

INTRODUCTION

Your new **ESQ 1** is actually two powerful devices -- an eight voice, poly-timbral Digital Synthesizer, and a flexible eight-track MIDI Sequencer -- built into one package. Whether you plan to use the **ESQ 1** by itself, or as the master controller in your MIDI set-up, you'll find that it is a tool of enormous power and versatility for performing, recording and composing music.

The Synthesizer

With three Digital Wave Oscillators per voice, thirty-two sampled and synthetic Waveforms to choose from, and 15 routable Modulation sources, the **ESQ 1** is capable of producing a wide variety of rich, complex sounds. The five-octave, velocity sensitive keyboard can be split for different sounds on each half, layered for two sounds playing together, or even programmed for a Split/Layer mode in which two totally different pairs of sounds play on each keyboard half.

Forty Programs, or 'patches', are stored in the Internal Memory, with another eighty available on an external, plug-in Cartridge, giving you 120 sounds to select from instantly. In addition, the eighty-character fluorescent Display shows the names of ten programs at a time, making it easy to quickly scroll through all the sounds, to find the one you want. These programs can be played as is, or they can be modified to suit your taste and then renamed and stored, either in the Internal or the Cartridge Memory.

Editing of all programs, sequences, and 'global' functions (such as Tuning, Bend Range, etc.) is handled from the informative, 'Page-driven' Display which shows at a glance all the parameters associated with a selected function.

Audio outputs are provided for true stereo, as well as a mono output. Programs can be panned continuously between the left and right channels. The **ESQ 1** also has an Amplitude Modulation (AM) mode which can produce bell and ring-modulator type effects, and a Sync mode for hard sync effects.

The Sequencer

The built-in Sequencer can record and play back 2400 notes (expandable to 10,000 with the optional Sequencer Expander Cartridge). It will store 30 different Sequences, which can be combined into 10 Songs. Sequences and Songs can be saved to tape or via MIDI to diskette using an **ENSONIQ Mirage** Digital Sampling Keyboard or **Mirage** Digital Multi-Sampler. (You do have a **Mirage**, don't you?)

It is a full eight track MIDI Sequencer, capable of playing eight separate polyphonic Tracks internally, each with its own sound; or sequencing eight separate MIDI devices at once; or both. Each Track has an adjustable Output level, a MIDI channel, a Program number, and a MIDI Status (LOCAL, MIDI or BOTH).

In addition to its own internal clock, the Sequencer can sync to the clock output of another MIDI device (such as a Drum Machine or another Sequencer), or record a sync track to audio tape, and sync to that, to get the most out of any multi-track set-up.

The **ESQ1** 1's Edit functions allow you to easily modify Songs, Sequences, Tracks, or individual Events in a variety of ways. Quantization (or Auto-Correct) is available to make each performance letter-perfect. The Auto-Locate controls give you quick access to any point in a Sequence or Song, and you can "Punch in" (or out of) a Track, just like on a tape deck.

However, each time you record over any part of a Track, the **ESQ 1** gives you the chance to listen to the new Track, and the original, before you decide which one to keep. Try that on a tape deck.

Control

In short, the **ESQ 1** employs the latest computer technology to combine a state-of-the-art Digital Synthesizer with a powerful MIDI Sequencer in one manageable, easy to use instrument, to give you a whole new level of control over your music.

Getting great sounds out of the **ESQ 1** is simple -- just read the sections entitled **Getting Started** and **Getting at the Sounds**, plug it in and play. Learning to take full advantage of its tremendous power and versatility will take a bit longer, but you'll find that it's worth the trip.

GETTING STARTED

Power

Insert the Power Cable into the receptacle on the back of the **ESQ 1**, next to the On/Off switch. Plug the other end of the cable into a grounded AC outlet. (The proper voltage for your **ESQ 1** is listed on the Serial Number Label on the Rear Panel.) Turn on the **ESQ 1** and make sure the Display lights up. If not, check your connections and power source.

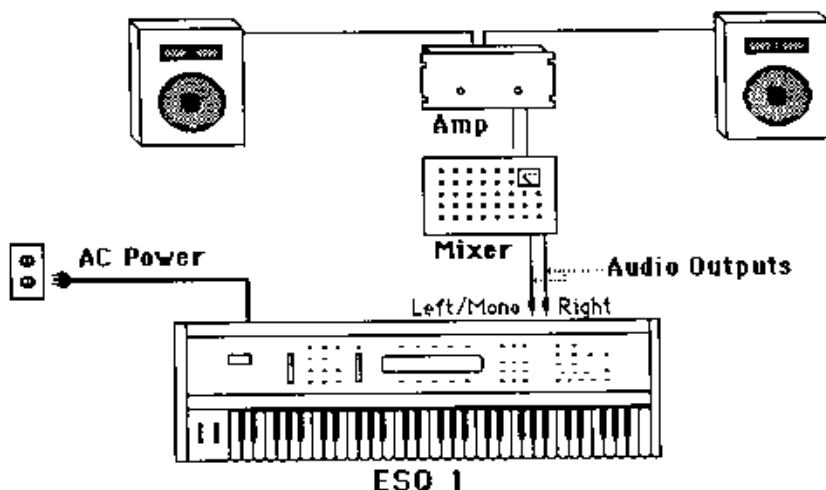
Amplification

Make sure your Audio system is turned off (or down) when making connections, to avoid damaging speakers or other components.

Connect the Audio Outputs of the **ESQ 1** to a mixer, instrument amplifier, stereo, or any other sound system, using 1/4 inch audio cables. If your system is stereo, connect the Left and Right Outputs to two channels of your mixer, stereo, etc. If not, use the **ESQ 1**'s Left / Mono Output only.

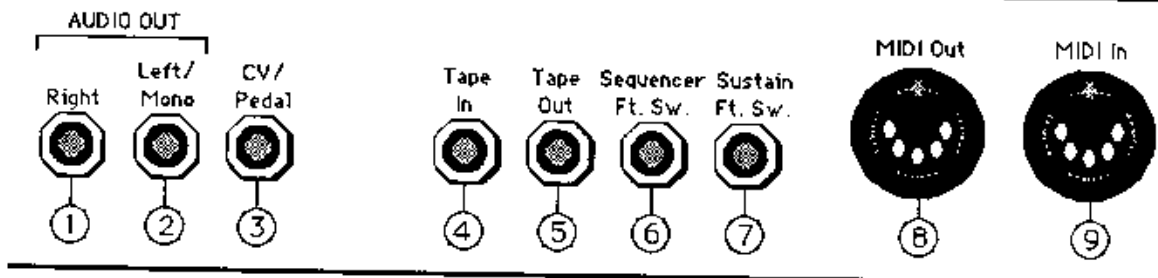
If you're running the **ESQ 1** through a mixer, in stereo, be sure to pan the Left input fully left, and the Right input fully right.

Basic Connections



Move the **Volume Fader** of the **ESQ 1** up about half way. Switch the audio system On, and adjust the amplifier volume for normal listening levels. If you hear no sound while playing the keyboard, switch the audio system Off and check your connections.

REAR PANEL CONNECTIONS



Rear Panel Connections

(Note: The order of the connectors on your unit might differ from the above diagram, but they will function exactly the same.)

AUDIO OUTPUTS:

1) **Right** -- To operate the **ESQ 1** in **Stereo**, connect this Output to a channel of your Mixer and pan that channel **Right**. If nothing is connected to this jack, both channels of the **ESQ 1**'s Output will be combined and sent out the **Left / Mono** Output.

2) **Left / Mono** -- When operating the **ESQ 1** in **Stereo**, connect this Output to a channel of your Mixer and pan that channel **Left**. To operate the **ESQ 1** in **Mono**, use this jack only. Again, if nothing has been connected to the **Right** Output jack, the **Left / Mono** jack will produce a **Mono** signal that is the sum of the two channels of the **ESQ 1**'s Output.

Specs: (Both Audio Outputs): 1 KOhm output impedance, DC coupled. Line level output into 10 KOhms or higher (one voice=1 Vp-p typical; all voices= 15 Vp-p)

3) CV / Pedal

This jack is for connecting an optional **ENSONIQ Model SW-10** Control Voltage Foot Pedal, which is assignable as a Modulator in the **Program** Section of the **ESQ 1**. The Pedal gives you a handy alternative Modulation source when, for example, you would want to use the **Mod Wheel** but both hands are busy.

Specs: 3-conductor (Tip=control voltage input, Ring=2KOhm resistor to +12 Volts, Sleeve=ground). 500 Kohm input impedance, DC coupled. Input voltage range=0 to 10 volts DC Scan rate=5mS (maximum recommended modulation input= 25 Hz). For use with an external control voltage, use a 2-conductor cable with the voltage on the tip and the sleeve grounded.

4) Tape In

This jack can be connected to the output of an audio tape recorder and used for one of three purposes:

-----> To Load and Verify **Program** or **Sequencer** Data which has been saved to Tape,

- > To read an incoming Clock Signal (or sync track) which has been recorded to tape, for the purpose of synchronizing the Sequencer to an audio tape recording, or
- > To read an incoming Clock Signal from another sequencing device (a drum machine, or other sequencer) for the purpose of synchronizing the **ESQ 1** Sequencer to that device without MIDI connections. To do this simply connect the Tape Out or Clock Out jack of the other device to the **Tape In** jack of the **ESQ 1**, and set the **ESQ 1's Clock Select for Tape Sync** (see **CONTROL** Page).

Specs: 10 Kohm input impedance, AC coupled. Triggers from 500 mVp-p up to 5 Vp-p, AC or DC coupled. 500 Hz maximum response for sync.

5) **Tape Out**

Connect this Jack to the Input of a Tape Recorder to:

- > Save **Program** or **Sequence Data** to Audio Tape, or
 - > Send out a Clock Signal (or sync track) to be recorded on audio tape so that you can synchronize the Sequencer to that track.
- Or,
- > Connect this Jack to the Tape In jack of another sequencing device, and set that device for **Tape Sync**, to sync it to the **ESQ 1's** clock without MIDI connections.

Specs: 22 Kohm output impedance, AC coupled. Drives 1 Vp-p into 10 KOhms (line level) and down to 100 mVp-p into 1 KOhm (mic level).

6) **Sequencer Foot Switch**

This jack is for an **ENSONIQ Model SW-1** Foot Switch. A Foot Switch connected here can be used to start and stop the Sequencer.

7) **Sustain Foot Switch**

This jack also takes an **ENSONIQ Model SW-1** Foot Switch. This switch acts as a **Sustain Pedal**. Holding it down will cause notes to continue to sustain after the key has been released.

*** * * * Note:** The **ENSONIQ Model SW-1** Foot Switch is wired with the contact Normally Open. Some other manufacturers' footswitches are wired this way, and will work with the **ESQ 1**. Some are wired the opposite way (Normally Closed) and will not work properly with the **ESQ 1**.

8) **MIDI Out**

This jack sends out MIDI (Musical Instrument Digital Interface) information to other instruments and computers.

9) **MIDI In**

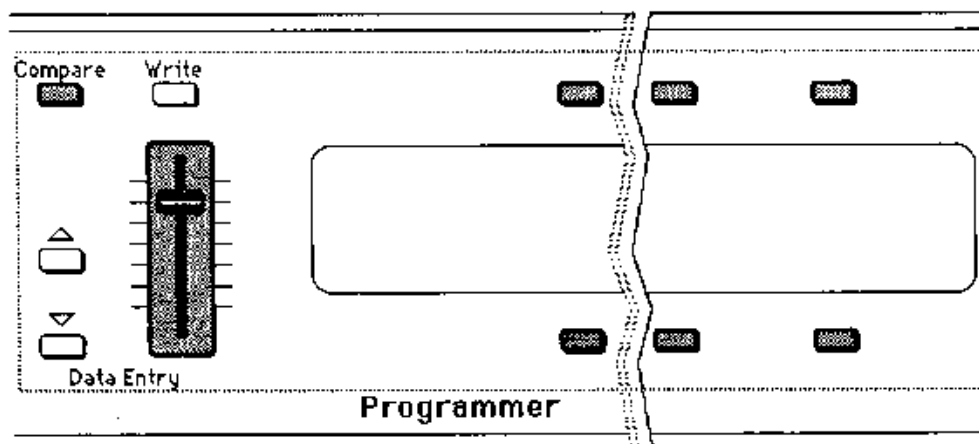
Receives out MIDI information from other MIDI instruments or computers.

About the Programmer

Everything you do on the **ESQ 1** -- whether it's selecting a Sound, editing that Sound, adjusting the Master Tuning, or operating the Sequencer, -- is controlled from the section of the Front Panel called the **Programmer**.

The **Programmer** is made up of:

- > The 80 character fluorescent **Display**,
- > The ten grey Buttons directly above and below the Display,
- > The **Data Entry Slider** to the left of the Display,
- > The two white **Up and Down Arrow Buttons** to the left of the Data Entry Slider,
- > The **Compare** Button, and
- > The **Write** Button.



The **Programmer** is primarily used to Select and modify things -- Sounds, Program Parameters, Tuning, Sequencer Control functions, etc. -- all depending on which Front Panel Button you press. Try pressing a few of the other buttons -- **MASTER**, **OSC 1**, **DCA 1**, or **FILTER**, for example -- and watch the Display. Notice that for each button you press, the Display changes to show you information related to that function. Each of these different Display configurations is called a **Page**.

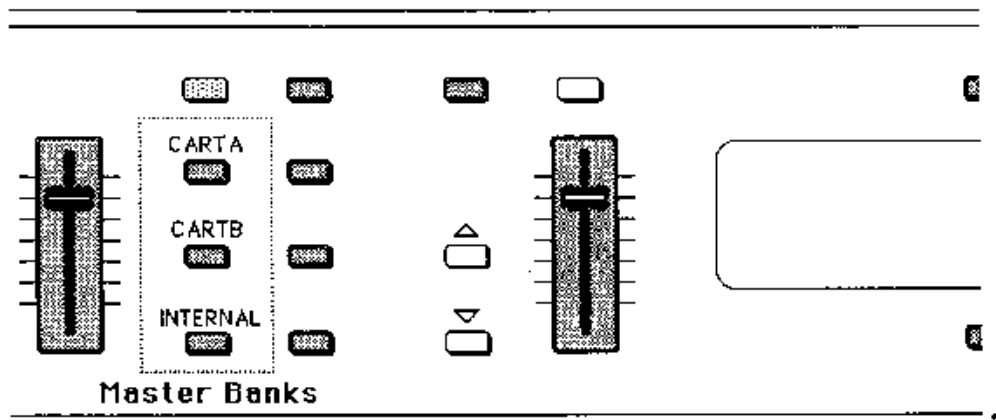
The ten Buttons above and below the Display have a new function each time you select a new Page -- that is, each time you press one of the buttons outside the **Programmer** section. Each of these ten buttons is used to select whatever is directly above or below it on the display. Whatever you select in this manner is immediately underlined, telling you that it is the current Program, Parameter, or Sequence, etc.

An in-depth description of the **Programmer** and its functions follows in the Section entitled **PROGRAMMING THE ESQ 1**.

GETTING AT THE SOUNDS

Master Banks

Each of the three **Master Banks**, (**INTERNAL**, **CART A** and **CART B**) designates a large area of memory which contains forty Programs. To play the Programs in the **Internal Memory**, press the **INTERNAL** Button.



Internal Memory

The **ESQ 1** holds 40 different Sounds, or "patches" in its **Internal Memory**. We refer to these Sounds as **Programs**. **Programs** can be selected using the **Master Bank** Button labeled **INTERNAL**, the four **Bank Select** Buttons, and the ten Buttons located directly above and below the Display. The **Internal Memory** retains its data even when the power is Off.

Cartridge Memory

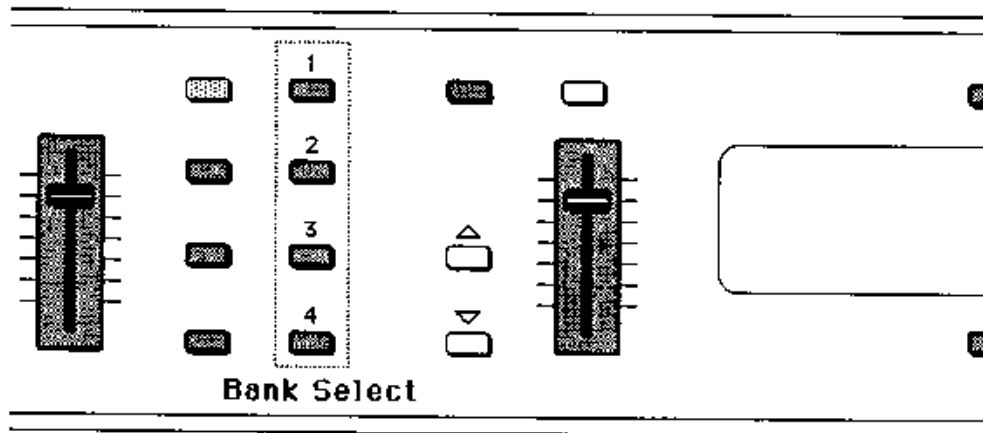
Before you can select the other two **Master Banks**, **CART A** and **CART B**, an **ENSONIQ E² PROM** Storage Cartridge must be inserted in the Cartridge slot. The procedures for playing, editing and saving Cartridge sounds are identical to those for Internal sounds. When a Cartridge has been inserted, all three **Master Banks** are instantly available.

The **E² PROM** Cartridge also retains its data when the power is Off, whether or not it is plugged into the **ESQ 1** Cartridge slot. When there is no Cartridge in the slot, pressing **CART A** or **CART B** will have no effect.

Bank Select Buttons

The four **Bank Select Buttons**, located to the right of the **Master Bank Buttons**, and labeled **1** through **4**, are used to call up the Programs in Memory, ten at a time, allowing you to then select the one you want to play.

Press **Bank Select Button #1**, and the Display shows you the names of the ten Programs in **Bank 1**. This is the **Program Select Page** for **Bank 1**. Press **Bank Select Button #2**, and the Display shows you the names of the ten Programs in **Bank 2**. And so on.



Selecting a Program -- INTERNAL

Now that you've selected one of the four Banks, you can see the names of the ten Programs in that Bank. Say you selected **Bank 1**. The Display should look like this:



Pressing the button above or below any of the ten Program names selects that Program as the current sound. Try selecting and playing a few different sounds. Notice that when you select a Program, its name is underlined.

The currently selected Program is always underlined.

Notice also that in the upper-left corner of the Display you will always find the **Page Name**, which corresponds to the name of the button (or buttons) you pressed to get to that Page. (In this case, **INT 1**, meaning **INTERNAL** Memory, Bank 1.)

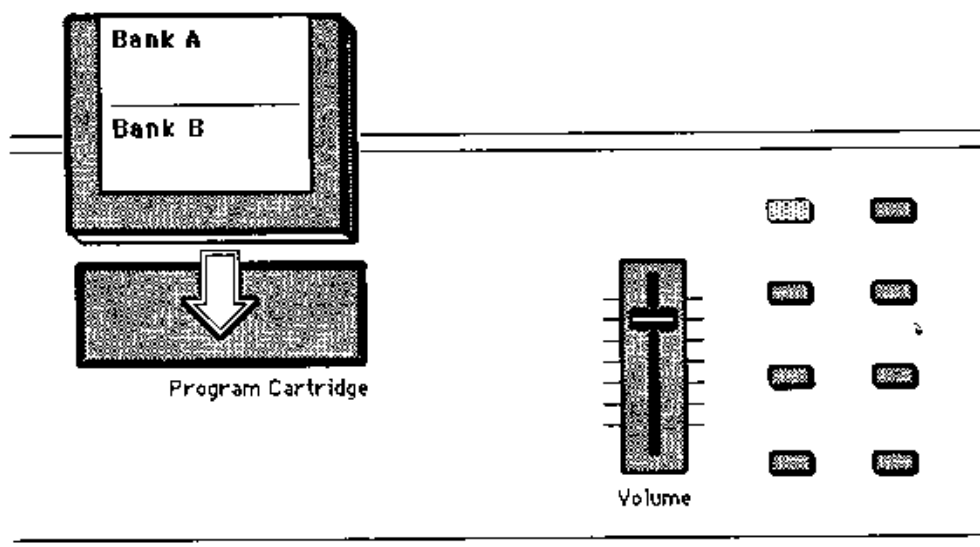
Press the other three **Bank Select Buttons #2, 3 and 4** to get to the other 30 Programs in the Internal Memory, and select them in the same way. Note that displaying a new Bank or Master Bank does not affect the selected Program. A new Program can only be selected by pressing one of the ten buttons above and below the Display.

To Select an Internal Sound:

- > Press **INTERNAL**.
- > Press **Bank Select #1, 2, 3, or 4**.
- > Select a **Program** by pressing the Button above or below a Program Name.

Selecting a Program -- Cartridge

First, insert an **ENSONIQ E² PROM** Storage Cartridge in the Cartridge Slot as shown below, with the label facing towards you.



Now follow the same procedure outlined above, except that instead of pressing **INTERNAL**, first press **CART A** or **CART B**.

To Select a Cartridge Sound:

- > Press **CART A** or **CART B**.
- > Press **Bank Select #1, 2, 3, or 4**.
- > Select a **Program** by pressing the Button above or below a Program Name.

Cartridge Insertion and Removal

The **E² PROM** Cartridge can be inserted or removed at any time (except while you're Writing Programs to it), even when the **ESQ 1**'s power is On, without doing any harm to the **ESQ 1** or the Cartridge. If the Cartridge is removed while a Cartridge Program is selected, the Display instantly switches to **Internal Bank #1**, and the Cartridge Sound disappears, replaced by the first sound in **Bank 1**, which becomes the selected Program.

Battery Maintenance

The reason that the **ESQ 1** "remembers" Programs and other parameters, even when the power is OFF, is that all of its Internal **RAM** (Random Access Memory) is "Battery Backed-up". (This includes the Sequencer Memory as well as all Program and "Global" parameters.) The Battery that keeps the **ESQ 1**'s Memory intact is located inside the **ESQ 1**, and when it becomes discharged, it must be replaced by an authorized **ENSONIQ** Repair Station.

The Battery that came in your **ESQ 1** is good for up to six years of life. You will know when it needs replacing, because the **ESQ 1** will tell you so. One day you will switch the Power ON, and instead of its usual wake-up message, the Display will read:

WARNING -- BATTERY VOLTAGE IS LOW
SAVE DATA AND CONSULT OWNERS MANUAL

When this message appears, you should make sure that all Programs and Sequencer Data are saved to tape, Cartridge or **Mirage**, and then take the **ESQ 1** to an authorized **ENSONIQ** Repair Station as soon as possible to have the Battery replaced.

Available Options

These optional accessories are available from your **ENSONIQ** dealer:

- > **ENSONIQ Model SW 1 Foot Switch** -- For Voice sustain or Starting and Stopping the Sequencer.
- > **Model STC-8 E² PROM Storage Cartridge** -- For Storing the Programs you create.
- > **Model STC-8A, STC-8B, etc. Program Cartridges** -- **ENSONIQ** will regularly release new versions of the **E² PROM** storage cartridge, each with 80 all new Factory- programmed Sounds.
- > **Model SQX-10 SEQUENCER EXPANDER Cartridge** -- To expand Sequencer Memory from 8k to 32k of **RAM**, or up to 10,000 notes.
- > **Model CVP-10 CV PEDAL** -- A Control Voltage Foot Pedal which can be assigned as a Modulator within the Voice section of the **ESQ 1**.

SECTION 2 -- PROGRAMMING THE ESQ 1

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ABOUT PAGE-DRIVEN PARAMETRIC PROGRAMMING

To modify or "edit" programs, the **ESQ 1** employs a method known as **Page-driven parametric programming**. Sounds scary, but don't worry. Once you've mastered a few basic concepts you'll find that programming the **ESQ 1** is really quite simple, given its enormous flexibility. You'll soon appreciate the ease and clarity with which it allows you to modify, or just keep track of, a great many variables.

Parametric programming

You may well have already encountered some form of **parametric programming** on other synthesizers. What this means is that instead of having a separate knob or Slider for each function, you have one master Data Entry Slider, and two buttons, which adjust the value of whichever parameter you select.

This approach has many advantages, the most obvious of which is that it greatly reduces the amount of hardware-- knobs, switches, faders, etc.-- needed to control a wide variety of functions. (If the **ESQ 1** had a separate control for each function, it would literally have hundreds of knobs.) The disadvantage has often been that you were only able to see the value of one parameter at a time, making it hard to keep track of things. This is where the Page concept comes in.

Pages

The **ESQ 1**'s 80 character fluorescent Display makes it possible to display information in **Pages**. For each function you select, the Display shows you its 'Page', which contains all the information (all the parameters) related to that function.

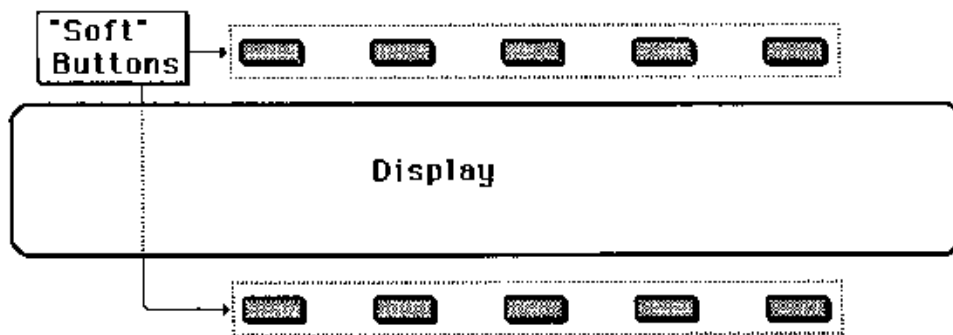
You can think of the **ESQ 1** in relation to a book -- each time you press one of the Programming buttons on the front panel, you are in effect "turning to" that function's **Page**. Once you have turned to the Page you want, the Display shows you which parameters are controlled from that Page. To activate a control, simply press the button directly above or below its name on the Display.

"Soft" Buttons

The ten Buttons above and below the Display thus have multiple functions -- what they select depends upon which Page is being displayed. Whenever you select a new Page, these ten Buttons serve to select whatever parameters are displayed on that Page.

We call these "**Soft**" Buttons, to distinguish them from buttons which have fixed, "**Hard**," functions, such as the **Bank Buttons**.

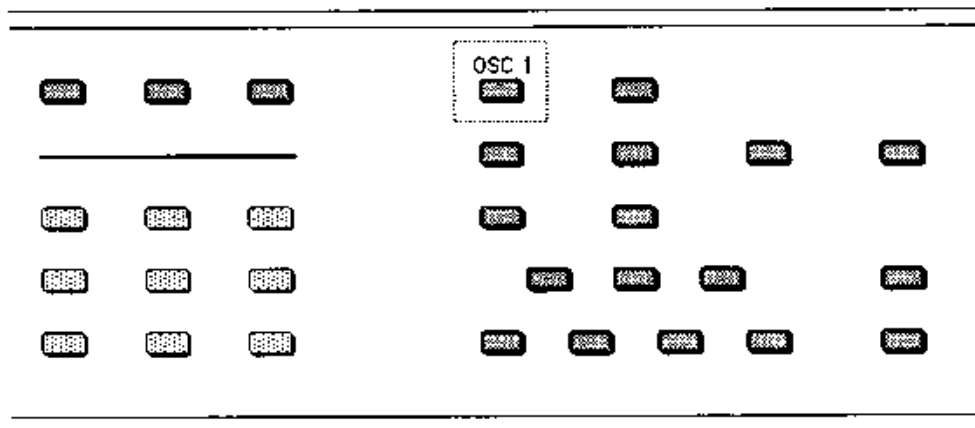
Not all "**Soft**" buttons are active on all Pages. Only those buttons related to a selectable parameter will be active on a given Page.



USING THE PROGRAMMER

Changing a Parameter

Suppose you want to adjust the pitch of **Oscillator 1**. Select the Program called **BASIC** in the Internal Memory. Now press the front panel Button labeled **OSC 1**:



The Display now shows **Oscillator 1's** Page. It looks like this:



In the top left-hand corner of the Display you will always find the Name of the Page, which corresponds to that of the button you pressed. To the right of that are the various parameters which can be selected and modified from this page.

To raise or lower the pitch of Oscillator 1 by an octave, press the button directly above where it says **OCT=**__. This segment of the Display will now be underlined, telling you that it has been **selected**, and can be modified.

The currently selected parameter on a Page is always underlined.

Now that you have selected a parameter to be modified (**OCT=**__), use the **Data Entry Slider** and/or the **Up and Down Arrow** buttons to the left of the Display to adjust its value. Moving the Slider will scroll quickly up and down through the available range of values. Pressing the **Up and Down Arrow** buttons will increase or decrease the value one step at a time.

To select and modify another parameter on the same Page, press the button above or below its name. That parameter will now be underlined, and its value can be adjusted as before, with the **Data Entry Slider** and the **Up and Down Arrow** buttons.

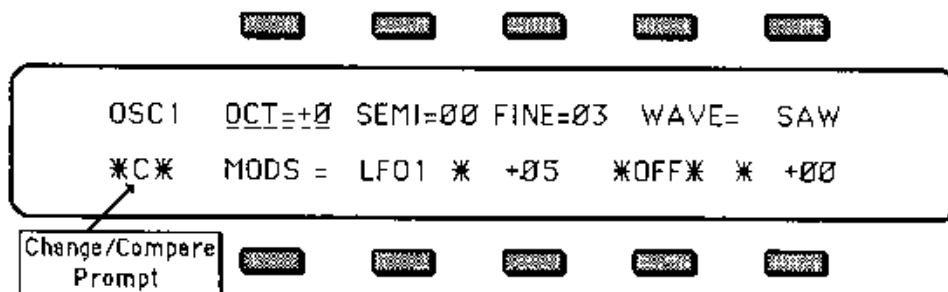
You'll notice that when changing Program parameters on the **ESQ 1**, you must **restrike** a key in order to hear the change. If you are **holding down** a key (or keys) when you change a parameter, you won't hear any difference until you release the key and play it (or any other key) again.

If you select another Page (**DCA 1** for instance), change some parameter on that Page, and then return to the **OSC 1** Page, the parameter you had last selected will still be underlined. The **ESQ 1** always "remembers" which parameter was last selected on a given Page, even when the power is turned off.

Be sure that the parameter you want to edit is selected before moving the **Data Entry Slider** or the **Up and Down Arrow** Buttons. Some parameter is always selected on any given Programming Page.

C -- Change/Compare

As soon as you change any parameter in a program, a ***C*** will appear in the lower left-hand corner of the Display, below the Page Name. It will remain there until you select another Program or save (Write) the newly edited Program into memory.



Once a parameter change of any kind has been made, the ***C*** prompt will appear

in the corner of **every** programming Page you select -- not just on the Page that has been modified. This is a constant reminder that something in the Program has been changed.

To hear the original, unchanged, Program, press the button labeled **COMPARE**. The *C* will disappear; you will hear the original sound and see the Page with its original settings. Press **COMPARE** again to return to your edited sound. You can toggle back and forth between the original and the edited sound as often as you like.

Edit Buffer

You can edit a Program, while keeping the original Program intact, because the edited version is kept in a special area of Memory called the **Edit Buffer**. Whenever you change any parameter of a Program, the altered Program is put in the **Edit Buffer**, replacing whatever was previously there. Only one Program at a time can reside there -- the **Edit Buffer** always contains the results of your last edit.

If you like the results of the changes you have made to a Program, you should rename it and save the new Program permanently, to another Location. The procedure for this is covered in **Section 3**.

When you press the **COMPARE** Button, what you are doing is alternating between the Program in the original Memory Location and the Program in the **Edit Buffer**. We refer to the Program in the **Edit Buffer** as the **Edit Program**.

You can return to the **Edit Program**, even after selecting another Program (as long as you don't change any parameters there) by pressing the **Compare** Button. This puts you back in the **Edit Buffer**, and any changes you make will affect the **Edit Program**.

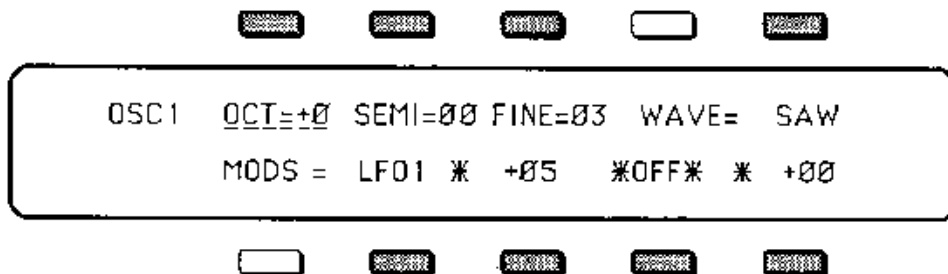
The rule of thumb is this: **Whatever Sound you hear, that's what you're editing.**

Bailing Out

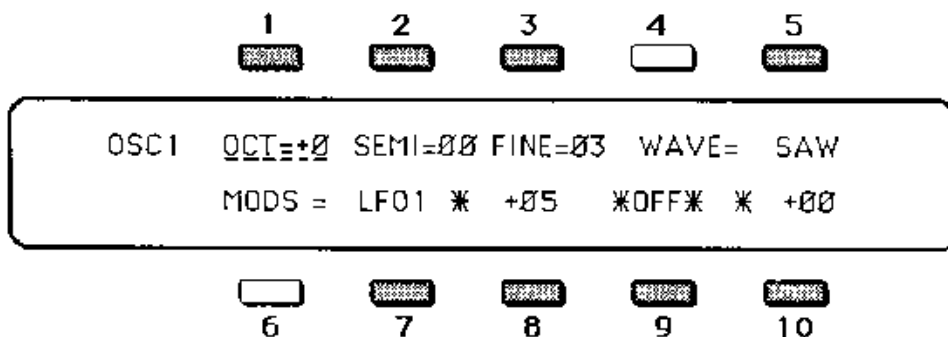
Should you decide, while editing a Program, that you're not happy with what you've done, and you want to start over with the original Program, just go to the proper **Program Select** Page and select the Program again. Then you can start editing the Program again from scratch. You will lose the one you were working on before.

Active and Inactive Buttons

As mentioned previously, not all buttons are active on a given Page. Throughout this Manual, whenever a Page is depicted, the active buttons will be shown in grey, the inactive ones in white. Taking the example used above, the **OSC 1** Page would appear like this:

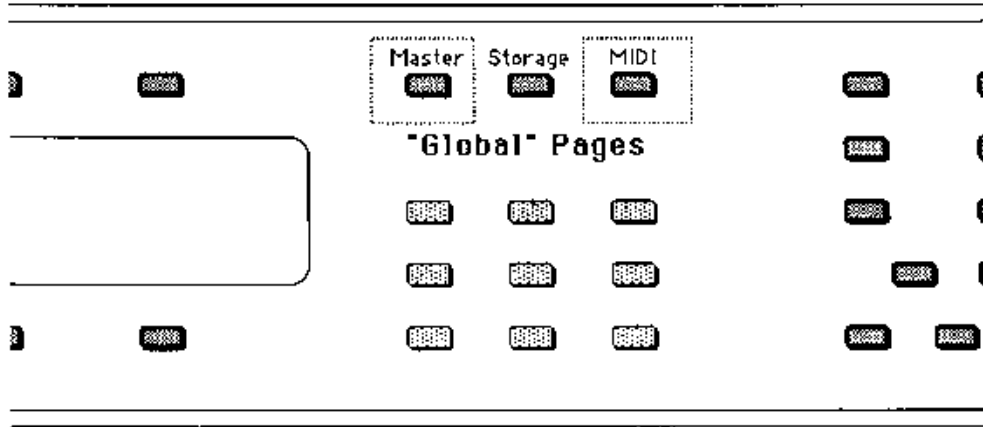


Also, for consistency's sake, these buttons will always be referred to by location number -- from upper left to lower right, **1** through **10**, as shown below:



So we see that on the **OSC 1** Page, Buttons number **1, 2, 3, 5, 7, 8, 9,** and **10** are active -- they can be pressed to select a parameter to be modified. Buttons **4** and **6** are inactive on this Page. Pressing them will have no effect.

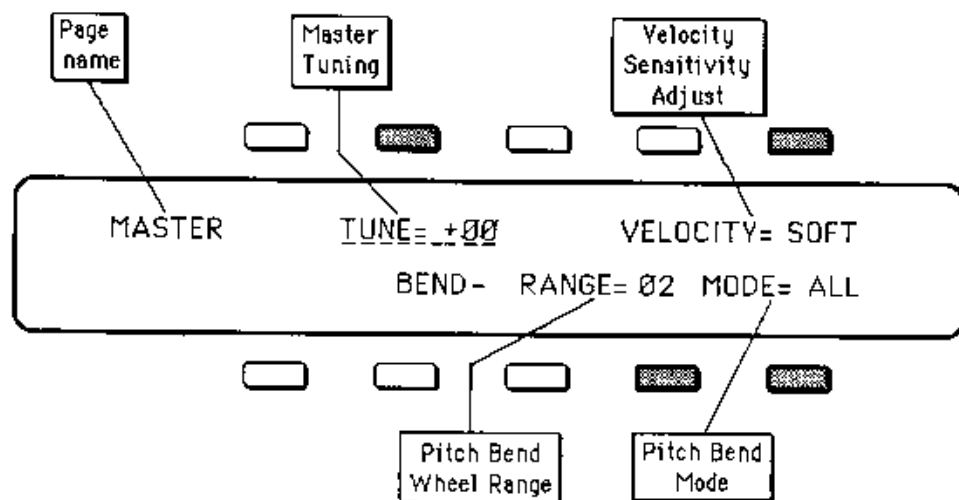
"GLOBAL" PAGES



The Parameters on the following Pages are Keyboard-wide, or "Global". Their settings will not change with different Programs, but will remain the same whichever Program is selected.

[MASTER] MASTER PAGE

Controls Keyboard Tuning, Velocity Sensitivity and Bend Range.



(Inactive Buttons appear in White)

The parameters on this page are keyboard-wide, or "Global." The settings here will not change with different Programs selected, but will remain in effect for whatever Program you are playing.

Aside from Master Tuning and overall Velocity Sensitivity, this page also contains a control for selecting between Pitch Bend Modes -- normal operation, where the Bend Wheel affects all notes; and a special "Held" mode in which the Bend Wheel only affects those keys which are being held down.

These settings, like all **ESQ 1** parameters, will be "remembered" even when the **ESQ 1** is turned OFF.

Use this Page to:

- 1) Adjust the **Master Tuning** of the keyboard;
- 2) Adjust the overall **Velocity Sensitivity** of the Instrument;
- 3) Set the **range** of the **Pitch Bend Wheel**; and
- 4) Select a **Pitch Bend Mode**.

[MASTER] MASTER PAGE (cont'd)

ACTIVE CONTROLS:

2. TUNE

Master Tune Adjust. Tunes the Keyboard to the desired Pitch. A setting of **TUNE= +00** will yield Concert A=440 tuning. The total range of this control is about a half step (semitone) up or down.

Range: -31 To +31.

5. VELOCITY

Velocity Sensitivity Adjust. This parameter determines the responsiveness of all Velocity-related parameters on the **ESQ 1**. You can adjust it to suit your own touch -- that is, how hard you play.

The three available settings are:

- > **SOFT** -- This is for someone with a light touch. On this setting, a minimum of force is required to reach the maximum level of any Velocity-controlled parameter.
- > **MED** -- Medium sensitivity. This setting should be right for the player with an average touch.
- > **HARD** -- This setting is for the player who really digs in. It provides the widest possible range of velocity sensitivity.

9. BEND RANGE

Pitch Bend Wheel Range. Adjusts how far the **Pitch Bend Wheel** will bend a note Up or Down. Each increment represents a Semitone.

Range: 0 To 12.

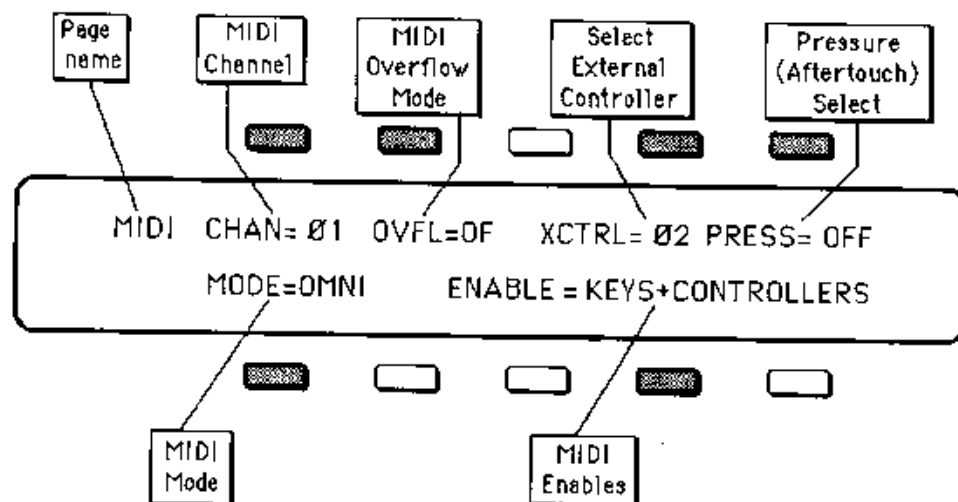
10. BEND MODE

Pitch Bend Wheel Mode. Selects between two modes of operation for the Pitch Bend Wheel. There are two Modes:

- > **ALL** -- Moving the Pitch Bend Wheel will affect the pitch of all notes that are being played. This is how most Pitch Wheels usually operate.
- > **HELD** -- In this Mode, only those keys that are being held down when you move the Pitch Wheel will be affected by the wheel. Keys that have been released will not bend, even if they are being sustained by holding down the Sustain Foot Switch. This enables you to bend certain notes while others remain unchanged in pitch. With a little practice you can simulate guitar and pedal steel-type techniques, and many other interesting effects.

[MIDI] MIDI PAGE

Controls MIDI Functions



(Inactive Buttons appear in White)

From this Page you control the **MIDI** (Musical Instrument Digital Interface) configuration of the **ESQ 1**. The MIDI implementation of the **ESQ 1** is a bit more involved than most synthesizers, because of its built-in Sequencer. In many ways, each Track of a Sequence acts like a separate little synthesizer. We need some way to distinguish between "Normal" Synth operation (which is what this half of the Manual is concerned with) and what happens when one of the Tracks of a Sequence is selected.

Accordingly, when no Sequencer Track is selected, we call this the "**Straight Synth**" mode. In "Straight Synth" operation, the keyboard is entirely independent of the Sequencer. You are automatically put in this mode whenever you select a Program in the usual way. Most of the time you are in the "Straight Synth" section of the **ESQ 1** -- you don't have to do anything special to get there. The only way to leave "Straight Synth" operation is to deliberately select one of the Tracks of a Sequence.

Use this Page to:

- 1) Select a MIDI Channel;
- 2) Turn On or Off the **MIDI Overflow Mode**;
- 3) Select an External Controller to be used as a Modulator;
- 4) Enable **Pressure** (Aftertouch) as an external MIDI Controller;
- 5) Select a MIDI Mode; and
- 6) Determine which types of information will be sent and received over MIDI by the **ESQ 1**.

ACTIVE CONTROLS:

1. CHAN -- Base MIDI Channel

We call this the **Base Channel**. It is the MIDI Channel that the "Straight Synth" section of **ESQ 1** will send and receive MIDI information on when no Sequencer Track is selected. When a Track is selected, that Track will receive on the Base Channel if the **ESQ 1** is in **POLY** Mode.

Any of the sixteen MIDI Channels may be selected. Range: **01 To 16**.

The **ESQ 1**'s "Straight Synth" section will always send MIDI information on the Base Channel, and only on this channel. Which Channel (or Channels) it receives on depends upon this setting and which MIDI Mode is selected (see #6 below).

2. OVFL -- MIDI Overflow Mode

MIDI Overflow Mode is a unique feature of the **ESQ 1** that allows two units connected together by MIDI to act like a single 16 Voice synthesizer.

When OFF: The **ESQ 1** will behave normally, sending out all enabled MIDI data.

When ON: The **ESQ 1** will send out no MIDI data until all eight Voices are playing, and another key is struck. At this point, instead of "stealing" a Voice to play the new note, it sends that note out over MIDI. It will continue sending notes out MIDI until there is an internal Voice available to play a note.

Note: Overflow Mode will work exactly the same way with any other synth set up to receive MIDI Data from the **ESQ 1**. However, the effect of a different synth, with a different patch, picking up and playing whenever the **ESQ 1** runs out of voices will be unpredictable at best.

4. XCTRL -- Select External Controller

One of the Modulators that can be selected in the Programming section of the **ESQ 1** is **XCTRL** -- External Controller. Each Controller on a Synthesizer (Breath Controller, MOD Wheel, or Pressure, for example) has a standardized MIDI number, which is the number you select here to make a particular Controller a Modulator in any of your Programs.

Suppose, for example, that you are driving the **ESQ 1** from a keyboard with a Breath Controller (or want to use Breath Controller as a Modulator when playing the **ESQ 1** Keyboard). You can set up a Program on the **ESQ 1** where the **Filter Cutoff Frequency**, or some other Manual Level, is modulated by **XCTRL**. Then assign this parameter a value of **XCTRL= 02**. The Breath Controller will now modulate the **Filter**, or whatever, on this Program. The chart on the next page lists the accepted MIDI Controller numbers.

[MIDI] MIDI PAGE (Cont'd)

The following Controller Numbers have been agreed upon:

Number	Controller	Number	Controller
1	Modulation Wheel	66	Sostenuto Pedal
2	Breath Controller	92	Tremelo
4	Foot Pedal Controller	93	Chorus
6	Data Entry Slider	94	Celeste
7	Volume Pedal	95	Phaser

Though the range of this Control is from **01** to **95**, most of the values other than those listed above have no accepted function, as yet. They are there to accommodate future MIDI standards.

5. PRESS -- Pressure (Aftertouch) Select

Pressure (also called Aftertouch) is available as a Modulator on many synthesizers and Keyboard Controllers. The **ESQ 1**, and its Sequencer, can receive Pressure via MIDI from those keyboards which send it. There are two types of Pressure -- **Channel Pressure** and **Key Pressure**. This control has three possible states:

- > **PRESS=OFF** -- The **ESQ 1** will not receive any Pressure information. All such information will be ignored.
- > **PRESS=CHAN** -- This enables the **ESQ 1** to receive the most common type of Pressure -- **Channel Pressure**. With Channel Pressure, after a note is played, pressing down harder on the key modulates every note currently playing. Like a MOD Wheel, Channel Pressure is "Global" -- it affects the entire keyboard when activated.
- > **PRESS=KEY** -- This enables the **ESQ 1** to receive another type of Pressure -- **Key Pressure**. Key Pressure (also called Polyphonic Pressure) only modulates the note that is pressed -- all others remain unmodulated.

You should consult the Manual of the MIDI instrument you will be using in conjunction with the **ESQ 1** and its Sequencer, to see which, if any, type of Pressure it has.

6. MODE -- Select MIDI Mode

The **MIDI Mode** determines how MIDI information will be received by the **ESQ 1** and its Sequencer. The MIDI Mode has no effect on what is sent -- The "Straight Synth" Section and eight Tracks of the Sequencer will always send on their selected MIDI channels. There are four MIDI Modes that can be selected here:

[MIDI] MIDI PAGE (Cont'd)

- > **OMNI** -- In **OMNI Mode** the "Straight Synth" section of the **ESQ 1** will receive on any of the sixteen MIDI channels, when no Track is selected. If one of the eight Tracks of a Sequence is selected, then the Track will receive any enabled MIDI data on any channel.
- > **POLY** -- In **POLY Mode** the "Straight Synth" section of the **ESQ 1** will receive only on the **Base MIDI** channel (see #1 above). Midi information on all other channels will be ignored. If any of the eight Tracks of a Sequence is selected, then the Track will receive incoming MIDI data, only on the **Base** channel.
- > **MULTI** -- **MULTI Mode** is an **ENSONIQ** innovation which was specially designed to make optimal use of the **ESQ 1's** Sequencer. In **MULTI Mode** the "Straight Synth" section and each of the Sequencer's eight Tracks can send and receive MIDI information independently on a different MIDI Channel.

The "Straight Synth" will send and receive on the Base Channel selected on this Page (#1 above). Each Track of a Sequence will send and receive on its selected Channel (selected on the **Mix/ Midi** Page in the Sequencer Section).

Different MIDI Channels should be selected for each Track! If the same MIDI Channel is selected twice, priority is given first to the "Straight Synth" and then to the lowest numbered Track that shares the Channel. For example:

If MIDI Channel 1 is selected on this Page for the "Straight Synth", and Channel 1 is also selected for Tracks 1 and 3, the "Straight Synth" will receive on Channel 1, and Tracks 1 and 3 will receive nothing. Or:

If MIDI Channel 6 is selected for Tracks 2, 4, and 7, then Track 2 will receive on Channel 6, and Tracks 4 and 7 will receive nothing.

- > **MONO** -- Before **MULTI Mode** was developed, **MONO Mode** was about the only way to have a poly-timbral synthesizer. It is particularly useful for driving the **ESQ 1** from a Guitar Controller, or any other application where having up to eight independent, monophonic, Channels is desirable.

When **MONO Mode** is selected:

- 1) The "Straight Synth" section becomes Monophonic -- only one note will play at a time. Unlike the usual **Mono Mode** of the **ESQ 1**, in this state there is no Note Memory -- releasing one note does not retrigger another note which is being held.
- 2) The "Straight Synth" Section does not receive any MIDI information at all.
- 3) The **Base MIDI Channel** selected on this Page (#1 above) will be received by Track 1 of the Sequencer. Track 2 will receive on the next Channel, Track 3 on the next, and so on. The Base Channel cannot have a value greater than nine.

[MIDI] MIDI PAGE (Cont'd)

The chart below shows the MIDI channels that will be received by the eight Tracks, in **MONO Mode**, for the possible Base Channels:

If Base Channel =	1	2	3	4	5	6	7	8	9
Track 1 receives on	1	2	3	4	5	6	7	8	9
Track 2	"	2	3	4	5	6	7	8	9
Track 3	"	"	3	4	5	6	7	8	9
Track 4	"	"	"	4	5	6	7	8	9
Track 5	"	"	"	"	5	6	7	8	9
Track 6	"	"	"	"	"	6	7	8	9
Track 7	"	"	"	"	"	"	7	8	9
Track 8	"	"	"	"	"	"	"	8	9

- 4) The Base Channel Minus One becomes a global MIDI Channel for Controllers (Pitch bend, Pressure, MOD Wheel, etc.). For example, if the Base Channel is Chan. 3, any Controllers received on Chan. 2 will affect all the Tracks. If the Base Channel is Chan. 1, Chan. 16 becomes the Global Channel for Controllers.

1) ENABLE -- MIDI Enables

This parameter determines what kinds of MIDI information will be sent and received by the **ESQ-1**, including the receiving of MIDI Song Selects (see p. 169). There are five possible states for this parameter:

- > **KEY EVENTS ONLY** -- In this state the **ESQ 1** will send and receive only notes that are played on the Keyboard, along with Song Selects (Song Selects are always sent). Controllers (such as MOD Wheel, Pitch Bend, etc.), Program changes, and Parameter Changes will not be sent or received. Song Selects will not be received.
- > **KEYS + CONTROLLERS** -- Key Events and Controllers only will be received. Parameter Changes and Song Selects will be sent, but not received. Program changes will not be sent or received.
- > **KEYS + CT + PROG CHNG** -- Key Events, Controllers, and Program Changes will be sent and received in this Mode. This means that changing Programs on the **ESQ 1** will instruct a slave unit to change to the same numbered Program; or, if the **ESQ 1** is being driven by another keyboard, Program changes made on that keyboard will cause the **ESQ 1** to change to the same-numbered Program. Again, Parameter Changes and Song Selects are sent but not received.
- > **KEYS + CT + PC + SNGSL** -- Same as **KEYS + CT + PROG CHNG** above, with the addition that MIDI Song Select messages will also be received. Key Events, Controllers, Program Changes and Song Selects will be sent and received in this Mode.
- > **KEYS + CT + PC + SS + SX** -- Key Events, Controllers, Program Changes, Song Selects and System Exclusive messages will all be received via MIDI in this Mode. This enables the **ESQ 1** to receive System Exclusive messages, such as Parameter Changes, Program Dumps, Sequencer Data, etc. Any Parameter (Program or Global) that is changed on the **ESQ 1** will also be changed on another **ESQ 1** connected to the first by MIDI.

WAVEFORMS

Digital Waveform Memory

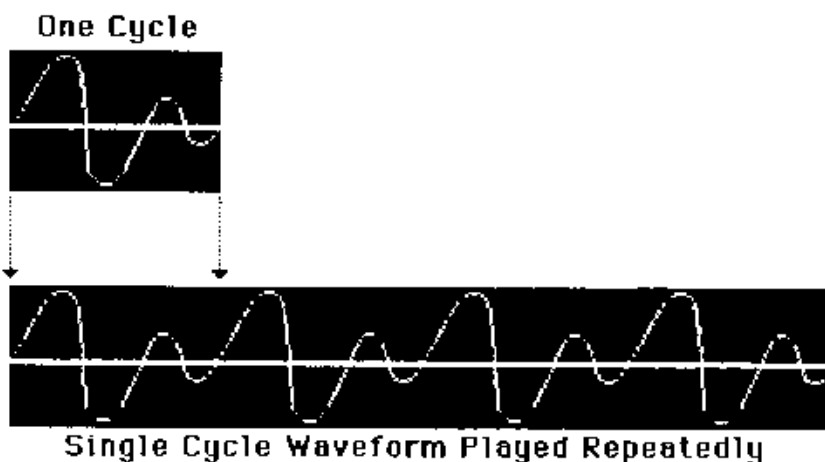
The same Digital technology that allowed the **ENSONIQ Mirage** to make Digital Sampling affordable gives the **ESQ 1** its ability to play complex sounds from "the real world". The **ESQ 1's** three Digital Oscillators, rather than just producing simple sawtooth or square waves, actually "read" from memory whichever Waveforms they are instructed to play.

The **ESQ 1** has 32 different **Waveforms** stored in its **Digital Waveform Memory**. Some of these Waveforms have been sampled (digitally recorded) from real musical sources; others have been created synthetically.

What's a Waveform?

The Waveforms are the "raw material" of the sounds that the **ESQ 1** makes. A waveform is a single cycle of a sound wave. It is Digitized, or converted into a series of numbers, and stored in the **ESQ 1's Digital Waveform Memory**. When you play a note, each of the **ESQ 1's** three Oscillators "reads" the proper Waveform from the Memory, similar to the way a Compact Disc player reads the music on the disc when you play a CD.

By rapidly repeating this single cycle over and over, the Oscillator can produce a pitched sound which becomes a continuous Sound wave.



Unlike the sounds generated by analog oscillators, Digital Waveforms can be very complex, and can contain any combination of harmonics -- frequencies that are multiples of the wave's fundamental frequency. Every Waveform has its own unique **Spectrum**, which is the number and amplitude of harmonics present in the Wave. It is this Spectrum which gives every sound its own identifiable characteristics.

Synthetic Waveforms

Most of the Waveforms in **ESQ 1**' Digital Waveform Memory have been generated synthetically, using a number of different techniques, to create a variety of Waves which contain specific harmonics in specific amounts. By assigning different combinations of these synthetic Waveforms to the three Oscillators, it is possible to create sounds with almost any timbral characteristics.

Sampled and Multisampled Waveforms

Other Waveforms are sampled -- a single cycle of a sound wave from some real musical source has been isolated and stored in Memory. By playing back these Waveforms in the manner described above, it is possible to synthesize sounds that capture the character of the Source instrument in a way that no ordinary synthesizer can.

Some of the **ESQ 1**'s Waveforms (such as the Piano Waveform) have been **Multisampled** -- that is, different waves play in different ranges of the instrument. This is because many sounds lose their realism if they are transposed too far from their source. The lowest note on a piano, if transposed up three octaves, doesn't sound like a piano any more. Neither does the highest note transposed down three octaves. Or to use another example -- take a recording of a human voice and play it back twice as fast. Does it sound like a human voice? No. What does it sound like? Chipmunks.

Multisampling means that the low notes of the Piano Waveform were sampled from a low note on the piano, the middle notes were sampled from a middle note, and so on. So really you get more than 32 Waveforms, since some of them are actually made up of several Waveforms. You don't have to do anything special to use these **Multisampled Waveforms**. The **ESQ 1** treats each one as a single Waveform, and they are selected just like the others.

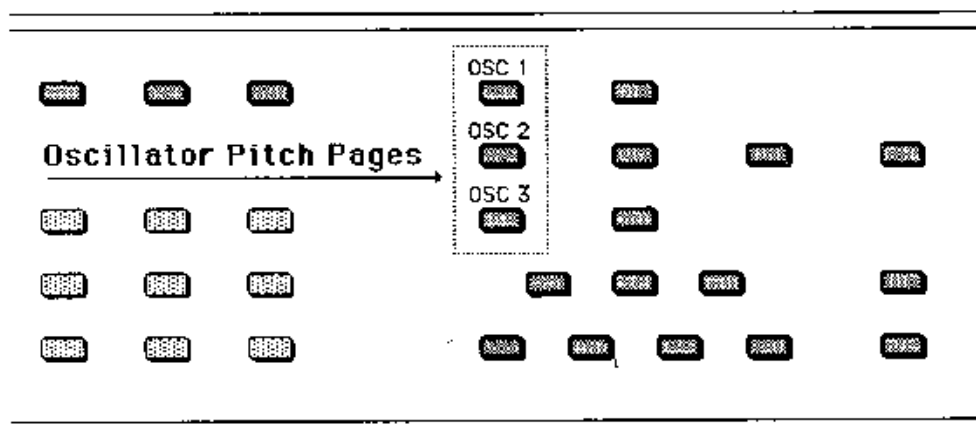
The Synthetic Waveforms can be combined with the Sampled ones, to add harmonic content which enhances the sound in some way. Any combination of Waveforms is possible, and each will have its own unique sound.

Names

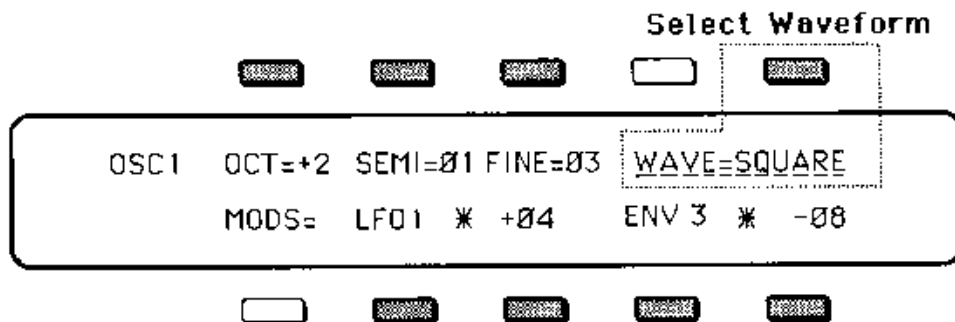
The **ESQ 1**'s 32 Waveforms are identified by their **Names**. In the case of the Sampled Waveforms especially, you should neither take them too literally, nor let yourself be limited by those Names. Don't, for example, expect the **VOICE** Waveform to always sound like Vocals -- everything depends on the Program (the Envelopes, the Filter settings, etc.). On the other hand, don't let the Names alone limit what you try in terms of being creative. For example, if you find that within a certain Program the **BASS** Waveform sounds like a harpsichord, or a kazoo, or whatever, go with it. Your ears are the only valid judge of what works.

Selecting a Waveform

Each of the three Oscillators can play a different Waveform within a Program. The Waveforms are selected from the **Oscillator Pitch Pages** [**OSC1**, **OSC2** and **OSC3**].



To select a Waveform for **Oscillator 1**, press the Button labeled **OSC 1**. The Display shows you **Oscillator 1's** Page. In the upper right portion of the Page you find the **Waveform** select.



Press the "Soft" Button above the **WAVE NAME**. Now you can use the **Data Entry Slider** and the **Up and Down Arrow** Buttons to change the Waveform that **OSC 1** will play. There are 32 available choices, each with its own Name. Follow the same procedure to select a Waveform for **OSC 2** and **OSC 3**. The following section details each Waveform by Name.

Check Them Out

The best way to understand the Waveforms is not to read about them, but to hear them. Select the Internal Program called **BASIC**. This Program has only one Oscillator playing, and all the Envelopes wide open. Select the **OSC 1** Page as shown above, and select **WAVE**. The Sawtooth Wave is selected (**WAVE= SAW**).

While repeatedly playing a note or chord, press the **Up Arrow Button** to step to the next **Waveform**. Press it again to hear the next one, and so on. In this way you can listen to each **Waveform** in succession, compare them to each other, and compare the timbral characteristics you hear in various ones to their text descriptions below. When you are looking for the right **Waveform** for a particular application, let your ears be the guide.

The Waveforms

1) CLASSIC SYNTH WAVEFORMS

These **Waveforms** collectively form the bases of almost all classic Analog synthesizer sounds. Their inclusion here gives the **ESQ 1** its ability to make those sounds with the best of them.

- > **SAW -- SAWTOOTH.** The Sawtooth Wave needs no introduction. It contains all the harmonics, and is extremely bright. The Sawtooth is the basis for many Analog sounds, notably Strings and Brass.
- > **BELL.** The Bell Waveform contains many widely spaced harmonics, many of them odd harmonics. It makes bright, Bell sounds.
- > **SINE.** The Sine Wave contains only the Fundamental, with no higher harmonics. It has very pure tone, good for flutes, organs, etc.
- > **SQUARE.** The Square Wave contains the Fundamental and all its odd-numbered harmonics at a fixed ratio. The level of the harmonics is the same as the Sawtooth, except that there are no even-numbered harmonics. The Square Wave has a hollow sound, and is also the basis for many classic synth sounds.
- > **PULSE.** This Pulse Wave contains the Fundamental and all its integral harmonics at equal amplitude. This is a very bright Waveform.
- > **NOISE 1.** This is a Waveform taken from filtered Noise. It works best when tuned down low (**OCT= -3**). (Note that the Noise Waveforms here differ from analog Noise generators, in that Waveforms are by definition repeating patterns, and Noise is random.)
- > **NOISE 2.** This is very close to White Noise. It has almost no pitch, but modulating the Oscillator playing this Waveform with a fast LFO or an Envelope, will eliminate what pitch tracking there is.
- > **NOISE 3.** This Waveform is good for putting random frequency components into a sound (the attack "ping" of a mallet instrument, for example). It has a clangorous, metallic quality, and its pitch tends to be unpredictable.

2) SAMPLED WAVEFORMS

The **Sampled Waveforms** contain harmonics that simply cannot be generated

by an ordinary synthesizer, since every musical source produces its own unique waveshapes and Frequency Spectrum.

- > **BASS.** This is a bright Bass Waveform, full of interesting harmonics, which, depending on the Program, makes a great regular or synth-type Bass. Higher up it takes on a Clav-like character,
- > **PIANO.** A multisampled acoustic Piano wave. Its best range is **OCT= -1.**
- > **EL PNO -- ELECTRIC PIANO.** A Waveform taken from a popular Electric Piano -- allows you to recreate this instrument with tremendous realism.
- > **VOICE 1.** A multisampled Vocal wave, saying "Ah".
- > **VOICE 2.** A multisampled Vocal wave, using the same waveforms as **VOICE 1,** but with a higher split point for each Wave
- > **KICK.** This Waveform is optimized for one application. Tuned to **OCT= -3,** properly enveloped, and played on the lowest key of the Keyboard, it reproduces a Kick drum.
- > **REED.** One cycle from an Alto saxophone wave. With different Programs it can sound like different Reed Instruments.
- > **ORGAN.** This Waveform contains the fundamental and four Octaves (2nd, 4th, 8th, 16th and 32nd harmonics). Instant Pipe Organ. Also good for Bells.

3) ADDITIVE SYNTHESIS WAVEFORMS

These three Waveforms were created through Digital Additive Synthesis. Each contains the Fundamental and certain specific harmonics in equal amounts.

- > **SYNTH 1.** Contains the fundamental, and every third harmonic, starting from the 2nd, up to the 26th, in equal amounts:
Harmonics: 1, 2, 5, 8, 11, 14, 17, 20, 23, 26.
- > **SYNTH 2.** Contains the fundamental, and every third harmonic, starting from the 4th, up to the 25th, in equal amounts:
Harmonics: 1, 4, 7, 10, 13, 16, 19, 22, 25.
- > **SYNTH 3.** Contains the fundamental, and the prime-numbered harmonics, up to the 23rd, in equal amounts:
Harmonics: 1, 2, 3, 5, 7, 11, 13, 17, 19, 23.

4) FORMANTS

These five Waveforms were created through a process called Time-Domain Formant-Wave-Function Synthesis. Each one has a sharp peak in its frequency spectrum -- like pushing one band of a graphic equalizer all the way up. These

Waves are multisampled in such a way that the frequency peak remains relatively constant up and down the keyboard, rather than tracking the pitch of the note. Each has its peak centered around a different frequency. They tend to have a nasal quality, and make excellent component waveforms for Vocals, Strings etc.

- > **FORMT 1.** Has a frequency peak centered around 750 hz.
- > **FORMT 2.** Has a frequency peak centered around 1 khz.
- > **FORMT 3.** Has a frequency peak centered around 1.4 khz.
- > **FORMT 4.** Has a frequency peak centered around 1.75 khz.
- > **FORMT 5.** Has a frequency peak centered around 2.25 khz.

5) **BAND LIMITED WAVEFORMS**

These Waveforms are Band Limited -- that is, their harmonic content has been restricted along certain specific lines. They are good for adding controlled harmonics to a sound, or for combining to achieve various timbres. Some are other Waves with some harmonics pulled out; some were built "from scratch" to contain only certain harmonics.

- > **PULSE2.** Originally a Pulse Wave, like the Pulse Wave above, but with only the first 11 harmonics left in.
- > **SQR 2.** Originally a Square Wave, but with only the first 7 harmonics left in.
- > **4 OCTS.** Contains, in equal amounts, only four harmonics -- 1st, 2nd, 4th, 8th. Fundamental and three Octaves; again, good for Organ sounds.
- > **PRIME.** Contains, in equal amounts, only the first five prime-numbered harmonics: 1st, 3rd, 5th, 7th, and 11th.
- > **BASS 2.** Originally the Bass Wave, but with only the first eighteen harmonics left in.
- > **E PNO2.** Originally an Electric Piano Wave, but with only the first nine harmonics left in. An Electric Piano without the "ping."
- > **OCTAVE.** Contains only the 1st and 2nd harmonics in equal amounts -- the Fundamental and one Octave.
- > **OCT+5.** Contains only the 1st, 2nd, and 3rd harmonics in equal amounts -- the Fundamental, one Octave and the Fifth above the octave.

MODULATORS

About Modulation

To **modulate** something is simply to cause it to change. Within the Voice architecture of the **ESQ 1** we begin by setting basic, or Manual, levels for Volume, Pitch, Brightness, etc., and we then **modulate** those levels in various ways in order to create movement and dynamics within the Sound.

Suppose you switch on your stereo, and turn the volume half way up. We can call this the Manual Volume setting. It will stay at that level until it's changed. Now suppose that you take the Volume knob and begin quickly turning it up and down, so the volume gets continuously louder and softer, louder and softer. What you would be doing is **modulating the volume** of your stereo. If you were to take the Treble control, and do the same to that knob, you would be **modulating the brightness** of your stereo.

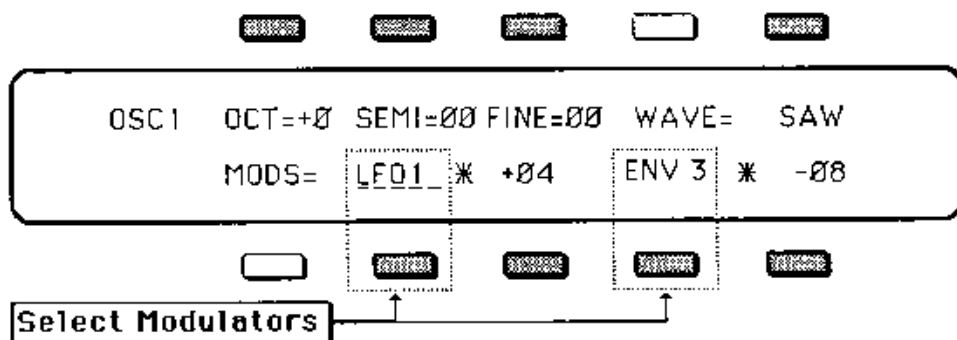
In much the same way we modulate various levels within the **ESQ 1** (though generally the approach is *less haphazard*). There are 15 different **Modulation Sources** available, and they can each be independently assigned to vary the Manual levels for:

- > The Pitch of each Oscillator [**OSC 1, OSC 2 and OSC 3**]
- > The Volume of each Oscillator [**DCA 1, DCA 2 and DCA 3**]
- > The **Filter Cutoff Frequency**, or the Brightness of the Program [**FILTER**]
- > The Depth of the **Low Frequency Oscillators** [**LFO 1, LFO 2 and LFO 3**]
- and
- > Panning the Program within the stereo mix [**DCA 4**] Page

The Final Volume of the Program [**DCA 4**] is a special case -- it is always controlled by **Envelope 4**, which is fixed as its Modulator.

Selecting a Modulator

On each of the **Oscillator Pitch Pages**, [**OSC 1, OSC 2 and OSC 3**], the **Oscillator Volume Pages**, [**DCA 1, DCA 2 and DCA 3**], and the **FILTER** Page, you can select two different Modulators. The format is similar for all these Pages -- the controls on the bottom row of the Page are used to Modulate the Levels set on the top row. Take for example the **OSC 1** Page:



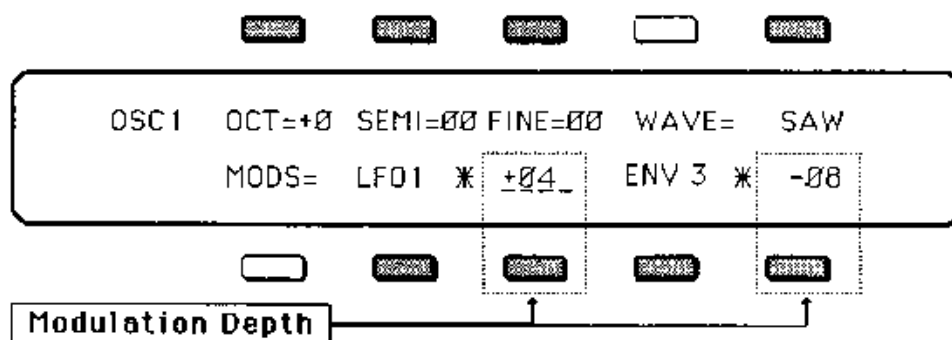
To select a **Modulator** (or **Modulators**) for the pitch of **Oscillator 1**, first press the **OSC 1 Button**, then press either of the **Select Modulator "Soft" Buttons** on the Display, as pictured above. Use the **Data Entry Slider** and the **Up and Down Arrow Buttons** to select from among the 15 available Modulation Sources. Follow the same procedure to select Modulators on the other Pages listed above.

For Modulating Program **Pan [DCA 4 Page]** and **LFO depth [LFO 1, LFO 2 and LFO 3 Pages]** only one Modulator can be selected.

*** * * * Helpful Hint:** Moving the **Data Entry Slider** all the way up selects ***OFF***, which is handy if you don't want a Modulator applied in a particular location.

Modulation Depth

Once you have selected a Modulator, use the control immediately to its right to adjust the **Modulation Depth**, or the amount by which the Modulator will affect the Manual Level.



Press the appropriate "Soft" Button, as shown above, and use the **Data Entry Slider** and the **Up and Down Arrow** Buttons to adjust the Modulation Depth. Modulation Depth can be Positive or Negative. A Modulation Depth of +00 has the same effect as turning the Modulator ***OFF***.

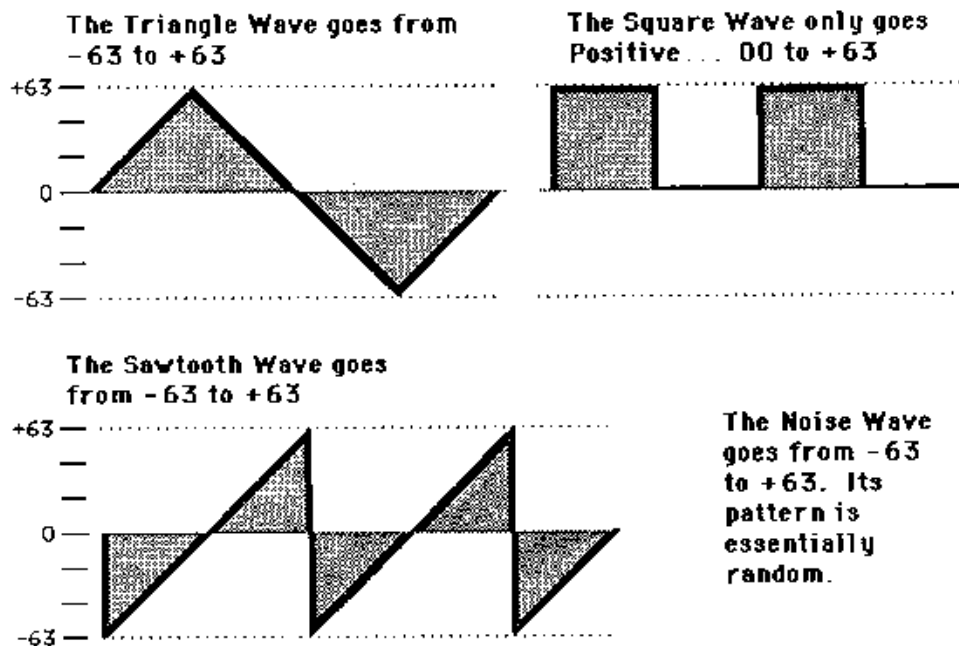
*** * * * Helpful Hint:** With Modulation Depth, as with all Parameter values that have a center value (in this case, +00), there is an easy way to reach that value. With the Modulation Depth selected, press the **Down Arrow** Button, and while holding it down, press the **Up Arrow** Button. This automatically sets the Modulation Depth to +00.

Modulation Sources

The 15 **Modulation Sources** available on the **ESQ 1** are as follows:

-----> **LFO 1, LFO 2 and LFO 3**

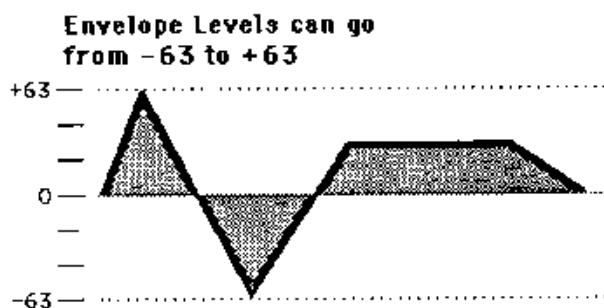
The three **Low Frequency Oscillators** generate only very low frequency waves, which can produce Vibrato, Tremelo, and many other effects, depending on the **LFO** wave selected, and where it is applied as a Modulator. There are four possible waveshapes for each **LFO**. The Square wave only goes in a positive direction; the Triangle, Sawtooth and Noise Waves go positive and negative. (Though negative Modulation depth will reverse the effect.) The Diagrams below show the maximum levels for each LFO waveshape.



See the **LFO Page** (p. 50) for a complete discussion of the LFO's.

-----> **ENV 1, ENV 2, ENV 3 and ENV 4**

The **ESQ 1** has four complex **Envelopes** which can be applied as Modulators. Envelope Levels can be positive or negative.



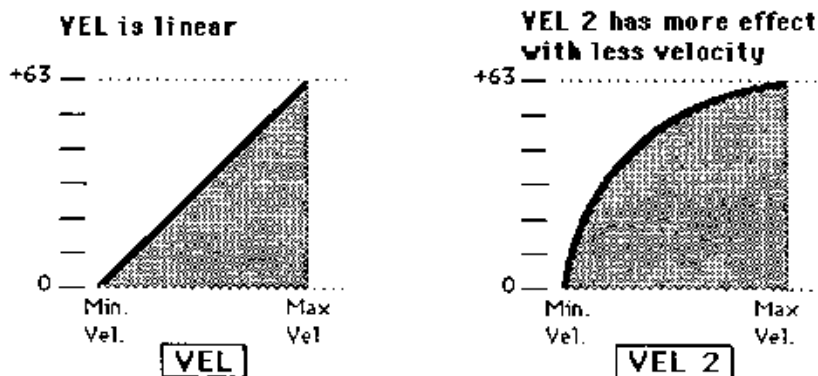
A comprehensive discussion of the **ESQ 1 Envelopes** follows in the Section entitled **Understanding the Envelopes**, p. 53.

----> **VEL -- Velocity**

Velocity means how hard you strike a key. Selecting **VEL** as a Modulator allows you to modulate any Manual Level with Velocity. Velocity as a Modulation Source only goes positive (though again, assigning a negative Modulation depth will make the net result be to decrease a Manual Level with Velocity). **VEL** is velocity with a straight linear curve.

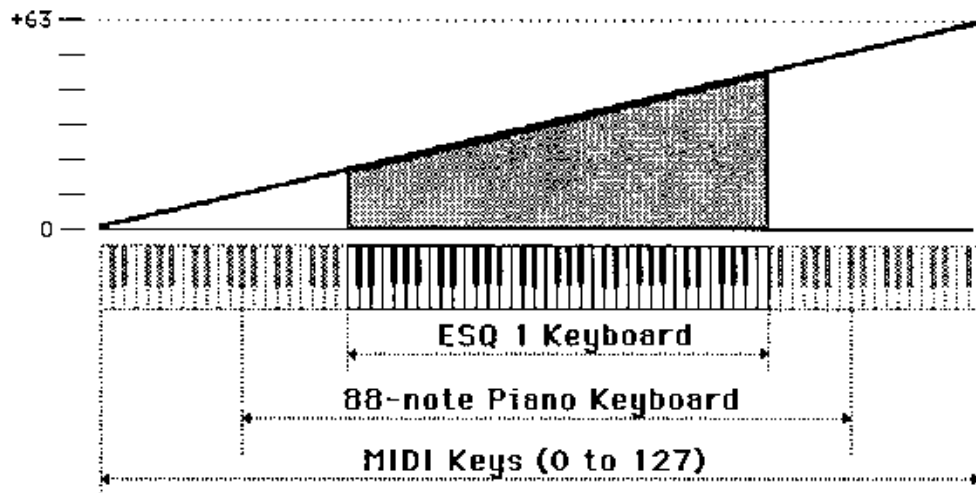
----> **VEL 2**

This is Velocity with a different Curve. Where the effect of **VEL** is linear, **VEL 2** reaches the top end of the Modulation range quicker, with less velocity, and after that the curve levels off. The illustration below shows the difference between **VEL** and **VEL 2**.



----> **KYBD -- Keyboard "Control Voltage"**

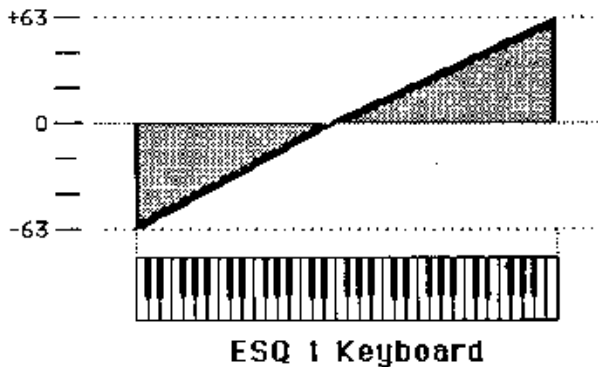
Uses the position of a note on the Keyboard as a Modulator. The scaling effect of this Modulator is figured from MIDI key 0 to MIDI key 127.



As the above illustration shows, the effect of **KYBD** is only positive-going (though a negative Modulation depth will reverse the effect). Since scaling starts from MIDI key 0, there will always be some effect on the **ESQ 1** keyboard, even on the lowest note. Manual Levels should be adjusted accordingly.

----> **KYBD 2**

Another way to modulate any Manual Level with the position of a note on the Keyboard, **KYBD 2** employs a different curve. **KYBD 2** goes negative as well as positive and, unlike **KYBD**, has its full effect over the **ESQ 1**'s Keyboard.



As the above illustration shows, the effect of **KYBD 2** is to reduce the Manual Level on notes below the break point (E above Middle C), and increase levels above that point. Negative Modulation depths will do the opposite.

----> **WHEEL -- Modulation Wheel**

The MOD Wheel to the left of the Keyboard is assignable wherever a Modulator is selected. To use the MOD Wheel for Vibrato (one common application) **WHEEL** must be assigned to modulate the LFO that is modulating Oscillator Pitch. The MOD Wheel's effect is positive-going only, from 0 (Wheel towards you) to +63 (Wheel away from you). Negative Modulation depths will reverse the effect.

----> **PEDAL -- Voltage Control Foot Pedal**

This selects the **SW-10** Foot Pedal, which can be plugged into the **CV/Pedal** Jack on the **ESQ 1**'s rear panel, as a Modulator. Its effect will be the same as that of the MOD Wheel. The Pedal makes an excellent alternative to the MOD Wheel when you wish to apply Modulation and both hands are full. It can be applied wherever a Modulator is selected.

----> **XCTRL -- External Controller (MIDI only)**

An External Controller such as a Breath Controller, Data Entry Slider, MOD Wheel, etc., which is received via MIDI from another synthesizer, can be assigned as a Modulator within your **ESQ 1** Programs. On the **MIDI** Page, you select the number of the External Controller that will be received by the **ESQ 1**.

You don't have to be playing the **ESQ 1** from an external instrument for this to work. For example, if you have a Keyboard with a Breath Controller; 1) Connect

its MIDI Out to the **ESQ 1's** MIDI In; **2)** Make sure both instruments have Controllers Enabled (**MIDI Page**); **3)** Select Breath Controller as the External Controller that will be received by the **ESQ 1** (**XCTRL=02**, also on the **MIDI Page**); **4)** assign **XCTRL** as a Modulator for Oscillator Volume, Filter Cutoff Frequency, or some other Manual level within a Program, as shown in the following Section; and **5)** Play the Sound from the **ESQ 1** keyboard, while blowing into the Breath Controller connected to the sending instrument. The Modulation will have the same effect as if you were playing from the sending instrument.

-----> **PRESS -- Pressure (Aftertouch) (MIDI only)**

Pressure, also called Aftertouch, is received by the **ESQ 1** and its Sequencer, and can be Programmed as a Modulator. A Control on the **MIDI Page** enables Pressure to be received, as well as determining which type will be received -- **Key** or **Channel Pressure**. (See p. 22.)

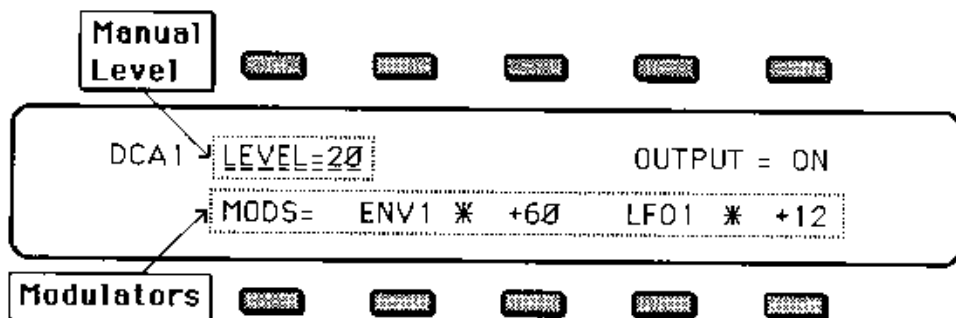
If you will be driving the **ESQ 1** from a synth which sends Pressure, you can assign Pressure as a Modulator within your **ESQ 1** Programs, just as you would the MOD Wheel, or the C.V.Pedal. Also the Sequencer will Record and Play back Pressure, if a Track is recorded from an external instrument which sends it. In either case, Pressure must be enabled on the **MIDI Page**.

USING MODULATORS

Modulating Oscillator Volume

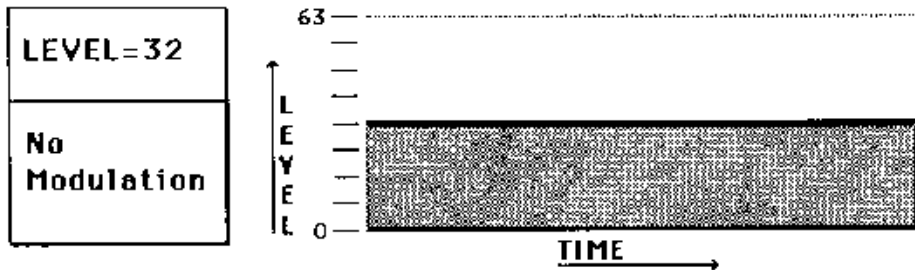
The Volume of each of the three Oscillators within a Program depends on a combination of two things:

- 1) the setting of the base, or Manual Level (the Control labeled **LEVEL=**__ on the **DCA 1**, **DCA 2** and **DCA 3** Pages), and
- 2) the effect of any **Modulators** applied on any of those Pages.

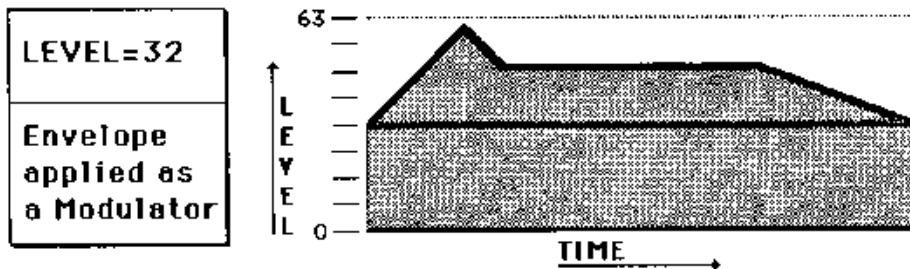


The Manual Level can be thought of as a **Volume Floor** :

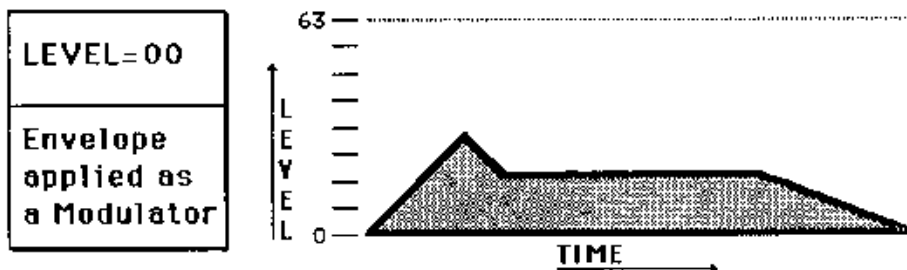
- > If this Level is set to some value greater than Zero for a given **DCA**, and no Modulators are applied, The Oscillator will play at that level as long as a key is held down.



- > If the Manual Level is set to some value greater than Zero, and a Modulator (in this case an Envelope) is selected and assigned a depth other than Zero, the effect of the Modulator will be added to (or subtracted from) the Manual Level.



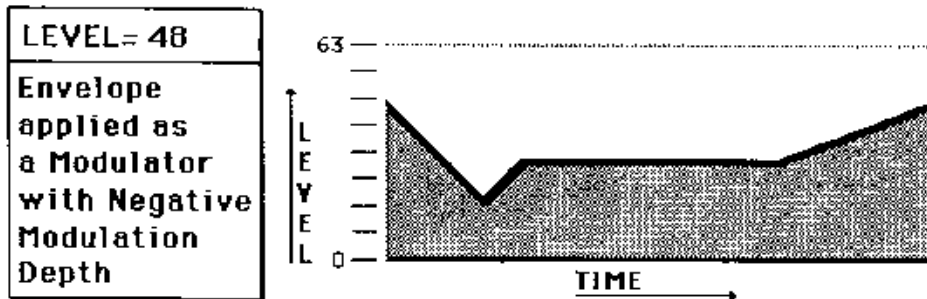
- > If the Manual Level is set to Zero, and a Modulator (the same Envelope) is selected and assigned a depth other than Zero, the depth of the Modulator alone will determine the Volume of the Oscillator.



Bear in mind that when you use an **Envelope** or an **LFO (Low Frequency Oscillator)** as a Modulator, the final effect will depend on the Modulation Depth and the Levels that are set for the Envelope or LFO on their respective Pages.

Negative Modulation

Modulation Depth can be Positive or Negative (ranging from **-63** to **+63**), making a great many interesting effects possible. If, for example, the Manual Level is set to **48**, and the same Envelope used in the previous examples is selected and assigned a Negative Modulation depth, the resulting Volume curve looks like this:

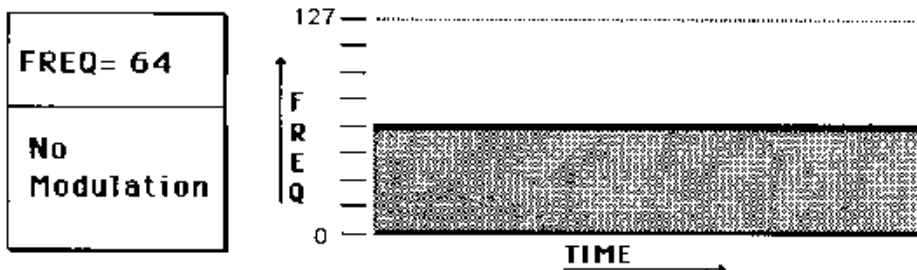


Modulating the Filter Cutoff Frequency

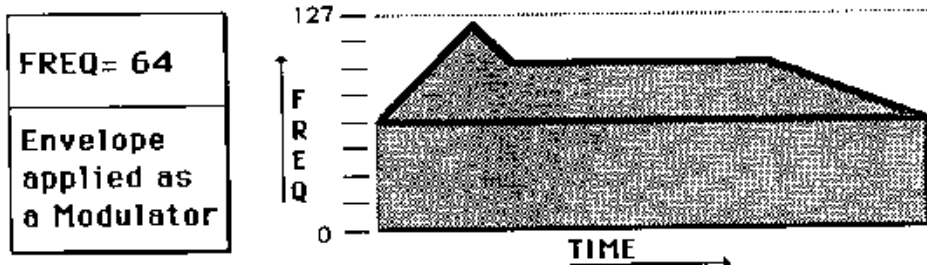
Like Oscillator Volume, the **Filter Cutoff Frequency**, or the Brightness contour of a Program, depends on a combination of two things:

- 1) the setting of the base, or Manual Level (the Control labeled **FREQ=**__ on the **FILTER** Page), and
- 2) the effect of any **Modulators** applied on that Page.

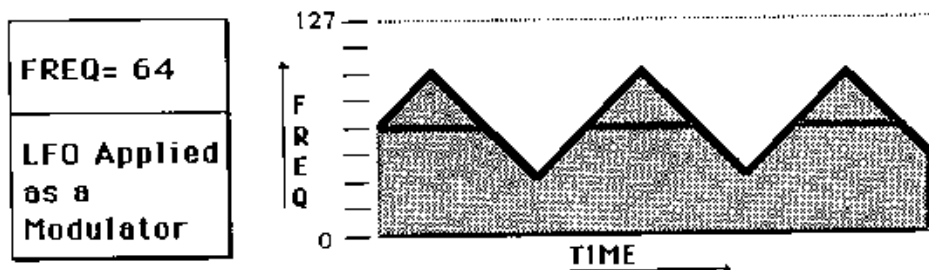
----> If we set the **Filter Cutoff Frequency** manually (by adjusting the parameter **FREQ =**__ on the **FILTER** Page) to a level of **64**, and turn all Modulators OFF, the Filter will open up to that level when a key is pressed, allowing frequencies below the Cutoff point to pass, and close down to Zero when the key is released.



- > If we select an Envelope as a Modulator on the **FILTER** Page and assign it a value greater than Zero, its effect will be added to the the Manual Level.



- > If, instead, we generate a Triangle-shape wave with one of the **LFOs (Low Frequency Oscillators)**, and apply that LFO wave as a Modulator on the **FILTER** Page, its effect will be added to the Manual Level, and the **Filter Cutoff Frequency** will rise and fall with the cycles of the LFO.



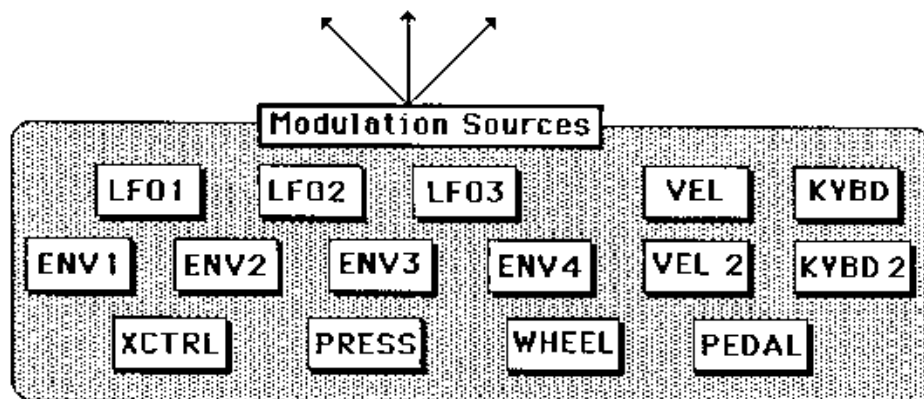
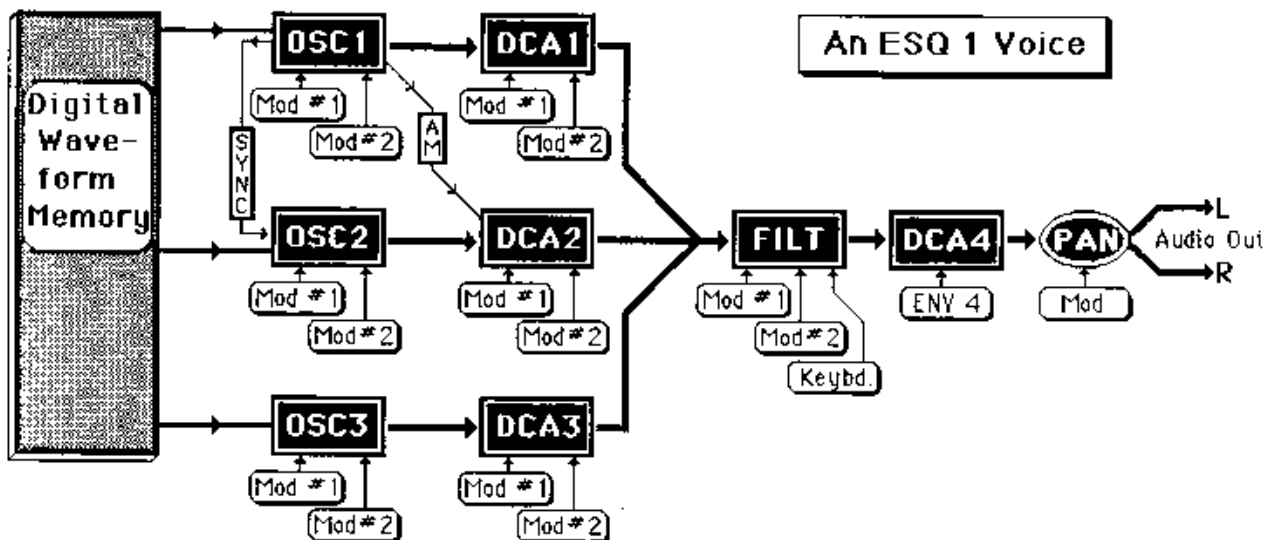
Of course, since two Modulators can be selected, you could apply both of these Modulators (or any other combination) to the **Filter Cutoff Frequency**, and their effect would be added together, and then added to the Manual Level.

As with Oscillator Volume, If the Manual Level on the **FILTER** Page is set to **FREQ= 00**, the **Filter Cutoff Frequency** will depend entirely on the depth and settings of any Modulators applied there.

Limits of Modulation

For all Modulation effects there is a maximum and a minimum range that cannot be exceeded. For example, if the **Filter Cutoff Frequency** is manually set to its maximum value [127], you will not be able to modulate the Frequency any higher, with an Envelope, LFO or other Modulator.

You cannot modulate an Oscillator's Output Level lower than Zero (silence). If a Modulator doesn't seem to be having any effect, check that the other Modulators and manual settings are at appropriate levels.

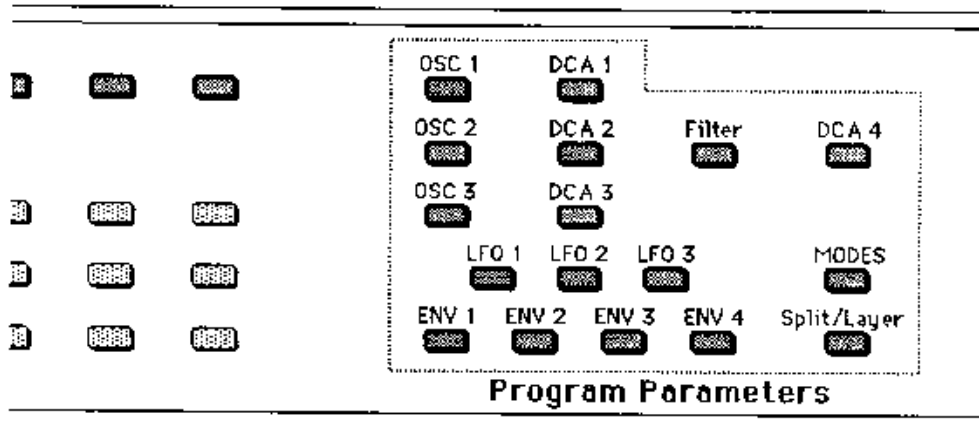


Any of these 15 Modulation Sources can be independently assigned wherever a MOD is indicated above.

For each of the ESQ 1's 8 Voices:

- Each Oscillator plays a Waveform from the Digital Waveform Memory;
- The output of each Oscillator passes through the same-numbered DCA (Digitally Controlled Amplifier);
- The output of the 3 DCA's passes through the Four-Pole Low-pass Filter;
- The output of the Filter goes to the Final DCA -- DCA 4;
- The output of DCA 4 goes to the Panner, which pans the Program between the Left and Right Audio Outputs.
- Wherever a **Mod** is indicated in the above diagram, any of the 15 available Modulators may be assigned to vary the "Manual" setting.

PROGRAMMING PAGES

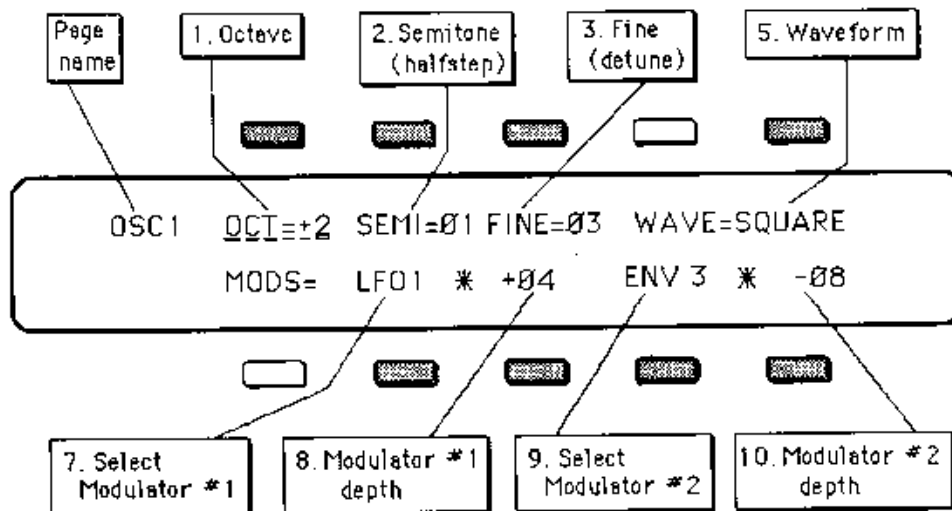


The **Page** descriptions in this Section encompass all the **Program Parameters** -- those Parameters which are saved with the individual Programs stored in the Memory of the **ESQ 1**.

In case you wish to make a written record of the settings for a particular Program, you will find a blank **Program Parameter Sheet** in the back of this Manual. **Feel free to photocopy this sheet and use the copies to record the Parameter settings.**

[OSC1] OSCILLATOR PITCH PAGE
[OSC2]
[OSC3]

Controls Oscillator pitch and selects the waveform to be played.



(Inactive Buttons appear in White)

The format of the **Oscillator Pitch Page** is the same for [OSC 1], [OSC 2] and [OSC 3], although each of these Pages is entirely independent.

Use these pages to:

- 1) Adjust the pitch of each Oscillator by octave, semitone, and fine increments;
- 2) Modulate the pitch of each Oscillator using any of the 15 available Modulation sources; and
- 3) Select the Waveform to be played by each Oscillator.

[OSC] OSCILLATOR PITCH PAGE (cont'd)

ACTIVE CONTROLS:

1. OCT

Adjusts the pitch of the Oscillator by octaves.

Range: -3 To +3.

2. SEMI

Adjusts the pitch of the Oscillator up by semitones (halfstep). Adjusting this control upwards beyond 11 automatically increases the **OCTAVE** by one.

Range: 0 To 11.

3. FINE

Adjusts the pitch of the Oscillator up by fine steps (detunes). Each step here is about 3 Cents (hundredths of a semitone).

Range: 0 To 31.

5. WAVE

Selects the **Waveform** that the Oscillator will play from among the 32 available Waveforms. (See **WAVEFORMS**, p. 25.)

7. MOD # 1

Selects the first source of Modulation. The Modulators selected on this page affect only the pitch of the Oscillator.

8. MOD # 1 DEPTH

Sets the depth, or amount, by which Modulator #1 will affect the pitch of the Oscillator. The Modulation amount can be positive or negative.

Range: -63 To + 63.

9. MOD # 2

Selects the second source of Modulation. The effects of Modulator #1 and Modulator #2 are added together. You can thus double the maximum Modulation depth of a given modulator by selecting the same source for Modulator #1 and Modulator #2. The Modulators selected on this page affect only the pitch of the Oscillator.

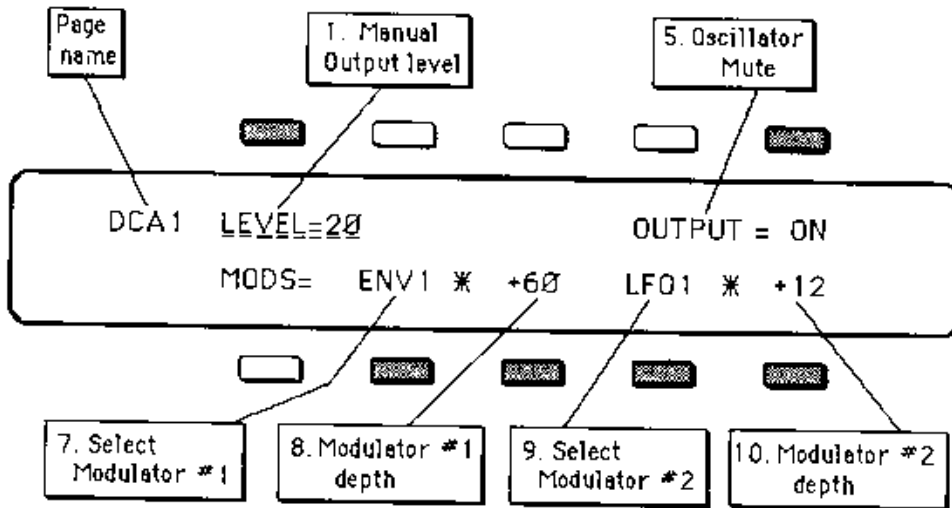
10. MOD # 2 DEPTH

Sets the depth, or amount, by which Modulator #2 will affect the pitch of the Oscillator. The Modulation amount can be positive or negative.

Range: -63 To + 63.

[DCA1] OSCILLATOR VOLUME PAGE
 [DCA2]
 [DCA3]

Controls The Volume of Oscillators 1 through 3.



(Inactive Buttons appear in White)

The format of the **Oscillator Volume Page** is the same for [DCA1], [DCA2] and [DCA3], although each of these Pages is entirely independent.

Each of these three **DCA's** (Digitally Controlled Amplifiers) controls the Volume (or amplitude) of the same-numbered Oscillator (**OSC**).

Use these pages to:

- 1) Set the Manual Output levels of the three Oscillators;
- 2) Modulate those levels using any of the 15 available Modulation Sources; and
- 3) Turn each Oscillator ON or OFF.

ACTIVE CONTROLS:

1. LEVEL

Determines the Manual, or base, volume (amplitude) of the Oscillator. This Level can be thought of as a 'Volume floor' -- the effect of any Modulator(s) is added to the Level set by this parameter. So even if **LEVEL = 0**, the Oscillator will still have some amplitude if there is a Modulator (an **Envelope** for instance,) selected and assigned a Depth greater than Zero. Negative modulation depths bring the volume lower than the **LEVEL** setting. Large amounts of negative Modulation can silence the Oscillator, regardless of the setting of this control.

DCA's 1, 2, and 3 have been set up so that it is possible to get full volume from just one Oscillator. This means, however, that it is possible to clip (overload) the output stage when all three Oscillators are at full level. Different Waveforms contain different amounts of fundamental energy, so the effect will vary. a conservative rule of thumb for Oscillator Volume is as follows:

With 1 Oscillator playing -- set that Oscillator to **63**.

With 2 Oscillators playing -- set both Oscillators to **56**.

With 3 Oscillators playing -- set all three Oscillators to **52**.

5. OSCILLATOR MUTE

Turns the Output of the Oscillator **ON** or **OFF**. This control is very helpful when setting up complex Programs, as it allows you to silence any Oscillator, and listen to the others, without disturbing your settings.

7. MOD # 1

Selects the first source of modulation. The modulators selected on this page affect only the amplitude of the Oscillator.

8. MOD # 1 DEPTH

Sets the depth, or amount, by which Modulator #1 will affect the amplitude of the Oscillator. The Modulation amount can be positive or negative.

Range: -63 To +63.

9. MOD # 2

Selects the second source of modulation. Again, a Modulator's maximum depth can be doubled, by assigning the same Modulator to **MOD #1** and **MOD #2**. The Modulators selected on this page affect only the amplitude of the Oscillator.

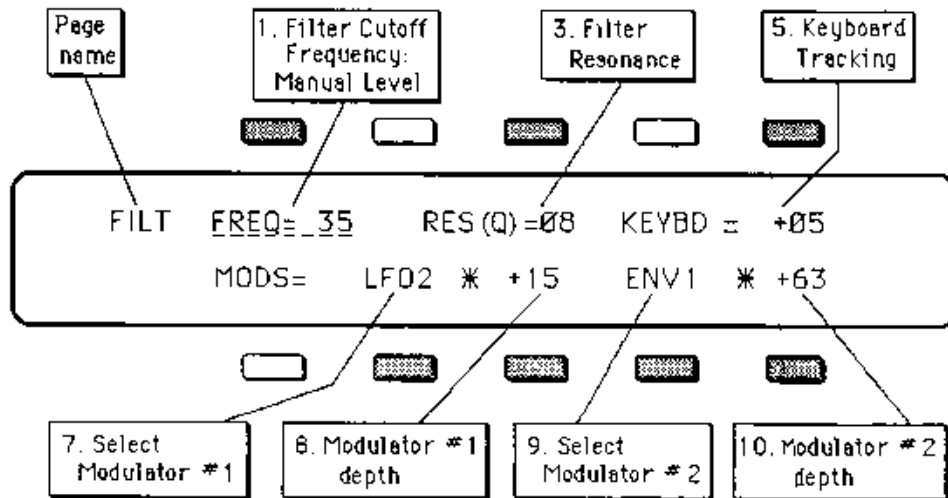
10. MOD # 2 DEPTH

Sets the depth, or amount, by which Modulator #2 will affect the amplitude of the Oscillator. The Modulation amount can be positive or negative.

Range: -63 To +63.

[FILT] FILTER PAGE

Controls the Four-Pole Low Pass Filter



(Inactive Buttons appear in White)

The outputs of the three Oscillators pass through the **Filter** before going to the Final Volume stage, [DCA4]. The **Filter settings** determine what frequencies will be allowed pass through to the output.

A **Low Pass Filter** allows only those frequencies below the **Filter Cutoff Frequency** to pass. Higher frequencies are filtered out. The Filter Cutoff Frequency is set to a certain level, and then it can be continually varied by modulating the Filter (with an **Envelope**, an **LFO**, **Velocity**, etc.).

Use this page to:

- 1) Set the **Manual Level** for the **Filter Cutoff Frequency**;
- 2) Set the amount of Filter Resonance (or **Q**); and
- 3) Modulate the **Filter Cutoff Frequency**, using the Keyboard "Control Voltage" and any of the 15 available Modulation Sources.

[FILT] FILTER PAGE (cont'd)

ACTIVE CONTROLS:

1. **FREQ**

Sets the initial, or **Manual Level** of the **Filter Cutoff Frequency**. A higher setting will result in a brighter sound. This setting represents the "Filter Floor" -- the effect of any selected Modulators will be added to (or subtracted from) this level.

Range: 0 To 127.

3. **RES (Q)**

Sets the amount of **Filter Resonance**, or **Q**. This controls the amplitude of the resonant peak of the filter. When the **Q** is raised, the **Filter Cutoff Frequency** is emphasized over all other frequencies. By then modulating the **Filter Cutoff Frequency** with an **Envelope**, **LFO**, **Mod Wheel** etc., you can create **Filter Sweeps**, **Wah** and **Growl** effects.

Range: 0 To 31.

5. **KEYBD**

Keyboard Filter Tracking. It sets the amount by which the location of a note on the keyboard will modulate the **Filter Cutoff Frequency**. (This is comparable to the **Keyboard Control Voltage** of most Analog synths.)

Higher values of this parameter will cause the Filter to open up more (get brighter) as you play higher up the keyboard. The maximum value (**63**) will raise the **Filter Cutoff Frequency** roughly one octave for each octave you go up the Keyboard.

Range: 0 To 63.

7. **MOD # 1**

Selects the first source of **Modulation** for the **Filter Cutoff Frequency**.

8. **MOD # 1 DEPTH**

Sets the depth, or amount, by which **Modulator #1** will affect the **Filter Cutoff Frequency**. Modulation amounts can be positive or negative.

Range: -63 To + 63.

9. **MOD # 2**

Selects the second source of **Modulation** for the **Filter Cutoff Frequency**.

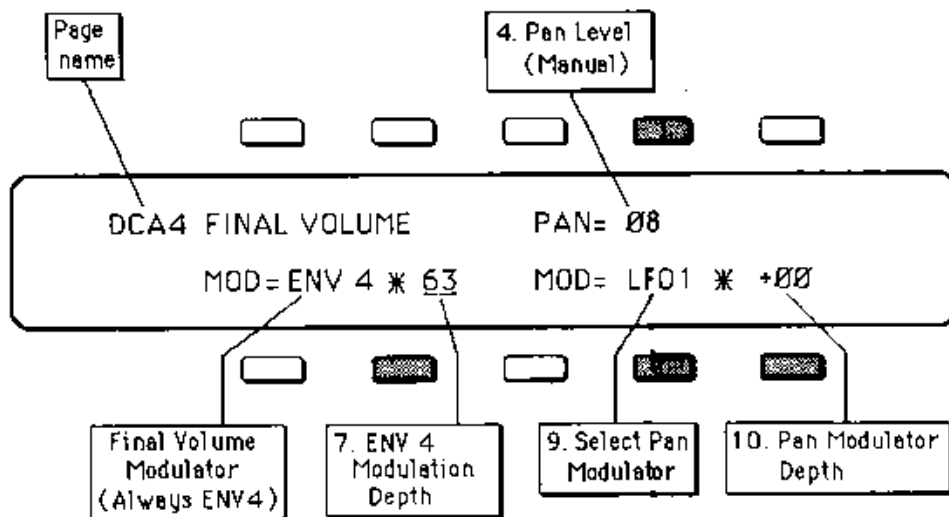
10. **MOD # 2 DEPTH**

Sets the depth, or amount, by which **Modulator #2** will affect the **Filter Cutoff Frequency**. Modulation amounts can be positive or negative.

Range: -63 To + 63

[DCA 4] FINAL VOLUME PAGE

Controls Program Volume and Panning.



(Inactive Buttons appear in White)

Note: The Modulation Source for [DCA 4] is always [ENV 4].

The outputs of the three Oscillators, after passing through the Filter, go to [DCA4]. This Final **DCA** (Digitally Controlled Amplifier), together with [ENV4], which is fixed as its Modulator, determines the overall volume envelope of the Program.

Use this page to:

- 1) Adjust the amplitude of the entire Program;
- 2) Pan the Program left, right or center; and
- 3) Modulate the Program Pan using any of the 15 available Modulation Sources.

ACTIVE CONTROLS:

4. PAN -- Manual Level

Pans the Program the between the Left and Right Outputs. Possible Values range from **00** (all the way to the Left), to **15** (all the way Right.) A value of **08** will pan the Program to Center. Note that the **ESQ 1's** audio outputs must be connected in Stereo for this parameter to have any effect.

Range: **00** to **15**.

8. ENV 4 MOD. DEPTH -- Final Volume

Determines the amount by which **DCA 4** will be Modulated by **ENV 4**, which is fixed as its Modulator. The net-effect of this parameter is to increase or decrease the Volume of the entire Program. This is useful for matching the levels of different Programs, to avoid radical volume changes when switching between them. Also it is useful for balancing the relative levels of Split and/or Layered Programs (see **SPLIT/LAYER** Page, p. 66).

Range: **00** to **63**.

Bear in mind that the overall Volume of the Program will depend on the setting of this parameter and the settings on the **ENV 4** Page.

9. Select PAN Modulator

This control selects a Modulator for the **PAN** Setting. Modulators applied here will add to, or subtract from, the Manual Level, just as they do elsewhere. Thus an **LFO** used as a Modulator here will make the Program Pan back and forth with Time. Applying **Velocity [VEL]** here would make a note's placement in the stereo mix depend on how hard you strike a key. And so on.

Or you can apply the Keyboard (**KYBD 2**) as a Modulator to make the low keys play on the left side, the middle keys in the middle, and the high keys on the right side of the stereo mix.

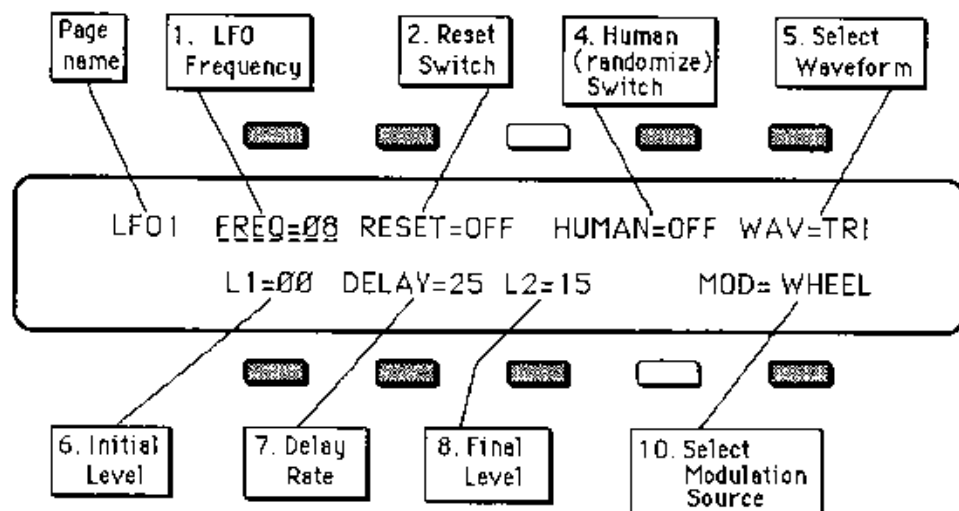
10. PAN Modulator Depth

Sets the amount by which the **PAN Modulator** will affect the Manual Pan Setting. Higher values will cause more dramatic Pan Modulation. Negative Modulation Depths are particularly useful here. Any Negative value here (**-32** for instance) will have exactly the opposite effect of the same, Positive, value (**+32**) in terms of how it affects the Pan of the Program (assuming a Manual Level of **08**).

Range: **-63** to **+63**.

[LFO 1] **LOW-FREQUENCY OSCILLATOR PAGE**
[LFO 2]
[LFO 3]

Controls the three Low-Frequency Oscillators (LFO's)



(Inactive Buttons appear in White)

The format of the **LFO Page** is the same for [LFO 1], [LFO 2], and [LFO 3], although each of these Pages is independent. The **Low Frequency Oscillators** are used as **Modulators**, and may be applied wherever a **Modulation Source** is to be selected.

Note that the **LFO Delay** (which normally allows the effect to enter gradually) is set using a **Ramp** which goes from **Level 1 (L1)** to **Level 2 (L2)**. Since **L1** can have a higher value than **L2**, the Ramp can actually be a decreasing one, causing the effect of the **LFO** to diminish, or disappear, over the time the key is held down.

Use this page to:

- 1) Set the **LFO Frequency** (speed);
- 2) Determine whether the **LFO** resets each time a key is struck;
- 3) Select the waveform that the **LFO** will play;
- 4) Set **LFO Delay** parameters; and
- 5) Select a **Modulator** from any of the 15 available Sources to modulate the Output Level of the **LFO**.

ACTIVE CONTROLS:

1. LFO FREQ.

Determines the speed of the LFO. Range: 0 To 63.

2. RESET

Turns **RESET** mode on or off.

When ON: The LFO Waveform will return to the beginning of its cycle each time a new key is struck. This is good for synchronizing LFO sweeps with key hits.

When OFF: The LFO wave will cycle continuously, without Resetting.

4. HUMAN

When ON: This control will add a random element to the LFO Frequency, making the effect less "mechanical"sounding.

When OFF: The LFO Frequency will behave normally, with perfect repetition.

5. WAV

Selects the **Waveform** which the LFO will play. The choices are:

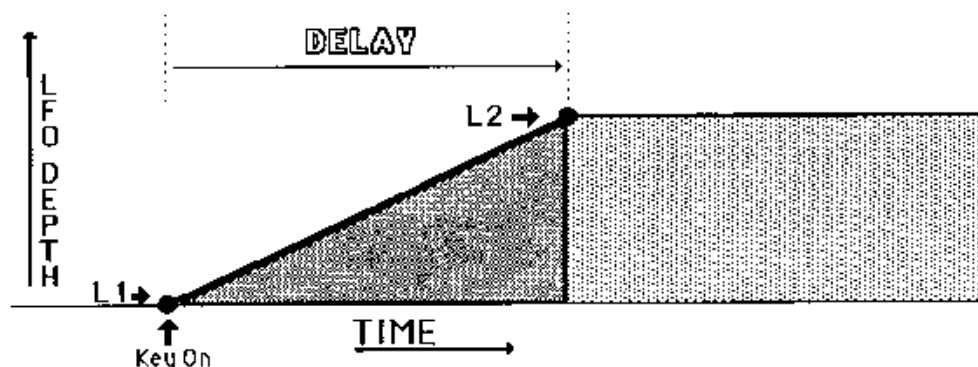
TRI -- Triangle wave

SAW -- Rising Sawtooth wave (Use negative modulation for a falling Sawtooth.)

SQR -- Square wave (positive-going only)

NOISE -- Random

NOTE: Controls # 6., 7., and 8. combine to form a linear Ramp which defines the **LFO Delay**. The Ramp goes from **LEVEL 1**, which is the starting Level, to **LEVEL 2**, which is the sustain Level, and it can be an increasing or a decreasing Ramp.



Example of LFO Modulation which 'fades in' over Time.

[LFO] LOW FREQUENCY OSCILLATOR PAGE (cont'd)

6. L1

This is **LEVEL 1**, the Level at which the **LFO** will play when the key is first struck.
Range: 0 To 63.

7. DELAY

Determines the **Rate** at which the **LFO's** amplitude will go from **LEVEL 1** to **LEVEL 2**. Range: 0 To 63.

Note that here it is the Rate of Change (or the Slope of the Ramp) which is set, not a fixed Time. Therefore, **lower** values of this parameter will cause a **longer** Delay; **higher** values will result in a **shorter** Delay. The amount of Time it takes for the **LFO** to reach **LEVEL 2** thus depends on both the Rate and the Level.

A value of Zero will cause the LFO to remain at LEVEL 1.

8. L2

This is **LEVEL 2**, the Level that the **LFO** will reach at the end of the Ramp defined by the **DELAY**. It will remain at this Level until the key is released.
Range: 0 To 63.

10. MOD

Selects the **Modulation Source** for **LFO** depth. The effect of this Modulator is added to the amount of **LFO** depth provided by the Ramp defined by Controls # **6.**, **7.** and **8.**

Note that the **LFO** itself can be used to modulate its own Output, or that of another **LFO**, producing unusual **LFO** waveforms.

The final, modulated, **LFO** Output is then available as a Modulation Source, whose depth can be adjusted precisely using the Modulation Depth controls on the other Pages.

*** * * * Note: To use the MOD Wheel for Vibrato** within a Program, perhaps the most common application for an **LFO**:

- 1) assign **WHEEL** as the Modulator for an **LFO**,
- 2) set **L1** and **DELAY** to Zero for that **LFO**, and
- 3) assign that **LFO** to modulate the Pitch of the Oscillators (**OSC** Pages).

Within the Factory Sounds that came with your **ESQ 1**, **LFO 1** is always used for Wheel Vibrato (where it is applicable).

UNDERSTANDING THE ENVELOPES

An **Envelope** is a shape, or "contour" that we apply to some signal source to make it change through time. Naturally occurring sounds have their own Envelopes. They don't just start and stop -- they might start loud and fade to silence, or slowly swell from silence to a huge crescendo; they might start out very bright and grow duller; they might have subtle variations in pitch, and so on.

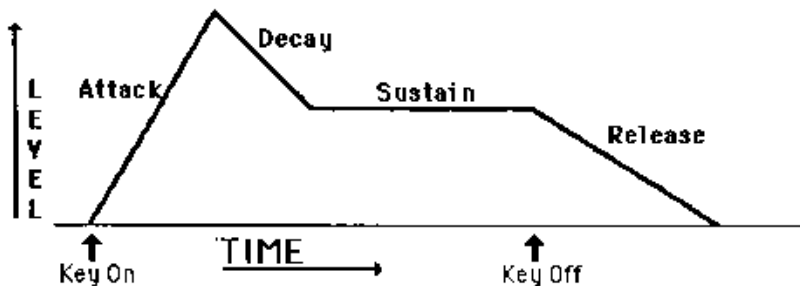
In a synthesizer we imitate these effects, and create wholly new ones, by generating Envelopes and then using them to modulate pitch, volume, brightness, etc. The **ESQ 1** has four **Envelopes** which can be independently assigned as modulation sources to the various **OSC's**, **DCA's**, **LFO's**, **PAN** and the **FILTER**.

The ADSR Connection

Let's start by taking a look at the commonly used **ADSR** (Attack, Decay, Sustain, Release) type Envelopes found on many synthesizers. With the **ADSR** Envelope, the name says it all. You have four parameters to control:

- Attack** -- The Time it takes to go from zero, when a key is struck, to peak level
- Decay** -- The Time it takes to go from the peak level to the Sustain Level
- Sustain** -- The Level at which the signal remains as long as the key is held down
- Release** -- The Time it takes to return to zero after the key is released

ADSR Envelope



Notice that an Envelope is really just a series of Levels that change through Time. With the four parameters of the **ADSR** Envelope, we can control three Times (Attack, Decay and Release) and one Level (Sustain). This is fine for many basic volume and brightness Envelopes, but for more complex sounds -- for subtle pitch Envelopes and other cool effects -- it becomes necessary to have more specific control over more **Times** and **Levels**. Which brings us back to the **ESQ 1**.

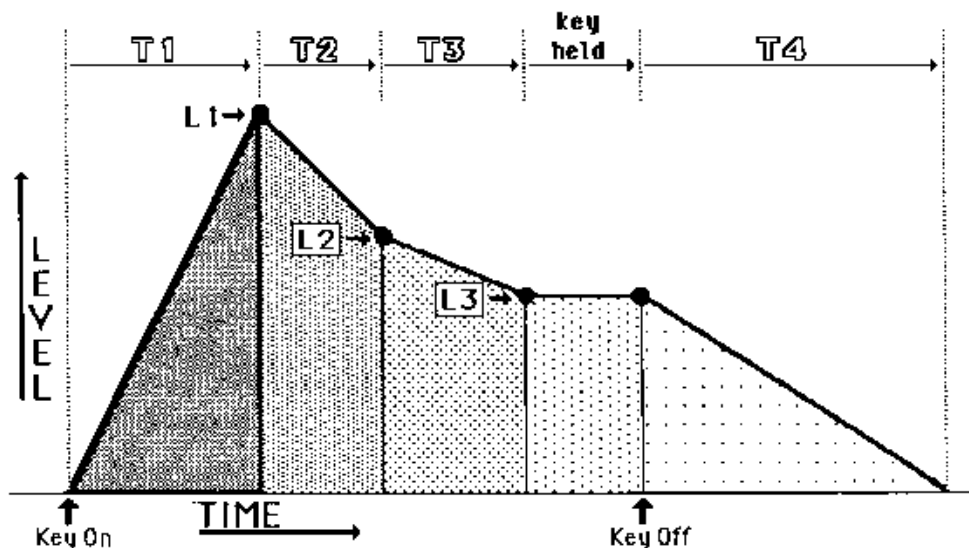
UNDERSTANDING THE ENVELOPES (Cont'd)

Times and Levels

The four Envelopes on the **ESQ 1** are defined in terms of **Time** and **Level**. For each Envelope, you have control over four **Time** segments (**TIME 1**, **TIME 2**, **TIME 3**, and **TIME 4**) and three **Levels** (**LEVEL 1**, **LEVEL 2** and **LEVEL 3**).

When a key is struck, the **Envelope** level, starting at Zero, takes a fixed amount of time, defined by **TIME 1**, to reach **LEVEL 1**. It then takes **TIME 2** to reach **LEVEL 2**. Next, at the end of **TIME 3** it reaches **LEVEL 3**, where it will remain as long as the key is held down. After the key is released the signal takes **TIME 4** to return to Zero.

The four **TIME** parameters appear on the **Envelope Page** as [T1], [T2], [T3] and [T4], the three **LEVEL** parameters as [L1], [L2] and [L3]. The figure below shows a typical Envelope as defined by the **ESQ 1** Envelope parameters:



Notice that the Envelope shape depicted above resembles the **ADSR** Envelope discussed earlier. Though this is only one of many shapes that are possible with the **ESQ 1** Envelopes, it is one of the most useful for modulating the Volume and Brightness of a Sound.

If we now look at the **ESQ 1** Envelope parameters as they apply to this standard **ADSR**-type Envelope, we can see that **TIME 1** represents the attack time; **TIME 2** and **TIME 3**, a two-stage decay; and **TIME 4** represents the release time. **LEVEL 1** is the peak level; **LEVEL 2** is an intermediate decay level; and **LEVEL 3** is the sustain level.

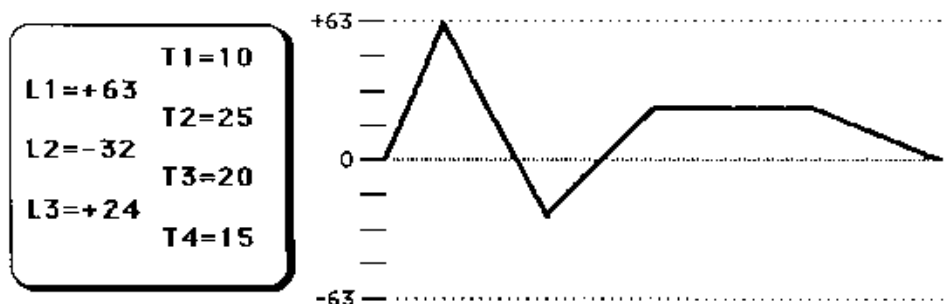
UNDERSTANDING THE ENVELOPES (Cont'd)

Time, not Rate

It is very important to note that all of the Envelopes' **Time** components, [T1], [T2], [T3] and [T4] are expressed in terms of **Time, not Rate**. Thus, for example, when a key is struck the signal will always travel from Zero to **LEVEL 1** in the fixed amount of time defined by **TIME 1**. If the value of **LEVEL 1** is raised, the signal will still reach the new, higher, **LEVEL 1** in the same amount of time.

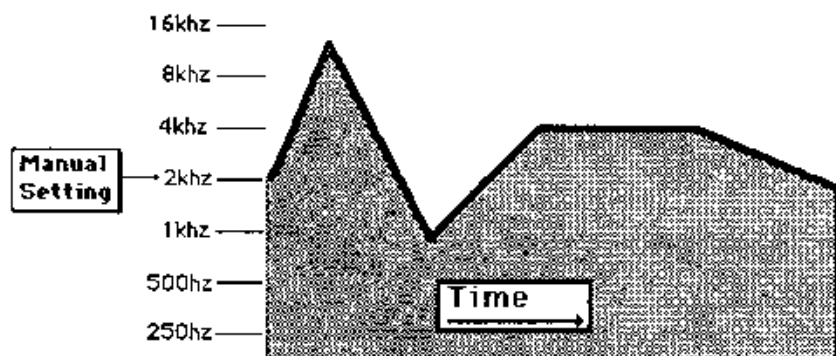
Negative Levels

In the sample Envelope shown above, all of the **Level** values were positive. But the **ESQ 1** also allows you to assign a negative value to any of the Envelope **Levels**, making possible a wide variety of interesting shapes. In the Envelope below, for example, **LEVEL 2** is given a value of **-32**.



Example of Envelope with LEVEL 2 Negative

Such an Envelope allows you to modulate a signal to levels below the Manual settings, as well as above them. Say you apply the Envelope shown above as a modulator to the **Filter Cutoff Frequency**. If the Manual setting on the **FILTER** Page, (**FREQ=**__) is set for about 2 khz., modulating the **Filter Cutoff Frequency** with this Envelope would cause the **Filter** to behave like this:



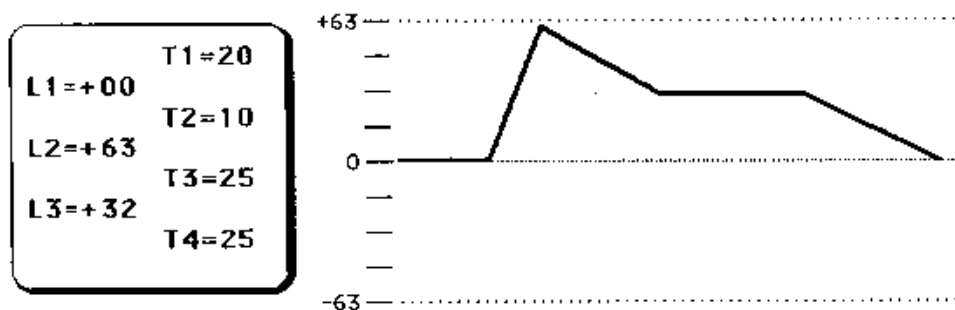
Filter Cutoff Frequency Modulated by a Complex Envelope

UNDERSTANDING THE ENVELOPES (Cont'd)

The extent of the effect in the example above would vary depending on the **Modulation depth**. Bear in mind that **Modulation depth** can also have a negative value. The combination of negative **Envelope Levels** and negative **Modulation depths** makes for almost infinite possibilities for controlling Pitch, Volume, Brightness, LFO depth, etc.

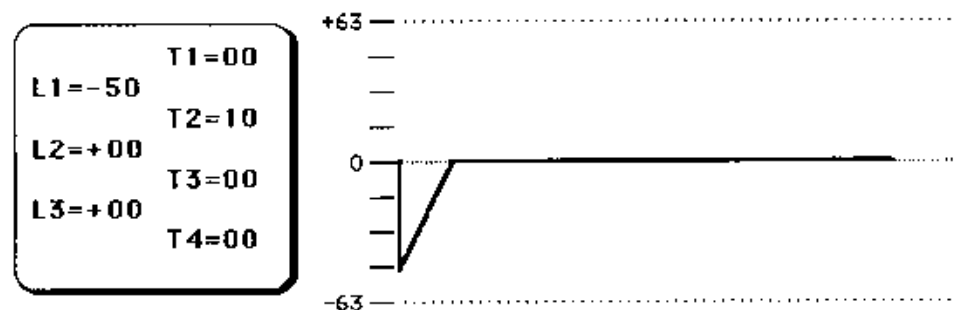
Other Envelope Shapes

There are many possibilities for creating interesting Envelopes -- here are just a few. If **LEVEL 1** is set to Zero, then **TIME 1** becomes a delay, **TIME 2** the attack time, **LEVEL 2** the peak level, and so on. Such an Envelope, applied to one of the **DCA's**, would cause that Oscillator to "wait" before beginning to play.



If LEVEL 1=0, TIME 1 Acts as a Delay

Another useful shape is a simple pitch Envelope. You can, for example, imitate the way Horns often "slide" into a note, rather than beginning right on pitch. By setting **TIME 1** to Zero, **LEVEL 1** to some negative value, and **LEVEL 2** and **LEVEL 3** to Zero, you now have an Envelope which, when used to modulate Oscillator Pitch, will cause the pitch to "slide" up to the proper note in the amount of time defined by **TIME 2**.



Rising Pitch Envelope

This could be a rather long, dramatic "slide", or an almost imperceptibly short one, depending on the value you assign to **T2**. How much the Pitch is altered will depend on the value of **LEVEL 1** and the Modulation depth.

UNDERSTANDING THE ENVELOPES (Cont'd)

Limits of Modulation

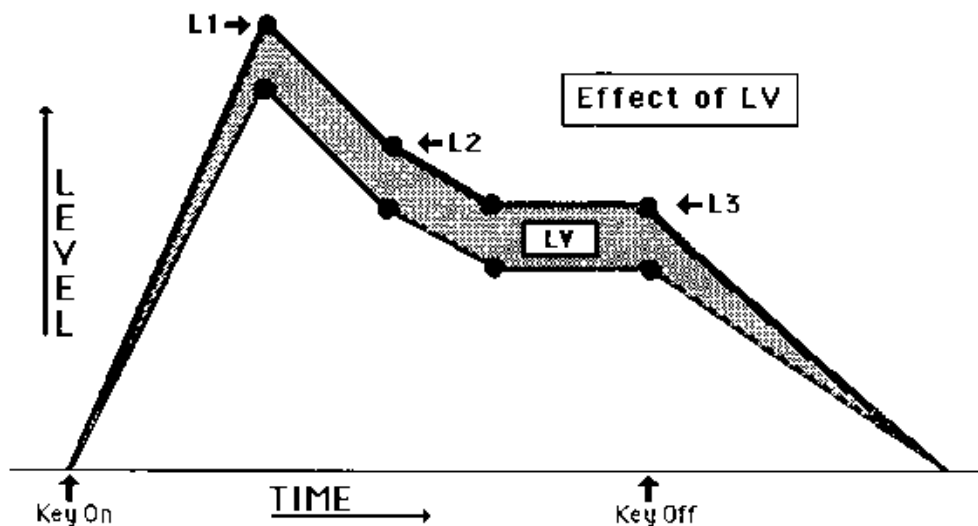
Note that for all Modulation effects there is a maximum and a minimum range that cannot be exceeded. For example, if the **Filter Cutoff Frequency** is manually set to its maximum value [127], you will not be able to modulate the Frequency any higher with an Envelope or other Modulator. You cannot modulate an Oscillator's Output Level lower than Zero (silence). If an Envelope or other Modulator doesn't seem to be having any effect, check that the other Modulators and manual settings are at appropriate levels.

Velocity Control Of Envelopes

There are two parameters on the **Envelope** Page allow you to alter an Envelope depending on keyboard velocity, or how hard you strike a key.

[LV] Velocity Level control

The first of these, **LV** or **Velocity Level Control**, will lower all three levels (**L1**, **L2** and **L3**) with a softer keystrike. This means that the settings you assign to **LEVEL 1**, **LEVEL 2**, and **LEVEL 3** are maximum Levels, the Levels that will be reached with the hardest keystrike. The amount of **LV** determines how much those Levels will be reduced as you play softer.

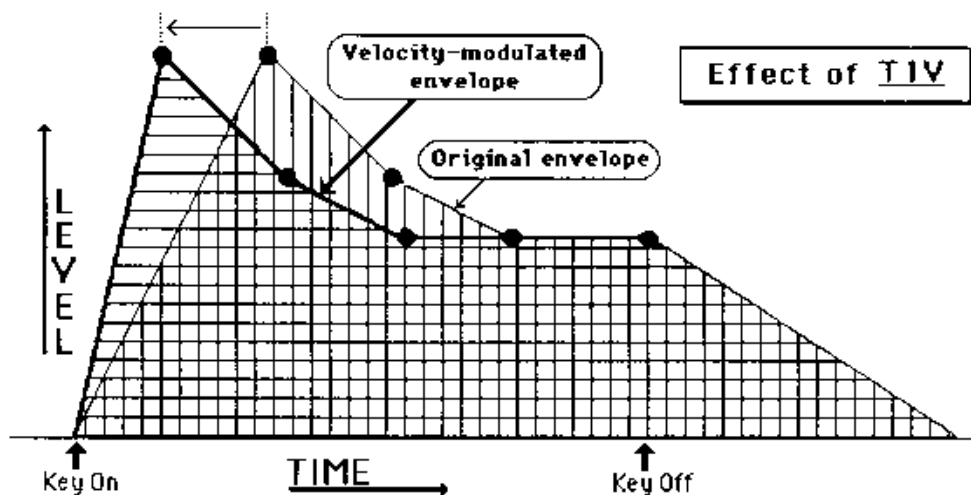


With this parameter you can have continuous dynamic control over the three levels by varying how hard you play. The most common uses of the **Velocity Level Control** have to do with varying the volume and brightness of a Program, though in the previous example, **[LV]** could be used to alter the depth of the **Pitch Envelope** with velocity.

UNDERSTANDING THE ENVELOPES (Cont'd)

[T1V] Velocity Attack control

The second velocity-related parameter is **T1V -- Velocity Attack Control**. As the name implies this parameter makes **TIME 1**, the Envelope attack time, respond to keyboard velocity. When the value of **T1V** is increased, a harder keystrike will decrease **TIME 1**, resulting in a faster attack.



This allows for great expression on String sounds and the like, making it possible to have a long, smooth Attack or a sharp, crisp Attack simply by varying how hard you play. The greater the value of **T1V**, the more **TIME 1** will be decreased with velocity. If **TIME 1** already equals Zero, this parameter will have no effect.

[TK] Keyboard Decay Scaling

The final Envelope parameter is **[TK] -- Keyboard Decay Scaling**. Raising the value of **TK** has the effect of decreasing **TIME 2** and **TIME 3** as you play higher up the Keyboard. Higher notes will therefore decay faster than lower ones. The higher the value assigned to **TK**, the greater the difference in Decay Time between the highest and lowest notes. This is useful for simulating the Decay patterns of many acoustic instruments (piano, for instance) whose lower notes tend to ring much longer than the higher ones.

Note that if **TIME 2** and **TIME 3** both have a value of Zero, this parameter will have no effect.

UNDERSTANDING THE ENVELOPES (Cont'd)

Envelope Times

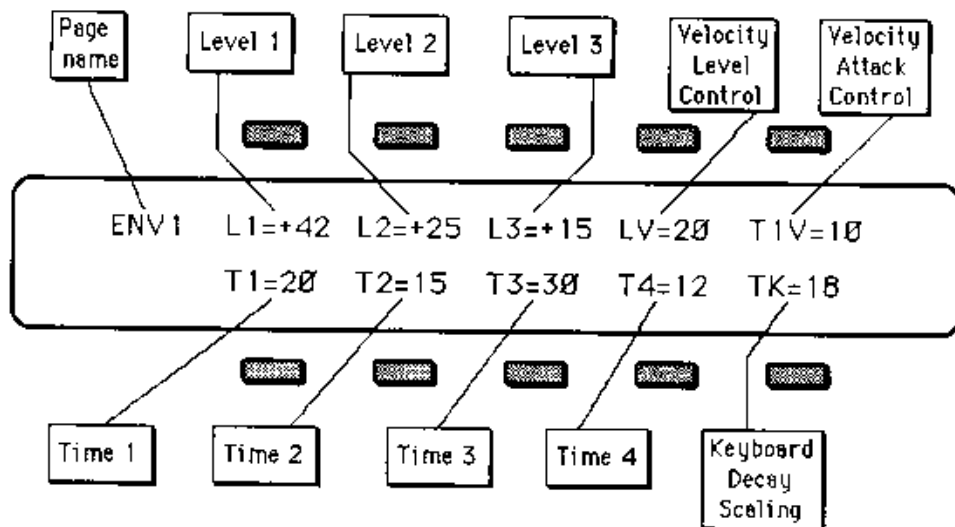
The chart below gives the approximate amount of Time, in seconds, that corresponds to each possible value of the **Time** components of the Envelopes (**T1**, **T2**, **T3** and **T4**). The numbers in **bold** type are the values that can be assigned to **T1**, **T2**, **T3** or **T4**; the numbers in plain type show how long a **Time** each of those values will yield.

<u>T=:</u>	<u>Time(sec.)</u>	<u>T=:</u>	<u>Time(sec.)</u>	<u>T=:</u>	<u>Time(sec.)</u>	<u>T=:</u>	<u>Time(sec.)</u>
0	.00	16	.09	32	.57	48	3.62
1	.01	17	.10	33	.64	49	4.06
2	.01	18	.11	34	.72	50	4.56
3	.02	19	.13	35	.81	51	5.12
4	.02	20	.14	36	.91	52	5.75
5	.03	21	.16	37	1.02	53	6.45
6	.03	22	.18	38	1.14	54	7.24
7	.03	23	.20	39	1.28	55	8.13
8	.04	24	.23	40	1.44	56	9.12
9	.04	25	.25	41	1.61	57	10.24
10	.04	26	.29	42	1.81	58	11.49
11	.05	27	.32	43	2.03	59	12.90
12	.06	28	.36	44	2.28	60	14.48
13	.06	29	.40	45	2.56	61	16.25
14	.07	30	.45	46	2.87	62	18.25
15	.08	31	.51	47	3.23	63	20.48

- * * * **Note:** Envelope Times will be as shown above only when **TK=0**, and **T1V=0**. These two parameters have the effect of decreasing Envelope Times (**TK** based a note's position on the keyboard, and **T1V** based on Velocity.) If either has a value greater than Zero, **T1**, **T2** or **T3** could be shorter than indicated by the chart, depending on where and how hard you play.

[ENV 1] ENVELOPE PAGE
 [ENV 2]
 [ENV 3]
 [ENV 4]

Controls the parameters of the four Envelopes.



The format of the **Envelope Page** is the same for [ENV 1], [ENV 2], [ENV 3] and [ENV 4], although each Page is independent. The **Envelopes** are used as Modulators, and may be applied wherever a **Modulation Source** is selected.

All **Envelope** parameters are expressed in terms of **TIME** and **LEVEL**. It is important to note that the Time components of the **Envelopes** ([T1], [T2], [T3], and [T4]) each define a fixed Time, not a Rate. Thus, if you raise the value of **LEVEL 1** but leave **TIME 1** the same, the **Envelope** will still take the same amount of Time to reach the new, higher, **LEVEL 1**.

Also note that the **Level** parameters can be positive or negative. This allows for a wide variety of Envelope shapes, especially useful for modulating the **FILTER** Frequency, the pitch of an **Oscillator**, etc.

[ENV] ENVELOPE PAGE (cont'd)

ACTIVE CONTROLS:

1. L1 - LEVEL 1

This is the **LEVEL** that the Envelope will reach at the end of the Time defined by **TIME 1**. All Envelopes start at a level of Zero and proceed toward **LEVEL 1** when a key is pressed.

Range: -63 To +63.

2. L2 - LEVEL 2

The **LEVEL** that the Envelope will reach at the end of **TIME 2**.

Range: -63 To +63.

3. L3 - LEVEL3

The **LEVEL** that the Envelope will reach at the end of **TIME 3**. This is the **Sustain Level**. The Envelope will remain at this level until the key is released. After the Key is released, the Envelope will return to Zero.

Range: -63 To +63.

4. LV

Velocity Level Control. This parameter makes all three Levels, **LEVEL 1**, **LEVEL 2** and **LEVEL 3**, respond to Keyboard Velocity, or how hard you strike the key. When the value of [LV] is raised, a **softer** keystrike will **decrease** all three Levels. The greater the value, the more the Levels will decrease as you play softer. Thus the Levels set by **LEVEL 1**, **LEVEL 2** and **LEVEL 3** define the **maximum** Levels, and parameter [LV] **subtracts** from those Levels.

Range: 0 To 63.

5. T1V

Velocity Attack Control. This control makes **TIME 1** respond to Keyboard Velocity. Raising its value will cause a **decrease** in the value of **TIME 1** as a key is struck harder, shortening the Attack Time. The greater the value, the faster **LEVEL 1** will be reached with a hard keystrike. (This Parameter will have no effect if **TIME 1 = 0**.)

Range: 0 To 63.

6. T1 - TIME 1

The amount of Time between when the key is struck and when the Envelope reaches **LEVEL 1**. In most applications this is the **Attack Time**. The higher the value the longer the **TIME**.

Range: 0 To 63.

[ENV] ENVELOPE PAGE (cont'd)

7. T2 - TIME 2

The Time it takes the Envelope to go from **LEVEL 1** to **LEVEL 2**. In most applications this is the first of two **Decay** stages.

Range: 0 To 63.

8. T3 - TIME 3

The Time it takes the Envelope to go from **LEVEL 2** to **LEVEL 3**. In most applications this is second **Decay** stage. At the end of **TIME 3**, the Envelope will remain at **LEVEL 3** until the key is released.

Range: 0 To 63.

9. T4 - TIME 4

Release Time. Defines the amount of Time it will take the Envelope to return to Zero from **LEVEL 3** (or from whatever it currently is, if **LEVEL 3** has not yet been reached) after the key is released.

Range: 0 To 63.

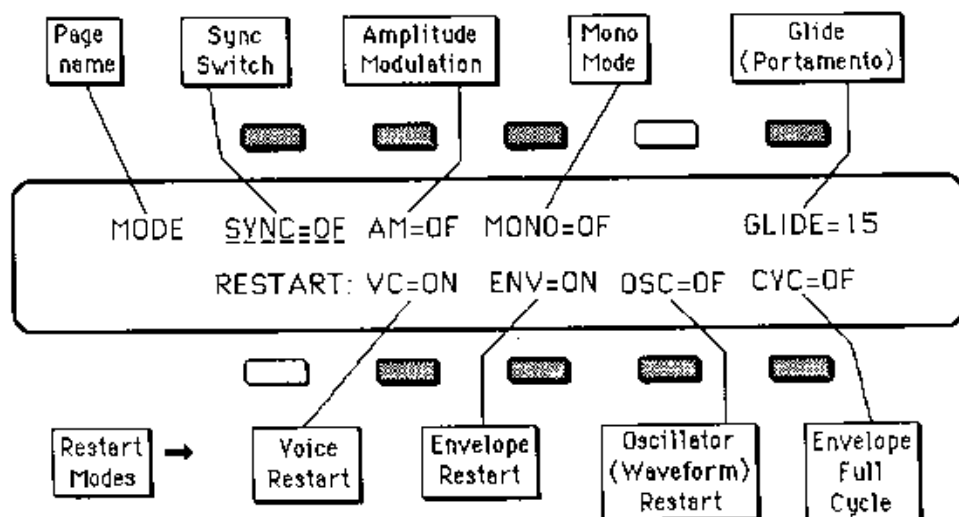
10. TK

Keyboard Decay Scaling. Raising the value of this parameter will cause the value of both **TIME 2** and **TIME 3** to **decrease** as you go higher up the keyboard. Thus higher notes will decay faster than lower ones. This is true of many acoustic instruments. The greater the value of **[TK]**, the more the decay time will **decrease** as you play higher up the keyboard. **[TK]** will have no effect if **TIME 2** and **TIME 3** are Zero.

Range: 0 To 63.

[MODE] MODE PAGE

Controls Glide, Sync, AM, and Mono Modes, as well as Voice, Envelope and Oscillator Restart Modes.



(Inactive Buttons appear in White)

All of the Parameters on this Page are part of the **Program** (or patch), and will apply only to the selected Program.

ACTIVE CONTROLS:

1. SYNC

Syncs the phase of **Oscillator 2** to that of **Oscillator 1**. In other words, whenever **OSC1** finishes playing one complete cycle of its waveform and begins another, **OSC 2** will reset to the beginning of its cycle, whether the previous cycle is complete or not.

This produces the popular "Hard Sync" effect, which can be similar to a Filter sweep. The effect is most noticeable when the Frequency of **Oscillator 2** is varied, or modulated.

2. AM

Amplitude Modulation. When ON, the Amplitude of **Oscillator 1** modulates the Amplitude of **Oscillator 2**. **OSC 2's** Amplitude Envelope will be ignored. This results in the creation of "Sideband" frequencies at the sum and difference of the frequencies being played by the two Oscillators.

[MODE] MODE PAGE (cont'd)

When **OSC 1** and **OSC 2** are tuned to simple intervals of each other (such as octaves or fifths, etc.), **AM Mode** can produce FM-like enharmonics, for bell sounds, etc. When the Oscillators are tuned to more complex intervals, the effect is more extreme.

Since the Amplitude of **Oscillator 2** is no longer being controlled by **DCA 2**, you must use **DCA 4** and **ENV 4** to control the volume of the Sound.

3. MONO

In **MONO mode** the **ESQ 1** behaves like a classic one-voice Monophonic synth. It is useful with lead-type sounds where chords are not necessary or desirable. With **MONO mode ON**, only one note can be played at a time. Priority is given to the **last note** played -- even if another note is being held down, the most recent note you play will sound. However, the envelope will not be re-triggered by striking a key as long as any other key is held down. **Mono mode** on the **ESQ 1** does not stack all eight voices on one key -- only one voice plays.

5. GLIDE

Also called **Portamento**. This causes the pitch of the Oscillators to "glide" between notes instead of the usual abrupt transition. The higher the value, the longer it will take to get from the pitch of the first note played to that of the second. Range: 0 To 63.

Note: The **GLIDE** function behaves in one of two ways, depending on whether or not **MONO mode** is engaged:

With **MONO mode OFF**: The pitch of any note played will 'glide' to its proper pitch from that of the note played immediately before it, at the rate that has been set. In this mode the **GLIDE** is **polyphonic**, and whole chords can be made to swoop up and down together. (Very dramatic.)

With **MONO mode ON**: You have what is called **Fingered Portamento**. If a key is pressed with no other keys held down, there is no **GLIDE**. If you then play a second key while holding down the first, the note will glide from the pitch of the first key to that of the second. Release the second key (still holding the first one down) and it glides back. In other words, **the effect is only present when a note is played while another key is held down**. You can thus play Staccato for runs without **GLIDE**, and Legato for runs with **GLIDE**.

Note: The next two Parameters (#7, [VC] VOICE Restart, and #8, [ENV] ENVELOPE Restart) affect only what happens when you play the same note twice in succession.

[MODE] MODE PAGE (cont'd)

7. VC --VOICE Restart

When ON: If the same key is restruck before the note has died away, it will be assigned the same **Voice** that was previously playing it. That Voice will be 'stolen' to play the new note. This is fine for many sounds, such as piano, but it can be annoying with others, especially sounds with long Attack or Release times, like strings, where you don't necessarily want a note to abruptly disappear just because you have played the same note again.

When OFF: If a key is restruck before the note has died away, a new **Voice** will be assigned to it, and the first Voice will continue to play. If there are already two Voices playing that note, the older of the two is 'stolen'. (Two Voices will alternate playing the note if it is struck repeatedly.) As mentioned above, for sounds with long Attack or Release times (such as long filter sweeps, etc.) this is often better.

8. ENV --ENVELOPE Restart.

When ON: If the same key is restruck, all four Envelopes will reset, and start their cycles at Zero level.

When OFF: Each Envelope will start its cycle at its present level, regardless of what that level is, when the same note is played again. It will then take **TIME 1** to reach **LEVEL 1**, whether the new ramp is in the same direction (up or down) as the original attack segment or not. In other words, each Envelope behaves normally, except that its **Starting Level**, normally Zero, becomes whatever Level it was at when the key was restruck.

9. OSC --Oscillator (Waveform) Restart

When ON: All three Oscillators are halted before the start of a sound, and are restarted together when a key is struck, so that they will start out playing in phase with each other. Any phasing, or "beating" between the oscillators (due to detuning, etc.) will be the same each time a key is struck.

When OFF: The Oscillators are not stopped before a new note is played, but continue to play. Therefore the relative phase of the Oscillators will be unpredictable. This will tend to randomly vary the phase shift and tonal characteristics of the sound.

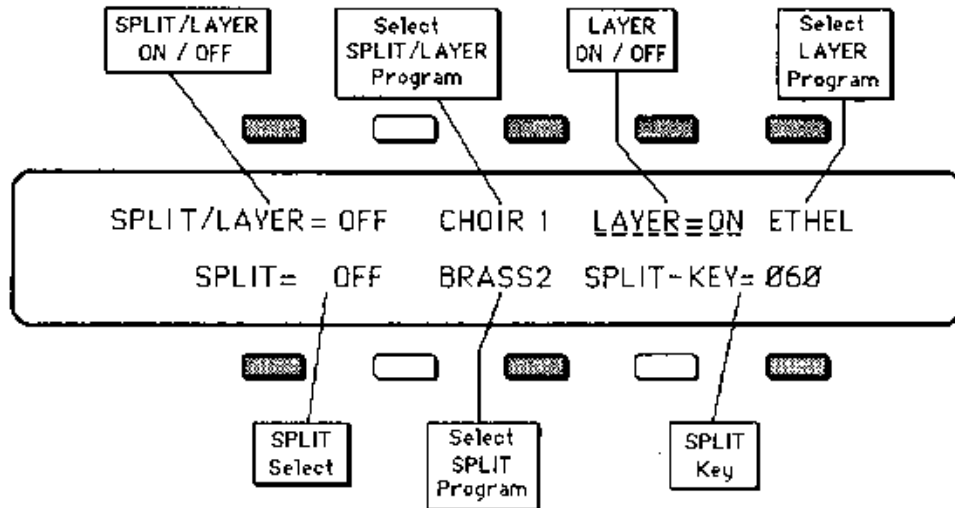
10. CYC --Envelope Full Cycle Mode

When ON: The Envelopes will pass through their full cycles every time a key is struck. In this Mode the **ESQ 1** pays no attention to whether you hold the key down or let it go immediately -- each Envelope simply 'runs' through all its stages (ignoring the sustain stage after **TIME 3**) with each keystroke. This can be useful for many percussion-type sounds, bell sounds, filter sweeps and other sounds where you want consistently repeatable Envelopes that are not dependent on keyboard technique.

When OFF: This is the Normal Mode of operation. All Envelopes will reset and begin their cycles from Zero whenever a new key is struck.

[SPLIT/LAYER] Split/Layer PAGE

Controls Splitting the Keyboard and Layering Different Sounds together



(Inactive Buttons appear in White)

Programs on the **ESQ 1** can be **Layered** (so that two Programs play at once over the whole keyboard), **Split** (so that each half of the keyboard plays a different Program), and **Split/Layered** (so that the **Split** Program is layered with yet another Program).

It is important to note that the parameters on this Page are all **part of the Program** -- that is, any **Split** and/or **Layer** configurations you set up here must be Saved as part of a new Program in order to be retained. For example, if you start with a Piano Program, and then Layer that with a String Program, you can now save the new Layered combination in a new Location -- the original String and Piano Sounds will remain intact in their original locations.

Also bear in mind that wherever two Programs are Layered, the **ESQ 1** becomes a four-voice Synthesizer -- it will start "stealing" voices after four have been played, rather than the usual eight.

Use this Page to:

- 1) Activate the **Layer** function;
- 2) Choose the **Layer Program**;
- 3) **Split** the Keyboard (Upper or Lower) between two different Programs;
- 4) Choose the **Split Program**;
- 5) Choose the **Split Key**;
- 6) Layer a second Sound with the Split Program (**Split/Layer** mode); and
- 7) Choose the **Split/Layer Program**.

ACTIVE CONTROLS:

1. SPLIT/LAYER ON/OFF

This activates the **Split/Layer** mode. In order for this control to have any effect, the Keyboard must first be **Split**, either Upper or Lower (see #6 below).

When ON: The **Split Program** will be Layered (will play simultaneously) with the Program whose name appears to the right of this control (#3). This will result in a reduction to four Voices only on the **SPLIT/LAYERED** half of the Keyboard.

3. Select SPLIT/LAYER Program

The Program whose name appears here will be Layered with the **Split Program** when an Upper or Lower Keyboard **Split** has been selected. It is possible to have a **Split/Layer** without **Layer** mode being on. The Program shown here is Layered only with the **Split Program**.

When this control is selected (Underlined), you can choose a new **SPLIT/LAYER** Program in one of two ways:

- 1) Use the **Data Entry Slider** and the **Up and Down Arrow** Buttons to scroll through the various Programs in Memory until you find the one you want; or
- 2) Press **Internal, CART A, or CART B** to select a Master Bank; then press one of the four **Bank Select** Buttons and, while holding it down, select the Program you want. You will be returned to the **Split/Layer** Page with the new Program selected as the **SPLIT/LAYER** Program. There will always be a Program name in this Location, whether the **SPLIT/LAYER** mode is engaged or not.

4. LAYER ON/OFF

This acts as a switch to turn On or Off the **Layer** mode.

When ON: The Current Program (the one you are editing) will be Layered (combined) with the Program whose name appears immediately to the right (see #5 below), and both Programs will play simultaneously. Activating the **Layer** mode reduces the number of available Voices to four (from eight).

5. Select LAYER Program

The Program whose name appears here will be Layered with the Current Program when the **Layer** mode is switched On. When this control is selected (Underlined), you can choose a new LAYER Program in one of two ways:

- 1) Use the **Data Entry Slider** and the **Up and Down Arrow** Buttons to scroll through the various Programs in Memory until you find the one you want; or
- 2) Press **Internal, CART A, or CART B** to select a Master Bank, then press one of the four **Bank Select** Buttons and, while holding it down, select the Program

[SPLIT/LAYER] Split/Layer PAGE (cont'd)

you want. You will be returned to the **Split/Layer** Page with the new Program selected as the **LAYER** Program.

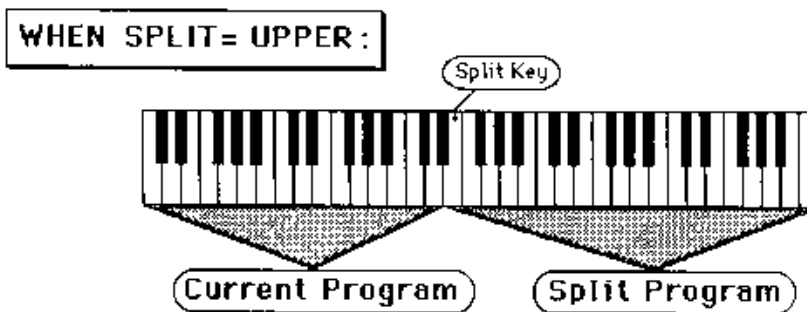
There will always be a Program name in this Location, whether the **Layer** mode is engaged or not.

6. SPLIT Select

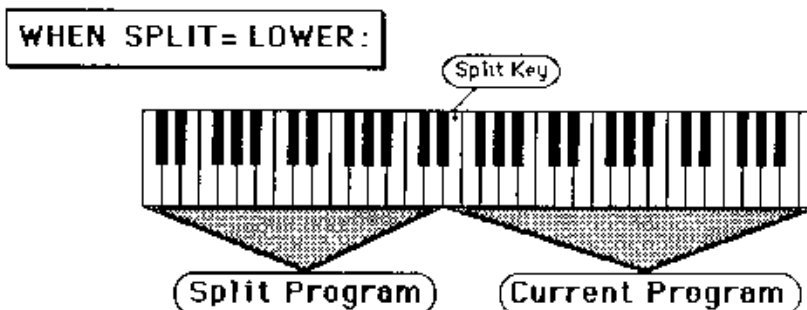
This control is used to **Split** the Keyboard between two Programs, as well as to determine which Keyboard half each will occupy. There are three possible states:

----> **OFF** -- Normal Keyboard assignment; no **Split**.

----> **UPPER** -- When **SPLIT=UPPER** is selected, the **Split Program** (see #8) will play on the Upper Keyboard (that is, above the **Split Key**), and the Current Program will play on the Lower Keyboard (below the **Split Key**).



----> **LOWER** -- When **SPLIT=LOWER** is selected, the **Split Program** will play on the Lower Keyboard (that is, below the **Split Key**), and the Current Program will play on the Upper Keyboard (above the **Split Key**).



[SPLIT/LAYER] Split/Layer PAGE (cont'd)

So when you select **UPPER** or **LOWER** here, you are selecting which area of the Keyboard the **Split Program** will occupy. The Current Program (the one you started from) will always occupy the the opposite Keyboard half.

8. Select SPLIT Program

The Program whose name appears here will occupy the half of the Keyboard as designated above (#6), if **SPLIT=UPPER** or **SPLIT=LOWER** has been selected.

When this control is selected (Underlined), you can choose a new **SPLIT** Program in one of two ways:

- 1) Use the **Data Entry Slider** and the **Up and Down Arrow** Buttons to scroll through the various Programs in Memory until you find the one you want; or
- 2) Press **Internal**, **CART A**, or **CART B** to select a Master Bank, then press one of the four **Bank Select** Buttons and, while holding it down, select the Program you want. You will be returned to the **Split/Layer** Page with the new Program selected as the **SPLIT** Program.

* * * * **Note:** Whenever you select a **Layer Program**, a **Split Program**, or a **Split/Layer Program**, the **ESQ 1** only "remembers" the Location of that Program in Internal or Cartridge Memory -- not the Program itself. If you move a Program, put another in its place, or transfer an entire Bank of Programs, the **Layer**, **Split**, or **Split/Layer** Program on this Page might still be "pointing to" a Location that no longer contains the sound you had in mind.

For example, if you create and save a Program where a Brass sound is Layered with a String sound, and you then Write over the String Program (or insert a different Cartridge in the case of Layering with a Cartridge Program,) a different Layer Program will play -- whatever is now in the Location originally occupied by the String sound.

If your **Layer**, **Split**, or **Split/Layer** Program is a Cartridge Program, and you remove the Cartridge, the word ***CART*** will appear instead of the Program name, and the Program that will play will be the Internal Program with the same relative Memory Location (until you replace the Cartridge).

This also means that if you transfer an entire Bank of Programs from a Cartridge to the Internal Memory (or vice versa), any **Layer**, **Split**, and **Split/Layer** Programs will still be "pointing to" their previous Locations, and may not work once the Cartridge is removed, or you insert a different Cartridge. In this case, you should go through the transferred Programs and edit them so that the **Layer**, **Split**, and **Split/Layer** Programs are in the new Bank, and then Save (Write) the Programs back into their current Locations

[SPLIT/LAYER] Split/Layer PAGE (cont'd)

Note also that if you select a Program for your **Layer**, **Split**, or **Split/Layer** Program that itself contains a Layer, or Split, only the main part of that Program will play -- not any Layers or Splits that are programmed into it. It is only possible for one **Layer**, **Split**, or **Split/Layer** to be active at any time. So you can't, for example, make a Triple Layer by selecting an already-Layered Program as the Layer Program.

10. Select SPLIT Key

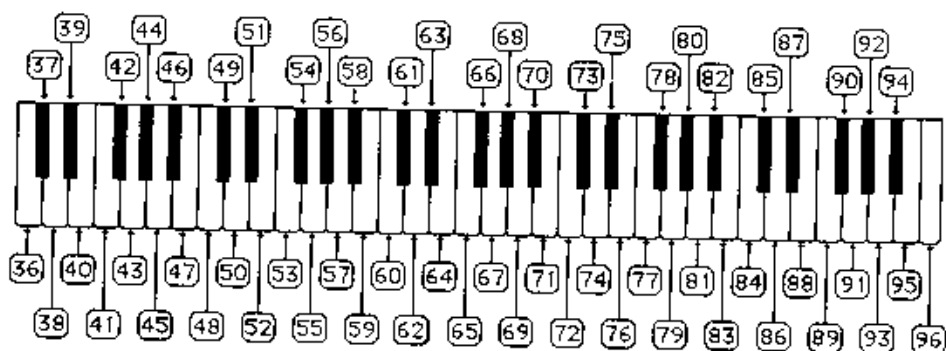
This designates the note on the keyboard at which the Programs will Split, if **SPLIT=UPPER** or **SPLIT=LOWER** has been selected (#8 above).

Range: 21 To 108.

Key Numbers given here are **MIDI key Numbers** -- they reflect the **MIDI** standard for numbering keys, rather than just counting up from the lowest note on the keyboard. Thus the Low C on the **ESQ 1** Keyboard is MIDI Key # 37; Middle C is MIDI Key # 60; the High C is MIDI key # 96.

The available range of values (**21 To 108**) corresponds to the the 88 key range of a grand piano. This allows the Split Key to actually be out of the range of the **ESQ 1** keyboard -- but such splits will only be effective if the **ESQ 1** is played via MIDI from an instrument with more than a 61-note keyboard. The **Split Key** itself always plays whichever Program is on the Upper half.

MIDI Key Numbers



PROGRAMMING CONVENTIONS

There are a number of Programming conventions that have been followed within the **ESQ 1** factory Programs. They will help you to know where to begin when editing factory Programs. You may also find them to be handy rules of thumb to follow when creating your own Programs.

LFO's

- > **LFO 1** is used for Wheel Vibrato, when it is part of the Program.
- > **LFO 2** and **LFO 3** are available for other purposes.

Envelopes

- > **ENV 1** is used for Pitch Envelopes (modulating **OSC 1, 2 or 3**.)
- > **ENV 2** is used for individual volume Envelopes (modulating **DCA 1, 2 or 3**.)
- > **ENV 3** is used for Filter Envelopes (modulating the **Filter Cutoff Frequency**.)
- > **ENV 4** is always fixed as the overall volume Envelope (**DCA 4**.)

Of course these do not all apply for every Program. Any Envelope can be routed anywhere you want it to go (except to **DCA 4**), and some Programs will call for different applications. But where applicable, the factory Programs follow these conventions.

Program Names

- > (/) Where a Program is Layered, a slash (/) is incorporated into the Name.
- > (+) Where a Program contains a Split, a plus sign (+) is incorporated into the Name.

SECTION 3 -- Saving and Storage of Programs

- 74 **WRITE PROGRAM Page**
- 74 Saving a New Program to Memory
- 77 Copying an Existing Program to Another Location

- 78 **STORAGE Page**

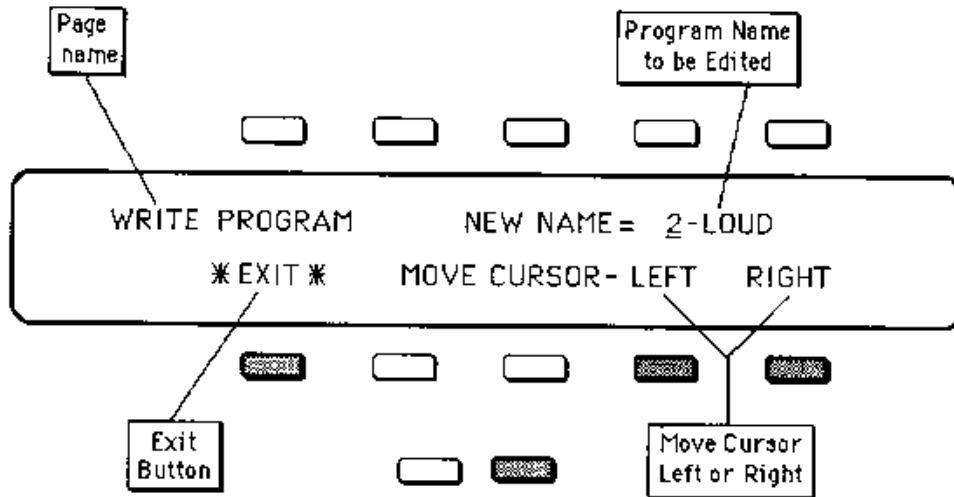
- 78 **Cartridge -- Bank Copy**
- 79 Transferring Internal Programs to Cartridge
- 79 Transferring Cartridge Programs to Internal Memory

- 80 **Tape Storage**
- 80 A "Decent" Tape Deck
- 81 Tape Connections
- 81 Saving all Internal Programs to Tape
- 82 Verifying Internal Programs Saved to Tape
- 83 Loading all Programs from Tape

- 84 **MIDI Transfer of Programs**
- 84 MIDI Connections
- 84 Sending All Internal Programs via MIDI to Another ESQ 1
- 85 Sending One Program via MIDI to Another ESQ 1

[WRITE] WRITE PROGRAM PAGE

To Save a New or Edited Program into Memory, or Copy an Existing Program to another Location.



(Inactive Buttons appear in White)

Saving a New Program Into Memory

Once you have modified an existing **Program**, or created an entirely new one, you can **Write**, or save, that **Program** to any **Internal** or **Cartridge Memory Location** using the **WRITE PROGRAM** Page. This Page is also used to **Rename** the **Program** with the name of your choice.

When you are ready to **Write** a **Program** into **Memory**, first decide on a **Name** of up to six letters for your new **Program**. Then:

1. **Select the WRITE Page** by pressing the button labeled **WRITE** on the front Panel. The Page will come up as shown above, with the current **Program Name** showing. You will see a **Cursor**, or underling, beneath the first letter of that **Name**.

2. **Edit the Program Name** using the **Data Entry Slider** and the two **Move Cursor** buttons on the **Display**, labeled **LEFT** and **RIGHT**. You can move the **Data Entry Slider** up and down to scroll through the available characters, or step through them one at a time with the **Up** and **Down Arrow** buttons. Experiment until you find the first letter you want. Then press the **RIGHT** button to move the **Cursor** to the next location. Again, scroll through the characters until you find the correct one. Repeat this procedure until the display shows the name you have chosen.

You can move the **Cursor** back and forth using the **LEFT** and **RIGHT** buttons, changing letters, as often as you like, until you're satisfied. There are some pretty weird

[WRITE] WRITE PROGRAM PAGE (cont'd)

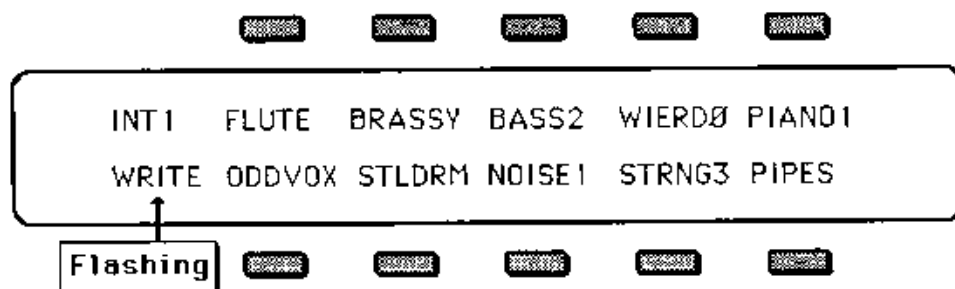
characters in there, along with the usual letters and numbers, to choose from. Be creative.

**** **Helpful Hint:** Moving the **Data Entry Slider** all the way down gives you a blank space.

3. Select a Memory Location for your new Program. You can "flip through" the various **Program Select Pages** in both the **Internal Memory** or the **Cartridge** to find a Program you want to write over. (Remember that you will be replacing whatever is already there, so be careful!)

Press one of the **Bank Select Buttons, 1 - 4**. As long as you hold the button down, the display will show the **Program Select Page** for that Bank, with two differences:

1) None of the **Program** names are underlined, and 2) the word **"WRITE"** is flashing in the lower left-hand corner, below the Page Name.



When you release the **Bank Select Button**, the Display will return to the **WRITE PROGRAM Page**. Press another **Bank Select Button** and the Display shows you the Programs for that Bank. To look at the Programs in a different **Master Bank** (**CART A** or **CART B** for instance), simply press the Button for that **Master Bank**, and then press and hold down any of the four **Bank Select Buttons**, as before.

4. "But Wait, I need to hear them!" You may find that it's not enough to look at all those Program Names -- you want to audition a few before deciding which to erase. In this case, press the button beneath the word ***EXIT*** on the Display. This returns you to the Page you were on before entering the **WRITE** mode.

Now use the **Bank Select Buttons** and the **Program Select Pages** in the usual way to select and listen to the Programs in memory. Your new Program is still safe in the **ESQ 1's** Edit buffer.

WARNING! -- While you're doing this, **DO NOT** change any parameters in the Programs you audition, as this would instantly replace your hard-earned new Program in the Edit Buffer with something else entirely, and you might get upset.

[WRITE] WRITE PROGRAM PAGE (cont'd)

When you are through listening, return to the Program you want to save by pressing the **COMPARE** Button. The *C* prompt will appear in the lower-left corner of the Page. Now press the **WRITE** Button to return to the **WRITE PROGRAM** Page. Your new Sound, and its new Name should be just where you left them.

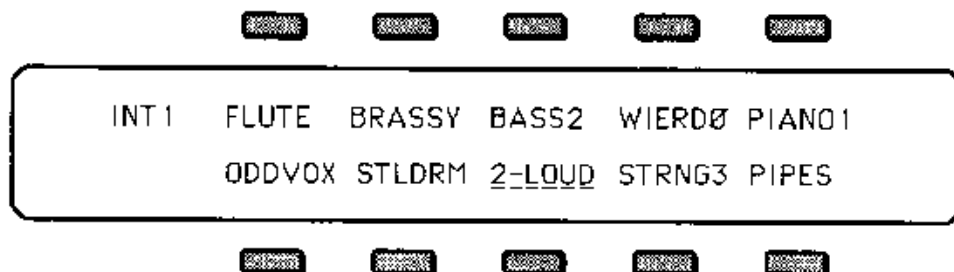
5. Write the Program in Memory. Once you have decided where you want to save the new Program, Press the appropriate **Bank Select** Button, and while holding it down, press the "Soft" Button which corresponds to the Program you wish to Write over. This Writes the new Program, with its new Name, into that Memory Location.

The Display will show a message



which will remain for about two seconds.

It will then return to the **Program Select** Page of the **Bank** into which the new Program has just been saved. The new Program is underlined, and is thus selected as the Current Program:



EXIT

The Button beneath the word *EXIT* can be pressed at any time to exit the **WRITE** Page and return to the Page you were on before entering it.

[WRITE] WRITE PROGRAM PAGE (cont'd)

Copying an Existing Program to Another Location

Sometimes you'll want to take an existing Program, one that you haven't been editing, and simply copy it to another Memory Location. For example, you might want to put the ten most commonly used Programs in the same Bank, for easy access during performance. Normally, the **WRITE** Page "looks" at the Edit Buffer. But you have the option of Writing an existing, unedited Program.

First select the Program you want to copy. Then press the **WRITE** Button. Pressing the **WRITE** Button when the ***C*** (**Change/Compare**) is not showing in the lower-left corner of the Display causes the **ESQ 1** to ask you the following question:

REPLACE EDIT PROGRAM WITH * YES *
CURRENT PROGRAM BEFORE WRITING * NO *

Answering ***YES*** places the Current Program onto the **WRITE** Page, and you can now use the **WRITE** Page exactly as before to copy that Program to any other Memory Location. Again, remember that you will erase whatever Program you write over -- it's not a bad idea to save all Internal Programs to a Cartridge or to audio tape before doing any major Memory reshuffling, because once a Program is gone, it's gone.

Answering ***NO*** will return you to the Page you were on before pressing the **WRITE** Button, leaving the Edit Program intact.

[STORAGE] STORAGE PAGE

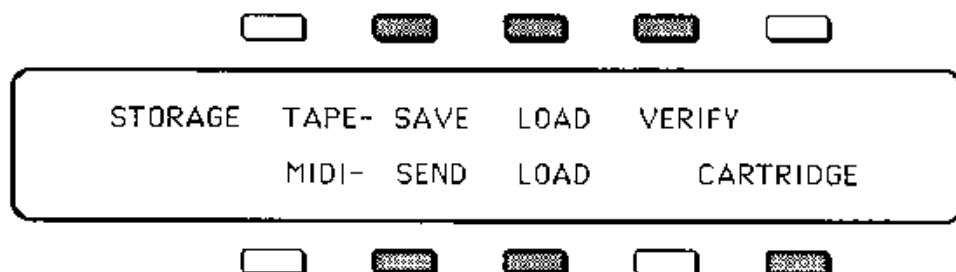
For Saving and Loading Programs and Sequencer Data to Cartridge, to Audio Tape, or Over MIDI.

The **STORAGE** Page is used to send and load Program and Sequence Data to various media for saving and storage. Transferring Sequencer Data is covered in the **Sequencer** half of this Manual. Here we are concerned with transferring Programs.

The **STORAGE** Page handles three basic types of Program Data transfer:

- 1) **CARTRIDGE** -- An entire Master Bank (all 40 Programs) can be transferred from the Internal Memory to **CART A** or **CART B**. Or the 40 Programs in **CART A** or **CART B** can be transferred to the Internal Memory.
- 2) **TAPE** -- The 40 Programs in the Internal Memory can be saved to Audio Tape, or a Bank of 40 Programs can be loaded into the internal Memory from Tape.
- 3) **MIDI** -- All 40 Internal Programs, or any single Internal or Cartridge Program, can be sent via MIDI to another **ESQ 1**, or to a Computer which has been programmed to accept such information.

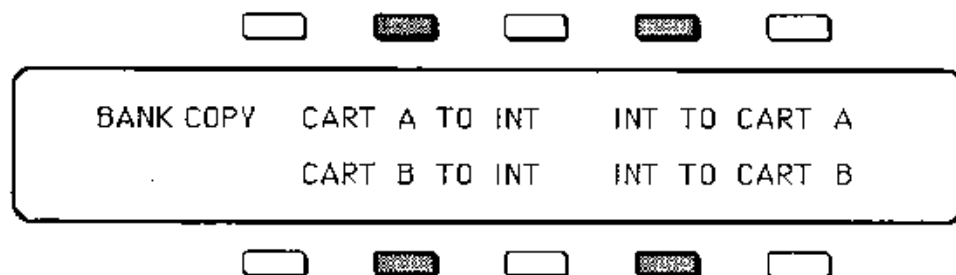
When you press **STORAGE**, the Page appears like this:



From here you choose which type of Data Transfer you want.

CARTRIDGE -- Bank Copy

When you press **CARTRIDGE** from the menu on the **STORAGE** Page, the following Page appears:



TRANSFERRING INTERNAL PROGRAMS TO A CARTRIDGE

To Transfer all 40 INTERNAL Programs to CART A:

- > Insert an **ENSONIQ E² PROM** Storage Cartridge in the Program Cartridge Slot.
- > Select the **STORAGE** Page.
- > Press **CARTRIDGE**. The **BANK COPY** Page appears as shown above.
- > Press **INT TO CART A**. The Display will ask **COPY PROGRAMS FROM INT TO CART A?** and give you the option of answering ***YES*** or ***NO***.
- > Press ***YES*** to Copy the Internal Programs to CART A. The Display will read **PROGRAMS BEING COPIED, PLEASE WAIT**. Copying an entire Bank to the Cartridge takes about two minutes. Or Press ***NO*** to cancel the procedure for any reason.
- > When the **PLEASE WAIT** message disappears, the transfer is complete.

To Transfer all 40 INTERNAL Programs to CART B:

- > Insert an **ENSONIQ E² PROM** Storage Cartridge in the Program Cartridge Slot.
- > Select the **STORAGE** Page.
- > Press **CARTRIDGE**. The **BANK COPY** Page appears as shown above.
- > Press **INT TO CART B**. The Display will ask **COPY PROGRAMS FROM INT TO CART B ?** and give you the option of answering ***YES*** or ***NO***.
- > Press ***YES*** to Copy the Internal Programs to CART B. The Display will read **PROGRAMS BEING COPIED, PLEASE WAIT**. This takes about two minutes. Or Press ***NO*** to cancel the procedure for any reason.
- > When the **PLEASE WAIT** message disappears, the transfer is complete.

TRANSFERRING CARTRIDGE PROGRAMS TO INTERNAL MEMORY

To Transfer all 40 CART A Programs to the INTERNAL Memory:

- > Insert an **ENSONIQ E² PROM** Storage Cartridge in the Program Cartridge Slot.
- > Select the **STORAGE** Page.
- > Press **CARTRIDGE**. The **BANK COPY** Page appears as shown above.
- > Press **CART A TO INT**. The Display will ask **COPY PROGRAMS FROM CART A TO INT?** and give you the option of answering ***YES*** or ***NO***.
- > Press ***YES*** to Copy the 40 Programs in CART A to the Internal Memory. The Display will read **PROGRAMS BEING COPIED, PLEASE WAIT**. Copying an entire Bank from a Cartridge to the Internal Memory takes only about two seconds. Or Press ***NO*** to cancel the procedure for any reason.
- > When the **PLEASE WAIT** message disappears, the transfer is complete.

To Transfer all 40 CART B Programs to the INTERNAL Memory:

- > Insert an **ENSONIQ E² PROM** Storage Cartridge in the Program Cartridge Slot.
- > Select the **STORAGE** Page.

- > Press **CARTRIDGE**. The **BANK COPY** Page appears as shown above.
- > Press **CART B TO INT**. The Display will ask **COPY PROGRAMS FROM CART B TO INT?** and give you the option of answering ***YES*** or ***NO***.
- > Press ***YES*** to Copy the 40 Programs in **CART B** to the Internal Memory. The Display will read **PROGRAMS BEING COPIED, PLEASE WAIT**. Or Press ***NO*** to cancel the procedure for any reason.
- > When the **PLEASE WAIT** message disappears, the transfer is complete.

TAPE STORAGE

The 40 Programs in the Internal Memory can be saved to audio Tape, cassette or reel-to-reel, and later loaded back into the **ESQ 1's** Internal Memory from Tape.

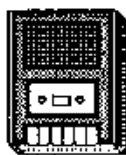
A "Decent" Tape Deck

Because of the sheer amount of information involved, the **ESQ 1** sends Data to Tape at a rate that is a good bit faster than most synthesizers. For this reason it is recommended that you use a "decent" Tape deck to Save and Load your **ESQ 1** Program and Sequence Data. This doesn't mean you need an audiophile unit -- any home stereo-type cassette or reel-to-reel deck should do fine. Decks specifically designed for use with computers should work as well.

What is definitely NOT recommended is a very cheap portable-type recorder. Such recorders cannot be relied upon to handle the **ESQ 1's** high speed data transfer.



YES



NO

The higher grade of tape you use, the more reliable the results you will get. Definitely do not use three-for-a-dollar generic cassettes. A good quality Normal Bias cassette should do the job; a Chrome Bias cassette is better; a Metal Bias cassette is best. Tapes which are specifically made for computer data storage will work. These are available at any Computer store.

It is generally recommended that you not use any Noise Reduction when Saving or Loading Programs, as Noise Reduction circuits tend to "round off" the square pulses that the **ESQ 1** uses to store information.

Small differences in record level can make a big difference when saving Data to Tape. You may need to experiment a bit to see what works best with your equipment.

Tape Connections

To Save Program Data to Tape, connect the **Tape Out Jack** on the Rear Panel of the **ESQ 1** to the **Input** of your tape recorder. For Loading Data, or Verifying Data that has been Saved, connect the proper **Output** of the tape recorder to the **Tape In** jack of the **ESQ 1**.

When Saving Data to Tape, it's not a bad idea to use a "Y" adapter at the tape recorder end of the cable, and to feed the signal to both channels of the deck. That way you can record duplicate copies of the information (on the left and right channels of the Tape), in case a dropout or other problem causes an error on one of the channels. Also, when you later Load the Data into the **ESQ 1**, this method allows you to monitor one channel while sending the other to the **ESQ 1**.

*** * * * Note:** The first time you save Data to Tape, it is a good idea to go through the procedure once without Starting the Tape Deck, just to get your Record levels properly adjusted. Also, recording some sort of spoken "Slate" on the tape, immediately before each batch of Programs you save, will help you keep Track of which Bank is where on the Tape.

To SAVE All 40 Internal Programs to Audio Tape

- > Connect the **ESQ 1's Tape Out Jack** to the **Input** of one channel of your tape recorder (or to both channels, as described above).
- > Put your Tape Deck in **Record/Pause**.
- > Select the **STORAGE** Page.
- > Press **TAPE SAVE**. The Display shows the following:



- > Start the Tape Deck Recording.
- > Press **INT BANKS**. This starts the DataTransfer. The Display will read ***SAVING DATA TO TAPE***. The **ESQ 1** will put out an eight second "Leader" tone, followed by the Program Data, which takes about 16 seconds. During the Leader tone, adjust the Recorder's Input level. The VU meter(s) should read between -3 and 0 dB for home and semi-pro cassette decks; lower (around -10 to -6) for professional equipment operating at +4 dBm.
- > When the Data has been transferred, the Display reads ***TAPE PROCEDURE COMPLETE***, and the **STORAGE** Page returns.
- > Stop the Tape Deck, and Verify the Transfer, as described below.

To VERIFY Program Data Saved to Audio Tape

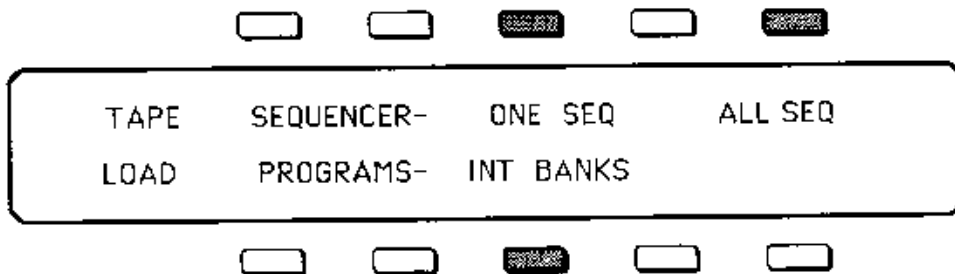
- > Connect the **Output** of the channel of your tape recorder that contains the Program Data to the **ESQ 1's Tape In Jack**.
- > Select the **STORAGE** Page.
- > Rewind the Tape Deck to the beginning of the Data to be Verified.
- > Press **TAPE VERIFY**. The Display shows the following:



- > Start the Tape Deck Playing. Listen to the Output, or watch the VU meters, and wait for the Leader Tone which precedes the Data to begin.
- > After the Leader Tone begins, press **INT BANKS**. This starts the **ESQ 1** checking the Data on the Tape. The Display will read ***READING DATA FROM TAPE***.
- > If the Data on the Tape is correct, the Display will say ***TAPE PROCEDURE COMPLETE***, and then return you to the **STORAGE** Page.
- > If the Verify is unsuccessful, you will get one of the following messages:
 - 1) ***TAPE NOT STARTED ON LEADER TONE*** -- The Leader Tone must be actually playing when you press **INT BANKS** to begin Verifying. Try the Procedure again.
 - 2) ***VERIFY FAILED -- INVALID TAPE DATA*** -- This can result from a number of things -- the Data was recorded at too high, or too low, a level; a serious dropout or other Tape problem has garbled the Data; or a bad connection has resulted in a loss of Data. In any case, when you get this message, Save the Data again, to another part of the Tape, or to another Tape.
 - 3) ***INCORRECT TYPE OF DATA ON TAPE*** -- This message would result if, for example, you pressed **INT BANKS** and then played Sequencer Data into the **ESQ 1**. Don't do that.
- > There is one more message you might get, which is not fatal, but requires your attention. If after a Verify, the Display reads ***DATA ERROR FROM TAPE WAS FIXED***, that means that the **ESQ 1** found one bit of wrong information on the Tape, but was able to correct it. This might indicate an aging Tape, or a slight dropout, and it is a good idea to save the information to another Tape.

To LOAD Program Data from Audio Tape

- > Connect the **Output** of the channel of your tape recorder that contains the Program Data to the **ESQ 1's Tape In Jack**.
- > Select the **STORAGE** Page.
- > The Tape Deck should be in Stop or Pause, at the beginning of the Data to be Loaded.
- > Press **TAPE LOAD**. The Display shows the following:



- > Start the Tape Deck Playing. Listen to the Output, or watch the VU meters, and wait for the Leader Tone, which precedes the Data, to begin.
- > After the Leader Tone begins, press **INT BANKS**. This starts the **ESQ 1** Loading the Data on the Tape. The Display will read ***READING DATA FROM TAPE***.
- > If the Load is successful, the Display will say ***TAPE PROCEDURE COMPLETE***, and then return you to the **STORAGE** Page.
- > If the Load is unsuccessful, one of the following error messages will appear:
 - 1) ***TAPE NOT STARTED ON LEADER TONE*** -- The Leader Tone must be actually playing when you press **INT BANKS** to begin Loading. Try the Procedure again.
 - 2) ***INCORRECT TYPE OF DATA ON TAPE*** -- The Data was not Program Data.
 - 3) ***FATAL ERRORS DETECTED-- ALL INTERNAL PROGRAMS RESET*** This means that midway through the transfer, the **ESQ 1** got some bad Data, and had to erase and re-initialize all the Internal Bank Programs.
- > The Display might read ***DATA ERROR FROM TAPE WAS FIXED***. This means that the **ESQ 1** found one bit of wrong information on the Tape, but was able to correct it. Save the information to another Tape location.
- * * *** **Note:** Whenever you get an error message while transferring Data by Tape or via MIDI, the message will remain on the Display until you press one of the front panel buttons. Press any button (except a Soft Button) to continue.

MIDI TRANSFER OF PROGRAMS

The **ESQ 1** can be instructed to send Program Data over MIDI to another **ESQ 1**. This Data could also be received by a Computer which has been programmed to receive such Data. Here we are concerned with sending Programs from one **ESQ 1** (the Sending Unit) to another (the Receiving Unit).

MIDI Connections

In the case of Sending Program Data via MIDI, it is only necessary that the **MIDI Out** jack of the Sending **ESQ 1** be connected to the **MIDI In** jack of the Receiving Unit. Three other conditions must be met:

- 1) Both Units must be set to the **same MIDI Channel**. (MIDI Page) MIDI Mode doesn't matter.)
- 2) The Receiving Unit must have System Exclusive messages Enabled. (On the MIDI Page, set MIDI Enables to **ENABLE=KEYS+CT+PC+SS+SX.**)
- 3) The Receiving Unit must be on a **Program Select** Page when receiving the Programs. Any Program Select Page, Internal or Cartridge, will do.

To SEND All Internal Programs via MIDI to another ESQ 1

This will Send the Internal Memory of the Sending Unit to the Internal Memory of the Receiving Unit, replacing whatever is there.

- > Connect the MIDI cable, and set up the units as described above.
- > On the Sending Unit, select the **STORAGE** Page, and press **MIDI SEND**. The following Page appears:



- > Press **INT PROG BANKS**. The Display will read ***MIDI DATA BEING TRANSFERRED* PLEASE WAIT...** for about two seconds
- > The Display will say ***MIDI PROCEDURE COMPLETE***, and then return to the **STORAGE** Page. The new Programs are now in the Internal Memory of the Receiving Unit.
- > If the Receiving Unit does not respond, check 1) your MIDI connections, 2) the MIDI Channel on both units, and 3) the MIDI Enables on the Receiving Unit, and try again.

To SEND One Program via MIDI to another ESQ 1

This will Send the selected Program of the Sending Unit to the Edit Buffer of the Receiving Unit, replacing whatever is there.

- > Connect the MIDI cable, and set up the units as described above.
- > On the Sending Unit, select the **STORAGE** Page, and press **MIDI SEND**.
- > Press **CURRENT PROGRAM**. The Display will flash ***MIDI DATA BEING TRANSFERRED* PLEASE WAIT...** (One Program doesn't take long)
- > The Display will say ***MIDI PROCEDURE COMPLETE***, and then return to the **STORAGE** Page. The new Program is now on the **WRITE** Page of the Receiving Unit. Edit its Name if you wish, and then Write it into Memory as described earlier (**WRITE PROGRAM** Page, p. 74).
- > If the Receiving Unit does not respond, check **1)** your MIDI connections, **2)** the MIDI Channel on both units, and **3)** the MIDI Enables on the Receiving Unit, and try again.

*** * * * Note:** When you save all Sequencer Data to a **Mirage** Digital Sampling Keyboard, or **Mirage** Digital Multi-Sampler, as described in Section 9, the 40 Internal **ESQ 1** Programs are sent to the **Mirage** along with the Sequencer Data. When you later Load the Sequencer Data back into the **ESQ 1**, you have the choice of Loading just the Sequencer Data, or the Sequencer Data plus the 40 Programs. You cannot Load just the Programs from a **Mirage**. This does, however, provide another method of storing Programs. The catch is that Sequence Data must be Loaded at the same time, replacing whatever Sequence Data was there before.

