the alpha syntauri system

a ancient synthisizer concept for the Apple II

General Overview

In the beginning of the 80�s electronics also entered the scene of making music. The very first electronic devices of making soundwaves and strange audiowaves with electronical equipment came into the market and first descriptions of different kinds of wavegenerators got published in various kinds of electronic magazins. Some of them are here present as own contribution pages at the indexpage. I�d just mention here the very first publication of the "Formant" in the magazin "elektor" and the few years later first time published concept of the polyphonic Synthisizer "POLYSYNTH" in the magazin "Elrad" just to name the basic entering to that topic here in Europe.

The first parts of equipment that entered the stage by using at the beginning analog electronic design came from companies like Moog and Roland. Of course there have been some companies existing that made "electronic organs" but their concept was restricted in those days to analog design of sinewave generators with transistors.... - the very new thing in the beginning of the 80�s was that now the technology presented very new sounds to the ear by designing sawwave, rectangularwaves and trianglewaves too and very shortly after also a mix of "enveloping concepts" by modulating a sawwave or sinewave with rectangular or triangular modulation waves. That was the point where the so called "Synthisizers" started the adventure of creating new sounds that have never been heard before....

Various new young musicians started creating very new sounds seeking for a new "band identity" hunting for new audiowaves to make the sound of the band that unique, that it could not be copied by any other band..... Just to name a few of this famous musicians Kieth Emerson from Emerson, Lake and Palmer, Alan Parson fron Alan Parson Project, and other Groups like Pink Floyd and YES - not to forget a lot of musicians from the taste of Jazz like Herbie Hancock and of course Miles Davis. In the mid 80�s for the Apple II the 2 most well known concepts for making music with the Apple II have been the DIY project from "ct" an electronic magazin with the description of the "ct Klangcomputer" (in engl. "ct soundcomputer") and the alpha syntauri. In fact while the "ct Klangcomputer" was a complete design with all related interface cards - the alpha syntauri was in fact a mix from various sources: The organlike keyboard and its interface came from alpha syntauri, while the interfacecards for making the sound originated from the company Mountain Computer and was sold as "Mountain Computer Music System". With both components together and an Apple II or Apple IIe a musician was upfront of a complex synthisizer system which permited to generate nearly every kind of sound from the Apple II series of computers.
The two persons upmost involved to the development of the alpha syntauri system have been Charlie Kellner and Ellen Lapham. In 1984 the company shut off business. An interview with Ellen Lapham introducing the alpha syntauri and explaining the concept is viewable at the computer chronicles - a video that can be viewed from the internet.

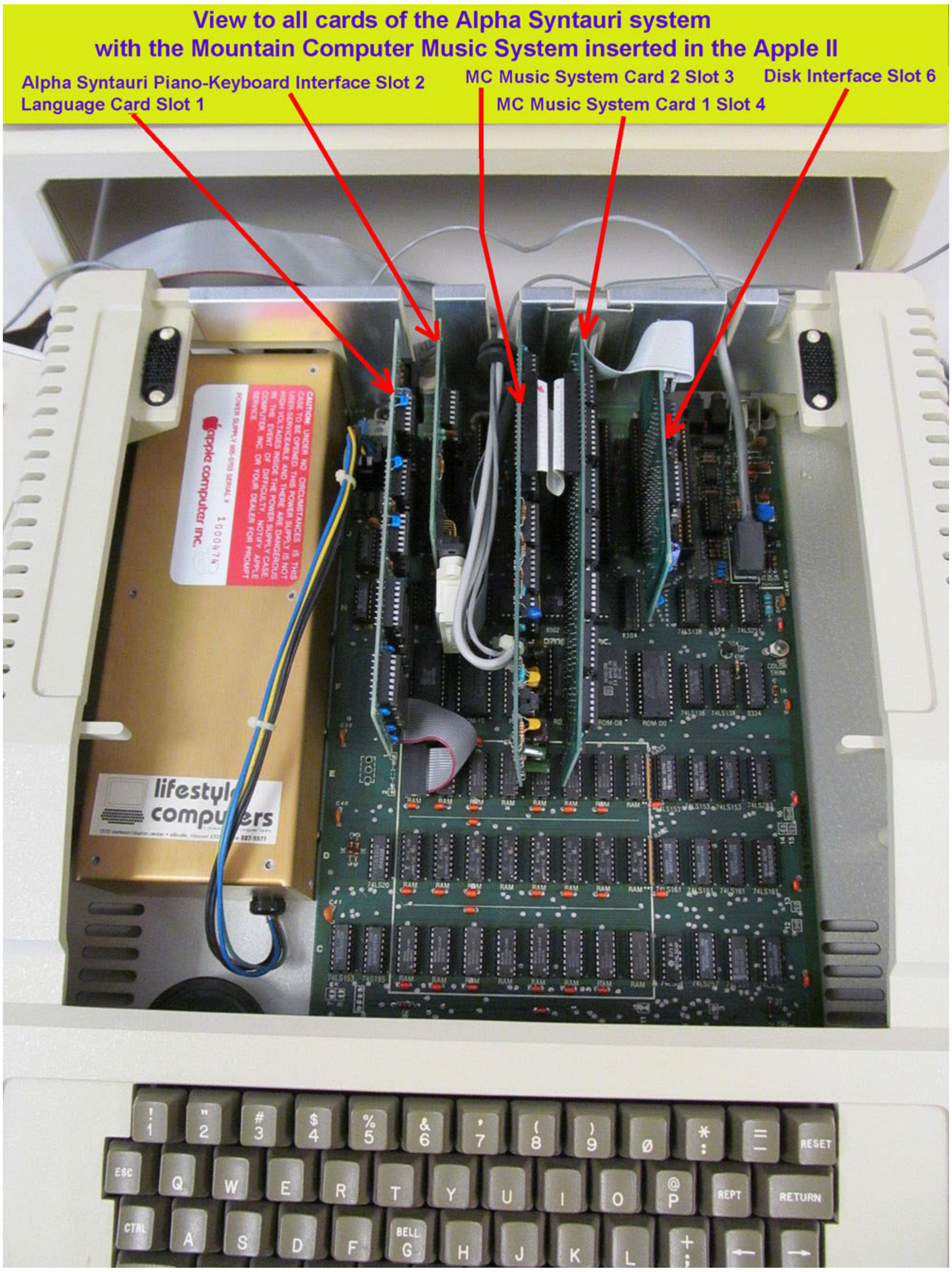
While the entire publication of the ct Klangcomputer is here availiable at another series of pages in the chapter of pages we�ll take a very closer look to the entire system with the alpha syntauri and the Mountain Computer Music System with strong focus to the technical side and reverse engineering of this entire system. The reason for this, is the fact that the documantation of the components is quite well for using the system, but if things go wrong and one of the components needs repair or service due to it�s age the documentation turns out to be a desert in the technical side bearing the lack of not containing any kind of technical information like circuitplans or pictures of vital parts of the components and desciption how this part interact with eachother.....
This shall be solved here and the target is to provide the entire missing part of the manuals by reverse engineering the system that far that a technician can check the system for correct function and in case of need carry out a service task or repair such a system and get it back to working condition and finally also to provide a downloadable document containing the circuitplans and vital information about the system far beyond the documentation provided in the ancient days with the manuals of that components.

And besides it�s also a target of this pages to present the components in working order and with pictures to teach several details about the system and how it�s working.

So lets start here first with the alpha syntauri keyboard itself and some pictures of it in general and in detail.

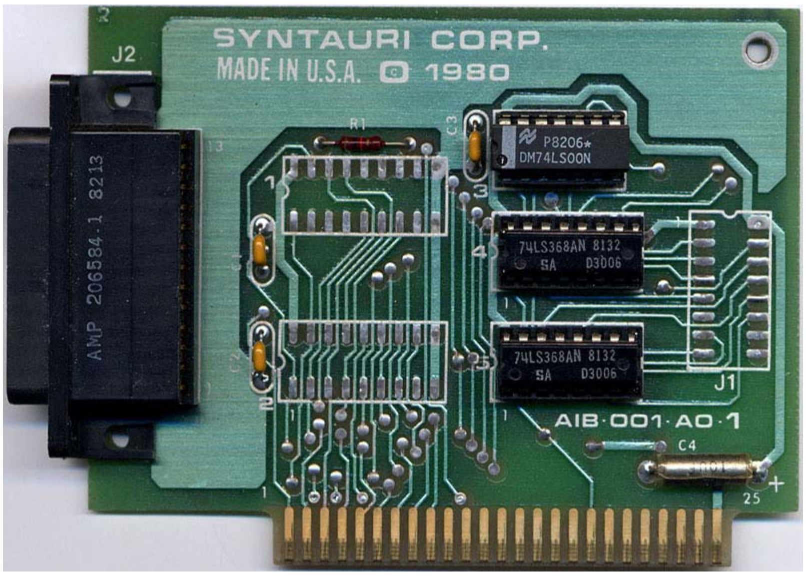
Here is the entire System:

Here is the view to the system components inside of the Apple II:

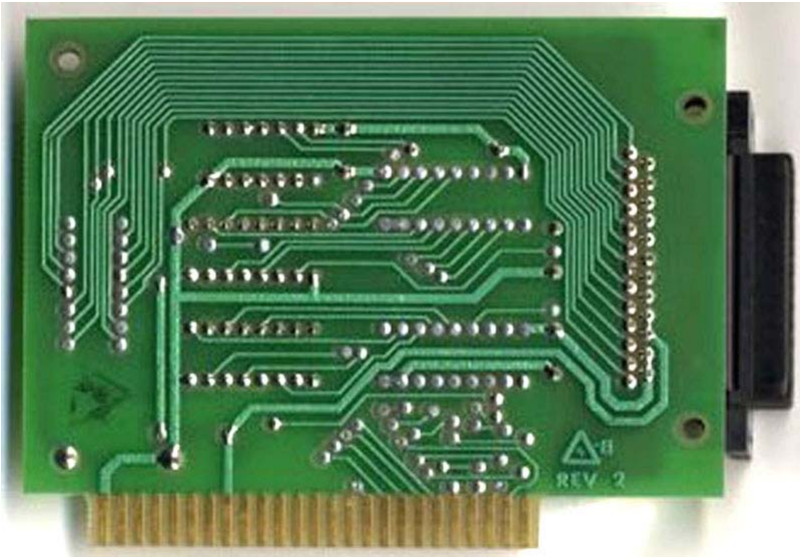


Here is the view to the external Alpha Syntauri components only:

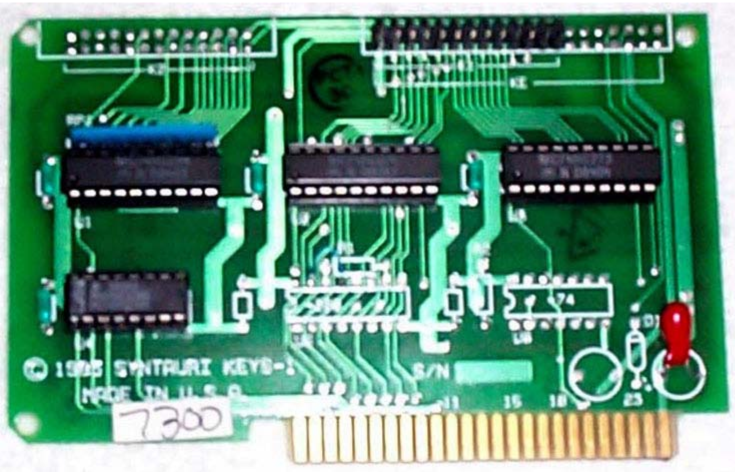
and here is the picture of the Interfacecard of the Alpha Syntauri (which is located inside of the Apple II) from componentside:



and here is the picture of the Interfacecard of the Alpha Syntauri (which is located inside of the Apple II) from solderingside:



and here is a (unfortunatly bad) picture of a later version of the Interfacecard of the Alpha Syntauri (which is located inside of the Apple II) from componentseide:



I am still searching for better pictures of this interface and more information on the card.
If a visitor of this page has such additional information please contact me at Applefritter.com.

After viewing the entire set of components lets get ahead to the next page with closer view to the Keyboard and the Footswitches as beeing the "external" Components of the Alpha Syntauri System and examining its details......

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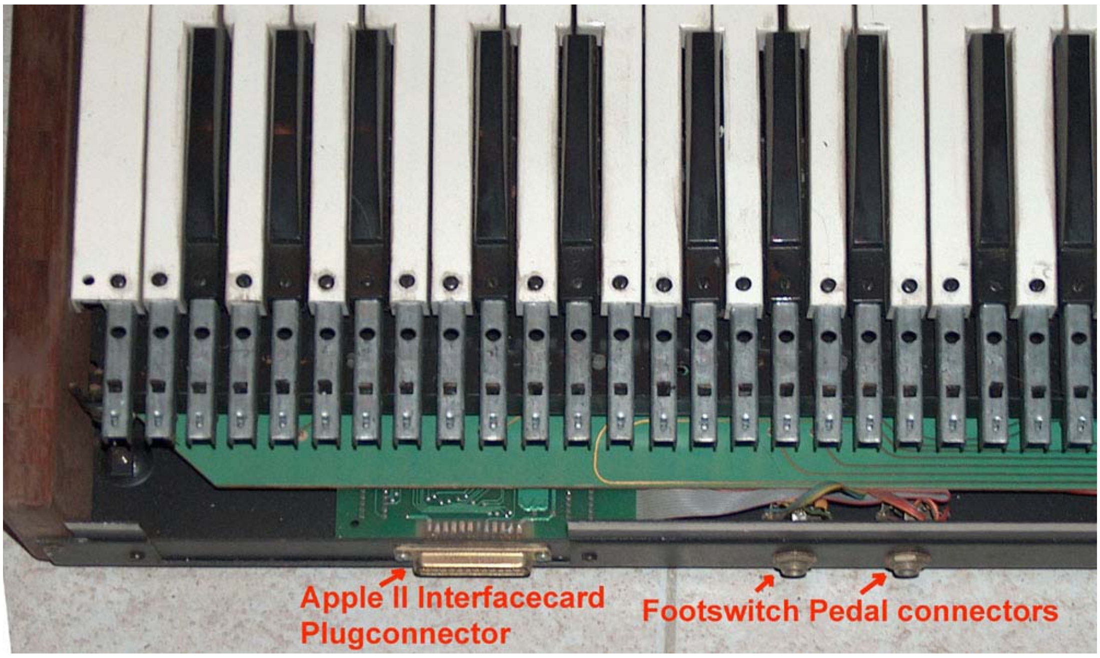
details about the keyboard and the footswitches

**Here we can inspect the later version of the keyboard. This later version has 61 keyswitches.
There has also been a earlier version sold with 48 keyswitches.**

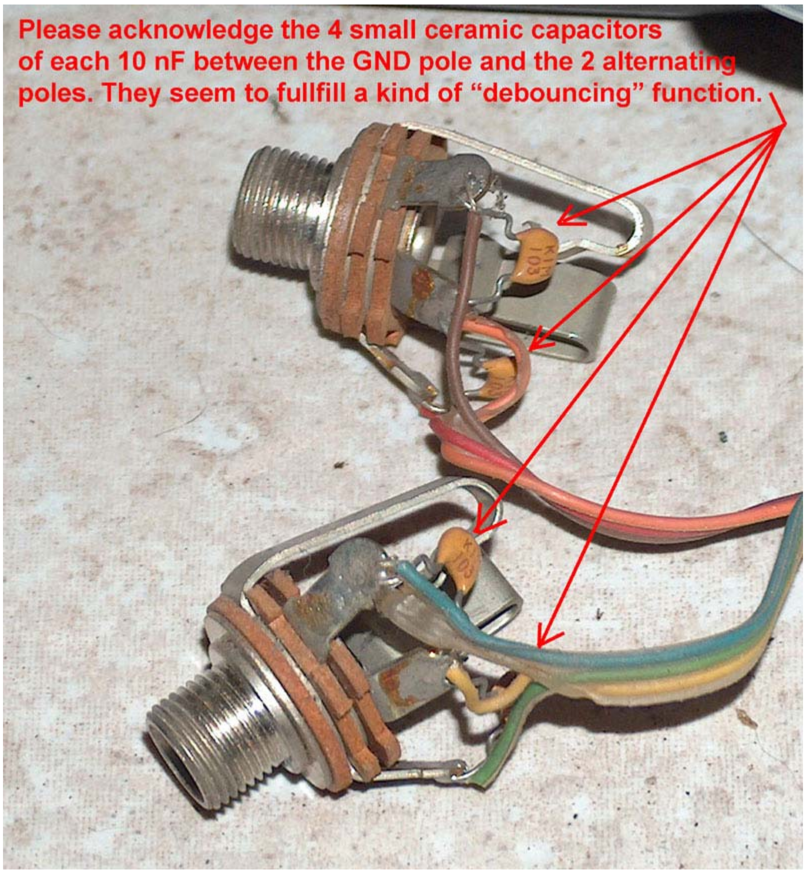
Lets startup with some pictures of the keyboard itself:

after removing the top plate you will see this:

a closer view to the right upper side will offer this view:

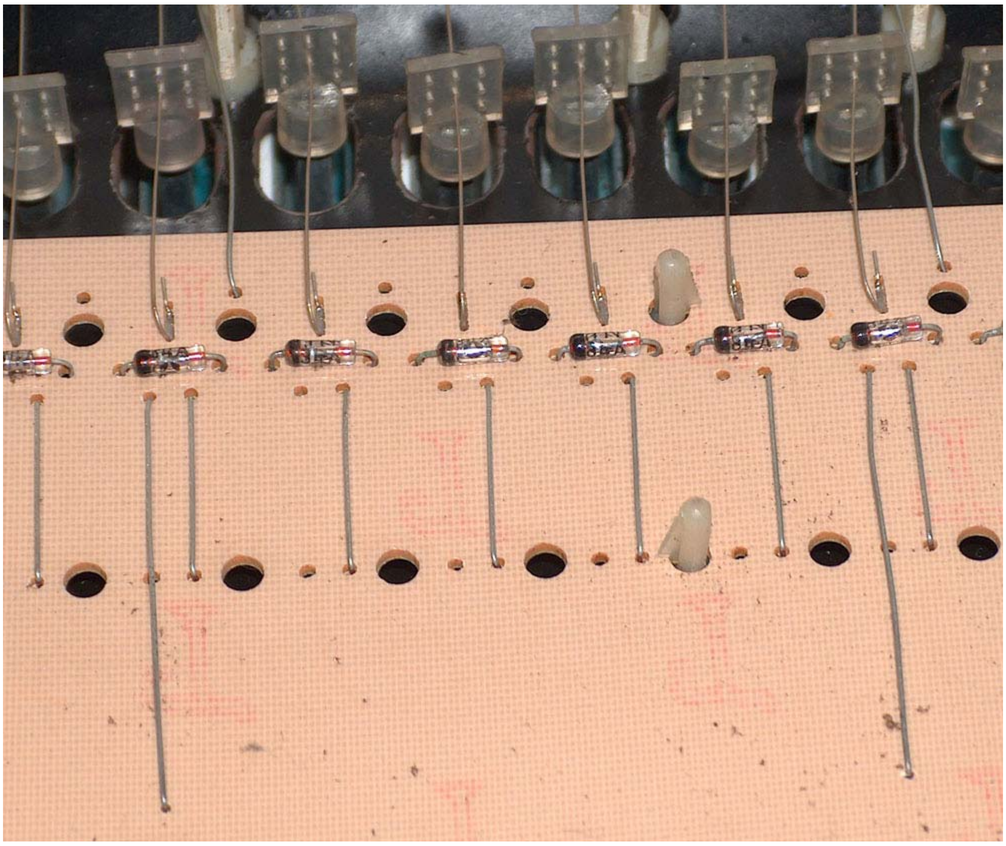


Before taking a closer view to the other internal parts of the keyboard lets just take a closeup view to the Footswitch pedal connectors, while being extracted:

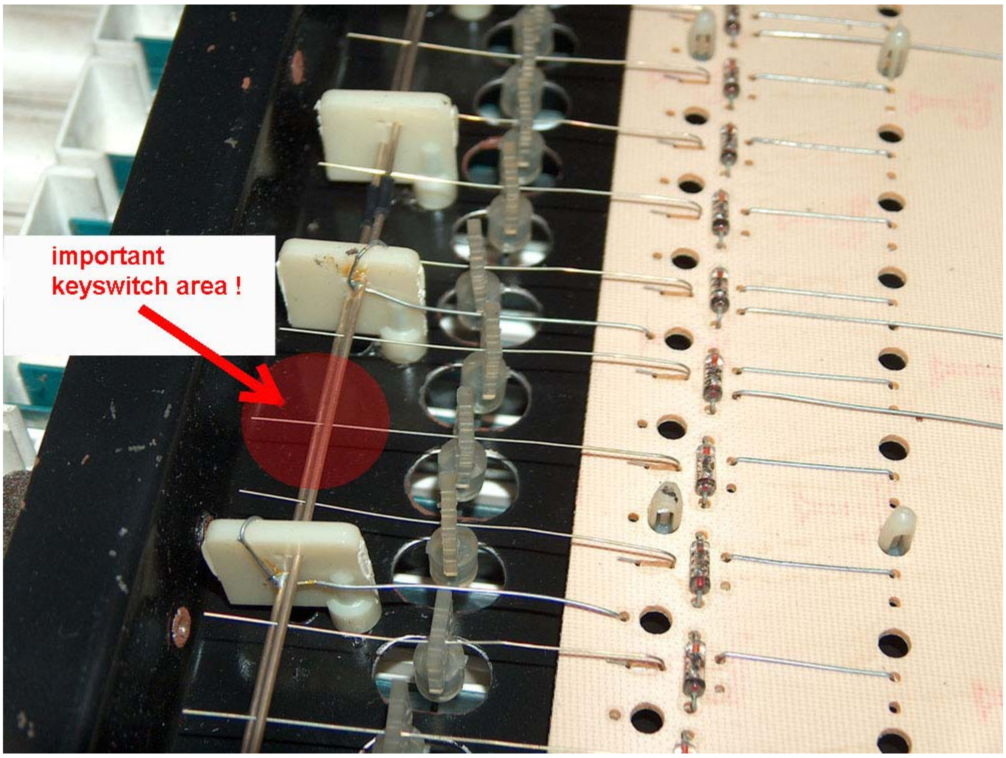


Then after refitting the top plate and turning the keyboard around to the bottomside, lets take a view after the bottom plate has been removed:

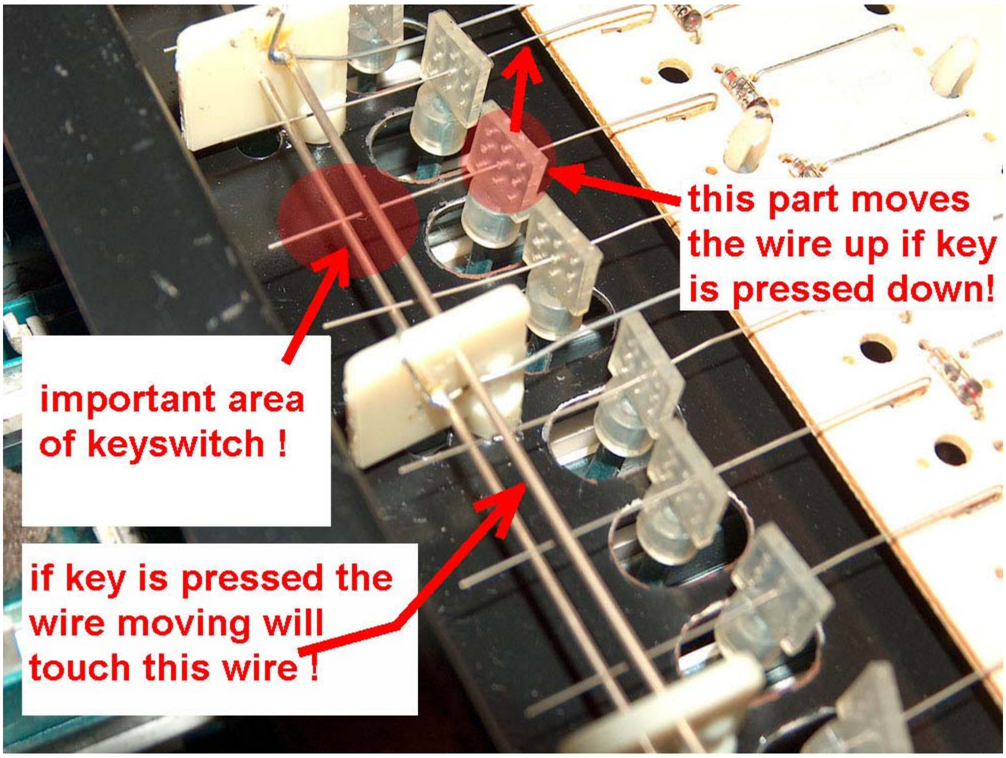
Next a closer view to the "giant PCB" that connects the keyswitches together - and we can drop the demand to examine the entire board - because it�s along it�s entire length eveywhare the same basic principal. there for here only one section in closeup view:



This pisture displays that each keyawitch is related to one rectifier diode.
The next picture displays a closeup to the keyswitch itself with a closeup view from the <u>rear</u>:



and to get a better view to the important part of the keyswitch now a closeup view in detail from the front:



This picture shows in detail the manner the keyswitch is operating:
If the key is released the long steelwire from the PCB is right between the long steelwire bars above and below of the wire.
If the kay becomes pressed down the wire moves towards the upper steelbarwire and makes contact with that steelbar wire.
Be aware that this view is reverse view to normal postion. In normal postion **the upper steelbar wire is the lower steelbar wire !**

The mechanical creation of the keys (better keyswitches) in the alpha syntauri is quite comparable to the description of the DIY procedure of the piano-keyboard of the FORMANT as explained in the magazine elektor. This is explained here in the publication of that device at page 2 of that scanned pages. Allthough the pages are still in German language the drawings are quite clear and selfexplaining.

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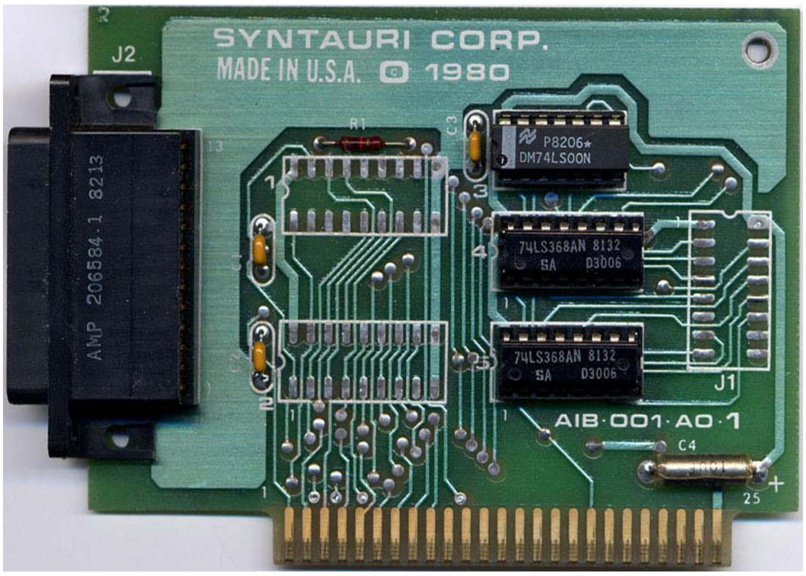
the Apple II interface card of the alpha syntauri

The interface of the alpha syntauri in the Apple II is rather simple due to the fact that it only passes over the information fron the internal decoder interface inside of the keyboard. Up to the moment it seems that one part of the information is a parallel set of the 8 Databits. And it seems that at the other hand some part of the information might be some kind of handshaking and probably some kind of Interrupt-handling. Unfortunatly this part of the information is not complete because the alpha syntauri system i have purchased from ebay did not have this interface card. The only information availiable at the moment yet, is taken from only 2 pictures that i have at the moment.

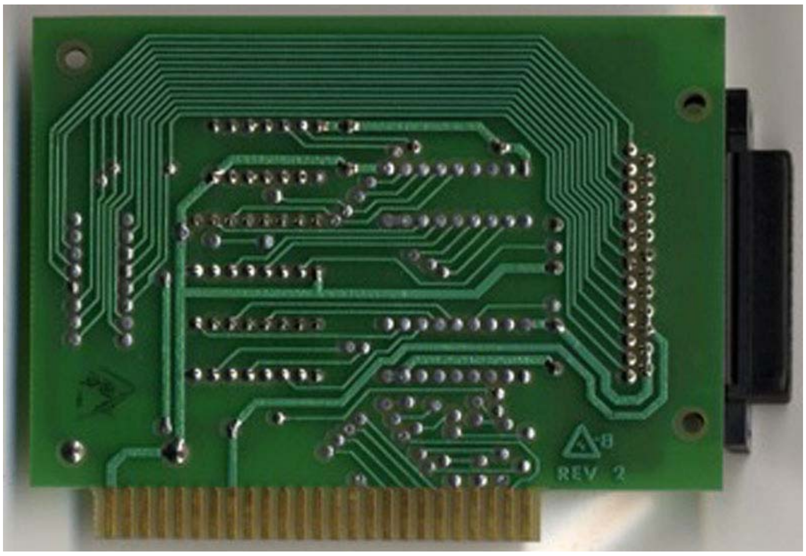
At the beginning just a important remark:
During the time of distribution of the alpha syntauri system, the system has changed several times with several revisions. The informations provided here cover the most common more later (but not last) revision of the system I try to research also informations on later and earlier revisions at the moment.
The moment such information gets accessable, i will add such informations to the currently blank page 6 of this series of pages.

Anyhow - lets proceed with the information availiable - at least at the moment - to the point, that might be claimed to be sure.

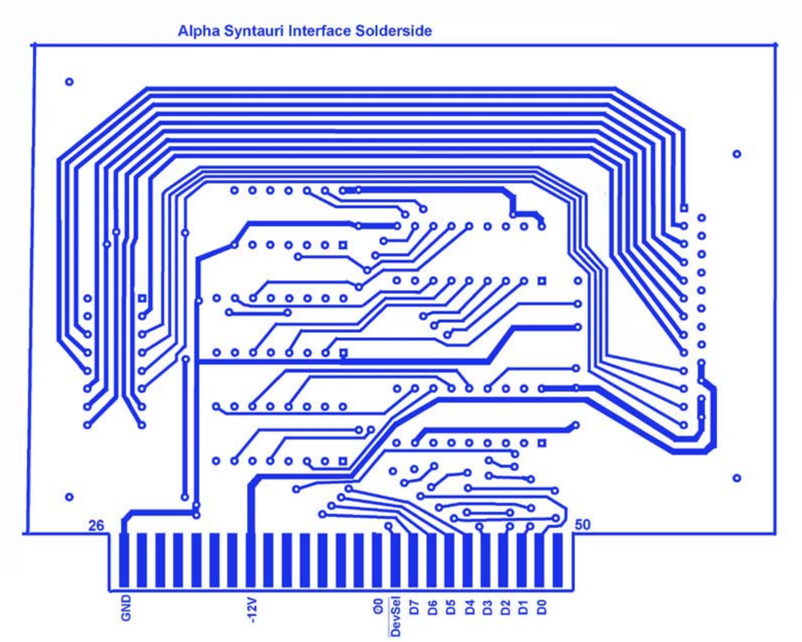
Here is the picture of the top of the interface:



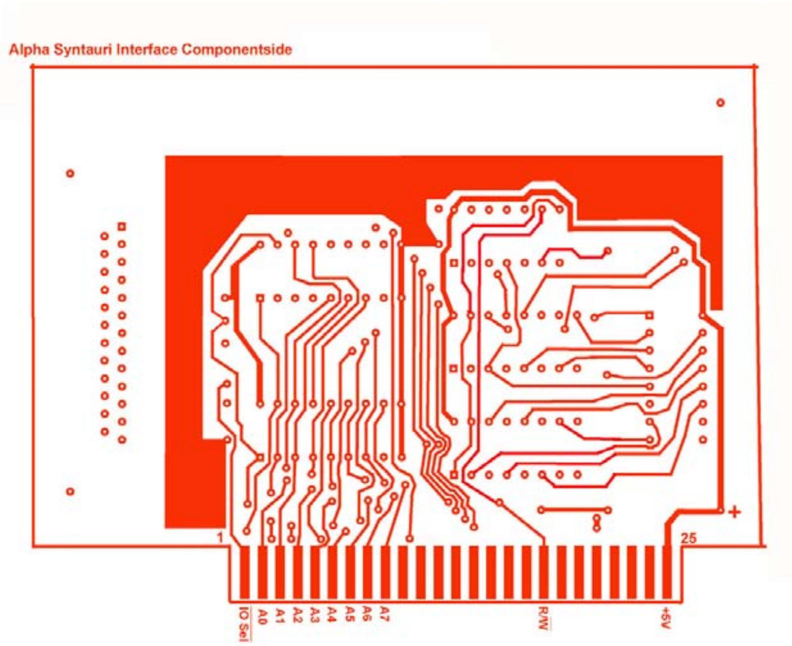
and now the picture of the solderingside of that interface card:



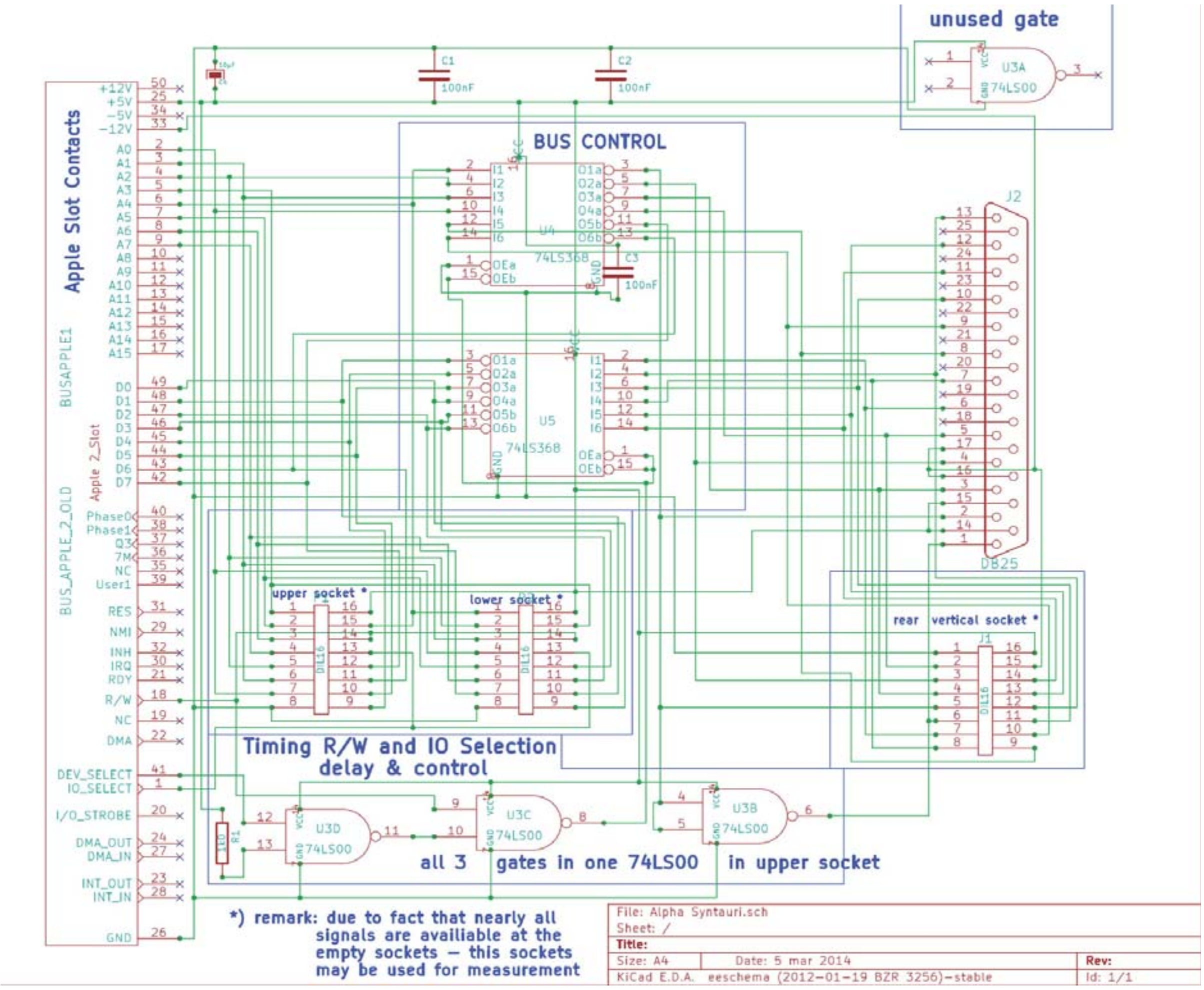
The following picture displays the traces fron the soldering side which are safe identified:



and here <u>the part</u> of the component side of the interface card <u>that is also detected for sure</u> as red layer:



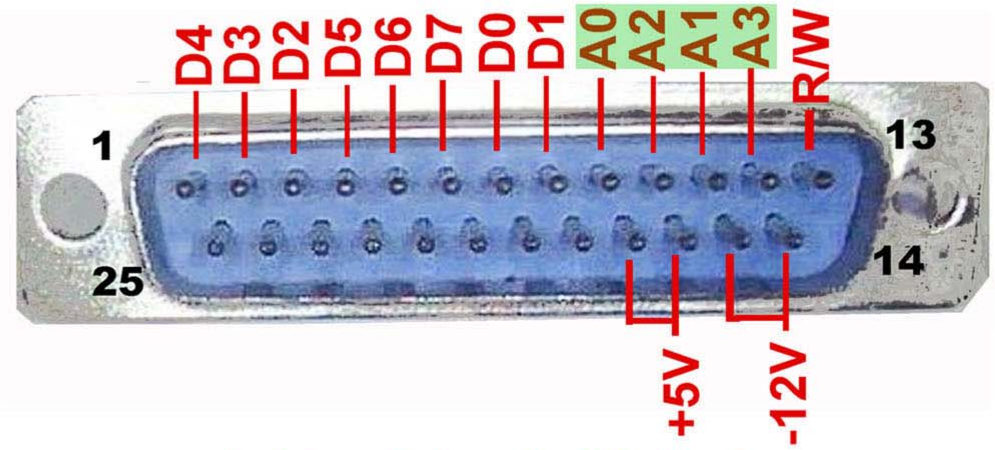
and here is a picture of the current circuitplan with the information <u>availiable up to this moment</u>...:



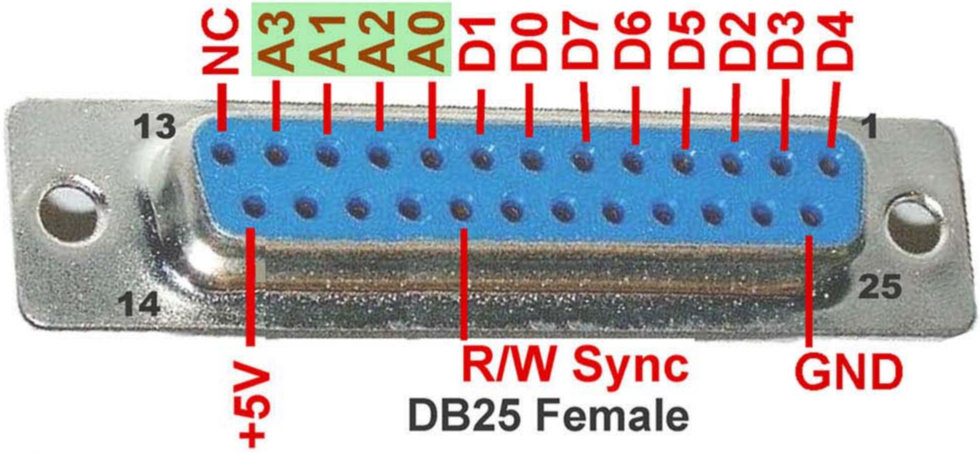
and here is the pinout of the cable from this Apple II interfacecard to the alpha syntauri keyboard:

Alpha Syntauri Cable

DB25 Male



at side of Apple II Interface



at side of alpha syntauri keyboard

there is also another kind of interface that was distributed along with the alpha syntauri system,
but the picture of that card is unfortunatly that bad,
that there is not the slightest chance to reverse engineer it by that picture
(even more because also a picture of the rearside / soldering side
of that card is missing/ not availiable):

been set (April 2013) and it might occur that references and contents may change by the fact that domains may have been discontinued from their former owners.
In such cases i can�t take any kind of responsibility to the changed contents. this is specialy valid to banners, advertisements or merchandising links in the targeted pages.

the alpha syntauri system

a ancient synthisizer concept for the Apple II

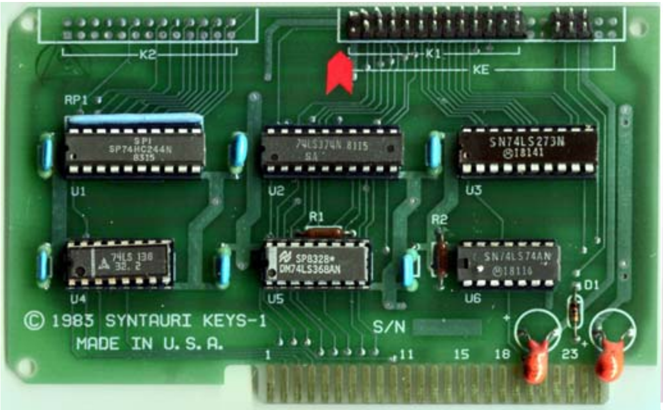
the Apple II interface card of the alpha syntauri - later version

The interface of the alpha syntauri in the Apple II is rather simple due to the fact that it only passes over the information from the internal decoder interface inside of the keyboard. Up to the moment it seems that one part of the information is a parallel set of the 8 Databits. And it seems that at the other hand some part of the information might be some kind of handshaking and probably some kind of Interrupt-handling.
Unfortunatly this part of the information is not complete because the alpha syntauri system i have purchased from ebay did not have this interface card. The only information availiable, was taken from only 2 pictures that i had in former days.

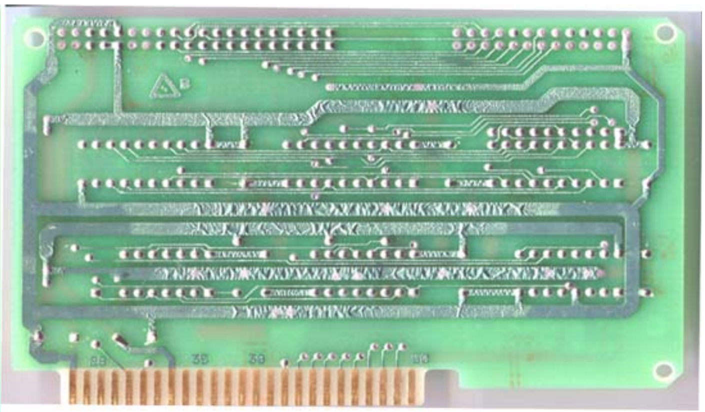
At the beginning just a important remark:
During the time of distribution of the alpha syntauri system, the system has changed several times with several revisions. The information provided here cover the most common more later (but not last) revision of the system I try to research also information on later and earlier revisions at the moment.
The moment such information gets accessable, i will add such informations to the currently blank pages of this series of pages.
Like with most topics i�ve recognized endurance to be one of the most powerfull skills......
The above displayed bad picture of a damaged interface card was for more than 4 years the only info i had on the kind of interface.

Now finally after that period of time i recieved last month a message at applefritter asking if I�m the author of this site and offering me information and support for examination of the final bit of unrevealed stuff at this topic and finally enable me to uncover the last mystery of this system. My special thanks adress to Mr. Charles Hobbs, who passed over the "missing link" by making dozends of pictures and answering a big bunch of questions about details of this Interface card.

The pictures below have been made by Mr. Hobbs and display a working version of this interface card with the small misfit that pin1 at the Connector K1 is broken and is to be repaired. I just enhanced the pictures a bit by correcting perspective and lighting. The left picture displays the component side while the right picture displays the same card at the soldering side.

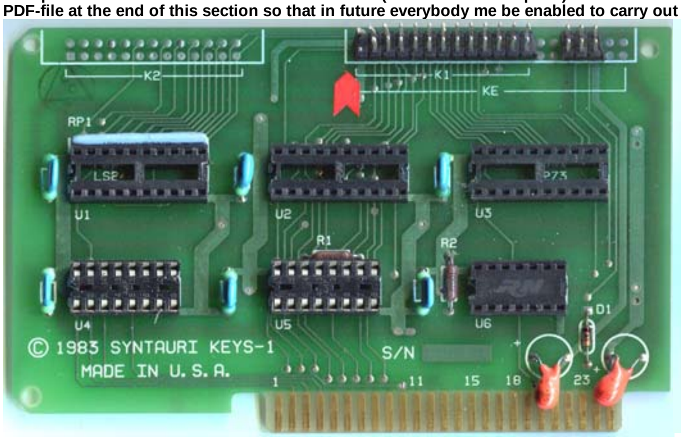


Component side

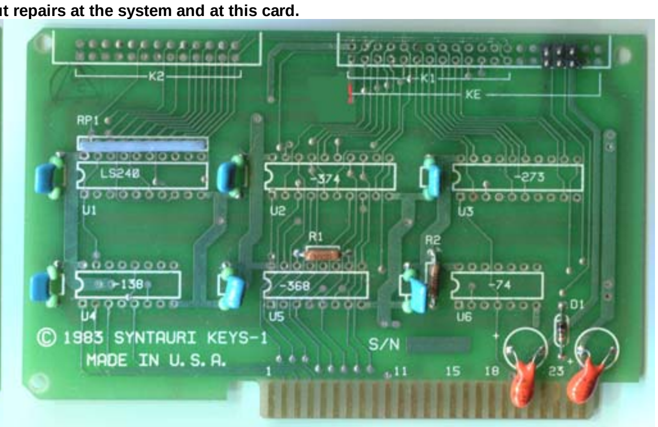


soldering side

Unfortunatly after removal of the Chips it turned out that most sockets didn�t permit very well examination of the traces below of the sockets and that would have required a large amount of testing measurements to detect the correct connections.
I was therefor very happy that Mr. Hobbs decided to desolder the sockets and send me a second set of pictures of the card with extracted sockets.
This permitted me to recreate the entire shematic (electronic circuit plan) of this interface card. I also added this information to the documentation PDF-file at the end of this section so that in future everybody me be enabled to carry out repairs at the system and at this card.

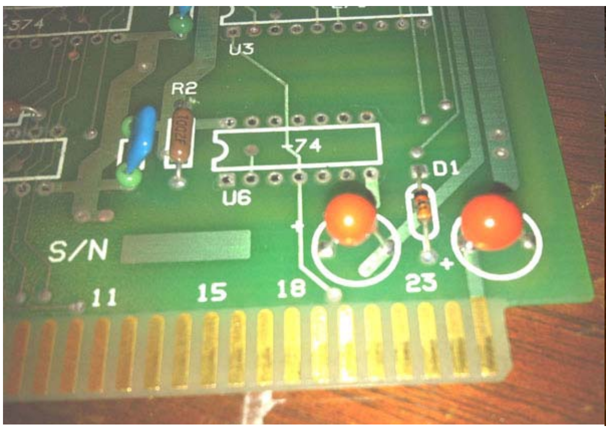


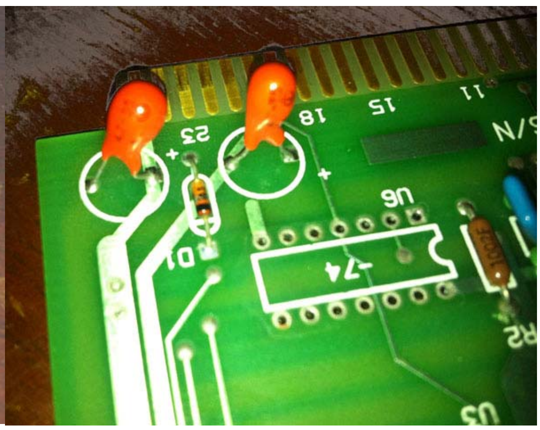
card with extracted chips but remaining sockets



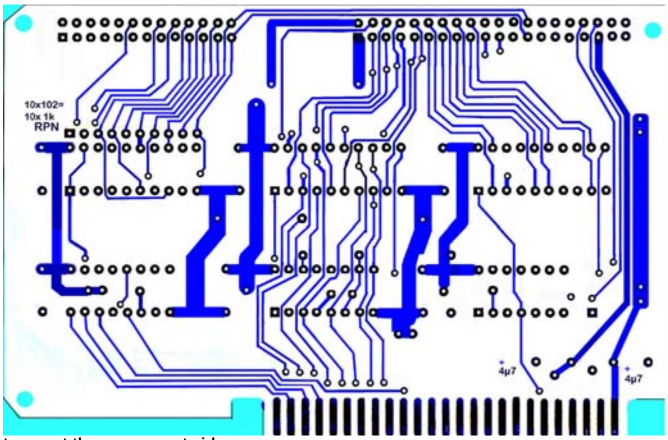
card with desoldered sockets

For identification of several components and details Mr. Hobbs has taken several more pictures that offered more details of the card.

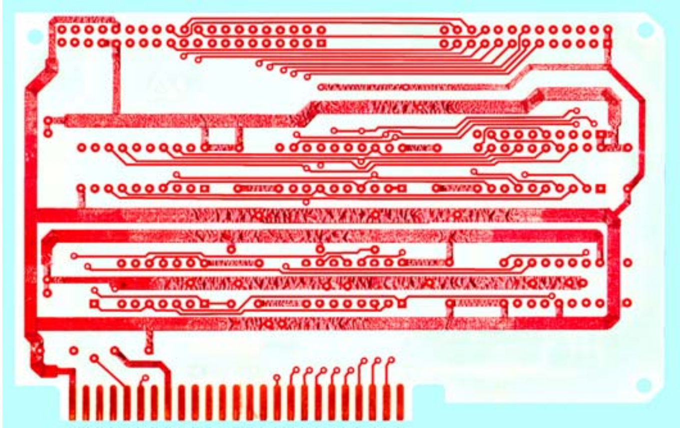




After i had the pictures i started working with Photoshop and converted colors to alter the pictures that way that at the end from both sides a kind of clean negativ film resulted for each side of the interface card and i used the blue color for traces at the component side of the interface card and red for the soldering side of the card.

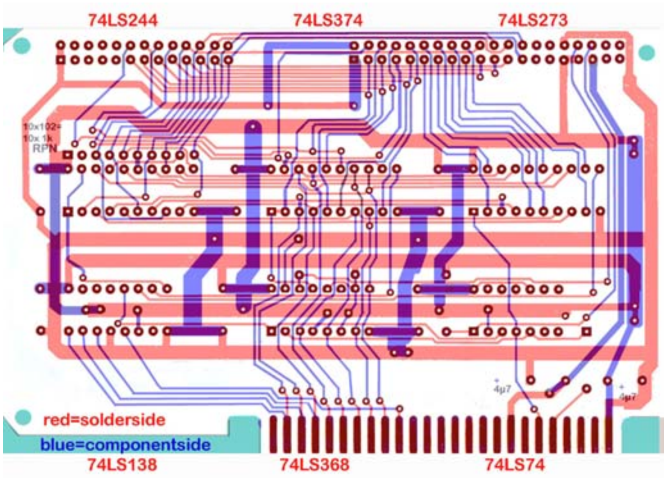


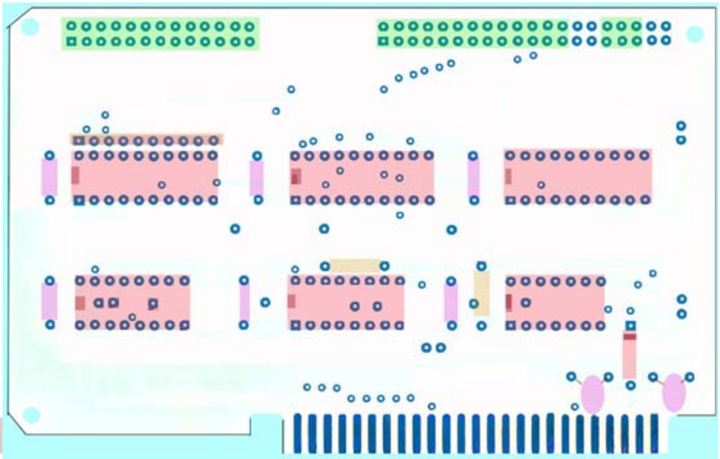
traces at the component side



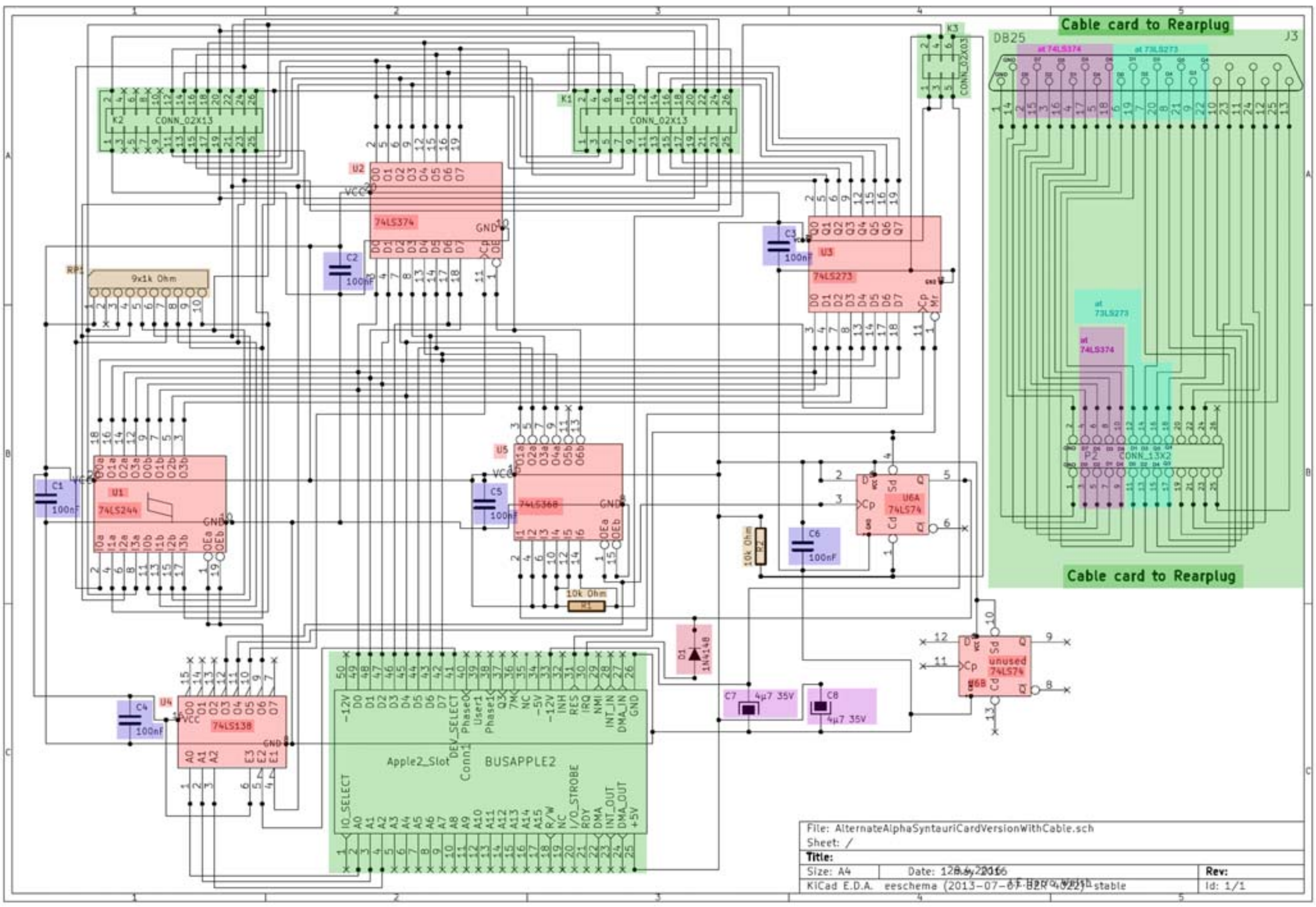
traces at the soldering side

Mounting both layers together gave me a very clear impression of all the connections at the interface and enabled me to recreate the entire schematic.
The picture at the right side just displays the location of the components.





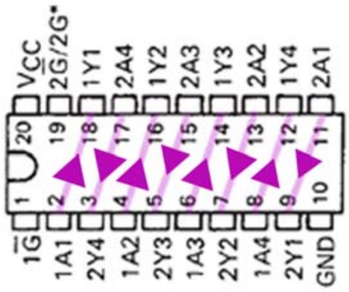
Resulting from this work now finally the picture below displays the complete schematic and the values of the used components like given at the original interfacecard.

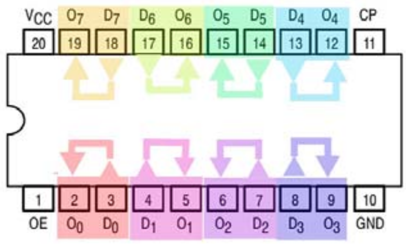


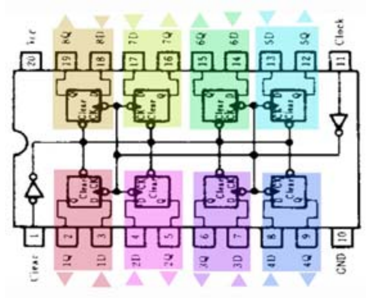
In ext part of this page are the function diagrams of the used chips and i sorted them in the same order they are placed at the interface card an i explain below the chips that are used at this card and the function they perform there at this card. While this order is given by the location on the card it does not order the the chips by their given order in the explaination.

Explaining the operation of the card :
We will start with the 74LS138 at the bottom row and left side
and next then the 74LS368 in the bottom row at the center, followed
by the 74LS374 in the top row at the center and
then the 74LS273 in the top row at the right and
finally from the top row at the left the 74LS244
followed at the end by the 74LS74 in the bottom row at the right side.

It�s therefor recommended to read the explaination of the chips in the box below of the chip in the order given by this previous listing !







74LS244 - a bus transciever

This controller controls 8 Bits of either data bus or adressing bus.

In this card the chip controls a data bus consisting of 8 bits and that bits are displayed either at the connectionplug to or from the keyboard or at the 74LS374 or the 74LS273 and at the 74LS368.

The "activation" of this chip is controlled by $\overline{O6}$ output (pin 9) of the 74LS138 which is selected by specific softwareadress at the appleslot.

At this card you may view the Databus consisting of the 8 Databits as a highway with 2 lanes:

1st lane is from Appleslot to the 74LS244 and the along the 74LS273 to the rearplug connector K2 and the

2nd lane is rather direct from rearplug connector K2 along the 74LS374 towards the appleslot.

The control lines are $\overline{1G}$ and $\overline{2G}$.

The $\overline{1G}$ line controls the 4 bits from 1A1 to 1A4 and $\overline{2G}$ line controls the 4 bits from 2A1 to 2A4.

If the contol-lines recieve a digital "low" signal then the input signals from 1A1 to 1A4 are transmitted to the output lines 1Y1 to 1Y4 and the input signals from 2A1 to 2A4 are transmitted to the output lines 2Y1 to 2A4.

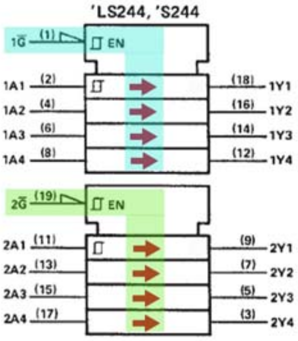
If the control-lines $\overline{1G}$ and $\overline{2G}$ are at digital "high" level then the transmission between the input-lines and the output lines at this chip are locked up and disabled.

FUNCTION TABLE

A	$\overline{1G}$	$\overline{2G}$	Y
L	L	L	L
H	L	L	H
X	H	H	Z

Note 1: Z : high-impedance
X : irrelevant

'LS244, 'S244



74LS374 - Octal D-Type Flip-Flop with 3-State Output

At this card you may view the Databus consisting of the 8 Databits as a highway with 2 lanes:

1st lane is from Appleslot to the 74LS244 and the along the 74LS273 to the rearplug connector K2 and the

2nd lane is rather direct from rearplug connector K2 along the 74LS374 towards the appleslot.

The SN74LS373 consists of eight latches with 3-state outputs for bus organized system applications. The flip-flops appear transparent to the data (data changes asynchronously) when Latch Enable (LE) is HIGH.

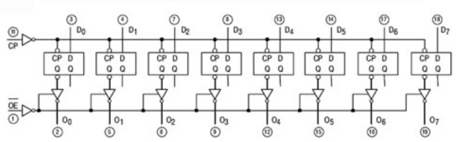
When LE is LOW, the data that meets the setup times is latched. Data appears on the bus when the Output Enable (OE) is LOW. When OE is HIGH the bus output is in the high impedance state.

The SN74LS374 is a high-speed, low-power Octal D-type Flip-Flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus oriented applications. A buffered Clock (CP) and Output Enable (OE) is common to all flip-flops.

The SN74LS374 is manufactured using advanced Low Power Schottky technology .

- **Eight Latches in a Single Package**
- **3-State Outputs for Bus Interfacing**
- **Hysteresis on Latch Enable**
- **Edge-Triggered D-Type Inputs**
- **Buffered Positive Edge-Triggered Clock**
- **Hysteresis on Clock Input to Improve Noise Margin**
- **Input Clamp Diodes Limit High Speed Termination Effects**

SN74LS374



PIN NAMES

$D_0 - D_7$	Data Inputs
LE	Latch Enable (Active HIGH) Input
$\overline{CP}$	Clock (Active HIGH Going Edge) Input
$\overline{OE}$	Output Enable (Active LOW) Input
$O_0 - O_7$	Outputs

TRUTH TABLE

LS374

D_n	LE	$\overline{OE}$	O_n
H	↑	L	H
L	↑	L	L
X	X	H	Z*

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance

* Note: Contents of flip-flops unaffected by the state of the Output Enable input ($\overline{OE}$).

74LS273 - a bus latch cotroller

All Databit lines of this chip have connection to the rearplug connector (pins 3 to 10) and may be assumed to be treated as real Dataport from / to keyboard and the Applebus at the slot.

This databits are that portion of information that will be interpreted as information of the pressed key at the dataport - opposite to that portion of databits that might be interpreted as commands between keyboard and interfacecard and appleslot that explain the devices, how to use the dataport databits (like keep a tone for a duration of time stored in a chip for echo effect .....). This chip may keep databits taken from the dataport dependent to the status of the clock-pin or the clear-pin in temporary storage and display that stored values for a period of time - until databit content is deleted by pulse at the clear-pin !

This function of storing databits is partially also served by the 74LS74 RS-FlopFlop.

That gate stores a value of the command in it's FlipFlop that portion of time - till it get's reseted by a command-bit from the appleslot -

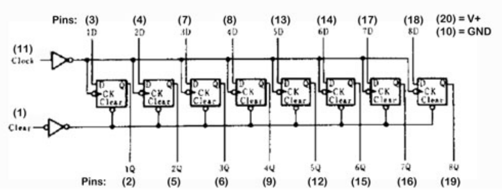
to be precise : from the reset-pin or the IRQ-pin (interrupt request) of the appleslot or by adressing selection from the 74LS138.

The HD74LS273, positive-edge-triggered flip-flops utilize LS TTL circuitry to implement D-type flip-flop logic with a direct clear input.

Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse.

Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse.

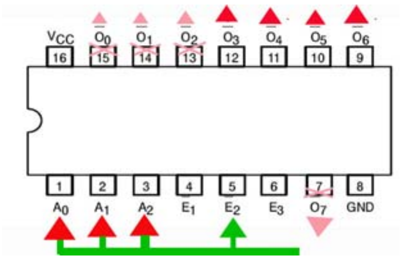
When the clock input is at either the high or low level, the D input signal has no effect at the output.



FUNCTION TABLE

Inputs			Output
Clear	Clock	D	Q
L	×	×	L
H	↑	H	H
H	↑	L	L
H	L	×	Q_0

Notes; H = high level, L = low level,
X = irrelevant
↑ = transition from low to high level
Q_0 = level of Q before the indicated steady-state input conditions were established.



74LS138 - a multiplexer chip used as 3 Bit - decoder

First a short explaination of the chipfunction:
Depending from the Gates E1 to E3 this chip decodes the condition at the gates A0 to A2 and switches one of the lines from $\overline{\text{O0}}$ to $\overline{\text{O7}}$ down to digital "low" status.

The control input E1 is connected to the pin 21 of the connector K1 / K2 at the top of the card and that gets it�s signal from the keyboard - in other words this line acts like a "hey i�m here present" - signal from the keyboard, if it gets digital "high" signal.

The control input E2 gets it�s signal from the Apple II slot from pin 41 = Device select and that signal only gets a digital "high" signal from the Apple - if the current IO-adressingrange is selected from the software indicating, that the software wants to talk with the card.

The 3rd control line E3 is just tied to the 5 Volt rail and therefor permanent in digital "high" status and permanent active.

In other words: the chip only decodes the status of the A0 to A2 (or if you prefer : the current selected adress within the valid adressing range of the card) if the card is selected by the Device-select signal of the Apple II slot and at the same time gets the "hey, i�m here present" signal from the pin 21 at the keyboard connector.
In that case it looks up at the A0 to A2 and decodes the 3 lowest bits of a byte and switches one of the 8 Output ports $\overline{\text{O0}}$ to $\overline{\text{O7}}$ to digital "low"-signal and thereby activates one of the 3 Bus control chips in the top row :
either the 74LS244 or the 74LS374 or the 74LS273.

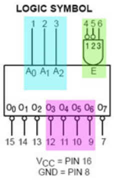
In case of operation of the 74LS138 the so called truth-table below indicates the results of the decoding process:

TRUTH TABLE

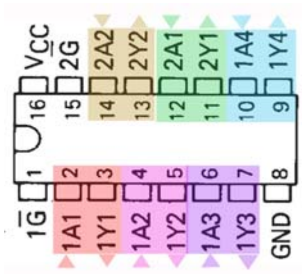
INPUTS						OUTPUTS							
$\overline{E_1}$	$\overline{E_2}$	E_3	A_0	A_1	A_2	$\overline{O_0}$	$\overline{O_1}$	$\overline{O_2}$	$\overline{O_3}$	$\overline{O_4}$	$\overline{O_5}$	$\overline{O_6}$	$\overline{O_7}$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care

LOGIC SYMBOL



Recognize that only 4 adresses from the 8 possible adresses are valid at this card due to the fact that only $\overline{\text{O3}}$ to $\overline{\text{O6}}$ are wired to the chips on the card and only the $\overline{\text{O3}}$ to



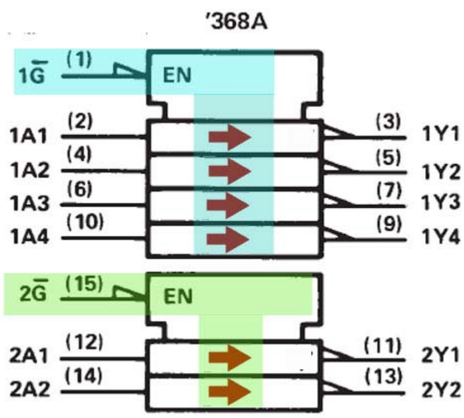
74LS368 - a bus transciever chip with inverting output of 6 bits.

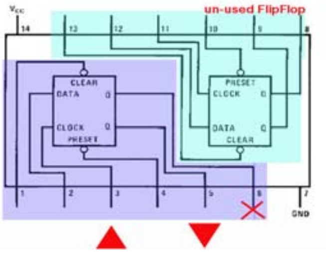
Due to the fact that at this chip the input-pins 4, 6, 10 and 12 are tied up to 5 Volt ("High" -signal) their output lines are also fixed to a defined level.
Pin 14 is in general also tied up to High-level by the 10 k resistor
and only drops to low- signal if it is pulled down by the pin 4 of the testing plug K3 (that 6-pin block).

So in fact only the value at pin 2 and pin 3 are variable.
This results to only 2 different possible status values that may become presented to the other chips and may be understood as a kind of switching between 2 different commands that trigger the other chips.

This commands are triggered by the 2 control-lines $\overline{\text{1G}}$ (pin 1) and $\overline{\text{2G}}$ (pin 15). In fact pin 15 is tied to "low"-level (the GND-line) .
So in fact it's only the signal from pin 12 of the 74LS138 that triggers both (74LS368 and 74LS74) at the same time - if the software passes a specific adress to the 74LS138 from the appleslot.

It�s function is also dependent in conjunction with the RS-FlipFlop in the 74LS74.
Due to this fact the databits at this chip must be valued not as regular data but instead as a kind of "command-bits" that control the communication of the interface and thereby the communication between applebus and the keyboard.





74LS74 - a chip with 2 RS flip flops that may store 1 bit for a temporary short period

In this schematic you may value the CP-line (pin 3) as the line
that is used like an input control.

It get's the instruction from pin 12 of the 74LS138 by the adressing
set at the 3 input lines of the 74LS138 given from the appleslot and the software and only at one specific adress the pin 12 of the 74LS138 is triggered.

The output of the 74LS74 is the Q-pin (pin 5) - that passes
the pin 1 of the 74LS368 and then is presented to the rest of
the other chips > from pin 3 of the 74LS368.

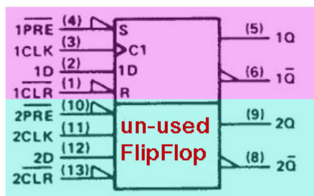
These devices contain two independent D-type positive-edge-triggered flip-flops. A low level at the preset or clear inputs sets or resets the outputs regardless of the levels of the other inputs. When preset and clear are inactive (high), data at the D input meeting the setup time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the D input may be changed without affecting the levels at the outputs.

FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{\text{PRE}}$	$\overline{\text{CLR}}$	CLK	D	Q	$\overline{\text{Q}}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H†	H†
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	$\overline{Q_0}$

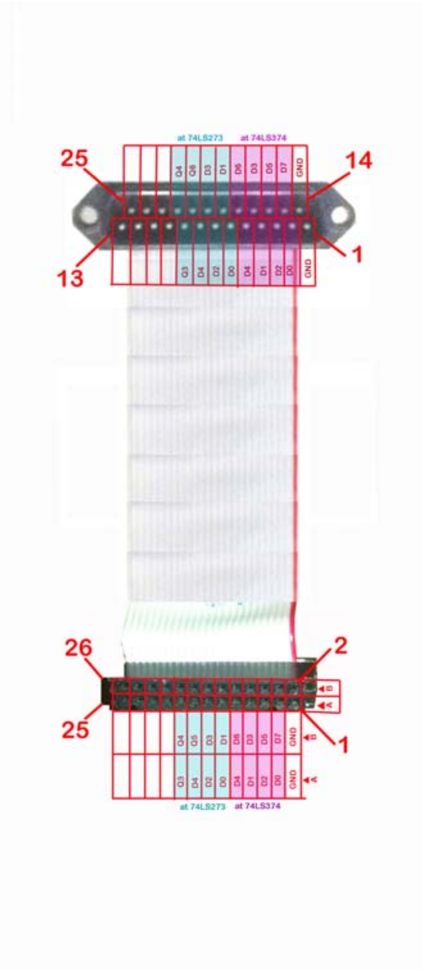
† The output levels in this configuration are not guaranteed to meet the minimum levels in V_{OH} if the lows at preset and clear are near V_{IL} maximum. Furthermore, this configuration is nonstable; that is, it will not persist when either preset or clear returns to its inactive (high) level.

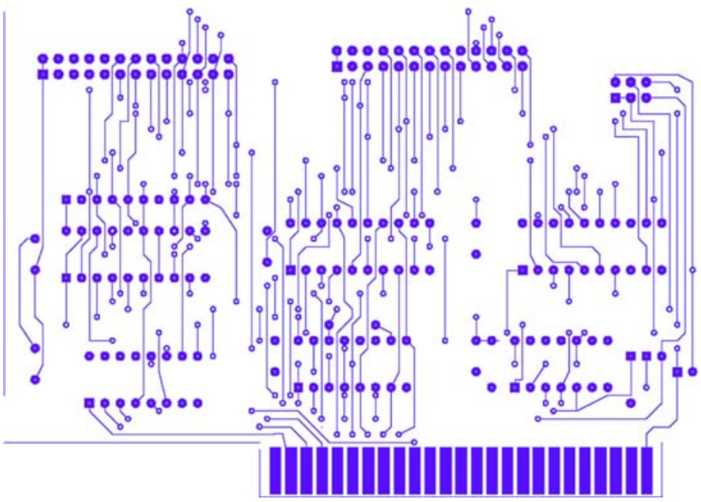
logic symbol‡

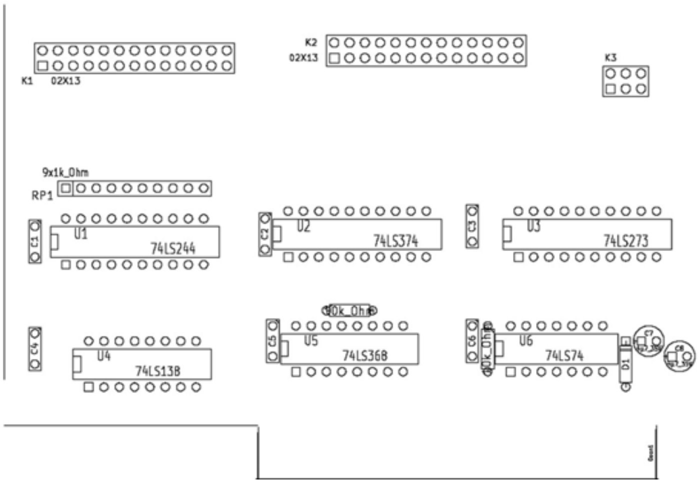


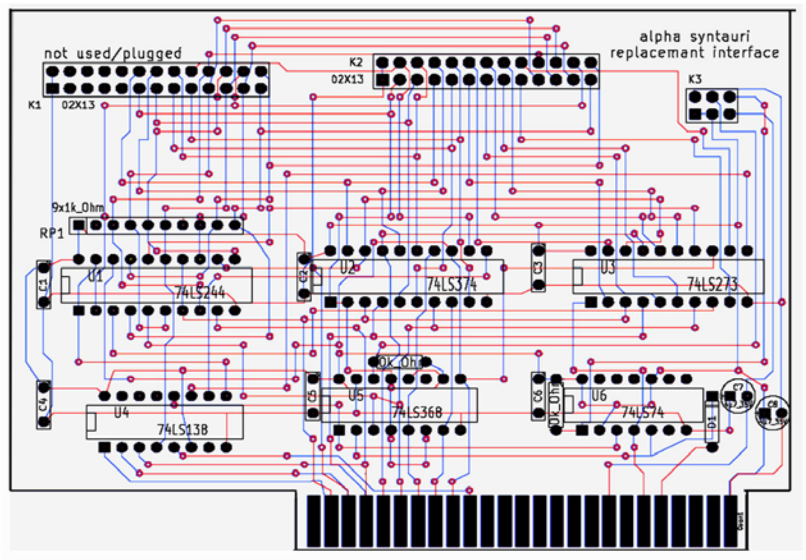
$\overline{O6}$ wire that is active "low" is really selected
!

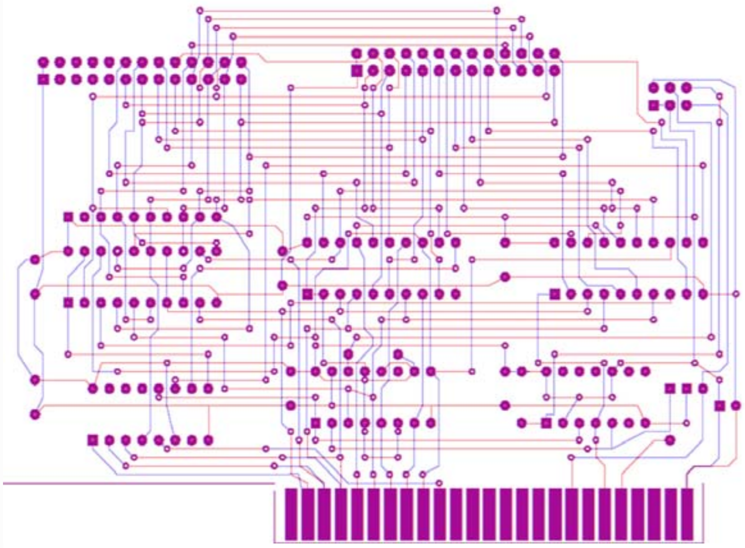
The relevant adresses are:
Cn00 + 3 (activates the 74LS368
and the 74LS74)
Cn00 + 4 (activates the 74LS273)
Cn00 + 5 (activates the 74LS374) and
Cn00 + 6 (activates the 74LS244).











due to european laws and german court decision:
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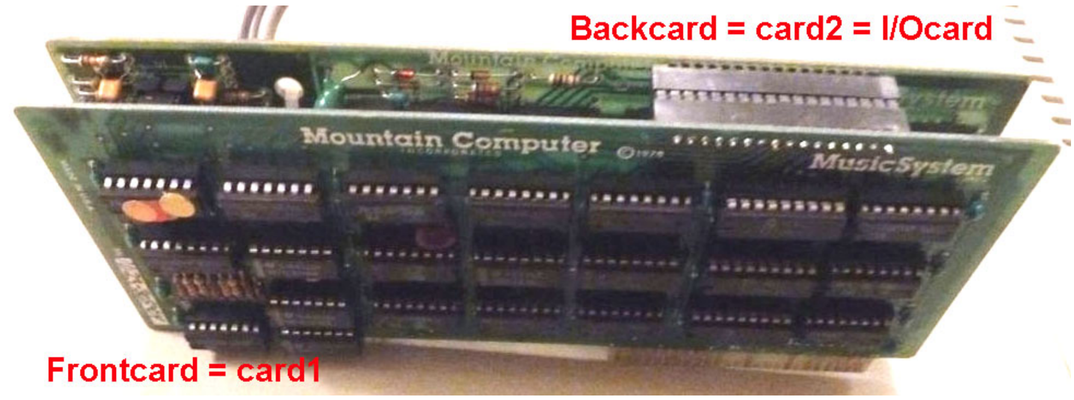
the alpha syntauri system
a ancient synthisizer concept for the Apple II
at this page we will examine the front card of the Mountain Computer Music System

**In very early versions of the alpha syntauri - the system was distributed with the ALF MC1 card.
That card is treated in a later page of this series.**

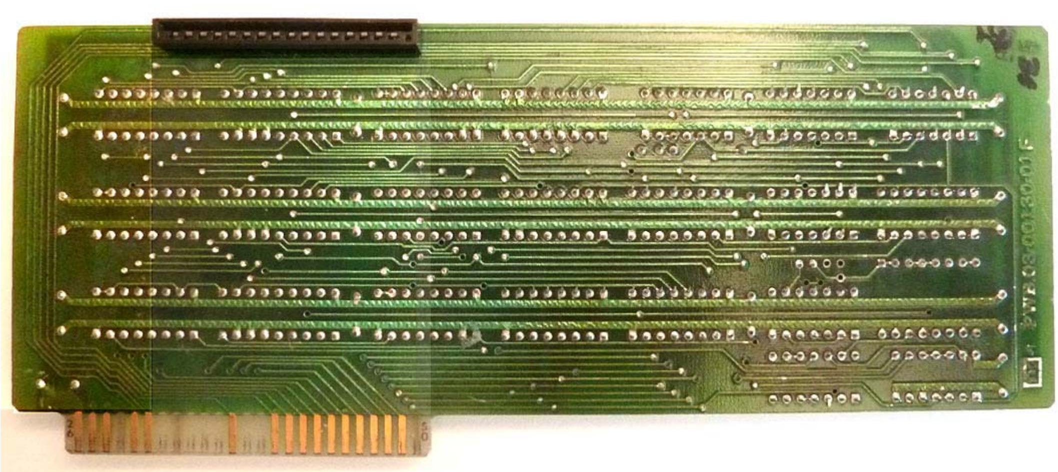
The purpose of the Mountain Computer Music System in relation / interaction with the alpha syntauri is the generation of the soundwaves. It�s the system to perform the translation from pressed keys at the keyboard to output of sound to an external Amplifioer and from there to the speakers. And besides of the software of the alpha syntauri, that in fact just stores the keypresses at the keyboard and the setup of sounds at the Mountain Computer Music System.

The Mountain Computer Music System itself consists of two cards: the front card which might be called the system interface that performes interaction between the computer and the software while the alternating card introduces in the later page might be called the "Generation card", that performs the real sound output and that also handles the communication with the lightpen and it�s interaction with the software.

Allthough in this picture both cards are connected with a hard linking connector system - some older systems (like the one i have) are linked together with a flexible system. That flexible system is very vulnerable. Therefor i decided to not only detect the traces below the IC-sockets, but instead to desolder / strip off the entire card and when performing the repopulation to replace the connectior between this cards with goldplated long pin pluging system.

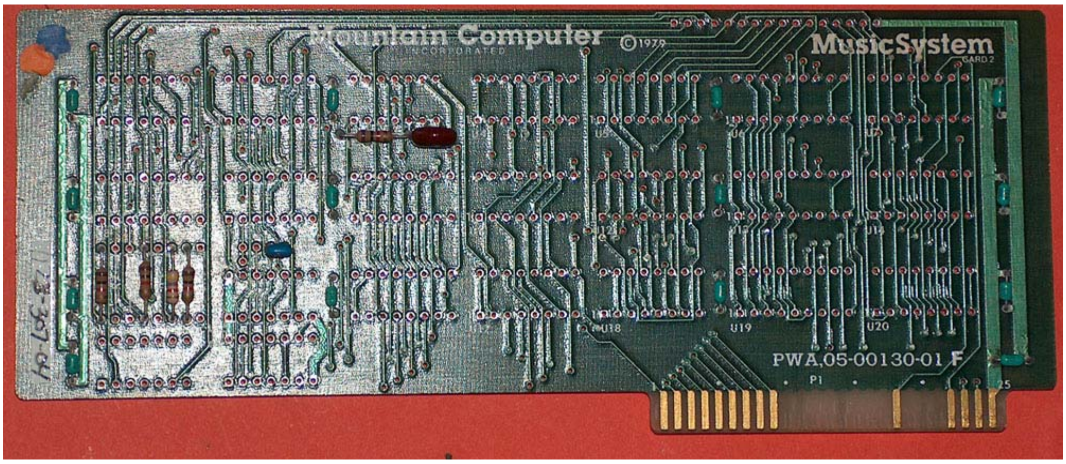


Here is the view to the rear soldering side of the front card (here with a "hard connector linking system):

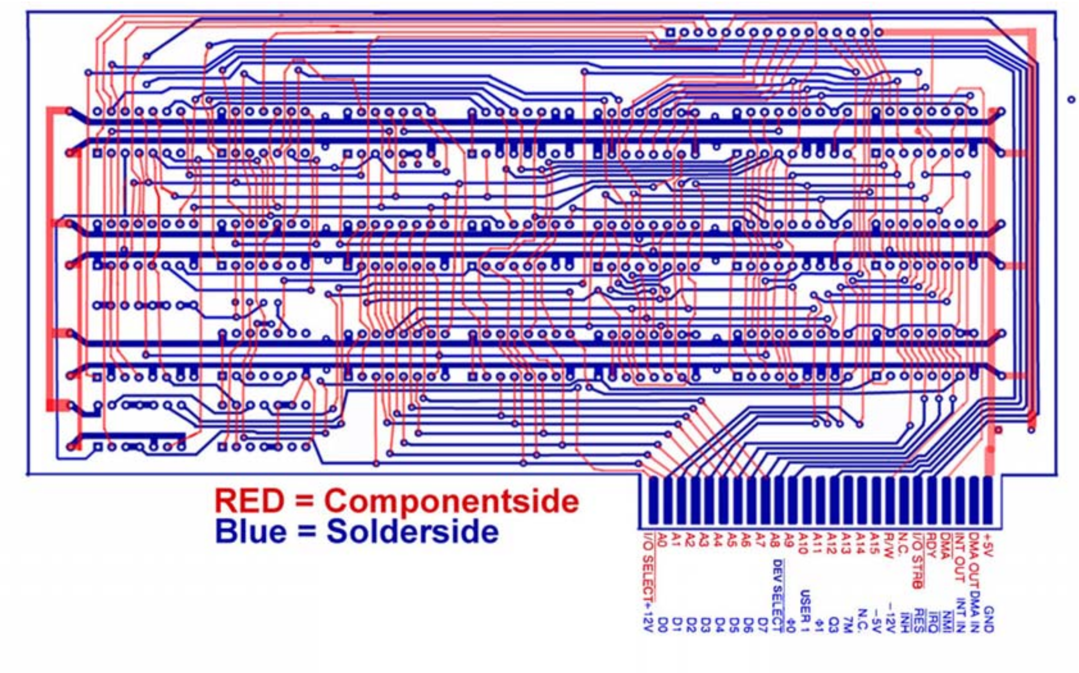


Here is the view to the populated side of this front card:

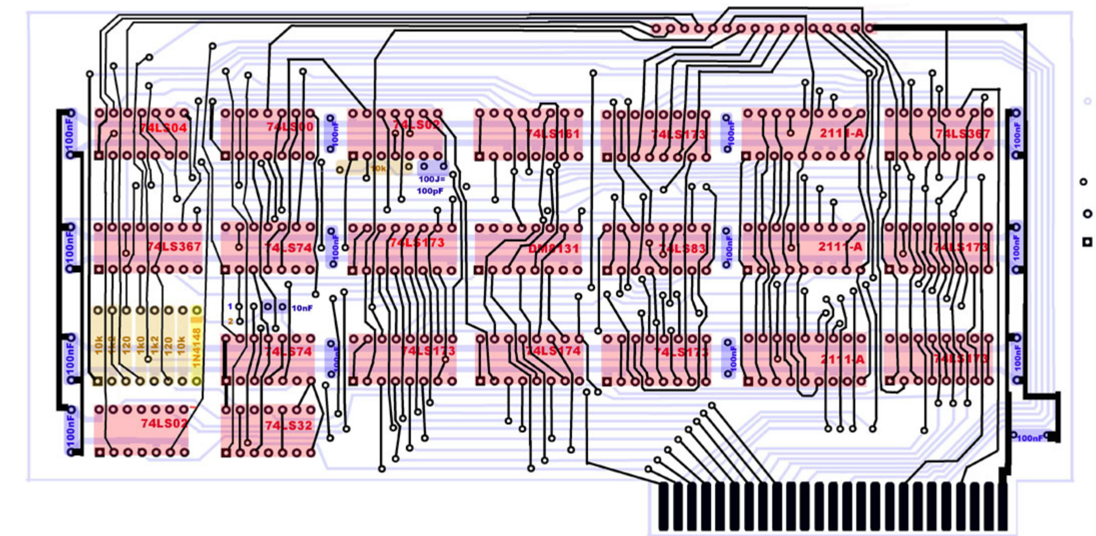
Here is the view to the (nearly entirely) desoldered card displaying the traces below of the sockets:



After reproducing a drawing and transfer of the traces to that draw�ngs (blue side represents soldering side and red side represents componentsisde) the resulting combination of both layers (solderingside and component side) to this map with both layers:

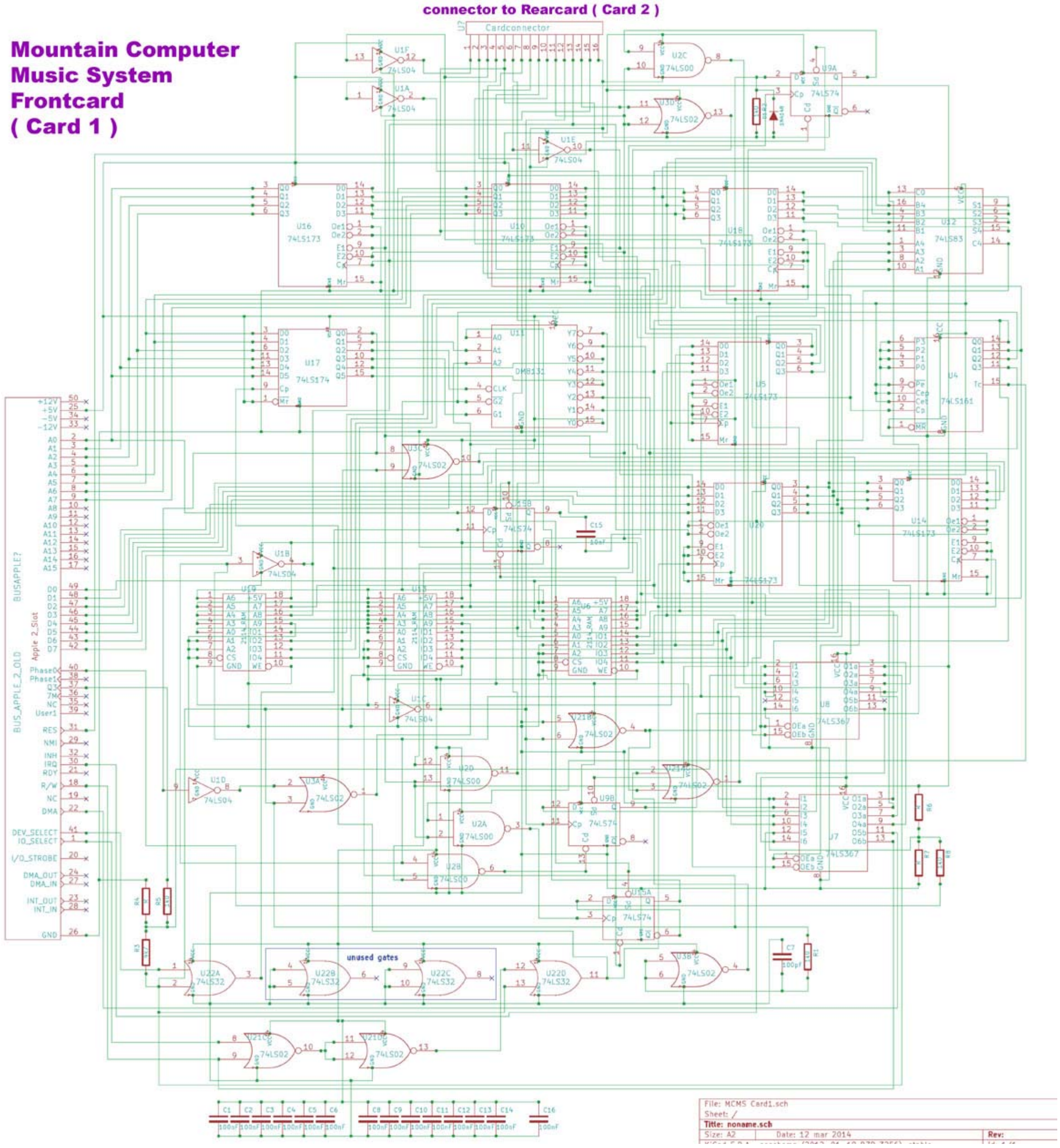


and here in the drawing that displays the used components and the used values (red = circuits, blue = capacitors, light brown = resistors, yellow = diode):



So now after 3 days of work this part of the task is completed and the circuitplan is completed:

Mountain Computer Music System Frontcard (Card 1)



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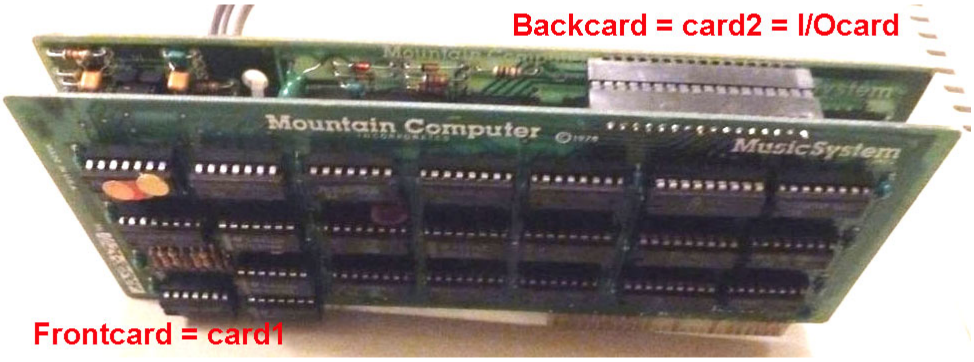
the alpha syntauri system
a ancient synthisizer concept for the Apple II
at this page we will examine the back card of the Mountain Computer Music System, I/O card



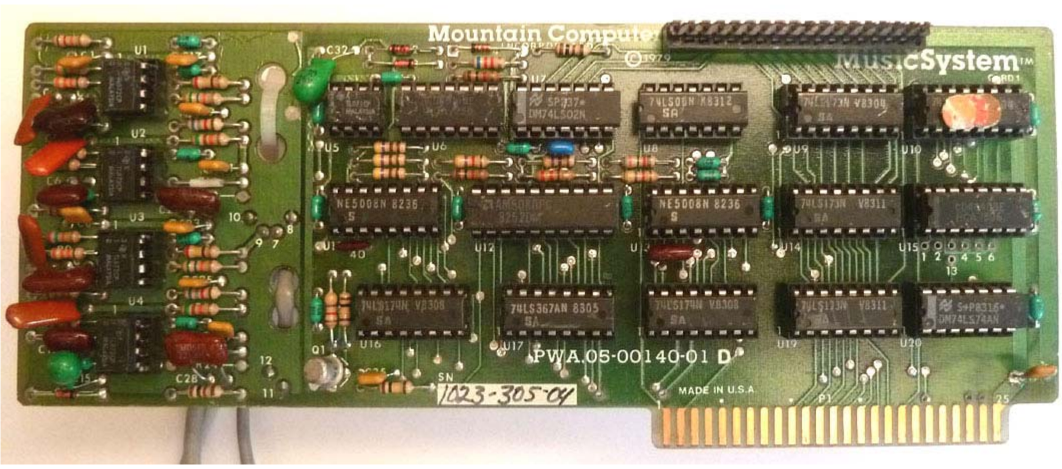
In this part i�ll show the details about the second rear card of the system.The cables to the external devices are connected to this card. The most simple part of the external devices is the lightpen. In fact it�s just a simple phototransistor that detects light and then it switches the power just like any normal switching transistor. The only difference is that instead of a voltage to the baseconnector in this transiostor has a lens at the base and the light causes the transistor to switch through. The Transistor is a MRD370. The pen is visible in the picture below of the card.

The other 2 cables are ending at chich connectors which are common within audio systems. Both cables together act as stereo output - one cable contains signals for right channel and the other contains the signals of the left channel. The output level is equal to standard audiosystems and equals to 0,7 Volt which is normalelly feeded to line inputs at the amplifier.So the part of the electronis on the card in position front (left side) of the holes where the cablebinders are located bear the analog electronic part of the board. The other part of the card contains 2 function blocks: The part that sychronizes the lightpen with the video output - it muist detect exactly the millisecond where the pixels are generated in the picture that display that area which shall be selected by the user. In that very moment the pixels get displayed the transistor passes over a switching pulse to the card and the card must pass over that detected signal to the software for the further handling and switch to the selected menuitem.

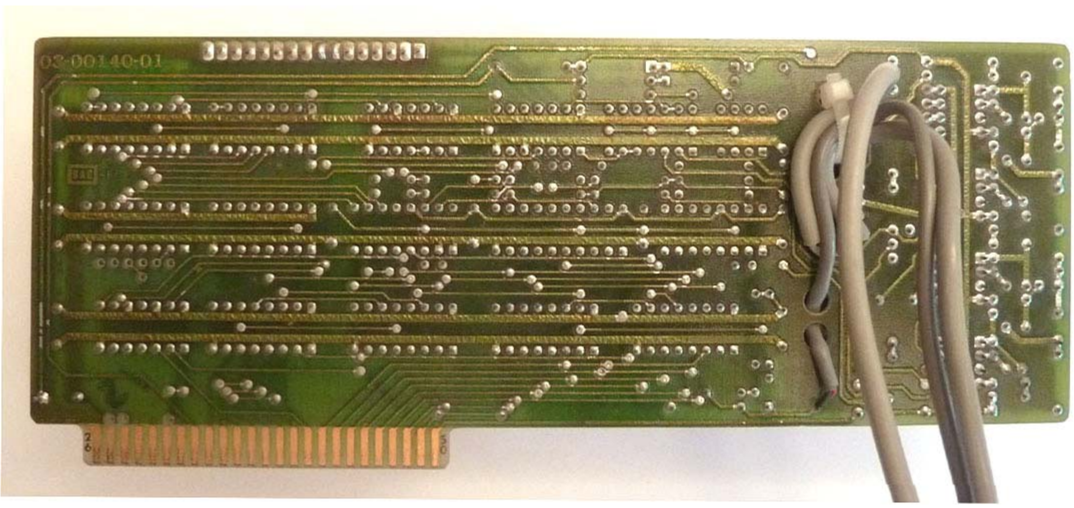
The other part of the electronic at the card the pulses setup by the soundconfiguration is prepared before it�s handed over to the audiopart. This primary audiopart determines such things like frequency, pulseduration and other parameters that have been selected by the software and passed over to the other frontcard. The connector on the top of the card passes over that data to this card.

So in a very unique way you may call the first card (front card) to be the part for handling software and memory storing the parameters and menuoptions and at this second card (rear card) there is a kind IO handling and a kind of synthisizergeneration for waveforms.

here is the view to the populated side of the second (rear) card:



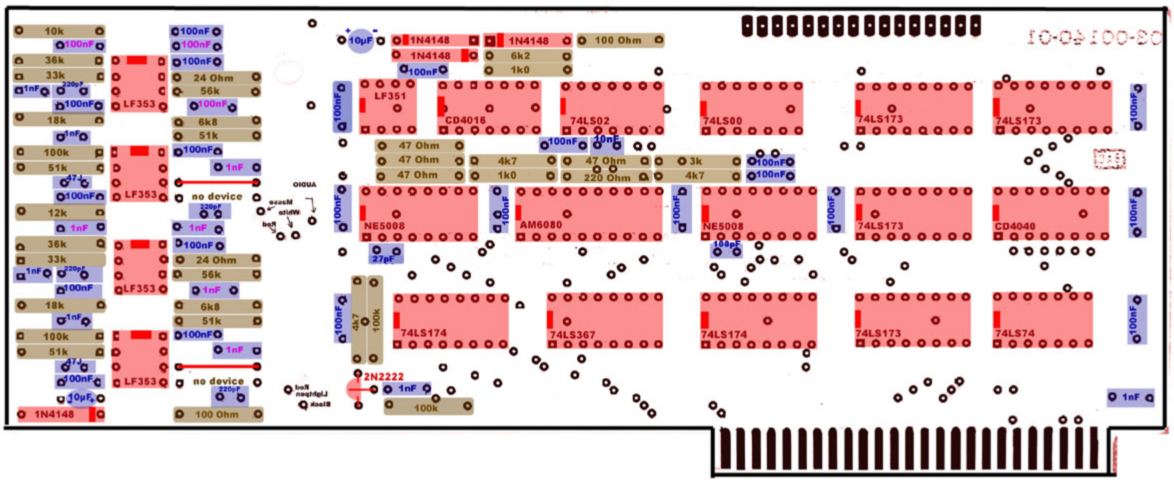
and here is the view to the soldering side of this second (rear) card:



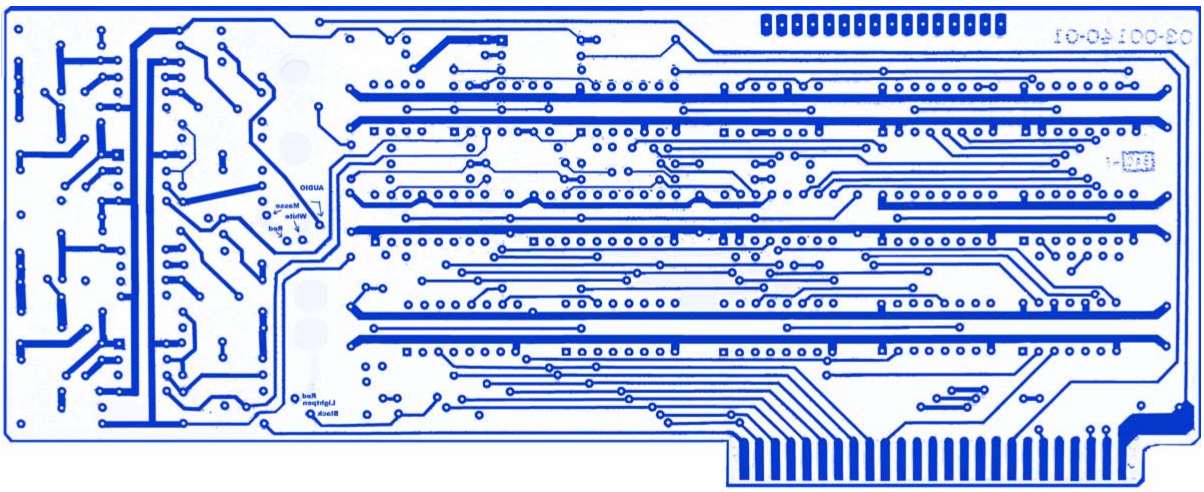
and here is the view to the "external" connection parts of this card : the light pen and the 2 audio-output- connectors.

so next here a view inside of the lightpen - it only contains a lightsensitive switching transistor :

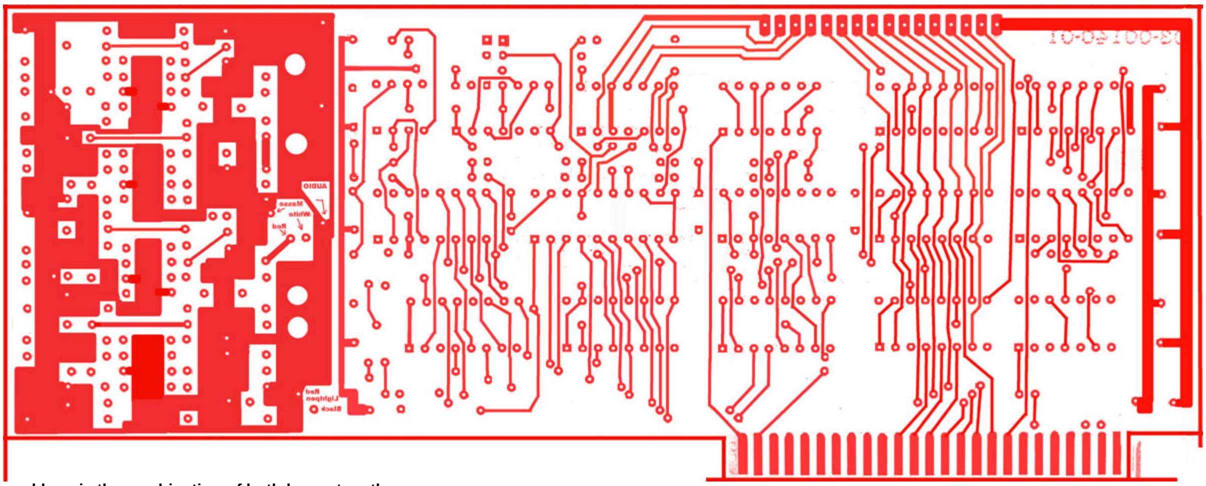
Here is the componentlayout of the card:



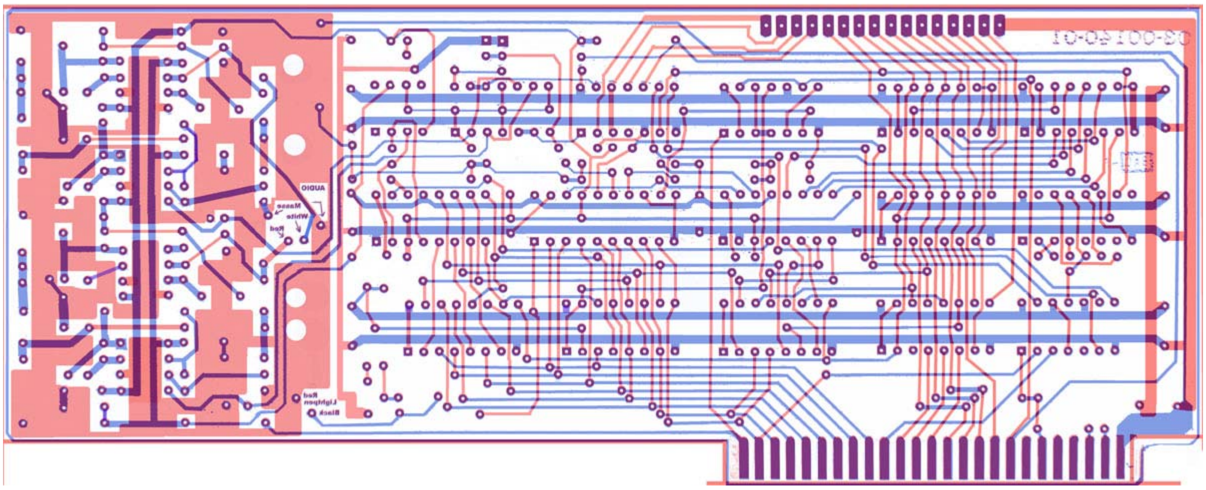
And here is a view to the solderside after it has been converted to be blue layer for later analysis of the card:



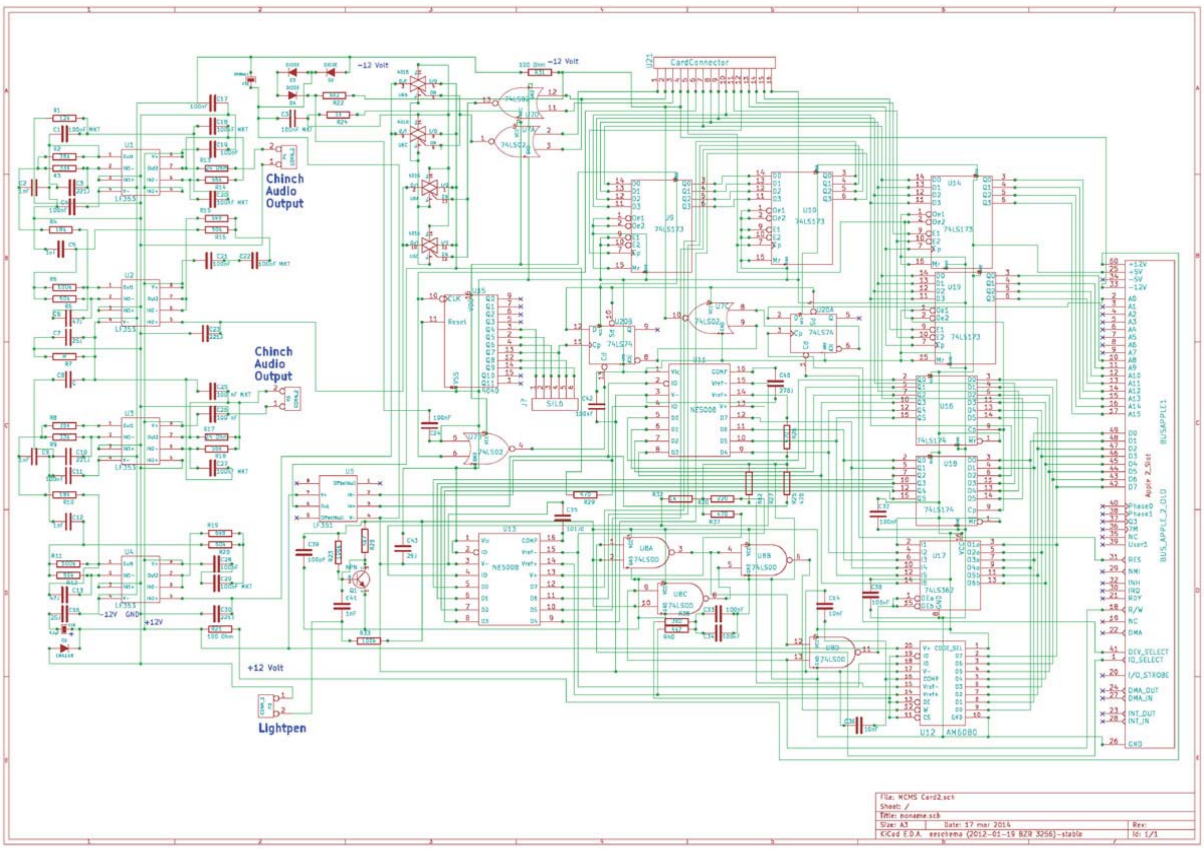
So now here is the red layer from componentside:



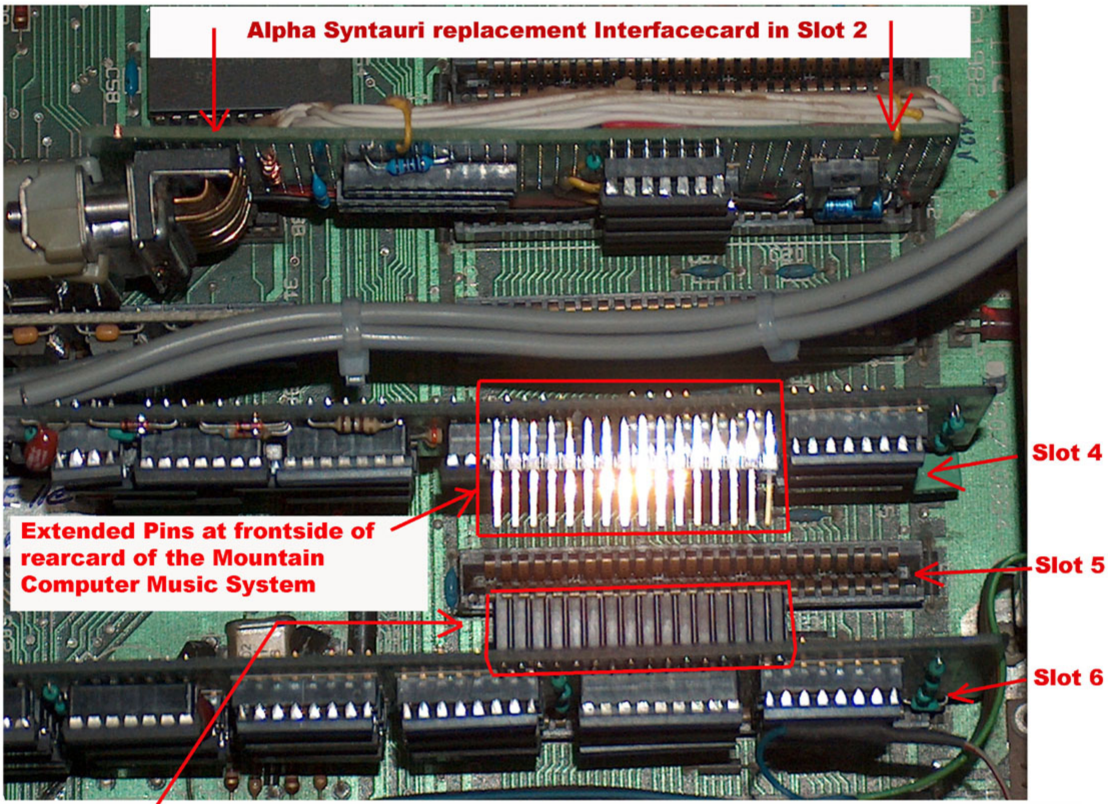
and here is the combination of both layers together:



So finally here is now also the circuitplan of the second card of the Mountain Computer Music System :

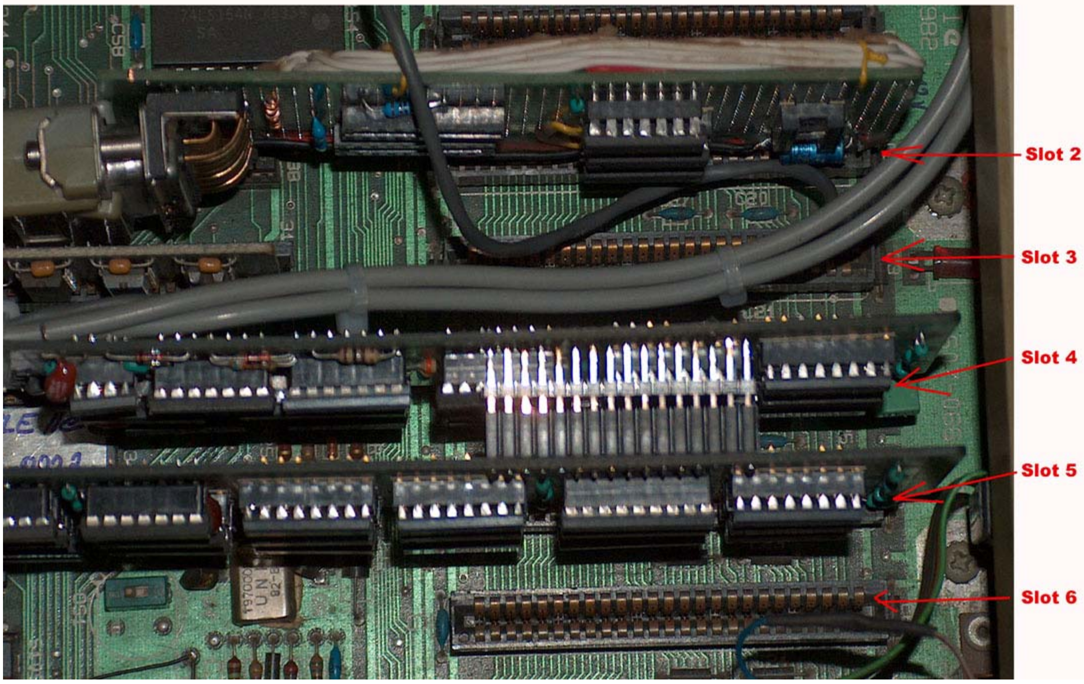


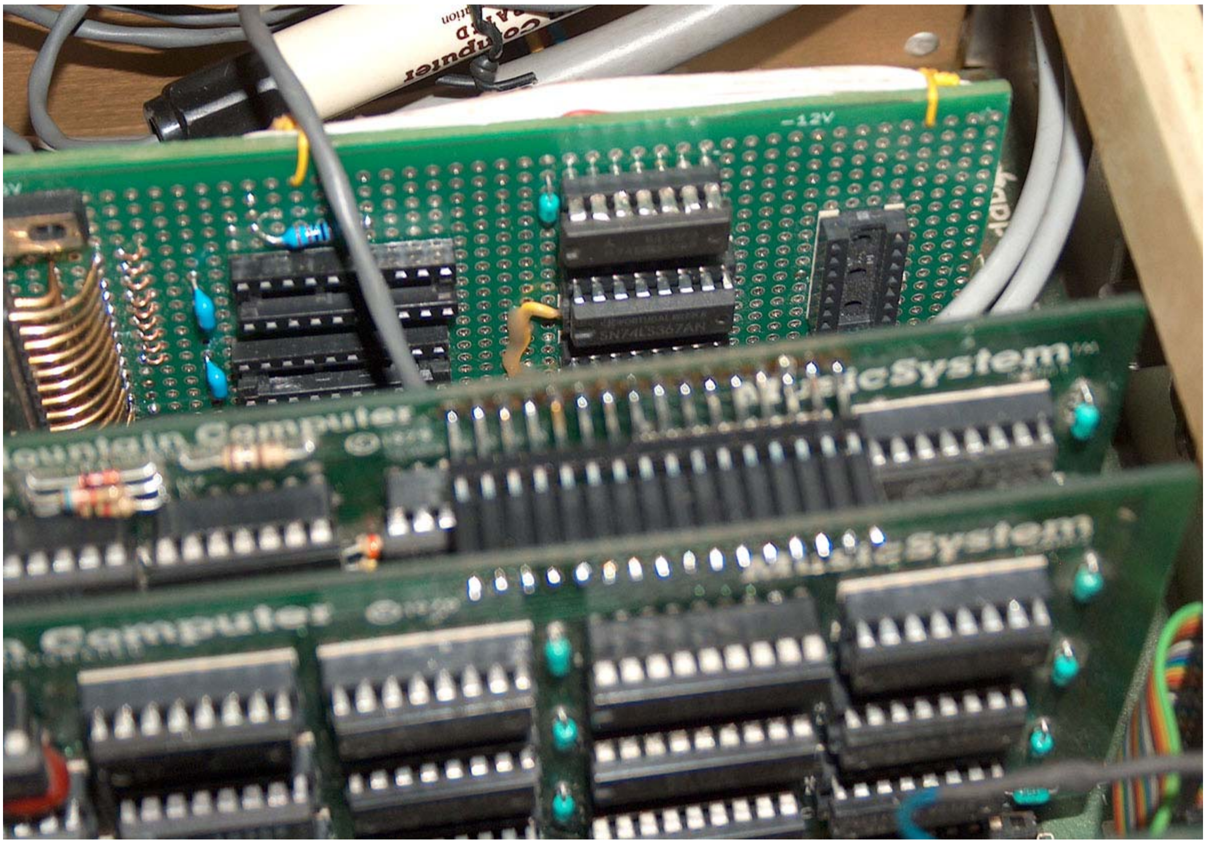
As explained in the previous page the connection between both cards in my system was not reliable. Therefor i replaced the connection in my system with goldplated extended pinconnectors. The following pictures show this replacing solution. In the first picture i have placed both cards apart from each other to mahe the connection visible. In the second and third picture the cards are both plugged together and set in their default slots.



Pinconnector at rearside of frontcard of Mountain Computer Music System
remark: distance of one additional slot left in this picture to demonstrate length of extended pins !

In this picture both cards of the Mountain Computer Music System are plugged together to each other and are placed in the regular default slots 4 and 5 ! The result : The card have perfect reliable connection to each other !





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the alpha syntauri system
a ancient synthisizer concept for the Apple II
details and circuitplan of the piano-keyboard part of the alpha syntauri

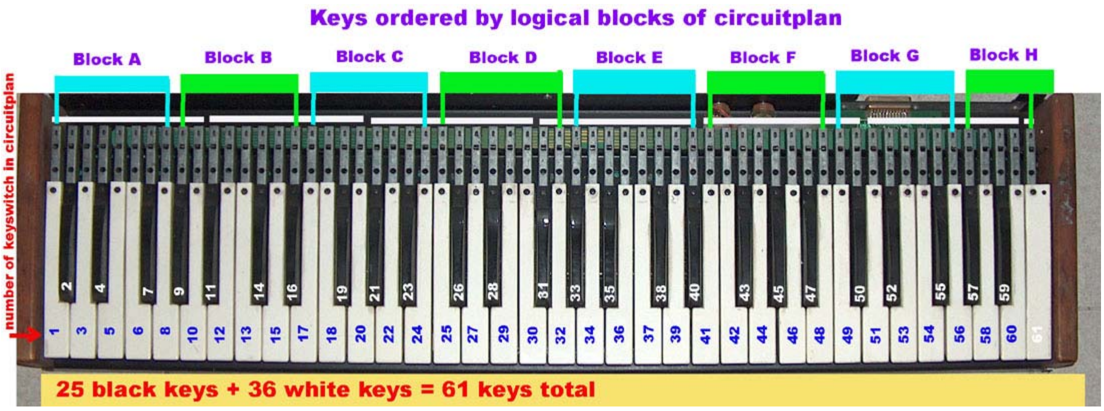
**During the distribution of the alpha syntauri system there have been 2 different pianokeyboards common to sales:
a version with 48 keyswitches was distributer with the early systems,
while later systems have been distributed with a 61 keyswich pianokeyboard.
Another difference was that the later version was able to recognize velocity, while the early version didn�t do that.**

This page displays the later common version with 61 keyswitches.

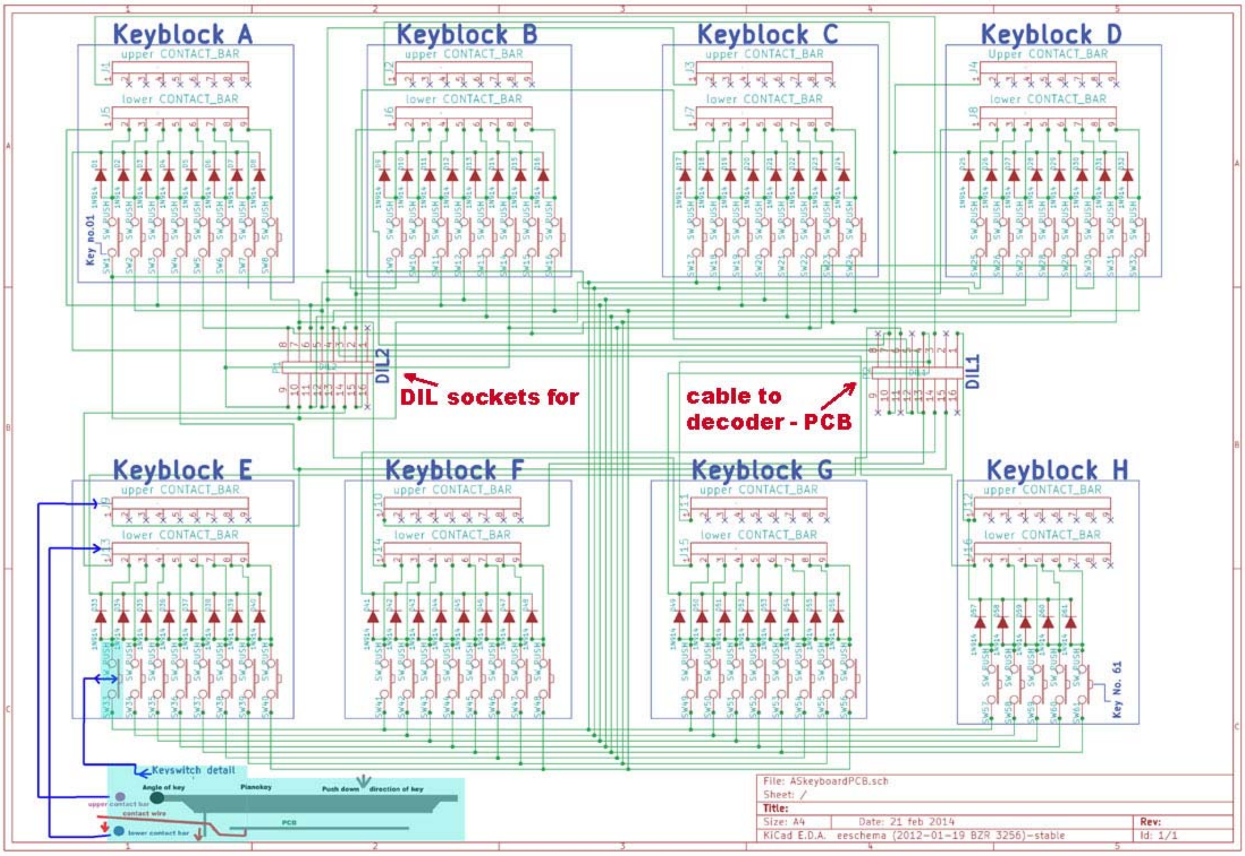
In the earlier pages the keyboard has been displayed in general. In this part we�ll take a closer view to the details of the piano-keyboard part of the alpha syntauri <u>before</u> the signals from the keyboard enter the decoder PCB inside of the keyboard case.

The keyboard has 61 keyswitches. To enable the user to assign each single key of the keyboard to it�s correct part in the circuitplan i have numbered the keys in the picture below. According also to this picture and the circuitplan you may recognize the "grouping" of each 8 keyswitches in a keyblock. This is also due to the "grouping" inside of the keyboard where 8 keys are collected to one group by the related "upper connector bar" and "lower connector bar". This will be explained later in other pictures.

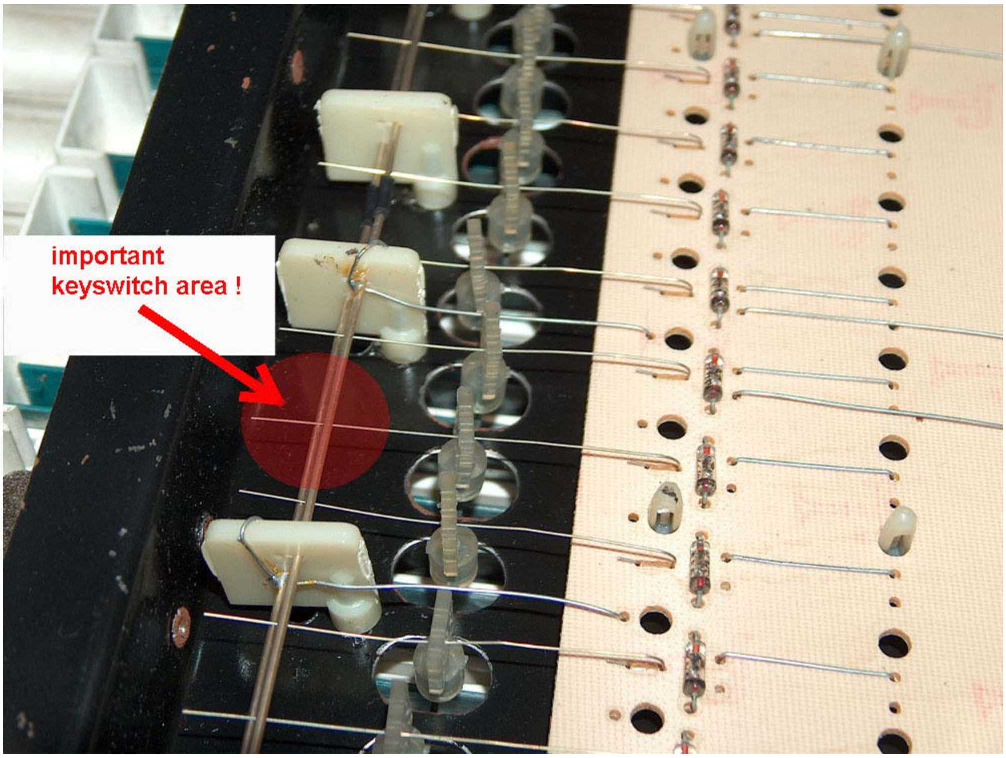
Here is the picture with the numbering of the keyswitches and it�s related "piano keys":



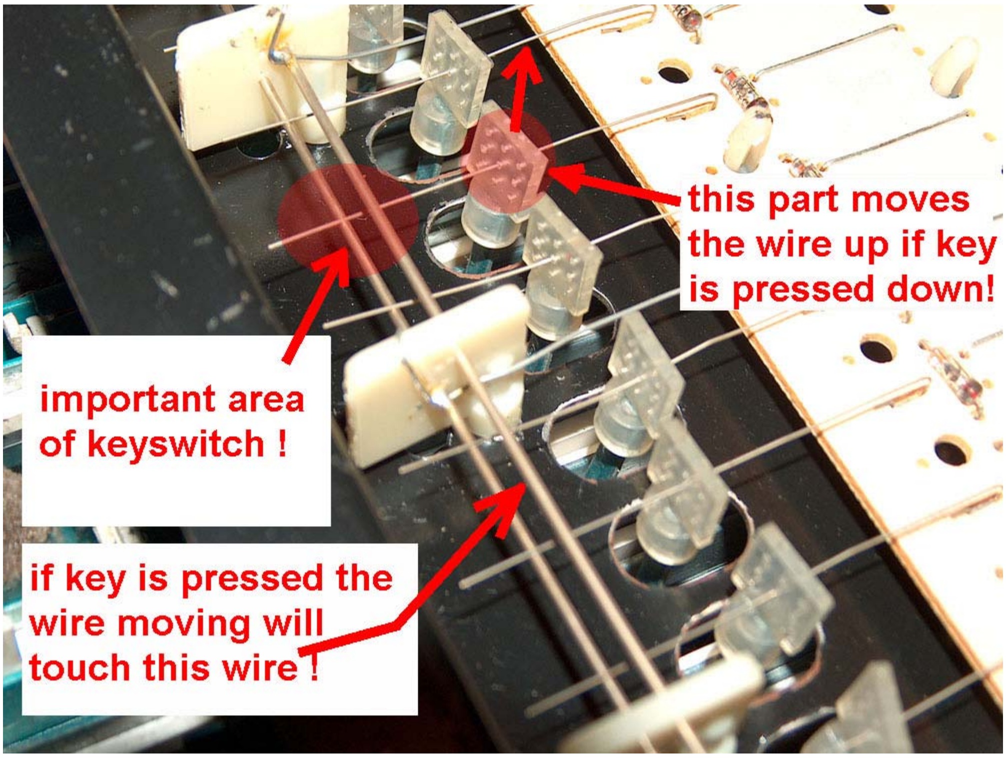
and here is the related circuitplan:



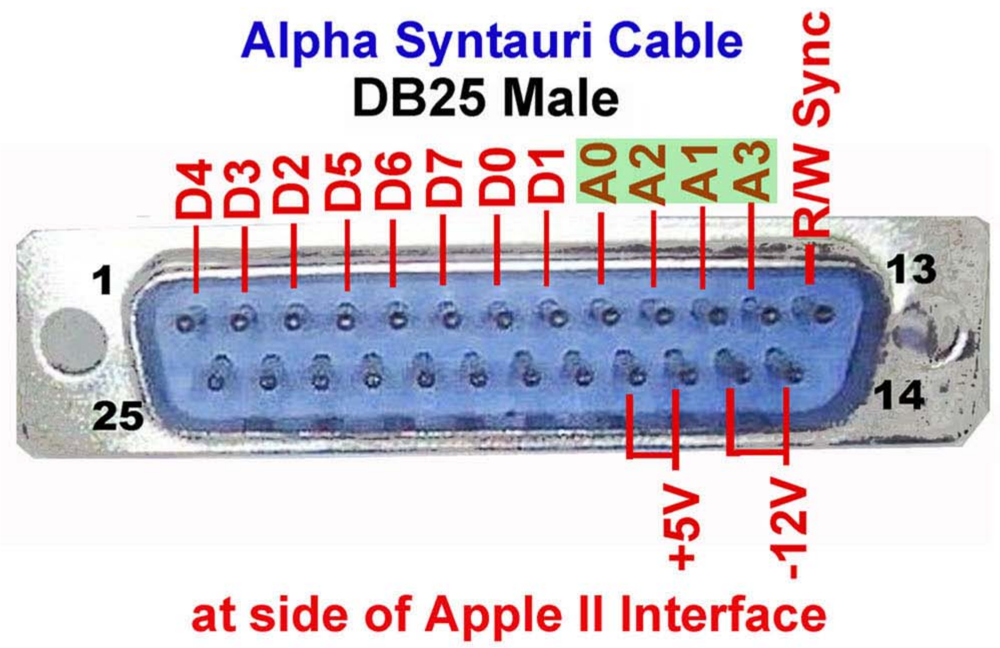
to recognize the details of the keyswitches here some more pictures of that section:

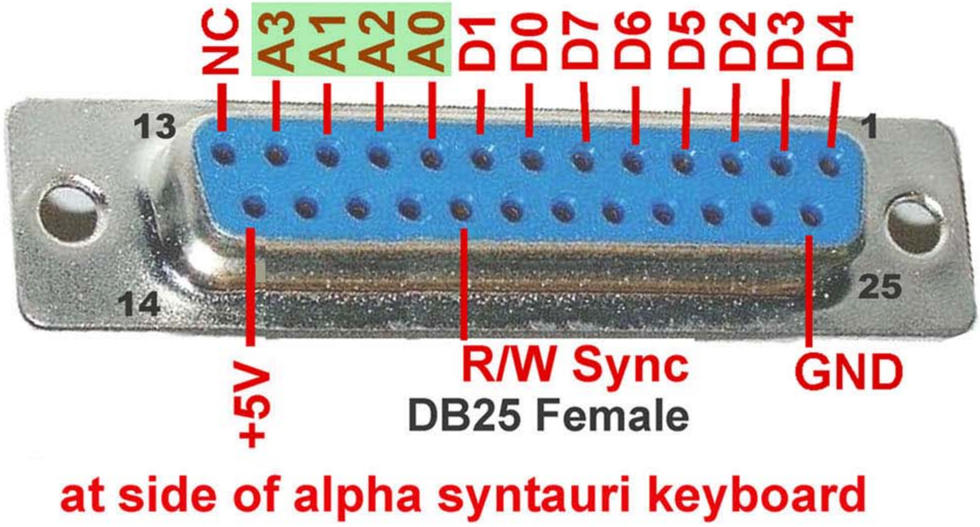


and here the second picture from another viewpoint:



and here is the pinout of the cable between the Apple II interfacecard and the keyboard:

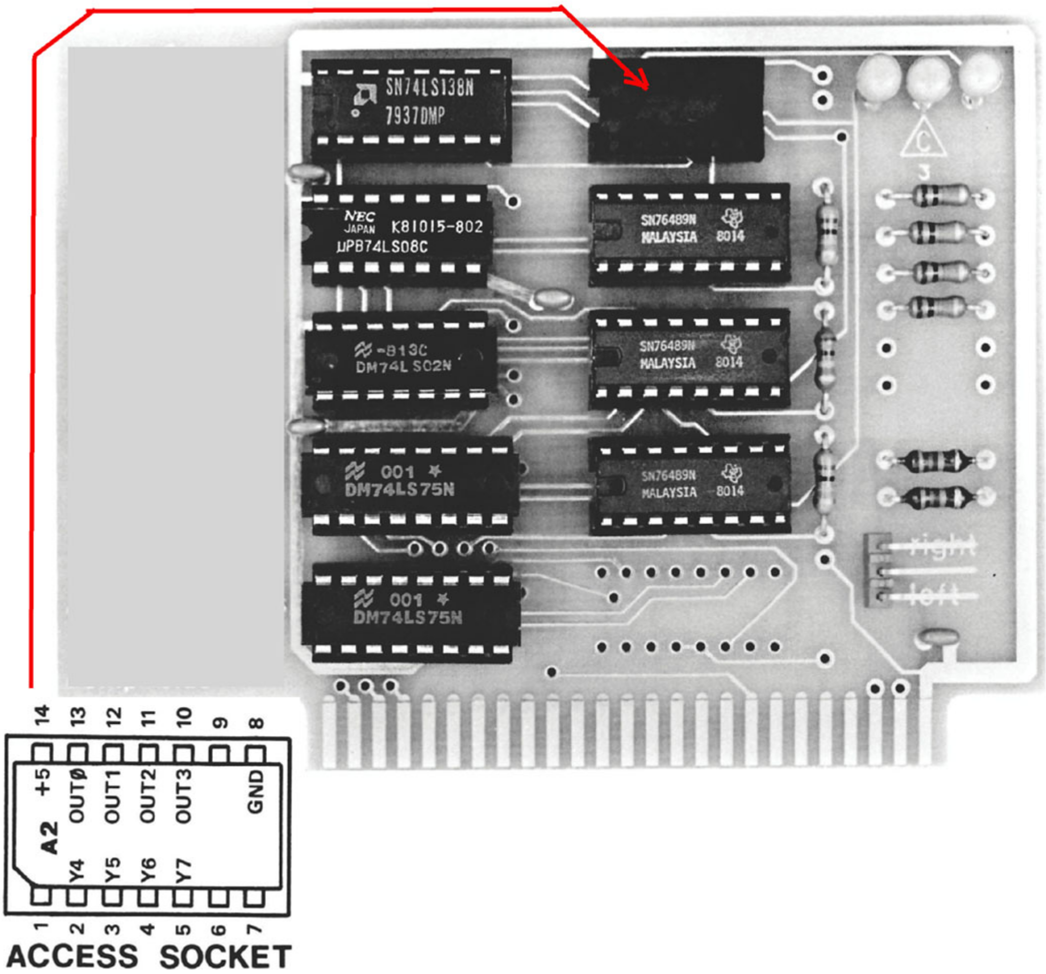

Alpha Syntauri Cable
DB25 Male
D4
D3
D2
D5
D6
D7
D0
D1
A0
A2
A1
A3
R/W Sync
1
13
25
14
+5V
-12V
at side of Apple II Interface


NC
A3
A1
A2
A0
D1
D0
D7
D6
D5
D2
D3
D4
13
1
14
25
+5V
R/W Sync
GND
DB25 Female
at side of alpha syntauri keyboard

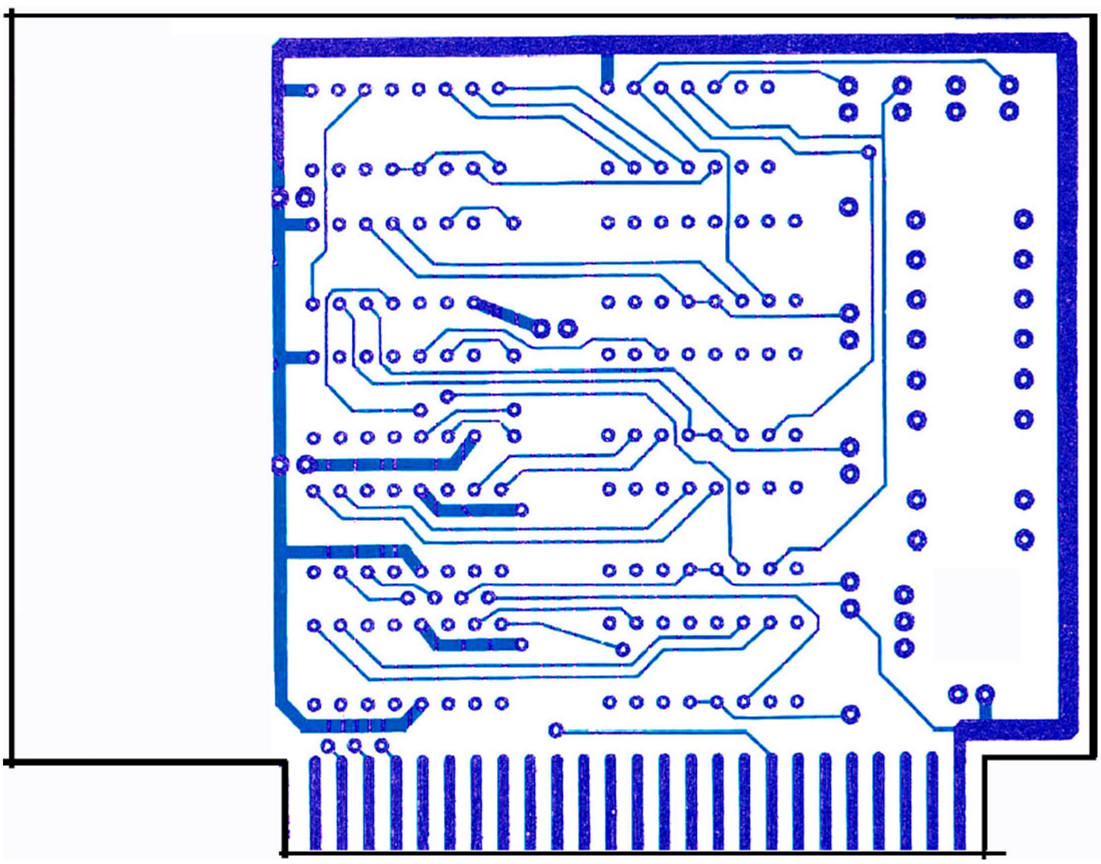
the alpha syntauri system
a ancient synthisizer concept for the Apple II
The early beginning with the ALF card

At the beginning the alpha syntauri was distributed with the ALF MC01 card. This was due to the fact that the card was rather cheap and it was rather cheap attempt of experiments to get a system with the pianokeyboard up and running. In later more common distribution the company decided to use the system with the cards from tha Mountain Computer Music System. Allthough that two cards have been in those days much more expensive the crew at syntauri decided to use that system, because it had not only better performance at sound output, but also the ability to use a lightpen as input device.

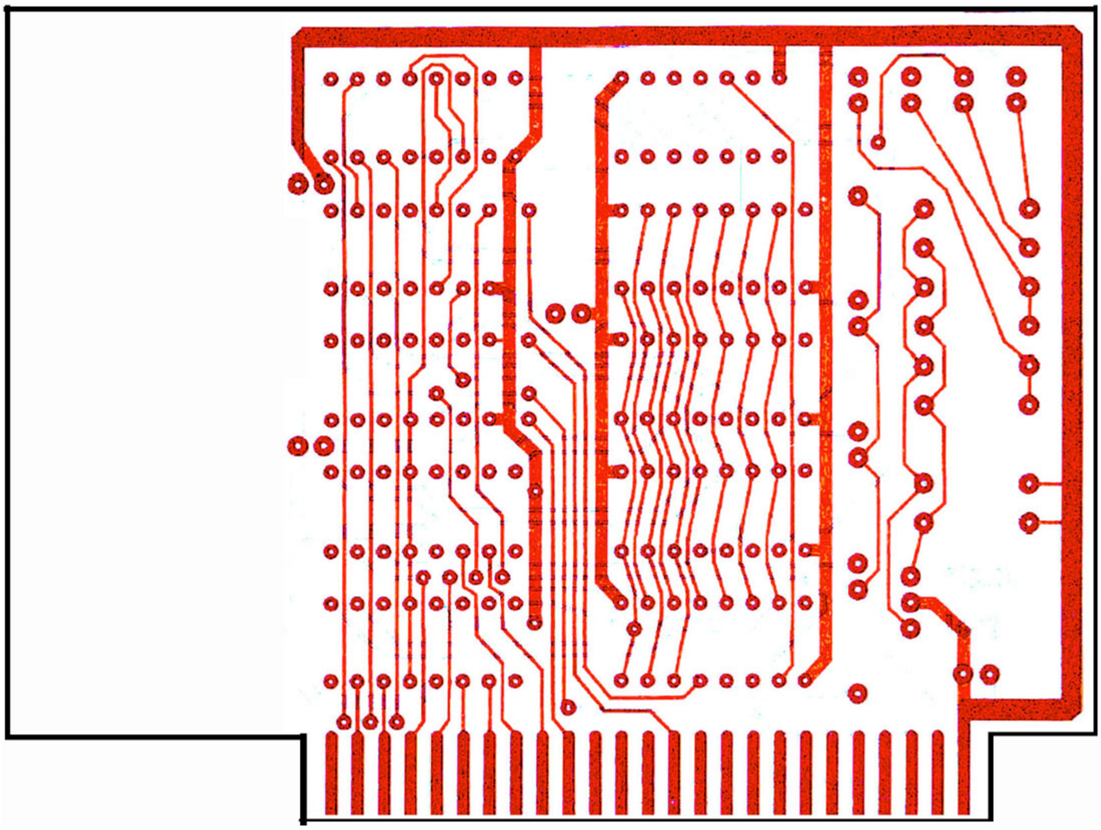
Here the component layout:



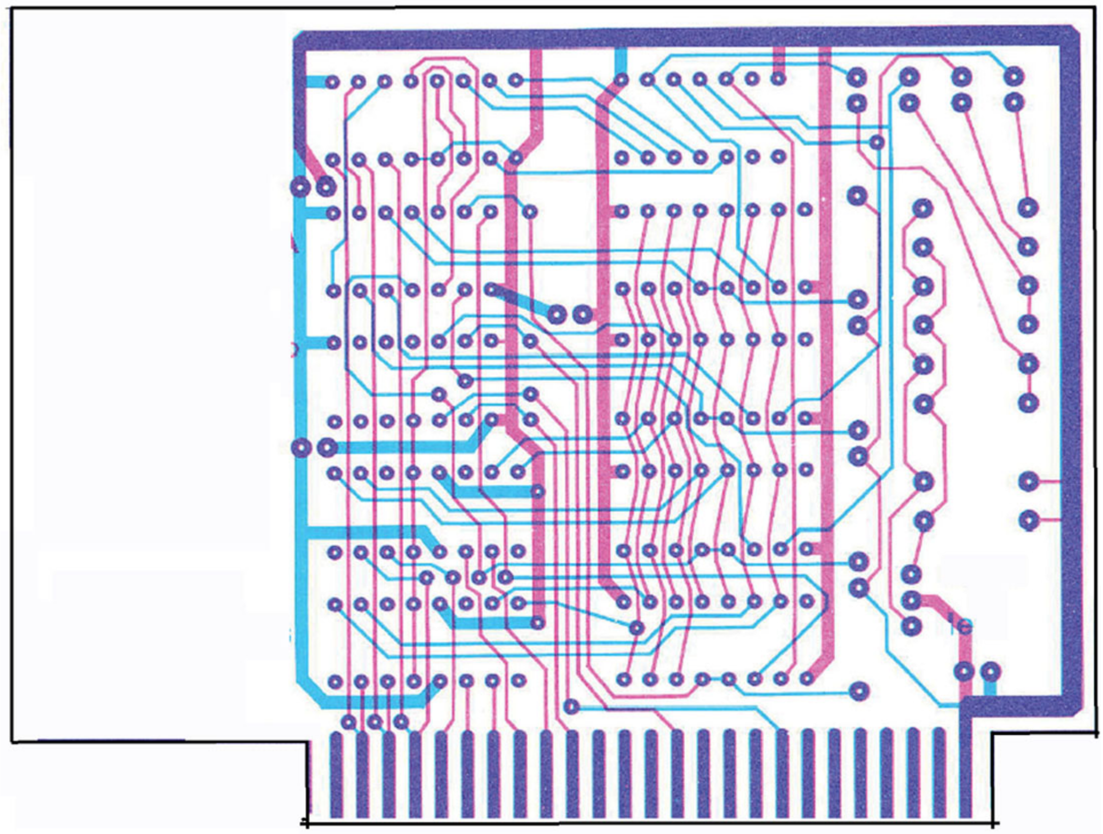
Here the picture of the solderside as layer:



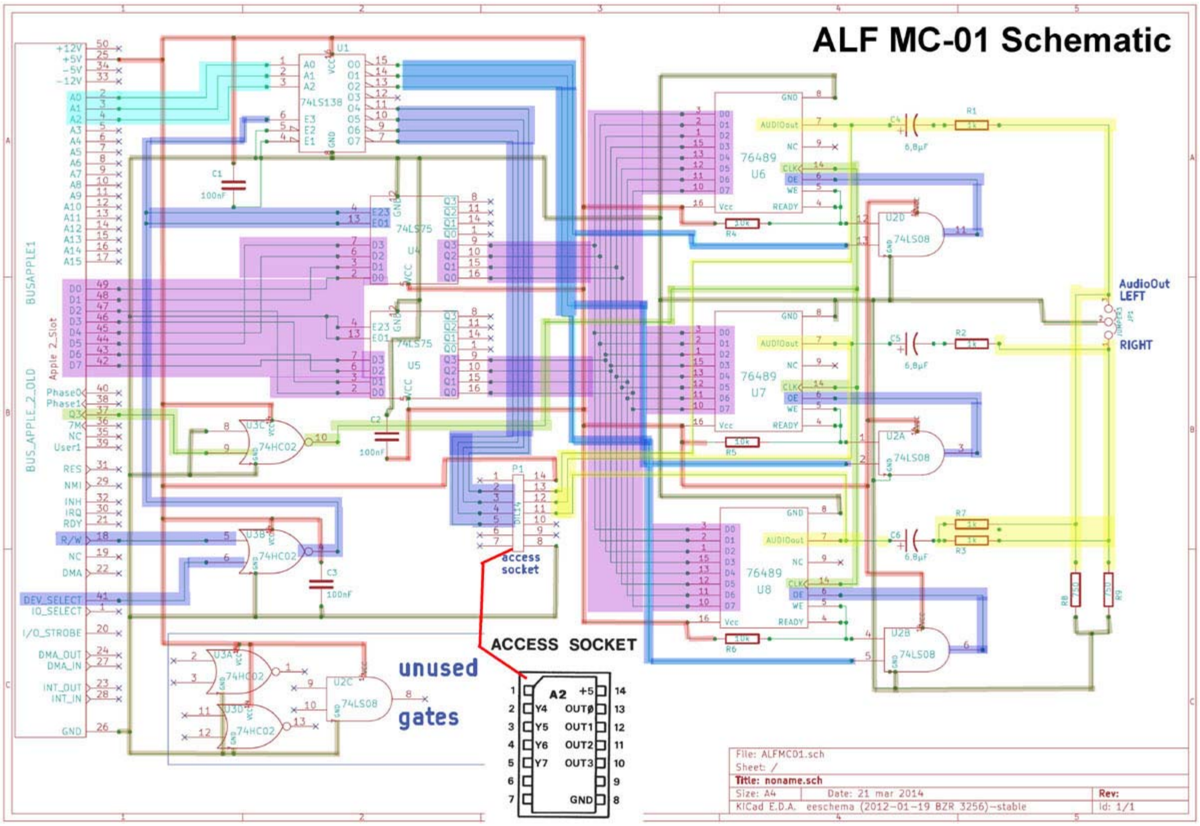
And here the view to the componentside as layer:



'Here again the combination of both layers:



and here is the schematic:



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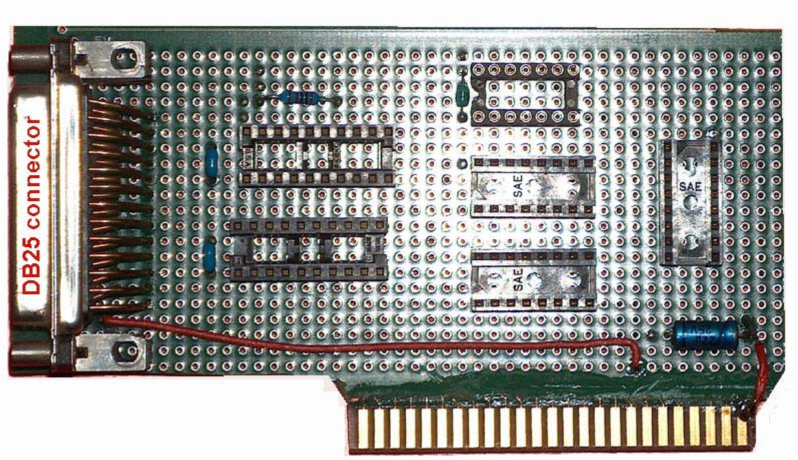
the alpha syntauri system
a ancient synthisizer concept for the Apple II
making of a replacement for the missing IFcard
of the alpha syntauri Keyboard

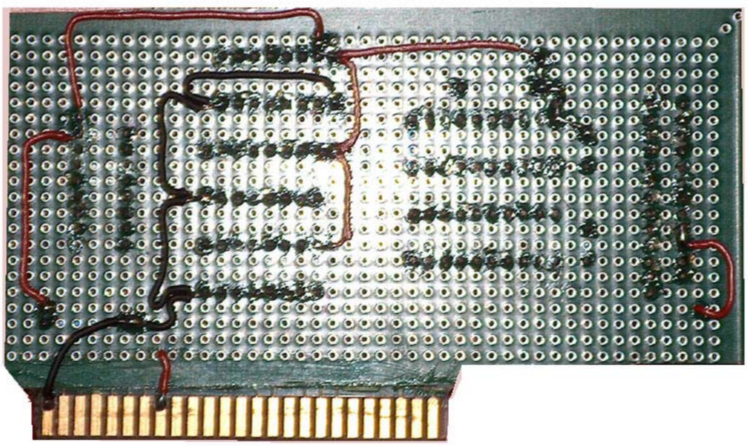
In the upper part of the page there is the description of making a "prototype looking card" while in the lower part of the page there is the description and the needed files for ordering a professional like looking replacement of the Interfacecard.

First of all after i have recieved all parts of the alpha syntauri system with the Mountain Computer Music System except of the missing alpha syntauri Apple II Interfacecard i decided to speed up things by making "on the fly" a "prototype like" interfacecard. the target is to get very fast a working setup, that permits me to check all components and the availiable software for correct basic functions. While entering data in the CAD system and getting the files required for ordering a replacement PCB with professional look i have the chance to get proof if anything is missing and that the circuitplan made for the Interfacecard turns out to be correct and gets verified. Besides i may recognize if the files i have picked from the archives in the internet for the system are working correct or if i have to continue hunting for somethiong that still is missing.

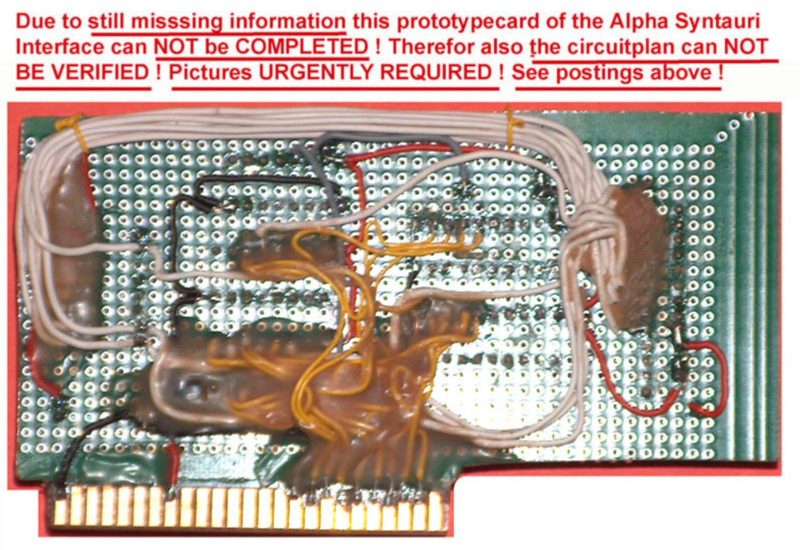
At the stage this picture has been made i only have mede the connections for the powersuppplylines. I keep the layout of the card same as the original.



That�s the rear soldering side of the card at this point:



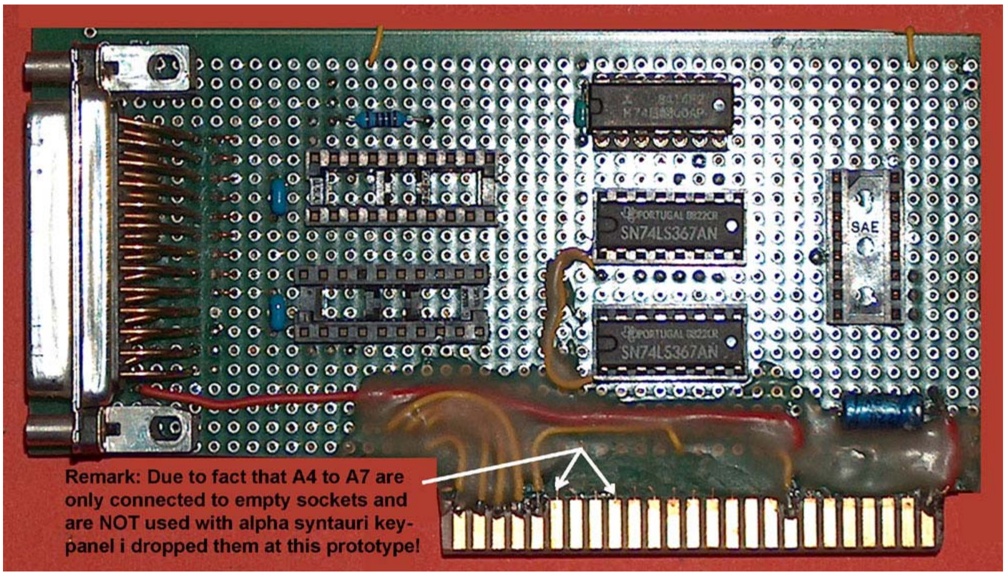
At this stage i have have made the card up to the point that i was able to detect from traces recognized from the picture of the soldering side and that parts that i was able to detect from the picture of the component side adding only very few parts that i have been able to assume by logic conclusion and knowledge of the internal functions of the used chips. But there are still important parts (related to the R/W line and the timing and the handling of the DevSel connecttion to the Apple II. This lines have been fixed after soldering with 2 component glue to protect the soldered wires from tear off or damage.



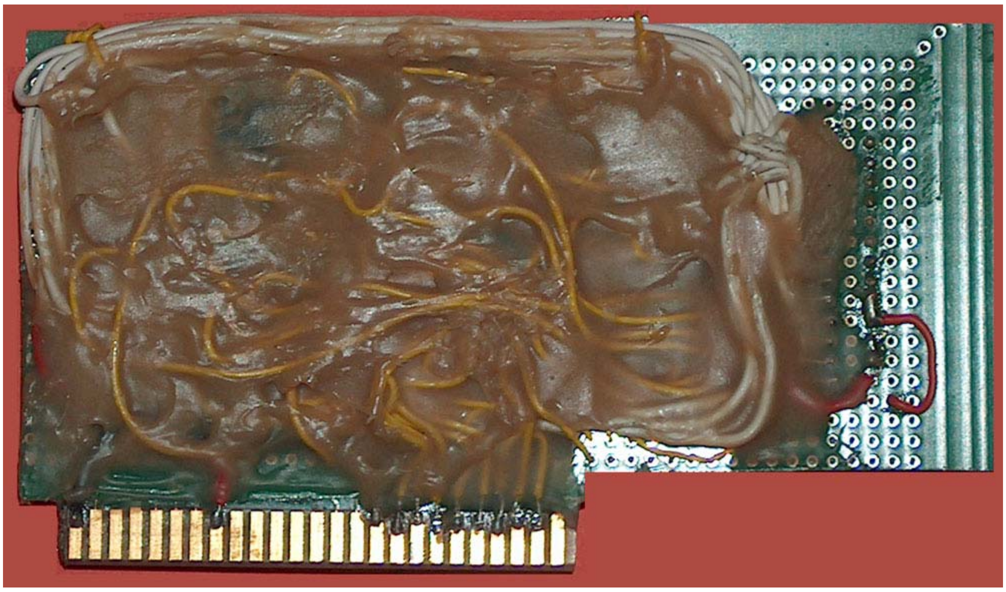
In the mean time i have recieved the upmost missing picture from the USA that displays the unpopulated (in this case even just desoldered) card and therfor i was able to detect the missing connections below of the circuits. So first of all i immediatlly started entering the data in the CAD system and then started with the missing part of the interfacecard.

So here now is the picture of the componentside of that "prototype like" interfacecard. It�s now finished and ready for testing. There is one big difference to the circuitplan: The Adressinglines from A4 to A7 are only connected to the empty sockets and therefor they are NOT used with the communication between Apple II and the alpha syntauri keyboard. Therefor i have left them away in this version. At the replacement interfacecard designed with the CAD system they are of course integrated and connected to the empty sockets - it permits to take signals from that sockets for measurement purposes. So at the card in the now following section that traces are connected exactly like at the original interface card - only the layout of the traces changed due to the fact that the CAD-programm carried out a job of rerouting that traces.

Here is the picture of the componentside of the prototypecard:



Here is the picture of the solderingside of the prototypecard:

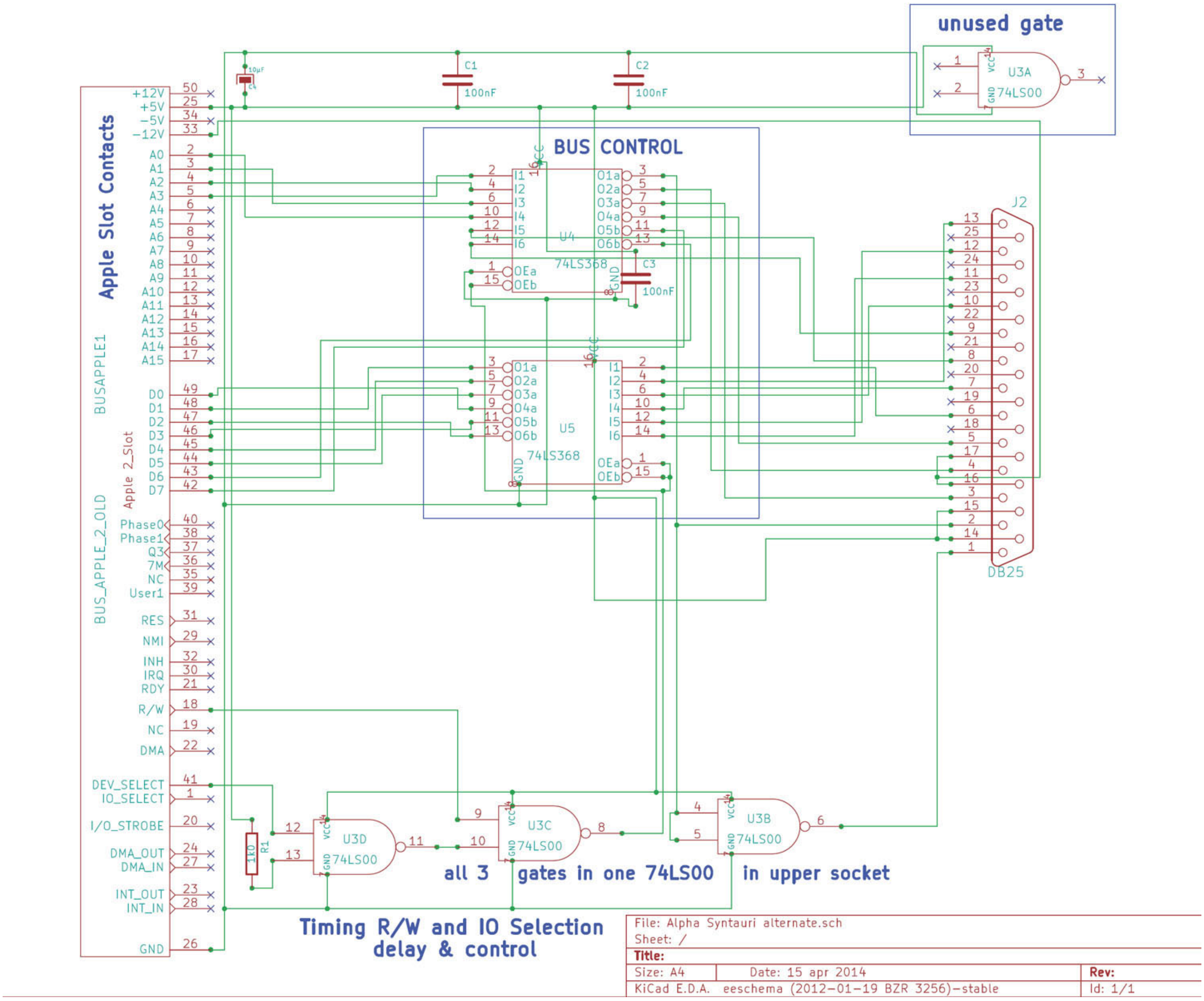


At this point i must state, that for the final documentation <u>i am still searching for pictures of the second version of the interface card</u> that was sold later by alpha syntauri. <u>That version did not have a DB25 connector on the interface card</u> but instead Pinrows on top of the card. <u>See at the bottom of the first page the very last picture</u>. It�s only thing i found about that card. <u>That card was also sold with the ALF card instread of the Mountain Computer Music System</u>. So if anybody has pictures , information, manuals, software of that second version please contact me at Applefritter.com . You may contact me there with my nickname "speedyG".

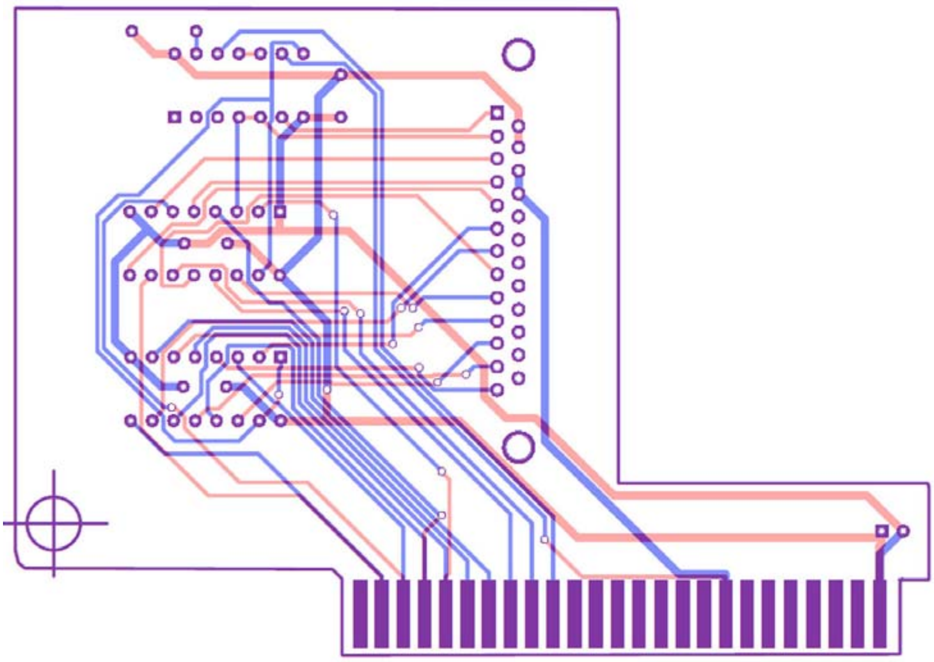
**After finally getting the missing pictures of the Interfacecard which have displayed the traces below the circuits,
it was passible to generate the productiondata that enables the user to get a chance of ordering a professional
looking replacement interfacecard from any PCB-manufacturer.
This alternate interfacecard is deffent from the original interfacecard by several marks:
I dropped of the empty sockets without use
i flipped the layout due to the fact that at original card the DB25plug connector was heading to the front of the Apple and
therefor the thick cable to the alpha syntauri needed to twist around to the rear outlets of the computer - in my design
the DB25-connector is set a bit forward bit flipped around - permitting the DB25plg to be connected within the Apple II and
the cable running staight back outside of the Apple II without inside twisting.**

The following pictures display a new rerouted interfacecard.

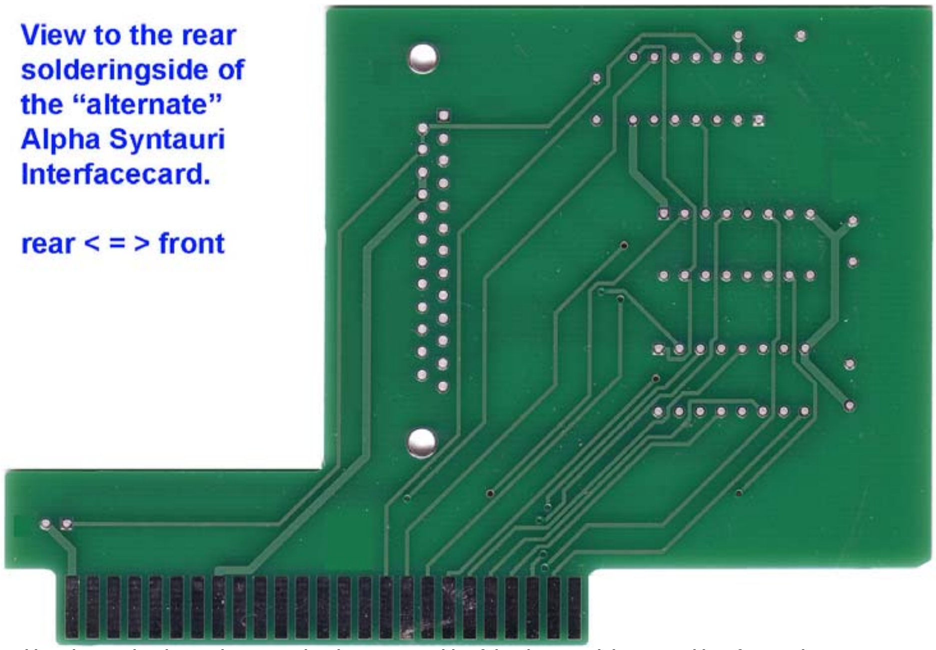
here is the circuitplan of this alternate interfacecard:



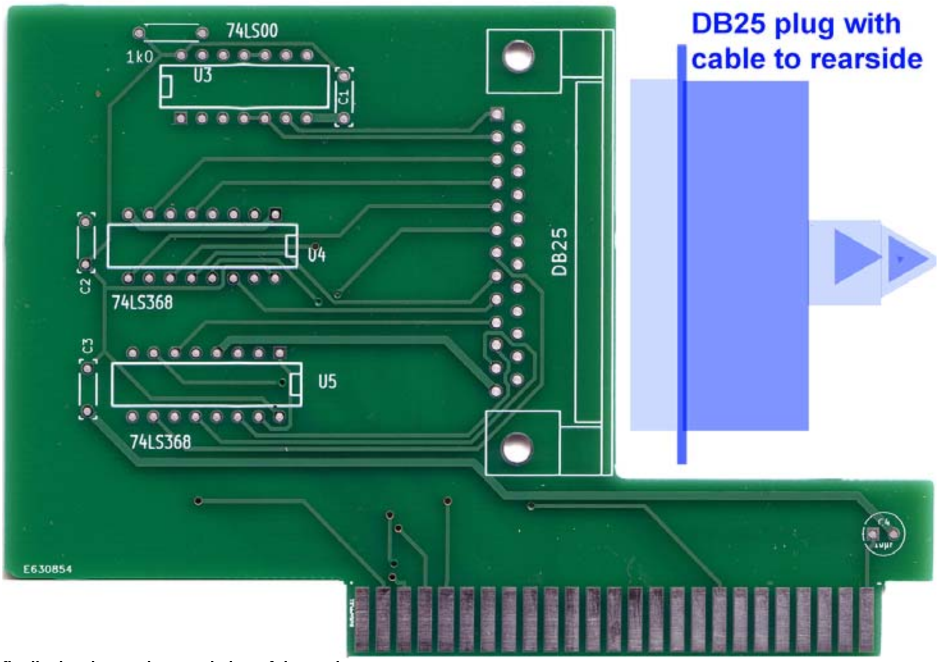
and here now is the view to the combination of both layers:



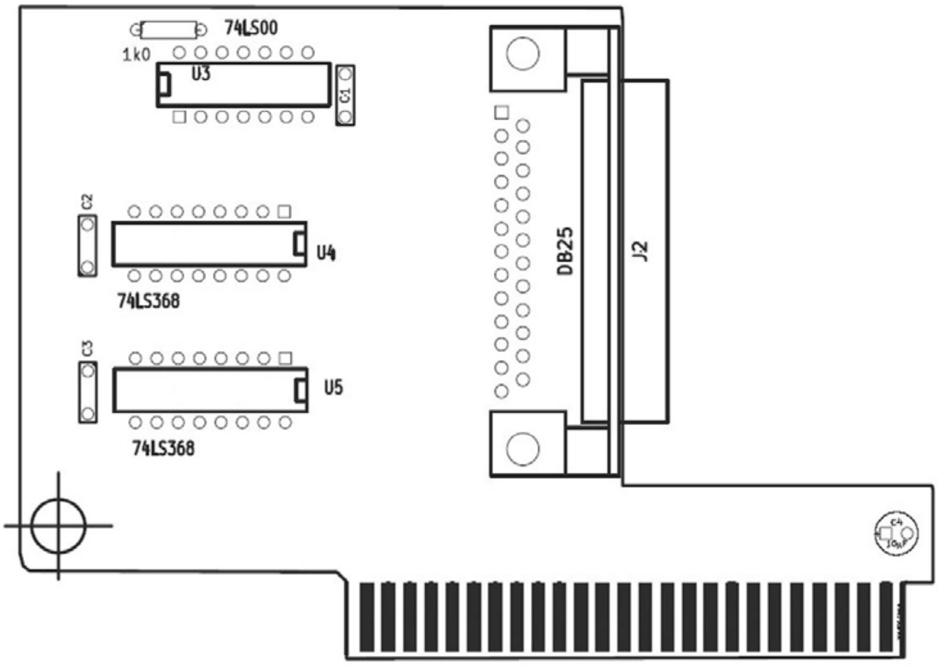
Here is now the solderingside of the new alternate alpha syntauri interfacecard:



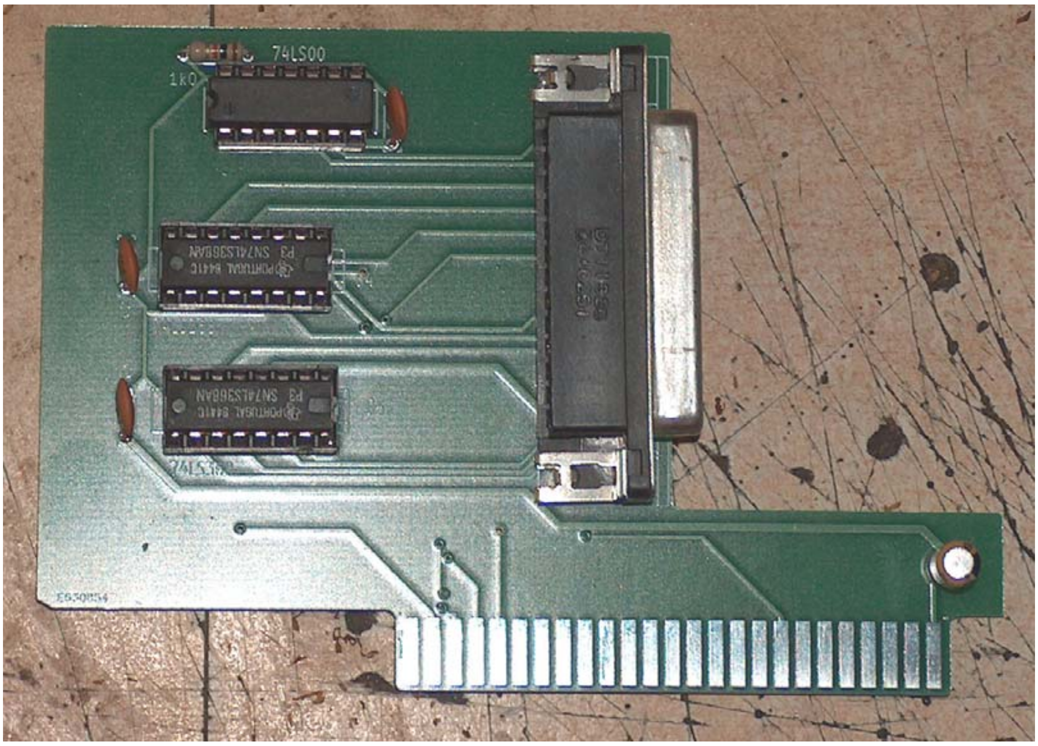
and here is now the view to the unpopulated componentside of the alternate alpha syntauri interface card:



finally the view to the population of the card:



and finally here is the completed and populated interfacecard of the alpha syntauri:



and for those with incomplete system and missing interface is the link to the file that contains the so called "Gerber-files" used for production of the replacement interfacecard and mailed to the PCB manufacturer:

ASalternateGerber.rar

Please recognize :
the measurement unit used in this files is Millimeters / Centimeters
and <u>not</u> inches !
Please inform manufacturer on this important fact !

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the alpha syntauri system
a ancient synthisizer concept for the Apple II
Downloadpage of aAlpha Syntauri and Mountain Computer Music System

Please note: Diskimages are to be used with ADT. That program permits user to keep this images at MAC or PC and transmit images by serial cable to Apple with Super Serial Card and generate at local Floppydrive on Apple the desired Disks in 5,25 "format (single sided, double density = 35 Tracks = 140 kB) . The letters ADT contain link to related pages.
Please first read carefully ADT instructions related to your availiable hardware !

Downloadable File:	REMARKS:	Typ:	Filename / Link:
The Alpha Syntauri System:			
General Program for use with alpha syntauri (system setup)		dsk	ALPHAPLUS.dsk
Examples of different instrumental setup�s		dsk	EXAMPLES.dsk
several recorded sound for demonstration purpose		dsk	DEMOSNOTES.dsk
Advanced Soundediting Program		dsk	SUPERPLUS.dsk
Special Handling of Soundgeneration and Waveform editing		dsk	PTWAVEFORMS.dsk
Multichannel Soundeditor		dsk	METATRAK.dsk
Multichannel Configurationfiles		dsk	METAFILES.dsk
Only for use with later alpha syntaurisystem with ALF Soundcard NOT FOR USE with Mountain Computer Music System !		dsk	SYNTAURI3.dsk
Manuals and REFs			
Synth Lab - User Manual		PDF	synthlab_usersmanual.pdf
Syntauri Metatrak - User Manual		PDF	Syntauri METATRAK - User's Manual.pdf
Syntauri Metatrak - Quick Ref		PDF	syntauri-metatrak-quickref.pdf
Syntauri Sounds Trio		PDF	syntauri-sounds-trio.pdf
Alpha Plus - Manual	Only for use with later alpha syntaurisystem with ALF Soundcard NOT FOR USE with Mountain Computer Music System !	PDF	syntauri-alphaplus.pdf
Alpha Plus - Quick Ref	Only for use with later alpha syntaurisystem with ALF Soundcard NOT FOR USE with Mountain Computer Music System !	PDF	syntauri_alphaplus_quick_reference_chart.pdf
Circuit Schematics			
Circuitplan from Alpha Syntauri Interfacecard	(old version with DB25) low Res pictures as .jpg		AS_InterfacecardFinalReleaseAllDetectedCircuitplan.jpg
Circuitplan from Alpha Syntauri Interfacecard	Hires .PDF File	PDF	circuitplan new final.pdf
Circuitplan from Alpha Syntauri Keyboard	low Res pictures as .jpg		ASkeyboardSwitchPCBcircuitplan.jpg
Circuitplan from Alpha Syntauri Keyboard	Hires .PDF File	PDF	Circuitplan ASinternPianokeyswitches.pdf
Circuitplan from Alpha Syntauri internal Decoder	low Res pictures as .jpg		ASinternKeyboardDecoderCircuitplan.jpg
Circuitplan from Alpha Syntauri internal Decoder	Hires .PDF File	PDF	Circuitplan ASinternDecoder.pdf
TECH Documents of the alpha syntauri system including datasheets and schematics		PDF	AS_TECH_DOCS.PDF
Mountain Computer Music System:			
Startup Disk with Baseprograms: Player, Editor,Merger		dsk	MusicSystemDisk1SideA.dsk
Sample Songs		dsk	MusicSystemDisk1SideB.dsk
Instrument Definer, Player		dsk	MusicSystem Disk2SideA.dsk
Instrument collection		dsk	MusicSystemDisk2Sid B.dsk
Mountain Computer Music System **Operation Manual (81 MB)**		PDF	MountainComputerMusicSystem OperatingManual.pdf
Mountain Computer Music System **Frontcard circuit schematics**	low Res picture as . jpg file		CircuitplanFrontcardCard1.jpg
Mountain Computer Music System **Frontcard circuit schematics**	Hires PDF-File	PDF	MCMS Card1.pdf
Mountain Computer Music System **Rearcard circuit schematics**	low Res picture as .jpg file		MCMScard2Circuitplan.jpg
Mountain Computer Music System **Frontcard circuit schematics**	Hires PDF-File	PDF	MCMS Circuitplan Card 2.pdf
		PDF	
AM6080 chip datasheet	PDF	chip	AM6080 datasheet.pdf
NE5008 chip datasheet	PDF	chip	NE5008 datasheet.pdf
LF351/LF353 Datasheet	PDF	chip	LF353 datasheet.pdf

In such cases i can�t take any kind of responsibility to the changed contents. this is specialy valid to banners, advertisements or merchandising links in the targeted pages.

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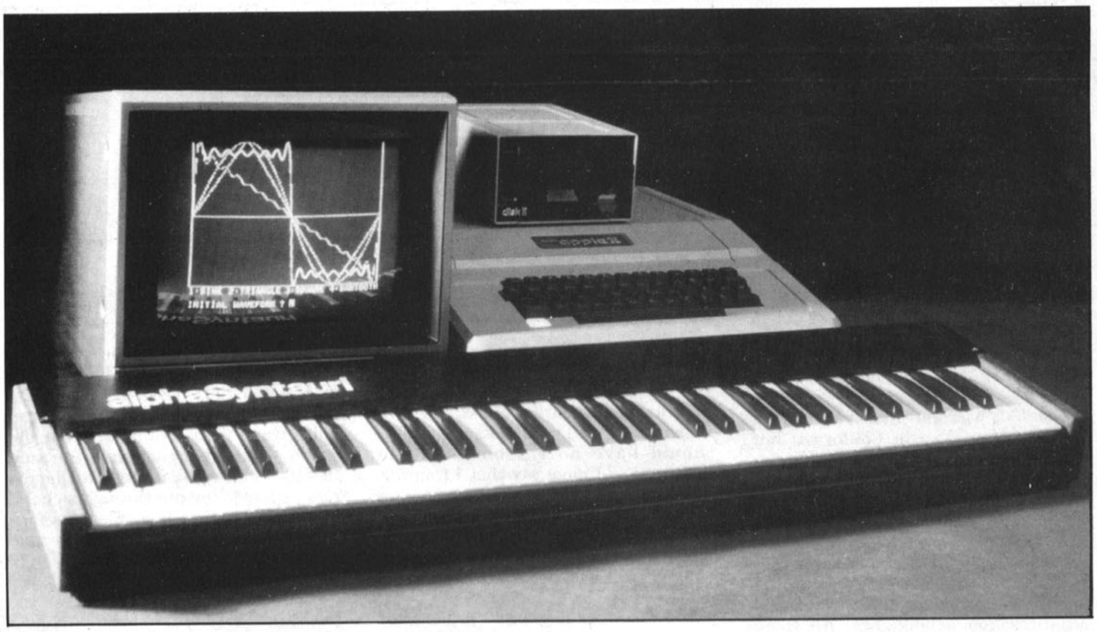
the alpha syntauri system

a review of the alpha syntauri system and a brief listing of softwareimages used at the Apple II and IIGS displaying the used sound/recording sources for search of diskimages and the related cards

Thankfully to Tom Arnold (from whom i recieved the missing pictures, i was hunting for - from the alpha syntauri interface card) , a contact i recieved from Mark Glinsky (a musician that also owned a alpha syntauri system and who also supported me by hunting missing pictures of the alpha syntauri system) i recieved the scans from an ancient magazin that contains a testing review of the alpha syntauri system:

Alpha Syntauri Pro 5 Music Synthesizer



The stated concept of the Syntauri synthesizer is "to provide synthesizers which are fully programmable, modular, expandable, and affordable." The way Syntauri has gone about achieving this stated goal is to base their instruments primarily around software, rather than hardware in designing their modular setups. Modular means expandable, though, and as more and more programs are designed for the Syntauri, the owner *will* have to make some hardware purchases to obtain the full benefits from the instrument. The basic setup is as follows: Syntauri Corp. provides a 5-octave, 61-note velocity sensing keyboard, interface cable, foot pedals, some basic software (disks), and instructional manuals. What must be obtained separately is a 48K Apple II or Apple II Plus computer, language card, at least one disk drive, a video monitor or color TV, an amplifier, and speaker(s) of some sort.

Standard features on the Syntauri Pro 5, which is the model we obtained for review (these are also standard on the alphaSyntauri Plus 4) include an 8 voice polyphonic synthesizer with two independent oscillators per voice, 32kHz sample rate, and 16 digital oscillators. There are foot pedals included for sustain and portamento, a 200 note sequencer, which can be auto-sequenced during playback, and storage facility for up to 20,000 notes per floppy disk.

Programmable features include two ADSR-type amplitude envelopes for each voice, with one envelope per wave form. There is facility for up to 20 banks of preset storage per disk, and individual waveforms and envelopes may also be saved. Vibrato is user-controllable for both rate and depth, and velocity-sensitivity on the keyboard is also user-definable. Standard effects include tremolo, chorus, pitch bend and pitch sweep.

We gave the complete alphaSyntauri Pro 5 to Ed Walsh, a session musician who has appeared on virtually hundreds of albums and jingles, and who is a recognized expert in the practical and commercial uses of computerized digital synthesizer technology. His report follows:

When you first power up the alphaSyntauri, it loads in Alpha Plus, which is the same language base you use with a standard Apple computer. The Syntauri then asks you to set some parameters, such as overall volume; a certain group of 10 presets (activated by the numerical keys 1 through 0) — it also turns on the various voice cards and interger card. Once you have let the computer know that all is done correctly, it then loads the information interger basic, etc. This sounds very lengthy, but all these things are accomplished in a relatively short period of time.

Now, on the screen before you, you have your first preset sound. As you play the keyboard, the notes you are playing appear on the screen in small rectangular shapes. Each octave takes up one horizontal line, the lowest octave being on the bottom, the highest on top. With a color monitor (necessary), each note is indicated by a different color. Towards the bottom of the screen are a number of preset parameters which you can modify. These are 10 musical instrument names — only one is active at a time. In the lower right hand corner of the

▶ 75

Scanned by T.Arnold

screen, you can find the name and number of the instrument you are currently making use of, as labelled by the computer.

The parameters are divided into two channels — the Primary and Percussion channels.

Primary

AR = Attack Rate
AV = Attack Volume
DR = Decay Rate
SV = Sustain Rate
RR = Release Rate
RV = Release Volume

Percussion

PR = Percussion Rate
PV = Percussion Volume
FR = Fall Rate
FV = Fall Volume

There are two foot switches included with the system. One allows you to play a note or chord and sustain it until you release the pedal. The other turns on and off the Portamento (glide), for which you set the rate. The alpha Syntauri also has a velocity sensing keyboard.

Besides modifying the Alpha with the parameters we have described, you can also change the volume of the individual harmonics by making use of a graphic display, which looks similar to the drawbars on a B-3. After you have modified the sound, you can save it as a new file, and assign it to a preset master, should you desire.

The software available is very good. There is a disk called 'Metatrak', which is a 16 track recorder. With this you can overlap sounds, and actually record and perform a composition on 16 tracks. We found this to be the greatest single strength of the Syntauri.

The presets that we especially liked were the organ, vibes, and flutes. The user's ability to modify these presets and create entirely new sounds is virtually unlimited, which is also an important plus.

The Trio Wave offers a B-3 sound, Auto-Pulse, and Wave-Draw. This disk gives you three ways to create sounds:

Wave-Draw: allows you to plot segments of a wave with a graphics tablet. You can actually draw the wave.

Auto-Pulse — You let the computer know what pulse width you desire (10% to 50%) and over how many segments you want it. The end results are fantastic, but very time-consuming.

B-3: Using draw bar graphics over a certain number of harmonics, you build a sound. alphaSyntauri also gives you other waveshapes from which to choose to assist in designing your own sounds.

Syntauri has recently introduced a new software package, which is a music writing disk. This allows you to transcribe notes and rhythms as you play them, literally creating a printed score of what you've played. Of course, a separate printer is required for this, which easily interfaces with the Apple.

In conclusion, we found the alphaSyntauri Pro 5 to be a great way in which to learn about computer music and digital synthesizers. One problem as of this writing, was that the manual tended to be a bit confusing. Another helpful idea would be to place instructions for each section on the individual disks themselves.

Of course, the price is one of the most attractive things about the system. At under $5000.00, it is definitely the most cost-effective computerized digital synth on the market, and the most versatile that you could find for such a low cost.

And while hunting for the information related to the alpha syntauri system and designing a multifuncional sound and speech card i collected various diskimages from the internet and created a table that displays which kind off software image will request which kind of hardware. So this table might become valuable to those who have a piece of MIDI- or Soundcard for the Apple II series (including the software that supports the IIGS internal soundchip) and who are searching for software that will support that hardware:

Used Ports SOFTWARE	Gameport	Cassette IN	Cassette OUT	Speaker OUT	IIGS Soundport	Mocking Board AY3-8910	Speechchips SC01 / SSM263	Soundmeister Card	76489 Chip	Alpha Syntauri	MIDI
AUDEX.DSK Extract sound from Cassette IN		●		●							
AppleRockerMasterDisk.dsk Game				●							
AppleRockerDataDisk.dsk Game				●							
AppleRockerNC.dsk Game				●							
BOB BISHOP Lisner.po							●				
CoolEd.dsk Sound editor notation											●
DEMO1.DSK Metatrak Demo										●	
DIGI.DEMO.DSK Shans Digicorder sampling from Gameport	●			●							
ElectricDuet.dsk create sound output speaker or tape			●	●							
DUET.DSK			●	●							
DUET1.DSK			●	●							
DUET2.DSK			●	●							
FMX.DSK Alpha Syntauri										●	
INFISOUND.dsk											
MB1.DSK Software for Mocking Board						●	●				
MB2.DSK Software for Mocking Board						●	●				
Mocking Board Developer Toolkit						●	●				
MCS.DSK Music Construction Set				●	●						
MEGAMUSIC2.DSK play music with speaker				●							
MICROMUSIC.DSK											
MICROMUSIC1.DSK											
MICROMUSIC2.dsk											
MICROMUSIC3.DSK											
MICROMUSIC4.DSK											
MICROMUSIC5.DSK											
MUSICOMP.DSK Music Composer Paul Lutus				●				●			

Used Ports											
SOFTWARE	Gameport	Cassette IN	Cassette OUT	Speaker OUT	IIGS Soundport	Mocking Board AY3-8910	Speechchips SC01 / SSM263	Soundmeister Card	76489 Chip	Alpha Syntauri	MIDI
MegaEcho.dsk soundrecording from cassette in		●	●	●							
MegaEchoMusicFiles.dsk soundrecording from cassette in		●	●	●							
Music Construction Set D1.dsk				●	●						
Music Construction Set.D2.dsk				●	●						
SynthLAB				●	●			●			●
MusicDisk.dsk made w. electronic duet create sound output speaker or tape		●	●	●							
MusicEditor.dsk											●
Apple ORGAN.DSK simple speaker organ				●							
RT.SYNTH.DSK Realtime Synthisizer //e											●
SNDED22.DSK Soundeditor Mahon (AS ?)										●	●
SOUNDWIZARD.dsk sound from cassette		●	●	●							
TIMELORD.DSK											
TIMELORD2B.PO											
TIMELORD2D.PO											
TWOVOICE.DSK											
WINDMILL.DSK belongs to Alpha Syntauri										●	
analyzer.dsk belongs to Alpha Syntauri									●	●	
fmwaves7.dsk belongs to Alpha Syntauri									●	●	
metafile.dsk belongs to Alpha Syntauri										●	
minisong.dsk											
wavemaker.dsk belongs to Alpha Syntauri									●	●	
Master Track Pro MIDI composing, editing and notation											●
Instant Synthisiser Apple or Passport MIDI composing, editing, and notation											
Digital Session compose, edit, notation and Play								●			

in a few weeks this list will be extended with a bunch of other software listed ....

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the alpha syntauri system

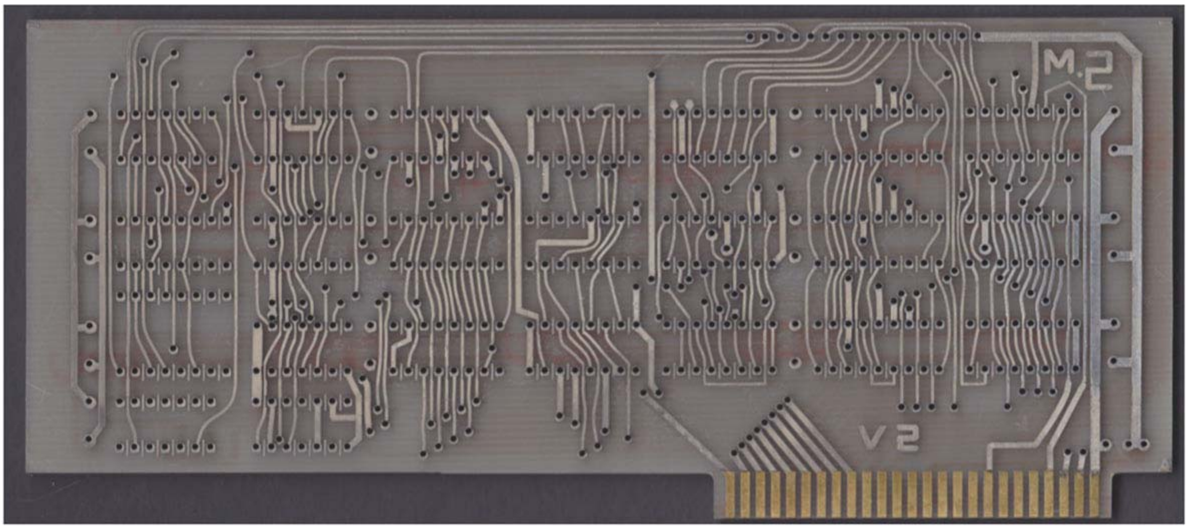
The story about the Apple Seed Clone Cards of the Mountain Computer Music System

Several weeks ago i recieved an email from a friend with attached pictures of bare PCB�s. After short examination it turned out to be a set of 2 clone PCB�s of the Mountain Computer Music system manufactured by Apple Seed - a group of enthusiasts that reverse engineered in former days a lot of common interface cards and located in Ontario in Canada. They had even in that days a catalog of that clone cards with the listings of the components for assembly of that cards.

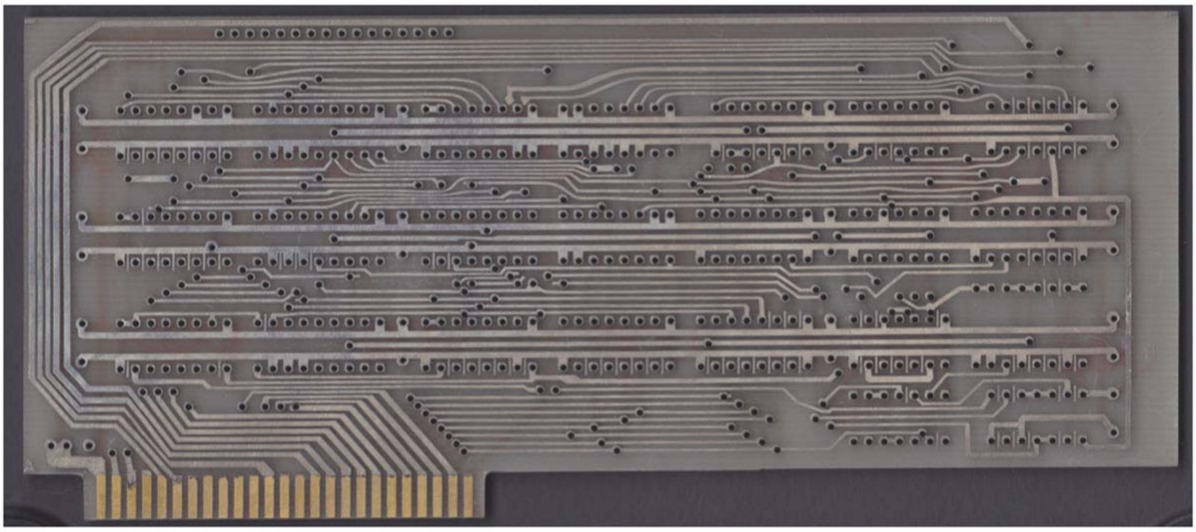
I really got excited when i faced that pictures because the y permitted me to also view several traces that have formerly not been detected that well below of the circuit sockets and some of the components. Because my friend asked me for assistance by assembly of the cards i was glad to accept and offer him my time for the assembly.

After the bare PCB�s arrived in my place i immediatly first scanned the PCB�s front and reaar side with high resolution for archieving purpose.
Here are the scans:

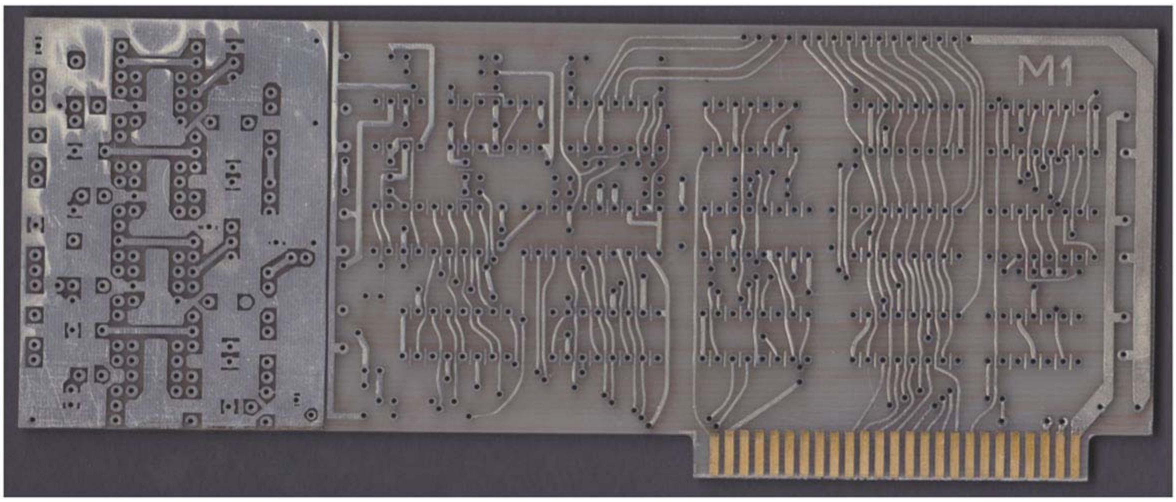
Digital Card Component side:



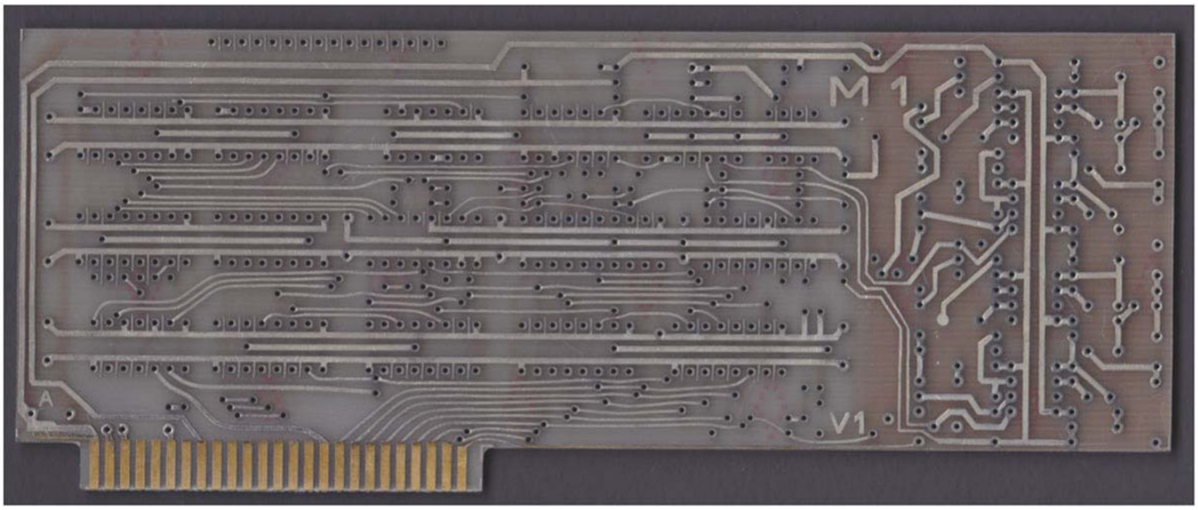
Digital Card Solderside:



Analog Card Component side:



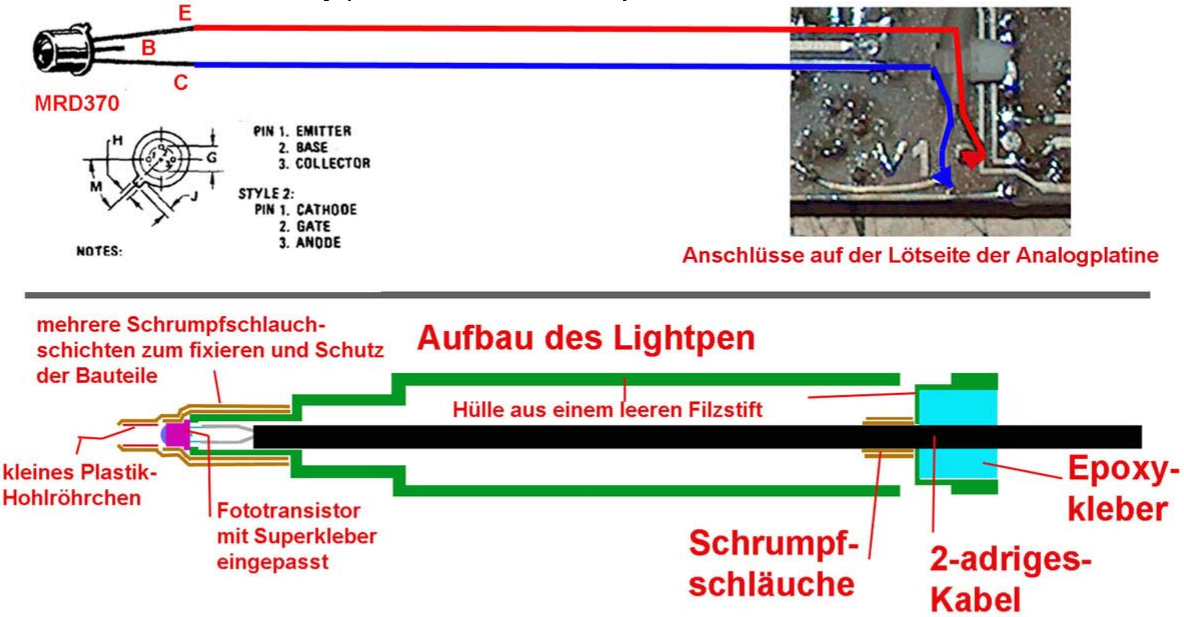
and the Analog Card soldering side:



After that i started inspecting my dungeaons of components to detect the parts still missing for the assembly. In general most of the parts are still rather common LS logic and standard components but some parts turned out to be really obsolete and rather more difficult to purchase.
Among the obsolete parts are: 2x NE5008 compression/decompresion chip (still availiable), 1 x DM813 bus transciever (rather more difficult to find), 1x AM6080 AD conversion chip (you must pay attention about faked IC�s), 3x P2111A static RAM (also rather difficult to get) and most difficult to find the phototransistor MRD370 (this really turned out to be the most difficult hunt).

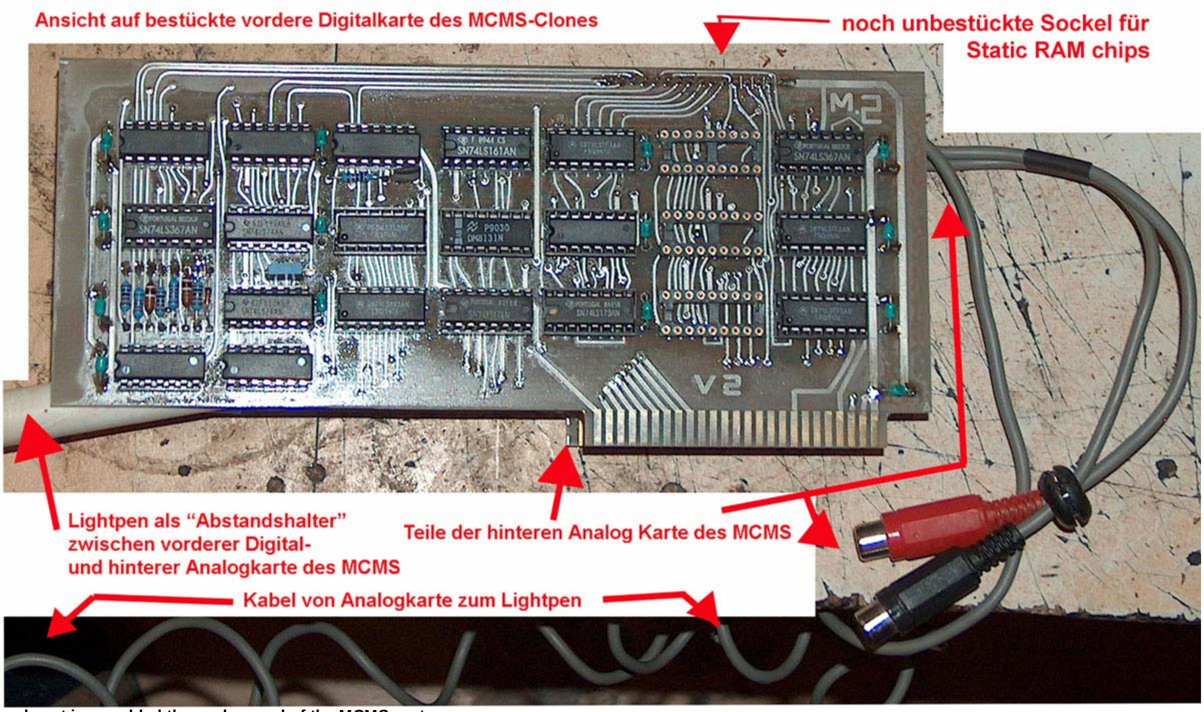
After finally i had recieved my purchases from across the world (AM6080 from Hong Kong) DM8131 and P2111A from Recyclers in USA and the MRD370 as new unused sparepart from Spain i started with the task of the assembly.

First of all i started to make a clone of the lightpen. Here is a sketch of the assembly:



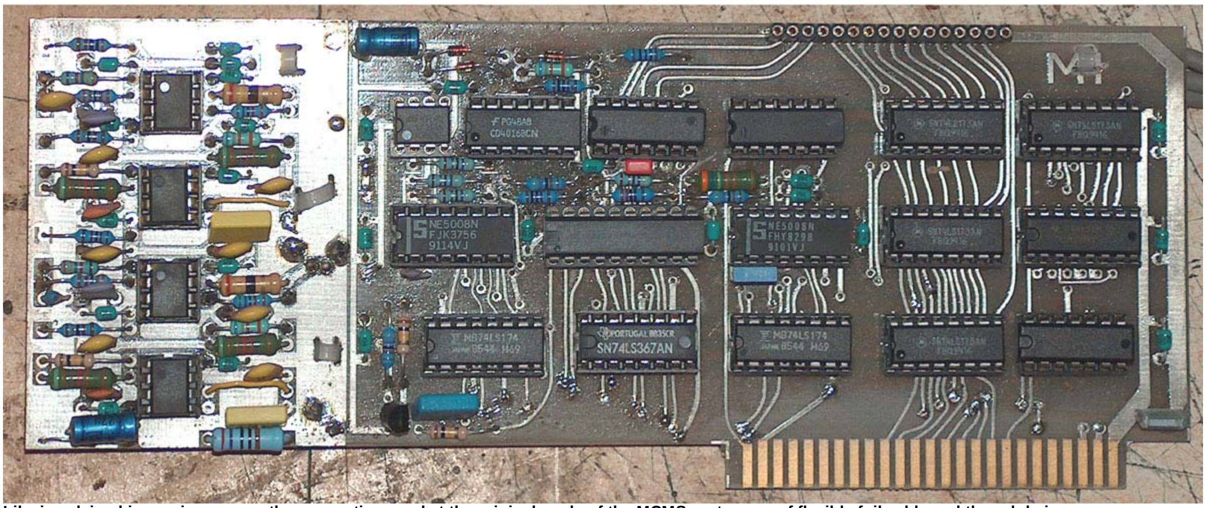
I used a empty case of a permanent marker, soldered the phototransistor to the thin cable and covered the pins with shrinking hose and then i put the cable through the rear stomp of that permanent marker an fixed that cabel also with shrinking hose that way that enough cable was remaining in the case of the permanent marker so in case of malfunction the phototransistor could be pulled of towards the front of the tip and some of the cable still there long enough for desoldering the transistor and replacing the device and pushing it back to the tip of that case and fix again with shrinking hose to the case. In front of the lense of the transistor is a tiny aluminium tube to focus the lens. and the transistor is fixed in place with small drop od superglue.

Next i populated the digital Interface card of the MCMS system:



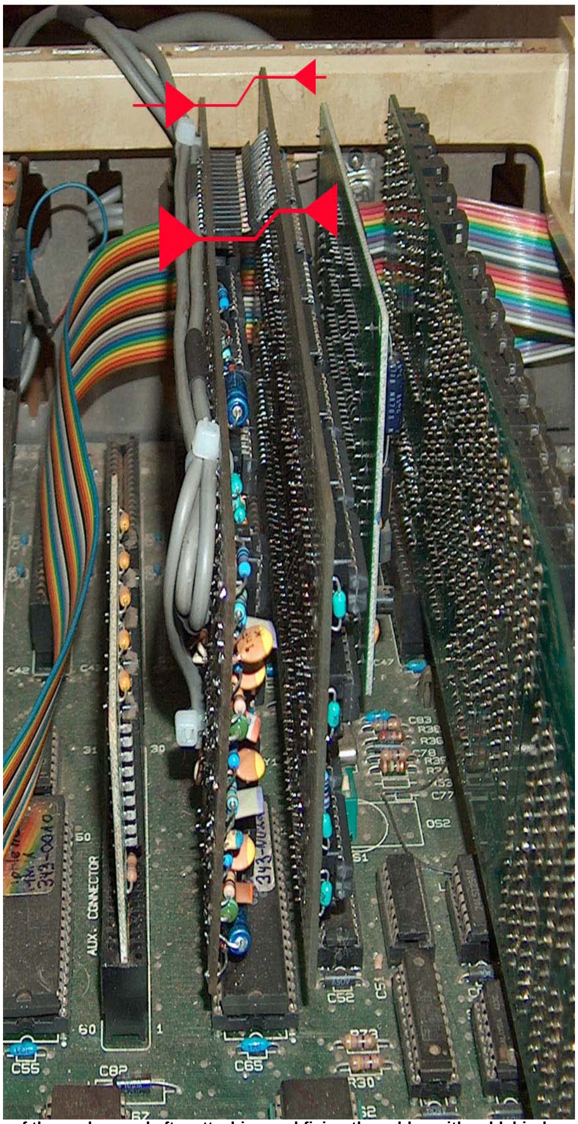
and next i assembled the analog card of the MCMS system:

fertig bestückte Seite der Analogkarte des MCMS-Clones



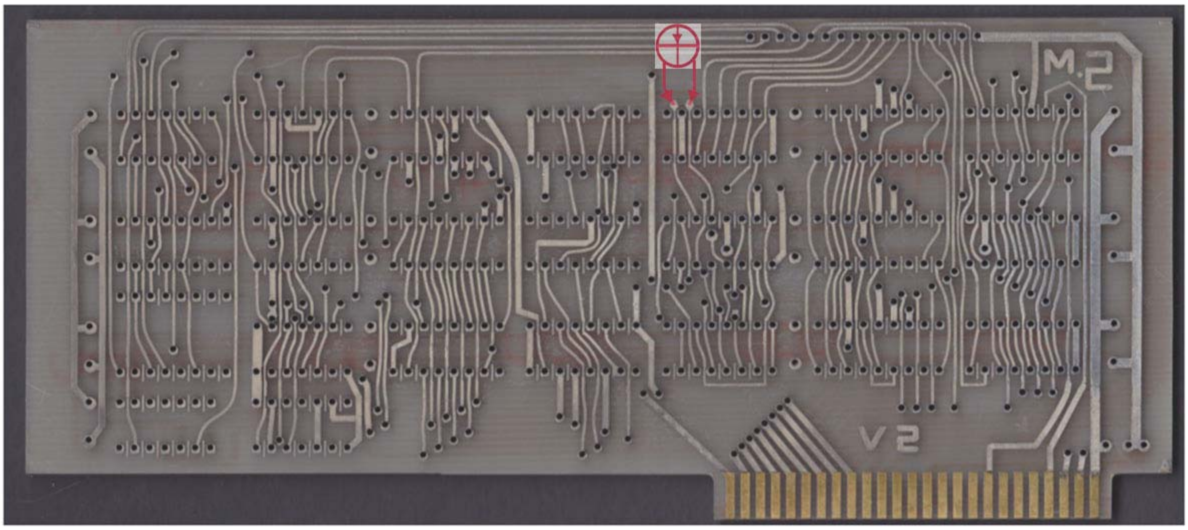
Like i explained in previous pages the connection used at the original cards of the MCMS system are of flexible foil cable and though being more flexible the weakness of the material by time ageing leads to non-reliable contact. Therefor i prefer and use instead hard long goldplated pins.
The disadvantege is that this connection is less felxible and need quite rough bending to fit to the different hights of that both cards.<
The next picture explains that fact of the different heights, which is at the clone cards even more extended than at the original cards:

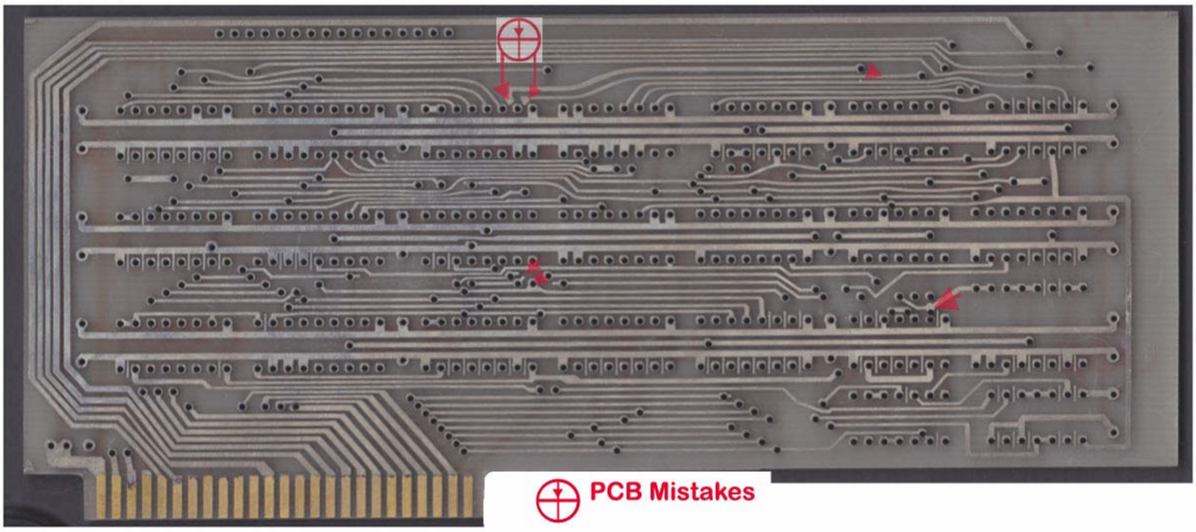
Differential height of PCB-connectors



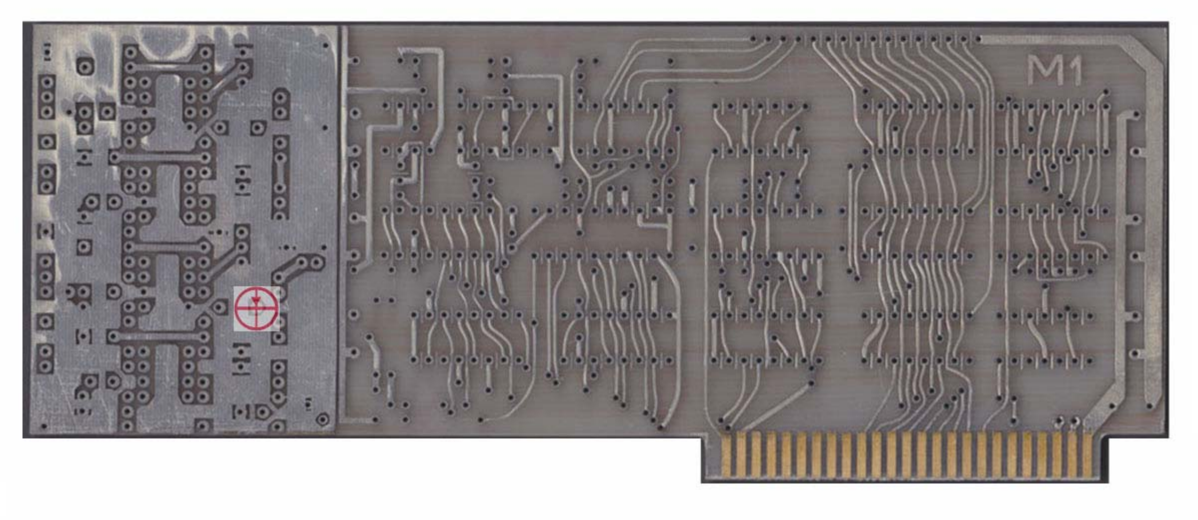
Here is a view to the soldering side of the analog card after attaching and fixing the cables with cablebinder:

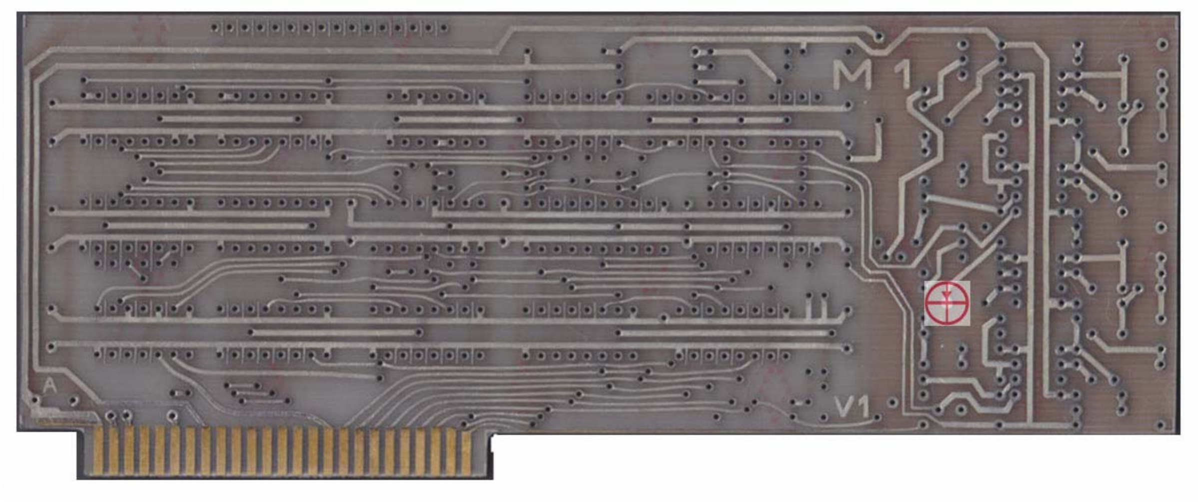
Important Hint:
The Apple Seed PCB�s have some severe mistakes that you must bear in mind while performing the assembly:
At the digital card two contact through holes are missing and that traces from topside must be contacted with the traces at the solder side by drilling and soldering at both sides see marks below.
And at some points the holes are rather dangerous to neighbor contacts. That spots also have been marked.





And also at the Analog board there is a drilling hole missing and must be added and the component must be soldered at both sides to ensure contact to both sides:





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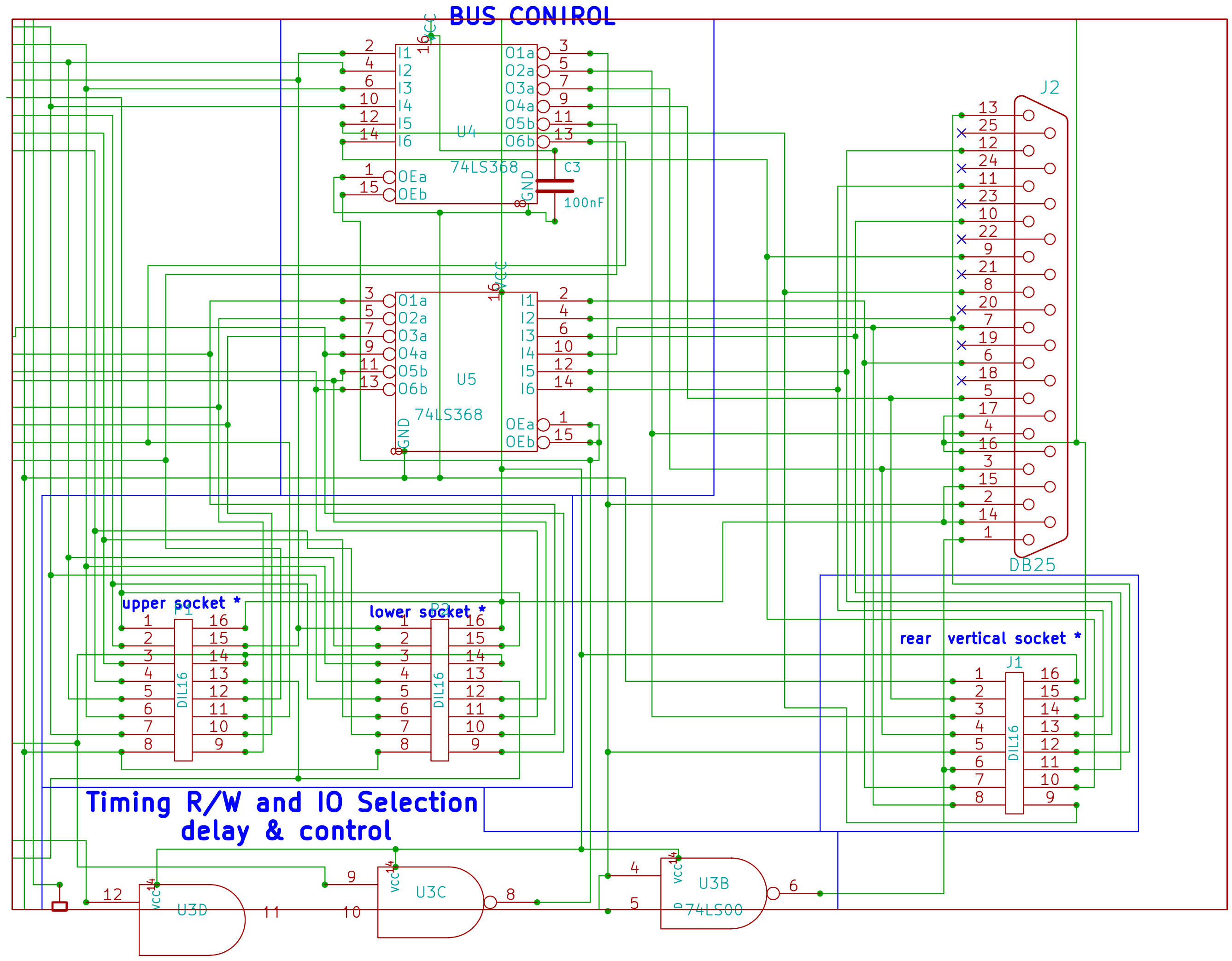
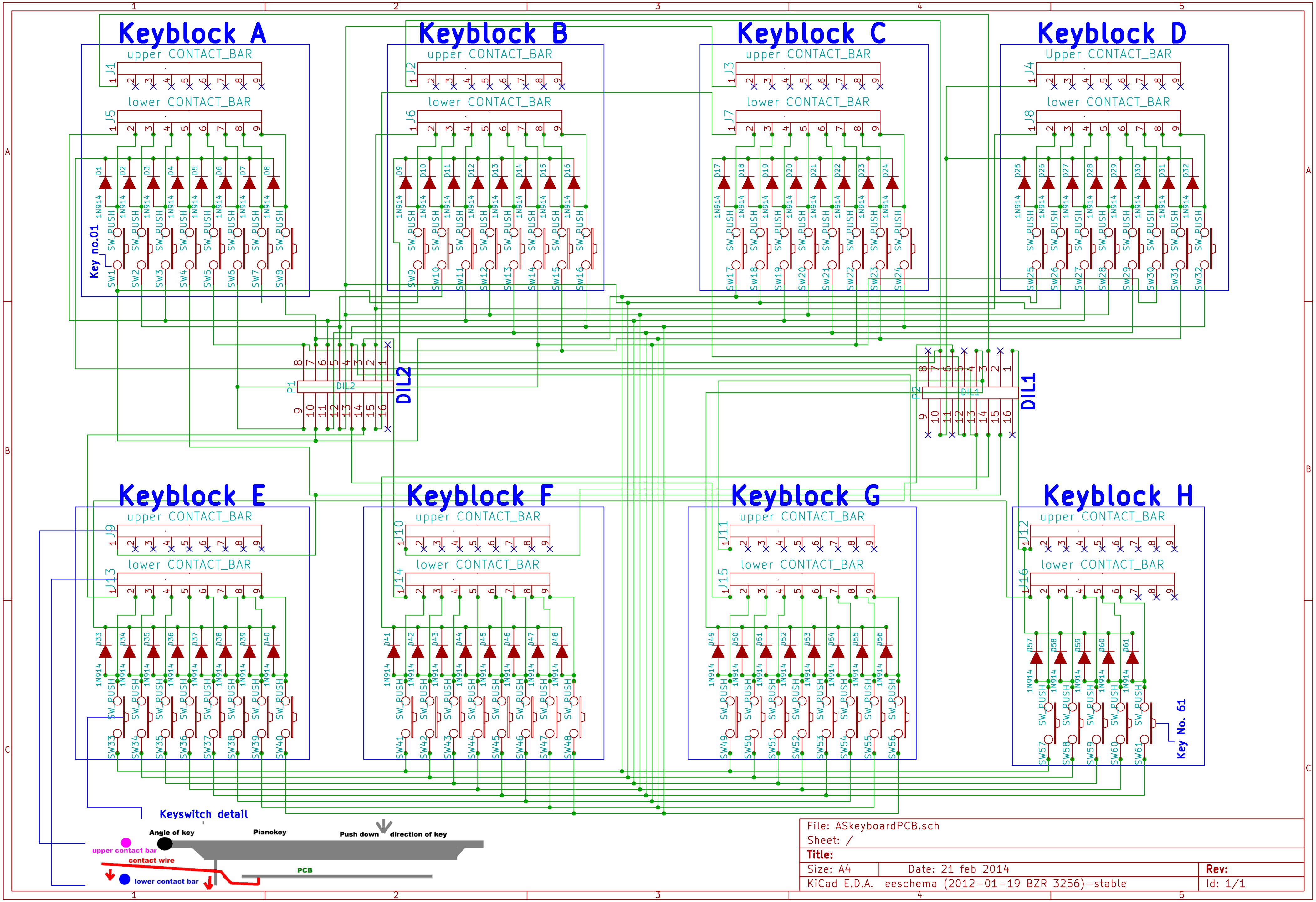
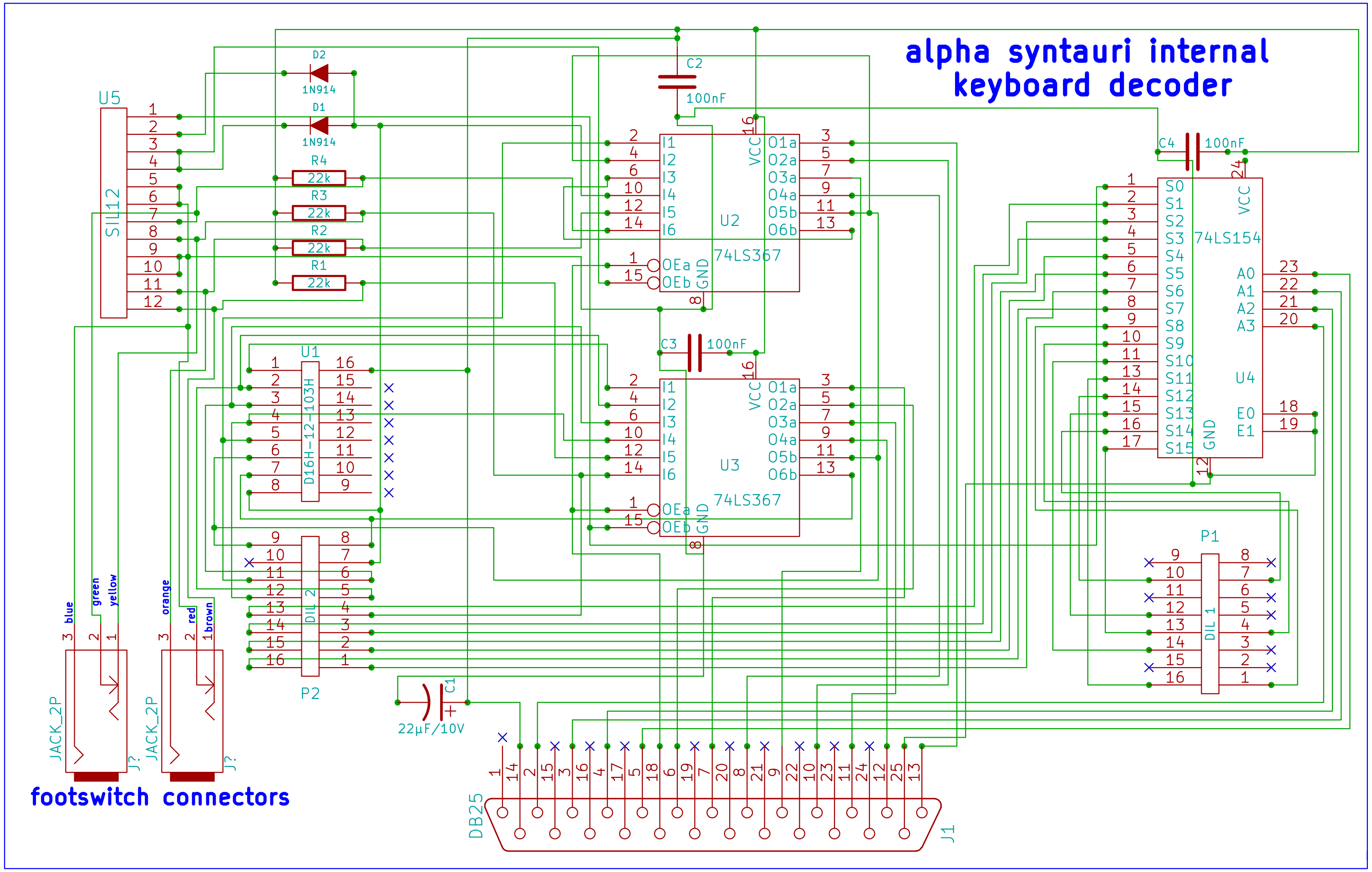
page back



BUS CONTROL
U4
74LS368
U5
74LS368
C3
100nF
J2
DB25
upper socket *
P1
lower socket *
P2
rear vertical socket *
J1
DIL16
Timing R/W and IO Selection
delay & control
U3D
U3C
U3B
74LS00



Keyblock A
Keyblock B
Keyblock C
Keyblock D
Keyblock E
Keyblock F
Keyblock G
Keyblock H
upper CONTACT_BAR
lower CONTACT_BAR
Key no.01
Key No. 61
DIL1
DIL2
Keyswitch detail
Angle of key
Pianokey
Push down
direction of key
upper contact bar
contact wire
lower contact bar
PCB
File: ASkeyboardPCB.sch
Sheet: /
Title:
Size: A4
Date: 21 feb 2014
Rev:
KiCad E.D.A. eeschema (2012-01-19 BZR 3256)-stable
Id: 1/1



File: ASinternDecoder.sch

Sheet: /

Title:

Size: A4 Date: 18 feb 2014 **Rev:**

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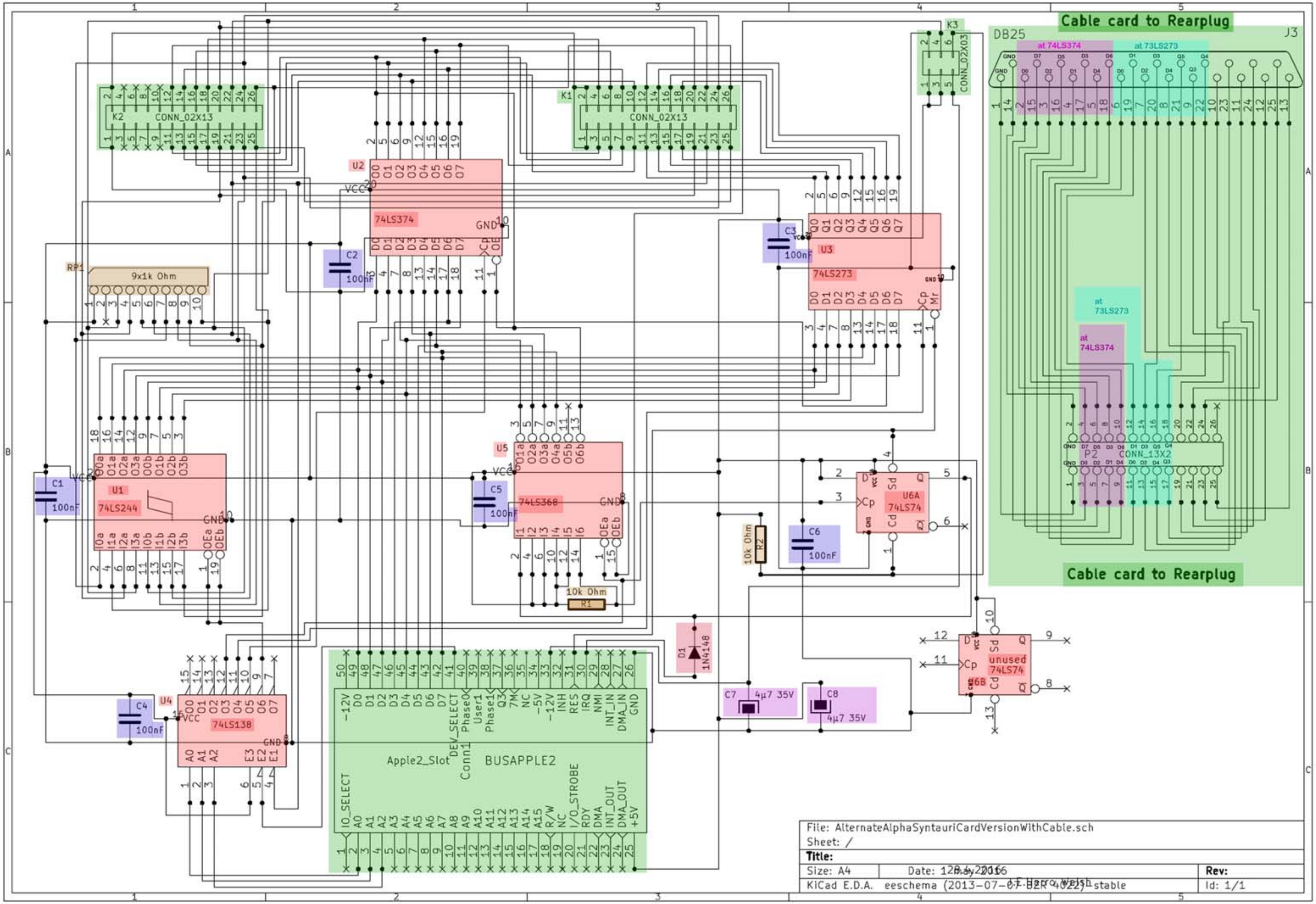
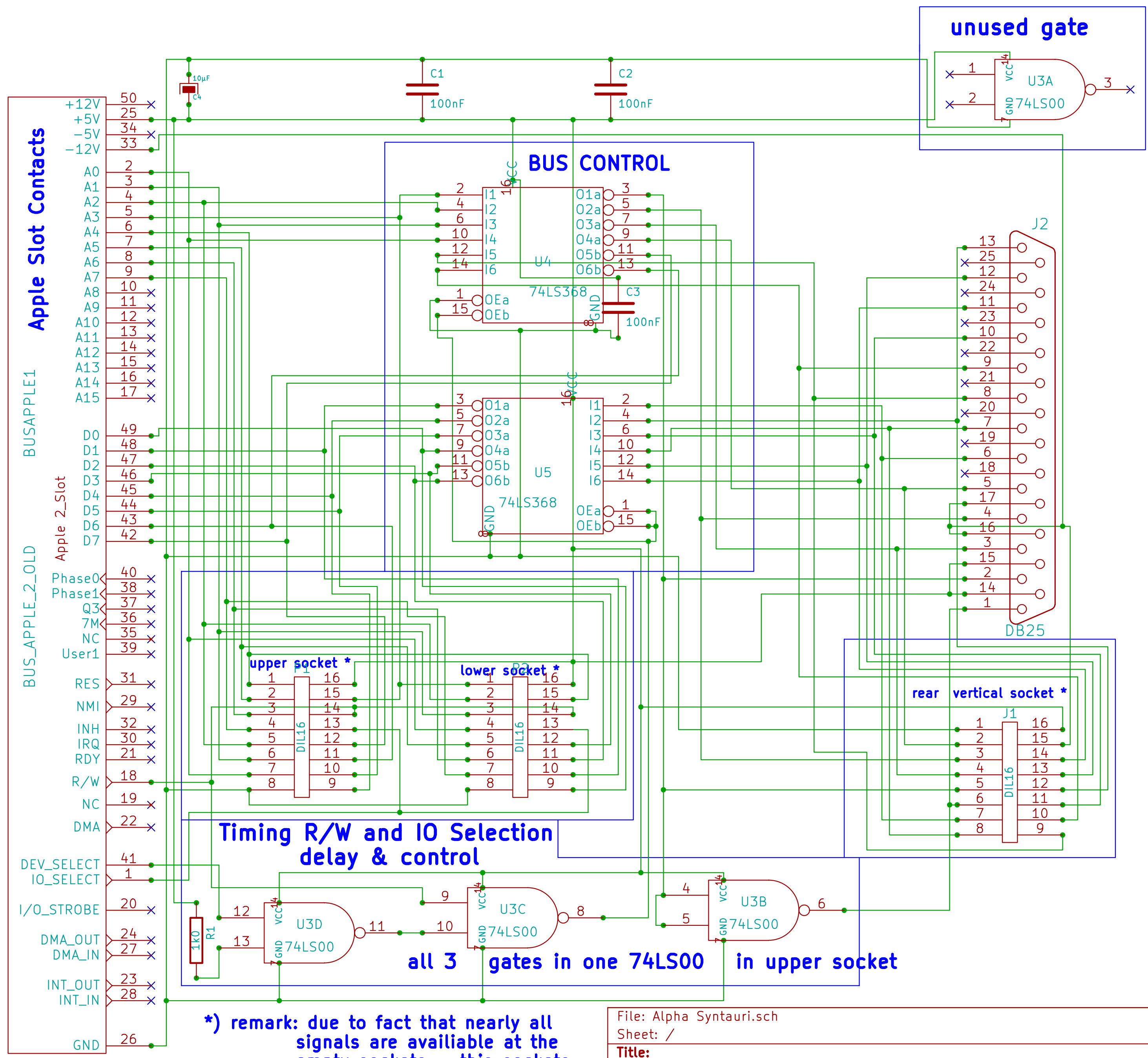

Cable card to Rearplug
DB25
J3
at 74LS374
at 73LS273
K3
CONN_02X03
K2
CONN_02X13
K1
CONN_02X13
U2
74LS374
U3
74LS273
RP1
9x1k Ohm
C1
100nF
C2
100nF
C3
100nF
C4
100nF
C5
100nF
C6
100nF
C7
4µ7 35V
C8
4µ7 35V
U1
74LS244
U5
74LS368
U6A
74LS74
U6B
unused
74LS74
U4
74LS138
R1
10k Ohm
R2
10k Ohm
D1
1N4148
P2
CONN_13X2
Apple2_Slot
Conn1
BUSAPPLE2
File: AlternateAlphaSyntauriCardVersionWithCable.sch
Sheet: /
Title:
Size: A4
Rev:
KiCad E.D.A. eeschema (2013-07-07 BZR 4022)-stable
Id: 1/1



*) remark: due to fact that nearly all signals are availiable at the empty sockets - this sockets may be used for measurement

File: Alpha Syntauri.sch
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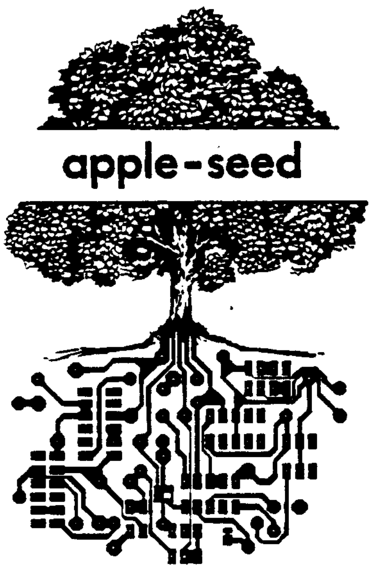
Size: A4 Date: 7 mar 2014 Rev:
KiCad E.D.A. eeschema (2012-01-19 BZR 3256)-stable Id: 1/1

Cover design by Andrea



COMPUTER ASSEMBLY MANUALS
by
RAYMOND KOSMIC

SURF BOARD: Assembly Guide for the 6502-based SURF BOARD Motherboard

APPLE-SEED I: Motherboard Assembly Manual

APPLE-SEED II: Assembly Guides for Apple-compatible Motherboards and Peripheral Circuit Cards

APPLE-SEED II UP DATE: Latest Thirty Guides from APPLE-SEED II

BIG BLUE SEED: Assembly Guides for IBM-compatible Motherboards and Peripheral Circuit Cards

BIG BLUE SEED UP DATE: Latest Twenty-five Guides from the BIG BLUE SEED

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To Juliet

PREFACE

This reference manual was prepared as an aid to those who wish to assemble Apple^{tm}-compatible peripheral circuit cards for their personal use. The sixty assembly guides presented here were originally prepared for Computer Parts Galore Inc., and Active Surplus Annex, and are distributed along with each card or kit as a parts list with condensed assembly instructions. The suppliers have kindly allowed us to compile these guides together into one reference manual.

Each one of the guides is complete in itself and is independent from the other guides. All have been checked for accuracy by the suppliers and our technical advisors, and are thought to be correct. However, with over four thousand components to be identified and correctly positioned on eighty-five cards, errors and/or omissions may occur. In no event will the suppliers or NuScope Associates be liable for damage resulting from the use of the information presented in this manual.

If you lack experience in electronics, you may wish to refer to the "apple-seed: Motherboard Assembly Manual". This self-directing guide was designed and written with the first-time hobbyist in mind, as an educational reference for the construction and assembly of electronic devices that use printed circuit boards, integrated circuits, and electronic devices.

It is planned to update this reference manual as other peripheral cards come to our attention. Any suggestions for improvement would be greatly appreciated.

ACKNOWLEDGEMENTS

I wish to express my appreciation to Tom Bell, Bramalea, John Kuzmich, Don Mills, and Andy Szego, Willowdale. Their valuable assistance and expert technical advice were instrumental in the completion of this manuscript.

ACKNOWLEDGEMENTS (Continued)

I also wish to thank the following suppliers for their encouragement and support, and for checking the accuracy of the peripheral circuit card guides as follows:

Rob Stewart and Bill Jackson of Computer Parts Galore Inc., 316 College St W, Toronto, Ont, M5T 1S3:

Disk Controller (Two Drives); Disk Controller (Four Drives); 16 K RAM; 16 K RAM; Language; 128 K RAMCARD; ROM Integer; 80-Column; Z-80; Printer Buffer; Parallel Printer Interface; Epson/Centronics Interface; Communications Interface; Serial; Modemcard; Voice Machine; Copycard; EPROM Programmer; Time; Input/Output; Multifunction; 80-Column/Soft Switch; Asynchronous Interface; Music Machine; Three Voice Synthesizer; AP-64 EPROM Writer, IEEE; A/D-D/A; Prototyping II.

Pete Brown and Fred Kohn of Active Surplus Annex, 345 Queen St W, Toronto, Ont, M5V 2A4:

80-Column VK; Sprite Graphics; EK Z80; K-Modem300; Music Card 1 and 2; Instrument Synthesizer MK1 and MK2 and Computer Interface Cards; ROM Blaster; RGB; K-Clock; Prototyping I.

Bill Wood of 4863 South Livonia Road, Livonia, NY, 14487:

8" Floppy Disk Drive Controller

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PART I

GUIDELINES TO SUCCESS

SAFETY

When cutting excessive wire leads from resistors, diodes, etc., protect your eyes. Wear safety glasses and keep the card at a reasonably safe distance. Turn your head to the side when trimming component leads.

Treat the soldering iron with respect. A hot iron can inflict a nasty burn. Do not touch the soldered connections before they have cooled down. Always rest the hot iron on a soldering stand when not in use. Turn the soldering iron off when you leave your work area.

Work in a well-ventilated area.

Observe all electrical and fire safety precautions.

There's less chance of an accident if your work area is clean and well organized.

USING THIS GUIDE

Examine the various assembly guides presented in this manual and select the card that you wish to build. Study the card in detail before mounting any components. Handle the card only by its edges, NEVER by its surface. Fingerprints may leave a fine film of oil on the solder pads and prevent the solder from making a solid joint. Clean both sides of the card with a special commercial cleaner or denatured alcohol (methyl alcohol) before soldering.

Visually inspect the card for breaks, shorts, etch-flaws, and irregularities in the lands (tracks). Illuminate the card from the solder side with a strong light. Examine the tracks for shorts and hair-line fractures. Pay special attention to the component side where the tracks will be covered over with sockets. You won't get a second chance to inspect these areas once hidden with components. Check the inner surface of the plated-thru holes; a shiny appearance indicates that they are, in fact, plated-thru. On the other hand, a dull appearance suggests a poorly-made circuit card. If flaws exist, either make the necessary repairs or return the card to the dealer.

Compare the silk-screening on the bare card to the silk-screening on the layout in the text. Record all differences. Check the parts list for availability and price. Mentally position each socket and electrical component and device in place before beginning the actual assembly.

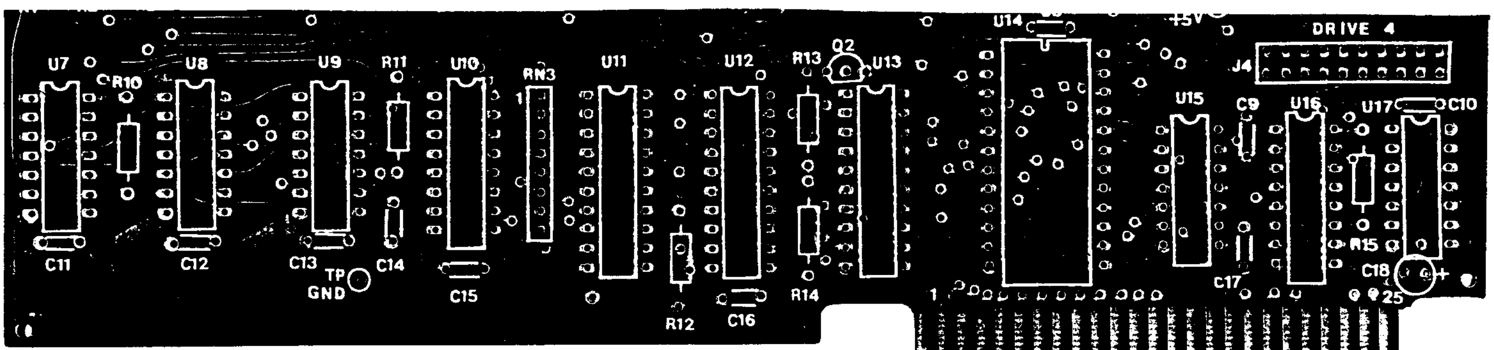
Orientate the card so that the component side faces you and the edge-card contacts are at the LOWER RIGHT.

ALL COMPONENTS ARE MOUNTED ON THE COMPONENT SIDE
AND SOLDERED ON THE SOLDER SIDE

Study the precautions thoroughly (marked with an asterisk * in the guides) before you begin to assemble a circuit card.

Each one of the guides is complete and independent of the others in this manual.

Use the guide as a shopping list. Refer to Fig. 1, A Portion of an Assembly Guide. Check off each component purchased in the space provided on the guide. Circle the appropriate component placement number after it has been installed. Some peripheral cards have the silk-screened labels printed directly under socket placements making it impossible to know which integrated circuit (IC) to install. Refer to the component placement layout for IC positioning.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

2 2 - 33 Ω @ R8,9 — 1 1 - 5 KΩ @ R3
1 1 - 100 Ω @ R11 — 1 1 - 1 KΩ @ R10
1 1 - 470 Ω @ R12
4 6 - 680 Ω @ R1,2,6,7,13,14
✓ 1 - 4.7 KΩ @ R15 ✓
✓ 1 - 47 KΩ @ R5 ✓
✓ 1 - 1 MΩ @ R4 ✓
?? 2 - 4S33 Ω SIP* (isolated) @ RN1,2
1 1 - 4.7 KΩ SIP* (bussed) @ RN3

OK

TRANSISTORS Q *Install the three EBC leads as shown
2 2 - 2N3906 @ Q1,2
B E C

DIODES D
2 3 - LED *Position longer lead (anode) of LEDs as shown @ CR1,2,3
NEED 1
anode

CONNECTORS
4 - 2x10 male header strip, straight

FIG. 1. A PORTION OF AN ASSEMBLY GUIDE.

The correct sequence of installing components is debatable. Try to keep all the components flush against the board. As a general rule, mount the components that are shortest in height first (diodes, resistors, sockets), followed by the taller components (capacitors, switches, resistor networks, etc.). This helps to keep the components tight against the board when soldering.

In some situations, it may be more practical to install sockets first. This may eliminate some confusion as to the placement of the smaller components, especially if the card is inadequately silk-screened or cluttered.

Component leads are NEVER inserted into FEED-THRU holes. On some of the cards illustrated, the FEED-THRU holes are smaller and can thus be distinguished from the larger COMPONENT holes.

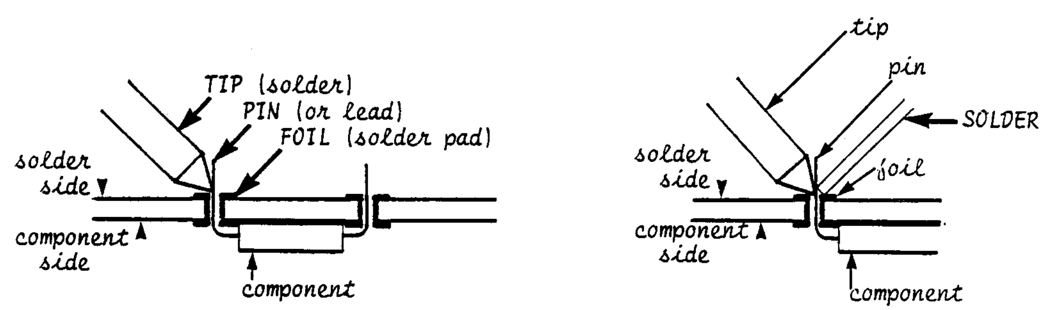
The spacing between two solder holes on any one circuit card is often the same for each type of component. Thus resistor leads are bent to the same length. By-pass capacitors (0.1 µF) have a smaller hole-to-hole spacing. This may help you to decide the mounting position of some of the components.

Use a low-wattage (less than 35 watts) soldering iron with a small pencil, pyramid, or screw-driver tip. Use only rosin-core, radio-type solder with a 60/40 or 63/37 tin/lead content. NEVER use acid-core solder! NEVER use a solder gun!

Take care with your soldering. The soldering iron TIP should make firm contact with the PIN or component lead and the solder PAD as illustrated in FIG. 2, Soldering Techniques. Apply solder to the opposite side of the pin touching both the pin and the pad. Follow this sequence:

IRON ON - SOLDER ON - SOLDER OFF - IRON OFF

Excessive heat may damage delicate components. If done correctly, soldering one pin or component lead should take no more than four to five seconds.



A. *Three-Point Contact*   B. *Applying the Solder*

FIG. 2. SOLDERING TECHNIQUES.

Some peripheral cards appear to have a preference for devices made by a specific manufacturer. The parts list shows this source in brackets following the device. Other devices that are followed by a manufacturer's name in brackets are made only by that manufacturer.

Some of the cards require modifications as illustrated in the MULTIFUNCTION CARD, GUIDE 10-4. Modifications are done on the solder side except where indicated. Study the details thoroughly before attempting any modifications.

Variations in silk-screening may be encountered in some of the circuit cards. Fig. 3 shows four variations of the 128 K RAMCARD. Compare these to the correctly silk-screened version in GUIDE 2-4. Component placement may be missing or incorrect. Integrated circuit pin number 1 may be turned thru 180^{0}. Return these cards to the supplier. If, on the other hand, you do decide to assemble cards that are incorrectly silk-screened, work cautiously and systematically. Apply a small dab of typewriter correction fluid to mark and identify pin 1 of sockets and ICs.

GUIDE TO COMPONENTS

For a more detailed look at component identification and placement, and for installation techniques, refer to the "apple-seed: Motherboard Assembly Manual".

DIODES AND LIGHT EMITTING DIODES (D)

Diodes are delicate and can be easily damaged by rough handling and excess heat. These devices are polarized and must be correctly oriented on the circuit card. Position the banded (cathode) end of the diode towards the tip of the arrow as shown in following figure (Fig. 4).

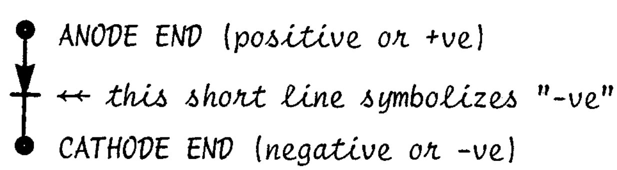


FIG. 4. IDENTIFYING THE CATHODE ON THE LAYOUT.

The polarity of light emitting diodes (LEDs) may be identified in one of the following ways:

-ve: a small "dot" on the body of the device

-ve: base of the device is "flat"

+ve: the "longer" terminal or lead

INDUCTORS (L)

The numerical value of inductors (coils) may be colour-coded on the body of the device. This value, in microhenries (µH), can be determined using Table I, Resistor Colour Code Chart.

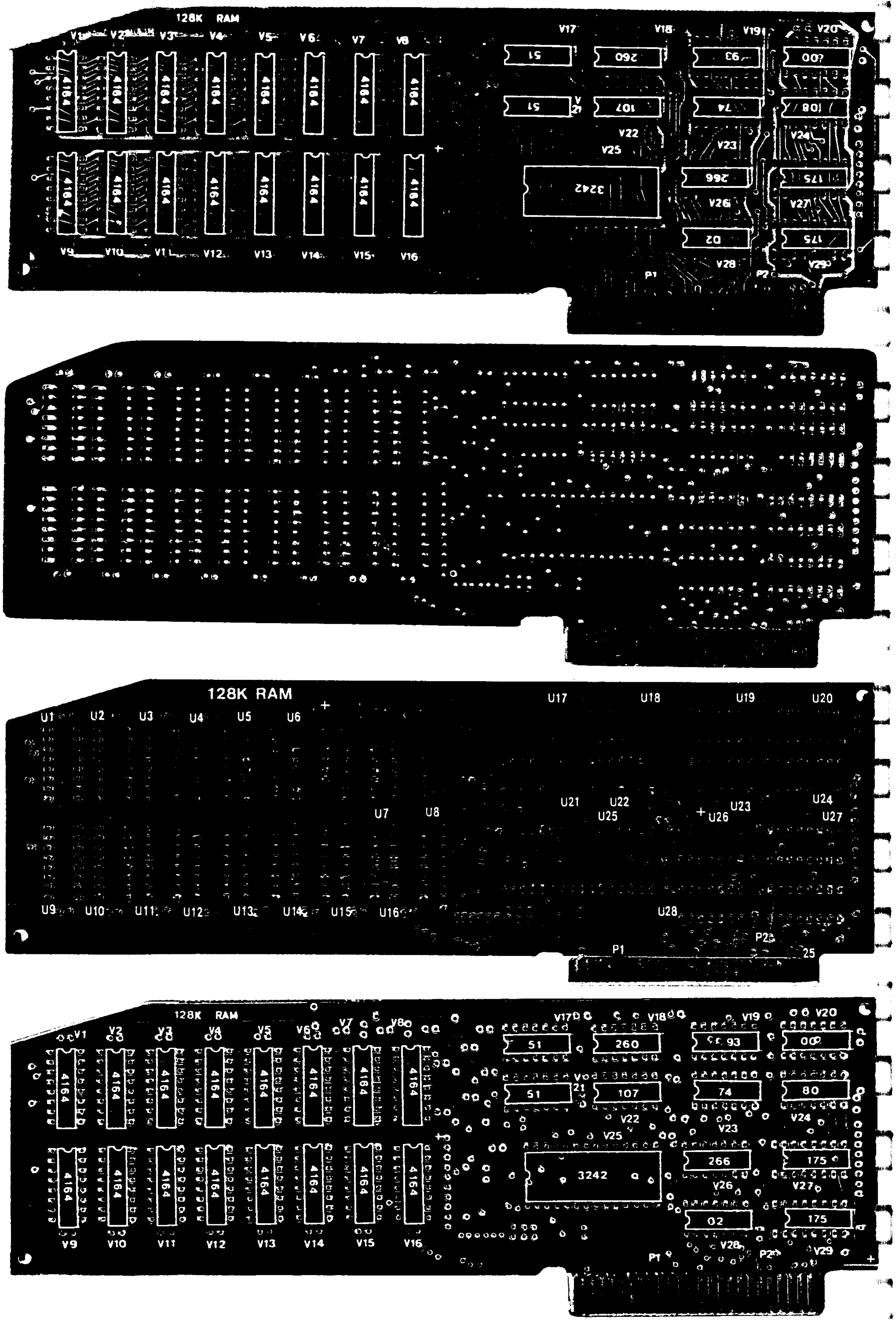
FIG. 3. VARIATIONS OF THE 128 K RAMCARD. Refer to GUIDE 2-4 for the CORRECT component placement. (Reduced in size).

VARIATION
I
INCORRECTLY
SILK-SCREENED

VARIATION
II
NOT
SILK-SCREENED

VARIATION
III
INCOMPLETELY
SILK-SCREENED

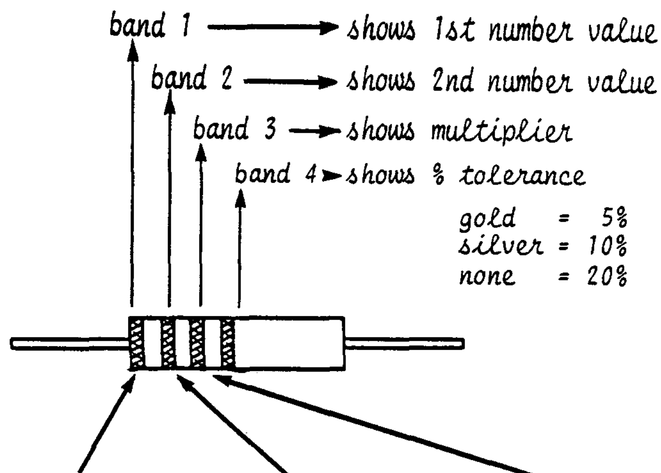
VARIATION
IV
INCORRECTLY
SILK-SCREENED



RESISTORS (R)

The resistors used to assemble the majority of peripheral cards illustrated in the manual are ¼ watt, with a tolerance of 5 percent (%). Refer to Table I, Resistor Colour Code Chart, to determine the ohms value of resistors.

Table I. Resistor Colour Code Chart.



colour	1st digit	2nd digit	multiplier
black	0	0	1
brown	1	1	10
red	2	2	100
orange	3	3	1,000
yellow	4	4	10,000
green	5	5	100,000
blue	6	6	1,000,000
violet	7	7	10,000,000
gray	8	8	100,000,000
white	9	9	1,000,000,000
gold	-	-	0.1
silver	-	-	0.01

EXAMPLES: a) *yellow, red, black, refers to*
4 7 X1 = 47 Ω (ohms)

b) *brown, green, red, refers to*
1 5 X100 = 1,500 ohms or 1.5 KΩ (K = Kilo)

The MODEMCARD, GUIDE 7-2, requires "precision" resistors. The first three bands of these resistors designate the numerical value; the fourth band the multiplier. A large gap separates the fourth and fifth band. The fifth band shows the % tolerance.

EXAMPLE:	*brown,*	*green,*	*black,*	*orange,*	*—,*	*brown,*	*refers to*
	1	*5*	*0*	*X1,000*		*1%*	*= 150,000 ohms, 1% (150 KΩ)*

Pin 1 of single-in-line package (SIP) resistors or resistor networks (RN) is common and must be positioned correctly on the card. Pin 1 may be identified by a "dot", a "bar", or a number "1" on the body of the device. Most cards require SIP "bussed" resistors. The DISC DRIVE CARD, GUIDE 1-3, on the other hand, uses SIP "isolated" resistors. If isolated SIPs are not available substitute the same number of single resistors of the same value. Stand them on their end as shown in Fig. 5, Installing a Resistor on its End. Leave a small gap between the end of the resistor and the circuit card to prevent "solder wicking", i.e., solder creeping along the card and possibly causing a short circuit.

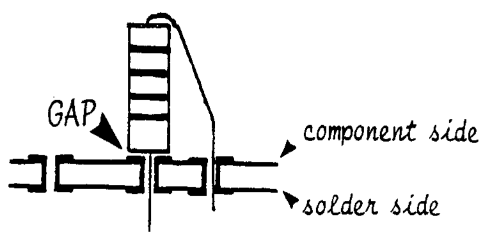


FIG. 5. INSTALLING A RESISTOR ON ITS END.

A SIP resistor with the correct number of pins may not always be available. Purchase one with more pins than required and cut off the extra number of pins as close to the body of the device as possible. Do NOT REMOVE pin number 1. Do NOT allow the cut portion of the pins remaining on the device to touch the circuit card as they may cause a short circuit.

SOCKETS

It is strongly recommended that ALL integrated circuits be socketed. One of the best forms of trouble-shooting is "chip-swapping". Use high-quality dual-in-line (DIP) solder-tail IC sockets.

CHECK AND RECHECK THAT:

- pin 1 of each socket is properly oriented on the card
- each socket is installed in the correct position, i.e., a 14-pin socket is not mounted in a 16-pin opening
- ALL socket pins have passed thru ALL holes, i.e., no folded-under pins
- each socket is flat against the card.

Do NOT attempt to remove a socket if it has been installed with pin 1 positioned incorrectly, i.e., socket turned thru 180°. Instead, apply a very small dab of typewriter correction fluid to the corner of the socket to identify pin number 1.

CAPACITORS (C)

Capacitors are either electrolytic (polarized) or non-electrolytic (non-polarized). Polarized capacitors must be connected in the circuit so that their positive and negative terminals are correctly positioned in the circuit. Match the +ve terminal of these capacitors with the +ve end as shown on the layout. Non-polarized capacitors have neither +ve nor -ve ends and may be installed in the circuit in any manner. Capacitors of values greater than 0.1 µF are generally polar. Refer to Table II for the capacitance and tolerance of capacitors.

Table II. Multiplier and Tolerance Chart for Capacitors.

MULTIPLIER		TOLERANCE		
for the number:	multiply by:	10 pF* or less	letter	over 10 pF
0	1	± 0.1 pF	B	-
1	10	± 0.25 pF	C	-
2	100	± 0.5 pF	D	-
3	1,000	± 1.0 pF	F	± 1%
4	10,000	± 2.0 pF	G	± 2%
5	100,000	-	H	± 3%
-	-	-	J	± 5%
8	0.01	-	K	± 10%
9	0.1	-	M	± 20%

*pF = *picofarad*

EXAMPLES: a) *221K printed on the device refers to a value of 22X10 = 220 pF with a tolerance of ± 10%*

b) *104M refers to 10X10,000 or 10X10^4 = 100,000 pF or 0.1 µF, ± 20%*

Voltage ratings, usually printed on the component, show how much voltage can safely be used without damaging the capacitor. The rating must be higher than the highest voltage in the circuit.

Install variable capacitors (trimmers or trimcaps) so that the common terminals of the device are aligned with the common solder pads on the card.

TRANSISTORS (Q)

Handle transistors with care. Protect them from mechanical injury. Use minimum heat when soldering. Transistors may be destroyed if their three leads are incorrectly positioned in the circuit. Identifying the emitter, collector, and base (EBC) terminals however, presents a problem: the body of the device may or may not be labelled; the circuit board may or may not be silk-screened; different manufacturers arrange the EBC leads differently. If in doubt, check with your dealer.

CRYSTALS (Y)

Crystals are delicate. A severe jolt may chip the crystal suspended in the metal case. Install crystals last to prevent excessive movement while working on other components. Fold the body of the device flat against the card before soldering if space is available on the card. Insulate the crystal from the card with two-way tape to prevent short circuits. Some of the cards have feed-thru holes at each side of the crystal so that the device can be secured in place. Refer to the MODEMCARD, GUIDE 7-2.

INTEGRATED CIRCUITS

Treat ICs with care. Handle them by the body, not the pins. Protect them from mechanical injury.

The power must be OFF when inserting or removing ICs or other devices. Excessive voltage, reversed polarity, short circuits, etc., can quickly destroy an IC. ICs must be correctly positioned in the circuit. Pin 1 of ICs can be identified by a "dot", a "triangle", a "1", a "notch", etc. Match pin 1 of ICs with pin 1 on the layout.

Metal-Oxide-Silicon (MOS) and Complementary Metal-Oxide-Silicon (CMOS) integrated circuits are very sensitive to static electrical discharge, and require special handling. Store them in their original shipping tubes or with their pins embedded in special conductive foam. Linear ICs are moderately sensitive, whereas Transistor-Transistor Logic (TTL) ICs are relatively insensitive to static discharge.

Difficulties in running some software programs may result when using RAM (Random-Access Memory) ICs of different speeds. Use 200 ns (nanosecond) RAM on both the motherboard and the peripheral cards, except where specified in the guide.

Keep EPROMs (Erasable Read-Only Memory) away from direct sunlight. Ultraviolet (UV) radiation of sunlight may partially erase some of the information programmed in an EPROM. Protect them by applying a non-transparent piece of tape or label over the transparent window on top of the device.

In some cases, it may be more convenient to use PROMs (Programmable Read-Only Memory) other than those specified in the guides. Refer to Table III, PROM Cross-Reference Chart, for appropriate substitutes.

Firmware (software written into EPROMs or PROMs) is the responsibility of the builder and can be programmed according to the wishes of the individual.

Table III. PROM Cross Reference Chart Showing the Manufacturer and the Corresponding Part Number. *Are used in Guides.

HAR	MMI	NAT	SIG	T.I.
7603	6331	74S88	82S123*	18S030
-	6309*	74S471	-	28S22
7649*	6349*	74S472	82S147*	28S42
7611	6301	74S287	82S129*	28S10

HAR - Harris
MMI - Monolithic Memories
NAT - National Semiconductors
SIG - Signetics
T.I. - Texas Instruments

CARD INSTALLATION AND REMOVAL

DEDICATED SLOTS

Remove the cover of the computer. Locate the row of eight edge connectors on the motherboard. Refer to Fig. 6, Top View of Motherboard, for slot numbering. These conventions are generally followed by most users.

SLOT Ø - Memory (RAM or ROM) Card
SLOT 1 - Printer Card
SLOT 3 - 80-Column Card
SLOT 6 - Disc Controller Card

CARD INSTALLATION

Turn the POWER OFF before installing or removing ANY peripheral card. Failure to do so will likely result in circuit damage to the card, other cards, and the motherboard.

Discharge STATIC ELECTRICITY in your body by touching the metal case of the power supply.

Orientate the peripheral card so that the SOLDER SIDE faces the power supply. Position the card carefully in the slot so that no "sliding" FRONT-TO-BACK movement occurs. This movment may strip the gold contacts from the card.

Insert the gold-plated fingers of the card into the appropriate connector. Gently rock the card from FRONT-TO-BACK while gently applying downward pressure. (Refer to Fig. 6 for the front-to-back orientation). The card must be firmly seated in the slot before turning on the power.

CARD REMOVAL

POWER OFF
DISCHARGE STATIC ELECTRICITY
ROCK FRONT-TO-BACK WHILE APPLYING UPWARD PRESSURE

PRECAUTIONS

Do NOT rock the card from side-to-side
Do NOT touch the gold-plated contact fingers of the card
Do NOT unecessarily install and remove cards. Some poor-quality card-edge connectors may break down creating poor or non-existent contacts.
Do NOT apply excessive force. You may flex the motherboard sufficiently to break one or more of the tracks.

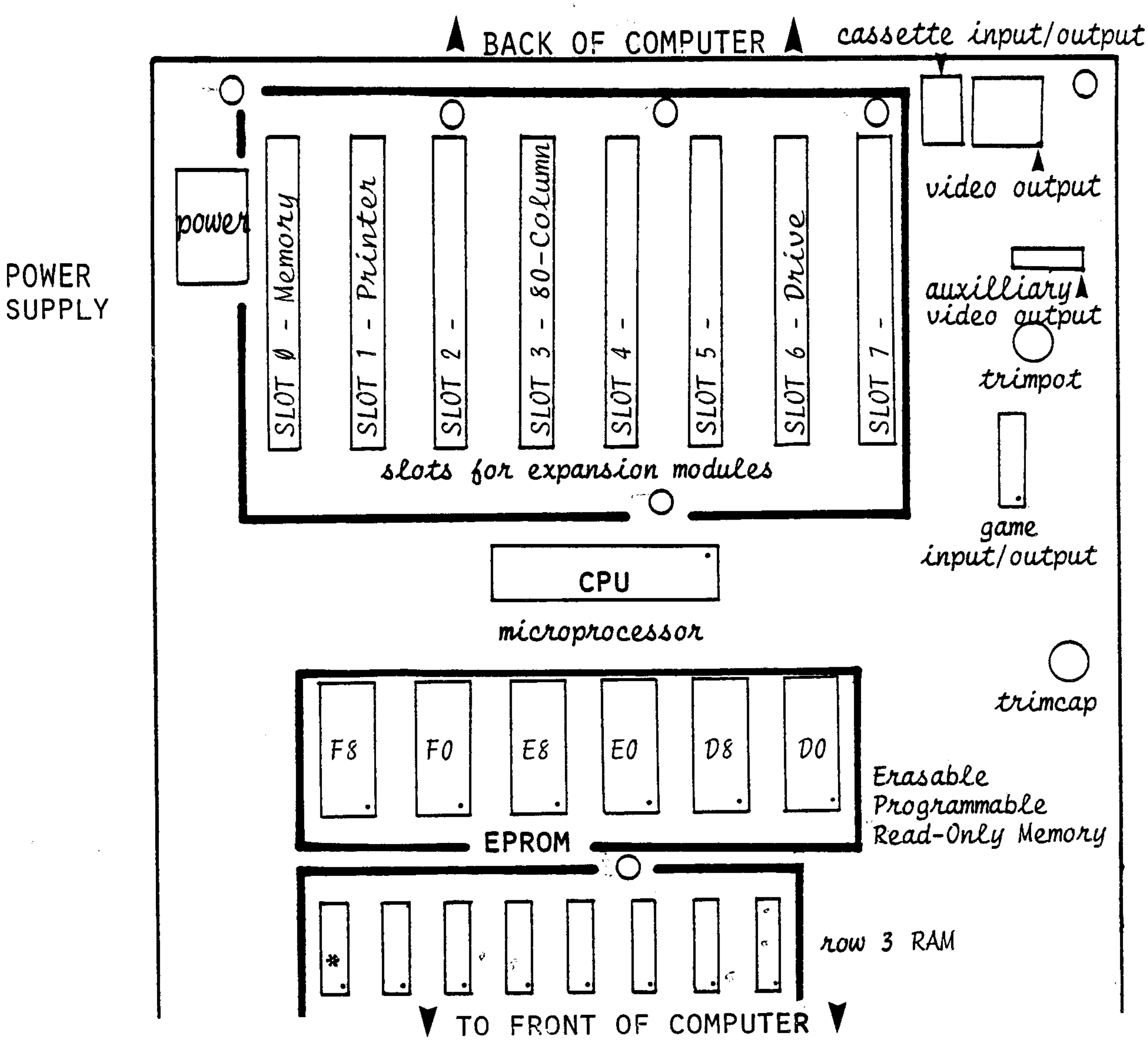


FIG. 6. A PORTION OF THE TOP VIEW OF THE MOTHERBOARD SHOWING FRONT-TO-BACK ORIENTATION AND DEDICATED SLOTS. Install ribbon cable from memory

CARD AND CONNECTOR PINOUT

Refer to Fig. 7 for the pinout for both the edge connector and the peripheral card. The reproductions are close to original size. To quickly identify any one of the pins or contacts, lay the card along the edge of the centre diagram and directly read off the pin number. Do NOT mistakenly interchange the component side with the solder side. Note the relative position of the power supply to the left of the motherboard.

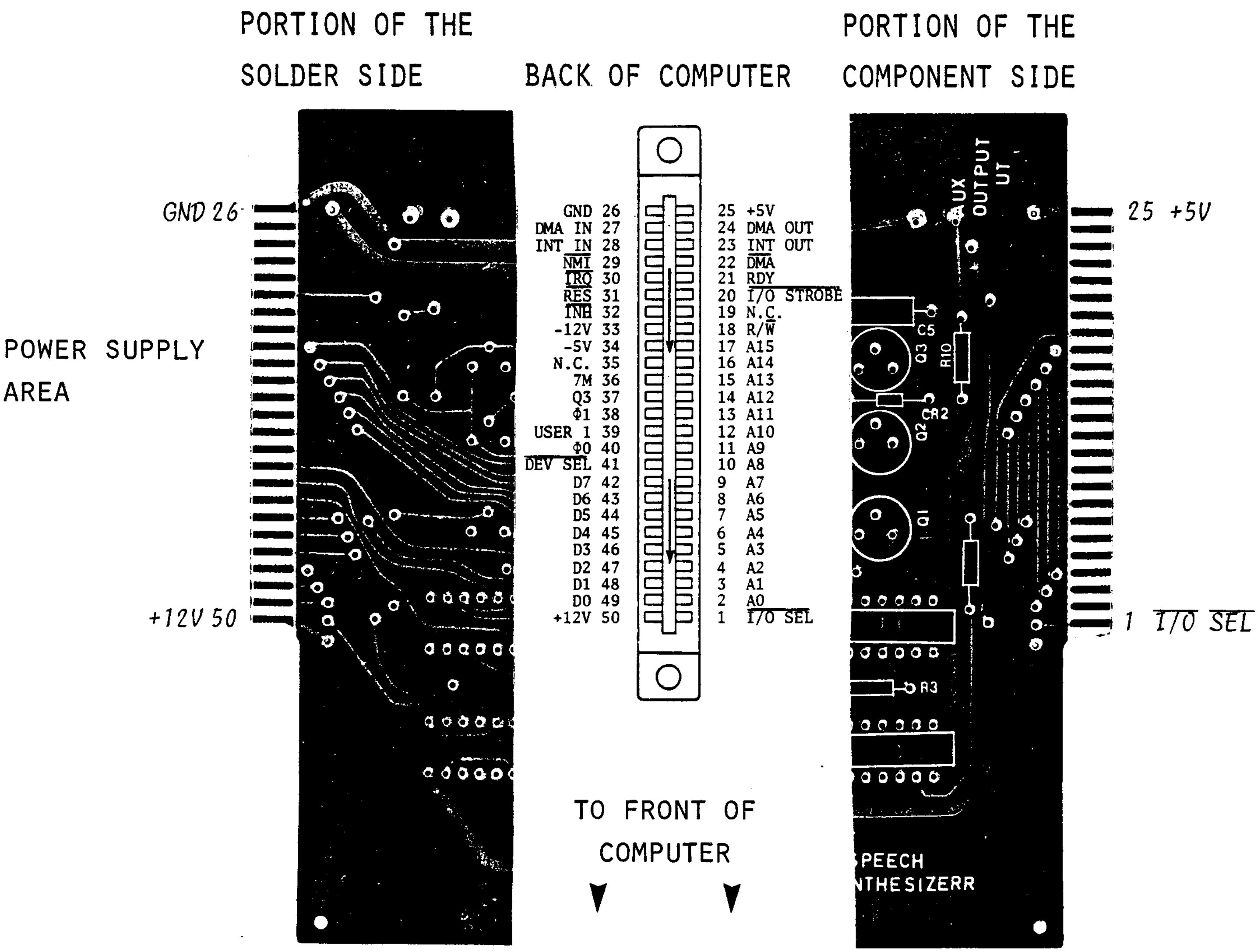


FIG. 7. PINOUT FOR THE EDGE CONNECTOR (CENTRE) AND BOTH SIDES OF THE PERIPHERAL CARD. Reproductions are close to original size.

APPENDIX

ABBREVIATIONS

Alt - Alternate
B - Base (Transistor)
BIT - Binary digIT
BYTE - a group of 8 BITs
C - Collector (Transistor)
C - letter code for Capacitor
CharGen - Character Generator
CMOS - Complementary Metal-Oxide-Silicon
Cont - Controller
CP/M - Control Program for Microprocessors
CPU - Central Processing Unit
CRT - Cathode Ray Tube
D - letter code for Diode
DIN - European type connector
DIP - Dual In-line Package
D.C. - Direct Current
DOS - Disk Operating System
DRAM - Dynamic RAM
DPDT - Double-Pole, Double-Throw
DUART - Dual Asynchronous Receiver Transmitter
E - Emitter (Transistor)
EPROM - Erasable PROM
FDC - Floppy Disk Controller
FET - Field Effect Transistor
GND - Ground
HIRES - High Resolution
Hz - Hertz
IC - Integrated Circuit
IEEE - Institute of Electrical and Electronic Engineers
I/O - Input/Output
J - Jumper
K - Kilobyte, 1,024 bytes
L - letter code for Coil or Inductor
LED - Light Emitting Diode
LPT - Line PrinTer
M - Megabyte, 1,024,000 bytes
MOS - Metal-Oxide-Silicon
MPU - Microprocessing Unit
-ve - negative
NiCad - Nickel Cadmium
ns - nano second
+ve - positive
P - post
PAL - Programmed Aray Logic
PC - Printed Circuit
PCB - Printed Circuit Board
PG - Power Good

Q	- letter code for Transistor
R	- letter code for Resistor
R	- Ring
RAM	- Random-Access Memory
RF	- Radio Frequency
RGB	- Red, Green, Blue
RN	- Resistor Network
ROM	- Read-Only Memory
RTN	- Return
S	- Schottky
S, SW	- Switch
S,SPKR	- Speaker
SIP	- Single In-line Package
SPDP	- Single-Pole, Double-Throw
TP	- Terminal Post
Trimcap	- Trim capacitor
Trimpot	- Trim potentiometer
TTL	- Transistor-Transistor Logic
UV	- Ultra Violet
V	- Volt
Vid	- Video
VR	- Variable Resistor
XTAL	- Crystal
XTL	- Crystal
Y	- letter code for Crystal
ZIF	- Zero Insertion Socket

METRIC PREFIXES Decimal points and large numbers are avoided.

p	pico	10^{-12}
n	nano	10^{-9}
μ	micro	10^{-6}
m	milli	10^{-3}
-	-	1.0^{1}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}

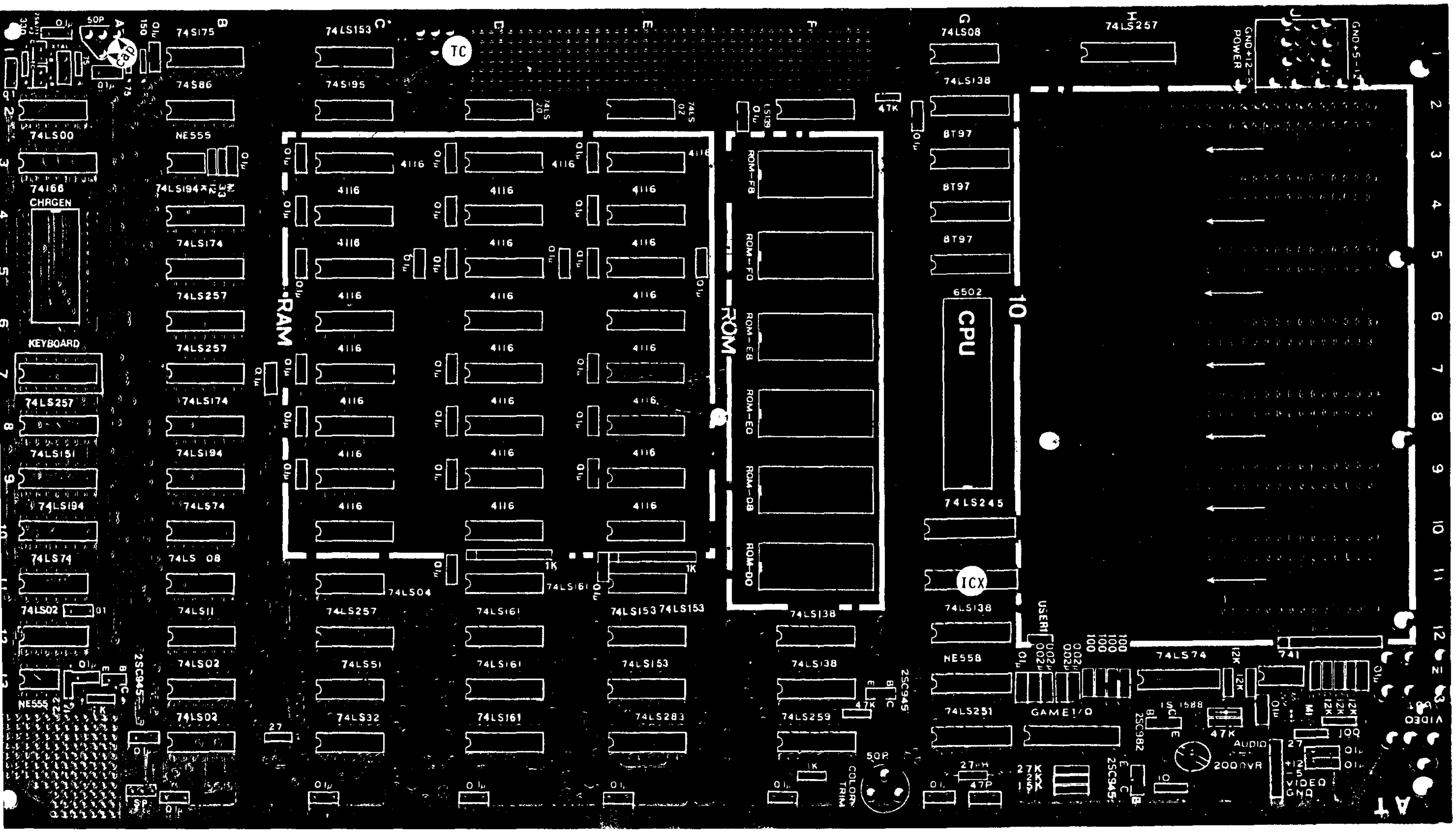
PART II

PERIPHERAL CIRCUIT CARD

ASSEMBLY GUIDES

Study PART 1, GUIDELINES TO SUCCESS, before attempting to assemble any of the following peripheral cards.

MOTHERBOARD I: System board features: 6502 MPU; 48 K bytes of RAM expandable to 64 K and up with memory card(s); eight expansion slots for numerous peripherals; colour graphics capability; I/O ports. Requires firmware (six 2716 EPROMs, or three 2732 EPROMs with modifications). Supports a variety of operating systems and programming languages.



Layout is reduced. Actual size is 21.8 x 306.3 cm
NB Install one 50 pF regular capacitor @ cap if colour is missing

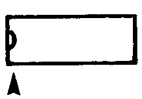
MOTHERBOARD (continued) SUGGESTED SEQUENCE *INDICATES A PRECAUTION

D *Position banded (cathode) end
de towards the arrow
- 1N914

ORS R ¼ watt, 5%
- 10 Ω
- 27 Ω
- 47 Ω @ 75
- 100 Ω
- 150 Ω
- 330 Ω
- 1 KΩ
- 1.5 KΩ
- 2 KΩ
- 2.7 KΩ
- 4.7 KΩ
- 12 KΩ
- 47 KΩ
- 1 MΩ
- 2.2 MΩ
- 3.3 MΩ
- 1 KΩ 9-pin SIP* Match pin 1 of SIPs with pin 1 (square) on the layout
- 200 Ω Trimpot

L
- 27 or 33 µH

TS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
- 8-pin
- 14-pin
- 16-pin
- 20-pin
- 24-pin
- 40-pin


pin 1

TORS C
- 47 pF
- 0.02 µF
- 0.1 µF Monolithic
- 50 pF Trimcap @ TC

*Refer to note on previous page

TRANSISTORS Q *Match EBC transistor leads with EBC on the layout
____ 2 - 2N4258 or SA711 @ SA711
____ 3 - 2N3904 or SC945 @ SC945
____ 1 - MPSA13 or SC982 @ SC982

CRYSTAL Y
____ 1 - 14.31818 MHz @ Xtal

CONNECTORS
____ 1 - RCA video jack @ VIDEO
____ 2 - audio jacks @ OUT IN
____ 1 - 1x3 header, male, straight @ SP
____ 1 - 1x6 header, male, straight @ J-14
____ 1 - power plug @ POWER
____ 8 - 50-pin card edge connectors

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00. *ICX is NOT equipped
____ 4 - 74LS02
____ 1 - 74LS04
____ 2 - 74LS08
____ 1 - 74LS11
____ 1 - 74LS20
____ 1 - 74LS32
____ 1 - 74LS51
____ 3 - 74LS74
____ 4 - 74LS138
____ 1 - 74LS139
____ 1 - 74LS151
____ 4 - 74LS153
____ 4 - 74LS161
____ 1 - 74166 @ 74LS166
____ 2 - 74LS174
____ 3 - 74LS194
____ 1 - 74S195 @ 74LS195
____ 1 - 74LS245
____ 1 - 74LS251
____ 5 - 74LS257
____ 1 - 74LS259
____ 1 - 74LS283
____ 3 - 74LS367 or 8T97

INTEGRATED CIRCUITS (continued)
____ 1 - 74S86
____ 1 - 74S175

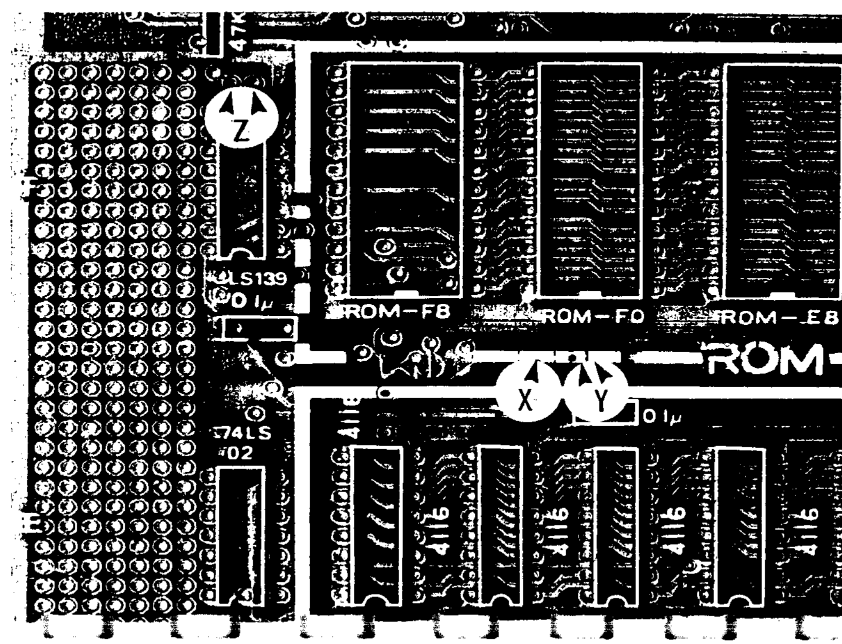
____ 2 - NE555
____ 1 - NE558
____ 1 - 741

____ 1 - 6502 CPU
____ 7 - 2716 EPROMs @ ROMs & CHRGEN
____ 24 - 4116 dynamic RAMs 200 ns or faster

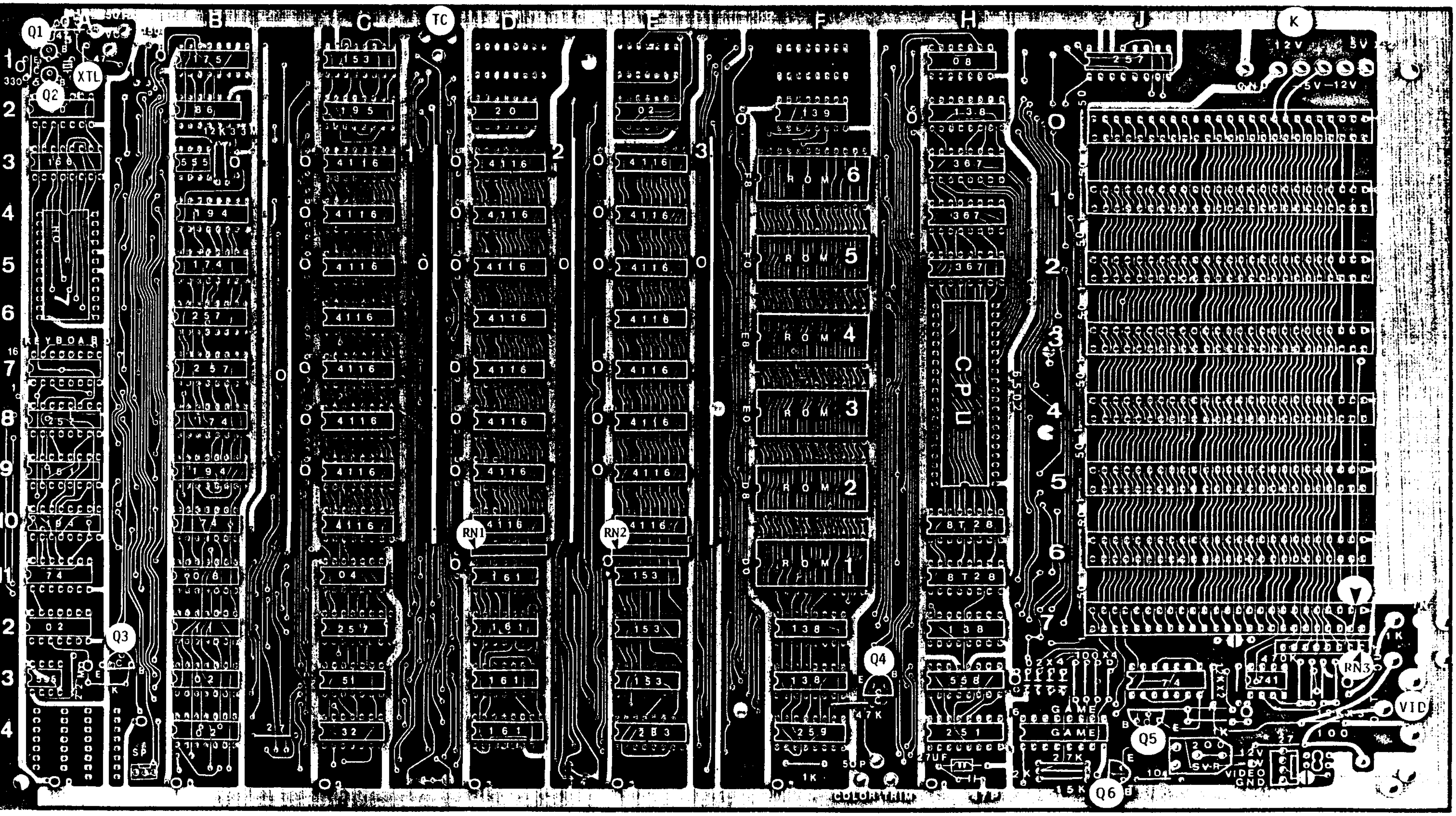
MISCELLANEOUS
____ 1 - ASCII Keyboard
____ 1 - switching power supply
____ 1 - case

MODIFICATION on COMPONENT SIDE to use 2732 EPROMs in place of 2716 EPROMs - Refer to the following layout:
A Cut "bow-tie" @ X
B Jumper "half-moons" @ Y
C Jumper the two feed-tru holes @ Z

Install three 2732 EPROMS @ ROM- FO, EO, DO



MOTHERBOARD II: System board-2 features: 6502 MPU; 48 K bytes of RAM expandable to 64 K and beyond with memory card(s); eight expansion slots for numerous peripherals; colour graphics capability; I/O ports. Requires firmware (six 2716 EPROMs) and modification (one cut on the solder side). Supports a variety of operating systems and programming languages.



Layout is reduced. Actual size is 21.9 x 307.3 cm

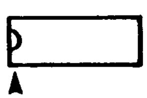
HERBOARD II (continued) SUGGESTED SEQUENCE *INDICATES A PRECAUTION *NOTE MODIFICATIONS

) *Position banded (cathode) end
liode towards the arrow
· 1N914

RS R ¼ watt, 5% @ •——•
· 10 Ω
· 27 Ω
· 47 Ω
· 100 Ω
· 150 Ω
· 330 Ω
· 1 KΩ
· 1.5 KΩ @ 15K
· 2 KΩ
· 2.7 KΩ @ 27K
· 4.7 KΩ @ 47K
· 12 KΩ
· 470 KΩ
· 2.2 MΩ @ 22M
· 3.3 MΩ @ 33M
· 1 KΩ 8-pin SIP* bussed @ RN1,2,3
*Match pin 1 of SIPs with pin 1 (arrow) on the layout
· 200 Ω Trimpot @ SV-R

· 27 or 33 μH @ 27 μF

*Match pin 1 of sockets with pin
on the layout. Check that ALL pins
ve passed thru ALL holes
· 8-pin
· 14-pin
· 16-pin
· 24-pin
· 40-pin



pin 1

ORS C
· 47 pF @ 47P
· 0.02 μF @ 02x4
· 0.1 μF @ •○•
· 50 pF Trimcap @ TC

TRANSISTORS Q *Match EBC transistor leads with the EBC leads on the layout
____ 2 - 2N4258 @ Q1,2
____ 3 - 2N3904 @ Q3,4,6
____ 1 - MPSA13 @ Q5

CRYSTAL Y *Solder case of crystal to ground
____ 1 - 14.31818 MHz @ XTL

CONNECTORS
____ 1 - RCA video jack @ VID
____ 2 - audio jacks @ IN OUT
____ 1 - 1x3 header, straight, male @ SP
____ 1 - 1x4 header, straight, male @ K-14
____ 1 - power plug @ K-1
____ 8 - 50-pin card edge connector*
*CHECK possible point for short on slot 7 (K-12) as follows: trace from pin 24 between pins 26 & 27 as shown on layout on COMPONENT SIDE

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00
____ 4 - 74LS02
____ 1 - 74LS04
____ 2 - 74LS08
____ 1 - 74LS11
____ 1 - 74LS20
____ 1 - 74LS32
____ 1 - 74LS51
____ 3 - 74LS74
____ 4 - 74LS138
____ 1 - 74LS139
____ 1 - 74LS151
____ 4 - 74LS153
____ 4 - 74LS161
____ 2 - 74LS174
____ 3 - 74LS194
____ 1 - 74LS251

INTEGRATED CIRCUITS (continued)
____ 5 - 74LS257
____ 1 - 74LS259
____ 1 - 74LS283
____ 3 - 74LS367 or 8T97

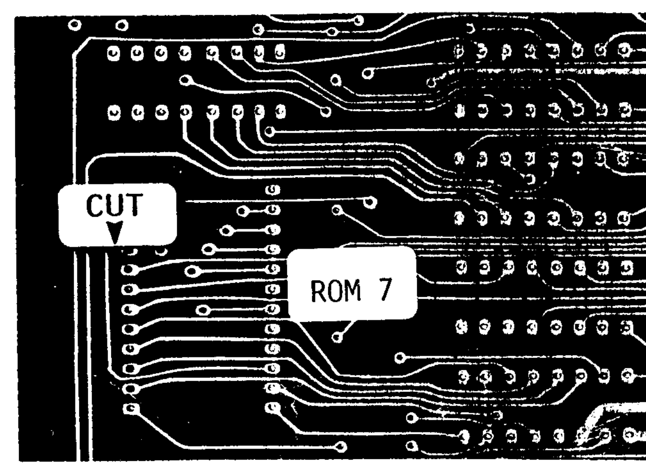
____ 1 - 74S86 @ 86
____ 1 - 74S175 @ 175
____ 1 - 74S195 @ 195

____ 1 - 74166 @ 166

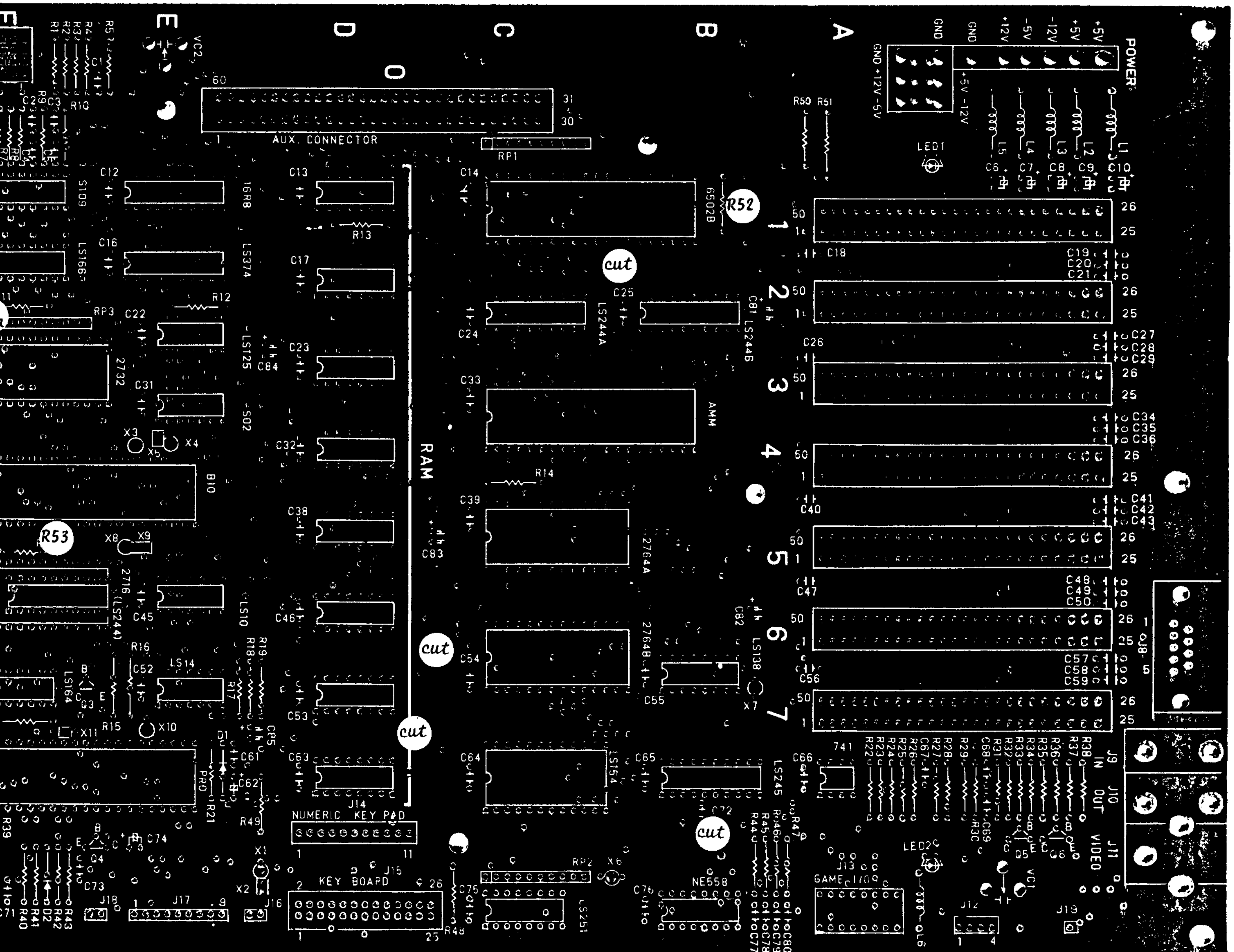
____ 2 - 8T28
____ 2 - NE555
____ 1 - NE558
____ 1 - 741

____ 1 - 6502 CPU
____ 7 - 2716 EPROMs @ ROM 1,2,3,4, ROM 5,6,7
____ 24 - 4116 dynamic RAM 200 ns or faster

*MODIFICATION REQUIRED ON SOLDER SIDE @ A-5,6 as shown below:
Cut trace from pin 9 of ROM 7 to line leading from pin 22 of ROM 7



RON 6502B/65C02 MOTHERBOARD: System Board features include: 6502B or 65C02 MPU; eight expansion slots for numerous peripherals (one 60-pin auxilliary slot and seven 50-pin slots); colour graphics capability; I/O ports. Requires modifications (four cuts on the component side), firmware (one 2716, one 2732 and two 2764 EPROMs), and three specialaized ICs. Supports various operating systems and programming languages.



actual size

29.2 cm x 22.2 cm

(layout is reduced)

NuScope Associates

RON 6502B/65C02 MOTHERBOARD (continued) *INDICATES A PRECAUTION

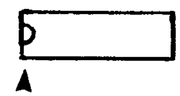
ES D *Position banded (cathode) end
of diode towards the arrow
2 - 1N914 @ D1,2

STORS R ¼ watt, 5% *R51 is 1 watt
*R20 is not equipped
3 - 47 Ω @ R5,13,14
1 - 51 Ω @ R4
2 - 75 Ω @ R38,40
7 - 100 Ω @ R27,36,37,44,45,46,47
1 - 100* Ω @ R51* 1 watt
5 - 120 Ω @ R1,6,8,9,10
1 - 150 Ω @ R2
2 - 200 Ω @ R41,50
1 - 270 Ω @ R3
1 - 330 Ω @ R31
2 - 470 Ω @ R43,48
6 - 1 KΩ @ R7,11,12,29,35,52
1 - 2.7 KΩ @ R30
2 - 4.7 KΩ @ R16,53
1 - 5.6 KΩ @ R33
2 - 6.8 KΩ @ R32,34
4 - 10 KΩ @ R17,18,19,21
5 - 12 KΩ @ R22,24,25,26,28
1 - 22 KΩ @ R15
1 - 47 KΩ @ R49
1 - 51 KΩ @ R42
1 - 100 KΩ @ R39
1 - 1 MΩ @ R23

ch pin 1 of the following SIPs
(bussed) with pin 1 (square pad)
on the layout
1 - 1 KΩ 10-pin SIP @ RP2
2 - 3.3 KΩ 10-pin SIP @ RP1,3

ETS *Match pin 1 of sockets with
pin 1 on the layout. Check that
ALL pins have passed thru ALL holes
1 - 8-pin

SOCKETS (continued)
5 - 14-pin
14 - 16-pin
3 - 20-pin
5 - 24-pin
2 - 28-pin
4 - 40-pin


pin 1

CAPACITORS C
2 - 47 pF @ C69,70
1 - 50 pF @ C21a @ location F-3
1 - 100 pF @ C68
4 - 220 pF @ C2,3,4,5
5 - 0.022 F @ C61,77,78,79,80
61 - 0.1 µF Monolithic @ C1,11 to 60,
@ C63,64,65,66,67,71,72,
@ C73,75,76
12 - 10 µF/16V Tantalum* @ C6,7,8,9,
@ C10,62,74,81,82,83,84,85
*Match + of Tantalums
with + on the layout
2 50 pF Trimcap @ VC1,2

TRANSISTORS Q *Match EBC transistor leads
with EBC on the layout
2 - 2N3904 @ Q3,6
3 - 2N3906 @ Q1,2,5
1 - MPSA13 @ Q4

CRYSTAL Y *Fold crystal flat against the
board before soldering.
1 - 14.31818 MHz @ XTAL1

COIL (CHOKE) L
1 - 27 µH @ L6
5 - Ferrite bead*, four-hole @ L1,2,3,
@ L4,5
*Not critical - hook-up wire may
be substituted at each location

LIGHT EMMITTING DIODES D *Position
flat part or shorter lead of
LED towards the arrow on layout
2 - LED @ LED1,2

HEADERS male, straight
1 - 1x4 @ J12 RF converter
1 - 1x11 @ J14 Num keypad
1 - 2x13 @ J15 Keyboard
1 - 1x2 @ J16
1 - 1x9 @ J17
1 - 1x2 @ J18 Speaker
1 - 1x1 @ J19 Video out

CONNECTORS
1 - 6-pin power @ POWER
1 - DE9S female, 90° @ J8
2 - Audio jacks @ J9,10
1 - RCA phono jack @ J11
1 - 60-pin card edge connector @ Ø
7 - 50-pin card edge connector
@ 1,2,3,4,5,6,7

INTEGRATED CIRCUITS *Match pin 1 of ICs
with pin 1 on the layout
1 - 74LS14 @ Location E-9
1 - 74LS10 @ E-8
1 - 74LS125 @ E-3
1 - 74LS138 @ B-9
1 - 74LS154 @ C-10
1 - 74LS164 @ F-9
1 - 74LS166 @ F-2
2 - 74LS244 @ B-3, C-3
1 - 74LS245 @ B-10
1 - 74LS251 @ C-11
1 - 74LS374 @ E-2

1 - 74S02 @ E-4
1 - 74S109 @ F-1

1 - NE558 @ B-11
1 - 741 @ A-10

BELTRON 6502B/65C02 MOTHERBOARD (continued)

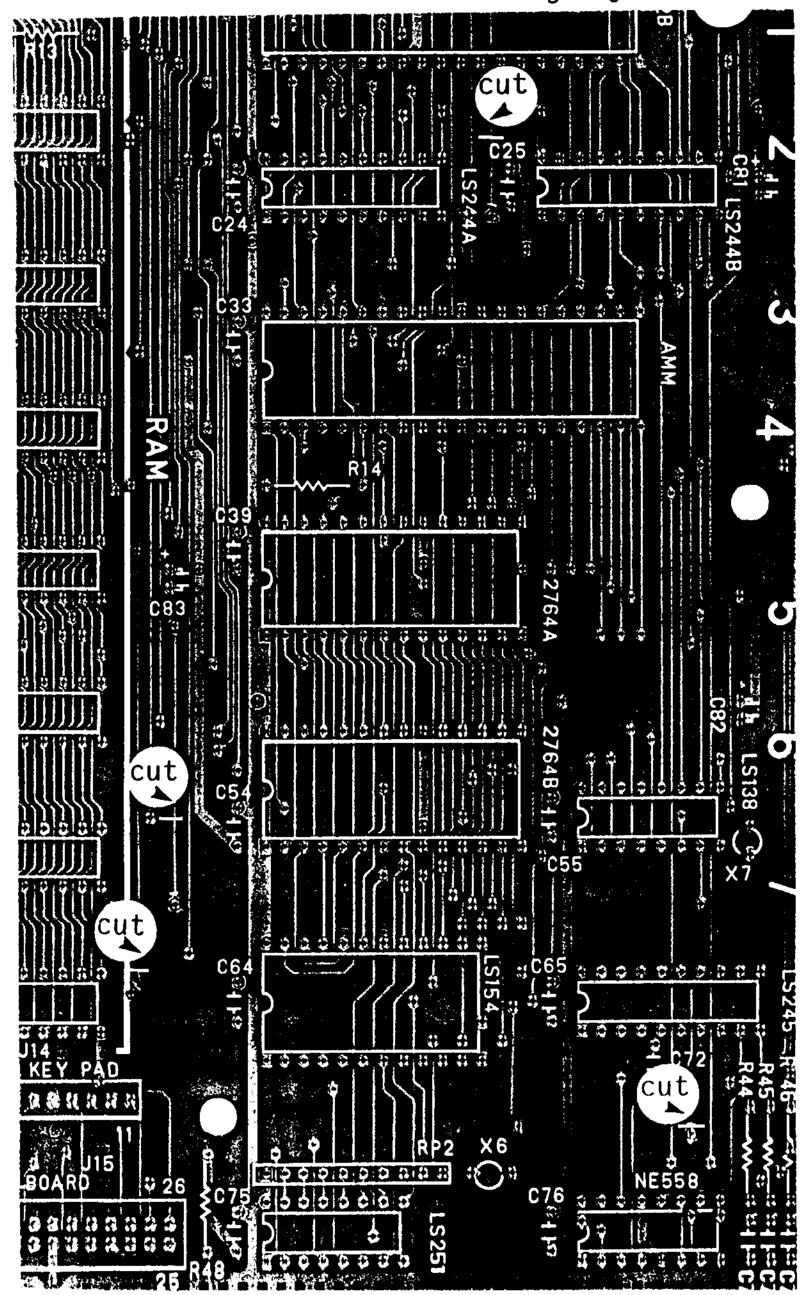
INTEGRATED CIRCUITS (continued)

____ 1 - 6502B MPU (or 65C02) @ BC-1
____ 1 - 2716 EPROM @ F-8
____ 1 - 2732 EPROM @ F-4
____ 1 - 2764 EPROM @ C-7
____ 1 - 2764 EPROM @ C-9
____ 8 - 4164 RAM 200 ns @ Row D
____ 1 - AY5-3600-PRO @ EF-10

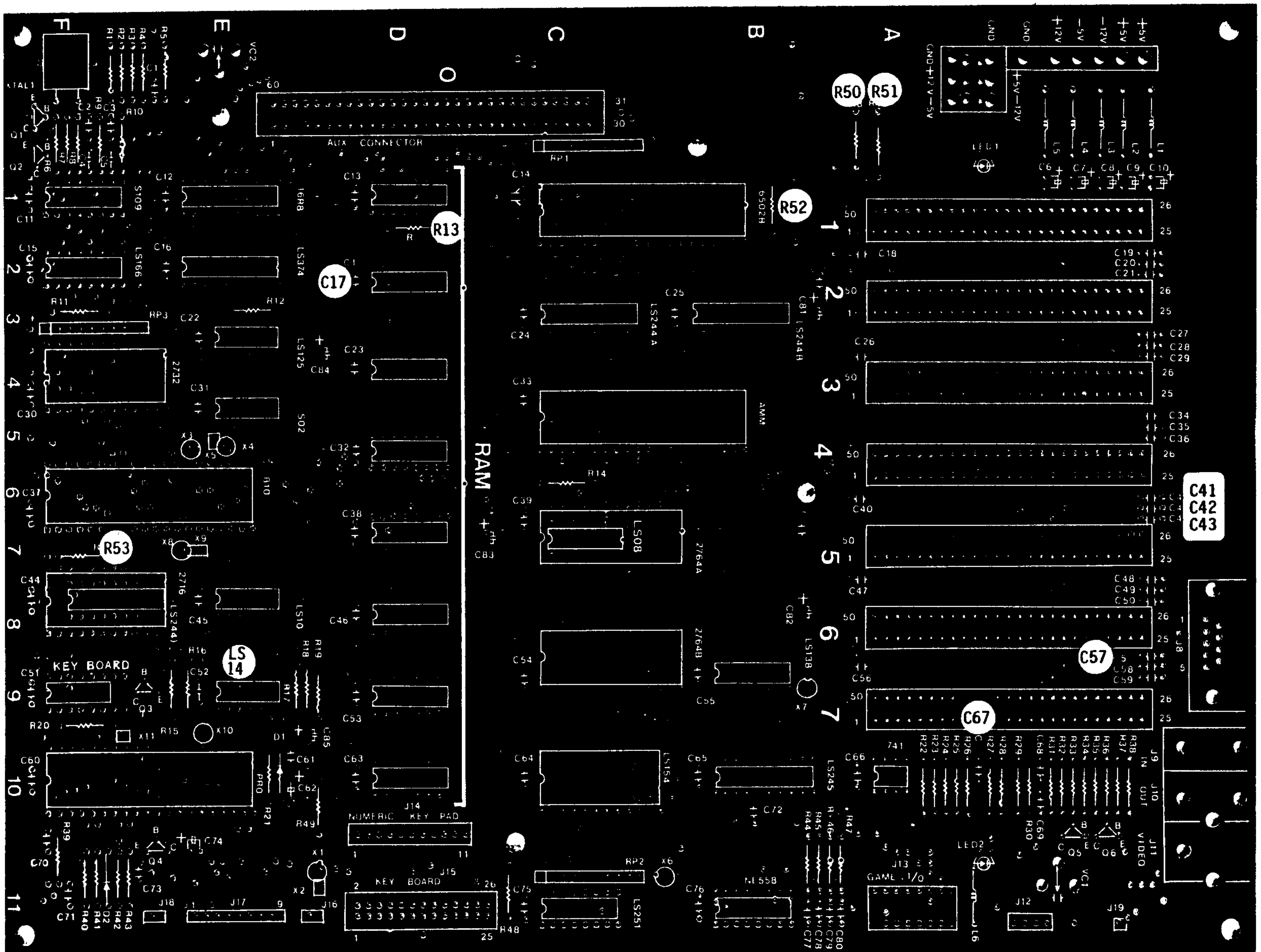
CUSTOM INTEGRATED CIRCUITS

____ 1 - STK65371 (or STK50371) @ BC-4
____ 1 - STK65301 @ EF-6
____ 1 - 16R8 PAL @ E-1

*MODIFICATIONS: Make four cuts on the COMPONENT SIDE as shown on the following layout:



JK 6502B/65C02 MOTHERBOARD: System board features include: 6502B or 65C02 MPU; 64 K of RAM expandable via the auxilliary slot; eight exansion slots for numerous peripherals (one 60-pin & seven 50-pin slots); colour graphics capability; I/O ports. Requires firmware* (one 2716, one 2732 & two 2764 EPROMs), & three specialized ICs. Supports various operating systems and programming languages. Requires modifications.



actual size
29.2 cm x 22.2 cm
(layout is reduced)

B/65C02 MOTHERBOARD: (continued) *INDICATES A PRECAUTION

D *Position banded (cathode) end
diode towards the arrow
- 1N914 @ D1,2

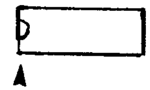
RS R ¼ watt, 5% *R51 is 1 watt
20 is not equipped
- 47 Ω @ R5,13,14
- 51 Ω @ R4
- 75 Ω @ R38,40
- 100 Ω @ R27,36,37,44,45,46,47
- 100* Ω @ R51* 1 watt
- 120 Ω @ R1,6,8,9,10
- 150 Ω @ R2
- 200 Ω @ R41,50
- 270 Ω @ R3
- 330 Ω @ R31
- 470 Ω @ R43,48
- 1 KΩ @ R7,11,12,29,35,52
- 2.7 KΩ @ R30
- 4.7 KΩ @ R16,53
- 5.6 KΩ @ R33
- 6.8 KΩ @ R32,34
- 10 KΩ @ R17,18,19,21
- 12 KΩ @ R22,24,25,26,28
- 22 KΩ @ R15
- 47 KΩ @ R49
- 51 KΩ @ R42
- 100 KΩ @ R39
- 1 MΩ @ R23

pin 1 of the following SIPs
ussed) with pin 1 (square pad)
the layout
- 1 KΩ 10-pin SIP @ RP2
- 4.7 KΩ 10-pin SIP @ RP1,3

*Match pin 1 of sockets with
n 1 on the layout. Check that
pins have passed thru ALL holes
- 8-pin

SOCKETS (continued)

____ 5 - 14-pin
____ 14 - 16-pin
____ 3 - 20-pin
____ 5 - 24-pin
____ 2 - 28-pin
____ 4 - 40-pin


pin 1

CAPACITORS C

____ 2 - 47 pF @ C69,70

____ 1 - 100 pF @ C68
____ 4 - 220 pF @ C2,3,4,5
____ 5 - 0.022µF @ C61,77,78,79,80
____ 61 - 0.1 µF Monolithic @ C1,11 to 60,
@ C63,64,65,66,67,71,72,
@ C73,75,76
____ 12 - 10 µF/16V Tantalum* @ C6,7,8,9,
@ C10,62,74,81,82,83,84,85
*Match + of Tantalums
with + on the layout
____ 2 50 pF Trimcap @ VC1,2

TRANSISTORS Q *Match EBC transistor leads
with EBC on the layout

____ 2 - 2N3904 @ Q3,6
____ 3 - 2N3906 @ Q1,2,5
____ 1 - MPSA13 @ Q4

CRYSTAL Y *Fold crystal flat against the
board before soldering.

____ 1 - 14.31818 MHz @ XTAL1

COIL (CHOKE) L

____ 1 - 27 µH @ L6
____ 5 - Ferrite bead*, four-hole @ L1,2,3,
@ L4,5
*Not critical - hook-up wire may
be substituted at each location

LIGHT EMMITTING DIODES D *Position
flat part or shorter lead of
LED towards the arrow on layout

____ 2 - LED @ LED1,2

HEADERS male, straight

____ 1 - 1x4 @ J12 RF converter
____ 1 - 1x11 @ J14 Num keypad
____ 1 - 2x13 @ J15 Keyboard
____ 1 - 1x2 @ J16
____ 1 - 1x9 @ J17
____ 1 - 1x2 @ J18 Speaker
____ 1 - 1x1 @ J19 Video out

CONNECTORS

____ 1 - 6-pin power @ POWER
____ 1 - DE9S female, 90° @ J8
____ 2 - Audio jacks @ J9,10
____ 1 - RCA phono jack @ J11
____ 1 - 60-pin card edge connector @ Ø
____ 7 - 50-pin card edge connector
@ 1,2,3,4,5,6,7

INTEGRATED CIRCUITS *Match pin 1 of ICs
with pin 1 on the layout

____ 1 - 74LS14 @ Location E-9
____ 1 - 74LS10 @ E-8
____ 1 - 74LS125 @ E-3
____ 1 - 74LS138 @ B-9
____ 1 - 74LS154 @ C-10

____ 1 - 74LS166 @ F-2
____ 2 - 74LS244 @ B-3, C-3
____ 1 - 74LS245 @ B-10
____ 1 - 74LS251 @ C-11
____ 1 - 74LS374 @ E-2

____ 1 - 74S02 @ E-4
____ 1 - 74S109 @ F-1

____ 1 - NE558 @ B-11
____ 1 - 741 @ A-10

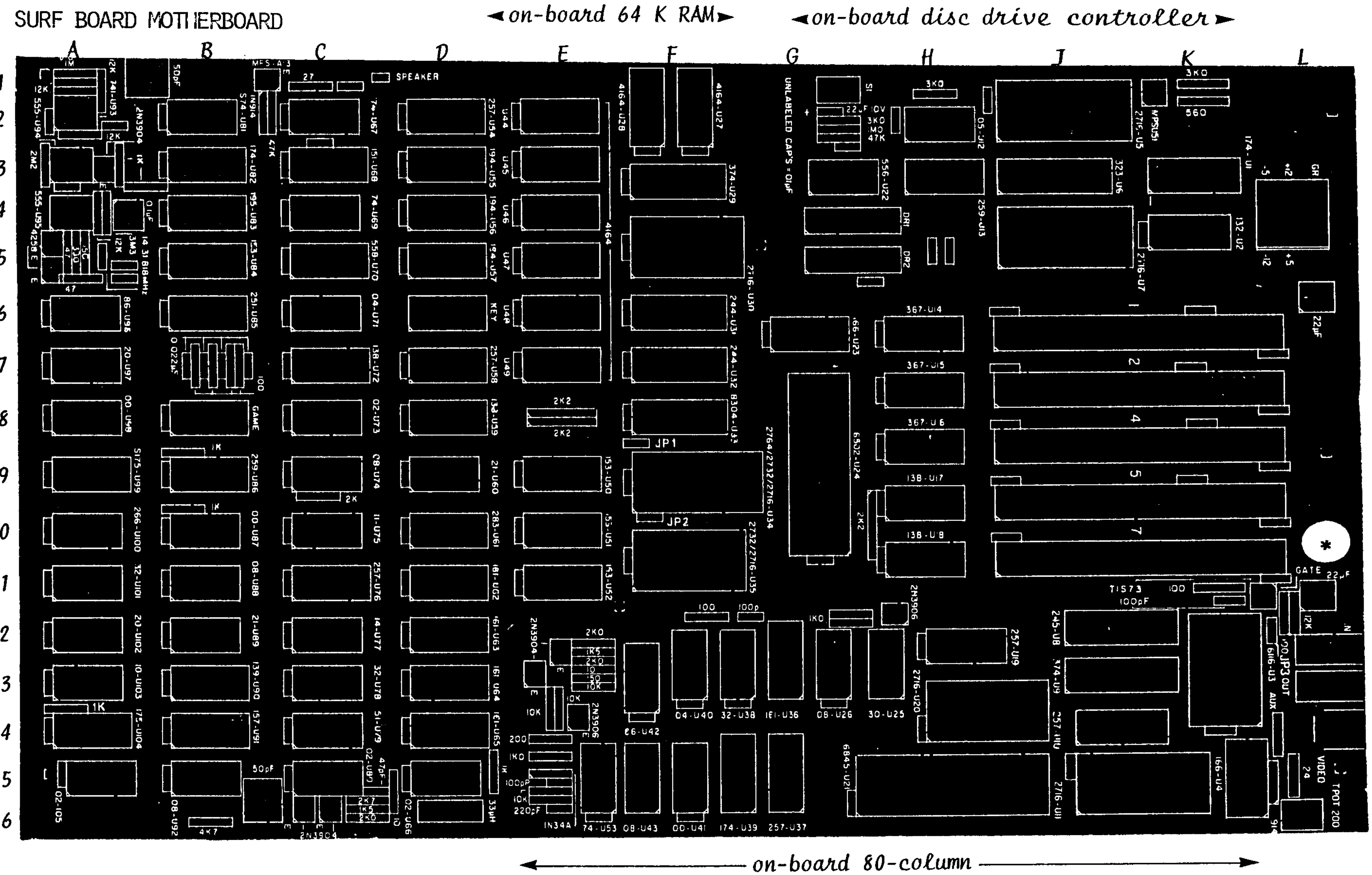
6502B/65C02 MOTHERBOARD (continued)

```
EGRATED CIRCUITS (continued)
_ 1 - 6502B MPU (or 65C02) @ BC-1
_ 1 - 2716  EPROM @ F-8 *74LS244 NOT required
                  @ F-8
_ 1 - 2732  EPROM @ F-4
_ 1 - 2764  EPEOM @ C-7
_ 1 - 2764  EPEOM @ C-9 *74LS08 NOT required
                  @ C-9
_ 8 - 4164  RAM 200 ns @ Row D
_ 1 - AY5-3600-PRO @ EF-10

TOM INTEGRATED CIRCUITS
_ 1 - STK65371 (or STK50371) @ BC-4
_ 1 - STK65301  @ EF-6
_ 1 - 16R8 PAL  @ E-1

IFICATIONS
_ - - cut split circle open @ X10 (E-10)
_ - - cut bowtie open @ X11 (E-10)
```

SURF BOARD MOTHERBOARD



A Fig. 2-16. A COPY OF THE COMPONENT SIDE OF THE SURF-BOARD PCB (REDUCED IN SIZE) SHOWING THE COMPONENT LAYOUT. SOME OF THE UNIQUE FEATURES OF THE SURF-BOARD NOT NORMALLY FOUND ON OTHER SIMILAR PERSONAL COMPUTERS INCLUDE: 64 K BYTES OF USER MEMORY, DUAL DISC DRIVE CONTROLLER; 80-COLUMN TEXT DISPLAY WITH UPPER/LOWER CASE, AS WELL AS HIGH/LOW RESOLUTION COLOUR GRAPHICS, FIVE EXPANSION SLOTS, CASSETTE AND JOYSTICK IN/OUTPUTS, ETC.

*The "GATE" of the TIS73 FET transistor is INCORRECTLY silk-screened on the motherboard. Refer to FIG. 5-2, B for correct installation.

B SURF-BOARD PARTS LIST

RESISTORS R, ¼ watt, 5%

____ 2 - 10 Ω
____ 1 - 24 Ω
____ 1 - 27 Ω
____ 2 - 47 Ω
____ 7 - 100 Ω
____ 2 - 150 Ω
____ 1 - 200 Ω
____ 1 - 330 Ω

____ 1 - 560 Ω
____ 9 - 1 KΩ
____ 2 - 1.5 KΩ
____ 4 - 2 KΩ
____ 1 - 2.7 KΩ
____ 3 - 3 KΩ
____ 1 - 4.7 KΩ
____ 5 - 10 KΩ

____ 6 - 12 KΩ
____ 2 - 47 KΩ
____ 2 - 1 MΩ
____ 1 - 2.2 MΩ
____ 1 - 3.3 MΩ
____ 3 - 2.2 KΩ x 8 SIP
____ 1 - 200 Ω Trimpot

DIODES D

____ 2 - IN914
____ 1 - IN34A or IN27C

COIL L

____ 1 - 33 µHz

CRYSTAL Y

____ 1 - 14.31818 MHz

CAPACITORS C

____ 1 - 47 pF
____ 3 - 100 pF
____ 1 - 220 pF
____ 116 - 0.1 µF
____ 3 - 22 µF Tantalum
____ 2 - 50 pF Trimcap
____ 4 -0.02 µF/10v Tantalum

TRANSISTORS Q

____ 5 - 2N3904
____ 2 - 2N3906
____ 2 - 2N4258
____ 1 - MPSA13
____ 1 - MPSU51
____ 1 - TIS73 (FET)

SOCKETS

____ 3 - 8-pin
____ 36 - 14-pin
____ 51 - 16-pin
____ 7 - 20-pin
____ 7 - 24-pin
____ 1 - 28-pin
____ 2 - 40-pin

INTEGRATED CIRCUITS IC

TTL 74LSxxx ICs

____ 3 - 74LS00 @ U41,87,98
____ 4 - 74LS02 @ U66,73,105, U80
____ 2 - 74LS04 @ U40,71
____ 1 - 74LS05 @ U12
____ 5 - 74LS08 @ U26,43,74, U88,92
____ 1 - 74LS10 @ U103
____ 1 - 74LS11 @ U75
____ 1 - 74LS14 @ U77
____ 2 - 74LS20 @ U97,102
____ 2 - 74LS21 @ U60,89
____ 1 - 74LS30 @ U25
____ 3 - 74LS32 @ U38,78,101
____ 1 - 74LS51 @ U79
____ 3 - 74LS74 @ U53,67,69
____ 2 - 74LS86 @ U42,69
____ 1 - 74LS132 @ U2
____ 4 - 74LS138 @ U17,18,59, U72
____ 1 - 74LS139 @ U90
____ 1 - 74LS151 @ U68
____ 4 - 74LS153 @ U50,51,52, U84
____ 1 - 74LS157 @ U91
____ 5 - 74LS161 @ U36,62...65

TTL 74LSxxx ICs (cont)

____ 2 - 74LS166 @ U4,23
____ 3 - 74LS174 @ U1,39,82
____ 1 - 74LS175 @ U104
____ 3 - 74LS194 @ U55,56,57,
____ 1 - 74LS195 @ U83
____ 2 - 74LS244 @ U31,32
____ 1 - 74LS245 @ U8
____ 1 - 74LS251 @ U85
____ 6 - 74LS257 @ U10,19,37, U54,58,76
____ 2 - 74LS259 @ U13,86
____ 1 - 74LS266 @ U100
____ 1 - 74LS283 @ U61
____ 1 - 74LS323 @ U6
____ 3 - 74LS367 @ U14,15,16
____ 2 - 74LS374 @ U9,29

TTL 74Sxxx ICs

____ 1 - 74S74 @ U81
____ 1 - 74S175 @ U99

LINEAR ICs

____ 2 - LM555 @ U94,95
____ 1 - LM741 @ U93
____ 1 - NE556 @ U22
____ 1 - NE558 @ U70

TTL BUFFER IC

____ 1 - 8304 @ U33

MEMORY ICS

Refer to Table 9-1

CPU ICs

____ 1 - 6502 @ U24
____ 1 - 6845 @ U21

DYNAMIC RAM ICs

____ 8 - 4164 @ U27,28, U44...49

STATIC RAM IC

____ 1 - 6116 @ U3

EPROM ICs

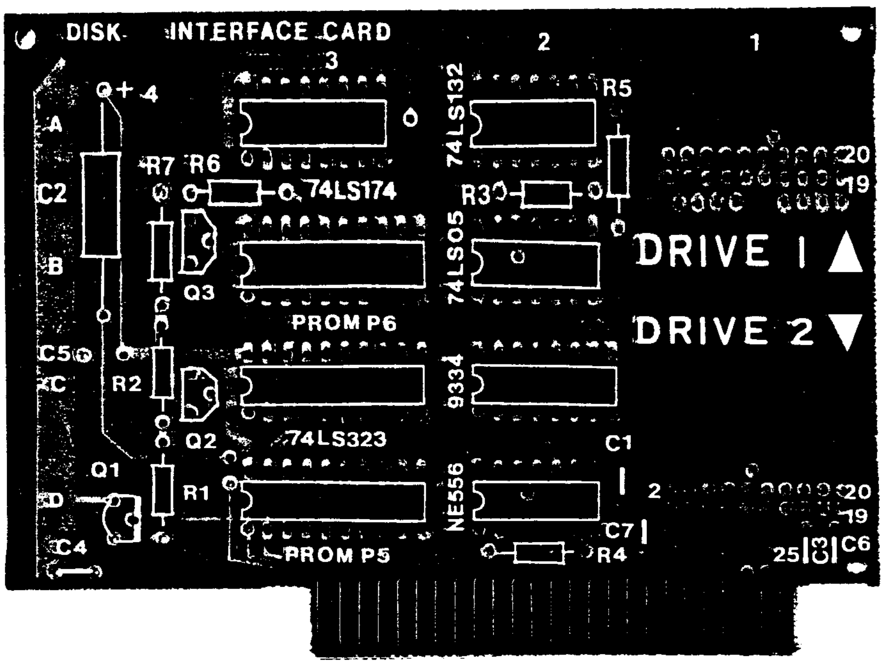
____ 1 - 2732 or 2716 @ U35
____ 1 - 2764 or 2732 or 2716 @ U34
____ 5 - 2716 @ U5,7,11, U20,30

ACCESSORIES

____ 1 - "Surf-Board" motherboard
____ 1 - RCA video jack (PCB mount)
____ 2 - audio jacks (PCB mount)
____ 2 - 2x10 male header strip (straight)
____ 1 - 1x16 male header strip (straight)
____ 1 - ABS keyboard case

DISK CONTROLLER CARD: (TWO DRIVES)

Allows one to interface one or two disk drives with the microcomputer. With power off, install in slot number 6. Requires firmware (two PROMS).



↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

*Position header pins of DRIVE 1 and DRIVE 2 UP.

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

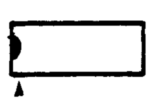
____ 1 - 68 Ω @ R2
____ 1 - 150 Ω @ R1
____ 1 - 560 Ω @ R6
____ 2 - 3 KΩ @ R3,7
____ 1 - 47 KΩ @ R5
____ 1 - 1 MΩ @ R4

CAPACITORS C

____ 6 - 0.1 μF @ C1,3,4,5,6,7
____ 1 - 22 μF/25v axial* @ C2
*Match + of capacitor to + on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins of sockets have passed thru ALL holes

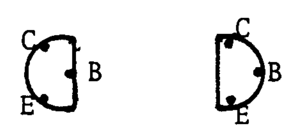
____ 3 - 14-pin
____ 2 - 16-pin
____ 3 - 20-pin



pin 1

TRANSISTORS Q *Install 3 leads as shown

____ 1 - 2N3906 @ Q1
____ 2 - MPSU51 @ Q2,3



Q1 Q2,3

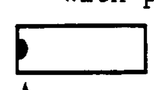
*Check with supplier re EBC leads of transistors

CONNECTORS *Connector pins must be positioned UP as shown by ↑ ↑ ↑ ↑ ↑ ↑

____ 2 - 2X10 male header strip, right angles

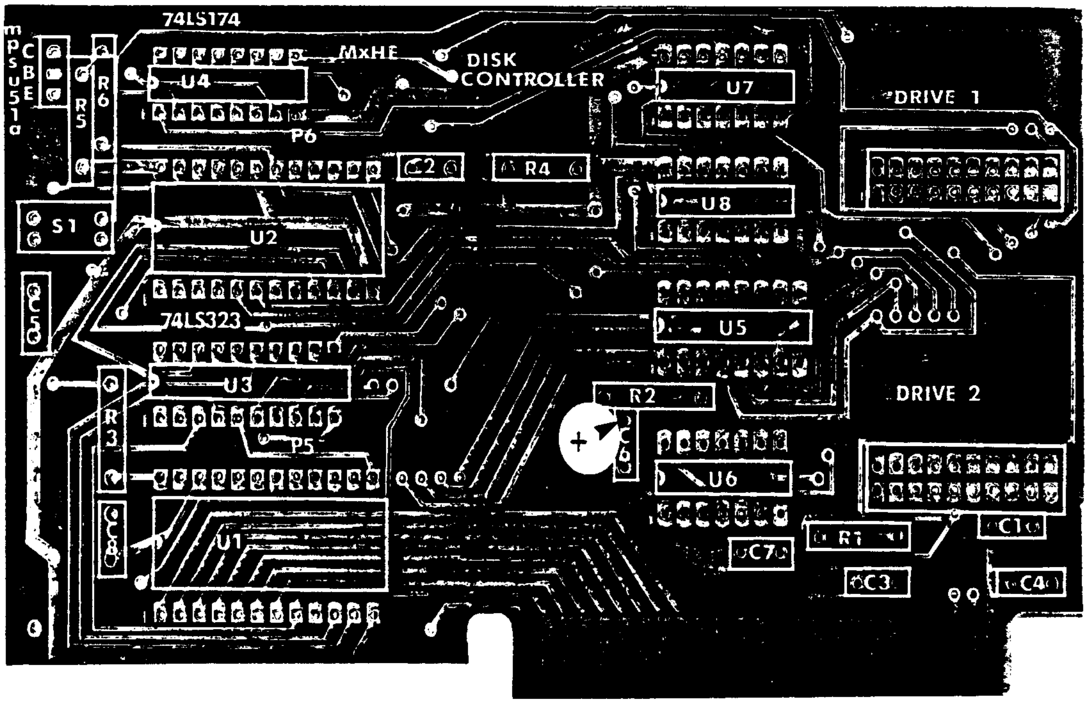
INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

____ 1 - 74LS05
____ 1 - 74LS174
____ 1 - 74LS132
____ 1 - 74LS323
____ 1 - 9334 (74LS259)
____ 1 - NE556
____ 2 - 6309 PROMs @ P5,6



pin 1 lower left for ALL sockets & ICs

APL-DISK CONTROLLER CARD: Allows user to interface one or two disk drives with the computer. With power off, install in slot number 6. Requires firmware (two EPROMS). Switch-selectable for DOS 3.2 or 3.3.



Position connector pins of drive 1 & 2 UP

SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 560 Ω @ R6
____ 3 - 3 KΩ @ R3,4,5
____ 1 - 47 KΩ @ R2
____ 1 - 1 MΩ @ R1

SOCKETS *Match pin 1 of sockets with pin 1 on the layout
____ 3 - 14-pin
____ 2 - 16-pin
____ 1 - 20-pin
____ 2 - 24-pin

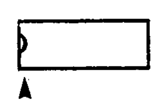
CAPACITORS C
____ 7 - 0.1 μF Monolithic @ C1,2,3,4,5, C7,8
____ 1 - 22 μF/25V radial* @ C6
*Match + of capacitor with + on the layout

TRANSISTOR Q *Position EBC leads as shown on the layout
____ 1 - MPSU51A

SWITCH
____ 1 - SPST PCB mount @ S1

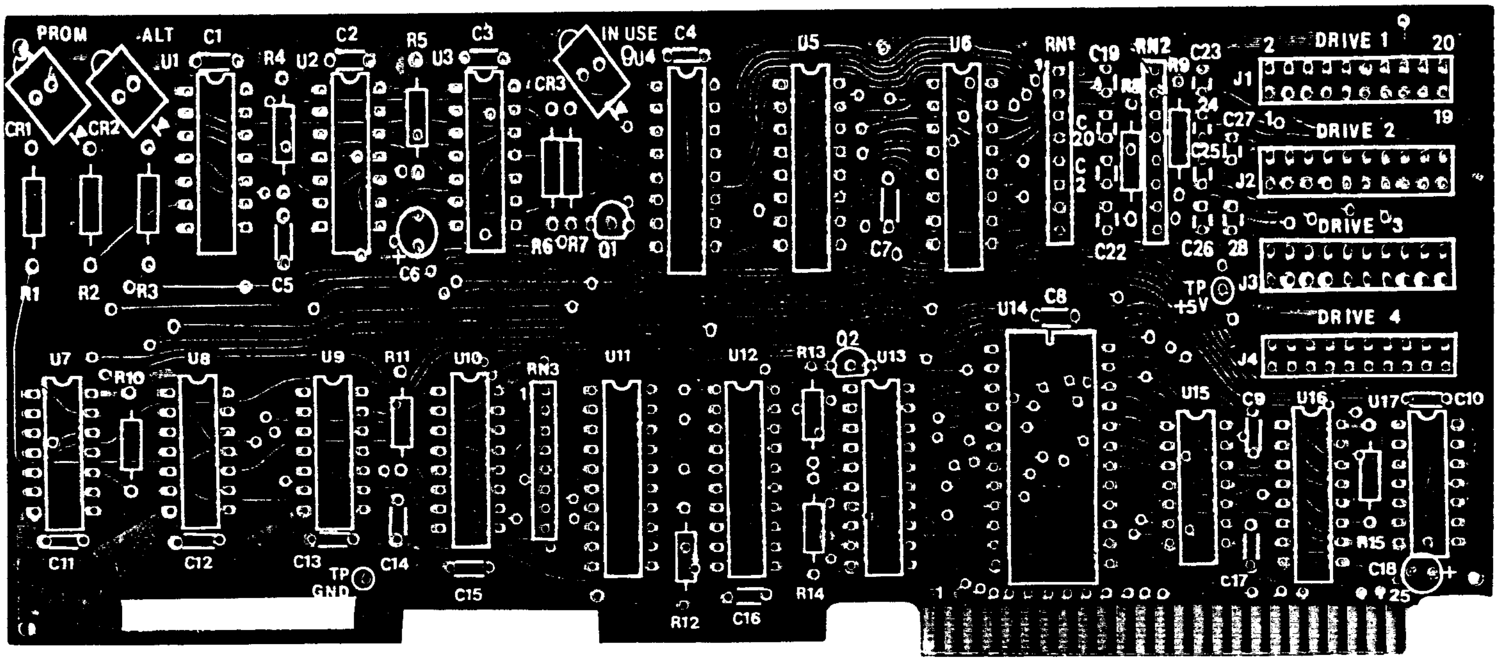
CONNECTORS *Position connector pins UP as shown on the layout
____ 2 - 2x10 male header strip, right angle

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 2716 EPROM 350 ns @ U1 (P5)
____ 1 - 2716 EPROM 350 ns @ U2 (P6)
____ 1 - 74LS323 @ U3
____ 1 - 74LS174 @ U4
____ 1 - 74LS259 @ U5
____ 1 - 556 @ U6
____ 1 - 74LS132 @ U7
____ 1 - 74LS05 @ U8



pin 1 lower left for ALL sockets & ICs

QUAD DRIVE CARD: Controls from one to four minifloppy disk drives. Automatically boots DOS 3.2 or 3.3, 13 or 16-sector. Requires software (one disk) and firmware (one PROM and one EPROM). With power off, install in slot 6.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 33 Ω @ R8,9
____ 1 - 100 Ω @ R11
____ 1 - 470 Ω @ R12
____ 6 - 680 Ω @ R1,2,6,7,13,14
____ 1 - 4.7 KΩ @ R15
____ 1 - 47 KΩ @ R5
____ 1 - 1 MΩ @ R4
____ 2 - 4S33 Ω SIP* (isolated) @ RN1,2
____ 1 - 4.7 KΩ SIP* (bussed) @ RN3
____ 1 - 5 KΩ @ R3
____ 1 - 1 KΩ @ R10

*Match pin 1 (common) of SIP with pin 1 on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout (upper left for ALL SOCKETS)

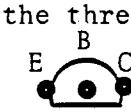
____ 8 - 14-pin
____ 5 - 16-pin
____ 3 - 20-pin
____ 1 - 24-pin

CAPACITORS C

____ 1 - 180 pF @ C14
____ 10 - 0.001 μF Monolithic @ C19,20,21, C22,23,24,25,26,27,28
____ 15 - 0.1 μF Monolithic @ C1,2,3,4, C5,7,8,9,10,11,12,13, C15,16,17
____ 1 - 4.7 μF/50v Radial* @ C18
____ 1 - 22 μF/16v Radial* @ C6

*Match + of capacitor with + on the layout

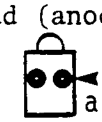
TRANSISTORS Q *Install the three EBC leads as shown



____ 2 - 2N3906 @ Q1,2

DIODES D

____ 3 - LED *Position longer lead (anode) of LEDs as shown @ CR1,2,3



CONNECTORS

____ 4 - 2x10 male header strip, straight

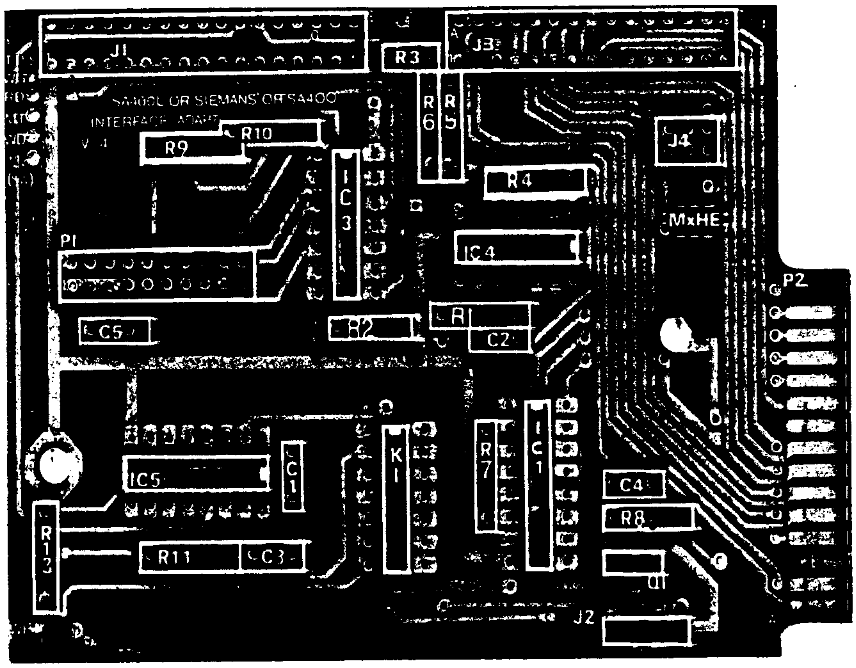
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on layout

____ 1 - 74LS00 @ U9
____ 1 - 74LS02 @ U17
____ 1 - 74LS05 @ U3
____ 1 - 74LS08 @ U8
____ 1 - 74LS30 @ U15
____ 2 - 74LS74 @ U1,7
____ 1 - 74LS138 @ U4
____ 1 - 74LS174 @ U10
____ 1 - 74LS257 @ U16
____ 1 - 74LS259 @ U6
____ 1 - 74LS323 @ U12
____ 1 - 74LS367 @ U5
____ 1 - NE556 @ U2
____ 1 - DP8304 @ U13
____ 1 - 2716 EPROM @ U14
____ 1 - 7649A-5 PROM @ U11

pin 1 upper left for ALL ICs & SOCKETS

N-Scope Associates

SHUGART DISK DRIVE INTERFACE ADAPTER CARD: Install in SA400L disk drive to interface drive with disk controller card of computer. Schematics available from supplier.

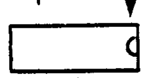


SEQUENCE * INDICATES A PRECUTION

RESISTORS R ¼ watt, 5%
*R3 & R12 are not equipped
____ 1 - 330 Ω @ R8
____ 1 - 560 Ω @ R7
____ 1 - 1.5 KΩ @ R11
____ 6 - 3 KΩ @ R1,2,4,5,6,13
*Mount R9 & R10 on the SOLDER SIDE
____ 2 - 3 KΩ @ R9,10

SOCKETS * Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 2 - 14-pin
____ 2 - 16-pin

pin 1



CAPACITORS C
____ 2 - 330 pF @ C2,3
____ 3 - 0.1 F Monolithic @ C1,4,5

TRANSISTOR Q *Match EBC transistor leads with EBC on the layout
____ 1 - MPSU51 @ Q1

CONNECTORS *J4 is not equipped
____ 1 - 1x4 header, male, straight @ J2

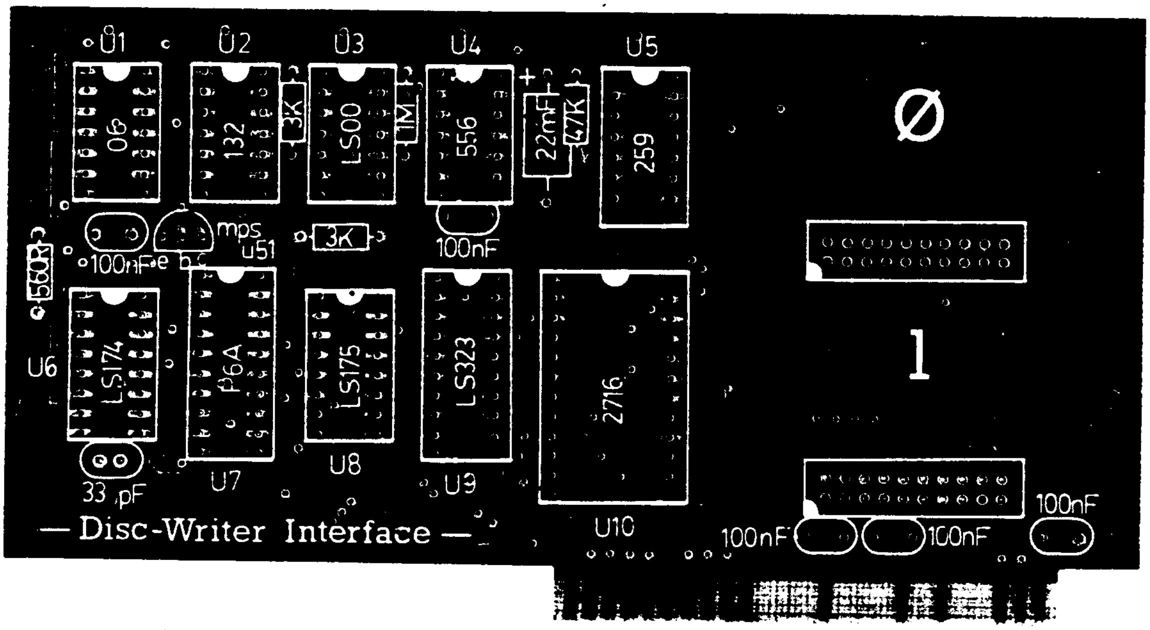
J2

+5 GND +12

____ 1 - 2x10 header, right angle PC mount @ P1 *Position pins UP
*Mount the following connectors on the SOLDER SIDE
____ 1 - 34-pin card edge connector @ J1
____ 1 - 30-pin card edge connector @ J3

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - ULN2003 (Sprague) @ IC1
____ 1 - 74LS125 @ IC3
____ 1 - 74LS86 @ IC4
____ 1 - 74LS123 @ IC5

DISK-WRITER INTERFACE CARD: Allows user to run one or two 5¼" floppy disk drives. Automatically boots 13 or 16-sector diskettes. With power off, install in slot number 6. Requires firmware (one PROM and one EPROM).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 560 Ω
____ 2 - 3 KΩ
____ 1 - 47 KΩ
____ 1 - 1 MΩ

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 4 - 14-pin
____ 3 - 16-pin
____ 2 - 20-pin
____ 1 - 24-pin

CAPACITORS C
____ 1 - 33 pF
____ 5 - 0.1 µF Monolithic @ 100 nF
____ 1 - 22 µF/16V Axial* @ 22 mF
*Match + of Axial with + on the layout

TRANSISTOR Q *Position the EBC leads as shown on the layout
____ 1 - 2N3904 @ MPSU51

CONNECTORS
____ 2 - 2x10 male header, right angles*
*Position header pins UP

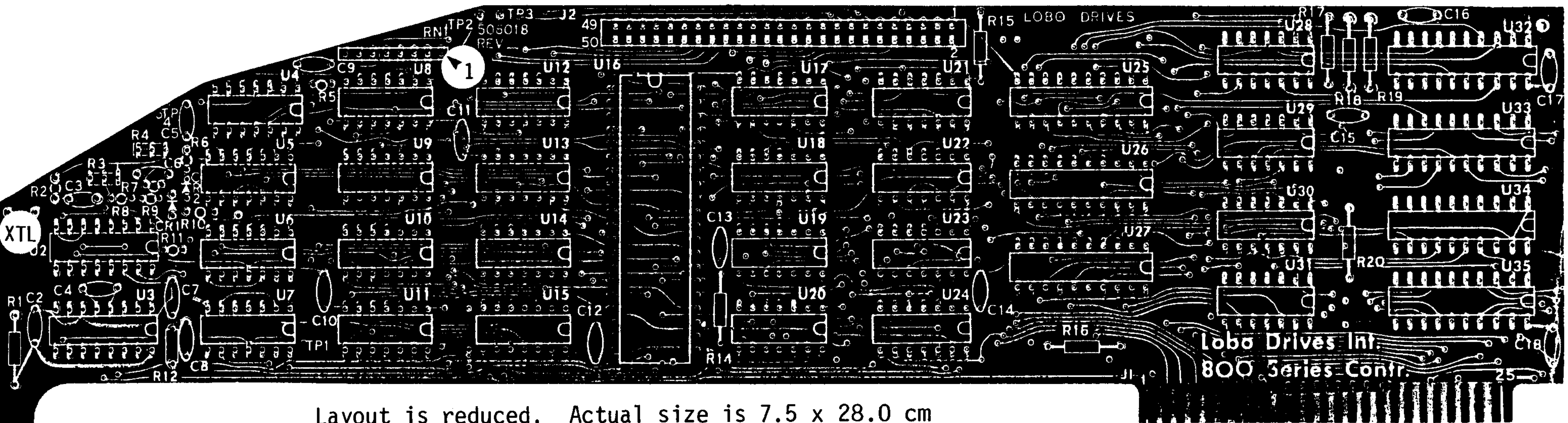
INTEGTATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 7406 @ U1
____ 1 - 74132 @ U2
____ 1 - 74259 @ U5

____ 1 - 74LS00 @ U3
____ 1 - 74LS174 @ U6
____ 1 - 74LS175 @ U8
____ 1 - 74LS323 @ U9

____ 1 - NE556 @ U4

____ 1 - 2716 EPROM @ U10
____ 1 - 68F5 (P6A) PROM @ U7

8-INCH FLOPPY DISK CONTROLLER CARD: Increases memory storage capacity by allowing user to interface up to four standard 8" single or double-sided, double-density floppy disk drives with the computer. Allows access to standard 8" CP/M disk with appropriate CP/M card installed & software. Documentation & schematics are avialable from the supplier. Requires firmware (one EPROM) & software (one disk).



Layout is reduced. Actual size is 7.5 x 28.0 cm

SUGGESTED SEQUENCE *INDICATES A PRECAUTION *INSTALL COMPONENTS LABELLED † ON THEIR ENDS

DIODES D *Position banded end of diode towards the arrow

____ 2 - 1N4148 @ CR1†,CR2†

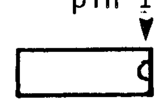
RESISTORS R ¼ watt, 5% *R13 is not equipped

____ 2 - 200 Ω @ R6†,R10†
____ 1 - 330 Ω @ R14
____ 4 - 1 KΩ @ R5†,R11†,R18,R19
____ 1 - 2.2 KΩ @ R16
____ 1 - 2.7 KΩ @ R7†
____ 4 - 4.7 KΩ @ R1,R12†,R15,R20
____ 1 - 5.6 KΩ @ R2†
____ 1 - 10 KΩ @ R17
____ 1 - 15 KΩ @ R9†
____ 1 - 100 KΩ @ R8†
____ 1 - 150 Ω 8-pin SIP* bussed @ RN1
*Match pin 1 of SIP with pin 1 on the layout
____ 2 - 5 KΩ Trimpot @ R3,4
10-turn recommended

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 23 - 14-pin
____ 3 - 16-pin
____ 7 - 20-pin
____ 1 - 40-pin

pin 1



CAPACITORS C *C1 is not equipped

____ 1 - 68 pF @ C3
____ 1 - 100 pF @ C13
____ 2 - 150 pF @ C7,8
____ 1 - 200 pF Silver Mica @ C4**
____ 1 - 0.001 µF @ C5
____ 1 - 0.01 µF @ C6
____ 10 - 0.1 µF Monolithic @ C2,9,10,11 C12,14,15,16,17,18

CRYSTAL Y *Fold crystal flat against the card before soldering

____ 1 - 8.0000 MHz @ XTL

TERMINAL POSTS ½" wire-wrap posts or 18-gage wire

____ 4 - @ TP1,2,3,4

CONNECTOR

____ 1 - 2x25 header, male, straight @ J2

(continued)

-INCH FLOPPY DISK CONTROLLER CARD (continued)

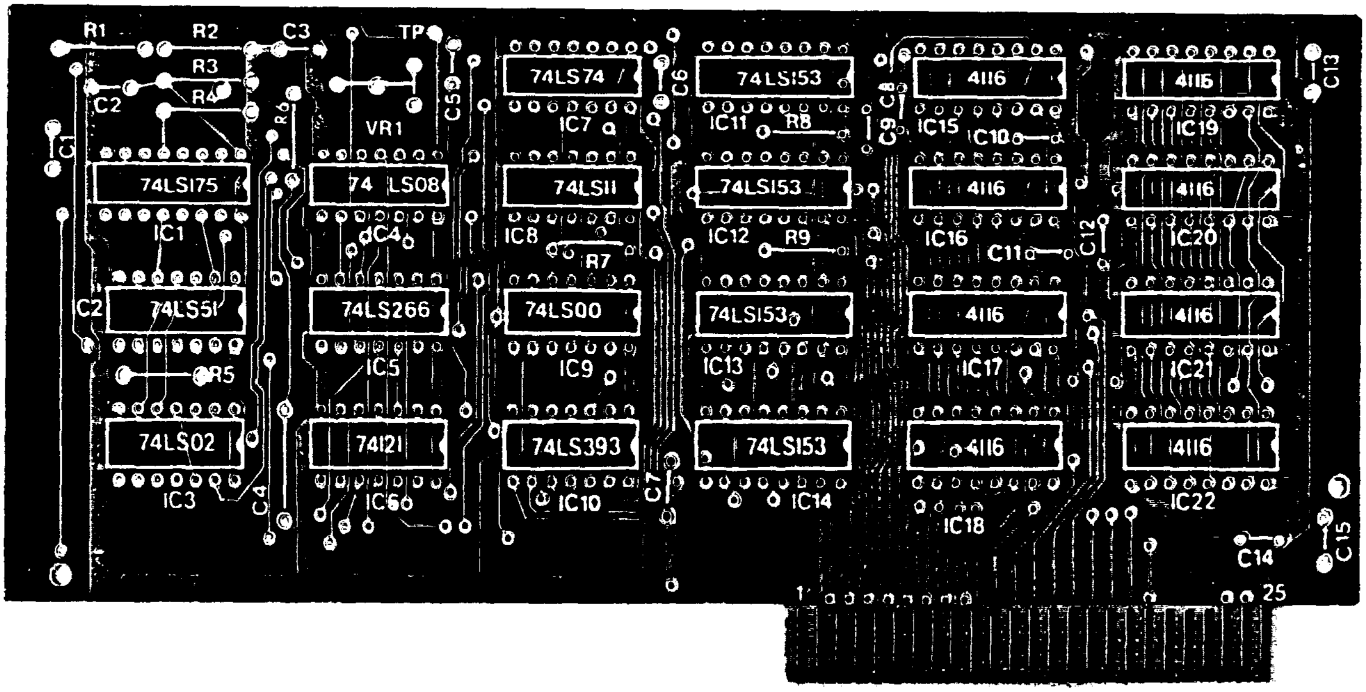
```
NTEGRATED CIRCUITS  *Match pin 1 of ICs
ith pin 1 on the layout
U1 is not equipped
___ 1 - 74LS00  @ U11
___ 1 - 74LS02  @ U9
___ 2 - 74LS04  @ U4,10
___ 2 - 74LS07  @ U12.20
___ 1 - 74LS08  @ U18
___ 2 - 74LS14  @ U8,24
___ 5 - 74LS32  @ U14,17,19,22,23
___ 4 - 74LS74  @ U5,6,7,21
___ 1 - 74LS123 @ U2
___ 1 - 74LS175 @ U15
___ 4 - 74LS177 or 74LS197
                @ U28,29,30,31
___ 2 - 74LS240 @ U33,34
___ 2 - 74LS244 @ U26,27
___ 1 - 74LS273 @ U32
___ 1 - 74LS373 @ U35

___ 1 - 7438    @ U13
___ 1 - 74124   @ U3 Substitues:
                  74LS124 - use 130 pF @ C4**
                  74S124  - use 330 pF @ C4**

___ 1 - MB8866 or MB8876 (Fujitsu)
               or WD1791 (Western Digital) @ U16

___ 1 - 28S42 (T.I.) 512x8 PROM
                @ U25
```

16 K RAM CARD: Expands the capabilities of your system by increasing its internal memory to 64 K of RAM memory. With power off, install in slot Ø.

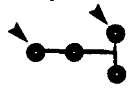


SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 4 - 2.7 KΩ @ R1,2,3,5
____ 5 - 1 KΩ @ R4,6,7,8,9
____ 1 - 2.2.KΩ @ VR1*

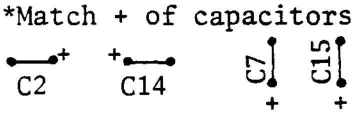
*Position this resistor as shown by arrows



CAPACITORS C

____ 1 - 68 pF @ C1
____ 9 - 0.1 μF @ C3,5,6,8,9,10,11,12,13
____ 1 - 100 pF @ C4
____ 4 - 15 μF/16v Tantalum*@ C2,7,14,15

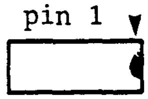
*Match + of capacitors as shown



SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 9 - 14-pin
____ 13 - 16-pin

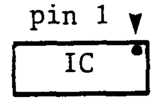
pin 1



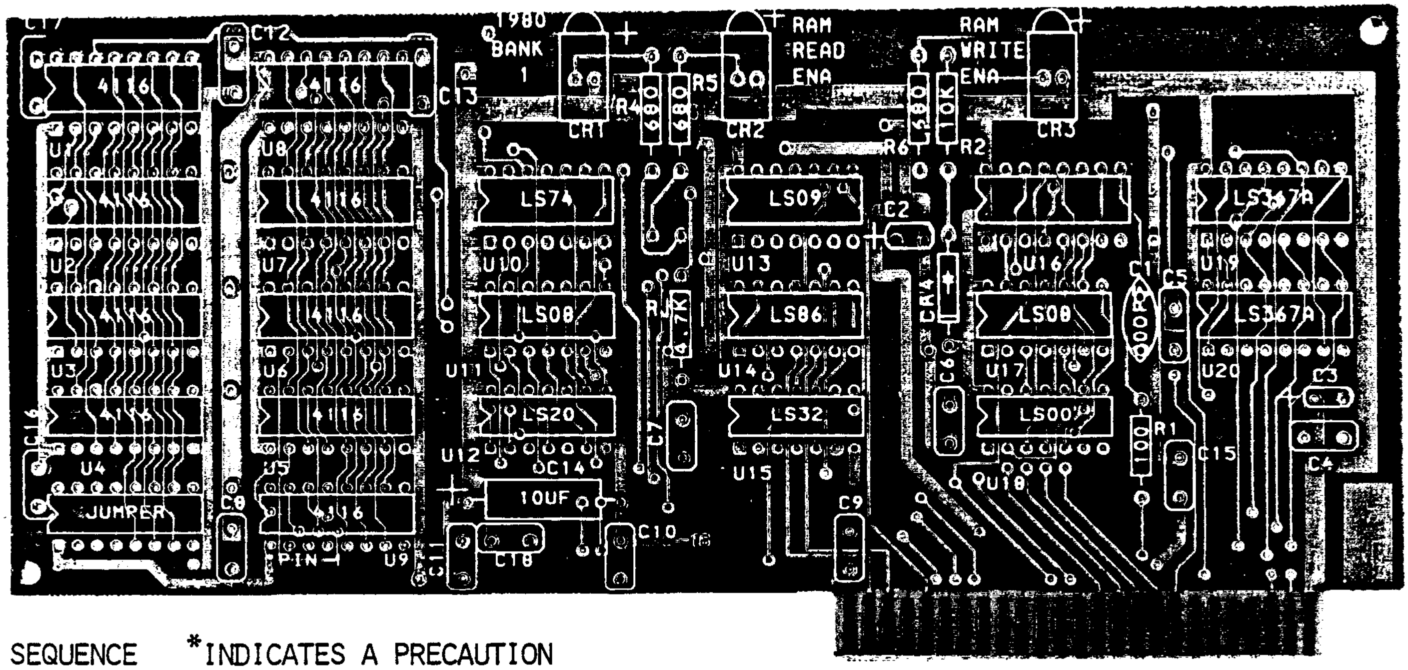
INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

____ 1 - 74LS00 @ IC9
____ 1 - 74LS02 @ IC3
____ 1 - 74LS08 @ IC4
____ 1 - 74LS11 @ IC8
____ 1 - 74LS51 @ IC2
____ 1 - 74LS74 (Hitachi) @ IC7
____ 1 - 74LS175 @ IC1
____ 1 - 74LS266 @ IC5
____ 1 - 74LS393 @ IC10
____ 1 - 74LS121 @ IC6
____ 4 - 74LS153 @ IC11,12,13,14
____ 8 - 4116 RAM (TI)@ IC15,16,17,18,19, IC20,21,22

pin 1



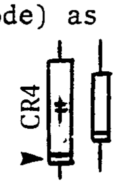
16 K RAM CARD: Adds an additional 16K of dynamic RAM to the 48K RAM on board. Can be used to hold a second language or as transient space for CP/M. With power off, install in slot number Ø.



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end of diode (cathode) as shown

____ 1 - 1N914



____ 3 - LED *Position longer lead (+ve) of diode as shown on the layout. Install LEDs last

RESISTORS R ¼ watt, 5%

____ 1 - 100 Ω @ R1
____ 3 - 680 Ω @ R4,5,6
____ 1 - 10 KΩ @ R2
____ 1 - 4.7 KΩ @ R3 *labelled "RJ" on the layout

CAPACITORS C

____ 1 - 220 pF @ C1
____14 - 0.1 μF Monolithic @ C4 to 13 & C15 to 18
____ 2 - 10 μF/25v Tantalum* @ C2,3
____ 1 - 10 μF/25v axial* @ C14
*Match + of capacitor with + on layout

SOCKETS *Match pin 1 of sockets with pin 1 on layout. Check that ALL pins have passed thru ALL holes

____ 8 - 14-pin
____13 - 16-pin

pin 1

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

____ 1 - 74LS00 @ U18
____ 2 - 74LS08 @ U11,17
____ 1 - 74LS09 @ U13
____ 1 - 74LS20 @ U12
____ 1 - 74LS32 @ U15
____ 1 - 74LS74 @ U10
____ 1 - 74LS86 @ U14
____ 1 - 74LS175 @ U16
____ 2 - 74LS367A @ U19,20
____ 9 - 4116 RAM @ U1 to 9

pin 1

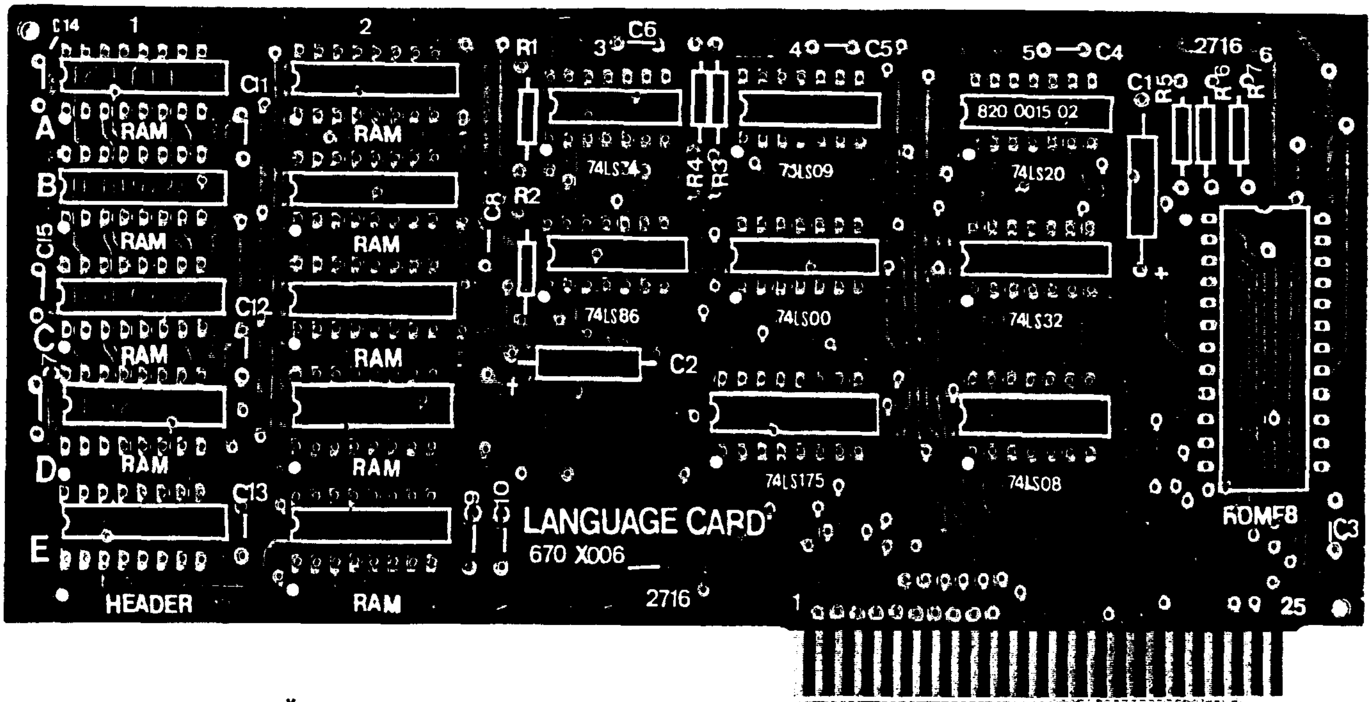
RIBBON CABLE (10-15 cm long)

____ 2 - 16-pin DIP headers

*With POWER OFF connect as follows: Remove one 4116 RAM IC from location E3 of motherboard (extreme upper left corner). Connect ribbon cable from location J1 (jumper) of language card to E3 of motherboard. MATCH pin 1 of card to pin 1 of motherboard.

NuScope Associates

LANGUAGE CARD: Adds an additional 16 K of dynamic RAM memory to the 48 K on board. Can be used to hold a second language or as transient space for CP/M. With power off, install in slot number Ø. Requires F8 ROM from motherboard on the card.

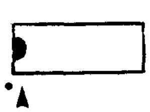


SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 5 - 3 K @ R1,2,3,5,6
____ 2 - 1 K @ R4,7

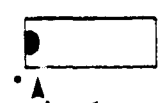
CAPACITORS C
____ 2 - 10 μF/25v axial* @ C1,2
____ 1 - 10 μF/25v Tantalum* @ C3
____12 - 0.1 μF @ C4 to 15
*Match + of capacitor to + on the layout

SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 7 - 14-pin
____11 - 16-pin
____ 1 - 24-pin



pin 1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (white dot)
____ 1 - 74LS00
____ 1 - 74LS08
____ 1 - 74LS09
____ 1 - 74LS20
____ 1 - 74LS32
____ 1 - 74LS74
____ 1 - 74LS86
____ 1 - 74LS175
____ 9 - 4116 RAM
____ 1 - F8 ROM from motherboard installed on the card @ ROMF8

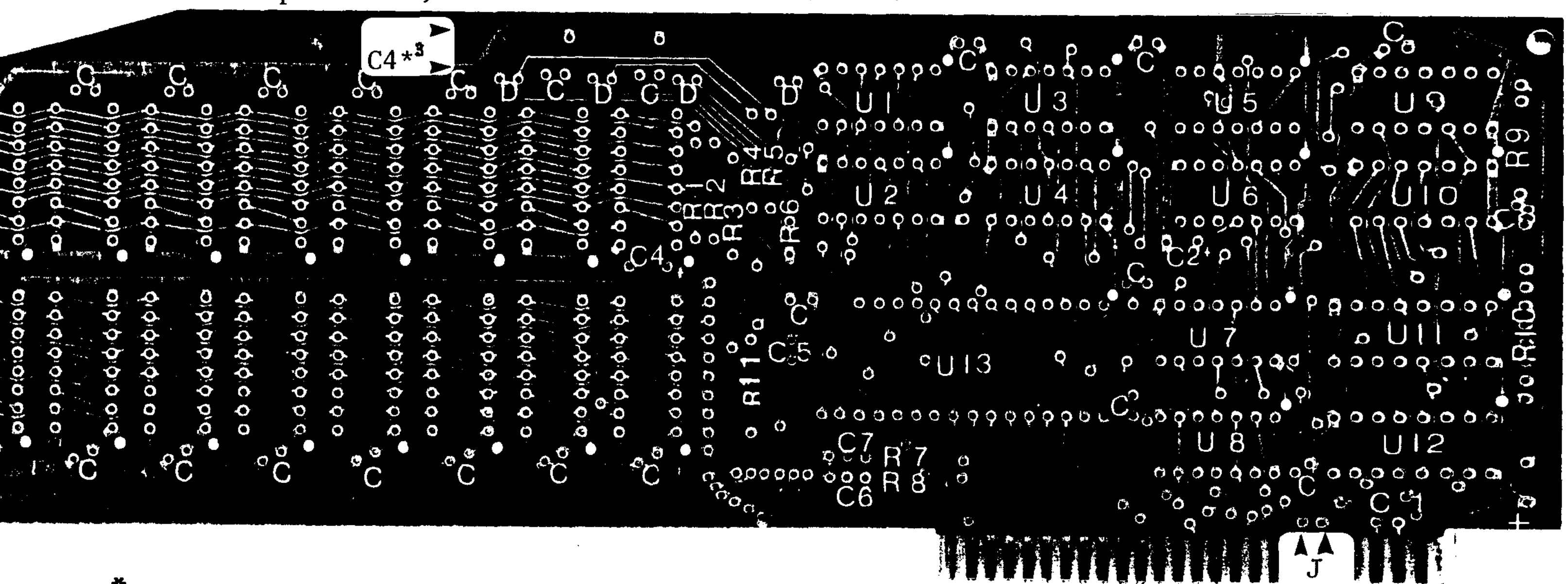


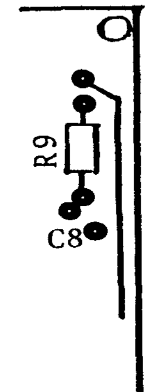
pin 1

RIBBON CABLE (10-15 cm long)
____ 1 - 16 pin DIP header

*With POWER OFF connect as follows: Remove one 4116 RAM IC from location E3 of motherboard (extreme upper left corner). Connect ribbon cable from location E1 of language card to E3 of motherboard. MATCH pin 1 of card to pin 1 of motherboard.

K RAMCARD: Allows the user to expand the on-board 48K RAM memory by 64K or 128K bytes. With power off, install in slot number Ø. Requires software (three disks).





*1 Position R9 as shown

C4*3 Some cards may have C4 positioned as shown on layout

NCE *INDICATES A PRECAUTION

TORS R ¼ watt, 5%
6 - 100 Ω @ R1,2,7,8,9*1,11
4 - 470 Ω @ R3,4,5,6
1 - 2.2 KΩ x 8 SIP @ R10
*Match pin 1 of SIP with white "dot" on layout

TS *Match pin 1 of sockets with white "dot" on layout. Check that ALL pins have passed thru ALL holes
10 - 14-pin
18 - 16-pin
1 - 28-pin

Refer to the APPLE-SEED by Raymond Kosmic for complete assembly instructions.

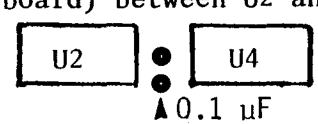
NuScope Associates

CAPACITORS C
____ 24 - 0.1 μF Monolithic @ positions C*2
____ 4 - 22 pF Monolithic @ C5,6,7,8
____ 2 - 2.2 μF/25V Tantalum* @ C2, C4*3
____ 1 - 10 μF/25V Axial* @ C1
*Match + of capacitors with + on the layout

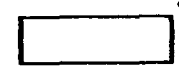
MODIFICATION *Strap (if required) the two feed-thru holes directly above pins 19 & 20 @ J as shown on the layout

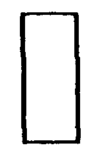
LIGHT EMITTING DIODE D
____ 4 - LEDs at locations labelled D
*Match + of diode with + on layout
●D● +

*2 Install a 0.1 μF cap (not shown on board) between U2 and U4



INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (white dot) on the layout

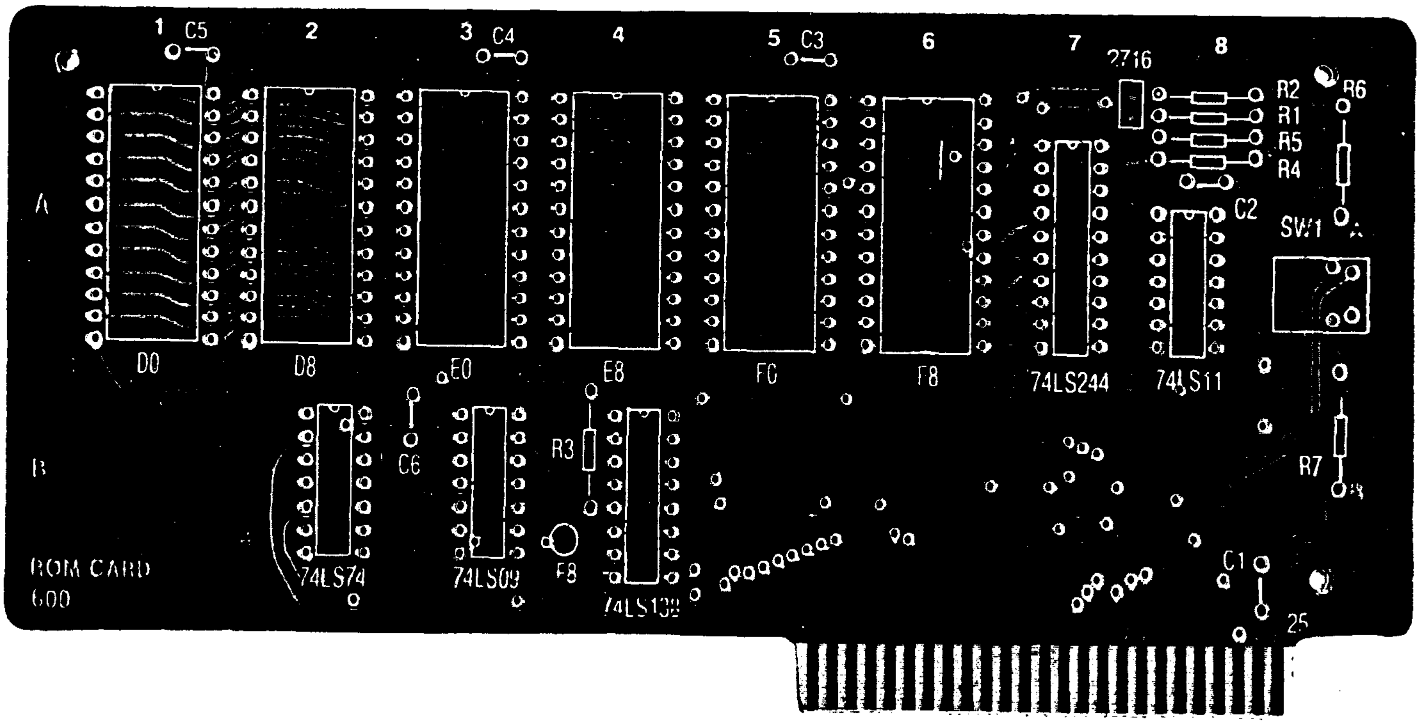




____ 1 - 74LS00 @ U9
____ 1 - 74LS02 @ U8
____ 1 - 74LS08 @ U10
____ 2 - 74LS51 @ U1,2
____ 1 - 74LS74 @ U6
____ 1 - 74LS93 @ U5
____ 1 - 74LS107 @ U4
____ 2 - 74LS175 @ U11,12
____ 1 - 74LS260 @ U3
____ 1 - 74LS266 @ U7
____ 1 - MC3242AP @ U13
____ 16 - TMS4164 RAM (or equivalent)

*For 64 K bytes of additional RAM install eight 4164s along the top row; for 128 K, use both rows

ROM INTEGER CARD: Allows an extra 16K of ROM to be switched in and out of memory in place of on-board ROM. With power off, install in slot number Ø. Requires firmware (EPROMS).



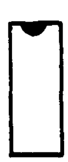
SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 5 - 2.7 KΩ @ R1,2,3,4,5
____ 2 - 10 KΩ @ R6,7

CAPACITORS C
____ 6 - 0.1 μF @ C1,2,3,4,5,6

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins of sockets have passed thru ALL holes

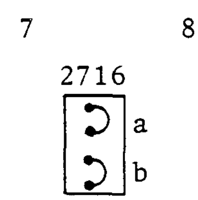
____ 3 - 14-pin
____ 1 - 16-pin
____ 1 - 20-pin
____ 6 - 24-pin

pin 1 ►


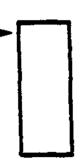
SWITCH
____ 1 - single-pole, double-throw @ SW1

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

*To use five 2716 EPROMs, jumper at a and b as shown (between 7 and 8)

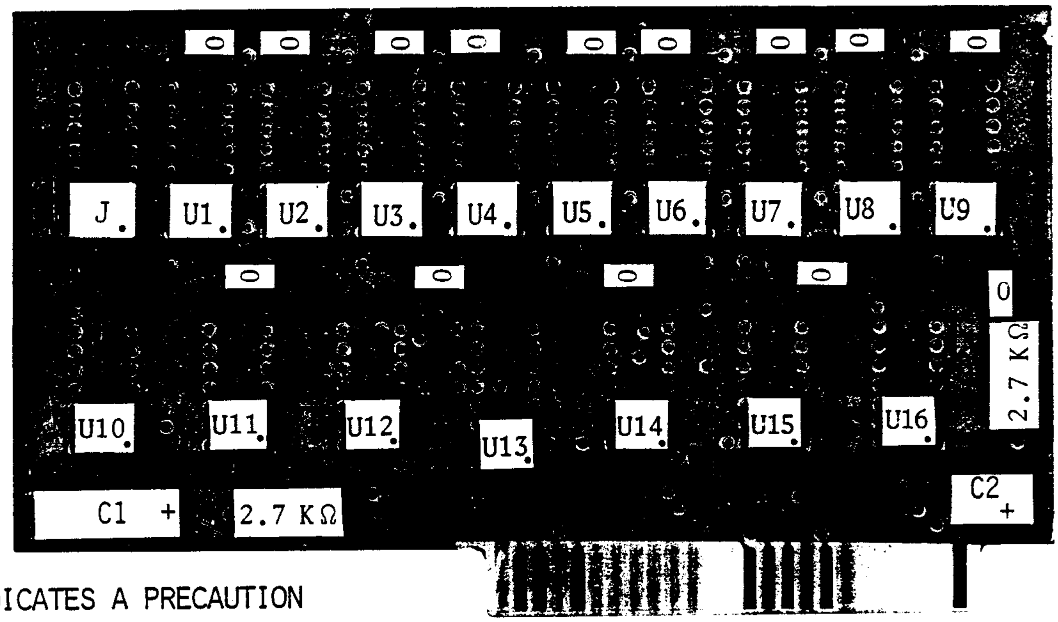


____ 1 - 74LS09
____ 1 - 74LS11
____ 1 - 74LS74
____ 1 - 74LS138
____ 1 - 74LS244
____ 6 - 2716 EPROMs @ D0,D8,E0,E8,F0,F8

pin 1 ►
upper left for ALL sockets & ICs


NuScope Associates

16 K RAM CARD: (W-69) Enhances the power of the computer by increasing the on-board 48 K of RAM to 64 K. Can be used to hold a second language or as a transient space for CP/M. With power off, install in slot number Ø.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 2 - 2.7 KΩ

SOCKETS *Match pin 1 of sockets with pin 1 (dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 6 - 14-pin
____ 11 - 16-pin

pin 1 lower right for ALL sockets

CAPACITORS C
____ 14 - 0.1 µF Monolithic @ ○
____ 1 - 10 µF/16V Axial* @ C1
____ 1 - 10 µF/16V Radial* @ C2
*Match + of TWO electrolytic capacitors with + on the layout

RIBBON CABLE
____ 1 - 10-15 cm length of 16-conductor ribbon cable with one 16-pin DIP header at each end

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (dot) on the layout
____ 9 - 4116 RAM @ U1,2,3,4,5,6,7,8,9
____ 1 - 74LS74 @ U10
____ 1 - 74LS00 @ U11
____ 1 - 74LS08 @ U12
____ 1 - 74LS175 @ U13
____ 1 - 74LS32 @ U14
____ 1 - 74LS86 @ U15
____ 1 - 74LS30 @ U16

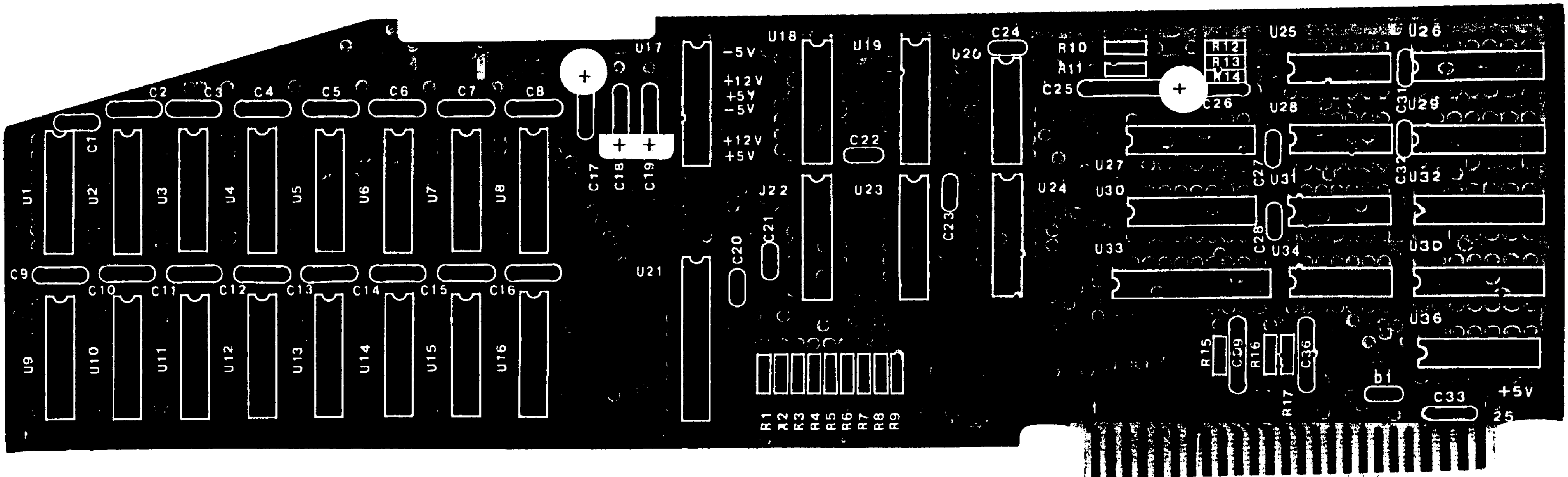
pin 1

INSTALLATION
*With POWER OFF, install as follows:
Remove one 4116 RAM IC from location E3 of motherboard (extreme upper left corner). Connect the ribbon cable from location J (jumper) of the 16 K card to E3 socket of the motherboard. *MATCH pin 1 of J to pin 1 on the motherboard.

apple-seed

NuScope Associates

128 K RAM EXPANDER: Allows user to expand the computer's memory to a full 128 K of dynamic RAM. With power off, install in: a) slot Ø, if no other memory card is available; b) any available slot, if other memory card is in slot Ø. Requires software (three disks) and firmware (one PAL).



SEQUENCE ***INDICATES A PRECAUTION**

DIODE D *Position banded end (cathode) of diode towards the SQUARE solder pad

____ 1 - 1N4148 @ D1

RESISTORS R ¼ watt, 5%

____ 3 - 100 Ω @ R15,16,17

____ 12 - 27 Ω @ R1 to 9, R11,13,14

____ 2 - 5.6 KΩ @ R 10,12

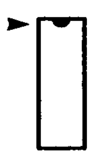
SOCKETS *Match pin 1 of sockets with pin 1 on layout. Check that ALL pins have passed thru ALL holes

____ 10 - 14-pin

____ 24 - 16-pin

____ 2 - 20-pin

pin 1 for ALL sockets and ICs



CAPACITORS C

____ 3 - 220 pF @ C26,36,39

____ 26 - 0.1 µF Monolithic @ C1,2,3,4,5,6,7,8,9,10,11, C12,13,14,15,16,20,21,22, C23,24,27,28,31,32,33

____ 4 - 10 µF/16V Axial* @ C17,18,19,25
*Match + of radials with + on the layout

NuScope Associates

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on the layout

____ 2 - 74LS08 @ U25,36

____ 1 - 74LS244 @ U21

____ 1 - 74LS32 @ U34

____ 1 - 74LS37 @ U28

____ 3 - 74LS74 @ U29,31,35

____ 1 - 74LS107 @ U32

____ 2 - 74LS158 @ U22,23

____ 2 - 74LS175 @ U27,30

____ 2 - 74LS258 @ U18,19

____ 1 - 74LS367 @ U24

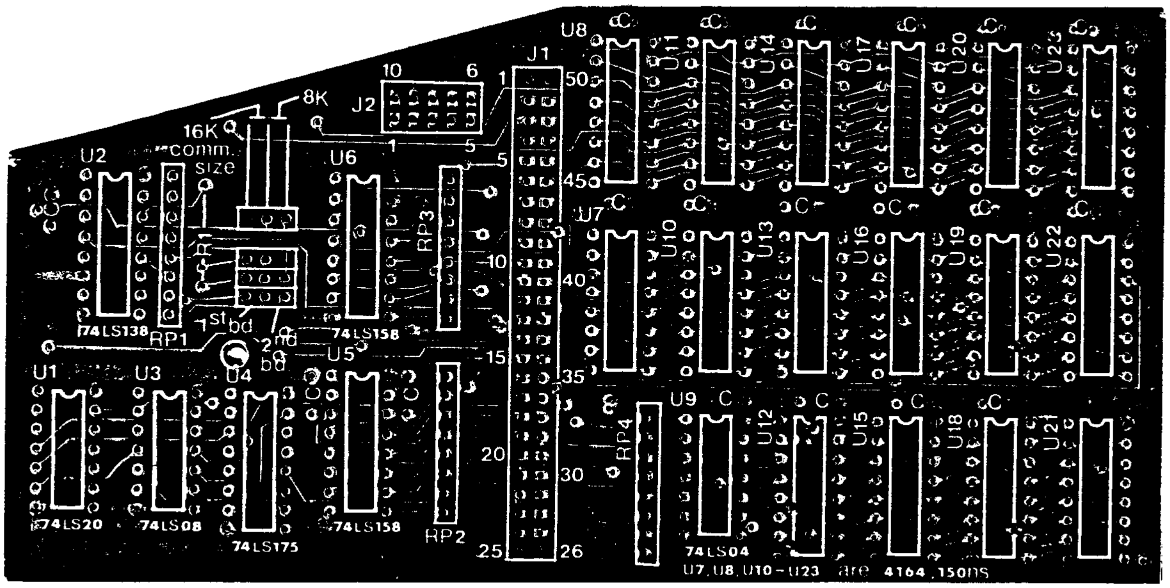
____ 2 - 74LS393 @ U20,26

____ - - empty slot @ U17

____ 1 - PAL10L8 (MMI) Programmed Array Logic

____ 16 - 4164 RAM, 200 ns @ U1 to 16

Z-80/64K 128 K RAM EXPANDER: This card adds 128 K bytes of memory and can only be used with the Z80/64 K card (GUIDE 4-4). With power off, mate female headers J1 & J2 of the EXPANDER card with the male headers P2 & P3 respectively, of the Z80/64 K card. Requires software.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 22 Ω R1
____ 4 - 22 Ω (or 33 Ω) SIP*, isolated @ RP1,2,3,4 White dot is pin 1
*Four discrete resistors may be substitued for each SIP

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 3 - 14-pin
____ 20 - 16-pin

pin 1 ➤

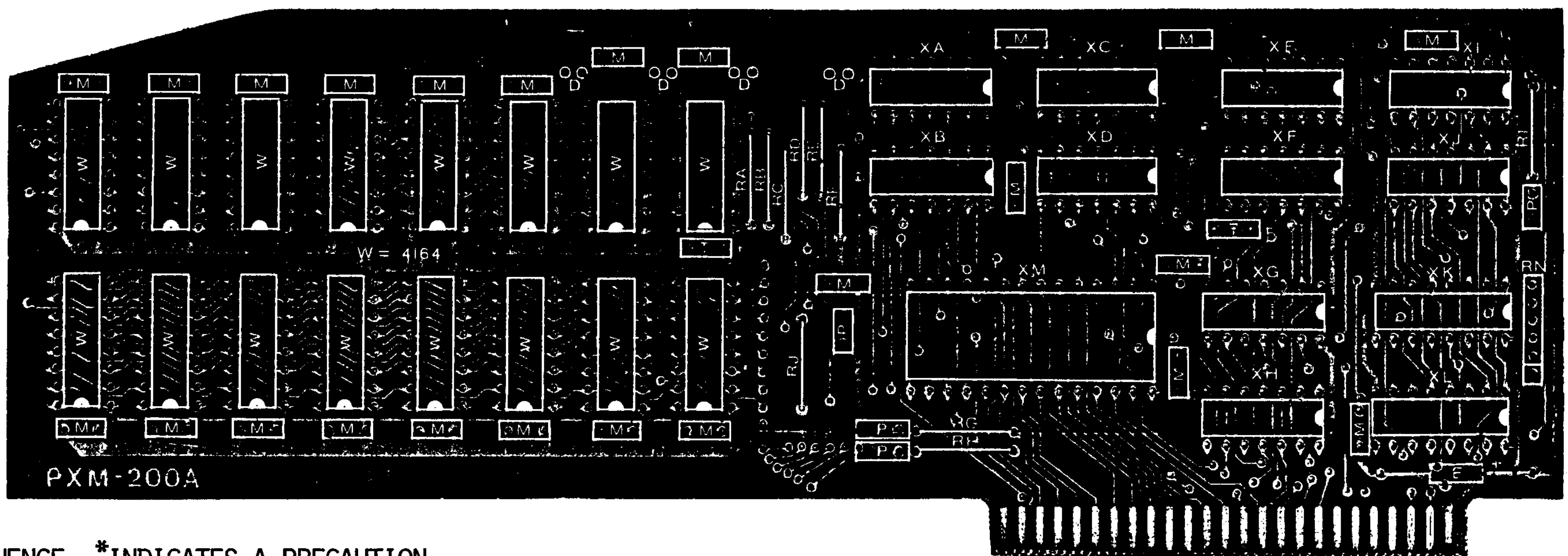
CAPACITORS C
____ 19 - 0.1 Monolithic

HEADER STRIPS
____ 1 - 1x2 male, straight @ 2
____ 3 - 1x3 male, straight @ 1,3,4
*J1 & *J2 are mounted on the SOLDER SIDE and soldered to the COMPONENT SIDE
____ 1 - 2x25 female @ J1*
____ 1 - 2x5 female @ J2*

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS04
____ 1 - 74LS08
____ 1 - 74LS20
____ 1 - 74LS138
____ 2 - 74LS158 or 74LS258
____ 1 - 74LS175
____ 16 - 4164 RAM 150 ns, 7-bit refresh

NuScope Associates

PRELUDE 128 EXTENDER: Increase the 48 K bytes of on-board memory by 128 K bytes. With power off, install in slot Ø. Requires software (three diskettes).



SEQUENCE ***INDICATES A PRECAUTION**

RESISTORS R ¼ watt, 5%
____ 6 - 100 Ω @ RA,B,G,H,I,J
____ 4 - 470 Ω @ RC,D,E,F
____ 1 - 2.2 KΩ 6-pin SIP* @ RN
*Match pin 1 of SIP with pin 1 (square) on layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____10 - 14-pin
____18 - 16-pin
____ 1 - 28-pin

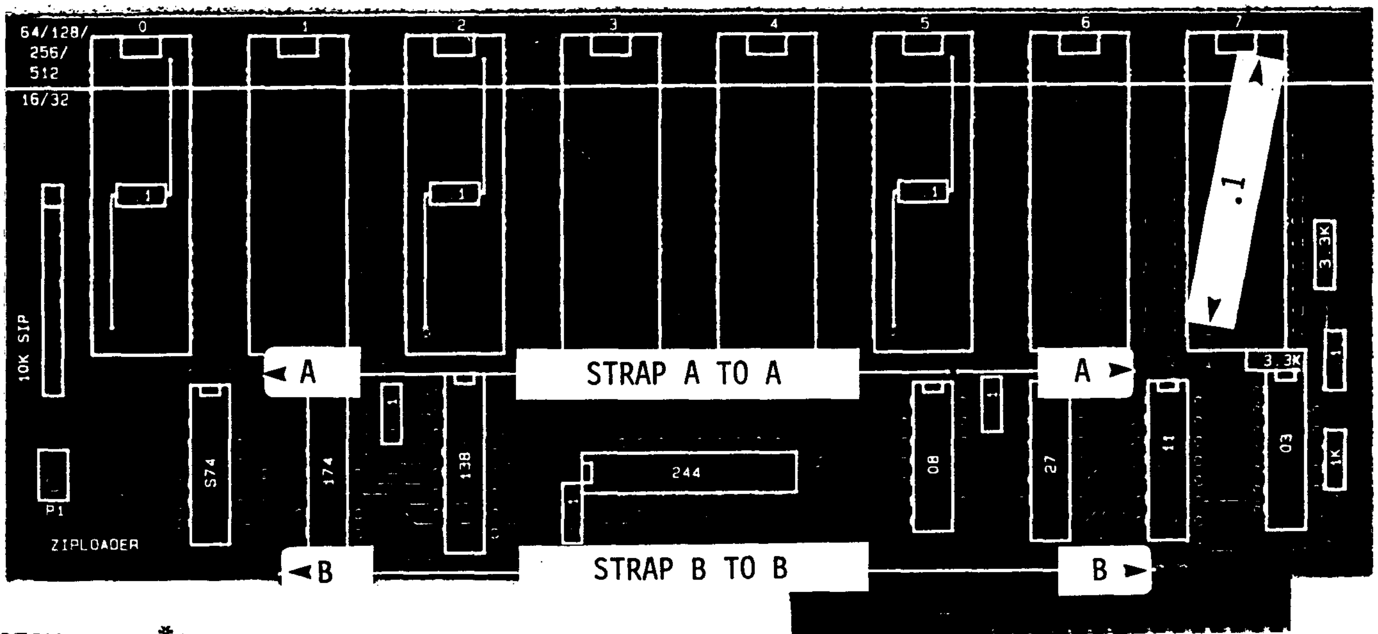
CAPACITORS C
____ 4 - 22 pF @ P
____24 - 0.1 μF Monolithic @ M
____ 2 - 2.2 μF/25V Tantalum* @ T
____ 1 - 10 μF/25V Axial* @ B
*Match + of capacitors with + on the layout

DIODES D (LED)
____ 4 - LEDs* @ D Match + of LEDs with + on the layout as shown

INTEGATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ XI
____ 1 - 74LS02 @ XH
____ 1 - 74LS08 @ XJ
____ 2 - 74LS51 @ XA,B
____ 1 - 74LS74 @ XF
____ 1 - 74LS93 @ XE
____ 1 - 74LS107 @ XD
____ 2 - 74LS175 @ XK,L
____ 1 - 74LS260 @ XC
____ 1 - 74LS266 @ XG
____ 1 - MC3242AP @ XM
____16 - 4164 RAM @ W

NuScope Associates

ZIP LOADER: Stores up to 512K RAM of programs in eight EPROMs for instant loading. Accepts standard 27 series (2708 to 27512) EPROMs. With power off, install in any slot except Ø. Requires software (one diskette).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS ¼ watt, 5%
____ 1 - 1 KΩ
____ 2 - 3.3 KΩ
____ 1 - 10 KΩ 10-pin SIP bussed* Match pin 1 of SIP with pin 1 (square) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 5 - 14-pin
____ 2 - 16-pin
____ 1 - 20-pin
____ 8 - 28-pin

CAPACITORS C
____ 4 - 0.1 μF Monolithic @ .1
*Install the following capacitors on the SOLDER SIDE
____ 4 - 0.1 μF axial labelled .1 in the middle of each EPROM socket Ø,2,5,7 as shown on the layout

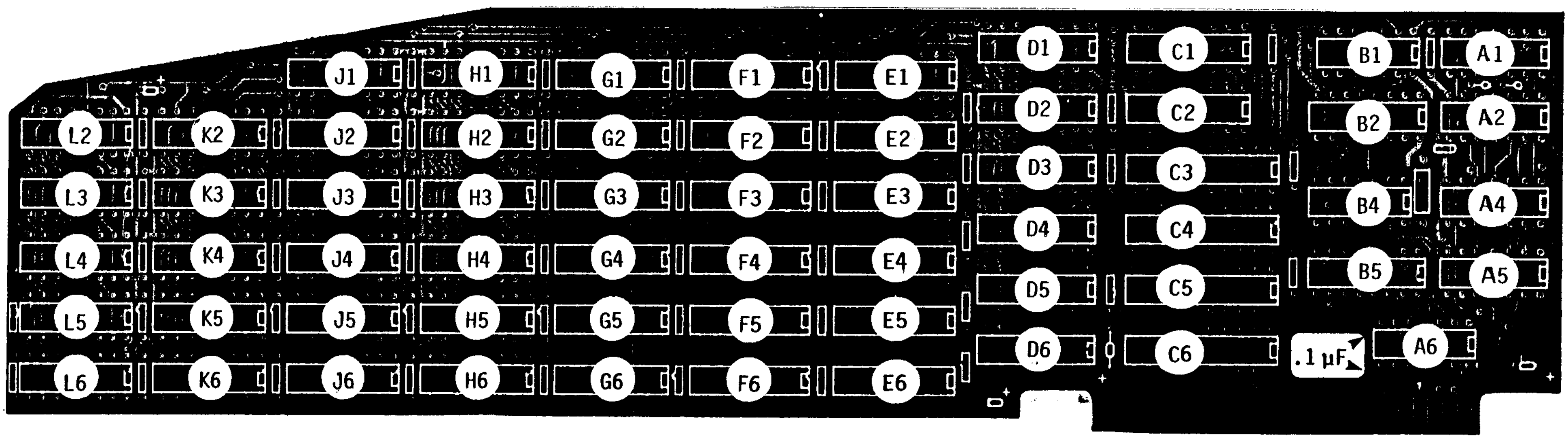
SWITCH
____ 1 - SP/ST (single pole single throw) @ P1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS03
____ 1 - 74LS08
____ 1 - 74LS11
____ 1 - 74LS27
____ 1 - 74LS74
____ 1 - 74LS138
____ 1 - 74LS174
____ 1 - 74LS244

MODIFICATION: as shown on the layout
Use two jumper wires to strap
A to A
B to B

NuScope Associates

FAST DISK II: RAM Disk Emulator. Stores data in RAM rather than on disks for fast recall. Each card holds 288 K bytes of memory - the equivalent of two disk drives. With power off, install in any slot. Recommended: Slot 5 for first Fast Disk; Slots 5 and 4 for first and second Fast Disk cards, respectively. Requires software drivers (DOS, CP/M, PASCAL).



SEQUENCE *INDICATES A PRECAUTION

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 7 - 14-pin
____50 - 16-pin
____ 4 - 20-pin

CAPACITORS C

____ 1 - 470 pF @
____49 - 0.1 µF Monolithic @
____ 4 - 10 µF/16V Tantalum* @ +
*Match + of Tantalums with + on the layout

RESISTORS R 5%

____ 2 - 33 Ω 1/8 watt @ Install on end
____ 1 - 1 KΩ 1/4 watt @ between A4 and B4

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on the layout

____ 2 - 74LS00 @ A1,B4
____ 2 - 74LS32 @ A4,A6
____ 1 - 74LS42 @ B5
____ 2 - 74LS74 @ A5,B1
____ 1 - 74LS132 @ A2
____ 1 - 74LS245 @ C6
____ 3 - 74LS374 @ C3,C4,C5
____ 1 - CD4040 @ B2

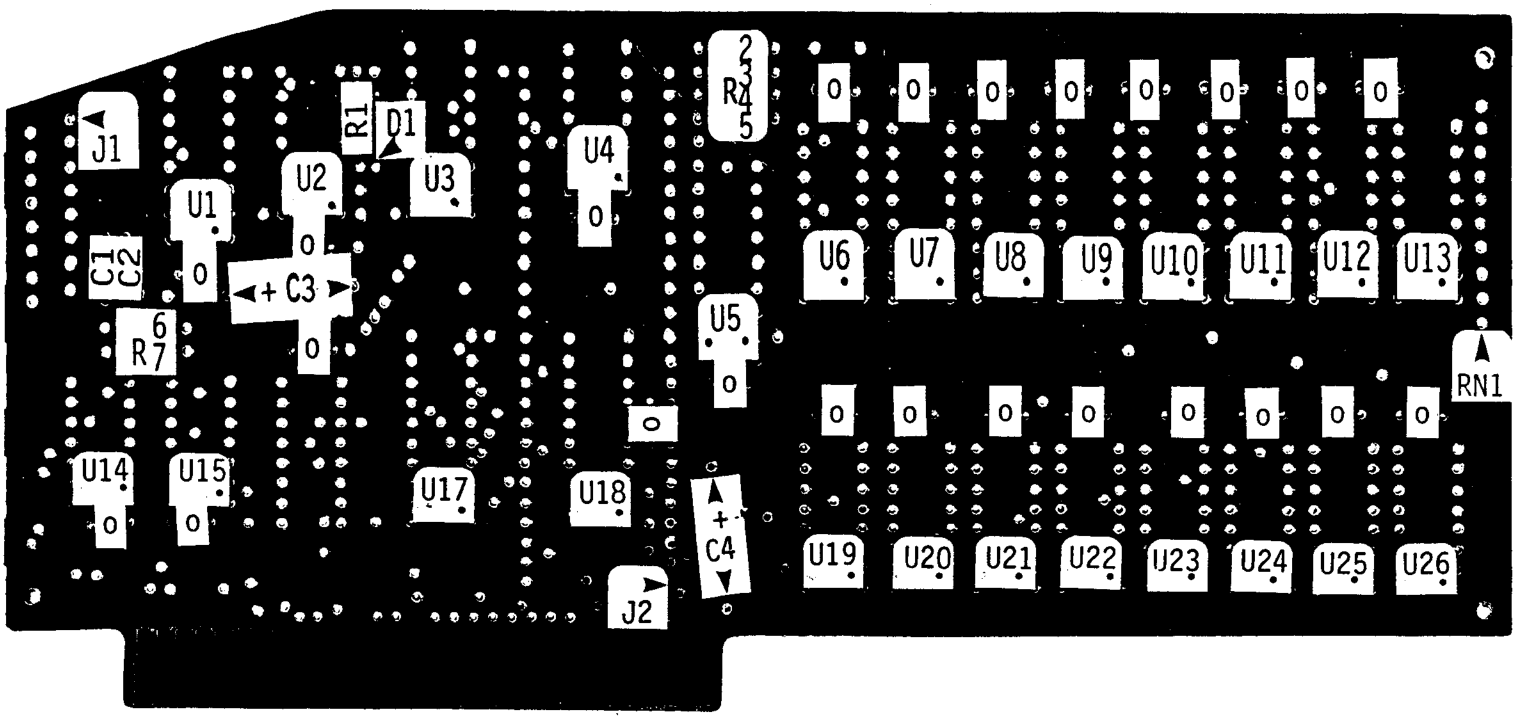
INTEGRATED CIRCUITS (continued)

____16 - 4116 DRAM 150 ns @ D5,6; E5,6; F5,6; G5,6; H5,6; J5,6; K5,6; L5,6
____32 - 4164 DRAM 150 ns @ C1,2; D1,2,3,4; E1,2,3,4; F1,2,3,4; G1,2,3,4; H1,2,3,4; J1,2,3,4; K2,3,4; L2,3,4

Memory ICs for second disk drive include: D3,4,6; E3,4,6; F3,4,6; G3,4,6; H3,4,6; J3,4,6; K3,4,6; L3,4,6

NuScope Associates

MEGAWORKS I (IIe): Add 80-column text, double Hi Res graphics, and up to 512K memory. With power off, install in auxilliary slot. Requires software (one to three diskettes), modification (one cut).



SEQUENCE *INDICATES A PRECAUTION *MODIFICATION REQUIRED ON COMPONENT SIDE

MODIFICATION REQUIRED ON THE COMPONENT SIDE: Cut trace between pin 13 of U15 and the nearest plate-thru hole

DIODES * Position banded end (cathode) of diode towards the arrow
____ 1 - 1N4148 @ D1 *Shortest distance

RESISTORS R ¼ watt, 5%
____ 5 - 56 Ω @ R2,3,4,5,7
____ 1 - 270 Ω @ R6
____ 1 - 2.2 KΩ @ R1
____ 1 - 1 KΩ 10-pin SIP*, bussed @ RN1. *Match pin 1 of SIP with pin 1 (arrow) on layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 4 - 14-pin
____ 19 - 16-pin
____ 3 - 20-pin

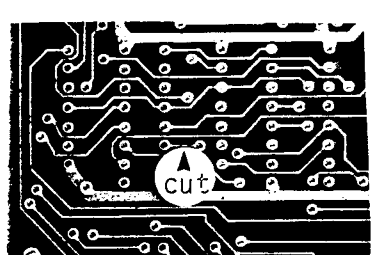
pin 1

CAPACITORS C
____ 2 - 22 pF @ C1,2
____ 24 - 0.1 μF Monolithic @ .o.
____ 2 - 10 μF/16V Axial* @ C3,4
* Match + of Axial with + on the layout

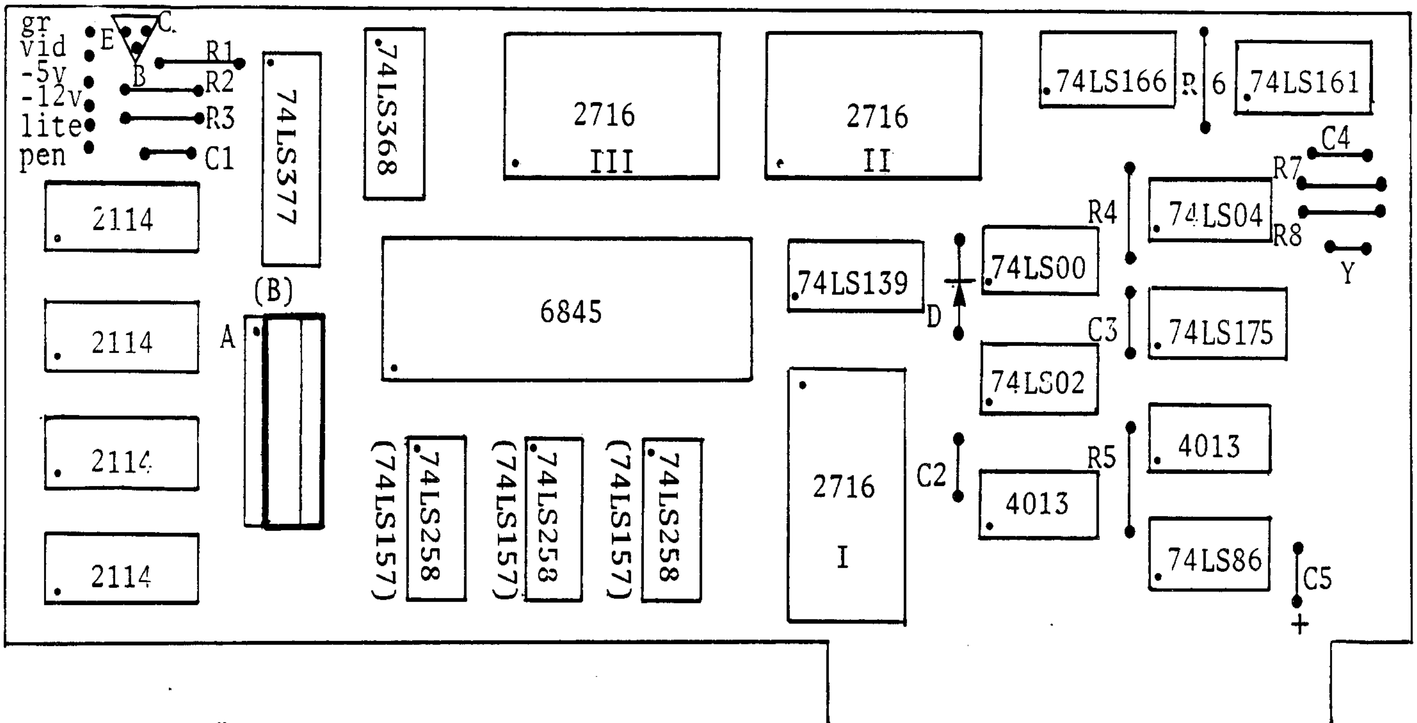
HEADERS female, install on component side
____ 1 - 1x8 @ J1
____ 1 - 1x24 @ J2 for 512 Add-on card

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ U15
____ 1 - 74LS08 @ U2
____ 1 - 74LS32 @ U4
____ 1 - 74LS51 @ U14
____ 1 - 74LS139 @ U1
____ 1 - 74LS173 @ U3
____ 1 - 74LS175 @ U16
____ 1 - 74LS245 @ U17
____ 1 - 74LS373 @ U5
____ 1 - 74LS374 @ U18
____ 16 - 41256 DRAM 150 ns @ U 6 to 13 @ U19 to 26

MODIFICATION: Cut trace from pin 13 of U15 as shown below



80-COLUMN CARD: Allows the user to display 80 characters on the video screen. With power off, install in slot 3. Requires firmware (2 or 3 EPROMS).

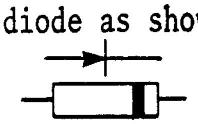


SEQUENCE

*INDICATES A PRECAUTION

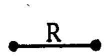
DIODE D *Position banded end (cathode) of diode as shown

____ 1 - 1N914



RESISTORS R ¼ watt, 5%

____ 1 - 180 Ω @ R1
____ 1 - 47 Ω @ R2
____ 1 - 20 Ω @ R3
____ 1 - 2.2 KΩ @ R4
____ 1 - 1.5 KΩ @ R5
____ 1 - 1 KΩ @ R6
____ 1 - 220 Ω @ R7,8

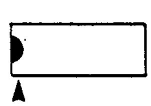


CAPACITORS C

____ 2 - 0.1 μF @ C1,2
____ 1 - 100 pF @ C3
____ 1 - 220 pF @ C4
____ 1 - 10 μF/16v Tantalum*@ C5
*Match + of capacitor with + on layout

SOCKETS *Match pin 1 of socket with pin 1 on layout. Check that ALL pins have passed thru ALL holes

____ 6 - 14-pin
____ 8 - 16-pin
____ 4 - 18-pin
____ 2 - 20-pin
____ 3 - 24-pin
____ 1 - 40-pin



TRANSISTOR Q *Position EBC leads as shown on the layout

____ 1 - 2N3904

CRYSTAL Y

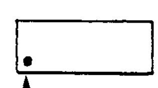
____ 1 - 17.430 @ Y *Fold crystal against the card before soldering

HEADER

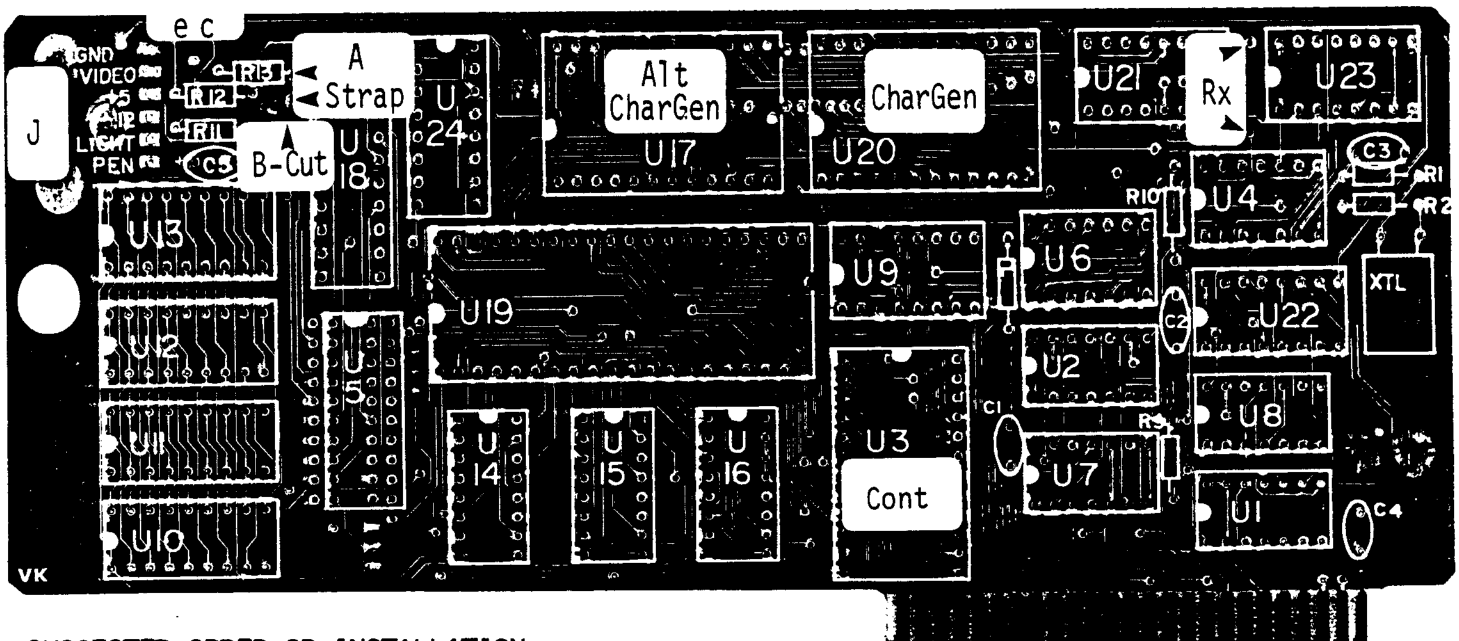
____ 1 - 1x6 male header strip, straight

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on layout

____ 1 - 74LS00
____ 1 - 74LS02
____ 1 - 74LS04
____ 1 - 74LS86
____ 1 - 74LS139
____ 1 - 74LS161
____ 1 - 74LS166
____ 1 - 74LS175
____ 3 - 74LS258 OR (74LS157)
____ 1 - 74LS368
____ 1 - 74LS373 @ A* OR (74LS245 @ B*)
____ 1 - 74LS377
____ 2 - CD4013
____ 3 - 2716 EPROMs
____ 1 - 6845 MPU
____ 4 - 2114 Static RAM



80-COLUMN CARD: Allows user to select 18 or 24 lines of text each of 80 characters;
(VK) can display upper or lower case. With power off, install in slot 3.
Q Requires firmware (two or three EPROMS).

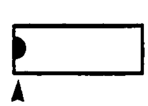


SUGGESTED ORDER OR INSTALLATION
*INDICATES A PRECAUTION

DIODES D * Position banded end (cathode) of diode as shown
____ 1 - 1N914

RESISTORS R ¼ watt, 5%
____ 1 - 10 Ω @ R13
____ 1 - 160 Ω @ R12
____ 1 - 200 Ω @ R11
____ 2 - 220 Ω @ R1,2
____ 1 - 1.5 KΩ @ R9
____ 1 - 2 KΩ @ R10
____ 1 - 1 KΩ @ Rx *As shown on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 6 - 14-pin
____ 8 - 16-pin
____ 4 - 18-pin
____ 2 - 20-pin
____ 3 - 24-pin
____ 1 - 40-pin



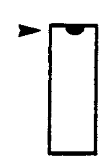
CAPACITORS C
____ 1 - 100 pF @ C2
____ 1 - 1,000 pF @ C4
____ 3 - 0.1 µF @ C1,4,5

CONNECTOR
____ 1 - 6-pin header, right angle AND/OR

TRANSISTOR Q *Position EBC leads as shown on the layout
____ 1 - 2N3904 @ Q

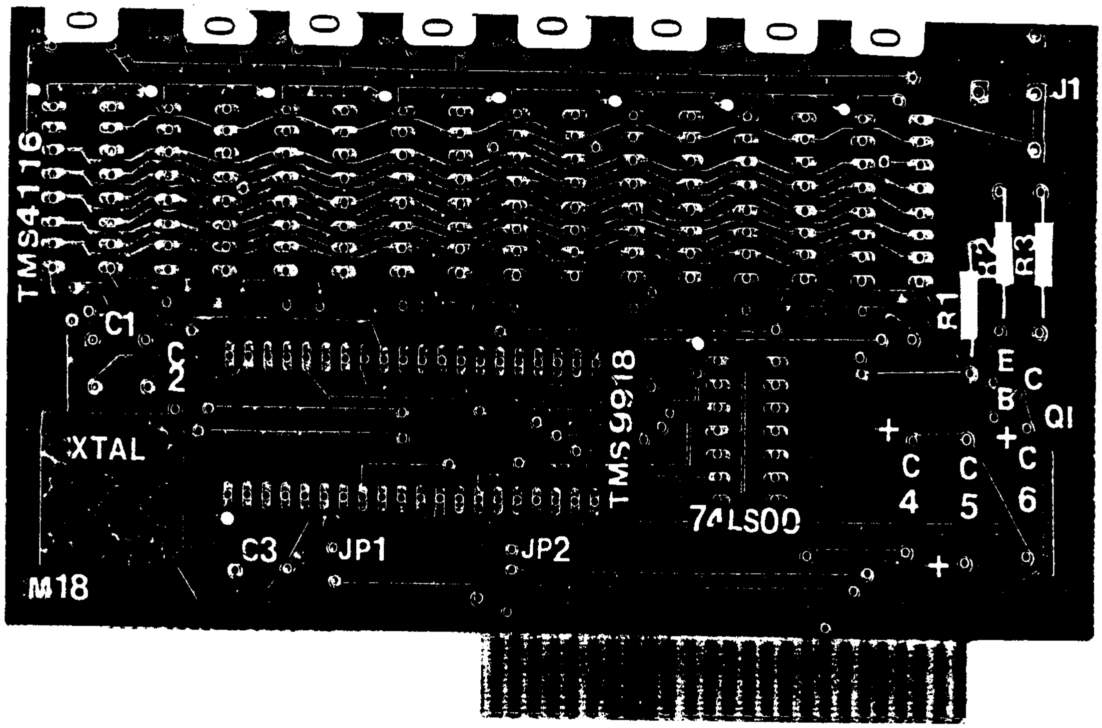
CRYSTAL Y
____ 1 - 17.430 MHz @ XTL *Fold body of crystal flat against the board before soldering

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ U6
____ 1 - 74LS02 @ U2
____ 1 - 74LS04 @ U4
____ 1 - 74LS86 @ U1
____ 1 - 74LS139 @ U9
____ 1 - 74LS161 @ U23
____ 1 - 74LS166 @ U21
____ 3 - 74LS157 @ U14,15,16
____ 1 - 74LS175 @ U22
____ 1 - 74LS245 @ U5
____ 1 - 74LS368 @ U24
____ 1 - 74LS374 @ U18
____ 2 - CD4013 @ U7,8
____ 1 - 6845 MPU @ U19
____ 2 - 2716 EPROMS @ U17,20
____ 1 - 2708 EPROM @ U3
____ 4 - 2114 Static RAM @ U10,11,12,13



MODIFICATIONS *As shown on the layout @ A & B
A-Strap the two large pads
B-Cut the trace between the two large pads

SPRITE GRAPHICS CARD: Create graphics that can be made to move smoothly & quickly across the screen. With power off, install in slot number 1-5. Reference: High-Resolution Sprite-Oriented Colour Graphics by Steven A Ciarcia; pg. 57; Aug, 1982; BYTE Publications Inc.



SUGGESTED ORDER OF INSTALLATION

*INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 1 - 33 Ω @ R2
____ 1 - 330 Ω @ R3
____ 1 - 10 KΩ @ R1

SOCKETS *Match pin 1 of sockets with the white dot (pin 1) on the layout. Check that ALL pins have passed thru ALL holes

____ 1 - 14-pin
____ 8 - 16-pin
____ 1 - 40-pin

CAPACITORS C

____ 2 - 33 pF disc @ C1,2
____ 1 - 5-50 pF trimcap @ C3
____ 8 - 0.1 μF Monolithic @ positions marked ⬭ on the layout
____ 3 - 10 μF/16v axial* @ C4,5,6 *Match + of capacitors with + on the layout

TRANSISTORS Q *Match the three EBC transistor leads with EBC on the layout

____ 1 - 2N2222 @ Q1

CRYSTAL Y

____ 1 - 10.7386 MHz @ XTAL *Position body of crystal against the card. Insulate the card from crystal with tape

CONNECTOR

____ 1 - RCA video jack, PCB mount @ J1

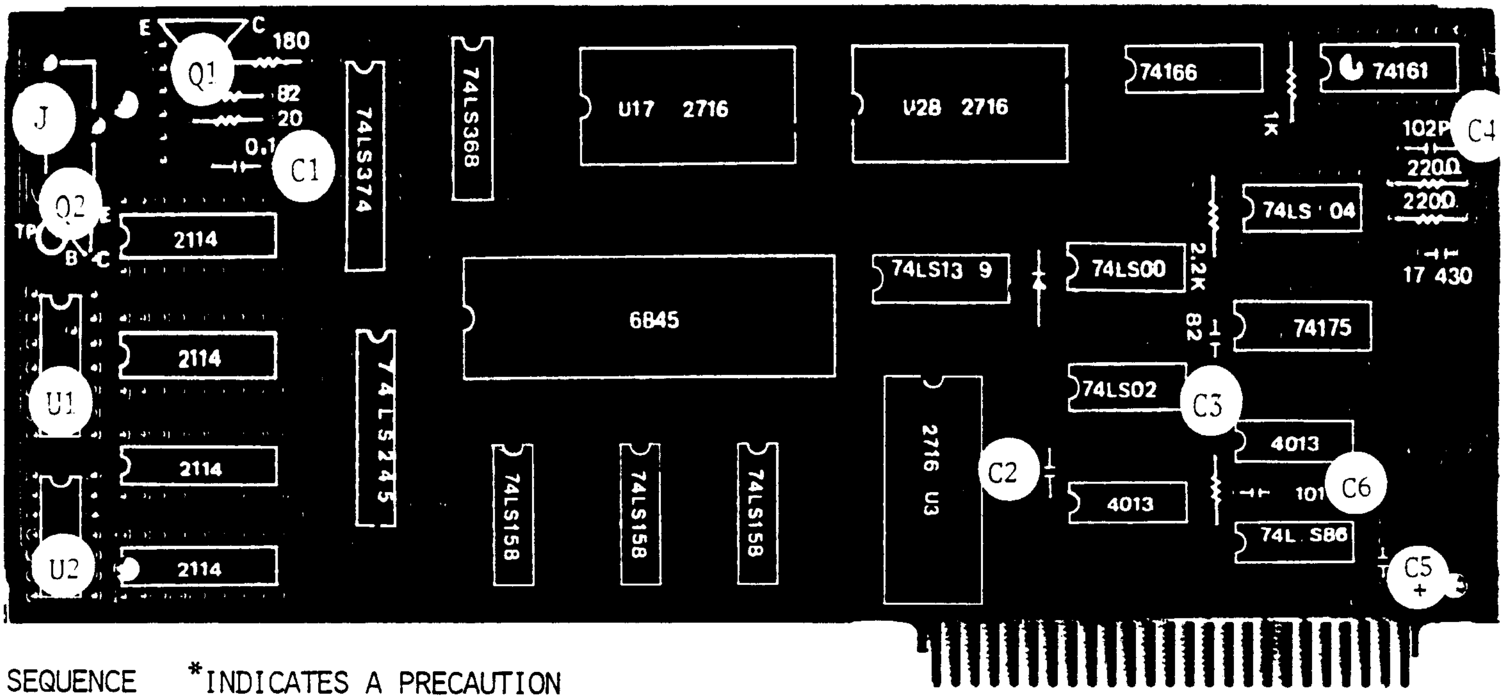
INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 (white dot) on layout

____ 1 - 74LS00
____ 8 - TMS4116 RAM
____ 1 - TMS9918A colour video display processo (T.I.)

pin 1 • white dot for ALL sockets & ICs

NuScope Associates

80-COLUMN/SOFT-SWITCH CARD: Displays 18 or 24 lines of text, each of 80 characters as well as upper and lower case. Automatically switches from 40 to 80 columns with built-in soft-switch. With power off, install in slot 3. Requires firmware (2 or 3 EPROMs).



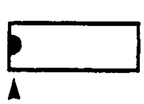
SEQUENCE *INDICATES A PRECAUTION

DIODE *Position banded end (cathode) of diode as shown cathode end
____ 1 - 1N914

RESISTORS R ¼ watt, 5%
____ 1 - 180 Ω
____ 1 - 82 Ω
____ 1 - 20 Ω
____ 1 - 2.2 KΩ
____ 1 - 1.5 KΩ
____ 1 - 1 KΩ
____ 2 - 220 Ω

CAPACITORS C
____ 3 - 0.1 µF @ C1,2,6
____ 1 - 82 pF @ C3
____ 1 - 0.001 µF @ C4
____ 1 - 10 µF/16V Tantalum @ C5 *Match + of capacitor with + on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 8 - 14-pin
____ 8 - 16-pin
____ 4 - 18-pin
____ 2 - 20-pin
____ 3 - 24-pin
____ 1 - 40-pin

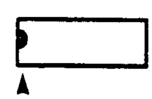

pin 1

CONNECTORS
____ 1 - 6-pin male header, straight AND/OR
____ 1 - RCA video jack, PCB mount, @ J
____ 1 - 1-pin male header, straight @ TP

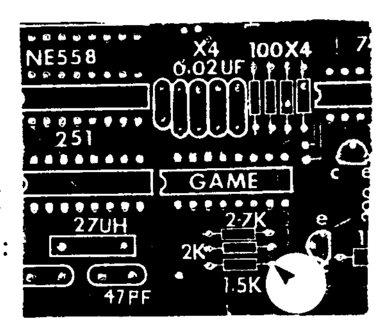
TRANSISTOR Q *Position EBC leads as shown on the layout
____ 1 - 2N3904 @ Q1

CRYSTAL Y *Insulate crystal & fold it flat against the card before soldering
____ 1 - 17.430 @ 17 430

INTEGRATED CIRCUITS * Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00
____ 1 - 74LS02
____ 1 - 74LS04
____ 1 - 74LS86
____ 1 - 74LS139
____ 1 - 74LS161
____ 1 - 74LS166
____ 1 - 74LS175
____ 3 - 74LS158
____ 1 - 74LS368
____ 1 - 74LS245
____ 1 - 74LS374
____ 2 - CD4013
____ 3 - 2716 EPROMs
____ 1 - 6845 MPU
____ 1 - 2114 Static RAM


pin 1

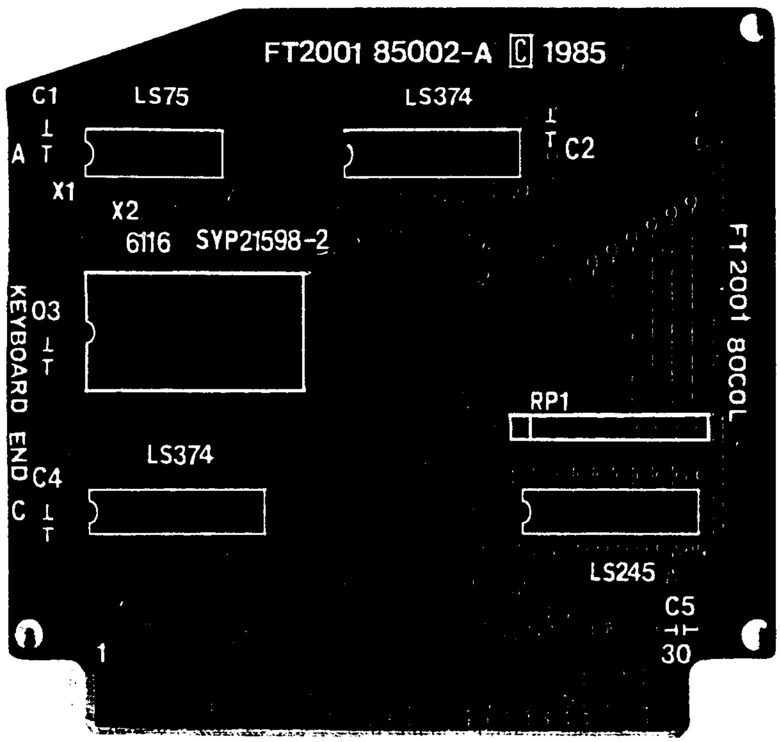
FOR SOFT-SWITCH, INSTALL:
____ 1 - 2N3904 @ Q2
____ 1 - 74LS125 @ U1
____ 1 - 74LS74 @ U2



MOTHERBOARD @ H-14

Connect an insulated wire from TP of card to resistors near game port on the motherboard.

80 COLUMN (IIe): Add 80 column text to the motherboard. With power off, install in the "auxilliary" slot.



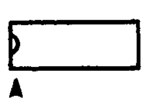
SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 1 - 3.3 KΩ 10-pin SIP* bussed @ RP1
*Match pin 1 of SIP with pin 1 (square) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 (square pad) on the layout. Check that ALL pins have passed thru ALL holes before soldering

____ 1 - 16-pin
____ 3 - 20-pin
____ 1 - 24-pin


pin 1

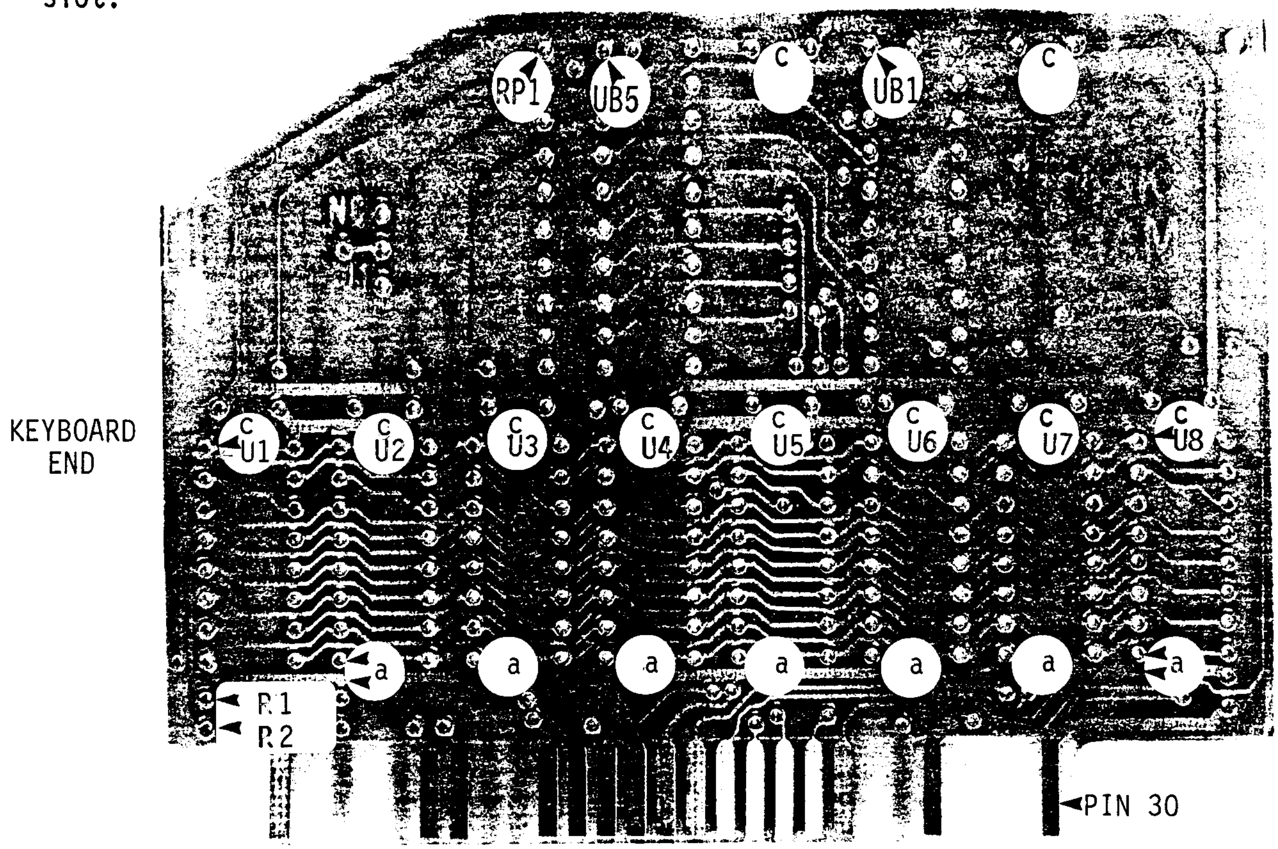
CAPACITORS C

____ 5 - 0.1μ F Monolithic @ C1,2,3,4,5

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS75
____ 1 - 74LS245
____ 2 - 74LS374
____ 1 - 6116

80 COLUMN/64K EXPANDER (IIE): Provides 80 column text as well as 64 K bytes of RAM memory to the motherboard. With power off, install in the special "auxilliary" slot.



Layout is magnified

SEQUENCE *INDICATES A PRECAUTION *SOME CARDS MAY REQUIRE MODIFICATION AT "a"

*MODIFICATION: At "a" strap pin 8 of each of U2,3,4,5,6,7,8 to bus bar connecting to pin 30 (+5V) of card edge connector as shown.

RESISTORS R ¼ watt, 5%
____ 2 - 47 Ω @ R1,2
____ 1 - 3.3 KΩ 10-pin SIP* bussed @ RP1
*Pin 1 is indicated by the arrow

SOCKETS *Match pin 1 of sockets with pin 1 (arrow) on the layout. Check that ALL pins have passed thru ALL holes.
____ 8 - 16-pin
____ 2 - 20-pin

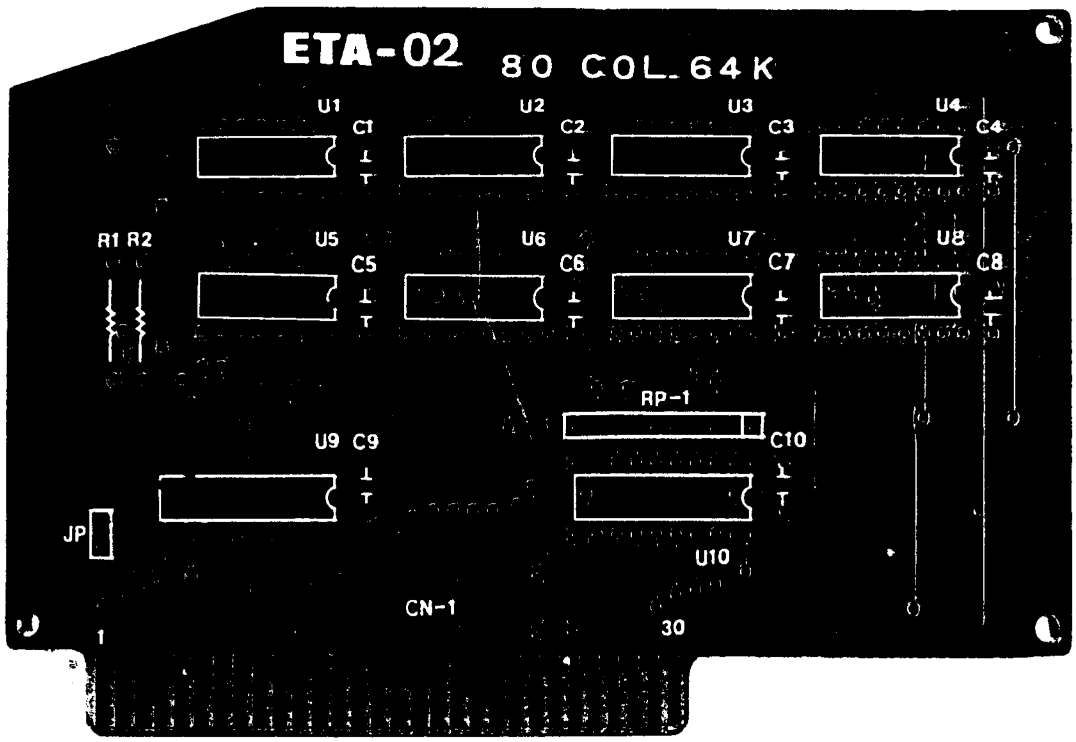
CAPACITORS C
____10 - 0.1 µF Monolithic @ "c"

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (arrow) on the layout
____ 1 - 74LS245 @ UB5
____ 1 - 74LS374 @ UB1
____ 8 - 4164 RAM @ U1,2,3,4,5,6,7,8

HEADER
____ 1 - 1x3 male, straight @ J1

COLLEGE 80 COLUMN/64 K CARD (IIe): Add an additional 64 K bytes of RAM memory to the motherboard as well as 80 column text. With power off, install in the "auxilliary" slot.

KEYBOARD END



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 47 Ω @ R1,2
____ 1 - 3.3 KΩ 10-pin SIP* bussed @ RP-1
*Match pin 1 of SIP with pin 1 (square) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 8 - 16-pin
____ 2 - 20-pin

◄ pin 1

CAPACITORS C

____10 - 0.1 µF Monolithic @ C1 to C10

HEADER

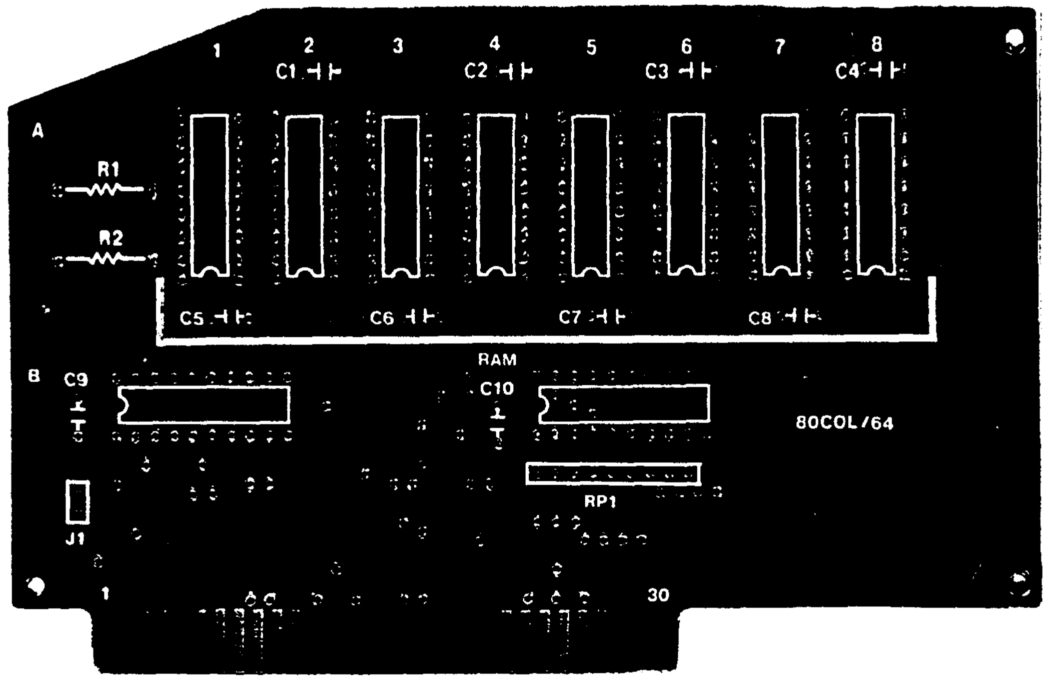
____ 1 - 1x2 header, straight, male @ JP

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS245 @ U10
____ 1 - 74LS374 @ U9
____ 8 - 4164 RAM @ U1,2,3,4,5,6,7,8

JK 80 COLUMN/64K CARD: Provides 80-column text as well as 64 K bytes of RAM memory to the motherboard. With power off, install in the special "auxilliary" slot.

KEYBOARD END



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 47 Ω @ R1,2

____ 1 - 3.3 KΩ 10-pin SIP* bussed @ RP1
*Match pin 1 of SIP with pin 1 (square) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 8 - 16-pin

____ 2 - 20-pin

CAPACITORS C

____10 - 0.1 µF Monolithic @ C1 to 10

HEADER

____ 1 - 1x2 straight, male @ J1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

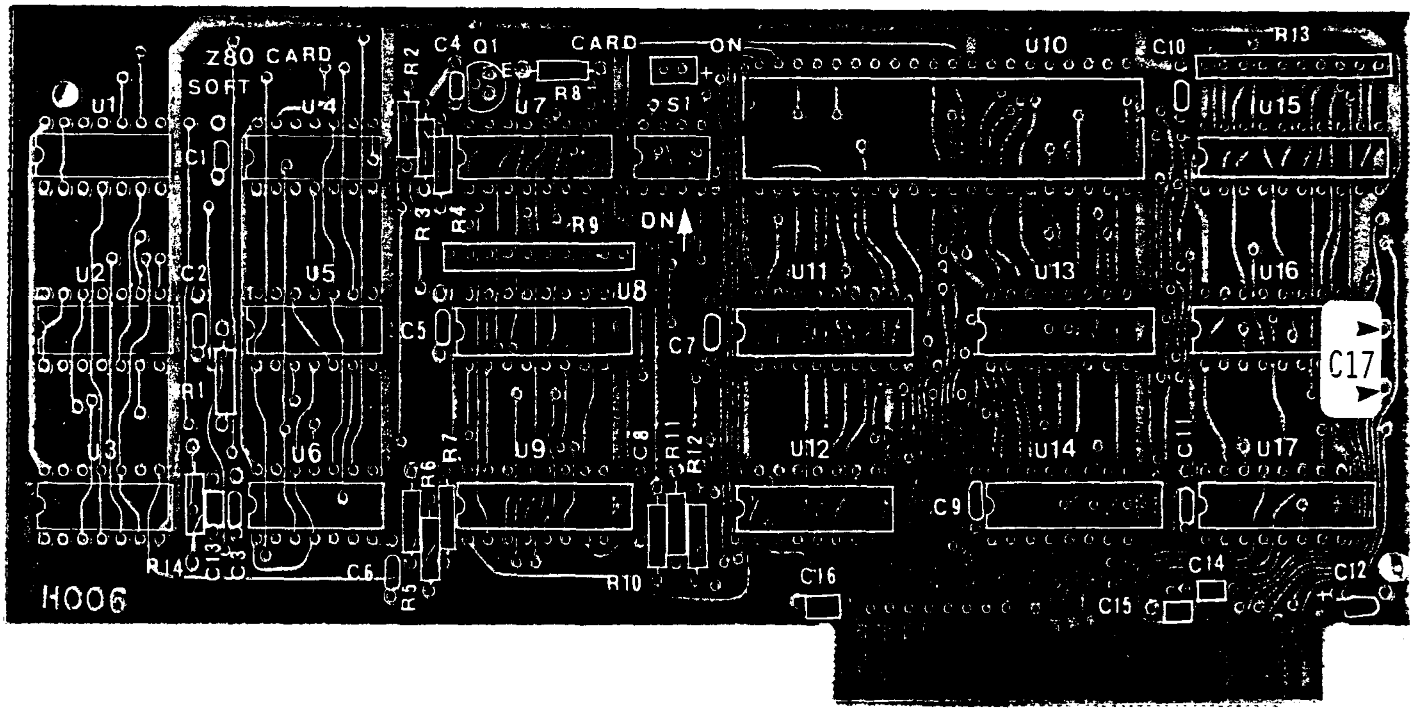
____ 1 - 74LS245 @ B-5

____ 1 - 74LS374 @ B-1

____ 8 - 4164 RAM @ A-1 to A-8

NuScope Associates

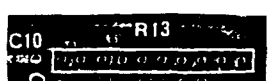
Z 80 CARD: Allows one to run software written for the Z 80 based microcomputer (CP/M operating system). With power off, install in slot number 4.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

- ____ 1 - 2.2 KΩ @ R1
- ____ 1 - 27 Ω @ R2
- ____ 1 - 220 Ω @ R3
- ____ 2 - 1 KΩ @ R4,14
- ____ 4 - 100 Ω @ R5,6,11 12
- ____ 2 - 4.7 KΩ @ R7,10
- ____ 1 - 680 Ω @ R8
- ____ 2 - 10 KΩ SIP @ R9,13



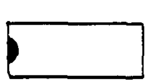
pin 1

CAPACITORS C

- ____ 11 - 0.1 µF @ C1,2,3,5,7,9,10 11,14,15,16
- ____ 1 - 50 pF @ C4
- ____ 3 - 220 pF @ C6,8,13
- ____ 1 - 4.7 µF/25v Tantalum @ C12 *match + of capacitor with + on layout

SOCKETS *Match pin 1 of socket with pin 1 on layout. Check that ALL pins have passed thru ALL holes.

- ____ 8 - 14-pin
- ____ 7 - 16-pin
- ____ 1 - 20-pin
- ____ 1 - 40-pin



pin 1

TRANSISTOR Q *Install 3 leads as shown.

- ____ 1 - 2N3906

*Check with supplier

LIGHT EMITTING DIODE

- ____ 1 - LED *position longer lead (+) as shown on layout

SWITCH S1

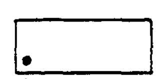
- ____ 1 - 4-position DIP

Functions:

1 - address offset when off
2 - Z80 DMA when on
3 - non-maskint when on
4 - Z80 interupts when on

INTEGRATED CIRCUITS * match pin 1 of IC with pin 1 on layout

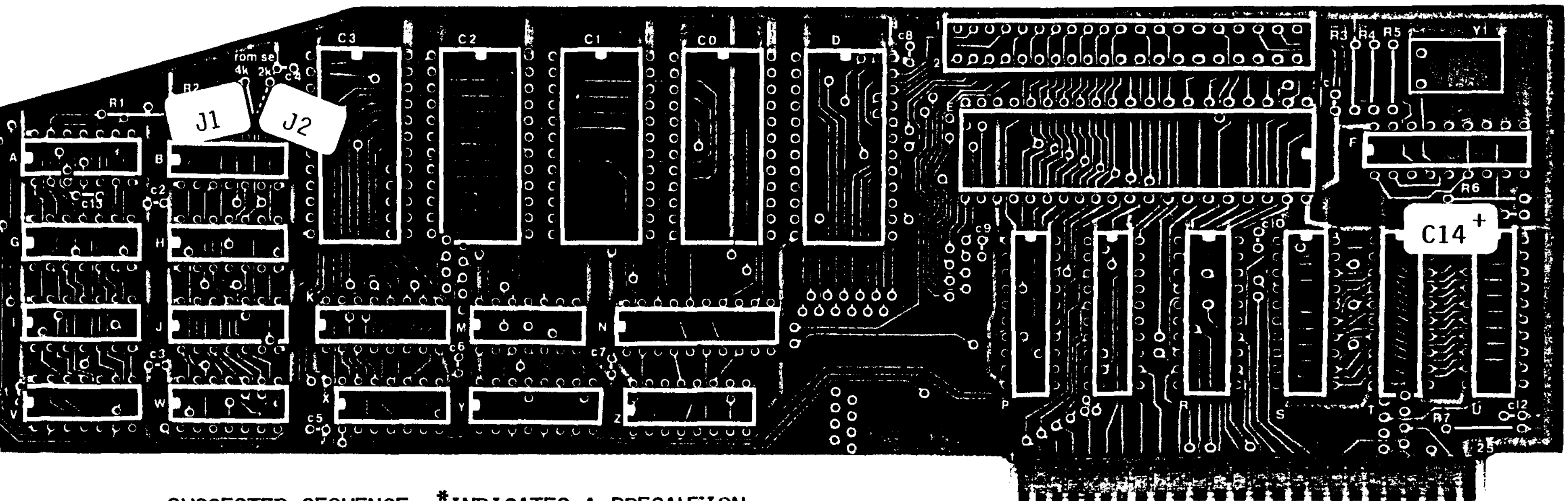
- ____ 1 - 74LS00 @ U1
- ____ 1 - 74LS05 @ U2
- ____ 1 - 74LS32 @ U3
- ____ 1 - 74S20 @ U12
- ____ 2 - 74LS74 @ U5,6
- ____ 1 - 74LS86 @ U7
- ____ 1 - 74LS107 @ U4
- ____ 1 - 74LS138 @ U11
- ____ 1 - 74LS283 @ U8
- ____ 5 - 74LS367 @ U9,13,14,16,17
- ____ 1 - 74LS373 @ U15
- ____ 1 - Z80A @ U10



pin 1

NuScope Associates

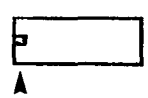
8 CARD: Accesses the 64K bytes of the computer's memory. The 8088 (16-bit word size) and the 6502 (8-bit) can both run simultaneously to provide faster execution speed of existing programs. Allows development of programs that will run on the 8088 microprocessor. With power off, install in any slot except Ø. Requires 64K bytes of RAM, firmware (one EPROM), and software (one disk).



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 4 - 2 KΩ @ R1,2,3,7
____ 2 - 510 Ω @ R4,5
____ 1 - 5.6 KΩ @ R6

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____10 - 14-pin
____ 3 - 16-pin
____ 1 - 18-pin
____ 7 - 20-pin
____ 5 - 24-pin
____ 1 - 40-pin



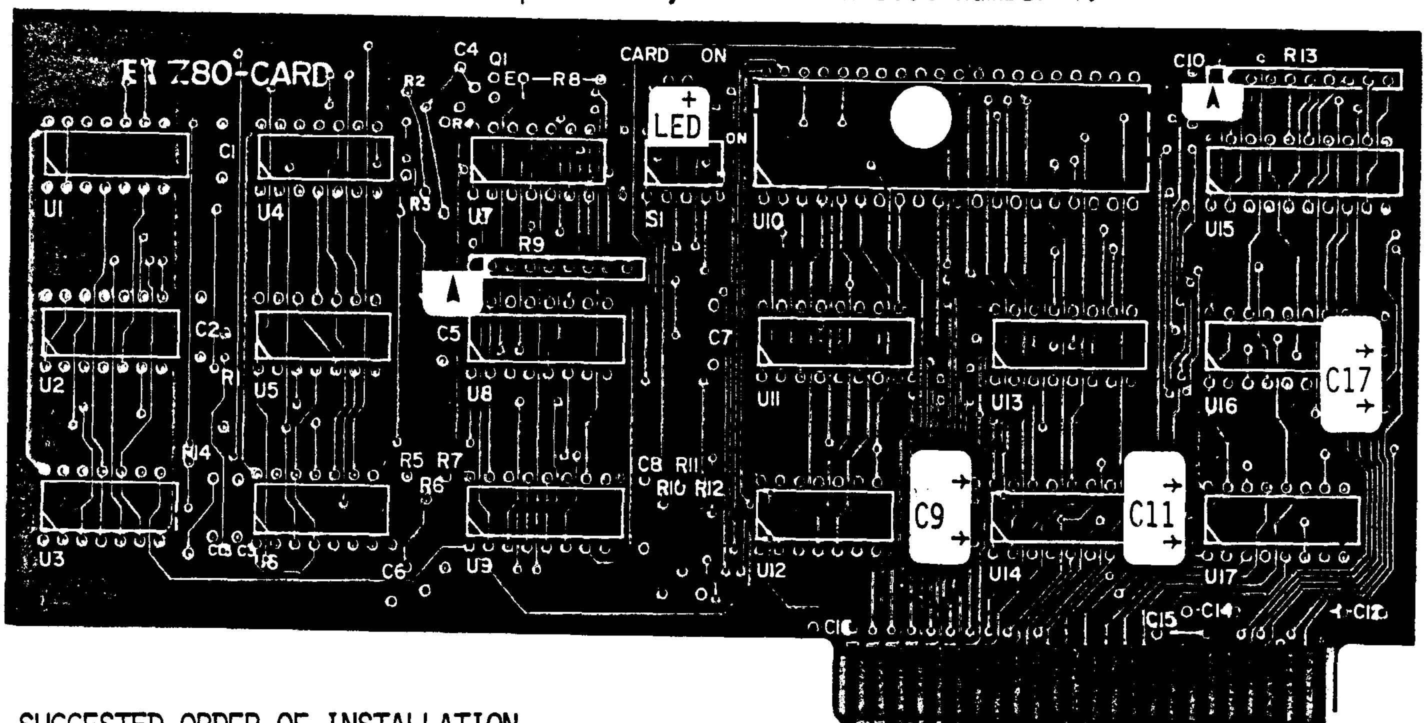
CAPACITORS C @ Positions labelled ●—● on the layout
____ 1 - 0.001 μF @ C13
____12 - 0.1 μF @ C1,2,3,4,5,6,7,8, C9,10,11,12
____ 1 - 6.8 μF/16V Tantalum* @ C14 *Match + of capacitor with + on the layout

CONNECTOR
____ 1 2x20 female header strip, straight

JUMPER
____ 1 - Refer to layout: J1 for 2732A 4K EPROM) @ rom sel
OR J2 for 2716 2K EPROM)

CRYSTAL Y
____ 1 - 15.000 MHz @ Y1 *Fold crystal flat against the card before soldering

EK Z80-CARD: Allows one to use the CP/M operating system with the Z80 microprocessor installed. With power off, install in slot number 4.



SUGGESTED ORDER OF INSTALLATION
*INDICATES A PRECAUTION

RESISTORS ¼ watt, 5%

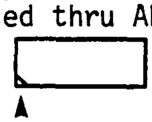
____ 1 - 2.2 KΩ @ R1
____ 1 - 22 Ω @ R2
____ 1 - 220 Ω @ R3
____ 1 - 1.2 KΩ @ R4
____ 5 - 100 Ω @ R5,6,11,12,14
____ 2 - 4.7 KΩ @ R7,10
____ 1 - 680 Ω @ R8
____ 2 - 10 KΩ SIP, 10-pin @ R9,13 *Position pin 1 of SIPs as shown on the layout

CAPACITORS C

____11 - 0.1 µF Monolithic @ C1,2,3,5,7,9,10, C11,14,15,16
____ 2 - 47 pF @ C4,17
____ 3 - 200 pF @ C6,8,13
____ 1 - 2.2 µF/35V Tantalum* @ C12 *Match + of capacitor with + on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes.

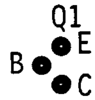
____ 8 - 14-pin
____ 7 - 16-pin
____ 1 - 20-pin
____ 1 - 40-pin



pin 1 lower left for ALL sockets

TRANSISTOR Q *Install EBC leads as shown

____ 1 - 2N3906



LIGHT EMITTING DIODE LED

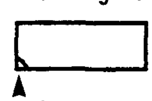
____ 1 - LED @ CARD ON *Position longer lead (+) as shown on the layout

SWITCH

____ 1 - DIP switch, 4-position @ S1
Functions: 1-address offset when off
2-Z80 DMA when on
3-non-mask int when on
4-Z80 interupts when on

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS00 @ U1
____ 1 - 74LS05 @ U2
____ 1 - 74LS32 @ U3
____ 1 - 74S20 @ U12
____ 2 - 74LS74 @ U5,6
____ 1 - 74LS86 @ U7
____ 1 - 74LS107 @ U4
____ 1 - 74LS138 @ U11
____ 1 - 74LS283 @ U8
____ 5 - 74LS367 @ U9,13.14,16,17
____ 1 - 74LS373 @ U15
____ 1 - Z80A @ U10



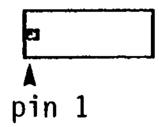
pin 1

apple-seed

8088 CARD (continued)

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

- ____ 1 - 74LS14 @ X
- ____ 1 - 74LS00 @ A
- ____ 1 - 74LS04 @ G
- ____ 1 - 74LS10 @ I
- ____ 1 - 74LS27 @ V
- ____ 1 - 74LS32 @ J
- ____ 3 - 74LS74A @ B,H,M
- ____ 1 - 74LS125 @ W
- ____ 1 - 74LS139 @ K
- ____ 2 - 74LS375 @ Y,Z
- ____ 4 - 74SC244 @ N,Q,R,S
- ____ 3 - 74SC373 @ P,T,U
- ____ 1 - 8088 @ E MPU
- ____ 1 - 8284 @ F Clock Generator and Driver
- ____ 1 - EPROM 350 ns @ D *Refer to the layout
  Strap J1 when using 2732A EPROM
  Strap J2 when using 2716 EPROM



____ 4 - TMM2016 (Toshiba) RAM, 2K bytes, 150 ns

REQUIRED:	1 RAM @ CØ	for 2K
EXPANSION:	2 RAM @ CØ,1	for 4K
	3 RAM @ CØ,1,2	for 6K
	4 RAM @ CØ,1,2,3	for 8K

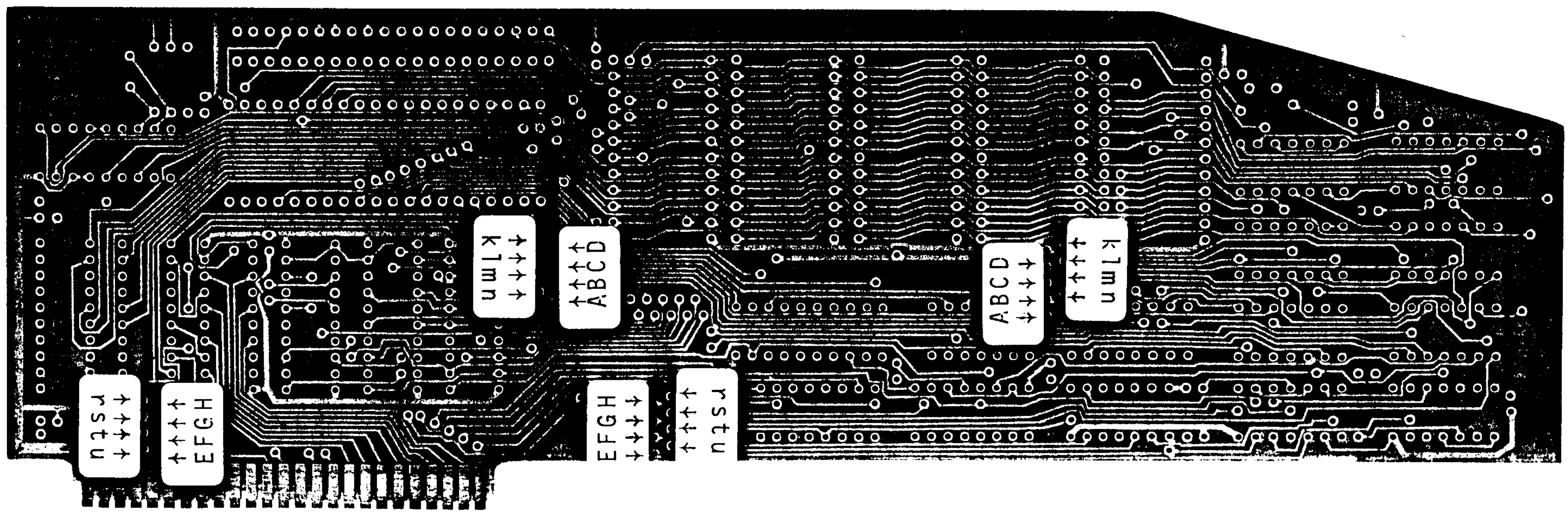
MODIFICATIONS TO THE SOLDER SIDE as shown on the layout

Connect jumper wires ON THE SOLDER SIDE as illustrated

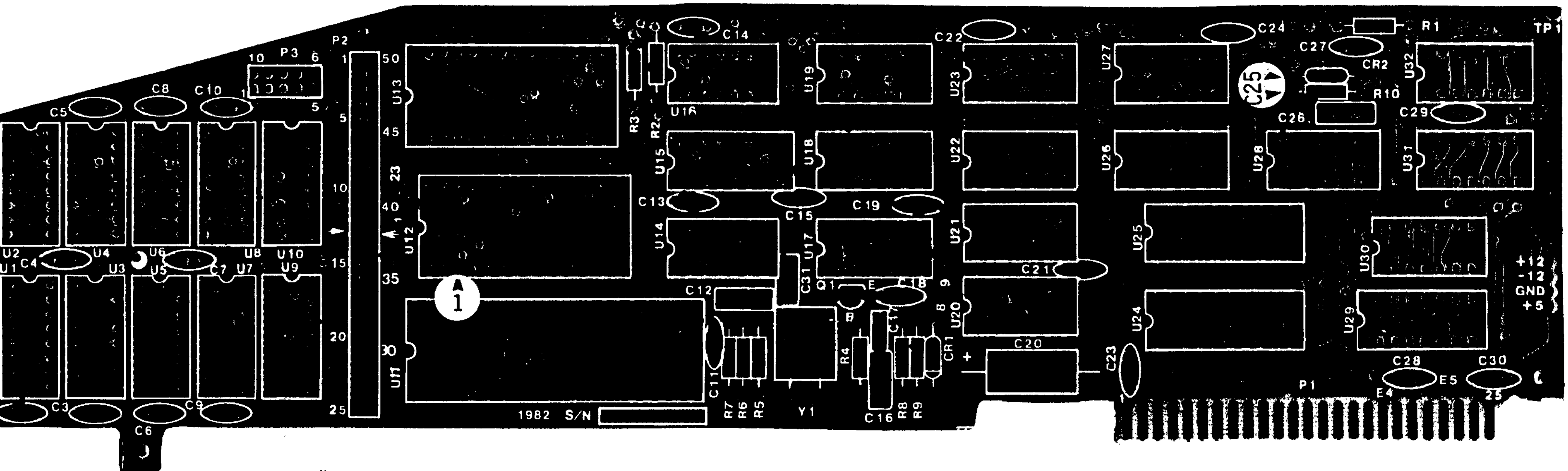
A to A		k to k
B-B		l-l
C-C		m-m
D-D	and	n-n
E-E		r-r
F-F		s-s
G-G		t-t
H-H		u-u

FURTHER MODIFICATION
Strap pin 13 to pin 14 on IC number M on the SOLDER SIDE

MODIFICATIONS TO THE SOLDER SIDE



Z80/64K CARD: Allows one to run software written for the Z-80 based microcomputer (CP/M operating system); expands on-board memory by 64 K. With power off, install in slot number 4. Requires firmware (one EPROM) and software (three disks).

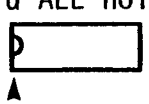


SEQUENCE *INDICATES A PRECAUTION

DIODES D *Match banded end (cathode) of diode with the bar on the layout
____ 1 - 1N4148 @ CR1 *Delete CR2

RESISTORS R ¼ watt, 5% *Delete R1,10
____ 1 - 27 Ω @ R7
____ 2 - 1 KΩ @ R5,6
____ 2 - 4.7 KΩ @ R2,3
____ 2 - 10 KΩ @ R8,9
____ 1 - 82 KΩ @ R4

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 15 - 14-pin
____ 12 - 16-pin
____ 2 - 20-pin
____ 2 - 24-pin
____ 1 - 40-pin


pin 1

CAPACITORS C *Delete C31
____ 2 - 47 pF @ C25,26
____ 2 - 33 pF @ C16,17
____ 1 - 0.01 μF @ C12
____ 24 - 0.1 μF Monolythic @ C1,2,3,4, C5,6,7,8,9,10,11,13,14,15, C18,19,21,22,23,24,27,28, C29,30
____ 1 - 100 μF/16V Axial* @ C20 *Match + of Axial with + on the layout

CRYSTAL *Fold crystal flat against the card before soldering
____ 1 - 12.000 MHz @ Y1

TRANSISTORS Q *Match the EBC transistor terminals with EBC on the layout
____ 1 - 2N2907 @ Q1

CONNECTORS
____ 1 - 25x2 male header, straight @ P2
____ 1 - 5x2 male header, straight @ P3
____ 1 - jumper plug: connect pin 13 to pin 38 of P2

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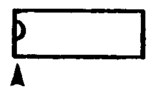
30/64 K CARD (continued)

TEGRATED CIRCUITS *Match pin 1 of
ICs with pin 1 on the layout

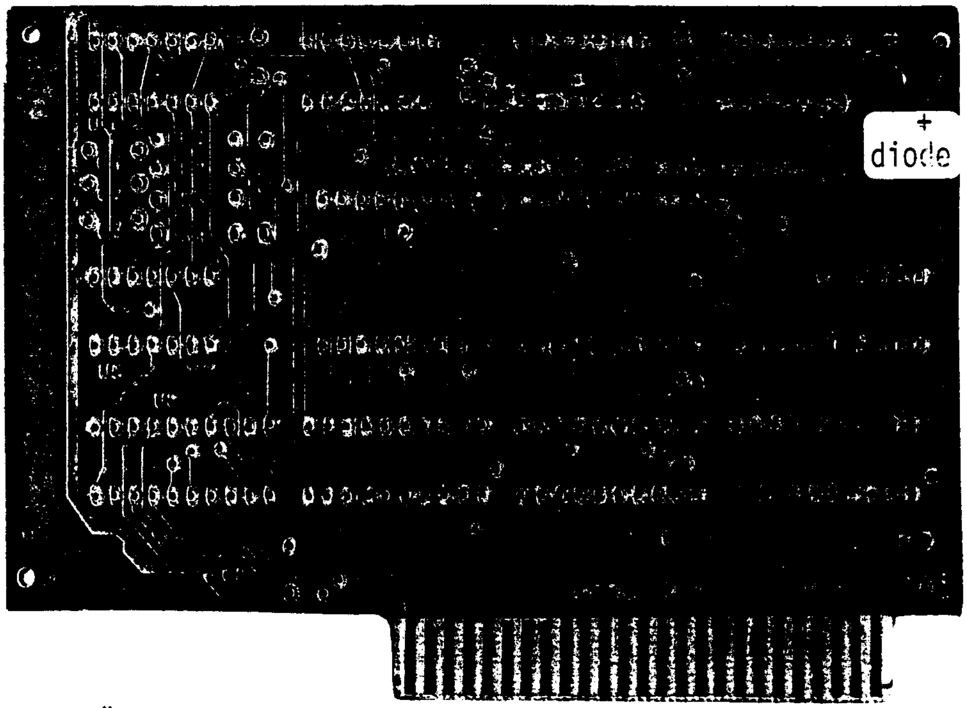


- 1 - 74LS00 @ U18
- 2 - 74LS04 @ U14,19
- 1 - 74LS08 @ U32
- 1 - 74ALS11 @ U23
- 2 - 74LS32 @ U16,28
- 4 - 74LS74 @ U17,22,27,30
- 1 - 74LS125 @ U31
- 1 - 74LS132 @ U21
- 2 - 74LS138 @ U15,29
- 2 - 74LS158 @ U9,10
- 2 - 74LS374 @ U24,25
- 1 - 74LS393 @ U26

- 1 - 74121 @ U20
- 8 - 4164 RAM, 150 ns @ U1,2,3,4,5,6,7,8
- 1 - Z80B CPU, 6 MHz @ U11
- 1 - Z80B CTC, 6 MHz @ U13 (optional)
- 1 - 2716 EPROM* @ U 12

*Note position of pin 1 on the layout

Z 80+ CARD: Allows user to run software written for the Z 80 based MPU (CP/M operating system). With power off, install in slot number 4.



*MODIFICATION REQUIRED:
Cut connection (short) between pin 2 & pin 3 of U6 on the SOLDER SIDE

SEQUENCE *INDICATES A PRECAUTION

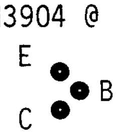
RESISTORS R ¼ watt, 5%
_____ 1 - 27 Ω @ R5
_____ 3 - 82 Ω @ R3,4,6
_____ 1 - 220 Ω @ R2
_____ 1 - 12 KΩ @ R1
_____ 2 - 1 KΩ 10-pin SIP* @ RP1,2
*Match pin 1 of SIPs with pin 1 on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
_____ 6 - 14-pin
_____ 3 - 20-pin
_____ 1 - 40-pin

pin 1
1

CAPACITORS C
_____ 1 - 37 pF @ C1
_____ 1 - 100 pF @ C3
_____ 2 - 200 pF @ C2,7
_____ 3 - 0.1 µF Monolithic @ C4,5,8
_____ 1 - 10 µF/16V Tantalum* @ C6
*Match + of Tantalum with + on the layout

TRANSISTOR Q *Position EBC transistor leads as shown
_____ 1 - 2N3904 @ Q1



DIODE D
_____ 1 - LED *Position longer lead (anode) of diode as shown @ D1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
_____ 1 - 7404 @ U7
_____ 1 - 7410 @ U3
_____ 2 - 7474 @ U4,5
_____ 1 - 74107 @ U1
_____ 1 - 74125 @ U2

_____ 2 - 74LS245 @ U9,10
_____ 1 - 74LS374 @ U8

_____ 1 - Z80A MPU @ U6
_____ 1 - 28L22 PROM @ U11

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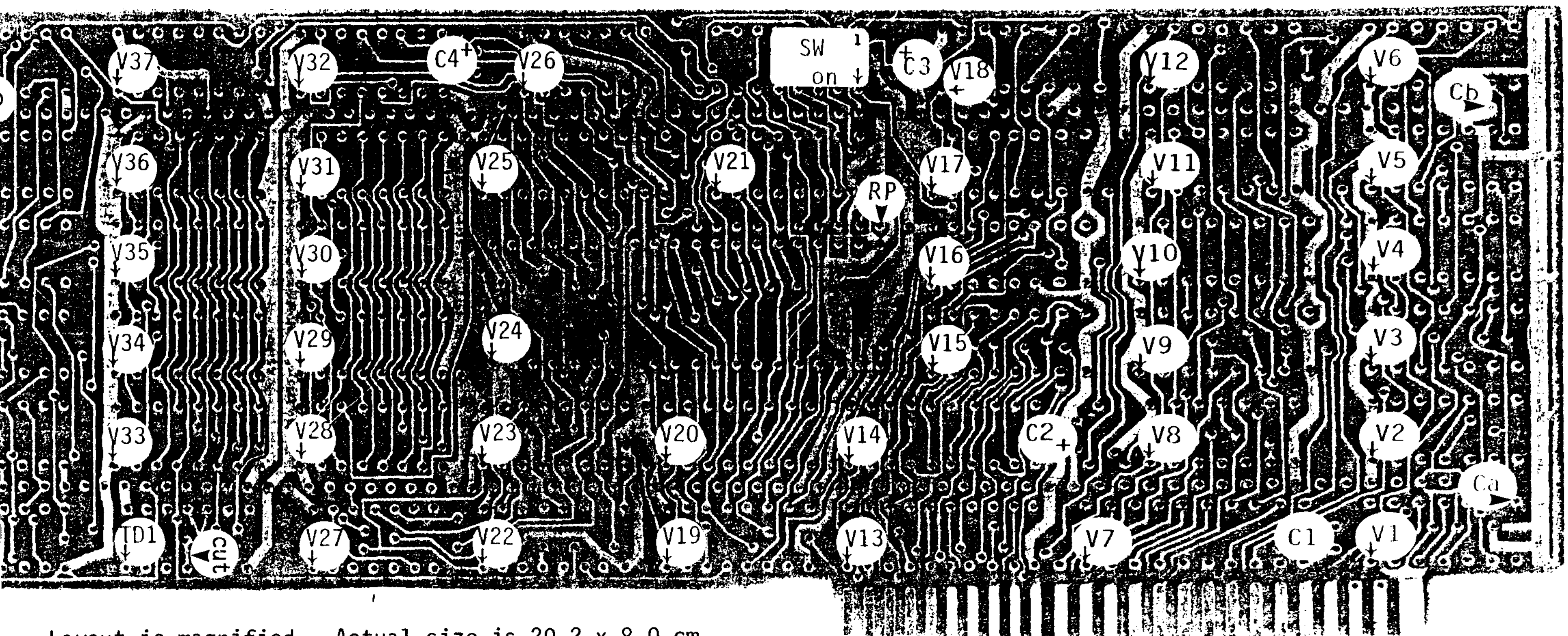
SPEEDY CARD: Uses the sofisticated 6502-C microprocessor to considerably increase the speed of the computer. ...th power off, install in slot 1 to 7. Documentation available from the supplier. Modification required.



Layout is magnified. Actual size is 20.2 x 8.0 cm

...: *INDICATES A PRECAUTION *MODIFICATION REQUIRED ON COMPONENT SIDE UNDER TD1

*Match pin 1 of sockets with ...1 (arrow) on the layout.
...ck that ALL pins have passed ...u ALL holes
- 40-pin @ V24
- 20-pin @ V7,13,14,25
- 16-pin @ V9,10,15,16,17,19,20, V21,22,23,28,29,30,31, V32,33,34,35,36,37
- 14-pin @ V1,2,3,4,5,6,8,11,12, V18,26,27,38,39,40,41, V42,43

RESISTORS R ¼ watt, 5%

____ 1 - 2.2 KΩ 10-pin SIP* bussed @ RP
*Match pin 1 of SIP with pin 1 (arrow) on the layout

CAPACITORS C

____ 1 - 0.1 μF Monolithic @ C1
____ 3 - 4.7 μF/16V Tantalum* @ C2,3,4
*Match + of Tantalum with + on the layout
____ 2 - 72-pin SIP capacitor between Ca,Cb Rogers Q/PAC

SWITCH

____ 1 - 8-position DIP @ SW
*Note the "on" position

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 2 - 74LS00 @ V6,18
____ 2 - 74LS02 @ V11,43
____ 2 - 74LS08 @ V12,26
____ 1 - 74LS10 @ V3
____ 1 - 74LS14 @ V8
____ 1 - 74LS32 @ V5

SPEEDY CARD (continued)

TED CIRCUITS (continued)

```
- 74LS74  @ V1,2,4,38,39,40
- 74LS80  @ V41 74LS86
- 74LS153 @ V21
- 74LS158 @ V19,20,22,23
- 74LS161 @ V10
- 74LS175 @ V32
- 74LS259 @ V17
- 74LS367 @ V15,16
- 74LS373 @ V7,13,14,25
- 74LS393 @ V27,42

- 4040    @ V37
- 24S10 PROM      @ V9
- G65SC02P1-2 MPU @ V24
- 4164 RAM 150 ns @ V28,29,30,31
                    V33,34,35,36
```

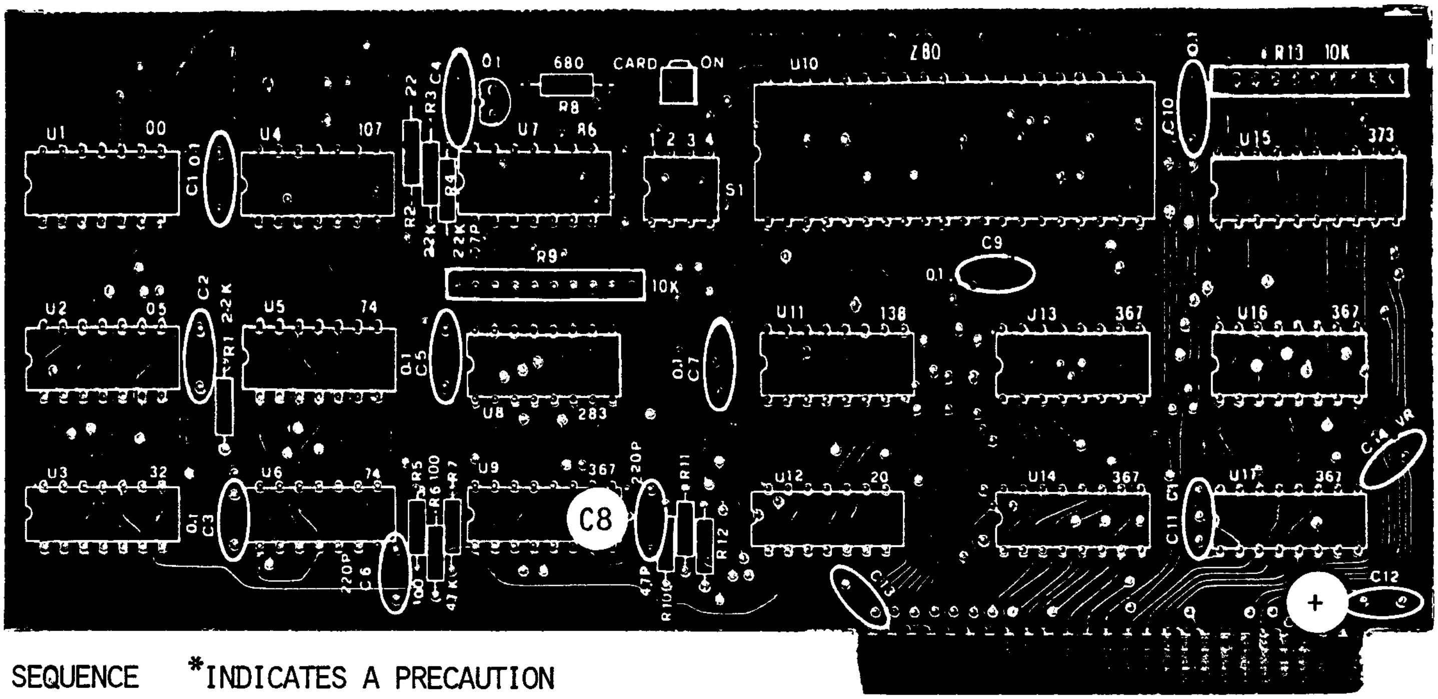
INE

- TTLDM-100 100 ns @ TD1

ATION ON COMPONENT SIDE:

- cut trace from pin 4 of TTLDM-11 as shown on the layout

ACE Z-80: Allows one to run software written for the Z-80 based MPU (CP/M operating system). With power off, install in slot 4.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 1 - 22 Ω @ R2
____ 4 - 100 Ω @ R5,6,11,12
____ 1 - 220 Ω @ R3
____ 1 - 680 Ω @ R8
____ 1 - 1.2 KΩ @ R4
____ 1 - 2.2 KΩ @ R1
____ 2 - 4.7 KΩ @ R7,10
____ 2 - 10 KΩ 10-pin SIP* bussed @ R9,13
*Match pin 1 of SIP with pin 1 (arrow) on the layout

CAPACITORS C

____ 1 - 50 pF @ C4
____ 3 - 200 pF @ C6,8,14
____ 9 - 0.1 µF Monolithic @ C1,2,3,5,6, @ C7,9,10,11,13
____ 1 - 10 µF/16V Tantalum* @ C12
*Match + of Tantalum with + on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 8 - 14-pin
____ 7 - 16-pin
____ 1 - 20-pin
____ 1 - 40-pin


pin 1

TRANSISTORS Q *Position EBC leads as shown

____ 1 - 2N3904 @ Q1

E
B D C

LIGHT EMITTING DIODE LED

____ 1 - LED @ CARD ON *Position longer lead (+) with + on the layout

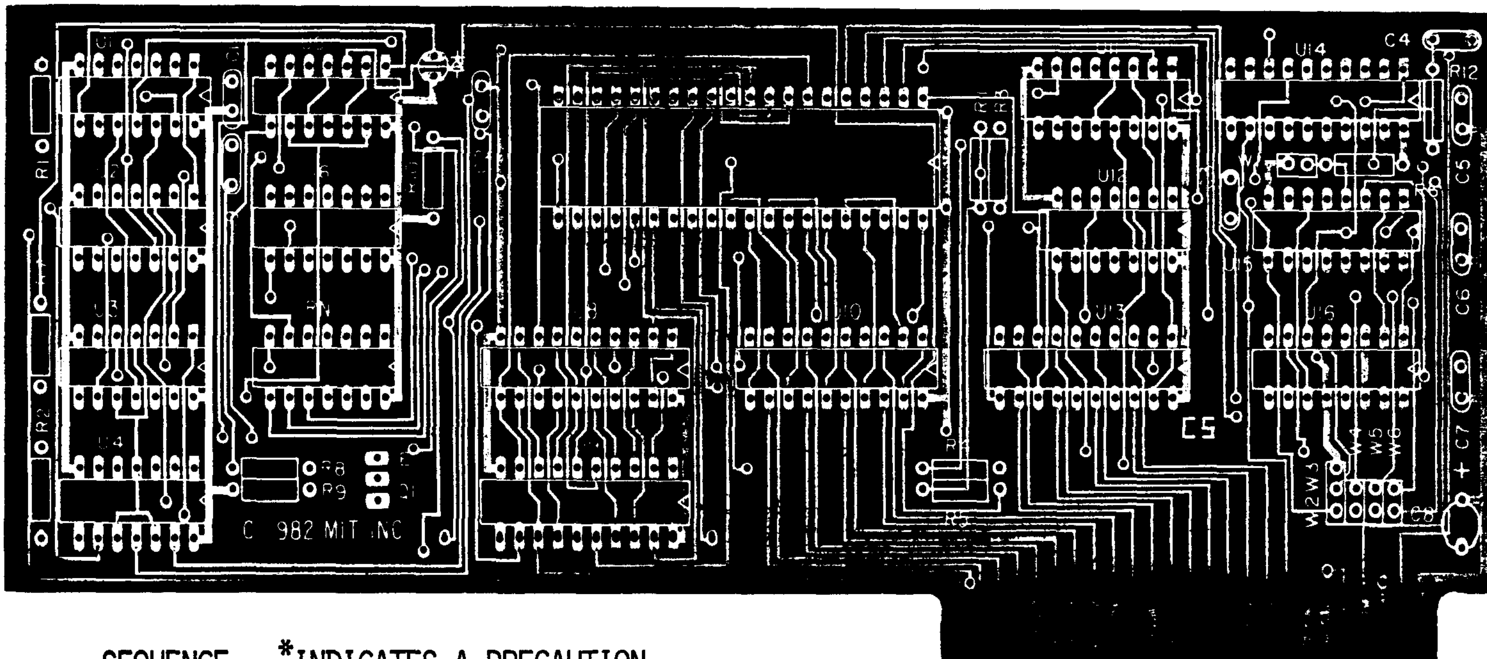
SWITCH

____ 1 - 4-position DIP @ S1
Functions: 1-address offset when off
2-Z80 DMA when off
3-non-mask int when off
4-Z-80 interupts when off

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS00 @ U1
____ 1 - 74LS05 @ U2
____ 1 - 74LS32 @ U3
____ 1 - 74LS20 @ U12
____ 2 - 74LS74 @ U5,6
____ 1 - 74LS86 @ U7
____ 1 - 74LS107 @ U4
____ 1 - 74LS138 @ U11
____ 1 - 74LS283 @ U8
____ 5 - 74LS367 @ U9,13,14,16,17
____ 1 - 74LS373 @ U15
____ 1 - Z80A @ U10

EXCEL Z80 CARD: Allows one to use the CP/M operating system with the Z80 microprocessor installed. With power off, install in slot 4.

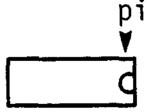


SEQUENCE *INDICATES A PRECAUTION
MODIFICATION REQUIRED ON THE SOLDER SIDE

RESISTORS R ½ watt, 5%
____ 1 - 30 Ω @ R9
____ 4 - 100 Ω @ R4,5,11,12
____ 1 - 220 Ω @ R8
____ 1 - 560 Ω @ R7
____ 1 - 1.2 KΩ @ R1
____ 1 - 1.5 KΩ @ R10
____ 3 - 2 KΩ @ R2,3,6
____ 1 - 10 KΩ 14-pin DIP @ RN

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 8 - 14-pin
____ 3 - 16-pin
____ 5 - 20-pin
____ 1 - 40-pin

pin 1



CAPACITORS C
____ 1 - 22 pF @ C3
____ 1 - 47 pF @ C9
____ 1 - 100 pF @ C4
____ 5 - 0.1 μF Monolithic @ C1,2,5,6,7
____ 1 - 10 μF/16V Tantalum* @ C8
*Match + of Tantalum with + on the layout

TRANSISTOR Q *Match ebc transistor leads with ebc on the layout
____ 1 - 2N3906 @ Q1

LIGHT EMITTING DIODE LED *Position cathode of diode toward the arrow
____ 1 - LED @

HEADERS male, straight
____ 4 - 1x2 @ W1,W4,W5,W6
____ 1 - 1x3 @ W2W3

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS04 @ U1
____ 2 - 74LS05 @ U5,15
____ 1 - 74LS08 @ U6
____ 1 - 74LS10 @ U12
____ 1 - 74LS32 @ U2
____ 2 - 74LS74 @ U3,14
____ 1 - 74LS112 @ U11
____ 4 - 74LS244 @ U8,10,13,14
____ 1 - 74LS283 @ U16
____ 1 - 74LS373 @ U9
____ 1 - Z80 MPU @ U7

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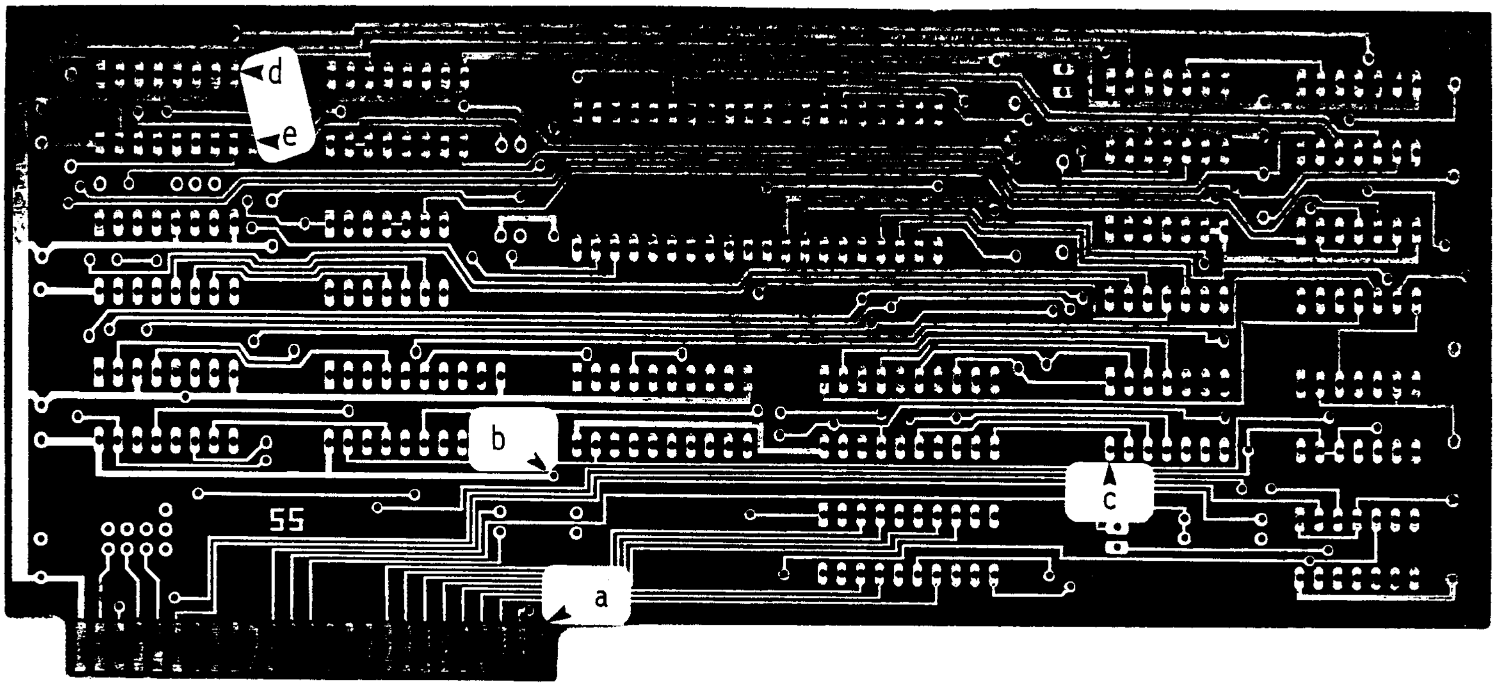
EXCEL Z80 CARD: (continued)



MODIFICATIONS ON THE SOLDER SIDE Refer to the preceding layout

1 - Install one 0.1 µF Monolithic capacitor between "a" pin 50 (+12V) of card edge connector to "b" plate-thru hole.

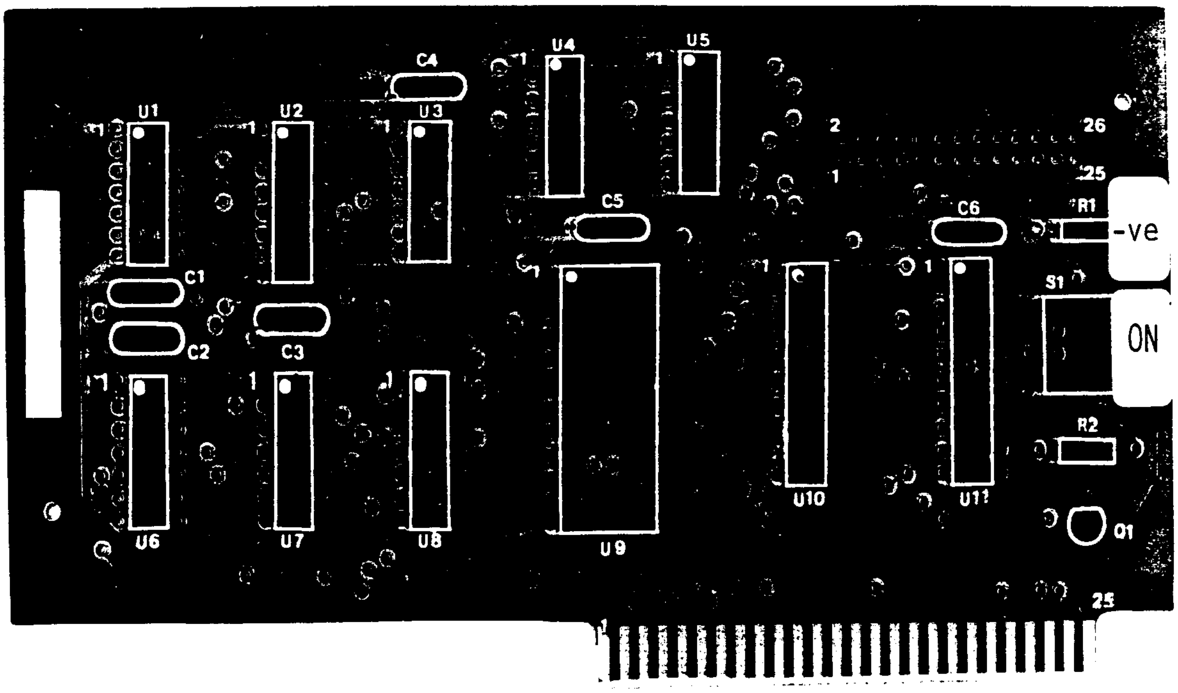
2 - Strap "b" plate-thru hole to "c" pin 14 of RN.

3 - Strap "d" pin 8 of U14 to "e" pin 12 of U14.

MODIFICATION ON THE COMPONENT SIDE

1 - Bend out pin 12 - NOT USED - of U14.

PARALLEL PRINTER CARD: Centronics compatible parallel interface featuring advanced text features and HIRES dot graphics. Requires firmware (one EPROM). With power off, install in slot number 1.



SEQUENCE * INDICATES A PRECAUTION

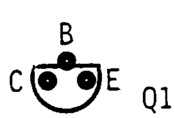
DIODE D *Position banded end (cathode, -ve) of diode as shown on the layout
____ 1 - 1N4001 @ R1 *Error on layout

RESISTORS R ¼ watt, 5%
____ 1 - 4.7 KΩ @ R2

SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 7 - 14-pin
____ 1 - 16-pin
____ 2 - 20-pin
____ 1 - 24-pin

CAPACITORS C
____ 1 - 100 pF disc ceramic @ C1
____ 1 - 470 pF disc ceramic @ C3
____ 4 - 0.1 μF Monolithic @ C2,4,5,6

TRANSISTOR Q *Match the EBC transistor leads as shown
____ 1 - 2N3904



CONNECTOR
____ 1 - 2x13 male header strip, right angle

SWITCH
____ 1 - 4-position DIP @ S1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 3 - 74LS00 @ U1,4,6
____ 1 - 74LS02 @ U3
____ 1 - 74LS08 @ U7
____ 1 - 74LS30 @ U8
____ 1 - 74LS74 @ U5
____ 1 - 74LS279 @ U2
____ 2 - 74LS373 @ U10,11
____ 1 - 2732 EPROM @ U9

pin 1 ►1 upper left for ALL sockets & ICs

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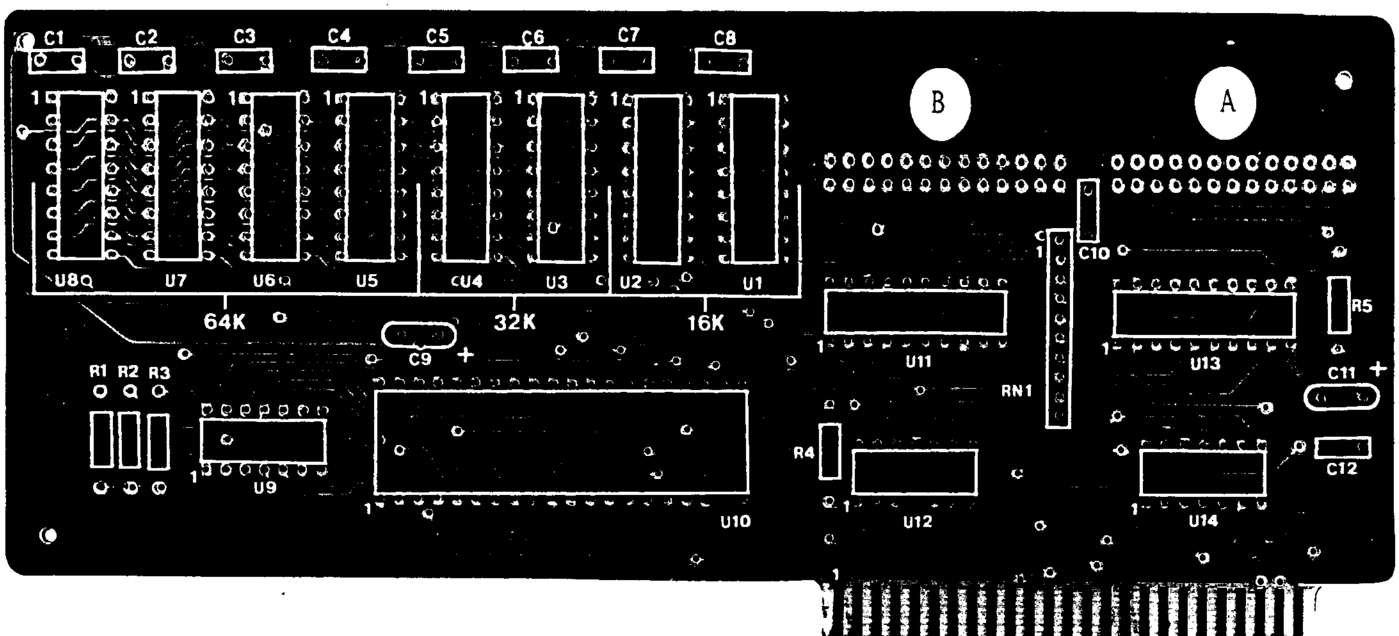
PRINTER BUFFER CARD: Adds memory - 16K, 32K, or 64K RAM - to your current parallel printer interface. With power off, connect by means of an appropriate cable, to your existing printer card: install in slot adjacent to printer card. Requires firmware (one EPROM).



SEQUENCE *A PRECAUTION *DO MODIFICATIONS FIRST

RESISTORS R ¼ watt, 5%

____ 5 - 4.6 KΩ @R1,2,3,4,5

____ 1 - 4.7 KΩ 9-pin SIP @ RN 1*
*Match pin 1 (common) of SIP with pin 1 of RN 1 on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 3 - 14-pin
____ 8 - 16-pin
____ 2 - 20-pin
____ 1 - 40-pin

1
▲ pin 1 for ALL sockets & ICs

CAPACITORS C

____10 - 0.1 μF Monolithic @ C1,2,3,4,5,6, C7,8,10,12

____ 1 - 2.2 μF/25v Radial* @ C9

____ 1 - 100 μF/16v Radial* @ C11
*Match + of capacitors with + on layout

MODIFICATIONS *On the COMPONENT SIDE

____ 7 - Cuts: Cut the trace from pin 14 to pin 14 of: U1-2; U2-3; U3-4; U4-5; U5-6; U6-7; U7-8

CONNECTORS

____ 2 - 2x13 male header strip, right-angle

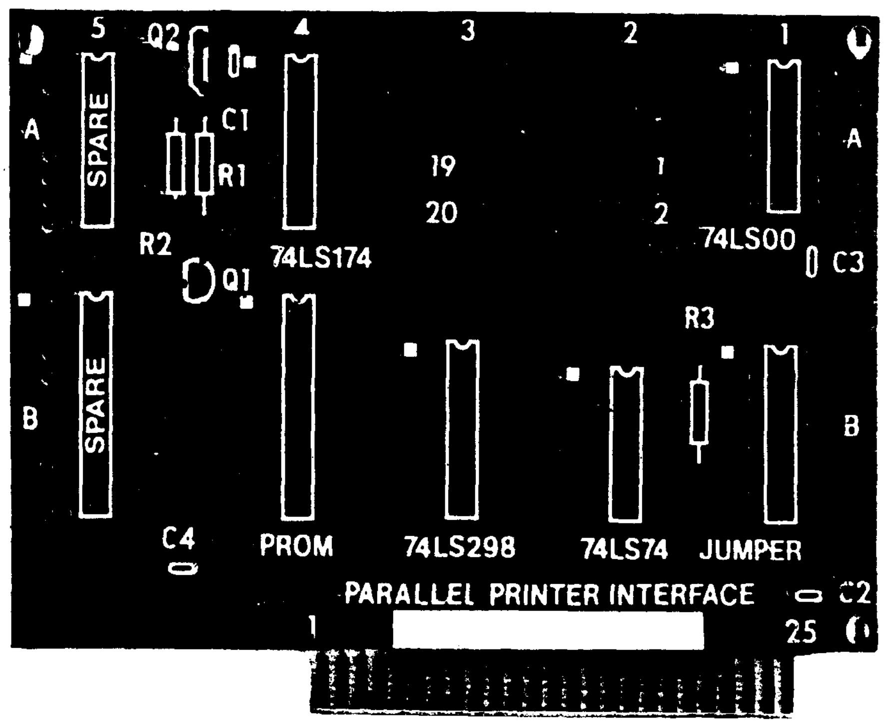
INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on the layout

____ 1 - 74LS32 @ U14
____ 1 - 74LS74 @ U12
____ 2 - 74LS374 @ U11,13
____ 1 - 74LS38 @ U9
____ 1 - D8748 8-bit CPU, 4K EPROM (8048) @ U10
____ 8 - 4564 RAM
@ U1,2 for 16K RAM
@ U1 to 4 for 32K RAM
@ U1 to 8 for 64K RAM

RIBBON CABLE CONNECTOR

____ 1 - 10-12 cm length, 26-conductor, with connectors @ each end to connect bufferboard from A on the layout to printer interface card. Use existing printer cable to connect bufferboard from B on the layout to the printer

PARALLEL PRINTER INTERFACE CARD: Allows one to produce printed output (hardcopy) on a variety of printers; may also be used as a general purpose output card to drive music synthesizers, analog-to-digital converters, etc. With power off, install in slot number 1. Requires firmware (one PROM).

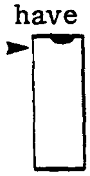


SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 150 Ω @ R1
____ 1 - 68 Ω @ R2
____ 1 - 12 KΩ @ R3

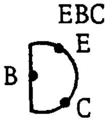
CAPACITORS C
____ 4 - 0.1 μF @ C1,2,3,4

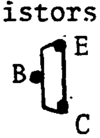
SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins of sockets have passed thru ALL holes

pin 1


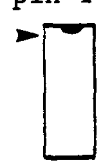
____ 2 - 14-pin
____ 3 - 16-pin
____ 1 - 20-pin

TRANSISTORS Q *Install EBC leads as shown
____ 1 - 2N3904 @ Q1
____ 1 - MPSU51 @ Q2
*Check with supplier re EBC leads of transistors

Q1


Q2


INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout
____ 1 - 74LS00
____ 1 - 74LS74
____ 1 - 74LS174
____ 1 - 74LS298
____ 1 - 6309 PROM

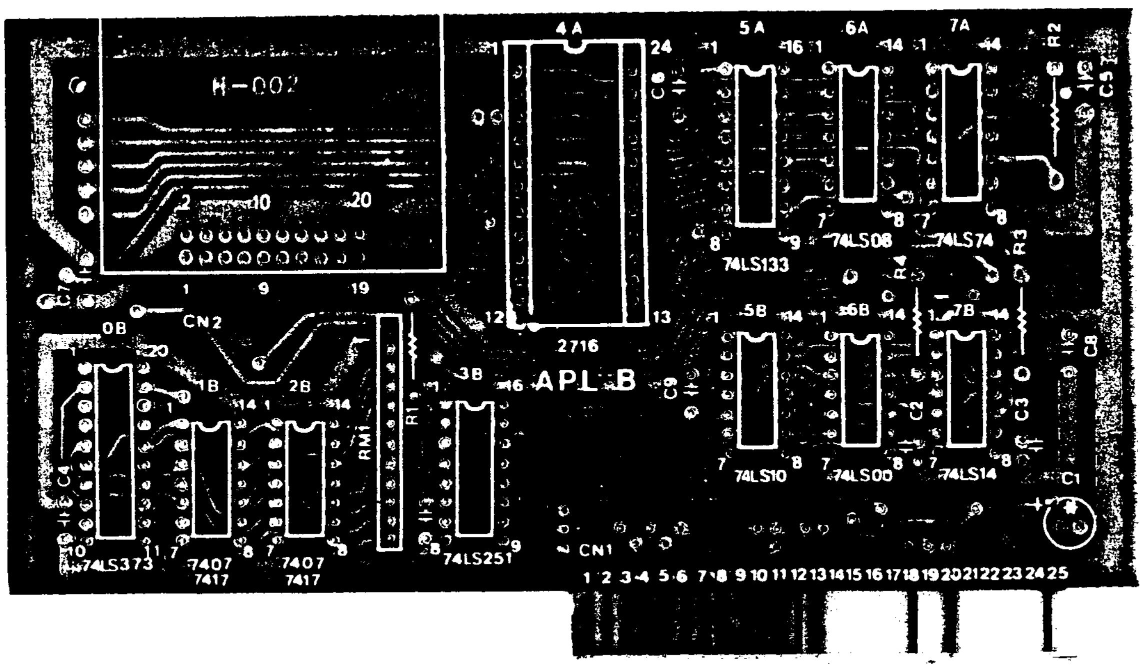
pin 1


CONNECTOR
____ 1 - 2x10 male header strip, right-angle
*Position pins UP
____ 1 - ribbon cable with appropriate connectors

JUMPER
____ 1 - 16-pin DIP header
____ 1 - jumper block

NOTE: The pin-out of the ribbon cable and the wiring of the jumper block must be customized for your specific printer. Refer to the appropriate printer interface card installation manual

EPSON/CENTRONICS INTERFACE CARD: Allows interface to parallel printers. With power off, install in slot number 1. Requires firmware (one EPROM).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

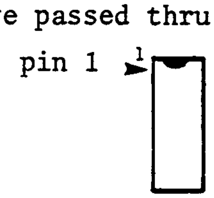
____ 2 - 12 KΩ @ R1,2
____ 2 - 100 Ω @ R3,4
____ 1 - 1 KΩ 11-pin SIP @ RM1
*Pin 1 of SIP is labelled "1" on the layout

CAPACITORS C

____ 1 - 10 μF/16v Tantalum* @ C1
*Match + of capacitor with + on the layout
____ 2 - 0.001 μF @ C2,3
____ 7 - 0.1 μF Monolithic @ C4 to C10
*C10 is NOT labelled on the layout and is located between the SIP and the 74LS251 IC

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 7 - 14-pin
____ 2 - 16-pin
____ 1 - 20-pin
____ 1 - 24-pin

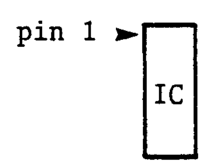


CONNECTOR

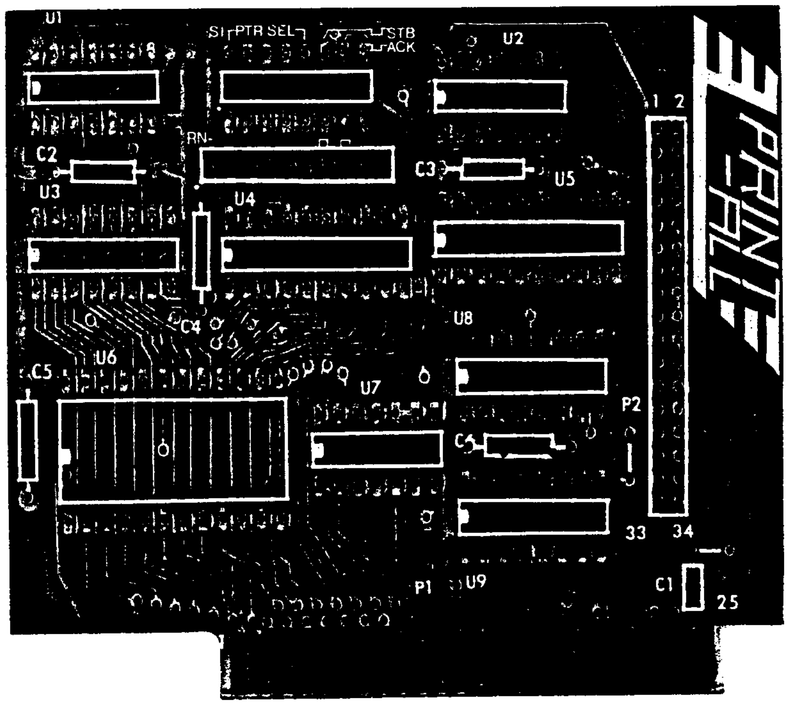
____ 1 - 2x10 male header strip, right angle
*Position pins UP

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on the layout

____ 1 - 74LS00
____ 2 - 74LS07
____ 1 - 74LS08
____ 1 - 74LS10
____ 1 - 74LS14
____ 1 - 74LS74
____ 1 - 74LS133
____ 1 - 74LS251
____ 1 - 74LS373
____ 1 - 2716 EPROM



PRINT-ALL CARD: Parallel printer interface card for text and graphics applications. With power off, install in slot number 1 (recommended). Requires firmware (one EPROM).



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS: R ¼ watt, 5%

____ 1 -2K-10 KΩ 10-pin SIP resistor @ RN

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 3 - 14-pin
____ 3 - 16-pin
____ 2 - 20-pin
____ 1 - 24-pin

pin 1

CAPACITORS C

____ 1 - 33 µF/16v Radial* @ C1
*Match + of capacitor as shown

C1 +

____ 5 - 0.1 µF Monolithic @ C2,3,4,5,6

SWITCH SW

____ 1 - 8-position DIP @ SW1
Set switches as per printer instructions

CONNECTOR

____ 1 - 2x17 header strip, straight @ P2

CABLE

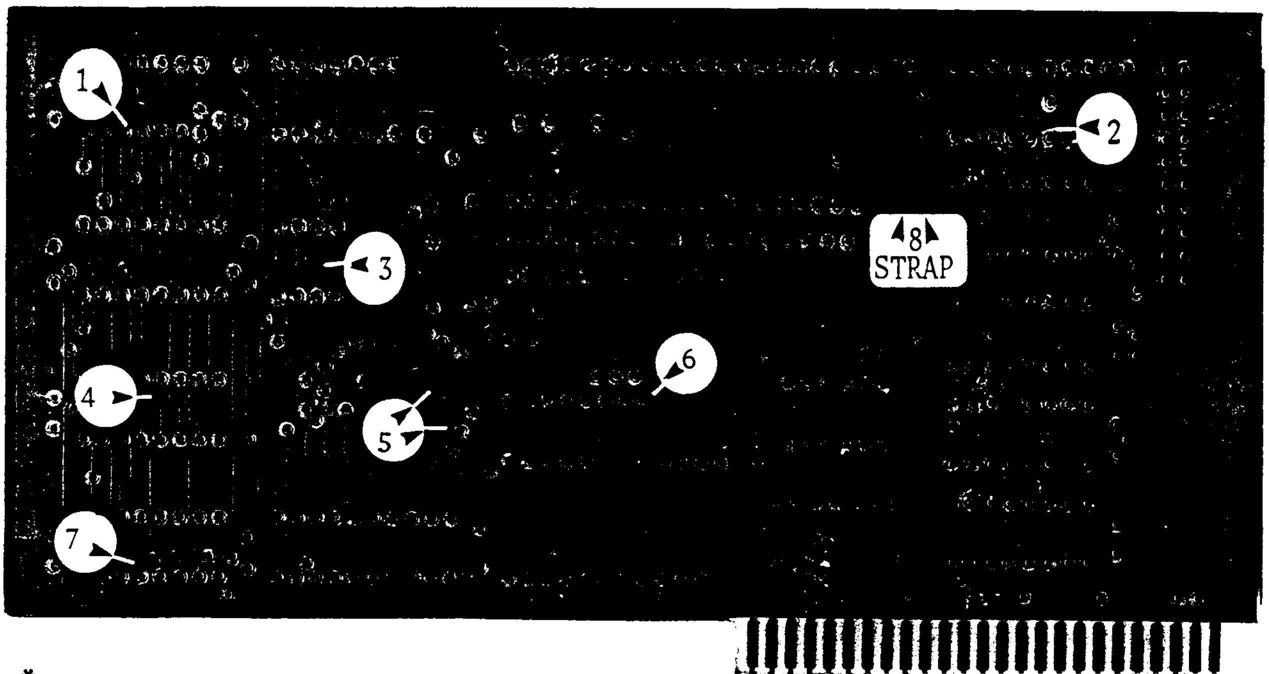
____ 1 - as per printer

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on the layout

____ 1 - 74LS02 @ U1
____ 1 - 74LS08 @ U7
____ 1 - 74LS86 @ U2
____ 1 - 74LS133 @ U3
____ 1 - 74LS138 @ U9
____ 1 - 74LS244 @ U4
____ 1 - 74LS273 @ U5
____ 1 - 74LS279 @ U8
____ 1 - 2732 EPROM @ U6

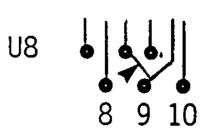
pin 1

MICRO-2-BUFFER: Centronics-compatible parallel printer interface featuring up to 32 K bytes of data buffering and advanced HIRES dump routines. Allows computer to simultaneously print and process. Requires firmware (two EPROMs). With power off, install in any slot except Ø (slot # 1 recommended). Modifications required.

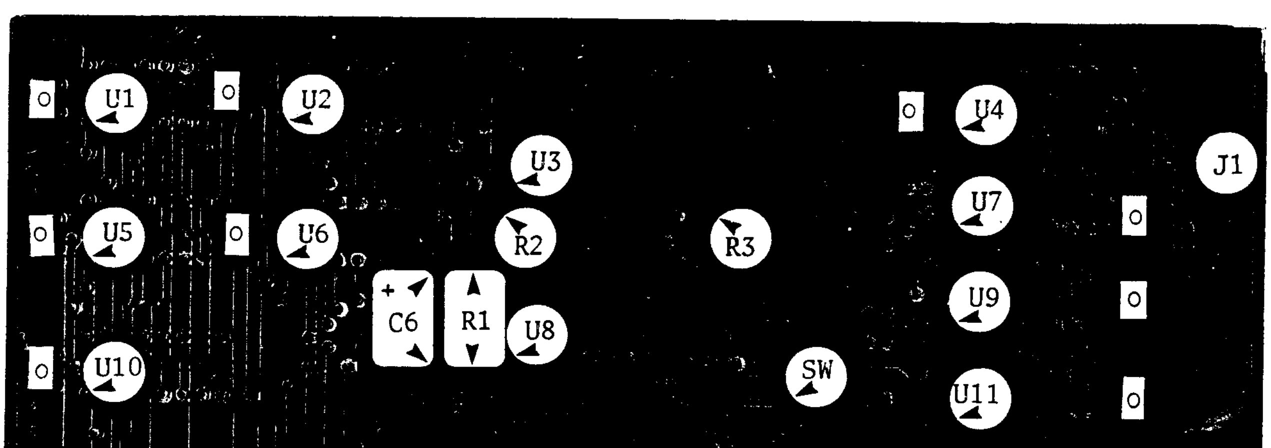


*MODIFICATIONS REQUIRED
ON THE COMPONENT SIDE. The following numbers refer to the numbers on the layout

1 cut trace directly above pin 2 of U1
2 cut trace between pin 7 of U4 & the feed-thru hole located directly above
3 cut trace directly above pin 4 of U6
4 cut trace connecting pin 4 of U10 to pin 13 of U10
5 isolate the -ve solder pad of C6 by making two cuts on either side
6 cut trace directly above pin 9 of U8



7 cut trace directly above pin 3 of U12
8 strap two feed-thru holes as shown



MICRO-2-BUFFER (continued)

SEQUENCE *INDICATES A PRECAUTION

RESISTORS ¼ watt, 5%

____ 1 - 470 Ω @ R1
____ 2 - 10 KΩ 10-pin SIP* bussed @ R2,3
*Match pin 1 of SIPs with pin 1 (arrow) on the layout

SOCKETS Match pin 1 of sockets with pin 1 (arrow) on the layout. Check that ALL pins have passed thru ALL holes

____ 4 - 14-pin @ U1,2,6,15
____ 7 - 16-pin @ U5,7,9,10, 11,12,16
____ 2 - 20-pin @ U4,13
____ 2 - 24-pin @ U8,14
____ 1 - 40-pin @ U3

CAPACITORS C

____13 - 0.1 F Monolithic @ o
____ 1 - 22 F/50V Axial* @ C6
*Match + of Axial with + on the layout

HEADER

____ 1 - 2x10 male, straight, @ J1

SWITCH -

____ 1 - 6-position DIP @ SW

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

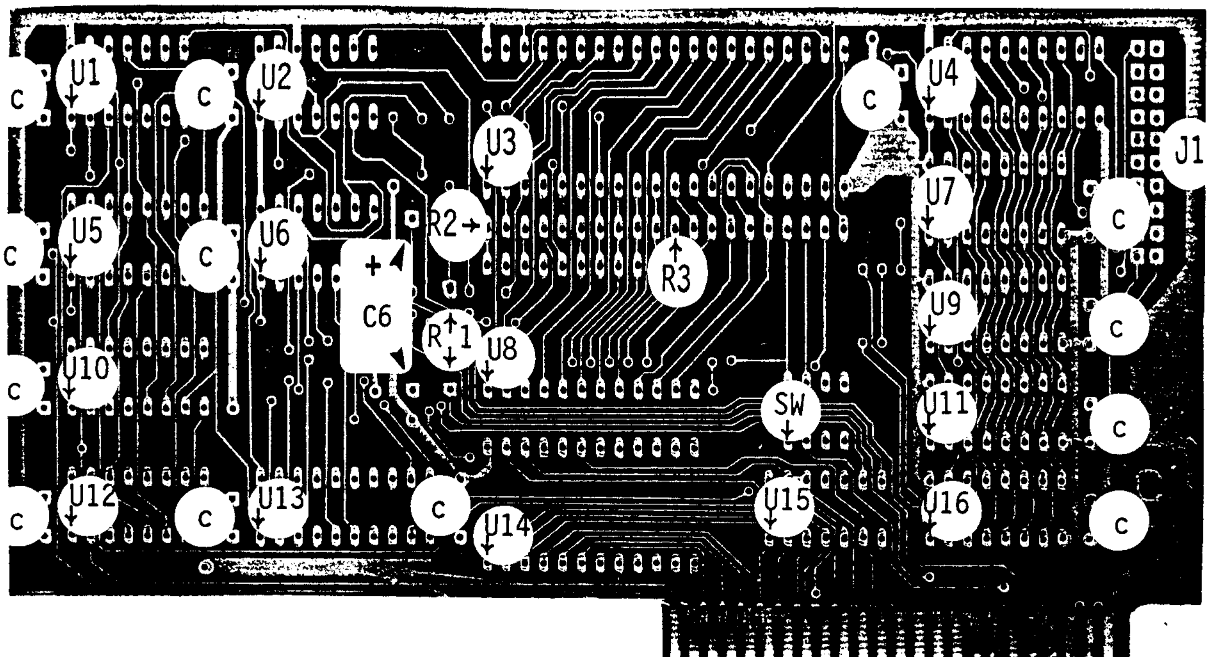
____ 1 - 74LS00 @ U1
____ 1 - 74LS30 @ U15
____ 1 - 74LS74 @ U2
____ 1 - 74LS132 @ U6
____ 1 - 74LS139 @ U12
____ 1 - 74LS279 @ U5
____ 1 - 74LS368 @ U10
____ 2 - 74LS374 @ U4,13

____ 1 - 1802 @ U3
____ 4 - 4164 64Kx1 dynamic RAM @ U7,9,11,16
____ 2 - 2716 EPROM @ U8,14

SWITCH SETTINGS

SWITCH	OFF	ON
1	40 column default/video on	80 column default/ video off
2	keyboard reset has no effect	keyboard reset clears buffer
3,4	not used	not used
5	32 K buffer	16 K buffer
6	buffer enabled	buffer disabled

PRELUDE 32 K PRINTER/BUFFERED CARD: Centronics-compatible parallel printer interface with 32 K bytes of data buffering, and advanced HIRES dump routines. Allows computer to simultaneously print and process. Requires firmware (two EPROMs). With power off, install in any slot except Ø (slot 1 recommended. Modifications required on the solder side .



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 470 Ω @ R1
____ 2 - 10 KΩ 10-pin SIP* bussed @ R2,3
*Match pin 1 of SIPs with pin 1 (arrow) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 (arrow) on the layout. Check that ALL pins have passed thru ALL holes
____ 4 - 14-pin @ U1,2,6,15
____ 7 - 16-pin @ U5,7,9,10,11,12,16
____ 2 - 20-pin @ U4,13
____ 2 - 24-pin @ U8,14
____ 1 - 40-pin @ U3

CAPACITORS C
____13 - 0.1 μF Monolithic @ c
____ 1 - 22 μF/50V Axial* @ C6
*Match + of axial with + on the layout

HEADER
____ 1 - 2x10 male, straight @ J1

SWITCH
____ 1 - 4-position DIP @ SW
*Arrow indicates switch 1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ U1
____ 1 - 74LS30 @ U15
____ 1 - 74LS74 @ U2
____ 1 - 74LS132 @ U6
____ 1 - 74LS139 @ U12
____ 1 - 74LS279 @ U5
____ 1 - 74LS368 @ U10
____ 2 - 74LS374 @ U4,13
____ 1 - 1802 @ U3
____ 4 - 4164 RAM @ U7,9,11,16
____ 2 - 2716 EPROM @ U8,14

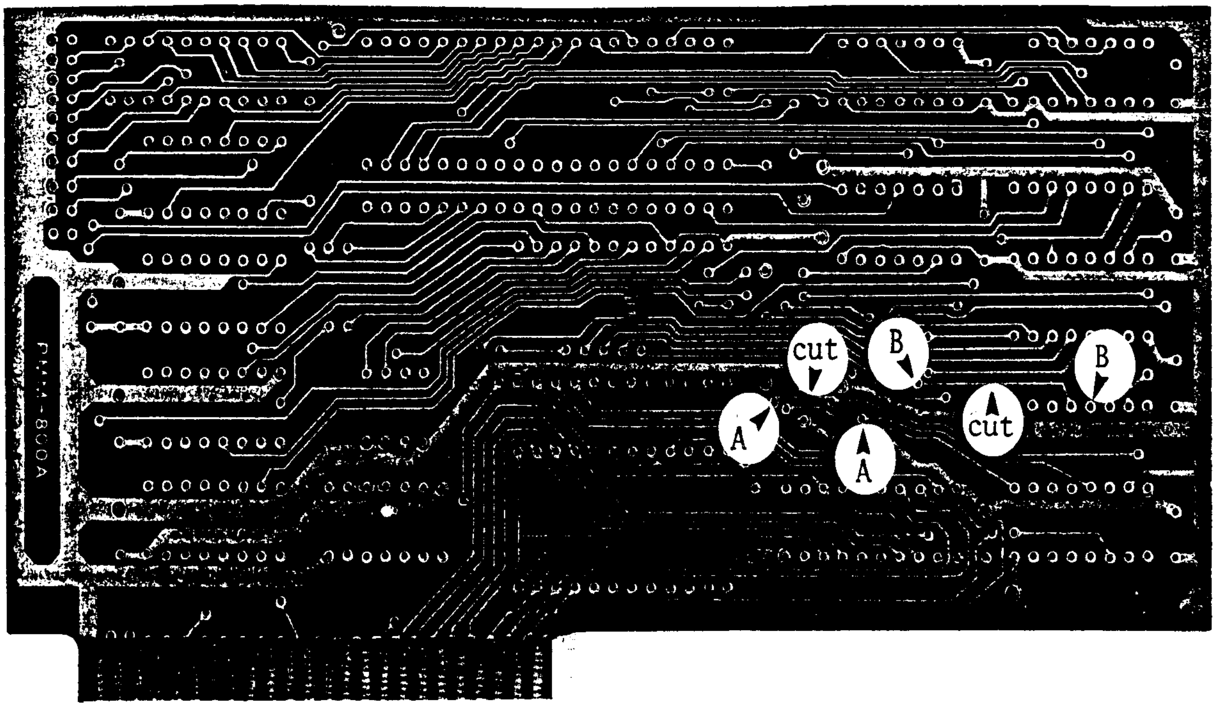
SWITCH SETTINGS

SWITCH	OFF	ON
1	40-column default/video on	80-column default/video off
2	keyboard reset has no effect	keyboard reset clears buffer

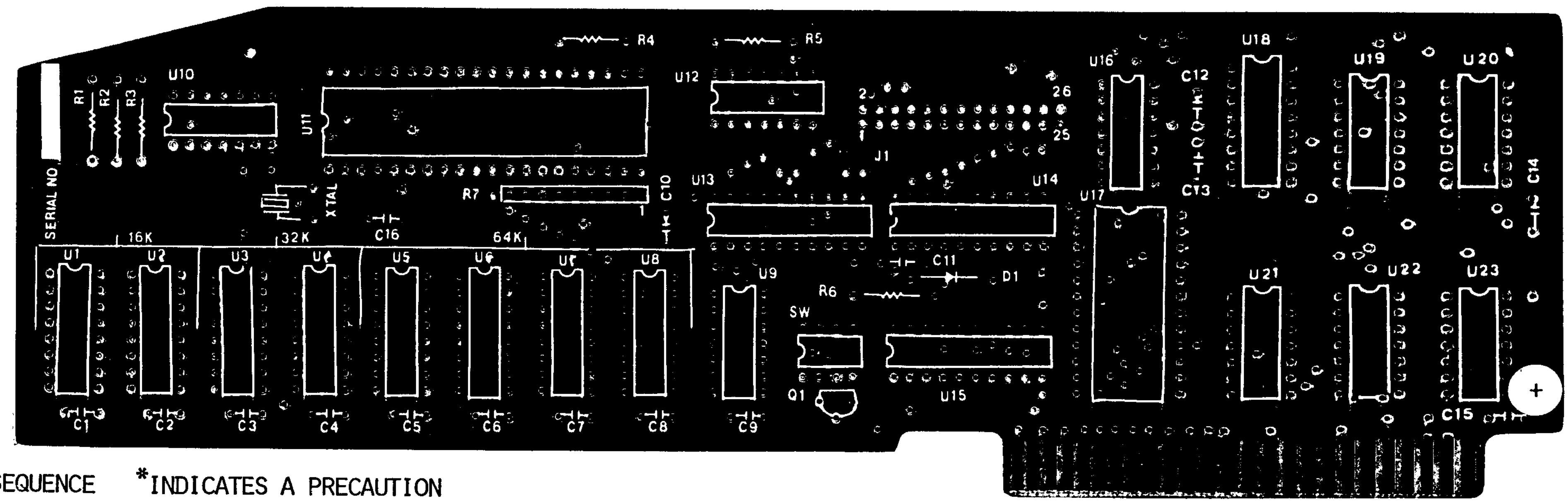
PRELUDE 32 K PRINTER/BUFFERED CARD (continued)

*MODIFICATION REQUIRED ON THE SOLDER SIDE as shown on the layout below

Make two cuts
Strap A to A and B to B



PRINTER BUFFER: Centronics-compatible parallel printer interface with up to 64 K RAM of buffered memory. With power off, install in slot 1. Requires firmware (one EPROM).



EQUENCE *INDICATES A PRECAUTION

IODE *Position banded end of diode towards the arrow
____ 1 - 1N4148 @ D1

ESISTORS R ¼ watt, 5%
____ 6 - 4.7 KΩ @ R1,2,3,4,5,6
____ 1 - 10 KΩ 9-pin SIP bussed @ R7
*Match pin 1 of SIP with pin 1 on the layout

OCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 9 - 14-pin
____ 9 - 16-pin
____ 3 - 20-pin
____ 1 - 24-pin
____ 1 - 40-pin

NuScope Associates

CAPACITORS C
____ 1 - 47 pF
____ 1 - 100 pF
____ 12 - 0.1 µF Monolithic @ C1 to 11 & @ C14
____ 1 - 2.2 µF/16V Tantalum* @ C15
____ 1 - 10 µF/16V Tamtalum* @ C16
*Match + of Tantalums with + on the layout

TRANSISTOR Q Match ebc leads as shown on the layout
____ 1 - 2N3904 @ Q1

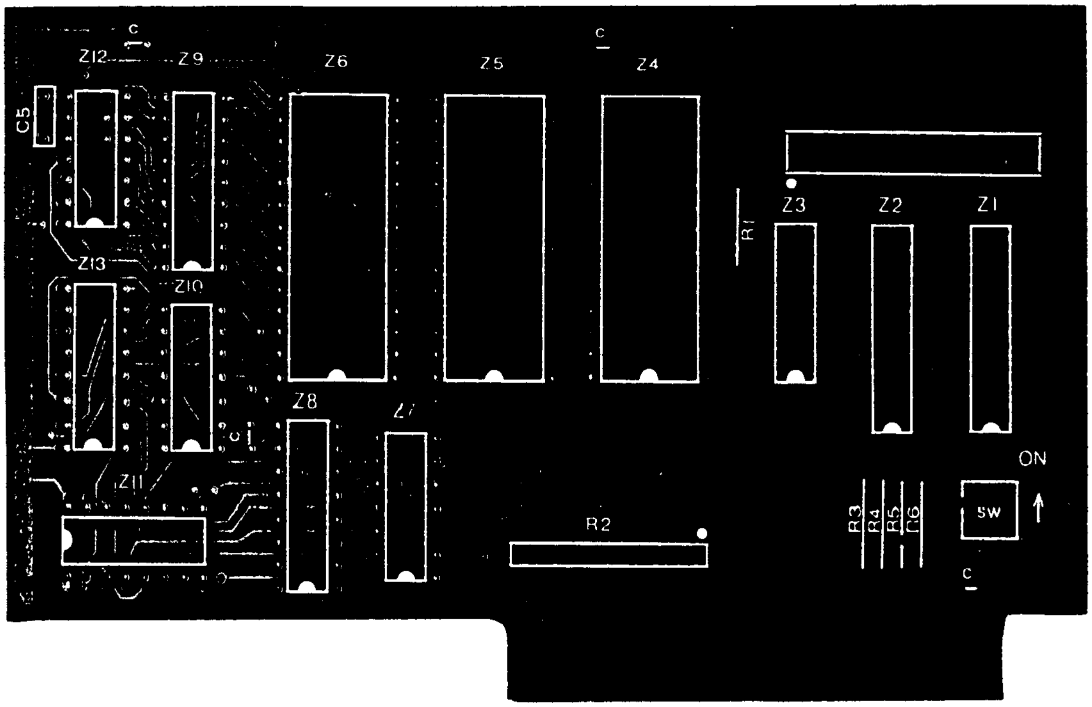
SWITCH
____ 1 - 4-position DIP @ SW

CRYSTAL Y *Not required

CONNECTOR
____ 1 - 2x13 header, male, straight @ J1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 3 - 74LS00 @ U16,19,23
____ 1 - 74LS02 @ U20
____ 1 - 74LS08 @ U22
____ 1 - 74LS30 @ U21
____ 1 - 74LS32 @ U9
____ 1 - 74LS38 @ U10
____ 1 - 74LS74 @ U12
____ 1 - 74LS279 @ U18
____ 1 - 74LS373 @ U15
____ 2 - 74LS374 @ U13,14
____ 1 - D8748 CPU-EPROM @ U11
____ 1 - 2732 EPROM @ U17
____ 8 - 4164 RAM @ U1 to U8

COLLEGE NICE PRINT CARD: Precision printer card that supports Epson & Gemini dot-matrix printers to produce normal & near-letter quality print. Has a) optional font styles (may be italicized); six pitches 5 to 17 in Pica, Elite, Condensed; and underline, boldface, subscript & superscript. With power off, install in slot 1. Documentaion available from supplier. Requires firmware (one EPROM).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ½ watt, 5%
____ 5 - 3.3 KΩ @ R1,3,4,5,6
____ 1 - 2.2 KΩ 10-pin SIP* bussed @ R2
*Match pin 1 of SIP with pin 1 (white dot) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 3 - 14-pin
____ 4 - 16-pin
____ 1 - 18-pin
____ 2 - 20-pin
____ 3 - 28-pin


pin 1

CAPACITORS C
____ 1 - 15 pF @ C5
____ 4 - 0.1 µF Monolithic @ C

SWITCH & SWITCH SETTINGS
____ 1 - 4-position DIP @ SW

EPSON: 1,2,3,4 on
GEMINI: 1,2,4 on; 3 off

CONNECTORS
____ 1 - 2x3 header, male, straight
____ 1 - appropriate printer cable

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ Z7
____ 1 - 74LS02 @ Z10
____ 1 - 74LS30 @ Z12
____ 2 - 74LS138 @ Z8,13
____ 1 - 74LS174 @ Z11
____ 1 - 74LS279 @ Z3
____ 2 - 74LS374 @ Z1,2
____ 1 - 2114 @ Z9
____ 1 - 2764 EPROM @ Z4
____ 2 - 2764 EPROM @ Z5,6 (optional)

NuScope
Associates

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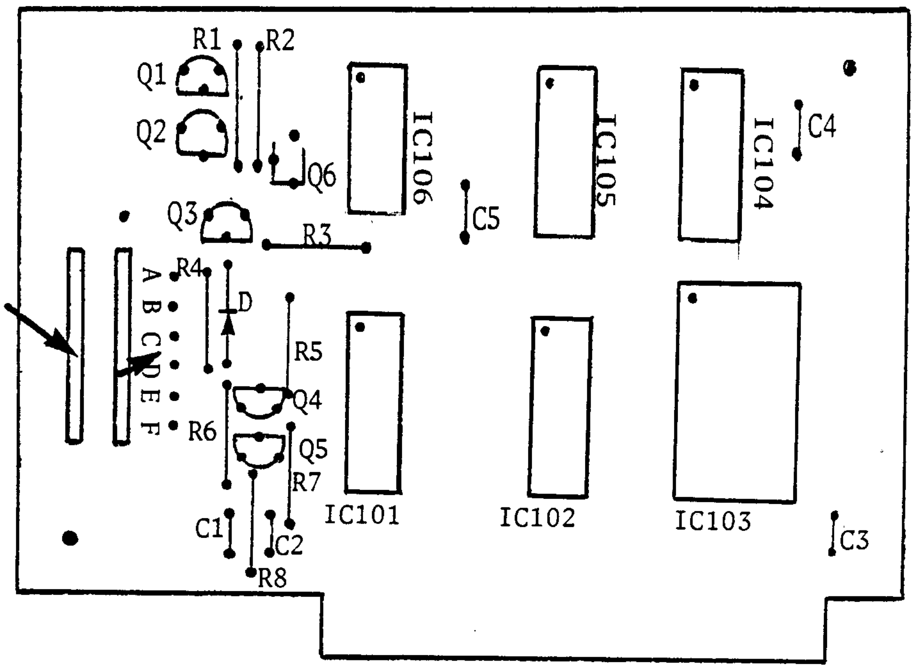
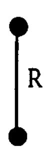
COMMUNICATIONS INTERFACE CARD: Bi-directional communication between the computer and external electronic devices such as printers, terminals, modems, other computers, etc. With power off, install in slot 1. Requires firmware (one EPROM).



SEQUENCE *INDICATES A PRECAUTION

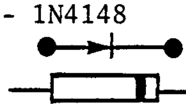
RESISTORS R ¼ watt, 5%

____ 2 - 150 Ω @ R1,6
____ 1 - 68 Ω @ R2
____ 4 - 3.3 KΩ @ R3,4,5,8
____ 1 - 10 KΩ @ R7



DIODE D *Position banded end (cathode) of diode as shown

____ 1 - 1N4148



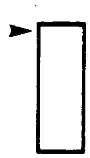
CAPACITORS C at 

____ 5 - 0.1 μF Monolithic @ C1,2,3,4,5

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes.

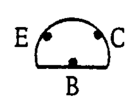
____ 2 - 10-pin
____ 1 - 14-pin
____ 2 - 16-pin
____ 1 - 24-pin

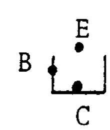
pin 1 upper left for ALL sockets & ICs



TRANSISTORS Q *Position EBC leads as shown

____ 3 - 2N3906 @ Q1,2,4
____ 2 - 2N3904 @ Q3,5
____ 1 - 2N4355 @ Q6

Q1-5 

 Q6

RIBBON CABLE: 6-wire with DB-25 connector
Connect as follows:

PC Board	DB-25
A	1
B	2
C	3
D	4
E	7
F	8

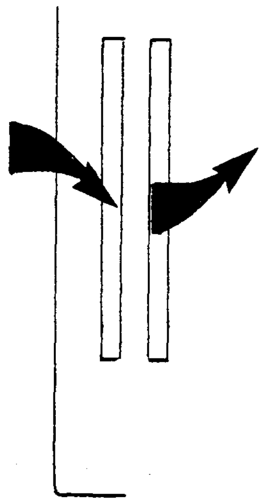
INTEGRATED CIRCUITS IC *Match pin 1 of ICs with pin 1 on the layout

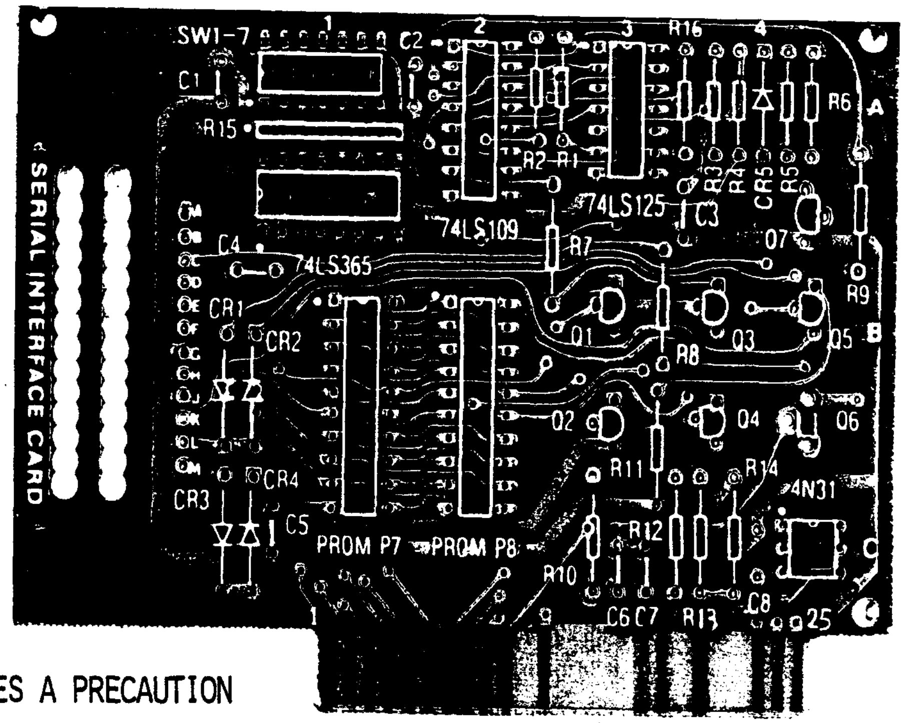
____ 1 - 6309 PROM @ 101
____ 1 - 74LS245 @ 102
____ 1 - 6850 @ 103
____ 2 - 74LS161 @ 104,105
____ 1 - 74LS74 @ 106

apple-seed

SERIAL CARD: Allows serial communication (RS-232) to peripheral devices such as printer, modem. With power off, install in slot number 2 . Requires firmware (two PROMS).

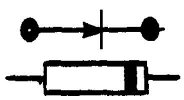
Secure ribbon cable in this manner:





SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown


cathode end
banded end

____ 5 - 1N4448 @ CR1,2,3,4,5

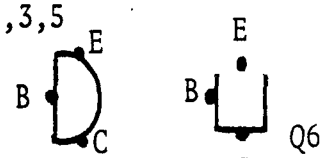
RESISTORS R ¼ watt, 5%
____ 2 - 1 KΩ @ R1,16
____ 6 - 3 KΩ @ R2,4,5,7,9,12
____ 1 - 68 Ω @ R3
____ 1 - 12 KΩ @ R6
____ 2 - 390 Ω @ R8,14
____ 1 - 150 Ω @ R10 ____ 1 - 2 KΩ @ R13
____ 1 - 100 Ω @ R11
____ 1 - 2.2 KΩ 8-pin SIP @ R15
*Pin 1 is indicated by a dot (•) on the layout

CAPACITORS C
____ 8 - 0.1 μF Monolithic @ C1,2,3,4,5,6,7,8

SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 1 - 6-pin
____ 1 - 14-pin
____ 2 - 16-pin
____ 2 - 20-pin


• pin 1

TRANSISTORS Q *Install 3 leads as shown
____ 4 - 2N3906 @ Q1,2,3,5
____ 2 - 2N3904 @ Q4,7
____ 1 - MPSU51 @ Q6



*Check with supplier re EBC leads of transistor

SWITCH
____ 1 - 7-position DIP switch

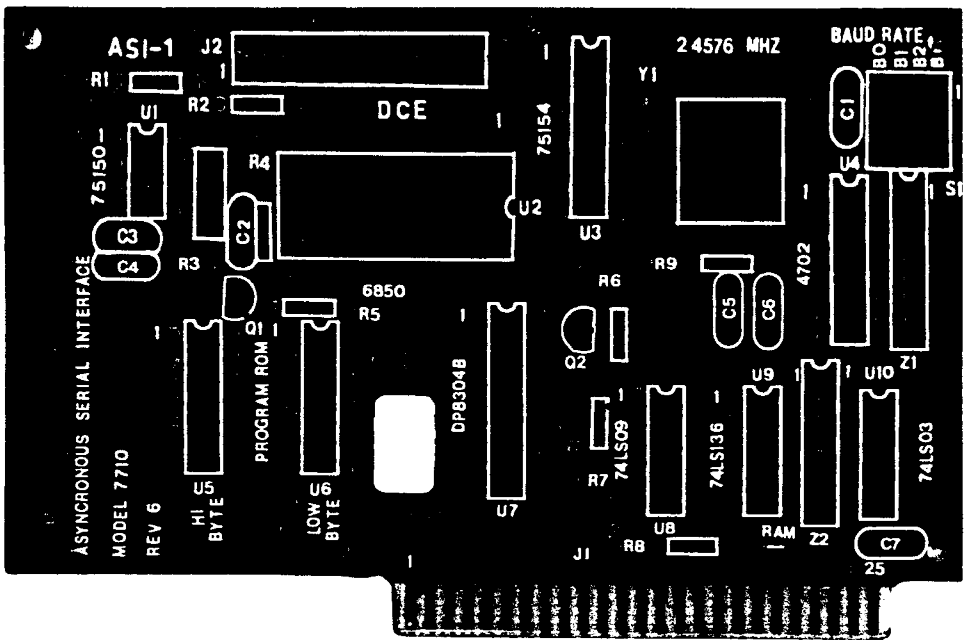
RIBBON CABLE 12-wire with DB-25 connector
Connect as follows

PC BOARD	DB-25	PC BOARD	DB-25
A	1	G	7
B	2	H	20
C	3	J	8
D	4	K	23
E	5	L	12
F	6	M	13

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 (white dot) on the layout
____ 1 - 74LS109
____ 1 - 74LS125
____ 1 - 74LS365
____ 1 - 4N31
____ 1 - 6309 PROM @ P7
____ 1 - 6349 PROM @ P8


• pin 1

ASYNCHRONOUS SERIAL INTERFACE CARD: Allows user to interface the computer to peripheral devices including line printers, paper tape units, video terminals, as well as other computers. With power off, install in any slot except Ø (slot 2 recommended). Requires firmware (two PROMS).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5% (except R3)
____ 1 - 10 Ω @ R1
____ 4 - 220 Ω @ R4,5,6,7
____ 1 - 680 Ω @ R2
____ 1 - 2.7 KΩ @ R8
____ 1 - 1 MΩ @ R9
____ 2 - 2.7 KΩ 8-pin SIP @ Z1,2 *Match pin 1 of SIPs with pin 1 on the layout
____ 1 - 100 Ω ½ watt, 5% @ R3

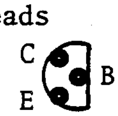
SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 1 - 8-pin
____ 3 - 14-pin
____ 4 - 16-pin
____ 1 - 20-pin
____ 1 - 24-pin

CAPACITORS C
____ 2 - 56 pF, 500VDC, Mica @ C5,6
____ 5 - 0.1 μF Monolithic @ C1,2,3,4,7

SWICH
____ 1 - 4-position, DIP @ S1

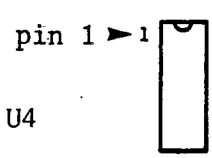
CONNECTOR
____ 1 - 2x13 male header strip, straight @ J2

TRANSISTOR Q *Position the EBC leads as shown
____ 2 - 2N2907 @ Q1,2



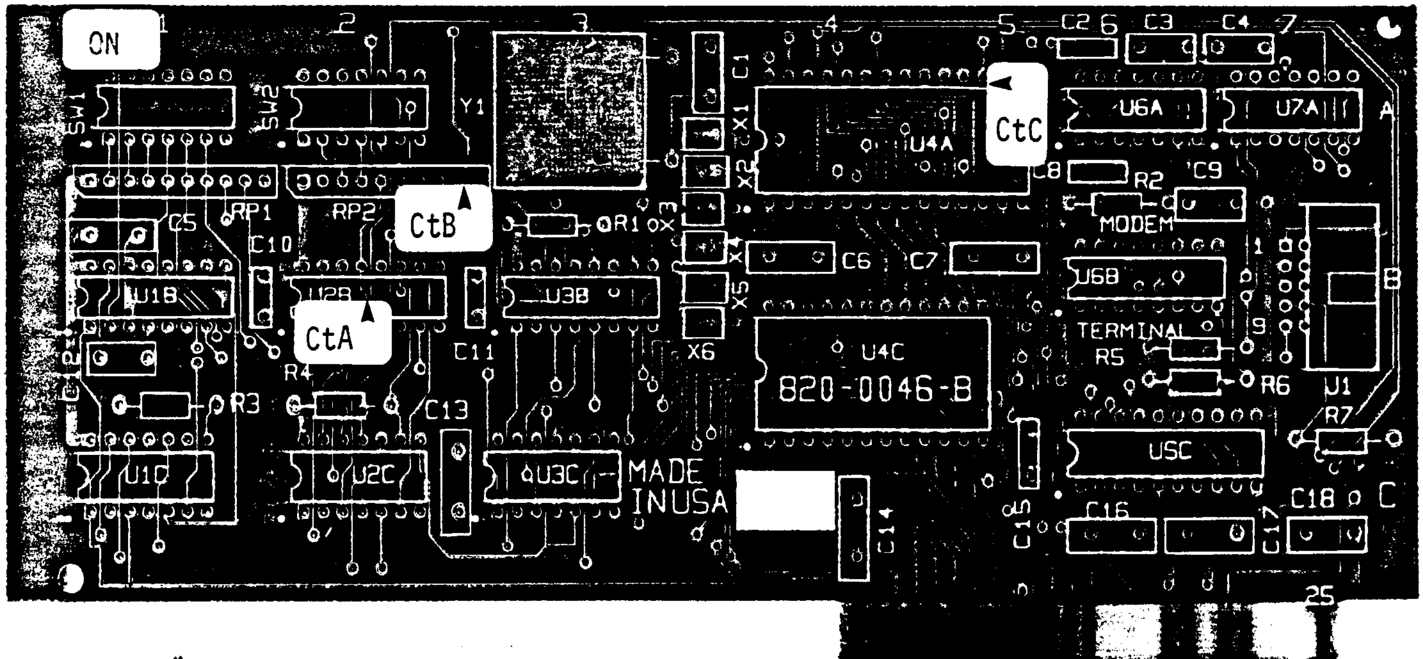
CRYSTAL Y
*Fold body of crystal flat against the card before soldering. Insulate
____ 1 - 2.4576 MHz @ Y1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 75150 @ U1
____ 1 - 6850 @ U2
____ 1 - 75154 @ U3
____ 1 - 4702 (Fairchild) @ U4
____ 1 - 8304B @ U7
____ 1 - 74LS09 @ U8
____ 1 - 74LS136 @ U9
____ 1 - 74LS03 @ U10
____ 2 - 82S129 PROMs @ U5,6



CABLE
____ 1 - 26-conductor ribbon cable, 20 cm long, with DB25S connector at one end and a 26-pin female header at the other end

SUPRA-SERIAL: Allows computer to be used as a terminal or modem. With power off, install in any slot except Ø (slot 2 recommended). Requires firmware (one EPROM).



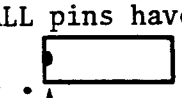
SEQUENCE *INDICATES A PERCAUTION

*MODIFICATIONS: Cut three traces on the component side as shown on the layout @ CtA, CtB, & CtC

RESISTORS R ¼ watt, 5%

____ 3 - 100 Ω @ R3,4,7
____ 1 - 3.3 KΩ @ R1
____ 3 - 15 KΩ @ R2,5,6
____ 2 - 3.3 KΩ 10-pin SIP @ RP1, RP2
*Match pin 1 of SIPs with pin 1 (square pad) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes



pin 1 lower left for ALL sockets

____ 7 - 14-pin
____ 2 - 16-pin
____ 1 - 20-pin
____ 1 - 24-pin
____ 1 - 28-pin

CAPACITORS C *Delete capacitor @ C1

____ 1 - 220 pF @ C12
____ 3 - 330 pF @ C3,4,9
____ 1 - 0.001 μF @ C18
____ 7 - 0.01 μF @ C5,6,7,13,14,16,17
____ 5 - 0.1 μF @ C2,8,10,11,15

SWITCHES

____ 2 - 7-position DIP @ SW1,2

CRYSTAL Y

CONNECTOR

____ 1 - 2x5 male header strip, 90°, @ J1

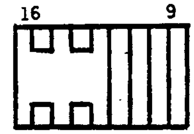
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (white dot) on the layout

____ 1 - 74LS00 @ U2C
____ 1 - 74LS11 @ U1C
____ 1 - 74LS32 @ U3C
____ 1 - 74LS245 @ U5C
____ 1 - 74LS279 @ U1B
____ 2 - 74LS365 @ U2B, U3B
____ 1 - 1488 @ U6A
____ 1 - 1489 @ U7A
____ 1 - 6551 MPU, ACIA @ U4A
____ 1 - 2716 EPROM @ U4C

pin 1

PLUG-IN-ADAPTER one 16-pin component carrier strapped as shown to reconfigure socket @ U6B for either modem or terminal use

this end towards keyboard for terminal use

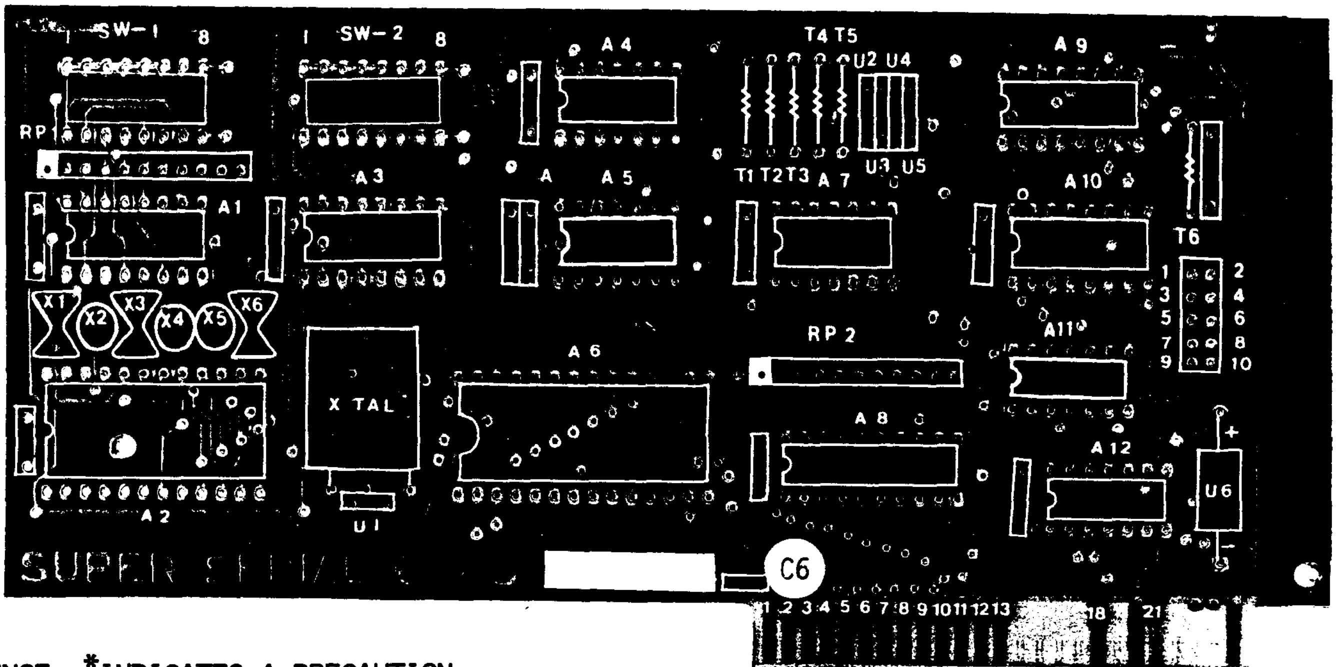


this end towards keyboard for modem use

RIBBON CABLE with appropriate connectors
Pin out for J1 includes:

CARD	DB25	CARD	DB25
1	1	6	6
2	2	7	19
3	3	8	7
4	4	9	20
5	5	10	8

SUPER SERIAL CARD: Serial interface between computer and various devices including printer, terminal, plotter, modem. With power off, install in any slot except Ø (slot #2 recommended). Requires firmware (one EPROM).



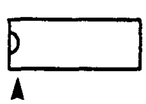
SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 120 Ω @ T5,6
____ 1 - 1 KΩ @ T1
____ 3 - 12 KΩ @ T2,3,4
____ 2 - 1 KΩ 11-pin SIP* bussed @ RP1,2
*Match pin 1 of SIPs with pin 1 (square) on the layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 5 - 14-pin
____ 3 - 16-pin
____ 1 - 20-pin
____ 1 - 24-pin
____ 1 - 28-pin



CAPACITORS C Delete capacitor @ C6

____ 1 - 22 pF @ U1
____ 4 - 0.0033 µF @ U2,3,4,5
____11 - 0.1 Monolithic @
____ 1 - 10 µF/25V Axial* @ U6
*Match + of Axial with + on the layout

CRYSTAL Y *Fold crystal flat against the card before soldering. Ground crystal to card

____ 1 - 1.8432 MHz @ X TAL

SWITCHES

____ 3 - 8-position DIP @ SW-1, SW-2, A9
*Switch @ A9 reconfigures header @ T6 for terminal or modem use

CONNECTOR

____ 1 - 2x5 header, male, 90°, @ T6

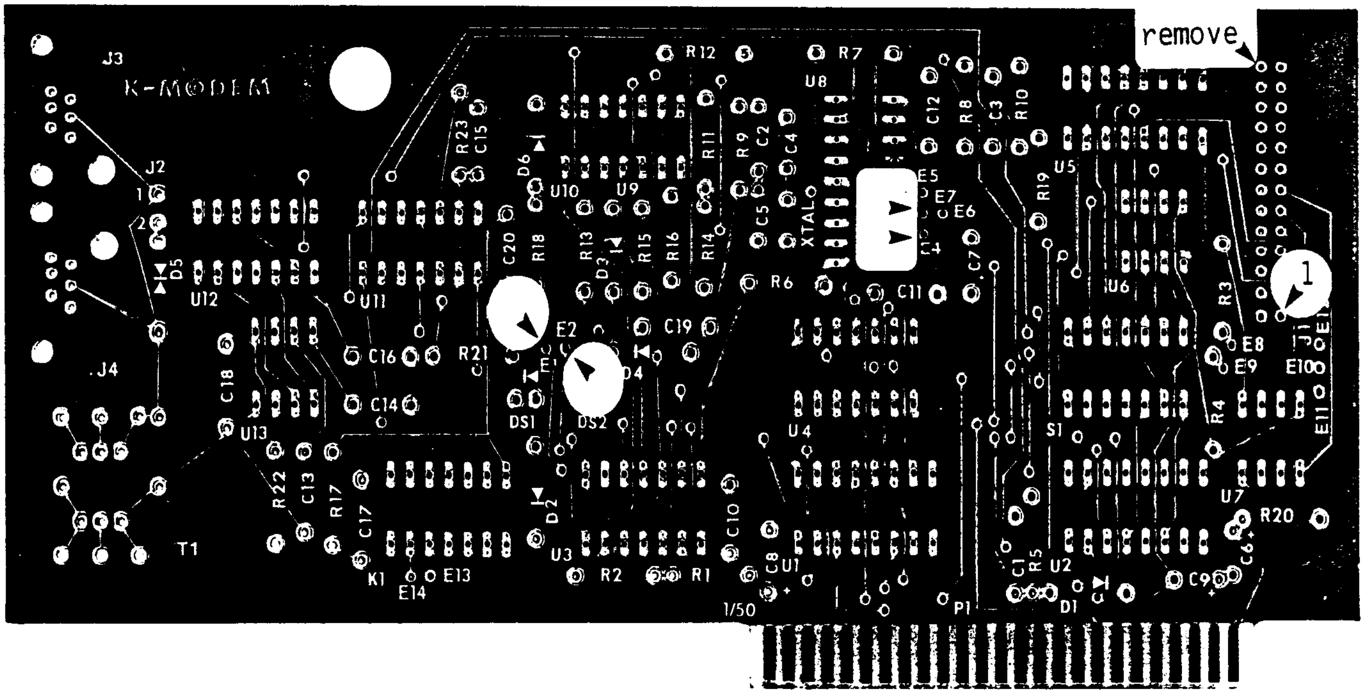
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS11 @ A12
____ 1 - 74LS32 @ A11
____ 1 - 74LS37 @ A7
____ 1 - 74LS245 @ A8
____ 1 - 74LS279 @ A10
____ 2 - 74LS365 @ A1,3
____ 1 - MC1488 @ A5
____ 1 - MC1489 @ A4
____ 1 - 6551A MPU @ A6
____ 1 - 2716 EPROM @ A2

RIBBON CABLE with appropriate connectors pinout for T6 as follows:

CARD	BD25	CARD	DB25
1	1	6	6
2	2	7	19
3	3	8	7
4	4	9	20
5	5	10	8

K-MODEM300: Direct connection to telephone line; allows for auto dialing and ring-detect for auto answering. Has built-in RS232 I/O for flexibility of application. With power off, install in any slot except 1 or 6. Requires software (one disk). User manual available from supplier.



SUGGESTED ORDER OF INSTALLATION
*INDICATES A PRECAUTION

DIODES D (Delete D5)
*Position banded end (cathode) of diodes as shown
cathode end
banded end

____ 1 - 1N914 @ D1
____ 2 - 1N4004 @ D2,6
____ 2 - 1N751A 5.1 Zener @ D3,4
____ 2 - RLC210 (Dialco) LED* @ DS1,2
*Match the "DOT" (cathode) on the LEDs with the cathode end on the layout

RESISTORS R ¼ watt, 5%
____ 1 - 560 Ω @ R16
____ 2 - 1 KΩ @ R10,18
____ 3 - 4.7 KΩ @ R17,19,20
____ 12 - 10 KΩ @ R1,2,3,4,5,6,7,8,12, R14,15,21
____ 1 - 6.8 KΩ @ R11
____ 1 - 47 KΩ @ R23
____ 1 - 100 KΩ @ R13
____ 2 - 10 MΩ @ R9,22

SOCKETS *Match pin 1 of sockets with pin 1 (Ux) on the layout. Check that ALL pins have passed thru ALL holes before soldering.

SOCKETS (continued)
____ 3 - 8-pin
____ 6 - 14-pin
____ 3 - 16-pin
____ 1 - 18-pin
Ux
pin 1

CAPACITORS C
____ 2 - 15 pF disc ceramic @ C4,5
____ 1 - 100 pF disc ceramic @ C16
____ 4 - 0.01 μF disc ceramic @ C2,14,15,19
____ 8 - 0.1 μF Monolithic @ C1,3,10,11,12, C17,18,20
____ 1 - 1 μF Radial @ C13
____ 4 - 22 μF/16v Tantalum* @ C6,7,8,9
*Match + of capacitor with + on the layout

SWITCH
____ 1 - 76SC04 (Grayhill) @ S1
*all closed (towards the top)

TRANSFORMER
____ 1 - 141H (Hammond) 600CT/600CT line matching @ T1

CRYSTAL Y
____ 1 - 4.032 MHz @ XTAL

(continued)

apple-seed

NuScope Associates

MODEM300 (continued)

CONNECTORS (Delete E3,5,6,8,9,10,11,12,13,14)

____ 2 - 2-pin headers, straight, @ E1-E2 & E4-E7 as shown on the layout
*Strap E1-E2 & E4-E7 for normal configuration

____ 1 - 2x13 male header strip, straight, @ J1 (RS232 port). Remove header pin as shown on the layout
*Note position of pin 1 on the layout

*Install EITHER A OR B connector for telephone cable

A___ 1 - permanent telephone cable of appropriate length terminating in a modular telephone plug
*Connect cable leads as shown

J2
1 green lead
2 red lead

Secure cable via ties at two large holes @ left of J2

OR

B___ 2 - modular telephone jacks, 6-pin PCB mount @ J3 and/or J4 (for second outlet)

RELAY

____ 1 - MRR1ADS-5v (Struthers-Dunn) @ K1

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (Ux) on the layout

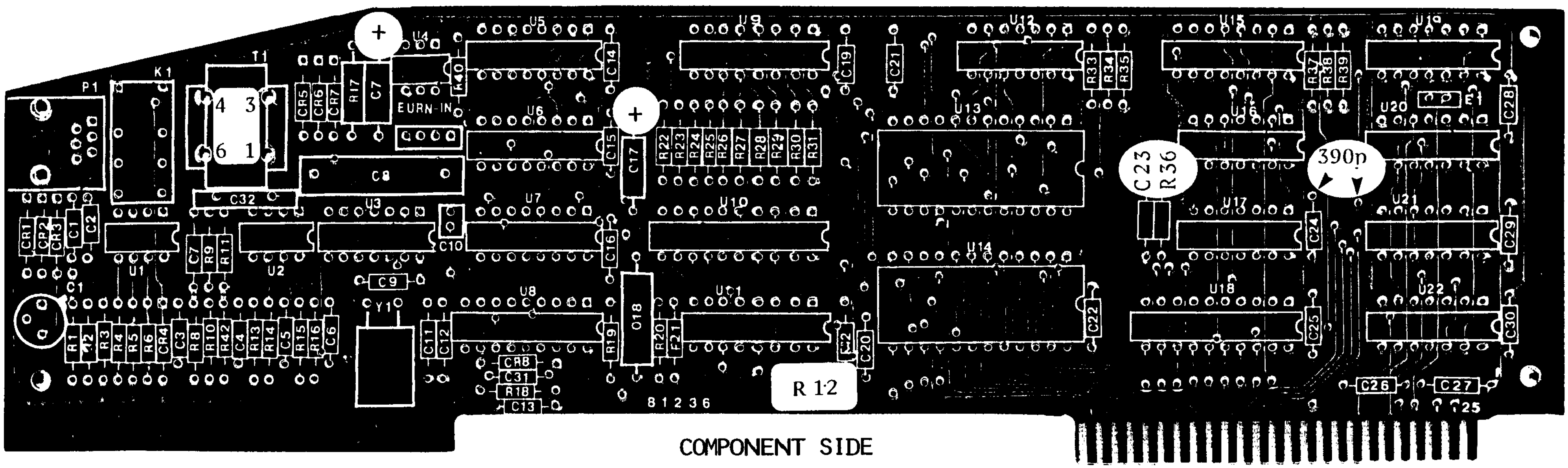
____	1 -	74LS174	@ U1	
____	1 -	74LS367	@ U2	
____	1 -	7406	@ U3	
____	1 -	74LS32	@ U4	
____	1 -	75154	@ U5	RS232 Receiver
____	2 -	75150	@ U6,7	RS232 Driver
____	1 -	TMS99532	@ U8	(T.I.) 103 Modem Chip
____	1 -	4558TC	@ U9	Dual Op Amp High Slew Rate
____	1 -	4N37	@ U10	Opto Isolator
____	2 -	74LS00	@ U11,12	
____	1 -	NE555	@ U13	Timer

Ux
pin 1
where x represents IC number

NOTE: ALTERNATE SEQUENCE

As this card appears to be "cluttered" it may be simpler to install ALL sockets first. Study the card thoroughly before beginning.

MODEMCARD: Direct connect to telephone line featuring 110 & 300 baud, half or full duplex, auto-answer/auto-dial, touch tone or pulse dialing. With power off, install in slot 2. Requires firmware (one EPROM).



COMPONENT SIDE

SEQUENCE *INDICATE A PRECAUTION INSTALL TALLEST COMPONENTS LAST

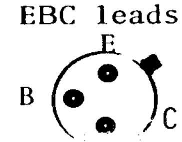
DIODES D *Position banded end of diode towards the SQUARE pad
- ____ 2 - 1N4735A 6.2 V Zener @ CR1,2
- ____ 2 - 1N4148 Switching @ CR3,5
- ____ 1 - 1N750A 4.7 V Zener @ CR4
- ____ 1 - 1N5231B 5.1 V Zener @ CR8
- ____ 2 - 1N5254B 27 V Zener @ CR6,7

RESISTORS R ¼ watt, 1% Precision
- ____ 1 - 150 KΩ @ R1
- ____ 4 - 10.0 KΩ @ R2,7,8,15
- ____ 1 - 348 Ω @ R9
- ____ 2 - 12.1 KΩ @ R10,11
- ____ 1 - 20.0 KΩ @ R42
- ____ 1 - 4.99 KΩ @ R14
- ____ 1 - 7.68 KΩ @ R16

½ watt, 5%
- ____ 1 - 5.6 KΩ @ R17

RESISTORS (continued)
¼ watt, 5%
- ____ 9 - 10 KΩ @ R3,5,21,33,34,35,37 R38,39
- ____ 1 - 3 MΩ @ R4
- ____ 1 - 13 KΩ @ R6
- ____ 1 - 2 KΩ @ R13
- ____ 1 - 560 Ω @ R18
- ____ 1 - 4.3 MΩ @ R19
- ____ 1 - 4.7 KΩ @ R20
- ____ 1 - 1 MΩ @ R22
- ____ 10 - 27 KΩ @ R23,24,25,26,27,28 R29,30,31,12
- ____ 1 - 470 Ω @ R36* Note position
- ____ 1 - 15 KΩ @ R40

TRANSISTOR *Position EBC leads as shown
- ____ 1 - 2N3904 @ Q1



SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
- ____ 1 - 6-pin
- ____ 2 - 8-pin
- ____ 8 - 14-pin
- ____ 6 - 16-pin
- ____ 1 - 18-pin
- ____ 2 - 20-pin
- ____ 2 - 24-pin

pin 1 upper right (square pad) for ALL sockets

CAPACITORS C *Match + of capacitors with + on the layout
- ____ 23 - 0.1 µF Monolithic @ C1,2,3,4,5, C6,9,13,14,15,16,19,20,21,22 C24,25,26,27,28,29,30,31
- ____ 2 - 3.3 µF/16v Tantalum* @ C7,17
- ____ 1 - 0.47 µF/250v Polyester @ C8
- ____ 1 - 390 pF disc ceramic @ C10

MODEMCARD (continued)

CAPACITORS (continued)

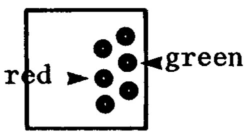
____ 2 - 20 pF disc ceramic @ C11,12
____ 1 - 0.047 µF/250v Mylar @ C18
____ 1 - 330 pF disc ceramic @ C23
____ 1 - 0.01 µF/1 KV disc ceramic @ C32
____ 1 - 390 pF disc ceramic between U17 & U21 as shown on the layout

CRYSTAL Y *Position body of cryatal flat against the card before soldering

____ 1 - 4.032 MHz @ Y1

CONNECTORS

____ 1 - 4-pin header, straight @ BURN IN
____ 1 - 2-pin header, straight @ E1
____ 1 - modular telephone jack, 6-pin PCB mount @ P1 *Connect leads as shown



RELAY

____ 1 - RKT-12 (TAICO) or 275-213 (Radio Shack) 12 V DC DPDT DIP relay

TRANSFORMER

____ 1 - 107H (Hammond) 1:1 600 Ω impedence line-matching remove pins 2 & 5; use ONLY pins 1,3,4,6

INTEGRATED CIRCUIRS *Match pin 1 of ICs with pin 1 on the layout

____ 2 - 1458P @ U1,2
____ 1 - CD4011 @ U3
____ 1 - 4N35 @ U4
____ 2 - 14526B @ U5,6
____ 1 - CD4538 @ U7
____ 1 - TMS99532 Modem (T.I.) @ U8
____ 1 - 5089 (T.I.) @ U9
____ 1 - 74LS273 @ U10
____ 1 - 74LS174 @ U11
____ 1 - 74LS125 @ U12
____ 1 - 6850 @ U13
____ 1 - 2716 @ U14 EPROM
____ 1 - 74LS155 @ U15
____ 1 - 74LS132 @ U16
____ 1 - 74LS30 @ U17

pin 1 upper right for ALL sockets & ICs

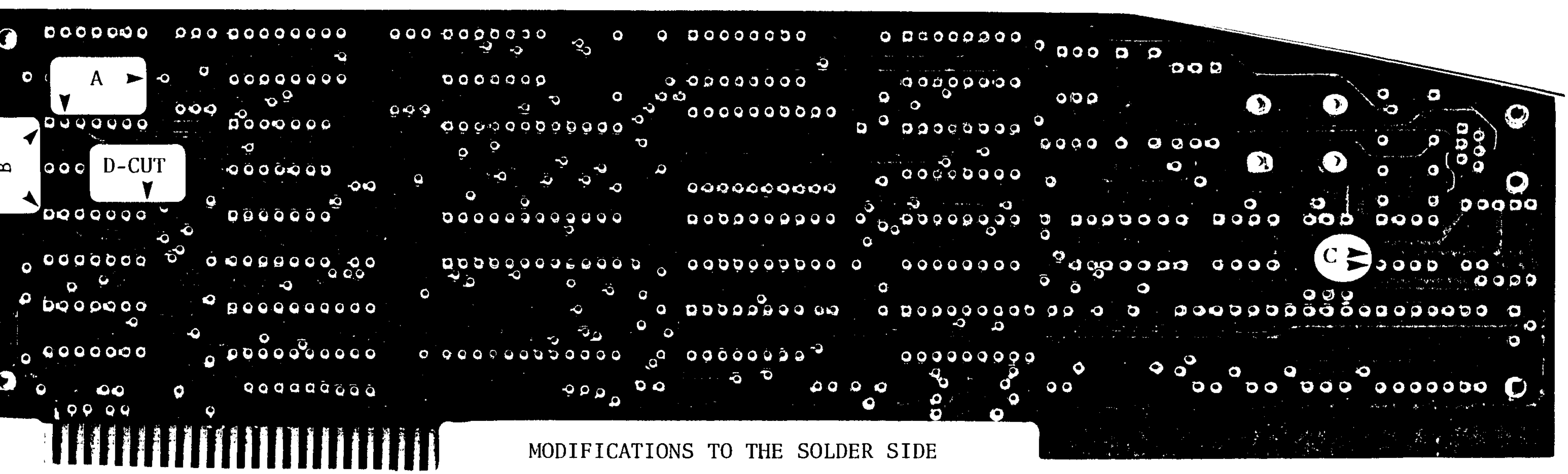
____ 1 - 74LS245 @ U18
____ 1 - 74LS197 @ U19
____ 1 - 74LS14 @ U20
____ 1 - 74LS08 @ U21
____ 1 - 74LS21 @ U22

MODIFICATIONS TO THE SOLDER SIDE Refer to layout below:

CONNECT jumper wires on the SOLDER SIDE as shown @ A,B,C

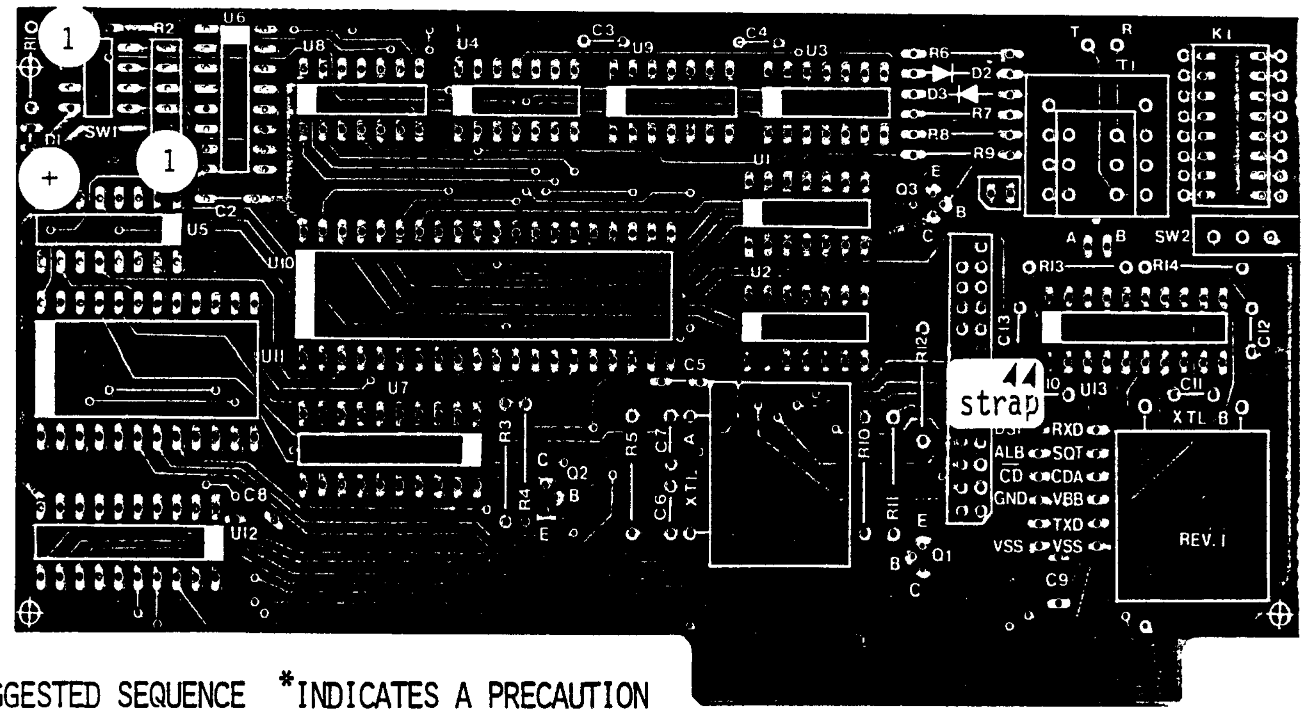
____ 1 - U20 pin 2 to U19 pin 8 @ A-A
____ 1 - U21 pin 1 to U20 pin 1 @ B-B
____ 1 - U1 pin 8 to thick track leading to +12 V (pin 50)@C

CUT track leading from pin 3, U21 on the SOLDER SIDE @ D



MODIFICATIONS TO THE SOLDER SIDE

RS232/MODEM: Offers serial I/O for external printer, terminal, or modem (300 BAUD). (1,200 BAUD available in future). Direct connect to telephone line featuring half/full duplex, auto-answer/auto-dial. With power off, install in any slot except Ø (slot 2 recommended). Requires firmware (one EPROM). Items labelled † are associated with the modem and may be omitted for serial use.



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

●→|—● cathode end

____ 2 - 1N914 @ D2,3

____ 1 - LED (red) @ D1 * Position longer lead (+) of LED as shown on the layout

RESISTORS R ¼ watt, 5%

____ 1 - 330 Ω @ R1

____ 2 - 180 Ω @ R3,4

† ____ 1 - 600 Ω @ R14

† ____ 1 - 3.5 KΩ @ R13

____ 7 - 4.7 KΩ @ R6,7,8,9,10,11,12

____ 1 - 1 MΩ @ R5

____ 1 - 1 KΩ 5-pin SIP @ R2 *Position pin 1 (common) of SIP as shown on the layout

SOCKETS *Match pin 1 of sockets with pin 1 (square pad) on the layout. Check that ALL pins have passed thru ALL holes

____ 7 - 14-pin

____ 1 - 16-pin

____ 3 - 20-pin

____ 1 - 24-pin

____ 1 - 40-pin

pin 1 (square pad)

SOCKETS (continued) * Note: The extra 16-pin pad @ K1 is available for future expansion

CAPACITORS C

____ 2 - 27 pF @ C6,7

____ 7 - 0.1 μF Monolithic @ C1,2,3,4,5,8,9

† ____ 3 - 0.1 μF Monolithic @ C11,12,13

† ____ 1 - 1.5 μF/10V Tantalum* @ C10

*Match + of capacitor with + as shown

C10 + U13

TRANSISTORS Q *Position the EBC leads as shown on the layout

____ 1 - 2N2904 @ Q1

____ 1 - 2N2906 @ Q2

____ 1 - 2N3906 @ Q3

CONNECTOR

____ 1 - 2x13 male header strip, straight

*Remove upper left pin of header

*Pin 1 is indicated by a cut corner on the layout

SWITCHES

____ 1 - 4-position DIP @ SW1* NB pin 1 on layout

† ____ 1 - SP/DT @ SW2 Answer/Originate

*Position switch so that the toggle extends beyond the card

TRANSFORMER T

† ____ 1 - 630D (Hammond) or substitute pulse transformer, 1:1 turns ratio to fit the board. *NOTE: Use pads A & B for:
1-other external transformer
2-future 1,200 BAUD IC modification

CRYSTALS Y *Position body of crystal against card.*Insulate card from crystal with tape

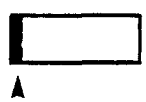
____ 1 - 1.8432 MHz @ XTL A
† ____ 1 - 3.5795 MHz @ XTL B

TELEPHONE CABLE

† ____ 1 - telephone cable of appropriate length terminating in a modular telephone plug
*Connect cable leads to T (Tip) and R (Ring)

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS04 @ U4
____ 1 - 74LS08 @ U3
____ 1 - 74LS10 @ U8
____ 1 - 74LS74 @ U9
____ 1 - 74LS175 @ U5
____ 2 - 74LS245 @ U7,12
____ 1 - 74LS367 @ U6
____ 1 - 1488 @ U1
____ 1 - 1489 @ U2
____ 1 - 8250 @ U10
____ 1 - 2716 EPROM @ U11
† ____ 1 - 74HC942 Modem IC (NAT) @ U13

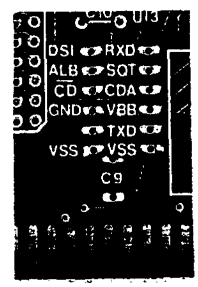

pin 1

MODIFICATION ON THE COMPONENT SIDE

____ 1 - Connect a jumper wire between C13 and the track from R13 as shown on the COMPONENT SIDE on the layout

RE MODEM CHIP

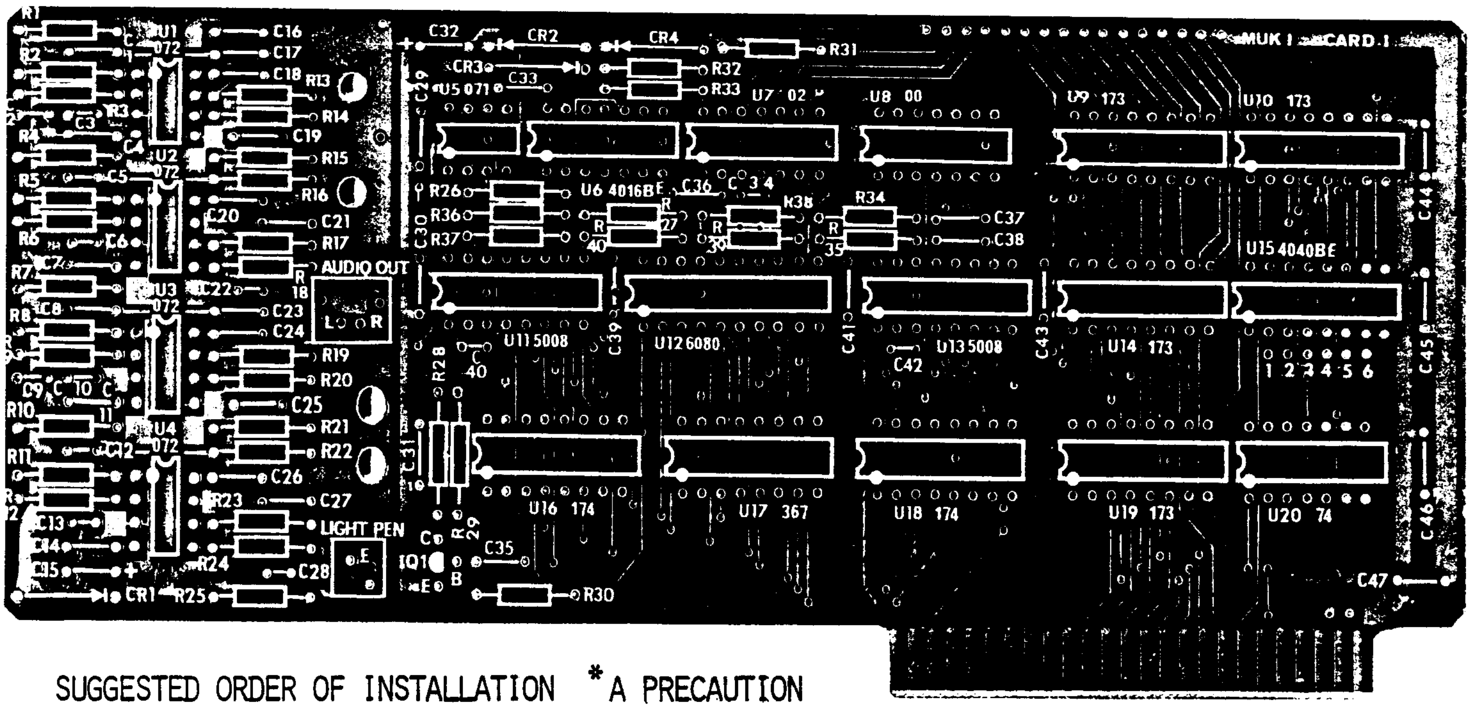
Refer to the National Semiconductor MM74HC942 300 Baud Modem Data Sheet for characteristics, applications, schematics and connection diagrams.



GUIDES 8-1 & 8-2

MUSIC SYSTEM: Consists of an analog card (CARD 1) interfaced with a digital card (CARD 2). Allows user to compose music, save it on disk and print copies of musical scores. With power off, install the connected cards in any two consecutive slots (except Ø) with CARD 1 in the LOWER numbered slot. Requires software (two disks) and documentation.

MUSIC CARD 1



SUGGESTED ORDER OF INSTALLATION *A PRECAUTION

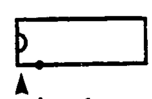
DIODES D *position banded end (cathode) of diode toward the arrow as shown


cathode end

____ 2 - 1N757A 9.1 V Zener @ CR1,4
____ 2 - 1N4148 @ CR2,3

RESISTORS R ¼ watt, 5%
____ 2 - 100 Ω @ R25,31
____ 1 - 220 Ω @ R39
____ 2 - 240 Ω @ R13,19
____ 4 - 470 Ω @ R26,36,37,38
____ 2 - 1 KΩ @ R33,40
____ 1 - 3 KΩ @ R34
____ 3 - 4.7 KΩ @ R27,28,35
____ 1 - 6.2 KΩ @ R32
____ 2 - 6.8 KΩ @ R15,21
____ 2 - 12 KΩ @ R1,7
____ 2 - 18 KΩ @ R4,10
____ 2 - 33 KΩ @ R3,9
____ 2 - 36 KΩ @ R2,8
____ 4 - 51 KΩ @ R6,12,16,22
____ 2 - 56 KΩ @ R14,20
____ 4 - 100 KΩ @ R5,11,29,30
____ 2 - Jumper @ R17,23
____ 2 - Blank @ R18,24

SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 5 - 8-pin
____ 4 - 14-pin
____ 10 - 16-pin
____ 1 - 20-pin


pin 1

CAPACITORS C
____ 1 - 27 pF Mica @ C40
____ 2 - 47 pF Mica @ C6,13
____ 1 - 100 pF Mica @ C42
____ 4 - 220 pF Mica @ C3,10,22,28
____ 4 - 0.001 µF @ C2,5,9,12
____ 1 - 0.01 µF @ C34
____ 32 - 0.1 µF Monolithic @ C1,4,7,8,11,14, C16,17,18,19,20,21,23,24, C25,26,27,29,30,31,33,35, C36,37,38,39,41,43,44,45, C46,47
____ 2 - 10 µF/25v Tantalum* @ C15,32
*Match + of capacitor with + on layout

CONNECTOR
____ 1 - 1x16 female header, 8 mm deep
*To interface with 1x16 male header of CARD 2

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MUSIC SYSTEM I (continued)

TRANSISTOR Q *Install the three EBC
transistor leads correctly

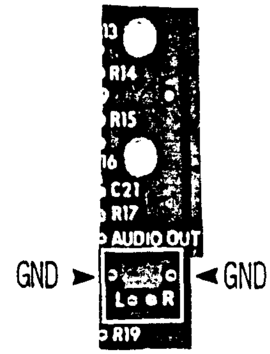
____ 1 - 2N2222A @ Q1

INTEGRATED CIRCUITS *Match pin 1 of IC
with pin 1 on the layout

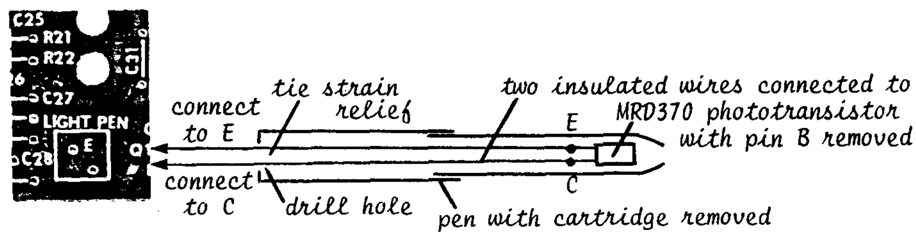
____ 1 - 74LS00 @ U8
____ 1 - 74LS02 @ U7
____ 1 - 74LS74 @ U20
____ 4 - 74LS173 @ U9,10,14,19
____ 2 - 74LS174 @ U16,18
____ 1 - 74LS367 @ U17

____ 4 - TL072 @ U1,2,3,4
____ 1 - TL071 @ U5
____ 1 - CD4016BE @ U6
____ 1 - CD4040BE @ U15
____ 2 - NE5008 @ U11,13
____ 1 - AM6080 (AMD) @ U12

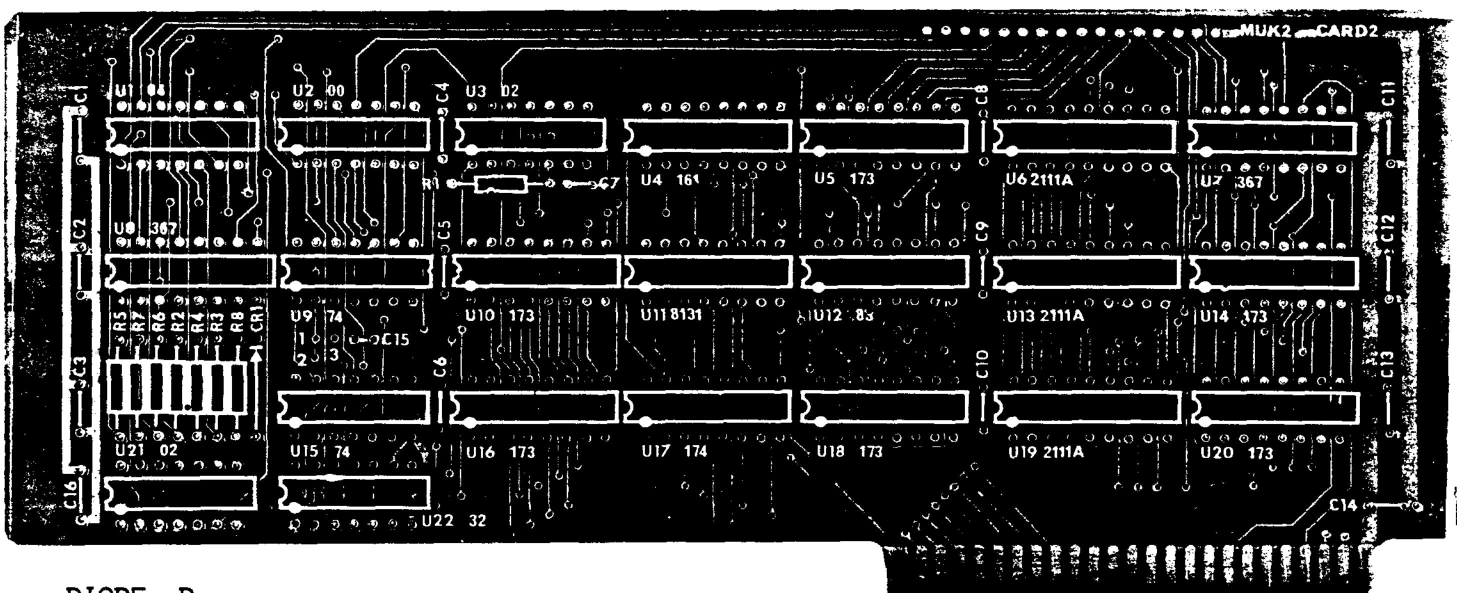
AUDIO OUTPUT CABLE
Shielded cable of appropriate length terminating in RCA dual phono plugs. For stereo, connect stripped end to jumper pins as shown
L = Left channel
R = Right channel
GND = Ground
Secure cable with an insulated tie thru the two large holes



LIGHT PEN *IMPROVISE!!*



MUSIC CARD 2



DIODE D
____ 1 - 1N4148 @ CR1

RESISTORS R ¼ watt 5%
____ 4 - 1 KΩ @ R1,2,5,8
____ 2 - 1.2 KΩ @ R4,7
____ 2 - 4.7 KΩ @ R3,6

SOCKETS
____ 7 - 14-pin
____ 12 - 16-pin
____ 3 - 18-pin

CAPACITORS C
____ 1 - 100 pF Mica @ C7

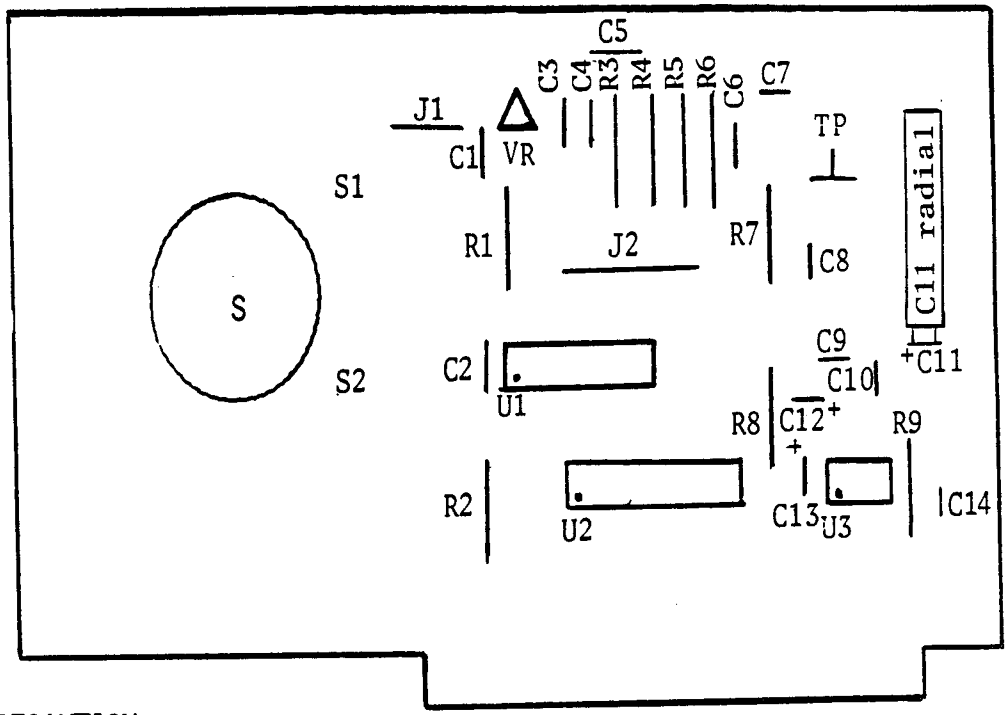
INTEGRATED CIRCUITS

____ 1 - 74LS00 @ U2
____ 2 - 74LS02 @ U3,21
____ 1 - 74LS04 @ U1
____ 1 - 74LS32 @ U22
____ 2 - 74LS74 @ U9,15
____ 1 - 74LS83 @ U12
____ 1 - 74LS161 @ U4
____ 6 - 74LS173 @ U5,10,14,16,18,20
____ 1 - 74LS174 @ U17
____ 2 - 74LS367 @ U7,8
____ 1 - DM8131 (NAT) @ U11

VOICE MACHINE: Versatile, high-quality speech synthesizer created entirely in software. Uses the phonetic alphabet. Type the word and produce the sound. With power off, install in slot number 5. Requires software (one disk).

COMPONENT SIDE
OF CARD

Single-layer, single-sided peripheral circuit card. Install components on the COMPONENT SIDE and solder to the SOLDER SIDE



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
- ____ 1 - 11 Ω @ R9
- ____ 1 - 560 Ω @ R3
- ____ 2 - 2 KΩ @ R2,4
- ____ 1 - 3.3 KΩ @ R1
- ____ 3 - 10 KΩ @ R5,7,8
- ____ 1 - 220 KΩ @ R6
- ____ 1 - 5 KΩ trimpot, @ TP

SOCKETS *Match pin 1 of sockets with pin 1 (dot) on the layout. Check that ALL pins have passed thru ALL holes
- ____ 1 - 8-pin
- ____ 1 - 16-pin
- ____ 1 - 20-pin

CAPACITORS C
- ____ 1 - 0.005 μF @ C7
- ____ 3 - 0.02 μF @ C5,6,9
- ____ 7 - 0.1 μF Monolithic @ C1,2,3,4 C8,10,14
- ____ 1 - 470 μF/16v radial* @ C11
- ____ 1 - 10 μF/16v radial* @ C12
- ____ 1 - 1 μF/16v radial* @ C13

*Match + of radial capacitors with + on the layout

JUMPER
- ____ 2 - @ J1,2

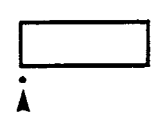
VOLTAGE REGULATOR
- ____ 1 - 7805 +5V @ VR

*Position "flat" part of device towards the top of the card

SPEAKER S
- ____ 1 - small, 8Ω @ S

Secure speaker in S opening and solder the two leads to S1 and S2

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (dot) on the layout
- ____ 1 - MC1408PB @ U1
- ____ 1 - 74LS273 @ U2
- ____ 1 - LM386 @ U3

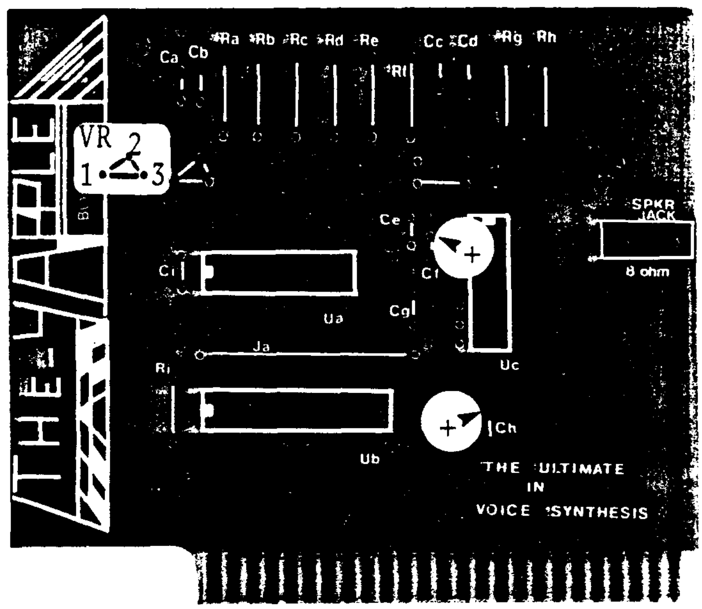


apple-seed

THE YAPPLE CARD: By typing the word using the phonetic alphabet, this speech synthesizer allows the user to blend sounds together into most English utterances. With power off, intall in slot number 4. Requires software (one disk). User manual available from supplier.

COMPONENT SIDE

Single-layer, single-sided circuit card
*Install components on the component side & solder to to solder side



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 5.6 KΩ @ Ra,d
____ 1 - 560 Ω @ Rb
____ 2 - 2.2 KΩ @ Rc,i
____ 1 - 220 Ω @ Re
____ 1 - 10 KΩ @ Rf
____ 2 - 1 KΩ @ Rg,j
____ 1 - 47 KΩ @ Rh

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 1 - 14-pin
____ 1 - 16-pin
____ 1 - 20-pin

CAPACITORS C

____ 5 - 0.1 μF @ Ca,b,e,g,i
____ 2 - 0.047 μF @ Cc,d
____ 1 - 10 μF/16V radial* @ Cf
____ 1 - 220 μF/16V radial* @ Ch
*Match + of radial capacitors with + on the layout

VOLTAGE REGULATOR

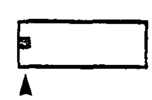
____ 1 - 78L05 5V @ VR *Position the three leads as shown on layout

SPEAKER AND CONNECTORS

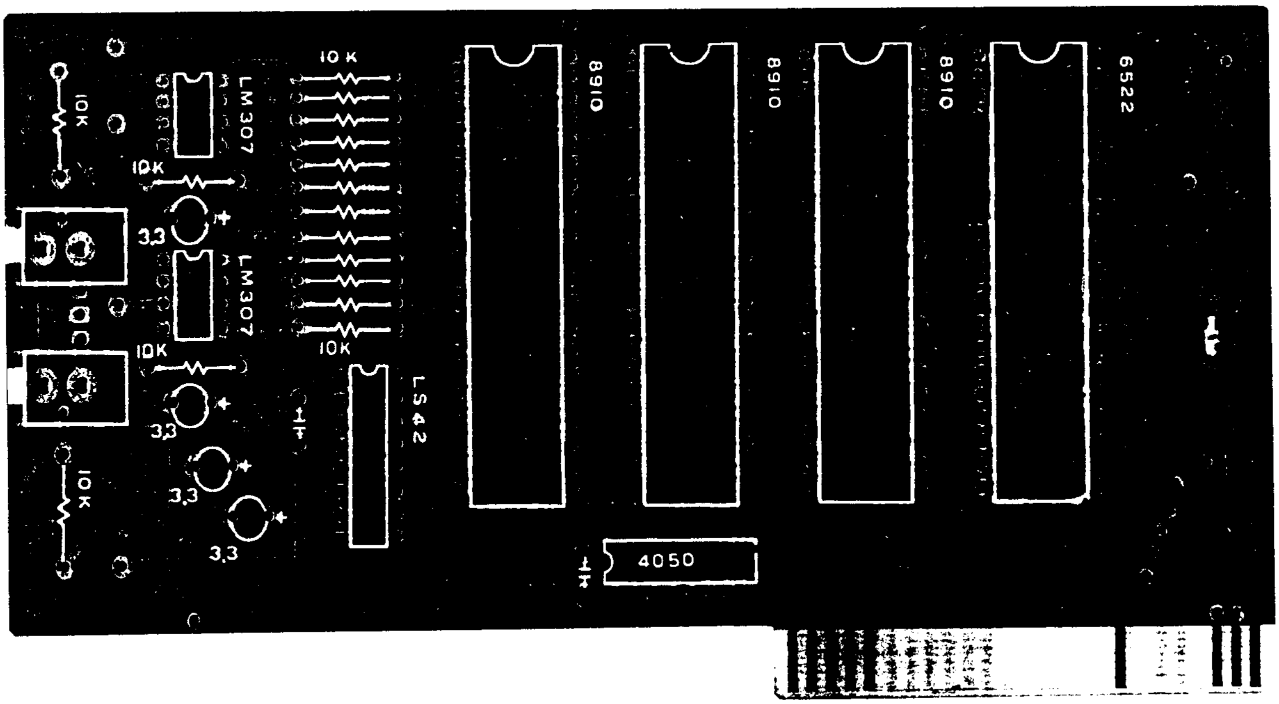
____ 2 - male header pins, straight @ SPKR JACK
____ 1 - 10-20 cm, 8-ohms speaker in vented box; connect speaker wires to jack

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - MC1408 @ Ua
____ 1 - 74LS273 @ Ub
____ 1 - LM380 @ Uc



MUSIC MACHINE: A nine-voice card that allows user to enter, modify, play, and create music. With power off, install in slot number 5. Requires software, documentation, paddles, and home stereo system.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS ¼ watt, 5%
____ 16 - 10 KΩ

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 2 - 8-pin
____ 2 - 16-pin
____ 4 - 40-pin

CAPACITORS C
____ 3 - 0.1 µF Monolithic @ location:

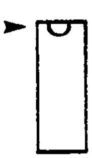
____ 4 - 3.3 µF/25v Tantalum* Match + of capacitor with + on the layout

JACKS
____ 2 - audio jacks, PCB mount

CABLES
____ 2 - audio cables to suit

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout
____ 2 - LM307
____ 1 - 74LS42
____ 1 - CD4050
____ 1 - 6522 VIA
____ 3 - 8910 (General Instruments) programmable sound generator

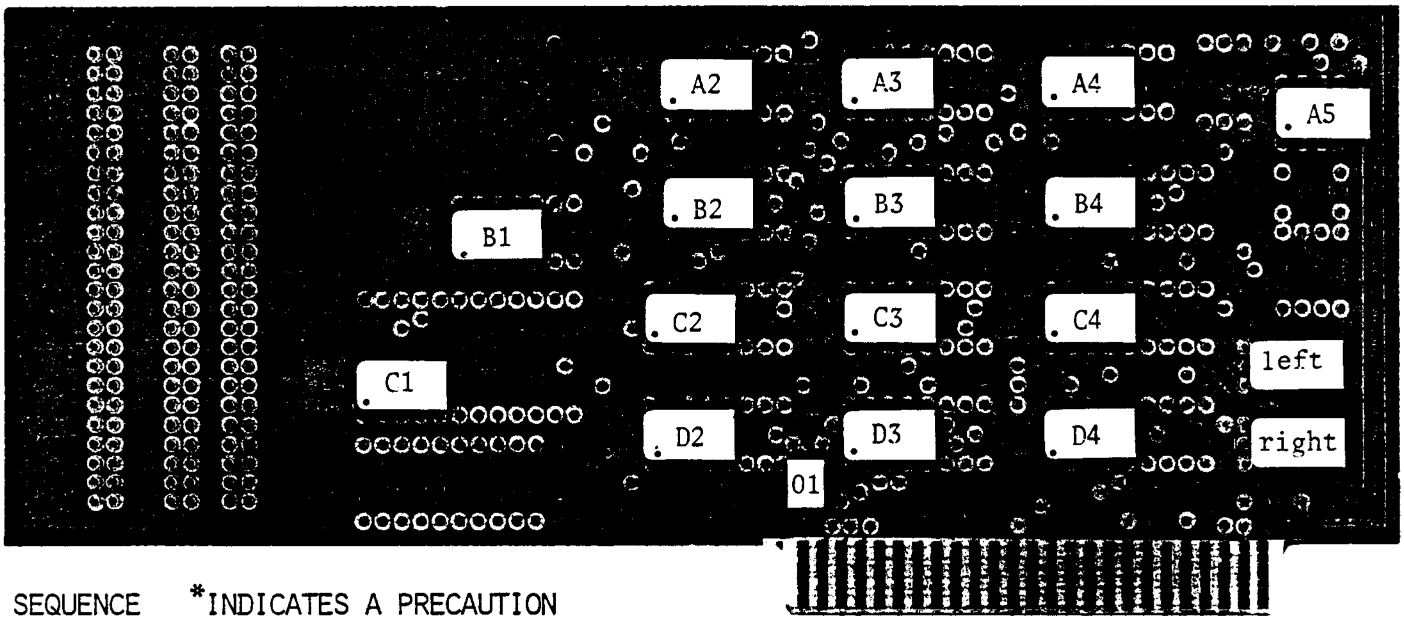
pin 1 ➤



apple-seed

NuScope Associates

THREE-VOICE SYNTHESIZER CARD: Computer-controlled music that plugs into a home stereo system. Each voice has contol of pitch, envelope, & volume. Use one card for mono; two for stereo. With power off, install in any slot (number 4 recommended). Requires software & documentation.



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 470 Ω
____ 2 - 1 KΩ
____ 2 - 2 KΩ
____ 14 10 KΩ

SOCKETS *Match pin 1 of sockets with pin 1 (dot) on the layout. Check that ALL pins have passed thru ALL holes

____ 1 - 8-pin
____ 4 - 14-pin
____ 6 - 16-pin
____ 3 - 18-pin
____ 1 - 24-pin

pin 1 lower left for ALL sockets and ICs

CAPACITORS C

____ 6 - 0.1 μF Monolithic @ ● 01 ●
____ 3 - 6.8 μF/35V Tantalum* @ ● 68 ●

*Match + of capacitors with + on the layout

CONNECTORS

____ 2 - 1X3 male header strip, 90^{O} @left & right, for audio output

VOLTAGE REGULATOR

____ 1 - 7805UC *Install three leads as shown

●
●05●

CRYSTAL Y

____ 1 - 1.7800 MHz @ XTAL *Position the crystal flat against the card before soldering

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (dot) on the layout

____ 1 - 74LS624 (74LS324) @ B1
____ 1 - 8253 @ C1
____ 1 - 74LS32 @ A2
____ 1 - 74LS04 @ B2
____ 2 - 74LS75 @ C2,D2
____ 4 - CD4723B @ A3,B3,C3,D3
____ - - Access Socket (empty) @ A4
____ 3 - 8227DP @ B4,C4,D4
____ 1 - LM307 @ A5

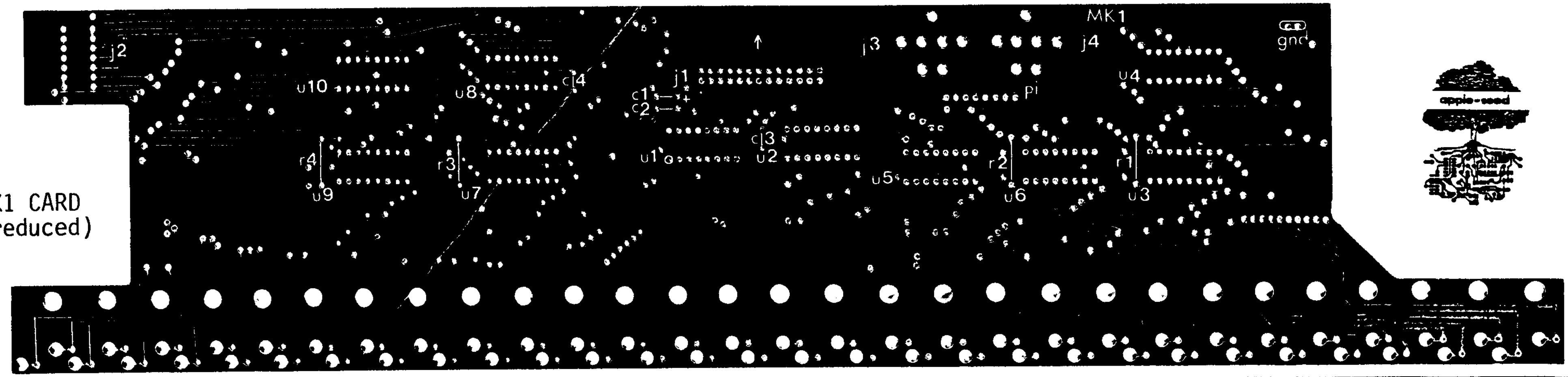
apple-seed

NuScope Associates

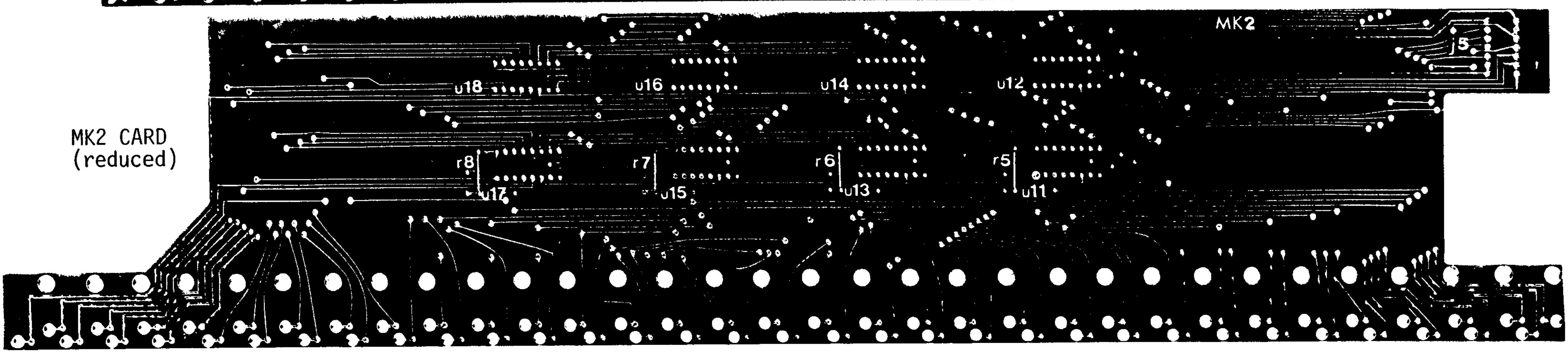
GUIDES 8-7, 8-8 & 8-9

INSTRUMENT SYNTHESIZER: A digital music synthesizer consisting of two cards (MK1 & MK2) to interface with a 5-octave organ keyboard, & one interface card that connects the keyboard to the computer (slot 2). Allows music to be played directly or recorded and recalled later. Requires pair of Music Cards (GUIDES 8-1 & 2) in slots 4 & 5 and software (5 disks). Available as three bare cards or complete system only.

MK1 CARD (reduced)



MK2 CARD (reduced)



SUGGESTED ORDER OF INSTALLATION *INDICATES A PRECAUTION *THE FOLLOWING REFERS TO BOTH THE MK1 & MK2 CARDS

RESISTORS R ¼ watt, 5%

____ 8 - 3 KΩ @ r1,2,3,4,5,6,7,8

SOCKETS *Match pin 1 of sockets with pin 1, lower left, on the layout. Check that ALL pins have passed thru ALL holes

____ 18 - 16-pin

____ 2 - 14-pin @ j2 & j5

CAPACITORS C

____ 3 - 0.1 μF Monolithic @ c2,3,4

____ 1 - 10 μF/16V Tantalum* @ c1*Match + of capacitor with + on layout

INTEGRATED CIRCUITS *Match pin 1 of ICs pin 1 on the layout

____ 2 - 74LS368 @ u1,2

____ 16 - 4C51BE @ u3,4,5,6,7,8,9,10,11, u12,13,14,15,16

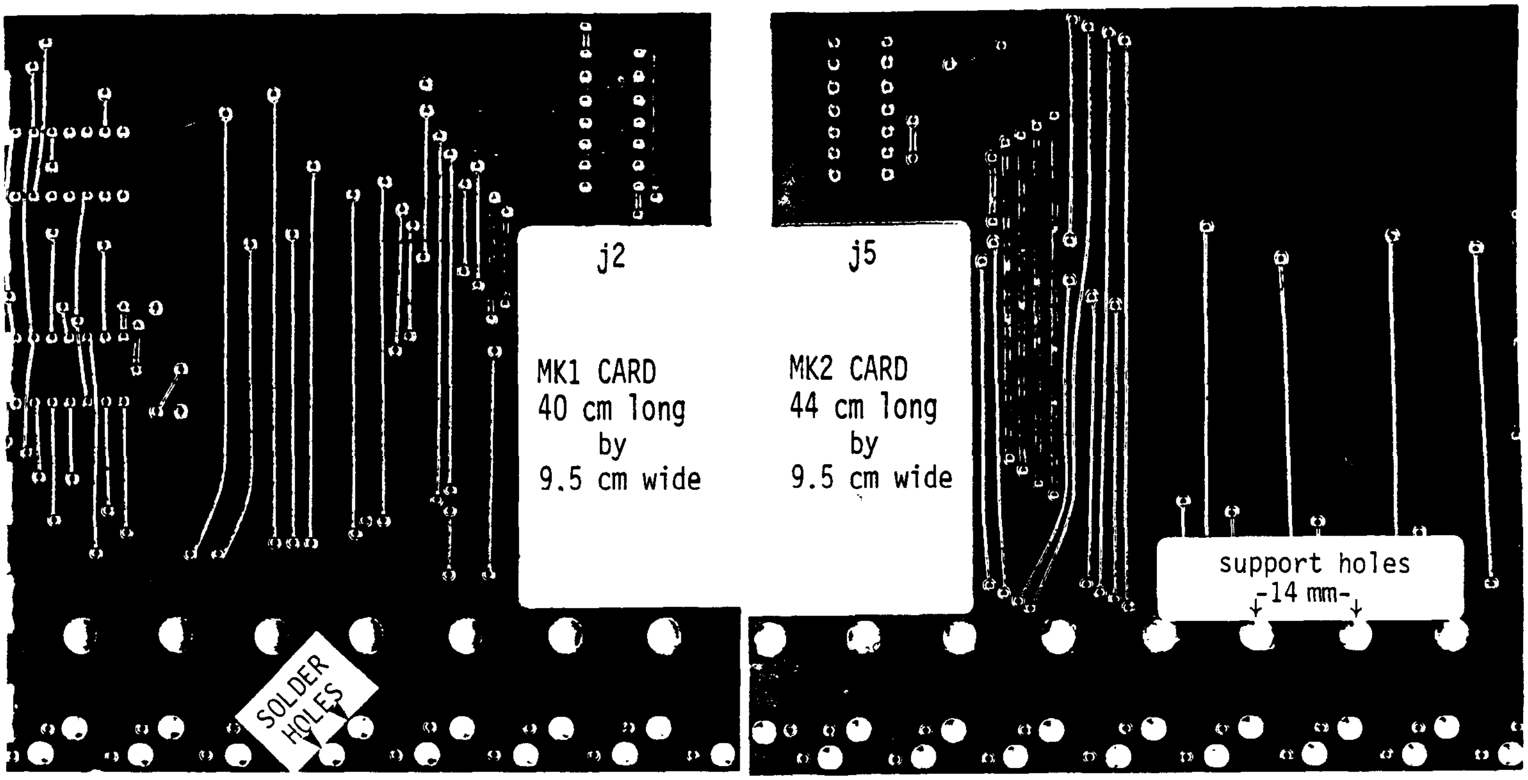
CONNECTORS

____ 2 - stereo jacks, PCB mount, @ j3,4, for foot pedals (Roland, model DP2, pedal switch)

____ 1 - 2x13 male header strip, right angle @ J1

____ 1 - 20 cm length of insulated wire at gnd (refer to installation instructions for hookup)

Solder Side of MK1 & MK2; Bottom View of Keyboard.
Close to Actual Size.



To FRONT of Keyboard

INSTALLATION of the MK1 @ MK2 cards to the two-bus, 61-key (5-octave) organ keyboard: The "pegs" of the keyboard fit thru the support holes of each card. Slip the 64 "solder leads" of the keyboard thru the 64 solder holes of MK2 & solder in place. Butt MK2 to MK1 as shown and solder the 58 "solder leads" to the 58 solder holes of MK1.

CABLES

____ 1 - 5-7 cm length of 14-conductor flat ribbon cable with DIP sockets to connect j2 of MK1 to j5 of MK2

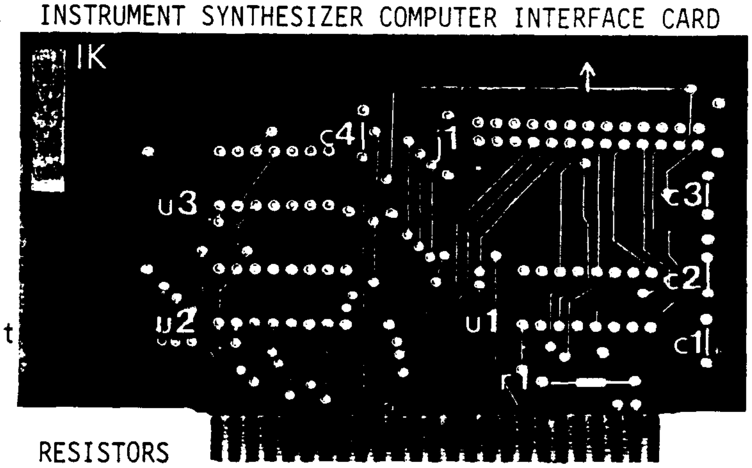
____ 1 - 6 m length of 26-conductor flat ribbon cable with two AMP header connectors to connect j1 of MK1 to j1 of computer interface card. *Match pin 1 (white dot) of j1 of MK1 to j1 (white dot) of interface card

____ 1 - 20 cm length of insulated wire from ground (gnd) of MK1 soldered to the chasis of the organ keyboard & the TWO keyboard bus lines

KEYBOARD: Pratt Read Co.
Model 10-0-1184-1-00
61-n c/c Keyboard
with switch

CASE: To suit

INSTRUMENT SYNTHESIZER COMPUTER INTERFACE CARD



RESISTORS

____ 1 - 1 KΩ @ r1

SOCKETS *pin 1: white dot

____ 1 - 14-pin

____ 2 - 16-pin

CAPACITORS

____ 3 - 0.1 μF Monolithic @ c2,3,4

____ 1 - 10 μF/16V Tantalum* @ c1

*Match + of capacitor with + on the layout

CONNECTOR

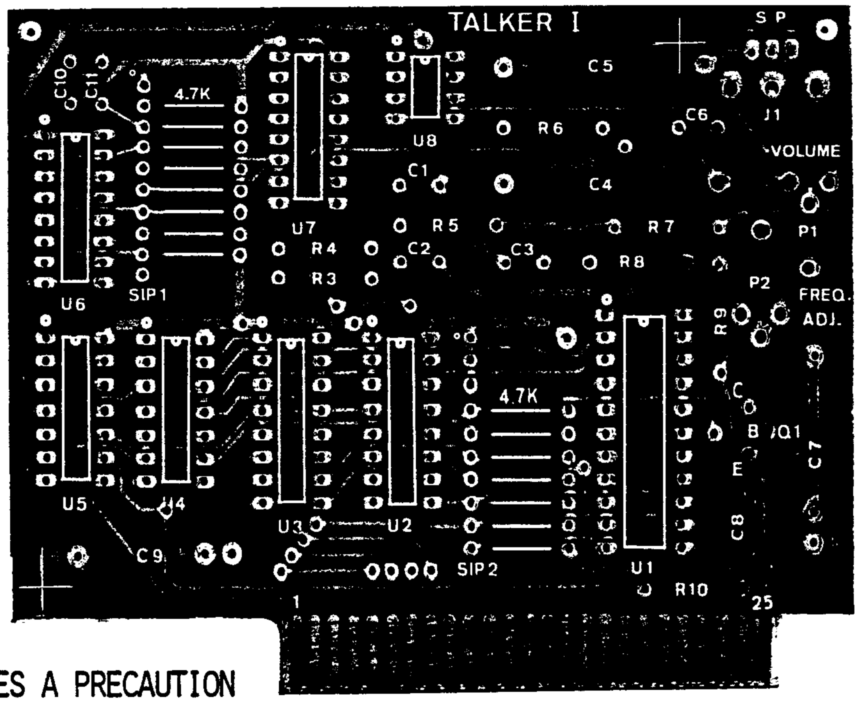
____ 1 - 2x13 male header strip, 90° @ j1

INTEGRATED CIRCUITS

____ 1 - 74LS00 @ u3

____ 2 - 74LS367 @ u1,2

TALKER I: Electronic speech synthesizer using the Votrax chip. Employs phoneme synthesis to allow user to construct an unlimited vocabulary by "pronouncing" in sequence the individual phonemes (simple sounds of spoken language). With power off, install in any slot except Ø. Requires software (one disk).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 1 - 10 Ω @ R6
____ 1 - 3.3 KΩ @ R5
____ 2 - 4.7 KΩ @ R3,4
____ 1 - 6.8 KΩ @ R8
____ 1 - 10 KΩ @ R7
____ 1 - 100 KΩ @ R10
____ 2 - 10 KΩ Trimpot @ P1,2
____ 2 - 4.7 KΩ 10-pin SIP* @ SIP 1,2
*Position pin 1 of SIPs at o as shown on the layout
____ 1 - R9 trim, if required. (2.7 KΩ to 3.9 KΩ coarse frequency adjustment)

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 1 - 8-pin
____ 2 - 14-pin
____ 4 - 16-pin
____ 1 - 22-pin

pin 1 upper left for ALL sockets and ICs

CONNECTORS

____ 1 - 2-pin Molex header @ SP or J1

TRANSISTOR Q *Position EBC leads correctly

____ 1 - 2N2222 @ Q1

CAPACITORS C

____ 1 - 150 pF @ C8
____ 3 - 0.01 µF @ C3,10,11
____ 3 - 0.1 µF Monolithic @ C1,2,6
____ 2 - 10 µF/16V Tantalum* @ C7,9
____ 2 - 220 µF/16V Axial* @ C4,5
*Match + of electrolytic capacitors with + on layout

INTEGRATED CIRCUITS * Match pin 1 of ICs with pin 1 (o) on layout

____ 1 - SC-01A @ U1 Votrax
____ 2 - 74LS75 @ U2,3
____ 1 - 7416 @ U4
____ 1 - 74LS02 @ U5
____ 1 - 74LS123 @ U6
____ 1 - 74LS367 @ U7
____ 1 - LM 386 @ U8 audio amp (1 watt)

ADJUST:

____ P1 pot for loudness (VOLUME)
____ P2 pot for tone (FREQ. ADJ.)

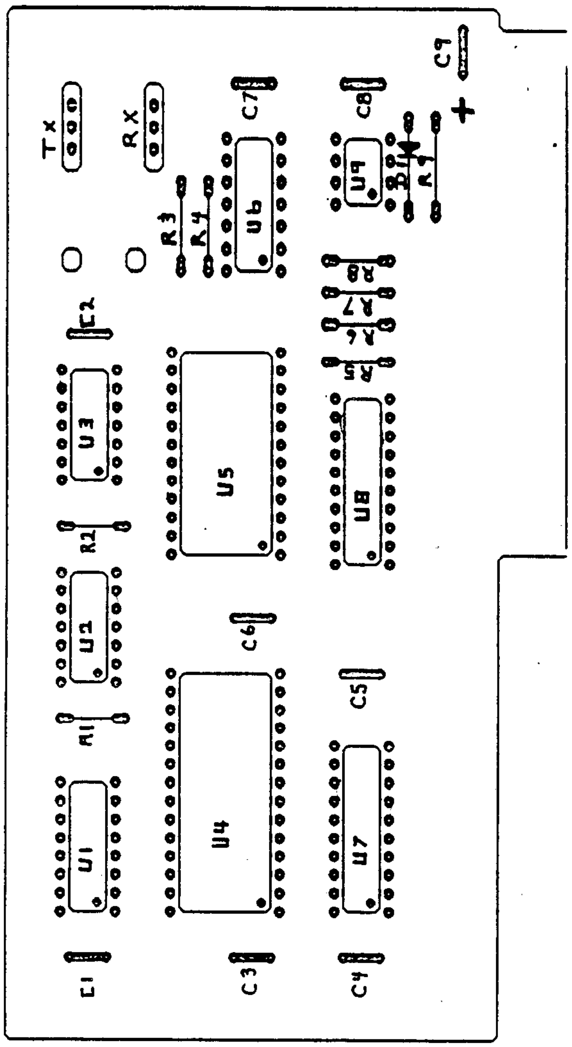
SPEAKER

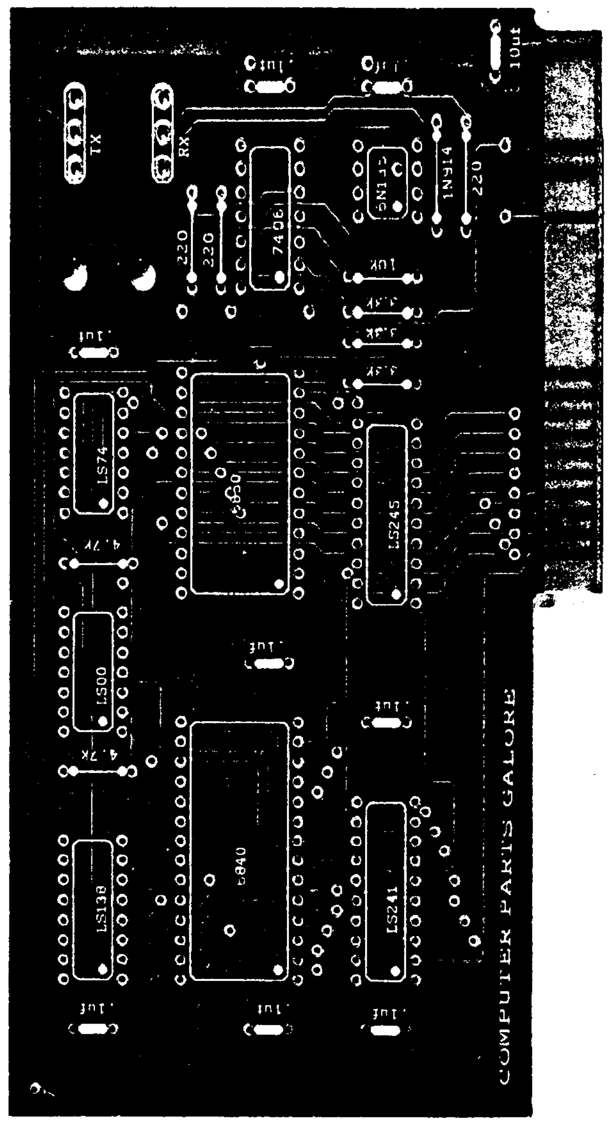
____ 1 - 8 Ohm

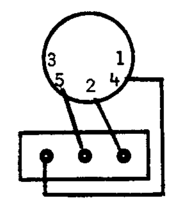
apple-seed

NuScope Associates

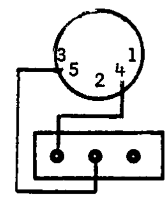
6850 MIDI CARD: Allows user to interface synthesizers, drum machines & other MIDI (Musical Instrument Device Interface) equipped musical instruments to the computer. Software required. Documentation available from supplier.







TX



RX

SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 3 - 220 Ω @ R3,4, ____ 1 22Ω @ R9

____ 3 - 3.3 KΩ @ R5,6,7

____ 2 - 4.7 KΩ @ R1,2

____ 1 - 10 KΩ @ R8

DIODES D *Position banded end of diode at arrow on the layout

____ 1 - 1N914* @ D1

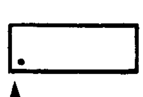
SOCKETS *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes

____ 1 - 8-pin

____ 3 - 14-pin

____ 1 - 16-pin

____ 2 - 20-pin



CAPACITORS (continued)

____ 1 - 10 μF/16 V Tantalum* Match + of cap @ C9 with + on layout

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS00 @ U2

____ 1 - 74LS74 @ U3

____ 1 - 74LS138 @ U1

____ 1 - 74LS241 @ U7

____ 1 - 74LS245 @ U8

____ 1 - 7406 @ U6

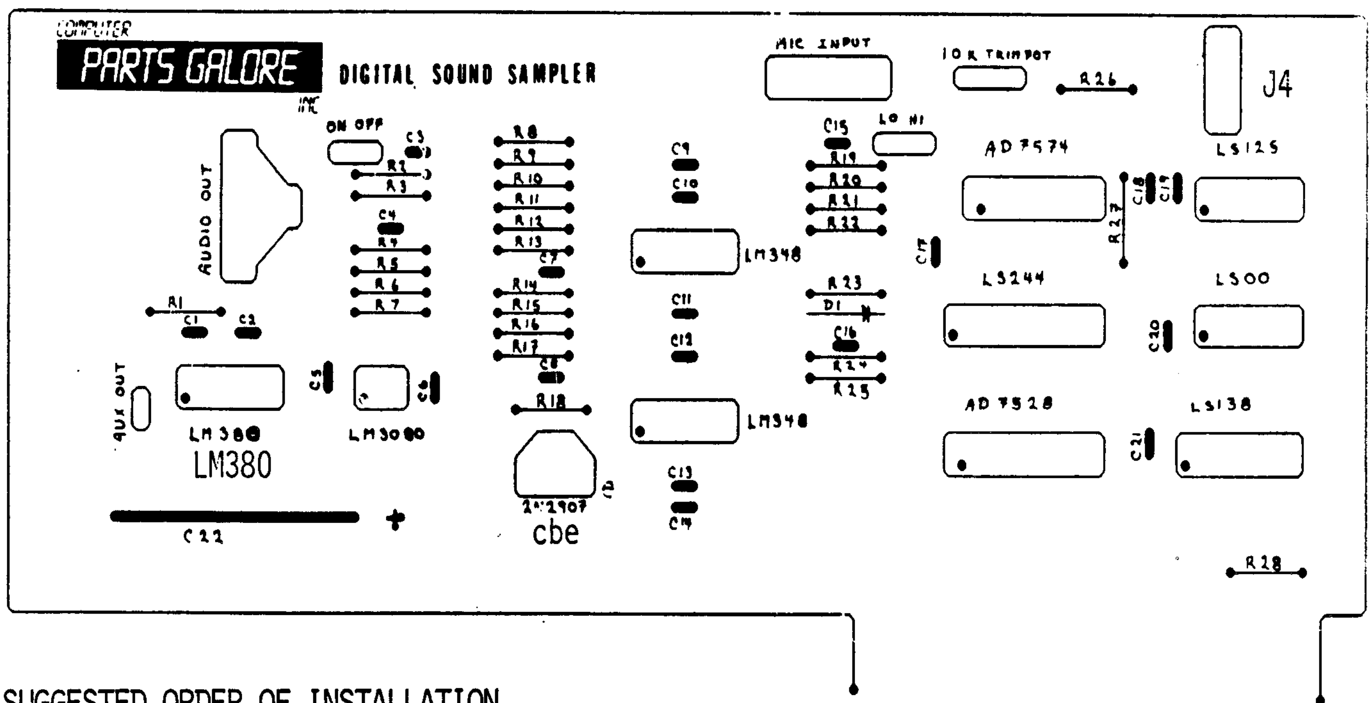
____ 1 - 6N135 @ U9

____ 1 - 6840 @ U4

____ 1 - 6850 @ U5

CONNECTORS

PG DIGITAL SOUND SAMPLER: Allows user to digitally sample an audio input and to reproduce the sounds digitally thru externally connected speakers. With power off, install in any slot. Software available from supplier.



SUGGESTED ORDER OF INSTALLATION
*INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode towards the arrow
____ 1 - 1N914

RESISTORS R ¼ watt 5%
____ 1 - 510 Ω @ R23
____ 7 - 1 KΩ @ R1,2,3,5,6,26,28
____ 1 - 5.1 KΩ @ R13
____ 1 - 6.8 KΩ @ R18
____ 6 - 10 KΩ @ R4,9,11,14,19,21
____ 4 - 100 KΩ @ R7,10,15.20
____ 1 - 180 KΩ @ R27
____ 1 - 220 KΩ @ R8
____ 2 - 330 KΩ @ R12,22
____ 2 - 5.1 KΩ metal oxide @ R16,17
____ 2 -25.1 KΩ metal oxide @ R24,25
____ 1 - 10 KΩ Trimpot @ 10 K TRIMPOT
controls input gain

SOCKETS *Match pin 1 of sockets with pin 1 (dot) on the layout. Check that ALL pins have passed thru ALL holes
____ 1 - 8-pin
____ 4 - 14-pin
____ 1 - 16-pin
____ 1 - 18-pin
____ 2 - 20-pin

CAPACITORS C *C17 is not equipped
2 - 100 pF @ C4,18

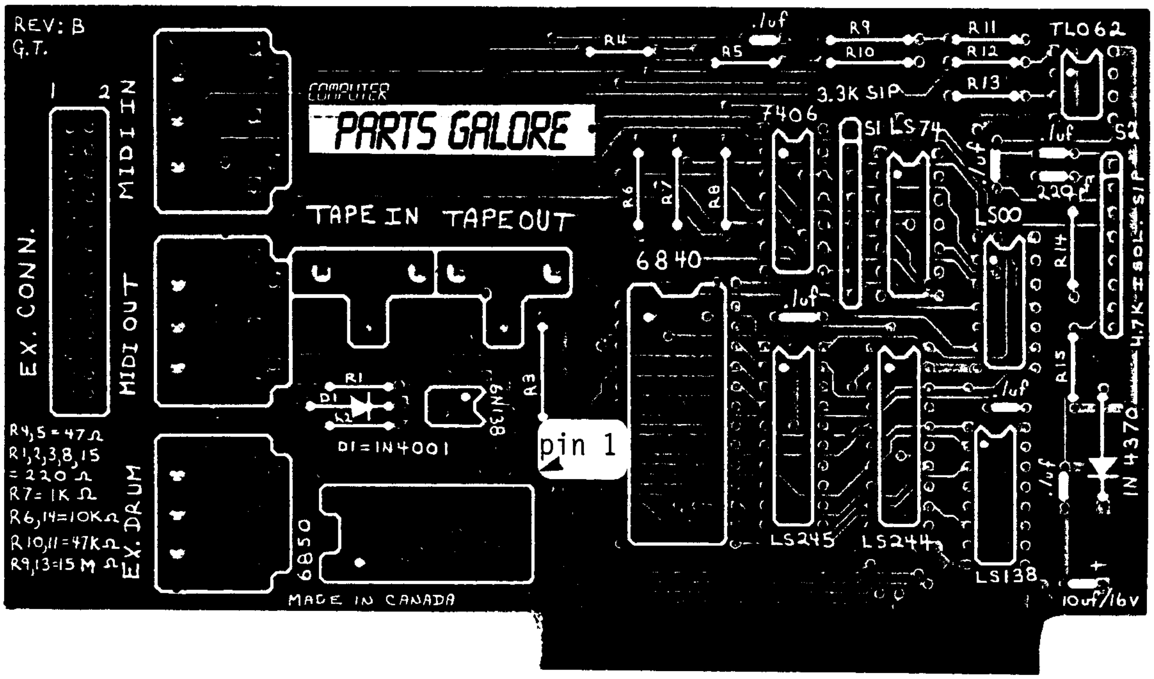
CAPACITORS (continued)
____ 4 - 0.47 F @ C7,9,14,15
____ 1 - 470 F/50V Axial* @ C22
*Match + of axial with + on layout

TRANSISTOR Q *Match ebc leads of transistor with ebc on the layout
____ 1 - 2N2907

CONNECTORS
____ 1 - 2-pin male header @ AUX OUT
provides a duplicate signal of the RCA audio output
____ 1 - 3-pin male header @ ON OFF
controls a simple hi frequency filter for the output
____ 1 - 3-pin male header @ LO HI
selects input sensitivity
HI = 10 mV to 200 mV (P-P)
LO = 200 mV to 4 volts (P-P)
____ 1 - 4-pin male header @ J4
to connect a feed back control pot for certain software. Not normally equipped
____ 1 - 3.5 female PC mount jack for MIC INPUT
____ 1 - RCA female PC mount jack for AUDIO OUT

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 ____ 1 - AD7574
____ 1 - 74LS125 ____ 2 - LM348

ADVANCED 6850 MIDI CARD (Ver 2): Allows user to interface synthesizers, drum machines & other MIDI (Musical Instument Device Interface) equipped musical instuments to the computer. Requires software. Documentaion available from supplier.



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode toward the arrow

- ____ 1 - 1N4001 @ D1
- ____ 1 - 1N4370 2.4 V Zener diode/500 mV @ 1N4370

RESISTORS R ½ watt, 5%

- ____ 2 - 47 Ω @ R4,5
- ____ 5 - 220 Ω @ R1,2,3,8,15
- ____ 1 - 470 Ω @ R12
- ____ 1 - 1 KΩ @ R7
- ____ 2 - 10 KΩ @ R6,14
- ____ 2 - 47 KΩ @ R10,11
- ____ 2 - 15 MΩ @ R9,13

*Match pin 1 of the following SIPs with pin 1 (white circle) on layout

- ____ 1 - 3.3 KΩ 8-pin SIP* bussed @ S1
- ____ 1 - 47 KΩ 8-pin SIP* isolated @ S2 (*NOT 4.7 KΩ)

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

- ____ 2 - 8-pin
- ____ 3 - 14-pin
- ____ 1 - 16-pin
- ____ 2 - 20-pin
- ____ 1 - 24-pin* Note corrected pin 1
- ____ 1 - 28-pin

pin 1 white dot

CAPACITORS C

- ____ 1 - 220 pF @ 220 pF
- ____ 6 - 0.1 µF Monolithic @ .1 µF
- ____ 1 - 10 µF/16V Tantalum* @ 10µF/16V

CONNECTORS

- ____ 2 - RCA female jacks, PCB mount @ TAPE IN, TAPE OUT
- ____ 3 - 5-pin DIN plugs, PCB mount @ EX. DRUM, MIDI OUT, MIDI IN
- ____ 1 - 2x13 header, right angle @ EX. CONN. (optional - use with external card in place of three 5-pin DIN plugs)

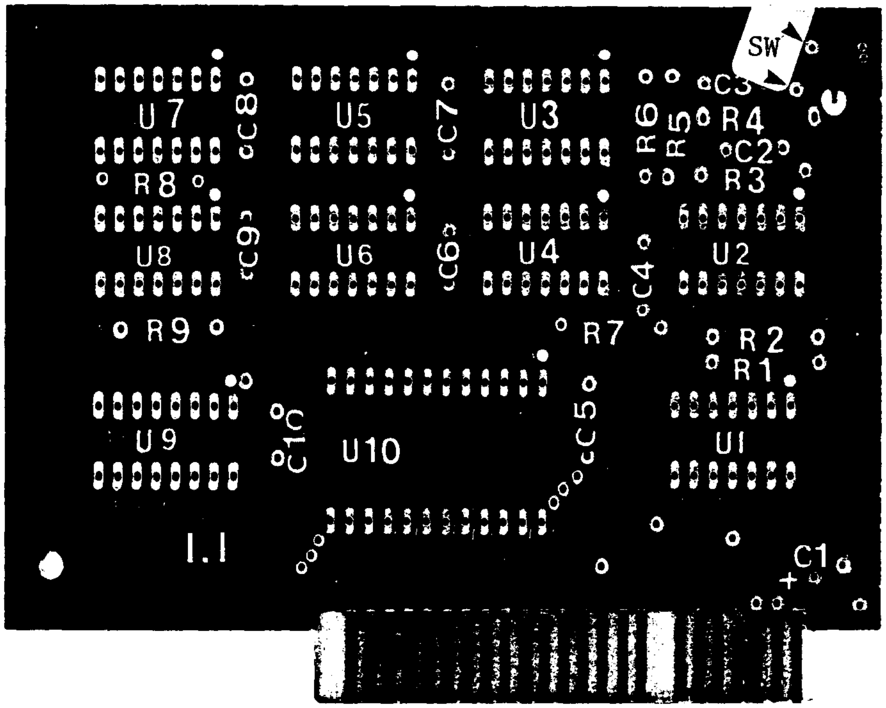
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

- ____ 1 - 7406
- ____ 1 - 74LS00
- ____ 1 - 74LS74
- ____ 1 - 74LS138
- ____ 1 - 74LS244
- ____ 1 - 74LS245
- ____ 1 - 6850 ACIA *Note corrected pin 1
- ____ 1 - 6840 TIMER
- ____ 1 - TL062 OP-AMP
- ____ 1 - 6N138 OPTO-ISOLATOR

apple-seed

NuScope Associates

COPY CARD: Allows you to make back-up copies of your protected software.. With power off, install in any free slot except Ø or 6. Requires 16 K RAM card, firmware (one EPROM, and software (one disk).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 7 - 6.8 KΩ @ R1,2,5,6,7,8,9
____ 2 - 100 Ω @ R3,4

CAPACITORS C

____ 8 - 0.1 μF Monolithic @ C3 to C10
____ 1 - 270 pF 2% silver mica @ C2
____ 1 - 2.2 μF/25v Tantalum* @ C1
*Match + of capacitor with + on layout

SOCKETS *Match pin 1 of socket with pin 1 on layout. Check that ALL pins have passed thru ALL holes.

____ 8 - 14-pin
____ 1 - 16-pin
____ 1 - 24-pin

• ◄ pin 1

SWITCH AND CABLE

____ 1 - pushbutton switch, single pole single throw (SPST)
____ 2 - 50-60 cm lengths of insulated wire

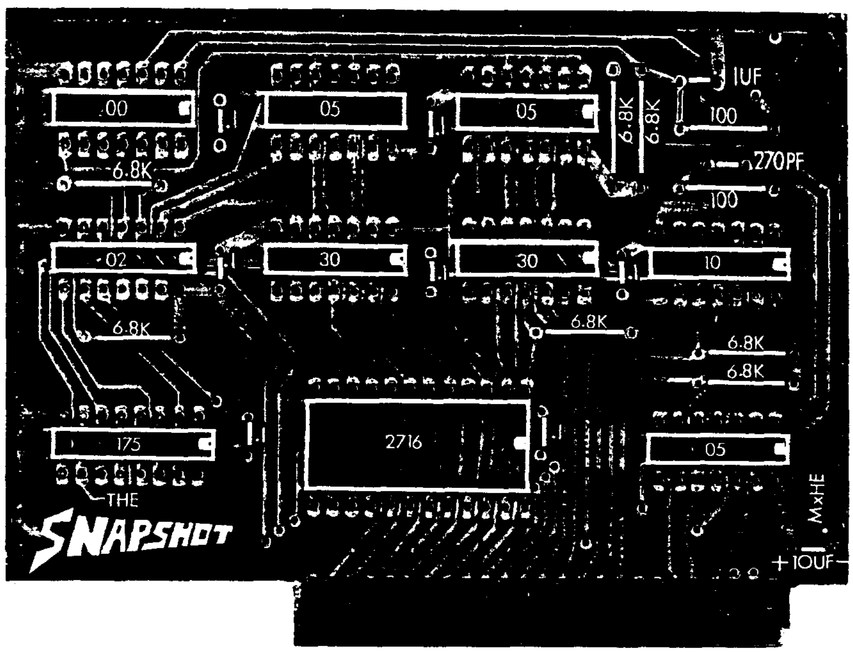
SWITCH AND CABLE (continued)

Solder the two wires to the lugs of the switch and cover with insulation. Slip the other end of the wires thru the large hole near R4. Tie a knot about 1-2 cm from the end to act as a "strain relief". Slip the leads thru the solder holes and solder to the solder side: i,e., Solder one lead to ground and the other lead to the solder pad connected to R4.

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 (white dot) on layout

____ 1 - 74LS00 @ U7
____ 1 - 74LS02 @ U8
____ 3 - 74LS05 @ U1,3,5
____ 1 - 74LS10 @ U2
____ 2 - 74LS30 @ U4,6
____ 1 - 74LS175 @ U9
____ 1 - 2716 EPROM @ U10

SNAPSHOT: Allows user to make backup copies of protected software. With power off, install in any slot except Ø. Requires 64 K of RAM, firmware (one EPROM), and software (one disk).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%

____ 2 - 100 Ω
____ 7 - 6.8 KΩ

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 8 - 14-pin
____ 1 - 16-pin
____ 1 - 24-pin

CAPACITORS C

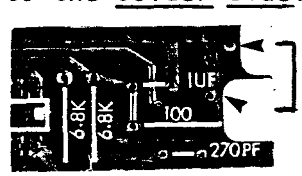
____ 1 - 270 pF
____ 8 - 0.1 μF Monolithic @ poitions labelled ".1"
____ 1 - 10 μF/16v radial *Match + of capacitor with + on layout

SWITCH & CABLE

____ 1 - pushbutton switch, SPST (single pole-single throw
____ 2 - 50-75 cm lengths of insulated wire

SWITCH & CABLE (continued)

Solder the ends of the two wires to the lugs of the switch and wrap with insulation.
Pass the other end of each wire thru the holes of the component side as shown and solder them to the solder side.

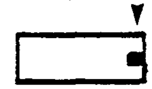


to switch

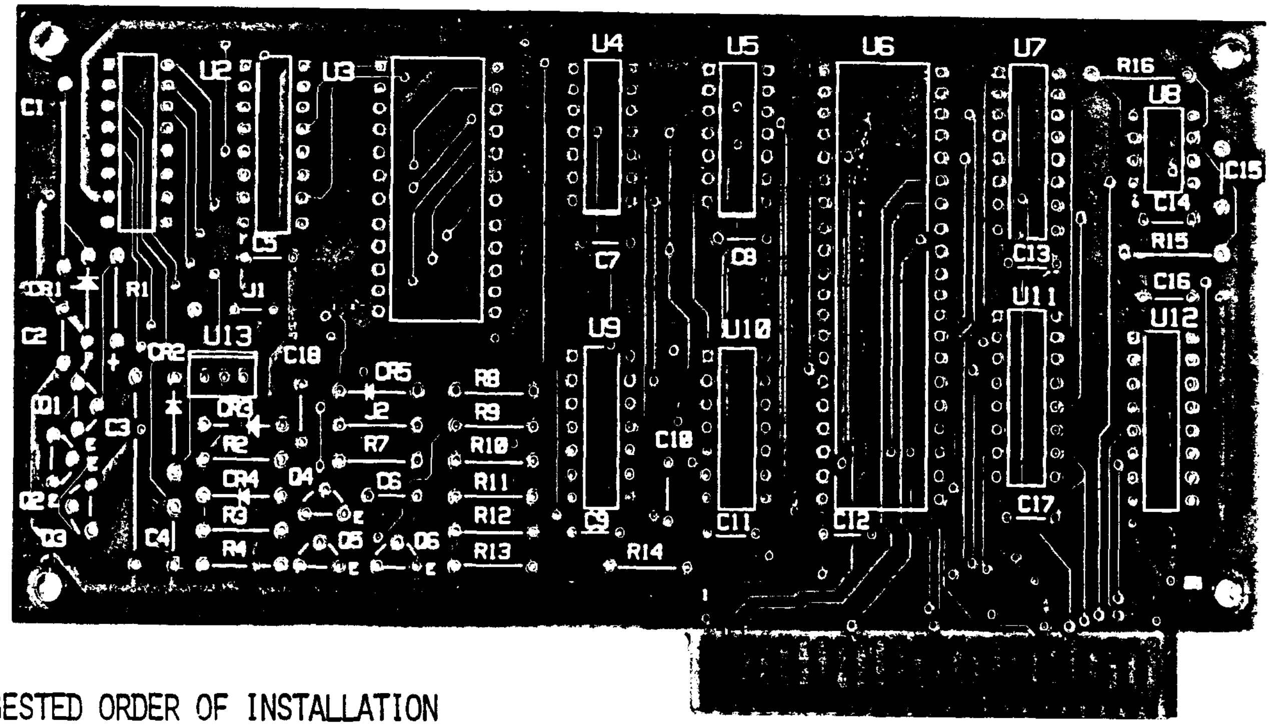
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS00
____ 1 - 74LS02
____ 3 - 74LS05
____ 1 - 74LS10
____ 2 - 74LS30
____ 1 - 74LS175
____ 1 - 2716 EPROM

pin 1



ROM BLASTER CARD: Allows user to read, write, or copy 2708-16-32 or 2508-16-32 EPROMS. With power off, insert in any slot except Ø. Requires software (one disk).



SUGGESTED ORDER OF INSTALLATION
*INDICATES A PRECAUTION

DIODES D *Postion banded end (cathode) of diode as shown

- ____ 3 - 1N4001 @ CR1,2,4
- ____ 1 - 1N754A 6.2 V Zener @ CR3
- ____ 1 - 1N751A 5.1 V Zener @ CR5

cathode end

RESISTORS R ½ watt, 5% *R5,6 is not silk-screened on the card

- ____ 1 - 10 Ω @ R3
- ____ 1 - 50 Ω @ R4
- ____ 1 - 390 Ω @ R7
- ____ 2 - 1 KΩ @ R1,15
- ____ 1 - 2.2 KΩ @ R9
- ____ 2 - 2.7 KΩ @ R10,11
- ____ 1 - 6.8 KΩ @ R8
- ____ 3 - 10 KΩ @ R2,12,13
- ____ 1 - 47 KΩ @ R16
- ____ 1 - 1.5 MΩ @ R14

JUMPER

- ____ 2 - @ J1,2

SOCKETS *Match pin 1 of sockets with pin 1 (square pad) on the layout. Check that ALL pins have passed thru ALL holes

SOCKETS (continued)

pin 1 upper left for ALL sockets

- ____ 1 - 8-pin
- ____ 4 - 14-pin
- ____ 5 - 16-pin
- ____ 1 - 40-pin
- ____ - - Personality Select Sockets
- ____ 1 - EPROM Socket, Zero Insertion Force (ZIF)

CAPACITORS C

- ____ 1 - 0.001 μF @ C15
- ____ 15 - 0.1 μF @ C2,4,5,6,7,8,9,10,11 C12,13,14,16,17,18
- ____ 2 - 22 μF/63v Axial* @ C1,3

*Match + of capacitors with + on the layout

TRANSISTORS Q *Match the three EBC transitor leads correctly

- ____ 3 - 2N5550 or 2N5551 @ Q1,2,3
- ____ 2 - 2N2907 @ Q4,5
- ____ 1 - 2N2222A @ Q6

B

C E*

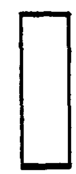
*Only E is silk-screened on the layout

(continued)

ROM BLASTER CARD (continued)

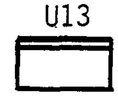
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 (white dot) on the layout.
Refer to SOCKETS for U1 & U3

pin 1 ► upper left for ALL ICs



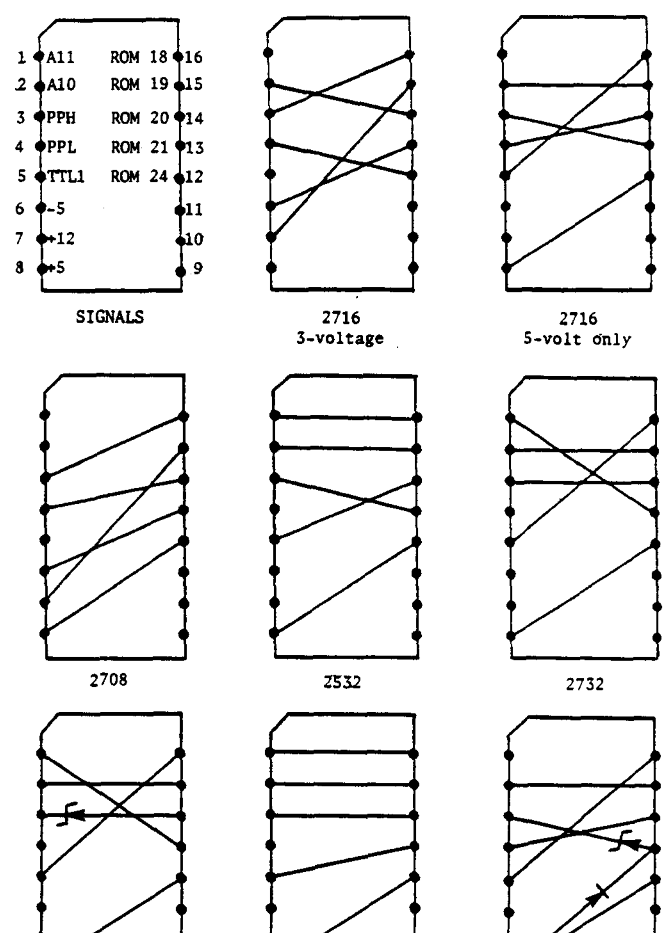
____ 1 - CD4040B @ U2 12-stage binary/ripple counter
____ 1 - 74LS02 @ U4
____ 1 - 74LS04 @ U5
____ 1 - one of
6820 or)
6821 or) @ U6 Peripheral Interface Adapter (PIA)
6521)
____ 3 - 74LS367 @ U7,11,12
____ 1 - NE555 @ U8 Timer
____ 1 - 7407 @ U9 Hex inverter buffer/driver
____ 1 - 74LS00 @ U10
____ 1 - 7820 @ U13 20 V voltage regulator*
*Position metal (heat sink) of voltage regulator along the double bar on the layout

U13



◄ metal of heat sink

PERSONALITY SELECT SOCKETS: plug-in adapters (16-pin component carriers strapped as shown) are used to reconfigure the programming socket to match the type of EPROM being programmed.



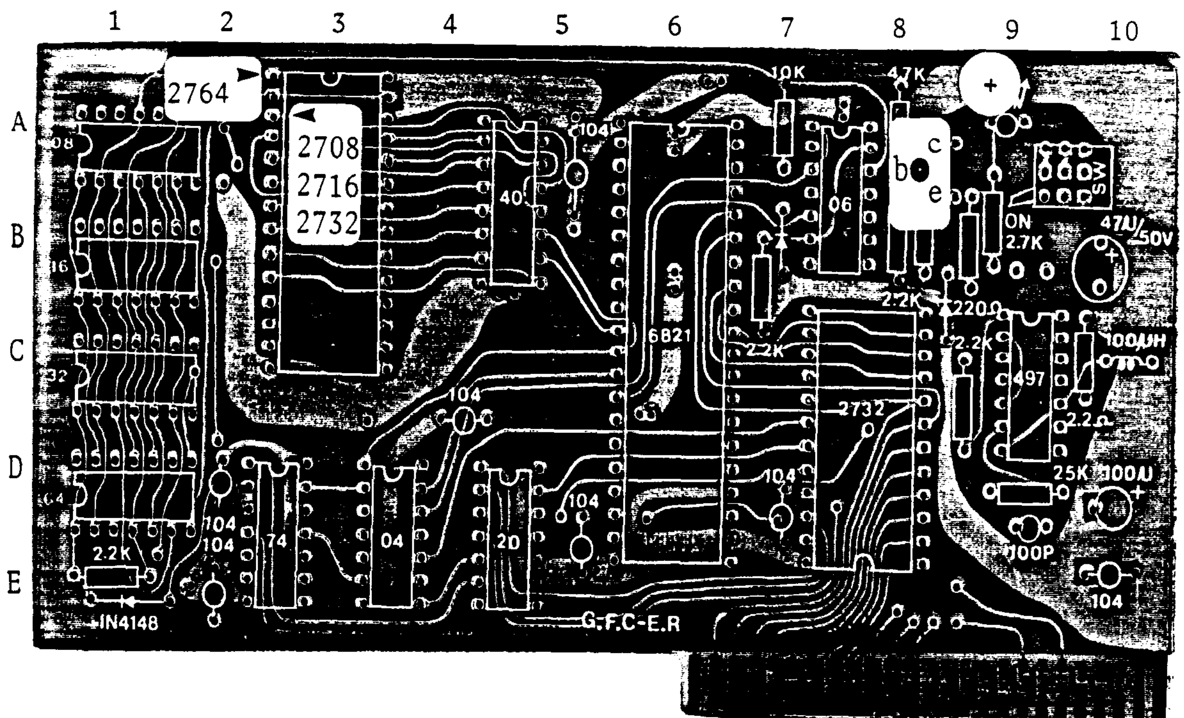
Use diodes as shown when programming 2732A or 2815/2816 EPROMS:

____ 2 - 1N5231 5.1V Zeners
____ 1 - 1N4001

*This card requires modifications to program 2764 EPROMs.

EPROM PROGRAMMER: Allows user to read, write or copy 2708,16,32,64 and 2532,64. With power off, install in any slot between 1 & 5. Requires firmware (one EPROM).

*NOTE THE COMPONENT CHANGES



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

____ 3 - 1N4148 cathode end

____ 1 - LED *Position longer lead (+) of LED as shown on the layout @ A-9

RESISTORS ¼ watt, 5% (unless indicated)

____ 1 - 10 KΩ @ A7
____ 1 - 4.7 KΩ @ A8
____ 1 - 2.2 KΩ @ B8
____ 1 - 100 Ω @ B8-9 in place of 1 KΩ
____ 1 - 22 Ω @ B8-9 in place of 220 Ω
____ 1 - 4.7 KΩ @ B9 in place of 2.7 kΩ
____ 1 - 2.2 KΩ @ B-C7
____ 1 - 1.0 Ω, ½W @ C10 in place of 2.2 Ω
____ 1 - 1 KΩ @ C-D9 in place of 2.2 KΩ
____ 1 - 22 KΩ, ½W @ D9 in place of 25 KΩ
____ 1 - 2.2 KΩ @ E1

INDUCTOR L

____ 1 - 100 uH RF choke

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 9 - 14-pin
____ 1 - 16-pin
____ 1 - 24-pin

CAPACITORS C

____ 1 - 100 pF
____ 5 - 0.1 uF Monolithic *delete 2 caps at A-B5 & E2
____ 1 - 22 uF/16v Tantalum* @ D10
____ 1 - 33 uF/16v Radial* @ B10
*Match + of capacitors with + on layout

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

____ 1 - 74LS04
____ 1 - 74LS20
____ 1 - 74LS74
____ 1 - CD4040
____ 1 - TL497
____ 1 - 7406
____ 1 - 6821P
____ 1 - 2716 EPROM

pin 1 for ALL sockets & ICs

TRANSISTOR Q

____ 1 - 2N3904 *Install the EBC leads as shown on the layout

SWITCH

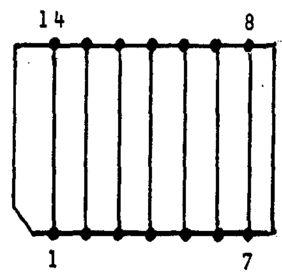
____ 1 - SPST PCB mount @ SW

(continued)

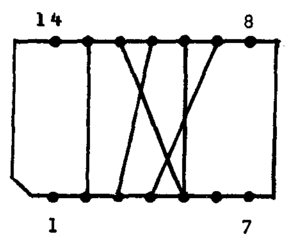
EPROM PROGRAMMER (continued)

PERSONALITY SELECT SOCKETS

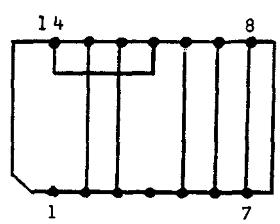
Plug-in adapters (14-pin component carriers strapped as shown) are used to reconfigure the programming sockets (labelled on the layout) to match the type of EPROM being programmed.



standard EPROMS 2708 2716 2732 2764

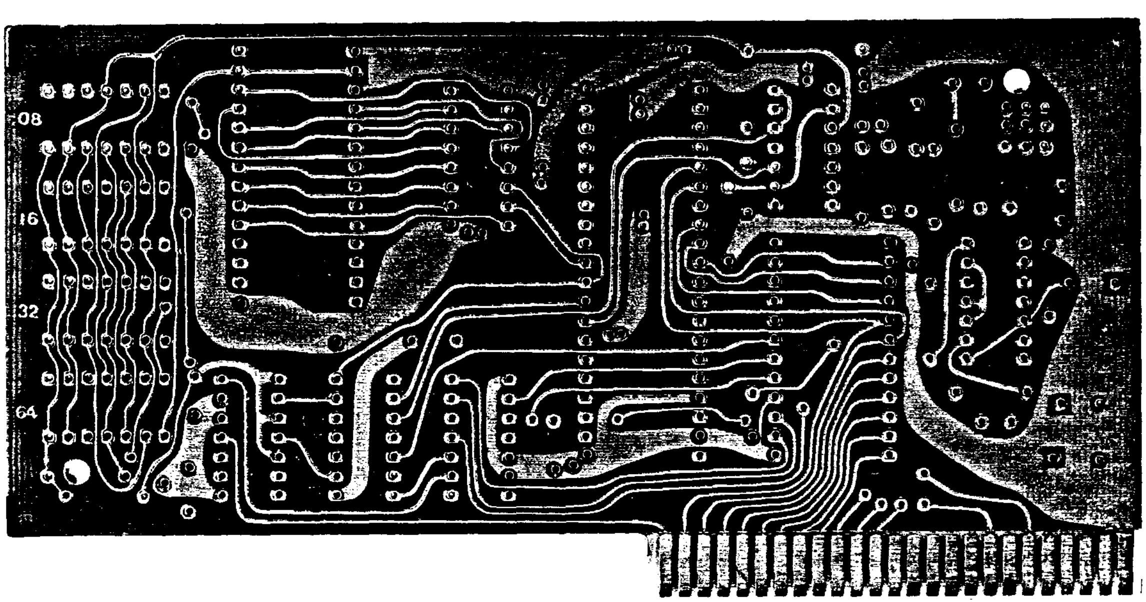


non standard EPROM 2532

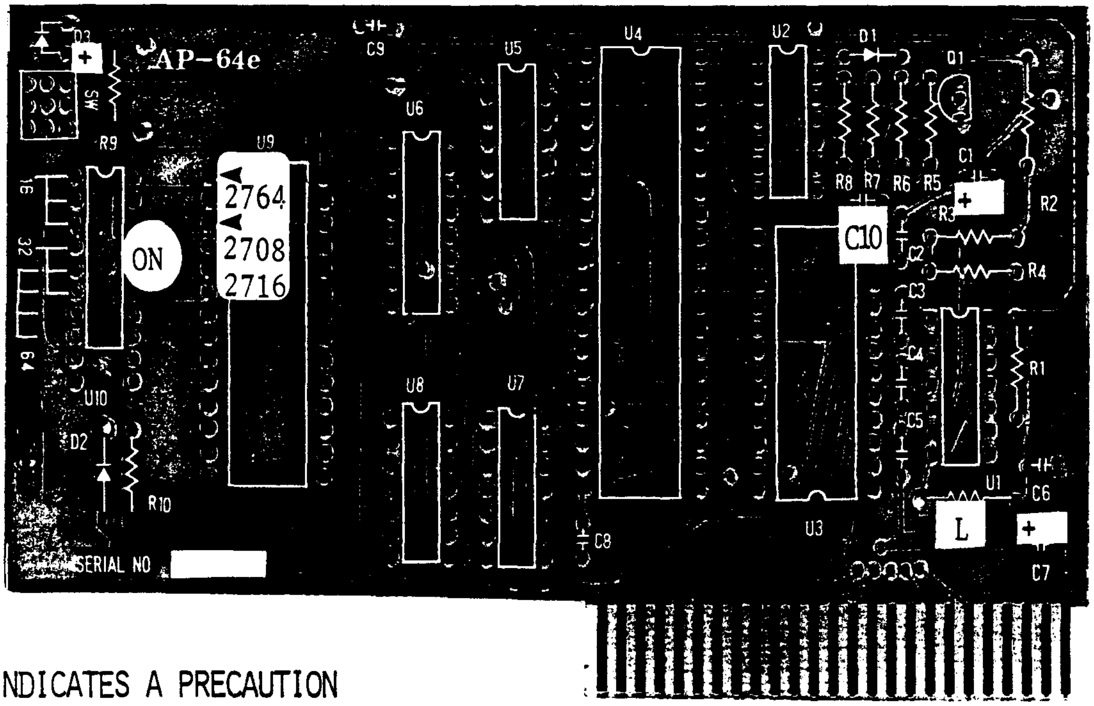


non standard EPROM 2564

EPROM PROGRAMMER: The component side of this card is NOT silk-screened. Refer to the Guide on the previous page for component placement.



AP-64 EPROM WRITER: Burns 2716-32-64 EPROMS. Functions include: write, read, copy, verify, blank check, monitor. Requires firmware (one EPROM) and documentation.



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

cathode end

____ 2 - 1N4001 @ D1,2
____ 1 - LED *Position longer lead(+) as shown an the layout @ D3

RESISTORS R ¼ watt, 5%

____ 1 - 1 Ω @ R1
____ 1 - 27 Ω @ R7
____ 1 - 100 Ω @ R10
____ 1 - 120 Ω @ R6
____ 1 - 680 Ω @ R4
____ 3 - 4.7 KΩ @ R5,8,9
____ 1 - 10 KΩ @ R3
____ 1 - 5 KΩ 2-cm rectangular trimpot, multi-turn adjustment @ R2

INDUCTOR L

____ 1 - 100 µH @ L

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 5 - 14-pin
____ 1 - 16-pin
____ 1 - 24-pin
____ 1 - 40-pin
____ 1 - 28-pin ZIF (Zero-Insertion Force)

CAPACITORS C

____ 1 - 100 pF disc ceramic @ C4
____ 7 - 0.1 µF Tantalum @ C2,3,5,7,8, C9,10

CAPACITORS (continued)

____ 1 - 2.2 µF/25V Radial* @ C1
____ 1 - 10 µF/16V Radial* @ C6

*Match + of Radials with + on the layout

TRANSISTOR Q *Position the EBC leads as shown

____ 1 - 2N3904 @ Q1

SWITCHES

____ 1 - SPST @ SW *up position for "on"
____ 1 - 8-position DIP @ U10, select as shown:

2716 - 1,2,3 on
2732 - 4,5,6 on
2764 - 5,6,7,8 on

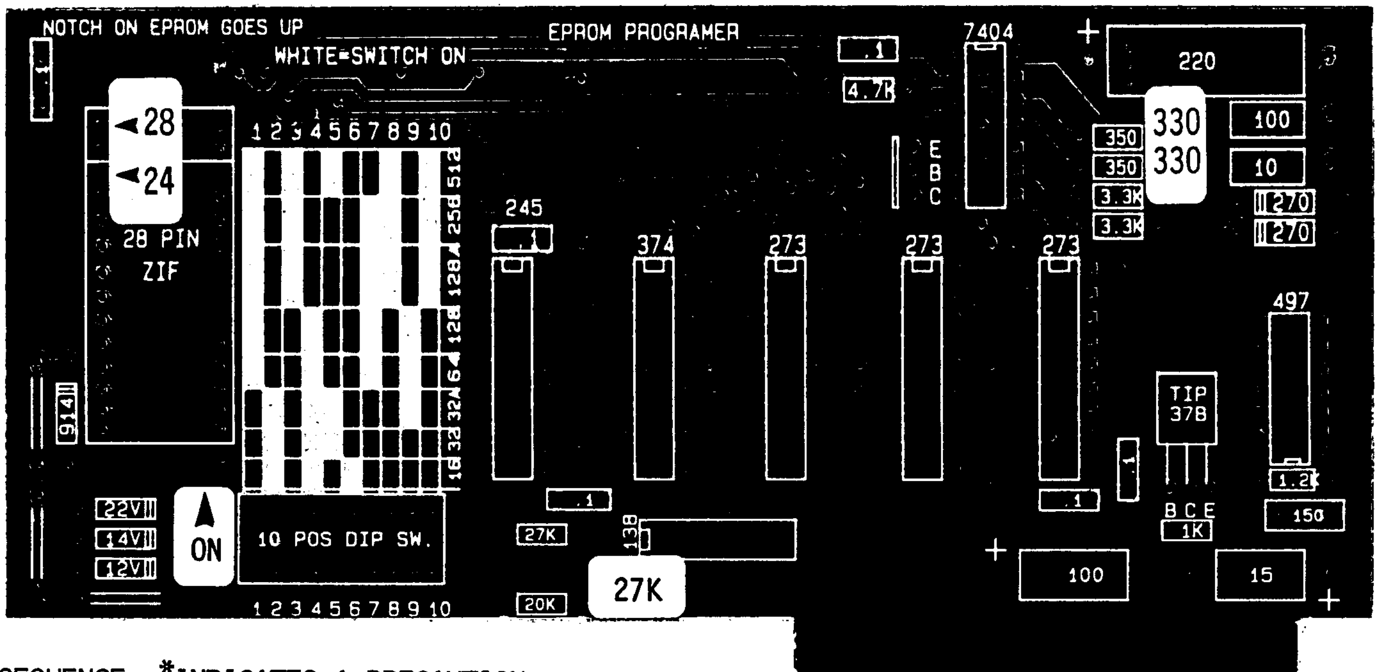
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS04 @ U5
____ 1 - 74LS20 @ U7
____ 1 - 74LS74 @ U8
____ 1 - CD4040 @ U6
____ 1 - TL497 @ U1
____ 1 - 7406 @ U2
____ 1 - 6821P @ U4
____ 1 - 2716 EPROM @ U3

pin 1 for all sockets and ICs

NOTE: Adjust trimpot @ R2 for correct voltage as outlined in the documentation

SUPER BURNER: Read, program any standard single-voltage EPROM including 27---- series 08, 16, 32, 32A, 64, 64A, 128, 128A, 256, 512 at either fast or normal burn speeds. With power off, install in any slot. Requires software (one diskette).



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

cathode

____ 2 - 1N270 @ 270
____ 1 - 1N914 @ 914
____ 1 - 12V 500 mw Zener @ 12V
____ 1 - 14V 500 mw Zener @ 14V
____ 1 - 22V 500 mw Zener @ 22V

RESISTORS R ¼ watt, 5% *Except 9.1 Ω
____ 1 - 9.1 Ω @ 10 *½ watt, 5%
____ 2 - 330 Ω @ 350
____ 1 - 1 KΩ @ 1K
____ 1 - 1.2 KΩ @ 1.2K
____ 2 - 3.3 KΩ @ 3.3K
____ 1 - 4.7 KΩ @ 4.7K
____ 2 - 27 KΩ @ 20K & 27K

COIL (RF CHOKE) L
____ 1 - 100 μH @ 100

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 2 - 14-pin
____ 1 - 16-pin
____ 5 - 20-pin
____ 1 - 28-pin ZIF (Zero Insertion Force)

TRANSISTORS Q *Match EBC leads of transistors with EBC on the layout
____ 1 - 2N3904 @ Q1
____ 1 - TIP31A @ Q2 (- TIP37B)

CAPACITORS C
____ 1 - 150 pF @ 150
____ 6 - 0.1 μF Monolithic @ .1

*Match + of the following AXIAL capacitors with + on the layout
____ 1 - 15 μF/25V axial* @ 15
____ 1 - 100 μF/16V axial* @ 100
____ 1 - 220 μF/50V axial* @ 220

SWITCH *Note "ON" position
____ 1 - 10-position DIP for EPROM select

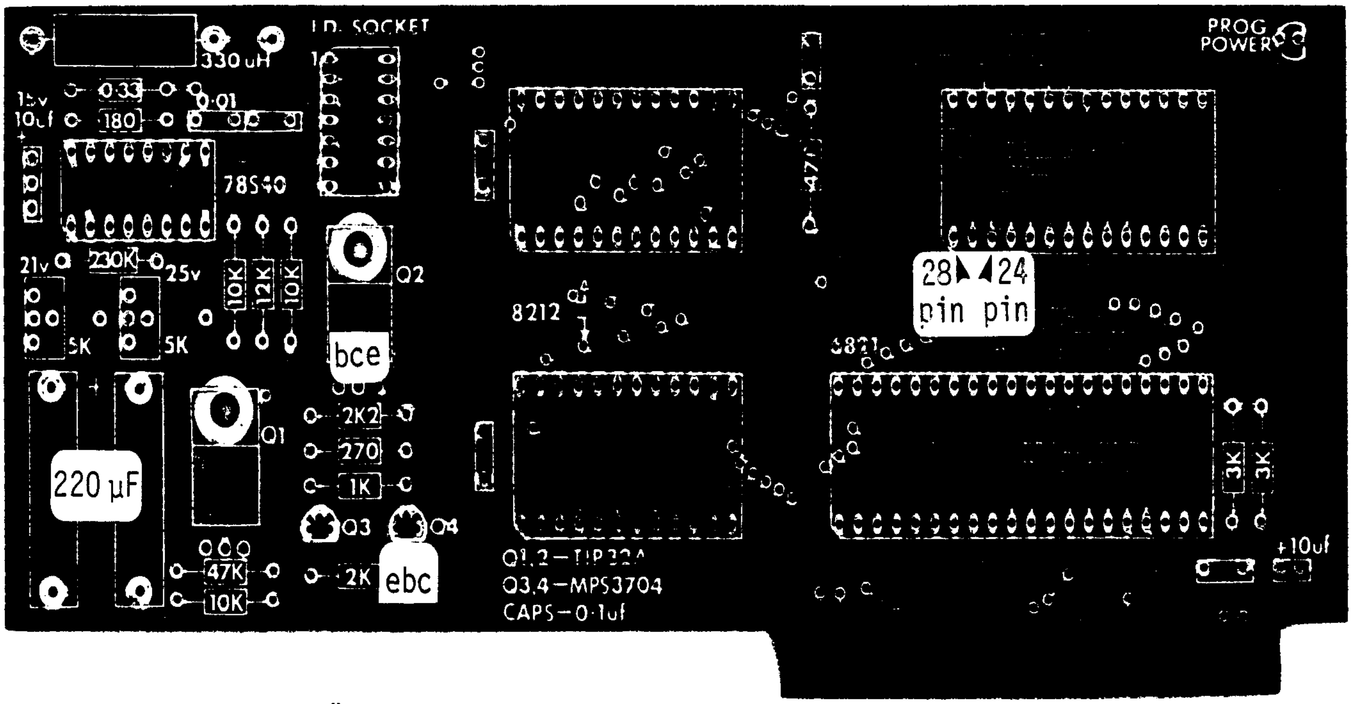
INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS07 @ 7404
____ 1 - 74LS138
____ 1 - 74LS245
____ 3 - 74LS273
____ 1 - 74LS374
____ 1 - TL497ACN

pin 1

SWITCH SETTINGS Set DIP switches ON according to the chart on the layout
e.g. For 2716 set # 2,4,6 ON
THE FOLLOWING ARE NOT SHOWN ON THE CHART:
For 2708 set #2,4,6 ON (as for 2716)
For 2764A set #1,4,7,8 on
For Toshiba 27256 set #1,3,7,9 ON

Jumpers:
____ 3 - strap @

EXCEL BURNER: Allows user to read, write, copy 2716, 1732, 2732A & 2764 EPROMs. With power off, install in any slot. Requires software (one diskette).



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 1 - 0.33 Ω *2 watt
____ 1 - 180 Ω
____ 1 - 270 Ω
____ 1 - 470 Ω
____ 1 - 1 KΩ
____ 1 - 2 KΩ
____ 1 - 2.2 KΩ
____ 2 - 3 KΩ
____ 3 - 10 KΩ
____ 1 - 12 KΩ
____ 1 - 47 KΩ
____ 1 - 230 KΩ
____ 2 - 5 KΩ Trimpot

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 1 - 14-pin
____ 1 - 16-pin
____ 2 - 24-pin
____ 1 - 40-pin
____ 1 - 28-pin ZIF (Zero-Insertion Force)


pin 1

CAPACITORS C
____ 1 - 0.01 µF
____ 4 - 0.1 µF Monolithic @

*Match + of the following capacitors with + on the layout
____ 2 - 10 µF/16V Tantalum*
____ 2 - 220 µF/25V Axial* @ 220 µF

TRANSISTORS Q *Match ebc leads of transistors with ebc on the layout
____ 2 - MPS3704 @ Q1
____ 2 - TIP32A @ Q1,2 Secure the top of the TIP32A transistors to the card with two nuts and bolts

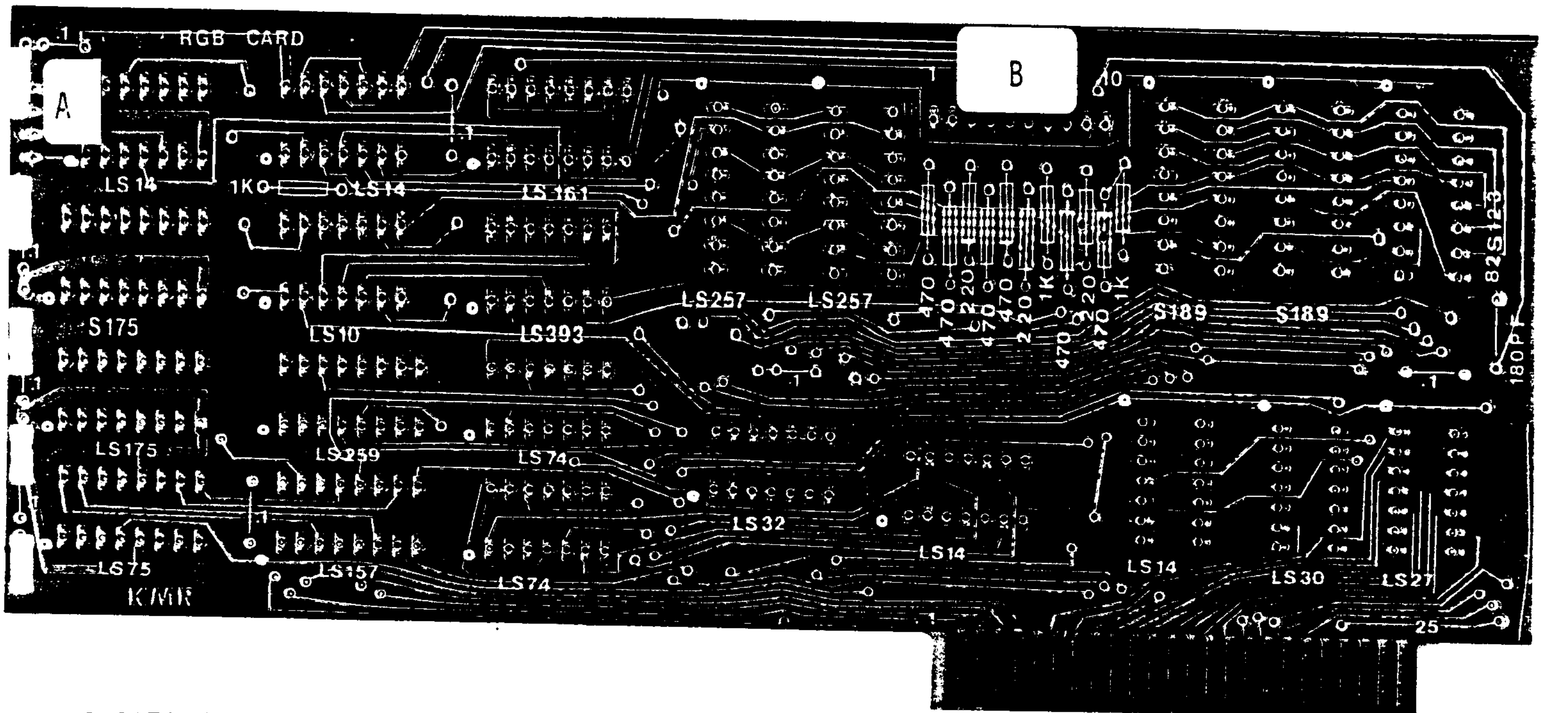
____ INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - UA78S40
____ 2 - 8212
____ 1 - 6821

LIGHT EMITTING DIODE
____ 1 - LED @ PROG POWER

INDUCTOR L
____ 1 - 330 µH

NuScope Associates

RGB CARD: Allows the user to interface an RGB colour monitor to the computer. With power off, install in slot number 7.



SUGGESTED ORDER OF INSTALLATION

*INDICATES A PRECAUTION

RESISTORS: R ¼ watt, 5%

____ 3 - 220 Ω
____ 5 - 470 Ω
____ 3 - 1 KΩ

CAPACITORS: C

____ 8 - 0.1 μF Monolithic
____ 1 - 180 pF Disc

SOCKETS: *Match pin 1 of sockets with pin 1 (white dot) on the layout. Check that ALL pins have passed thru ALL holes

____11 - 14-pin
____11 - 16-pin

CONNECTORS:

____ 1 - 1x4 male header strip, right-angle @ A on the layout for input from motherboard

____ 1 - 1X10 male header strip, straight @ B on the layout for output to RGB monitor
Refer to appropriate user manual for correct interfacing

INTEGRATED CIRCUITS: *Match pin 1 of IC with pin 1 (white dot) on layout

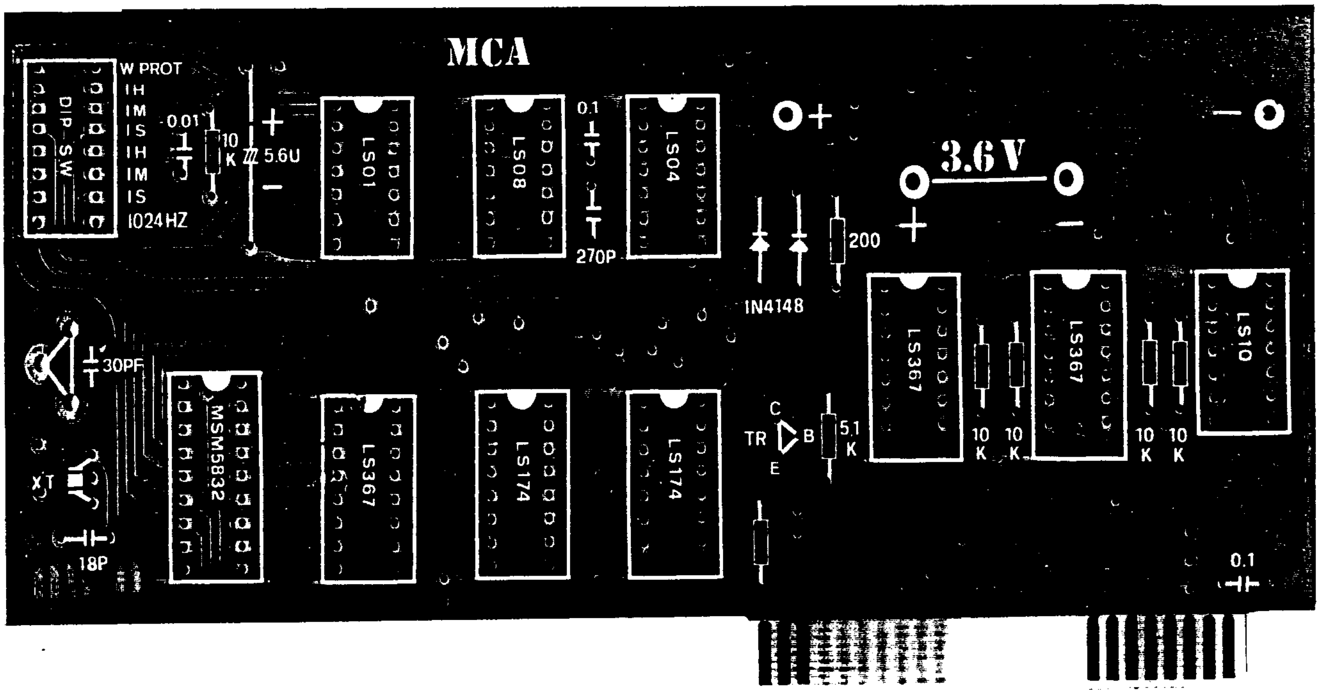
____ 1 - 74LS10
____ 4 - 74LS14
____ 1 - 74LS27
____ 1 - 74LS30
____ 1 - 74LS32
____ 2 - 74LS74
____ 1 - 74LS75
____ 1 - 74LS157
____ 1 - 74LS161
____ 1 - 74LS175
____ 2 - 74LS257
____ 1 - 74LS259
____ 1 - 74LS393

____ 1 - 74S175
____ 2 - 74S189
____ 1 - 82S123 PROM

pin 1 - white dot for ALL sockets and ICs

apple-seed

TIME CARD: Real time clock/calendar with on board battery backup power, charges when the computer is on. With power off, install in any slot except Ø (slot 5 recommended). Requires software (one disk).



SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

cathode end

____ 2 - 1N4148

RESISTORS R ¼ watt, 5%

____ 1 - 200 Ω
____ 1 - 5.1 Ω
____ 5 - 10 KΩ
____ 1 - 680 Ω @ position unlabelled

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 4 - 14-pin
____ 5 - 16-pin
____ 1 - 18-pin

CAPACITORS C

____ 1 - 18 pF
____ 1 - 270 pF
____ 1 - 0.01 μF
____ 2 - 0.1 μF
____ 1 - 30 pF variable capacitor
____ 1 - 5.6 μF/16v axial*

*Match + of capacitor with + on the layout

TRANSISTOR Q *Install the three EBC transistor leads correctly

____ 1 - 2N3904 @ TR

CRYSTAL Y

____ 1 - 32.708 KHz @ XT

on DIP S.W off

SWITCH

____ 1 - 8-position DIP S.W

BATTERY

____ 1 - 3.6 V NiCad rechargeable appropriately mounted

INTEGRATED CIRCUITS *Match pin 1 of IC with pin 1 on layout

____ 1 - 74LS01
____ 1 - 74LS04
____ 1 - 74LS08
____ 1 - 74LS10
____ 2 - 74LS174
____ 3 - 74LS367
____ 1 - MSM5832 real time clock/calender (OKI)

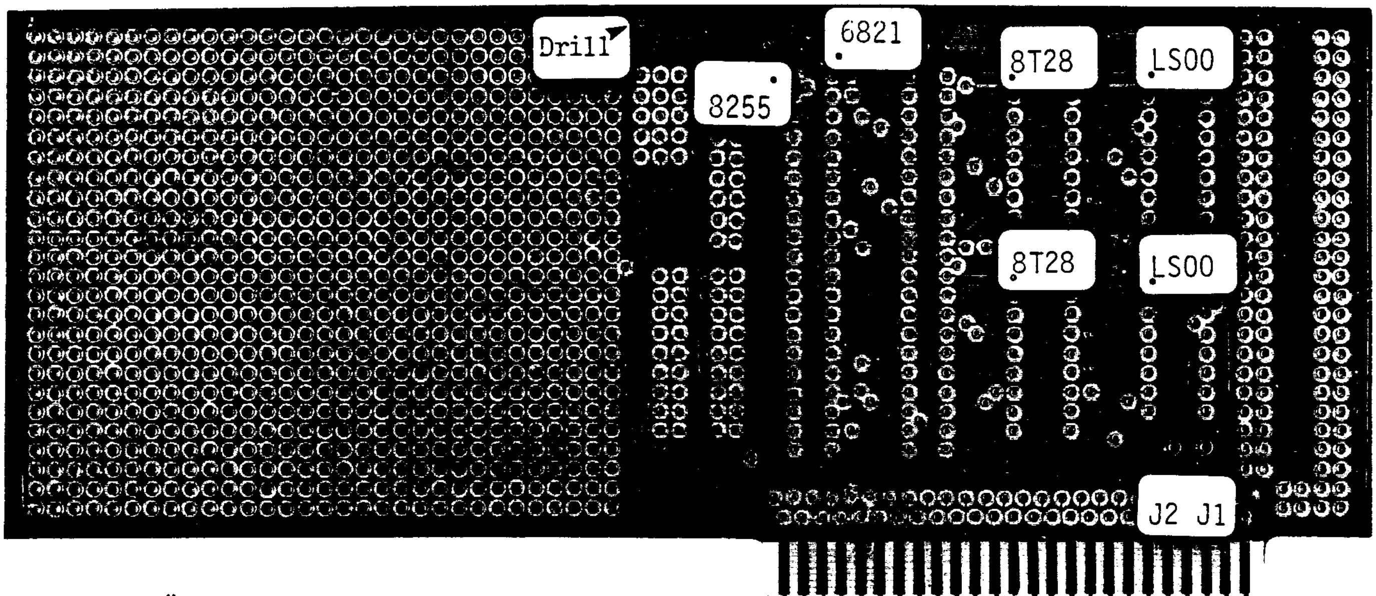
pin 1 ► upper left for ALL sockets and ICs

apple-seed

NuScope Associates

GUIDE 10-3

INPUT/OUTPUT CARD: Universal interface card with prototyping area for custom design. Install either Peripheral Interface Adapter MPU or Programmable Interface Adapter MPU.



SEQUENCE *INDICATES A PRECAUTION

SOCKETS *Match pin 1 of sockets with pin 1 (dot) on the layout. Check that ALL pins have passed thru ALL holes

____ 2 - 14-pin
____ 2 - 16-pin
____ 1 - 40-pin

CONNECTORS

____ 2 - 2-pin male header, straight @ J1,2

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 2 - 74LS00 quad 2 input NAND gate
____ 2 - 8T28 quad tri-state bus transeiver

ONE OF THE FOLLOWING:

____ 1 - 6821 Peripheral Interface Adapter
*Note pin 1 position

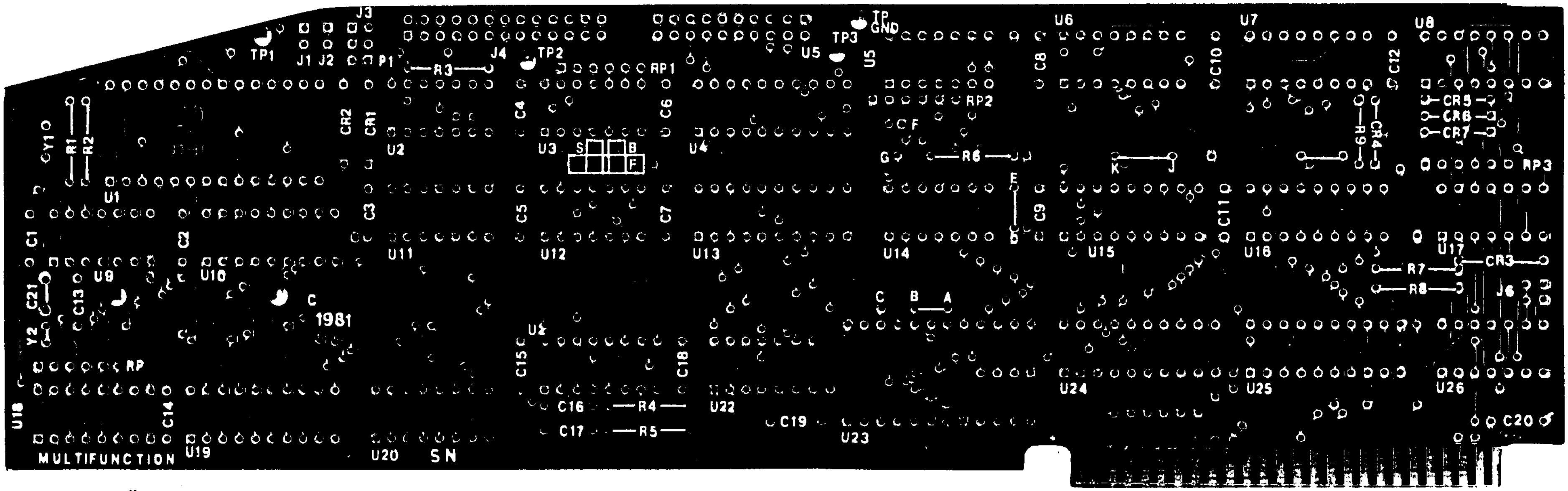
OR

____ 1 - 8255 Programmable Interface Adapter
*Note pin 1 position

MODIFICATION: If necessary, drill the feed-thru hole labelled "Drill" on the layout to prevent a short between GND & +5V

NuScope Associates

MULTIFUNCTION CARD: Provides an interface between the computer & external support devices including a bi-directional serial port, a parallel output interface, & a real-time clock/calender. With power off, install in any slot except Ø. Requires firmware (one EPROM), software (one disk), & documentation.



SEQUENCE * **INDICATES A PRECAUTION**

COMPONENT SIDE

DIODES D *Position banded end (cathode) of diodes towards the "square" pad
____ 6 - 1N4148 @ CR1,2,3,4,5,6

RESISTORS R ¼ watt, 5%
____ 1 - 51 Ω @ CR7*NOT an R number
____ 1 - 100 Ω @ R3
____ 1 - 510 Ω @ R9
____ 1 - 620 Ω @ R6
____ 2 - 1 KΩ @ R7,8
____ 2 - 1.5 KΩ @ R1,2
____ 1 - 10 KΩ @ R4
____ 1 - 20 KΩ @ R5
____ 2 - 10 K SIP* @ RP1,4
____ 1 - 1 K SIP* @ RP2
____ 1 - 10 K SIP* @ RP3
*Match pin 1 of SIPs with "square" solder pad (GND)

SOCKETS *Match pin 1 of sockets with pin 1 (square pad) on the layout. Check that ALL pins pass thru ALL holes
____10 - 14-pin
____ 6 - 16-pin
____ 3 - 18-pin
____ 5 - 20-pin
____ 2 - 40-pin

pin 1 lower left for ALL sockets

CAPACITORS C
____ 1 - 10 pF/100V Mica @ C13
____ 1 - 100 pF/500V Mica @ C16,17
____17 - 0.1 μF Monolithic @ C1,2,3,4,5,6 C7,8,9,10,11,12,14,15,18,19,20
____ 1 -0-50 pF Trimcap @ C21

CONNECTORS
____ 4 - terminal posts @ TP1,2,3,TP-GND

CONNECTORS (Cont) Headers are straight
____ 1 - 2x13 male header strip @ J4
____ 1 - 2x10 male header strip @ J5*
*J5 is silk-screened "U5"
____ 1 - 14-pin male header: Use as 2-pin connectors @ J1,2,3,6, & @ the 4 squares between S&B

CRYSTAL Y
____ 1 - 32.768 KHz (CLOCK) @ Y2
____ 1 - 5.0688 MHz (UART) @ Y1

BATTERY
____ 2 - 1.5 alkaline (AA) @ P1*

Mount battery with appropriate holder on soder side & secure with ties

+ve red
J2 P1*
-ve black

(Continued)

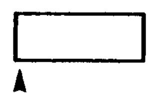
MULTIFUNCTION CARD (Continued)

FLAT RIBBON CABLES

____ 1 - serial, 26-conductor to 25-pin "D" connector
____ 1 - parallel, 20-conductor to 36-pin "Centronics" style connector

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS03 @ U5
____ 1 - 74LS04 @ U9
____ 1 - 74LS08 @ U17
____ 1 - 74LS09 @ U14
____ 2 - 74LS32 @ U22,26
____ 1 - 74LS74 @ U12
____ 1 - 74LS123 @ U21
____ 1 - 74LS136 @ U3
____ 2 - 74LS138 @ U6,7
____ 1 - 74LS155 @ U8
____ 1 - 74LS173 @ U18
____ 2 - 74LS273 @ U13,19
____ 1 - 74LS357 (T.I.) @ U25
____ 1 - 74LS367 @ U20
____ 1 - 74LS374 @ U4



pin 1 lower left for ALL ICs

INTEGRATED CIRCUITS (Continued)

____ 1 - 2716 EPROM @ U23
____ 1 - 8T245 or 74F245 @ U24
____ 1 - INS2651N (NAT) @ U1
____ 1 - 75188 (MC1488) @ U11
____ 1 - 75189 (MC1489) @ U2
____ 1 - MSM5832 MPU (OKI) real time clock/calender @ U10
____ 2 - HM-6513-9 512x4 CMOS static RAM (NAT), (HAR) @ U15,16

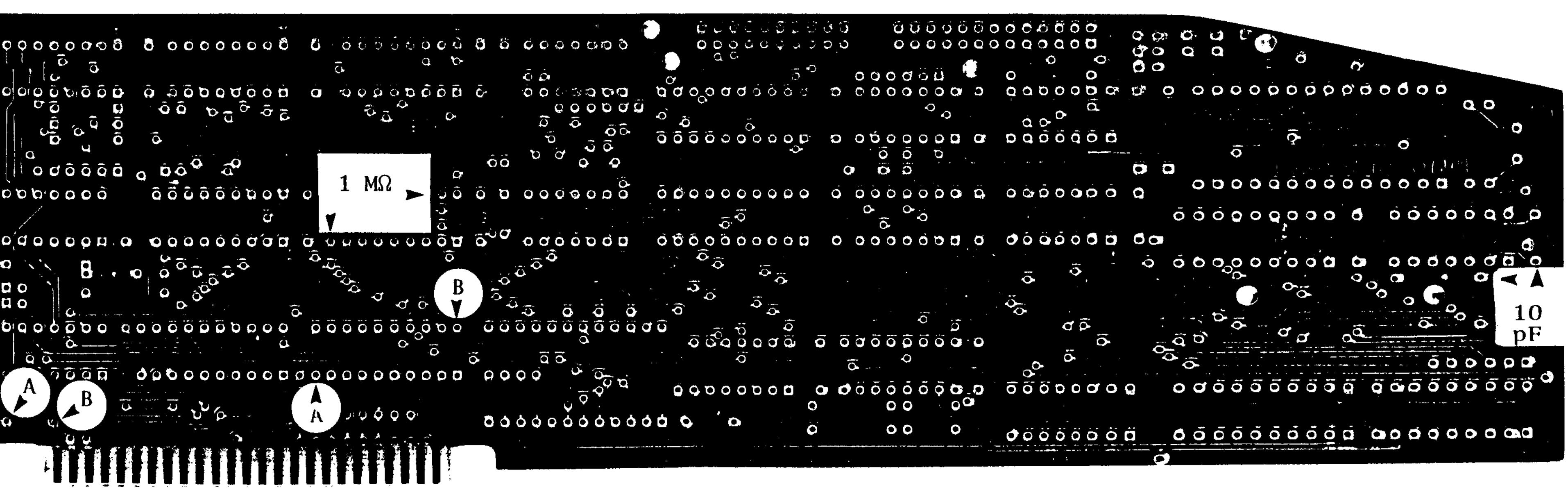
MODIFICATIONS TO THE SOLDER SIDE: Refer to the layout below

____ 1 - 10 pF/100V Mica capacitor @ pin 1 of U9 to bus strip directly below
____ 1 - 1 MΩ resistor @ U15, pin 9 to U15, pin 17

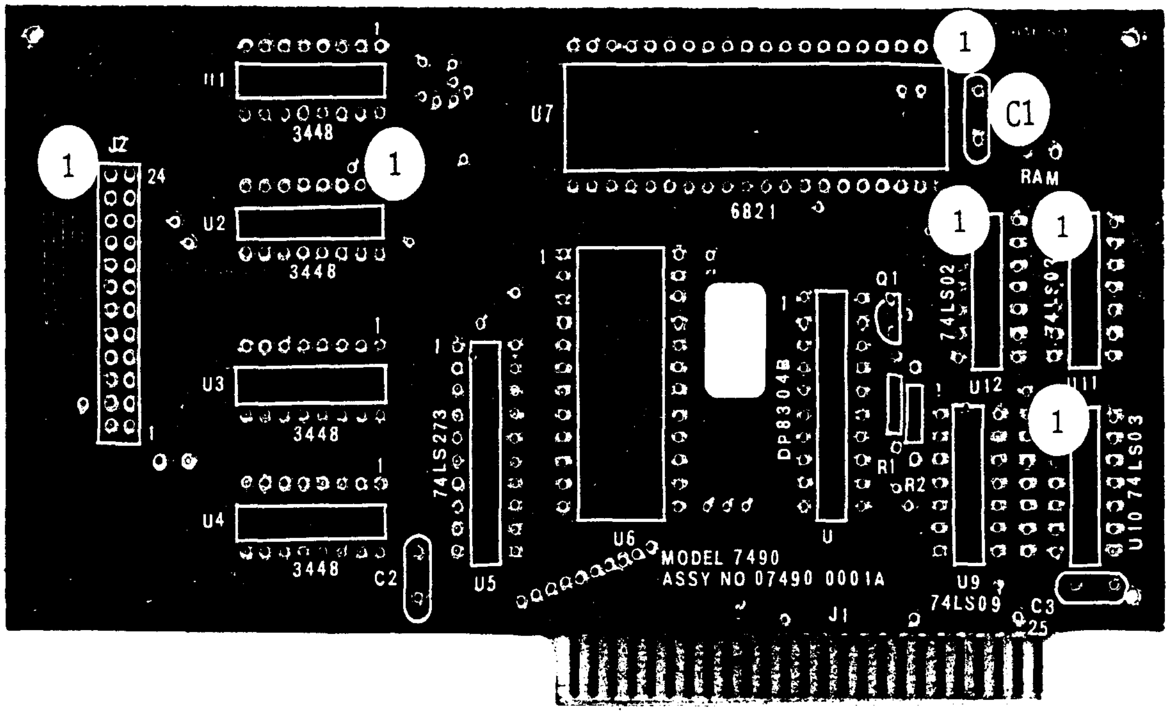
CONNECT insulated jumper wires on the SOLDER SIDE as shown

____ 1 - pin 10 of U24 to interface pin 26 (GND) of edge card connector @ A-A
____ 1 - pin 20 of U24 to interface pin 25 (+5V) of edge card connector @ B-B

MODIFICATIONS TO THE SOLDER SIDE



IEEE-INSTRUMENT CONTROLLER CARD: A parallel communication interface between the host computer and digitally-controlled equipment (for test, measure and control). Supports the instrument bus sanctioned by the IEEE. With power off, install in any slot except Ø (solt 3,4,or 5 recommended). Requires firmware (one EPROM) and documentation.



SEQUENCE *INDICATES A PRECAUTION

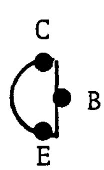
RESISTORS ¼ watt, 5%
____ 2 - 220 Ω @R1,2
____ 1 - 2.2 KΩ 8-pin SIP between U9 & U10
*Pin 1 (common) is directly between U12 & U11

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes.
____ 4 - 14-pin
____ 4 - 16-pin
____ 2 - 20-pin
____ 1 - 24-pin
____ 1 - 40-pin

pin 1 ➤ 1
for ALL
sockets
and ICs

CAPACITORS C
____ 3 - 0.1 uF Monolithic @ C1 (between U7 & "RAM"), C2, C3

TRANSISTOR Q *Install the three EBC leads as shown
____ 1 - 2N3906 @ Q1

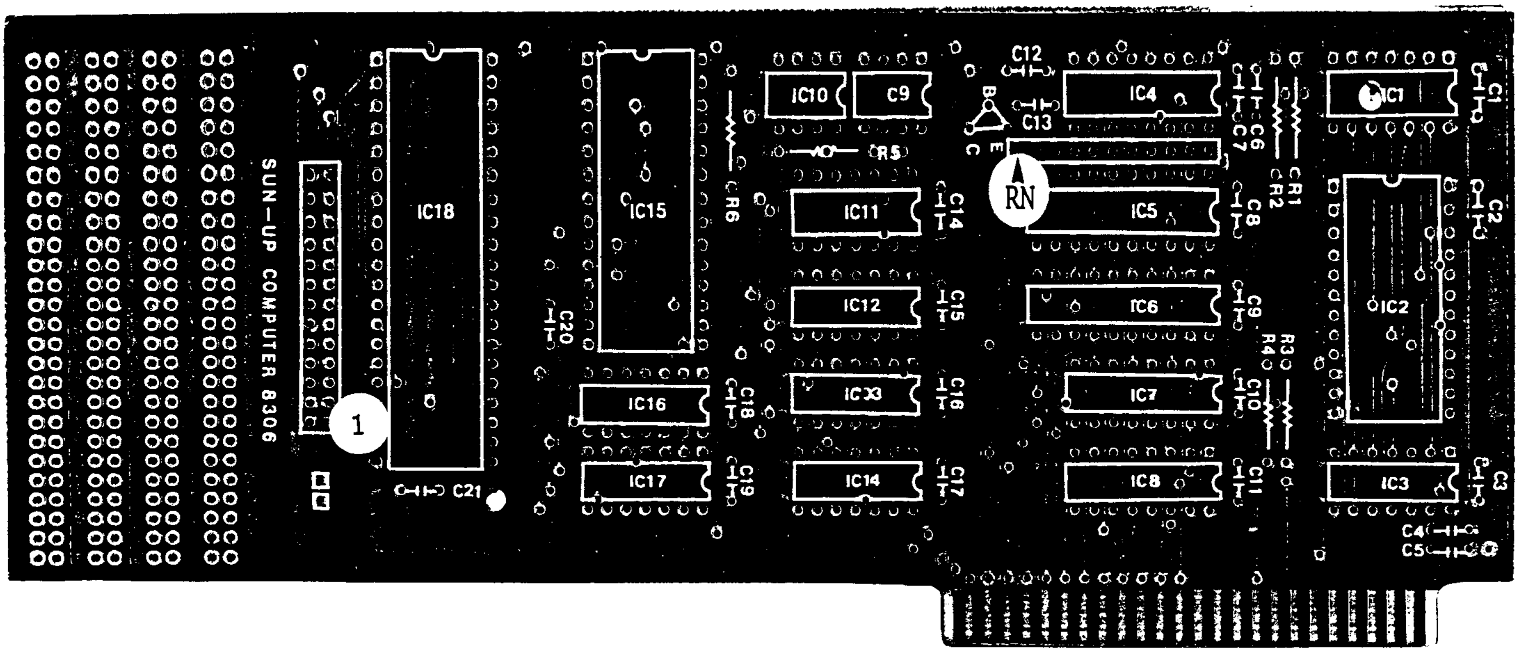


CONNECTOR
____ 1 - 2x12 male header strip, straight @ J2

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 4 - 3448 @ U1,2,3,4
____ 1 - 74LS273 @ U5
____ 1 - 2716 EPROM @ U6
____ 1 - 6821 PIA @ U7
____ 1 - DP8304B @ U ("8" is missing)
____ 1 - 74LS09 @ U9
____ 1 - 74LS03 @ U10
____ 1 - 74LS00 @ U11
____ 1 - 74LS02 @ U12

RAM OPTION
____ 1 - 1x2 male header strip, straight @ RAM
Jumper the two pins and replace the EPROM with 2K x 8 RAM @ U6

A/D-D/A CARD: A data acquisition, recording, and monitoring system. Has on-board 8-channel (optional 16-channel) analog to digital converter, as well as expandable 1-channel digital to analog converter. With power off, install in slot number 2. Requires software (one disc).



SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 4 - 4.7 KΩ @ R1,2,3,4,5
____ 1 - 10 KΩ 11-pin trimpot @ RN*
*Position common pin as shown by the arrow
____ 1 - 100 KΩ 2 cm rectangular trimpot, multiturn @ R6

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 2 - 8-pin
____ 8 - 14-pin
____ 3 - 16-pin
____ 2 - 20-pin
____ 1 - 24-pin
____ 1 - 28-pin
____ 1 - 40-pin

CAPACITORS C
____ 1 - 100 pF @ C8
____ 20 - 0.1 uF Monolithic @ C1,2,3,4,5,6,7 C8,9,10,11,12,13,14,15,16, C17,18,19,20,21

TRANSISTOR Q *Position the three EBC leads correctly
____ 1 - 2N3904

CONNECTOR
____ 1 - 2x13 male header strip, straight

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS00 @ IC16
____ 3 - 74LS02 @ IC1,3,14
____ 1 - 74LS04 @ IC17
____ 1 - 74LS32 @ IC32
____ 2 - 74LS74 @ IC11,13
____ 2 - 74LS365 @ IC7,8
____ 2 - 74LS373 @ IC5,6
____ 1 - DM74159 @ IC2
____ 1 - DAC0808 @ IC4
____ 1 - ADC0808 @ IC15 *For 8-channel
____ 1 - MC1456 @ IC9
____ 1 - – @ IC10
____ 1 - ADC0816 @ IC18 *For 16-channel

*USE EITHER IC15 OR IC18 BUT NOT BOTH

CABLE
____ 1 - to suit

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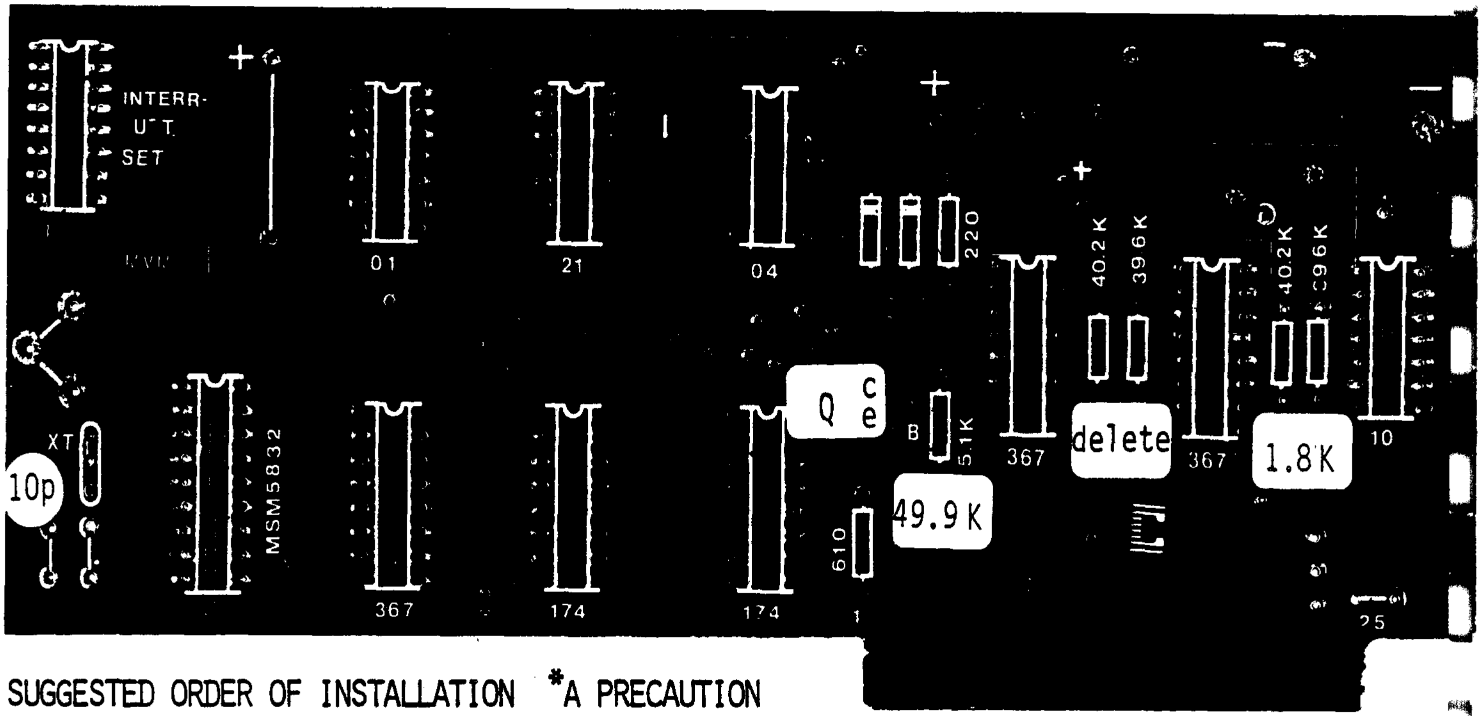
K-CLOCK CARD: Real-time clock/calender with 3.6 V rechargeable battery on board. Battery charges when computer is on. With power off, install in any slot except Ø (slot 5 recommended). Requires software (one disc).



SUGGESTED ORDER OF INSTALLATION *A PRECAUTION

DIODES D *Position banded end (cathode) of diode as shown

cathode end

____ 2 - 1N4148

RESISTORS R ¼ watt, 1% except 220 Ω

____ 1 - 220 Ω 5%
____ 1 - 619 Ω @ 610
____ 2 - 1.80 KΩ
____ 1 - 49.9 KΩ

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes

____ 4 - 14-pin
____ 5 - 16-pin
____ 1 - 18-pin

pin 1 upper left for ALL sockets and ICs

CAPACITORS C

____ 1 - 10 pF
____ 3 - 0.1 μF
____ 1 - 10 μF/40V Axial *Match + of axial with+ on the layout
____ 1 - 30 pF variable capacitor

TRANSISTOR Q Install the EBC leads as shown on the layout

____ 1 - 2N3904 @ Q

CRYSTAL Y

____ 1 - 32.708 KHz @ XT

SWITCH

____ 1 - 8-position DIP @ INTERUPT SET

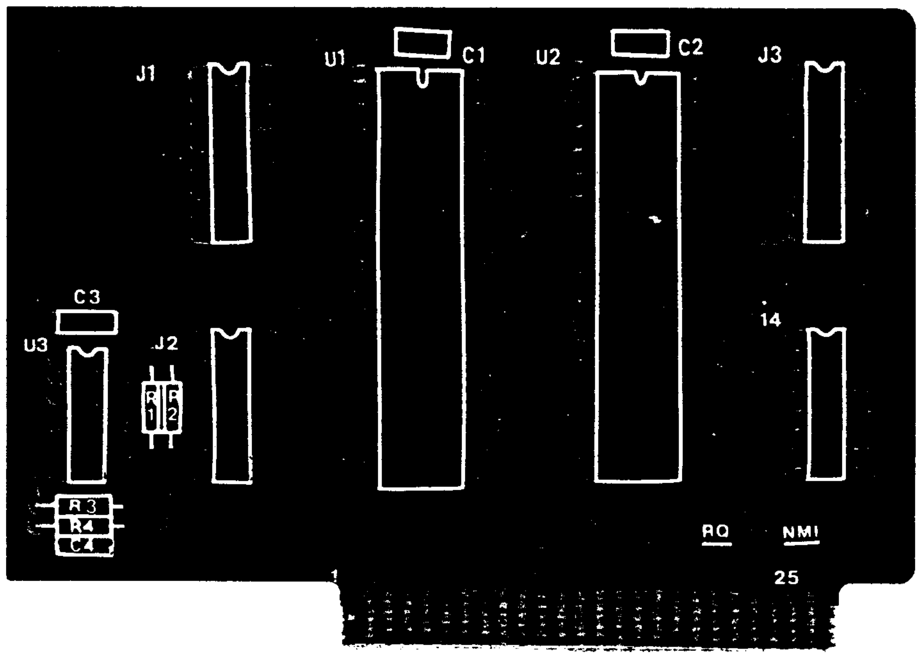
BATERY

____ 1 - 3.6 V NiCad, rechargeable appropriately mounted

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout

____ 1 - 74LS01
____ 1 - 74LS04
____ 1 - 74LS10
____ 1 - 74LS21
____ 2 - 74LS174
____ 3 - 74LS367
____ 1 - MSM5832 (OKI) real-time clock/calender

6522 VIA: Allows user to perform I/O and timing/counting functions in 6502-based systems. The 6522 VIA chip shares the same bus and control signals provided by the 6502 MPU. Has four 16-pin sockets for connection to peripheral devices. With power off, install in any slot except Ø. Requires documentaion.



SUGGESTED SEQUENCE *INDICATES A PRECAUTION

RESISTORS R ¼ watt, 5%
____ 2 - 1 KΩ @ R1,2
____ 2 - 4.7 KΩ @ R3,4

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 1 - 14-pin
____ 2 - 40-pin
____ 4 - 16-pin for connection to peripheral devices via ribbon cables

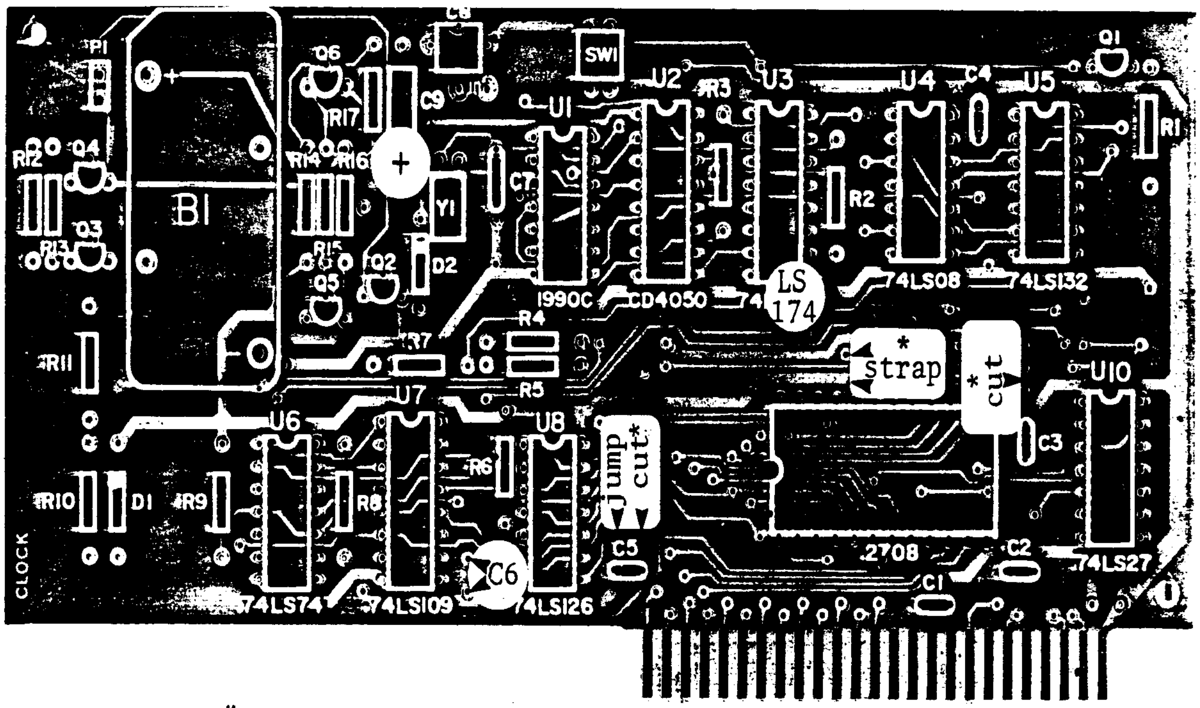
CAPACITORS C
____ 3 - 0.1 µF Monolithic @ C1,2,3
____ 1 - 100 pF Disc @ C4

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS05
____ 2 - R6522P VIA (versatile interface adapter) IC

JUMPERS
____ 2 - 2-pin male header as feed-thru @ IRQ & MNI
____ 1 - solder jumper on solder side for 12V supply for peripherals (as required)

pin 1 ►
upper left for
ALL sockets
and ICs

PRO-TIME CARD: Versatile real time clock/calender used with DOS & ProDOS™ operating systems. Gives access to year, month, day, hour, minute, second, for dating files. With optional transducer can give remote control of AC outlets. With power off, install in any slot 1 thru 7. Requires software (one disk) & firmware (one EPROM).



*MODIFICATION FOR USE WITH 2716 EPROM: Requires two cuts & two jumpers as shown on layout

SEQUENCE *INDICATES A PRECAUTION

DIODES D *Position banded end (cathode) of diodes towards the band on the layout
____ 1 - 1N5226 @ D1
____ 1 - 1N4001 @ D2

RESISTORS R ¼ watt, 5%
____ 1 - 82 Ω @ R10
____ 1 - 470 Ω @ R16
____ 1 - 1 KΩ @ R15
____ 2 - 3.3 KΩ @ R6,9
____ 1 - 4.7 KΩ @ R17
____ 3 - 10 KΩ @ R1,7,11
____ 1 - 15 KΩ @ R14
____ 5 - 47 KΩ @ R2,3,4,5,8
____ 2 - 1 MΩ @ R12,13

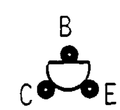
SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thru ALL holes
____ 6 - 14-pin
____ 3 - 16-pin
____ 1 - 24-pin

pin 1

CAPACITORS C *
____ 1 - 22 pF @ C7* Try 10pF
____ 6 - 0.1 µF Monolithic @ C1,2,3,4,5,6
____ 1 - 4.7 µF/16V Radial* @ C9 Match + of Radial with + on the layout
____ 1 - 5-50 pF Trimcap @ C8 (fast/slow adjust)

CRYSTAL Y
____ 1 - 32.768 KHz @ Y1

TRANSISTORS Q *Position EBC transistors leads as shown
____ 5 - 2N3904 @ Q1,2,3,4,6
____ 1 - 2N3906 @ Q5



SWITCH
____ 1 - two-position DIP @ SW1 (set/protect switch)

CONNECTORS
____ 1 - 2-pin header, male, 90° @ P1 (for optional transducer)

BATTERY
____ 1 - 3.6 V rechargeable NiCad (GE DS3D) (or appropriate substitute)

INTEGRATED CIRCUITS *Match pin 1 of ICs with pin 1 on the layout
____ 1 - 74LS08 @ U4
____ 1 - 74LS27 @ U10
____ 1 - 74LS74 @ U6
____ 1 - 74LS109 @ U7
____ 1 - 74LS126 @ U8
____ 1 - 74LS132 @ U5
____ 1 - 74LS174 @ U3
____ 1 - UPD1990C (NEC) @ U1 clock IC
____ 1 - CD4050 @ U2

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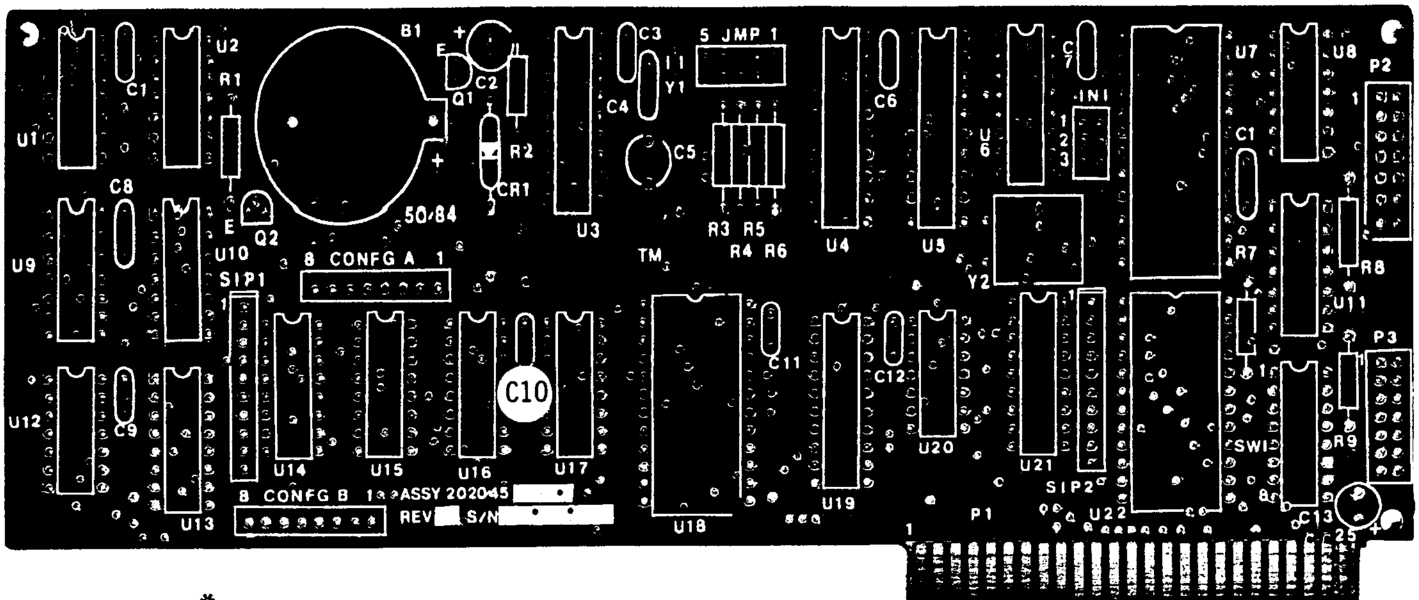
MULTIFUNCTION II (IIe): Provides: serial printer port; RS232 asynchronous serial communications port for remote terminal or external modem; real time clock/calendar with battery back-up. With power off, install in slot 1. Requires software (one diskette) and firmware (one EPROM).



SEQUENCE *INDICATES A PRECAUTION

DIODE *Position banded end of diode towards the arrow
____ 1 - 1N914 @ CR1

RESISTORS R ¼ watt, 5%
____ 4 - 4.7 KΩ @ R1,7,8,9
____ 5 - 10 MΩ @ R2,3,4,5,6
____ 2 - 4.7 KΩ 10-pin SIP* bussed, @ SIP 1,2. *Match pin 1 of SIP with pin 1 on layout

SOCKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins have passed thu ALL holes
____ 8 - 14-pin
____ 6 - 16-pin
____ 2 - 18-pin
____ 3 - 20-pin
____ 3 - 24-pin

CAPACITORS C *C1, above R7 is NOT equipped
____ 1 - 22 pF @ C4
____ 9 - 0.1 µF Monolithic @ C1,3,6,7,8,9, C10,11,12
____ 2 - 1 µF/16V Tantalum* @ C2,13 *Match + of Tantalum with + on the layout
____ 1 - 5-50 pF Trimcap @ C5

TRANSISTORS Q *Match ebc transistor leads as shown on the layout
____ 1 - 2N2907A @ Q1
____ 1 - 2N2222A @ Q2

CRYSTAL Y
____ 1 - 32.768 KHz @ Y1
____ 1 - 5.068 MHz @ Y2* Fold crystal flat against the card before soldering

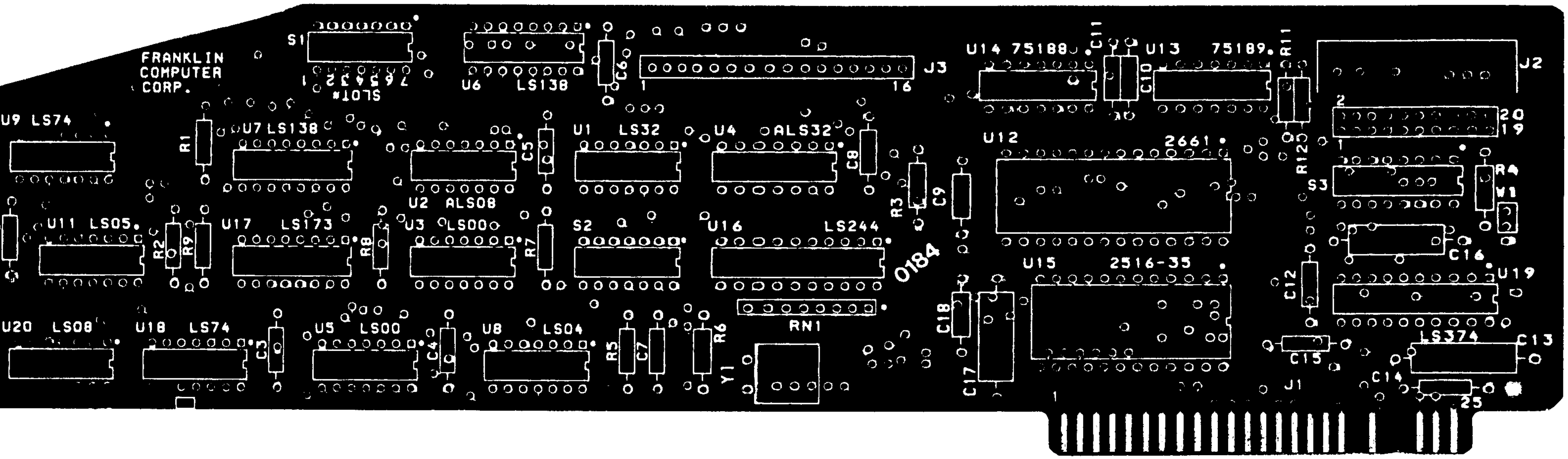
SWITCH
____ 1 - 8-position DIP @ SW1 -baud rate

HEADERS male, straight
____ 2 - 1x8 @ CONFG A,B -slot select
____ 1 - 2x3 @ INI
____ 1 - 2x5 @ JMP1 -set clock
____ 2 - 2x7 @ P2 -printer port
@ P3 -communica. port

BATTERY Match + of battery with + on layout
____ 1 - 3 V Lithium @ B1

INTEGRATED CIRCUITS * Match pin 1 of ICs with pin on the layout
____ 1 - 74LS00 @ U9
____ 1 - 74LS04 @ U2
____ 1 - 74LS08 @ U12
____ 1 - 74LS21 @ U10
____ 1 - 74LS32 @ U20
____ 1 - 74LS74 @ U1
____ 1 - 74LS133 @ U17
____ 3 - 74LS138 @ U13 U14,15
____ 1 - 74LS157 @ U16
____ 1 - 74LS245 @ U19
____ 1 - 74LS273 @ U5
____ 1 - 74LS367 @ U6
____ 1 - 74LS373 @ U4
____ 1 - 1488 @ U8
____ 1 - 1489 @ U11
____ 2 - 68A50 @ U7,22
____ 1 - COM8116 @ U21
____ 1 - M5832 @ U3
____ 1 - 2732 @ U18

ACE DUAL I/O CARD: Centronics-compatible parallel printer interface and serial communication (RS232) interface on one card. With power off, install in slot 1 or 2. Use switch settings to control "phantom" slot assignment. Requires firmware (one EPROM). Documentation & schematics available from supplier.

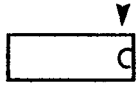


EQUENCE *INDICATES A PRECAUTION

ESISTORS R ¼ watt, 5%
___ 1 - 100 Ω @ R4
___ 2 - 1.5 KΩ @ R5,6
___ 3 - 4.7 KΩ @ R1,7,8
___ 6 - 10 KΩ @ R2,3,9,10,11,12
___ 1 - 1 KΩ 8-pin SIP* bussed @ RN1
*Match pin 1 od SIP with pin 1 (white dot) on the layout

CKETS *Match pin 1 of sockets with pin 1 on the layout. Check that ALL pins pass thru ALL holes
___12 - 14-pin
___ 3 - 16-pin
___ 2 - 20-pin
___ 1 - 24-pin
___ 1 - 28-pin

pin 1



CAPACITORS C
___ 1 - 0.01 F Monolithic @ C7
___14 - 0.1 F Monolithic @ C1,2,3,4,5,6,8, C9,10,11,12,14,15,18
___ 3 - 10 F/16V Axial* @ C13,16,17
*Match + of Axial with + on layout

CRYSTAL Y *Insulate and fold flat against the card before soldering
___ 1 - 4.9152 MHz @ Y1

SWITCH
___ 2 - 7-position DIP @ S1, S2
___ 1 - 8-position DIP @ S3

CONNECTORS
___ 1 - 1x2 header, right angle @ W1
___ 1 - 1x16 header, right angle @ J3 - Parallel
___ 1 - 1x20 header, right angle @ J2 - Serial
___ 1 - shorting clip for W1

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JAL I/O CARD (continued)

RATED CIRCUITS *Match pin 1 of ICs
with pin 1 on the layout. U10 is NOT
shown on the layout.

2 - 74LS00 @ U3,5
1 - 74LS04 @ U8
1 - 74LS05 @ U11
1 - 74LS08 @ U20
1 - 74LS32 @ U1
2 - 74LS74 @ U9,18 (TI only)
2 - 74LS138 @ U6,7
1 - 74LS173 @ U17
1 - 74LS244 @ U16
1 - 74LS374 @ U19

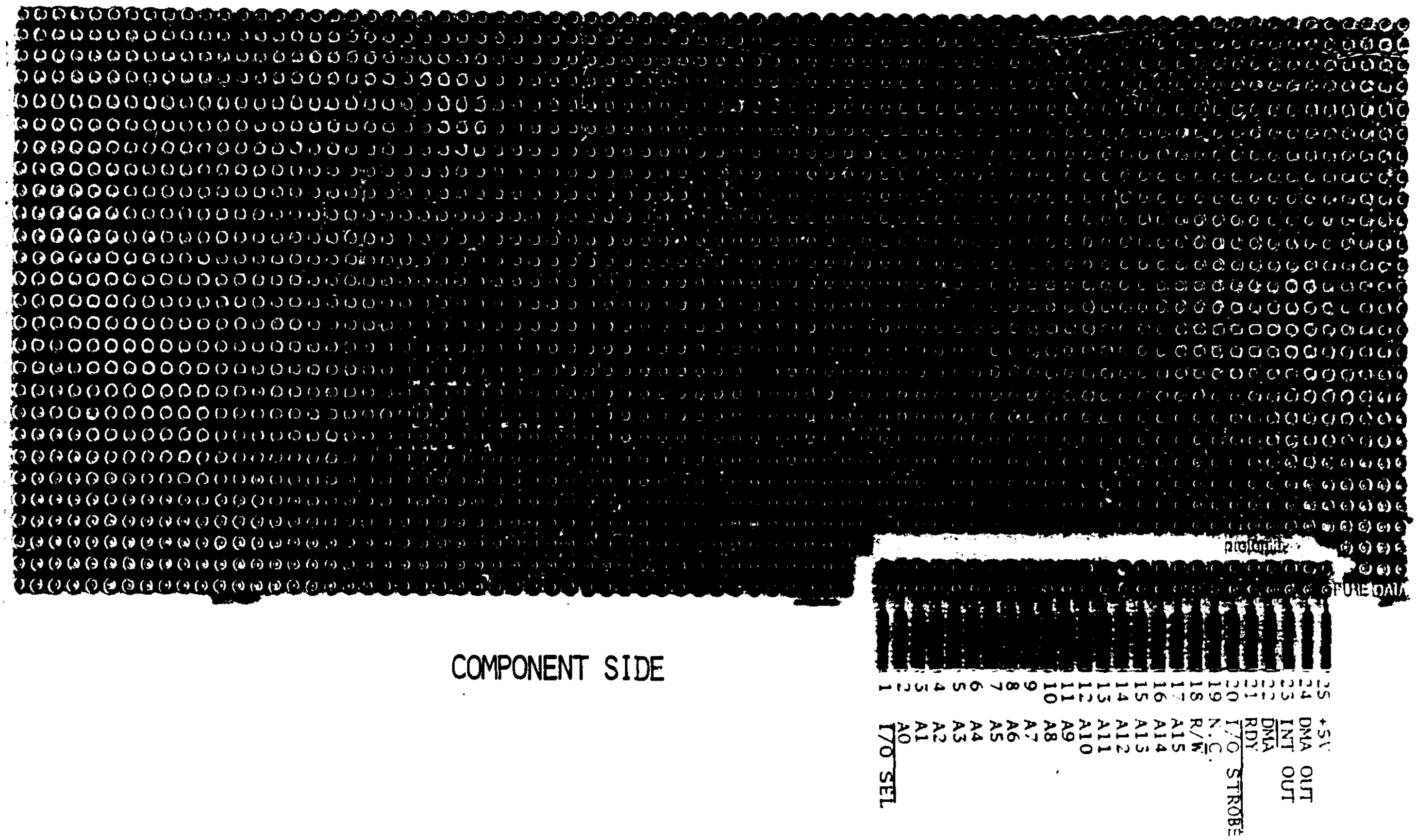
1 - 74ALS08 @ U2
1 - 74ALS32 @ U4 (74LS32)

1 - 75188 @ U14 (MC1488)
1 - 75189 @ U13 (MC1489)

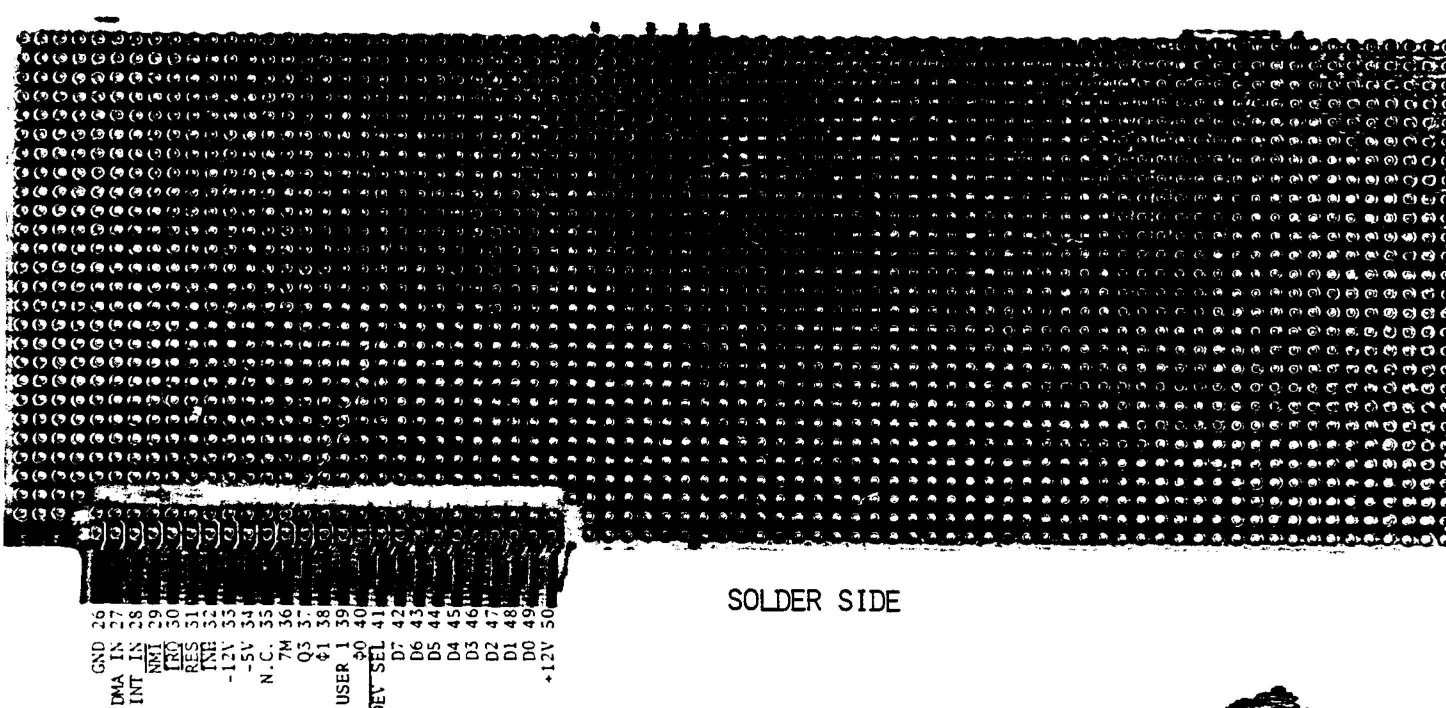
1 - 2661 USART @ U12
1 - 2716 EPROM @ U15

GUIDE 11-1

PROTOTYPING CARD I: For high-density wire wrap prototyping work. Has over 1,900 solder pads on 0.1 inch spacing.

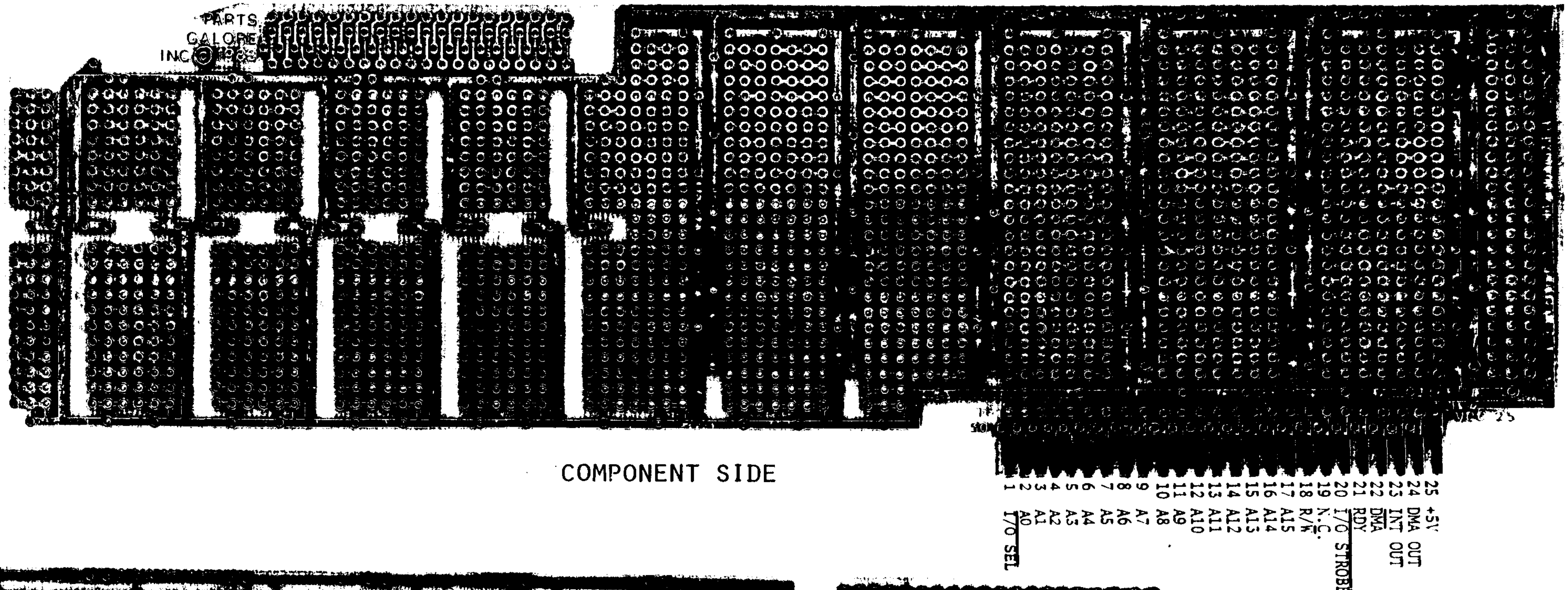


COMPONENT SIDE

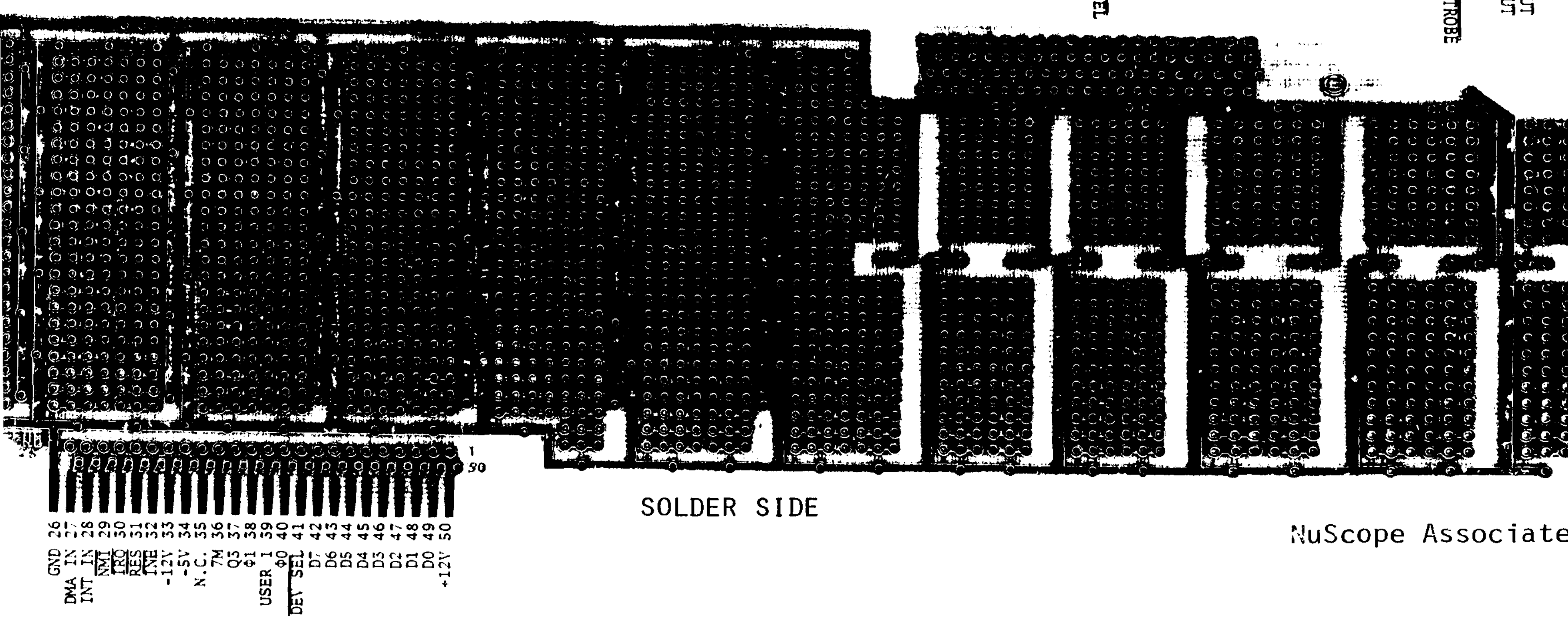


SOLDER SIDE

PROTOTYPING CARD II: For point-to-point hand-wired custom work. Has on-board +5 V power bus & ground bus.



COMPONENT SIDE



SOLDER SIDE

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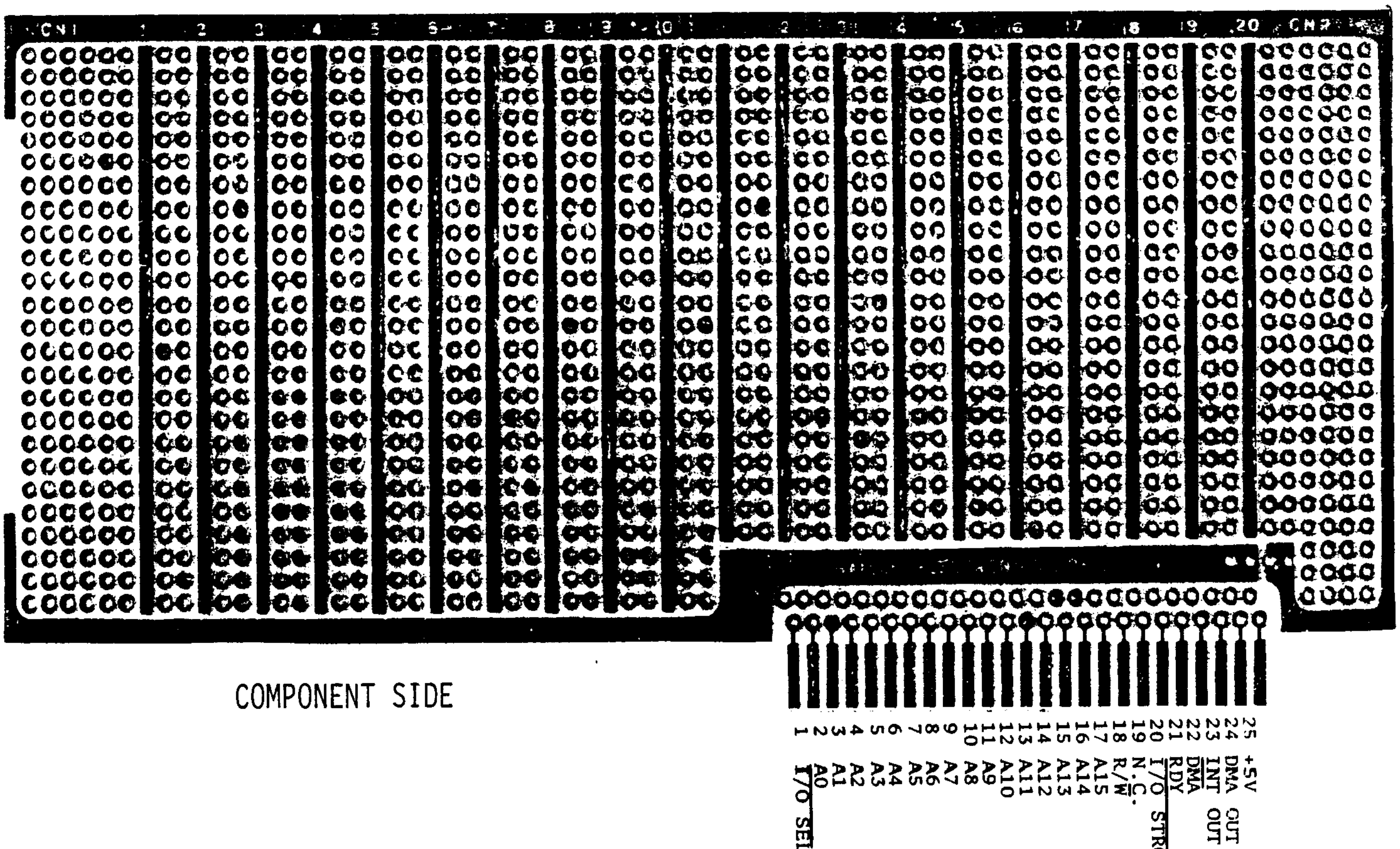
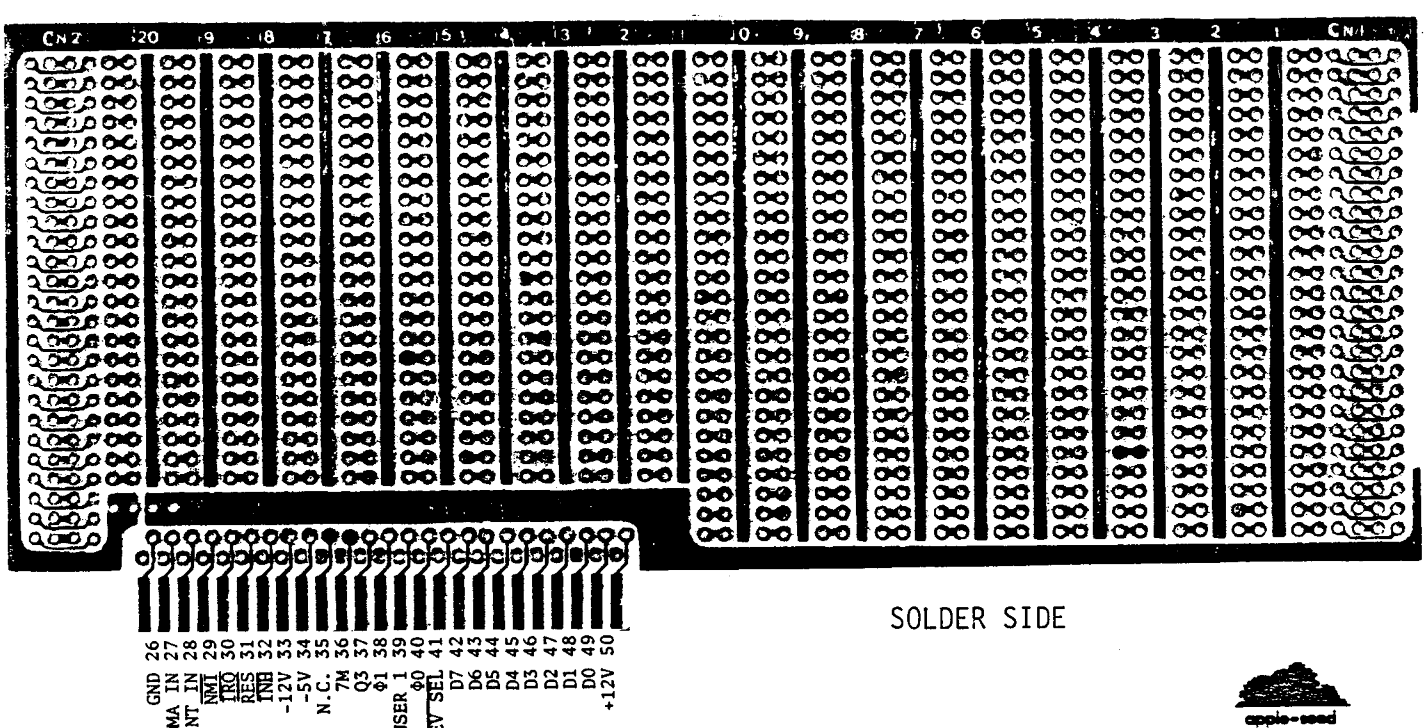
PROTOTYPING CARD III: For point-to-point hand-wired custom work.



COMPONENT SIDE

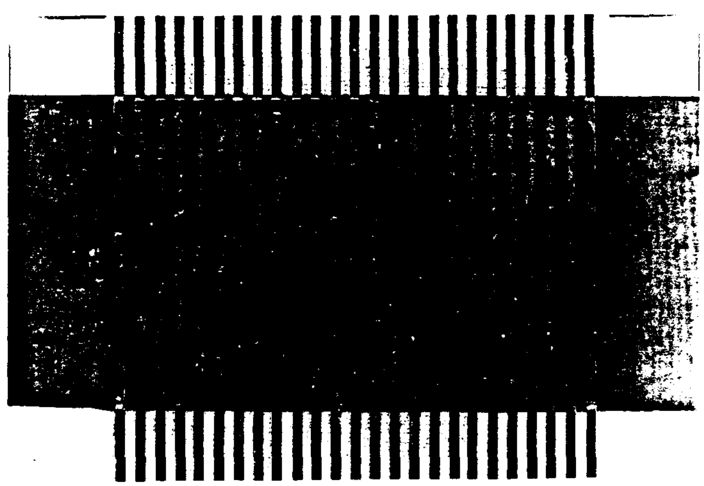


SOLDER SIDE

EXTEND-A-CARD: Lifts card 5 cm above the motherboard for easy testing & servicing.

Secure a 50-pin card edge connector to the top of the card so that the pins of the connector line up with the traces on the card. Centre the connector and solder the end pins to the card. Check that pins are correctly lined up. Solder the remaining pins to the card. Appropriately label one end of the connector pin 1 and pin 26.

SOLDER CARD EDGE CONNECTOR
TO
TOP OF CARD



gold fingers

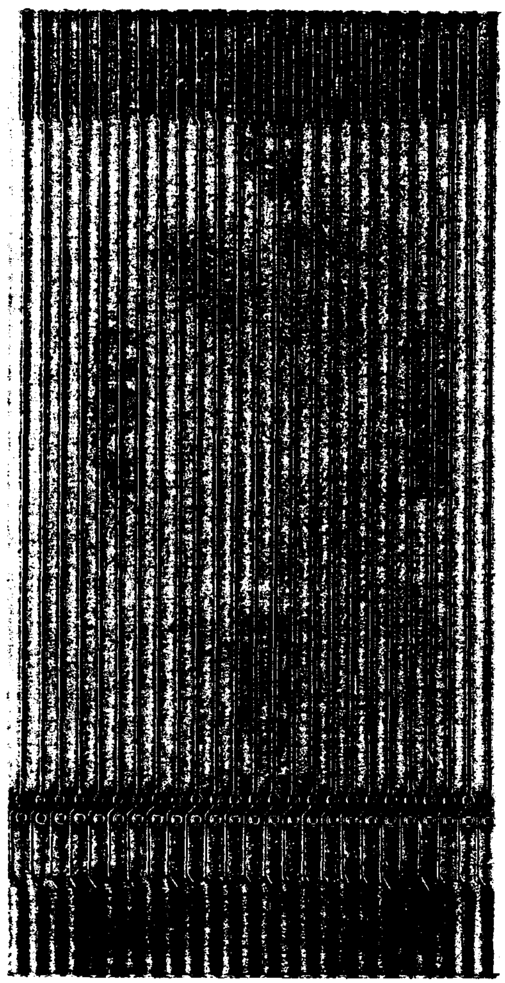
CONNECT TO MOTHERBOARD

apple-seed

EK CARD EXTENDER: Lifts card 11 cm above the motherboard for ease of servicing testing and troubleshooting.

Secure a 50-pin card edge connector to the top of the card so that the pins of the connector line up with the traces on the card. Solder the four end pins to the card. Check that the rest to the pins are aligned. Solder the remaining pins to the card. Appropriately label one end of the connector pin 1 and pin 26.

SOLDER CARD EDGE CONNECTOR
TO
TOP OF CARD

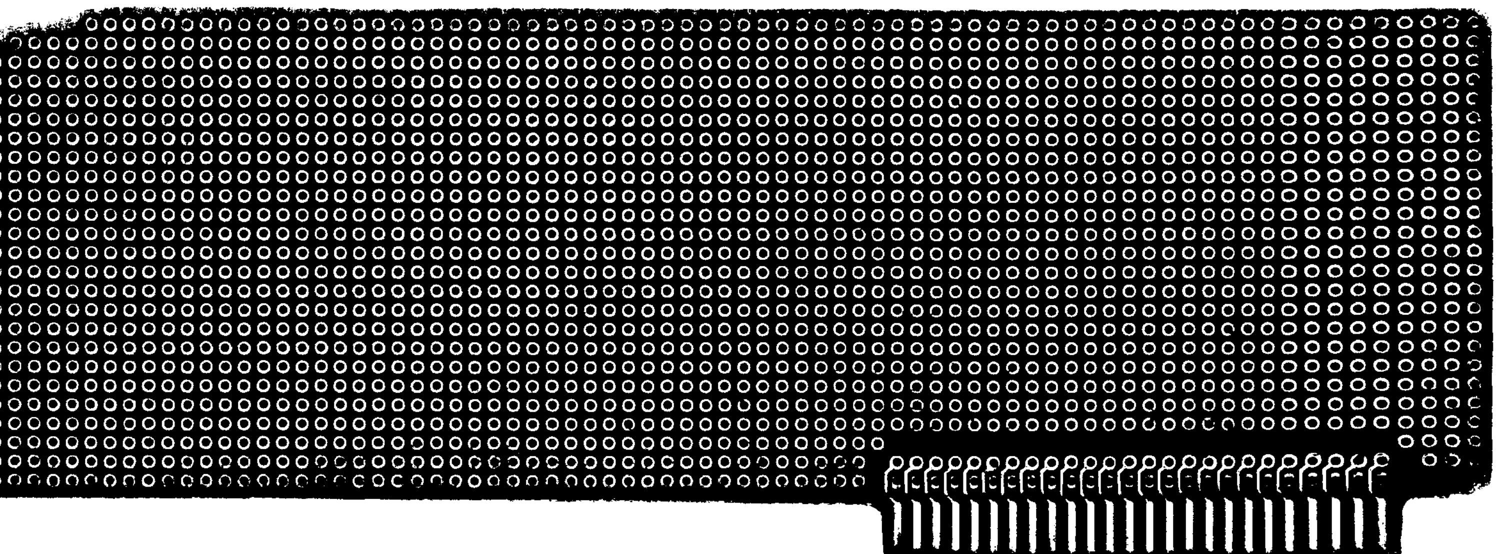


gold fingers

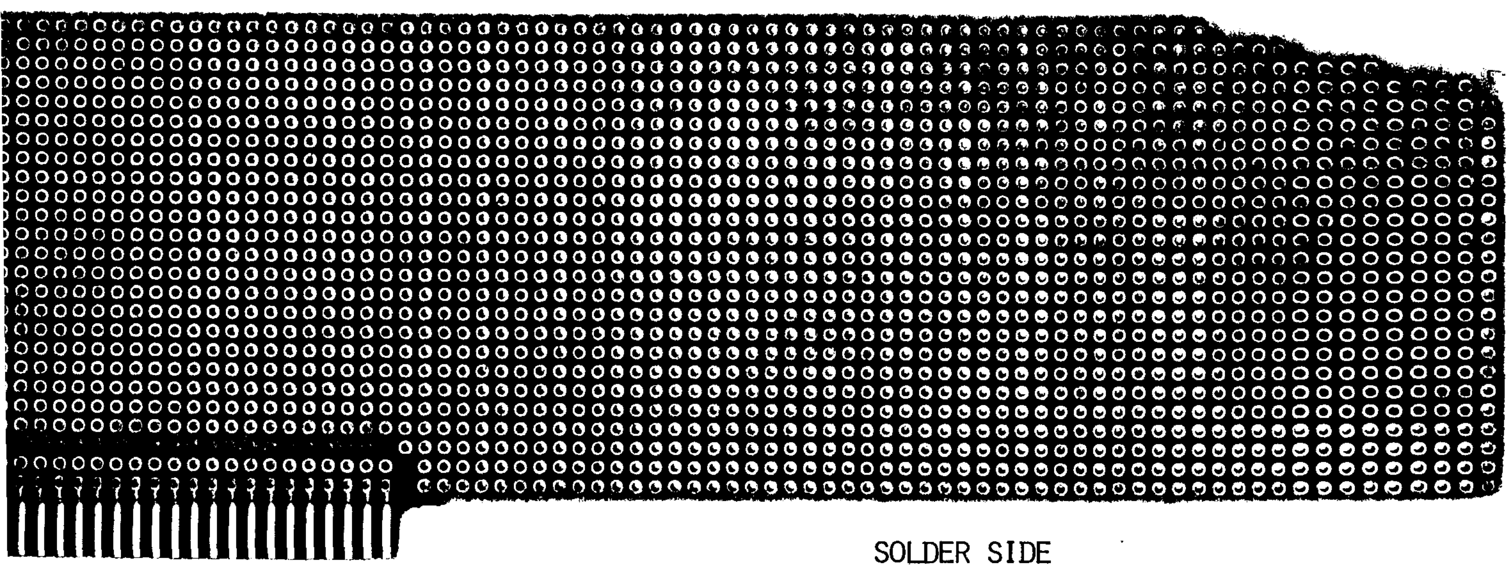
INSTALL IN MOTHERBOARD

GUIDE 11-6

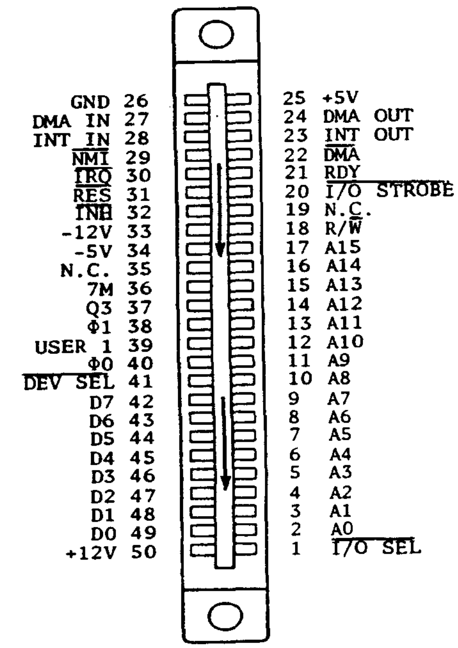
OTYPING IV: For high-density wire wrap prototyping work. Has approximately 2,000 solder pads on 0.1 " spacing.



COMPONENT SIDE



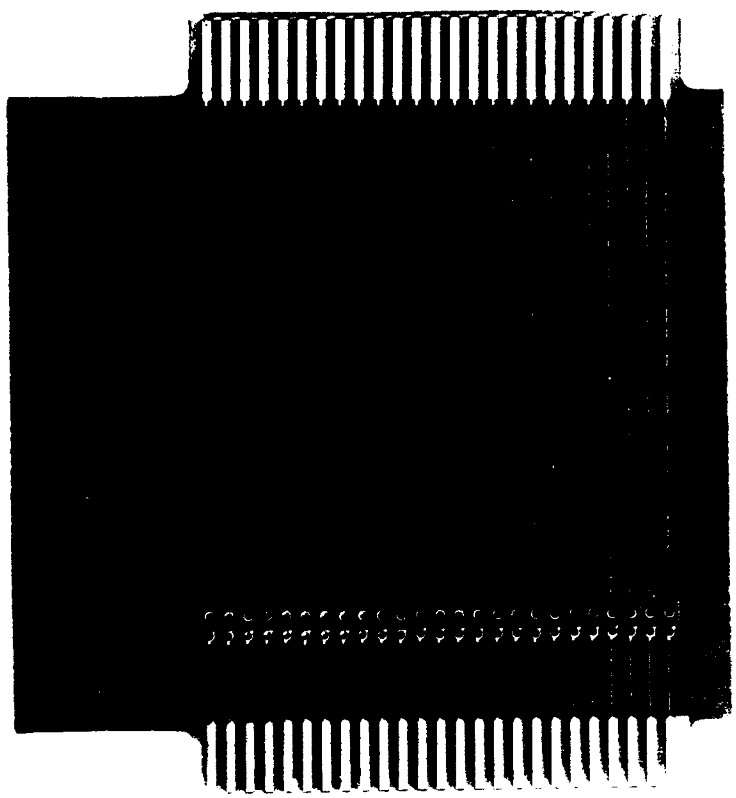
SOLDER SIDE



JK EXTENDER: Lifts card 9 cm above the motherboard for easy testing & servicing.

Secure a 50-pin card edge connector to the top of the card so that the pins of the connector line up with the traces on the card. Centre the connector and solder the end pins to the card. Check that pins are correctly lined up. Solder the remaining pins to the card. Appropriately label one end of the connector pin 1 and pin 26.

SOLDER CARD EDGE CONNECTOR
TO
TOP OF CARD



gold fingers

CONNECT TO MOTHERBOARD

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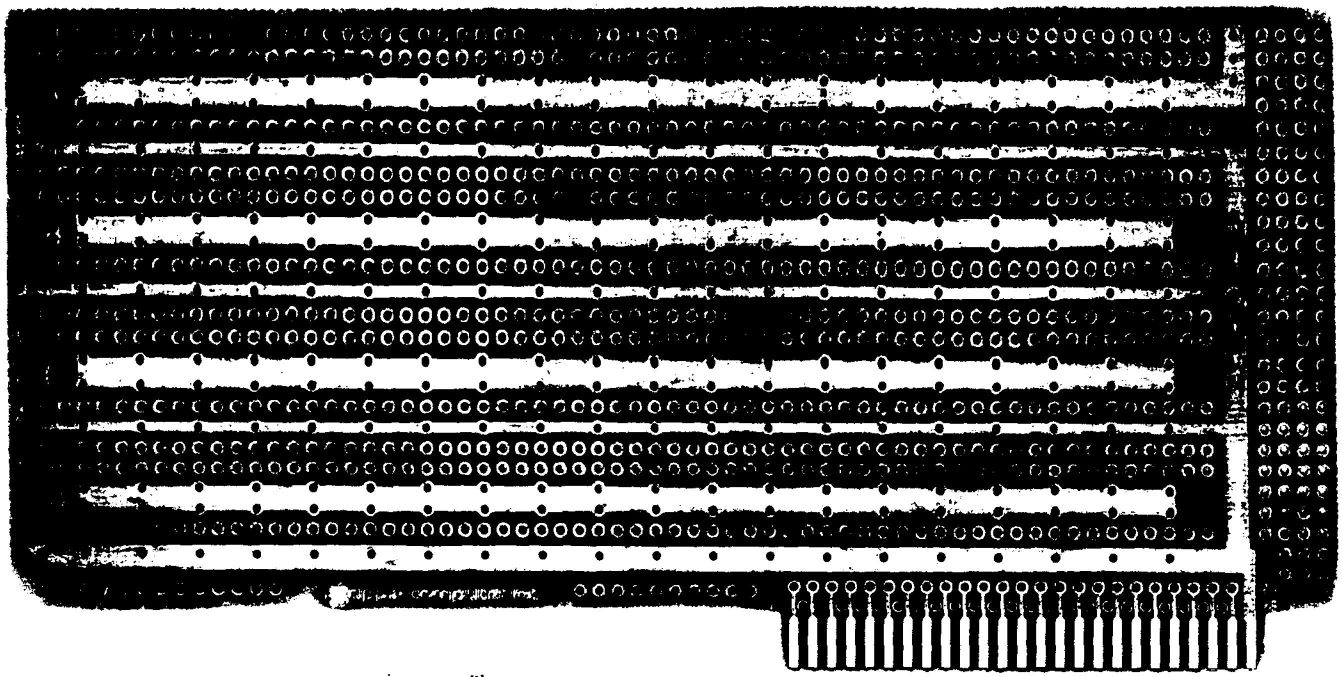
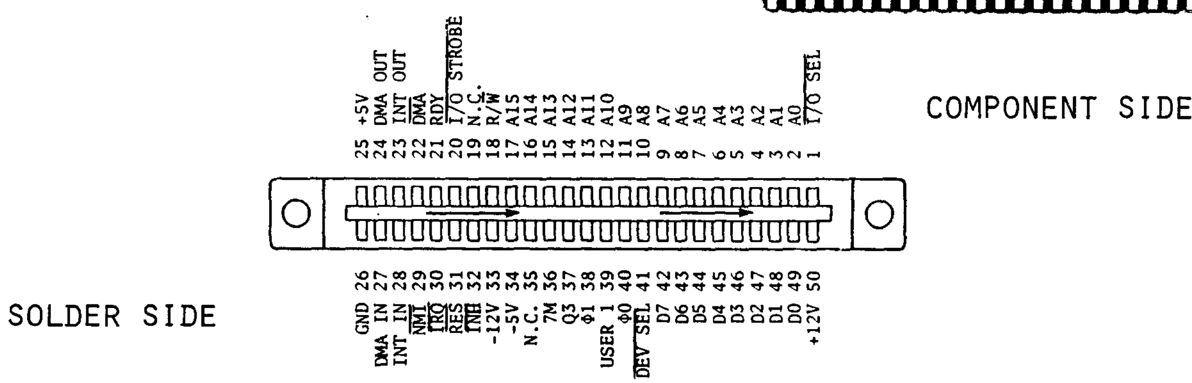
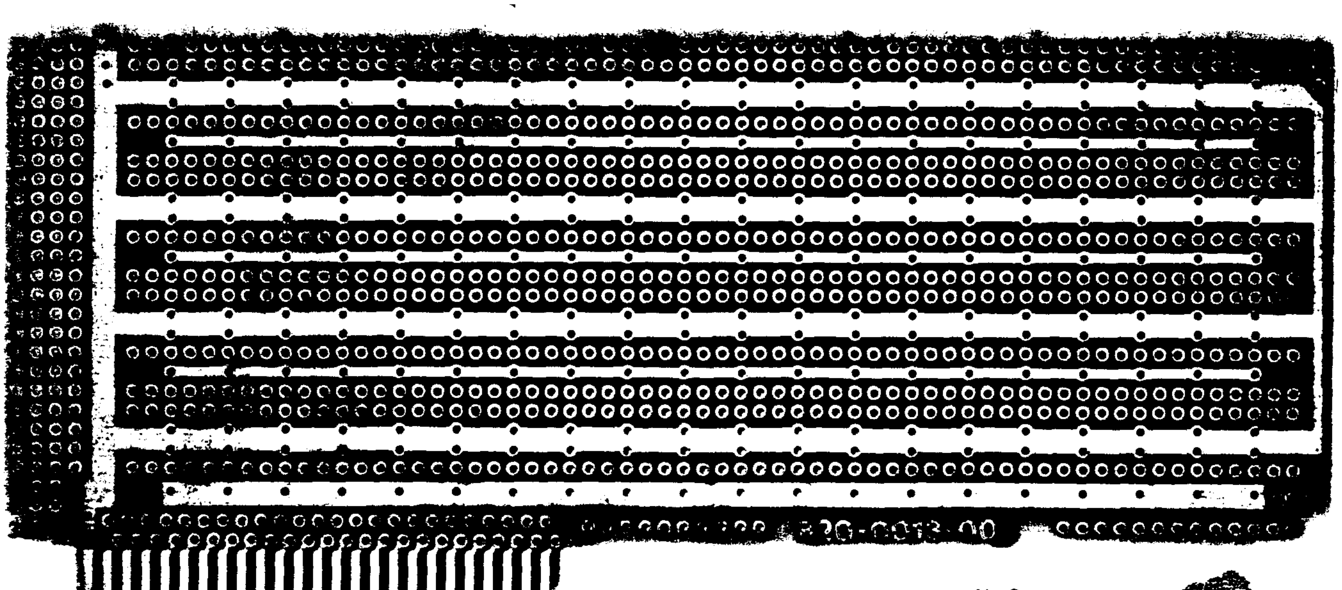
GUIDE 11-8

APL PROTOTYPING V: Two-sided prototyping PCB for poin-to-point or wire-wrap custom work. Solder pads are on 0.1 spacing. Has power and ground bus. Documentation available from supplier.







NuScope

alphaPlus™

Operating system
for the alphaSyntauri® digital synthesizer

Syntauri

alphaPlus™ Tutorial Manual

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Palo Alto, California 94306, USA
(415) 494-1017

Written by: Philip Casella

alphaPlus Tutorial

Table of Contents

Chapter 1
About the Manual

Welcome to this introduction to the alphaPlus™ operating system, used with the alphaSyntauri™ synthesizer.

Written in **tutorial**, hands-on format, this manual will take you step by step through the basic use of the system. It will also provide some important background information along the way, concentrating on the fundamentals -- enough to get most people started in musical synthesis.

We are sticking to the basics because we want to focus on using the instrument -- that is, creating and modifying musical sounds. Once you know how to use the system, you can get more information from texts on musical synthesis theory (some are cited in the bibliography).

As you go through the tutorial, you may tempted to depart from the path we're taking and experiment on your own. Well, **please do.** You'll be learning about each feature, then trying it out on the system. It's up to you whether you spend fifteen minutes or two days trying each feature before you come back to learn about the next.

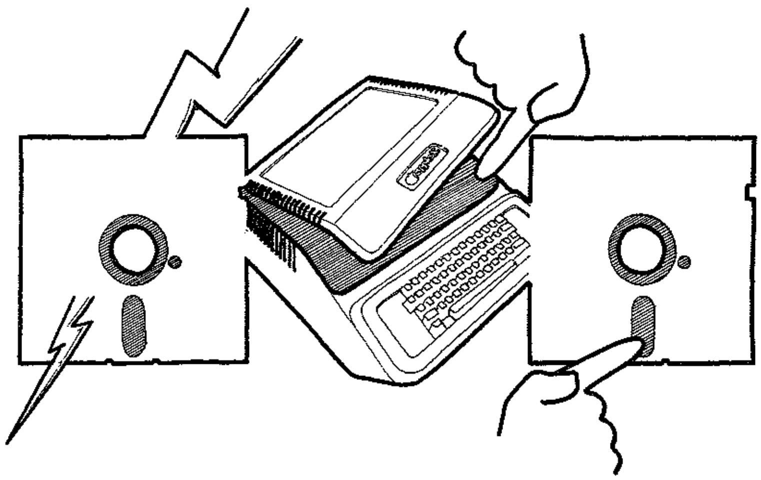
And don't worry about making mistakes. Once you get the system set up and running (by **carefully** reading and following the setup instructions in Appendix A), there is nothing you can do (short of physical abuse) that will damage anything. The worst that can happen is that you will accidentally erase one of the system diskettes, and of course you will have taken our advice (coming up) to **make at least one backup copy** of every diskette that can be copied.

You will do that, won't you? We'll discuss this further in Appendix A, **Setup & Initialization.**

A Few Cautions

We said earlier that there was nothing you could do to damage the system, short of physical abuse. Well, take note that the term "physical abuse" isn't restricted to kicking, mauling, and dowsing with liquid. Other things you should avoid are:

- o Fooling around with internal Apple components while the computer is on.
- o Touching diskettes anywhere not protected by the casing.
- o Neglecting diskettes -- leaving them out in the sun or dust, or near a power amp, TV, or other source of electromagnetic radiation.



A Few Conventions

We've adopted a few special ways to help make reading and using this manual easier. For one thing, when we want you to press a certain key on the Apple keyboard, we'll enclose its label in these brackets: < >.

So if we say "Type <B>" -- it means "Press the key labeled 'B'," or "Type the letter 'B'." Usually a statement like that will be followed by "and press <RETURN>," since that's how you let the computer know you've typed something.

One exception to this is when you press <CTRL> (the key labeled "CTRL", right?) and another key at the same time. In the alpha-Syntauri system, the computer senses these double keystrokes immediately, and you won't have to press <RETURN>.

You'll be using <CTRL> often, and always together with another key. We indicate this by enclosing CTRL and the other key symbol in the same set of brackets. So "Press <CTRL-P>" means "Hold down <CTRL> and press <P>."

Got it?

And one more thing: you'll be setting this book aside frequently to use the system. To help you find your place when you come back, we'll insert a row of asterisks, like this:

* * * * *

...unless there's already an illustration there, or you're at the bottom of a page or the end of a topic.

Onward and Upward

If your Apple computer and alphaSyntauri synthesizer are set up and ready to go, then continue with this tutorial. If not, turn to Appendix A, **Setup & Initialization**. When you've completed the procedures described there, continue with Chapter 2.

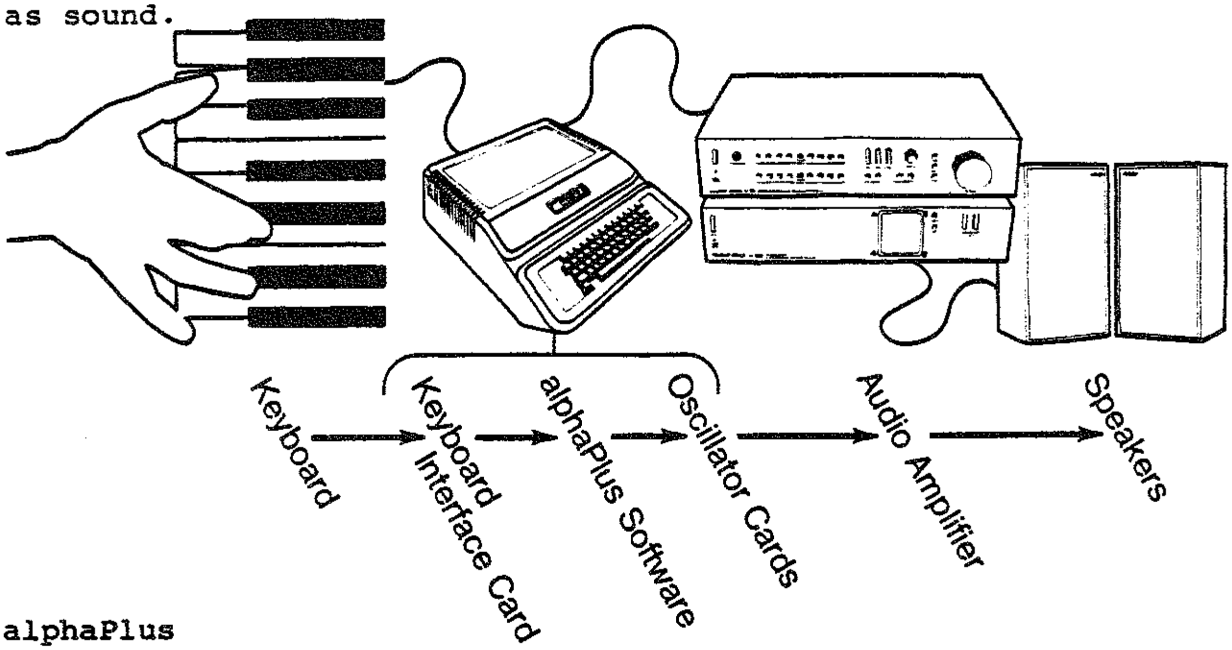
Chapter 2
About the System

The purpose of this section is to give you a general understanding of how the alphaSyntauri synthesizer and the alphaPlus operating system work, their features and how you can use them, and what kind of results you can expect.

The alphaSyntauri Synthesizer

The alphaSyntauri synthesizer **hardware** consists of a piano-like keyboard and two "oscillator boards" connected to an Apple II computer. Also connected to the system is some kind of amplifier -- like your stereo system.

When you start up the alphaSyntauri instrument, the operating system **software** (alphaPlus) will be inside your Apple, waiting for you to strike a key on the alpha keyboard. This will send a signal to the Apple, which alphaPlus will grab, interpret according to instructions we've programmed (which you can modify), and send through the oscillator cards to the amplifier...where it comes out as sound.



alphaPlus

The operating system supplies the magic. Using alphaPlus, you control the qualities of the sound produced when you play the alphaSyntauri keyboard. You can make it sound like a piano or an organ, a woodwind or a brass, a violin or an instrument not yet heard on earth.

What You'll Learn

In the pages that follow, you'll work with the three basic elements of sound -- pitch, loudness, and timbre -- and learn how you can use alphaPlus to shape them to please your ear. You'll also learn about vibrato and special effects, recording and playing back (without a tape recorder), echo and transposition, creating and saving waveforms and envelopes, and other features.

There is really no end to the possibilities. Sound is so simple to the ear, and yet so rich and complex in its construction that you can always extend, but never exhaust, the potential for new textures and effects.

Of course, you don't have to devote a lifetime to expanding your grasp of the subtleties of music. In fact, you can be playing a wide range of synthesized instruments within minutes of turning the alphaSyntauri system on, using built-in sounds!

Depending on your background in musical synthesis, you may be able to get the information you need from the quick-reference card that comes with this manual after reading only a few more pages of this tutorial; but we recommend that you finish it. It won't take long, and you'll get a strong foundation for setting and reaching your musical goals.

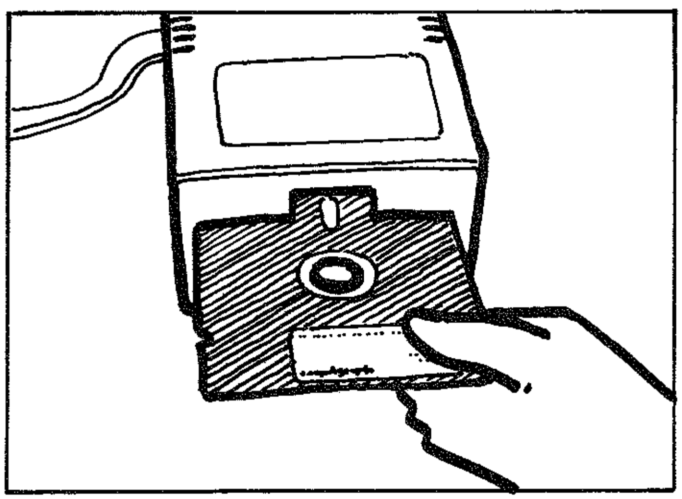
Chapter 3
Starting Up

At this point your alphaSyntauri synthesizer should be completely set up and ready to go. If it isn't, or if you're not sure, turn to Appendix A for a description of the setup and initialization procedures.

Getting the System Running

If, once you're set up, things don't seem to be turning out the way we say they should in this next section, we've got an appendix for that, too: Appendix B, **Troubleshooting**. If you have a problem getting started, check there first.

Still with us? Okay. The first step is to open the disk drive door and insert the alphaPlus diskette (or the backup...you did make a backup*, didn't you?) into the disk drive. If you have more than one drive, insert the diskette into Drive 1. The label on the diskette should be facing up, and the elliptical slot in the casing should be inserted first, as in the illustration below.



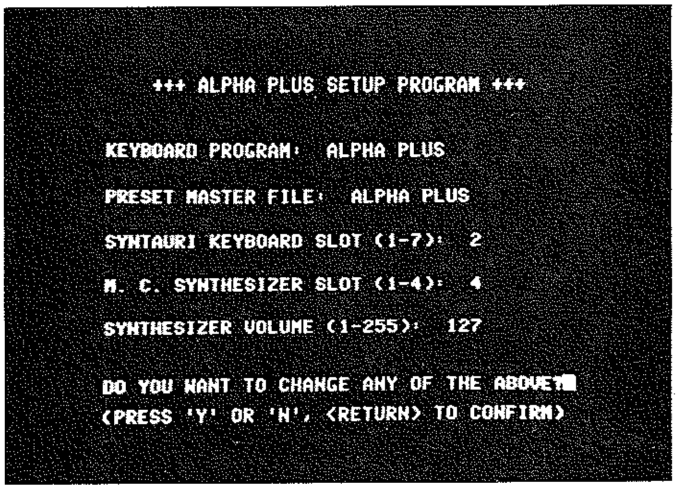
When the diskette is completely inside, close the disk drive door. Turn your amplifier on, but keep the volume very low.

*See Appendix C and Apple DOS manual for disk duplication procedures, using COPY or COPYA on DOS System Master diskette.

Next, turn on the monitor and the Apple (the Apple's off/on switch is on the back of the unit, on the left).

Immediately, the disk drive's red **IN USE** light should come on, and the drive may make a few strange noises. If you watch your monitor, you will see periodic messages telling you what's going on.

The first time you "boot" the system (that's what you're doing now), you have to supply some information about how your computer is set up. When the IN USE light on the disk drive goes out, you should see this on the screen:



If the system was already set up when you got to it, you may not see the screen in the above illustration. If that's the case, skip to **Ready to Play,** a few paragraphs down.

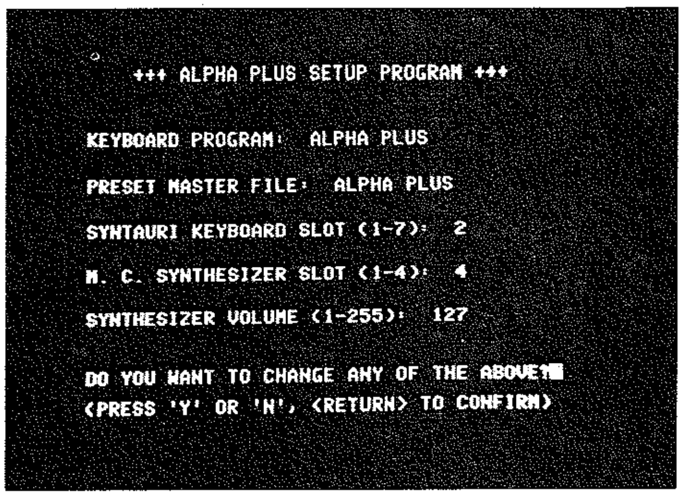
If you aren't the person who set up the system, and you see this screen anyway, assume (for now) that the necessary information has already been supplied. Type <N> (for **NO**) and press <RETURN>. Then skip down to **Ready to Play.**

If you personally set up the system according to the directions in Appendix A, then you probably followed our advice and wrote down the slot numbers into which you inserted the system cards. Get this information now. If you don't have it, you'll have to remove the top cover from the Apple, **being especially careful not to disturb any of the internals while the Apple is on,** and note which cards are in which slots. (The slot numbers -- Ø through 7 -- are behind the slots. Or just count from left to right.)

* * * * *

If the slot numbers are the same as presented on the screen, fine. Type <N> and press <RETURN>. Skip down to **Ready to Play.**

If the slot numbers -- any of them -- are different, then type <Y> and press <RETURN>. The cursor (the small white rectangle on the screen) will move to the first item. Press <RETURN> to skip this one, and again to skip the next one.



The third item asks which slot the Syntauri keyboard interface is in. This is the rectangular printed circuit board that says **Syntauri** on it, installed upright inside the Apple. It has a long cable running to the keyboard. Type in the number of the slot holding this card, and press <RETURN>. (The slot numbers, from Ø-7, are printed in back of each slot.)

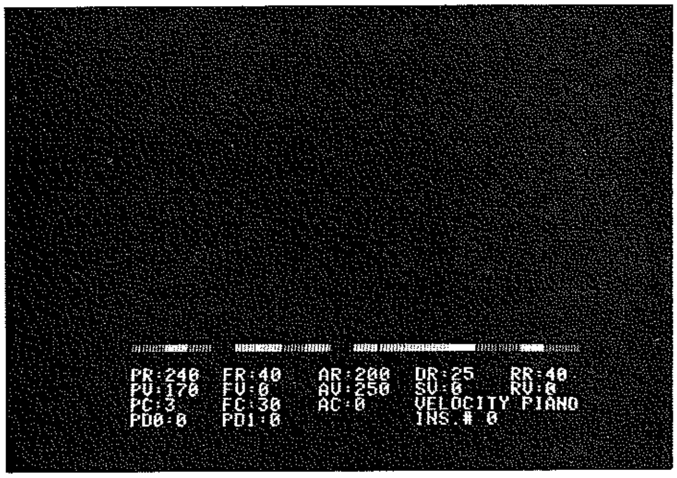
(This card, and the ones mentioned in the next paragraph, are illustrated in Appendix A.)

The fourth question wants a slot number for the Mountain Computer MusicSystem cards. There are two of them, interconnected: type in the number of the slot the card on the **left** is in (the one with the phone plug attachment). Press <RETURN>.

Press <RETURN> again to skip the last item, type <N> in response to the question at the bottom, and press <RETURN> one last time.

Ready to Play

When the **IN USE** light goes out, you'll see this on the screen:



(If you don't, go to Appendix B, **Troubleshooting**. Otherwise, keep reading.)

Now it's safe to turn up the volume on your amplifier. You're ready to play. Try it: play a few notes or chords on the alpha keyboard -- or more than a few, if you like. And take a look at the screen while you're playing.

* * * * *

When you have the system running, you will probably want to "kill" the setup program so that you don't have to reassure the Apple about all the cards being in the right slots every time you boot up. To do this, first type <CTRL-K> (hold down the key labeled CTRL (for Control) and press the K key, remember?). Don't press <RETURN>.

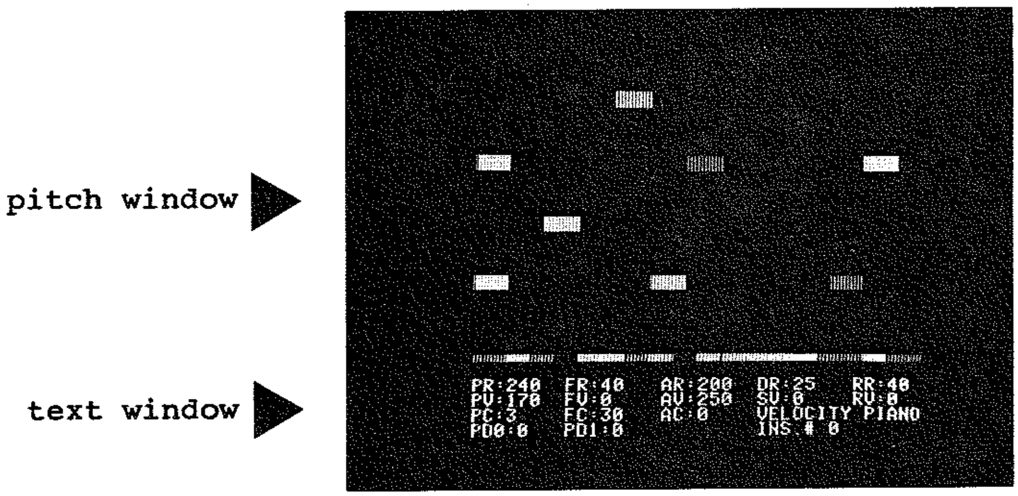
INCLUDE SETUP ON POWER UP (Y/N)?

We have to answer the question on the screen. Type <N>, for No, and press <RETURN>. That's all there is to it. You can restore the setup program at any time with another <CTRL-K>, followed by <Y>.

* * * * *

Why would you want to restore the setup program, you ask? Because you may someday want to put the cards in different slots; if you do, you'll have to tell alphaPlus about it.

You probably noticed (hard not to) the visual display on the screen while you played the alpha. The top part of the display is called the **pitch window.** Each note in the 12-tone octave is represented by a small rectangle of a different color (for which, obviously, you need a color display). The vertical position of the rectangle corresponds to the octave played, and the horizontal position corresponds to the specific tone within the octave.



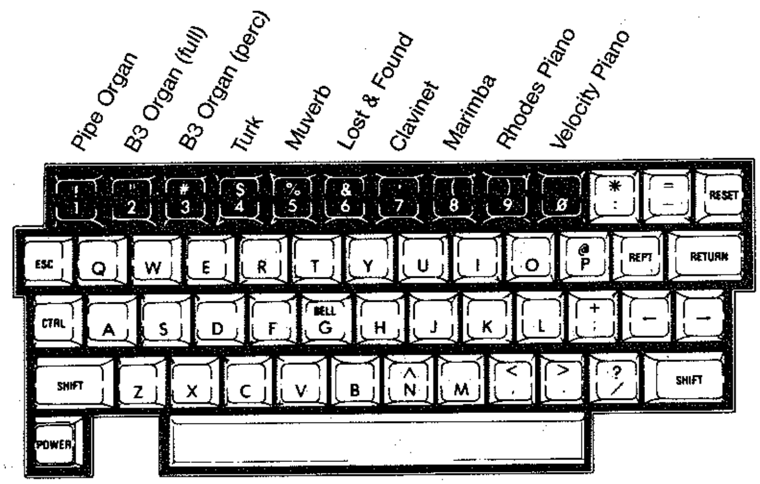
Whenever you see this on the screen, the alpha keyboard is active, or ready to play; this is called **live mode.** There's not much more to say about this, except that you can tell a lot about how you're playing by watching the display: we give you a visual perspective in addition to the audio!

The bottom part of the screen, with all the numbers, is called the **text window.**

If you look in the lower right corner of the text window, you'll find the name and number of the instrument you've been playing. The number corresponds to one of the ten number keys in the top row of the Apple keyboard.

In fact, you have ten instruments at your immediate disposal, and you can "call up" any one of them simply by pressing one of those ten keys -- Ø through 9. Try it, and take a few minutes (or hours) to play around with the various instruments. Note that instrument zero -- the Velocity Piano -- makes use of the Velocity Sensing feature: it sounds louder if you strike the keys faster.

These ten instruments make up a preset master, which is loaded into the Apple automatically when you boot the system.



Later on you'll also learn how to define your own instruments and compile them into preset masters.

The letter and number pairs in the text window (like AR:200) are called **parameters,** meaning values that determine the characteristics of something. Here, the values determine many characteristics of the sound produced by each instrument. For example, AR:200 indicates that the **attack rate** for that instrument is set to 200.

If you don't know what an attack rate is, or why you should care, don't worry. We'll get to it in Chapter 5.

In the meantime, let's consider something more concrete -- like the pedals. The **sustain pedal** is plugged into the right-hand jack on the back of the alpha keyboard. For many instruments, this pedal will prolong the note played after the key is released. Why not for all the instruments? You'll understand that after we discuss the text window parameters.

The pedal plugged into the left-hand jack controls the **portamento.** Pressing this pedal sweeps the pitch rapidly from one note to the next as you play.

Try these pedals out with the ten instruments in the preset master.

You also have another preset master of ten instruments on your alphaPlus diskette, and even more preset masters on the diskette labeled **Preset Masters** (naturally), which comes with your alpha-Syntauri system.

To get at a preset master, you have to **load** it from the diskette. Try it: press <CTRL-P>, and you'll see this:

LOAD PRESET MASTER: ALPHA PLUS

ALPHA PLUS is the name of the current preset master. To load the other preset master from the alphaPlus diskette, you have to type its name over the name supplied by the system (i.e., ALPHA PLUS) and press <RETURN>.

The name of the other preset master on this diskette is INSTR. Type that name now, just that way -- <INSTR > -- and press <RETURN>. In a few moments, ten new sounds will be available from the same ten number keys.

* * * * *

If you're wondering what else is on the diskette, do this: type <?>.

* * * * *

This is the diskette **catalog**, and it lists all the files on the diskette in the drive. Press any key to move the list along, until you return to live mode. We'll discuss other file types later in the tutorial. For now, play with the ten instruments in the preset master INSTR for a while, and when you come back we'll try out some more system features.

Chapter 4
Record/Playback

We're going to move through this topic fairly quickly, so that you can try out the procedures on the system without spending a lot of time reading. Don't worry about memorizing at this point: the main thing is that you know what features are available. The quick-reference chart will help you with the details.

Record/Playback Overview

One of the most exciting and versatile features of the alphaSyntauri synthesizer is the Record/Playback feature. With alphaPlus, you can record (in the computer's memory) up to 2000 notes, and save them as a **notes file** on diskette.

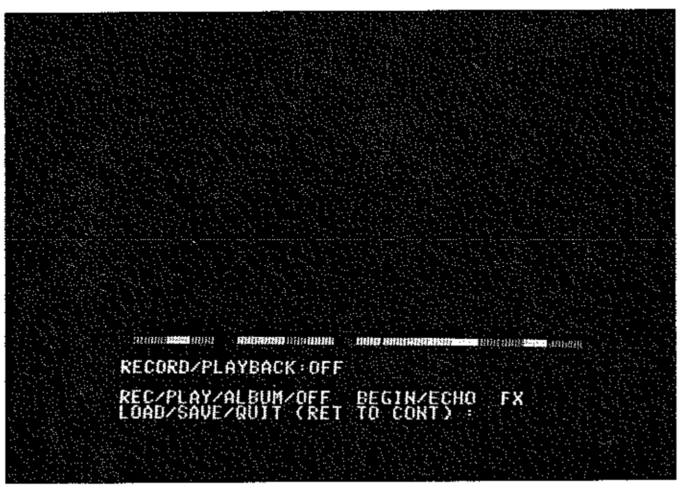
You can play back the recording slower or faster, or in a different key, or through different instruments. You can stop the playback at any time and start recording again from that point. And the **Echo** feature will let you set a recording to "loop" (play over and over again) for repeating bass lines and background textures.

In addition, you can link your notes files in an "album," to hear them play back in sequence, automatically.

How do you do all this? Easy.

Record

First, press <spacebar> to get into the Record/Playback mode.



Chapter 4: Record/Playback

This menu gives you access to a number of interesting features. Most of them control recording and playing back notes files.

Now type <R> for Record, <RETURN>, and <B> for Begin, <RETURN>.

* * * * *

The alpha keyboard is now set to record: the instrument name on the screen is in inverse video (black letters on a white field).

The recording won't begin until you press a key or a footpedal. From that point, every note, pedal effect, and pause will be recorded. Before you start, we ought to tell you how to stop the recording: just press <spacebar>. This will return you to the Record/Playback menu, and we'll take it from there.

For now, play a few notes "for the record" (don't worry, they're easy to erase).

Playback

Presumably, you've recorded a short piece and pressed <spacebar> to halt the recording. Now you'd like to play it back. (If not, type <O> and <RETURN> to turn off the Record mode.) The Record/Playback menu should be on the screen. Type <P> and press <RETURN>.

PLAYSPEED 50% TO 200%:

How fast do you want to hear it? Type a number between 50 and 200 (**don't** enter the % sign) and get ready to press <RETURN>, but first we ought to tell you that --

- o You can change the tempo during playback with the arrow keys: <-- to slow down, --> to speed up. The speed will change by 5% each time you press one of these keys.
- o You can still use the alpha keyboard during playback, and the pedals are live as well.

Now press <RETURN> for a playback.

Want to hear it again? Maybe with a different instrument? First type <I>, then pick your instrument with one of the number keys, then <spacebar>, <P>...the same routine.

Continue Recording a Pre-recorded Piece

If you wanted to continue recording from any point, you would just press <spacebar> at that point, then <R>, <RETURN>. Once again, recording won't start until you use the alpha keyboard or one of the pedals. Try it. (Note: if you want to start over from the beginning, just type <B>, for Begin, and press <RETURN>.)

Save a Recorded Notes File

To save your recording on diskette as a notes file, you would go to the Record/Playback menu (<spacebar>), type <S> (for Save), and <RETURN>. The system now asks you for the filename.

RECORDING LENGTH = xx NOTES
SAVE NOTES:

Type any name you like (but it must be no more than 14 characters long; and don't use commas) and press <RETURN>. Your notes file will be saved for posterity.

Normally you should use a spare diskette for saving recordings, not the alphaPlus operating system diskette. This will give you more room for storage, and help keep things organized. See Chapter 9 for hints on organizing your diskettes. (Initializing new diskettes is covered in Appendix A and the Apple DOS Manual.)

Retrieving a Notes File

To load the notes file from diskette, press <spacebar> to get to the command menu, type <L> (for Load), <RETURN>, and enter the name of the file after the prompt shown below. (Enter means type something and press <RETURN>.

LOAD NOTES:

Once you've retrieved the notes file from diskette, you can play it as if you had just recorded it: <P>, <RETURN>, and enter the playback speed.

Any notes file can be played back on any instrument, although the number of the original instrument is "remembered" when you load it. If you play it back in a different preset master, it will play in the instrument with the same number as the one it was recorded with.

If you're not sure of the name of a notes file you want, you can look at the diskette **catalog** (a listing of all the files on the diskette) by pressing <?> while the text window is on the screen, or <?>, <RETURN> from the record/playback menu. Notes files are all those with the prefix NOTES:. There are some demonstration notes files on the alphaPlus diskette. If you wish, try loading them and playing them back.

The Echo Feature

Entering <E> from the command screen turns on the Echo feature, and displays an inverse "E" in the text window.

Once on, Echo will stay on until you enter <E> again, but it won't have any effect unless you are recording or playing back.

When you record with Echo on, then hit <spacebar>, the piece you recorded will be played back over and over again, until you hit <spacebar>, <O> (for Off), and <RETURN>. The timing for hitting the spacebar is crucial, however; you'll probably have to experiment for a while to get the hang of it. Also, make sure you let up on the key for the last note before hitting the spacebar -- otherwise, that note may not play properly.

You can play back any piece, whether it was recorded with Echo or not, in this "continuous loop" fashion by playing back with Echo.

Metronome

alphaPlus has a built-in metronome to help you achieve perfect timing while recording, or for practice. The metronome clicks the speaker inside the Apple, displays a moving rectangular bar on the screen, and sends a signal pulse to the cassette output port at the rear of the Apple, which allows it to be further amplified.

You turn the metronome on, and set its rate, by typing <CTRL-Z) and entering the number of beats per minute. You turn off the metronome by entering zero (<Ø>).

Once on, the metronome will sound continuously during live mode and recording, but <u>not</u> during playback.

Create an Album

You can create an "album" by specifying two or more notes files to be played back automatically, in sequence. (If you want to try this, there are some notes files on the demo disk; they're easy to find, since they all have the prefix NOTES:.) Here, as with the FX mod, you type only the part of the name after the colon.

As with an LP record, all notes files in an album must be on the same diskette.

To create an album, press <spacebar> and <Q> (for Quit). This is how you will normally exit the synthesizer. When you do, you will be given a chance to save any notes file you may have recorded, and the preset master, in case you've made any changes to it.

If you don't want to save any notes files or the preset master, just press <RETURN> to skip these "SAVE" options.

After you quit the system, you'll see the right bracket prompt (or >) that indicates you are in BASIC, within the Apple's operating system. With the alphaPlus diskette in the drive, type <RUN ALBUM>. The disk drive will start up, and you'll be asked to name the album you're about to create. (Hint: Naming the album after the preset master the notes files were recorded with makes it easier to play back with the same instruments.)

After you name the album you'll see this:

ALBUM NAME:(as you typed it)
NOTES FILE 1:

At this point, make sure the diskette containing all the notes files you intend to include in the album is in the drive. Enter the names of the notes files you want to hear, in the order you want them. When you're done, hit <RETURN> an extra time.

When you see the right bracket prompt again, make sure the alphaPlus diskette is in the drive and type <RUN ALPHA PLUS> to get back to the synthesizer.

Play an Album

All the notes files you specified for an album must be together on the same diskette for you to play back the album. To play it back, put that diskette in the drive, press <spacebar>, <A>, <RETURN>, and enter of the name of the album.

- **To skip to the next notes file:** press <spacebar>.
- **To abort the album sequence and return to live mode:** press <ESC>.

Recess

We've covered a lot of ground in this chapter. You've learned about many basic features of the alphaPlus operating system; and there are more to come! We still haven't looked closely at the parameters for instrument definition, and we haven't begun to consider waveforms.

For now, we suggest you take a break and use the features you've learned about in new combinations. Make some music for a while, and when you come back we'll start getting to the heart of the system: envelopes and waves.

CHAPTER 5
INSTRUMENT OVERVIEW

This is a short chapter, but an important one. It has some background information you'll need for the rest of the tutorial, so in spite of the fact that it's "all read and no play," please finish it before continuing.

For this chapter, you don't have to be at the alphaSyntauri synthesizer. You can read it in bed or on a picnic. So make yourself comfortable and dig in.

Getting Started with Synthesis

By now you should have a practical understanding of what we mean by the term "instrument": it's one of ten different "types" of musical sound in a preset master, and you can choose among them by pressing one of the ten number keys while in the live mode.

We've hinted that there's more to an instrument, and the details may seem a bit mysterious to you. We've purposely put off getting into the details until you had a chance to play around with the synthesizer. Now you're ready to get deeper into musical synthesis.

We created those ten instruments (and others on the diskette) using alphaPlus. We created them, fine-tuned them, and gave them names suggestive of the sound quality they produce. The main point is this: what we did, you can do (with practice).

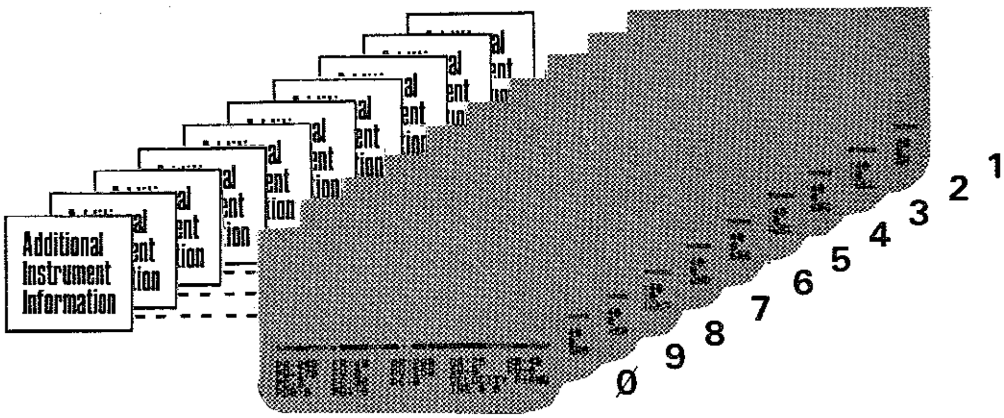
We've designed alphaPlus to make it as easy as possible for you to experiment, to try things out and hear the results immediately. And the tutorial will make it easier, guiding you through the most important steps.

What's in an Instrument?

The purpose of this chapter is to give you an idea of the components of an instrument and how alphaPlus organizes them. You'll learn more about the elements of sound, and how to use alphaPlus to control them, in the next two chapters.

Instruments are collected in **preset masters**, in groups of ten. A preset master contains:

- ten instrument names,
- the parameter values displayed in the text window for each instrument, and
- instructions to the system about where to look on the diskette for information that further defines each of the ten instruments.



It's much better to save instruments on a diskette in preset masters than individually. If they're not collected in a preset master, you have to type in additional information on the Apple keyboard each time you load an individual instrument.

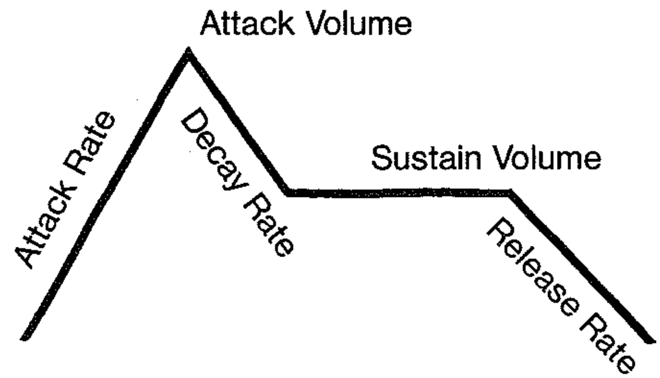
On the other hand, when the instruments are saved in a preset master, all the information is there, and you can bring them in from the diskette ten at a time.

If you don't have ten different instruments to save, you can always duplicate an entire preset master, under a different name, and replace instruments within it, one at a time. (See Chapter 9 for hints on naming files.)

Envelopes Explained

Most of the parameters in the text window have to do with the envelopes for the instrument. Each instrument has two channels -- primary and percussion -- and two envelopes, one for each channel.

An envelope is a representation of the loudness history of a tone, in terms of **attack, decay, sustain,** and **release.** A picture will make this clearer:



The envelope describes how quickly the tone reaches maximum loudness, how loud it can get, and how quickly it fades out. A tone's envelope is one of the main factors determining what that tone will sound like.

Every time you strike a key on the alpha keyboard, it takes a certain finite time for the tone played to reach its maximum loudness. How long depends on the **attack rate.**

The maximum volume is itself another important parameter, called the **attack volume.**

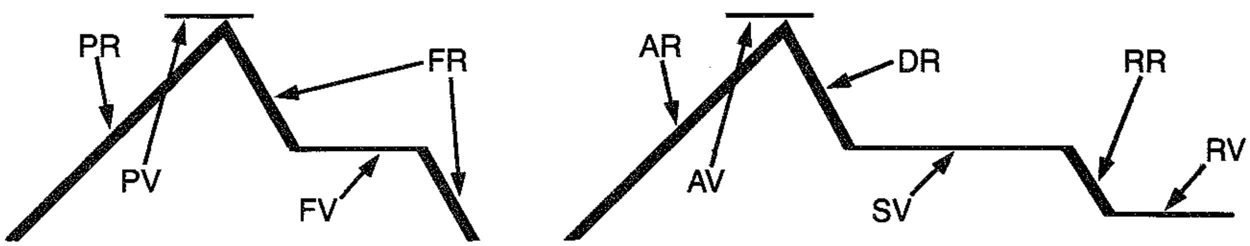
How fast does the tone diminish? This depends on the **decay rate.**

Does the tone decay to a certain loudness and then persist until the key is released? If so, that loudness is determined by the **sustain volume** parameter.

How fast does the tone's loudness fall off when the key is released? That depends on the **release rate.**

Occasionally you may want an instrument to produce tones that retain a certain loudness indefinitely, long after the key is released. This is the **release volume.**

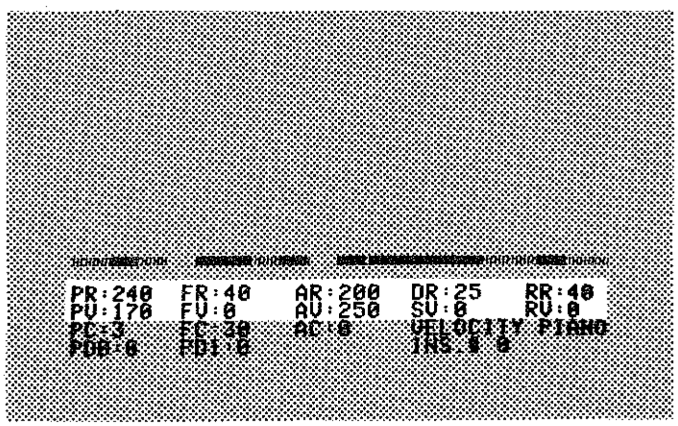
That's what it takes to define a single envelope. The six terms we used above apply to only one of alphaSyntauri's two audio channels: the **primary** channel. The envelope for the **percussion** channel has only four of these parameters, and with slightly different names -- just to enable you to distinguish them on the screen. The table below shows how they correspond.



percussion channel   primary channel

Primary Channel	Percussion Channel
AR: Attack Rate	PR: Percussion Rate
AV: Attack Volume	PV: Percussion Volume
DR: Decay Rate	FR: Fall Rate
SV: Sustain Volume	FV: Fall Volume
RR: Release Rate	same as FR
RV: Release Volume	None

Now compare the parameters in the text window with the list above:



For the most part, the envelope parameters for the primary and percussion channels are the same. The difference is that the percussion channel uses the fall rate for its release rate, and has no release volume parameter. We'll show you how to change the envelope parameters, and the other text window parameters, in the next chapter.

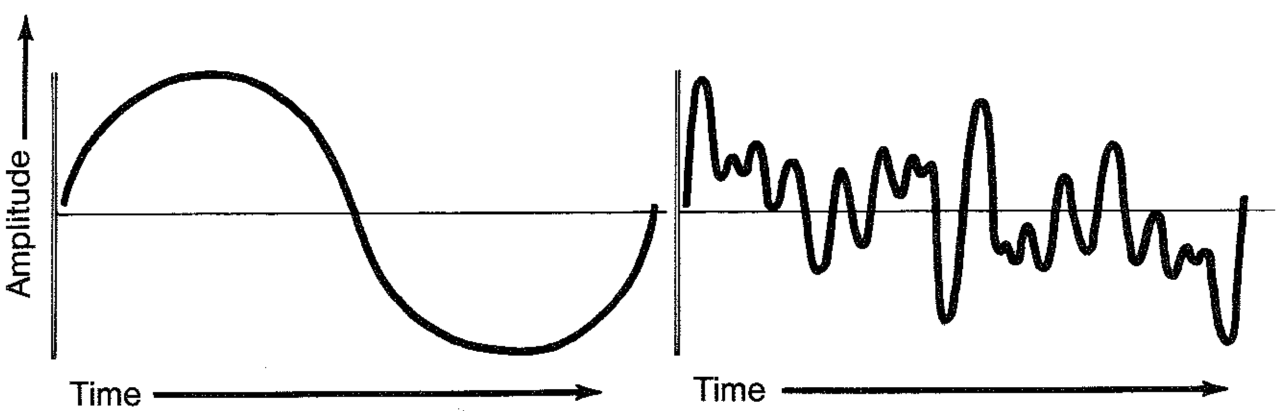
Waves Explained

Waveforms are the other main factor that determines what a tone will sound like.

A wave is a purely mathematical representation of sound. Nonetheless, it is a technically accurate one, especially useful in musical synthesis.

As you may know, what your ear and brain perceive as sound is actually the rapidly alternating compression and expansion of air (or water, if you're skin-diving) caused by a vibrating object.

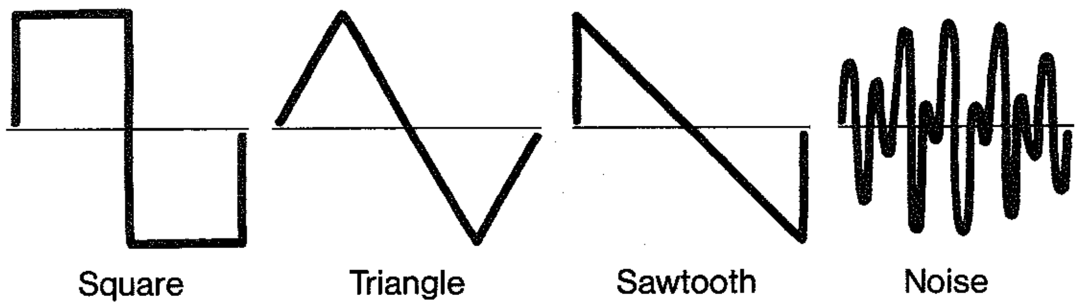
The back-and-forth motion of any vibrating object -- for example, the cone of a speaker -- can be described in terms of a wave on a graph: the vertical axis represents the two extremes of the object's motion, which for any particular object determine the loudness of the tone produced; and the horizontal axis represents time.



For this vibration to be perceived as sound, the motion must be very rapid: the lowest tone the human ear can hear results from a vibration of around 20 cycles per second (or **Hertz, Hz** for short). This is called the **frequency** of the wave.

So a tuning fork that sounds a concert A-440 is actually vibrating at a rate of 440 times a second.

The **sine wave** (pictured above) is a basic type of sound: it depicts a single vibrating motion. There are several other types of waves that are common enough to have standard names, for example:



These waves represent various combinations of sine waves. You'll learn how they're formed later on.

It probably won't surprise you to learn that each instrument uses two waves -- primary and percussion, one for each channel. However, you can use the same wave for both channels.

With alphaPlus, you can build your own waves and save them on diskette as **waveform tables**. You can then assign them to different instruments in a preset master, or "mix and match," trying out different waveforms with different envelopes.

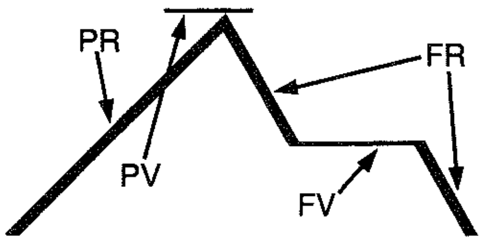
We've provided two programs for wave-building in alphaPlus. You'll find that it's easy to create a waveform and combine it with different envelopes. What's not so easy is to figure out ahead of time what waves you should use to create a specific sound. We'll give you some guidelines to start out with, but it's mainly a matter of experimentation until you can develop an "ear" for it.

Back to the Keyboard!

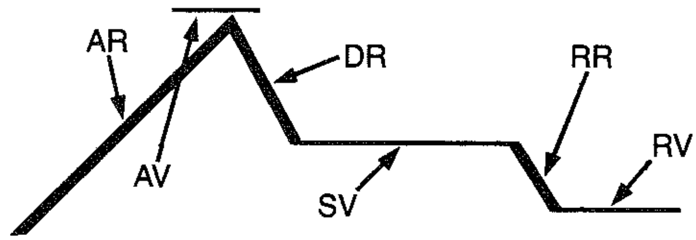
That's about as much of an introduction as we need. The next step is for you to try out what we've been talking about on the system, and hear the results of your experiments for yourself.

Chapter 6
Envelopes in Depth

We've described a tone's envelope as the loudness history of that tone. Let's repeat a few illustrations from the previous chapter, just to keep them fresh in your mind:

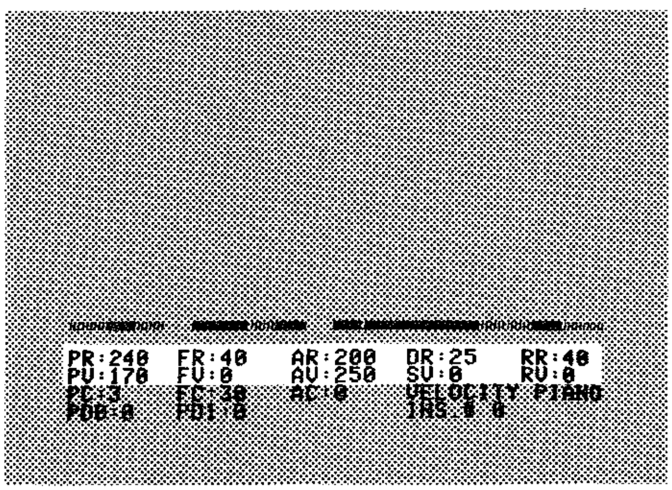


percussion channel



primary channel

Primary Channel	Percussion Channel
AR: Attack Rate	PR: Percussion Rate
AV: Attack Volume	PV: Percussion Volume
DR: Decay Rate	FR: Fall Rate
SV: Sustain Volume	FV: Fall Volume
RR: Release Rate	Same as FR
RV: Release Volume	None



That last illustration should be especially familiar to you: it's the text window, which is on the screen whenever you're using an instrument on the alphaSyntauri. At this point, it would be a good idea to boot up the system, because we're going to be working with the parameters in the text window.

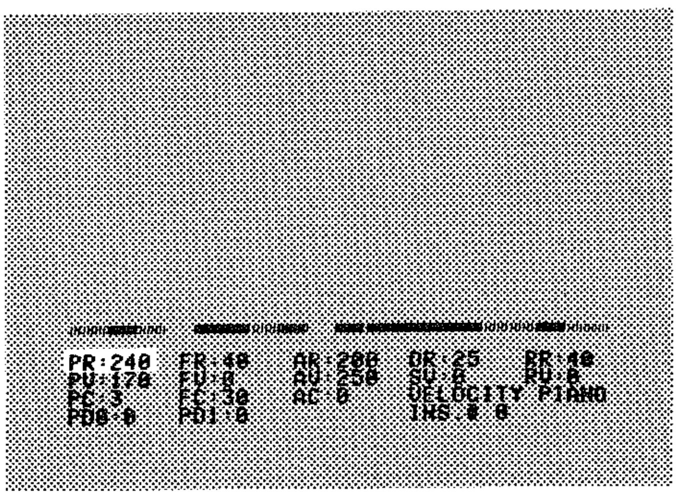
The parameters in the top two rows are the ones that determine the primary and percussion envelopes. The first order of business is to learn how to make changes to these parameters.

Getting Around the Text Window

In order to change any of the parameters, it's obvious that you have to take two steps: (1) single out a parameter, and (2) enter a new value.

The second step's easy: the envelope parameters can be any value between Ø and 255, and you enter the number from the Apple keyboard. You know that, normally, pressing a number key causes a new instrument to come to the screen. How do you indicate that you want to change a parameter, rather than an instrument?

That's the first step. <u>You select a parameter to change by typing one or more letters that identify that parameter on the screen</u>. This is easier to demonstrate than explain, so do this: press <P> and look at the screen.



The value after PR: (the first parameter in the first row) should now appear in "inverse" -- black letters on a white field. Let's call the inverse rectangle over the value the "cursor." The cursor indicates which value will change if you next press a number key.

Instead of a number, press <F>. The cursor will move to the value for FR:. Now press <V>, and watch the results.

For the first two rows, the rule is: Press the first initial of any parameter in the top row to put the cursor there, then press <V> to move to the value just below it.

From there, pressing <C> will get you to the corresponding value in the third row, which has three parameters: PC (percussion control), FC (frequency control), and AC (attack control).

> **Percussion control** lets you select primary channel only, or both primary and percussion, as well as whether or not to have velocity sensing (speed of keypress determines loudness and attack rate.)
>
> **Frequency control** lets you adjust the pitch of the keyboard in quarter-tones. Normal is FC:54, which puts middle C right where you'd expect it. You use this parameter for tuning (each unit of change is a quarter-tone) and transposition.
>
> **Attack control** gives you effects like tremolo and flutter (if AC:1) by repeating the attack/decay cycle when you hold a note, rather than proceeding normally to the sustain and release segments of the envelope.

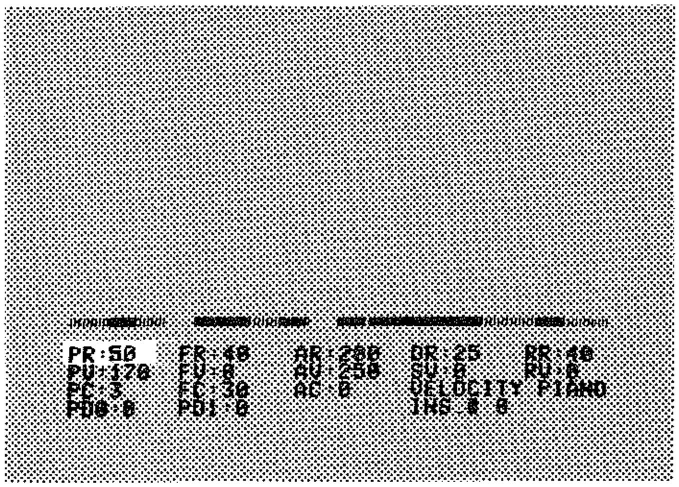
We won't go into these controls in detail here. You can find more information about them in Chapter 8.

There's one more wrinkle to getting around the text window: getting **out** of it so that you can go back to choosing instruments again. That's easy: just press <I>. When you do that, the cursor will disappear, and any number you press will pick one of the ten instruments in the preset master. Try it now: press <I>.

Changing Parameters

The next step is changing the values in the text window. If you've gotten out of the text window (if the cursor is gone), type <1> to select instrument #1 (Pipe Organ). Then get back into the text window by pressing <P>, to make the cursor appear at the PR: parameter.

Any number you type now will appear in the cursor. Press <50> and look at the screen.



So far, you haven't actually changed the parameter. If you play a few notes, you'll notice that the sound hasn't changed. And if you press <ESC>, the original PR value will reappear. Try it.

* * * * *

Now type <50> again, and press <RETURN>. The cursor hasn't moved, but the change has taken effect. If you play a few notes, you should hear the difference.

If you press more numbers, they'll appear in the cursor. However, you won't be able to make the number in the cursor greater than 255. Try it, pressing <ESC> to get "unstuck" when the number reaches 255.

* * * * *

As soon as there are three digits in the cursor, alphaPlus checks the value to make sure it's less than 255. If it is, you can change the value. Once the total reaches or exceeds 255, you are "stuck" with 255 until you--

- press <ESC>,
- move the cursor to another parameter and back, or
- press <I> (which will eliminate the cursor and let you select instruments) and then <P> again.

One more thing: while the cursor is on a particular value, you can use the left and right arrow keys to decrease and increase (respectively) that value by 1 for each press. Combined with the use of the <REPT> key, this is handy for making small changes to the values. But note that **these changes take effect immediately, with no requirement to press <RETURN>.**

Experiment with this feature now, if you like.

* * * * *

We've covered the **rules** for making changes to the text window. The use of shortened commands enables you to make changes with as few keystrokes as possible. After some practice, you'll appreciate that. Until then, **be sure to check the screen before pressing <RETURN>.** Of course, you can always reverse any changes you make, but you'll save yourself some trouble by looking before you leap.

Once you've changed some envelope values, what then? Well, you can save the **preset** (a collective name for all the values in the text window) on diskette with the **<CTRL-S>** command, and load any preset on a diskette into an instrument with **<CTRL-L>.** In this case, what you're doing is combining a preset with primary and percussion channel waveforms.

We'll be using these commands, and others, in hands-on exercises in this tutorial.

Changing Envelopes: An Exercise

For this exercise, the ALPHA PLUS preset master should be in the computer. (If you've booted the system normally, and not loaded a different preset master, it will be.)

Press <I> to get back to live mode, and then press <2> to call up the "B3 ORGAN FULL" instrument.

* * * * *

We'll use the B3 ORGAN FULL waveform, but not its envelope. The envelope we want to use for this exercise is part of the preset called "ORGAN." It's on the system diskette. To load the preset into the B3 ORGAN FULL instrument, first press <CTRL-L>. This is the command you use to load a **preset** (text window values -- envelope and control parameters) from the diskette. Then type in <ORGAN> over the name of the existing preset.

LOAD PRESET: ORGANGAN FULL

(No, that's not a typo -- that's what it looks like when you type "ORGAN" over "B3 ORGAN FULL.")

Press <RETURN> and the preset named ORGAN will be loaded from the diskette. Play a few notes, if you like.

Linear vs. Exponential Envelopes

For the envelope in this exercise we're using the **linear** mode, rather than the **exponential**. What's the difference?

The parameter values for linear and exponential envelopes might be the same. The difference is that the rates in an exponential envelope are interpreted somewhat differently. It takes the same time to get to peak volume, but the progression is exponential rather than linear (see the illustration below).

So what? Well, exponential and linear interpretations give rise to different sounds. In general, exponential envelopes are better for keyboards and percussion instruments, linear for brass and strings. However, most instrument sounds can be created using linear envelopes; the same isn't true for exponential envelopes.

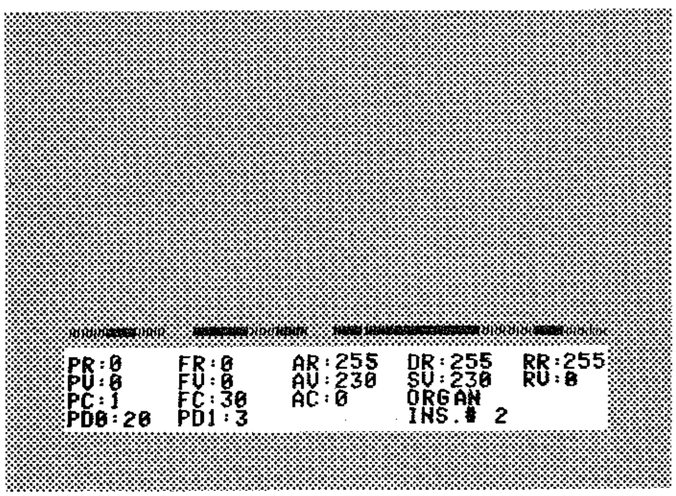
You can, if you like, use the same envelope in both modes. To change an instrument's envelope from linear to exponential, or vice-versa, just press <CTRL-A>. You'll see this on the screen:

CURRENT ENVELOPE: LINEAR
WISH TO CHANGE THIS (Y/N)?

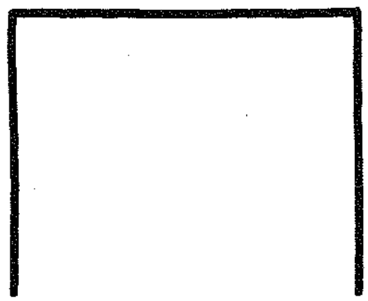
Of course, if you're currently using an exponential envelope, it will say EXPONENTIAL rather than LINEAR. To change this setting, just type <Y> and press <RETURN>. To leave it as is, just press <RETURN>. (To minimize keystrokes, we've designed the system so that you can usually answer in the negative, or skip an option, just by pressing RETURN. In this case, you don't have to type <N>.)

What Does an Organ Sound Look Like?

These parameters should be in the text window:



The primary channel parameters define an envelope that looks like this:



Organ

This is a representation of the primary envelope for the instrument now active in the synthesizer. To make things simpler, we want to hear **only** the primary envelope, so we've set all the percussion envelope parameter values to Ø. With stereo output, this means one channel only.

Play a few notes to familiarize yourself with the sound. Notice that the attack is virtually instantaneous: the tone reaches full volume almost immediately after the key is struck. The volume stays at that level until you release the key, then falls off as quickly as it began. Do you see how this is reflected in the shape of the envelope? Look at the numeric values we used to achieve this effect.

The attack rate is 255 -- the fastest rate possible.

The attack volume is 23Ø, but this isn't especially significant here, since the instrument would sound the same with a lower value -- only quieter. What is significant is that the sustain volume is also 23Ø. In other words, the note reaches peak volume and <u>stays there</u> until the key is released.

Since the attack volume and the sustain volume are the same, the decay rate is unimportant. Why? Because the decay rate determines how fast the tone goes from attack volume to sustain volume.

When the key is released, the release rate takes over. This value is 255, the same as the attack rate.

This discussion should help you relate the shape of the envelope to the sound that this instrument makes. The next step is to change the envelope to achieve a specific effect.

Step 1: From Organ to Piano

Compared to an organ, what does a piano sound like? Well, the attack rate is about the same -- very fast. But the notes start losing volume right away. When you release the key, the sound drops off faster, but not so abruptly as an organ.

So what parameters should we change to make our organ envelope sound more like a piano?

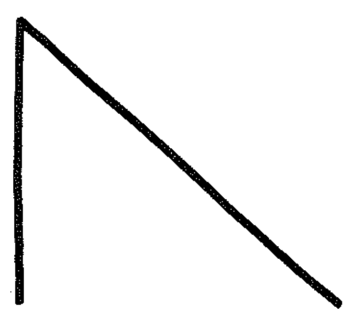
To do that, we need to change the **decay rate,** the **sustain volume,** and the **release rate.**

The piano envelope is on the diskette as PIANO, and you can load it in with <CTRL-L> if you like. But you'll probably find it more interesting to change the values manually, one by one, and test the sound after each change.

If you decide to do this, here are the parameters that you need to change:

Decay Rate (DR:)	from 255 to 25
Sustain Volume (SV:)	from 230 to 0
Release Rate (RR:)	from 255 to 60

And here's the envelope that you've created with these changes:



Piano

As you can see, the attack is the same: virtually instantaneous; but the volume starts falling off (decaying) at once. Play a few notes and hear the effect.

* * * * *

This doesn't sound exactly like a piano, mainly because we're still using the same wave as for the organ. But it should be close enough to give you the idea.

Step 2: From Piano to Clarinet

This is a bigger jump. Think about it: how does a clarinet envelope differ from a piano envelope?

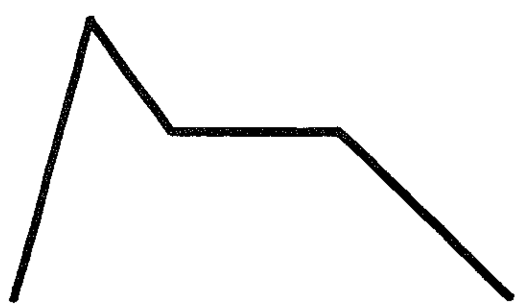
The main change is that the attack is slower with a clarinet. Wind instruments tend to build relatively slowly to peak volume. They also have more sustain.

Except for the attack rate and the sustain volume, the parameters don't change very much. Here are the numbers:

Attack Rate:	From 255 to 8Ø
Attack Volume:	From 23Ø to 24Ø
Decay Rate:	From 25 to 4Ø
Sustain Volume:	From Ø to 2ØØ
Release Rate:	From 6Ø to 8Ø

Once again, you can type these changes in directly, or load the envelope named CLARINET from the diskette.

Here is the graphic representation of the envelope:



Clarinet

This envelope has all four elements: attack, decay, sustain, and release. The attack is more gradual than an organ or piano; and the decay rate/sustain volume combination make it distinctively non-percussive.

But something's missing. Again, the problem is the waveform. While an organ waveform might sound all right for a piano, it just won't do for a clarinet.

Some Practice with Waves

To hear what a difference a wave makes, load the wave named SQUARE from the diskette. To do this, type <CTRL-W>, then type <SQUARE> over the name (supplied by the system) of the current wave:

PRIMARY.......LOAD WAVE:SQUARE

Press <RETURN>, and the system will prompt you to load a wave for the percussion channel. Since we're not using this channel, just press <RETURN> again.

Play a few notes. Hear the difference? In the next chapter, we'll show you how to create waves of your own; for now, let's try a few others.

Clarinet to Flute

To get a flute-like sound, use <CTRL-W> to load the wave named SINE. (Once again, for the primary channel only.)

* * * * *

Of course, coaxing any particular sound out of a synthesizer is partly a matter of keyboard technique: you must mimic the playing style of the instrument. In any case, you'll be able to hear the potential for a flute in this sound.

Flute to Violin

You can get an approximate violin sound out of the current envelope by loading in the wave named SAWTOOTH. Do this now, just as you did for SQUARE and SINE.

With a little practice, you'll be able to predict the effects of changes to an instrument's envelope. You can even draw the envelope you want on paper and plug in the values that will create it.

In comparison, the shape of a wave tells you almost nothing about how it will sound. There are a few standard waveforms, like the sine wave, the square wave, the triangle wave, and the sawtooth wave; and you can learn to recognize the characteristic sound of each.

However, most waveforms that you'll use for instruments are built up of several (usually from two to sixteen) other basic waves, and the resulting graphic representation of the waveform is not a good indicator of its sound. The best way to develop your ability to achieve the wave effect you want is with lots of practice.

And while you're working on developing your ear for waves, you're bound to happen on some sounds that you like. You can apply them to existing envelopes, or envelopes you define yourself, to create some interesting instruments.

The examples in this chapter used the envelope for the primary channel only. <u>Far more interesting sounds are possible when you use both envelopes (and waveforms) and play them against each other, combining greatly different sounds</u>. This opens up a whole new range of possibilities that we haven't touched on here.

If it seems that there are just too many possibilities, don't despair! You can proceed at your own pace, perfecting your control, and bringing together different elements in new ways when you want to experiment.

The alphaPlus operating system has features to make practice and experimentation as easy and instructive as possible. Envelopes? The numbers are right on the screen, easy to change and to save as a group. Waves? You can see the waveform taking shape as you build it, and hear the effect at the same time.

Chapter 9 considers the different file types you'll be using with the alphaSyntauri instrument, and how to manipulate them.

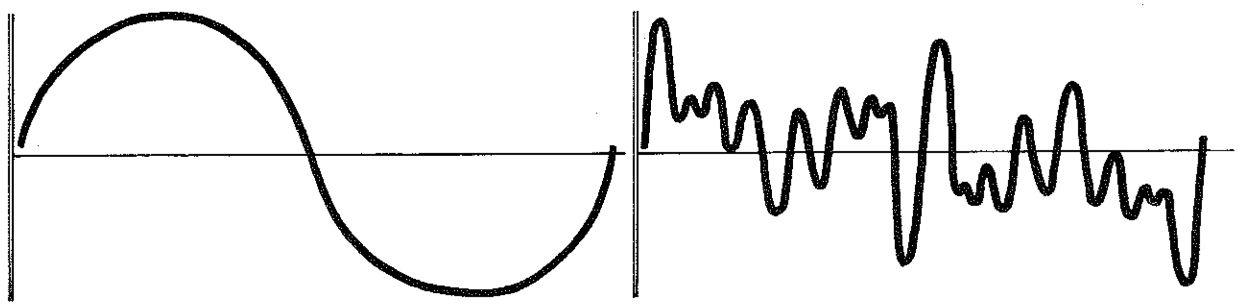
In the next chapter, we'll cover using the features of alphaPlus that let you create and manipulate waveforms.

Chapter 7
Waves in Depth

Envelopes, as you know by now, describe the "loudness history" of a tone, in terms of attack, decay, sustain, and release. But that's only part of the story. There is another factor that makes a piano sound the way it does, or a flute, a human voice, fingernails on a blackboard -- any sound at all, musical or not. That factor is the composite waveform of the sound.

We have already described a wave as a mathematical representation of the back-and-forth movement of any vibrating object. Most musical sounds are made up of many waves. These waves can be expressed as a single "composite" wave that is the combination, point for point, of all the individual waves.

As it turns out, the only "single" wave that exists is a sine wave. Here's an example, along with the composite waveform of a pipe organ:



Sine   Organ

A sine wave by itself, as you will soon hear, sounds pleasant, but a bit too sweet and simple for extended listening.

The pipe organ waveform is made up of dozens of individual waves of different frequencies and amplitudes (loudnesses). The wave itself has a perceivable frequency (pitch), that of the **fundamental harmonic**. The fundamental usually has the lowest frequency and the highest amplitude.

Where do these other waves come in? They are called **overtones**, or harmonics, and the specific overtones produced by a given musical instrument determine, in large part, its **timbre** (pronounced tam'-ber -- the distinctive quality of a sound, the overall effect of that sound's waveform and envelope).

In a musical instrument, harmonics are tones with frequencies that are integral multiples of the fundamental frequency. That is, if the fundamental (the **first harmonic**) has a frequency of 100 Hz (cycles per second) the second harmonic will have a frequency of 200 Hz, the third a frequency of 300 Hz, then 400, 500, 600, etc.

The fundamental and its harmonic overtones make up the **harmonic series**. If you compute the pitches that overtones in the harmonic series have, the musical intervals (between the fundamental and each harmonic) work out as follows:

Harmonic	Frequency (Example, in Hertz)	Musical Interval
First (FUNDAMENTAL)	100	(Unison)
Second	200	Octave
Third	300	Fifth
Fourth	400	Octave
Fifth	500	Major third
Sixth	600	Fifth
Seventh	700	Minor seventh
Eighth	800	Octave
Ninth	900	Major second
Tenth	1000	Major third
Eleventh	1100	Diminished fifth
Twelfth	1200	Fifth
Thirteenth	1300	Major seventh
Fourteenth	1400	Minor seventh
Fifteenth	1500	Major seventh
Sixteenth	1600	Octave

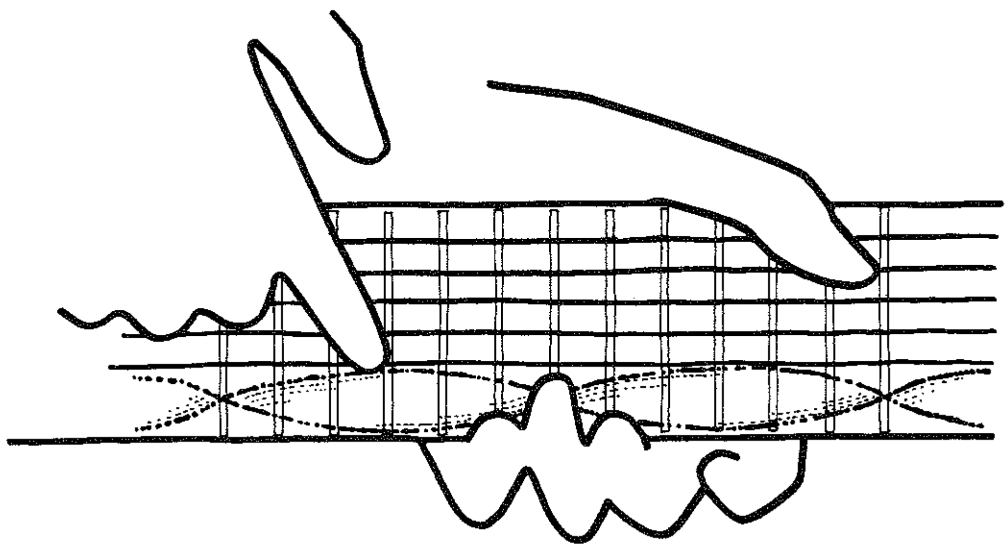
...and so on, to beyond the range of human hearing.

The point is that most musical instruments achieve their characteristic timbre by producing a waveform made up of overtones from the harmonic series. And yet it is the fundamental frequency that is perceived as the pitch of the note.

In fact, even when the fundamental is missing (a condition you can create with alphaPlus), your ear will somehow "compute" it, if enough overtones are present, so that the fundamental pitch will be the one you hear.

Where do overtones come from? From sympathetic vibrations that are set in motion by the fundamental. No doubt you've had the experience of "feeling" bass tones, rather than simply hearing them. The sound waves coming from any vibrating object will al-always tend to induce a similar **resonance** in anything they encounter.

Resonance is the result of sympathetic vibrations that occur in the wood or strings of a violin or piano, or in the metal of a trumpet. You can hear them directly by resting your finger lightly on the midpoint of a guitar string, then plucking the string sharply with a fingernail of the other hand. Here's an illustration of what happens:



In this case, the fundamental is dampened by your finger, but each half of the string vibrates at the rate of the second harmonic -- one octave above the fundamental.

But even without your finger there, the string would not simply vibrate at the frequency of the fundamental; if it did, a simple sine wave would suffice to describe its motion. No, it would vibrate in a very complicated way, in halves, thirds, fourths, and so on. That is part of what makes a guitar sound like a guitar.

Hearing Is Believing

Let's try out some of these ideas by loading a program from the alphaPlus diskette called **Quickwave.**

To load Quickwave, first boot alphaPlus. Once in live mode, press <CTRL-X>. When you do this, you'll be asked:

LOAD QUICKWAVE (Y/N)?

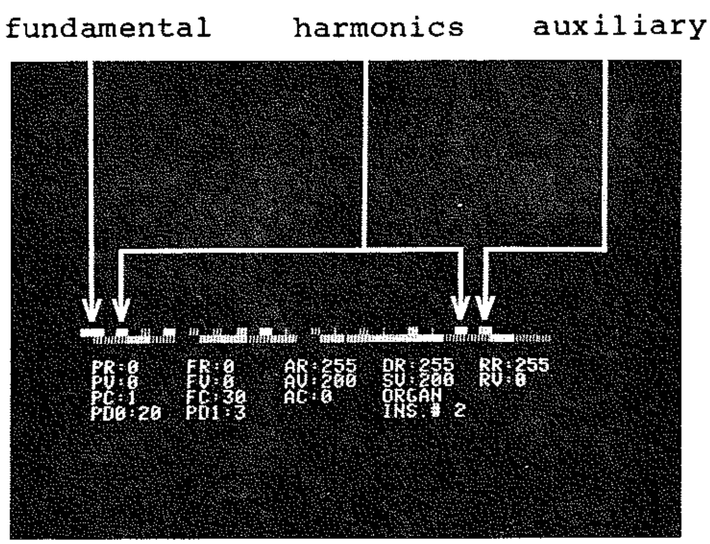
Type <Y> and press <RETURN>. You will be given a chance to save any notes files you may have created. (Quickwave is loaded into part of the same space in memory that notes files use, partly erasing any such file. Of course, if you use a different diskette for saving notes files, make sure the alphaPlus diskette is in the disk drive before you call up Quickwave.)

After you respond by typing in a notes file name and pressing <RETURN> (or just pressing <RETURN> if you don't want to save a notes file), you'll be running Quickwave.

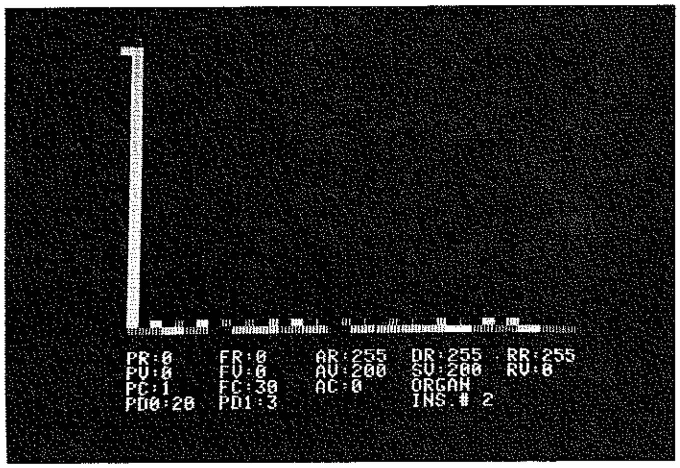
Using Quickwave

There should be a row of small colored boxes above the text window, as in the illustration below. The leftmost box, which is pink, is the cursor. This is similar to the cursor you used to enter envelope values in the pitch window. Its purpose is to let you select harmonics -- represented by the other 16 boxes.

The box just to the right of the cursor's present position represents a harmonic at the frequency of the fundamental. The other boxes, as labeled, represent the next 15 tones in the harmonic series, and an auxiliary wave (which we'll explain soon) at the same frequency as the fundamental.



Right now, each harmonic has an amplitude of Ø, which you can increase by positioning the cursor to the left of a harmonic (a box) and pressing a number between 1 and 9. The box becomes a column. Its height, and thus its amplitude, depend on the number you press. The cursor moves to the next box to the right.



As soon as you press a number, the **primary** and **percussion** waves of the instrument you're in will be replaced by the tone represented by the column. With Quickwave you can build a wave up from the available harmonics (and the auxiliary wave), and hear it as you build it. The entire keyboard is active, as it is during live play, and the envelope used is the one for the instrument you were in when you pressed <CTRL-X>.

Note that Quickwave won't **analyze** a waveform for you: you can't get a representation (in columns of various heights) of an existing wave. If you want to find out the amplitudes of the various harmonics that make up a given waveform, there is a program on the alphaPlus diskette called ANALYZER that will do just that. This program is described later in this section.

What you **can** do with Quickwave is assemble different harmonics of a waveform at different amplitudes. Furthermore, you can add in another waveform at the pitch of the fundamental using the auxiliary wave.

Now let's take Quickwave for a test drive.

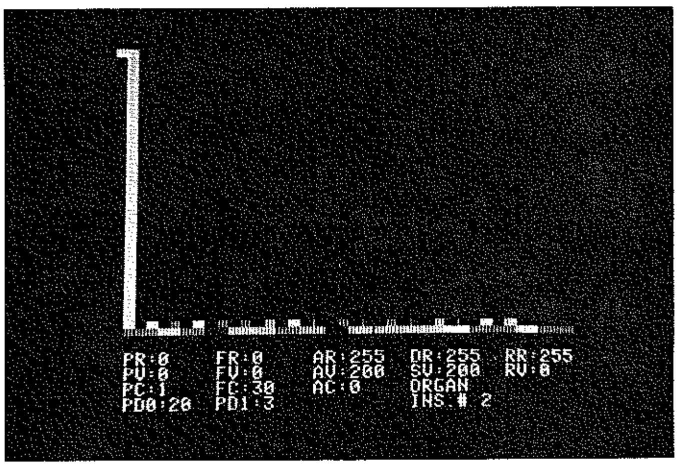
Moving the Cursor

Press <K> several times, and watch the cursor move to the right. When you reach the edge of the screen it will appear again at the left.

Got that? You can also move the cursor to the left by pressing <J>. Using these two keys, move the cursor back to its original position -- to the left of the first harmonic.

* * * * *

Now press <9>, and watch the box to the right of the cursor.



You have just created a wave: you've set the fundamental to a relative amplitude of 9. If you don't believe it, play a few notes on the alpha keyboard.

* * * * *

That's a sine wave, since there are no overtones. Sounds nice, but not very interesting.

The cursor is now resting to the left of the second harmonic. From the table presented earlier, we can determine that it is an octave of the fundamental. Prove it: hold down a key on the alpha keyboard and press <5>.

* * * * *

Did you hear the octave chime in? If you keep playing, the fundaental and the overtone will start to sound like one note. Add another overtone: press <3> to assign a relative amplitude of three to the third harmonic.

* * * * *

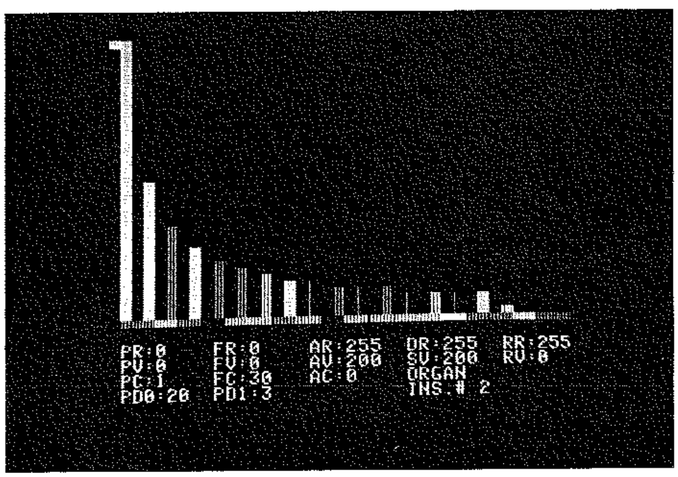
Whether you know it or not, you're building a **sawtooth** wave, which is made up of all the harmonics. Each harmonic has a certain set amplitude: the second is 1/2 the fundamental, the third is 1/3 the fundamental, the fourth 1/4, the fifth 1/5, and so on.

Actually, the second harmonic should have an amplitude of <u>4.5</u> (1/2 x 9 -- the fundamental), and not 5. Here's how you accomplish this: move the cursor to the left until it's at the top of the column for the second harmonic (the one set at 5), and press the left arrow key twice.

* * * * *

The column moved down slightly. To be precise, it moved down 1/4 of a unit for each press of the left arrow key. Since you pressed that key twice, it went down 1/2, and is now set at 4 1/2.

You can also increase any column value by 1/4 by pressing the right arrow key. The use of the arrow keys gives each harmonic 36 different units of amplitude.



The third harmonic is already correct, at 3 (1/3 x 9). With what you know now, you should have no trouble setting the fourth harmonic to 2 1/4 (1/4 x 9). Try it.

If you like, you can continue to build the sawtooth wave; or you can experiment with Quickwave, setting different harmonics to different values and playing a few notes to hear the results. If you create a waveform that you decide you want to **save as a WAVE: file,** here's how you do that:

1. Press <CTRL-E>
2. You'll see this on the screen:

   PRIMARY.......SAVE WAVE:SAWTOOTH

   The name supplied by the system is that of the wave used in the primary channel of the instrument before you entered Quickwave. Choose a new name for your wave and type it in over the name supplied.
3. Press <RETURN>
4. You'll see this on the screen:

   PERCUSSION.......SAVE WAVE:B3 ORGAN FULL

   Again, this is the name of the percussion wave used before Quickwave. Just press <RETURN>
5. Press <CTRL-X> to get back to Quickwave.

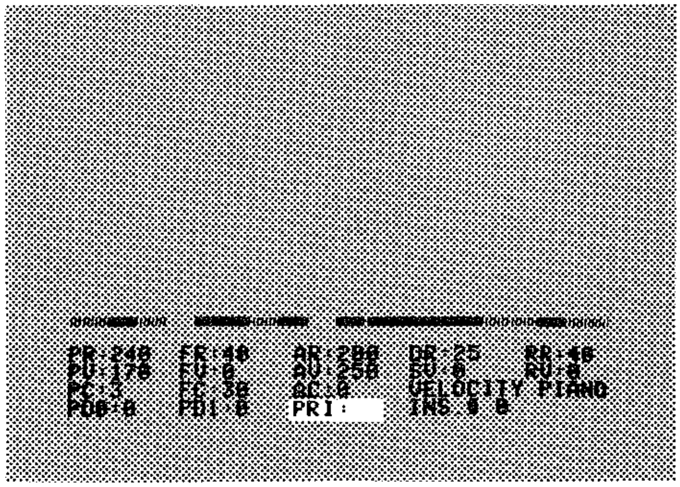
This procedure will save any wave currently in the primary channel (or the percussion channel, if you type in a name before you press <RETURN>) on diskette as a WAVE: file. You can load this wave into any instrument with the <CTRL-W> command.

More About Quickwave

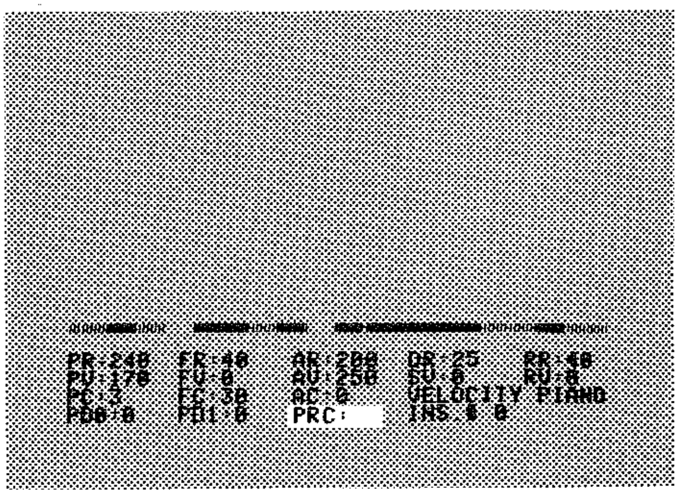
As you know, the alphaSyntauri synthesizer uses two separate channels: primary and percussion. Each channel has its own wave (although they may be identical). When, in Quickwave, you first pressed a number to assign an amplitude to one of the harmonics, that tone replaced the primary and percussion waves of the instrument you were in.

1. Quickwave on Separate Channels

However, with Quickwave you can work on either of the channels separately, leaving the other wave intact, by using the slash key (</>). Try it now.



The letters "PRI" stand for primary, telling you that any changes you make to the columns now will affect only the primary channel. Now press </> again.



Now any changes will affect only the percussion channel. From now on, pressing </> will toggle you back and forth between the two channels.

2. Quickwave on Both Channels

To get back to working on both channels, you would press <CTRL-X>. After you do this, any changes you make will affect both channels unless you press </> again. In fact, if you used Quickwave to build up two separate waves, then pressed <CTRL-X>, making any change before pressing </> would make both waves the same.

There's a lot to this, but it will all come naturally when you've worked with Quickwave for a while. Check the reference section for a summary of Quickwave features.

Using Other Waves with Quickwave

The **base wave** -- that is, the waveform normally used to build the fundamental and harmonics in Quickwave -- is a sine wave. The sine wave is a basic building-block of more complex waves.

To add a little variety, the wave used as the **auxiliary** is one from the alphaPlus diskette called **NOISE**. (Soon we'll show you several ways to make use of both the base and the auxiliary wave.)

However, you're not restricted to using the sine wave. In fact, you can use any wave that exists as a WAVE: file on any diskette (just make sure the diskette containing that wave is in the disk drive!).

The following three exercises demonstrate this, and other uses for Quickwave. (If you decide not to try the exercises just now, you should at least read through them. To get back to live mode, just press any key that doesn't have a specific Quickwave function -- like <RETURN>. Quickwave will still be in memory, and will come up instantly when you press <CTRL-X>. In fact, unless you exit alphaPlus or record a notes file, Quickwave will still remember all the changes you made, to every instrument!)

Sine vs. Square

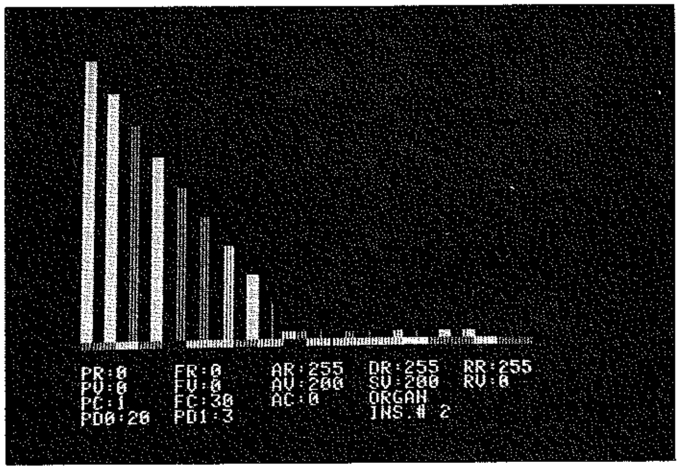
First, set all the harmonics to zero (press <Ø> repeatedly until all the columns are boxes.)

* * * * *

Remember, the base wave is presently a sine wave. Set the first 9 harmonics to the following values:

Harmonic:	1	2	3	4	5	6	7	8	9
Value:	9	8	7	6	5	4	3	2	1

When you're done, the screen should look like this:



Play a few notes to get an idea of the sound produced by this waveform.

* * * * *

Now press <CTRL-Q>. You'll see this on the screen:

LOAD HARMONIC BASE WAVE:SINE

Type in the wave name <SQUARE> and press <RETURN>.

* * * * *

You are then asked to supply the name of a new waveform for the auxiliary (in place of NOISE). Since we're not using the auxiliary wave here, just press <RETURN>.

* * * * *

The normal text and pitch windows will show on the screen. Press <CTRL-X> and the Quickwave screen will return with the same harmonics at the same amplitudes. You've loaded in a new base wave (SQUARE, to replace SINE), but <u>the waveform won't be recalculated until you make an amplitude number entry</u>. Since we want all the amplitude values to stay the same, move the cursor back to the first harmonic (using <J>) and type <9>. This won't change the value, but it will recalculate the waveform using the SQUARE wave rather than SINE.

The fundamental and all the overtones that you set are now harmonics of the waveform SQUARE rather than of SINE.

Again, play a few notes. Do you hear the difference in sound? The tones are comparatively hollow.

Harmonic Augmentation

Press <I> and <2> to get to the B3 ORGAN FULL instrument.

* * * * *

For this exercise, you'll be using the B3 ORGAN FULL waveform with Quickwave. However, since this waveform is not presently on the diskette as a WAVE: file, but only within the ALPHA PLUS preset, you must first save B3 ORGAN FULL as a WAVE: file.

To do this, first press <CTRL-E>.

PRIMARY.......SAVE WAVE:B3 ORGAN FULL

(NOTE: If you haven't restarted alphaPlus since you did the envelope experiments in Chapter 6, the wave name shown here will be ORGAN; if that's the case, press <RETURN> and apply the instructions in the next paragraph to the B3 ORGAN FULL waveform in the percussion channel.)

Now hold down the right arrow and REPT keys together until the cursor moves to the right of the words B3 ORGAN FULL. (You are in effect "retyping" these words.) Then press <RETURN>.

* * * * *

The next screen will offer you the chance to save the percussion channel waveform. This is the same, B3 ORGAN FULL, so there is no need to save it again. Press <RETURN>.

* * * * *

Now press <CTRL-X> to get back into Quickwave. Set all the amplitudes to zero by pressing <Ø> repeatedly until all the columns are boxes.

The next step is to load SINE as the base wave, and B3 ORGAN FULL as the auxiliary wave. Press <CTRL-Q>.

LOAD HARMONIC BASE WAVE:SINE

(NOTE: If you haven't restarted alphaPlus since Chapter 6, the wave name here may be SQUARE; if so, just type in SINE and press <RETURN>.)

"Retype" the wave name SINE with the right arrow and REPT keys, and press <RETURN>.

LOAD HARMONIC AUX WAVE:SINE

Now type in B3 ORGAN FULL as the auxiliary waveform, and press <RETURN>.

* * * * *

SINE is now the base wave, and B3 ORGAN FULL the auxiliary. As it happens, SINE is the wave that was originally used to create B3 ORGAN FULL. In this exercise, you'll be modifying the B3 ORGAN FULL wave by increasing one of the harmonics of SINE.

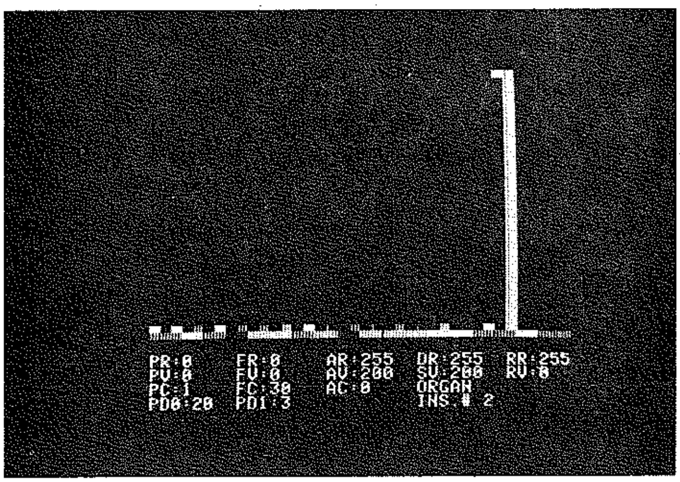
The illustration below shows the harmonic makeup of B3 ORGAN FULL. Note that the harmonics specified are those of the SINE wave. Together, these harmonics, at the amplitudes shown, compose the waveform B3 ORGAN FULL:

B3 ORGAN FULL (using SINE harmonics)

Harmonic	Amplitude (relative)	
1st	17.2	
2nd	17.2	
3rd	17.3	
4th	17.2	
6th	17.2	(include illus of
8th	17.3	B3 ORGAN FULL waveform)
10th	17.2	
12th	17.2	
16th	17.3	

The amplitude for each harmonic was set when the waveform was first created. You can use Quickwave to <u>augment</u> (but not to diminish) any of the harmonics, or to add others. You've already got the two waveforms (SINE and B3 ORGAN FULL) in the system as the base and auxiliary waves, so we'll proceed from there.

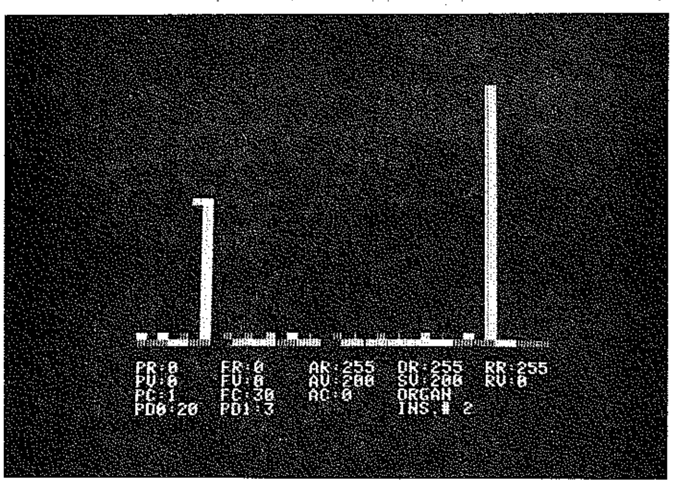
Use <K> to move the cursor to the last box on the right (the auxiliary waveform indicator) and press <9>.



Play a few notes. They should sound identical to the B3 ORGAN FULL instrument, since you're using the same envelope and the same wave.

* * * * *

Now move the cursor to the fourth box from the left -- <u>the fourth harmonic of the base wave, SINE</u> -- and hit the right arrow key repeatedly to increase the amplitude. Play a few notes after every few times you hit this key, and keep going until the column reaches the top of the screen.



Every time you press the right arrow key, you are increasing the fourth harmonic, using a sine wave. The list above shows you the relative amplitude of this harmonic in the original waveform B3 ORGAN FULL. That relative amplitude increases by 2.7 percent (1/36th) with each press of the right arrow key.

Listen for the effect that increasing this harmonic has on the sound of the instrument. If you like, try modifying other harmonics.

Square and Triangle Together

In this exercise, you'll combine one waveform with a harmonic made up of another. This is similar to the previous exercise, except that last time the harmonic (a sine wave) was already a component of the waveform (B3 ORGAN FULL). This time, the two waveforms will be unrelated (as much as any two musical sound waves can ever be).

When you combine the waveform with the unrelated harmonic and play the keyboard, every note will be in effect two notes. In synthesizer terms, this is like having two oscillators set a certain interval apart.

First, set all the harmonics on the Quickwave screen to zero by pressing <Ø> repeatedly, until all the columns are boxes.

* * * * *

Now use <CTRL-Q> to load SQUARE as the base waveform, and TRIANGLE as the auxiliary waveform.

* * * * *

Set the auxiliary waveform, TRIANGLE, to an amplitude of <9>, and play a few notes. (Remember, the auxiliary wave is always at the fundamental frequency.)

* * * * *

Set the cursor at the third harmonic of the base waveform. As you play the keyboard, use the right arrow key to increase this harmonic. You'll hear the new tone gradually getting louder. This tone is an octave plus a fifth above the fundamental (TRIANGLE), so that every note you play in effect gives you two tones.

Now increase the third harmonic to <9>. Try this same experiment with other harmonics, in combination or singly (that is, setting each one back to zero before you go on to the next).

* * * * *

We hope that these exercises give you an interest in exploring further into the capabilities of Quickwave. Any time you create a waveform that interests you, you can save it on a diskette (using <CTRL-E>. (Note: In Chapter 9 we recommend that you segregate your files, saving all waves on a separate diskette. Read that chapter before doing any serious development work.)

You can also build a waveform using Quickwave, save it, then press <CTRL-Q> and reload it into Quickwave. The entire waveform will become the fundamental (base wave), with all Quickwave amplitudes set to zero.

You can also load that waveform (or any waveform built up from that waveform) into any instrument, using <CTRL-W>.

The possibilities are limitless, and we encourage you to experiment with them.

Another Wave-Building Program

Quickwave is your introduction to wave-building, and you'll probably find it useful in the future for trying out different harmonic combinations on the keyboard. However, there's another program called **WAVE**, which gives you much more precise control over harmonics and amplitudes.

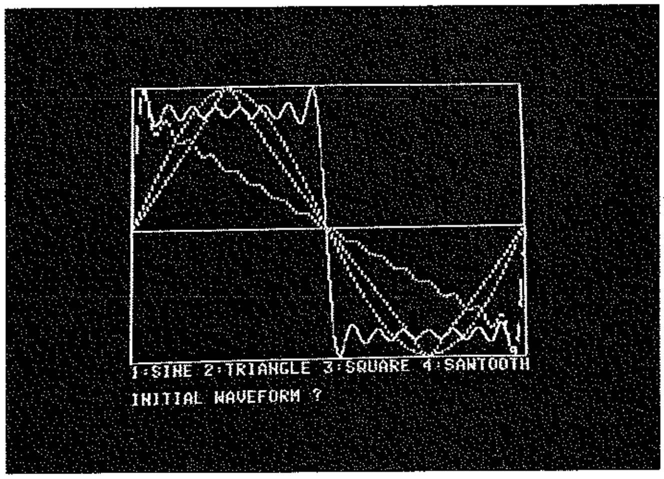
A primary difference between Quickwave and **WAVE** is that you don't immediately hear your results on the alpha keyboard. You must first save the waveform to diskette, reload alphaPlus, and then load your new waveform. We've made this process as smooth as possible for you.

Instead of hearing the tone from the keyboard, you hear it as a 132-Hz **reference tone** that WAVE provides as you build sounds. As you get some experience with WAVE, you'll find this tone very informative.

The advantage of WAVE is that it is terrific for precise wave-building. You'll see what we mean as we go along.

To run WAVE, just press <CTRL-C>. (You can run this program from BASIC -- that is, without first booting alphaPlus -- by typing <RUN WAVE> and pressing <RETURN>.)

In a moment you'll see four waves built on the screen, one at a time, and hear each one as it's finished.



When this demonstration ends, you'll be presented with the question "INITIAL WAVEFORM ?"

WAVE is asking you to specify which of the four waves you want to start with in building a new composite waveform. Your choices are:

1 -- SINE
2 -- TRIANGLE
3 -- SQUARE
4 -- SAWTOOTH

Another possibility: You can use as your "initial" wave any waveform that exists as a WAVE: file on diskette. (For example, B3 ORGAN FULL.)

Building a Sawtooth with WAVE

In this exercise, you'll be able to direct and observe the gradual creation of a sawtooth waveform out of pure sine waves.

You may remember from a few pages back that a sawtooth wave can be made out of successive harmonics of a sine wave with amplitudes (relative to the fundamental) of 1/2, 1/3, 1/4, 1/5, and so on. We can express this progression of amplitudes as 1/N, where N equals the number of the harmonic (in the harmonic series).

(In contrast, a square wave consists of odd harmonics only, with relative amplitudes of 1/N; and a triangle wave consists of odd harmonics only, with relative amplitudes of $1/N^2$, which works out to relative amplitudes of 1 (fundamental), 1/9, 1/25, 1/49.... You can see that, with Quickwave's resolution limit of 36 different amplitudes, you would be unable to assign an amplitude small enough to be 1/49 of the fundamental. Not so with WAVE.)

Back to the screen. To the question "INITIAL WAVEFORM?", answer <1> and press <RETURN>.

```
INITIAL WAVEFORM ? 1
HARMONIC ?
```

Since a sawtooth includes all harmonics, let's start with the first: answer <1>, and press <RETURN>.

```
HARMONIC ? 1
AMPLITUDE?
```

You could put in virtually any number here (including decimals), since all other entries will be gauged in relation to this one; but just to keep things simple, fill in <1ØØ> and press <RETURN>.

```
HARMONIC ? 1
AMPLITUDE? 1ØØ
```

The screen will clear, and a sine wave will be drawn in. As you supply information about successive harmonics, this wave will be redrawn again and again, each time modified by addition of the latest wave.

Your task now is to fill in the rest of the numbers for the sawtooth, out to the 16th harmonic. You could probably figure out the relative amplitudes yourself, but just to save you the trouble...

Wave	**Harmonic**	**Amplitude**
1	2	5Ø
1	3	33.3
1	4	25
1	5	2Ø
1	6	16.7
1	7	14.3
1	8	12.5
1	9	11.1
1	1Ø	1Ø
1	11	9.1
1	12	8.3
1	13	7.7
1	14	7.1
1	15	6.7
1	16	6.3

When the question "WAVEFORM?" comes up after you enter the 16th harmonic, answer <Ø> -- to quit. Save the waveform under the name SAW, and when WAVE asks you if you would like to do another waveform, answer <Y> to do the next exercise, or <N> to take a break, and press <RETURN>. (Note: If you type <N>, WAVE will attempt to restart the alphaPlus operating system. If this is what you want, make sure the alphaPlus diskette is in the drive. If not, <u>open the disk drive door</u> and press <CTRL-RESET> to stop the drive.)

* * * * *

A few points before we go on to the next exercise. First of all, there's no special significance to the first amplitude entry of 1ØØ. We could just as easily have made it 1ØØØ, or 1Ø. The important point is that all amplitude entries are relative. We used 1ØØ to make it easier to calculate succeeding entries, according to the ratio 1/N.

We only went out to the 16th harmonic, although we could have entered a harmonic number as large as 255. Actually, in a series of diminishing amplitudes like this, 16 harmonics are usually enough to define the sound. But a more compelling reason for stopping at 16 is a phenomenon called **foldover**, or **aliasing**.

Briefly, foldover is a type of audio distortion caused by the presence in a waveform of harmonics tones too high for the system to reproduce. The alphaSyntauri system is capable of producing sounds as high as 16,ØØØ Hz. Harmonics higher in the series, when played in the keyboard's upper registers, can cause aliasing.

One more point: we can also enter **negative** harmonics, by preceding the amplitude entry with a minus sign (-). If there is only one wave of a specific harmonic, it doesn't matter whether the amplitude is positive or negative.

Furthermore, you can partially or completely cancel out the effect of any harmonic by entering a wave of the same type, and the same harmonic, with the opposite amplitude. For example, if you enter a sine wave at the 5th harmonic with an amplitude of 5Ø, then change your mind, you can negate the effect of that harmonic by entering a sine wave at the 5th harmonic with an amplitude of -5Ø.

Wave Stew

The purpose of this exercise is to take you quickly through the procedures for (1) combining the different waveforms in the WAVE program, and (2) bringing in waves from WAVE: files on the diskette.

Let's start with the wave you created and saved in the previous exercise: SAW. (If you didn't go through the previous exercise, you can use the wave SAWTOOTH, which is already on the alphaPlus diskette.)

The question "INITIAL WAVEFORM" should be on the screen. In response, type <SAW> (or <SAWTOOTH>, as noted above). Of course, you could simply enter <4>, and use the sawtooth wave provided with the program, but then you wouldn't get the chance to call up the wave you just created. Specify the first harmonic and an amplitude of <1ØØ>.

* * * * *

The sawtooth wave is drawn on the screen, and its sound comes from the speakers.

Now, one at a time, add each of the other three waves in the program: SINE, SQUARE, and TRIANGLE (<1>, <2>, and <3>). For each, specify the first harmonic and an amplitude of <1ØØ>.

In this exercise, you called a waveform from diskette, saw the changes to the developing waveform, and heard its sound as each new waveform was added.

WAVE is a separate program from the rest of the alphaPlus operating system. Therefore, as noted above, to get back to live mode, make sure the alphaPlus diskette is in the drive when you answer <N> to the question "ANOTHER WAVEFORM?"

Analyzing Waveforms

We mentioned earlier that there is a program called ANALYZER on the alphaPlus diskette that will let you find out what harmonics, at what amplitude, constitute any waveform (as long as it's saved as a WAVE: file on diskette).

You run ANALYZER from BASIC -- that is, outside of alphaPlus. With the alphaPlus diskette in the drive, type <RUN ANALYZER> and press <RETURN>. When you are prompted, supply the name of a waveform file and press <RETURN> again (if the file is on another diskette, be sure to insert that diskette in the drive before you press <RETURN>).

The waveform will be located on the diskette and drawn on the screen. Then the first 2Ø harmonics will be displayed on the bottom four lines of the display. Finally, the representation of the waveform will disappear and you'll be able to see all 2Ø harmonics, with their relative amplitudes.

By now you've had some experience with the basic capabilities of WAVE and Quickwave, and have learned to make use of both programs. You can make waveforms, save them to diskette, and combine them with different envelopes. The rest is a matter of practice, creating and comparing waveforms and envelopes.

There's a lot to the alphaSyntauri synthesizer, and you won't become an expert overnight. However, you'll find learning about it an enjoyable experience, since you can create your own instruments with what you know now. As your skills develop, you'll be able to modify instruments to meet your tastes and needs, and to create others to match the sounds that you can imagine.

Going Full Circle

Remember, waveforms and envelopes are not independent of each other. Becoming an expert in one or the other is not enough: you have to learn to use them together.

It only takes a few keystrokes to bring in a different preset from the diskette to try with the current waveform, and vice-versa. Keep trying out new combinations, and listen for the differences. Soon you'll find that you can predict what the effect of a new combination will be, and your experimentation will become less and less haphazard.

Finally, Chapter 9, **About Files**, has some useful advice that will help you keep your growing collection of sounds organized.

Chapter 8
A Few More Features

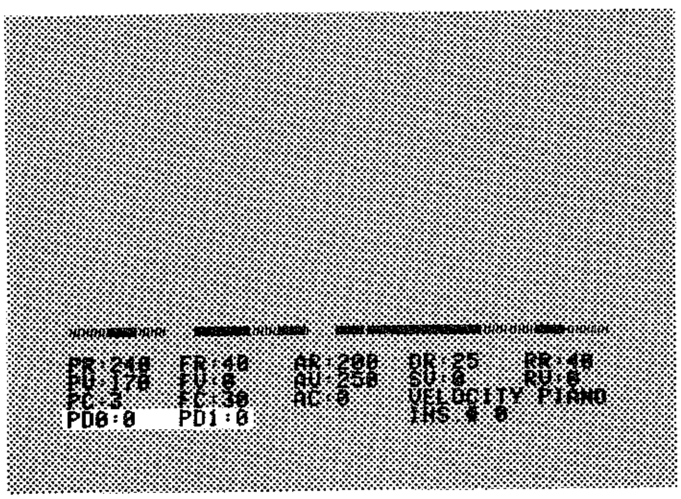
By now you've read about most of the features of alphaplus, and practiced many of them. You may feel that you can get any further information you need from the quick-reference chart. If so, you can skip this chapter, which will move quickly through the few alphaPlus features we haven't covered, or covered only briefly.

Of course, if you later find you need a bit more explanation, you can always come back to the Tutorial.

Vibrato (CTRL-V)

Vibrato, as you may know, is a musical effect caused by slight and rapid variations in pitch. With alphaPlus, you can change the waveform used for these frequency shifts, as well as the **rate** and extent (or **depth**) of the variations.

While in live mode, look at the text window parameters. In the lower left are shown the current values for vibrato rate and depth, as PDØ: and PD1:, respectively.



PDØ determines how **fast** the frequency will shift, and PD1 determines how **far**.

The **vibrato waveform** is the waveform used for the rapid frequency shifts. This is normally a sine wave, but you can substitute any waveform contained in a WAVE: file on diskette. (The next time you load the preset master, the SINE wave will again be used as the vibrato waveform.)

To change waveform, rate, and depth, type <CTRL-V>. You'll see this on the screen:

VIBRATO.......LOAD WAVE:SINE

Just type in the name of any WAVE: file on the diskette (remember, <?> lets you see the diskette catalog) and press <RETURN>. Of course, you can leave the current wave in place by pressing <RETURN> without typing in a name.

Next you'll have an opportunity to type in specific values for vibrato rate and depth.

ENTER VIBRATO RATE: 2Ø

ENTER VIBRATO DEPTH: 3

Type in a new number (and press <RETURN>), or just press <RETURN> to accept the current value.

Changing Vibrato Rate and Depth with the Paddles

You can change vibrato rate and depth much more dynamically by using the Apple game paddles.

When alphaPlus is first started, it doesn't matter where the game paddles are set -- the PDØ and PD1 values on the screen don't correspond to the paddle settings. They are part of the instrument definition included in the preset master ALPHA PLUS. (Before you change them, you may want to note what they start out as so you can get the original sound back without reloading the preset master (using <CTRL-P>).)

To make these parameters take on the values of the paddle settings, thereby changing the vibrato rate and depth, just press <B>. Then rotate one of the paddles and press <B> again, and take a look at the corresponding PD value on the screen. (If you're not sure which paddle is Ø and which is 1, this is a good way to find out; then label them for future reference.)

Repeat this with the other paddle. Try various values for rate and depth, and play some notes to get an idea of what changing these values does to the sound. If the vibrato effect intrigues you, try different rates and depths for different instruments. Remember, however, to note the original values. (If worse comes to worst, you can get either of the preset masters back by using <CTRL-P> and typing its name: either INSTR or ALPHA PLUS.)

For a really bizarre effect, try setting both the rate and the depth of vibrato very high -- say 175 or so -- for a particular instrument, then press the portamento pedal, together with <REPT> and one of the arrow keys.

FX Mods

Here's another way to get some interesting special effects. Try this: type <CTRL-F>.

EXEC 'FX' MOD:

The system wants to know which FX mod (effects modification) you want. Any file on the catalog that begins with the prefix MOD: is an FX mod. Look for one with the name **MOD:TS**. If you don't see it on one part of the list, touch any key on the Apple keyboard to move the list up another screenful.

To load the mod, type the last part of the name of that mod -- in the case of **MOD:TS**, you would type just the letters TS. Then press <RETURN>.

Using the paddles, you can go further and change the FX mod characteristics. Normally the paddles control vibrato, but when an FX mod is in effect, they are programmed to affect the FX mod characteristics. Instead of pressing <B>, as you did for vibrato, you use the button or switch on one or the other of the paddles to make the change take effect.

Finally, to turn off the FX mod, press <CTRL-F>, <RETURN>, <O>, <RETURN>.

The other FX mods available on the alphaPlus diskette are:

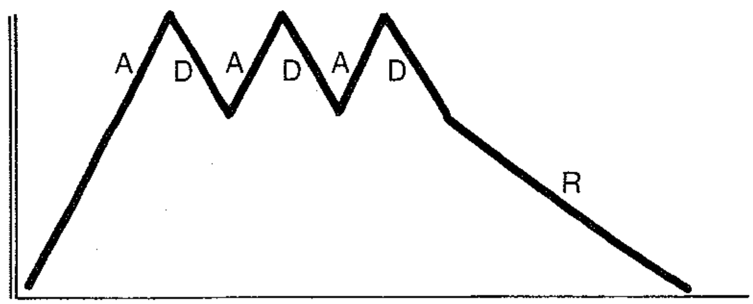
AM	amplitude modulation
CH	chorus effect
PB	pitch bend
PS	pitch scan

Back to the Text Window

There are three text window parameters that we discussed, briefly, in Chapter 6: attack control (AC), frequency control (FC), and percussion control (PC). You change these values just as you change envelope values: move the text window cursor to the value after the initials (see Chapter 6 for directions on moving the text window cursor), type in the new value, and press <RETURN>.

Attack Control

This parameter can only take a value of zero or one. When AC = 1, the attack/decay cycle of the primary envelope is repeated as long as a note is held:



You can use this to achieve a tremolo effect, as well as other more striking effects.

Frequency Control

This parameter does just what it says: you can use it to change the alpha keyboard frequency. This means that the pitch of every note will change.

The FC value may be set anywhere from Ø-255. Every unit of change increases or decreases the keyboard pitch by one quarter-tone.

Here are some significant values:

FC = 3Ø	Middle C
FC = 6	Down one octave (24 quarter-tones)
FC = 54	Up one octave (from Middle C)

Try this: type <FC> to get the cursor to the FC value, then use the arrow keys (with or without REPT) to glide from one value to another as you play the alpha keyboard.

The FC: parameter is very useful for transposing from one key to another.

Percussion Control

The value in this parameter determines whether the percussion channel is on or off, and whether or not velocity sensing is in effect. (Velocity sensing means that how fast you press down the alpha keys determines how loud the note will be, and how abrupt the attack.) This feature is only available with the five-octave alphaSyntauri keyboard.

Velocity sensing affects only the primary channel. The specific envelope and waveform in the percussion channel will greatly affect the overall sound and sensitivity.

The PC: parameter may be set from Ø-3:

PC	Percussion Channel	Velocity Sensing
Ø	OFF	OFF
1	ON	OFF
2	OFF	ON
3	ON	ON

Touch Sensitivity (CTRL-T)

Touch sensitivity is a feature related to velocity sensing. The value may vary from Ø-7, with zero being the most sensitive, seven the least.

This value determines for what range of play (slow to fast key-presses) the attack rate and the attack volume increase. With touch sensitivity set to zero (and velocity sensing ON), the attack is faster and louder, depending on speed of keypress, across the entire range of play.

Set touch sensitivity to seven, and the attack gets faster and louder only for the fastest keypresses.

Pressing <CTRL-T> momentarily exits alphaPlus, first giving you a chance to save notes files (if you recorded any) and the preset master (in case you made some changes to it).

You can then change the current touch sensitivity value, or leave it as is. In either case, you are then shown the velocity rates and limits now in effect, in the form of two three-column tables.

Tuning Offset (CTRL-O)

Most instruments are not evenly tuned: a certain "detuning" is necessary to achieve the best effect.

The alphaSyntauri keyboard may be detuned in units of 1/32 of a tone. To do this, just press <CTRL-O> and enter the detuning value you want to hear.

You can enter any value from Ø-255. An offset of 1 or 2 will make for a richer, fuller sound. You can also have an offset of a tonic interval, like a fourth (8Ø), a fifth (112) or an octave (192). This will make each note sound like a chord.

A changed offset value can only be saved as part of a preset master. Practice with different values for different instruments to get the specific effect you want.

Changing Scales or Intervals per Octave

The alphaSyntauri keyboard is normally set, according to the standards of Western music, at 12 tones per octave. Also, it is equal-tempered. You can change this with <CTRL-N>. (Note that this will reload the default preset master, ALPHA PLUS, from the alphaPlus oper- ating system diskette.)

After you press <CTRL-N>, you can choose between equal and international tuning, and enter the number of intervals per octave (anywhere from 1-32), if you like.

That covers the features available in alphaPlus. For a quick reminder of the features and commands in alphaPlus, use the quick-reference chart that came with this package.

Don't stop reading yet, though: The next chapter has some information that will be invaluable to you when you start accumulating a lot of files of your own. Please read it before you do any serious development on the alphaSyntauri.

Chapter 9
About Files

You've been through it all, now -- or almost. We've taken you through the most important features of alphaPlus, and have touched on many others.

This chapter is about the **file structure** of alphaPlus. You've seen these files on your video display, heard them through your amplifier, used them as synthesizer features.

Now you will see them as files, learn how they are organized, and become better able to use them for your own purposes.

A file is a related body of information, stored on a diskette, and loaded into the computer's random access memory (RAM). Files have to be stored on diskettes because RAM is erased when the computer is turned off; also, RAM space is limited, and some files overwrite others when they're loaded from the diskette.

Many files on the alphaPlus system diskette are program files containing the instructions that make the computer do what it does. You don't have to be concerned about these, because you won't be doing anything with them except loading them.

We're more concerned here with files you'll be creating and modifying. These are:

- Preset Master files
- Waveform files
- Preset (envelope) files
- Notes files
- Album files

Another file type that you should learn to recognize is the FX mod file.

Preset Master Files

We've had a lot to say about preset master files, since that's where you'll be storing instruments you create. As we've discussed, the preset master groups together all the information you need for a complete description of ten instruments. (You could load several individual files, in sequence, to make up an instrument, but you would still have to specify parameters like the vibrato rate and depth.)

There are two preset masters on the alphaPlus system diskette: **PRESET MASTER:ALPHA PLUS** and **PRESET MASTER:INSTR.**

PRESET MASTER: is a prefix that the system will attach whenever you save a preset master. You don't type in those words when you load or save a preset master -- they're just there to identify them in the diskette catalog.

Each preset master file has associated with it a **Wave Master** file, from which it takes the waveforms for the ten primary and percussion waves, and an **LFO master** file, from which it takes the vibrato and offset values.

To save a preset master: <CTRL-R>, (name), <RETURN>.

To load a preset master: <CTRL-P>, (name), <RETURN>.

Wave and LFO masters are saved and loaded automatically by alphaPlus.

Included with the alphaSyntauri software is a diskette of various preset masters. The instruments are listed in Appendix D.

Waveform Files

Five waveform files come on the alphaPlus diskette:

- WAVE:NOISE
- WAVE:SAWTOOTH
- WAVE:SINE
- WAVE:SQUARE
- WAVE:TRIANGLE

Again, note the prefix **WAVE:**. Any file on the diskette that begins with the prefix "WAVE:" is a waveform file (but not WAVE.B -- that's a period, not a colon). Remember, you shouldn't type in these prefixes. When you load a waveform file, the computer system knows what to look for.

A waveform file is just what it says: a waveform, which you can load into any channel of any instrument.

You create waveform files with Quickwave (<CTRL-X> or WAVE <CTRL-C>.

To save a waveform file: <CTRL-E>, (name), <RETURN>.
(from any instrument)

To load a waveform file: <CTRL-W>, (name), <RETURN>.
(into any instrument)

Preset (Envelope) Files

A Preset file contains the envelope values for both the primary and percussion channels, as well as the three control values: percussion control (PC), frequency control (FC), and attack control (AC).

These parameters are presented in the text window when an instrument is selected. You create a new envelope by altering these values.

To save a preset file: <CTRL-S>, (name), <RETURN>.

To load a preset file: <CTRL-L>, (name), <RETURN>.

Notes Files

Notes files are pieces you have recorded on the alpha keyboard. You create notes files by setting the synthesizer to record and playing the alpha keyboard. A notes file can contain up to 2000 notes.

You play back a notes file by loading it (or creating it from the keyboard) and setting the synthesizer to play back. You can set the notes file to repeat indefinitely with the Echo feature.

> **To save a notes file** (from record/playback command menu): <S>, <RETURN>, (name), <RETURN>.
>
> **To load a notes file** (from record/playback command menu): <L>, <RETURN>, (name), <RETURN>.

Album Files

Album files contain a list of notes file names. When you play an album file, it automatically calls the notes files, in sequence -- as long as they are on the same diskette.

During album playback you may advance to the next notes file in sequence by pressing <spacebar>.

> **To create and save an album file:**
>
> - From record/playback command menu: <Q>, <RETURN>, <RUN ALBUM>, (name of album), <RETURN>, (name of each notes file followed by <RETURN>).
> - From BASIC: <RUN ALBUM>, (name of album), <RETURN>, (name of each notes file followed by <RETURN>).
>
> **To load and save an album file:** (from record/playback command menu) <A>, <RETURN>, (name of album), <RETURN>.

FX Mod Files

FX Mod files are those files on the diskette with the prefix MOD:. You load existing FX Mod files to "post-process" your sounds. You will find the details about how each FX Mod affects the sound in the reference portions of this manual.

> **To load an FX Mod** (from record/playback menu): <F>, (name of FX Mod), <RETURN>.
>
> **To turn off an FX Mod** (from record/playback menu): <F>, <O>, <RETURN>.

Staying Organized

Within a few weeks, there's a good chance that you'll have files coming out your ears. There are three important steps you can take to assure that you'll know where things are and what you had in mind when you created them.

1. Keep notes.

Every time you create a file, make a note of the date, and of your intended use for the file. If it's a waveform file: what envelope did you try it with that sounded good? A notes file: is it a bass refrain for some other melody?

You know how you work, and how you use the sounds you make. We suggest only that you document them. Nothing is quite so unhelpful as a nondescript name on a catalog of a file you created weeks ago and can't remember why.

2. Name your files carefully

<u>Develop a system to organize your files that makes sense</u>. For instance, use associations or the same names to clarify which envelope goes with which wave.

Example:	PRESET:B3	(envelope)
	WAVE:B3 PRI WAVE:B3 PERC	(waveforms)

Do the same with the names of instruments in a preset master, adding cues to characterize each instrument for you. (Remember the fourteen-character limit on names, however!)

3. Segregrate your files!

Take it from us -- keep your waveforms on a waveform diskette, your presets on a preset diskette, and your preset masters on a preset master diskette. This may not seem necessary at first, but as you progress and these files multiply, you'll find that it's an incredible relief to **know** where a particular file is, and not to have to search through seven diskettes' worth of catalogs (especially in the middle of a performance!)

You'll probably be doing most of your diskette "housekeeping" from outside the alphaPlus operating system -- that is, from Apple's DOS (disk operating system). Set some time aside to go through your Apple DOS manual to learn about the commands available, and how to use them.

For convenience, we've provided a command (CTRL-D) that will let you exercise any DOS command from within alphaPlus. For example, to erase a file without exiting alphaPlus, you could just type <CTRL-D>, <DELETE (filename)>, <RETURN>.

That's about it. Oh, one more piece of advice: **back up your files!** Well, no, not every one, but those special ones that you'd really hate to lose...

The test is: is it worth the price of a diskette? If so, back it up and store it someplace safe. The best way to back up an entire diskette is with the COPYA (from Applesoft BASIC) or COPY (from Integer BASIC) program on the Apple DOS diskette. To back up selected files, use FID (also on the Apple DOS diskette).

Appendix C covers the use of these programs for this purpose. You can learn more about them from the Apple DOS Manual.

Appendix A
Setup & Initialization

Since you've found this manual, you've obviously started unpacking your alphaSyntauri digital synthesizer. If you haven't finished, do so now. When you're done, you should have the following items:

- alphaSyntauri music keyboard, 4- or 5-octave
- Cable (music keyboard to interface card)
- Keyboard interface card to the Apple II computer
- Mountain Computer MusicSystem™ , software, & manual
- Two footswitches
- alphaSyntauri diskettes (as per packing list)

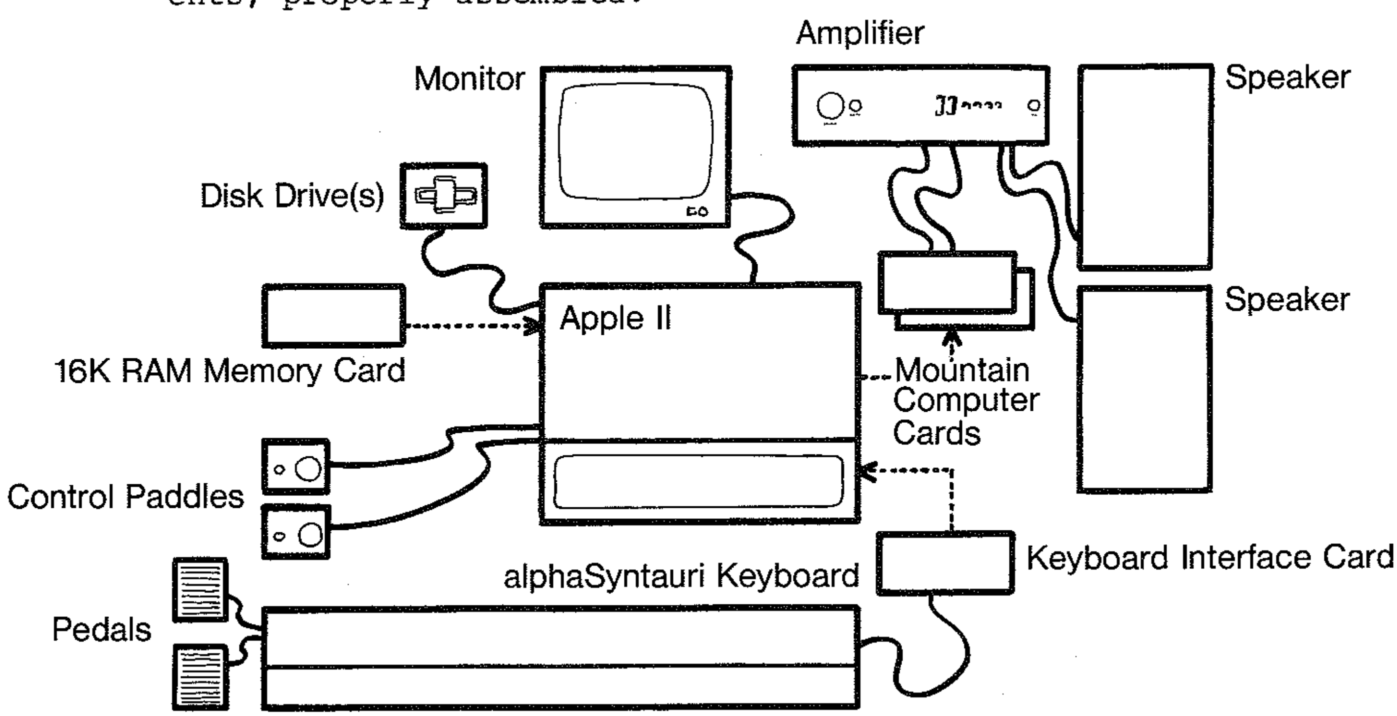
Contact your dealer if any parts are missing.

In addition, there are certain things you must provide:

- Apple II computer, 48K RAM, DOS 3.3 operating system
- RAM card (16K or greater)
- Apple disk controller and at least one disk drive
- Apple game paddles
- Video monitor or TV w/RF modulator
- Audio amplifier and speakers
- At least 1Ø blank diskettes (recommended)

Putting It Together

This diagram shows the interrelationships of the system components, properly assembled.



Your Apple system may already be assembled and working. If not, turn first to the Applesoft Tutorial and the DOS Manual for instructions on getting that system going.

****

Back already? Okay -- as things stand now, you should have your disk controller card plugged into slot 6 inside the Apple, and the disk drive cable should be plugged into the upper set of pins on the controller card. The language card or 16K RAM board should be plugged into slot Ø.

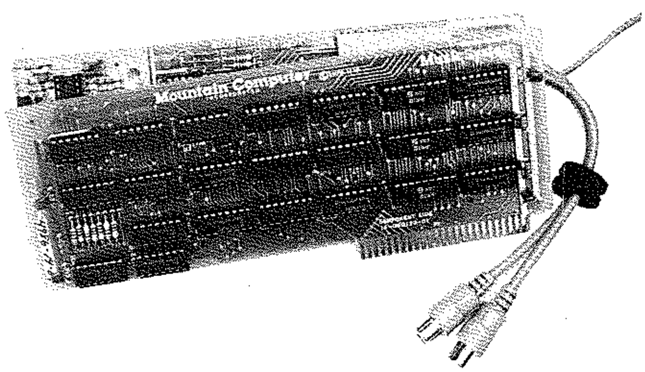
Furthermore, the paddles should be plugged into the back of the Apple, as well as your video monitor or TV and RF modulator.

We'll take it from here.

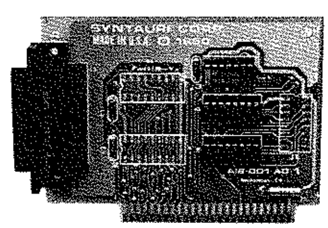
The Apple should, of course, be **turned off** during installation. This is vital!

Step 1: The Cards

The "cards" are the flat, rectangular printed circuit boards that fit into the slots in the back of your Apple. Here are the cards that help make up the alphaSyntauri synthesizer:



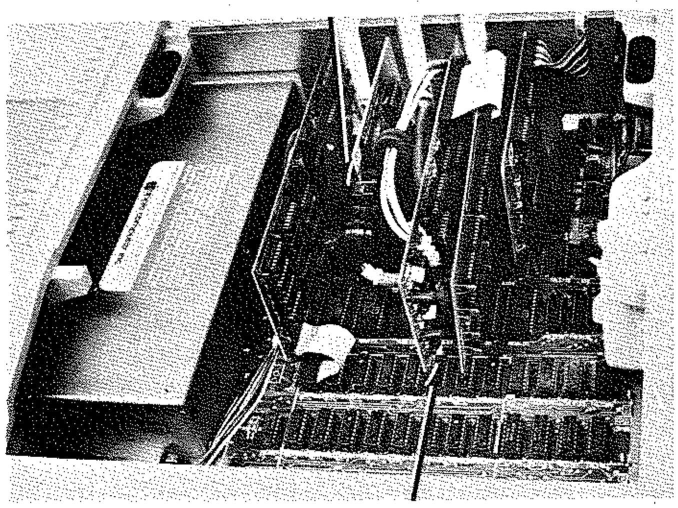
Mountain Computer Cards



Keyboard Interface Card

We suggest putting the keyboard interface card in slot 2, and the Mountain Computer cards in slots 4 and 5

slot 2



slots 4 and 5

These cards can go into any of the slots in the back of the Apple, with these restrictions:

- o The Mountain Computer cards must be installed in adjacent slots (obviously, since they're attached to each other).
- o The leftmost Mountain Computer card (the one with the audio jacks) must be installed in slot 1, 2, 3, or 4. This means, of course, that the rightmost MC card must be in slot 2, 3, 4, or 5. (Note that the slots are numbered from Ø to 7. The number is printed just behind each slot.)

The keyboard interface card can go in any unoccupied slot.

Install these cards now, and make a note of where you put them, because you'll have to supply the information to the computer later.

Step 2: The Cords

Now to connect the separate system components.

First, the alphaSyntauri keyboard: connect it to the keyboard interface card by means of the six-foot long cable.

Next, the footswitches: plug these into the back of the music keyboard.

Place the footswitches under the keyboard. The one plugged into the left jack should be on the left. (Portamento is the left jack, sustain the right.)

Finally, the amplifier: connect one end of the grey stereo audio cable (supplied in the MusicSystem box) to the RCA plugs that extend from the Mountain Computer cards. With your audio system OFF, plug the other end of this cable into the AUX or TAPE inputs of your amplifier. Do **NOT** use the MIC or PHONO inputs: this could harm your amplifier.

That's It

If you've connected everything according to the preceding directions, your alphaSyntauri synthesizer is ready to go. But before you turn things on, see Chapter 2 of the alphaPlus Tutorial and do it right.

Appendix B
Troubleshooting

What Went Wrong?

Well, if you're reading this, you're just plain curious, or for some reason the system didn't start up as it should have. There are several possible reasons -- and solutions -- for this.

1. **Something isn't plugged in.**
   SOLUTION: Check <u>everything</u> -- computer, monitor, and amplifier.

2. **The amplifier isn't on, or the volume isn't high enough.**
   SOLUTION: Again, check everything. For example, is the amplifier set to the right mode for the jack you plugged the interface cable into? Speaking of which...

3. **The keyboard cable isn't connected properly.**
   SOLUTION: Check both ends. There should be no perceptible "wiggle" at either one (be careful when you check this! Turn off the Apple beforehand, and be gentle when you handle the cards.).

4. **One or more of the cards in the back of the Apple is not inserted properly.**
   SOLUTION: Turn **off** the Apple, remove the back cover, and gently but firmly press down on each of the cards. Rock them back and forth **very slightly** to seat them in their slots. Then go through the steps for turning on the system again.

5. **One or more of the cards is not in the right slot, or not in the slot you told the system it was in.**
   SOLUTION: Read through Appendix A again, checking the slot positions carefully. Note the few restrictions on which cards can go in which slots. Then boot the system again, double-checking the slot numbers with the positions of the cards.

6. **You used a backup diskette that was defective.**
   SOLUTION: Make another backup, and try again with the original. If that works, check the new backup and make sure this one works too.

7. **Something's wrong with your hardware.**
SOLUTION: Try to isolate the problem. Try your Apple with other software. Try out the Mountain Computer software to check the Mountain Computer boards. Is the inside of the Apple getting too hot? (We recommend installing a fan.)

Appendix C
Backup Procedures

<u>All diskettes and files should be backed up!</u> (This means copied onto an extra diskette that is kept locked away, in a safe place.) Some diskettes provided with the system can't be copied. You can purchase backups from Syntauri Corporation.

Diskettes

First, of course, you'll need a supply of blank diskettes. Normally you have to **initialize** diskettes, which prepares them for holding your data. However, the Apple system master programs COPYA and COPY initialize diskettes as well as copy the entire contents of other diskettes unto them.

To use COPY (or COPYA):

1. Put the DOS system master diskette in the drive and turn on your Apple.
2. Most likely, the Applesoft BASIC prompt -- -- will be on the screen. Type <RUN COPYA>, and press <RETURN>. If you are in Integer BASIC (that is, if the angle-bracket prompt -- > -- is on the screen), just type <RUN COPY>.

Once the program -- either one -- is running, you have to supply the copy program with some information. How you answer will depend on whether you have one disk drive or two. You should see this on the screen:

```
ORIGINAL SLOT:    DEFAULT = 6
```

Your disk controller card should be in slot 6, so just press <RETURN> to accept this one.

When you see this:

DRIVE: DEFAULT = 1

Press <RETURN> again. Do the same for --

DUPLICATE SLOT: DEFAULT = 6

since the card in slot 6 accommodates two drives.

If you have two drives, press <RETURN> to accept --

DRIVE: DEFAULT = 2

BUT if you have only one drive, you will have to use that drive for both the original diskette and the duplicate, so type <1> and press <RETURN>.

Next you'll see the message --

-- PRESS 'RETURN' KEY TO BEGIN COPY --

but **before you do that,** remove the system master from drive 1 and replace it with the diskette you want to copy. If you have two drives, put a blank (or expendable) diskette in drive 2. If not, the program will prompt you to remove the original from drive 1 and replace it with the copy. This will happen several times.

When you have the original in drive 1 (and the blank in drive 2, if there is one), press <RETURN>. Those of you with two drives will find the process automatic from here; those with only one will have to make the switch, when prompted, several times.

When the copy is made, the screen will say --

DO YOU WISH TO MAKE ANOTHER COPY?

If you do, just type <Y> and press <RETURN> to go through the same procedure with another original (and another blank) diskette. If not, just press <RETURN>.

Files (and Initializing Diskettes)

At some point you'll probably want to copy a single file onto another diskette, either to back it up or to transfer it. You can do this directly from alphaPlus, by loading the file and then saving it on another diskette (the original, of course, remains on the diskette you loaded it from).

However, you may find it more convenient to use a program on the Apple DOS system master called FID (short for FIle Developer).

COPY and COPYA will copy an entire diskette, but any information that was already on the diskette you copy to is lost. FID lets you move files one at a time, keeping the destination diskette intact.

If you are copying files to a brand-new diskette with FID, you must first **initialize** the diskette.

When you initialize a diskette, the computer puts certain information on it to prepare it for holding files. You may have noticed that many diskettes have a program on them called HELLO. That is, by tradition, the name of the program that the computer puts on the diskette while initializing it.

You initialize a diskette from either Integer or Applesoft BASIC, after booting up with a DOS diskette (such as the DOS system master). Insert the diskette to be initialized in the drive and type the following (press <RETURN> after each line):

```
NEW
10 REM HELLO
INIT HELLO
```

The first line erases any existing program in Apple's memory; the second is a one-line program that doesn't really do anything except allow the diskette to be initialized (any program would do); and the third is a command to initialize the diskette with this program, and call it HELLO. (You could type <INTI> anything here, if you wanted to break with tradition.)

After you press <RETURN> the third time, the disk will make a few strange noises and spend the next few moments initializing. When it stops, the diskette is initialized, and can be used to store files.

To use FID, insert the DOS system master and type <BRUN FID>. When the program is loaded, you'll see a menu that offers several choices, of which COPY FILES is the first.

If you choose COPY FILES, you will need to specify source and destination drives, just as you did with COPY. The main difference is that you have to specify the files you want to copy. You can do this by naming them (one at a time -- boring), or just type <=> for the filename. When the program asks you if you want prompting, answer <Y> (and press <RETURN>).

The program will then display the name of every file on the diskette, waiting for you to specify <Y> (for yes, copy it) or <N> (for no, skip this one). Every time you type <Y>, the file will be copied, and the program will prompt you to switch diskettes if you have only one disk drive.

Be sure to check the Apple DOS Manual for other uses of FID, and for more information about files and the use of the disk operating system.

GLOSSARY

Computer Terms

Boot: To start up the system by inserting a diskette (in this case, the alphaPlus system master) in the disk drive and turning on the computer.

Cursor: A symbol on the display screen that indicates the position where the next computer keyboard action will have an effect. In alphaPlus, a cursor is used to indicate which (1) text window parameter or (2) Quickwave harmonic will be changed by the next keystroke.

Diskette: A small square piece of magnetic material (5 1/4" in the Apple system) encased in heavy paper and used to store various kinds of information so that it can be read by the computer.

Drive: Peripheral device used to store information on the diskette, and retrieve it as needed.

Enter: To press a computer keyboard key and (usually) press RETURN to make it official for the computer. Some keystrokes do not require you to press RETURN, most notably those that involve pressing the CTRL (Control) key at the same time as another key.

File: An organized body of information stored on a diskette. alphaPlus uses notes files, waveform files, and others (see Chapter 8 of the Tutorial).

Inverse: Refers to characters presented on the display screen as black on a white background (white on black is normal).

Load: To bring a program file in from diskette and start it running in the computer.

Program: A set of instructions to the computer, usually stored on diskette until needed. A computer needs a program of one sort or another in order to do anything at all. Some programs run other programs, like alphaPlus, which runs Quickwave and other programs.

Retrieve: To bring information into the computer's memory from a diskette.

Syntauri/Synthesis Terms

Envelope: The "loudness history" of a tone, expressed in terms of attack, decay, sustain, and release. Graphically, a curve portraying the changing loudness of a tone from start ("attack") to finish ("release").

Exponential: Refers to envelopes whose loudness increases slowly at first, then much faster. Such envelopes are most appropriate for strings, brass instruments, and the like. See also **linear**.

Harmonic: A tone produced by sympathetic vibrations caused by another tone, called the fundamental. The frequency of a harmonic is always an integer multiple of that of the fundamental.

Instrument: In alphaPlus, a combination of specifications for various sonic elements that enable the alphaSyntauri to produce a certain sound. An instrument includes specifications for waveform(s), envelope(s), vibrato, and tuning offset (slight detuning).

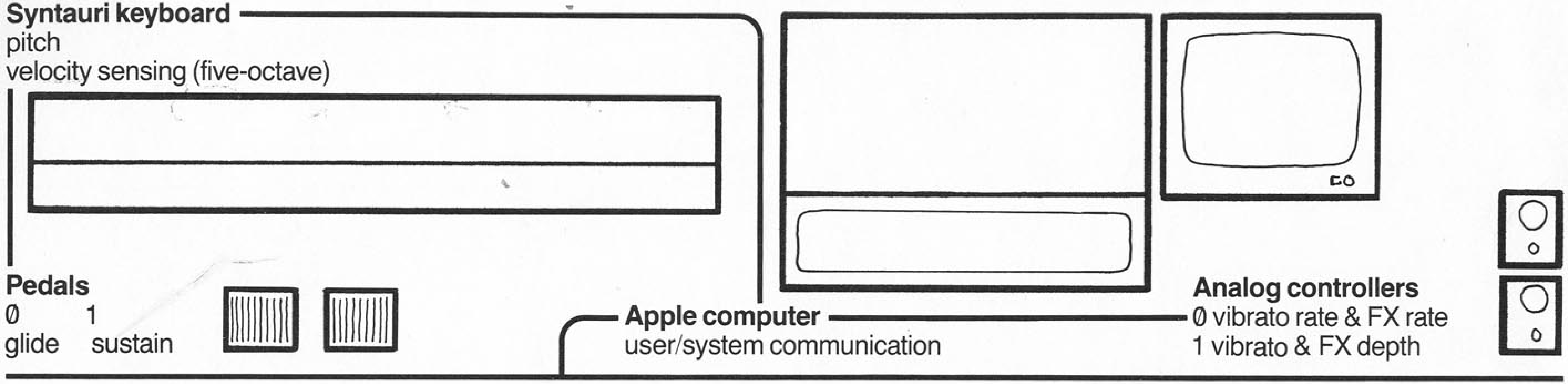
Linear: Refers to envelopes that increase to maximum loudness at a steady rate. Such envelopes are most appropriate for pianos, organs, and the like. See also **exponential**.

Preset Master: In alphaPlus, a collection of specifications for ten instruments, stored on a diskette and loaded into the computer as a block.

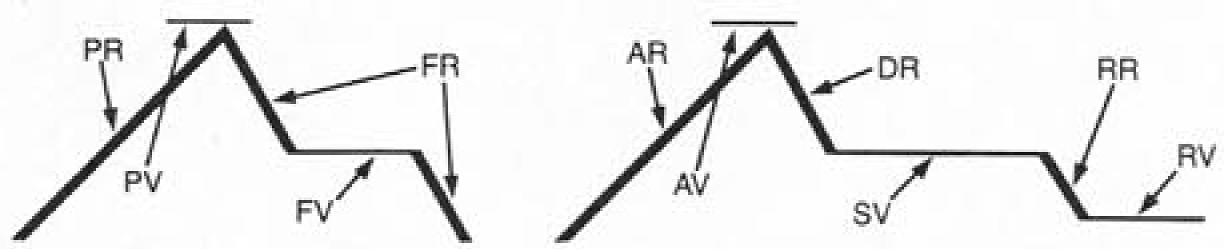
System Master: The diskette that comes with the alphaSyntauri and includes the alphaPlus operating system.

Waveform: A representation of any sound in terms of the frequencies of its harmonics.

alphaPlus Quick-Reference Chart



Live mode



Apple keyboard entries ▷ P F A D R

	P	F	A	D	R
▽	percussion Rate Ø...255	Fall Rate Ø...255	Attack Rate Ø...255	Decay Rate Ø...255	Release Rate Ø...255
V	Percussion Volume Ø...255	Fall Volume Ø...255	Attack Volume Ø...255	Sustain Volume Ø...255	Release Volume Ø...255
C	Percussion Control Ø 1 2 3 per ch off on off on touch off off on on	Frequency Control C=6, 30, 54, 78 when A=440 with 12 steps/octave	Attack Control Ø 1 off on (AR/DR repeat)	Instrument name ______	
	PaDdleØ Ø...255	PaDdle1 Ø...255	quickwave channel indicator	INS. # (preset number) Ø...9	echo flag

(see also <CTRL> V)

screen text window

update vi**B**rato rate/depth

J,K quickwave cursor

/ quickwave Pri or Perc

change **I**nstrument

? list catalog

→increase / ←decrease value or playback speed

Record/Playback menu

<SPACEBAR>, then:

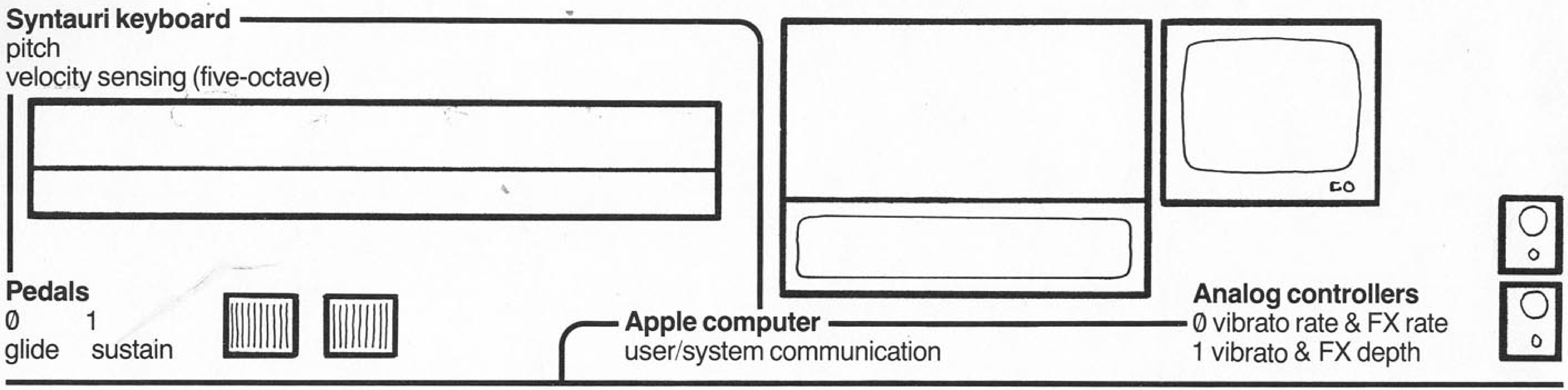
- **R** **record** into memory
- **P** **playback** from memory
- **A** **album** load-&-play (abort: **esc)**
- **O** **off:** exit record or play
- **B** go to **beginning** in **P** or **R**
- **E** **echo:** repeat playback
- **F** **fx-mod** load (special effect)
- **L** **load** a performance
- **S** **save** a performance
- **Q** **quit** alphaPlus
- **?** **catalog** listing
- **<RETURN>** **exit** to live mode

<CTRL> **key** functions

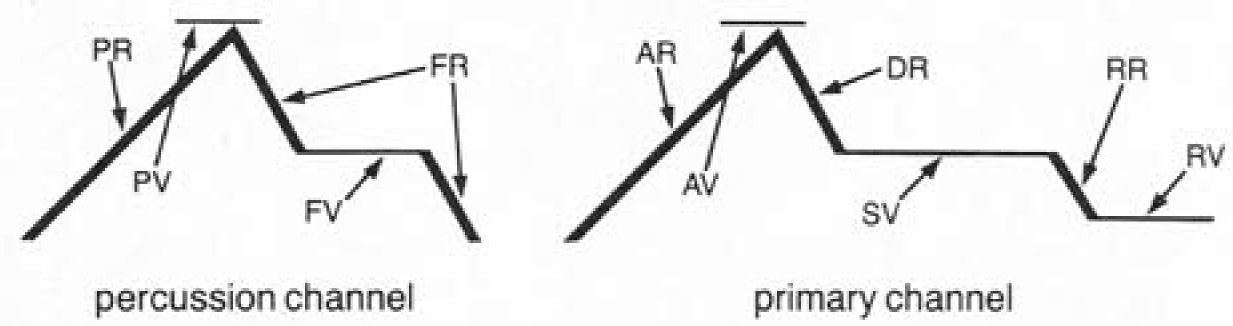
<CTRL> and:

- **A** **exponential** or **linear** envelopes
- **C** **wave** waveform creator
- **D** run DOS command
- **E** save audio waveform
- **F** **fx-mod** load (special effect)
- **K** **kill dragon** & **setup**
- **L** load preset
- **N** **intervals per octave** & **tuning**
- **O** **frequency offset**
- **P** load preset master
- **Q** load quickwave waveform
- **R** save preset master
- **S** save preset
- **T** **touch sensitivity**
- **V** load vibrato waveform also set vibrato rate/depth
- **W** load audio waveform
- **X** **quickwave** waveform creator
- **Z** **metronome**

alphaPlus Quick-Reference Chart



Live mode



Apple keyboard entries

	P	F	A	D	R
	Percussion Rate 0…255	Fall Rate 0…255	Attack Rate 0…255	Decay Rate 0…255	Release Rate 0…255
V	Percussion Volume 0…255	Fall Volume 0…255	Attack Volume 0…255	Sustain Volume 0…255	Release Volume 0…255
C	Percussion Control 0 1 2 3 per ch off on off on touch off off on on	Frequency Control C=6, 30, 54, 78 when A=440 with 12 steps/octave	Attack Control 0 1 off on (AR/DR repeat)	Instrument name	
	PaDdleØ 0…255	PaDdle1 0…255	quickwave channel indicator	INS. # (preset number) 0…9	echo flag

(see also <CTRL> V)

screen text window

update vi**B**rato rate/depth

change **I**nstrument

J,K quickwave cursor

/ quickwave Pri or Perc

? list catalog

→increase / ←decrease — value or playback speed

Record/Playback menu

<SPACEBAR>, then:

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A	**album** load-&-play (abort: **esc)**
O	**off:** exit record or play
B	go to **beginning** in **P** or **R**
E	**echo:** repeat playback
F	**fx-mod** load (special effect)
L	**load** a performance
S	**save** a performance
Q	**quit** alphaPlus
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<RETURN>	**exit** to live mode

<CTRL> **key** functions

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A	**exponential** or **linear** envelopes
C	**wave** waveform creator
D	run DOS command
E	save audio waveform
F	**fx-mod** load (special effect)
K	**kill dragon** & **setup**
L	load preset
N	**intervals per octave** & **tuning**
O	**frequency offset**
P	load preset master
Q	load quickwave waveform
R	save preset master
S	save preset
T	**touch sensitivity**
V	load vibrato waveform also set vibrato rate/depth
W	load audio waveform
X	**quickwave** waveform creator
Z	**metronome**

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METATRAK™

A multi-track recording system
for the alphaSyntauri digital synthesizer.

Syntauri

M E T A T R A K   M A N U A L

********ERRATA SHEET*********

PLEASE NOTE THE FOLLOWING CORRECTIONS:

LOCATION	CORRECTION
Page 6	(Oscillator Offset) 32th tone should be 32nd tone.
Page 33	(CTRL-O) same as above
Page 35	(STEP 5) After the recording is loaded from disk the track master will appear on the screen; type consecutive "RETURNS" until your hear the recording playback.
Page 35	APPENDIX C should be APPENDIX D
Page 36	APPENDIX C should be APPENDIX E

M E T A T R A K   M A N U A L

*********ERRATA SHEET***********

METATRAK^{tm}

Users Manual

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Metatrak basic code was compiled using the "Integer Basic Compiler" by Synergistics Software, Renton, Washington.

METATRAK™ TABLE OF CONTENTS

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I. METATRAK OVERVIEW

A. General Description

Metatrak is one of the most valuable compositional tools a musician can use: a synthesizer-based multi-track recorder. Metatrak allows you to orchestrate a composition by simultaneously recording numerous performances varying in instrumentation. The end result is a quick and cost effective recording that can be used for compositional arranging, recording studio preparation, background to live performance, or simply for listening pleasure at a later time.

A software upgrade product for the alphaSyntauri™ digital synthesizer, Metatrak offers a number of features specially geared towards live performance and recording situations:

* A 16 track synthesizer recording system
* Conventional recording controls: record, play, erase, fast forward, punch-in/punch-out
* Independent track control over instrument, vibrato state, and volume
* Special record modes for sequencing and playback speed adjustment
* A built-in metronome/click track
* Split keyboard capability from one to eight splits
* Compatibility with alphaPlus™ preset masters (instrument banks)

B. How to use this Manual

This manual describes the proper operation of the Metatrak operating system software. It is divided into nine main sections covering all aspects of the Metatrak system. In addition, the appendix offers additional information which you will find useful. These sections are all referenced in the Table of Contents.

C. Metatrak and alphaPlus

Although not mandatory, you should first get familiar with the alphaPlus operating system before going on to Metatrak. This is important, for much of the fundamental operation is similar and most instruments used in Metatrak are defined in alphaPlus. In fact, the two software packages should be used in conjunction. Think of alphaPlus as your instrument development software and Metatrak as your advanced performance and recording software. The combination of the two make the alphaSyntauri system a powerful general purpose synthesizer

II. GETTING STARTED

A. Set-Up

Metatrak software must be used with the alphaSyntauri synthesizer system (see Figure 1). The system configuration for Metatrak includes the following components:

* Metatrak (V1.0) operating system software on floppy diskette
* AlphaSyntauri interface card, cable and five octave keyboard
* Mountain Hardware MusicSystem^{tm} cards
* Apple II^{tm} or Apple II Plus 48K RAM computer with 16K RAM card (not ROM card)
* Disk II disk drive and controller card
* Video monitor (or TV with RF MOD)
* Analog control paddles
* Audio system or headphones

In addition to the above list, the alphaPlus software and any diskettes containing preset masters will be useful if instrument sounds are to be modified. Also, have an extra diskette handy for storing recordings (see Appendix A for instructions on initializing a new disk). Before using Metatrak be sure to MAKE A BACK-UP COPY of the Metatrak diskette (see Appendix A for instructions on copying diskettes).

Figure 1: The alphaSyntauri Synthesizer System

II. Getting Started

To begin, follow the set-up procedure for the alphaSyntauri system as explained in the alphaSyntauri users manual. Once correctly set-up, insert the Metatrak software diskette into the disk drive and turn on the power switch of the Apple. This will "boot-up" the Metatrak software. Make sure your audio system volume is down until the boot-up is completed.

During boot-up a Metatrak set-up display will appear showing default conditions for initial preset master, master volume and card slot positions (see Figure 2). Make sure that these conditions correspond to the way your alphaSyntauri is set up; specifically, the slot numbers of the Syntauri interface card (set for slot 2), and Mountain Hardware MusicSystem cards (set for slot 4 and 5; make sure the card with the audio cables is on the left side). If your configuration varies from this, make the appropriate changes as asked below the set-up display. Note, once properly configured, the set-up program can be bypassed for future boot-up (see Appendix B).

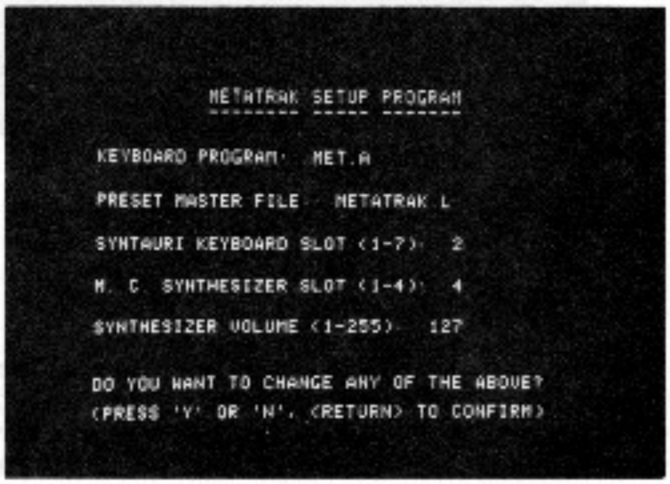

Figure 2: Set-up Screen Display

B. The Screen Display (Live Mode)

Once the Metatrak diskette has completed boot-up, the "live" mode screen display will be seen as shown in Figure 3. Playing any notes on the keyboard will cause a response both audibly and visually.

The upper portion of the screen dynamically displays each note played with a rectangular bar. The bars are arranged horizontally in octaves of C. Besides having a hypnotic effect, the display is useful for analyzing keyboard technique. It also helps keep track of the total number of simultaneous notes while recording (this is covered in more detail in the recording sections of this manual).

On the lower portion of the screen are various parameters for Metatrak live mode, including: current instrument name, split instrument status, vibrato and master volume controls. (Detailed usage of these parameters will be covered in their applicable sections).

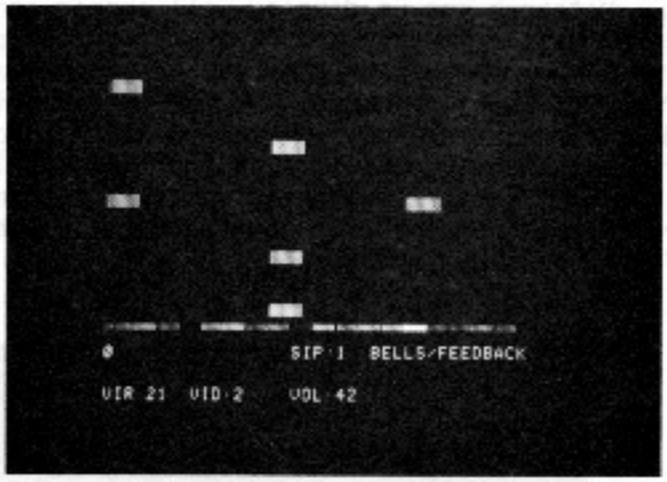

Figure 3: Metatrak "Live Mode" Screen Display

C. Instrument Selection (0-9,U)

Any one of the ten instruments in the current "preset master" can be selected as with alphaPlus. Type any number between 0 and 9 on the Apple to change the entire keyboard to a new instrument. In Metatrak, instruments can be changed instantly whereas it takes approximately one second with alphaPlus.

By typing the "U" key, the name of the instrument will be updated on the screen. Besides the instrument name the "U" key updates other parameters on the screen which are covered further in this manual.

D. Loading A Preset Master (CTRL-P,?)

As referred to earlier, a preset master is a bank of ten instruments that can created using the alphaPlus software. In Metatrak, one preset master can be resident at a time. A new preset master can be loaded by holding down the "CTRL" key while typing "P". Doing this will cause a prompt to appear asking for the name of the preset master that is to be loaded from disk:

"LOAD PRESET MASTER:"

Enter the preset master name followed by "RETURN". Loading a preset master that was created with software previous to alphaPlus (V2.0) will cause an error stating "LFO MASTER NOT FOUND". This will not prevent the preset master from being loaded. (See Appendix E for more information on this subject.)

To examine the contents of a diskette for loading a preset master, type "?" any time during live mode or at the first letter of a preset master load. The actual preset master name on the diskette will be preceded by "PRESET MASTER:". Included on the Metatrak diskette are two preset masters named; METATRAK.L and ALPHA PLUS. As specified in the set-up program, METATRAK.L is automatically loaded from boot-up.

E. Commands and Files

Similar to using the CTRL-P "command", to load a preset master "file", there are many other commands and files used throughout Metatrak. A list describing all Metatrak commands is provided in Appendix B, and file type descriptions are covered in Appendix C. Reviewing both these sections will help to give you a general perspective of the Metatrak software and serve as a quick reference guide once you understand its operation. More detailed descriptions of Metatrak commands and file types are covered in applicable sections of this manual.

F. Demonstration Recording

A Metatrak demonstration recording is provided on your Metatrak diskette. Listening to it will give you an idea of the capabilities and potential Metatrak offers. To hear the demonstration recording, follow the step by step instructions in Appendix D. After you are through listening, resume reading the manual to learn how to properly use Metatrak for your own recordings.

III. PARAMETER CONTROL

Although actual sound development of an instrument is done using alphaPlus, Metatrak provides control over many parameters specifically needed in a performance or recording situation.

A. Envelopes (E,L)

As in alphaPlus there are two types of envelopes, linear and exponential. Exponential envelopes tend to be more effective when defining keyboard instruments, whereas linear has a smoother attack that works best for orchestral instrument sounds. Selection of either type should be done when defining the original sound in alphaPlus.

By default, an entire preset master will be set to exponential unless the preset master name has a ".L" in it. For example, a preset master called "STRINGS.L" will automatically select linear envelopes immediately after loading.

Envelope type can also be changed by typing "E" for exponential envelopes or "L" for linear while in live mode. In doing this the master volume will be adjusted to compensate for the apparent difference between the two envelope types.

B. Master Volume <- ->

Master volume of all instruments can be dynamically controlled using the left and right arrow keys on the Apple keyboard. Typing the "<-" key lowers system volume by 5. Typing the "->" key raises system volume by 5. The range of the master volume is from 0 to 255.

The master volume is shown on the screen display when in live mode by "VOL". The current volume, as adjusted by the arrow keys, can be updated on the screen by typing "U" for update. The value upon boot-up will be whatever the master volume is set at in the set-up procedure. The standard setting is 127 for exponential envelopes which automatically adjusts to 42 for linear.

C. Oscillator Offset (CTRL-O)

Each instrument uses two oscillators, one for the primary channel and one for the percussion channel. In Metatrak, the frequency offset between the channels of each instrument can be set by holding down the "CTRL" key and typing the "O" key. The following prompt should appear:

"SET OFFSET: 2"

The current offset for the instrument will be shown. A new offset is selected by entering a number between 0 and 255. If the offset is not to be changed simply type "RETURN". The offset value corresponds to 32th tone increments applied to the percussion channel. A value of zero will give no offset. By slightly offsetting the frequency with a value of 1 or 2, the sound will usually become much richer and full. In some cases setting the offset for tonic intervals such as a fourth (80), or fifth (112), can be effective making each note sound like a chord. A value of 192 causes an octave of offset.

Even though offset can be set in Metatrak, the actual change cannot be saved. This must be done by defining and saving the preset master in alphaPlus (V2.0).

D. Vibrato (O,V,CTRL-V)

Vibrato rate, "VIR", and vibrato depth, "VID", are shown on the screen while in live mode. By typing "U", the current instrument vibrato rate and depth will be updated on the screen. To instantly turn off the vibrato, type the "O" key. Re-typing the instrument number will reinstate the instrument's vibrato.

Although each instrument in live mode has its own individual vibrato rate and depth settings, only one vibrato (frequency LFO) exists in the operating system. Thus, when using multiple instruments as with Metatrak recording or with split keyboard, the current vibrato setting displayed is shared by all.

Vibrato rates or depths can be modified. One method of doing this is by adjusting the analog control paddles and sampling their position by typing "V". Another way is by first holding down the "CTRL" key then typing "V". This will cause the following sequence of prompts to appear:

"LOAD VIBRATO WAVE: SINE"

Here, the vibrato modulation waveform may be changed to a new waveform called from the diskette. To leave as is type "RETURN". The next prompt will be:

"VIBRATO RATE: 21"

The current vibrato rate will be shown. To change, type in the new value followed by "RETURN". If no change is to occur simply type "RETURN". The last prompt displayed is:

"VIBRATO DEPTH: 3"

Changing depth is handled as with vibrato rate. Again, typing "RETURN" will cause the displayed value to be used. After this sequence, the system will return to live mode. The new vibrato values selected will replace the current instrument's vibrato values. Note, like offset, vibrato settings will not be permanent unless the preset master is defined and saved using alphaPlus.

E. Pitch-Bend (CTRL-B)

Metatrak has a built-in pitch-bend control as opposed to being implemented in an FX mod as with alphaPlus. The pitch-bend feature can be accessed by holding down the "CTRL" key while typing "B". Doing this will allow pitch control through the analog control paddle 0. When pitch-bend is selected a "PB" will appear on the screen to the right of "VOL".

Pitch-bend is normally used by controlling the paddle with one hand using your thumb, while playing the keyboard with the other. Pitch-bend is only applied to the live keyboard instrument and it cannot be recorded. To turn pitch-bend off type "CTRL" "B" again.

F. Fine Tuning

The alphaSyntauri keyboard in Metatrak is tuned to A=440HZ in an equal tempered scale. If it's necessary to change the fine tuning, the alphaSyntauri tuning can be modified with the "scale update program".

To use the scale update program, quit Metatrak by pressing the spacebar from live mode, then type "Q" followed by "RETURN". By doing this the basic prompt "]" should appear. Make sure the Metatrak diskette is in the disk drive, then type "RUN SCALE UPDATE" followed by "RETURN".

After the program is loaded from disk, a prompt will appear on the screen specifying the current frequency of A above middle C. To change the value enter the new frequency in HZ followed by "RETURN". Note: for reference, when A=440HZ, A flat=415HZ and B flat=466HZ.

After selecting the frequency, a prompt will appear for specifying intervals per octave. Standard equal tempered scale is twelve intervals per octave. In Metatrak, any value from one to fifteen intervals per octave can be selected. If this is not to be changed, simply type "RETURN". The scale update program will then load and run Metatrak again.

Note that pitch-bend can also be used as a fast, though temporary, method of tuning to raise the pitch in 32nd tones. Pitch-bend, however, will only affect the live keyboard; tuning of recordings will stay as specified in the scale update program.

Coarse tuning for transposition of key or octaves can be controlled within the instrument definition by using alpha plus.

G. FX Mods (CTRL-F)

The Metatrak software has a special feature that allows "FX mods" to be loaded off diskette and into the main program loop. FX mods are small assembly language programs that serve specific functions for sound modification.

There are several FX mods available on the Metatrak diskette for immediate use. The FX mods included are individually described in Appendix F. Future software releases from Syntauri will include additional FX mods for Metatrak.
An FX mod can be loaded by holding down the "CTRL" key while typing "F". A prompt will appear:

```
"MFX MODE
 L)OAD, S)AVE OR O)FF:"
```

By typing "L" the following prompt will appear:

"LOAD MFX MOD:"

Type the name of the FX mod desired followed by "RETURN". (Note: the "M" in MFX is to distinguish a Metatrak FX mod from an alphaPlus FX mod. The two file formats are different and cannot be mutually used.) After the FX mod is loaded another prompt will appear:

"LOWEST TRACK:"

Enter the lowest track number, (0-16) followed by "RETURN", that is to use the FX mod. By simply typing "RETURN", the track assignment will default to the track number already in the FX mod. (To fully understand the implications of this prompt, you must become familiar with the track master, explained in section V. Not all FX mods can be assigned to a track region, see Appendix F.) A final prompt in this sequence will then appear:

"HIGHEST TRACK:"

Similar to the preceding prompt, enter the highest track number, (0-16) followed by "RETURN", that is to use the FX mod. The combination of these specifications sets up a region of tracks that use the FX mod. Those tracks outside of the region are left in their normal state. After this the system will return to live mode.

Control of Fx mods varies, some may be fixed, others allow their parameters to be modified through the analog control paddles. Once a modifiable FX mod is set to your liking, its state can be saved along with the track region assinged to it. To do this hold down the "CTRL" key while typing "F", as explained earlier for loading an FX mod. This time, however, type "S" for save FX mod. The following prompt will appear:

"SAVE MFX MOD:"

By typing a new name for the FX mod, followed by "RETURN", the current state of the FX mod will be saved to disk for later use.

To turn off any FX mod hold down "CTRL" and type "F" again, then type "O" followed by "RETURN". After turning the FX mod off the system will go back to live mode.

IV. THE SPLIT KEYBOARD FEATURE

Metatrak has a powerful split keyboard capability that allows the alphaSyntauri keyboard to be sectioned with a different instrument assigned to each. Up to eight sections can be defined.

The split keyboard feature is very effective for a live performance. For example, the lower two octaves might be set for bass guitar while the upper octaves could be set for strings. Using the split in conjunction with recording makes it possible to record then play back a repeating background line while playing a few different instruments live in split mode on the keyboard.

The following sections provide information on defining a split, changing instruments in a split, and saving or loading a split master via disk.

A. Split Keyboard Parameters

Looking at the video display while in the live mode you will see various parameters on the lower portion of the screen (see Figure 4). Those specifically associated with split keyboard are in the top line. The parameters are defined as follows:

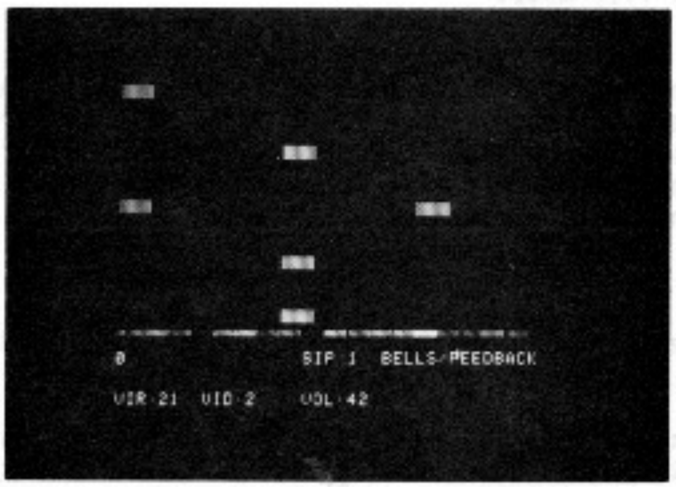

Figure 4: Live Mode (without keyboard split)

"0"

Shows that the only instrument in use is instrument number 0. Since only one number is displayed the keyboard isn't split. When two numbers are displayed there are two instruments in split mode at the keyboard, and so on up to eight numbers and eight splits.

"SIP: 1"

Shows that the "Split Instrument Pointer" is set to 1. Since only one instrument is currently defined, a numeric key (between 0 and 9) struck on the Apple will change the instrument for the entire alpha keyboard. Please remember that you must type "U" to update the video screen display when you change instruments.

"BELLS/FEEDBACK"

Shows the name of the current instrument being pointed at by SIP. As previously mentioned "U" must be typed to update the screen for current status.

B. Defining A Split (CTRL-S)

Defining a split keyboard can be accomplished by holding down "CTRL" while typing "S". The following prompt will appear:

"SPLIT MASTER MODE
(L)OAD, (S)AVE OR (D)EFINE   WHICH:"

To define a split type "D" followed by "RETURN". Next, a prompt will appear that asks to specify the number of splits to be used:

"NUMBER OF SPLIT INS. (MAX=8)"

For demonstration purposes, type "2". The next prompt will ask you to set the position of the split on the keyboard:

"HIT KEY FOR SPLIT POINT #1"

You can now set a split point by pressing the key on the alphaSyntauri keyboard where you want the split. Again, for demonstration purposes press a key somewhere in the middle of the keyboard. Immediately after this is done a list of all the instruments in the preset master will be displayed on the screen (see Figure 5). Below the list a prompt will ask you to assign an instrument number to a split position:

"ENTER SPLIT INSTR. #1"

Typing an instrument number will assign the corresponding instrument to the left most split. For example, type 7. The prompt will then update for assigning the next split instrument; type 5. After instrument selection the alphaSyntauri will be back in live mode. By playing the keyboard you will hear the two instruments divided by the split. Looking at the screen (Figure 6) you should also notice changes in the split keyboard parameters.

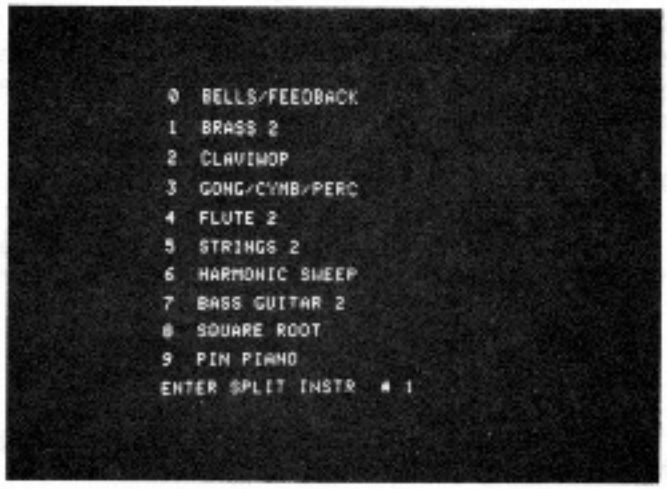

Figure 5: Preset Master list for assigning instruments to splits

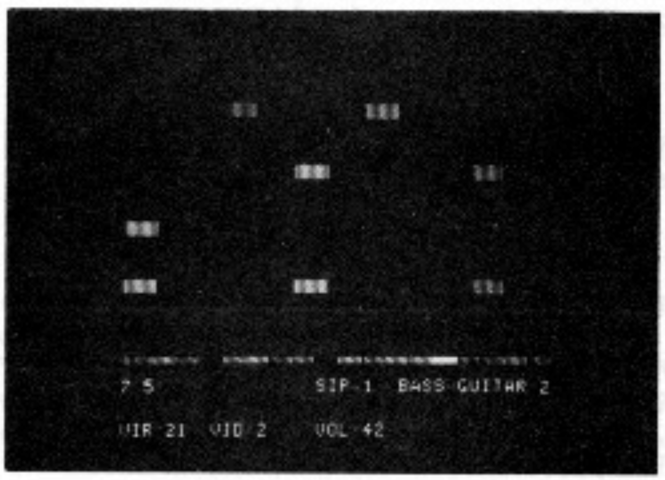

Figure 6: Live Mode with a split of two instruments

"7 5"

Shows there are two instruments on the alphaSyntauri keyboard. Instrument #7 is on the lower portion and instrument #5 on the upper portion.

"SIP: 1"

Shows that the split instrument pointer is now set for controlling the lower split instrument. Typing a key between 0-9, will change the lower instrument.

"BASS GUITAR 2"

This shows the current instrument name of the split pointed at by SIP.

The preceding was a basic run through of defining a split keyboard. As you can see it is very straight forward and the more practice you get the simpler it will become. Try setting up all eight splits with instruments 0-7! To reset the keyboard back to one split, define a split of one and hit the uppermost key for the split position.

C. Changing Instruments (J,K,0-9,U)

Once a split is defined, it is possible to change the instruments associated with a split while in live mode. This is done by controlling the SIP. The number specified by SIP is the number of the split that can currently have its instrument changed. For example, if SIP=2 and there were four splits, then the second from the left split can have its instrument changed by typing a number (0-9).

To control SIP the "J" and "K" keys on the Apple are used. Typing "K" increments SIP by one. Typing "J" decrements SIP by one. (Notice that it isn't necessary to type "U" to show the current state of SIP.)

With a keyboard split of two, typing "K" will allow the upper split to be controlled, typing "J" will allow the lower to be controlled. If the instrument or SIP is changed, the correct instrument name will only be displayed by typing "U".

D. Saving or Loading a Split Master (CTRL-S,?)

Because some split keyboard definitions can become quite complex, Metatrak provides the capability for saving and loading a split master. The split master contains all the specifications for a given split keyboard definition.

To save a split master to disk, hold down the "CTRL" key while typing "S". When the prompt appears for load, save or define, type "S" for save. Next a prompt will appear:

"SAVE SPLIT MASTER:"

Type the name for the current split followed by "RETURN". Associating the split master name with the musical piece and preset master it is used with, will serve as a reminder for later use. After the split master is saved to disk, live mode will be reinstated.

Loading a split master is handled in the same fashion. When selecting the split mode type "L" for load. The following prompt will appear:

"LOAD SPLIT MASTER:"

Enter the name of the split to be loaded from disk followed by "RETURN". Remember, typing a "?" while in live mode or before entering a file name for load or save, will display the contents of the diskette.

V. THE RECORDING PROCESS: BACKGROUND INFORMATION

A powerful compositional tool, the Metatrak record feature additively combines multiple recorded performances for simultaneous playback. Take for example, the creation of a composition consisting of three different instrument parts; bass guitar, electric piano and flute. Using Metatrak the bass guitar could be recorded first. Once completed, the recording is played back and listened to while simultaneously recording the electric piano. Similarly, the flute can be added while listening to the two earlier recorded parts. The result is a quick and cost effective recording which may be used for compositional arranging, recording studio preperation, background to live performance, or simply for listening pleasure at a later time.

The process of recording with Metatrak is broken down into three catagories:

* Standard Recording - Used to lay down the first track.

* Metatrak Recording - Used for adding subsequent track recordings while listening to earlier ones playback.

* Mix-Down/Playback - Used for the final review and adjustment of all track parameters.

Compared with tape based multi-track recording techniques, this process is respectively analogous to "record only", "sync" and "playback only" modes.

The following sections cover these three categories and how they work in conjunction with the "track master". In addition, a comparison with tape based multi-track recording is made and other important aspects of Metatrak are discussed. For a demonstration of a Metatrak recording, see to Appendix D.

A. Tape Based Multi-track Versus Metatrak

With Metatrak, each recording is associated with an individual track number of which there are sixteen available. The term track comes from conventional tape based multi-track recording where record/playback control over each track is accomplished by electromagnetically dividing the tape into multiple parallel sections. Each section has its own erase, record and playback heads.

Multi-track recorders started making their appearance in the late 1960s when half track (stereo) and quarter track (4 track) were commonly used. Now it is common place for recording studios to have a number of multi-track recording systems consisting of 2, 4, 8, 16 or 24 tracks.

There are similarities and differences between a tape-based multi-track recorder and Metatrak. Both methods of recording have their particular advantages but should not be confused as being the same. Similarities are the provision of standard multi-track recording features such as: record, playback, erase, fast forward, punch in/punch out, click track and track parameter control.

A major difference between the two methods, however, is that a tape based recording system is capable of recording virtually any audio sound, including various acoustic instruments and vocals. Metatrak exclusively records sounds played on the alphaSyntauri keyboard. Because the alphaSyntauri implements recording digitally, it provides features and capabilities not possible on conventional tape based systems. Such features and capabilities include: changing instrumentation of an already recorded piece, playback speed adjustment without pitch change, and special sequence recording modes. Combining standard multi-track capabilities with special recording features, Metatrak proves an effective compositional tool.

B. The Track Master (CTRL-R)

Before starting to record, you should understand the concept and use of the track master. As compared to a tape based multi-track recorder, the track master acts as the control console and interconnection to the instrument being recorded. It provides all the information for assigning an instrument and controlling parameters of a given track. Its specific use and access depends on what function is being implemented, whether it be standard recording, Metatrak recording or mix-down/playback.

The track master can be accessed for viewing in live mode, by holding down the "CTRL" key while typing "R". In doing this a track master display will appear on the screen looking similar to figure 7. Looking at the display you can see that each of the sixteen tracks, plus the live keyboard (track 0) are listed vertically at the left side of the screen. Each track has associated with it a "field" for instrument number, instrument name, record status, vibrato status and volume. Below the track master display is the prompt:

"CHANGE VALUES FOR TRACK NUMBER:"

This allows you to change the track master. For now, though, let's just review the functions of the track master (detailed explanations are covered later).

Figure 7: The Track Master

Instrument Number and Name

The instrument field of the track master (as shown in figure 7), defines which of the ten instruments of the current preset master is assigned to a track. The assignment is controlled by the instrument number. Each track doesn't have to be different. A single instrument can be assigned to more than one track. Note that the instrumentation specified by the track master is dependent on the current preset master. Thus, to achieve the original orchestration in later playbacks, the preset master and track master used in the recording must be loaded. Loading and saving a track master is covered further in this section.

Record Status (RSTAT)

The "RSTAT" field in the track master specifies the current mode of operation for a given track: playback, record or erase. When accessed in live mode or during playback, "RSTAT" for all tracks will be set to "PLA" for playback. In standard recording the "RSTAT" field may also specify "REC". In Metatrak recording all modes are possible: "PLA", "REC" and "ERA" (for erase). Only one track can be set to "REC" at a given time.

Vibrato Status (VSTAT)

A vibrato status field, "VSTAT", is provided for turning vibrato on or off for each track in each. Although each instrument in live mode has its own individual vibrato setting, only one vibrato (frequency LFO) exists in the operating system. Thus, when using multiple instruments, as in Metatrak, the vibrato setting is that of the current keyboard (track 0) instrument. Using "VSTAT" the global vibrato can be selectively applied. When "VSTAT" is set to 1, vibrato is applied. When set to 0, it is off.

Volume (VOL)

The last parameter field in the track master is volume, "VOL". The "VOL" setting is used especially in mix-down/playback to bring out or subdue specific instruments relative to one another. The volume range is from 0 (off) to 255 (full on). Unlike the master volume which is absolute and completely linear. The "VOL" setting is actually a limit for the maximum volume of an instruments amplitude envelopes. It has a similar effect to lowering or raising the PV, AV and SV envelope parameters in alphaPlus.

Two things should be kept in mind when using "VOL". First, being a limit control rather than absolute volume, "VOL" will only affect volume if set below the envelope volumes as defined with alphaPlus. If set above, the instrument will stay as it was originally defined. Second, the overall adjusting effect will be different with linear envelopes as opposed to exponential. If linear envelopes are used "VOL" will respond in a linear fashion. If exponential envelopes are used, "VOL" responds exponentially.

C. Saving or Loading a Track Master (CTRL-T,?)

The track master is an integral part in the recording and playback process. Because it will vary from recording to recording, a provision is made for saving and loading a track master via disk. With this capability a complete multi-track recording can be worked on and then saved with all the track master settings accessible at a later time. Saving or loading a track master is done in live mode by holding down "CTRL" and typing "T". A prompt will appear:

"TRACK MASTER MODE
L)OAD OR S)AVE   WHICH:"

Typing "L" followed by "RETURN" will select the loading of a track master from disk. Typing "S" followed by "RETURN" will select the saving of the current track master to disk. Once either is selected a prompt for typing the track name will appear. Enter the appropriate name followed by "RETURN". After the disk is accessed, live mode will be reinstated.

As mentioned earlier, typing "?", in live mode or at the first letter position of a file load or save, displays diskette contents. This allows viewing for track master file names which are preceded by, "TRACK MASTER:".

D. Oscillators, Instruments, Voices and Tracks

Understanding the relation between oscillators, instruments, voices and tracks, will help you in preparation and creation of a good Metatrak recording. These four entities can easily be confused at first; however, each one serves an individual function. The following is a brief description of each:

Oscillators

Digital oscillators are the waveform sound source for the alphaSyntauri synthesizer. There are a total of sixteen available for use.

Instruments

Instruments are preset sounds defined using the alphaPlus software. Each has information for controlling two oscillators per voice. Instruments are loaded into Metatrak as a preset master, a bank of ten instruments.

Voices

A voice is a single active instrument sound. Each new note played activates a voice. Since, each instrument definition controls two oscillators, each voice uses two oscillators. Having sixteen oscillators available, up to a total of eight voices can be active simultaneously.

Tracks

A track is the means for associating notes being recorded with a specific instrument. There are sixteen tracks available for recording, (not to be confused with sixteen oscillators). Any track can have any instrument in the preset master assigned to it.

To summarize the above descriptions in reference to Metatrak: You have sixteen tracks available for recording. Each track can have any of ten instruments in the preset master assigned to it. Up to eight voices can occur simultaneously among all the tracks.

Considering the fact that only eight voices are available, you might wonder, "Why have sixteen tracks?" The voice limitation is eight "simultaneous" voices. This does not mean only eight instruments can be used throughout a piece. Thus, it is possible to have various instruments with different track settings, (volume, vibrato, FX mods), occurring at different places within a Metatrak recording as long as no more than eight occur simultaneously. If eight voices are exceeded, the voice with the lowest volume will be removed. The live screen display can prove useful for seeing how many voices are active at a given time.

Selecting instruments can play a very important part in the final outcome of a Metatrak recording. There are a number of preset masters available within the alphaSyntauri synthesizer software library. These preset masters may serve your initial recording needs, or you may choose to create instruments yourself using alphaPlus. Besides considering general orchestration among tracks, certain defined characteristics of an instrument will have an effect on the recording. This is especially the case with envelope parameters.

If an instrument's envelope has a long release time (the note sustains after releasing a key), it is easy to use many voices in a short period of time. Consider the situation of playing one note at a time quickly up the keyboard. If the release time was lengthy, all of the eight possible simultaneous voices could be used, even though only one key was struck at a time. This occurs because an oscillator pair will stay assigned to each sustaining voice.

To maximize the number of voices available at a given time, it is best to use shorter envelope release times. Doing so will prevent clipping of notes (turning off an active voice for a new one), in case the maximum number of simultaneous voices is exceeded. If a particular instrument needs a long release time at a certain point within a recording, use the sustain pedal to accomplish this so it can be turned on or off as needed.

E. The Metronome/Click-Track (CTRL-Z)

Since Metatrak recording is an accumulative process of recording a new track while listening to previous ones, the most important recording is the first. This is especially the case for timing. To assist in recording a good first track, in perfect timing, Metatrak provides a "metronome/click-track".

The metronome/click-track is a visual and audible assistant used while playing music at a specific tempo. Although its primary function is assisting in recording a first track, it also can be used as a timing marker for subsequent tracks, or just for practice in live mode.

The metronome/click-track can be accessed from live mode by holding down "CTRL" and typing "Z". In doing this, a prompt will appear asking to set the tempo at a value of 0 to 280 beats/minute.

"SET METRONOME TEMPO (0-280):"

To set a tempo, type in the desired value followed by "RETURN". A value of "0" turns the metronome/click-track off. After set, the system will return to live mode with both visual and audio feedback.

For visual indication a rectangular block alternating from one side of the screen to the other will appear. Simultaneously, an audible click will be heard coming from the speaker inside the Apple. In addition, the metronome/click-track signal is sent to the cassette output connector on the back of the Apple. This allows for further audio amplification by connecting a cable from the output to your audio system.

Note the metronome/click-track should not be used with the "echo/repeat" feature in Metatrak record mode (see section VII, echo/repeat feature).

VI. STANDARD RECORDING MODE

Standard recording in Metatrak is used for recording the first track of a multitrack piece, or simply for laying down a single track. It is very similar to recording in the alphaPlus operating system software using the record/playback menu to control the recording process. A major difference, though, is in the assignment and control of one of sixteen tracks for recording. As mentioned earlier, this function is accomplished through the track master.

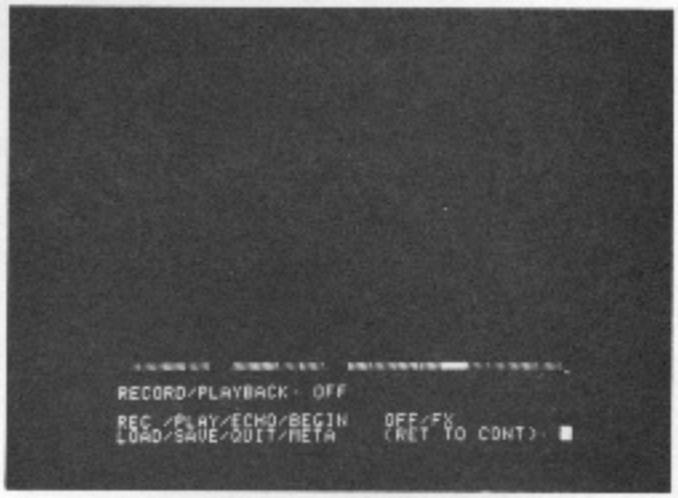

Figure 8, The Record/Playback Menu

A. The Track Master In Standard Recording

The track master is accessed in standard recording in-line with the recording process. To start a recording, the record/playback menu must be called by pressing the space bar in live mode (see figure 8). To select standard recording type "R" followed by "RETURN". At this time the track master display will appear on the screen.

At any given time only one track can be in record mode. The track showing "REC" in its "RSTAT" field, is the current recording track. All other tracks are set to playback, "PLA", even though they are not in use. Below the track master display is the prompt:

"CHANGE VALUES FOR TRACK NUMBER:"

If the current state of the track master is acceptable, simply hit "RETURN" to continue into the recording process. If you wish to change the assinged instrument, record status, vibrato status or volume of a track, type the number of the track you wish to change followed by "RETURN". Although not mandatory,for organization sake, it is usually best to use track number "1" for your first recording.

After responding to the prompt with a track number, a cursor will appear at the instrument number of the track. To change the instrument, type the new instrument number followed by "RETURN". Notice this will also update the instrument name. If the instrument is not to be changed, hit "RETURN" to step to the next field.

The next field encountered is "RSTAT" (record status). If you wish to use this track for your first recording and "RSTAT" is already in record, simply hit "RETURN". If not, type "R" and the status will update to record mode, "REC".

Hitting "RETURN" will move the cursor to "VSTAT" (vibrato status). Vibrato status is a switch that can restrict or apply vibrato to a track. To change, enter the desired value (1=on, 0=off), followed by "RETURN". Again, if no change is required, hit "RETURN".

The last field is "VOL" (track volume). To change, enter the desired value (0-255) followed by "RETURN", or just hit "RETURN" to leave as is. At this point the following prompt will appear again:

"CHANGE VALUES FOR TRACK NUMBER:"

If the track master is set up correctly, hit "RETURN". If not, follow through as explained previously.

B. Recording The First Track

Once the track master has been set for recording your first track, the record/playback menu will again be displayed. From this point on the general recording techniques of alphaPlus are applicable. Hitting "RETURN" will put the system in live mode with the instrument name in reverse video (signifing record), and the track number being recorded displayed by "REC:" The actual recording will not start until a key or pedal is depressed. (Note: The sustain and portamento pedals are also recorded). At this time the metronome/click track, "CTRL-Z", can be set if desired (see section V for more information on the metronome/click track)

As explained in section V, the metronome/click track can be used for keeping tempo or to serve as a guide for future tracks. Although the metronome/click track will serve most purposes, at times you may also want to use the first track as a "click track recording". Its primary purpose is to serve as a guide for later tracks. A click track recording will usually last the entire duration of the recording and sometimes use many voices. Once all other tracks are added, the original click track can be erased. If you choose to approach recordings in this fashion, the instrument used should be defined in alphaPlus with envelope peak and sustain values that are relatively low compared to the other instruments. This way, even if too many voices are played the click track recording will disappear first.

It is important to remember when laying down your first track not to use too many voices. That is, playing many notes simultaneously. A maximum of eight notes (voices) can be active at a given time for all track recordings. Being conservative will free up voices for later tracks. Effective use of voices is covered in section IX.

Another type of first track recording is the "dummy track". A dummy track is basically recorded time elapsing, without keyboard input. It can be used when you are not interested in following a first track recording while adding subsequent tracks. An example of this might be a composition that changes instrumentation sequentially from beginning to end. To record a dummy first track, simply press one of the footpedals down and up once, then let the system record time for as long as the expected duration of the piece. For example, if the length of the total piece was around five minutes, record the dummy track for five minutes then terminate the recording and save it to disk.

To terminate any type of recording press the SPACEBAR. If you are satisfied with the recording for your first track, save it to diskette from the record/playback menu by typing "S" followed by "RETURN". A prompt will appear:

"RECORDING COMPLETE:"
NAME TO SAVE:

Type the name you wish to give the recording (not to exceed fourteen characters), followed by "RETURN".

If you wish not to save the recording, but rather start over, reset the record buffer to the beginning by typing "B" followed by "RETURN" in the record/playback menu.

Other standard functions of the record/playback menu can also be useful in assistance to the recording process. Playback of the recording is accomplished by typing "P" followed by consecutive "RETURN"s until heard. The echo feature, "E" followed by "RETURN", will allow a sequence repeating of the recording after terminated by the spacebar. If a recording that was saved to disk needs to be reviewed, the load function can be selected by typing "L" followed by "RETURN".

C. Meta Files

The length of a recording is measured by the total number of notes recorded and stored in memory. This is specified in the record/playback menu whenever a recording is terminated. The maximum number of notes allowed in basic Metatrak is approximately 3000 notes (see Appendix E for recording errors and warnings). Future product releases from Syntauri will expand the number up to 20,000 notes. The length of a recording relative to time, will depend on how quickly or slowly the notes are played.

In Metatrak the actual recording saved or loaded from the disk is called a meta file. A meta file is not compatible with previous alphaSyntauri operating system recordings, called note files. Thus, recordings saved as note files cannot be loaded into Metatrak and vice versa. The primary difference between the two file types is that Metatrak stores track information in a command byte format. A note file does not contain any track information.

VII. METATRAK RECORDING MODE

As explained earlier, Metatrak recording is the process of recording new tracks while listening to previously recorded tracks in playback. Sixteen tracks are available for recording, using any of the ten instruments of the preset master. Metatrak also has special recording operations for sequencing and adjusting the speed of tracks in playback. Additionally, many common tape-based recorder controls such as; track erase, punch in/punch out, and fast forward, are included.

Entering the Metatrak record mode can be accomplished from the record/playback menu by typing "M" for Metatrak followed by "RETURN". A prompt will appear stating:

"LOAD META FILE:"

Type the name of the meta file to be worked with followed by "RETURN". The meta file can be a first track recording or a previously worked on Metatrak recording. As additional tracks are being added, the meta file loaded will be updated unless you change the name during the Metatrak process.

A. Using The Track Master In Metatrak Recording

Once the initial meta file is loaded the track master display will appear on the screen. Control of and access to the track master is handled as in standard record mode. The first step in Metatrak record mode is to select the next track for recording. If only one track, (a first track recording), was loaded chances are track 1 will be the track currently in record mode. As in the standard record mode, one track will always be set to record. To update the current record track follow through with the prompt sequence as with standard recording, section VI.

B. Recording Additional Tracks

Once the track master is set up as desired, actual Metatrak recording can begin. Two prompts will appear after leaving the track master display. The first one will state:

"ECHO/REPEAT (Y/N):"

This allows the echo/repeat feature to be used. The default for this feature is "NO". For now, simply hit "RETURN". The second prompt will appear:

"PLAYBACK SPEED (1-800%):100"

The default for this feature is normal speed (100%). For now, also hit "RETURN". Both these special features will be covered in more detail later.

At this point the system should be back in live mode, ready to record a new track while earlier recorded tracks are in playback. The instrument heard from the keyboard will be the instrument assigned to the current record track. The current record track number is indicated on the screen by "REC:". Whatever is played on the keyboard will be recorded in sync with the previous recordings. Note, the lower right side of the screen displays "METATRAK" as an indication of being in Metatrak record mode. At any time during recording "CTRL-R" can be used to change the track master or simply to pause (this will not effect the timing).

The recording can be terminated in two ways. The first is to let the previously recorded track complete playback. The second is to press the SPACEBAR at any given time during the process. Either method of termination will allow the option of saving what was recorded or disregarding it and starting over. The prompt that appears after pressing the SPACEBAR is:

"SAVE THIS TRACK (Y/N)?"

If "Y" is typed, the following prompt will appear:

"SAVE AS FILENAME:"

The name of the meta file loaded last will appear after the prompt. If you wish to keep the same name, simply type "RETURN". To change the name, type in a new name followed by "RETURN". IN EITHER CASE, THE newly recorded track combined with the earlier tracks will be saved to disk as a meta file. If the track is not to be saved, hit "RETURN". Either choice or originally typing "N" to "SAVE THIS TRACK" will encounter the prompt:

"Q)UIT OR M)ETA"

Now, if additional Metatrak recording is to be done, typing "RETURN" will reload the new accumulative recording from disk. This function is similar to rewind on a tape based recorder. The track display will then appear on the screen waiting for the next track to be selected for record or modification. To record additional tracks follow the same sequence as previously explained.

If no other tracks are to be added then typing "Q" for quit will route the system back to live mode. Before this happens though, the following prompt will appear:

"SAVE TRACK MASTER (Y/N)?"

Even though further mix-down work may be necessary, this prompt acts as a safeguard to save the current status of the track master. Typing "Y" followed by "RETURN" will allow saving the track master. Just typing "RETURN" moves the system on to live mode for mix-down of the Metatrak recording.

C. Erasing A Track

After recording several tracks you may decide to remove one completely from the accumulative recording. One quick way to accomplish a similar effect, is to zero out the volume parameter associated with the track. However, even though this removes the track's audio output, the track is still using up memory and occasionally using up oscillators that get assigned to it. If a track is no longer to be used, (as might be the case with a first "click" track recording), it is best to erase the track.

Considering how tape based recorders work, it would seem the simplest way to erase a track is to re-record on it without giving any input. With Metatrak, once a track is recorded, the recording stays even if you record over it again. The reason behind this, is to make sound on sound recording possible on each individual track. So, to provide for complete removal of a track's recording, Metatrak includes an erase mode.

Any number of tracks can be set into erase mode by typing "E" after stepping to the "RSTAT" field of a track in the track master. Once set, the status "ERA" will flash on and off as a reminder that it is in erase mode. The actual erase requires going completely through the piece in Metatrak record mode and saving the track after termination. The tracks will stay in erase until reset to either play or record status. Play status can be reinstated by typing "P" after stepping to the "RSTAT" field in the track master. Erase will not affect a section of a track recording that was scanned through using the "fast forward" feature.

D. Punch-In / Punch-Out (ESC)

Being human and not a computer, we all make mistakes. Typically in the process of recording, the worst mistakes are at the end of an otherwise pefectly performed track. This is a form of "red light fever" which can be terminal to a musician in an expensive recording studio with an impatient producer hanging over him. With Metatrak it's not so bad, for like a recording studio, you have "punch-in/punch-out".

Punch-in/punch-out is an edit facility that allows selective erasing of unwanted portions of a recording. At the same time the old section is being erased, a new attempt can be made at recording it properly. Punch-in/punch-out is possible only in the Metatrak record mode.

To use punch-in/punch-out, set "RSTAT" to "REC" for the track to be worked on, (remember that re-recording over a track does not automatically erase it, but sets it up for sound on sound). Follow through the track master and record sequence until back in live mode listening to playback. When the portion to be removed approaches, type the "ESC" key once to punch-in. This will start the erase of the track. At this time the correction can be made. Notice that when punch-in active, the track number specified by "REC:" on the screen, will flash. To stop the erase, punch-out by again typing the "ESC" key.

Punch-in/punch-out can be used as many times through a recording as needed. After reaching the end of the recording it must be saved as with any new track recording. If it is not saved, the corrections made using punch-in/punch-out will be lost.

E. Fast Forward (F)

To speed up the process of adding to or correcting a recording, Metatrak provides a fast forward control. To set playback tracks into fast forward, type the "F" key. Doing this will speed playback up by eight times normal speed (800%). Fast forward provides the capability for "cueing" the playback of earlier tracks. To return to normal speed type "F" again. Fast forward will not affect the resulting tempo of the recording as other speed of playback adjustments do. Please note, in Metatrak record mode fast forward will only work up until approximately 1500 notes (one half the total buffer size). Once this point is reached normal speed will automatically be resumed.

F. Restart (R)

If while recording a new track you make a mistake or just choose to start over you can instantly "restart" the piece by typing "R". In doing this, anything just recorded on the current track will be lost. The same general function can be accomplished by pressing the spacebar and specifying not to save the track, however, this requires a disk load which will take some time. Like fast forward restart will work up until half of the total possible number of notes played, approximately 1500 out of 3000.

G. Echo/Repeat

The echo/repeat feature allows sequencing of playback tracks while a new track is added. This is especially useful when laying down a first track such as a bass line that is to continue through the entire piece. Another application might be a background progression of several tracks that repeat while adding a lead line that varies throughout the piece.

The actual process is simple. Let's say you have just loaded a short meta file for Metatrak recording. After your track master is set for recording the next track and no further changes are to be made, you will encounter the prompt:

"ECHO/REPEAT (Y/N)?"

To set echo/repeat type "Y" followed by "RETURN". Just typing "RETURN" will turn echo/repeat off. After selecting echo/repeat the playback speed prompt will appear, for now, hit "RETURN".

At this point the first track should be playing back from beginning to end then, starting over again in a continuous sequence. While this is happening the new track can be added via the keyboard. To terminate the recording press the SPACEBAR. Once saved and listened to, you will notice that the new meta file is the cumulative result of the sequenced tracks and the new track.

Do not use the echo/repeat feature and metronome/click-track together while in Metatrak record mode; The recording will more than likely get out of sync. This is because the beginning and end termination points of an echo/repeat sequence, relative to the beat, are only as accurate as you originally recorded them. Considering most of us do not have millisecond acuracy in our hands, the timing is bound to be slightly off. This slight timing discrepency can cause a noticable timing error when repeated numerous times, as will occur when using echo/repeat.

See Appendix E for possible recording errors and warnings related to echo/repeat.

H. Playback Speed Control < , >

Another useful feature in Metatrak recording is the playback speed control. With this unique feature, playback tracks can have their tempo modified while adding a new track at normal speed. All of this is done without changing pitch, as with conventional tape-based systems. For example, you can record an extremely complex piece at a slower tempo, then modify it for the correct speed. It can also be used for adjusting a piece to fit within a certain time limit or accelerating or retarding sections of a piece.

There are two methods of playback speed control; one is used for exact pre-specification of playback before recording, the other is used for gradual dynamic speed control during playback.

To preset the exact playback speed, set up the track master and start the recording sequence. After the echo/repeat prompt is answered, the following prompt will appear:

"PLAYBACK SPEED (1-800%):100"

The default upon "RETURN" is 100% (normal speed). To change, type in the desired playback percentage from 1 to 800%, followed by "RETURN", (Note: 200% is twice the speed, 400% is four times the speed and so on). After being entered the playback track should be heard at the altered speed while the new track can be recorded at a normal speed.

To terminate, either wait until the end of the piece, (if not in echo/repeat), or press the SPACEBAR. When listened to at normal playback speed (100%), the result should be the same as when in the recording process.

There are many ways to use this feature. In some cases, it may take a couple of recordings, with modified speed, to get the desired result. An example of this situation might be, adding an extremely fast lead line to a piece at normal tempo. This can be accomplished by recording the selection prior to the lead line at normal tempo. To add the fast lead line slow the playback of the earlier tracks down to, maybe, 50% (half speed). Once the lead line has been added and the meta file saved, go back into Metatrak recording and adjust the speed to 200%. Let the piece complete recording without adding anything and then save it. The result will have all tracks at normal speed except the lead line track which will be doubled saved in the final recording.

For gradual changes in playback speed, the "<" and ">" keys can be used during playback. Pressing the "<" key once lowers the playback speed by 5%. Pressing the ">" key raises playback speed by 5%. using these keys in conjunction with the "REPT" key will allow gradual speed transitions for "accelerando" or "ritardando". Once saved, the gradual speed changes will remain in the recording.

In either method of speed control, if you are going to use a very fast playback speed, make sure when originally recording, not to play notes too quickly. Extremely short notes that have been speeded up may seem to completely disappear. The particular envelope used also can have a big effect on the audible outcome of a recording played back at very fast speeds.

VIII. MIX-DOWN / PLAYBACK

In the conventional tape-based recording process, mix-down is the last major step before completion. In Metatrak, mix-down pertains to the reviewing process of a Metatrak recording and final adjustment of the track master before it is saved.

During Metatrak mix-down, instruments can be reassigned to different tracks, vibrato status set on or off, and most importantly, track volumes can be adjusted relative to one another. Granted, such functions can also be handled while in Metatrack recording, and in some cases should. However, the mix-down process tends to be more convenient, expedient and fail safe in standard playback.

There are various reasons why mix-down is best handled in standard playback. For one, tracks cannot be in record mode, alleviating the possibility of accidently adding to a piece. Another reason is, the meta file doesn't have to be reloaded for each complete listening. This saves quite a lot of time when reviewing a recording numerous times. Also, playback speed can be dynamically incremented or decremented without modifying the final recording. This allows a controlled scanning through certain sections or adjusting for total time duration until satisfied with the results.

During mix-down/playback you may want to go back into Metatrak recording to modify a recorded piece. In fact, the two processes should be used interactively; using Metatrak recording primarily for adding or modifying track recordings and standard playback for periodic and final review for mix-down.

Exiting the Metatrak record mode will route the system back to live mode. Playback can then be selected by pressing the spacebar to get the record playback menu and typing "P" followed by three "RETURN"s.

A. The Track Master in Mix-Down/Playback

After selecting standard playback, the current track master will be displayed on the screen. At this point, changes to instrumentation, vibrato status or volume can be made for each individual track. Unless you are already aware of changes to be made, it is best to start playback to review the recording. To do this, type "RETURN" until playback starts.

If while listening to playback you find it necessary to make a change to the track master, type "CTRL-R". Doing this will display the track master and allow changes to be made. Altering the track master parameters is accomplished as explained in Standard Recording, section VI.

There are three main mix-down functions that should be adjusted as necessary during playback: instrumentation, vibrato state and track volume. The first of these to be finalized is instrumentation. Since each track recording is dependent only on the track number, any instrument in the preset master can be assigned to any given track. This also means a completely different preset master with ten new instruments can be loaded by typing "CTRL-P". If any single instrument in the preset master needs to be modified or completely replaced, this should be done using alphaPlus.

Once the instrumentation is finalized vibrato should be set. As explained in the track master section of this manual, one vibrato depth and rate is shared by all tracks. The vibrato used is that of the current keyboard (track 0) instrument. Applying vibrato to a track can be specified in the "VSTAT" field; a 1 = on, a 0 = off. Setting the global vibrato depth and rate is explained in Parameter Control, section III. Using vibrato on a given instrument is really up to your own listening discretion. Traditional orchestral instruments, (strings, brass), usually sound more realistic with vibrato, where as keyboard instruments, (piano, organ), usually are better off without it.

As explained in Parameter Control, section III, the "VOL" field specifies a volume limit that a track's instrument cannot exceed. The values can range from 255 (full on) to 0 (off). They also react differently if in linear or exponential envelope modes.

Setting "VOL" is done as explained in Standard Record Mode, section VI. Adjusting the volume of each track can have a great effect on the final outcome of a Metatrak recording. Proper usage of the volume control allows each track to be enhanced or subdued relative to the other.

An individual track volume remains as set throughout the entire recording. Variation of a volume for a single instrument part can be accomplished by re-recording on a new track the portion of the recording where the volume change is needed. Then the original section of the first track can be erased using the punch-in/punch-out feature. This allows the track volumes to be set as desired, having the same effect as changing volume during the recording.

In some cases you may want to completely eliminate a track. Turning the volume to 0 will audibly accomplish this. However, if the track is not going to be used, it should be erased. This is because the actual recording information is still being processed, and will affect voice allocation and meta file length.

B. Playback Reviewing <,>

It may take you several times through playback to properly mix down a recording. To speed up the process three playback speed controls are provided. Upon entering playback a speed control prompt will appear:

"ENTER PLAYBACK SPEED (1-800%):"

This prompt is handled exactly as in the Metatrack recording process. The only difference is that it won't permanently affect the recordings tempo. Typing "RETURN", without entering a value, causes a default to 100%, normal speed.

Once in playback two other methods of speed control can be used; a fast forward control and an incremental speed control. Fast forward, as in Metatrak recording, can be implemented by typing "F". Unlike Metatrak record mode, fast forward in standard playback can be used from beginning to end, regardless of the meta file length. The incremental speed control can be used by holding down the shift key and typing ">", causing a 5% speed increase. Applying the "<" key in the same fashion will decrease speed by 5%. Using either of these methods makes it possible to bypass sections not requiring further review or to slow down for sections needing attention.

If a recording needs to be reviewed many times there are three methods to re-start playback from the beginning of a piece. First, by pressing the SPACEBAR to select the record/playback menu and then typing "B" followed by "RETURN", the meta file "buffer pointer" will be reset to the beginning. Once the buffer is reset, playback can be re-started by hitting "RETURN". Another method is selecting "P" for playback again, re-starting the complete playback process. A third method, typing "E" for "ECHO", will cause playback to repeat automatically.

D. The Final Production (CTRL-D)

Once satisfied with all recorded tracks, the preset master and the track master, it is time to save the final production for later use. To do this both the meta file recording and its associated track master must be saved to disk. Use an extra disk for saving these files, it will help keep things organized. The recording can be saved as specified earlier in Standard Record Mode, section VI. The track master is saved as explained in The Recording Process, section V.

To provide a means of quick identification, it may help to name both the track master and recording with reference to the preset master that was used. For example, a track master named "JAZZ 1" using preset master "ALPHAPLUS" might be saved as "AP-JAZZ 1". The same goes for the associated meta file recording. Use whatever naming convention that works best for you, as long as names do not exceed fourteen characters. Relating file names will assure that the proper combination of track master, meta file recording and preset master will be loaded for playback at a later time.

In the final production stage you might want to clean up and organize the files on your diskette. To assist in this process, Metatrak provides access to standard Apple DOS commands by holding the "CTRL" key down and typing "D".

There are number of uses for DOS commands relative to Metatrak in the final production stage. For example, in the process of recording, files of various names may have been saved to disk. If these files are no longer needed they can be "deleted" from the disk using the DOS "DELETE" command. Besides deleting files you may want to fully protect your files from being accidentally written to by "locking" them using the DOS "LOCK" command. Another useful command is "RENAME". If you are not already familiar with these DOS commands see Appendix A and your Apple DOS manual.

IX. CONCLUSION

Well, if you have already successfully created a Metatrak recording or if you actually read this entire manual in preperation to do so, congratulations! From the descriptions and examples throughout this manual, it's easy to realize the value Metatrak offers to composers, arrangers, educators, recording studios, and musicians in general; and think, this is only the beginning! Metatrak will have even more features and performance power in future versions, further expanding your alphaSyntauri synthesizers capabilities.

If you have any comments or suggestions for future enhancements, write them down and send to Syntauri with your warranty card or in a separate letter. We at Syntauri want to develop the products you want, so let us know what you think.

Enjoy Metatrak, we're sure you'll find it an effective performance and recording tool for all your music efforts.

There are many standard disk and file maintenance commands and programs that can be helpful when using your alphaSyntauri synthesizer and Metatrak software. If you are not already familiar with these commands or programs, the following is a brief description of how to use a few of them. For more information reference your Apple DOS manual.

Copying a Diskette

A back-up copy of your Metatrak diskette can be made via the copy program provided on your Apple DOS 3.3 diskette. To use this program; first boot the diskette until a basic prompt ("]") appears, then type, "RUN COPYA" followed by "RETURN". The program will ask you to define the slot and position of your disk drive(s) for source and destination. If you have only one disk drive the source and destination will be the same. Once set correctly, insert the disk you wish to copy.

Initializing a Diskette

A new blank diskette can be initialized for storing files by using the INIT command. The INIT command can be entered after booting your DOS 3.3 diskette. To initialize, put the new blank diskette into the disk drive, then type "INIT HELLO" followed by "RETURN". After the disk stops swirling and grunting, it will be initialized for use.

Deleting a File

To delete a file from diskette use the DELETE command. It can be used after booting your DOS 3.3 disk or during Metatrak by typing CTRL-D in Metatrak live mode. To delete a file simply type "DELETE" followed by the full name of the file you wish to delete, followed by "RETURN".

Other Commands and Programs

There are a number of other disk commands and programs you might find useful when working with the alphaSyntauri synthesizer. Some of these include: the 'CATALOG", "RENAME", "LOCK" and "UNLOCK" commands, and the file copy program "FID". See your Apple DOS manuals for further information on these commands and programs.

Here is a list of commands entered from the Apple Keyboard and a brief explanation of what they do. This list is meant for quick reference only. Refer to the appropriate sections of this manual for more detailed explanation.

E	Sets the envelope mode to exponential.
F	Fast forward (on/off toggle)
J	Move the split instrument pointer down by 1.
K	Move the split instrument pointer up by 1.
L	Sets the envelope mode to linear.
O	Turn the vibrato off.
R	Restart track record attempt (Metatrak record mode only)
U	Updates the video screen.
V	Sets the vibrato rate from paddle 0 and vibrato depth from paddle 1.
ESC	Record punch-in/punch-out (Metatrak record mode only).
<-	(left arrow) Lowers the system volume by 5.
->	(right arrow) Raises the system volume by 5.
<	Decreases playback speed by 5% in playback mode.
>	Increases playback speed by 5% in playback mode.
?	Display diskette catalog.
CTRL-B	Pitch bend on/off controlled by paddle 0.
CTRL-D	Access DOS commands
CTRL-F	Load an Fx mod (not compatible with alphaPlus FX mods)
CTRL-K	Include or exclude set-up program when you boot up.
CTRL-O	Change the offset (percussion channel tuning) in 32th tones.
CTRL-P	Load a Preset Master from diskette.
CTRL-R	Display track master for changes.
CTRL-S	Define, load or save a split keyboard definition.
CTRL-T	Load or save track master.
CTRL-V	Load a vibrato waveform from diskette and set vibrato rate and depth.
CTRL-Z	Set the metronome tempo (0 to 280 beats per minute).
0-9	Change an instrument (split dependent).
SPACEBAR	Access record/playback menu.

Below is a list of file types associated with Metatrak. Each file type is functionally described, and how its name appears on diskette is shown.

"PRESET MASTER: (name)"

A preset master is a file containing parameters for a bank of ten instruments created in alphaPlus. When loaded into the preset master, Metatrak uses "CTRL-P". It automatically loads the wave master file and LFO master file associated with it.

"WAVE MASTER: (name)"

A wave master file contains the waveforms for the ten instruments in a preset master. It is automatically loaded with its associated preset master.

"LFO MASTER: (name)"

An LFO master holds the vibrato and offset parameters of a preset master. It can only be created using an alphaPlus (version 2.0). The LFO master will automatically be loaded with its associated preset master. If a preset master that doesn't have an LFO master is loaded it will cause an error message, but will load the preset master properly.

"SPLIT MASTER: (name)"

A split master is a file that stores the number of splits and which instrument numbers are used in a split. The information is used for updating the screen. A split master can be loaded or saved using the "CTRL-S" command in Metatrak live mode. It automatically loads or saves a split bank file.

"SPLIT BANK: (name)"

A split bank file contains information for associating instrument numbers with key positions. It is automatically loaded or saved with a split master.

"TRACK MASTER: (name)"

A track master is a file that contains all the information for how the sixteen tracks in Metatrak were set in regards to instrument and control parameter assignment. A track master can be loaded or saved using the "CTRL-T" command in Metatrak live mode. It is meant to be used in conjunction with the preset master used in recording a meta file.

"META: (name)"

A meta file contains note and track information for a Metatrak recording. It can be loaded or saved in Metatrak via the record/playback menu.

"MFX: (name)"

A MFX file holds a Metatrak FX mod (special effect). An FX mod is a small assembly language program used for sound modification. FX mods can be loaded and saved using the "CTRL-F" command in live mode. The alphaPlus FX mods are not compatible with Metatrak.

APPENDIX C: Demonstration Recording Instructions

A Metatrak demonstration recording is provided on your Metatrak diskette. Listening to the recorded example will give you a quick idea of the possibilities and potential Metatrak offers.

There are a few steps to go through to prepare for proper playback. The explanation of each step is thorough for those who have not used the alphaSyntauri synthesizer before. Simply follow the instructions below. Detailed explanations for the process are covered in this manual.

STEP 1

Make sure you are in "live" mode, that is, you can hear sound as you play the alphaSyntauri keyboard and the diskette labeled Metatrak is in the disk drive.

STEP 2

If not already loaded, load preset master METATRAK.L, by holding down the "CTRL" key while typing "P", and then typing METATRAK.L followed by a "RETURN".

STEP 3

Once back in "live" mode, hold down the "CTRL" key while typing "T". A prompt for loading or saving a "track master" will appear; type "L" followed by "RETURN". Now type GALAXY GAP followed by "RETURN". This will load a track master, restoring Metatrak to the state it was in during the original recording.

STEP 4

When back in live mode again press the SPACEBAR. This will cause the record/playback menu to be displayed. Type "L" followed by "RETURN". This will allow you to load the metafile recording. Type GALAXY GAP followed by "RETURN".

STEP 5

The record/playback menu should reappear after the meta file is loaded from the disk. Type "P" followed by consecutive "RETURN"s until you hear the recording playback.

STEP 6

When the recording is finished, the screen will go back to the record/playback menu. Type "0" followed by "RETURN" to turn the playback off. Typing "RETURN" again will put you back into the live mode

Since the meta file buffer is divided into two parts during the Metatrak recording, it is possible for the "track" being recorded to overwrite the playback "track". This may or may not be inconvenient depending on:

* Whether or not the Echo/Repeat has been chosen.

* The type of material being recorded from the alpha keyboard.

As a result, a number of safety checks have been included in the software to minimize these occurrences. Below is a brief discussion of each check and what it does.

Maximum Meta File Length

Each time a meta file is loaded in the Metatrak recording mode, the length of the file is checked before it is loaded. If the file when loaded, does not allow at least a 50 note difference between the beginning of the recording buffer and the playback buffer, an error message will be displayed on the video monitor, and the Meta file will not be loaded.

Buffer Collision Warning

When the meta file to be loaded meets the limits described above, the file is loaded and you may begin recording. The difference between the two buffer pointers is then monitored. If at any time a 200 note difference is violated, a flashing exclamation point will be displayed at the bottom right portion of the video screen to alert you to this fact. If you continue playing until the buffers finally overlap, you will exit the Metatrak record mode and be asked if you want to save the "track". If this happens save it as a different name so you still have the previous meta file ti work with.

Echo/Repeat Shutoff

If you are using the Echo/Repeat option while in Metatrak record mode and you write over the beginning of the playback notes file because you ignored the buffer collision warning, the Echo/Repeat will stop automatically since that information has been written over during the recording process (when you reach the end of the playback meta file). You will exit the Metatrak record mode and be asked if you wish to save the track.

The following are descriptions of the Metatrak FX mods. A general explanation for using FX mods is covered in Parameter Control, section III. Note: Metatrak FX mods are not compatible with alphaPlus FX mods.

TS - Timbre Scan

TS scans through all the primary and percussion waveforms of the current preset master while using the envelope charactristics of the assigned instrument. The rate of the scan is controlled by adjusting paddle 0, and then pushing the paddle 0 button. Timbre scan can be assigned to a range of tracks when it is loaded. If no track range is specified it will affect tracks 0, (the live keyboard), through 8.

PS - Pitch Sweep

PS dynamically varies the pitch as controlled by the assigned instrument attack rate and position of paddle 1 when pushing the paddle 1 button. Special effects can be obtained by varying the control paddle until the pitch goes into or out of "aliasing". Pitch sweep, like timbre scan, can be assigned to a range of tracks.

AM - Amplitude Modulation

AM allows you to produce a tremolo effect with your master volume. The rate and depth are controlled by paddles 0 and 1, respectively. Use the paddle buttons to set the values. AM is a global FX mod for all tracks, a range cannot be defined.

VIB1 - Keyboard Following Vibrato

VIB1 emulates voltage-keyboard-follow control of analog synthesizers. The higher the key struck the faster the vibrato rate and the greater the vibrato depth. When using VIB1, vibrato cannot be updated by standard methods. VIB1 is a global FX mod for all tracks, a range cannot be defined.

OFF1 - Keyboard Following Offset

OFF1 works in the same fashion as VIB1, except that offset is affected rather than vibrato. The higher the key struck, the greater the offset detuning between the primary and percussion oscillators. OFF1 is a global FX mod for all tracks, a range cannot be defined.

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Metatrak™ Quick-reference Guide

Syntauri™

September 1983

METATRAK CONTROL FUNCTIONS

FUNCTION	page	command	mode	remarks
BOOT	3			1
CATALOG	5	?	L	2
CURSOR-move down	7	R^e	E	
" - " up	7	P	E	
" - " to top	7	S	E	
DELETE (a file)	36	^D	L	
DOS-to access	36	^D	L	
DRUM MACHINE-set up	39	^I	L	
ECHO-on/off toggle	36	E	M	
"	31		T	
ENSEMBLE-on/off togg.	37	E	L	
" SEQUENCE " "	38	S	L	10
ENVELOPE-load/sav/def	6	^E	L	07
" -to get out of	"	Ø	E	
" -to change	7		E	9
ERASE-(a track)	30	E	T	
FAST FORWARD-on/off	31	E	T	
FX MODS	31	^F	P	36
" " -to turn off		^F,O	L	
INSTRUMENT-change	4	#	L	
" -SPLIT-move up 1	17	K	L	
" - " - " down 1	17	J	L	
KEYBOARD SPLIT-l/s/d	15	^S	L	17
KILL SET-UP (in boot)		^K		
LOAD-a piece of music	D1	L	M	
" -an envelope	35	E	L	
" -a preset master	35	P	L	3
" -a waveform	9	W	L	35
" -keyboard split	15	S	L	17
LOCK-(a file)	36			
LOOP (see ECHO)	31		T	36
METRONOME-on/set temp	23	^Z	1	28
" -turn off	39	O		

FUNCTION	page	command	mode	remarks
MENU-to access		Ø	L	
OFFSET-to change	10	^O	L	
PITCHBEND-on/off togg.	11	^B	L	
PLAYBACK	34	P	M	4
PRESET-load/save/def.	35	^E	L	
PRESET MASTER-load/s/d	5	^P	L	3
" "	35			
PUNCH IN/OUT	31	ESC	R	5
RECORDING-to get into	28	R	M	
" -to get out of	30	Q	M	
" -to rename	36			6
" -to save	29	S	M	
" -to terminate	32	Ø	R	
" -to restart	31	R	R	36
" -to redo	36	B	M	
SEQUENCE (see ECHO)	31	E	M	36
SPEED (P/B)-raise 5%	29	>	L	32
" -lower 5%	33	<	L	36
SPLIT KEYBOARD	15	^S	L	17
SYNC-TO-TAPE-setup	41	^X	L	
TEMPO-(see metronome)				
TRACKMASTER-to display		^R	L	
" -to load or save	21	^T	L	
TRANSPOSE-in playback	39	T	P+	
TUNE	11	Q	M	7
UPDATE-(inst. on kbd.)	4	U	L	
VIBRATO-load or set	10	^V	L	8
" -turn off	10	O	L	8
" -turn on	10	V	L	8
VOLUME-(master) up 5%	11	<-	L	
" - " down 5%	11	->	L	
" - " see what is	11	U	L	
WAVEFORM-load or save	9	^W	L	

DSW/7-5-83

NOTES ON 'METATRAK CONTROL FUNCTIONS'

1. To "BOOT" - Put a diskette in Disc Drive #1. A) For Apple II or II+, turn power on assuming it was off. If it was on, turn off, then on. B) For Apple IIe, hold down "open apple" key, then CTRL; hit reset.
2. This will list the contents of whatever diskette is in the drive.
3. Use game paddle 0 to control it. Note tuning is changed.
4. Several Returns are required.
5. This only works in "Record" mode.
6. A "DOS" command - "RENAME"
7. Then "RUN SCALE UPDATE".
8. Use game paddle 0 to set rate.
   Use game paddle 1 to set depth.
9. To change an envelope, hit CTRL-E, then D, then return. Make sure the instrument you want to change is named at the top of the screen and if not, change it by typing the appropriate number. Then, as you step down the list, using the "RETURN" key, you can change the envelope parameters. Type P, return to go up one line; S, return, to go to top. To return to Live mode, hit the Spacebar if you are at the top of the list (nothing flashing), otherwise hit Spacebar, then Return.
10. Ensemble sequence can be recorded by putting system in record mode.

All numbers over 10 are additional page references in the Metatrak manual.

ABBREVIATIONS

A. Page # refers to the page in the Metatrak II User's Manual.
B. Command procedure abbreviations:
   ^ = Hit "Control and the letter shown under the "^".
   0 = Hit the Spacebar.
   O = The letter "O". (falls between N and P).
   R = Hit the "RETURN" key.
   Y = Yes N = No L = Load S = Save D = Define
C. Modes
   L = live - this is the playing state the instrument is in after "BOOTING". Commands that work in this mode will also work in the Playback mode.
   M = Menu. Refers to the state you are in after hitting the spacebar when you were in L (live) or playback.
   T = Trackmaster mode (accessed by R + RETURN).
   C = Choice made.
   SC = Speed choice.
   E = Envelope modifying mode. Access by CTRL-E + D, then return.
   R = Record mode.

SYNTAURI SOUNDS - THEIR MANAGEMENT

Sounds, which are also known in synthesizer parlance as "voices", "patches" and "presets", are organized in the Syntauri system into groups of ten. Each group of ten is called a "PRESET MASTER". These "PRESET MASTERS" are kept on the disks you received with your alphaSyntauri, including your alphaPlus, Metatrak, and, your "Preset Sounds" disk. Each sound and each PRESET MASTER has to have its own name, as do all "files" stored in a computer memory device. Each PRESET MASTER contains three sets, ten per set, of data which, when "loaded" into the computer's Random Access Memory (called "RAM"), supply the sound parameters the computer needs to create ten specific sounds. These sets of data consist of the following:

1. Envelope Data - called "PRESET" files.
2. Waveform data - callled "WAVES" files.
3. Vibrato and pitch offset data - called "LFO" files.

All three sets are loaded automatically when you load a new "PRESET MASTER". You do this by typing "CTRL-P", that is, holding down the 'CTRL' key and typing "P", then "L", then return, then the name of the PRESET MASTER you want. Examples are "ALPHA PLUS", "INSTR", "LSYN", etc. When you do this, the set of 10 sounds previously loaded in RAM (and ready for use), is discarded from RAM and the new preset master set of 10 sounds is loaded, assuming a diskette withthe required information was in disk drive #1 when you completed the above commands. If not, the screen will display an "ERROR" message and the existing preset master (set of 10 sounds) will remain, loaded in RAM. A list of the waves used in all the PRESET MASTERS on the disk of "PRESET MASTERS" which came with your alphaSyntauri is given in your owner's manual, in the section tabbed "UTILITIES".

To swap parameters (eg. envelopes (presets) or waveforms (waves), from sound to sound, YOU MUST HAVE THEM STORED SEPARATELY on the disk in the drive at the time you request them. A number of basic waveforms are separately recorded on your alphaPlus disk - namely "SINE", "SQUARE", "TRIANGLE", "SAWTOOTH", and "NOISE". As these are stored on the disk as separate files, you can swap them (load them) into any sound currently displayed on the screen with the following commands: CTRL W, then the name of the wave, then RETURN. (See page 71) In order to have a wide range of waves available, and to keep the ones you make yourself (with Quickwave, Drawaves, etc.), you should store them by themselves (not only as part of a Preset Master) on a couple of disks. The commands to do this are: CTRL E, new name of wave if you have modified it, then RETURN. OR , if there was no change made to the wave, then CTRL W, then --> to the end of the title given on the screen, then RETURN. (see page 71 in the alphaPlus manual and page 9 in the Metatrak manual). NOTE : The commands in Metatrak are: CTRL W, L, name, RETURN, or CTRL W, S, name, RETURN.

Keep a written record of the waves you have stored so that you have stored so that you can select the disk quickly and type the name accurately for fast loading.

METATRAK VERSUS ALPHAPLUS

Although you can change envelope parameters in Metatrak, using the CTRL E command, and L)oad or S)ave envelopes (CTRL-E) and waves (CTRL-W), (see pages 6 & 7 of the Metatrak manual) Metatrak is intended primarily for performance and multitrack recording. alphaPlus provided you with the additional controls you need for waveform building and modification.

Certain alphaSyntauri sound controls are intended for use at "performance time only" and are not stored with the basic sound parameters. Examples are PORTAMENTO, PITCHBEND, SUSTAIN and FX MODS. These are well covered in the Owner's Manual.

ALPHASYNTAURI SOUND CONTROL NOMENCLATURE

Each sound is a blend of two channnels, designated PRIMARY and PERCUSSION.

Syntauri sounds are not "true stereo" although you can locate a sound far left or far right. In addition, by adjusting the relative loudness of the two envelopes (Primary and Percussion), a sound can not only be "placed", but also "panned" during performance. This is done by using a faster attack on one channel than on the other.

To save all <u>three</u> pieces of information about just one sound you must save the whole PRESET MASTER. Envelopes (CTRL-E) and waveforms (CTRL-W) <u>can</u> be saved without saving the entire PRESET MASTER if you are willing to <u>write down</u> vibrato rate and depth and offset (CTRL-O). So, to keep things straight, you would choose a new name for the PRESET MASTER at the time you SAVED it to disk. This assumes that you had made a change to one or more sounds and that you wanted to keep the original in its original state. The command to do this is CTRL P, S, name, RETURN,. (See also page 5 of your Metatrak manual). A suitable name for your new PRESET MASTER might be WLB, if your name happened to be Walter L. Benson. You could then develop it into a series, eg. WLB, WLB1, WLB2, WLB3, etc., as you made later changes to the PRESETS in the PRESET MASTER. You would probably also rename the individual sounds, in order to keep them properly identified. You'd want to delete the obsolete versions as you went along to conserve disk space. If you were organizing your sounds by orchestral sections, you might name your PRESET MASTERS something like "STRINGS", "BRASS", etc.

LFO INFORMATION

These files store the VIBRATO and OFFSET information for all the sounds in a PRESET MASTER. OFFSET identifies the amount of pitch difference between one channel and the other in a single sound. This usually slight difference can give a sound increased richness. Although different OFFSET data is used for each sound in a PRESET MASTER, only one VIBRATO rate and depth is used at one time. The values used are whatever values are defined on the instrument used on the keyboard. This is track 0 in Metatrak.

Offset is changed with the command CTRL O. (See page 68 of the alphaPlus manual)

OTHER DATA STORED AS PART OF THE ENVELOPE:

FC - "frequency Control" - defines the range in which the instrument will play. The larger this number, the higher the pitch produced by a given keystroke. Units are in quarter tones. This allows you to make a particular sound play like a high instrument (FC=66) or a bass one (FC=6). In addition, this control enables you to play instrumental scores (as for an E flat trumpet) in concert C, by setting the FC to the correct number. (eg. FC=60) See pages 31 and 66 in the alphaPlus manual for more details.

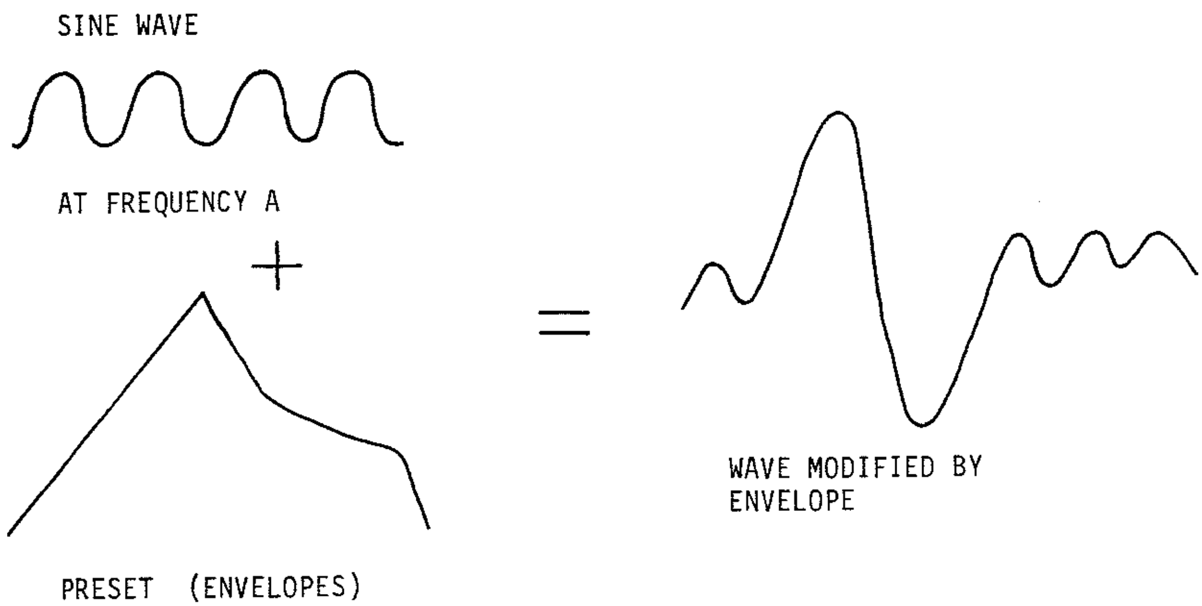
PC - PERCUSSION CONTROL - is a dual purpose "switch" with four positions. It turns the Percussion Channel On or Off and does the same to the keyboard's VELOCITY SENSING. For more details, see page 68 of your alphaPlus manual.

AC - ATTACK CONTROL - is an On/Off switch that causes the Attack/Decay cycle to repeat, when set = 1. This gives a TREMOLO-like effect. (See page 66 of the alphaPlus manual.)

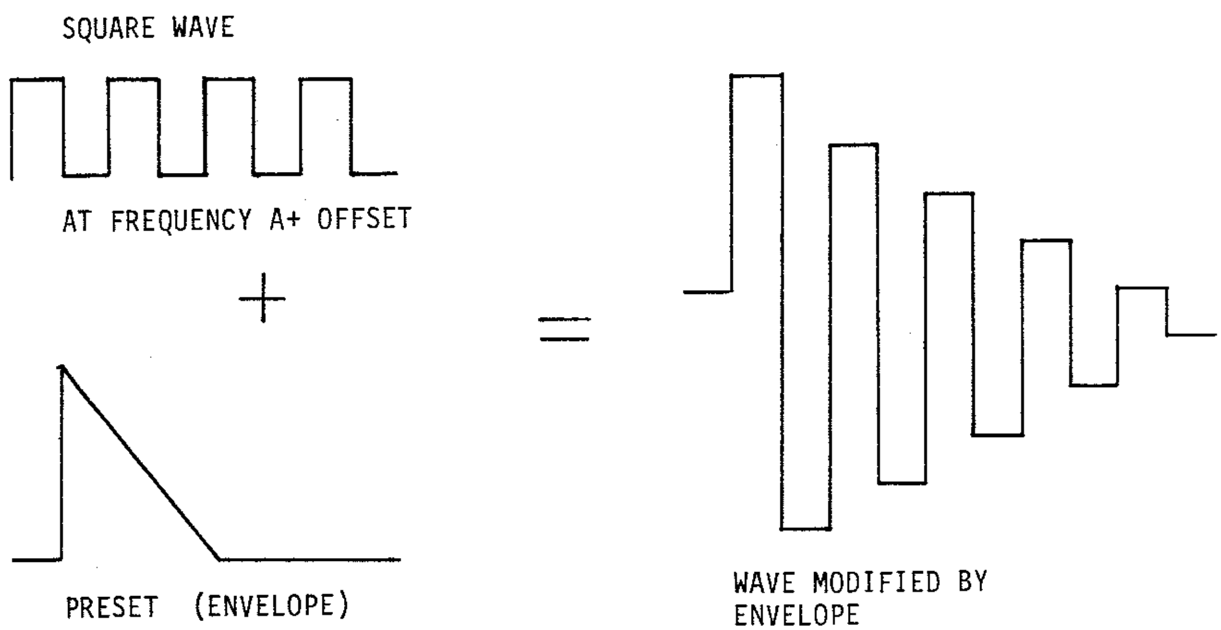
AN ATTEMPT AT A GRAPHIC REPRESENTATION OF A SYNTAURI SOUND

It is difficult to show graphically all the information represented by a single sound or "voice";as a number of things are going on at once. The basic waveforms are shaped by the envelopes and this result is then varied by the vibrato and offset values (LFO). In building or modifying a sound, you will work with all these elements until you get what you want. The drawings on the next page attempt to graphically describe the elements.

PRIMARY CHANNEL



PERCUSSION CHANNEL



Metatrak™ II

A multi-track recording system
for the alphaSyntauri® digital synthesizer

Syntauri

METATRAK™ II

USERS MANUAL

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Palo Alto, California 94306, USA
(415)494-1017

Written by: Robin J. Jigour

Metatrak basic code was compiled using the "Integer Basic Compiler" by Synergistics Software, Renton, Washington.

METATRAK II TABLE OF CONTENTS

I. METATRAK OVERVIEW

A. General Description

Metatrak is one of the most valuable compositional tools a musician can use: a synthesizer-based multi-track recorder. Metatrak allows you to orchestrate a composition by simultaneously recording numerous performances varying in instrumentation. The end result is a quick and cost effective recording that can be used for compositional arranging, recording studio preparation, background to live performance, or simply for listening pleasure at a later time.

An advanced software product for the alphaSyntauri digital synthesizer, Metatrak offers a number of features specially geared towards live performance and recording situations:

* A 16 track synthesizer recording system
* Conventional recording controls: record, play, erase, fast forward, punch-in/punch-out
* Independent track control over instrument, vibrato and volume
* Special record modes: sequencing, playback speed adjustment and built in metronome/click track
* Special performance modes: split keyboard, ensemble, and transposition
* Drum machine and Sync-to-Tape interfaces
* Instrument definition capability and compatibility with alphaPlus preset masters (instrument banks)

B. How to use this Manual

This manual describes the proper operation of the Metatrak operating system software. It is divided into nine main sections covering all aspects of the Metatrak system. In addition, the appendix offers additional information which you will find useful. These sections are referenced in the Table of Contents.

C. Metatrak and alphaPlus

Although not mandatory, you should first get familiar with the alphaPlus operating system before going on to Metatrak, since much of the fundamental operation is similar. Also, alphaPlus has complete waveform creation capability which may make it more desirable for defining instrument sounds. In fact, the two software packages are best used in conjunction. Think of alphaPlus as your primary instrument development software and Metatrak as your advanced performance and recording software. The two in combination make the alphaSyntauri system a powerful general purpose synthesizer.

II. GETTING STARTED

A. Set-Up

Metatrak software must be used with the alphaSyntauri synthesizer system (see Figure 1). The system configuration for Metatrak includes the following components:

* Metatrak (V2.0) operating system software on floppy diskette

* AlphaSyntauri interface card, cable and four or five octave keyboard

* Mountain Hardware MusicSystem cards

* Apple II Plus 48K RAM computer with 16K RAM card (not ROM card)

* Disk II disk drive and controller card

* Video monitor (or TV with RF MOD)

* Analog control paddles

* Audio system or headphones

In addition to the above list, the alphaPlus software and any diskettes containing preset masters will be useful if instrument sounds are to be modified. Also, have an extra diskette handy for storing recordings (see Appendix A for instructions on initializing a new disk). Before using Metatrak be sure to **MAKE A BACK-UP COPY** of the Metatrak diskette (see Appendix A for instructions on copying diskettes).

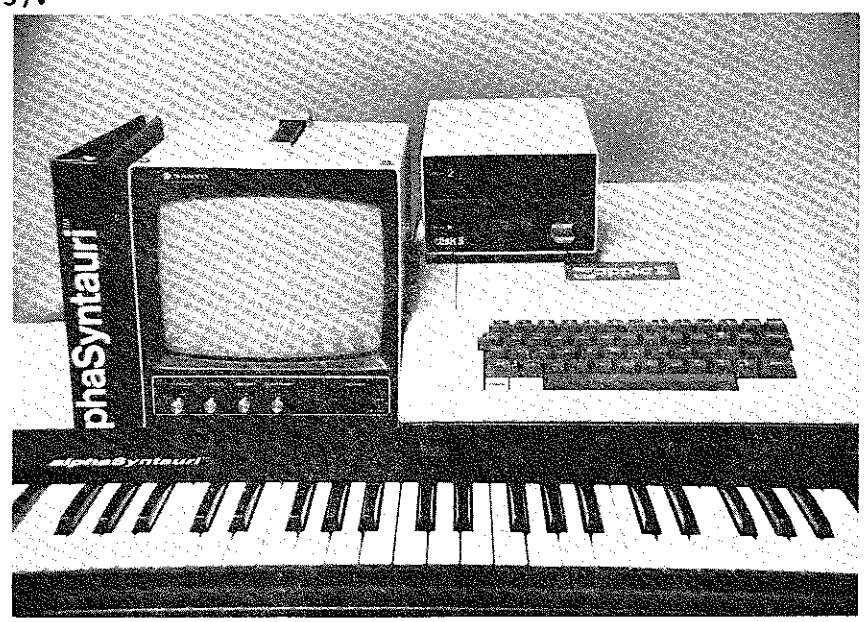


Figure 1: The alphaSyntauri Synthesizer System

II. Getting Started

To begin, follow the set-up procedure for the alphaSyntauri system as explained in the alphaSyntauri users manual. Once correctly set-up, turn off the Apple power first, then insert the Metatrak software diskette into the disk drive and turn on the power switch of the Apple. This will "boot-up" Metatrak software. Make sure your audio system volume is down until the boot-up is completed.

During boot-up a Metatrak set-up display will appear showing default conditions for initial preset master, master volume and card slot positions (see Figure 2). Make sure that these conditions correspond to the way your alphaSyntauri is set up; specifically, the slot numbers of the **Syntauri interface card (set for slot 2)**, and **Mountain Hardware MusicSystem cards (set for slots 4 and 5**; make sure the card with the audio cables is on the left side). If your configuration varies from this, make the appropriate changes as asked below the set-up display. Note: once properly configured, the set-up program can be bypassed for future boot-up (see Appendix B).

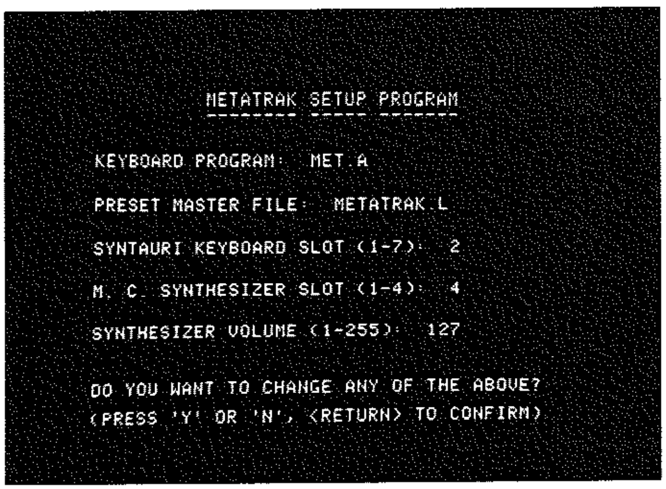


Figure 2: Set-up Screen Display

B. The Screen Display (Live Mode)

Once the Metatrak diskette has completed boot-up, the "live" mode screen display will be seen as shown in Figure 3. Playing any notes on the keyboard will cause a response both audibly and visually.

The upper portion of the screen dynamically displays each note played with a rectangular bar. The bars are arranged horizontally in octaves of C. Besides having a hypnotic effect, the display is useful for analyzing keyboard technique. It also helps keep track of the total number of simultaneous notes while recording (this is covered in more detail later on).

On the lower portion of the screen are various parameters for Metatrak live mode, including: current instrument name, split instrument status, vibrato and master volume controls. (Detailed usage of these parameters will be covered in their applicable sections).

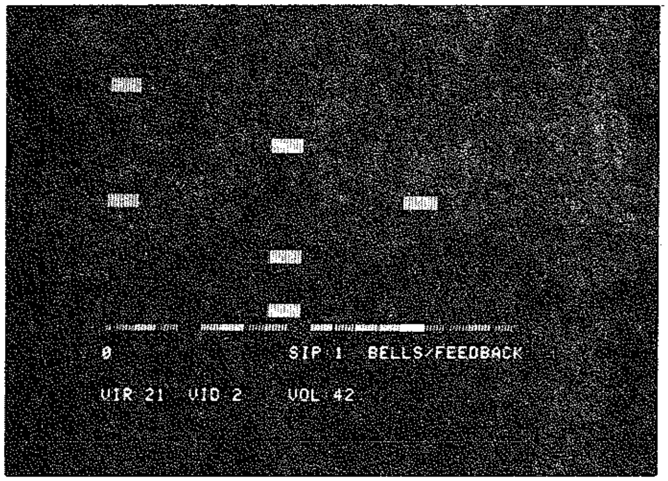


Figure 3: Metatrak "Live Mode" Screen Display

C. Instrument Selection (0-9,U)

Any one of the ten instruments in the current "preset master" can be selected as with alphaPlus. Additional preset masters can be loaded or created as explained in section III. Type any number between 0 and 9 on the Apple to change the entire keyboard to a new instrument. In Metatrak, instruments can be changed instantly whereas it takes approximately one second with alphaPlus. By typing the "U" key, the name of the instrument will be updated on the screen. Other parameters are also updated, as detailed later in this manual.

D. Commands and Files

There are many commands and files used throughout Metatrak. **A list describing all Metatrak commands is provided in Appendix B, and file type descriptions are covered in Appendix C.** Reviewing both these sections will help to give you a general perspective of the Metatrak software and serve as a quick reference guide once you understand its operation. More detailed descriptions of Metatrak commands and file types are covered in applicable sections of this manual.

E. Demonstration Recording

A Metatrak demonstration recording is provided on your Metatrak diskette. Listening to it will give you an idea of the capabilities and potential Metatrak offers. **To hear the demonstration recording, follow the step by step instructions in Appendix D.**

After you are through listening, resume reading the manual to learn how to properly use Metatrak for your own recordings.

III. INSTRUMENT MODIFICATION AND CONTROL

Metatrak provides control over all the instrument definition parameters that are in alphPlus (with the exception of waveform creation), and many other sound modification parameters that are specifically useful in performance and recording situations. To acquire a thorough understanding of how instruments are defined using the alphaSyntauri synthesizer, please refer to the alphaPlus tutorial manual. The following explanations on this subject will not go into great detail but will be general, specifically covering access to the parameters available in alphaPlus.

A. The Preset Master (CTRL-P,?)

As referred to earlier, a preset master is a bank of ten instruments that can be created using the alphaPlus or Metatrak software. Only one preset master can be resident at a time. To load a new preset master or to save one that may have been modified, hold down the "CTRL" key while typing "P". Doing this will cause the following prompt to appear:

"PRESET MASTER
L)OAD OR S)AVE WHICH?"

To load a preset master from disk type "L" followed by "RETURN". The following prompt will appear:

LOAD PRESET MASTER:

Type the name of the new preset master you wish to load from disk followed by "RETURN". The disk will be accessed to aquire the related files for the preset master and then the system will return to live mode with the new instruments. If CTRL-P is typed and RETURN is immediately entered, the system will resume live mode.

To examine the contents of a diskette for loading a preset master, type "?" any time during live mode or at the first letter of a preset master (or other file) load or save. The actual preset master name on the diskette will be preceded by "PRESET MASTER:". Included on the Metatrak diskette are two preset masters named METATRAK and ALPHA PLUS. As specified in the set-up program, METATRAK is automatically loaded from boot-up. Other preset masters are available from the "Preset Masters" diskette product from Syntauri.

Similar to loading a preset master, it can also be saved using "CTRL-P". Typing "S" for save followed by "RETURN" will cause the following prompt to appear:

SAVE PRESET MASTER:

To save a preset master to disk, type the desired name followed by "RETURN". This will cause the current state of the ten instruments to be saved to disk.

Be cautious when using any file save command since you might accidentally write over an existing file with the same name. If you wish to protect this from happening use the DOS "lock" command explained in Appendix A. A number of the files on the Metatrak disk are locked including the Metatrak preset master.

When a preset master is loaded or saved it actually loads and saves three files; the PRESET MASTER, WAVEMASTER and LFO MASTER. Each of these files contain a portion of each individual instrument in the preset master.

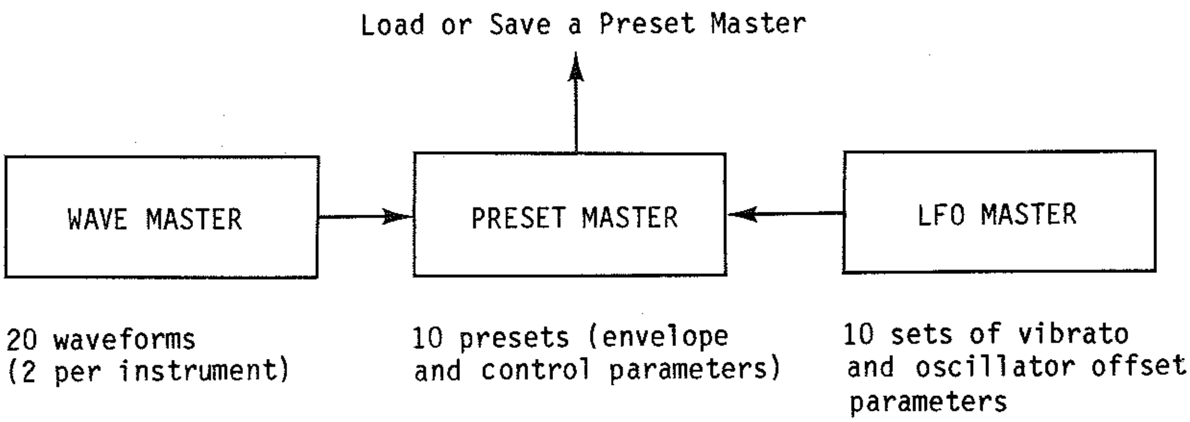


Figure 4: The preset master and related files

Individual instruments can not be saved or loaded in their entirety as occurs with the preset master. There are, however, certain portions of each instrument that can be saved and loaded via disk: waveforms and presets (envelope and control parameters).

B. **Presets (Envelopes and Control Parameters) (CTRL-E)**

As in alphaPlus, Metatrak has complete control over the preset (envelope and control parameters) for each instrument. This is extremely useful when tailoring instruments to a compositonal orchestration. A preset of any instrument can be loaded, saved or defined by holding down the CTRL key and typing "E".

The following prompt will appear:

```
"PRESET (ENVELOPES)
 L)OAD S)AVE OR D)EFINE    WHICH?"
```

If none of the options are to be used simply type "RETURN". To define the envelope and control parameters type "D" followed by "RETURN". The screen should be similar to the following list of parameters.

III. Instrument Modification and Control

BELLS/FEEDBACK INS.#:0

PR:11
FR:45
AR:189 — ENVELOPE RATES
DR:19
RR:68

PV:222
FV:0
AV:227 — ENVELOPE VOLUMES
SV:0
RV:0

PC:1
FC:54 — CONTROL
AC:0
ET:0

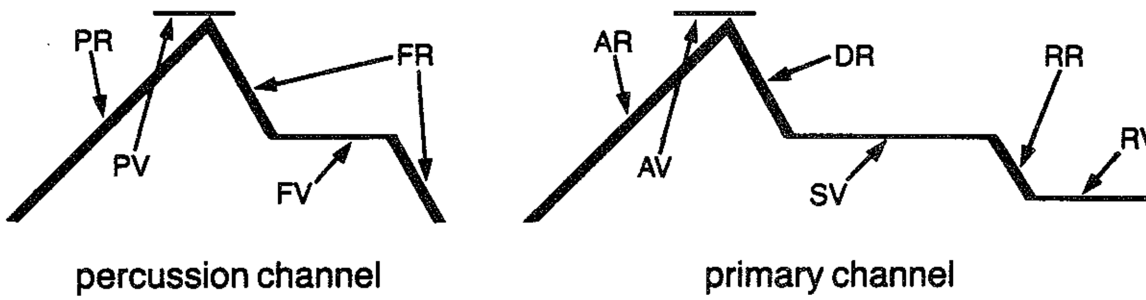
ENTER SPACE <RETURN> TO EXIT

The means of modifying parameters in Metatrak is different from that in alphaPlus. Before changing an instrument's parameters, make sure you have selected the correct instrument. This can be done by typing a number (0-9) corresponding to the instrument you wish to modify. Notice that each time this is done the screen will update to the new instrument.

To change a parameter hit "RETURN". This will move the cursor down from one parameter you wish to change and type in the new value followed by "RETURN". To move around the screen the "RETURN" key can be used to repeatedly loop through the parameters. Typing "P" followed by RETURN will move the cursor to the previous value. Typing "S" followed by "RETURN" sets the cursor to the instrument number.

To completely leave the preset definition screen hit the spacebar followed by "RETURN". This will send you back to live mode allowing you to hear any of the changes made to the preset parameters. Figure 5 briefly shows and describes the functions of each preset parameter.

ENVELOPE PARAMETERS



Percussion Channel

PR: Percussion Rate
PV: Percussion Volume
FR: Fall Rate
FV: Fall Volume

Primary Channel

AR: Attack Rate
AV: Attack Volume
DR: Decay Rate
SV: Sustain Volume
RR: Release Rate
RV: Release Volume

CONTROL PARAMETERS

PC = Percussion Control =

	0	1	2	3
Perc. Chan.	off	on	off	on
Velocity	off	off	on	on

FC - Frequency Control = 1/4 steps; C=6,30,54,78 when A=440HZ

AC - Attack Control = attack-decay repeat, 0=off 1=on

ET - Envelope Control = 0=Linear, 1=Exponential

Figure 5: Preset Parameters

The control parameter, "ET" (envelope type) has the same function as the "CTRL-A" command of alphaPlus. Note that with Metatrak 1.1, 2.0 and alpha Plus 2.0, it is possible to have linear and exponential instruments in the same preset master. This wasn't possible in earlier versions. To do this, the linear envelope had to be internally altered. Any linear preset masters that were created with earlier versions of alphaPlus will have to be converted to the new format or they will not sound right. Conversion can be done by booting up a DOS 3.3 disk, putting the Metatrak disk into the disk drive and typing "RUN LINEAR-CONVERT". This is a program that will automatically convert old linear preset masters into the new ones.

Like a preset master, each individual preset can be saved or loaded. To do this use CTRL-E and select the desired function "S" (for save) or "L" (for load). A prompt will appear allowing the disk access to occur. The same conventions in loading or saving a preset master apply for the individual preset. Note: the complete individual instrument isn't saved or loaded within the preset, only the envelope and control parameters (waveforms, vibrato and oscillator offset aren't included).

C. Waveforms (CTRL-W,?)

Although actual waveform creation can't be implemented within Metatrak it does provide for loading and saving of waveforms. Thus waveforms can be created using alpha Plus or Sounds Trio and then loaded directly into Metatrak. To load or save a waveform via disk, type CTRL-W. The following prompt will appear:

```
"WAVEFORMS
 L)OAD OR S)AVE WHICH?"
```

To load a waveform type "L" followed by "RETURN". The following prompt will appear:

```
"INSTRUMENT #:0"
```

Select the instrument number you wish to work with followed by "RETURN". The primary channel waveform prompt will appear first enter the new waveform to be loaded followed by "RETURN". If it is to be left as is just hit "RETURN". The percussion channel waveform prompt will then also appear. Follow the same procedure as previously mentioned for the primary wave.

```
PRIMARY .........LOAD WAVE: SINE 1 & 4
PERCUSSION ......LOAD WAVE: SINE 2
```

Saving a waveform to disk is handled the same as loading a waveform. Rememeber a "?" can be typed at the beginning of any file name to show the contents of the disk before loading or saving. This is very useful if you are using a previously prepared disk with many waveforms on it and you need to make reference to the correct spelling or just what is available.

D. Oscillator Offset (CTRL-O)

Each instrument uses two oscillators, one for the primary channel and one for the percussion channel. In Metatrak, the frequency offset between the channels of each instrument can be set by holding down the "CTRL" key and typing the "O" key. The following prompt should appear:

"SET OFFSET: 2"

The current offset for the instrument will be shown. A new offset is selected by entering a number between 0 and 255. If the offset is not to be changed simply type "RETURN". The offset value corresponds to 32nd tone increments applied to the percussion channel. A value of zero will give no offset. By slightly offsetting the frequency with a value of 1 or 2, the sound will usually become much richer and full. In some cases setting the offset for tonic intervals such as a fourth (80), or fifth (112), can be effective making each note sound like a chord. A value of 192 causes an octave of offset. Changes to an instrument oscillator offset can only be saved within a preset master.

E. Vibrato (O,V,CTRL-V)

Vibrato rate, "VIR", and vibrato depth, "VID", are shown on the screen while in live mode. By typing "U", the current instrument vibrato rate and depth will be updated on the screen. To instantly turn off the vibrato, type the "O" key. Re-typing the instrument number will reinstate the instrument's vibrato.

Although each instrument in live mode has its own individual vibrato rate and depth settings, only one vibrato (frequency LFO) exists in the operating system. Thus, when using multiple instruments as with Metatrak recording or with split keyboard, the current vibrato setting displayed is shared by all.

Vibrato rates or depths can be modified. One method of doing this is by adjusting the analog control paddles and sampling their position by typing "V". Another way is by first holding down the "CTRL" key then typing "V". This will cause the following sequence of prompts to appear:

"LOAD VIBRATO WAVE: SINE"

Here, the vibrato modulation waveform may be changed to a new waveform called from the diskette. To leave as is type "RETURN". The next prompt will be:

"VIBRATO RATE: 21"

The current vibrato rate will be shown. To change, type in the new value followed by "RETURN". If no change is to occur simply type "RETURN". The last prompt displayed is:

"VIBRATO DEPTH: 3"

Changing depth is handled as with vibrato rate. Again, typing "RETURN" will cause the displayed value to be used. After this sequence, the system will return to live mode. The new vibrato values selected will replace the current instrument's vibrato values. Note: like offset, vibrato settings are only saved within the preset master.

F. Master Volume <- ->

Master volume of all instruments can be dynamically controlled using the left and right arrow keys on the Apple keyboard. Typing the "<-" key lowers system volume by 5. Typing the "->" key raises system volume by 5. The range of the master volume is from 0 to 255.

The master volume is shown on the screen display when in live mode by "VOL". The current volume, as adjusted by the arrow keys, can be updated on the screen by typing "U" for update. The value upon boot-up will be whatever the master volume is set at in the set-up procedure.

G. Pitch-Bend (CTRL-B)

Metatrak has a built-in pitch-bend control as opposed to being implemented in an FX mod as with alphaPlus. The pitch-bend feature can be accessed by holding down the "CTRL" key while typing "B". Doing this will allow pitch control through the analog control paddle 0. When pitch-bend is selected a "PB" will appear on the screen to the right of "VOL".

Pitch-bend is normally used by controlling the paddle with one hand using your thumb, while playing the keyboard with the other. Pitch-bend is only applied to the live keyboard instrument and it cannot be recorded. To turn pitch-bend off type "CTRL" "B" again.

H. Fine Tuning

The alphaSyntauri keyboard in Metatrak is tuned to A=440HZ in an equal tempered scale. If it's necessary to change the fine tuning, the alphaSyntauri tuning can be modified with the "scale update program".

To use the scale update program, quit Metatrak by pressing the spacebar from live mode, then type "Q" followed by "RETURN". By doing this the basic prompt "]" should appear. Make sure the Metatrak diskette is in the disk drive, then type "RUN SCALE UPDATE" followed by "RETURN".

After the program is loaded from disk, a prompt will appear on the screen specifying the current frequency of A above middle C. To change the value enter the new frequency in HZ followed by "RETURN". Note: for reference, when A=440HZ, A flat=415HZ and B flat=466HZ.

After selecting the frequency, a prompt will appear for specifying intervals per octave. Standard equal tempered scale is twelve intervals per octave. In Metatrak, any value from one to fifteen intervals per octave can be selected. If this is not to be changed, simply type "RETURN". The scale update program will then load and run Metatrak again.

Note that pitch-bend can also be used as a fast, although temporary, method of tuning to raise the pitch in 32nd tones. Pitch-bend, however, will only affect the live keyboard; tuning of recordings will stay as specified in the scale update program.

Coarse tuning for transposition of key or octaves can be controlled within the instrument definition or by using the transpose.

I. FX Mods (CTRL-F)

The Metatrak software has a special feature that allows "FX mods" to be loaded off diskette and into the main program loop. FX mods are small assembly language programs that serve specific functions for sound modification.

There are several FX mods available on the Metatrak diskette for immediate use. The FX mods included are individually described in Appendix F. Future software releases from Syntauri will include additional FX mods for Metatrak.

An FX mod can be loaded by holding down the "CTRL" key while typing "F". A prompt will appear:

"MFX MODE
L)OAD, S)AVE OR O)FF:"

By typing "L" the following prompt will appear:

"LOAD MFX MOD:"

Type the name of the FX mod desired followed by "RETURN". (Note: the "M" in MFX is to distinguish a Metatrak FX mod from an alphaPlus FX mod. The two file formats are different and cannot be mutually used.) After the FX mod is loaded another prompt will appear:

"LOWEST TRACK:"

Enter the lowest track number, (0-16) followed by "RETURN", that is to use the FX mod. By simply typing "RETURN", the track assignment will default to the track number already in the FX mod. (To fully understand the implications of this prompt, you must become familiar with the track master, explained in section V. Not all FX mods can be assigned to a track region. See Appendix F.) A final prompt in this sequence will then appear:

"HIGHEST TRACK:"

Similar to the preceding prompt, enter the highest track number, (0-16) followed by "RETURN", that is to use the FX mod. The combination of these specifications sets up a region of tracks that use the FX mod. Those tracks outside of the region are left in their normal state. After this the system will return to live mode.

Control of FX mods varies, some may be fixed, others allow their parameters to be modified through the analog control paddles. Once a modifiable FX mod is set to your liking, its state can be saved along with the track region assinged to it. To do this hold down the "CTRL" key while typing "F", as explained earlier for loading an FX mod. This time, however, type "S" for save FX mod. The following prompt will appear:

"SAVE MFX MOD:"

By typing a new name for the FX mod, followed by "RETURN", the current state of the FX mod will be saved to disk for later use.

To turn off any FX mod hold down "CTRL" and type "F" again, then type "0" followed by "RETURN". After turning the FX mod off the system will go back to live mode.

IV. THE SPLIT KEYBOARD FEATURE

Metatrak has a powerful split keyboard capability that allows the alphaSyntauri keyboard to be sectioned with a different instrument assigned to each. Up to eight sections can be defined.

The split keyboard feature is very effective for a live performance. For example, the lower two octaves might be set for bass guitar while the upper octaves could be set for strings. Using the split in conjunction with recording makes it possible to record then play back a repeating background line while playing a few different instruments live in split mode on the keyboard.

The following sections provide information on defining a split, changing instruments in a split, and saving or loading a split master via disk.

A. Split Keyboard Parameters

Looking at the video display while in the live mode you will see various parameters on the lower portion of the screen (see Figure 6). Those specifically associated with split keyboard are in the top line. The parameters are defined as follows:

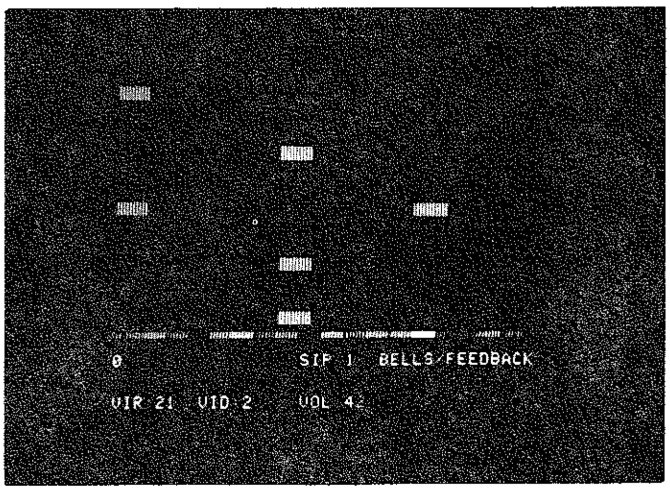


Figure 6: Live Mode (without keyboard split)

"0"

Shows that the only instrument in use is instrument number 0. Since only one number is displayed the keyboard isn't split. When two numbers are displayed there are two instruments in split mode at the keyboard, and so on up to eight numbers and eight splits.

"SIP: 1"

Shows that the "Split Instrument Pointer" is set to 1. Since only one instrument is currently defined, a numeric key (between 0 and 9) struck on the Apple will change the instrument for the entire alpha keyboard. Please remember that you must type "U" to update the video screen display when you change instruments.

"BELLS/FEEDBACK"

Shows the name of the current instrument being pointed at by SIP. As previously mentioned "U" must be typed to update the screen for current status.

B. Defining A Split (CTRL-S)

Defining a split keyboard can be accomplished by holding down "CTRL" while typing "S". The following prompt will appear:

"SPLIT MASTER MODE
(L)OAD, (S)AVE OR (D)EFINE WHICH:"

To define a split type "D" followed by "RETURN". Next, a prompt will appear that asks to specify the number of splits to be used:

"NUMBER OF SPLIT INS. (MAX=8)"

For demonstration purposes, type "2". The next prompt will ask you to set the position of the split on the keyboard:

"HIT KEY FOR SPLIT POINT #1"

You can now set a split point by pressing the key on the alphaSyntauri keyboard where you want the split. Again, for demonstration purposes press a key somewhere in the middle of the keyboard. Immediately after this is done a list of all the instruments in the preset master will be displayed on the screen (see Figure 7). Below the list a prompt will ask you to assign an instrument number to a split position:

"ENTER SPLIT INSTR. #1"

Typing an instrument number will assign the corresponding instrument to the left most split. For example, type 7. The prompt will then update for assigning the next split instrument; type 5. After instrument selection the alphaSyntauri will be back in live mode. By playing the keyboard you will hear the two instruments divided by the split. Looking at the screen (Figure 8) you should also notice changes in the split keyboard parameters.

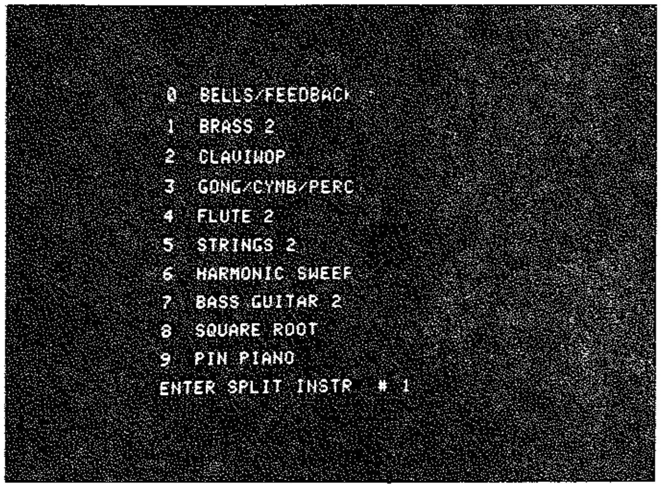


Figure 7: Preset Master list for assigning instruments to splits

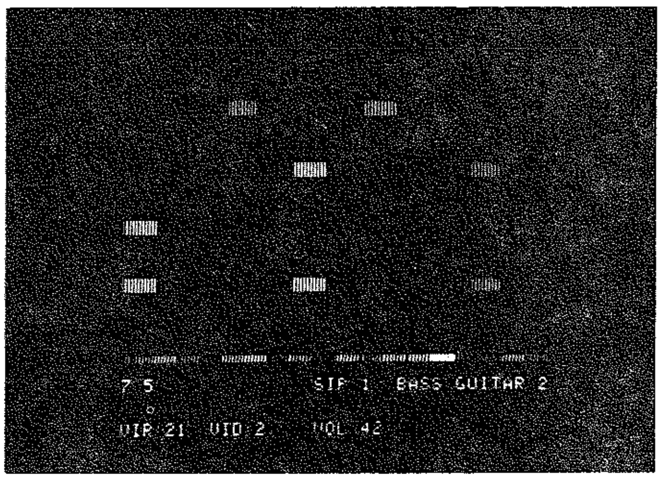


Figure 8: Live Mode with a split of two instruments

"7 5"

Shows there are two instruments on the alphaSyntauri keyboard. Instrument #7 is on the lower portion and instrument #5 on the upper portion.

"SIP: 1"

Shows that the split instrument pointer is now set for controlling the lower split instrument. Typing a key between 0-9, will change the lower instrument.

"BASS GUITAR 2"

This shows the current instrument name of the split pointed at by SIP.

The preceding was a basic run through of defining a split keyboard. As you can see it is very straight forward and the more practice you get the simpler it will become. Try setting up all eight splits with instruments 0-7! To reset the keyboard back to one split, define a split of one and hit the uppermost key for the split position.

C. Changing Instruments (J,K,0-9,U)

Once a split is defined, it is possible to change the instruments associated with a split while in live mode. This is done by controlling the SIP. The number specified by SIP is the number of the split that can currently have its instrument changed. For example, if SIP=2 and there were four splits, then the second from the left split can have its instrument changed by typing a number (0-9).

To control SIP the "J" and "K" keys on the Apple are used. Typing "K" increments SIP by one. Typing "J" decrements SIP by one. (Notice that it isn't necessary to type "U" to show the current state of SIP.)

With a keyboard split of two, typing "K" will allow the upper split to be controlled, typing "J" will allow the lower to be controlled. If the instrument or SIP is changed, the correct instrument name will only be displayed by typing "U".

D. Saving or Loading a Split Master (CTRL-S,?)

Because some split keyboard definitions can become quite complex, Metatrak provides the capability for saving and loading a split master. The split master contains all the specifications for a given split keyboard definition.

To save a split master to disk, hold down the "CTRL" key while typing "S". When the prompt appears for load, save or define, type "S" for save. Next a prompt will appear:

"SAVE SPLIT MASTER:"

Type the name for the current split followed by "RETURN". Associating the split master name with the musical piece and preset master it is used with, will serve as a reminder for later use. After the split master is saved to disk, live mode will be reinstated.

Loading a split master is handled in the same fashion. When selecting the split mode type "L" for load. The following prompt will appear:

"LOAD SPLIT MASTER:"

Enter the name of the split to be loaded from disk followed by "RETURN". Remember, typing a "?" while in live mode or before entering a file name for load or save, will display the contents of the diskette.

V. THE RECORDING PROCESS: BACKGROUND INFORMATION

A powerful compositional tool, the Metatrak record feature additively combines multiple recorded performances for simultaneous playback. For example, take the creation of a composition consisting of three different instrument parts: bass guitar, electric piano and flute. Using Metatrak the bass guitar could be recorded first. Once completed, the recording is played back and listened to while simultaneously recording the electric piano. Similarly, the flute can be added while listening to the two earlier recorded parts. The result is a quick and cost effective recording which may be used for compositional arranging, recording studio preparation, background to live performance, or simply for listening pleasure at a later time.

The process of recording with Metatrak is broken down into three catagories:

* Standard Recording - Used to lay down the first track
* Metatrak Recording - Used for adding subsequent track recordings while listening to earlier ones play back
* Mix-Down/Playback - Used for the final review and adjustment of all track parameters

Compared with tape based multi-track recording techniques, this process is respectively analogous to "record only", "sync" and "playback only" modes.

The following sections cover these three categories and how they work in conjunction with the "track master". In addition, a comparison with tape based multi-track recording is made and other important aspects of Metatrak are discussed. For a demonstration of a Metatrak recording, see Appendix D.

A. Tape Based Multi-track Versus Metatrak

With Metatrak, each recording is associated with an individual track number of which there are sixteen available. The term "track" comes from conventional tape based multi-track recording where record/playback control over each track is accomplished by electromagnetically dividing the tape into multiple parallel sections. Each section has its own erase, record and playback heads.

Multi-track recorders started making their appearance in the late 1960s when half track (stereo) and quarter track (4 track) were commonly used. Now it is common for recording studios to have a number of multi-track recording systems consisting of 2, 4, 8, 16 or 24 tracks.

There are similarities and differences between a tape-based multi-track recorder and Metatrak. Both methods of recording have their particular advantages, but they are not the same. Similarities are the provision of standard multi-track recording features such as: record, playback, erase, fast forward, punch in/punch out, click track and track parameter control.

A major difference between the two methods, however, is that a tape based recording system is capable of recording virtually any audio sound, including various acoustic instruments and vocals. Metatrak exclusively records sounds played on the alphaSyntauri keyboard. Because the alphaSyntauri implements recording digitally, it provides features and capabilities not possible on conventional tape based systems. Such features and capabilities include: changing instrumentation of an already recorded piece, playback speed adjustment without pitch change, and special sequence recording modes. Combining standard multi-track capabilities with special recording features, Metatrak proves an effective compositional tool.

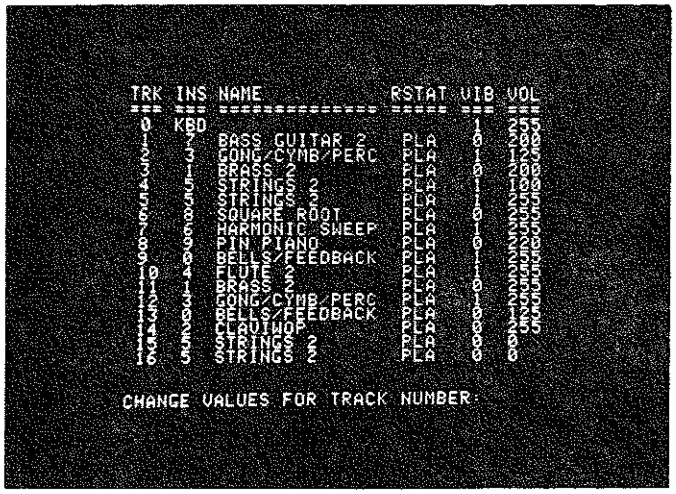
B. The Track Master (CTRL-R)

Before starting to record, you should understand the concept and use of the track master. As compared to a tape based multi-track recorder, the track master acts as the control console and interconnection to the instrument being recorded. It provides all the information for assigning an instrument and controlling parameters of a given track. Its specific use and access depends on what function is being implemented, whether it be standard recording, Metatrak recording or mix-down/playback.

The track master can be accessed for viewing in live mode, by holding down the "CTRL" key while typing "R". In doing this a track master display will appear on the screen looking similar to figure 9. Looking at the display you can see that each of the sixteen tracks, plus the live keyboard (track 0) are listed vertically at the left side of the screen. Each track has associated with it a "field" for instrument number, instrument name, record status, vibrato status and volume. Below the track master display is the prompt:

"CHANGE VALUES FOR TRACK NUMBER:"

This allows you to change the track master. For now, though, let's just review the functions of the track master (detailed explanations are covered later).



TRK	INS	NAME	RSTAT	VIB	VOL
0	KBD			1	255
1	7	BASS GUITAR 2	PLA	0	200
2	3	GONG/CYMB/PERC	PLA	1	125
3	1	BRASS 2	PLA	0	200
4	5	STRINGS 2	PLA	1	100
5	5	STRINGS 2	PLA	1	255
6	8	SQUARE ROOT	PLA	0	255
7	6	HARMONIC SWEEP	PLA	1	255
8	9	PIN PIANO	PLA	0	220
9	0	BELLS/FEEDBACK	PLA	1	255
10	4	FLUTE 2	PLA	1	255
11	1	BRASS 2	PLA	0	255
12	3	GONG/CYMB/PERC	PLA	1	255
13	0	BELLS/FEEDBACK	PLA	0	125
14	2	CLAVIWOP	PLA	0	255
15	5	STRINGS 2	PLA	0	0
16	5	STRINGS 2	PLA	0	0

CHANGE VALUES FOR TRACK NUMBER:

Figure 9: The Track Master

Instrument Number and Name

The instrument field of the track master (as shown in figure 9), defines which of the ten instruments of the current preset master is assigned to a track. The assignment is controlled by the instrument number. Each track doesn't have to be different. A single instrument can be assigned to more than one track. Note that the instrumentation specified by the track master is dependent on the current preset master. Thus, to achieve the original orchestration in later playbacks, the preset master and track master used in the recording must be loaded. Loading and saving a track master is covered later in this section.

Record Status (RSTAT)

The "RSTAT" field in the track master specifies the current mode of operation for a given track: playback, record or erase. When accessed in live mode or during playback, "RSTAT" for all tracks will be set to "PLA" for playback. In standard recording the "RSTAT" field may also specify "REC". In Metatrak recording all modes are possible: "PLA", "REC" and "ERA" (for erase). Only one track can be set to "REC" at a given time (except in ensemble mode).

Vibrato Status (VSTAT)

A vibrato status field, "VSTAT", is provided for turning vibrato on or off for each track. Although each instrument in live mode has its own individual vibrato setting, only one vibrato (frequency LFO) exists in the operating system. Thus, when using multiple instruments, as in Metatrak, the vibrato setting is that of the current keyboard (track 0) instrument. Using "VSTAT" the global vibrato can be selectively applied. When "VSTAT" is set to 1, vibrato is applied. When set to 0, it is off.

Volume (VOL)

The last parameter field in the track master is volume, "VOL". The "VOL" setting is used especially in mix-down/playback to bring out or subdue specific instruments relative to one another. The volume range is from 0 (off) to 255 (full on). Unlike the master volume which is absolute and completely linear. The "VOL" setting is actually a limit for the maximum volume of an instruments amplitude envelopes. It has a similar effect to lowering or raising the PV, AV and SV envelope parameters.

Two things should be kept in mind when using "VOL". First, being a limit control rather than absolute volume, "VOL" will only affect volume if set below the envelope volumes as defined with alphaPlus. If set above, the instrument will stay as it was originally defined. Second, the overall adjusting effect will respond exponentially.

C. Saving or Loading a Track Master (CTRL-T,?)

The track master is an integral part in the recording and playback process. Because it will vary from recording to recording, a provision is made for saving and loading a track master via disk. With this capability a complete multi-track recording can be worked on and then saved with all the track master settings accessible at a later time. Saving or loading a track master is done in live mode by holding down "CTRL" and typing "T". A prompt will appear:

```
"TRACK MASTER MODE
 L)OAD OR S)AVE      WHICH:"
```

Typing "L" followed by "RETURN" will select the loading of a track master from disk. Typing "S" followed by "RETURN" will select the saving of the current track master to disk. Once either is selected a prompt for typing the track name will appear. Enter the appropriate name followed by "RETURN". After the disk is accessed, live mode will be reinstated.

As mentioned earlier, typing "?", in live mode or at the first letter position of a file load or save, displays diskette contents. This allows viewing for track master file names which are preceded by "TRACK MASTER:".

D. Oscillators, Instruments, Voices and Tracks

Understanding the relation between oscillators, instruments, voices and tracks, will help you in preparation and creation of a good Metatrak recording. These four entities can easily be confused at first; however, each one serves an individual function. A brief description of each of these key entities is presented below.

Oscillators

Digital oscillators are the waveform sound source for the alphaSyntauri synthesizer. There are a total of sixteen available for use.

Instruments

Instruments are preset sounds. Each has information for controlling two oscillators per voice. Instruments are loaded into Metatrak as a preset master, a bank of ten instruments.

Voices

A voice is a single active instrument sound. Each new note played activates a voice. Since each instrument definition controls two oscillators, each voice uses two oscillators. Having sixteen oscillators available, up to a total of eight voices can be active simultaneously.

Tracks

A track is the means for associating notes being recorded with a specific instrument. There are sixteen tracks available for recording, (not to be confused with sixteen oscillators). Any track can have any instrument in the preset master assigned to it.

To summarize the above descriptions in reference to Metatrak: You have sixteen tracks available for recording. Each track can have any of ten instruments in the preset master assigned to it. Up to eight voices can occur simultaneously among all the tracks.

Considering the fact that only eight voices are available, you might wonder, "Why have sixteen tracks?" The voice limitation is eight "simultaneous" voices. This does not mean only eight instruments can be used throughout a piece. Thus, it is possible to have various instruments with different track settings, (volume, vibrato, FX mods), occurring at different places within a Metatrak recording as long as no more than eight occur simultaneously. If eight voices are exceeded, the voice with the lowest volume will be removed. The live screen display can prove useful for seeing how many voices are active at a given time.

Selecting instruments can play a very important part in the final outcome of a Metatrak recording. There are a number of preset masters available within the alphaSyntauri synthesizer software library. These preset masters may serve your initial recording needs, or you may choose to create instruments yourself using alphaPlus. Besides considering general orchestration among tracks, certain defined characteristics of an instrument will have an effect on the recording. This is especially the case with envelope parameters.

If an instrument's envelope has a long release time (the note sustains after releasing a key), it is easy to use many voices in a short period of time. Consider the situation of playing one note at a time quickly up the keyboard. If the release time was lengthy, all of the eight possible simultaneous voices could be used, even though only one key was struck at a time. This occurs because an oscillator pair will stay assigned to each sustaining voice.

To maximize the number of voices available at a given time, it is best to use shorter envelope release times. Doing so will prevent clipping of notes (turning off an active voice for a new one), in case the maximum number of simultaneous voices is exceeded. If a particular instrument needs a long release time at a certain point within a recording, use the sustain pedal to accomplish this so it can be turned on or off as needed.

E. The Metronome/Click-Track (CTRL-Z)

Since Metatrak recording is an accumulative process of recording a new track while listening to previous ones, the most important recording is the first. This is especially the case for timing. To assist in recording a good first track, in perfect timing, Metatrak provides a "metronome/click-track".

The metronome/click-track is a visual and audible assistant used while playing music at a specific tempo. It serves many functions including: assistance in recording a good first track, a timing marker (click track) for subsequent tracks, drum machine tempo (see section IX) or just practice in live mode.

The metronome/click-track can be accessed in line with the record and playback commands or from live mode by holding down "CTRL" and typing "Z". In doing this, a prompt will appear asking to set the tempo at a value of 0 to 280 beats/minute (0-155 if drum interface is on).

" METRO TEMPO (0-280):"

To set a tempo, type in the desired value followed by "RETURN". A value of "0" turns the metronome/click-track off. After set, a second prompt will appear.

"METRO PRE-COUNT (0-16):"

The pre-count prompt is used to set up a preliminary count that allows you to monitor the tempo before any playback or recording starts. The most useful application for pre-count is in the Metatrak record mode since playback normally starts immediately. You probably won't find it that useful in other cases so just typing "RETURN" will ignore it. Entering a value up to 16 will cause it to count the specified number of metronome beats before playback or recording begins.

Once back in live mode, the system provides both visual and audio feedback. For visual indication a rectangular block alternating from one side of the screen to the other will appear. Simultaneously, an audible click will be heard coming from the speaker inside the Apple. In addition, the metronome/click-track signal is sent to the cassette output connector on the back of the Apple. This allows for further audio amplification by connecting a cable from the output to your audio system.

Note when using the metronome while recording, it is necessary to anticipate the beat slightly to terminate properly. This is because the spacebar when pressed will wait until the next metronome beat before it actually terminates the recording. This allows perfect synchronization for using the ECHO/REPEAT feature. By anticipating the beat slightly you can be assured to terminate at the correct time.

VI. STANDARD RECORDING MODE

Standard recording in Metatrak is used for recording the first track of a multitrack piece, or simply for laying down a single track. It is very similar to recording in the alphaPlus operating system software using the record/playback menu to control the recording process. A major difference, though, is in the assignment and control of one of sixteen tracks for recording. As mentioned earlier, this function is accomplished through the track master.

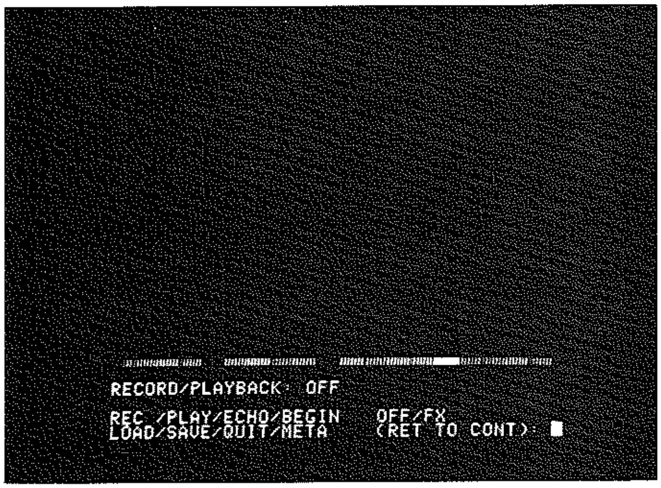


Figure 10: The Record/Playback Menu

A. The Track Master In Standard Recording

The track master is accessed in standard recording in-line with the recording process. To start a recording, the record/playback menu must be called by pressing the space bar in live mode (see figure 10). To select standard recording type "R" followed by "RETURN". The metronome prompt will then appear (see section V.) followed by the track master.

At any given time only one track can be in record mode (ensemble mode is an exception to this). The track showing "REC" in its "RSTAT" field, is the current recording track. All other tracks are set to playback, "PLA", even though they are not in use. Below the track master display is the prompt:

"CHANGE VALUES FOR TRACK NUMBER:"

If the current state of the track master is acceptable, simply hit "RETURN" to continue into the recording process. If you wish to change the assinged instrument, record status, vibrato status or volume of a track, type the number of the track you wish to change followed by "RETURN". Although not mandatory it is usually best, for the sake of organizaton, to use track number "1" for your first recording.

After responding to the prompt with a track number, a cursor will appear at the instrument number of the track. To change the instrument, type the new instrument number followed by "RETURN". Notice this will also update the instrument name. If the instrument is not to be changed, hit "RETURN" to step to the next field.

The next field encountered is "RSTAT" (record status). If you wish to use this track for your first recording and "RSTAT" is already in record, simply hit "RETURN". If not, type "R" and the status will update to record mode, "REC".

Hitting "RETURN" will move the cursor to "VSTAT" (vibrato status). Vibrato status is a switch that can restrict or apply vibrato to a track. To change, enter the desired value (1=on, 0=off), followed by "RETURN". Again, if no change is required, hit "RETURN".

The last field is "VOL" (track volume). To change, enter the desired value (0-255) followed by "RETURN", or just hit "RETURN" to leave as is. At this point the following prompt will appear again:

"CHANGE VALUES FOR TRACK NUMBER:"

If the track master is set up correctly, hit "RETURN". If not, follow through as explained previously.

B. Recording The First Track

Once the track master has been set for recording your first track, the record/playback menu will again be displayed. From this point on the general recording techniques of alphaPlus are applicable. Hitting "RETURN" will put the system in live mode with the instrument name in reverse video (signifing record), and the track number being recorded displayed by "REC:" The actual recording will not start until a key or pedal is depressed. (Note: The sustain and portamento pedals are also recorded).

As explained in Section V, the metronome/click track can be used for keeping tempo or to serve as a guide for future tracks. Although the metronome/click track will serve most purposes, at times you may also want to use the first track as a "click track recording". Its primary purpose is to serve as a guide for later tracks. A click track recording will usually last the entire duration of the recording and sometimes use many voices. Once all other tracks are added, the original click track can be erased. If you choose to approach recordings in this fashion, the instrument used should be defined with envelope peak and sustain values that are relatively low compared to the other instruments. This way, even if too many voices are played the click track recording will disappear first.

It is important to remember when laying down your first track not to use too many voices. That is, playing many notes simultaneously. A maximum of eight notes (voices) can be active at a given time for all track recordings. Being conservative will free up voices for later tracks. Effective use of voices is covered in Section V.

Another type of first track recording is the "dummy track". A dummy track is basically recorded time elapsing, without keyboard input. It can be used when you are not interested in following a first track recording while adding subsequent tracks. An example of this might be a composition that changes instrumentation sequentially from beginning to end. To record a dummy first track, simply press one of the footpedals down and up once, then let the system record time for as long as the expected duration of the piece. For example, if the length of the total piece was around five minutes, record the dummy track for five minutes then terminate the recording and save it to disk.

To terminate any type of recording press the SPACEBAR. If you are satisfied with the recording for your first track, save it to diskette from the record/playback menu by typing "S" followed by "RETURN". A prompt will appear:

"RECORDING COMPLETE:"
NAME TO SAVE:

Type the name you wish to give the recording (not to exceed fourteen characters), followed by "RETURN".

If you wish not to save the recording, but rather start over, reset the record buffer to the beginning by typing "B" followed by "RETURN" in the record/playback menu.

Other standard functions of the record/playback menu can also be useful in assistance to the recording process. Playback of the recording is accomplished by typing "P" followed by consecutive "RETURN"s until heard. The echo feature, "E" followed by "RETURN", will allow a sequence repeating of the recording after terminated by the spacebar. If a recording that was saved to disk needs to be reviewed, the load function can be selected by typing "L" followed by "RETURN".

C. Meta Files

The length of a recording is measured by the total number of notes recorded and stored in memory. This is specified in the record/playback menu whenever a recording is terminated. The maximum number of notes allowed in basic Metatrak is approximately 3000 notes. Future product releases from Syntauri will expand the number up to 20,000 notes. The length of a recording relative to time, will depend on how quickly or slowly the notes are played.

In Metatrak the actual recording saved or loaded from the disk is called a meta file. A meta file is not compatible with previous alphaSyntauri operating system recordings, called note files. Thus, recordings saved as note files cannot be loaded into Metatrak and vice versa. The primary difference between the two file types is that Metatrak stores track information in a command byte format. A note file does not contain any track information.

VII. METATRAK RECORDING MODE

As explained earlier, Metatrak recording is the process of recording new tracks while listening to previously recorded tracks in playback. Sixteen tracks are available for recording, using any of the ten instruments of the preset master. Metatrak also has special recording operations for sequencing and adjusting the speed of tracks in playback. Additionally, many common tape-based recorder controls such as; track erase, punch in/punch out, and fast forward, are included.

Entering the Metatrak record mode can be accomplished from the record/playback menu by typing "M" for Metatrak followed by "RETURN". A prompt will appear stating:

"LOAD META FILE:"

Type the name of the meta file to be worked with followed by "RETURN". The meta file can be a first track recording or a previously worked on Metatrak recording. As additional tracks are being added, the meta file loaded will be updated unless you change the name during the Metatrak process. After the meta file is loaded the following prompt will appear:

"LOAD TRACK MASTER:"

This is provided for convience in case a track master is to be loaded, if not, simply hit "RETURN".

A. Using The Track Master In Metatrak Recording

After the initial meta file is loaded the track master display will appear on the screen. Control of and access to the track master is handled as in standard record mode. The first step in Metatrak record mode is to select the next track for recording. If only one track, (a first track recording), was loaded chances are track 1 will be the track currently in record mode. As in the standard record mode, one track will always be set to record. To update the current record track follow through with the prompt sequence as with standard recording, section VI.

B. Recording Additional Tracks

Once the track master is set up as desired, actual Metatrak recording can begin. Prompts will appear after leaving the track master display. The first one will state:

"ECHO/REPEAT (Y/N):"

This allows the echo/repeat feature to be used. The default for this feature is "NO". For now, simply hit "RETURN". The second prompt will appear:

"METRO TEMPO (0-280):"
"METRO PRECOUNT (0-16):"

This allows setting the metronome before entering Metatrak recordings. The metro pre-count will only appear if the metronome was set. The next prompt is:

"PLAYBACK SPEED (1-800%):100"

The default for this feature is normal speed (100%). For now, also hit "RETURN". Both these special features will be covered in more detail later.

At this point the system should be back in live mode, ready to record a new track while earlier recorded tracks are in playback. The instrument heard from the keyboard will be the instrument assigned to the current record track. The current record track number is indicated on the screen by "REC:". Whatever is played on the keyboard will be recorded in sync with the previous recordings. Note, the lower right side of the screen displays "METATRAK" as an indication of being in Metatrak record mode.

The recording can be terminated in two ways. The first is to let the previously recorded track complete playback. The second is to press the SPACEBAR at any given time during the process (the spacebar works slightly different with the metronome on, see section V.). Either method of termination will allow the option of saving what was recorded or disregarding it and starting over. The prompt that appears after pressing the SPACEBAR is:

"SAVE THIS TRACK (Y/N)?"

If "Y" is typed, the following prompt will appear:

"SAVE AS FILENAME:"

The name of the meta file loaded last will appear after the prompt. If you wish to keep the same name, simply type "RETURN". To change the name, type in a new name followed by "RETURN". IN EITHER CASE, THE newly recorded track combined with the earlier tracks will be saved to disk as a meta file. If the track is not to be saved, hit "RETURN". Either choice or originally typing "N" to "SAVE THIS TRACK" will encounter the prompt:

"Q)UIT OR M)ETA"

Now, if additional Metatrak recording is to be done, typing "RETURN" will cause the next prompt to appear:

"RELOAD (Y/N)?"

If "Y" is typed followed by "RETURN" it will go to a prompt to reload the new accumulative recording from disk. If "RETURN" is typed it will continue to work on the piece in memory. This function is similar to rewind on a tape based recorder. The track display will then appear on the screen waiting for the next track to be selected for record or modification. To record additional tracks follow the same sequence as previously explained.

If no other tracks are to be added then typing "Q" for quit will route the system back to live mode. Before this happens though, the following prompt will appear:

"SAVE TRACK MASTER (Y/N)?"

Even though further mix-down work may be necessary, this prompt acts as a safeguard to save the current status of the track master. Typing "Y" followed by "RETURN" will allow saving the track master. Just typing "RETURN" moves the system on to live mode for mix-down of the Metatrak recording.

C. Erasing A Track

After recording several tracks you may decide to remove one completely from the accumulative recording. One quick way to accomplish a similar effect, is to zero out the volume parameter associated with the track. However, even though this removes the track's audio output, the track is still using up memory and occasionally using up oscillators that get assigned to it. If a track is no longer to be used, (as might be the case with a first "click" track recording), it is best to erase the track.

Considering how tape based recorders work, it would seem the simplest way to erase a track is to re-record on it without giving any input. With Metatrak, once a track is recorded, the recording stays even if you record over it again. The reason behind this is to make sound on sound recording possible on each individual track. So, to provide for complete removal of a track's recording, Metatrak includes an erase mode.

Any number of tracks can be set into erase mode by typing "E" after stepping to the "RSTAT" field of a track in the track master. Once set, the status "ERA" will flash on and off as a reminder that it is in erase mode. The actual erase requires going completely through the piece in Metatrak record mode and saving the track after termination. The tracks will stay in erase until reset to either play or record status. Play status can be reinstated by typing "P" after stepping to the "RSTAT" field in the track master. Erase will not affect a section of a track recording that was scanned through using the "fast forward" feature.

D. Punch-In / Punch-Out (ESC)

Being human and not a computer, we all make mistakes. Typically in the process of recording, the worst mistakes are at the end of an otherwise perfectly performed track. This is a form of "red light fever" which can be terminal to a musician in an expensive recording studio with an impatient producer hanging over him. With Metatrak it's not so bad, for like a recording studio, you have "punch-in/punch-out".

Punch-in/punch-out is an edit facility that allows selective erasing of unwanted portions of a recording. At the same time the old section is being erased, a new attempt can be made at recording it properly. Punch-in/punch-out is possible only in the Metatrak record mode.

To use punch-in/punch-out, set "RSTAT" to "REC" for the track to be worked on, (remember that re-recording over a track does not automatically erase it, but sets it up for sound on sound). Follow through the track master and record sequence until back in live mode listening to playback. When the portion to be removed approaches, type the "ESC" key once to punch-in. This will start the erase of the track. At this time the correction can be made. Notice that when punch-in active, the track number specified by "REC:" on the screen, will flash. To stop the erase, punch-out by again typing the "ESC" key.

Punch-in/punch-out can be used as many times through a recording as needed. After reaching the end of the recording it must be saved as with any new track recording. If it is not saved, the corrections made using punch-in/punch-out will be lost.

E. Fast Forward (F)

To speed up the process of adding to or correcting a recording, Metatrak provides a fast forward control. To set playback tracks into fast forward, type the "F" key. Doing this will speed playback up by eight times normal speed (800%). Fast forward provides the capability for "cueing" the playback of earlier tracks. To return to normal speed type "F" again. Fast forward will not affect the resulting tempo of the recording as other speed of playback adjustments do. Fast forward can't be used in conjunction with echo repeat.

F. Restart (R)

If while recording a new track you make a mistake or just choose to start over you can instantly "restart" the piece by typing "R". In doing this, anything just recorded on the current track will be lost. The same general function can be accomplished by pressing the spacebar, specifying not to save the track and reloading; this, however, requires a disk load which will take some time. If the metronome is on Restart will cause the metronome prompt sequence to occur. **Restart will only work up until half of the total possible number of notes played, approximately 1500 out of 3000.**

G. Echo/Repeat

The echo/repeat feature allows sequencing of playback tracks while a new track is added. This is especially useful when laying down a first track such as a bass line that is to continue through the entire piece. Another application might be a background progression of several tracks that repeat while adding a lead line that varies throughout the piece.

The actual process is simple. Let's say you have just loaded a short meta file for Metatrak recording. After your track master is set for recording the next track and no further changes are to be made, you will encounter the prompt:

"ECHO/REPEAT (Y/N)?"

To set echo/repeat type "Y" followed by "RETURN". Just typing "RETURN" will turn echo/repeat off. After selecting echo/repeat the playback speed prompt will appear, for now, hit "RETURN".

At this point the first track should be playing back from beginning to end then, starting over again in a continuous sequence. While this is happening the new track can be added via the keyboard. To terminate the recording press the SPACEBAR. Once saved and listened to, you will notice that the new meta file is the cumulative result of the sequenced tracks and the new track.

See appendix E for possible recording errors and warnings related to echo/repeat.

H. Playback Speed Control < , >

Another useful feature in Metatrak recording is the playback speed control. With this unique feature, playback tracks can have their tempo modified while adding a new track at normal speed. All of this is done without changing pitch, as with conventional tape-based systems. For example, you can record an extremely complex piece at a slower tempo, then modify it for the correct speed. It can also be used for adjusting a piece to fit within a certain time limit or accelerating or retarding sections of a piece.

There are two methods of playback speed control; one is used for exact pre-specification of playback before recording, the other is used for gradual dynamic speed control during playback.

To preset the exact playback speed, set up the track master and start the recording sequence. After the echo/repeat prompt is answered, the following prompt will appear:

"PLAYBACK SPEED (1-800%):100"

The default upon "RETURN" is 100% (normal speed). To change, type in the desired playback percentage from 1 to 800%, followed by "RETURN", (Note: 200% is twice the speed, 400% is four times the speed and so on). After being entered the playback track should be heard at the altered speed while the new track can be recorded at a normal speed.

To terminate, either wait until the end of the piece, (if not in echo/repeat), or press the SPACEBAR. When listened to at normal playback speed (100%), the result should be the same as when in the recording process.

There are many ways to use this feature. In some cases, it may take a couple of recordings, with modified speed, to get the desired result. An example of this situation might be, adding an extremely fast lead line to a piece at normal tempo. This can be accomplished by recording the selection prior to the lead line at normal tempo.

To add the fast lead line slow the playback of the earlier tracks down to, maybe, 50% (half speed). Once the lead line has been added and the meta file saved, go back into Metatrak recording and adjust the speed to 200%. Let the piece complete recording without adding anything and then save it. The result will have all tracks at normal speed except the lead line track which will be doubled saved in the final recording.

For gradual changes in playback speed, the "<" and ">" keys can be used during playback. Pressing the "<" key once lowers the playback speed by 5%. Pressing the ">" key raises playback speed by 5%. Using these keys in conjunction with the "REPT" key will allow gradual speed transitions for "accelerando" or "ritardando". Once saved, the gradual speed changes will remain in the recording.

In either method of speed control, if you are going to use a very fast playback speed, make sure when originally recording, not to play notes too quickly. Extremely short notes that have been speeded up may seem to completely disappear. The particular envelope used also can have a big effect on the audible outcome of a recording played back at very fast speeds.

VIII. MIX-DOWN / PLAYBACK

In the conventional tape-based recording process, mix-down is the last major step before completion. In Metatrak, mix-down pertains to the reviewing process of a Metatrak recording and final adjustment of the track master before it is saved.

During Metatrak mix-down, instruments can be reassigned to different tracks, vibrato status set on or off, and most importantly, track volumes can be adjusted relative to one another. Granted, such functions can also be handled while in Metatrack recording, and in some cases should. However, the mix-down process tends to be more convenient, expedient and fail safe in standard playback.

There are various reasons why mix-down is best handled in standard playback. For one, tracks cannot be in record mode, alleviating the possibility of accidently adding to a piece. Another reason is, the meta file doesn't have to be reloaded for each complete listening. This saves quite a lot of time when reviewing a recording numerous times. Also, playback speed can be dynamically incremented or decremented without modifying the final recording. This allows a controlled scanning through certain sections or adjusting for total time duration until satisfied with the results.

During mix-down/playback you may want to go back into Metatrak recording to modify a recorded piece. In fact, the two processes should be used interactively by using Metatrak recording primarily for adding or modifying track recordings, and using standard playback for periodic and final review for mix-down.

Exiting the Metatrak record mode will route the system back to live mode. Playback can then be selected by pressing the spacebar to get the record playback menu and typing "P" followed by consecutive "RETURN"s.

A. The Track Master in Mix-Down/Playback

After selecting standard playback, the current track master will be displayed on the screen. At this point, changes to instrumentation, vibrato status or volume can be made for each individual track. Unless you are already aware of changes to be made, it is best to start playback to review the recording. To do this, type "RETURN" until playback starts.

If while listening to playback you find it necessary to make a change to the track master, type "CTRL-R". Doing this will display the track master and allow changes to be made. Altering the track master parameters is accomplished as explained in Standard Recording, Section VI.

There are three main mix-down functions that should be adjusted as necessary during playback: instrumentation, vibrato state and track volume. The first of these to be finalized is instrumentation. Since each track recording is dependent only on the track number, any instrument in the preset master can be assigned to any given track. This also means a completely different preset master with ten new instruments can be loaded by typing "CTRL-P"; or, single presets "CTRL-E" or waveform "CTRL-W" can be loaded.

Once the instrumentation is finalized vibrato should be set. As explained in the track master section of this manual, one vibrato depth and rate is shared by all tracks. The vibrato used is that of the current keyboard (track 0) instrument. Applying vibrato to a track can be specified in the "VSTAT" field; a 1 = on, a 0 = off. Setting the global vibrato depth and rate is explained in Parameter Control, Section III. Using vibrato on a given instrument is really up to your own listening discretion. Traditional orchestral instruments, (strings, brass), usually sound more realistic with vibrato, where as keyboard instruments, (piano, organ), usually are better off without it.

As explained in Parameter Control, Section III, the "VOL" field specifies a volume limit that a track's instrument cannot exceed. The values can range from 255 (full on) to 0 (off). They also react differently if in linear or exponential envelope modes.

Setting "VOL" is done as explained in Standard Record Mode, section VI. Adjusting the volume of each track can have a great effect on the final outcome of a Metatrak recording. Proper usage of the volume control allows each track to be enhanced or subdued relative to the other.

An individual track volume remains as set throughout the entire recording. Variation of a volume for a single instrument part can be accomplished by re-recording on a new track the portion of the recording where the volume change is needed. Then the original section of the first track can be erased using the punch-in/punch-out feature. This allows the track volumes to be set as desired, having the same effect as changing volume during the recording.

In some cases you may want to completely eliminate a track. Turning the volume to 0 will audibly accomplish this. However, if the track is not going to be used, it should be erased. This is because the actual recording information is still in the meta file, thus will eat up memory for further use or disk storage.

B. Playback Reviewing <,>

It may take you several times through playback to properly mix down a recording. To speed up the process three playback speed controls are provided. Upon entering playback a speed control prompt will appear:

"ENTER PLAYBACK SPEED (1-800%):"

This prompt is handled exactly as in the Metatrack recording process. The only difference is that it won't permanently affect the recordings tempo. Typing "RETURN", without entering a value, causes a default to 100%, normal speed.

Once in playback two other methods of speed control can be used; a fast forward control and an incremental speed control. Fast forward, as in Metatrak recording, can be implemented by typing "F". The incremental speed control can be used by holding down the shift key and typing ">", causing a 5% speed increase. Applying the "<" key in the same fashion will decrease speed by 5%. Using either of these methods makes it possible to bypass sections not requiring further review or to slow down for sections needing attention.

If a recording needs to be reviewed many times there are a number of methods to re-start playback from the beginning of a piece. First, by pressing the SPACEBAR to select the record/playback menu and then typing "B" followed by "RETURN", the meta file "buffer pointer" will be reset to the beginning. Once the buffer is reset, playback can be re-started by hitting "RETURN". Typing "R" (for restart) will accomplish the same thing. Another method is selecting "P" for playback again, re-starting the complete playback process. A third method, typing "E" for "ECHO", will cause playback to repeat automatically.

C. The Final Production (CTRL-D)

Once satisfied with all recorded tracks, the preset master and the track master, it is time to save the final production for later use. To do this both the meta file recording and its associated track master must be saved to disk. Use an extra disk for saving these files, it will help keep things organized. The recording can be saved as specified earlier in Standard Record Mode, Section VI. The track master is saved as explained in The Recording Process, Section V.

To provide a means of quick identification, it may help to name both the track master and recording with reference to the preset master that was used. For example, a track master named "JAZZ 1" using preset master "ALPHAPLUS" might be saved as "AP-JAZZ 1". The same goes for the associated meta file recording. Use whatever naming convention that works best for you, as long as names do not exceed fourteen characters. Relating file names will assure that the proper combination of track master, meta file recording and preset master will be loaded for playback at a later time.

In the final production stage you might want to clean up and organize the files on your diskette. To assist in this process, Metatrak provides access to standard Apple DOS commands by holding the "CTRL" key down and typing "D".

There are number of uses for DOS commands relative to Metatrak in the final production stage. For example, in the process of recording, files of various names may have been saved to disk. If these files are no longer needed they can be "deleted" from the disk using the DOS "DELETE" command. Besides deleting files you may want to fully protect your files from being accidentally written to by "locking" them using the DOS "LOCK" command. Another useful command is "RENAME". If you are not already familiar with these DOS commands see Appendix A and your Apple DOS manual.

IX. Additional Special Features

Outside of the recording and performance operations described so far, Metatrak offers additional special features that may be of great value to you. These additional features include:

*Ensemble - Allows multiple instruments to be sounded simultaneously per single key depression.

*Transpose Playback/Sequence - Transposes any Metatrak file being played back dynamically by using the lowest key depressed to designate key signature.

*Drum Machine Interface - Allows Metatrak recordings to be played back in perfect synchronization with rhythms programmed on various "drum machines".

*External Sync-to-Tape - Provides a synchronous interface for dumping one or more tracks at a time to a conventional multi-track tape recorder. This allows individual track post processing.

A. Ensemble (E)

By allowing more than one instrument to be sounded at the same time per key depression, the ensemble feature greatly enhance Metatrak's capabilities in performance, recording and sound definition. For performance use, ensemble gives dynamic control over the number of instruments "layered" at any time. In recording, ensemble will allow multiple tracks to be in record simultaneously. For sound definition ensemble makes it possible to create complex and fatter sounds with greater deversity in the way timbre evolves.

Ensemble is used in conjunction with the track master which can be accessed by typing CTRL-R. Before setting up an ensemble sound, decide on the instruments you wish to use from the preset master. Note: the more instruments layered in ensemble mode, the fewer the number of voices available (see Section V-D).

When using ensemble the first main instrument will be the live keyboard instrument. The others are specified in order by track number starting with track 1 in the track master. For example, if you wish to have any ensemble sound including Bells/Feedback, Brass 2 and Pin Piano, first make sure that the track master has Brass 2 in track number 1 and Pin Piano in track number 2. Return to live mode and type "0" to select Bells/Feedback. At this point only Bells/Feedback should be audible.

To enter ensemble mode type "E". The status character "EMO" will appear on the screen flashing. In ensemble mode the number keys no longer select different individual instruments but rather the depth of the ensemble (number of layered instrument) relative to the the track numbers in the track master. To get the ensemble combination that we are after, type "2". The status character on the screen will change to "EM2" and each note played will cause Bells/Feedback, Brass 2 and Pin Piano to sound. Typing "1" will remove Pin Piano. Typing "0" will bring us back to only Bells/Feedback.

Other combinations of ensemble voicing can be approached in the same way.

Using ensemble mode for recording is similar to that of performance. The only difference is that the first main instrument of the ensemble is the instrument of the track specified for recording under REC in the track master. When using ensemble for recording specify a track that isn't used within the additional ensemble tracks. For example, if a four layer ensemble is to be used, tracks 1, 2, and 3 will be active with the record track. Thus a track number other than 1, 2, or 3 should be specified for the main record track. If the main record track conflicts with an ensemble track it will be bounced to track 16.

Although ensemble mode is set up primarily for use of one ensemble sound at a time there are ways to get around this when recording. For example, if you were interested in recording a Strings and Brass ensemble separate from a Bells/Feedback and Flute ensemble, set up the track master with the instruments in track 1 through 4 in the order mentioned. Set the volumes of the lowest two tracks to 0, select track 4 as the record track, use an ensemble setting of 3 and record. Only the first ensemble will record. To record the other ensemble, reset the volumes and move the record track to track 2 and set an ensemble of 1. This may seem a bit cumbersome at first but the results will be well worth it.

The erase and punch-in/punch-out functions in Metatrak record mode give another good reason for using ensemble recording other than just layering or making fatter sounds. With this function it's possible to record the same piece with multiple instruments and then selectively and independently erase sections at various parts of the recording. This allows precise control over orchestration and takes the burden off of the actual recording process.

B. Ensemble Sequence (S)

Ensemble sequence is a performance feature similar in operation to ensemble mode. Rather than sounding multiple instruments simultaneously though, it cycles through the ensemble instruments one at a time with each successive note played. To use, set up the track master with the desired ensemble instruments as is described for ensemble mode.

To select ensemble sequence mode type "S" instead of "E" and a status character "SMO" will appear on the screen. Set the ensemble to a number greater than 0 and the effect of ensemble sequence mode should become quite obvious after playing the keyboard. Note: ensemble sequence only works for performance in live mode and can not be recorded.

C. Transpose Playback/Sequence (T)

The transpose playback/sequence feature provides a dynamic means of tranposing any meta file in playback to a different key signature. This becomes especially powerful for performance when using short sequenced recordings and split keyboard which we'll cover shortly.

The general operation is simple: just record or load a recorded meta file from disk and set it into playback using the standard record/playback menu. While in playback, type "T" for transpose. The video screen will show a status character "TX" designating the system is in transpose mode. To transpose playback, press any key on the alphaSyntauri keyboard. The transpose interval will be upward relative to the lowest key (C0) on the keyboard. The transpose will always occur on the newest keyboard key pressed. To turn transpose off just type "T" again.

This is very straightforward if the music in playback is in the key of C originally, any key pressed will change playback to that specified key signature. For most cases though, the transpose operation should be thought of as a relative interval based on the lowest keyboard key which just happens to be C. Thus, if the lowest D is pressed, the music, regardless of what key signature it is in, is tranposed upward by a MAJ 2nd. If the second to the lowest G key is pressed (G1), then the music in playback is transposed an octave and a MAJ 5th upward. It doesn't take long to get the hang of it.

Probably the most useful application of the transpose feature is when it is used with short sequenced recordings (ECHO) and split keyboard. The combination of these features allow for extremely powerful performance capabilities. The reason for this is that the transpose will solely be controlled by the lowest split freeing the upper split(s) to be used for live performance. This means an intricate bass line or background sequence can be played back pressing single keys down on the lower split while the upper split can be used for lead voicing.

Note: if the recording in playback isn't in the key of C the live keyboard voicing will most likely clash. For example, if the piece is originally in the key of D and D is pressed on the keyboard, the playback will be in the key of E (MAJ 2nd) while the keyboard voice will still be in D. There are two ways to remedy this. One way is to turn the volume of the keyboard off in the track master (CTRL-R). This works fine if only transposing playback but if split keyboard is to be used the keyboard volume must be left on. To handle this case it is best to define an instrument with zero volume or a slow attack time and assign it to the lowest split.

D. Drum Machine Interface (CTRL-I)

Although the alphaSyntauri is capable of generating percussion type sounds, doing so may use a good portion of the voices available for actual instruments. If any serious percussion sounds are necessary there are a number of "drum machines" that will handle the job rather nicely. These drum machines can be found in most music stores ranging in price from the low hundreds of dollars to around three thousand dollars. The less expensive models are synthesized drum sounds, where the more expensive have actual recordings of real drums.

The Metatrak software for the alphaSyntauri supports four models of drum machines: the Roland TR606 and TR808, the Linn and the Oberheim DMX. To use this feature the appropriate interface cable is necessary (this can be purchased from Syntauri). There are two interface cable types; the Roland cable which uses a 6 pin DIN connector and the Linn and Oberheim cable which use 1/4 phono plug connectors. The cable plugs into the drum machine at one end and into the game paddle socket of the Apple at the other end. Note: the game paddles can still be used with the cable plugged in by "piggy-backing" the connectors.

The function of the drum machine interface is to assure that meta files played back will start, stay and stop in perfect synchronization with the drum machine. To accomplish this the Metatrak software actually takes control of the drum machines clock for determining the tempo. The tempo is set via the metronome in beats/minute. Before the metronome can take control, the specific drum machine being used must be specified.

Selection of drum machine type is done using the "CTRL-I" command. By typing CTRL-I the following prompt will appear:

"ENTER DRUM MACHINE TYPE (0-3): 0"

Select the appropriate drum machine by number (1=Roland, 2=Linn, 3=Oberheim and 0=Off) followed by "RETURN". Just hitting "RETURN" will leave the status as it is. Once the drum machine type is specified the metronome can be set to the desired tempo enabling the drum machine to play.

Setting the metronome can be acomplished by two methods, the CTRL-Z command or in-line within the record or playback sequence. In either case the following prompt will appear:

"TEMPO (0-155) ? 0"

The desired tempos should be entered followed by "RETURN". Just hitting "RETURN" will leave the current value set. Entering 0 turns the metronome and interface off. Note: the tempo range is different when using the drum machine interface (0-155) as opposed to (0-280) the normal metronome. This shorter tempo range may require the resolution of a particular rhythm pattern to be cut in half to obtain a very fast tempo.

Before starting a recording or playback the rhythm on the drum machine should be pre-selected. This operation varies from machine to machine, for example, the Roland TR606 and TR808 require the metronome to be running in order to switch rhythm patterns where as the Oberheim DMX will allow pre-selecting of a rhythm while the metronome is off. None of the drum machines will allow a sequence of rhythms, complete "track" (Roland), or "song" (Oberheim) to be automatically restarted, only individual rhythms. Thus it is necessary to press the clear or reset buttons on the drum machine before record or playback to restart the sequenced rhythms back to the beginning. For more information reference the users manual for the specific drum machine being used.

Once a rhythm is pre-set, recording or playback can begin. Set the metronome to the desired tempo during the record or playback sequence. As soon as "live mode" is resumed the metronome and drum machine will start. Actual recording, in standard record mode, will not start until a key or pedal is depressed. Terminating a recording (and drum machine control) is accomplished by hitting the spacebar. Note that in order to end on the beat, the spacebar must be hit just prior to the last metronome beat. This allows for perfect synchronization for looping on recordings using the "ECHO" mode, (see Section IV-E).

After a recording that used the drum machine interface is completed it is a good idea to either take notes or indicate in the recordings name the specific tempo and/or rhythms that were used. Doing so will make preparation for playback much more organized and expedient.

E. External Sync-to-Tape (CTRL-X)

The multi-track recording functions within Metatrak make it an extremely powerful compositional tool as well as a convenient and versatile performance aid. However, when it comes to transferring the final recording to tape, the best results may be achieved outside of the system by dumping the recording to a multi-track recorder via the external sync-to-tape feature. This feature widens the range of possibilities for mixing down the final production by allowing one or more Metatrak tracks at a time to be dumped to any tape track. This makes it possible for post processing effects like reverb, flanging or delay, dynamic adjustments to the volume, frequency equalization, and stereo panned mix-down to be implemented on a per track basis.

To use the external sync-to-tape feature a multi-track tape recorder is necessary. One tape track must be used for synchronization purposes where as all others may be used for the transferring process. This means at least three tape tracks are required to do any type of stereo mix-down. The more tape tracks available the more control over the final production.

To use the external sync-to-tape a special "header-signal" must first be written from the alphaSyntauri system to one of the tape tracks. A miniture plug connector from the cassette output at the back of the Apple to the input of the designated tape track provides the necessary interface for this to be done. To initiate writing the header signal the CTRL-X command is used. By typing CTRL-X the following prompt will appear:

```
"EXTERNAL SYNC MODE        OFF
 R)EAD/W)RITE/O)FF         WHICH?"
```

First, start running the tape in record. Select "W" for write followed by "RETURN". The header signal will take approximately 20 seconds to write after which the Apple speaker will beep. Make sure the signal has a high enough level on the VU meter to properly record on the tape. Once the header signal is recorded it will serve as the starting trigger for all subsequent playback transfers. Rewind the tape prior to the signal header.

To start dumping Metatrak tracks to tape first load the meta file, track master and preset master. Any tracks not to be transferred must have their volumes set to 0. Those to be transferred should be left as is or set to maximum (255). The cable must now be connected from the output of the tape track with the header signal to the cassette input. Again execute the CTRL-X command. This time select "R", for read, followed by "RETURN". The next time the system is set to playback it will wait for the header signal from the tape before starting playback. This read procedure is repeated for subsequent track transfers to tape.

Note: if you run into any problems with playback not starting, it may be due to the level going into the cassette input. This may need to be adjusted for proper operation. If you wish to get it out of the read mode at any time press CTRL-X and OFF, "RESET" or "CTRL RESET". This will reinstate the system back to normal control.

Once you get the hang of using the external sync-to-tape feature its value will become self evident. In fact it opens a whole new range of possible uses with Metatrak. For example, since a track with a 0 volume in the track master will not be assigned to any voices, it is possible to get many more voices than the current simultaneous eight by using sync-to-tape. To do this simply record one track as a click track recording to be followed by other track recordings. Then record each subsequent track individually with only the click track playing back (all other tracks should have their volumes set to 0). Doing this allows many voices to be used on each individual track. The end result after using external sync-to-tape could mean getting up to 128 voices out of a single Metatrak recording!

There are other possible enhancements using sync-to-tape. Different preset masters can be used for additional instrumentation over the standard ten. Also, the same tracks can be played back twice with slight modifications to their sound parameters causing effects such as delay or phasing.

Using the external sync-to-tape feature effectively will allow a great deal of pre-production work to be done right on the alphaSyntauri. Then once you're satisfied with what has been composed and performed a true professional mix-down is possible.

CONCLUSION

Well, if you have already successfully created a Metatrak recording or if you actually read this entire manual in preparation to do so, congratulations! From the descriptions and examples throughout this manual, it's easy to realize the value Metatrak offers to composers, arrangers, educators, recording studios, and musicians in general; and think, this is only the beginning! Metatrak will have even more features and performance power in future versions, further expanding your alphaSyntauri synthesizer's capabilities.

If you have any comments or suggestions for future enhancements, write them down and send to Syntauri with your warranty card or in a separate letter. We at Syntauri want to develop the products you want, so let us know what you think.

Enjoy Metatrak, we're sure you'll find it an effective performance and recording tool for all your music efforts.

There are many standard disk and file maintenance commands and programs that can be helpful when using your alphaSyntauri synthesizer and Metatrak software. If you are not already familiar with these commands or programs, the following is a brief description of how to use a few of them. For more information reference your Apple DOS manual.

Copying a Diskette

A back-up copy of your Metatrak diskette can be made via the copy program provided on your Apple DOS 3.3 diskette. To use this program; first boot the diskette until a basic prompt ("]") appears, then type, "RUN COPYA" followed by "RETURN". The program will ask you to define the slot and position of your disk drive(s) for source and destination. If you have only one disk drive the source and destination will be the same. Once set correctly, insert the disk you wish to copy.

Initializing a Diskette

A new blank diskette can be initialized for storing files by using the INIT command. The INIT command can be entered after booting your DOS 3.3 diskette. To initialize, put the new blank diskette into the disk drive, then type "INIT HELLO" followed by "RETURN". After the disk stops swirling and grunting, it will be initialized for use.

Deleting a File

To delete a file from diskette use the DELETE command. It can be used after booting your DOS 3.3 disk or during Metatrak by typing CTRL-D in Metatrak live mode. To delete a file simply type "DELETE" followed by the full name of the file you wish to delete, followed by "RETURN".

Other Commands and Programs

There are a number of other disk commands and programs you might find useful when working with the alphaSyntauri synthesizer. Some of these include: the "CATALOG", "RENAME", "LOCK" and "UNLOCK" commands, and the file copy program "FID". See your Apple DOS manuals for further information on these commands and programs.

APPENDIX B: Metatrak Command List

Here is a list of commands entered from the Apple Keyboard and a brief explanation of what they do. This list is meant for quick reference only. Refer to the appropriate sections of this manual for more detailed explanation.

E	Ensemble mode (on/off toggle).
F	Fast forward (on/off toggle).
J	Move the split instrument pointer down by 1.
K	Move the split instrument pointer up by 1.
O	Turn the vibrato off.
R	Restart track record attempt.
S	Ensemble sequence mode (on/off toggle).
T	Transpose playback/sequence mode (on/off toggle).
U	Updates the video screen.
V	Sets the vibrato rate from paddle 0 and vibrato depth from paddle 1.
ESC	Record punch-in/punch-out (Metatrak record mode only).
<-	(left arrow) Lowers the system volume by 5.
->	(right arrow) Raises the system volume by 5.
<	Decreases playback speed by 5% in playback mode.
>	Increases playback speed by 5% in playback mode.
?	Display diskette catalog.
CTRL-B	Pitch bend on/off controlled by paddle 0.
CTRL-D	Access DOS commands.
CTRL-E	Load, save or define presets (envelopes and control parameters).
CTRL-F	Load an Fx mod (not compatible with alphaPlus FX mods)
CTRL-I	Set drum machine interface (0=off, 1=Roland, 2=Linn, 3=DMX).
CTRL-K	Include or exclude set-up program when you boot up.
CTRL-O	Change the offset (percussion channel tuning) 32nd tones.
CTRL-P	Load or save a Preset Master.
CTRL-R	Display track master for changes.
CTRL-S	Define, load or save a split keyboard definition.
CTRL-T	Load or save track master.
CTRL-V	Load a vibrato waveform from diskette and set vibrato rate and depth.
CTRL-W	Load or save a waveform.
CTRL X	External sync-to-tape.
CTRL-Z	Set the metronome tempo.
0-9	Change an instrument (split dependent).
SPACEBAR	Access record/playback menu.
SHIFT CTRL-M	Key release off bottom or top bar (5 octave only)

Below is a list of file types associated with Metatrak. Each file type is functionally described, and how its name appears on diskette is shown.

"PRESET MASTER: (name)"
A preset master is a file containing parameters for a bank of ten instruments. When loaded into the preset master, Metatrak uses "CTRL-P". It automatically loads the wave master file and LFO master file associated with it.

"WAVE MASTER: (name)"
A wave master file contains the waveforms for the ten instruments in a preset master. It is automatically loaded with its associated preset master.

"LFO MASTER: (name)"
An LFO master holds the vibrato and offset parameters of a preset master. It can only be created using an alphaPlus (version 2.0). The LFO master will automatically be loaded with its associated preset master. If a preset master that doesn't have an LFO master is loaded it will cause an error message, but will load the preset master properly.

"SPLIT MASTER: (name)"
A split master is a file that stores the number of splits and which instrument numbers are used in a split. The information is used for updating the screen. A split master can be loaded or saved using the "CTRL-S" command in Metatrak live mode. It automatically loads or saves a split bank file.

"SPLIT BANK: (name)"
A split bank file contains information for associating instrument numbers with key positions. It is automatically loaded or saved with a split master.

"TRACK MASTER: (name)"
A track master is a file that contains all the information for how the sixteen tracks in Metatrak were set in regards to instrument and control parameter assignment. A track master can be loaded or saved using the "CTRL-T" command in Metatrak live mode. It is meant to be used in conjunction with the preset master used in recording a meta file.

"META: (name)"
A meta file contains note and track information for a Metatrak recording. It can be loaded or saved in Metatrak via the record/playback menu.

"MFX: (name)"
A MFX file holds a Metatrak FX mod (special effect). An FX mod is a small assembly language program used for sound modification. FX mods can be loaded and saved using the "CTRL-F" command in live mode. The alphaPlus FX mods are not compatible with Metatrak.

A Metatrak demonstration recording is provided on your Metatrak diskette. Listening to the recorded example will give you a quick idea of the possibilities and potential Metatrak offers.

There are a few steps to go through to prepare for proper playback. The explanation of each step is thorough for those who have not used the alphaSyntauri synthesizer before. Simply follow the instructions below. Detailed explanations for the process are covered in this manual.

STEP 1

Make sure you are in "live" mode, that is, you can hear sound as you play the alphaSyntauri keyboard and the diskette labeled Metatrak is in the disk drive.

STEP 2

If not already loaded, load preset master METATRAK.L, by holding down the "CTRL" key while typing "P", and then typing METATRAK.L followed by a "RETURN".

STEP 3

When back in live mode again press the SPACEBAR. This will cause the record/playback menu to be displayed. Type "L" followed by "RETURN". This will allow you to load the meta file recording. Type GALAXY GAP followed by "RETURN".

STEP 4

After the meta file is loaded a prompt will apear to load the "track master". Type GALAXY GAP followed by "RETURN". This will load a track master, restoring Metatrak to the state it was in during the original recording.

STEP 5

After the track master is loaded, type consecutive "RETURN"s until you hear the recording playback.

STEP 6

When the recording is finished, the screen will go back to the record/playback menu. Type "O" followed by "RETURN" to turn the playback off. Typing "RETURN" again will put you back into the live mode

"Galaxy Gap" written, performed and copyrighted by: Robin J. Jigour

Since the meta file buffer is divided into two parts during the Metatrak recording, it is possible for the "track" being recorded to overwrite the playback "track". This may or may not be inconvenient depending on:

* Whether or not the Echo/Repeat has been chosen.

* The type of material being recorded from the alpha keyboard.

As a result, a number of safety checks have been included in the software to minimize these occurrences. Below is a brief discussion of each check and what it does.

Maximum Meta File Length

Each time a meta file is loaded in the Metatrak recording mode, the length of the file is checked before it is loaded. If the file when loaded, does not allow at least a 50 note difference between the beginning of the recording buffer and the playback buffer, an error message will be displayed on the video monitor, and the Meta file will not be loaded.

Buffer Collision Warning

When the meta file to be loaded meets the limits described above, the file is loaded and you may begin recording. The difference between the two buffer pointers is then monitored. If at any time a 200 note difference is violated, a flashing exclamation point will be displayed at the bottom right portion of the video screen to alert you to this fact. If you continue playing until the buffers finally overlap, you will exit the Metatrak record mode and be asked if you want to save the "track". If this happens save it as a different name so you still have the previous meta file ti work with.

Echo/Repeat Shutoff

If you are using the Echo/Repeat option while in Metatrak record mode and you write over the beginning of the playback notes file because you ignored the buffer collision warning, the Echo/Repeat will stop automatically since that information has been written over during the recording process (when you reach the end of the playback meta file). You will exit the Metatrak record mode and be asked if you wish to save the track.

The following are descriptions of the Metatrak FX mods. A general explanation for using FX mods is covered in Parameter Control, section III. Note: Metatrak FX mods are not compatible with alphaPlus FX mods.

TS - Timbre Scan

TS scans through all the primary and percussion waveforms of the current preset master while using the envelope characteristics of the assigned instrument. The rate of the scan is controlled by adjusting paddle 0, and then pushing the paddle 0 button. Timbre scan can be assigned to a range of tracks when it is loaded. If no track range is specified it will affect tracks 0, (the live keyboard), through 8.

PS - Pitch Sweep

PS dynamically varies the pitch as controlled by the assigned instrument attack rate and position of paddle 1 when pushing the paddle 1 button. Special effects can be obtained by varying the control paddle until the pitch goes into or out of "aliasing". Pitch sweep, like timbre scan, can be assigned to a range of tracks.

AM - Amplitude Modulation

AM allows you to produce a tremolo effect with your master volume. The rate and depth are controlled by paddles 0 and 1, respectively. Use the paddle buttons to set the values. AM is a global FX mod for all tracks, a range cannot be defined.

VIB1 - Keyboard Following Vibrato

VIB1 emulates voltage-keyboard-follow control of analog synthesizers. The higher the key struck the faster the vibrato rate and the greater the vibrato depth. When using VIB1, vibrato cannot be updated by standard methods. VIB1 is a global FX mod for all tracks, a range cannot be defined.

OFF1 - Keyboard Following Offset

OFF1 works in the same fashion as VIB1, except that offset is affected rather than vibrato. The higher the key struck, the greater the offset detuning between the primary and percussion oscillators. OFF1 is a global FX mod for all tracks, a range cannot be defined.

Sounds Trio™

Utility software that creates waveforms for the alphaSyntauri® digital synthesizer

Syntauri

SoundsTrio

The SoundsTrio software package contains three utility software programs for creating waveforms: DrawWaves, B-3, and autoPulse. Included are two diskettes, SoundsTrio Wavemaker and SoundsTrio Waveforms. The SoundsTrio Wavemaker diskette has on it autoPulse, DrawWaves, and B-3. SoundsTrio Waveforms has already created waveforms from autoPulse and B-3, and two B-3 preset masters.

Draw Waves

Getting Started:

Turn off your Apple and insert your Sounds Trio Wavemaker diskette in your disk drive. Now power up your Apple and the MENU will appear. Enter 3 to display the Draw Waves menu. To run a program, enter 1,2 or 3. To exit enter 4 to return to the main menu.

Description and Use:

DRAW WAVES contains 3 programs:

1.) POINTS

2.) LINES

3.) VECTORS

These programs have been designed to allow you to create new and exciting waveforms for your alphaSyntauri synthesizer.

POINTS (program #1) and LINES (program #2) allow you to draw a waveform using game paddle #1. By holding the <REPEAT> key and any other key EXCEPT <RETURN>, a number will be displayed at the lower left portion of the monitor. This represents the value of paddle #1 which will be put into memory when you hit <RETURN>. The number displayed at the lower right portion of the screen tells you which point in the waveform you are about to plot. The first point you will plot will be 'Ø' and the last will be '255'. By holding the <REPEAT> key at the same time, you will be able to plot consecutive points very quickly. This technique required a little practice to get the results desired so don't despair if it seems a bit difficult in the beginning.

VECTORS (program #3) allows you to draw waveforms using straight lines. The waveform is constructed by specifying an X, Y coordinate, where X is the point in the waveform table and Y is the value of the point. For example, to create a triangle wave you would input the following:

INPUT REQUEST	YOUR RESPONSE
Enter the starting value:	127
Input point, value (X,Y):	64,255
Input point, value (X,Y):	192,Ø
Input point, value (X,Y):	255,127

You will notice that the starting point and ending point are both equal to 127. I recommend this procedure in making your waveform to reduce DC offset at the DAC of the oscillator boards.

autoPulse

Description

The **autoPulse** program allows you to make precise representations of pulse waves with duty cycles between Ø and 5Ø% with a user defined number of harmonics.

Waveforms

Any complex waveform may be broken down into its' individual parts or sine harmonics. Certain standard waveforms have a known harmonic content. Some of these formulas are:

Sawtooth:	1/P	all harmonics
Triangle:	$1/P^2$	odd harmonics only
Sine:	1/P	1st harmonic only
Square:	1/P	odd harmonics only

For example, to build a sawtooth wave the relative harmonic structure is:

1/1 or 1ØØ%	Harmonic 1
1/2 or 5Ø%	Harmonic 2
1/3 or 33%	Harmonic 3
1/4 or 25%	Harmonic 4
etc.	

where 'P' is the partial number.

Necessity

Why is **autoPulse** useful?

1. Pulse waves are found in many acoustic instruments such as the string family and the woodwind family.
2. Pulse waves are a common sound source in electronic music.

An important point to realize is that the harmonic content of a pulse wave is directly related to its' duty cycle. A 5Ø% pulse wave will sound very 'hollow' or clarinet like whereas a 5% pulse will sound very 'nasal' or double-reed like.

This difference is due to the vast difference in the harmonic content of each waveform. It would take a great deal of time and effort to calculate which harmonics would appear in a given pulse wave and what their amplitudes would be. A computer, however, lends itself quite nicely to this task.

Running the Program

First boot the Sounds Trio Wavemaker diskette. A display menu will appear; enter a 1 to display the autoPulse menu then type "2" to run the program. The program will ask you for the following input:

1. The location of your M.C. boards.
2. The name you wish to use for saving your waveform.
3. The duty cycle (Ø - 5Ø%).
4. The number of harmonics for the waveform.

After you have input all of the above, the program will build the waveform and ask you to insert a diskette to save the waveform.

The program will then ask if you wish to make another waveform. If you reply no the program will end. Otherwise the program will restart so that you may continue.

Why a Different Number of Harmonics

In the world of digital synthesis it is known that the frequency response of the instrument is SR/2 or 1/2 the sampling rate.

The Mountain Computer Music System tm has a sampling rate of 32,ØØØ hertz, therefore its' frequency response is 16,ØØØ hertz. Any frequency generated above 16 khz will appear as an inharmonic function. This is known as 'foldover' or 'aliasing'. If many harmonics are generated above 16 khz, the net result will sound very distorted in higher registers.

In some applications, this is a desired effect; however, in most cases it is not. In order to avoid this you could use a waveform with many harmonics in lower registers and waveforms with few harmonics in higher registers.

For example, if you were using a waveform to produce a double bass several octaves below middle C, you might use a pulse wave with 4Ø or 5Ø harmonics. On the other hand, if you were re-creating violins several octaves above middle C you might only use a pulse wave with 1Ø or 2Ø harmonics in order to avoid foldover.

Waveforms

In addition you will find included on the Sounds Trio Wave-form diskette a number of waveforms. These have been made for your use with the ALPHA SYSTEM. The name format for these wave-forms is as follows:

Wave:PXX% YYH

where XX is the duty cycle and YY is the number of harmonics.

Besides the sine wave on the diskette (needed for program execution) the waveforms are:

5% to 5Ø% duty cycles in 5%
Increments and 1Ø to 4Ø
Harmonics in 1Ø harmonic increments

B-3 Wave Maker

Description

The B-3 Wave Maker program allows you to precisely simulate the mixing of harmonics to produce the sounds of a Hammond B-3 organ.

History

The B-3 has long been a staple of modern church music. In the last few decades it has also gained much popularity in contemporary music including gospel, R&B, and Rock & Roll.

You might say that the B-3 was the most primitive synthesizer By mixing different harmonics of different amplitudes it is possible to simulate orchestral timbres.

Unlike modern synthesizers however, the B-3 had no provisions for complex envelope generation. The organist could, however, use the volume pedal to create a certain degree of dynamic expression.

The B-3 contains two sets of drawbars for each of the organ manuals, upper and lower. Each set of drawbars contains nine individual drawbars. Each drawbar corresponds to a particular harmonic and is similar to a volume control.

The value range for each drawbar is from Ø to 8 where Ø is off and 8 is the maximum loudness. By mixing the drawbars the organist creates his or her individual timbres.

At the bottom of each manual there is one octave of keys in inverse colors - hence the white keys are black and the black keys are white. These keys are referred to as 'preset' keys. Each of the keys between C# and A natural are preset at the factory. The C natural key is the 'cancel' key. The A# key and the B natural key correspond to the two sets of drawbars for that manual.

These factory 'preset' sounds are included on the Sounds Trio Waveform diskette as:

WAVE:B-3 XX Y

where XX is UM for upper manual
LM for lower manual
and Y is the 'Preset' key

Preset Masters

In addition to the upper and lower manual waveforms there are two preset and wave masters contained on the Sounds Trio Waveform diskette. They are:

PRESET MASTER:B-3 UPPER
PRESET MASTER:B-3 LOWER

These two preset and wave masters contain the waveform and envelopes to enable you to load the standard B-3 presets to your Alpha system just like any other preset master.

Percussion

The B-3 contains the provision to generate a percussive tone with each key depression.

There are two harmonics available for this purpose. They are the 2nd and 3rd harmonics. On the Sounds Trio Waveform diskette you will find two harmonics for this function. These are stored as:

WAVE:2nd HARM
WAVE:3rd HARM

By loading one of these waveforms in the percussion channel and setting up a 'piano-like' envelope you may duplicate the percussion effect of the B-3.

Running the Program

First boot the Sounds Trio Wavemaker diskette. A display menu will appear; enter a 2 to display the B-3 WaveMaker menu then type "2" to run the program. The program will ask for the following input:

1. The location of your M.C. board.
2. The values for the 9 drawbars.
3. The name you wish to use for saving your waveform.

At that point the program will ask if you want to build another waveform. Any response other than yes will end the program.

Conclusion

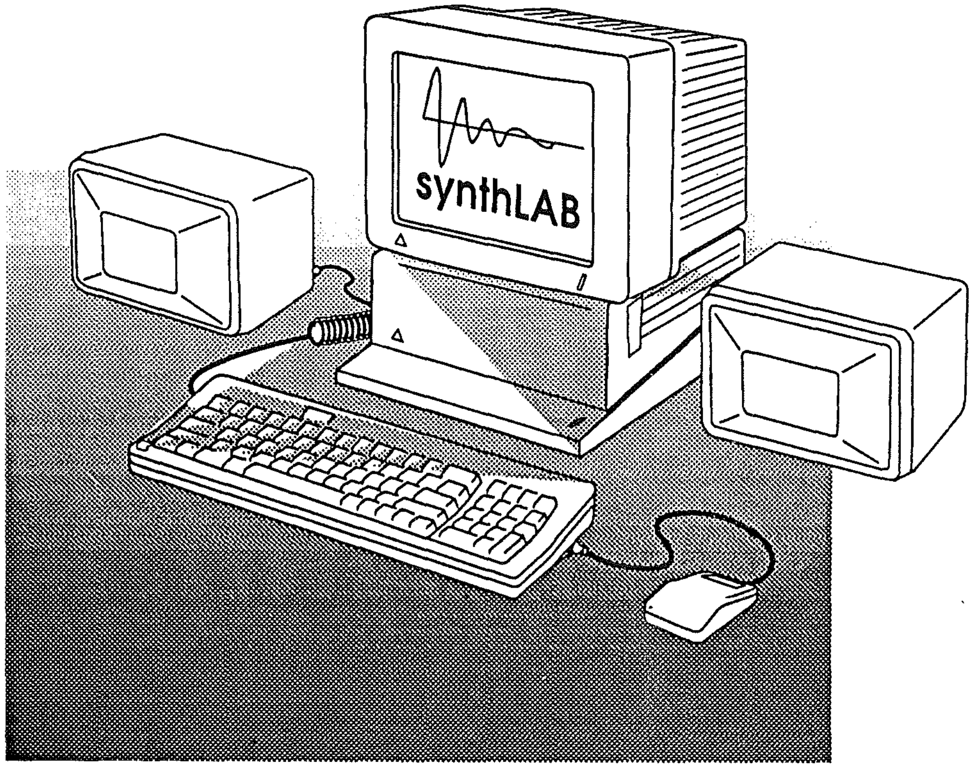
I hope this documentation has provided you with enough information to use this system to its' maximum potential.

If you have any questions or problems direct your correspondence to:

SYNTAURI CORP.
3506 Waverley St.
Palo Alto, CA. 94306

synthLAB™

User's Manual



by
Mark Cecys

Art and text by Mark Cecys

6/28/90

Table of Contents

Introduction

As the computer industry grows and matures, developers are under increasing pressure to continually create more complex and more sophisticated applications. At Apple Computer, we try to minimize this burden on developers by providing them with a wealth of OS routines called System Tools. Over the years, these Tools have grown and become very complex and sometimes unmanageable. For example, creating a new system Tool with a few vague notes written down by the engineer is no longer considered adequate support. We realize that you, as developers for the Apple GS, need additional support in dealing with the continually increasing complexity of your applications.

synthLAB is a support application for developers who are creating programs using MIDI Synth (system Tool035). And like MIDI Synth, it has three basic parts to it: a synthesizer, a sequencer and a MIDI driver. With synthLAB, you can create the instruments you'll need for your application, either by modifying existing ones, or by creating totally new and original ones. With the synthLAB sequencer, you can record your custom sequences used in your application. You can take advantage of MIDI Synth's multi-timbral feature by experimenting with different instrument combinations until you get the sound that you want. You no longer have to "hand-code" instruments and sequences into your source code without the benefit of hearing exactly what your creating. Using a tool like synthLAB, creating sound in your application should be easier and the result will certainly be more interesting to your users.

Since synthLAB itself is built around MIDI Synth, it makes for a great learning tool in understanding how MIDI Synth works. Most of synthLAB's parameters directly correspond to MIDI Synth parameters.If you're not quite sure how a certain parameter affects MIDI Synth, with synthLAB you can go and actually try it, playing with different values until it becomes clear. You can also learn and develop the techniques needed in creating your own quality instruments by examining and manipulating the existing instruments provided with synthLAB. Making interesting instruments is an art, and the best way to learn this is by actually trying it yourself. So, synthLAB is also a powerful educational tool for developers.

And finally, if you have any musical inclinations, take a break and have some fun. Connect a MIDI keyboard and record your favorite music, experiment with different arrangements of instruments. You'll surprise yourself on how creative you can be, given the right tools to express yourself. Unlike any other personal computer, your GS is a powerful music synthesizer.

synthLAB Quick-Start

After booting the synthLAB Program disk, double-click on the "synthLAB" icon to launch the program. Once loaded, you'll get the "player keyboard" title screen. If you don't hear any output sound or if you get an error message, see the topic "Getting Starting" later in this section. When you're through listening to the demo, press either the GS keyboard "return" key or click on the *arrow* button on the bottom right of the screen to exit. The screen now shows the Sequencer Page, with deck control buttons to the left and eight sets of track controls on the right of the screen.

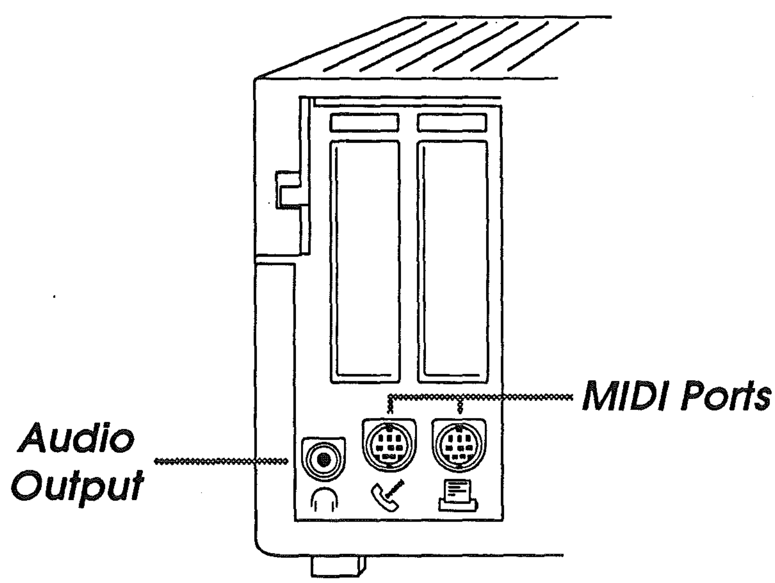
If you want, you can load and play some of the sample sequences and instruments on the Sequences and Instruments disk. Pull down the File menu button and select the "Load Sequence..." item. Remove the synthLAB Program disk and insert the Sequences and Instruments disk. Click on the *Drive* button to list the sequences found on this disk. After double-clicking on your selection, the file dialog box goes away and synthLAB will load in the selected sequence with the appropriate instruments. When the arrow cursor returns, you're ready to play the sequence. You can either click on the deck *Play* button, or if you want to see the actual notes being played, select the "About synthLAB..." item from the "Δ" menu button. Either way will play the sequence for you.

To get the full effect from synthLAB, try using a stereo interface card with the output going to an external amplifier/speaker system. You'll miss quite a lot if you only play synthLAB in "mono" through the low-quality internal speaker.

How to use this manual

This manual is a general reference guide for starting and navigating around synthLAB. By itself, it certainly is not complete, especially if you're going to create your own instruments. synthLAB's primary goal is to support and encourage developers working with MIDI Synth. Although in some ways it could be used as such, synthLAB is not a consumer product. The system architecture and many of the parameters and functions which synthLAB controls are described in the "MIDI Synth External ERS" and are not duplicated here. The "ERS" is very technically oriented, written primarily for programmers and developers. It is intended that you use this manual, synthLAB and the "ERS" together, referencing various sections in each until you get solid understanding of how things work. It is important that you read the "ERS", since this information is not covered here.

This manual and the "ERS" assumes that you have a good understanding of how MIDI works. Explaining and describing all the many aspects of MIDI is beyond the scope of this manual. There are many excellent books written about MIDI, which are available at your local music dealer if you need additional information.



Finally, there are some terms used in this manual that might cause some confusion. The term *keyboard* will always refer to an external MIDI keyboard (the musical kind). The keyboard that's part of your GS computer system that you type with, will be called the *GS keyboard*. Also, new names are given to some of the hardware ports on your GS. Since MIDI devices are connected to either the

Modem or Printer ports on the back of the GS, either one will be refered to as a *MIDI port.* The headphone jack, which usually goes to some sort of external amplifier (if you're the least bit serious about sound quality), is called the *audio output port.* If you're using a stereo interface card, then the audio output port is the stereo output connector on the card.

Getting Started

As usual, the first thing you should do is make a back-up copy of the synthLAB disk, then store the original away somewhere safe. If you're using a hard disk, just copy the "synthLAB" folder over to your hard disk.

Next, copy "Tool035" (MIDI Synth) over to your "Tools" folder, which is found inside your boot "System" folder. If your boot disk is already full and you don't have any more room available then leave MIDI Synth in the same folder with synthLAB. When it initially runs, synthLAB tries to load MIDI Synth from the system "Tools" folder. If it can't find it there, it then looks for it in its own folder. If you have a hard disk, this should not be a problem.

If you plan on using MIDI along with synthLAB, you'll need to install MIDI into your system with the new MIDI CDEV. Simply move the file from the synthLAB disk called "MIDI" over to the "CDev" folder on your boot disk (found inside the "System" folder). Before running synthLAB, run the Control Panel NDA from the Apple menu. Select the CDEV called "MIDI" and enter the correct information which describes your MIDI setup (see Appendix B). Return back to the Finder and launch synthLAB.

After synthLAB has loaded, you should hear music playing at the title screen. If synthLAB encountered an error while trying to start, you'll get an error message telling you what is wrong.

You'll get an error if AppleTalk is active. Due to the way interrupts work on the GS, you can't run MIDI and AppleTalk together (AppleTalk also eats up CPU time, which would degrade our performance). Go to the Control Panel and de-select AppleTalk. Reset, re-boot and try again.

Try to avoid using Inits and DA's which install themselves in the background (menu clocks, screen savers, etc.). Remember, nothing comes for free. These background programs continually steal valuable CPU time, making applications run slower. For 'real-time' programs like synthLAB, this is especially critical since they are competing for the same background interrupt time.

Requirements

- Apple IIGS system
- 1M of system memory or greater
- GS/OS 5.02 or greater
- One 3.5" drive
- "MIDI Synth External ERS" manual

Recommended

- External amplifier/speakers (home stereo, powered monitors, etc.)
- MIDI interface (Apple MIDI, *Audio Animator,* etc.)

• MIDI controller (external MIDI keyboard, MIDI guitar, wind controller, etc.)
• Stereo interface card (*Audio Animator*, etc)

Optional
• Reverb or Effects Processor
• MIDI synthesizer, sampler, etc.
• Hard disk

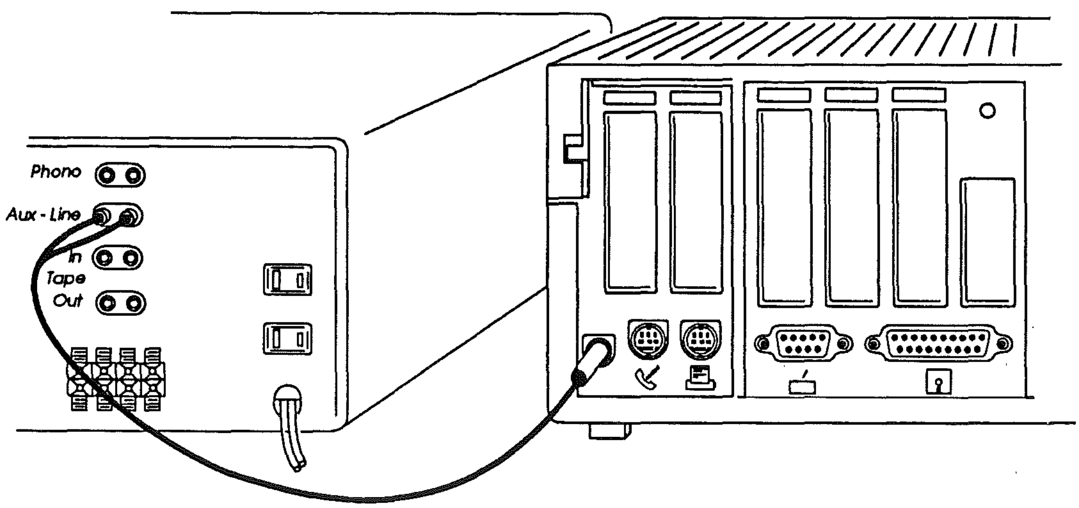
synthLAB will work on all GS models with a Rom version 01 or higher. Like most new applications these days, you'll need a minimum 1 meg of system ram. If your GS does not have 1 MB on the motherboard, you'll need a 1 meg. expansion card installed.

We don't know why anyone would have a GS with a monochrome monitor, but if you do, it won't be pretty.

If you're using an older version of GS/OS, then see your dealer for an upgrade to the latest version.

Audio Output

Unless you're the type who enjoys listening to music through a cheap 25-cent speaker, hook the GS audio output to an external audio system. Any home stereo or powered monitor speaker will do. If you're using a home stereo system, you'll need a *1/8" stereo mini plug to phono (RCA) plug* adapter cable to connect your GS to your amplifier. The *mini* plug goes to the audio output (headphone) jack on the back of your GS or your stereo interface card, while the two *phono* ends go to the *line* or *Aux* inputs usually on the back of your stereo amplifier (Even though the plugs are called *phono*, do NOT plug them into the *phono* input on your amplifier, you could damage your speakers if you do).



There are several things you can do to improve the overall quality of sound coming from your GS. First, try turning the *treble* control on your amplifier down a bit to filter out the "hiss" if you have a noisy GS or a noisy stereo interface.

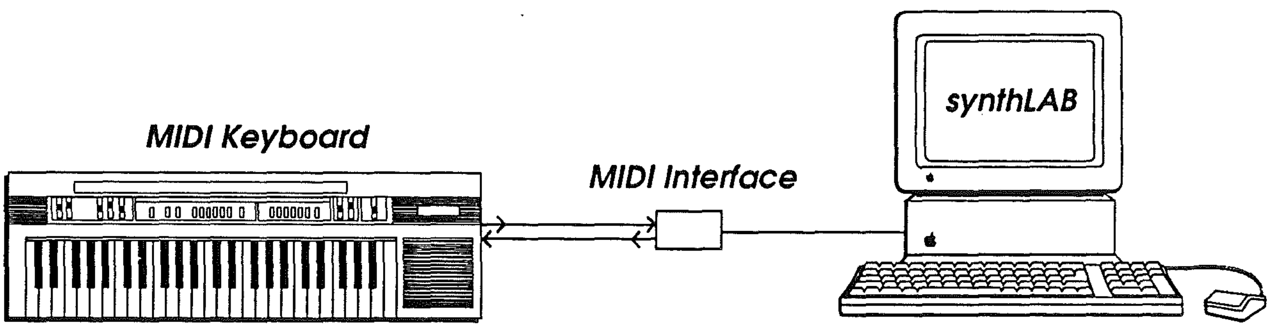
Second, both synthLAB and MIDI Synth are designed to be most effective when played in stereo. By being able to assign each Generator (1/2 of an Instrument) to either stereo channel, many interesting stereo effects can be created. If you have a stereo interface card, see the owner's manual for installation instructions.

The author's personal recommendation is Applied Engineering's *Audio Annimator.* Not only does this card produce very good quality stereo output, but it has a built-in MIDI interface, an excellent stereo digitizer and a convenient external control box for all your connections and level controls. This audio system includes useful software for digitizing and editing your own sounds, and for recording and playing MIDI sequences.

Finally, if you have a reverb unit or a special effects box, try using it on your GS. You'll be surprised that by adding a small amount of reverb will suddenly make your GS sound like a $1,000 professional synthesizer (they all have reverb built-in these days).

Connecting a MIDI Device to synthLAB

If you happen to have one, hook an external MIDI keyboard up to your GS. Whether you're creating instruments and sequences, or if you just want to play your GS as a synthesizer, you'll get the most out of synthLAB if you control it thru MIDI.

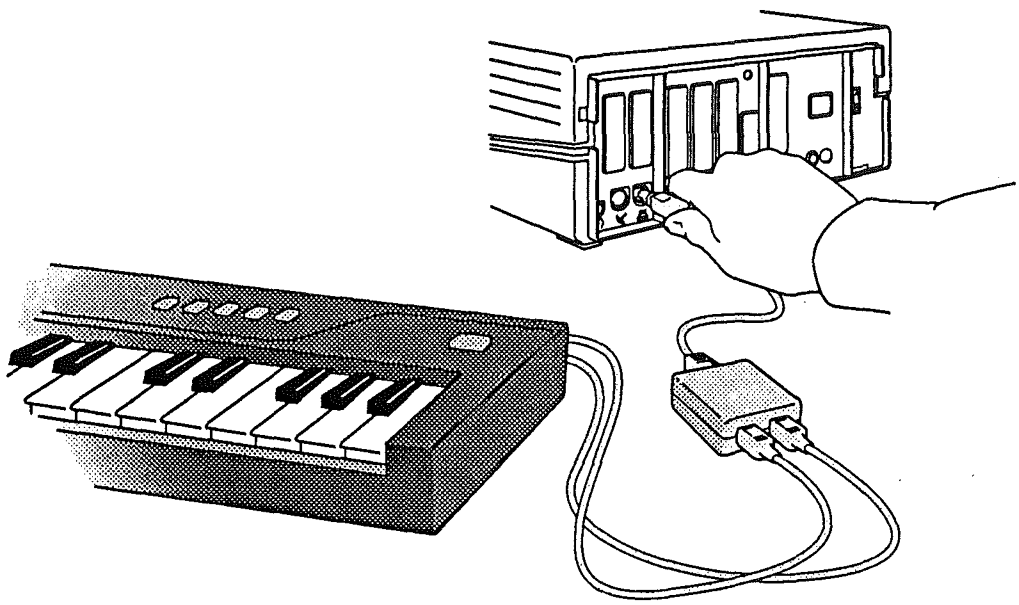


Since synthLAB is both a synthesizer and a sequencer, you can do many useful things with your GS connected to a MIDI keyboard. As mentioned above, you can simply play your GS as a synthesizer. Play notes on the keyboard, and your GS will track them by playing selected instruments. It will even respond to note velocity, pitch-bend and your volume and sustain pedals. Next, you can record your performances into an eight-track sequencer, recording each track separately using different instruments. You can save these sequences on disk, building your own personal library. Finally, you can have synthLAB play your MIDI keyboard. If you run out of instruments or voices with synthLAB, you can assign any tracks to output their MIDI data out to your keyboard.

When creating instruments, the keyboard gives you more control in defining the various parameters. You can quickly test your instrument over the complete note and velocity range. Many instruments sound different when they interact with other voices, so you can play chords or octaves and hear this effect. If the instrument is multi-sampled (different waves for note zones), you can make sure that the transitions between WaveLists are seamless and that each multi-sample is balanced correctly with the others.

Since MIDI signals are electrically different from signals that computers use, you'll need to connect your keyboard through an special MIDI interface. Any 1mhz external type of interface (Apple MIDI for example) or an internal card interface (like Applied Engineering's *Audio Animator*) will work. For example, when using the Apple MIDI interface, you simply plug the MIDI cables into one end of the interface which connects to your MIDI keyboard, then plug the other end into a MIDI port on your GS (Modem or Printer, see diagram below).

Once you start synthLAB, you'll need to enable the MIDI port. Pull the "Setup" menu down and select the "MIDI..." item. Then from the dialog box, click on the *MIDI In Enable* button to enable it (it's the icon with the arrow pointing into the computer). Press a few notes on the keyboard, and you should hear your GS play them. Notice that the "MIDI In" display on the top right corner of the screen lights up for every MIDI message received.



Connecting an Apple MIDI interface

Limitations

When writing any application, you must limit the scope in which you intend to cover, in order to maintain a realistic schedule. Because of this, all applications have their limitations, and do not have all the features necessary to meet all user's needs. Just as it's important to know what an application does, it's also just as important to know what an application will not do.

• synthLAB is intended to be an instrument editor. It works on banks of 16 instruments at a time. It does not have any "librarian" features enabling you to move instruments between banks. This would certainly be useful.

• synthLAB is not a waveform editor. The waves must be created and edited elsewhere. We at Apple will provide wave files for you to use, but it would be nice if you could sample and edit your own.

• The sequencer in synthLAB is very limited and lacks many of the editing features found in more advanced types of sequencers.

• Since synthLAB does not use QuickDraw to draw all images on the video screen, there are times when it does not know anything about "foreign" windows. Therefor, it can't support NDA's.

Developers should note that these are limitations of only synthLAB and not the System Tool, MIDI Synth. A professional style sequencer can very well be written around MIDI Synth. The custom interface was the author's personal preference: MIDI Synth was designed to work well with the standard GS Desktop (Windows, Menus, Controls, etc.).

synthLAB has three basic parts to it: a synthesizer, a sequencer and a MIDI driver. Everything synthLAB does relates to one of these three parts. Since synthLAB's main purpose is to create instruments for MIDI Synth, it obviously has controls to manipulate all the parameters defined in an Instrument Record. To play an instrument, we need the synthesizer, so synthLAB has controls for that too. And finally, there are controls for the sequencer and the MIDI driver.

File Types

When you use a word processor, you typically load in your text file, manipulate the file by adding and editing words and sentences to the file, and when you're done, you save this file back to disk. The word processor creates and manipulates text files. synthLAB is, in many ways, like a word processor. But instead of working on text files, synthLAB works on instrument files and sequence files.

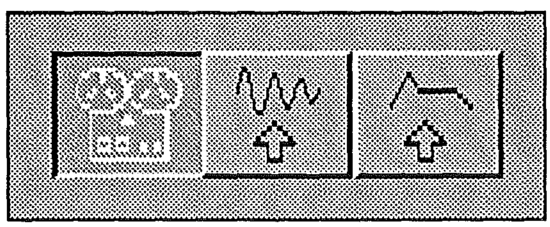
An *instrument file* is a collection of instruments grouped together in what is called an instrument *bank*. Each bank has 16 instruments and each instrument is actually an Instrument Record defining how the sound is built. In other words, a bank is simply a group of 16 Instrument Records. The instruments in a bank are all related to one another in that they all share the same *wave file*. This file contains the actual waveforms used in producing the output sound. synthLAB does not manipulate the wave file in any way, it only loads it into DOC ram after you load an instrument file . Once an instrument file is loaded, synthLAB can now edit and/or play any one of these 16 instruments.

A *sequence file* is the data output created by the sequencer. A Sequence File can contain only one sequence.

Navigating synthLAB

Since all of synthLAB's features can't fit onto asingle screen, the various functions have been divided up and placed into either separate video screens or grouped inside the menu buttons at the top of the screen. The three main video screens are called *pages*, and you can access any one of them them by pressing one of the three page buttons.

The left button selects the *Sequencer* page. You use this page whenever you wish to control sequence record or playback. The middle button selects the *WaveList Edit* page, which has controls to change the WaveList Record parameters. The button on the right, the *Envelope Edit* page, selects the controls used to edit Envelope Record parameters. These last two pages are used to define Instrument Records (see "MIDI Synth ERS").

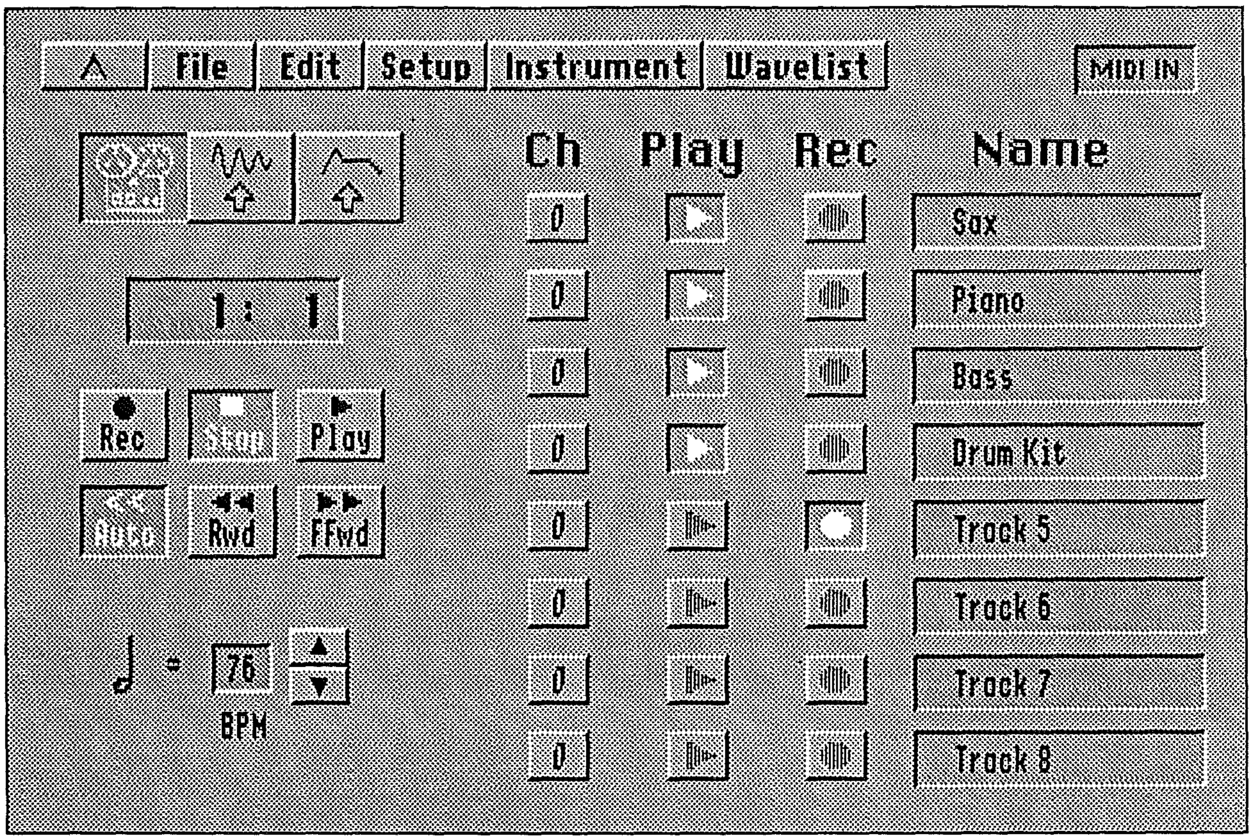


Page Buttons

The *menu buttons* have functions which are common for all three pages. Things like file I/O, program setup and instrument selection, are all initiated from these buttons.

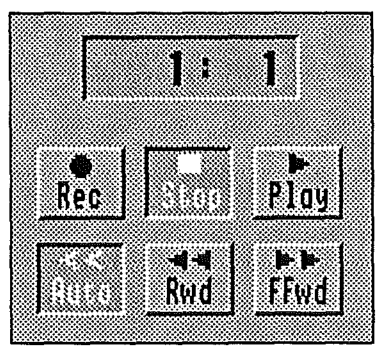
The Sequencer Page

The Sequencer page can be grouped into three main areas. On the left are the *deck controls*. They behave like controls on a typical tape recorder. In the lower left corner is the *tempo control*, which sets the speed or playback rate of the sequence. And finally, the right half of the page has the *track controls*. These are eight duplicate sets of controls, one set for each of the eight tracks used by the sequencer.



The Deck Controls

If you're familiar with how to control a tape recorder, then you should find these controls very straightforward. Play, Stop, Rec, Fast-Forward, Rewind and Auto-Rewind all work the same as their tape deck counterparts. They control the basic sequencer functions. Above the deck control buttons is the position counter, which shows you where you are in the sequence.



Deck Controls

Play

To play a sequence from memory, press the Play button. It starts at the current location as displayed by the counter. The sequencer will automatically stop when it reaches the end.

Record

Pressing this button will start recording MIDI messages received at the MIDI port. In other words, if you have a keyboard connected to the MIDI port and MIDI is enabled (see "MIDI Setup"), then synthLAB will start recording everything you play. At the same time it can also play-back selected tracks while you record. Like the play function, recording starts at the position indicated by the counter.

Stop

Will immediately halt a play or record process.

Fast-Forward

If you want to advance the the counter forward, then press and hold this button until you reach the desired position. If you hold this button down while a sequence is playing, then the tempo will double and stay at that speed until you release the button.

Rewind

This button will advance the position counter backward. Double-clicking this button will reset the counter to the beginning of the sequence (1:1).

Auto-Rewind

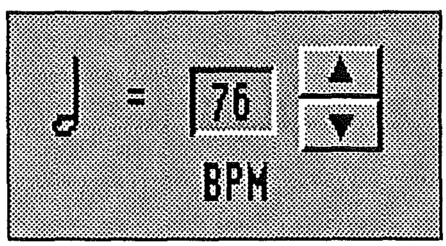
When this button is on, anytime the sequence stops it will automatically rewind to the beginning of the sequence. Otherwise, if it's off, then it remains at the current location.

Counter Display

The counter shows you the where you are positioned in the sequence. It displays the position in measures and beats. You can't directly edit the value, you move it forward or backward by using the deck buttons.

Tempo Control

This control sets the speed in which the sequencer plays. It sets this speed in units of half-note beats per minute. If you are used to working with quarter-note beats, then the quarter-note BPM value is twice the half-note value displayed. For example, when the tempo display shows 60, this is equivalent to 120 quarter-note beats per measure.



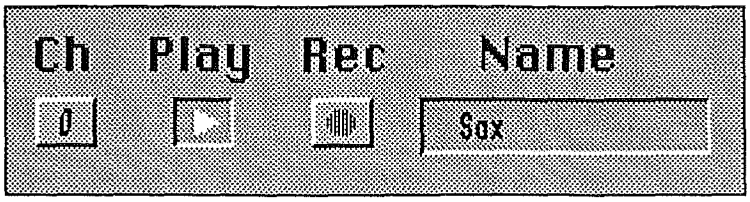
Tempo Control

Track Controls

The synthLAB sequencer is in many ways like an eight-track tape recorder. And like a multi-track tape deck, you can record one track of music at a time, using different instruments or combinations on each separate track. Then during play-back, you can select any or all of the tracks you wish to hear. You can play-back selected tracks at the same time that you are recording on another track. You can even over-dub any track until it sounds right.

But unlike a tape recorder, you are recording only MIDI messages, and not the actual sound being heard. When the sequencer plays, it sends these MIDI messages over to the synthesizer, which then reproduces the instruments you recorded in the first place. The advantage over a tape recorder is that you have the flexibility to experiment and re-orchestrate your sequence even after your done recording.

The track controls consist of eight duplicate sets of controls, one set for each track. Track number one is the top set, while the bottom most set is track eight. There are four controls for each track. You can give each track a name, select one track for recording, enable any or all tracks for play-back and finally, you can force any track to play a selected instrument.



Track Controls

Track Name

This control lets you reference the track by an entered name. You can put any type of notes or labels in here, which you may find useful. After clicking on the control, you'll get a line-edit type of dialog box. Type the name you want and click the "Done" button to exit. Up to 15 characters can be entered.

Track Record

Before you start recording, you have to tell the sequencer which one of the eight tracks it must record on. This button selects the record track. Note that synthLAB allows you to select only one track for this at a time. If you change the record track by pressing a new button, synthLAB will automatically turn the previous selected button off. Pressing a track record button while it's already on will turn it off, leaving no tracks selected for record.

Recording on a track that already has information on it will overwrite the previous data with new data.

Track Play

During a play or record process, individual tracks can be turned on or off for play-back by pressing these buttons. Unlike the track record buttons, any number or combinations of tracks can be selected for play-back. Clicking on a selected button will turn it off.

Track Channel

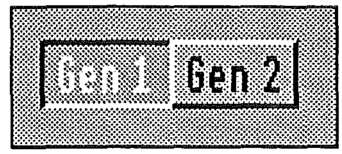
With this control, you can force all MIDI messages in the track to play a specific instrument. Since the sequencer always plays in "multi" mode (see the "ERS"), the channel part of the MIDI message specifies which one of the 16 instruments to play. This control makes all messages in the track to have one specified channel number, and thus one specified instrument. Channel one plays instrument number one, channel two plays instrument number two and so on. A channel number of zero will leave the message alone, letting it play whatever channel or instrument was originally recorded.

The reason you have to specify channel number is that it also affects the MIDI data that gets sent out the MIDI port, if it's enabled. All MIDI data sent out from the track will now be on the entered channel.

When you click on the button, you'll get a dialog box with a control that lets you change the channel number. Press the up or down arrow keys to set it to the value you want, then exit.

Editing Instrument Records

The WaveList Edit and Envelope Edit pages are used to edit Instrument Records, which define the instruments used by MIDI Synth (see "MIDI Synth ERS" for details on Instrument Records). Remember, each Instrument Record has two Generators (Gen 1 and Gen 2), and each Generator has one Envelope Record and eight WaveList Records (WaveList 1-8). If you look at the two Edit pages, you'll notice that they both have Generator select buttons (Gen 1, Gen 2). You use this to select which one of the two Generators you wish to work on. In the Envelope Edit page, it selects one of the two Envelope Records, while in the WaveList Edit page, this selects which of the two sets of eight WaveList Records you want. You use the WaveList menu button to further select which specific WaveList to edit while in the WaveList Edit page.



Gen Select Buttons

Since each synthLAB instrument bank has 16 instruments, you first have to select which instrument you want to edit. The Instrument menu button lets you make this selection. Pull it down and select the instrument. Next, you select a Generator by clicking one of the Generator select buttons. Finally, if you are editing a WaveList parameter, you need to select a WaveList from the WaveList menu button.

Before editing a WaveList, check the *Top Key* parameters to make sure that you have the correct WaveList selected for the desired note range. This is the most common mistake that users make when editing WaveLists.

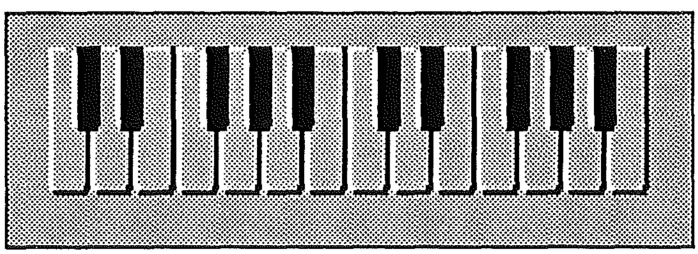
To get to any specific Instrument Record parameter, you need to:

1. *Select the correct instrument from the Instrument menu.*
2. *Select one of the two Generators with the Gen buttons.*
3. *If it's a WaveList parameter, then select the correct WaveList number from the WaveList menu.*

Because there is so much data to edit, this probably sounds confusing at first. Once you start working with it, this organization will start to make some sense to you.

Screen Keyboard

The two-octave screen keyboard will play whatever instrument is currently selected for edit (from the *Instrument* menu button). Clicking on the keys will play them. You can change the keyboard

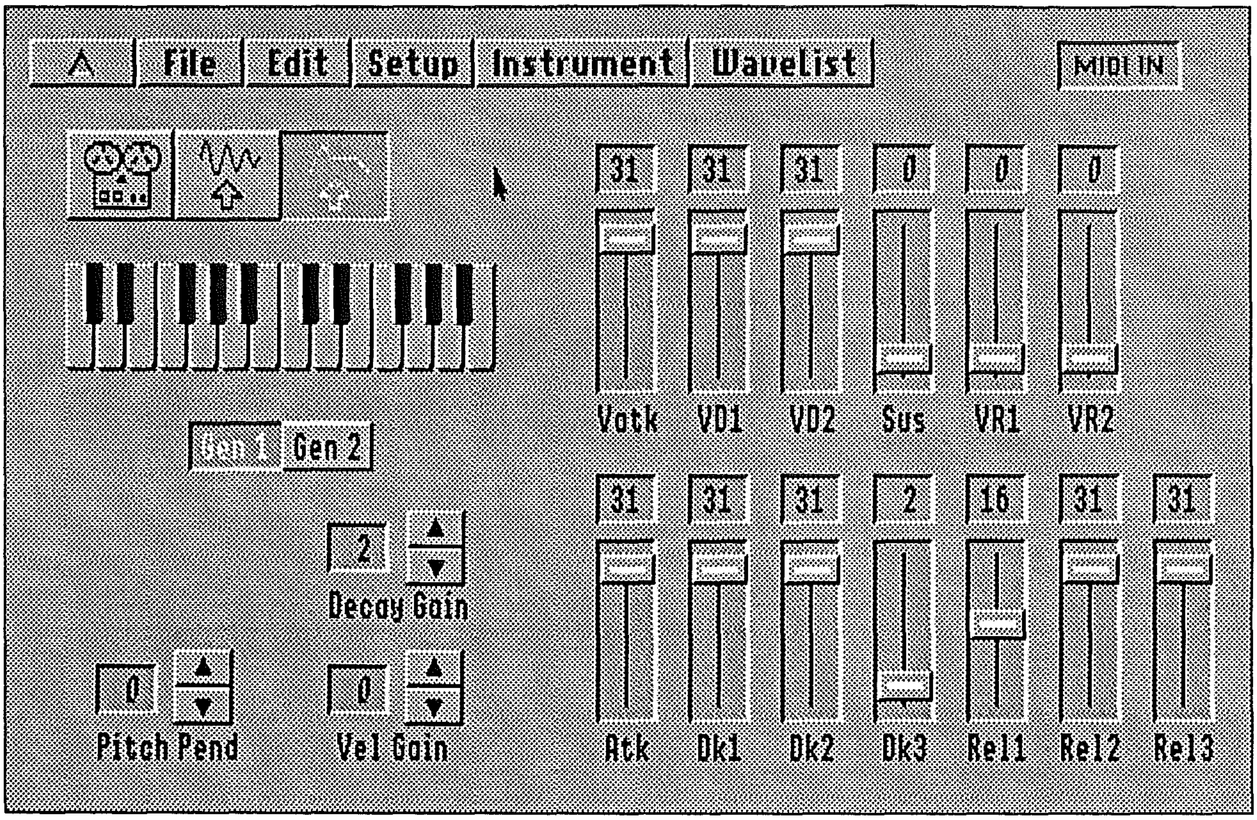

Screen Keyboard

range and volume from the *System Setup* menu item found under the *Setup* menu button on the top of the screen (see "Setup Menu").

If you click on the keyboard while you're recording a track, synthLAB will record those notes.

Envelope Edit Page

This page lets you edit Envelope Records (see "MIDI Synth ERS" for information on Instrument Records). There are two independent envelopes for each instrument, one for Gen 1 and another one for Gen 2. The sliders found on the right set the envelope parameters, while the buttons on the bottom left control the remaining parameters found in an Envelope Record.



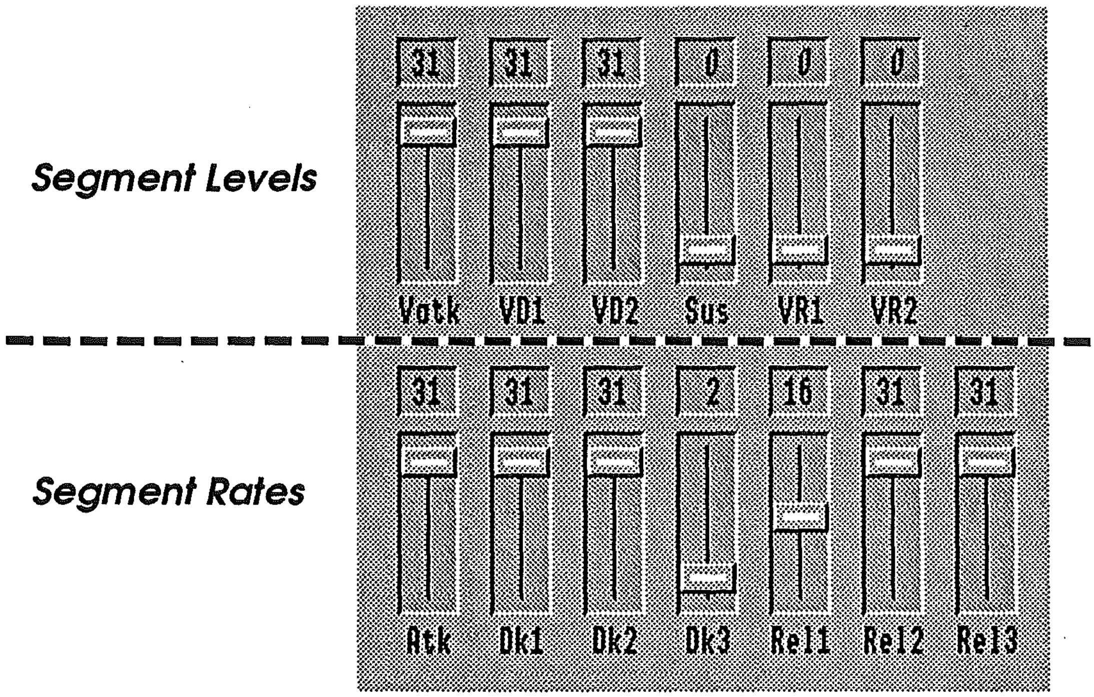
Envelope Sliders

These sliders let you edit the eight envelope segments. The top six sliders set the **level** values while the bottom seven sliders set the **rates**.

Here's a brief summary of the envelope (see "Instrument Records" in the "ERS" for details):

1. Start ramping from zero at *Atk* rate to *Vatk* level.
2. Ramp at *Dk1* rate to *VD1* level.
3. Ramp at *Dk2* rate to *VD2* level.
4. Ramp at *Dk3* rate to *Sus* level.
5. Hold at *Sus* level until "Note Off".
6. Ramp at *Rel1* rate to *VR1* level.
7. Ramp at *Rel2* rate to *VR2* level.
8. Ramp at *Rel3* rate to a zero level.

If any level is set to zero, then the envelope ends at that point. The level sliders display 1/4th the real value. In other words, a level slider value of 25 sets a value of 100 into the Envelope Record.



Velocity Gain

This sets the envelope's sensitivity to MIDI velocity data (see "Instrument Records" in the "ERS" for details). Note that the Gen 1 control affects the entire instrument; both the Gen 1 envelope and the Gen 2 envelope.

Decay Gain

Increases the the Decay rates for higher pitched notes (see "Instrument Records" in the "ERS" for details).

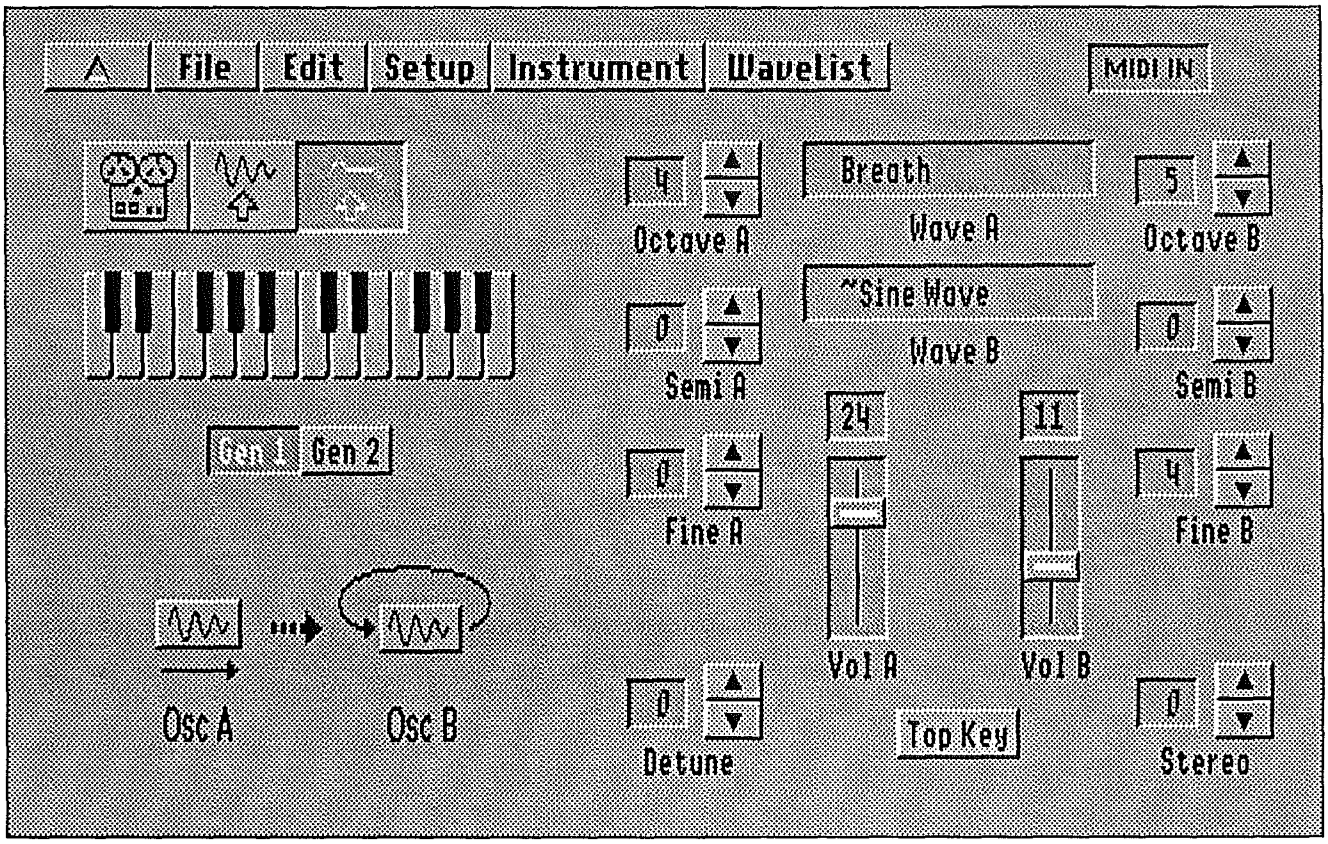
Pitch Bend

This sets the instrument's sensitivity to MIDI pitch bend data (see "Instrument Records" in the "ERS" for details). Like Velocity Gain, the Gen 1 control affects the entire instrument; both the Gen 1 envelope and the Gen 2 envelope.

WaveList Edit Page

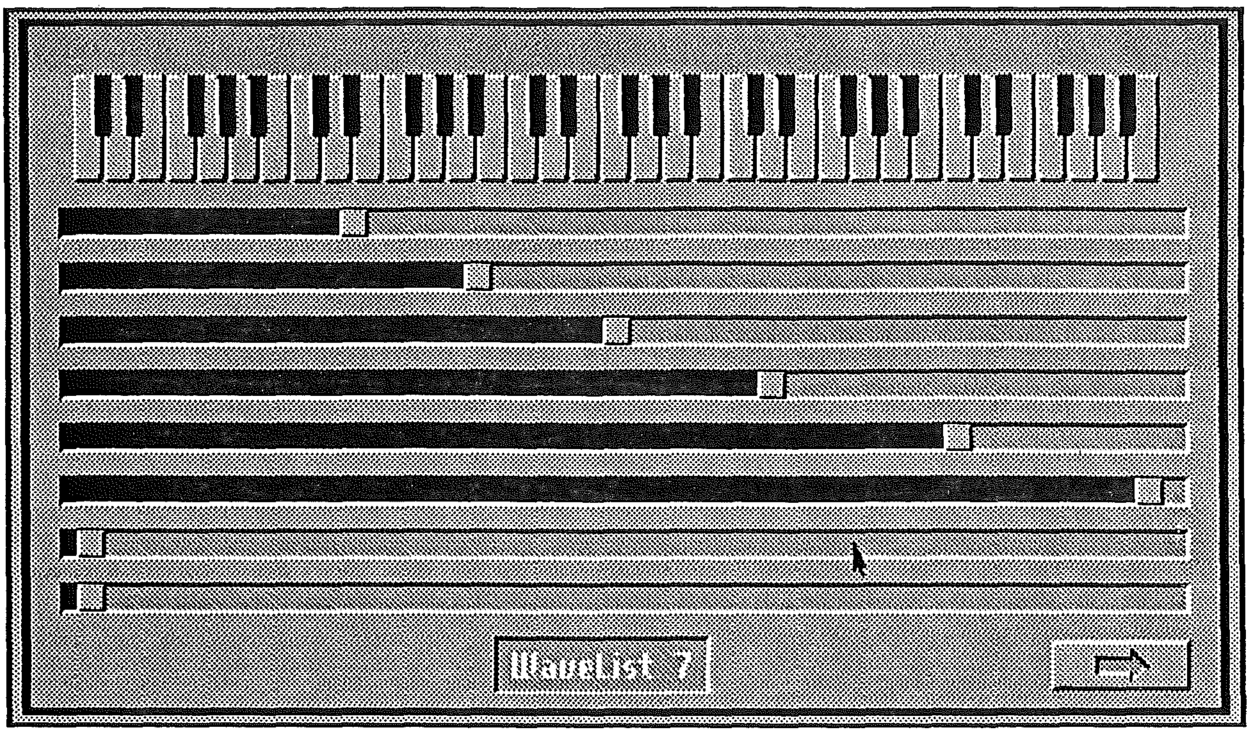
This page lets you edit WaveList Records (see "MIDI Synth ERS" for information on WaveList Records). There are 16 WaveLists for each instrument, eight for Gen 1 and another eight for Gen 2. Make sure that you have the correct WaveList selected from the WaveList menu button whenever you are editing in this page.

Keep in mind that there are four oscillators for each instrument, two for Gen 1 and two for Gen 2. The two oscillators (Osc A and Osc B) in each generator are independently controlled. Each oscillator can have its tuning (*Octave*, *Semi* and *Fine*), volume, wave and configuration set from this page.



Top Key

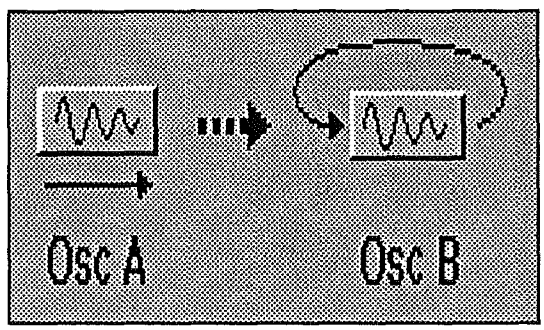
Each one of the eight WaveLists can be made active to play in only a specific range of notes. This allows you to create "multi-sampled" instruments with a different wavesample for each WaveList (see WaveList Records in the "ERS" for details). Clicking the Top Key button will display a dialog box with eight horizontal sliders, one for each WaveList. Remember that the Top Keys are prioritized in order from WaveList 1 to WaveList 8. This means that WaveList 2 starts from where WaveList 1 ended, WaveList 3 starts from where WaveList 2 ended, and so on.



Top Key Dialog Box

Oscillator Configuration

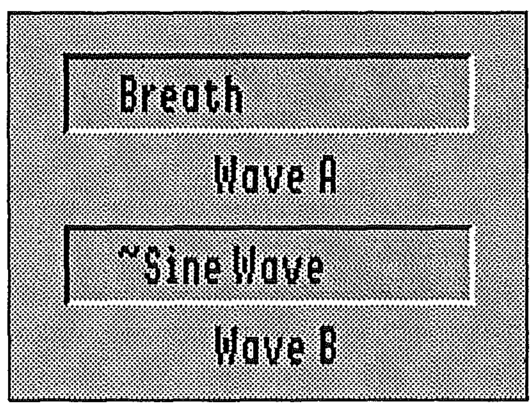
The two oscillators in each generator can be set to any one of six different modes or *configurations* (see WaveList Records in the "ERS" for details). This is a very powerful feature of MIDI Synth since it gives you great flexibility in controlling how the two oscillators interact with each other. Clicking on the control will step to the next configuration (Type 0 thru Type 5).



Type 3 Configuration

Wave Select

Holding down the mouse button on either of the two *Wave Select* controls (Wave A and Wave B) will produce a pop-up menu of available waves from the current Wave File.



Wave Select Controls

The convention used by synthLAB to notate the difference between wave types is to start 'loop' type wave names with the character "~". For example, if you had two waves titled "Piano" and "~Piano", the wave "Piano" would be a sampled recording of a piano attack while the wave "~Piano" would be a single-cycle wave of the piano's sustain and release. The "Piano" wave should be played with a 'one-shot' configuration and the "~Piano" wave should be played with a 'loop' type configuration . In this example, you may want to use Configuration *Mode 3* with Osc A playing the sampled "Piano" attack and Osc B playing the single-cycle "~Piano" wave.

Oscillator Tuning

There are several important reasons why you need to independently tune each individual oscillator. Since sampled waves are dependent on the input and output sampling rate and on the pitch of the original source, they most probably are not going to play back at the correct pitch. If you're using multi-sampled sounds, they'll need to be tuned to the correct octave. So the most obvious use is to tune the waves to the correct pitch.

Many effects can be created by altering the tuning ratio between different oscillators. If you fine tune two "loop" mode oscillators with a slight difference in pitch, you get an interesting effect of "movement" while the two oscillators slowly beat against each other. When you tune the two oscillators further apart in pitch, the sound's "texture" increases giving a richer and thicker sound. If you slightly detune two oscillators playing the same sampled sound, you get the familiar "phasing" effect.

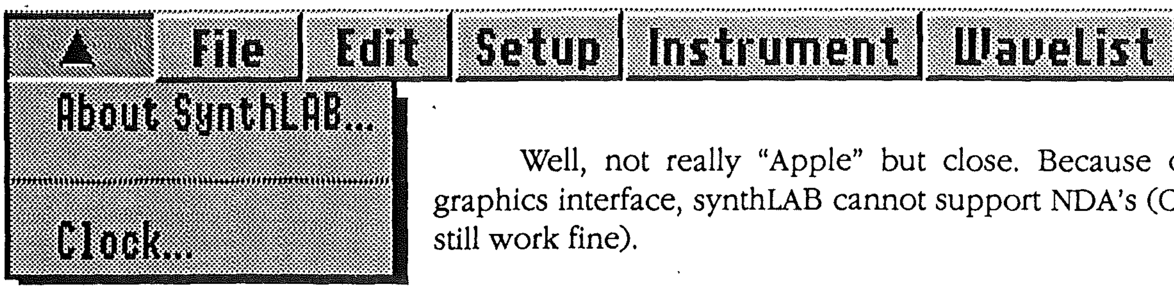
There are three tuning controls for each oscillator. The Octave control is centered around a normalized value of 3. This means that single-cycle waves will produce the correct pitch (middle A is 440 hz) when The Octave is set to 3, and both Semi and Fine are set to zero. The Semi control increases the pitch by semi-tone increments and the Fine control increases the pitch by fractions of a semi-tone.

Oscillator Volume

These sliders let you set each oscillator's output level. If you want to turn an oscillator off, set the *Volume* to zero. Like the Envelope sliders, these sliders display 1/4th the real value set in the Instrument Record.

There are a couple of points you should keep in mind when you're making instruments. Since sampled waves usually have a recorded envelope in them, their output volume will sound lower than single-cycle waves. So if you're mixing the two types, you'll usually need to play single-cycle waves at a lower level to get the correct balance.

There's a slight amount of cross-talk between Osc A and Osc B. If you're not using one of the oscillators (zero volume), make sure that you select a wave for the unused oscillator that has very little high harmonic content (like a sine wave). Also, tune the unused oscillator to a low frequency. Even though the volume is set to zero, you may still be able to hear the oscillator if its selected wave is very bright or at a high pitch.

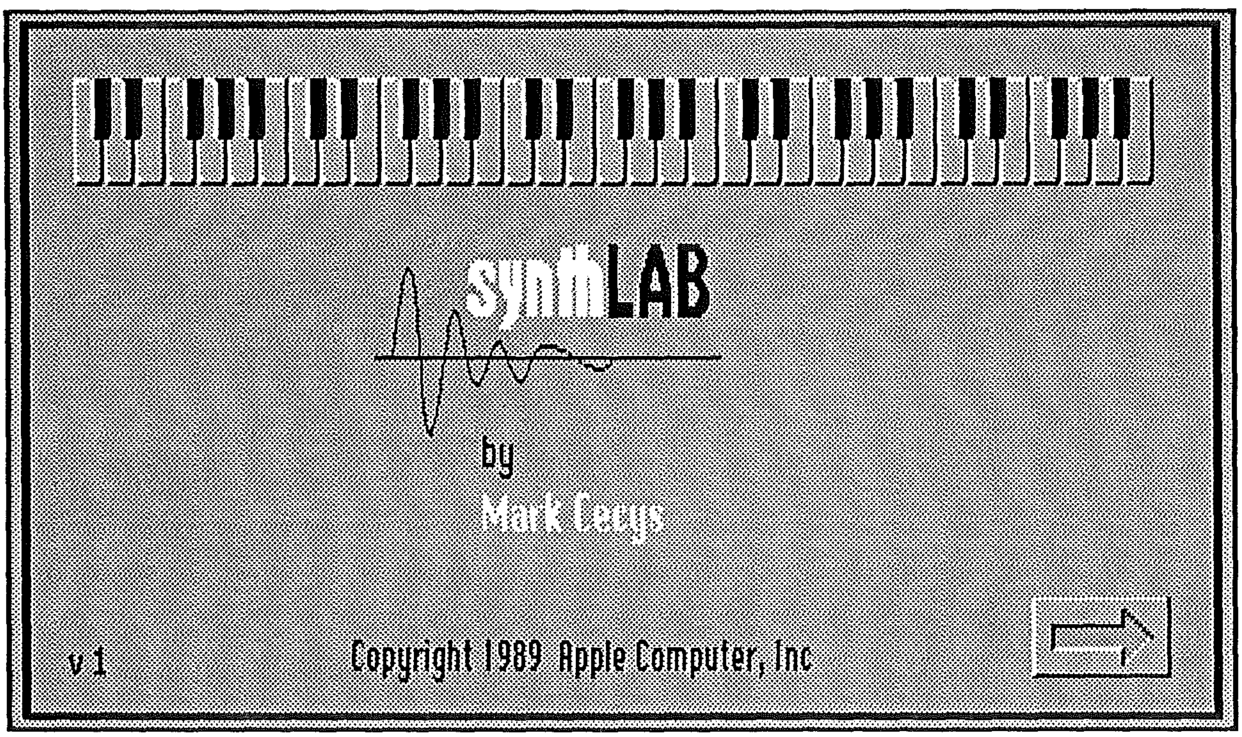


Well, not really "Apple" but close. Because of its graphics interface, synthLAB cannot support NDA's (CDA's still work fine).

This interface is a result of the author's personal choice, and does not reflect on MIDI Synth's compatibility with the "Mac desktop" interface. MIDI Synth is optimized for speed, so it works well with any desktop/non-desktop interface.

About SynthLAB...

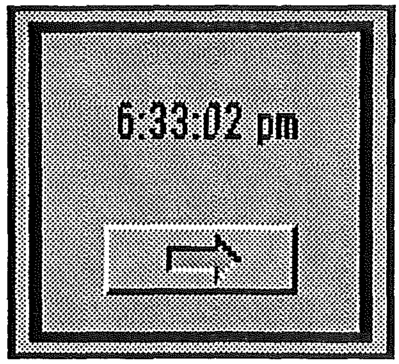
Selecting this item brings up the "player keyboard" dialog box. The "keyboard" will play whatever sequence is currently in memory. The displayed number on the lower left side of the dialog box shows the program version number.



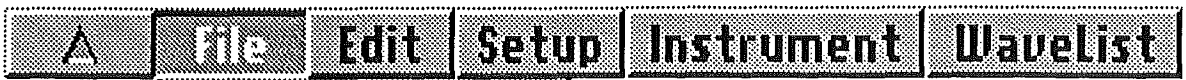
About synthLAB... Dialog Box

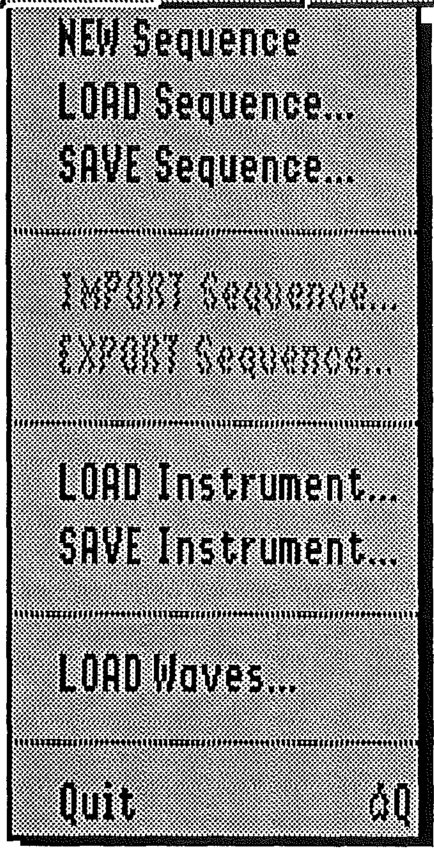
Clock...

Even if you can't use your favorite NDA's, you still have your clock. This impressive "synthLAB NDA" alone is well worth the price you paid for synthLAB.



Clock





As mentioned earlier, synthLAB deals with several different types of documents. For the sequencer, it uses *Sequence Files.* This file contains all the note information, how fast to play these notes and what instruments to use when playing the notes. For the synthesizer, it loads, saves and edits *Instrument Files.* These contain information on how to build instruments, how the instruments behave to certain MIDI events and which waves to output when playing.

When you save an instrument, synthLAB will save the name of the current Wave File as part of the Instrument File. So the next time you load this Instrument File, the correct Wave File will also get loaded. The Wave File must be in the same directory as the Instrument File. An error message will be displayed if synthLAB can't find the Wave File.

Along with the actual sequence information, Sequence Files also contain the name of the Instrument File used when the Sequence File was saved. When loading the Sequence File, synthLAB will search the same directory for the Instrument File (along with its Wave File). It's important to understand that synthLAB does not save the Instrument File when it saves a Sequence File, it only saves the name of the current Instrument File as part of the Sequence File. If you changed some instruments and plan on saving them under a new file name, make sure to save the new Instrument File first, before saving the sequence. This way the Sequence File will have the name of your new Instrument File, since the sequence will be saved after you gave the Instrument File a new name. Otherwise synthLAB will still load the old instruments in whenever that sequence gets loaded.

As you can see, synthLAB expects Sequence, Instrument and Wave Files to all be in the same directory. Loading a Sequence File will automatically cause an Instrument File to be loaded, which in turn will automatically cause a Wave File to be loaded. If these files are not in the same directory, you'll have to load them in manually. For example, If your Instrument and Wave Files are in a different directory from your sequences, after loading in a sequence, you'll get an error message telling you that synthLAB couldn't find the appropriate Instrument File. This message is useful since it gives you the name of the Instrument File that goes with the sequence. At this point, you'll have to select the "Load Instrument..." item from the "File" menu and find the correct Instrument File.

New Sequence

Selecting this item will set the sequencer to default values. This is used if you're making a new sequence from scratch. Be careful with this selection because it will erase any sequence currently recorded in memory.

All eight tracks will be given default names ("Track 1" - "Track 8") and track channels will be set to 'thru' (0) mode. Track 1 will be set to both record and play with the counter reset to the first beat (1:1). Finally, all 16 instrument volumes (see "Volumes..." in the menu "Setup" section) will be set to maximum values.

New Sequence does not affect the tempo value, metronome, count-off, key start, beat value, beats per measure and the sequencer clock source. Nor does it affect the instruments in any way.

Load Sequence...

After selecting this item, select a Sequence File from the displayed dialog box. The appropriate instruments and waves will also automatically be loaded along with the sequence. Remember, synthLAB expects the Instrument and Wave Files used by the sequence to be in the same directory as the sequence. If they're not, you'll get an error message telling you what file synthLAB couldn't find.

All the information that was saved (see "Save Sequence...") with the sequence will be restored when the Sequence File is loaded. Loading a sequence will over-write any current sequence you may have in memory. So be sure to save your old sequence before loading in a new one.

synthLAB can't handle sequences which are larger than 128k bytes in size. If you're loading sequences made by synthLAB, this should not be a problem. If you're importing sequences from other programs, make sure that they are less than this amount.

Save Sequence...

This item brings up the standard dialog box for saving files. Type in the name of your Sequence File at the bottom an click on the Save button. If you want synthLAB to automatically load your instruments in the next time you load this sequence, make sure that you save the sequence in the same directory where the Instrument and Wave Files are located. synthLAB will save the current Instrument File name along with the sequence, and tries to load these instruments whenever the sequence is loaded.

Besides saving all the note and MIDI information in your sequence, all track names, track channel, track play, track record, instrument volumes, beat value, beats per measure and the tempo value will also be saved with the sequence (see section "Sequence File Format").

Import/Export Sequence

These two items are not currently implemented. They may be implemented in a future version of synthLAB.

Load Instrument...

After selecting this item, select an Instrument File from the displayed dialog box. The appropriate Wave File will also automatically be loaded along with the instruments. Remember, synthLAB expects the Wave File to be in the same directory where the Instrument File is located. If it's not, you'll get an error message telling you the Wave File name synthLAB couldn't find.

Save Instrument...

This item brings up a dialog box for saving Instrument Files. Type in the name of your Instrument File at the bottom an click on the Save button. If you want synthLAB to automatically load the Wave File in the next time you load these instruments, make sure that you save the Instrument File in the same directory where the Wave File is located. synthLAB will save the current Wave File name along with the instruments (see section "Instrument File Format"), and tries to load this Wave File whenever the instruments are loaded.

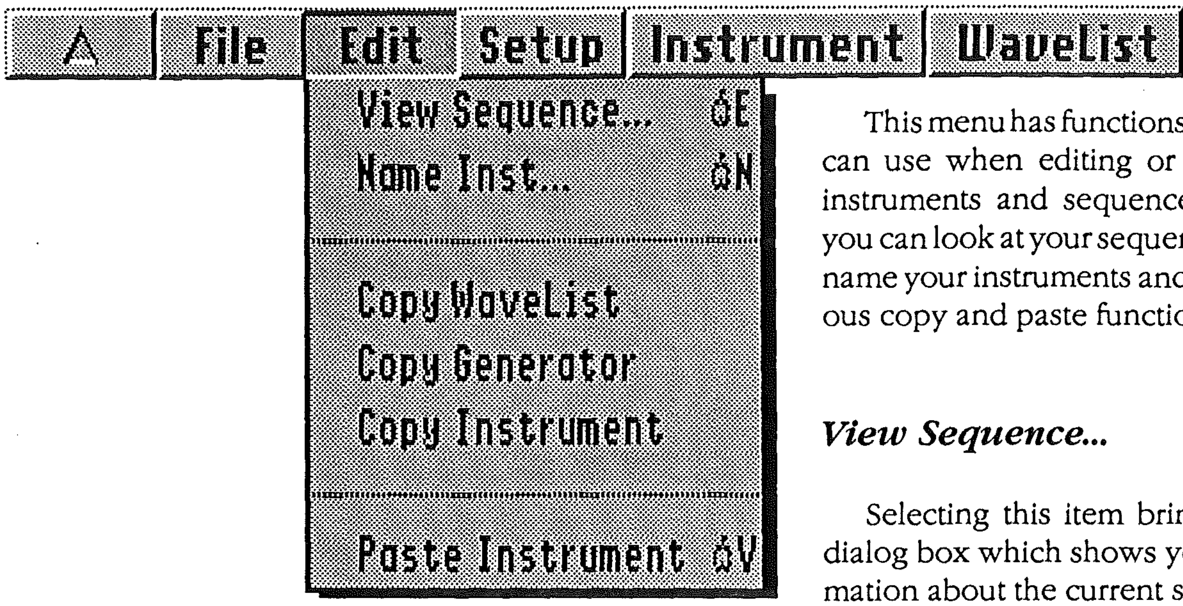
Load Waves...

This item can be used to load Wave Files located in different directories from their Instrument Files. If synthLAB can't find the Wave File when loading instruments, it will display an error message telling you the name of the Wave File needed. You can then select this menu item and load the correct Wave File from its directory.

If you load a new Wave File that is different from the one that was used when the instruments were created, you'll need to redo most of the instrument controls to work with the new waves. In other words you'll have to build the instruments from scratch.

Quit

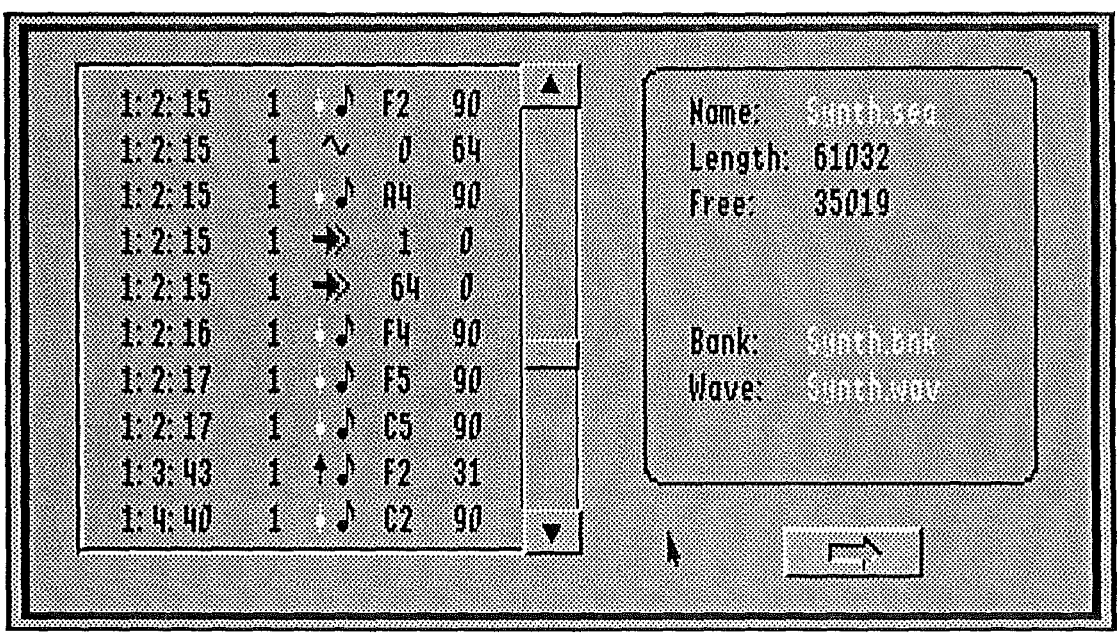
Selecting this item will terminate synthLAB and return program control back to the launching application (usually the Finder). Before selecting this, make sure that you saved any changed sequence and instruments. If you don't, they'll be gone forever.



This menu has functions that you can use when editing or creating instruments and sequences. here, you can look at your sequence data, name your instruments and do various copy and paste functions.

View Sequence...

Selecting this item brings up a dialog box which shows you information about the current sequence in memory. On the right side you'll see the name of the sequence (actually the name of the last loaded or saved sequence), its length in bytes and the number of bytes available in the seq buffer. Below this is the name of the current Instrument File (Bank) and the name of the current Wave File (Wave).



On the left side is a list control which shows you each individual seq item in your sequence (the scroll thumb does not function in the current version). The left-most value displayed in the seq item is the time-stamp shown in *measure: beat: remainder ticks* format. Remember that beats are based on a value of 96 ticks in a quarter note. So when displaying any seq item that does not fall on a beat, the remainder field will show the number of ticks past the last beat. If the beat is a quarter note, then the remainder will have a value between 0 and 95. An eight note beat will have

	Note Off - $8x
	Note On - $9x
	Poly After-Touch - $Ax
	Control Change - $Bx
	Program Change - $Cx
	Mono After-Touch - $Dx
	Pitch Wheel- $Ex

MIDI Status Messages

remainders between 0 and 47, and so on.

Displayed to the right of the time-stamp, is the channel number. If you're playing the synthesizer, then this is also the instrument number.

Finally, the remaining three fields on the right show the MIDI message and data bytes. The MIDI message status field is represented by any one of the symbols shown in the chart. Since only valid data bytes are shown, you may see one, two or no data bytes following the message status.

Name Inst...

This item lets you modify the name of the instrument which is currently selected for editing (selected from the Instrument menu). Up to 15 characters can be entered as an instrument name.

Copy WaveList
Copy Generator
Copy Instrument

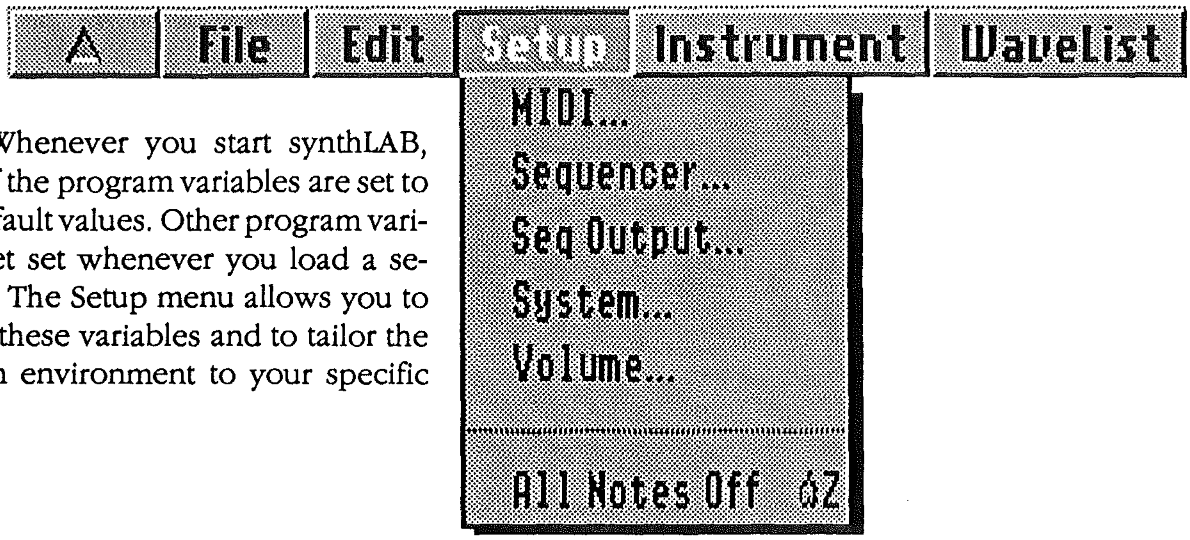
Selecting any one of these items will copy the specified parameters into an internal clipboard. This is used to duplicate the contents of a WaveList, Generator or Instrument. Once the parameters have been copied into the clipboard, you can then select another WaveList, Generator or Instrument, and paste those parameters into the new location.

A "Copy WaveList" selection will only copy the 16 parameters of the selected WaveList. Copying a Generator will copy one Envelope and eight WaveLists. Finally, when you copy an Instrument, all parameters from both Generators (both Envelopes and all 16 WaveLists), including the instrument name, will be placed into the clipboard. The original parameters will not be affected in any way by this.

Paste

Once a Copy function has been completed, you can use this item to place the contents of the clipboard into some other location. If the clipboard is empty, this item will be disabled. Whenever the clipboard has something in it, this item will show you what type of parameters that are in there. For example, if you copied a WaveList, the Paste item will read "Paste WaveList". Selecting the Paste item will over-write the original parameters, so use this carefully.

Setup Menu

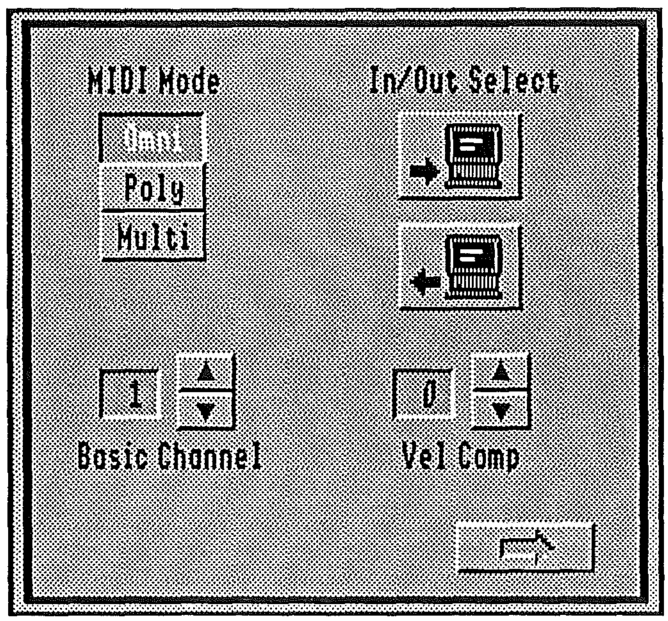


Whenever you start synthLAB, many of the program variables are set to their default values. Other program variables get set whenever you load a sequence. The Setup menu allows you to change these variables and to tailor the program environment to your specific needs.

MIDI...

synthLAB always starts with MIDI disabled. If you have a MIDI interface connected to your GS, then you must first enable and configure the MIDI port from here, before synthLAB can respond to your MIDI keyboard.

A dialog box is displayed with controls for the various MIDI parameters. You can select the MIDI mode, enable MIDI input or output, enter the Basic Channel number and set the velocity compensation value (see the "ERS" for details on MIDI parameters).



MIDI Setup Dialog

The top button of the "In/Out Select" enables or disables the *MIDI In* function (note that in the icon, the arrow points IN to the computer, indicating the direction of MIDI data). When *MIDI in* is enabled you'll see the MIDI IN display (top right corner of the screen) become active. This display will light-up whenever a MIDI message is received at the MIDI port.

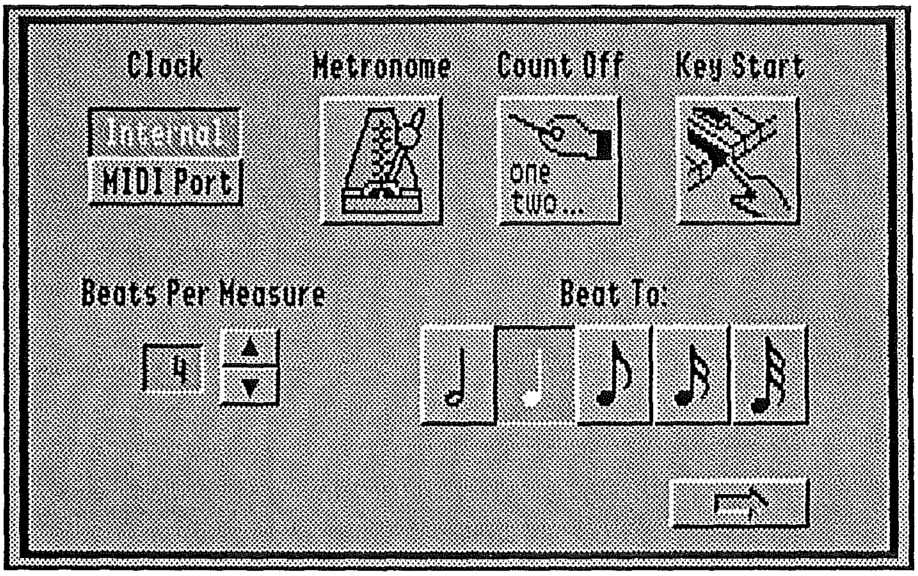
The lower button enables or disables the *MIDI Out* function. If you're not using this function, then make sure it is off (button is 'out').

If there's a problem with your MIDI setup, you'll get an error dialog instead of the setup dialog. See Appendix B for configuring MIDI correctly into your system.

Sequencer...

Selecting this item displays a dialog box that has controls which affect the sequencer operation. The bottom two controls specify the values for measures and beats. The counter display, metronome and tempo control are all affected by these.

The Metronome will cause an audible woodblock tick to sound on every beat whenever you play or record with the sequencer. When Count Off is enabled, the sequencer counts off one measure before starting to play or record. You can force the sequencer to wait until it receives a MIDI note off message thru the MIDI port before it starts playing or recording by enabling the Key Start control.



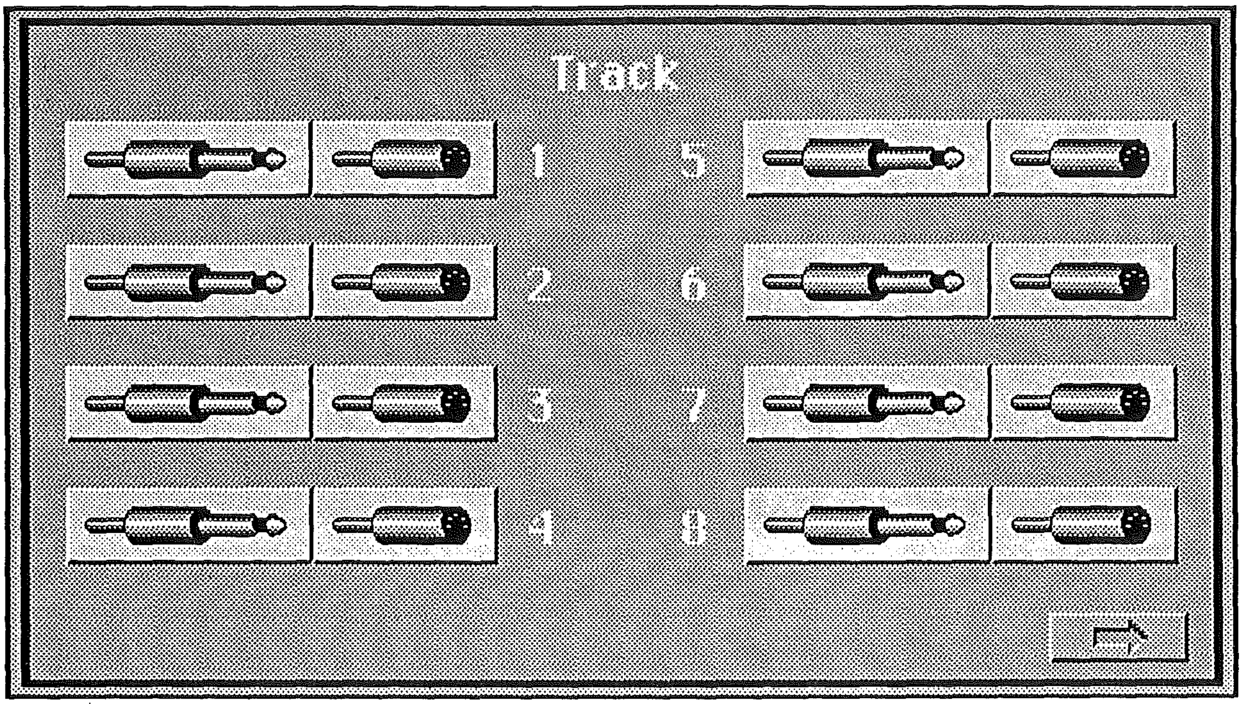
Sequencer Setup Dialog

Normally you use the Internal clock to advance the sequencer timer. This means that whenever you start the sequencer, it starts to increment its timer based on the current tempo value. If you need to synchronize the sequencer to an external MIDI device (like a drum machine or another sequencer), you can slave synthLAB thru MIDI by selecting the MIDI Port clock. Note that synthLAB can only receive MIDI timing clocks, it does not send them. This means that synthLAB can be slave device and not a master.

Seq Output...

With synthLAB (and MIDI Synth), you can specify where to send the output from each track whenever the sequencer is playing. You can have the sequencer for example, play only the synthesizer on tracks 1,2 and 5, while playing only a MIDI device on track 4, and have it play both the synthesizer and the MIDI device on track 3. This sequencer output configuration is mapped from the dialog box which is displayed whenever this menu item is selected.

Think of the sequencer as a box with eight audio jacks which can connect to the synthesizer and eight MIDI ports which can connect to your external MIDI device, one set for each track. This dialog box has two controls for each track. The left button with the "audio plug" icon connects the



Sequencer Output Dialog

sequencer track to the synthesizer, while the "MIDI plug" button connects the track to the MIDI port.

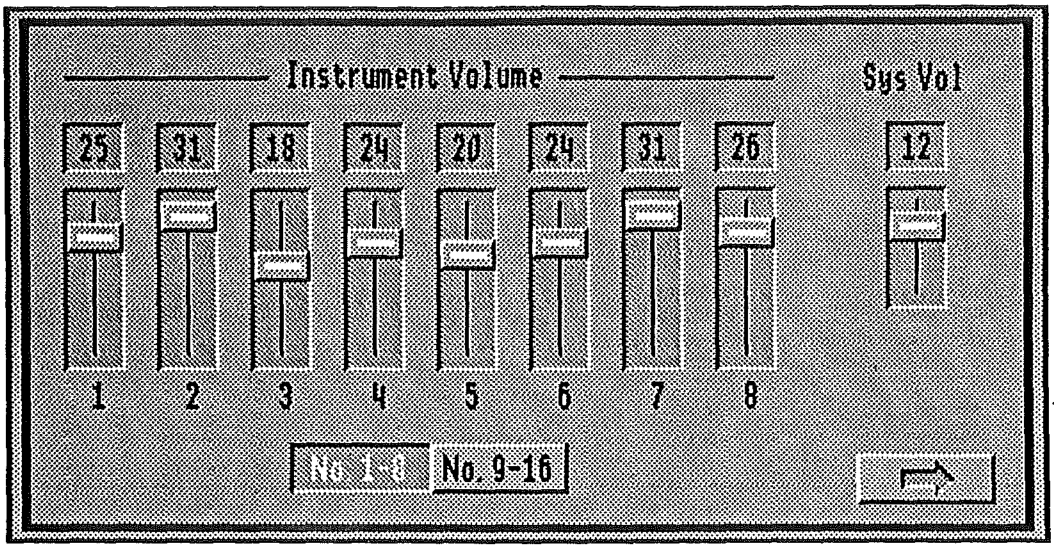
If you're using MIDI output, make sure that the *MIDI Out* button in the MIDI Setup dialog is on. This button acts as a master control, enabling or disabling MIDI out globally on all tracks.

System...

This item lets you adjust the pitch and volume of the screen keyboard found on the WaveList and Envelope pages.

Volume...

The volume level of each one of the 16 instruments can be adjusted independently from this dialog box. These controls are intended to be used with the sequencer to balance instrument levels when playing many instruments together. These settings are saved in the Sequence File, and are



Volume Setup Dialog

restored whenever you load a sequence.

The System Volume control sets the overall output level for the headphone jack on the back of your GS. It will have no effect on the volume if you're using a stereo interface card (you'll have to use the volume control on your stereo amplifier).

All Notes Off

This is the equivalent of the "panic" button found on some synthesizers used to kill any hung notes (notes that never got an off message). Selecting this item will send a 'note off' message to all voices active in the synthesizer.

Appendix A

synthLAB File Formats

Instrument File Format

File Type: $D6
Aux Type: $0001

Instrument File - $1600 bytes

$0000	Instrument Header
$0400	Instr #1 Def Record
$0520	Instr #2 Def Record
•	
•	
$14E0	Instr #16 Def Record

Instrument Header - $400 bytes

$000	Long	File Type: "INST"
$004	Word	Version: $0100
$006	Word	Header Size ($400)
$008	Str[16]	Owner application name*
$018	Str[16]	Wave File name
$028	Byte	Master Semi-tone tuning*
$029	Byte	Master Fine tuning*
$02A	Byte	Reserved
$02B	Byte	Master Volume (0-15)*
$02C	Byte	Number of instruments (1-16)*
$02D	Word	Reserved
$030	Bytes[512]	Wave Ref Block
$230	Bytes[208]	Free
$300	Str[16]	Instrument #1 name
$310	Str[16]	Instrument #2 name
•		
•		
$3F0	Str[16]	Instrument #16 name

* not used by synthLAB

Instrument Def Record - $120 bytes

$0000	Envelope Record	Generator 1
$0010	WaveList Record 1	
$0020	WaveList Record 2	
•		
•		
$0080	WaveList Record 8	
$0090	Envelope Record	Generator 2
$00A0	WaveList Record 1	
$00B0	WaveList Record 2	
•		
•		
$0110	WaveList Record 8	

Envelope Record - $10 bytes

$00	Byte	Attack level
$01	Byte	Attack rate
$02	Byte	Decay 1 level
$03	Byte	Decay 1 rate
$04	Byte	Decay 2 level
$05	Byte	Decay 2 rate
$06	Byte	Sustain level
$07	Byte	Decay 3 rate
$08	Byte	Release 1 level
$09	Byte	Release 1 rate
$0A	Byte	Release 2 level
$0B	Byte	Release 2 rate
$0C	Byte	Release 3 rate
$0D	Byte	Decay Gain
$0E	Byte	Velocity Gain**
$0F	Byte	Pitch Bend**

WaveList Record - $10 bytes

$00	Byte	Top Key**
$01	Byte	Configuration
$02	Byte	Channel
$03	Byte	Detune
$04	Byte	Wave Address A
$05	Byte	Wave Size A
$06	Byte	Volume A
$07	Byte	Octave Tuning A
$08	Byte	Semi-tone Tuning A
$09	Byte	Fine Tuning A
$0A	Byte	Wave Address B
$0B	Byte	Wave Size B
$0C	Byte	Volume B
$0D	Byte	Octave Tuning B
$0E	Byte	Semi-tone Tuning B
$0F	Byte	Fine Tuning B

** Generator 1 value used for both Generators

Wave Ref Block - $200 bytes

$000	Instr #1 Wave Ref
$020	Instr #2 Wave Ref
•	
•	
$1E0	Instr #16 Wave Ref

Wave Ref - $20 bytes

$00	Byte	WaveList 1 wave number		
$01	Byte	WaveList 2 wave number		
•	•	•	Osc A	
•	•	•		
$07	Byte	WaveList 8 wave number		Generator 1
$08	Byte	WaveList 1 wave number		
$09	Byte	WaveList 2 wave number		
•	•	•	Osc B	
•	•	•		
$0F	Byte	WaveList 8 wave number		
$10	Byte	WaveList 1 wave number		
$11	Byte	WaveList 2 wave number		
•	•	•	Osc A	
•	•	•		
$17	Byte	WaveList 8 wave number		Generator 2
$18	Byte	WaveList 1 wave number		
$19	Byte	WaveList 2 wave number		
•	•	•	Osc B	
•	•	•		
$1F	Byte	WaveList 8 wave number		

wave number = $00-$3F (see Wave File format)

Wave File Format

File Type: $D8
Aux Type: $0004

Wave File - $10900 bytes

$0000	Wave Header Record
$0100	Wave Def Record #1
$0120	Wave Def Record #2
	•
	•
$08E0	Wave Def Record #64
$0900	PCM Data

Wave Header Record - $100 bytes

$00	Long	File Type: "WAVE"
$04	Word	Version: $0100
$06	Word	Offset to Wave data
$08	Str[16]	Owner application name*
$18	Word	Number of valid Wave Defs
$1A	Bytes[230]	Free*

Wave Def Record - $20 bytes

$00	Str[16]	Wave name
$10	Word	DOC Address
$12	Byte	Set to zero
$13	Byte	Size
$14	Byte	Volume*
$15	Byte	Octave Tuning*
$16	Byte	Semi-tone Tuning*
$17	Byte	Fine Tuning*
$18	Bytes[8]	Free*

* not used by synthLAB

PCM Data - $10000 bytes

64k image of DOC ram.
Must not contain samples with a value of zero.

```
* Wave sizes

s256        equ 0
s512        equ 1
s1K         equ 2
s2K         equ 3
s4K         equ 4
s8K         equ 5
s16K        equ 6
s32K        equ 7


WHeader
     DC.B 'WAVE'      ; file type
     DC.W $0100       ; version = 1.00
     DC.W 2048+256    ; offset to wave data (256 bytes for header,
;                                          2k bytes for Wave Defs)
     DC.B 'SynthLAB'; owner (your application name)
     DS.B 8           ; filler (owner field is 16 bytes)
     DC.W 1           ; # of valid Wave Defs
     DS.B 230         ; free (your app can use this)


WaveStr1
     str 'Flute'           ; name
     DS.B 16-(*-WaveStr1); filler (Wave Name field is 16 bytes)
     DC.W $2000            ; DOC ram address
     DC.B 0                ; reserved, set to zero
     DC.B s4K              ; size, 4k bytes
     DC.B 0                ; vol- not used
     DC.B 0                ; oct- not used
     DC.B 0                ; semi- not used
     DC.B 0                ; fine- not used
     DS.B 8                ; your app can put additional info here
```

MPW IIGS Example of Wave File (Header and Wave Def)

Sequence File Format

File Type: $D5
Aux Type: $0001

Sequence Header

$000	Long	File Type: "MSEQ"
$004	Word	Version: $0100
$006	Word	Offset to Seq Data
$008	Str[16]	Owner application name
$018	Str[16]	Instrument #1 File name
$028	Str[16]	Track #1 name
$038	Str[16]	Track #2 name
•	•	•
•	•	•
$118	Str[16]	Track #16 name

Sequence Initialization

$128	Word[16]	ChannelVolumes
$148	Word[16]	Track Channels
$168	Word[16]	Track Play
$188	Word	Record Track
$18A	Word	Tempo
$18C	Word	Beats per Measure
$18E	Word	Beat Value
$190	Word	Ticks per Beat
$192	Word[16]	Track Output Map
$1B2	Word[16]	Reserved

Seq Data

Image of MIDI Synth Sequence.
Must not exceed 128k length.
Must terminate with EOS ($FFFF).

```
HeadStart
     DC.B 'MSEQ'      ; file type
     DC.W $0100       ; version = 1.00
     DC.W HeadEnd-HeadStart    ; index to seq data (header size)
     str 'SynthLAB' ; owner
     DS.B 8           ; filler (owner field is 16 bytes)
     str 'Synth.bnk'; instrument
     DS.B  7,0        ; filler (instrument field is 16 bytes)
     str 'the Demo'
     DS.B  8,0        ; filler (track name field is 16 bytes)
     str 'Track 2'
     DS.B  9,0
        •
        •             ; insert names for Tracks #3 - #15
        •
     str 'Track 16'
     DCB.B 8,0

* Seq Initilization

     DCB.W 16,127     ; Channel volumes = $7F
     DCB.W 16,-1      ; Track channels = 'Thru' mode

     DC.W -1,0,0,0,0,0,0,0
     DC.W 0,0,0,0,0,0,0,0; play Track #1 only


     DC.W 2           ; Record on Track #2
     DC.W 60          ; tempo
     DC.W 4           ; beats/measure
     DC.W 1           ; beat to: (quarter note)
;                      This is used to hilite the "Beat To:" buttons
;                       in the Seq Setup dialog.
;                      Not needed to play a seq with MIDI Synth.
;                      0= half note  1= quarter   2 = 1/8th, etc.
     DC.W 96          ; ticks/beat = quarter note

     DCB.W 16,0       ; Output map
     DCB.W 16,0       ; reserved
HeadEnd
```

MPW IIGS Seq File Example
(Header and Initialization)

Appendix B

The MIDI CDEV

The MIDI CDEV was created to encourage developers to specify MIDI in a uniform manner inside their applications. Whenever a user runs a MIDI program for the first time, the user usually has to input information about their specific MIDI setup through some sort of dialog box. When they run another MIDI program, they must give that program the exact same information all over again. The problem occurs when the user changes their MIDI setup. Now they must enter this new setup into all their MIDI programs, one by one. Another problem is that the user might not remember exactly what their setup is a year later when they buy a new MIDI program.

With the MIDI CDEV, the user enters their specific MIDI setup only once through the NDA Control Panel. The MIDI CDEV creates a setup file (*Midi.Setup*) inside the "Drivers" folder which contains information about the user's MIDI connection. From there, all MIDI applications can use the *Midi.Setup* file to configure themselves.

Installing the MIDI CDEV

1. Copy the file called "MIDI" from the synthLAB disk to the "CDevs" folder, which is found inside the "System" folder on your boot disk. You have now added a new selection to the NDA Control Panel called *MIDI.*

2. From the Finder, select the "Control Panel" NDA from the Apple Menu. Scroll down the selection list until you find the icon called *MIDI* (shown in Fig. 1 on the left side). With your mouse, click on it to select it.

3. Once MIDI is selected, you'll get the setup options, shown in Fig. 1 on the right. The options on the top select where the MIDI interface is connected to your GS. The list on the bottom lets you select the appropriate MIDI Driver file.

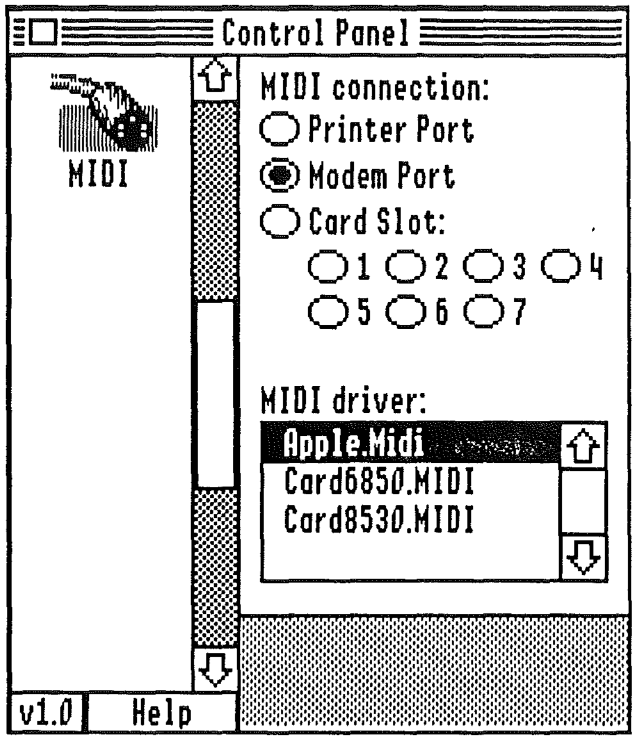


Fig. 1 - MIDI CDEV

MIDI connection

If you're using an external type of MIDI interface (*Apple MIDI*) that connects to a serial port on the back of your GS, then only select either the Printer or Modem ports. If you are using an internal card as a MIDI interface, such as the Applied Engineering *Audio Animator*, then select the "Card slot" button and one of the seven slot numbers.

MIDI Driver

The MIDI CDEV scans your "Drivers" folder and displays all of the MIDI type of driver files it finds there. From this list, you must select the appropriate driver for your interface. If there are no drivers shown in the list then consult your MIDI interface manual for instructions.

Midi.Setup File Format

WORD	External/Internal (0,1)
WORD	Slot number (1-7)
Str[32]	MIDI Driver file name Pascal string. (Not a pathname, file name only. Assumes path of */System/Drivers/)