Oberheim OB-Xa

Qick-Setup-Guide for Professionals

Parts from the SERVICE MANUAL

THIRD EDITION

June 1982

Blue-Jet-Edition

BiAge 2019 V.1.3

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:                                                              :
:   Covering Units With Serial Numbers 820818 And Above        :
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OB-Xa SOFTWARE HISTORY - JUNE 1982

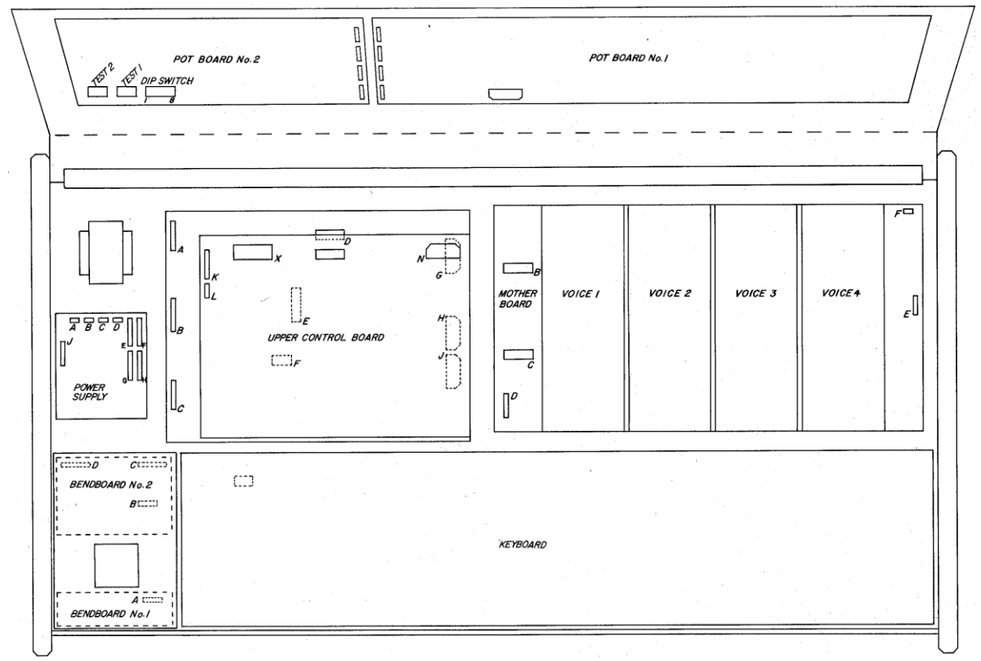
The evolution of the software in the OB-Xa is documented in this section. This service manual covers units with the lates software version „G“ (#8 & 9, below) only.

Ver	eProms	Start Serial	Features
1	(2716s) XA-AB0 -AB1 -AB2	810101 Jan 81	32 Programs, old Auto-Tune, old Cass.Interface, old Edit
2	XA-AD0 -A1 -A2	810201 Jan 81	32 Programs, old Auto-Tune, old, Cass.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 Cass.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 and disables voice if not in tune), old Cass.Interface, new Edit, piggyback Memory Board
5	XA-C0 -CA1 -C2	814401 Nov 81	120 Programs, new Auto-Tune, new Cass.Interface, new Edit, piggyback Memory Board Note: this Version produced through Feb. 82
6	(2732s) XA-F0 -F1	814701 Nov 81	120 Programs, new Auto-Tune, new Cass.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 Grograms, new Auto-Tune, new Cass.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)

OB-XA Test and Service Procedure

On the left Pot-Board inside the OB-Xa are two slide switches and an 8-position DIP switch (will be needed for later voice-card-tuning).

DIP 1-8 off (down)	Voice 1-8 off
DIP 1-8 on (up)	Voice 1-8 on
Test 1 off (down)	Tuning to mid-scale
Test 1 on (up)	Normal Auto-Tune
Test 2 off (down)	Out-of-tune voices will remain in the voice assignment
Test 2 on (up)	Out-of-tune voices will be disabled



A. Power Supply

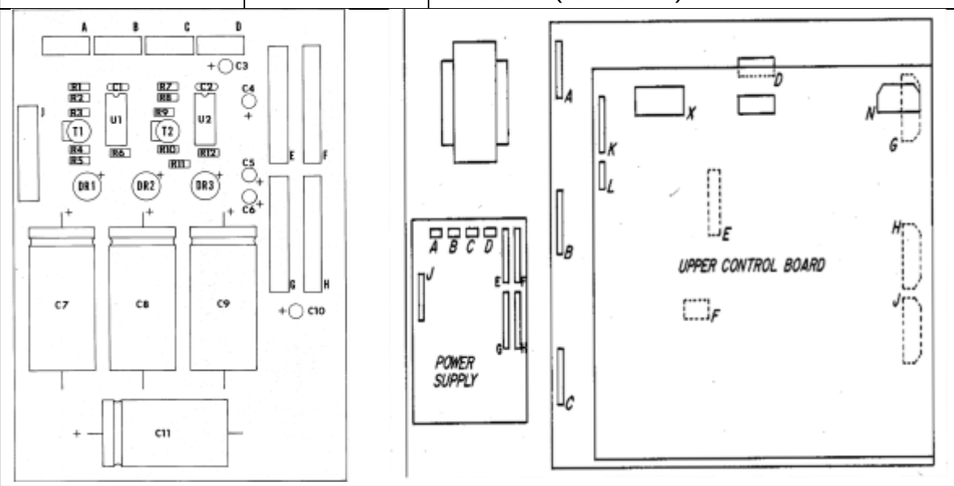
1. CMOS-RAM current drain

Before applying AC power, the current drain oft he 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 current drain of 10 uA.

2. PSU CALIBRATION

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

Connector K - 6	Trimmer T2	+ 15.000 V (+/- 20 mV)
Connector C - 10	Trimmer T1	- 5.000 V (+/- 20 mV)



3. VOLTAGE VERIFICATION (All voltages are D.C. unless specified otherwise)

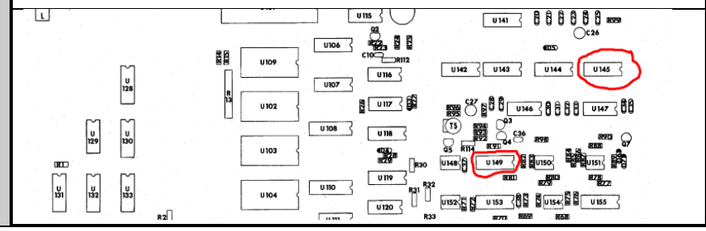
3.1. Control Boards, Connectors K & A

PIN	V	Tolerance
1	5.5 VAC	+/- 2V
2	+5 V	+/- 250 mV
3	+5 V	+/- 250 mV
4	key	
5	+15 V	+/- 20mV
6	+15 V	+/- 20mV
7	GND	
8	GND	
9	-15 V	+/- 750 mV
10	-15 V	+/- 750 mV

3.2 Mother Boards, Connectors D

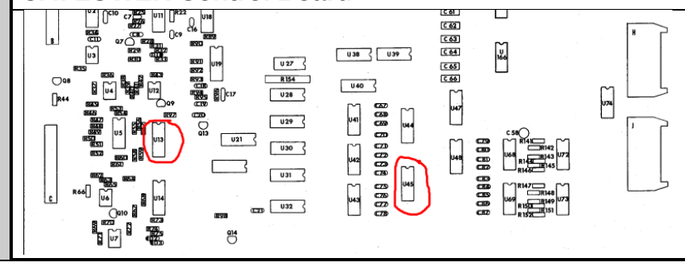
PIN	V	Tolerance
1	-15 V	+/- 750 mV
2	key	
3	+15 V	+/- 20 mV
4	+15 V	+/- 20 mV
5	GND	
6	GND	
7	GND	
8	GND	
9	-5 V	+/- 20 mV
10	-5 V	+/- 20 mV

3.3. UPPER Control Board



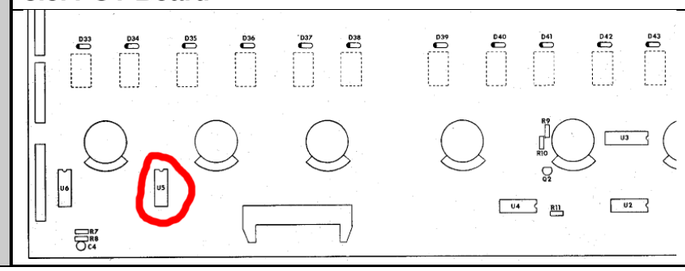
IC	PIN	V	Tolerance
#145 (4051)	16	+5.6	+/- 200 mV
#149 (4053)	7	-10	+/- 1 V

3.4. LOWER Control Board



IC	PIN	V	Tolerance
#45 (4051)	16	+5.6	+/- 200 mV
#13 (4053)	7	-10	+/- 1 V

3.5. POT Board



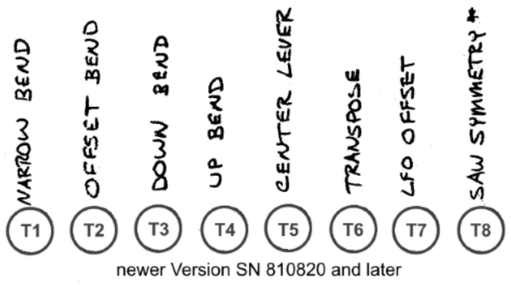
IC	PIN	V	Tolerance
#5	16	+5.6	+/- 350 mV
#5	7	-5	+/- 500 mV

B. MODULATION Assembly Calibration

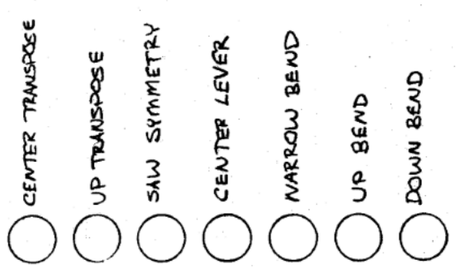
Below are two methods of modulation assembly calibration: the first utilizes a DVM, and the second is an audio method that does not use a DVM. Locate the trimmers which are accessible through the holes on the top of the Bend Assembly. Refer to the "Trimmer Location Diagram" for locations.

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

Note: There are two versions of the Modulation Assembly:



newer Version SN 810820 and later



early Version with Saw Symmetry Trimmer inside

B1. CALIBRATION WITH DVM

1.0 (Optional) If IC #8 has been replaced		
Center Bend Trimmer	IC 8-1 0.000 V (+/- 25 mV)	
Bend Offset Trimmer	IC 8-7 0.000 V (+/- 2 mV)	

1.1 Center Bend Trimmer Adjustment needs to be performed only if the "Up or Down Bend" cannot be brought into range, i.e., will not bend an octave.	IC 8-1 0.000 V (+/- 25 mV)

1.2 Bend Offset Trimmer If excessive beating between the two OSC when "OSC2 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/ s), press "OSC 2 ONLY" switch (LED on). Adjust the "Bend Offset" trimmer for beating is less than 1 beat per second.

1.3.0 Bend Offset Voltage: This voltage must be added to (or subtracted from) the voltages stated for the following three adjustments:	**Connector C-10** **0.000 V** (+/- 20mV)
1.3.1 UP Bend Trimmer: Move the bend lever fully towards the front of the unit.	**Connector C-10** **-1.000 V (+/- 2mV)** (+/- offset)
1.3.2 Down Bend Trimmer: Move the bend lever fully towards the back of the unit.	**Connector C-10** **+1.000 V (+/- 2mV)** (+/- offset)
1.3.3 Narrow Bend Trimmer: Press the „Narrow“ switch (LED on). Move the bend lever fully towards the back of the unit.	**Connector C-10** **-0.167 V (+/- 2mV)** (+/- offset)

1.4 Up Transpose Trimmer: Press the "UP TRANSPOSE" switch (LED on). Adjust the "Up Transpose" trimmer until the voltage is +2 V more than the voltage measured in the "DOWN TRANSPOSE" position.	**Connector C-5** **+2.000 V** (+/- 2mV)

1.5 LFO Offset Trimmer: This adjustment needs to 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:	**IC 7 – 7** **0.00 V** **(+/- 5 mV)**

1.6 Saw Symmetry Trimmer: 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 symmetrical waveform, but theamplitude will be half the required value. The required amplitude is 2 to 3 V peak to peak.

B2. Calibration with Audio Method

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

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

2.1. 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.

2.2. Bend Off set 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.

2.3. 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.

2.4. 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.

2.5. 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).

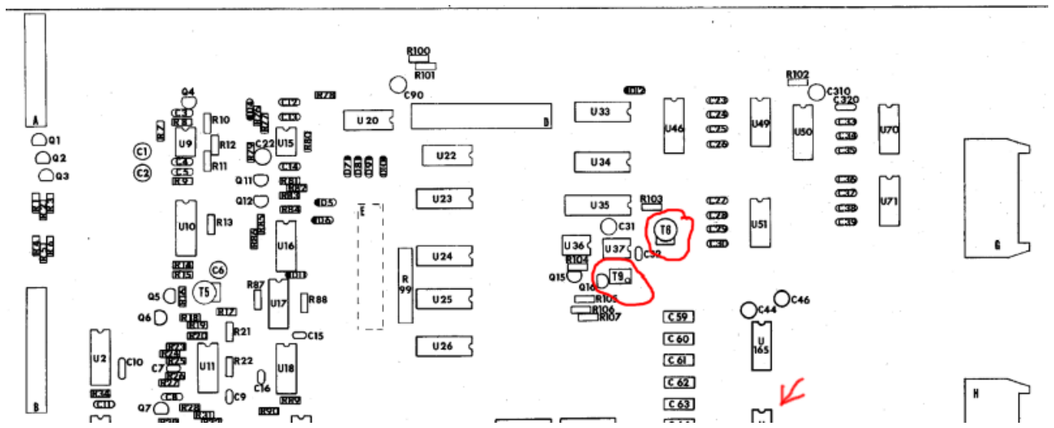
2.6. Up Transpose Adjustment:
Press the „UP TRANSPOSE" switch (LED on). Adjust the „UpTranspose" trimmer until the interval between the „UP TRANSPOSE" and the „Down TRANSPOSE" positions is exactly two Octaves.

2.7. LFO Offset Adjustment:
This adjustment needs to 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.

2.8. Symmetry Adjustment:
Pull up the „RATE" knob on the modulation panel. This will select a Sawtooth wavefrom on 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 wil l provide a symmetrical waveform but the amplitude will be too low.

C. DAC

Note: in newer revision of the lower processor board IC #64 is obsolet.
Messure at IC #166 PIN #7 (KeyCV1)
DAC OFFSET ADJUSTMENT
Press the "UNISON" switch, Press Low C (C0) Measure the voltage at Pin #7 of IC #64 (IC #166) and adjust Trimmer T 6 (near IC #35) for 0.000 V +/-2 mV.
DAC FULL SCALE ADJUSTMENT
Press High C (C5). Measure the voltage at Pin #7 of IC #64 (IC #166) and adjust Trimmer T9 for 5.000 V +/- 2mV.
DAC LINEARITY VERIFICATION
While monitoring the voltage at Pin #7 of IC #64 (IC #166):
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.



D. 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.

Prepare: Enter „MANUAL" mode. Set the controls as follows:
All pots down (fully counter clockwise) except:

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:	
OSC 1	On
OSC 1 FREQUENCY MODULATION	On
LFO WAVEFORM	Square

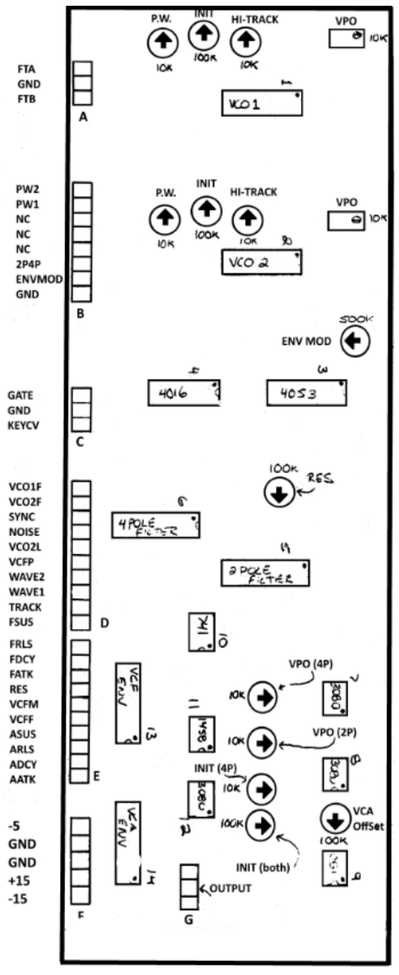
Write the above patch into memory locations A1.
Press „SPLIT". The keyboard will be split at note C2.
Program A1 on the lower half and program A2 will be on the Upper half.

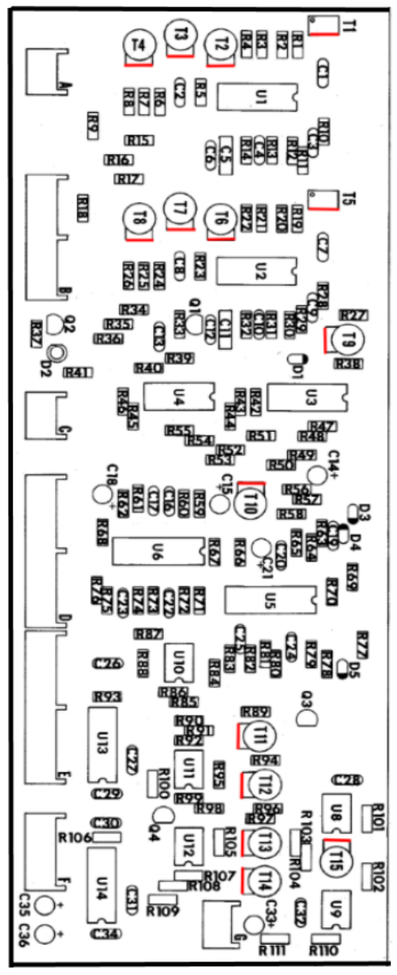
Note: The synthesizer will be split with these programs upon power up. If the Split or Double modes have been previously entered, the synthesizer will remember the split point and programs previously recalled.
Hold note C1 while listening to the oscillator being modulated, adjust Trimmer T5 (Lower Board) for a LFO rate of 2-4 Hz.
Hold note C2 and while listening to the oscillator being modulated, adjust the trimmer T5 on the Upper Board (near IC #148) for a LFO rate of 2-4 Hz.

E. VOICE-CARD CALIBRATION

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

	VCO1	VCO2	VCF	VCA
Volts per Octave	T1	T5		
High Track	T2	T6		
Initial Frequency	T3	T7		
Pulsewidth	T4	T8		
Filter Envelope Modulation			T9	
Filter Resonance			T10	
Filter Volts/Octave (4-Pole)			T11	
Filter Volts/Octave (2-Pole)			T12	
Filter Init Frequency (4-Pol)			T13	
Filter Init Frequency (both)			T14	
VCA Offset				T15





1. OSCILLATOR TUNING and Calibration (VCOs)

1.1. Prepare:
Enter „MANUAL" mode.
All pots down (fully counter clockwise) except:

FILTER FREQUENCY	Fully Clockwise
FILTER MODULATION	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 0' Clock (dead zone)
VCO2 DETUNE	12 0' Clock (LED out)

All switches OFF, except:

OSC1	On
OSC1 WAVEFORM	Pulse
TRACK	On
Transpose (Bend Assembly)	Down Octave

1.2. Lift Front Panel. Watch the LEDs on the Voice-Cards. Play C5 repeatedly until Voice 1 is playing and press „HOLD“ (this is for reference)

1.3. Using the 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.
TEST1 OFF (down / mid-scale). Adjust Trimmer T3 (Init) for no beats.
TEST1 ON (up). Press Auto-Tune and make sure that there are still no beats.

1.4. 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.

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

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

1.7. For HIGH-TRACK ADJUSTMENT set TRANSPOSE (Bend Assembly) „UP OCTAVE". Holding note C5, turn the "High Track" Trimmer (T 2) until no beats are heard.

1.8 PULSE WIDTH CALIBRATION: With the DIP switch turn only the voice to be calibrated on. Press note C3 and adjust the „Pulse Width" trimmer (T 4) 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 50% duty cycle.
Repeat the above VCO calibration for VCO2. Turn VCO1 off and VCO2 on.

Repeat steps 3 through 8 for all voices.

2. ENVELOPE MODULATION CALIBRATION

Prepare: Enter „MANUAL“ mode. Set the controls as follows:

All pots down (fully counter clockwise) except:

FILTER FREQUENCY	Fully Clockwise
FILTER MODULATION	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 0' Clock (dead zone)
VCO2 DETUNE	12 0' Clock (LED out)

All switches OFF, except:

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 (T 9) until VCO 2 is exactly one Octave above VCO 1.

3. FILTER CALIBRATION

3.1. Filter Reference Calibration

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

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

Enter „MANUAL" mode. Set the controls as follows:

All pots down (fully counterclockwise) except:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 0' Clock (dead zone)

All switches OFF, except:

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

3.1.1 INITIAL FREQUENCY CALIBRATION (Reference)

PIaying note C3, alternate between NOISE and OSC 2 HALF. Adjust the „Filter Initial Frequency" Trimmer (T 14) until the pitch of the noise is the same pitch as VCO2.

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

PIaying note C2, again alternate between NOISE and OSC 2.
Adjust the "Filter VPO" Trimmer (T 12) 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 (T 12), until the new voice is the same pitch as the reference.
Recheck the „Initial Frequency" adjustment.

3.2. FILTER CALIBRATION WITH A REFERENCE

Prepare: Using the voice selection DIP switch, turn on the voice to be calibrated and the voice to be used as a reference. Enter „MANUAL" mode.

All pots down (fully counter clockwise) except:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 0' ock (dead zone)

All swi tches OFF, except:

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

3.2.1 INITIAL FREQUENCY CALIBRATION

Playing note C3, alternate between the reference voice and the voice to be calibrated. Adjust the „Filter Initial Frequency" Trimmer (T 14), until the new voice is the same pitch as the reference.

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

PIaying note C2, again alternate between the reference voice and the voice to be calibrated.
Adjust the „Filter VPO“ Trimmer (T 12) 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 (T 12) until the new voice is the same pitch as the reference.
Recheck the „Initial Frequency“ adjustment.

3.3. RESONANCE CALIBRATION

Prerpare: Enter „Manual“ Mode.

All pots down (fully counterclockwise) except:

RESONANCE	Fully Clockwise
VCA and VCF ENVELOPES SUSTAIN	Fully Clockwise
MASTER TUNE	12 0' Clock (dead zone)

All switches OFF, except:

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

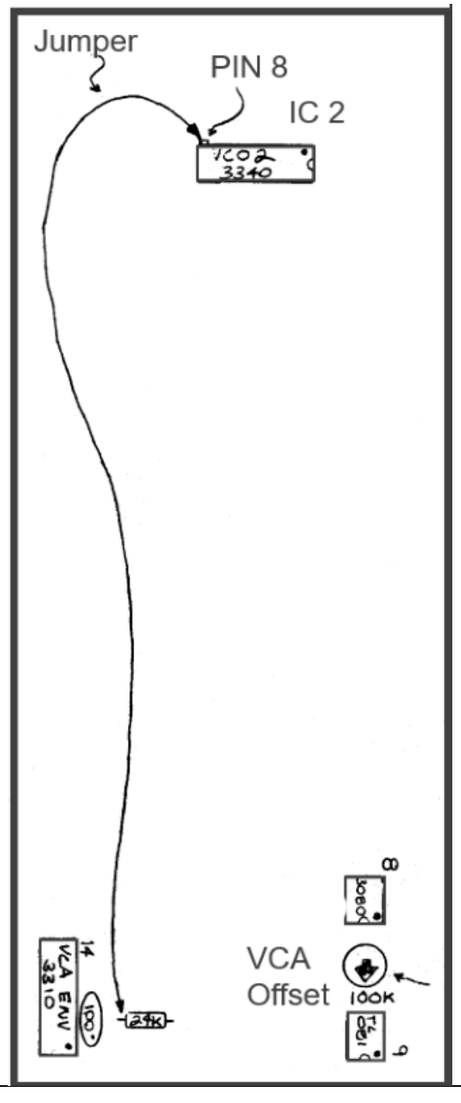
Hold note C3 and listen to the voice card being calibrated. Turn the „Resonance“ trimmer (T 10) up until a low frequency oscillation (approx. 500 Hz sine wave) is heard, then turn the trimmer back just to the point at which the oscillation stops.
If the above test is questionable as to whether there 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.

3.4. 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 (T 13) for initial frequency calibration, and the „4-Pole VPO“ trimmer (T 11) for VPO calibration.
There is not a resonance adjustment for the 4-pole filter.

3.5 VCA OFFSET CALIBRATION

Prepare: Put the unit into the "MANUAL" mode.
Set the controls as follows:
All pots down (fully counter clockwise) except:
VCA ENVELOPE SUSTAIN Fully Clockwise
All switches OFF.



Install a jumper on the card. Press key C3.

Turn the „VCA Offset“ trimmer (T 15) until a minimum amplitude of the tone is heard.