

HES

Synthesound™

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Instruction Manual

HES

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SYNTHESOUND

Manual from collection of Gary Tanin, GTLabs
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Manual by Theodore (Barry) Vincent

Illustrations by Tom Wahl

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SESSION ONE

INTRODUCTION

Hello there! You have entered the exciting world of SYNTHESOUND. This up-to-date synthesiser features 12 controls, a 2 octave fast-attack keyboard, 3 voices, a 4 1/2 octave range, a High-Resolution display of Controls and Keyboard fingering, E Z CODED songs, a 4 voice sequencer for repeating melodies or drum beats, and other music-synthesis features.

With SYNTHESOUND and this user-friendly manual you can play songs with synthesized instruments, build up songs, create many special effects, and learn the keys to electronic music production with step by step guidance.

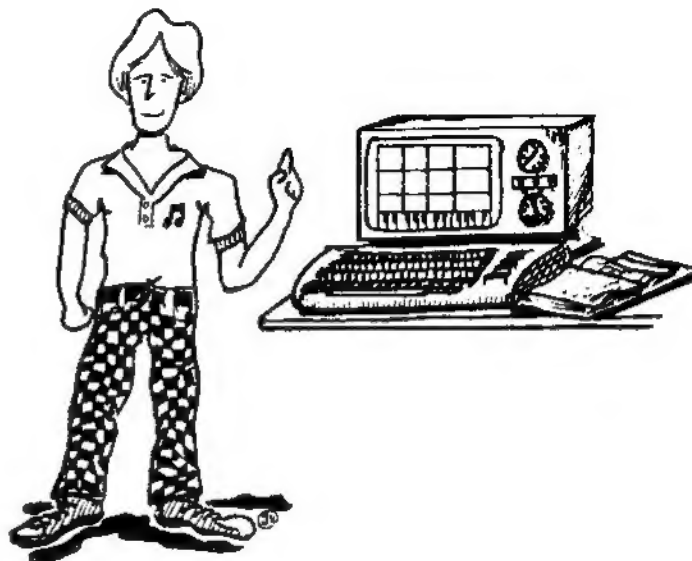
SYNTHESOUND is a Software Synthesizer that can be an interesting learning tool for a computer person playing music, or a musician operating a computer. Be prepared for learning some new music-synthesis tricks that you may have never dreamed of, and be prepared for a learning guide to better understanding of what you may already know.

It has been written in easy-to-read English, with the technical information in the latter sessions.

Now let's look at the SYNTHESOUND manual. You will be guided through the synthesizer's possibilities by a character named FRED. You see FRED was one of the first people to use a computer-synthesizer, and from the wisdom that he gained in his path to music-programmer and computer-artist, he designed the format and information in this manual.

Many examples are presented so that each 'session' will enlighten and entertain you and together form a useful tool for learning and performing. There is a great deal to be learned, and the information has been structured so that finding what you want is easy. You will also notice at the back of the book a glossary of music and computer terms that apply.

Music systems are very interactive and are designed only to please. Of all electronic systems, music systems are perhaps the most communicative because of the conveying of mood. This guide is for the crossover of music theories and computer systems.

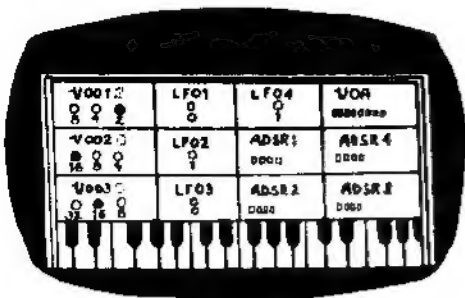


SESSION TWO

START UP.

Here we will start up the machine, and learn the art of note translation. Turn off the VIC-20 Computer. Now plug in your SYNTHE SOUND cartridge. Turn on your VIC-20 and the program will run automatically. Before hitting the F1 key to start the program you can center the image by using the cursor movement keys.

You will see on your screen 12 boxes and a long numbered section at the bottom of the screen. Your SYNTHE SOUND is now ready to play.



The top row of the VIC keyboard is used as the black notes of a piano, the next row is for the white notes. The second row equals the natural notes, for example: A, B, C, and so on. The top row equals the sharps and flats (omitting certain keys because there are no black notes there) for example: 1 is C sharp, 2 is D sharp, 3 is not used since there is no black note between E and F. Note: the lowest note is C, the back arrow key, in the upper-left, and high C, the home key, the 2nd highest note. Both are on the top row.

Press the U key. You will see a number of the indicators (simulated Light Emitting Diodes or LED's) turning on and off on different controls and hear a note build up in volume. That note is the "middle C" of this synthesizer. Now press the R key. That note is G.



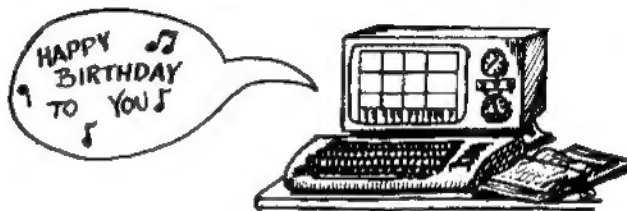
Congratulations! You now have computer-synthesizer experience!

Now try coding these letters.

CODING

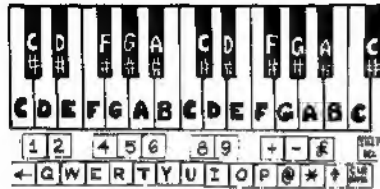
```
R R T R U Y (pause)
R R T R I U (pause)
R R @ O U Y T (pause)
P P O U I U (pause)
```

HAPPY BIRTHDAY



VIC SINGS

There are more exciting examples in session 6!



KEYBOARD

Now you can play melodies that you know on piano or organ. So you have another way to play SYNTHESOUND.

Table 1

NOTE=VIC	NOTE=VIC
C = 'LEFT ARROW'	C sharp = '1'
D = 'Q'	D sharp = '2'
E = 'W'	
F = 'E'	F sharp = '4'
G = 'R'	G sharp = '5'
A = 'T'	A sharp = '6'
B = 'Y'	
C = 'U'	C sharp = '8'
D = 'I'	D sharp = '9'
E = 'O'	
F = 'P'	F sharp = '+'
G = '@'	G sharp = '-'
A = '*'	A sharp = 'POUND'
B = 'UP ARROW'	
C = 'HOME'	C sharp = 'DEL'

Try coding the C MAJOR scale:

'U' 'I' 'O' 'P' '@' '*' 'UP ARROW' 'HOME'

PLAYER MODE AND PROGRAMMER MODE

So far you have been in PLAYER MODE. Below is an example of how to change modes and enter PROGRAMMER MODE. PROGRAMMER MODE is another type of synthesizer operation. It is the mode that you use to program the synthesizer by setting the controls.

To switch modes press the long space bar key. The screen will do some interesting graphics as you go through modes.

Now you are in PROGRAMMER MODE and you are controlling VCO1. You can see that you are controlling VCO1 because the LED for VCO1's octave (4) is blinking.

From VCO1 control you can EXIT PROGRAMMER MODE and return to PLAYER MODE by pressing the space bar.

It might interest you to know that you can view the NOTES that you are playing on a computer simulated piano keyboard! Press the "HOME" key. This is one of the finest features of the SYNTHESOUND system, the high-resolution graphic piano keyboard that is now at the bottom of the screen. You can remove it by pressing the DEL key.

Set up the PIANO DISPLAY in PROGRAMMER MODE and return to PLAYER MODE. You can press a note on the VIC-20 keyboard, and the piano keyboard will be played by a graphic color-coded square appearing ON THE PIANO DISPLAY of the note. Voice 1 (VCO1) is represented by a small yellow square, voice 2 (VCO2) red, and voice 3 (VCO3) blue. These are the three

voices; if they are all set the same (setting is next to letters VCO1, VCO2, and VCO3) then the color square is a mixture of them.

PROGRAMMER MODE

A common thing to do is to experiment with the controls and see what results they get. Another way to get familiar with the SYNTHESOUND features is to take one control at a time (probably from first to last) and completely learn it before going on to the next. Fred suggests that you FIRST read over all of the controls one at a time and remember where the information is, then start imagining and creating and experimenting with the many different settings.

The controls are grouped as follows: Voltage Controlled Oscillators VCO1, VCO2, and VCO3 are the three voices.

Low Frequency Oscillators LFO1, LFO2, and LFO3 are independant filters. They make vibrato effects (vibrations in the voices). LFO1 works on VCO1, LFO2 works on VCO2 and LFO3 works on VCO3. LFO4 is special. It makes a tremolo effect control on the master volume.

VCA is the master volume monitor and control.

The ADSRs are Attack, Decay, Sustain and Release controls. The ADSR1 allows LFO1 to affect VCO1, ADSR2 allows LFO2 to affect VCO2, ADSR3 allows LFO3 to affect VCO3. ADSR4 controls the Attack Time, Delay Time, Sustain Time, and Release Time controls on the volume. This control is just about the most important since it directs the overall master volume.

<u>KEY</u>	<u>MAP</u> <u>USE</u>
SPACE BAR	switches PGMR/PLYR MODES
RETURN	takes you to next control
UP ARROW	takes you to VCO1, up or down the controls
CURSOR DOWN	increments values
CURSOR RIGHT	decrements values
HOME	displays piano keyboard
DEL	erases piano keyboard



PROGRAMMER MODE CONTROLS

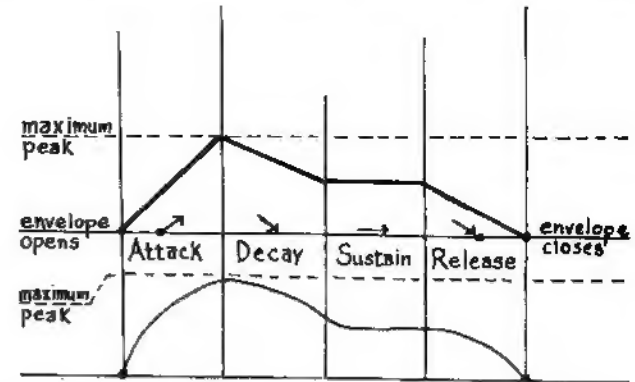
Sounds are created by oscillators. Oscillators make vibrations that are waves measured in frequency. The frequency (speed) at which they repeat creates pitches (different notes). Faster frequencies makes higher notes, lower frequencies make lower notes. You have control over 3 oscillators. They are the first 3 controls: (Voltage Controlled Oscillators) VCO1, VCO2, and VCO3. They are all set on 'C' with VCO1 on the highest octave.

Low Frequency Oscillators modify the pitch made by the oscillator. You have control over the vibrato modification rates of LFO1, LFO2, and LFO3. LFO1 modifies VCO1 depending on ADSR1, LFO2 modifies VCO2 depending on ADSR2, LFO3 modifies VCO3 depending on ADSR3. They all work separately giving you a lot of control. LFO4 is an overall modifier that makes tremolo effects. The VCA (Voltage Controlled Amplifier) monitors and maximizes the amplification (volume).

There are many different types of music production under computer control. Some are: Sound generation and wave forming, timing operations in playback, routing and modulating, simulation, and many more. Modifying the ADSR envelope is the first step to a grand understanding of music synthesis. SYNTHESOUND users, by knowing the tools of sound shaping can create from a broader choice of sounds, and have more freedom to create with the understanding of the controls.

Every sound has many characteristics, percussive amount (softness or 'punch') is one, volume is another, the length of the note is yet another, modulation amount, and so on. To see what we are doing with the sound we must know the format of sounds. Let's break apart and look at a sound.

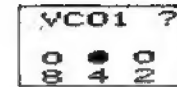
The ENVELOPE is a detailed display or control over how the sound "looks" from start to end. A common ENVELOPE is the ADSR ENVELOPE. This envelope shows or controls the [A]TTACK TIME, [D]ECAY TIME, [S]USTAIN TIME, and [R]ELEASE TIME of a sound. We want to find out our controls over these parts of a sound and all of the ways that we can use them.



Together the parts of a sound form a "shell" for the sound to "fit" into.

From the instant of starting, many instruments and sounds do not start right up but gradually reach highest PEAK. A drum has instant peak, but a bowed violin has gradual slope to PEAK. Pause and think about your favorite instruments. Do their sounds hit you right away with FAST ATTACK, or do they have smooth SLOW ATTACK?

CONTROLS



The DECAY part of a sound is a sophisticated second-step part of the sound. Immediately after ATTACK the sound may: die down completely (no sustain) in one slope back down to silent again, or it may go to another level in between and sustain that second level as in the examples shown.

SYNTHESOUND makes this use of the DECAY: when there IS modulation by LFO in the DECAY part of one of the VCO voices, if you press a note, the amplitude height of the graph goes up to peak and then DECAYS straight from PEAK to silent. If the key is RELEASED during the slope from DECAY TO SILENT, the note does not die, but goes to the release part with the height that it was at when it was released.

SUSTAIN TIME is the time between the ATTACK or ATTACK / DECAY and RELEASE. Again, if there is a DECAY amount then the SUSTAIN part is not used.

If you press down a note, you can usually stop pressing the note before it dies out. If you do this, the sound goes into the RELEASE TIME part of the sound. The RELEASE is what happens to the sound after the note is no longer pressed.

All of these parts of the sound can be viewed by watching the LED's indicate what is going on while you play and watch. Together the slopes create a vehicle for the sound to be shaped and timed just right, the ADSR ENVELOPE.

VCO1 is the first control as you enter Programmer Mode. When the control is on VCO1 you may: 1) Leave Programmer Mode by pressing the space bar; 2) Get the graphic keyboard by pressing the HOME key; 3) Erase the graphic keyboard (view sequencer) by pressing the DEL key; 4) Enter Sequencer Programming Mode by pressing the F1 key; 5) Vary the settings of VCO1; 6) Go through VCO1 control by pressing return.

From the electric circuitry octave scales are created. Naturally it is done by halving or doubling lengths of pipe, string or size of instrument struck. SYNTHESOUND uses halved and doubled numbers to describe the octaves.

When CONTROLLING VCO1, you have your three octaves displayed in front of you: 8, 4, and 2. You will see the LED blinking under the 8 (the lowest octave). Press the cursor right key, the LED under 4 blinks indicating that you have changed (up 1) octave. Do this again and the LED under 2 now blinks. Again and the LED disappears indicating that the voice is not to be played. Once again and the LED blinks under 8 again (wrapping around). Select by pressing RETURN. If there was no number next to VCO1, a number will appear. Now change the number of half steps above 'C' with cursor down and cursor right keys, select one of the octaves or

silence that VC by pressing return. You are now controlling VCO2. Pressing RETURN takes you to the next control and completely through programmer mode. Up arrow takes you to VCO1, (the shorter of) either forward or reverse so you only have to press up arrow about 5 times and you will be there.

Here are some other possible uses of the VCO's:

To set a drone voice (a voice that stays on one note regardless of what note is pressed), turn on the oscillator, go to PLAYER MODE, play the note that you want (the last note that you play is stored), and go to PROGRAMMER MODE. Now turn the oscillator off and when you return to PLAYER MODE that voice stays on the note that you last entered. All voices can not be drones. Try setting the voices on different notes, make chords if possible. To turn off a voice: turn on the oscillator, enter and leave PLAYER MODE without playing. Now turn off the oscillator.

VCO2 ?		
●	0	0
16	8	4

VCO2 is the middle oscillator, it is set on the 'middle C' of this synthesizer, equivalent to B flat on a 'concert tuned' instrument. You can change the octave or turn off VCO2 with the cursor down, and cursor right keys. The LEDs will go through the cycle 16, 8, 4, off, 16 again. Select by pressing return. Now change the number of half steps above 'Middle C' with cursor down and cursor right keys, select by pressing return.

VCO3 is set on 'C' below 'Middle C' of this synthesizer. This is the lowest oscillator available, try some bass notes with VCO3. Set the octave and number of half steps as above.

LFO1
0
0

LFO1 is a Low Frequency Oscillator that modifies the pitch created by VCO1. The modification is 'vibrato' (wavering of the frequency) on the original pitch.

It starts out at 0 which is a real amount as far as SYNTHESOUND is concerned. This just means that it is set to be very slow in its initial state. LFO1 only works as specified by ADSR1. If ADSR1 has no values at all, LFO1 will not modify the sound from VCO1. Depending upon which section of ADSR1 you place values in you can make VCO1 waver with the vibrato rate of LFO1 amount.

Use cursor down and cursor right to increase or decrease the number of the amount, select with the return key. The value may be specified from 0 (slow) to 20 (very fast). Settings above 20 are possible, only not visible. Suggested setting is about 3 for slow, 10 for fast, but if you want effects, try about 20.

```

LF02
 0
 1

```

LF02 is a Low Frequency Oscillator that modifies (makes vibrato on) VCO2 as determined by ADSR2. It works the same as LF01 works on VCO1 as determined by ADSR1. See the information on LF01. The LFOs are independent, and they create very interesting effects when set differently.

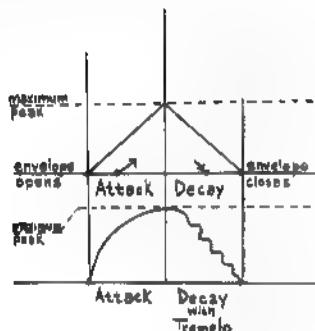
LF03 modifies VCO3 (with vibrato) as determined by ADSR3. See above.

```

LF04
 0
 1

```

Low Frequency Oscillator 4 is separate from LFOs 1 - 3, and modifies the RELEASE of the overall sound. It is a tremolo effect, which is volume increasing and decreasing at a fast rate making a broken up sound.



It can be set from 0 (none) to 3 (medium). Use the cursor down and cursor right keys to set it, press return to select.

```

VCA
■■■■■■■■
?
```

VCA is the Voltage Controlled Amplification of the sounds combined. It is the master volume monitor and control. When you are CONTROLLING the VCA a question mark appears under the LEDs. Change the value with the cursor down and cursor right keys, select with the return key. It is a maximum volume control, from 1 to 13.

When viewed in PLAYER MODE the LEDs give a graphic representation of the volume when a note is played. At highest volume the rightmost LED is on. At lowest volume, the leftmost LED is on.

```

ADSR1
■■■■
< ? >
```

ADSR1 allows you to put vibrato effect in the ATTACK, DECAY, SUSTAIN and RELEASE parts of voice VCO1. You may want to review the ADSR ENVELOPE in session 4, page 21. Initially ADSR1 is set at 0,0,0,0 so there is no vibrato effect on VCO1 at all. The speed of the vibrato effect is controlled by LF01. For trying different ADSR1 settings you should set LF01 to 8.

When you start controlling ADSR1 you will see a question mark '?' under the A first and a number to the side (initially 0). Use the curser down and

cursor right to change the setting, select with the return key, then the question mark will move to the next part, D, and on through all of the ADSRs.

To make the sound start up with a vibrato effect, put 1 in the ATTACK part. The sound starts up slowly, with vibrato effect in it. To make the sound end with vibrato put 15 in the RELEASE part.

This is how special effects can be made and tied together. For example if you set ADSR1 to 1,1,0,10 then you can have three types of vibration in one sound! There are more example settings in session 6.



ADSR2 allows vibrato effect in any part of VCO2's ATTACK, DECAY, SUSTAIN or RELEASE. The speed of the vibrato effect is controlled by LFO2. ADSR2 works exactly the same as ADSR1, please see the previous information.



ADSR3 allows vibrato effect in any of the 4 ADSR3 parts of VCO3. LFO3 controls the speed of the vibrato effect. ADSR3 works exactly the same as ADSR1, please see the information on ADSR1.

ADSR4 is the master volume shaper, allowing you to program the envelope or shape of the master volume. One of the biggest distinctions between instrument's sounds is the way that the master volume is shaped. This is an excellent control for testing and creating. You may want to review the ADSR envelope in session 4, page 21.

Here is a handy reference: LOW ATTACK = quick to peak volume. HIGH ATTACK = slow to peak volume. LOW DECAY = quick from peak to silent. HIGH DECAY = slow drop from peak to silent. LOW SUSTAIN = short duration while key is held down. HIGH SUSTAIN = long duration while key is held down. LOW RELEASE = quick drop to silent. HIGH RELEASE = slow drop to silent.

SESSION FIVE

PROGRAMMING THE SEQUENCER

Lets look into the most up-to-date feature of SYNTHESOUND, the 4-voice programmable sequencer. With the sequencer, you can repeat melodies or rhythm patterns (drum lines) with a maximum of 20 notes or rests (silence between notes). The patterns you create may be at a set tempo (playing speed) or you may create patterns and speed them up or slow them down as they repeat. This state-of-the-art feature makes the VIC-20 into a very useful addition to any musicians equipment. Using the sequencer, SYNTHESOUND actually plays itself, allowing the user to play along and be a one-man-band which is the way many contemporary songs are created and performed.

To use the sequencer you must be in Programmer Mode and erase the graphic piano keyboard on the bottom of the screen. Now you can see the 20 LEDs and their numbers, 1 to 20. These are the 20 note registers that we can program. You should have a good idea of the entire melody and the timing of each note and rest. The control must be on VCO1 to start. The VIC-20 keys that are used to program the sequencer are: F1 = START; F3 = SKIP; F5 = SELECT; F7 = RESTART.

Press F1. You will see a question mark '?' and the letters VCO1 on the sequencer panel. The sequencer is asking if the melody is to use the voice of VCO1. Answer with the F3 (skip) or F5 (select). It will continue to ask about VCO2 and VCO3, and then VCO4. VCO4 is a noise generator,

used to make rhythm patterns.

After you have selected the voice(s) that you want, the LED above 1 turns on. Now you choose note 1 by pressing one of the notes on the VIC-20 two octave keyboard and then selecting it by pressing F5 (select). Now the number underneath goes to 0 waiting for you to enter the duration of the note in 20ths of a second with the curser down and curser right keys, select with F1 (select). After you have entered the note into register 1, then the duration of the note, the LED above 2 turns on. If you want a rest (silence), press F3 (skip) and enter and select the duration. Press return when you are through.

Now turn off all of the oscillators, VCO1, VCO2, and VCO3 (see page 12 for review). Press the space bar and go to Player Mode. Your melody will play back to you now! Press different keys while it is playing to speed it up!

Try this for fun: In SEQUENCER PROGRAMMING MODE: enter 9 0 9 U , and give the notes high duration values. This melody just might surprise you!

You can go back into SEQUENCER PROGRAMMING MODE and change the voice(s), add to your melody, or try turning on the oscillators for some funny effects! I think making arrangements is the way to go, giving SYNTHESOUND the basic track and then singing and playing other instruments on top.

CONGRATULATIONS!!! And good luck in your application of SYNTHESOUND. Remember you learned it here, and next time someone asks what instrument you play, just tell them, "I play the computer!"



SESSION SIX

EXAMPLES AND USES

Bagpipes.....VCO1 octave 2, steps 2, VCO2 octave 4, steps 2, VCO3 off, LFOs off, ADSRs all off.

Bass.....VCO1 off, VCO2 octave 8, step 1, VCO3 octave 32, step 1, LFOs off, ADSRs 1-3 off, ADSR4 0,10,0,1.

Brass instruments.....VCO1 octave 8, step 5, VCO2 and 3 off, LFOs off, ADSRs 1-3 off, ADSR4 0,0,20,1.

Cello.....VCO1 octave 8, step 0, VCO2 octave 16, step 0, VCO3 octave 32, step 0, LFOs off, ADSRs 1-3 off, ADSR4 5,5,0,2.

C Chord.....VCO1 octave 4, step 7, VCO2 octave 8, step 4, VCO3 octave 16, step 0, LFO1, 2 and 3 off, ADSR1, 2 and 3 off, ADSR4 8,0,0,2.

Piano.....VCO1 octave 4, step 0, VCO2 octave 8, step 0, VCO3 off, LFOs off, ADSRs 1-3 off, ADSR4 0,6,0,1.

Flute.....VCO1 octave 4, step 0, VCO2 and 3 off, LFOs off, ADSRs 1-3 off, ADSR4 1,0,0,2.

SYNTHESOUND.....VCO1, 2 and 3 are octave 8, step 0, LFOs 1-3 set at 2, ADSRs 1, 2 and 3 set at 0,1,0,0, ADSR4 0,0,0,1.

OUTER SPACE PANIC.....VCO1 and VCO2 octave 8, step 0, VCO3 octave 16, step 0, LFO1 15, LFO2 20, LFO3 30 (Approx.), LFO4 off, ADSR1, 2, and 3 0,8,0,0, ADSR4 0,0,0,1

Chord.....VCO1 octave 4, step 7, VCO2 octave 8, step 4, VCO3 octave 16, step 0, LFO's off, ADSR1, 2, and 3 off, ADSR4 8,0,0,2

Violin.....VCO1 octave 4, step 0, VCO2 and 3 off, LFOs off, ADSRs 1-3 off, ADSR4 12,20,0,3.

To try the LFOs, put a 1 in the 'A' of one of the ADSRs. For an effect, put a 1 in the 'R' of and ADSR. Change the LFO setting for that ADSR also.

GLOSSARY

ADSR.....The four parts of a sound--attack, decay, sustain, and release.

Amplifier....Electronic device that increases amplitude (strength).

Attack.....The time it takes from silence to full volume.

Decay.....The time from full volume to silence in straight slope.

Envelope.....A graphic diagram of a sound or effect from beginning to end.

Frequency.....Speed of vibrations that make pitches. Measured in Hertz per second.

LFO.....Low Frequency Oscillator, used to modify other oscillations.

Oscillator....Device with voltage inputs that produces waveforms and sounds.

Release.....The duration of the note after the key is released.

Sequencer....Device that repeats melodies and sounds previously programmed in.

Sustain.....The duration of the note while the key is held down.

Voltage.....Activates (powers) many devices. Variance (+ or -) is control.

VCA.....Voltage Controlled Amplifier, the volume control.

VCO.....Voltage Controlled Oscillator. Creates specified oscillations (sounds).

NOTES