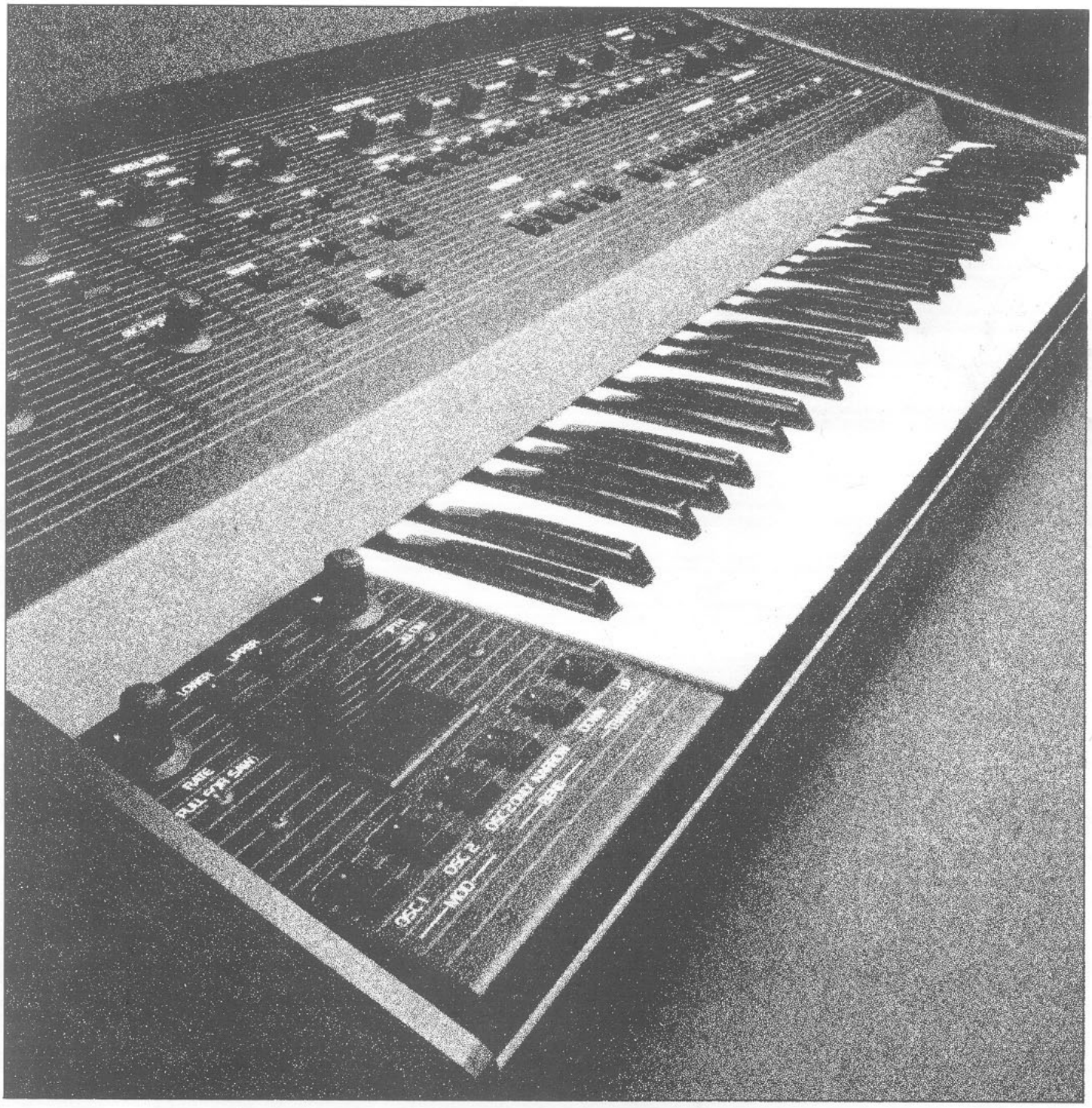
THIRD EDITION

OB-Xa

SERVICE MANUAL



OB-Xa
PROGRAMMABLE POLYPHONIC SYNTHESIZER

SERVICE MANUAL

THIRD EDITION JUNE 1982

Covering Units With Serial Numbers 820818 And Above

TABLE OF CONTENTS

OBERHEIM ELECTRONICS, INC.
2250 So. Barrington Ave.
Los Angeles, CA 90064 USA

SYNTHESIZER COMPONENTS: 4, 6, or 8 Voices; 3 Low Frequency Oscillators, Pink Noise Source

COMPONENTS IN EACH VOICE:
- 2 Voltage Controlled Oscillators
- 2 Voltage Controlled Filters (2-Pole or 4-Pole low pass type, selectable)
- 2 Envelope Generators
- 1 Voltage Controlled Amplifier

NUMBER OF PROGRAMS: 120

KEYBOARD: 5 Octaves

KEYBOARD MODES: FULL, SPLIT (splits OB-Xa into two independent synthesizers), and DOUBLE (plays both independent synthesizers simultaneously); programmable split point and transpositions anywhere on the keyboard (in split or double)

OUTPUTS: Stereo and Mono signal outputs, Cassette Interface inputs and outputs, Computer Interface

FOOT CONTROLS: Sustain, Hold, Program Advance Footswitches; Filter, Vibrato Pedals

POWER: 90-130 or 180-260 Volts AC, 50-60 Hz, 45 Watts

DIMENSIONS: 40"(101.6cm) wide, 20"(50.8cm) deep, 6"(15.24cm) high

WEIGHT: 45 lbs. (20.41kg)

Since its introduction in January 1981, the OB-Xa has undergone a great many improvements and additions. Since this manual is concerned with units with serial numbers of 820818 and above, only changes that have occured since February 1982 are noted here. These units incorporate all of the earlier changes.

ECO #134: Changing two resistors on the Upper Control Board and one on the Lower Control Board reduces the volume of the NOISE function.

ECO #135: Changing U137 on the Upper Control Board from a LM324 to a TL084 matches Filter Envelope characteristics between upper and lower trays.

ECO #136: Changing 2 resistors on each of the two Mother Boards increases the gain of the output. Changing a resistor on the Cassette Monitor Switch (rear panel) raises the cassette monitor volume, keeping the ratio of the volumes of synthesizer output and cassette monitor constant.

ECO #140: This change implements software version XA-GA0. The change is made to eliminate an "edit doubling" effect in the first "G" software.

ECO #143: Cutting the lead going to pin #12 of the -5 723 regulator and running pin #12 to the + lead of the +5 filter capacitor allows for operation down to 90VAC input.

The listing of the OB-Xa's Software History (next page) contains a brief discription of all of the major changes in the OB-Xa since its introduction.

The evolution of the software in the OB-Xa is documented in this section. This service manual covers units with the latest software version "G" (#8 & 9, below) only.

VERSION	EPROM MARKING	STARTING SERIAL #	FEATURES
	(2716s)		
1.	XA-AB0 -A1 -A2	810101 Jan 81	32 Programs, Old Auto-Tune, Old Cassette Interface, Old Edit
2.	XA-AD0 -A1 -A2	810201 Jan 81	32 Programs, Old Auto-Tune, Old Cassette Interface, New Edit--2 Bit delay (for pot jitter) and ability to push both GROUP and PROGRAM buttons at once
3.	XA-B0 -BA1 -B2	813701 Sep 81	120 Programs, Old Auto-Tune, New Cassette Interface--Arms PLAY function more reliably, New Edit, Piggyback Memory Board
4.	XA-C0 -C1 -C2	814203 Oct 81	120 Programs, New Auto-Tune--tunes each voice more closely, lights PROGRAM LEDs as it tunes each voice, flashes corresponding PROGRAM LED and disables voice if it cannot be tuned; Old Cassette Interface, New Edit, piggyback memory board
5.	XA-C0 -CA1 -C2	814401 Nov 81	120 Programs, New Auto-Tune, New Cassette Interface, New Edit, Piggyback Memory Board Note: this version produced through Feb 82.
	(2732s)		
6.	XA-F0 -F1	814701 Nov 81	120 Programs, New Auto-Tune, New Cassette Interface, New Edit, New Processor Board
7.	XA-FA0 -F1	820301 Jan 82	Same as F0, only with software noise fix (ECO #132)
8.	XA-G0 -G1	820818 Feb 82	120 Programs, New Auto-Tune, New Cassette Interface, New Edit, New Processor Board, Digital Portamento
9.	XA-GA0 -G1	820901 Feb 82	Same as G0, only with edit doubling fix (ECO #140)

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

1. Power Supply
2. Modulation Assembly
3. Control/Processor Board
4. Voice Cards

Equipment required:

Digital Voltmeter (4 1/2 digit minimum)
Strobe Tuner (optional)
Audio amplifier with speakers or headphones
Oscilloscope

DIP SWITCH FUNCTION

On the Left Pot Board inside the OB-Xa is an 8 position DIP switch. This switch is used for voice selection, and is labelled "VOICES". If the switch is down (OPEN) that voice will be turned off. Position 1 is for Voice 1, position 2 is for Voice 2, and so on.

TEST SWITCHES

Next to the DIP switch you will find two large slide switches labelled TEST 1 and TEST 2.

The TEST 1 switch, 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.

The new Auto-Tune circuit (on units starting with serial number 814203) will remove voices which it cannot tune from the voice assignment rotation. The TEST 2 switch defeats this feature. When the switch is in the Off (Down) position, voices which cannot be tuned by the Auto-Tune circuit will remain in the voice assignment rotation.

CMOS MEMORY CURRENT DRAIN

BEFORE APPLYING AC POWER, the current drain of the CMOS memory (6116) is measured.

[It is important that no power be applied to the unit for a minimum of five minutes before making this measurement.]

Check for any ground connections to the DVM common input other than the one ground lead used for the measurement.

Locate the 10K resistor to the right of the battery on the upper control board. Measure the voltage across the resistor. It should be less than 100 mV. This corresponds to a current drain of 10 uA.

POWER SUPPLY CALIBRATION AND VERIFICATION

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

On the Power Supply Board, locate the trimmer next to the leftmost 723 voltage regulator; it is labeled "-5". Locate the trimmer next to the rightmost 723 voltage regulator; it is labeled "+15".

Attach the DVM ground lead to Pin 4 of Connector C (on the Lower Control Board).

+15 ADJUSTMENT:

Attach the DVM positive lead to Pin 6 of Connector K (Upper Control Board). Monitor this voltage; adjust the +15 Trimmer for +15.000 V +/-20 mV.

-5 ADJUSTMENT:

Attach the DVM positive lead to Pin 10 of Connector C (Upper Control Board). Monitor this voltage; adjust the -5 Trimmer for -5.000 V +/-20 mV.

VOLTAGE VERIFICATION

All voltages are D.C. unless specified otherwise.

Refer to the chart below:

CONTROL BOARD, Upper and Lower, Connectors K & A, respectively:

PIN #	VOLTAGE	TOLERANCE
1	~5.5 VAC	+/-2 V
2	+5.0 V	+/-250 mV
3	+5.0 V	+/-250 mV
4	key	
5	+15.0 V	+/-20 mV
6	+15.0 V	+/-20 mV
7	gnd	
8	gnd	
9	-15.0 V	+/-750 mV
10	-15.0 V	+/-750 mV

MOTHER BOARD, Upper and Lower, Connector D:

PIN #	VOLTAGE	TOLERANCE
1	-15.0 V	+/-750 mV
2	key	
3	+15.0 V	+/-20 mV
4	+15.0 V	+/-20 mV
5	gnd	
6	gnd	
7	gnd	
8	gnd	
9	-5.0 V	+/-20 mV
10	-5.0 V	+/-20 mV

UPPER CONTROL BOARD VOLTAGE VERIFICATION

Verify the +5.6 V supply at Pin 16 of I.C. #145 (4051), tolerance is +/-200 mV.

Verify the -10 V supply at pin 7 of I.C. #149 (4053), tolerance is +/-1 V.

LOWER CONTROL BOARD VOLTAGE VERIFICATION

Verify the +5.6 V supply at Pin 16 of I.C. #45 (4051), tolerance is +/-200 mV.

Verify the -10 V supply at pin 7 of I.C. #13 (4053), tolerance is +/-1 V.

POT BOARD VOLTAGE VERIFICATION

Two voltages are developed on the Pot Board, +5.6 V and -5.0 V.

Verify the +5.6 V supply at Pin 16 of I.C. #5 on the Pot Board. Tolerance is +/-350 mV.

Verify the -5.0 V supply at pin 7 of I.C. #5. Tolerance is +/-500 mV.

Below are two methods of modulation assembly calibration: the first utilizes a DVM, and the second is an audio method that does not use a DVM.

Locate the trimmers which are accessible through the holes on the top of the Bend Assembly. Refer to the "Trimmer Location Diagram" for locations.

All switches on the Bend Assembly should be off (LED out), except the "Down Transpose" and "Lower & Upper" switches.

CALIBRATION WITH DVM

1- Center Lever Adjustment

The Center Lever adjustment needs to be performed only if the "Up or Down Bend" cannot be brought into range, i.e., will not bend an octave.

Measure the voltage at Pin 1 of IC #8. Adjust the "Center Lever" trimmer for 0.000 V +/-25 mV.

2- Bend Offset Adjustment

The bend offset adjustment needs to be performed only if there is excessive beating between the two oscillators when "OSC 2 ONLY" is pressed. Do the following:

Hold note C5, press "AUTO" to autotune the oscillators, be sure the Oscillators are beatless (less than 1 beat per second), press "OSC 2 ONLY" switch (LED on). Adjust the "Bend Offset" trimmer until the beating is less than 1 beat per second.

If IC #8 has been replaced, the following calibration procedure is used:

Measure the voltage at Pin 1 of IC #8. Adjust the "Center Bend" trimmer for 0.000 V +/-25 mV.

Measure the voltage at Pin 7 of IC #8. Adjust the "Bend Offset" trimmer for 0.000 V +/-2 mV.

Measure the voltage at Pin 10 of Connector C. This voltage, which should be 0.000 V +/-20 mV, is the bend circuit offset voltage. This voltage must be added to (or subracted from) the voltages stated for the following three adjustments:

3- Up Bend Adjustment:

Move the bend lever fully towards the front of the unit. Monitor the voltage at Pin 10 of Connector C (Lower Control Board). Adjust the "Up Bend" trimmer until the voltage is -1.000 V +/-2 mV (+/- the bend circuit offset).

4- Down Bend Adjustment:
Move the bend lever fully towards the back of the unit. Monitor the voltage at Pin 10 of Connector C (Lower Control Board). Adjust the "Down Bend" trimmer until the voltage is +1.000 V +/-2 mV (+/- the bend circuit offset).

5- Narrow Bend Adjustment:
Press the "NARROW" switch (LED on). Move the bend lever fully towards the front of the unit. Monitor the voltage at Pin 10 of Connector C (Lower Control Board). Adjust the "Narrow Bend" trimmer until the voltage is -0.167 V +/-2 mV (+/- the bend circuit offset).

6- Up Transpose Adjustment:
Measure the voltage at Pin 5 of Connector C. Press the "UP TRANSPOSE" switch (LED on). Adjust the "Up Transpose" trimmer until the voltage is +2.000 V +/-2 mV more than the voltage measured in the "DOWN TRANSPOSE" position.

7- LFO Offset Adjustment:
This adjustment need be performed only if there is excessive beating between VCO 1 and VCO 2 when the "MOD" assign switches on the Bend Assembly are on and the "DEPTH" is off (knob down).

Press the "OSC 1 MOD" switch. Adjust the "LFO Offset" trimmer until the beating is less than 1 beat per second.

If IC #7 has been replaced, the following calibration procedure is used:

Measure the voltage at Pin 7 of IC #7. Adjust the "LFO Offset" trimmer for 0.000 V +/-5 mV.

8- Saw Symmetry Adjustment:
With an oscilloscope, monitor the sawtooth waveform at Pin 8 of IC #6. Adjust the "Saw Symmetry" trimmer for minimum distortion of the waveform. Note: turning the trimmer fully clockwise will provide a symmetrical waveform but the amplitude will be half the required value. The required amplitude is 2 to 3 V peak to peak.

Locate the trimmers which are accessible through the holes on the top of the Bend Assembly. Refer to the "Trimmer Location Diagram" for locations.

All switches on the Bend Assembly should be off (LED out), except the "Down Transpose" and "Lower & Upper" switches.

1- Center Lever Adjustment

The Center Lever adjustment needs to be performed only if the "Up or Down Bend" cannot be brought into range, i.e., will not bend an octave.

Hold note C5, press "AUTO" to autotune the oscillators, be sure the Oscillators are beatless (less than 1 beat per second). Press the "NARROW" switch. Adjust the "Center Lever" trimmer so that pressing the "NARROW" switch on and off causes no change in pitch.

NOTE: Adjustment of the "Center Lever" trimmer without a DVM may cause the center of the "MASTER TUNE" control on the front panel to be flat or sharp of A=440. We recommend adjusting the "Center Bend" trimmer only if necessary.

2- Bend Offset Adjustment

The bend offset adjustment needs to be performed only if there is excessive beating between the two oscillators when "OSC 2 ONLY" is pressed. Do the following:

Hold note C5, press "AUTO" to autotune the oscillators, be sure the Oscillators are beatless (less than 1 beat per second), press "OSC 2 ONLY" switch (LED on). Adjust the "Bend Offset" trimmer until the beating is less than 1 beat per second.

3- Up Bend Adjustment:

Turn on the "OSC 2 ONLY" (LED on), and make sure the NARROW switch is off (LED off). Hold note C5, press "AUTO" to autotune the oscillators, be sure the Oscillators are beatless (less than 1 beat per second). Move the bend lever fully towards the front of the unit. Adjust the "Up Bend" trimmer until the interval between OSC 1 and OSC 2 is exactly One Octave.

4- Down Bend Adjustment:

Move the bend lever fully towards the back of the unit. Adjust the "Down Bend" trimmer until the interval between OSC 1 and OSC 2 is exactly One Octave.

5- Narrow Bend Adjustment:
Press the "NARROW" switch (LED on). Move the bend lever fully towards the front of the unit. Adjust the "Narrow Bend" trimmer until interval between OSC 1 and OSC 2 is exactly a Major Second (whole step).

6- Up Transpose Adjustment:
Press the "UP TRANSPOSE" switch (LED on). Adjust the "Up Transpose" trimmer until the interval between the "UP TRANSPOSE" and the "DOWN TRANSPOSE" positions is exactly Two Octaves.

7- LFO Offset Adjustment:
This adjustment need be performed only if there is excessive beating between VCO 1 and VCO 2 when the "MOD" assign switches on the Bend Assembly are on and the "DEPTH" is off (knob down).

Press the "OSC 1 MOD" switch. Adjust the "LFO Offset" trimmer until the beating is less than 1 beat per second.

8- Saw Symmetry Adjustment:
Pull up the "RATE" knob on the modulation panel. This will select a Sawtooth wave from the Modulation Assembly. Set the "RATE" knob to approximately 9 O'Clock. Pull up the "DEPTH" knob and turn the knob all the way up. Play and hold a note. Adjust the "Saw Symmetry" trimmer until the waveform is one, smooth Sawtooth wave. Note: turning the trimmer fully clockwise will provide a symmetrical waveform but the amplitude will be too low.

This calibration procedure makes reference to notes C0 through C5. C0 is the lowest C on the keyboard, and C5 is the highest C.

There are four trimmers for calibration on the Upper and Lower Control Boards. Their adjustments are described below:

DAC OFFSET ADJUSTMENT

Press the "UNISON" switch. Press Low C (C0). Measure the voltage at Pin 7 of IC #64 and adjust Trimmer T6 (near IC #35) for 0.000 V +/-2 mV.

DAC FULL SCALE ADJUSTMENT

Press High C (C5). Measure the voltage at Pin 9 of IC #64 and adjust Trimmer T9 for 5.000 V +/-2 mV.

DAC LINEARITY VERIFICATION

While monitoring the voltage at Pin 7 of IC #64:
Press key C1, this voltage equals 1.000 V +/-2 mV.
Press key C2, this voltage equals 2.000 V +/-2 mV.
Press key C3, this voltage equals 3.000 V +/-2 mV.
Press key C4, this voltage equals 4.000 V +/-2 mV.

UPPER AND LOWER LFO CALIBRATION

The OB-Xa has two LFO's on the main control boards. One is on the Upper Control Board, the other is on the Lower Control Board. The lower LFO is the master LFO (modulates all voices) when the unit is in any mode except "SPLIT" or "DOUBLE". When in "SPLIT" or "DOUBLE", the upper LFO modulates the upper voice tray and the lower LFO modulates the lower voice tray.

To adjust the LFO's, the technician will be required to write a patch setting into locations A1 and A2. Be certain to save the existing patches on cassette tape before proceding with this adjustment.

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

FILTER FREQUENCY	Fully Clockwise
FILTER MODULATION DEPTH	Fully Clockwise
LFO RATE	12 O'Clock
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise

All switches OFF, except the following:

OSC 1	On
OSC 1 FREQUENCY MODULATION	On
LFO WAVEFORM	Square

Write the above patch into memory locations A1 and A2. See the OB-Xa Owner's Manual (Page 3- Writing a Program), for a description of this procedure.

Press "SPLIT". The synthesizer will enter the Split Mode. The keyboard will be split at note C2. Program A1 will be on the lower half of the keyboard and program A2 will be on the upper half. Note: The synthesizer will be split with these programs upon power up. If the Split or Double modes have been previously entered, the synthesizer will remember the split point and programs previously recalled.

Hold note C1 and while listening to the oscillator being modulated, adjust Trimmer T5 (Lower Board) for a LFO rate of 2-4 Hz.

Hold note C2 and while listening to the oscillator being modulated, adjust the trimmer on the Upper Board (near IC #148) for a LFO rate of 2-4 Hz.

The following equipment is required for calibrating the voice cards in the OB-Xa:

Audio amplifier with speakers or headphones
Mini to Mini jumper clip
Oscilloscope (optional)

There are 15 Trimmers on the OB-Xa voice card for calibration. They are:

T1	VCO1 Volts Per Octave
T2	VCO1 High Track
T3	VCO1 Initial Frequency
T4	VCO1 Pulse Width
T5	VCO2 Volts Per Octave
T6	VCO2 High Track
T7	VCO2 Initial Frequency
T8	VCO2 Pulse Width
T9	Filter Envelope Modulation
T10	Filter Resonance
T11	Filter Volts Per Octave (4-Pole)
T12	Filter Volts Per Octave (2-Pole)
T13	Filter Initial Frequency (4-Pole)
T14	Filter Initial Frequency (both filters)
T15	VCA Offset

OSCILLATOR TUNING (VCO's)

1. Put the unit into the "MANUAL" mode. Set the controls as follows:

   All pots down (fully counter clockwise) except the following:

FILTER FREQUENCY	Fully Clockwise
FILTER MODULATION	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 O'Clock (dead zone)
VCO2 DETUNE	12 O'Clock (LED out)

   All switches OFF, except the following:

OSC 1	On
OSC 1 WAVEFORM	Pulse
TRACK	On
TRANSPOSE (on bend assembly)	Down Octave

2. Lift the front panel. Watch the LEDs on the voice cards. Play C5 repeatedly until Voice 1 is playing and press "HOLD". (This is for reference).

3. Using the voice selection DIP switch, turn off all of the voices except 1 and 2. Play C5. You should now hear Voice 1 Osc 1, and Voice 2 Osc 1. Press Auto-Tune. If the two oscillators are not in tune, the initial frequency of one or both needs to be calibrated. Turn off the TEST1 switch (down). Adjust Trimmer T3 for no beats. Turn on the TEST1 switch once again. Press Auto-Tune and make sure that there are still no beats.

4. Play C3 and listen for beats. Turn the Volts per Octave trimmer (T1 for VCO1) further out of tune until there are double the amount of beats per second.

5. Press Auto-Tune, play C5, and make sure the oscillators are still in tune.

6. Repeat steps 4 and 5 until tuning is satisfactory.

7. Repeat steps 3 through 6 for all voices.

HIGH-TRACK ADJUSTMENT

Set the TRANSPOSE switch on the Bend Assembly "UP OCTAVE". Verify the "Transpose" circuit is within specification (see the section on "Modulation Assembly Calibration"). All other switches and pots stay the same.

Holding note C5, turn the "High Track" Trimmer (T2) until no beats are heard.

USING A STROBE TUNER FOR OSCILLATOR CALIBRATION

Using a strobe tuner will result in the oscillators being tuned more accurately. To use a strobe tuner for measuring the pitch of the oscillators follow the above procedure, turning only the voice card being calibrated on. Plug the tuner into the audio output (use the MONO output).

Playing C1 on the keyboard should make the first octave scale appear stationary on the strobe tuner. C2 will make the second octave scale stop, and so on.

It recommended that only one voice be calibrated with the strobe tuner and that this voice then be used as a reference for tuning the other oscillators.

PULSE WIDTH CALIBRATION

With the DIP switch, turn only the voice to be calibrated on. Press note C3 and adjust the "Pulse Width" trimmer (T4) for the most "hollow" sound.

If an oscilloscope is being used, monitor the output of the voice card at Pin 2 of Connector G. Adjust the "Pulse Width" trimmers for a 50% duty cycle.

Repeat the above VCO calibration for VCO2. Turn VCO1 off and turn VCO2 on.

ENVELOPE MODULATION CALIBRATION

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

FILTER FREQUENCY	Fully Clockwise
FILTER MODULATION	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 O'Clock (dead zone)
VCO2 DETUNE	12 O'Clock (LED out)

All switches OFF, except the following:

OSC 1	On
OSC 2	On
F-ENV	On
TRACK	On
TRANSPOSE (on bend assembly)	Down Octave

Using the DIP switch, turn on only the voice to be calibrated.

While listening to both oscillators, adjust the F-ENV trimmer (T9) until VCO 2 is exactly One Octave above VCO 1.

FILTER CALIBRATION

To calibrate the filter, it is necessary to calibrate one voice as a reference, and then calibrate the other voices to that reference.

FILTER REFERENCE CALIBRATION

Using the voice selection DIP switch, turn on the voice to be used as a reference.

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 O'Clock (dead zone)

All switches OFF, except the following:

NOISE	On
TRACK	On
TRANSPOSE (on bend assembly)	Center Octave (LEDs off)

INITIAL FREQUENCY CALIBRATION

Playing note C3, alternate between NOISE and OSC 2 HALF. Adjust the "Filter Initial Frequency" Trimmer (T14), until the pitch of the noise is the same pitch as VCO 2.

VOLTS PER OCTAVE CALIBRATION (VPO) (2-POLE)

Playing note C2, again alternate between NOISE and OSC 2 HALF. Adjust the "Filter VPO" Trimmer (T12), until the new voice is the same pitch as the reference.

Recheck the "Initial Frequency" adjustment.

Playing note C4, again alternate between NOISE and OSC 2 HALF. Adjust the "Filter VPO" Trimmer (T12), until the new voice is the same pitch as the reference.

Recheck the "Initial Frequency" adjustment.

FILTER CALIBRATION WITH A REFERENCE

Using the voice selection DIP switch, turn on the voice to be calibrated and the voice to be used as a reference.

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 O'Clock (dead zone)

All switches OFF, except the following:

NOISE	On
TRACK	On
TRANSPOSE (on bend assembly)	Center Octave (LEDs off)

INITIAL FREQUENCY CALIBRATION

Playing note C3, alternate between the reference voice and the voice to be calibrated. Adjust the "Filter Initial Frequency" Trimmer (T14), until the new voice is the same pitch as the reference.

VOLTS PER OCTAVE CALIBRATION (VPO) (2-POLE)

Playing note C2, again alternate between the reference voice and the voice to be calibrated. Adjust the "Filter VPO" Trimmer (T12), until the new voice is the same pitch as the reference.

Recheck the "Initial Frequency" adjustment.

Playing note C4, again alternate between the reference voice and the voice to be calibrated. Adjust the "Filter VPO" Trimmer (T12), until the new voice is the same pitch as the reference.

Recheck the "Initial Frequency" adjustment.

RESONANCE CALIBRATION

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 O'Clock (dead zone)

All switches OFF, except the following:

TRACK	On
TRANSPOSE (on bend assembly)	Center Octave (LEDs off)

Hold note C3 and listen to the voice card being calibrated. Turn the "Resonance" trimmer (T10) up until a low frequency oscillation (approx. 500 Hz sine wave) is heard, then turn the trimmer back just to the point at which the oscillation stops.

If the above test is questionable as to whether there is oscillation, monitor the output of the voice at Connector G2 with an oscilloscope. Look for any oscillation with an amplitude greater than 10 mV.

4-POLE FILTER CALIBRATION

Press the "4-POLE" switch. Repeat the procedure used for the 2-Pole filter, except use the "4-Pole Initial Frequency" trimmer (T13) for initial frequency calibration, and the "4-Pole VPO" trimmer (T11) for VPO calibration.

There is not a resonance adjustment for the 4-pole filter.

VCA OFFSET CALIBRATION

Put the unit into the "MANUAL" mode. Set the controls as follows:

All pots down (fully counter clockwise) except the following:

VCA ENVELOPE SUSTAIN	Fully Clockwise

All switches OFF.

Install a jumper on the card to be calibrated; see "VCA Offset" diagram.

Press key C3. Turn the "VCA Offset" trimmer (T15) until a minimum amplitude of the tone is heard.

DESCRIPTION

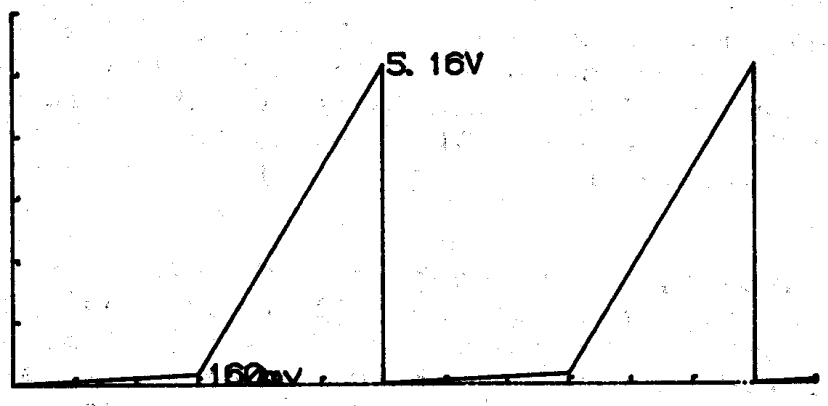
The diagnostic EPROM contains 5 subroutines which exercise and test various portions of the logic and control circuitry on the processor and control boards. Some tests, such as the sample/hold staircase and the latch test, merely exercise a portion of the circuitry in a specific manner and require the technicianto observe the operation of that circuitry with an oscilloscope while the test is being run. Other tests, such as LED, periodmeter, and cassette routine, only require the technician to observe the relevent LED to determine whether the test was sucsessful.

When the OB-Xa is initially turned on with a diagnostic EPROM installed, it starts running Test 1, which is indicated by the illumination of the PROGRAM 1 LED. Other tests can be selected, in any order, by depressing the appropriate PROGRAM switch (1 through 5 only). When a test routine has finished running, the PROGRAM switches are sampled to determine if any one is depressed. If so, the program goes to that test routine; if no switch is depressed, the program again runs the routine it just completed. The net effect of this procedure is that a test routine is run repeatedly until another test is selected.

The diagnostic EPROM is inserted in the socket for EPROM 0 (location A104). EPROMs 1 and 2 may be either in the system or not; they have no effect on the diagnostic program.

TEST 1 - SAMPLE/HOLD STAIRCASE

Test 1 exercises all S/Hs by first stepping through the 6 LSBs of DAC (64 steps), then stepping through the 6 MSBs (64 steps). The result os a S/H waveform similar to the following:



The program outputs one DAC value to all 64 S/H, then increments the input to the DAC and outputs the new value to all S/Hs.

All S/H outputs which go off the board should be observed at the connector in order to maximize the amount of circuitry and board tested. Those S/Hs which are used internally on the control board must be observed at the S/H output. It should be realized that the ATTACK, DECAY, and RELEASE signals for both the filter and the amplifier envelopes (LFATK, LAATK, LFDCY, LADCY, LFREL, LAREL for the lower control, UFATK, UAATK, UFDCY, UADCY, UFREL, UAREL for the upper), as well as the KEYCV signals will not conform to the waveform shown above. The envelope parameters will exhibit a waveshape inverted from that shown above and will vary from ground to about -250mv. In units without digital portamento, the KEYCV waveform at the connector will appear rounded and will level off at about 2 volts. The reason for this distortion is that the portamento CV (LPORTCV, UPORTCV) is increasing at the same time as the KEYCVs. Thus, at the high end of the range the portamento CV is high enough to prevent the KEYCVs from changing within the time between DSC increments.

TEST 2 - LED LATCHES AND LAMPS

This routine turns on all of the front panel LEDs, except for the cassette and bend box LEDs which must be turned on manually. A sucessful test is determined by visually observing that all the LEDs are illuminated. Since this is Test 2, the PROGRAM 2 LED will flashes.

TEST 3 - PERIODMETER

This test checks the periodmeter for the autotune circuit. However, this periodmeter test is designed to test the original autotune circuit in units before serial number 814203 (software labelled XA-AB0, XA-AD0, and XA-B0). It will not thest the new autotune circuit which sequences the PROGRAM LEDs as it tunes the voices.

When using Test 3 the CASSETTE ENABLE switch on the rear panel should be turned on, otherwise the PROGRAM 3 LED will flash to indicate that the test cannot be completed. Test 3 checks for a satisfactory running of the periodmeter constituted by A123, A114, A112, A104, A105, A113, A120, A121, A122, and A119 on the upper control board, used during autotune to check the period of each VCO.

At the beginning of the test, the PROGRAM 1 and 2 LEDs are lit, the counter is reset, and an "all ones" condition is tested at the output of the tri-state gates A112, A113, A105, and A104. The counter is started and the output is checked again after 65535 clock pulses for an "all zeros" condition, except for the 3 LSBs which are not taken into account. If the "all ones" or "all zeros" conditions fail on the 8 LSBs, the PROGRAM 1 LED is turned off, and if the "all ones" or "all zeros" conditions fail on the 8 MSBs, the PROGRAM 2 LED is turned off. A successful test is indicated by the PROGRAM 1 and 2 LEDs in a steady on state.

TEST 4 - CASSETTE INTERFACE

A step up transformer or mic-to-line amplifier is needed for this test because the level of the "TO CASSETTE INPUT" signal is not high enough to drive the signal present detection circuitry in the input section of the interface. A 5:1 transformer (Triad TZ-17X, available from Oberheim) or mic preamp is suggested to increase the level to the 2 volts peak-to-peak required.

Before running this test, it is necessary to turn on the CASSETTE ENABLE switch, turn the CASSETTE MONITOR switch to OFF, and connect the step up transformer between between the "TO CASSETTE AUX INPUT" and the "TO CASSETTE OUTPUT" jacks.

The cassette interface test program begins by turning on the PROGRAM 1 and 2 LEDs, resetting the data out (CDATO) to "0", and then setting the UNISON bit. With UNISON at "1" the 6.8mf capacitor is discharged. After a 1.3ms wait for the cap to discharge, RGATE is sampled to assure that it is "0". UNISON is then reset, thus allowing the cap to be charged by the input signal. Because of the input signal level and the circuit parameters, it takes about 2 or 3 seconds for the cap to charge sufficiently to enable RGATE to go active; the routine therefore has a 3 to 4 second wait after resetting UNISON before sampling RGATE. Improper functioning of the RGATE circuitry is indicated by the PROGRAM 1 LED being turned off.

After testing RGATE, the routine repeatedly outputs a train of 4 zeros and 4 ones (4 1.2KHz sine periods and 4 2.4KHz sine periods). Each period is checked to be the proper timing. An error in the data transmission is shown by the PROGRAM 2 LED being turned off.

A satisfactory completion of the test results in the PROGRAM 1 and 2 LEDs being lit steadily (it is necessary to wait 2 to 4 seconds from the beginning of the cassette interface test to get a significant result).

TEST 5 - LATCH TEST

Test 5 puts a squarewave of about 500 Hz on all the outputs of the following latches and controls:

- All outputs of A159, A161, A162, A163 on the upper control board
- All outputs of A30, A32, A31, A29 on the lower control board
- All gates.

The cassette interface allows data stored in the unit's memory to be preserved on audio cassette tape. The circuitry consists of an Output-to-Tape section and an Input-from-Tape section.

OUTPUT-TO-TAPE SECTION

For each "1" which the microprocessor finds in memory and sends to the Cassette Interface Output-to-Tape section, the circuitry will generate one period of a 2400 Hz. sine wave, and for each "0" one period of a 1200 Hz. sine wave. This is accomplished as follows:

1. U114 divides the system clock in order to produce a 19.2 KHz. clock on pin 6. The differentiator consisting of C15 and R88 takes this signal and produces a narrow pulse which is applied to U17-8.

2. U18-2 is the 19.2 KHz. clock divided by two. It is applied to U17-13.

3. CDATO is the data bit stream supplied by the microprocessor and is applied to U17-12.

4. The result of this logic is U17-10 which goes to U19-14. This signal is a pulse train with pulses occuring at a 9.6 KHz. rate if CDATO is a "0" and at 19.2 KHz. if CDATO is a "1".

5. U19 is a Johnson counter (shift register-counter) which is combined with three resistors in a simple D-to-A configuration to both divide the incoming pulse train by 8, and produce a rough approximation of a sine wave at either a 1200 Hz. rate (CDATO = "0"), or a 2400 Hz. rate (CDATO = "1").

6. The signal DREQ* (U19-4) informs the microprocessor that the next data bit can be transmitted on CDATO.

7. Q13 and the associated capacitors and resistors comprise a filter which smooths the rough sine wave output. This final signal is then sent to the recorder.

The general format for data recorded on tape is:

- LEADER (6 seconds at 1200 Hz.)

- then repeated 128 times:
  - SYNCHRONIZATION NIBBLE (0101)
  - DATA (16 Bytes)
  - CHECKSUM (nibble)
  - 2 BYTES OF ZEROS

- TRAILER (1200 Hz. Tone)

INPUT-FROM-TAPE SECTION

The purpose of the Input-from-Tape section is to notify the microprocessor that a signal is being received from the recorder and to convert each period of an incoming 1200 Hz. signal into a "0" and each period of an incoming 2400 Hz. signal into a "1". This is accomplished as follows:

1. The circuitry surrounding U15-1 is a signal detector which produces a logic signal (RGATE*) to inform the microprocessor that a signal of sufficient level is being received from the recorder. A 4 second delay is provided by R79 and C22, and two gates in U17 provide a Schmitt trigger to convert the delayed signal to logic levels. Transistor Q11 resets C22 during the initialization period.

2. U15-7 is a high gain amplifier which converts the incoming audio signal into a logic signal (CDATI*) for use by the microprocessor.

3. The microprocessor, by interrogating CDATI*, can measure the length of each incoming half-period. Depending upon the length, it stores into memory either a "0" or a "1". Since only the positive half-period is reliable, A NON SIGNAL INVERTING CASSETTE RECORDER MUST BE USED. That is, the input and output signals of the recorder must be in phase.

4. At the end of the read process, an error message will be displayed if the checksum which is calculated while the data is being read in does not equal the checksum recorded on tape.

When an OB-Xa is ready to transmit data to the COMPUTER INTERFACE, the HINT* line goes low (active). The OB-Xa then waits approximately 100 microseconds for a BUSRQ*. During this time the HRV* line must go low in order to read in the vector placed on the first five data lines, followed by BUSRQ* going low (within the 100 microseconds). The three most significant bits must be masked off the vector since they contain random data. The five bits of data are used to determine at what point in the program the OB-Xa is in. After the 100 microseconds, (plus the time that BUSRQ* was held low), the OB-Xa will reset the HINT* line, reset the five data lines, and read in COMFLG into the A register, to possibly be used in the OB-Xa.

HINT*	D0	D1	D2	D3	D4	LOCATION IN PROGRAM
0	0	0	0	0	0	KEYBOARD ROUTINE, JUST AFTER SCANNING KEYBOARD
0	0	1	1	0	0	BEGINNING OF PROGRAMMER ROUTINE
0	0	1	1	1	0	BEGINNING OF MAIN SCAN JUST AFTER SCANNING THE SWITCHES

If during the keyboard interrupt, COMFLG is made non-zero, the rest of the keyboard routine is skipped. This allows the insertion of notes directly to specific voices (called NVAL, located in RAM at 4010 to 4017 hex) while ignoring any notes being played on the keyboard. If during the programmer interrupt COMFLG is made non-zero, the OB-Xa will assume a program change has been made (by altering OLDPGM, located at RAM location 402E hex), and act accordingly. COMFLG has no affect on the main scan interrupt.

OB-Xa RAM LOCATIONS

ADDRESS	NAME	DESCRIPTION
4010-4017	NVAL	NOTES PLAYED BY THE 8 VOICES
4001-4009	BUFF	KEYS BEING DEPRESSED ON THE KEYBOARD
402E	OLDPGM	CURRENT PROGRAM
40AA	COMFLG	COMPUTER INTERFACE FLAG
40E0-40EF	SW	STORAGE LOCATIONS FOR FRONT PANEL SWITCH POSITIONS

NVAL: These 8 locations contain the data currently being played by the voices in the OB-Xa. NVAL contains information for voice 1, NVAL+1 contains information for voice 2, etc. The information is stored as follows: Bit 0-5 contain the note number (0 through 63), bit 6 is the HOLD bit and bit 7 is the GATE bit. The HOLD bit, when set, causes a voice to remain at its current pitch even if the keys are released. The GATE bit when set, sends a gate voltage to both envelope generators of the selected voice.

BUFF: These 9 locations contain data relating to the keys currently being played on the keyboard. The data can represent a key (0-63H), or it can represent no key being depressed at that location (FFH). BUFF+9 contains the lowest note being played on the keyboard, and BUFF is the highest. The OB-Xa uses this data during the keyboard routine to determine what notes to output to the voices.

OLDPGM: This location contains the program number currently being used in the instrument. In the OB-X, it can be 0-1FH; in the OB-SX, 0-17H; in the OB-Xa, 0-1FH; in the OB-Xa/120, 0-77H. These numbers relate to the selected programs in the following manner: The three least significant bits represent the PROGRAM number 1-8, bits 3 & 4 represent the GROUP A-D (on the OB-Xa/120 there are 15 possible groups, represented with bits 3 through 6).

COMFLG: This location is used to tell the OB-Xa to respond in a predetermined manner to the information given to it from the computer interface.

SW: These 16 locations contain a bit for each switch and each key on the keyboard on the OB-Xa only. That data is arranged as follows:

ADDRESS	D0	D1	D2	D3	D4	D5	D6	D7
40E0	C0	C#0	D0	D#0	E0	F0	F#0	G0
40E1	G#0	A0	A#0	B0	C1	C#1	D1	D#1
40E2	E1	F1	F#1	G1	G#1	A1	A#1	B1
40E3	C2	C#2	D2	D#2	E2	F2	F#2	G2
40E4	G#2	A2	A#2	B2	C3	C#3	D3	D#3
40E5	E3	F3	F#3	G3	G#3	A3	A#3	B3
40E6	C4	C#4	D4	D#4	E4	F4	F#4	G4
40E7	G#4	A4	A#4	B4	C5	--	--	--
40E8	PROG1	PROG2	PROG3	PROG4	PROG5	PROG6	PROG7	PROG8
40E9	GRP A	GRP B	GRP C	GRP D	HOLD	CHORD	SUSTFS	PRGADV
40EA	--	--	--	UNISON	LFOSIN	LFOSQR	LFOS/H	FMOSC1
40EB	FMOSC2	FMFILT	PMOSC1	PMOSC2	OSC1SW	OSC1SQ	OSC2SW	OSC2SQ
40EC	OSC1FL	TRACK	OSC2HF	OSC2FL	NOISE	4-POLE	SYNC	F-ENV
40ED	--	LOWER	UPPER	SPLIT	--	TEST1	TEST2	AUTO
40EE	MANUAL	WRITE	DOUBLE	--	RGATE*	CASSET	CDATI*	DREQ*
40EF	VOICE1	VOICE2	VOICE3	VOICE4	VOICE5	VOICE6	VOICE7	VOICE8

Here is an description of how communication occurs between an OB-Xa and a DSX when connected together through the computer interface.

The DSX, while in play, keeps track of the current "time of day" with its real time clock and decides whether or not it is time to play a note. When it is time to play a note, the DSX stores that note into a particular place in its memory. When it is time to stop playing that note, it takes the note out of that place in memory. In the mean time, if the OB-Xa has reached one of its three routines in which it calls the Computer Interface, it will place a vector onto the first 5 data lines and set the HINT* line low. This signal causes a non-maskable interrupt to occur in the Z80 of the DSX, forcing it to stop what it is doing and immediately execute a specific part of its program. This program will read in the vector and then set BUSRQ* low. The Z80 in the OB-Xa will send a BUSAK* signal and then stop everything until the BUSRQ* line returns to its normally high state. The DSX will then determine, using the vector, whether or not any communication is necessary between the DSX and the OB-Xa. If the vector indicated that the OB-Xa was in its keyboard routine and the DSX had a note to play, the DSX would then output the note into the appropriate memory location of the OB-Xa and make the memory location COMFLG non-zero. After this the DSX would return BUSRQ* to a high state, allowing the OB-Xa to resume its program. The OB-Xa would then output the note to the proper voice.

CABLE #3 -- Power Supply to Lower Mother Board

POWER SUPPLY				MOTHER BOARD
PH1	-	-15V	-	MLD1
PH2	-	KEY	-	MLD2
PH3	-	+15V	-	MLD3
PH4	-	+15V	-	MLD4
PH5	-	GND	-	MLD5
PH6	-	GND	-	MLD6
PH7	-	GND	-	MLD7
PH8	-	GND	-	MLD8
PH9	-	-5V	-	MLD9
PH10	-	-5V	-	MLD10

CABLE #4 -- Power Supply to Upper Mother Board

POWER SUPPLY				Mother Board
PG1	-	-15V	-	MUD1
PG2	-	KEY	-	MUD2
PG3	-	+15V	-	MUD3
PG4	-	+15V	-	MUD4
PG5	-	GND	-	MUD5
PG6	-	GND	-	MUD6
PG7	-	GND	-	MUD7
PG8	-	GND	-	MUD8
PG9	-	-5V	-	MUD9
PG10	-	-5V	-	MUD10

CABLE #6 -- Mother Board to Rear Panel

MOTHER BOARD		
F1	-	AUDIO OUT LEFT
F2	-	GND
F3	-	GND
F4	-	AUDIO OUT RIGHT

CABLE #7 -- Lower Control Board to Rear Panel Jacks and Switches

LOWER CONTROL BOARD		
B1	-	
B2	-	VCFP
B3	-	VIBP = VPED
B4	-	AUXOUT
B5	-	CASSIN
B6	-	CEN*
B7	-	KEY
B8	-	PADV*
B9	-	HLDP*
B10	-	SUST*

CABLE #8 -- Modulation Panel to Upper and Lower Control Boards

MODULATION PANEL			CONTROL BOARD LOWER -	- UPPER
D1	-	AUTUN	- C1	
D2	-	+5V	- C2	
D3	-	VPED	- C3	
D4	-	GND	- C4	
D5	-	TRANSPOSE	- C5	- L1
D6	-	SPLIT*	- C6	
D7	-	-15V	- C7	
D8	-	KEY	- C8	- L2
D9	-	OSC1UP		- L3
D10	-	+15V	- C9	
D11	-	OSC2UP		- L4
D12	-	OSC2LOW	- C11	
D13	-	OSC1LOW	- C10	

CABLE #9 -- Power Supply to Upper Control Board

UPPER CONTROL BOARD				POWER SUPPLY
A1	-	5VAC (FOR PUP CIRCUIT)	-	F1
A2	-	+5V	-	F2
A3	-	+5V	-	F3
A4	-	KEY	-	F4
A5	-	+15V	-	F5
A6	-	+15V	-	F6
A7	-	GND	-	F7
A8	-	GND	-	F8
A9	-	-15V	-	F9
A10	-	-15V	-	F10

CABLE #10 -- Power Supply to Lower Control Board

LOWER CONTROL BOARD				POWER SUPPLY
K1	-	5VAC (FOR PUP CIRCUIT)	-	E1
K2	-	+5V	-	E2
K3	-	+5V	-	E3
K4	-	KEY	-	E4
K5	-	+15V	-	E5
K6	-	+15V	-	E6
K7	-	GND	-	E7
K8	-	GND	-	E8
K9	-	-15V	-	E9
K10	-	-15V	-	E10

CABLE #15 -- Lower Control Board to Pot Board

LOWER CONTROL BOARD			POT BOARD (connector not marked)
E1	-	LR07	-
E2	-	LR06	-
E3	-	LR05	-
E4	-	LR04	-
E5	-	LR03	-
E6	-	LR02	-
E7	-	LR01	-
E8	-	LR00	-
E9	-	GND	-
E10	-	ANLGIN	-
E11	-	GND	-
E12	-	VOLPOT	-
E13	-	MTUN	-
E14	-		-
E15	-	SWEND*	-
E16	-	-15V	-
E17	-	+15V	-
E18	-	SWENE*	-
E19	-	CEN*	-
E20	-	+5V	-
E21	-	SWD6*	-
E22	-	SWD7*	-
E23	-	SWD2*	-
E24	-	SWD1*	-
E25	-	SWD5*	-
E26	-	SWD0*	-
E27	-	SWD4*	-
E28	-	SWD3*	-
E29	-	AR5	-
E30	-	AR4	-
E31	-	AR3	-
E32	-	AR2	-
E33	-	AR1	-
E34	-	AR0	-

CABLE #16 -- Upper Control Board to Lower Control Board

UPPER CONTROL BOARD				LOWER CONTROL BOARD
D1	-	A4	-	D1
D2	-	A5	-	D2
D3	-	A6	-	D3
D4	-	A1	-	D4
D5	-	A2	-	D5
D6	-	A3	-	D6
D7	-	AOA	-	D7
D8	-	A9	-	D8
D9	-	A8	-	D9
D10	-	A7	-	D10
D11	-	D7	-	D11
D12	-	D6	-	D12
D13	-	D5	-	D13
D14	-	D4	-	D14
D15	-	D3	-	D15
D16	-	D2	-	D16
D17	-	D1	-	D17
D18	-	DO	-	D18
D19	-	IOR*	-	D19
D20	-	ANLGOUT	-	D20
D21	-	MTUNE	-	D21
D22	-	OSCMUX	-	D22
D23	-	UR50* = LR50*	-	D23
D24	-	NOISE	-	D24
D25	-	SPLIT*	-	D25
D26	-	IOW*	-	D26
D27	-	CEN*	-	D27
D28	-	LLFO	-	D28
D29	-	ATRST*	-	D29
D30	-		-	D30
D31	-	LLFO	-	D31
D32	-	VCFP	-	D32
D33	-	CASCLK	-	D33

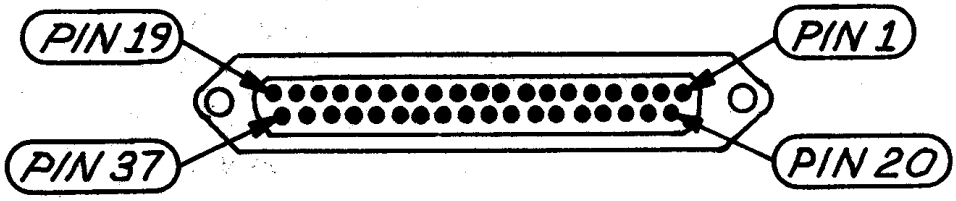
CABLE #20 -- Modulation Panel Internal Cable

MOD PANEL CONNECTOR A				MOD PANEL CONNECTOR C
A1	-	UP TRANSPOSE	-	C1
A2	-	DN TRANSPOSE	-	C2
A3	-	NARROW	-	C3
A4	-	2 ONLY*	-	C4
A5	-	KEY	-	C5
A6	-	MOD 1	-	C6
A7	-	MOD 2	-	C7
A8	-	GND	-	C8
A9	-	+5V	-	C9
A10	-	AUTUN	-	C10

CABLE #21 -- Computer Interface (Upper Control Board to Rear Panel)

CONTROL BOARD		REAR PANEL INTERFACE CONNECTOR		
X1	-	HA 11	-	37
X2	-	HA 10	-	36
X3	-	HA 9	-	35
X4	-	HA 8	-	34
X5	-	HA 7	-	33
X6	-	HA 5	-	32
X7	-	HA 3	-	31
X8	-	HA 1	-	30
X9	-	HD 0	-	29
X10	-	HD 1	-	28
X11	-	HD 2	-	27
X12	-	HD 3	-	26
X13	-	HRV*	-	25
X14	-	BUSRQ*	-	24
X15	-	BUSAKA*	-	23
X16	-	HINT*	-	22
X17	-	HWR*	-	21
X18	-	HMRQ*	-	20
X19	-			
X20	-			
X21	-			
X22	-	HRD*	-	1
X23	-	GROUND	-	2
X24	-	GROUND	-	3
X25	-	GROUND	-	4
X26	-	GROUND	-	5
X27	-	GROUND	-	6
X28	-	OSC MUX	-	7
X29	-	HD 4	-	8
X30	-	HD 5	-	9
X31	-	HD 6	-	10
X32	-	HD 7	-	11
X33	-	HA 0	-	12
X34	-	HA 2	-	13
X35	-	HA 4	-	14
X36	-	HA 6	-	15
X37	-	HA 15	-	16
X38	-	HA 14	-	17
X39	-	HA 13	-	18
X40	-	HA 12	-	19

This diagram shows the location of PIN #1 on the 37 pin Rear Panel Interface Connector:



OB-XA
FEMALE
CONNECTOR

CABLE #23 -- Upper Mother Board to Lower Mother Board

E1	-	LEFT AUDIO	-	E1
E2	-	RIGHT AUDIO	-	E2
E3	-	BALANCE	-	E3
E4	-	VOLUME	-	E4
E5	-	KEY	-	E5
E6	-	OSC MUX	-	E6

Pot Board Interconnect List --

NOTE: These connectors are not labeled. These connectors are described from top to bottom with the unit opened up.

POT BOARD #1		POT BOARD #2
A1	SWEN9*	A1
A2	(NC)	A2
A3	LED C6	A3
A4	LED R4	A4
A5	LED R3	A5
A6	LED R2	A6
A7	LED R1	A7
A8	LED R0	A8
B1	SWD7*	B1
B2	SWD6*	B2
B3	SWD5*	B3
B4	SWD4*	B4
B5	SWD3*	B5
B6	SWD2*	B6
B7	SWD1*	B7
B8	SWD0*	B8
C1	SWENB*	C1
C2	LED C1	C2
C3	SWENA*	C3
C4	LED C0	C4
C5	SWEND*	C5
C6	MTUN	C6
C7	VOLPOT	C7
C8	GND	C8
D1	+5.6V	D1
D2	VCO2 DETUNE	D2
D3	PWM AMT	D3
D4	FM AMT	D4
D5	LFO FREQ	D5
D6	PORT AMT	D6
D7	+15	D7
D8	-15	D8
D9	SWENF*	D9
D10	BAL	D10

OBERHEIM ELECTRONICS, INC.

ENGINEERING CHANGE ORDER

ECO NO 134

PRODUCT AFFECTED

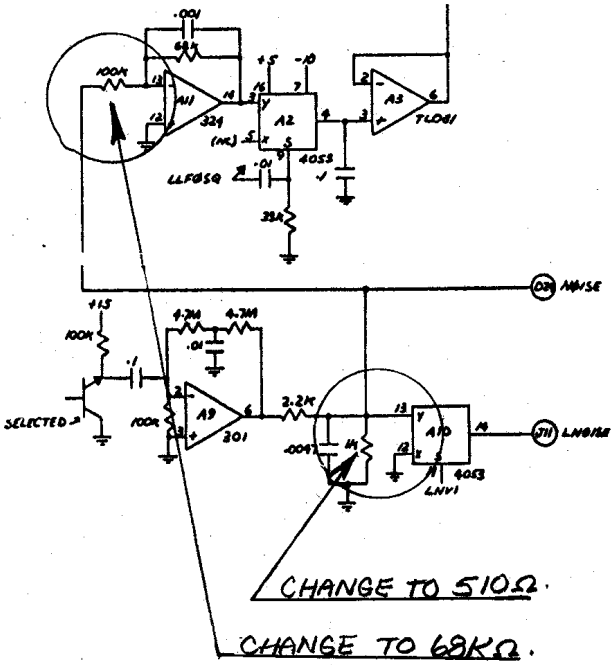
OB-XA

DRAWINGS AFFECTED

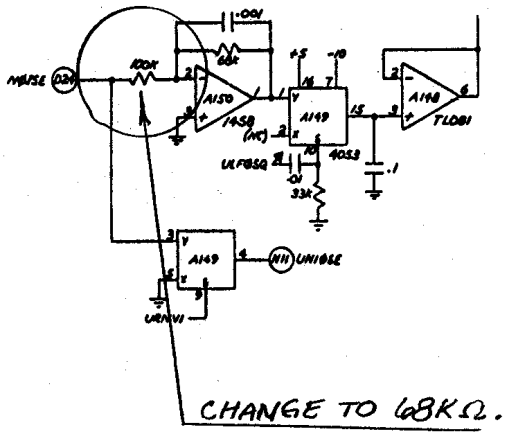
SCHEMATIC	1517A	UPPER CONTROL
ASSEMBLY	720054	"
SCHEMATIC	1516A	LOWER CONTROL
ASSEMBLY	720053	"

DESCRIPTION OF CHANGE - CHANGE 3 RESISTORS

UPPER CONTROL BD:
1517A SHEET 2



LOWER CONTROL BD:
1516A SHEET 4



REASON FOR CHANGE

TO REDUCE THE VOLUME OF THE NOISE FUNCTION

EFFECTIVITY

- [x] FUTURE PRODUCTION ONLY
- [ ] RETROFIT UNITS IN PRODUCTION AND INVENTORY
- [ ] RETROFIT UNITS IN FIELD
- [ ] DRAWING CORRECTION ONLY; HARDWARE NOT AFFECTED
- [ ] _____

WRITTEN BY

ANNE 3-5-82

APPROVED BY

3-5-82

OBERHEIM ELECTRONICS, INC.

ENGINEERING CHANGE ORDER

ECO NO. 135

PRODUCT AFFECTED

.OB-XA

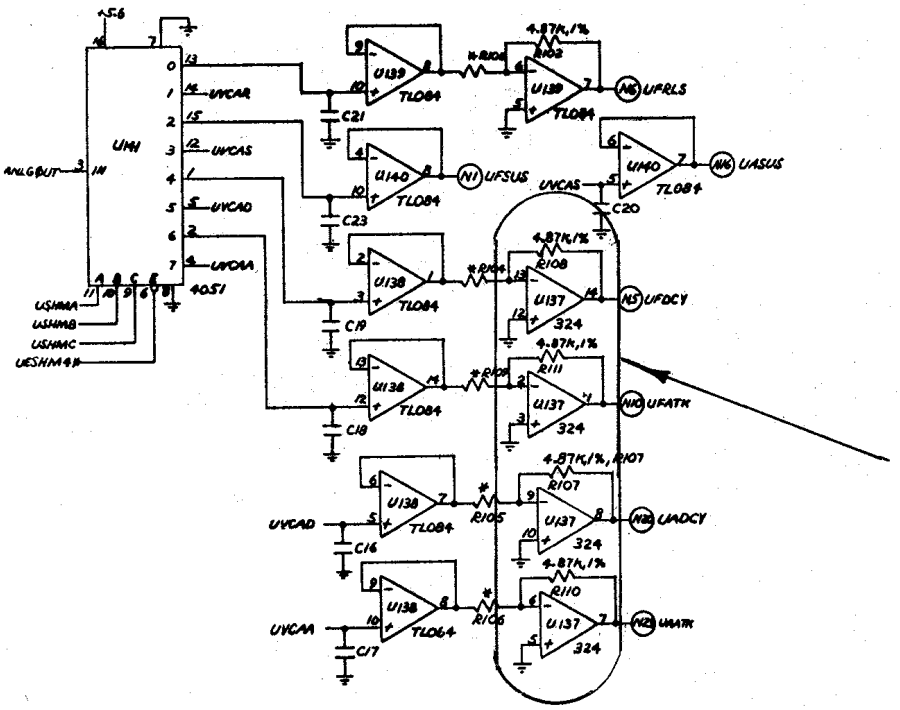
DRAWINGS AFFECTED

SCHEMATIC 1517A SHEET 2 UPPER CONTROL

ASSEMBLY 720054 UPPER CONTROL

DESCRIPTION OF CHANGE

CHANGE U137 FROM AN LM324 TO A TL084.



REASON FOR CHANGE

TO MATCH FILTER ENVELOPE CHARACTERISTICS BETWEEN TOP AND BOTTOM TRAYS.

EFFECTIVITY

- [x] FUTURE PRODUCTION ONLY
- [x] RETROFIT UNITS IN PRODUCTION AND INVENTORY AS NEEDED
- [ ] RETROFIT UNITS IN FIELD
- [ ] DRAWING CORRECTION ONLY; HARDWARE NOT AFFECTED
- [x] AS NEEDED IN TEST.

WRITTEN BY D

ANNE 3-5-82

APPROVED BY D

3-5-82

OBERHEIM ELECTRONICS, INC.

ENGINEERING CHANGE ORDER

ECO NO. 136

PRODUCT AFFECTED

.OB-XA

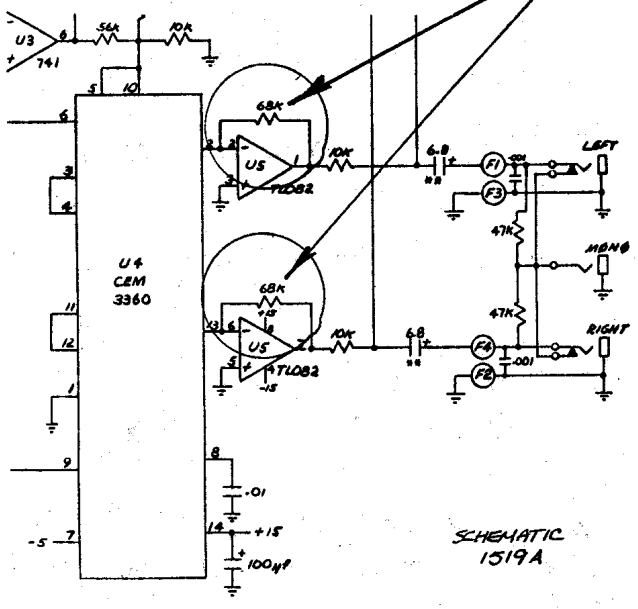
DRAWINGS AFFECTED

SCHEMATIC 1516A SHEET 4 (REAR PANEL)
SCHEMATIC 1519A MOTHER BD.
ASSEMBLY 720057 & 720057-0 (LOWER)
ASSEMBLY 720061 & 720061-0 (UPPER)
ASSEMBLY 750129-1 (XA CABLE #7)

DESCRIPTION OF CHANGE

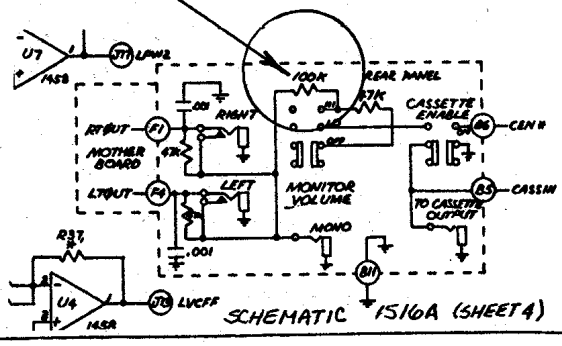
1. CHANGE A TOTAL OF 4 RESISTORS PER OB-XA UNIT FROM 68K TO 120K.

CHANGE TO 120K ON TWO MOTHER BOARDS.



2. CHANGE RESISTOR ON CASSETTE MONITOR SWITCH (REAR PANEL) TO 68KΩ. THIS RAISES CASSETTE MONITOR VOLUME, KEEPING RATIO OF THE VOLUMES OF SYNTHESIZER OUTPUT AND CASSETTE MONITOR CONSISTANT.

CHANGE TO 68KΩ



REASON FOR CHANGE

TO INCREASE GAIN OF OUTPUT.

EFFECTIVITY

- [x] FUTURE PRODUCTION ONLY
- [x] RETROFIT UNITS IN PRODUCTION AND INVENTORY
- [x] RETROFIT UNITS IN FIELD
- [ ] DRAWING CORRECTION ONLY; HARDWARE NOT AFFECTED
- [ ] _____

WRITTEN BY — DATE

ANNE — 3-5-82

APPROVED BY — DATE

3-5-82

OBERHEIM ELECTRONICS, INC.

ENGINEERING CHANGE ORDER

ECO NO. 140

PRODUCT AFFECTED

OB-XA

DRAWINGS AFFECTED

ASSEMBLY # 120054 OB-XA UPPER CONT

DESCRIPTION OF CHANGE

CHANGE EPROM LABLED XA-GØ (PART NO. 310001-GØ)

TO EPROM LABLED XA-GAØ (PART NO. 310001-GAØ)

EXPLANATION: IF THE FOLLOWING ACTIONS ARE TAKEN, AN ERROR WILL OCCUR.

1. ENTER MANUAL MODE.
2. WHILE IN MANUAL MODE, PERFORM AN "EDIT". (EXAMPLE: RAISE THE FREQ OF VCO2 UNTIL IT IS DOUBLED.)
3. PUSH WRITE BUTTON
4. PUSH PROGRAM NUMBER YOU WANT SAVE PATCH IN
5. LET GO OF PROGRAM NUMBER BUTTON BEFORE YOU
6. LET GO OF WRITE BUTTON.

IF YOU LISTEN NOW, VCO 2 WILL BE DOUBLED, AGAIN. IT'S AS IF THE SAME EDIT WERE PERFORMED TWICE. THE PROGRAM WAS SAVED CORRECTLY, HOWEVER. PUSHING THE PROGRAM BUTTON AGAIN WILL RESTORE YOUR PATCH.

THIS ERROR IS CORRECTED IN XA-GAØ.

REF. S002

REASON FOR CHANGE

TO ELIMINATE "EDIT-DOUBLING" ERROR CONTAINED IN XA-GØ. (SEE EXPLANATION ABOVE)

EFFECTIVITY

- [X] FUTURE PRODUCTION ONLY
- [X] RETROFIT UNITS IN PRODUCTION AND INVENTORY
- [ ] RETROFIT UNITS IN FIELD
- [ ] DRAWING CORRECTION ONLY; HARDWARE NOT AFFECTED
- [ ] _____

WRITTEN BY — DATE

ANNE — 3-4-82

APPROVED BY — DATE

JCO — 3-4-82

OBERHEIM ELECTRONICS, INC.

ENGINEERING CHANGE ORDER

ECO NO. 143

PRODUCT AFFECTED

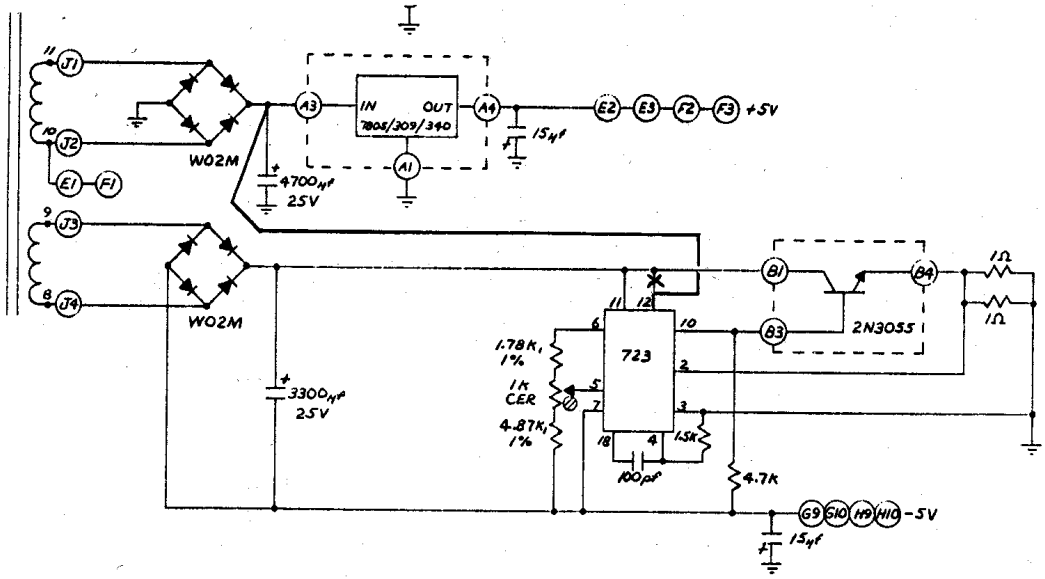
OB-Xa

DRAWINGS AFFECTED

Schematic - 1515

DESCRIPTION OF CHANGE

Cut lead going to pin 12 of the -5 723 regulator & run that pin to the + lead of the +5 filter cap.



REASON FOR CHANGE

Allow for operation down to 90 VAC Input.

EFFECTIVITY

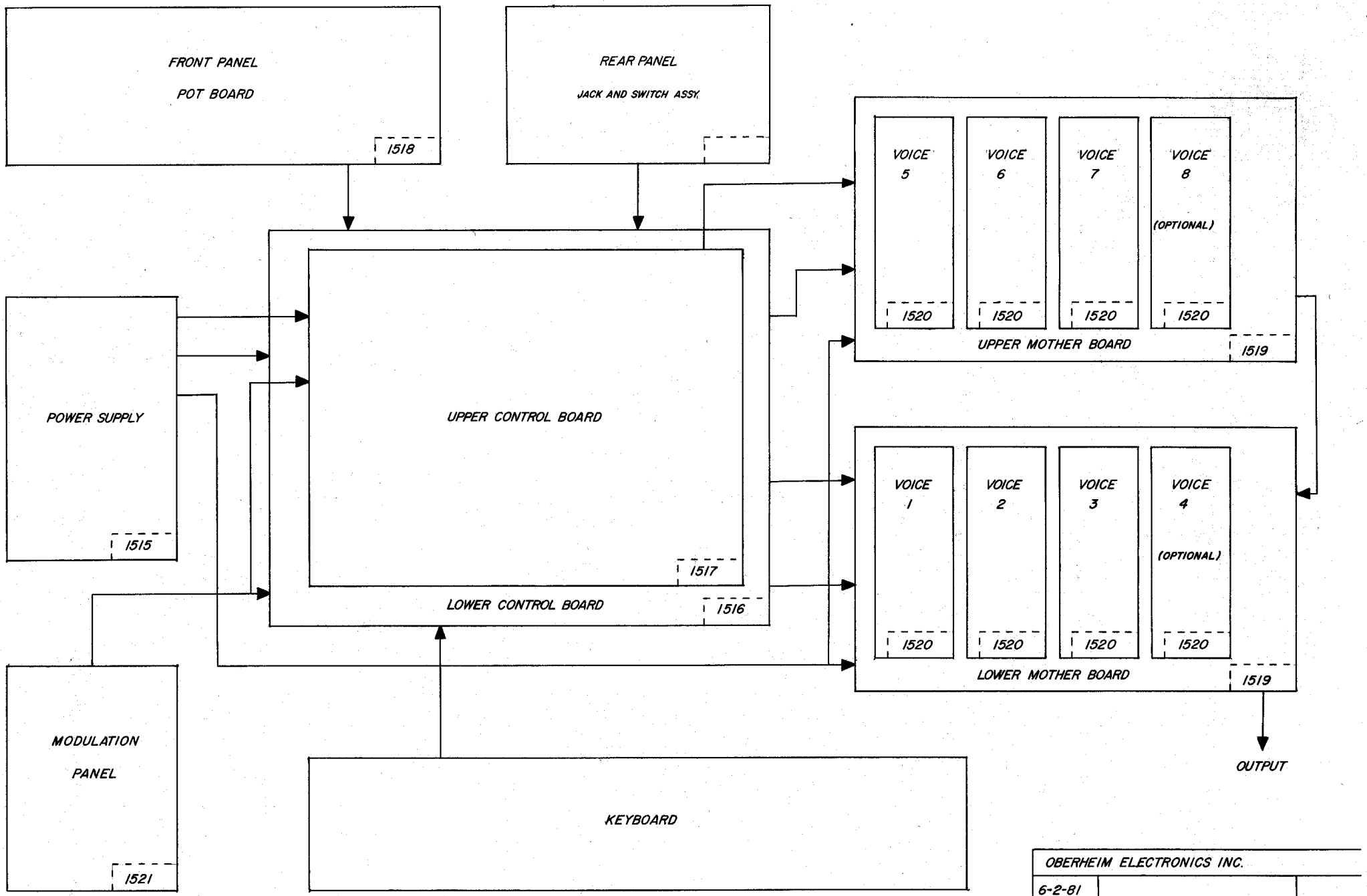
- [x] FUTURE PRODUCTION ONLY
- [ ] RETROFIT UNITS IN PRODUCTION AND INVENTORY
- [ ] RETROFIT UNITS IN FIELD
- [ ] DRAWING CORRECTION ONLY; HARDWARE NOT AFFECTED
- [ ] _____

WRITTEN BY — DAT

4/5/82

APPROVED BY — DAT

4/5/82



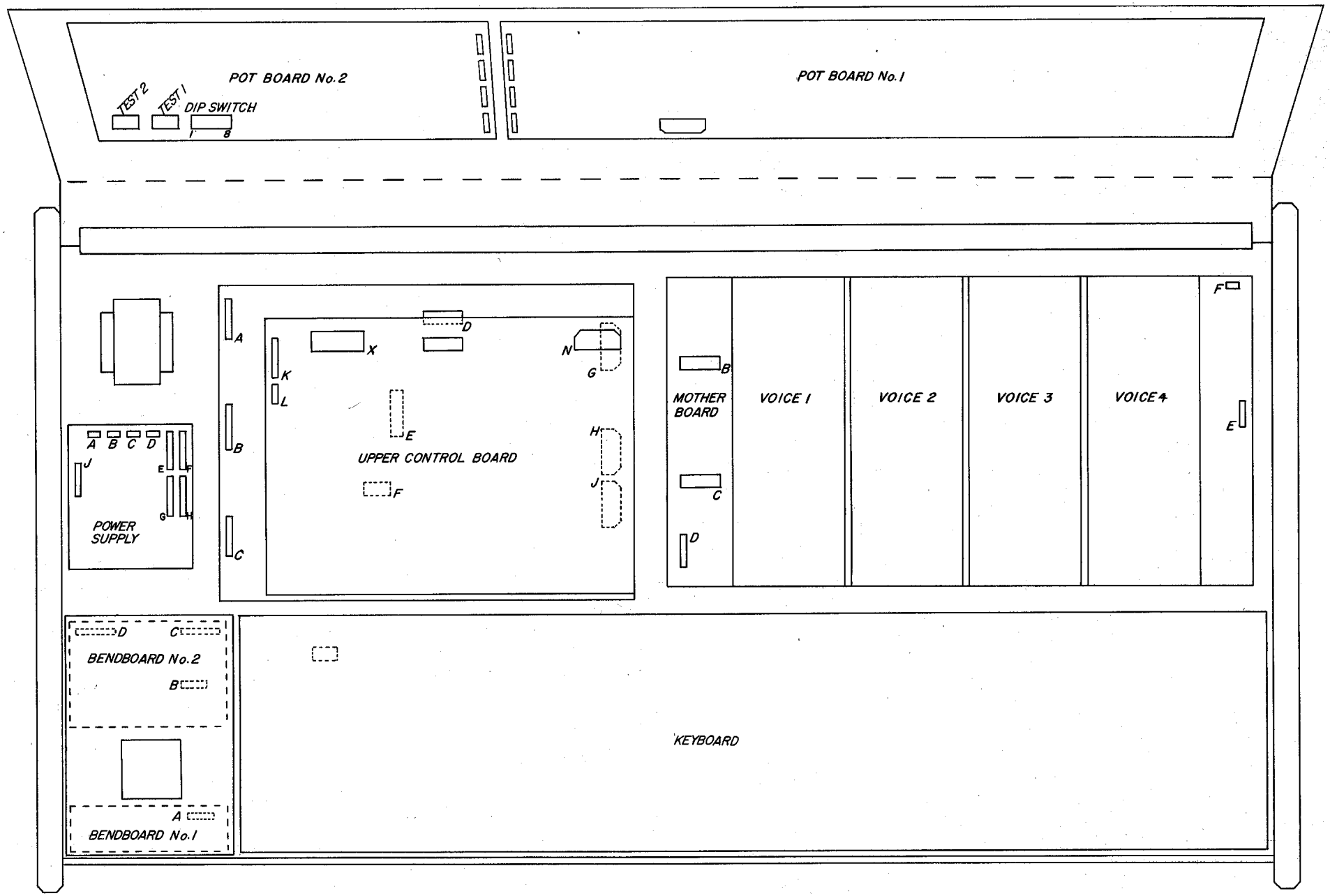
SCHEMATIC DWA. NO'S SHOWN IN DOTTED BOXES

OBERHEIM ELECTRONICS INC.

6-2-81

OB-XA WIRING BLOCK DIAGRAM
REV'D 8-7-81

1577A



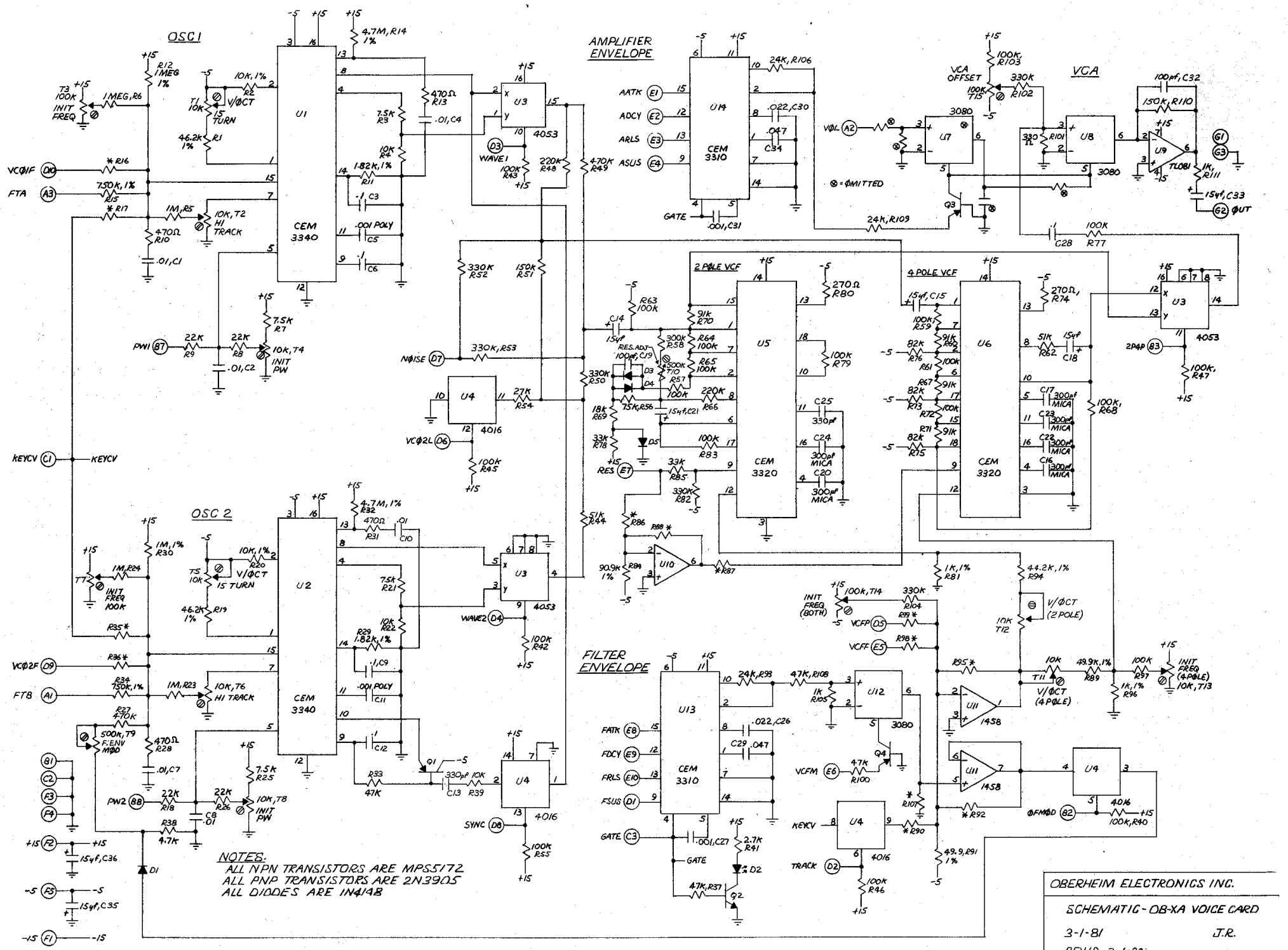
NOTE: MOTHER BOARD No. 2
AND VOICE 5 TO 8
NOT SHOWN.

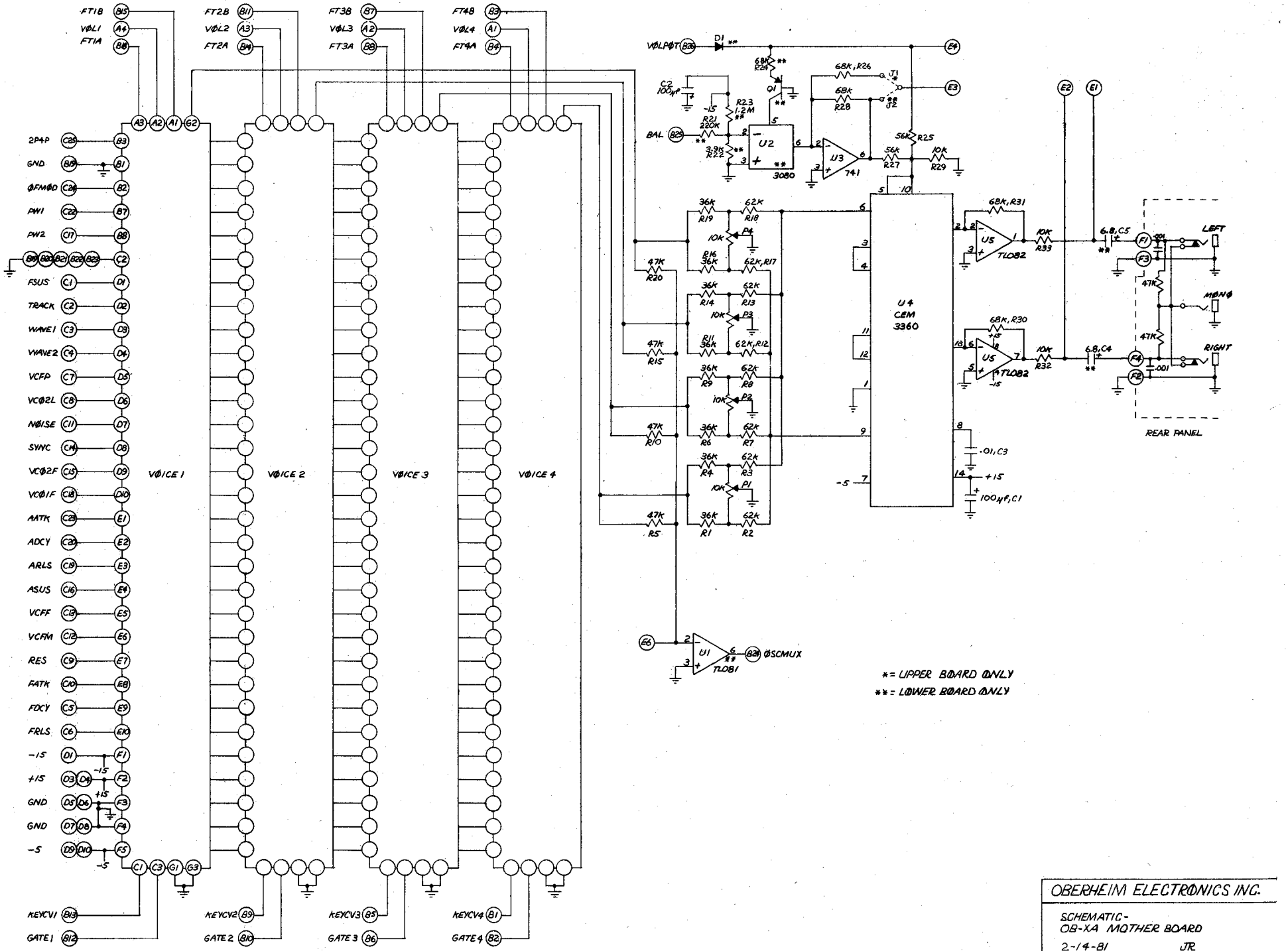
OBERHEIM ELECTRONICS INC.

6-2-81

OB-XA SUB ASSEMBLY AND CONNECTORS
PLACEMENT DIAGRAM.
REV'D 8-7-81

1578A


OSC 1
OSC 2
AMPLIFIER ENVELOPE
VCA
2 POLE VCF
4 POLE VCF
FILTER ENVELOPE
CEM 3340
CEM 3310
CEM 3320
4053
4016
1458
3080
TL081
NOTES:
ALL NPN TRANSISTORS ARE MPS5172
ALL PNP TRANSISTORS ARE 2N3905
ALL DIODES ARE IN4148
OBERHEIM ELECTRONICS INC.
SCHEMATIC - OB-XA VOICE CARD
3-1-81 J.R.
REV'D 3-1-82
15200



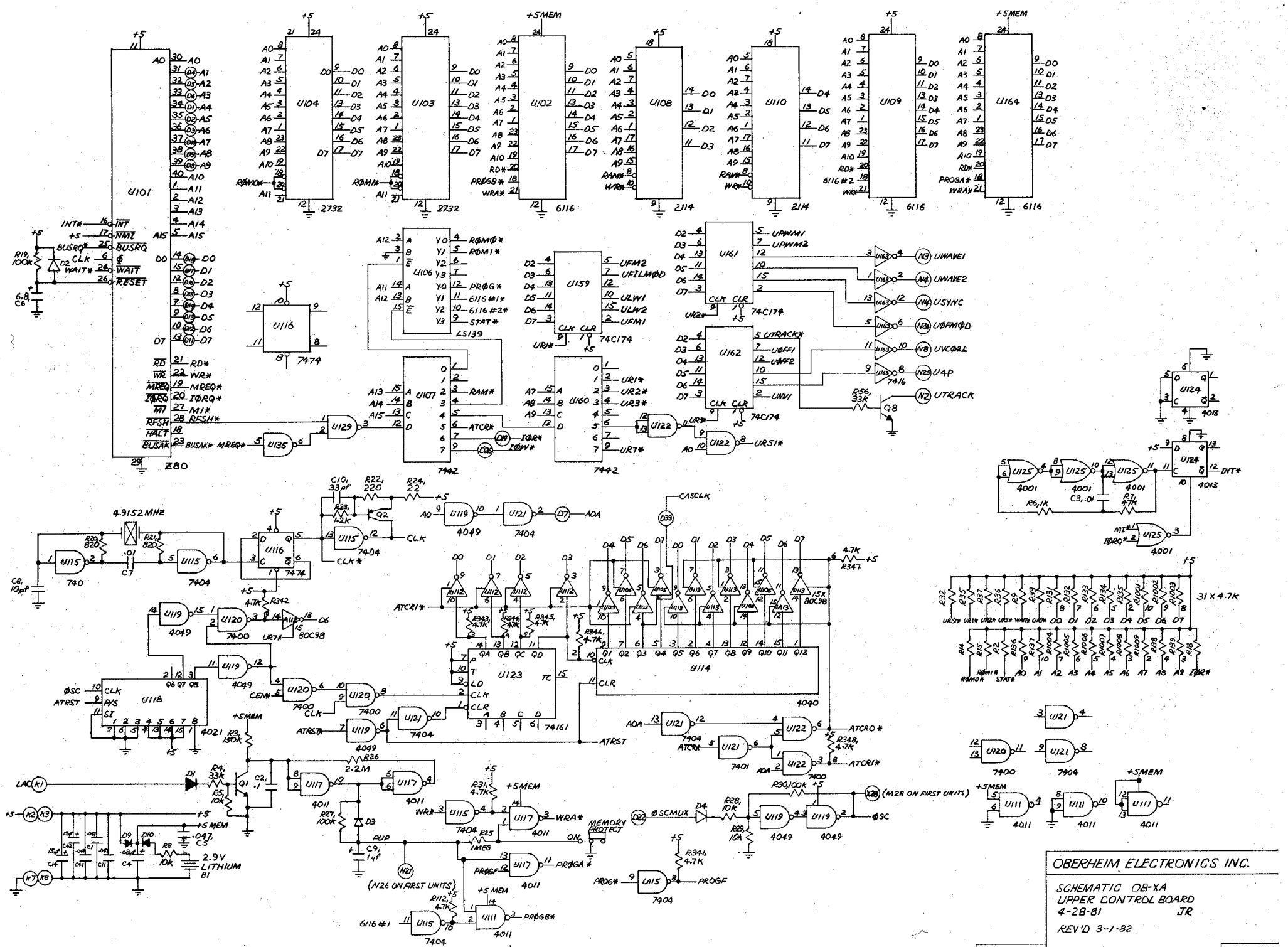
OBERHEIM ELECTRONICS INC.

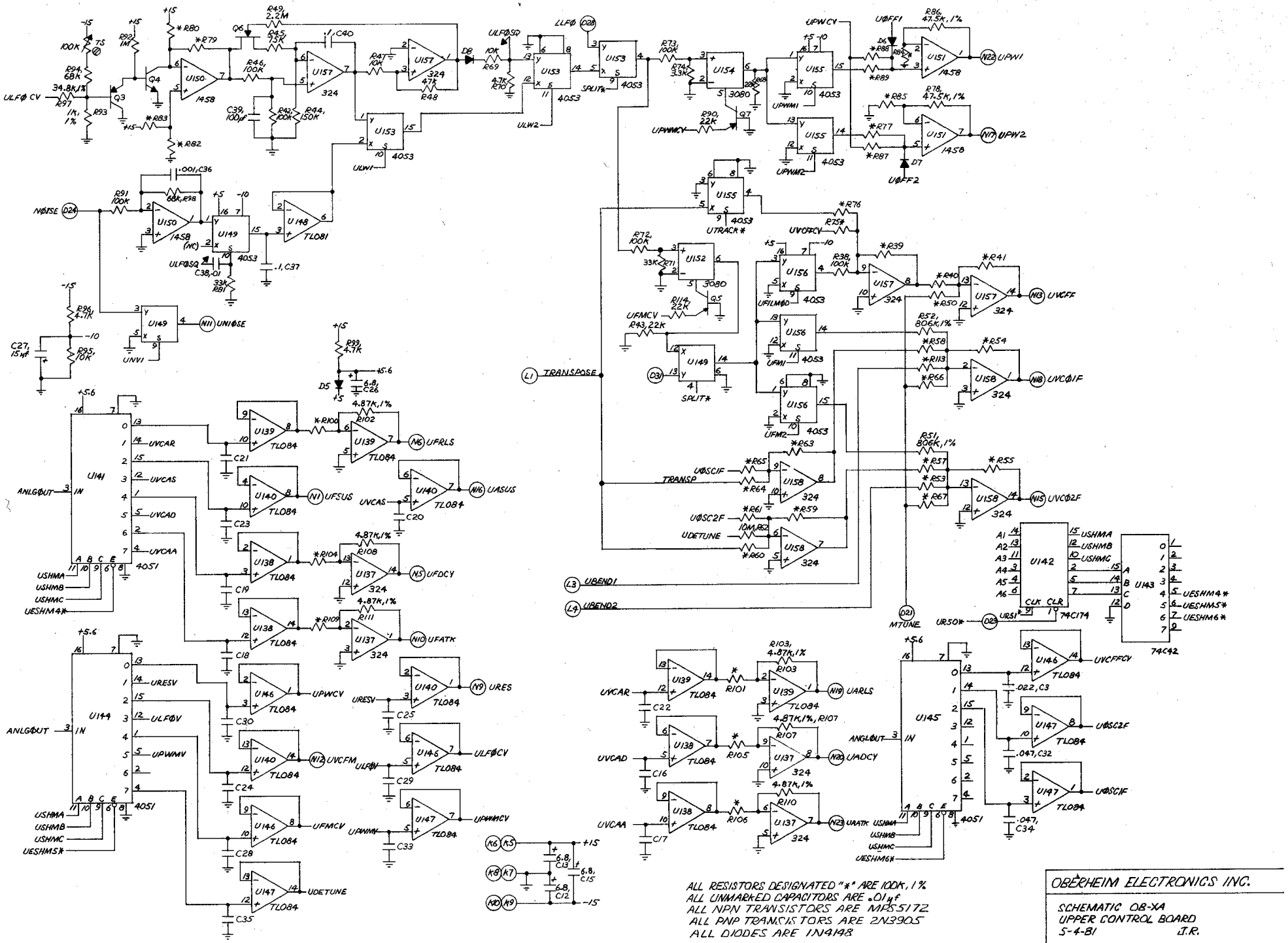
SCHEMATIC -
OB-XA MOTHER BOARD

2-14-81 JR

REV'D 3-1-82

1519C


U101
Z80
U104
U103
U102
U108
U110
U109
U164
2732
6116
2114
U116
7474
U106
LS139
U107
7442
U160
U159
74C174
U161
U162
7416
U163
U124
4013
U125
4001
U129
U135
U122
U115
7404
U119
4049
U120
7400
U121
7408
U112
80C98
U123
74161
U114
4040
U118
4021
U117
4011
U111
4011
4.9152 MHZ
31 X 4.7K
2.9V LITHIUM B1
MEMORY PROTECT
OBERHEIM ELECTRONICS INC.
SCHEMATIC OB-XA
UPPER CONTROL BOARD
4-28-81 JR
REV'D 3-1-82
SHEET 1 OF 3
1517G



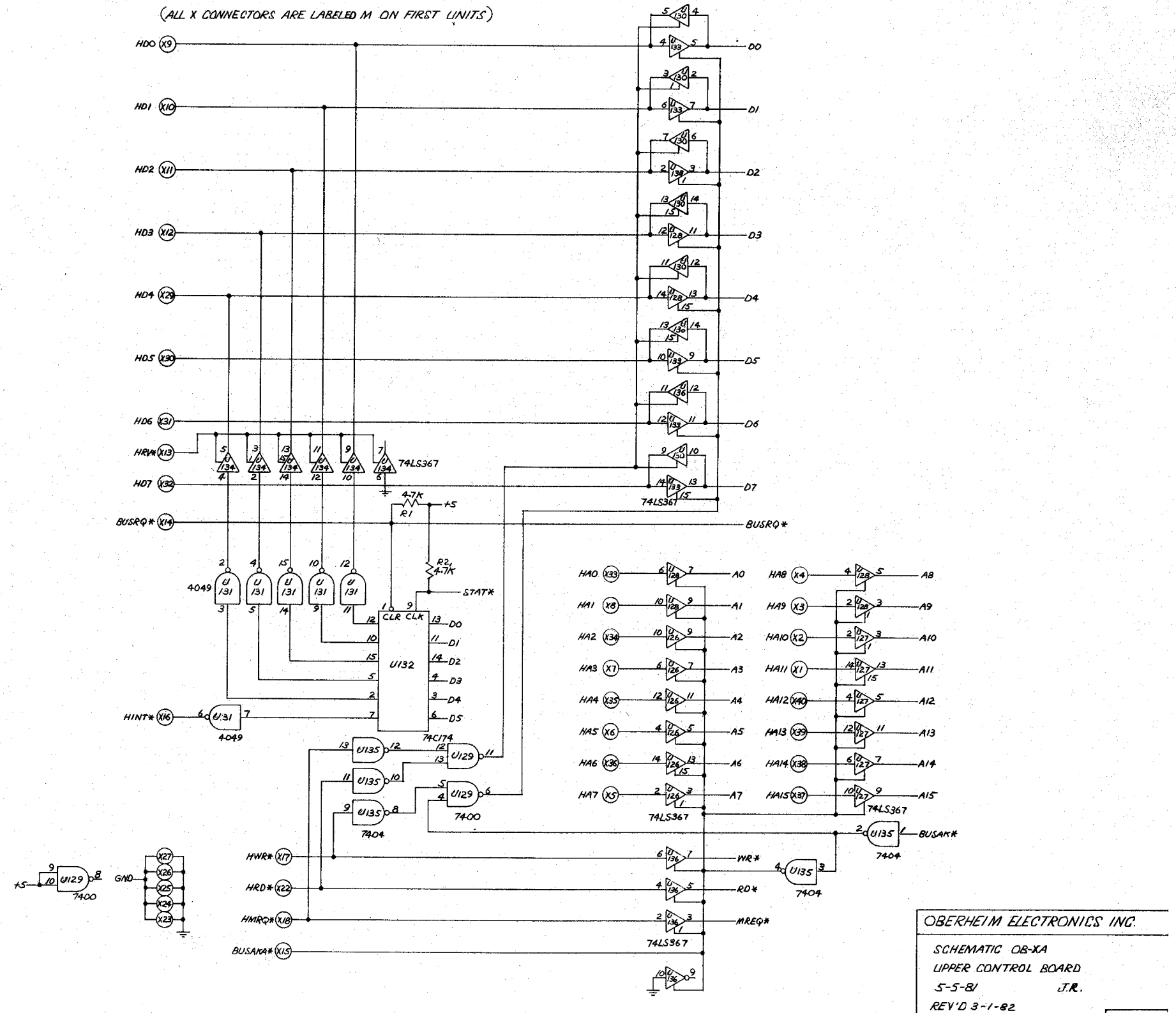
ALL RESISTORS DESIGNATED "*" ARE 100K, 1%
ALL UNMARKED CAPACITORS ARE .01μf
ALL NPN TRANSISTORS ARE MPS5172
ALL PNP TRANSISTORS ARE 2N3905
ALL DIODES ARE 1N4148

OBERHEIM ELECTRONICS INC.

SCHEMATIC OB-XA
UPPER CONTROL BOARD
5-4-81 J.R.
REV'D 3-1-82

SHEET 2 OF 3

15170



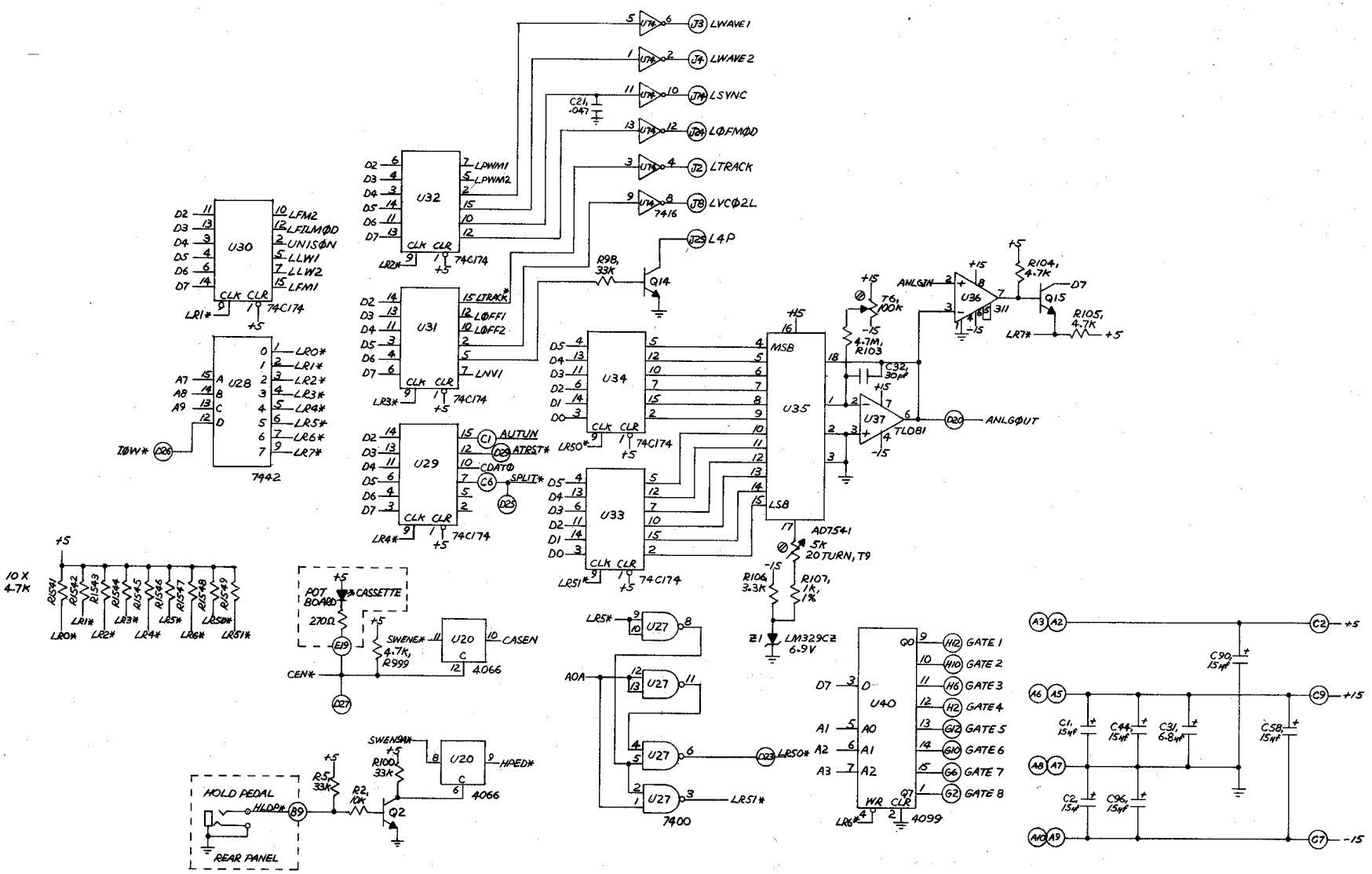
OBERHEIM ELECTRONICS INC.

SCHEMATIC OB-XA

UPPER CONTROL BOARD

5-5-81 J.R.

REV'D 3-1-82



OBERHEIM ELECTRONICS INC.

SCHEMATIC - OB-XA

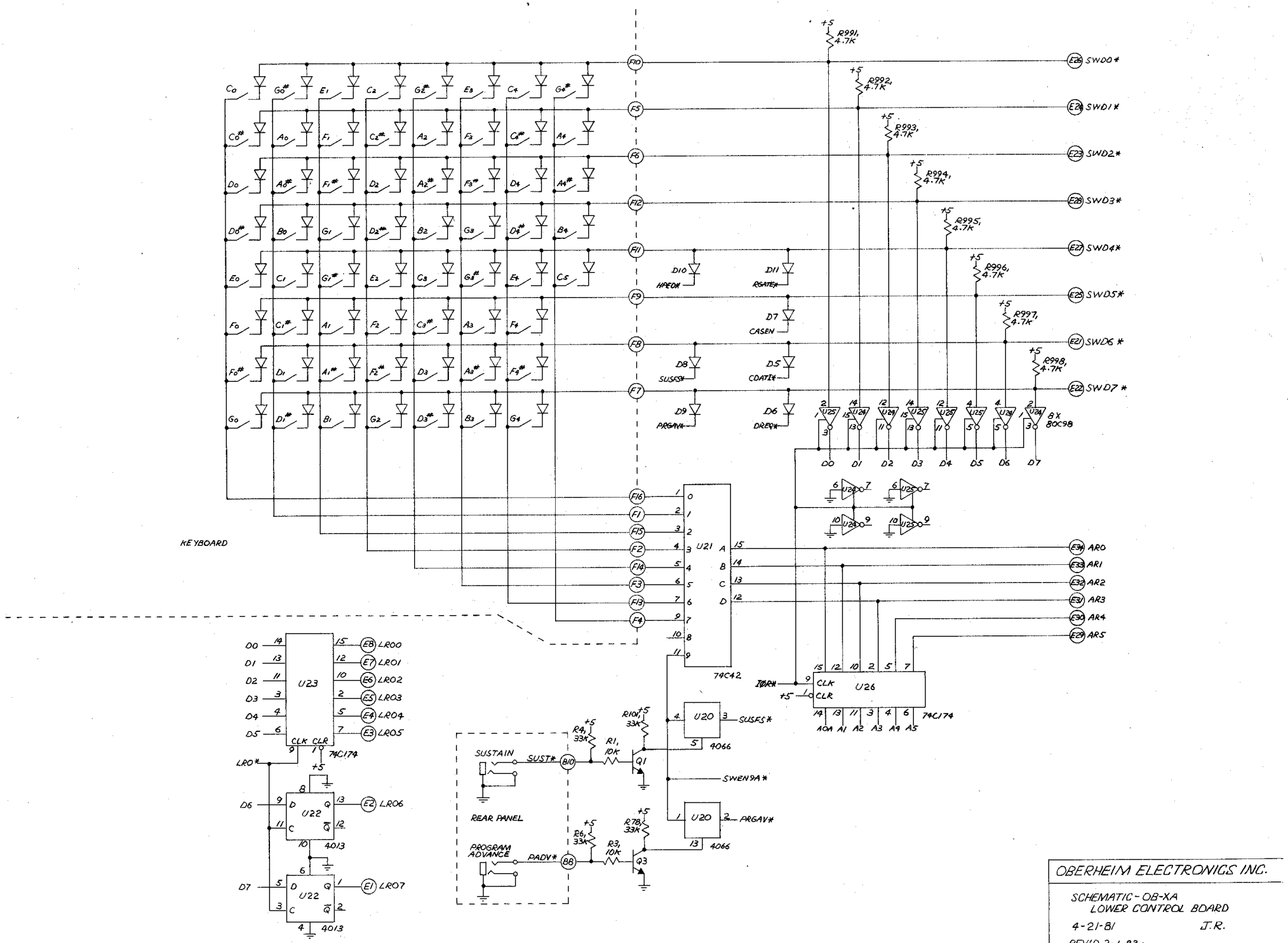
LOWER CONTROL BOARD

4-30-81 JR

REV'D 3-1-82

SHEET 1 OF 4

1516C



OBERHEIM ELECTRONICS INC.

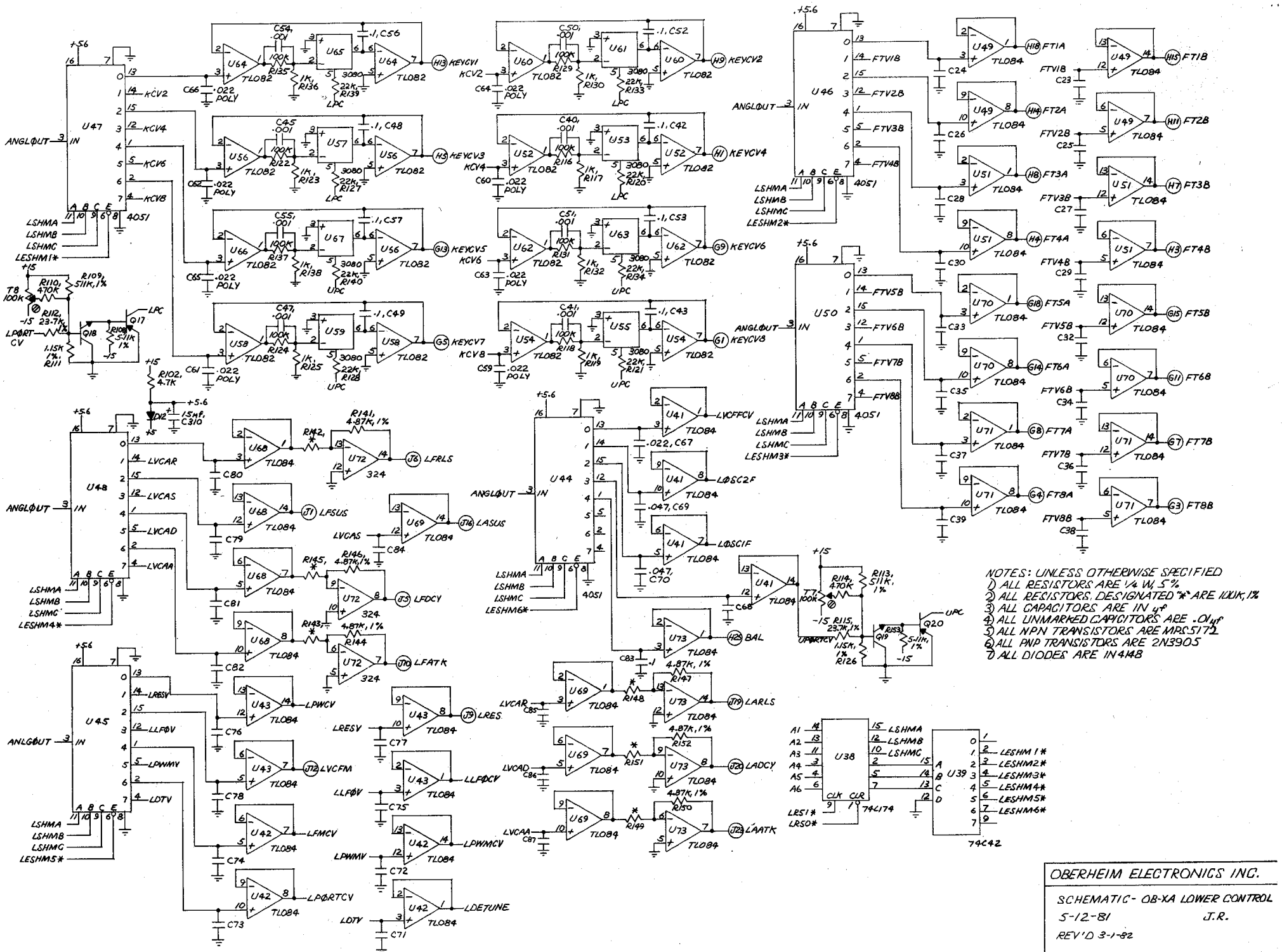
SCHEMATIC - OB-XA
LOWER CONTROL BOARD

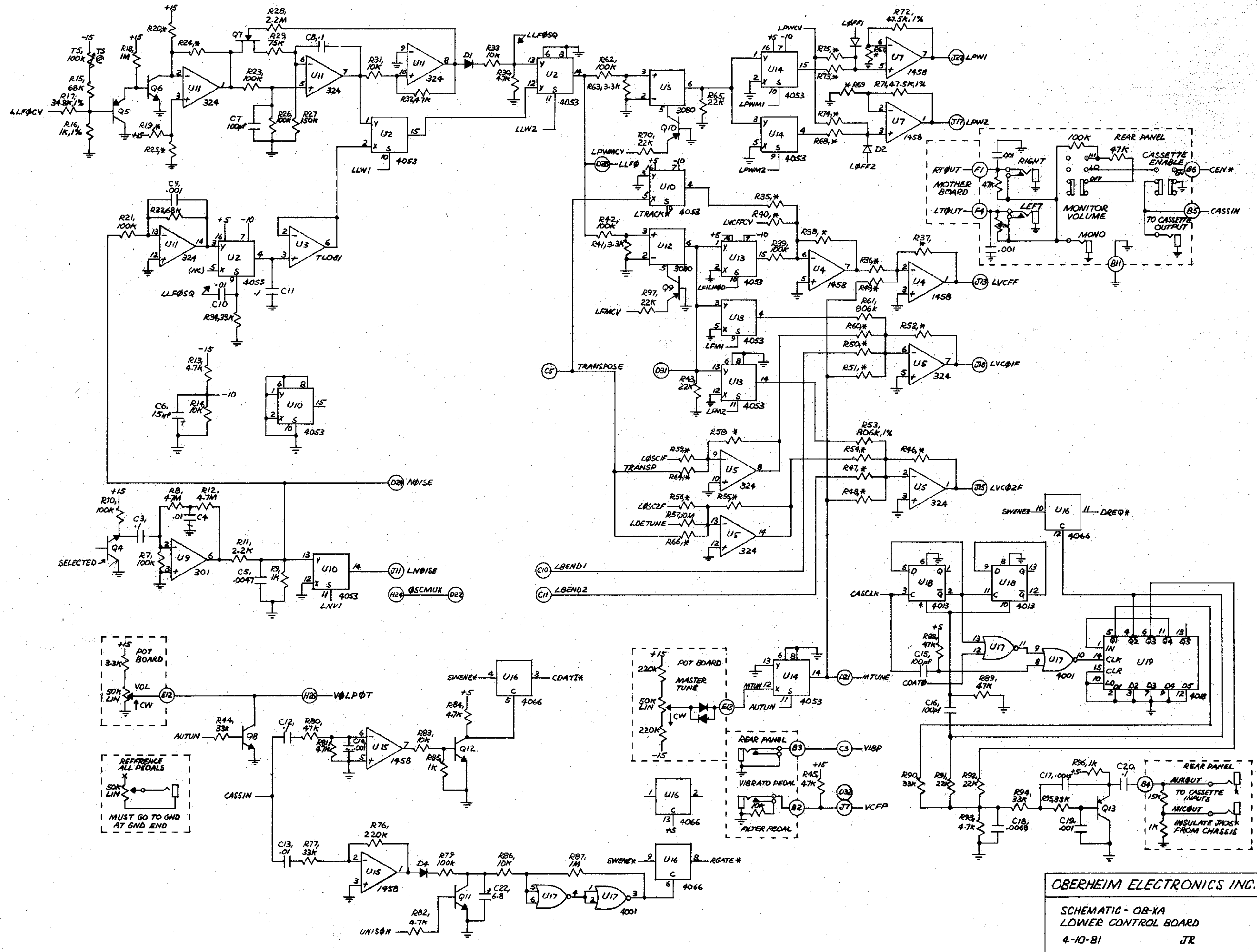
4-21-81 J.R.

REV'D 3-1-82

SHEET 2 OF 4

1516C


NOTES: UNLESS OTHERWISE SPECIFIED
1) ALL RESISTORS ARE 1/4 W, 5%
2) ALL RESISTORS DESIGNATED "*" ARE 100K, 1%
3) ALL CAPACITORS ARE IN µF
4) ALL UNMARKED CAPACITORS ARE .01µF
5) ALL NPN TRANSISTORS ARE MPS5172
6) ALL PNP TRANSISTORS ARE 2N3905
7) ALL DIODES ARE IN4148
OBERHEIM ELECTRONICS INC.
SCHEMATIC- OB-XA LOWER CONTROL
5-12-81 J.R.
REV'D 3-1-82
SHEET 3 OF 4
1516C

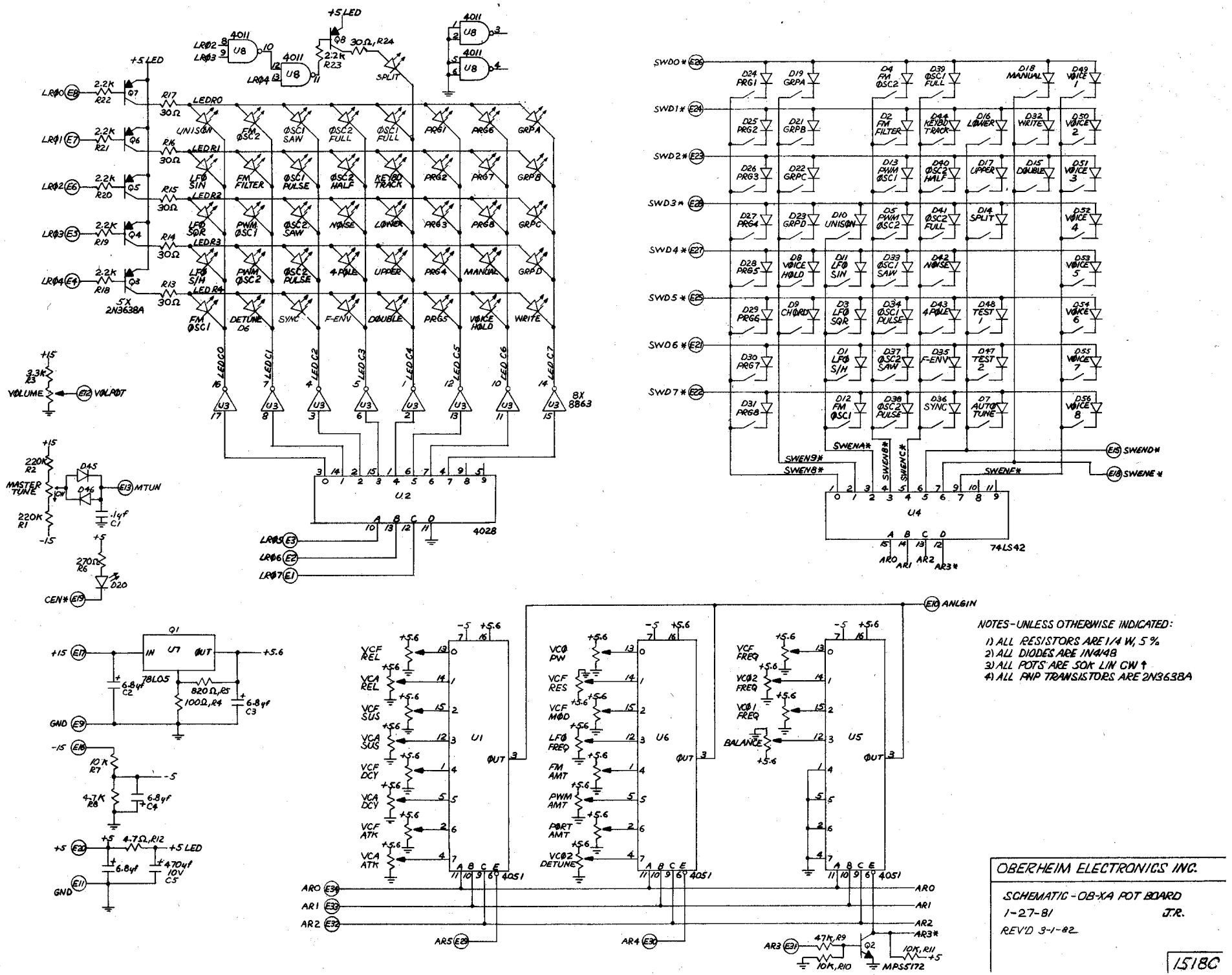


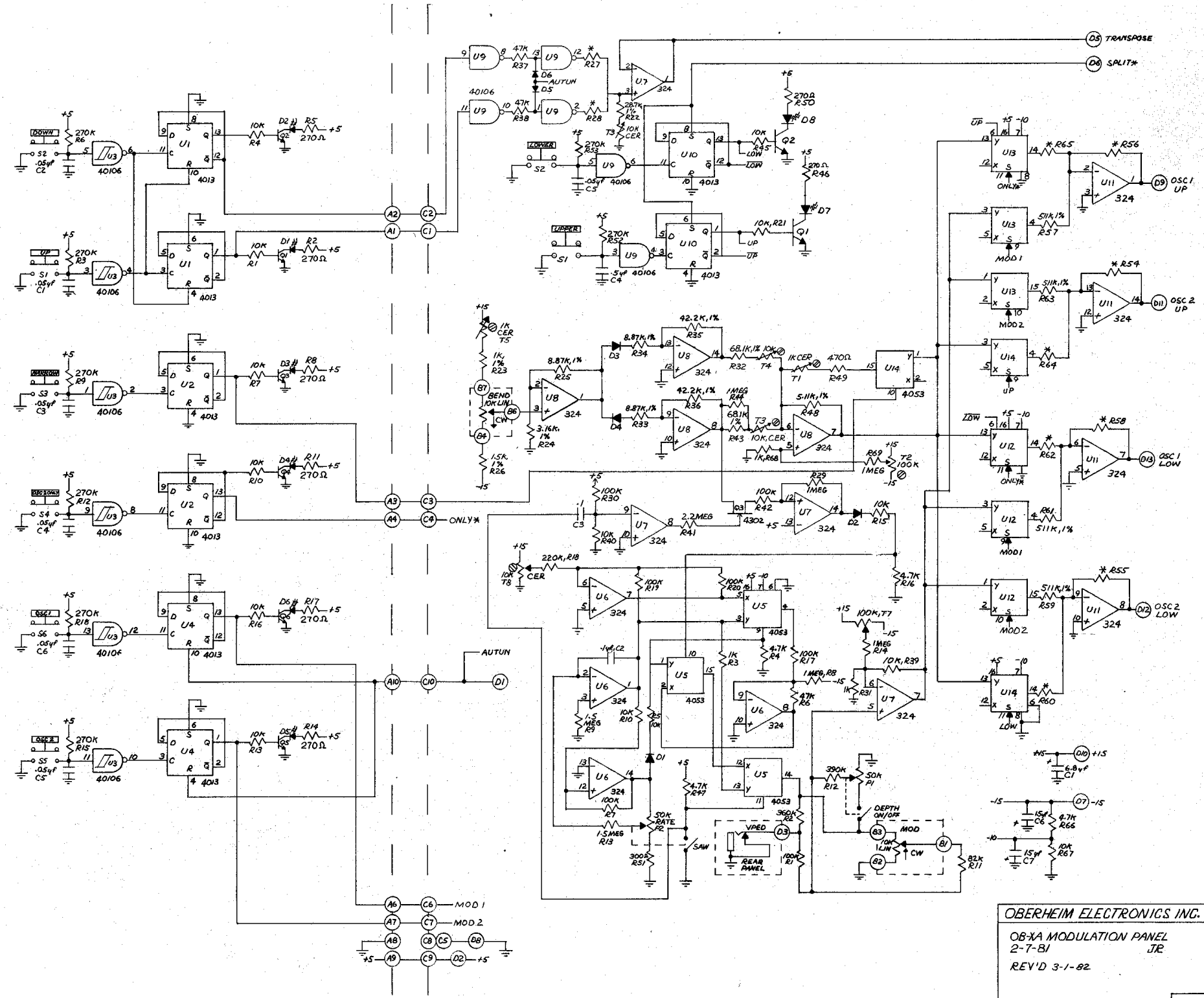
OBERHEIM ELECTRONICS INC.

SCHEMATIC - OB-XA
LOWER CONTROL BOARD
4-10-81 JR
REV'D 3-1-82

SHEET 4 OF 4

1516C

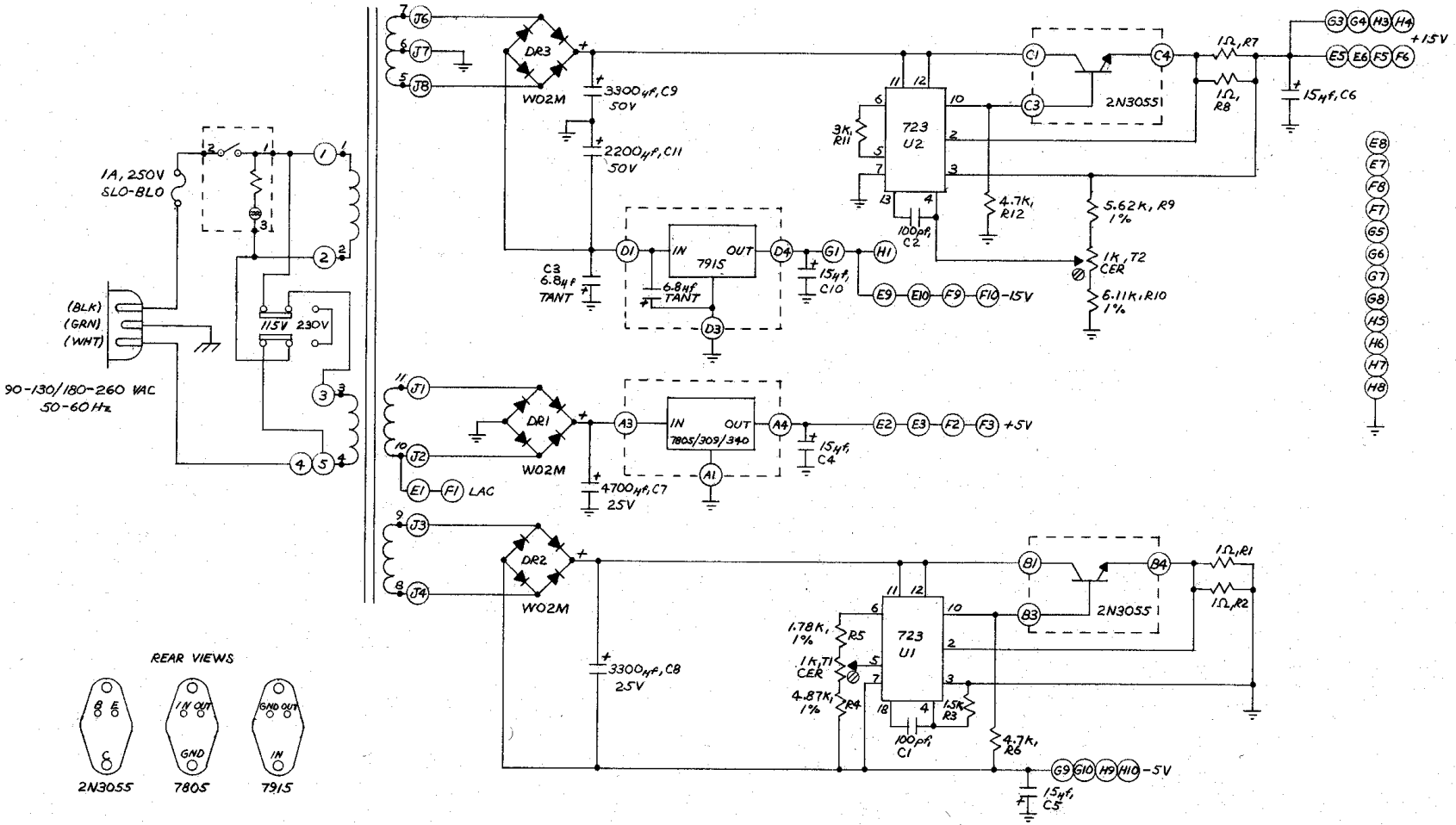

+5 LED
4011
U8
Q8 30Ω, R24
2.2K R23
SPLIT
LR02
LR03
LR04
LR00
LR01
LR02
LR03
LR04
2.2K R22
2.2K R21
2.2K R20
2.2K R19
2.2K R18
Q7
Q6
Q5
Q4
Q3
5X 2N3638A
R17 30Ω
R16 30Ω
R15 30Ω
R14 30Ω
R13 30Ω
LED R0
LED R1
LED R2
LED R3
LED R4
UNISON
FM OSC2
OSC1 SAW
OSC2 FULL
OSC1 FULL
PRG1
PRG6
GRP A
LFO SIN
FM FILTER
OSC1 PULSE
OSC2 HALF
KEYBD TRACK
PRG2
PRG7
GRP B
LFO SQR
PWM OSC1
OSC2 SAW
NOISE
LOWER
PRG3
PRG8
GRP C
LFO S/H
PWM OSC2
OSC2 PULSE
4-POLE
UPPER
PRG4
MANUAL
GRP D
FM OSC1
DETUNE D6
SYNC
F-ENV
DOUBLE
PRG5
VOICE HOLD
WRITE
LED C0
LED C1
LED C2
LED C3
LED C4
LED C5
LED C6
LED C7
8X 8863
U3
U2
4028
A B C D
LR05 E3
LR06 E2
LR07 E1
+15
3.3K R23
VOLUME
E12 VOLPOT
220K R2
MASTER TUNE
CW
220K R1
-15
D45
D46
E13 MTUN
.1μf C1
+5
270Ω R6
D20
CEN* E19
SWD0* E26
SWD1* E24
SWD2* E23
SWD3* E28
SWD4* E27
SWD5* E25
SWD6* E21
SWD7* E22
D24 PRG1
D19 GRP A
D4 FM OSC2
D39 OSC1 FULL
D18 MANUAL
D49 VOICE 1
D25 PRG2
D21 GRP B
D2 FM FILTER
D44 KEYBD TRACK
D16 LOWER
D32 WRITE
D50 VOICE 2
D26 PRG3
D22 GRP C
D13 PWM OSC1
D40 OSC2 HALF
D17 UPPER
D15 DOUBLE
D51 VOICE 3
D27 PRG4
D23 GRP D
D10 UNISON
D5 PWM OSC2
D41 OSC2 FULL
D14 SPLIT
D52 VOICE 4
D28 PRG5
D8 VOICE HOLD
D11 LFO SIN
D33 OSC1 SAW
D42 NOISE
D53 VOICE 5
D29 PRG6
D9 CHORD
D3 LFO SQR
D34 OSC1 PULSE
D43 4-POLE
D48 TEST 1
D54 VOICE 6
D30 PRG7
D1 LFO S/H
D37 OSC2 SAW
D35 F-ENV
D47 TEST 2
D55 VOICE 7
D31 PRG8
D12 FM OSC1
D38 OSC2 PULSE
D36 SYNC
D7 AUTO TUNE
D56 VOICE 8
SWENA*
SWEN9*
SWEN8*
SWEN7*
SWEN6*
SWEN5*
SWEN4*
E15 SWEND*
E18 SWENE*
U4
74LS42
AR0
AR1
AR2
AR3*
Q1
+15 E17
IN U7 OUT
78L05
+5.6
6.8μf C2
820Ω, R5
100Ω, R4
6.8μf C3
GND E9
-15 E18
10K R7
-5
4.7K R8
6.8μf C4
+5 E20
4.7Ω, R12
+5 LED
6.8μf
470μf 10V C5
GND E11
+5.6
-5
VCF REL
VCA REL
VCF SUS
VCA SUS
VCF DCY
VCA DCY
VCF ATK
VCA ATK
U1
OUT
4051
VCO PW
VCF RES
VCF MOD
LFO FREQ
FM AMT
PWM AMT
PORT AMT
VCO2 DETUNE
U6
VCF FREQ
VCO2 FREQ
VCO1 FREQ
BALANCE
U5
E10 ANLGIN
ARO E34
AR1 E33
AR2 E32
AR5 E29
AR4 E30
AR3 E31
47K, R9
10K, R10
Q2
MPS5172
10K, R11
+5
NOTES - UNLESS OTHERWISE INDICATED:
1) ALL RESISTORS ARE 1/4 W, 5%
2) ALL DIODES ARE IN4148
3) ALL POTS ARE 50K LIN CW ↑
4) ALL PNP TRANSISTORS ARE 2N3638A
OBERHEIM ELECTRONICS INC.
SCHEMATIC - OB-XA POT BOARD
1-27-81 J.R.
REV'D 3-1-82
1518C



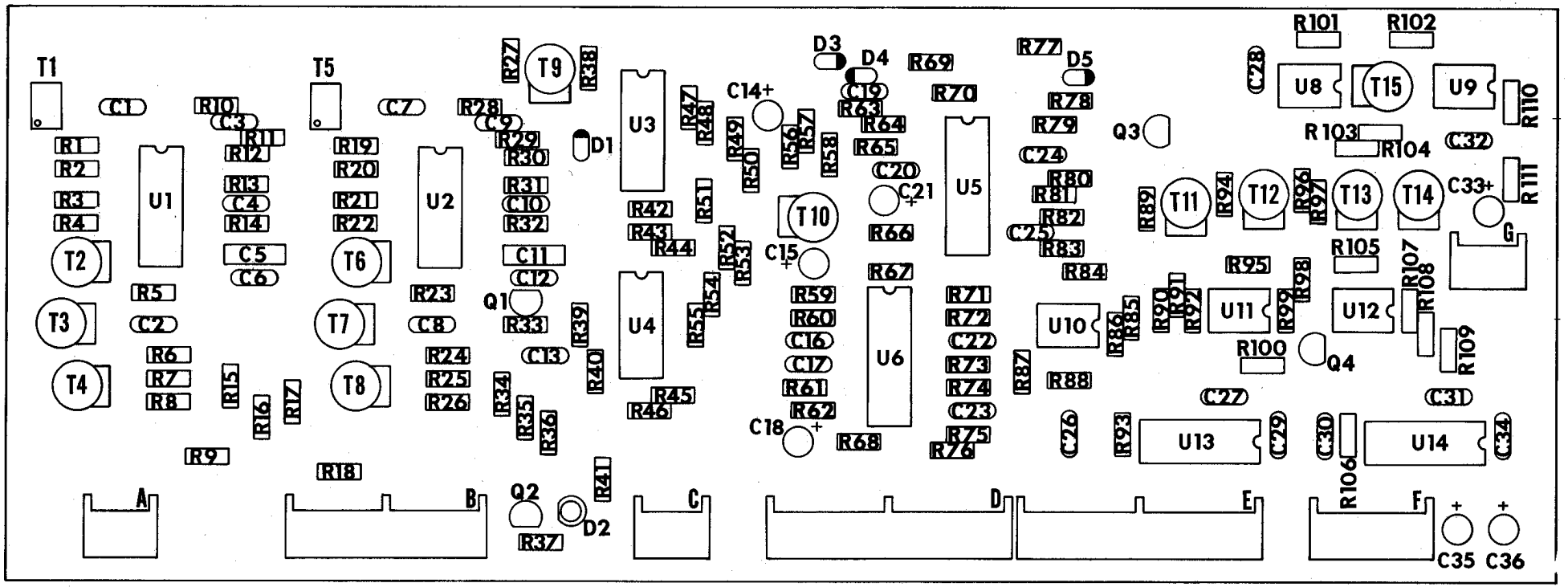
OBERHEIM ELECTRONICS INC.

OB-XA MODULATION PANEL
2-7-81 JR
REV'D 3-1-82

1521C



OBERHEIM ELECTRONICS INC.
OB-XA POWER SUPPLY
5-27-81 JR
REV'D 3-1-82
1515C



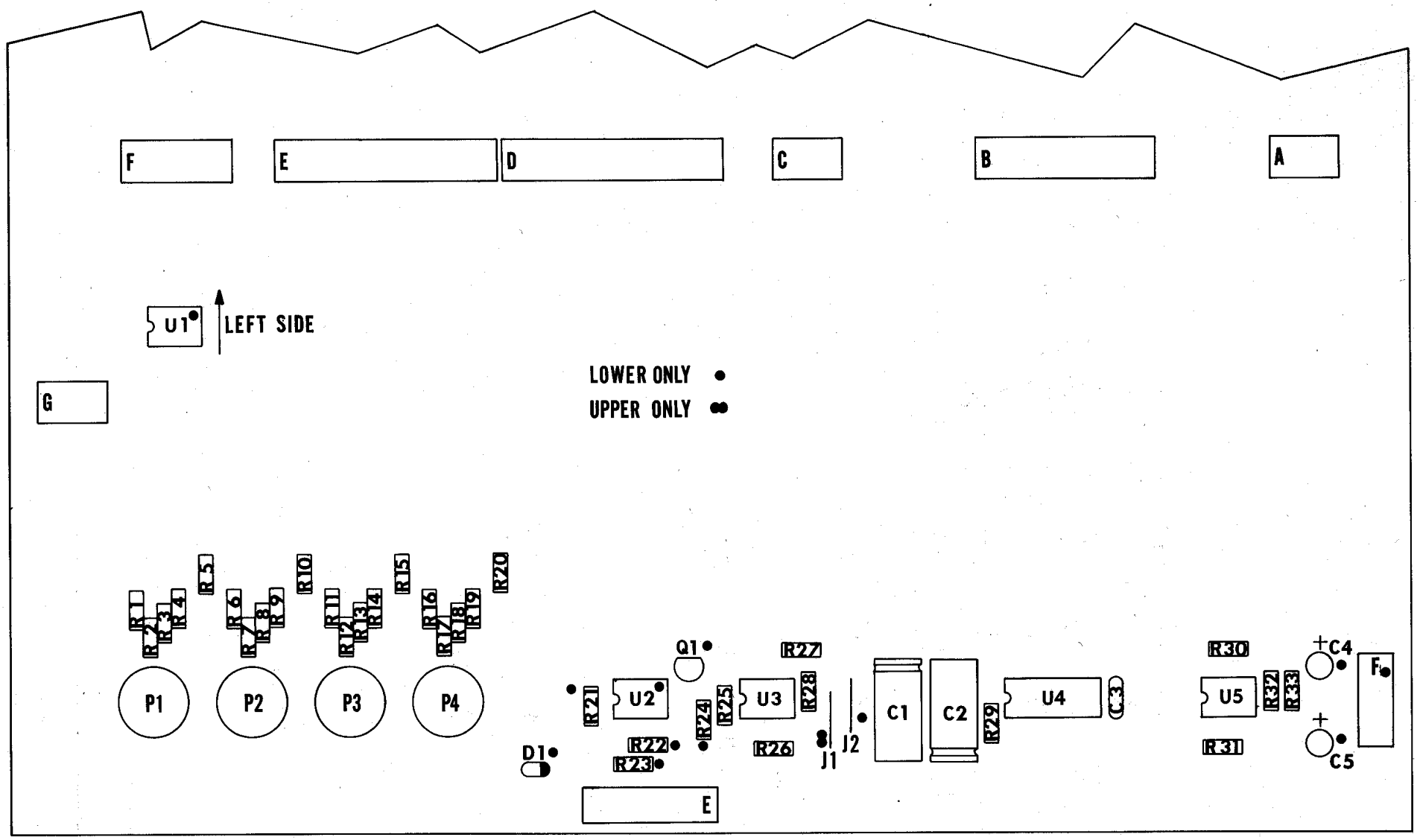
LTR	REVISION	DATE
C		3-1-82

OBERHEIM ELECTRONICS INC.

-PARTS LAYOUT-
OB-XA VOICE BOARD

1-5-81

1635C



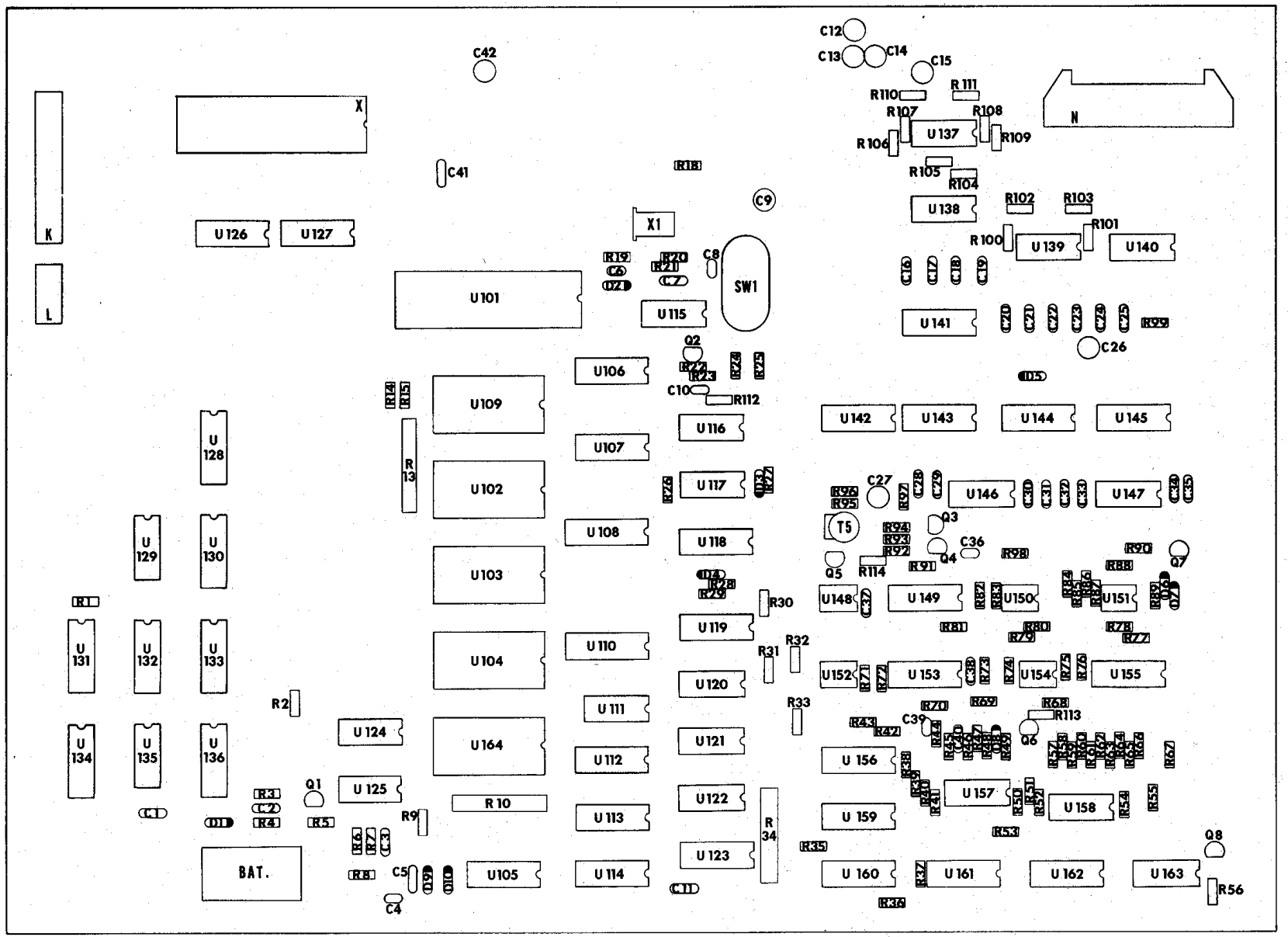
LTR	REVISION	DATE
C		3-1-82

OBERHEIM ELECTRONICS INC.

-PARTS LAYOUT-
OB-XA MOTHER BOARD

2-14-81

1636C

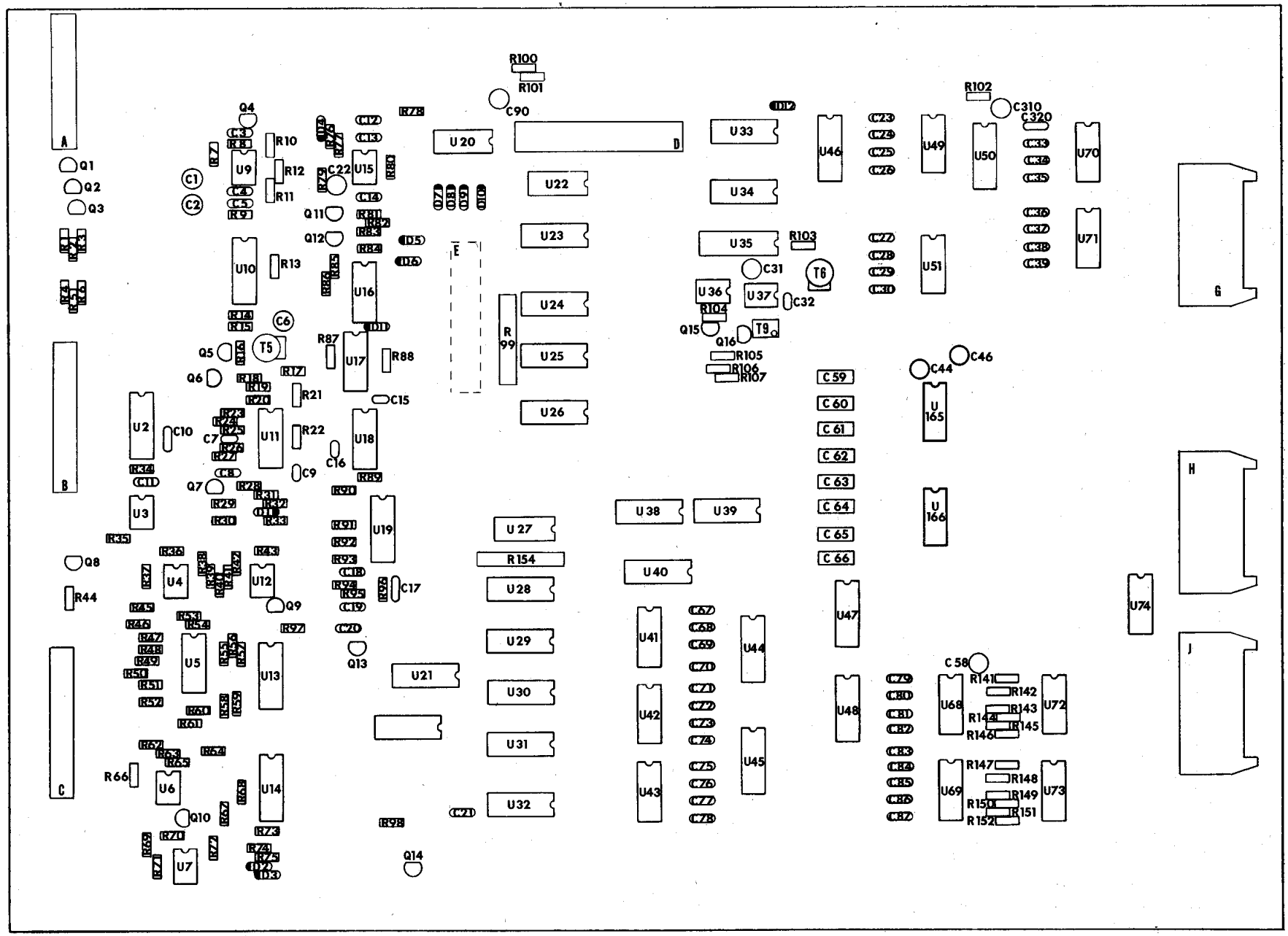


LTR	REVISION	DATE
C		3-1-82

OBERHEIM ELECTRONICS INC.

PARTS LAYOUT
OB-XA UPPER CONTROL BOARD
5-4-81

1634C



OBERHEIM

LTR	REVISION	DATE
C		3-1-82

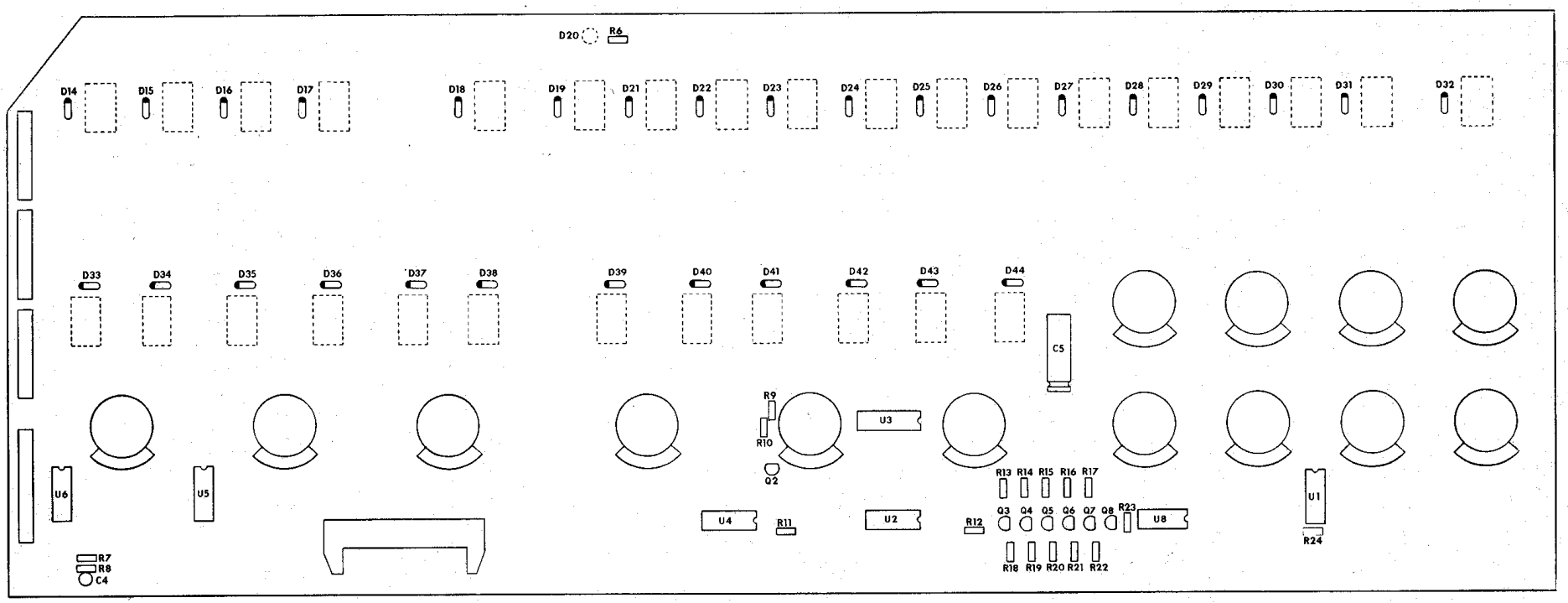
OBERHEIM ELECTRONICS INC.

PARTS LAYOUT

OB-XA LOWER CONTROL

5-12-81

1633C



LTR	REVISION	DATE
C		3-1-82

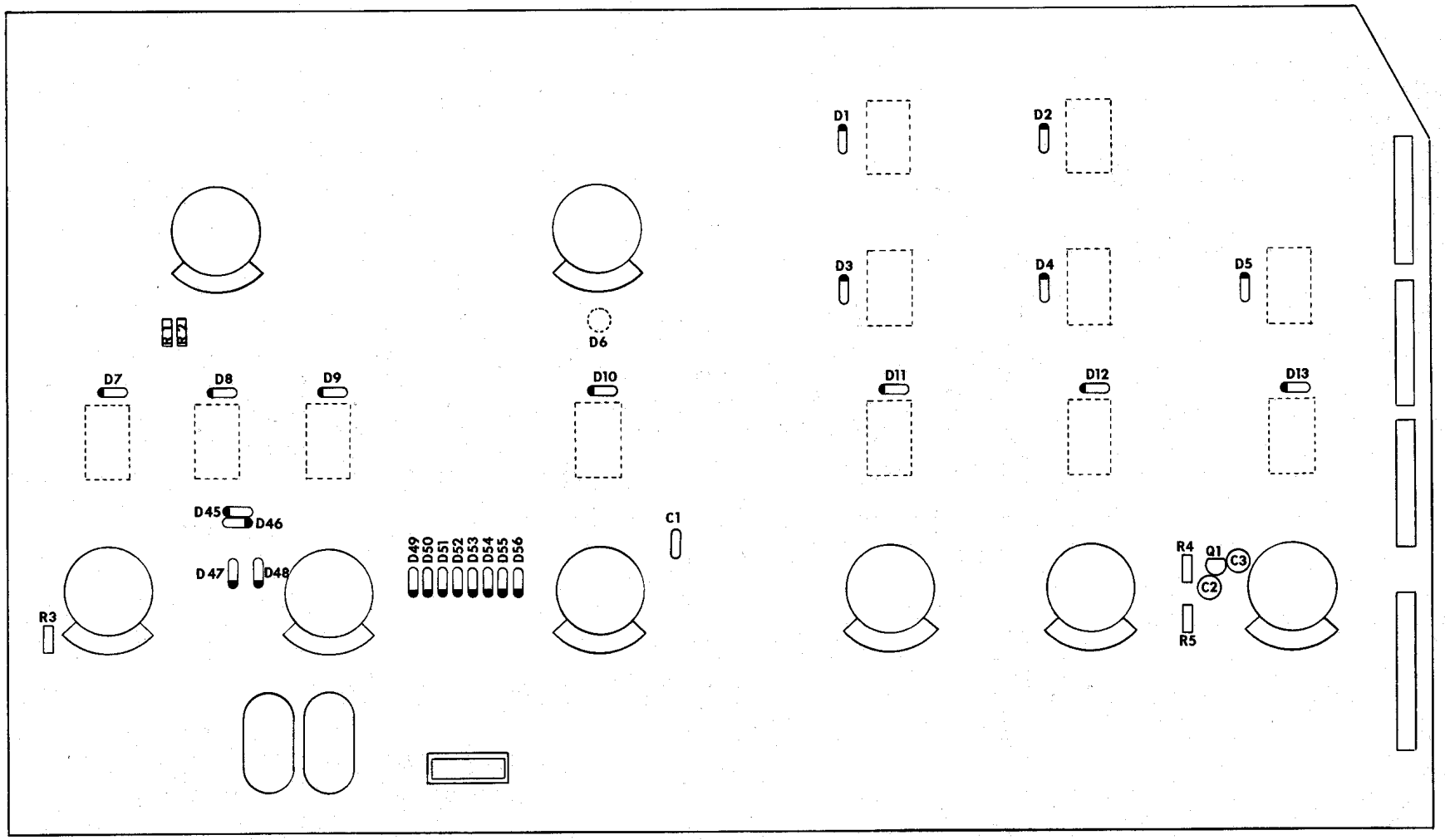
OBERHEIM ELECTRONICS INC.

PARTS LAYOUT

OB-XA POT BOARD #1

12-10-81

1646C



LTR	REVISION	DATE
C		3-1-82

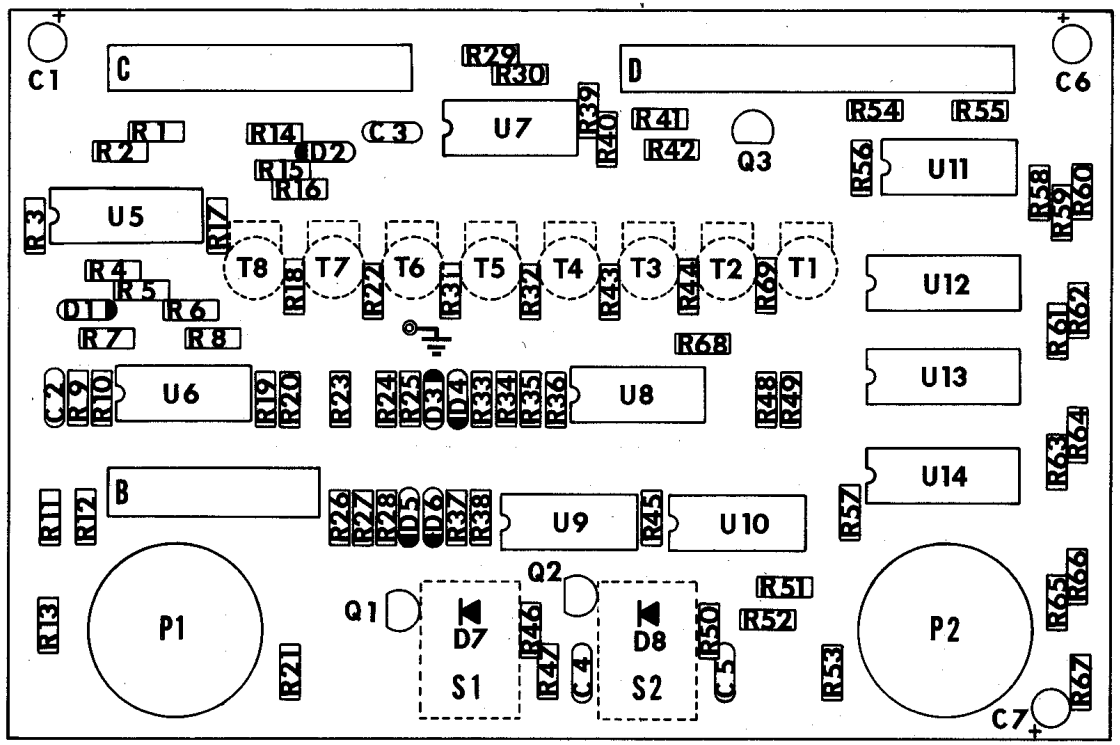
OBERHEIM ELECTRONICS INC.

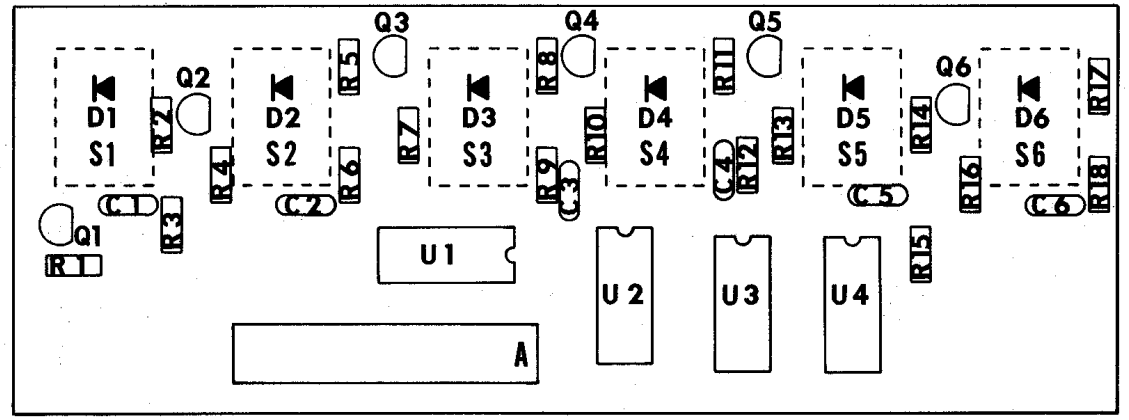
PARTS LAYOUT

OB-XA POT BOARD #2

7-14-81

1647C





LTR	REVISION	DATE
C		3-1-82

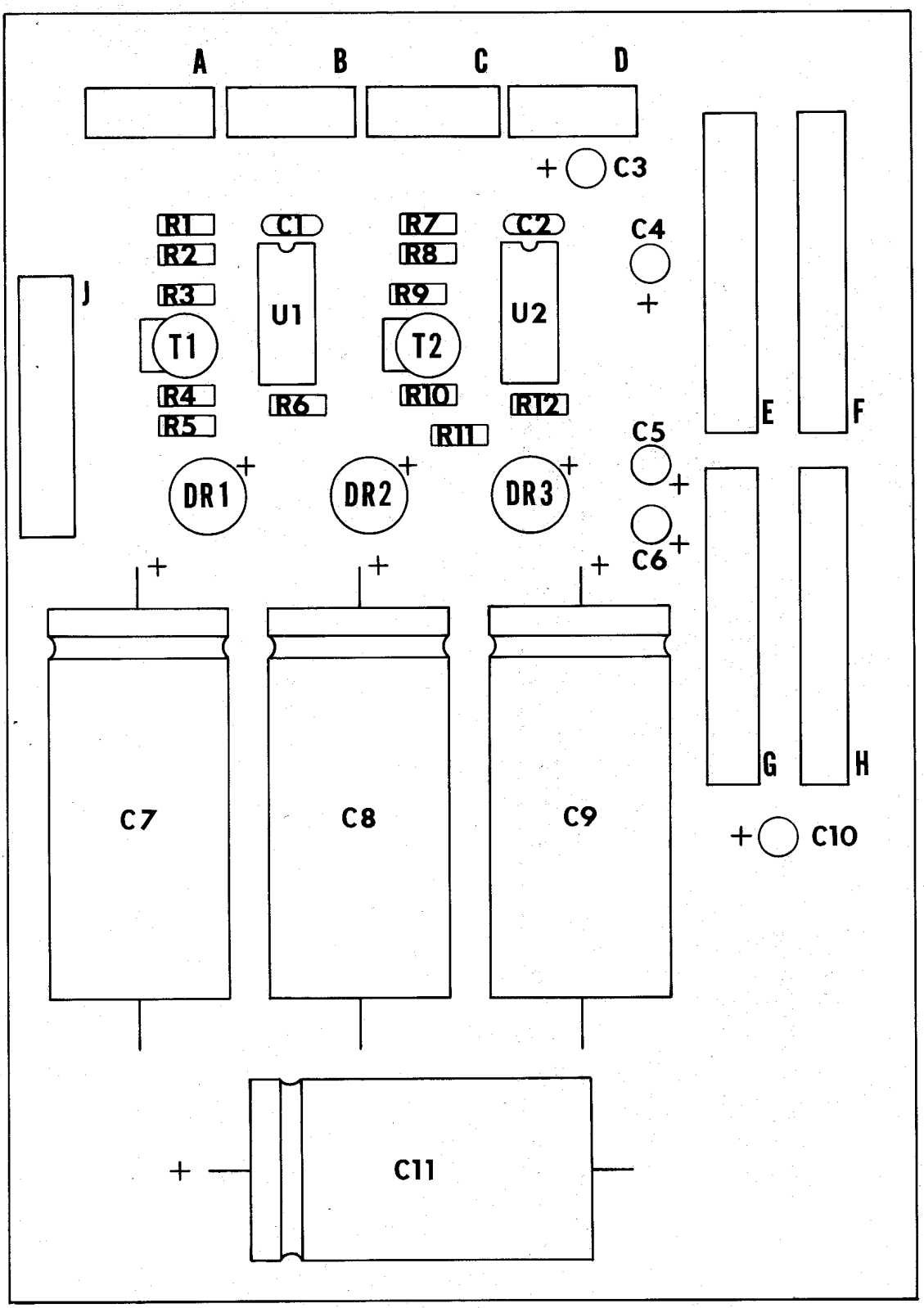
OBERHEIM ELECTRONICS INC.

-PARTS LAYOUT-

OB-XA BEND BOARD

2-7-81

1632C



OBERHEIM ELECTRONICS INC.

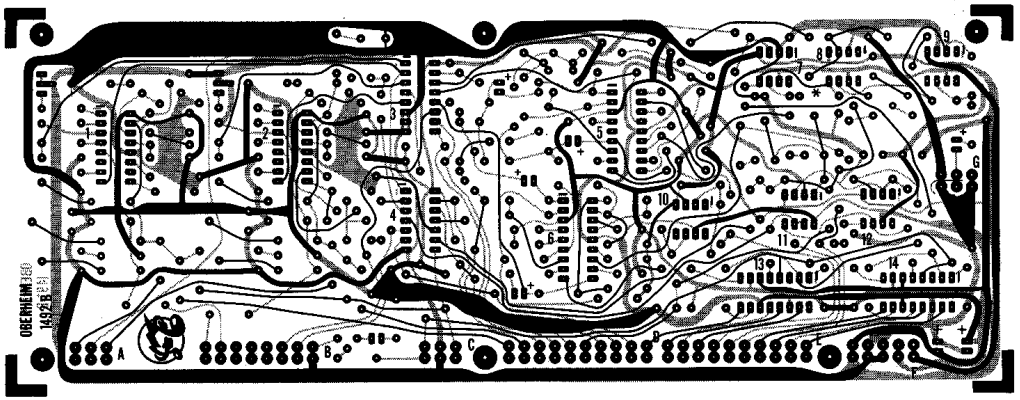
PARTS LAYOUT

OB-XA POWER SUPPLY

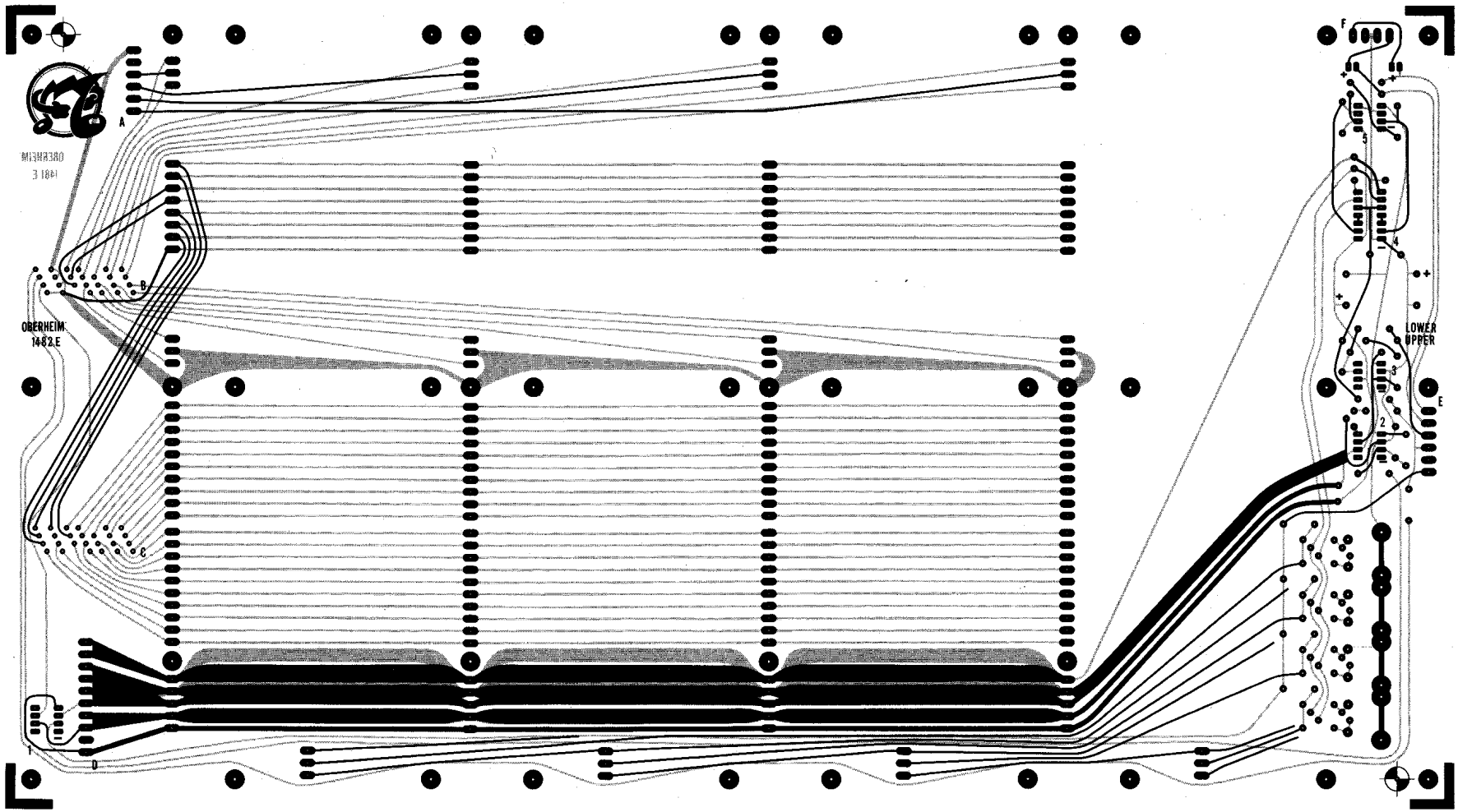
5-27-81

1631C

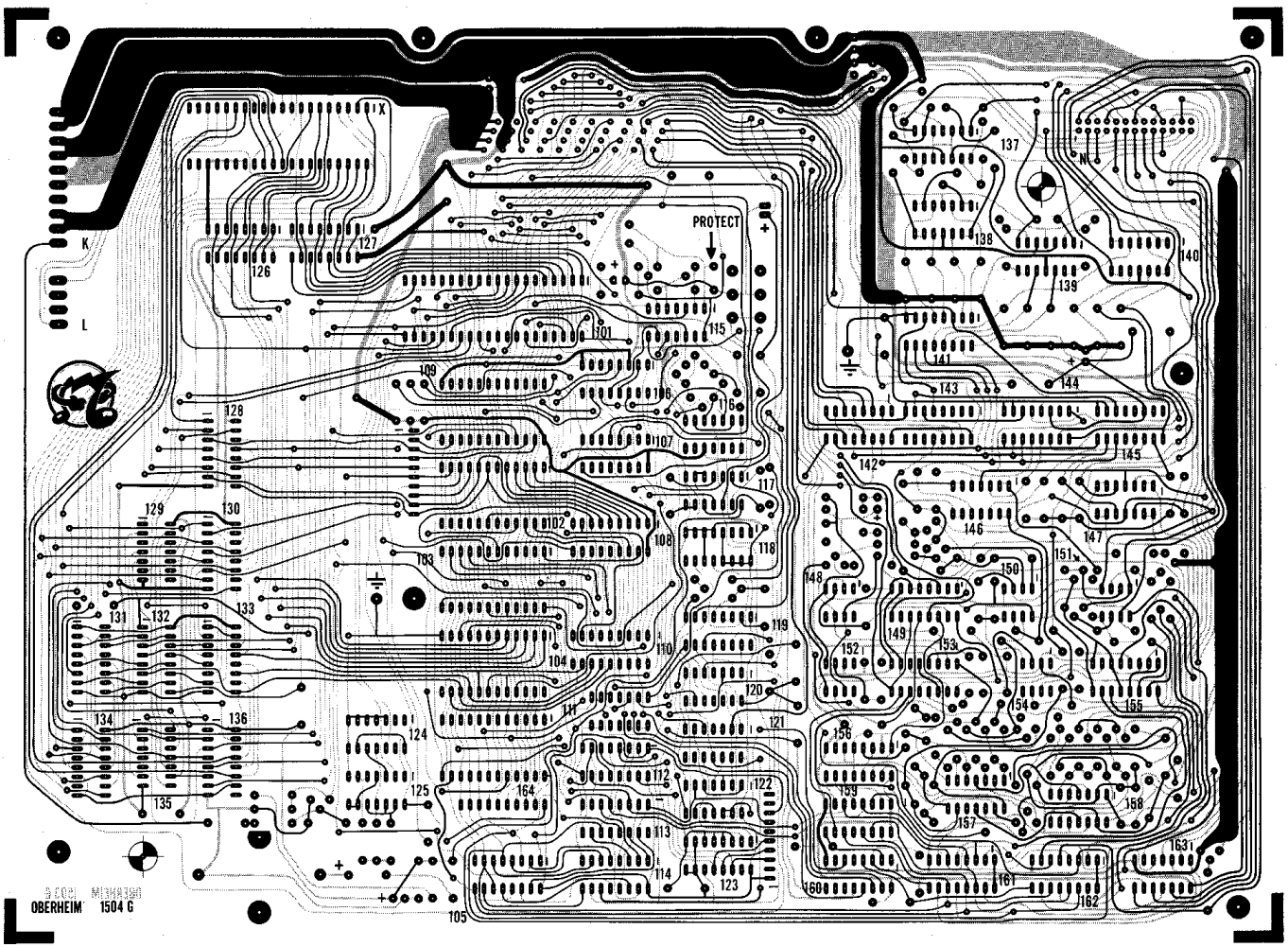
LTR	REVISION	DATE
C		3-1-82



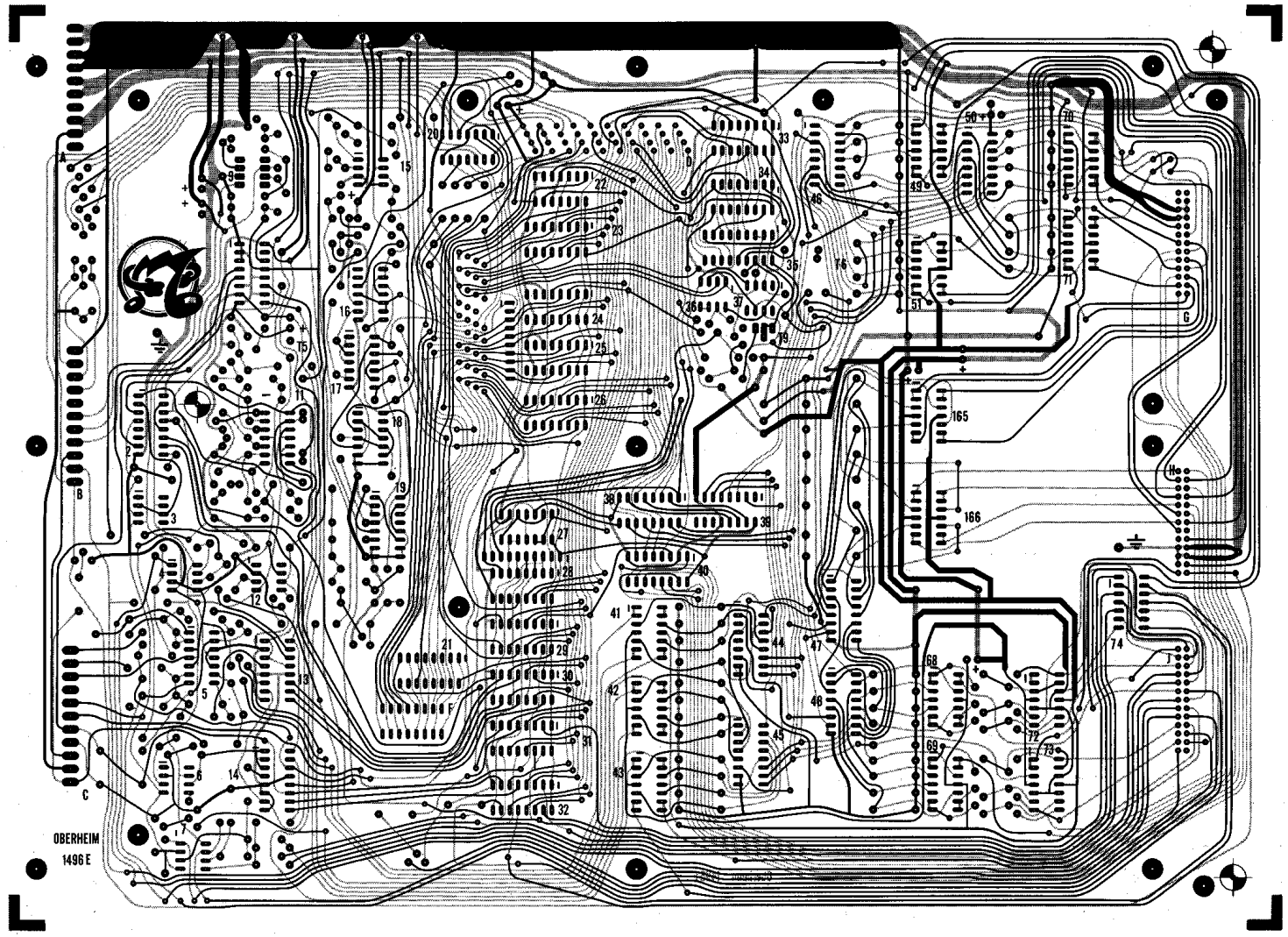
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 1-5-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA VOICE CARD		DRAWING NUMBER 164-B C



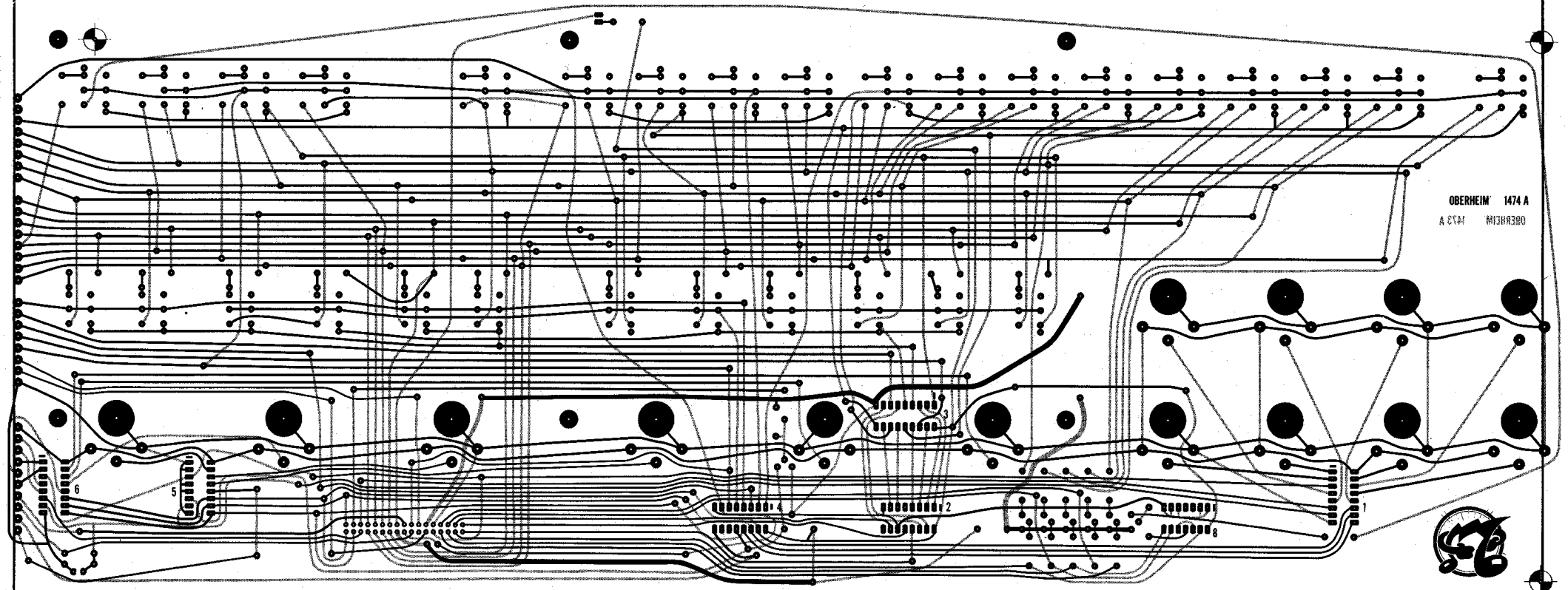
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 7-14-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA MOTHER BOARD		DRAWING NUMBER 1643 C



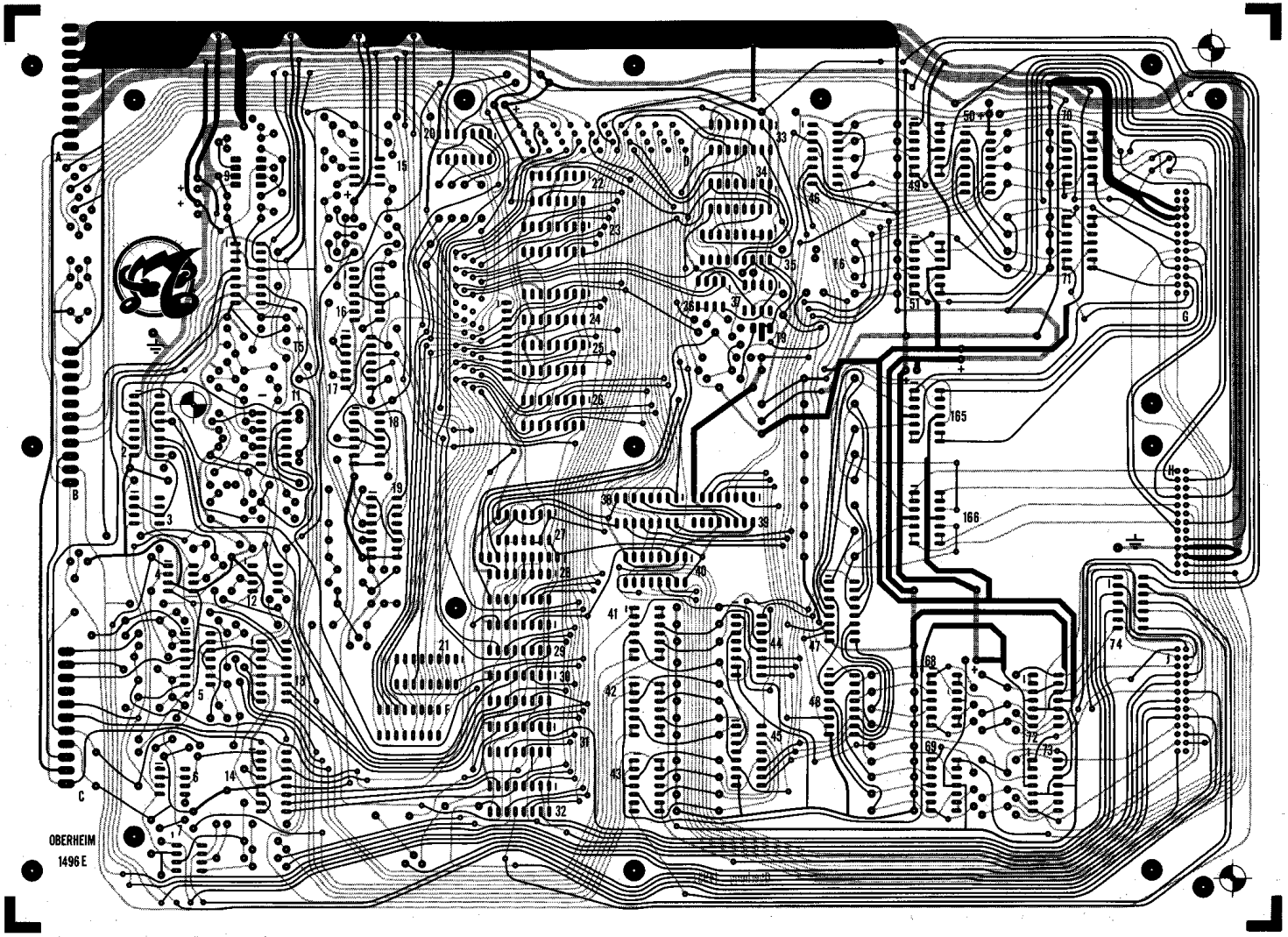
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 2-14-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA UPPER CONTROL BOARD		DRAWING NUMBER 1642C



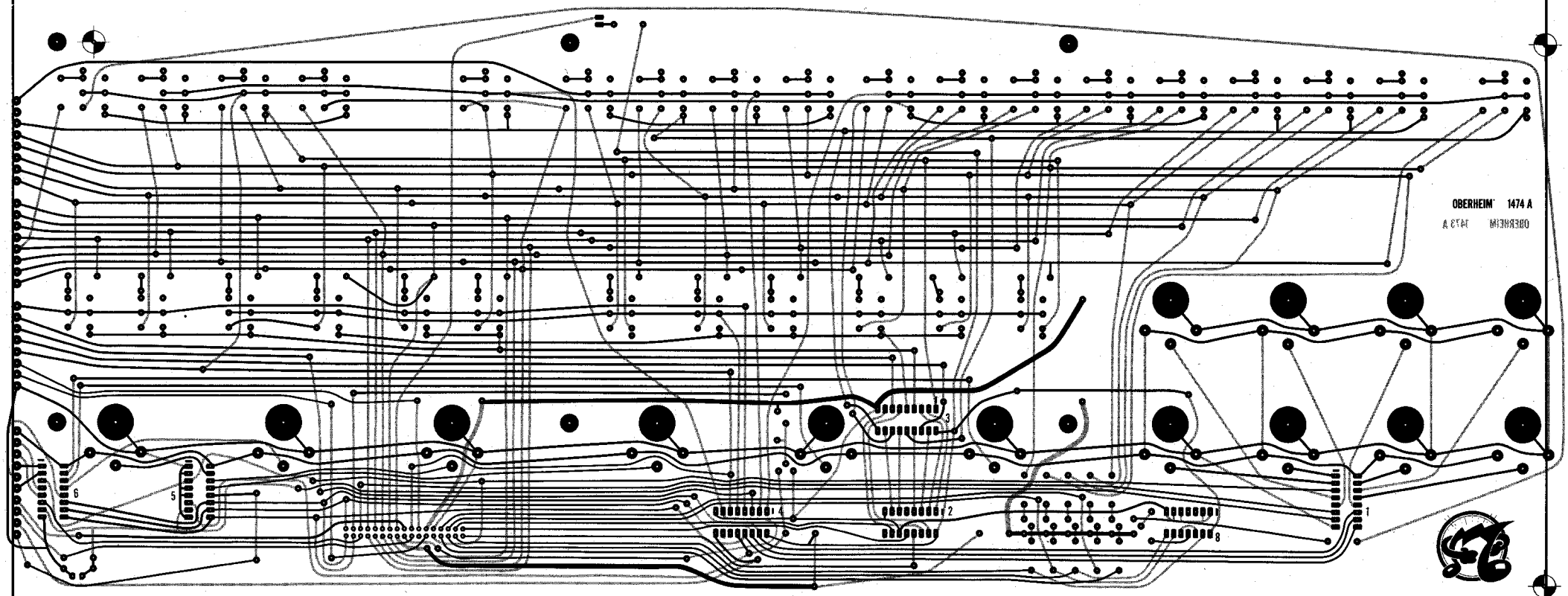
OBERHEIM ELECTRONICS INC.		
SCALE 1/1	APPROVED BY:	DRAWN BY
DATE 5-12-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA LOWER CONTROL BOARD		DRAWING NUMBER 1640C



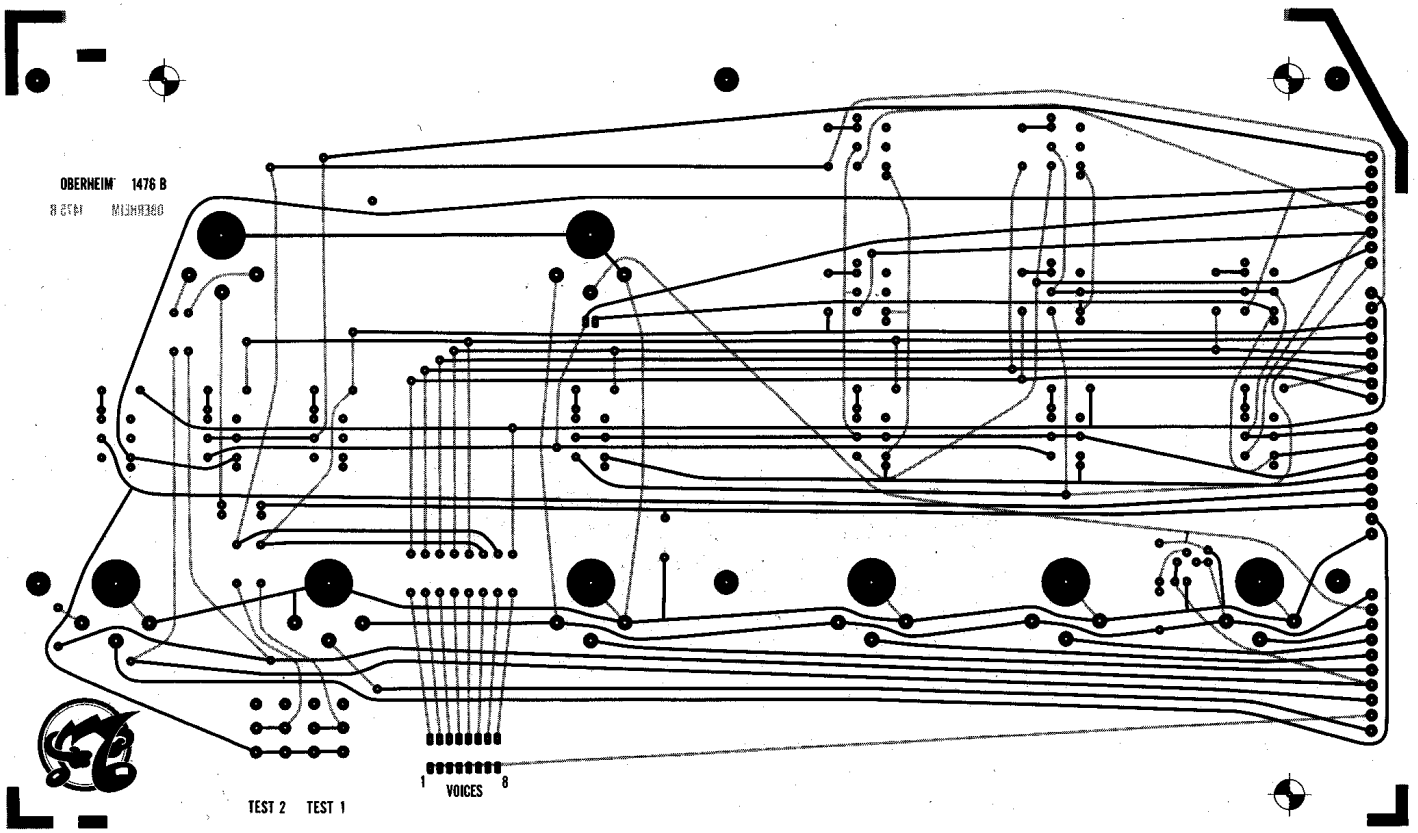
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 12-10-80		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA POT BOARD #1		DRAWING NUMBER 1644C



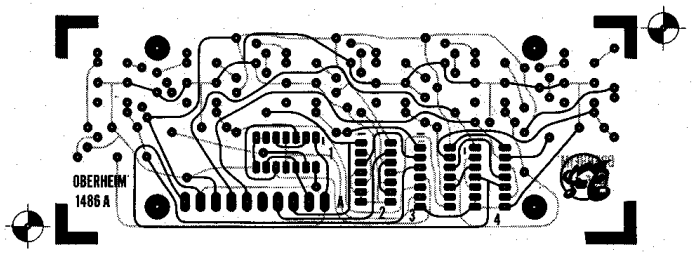
OBERHEIM ELECTRONICS INC.		
SCALE 1/1	APPROVED BY:	DRAWN BY
DATE 5-12-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA LOWER CONTROL BOARD		DRAWING NUMBER 1640C



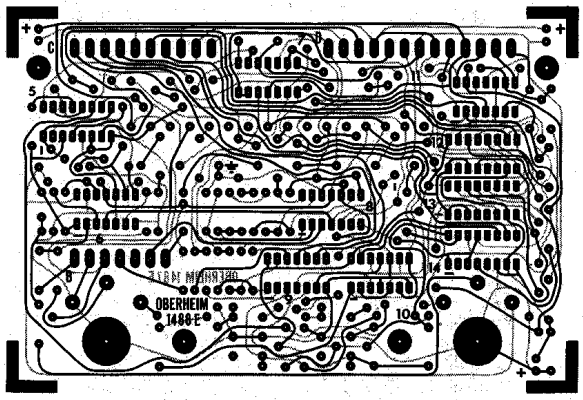
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 12-10-80		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA POT BOARD #1		DRAWING NUMBER 1644C



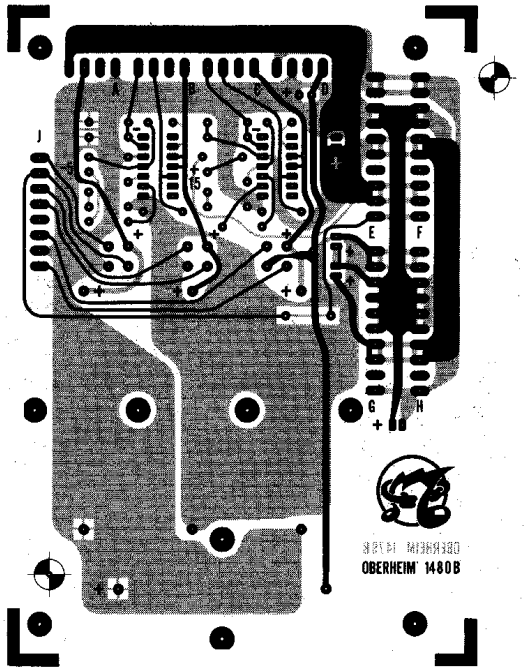
OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 7-14-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA POT BOARD # 2		DRAWING NUMBER 1645C



OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE: 12-27-80		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA BEND BOARD #1		DRAWING NUMBER 1638C



OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE 10-4-81		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA BEND BOARD #2		DRAWING NUMBER 1639C



OBERHEIM ELECTRONICS INC.		
SCALE: 1/1	APPROVED BY:	DRAWN BY
DATE 12-12-80		REVISED 3-1-82
P.C. COMPOSITE		
OB-XA POWER SUPPLY BOARD		DRAWING NUMBER 1637C

WE NEED YOUR HELP

If you find errors in this manual, or feel that needed information is missing or unclear, please write your comments on the reverse side of this form and return it to us.

Oberheim Electronics, Inc.

Fold Here First

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 62816 LOS ANGELES, CA 90029

POSTAGE WILL BE PAID BY ADDRESSEE

OBERHEIM ELECTRONICS, INC.

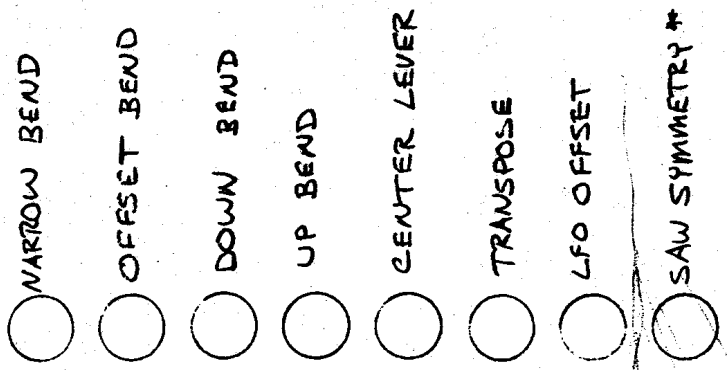
2250 South Barrington Avenue
Los Angeles, California 90064

Attn. Publications Dept.

Fold Here Second

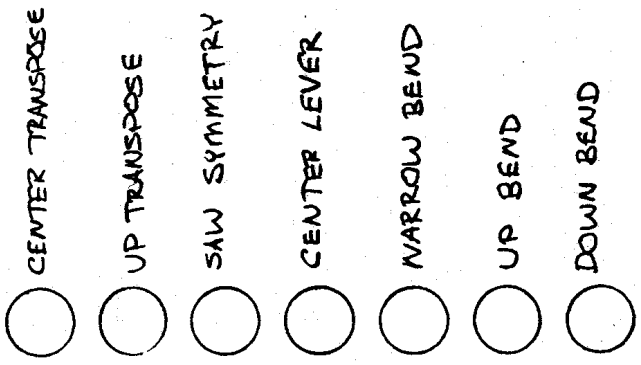
Seal Here

Notes



SERIAL NUMBER
81-320 AND AFTER

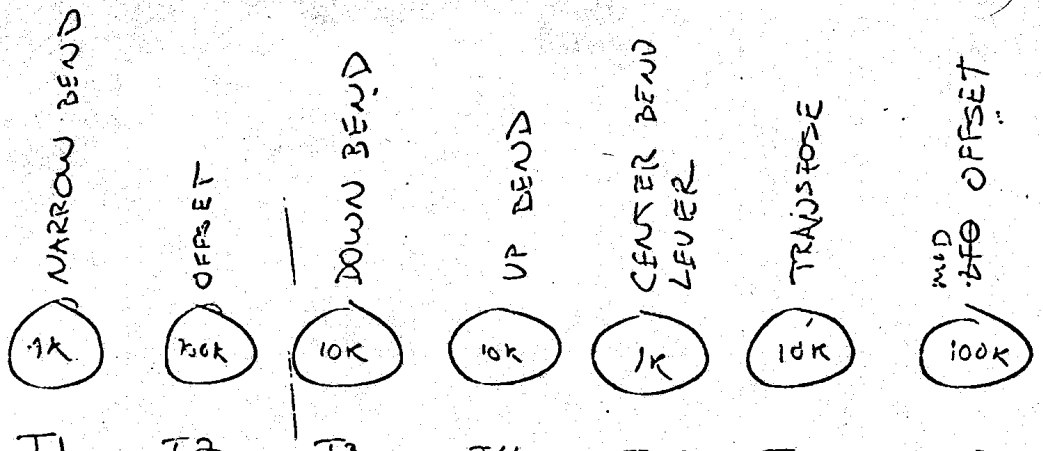
*UNITS BEFORE MAY 1981 HAVE THE SAW SYMMETRY TRIMMER INSIDE.



SERIAL NUMBER
81081 AND BEFORE

MODULATION ASSEMBLY
TRIMMER LOCATIONS

TRIMMER C.W. BOTTOM - 10K SAW (T6). SYME



T1 - NARROW BEND
ADJUST FOR .16>V at C10
Repeat T2 for no change on/off

TEST POINTS

T1, T3, T4 : C10 LOWER CONTROL

T2 : A8-7 0V

T5 : A8-1 0V

T6 : C5 LOWER CONTROL

T7 :

ORDER

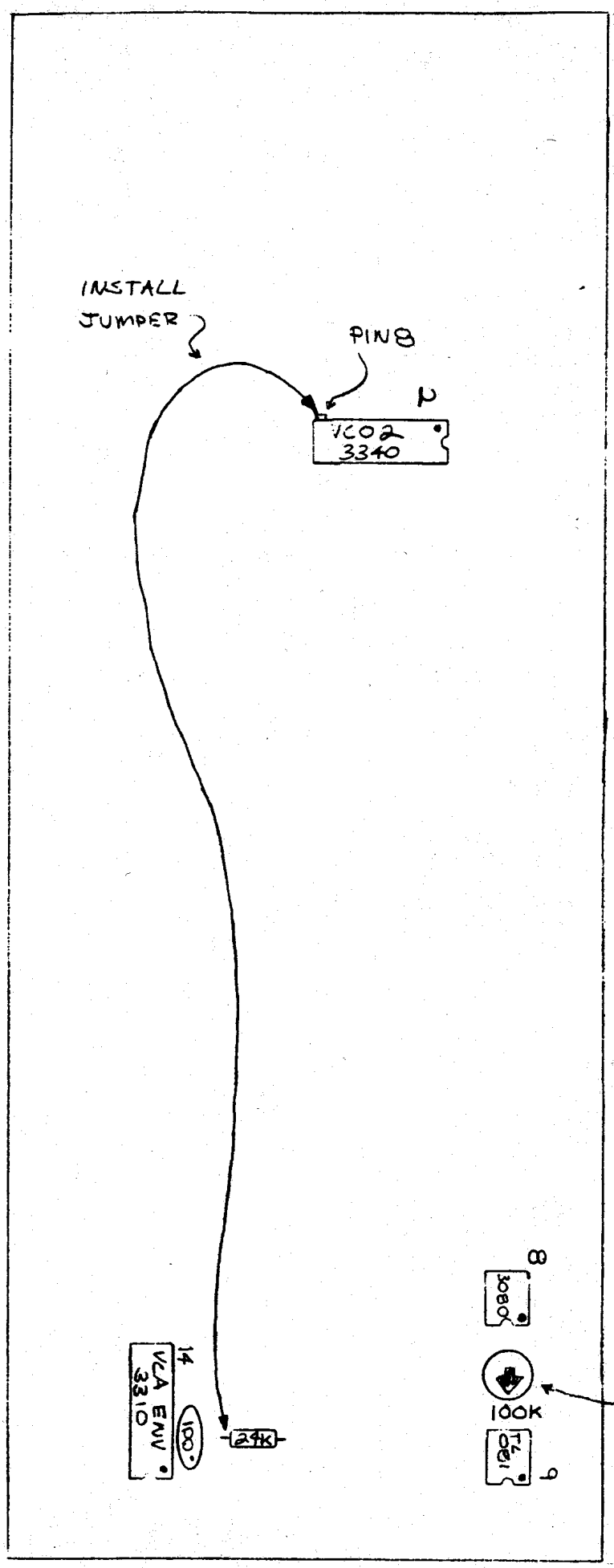
T5, T2, T3, T4, T1, T6, T7, SAW on back

SELECT SQUARE WAVE

PUSH BEND LEVER TOWARDS PICK DOWN BEND PULL UP ON RATE KNOB

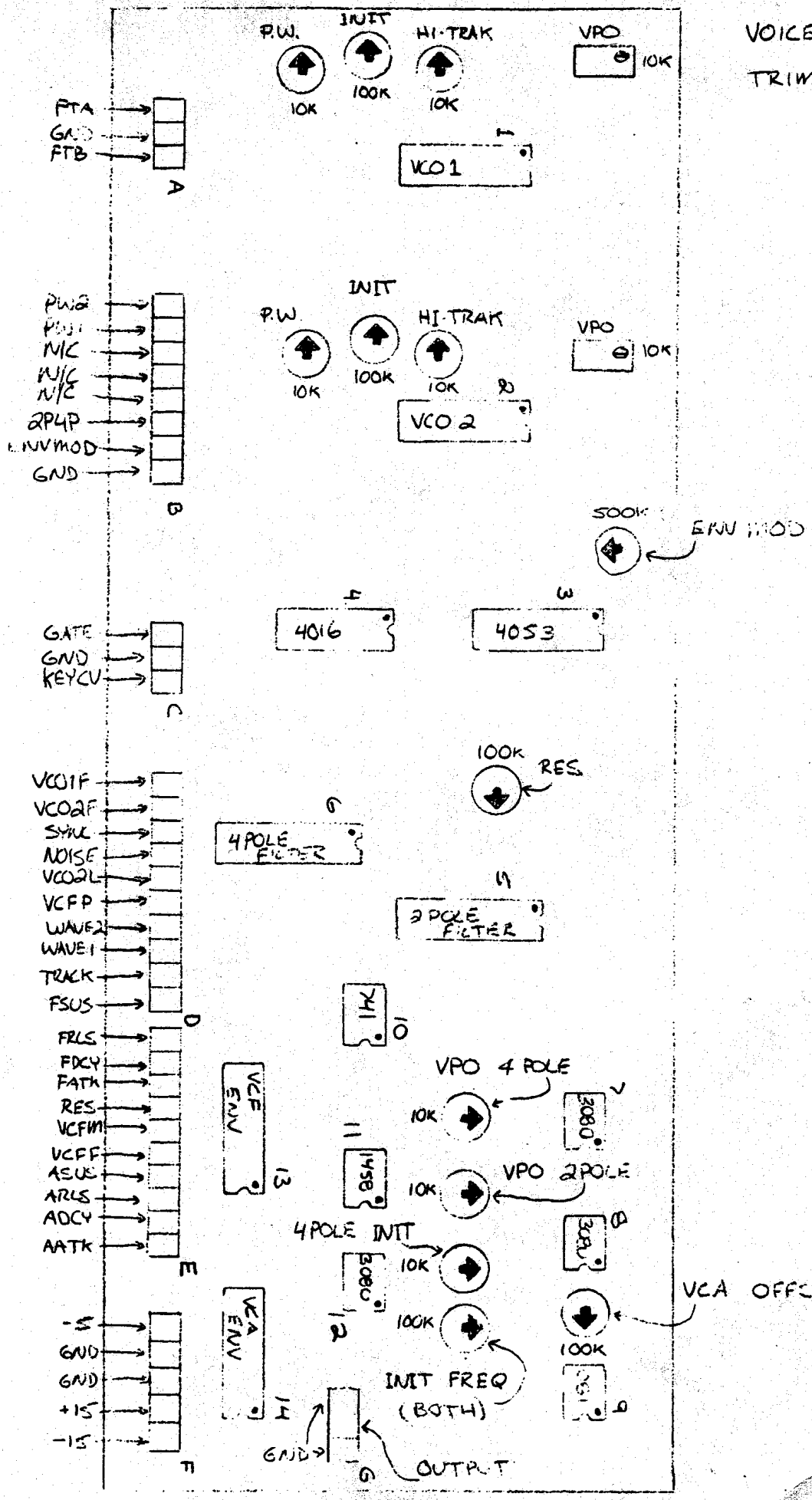
VCA OFFSET

OBX-a VOICE CARD



VCA OFFSET TRIMMER

CS-XA
VOICE CARD
TRIMMER LOCATION



21 NOV 80