CRUMAR
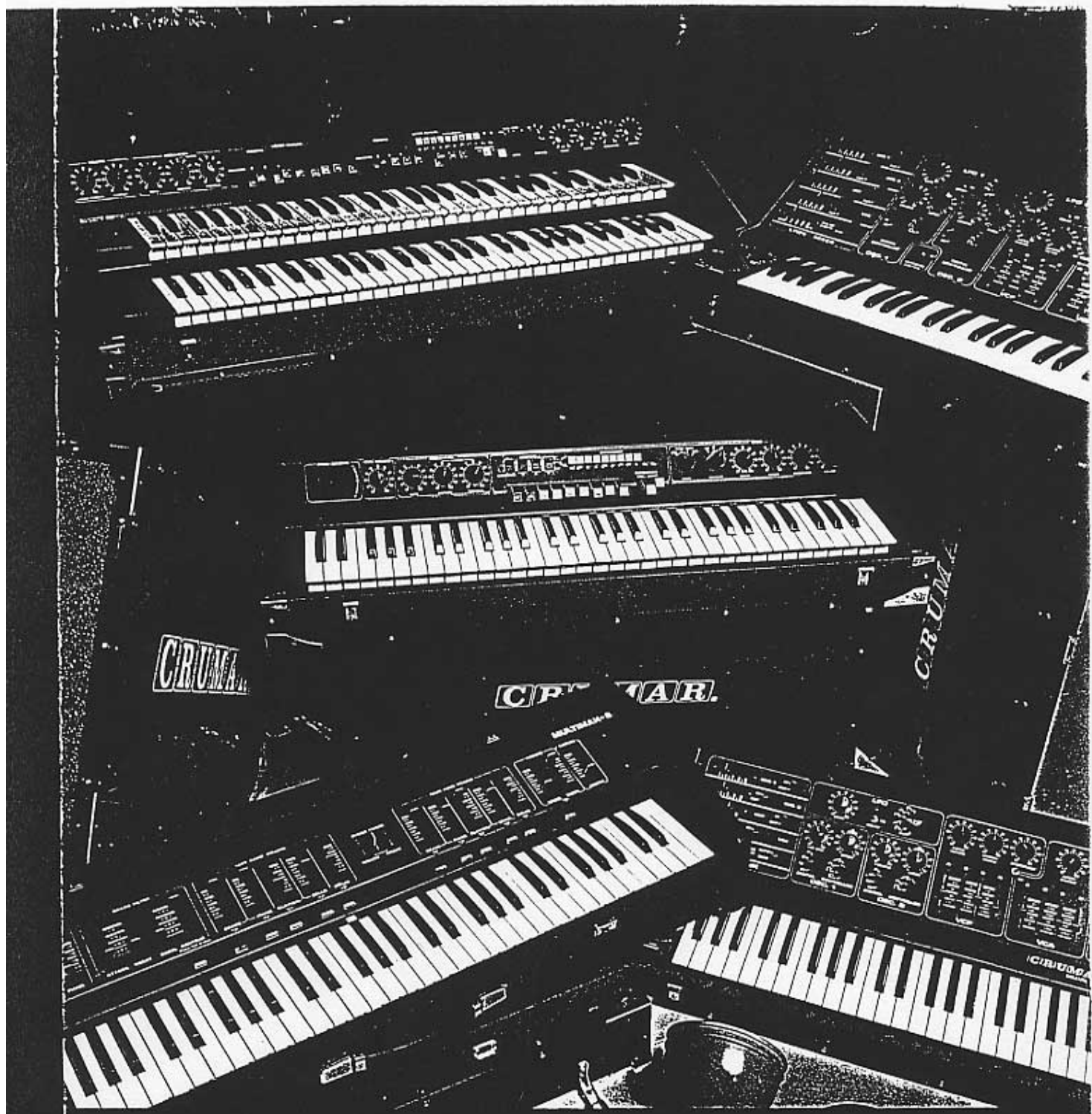
sound design for the creative musician

MANUALE D'ISTRUZIONI
MANUEL D'INSTRUCTIONS
OWNER'S MANUAL
BEDIENUNGSANLEITUNG

CRUMAR

DS1-DS2
Digital Synthesizer

A monumental breakthrough in musical technology is apparent in Crumar's new synthesizer models which are quality reproduction and recording. High quality filtres and oscillators add 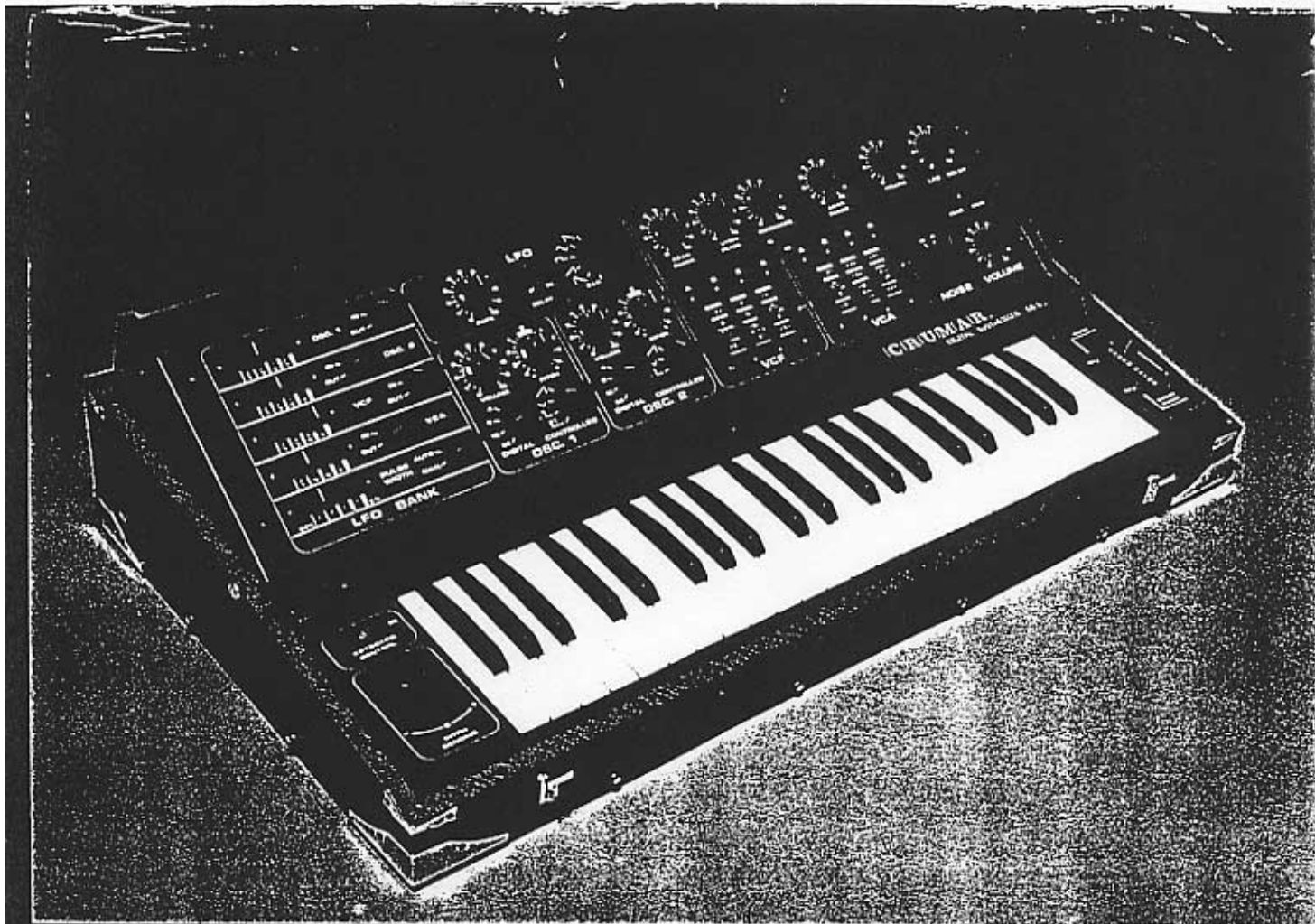to accuracy, a pureness of sound will blow the mind of musicians, amateur and professional alike. For roadies good news too!

DIGITAL SYNTHESIZER DS 2

DIGITAL SYNTHESIZER DS1

44 notes keyboard (F - C).

DCO 1 (Digital Controlled Oscillator).

Control:
Volume rotary control.
Pitch rotary control.
Range selector (32' - 16' - 8' - 4').
Wave Form selector (Sawtooth - Triangle
Square - Pulse Variable).

DCO 2 (Digital Controlled Oscillator)

Controls:
Volume rotary control.
Pitch rotary control.
Range selector (32' - 16' - 8' - 4').
Wave Form selector (Sawtooth - Triangle -
Square).

V.C.F.
Controls:
A.D.S.R. Range rotary control.
Cut-off Frequency rotary control.
Resonance Rotary control.
Attack - Decay - Sustain - Release slide
control.

V.C.A.
Controls:

A.D.S.R. Range rotary control.
Attack - Decay - Sustain - Release slide
control.
A.D.S.R. to V.C.A. IN selector.

L.F.O.
Controls:
Rate rotary control..
Wave Form selector (Sawtooth - Reverse
Sawtooth - Triangle - Square - Sample &
Hold - Staircase).
Delay Vibrato on/off selector.

DELAY VIBRATO RANGE rotary control

L.F.O. MIXER
Oscillator 1: L.F.O. selector with Range
slide control.
Oscillator 2: L.F.O. selector with Range
slide control.
V.C.F.: L.F.O. selector with Range slide
control.
V.C.A.: L.F.O. selector with Range slide
control.
Pulse Width: L.F.O. selector with Range
slide control..

NOISE GENERATOR
Selector for White or Pink Noise.

GLIDE (Portamento)
Controls:
On/Off selector.
2 speed position selector with
speed Glide slide control.

OTHER FEATURES

Keyboard Control selector.
Pitch Bending handle control.
Headphone/Main selector.
General Volume rotary control.

OUTPUTS

Main (Hi - Lo).
Headphone input.
Gate (IN and OUT).

DIMENSIONS

Width: cms. 79 (31").
Depth: cms. 45 (17").
Height: cms. 23 (9").

WEIGHT   Kgs. 22 (48 lbs.).

FINISH   Dark grey.

M&T PUBBLICITA'

44 notes keyboard (F - C).

DCO 1 (Digital Controlled Oscillator).
Controls:
Volume rotary control.
Pitch rotary control.
Range selector (32' - 16' - 8' - 4').
Wave Form selector (Sawtooth - Triangle Square - Pulse Variable).

DCO 2 (Digital Controlled Oscillator)
Controls:
Volume rotary control.
Pitch rotary control.
Range selector (32' - 16' - 8' - 4').
Wave Form selector (Sawtooth - Triangle - Square).

V.C.F.
Controls:
A.D.S.R. Range rotary control.
Cut-off Frequency rotary control.
Resonance Rotary control.
Attack - Decay - Sustain - Release slide control.

V.C.A.
Controls:
A.D.S.R. Range rotary control.
Attack - Decay - Sustain - Release slide control.
A.D.S.R. to V.C.A. IN selector.

L.F.O. 1
Controls:
Rate rotary control.
Wave Form selector (Sawtooth - Triangle - Square - Reverse Sawtooth).
Delay Vibrato on/off selector.

L.F.O. 2
Controls:
Rate rotary control.
Wave Form selector (Sample & Hold - Triangle - Square - Staircase).
Delay Vibrato on/off selector.

DELAY VIBRATO RANGE rotary control

L.F.O. MIXER
Oscillator 1: L.F.O. selector (1 - 2 - 1+2 - out) with Range slide control.
Oscillator 2: L.F.O. selector (1 - 2 - 1+2 - out) with Range slide control.
V.C.F.: L.F.O. selector (1 - 2 - 1+2 - out) with Range slide control.
V.C.A.: L.F.O. selector (1 - 2 - 1+2 - out) with Range slide control.
Pulse Width: L.F.O. selector (1 - 2 - manual) with Range slide control. (50% to 5%)

NOISE GENERATOR
Selector for White or Pink Noise.
Volume rotary control.

POLY SECTION
Controls:
On/Off selector.
High Pass - Low Pass Filter rotary controls.
Range selector (16' - 8' - 4').
Pitch Poly rotary control.
L.F.O. Poly.
L.F.O. selector (1 - 2 - 1+2 - out) with rate slide control.

GLIDE (Portamento)
Controls:
On/Off selector.
2 speed position selector with speed Glide slide control.

OTHER FEATURES
Keyboard Control selector.
Pitch Bending handle control.
Headphone/Main selector.
General Volume rotary control.

OUTPUTS
Main (Hi - Lo).
Headphone input.
Poly Section.
Gate (IN and OUT).

DIMENSIONS
Width: cm. 83 (32").
Depth: cm. 45 (17").
Height: cm. 27,5 (10").

WEIGHT
Kg. 23 (50,6 lbs).

FINISH
Dark grey.

Manufacturer reserves the right to make changes in models, specifications, prices, colors, materials and equipments and to discontinue models. Specification contained herein based upon latest available information at time of publication.

CRUMAR

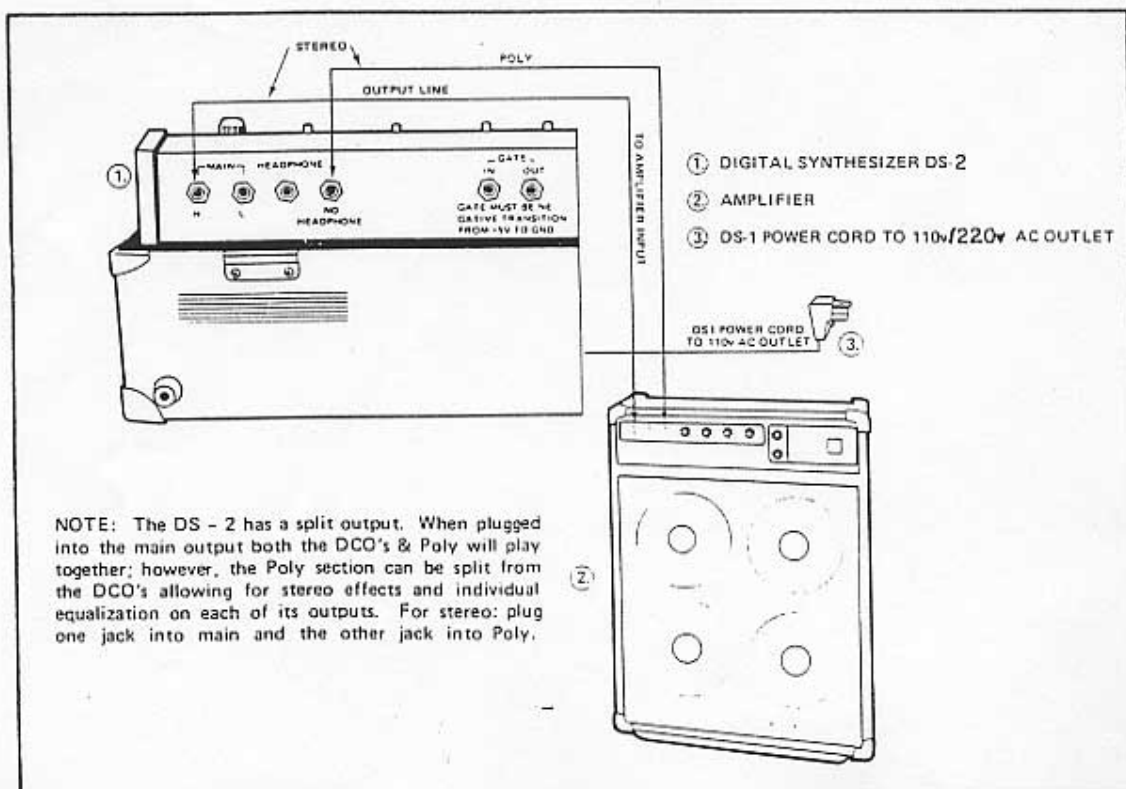# CRUMAR DS-2 DIGITAL SYNTHESIZER OPERATING MANUAL

INTRODUCTION

DESCRIPTION

Your DS-2 Digital Synthesizer comes equipped with a power cord, and a patch cord used for connecting the synthesizer to an amplifier.

AMPLIFICATION

Your DS-2 Digital Synthesizer can be connected to any conventional power amplifier and speaker system that accepts a monophonic phone plug from the instrument's main output. (Note: if played through a conventional home hi-fi amplifier, use a commercially available phone plug to RCA plug adapter between the patch cord and the amplifier, but expect considerably less volume than when played through a conventional musician's road amplifier.)

We suggest an amplifier with sufficient power to prevent overloading or distortion from occurring. If possible avoid using a bass or lead amplifier since neither was designed to accommodate the full range of frequencies your Crumar synthesizer is capable of producing. For optimum results, use a full range high powered linear amplifier such as found in P.A. systems or keyboard amplifiers.

Before beginning to play the instrument, connect the standard ¼ inch phone jack (supplied with the unit) to any amplifier input. Choose either the high or low outputs depending on the power of the amplifier. After connecting the power cord into a standard 110 AC power supply turn the power switch on. The LED light on the front panel will start flashing indicating that the unit is on.


① DIGITAL SYNTHESIZER DS-2
② AMPLIFIER
③ DS-1 POWER CORD TO 110v/220v AC OUTLET

NOTE: The DS-2 has a split output. When plugged into the main output both the DCO's & Poly will play together; however, the Poly section can be split from the DCO's allowing for stereo effects and individual equalization on each of its outputs. For stereo: plug one jack into main and the other jack into Poly.

HEADPHONE OPTION

y plugging in a set of stereo headphones directly
ito the headphone jack found in the back of the
ynthesizer the musician can hear himself without
ny amplifier and (or) pre-set a specific sound be-
ore switching over to the audio of an amplifier.
his proves especially helpful with a variable syn-
hesizer in live performance situations enabling the
erformer to achieve the desired result while listen-
ig under the phones.
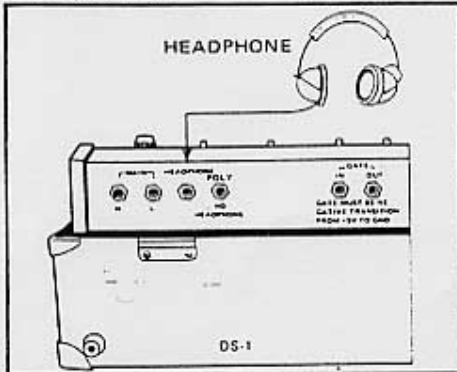
A toggle switch on the front panel designates
whether the signal from the synthesizer will go to
the head phones or the amplifier .
Whether you've chosen just the headphone position
or you're playing through an amplifier, you're
ready to begin.

HEADPHONE

DS-1

HEAD   MAIN

TOGGLE
SWITCH
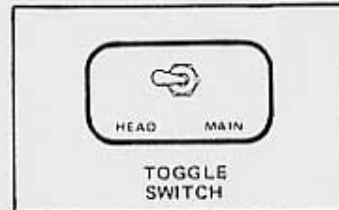
WARNING: Be sure the volume is turned down
on the synthesizer before you play it to prevent
any damage to your speakers due to High Volume
Levels.

GETTING A SOUND

The illustration below demonstrates simply how sound travels through the various control functions of the synthesizer.

|					Low Frequency Oscillator DELAY		
Low Frequency Oscillator Routing	Low Frequency Oscillator No. 1 Speed & Shape	Low Frequency Oscillator No. 2 Speed & Shape					Polyphonic Section
	Oscillator 1	Oscillator 2		Voltage Controlled Filter	Voltage Controlled Amplifier	N O I S E	Headphone
		Keyboard Control					Master Volume
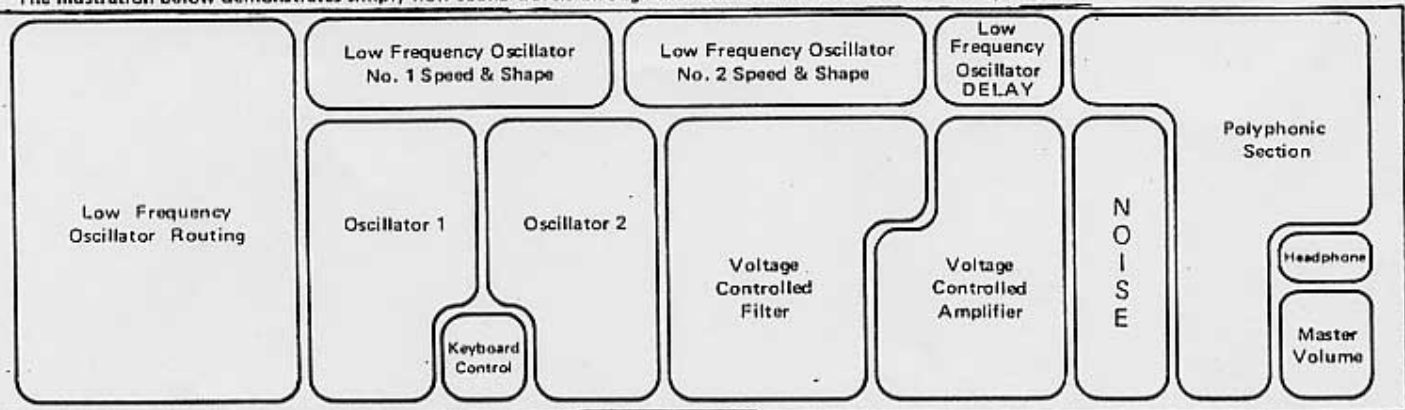
FLOW CHART

Set the dials on your synthesizer according to the diagram below to get a basic sound which we will modify as we explore each module.
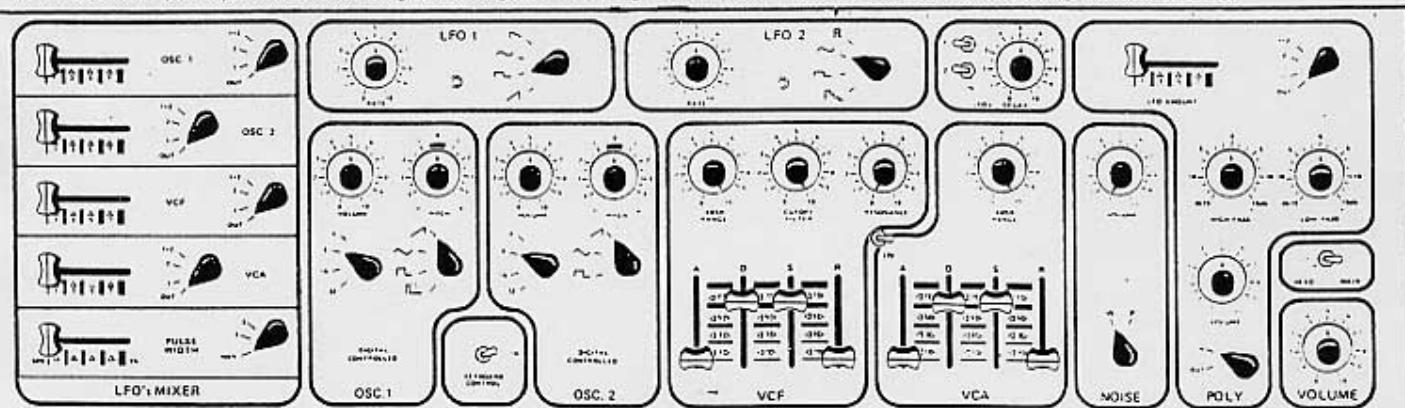

NEUTRAL SETTING

OSCILLATOR –1

OSC.1
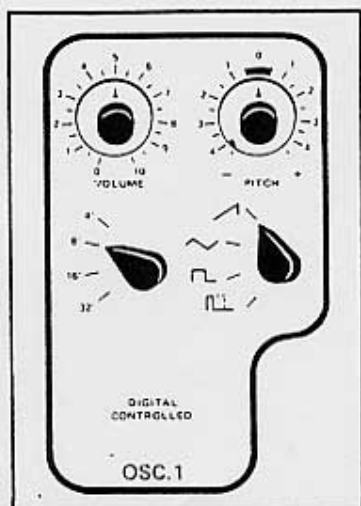
The Oscillator 1 generates the source or raw sound which will be modified by the other controls on the synthesizer. This is your primary oscillator so use it to tune to a-440 or to the other instruments in the group.

There are four basic controls: '

1. Volume — controls the amplitude (in most cases the loudness) of the wave.

2. Pitch — controls the operating frequency of the oscillator which has a variable range of one octave.

3. Octave — provides a rotary control that selects one of four playing ranges (32', 16', 8', 4'). This extends the keyboard from 3½ octaves to one that scans 6½ octaves quickly and accurately.

4. Wave Form Selector — controls the basic wave form produced by the oscillator. There are four basic wave shapes each containing a different harmonic content. These four wave forms, in conjunction with the filter, will provide a vast palate of timbres.

WAVE FORM SELECTOR
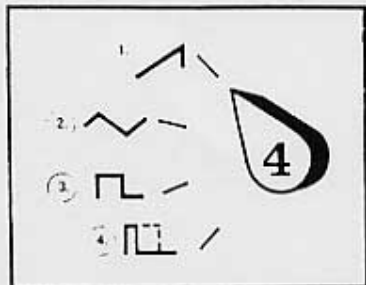
1. Sawtooth Wave ╱│ — consists of all harmonics, it has a brass type sound and is very bright and piercing.

2. Triangle Wave ╱╲ —consists of odd harmonics, the amplitudes of which are weak in comparison to the fundamental, which renders a mellow or soft quality.

3. Square Wave ⌐│_ —consists of odd harmonics, which are much stronger in comparison to the fundamental than the triangle wave, and has a very full sound. It is identified with a reedy type of quality similar to that of a clarinet.

4. Pulse Wave │‾│_ — a variation of the Square Wave used for hollow tones, such as bassoons, oboes, and bowed strings. This wave form can be contoured by the variable slide control found directly to its left. By moving this slide from left to right you will be lengthening or diminishing the width (duty cycle) of the pulse wave form. This will musically alter the characteristics of the voice from a fuzzy reedy sound to a richer one.
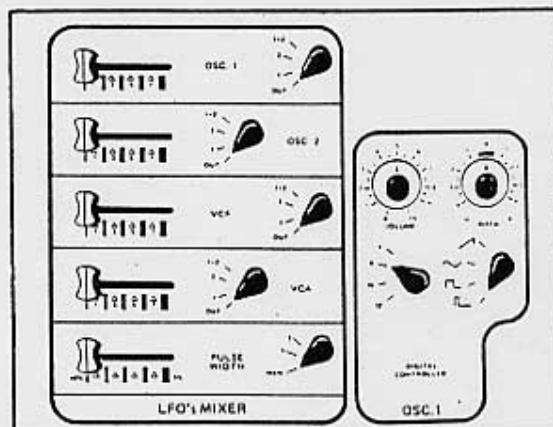
Experiment by playing a note and varying each control and see how the sound produced is changed.

OSCILLATOR-2

OSC. 2
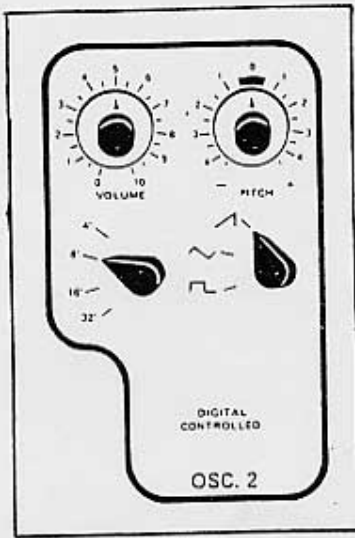
The Oscillator 2 contains essentially the same specifications and features as Oscillator 1 except for two differences: (1) the range of Oscillator 2 is an octave and a half and (2) there is no variable pulse wave form. This oscillator can be used for unison tunings or parallel intervals with Oscillator 1 such as 3rds, 4ths, 5ths, 7ths. If a phasing effect is desired put Oscillator 2 slightly out of tune with Oscillator 1.

FILTER

This filter is a high-Q four pole design and represents a highly technological achievement affording a maximum amount of precision and flexability. In essence, the filter operates as a tonal modifier. It will not affect pitch, but instead the harmonic content of the sound. The filter alters the basic waveform into an endless array of variations. The filter's capabilities and responses depend on what waveshape has been selected as the source for sound production. The richer or more complex the waveshape the greater the potential for sound modification.

ADSR RANGE   CUTOFF FILTER   RESONANCE

A graph of 3 filter settings looks like this:
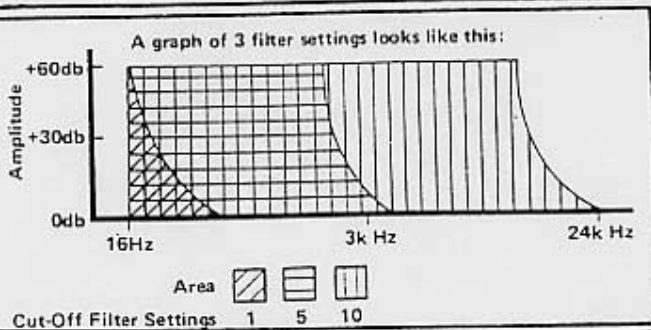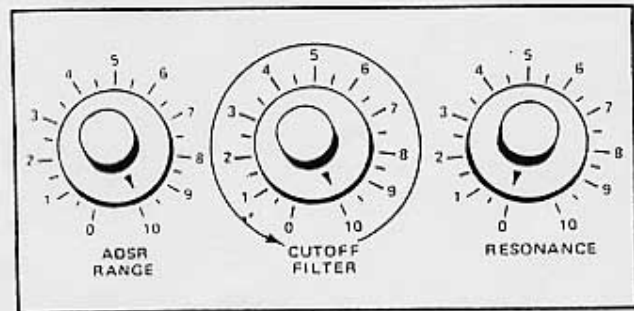
CUT-OFF FILTER

(ADSR Range pre-set at 10 and resonance set at 0) By rotating the cut-off filter in a counter-clockwise direction, you are lowering the filter's cut-off point. In other words, when the cut-off filter's control is set at 10, you're letting in the full spectrum of harmonics and partials, and when set at 0 you are not passing any of the frequencies.

RESONANCE

By moving the resonance control in a clockwise position, the frequencies below the cut-off frequency set by the cut-off control are gradually attenuated until, at about 8½, only a narrow band directly around the cut-off frequency still remains.

After that point, the filter rings itself, producing a sine wave no matter what is going into the filter. In other words, after 8½, the filter transforms from a modifying device to a sine oscillator, the pitch of which is controlled by the cut-off frequency.
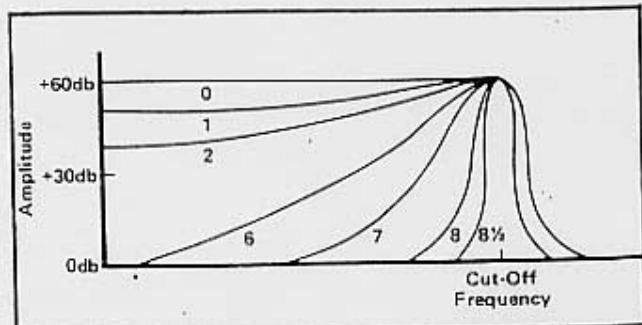
ADSR CIRCUITS

The envelope or ADSR of the instrument controls the beginning, middle and end of each note. This shapes how a note will be expressed in terms of attack, decay, sustain and release (ADSR).

A picture of an envelope would look like this:
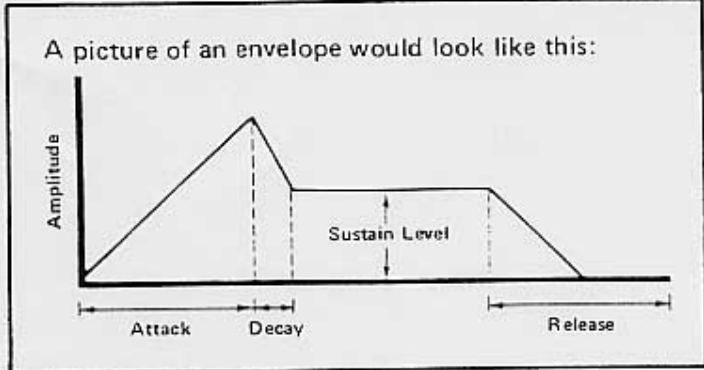
ADSR in the filter boosts the cut-off frequency preset by the cut-off control. The ADSR Range Control determines the amount of effect the ADSR has on the pre-set cut-off frequency. At 0, the ADSR has no effect. At 10, it pushes the cut-off frequency to the top of the audio range. The Attack Control determines the length of time it takes the envelope to go from 0 to the maximum frequency, as set by the ADSR range. The Decay Control then takes over and determines how long it takes the cut-off frequency to reach your sustain level, which is held as long as you depress a key. When you release the key, the Release Control determines the final decay time. Remember that the Sustain Control sets a level, and is not a time constant.


Examples Of Envelopes

If you stop playing a note before the sustain level has been reached, the envelope will go from where it was left off to 0 at a pace determined by the Release Control.
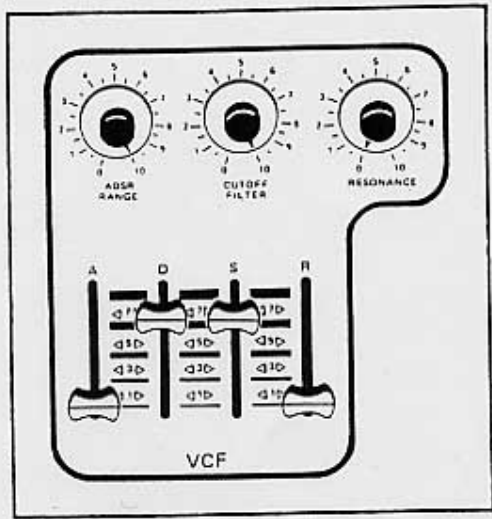
The envelope shape, range, cut-off, and resonance work with one another to produce vastly different effects from a single source, and virtually unlimited effects from all combinations of sources.

VCA

The VCA (Voltage Controlled Amplifier) is simply an amplifier with an ADSR controlling the amplitude of the sound.
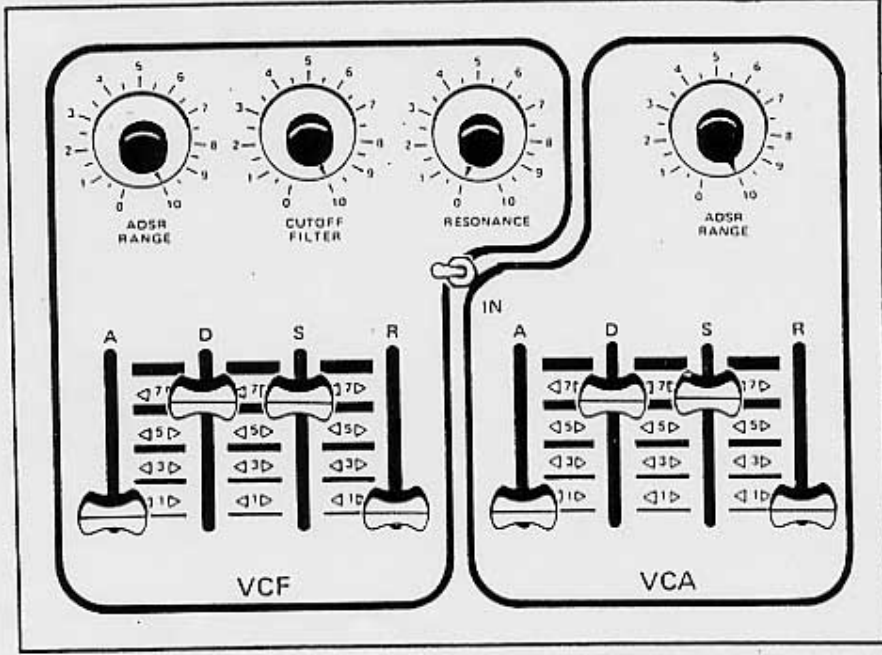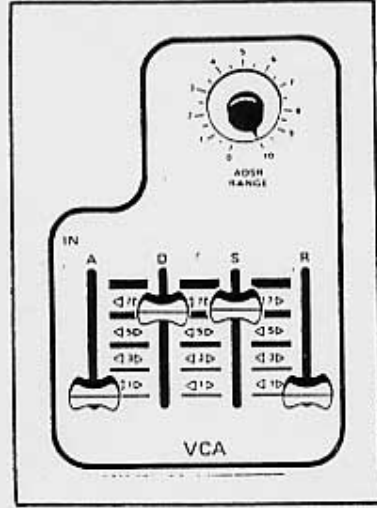
This ADSR works the same as the filter ADSR, and the ADSR Range Control again determines the amount of effect the ADSR has on the VCA. By throwing the toggle switch in-between the the VCF (Voltage Controlled Filter) and the VCA to the left, the Filter's ADSR operates both the VCF and the VCA. This can be used for quick set-ups and changes in live performances.
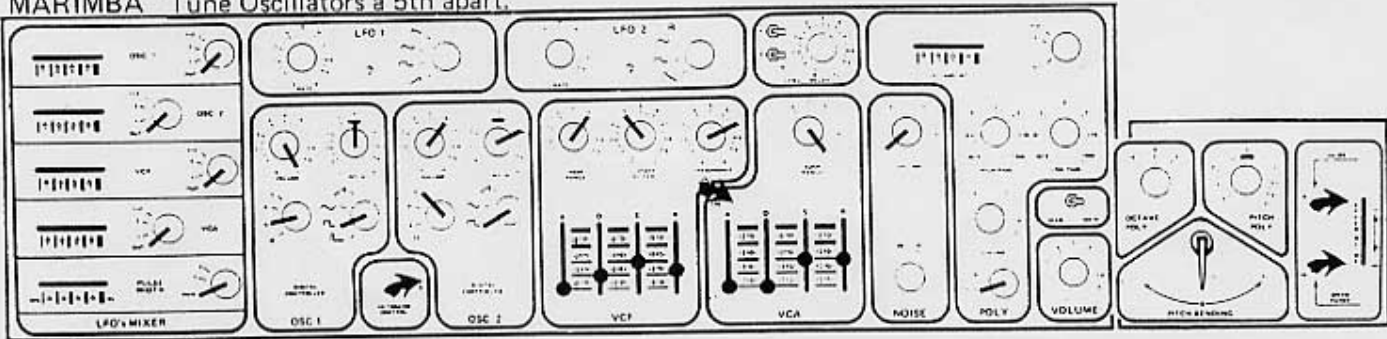
FRENCH HORN Change to Pulse wave for oboe. Then increase the VCF ADSR Range to 9 and switch OSC 1 to 4' for trumpet
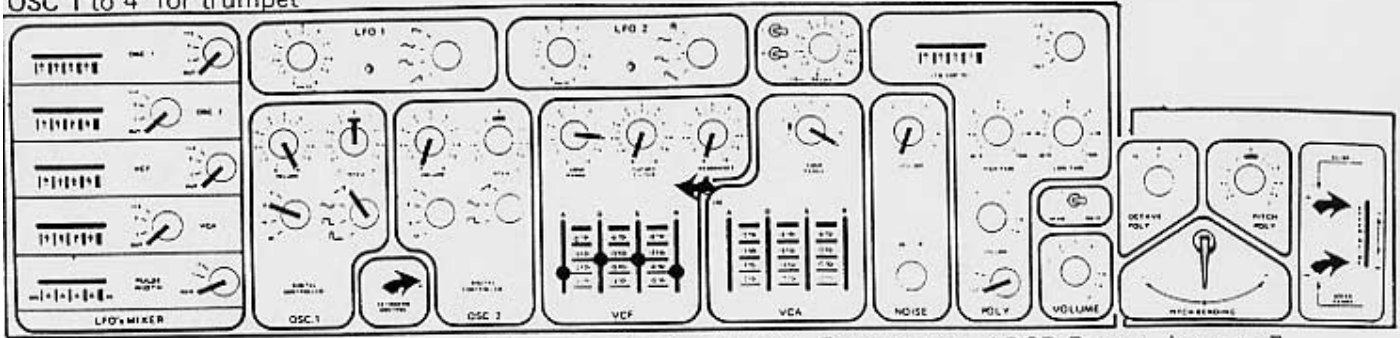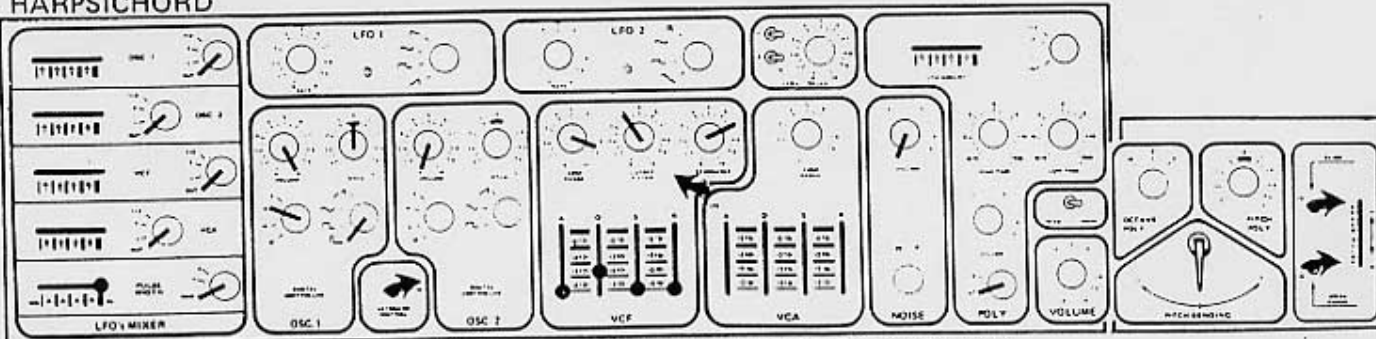

JAZZ BASS Adjust ADSR Range and Resonance for funky bass. For instance, ADSR Range is set to 7, Resonance is set to 8½
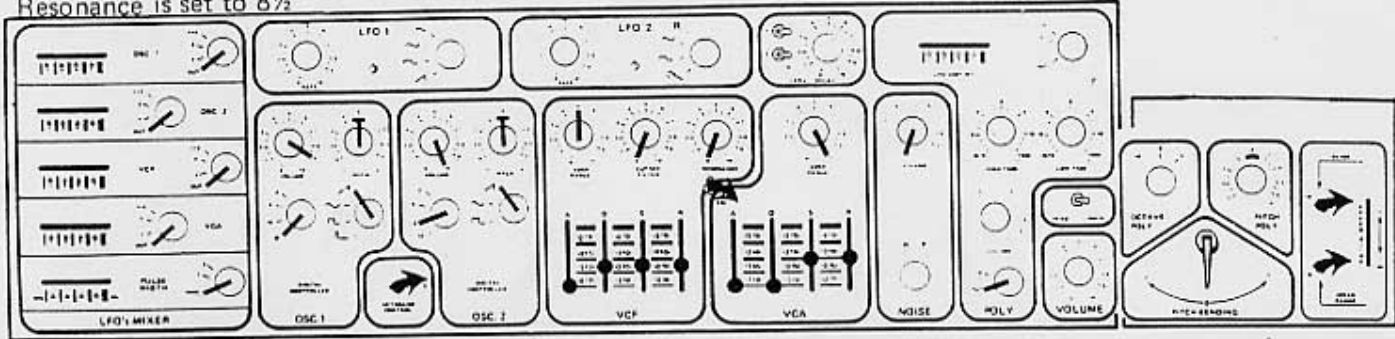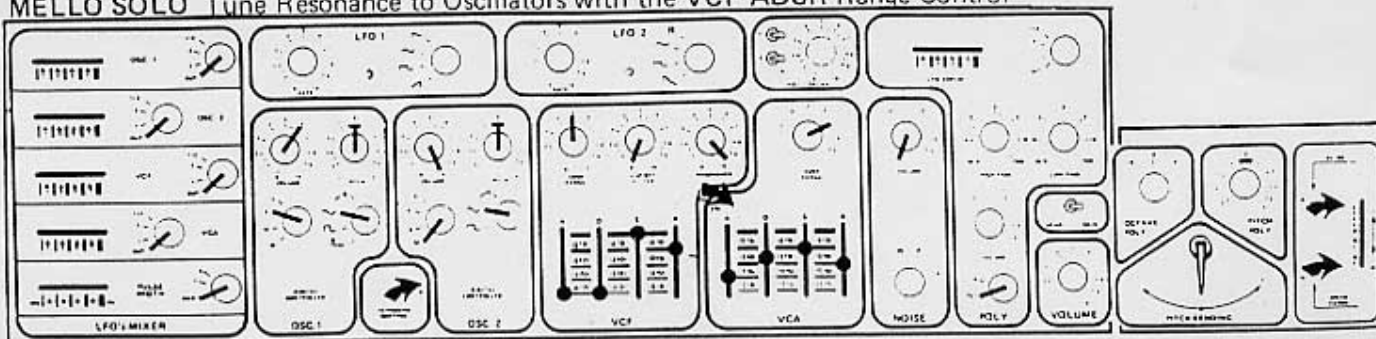

**MARIMBA** Tune Oscillators a 5th apart.

HARPSICHORD

MELLO SOLO Tune Resonance to Oscillators with the VCF ADSR Range Control

POLY

As an amazing added feature, the DS-2 allows you to play as many notes as you want at once, in the POLY section. You activate Poly by turning the POLY switch from OUT to IN. The Poly section produces notes that are sawtooth waves, the octave and tuning of which are controlled on the left side of the keyboard itself.
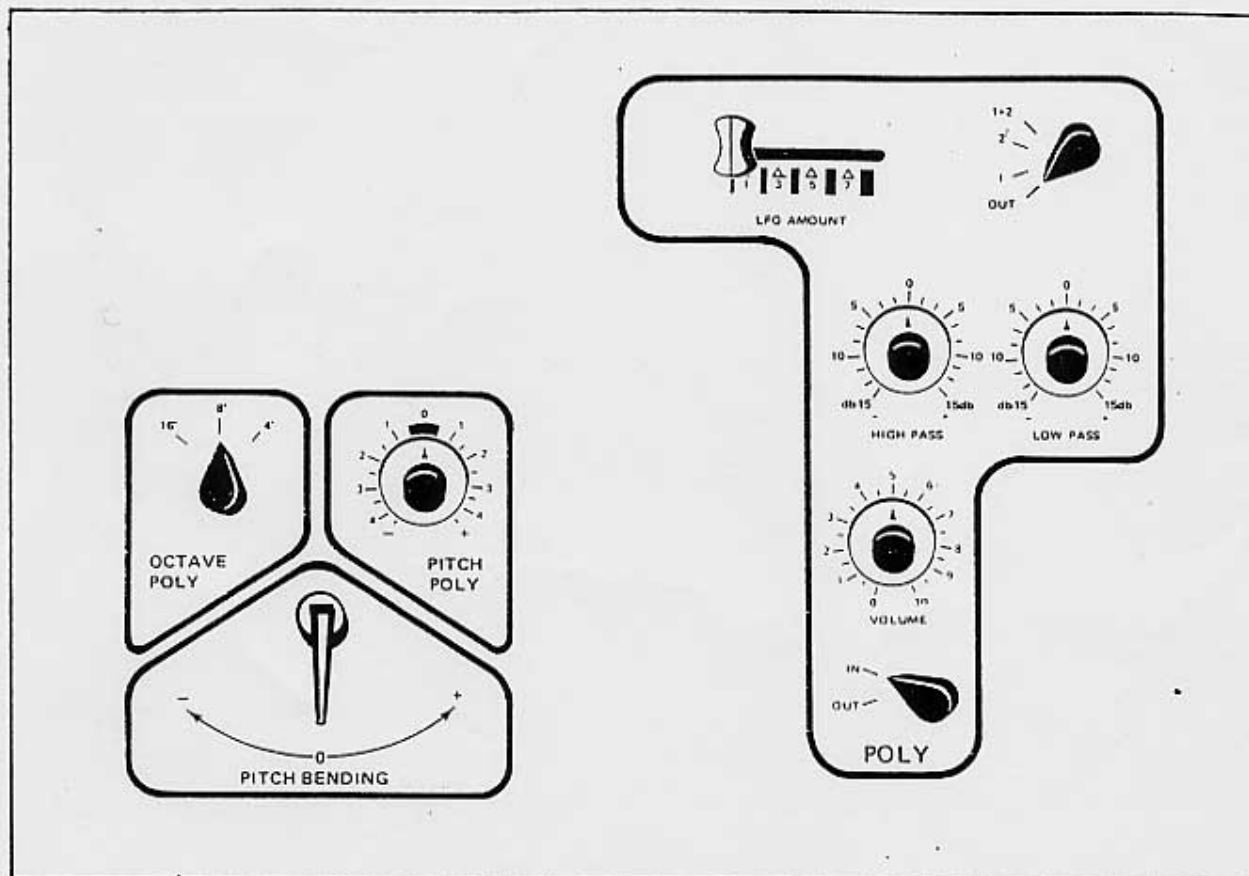
The Poly section also includes a high and low pass filter, controlling just the polyphonic notes. The high pass filter can either boost or attenuate the highs by 15 decibels (db) either way, and the low pass filter boosts or attenuates the lows to a similar degree. This can be used to have the Poly accentuate just the bass or add just to the highs (in conjunction with the oscillators) if desired. Or, with both filters set at 0, it produces an even range of sound across the keyboard. The Poly of course goes into the Filter and is then affected and modulated there like any other signal. The only difference is that there is no final release to the Poly. If a slow decay is desired, this can be done most easily one of two ways: 1) put the sustain down to 0 and use the Decay control as a final release; and 2) with the sustain set high, manually bring the sustain down to 0 for a decay rate determined by the setting of the Decay control.

Noise gives you an output of random frequencies over the entire audio range. W (white) noise is un-biased and sounds fairly high, and P (pink) noise is biased to emphasize the lows. Careful control of the resonance and ADSR settings of the filter give noise the capability of being thunder, rain, surf, wind, explosions, or whistling.

KEYBOARD CONTROL

The Toggle switch (keyboard control) found in-between the two oscillators functions in one of two ways. In its right-hand position, the filter swings in response to pitch changes, music-ally offering an evenness of sound across the entire keyboard range. In other words, the higher on the keyboard you play (the higher pitched the sound), the brighter the sound gets. When the toggle switch is in the left-hand pos-ition, the filter locks into whatever setting has been set up, no longer being affected by pitch changes. In essence, the filter completely dis-engages itself from the keyboard.

INTERFACING

The keyboard (44 notes) functions both as a trigger (initial starting pulse) and gate (continuous pulse that lasts as long as the key is depressed.) The key-board's precise tracking capabilities are due to the fact that it is digital. The keyboard scans at an incredibly fast rate, selecting the highest note de-pressed (high-note priority). By using a system of binary counting for obtaining the diatonic scale all possible problems of frequency drift are eliminated. The keyboard, besides establishing a highly accur-ate and stable tuning system, converts the signal out of digital to analog, making it compatible with any conventional analog interface.

TECHNICAL NOTE: When using a gate of 0 to +5 volts, no alteration has to be made. However, any other system must be specially interfaced. If you have any question as to the suitability of a possible interface, write to us before attempting the connection.

GLIDE

The Glide Circuit is an integral part of the Digital Keyboard's total accuracy. To activate the circuit, place glide toggle to "in" position. By manipulat-ing the slide control up and down you'll begin to hear the different rates of pitch shift or portamento that exists. The portamento will function without having to hold down the note since the keyboard always remembers the last note selected. The rate of glide is further controlled by the other toggle which extends the overall range of the portamento greatly.

BAT HANDLE

The bat handle controls overall pitch of Oscillator I and Oscillator II. When moving the bat handle all the way to the right, the pitch moves upward a minor third and when moving the bat handle to the left the pitch drops a minor third. Of course, manipulating the handle shorter distances will pro-vide a smaller interval for the oscillators to travel. A spring in the mechanism will immediately restore the bat handle to a neutral or original setting.

This system provides the most effective way to bend pitch, taking the tempered keyboard out of its traditional capabilities. This truly enables the musician to achieve subtelties unlike any other con-ventional keyboard, bending the pitch as does a guitar or trombone.

LOW FREQUENCY OSCILLATORS & LFO MIXER

The LFO or Low Frequency Oscillator is a slow frequency waveform that can be used to modulate the pitch, filtering, loudness, or wave shape of the sound. How it affects the sound depends on the wave shape, the rate (frequency) of the wave, the amount (amplitude) of the wave, and to what part of the sound the LFO has been directed.

With LFO 1 rate set at 5 and shape at square (⊓), let's put it into the frequency of OSC.1 by turning the OSC.1 switch on the LFO mixer from "OUT" to "1" (i.e., LFO 1).

Turn off the volume of OSC.2, Noise, and Poly so as to more clearly hear what is happening. Now the frequency of OSC.1 will vary depending on the speed of LFO 1 (.3 Hz to 30 Hz) and the amount of modulation allowed in at the mixing bank. Play around with these controls as well as the wave shape of LFO 1 until you are familiar with how it affects the sound.

In a similar manner, LFO 1 can control: the pitch of OSC. 2;

the cut-off frequency of the filter, for Wah-Wah type effects;

the amplitude of the VCA for Tremolo-type effects;

the pulse width of OSC.1 pulse wave, in which the closer to 5% you set the width, the more change will take place;
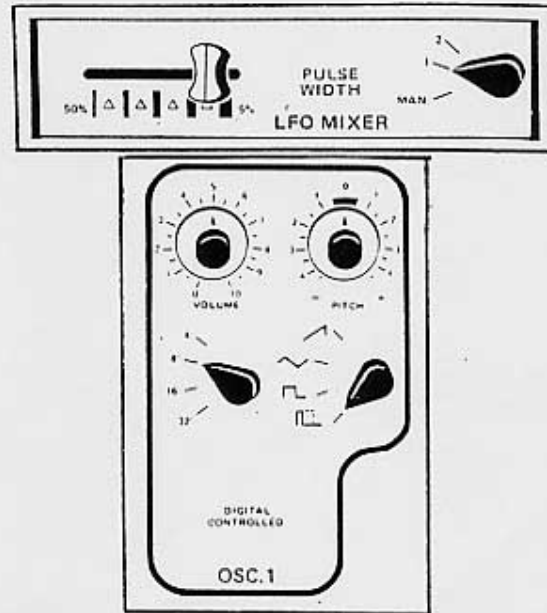
and the pitches of any notes or chords you play in the Poly section
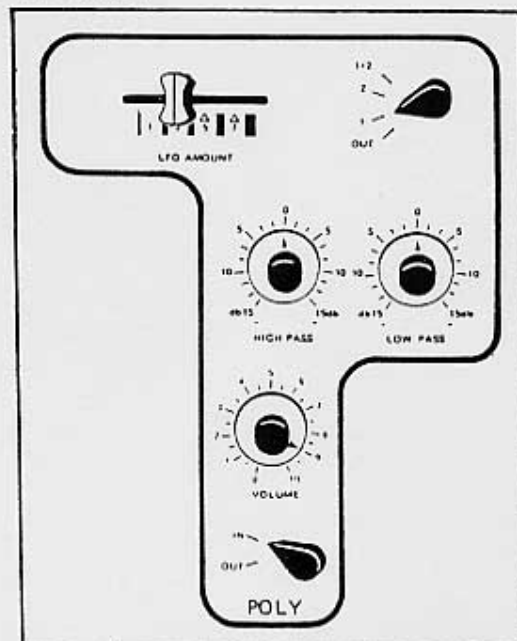
LFO 1 has 4 wave shapes to choose from, which we have discussed before. Just as in the oscillator sections, each wave shape has a different musical significance. For instance, the triangular waveform is most commonly used for vibrato effects, while the square wave can provide drastic shifts of frequency (by an octave or other intervallic transpositions). LFO 2 also has 4 waveforms, 2 of them new. ⌐⌐⌐ is the staircase wave and produces a cascading wave, but bumpy like a staircase, not smooth like the inverted sawtooth wave (⌐—) on LFO 1. And R produces a repeating random pattern, and is most effective when used to modulate the filter.

By turning the switches on the LFO Mixing Bank from 1 or 2 to 1 + 2, you are combining the effects of the two LFO's, which can yield vastly complex yet very controllable modulation effects. Further versatility is achieved by the separate control of the LFO's in the LFO Mixer. OSC 1 can be un-modulated, OSC 2 modulated by LFO 2, VCF modulated by LFO 1, and Poly modulated by LFO 1 and 2 combined, all simultaneously!

LFO DELAY

The LFO Delay is activated for each LFO by switching their respective toggles on the LFO Delay module to "IN".
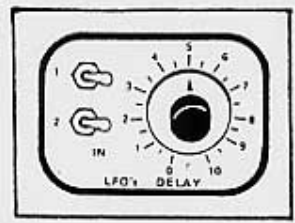
Then, the amount of delay before the activated LFO's start to take effect is determined by the LFO Delay Control on the right.

The following patches are intended to give you some idea as to the range of possibilities of the DS-2.
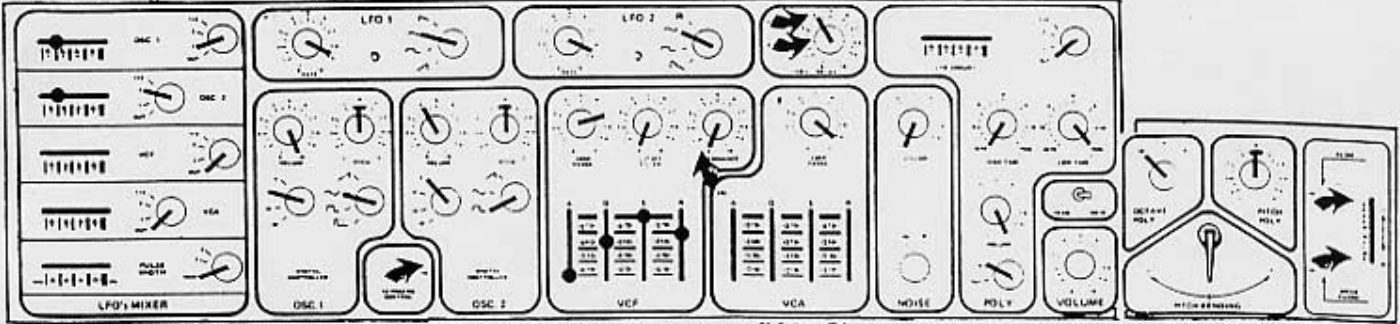
SPOOK SOLO Play slow, detached notes
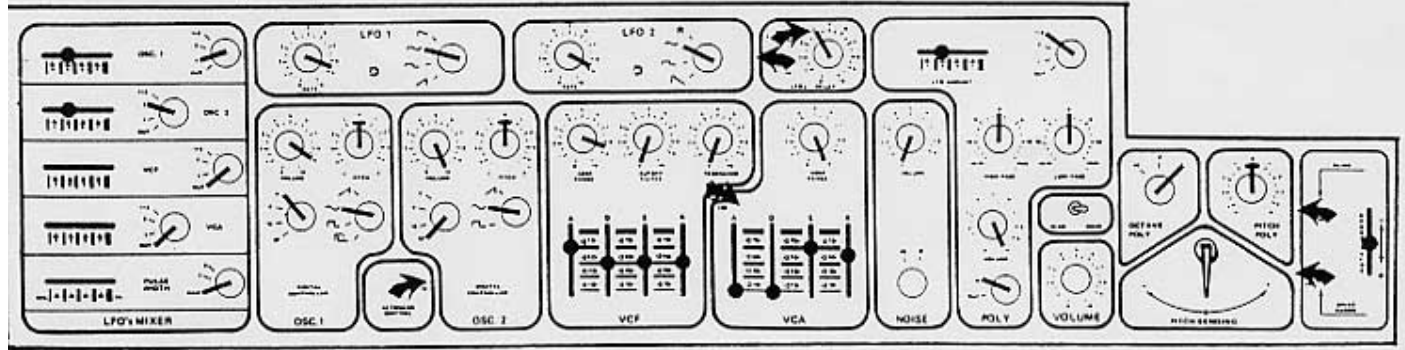
POPCORN Tune LFO and set Poly to Major 3rd
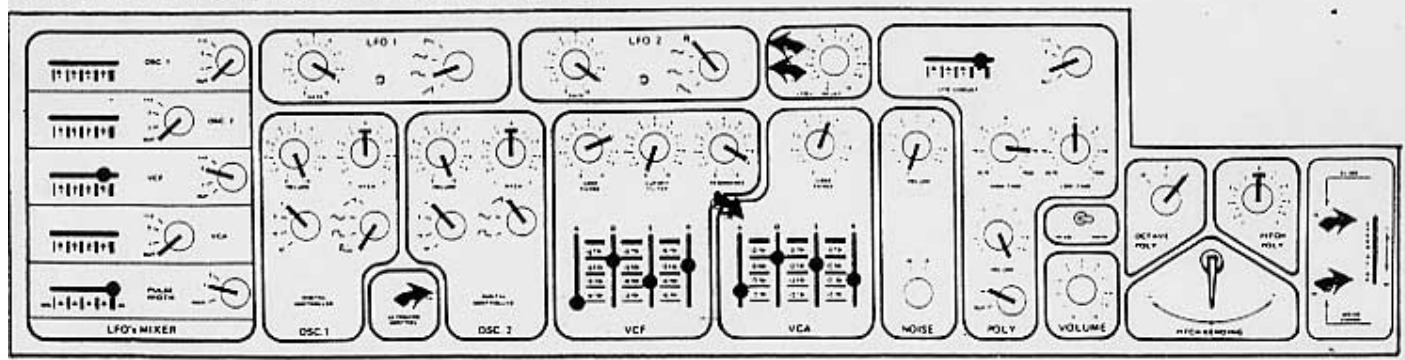
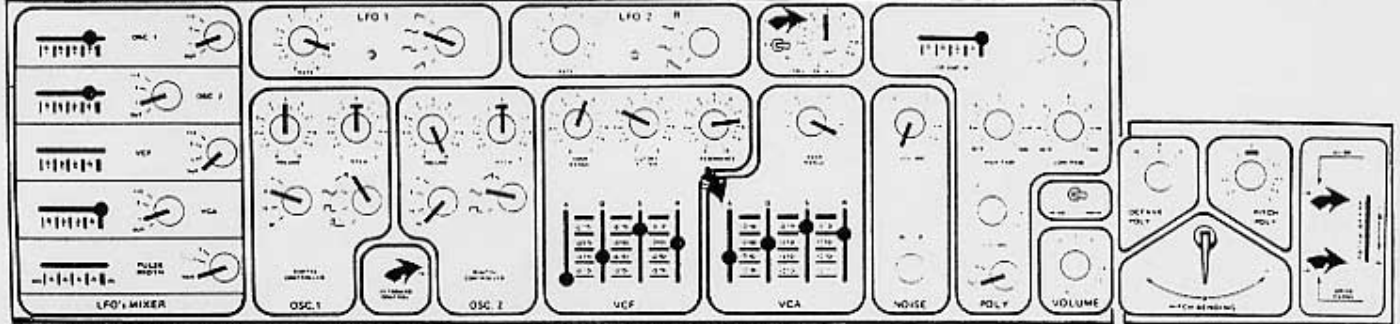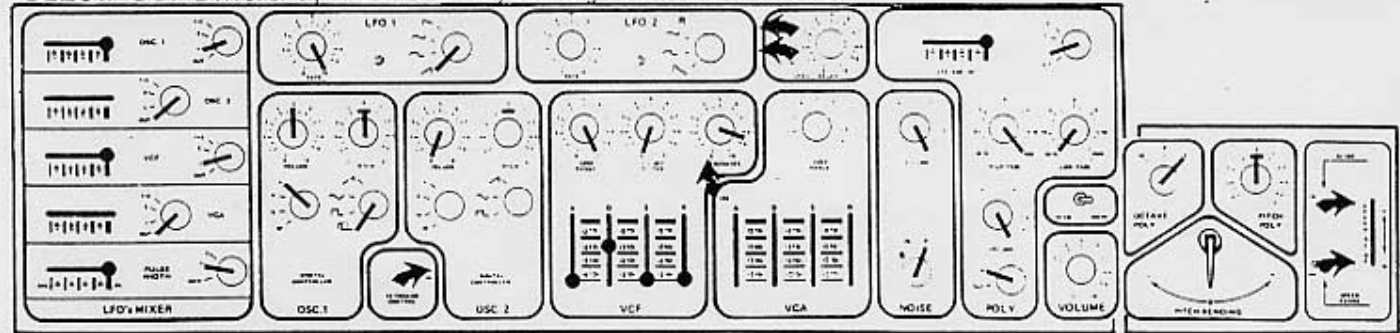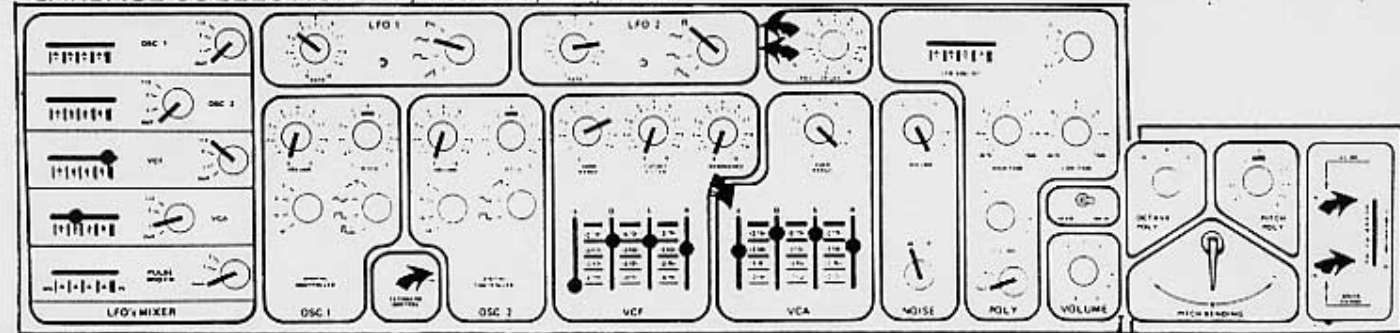## WALKING BASS With MELODY And CHORDS Play bass with the left hand, chords and melody with the right

AFTERGLOW Tune LFO   OSC 1 and 2 to an octave or a fifth. Play staccato notes for the melody, held down for "Afterglow" Play with Resonance level
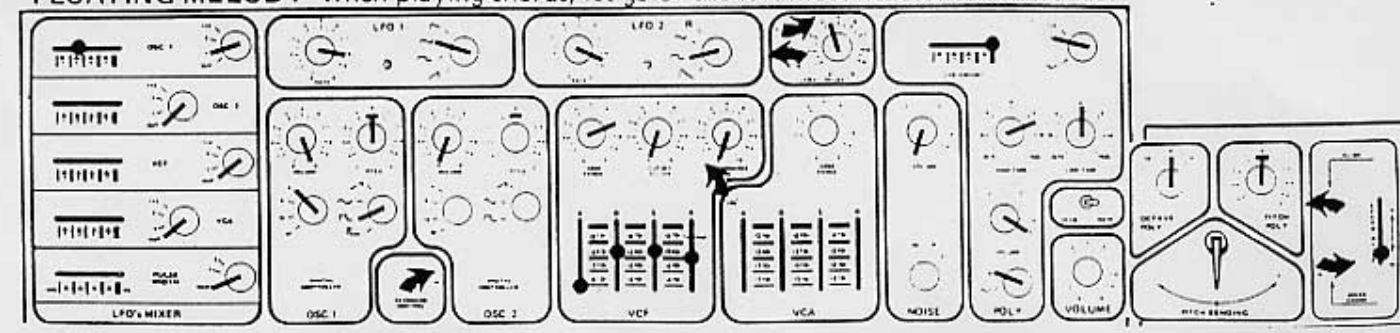

BEZOINGG! Different parts of the Keyboard give different effects
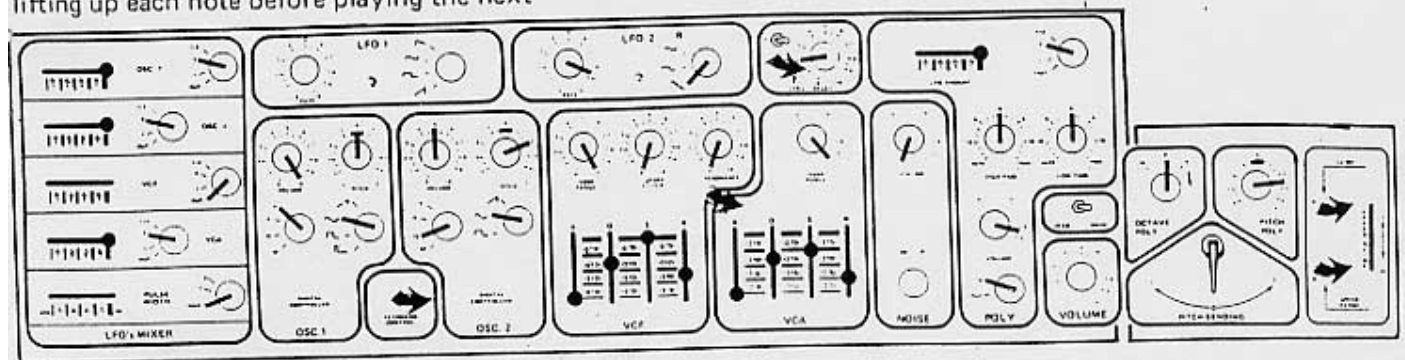

GARBAGE COLLECTION Play detached, long notes

## FLOATING MELODY When playing chords, let go of the left-most note of the chord last

FILIGREE NOTES Set LFO rate at comfortable 16th-note pace. Play a new note at the start of each cycle, fully lifting up each note before playing the next

MARIMBANET With ROLLED ACCENTS Tune LFO 1 → OSC 2 so that it goes down a 5th. Play most melodic notes "marcato", holding the keys down, with long accented notes "slapped" very staccato
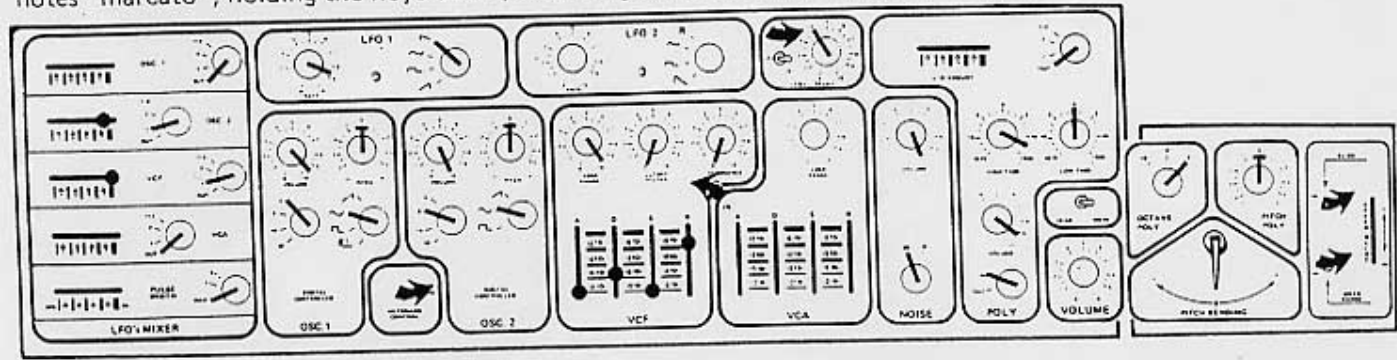
DRUNK MACHINE
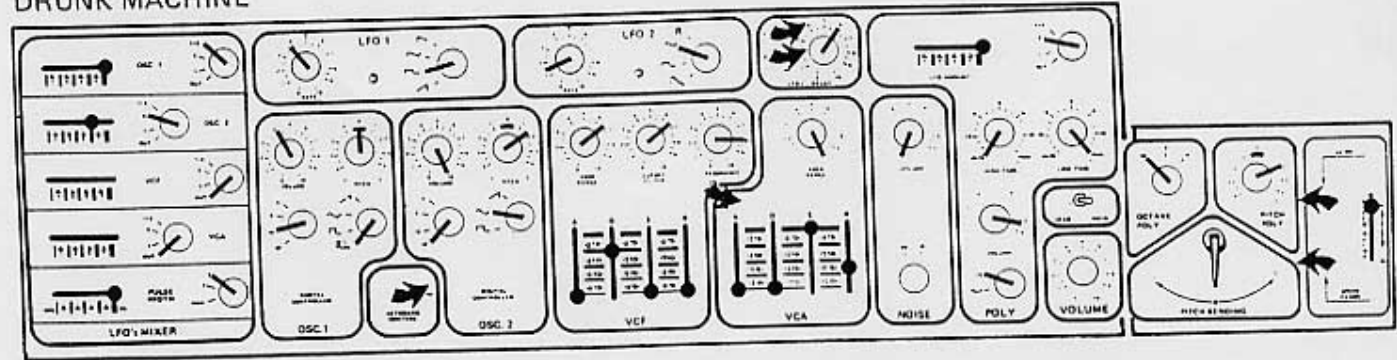
TOO MANY MONKEYS Play melody lines staccato, hold the note for the monkeys