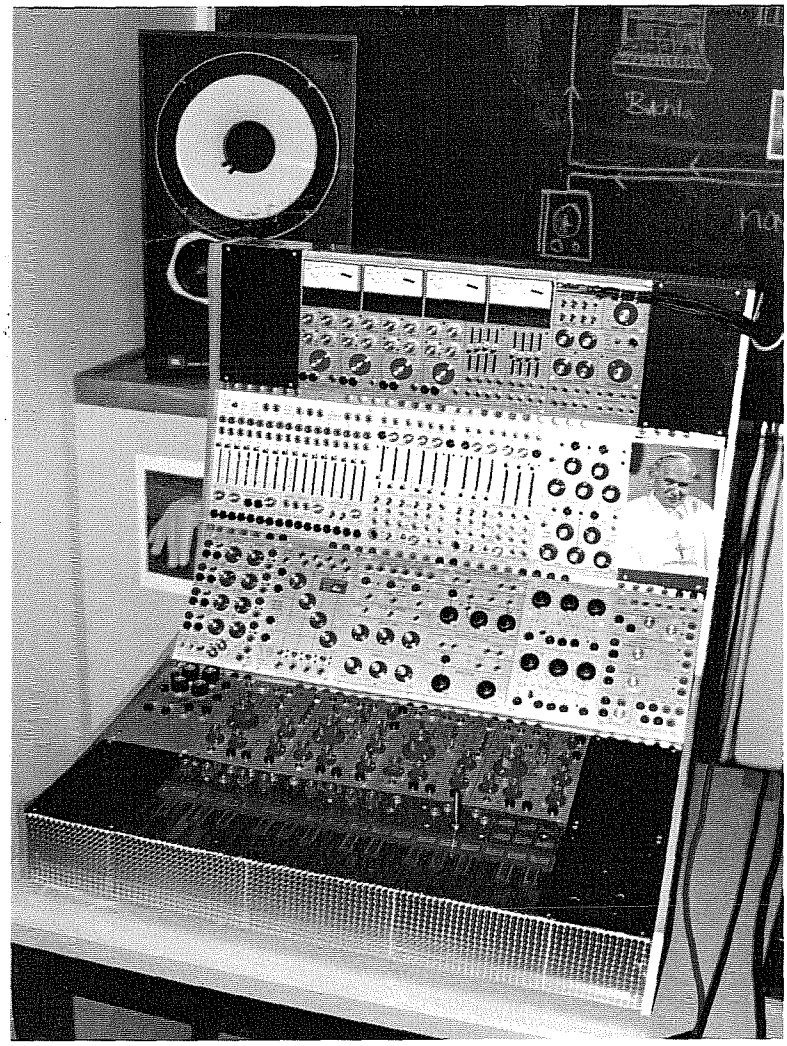
Buchla Manual



The Series 200 Buchla synthesizer

300 ACTUALLY :)

INTRODUCTION

BUCHLA BASICS

TUTORIALS

USING PAIA

GLOSSARY, APPENDIX

1.1 INTRODUCTION

This manual is intended to be used as a working guide for those not familiar with analogue synthesizers, so that they can begin to experiment with Buchla without fear of damaging it, and with some idea of what they are doing. Having grasped the basics herein provided, the user should be able to refer to Daniel Scheidt's Buchla manual, which details the specific functions and operation of all Buchla's modules.

In Section 1, there is a brief history of analogue synthesizers, with special emphasis on the history of Buchla; a sample of the professionals who have used analogue synthesizers in their music; and a brief overview of UVic'c own Buchla.

In Section 2, the necessary fundamentals of Buchla use are explained.

In Section 3, a series of tutorials will aquaint the user with a few of Buchla's more basic capabilities.

Section 4 deals with the use of the PAiA MIDI to Control Voltage converter.

Section 5 is a glossary of important terms, and a copy of Daniel Schiedt's manual.

1.2 ORIGINS OF ANALOGUE SYNTHESIS

The first analogue synthesizers took shape in the early 1960's. Donald Buchla, and Robert Moog, working at approximately the same time, independently began to build the crude ancestors of the eventual modular synthesizers of the late 1960's. Moog did not actually refer to his contraptions as synthesizers until 1967. This coincided with the growth in commercial popularity of modular analogue synths.

Previous to this more widespread interest, Moog and Buchla's electronic music boxes were known only to afficianados of electronic music, such as geeks and contemporary composers. One such composer was Morton Subotnick, who, together with Ramon Sender, both of whom were working at the San Francisco Tape Music Center at the time, came up in 1963 with the idea for

an optically controlled synthesizer. Donald Buchla designed and built it. Deciding that this first machine, which produced a tone of varying complexity according to how the operator shaped his hand in front of an optical sensor, was the wrong way to go about building an electronic instrument, Buchla decided instead to devise a voltage-controlled modular system (Moog had decided on a similar approach at about this time).

Buchla's design included a touch-sensitive keyboard (similar to the keyboard on UVic's Buchla), and an analogue sequencer. Through a grant from the Rockefeller Foundation, he was able to build it, and brought it to the SFTMC in early 1965. In 1966, after further refinement of his ideas, he formed a company, Buchla and Associates, and began to market his machines. Over the course of the 1970's, they became more complex, often incorporating digital technology, in the form of digital tuning, and programmable digital sequencers. Digital synthesizers eventually overtook the analogue machines in popularity, due in no small part to their reduced size and increased reliability. Nonetheless, the Buchla analogue synthesizer is still a formidable tool for sound production and manipulation.

1.3 SUGGESTED LISTENING

The following are composers, artists and musical groups who have used analogue synthesizers to notable effect. Of special note is Morton Subotnick, given his involvement with the very beginnings of Don Buchla's work with analogue synthesis.

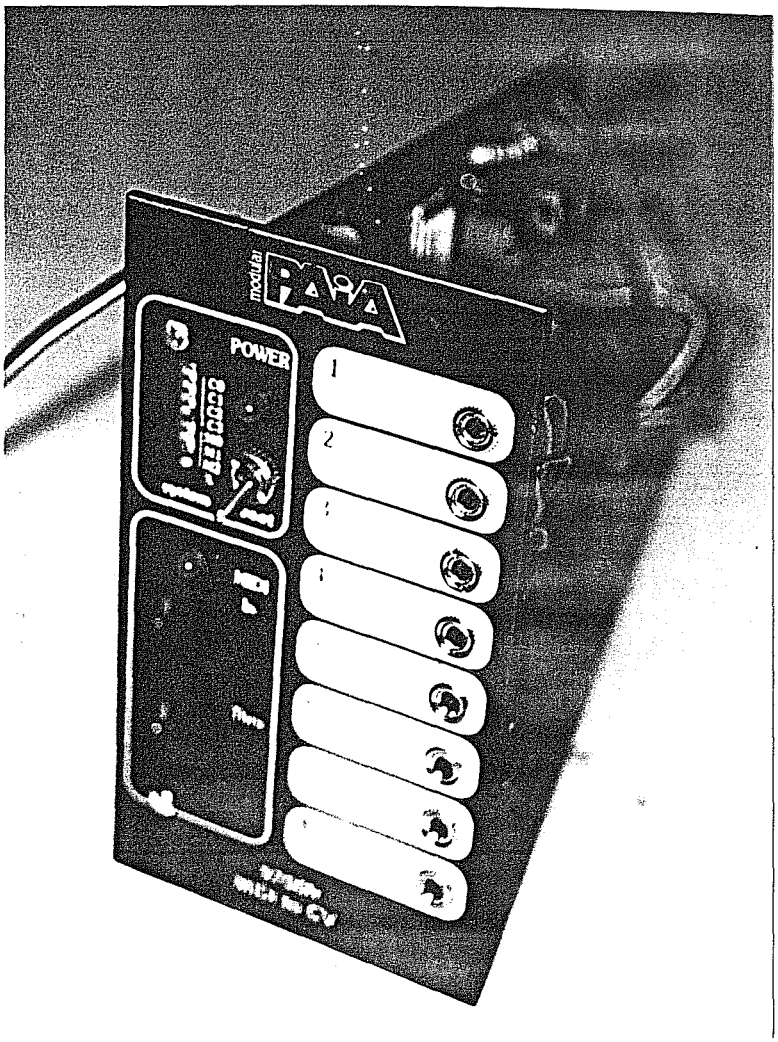
-Emerson, Lake and Palmer
-Blood, Sweat and Tears
-Jan Hammer
-John McLaughlin
-Iseo Tomita
-Stevie Wonder
-Pink Floyd
-Herbie Hancock
-Chick Corea
-Morton Subotnick

1.3 BUCHLA AT UVIC

The Series 200 Buchla synthesizer owned by the University of Victoria music school was built in 1978. It was intended to compliment the New England Digital Synthesizer, as a signal processor. As such, it has only four oscillators, and a number of signal processing modules. The Series 200 Buchlas were designed to interface with a special computer designed by Don Buchla, which this school does not have. Recently, however, the electronic

NOTE: This has been replaced by the Buchla MIDI / USB DECODER MODEL 225e

music department purchased a MIDI to Control Voltage converter manufactured by PAiA. This device allows the user to program up to 8 individual control voltages using MIDI.



2.1 INTRODUCTION

This chapter is intended to provide you with a basic working knowledge of Buchla, so that you can further your understanding of modular analogue synthesis. At first glance, Buchla may seem complex and bewildering, but once you understand the way in which Buchla is organized, it will not take you long to aquire a solid grasp of its possibilities.

2.2 POWER SWITCH, WARNINGS

The power switch is on the back of Buchla, on the lower left-hand side as you face the front. It would be worthwhile to go around to the back the first time you turn it on. It is a small silver lever-switch, up is 'on', down is 'off'. Be careful not to disturb any of the nearby wires when turning Buchla on.

If you heed the following warnings, you will not have to worry about damaging Buchla during your sonic adventures.

1. Buchla is designed to be portable. The upright half of the console folds down for transport and is not locked in place. Considering this, be careful not to fold the top down abruptly, or by accident.

2. All pots (potentiometers, or knobs), switches and sliders should be treated **gently**, and patch cords must be unplugged by holding the plug, not the cord.

3. The keyboard is mounted on a floating bracket, and as such is delicate. Do **not** lean on it, or place objects on it.

4. **Always connect outputs to inputs**. Outputs to outputs or inputs to inputs can cause Buchla harm. Identifying which is which is covered later this chaper.

5. Do **not** attempt to force banana plugs into signal (metal-rimmed) jacks. If a plug does not seem to want to go into a particular jack, it probably isn't supposed to.

6. Lastly, there are four switches on Buchla labelled "control source." They should all be set to **local**, or confusion will ensue.

2.3 BUCHLA IS A MODULAR SYNTHESIZER

Buchla is made up of individual units, or **modules**, each of which is capable of performing certain functions. You may have noticed that the surface of Buchla is divided into individual rectangular metal plates. Each of these plates houses one of Buchla's modules. At the top of each module you will find the module's name, which describes the function of the module. (See if you can find the '**Programmable Spectral Processor**.')

The key to using Buchla, and the reason that it is so exciting in its variety of possibilities, is that none of the modules are connected unless you connect them. For the modules to be of any use, they must be connected to each other, according to their function.

2.4 ANALOGUE SYNTHESIS

In order to fully understand how Buchla works, it is necessary at this point to have an understanding of how analogue synthesis is possible. It can be simply explained in terms of **voltage medium**. All sound production and manipulation within Buchla takes place in this voltage medium. The idea behind this is that sound itself is **changes in intensity** in a medium, which we percieve as sound. We only hear sound in the air medium, and in water, but the actual characteristic of sound that makes it what it is, **vibration**, can be translated into media besides what we are familiar with. This is what a microphone does; with a very sensitive diaphragm, it converts changes in **air pressure** to changes in **voltage intensity**. Speakers do the reverse. So it makes a certain amount of sense to suppose that it should be possible to create vibrations in the voltage medium, and then transduce them into the air medium to see what they sound like. This is what Buchla does.

2.5 SIGNAL VS. CONTROL VOLTAGE

The actual electrical vibrations that you hear from the speaker are called **signal voltages** by Buchla, and are carried by a particular kind of patch cord, called a **signal patch**. Buchla also uses a second kind of voltage, which is entirely separate from signal voltage, and with which cannot be interchanged (the exception to this is the signal to control voltage conversion module). This second voltage system is used to control the variables of the modules that produce and process signal voltages, and is thus called **control voltage**.

2.6 SIGNAL PATCHES AND CONTROL PATCHES

Signal patchcords have mini-phono (1/8") plugs, and use the metal jacks. Inputs and outputs are marked on the module.

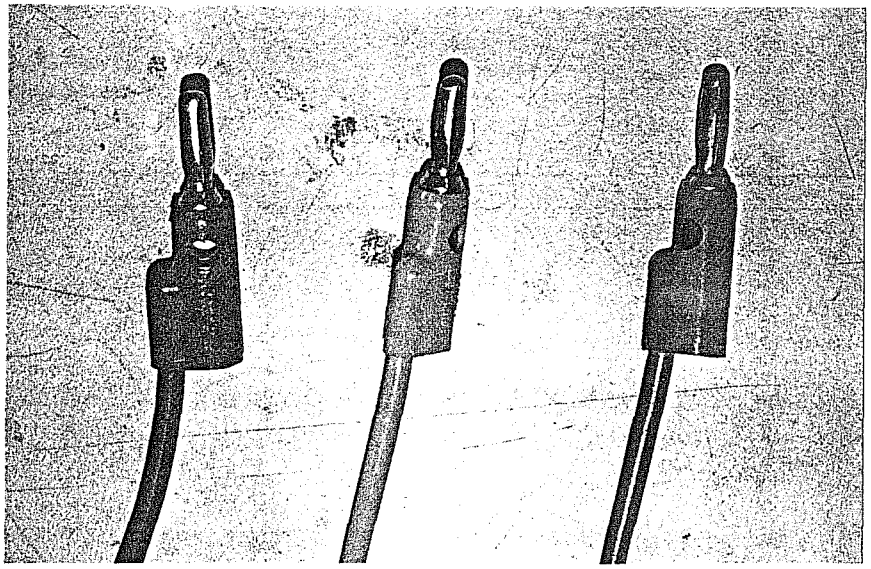
Control patchcords have plastic banana plugs and use the plastic banana jacks. The jacks are colour-coded as follows:

1. Black jacks are inputs (with the exception of the outputs of the DUAL VOLTAGE PROCESSOR module, and the joystick.)

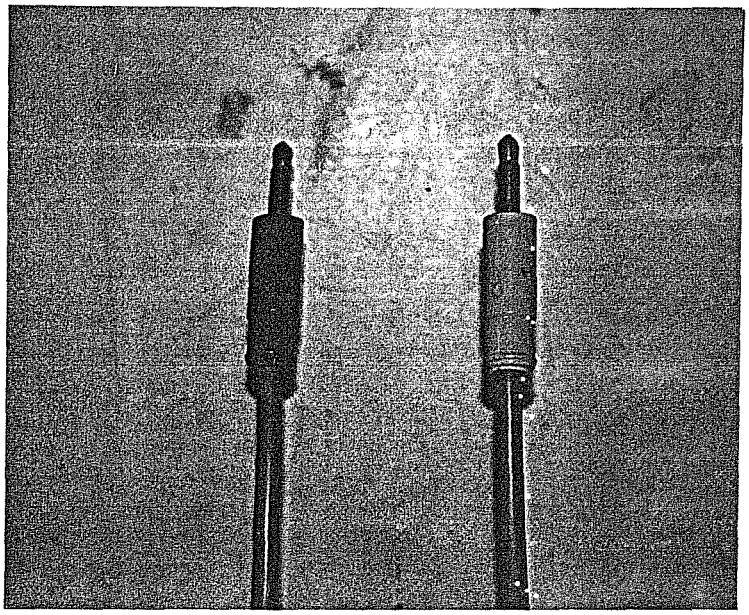
2. Blue or purple jacks are outputs. ~~There is no difference between blue or purple.~~ PURPLE = PRESSURE

3. Red jacks are for pulses are are labelled as inputs or outputs.

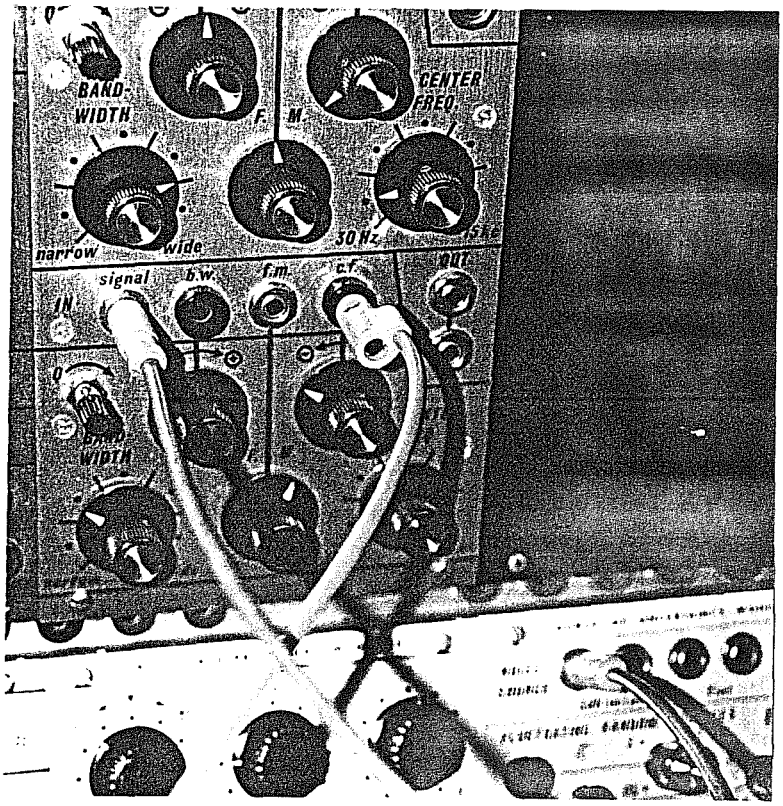
Note: banana plugs can be stacked on each other, allowing one output to supply multiple inputs-do not send more than one output to one input.



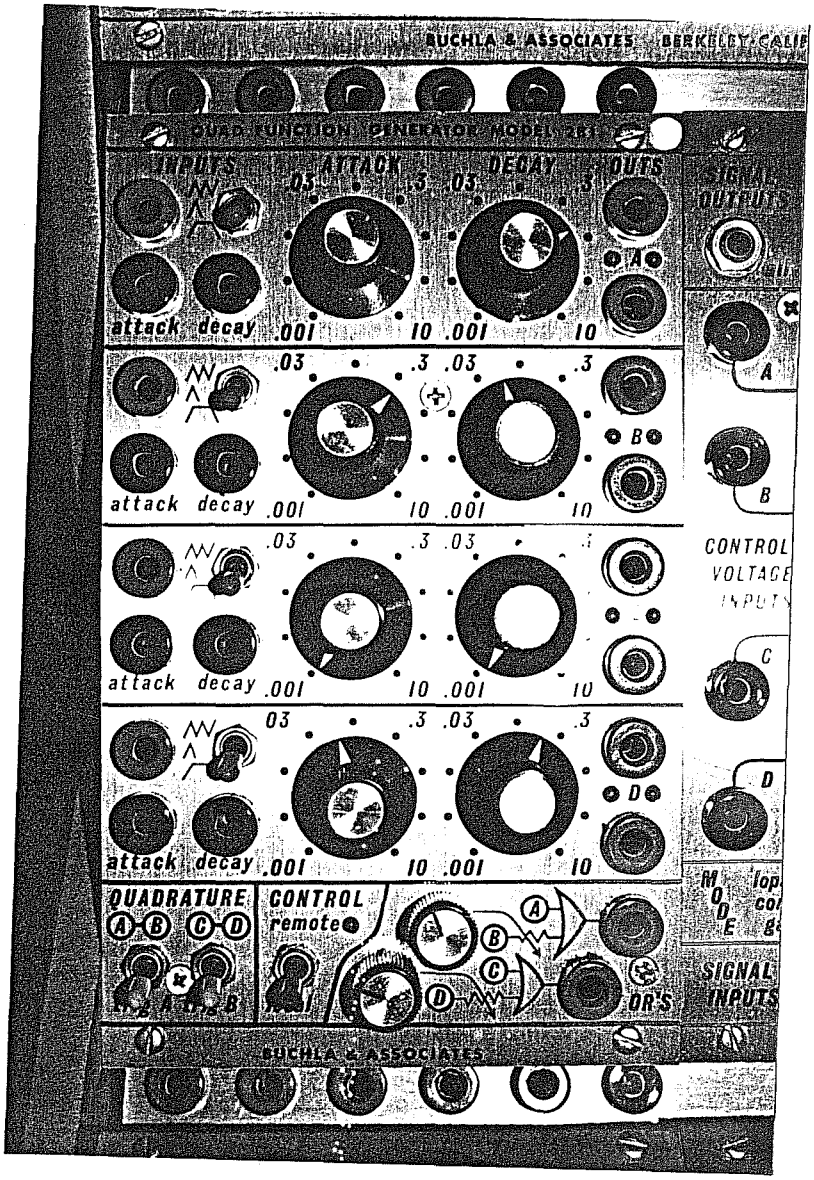
Banana plugs



Signal plugs



Example of appropriate plugs in jacks



Example of banana jacks

2.7 POTENTIOMETERS

"Potentiometer," or "**pot**", for short, is the name given to the knobs on Buchla that change variables in the module's function. Some pots control amplitude (sound volume), while others control which frequencies are attenuated (decreased) from a sound. For instance, on the portion of Buchla which lies flat on the table, you will find four large knobs, all in a row. Each of these knobs is a potentiometer, and each controls the main pitch of a separate oscillator.

Many of the pots have control voltage inputs associated with them; these inputs allow you to use a control voltage (from a

source of your choice; perhaps an oscillator, or even the keyboard) to affect whatever the associated pot normally does. This is basically a way of automating the movement of pots, so you don't have to do it by hand. In all cases, the control voltage is added to whatever the pot normally used to control is set at. For example, if you were to connect the control voltage output of the keyboard to the control voltage imput of one of the oscillators, you would find that the keyboard would start its lowest note from wherever you set the main frequency pot on the oscillator, and go up from there.

You will also find pots with a plus and a minus symbol above them, on either side of a line. These pots are called **inverse attenuator pots**, and they determine the effect that that control voltage inputted through them will have on the parameter of the module they are related to. For example, the dual voltage-controlled filters each have a pot for bandwidth and center frequency. They also have black CV (control voltage) inputs with pots below them with the +/- designation. With the pot set in the middle, between + and -, the CV inputs will have no effect. But the more you turn the pot towards the positive, the more the CV input will be added to the setting of the main control pot on the module, and the more you turn the pot towards the negative, the more the CV input will be subtracted from the setting on the main control pot.

Sliders (such as those found on the Programmable Spectral Processor) work in the same way as faders on a mixing board.

The little red lights (leds) found on some of the modules are voltage intensity indicators.

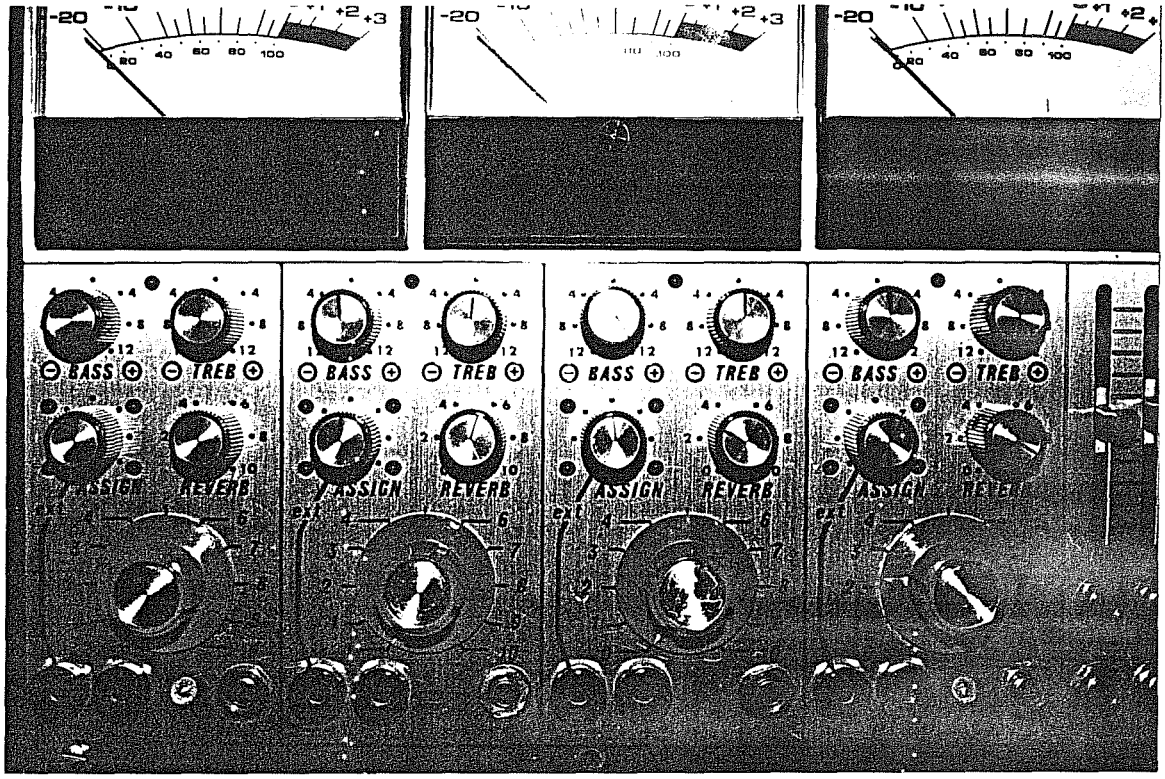
2.8 LINEAR SOUND PATH

Now that you have an understanding of the fundamental elements of Buchla, you will want to make the acquaintance of one more idea before you dive into your sonic adventures.

As you begin to explore Buchla's possibilities, keep in mind the concept of a **linear sound path**. This means that all sounds start at some point in Buchla, travel through whatever route you have made with patch cords, and exit at one of the four **main outs**.

The idea of a linear sound path is helpful because it encourages you to be conscious of the steps that your patch (in this sense referring to your total system of patchcorcs) involves,

and allows you to begin to hear how modules and combinations of modules sound.



Main outs

3.1 INTRODUCTION

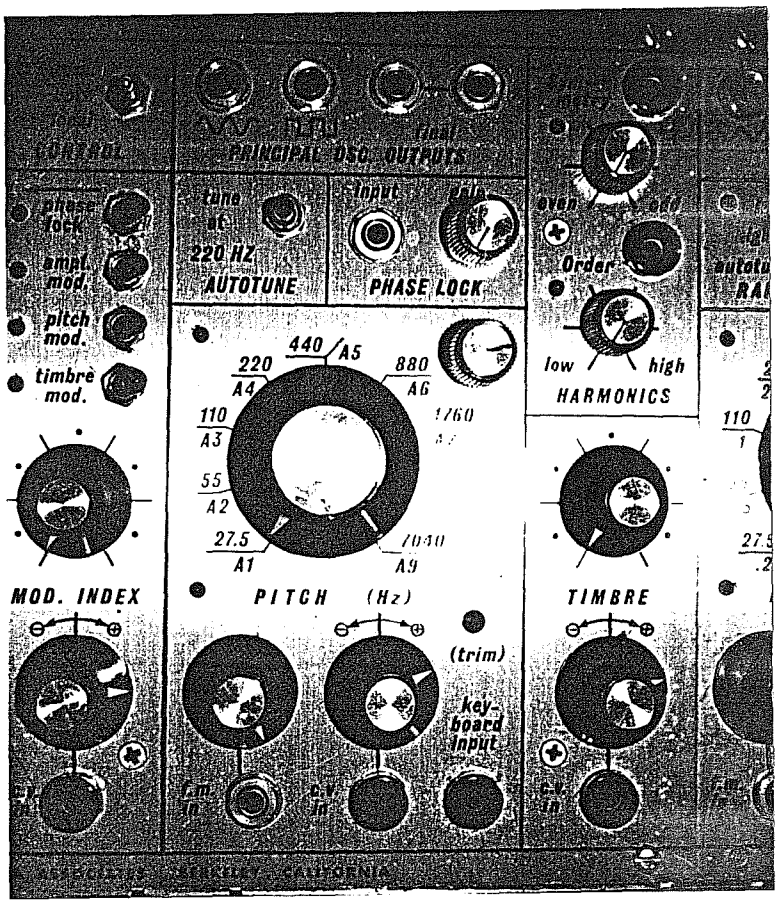
In the course of this chapter you will be introduced to various basic capabilities of Buchla, such as the oscillators, the quadraphonic panning, and voltage-controlled filters. (Note: for the sake of convenience, "up" on the console is away from you, "down" is towards you.)

3.2 USING AN OSCILLATOR

To begin, you need to take one of the longer signal patches, and connect the signal **out** (called "Principal Oscillator Output" on the module) of one of the oscillators to the input of one of the four main outs.

The oscillators are found on the flat-laying part of Buchla's console, on the further side of the keyboard from you as you stand facing Buchla. Their signal outs are at the top of each of the modules, at the edge of where Buchla's two halves (upright and flat) meet.

There are two volume controls you need to be aware of when using Buchla. Each of the four main outs has its own voume pot, and there is a main volume pot for all channels, called **Program Level**, to the right of the main outs. If the main out channel volume is at about '3' or '4', and the master 'program' volume is also at '3' or '4', you should hear a sound from the oscillator. If the frequency of the oscillator is set very low, you may not hear it until you change it to a higher range. You can do this by rotating the main frequency pot, identifiable as the largest pot, in the center of the oscillator module. You will note that there are four of these oscillator modules, and you may have noticed that the oscillators are paired in groups of two. The two pairs are identical. In each pair, the oscillators are pre-wired together so that, by activating the appropriate switch, the left oscillator of the pair will affect the right. This function is controlled by the row of switches and potentiometer that separate the paired oscillators. Each of the switches activates a particular form of modulation, and the pot immediately below the swtiches decides the degree to which the left oscillator will affect the right.



Oscillator

3.3 QUADRAPHONIC PANNING

Buchla is capable of **quadraphonic sound** (like stereophonic, only with double the channels, all of which are independent of each other) , and can be made to pan sounds from one speaker to another quite easily. Where a sound is panned to is controlled at the main out.

You can either use the pan pot to manually move the sound from speaker to speaker, or you can voltage control it. To activate this option, turn the pan pot on the channel that your oscillator is going through as far counter clockwise as it will go (gently!). Now, any control voltage you patch into the **x** and **y** inputs of the main out will pan the sound to the appropriate speaker. You can tell by the LEDs which speaker the sound is going to.

Perhaps the most intuitive means of voltage-controlling pan is with the **joystick**, which is part of the **keyboard module**. Using longer control patches, plug two of the outputs from the joystick into the **x** and **y** inputs in the main out channel that you have chosen. You should now be able to control which speaker your sound goes to by moving the joystick.

3.4 VOLTAGE-CONTROLLED FILTER

Now that you have made a sound and learned how to pan it quadraphonically, you will want to explore the wonderful world of **filters**. We will start with the Dual Voltage Controlled filter, which is found on the right hand side of the upright console. Grab an extra signal patch and move the main out end of your first patch cord to the input of the filter, and use the second patch to connect the **out** of the filter to a main out. Try playing with the filter pots. The inverse attenuator pots connected by blue lines to banana plugs will not affect the sound unless they are receiving a control voltage.

4.1 INTRODUCTION

The **PAiA midi2cv8** makes the use of **MIDI** as a control language for Buchla possible. With the use of software such as **Max**, it is possible to create commands of considerable complexity, and program up to 8 different control voltages. This chapter deals with using the PAiA on a basic level, and ignores alternate PAiA modes.

NOTE: The PAiA has been replaced by the Buchla MIDI / USB DECODER MODEL 225e

4.2 MIDI

Basically, MIDI is a control language that allows one electronic instrument (such as a keyboard) to tell another electronic instrument (such as a sampler) when to play a note, how loud it should be, from what bank of pre-recorded sounds it should be chosen, etc. In this context, the PAiA converts the full MIDI range (0-127) into a conventional control voltage range (0-10V). (The joystick outputs on Buchla also produce a 0-10V range.)

4.3 MAX

Max is a useful program for manipulating and producing MIDI numbers, and as such is well-suited to the task of providing Buchla with structured commands. Currently, Max is being run on an older Macintosh computer which you will find close to Buchla.

Max is somewhat like Buchla, in that there are virtual 'modules' called **objects**, which have specific functions to do with processing numbers, much the same way that Buchla's modules process voltages. As well, it is up to you to connect Max's objects together, 'outs' to 'ins', in order to build patch systems.

4.4 USING THE PAiA

To begin, you will want the PAiA sitting on or close to Buchla. Check that the PAiA's power supply is plugged in (the wall socket to the left of the Buchla table is closest), then check that there is a black MIDI cable going from the Macintosh computer to the PAiA. There should also be a special patch cord plugged into channel 1 of the PAiA. From the end plugged into the PAiA, the cord should split into two, a **red** and a **yellow** wire. The yellow wire is a ground connection, and should be plugged into Buchla somewhere where it will not get in the way. **If this yellow ground wire is not plugged into Buchla, the PAiA will not work**. The red wire can go into whatever control voltage input you wish.

To start, try plugging it into the keyboard input of one of the oscillators. Then use a signal patch to connect the output of your

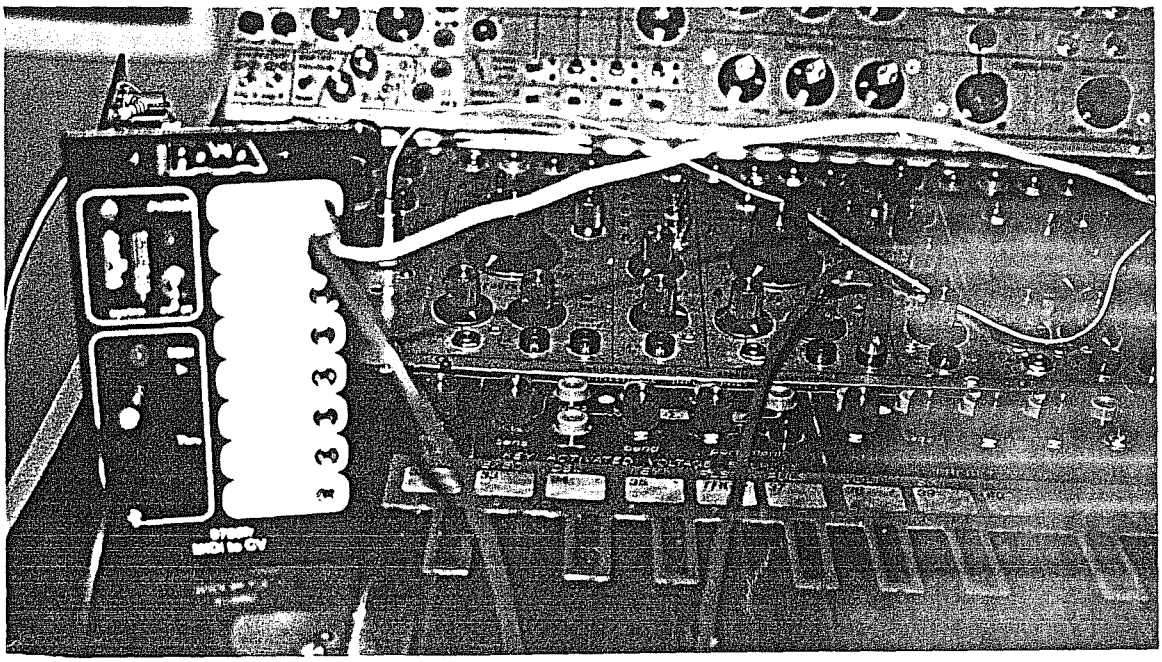
chosen oscillator to one of the main outs. Now you are ready to turn on the computer. (The power switch is on the back, on the left-hand side). Once the computer has booted up, double-click "on" on the icon on the right of the screen which says **"Max 2.01"**. Eventually, a window will appear and list some words. Once this is done, go to the **file** menu and select **open...**.

Open the file named "PAIA". A window will then appear with five Max objects in it, patched together. Two of these objects will be long vertical sliders. Set the left one on zero and the right one on anything above 30, and turn the PAiA unit on. At this oint, moving the left slider up and down should cause your oscillator to change its pitch.

Now, whatever number from 0-127 that you patch into the left-most input on the **noteout** object will be converted into control voltage by the PAiA.

Thus, you don't have to use only the sliders; there are dozens of objects in Max that will produce numbers recognizable to the PAiA unit. How you decide to do this is up to your familiarity with Max.

One further note: in order to get more than one independent control voltage from the PAiA, you must send it a "**program #0**" command. This is accomplished by sending a number zero through the leftmost out put of a "**pgmout 1**" object. For an example, open the Max file named "fourpaia". In the top righthand side of the screen, you will see a number box containing a zero connected to a "pgmout" object. By clicking on the zero, the command is sent, the PAiA is set to **multiple mode**, and the control voltage channels are made independent. (When not in multimode, the PAiA CV channels are not independent of each other.)



PAiA in basic hookup