Oberheim

INSTRUCTION MANUAL FOR THE 4-VOICE SYNTHESIZER WITH PROGRAMMER

INTRODUCTION

The Oberheim 4-Voice Polyphonic Synthesizer is an unique and powerful electronic musical instrument, permitting up to four notes on the keyboard to be sounded simultaneously. Each of the four notes triggers a separate Synthesizer Expander Module (SEM), which is a complete set of tone generators and modulators required for a synthesizer "voice." Other electronic modules provide keyboard logic and voice mixing controls. A programmable memory module is available for storage of selected voice settings, which can be instantly recalled at the touch of a button.

This manual assumes the student has had only minimal experience with synthesizers. This manual also assumes students are eager to make some sounds as quickly as possible on their new instrument. The following instructions will lead the student directly through the basic steps of generating a sound as well as briefly introducing each of the electronic modules.

Photos and illustrations are on foldout pages at the back of this manual for easy reference. After enough step-by-step instructions have been given to set all electronic modules properly to generate a sound, a more detailed explanation of each module will follow, with suggestions on how to use each control to modify the basic sound set up initially.

QUICK SETUP PROCEDURE

While you're reading this manual, plug in and turn on the machine. This will allow the electronic circuits to stabilize (about 15 minutes). The photo in Figure 1 shows the Oberheim 4-Voice with Programmer installed. Units supplied without Programmer are fitted with a blank panel in the Programmer space. The initial instructions will not deal with the Programmer except to assure it is switched out of operation until the student is acquainted with the operation of the other modules.

The electronic modules are numbered in order of importance in setting up a preliminary sound:

1. PROGRAMMER (if installed). Set all switches and controls as shown in Figure 2.

2. OUTPUT MODULE. Turn all controls to the settings indicated in Figure 3. The output from the synthesizer is at line level and should be patched into the high level input of an amplifier or mixing console. The PAN controls for each voice can be used if a stereo amplifier is available. If only a single amplifier is to be used, be sure the PAN controls are all fully to one side or the other and the patch cord to the amplifier is plugged into the corresponding output. Each of the headphone jacks is for a pair of stereo headphones. Note that the individual LEVEL controls are turned almost all the way up. This is necessary if maximum system signal-to-noise ratio is to be obtained.

3. POLYPHONIC KEYBOARD ELECTRONICS. Set all controls and switches as shown in Figure 4.

DETAILED MODULE DESCRIPTION

4. SYNTHESIZER EXPANDER MODULES (SEMs). Set all controls and switches on all SEMs as shown in Figure 5. Press a key on the keyboard. The red LED indicator will light on all SEMs. On SEM #1 (furthest to the left), turn VCO 1 filter input (knob Ⓐ) fully clockwise, and press note *A* below middle *C* on the keyboard. A low pitched buzzy sound will be heard. Using VCO 1 Frequency control (knob Ⓑ), tune the pitch up to *A*-440, using a tuning fork or piano for reference, or, if not critical, just tune to a medium frequency pitch. Then turn VCO 2 control (knob Ⓒ) fully clockwise. Keeping the *A* note depressed, tune VCO 2 Frequency (knob Ⓓ) until its pitch is in unison with VCO 1. Then turn VCO 2 (knob Ⓒ) back to the vertical position (OFF).

On SEM #2 turn VCO 1 (knob Ⓐ) clockwise, and tune to unison with the tone from SEM #1. Then turn off VCO 1 on SEM #2 and turn on VCO 2 and tune it to unison with the tone from SEM #1. Then turn off VCO 2.

Repeat this procedure with SEMs #3 and #4, always using the single tone from VCO 1, SEM #1, as a reference tone.

Now turn on all VCOs (all knobs Ⓐ and Ⓒ fully clockwise) and press a key on the keyboard. All voices will sound in unison.

The synthesizer is now set as a single line instrument with a very big bright sound. Care should be taken to not disturb the VCO Frequency tuning knobs for the remain-

der of these initial procedures. From this point the options for experimentation are considerable.

POLYPHONIC KEYBOARD ELECTRONICS (See Figure 4.) Mounted next to the keyboard itself is the Polyphonic Keyboard Electronics module, comprised of 3 blocks of controls adjusting the behavior of the keyboard; MODE, PORTAMENTO, and TUNE. MODE — This set of controls determines how the separate voices are selected by the keyboard. In the preliminary setup above, the UNISON switch was moved to the ON position, which causes all SEMs to sound at the same time when only one key is struck. Moving the UNISON switch to OFF allows several possibilities of single voice combinations according to the other switches in the MODE block. This also permits polyphonic action from the keyboard. Try playing simple chordal and harmony figures throughout the following steps to determine the *musical qualities* of each control mode. Actuate the switches in the following order:

1. ASSIGNMENT
   a. CONT (Continuous) position — A single key actuates a single voice, but each successive striking of a key will step to the SEM to the right. Strike one key repeatedly and see how the note is sounded from each SEM in sequence.
   b. R/C (Reset/Continous) position — The first key struck always actuates SEM #1. As long as that key is held down, any more keys that are struck will actuate the remaining SEMs in sequence, as in the CONT mode above.
   c. RESET (Reset) position — The first key struck always actuates SEM #1. Subsequent keys that are struck and held will actuate the lowest SEM that is not already actuated.
2. REASSIGN
   a. ON — Normal operating position
   b. OFF — Normal assignment modes (CONT-R/C-RST) are overridden. If a note being played was the most recent note assigned to one or more voices, then that note is directly assigned to those voices.
3. SPLIT
   a. OFF — Normal operating position.
   b. ON — Divides the keyboard into two separate halves, with the division between middle *B* and *C*. Each half controls selected groups of SEMs, with the groups determined by the 3/1-2/2-1/3 switch.
4. 3/1-2/2-1/3 SWITCH
   a. 3/1 — Lower half of keyboard controls SEMs 1, 2,

and 3; while the upper half operates on SEM 4 only.

b. 2/2 — Lower half controls SEMs 1 and 2 upper half controls SEMs 3 and 4.

c. 1/3 — Lower half controls only SEM 1, upper half controls all others

5. FREEZE

a. OFF — Normal operating position.

b. ON — Stops the stepping and selecting action of the ASSIGNMENT switch, locking the keyboard to one single SEM. To freeze on a given desired SEM, the FREEZE switch must be set to OFF, and the ASSIGNMENT switch set to CONT. Press keys repeatedly until the SEM just before the desired one is selected, then slide the FREEZE switch to the ON position. All further keys struck will activate the chosen SEM alone. Switching FREEZE to OFF restores the synthesizer to normal operation.

Each combination of switch positions in the MODE block causes a different response in keyboard-SEM selection. The musical possibilities and keyboard fingering techniques for each switch position will become apparent to the player with practice.

PORTAMENTO — Switching Portamento ON causes the voices to glide from one note to another as successive notes are played on the keyboard. The Portamento Pot adjusts the glide time. The switch labeled UPPER-BOTH-LOWER is effective only when the SPLIT switch in the MODE block has been engaged, and selects which half of the keyboard has Portamento.

TUNE — A master PITCH control (VCO) adjusts the pitch of all SEMs simultaneously, over a continuously variable range of ±1 octave, with a click-stop in the center position. In addition to this, a 3 position switch also changes the pitch of all SEMs ±1 octave. The effects of the switch and potentiometer are additive, so a pitch shift of ±2 octaves is possible without touching the SEMs. This is useful as a "pitch bender" or to tune the synthesizer as a whole to an exterior reference pitch.

A master Filter control (VCF) adjusts the cutoff frequency of the filters in all SEMs simultaneously. This can be used to change the sound of all SEMs at once, or to "swell" the sound of the entire instrument. This function can also be controlled by an optional foot pedal.

SYNTHESIZER EXPANDER MODULES (SEMs) (See Figure 6)

The SEMs are the sound generators, or voice modules, for

the synthesizer. A separate manual is available for a complete description of the SEM, but a short discussion of general synthesizer terms and principles as applied to the SEMs and the 4-voice is appropriate at this time.

In the first section of this manual the controls on each SEM were set for the simplest sound possible. Each was tuned to the same pitch to best use the polyphonic capabilities of the machine. For the remainder of this manual it will be assumed that these initial pitch settings for each SEM remain the same.

The other controls on the SEMs affect the quality of the sound generated in terms of timbre, duration, percussiveness, vibrato, and volume. All of these sound *qualities* are the results of the interactions between only two basic sound *quantities:* frequency (pitch information) and level (loudness information). The controls on the SEMs generate and manipulate these *quantities* to produce a desired *quality.*

An important concept to understand in using *any* synthesizer is the difference between audio (or sound) signals and control signals.

The audio signals are generated and modulated by 3 basic electronic elements which are controlled by either manual adjustments or by electronic control signals from control sources. The 3 electronic elements which directly manipulate frequency and level are:

1. The VOLTAGE CONTROLLED OSCILLATOR (VCO). A tone generator whose fundamental frequency (or pitch) is determined by an electrical signal (or voltage) from a control source (keyboard, ribbon controller, potentiometer, etc.). The *quality* or timbre of this tone depends upon the waveform generated (Sawtooth, Square, or Pulse). Different waveforms are characterized by different distributions of harmonic frequencies superimposed on the fundamental frequency.

2. The VOLTAGE CONTROLLED FILTER (VCF). A filter is an element that can change the relative strengths of the different frequencies contained in any given waveform. A LOW PASS filter pases low frequencies unaltered, but above a certain frequency (called the CUTOFF FREQENCY) the tones are reduced in strength. Adjusting the cutoff frequency in effect adjusts the amount of filtering. Filtering not only alters the frequency balance of a waveform, but also alters the relative loudness or volume of the signal. For example, a low pass filter set to a very low cutoff frequency will not pass much signal at all.

In a voltage controlled filter, the cutoff frequency is controlled by an electrical signal from a control source, as with the VCO.

3. The VOLTAGE CONTROLLED AMPLIFIER (VCA). A loudness or volume control which is proportional to an electrical signal from a control source, as with the VCO and VCF. The VCA, in itself, has no frequency dependent characteristics and affects all frequencies equally.

The dynamic qualities of sounds are created and adjusted by modulating frequency and level with the above 3 voltage controlled devices. A fourth electronic element is necessary to generate a time varying Control Signal, or ENVELOPE which may be connected to the control inputs of any of the above devices. This fourth element is known as the ENVELOPE GENERATOR. When triggered by the keyboard of the two basic *quantities* of frequency and level are manipulated with respect to TIME, creating the sound *qualities* of duration, stacatto, legato, vocalization, etc.
Refer to Figure 6 for the location of the controls on the SEM. In the diagram they are grouped by similar functions for easy understanding.

1a, 2a — FREQUENCY — These are the manual tuning controls for VCO 1 and VCO 2 respectively. The lower flanged portion of each knob is for coarse tuning, and the upper part of the knob is a vernier fine tuner.

1b , 2b — MODULATION — The three position switch selects one of three control signals, indicated on the panel, to be routed through the rotary pot just above the switch. If this knob is rotated to the right, the selected control voltage will affect the VCO *pulse width.* If this knob is rotated to the left, the selected control voltage will affect the VCO *frequency.* If the knob is left in its vertical position (as in the drawing), the selected control voltage will have no effect on the VCO at all.

1c , 2c — PULSE WIDTH — These are manual pulse width controls for the two oscillators. In the vertical position, as in the diagram, the pulse produced in each cycle is exactly one-half as long as the cycle itself; such a signal is called a Square Wave. As the knob is rotated in either direction from vertical, the pulse becomes wider (to the right) or narrower (left).

3 — SYNC — When this switch is moved to the right VCO 2 is synchronized to the frequency of VCO 1. VCO 1 is not affected by this switch, but VCO 2, when it is "sync'd" to VCO 1, can produce only harmonics of the

frequency to which VCO 1 is set. When the switch is off the two oscillators are completely independent.

4 — VCF — These are the three manual controls for the filter. The smaller knob at the lower right determines whether the filter will act as a *bandpass filter* (at the click-stop position labelled "BP"), *lowpass filter* (immediately clockwise from the click-stop, labelled "LP"), *notch filter* (vertical, at the word "notch"), or *highpass filter* (extreme clockwise, labelled "HP"). Do not try to turn the knob clockwise past the highpass stop.

The FREQUENCY control at the upper left determines the cutoff frequency of the filter.

The large single knob labelled RESONANCE determines the filter resonance at its cutoff frequency. When this knob is fully counterclockwise the filter resonance is at a minimum; as it is rotated to the right the resonance increases. RESONANCE is a term for the gain of the filter at or near its cutoff frequency. At maximum resonance, for example, the filter amplifies strongly any components of the input signal that lie within a semitone or so of the cutoff frequency, but virtually ignores components that are not near the cutoff frequency. In other words, a pronounced "peak" occurs in the filter frequency response as the resonance is increased, which grows higher in amplitude as it grows narrower in width. When the center of this peak is exactly at the frequency of an audio input to the filter, a relatively weak signal can drive the filter to produce a very strong output.

5 — MODULATION — The switch selects one of the three sources for a control input to the filter. The left and right positions are self-explanatory; the center position allows control by the Programmer, if installed. The knob is a "reversible attenuator" for the control signal selected; in the diagram no signal will pass through to have any effect on the VCF cutoff frequency. As the knob is rotated to the right, the selected control signal affects the VCF directly; as the knob is rotated to the left, the signal affects the VCF *inversely,* that is, a positive voltage drives the VCF frequency *down* rather than *up.*

6 — AUDIO INPUT SELECTOR/ATTENUATORS for the VCF. In the illustrated positions, they are all OFF. Unless at least one of these is "open," i.e., rotated either to the left or to the right, the module will produce no sound regardless of any of the other settings anywhere on the module panel.

The first knob on the left, labelled VCO 1, selects either the sawtooth or pulse signals from VCO 1 as an audio

input to the VCF. The second knob does the same for signals from VCO 2. The third knob is for adding signals from external sources.

Signals from the two oscillators and exterior source may be *mixed* in various proportions by opening all three of the input attenuators at the same time.

7 — ENVELOPE GENERATOR 1 — The first two knobs set two *time constants:* the *attack* time constant is the amount of time required for the ENV 1 output voltage to rise from 0 to maximum, and the *decay* time constant is the amount of time required for the ENV 1 output to fall . . .

. . . from maximum to the sustain level set by the third knob, and

. . . from this sustain level back to 0.

The third knob determines, not a time constant, but a voltage constant. This constant is the level at which the ENV 1 output will be *sustained* (hence the label) for as long as a GATE signal is present at the gate input of the envelope generator (as long as a key is held down).

8 — ENVELOPE GENERATOR 2 — This second generator has the same controls as the first.

NOTE: As you can see by examining the MODULATION switches for the two VCOs and the VCF, ENV 1 can be used to control VCO 1, and ENV 2 can be used to control VCO 2 and/or the VCF. In ordinary keyboard use, ENV 1 will be used only to control the VCA, and ENV 2 will be used only to control the VCF.

9 — LFO — Low Frequency Oscillator. The output of this oscillator is a sine wave and is available to control the VCOs and/or the VCF through the voltage select switches described in 1b, 2b, and 5 above. The frequency of the LFO is set by the knob indicated here.

10 — LED indicator — This light indicates the presence of a GATE signal at the input to two ENVELOPE GENERATORS.

THE PROGRAMMER (See Figure 2.)

Some experimenting with the controls on the SEMs will acquaint the student with the range of possibilities for different kinds of sounds. At the same time it becomes obvious that setting *all* the controls on *all* the SEMs is a time consuming and sometimes confusing process. The Programmer provides certain controls which can affect *all* SEMs collectively (as well as individually), thereby simplifying setup procedures to achieve a desired sound. The Programmer also is blessed with an electronic MEMORY,

which can store up to 16 sets of these programmed settings, which can be recalled by pressing a button.

To utilize the Programmer, set all SEM controls as shown in Figure 7, except for the VCO frequency pots. This deactivates the interior control sources and connects the SEMs to the appropriate control sources in the Programmer.

Notice that the slide switches labelled "1-8" are all in the MANUAL position. In this position, the Programmer knobs affect the SEMs directly. When a given switch is set to MEMORY, then data from the memory affects the associated SEM.

Make sure that the Programmer controls are still set as in Figure 2. Notice that the groups of control knobs in the upper half of the module resemble similar groups in the SEMs. In fact, the functions of these groups in the Programmer either replace or are *added* to the corresponding group functions in the SEMs. Let's take them one at a time.

1. VCO 1 and VCO 2 FREQUENCY — These are master VCO 1 and 2 PITCH controls and affect all SEMs simultaneously. This is in *addition* to the master VCO Tune control on the Keyboard Electronics module. Notice, however, that the VCO 1 and 2 controls on the Programmer change the pitch of their respective oscillators in half step increments, rather than continuously. This QUANTIZING effect makes relative tuning of the oscillators much easier. For example, see how easy it is to tune all VCO 1's up on octave. Then tune all VCO 2's up one octave, then up an additional 5th, then up to a second octave above the original. Quantizing makes it easy. Take note, though, that the frequency control knobs on each individual SEM are still the primary tuning controls for each voice. They should not be disturbed from their original unison setting described earlier in this manual.

2. VCF FREQUENCY — This is a master VCF frequency control, and its effect is additive to the master VCF control on the Keyboard Electronics module (which should be set nominally at 12 O'clock) as well as the individual VCF controls on the SEMs (set fully counterclockwise).

3. VCF MODULATION—This controls the amount of filter modulation from the ENV 2 block on the Programmer. Note that there is no master RESONANCE control on the Programmer, nor is there a master BP/LP/Notch/HP control. These adjustments must be made on each SEM individually, and are not programmable functions.

4. ENV 1 and 2. These voltage-controlled ENVELOPE GENERATORS which replace the corresponding Envelope Generators in the SEMs. ENV 1's controls the VCAs in the SEMs directly, and ENV 2's control the VCFs.

5. VIBRATO FREQUENCY and AMOUNT — These controls are more convenient to use than the function of the LFO in the SEMs. Frequency is simply the speed of vibrato, and Amount controls how much modulation is added to the pitch controls to each SEM.

The switches in the lower half of the module pertain to entering into and recalling from MEMORY the settings of the programmable controls. Before attempting to use these switches, the student is advised to experiment freely with the programming controls to become familiar with their capabilities.

Eventually a group of program control settings will be found which generate a sound the student will wish to enter into the Programmer memory.

The bottom row of lighted pushbuttons, (PROGRAM SELECT) designates a memory slot, or address. 16 memory addresses are available, and they are selected by means of the lighted pushbuttons and the MEMORY SELECT slide switch to the left of the pushbuttons.

1. With MEMORY SELECT in the 1-8 position, press PROGRAM SELECT switch #1.

2. With the left hand, pull down the first ("1") spring loaded slide switch above the pushbuttons to the WRITE position and hold it there against the spring tension, while with the right hand the WRITE slide switch is also actuated. This enters the program control settings for the first voice into the memory.

Repeat the process with slide switches #2, 3, and 4. Both hands are required to perform this as a safety feature, to avoid accidental erasure of a programmed setting.

3. Move the 4 slide switches to the MEMORY position. The Programmer is now controlling the SEMs according to the control settings in the Memory. The control knobs on the Programmer are no longer functional. In fact, the manual controls are only effective with the slide switches in the MANUAL Position, and in the WRITE position when their settings are entered into the memory.

Each of the 8 MEMORY/MANUAL/WRITE switches pertains to only one SEM, or voice. In the 4-Voice, only the first 4 switches are active. Switches 5-8 are for additional voices if they are installed.

The programmed settings for all voices are the same in the above example, that is, identical Programmer controls were applied to all 4 voices when the settings were entered into the memory. But it is possible (and often desirable to have *different* programmed settings for each voice entered into a single memory address. Here's how:

1. Move all Programmer slide switches to MANUAL. Press PROGRAM SELECT Pushbutton #2.

2. Using the Keyboard Electronics module, freeze the synthesizer on SEM #1.

3. Adjust the Programmer controls for an unique and recognizable sound from SEM # 1.

4. Pull down MEMORY/MANUAL/WRITE switch #1 to the WRITE position and hold while the other hand actuates the WRITE switch. Then move the first switch to MEMORY.

5. Using the Keyboard Electronics again, step and freeze the synthesizer onto SEM #2.

6. Readjust the Programmer controls to achieve a different sound on SEM #2 from that set up previously on SEM #1.

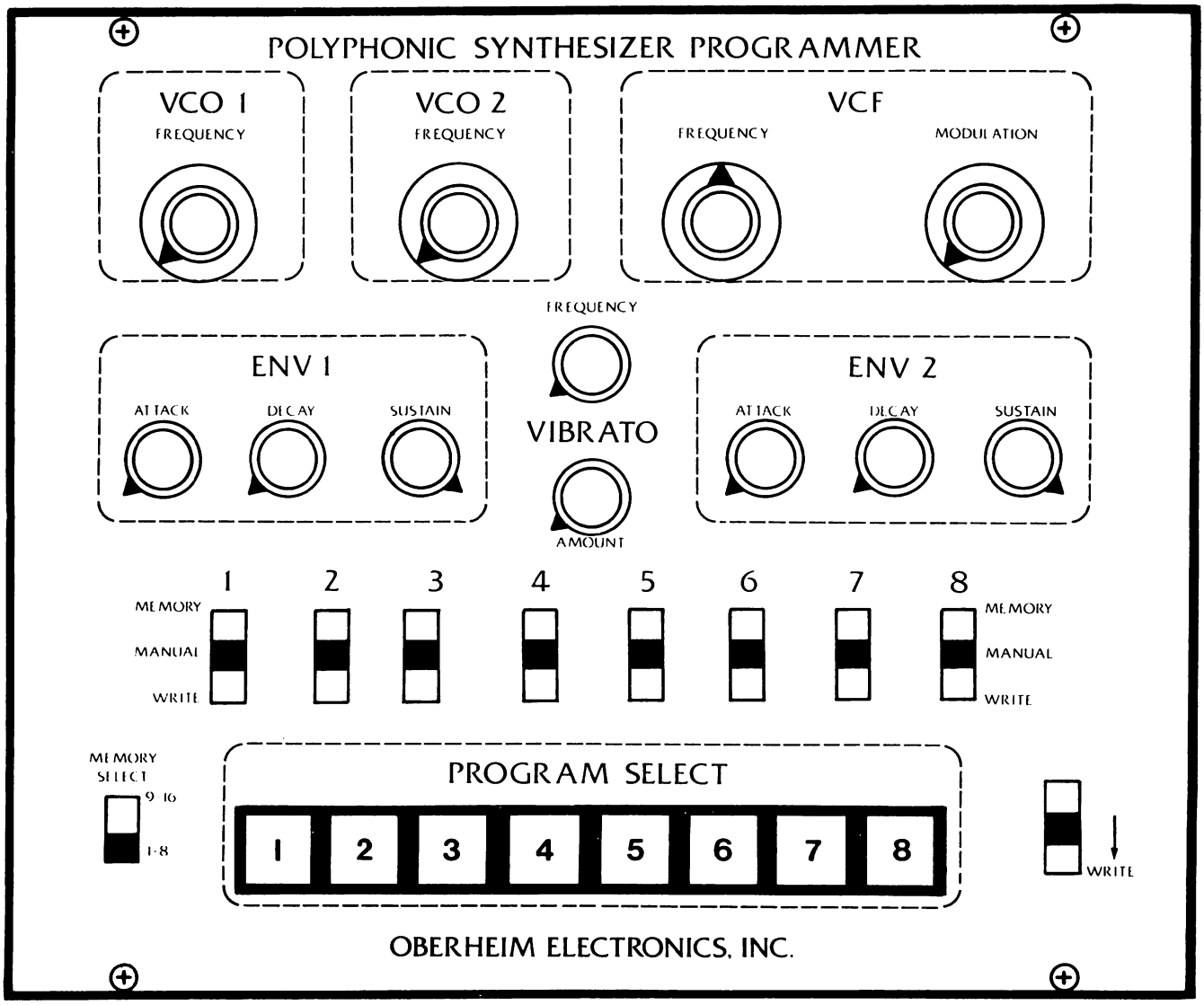
7. Pull down MEMORY/MANUAL/WRITE switch #2 to WRITE and enter into the memory.

8. Repeat steps 5, 6, and 7 for SEM #3, and again for SEM #4.

9. Using the Keyboard Electronics, unfreeze the synthesizer and play in a polyphonic mode. Each voice will be heard to have its own distinctive preprogrammed sound.

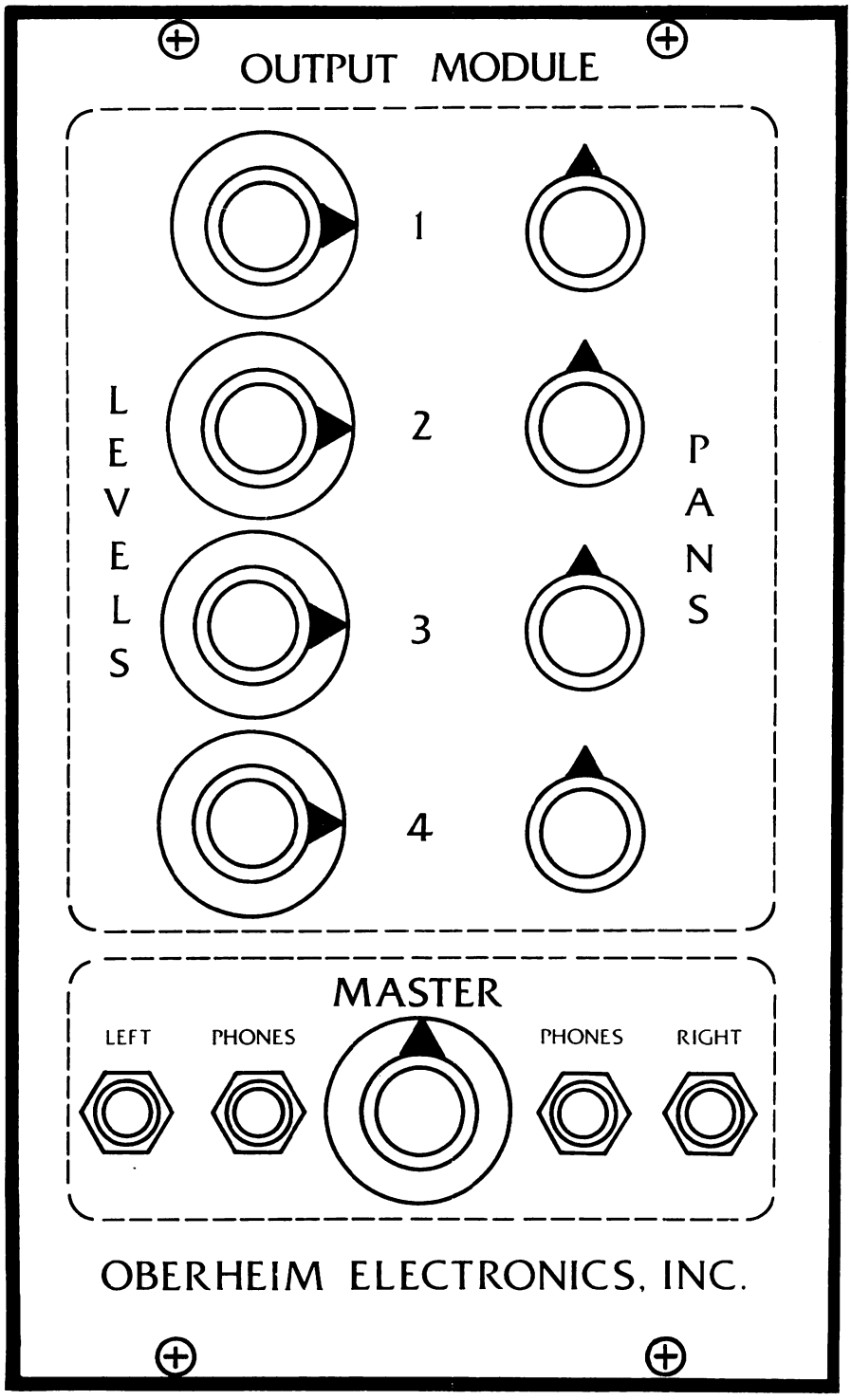
ILLUSTRATIONS

FIGURE 2



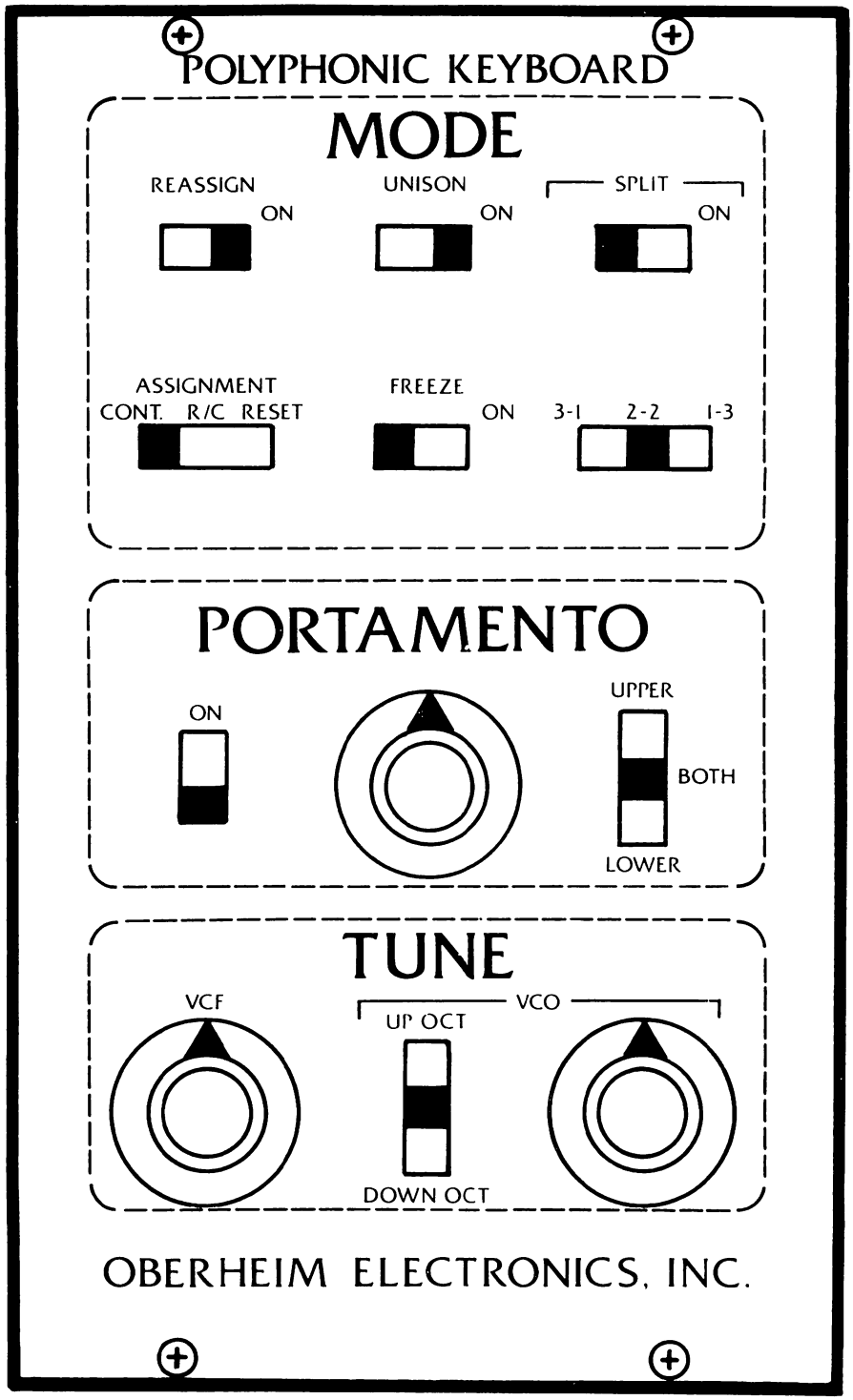
THE PROGRAMMER

FIGURE 3



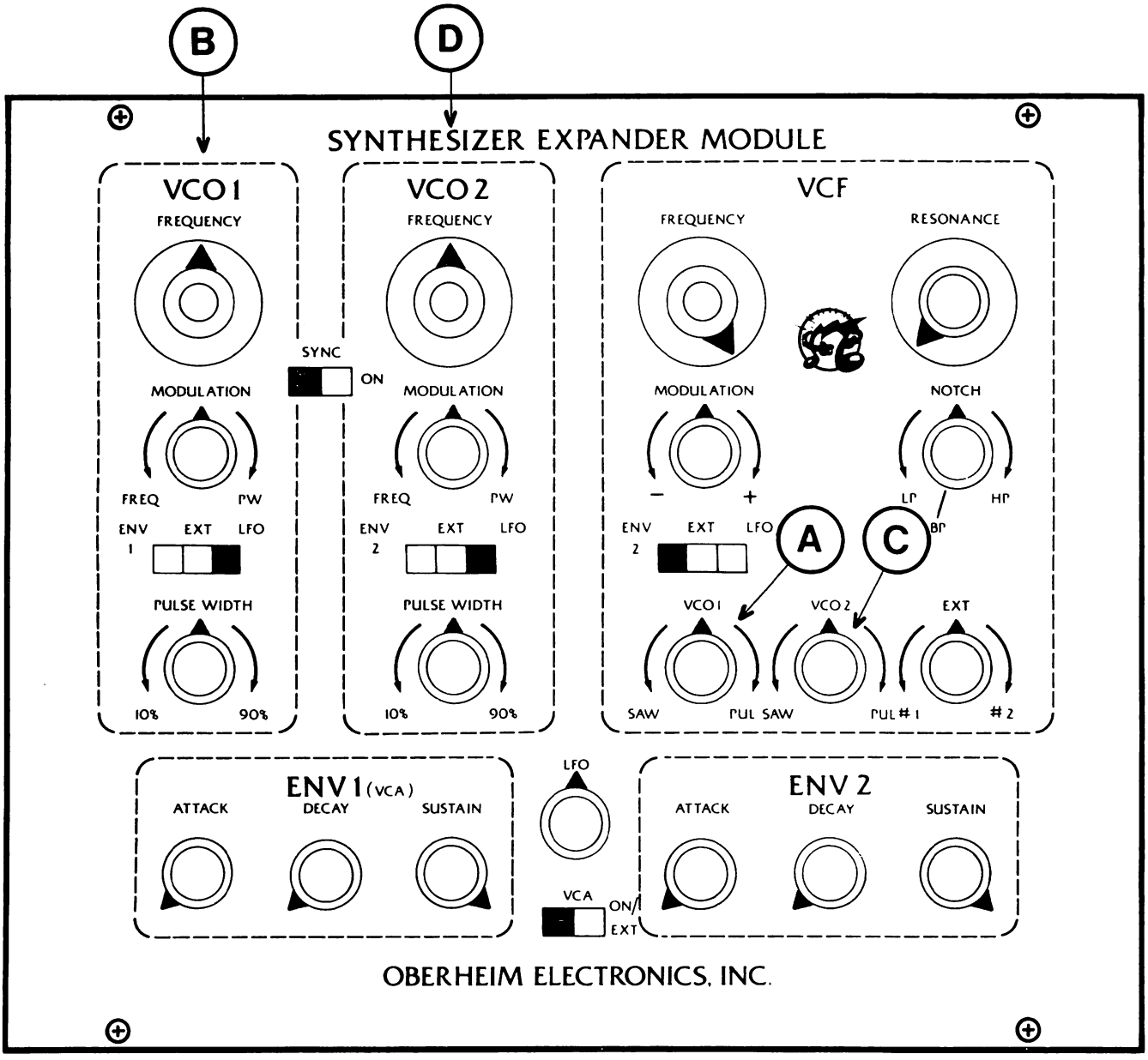
THE OUTPUT MODULE

FIGURE 4



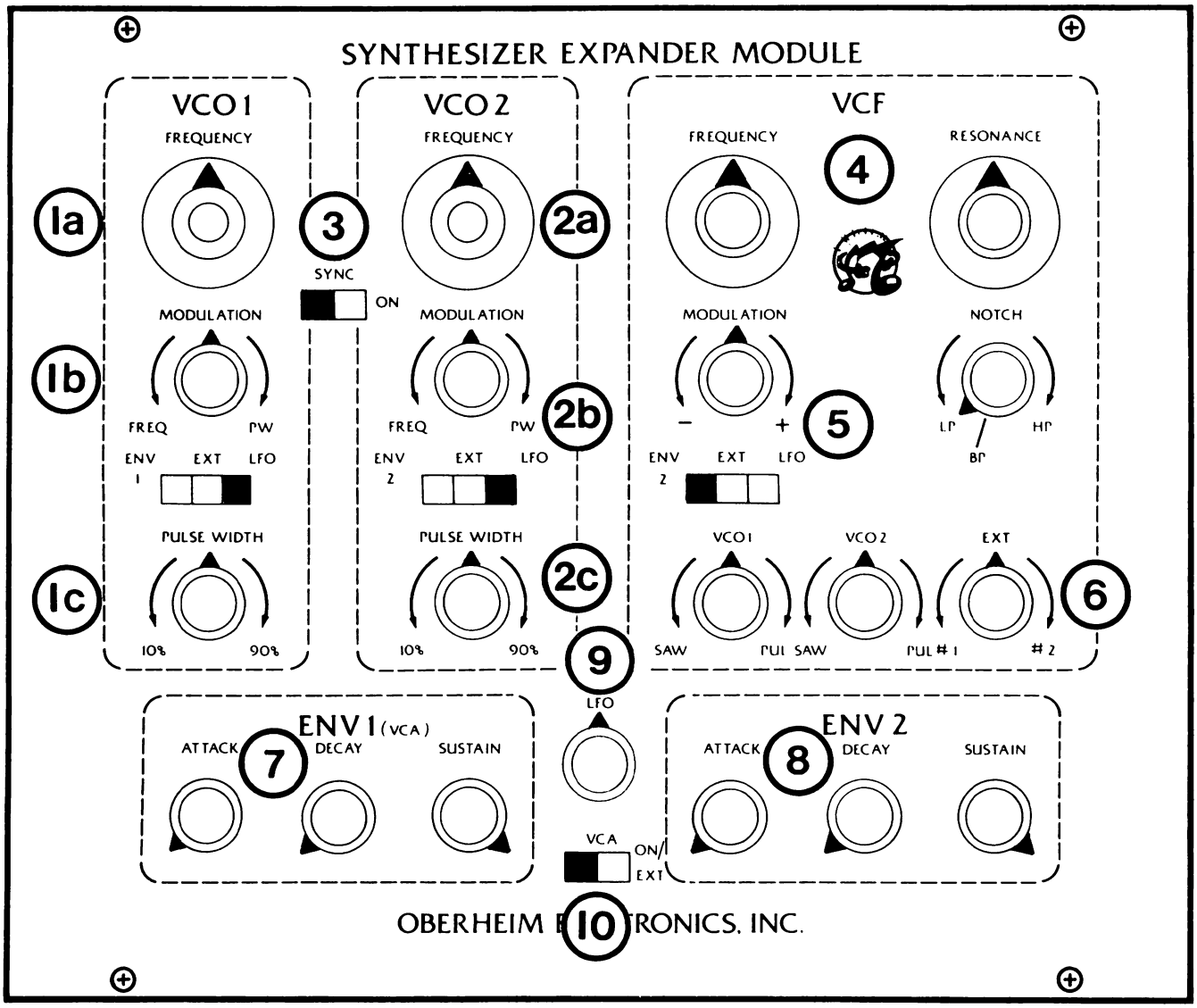
KEYBOARD ELECTRONICS MODULE

FIGURE 5



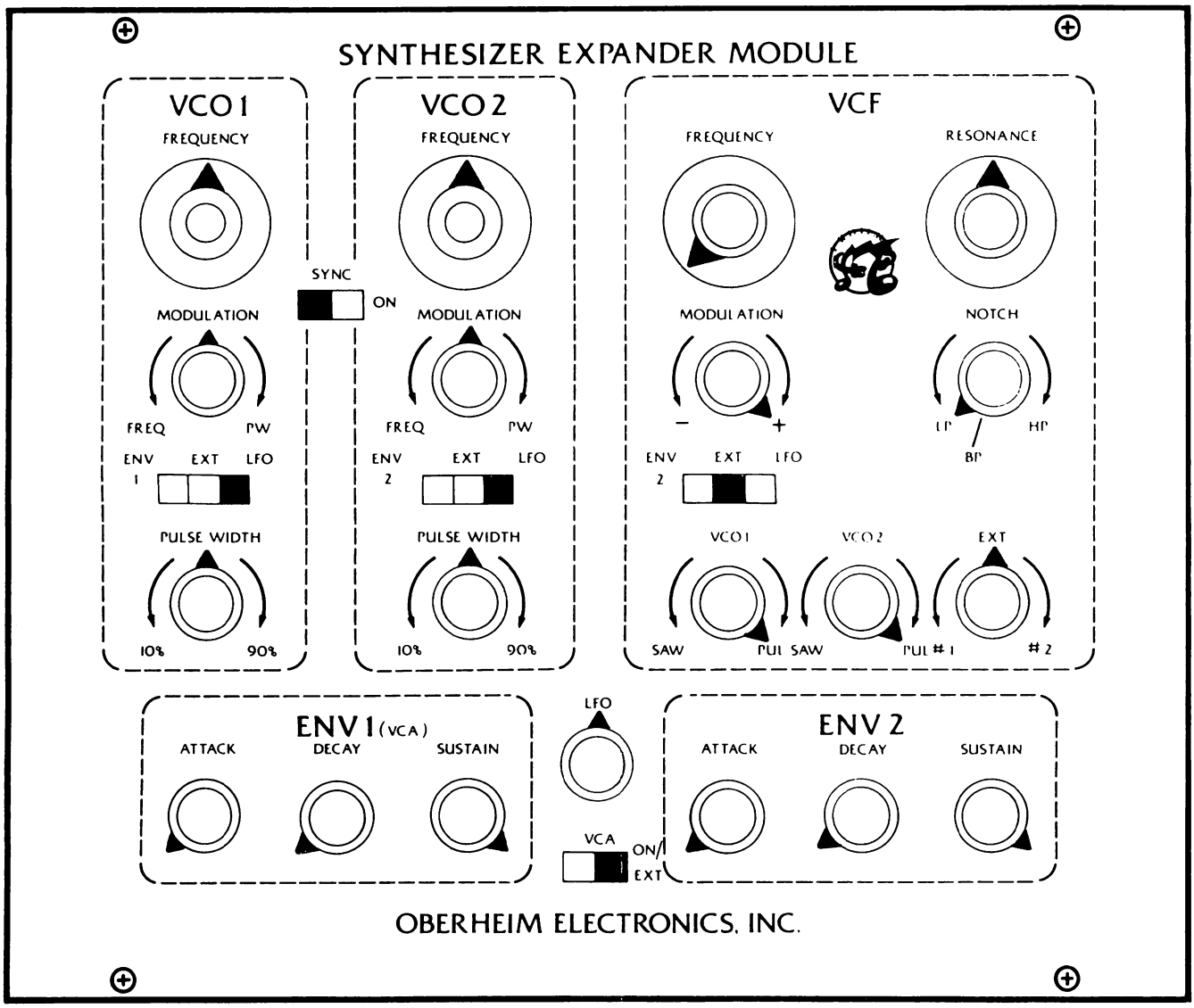
SYNTHESIZER EXPANDER MODULE (Initial Setup)

FIGURE 6



SYNTHESIZER EXPANDER MODULE (General)

FIGURE 7



SYNTHESIZER EXPANDER MODULE (For use with Programmer)

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FIGURE 1