

Service Manual

OB-X

Polyphonic Synthesizer

This manual applies to OB-X units with serial numbers 794801 and above. For servicing units with serial numbers prior to the above, refer to OB-X Service Manual, First Edition, September 1979.

**Second Edition
February 1980**

**Second Printing
June 1980**

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1455 19th Street
San Monica, Ca 90404**

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This is the second edition of the OB-X Service Manual. All Engineering Change Orders (ECO's) which were outstanding as of the date of this Manual have been incorporated on the affected drawings.

AUTO TUNE

The operation of the Auto Tune circuitry in the OB-X has been the subject of considerable confusion. As a result, the following description is included in order to assist service personnel in understanding and troubleshooting this portion of the circuitry.

The Auto Tune software sequentially tunes each oscillator in the unit by gating on one voice at a time and, using the OFF1* and OFF2* signals, forcing the pulse width of one of the oscillators to zero, thus effectively turning off that oscillator. The VCO1F and VCO2F control voltages are set to 0.0 v, KEYCV's are set to 4.0 v, and the Fine Tune voltages are initially set to mid-scale (2.667 v). The principal Auto Tune circuitry is located on the Processor Board (Drawing No. 1429, Sheet 1). This circuitry consists of a Schmitt trigger to square-up the input oscillator waveform, a shift register used as a counter to count two full cycles of the oscillator signal, and a 15-bit counter which times the period of those two cycles.

At the beginning of each Auto Tune computation the program generates Auto Tune Reset (ATRST*), which clears the 15-bit counter (A125 contains the 4 LSB's of the counter, and the remainder are in A116), and loads the parallel-load shift register (A120) with "1"s in bits 6 and 7 and "0"s in the other bit positions. After ATRST* is removed, the first positive transition of the oscillator signal (OSCMUX, which becomes OSC through the Schmitt trigger) clocks the shift register, thus shifting a "1" into bit 8. A "1" in bit 8 gates the system 2.4576 MHz clock to the 15-bit counter. On the next positive transition of OSC a "1" is again shifted into bit 8, but on the third positive transition a "0" is shifted into bit 8, which gates off the clock to the 15-bit counter. At this point the contents of the counter represent the period of two cycles of the input oscillator.

The program determines when the two cycles have been completed by testing bit 7 of the data bus (D7) at a particular address. From the time the shift register is initially loaded by ATRST* through the second positive transition of the oscillator, A122 pin 3 is held at a "1". After the third positive transition, however, A122-3 goes to a "0". A122-3 is enabled to D7 on the data bus when the program sends out the address represented by ATCRO*.

When the program has determined that A122-3 is "0" it reads the contents of the 15-bit counter. The program then uses this count value to compute an approximate Fine Tune voltage for the oscillator under test. After this voltage is set in the relevant Fine Tune Sample/Hold, another two cycle period measurement is made. This process of measuring two cycles then computing a Fine Tune voltage is repeated for each oscillator until the measured period is within a predetermined tolerance from the expected value. However, the process is repeated a maximum of only six times per oscillator, regardless of the period measurement. Any properly functioning oscillator will be brought into tolerance in less than six iterations, so any oscillator not in tolerance after six attempts is assumed to be defective and incapable of being tuned.

TEST SWITCHES

With the OB-X cover open you will find two large slide switches and a small module containing eight switches located on the Pot Board in the lower left-hand area of the inside of the cover. The large slide switches are labeled Test 2 and Test 1, and the eight-switch module is labeled Voices. The Test 2 switch is not functional at this time and it has no effect on the unit. Test 1, when in the Off (down) position, forces all of the Fine Tune voltages to the voice cards to mid-scale, thus disabling the effect of Auto Tune. This feature is used during calibration of the voice cards, which is described later in this Manual. Note: When Test 1 is again turned On, the Fine Tune voltages remain at mid-scale until the Auto Tune switch is depressed.

VOICES ENABLE SWITCHES

The switches in the module, which are numbered 1 through 8, enable and disable each of the eight possible voices. For normal operation switches 1 through 4, 1 through 6, or 1 through 8 should be On, depending on whether the unit is a four-, six-, or eight-voice unit, and the remaining switches should be Off. However, if one voice ceases to function for any reason, turning Off the corresponding switch will cause the unit to thereafter automatically skip the disabled voice, but to otherwise operate normally. As an example, if you have a six-voice unit and one of its voices fails, after turning Off the related switch you will have a fully functioning five-voice unit. Note: Because it does not make sense to have a unit with zero voices, a condition of all eight switches Off is interpreted as an eight-voice unit.

CONTROL BOARD CALIBRATION

This document describes the procedure for calibrating the OB-X Control board. The following equipment is required:

Digital voltmeter (DVM) - 4 1/2 digits minimum
Oscilloscope

Audio amplifier with speaker or headphones

(Note: Headphones may be plugged directly into the OB-X providing they are wired monophonically and have an input impedance of at least 600 ohms.)

This procedure makes reference to notes C0 through C5. C0 is low C on the keyboard, and C5 is high C. Refer to the Control Board and Voice Card Trimmer Placement Diagram for locations of trimmers to be adjusted.

Set the following front panel controls as indicated:

| | |
|----------------|----------------------|
| Manual | - On |
| Unison | - On |
| Portamento | - Minimum (full CCW) |
| VC01 Frequency | - Minimum (full CCW) |
| VC02 Frequency | - Minimum (full CCW) |
| VC02 Detune | - Center (LED off) |
| Master Tune | - Center |
| Volume | - As desired |

All voltage measurements should be referenced to ground at connector pin A8.

DAC CALIBRATION

Using the DVM, monitor KEYCV1 at connector pin M9. Depress key C0 and note the voltage; this is the offset voltage and it should be 0.000 v +/- 25 mv. Depress C1 and adjust trimmer T9 so that KEYCV1 is 1.000 v +/- 2 mv more than the offset voltage. Repeat this procedure for each octave (C2, C3, and C4) to obtain KEYCV1 voltages of 2.000 v, 3.000 v, and 4.000 v +/- 2 mv more than the offset.

BEND CIRCUIT CALIBRATION

Set the switches on the Bend assembly as follows:

| | |
|-----------------------|---------------|
| Up Octave/Down Octave | - Down Octave |
| Narrow/Broad | - Broad |
| VC02 Only/Both | - Both |

Monitor the voltage at pin 1 of the 324 IC at location A1, and adjust trimmer T4 for 0.000 v +/- 20 mv.

Measure the VC01 Frequency control voltage, VC01F, at connector pin N1. This voltage, which should be 0.000 v +/- 25 mv, is the Bend pot offset voltage. This offset voltage must be added to (or subtracted from) the voltages stated for the following Bend circuit adjustments; e. g., if the offset voltage is -20 mv, T1 would be adjusted for 0.980 v and T2 would be adjusted for -1.020 v.

Move the Bend lever fully towards the front of the unit, and adjust trimmer T1 for 1.000 v +/- 2 mv (+/- offset voltage).

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

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

Set the Octave switch to its center position, and adjust trimmer T6 for 1.000 v +/- 2 mv (+/- offset voltage).

Set the Octave switch to the Up position, and adjust trimmer T7 for 2.000 v +/- 2 mv (+/- offset voltage).

LFO RATE CALIBRATION

Set the LFO Rate pot to maximum (full CW). Observe the triangle wave with an oscilloscope at pin 7 of the 324 IC at location A11, and adjust trimmer T5 to obtain a period of 50 +/- 5 msec.

PORTAMENTO CALIBRATION

Depress key C0, then set the Portamento pot to maximum (full CW). Next, turn Unison Off, and depress key C1 once for each voice in the unit (for example, with a six-voice unit depress C1 six times) while listening for the amount of portamento on each voice; i. e., the period of time it takes the oscillators on each voice to change from one pitch to the next. Repeat this procedure of listening for the amount of portamento at each octave (C2, C3, C4, C5) while adjusting trimmer T8 until the amount of portamento is approximately 2 to 4 seconds on each voice. If necessary, you can work down the keyboard in one octave steps if T8 is not properly adjusted after you have reached C5. If you are unable to adjust T8 to get all oscillators within the 2 to 4 second range, exchange some of the 3080 IC's in the portamento circuits (locations A53, A55, A57, A59, A61, A63, A65, and A67). For example, try exchanging the 3080's for the voices which exhibit the shortest and longest portamento periods.

VOICE CARD REPLACEMENT AND CALIBRATION PROCEDURE

This document describes the procedure for replacing and calibrating voice cards in the OB-X. The following equipment is necessary for calibration:

- Digital voltmeter (DVM) - 3 1/2 digits minimum
- Oscilloscope (optional)
- Strobe tuner (optional)
- Audio amplifier with speaker or headphones
(Note: Headphones may be plugged directly into the OB-X provided they are wired monophonically and have an input impedance of at least 600 ohms.)

This procedure makes reference to notes C0 through C5. C0 is low C on the keyboard, and C5 is high C. Refer to the Control Board and Voice Card Trimmer Placement Diagram for locations of the trimmers to be adjusted.

VOICE CARD REPLACEMENT AND PRELIMINARY CONTROL SETTINGS

Locate the defective voice card, and replace it with a new card.

CAUTION: A.C. POWER MUST BE OFF DURING
CARD REMOVAL AND REPLACEMENT.

A defective card can be located by stepping through the voices, using the keyboard and with Unison Off, until the defective voice is gated on. The gate LED on the card identifies which voice is on.

With a new voice card installed, close the cover, turn on power, and wait 15 minutes to allow the unit to warm up. Plug the amplifier or headphones into the Left Output jack. Set the following switches and controls as indicated:

- Manual - On
- Unison - On
- Volume - As desired
- Master Tune - Center (dead zone)
- Test 1 - Off (Down)

Set the Pan pots on the Mother Board to full Left (full CCW) position for the new voice and for one known, calibrated voice to be used as a reference; set all other Pan pots to full Right. (Refer to the Power Supply & Mother Board Trimmer Placement Diagram for locations of the Pan pots.)

Two methods are described for VCO calibration--an audio method and a method which utilizes a strobe tuner. (Oberheim has used Conn and Peterson strobe tuners for the latter method; it is assumed that other makes can also be used.)

VCO1 CALIBRATION (AUDIO METHOD)

Initial Frequency Adjustment

Set switches and controls as follows:

| | |
|--|-------------------------|
| VCO1 | - On |
| VCO2 | - Off |
| VCO1 Waveform | - Pulse |
| VCO2 Waveform | - Pulse |
| VCO2 Detune | - Center (LED off) |
| Filter Frequency | - Maximum (full CW) |
| Loudness Sustain | - Center or more CW |
| Up/Down Octave | - Off (center position) |
| All other parameters not otherwise set - Full CCW or Off | |

Hold note C3 and adjust trimmer T4 until the frequency of the new voice is beatless with the reference voice.

NOTE: The following two adjustments, Volt/Octave and Hi-Track, are performed at the factory and normally do not require readjustment upon installation of the card in a unit. However, they should be performed if the voice does not sound right after the rest of the adjustment procedure has been performed.

Volt/Octave Adjustment

Hold note C0 and adjust trimmer T8 until the voice is beatless with the reference. Hold note C3 and determine if still beatless; if not, repeat the Initial Frequency adjustment (trimmer T4). It is sometimes necessary to repeat the Initial Frequency and Volt/Octave adjustments a few times in order to obtain proper tracking of the voice card to the keyboard.

Hi-Track Adjustment

Hold note C5 and adjust trimmer T5 until beatless. Recheck the Initial Frequency and Volt/Octave adjustments, and repeat if necessary.

Pulse Width Adjustment

Set the Pulse Width pot on the front panel to full CCW, and adjust trimmer T6 for a 50% duty cycle. If an oscilloscope is available, the voice output can be monitored at connector pin G2; if the adjustment is being made by ear, adjust T6 for the most "hollow" sound. (The reference voice can be eliminated during this adjustment by turning its Pan pot fully CW.)

VCO1 CALIBRATION (STROBE TUNER METHOD)

Initial Frequency Adjustment

All switches and controls are set the same as for the audio method, described above, except that the Pan pot for only the voice to be calibrated should be set to full Left, and all other Pan pots full Right. (The reference voice is not used.) Connect the strobe tuner to the Left Output jack, and set the strobe as follows:

Note - C
Cents - 0

Hold note C3 and adjust trimmer T4 until the 4th octave scale on the strobe appears stationary.

As explained above for the manual method, normally it is not necessary to readjust the Volt/Octave and Hi-Track trimmers when a card is installed in a unit; these adjustments need be performed only if the voice does not sound right after the remainder of the adjustment procedure has been performed.

Volt/Octave Adjustment

Hold note C0 and adjust trimmer T8 until the 1st octave scale on the strobe appears stationary. Repeat the Initial Frequency adjustment (trimmer T4); it may be necessary to alternate between the Initial Frequency and Volt/Octave adjustments a few times in order to obtain proper tracking of the voice card.

Hi-Track Adjustment

Hold note C5 and adjust trimmer T5 until the 6th octave scale on the strobe appears stationary.

Pulse Width Adjustment

The strobe tuner can not be used for the Pulse Width adjustment; refer to the audio method described above.

VC02 CALIBRATION

VC02 is calibrated by repeating either of the above procedures, with VC01 Off and VC02 On, and adjusting the following trimmers:

| | |
|-------------------|------|
| Initial Frequency | - T1 |
| Volt/Octave | - T7 |
| Hi-Track | - T2 |
| Pulse Width | - T3 |

FILTER CALIBRATION

Set the front panel controls and switches as follows:

| | |
|------------------|----------------------|
| VC01 | - Off |
| VC02 | - Off |
| Noise | - Full |
| KBD Track | - On |
| Filter Frequency | - Minimum (full CCW) |
| Modulation | - Minimum (full CCW) |
| Resonance | - Maximum (full CW) |

Initial Frequency Adjustment

Hold note C3 and, using the Pan pots to control the audio, listen to the two voices (new card and reference) alternately. Adjust trimmer T9 to tune the card being calibrated to the same pitch as the reference.

Volt/Octave Adjustment

Hold note C2 and, again listening to the two voices alternately, adjust trimmer T10 until the new voice is the same pitch as the reference. Hold note C3 and check the Initial Frequency adjustment; repeat these two adjustments as necessary. Hold note C4 and again adjust trimmer T10 until the two voices have the same pitch. Recheck the Initial Frequency at C3 and readjust as necessary. (Note: the filter will track the keyboard over only an approximately three octave range.

VCA OFFSET

With both oscillators off, gate the voice on (depress any key). Measure the voltage at pin 6 of the TL081 at location A17 with a DVM, and adjust trimmer T11 for 0.000 v +/- 10 mv.

CAUTION--AT THE CONCLUSION OF THIS PROCEDURE
BE SURE TO DO THE FOLLOWING:

TURN ON THE TEST 1 SWITCH (SET TO THE UP POSITION)

RETURN THE PAN POTS TO THEIR ORIGINAL POSITIONS

ON 6- AND 8-VOICE UNITS, RECONNECT THE CABLES TO
MOTHER BOARD NO. 2 AND REINSTALL THE RETAINING SCREWS

POWER SUPPLY CALIBRATION

This document describes the procedure for calibrating the OB-X Power Supply board. The only two voltages requiring calibration are +19 v and -19 v; all other voltages are developed by 3-terminal regulators having no adjustment capability.

Using connector pin F2 as the ground reference, monitor the voltage on pin F1 and adjust trimmer T102 for +19.0 v +/- 200 mv. Monitor the voltage at pin F4 and adjust trimmer T101 for -19.0 v +/- 200 mv.

The other voltages generated on the Power Supply board should also be checked to assure that they are within tolerance, as follows:

| | |
|----|--------------------|
| E1 | - 5.0 v +/- 250 mv |
| E3 | +12.0 v +/- 600 mv |
| E4 | + 4.8 v +/- 500 mv |
| E6 | + 5.0 v +/- 250 mv |
| E7 | +15.0 v +/- 750 mv |
| E9 | -15.0 v +/- 750 mv |

Note: Pin E4 should measure a minimum of 2.3 v with power off (this is the backup battery voltage for the program memory).

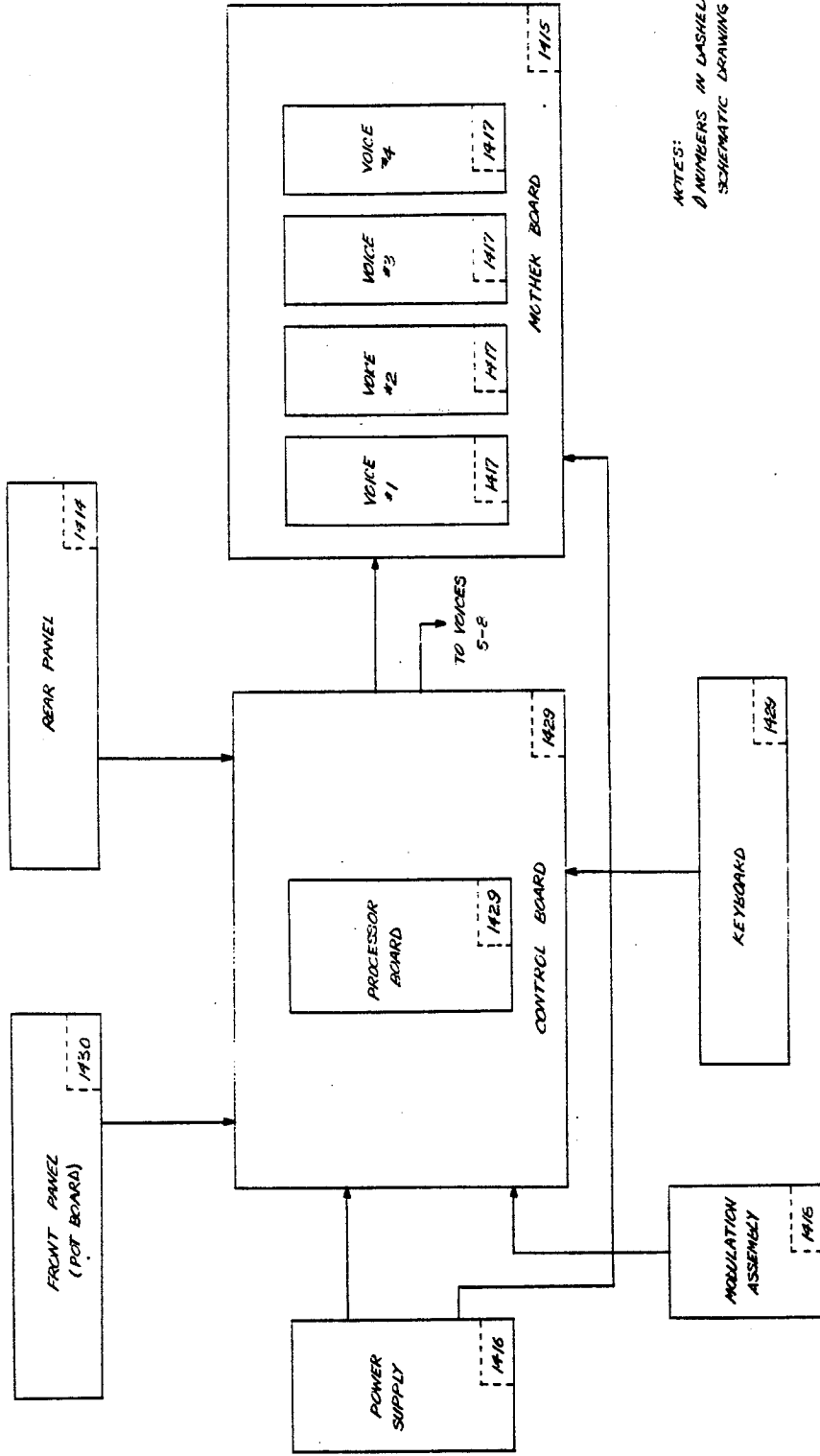
MOTHER BOARD CALIBRATION

This document describes the procedure for calibrating the OB-X Mother board. Calibration consists of adjusting the two distortion trimmers, T201 and T202. For this procedure the front panel Volume pot must be set to maximum (full CW), and no keys on the keyboard should be depressed.

Using a DVM, monitor the output (pin 6) of the final TL081 in the right channel and adjust trimmer T201 for 0.00 v +/- 20 mv. Repeat this procedure for the left channel, adjusting trimmer T202.

As an alternative, an audio method of calibration can be used. Plug an amplifier with a speaker or headphones into the Right Output jack, hold down the Auto Tune switch on the front panel, and adjust T201 for minimum loudness of the "thump". Repeat for the left channel.

CAUTION: WHEN USING THE AUDIO METHOD, THE VOLUME MUST BE SET AT A RELATIVELY LOW LEVEL. AT A HIGH VOLUME LEVEL THE "THUMP" CAN CAUSE DAMAGE TO THE SPEAKER OR HEADPHONES.



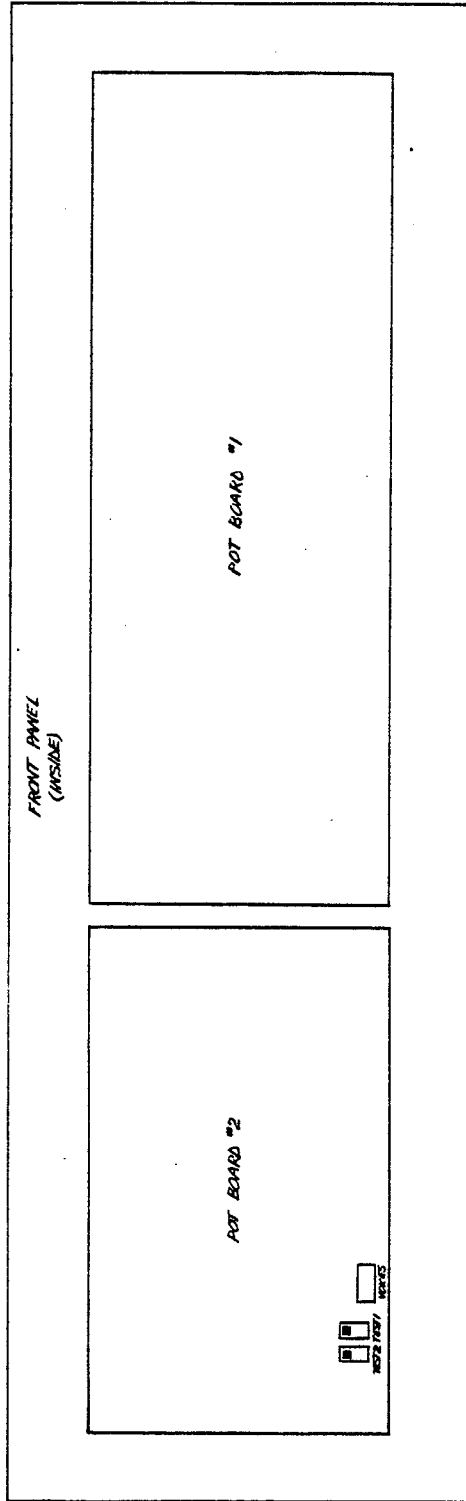
NOTES:
 Ø NUMBERS IN DASHED BLOCKS INDICATE
 SCHEMATIC DRAWING NUMBERS

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CB-X WIRING BLOCK DIAGRAM
 VERSION 2

9-7-79
 2-11-80

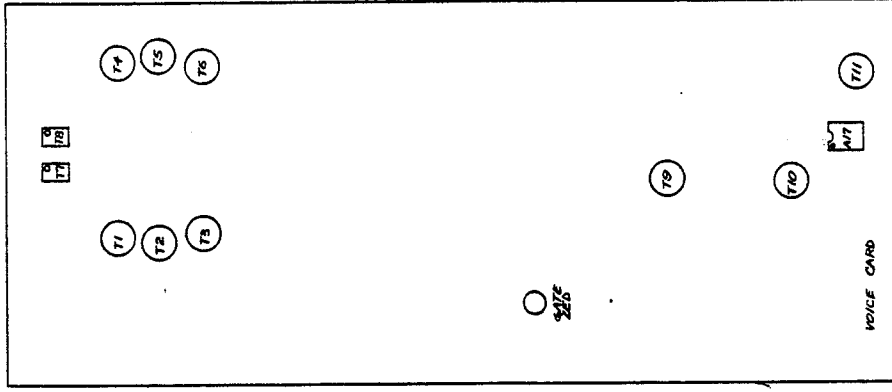
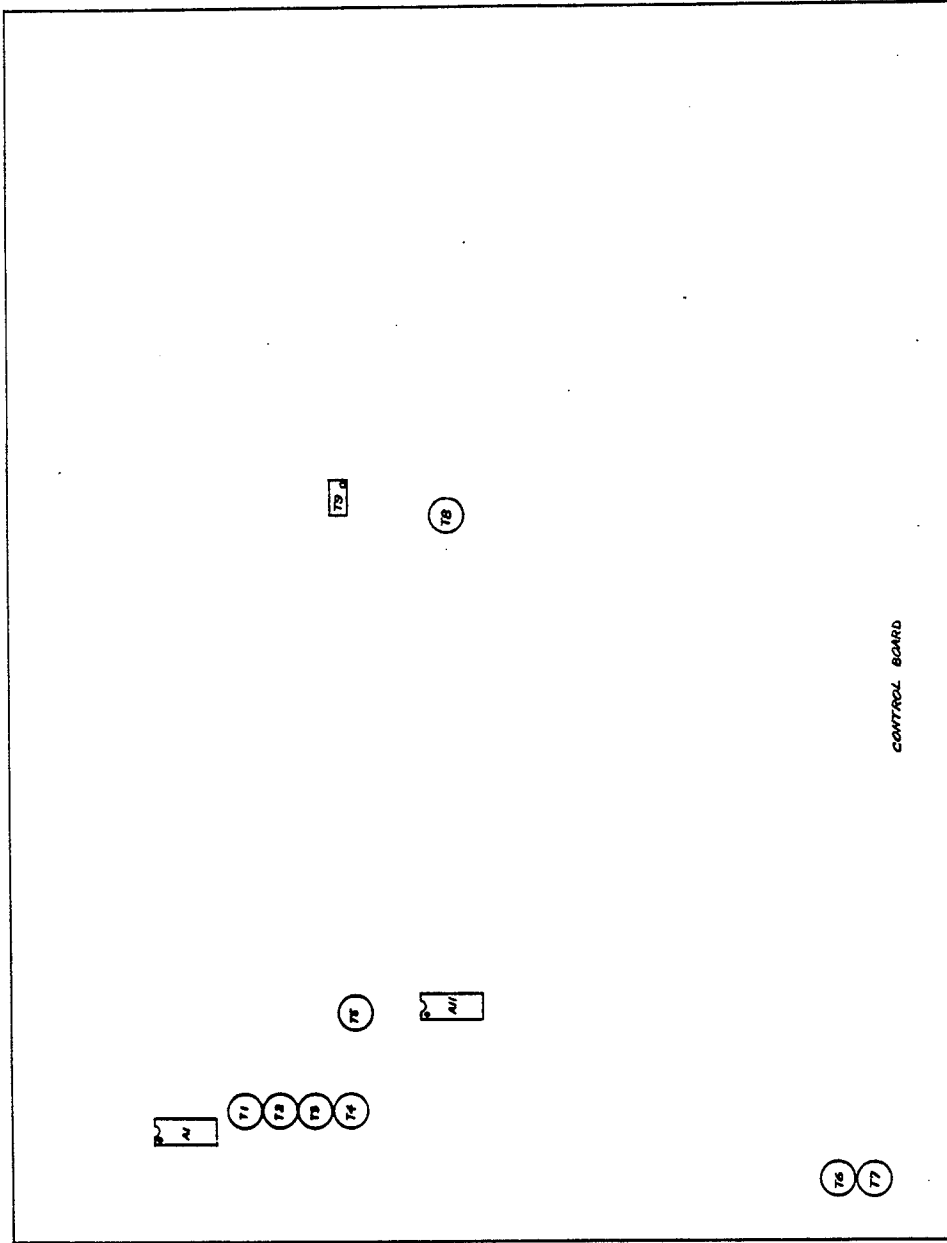
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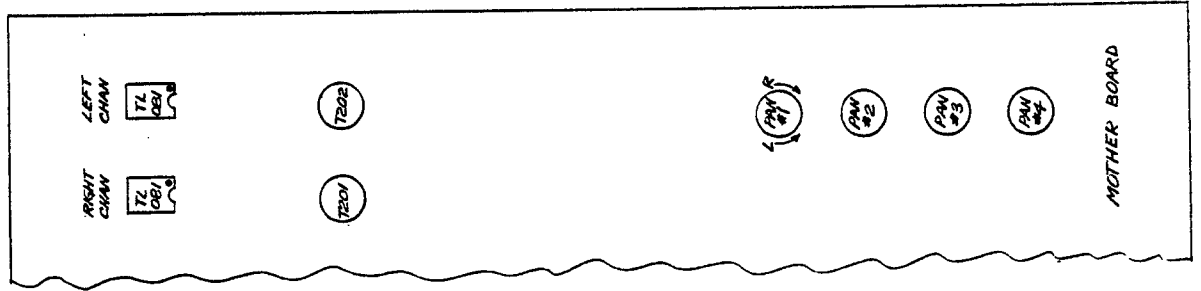
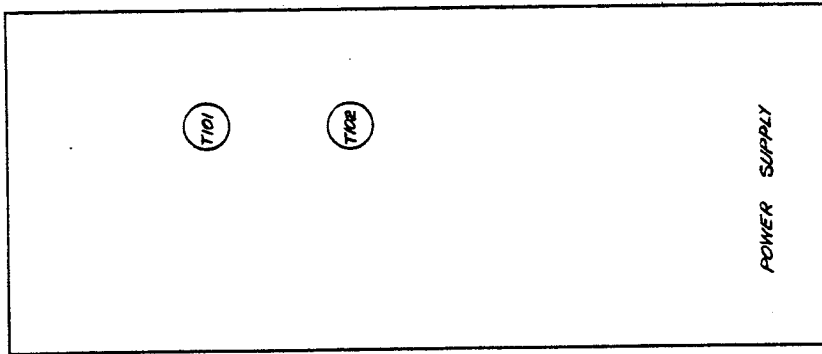
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C8-X POT BOARD SWITCHES
PLACEMENT DIAGRAM
VERSION 2

2-13-60



OBERHEIM ELECTRONICS, INC.
 OR-X CONTROL BOARD & VOICE CARD
 TRIMMER ADJUSTMENT DIAGRAM
 VERSION 2
 8-18-70
 2-11-80
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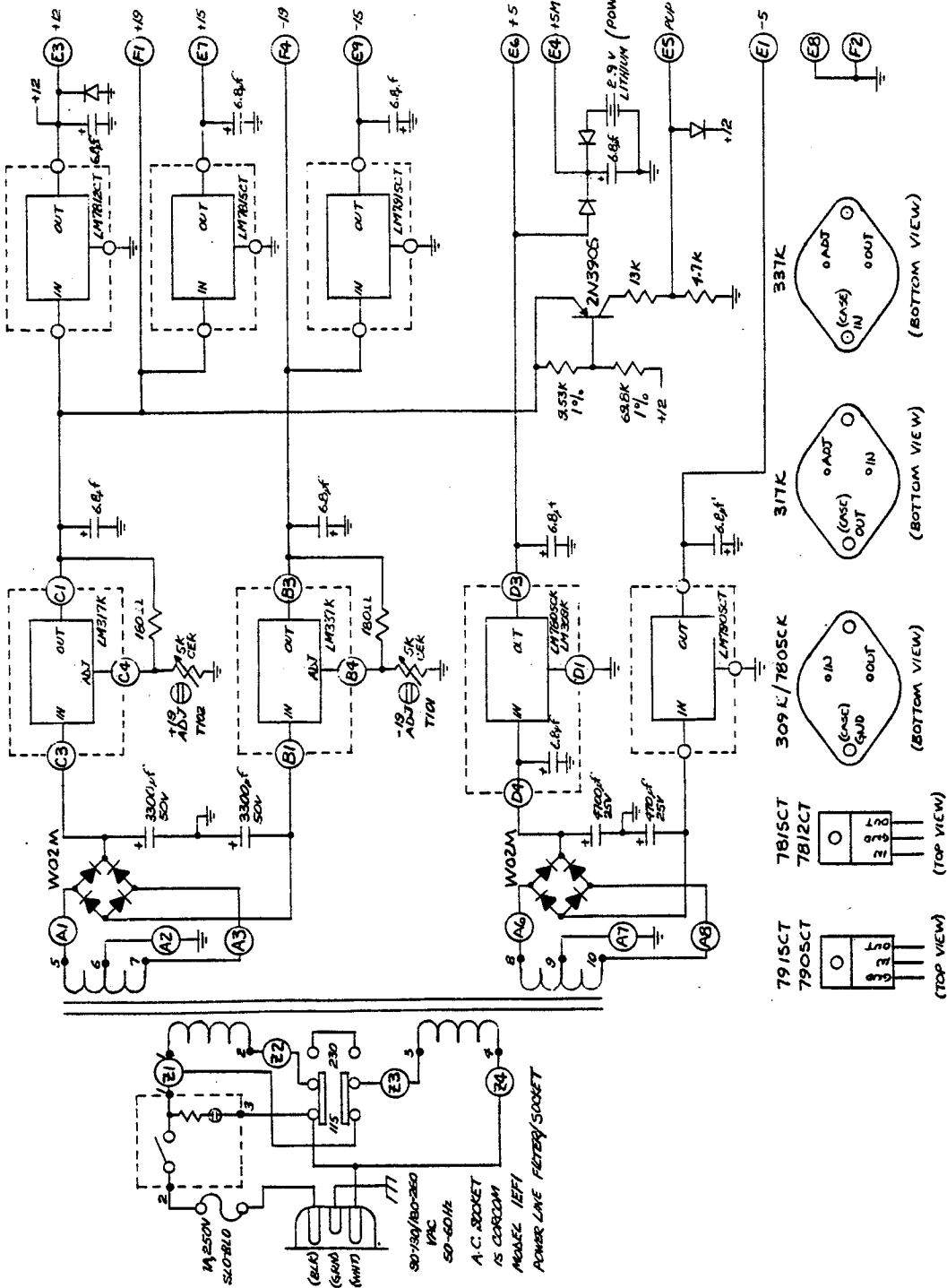
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OB-X POWER SUPPLY & MOTHER BOARD
TRIMMER PLACEMENT DIAGRAM

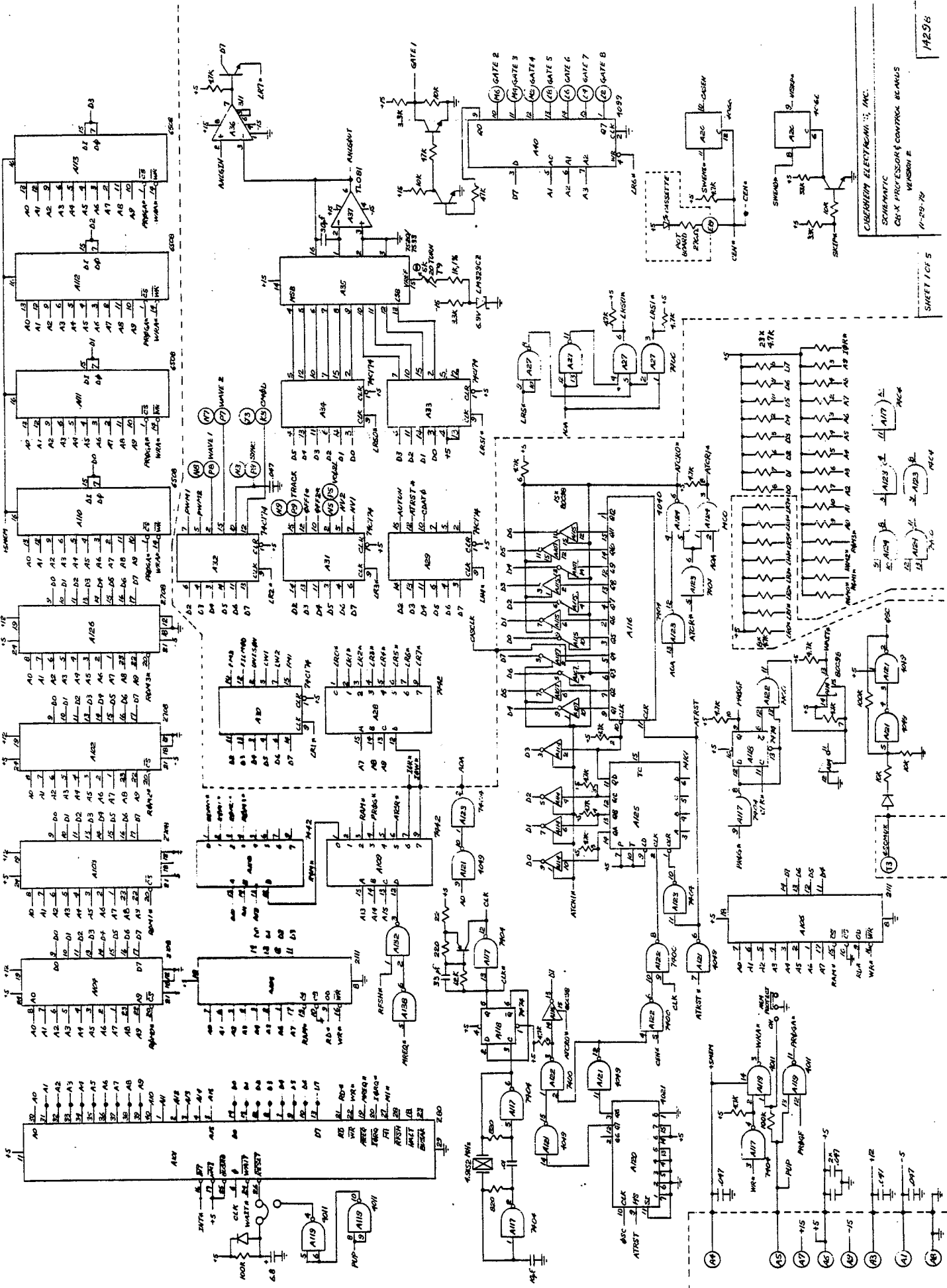
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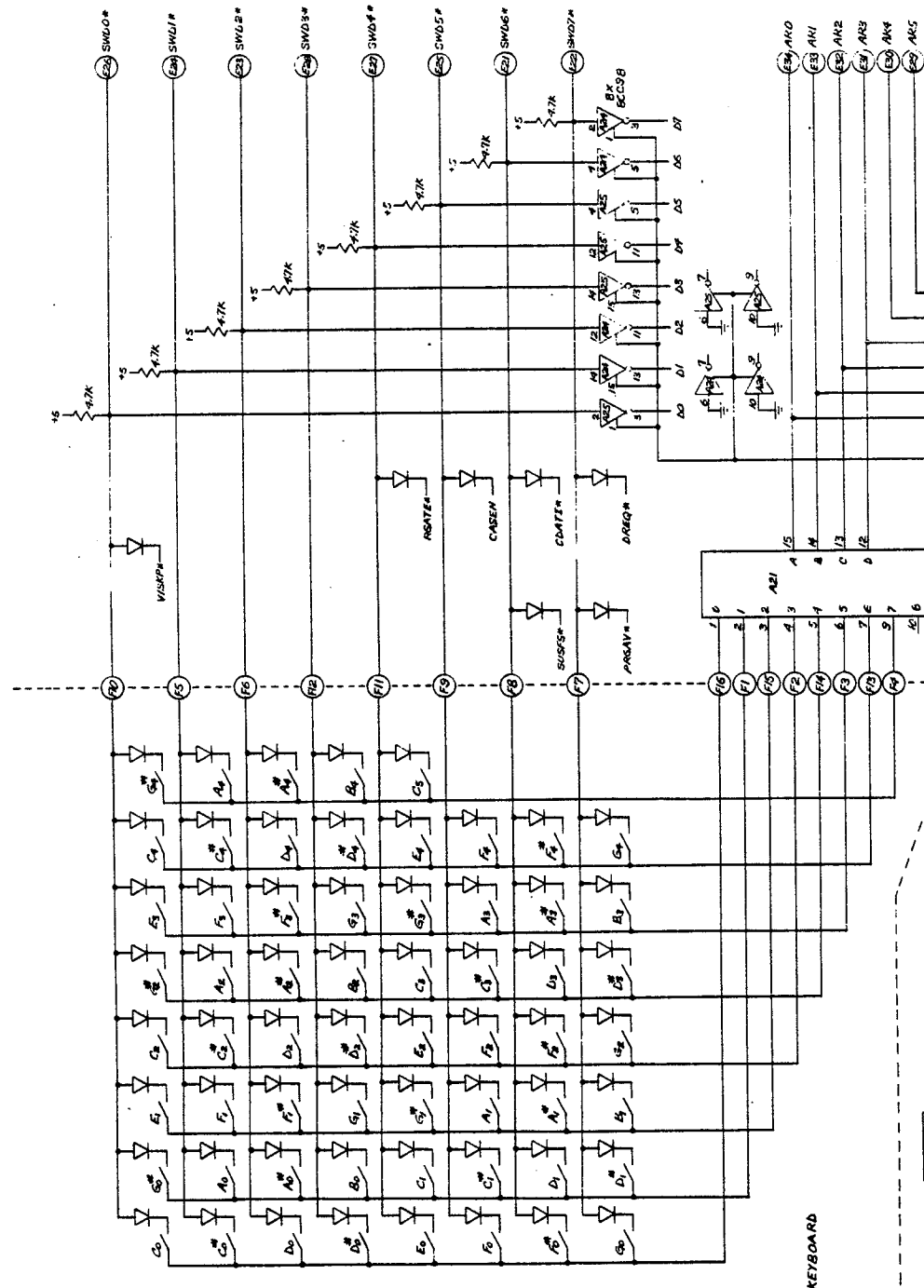
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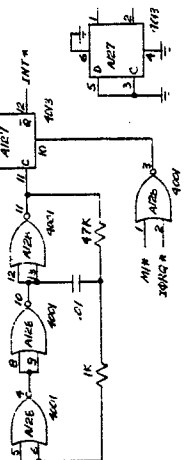
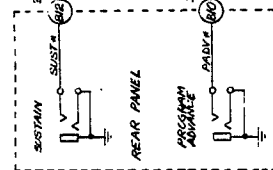
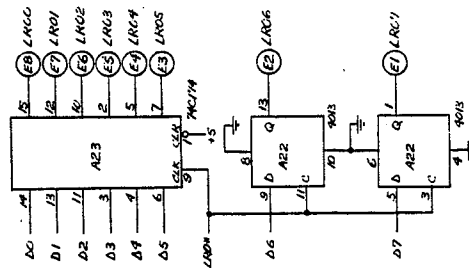
NOTES: UNLESS SPECIFIED OTHERWISE
 ALL DIODES ARE 1N4148



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| B | 11/25/64 |



KEYBOARD

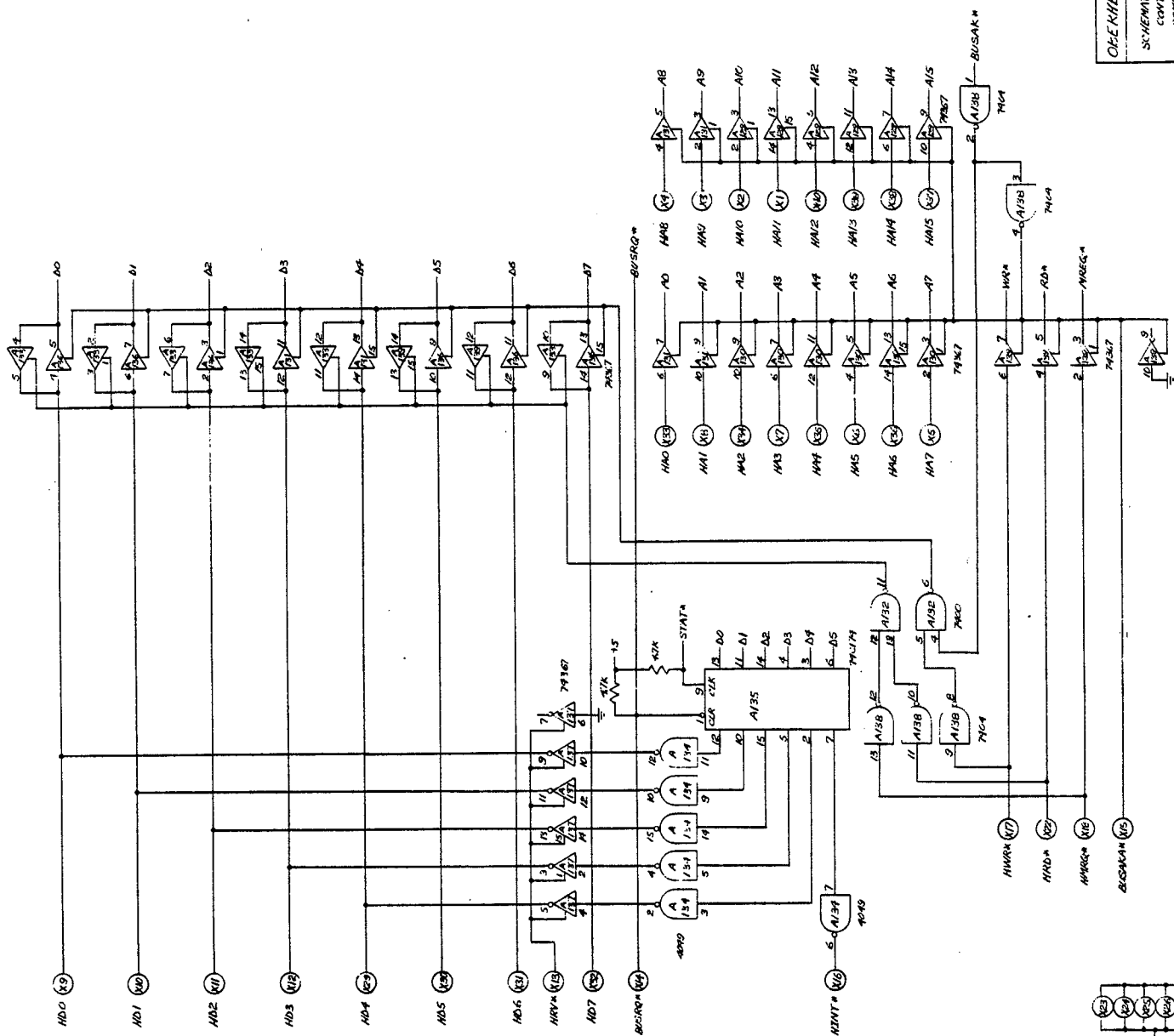


SCHEMATIC - 68-X PACE DESIGN &
CONTACT ARTISTS
VERSION 2

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SHEET 8 OF 5

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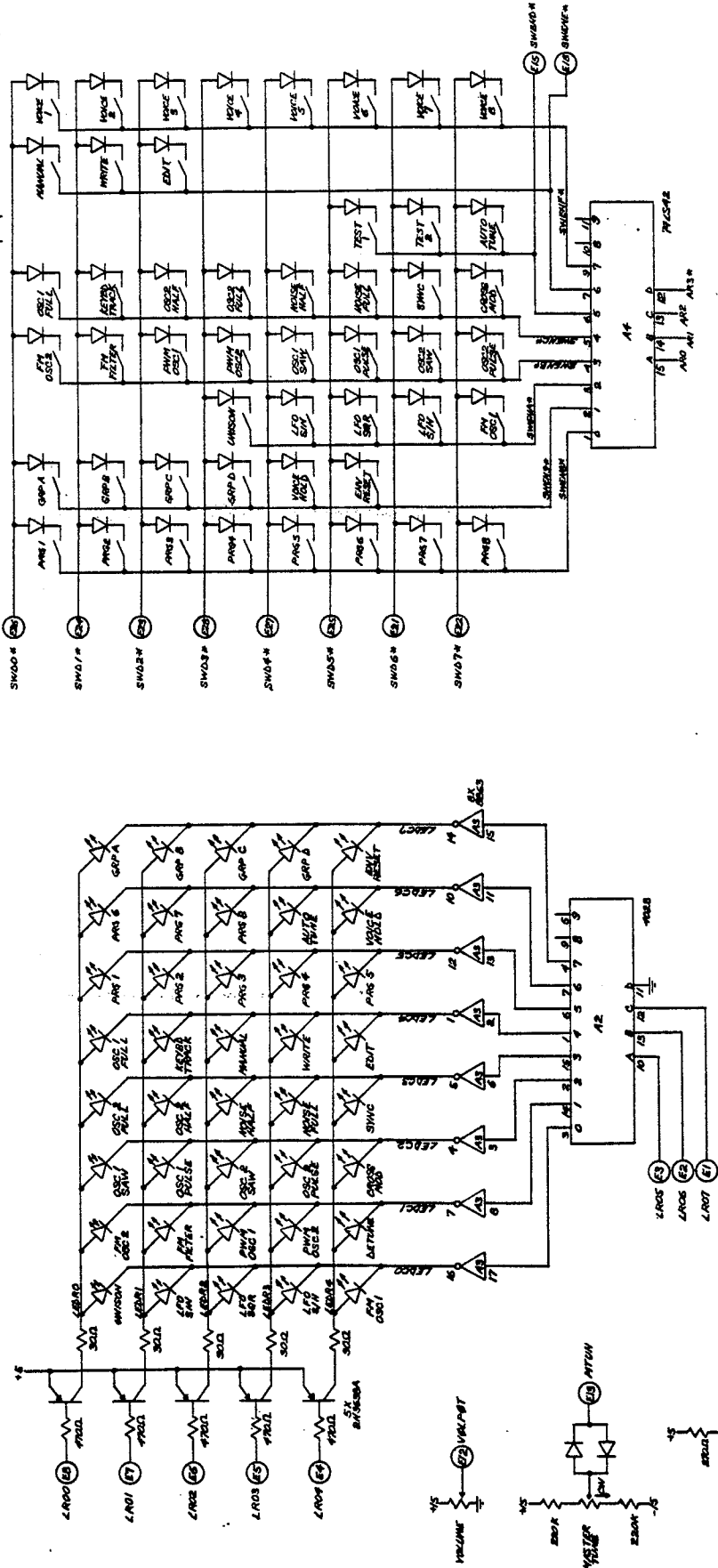
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SCHEMATIC - DB-X PROCESSOR &
CONTROL BLOCKS
COMPUTER INTERFERENCE

14256

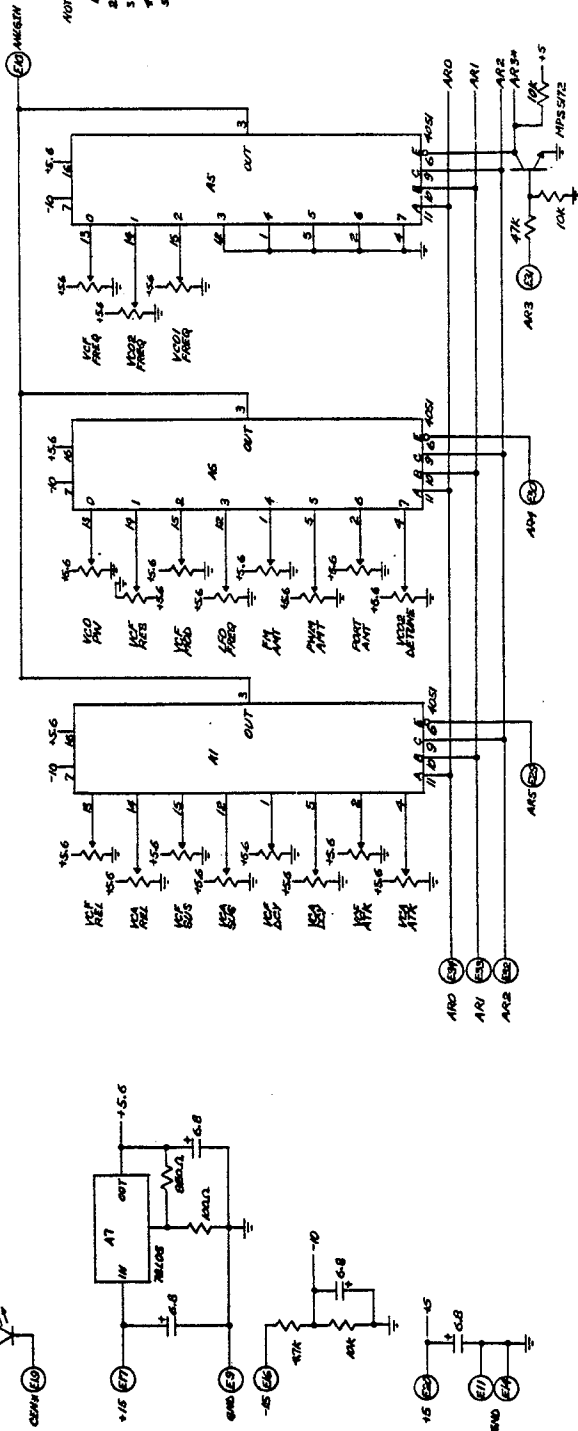
SHEET 5 OF 5

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| 1 | 11-25-70 | WJ | WJ |



NOTES - UNLESS NOTED OTHERWISE:

1. ALL RESISTORS ARE 1/4 W 5%
2. ALL CAPACITORS ARE 10 μ F
3. ALL DIODES ARE 1N4148
4. ALL POTS ARE 50K 20M CM
5. ALL PNP TRANSISTORS ARE 2N3638



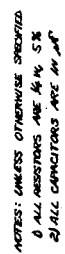
COBBELEM ELECTRONICS, INC.

SCHEMATIC - CB-X POT BOARD

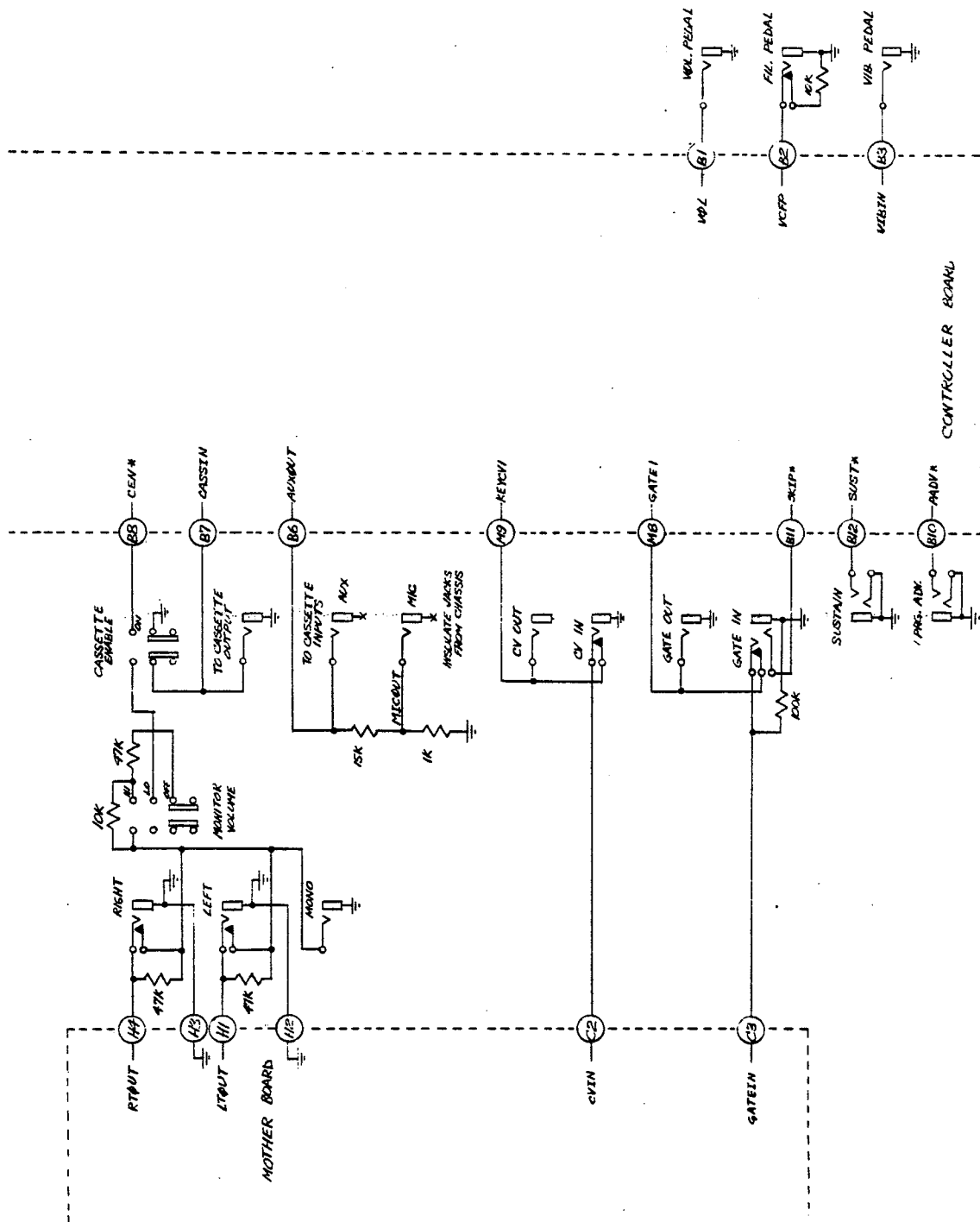
VERSION 2

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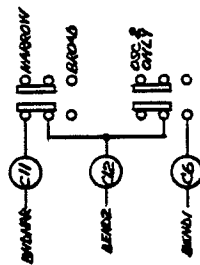
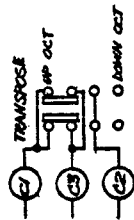
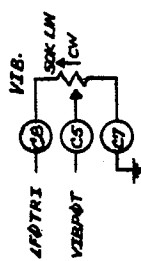
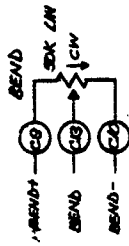


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SCHEMATIC - CB-X REAR PANEL

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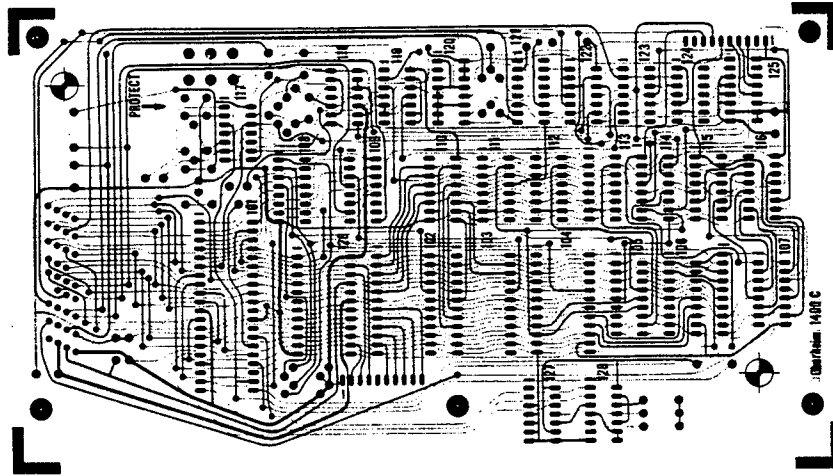
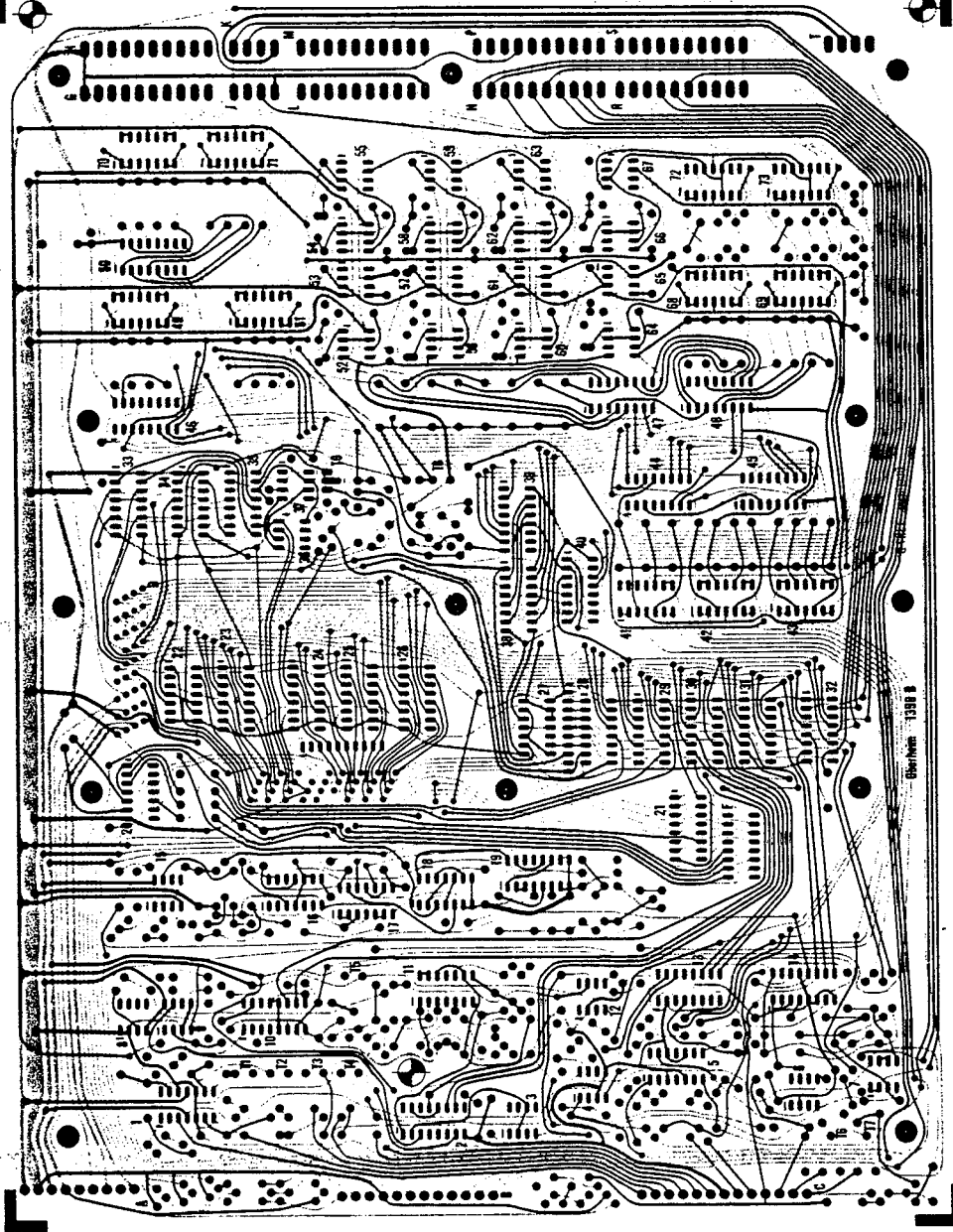


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SCHEMATIC - OB-X BEND ASSEMBLY

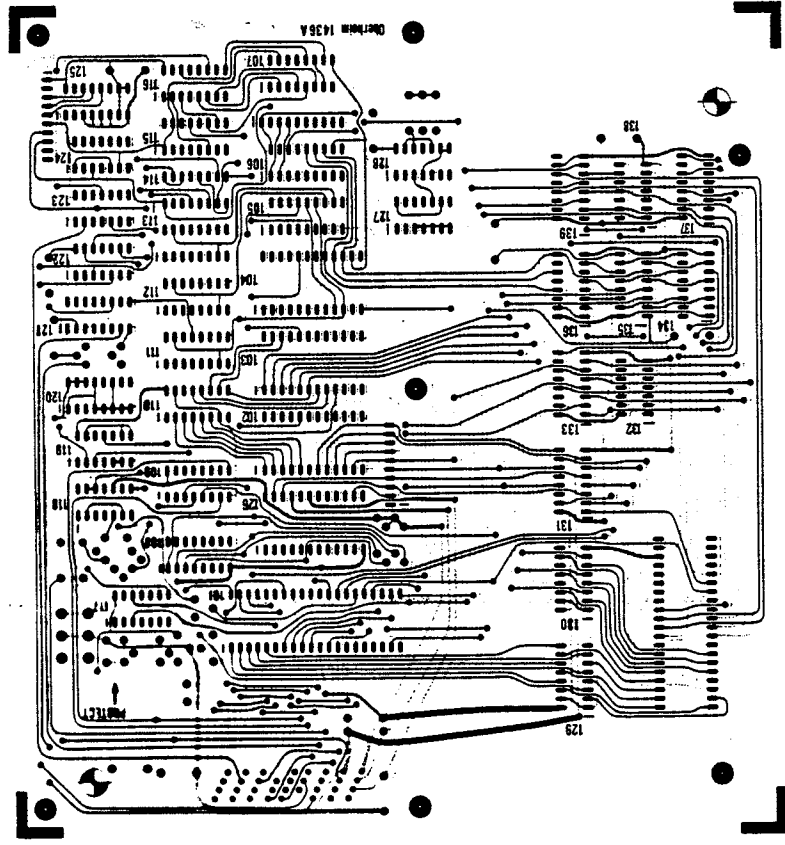
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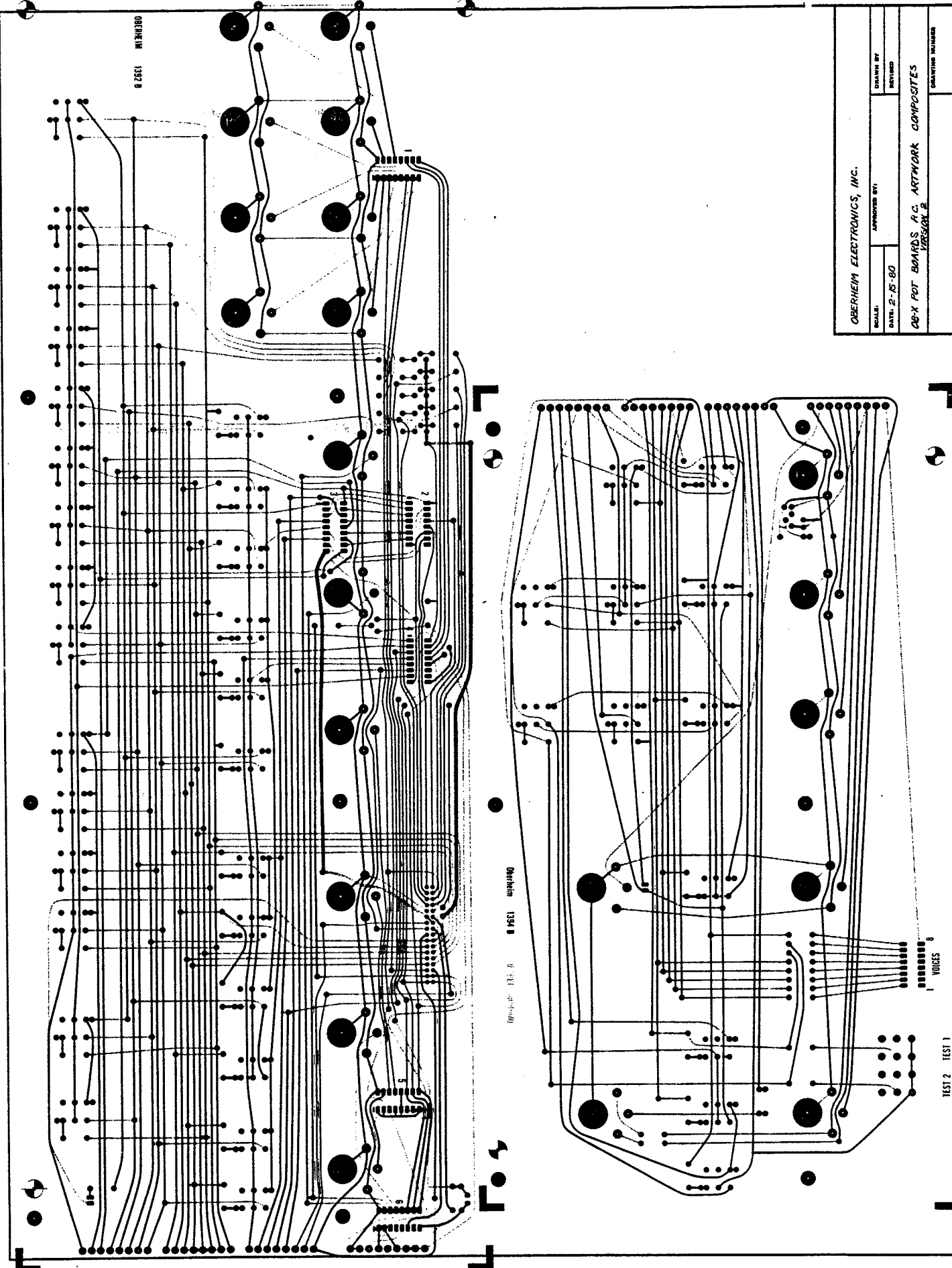


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| REVISED: | | OB-X PROCESSOR & CONTROL BOARDS P.C. ARTWORK COMPOSITES - VERSION 2 | DRAWING NUMBER: |
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Oberheim 1382 B

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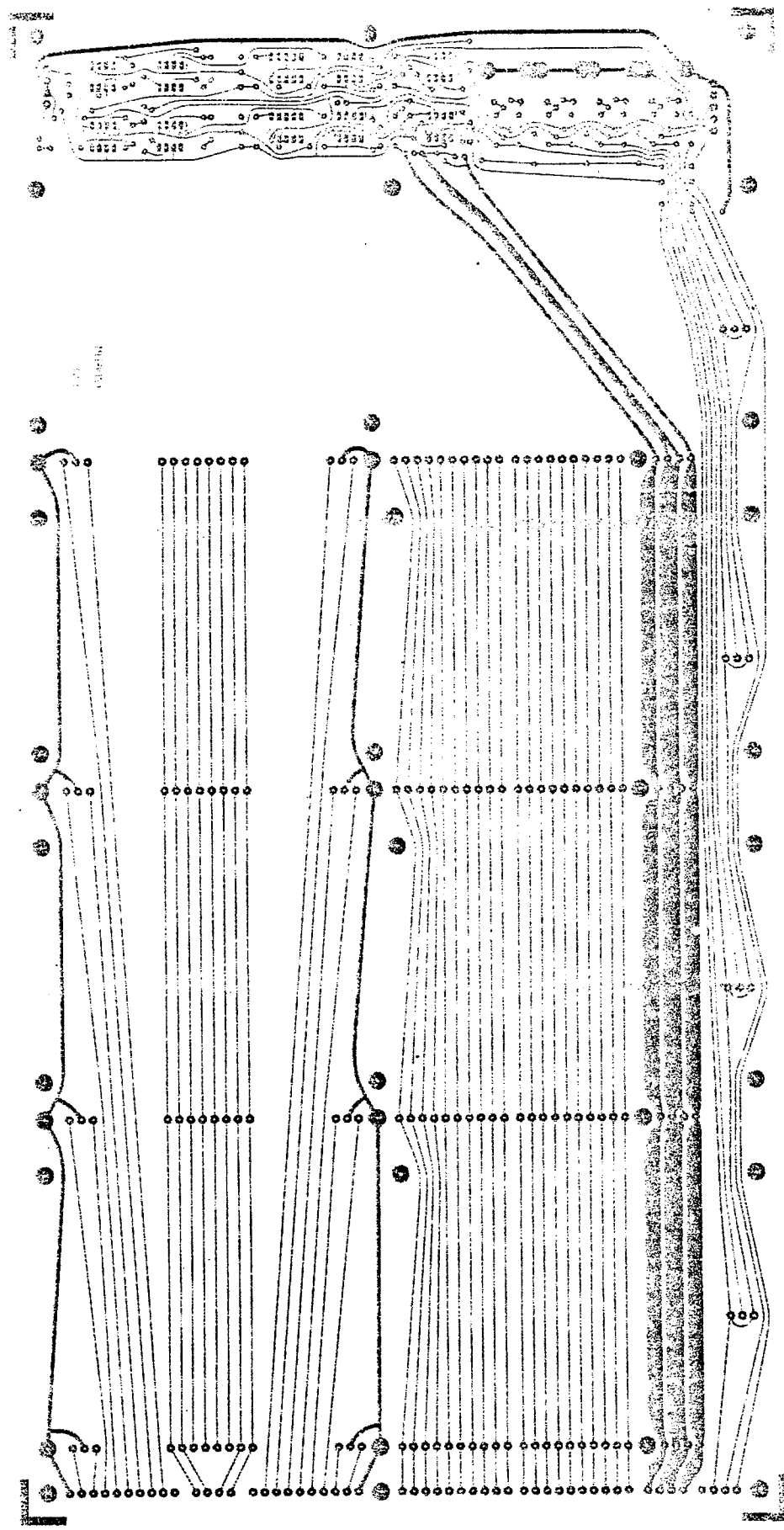
DESIGNED BY:

REVIEWED:

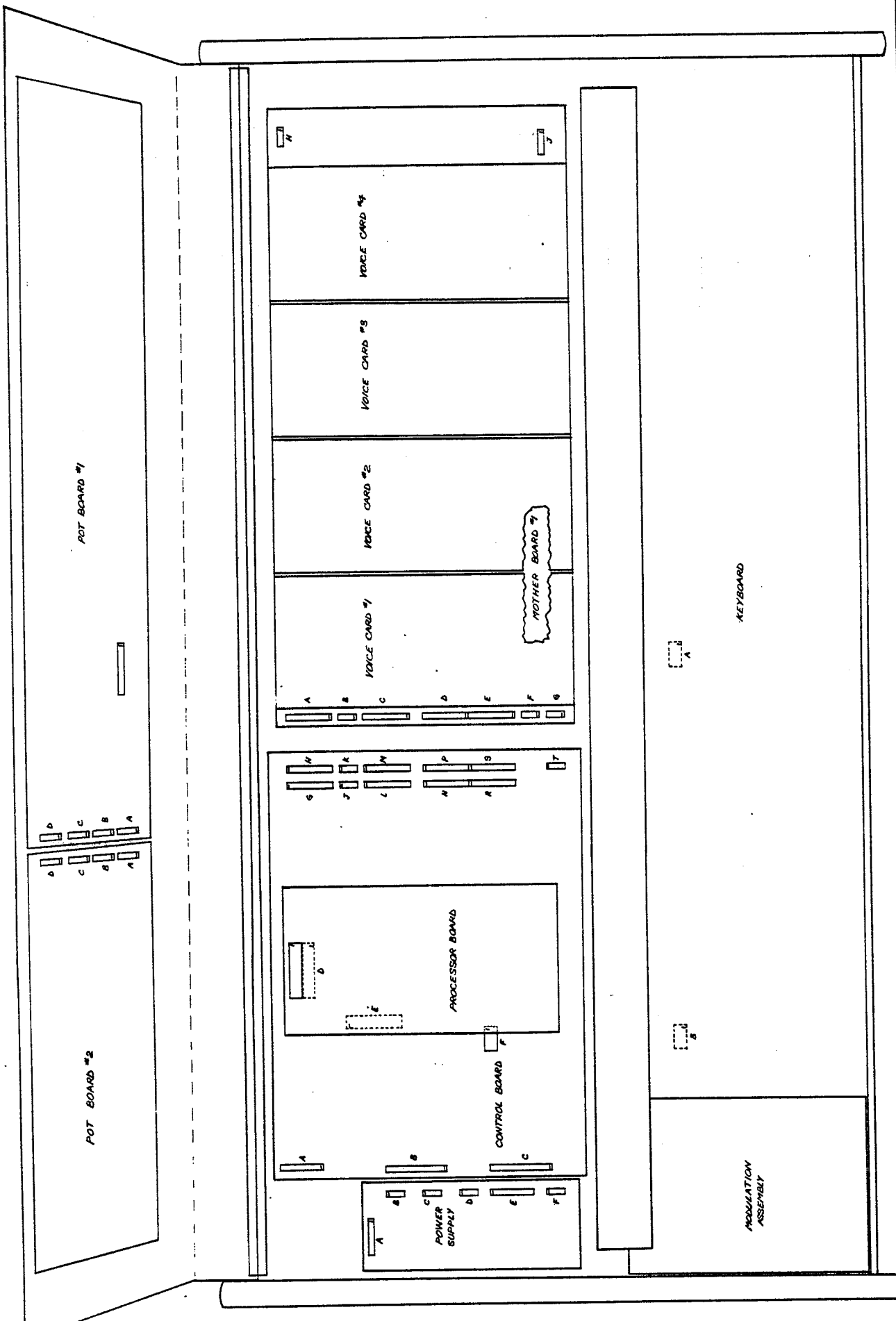
Q8-X POT BOARDS P.C. ARTWORK COMPOSITES
VERSION B

QUANTITY NUMBER

TEST 2 TEST 1



| | |
|---|--------------|
| OBERHEIM ELECTRONICS INC. | |
| SCALE: | APPROVED BY: |
| DATE: 9-21-79 | DESIGNED BY: |
| COP-X MOTHER BOARD A.C. ARTWORK COMPOSITE | |
| DRAWING NUMBER | |



NOTE: MOTHER BOARD #8
 & VOICES #5 THRU
 #8 NOT SHOWN

OBERHEIM ELECTRONICS, INC.
 OS-X SUB-ASSEMBLY & CONVERTOR
 PLACEMENT DIAGRAM

9-17-78

OBERHEIM ELECTRONICS, INC.

NO.

SERVICE NOTE

002

| PRODUCT AFFECTED | ASSEMBLIES AFFECTED | DRAWINGS AFFECTED |
|------------------|----------------------------|-------------------|
| OB-X | PROCESSOR & CONTROL BOARDS | |

Oberheim now has available a diagnostic EPROM which simplifies testing and fault isolation of the OB-X Processor and Control boards. The EPROM contains six separate diagnostic programs, described below:

1. Staircase output on all Sample/Holds
2. Square wave on all Gates
3. Scratchpad RAM test
4. Program (CMOS) memory test
5. Cassette Interface test
6. LED test

The first two tests exercise the DAC, Sample/Holds, and Gates in a predetermined manner; correct operation of the circuitry can be determined by running the appropriate test and observing the Sample/Hold and Gate outputs with an oscilloscope. If an error is observed, its source can be readily located by working back through the circuitry while the test program is running. Correct operation of the four remaining tests is verified by merely observing the LED's on the front panel. If the test is not successful, the relevant circuitry can be checked-out in a straightforward manner since the EPROM repetitively runs a known program.

The only equipment required to utilize the diagnostic EPROM is standard lab test equipment, plus a cassette recorder for the Cassette Interface test.

The EPROM, together with a manual describing the operation and use of the diagnostic programs, is available from the factory at \$25.00 each. In addition, should you not have a recorder available for the Cassette Interface test, a transformer with miniature phone plugs which can be connected between the Cassette Input and Output jacks is offered by Oberheim for an additional \$25.00 each.

WRITTEN BY

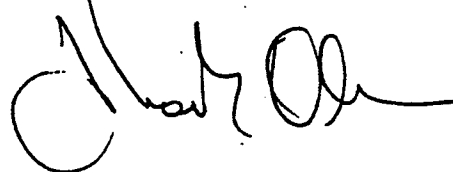
DATE

APPROVED BY

DATE

ED Schell

10-29-79



10/30/79

OBERHEIM ELECTRONICS, INC.

SERVICE NOTE

NO.

003

PRODUCT AFFECTED

OB-X

ASSEMBLIES AFFECTED

CONTROL BOARD

DRAWINGS AFFECTED

The four 100K resistors connected to pins 3 and 5 of I.C. A7 (two resistors connected to each pin) should be matched 1% resistors. However, some units have been built with 5% resistors. This situation can cause some oscillators to be turned off when the Pulse Width is set to maximum (i.e., the pulse becomes a D.C. level). Replacing these resistors with 1% tolerance resistors will correct this problem. The locations of these resistors are shown on the attached drawing.

Note: This is not a mandatory change. The resistors need be changed only on units in which the oscillator turn-off at maximum pulse width problem occurs and is found to be objectionable.

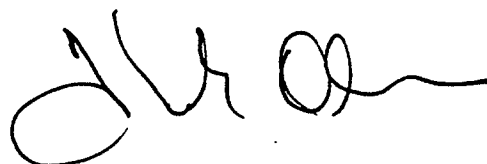
WRITTEN BY

ED Schlock

DATE

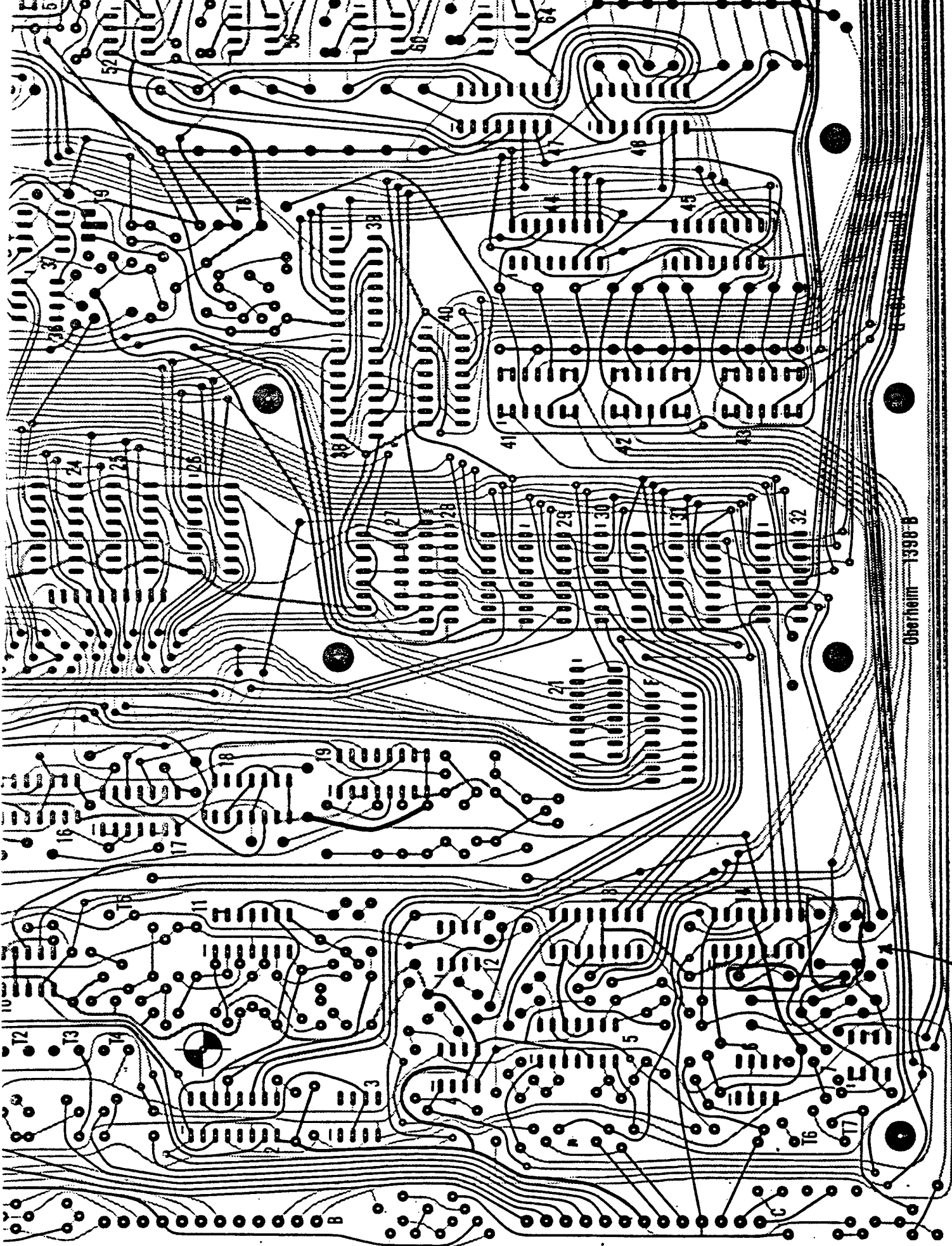
1-11-80

APPROVED BY



DATE

1-11-80



Oberheim 1390-B

Attachment to Service Note No. 003

For 100K, 5%
to be changed to 100K 1%

CONTROL BOARD INTERCONNECT LIST

CONTROL

A1 -5V
A2 (KEY)
A3 +12V
A4 +5MEM
A5 PUP
A6 +5V
A7 +15V
A8 GND
A9 -15V

POWER SUPPLY

E1
E2
E3
E4
E5
E6
E7
E8
E9

CONTROL

B1 VOL
B2 VCFP
B3 VIBIN
B4 (NC)
B5 (KEY)
B6 AUXOUT
B7 CASSIN
B8 CEN*
B9 GND
B10 PADV*
B11 SKIP*
B12 SUST*

REAR PANEL

VOLUME PEDAL JACK--TIP
FILTER PEDAL JACK--TIP
VIBRATO PEDAL JACK--TIP

TO CASS AUX INPUT JACK--TIP
TO CASS OUTPUT JACK--TIP
CASSETTE ENABLE SWITCH--ON

PROGRAM ADVANCE JACK--TIP
GATE IN JACK--RING
SUSTAIN FOOTSWITCH JACK--TIP

CONTROL

C1 TRUP
C2 TRDN
C3 TRANSP
C4 (KEY)
C5 VIBPOT
C6 BEND1
C7 GND
C8 LFOTRI
C9 BEND+
C10 BEND-
C11 BNDNAR
C12 BEND2
C13 BEND

MODULATION ASSEMBLY

TRANSPOSE SWITCH--UP
TRANSPOSE SWITCH--DOWN
TRANSPOSE SWITCH--CENTER

VIBRATO POT--WIPER
BEND OSC SWITCH--BOTH

VIBRATO POT--CW END
BEND POT--CCW END
BEND POT--CW END
BEND RANGE SWITCH--NARROW
BEND OSC & RANGE SW'S--CENTER
BEND POT--WIPER

CONTROL

PROCESSOR

| | | |
|-----|--------|----|
| D1 | A4 | 1 |
| D2 | A5 | 2 |
| D3 | A6 | 3 |
| D4 | A1 | 4 |
| D5 | A2 | 5 |
| D6 | A3 | 6 |
| D7 | AOA | 7 |
| D8 | A9 | 8 |
| D9 | A8 | 9 |
| D10 | A7 | 10 |
| D11 | D7 | 11 |
| D12 | D6 | 12 |
| D13 | D5 | 13 |
| D14 | D4 | 14 |
| D15 | D3 | 15 |
| D16 | D2 | 16 |
| D17 | D1 | 17 |
| D18 | D0 | 18 |
| D19 | IOR* | 19 |
| D20 | IOW* | 20 |
| D21 | CEN* | 21 |
| D22 | (NC) | 22 |
| D23 | ATRST | 23 |
| D24 | (NC) | 24 |
| D25 | OSCMUX | 25 |
| D26 | PUP | 26 |
| D27 | CASCLK | 27 |
| D28 | (NC) | 28 |
| D29 | +5MEM | 29 |
| D30 | GND | 30 |
| D31 | (NC) | 31 |
| D32 | +12V | 32 |
| D33 | -5V | 33 |
| D34 | +5V | 34 |

CONTROL

POT NO. 1

| | | |
|-----|------------|----|
| E1 | LR07 | 1 |
| E2 | LR06 | 2 |
| E3 | LR05 | 3 |
| E4 | LR04 | 4 |
| E5 | LR03 | 5 |
| E6 | LR02 | 6 |
| E7 | LR01 | 7 |
| E8 | LR00 | 8 |
| E9 | GND (ANLG) | 9 |
| E10 | ANLGIN | 10 |
| E11 | GND | 11 |
| E12 | VOLPOT | 12 |
| E13 | MTUN | 13 |
| E14 | GND | 14 |
| E15 | SWEND* | 15 |
| E16 | -15V | 16 |
| E17 | +15V | 17 |
| E18 | SWENE* | 18 |
| E19 | CEN* | 19 |
| E20 | +5V | 20 |
| E21 | SWD6* | 21 |
| E22 | SWD7* | 22 |
| E23 | SWD2* | 23 |
| E24 | SWD1* | 24 |
| E25 | SWD5* | 25 |
| E26 | SWD0* | 26 |
| E27 | SWD4* | 27 |
| E28 | SWD3* | 28 |
| E29 | AR5 | 29 |
| E30 | AR4 | 30 |
| E31 | AR3 | 31 |
| E32 | AR2 | 32 |
| E33 | AR1 | 33 |
| E34 | AR0 | 34 |

CONTROL

KEYBOARD

| | | |
|-----|--------|-----|
| F1 | SWEN1* | A1 |
| F2 | SWEN3* | A2 |
| F3 | SWEN5* | A3 |
| F4 | SWEN7* | A4 |
| F5 | SWD1* | A5 |
| F6 | SWD2* | A6 |
| F7 | SWD7* | A7 |
| F8 | SWD6* | A9 |
| F9 | SWD5* | B15 |
| F10 | SWD0* | B14 |
| F11 | SWD4* | B1 |
| F12 | SWD3* | B2 |
| F13 | SWEN6* | B3 |
| F14 | SWEN4* | B4 |
| F15 | SWEN2* | B6 |
| F16 | SWEN0* | B7 |

CONTROL

MOTHER NO. 2

| | | |
|-----|------|-----|
| G1 | GND | A10 |
| G2 | FT5A | A9 |
| G3 | FT5B | A8 |
| G4 | FT6A | A7 |
| G5 | FT6B | A6 |
| G6 | FT7A | A5 |
| G7 | FT7B | A4 |
| G8 | FT8A | A3 |
| G9 | FT8B | A2 |
| G10 | (NC) | A1 |

CONTROL

MOTHER NO. 1

| | | |
|-----|------|-----|
| H1 | GND | A10 |
| H2 | FT1A | A9 |
| H3 | FT1B | A8 |
| H4 | FT2A | A7 |
| H5 | FT2B | A6 |
| H6 | FT3A | A5 |
| H7 | FT3B | A4 |
| H8 | FT4A | A3 |
| H9 | FT4B | A2 |
| H10 | (NC) | A1 |

CONTROL

MOTHER NO. 2

| | | |
|----|------|----|
| J1 | PW2 | B4 |
| J2 | PW1 | B3 |
| J3 | CMOD | B2 |
| J4 | GND | B1 |

CONTROL

MOTHER NO. 1

| | | |
|----|------|----|
| K1 | PW2 | B4 |
| K2 | PW1 | B3 |
| K3 | CMOD | B2 |
| K4 | GND | B1 |

CONTROL

MOTHER NO. 2

| | | |
|-----|--------|-----|
| L1 | (NC) | C10 |
| L2 | GATE8 | C9 |
| L3 | KEYCV8 | C8 |
| L4 | GATE7 | C7 |
| L5 | KEYCV7 | C6 |
| L6 | GATE6 | C5 |
| L7 | KEYCV6 | C4 |
| L8 | GATE5 | C3 |
| L9 | KEYCV5 | C2 |
| L10 | GND | C1 |

CONTROL

M1 (NC)
M2 GATE4
M3 KEYCV4
M4 GATE3
M5 KEYCV3
M6 GATE2
M7 KEYCV2
M10 GND

MOTHER NO. 1

C10
C9
C8
C7
C6
C5
C4
C1

CONTROL

M8 GATE1
M9 KEYCV1

REAR PANEL

GATE OUT JACK--TIP
CV OUT JACK--TIP

REAR PANEL

GATE IN JACK--TIP
CV IN JACK--TIP

MOTHER NO. 1

C3
C2

CONTROL

N1 VC01F
N2 VC02F
N3 SYNC
N4 NOISE
N5 VC02L
N6 VCFP
N7 WAVE2
N8 WAVE1
N9 TRACK
N10 FSUS

MOTHER NO. 2

D10
D9
D8
D7
D6
D5
D4
D3
D2
D1

CONTROL

P1 VC01F
P2 VC02F
P3 SYNC
P4 NOISE
P5 VC02L
P6 VCFP
P7 WAVE2
P8 WAVE1
P9 TRACK
P10 FSUS

MOTHER NO. 1

D10
D9
D8
D7
D6
D5
D4
D3
D2
D1

CONTROL

R1 FRLS
R2 FDCY
R3 FATK
R4 RES
R5 VCFM
R6 VCFF
R7 ASUS
R8 ARLS
R9 ADCY
R10 AATK

MOTHER NO. 2

E10
E9
E8
E7
E6
E5
E4
E3
E2
E1

CONTROL

S1 FRLS
S2 FDCY
S3 FATK
S4 RES
S5 VCFM
S6 VCFF
S7 ASUS
S8 ARLS
S9 ADCY
S10 AATK

MOTHER NO. 1

E10
E9
E8
E7
E6
E5
E4
E3
E2
E1

CONTROL

T1 (NC)
T2 GND
T3 OSCMUX
T4 VOL

MOTHER NO. 1

G4
G3
G2
G1

POWER SUPPLY BOARD INTERCONNECT LIST

POWER SUPPLY

| | |
|----|----------|
| A1 | 26VAC |
| A2 | GND (CT) |
| A3 | 26VAC |
| A4 | (KEY) |
| A5 | (NC) |
| A6 | 10VAC |
| A7 | GND (CT) |
| A8 | 10VAC |

TRANSFORMER

| |
|----|
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |
| 10 |

POWER SUPPLY

| | |
|----|-------|
| B1 | -32V |
| B2 | (KEY) |
| B3 | -19V |
| B4 | ADJ |

LM337K

| |
|------|
| CASE |
| 2 |
| 1 |

POWER SUPPLY

| | |
|----|-------|
| C1 | +19V |
| C2 | (KEY) |
| C3 | +32V |
| C4 | ADJ |

LM317K

| |
|------|
| CASE |
| 2 |
| 1 |

POWER SUPPLY

| | |
|----|-------|
| D1 | GND |
| D2 | (KEY) |
| D3 | +5V |
| D4 | +12V |

LM340K

| |
|------|
| CASE |
| 2 |
| 1 |

POWER SUPPLY

| | |
|----|-------|
| F1 | +19V |
| F2 | GND |
| F3 | (KEY) |
| F4 | -19V |

MOTHER NO. 1)

| | |
|----|---|
| F1 |) |
| F2 |) |
| F3 |) |
| F4 |) |

CONTAINED
IN A

MOTHER NO. 1

| | |
|----|-------|
| F1 | +19V |
| F2 | GND |
| F3 | (KEY) |
| F4 | -19V |

MOTHER NO. 2)

| | |
|----|---|
| F1 |) |
| F2 |) |
| F3 |) |
| F4 |) |

SINGLE
CABLE

POT BOARD INTERCONNECT LIST

POT NO. 1

| | |
|----|--------|
| A1 | SWENF* |
| A2 | -15V |
| A3 | +15V |
| A4 | PORT |
| A5 | LFOPOT |
| A6 | FMPOT |
| A7 | PWMPOT |
| A8 | DETUNE |
| A9 | +5POT |

POT NO. 2

| |
|----|
| A1 |
| A2 |
| A3 |
| A4 |
| A5 |
| A6 |
| A7 |
| A8 |
| A9 |

POT NO. 1

| | |
|----|--------|
| B1 | GND |
| B2 | VOLPOT |
| B3 | MTUN |
| B4 | SWEND* |
| B5 | LEDCO* |
| B6 | SWENA* |
| B7 | LEDC1* |
| B8 | SWENB* |

POT NO. 2

| |
|----|
| B1 |
| B2 |
| B3 |
| B4 |
| B5 |
| B6 |
| B7 |
| B8 |

POT NO. 1

| | |
|----|-------|
| C1 | SWD0* |
| C2 | SWD1* |
| C3 | SWD2* |
| C4 | SWD3* |
| C5 | SWD4* |
| C6 | SWD5* |
| C7 | SWD6* |
| C8 | SWD7* |

POT NO. 2

| |
|----|
| C1 |
| C2 |
| C3 |
| C4 |
| C5 |
| C6 |
| C7 |
| C8 |

POT NO. 1

| | |
|----|--------|
| D1 | LEDRO |
| D2 | LEDR1 |
| D3 | LEDR2 |
| D4 | LEDR3 |
| D5 | LEDR4 |
| D6 | LEDC6* |
| D7 | LEDC7* |
| D8 | SWEN9* |

POT NO. 2

| |
|----|
| D1 |
| D2 |
| D3 |
| D4 |
| D5 |
| D6 |
| D7 |
| D8 |

MOTHER BOARD INTERCONNECT LIST

MOTHER NO. 1

| | |
|----|--------|
| H1 | LTOUT |
| H2 | SHIELD |
| H3 | SHIELD |
| H4 | RTOUT |

REAR PANEL

| |
|---------------------------|
| LEFT OUTPUT JACK--TIP |
| LEFT OUTPUT JACK--SLEEVE |
| RIGHT OUTPUT JACK--SLEEVE |
| RIGHT OUTPUT JACK--TIP |

MOTHER NO. 1

| | |
|----|--------|
| J1 | GND |
| J2 | (NC) |
| J3 | LAUX |
| J4 | RAUX |
| J5 | OSCSUM |

MOTHER NO. 2

| |
|----|
| J1 |
| J2 |
| J3 |
| J4 |
| J5 |