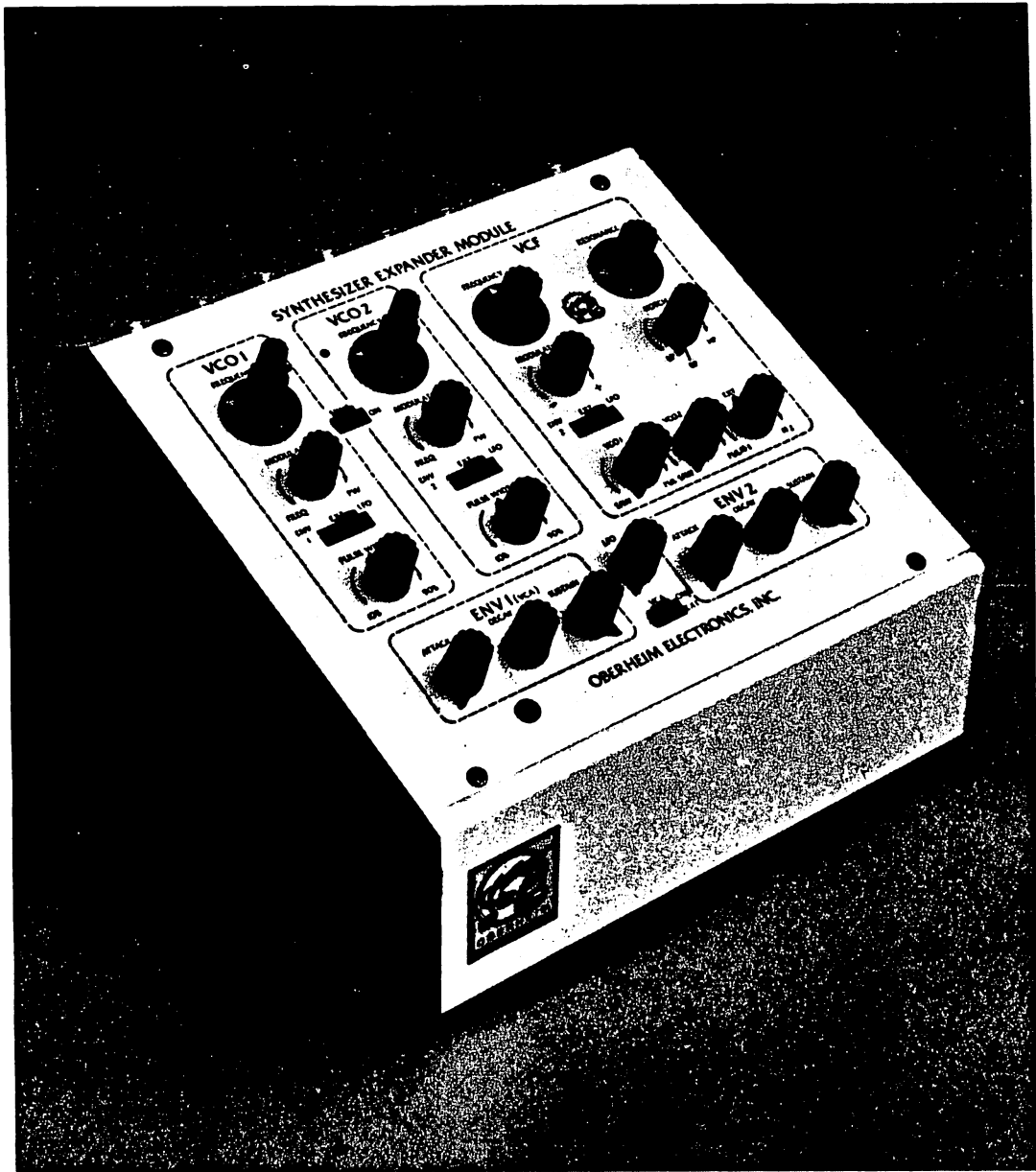


Oberheim

INSTRUCTION MANUAL FOR THE SYNTHESIZER EXPANDER MODULE



INSTRUCTION MANUAL
SYNTHESIZER EXPANDER MODULE

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Power Supply Schematic

SEM-1A Schematic

Second Edition

August 1978

OBERHEIM ELECTRONICS, INC.
1455 19th Street
Santa Monica, CA 90404

*****INTRODUCTION*****

The Oberheim Synthesizer Expander Module is a precision electronic music system with a variety of uses. It combines the most often needed circuitry of an electronic music synthesizer in one compact, versatile module. Two voltage controlled oscillators are configured with a four mode voltage controlled filter, two envelope generators, a low frequency oscillator, and a voltage controlled amplifier. The Synthesizer Expander Module can be used in the following applications:

- With a keyboard to form a small electronic music synthesizer
- To expand the capability of existing synthesizers at low cost
- With systems employing a digital sequencer to allow both the main synthesizer and the sequencer to be played simultaneously
- With polyphonic keyboards to form multi-voice polyphonic synthesizer systems
- As a precision laboratory signal generation and processing device

The various circuits on the Synthesizer Expander Module can be interconnected by potentiometers and switches on the unit's front panel. These interconnections allow many useful synthesizer "patches" to be quickly and easily generated. A multitude of circuit input and output points are available on connectors internal to the unit. Desirable patches not possible with front panel controls can often be accomplished by simple wire connections at these internal points. In addition, these internal points can be brought out to external connector jacks and connected to other equipment in a variety of useful ways.

The Synthesizer Expander Module can be configured to be compatible with virtually any existing voltage-controlled synthesizer. Normally the unit is constructed at the factory to accept a nominal one volt per octave control voltage, which is the industry standard, however other control voltage ranges can be accommodated. The unit has provisions for being easily rewired for most known gate/trigger voltage arrangements by means of internal strapping options.

The Expander Module is packaged in a rugged metal case and is self-powered. Oscillator stability is unsurpassed. Due to the unique "piggy-back" printed circuit board construction technique used, the unit is virtually wire free, which enhances reliability and serviceability.

*****FEATURES*****

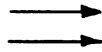
- Two voltage controlled oscillators (VCO's) with sawtooth and pulse outputs
- VCO frequency and pulse width can be modulated by either an envelope generator, the low frequency oscillator, or an external source
- VCO's can be phase synchronized
- One voltage controlled filter (VCF) with low-pass, band-pass, high-pass, or notch response
- VCF frequency can be modulated in either the positive or negative direction by either an envelope generator, the low frequency oscillator, or an external source
- VCF has an integral three-input mixer allowing combination of signals from VCO 1, VCO 2, and either of two external sources
- Two envelope generators with adjustable Attack, Decay, and Sustain
- One low-frequency oscillator
- All circuit inputs and outputs are available on internal connectors and can be brought out to jacks for interconnection to other equipment
- Can be configured to be compatible with virtually any voltage controlled synthesizer
- Unique packaging technique enhances reliability and makes servicing and modification easy
- Two cascaded regulated power supplies make unit immune to power line variations

*****EXPANDER MODULE INTERFACING*****

OBERHEIM 2- OR 4-VOICE

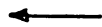
EXPANDER MODULE

CV-OUT
GATE-OUT



CV-IN
GATE-IN

AMPLIFIER

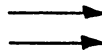


AUDIO-OUT OR LOW-OUT

ARP ODYSSEY, 2600, ETC.

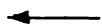
EXPANDER MODULE

CV-OUT
GATE-OUT



CV-IN
GATE-IN

AMPLIFIER

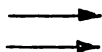


AUDIO-OUT OR LOW-OUT

MINI-MOOG

EXPANDER MODULE

CV-OUT (MODIFICATION)
S-TRIG



CV-IN
MOOG-GATE

AMPLIFIER



AUDIO-OUT OR LOW-OUT

360 SYSTEMS

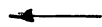
EXPANDER MODULE

PITCH
TRIGGER
LOUDNESS
GUITAR



CV-IN
GATE-IN
VCA-CTRL
AUDIO-IN

AMPLIFIER



AUDIO-OUT OR LOW-OUT

*******VOLTS/OCTAVE ADJUSTMENTS*******

After the connections to your synthesizer are made, it may be necessary to adjust the volts/octave characteristics of the Expander Module oscillators to match the volts/octave output of your synthesizer. This is accomplished as follows:

- 1) Play a note three octaves above the bottom note on the keyboard of your synthesizer. Using the VCO 1 FREQUENCY knob, tune VCO 1 to the same note your synthesizer is sounding.
- 2) Play the bottom note on the keyboard and without changing either the Expander Module FREQUENCY knob or the synthesizer's frequency knob, tune the two oscillators together by adjusting the trimmer which is accessible through the small hole in the Expander Module's front panel, adjacent to the FREQUENCY knob.
- 3) Repeat 1) and 2) as necessary to make the Expander Module oscillator track with your synthesizer's oscillator.
- 4) Repeat 1), 2), and 3) for VCO 2.

*****FRONT PANEL CONTROLS*****

VCO 1 & VCO 2 CONTROLS:

- "FREQUENCY" Controls initial frequency setting of oscillator; covers a five octave range
- "MODULATION" When turned to the left, the selected modulation source modulates the frequency of the oscillator; when turned to the right, the selected modulation source modulates the pulse width of the pulse waveform
- "ENV-EXT-LFO" Selects modulation source for the "MODULATION" pot from either an envelope generator, an external source, or the low frequency oscillator
- "PULSE WIDTH" Controls initial pulse width of the pulse waveform, from 10% to 90% duty cycle

VCF CONTROLS:

- "FREQUENCY" Controls initial frequency setting of the filter
- "RESONANCE" When turned to the right, causes peaking action in the filter
- "MODULATION" When turned to the left, the selected modulation source modulates the frequency of the filter in the negative direction; when turned to the right, the selected modulation source modulates the frequency of the filter in the positive direction
- "ENV2-EXT-LFO" Selects modulation source for the "MODULATION" pot from either envelope generator No. 2, an external source, or the low frequency oscillator
- "BP-LP-NOTCH-HP" When turned all the way to the left and clicked "off", selects BANDPASS filter response; when turned all the way to the left but not clicked "off", selects LOW-PASS filter response; when set at the 12 o'clock position, selects NOTCH filter response; when turned all the way to the right, selects HIGH-PASS filter response

"VCO 1" Filter input mixer pot No. 1; when turned to the left, selects sawtooth waveform from VCO 1; when turned to the right, selects pulse waveform from VCO 1; when set at the center detent position, turns off VCO 1 as an input to the VCF

"VCO 2" Filter input mixer pot No. 2; when turned to the left, selects sawtooth waveform from VCO 2; when turned to the right, selects pulse waveform from VCO 2; when set at the center detent position, turns off VCO 2 as an input to the VCF

"EXT" Filter input mixer pot No. 3; when turned to the left, selects external audio input No. 1; when turned to the right, selects external audio input No. 2; when set at the center detent position, turns off the external inputs as inputs to the VCF

ENV 1 & ENV 2 CONTROLS:

"ATTACK" When turned to the right, increases attack time of the envelope generator

"DECAY" When turned to the right, increases decay time of the envelope generator

"SUSTAIN" When turned to the right, increases sustain level of the envelope generator

LFO CONTROL:

"LFO" When turned to the right, increases frequency of oscillation of the low frequency oscillator

VCA CONTROL:

"VCA-ON/EXT" When switched "on", envelope generator control of the VCA is overridden, forcing it into the full amplification state, unless an external "VCA Control Input" is applied, in which case that signal controls the VCA

*****INPUT-OUTPUT CONNECTIONS*****

All input and output signal connections to the Expander Module occur on several color-coded Molex connectors on the electronics board. The following table summarizes these connections. The connectors can be identified by noting the single alphabetic letter, etched onto the board, adjacent to each connector. Pin 1 of each connector is the pin at the beveled end of the connector.

CONN. PIN	FUNCTION	CONN. COLOR
A1	External Modulation Input - VCO 1	Orange
A2	Sawtooth Output - VCO 1	
A3	Pulse Output - VCO 1	
B1	Control Voltage Input No. 1 - VCO 1	Red
B2	Ground	
B3	Control Voltage Input No. 2 - VCO 1	
C1	Sync Output - VCO 1	Yellow
C2	Ground	
C3	Sync Input - VCO 1	
D1	Control Voltage Input No. 1 - VCO 2	Red
D2	Ground	
D3	Control Voltage Input No. 2 - VCO 2	
E1	External Modulation Input - VCO 2	Orange
E2	Sawtooth Output - VCO 2	
E3	Pulse Output - VCO 2	
F1	Sync Output - VCO 2	Yellow
F2	VCA Control Input	
F3	Sync Input - VCO 2	
G1	LFO Trigger Input	Brown
G2	Ground	
G3	LFO Output	
H1	Control Voltage Input No. 1 - VCF	Grey
H2	Control Voltage Input No. 2 - VCF	
H3	External Modulation Input - VCF	
I1	VCA Output	White
I2	Ground	
I3	Output Amplifier Input	
J1	Hi Pass Output - VCF	White
J2	Ground	
J3	Bandpass Output - VCF	

K1	Selected VCF Response Output	
K2	Ground	White
K3	Low Pass Output - VCF	
L1	External Audio Input No. 1	
L2	Ground	Blue
L3	External Audio Input No. 1	
M1	External Audio Input No. 2	
M2	Ground	Blue
M3	External Audio Input No. 2	
X1	Output - ENV 1	
X2	Gate Input - ENV 1	Green
X3	Trigger Input - ENV 1	
Y1	Output - ENV 2	
Y2	Gate Input - ENV 2	Green
Y3	Trigger Input - ENV 2	
Z1	+18.5V Regulated Voltage Input	
Z2	Ground	Black
Z3	Ground	
Z4	-18.5V Regulated Voltage Input	

*******STRAPPING OPTIONS*******

The Expander Module electronics board is configured to allow various strapping options which can be changed by the user. Refer to the Electronics Board Identification Diagram for location of strapping option jumpers.

CONTROL VOLTAGE JUMPERS


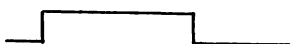
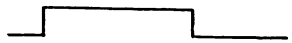
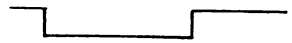
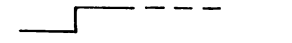
Normally, Expander Modules are configured at the factory with the control voltage jumpers installed. These jumpers allow both VCO's to be driven from the same control voltage. By removing these jumpers the two VCO's can be driven from separate control voltages.

GATE AND TRIGGER JUMPERS

As with the VCO jumpers, Expander Modules are configured at the factory with the gate and trigger jumpers installed. These jumpers allow both envelope generators to be driven from the same gate and/or trigger signals. By removing them, the envelope generators can be triggered separately.

VELOPE GENERATOR INPUT OPTION JUMPERS

The Expander Module envelope generators can be configured by these jumpers to accept different combinations of gate and trigger signals and polarities. When the connections listed in the first two columns below are made, the envelope generators will respond properly to the gate and/or trigger signals described in the last column. The letters refer to the jumper wire pads located at the lower corners of the Expander Module electronics board.

ENV 1 JUMPERS	ENV 2 JUMPERS	INPUT SIGNAL
X-->C W-->A B-->E	Z-->H Y-->F G-->J	TRIG:  + GATE: 
D-->C W-->A B-->E	I-->H Y-->F G-->J	GATE: 
D-->C W-->B B-->E	I-->H Y-->G G-->J	GATE: 
X-->C	Z-->H	TRIG: 

Synthesizer Expander Modules are configured at the factory as required by various complete Oberheim systems. The table below summarizes these factory configurations.

	CPS-1A CASE & POWER SUPPLY	2-VOICE SYNTHESIZER	4- & 8-VOICE SYNTHESIZER
CV No. 1 JUMPER (B1-->D1)	YES	YES	NO
CV No. 2 JUMPER (B3-->D3)	YES	YES	YES
VCA "ON SW" RESISTOR	NO	YES	NO
"AUDIO IN" RESISTOR	47K//220K	220K	220K
ENVELOPE JUMPERS			
D-->C	YES	YES	YES
W-->A	YES	YES	YES
B-->E	YES	YES	YES
B-->X	YES	NO	NO
I-->H	YES	YES	YES
Y-->F	YES	YES	YES
G-->J	YES	YES	YES
G-->Z	YES	NO	NO

*******EXPANDER MODULE ADJUSTMENTS*******

A) GENERAL

The following adjustments require an oscilloscope and a digital volt meter (DVM). All references to trimmers, connector pins, etc., are keyed to the Electronics Board Identification Diagram.

B) POWER SUPPLY ADJUSTMENT

Adjust the +15 VOLTS ADJ trimmer so that the voltage measured across the +15 volt capacitor is 15.00 volts.

C) VCF OFFSET ADJUSTMENTS

Set the VCF FREQUENCY pot on the front panel to its center position, and turn the RESONANCE pot fully CCW. Turn off all audio inputs by turning the VCO 1, VCO 2, and EXT pots to their center detent positions. Connect a DVM to pin J3 and adjust the VCF OFFSET NO. 1 trimmer for zero volts. Connect the DVM to pin J1 and adjust the VCF OFFSET NO. 2 trimmer for zero volts.

D) VCA OFFSET ADJUSTMENT

Turn the VCA switch on. Connect a DVM to pin 6 of the type 741 I.C. nearest to connector I and adjust the VCA OFFSET trimmer for zero volts.

E) VCO ADJUSTMENTS

- 1) Set the VCO 1 PULSE WIDTH pot in the center of its range (12 o'clock position). Using an oscilloscope, observe the VCO 1 output at pin A3 and adjust the INIT PW trimmer for a 50% duty cycle pulse wave. Repeat for VCO 2, observing its output at pin E3.
- 2) Set the VCO 1 INIT FREQ and HI-FREQ TRACK trimmers in their center positions. Apply a +3 volts control voltage to CV-IN and listen to VCO 1. Using an external oscillator with an accurate volts/octave relationship and driven by the same +3 volts control voltage (frequency should be approximately 500 Hz), adjust the front panel FREQUENCY pot until the beat frequency between VCO 1 and the external oscillator is zero.

Change the control voltage to zero volts and adjust the VCO 1 VOLTS/OCT trimmer (accessible through the hole in the front panel adjacent to the FREQUENCY pot) for zero beat. Repeat this procedure as necessary until VCO 1 tracks the external oscillator.

- 3) Turn the front panel FREQUENCY pot fully clockwise. With zero volts at CV-IN, adjust the INIT FREQ trimmer for zero beat to the external oscillator. Change the control voltage to +3 volts and note the beat frequency. Adjust the HI-FREQ TRACK trimmer past zero beat frequency to the same number of beats per second as first heard when the control voltage was changed to +3 volts. Repeat this procedure until the VCO properly tracks the external oscillator.
- 4) Repeat steps 2) and 3) as necessary.
- 5) Turn the front panel FREQUENCY pot fully CCW. Adjust the INIT FREQ trimmer to approximately 130 Hz for zero beat with +3 volts at CV-IN. Change the control voltage to zero volts and check tracking of the VCO to the external oscillator.
- 6) Repeat steps 2) through 5) for VCO 2.

F) VCF ADJUSTMENTS

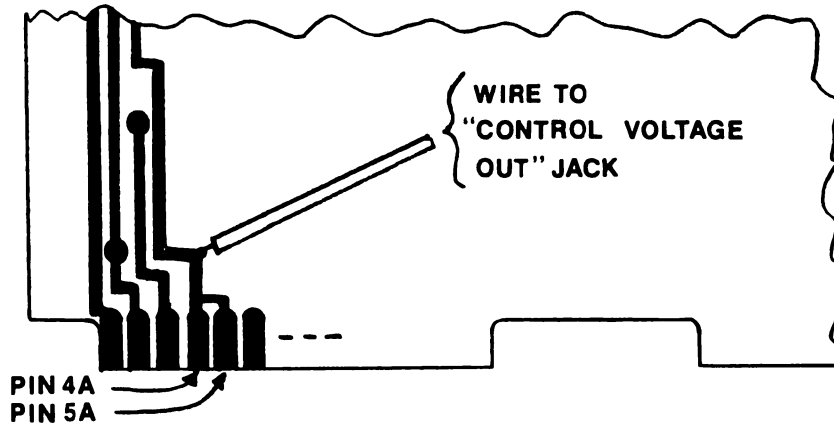
Turn the front panel FREQUENCY pot fully CCW and the RESONANCE pot fully CW. Turn the VCO 1 FREQUENCY pot fully CCW. Set the VCO 2 and EXT pots to their center detent positions. Apply a pulse wave by turning the VCO 1 pot clockwise. Apply a +3 volts control voltage to both CV-IN and pin H1. Adjust the VCF INIT FREQ trimmer for maximum signal amplitude. Change the control voltage to zero volts and adjust the VCF VOLTS/OCT trimmer for maximum signal amplitude.

*******MINI-MOOG MODIFICATION*******

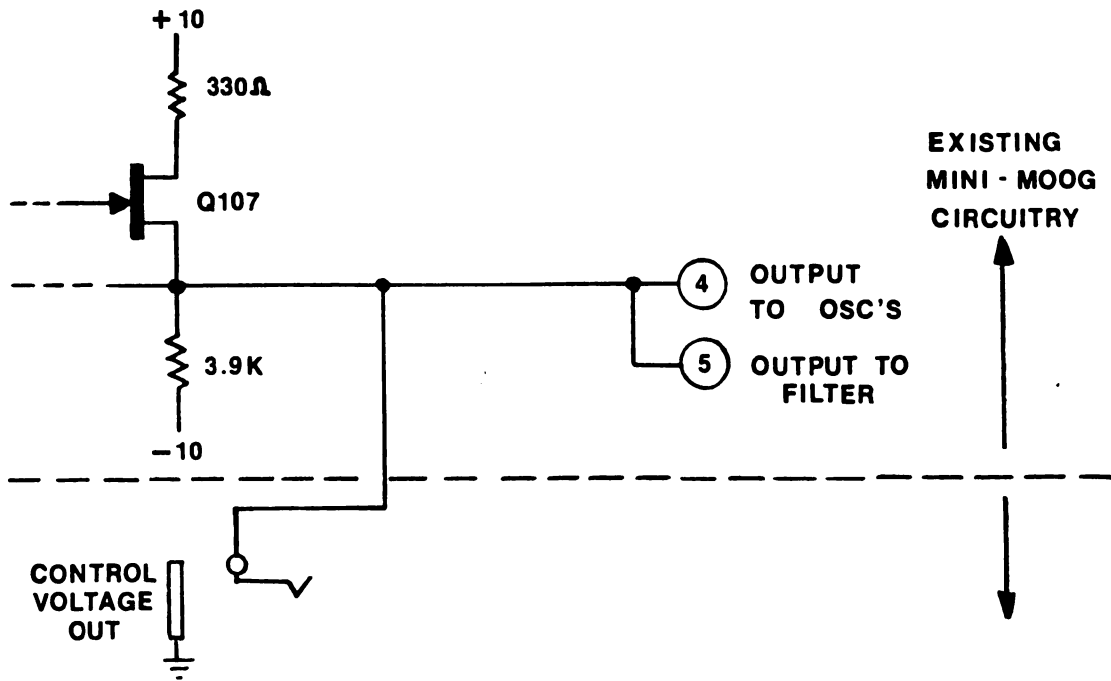
The standard Mini-Moog does not have its keyboard control voltage available on an external jack. The following modification describes how such a jack may be added so that the Synthesizer Expander Module may be used with a Mini-Moog.

- 1) Expose the Mini-Moog's electronic circuitry by removing the metal cover held on by 18 sheet metal screws.
- 2) Looking at the rear of the Mini-Moog, remove the right-hand printed circuit board (Board No. 1) and set it aside temporarily.
- 3) Remove the other right-hand printed circuit board (Board No. 2) which resides behind Board No. 1.
- 4) Install a phone jack (such as a Switchcraft No. 1) just left of the jack labeled "LOUDNESS EXTERNAL CONTROL INPUT". Label this jack "CONTROL VOLTAGE OUT".
- 5) On Board No. 2, solder a 14-inch wire to the etching point shown in the Figure.
- 6) Solder the other end of this wire to the jack you just installed.
- 7) Connect the ground terminal of the new jack to the ground terminal of an adjacent jack.
- 8) Replace both printed circuit boards and the metal cover.

MINI-MOOG
BOARD #2



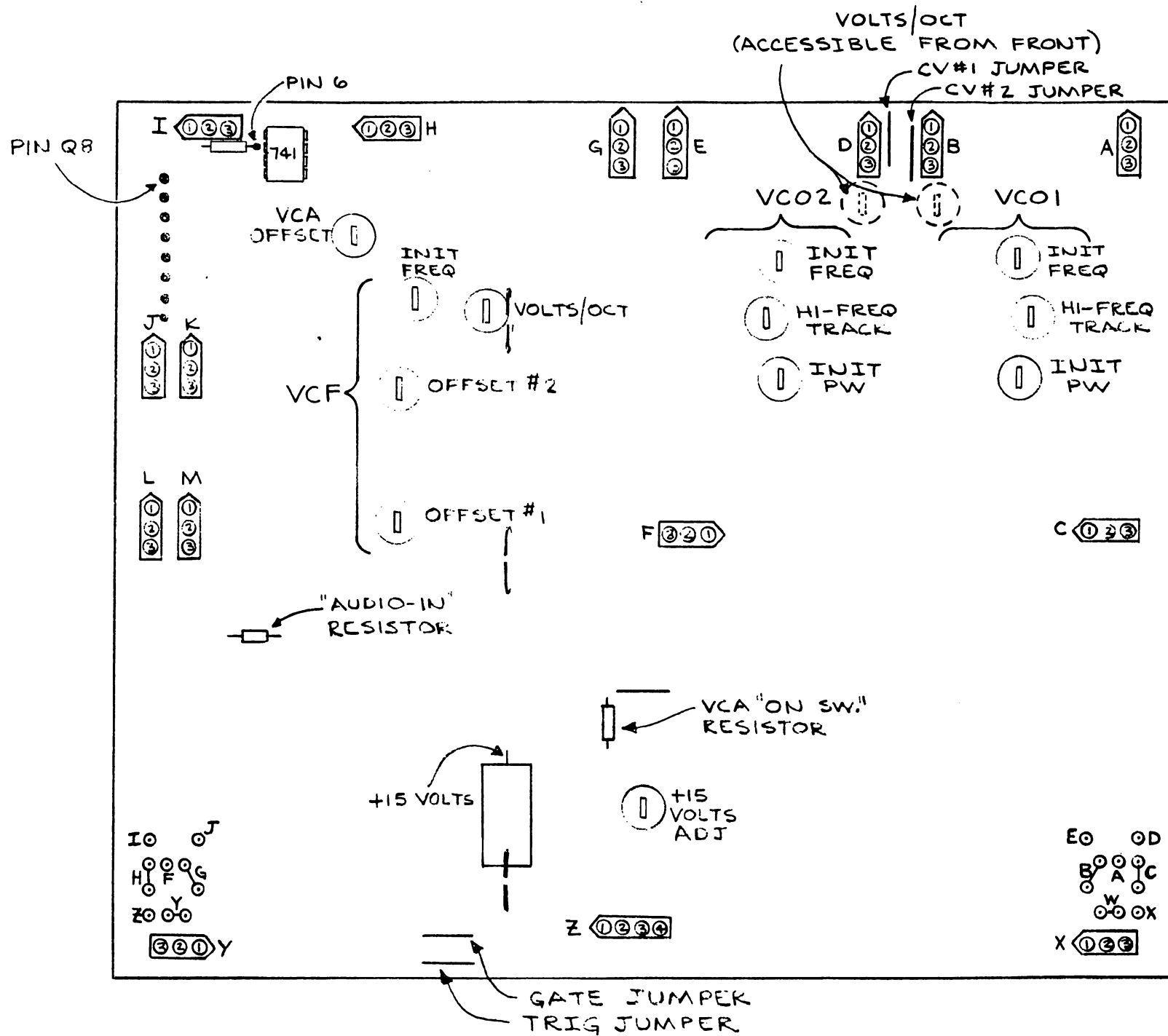
FIGURE



SCHEMATICS

EXISTING
MINI-MOOG
CIRCUITRY

MINI-MOOG
MODIFICATION
FOR USE WITH
OBERHEIM
EXPANDER MODULE



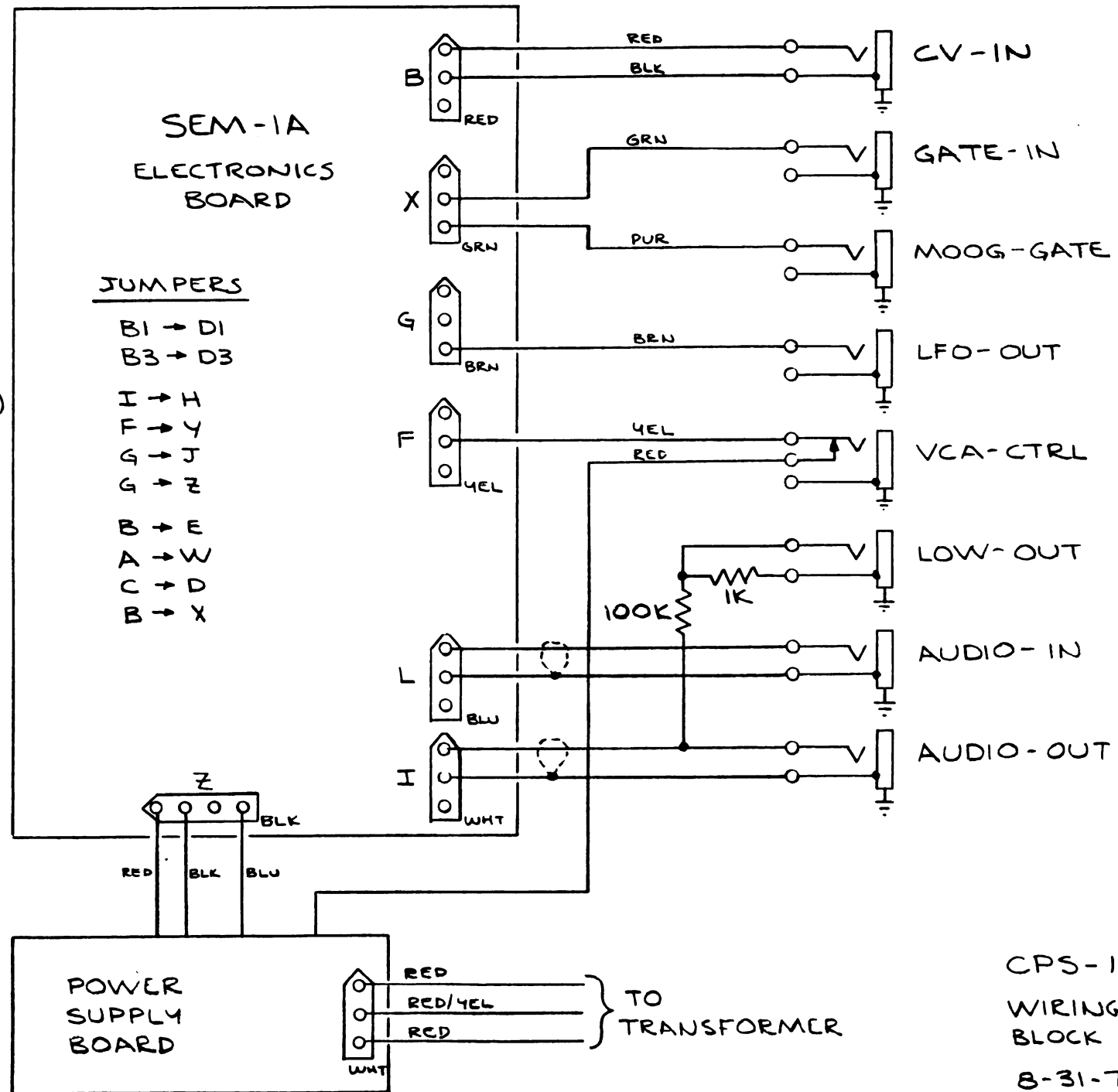
2-15-75
REV 8-31-78

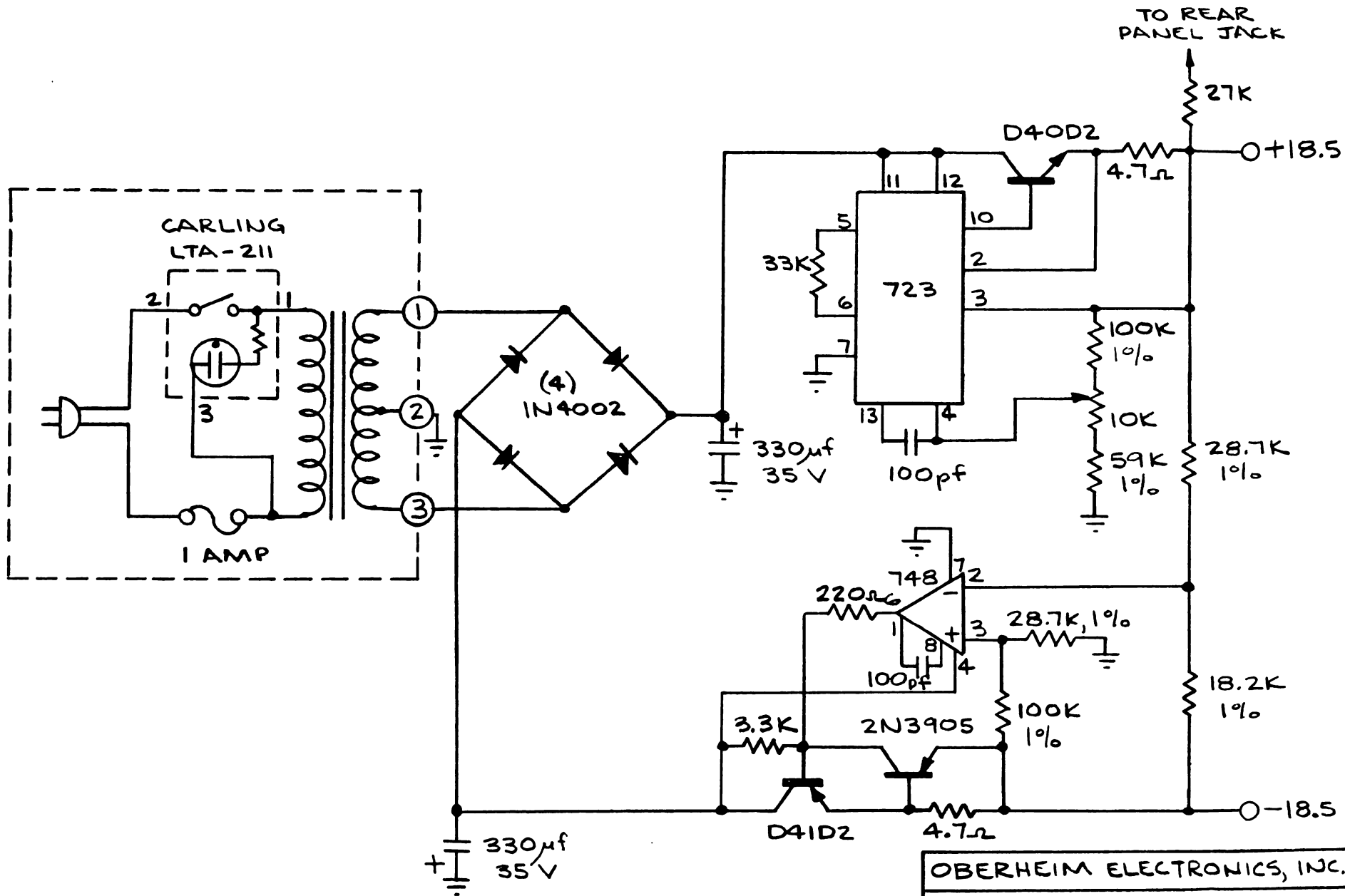
ELECTRONICS BOARD
IDENTIFICATION
DIAGRAM

CHANGES
TO SEM-1A
ELECTRONICS
BOARD WHEN
USED IN CPS-1A:

1) VCA "ON-SW"
RESISTOR (22K)
IS REMOVED.

2) AUDIO-IN
SUMMING
RESISTOR
(R135, 220K)
IS PARALLELED
WITH 47K.





OBERHEIM ELECTRONICS, INC.

SCHMATIC

POWER SUPPLY-
EXPANDER MODULE

2-15-75
REV 8-31-78

1088A

1955 19th st,
service address

**Oberheim
Electronics, Inc.**

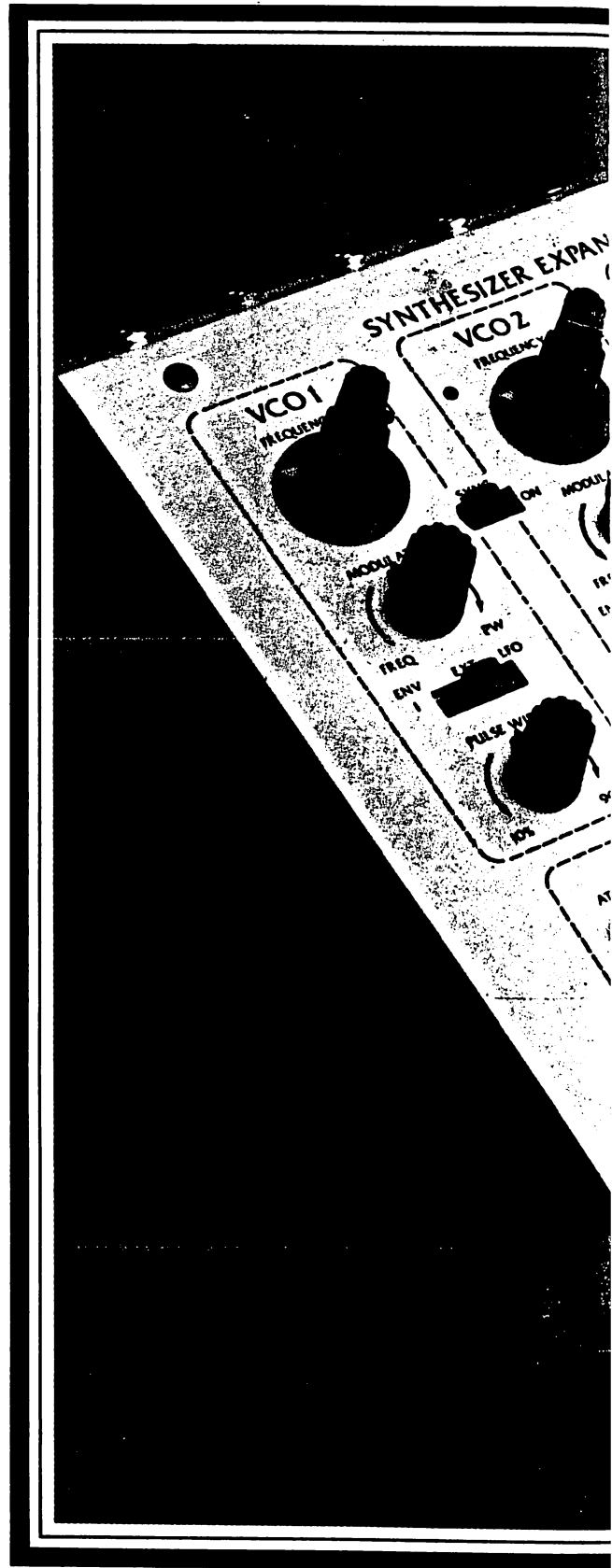
1455 19th Street *office
Address*

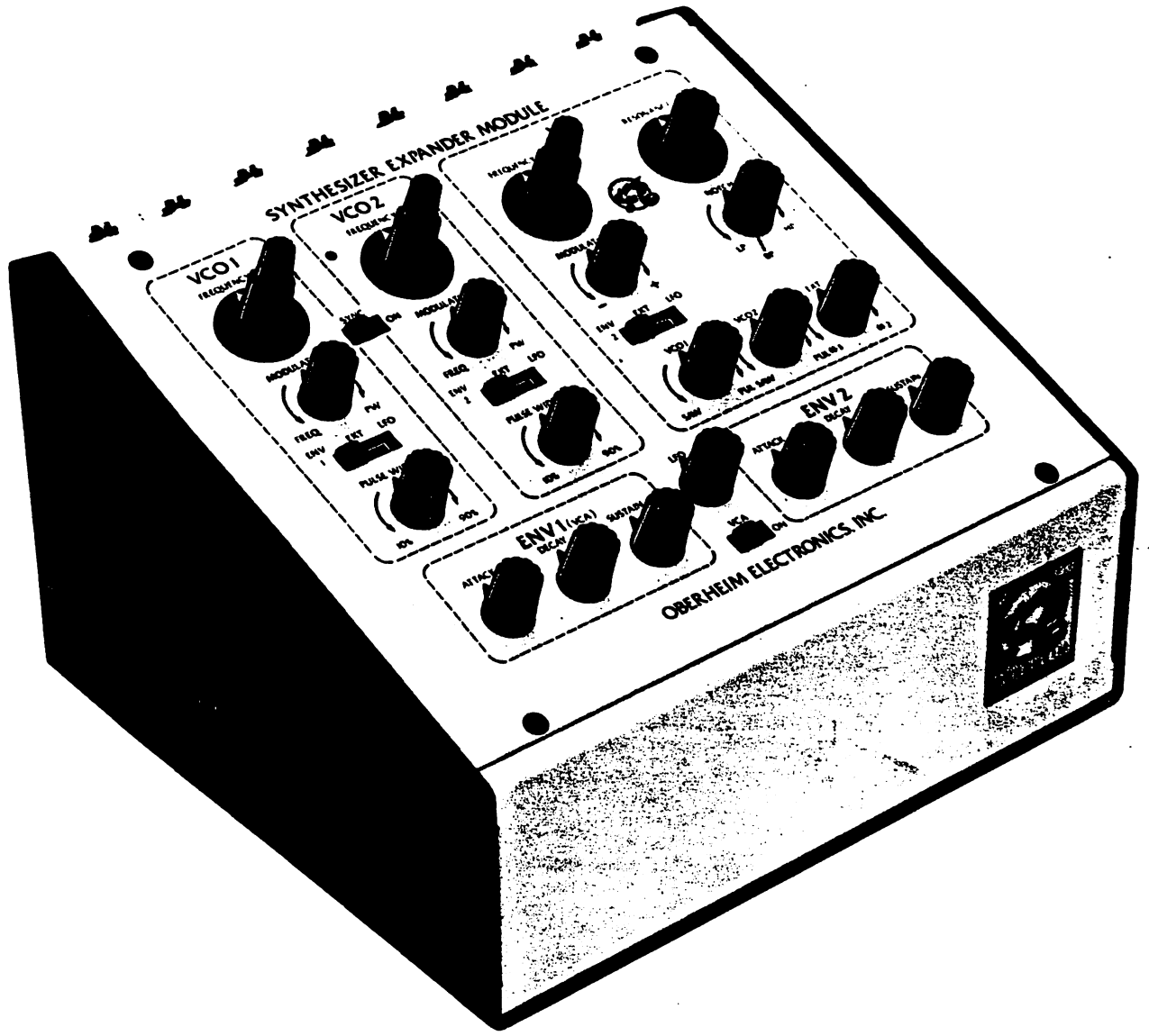
Santa Monica

Ca. 90404

(213) 829-6831

11/78





INSTRUCTION MANUAL
SYNTHESIZER EXPANDER MODULE

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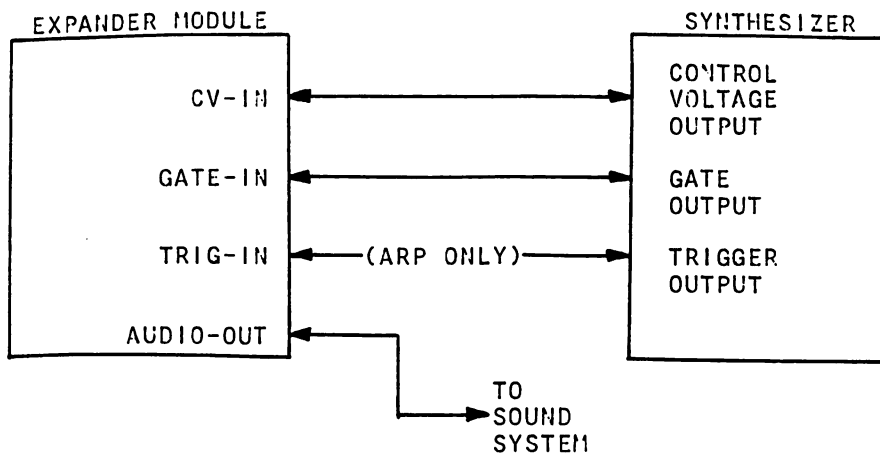
*****FEATURES*****

- Two voltage controlled oscillators (VCO's) with sawtooth and pulse outputs
- VCO frequency and pulse width can be modulated by either an envelope generator, the low frequency oscillator or from an external source
- VCO's can be phase synchronized
- One voltage controlled filter (VCF) with low-pass, band-pass, high-pass or notch response
- VCF frequency can be modulated in either the positive or negative direction by either an envelope generator, the low frequency oscillator or from an external source
- VCF has an integral three-input mixer allowing combination of signals from VCO 1, VCO 2, or either of two external sources
- Two envelope generators with adjustable Attack, Decay and Sustain
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- All circuit inputs and outputs are available on internal connectors and can be brought out to jacks for inter-connection to other equipment
- Can be configured to be compatible with virtually any voltage controlled synthesizer
- Unique packaging technique enhances reliability and makes servicing and modifications easy
- Two cascaded regulated power supplies makes unit immune to power line variations

***** INSTALLATION INSTRUCTIONS *****

HOOKUP

To connect the Expander Module to your synthesizer, make the following connections:



CONTROL VOLTAGE ADJUSTMENTS

After the above connections are made, it may be necessary to adjust the Volts/Octave characteristics of the Expander Module oscillators to match the Volts/Octave output of your synthesizer. This is accomplished as follows:

- 1) Play a note three octaves above the bottom note on the keyboard and tune VCO 1 to the same note your synthesizer is sounding, using the VCO 1 FREQUENCY knob
- 2) Play the bottom note on the keyboard and without changing either the Expander Module FREQUENCY knob or the synthesizer's frequency knob, tune the two oscillators together by adjusting the trimmer which is accessible thru the small hole in the control panel
- 3) Repeat 1) and 2) as necessary to make the Expander Module oscillator track with the synthesizer oscillator
- 4) Repeat 1), 2) and 3) for VCO 2

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Incorporated
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(213) 393-0136**



Oberheim synthesizer expander module



INSTRUCTION MANUAL
SYNTHESIZER EXPANDER MODULE

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The various circuits on the Synthesizer Expander Module can be interconnected by potentiometers and switches on the unit's front panel. These interconnections allow many useful synthesizer "patches" to be quickly and easily generated. A multitude of circuit input and output points are available on connectors internal to the unit. Desired patches not possible with front panel controls can often be accomplished by simple wire connections at these internal points. In addition, these internal points can be brought out to external connector jacks and connected to other equipment in a variety of useful ways.

The Synthesizer Expander Module can be configured to be compatible with virtually any existing voltage-controlled synthesizer. Normally the unit is constructed at the factory to accept a nominal one volt per octave control voltage, which is the industry standard, however other control voltage ranges can be accommodated. The unit has provisions for being easily rewired for most known gate/trigger voltage arrangements by means of internal strapping options.

The Expander Module is packaged in a rugged metal case and is self-powered. Oscillator stability is unsurpassed. Due to the unique "piggy-back" printed circuit board construction technique used, the unit is virtually wire free, which enhances reliability and serviceability.

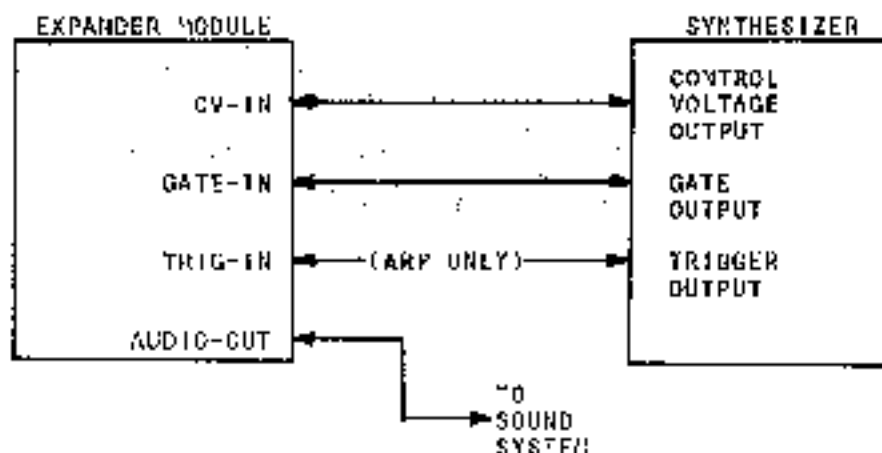
*****FEATURES*****

- Two voltage controlled oscillators (VCO's) with sawtooth and pulse outputs
- VCO frequency and pulse width can be modulated by either an envelope generator, the low frequency oscillator or from an external source
- VCO's can be phase synchronized
- One voltage controlled filter (VCF) with low-pass, band-pass, high-pass or notch response
- VCF frequency can be modulated in either the positive or negative direction by either an envelope generator, the low frequency oscillator or from an external source
- VCF has an integral three-input mixer allowing combination of signals from VCO 1, VCO 2, or either of two external sources
- Two envelope generators with adjustable Attack, Decay and Sustain
- One low-frequency oscillator
- All circuit inputs and outputs are available on internal connectors and can be brought out to jacks for inter-connection to other equipment
- Can be configured to be compatible with virtually any voltage controlled synthesizer
- Unique packaging technique enhances reliability and makes servicing and modifications easy
- Two cascaded regulated power supplies makes unit immune to power line variations

***** INSTALLATION INSTRUCTIONS *****

HOOKUP

To connect the Expander Module to your synthesizer, make the following connections:



CONTROL VOLTAGE ADJUSTMENTS

After the above connections are made, it may be necessary to adjust the Volts/Octave characteristics of the Expander Module oscillators to match the Volts/Octave output of your synthesizer. This is accomplished as follows:

- 1) Play a note three octaves above the bottom note on the keyboard and tune VCO 1 to the same note your synthesizer is sounding, using the VCO 1 FREQUENCY knob
- 2) Play the bottom note on the keyboard and without changing either the Expander Module FREQUENCY knob or the synthesizer's frequency knob, tune the two oscillators together by adjusting the trimmer which is accessible thru the small hole in the control panel.
- 3) Repeat 1) and 2) as necessary to make the Expander Module oscillator track with the synthesizer oscillator
- 4) Repeat 1), 2) and 3) for VCO 2

***** FRONT PANEL CONTROLS *****

VCO 1 & VCO 2 CONTROLS:

- "FREQUENCY" - Controls initial frequency setting of oscillator; covers a five octave range
- "MODULATION" - When turned to the left, selected modulation source modulates the frequency of the oscillator; when turned to the right, selected modulation source modulates the pulse width of the pulse waveform
- "ENV-EXT-LFO" - Selects the modulation source for the "MODULATION" pot from either an envelope generator, an external source or the low frequency oscillator
- "PULSE WIDTH" - Controls initial pulse width of pulse waveform from 10% to 90% duty cycle

VCF CONTROLS:

- "FREQUENCY" - Controls initial frequency setting of filter
- "RESONANCE" - When turned to the right, causes peaking action in the filter
- "MODULATION" - When turned to the left, selected modulation source modulates the frequency of the filter in the negative direction; when turned to the right, selected modulation source modulates the frequency of the filter in the positive direction
- "ENV2-EXT-LFO" - Selects the modulation source for the "MODULATION" pot from either envelope generator #2, an external source, or the low frequency oscillator
- "BP-1P-NOTCH-HP" - When turned all the way to the left and clicked "off", selects BANDPASS filter response; when turned all the way to the left but not clicked "off", selects LOW-PASS filter response; when set at the 1/2 o'clock position, selects NOTCH filter response; when turned all the way to the right, selects HIGH-PASS filter response

- "VCO 1" - Filter input mixer pot #1; when turned to the left, selects sawtooth waveform from VCO 1; when turned to the right, selects pulse waveform from VCO 1
- "VCO 2" - Filter input mixer pot #2; when turned to the left, selects sawtooth waveform from VCO 2; when turned to the right, selects pulse waveform from VCO 2
- "EXT" - Filter input mixer pot #3; when turned to left, selects external audio input #1; when turned to the right, selects external audio input #2

ENV 1 & ENV 2 CONTROLS:

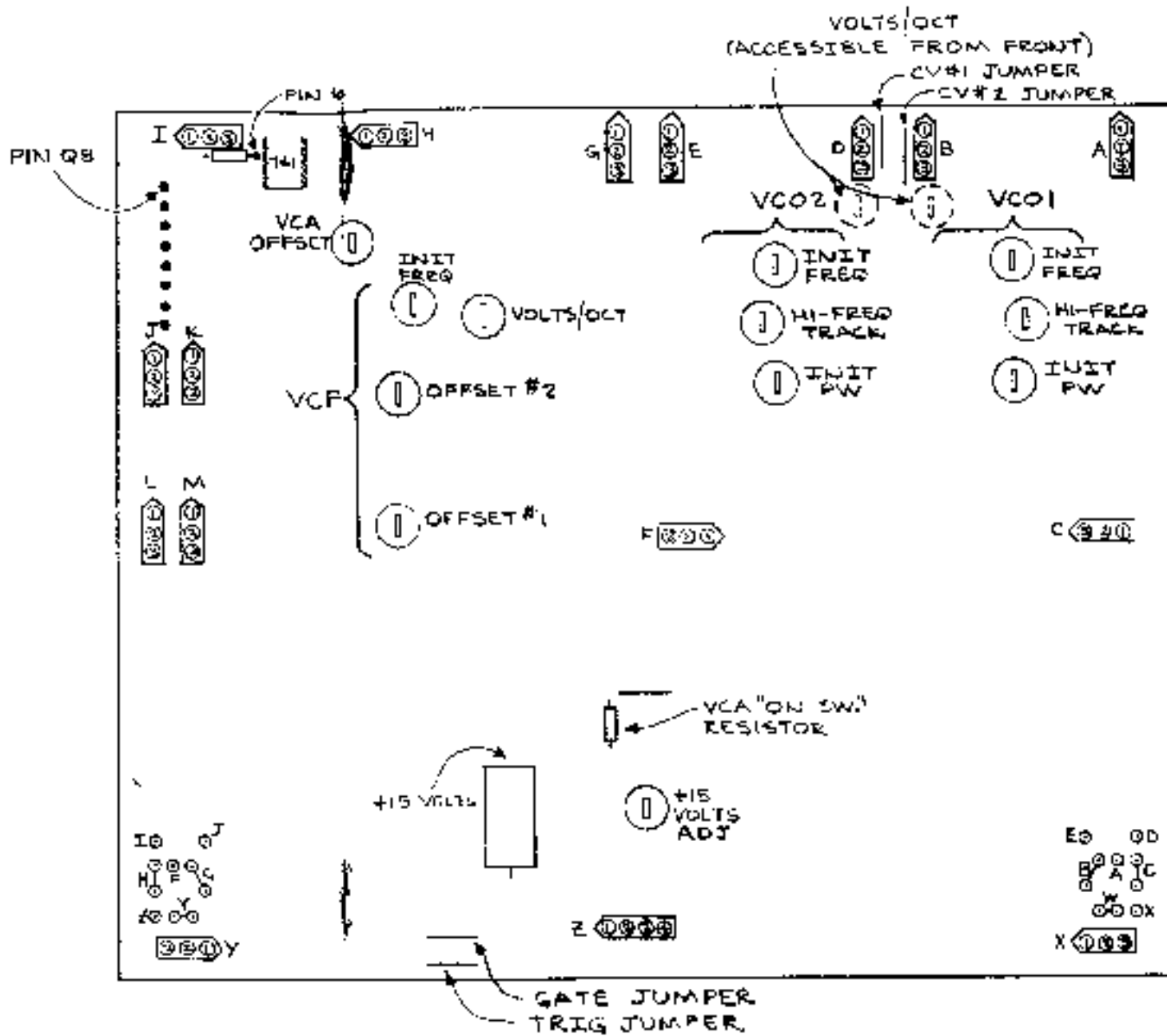
- "ATTACK" - When turned to the right, increases attack time of envelope generator
- "DECAY" - When turned to the right, increases decay time of envelope generator
- "SUSTAIN" - When turned to the right, increases sustain level of envelope generator

LFO CONTROL:

- "LFO" - When turned to the right, increases frequency of oscillation of low frequency oscillator

VCA CONTROL:

- "VCA-ON/EXT" - When switched "on", envelope generator control of VCA is overridden, forcing it into the full amplification state, unless an external "VCA Control Input" is applied, in which case that signal controls VCA



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ELECTRONICS BOARD
IDENTIFICATION
DIAGRAM

*****INPUT-OUTPUT CONNECTIONS*****

All input and output signal connections to the Expander Module occur on several color-coded Molex connectors on the electronics board. The following table summarizes these connections. The connectors can be identified by noting the single alphabetic letter, etched onto the board, adjacent to each connector. Pin 1 of each connector is the pin at the beveled end of the connector.

CONN. PIN	FUNCTION	CONN. COLOR
A1	External Modulation Input - VCO 1	Orange
A2	Sawtooth Output - VCO 1	
A3	Pulse Output - VCO 1	
B1	Control Voltage Input #1 - VCO 1	Red
B2	Ground	
B3	Control Voltage Input #2 - VCO 1	
C1	Sync Output - VCO 1	Yellow
C2	Ground	
C3	Sync Input - VCO 1	
D1	Control Voltage Input #1 - VCO 2	Red
D2	Ground	
D3	Control Voltage Input #2 - VCO 2	
E1	External Modulation Input - VCO 2	Orange
E2	Sawtooth Output - VCO 2	
E3	Pulse Output - VCO 2	
F1	Sync Output - VCO 2	Yellow
F2	VCA Control Input	
F3	Sync Input - VCO 2	
G1	LFO Trigger Input	Brown
G2	Ground	
G3	LFO Output	
H1	Control Voltage Input #1 - VCF	Gray
H2	Control Voltage Input #2 - VCF	
H3	External Modulation Input - VCF	
I1	VCA Output	White
I2	Ground	
I3	Output Amplifier Input	
J1	HP Pass Output - VCF	White
J2	Ground	
J3	Bandpass Output - VCF	

K1	Selected VCF Response Output	
K2	Ground	White
K3	Low Pass Output - VCF	
L1	External Audio Input #1	
L2	Ground	Blue
L3	External Audio Input #1	
M1	External Audio Input #2	
M2	Ground	Blue
M3	External Audio Input #2	
X1	Output - ENV 1	
X2	Gate Input - ENV 1	Green
X3	Trigger Input - ENV 1	
Y1	Output - ENV 2	
Y2	Gate Input - ENV 2	Green
Y3	Trigger Input - ENV 2	
Z1	+18.5 Regulated Voltage Input	
Z2	Ground	Black
Z3	Ground	
Z4	18.5 Regulated Voltage Input	

***** STRAPPING OPTIONS *****

The Expander Module electronics board is configured to allow various strapping options which can be changed by the user. Refer to the Identification Diagram for location of strapping option jumpers.

CONTROL VOLTAGE JUMPERS






Normally, Expander Modules are configured at the factory with the control voltage jumpers installed. These jumpers allow both VCO's to be driven from the same control voltage. By removing these jumpers the two VCO's can be driven from separate control voltages.

GATE AND TRIGGER JUMPERS

As with the VCO jumpers, Expander Modules are configured at the factory with the gate and trigger jumpers installed. These jumpers allow both envelope generators to be driven from the same gate and/or trigger signals. By removing them, the envelope generators can be triggered separately.

ENVELOPE GENERATOR INPUT OPTION JUMPERS

The Expander Module envelope generators can be configured by these jumpers to accept different combinations of gate and trigger signals and polarities. When the connections listed in the first two columns are made, the envelope generators will respond properly to the gate and/or trigger signals described in the last column. The letters refer to the jumper wire pads located at the lower corners of the Expander Module electronics board.

ENV 1 JUMPERS	ENV 2 JUMPERS	INPUT SIGNAL REQUIREMENTS
X+C W+A B+E	Z+H Y+F G+J	TRIG:  + GATE: 
D+C W+A B+E	I+H Y+F G+J	GATE: 
D+C H+B B+E	I+H Y+G G+J	GATE: 
X+C	Z+H	TRIG: 

In order to allow maximum flexibility of use with ARP-interface configured Expander Modules, the Gate + Trigger jumper option is recommended. In addition, +15 volts is wired to the "Gate-In" connector's "sleeve" connection. This allows the Expander Module to be used with an ARP's Gate and Trigger signals when it is driven directly by an ARP synthesizer, or if the "Gate-In" connector has no cord plugged into it, just a Trigger signal will cause the envelope generators to operate (such as provided by a Digital Sequencer).

***** EXPANDER MODULE ADJUSTMENTS *****

A) POWER SUPPLY ADJUSTMENTS:

Adjust "+15 Volts" trimmer so that the voltage measured across the +15 volt capacitor is 15.00 volts.

B) VCO 1 ADJUSTMENTS:

- 1) Using oscilloscope, observe OSC 1 output at pin A3 and adjust "Init PW" trimmer for 50% duty cycle pulse wave with PULSE WIDTH pot set in the center of its range.
- 2) Set FREQUENCY pot full CCW and adjust "Init Freq" trimmer for 35 HZ output with no CV-IN.
- 3) With a CV-IN of approximately +3 volts (three octaves up from bottom of keyboard), zero beat output of OSC 1 with an external oscillator with accurate volts/octave relationship and driven by the same CV-IN, by adjusting FREQUENCY pot. Then change CV-IN to 0 volts (bottom note on keyboard) and adjust "Volts/Octave" trimmer (accessible thru hole in control panel) for zero beat. Repeat as necessary to make the two oscillators track.
- 4) Move FREQUENCY pots on both OSC 1 and external oscillator up several octaves and zero beat with 0 volts CV-IN (using FREQUENCY pot). Apply -3 volts CV-IN and zero beat by adjusting "HI-Freq Track" trimmer.
- 5) Repeat 3) and 4) once.

C) VCO 2 ADJUSTMENTS:

- 1) Repeat procedure B), steps 1) thru 5), except use OSC 1 rather than external oscillator.
- 2) After above adjustments are completed, set both OSC 1 and OSC 2 FREQUENCY pots fully CCW and adjust OSC 2 "Init Freq" trimmer to zero beat oscillators.

D) VCF ADJUSTMENTS:

- 1) Using oscilloscope, observe pin 28 on board-to-board connector. (This pin is the one nearest connector pin 1)
- 2) Turn NOTCH pot to "HP".
- 3) Adjust "Offset 1" trimmer for zero volts.
- 4) Turn NOTCH pot to "LF".
- 5) Adjust "Offset 2" trimmer for zero volts.
- 6) Center VCO 1 FREQUENCY pot and VCF FREQUENCY pot.
- 7) Apply VCO 1 pulse waveform to VCF and rotate RESONANCE pot fully CW.
- 8) Adjust VCF "Inlt Freq" trimmer until fundamental (first harmonic) is prominent.
- 9) Jumper CV-IN to pin 41.
- 10) Depress key one octave above lowest key and adjust VCF "Volts/Octave" trimmer for maximum signal.
- 11) Repeat steps 1) thru 5).

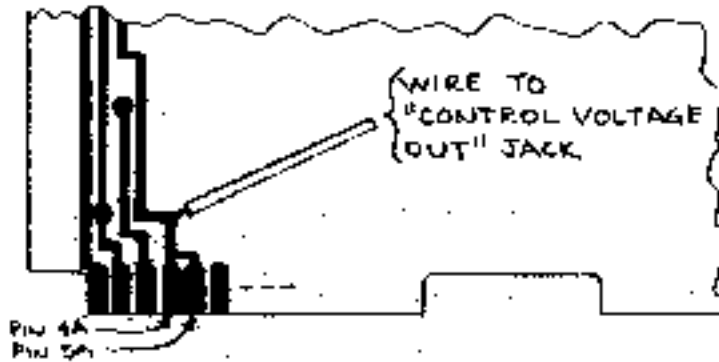
E) VCA ADJUSTMENTS:

- 1) Using oscilloscope, observe pin 5 of 741 op. amp. nearest connector 1.
- 2) While repeatedly pressing and releasing keyboard key (to generate Gate and/or Trigger pulses) adjust VCA "Offset" trimmer for no voltage change.

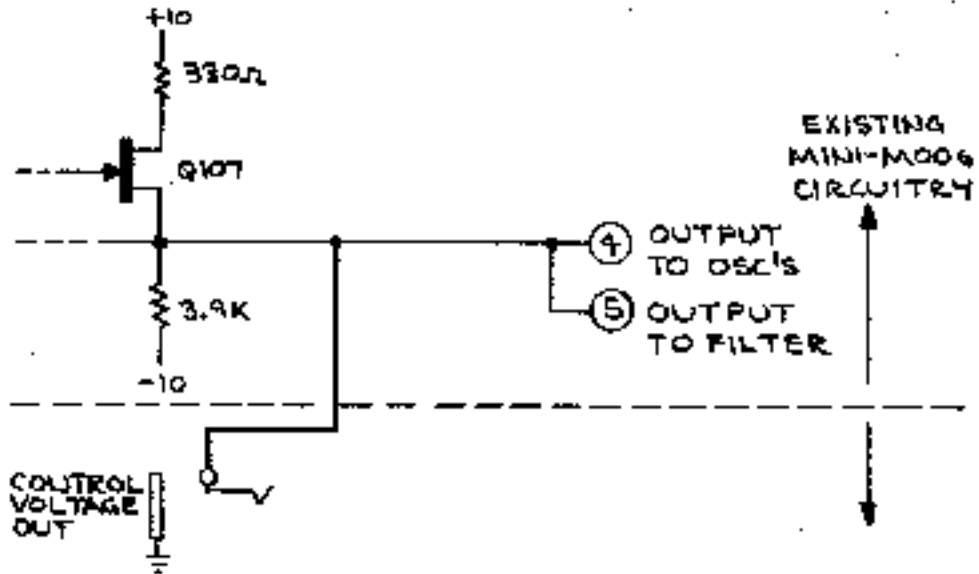
***** MINI-MOOG MODIFICATIONS *****

- 1) Expose electronic circuitry by removing metal cover held on by 18 sheet metal screws.
- 2) Looking at rear of Mini-Moog, remove right-hand printed circuit board (Board #1). Set aside temporarily.
- 3) Remove other right-hand printed circuit board (Board #2) which resides behind Board #1.
- 4) Install a phone jack (such as Switchcraft #11) just left of the jack labeled "LOUDNESS EXTERNAL CONTROL INPUT". Label this jack "CONTROL VOLTAGE OUT".
- 5) On Board #2, solder a 14-inch wire to the etching point shown in the Figure.
- 6) Solder the other end of this wire to the Jack you just installed.
- 7) Connect the ground terminal of the new jack to the ground terminal of an adjacent jack.
- 8) Replace both printed circuit boards and the metal cover.

MINI-MOOG
BOARD #2



FIGURE



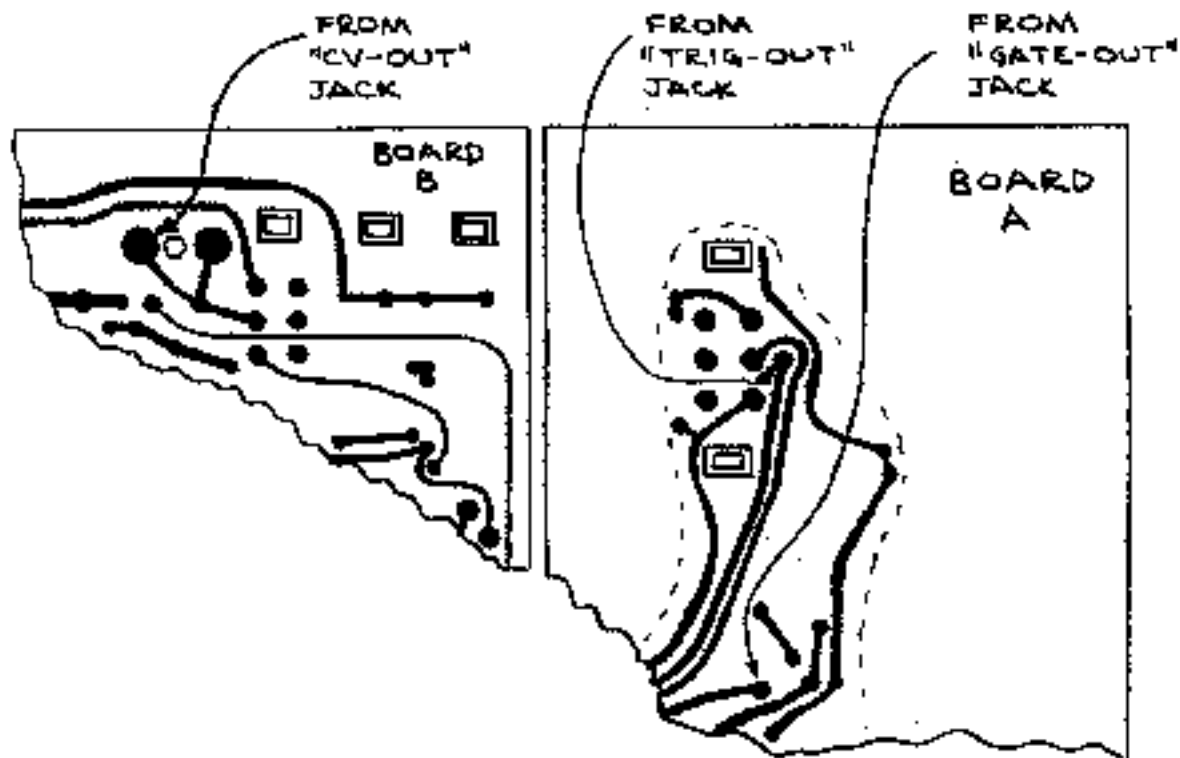
2-15-75

SCHMATIC

MINI-MOOG
MODIFICATION
FOR USE WITH
OBERHEIM
EXPANDER MODULE

***** ODYSSEY MODIFICATIONS *****

- 1) Remove Odyssey plastic bottom to expose circuitry.
- 2) Drill three 1/4" holes and install three mini-jacks (such as Switchcraft # 142A) between the jack labeled "High Level" and the side of the Odyssey. Position these holes toward the bottom flange so that the jacks do not interfere with the Odyssey circuitry.
- 3) Label the mini-jacks:
"CY-OUT"
"GATE-OUT"
"TRIG-OUT"
- 4) Wire the jacks to the appropriate circuit points by referring to the diagram.
- 5) Replace the plastic bottom.



FIGURE

2-15-75

ODYSSEY
 MODIFICATIONS
 FOR USE WITH
 OBERHEIM
 EXPANDER MODULE

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Electronics
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