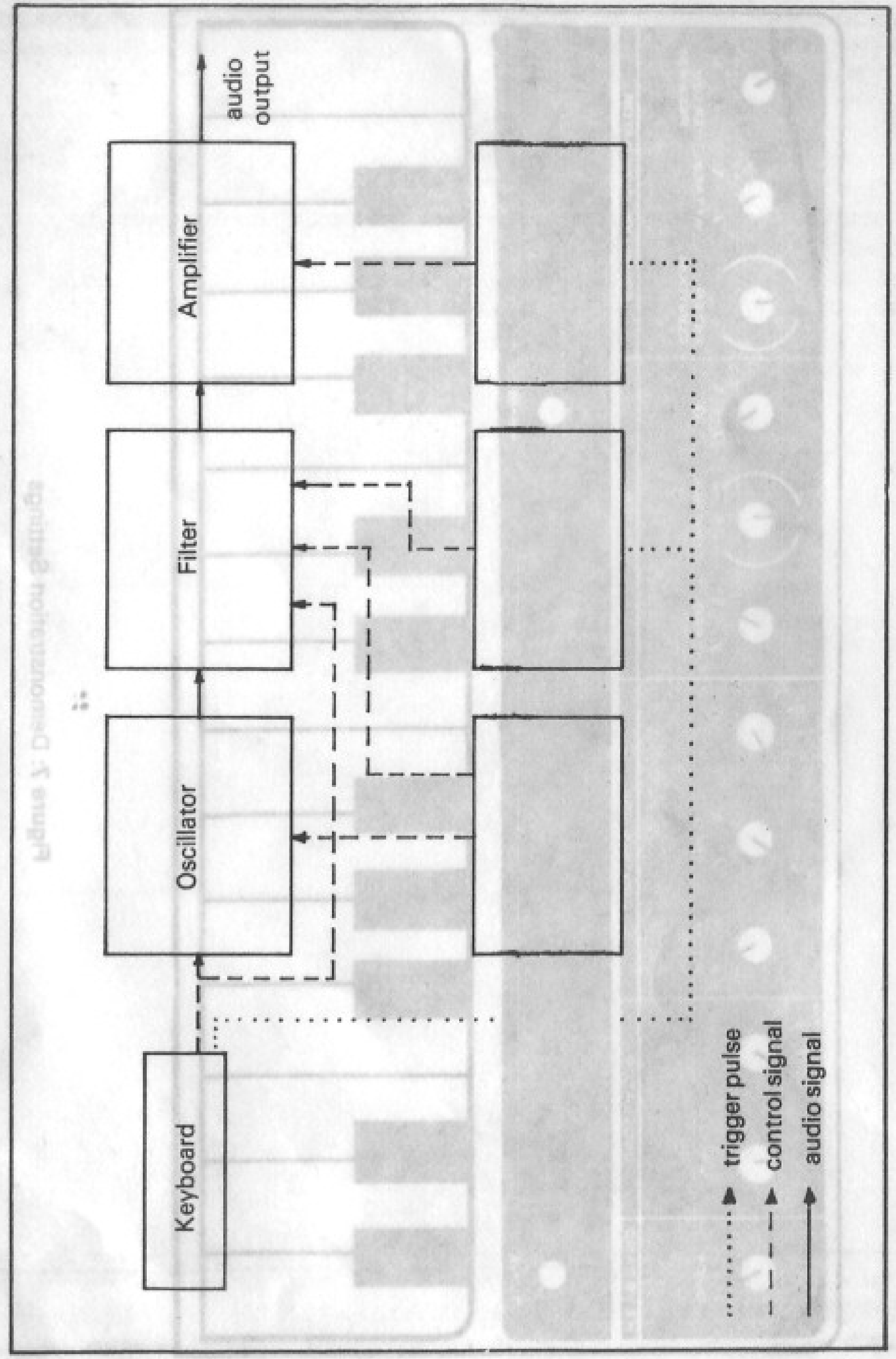


Figure 6: Block diagram of the GNAT

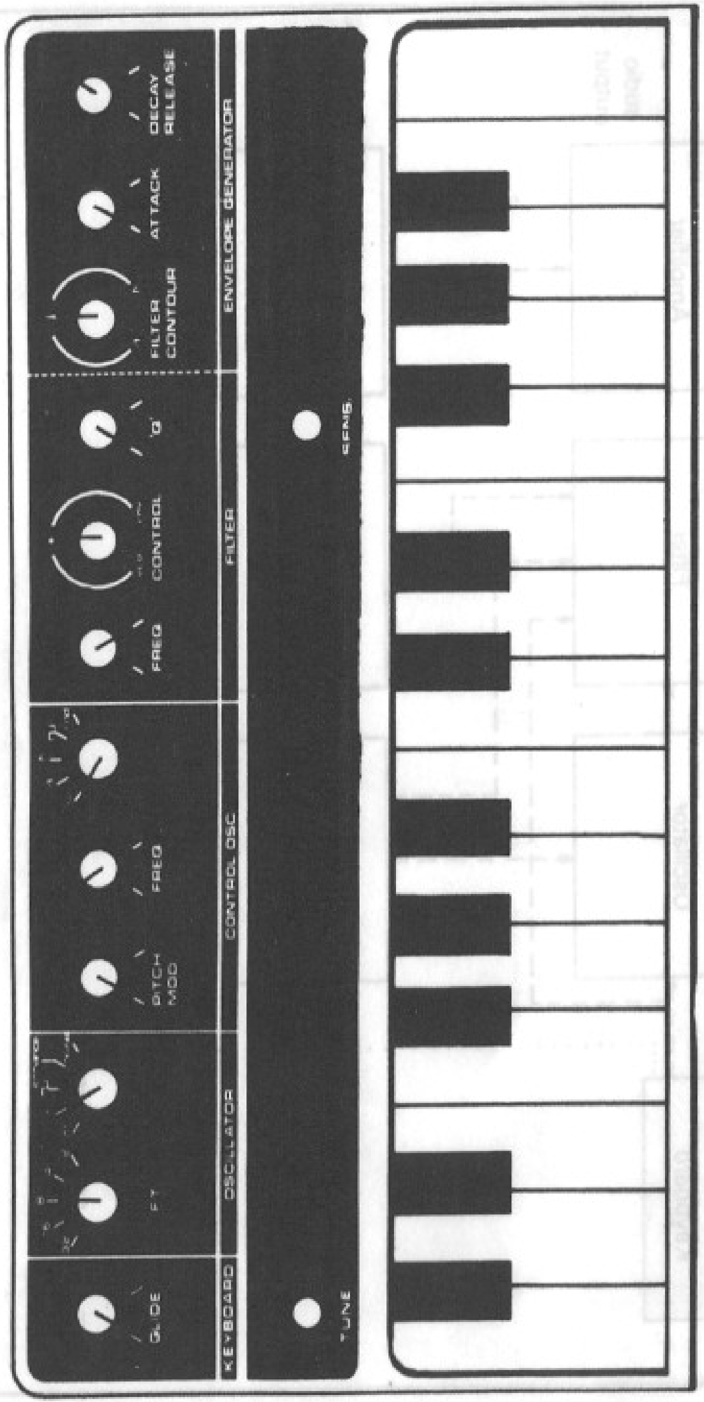


Figure 7: Demonstration Settings

Section III – You and Your Gnat

Right, you've powered up your Gnat so you are now ready to unravel the mysteries of this exciting instrument. You will find things a lot clearer if you have your Gnat beside you. As we deal with each feature, there will be an **'ACTION'** example, so that you can hear the effect that is being described.

The block diagram (figure 6) of the Gnat shows how the various synthesizer elements are related to one another. Remember the basic structure of sound: pitch is determined by the oscillators, timbre by the filter, loudness by the amplifier. The envelope generator and filter contour vary the loudness and timbre with time, and the control oscillator provides a periodic low-frequency waveform which is used to modulate (control) the pitch and timbre.

ACTION: Set up your Gnat so that the controls look as they do in figure 7. We will use this patch as a start position for illustrating the various features.

III 1. The Oscillator

The oscillator is the vibrating medium that determines the pitch of the note, but this pitch is governed by several factors:

a) The keyboard (1), which controls the oscillator over a two-octave range – C to C;

b) The footage (F.T.) selector (4), which steps the oscillator over a five-octave range.

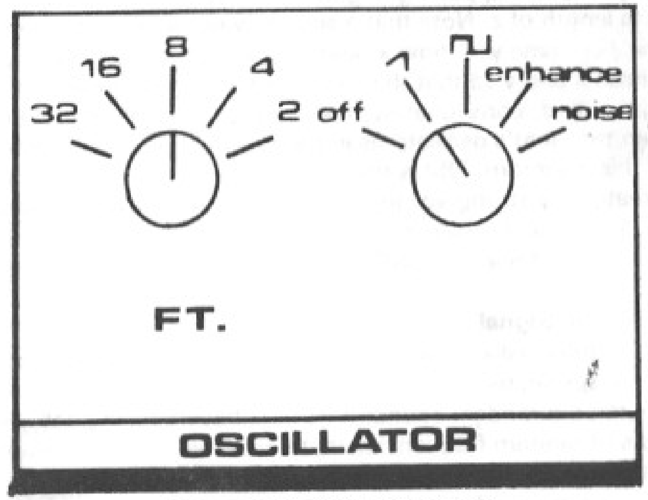


Figure 8: Oscillator Controls

ACTION: Hold a note and turn the footage control down to 32, up to 2, then back to 8. The numbers 2, 4, 8, 16, and 32 originate from the days of the pipe organs, and refer to the length of the pipes – the longer the pipe, the lower the note, and, if the length of a pipe is halved, its pitch will be raised by one octave.

You can hear that the 32 position is two octaves lower than the 8 position.
c) The PITCH MODULATION control (6), which is dealt with in Section III 4.
d) The TUNE preset (3). See Section III 3 for full details.

All these parameters will affect the pitch of the Oscillator. In addition to the footage control, there is a waveform selector (5) included in the Oscillator section. This control determines the way in which the oscillator vibrates, and, consequently, will change timbre. We said earlier that the filter is responsible for the timbre, and the oscillator for the pitch, which is true: however, the waveshape produced by the oscillator also plays a part in determining the overall timbre of the sound, and it is more logical for this control to be included in the Oscillator section.
The Gnat's oscillator can produce three different waveforms: sawtooth (often known as ramp), designated by the symbol ⊿ ; square, shown as ⊓⊔ , and 'Enhance'. You will notice that there is a further position marked 'NOISE' on this waveform selector. This will be dealt with in III 2.
ACTION: With the Gnat set up as shown in figure 7, press and hold a note. You will now be hearing a sawtooth wave. Switch to the square wave position and listen to the difference. The square wave sounds much cleaner: this is because it contains less harmonics than the sawtooth wave, and has a hollow quality to it.
ACTION: Whilst still holding a note, switch the waveform selector to the ENHANCE position. You may be surprised to hear a moving sound. Those of you who are more familiar with synthesizer terminology may know this waveform better as a pulse width modulated square wave. If we look at figure 9, we can see more clearly what is happening. Figure 9a shows a series of square waves, each with a cycle length of z. Note that a square wave is 'high' the same length of time as it is 'low', i.e. time y = time x, and y + x = the cycle length z. If, however, we vary the times x and y so that they are continually changing, but retain the same cycle length z (and, consequently, the same pitch), then the effect that can be heard when the Gnat's oscillator is in the Enhance position is achieved. The beauty of this waveform (9b) is that it sounds very full and rich, and so it can be used to create very strong voicings, especially in the lower registers.
ACTION: Set the F.T. selector to 32, and compare the difference between the SQUARE wave and the ENHANCE wave outputs of the oscillator.

III 2. The NOISE Signal
In addition to the oscillator, there is a second sound generator, which, for convenience, is selected by means of the waveform selector. The Noise is a digitally-generated random sound: it doesn't have a fixed pitch, like an oscillator, but consists of random frequencies that cover the audio spectrum. It is a similar sound to that emitted by an F.M. receiver when tuned between stations.
ACTION: Switch waveform selector (5) to NOISE, and play a note: it doesn't matter which note is pressed, as, with this patch, every key will produce an identical sound. On its own, the characteristic hissing does not sound very exciting, but it is a particularly useful sound source, especially when used in conjunction with the filter for percussive voicings, and for sound effects.

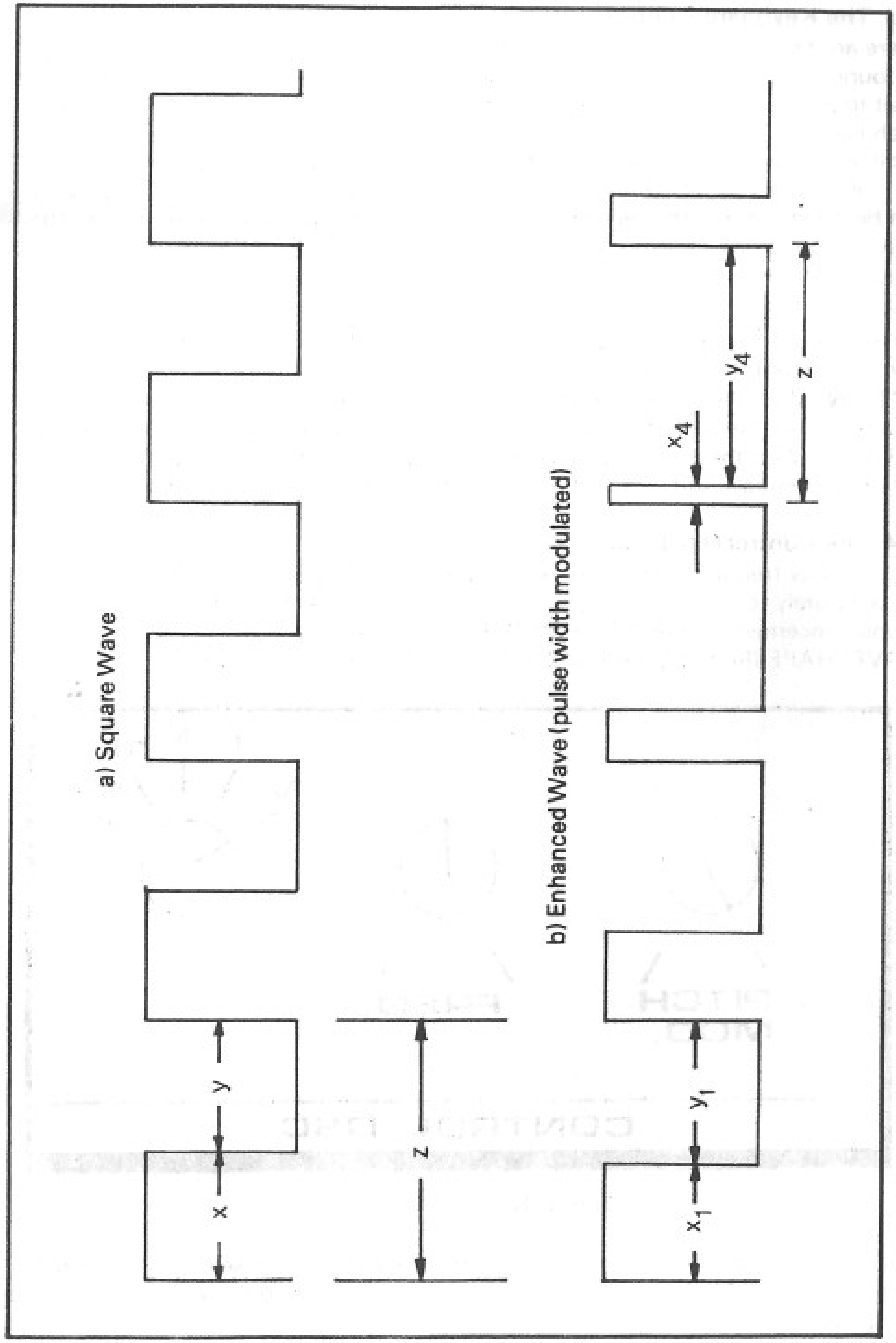


Figure 9: The Enhanced Waveform

III 3. The Keyboard Controls

There are two controls directly associated with the Gnat's keyboard: both are to be found to the far left of the instrument. The TUNE preset (3) is used to tune the Gnat to a specific pitch (e.g. to A-440, the reference pitch, or to that of a fixed pitch instrument such as a piano). To tune the Gnat, simply make sure that the oscillator is running at a steady pitch, i.e. as in our start patch, with no vibrato, etc., and rotate the TUNE trimmer (3), until the Gnat is at the desired pitch. This can be done either with one's fingers or with a small flat-bladed screwdriver. The TUNE trimmer has a range of three tones, so it should be possible to tune the Gnat to any instrument.

The GLIDE control (2), often known as PORTAMENTO, is used to introduce a slurring between notes, i.e. when playing a series of notes, the pitch will sweep from one to another instead of jumping cleanly between notes.

ACTION: With the controls in the initial patch position, play octaves from middle C to top C. At the same time, increase the amount of Glide, and notice the effect. Unlike many synthesizers, the Gnat will glide to the last note played, even if that note has been released before the pitch of that note has been reached.

III.4. The Control Oscillator

This is a low-frequency oscillator which does not produce any sound as such, but is used purely to control the signal oscillator (III 1) and the filter (III 5). The control knobs concerned are the PITCH MOD (6), the FREQuency (7), and the WAVESHAPE (8), in figure 1, and these are also set out in figure 10.

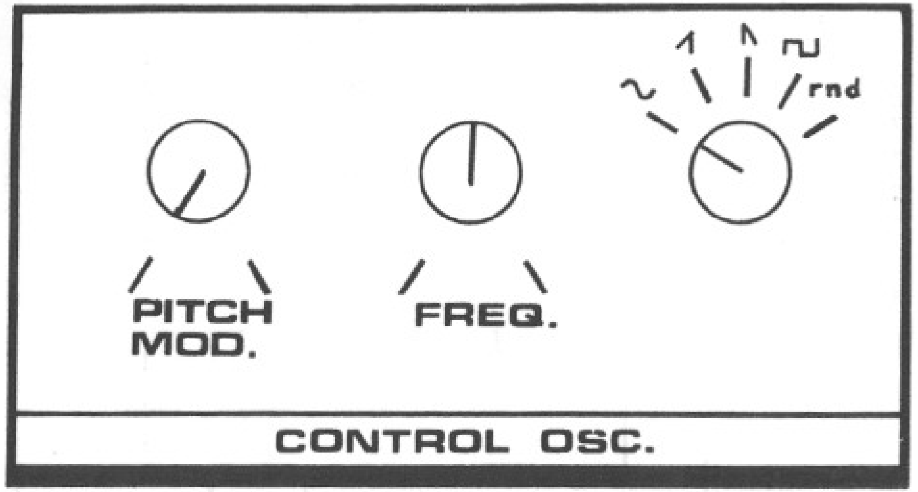


Figure 10: Control Oscillator

The control oscillator can produce five different waveshapes selected by the rotary switch (8). Reading clockwise, these are sine wave, sawtooth (ramp up), sawtooth (ramp down), square, and random.

The frequency control determines the rate of the control oscillator. The range of this control is far greater than you would expect to find on most synthesizers, and this is particularly useful because the control oscillator can be used to modulate the signal oscillator and/or the filter at both conventional low frequencies and much higher frequencies.

ACTION: Set the controls to our initial start position, and hold a note. Turn up the PITCH MOD (6) to the 12 o'clock position. The pitch of the oscillator will smoothly rise and fall as represented by the shape of the sine wave.

Now try the effects of the other waveshapes. Note that the random position (rnd) pitches the oscillator in a completely arbitrary manner, but at a rate determined by the FREQuency control (7).

Return to the sine waveform modulation, and now increase the frequency of the control oscillator. You will hear all manner of strange frequencies creeping in. This may not sound particularly musical at this stage; however, this very complicated modulated signal is ideal for simulating clangorous sounds (bells, gongs, etc.).

Experiment with different combinations of the controls (6), (7) and (8).

The GLIDE control will affect the shape of this modulating waveform. As an example, set the controls to give a slow modulating square waveform. Hold a note and gradually release the GLIDE amount. Note how the initial two clear notes transform into a single sweeping pitch.

The Control Oscillator is also used to modulate the cut-off frequency of the filter. See Section III 5.

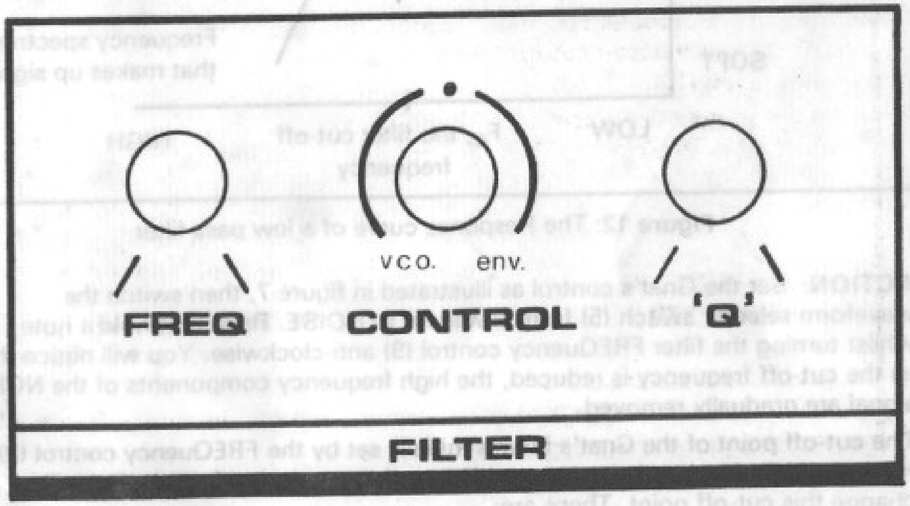


Figure 11: Filter Controls

III 5. The Filter

From our block diagram, figure 6, we can see that the signal from either the oscillator or the noise source is fed into the filter; this can be considered as a complex type of tone control. There are various types of filter, but the one incorporated into the Gnat is the most popular and useful—namely a low pass filter.

A low pass filter acts on a signal such that it lets through frequencies below a certain frequency, known as the cut-off frequency. Figure 12 illustrates graphically the way in which the low pass filter acts on a signal. It should be noted that there is no sudden attenuation of the signal above the cut-off point, but, as can be seen in the figure, there is a gradual decrease in volume of pitches moving up and away from the cut-off frequency.

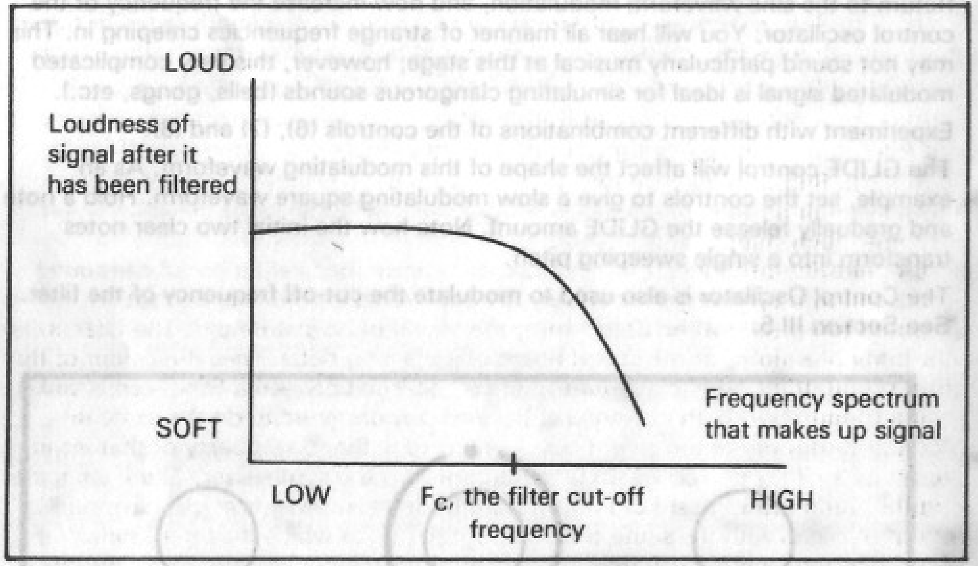


Figure 12: The Response curve of a low pass filter

ACTION: Set the Gnat's control as illustrated in figure 7, then switch the waveform selector switch (5) from sawtooth to NOISE. Press and hold a note whilst turning the filter FREQuency control (9) anti-clockwise. You will notice that, as the cut-off frequency is reduced, the high frequency components of the NOISE signal are gradually removed.

The cut-off point of the Gnat's filter is initially set by the FREQuency control (9). However, as with the pitch of the oscillator, there are other factors that will change this cut-off point. These are:

a) The note that is played on the keyboard. The filter tracks the keyboard (this can be seen from the block diagram, figure 6). This is so that every note will be filtered in the same way: if there were no keyboard track, the higher notes would be more heavily filtered than the lower ones.

ACTION: Set the Gnat up to provide a Noise source, as above. Set the Filter FREQuency knob to the 12 o'clock position. If bottom C, middle C and top C are then played in turn, you will notice that the filter is following the keyboard, and almost giving the noise source a definite pitch.

b) The filter CONTROL knob (10), which is used to introduce either periodic modulation of the filter cut-off frequency by the control oscillator, or a periodic contour modulation (filter sweep) from the filter contour generator. See Section III 6.

ACTION: Set up the Gnat's controls, as above, with the NOISE selected, and the filter FREQuency knob (9) in the 12 o'clock position. Rotate the filter CONTROL knob (10) anti-clockwise to the 9 o'clock position and hold a note. You will hear a slow cyclic modulation of the filter cut-off frequency. Experiment with other control oscillator waveforms by changing the selector switch (8).

c) The fine TUNE trimmer (3). As this control only has a maximum range of three tones, its effect is insignificant and therefore its position in relation to the filter is unimportant.

The 'Q' control (11), often called RESONANCE by other manufacturers, causes the filter to emphasise any signal or part of the signal close to the cut-off point.

ACTION: Repeat the above two 'Actions' with the filter resonance set at or near the maximum position (i.e. fully clockwise). You will notice that the sound has become much sharper and harsher.

We've already mentioned that the filter determines the final timbre of the sound produced by a synthesizer; however, the importance of the filter cannot be stressed too greatly when determining the sound of an instrument. The filter is like the body of a violin, or the sound board of a piano: it determines the colour of the final sound. If we go back to our earlier comparison between a Stradivarius violin and a cheap copy, both instruments have a body designed to do the same task, but the superiority of the older body is reflected in the tonal quality of that violin. A similar analogy can be drawn when considering the synthesizer. The filter is the synthesizer's sound board or body. Two different instruments might have similar low pass filters with the same cut-off rate (the rate at which the filter attenuates signals as they move away from the cut-off frequency point); however, they will sound quite different due to their designs. If you listen to the colour of the Gnat's output signal (preferably through an external amplification system), you will notice the warmth and fullness of the sound. This is because the Gnat's filter has been specially designed to give the instrument this desirable characteristic tone, and if you compare this synthesizer to most other synthesizers, you will appreciate the edge this gives the Gnat.

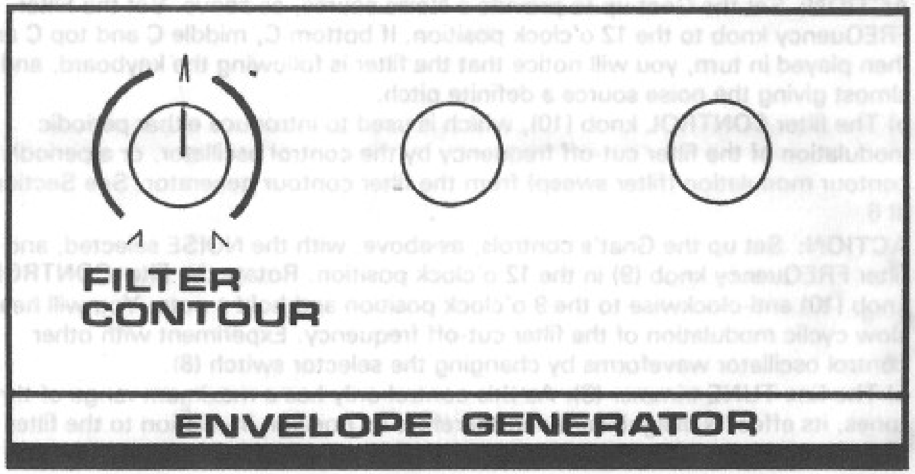


Figure 13: Filter Contour

III 6. The Filter CONTOUR

This control (14) is designed to change the cut-off frequency of the filter whilst the note is sounding, i.e. varying the timbre periodically with time. Again, the Gnat exhibits a unique design feature in that three completely different types of contour can be selected from one rotary control. Figure 14 shows the various contours that correspond to the different positions of this control. The amount of effect that this contour has over the filter cut-off frequency is determined by the position of the CONTROL knob (10).

ACTION: Set the Gnat's controls as shown in Figure 7. Set the filter FREQuency control (9) to the 8 o'clock position. Turn the filter CONTROL (10) clockwise. Touch a note. You should hear a click followed by a warm, heavily-filtered tone. This is because the filter contour is set to provide just a spike (Figure 14a).
Turn the FILTER CONTOUR knob (14) fully anti-clockwise, and then hold a note. The effect you should hear is that of the filter opening up slowly, then closing down abruptly. This means that the filter cut-off frequency is gradually increasing before reaching its maximum value, then falling back to its starting point.
Turn the FILTER CONTOUR knob fully clockwise, and touch a note. The filter will immediately open up, then close down gradually, removing all the higher frequencies as it closes down.
Experiment with the FILTER CONTOUR knob set in the intermediary positions.

Note: That the FILTER CONTOUR will only trigger once the previous note played has been released. This can be put to advantage, as it enables just certain notes in a passage or phrase to be emphasised by opening up the filter.

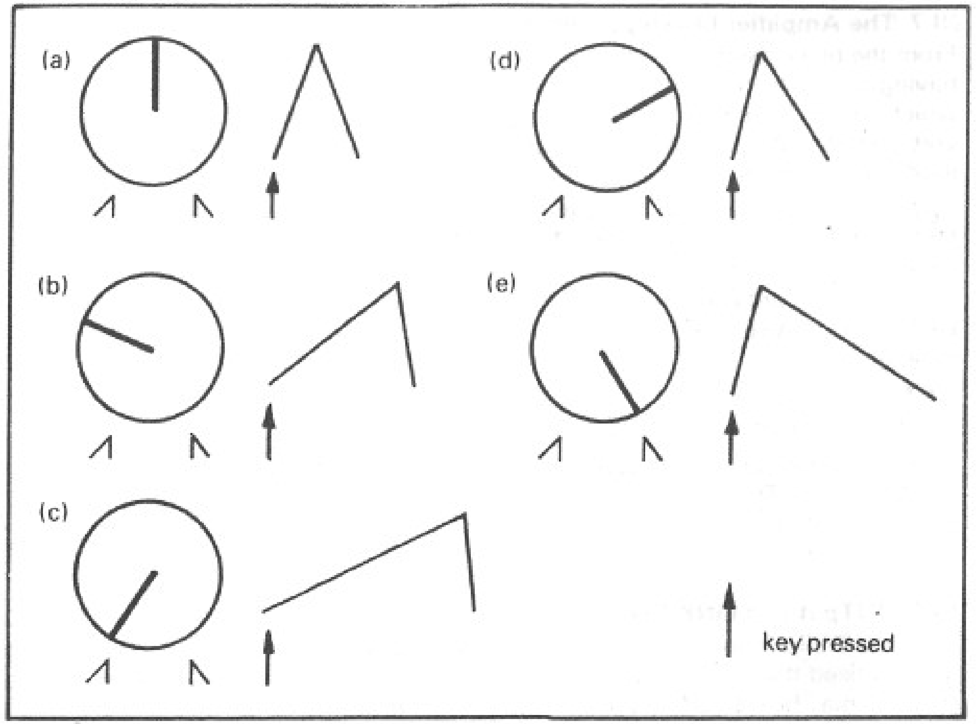


Figure 14: Effects of Filter Contour Control

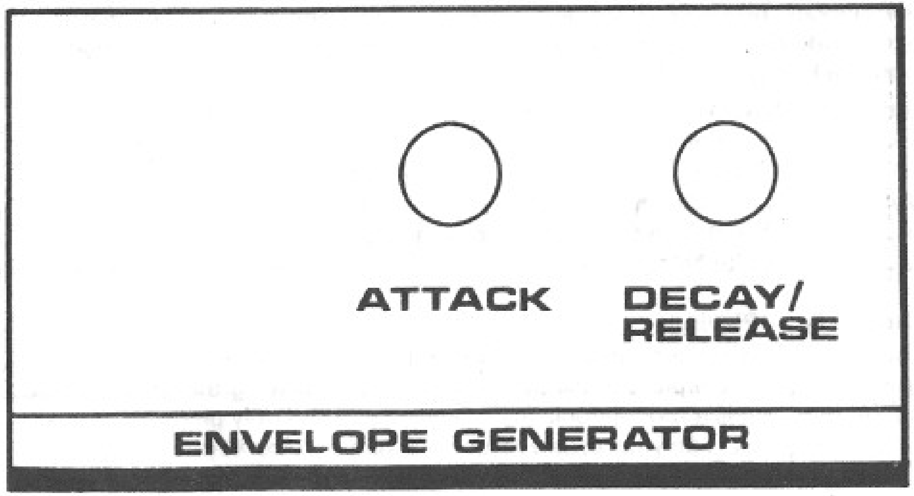


Figure 15: Amplifier Envelope Generator

III 7. The Amplifier Envelope Generator

From the block diagram of the Gnat (Figure 6) it can be seen that the signal after having been filtered is then fed to a device known as a voltage controlled amplifier, which varies the output level of the signal in amount directly proportional to the voltage fed to it from the envelope generator. Consequently, the output signal's loudness corresponds directly to the shape of the envelope.

The Gnat's loudness envelope is determined by two controls marked ATTACK (15), and DECAY/RELEASE (16). The ATTACK knob sets the time it takes for the envelope to reach its maximum level. At this point the envelope sustains the note until the keyboard is released, and the note dies away at a rate determined by the DECAY/RELEASE control. Figure 16 shows some envelopes possible with this generator.

ACTION: Set up the Gnat controls as shown in Figure 7. Position the envelope controls as shown in Figure 16 and note the results.

You now know, or at least have the basic knowledge of how the controls of the Gnat function. The best way to become fully adept with the instrument is through experimentation and let's face it this is always the most exciting part of playing any synthesiser.

III 8. OUTput and LINK Section

The Line OUTput socket (17) has already been dealt with in Section I. You may have noticed that the Gnat has no output volume control: this is in order that more features may be offered on the front panel. However, if you are using an external amplifier, a volume footpedal can be inserted between the Gnat and the amplifier, and, of course, the volume can be adjusted from the amplifier control panel.
Note: the LINE OUTput socket should not be used with ordinary stereo headphones; however, it can be used with the powered headphones that incorporate their own micro-amplification circuit. These are normally fitted with a mono jack-plug, or with a special switch to convert the stereo plug to mono.

The 7-pin DIN sockets (18), located in the recess on the right-hand side of the Gnat enable the synthesizer to be connected to the SPIDER sequencer, the CATERPILLAR polyphonic keyboard, or to other Gnats or WASPs.
Note: NEVER use a 5-pin DIN plug, as this could destroy some of the Gnat's internal circuitry. It is also important not to try to plug anything like a tape recorder into this socket, as this is designed for passing digitally encoded information only.

Section IV — Playing

You should now be familiar with the workings of all the Gnat's controls, so we can now move on to the pleasurable business of actually playing the Gnat. As you are aware, the Gnat is a monophonic instrument, i.e. it will only play one note at a time; therefore it is only necessary to use one hand on the keyboard and to use the other for the controls.

As a guide to some of the sounds possible with the Gnat, we've included some 'patches' for you to set up. Where the setting of the control is shaded, we suggest that you experiment with the exact positioning of that control, in order to achieve the best effect. A very small variation in just one parameter (most notably, the filter cut-off frequency) will make a considerable difference to the final sound.

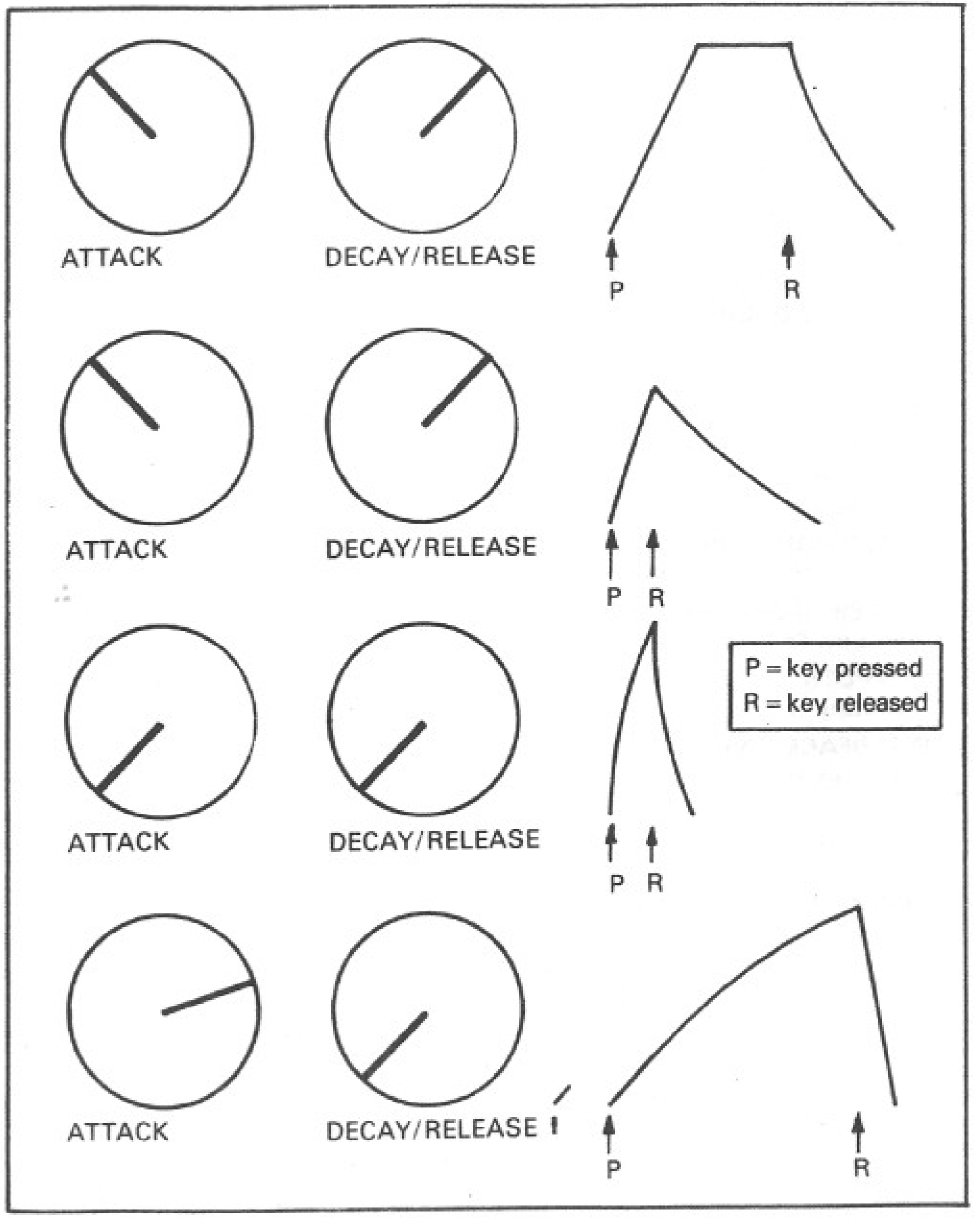


Figure 16: Various possible Loudness Envelopes

Now the rest is up to you. Experiment with every single control. There are no rules you have to obey; however, if you are trying to imitate another instrument, try to play the keyboard in the manner of that instrument, e.g. a flute passage is normally spritely and lively, so , when simulating a flute, play the keyboard accordingly. Finally, remember that both hands should be used to play the Gnat, one for the keyboard, and the other for the controls, and don't be afraid to try changing parameters as you are playing—if done well, this will add a new dimension to your synthesizing. Good Luck.

Section V – Technical Data

Keyboard – TUNE: approx. one and a half semitones up or down (preset to A = 440 Hz). GLIDE: rate adjustable up to 4 seconds for 2 octave sweep.

OSCILLATOR – Footage: 5 octave steps 32 to 2. Waveform: Sawtooth, Square, Enhance (Pulse width mod.)

CONTROL OSCILLATOR – Range: approx. 0.5 Hz to 500 Hz (continuous). Waveforms: Sine, Sawtooth (ramp up), Sawtooth (Ramp down), Square, Random.

NOISE – Digitally generated Pseudo-random noise.

FILTER – Type: 12dB/octave low pass with bass enhancement. Cut-off frequency 3 to 16 kHz (continuous). Proportional keyboard control. Q Factor: Variable (continuous) from flat to verge of oscillation.

FILTER CONTOUR – AD type envelope, fully variable from ramp up, through spike, to ramp down. (See text).

VCA Envelope Generator – AR type. Attack time 3 ms to 4 seconds. Release time 3 ms to 12 seconds.

OUTPUTS – Line output: –10dBm into 600 ohms. Noise level in quiescent state –65dBm. Speaker: OdBm into 50 ohm speaker.

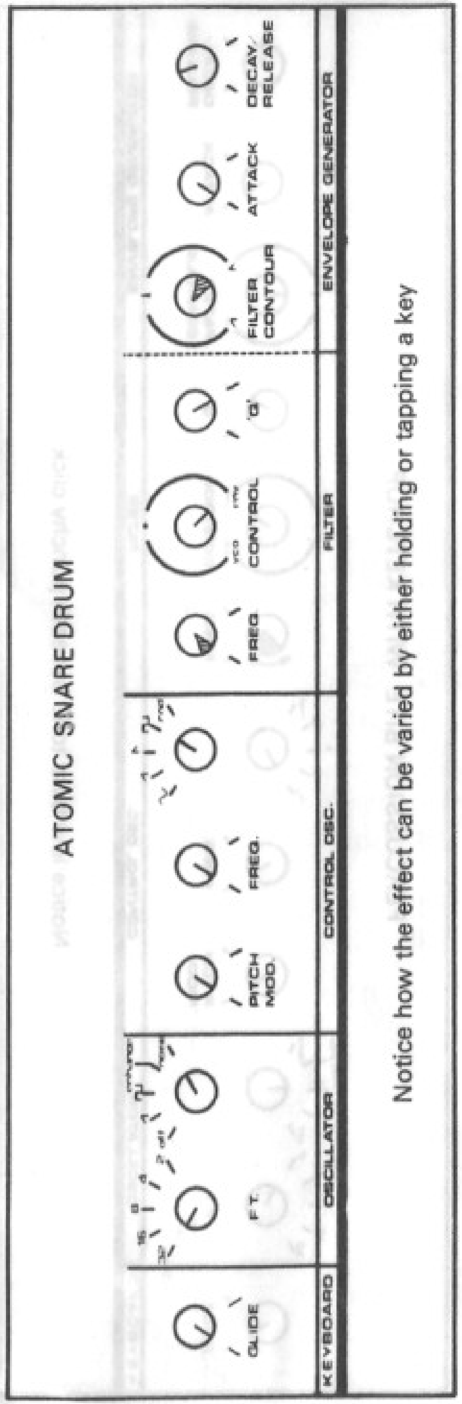
INTERFACE LINES – Seven tri-state lines, operating at 5 volt C-MOS logic levels. Six keyboard code lines and one trigger line.

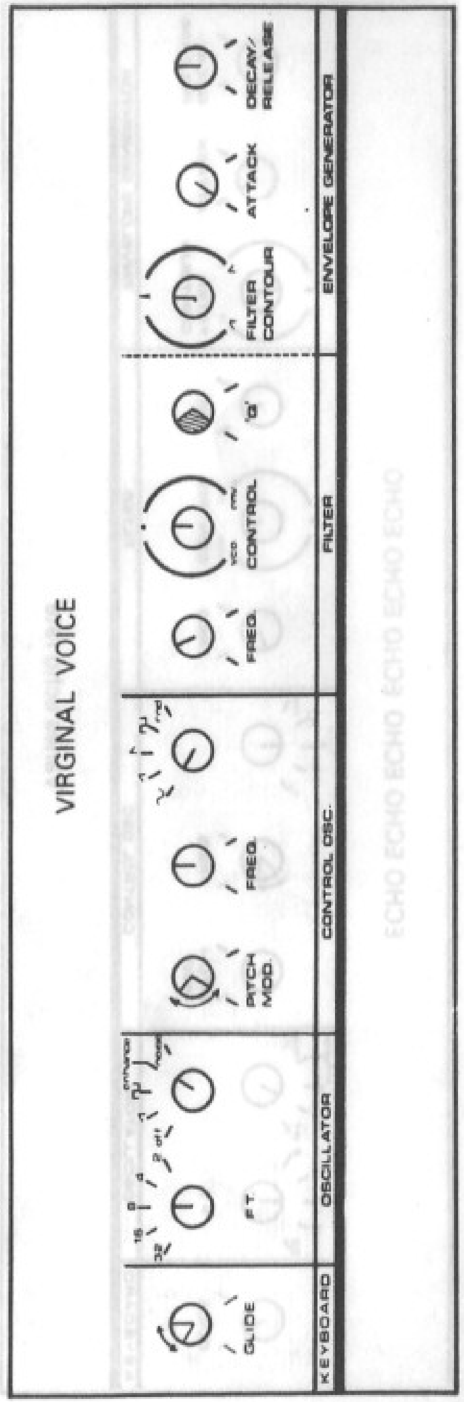
EXAMPLE & BLANK PATCHES

The following 12 'patches' will show you some of the sounds available to you with your GNAT. The names given to each sound are as a guide only, and shouldn't be taken as an exact representation.

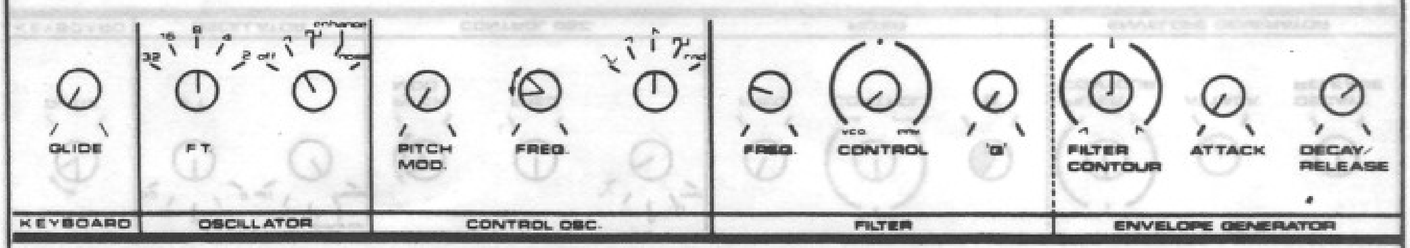
The shaded areas indicate that the control knob should be positioned anywhere in this area. You should adjust these controls to give the most desirable effect. Where a control is marked with a double headed arrow, the control can be moved during the course of a sound to give the voicing an extra dimension.

Remember it is important to play the keyboard as one would play the instrument that you are trying to simulate. For example try sliding your finger between notes with the Clarinet setting. This will simulate the characteristic runs associated with the Clarinet.



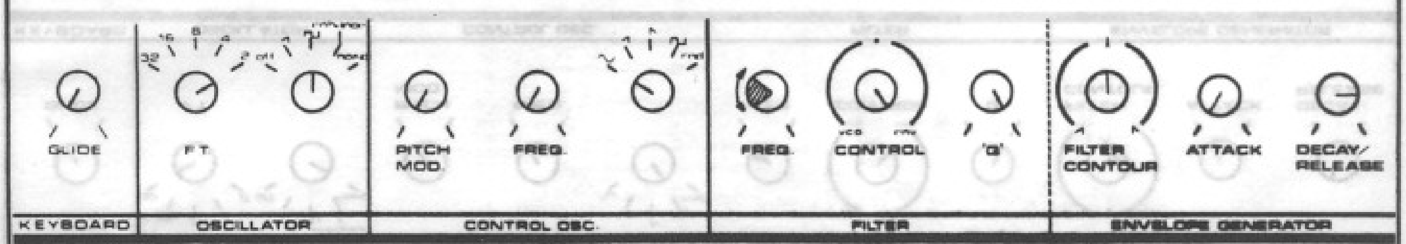


ECHO ECHO ECHO ECHO ECHO ECHO



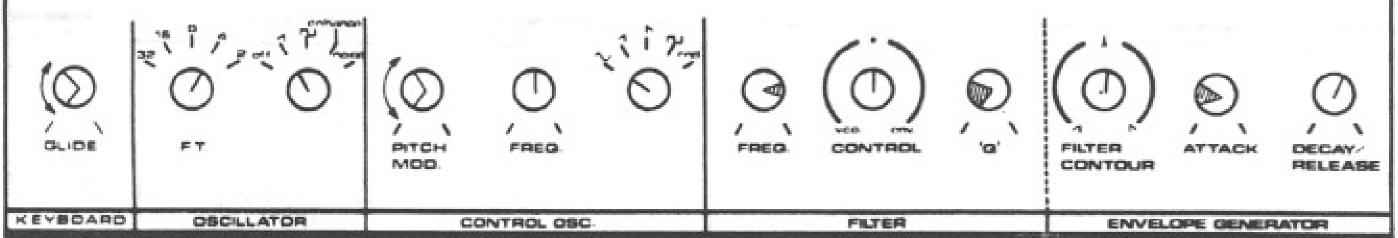
Varies echo rate

PERCUSSION BITE WITH KETCHUP



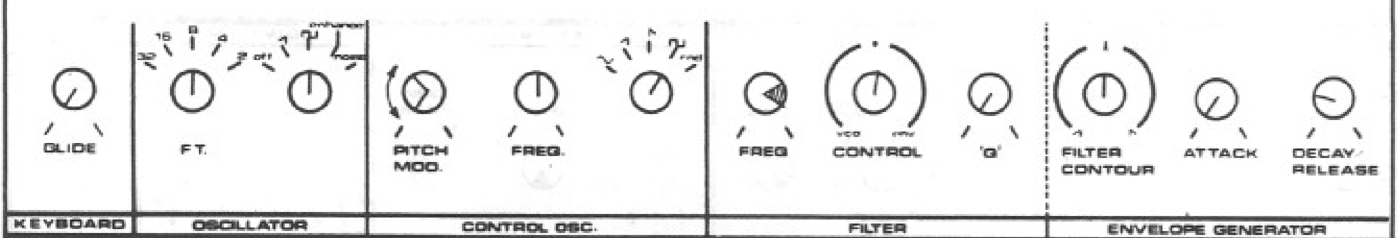
Notice low bass tone beneath punchy click

SOLO VIOLIN (ON ITS OWN) (SINGLY)



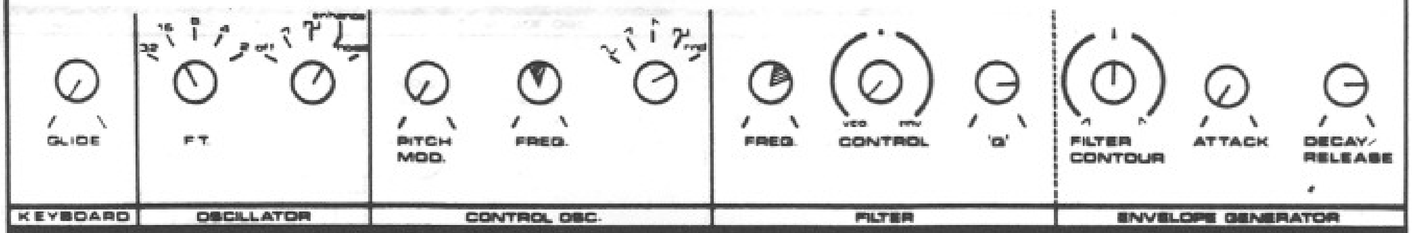
Introduce vibrato during note

RUBBER CLARINET

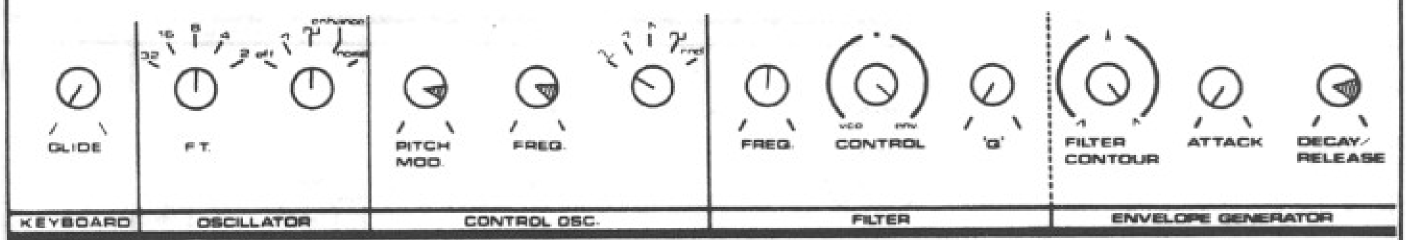


Introduce trill as necessary

FUNKY RHYTHM DISCO-PHONIC BASS

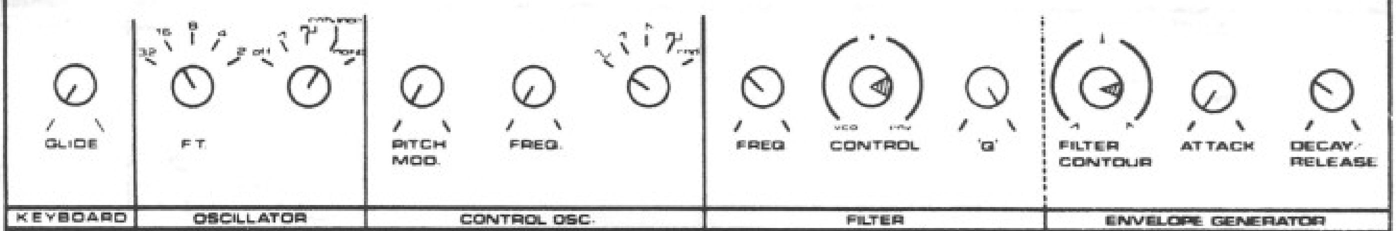


FLYING GONG/CHIME



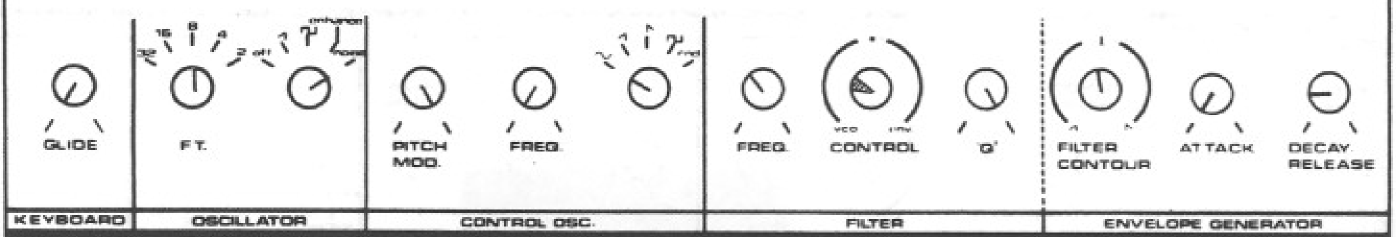
Play single slow notes. Each note will have a completely different quality

MANIC SYNTH BASS



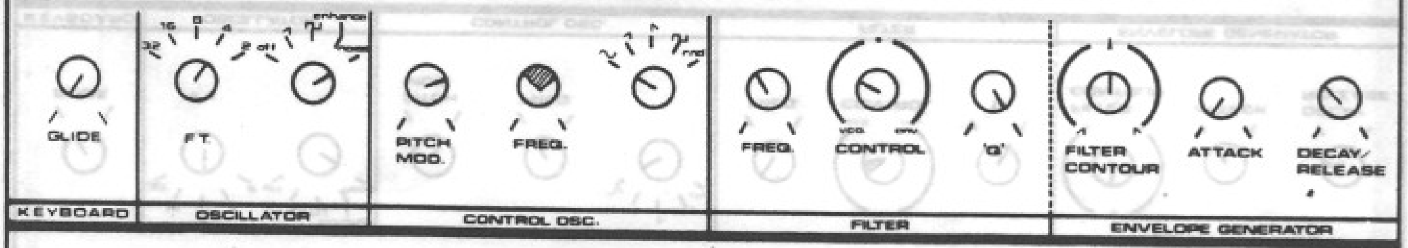
Filter Control & Filter Contour set so that Filter closes over note to give desired effect

FUTURISTIC SNARE



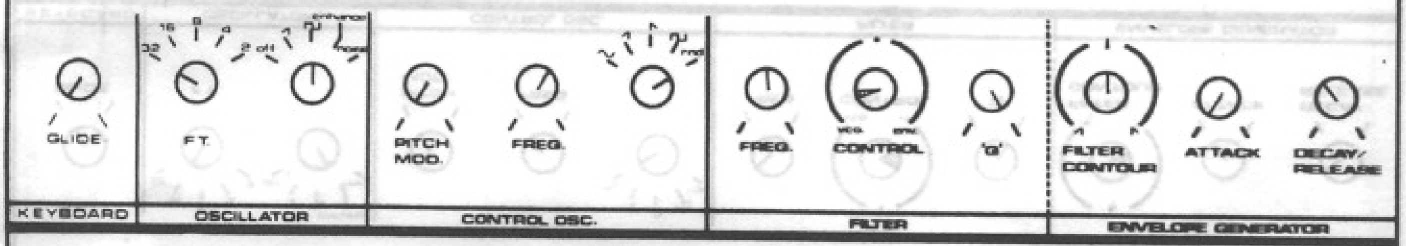
Play as a snare drum by playing in different positions on keyboard

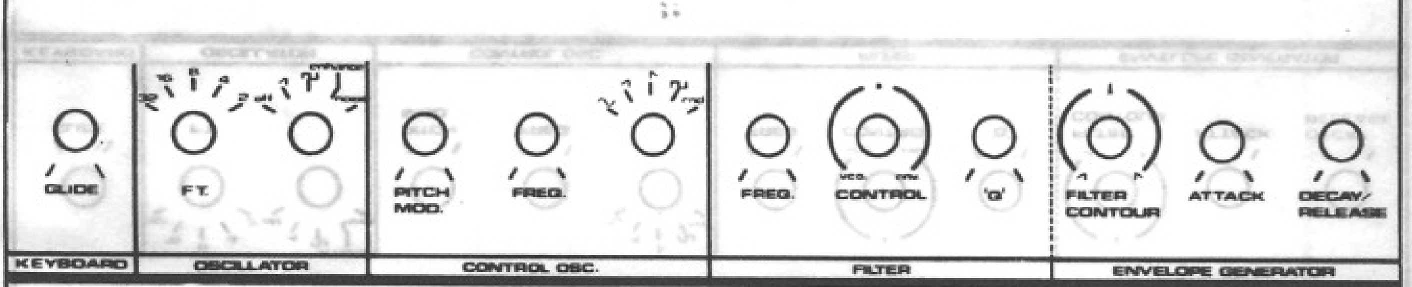
FRIGHTENED HELICOPTER

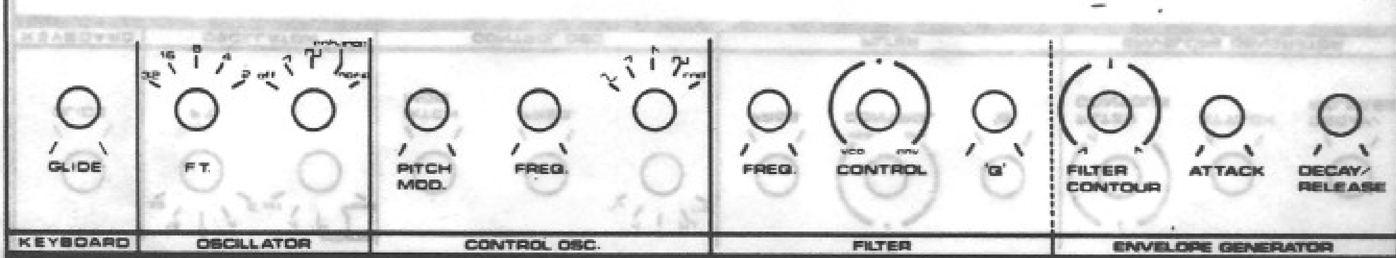


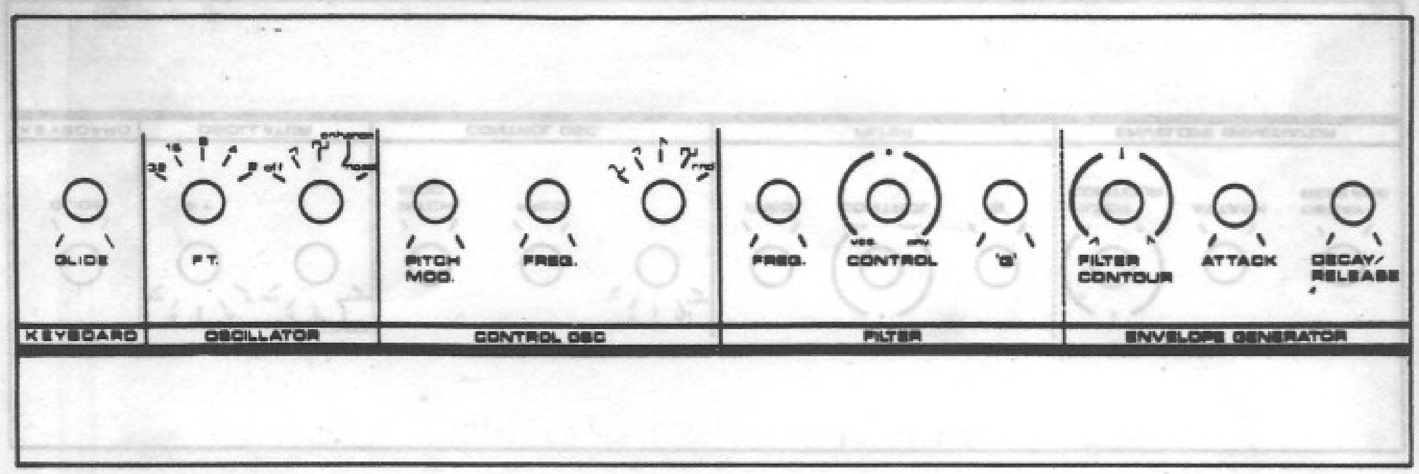
Speed up frequency for helicopter take off

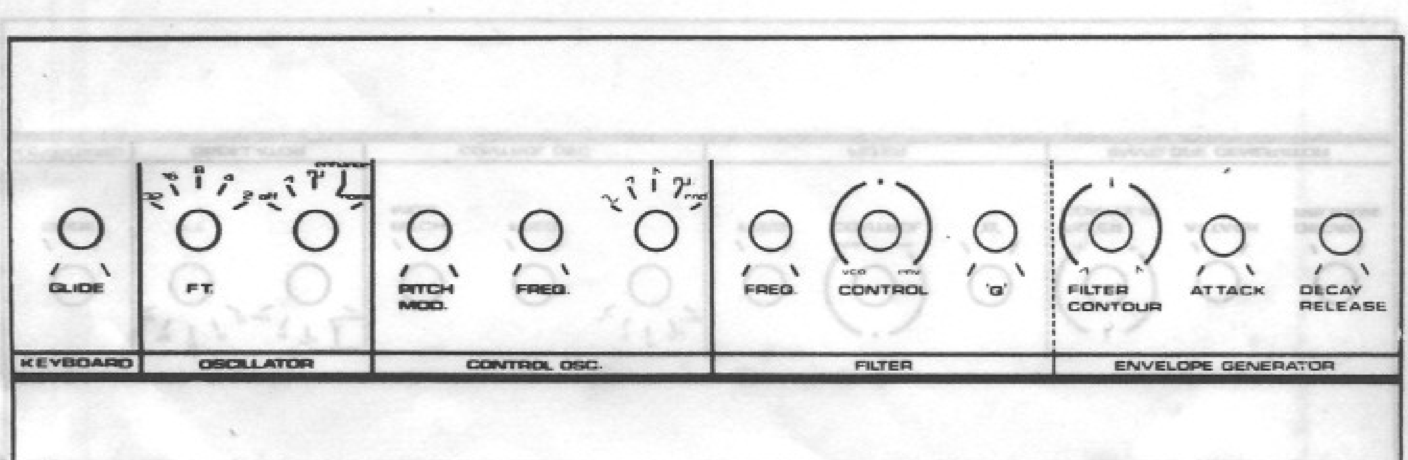
DITCHWATER SUB-BASS








GLIDE
F.T.
PITCH MOD.
FREQ.
FREQ.
CONTROL
'Q'
FILTER CONTOUR
ATTACK
DECAY/ RELEASE
KEYBOARD
OSCILLATOR
CONTROL OSC
FILTER
ENVELOPE GENERATOR


GLIDE
F.T.
PITCH MOD.
FREQ.
FREQ.
CONTROL
'Q'
FILTER CONTOUR
ATTACK
DECAY RELEASE
KEYBOARD
OSCILLATOR
CONTROL OSC.
FILTER
ENVELOPE GENERATOR