

**Service
Manual**

OBSX

**Polyphonic
Synthesizer**

PRELIMINARY

**First Edition
November 1980**

**Oberhelm Electronics, Inc.
1455 19th Street
Santa Monica, CA 90404**

OB-SX TEST PROCEDURE (FIELD-SERVICE APPENDMENT)

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This procedure will enable the technician to test and calibrate the following functions:

- 1-Power supply
- 2-Control/Processor
- 3-Voice cards
- 4-Mother board (output VCA)

Equipment required:

Digital voltmeter (DVM) -4 1/2 digits
Strobe Tuner
Audio amplifier with speaker or headphones

POWER SUPPLY TEST

- 1- +5V ;used for digital I.C's
- 2- +12V ;used for EPROMS only
- 3- -5V ;used for EPROMS and voice cards
- 4- +15V ;used for analog I.C's and voice cards
- 5- -15V ;used for analog I.C's, VCA on voice cards and mother board output section
- 6- +5.6V;used for pots and sample/holds, it is developed by a voltage divider using the +15 V supply
- 7- -10V ;used for the 4053 I.C's which switch modulation parameters, it is developed by a voltage divider using the -15 V supply

Two voltages are adjustable, they are the +15V and -5V.

ADJUSTMENT

Attach the DVM ground lead to pin 5 of connector E, then monitor the voltage at pin 3 of connector D; turn trimmer labeled +15 (near 723 regulators) to obtain +15.000V +/- 20mV. Monitor the voltage at pin 7 of connector D; turn the trimmer labeled -5 (near 723 regulators) to obtain -5.000V +/- 20mV.

VERIFICATION

The 5 remaining voltages are not adjustable. However they are checked to be within spec. Three voltages (-15, +5, +12) are developed by 3 terminal regulators. They have a +/-5% tolerance. See the "Quick Spec Sheet" for figures. The input voltage to the +5 and -15 regulators is provided directly from unregulated DC. The +12 is developed by using double regulation techniques. The first stage is provided by the +15V supply. Therefore if the +15V supply is not functioning or is below +14.0V the +12V regulator will not function properly. The -10V and the +5.6V supplies have a 10% tolerance. Verify the -10V supply by monitoring the voltage at pin 7 of I.C. A24 (4053) on the control board. Verify the +5.6V supply by monitoring the voltage at pin 16 of I.C. A44 (4051).

CONTROL/PROCESSOR BOARD CALIBRATION

The control board requires adjustment of 10 trimmers for proper operation. They are described below:

- T8 -DAC offset
- T9 -DAC full scale
- T4 -Bend offset
- T1 -Bend up octave (broad)
- T2 -Bend down octave (broad)
- T3 -Bend whole step (narrow)
- T5 -Transpose center octave
- T6 -Transpose up octave
- T7 -LFO rate
- T10 -Portamento amount

DAC CALIBRATION AND LINEARITY TEST

Using a DVM, monitor KEYCV1 at pin 1 of connector C on voice 1. depress key C0 and adjust trimmer T8 so that KEYCV1 is 0.000V +/-2mV. Depress key C4 and adjust trimmer T9 so that KEYCV1 is 4.000V +/-2mV. Depress key C1 and note this voltage, it equals 1.000V +/-3mV. Depress key C2 and note this voltage, it equals 2.000V +/-3mV. Depress key C3 and note this voltage, it equals 3.000V +/-3mV. Each octave shouldn't vary more than +/-3mV for a 1 Volt/Octave scale.

BEND CIRCUIT CALIBRATION

Set the switches on the Bend assembly as follows:

- Up Octave/Down Octave - Down Octave
- Narrow/Broad - Broad
- VCO2 Only/Both - Both

Monitor the voltage at pin 1 of IC.A1 (LM324), and adjust trimmer T4 for 0.000V +/- 10mV.

Measure the VCO1 frequency control voltage, VCO1F, at pin 10 of connector D. This voltage, which should be 0.000V +/- 25mV, is the Bend pot offset voltage. This voltage must be added to (or subtracted from) the voltages stated for the following adjustments;

Move the bend lever fully towards the front of the unit, and adjust trimmer T1 for 1.000V +/-2mV (+/- offset).

Move the Bend lever fully towards the rear of the unit, and adjust trimmer T2 for -1.000V +/-2mV (+/- offset).

Set the Narrow/Broad switch to Narrow, move the Bend lever fully to the front, and adjust trimmer T3 for +0.167V +/- 2mV (+/- offset).

Set the Octave switch to its center position, and adjust trimmer T5 for 1.000V +/-2mV (+/- offset).

Set the octave switch to its Up position, and adjust trimmer T6 for 2.000V +/-2mV (+/- offset).

LFO CALIBRATION

Select program B6. While holding down any key, adjust trimmer T7 for a LFO rate of 6 to 8 Hz.

PORTAMENTO CALIBRATION

Turn Unison on, depress key C0, then turn portamento pot to maximum (full CW). Depress key C1 and listen for the amount of portamento; i.e., the period of time it takes the oscillators to change from one pitch to the next. Repeat this procedure of listening for the amount of portamento at each octave (C2, C3, C4) while adjusting trimmer T10 until the amount of portamento is approximately 3 to 5 seconds per octave.

VOICE CARD CALIBRATION

Refer to the "Voice Card Replacement and Calibration Procedure".

MOTHER BOARD CALIBRATION

Set the front panel volume pot to 2 o'clock. Hold down the Auto-Tune switch, and while listening to the output, adjust the trimmer on the mother board for minimum loudness of the "thump".

THE QUICK SPEC SHEET

POWER SUPPLY

Connector	Voltage	Tolerance
D1	-15.000	+/-750mV
D2	ground	
D3	+15.000	+/- 20mV
D4	+5.000	+/-250mV
D5	key	
D6	+12.000	+/-600mV
D7	-5.000	+/- 20mV
E1	-15.000	+/-750mV
E2	key	
E3	+15.000	+/-750mV
E4	+15.000	+/-750mV
E5	ground	
E6	ground	
E7	-5.000	+/- 20mV
E8	-5.000	+/- 20mV

CONTROL/PROCESSOR BOARD

Trimmer	Spec	Tolerance
T8	+0.000V	+/- 2mV (DAC offset)
T9	+4.000V	+/- 2mV (DAC full-scale)
T4	0.000V	+/-10mV (bend offset)
T1	+1.000V	+/- 2mV (up-bend)
T2	-1.000V	+/- 2mV (down-bend)
T3	+0.167V	+/- 2mV (narrow-bend)
T5	+1.000V	+/- 2mV (center-octave)
T6	+2.000V	+/- 2mV (up-octave)
T7	6 to 8Hz	(LFO range is .1Hz to 20Hz)
T10	3 to 5 sec/octave	(portamento)

OSCILLATOR TUNING

Auto-Tune at note C4; No more than 2 'beats' per second.

VPO; Any OSC not to vary more than 4 Cents at any octave below C4.

Hi-Track, At octave 6, no more than 4 Cents from C4.

FILTER TRACKING

Must track the keyboard from C2 to C4

VCO1F-VCO2F VARIANCE

No more than 3 'beats' per second for any position of the Narrow/Broad or OSC2 Only switch.

VOICE CARD REPLACEMENT AND CALIBRATION PROCEDURE

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This document describes the procedure for calibrating voice cards in the OB-SX. The following equipment is necessary:

Strobe Tuner
Audio amplifier with speakers or headphones
Oscilloscope (optional)

VOICE CARD REPLACEMENT AND DIP SWITCH FUNCTION

With AC POWER OFF, install new voice card(s). Close the cover, turn on the power, and wait 15 minutes to allow the unit to warm up. Do not press auto-tune.

Open cover and locate the DIP switch on the P.C. board holding the front panel program select switches. The 8 positions on the switch follow:

Positions 1 through 6 are for voice selection (I.E. position 1= voice 1, position 2= voice 2, and so on). If the switch is up (on) that voice is enabled. For a 4 voice unit positions 1 through 4 are up, 5 and 6 are down. For a 6 voice unit positions 1 through 6 are up. Positions 7 and 8 are for calibrating. Their function follows:

7 up, 8 up normal operation
7 up, 8 down VCO1 on, VCO2 off
7 down, 8 up VCO1 off, VCO2 on
7 down, 8 down VCO1 on, VCO2 on; auto-tune disabled

When any combination of 7 or 8 is down the unit is affected as follows:

No modulation to any parameter

Waveform=pulse; the duty cycle is dependent on the voltage (pulse width C.V.) on connector B3 and B4 of the voice cards. This will vary according to the program selected. Therefore when setting the pulse width it is important the voltage on connector B3 and B4 is 0.000V +/-20mV.

No Unison; Led on the unison switch lights but without the unison function.

To re-enter normal operation; 7 and 8 up, depress a program switch, depress auto-tune (don't press auto-tune until calibration is complete).

PRELIMINARY CONTROL SETTINGS

With the DIP switch turn off all the voice cards except the one to be calibrated.

Program A1
Octave switch (bend assembly), down octave
DIP switch 7 up, 8 down (VCO1 only)
Plug amplifier into the output jack
MASTER-TUNE, Center (dead zone)
VCO2 DETUNE, Center (LED off)

The following adjustments are performed at the factory and shouldn't require re-adjustment. However if the card doesn't sound correct, they should be performed. Refer to diagram #1 for trimmer locations.

PULSE WIDTH ADJUSTMENT

Adjust the pulse width trimmer for 50% duty cycle. If a oscilloscope is available, the voice output can be monitored at connector G2; if the adjustment is being made by ear, adjust for the most "hollow" sound.

INITIAL FREQUENCY ADJUSTMENT

Connect a strobe tuner to the output jack and set the strobe as follows:
Note - C
Cents- 0

Hold note C1 and adjust the initial frequency trimmer until the 1st octave scale stops.

VOLT/OCTAVE ADJUSTMENT

Hold note C2 and adjust VPO trimmer until the 2nd octave scale stops. Readjust initial trimmer at C1.

Hold note C3 and adjust VPO trimmer until the 3rd octave scale stops. Readjust initial trimmer at C1.

Hold note C4 and adjust VPO trimmer until the 4th octave scale stops. Readjust the initial trimmer at C1.

It will be necessary to repeat these adjustments a few times until proper tracking is obtained.

HI-TRACK ADJUSTMENT

Octave switch - center octave position

Hold note C4 and adjust the Hi-Trak trimmer until the 5th octave scale stops.

DIP switch - 7 down, 8 up (VCO2 only)

Repeat steps for VCO1, and adjust the trimmers for VCO2. See diagram #1 for locations.

INITIAL FREQUENCY ADJUSTMENT

DIP switch- positions 7 and 8 up
Select program A4 (electric piano)
Octave switch -center octave

With the DIP switch, turn a known good voice on (to be used as a reference) and the voice to be calibrated on.

Press note C3, while listening to the two voices (new card and the reference) alternately. Adjust the filter initial frequency trimmer until the new voice is the same timbre as the reference.

VOLT/OCTAVE ADJUSTMENT

Hold note C2 and again listening to the two voices alternately, adjust the Filter VFO trimmer until the new voice is the same timbre as the reference. Recheck the Initial Frequency adjustment, repeat if necessary.

VCA OFFSET ADJUSTMENT

Press key C3
DIP switch- 7 up, 8 down; Voice to be calibrated off
Install jumpers, See diagram #2
Turn volume to 3 o'clock

Turn VCA offset trimmer until a minimum amplitude of the tone is heard.

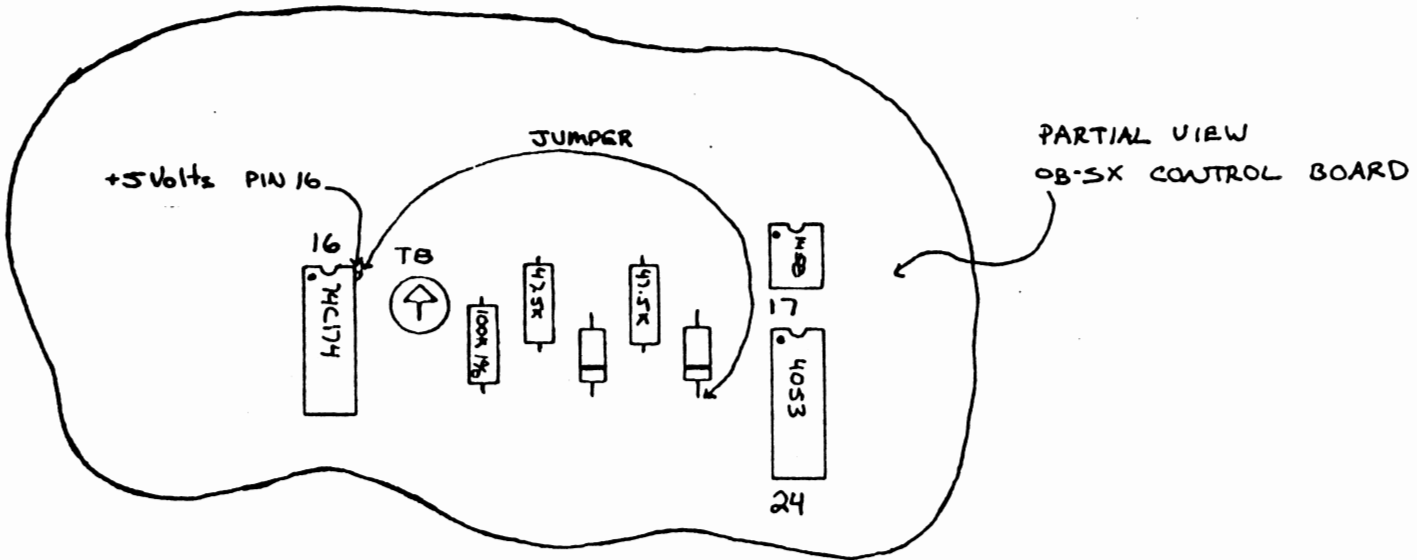
CONCLUSION

DIP switch 7 and 8 up; Voice selection as required
Remove jumper
Install screws in voice card
Close cover, reinstall retaining screws

DIAGRAM #2

OSCILLATOR SHUTOFF OB-SX

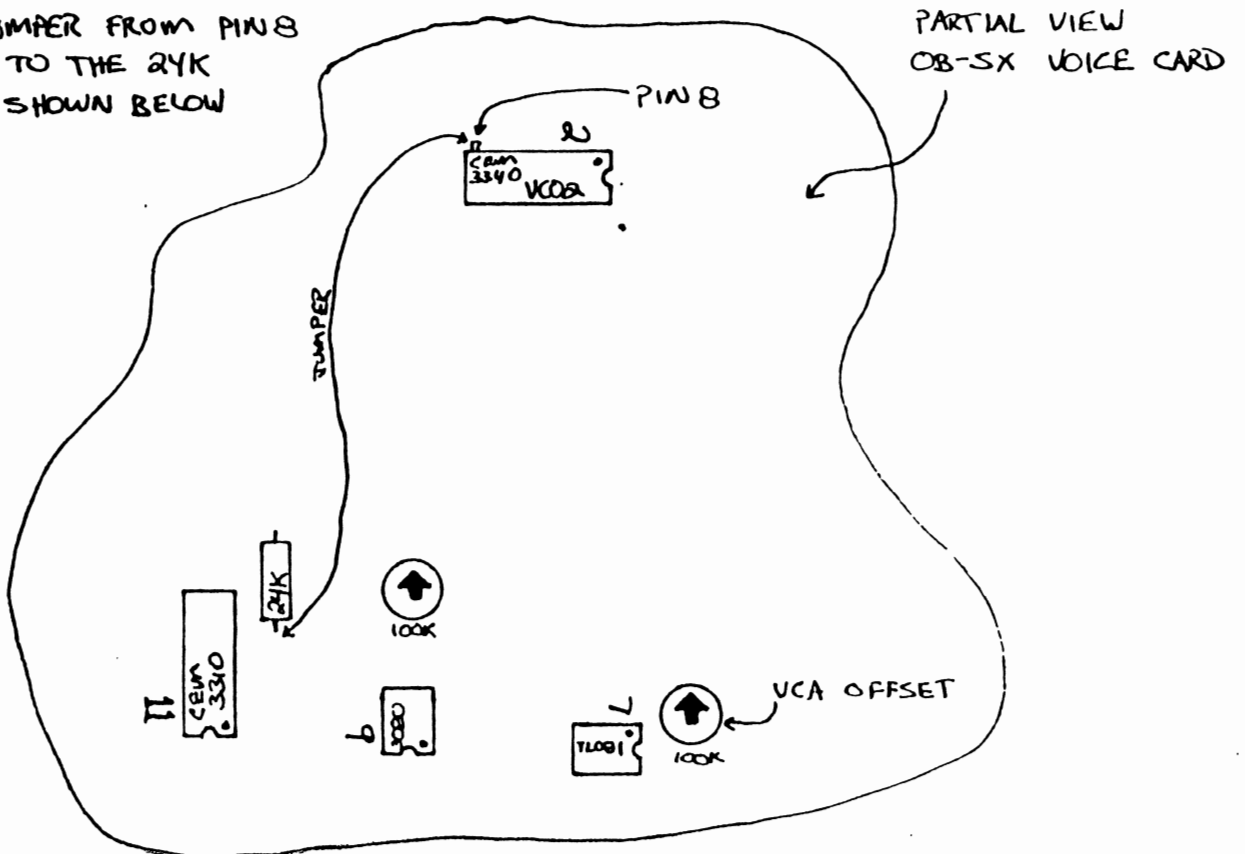
- VCA ADJUSTMENT -

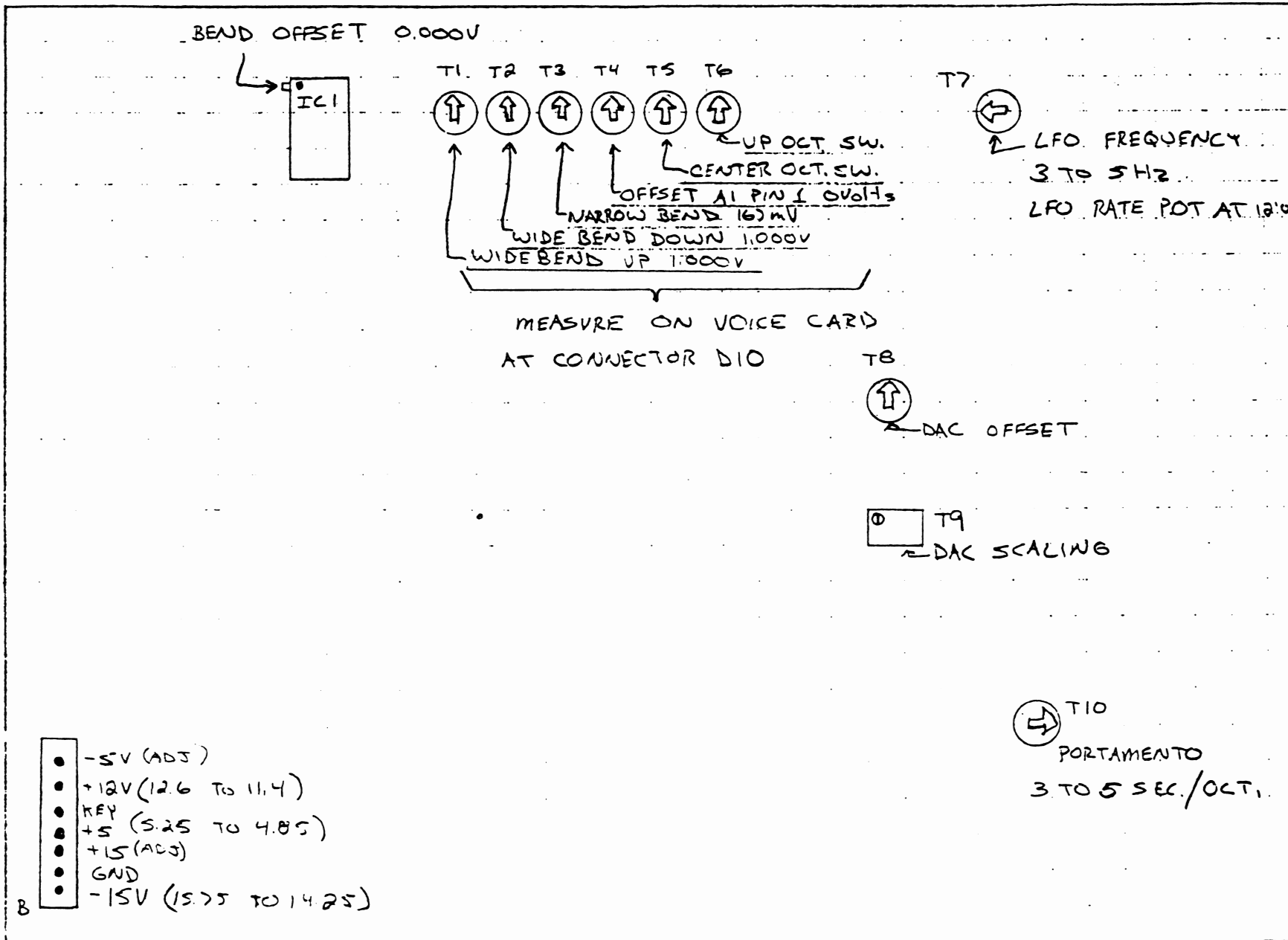


- INSTALL JUMPER FROM PIN 16 OF IC#16 TO CATHODE OF DIODE AS SHOWN ABOVE.

- DIP SWITCH, 7 up, 8 down

- INSTALL JUMPER FROM PIN 8 OF IC#2 TO THE 24K RESISTOR AS SHOWN BELOW

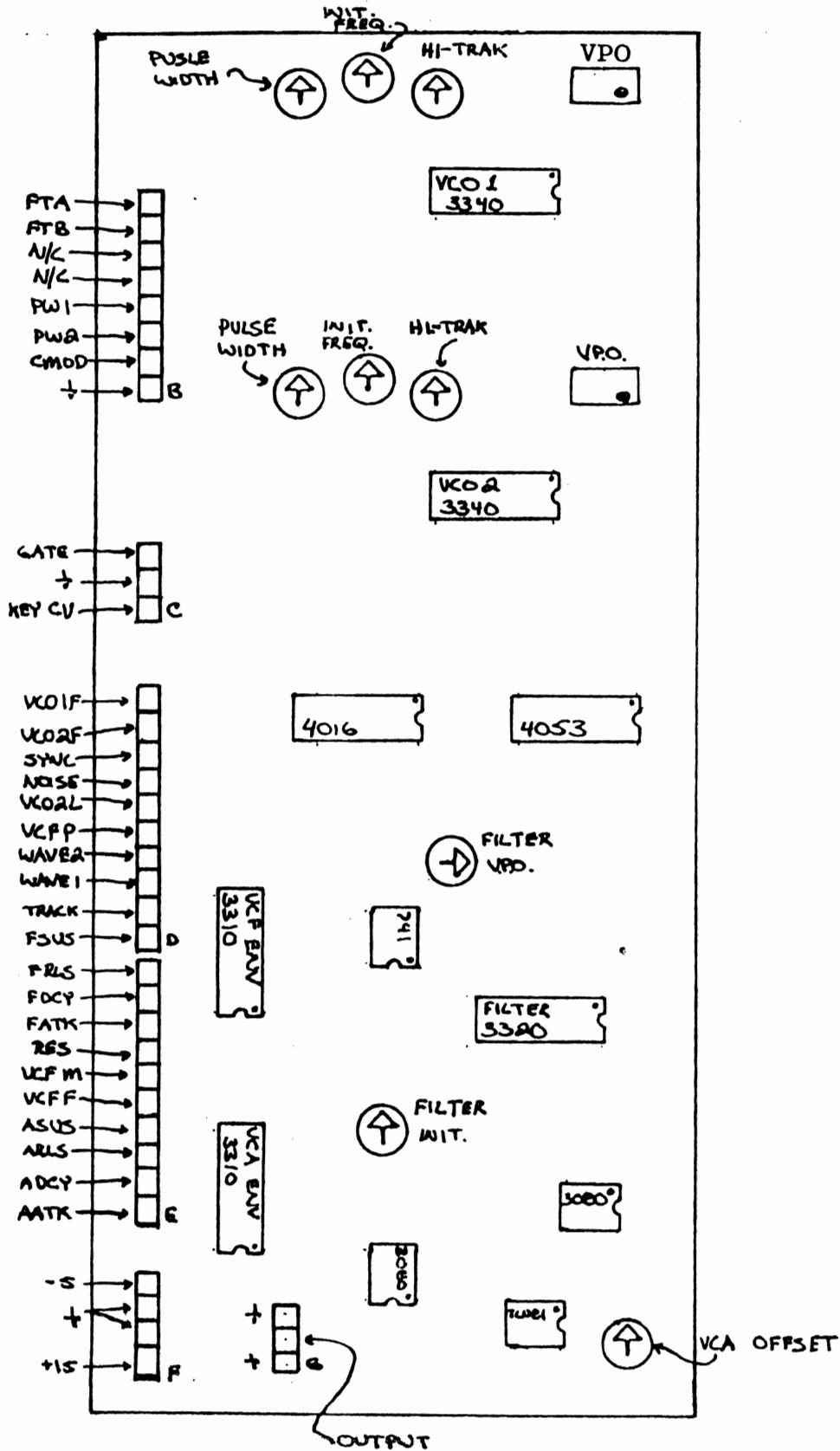




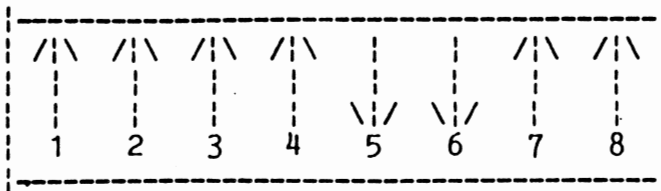
- B
- -5V (ADJ)
 - +12V (12.6 TO 11.4)
 - KEY
 - +5 (5.25 TO 4.85)
 - +15 (ADJ)
 - GND
 - -15V (15.75 TO 14.25)

DIAGRAM #1

OB-SX VOICE CARD
TRIMMER LOCATIONS



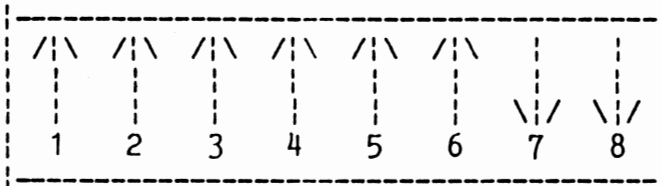
OB-SX DIP SWITCH OPERATION



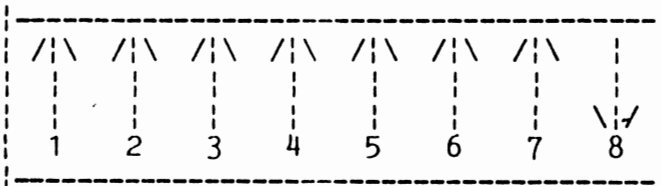
FOUR VOICE
AUTO-TUNE ENABLED



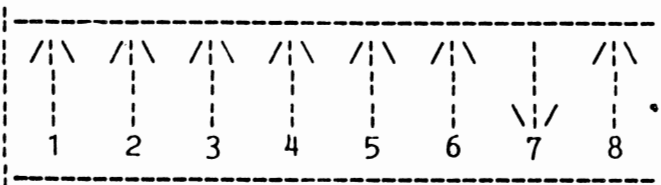
SIX VOICE
AUTO-TUNE ENABLED



SIX VOICE
AUTO-TUNE DISABLED

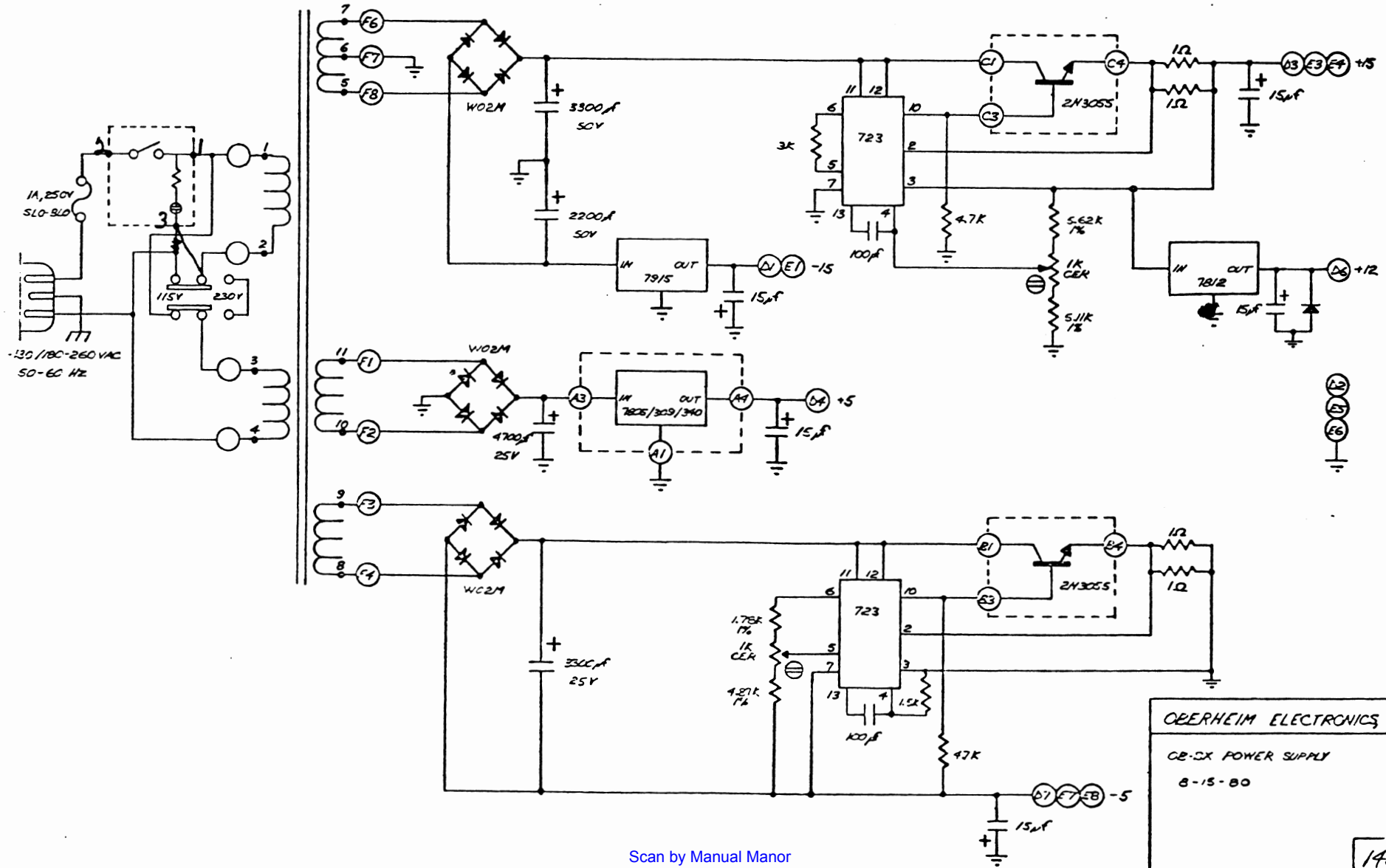


SIX VOICE
AUTO-TUNE ENABLED
OSCILLATOR 2 OFF

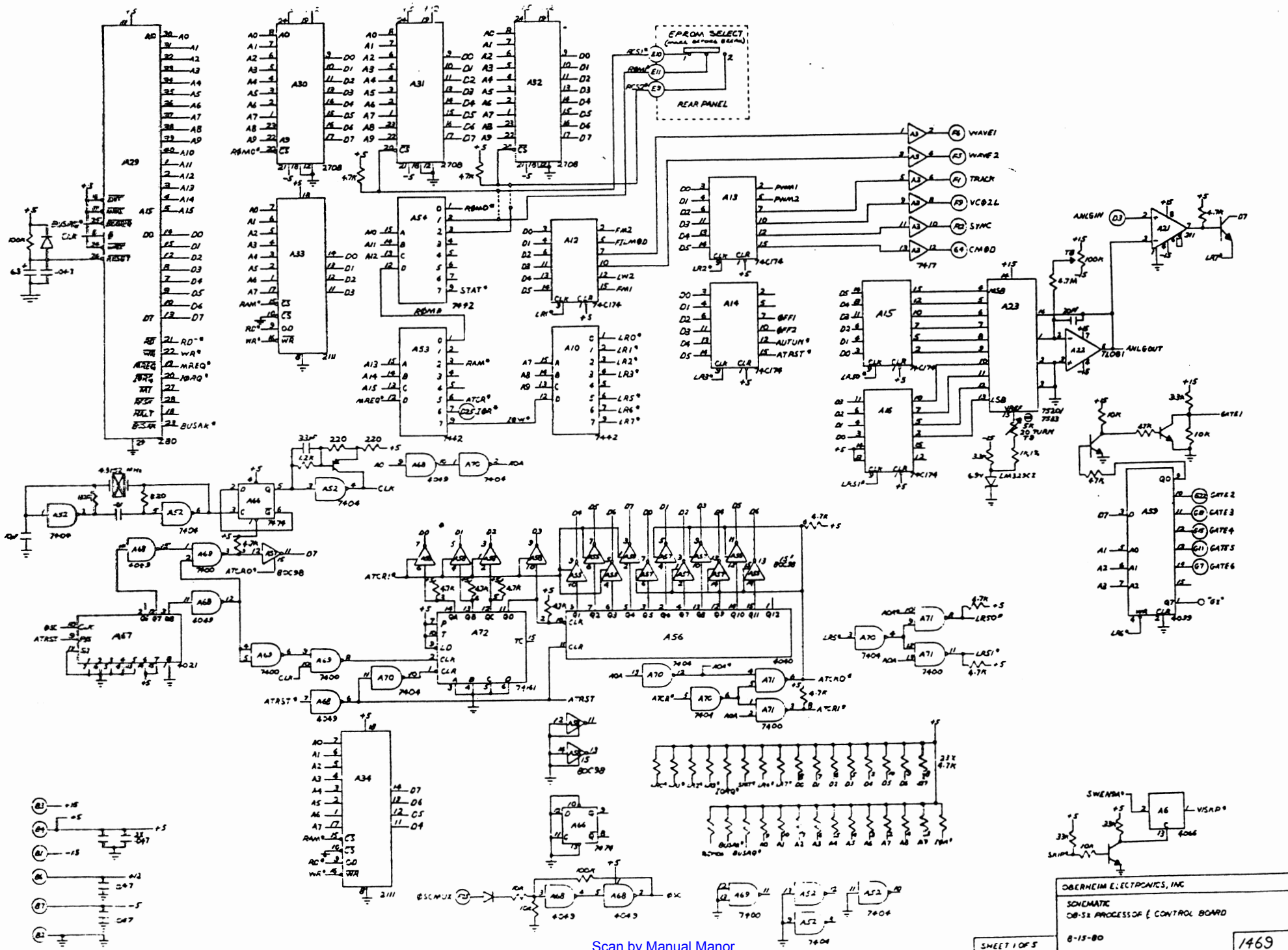


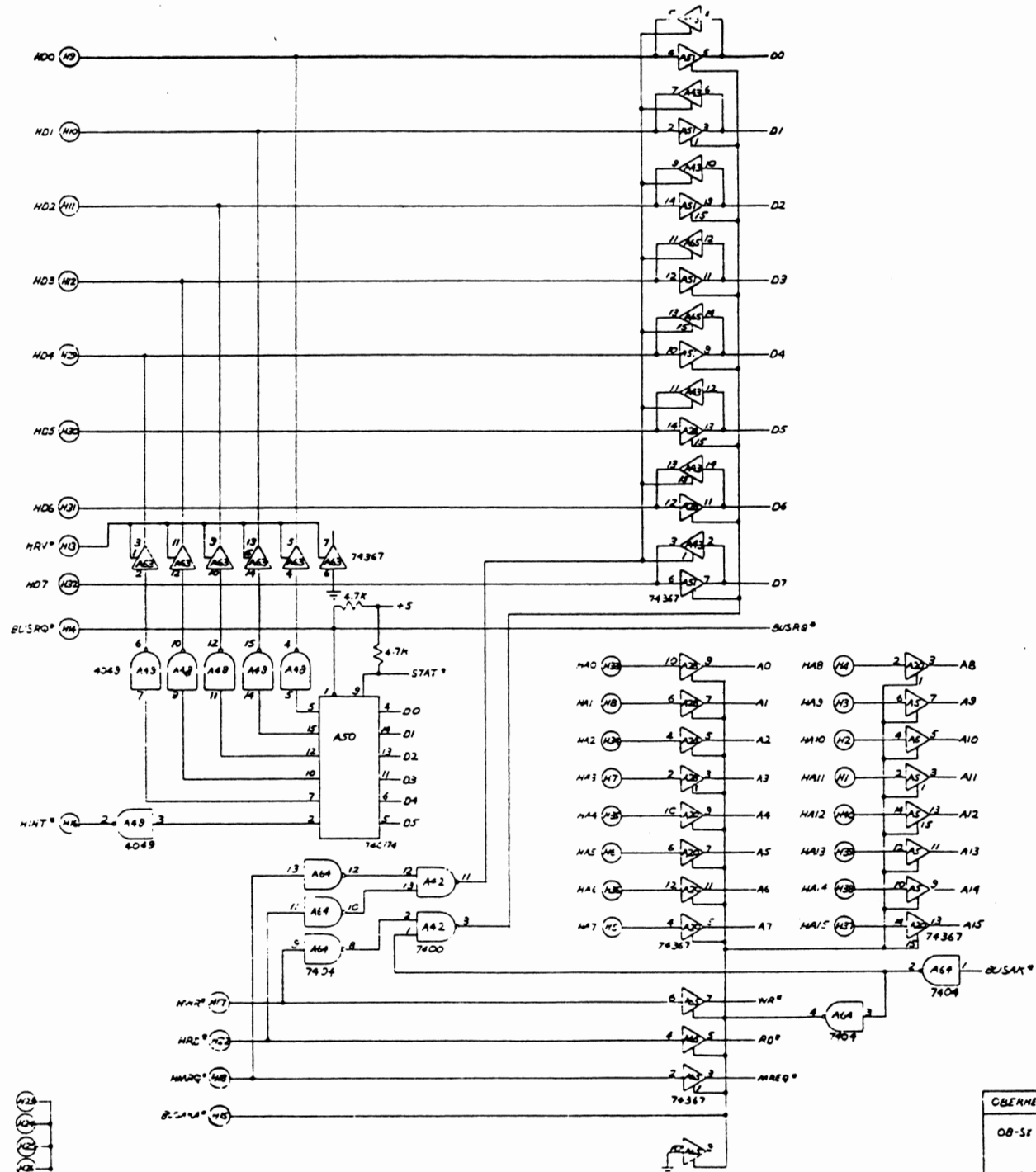
SIX VOICE
AUTO-TUNE ENABLED
OSCILLATOR 1 OFF

NOTE: WHEN EITHER SWITCH SEVEN OR EIGHT OR BOTH ARE
DOWN, ALL FREQUENCY AND PULSE WIDTH MODULATION
IS DEFEATED.

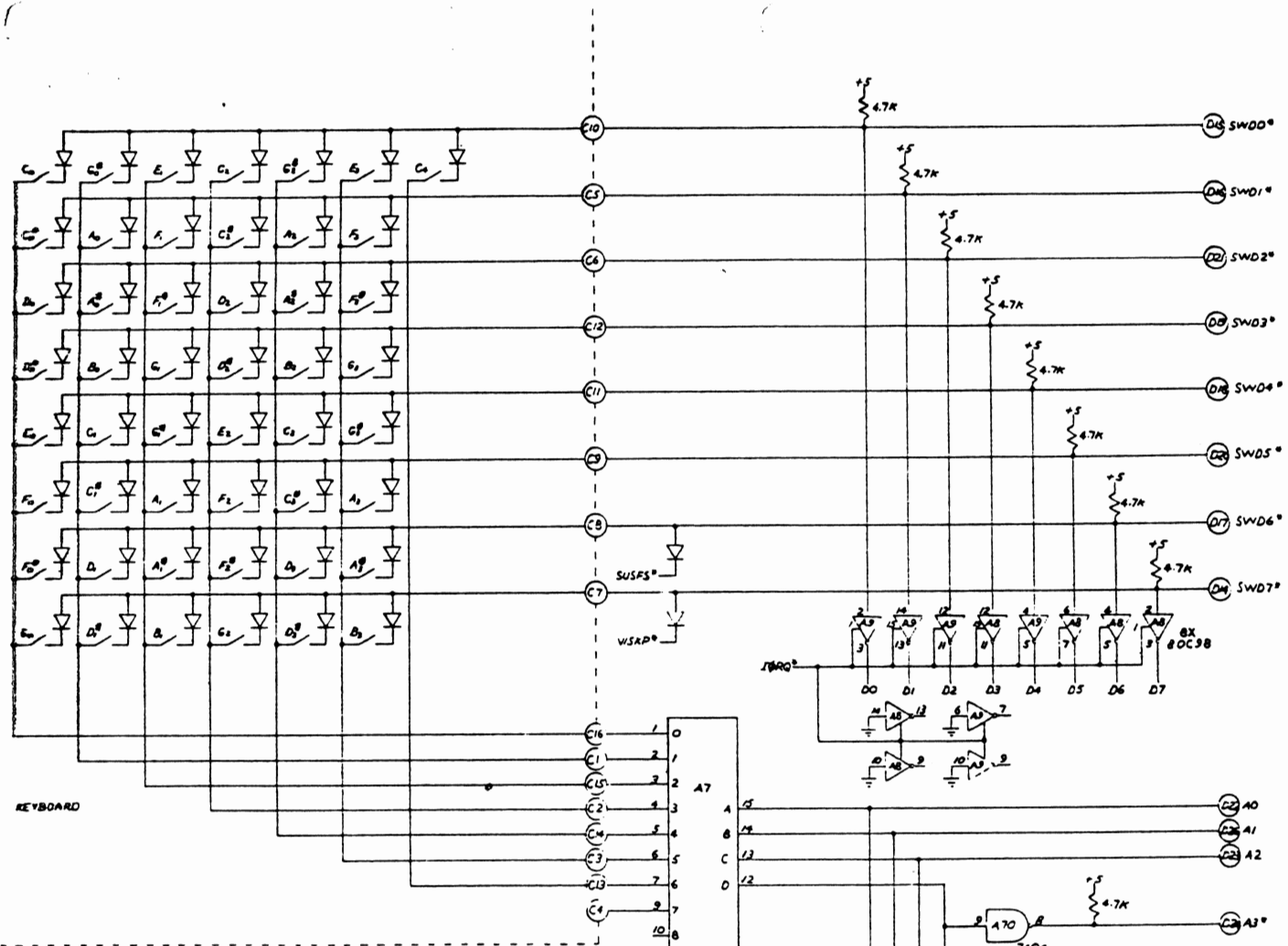


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 CE-SX POWER SUPPLY
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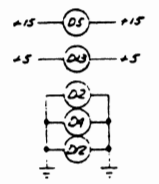
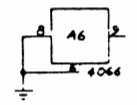
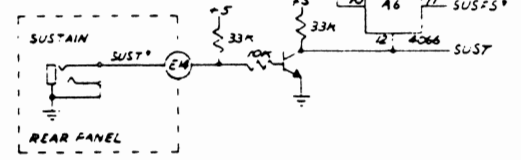
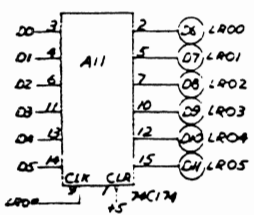




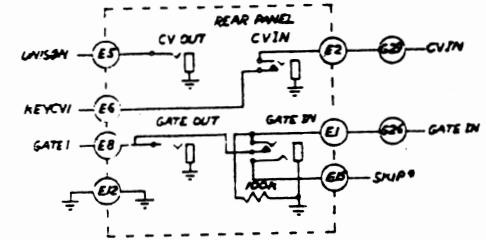
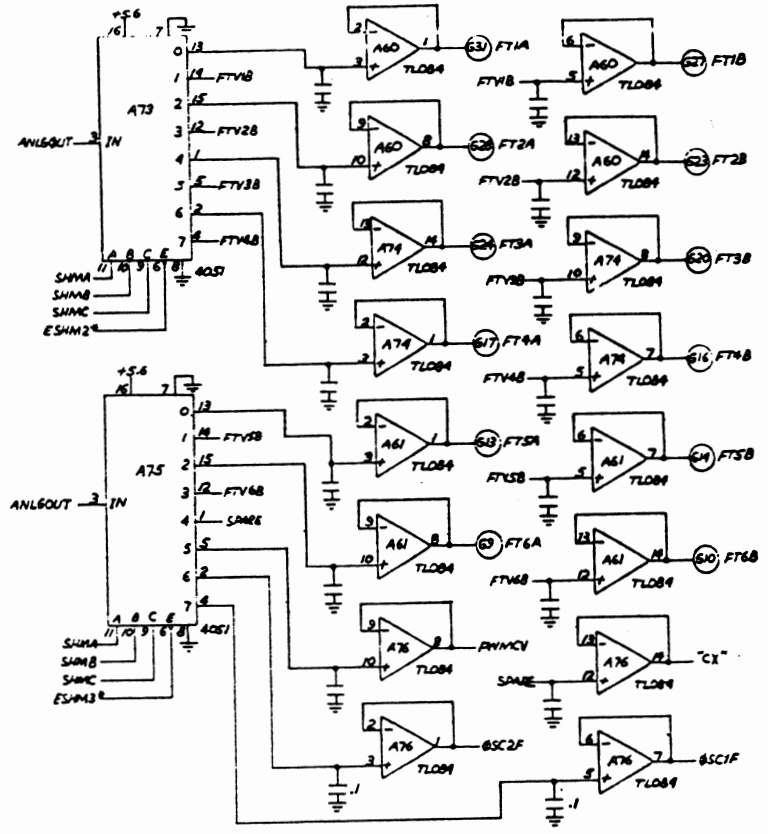
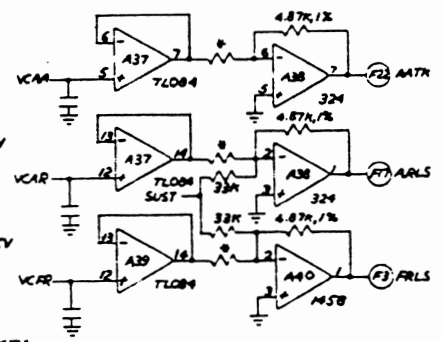
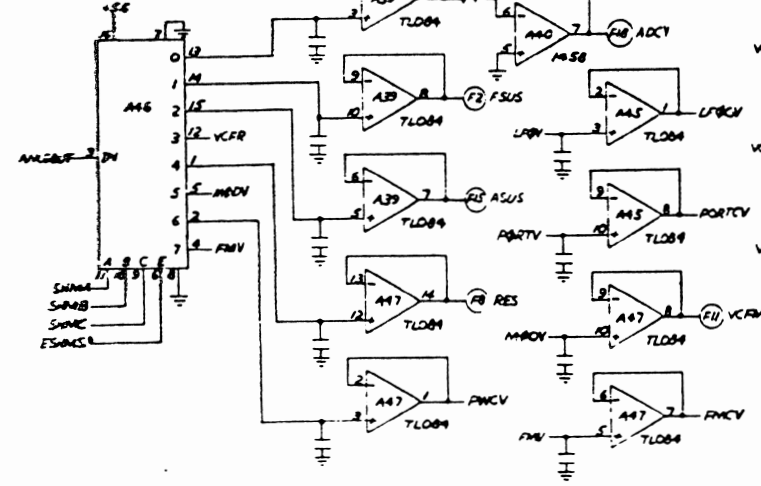
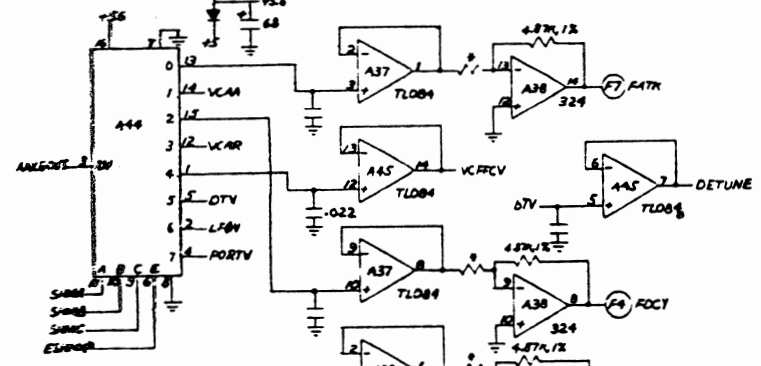
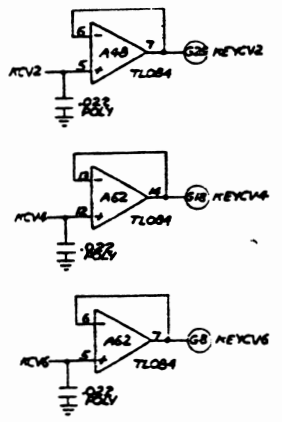
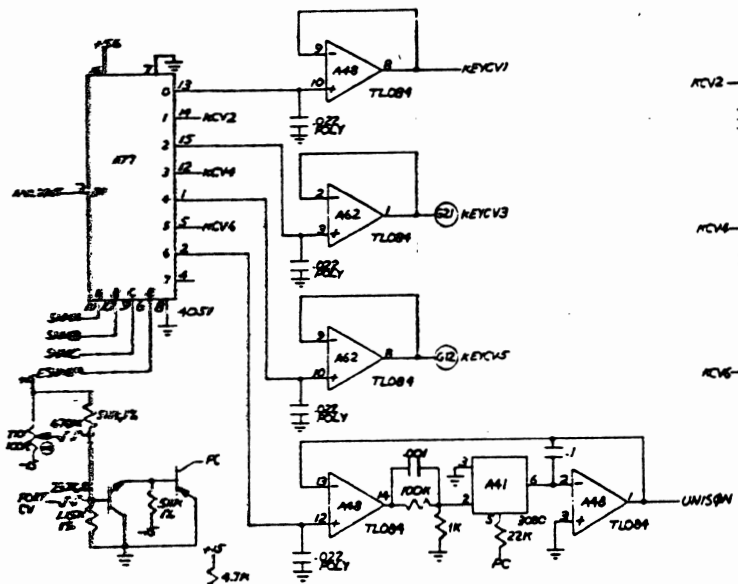
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 OB-SI PROCESSOR CONTROL BOARD
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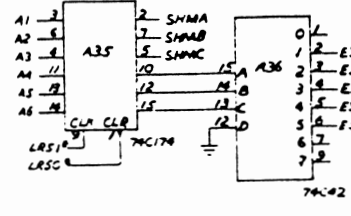
KEYBOARD



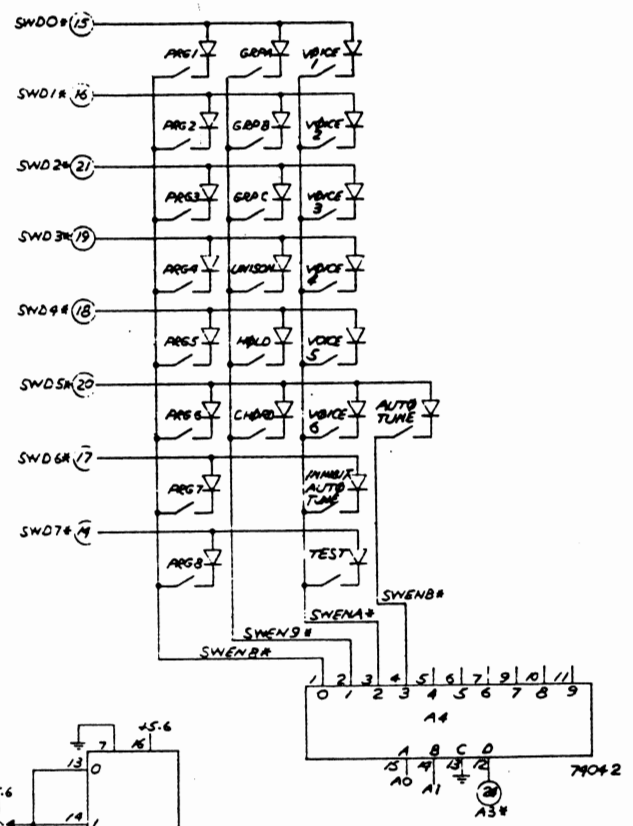
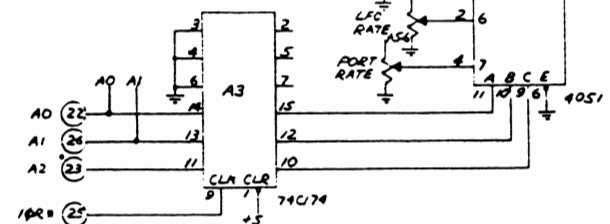
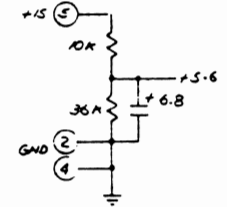
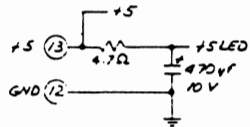
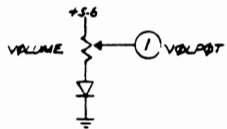
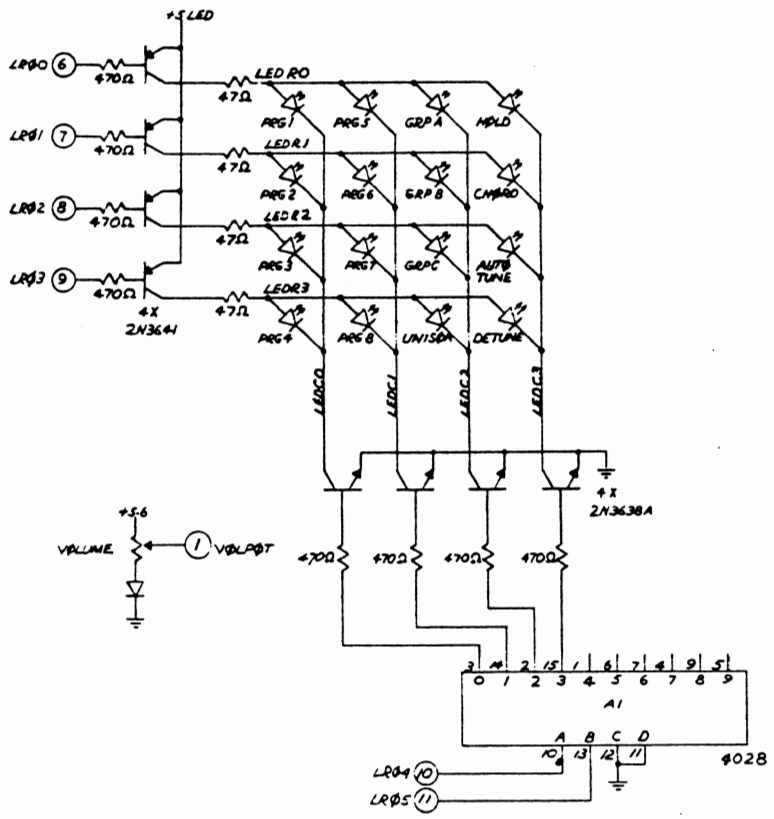
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 SCHEMATIC - CB-SX PROCESSOR &
 CONTROL BOARD
 B-15-80



- NOTES: UNLESS OTHERWISE SPECIFIED
- 1) ALL RESISTORS ARE 1/4W, 5%
 - 2) ALL RESISTORS DESIGNATED "R" ARE 100K, 1%
 - 3) ALL CAPACITORS ARE IN uF
 - 4) ALL UNMARKED CAPACITORS ARE .01 uF
 - 5) ALL NPN TRANSISTORS ARE MJE1572
 - 6) ALL PNP TRANSISTORS ARE 2N3905
 - 7) ALL DIODES ARE 1N4148

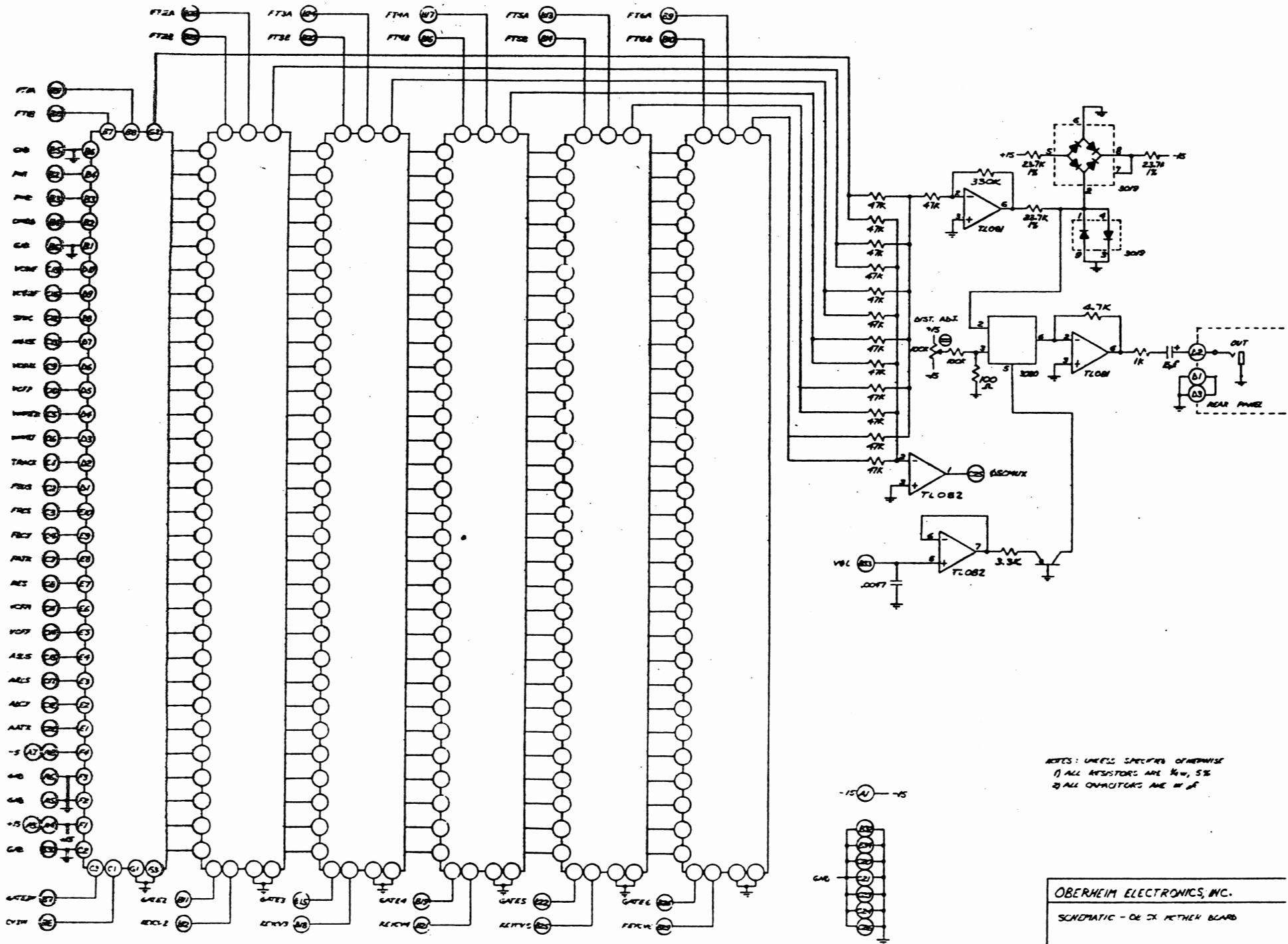


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 OB-SK PROCESSOR & CONTROL BOARD
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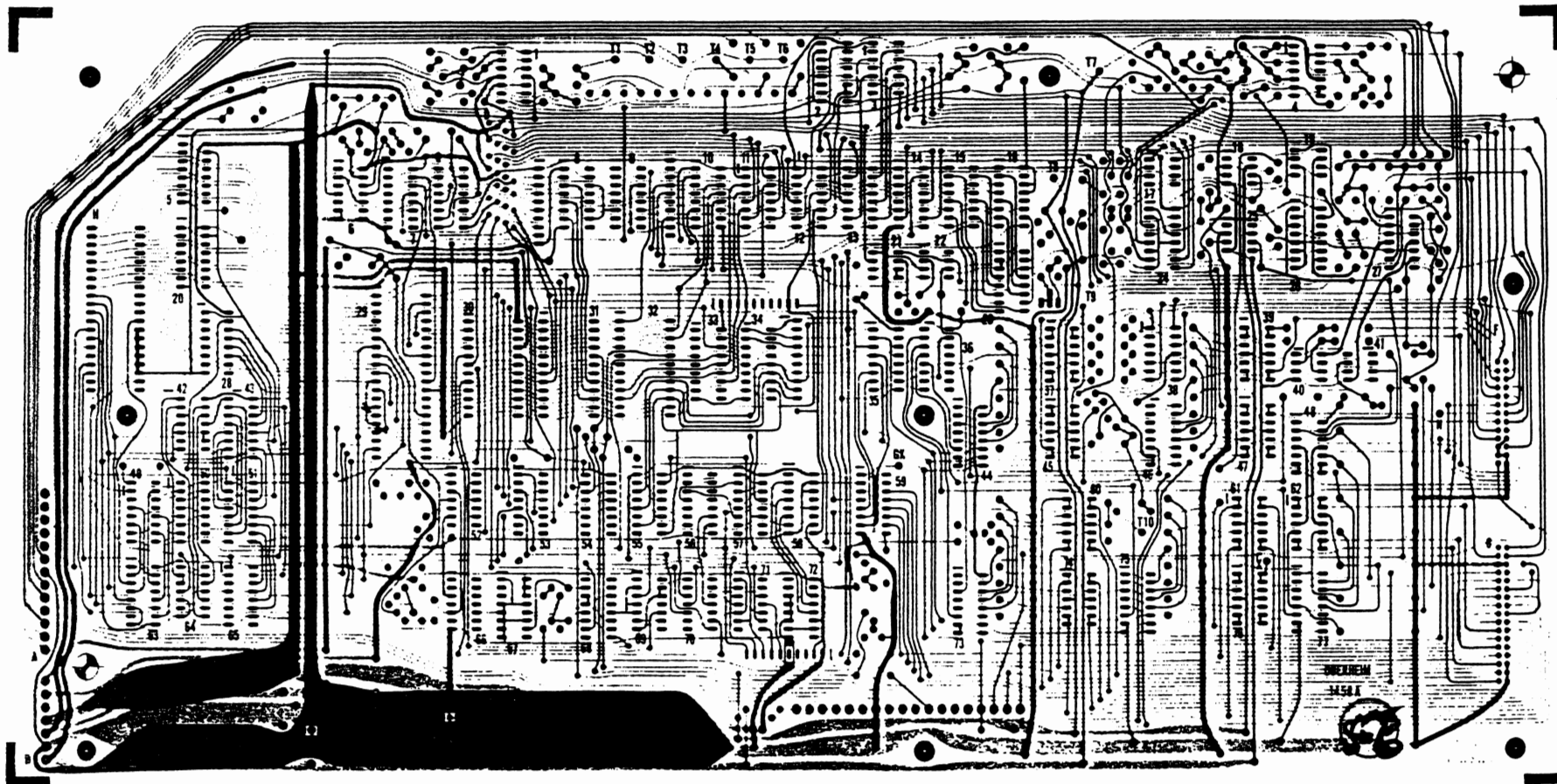
- NOTES - UNLESS INDICATED OTHERWISE
- 1) ALL RESISTORS ARE 1/4 W, 5%
 - 2) ALL CAPACITORS ARE IN uF
 - 3) ALL DIODES ARE 1N4148
 - 4) ALL POTS 50K LIN C/W

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 SCHEMATIC - OB-SX POT BOARD
 B-75-80 JR.
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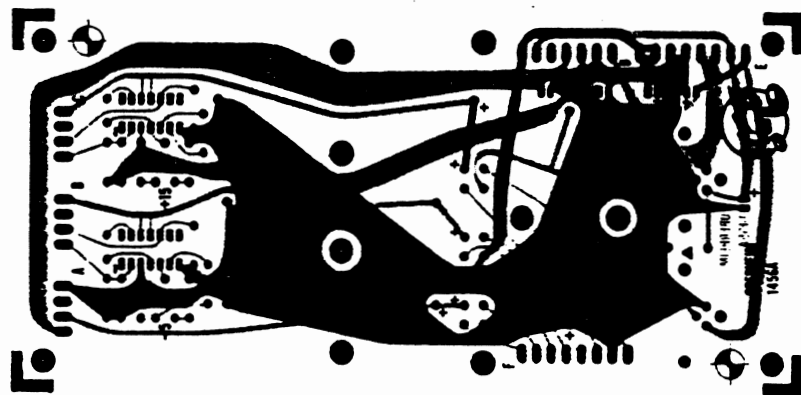


NOTES: UNLESS SPECIFIED OTHERWISE
 1) ALL RESISTORS ARE 1/4W, 5%
 2) ALL CAPACITORS ARE 100 pF

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 SCHEMATIC - DE OR MEMORY BOARD
 8-13-80



OBERHEIM ELECTRONICS, INC.		
SCALE	APPROVED BY	DRAWN BY
DATE		REV. 002
P.C. COMPOSITE - OBSX CONT/PROC BOARD		
		DRAWING NUMBER



OBERHEIM ELECTRONICS, INC.		
SCALE	APPROVED BY	DESIGNED BY
DATE		REVISED
P.C. COMPOSITE - OB-5X POWER SUPPLY		
		DRAWING NUMBER