

Transoniq Hacker

The Independent Ensoniq User's Newsletter

NOW INCLUDING ESQ-1 COVERAGE

MASOS FOR THE MASSES

PART TWO

By Clark Salisbury

Welcome back! Here we are again, ready for some more MASOS-type stuff.

If you were with me last month, by now you should be sliding samples all over the place using the handy MASOS copy commands. But MASOS does a lot more than simply allow you to move samples around. Actually, there are eight distinct MASOS functions available, apart from the wavesample copy functions discussed last month (and not counting the fact that MASOS allows you to rotate a waveform left or right by a specified number of samples). There is one trick to using MASOS, though. As is stated in the MASOS manual, data manipulations using MASOS "are not restricted to operating on wavesample boundaries." What this means is that MASOS will allow you to operate directly on any area of memory you choose, regardless of where individual samples may be located within that chunk of memory. So my warning from last month's article goes doubly here. Always make sure you know what areas of memory you are working with before initiating any MASOS functions; otherwise you stand to screw something up. The safest approach is to save any work to disk before implementing any MASOS functions. Of course, it's always a good idea to save periodically anyway.

As I've said, there are eight distinct operations available when MASOS is installed. Function #1 is a copy function; it allows you to copy any section of memory to any other section, upper or lower. #2 is a fade in and #3 is fade out these allow you to fade into or out of any portion of memory. #4 is called scale. It's similar to the fade functions, except that levels needn't start or end at zero; you can use it to make samples get somewhat quieter or louder over time. #5 is an add utility; it allows you to add any two samples together. #6 inverts a sample. All of the positive samples become negative, and vice-versa (you probably won't be able to hear the difference between an inverted waveform and a non-inverted one - this function's primary usefulness is for looping, and even then, like the rotation command, you really need one of the visual editors to actually use it). #7 reverses a wavesample (or portion thereof) and this is one you will be able to hear. We'll work with it in a minute. And #8 is replicate. This takes the first page of memory that you select, and copies it to all the subsequent pages of memory that you've selected. Each function is accessed by pressing the LOAD SEQUENCE key, followed by the appropriate number (1-8) key. Once the number key has been pressed, a two

letter mnemonic message will flash to confirm your choice, such as "rd" - for reverse data. To initiate the MASOS function, simply press ENTER. The display will go blank briefly and then return with the message "Fc" (function completed).

Simple, huh? Of course not, and you know it. Before you actually initiate any of these functions you have to know a couple of things (same as last month): "Where am I now, and where the heck am I going?" Within one keyboard half of the Mirage's memory there could be as many as eight different wavesamples, and within any one wavesample there could be as many as 256 pages of memory. Not only that, but did you know that two different wavesamples might share the same chunk of memory? And so how is the Mirage going to know which wavesample you want to diddle? This is where MASOS parameters 85 through 94 come in. These parameters allow you to tell the Mirage what area of the memory you want to work with.

To get a feel for this, let's try a little experiment. Do you all have your Mirages on and loaded with MASOS? Well, get with it! Now, let's take Sound Disk #3.2 (you may have it as Disk #3 if it's an earlier version) and load the upright bass (Lower Sound #1) into the lower half of the keyboard. What we are going to do here is reverse the wavesample, so that it plays backwards. Sounds like fun, eh?

The first thing we want to do is to verify that we are dealing with the right wavesample - so let's check it out. Is there more than one wavesample used to create the bass sound on the lower keyboard half? Hit Initial Wavesample [P27] (make sure you are working with the lower half of the keyboard), and then press the VALUE key. Yup, it reads out "1", so it's a good bet that the first wavesample on the lower part of the keyboard is in fact wavesample #1. Hit Top Key [P72]. It reads out "12", so we now know that wavesample #1 covers the first 12 keys of the keyboard. Since we can hear that the bass actually covers the first two octaves of the keyboard, we can assume that there is at least one other wavesample involved here, covering the 12 keys in the second octave of the keyboard. Let's find out if there's more than one. Hit Initial Wavesample [P27]. Check its value. It should still read "1". Play a note in the low octave of the keyboard. Sounds like an upright bass, doesn't it? Hit the ON key to increase P27's value to 2 and then play the lower octave of the keyboard again. Still sounds like the bass sam-

pie, right? By changing P27 to 2, we've told the Mirage to use wavesample #2 as its first wavesample, and since it still sounds like bass we can surmise that wavesample #2 is indeed another bass sample. Now set the value of P27 to 3 and listen to the results. Bingo! Sounds like the bari sax sample used in the Lower Program #4 on this disk. So now we have determined that the bass sound on the lower keyboard half is actually made up of two samples. If you want, hit PLAY SEQ and the number 2 (to select lower wavesample #2), hit Top Key [P72], and then hit the VALUE key to verify that wavesample #2 does indeed have a top key setting of 24.

Now, what we want to do is to reverse the waveform that is in wavesample #1. But we need to be able to tell the Mirage which wavesample, or more specifically, which area of memory to reverse. First, hit PLAY SEQ and the number 1 to select wavesample #1 on the lower keyboard. Key in Wavesample Start [P60], hit the VALUE key and take a reading. You should come up with the number 0.2. This is the number of the first page of memory used for wavesample #1. Similarly, key in Wavesample End [P61], and take another reading. This is the last page used in wavesample #1. You should get the number 6.F (hex). Now we know that wavesample #1 occupies a strip of memory beginning on page 0.2, and ending on page 6.F. Remember those numbers.

What we need to do next is tell the Mirage that we want to operate on this specific area of its memory. This is where parameters 85 to 94 come in. (For this specific operation, we won't be using all of these parameters.) Source Start: Page Number [P85] is used to set the first page of memory that you want your MASOS function to affect. Set this parameter to 0.2 (the first page of wavesample #1). Parameter 86 (Source Start: Sample Number) is used to set Source Start WITHIN a page of memory. For example, if you wanted to copy only the last half of a page of memory you would set this number to 8.0 (hex). MASOS would then ignore any data before that point. For now, we want to include this entire page in our operation - so leave this parameter set to its default (0.0). Since we want this operation to be performed on the entire bass sample, from 0.2 to 6.F, we also need to set Source End: Page Number [P87] to 6.F. Parameter 88 works similarly to Parameter 86 - it allows you to set the end point anywhere WITHIN the last page. For now we want to include the entire last page, so set Parameter 86 to F.F (the last sample on a page). One final thing - turn the Loop Switch [P65] off. Your results will be more predictable.

Now we should be set. Hit the MASOS Function Key (LOAD SEQ), and press key #7 (reverse data from start to end), then press ENTER. In a few seconds the display should read "Fc" (function complete) and you should have a reverse-plucked upright bass. Except that you will hear just the beginning of the of the sax sample start to play at the end of your sample. Why? I'm not sure, but my guess is that the end of each sample within the Mirage contains a few zeros or some such which act to tell the Mirage that it is the end of that particular wavesample, and not to play into the next sample. By reversing the entire sample, we've put the marker at the beginning of the sample and left nothing at the end. This seems to be easily remedied, however. By setting Source End: Page Number [P87] to a value that is one less

than the actual end of the wavesample (in this case, it would be 6.E instead of 6.F) we can reverse the sample and still leave the end marker intact. Another thing that works if you have already reversed the waveform (for those of you who actually plunge ahead without reading ahead) is to simply switch the value of Wavesample End [P61] to another number (any other number) and then back to its original setting. Or you can toggle the Loop Switch [P65] off and then on. Either of these will restore the marker.

So now you've got this keen backwards bass, but wait - something funny happened to the bass sound in the second octave on the keyboard. It may have lost some of its attack, or it may no longer be looped - so what gives? Well, what I didn't tell you was that wavesample #2 is identical to wavesample #1. It even uses the same chunk of memory. The only difference between the two wavesamples is that wavesample #2 starts on page 0.0, and #1 starts on page 0.2. Since the attack of the note on an upright bass is so important to how we hear that note, and since the attacks of notes play back faster the higher you play a sample, the Ensoniq folks have used this handy little trick to even out the attacks of the bass sample in its lower and higher registers. The original upright bass sample has a bit too long and sluggish an attack for the lower notes, so the lower wavesample (#1) is simply started two pages in, effectively chopping off the first little bit of the attack. This brings me to an interesting trick. Have you ever made a sample that had a little junk at the beginning that you wanted to get rid of? Try this. Set your wavesample start point for the place where you'd like the waveform to start playing from. Listen to it. If it sounds good, count the number of pages you are from the start of the wavesample. Reverse the wavesample. Truncate the end of the reversed wavesample by the same number of pages that you counted. Reverse it again. Now you can use those few pages of memory for something else. (Unless of course you happen to be working with wavesample #1, in which case you may need to copy it a couple of times to move it back so it starts on page one.)

Anyway, there you have a basic application for the reverse function available with MASOS. As you may have gathered, there are other uses you may find for reversed waveforms. And there are another seven MASOS functions we haven't even talked about yet. Not to mention the uses for destination and scaling functions. But if you have been paying attention, you're probably getting a good idea of what's going on with MASOS by now. Next trip, I want to get to as many of the other MASOS parameters as space permits - as well as getting into some of the fun stuff: applications. You know - cross fading, bi-directional looping - the good stuff. So hang in there and keep rotating.

Clark Salisbury is Product Specialist with Portland Music Co. in Oregon, and is also a partner in "The Midi Connection," a Portland-based consulting firm. He has been actively involved in the composition, performing, and recording of electronic music for over six years, and is currently involved in producing and marketing his own pop-oriented compositions.

SOFTWARE REVIEWS

Enharmonics VISUAL DISPLAY SYSTEM for the C-64

By Walter Daniel

INTRODUCTION. It seems as if there has been an explosion in Commodore 64 waveform display/edit programs of late. In addition to Sonic Editor from Sonic Access (reviewed in Issue 9), Ensoniq is preparing a C64 version of the VES and Enharmonik has released the Visual Display System (VDS). The VDS performs graphing and editing functions with some utilities for speeding loop point searches. In addition to displays, the VDS offers waveform generation and basic harmonic analysis functions.

BASICS. The VDS requires a Commodore 64 home computer, a disk drive, a display (TV or monitor), and a Sequential or Passport compatible MIDI interface. WASOS must be booted on the Mirage being used since the program makes use of the extensive wavesample access capabilities of that operating system. VDS operations are controlled with menus in most places. There are occasional prompts for data, but the manual explains what is expected and what typical values are.

DISPLAYS. The waveform display function is accessed from the main menu. Any single page in the Mirage memory may be plotted by entering the number of that page. After a plot is finished, the "+" and "-" keys can be used to increment and decrement the plotted page number by one. The program works with decimal numbers; a decimal/hexadecimal converter can be accessed from the main menu. What is shown on the screen is a point-by-point graph of the waveform. Many waveforms are not clear unless lines connect the points, a feature VDS does not offer. No page number is indicated on the plot, but that information is given by the main menu. The waveform currently in computer memory can also be plotted, whether it was read in from the Mirage or created by the program. There is a plotting routine that graphs one point from each of the 256 pages of memory. This plot is useful for viewing overall amplitude and can make looping easier. For example, the screen can give an indication as to the number of pages into the wavesample before the initial transients in a sound die out.

Waveforms may be edited in a non-graphic format, actually a "brute-force" method. The page in memory can be stepped through, sample by sample, and altered numerically. If that last point doesn't quite match up for a good loop, change it. This technique is only effective for rather subtle edits and can be tedious in working through all 256 samples in a page. Another looping helper is a search-for-zero-crossings function. A search may be performed (over a specified range) for pages that begin with a zero (or +/-1 or other number entered) sample as the first point in the page. The idea is to narrow the choices for the loop start page to a workable number.

Transfer of waveforms into and out of computer memory is straight-forward. When plotting pages, the program requests the page number entered as well as asking for the upper or lower keyboard sound. Sending a waveform back to the Mirage is accomplished from the main menu. The single page in memory can be sent to any page number in the upper or lower sound. Single-page waveforms may be saved to the computer disk drive as well as loaded into memory from a disk. A disk directory function is included, but it involves leaving the program, viewing the directory, then running the program again.

VDS has extensive parameter displays. One display shows the configuration parameters (applicable to both upper and lower sounds). The wavesample and program parameters are shown on separate screens; either the upper or lower sound may be selected. Loading the parameters will overwrite any waveform in memory - so save that edited waveform.

WAVEFORMS. There are four waveform-creation techniques implemented in the VDS: additive, frequency modulation, waveshaping, and Karplus-Strong synthesis. For analyzing waveforms, VDS offers a Fast Fourier Transform to determine the magnitudes of the different harmonics.

Additive synthesis consists of setting the magnitude of the harmonics, then calculating the waveform. Many early digital synthesizers used this technique. Drawbar organs operate on the same principle. The VDS implementation can work with up to the 20th harmonic and allows phase deviations of each. After receiving the necessary information, the computer calculates a one-page waveform with the desired harmonic content. It may be saved or sent to the Mirage.

Frequency modulation (FM) synthesis involves multiplying two sine waves to create a waveform. This technique was developed by John Chowning at Stanford and made popular by the Yamaha DX-series instruments. The program allows up to six modulators for the single carrier. Frequency ratios of the modulators are entered as numbers, so non-harmonic components of the sound are possible. Again, the computer calculates a one-page waveform that represents the information input.

Waveshaping synthesis is similar to FM in that a waveform is multiplied with a function, but now the second waveform is a "nonlinear" function. The VDS implementation of this function is an array of the values -1, 0, or 1. If all the members of the array are 1, then multiplying a waveform by this function yields the original waveform. The trick is to set up a table of values that will do interesting things. Users can create their own functions and save them to

disk. The manual includes instructions about modifying the BASIC portion of VDS to create user-defined shaping functions.

Karplus-Strong synthesis is a waveform generation technique that was developed to simulate plucked string and drum sounds. VDS uses the process to create a waveform that uses all 256 pages of memory of a Mirage upper or lower sound. The technique involves starting with an array of random numbers, averaging two successive values, then storing the average back into the array. Eventually, all values will become zero. Alas, performing these calculations in BASIC is slow - it can take up to two hours to create a 256-page waveform. The timbres generating are nice, plus one can always extract any single interesting page out of the waveform for other uses.

The Fast Fourier Transform (FFT) section does not create waveforms, it analyzes them. The information it produces is simply the amplitudes of the harmonics. Having a FFT around is useful for examining why a sound works as it does. Again, programming this math in BASIC is slow. The VDS FFT can only analyze a one-page waveform; the computer takes about four minutes to complete the calculations.

There is a program on the VDS disk (not part of the main program) that creates pulse waves. It turns out that the waveform generation techniques in the main program (e.g, FM) cannot effectively create waves. One can get close to a pulse - especially if many harmonics or operators are used - but the best pulse waves are those created directly. A bit of history: square waves were created by analog circuitry such as op-amps by saturating the output at either the plus or negative supply voltages. The gain of the amp coupled with the feedback in the circuit would cause the changes in state to be almost instantaneous. Sine wave techniques such as FM or additive synthesis have trouble modelling abrupt changes as the source materials are smooth. The pulse program can create waves with duty cycles of 1 to 50 percent and can vary the cycle over many pages for pulse-width modulation effects.

MANUAL. The manual is well written with many examples and a quick reference guide at the end of each section. The copy is not clean and the layout a bit ragged in spots, but neither problem affects legibility. A detailed reference section is included for those interested in exploring the hows and whys of the various waveforms creation techniques.

CONCLUSIONS. It really is refreshing to see that someone regards the Mirage as a synthesizer with numerical control of waveforms. Sampling is great, but the VDS utilizes many other features of the machine. Graphics are not the strong point of this program; plots of complex waveforms are not clear at all. Nor does the program allow for drawing of

waveforms with graphic controllers such as light pens or game paddles. However, the Visual Display System excels at creation and application of unique waveforms.

Author's bio: Walter Daniel may or may not still be a graduate student at Georgia Tech. Thanks to MIDI, computers and modems, he'll probably never finish another song in his life. His CompuServe ID is 75066,164.

BACK ISSUES

Back issues are available for \$2 each. Some back issues are no longer available in their original printed form and a photocopy will be substituted.

VDS SYSTEM

A Visual Display System and Waveform Editor for the Commodore 64/128 and the Ensoniq Mirage

- HIGH RESOLUTION GRAPH OF SAMPLED WAVEFORMS: QUICK ACCESS TO ANY PAGE OR SAMPLE OF THE MIRAGE MEMORY
- EDIT MIRAGE WAVEFORMS
- SYNTHESIZE WAVEFORMS USING ADDITIVE OR FM SYNTHESIS
- LOAD AND SAVE MIRAGE WAVEFORMS TO THE COMMODORE DISK DRIVE
- PARAMETER DISPLAY: ALL PARAMETERS
- FOURIER ANALYSIS OF WAVEFORMS

V.D.S. System Requirements:

- COMMODORE™ 64/128 COMPUTER WITH DISK DRIVE AND MONITOR
- ENSONIQ MIRAGE™ SAMPLING KEYBOARD WITH MASOS™ OPERATING SYSTEM
- PASSPORT™ OR SEQUENTIAL™ COMPATIBLE INTERFACE

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Part III

By Richard Boulanger, PhD

SOURCE RECORDINGS

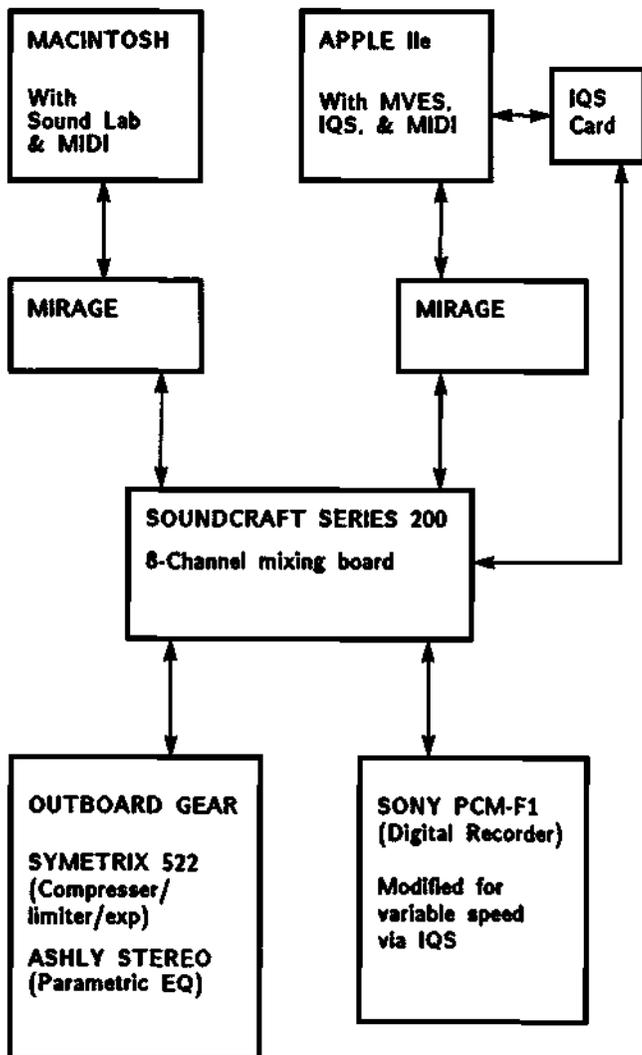
Boulanger When you are collecting your source materials, is there a particular mike you prefer?

Metcalf We pretty much leave the miking up to the people in the studios. They know the mikes they have, they know the room we're recording in. We draw on their expertise.

Boulanger So you go into a legitimate studio to collect your sources?

Metcalf Definitely. The room is there, the mikes are there, and until recently, we did not have the -facilities to do it here. We have just finished two studios at Ensoniq and will be doing some recording here in the near future. We'll probably still go into a real studio to do larger things, but we'll be doing some solo instrument things here.

Boulanger I have included a diagram of your set-up along with the interview and have asked the editors to publish a copy of it.



Metcalf Great. That's where we do all our sampling. The diagram lists all the equipment we use to make the -factory disks.

Boulanger You said you used an F1 to collect your sources, do you bring that into the studio with you?

Metcalf Yes. When we go into a larger studio we bring our F1 with us. We basically sit there and try to make sure that what we get on tape will work. But our reckoning isn't always on the money. Let me give you an example. It involves the electric guitar on sound disk #6.

We did that at a studio. A really good player came in to do some stuff. When we got back to Ensoniq, the solo stuff he played for the top of the keyboard didn't work at all. His fifths, on the other hand, worked really well, so we used them on the bottom of the keyboard.

We discovered that the electric guitar has a really complex tone color, and an amazing variety of shades, all of which are associated with the inflections of the pick. Controlling these picking subtleties turned out to be a crucial factor in getting the sound to work on the keyboard. What we brought back from the studio didn't work at all.

So one of the software guys at Ensoniq brought in his guitar and a distortion box. We experimented with it until we got a sound that worked on the keyboard. This was one of the few sounds that was done direct into the Mirage. It is multisampled and all - directly into the Mirage. It took a good amount of time to get it right.

Boulanger It's funny you mention the guitar, seeing that it is not only the first instrument that I attempted to sample, but it is also one of the first instruments which you suggest the new user should try to sample in the "Musician's Manual." What happened to me, and I believe it's a common problem, is that I did ultimately get a good sample, but it sounded nothing like a guitar.

Metcalf You're not alone. That happens to us here too. I mean, a lot of times you do something, and for some reason you put it in the sampling machine, and when you play it back it just doesn't sound right. That's where it gets down to the true test of your patience. You have to keep trying different things.

I should point out too, that it is not just Mirages that do this. I recently read an article in a British magazine written by a gentleman who works extensively with one of the Fairlights. He was saying that a feature he liked most about the Fairlight was that it tended not to give him back what he put in. So I believe that, to varying degrees, getting out exactly what you think you're putting in is a problem with all samplers.



Presents:

Vision

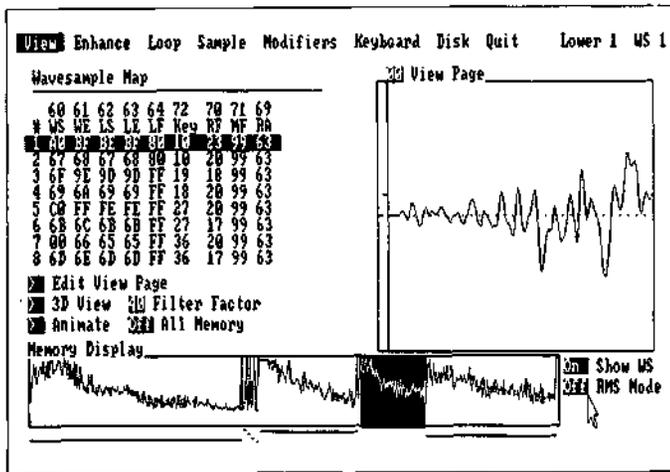
Visual Editing for the Mirage
and IBM PC, XT, AT

by Turtle Beach Softworks

Created by seasoned samplers, **Vision** is an unbeatable new sound design program for the IBM, PC, XT, AT or compatible, that can make sound manipulation easier for Mirage users. The program is designed specifically for visual editing and allows fast, easy wavesample editing and parameter manipulation without many of the drawbacks of other sound design programs.

Vision features 8 different screens which are simple to locate and easy to read. Each **screen** performs several distinct functions, making such chores as looping and editing a snap rather than a hit or miss ordeal.

Vision contains a complete manual, program diskette for the PC and 2 MASOS-I diskettes.



The View Screen

FEATURES:

- 3-D graphic wavesample display
- Easy to remember one key commands
- 4 note PC keyboard sound ability
- Exclusive animate function
- Specially designed user interface to ease parameter modification
- PC disk sound storage ability
- A Mirage diskette copy function
- Advanced Samplers Guide style printout for all program parameters

Vision has been given an exclusive endorsement by Ensoniq and is available through authorized Ensoniq dealers worldwide. For more information contact Turtle Beach Softworks at 1912 Alcott Road, York, PA 17402.

The View Screen - The View screen shows the wavesample memory of the entire keyboard with the current wavesample highlighted. View, edit and **Vision's** exclusive animate function permit waveform manipulation and even allow you to help correct tuning and volume problems and find ideal loop points.

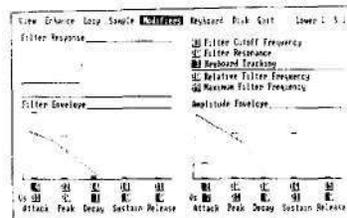
The 3D Screen - The 3D screen allows you to see changes in the wavesample's pitch, amplitude, phase and volume all at the same time. The 3D page and animate page combine to give you unsurpassed ability to view wavesamples as they occur in time.

The Modifiers Screen - This screen permits editing of all filter and amplifier settings, plotting the filter and amplifier envelopes and velocity information as you change them.

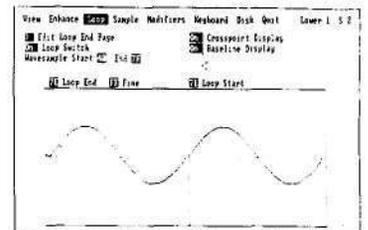
The Loop Screen - Short and long loops are easily found with the loop screen. The edit option allows you to fine tune the loop end page to produce clickless loops.

This system requires:

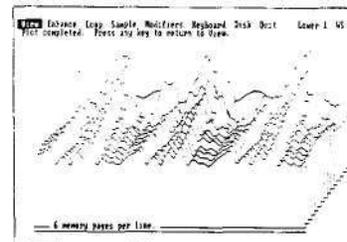
- An IBM PC, XT, AT or compatible 8088 based computer
- An IBM Color Graphics Adapter, Hercules Graphics Adapter or other popular graphics adapters
- At least 320K memory, 1 disk drive, and DOS 2.0 in the PC
- An IBM PC MIDI Interface: either an Octave-Plateau OP-4001 or a Roland MPU-401/MIF-lpc
- An Ensoniq Mirage DSK-8 or Multi-Sampler DMS-8
- 2 MIDI cables



The Modifiers Screen



The Loop Screen



The 3D Screen



Boulanger So there's no magical device that makes it happen? Your gear seems fairly standard.

Metcalf We really have that problem. Although people might think that it's easy here, a lot of times we go through hell trying to figure out what it is about a sound that makes it work. And often times you never really end up with an answer. You just do the best you can.

Boulanger How long does it take from beginning to end? I mean, exactly what is the degree of patience you are asking me to develop? How long did it take to do the guitar for example?

Metcalf It's not uncommon for a multisample sound - where you are trying to match up samples and get them to play right - to take a bit over a week to do a single sound. Now that week means me coming in and working all day long, 40+ hours, for a single sound. Sure, some of the sounds don't take that long. For example, single sample sounds, where you *are* not trying to match things up, don't take too long.

Boulanger Tell me about two or three of the disks which use single samples?

Metcalf The brass section things were all single samples just because you need a big loop. Some of the pipe organ sounds were loop's - location *ttl* comes to mind. On that disk there was no more memory to do multisamples. The cellos and the strings are single samples. Some of the choir things *are* single samples.

SAMPLING SPECIFICS

Boulanger Let's get back to the specifics of sampling. You've recorded the musician in the studio; you return to the lab; you spend a great deal of time finding the right "note;" then what?

Metcalf You go up a lot of blind alleys. For example, the hardest thing when doing a multisample sound, is trying to figure out where to make the splits. Where do you want to make the sacrifices?

In the case of the bass clarinet on sound disk #7, for example, I opted to put the samples close together, kind of in the middle and lower half of the keyboard. I kind of let it go to hell at the ends because I felt that these extremities of the range were less typical of the instrument. I also opted to do a mix mode, where I mixed in a little of the action noise. When I did the session, the thing that stuck out in my mind was the sound of all those little clicks when the instrument was played. So I mixed this "noise" in at a very low level because I thought it was important. You have to take them as they come.

At this stage of the game, I think the things that take the most time to do are the multisampled sounds. With the long looped things I have, more or less, gotten to the point of doing them by rote. I mean, you know

this Mill work and BO you just go ahead and do it.

THE PERFECT LONG LOOP: EVERY TIME

Boulanger Great. Tell me the Metcalf system •for perfect long loops every time?

Metcalf One of the things that works really well is cross-fading some of the information which comes before the start of the loop into the end of it. Just about every time, this gives you a loop with a characteristically smooth transition.

First, you'll have to decide how much time to crossfade over. However, you could still encounter some problems if your loop is a decaying sound, a sound in which the tonal qualities are di-f-ferent. This acoustic situation is not going to work very well unless you do some other things in addition to the "end-fade" technique.

TONAL AND VOLUME INCONSISTENCY IN THE LOOP

Metcal-f Let's use a gong -for example. A-fter determining the section of the sound I'm going to loop, I'll do a -3dB fade on the whole thing. Then, I'll copy the faded version somewhere, reverse it, and add it back upon itself. In this way, the tonal quality at each end of the loop is the same. In addition, there is a smooth transition throughout the entire loop.

To further clarify both of the above techniques, think of it like this. When you sample a sound and play it with no loop, there are no ticks or clicks in there. Its smooth, because that's the way it is. It is a continuous acoustic phenomena. So take advantage of that.

The real problem with any loop is that you are literally "butt-splicing" two different harmonic structures together. If the harmonics aren't in phase, they are going to bump and click. It ultimately gets down to a case of hit or miss, whether you are going to get things to line up or not. Sometimes you do, sometimes you don't.

These two techniques works more often than not. The "endfade" technique always works to get rid of bumps and clicks. How the "reversefade" technique works from a "spectral" standpoint, depends on the sound.

Boulanger Are there any other considerations we should be aware of?

Metcalf Yes. In the "endfade" technique, you'll need to be aware of the fact that you are essentially taking a little bit of the sound from its attack and crossfading that into the end. Thus you must have enough useable sound before the loop begins to do the fade. This implies a potentially significant tradeoff, because now your loop isn't quite as long as it might have been if you hadn't used the "endfade" technique. Still, the loop you get in return is so much smoother, it is often worth the loss in length.

SOUND DESIGNER

Now Available for the Ensoniq Mirage Multisampler!

Digidesign's revolutionary Sound Designer™ Macintosh software is now available for the Ensoniq Mirage and Mirage Multisampler. Sound Designer is the most powerful waveform editing and digital signal processing program available for the Mirage. Compare these features to other Mirage visual editing systems:

Full Waveform Editing - Edit sounds using standard Macintosh "cut and paste" style editing, with an editing accuracy of 1/50,000th of a second! Use Sound Designer's "pencil" to draw or repair waveforms.

Multiple Windows - Sound Designer is the only system that offers multiple sound windows for displaying and editing up to three sounds at the same time.

Digital Equalization - Sound Designer includes a fully parametric, high quality digital equalization program. Used with Sound Designer's FFT frequency analysis, it is the ultimate equalizer.

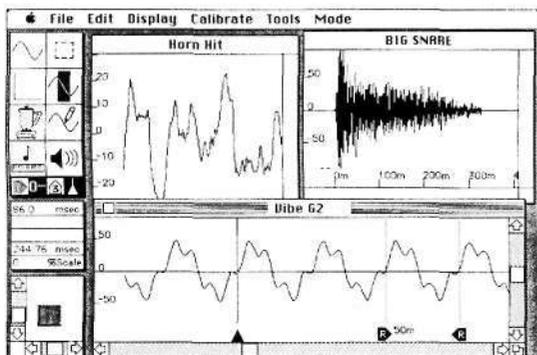
Visual Looping - Assign loops visually and fine tune the loop points using the "Loop Window". A crossfade looping program creates a good loop in difficult sounds.

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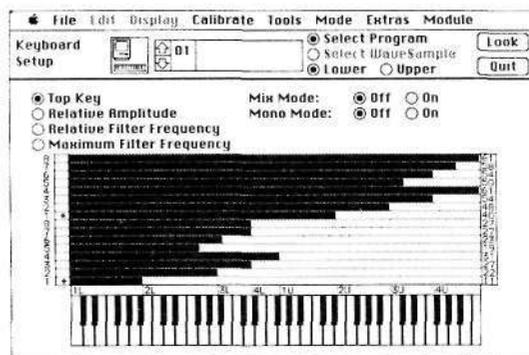
Digital Synthesis - Another Sound Designer first. Digitally synthesize sounds on the Macintosh, then transfer them to the Mirage for playback!

Mirage Programming Screens - Of course, Sound Designer includes a full complement of graphic programming screens for all Mirage functions (including a complete MASOS module). These screens alone perform virtually all of the functions found in other visual editing systems! If you have a rack mount Multisampler, Sound Designer includes an on-screen MIDI keyboard/sequencer to "play" the Mirage.

Sound Designer is the most powerful visual editing/processing software available for the Mirage. But don't take our word for it! Send us \$15, and we'll send you a pair of demo disks (Macintosh). We think you'll be quite amazed.



Multiple Waveform Windows



Keyboard Setup

digidesign

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THE ENDFADE TECHNIQUE IN DETAIL

Boulanger This is very important. Can we step through an example in some detail? Let's use the bowed violin as an example. Acoustically it is characterized by the bow noise at time of attack. This is followed by the periodic sawtooth motion caused by the rosin on the hair of the bow literally catching and releasing the string at periodic intervals. This rich harmonic tone is filtered by the instrument's body to produce the resulting timbre which we hear. As the bow is released and the tone fades away, its rich harmonic spectra is gradually filtered into a pure sine wave.

Metcal-f Good example. Let's say that we are doing a single sample and it fills our lower memory from 00 to EF (hex). Suppose we notice that our waveform hasn't actually stabilized until page 20.

Since the steady state of our violin tone runs from page 20 to EF, let's say, we have a nice chunk of useable loop material. However, if you want to use the "endfade" technique to guarantee a smooth loop transition, you would be crossfading in some fairly unsettled material - from before page 20. I assure you that your loop will not pop or click, but it will sound like crap.

Boulanger So we'll have to steal from the loop in this case.

Metcal-f Exactly. What you'll have to do is start the loop at say, page 40, and use the settled information - from page 20 to 3F - for a clean fade at the end. What you have done is sacrificed a little bit of loop length, but you've ended up with a loop that is much smoother than you could have done originally.

Boulanger Let's see if I understand it from here. I would copy the lower memory contents from page 20 to 3F into the same location in the upper memory let's say, do a fade in on it, and add it back into the end of the loop from D0 to EF.

Metcal-f Exactly, and you have a nice smooth transition from the end of the loop to the beginning of it. Obviously, the reason that the waveform at the very end of the loop passes so smoothly to the beginning of the loop is because it did so originally. It's a guaranteed fix.

Boulanger What about the phase alignment of the crossfaded waveforms?

Metcal-f True. Phase is a consideration. If you are looking at your sound on a visual editor, and you can see that it has a definite pitch - a clearly discernable periodicity - then you have to be concerned about phase when you "endfade."

Since it was a long loop, you probably didn't take the time to see that it was lined up

one sample per page. Now you are -faced with a problem. If you take the information at the beginning of the loop and fade it into the end, you have to make sure that the waveforms *are* in phase, otherwise there will be cancellation where you crossfade them. You *are* basically looking at the fundamental of the waveform, and you need to make sure that it is not going to cancel itself out when added.

MULTISAMPL.ES

Boulanger Is there any light which you might shed on the problems associated with multisampling?

Metcal-f Well, since you have to do more samples it takes more time. From a looping standpoint, single instrument, multisampled sounds, are actually pretty easy. All you have to do is get the thing lined up, turn the loop on, and find the page that loops the best and sounds the best.

When you *are* doing a multisample. You throw one in there and start playing it. Next, you determine how much useful range it's got. That's where you throw in another sample. In the act of putting the sample in the machine, you may find that there are some frequencies in there that just sound wrong. If this is the case you should play the sound at the pitch you sampled it at, plug the output through your EQ and get rid of the objectionable frequencies. When you've gotten rid of that weird stuff, you merely resample the sound through the EQ. It works amazingly well.

Boulanger It seems that there are no problems with multisamples?

Metcal-f Not true. There are always problems. The thing that comes to mind is the piano. In that case you've got a lot of enharmonics in its spectrum. When you do a single cycle loop on something with a lot of enharmonics floating through it, the loop is going to make those enharmonics shift pitch. Essentially you are removing the enharmonics when you hit the loop.

Boulanger Sure. This is because of the fact that a loop implies periodicity, and period implies pitch. When you loop a page of ANY sound, even noise, you, in effect, turn that complex waveshape into a perfectly periodic one, and you give it a pitch.

SMOOTHNESS OF TONE

Boulanger I'm glad you brought up the piano. How did you get the smoothness of tone over the entire keyboard?

Metcal-f With a lot of EQ. As far as sampling goes, the most important tool I have is my stereo 4-band parametric EQ. I use the heck out of it.

AN ESSENTIAL TOOL: PARAMETRIC EQ

Boulanger OK. I'm a serious, sampling-oriented, Mirage owner. What should I go out and buy tomorrow to improve the quality of my work?

Metcal-f An input sampling filter and some type of parametric equalizer - absolutely.

Boulanger How do you use the parametric EQ? Do you sample the sound first, EQ the output of the Mirage, and then resample with the new EQ settings?

Metcal-f Exactly. A lot of times when you sample something and you play back the single note, it sounds fine. Then as you start transposing it over a half-octave or so, you'll notice that there are some funny frequencies in there that really sound wrong.

Boulanger Yes. What is happening is that you are transposing the formant structure up in parallel with the transposition of the frequency. This rarely happens acoustically when a pitch is transposed. An instrument's identity is defined acoustically by two principal factors: (1) by its mode of excitation (i.e., blown, struck, bowed?), and (2) by its unique formant structure.

The voice is a very interesting case. The effect which is popularly called "munchkinization" is the byproduct of the coupled transposition of the formant structure and the fundamental frequency. From my experiments with software analysis-resynthesis tools such as the phase vocoder, I have been able to de-couple the formant structure from the frequency, and thus transpose the voice up many octaves without changing the "implied" physical size or identity of the speaker. It sounds like the speaker is getting younger, not shorter - the transformation is from man to boy, not man to elf.

Metcal-f Interesting. In the Mirage, there is often some little noise component which just doesn't transpose well. Under transposition it sounds quite strange. Given that we don't have a phase vocoder, and we do no resynthesis, the solution is the parametric.

If you can go in and simply notch out the objectionable artifacts, you'll often end up with something which, although not exactly the original, sounds much better when transposed. With the parametric, you can often take some of these things down enough so that they don't get in the way. However, there are some sounds which simply do not transpose, and in these cases there is little you can do.

Mainly, the EQ allows you to make one sample sound enough like another so that the two *are* more consistent and will ultimately blend. The other thing that the EQ can do for you is to remove those funny little noises.

THE MIRA6E PIANO

Metcal-f On the piano, for example, there is a clearly discernable "thud" associated with each "note." Yet on the Mirage piano, most of that "thud" is notched out. The strong "thud" just didn't work in the high end at all. It sounded quite strange. So, given the amount which I had to transpose the individual notes, I had to notch out most of the "thud" to make it work.

Boulanger Now this is interesting because I would have thought that the little "thud" of

the hammer striking the string was one of those essential noises which cue us in to the acoustic piano?

Metcalf It Definitely is. This is one of those cases where there is just enough "thud" left in for the timbral cue, but not enough to get in the way of the general utility of the sampled sound. There is a delicate balance and some tradeoff too.

Boulanger The piano is multisampled right?

Metcalf Yes, it's seven samples - seven or fourteen depending on how you look at it. There are actually seven samples, but it's a mixmode sound. Each division on the keyboard has a piano hit which goes into a loop, against which there is another loop. This keeps the movement in there when the sample goes into the loop.

ACHIEVING RICHNESS IN SHORT LOOPS

Boulanger Now this sounds like a very useful technique. I must admit that I have a real problem with short loops because the sound becomes so static, and the chorusing thing is equally mundane. Is this dual loop technique your solution to the problem?

Metcalf Exactly. In a short loop, the sound becomes totally static. What works really well a lot of times, is to start with a really short sample that loops well. Then, take another waveform, one which is different from the one which you are looping, maybe reduce its amplitude a little bit, or use the mix mode to adjust the relative amplitude of the two. Detune it slightly, and mix it in there with the original. This will give you enough movement so that it sounds quite natural in the loop.

Boulanger This is sort of what I had in mind when I asked you about hybrid tones or a template.

Metcalf The distinction which I make is that there are no synthesized waves. They are all from the instrument. If you think about it, looping is a very unnatural thing. When you take any sound and loop it, you are doing an unnatural thing to it. A thing that would never happen in nature. So, as regards hybrids or synthetic/sampled mixtures, it kind of depends on your definition of an.....

Boulanger unnatural act?

Metcalf Yeah.

Boulanger All sorts of possibilities come to mind.....

But getting back into the piano, it seems that you *amm* using the design of the instrument as the model. The sonic richness of the piano can be attributed, in part, to the pairing of two and three "unison" strings per key. You have adopted this model to the Mirage and are utilizing two loops per "note."

Metcalf Exactly. However, on some instruments the short loop works quite well without doubling things up. It really depends on the basic quality of the instrument.

SOME FINAL WORDS OF ENCOURAGEMENT

Boulanger Are there any final words you might like to add?

Metcalf Getting good samples is really just a matter of spending time with it. To get decent sounds takes time. That's why it's my full time job here. This is true on the synthesizer as well.

I remember working with my Chroma. It took a great deal of my time and energy to produce a sound with some nuance to it. Quite honestly, I think most people would rather spend that time playing. It just depends on what you want to do with your time and energy.

Boulanger What if you want to do it all?

Metcalf Then what it boils down to is just doing it. A lot of my rules, methods, and tricks get me 80% of the way. But there is a certain amount of just sticking with it. You try things, you screw up, and you learn. You start to get a feel for what kind of works and what doesn't. When you hit a sound that's giving you a lot of problems, and this is true with me, you learn a great deal just by playing with it. There really is a learning curve on each sound.

Boulanger Even though all sounds present their own set of unique circumstances, you've still helped us cut through to some tested methods.

Metcalf Well, it's really quite impossible to prescribe what works. It's ultimately a judgement thing.

ACKNOWLEDGEMENTS

Metcalf There is one additional thing I would like to add. I owe a great debt of gratitude to the people here in the software area for all their support. Back in the early days of doing these sounds, I often found myself at a dead end. I would run in here and ask these guys to write me a special piece of software, or run to John Senior and ask him if he could make the Apple Visual Editor do this. These guys would take the time to listen to me, and then put forth the effort to do it. In particular, I'd like to thank Alex Limberis, William Mauchly and John Senior.

Boulanger I don't think I'd be out of line if I too, on behalf of the editors and subscribers, join you in thanking the software people at En.soniq.

To this I would add my sincerest thanks to you Tom, for pointing both your colleagues, and all of us, in the right direction.

There may not be one surefire solution to the numerous and subtle problems facing serious samplers, but you have helped to bring us from our 20% to somewhere near your 80%. At the same time, you have given us some beautiful sounds in the process. You've been very generous, and your efforts are much appreciated. Thanks.

Richard Boulanger (born 1956) received his PhD in Computer Music from the University of California in San Diego (UCSD). His dissertation concerned the musical application of digital filtering techniques to transform speech into rich musical textures and variegated timbres. Boulanger received his Master's and Bachelor's degrees, both in composition, from Virginia Commonwealth University and the New England Conservatory of Music. His composition teachers have included Roger Reynolds, Jack Jarrett, Malcolm Peyton, and Hugo Norden.

At UCSD, Boulanger worked as a teaching assistant in the Department of Music and as a Research assistant at the Center for Music Experiment's Computer Audio Research Lab (CARL). Prior to his tenure at UCSD, he was employed as a High School Music Educator, and as a consultant for the ARP Synthesizer

Company. He is presently a visiting researcher at the MIT Experimental Music Studio and an Associate Artist of the McColl Studio at Brown University.

His electroacoustic and computer generated compositions have been performed and broadcast in Europe, Australia, Canada, Japan, and throughout the United States. His most recent work **Three Chapters from the BOOK OF DREAMS** features the Mirage sampling keyboard controlled, from the stage, by a violinist performing on a specially modified version of the Mathews' Electronic Violin. The work, which has been performed in Paris and Basel, received its American premiere on February 21 at the Kennedy Center in Washington, D.C. "Compositionally, I am concerned with the extension of traditional vocal, instrumental, and formal resources via technological means."

CLASSIFIEDS

USER GROUPS

INTERNATIONAL USER'S GROUP. Join M.U.G. for the price of one factory disk. Receive one complimentary disk of the latest samples circulating. Monthly updated lists of members, addresses and phone numbers. Monthly lists of quality user samples to be traded, bought, and sold. One year membership: \$20. Lifetime membership: \$40 (two complimentary disks). M.U.G., G-4 Productions, 622 Odell Ave., Yonkers, NY 10710.

Want to form Mirage User's Group in Hawaii. Contact Kelly Randall c/o KKUA, 765 Amona St., Honolulu, HI 96814. (808) 946-2869.

Milwaukee/Madison area - are there any other Mirage owners out there? I'm interested in sharing ideas, set-ups, custom sounds, etc. Call or write if you're interested. Mike Shawaluk, 2710 Horseshoe Bend, Hartland, WI 53029. (414) 367-4838 nights. (414) 382-3454 days.

SYRACUSE AREA MIRAGE OWNERS UNITE: MIDIOTS is a growing Mirage user-group. Meetings, sample trading, and techniques are just the tip of the iceberg. If interested, contact: JIM LOGAN, 339 BURNS AVE, SYRACUSE, NY 13206. (315) 437-8761. Motto: Don't be an idiot, MIDI-it.

Recording studio interested in contacting other Mirage owners in N.Y.C. and Westchester area to start user group, exchange sounds and info. Al Hemberger, LIPS MUSIC, (914) 961-9637, Bronxville.

NY, NJ, CONN - Tri-state area. Exchanging samples and ideas. Will consider mailing across country with honest and sincere Mirage owners. Any interesting and clean samples out there? Gordon G. G. Gerbert, G4 Productions, 622 Odell Ave., Yonkers, NY 10710. (914) 969-5682.

SAMPLES

Looking for: a good lead guitar sound, sounds used by 1%. Mister, and Emulator sounds for the Mirage. Also have sampled sounds. Write: Mark Ray, PO Box 2409, Shoals, AL 35662.

Wanted: If you live in the Baltimore area or in Ocean City, MD, and are interested in exchanging sounds, please call Don at (301) 665-2946, or write to 8329 Hillendale Rd., Baltimore, MD 21234.

Wanted - I would like to trade samples with others via the mail. I have all kinds of sound effects and instrument sounds. I am very interested in samples of Oberheim or other "thick" synth type sounds. If anyone has a VES for a Commodore 64, I would be interested in any comments you may have about it. Call Kelly Morris at 205-284-1353 after 5:00 CDT or write to: Kelly Norris, 1127 Birdwood Ct., Montgomery, AL 36111.

WOW!! Novelty disks - The Three Stooges, Warner cartoons, Johnny Weismueller "Tarzans," Johnny Carson Show, etc. Fully guaranteed at \$15.95 per disk. For list and prices, send S.A.S.E. to: Talance Recording, 906 E. Elmwood Ave., Burbank, CA 91501.

I am interested in trading Mirage Disks (I own them all) for the K-MUSE "New York" series (10 disks). Contact Dave at 13440 Cambridge #308, Southgate, MI 48195.

MIRAGE OWNERS. New from OASIS - A virtual sound effects library at your fingertips. 10 new disks, 24 effects per disk, \$19.95 each. Send \$1 for catalog or \$5 for catalog plus demo cassette (refundable with first purchase). To: OASIS SOUND LIBRARY, PO BOX 1006, FULLERTON, CA 92632.

SAMPLING? - Use S.O.S. IF YOU OWN A SAMPLING DEVICE OR ARE INTO SAMPLING IN ANY FORM, YOU NEED S.O.S. S.O.S. cassettes contain dozens of sounds for you to sample. All sounds are professionally recorded on pro equipment then dubbed to high quality chrome cassettes. Best of all you can sample direct from cassette deck to sampler, repeat the sound exactly again & again, & no additional instruments, devices, or people are required. Sample any portion of the sound, mix outputs from two tapes playing different segments for totally new and different sounds. Easy cueing, great fidelity, they're GREAT!!! Tape A: sound effects, Tape B: musical instruments, Tape C: percussive. ORDER TODAY!! ONLY \$9.95 each, including postage (within U.S.A.). ALL 3 TAPES FOR ONLY \$25.00!!! (Texas residents add 5% for tax.) S.O.S. CASSETTES, Rt. 2 Box 552, Roanoke, TX 76262. Checks payable to: LAKE SOUND.

SERVICES

Don't have time to wade through MASOS to customize disks for specific song/set needs? Need cowbell, clap, and crash on keys 1-3, choir and organ switchable through programs to synth and voices or piano and organ or...? You set the requirements. P. Wacker, 4221 III Dunlap ##250, Phoenix, AZ 85021.

WHY PROGRAM WHEN YOU COULD BE PLAYING? Giant patch libraries for DX7/TX7, CASIO-CZ, KORG DW8000. Any 32 patches for \$24.95! Bulk discounts! Index - \$2, demo cassette w/index - \$5. Specify synth. Also: patches for Juno1/2, Jupiter6, Poly800, Juno106. Write for details. Syntech, Hybrid Arts software priced LOW. Livewire Audio, Dept TH, 79 Shrewsbury Ave., Oceanport, NJ 07757. (201) 870-3115.

EQUIPMENT

For sale - Ensoniq Mirage. Purchased November. Still under warranty. Perfect condition. 8 disks, MASOS, and Advanced Sampler's Guide. \$1350 firm. Call or write: John Mulreman, 19 Mercer Ave., Port Monmouth, NJ 07758. 201-495-9028.

Mirage rev. 2 for sale. 6 months old w/10 factory disks, 10 blank disks, MASOS, and Advanced Sampler's Guide. Never taken on road. \$1800 or trade for Ensoniq ESQ-1. Joe (215) 698-8424. Philadelphia area.

Ensoniq Mirage (original version) Digital Sampling Keyboard. Perfect condition, with 8 disks. Six months old. \$1300 or trade for rack-mount. Markus McDowell. (805) 987-9932.

MASOS and formatting diskettes and original "Advanced Sampler's Guide." (I had an old Mirage & got a new one.) Also - I'm looking for a clean Fairlight thick breathy flute and a Roland Jupiter samples. Write: Don Carineri, 8329 Hillendale Rd., Baltimore, MD 21234.

Mirage for sale. Still under warranty. Over 30 disks and Sampler's Guide. I'm upgrading. \$2000 firm. Yamaha CS 60 with all accessories: \$695. Cerwin Vega cabinet: \$165 or free with purchase. Gordon Gerbert, 622 Odell Ave., Yonkers, NY 10710. (914) 969-5682.

SOFTWARE

IBM-PC and Mirage owners! Software is now available. For information, write: DSKIS, PO Box 8303, Cherry Hill, NJ 08002.

FREE CLASSIFIEDS!

Well, - within limits. We're offering free classified advertising (up to 50 words) to all readers for exchanging or selling your sampled sounds on Mirage-readable disks. Additional words, or ads for other products or services, are 15 cents per word. (Unless renewed, freebie ads are removed after 5 issues.)

Wanted: The sound used by Loverboy in "This Could be the Night." A bright bell attack with a light synth body. Also wanted: The vocal sound used by ZZ Top in "Rough Boys." P. Wacker, 4221 III Dunlap ##250, Phoenix, AZ 85021.

TWO HOT NEW SOUND DISKS: We at I.A.M. Productions first gave you Disk 1 "Exploration in Percussion and Drums," which was a collection of 20 explosive drum and percussion sounds. Now we have Disk 2 "Effects and Drums." This diskette contains a wide range of odd effect and drum sounds. Everything from a glass tap to our dog Rover. Each diskette is \$17.95 + \$2.95 shipping and handling. Mail personal check or money order to: I.A.M. Productions, 412 North Eleventh Street, Newark, NJ 07107. Ask for details on future happenings.

NEW SOUND DISK FOR MIRAGE with Sequential Prophet 5, "The Legend," best sounds and Fairlight "Breathy" voices. Recorded in 24-channel recording studio. Sounds guaranteed faithfully. Price: \$29.95. Please send check or international money order - account: Ljubljanska Banka Zagreb, Ace. No. 30101-620-42-727-70170-4298/99/. Address: DARANK DIGITAL, Davorin Chuvalo, Konjoscinska 21, 41040-Zagreb, Yugoslavia, Europe.

I would be interested in trading or purchasing more usable samples with anyone in the Detroit metro or suburb area. Brian Caldwell, West River Rd., Grosse lie, MI 48138. 671-1585 (around noon).

K-MUSE INC.'S "SOUND COMPOSER'S SERIES" The first comprehensive professional sound library produced by professionals. Simply the newest and best available! Set of ten disks: \$199 retail, 1055 discount for COD or prepay. The first sets available: R&B, ROCK & ROLL, LONDON, NEW YORK, SPIRITUAL, CLASSICAL, and COMEDY. K-Muse Inc., 18653 Ventura Blvd., Suite 359, Tarzana, CA 91356 or call (818) 703-1562 for info.

WANTED: A clean sample of a DX-7 electric piano (Bell-piano...) with plenty of "metallic-bell" attack content. Please contact Mark Wyar, 1121 Middle Ave., Elyria, OH 44035 with price and info. Thanks!



Well, the changes and corrections are coming in for the wonderful little chart we published last month on available waveform editors: Blank Software is actually at 1034 Natoma St. (not Matoma). Turtle Beach Softworks has gotten themselves a post office box. Their new address is: P0 Box 5074, York, PA 17405. And the price given for the Sound Designer from Digidesign is evidently not the retail price. The actual retail price is \$395. We'll rerun an updated chart when we have the space.

* * *

Speaking of space... As you've probably noticed by now, this issue marks another increase in size - 20 pages. Like it? Well, so do we. Every month we have more material than we have room to print. The problem with these improvements is that the cost is starting to add up. If we're going to have more 20-page issues, we're going to have to raise the price to \$20/year (U.S.). The other alternative is to fit more material in the same space by going to an all-typeset format. We'll probably do this eventually, but for now, it has the same problems more expense. We'd like some feedback from readers on this. Which do you prefer cheap or bigger?

* * »

Now that we're starting to mail out renewal notices (which go 1st Class), we're starting to find people who have moved and are wondering what happened to their issues (which are mailed 3rd Class). Our favorites usually have a comment like this "Hey, where's my 6 missing issues! P.S. Here's my new addresss xxxxx" Don't let this happen to you. We REALLY DO need your new address. The Post Office RARELY forwards this class of mail and we can't afford to be doing double mailings to someone who forgets to let us know when they move.

* * »

If you're writing an article for us, it's not necessary, but we really appreciate it if you could include an electronic copy. For now, we can read 520ST or IBM-PC (or compatible) disks, or you could e-mail it to us via the PAN Network (addresss TRANSONIQ).

MIRAGE-NET

The following people or organizations have agreed to help with questionss

MIRAGE COMPUTER BULLETIN BOARD - Provided by John Connolly of Portland, Oregon for information exchange and file transfer. Phone (voice)s 503-641-B2B0. Phone (BBS/computer)s 503-646-2095. Free messages. Yearly membership for upload/downloads \$25.

SAMPLING - Mark Wyar, (216) 323-1205. Eastern time zone (OH). Calls between 6pm and 11pm.

MIDI & SEQUENCING - Leslie Fradkin or Elizabeth Rose, MIDI-MAX Studios. Eastern time (NY). Calls between 10am and 9pm. (212) 628-5551.

MIDI & SEQUENCING - Markus McDowell. Any ol' time. (805) 987-9932 (Calif.)

MIRAGE HARDWARE & FIRMWARE - Scott D. Willingham. Eastern time (NY). Days. (716) 477-8089.

MIRAGE OPERATING SYSTEM - Mark Cecys. Eastern time (NY). Days. (716) 773-4085.

MASOS - Pete Wacker. Mountain time (AZ). 3 pm to 9 pm. (602) 937-1177.

If YOU'RE interested in being listed on the Net, please give us a call. (503) 245-4763.

HYPERSOINIQ

- NEW PRODUCT RELEASES -

BLANK SOFTWARE ANNOUNCES THE RELEASE OF SOUND LAB VERSION 1.1. The updated sound design package will now accommodate the macintosh Plus and the rack-mount Mirage Digital Multi-Sampler. In addition, a list of new waveform editing/processing features has been added. These include a new high-speed sample rate conversion algorithm for improved frequency response and increased looping flexibility, a 3-D time-domain waveform analysis display, and fine-resolution editing with memory-page boundaries. Other new features include: enhanced librarian functions, remote MIDI keyboard operation, improved wavedata transfers and more. SOUND LAB update 1.1 is available to registered owners of SOUND LAB 1.0 free of charge. Contact: Blank Software, 1034 Natoma St., San Francisco, CA 94103.

TURTLE BEACH SOFTWORKS ANNOUNCES A TWO-DISK DEMO of their IBM waveform-editing package: VISION. The package is available for \$10 and includes a "slide show" and a working demo. Turtle Beach also has several programs in the works for the new ESQ-1 from Ensoniq. Turtle Beach Softworks, P0 Box 5074, York, PA 17405. (717) 741-4972.

CHANGE OF ADDRESS

Please let us know at least four weeks in advance to avoid missing any issues. The Post Office will not reliably forward this type of mail. We need to know both your old and your new address. (Issues missed due to late or no change notification are your own dumb fault - we mailed them!)

The Mirage / IBM-PC Link !!

SYNTHASSIST TM

Complete Parameter Controls and Graphics

WAVESAMPLES

The Wavesample screen graphically displays the entire keyboard and wavesample assignments. The parameters for all eight lower samples can be quickly and comprehensively edited. Simple one keystroke commands move you to the upper samples or anywhere within the SYNTHASSIST visual editing system.



WAVESAMPLE PARAMETERS - LOWER								
	1	2	3	4	5	6	7	8
WAVESAMPLE START	[0]	[34]	[76]	[120]	[0]	[0]	[0]	[0]
WAVESAMPLE END	[33]	[75]	[127]	[203]	[255]	[255]	[255]	[255]
LOOP START	[32]	[74]	[126]	[120]	[254]	[254]	[254]	[254]
LOOP END	[32]	[74]	[126]	[202]	[254]	[254]	[254]	[254]
LOOP END FINE	[255]	[255]	[255]	[255]	[255]	[255]	[255]	[255]
LOOP SWITCH	[ON]	[ON]	[ON]	[ON]	[OFF]	[OFF]	[OFF]	[OFF]
COARSE TUNE	[3]	[3]	[3]	[4]	[3]	[3]	[3]	[3]
FINE TUNE	[120]	[120]	[125]	[10]	[230]	[230]	[230]	[230]
REL. AMPLITUDE	[55]	[63]	[0]	[63]	[0]	[0]	[43]	[0]
REL. FILTER FREQ.	[20]	[17]	[0]	[43]	[22]	[20]	[20]	[0]
MAX. FILTER FREQ.	[99]	[93]	[99]	[95]	[92]	[95]	[99]	[95]
TOP KEY	[17]	[17]	[29]	[29]	[1]	[1]	[1]	[1]

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NEW PRODUCT REVIEWS

THE ENSONIQ ESQ-1

Clark Salisbury

As some of you may already know, I work in a music store. As a matter of fact, for five-plus years I've been working in the keyboard department of one of Oregon's largest retail combo-products stores (so I'm a masochist - I don't deny it). One of the fun things about working in a music store, though, is that once or twice a year, usually a few months after NAWL show, it's Christmas. All the new products that I'll be demoing and living with for the next few months begin to roll in from our various suppliers. Over the course of five years or so one begins to get jaded, however. One sees so many new products that it takes a lot more than a few blinking LED's and a couple of decent factory patches to get one's blood to burning with a longing that wells up from the very depths of one's being, causing one to cry out, "I must have that (synthesizer, drum machine, MIDI tuba, etc.)!" And when it does happen, the item in question is usually so expensive that you have to have a doctor's OK before even looking into financing.

In other words, I'm not easily impressed. But Ensoniq has finally released their long-awaited ESQ-1 sequencer/synthesizer, and now that my blood has reduced from a rolling boil to a gentle simmer, I'd like to say a couple of words about it (all the while trying not to sound like the salesman that I actually am.)

Remarkable is one that springs to mind. Awesome is another, but I hate that word.

Let's put it this way. Eight-voice digital waveform synthesizer with splitting, layering, and a unique split/layering mode that allows for two completely different sounds on either half of the keyboard (you'll be happy to hear that the split point is easily assignable to any point on the keyboard - no top key settings). Each voice consists of three digital oscillators, each oscillator capable of producing any of 32 waveforms stored in wavetables. Included are analog (you should hear the strings and brass) digital (a couple of suspiciously familiar sounding bass and electric piano patches) and multi-sampled (acoustic piano, human voice) waveforms. Each oscillator has its own DCA

(Digitally Controlled Amplifier), and there are provisions for sync and AW (Amplitude Modulation). There is a 24db-per-octave resonant filter for each voice, three multiple waveform LFOs, and four - count 'em - four envelope generators.

And stereo panning. Any voice can be panned to either or both left and right outputs. Or panning can be controlled from an LFO. Or an envelope generator. Or from keyboard velocity, or keyboard position. Or...well, you get the idea.

How about an eight-track sequencer that allows you to use the ESQ-1 multi-timbrally? That means as many as eight different sounds can be overdubbed one at a time and played back together from the ESQ-1. The sequencer will quantize (auto-correct), step edit,

and auto-locate. And each track can send polyphonically on its own MIDI channel, allowing you to control up to eight separate polyphonic synthesizers from the ESQ-1's sequencer. Up to ten songs can be stored in memory by stringing together any of the 30 individual sequences available. Memory capacity? Up to 10,000 (that's right, 10,000) notes with an optional memory cartridge that sells for \$89. This is a serious sequencer, here.

So how does it sound? It sounds great. Not only can the ESQ-1 sound like an analog synthesizer, a digital synthesizer, or a sampling keyboard, but it can sound like all of them at the same time. It's kind of scary. And at a list price of \$1395 the only problem will be getting enough of them to go around. Now if only I could think of a good synonym for awesome....

Venture Deep Inside the Operating System With a "Monitor" ROM by Richard H. Lord

A significant number of HACKER readers have probably been wondering what goes on inside their MIRAGE. Some of the more intrepid hackers may already be thinking about modifications to the operating system to make their keyboards do things the factory never dreamed of.

Fortunately for the serious hacker, ENSONIQ has provided you with full access to their machine through the expansion port. The ROM module described in this article will let you control the computer that is already built into your keyboard. You can then examine the operating system and modify it to change keyboard temperament and even to control parameters that aren't on the official list. The ROM in this plug-in module contains a program known as a "monitor" that lets you display blocks of memory, examine and modify individual memory locations, dump memory to and load it from an external computer, start a program at some address, or return to the MIRAGE operating system.

When the miRAGE is booted, it looks at the contents of hex locations C000-C00F. If they contain 00-0F then the MIRAGE is satisfied that there is a valid ROM and control is transferred to whatever program resides at hex C010. This starts the monitor program which sets the MIRAGE serial port to 1200 baud and sends the message "Ensoniq Monitor ROM" to the terminal followed by a command prompt ">". The monitor is now waiting for you to give it a command. Valid commands are as follows:

MONITOR COMMANDS

Dxxxxyyyy - Display in hex and ASCII the contents of memory locations xxxx thru yyyy

Mxxxx - Display contents of location xxxx. You may then type "dd" to change the data, "space" to step forward, or "return" to exit back to the monitor.

Jxxxx - Jump to xxxx and run program

L - Load memory data in Motorola S-record format.

Pxxxxyyyy - Dump memory from xxxx to yyyy as S-records.

Bxxxxyyyy - Dump memory from xxxx to yyyy as raw binary data preceded by an "\$" marker.

Q - Return to MIRAGE operating sys.

The hexadecimal contents of the "monitor" program are given in the listing. It was "hacked" and doesn't yet have a source listing. If you have access to an EPROM programmer, fill its buffer with FF's and then enter the data shown in the listing. The program does not use all of the EPROM, so you do not have to enter data beyond hex C391.

The circuitry of the monitor card is very simple and requires only two integrated circuits - an EPROM that contains the monitor program and a three-input gate circuit. A toggle switch allows the card to be disabled while you boot-up your operating system disk. You can then turn on the monitor card and transfer control to it with the "Load Upper/ Lower 0" re-boot command.

An optional RS232 port is shown in case you can't talk to your terminal or computer over the MIDI cables. This circuitry does not interfere with MIDI

operation, but the RS232 and MIDI input data are "OR"ed together and should not be used simultaneously. The output data is sent to both MIDI and RS232. The monitor, as programmed, changes the data rate from the 31.25 kilobaud MIDI rate to a more standard 1200 baud computer rate during monitor operation. The port returns to MIDI rate when the operating system is re-started. While this seems awkward, most computer terminals and communication programs cannot be set to the MIDI rate. Other rates besides 1200 baud can be programmed by changing locations hex C119 as follows: 300b=D0, 600b=68, 1200b=34, 2400b=1A, 4800b=0D.

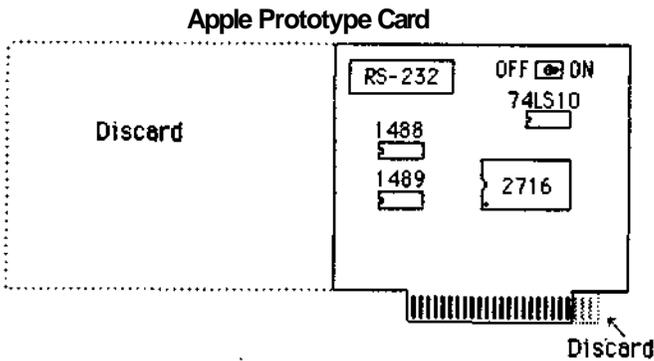
The simplest way to construct this plug-in is to modify a prototyping card for the APPLE 2+ or 2e. You will probably want to cut the prototyping board down so that it doesn't interfere with the MIDI jacks when it is plugged in. Cut three pairs of fingers off one end of the edge connector to convert it from 50 pins to 44. The cut should be made so that the remaining edge connector fits snugly into the MIRAGE connector. This cut will pass through the center of the third finger, so you will have to scrape the remains of this finger off both top and bottom with a knife. Check to make sure that there are no shorts between the power bus and the ground bus of the proto-card caused by your surgery.

If all of this construction and EPROM programming seems to be too complicated or too much bother, I plan to make up a circuit board for this module and to sell both kit and wired versions soon. Watch the HACKER classifieds for more info.

This plug-in module is helping me unlock the secrets of the MIRAGE. I will be writing several articles about how the operating system works and how you can use this plug-in monitor module to change your MIRAGE'S temperament and alter the operating system to do new things. Stay tuned and keep hacking.

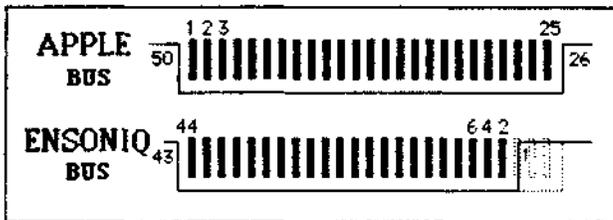
ROM Monitor

Richard H. Lord 03/28/86

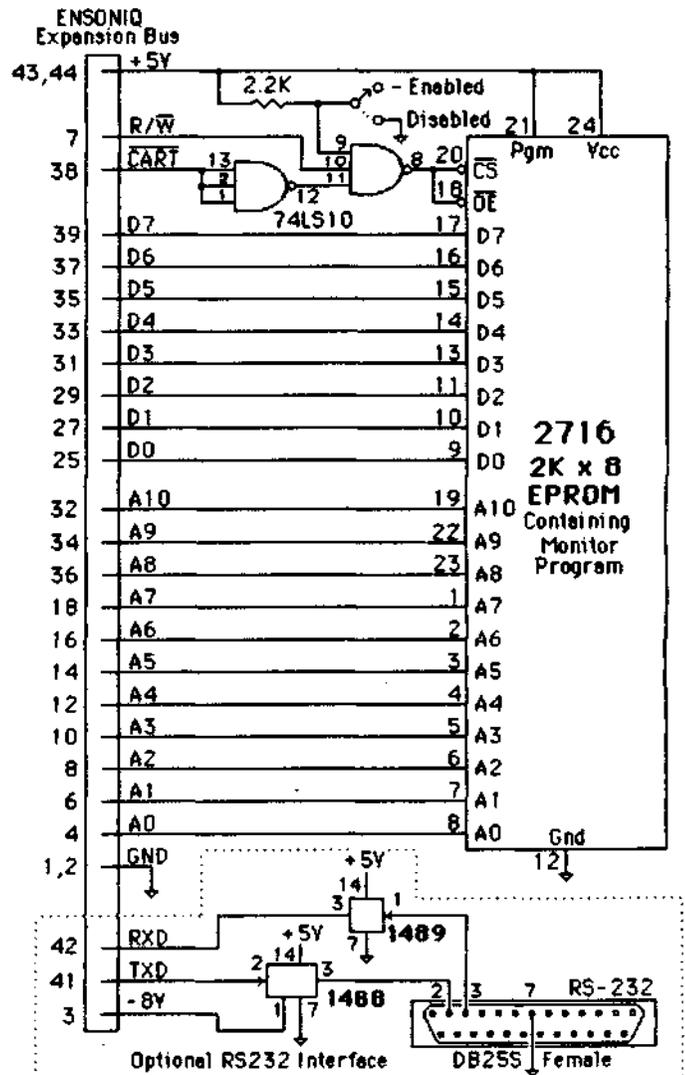


Be careful to observe that the MIRAGE bus pin numbering scheme bears no resemblance to that employed by APPLE.

Bus Pin Numbering



The odd numbered pins are on the underside of the board in the MIRAGE numbering system. The wiring can be accomplished with conventional wire-wrap techniques.



```

C000 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
C010 7E C1 08 7E C0 71 7E C0 A8 FF FF FF FF FF FF FF
C020 8D 09 29 43 1F 12 86 2D BD C0 A8 8D 0F 29 38 1F
C030 01 8D 09 29 32 34 10 A7 61 35 10 39 8D 11 29 27
C040 48 48 48 48 1F 89 8D 07 29 1D 34 04 AB E0 39 8D
C050 19 81 30 25 12 81 39 22 03 80 30 39 81 41 25 07
C060 81 46 22 03 80 37 39 1A 02 39 8D 05 84 7F 7E C0
C070 A8 B6 E1 00 47 24 FA B6 E1 01 39 8D 06 8D 04 86
C080 20 20 25 A6 80 34 02 44 44 44 44 8D 02 35 02 84
C090 0F 8B 30 81 39 2F 02 8B 07 20 0D 8D 0B A6 80 26
C0A0 FA 39 86 0D 8D 02 86 0A 34 02 B6 E1 00 47 47 24
C0B0 F9 35 02 B7 E1 01 39 34 02 B6 E1 00 85 20 35 02
C0C0 39 FF FF
C0D0 FF FF
C0E0 FF FF
C0F0 FF FF
C100 1A 50 86 1F B7 E2 02 86 10 B7 E2 00 10 CE BF 80
C110 8D F1 5D 86 15 B7 E1 00 86 34 B7 E2 06 CC 00 00
C120 83 00 01 26 FB 86 18 B7 E2 0F 8E C1 70 BD C0 9D
C130 BD C1 F0 81 42 26 05 BD C1 A0 20 EE 81 44 26 05
C140 BD C1 FE 20 F5 81 4D 26 05 BD C2 40 20 F5 81 4C
C150 26 05 BD C2 90 20 F5 81 50 26 05 BD C3 30 20 F5
C160 81 4A 26 03 7E C1 90 81 51 26 F3 7E F0 F0 FF FF
C170 0D 0A 45 6E 73 6F 6E 69 71 20 4D 6F 6E 69 74 6F
C180 72 20 52 4F 4D 0D 0A 3E 00 FF FF FF FF FF FF FF
C190 BD C0 2B 34 10 39 FF FF FF FF FF FF FF FF FF FF
C1A0 BD C1 BA 29 08 1E 12 34 20 AC E1 25 01 39 A6 80
C1B0 BD C0 A8 20 F2 FF FF FF FF FF FF BD C0 20 28 01 39
C1C0 CC 00 00 83 00 01 26 FB 86 40 BD C0 A8 39 FF FF
C1D0 FF FF
C1E0 FF FF
C1F0 BD C0 6A 34 02 BD C0 7F 35 02 39 FF FF FF BD C0
C200 20 29 08 1E 12 34 20 AC E1 25 01 39 BD C0 B7 26
C210 FA 5D C0 A2 34 10 1F 41 BD C0 7B AE E4 C6 10 BD
C220 C0 7D 5A 26 FA AE E1 C6 10 A6 80 81 20 25 04 81
C230 7E 23 02 86 2E BD C0 A8 5A 26 EE 20 C8 FF FF FF
C240 BD C0 2B 29 25 34 10 8E C2 84 BD C0 9D 1F 41 BD
C250 C0 7B 35 10 1F 12 BD C0 7D BD C0 3C 28 0D 81 08
C260 27 19 81 5E 27 19 81 0D 26 0F 39 A7 A4 A1 A4 27
C270 08 BD C0 7F 86 3F BD C0 A8 31 21 1F 21 20 C6 31
C280 3F 20 FB FF 0D 0A 2D 20 00 FF FF FF FF FF FF FF
C290 BD C3 1B 81 53 26 F9 BD C3 1B 81 39 27 3D 81 31
C2A0 26 F1 BD C2 ED 34 02 29 26 BD C2 DC 29 21 34 10
C2B0 E6 E0 EB E0 EB E4 6A E4 6A E4 34 04 BD C2 ED 35
C2C0 04 29 0C 34 02 EB E0 6A E4 27 05 A7 80 20 EB 5F
C2D0 35 02 C1 FF 27 BA 86 3F BD C0 A8 39 8D 0F 29 38
C2E0 1F 01 8D 09 29 32 34 10 A7 61 35 10 39 8D 11 29
C2F0 27 48 48 48 48 1F 89 8D 07 29 1D 34 04 AB E0 39
C300 8D 19 81 30 25 12 81 39 22 03 80 30 39 81 41 25
C310 07 81 46 22 03 80 37 39 1A 02 39 BD C0 71 84 7F
C320 39 FF FF
C330 6F E2 BD C0 20 34 30 29 45 AC 62 25 41 30 01 AF
C340 E4 EC E4 A3 62 27 06 10 83 00 20 23 02 C6 20 E7
C350 64 8E C3 8D BD C0 9D CB 03 1F 98 BD C0 85 AE 62
C360 BD C3 81 EB 62 EB 63 EB 84 A6 80 BD C0 85 6A 64
C370 26 F5 53 1F 98 BD C0 85 AF 62 AC E4 26 C3 32 65
C380 39 34 10 35 02 BD C0 85 35 02 7E C0 85 0D 0A 53
C390 31 00 FF FF
C3A0 FF FF
C3B0 FF FF

```

```

.....
~A.~@q~@(  

...)C...-=@(...)8.  

...)24.'a5.9..)'  

HHHH.....).4.+`9.  

..0%..9"..09.A%  

.F"..79..9...~@  

(6a.G#z6a.9.....  

%&.4.DDDD..5..  

..0.9/... ..&.&  

z9.....4.6a.GG#  

y5.7a.94.6a.. 5.  

9  

.P..7b...7b..N?.  

=q].7a..47b.L..  

...&(.7b..Ap=@.  

=Ap.B&.=A n.D&.  

=A~ u.M&.=B@ u.L  

&.=B. u.F&.=C0 u  

.J&~A..Q&s~pp  

..Ensoniq Monito  

r ROM..>.  

=@+4.9  

=A:)...4 ,a%.9&.  

=@( r=@ (.9  

L.....&(.a=@(9  

=@j4.=@5.9=@  

)...4 ,a%.9=@7&  

z=@"4..A=@(.dF.=  

@)Z&z.aF.&.. %..  

~#...=@(Z&n H  

=@+)%4..B.=@..A=  

@(.5...=@)=@<(...  

'.^'...&.9'#!$'  

.=@.?=@<(!.!! F1  

? x...- .  

=C..S&y=C..9'=.1  

&q=Bm4.)&=B\)!4.  

f`k`k`kdj`jd4.=Bm5  

.)4.k`j`d'.'. k_  

5.A':.?=@(9..>8  

....)24.'a5.9..)  

'HHHH.....).4.+`9  

..0%..9"..09.A%  

..F"..79..9=@q.  

9  

ob=@ 40)E,b%A0./  

d1d#b'.... #.F g  

d.C.=@.K...=@..b  

=C.kbkck.&.=@.jd  

&uS..=@./b,d&C2e  

94.5.=@.5.^@...S  

1.

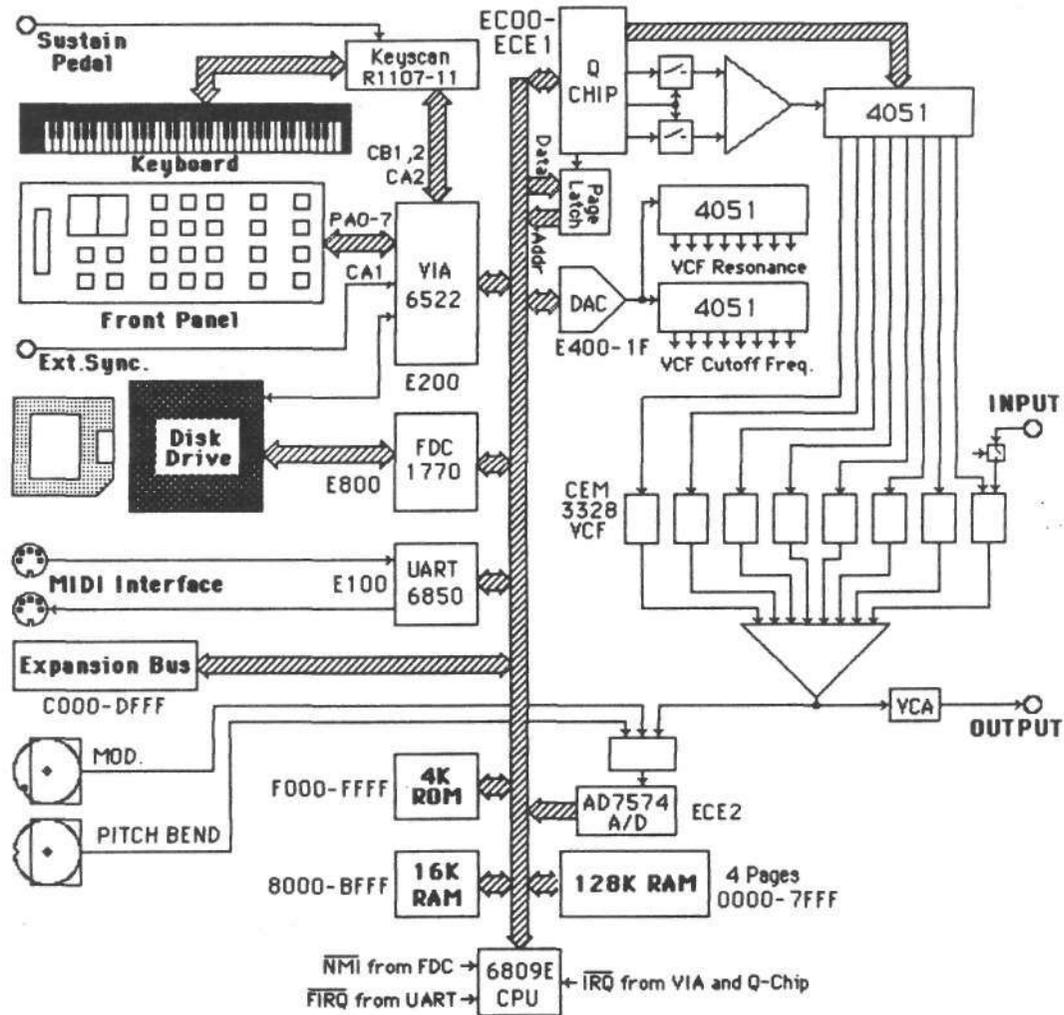
```

In Richard Lord's article last month, "What Makes the Mirage Tick?" we (not him) left out the block diagram. Sorry about that. Here it is:

Ensoniq Mirage

Overall Block Diagram

03/26/1986 R.H.Lord



THE INTERFACE

Dear Transoniq Hacker,

First of all, let me thank you for your fine publication. It has certainly helped me get more out of my Mirage. I have three questions/comments:

1) I like to record short looping sequences and then play them back while playing along on my drum set (a sort of glorified metronome). However, I have noticed that pushing the stop button to end recording a sequence is very imprecise, adding 1/4 second or so to the last note. This means I must try to push the stop button a few hundred milliseconds or so before the beat I would like to stop on. It usually takes

several tries to get it right, and can be rather frustrating when recording a sequence of more than a few seconds in length. Can't Ensoniq fix this software bug by scanning the stop button more often during sequence recording or perhaps by adding some timing "fudge factor" to the last note?

2) On my Mirage, when more than four or five notes are pressed simultaneously, there can be a quite perceptible delay before the onset of sound. I presume this is because of the way the software is written and the poor little microprocessor not being able to keep up with all those sudden changes. While I don't expect much to be done about this for my

current Mirage, Ensoniq should make every effort to remove this bug from their future products. I wonder why I haven't heard anything about this before? I'm sure my ears aren't all that much more sensitive than everyone else's.

3) Where can I get technical information (schematics?) about my Mirage. I would very much like to design/build (market?) some custom hardware for the Mirage, such as an expanded sample memory using some sort of bank switching technique. Since I have heard rumors of such products being in the works by third parties, that information must be available somewhere. Or are these people simply reverse engineering the Mirage? As far as Mirage being leery of letting their schematics out the door, they should take a lesson from Apple Computer and make the Mirage a totally open system. This would make the Mirage truly a hacker's dream. The plethora of Mirage compatible products which would appear would more than offset any advantage that Ensoniq's competitors might gain. Besides, since the Mirage uses custom silicon, there is certainly no chance of anyone coming out with Mirage clones.

Thanks again for a great publication,

Jeff Cunningham
Lilburn, GA

[Ed. • - We're going to be doing several articles on the inner workings of the Mirage. Right now, I don't know if it'll go so far as to print complete schematics - but there are some people out there that have actually gone to the trouble to work them out. A "wanted" ad in our classifieds might get results.]

[Ensoniq's response: You could try using the footswitch to end your sequence by switching Parameter 89 (footswitch select) to on. Also, you can record your sequences at a slower rate to get the timing right, then speed it up on playback by increasing the tempo (Parameter 87).

ftlmost all electronic keyboards have some delay. Your analysis is correct.

We have made schematics available to a limited number of firms that we have approved as developers. These firms are ongoing operations who have shown past ability in developing add-on products. We have limited the release of schematics for a number of reasons, however. As you know, they are not required by our authorized Repair Stations as we have instituted a module swap program to insure speedy service. While the schematics are proprietary, we are also concerned about the number of questions we would create by releasing them to anyone. Therefore, we have only shared them with those firms who we feel that we can devote the proper engineering time needed to assist them with their projects. Otherwise, we would be doing nothing but responding to schematic questions (and service problems) and would not be doing things like producing ESQ-1s or Pianos.]

Dear Hackers,

In Issue #10, Erick Hailstone's review of SD #13 was not accurate: the three piano samples used are identical to those of SD #1 upper piano. Some playback parameters are the only difference. (The first sample covers an additional 12 notes previously handled by the lower piano samples, but from note 37 up the samples and split points are identical.)

Problem: I was trying to squeeze additional samples into a disk of mine to obtain different sounds for each program. I ran into trouble when I had to change memory addresses to avoid conflict. I set up appropriate memory allocations but when I used (17) and (18) to copy, (61) was changed to FF during each of the many frustrating attempts (resulting in a strange sound). I had to resort to copying the data to its new locations before bumping it down to lower memory (to be retrieved after the desired upper memory was loaded). My conclusion: (17) and (18) only work when the memories are not only the same size, but in the same place in memory. I have not figured out how to make my add function work either (no change in sound after setting up and executing the add function). But I hope that the new version of MASOS will solve this when I get my upgrade (very soon). I'm now using MASOS 1.2.

Bravissimo to Ensoniq for replacing my trash keyboard with a much better replacement (still old version). The new keys have a much more solid feel (not quite as good as the weighted keys on the new models, but I can now live with it...)

Keep up the fine job T-Hacker! I read each issue cover to cover as soon as it arrives!

Sincerely,

Pete Wacker
Phoenix, Az

P.S. Wish list: Keyboard tracking of (33) to reduce its effect on lower notes.

Dear Hacker,

It's nice to see the newsletter growing and improving. My mind turns into a sponge every time an issue comes in.

The following is a bunch of suggestions, thoughts and questions.

More opinions on the sample disk reviews would be better. You people have more contact with other equipment so your opinions are important.

I use a DX-7 as a keyboard controller but I find that on certain DX programs using the Mirage keyboard brings out more life in the sound because of the different velocity.

Transoniq Hacker

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Having done some sampling with results ranging from adequate to great, I can now better appreciate what Ensoniq goes through. However, is it possible to get a better French horn, trumpet, violin, oboe and muted trumpet? Despite the faults of the string samples I really like them. Now what about violas and other possibilities? I find myself having a love/hate relationship with some samples. I guess the ultimate string sound has digital, analog, and sampling MIDIed together.

Will the Macintosh Sound Lab program • out now be compatible with the Mac Plus? - or will it be even better? Could you please review Digidesign's Sound Designer soon? Digital synthesis on the Mirage and swapping samples with an Emulator? It almost sounds too good to be true. What will the true results be? Also, are the Mac software people pricing themselves out of the market? Do you plan on reviewing the new Ensoniq synth soon? - it sounds interesting.

Yours,

Del Carry
Frobisher Bay, NWT
Canada

[Ed. - We not only plan on reviewing the new synth, we want to make it a regular feature with "patch contests" and the like. However, a lot of this will have to wait till WE CAN GET OUR HANDS ON ONE OF THEM! After a slow start getting it out the door, Ensoniq's presently having trouble catching up with the demand.]

[Ensoniq - The Mirage has a full velocity range of 0 to 127 - which is an improvement over the DX-7.

Try out Sound Disk #14.

Sound Lab is compatible as long as the MIDI interface is compatible.]

Hacker:

How can you put 24 DIFFERENT sounds on a disk? Are two different audio outputs possible?

Dennis Provisor ' >.

[Ed. - Check out "Splitting and the Mirage - How to Get 24 Sounds on a Disk" in Issue #3. Two audio outs? •* can't get there from here.]

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If you've got some space on your magazine or promotion material racks and you'd like to fill it up with some snazzy HACKERS, please drop us a line and find out about our quantity discounts.