Fastfingers 3 or FF3 for Short

FF3 is a departure from the aims of FF2 and original Fastfingers. The original goal of Fastfingers and FF2 was to produce sounds with the 6581 SID that would compete with real MONO LEAD SYNTHESIZERS and making those sounds heard by playing on full sized keyboards. With FF1 the Mattel Intellivision keyboard was used, and with FF2 almost any MIDI keyboard, or MIDI sequencer would work as a controller.

Even though, 256 sounds were sculptured for FF1 and FF2, the end user could also learn how to make their own sounds and sequences. As time went on, the SEQUENCER in Fastfingers 2 grew so powerful that its sequences practically cried to get out of the box and into the MIDI world. Thus the need for Fastfingers 3 was born.

FASTFINGERS 3

Fastfingers 3 still has the great sounds of Fastfingers 2, but now the emphasis has switched from a MIDI IN interface to a MIDI OUT interface. Now the goal is to play those great FF2 sounds but also send those NOTES and VELOCITY values out to MIDI, the sounds blended, or not, with the MIDI sounds.

FF3 is a "turnkey system" on a cartridge and midi interface with MIDI OUT

With 32 Velocity volume sequences and INVERSIONS of those velocity sequences, when combined with 528 built in PITCH sequences, end users can create over 32,000 musical sequences. Each PAGE of 16 sequences is based on a single CHORD or type. AND SAME AS WITH FF1 OR FF2, END USERS CAN SAVE THEIR SOUNDS AND SEQUENCES TO DISKETTE OR SDCARD (with sdcard adapter from Jim Brain or other 3rd party manufacturer) This sequencer sends out to all channels at once , but because of variations of Velocity curves, certain instruments will "jump out" where others may be nearly mute. This can be used to create some very interesting "bed tracks"

Of course this will also play Fastfinger 6581 SID synth sounds as well at the same time.

My aim with the 6581 SID was never to use the 3 voices as INDEPENDENT voices making all of the popular game sounds, but rather combining all 3 voices to build a powerful lead synthesizer. I'll be getting a few SwinSid chips in the new year and finally will be able to hear these sounds as I intended them, hopefully without noise.

FastFingers 3

Having stood the "test of time" ,in the September 1991 issue ,COMPUTE magazine wrote,"FASTFINGERS was written before the MIDI explosion, yet Laskowski programmed it for 256 sounds and even coaxed an extra suboctave out of the SID chip."

FASTFINGERS 3 INSTRUCTION MANUAL 2.0 REVISED November 2022

The Commodore 64 and Commodore 128 computers are approaching 40 years old and ,for professionals, it is recommended that you have a few of these on hand at a time. The 6581 SID chip DOES NOT sound exactly the same on every C64 or C128, therefore, you may need to TWEAK sounds to get the sound that you want by adjusting filter cutoff and filter resonance, or adjusting external equalization on your mixer.
* COMMODORE is a trademark of COMMODORE INTERNATIONAL

FASTFINGERS 3 QUICKSTART

By Les Mathers 1990
Edited by Dan Laskowski 2020

A QUICKSTART GUIDE

Introduction
FASTFINGERS 3 is a complex program!
This short guide is designed simply to let you get the feel of its power quickly. Even if you're a veteran user of the C64, and intimately familiar with the, "SID," chip, you will benefit from starting your journey with FASTFINGERS 3 by first using this quickstart guide. Later, the full manual will allow you to explore all the complexity FASTFINGERS 3 offers any devotee of sound from the C64 computer.
Happy exploration!

What is FASTFINGERS 3?

FASTFINGERS 3 allows you to make, shape, and save your own sounds.
FASTFINGERS 3 allows you to set up these sounds so that **your Commodore 64 can become the lead synthesizer for live performances.**
FASTFINGERS 3 can be also a POWERFUL LOOPING ENGINE, with 3 independent looping devices…**PITCH ,VELOCITY, and Dynamic ADSR or DADSR** for short.
These have 4 independent EDITING SCREENS.
But this program does much more.
You can change note parameters on the fly and add a variety of custom effects.
The philosophy of FASTFINGERS 3 is to put total flexibility at your fingertips, giving you unprecedented access to the power of the SID chip **AS WELL AS AN EXTREMELY VERSATILE MIDI SEQUENCER!**

Starting Out

LOADING THE PROGRAM FROM DISKETTE is no longer supported, but you will still be able to load and save your own sounds and sequences.

Always work from a backup.

Loading in sound modules

The **F1** key is the loading key for default **DEVICE 8** preset sound modules, arpeggios, and transpose data. You must hold down both the **CTRL** and the **Commodore** keys and then simply hit the **F1** function key. Once the drive light goes out (in about 25 secs) you should be able to get a sound by depressing some of the keys on the bottom two rows of your keyboard.

Now comes the fun stuff! Turn up the volume.

Changing Instruments

Hit any of the 16 keys, on the top of your keyboard and tap keys in the bottom two rows to hear all of the different sounds available in just this one bank!

Want Chords?
We got one-finger chords! To select a chord simply hit a key in the "QWERTY," row on the keyboard, and then "play," the keys on the bottom two rows of your keyboard.

Changing Sounds

Out of the box FASTFINGERS 3 comes with a wealth of different sounds. ..256 internal SID sounds to be exact. It is a little complex to explain.. .but stay with us. ..the results you will hear will be worth it! Let's try to change banks of sounds. Depress and hold down the **CTRL** key and a new screen will appear. This is the sound menu. Select a kind of sound like winds or organs. For example, the "**Y**," key represents organs while you are on this screen. Hit the "**Y**," key. You have now entered the organ bank which has 16 different sounds.
To select one of these organ sounds, first hit any of the keys in the top row of your keyboard. Next, hit the, **"GET" key**. This is the **up-arrow** on the right-hand side in the second row from the top of your keyboard.
Remember to keep the "**CTRL**" key depressed during all of this.
Once the new sound is assigned you can release the "**CTRL**," key.
Now, "play," the bottom two rows of your keyboard ,or your midi keyboard to hear your new sounds.
If you look at the sound menu, you will see that there are eight blue columns with words like "Bass, Varied, Winds." Half the columns are fat, and half are skinny. The skinny

columns represent banks of 16 sounds, while the fat columns actually give you access to 32 sounds.

To access the additional sounds, hit the corresponding key at the top of the column (a Qwerty-row key) before selecting one of the keys at the top of your keyboard. But, other sounds are also available. If you look at the right hand side of the Sound menu you will see that the **F1**, **F3**, **F5**, and **F7** function keys have also been designated to access sound banks.

Try the **F7** Key, it puts you in outer space!

With FF3, the LAST BANK SELECTED will also be immediately available on the top row of Commodore keys on the HOME SCREEN.

Changing Octaves

When you first boot Fastfingers 3, the default sounds are comfortable in a variety of octaves. To place a sound in a different octave, depress and hold down both the **Shift** and **CTRL** keys. Then, to select an octave, simply hit any key from, "**Q**," to "**I**," with octaves rising from left to right. **THIS WILL ALSO SEND THE NOTES OUT IN MIDI IN THE HIGHER OCTAVE.**

Sometimes you may place a sound outside the range of the Sid chip. If you do that, when you return to the original menu and try to play that sound, you won't hear anything or you may hear a distorted sound. Go back and choose a lower octave for that sound, because you are out of the range of the SID chip. However, the MIDI sound may still play.

PLAYBACK
Sequencer memory is setup as such.

1. PITCH sequences are limited to 16 note lengths or shorter from $5300h-$5400h at a time. In FF3, there are 33 PITCH BANKS/PAGES, each PAGE containing 16 x 16 NOTE sequences, FOR A TOTAL OF 528 16 note SEQUENCES. Each PAGE of NOTE or PITCH sequences is made up of a

single CHORD so that 16 sequences in the same chord can be easily switched in and out from the HOME SCREEN. All 32 PAGES can't be in

2. memory at the same time, but rather reside on the cartridge.They can be edited, **while in memory**, and saved to floppy, if desired.

3.

Velocity sequences are limited to 16 event lengths or shorter from $5400h-$5600h VELOCITY can have 32 sequences X 16 events. **PLUS VELOCITY events can also be INVERTED FOR ALL 32 SEQUENCES creating 64 sequences in all.**

DADSR are limited to 255 events from $5600h-$5700h

Fastfingers 3 can speed up, or slow down your sequences as well. You will see on the main screen that **faster** is the **F5** key, while **slower** is the **F7** key.
The main screen also has a speedometer that shows you in numbers (0 to 255) the speed at which your recording is playing back.
These speed numbers are not always what you expect. Sometimes, a sound with several effects will play the sequence slower than a sound with fewer effects and "hands off sequencer" will always play faster than hands on sequencer.

Now 3 of these loop banks can be used for ONE KEY ARPEGGIOS...PITCH, VELOCITY and DADSR.

ARPEGGIOS

Arpeggios are a fast stream of quick notes...and fun!
FASTFINGERS 3 has 528 arpeggios built-in along with 64 Velocity sequences,when combined, will create potentially over 32 THOUSAND combinations.
To hear them, hit the [F] key (check to see of **CONT** turns Green) and then hold down the **SHIFT** key while playing a midi key or using the bottom row on the C64 keyboard.
You should see the word, **"SEQUENCER"** flashing . Now, your bottom two rows of designated sound keys (KEY BUTTONS)(z,x,c,v,b,n,m,<,>,?,s,d,g,h,j,l,[) will play the arpeggio instead of regular notes as long as you keep the **SHIFT** key depressed. These are just 16 of the built in sequences. In the detailed instructions I will tell you how to access the other 512 pitch sequences.

STEP PITCH EDITOR DAN LASKOWSKI 2022

|							
0004	2012	0804	2008	1204	0816	0400	0408←
0003	0603	0609	0609	1209	1215	1209	06031
0004	0812	1620	2428	3228	2420	1612	08042
0002	0406	0204	0608	0406	0810	0806	04023
0004	0812	0408	1216	0812	1620	1612	08044
0006	1206	1218	1218	2418	2430	2418	12065
0005	1005	1015	1015	2015	2025	2015	10056
0005	0705	0710	0710	1210	1217	1217	19227
2222	1717	1212	1712	1012	1019	1019	17198
0005	0712	1705	0712	1907	1219	2412	19249
0005	0710	1205	0710	1217	0710	1217	19120
0007	1219	2419	2431	3631	3631	2419	1207+
1712	1007	1917	1210	0705	1712	1007	0500-
0005	0710	1217	1905	0710	1217	1922	1207£
0012	1722	1917	1210	0705	1917	1210	0505C
0007	1207	1219	1219	2412	1924	3136	4348D

THE SEQUENCE EDITOR

In FASTFINGERS 3, you can set up your own arpeggios. To do so you need to access the **SEQUENCE EDITOR** screen. **You may need to turn the sequencer off.** The sequencer toggles on/off with the **Shift** and **Commodore** keys, and make sure to **UNLOCK** the SHIFT KEY if you have it locked.

Look at the top center of the screen. There will be a **P,V,OR D Pitch, Velocity** or **D**ADSR. This is to tell you which sequencer you will edit or select. Select which one by tapping the **SPACEBAR**

Now, hit the far right arrow key, on the bottom row of the Commodore Keyboard, and you will be in the sequencer edit screen.
To leave the SEQUENCER EDITOR screen simply hit the **"RETURN"** key and you will save your EDITED sequence or the auxilary cartridge sequence.(more about this later) **If you hit RUN/STOP you are back to the main screen WITHOUT CHANGING the sequence.** More details about editing will be in the full manual….which follows.
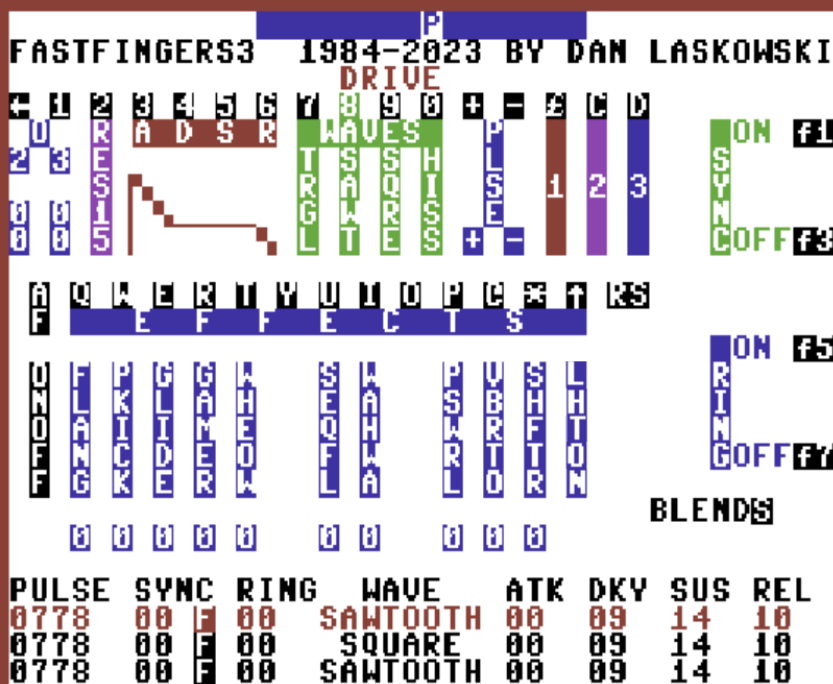
Special Effects

Out of the box, FASTFINGERS 3 has some pretty wild and exotic special effects only techno stars or DJ's will really appreciate. They include, "Wah-Wah," "Flang," and "Glide," To access these features, hold down the **Commodore** key to see an entirely new screen. There are 10 effects listed in vertical columns and **LHTON** for LIGHT SHOW ON (ONLY WORKS WHEN **CONT**INOUS IS ON). **DON'T GET HYPNOTIZED !!** To get one into your sounds, just keep the **Commodore** key depressed and hit that effect's corresponding key in the, "Qwerty," row.

You will notice numbers at the bottom of each column. 0 means the effect is off, while the number 1 means that the effect has been selected. Some columns have two levels of an effect so if you tap that column's key again you will see the number 2.

Tap it a third time and it toggles back to 0, or off.
A sound can have more than one effect assigned to it... so experiment.
Release the [COMMODORE] key to go back to the main screen and then play your note keys to hear the effect(s) you've just selected.

In addition, some of the more common effects, such a VFLP, as well as the new effects SPARKLE, V54 and DADSR can be TOGGLED ON and OFF from the HOME screen.

Shaping your Sounds

When you're playing or recording with Fastfingers 3 all three voices are being used as one single powerful sound. FASTFINGERS 3 IS A MONO LEAD OR GROOVE SEQUENCER. But, FASTFINGERS 3 gets deeply into individual sounds for each

SID voice.(SID CHIP the sound chip on the C64 or C128 in C64 mode) You have an almost unlimited ability to alter the sound each voice makes.

It has two different screens that can be used to alter the sounds of each voice.

To see one of these screens hold down the "**Commodore**," key. To change the voice to be altered, hit the English Pound £, Clear/Home, or Inst/Del keys. You will notice the highlighted row on the bottom will change, indicating which voice you are modifying.

This screen has selection keys that allow you to change waves, deepen or shorten pulses, and change sound parameters. These are known as the Attack, Decay, Sustain, and Release. You can also fool with resonance, filters, and modulations.

FASTFINGERS 3 also takes advantage of a unique feature of the SID chip. ..the ability to mix, or combine some kinds of waves for a particular voice.

It will combine triangle with square, or triangle with sawtooth waves. Simply hit the "s" key while you have the **Commodore** key depressed.

Using some of these keys will give you an immediate audio feedback, while others require you to return to the main screen to hear what you've created.

By now, you should be able, with a little experimenting, change existing sounds more to your liking.

Saving to Disk

If you want to save the work from your session with FASTFINGERS 3, you will need a BLANK formatted diskette and a 1541 ,a 1571 drive **or equivalent sdcard**

setup. FASTFINGERS 3 is the FIRST of the Fastfingers series to allow loading/saving to device #8, #9 or #10, by default drive #8

FASTFINGERS 3 does an idiot, bulk save. ..meaning it saves all the blocks of the computer's memory where you have stored your sounds and arpeggios during the current session. It doesn't check to see if there is actually anything there. FASTFINGERS 3 saves your work using one file name...and one file name only..."Sounds.", so you will only be able to save a single sound bank/ arpeggio bank to a single disk or sdcard.

To begin your save, make sure your new, formatted disk is in your drive. Then depress the **CTRL** and   **Commodore** keys. While these two keys are depressed hit the   "8" or "9" or "0" key on the top row to select drive number 8,9,   or 10. The drive selected will turn **GREEN** on the screen.   Then release all of the keys. Next depress the **CTRL** and **Commodore** keys again. While these two keys are depressed, hold the **F3** function key . Your disk light should come on.

Next time you want to use FASTFINGERS 3, boot with the FASTFINGERS 3 cartridge. To load your saved sequence, put in the data disk you made from your last session. Then depress the **CTRL** and **Commodore** keys and hit the **F1** function key. You will see the word "**LOAD**" change color to **GREEN**. Your work is now loaded from last time.

Remember if you resave to this disk, you will be erasing your original session , and replacing it completely. So if you are planning to save your latest session, but want to keep the original, make sure you have another formatted disk or sdcard handy.
From you're experimenting you can hear just how flexible FASTFINGERS 3 is for getting at all of the sounds and sequences locked up in you Commodore 64.

A couple of caveats……

Chords may not sound right if you have ring modulation on any one of the three voices.

FASTFINGERS 3 has an optional MIDI interface...BUT WHY WOULDN'T YOU WANT IT ?
Unlike , Fastfingers II, the focus, with FF3, has switched from RECEIVING MIDI from a keyboard to SENDING MIDI NOTES/VELOCITY OUT TO ANY MIDI MODULES or keyboards ! More about this will follow.

We hope you are now well on your way to understanding and enjoying the power of FASTFINGERS 3. Write us if we can help you in any way.

When Fastfingers was first released, tuning was tricky?
Back in 1984, when Fastfingers was first released, tuning was tricky. We never had the cheap electronic tuners that we have today. Recently I discovered that 10% of the time you may hit a C and be playing a G or E. Most of the time this is due to RING modulation which modulates the main key with a part of the chord. Because of this, for 2011, I have gone through the entire 256 STANDARD sound bank and tweaked most of the sounds to try and fix this problem. There is also a CORRECTOR now in FF3. More about this later in the full manual. The program has a new pitch table. The difference isn't very noticeable but some tuners may pick it up. The original version may have been out of tune less than 1 CENT for North American C64 computers. The North American table in the Commodore 64 Programmers Reference Manual was based on a 1 mhz clock and the clock isn't really EXACTLY 1 mhz. I punched in the new NTSC frequency table for North America. Now ,up above, I was talking about the STANDARD sound bank, but there is also a DBX sound bank which I created way back IN 1984. It is no longer necessary. **Modern digital recording "GATES" or expanders can now be used to clean up noise. I will also be experimenting with a SWINSID .**
Another big change with FASTFINGERS 3 is the the way that the sequencer or arpeggios work. Originally it was a SINGLE 256 note sequencer and recorded in step time. Today with FASTFINGERS 3, it is divided into 32 PAGES of 16 note arpeggios and input on 4 screens for Pitch ,Velocity, Velocity Bank2 and DADSR.

IN DEPTH INSTRUCTIONS FOLLOW ...

IN DEPTH INSTRUCTIONS
FASTFINGERS 3 MONO LEAD SYNTHESIZER

Fastfingers was originally released in 1985. FASTFINGERS 3 was originally released in 2022.

Having stood the "test of time" ,in 1991 ,COMPUTE magazine wrote,"FastFingers was written before the MIDI explosion, yet Laskowski programmed it for 256 sounds and even coaxed an extra suboctave out of the SID chip."

The Commodore 64 and Commodore 128 computers are approaching 40 years old and ,for professionals, it is recommended that you have a few of these on hand at a time. The 6581 SID chip DOES NOT sound exactly the same on every C64 or C128, therefore, you may need to TWEAK sounds to get the sound that you want by adjusting filter cutoff and filter resonance, or adjusting external equalization on your mixer.

DAN LASKOWSKI
933 FRANK AVE.
WINDSOR, ONTARIO
CANADA
N8S 3P4   wizard@musicinit.com
PLEASE USE THE WORDS "FASTFINGER" AND "SUPPORT" IN YOUR LETTER. OTHERWISE
YOUR LETTER MAY GET THROWN OUT BY MISTAKE. I GET 100'S OF EMAIL EVERY DAY.
WATCH FOR UPDATES AT http://musicinit.com/fastfingers.php
LATEST VERSION OF THESE INSTRUCTIONS WILL BE AT
http://musicinit.com/fastfingers3.pdf

HOW TO USE THIS MANUAL

This manual is written in logical order and the way to get the most out of FASTFINGERS 3 is to go through the entire manual from beginning to end, IN ORDER. If you see a strange bit of jargon it has already been explained in previous pages.

As you are reading through this manual, you will see things like "HIT THE [SAVE] BUTTON" or "HIT THE [LOAD] BUTTON". I know that your keys are not labeled this way, but please don't go out and buy a new keyboard.

This program is entirely MENU DRIVEN and at any given time, you will be able to look at the video display, to see what most of the keys will do. YOU MAY NOT NEED A VIDEO DISPLAY WHILE PERFORMING. (ONLY DURING EDITING)You will see that the F5 key is in fact, the FASTER button and that F7 is the SLOWER button. (When no CONTROL keys are pressed). This general rule applies to the whole manual and the whole program. There are 4 menus.........…

NO CONTROL KEYS	Performance and Play mode
Commodore Key	Sound Shaper and Effects
CTRL KEY	Sound Banks
CTRL/ SHIFT	Sound Shaper and OCTAVES
SHIFT KEY	ARPEGGIO SEQUENCER

FORMAT OF THE MANUAL WILL BE AS FOLLOWS
COMPUTER OUTPUT WILL BE **"LIKE THIS"**
USER INPUT WILL BE **[LIKE THIS]** (REAL BUTTONS).
USER INPUT WILL BE <**LIKE THIS**> (FOR VIRTUAL ASSIGNED BUTTONS
ACCORDING TO THE DISPLAY ASSIGNMENTS)
"PIANO KEYS" REFER TO KEYS ON EXTERNAL KEYBOARD.
**WITH FF3, ONLY "PIANO BUTTONS" ARE USED AS THERE IS NOT
MIDI IN.**

**YOU MAY NOT NEED A VIDEO DISPLAY WHILE PERFORMING. (ONLY
DURING EDITING)**
Once people learn how to use FASTFINGERS 3, they might be able to work the
program, without a display if you have an incredible memory ! This is because the
program works with ONE KEY COMMANDS and KEY COMBINATIONS .

*The [CONTROL] KEY ON THE C128 WILL HEREAFTER BE REFERED TO
[CTRL] AS ON THE C64.

CHAPTER 1 STARTING UP

SETTING UP THE MIDI INTERFACE

If you will be using a MIDI sounds from a keyboard, or module, then read these instructions carefully and DO THESE STEPS IN ORDER.

1) MAKE SURE YOUR C128 OR C64 IS TURNED OFF

2) plug the MIDI cable into the FF3 adapter and plug the other end of the MIDI cable into the keyboard or module MIDI IN port.

3) WITH THE COMPUTER TURNED OFF, mate the MIDI ADAPTER to the C64 or C128 USERPORT WITH THE DOUBLE 7 SEGMENT DISPLAY ON TOP.

4)If you have the CARTRIDGE version make sure to insert it into the cartridge slot with the GROOVED NUMBER 3 SIDE UP.

5) **Now you can turn the power on and begin.**
You now can select 16 different sounds using the top row of the C64 keyboard depending on which BANK you selected previously or BANK 1 by default.

With the cartridge version, the sounds and sequences / arpeggios will be loaded into memory automatically. However , you will still need to retrieve a sound first by hitting at least 1 key in the top row on the C64 keyboard or loading from one of the memory BANKs <LOAD> and <SAVE> will still be used for CUSTOM SOUNDS and SEQUENCES.

LOADING CUSTOM SOUNDS AND SEQUENCES

To load your saved sequence, put in the data disk you made from your last session. Then depress the **CTRL** and **Commodore** keys and hit the **F1** function key. You

will see the word "**LOAD**" change color to **GREEN**. Your work is now loaded from last time.

While pressing **[CTRL/COMMODORE]** ,HIT **<LOAD> [F1]**. WHEN THE PROGRAM IS FINISHED LOADING, MAKE A SPOT CHECK, TO SEE THAT EVERYTHING LOADED OK, BEFORE GOING ON.

USING FAST PRE-SETS

In the upper left hand area of the display, you will find "FAST PRE-SETS". After loading the sounds from diskette, simply hit one of the 10* **<FAST PRE-SET>** keys and then play.
The FAST PRE-SETS are just a subset of the 256 sounds in the bank. They can be used where you want to quickly switch back and forth from one sound to another, DURING A LIVE PERFORMANCE. You can use the sounds which are already in the FAST PRE-SETS or put your own in there. You could also transfer any of the 256 sounds to this area. The TOP ROW of keys, while on the HOME screen are the fast pre-sets.
*16 SOUNDS ,ENTIRE TOP ROW, IN FAST PRE-SETS ARE DEPENDENT ON WHICH BANK IS SELECTED AT THE TIME.

PLAYING SOUNDS
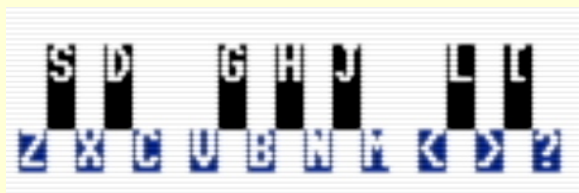
After GETTING the sound that you want, you can play it by either hitting the PIANO BUTTONS listed on your video display, **(Z,X,C,V,B,N,M,<, >,?,S,D,G,H,J,L,)**

"CHORDS" IMPLEMENTATION

There is also a bank of easy to use chords. With these, you will be able to play chords with a single finger. There are 3 MAJOR chords and 3 MINOR chords included in the bank. The other 6 CHORDS keys have assorted chords. The **<[C]ANCEL>** button **(UP ARROW)** is found to the far right of the "CHORDS".

The **<[C]ANCEL>** button is used to cancel chords and all 3 voices will be playing the same note in unison when **<[C]ANCEL>** is used. Orchestral like chords can also be played by using the HARMONICS function in conjunction with a chord.(See section on HARMONICS).

Another thing to mention is that **CHORDS function will not produce a predictable result when used with RING MODULATION or SYNCRONIZATION**. The CHORDS produce different types of bells and gongs when used with RING MODULATION but will not produce 3 note chords. Sometimes the results will be pleasant, but they won't always be predictable. Ring modulation may also knock the sound into a different key.

To use CHORDS ,first you hit one of the **<CHORD>** keys. (QWERTYUIOP@*) Then, you play the sounds on your keyboard and you will notice a difference. There will be an apparent difference with MOST sounds. With some sounds,though, there will be very little difference because 1 of the 3 voices may be so much louder than the other 2 voices. This is only a "ONE FINGER CHORD". In other words, to play a CHORD you only hit one key. ==Actually the [UP ARROW] key cancels out chords and plays the same note/octave in all 3 voices.==
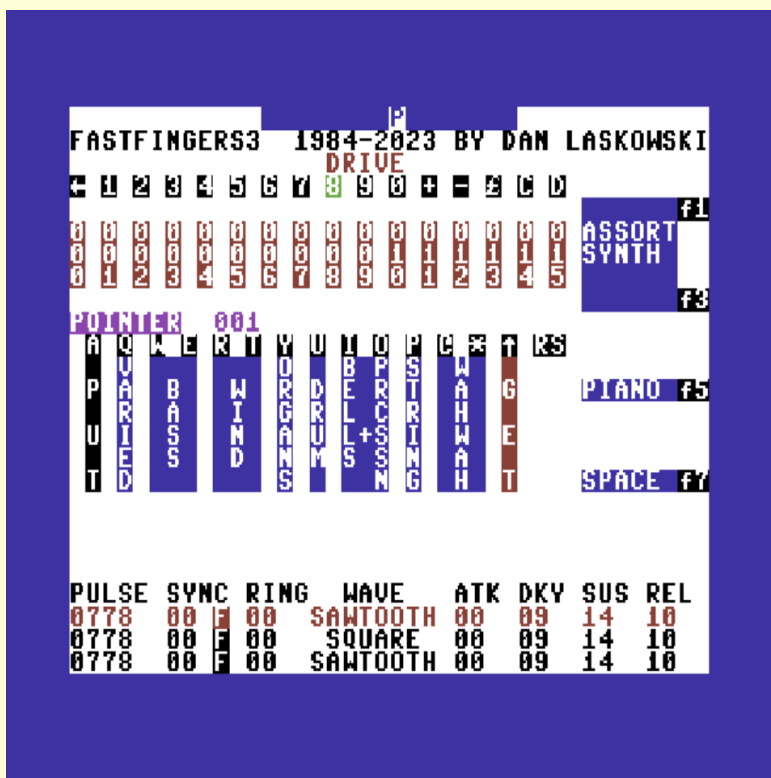
GETTING SOUNDS FROM BANK

After loading the sounds from the diskette, or cartridge, you will then want to select one from the bank to

play. **WHILE HOLDING DOWN [CTRL],** in front of you will be a MENU OF SOUNDS. You will first select which one of the banks that you want, then the specific sound from that bank. For example, hit **<BELLS + PRCSSN>** . Then depress **[LEFT ARROW]**, (top row left)because the top 16 keys select the individual sound and we are selecting the first sound from the percussion bank. Take note of the "POINTER" number and while the **[CTRL]** key is still depressed, hit **<GET> (UP ARROW)**. Now you can release the **[CTRL]** key and PLAY the sound.

STORING SOUNDS IN MEMORY

Before making any new sounds, you should first check to find a place where you can put the new sound, so that you are not erasing a sound that you like. See section on GETTING SOUNDS FROM BANK. Write down the "POINTER" and BANK NAME, once you've found the empty or unpopular spot. Do this immediately after **<GET>**. Then make the new sound. Then store it, as instructed below.

After you already have the sound that you like, whether it is from the BANK, or whether you made it yourself, you may want to move it in the sound bank, for permanent or temporary storage. While holding down **[CTRL]**, hit the bank where you want to place it. EXAMPLE If you want to place the sound in the FAST PRE-SETS bank, you will want to set the pointer for the first bank. Hit **<VARIED>**. At the top of the screen, you will see 16 vertical pointer numbers. In this example, they will be from 000-015 inclusive. ("FAST PRE-SETS" are located from 000-009* inclusive.) Then hit, for example, **[#3]** key. Now the pointer shows "003". Now, while still holding down **[CTRL],** hit **<PUT>** (letter "A") and the sound will be in the bank. Then you can save it to disk, or just use it for today.

*16 SOUNDS ,ENTIRE TOP ROW, IN FAST PRE-SETS WITH MIDI KEYBOARD RUNNING AND ARE DEPENDENT ON WHICH BANK IS SELECTED AT THE TIME.

OCTAVES FUNCTION
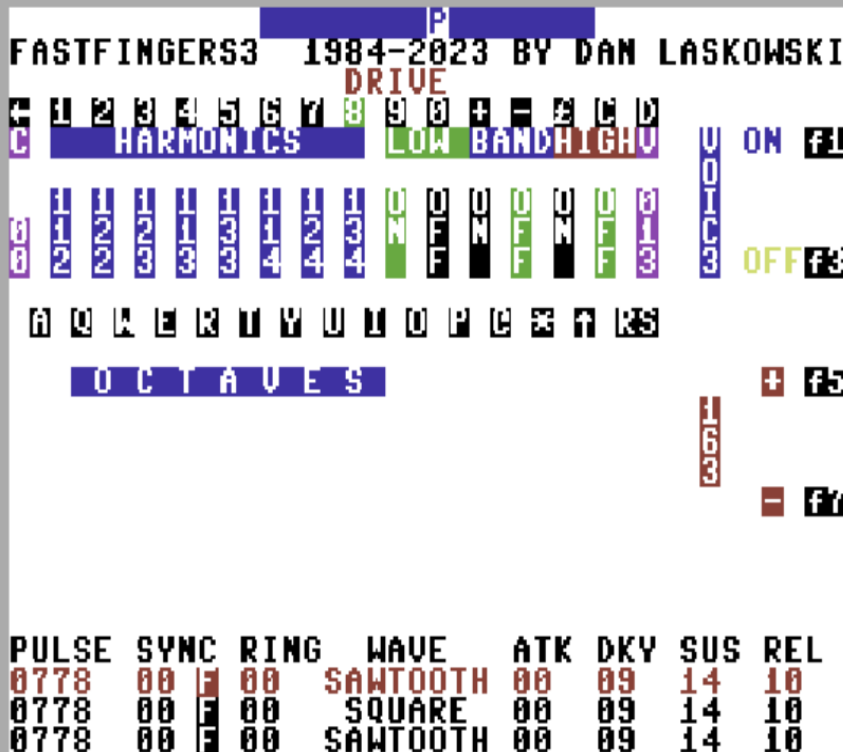
OCTAVES will select which octave range your COMMODORE PIANO KEYBOARD **BUTTONS** will play in and also TRANSPOSE the MIDI going out to your modules. While holding **[CTRL/SHIFT]**, press one of the OCTAVES buttons. (QWERTYUI) There are 8 OCTAVE RANGES. The lower octaves are on the left and the higher octaves are on the right. If you hear a distorted sound or no sound, when you play, it means that you are trying to play a note which is too high. Either play on lower keys, or set the keyboard to a lower octave.

If you ever hear a screeching sound, it means that you have a sound which goes out of the range of the SID chip. Select a lower octave or play in a lower octave.

CHAPTER 2

THE ULTIMATE SEQUENCER

TERMS YOU SHOULD KNOW

ARPEGGIO is a fast run of notes. (usually 16th and 32nd notes or fast triplets.)
EVENT is whatever happens in one STEP of time. Example 1 note or 1 rest.
LOOP is a repetitious function where the music will play over and over.
SEQUENCER is a device which will store and play back 1 EVENT at a time, at a variety of speeds.

INTRODUCTION

Here is where you will be able to do the real powerful things with this system., even if you never played a keyboard instrument before. Just imagine EDITING a track at your own pace and playing it back as fast as you could possibly want ! You will also be able to edit shorter ARPEGGIOS and be able to call these up at the press of a button. Have fun!

Some basic rules which apply to all 3 STEP editors

HIT [SPACEBAR] TO TOGGLE BEWEEN 4 TYPES OF SEQUENCES.
LOOK AT THE TOP CENTER OF THE SCREEN WHILE SELECTING.
BEFORE YOU BEGIN EDITING , TAKE NOTE OF THE CENTER TOP OF THE SCREEN
P   IS FOR PITCH sequences 5300H TO 53FF H
V   IS FOR VELOCITY sequences 5400H TO 55FF H
D   IS FOR DADSR sequences 5600H TO 56FF H

TRANSPOSER / PLAY MODE   ARE NO LONGER USED IN FASTFINGERS 3.
The extra keys released by this allow for 16 sounds on the top row or 16 sequences

to be accessed "on the fly". **CONT**inuous mode allows the sequencer to play FOREVER if need be. You only need to change keys with one finger.
Getting back to the SEQUENCER EDITOR...
Hit CRSR RIGHT / LEFT to open the sequence editors (far right key on bottom row)

EDITOR RULES

1) Only numeric numbers and arrow keys will effect the editors

2) Only numbers between 0 and 63 will be allowed. Higher numbers will automatically be saved as zero , if entered. These numbers are DOUBLED for actual velocities. In Other Words, a velocity that shows #63 is actually sent out to midi as #126, #40 would be #80 etc. This enabled cramming 256 event on a single PAGE using DECIMAL rather than hexadecimal.

3) If the cursor disappears to the right just hit the up/down or right/left button to see it.
4) When opening an editor, the cursor will be near the center of the screen
5) The characters DISPLAYED in the far right column represent the TOP ROW buttons as a guide.

6)This is the loop end marker. Hit the top row far left arrow twice to indicate loop end.
7)To exit from the any editor screen **without keeping the changes** hit the **[run/stop]** key.

8)Always use the **up/down or right/left buttons** to navigate around the screen.
9)To keep the changes you made, hit [RETURN] instead, but you must SAVE to really keep it. See "**SAVING ON DISKETTE" for more details.**

STEP PITCH EDITOR DAN LASKOWSKI 2022

0004	2012	0804	2008	1204	0816	0400	0408
0003	0603	0609	0609	1209	1215	1209	0603
0004	0812	1620	2428	3228	2420	1612	0804
0002	0406	0204	0608	0406	0810	0806	0402
0004	0812	0408	1216	0812	1620	1612	0804
0006	1206	1218	1218	2418	2430	2418	1206
0005	1005	1015	1015	2015	2025	2015	1005
0005	0705	0710	0710	1210	1217	1217	1922
2222	1717	1212	1712	1012	1019	1019	1719
0005	0712	1705	0712	1907	1219	2412	1924
0005	0710	1205	0710	1217	0710	1217	1912
0007	1219	2419	2431	3631	3631	2419	1207
1712	1007	1917	1210	0705	1712	1007	0500
0005	0710	1217	1905	0710	1217	1922	1207
0012	1722	1917	1210	0705	1917	1210	0505
0007	1207	1219	1219	2412	1924	3136	4348

SPECIFICS FOR THE PITCH EDITOR

LOOK FOR [P] AT THE TOP CENTER OF THE HOME SCREEN BEFORE OPENING THIS EDITOR.

<Not a big thing, but those little
<numbers on the right side will help find
<your way around. I was writing the
<instruction manual and put them in as a
<guide. Then I said to myself "Why not
<put them right in the program?"
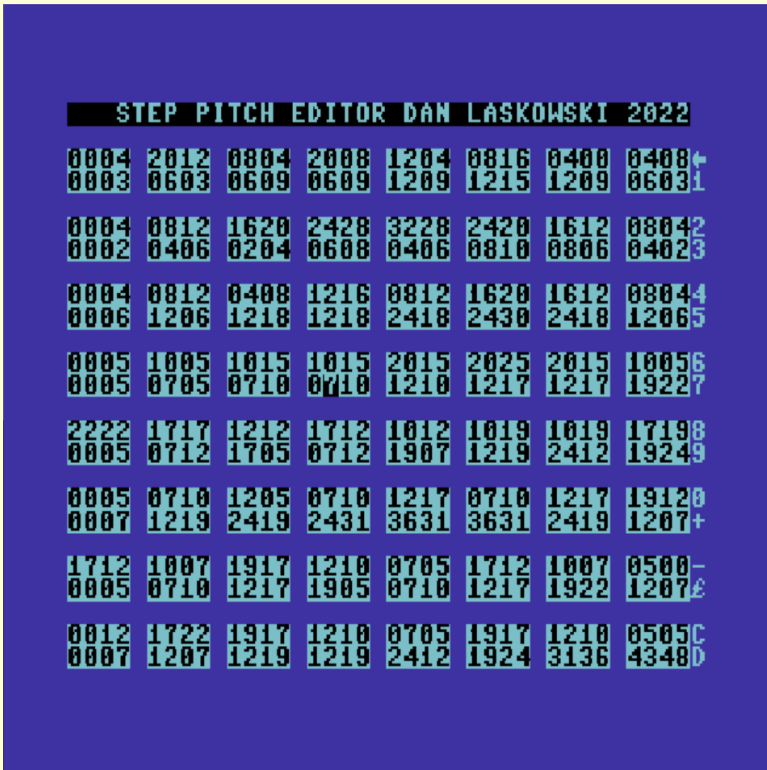
LOOP END MARKERS ARE OPTIONAL FOR THE VELOCITY EDITOR AND SEQUENCES ARE LIMITED TO 16 NOTES IF THE MARKER ISN'T PRESENT.

00 (zero) represents the root key. This is the key you are holding down on the keyboard, while running the "hands off" or "hands on" sequencer, or the first note of the transpose table (while in automatic play mode). If you hold down a **"C"** key ,each number up from that represents a semi-tone. In other words #03 would be **D#** #04 would be **E ,** and #12 would be **"C"** an octave higher. If you hold down a different key , the sequencer will play will transpose to that key. You are only allowed a range of 64 notes (0-63) in the sequencer because of the 8-9 octave limit of the SID chip. The most melodic sequences will only be in a 2 octave range. (0-24)

This is the basic note system for the sequences. The contained 32 chord pages will be displayed entirely
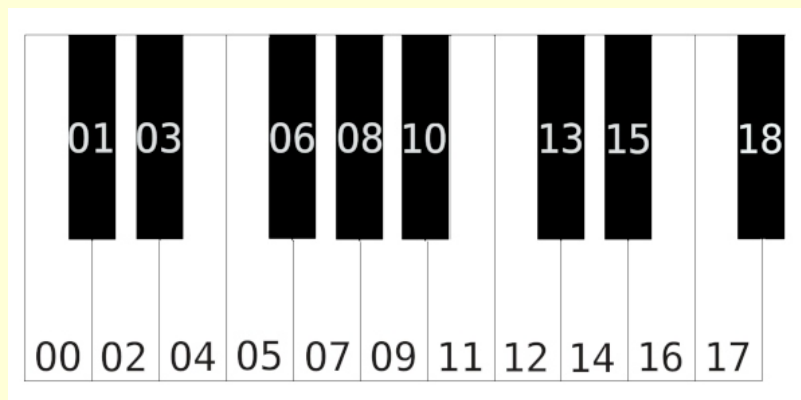
HOW TO GET ACCESS TO ALL 32 PAGES OF SEQUENCES

HOLD the **[CTRL]** KEY DOWN WHILE YOU DO THIS
CHANGE SEQUENCER PAGE POINTER BY HITTING ONE OF THE 16 KEYS ON THE
TOP ROW
(KEEP **[CTRL]** KEY DOWN WHILE YOU DO THIS) THEN SELECT AUX SEQUENCER
BANK **60XXh** OR **70XXh** BY EITHER HITTING UP/DOWN KEY FOR 60XXH OR
RIGHT/LEFT KEY FOR 70XXh
THIS WILL BRING UP THE SEQUENCER EDITOR WITH YOUR NEW BANK.
TO MAKE THE NEW BANK YOUR new **CURRENT BANK**, YOU MUST HIT **[RETURN]**
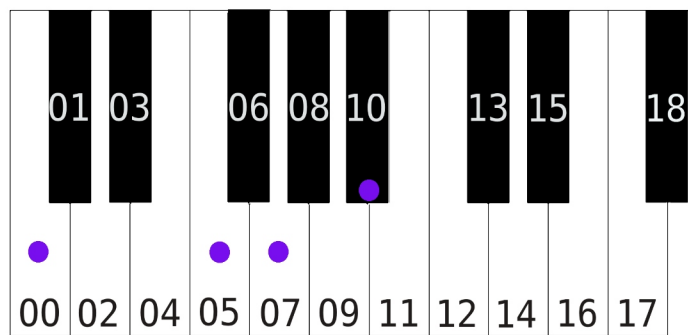
THEN THE **TOP ROW** ,while in the **HOME SCREEN**, WILL SELECT SEQUENCES SAME
AS BEFORE...BUT NOW WITH THIS **NEW PAGE** BANK OF 16 NEW SEQUENCES.
AS WITH ANY DECENT SEQUENCER, YOU CAN MOVE UP AND DOWN KEY WITH
ANY OF THESE 512 SEQUENCES BY HITTING THE PIANO BUTTONS ON YOUR C64
KEYBOARD!
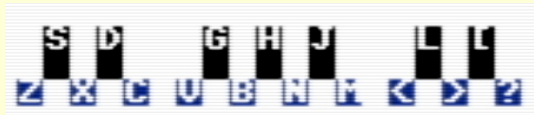
**So on the HOME SCREEN you will
also see something like this. The 60
next to SQBANK will mean that you
are in the startup PAGE of sequences,
or in PAGE $60XX
Because the bank is relocated to
PAGE $5300, you will actually be
playing the sequence located at 6090h on the cartridge, but it will read $5300-$53f0
depending on which key you hit on the top row,WHILE THE SEQUENCE IS PLAYING.
All PLAYABLE pitch sequences are from 5300h to 53FFh. Consider page $5300 as a
HOME pitch sequence area. Anything you <SAVE>[ctrl] [commodore] [F3] will be saved
from this area. To recover the DEFAULT startup sequence hit the left ARROW on the top
row WHILE HOLDING DOWN THE [CTRL] key. Then hit [return].**

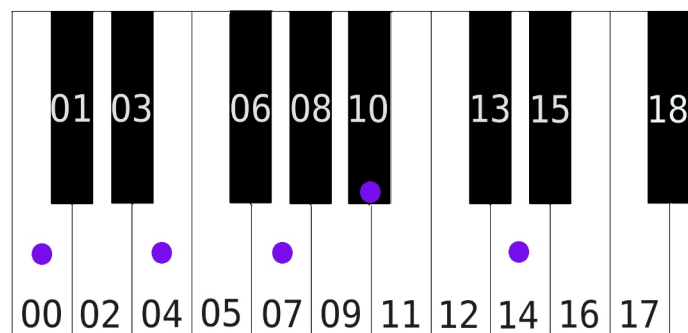**PAGE $6000 BELOW   MAJOR C 7/4**   **PAGE $7000 BELOW MAJOR C 7/4**
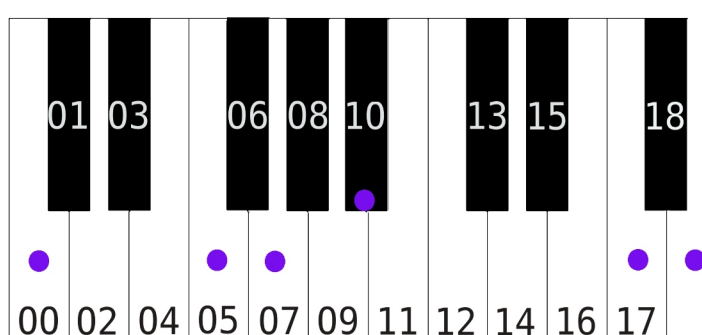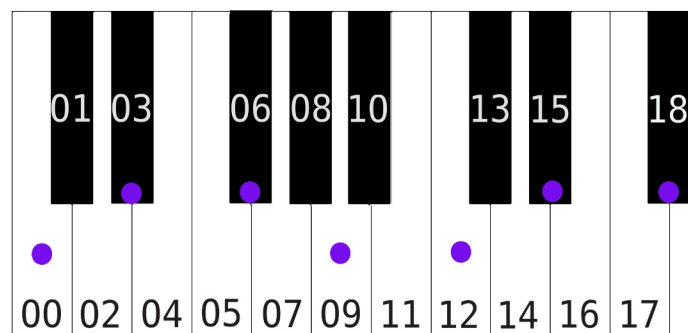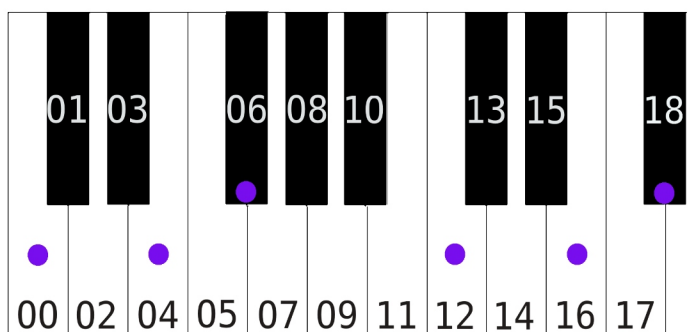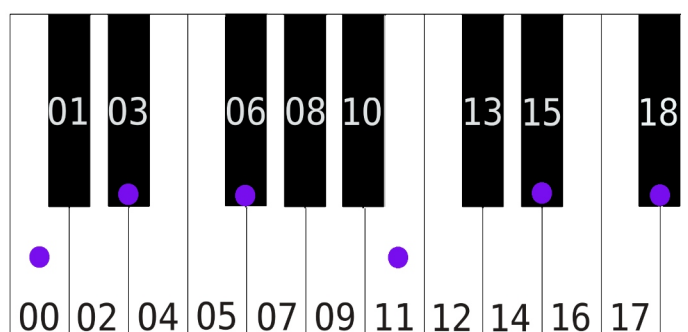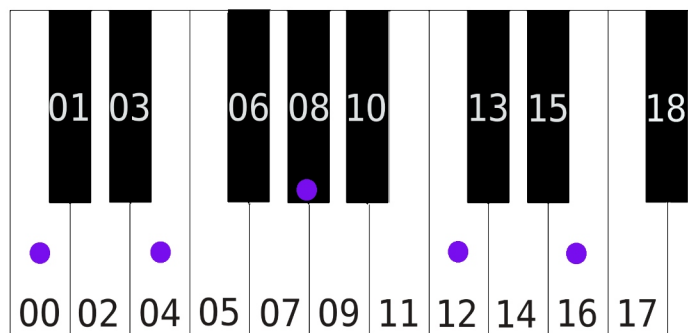
PAGE $7100 BELOW MAJOR 9
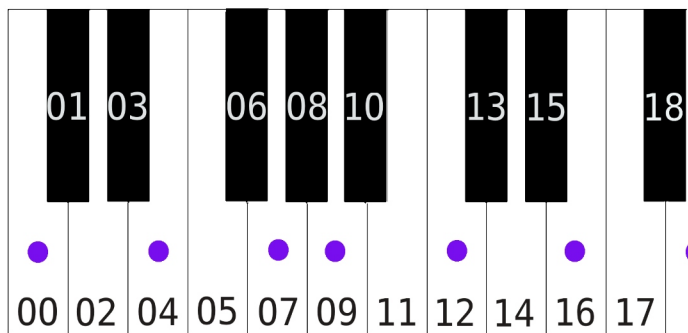
PAGE $6200 + $7200 BELOW 7 DIM
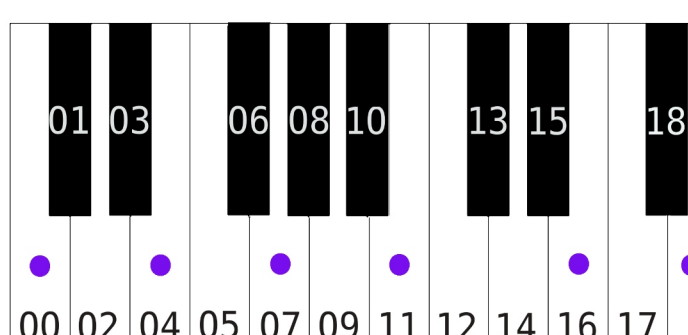
PAGE $6300 + $7300 BELOW -5

PAGE $7400 BELOW MINOR M7-5

$6400 BELOW 4 SEMITONE JUMPS

PAGE $6500 BELOW MAJOR 6

PAGE $6600 + $7600 BELOW M7

PAGE $6700 + $7700 BELOW M7-5
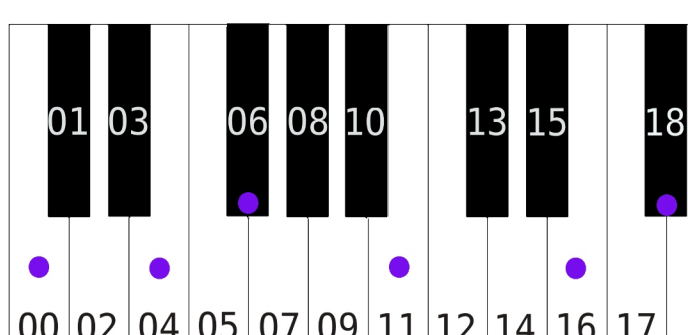
PAGE $6800 + $7800 BELOW C MAJOR 11

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $6900 BELOW   C MINOR 9

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $7900 BELOW MAJOR 9

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $6A00 + $7A00 BELOW   M13

01	03		06	08	10		13	15		18	20
00	02	04	05	07	09	11	12	14	16	17	19	21
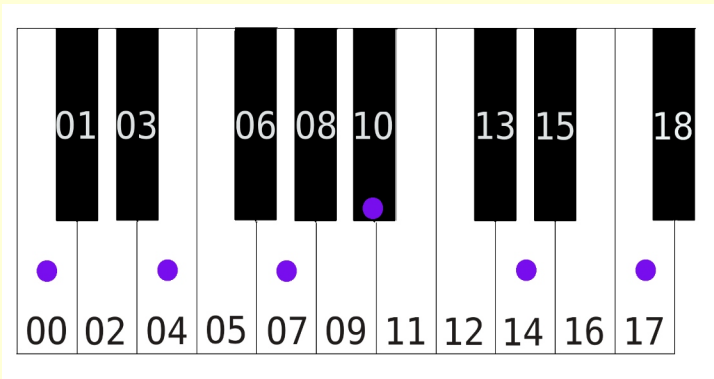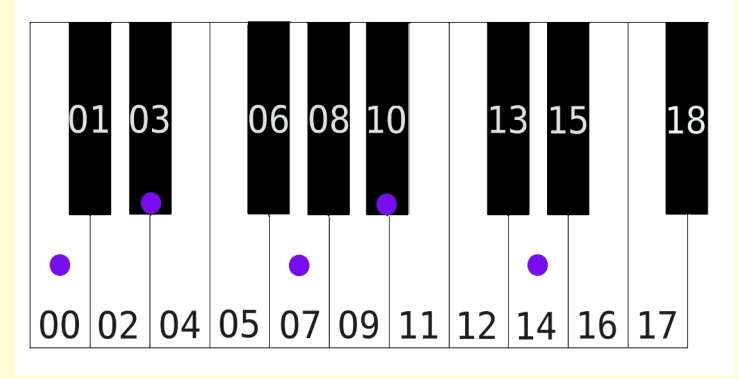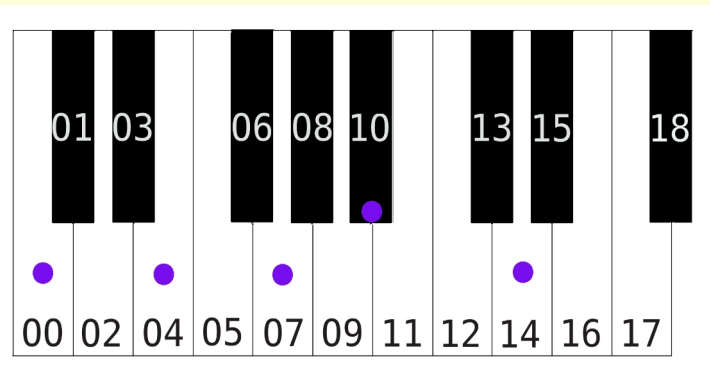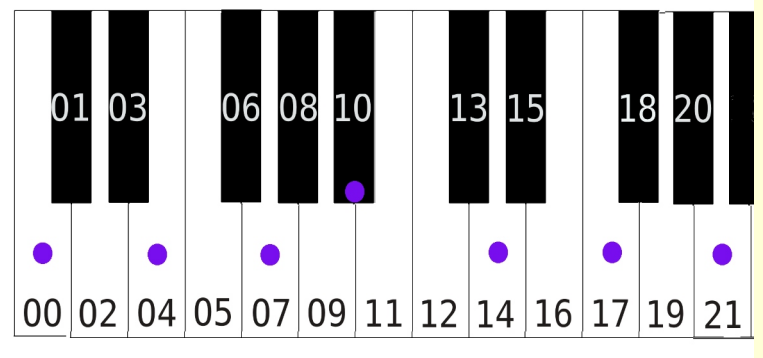
PAGE $6B00+$7B00 BELOW C MINOR 11

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17
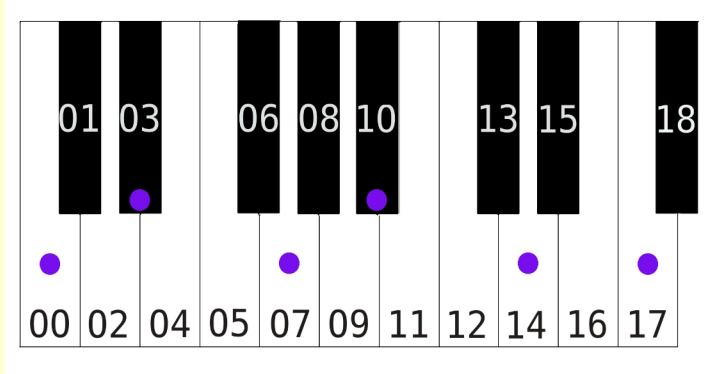
PAGE $6C00+$7C00 BELOW C MINOR

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $6D00 BELOW C MINOR 7
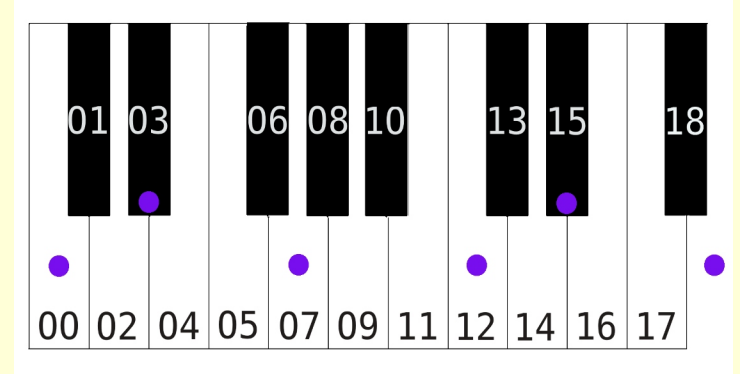
01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $7D00 BELOW C Minor 7

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $6E00 BELOW

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $7E00 BELOW 7 DIM

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17
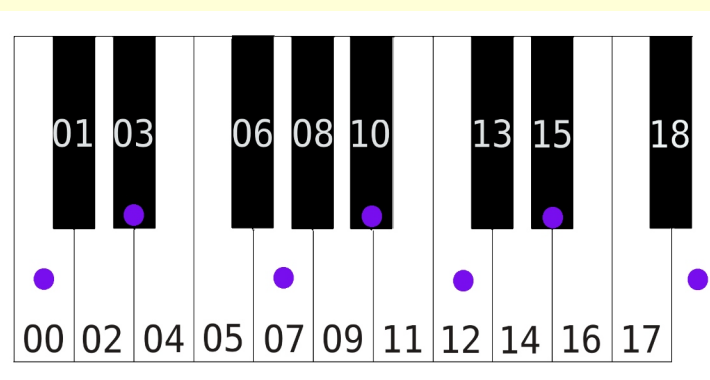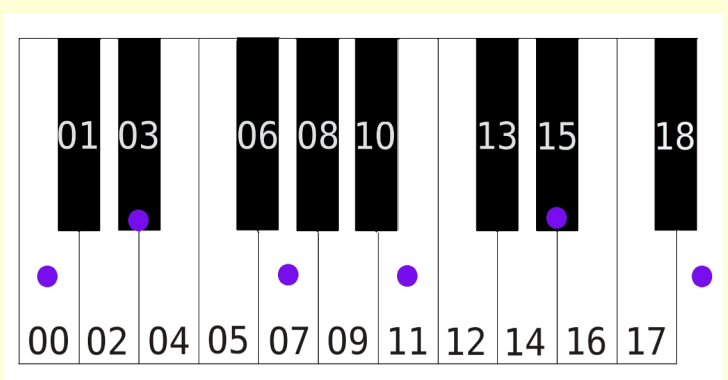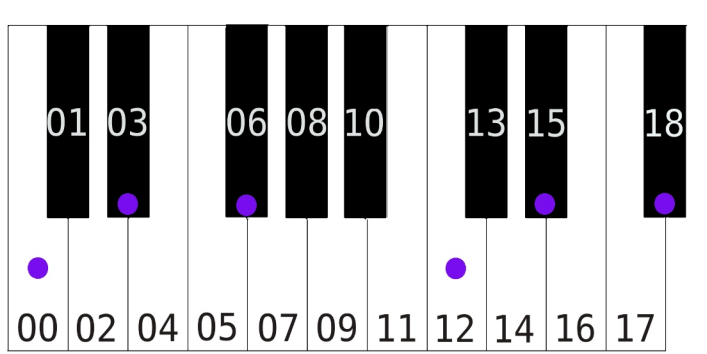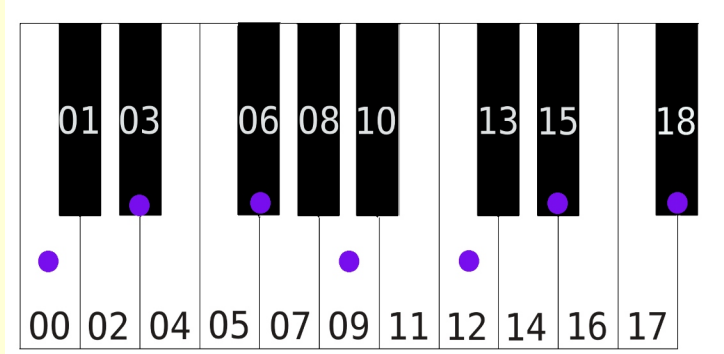
PAGE $7300 BELOW DOMINANT 7/5

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17
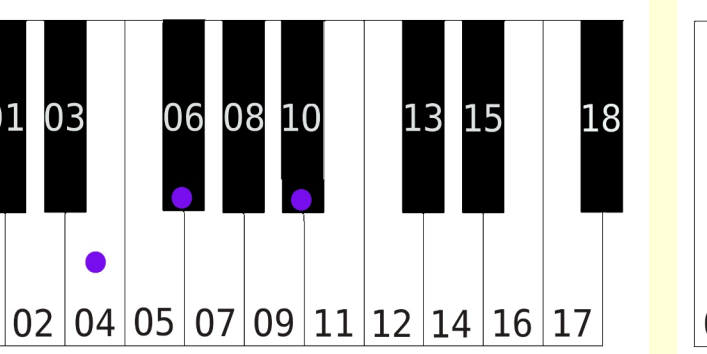
PAGE $6F00+$7F00 BELOW MINOR 13

01	03		06	08	10		13	15		18	20
00	02	04	05	07	09	11	12	14	16	17	19	21
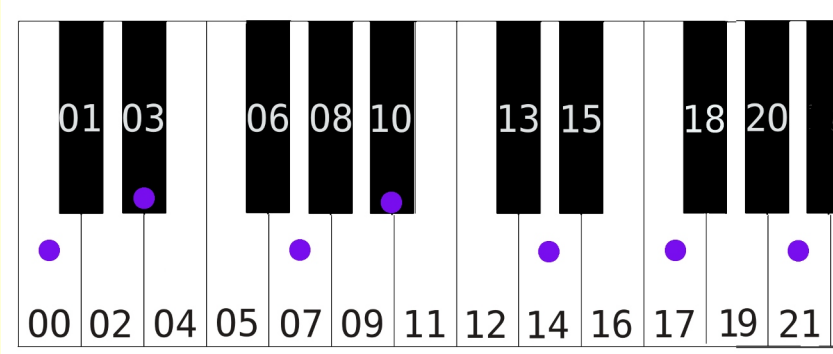
PAGE $7500 HALF DIMINISHED

01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17

PAGE $6100 AUGMENTED 7
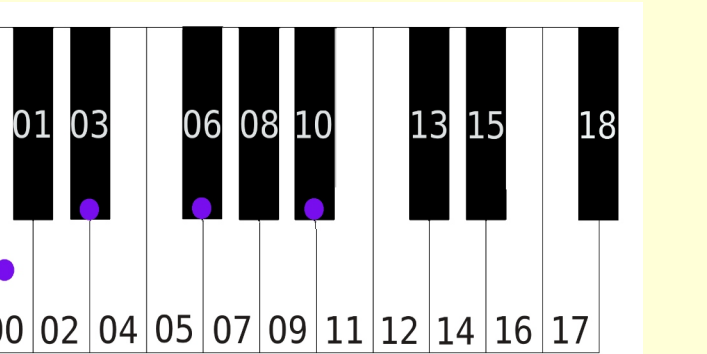
01	03		06	08	10		13	15		18
00	02	04	05	07	09	11	12	14	16	17
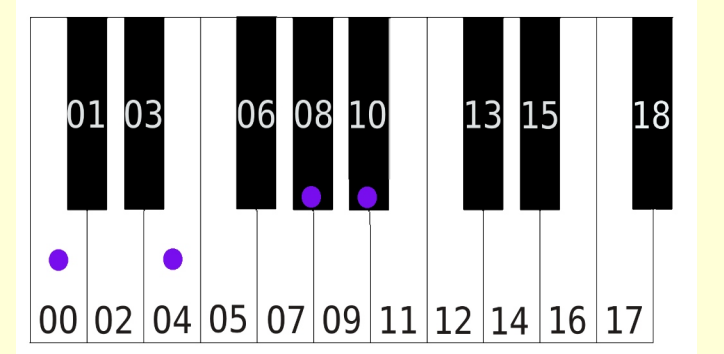
SPECIFICS FOR THE VELOCITY EDITOR


```
STEP VELOCITY EDITOR DAN LASKOWSKI 2020

6020 1060 2010 1060 2010 6020 1060 2010+
2020 6020 2060 2020 6020 2060 2020 20601

6020 2022 2060 2020 2020 6022 2020 20602
2020 6020 2020 2060 6020 2020 2060 22203

4010 4010 4010 4010 6020 1060 2010 10604
1010 4010 1010 4010 1010 4010 1010 40105

1040 1040 1141 1141 1141 1141 1040 10406
1020 3040 1020 1003 45   3040 1020 30407

0510 1520 2530 3540 0510 1520 2530 35408
1020 3040 1040 1040 4010 4010 4010 40109

4010 4010 4010 1010 4010 4010 4010 10100
1010 4010 4010 4010 1010 4010 4010 4010+

4010 4010 4010 1010 1010 4010 4010 4010-
4010 4010 1040 1040 4010 4010 1040 1040

6000 3060 0030 6000 3060 0030
6050 4030 2060 6050 4030 2060
```

LOOK FOR V AT THE TOP CENTER OF THE SCREEN BEFORE OPENING THIS EDITOR.

LOOP END MARKERS ARE OPTIONAL FOR THE VELOCITY EDITOR AND SEQUENCES ARE LIMITED TO 16 NOTES IF THE MARKER ISN'T PRESENT.

VELOCITY WILL EFFECT THE VOLUME AND TIMBRE OF THE SOUND. If the sound is designed properly (the way I like it) the harder you hit the key the higher the timbre or in other words , more treble . There is a new button in the **HOME** screen called **<velof>** or in other words **velocity flip**. This will change the way velocity effects the filter of the sound. Generally speaking it is advisable to enter values between 20 and 63 INTO THE VELOCITY EDITOR. Values less than 10 will be hard to hear but this may be another way to create a rest.

Filter effects will be more of less noticable depending on 5 factors.
1) filter resonance
2) filter selected (I like low pass filtering.)
3) how wildly the the notes are edited in the velocity editor. Extremes like 20,60 or more gradual velocity changes like 20,30,40,50
4) whether or not tremolo, swirl and/or wahwah are enabled also effects the filtering.
5) the playing style of the performing artist. that's YOU !

Remember that the filter register only has a range of 256 settings so the more effects you select, the more difficult it will be to hear REAL TIME performing velocity

SPECIFICS FOR THE DADSR EDITOR

```
▌DYNAMIC ADSR EDITOR DAN LASKOWSKI 2022▐

3636 3636 4040 4040 4444 4444 4444 4444←
4848 4848 5252 5252 5656 5656 6060 6060 1

6464 6464 6060 6060 5656 5656 5252 5252 2
4848 4848 4444 4444 4444 4036 3636 3636 3

4044 4852 5660 6460 5652 4844 403  ←←28 4
2428 3236 4044 4852 5660 6460 5652 4844 5

4440 4036 3632 3228 2832 3236 3640 4044 6
4448 4852 5256 5660 6064 6460 5652 4844 7

6464 6460 6060 5656 5652 5252 4848 4848 8
4444 4040 4036 3636 3232 3228 2828 2424 9

2428 2828 3232 3236 3636 4040 4044 4444 0
4848 4852 5252 5656 5660 6060 6060 6464 +

6464 6464 6460 6060 6060 5656 5656 5652 −
5252 5252 4848 4848 4844 4444 4444 4040 £

4040 4036 3636 3636 4040 4040 4044 4444 C
4444 4848 4848 5252 5252 5656 5656 6060 D
```

LOOK FOR **D** AT THE TOP CENTER OF THE SCREEN BEFORE OPENING THIS EDITOR.

WE MUST use the LOOP END MARKER to end a loop with DADSR. If, during playback, we select a point in the middle of the DADSR sequence while in D mode, the sequence will play from the middle up to the LOOP END MARKER and then back to the selected beginning. Numbers input into the DADSR editor should be in range between 30 and 63. these numbers effect both the **decay and release** of the sounds. If the numbers are much smaller than 30, the sound may just sound like CLICKS. At 30 they sound like strong plucking. The first sequence ,in the DADSR example below, is a gradual changing from a short ADSR to a longer ADSR and then back in a cycle. As I was listening to an old recording of Tangerine Dream, I noticed that the decay and release cycles were getting shorter and longer gradually. This gave me the idea for this effect.

PLAYING BACK YOUR sequences

BEFORE YOU BEGIN PLAYING , TAKE NOTE OF THE CENTER TOP OF THE SCREEN
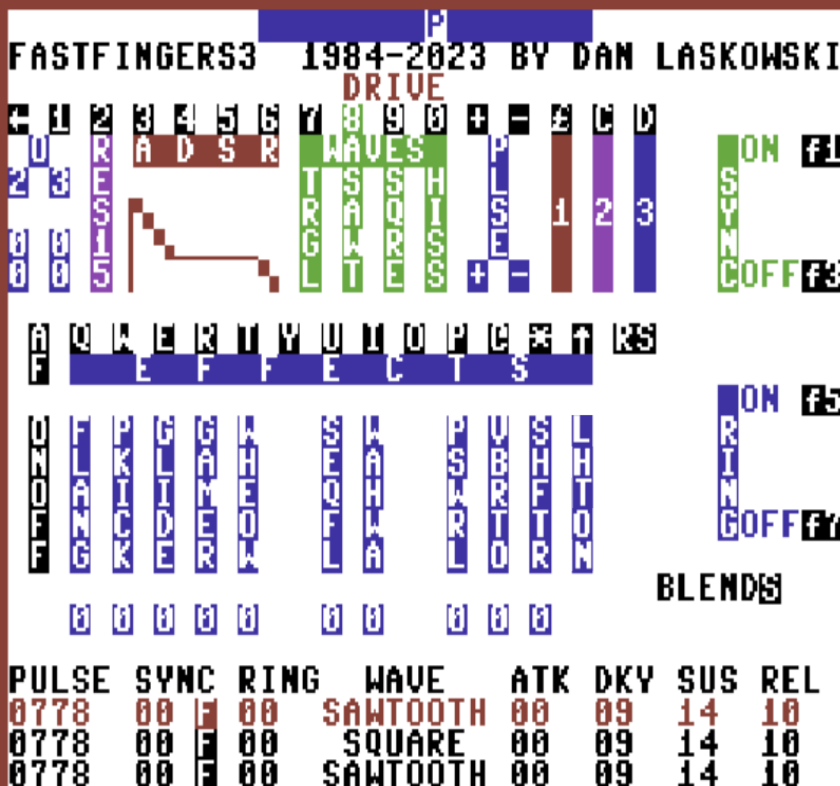
P IS FOR PITCH sequences 5300H TO 53FF H

V IS FOR VELOCITY sequences 5400H TO 55FF H

D IS FOR DADSR sequences 5600H TO 56FF H speedometer that shows you in numbers (0 to 255) the speed at which your SEQUENCE is played back. This speed control also works for the arpeggios, sparkle and SQFL. These speed numbers are not always what you expect. Sometimes , a sound with several effects will play the sequence slower than a sound with fewer effects and "hands off sequencer " always play faster than hands on sequencer.

**[Spacebar] will toggle between P or V or D**
The numbers displayed at **"WHERE"** are the memory locations where the sequences are being stored and retrieved . Hexadecimal is used here to conserve space. These numbers will give you an idea of **where you are at** , in each of the 4 loop engines. Every memory location gets the same duration.

PLAYING BACK ARPEGGIOS

Here's where the fun begins! Arpeggios are stored in 16 banks of 16 EVENTS and can be selected by one of the keys in the top row, **WHILE IN SEQUENCER MODE** with **"SEQUENCER" FLASHING** .

You will also be able to edit arpeggios and the velocities for those arpeggios using the new STEP EDITOR.
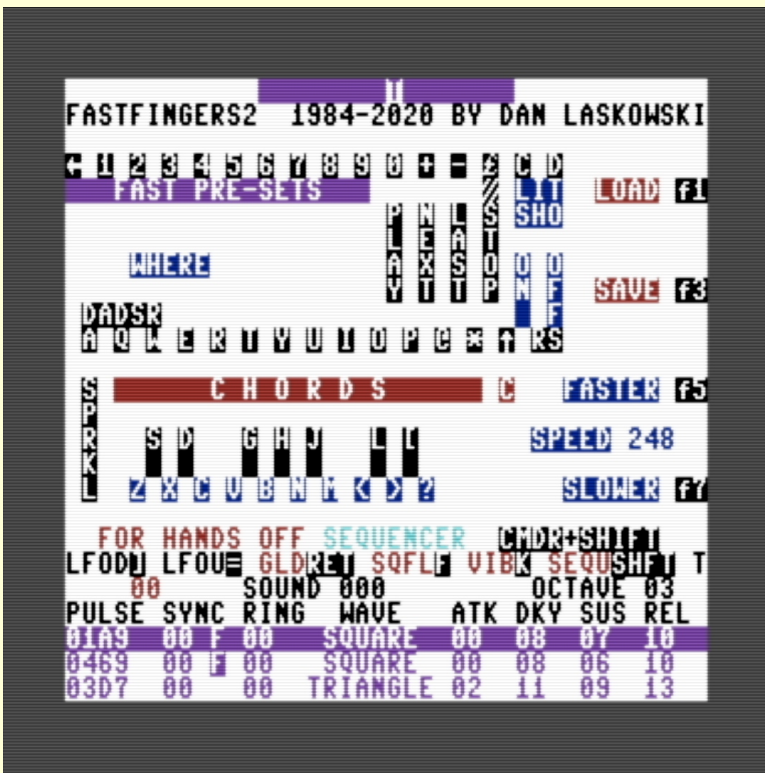
USING THE "HANDS ON SEQUENCER"The hands on

sequencer is turned on by holding down [shift] or locking shift (but you must remember to unlock it when done with the sequencer !
When the SEQUENCER is activated, there will be no more control of PLAYBACK , <LIGHTSHOW> or <FAST PRE-SETS>. This ENTIRE TOP row will allow you to select any one of 16 different sequences.
The most powerful way to implement the arpeggios, is to use the arpeggio when you are playing live or recording. When you want a quick fill or riff at the ends of you fingers, but you are too slow to play it, hold the **[shift]** key down while you are playing the note. **With the "HANDS ON" sequencer, the arpeggio will play, at the speed that you set, in the key that you are holding down, only as long as you are holding down the piano key or piano button.**

USING THE "HANDS OFF SEQUENCER"

You will also have the use of the "HANDS OFF SEQUENCER". To turn this function ON, simply hit **[COMMODORE/SHIFT]** simultaneously. Now you need to only hit the PIANO buttons or PIANO keys to start the arpeggio off and the arpeggio will play back until it is finished or until you hit another key .When the

SEQUENCER is activated, there will be no more control of PLAYBACK , <LIGHTSHOW> or <FAST PRE-SETS>. This ENTIRE TOP row will allow you to select any one of 16 different sequences. The far left key (left pointing arrow) of the top row would play the first sequence, and the second key **[1]** would play the next sequence and so on up until the **[Ins/Del]** key which would play the 16th sequence.

N 0 T E......ADJUSTING SUSTAIN MAY BE NECESSARY FOR DESIRED RESULTS **SUSTAIN VALUE of LESS THAN 14** RECOMMENDED. **SOME SOUNDS MAY NOT BE SUITABLE FOR FASTER ARPEGGIOS**, ESPECIALLY THOSE WITH GLIDE.
To shut off the "HANDS OFF SEQUENCER"
Hit **[COMMODORE/SHIFT]** simultaneously **again**

REMEMBER THAT PIANO BUTTONS WILL NOT WORK WHILE PLAYING THE MIDI KEYBOARD AND THE TOP ROW OF KEYS WILL BE A DEDICATED SEQUENCER SELECTOR WHEN THE SEQUENCER IS RUNNING. CANCEL MIDI BY HITTING [CTRL] AND CANCEL SEQUENCER BY HITTING [COMMODORE/SHIFT] SIMULTANEOUSLY A SECOND TIME, AND OR RELEASING THE [SHIFT] KEY.

ARPEGGIO NOTES ARE ONLY HIGHER THAN THE ROOT NOTE (THE NOTE THAT YOU STARTED WITH USUALLY ZERO "0")
Remember that the "root note" is the key that you are holding down or hit to play the sequence arpeggio.

SAVING ON DISKETTE

After you have the PITCH,TRANSPOSER,VELOCITY,DADSR and SOUND BANK the way you want them, you can save the whole thing onto disk in one simple step. **BE SURE THAT YOU USE A 1541or 1571 FORMATTED DISKETTE or sdcard WHICH DOESN'T CONTAIN "SOUNDS", THAT**

YOU WILL WANT TO KEEP. THIS IS BECAUSE <SAVE> AUTOMATICALLY REPLACES THE OLD "SOUNDS" WITH THE NEW. WHEN YOU SAVE TO DISKETTE, MAKE AT LEAST 3 COPIES. THIS IS BECAUSE DISKETTE STORAGE IS SOMETIMES UNRELIABLE. (The name of the file is "SOUNDS") YOU CAN ONLY SAVE ONE MUSIC FILE PER DISKETTE.

To begin your save, make sure your new, formatted disk is in your drive. Then depress the [CTRL] and [Commodore] keys. While these two keys are depressed hit the "8" or "9" or "0" key on the top row to select drive number 8,9, or 10. The drive selected will turn GREEN on the screen. Then release all of the keys. Next depress the [CTRL] and [Commodore] keys again. While these two keys are depressed, hold the [F3]<SAVE> function key . Your disk light should come on.

Remember, when you **<SAVE>** with FASTFINGERS 3, you will be saving ALL the DATA with one hit of the **<SAVE>** button. In other words, you will be saving the PITCH,VELOCITY, and DADSR banks which you edited along with the last sound that you played AND ALL EDITED SOUNDS AS WELL. **These will be written over top of any similar information you may have on the diskette.THAT IS WHY YOU NEED A FRESH DISKETTE.**

CHAPTER 3
USING EFFECTS

After you get done this chapter, you will have a better idea of what went into making some of the 256 sounds and you will be able to customize and save your own sounds to memory and diskette.

EFFECTS OVERVIEW

These EFFECTS are software effects to simulate or replace hardware effects and "stomp boxes", such as phase shifters and tremelo. These effects have been incorporated into many of the 256 sounds which are already in the sound bank.
To get into EFFECTS MODE, hold down **[SHIFT]** and you will see the words "EFFECTS" with the words "FLANG", "PKICK" etc. If an effect is already on, you will see a "1" or "2" below the effect. To turn an effect on, hit the corresponding key, for the effect and then "play away". If the effect doesn't fit with a particular sound, then hit the same effect key again and you will shut the effect off. (Some effects have 2 modes of operation and you may have to hit the effect key ONCE OR TWICE to shut the effect off)
EFFECTS WORK ON ALL THREE VOICES. **Of course, if a voice uses a triangle wave, a pulse width effect will have no effect, on that voice, nor will a filter effect have any effect on a voice which is not routed through the filter.**

THE EFFECTS

FLANG Flanger effect actually plays all three oscillators slightly out of tune, in respect to each other, to produce the flanging effect. You can only turn this effect on or off. The flanger will be less noticeable with CHORDS and more or less noticable with various HARMONICS.

PKICK Pulse Width Kick #1 will give your pulse wave sound extra KICK. #2 PKICK is is the inverse ADSR of PKICK1.

GLIDE is when one note GLIDES, SLEWS or CHANGES to the next note and this change of one note to the other is not sudden. This effect can be used to simulate anything from the rubbing of a bow on a violin string, to a police siren. **GLIDE** will also toggle endless **GAMER** sounds.

GAMER will make arcade type game sounds, not too musical but interesting to trigger. After the initial triggering of the **GAMER** sound it will sustain normally UNLESS GLIDE is also selected. **IF** GLIDE is also   selected, then the **GAMER** sound will continue on as long as you have you finger on the KEYBOARD, or KEYPADS.

WEOW #1 will make an upward pitch slew as you release the piano key and #2 will make a downward slew as you release the key. **WEOW #2** is especially useful for drum sounds, such as tom toms and electronic drum sounds.

SEQFL This takes the pitch/velocity SEQUENCER (when it is running) and makes it control tone timbre. When this effect is ON, the sequencer will no longer control pitch. *To get the most desirable sound with this effect, you may need to adjust filter frequencies, filter types and filter resonance. See next chapter.*

WAHWA #1 Tone timbre change follows ENVELOPE. **WAHWA** #2 Tone timbre follows invert of ENVELOPE.In other words, this note will get more TREBLEY when decaying. *To get the most desirable sound with this effect, you may need to adjust filter frequencies, filter types and filter resonance. See next chapter.*
PSWRL   Pulse width SWIRL, slow or fast oscillating up and down pulse width, **based on the speed of the LFO.** Only can be heard with SQUARE waves.You need to have at least one square/ pulse wave in your sound for this to work. *See next chapter for more info*
VBRTO VIBRATO is a gentle changing of the pitch up and down from the true pitch. (only about 1%) This effect will help to synthesize many violins.
SHFTR PHASE SHIFTER is similar to the FLANGER, but with this effect, only one VOICE is slightly out of tune.

In 2019 I decided that the most popular effects should be easily accessible from the home / performance screen. This allows you, the performer, to keep the sequencer going while you toggle on or off the effects and switch sequencer events, VELOCITY banks or even invert velocity. There are also a few new effects as well. DADSR and SPARKLE are new but are NOT saved along with your sounds and sequences.

HOME SCREEN EFFECTS

LFO FREQUENCY UP <LFOU> hit or hold the **[=]** key to toggle on and SPEED UP. The low frequency oscillator LFO , will effect the filtering to produce TREMELO and swirling FILTER EFFECTS. The filters must be on and set to the right settings for this to be audible. The LFO , will also effect the pulse width when a SQUARE wave is being used while PSWRL is turned on.

LFO FREQUENCY DOWN <LFOD> hit the **[ ]]**to SLOW DOWN and turn off. Also attached to the LFO. See **LFOU** above.
THE LFO WILL BE SAVED WITH EACH SOUND. The LFO is based on a simple RAMP or SAWTOOTH wave.
..These buttons are logically NEXT to each other on the C64. Right hand button up and left hand button down. Tremelo and Swirl are redundant and have been replaced with this LFO.

VFLP   *VELOCITY BECOMES MUCH MORE PRONOUNCED /OBVIOUS WITH MIDI MODULES mixed in AS THE SOUND SOURCE* . Velocity Flip will effect the way that Velocity triggers your sound filters and "FEEL" of the velocity. If you don't like the way the filters react you can "flip" them to get a better OR different feel. I personally like the higher timbre for a harder pressed key but you may like the opposite. This can help you. *To get the most desirable sound with this effect, you may need to adjust filter frequencies, filter types and filter resonance. See next*

chapter. There is no indicator on the Effect screen, but VFLP (velocity invert) on the HOME SCREEN will be GREEN if this is selected. It can be toggled on and off on the home screen with the [RETURN] KEY.

V54 TWO banks of VELOCITY settings in FF3 The original bank resides at **h5500** and the new bank is at **h5400.** The **[K]** key toggles between the two banks.

SO WHAT IS SPARKLE ?
It is a secret ! Just toggle it on while the sequencer is running to find out ! Toggle **[A]** key. You will have to experience it to find out. It will cycle at the speed of the sequencer but the sequencer will no longer play the pitch sequence on the C64, unless CONT is on. but **THE PITCH SEQUENCE WILL PLAY ON THE MIDI MODULE**. You can also select some major chords while it is running. and pick sounds in the 5th and 6th octaves to play. It will work properly when [shift] alone is pressed or while [commodore/shift] have been toggled when [shift] is also locked. In other words "hands off" and "hands on" sequencer together will produce the most desired effect ,with sparkle.

FASTFINGERS 3 SEQUENCER FUNKYNESS
<CONT> [F] (short for **continuous**) MODE MUST BE SELECTED TO HEAR THE COMMODORE SID PLAY IN UNISON WITH THE MIDI. OTHERWISE THE COMMODORE WILL HOLD THE NOTE AS YOU HOLD YOUR FINGER ON THE KEYBOARD. THIS MAKES **SQFL** REDUNDANT NOW. IF IN "HANDS OFF" MODE THE COMMODORE SOUND WILL FADE DEPENDING ON THE SUSTAIN AND RELEASE SETTINGS ON THE SID CHIP. <CONT> mode will play continuously until you tap **[COMMODORE][SHIFT]** together to shut it off. This replaces PLAY from previous versions of Fastfingers and allows the TOP ROW of the keyboard to be dedicated to changing sounds and sequences **on the fly.**

CHAPTER 4
SHAPING SOUNDS

In Chapter 3, you started to modify sounds using effects. In this chapter, you will learn how to build up your own sounds from scratch.

TERMS THAT YOU SHOULD KNOW

SID CHIP is the Sound Interface Device. It is just the part of the computer which generates the sounds that you hear.

PARAMETER. If you were baking a cake, you would need the ingredients and the recipe, a little bit of sugar, a.few eggs etc. If you are building a sound you need ingredients also, a little bit of triangle wave, a dash of vibrato etc. The components which make up the sound as well as the amount of each component are the PARAMETERS. If you know ALL the PARAMETERS for a flute, you should have little trouble to synthesize a flute.

A "HANDS ON" INTRODUCTION TO SYNTHESIS

OSCILLATORS

OSCILLATORS generate the TONES for each sound. Each oscillator can only make 1 tone at a time. Sounds in real life are made of many tones or HARMONICS and many different WAVE FORMS. So in an attempt to synthesize a realistic sound, we will use ALL 3 of the oscillators built into the SID CHIP.

With FASTFINGERS 3, you will be able to adjust each oscillator, up and down, in semi-tone increments and also bend the pitch out of tune using the EFFECTS. (CHAPTER 3) You will also be able to set the three oscillators to pre-set CHORDS and HARMONICS. You will also be able to select various WAVEFORMS.

USING HARMONICS

1) Call up the SOUND BANK by holding down **[CTRL]** and pull up an ORGAN sound. (CHAPTER 1). The specific characteristics of organ sounds will illustrate OSCILLATOR effects better.

PLAY the sound and listen to it. Now **<[C]ANCEL>**(up arrow) out all the HARMONICS and CHORDS and listen to the sound. It sounds different, right? Now hit different **<CHORDS>** then play them and notice how different each chord sounds. Now, while holding down **[CTRL/SHIFT]**, hit the various **<HARMONICS>*** buttons and then play these sounds. Did you hear the dramatic difference in sounds? Though you heard a great variety of sounds, toy organs, church organs, etc., you were only playing with 1 PARAMETER, the PITCH of the

oscillators. There are about 30 more PARAMETERS to play with, so this should give you some idea of the vast variety of sounds, which can be created with this system. *NOTE <CHORDS> will override <HARMONICS> but <HARMONICS> will not override <CHORDS> so if you want to create a wider chord hit "harmonics" AFTER selecting the chord.*

The oscillators are capable of playing many different WAVEFORMS as well. I'm not going into the physics of how each waveform varies in frequency content and energy content though. Simply play with each waveform and listen for yourself. Here's how. *While playing with **<HARMONICS>** it is easy to make sounds that can play outside the 8 octave range of the SID chip. When and if this happens , the sound will be sour. **SO, Play in a lower octave.**

SELECTING A VOICE (**<1>,< 2>**, OR **<3>**)

First you must select which one of the 3 voices you want to change. Hold down the **[commodore]** key and you will see 1, 2 and 3 displayed in the upper right hand area of the display. Hit one of these VOICE keys to select the VOICE that you want to modify. **You must do this first before modifying any individual 1 of the 3 voices.** At the bottom of the screen, you will see a long horizontal cursor which will indicate which voice/channel that you are working on.

While still holding **[commodore]**, press **<TRGL>** or **<SAWT>** or **<SQRE>** or **<HISS>**. Play each of these waveforms and listen to the way they sound. Also notice how the indicators, under the long cursor changed. After you have a square or sawtooth wave on, hit the **<TBLEND>** button to experience 2 new waveforms, the ANDed waves which are somewhat weaker, but have their uses when used in conjunction with other waves. THERE WILL BE NO CHANGE, IN THE DISPLAY, to indicate that ANDED waves are there, but when, you play them, their distinctive, sharp quieter sound should give you an idea of their presence.

GENERAL APPLICATIONS OF VARIOUS WAVES

TRIANGLE waves are very smooth and are good for flute like sounds.
SAWTOOTH waves are a little coarse and are good for trumpets and other horn instruments.

NOISE OR <**HISS**>is best used for cymbals, snare drums and wind sounds. **PULSE** AND **SQUARE** waves are very coarse and will be best used with FILTERING, because natural sounds seldom occur with pulse waves.

ADJUSTING OSCILLATORS UP 1 SEMI-TONE
This adjustment is meant to adjust the #2 and #3 oscillators, relative to the #1 oscillator. There are already many pre-set chords for you to select, but if you want more chords or special tuning for RING MODULATION, this adjustment will be helpful. While holding down the **[commodore] KEY**, tap either the **<Oscillator2>** or **<Oscillator3>** (Top row far left side) buttons repeatedly, to get the desired result.

FILTERING

Filtering is what happens when a waveform passes through a FILTER and the unwanted parts of the waveform are REMOVED. In the SID CHIP all of the voices pass through the same filtering system and because of this, **your 3 voices are basically tied together, as far as filtering is concerned**. The only way for each voice to have independence, as far as filtering is concerned, is to have some voices **BYPASS** the filters. Here's how.

SELECTING WHICH VOICES WILL BE ROUTED THROUGH THE FILTERS
While holding down **[commodore] KEY**, hit **<F ON OFF>** repeatedly until the desired **"F"** combination is achieved. When an "F" is displayed, THAT voice is going through the filters. (The "F" is displayed in the lower left hand area of the display.)

LOWPASS, BANDPASS AND HIGHPASS FILTERS

When you have selected which voices will be routed through the filters, you will then have to decide whether you want HIGHPASS, LOWPASS, or BANDPASS filters.

The **LOWPASS** filter does just what• the name implies. It passes low frequencies and rejects all others. It is like playing your stereo, without any treble and turning the bass up at the same time.

The **BANDPASS** filter passes medium or midrange frequencies and rejects highs and lows.

The **HIGHPASS** filter will allow or pass high frequencies. Sounds passing through this filter alone will sound "tinny".

SELECTING HIGHPASS, BANDPASS, and LOWPASS

While holding down **[CTRL/SHIFT]**, hit **<BAND OFF>**, **<HIGH OFF>**, AND **<LOW ON>**. In this way, you have just selected a lowpass filter and if all 3 voices are passing through this filter, the sound will be very "bassy". Select other filters in a similar manner. You can also try any combinations of all 3 filters.

SELECTING THE FILTER CUTOFF FREQUENCY

Another thing which will affect filter output, is the FILTER CUT control. While holding down the **[CTRL/SHIFT]** keys hold down **[F7]** - until the number on the display shows "064". Notice that the sound is more "muddy" now. Now while depressing **[CTRL/SHIFT]**, hold down **[F5]+**, until the number reads "255". Notice that the sound is much brighter now. There are 256 graduations of filter cut, and so we will be able to get quite a variety of TIMBRES. With a LOWPASS filter set to 080, we will get bass guitar and with a BANDPASS filter set to 150, we may get a horn sound. ***Adjusting filter cut, will make WAH WAH, TREMELO, and or SWIRL more or less pronounced.*** **Playing with THIS FILTER WILL also MAKE VELOCITY EFFECTS MORE or less PRONOUNCED.**

FILTER RESONANCE

We also have a RESONANCE control, which will make the filtering stronger or weaker. While holding down **[commodore]**, tap on **<RES>** ([2] key) repeatedly and notice the change in sound. RESONANCE will affect WAH WAH, TREMELO and

or SWIRL because these are all FILTER effects. A higher resonance will make a rougher sound and can even be used to create a distortion of sorts.

The LFO

In 2019 I decided to replace SWIRL and TREMELO with a 64 graduation LFO. A SWIRL-LIKE effect can be achieved when the LFO is set to 1. Swirl is like having one hand on the TONE control going up and down slowly while playing the keyboard with the other hand. The LFO is effecting the filtering. It's nice to sit back with your finger on the keyboard and listen to this effect through a good amplifier. To get the most desirable sound with this effect, you may need to adjust filter frequencies, filter types and filter resonance. With all filters OFF you may not hear this at all. Another way to hear the LFO is through the SQUARE or PULSE WAVE by using PSWIRL. More on this in **EFFECTS**.

THE ADSR

When you blow a trumpet, the volume of the sound rises slowly to a PEAK or ATTACKS slowly. Then the volume drops or DECAYS to a SUSTAIN level, which will be maintained as long as you are blowing and then quickly RELEASES to fade away. ATTACK, DECAY, SUSTAIN, RELEASE is where we get the term ADSR from. In the SID we have 3 such TRANSIENT or ADSR generators, 4 registers for each of the 3 voices, so that we can imitate the STRIKING of a piano key or the BLOWING of a bassoon.
We can put a number in each register, between 0 and 15. The smaller the number is, the shorter the time will be. This doesn't apply to SUSTAIN though.
The number, in the sustain register, will affect the VOLUME LEVEL of the sustaining sound. To learn how the ADSR works, I would recommend that you pull some sounds out of the BANK, listen to them, and examine each of their ADSRs. Then experiment yourself.

MODIFYING THE ADSR

While holding down the [SHIFT] key, depress <1>,<2> or <3>, (top row ,far right 3 keys) to select the channel that you want to modify. **YOU MUST DO THIS FIRST.**

In the upper display, you will see "A D S R" . These ADSR keys are the ones which will be referred to in the following instructions.

<ADSR>= [3] [4] [5] [6] keys on top row

1) If you want to adjust ATTACK, tap the **<A>** key repeatedly.
2) If you want to adjust DECAY, tap the **<D>** key repeatedly.
3) If you want to adjust SUSTAIN, tap the **<S>** key repeatedly.
4) If you want to adjust RELEASE, tap the **<R>** key.

NOTE If modifying the ADSR is new to you, you may want to listen to each sound as you are modifying it. **Also, if you put a very long ATTACK time, don't expect to be able to play the keyboard very quickly. This is because the sound will never reach the PEAK, while you will already be hitting the next key.**

TURNING RING MODULATION ON
RING MODULATION is used to produce GONGS, BELLS and XYLOPHONES. To turn it on, hold down **[commodore]** and tap the **<RING ON>[F5]** key, for the selected voice. Since the SID CHIP needs a triangle wave, for RING MODULATION, 2 things will happen. First the waveform will switch over automatically to "TRIANGLE" and then the RING MODULATION will be turned on. This is a good to know, especially if you had a PULSE wave with all kinds of PULSE EFFECTS.

TURNING RING MODULATION OFF
While holding down **[commodore]**, hit the **<RING OFF> ([F7])** button, for the selected channel. If ring modulation was on, only momentarily, the old waveform will be restored and RING MODULATION will be turned off. In this way, you will be able to see if you want RING MODULATION, and if you don't, change things back quickly, with a minimum of keystrokes. Sometimes, when we are using RING MODULATION, it is desirable to shut off the sound, from VOICE 3. While holding down **[CTRL/SHIFT]**, hit <**VOIC3 OFF> ([F3])**, to turn off voice 3.
While holding down **[CTRL/SHIFT]**, hit <**VOIC3 ON>([F1])** to turn voice 3 on.

TURNING SYNC ON
While holding down the **[commodore]** key, hit the **<SYNC ON>([F1])** button, for the selected voice.

TURNING SYNC OFF

While holding down the **[commodore]** key, hit the **<SYNC OFF>([F3]**) button, for the selected channel.

ADJUSTING PULSE WIDTH

Adjusting PULSE WIDTH, will make the sound thinner, or richer. This adjustment will only work with a SQUARE/PULSE wave. First select the channel. Then, while holding down **[SHIFT]**, hold down **[PLSE +]** or **[PLSE -]** to change the PULSE WIDTH. You will hear the sound change, as you do this, for the voice that you are adjusting. **This will only work for the VOICE that you are working on and ONLY FOR SQUARE waves.**

VOLUME

VOLUME CONTROL is also available with FASTFINGERS 3. Though it is more important with MULTI-SID systems, for mixing, volume control does have a purpose with a single SID. If we try to set all of our sounds, to approximately the same volume, we won't have to worry about blowing speakers up, when we change from one sound to another. HOWEVER, TO KEEP NOISE TO A MINIMUM, MOST OF THE PRE-SET SOUND VOLUMES ARE AT THE TOP.

ADJUSTING VOLUME

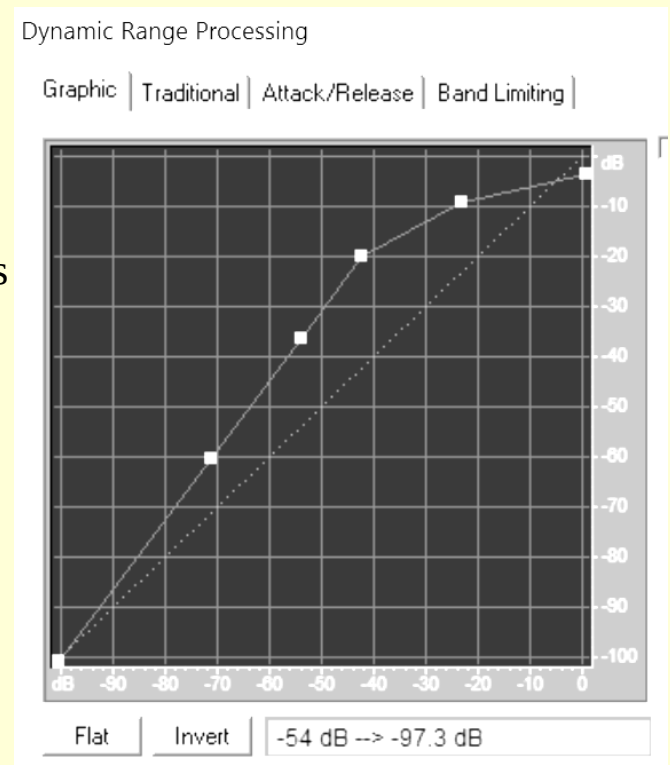While holding down **[CTRL/SHIFT]**, tap on **[V]**, [INST/DEL] until you get the desired volume.

CHAPTER 5

NOISE REDUCTION AND DYNAMIC RANGE

As long as you are using this system for live performance or just having fun with it you won't have to bother with this chapter. If you want to make professional recordings with this system, then read on.

I have done everything possible, to get the noise level down using filtering and monitoring of the ENV3 register on the SID chip, but if you want to make it even quieter for recording check this out.

Processing through several DAW programs or wave editors such as Cool Edit , SoundForge or Cubase , you can set up gates or change dynamic range to make quite parts even quieter and loud parts of the recording even louder. This will cut the noise after your note has stopped playing and is best if you use a single track for each FastFingers sound. In other words, it is better to use this BEFORE mixing all of your FASTFINGERS 3 parts together. In **COOL EDIT 2000** , my **Dynamics Processing** will usually look like the picture to the right.

Dynamic Range Processing

Graphic | Traditional | Attack/Release | Band Limiting

Flat   Invert   -54 dB --> -97.3 dB

COMMAND SUMMARY
SHORTCUTS QUICK REFERENCE
MENU 1
PERFORMANCE MODE

1) <FAST> PRE-SETS Up to 16 different pre-sets can be called up quickly from the bank. <mark>*16 SOUNDS ,ENTIRE TOP ROW, IN FAST PRE-SETS WITH MIDI KEYBOARD RUNNING AND ARE DEPENDENT ON WHICH BANK IS SELECTED AT THE TIME.</mark>

THE ABOVE 16 KEYS WILL NOT BE AVAILABLE WHILE THE "SEQUENCER" IS IN OPERATION . THEY WILL BE USED TO SELECT A SEQUENCER

7) <LOAD> + <SAVE> Load and save sounds and sequences from and to disk. You must also depress the [CTRL/COMMODORE] keys at the same time. *When midi is enabled this is disabled.*

8) <FASTER>-<SLOWER> Speed up or slow down recording and playback speed.

9) <CHORDS> Select 3 major and 3 minor chords here or 6 other chords

10) <C CANCELS out CHORDS. (All three voices play the same note or tone.

11) Z,X,C,V,B,N,M,(,),?,S,D,G,H,J,L ,, [....These are the buttons that you strike to make music but not when using the MIDI keyboard. *When midi is enabled this is disabled.*

12a) [COMMODORE]/[SHIFT] (simultaneously) Depress once to turn "HANDS OFF SEQUENCER" ON and depress again to turn off "HANDS OFF SEQUENCER".

12b) To use the "HANDS OFF SEQUENCER", just hit any key and the sequence will play in the key which was struck until the sequence is over. You could also hit the space bar to trigger this.

12c) To use "HANDS ON SEQUENCER" hold down [shift] while playing on the piano keys.

13)

Tap the **[SPACEBAR]** to select

a)   **P**   at the top of the screen Select pitch sequencer.

b)   **V**   at the top of the screen Select velocity sequencer.

c)   **D**   at the top of the screen Select dadsr sequencer.

SPARKLE <SPRKL> hit the [**A**] key to toggle on and off

VELOCITY FLIP <VFLP> hit the [**RETURN**] key to toggle on and off.
VELOCITY BANK 5400H <V54> hit the [**K**] key to toggle on and off
CONTINUOUS Mode <CONT> hit the [**F**] key to toggle on and off.
DADSR ON/OFF [RUN/STOP]
LFO FREQUENCY UP <LFOU> hit/hold [**=**] key to toggle on and SPEED UP.
LFO FREQUENCY DOWN <LFOD> hit the [**]**]to SLOW DOWN and turn off.

MENU 2 [commodore] KEY
SOUND SHAPER AND EFFECTS

1) <0 2>   Oscillator #2 up one semi-tone.
2) <0 3>   Oscillator #3 up one semi-tone.
3) <RES> Resonance control for filters.
4) <A> ATTACK up.
5) <D>   DECAY   up.
6) <S>   SUSTAIN up.
7) <R>   RELEASE up.
8) <TRGL>   Select TRIANGLE wave.
9) <SAWT>   Select SAWTOOTH wave.
10) <SQRE>   Select SQUARE or PULSE wave.
11) <HISS>   Select NOISE wave.
12) <PLSE> + -   Pulse width up or down.
13) <RING> ON-OFF   Turn on or off RING MODULATION.
14) <SYNC> ON-OFF   Turn on or off SYNC
15) <1, 2, 3>, Select the voice that you will shape.
16) <F ONOFF>   Hit this key repeatedly to select which voices will be routed through the filters.
17) <T BLEND>   Will blend the TRIANGLE wave with a SAWTOOTH or SQUARE/PULSE wave, in the voice selected, to create new timbres and sounds.
18) **E F F E C T S   Designated effects are OFF when 0 is displayed.**
A) <FLANG>   Flanger effect.
B) <PKICK > #1 Pulse width controlled by ADSR. #2 Pulse width quickly oscillating up and down.
C) <GLIDE> Notes will slide or glide into each other.

D) <THICK> Thick will add a little roughness to the sound. (good for horn sounds)

E) <WHEOW>   Will cause a pitch slew either up, (#l),or down, (#2), directly proportional to the ADSR #3 output.

F) <SEQFL> This takes the pitch SEQUENCER (when it is running) and makes it control tone timbre. When this effect is ON, the sequencer will no longer control pitch.

G) <WAHWA> #1 The popular wah-wah effect.Tone timbre change follows ENVELOPE. #2 Tone timbre follows invert of ENVELOPE.In other words, this note will get more TREBLEY when decaying.

H) <PSWRL> Pulse width SWIRL, slow or fast oscillating up and down pulse width, **based on the speed of the LFO.** Only can be heard with SQUARE waves.

K)<VBRTO> Vibrato

L) <SHFTR> Similar to the FLANGER but not as pronounced.

M) <LHTON> LIGHT SHOW ON WILL ONLY WORK WITH CONTinuous ON so not to hypnotize you. This is only made to light a dark room for a DJ. Don't stare directly at the screen while the sequencer is playing.

MENU 3 [CTRL] KEY
BANK MODE

1) <GET>   Get a sound from bank.

2) <PUT>   Put a sound into bank.

NOTE To get a sound or put a sound you must set the "POINTER" to set up the location. There are locations for 256 different sounds and the "FAST PRE-SETS" are a subset of these 256.

3a) First select one the 16 banks varied, bass, wind, drum, bells, string, wah wah, assort, piano, space, etc.

3b) Then hit one of the 16 keys in the top row to set the pointer

3c) Then either hit <PUT> or <GET>

MENU 4 [CTRL]-[SHIFT]
SOUND SHAPER MODE

1) "C" **Cancel Video** WHEN SET TO ZERO, THE DISPLAY WILL WORK WHEN MIDI IS ENGAGED. OTHERWISE THE SCREEN WILL GO BLANK WHEN MIDI IS ENGAGED. This is the top left key.
2) HARMONICS 112, 122, 123, 113, 114, 124, 134, and 133, these are octaves that will play...
EXAMPLE 1,2,3 means that the sound will play a low octave on voice 1, one higher octave on voice 2, and 3rd octave on voice 3
3) <LOW> ON-OFF Low pass filter on or off.
4) <BAND> ON-OFF Band pass filter on or off
5) <HIGH> ON-OFF High pass filter on or off
6) <VOIC3> ON-OFF Voice 3 on or off
7) <FILTER> + OR - Filter cut off frequency up or down
8) <OCTAVES> select octave that keyboard will play.
9) <V> VOLUME up

SCREENS 5,6,7,8 THE SEQUENCER EDITOR WINDOWS

HIT THE RIGHT/LEFT ARROW AT THE BOTTOM RIGHT OF THE KEYBOARD TO SELECT THESE.

SUPPLEMENTAL INFORMATION

IF you just hit a note outside of the range of the SID chip it should be silent. With the sequencer running, only silence for notes out of the range. **THIS CAN BE UTILIZED TO CREATE RESTS.** Just move the keyboard down 1 OCTAVE with the OCTAVES function. If you get silence or sour notes, then move down again. **Remember, you could force a note to go too high just by the CHORDS and HARMONICS that you select**. So when you make a sound, the proper procedure is to completely sculpture the sound ,including CHORDS and HARMONICS, then adjust the volume and then select the OCTAVES range last...unless you are willing to use only a few octaves for live performance.

SOME OF THE SOUNDS PLAY VERY FAINT

Sometimes an ANDed wave is playing this can cause this problem. (see section on TBLEND) to shut this off go back and select the waves are showing up on the bottom of the screen Or…..
If you notice that some of the sounds are very faint, when played with YOUR C64, this is mostly because of the way that some SID chips use the FILTERS. First, you should try to adjust FILTER CUT). If you are still not satisfied with the sound, adjust the volume control . If the volume is still not loud enough and you are playing live, simply turn up your amplifier. If you are recording to tape, turn up that channel of your mixer. Remember, though a bass sound may not sound loud to your ears, it may already be too loud to record (look at your VU meters) or may already be overtaxing your speakers. (is the cone bouncing in and out?) The reason that bass sounds are apparently quieter is because the low pass filters only pass the low

frequency sounds. The more LOWS in a sound the louder a sound will be. In other words, don't expect to play a bass guitar way up in a high OCTAVE. It will be inaudible (quiet) way up there. Don't expect to hear any real deep bass sounds out of your computer speaker or monitor because the speakers and amp in the monitor have poor low frequency response. Since a poor amp/speaker will also have few "highs", you should sculpture sounds with the amplifier and speaker that you will most often be using for playback or "live" play. The amp should have BASS,MID and TREBLE set to 12 o'clock or the midway position.

WHY HEXADECIMAL ANYWAY?

Originally, all of the numbers displayed were in hex. I later realized that most musicians would be alien to this numbering system, so I wrote an 8 bit decimal display routine (only displays numbers from 0-255). The decimal routine took care of everything except "PULSE WIDTH" and "WHERE". Both of these needed a 16 bit display routine. They had a display only as an aid. In other words the PULSE WIDTH will be adjusted by your hearing preference. The only place where a decimal display may make a real major difference, is with ARPEGGIO recording. Here you will want you ARPEGGIOS to be a standard length long such as 48 events (for 16th note triplets) ,96 ,32 ,64 ,128 etc. To help you below is a table.

HEXADECIMAL	DECIMAL
A	10
B	11
C	12
D	13
E	14
F	15
10	16
20	32
30	48
60	96
80	128

90	**144**
A0	**160**
B0	**176**

TRICKS WITH THE SEQUENCE EDITOR

A quick way to change a sequence is to simply add a LOOP MARKER.
Sophisticated sequence combinations can also be created this way. You could change
a 16 note VELOCITY SEQUENCE from 16 to 15 events while the NotePitch
sequence is playing only 4 notes to create "4 against 15" type rhythm sequences.

EXPERIMENT !