the
minimoog
synthesizer

operation manual

moog
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A GUIDE TO THE OPERATION OF THE MINI MOOG MODEL D

contents

introduction

An electronic music synthesizer is a musical instrument whose circuitry can be interconnected and set up in a large variety of ways to produce a broad spectrum of musical sounds. The component circuit controls and interconnections of the Mini Moog Synthesizer are arranged in a logical and convenient way which is ideal for live performance.

The purpose of this manual is to acquaint you with the component circuitry of the Mini Moog and the operation of each of the controls and switches regulating the generators, modifiers, and control devices involved in the synthesizing of a musical sound. After proceeding step by step through the instructions outlined below, you should be ready to begin using your instrument creatively and efficiently.

basic mini moog features

The Mini Moog contains the basic components and features to be found on larger, studio-oriented synthesizers. Its five sound sources include three oscillators for the production of pitched tones, one noise source for the production of unpitched sounds, and one microphone preamplifier for the introduction of live signals. Mixer controls are available for balancing these signals.

Sound modifiers include a lowpass filter and an amplifier, both of which have their own contour generators. The control devices include a 44-note keyboard for use by the right hand, and two wheel controls and two switches for use by the left hand.

Provision is made at the rear of the instrument for connecting external controlling devices such as sequencers, foot pedals, and two-dimensional (joystick) controllers. These may be used to control volume, pitch, and filter characteristic. Timing signals may also be introduced to trigger the contour generators.

audio, control, and timing signals

Sound travels through the Mini Moog circuitry in the form of electrical signals which are called AUDIO signals. These audio signals are generated by the five sound sources, and after undergoing extensive modification emerge as the output signal. It is this signal, amplified, which is translated into sound by your speaker system.

There are two other types of signals which are not heard directly as sound, but instead are used to influence the way in which the generating and modifying circuitry performs:

> CONTROL signals are used to change the pitches of the oscillators, the characteristics of the filter, and the amount of amplification by the amplifier. These control signals are responsible for all of the musically significant changes and contours in the musical sounds produced by the Mini Moog.
>
> TIMING signals come from the keyboard (or from an external source) and are used to trigger, or start off, the contours which open and close the filter and amplifier. A timing signal begins whenever a key on the keyboard is depressed, and stops when all keys are released. Timing signals are used to initiate and terminate musical sounds, whereas control signals are used to shape and change these sounds while they occur.

setting up the instrument

Place the instrument at a convenient level for playing and secure the Front Panel in the "up" position by means of the metal bracket underneath.

1. Set all switches in the off position (left-hand or bottom half depressed).

2. Referring to Fig. 1, below, set all of the control knobs as indicated.

3. Plug the power cord into any conventional 117 Volt A.C. outlet.

4. Two 6' patch-cords are supplied with the Mini Moog. If you are using a portable, guitar-type amplifier, run the cord with the phone plug at each end from the LOW level MAIN OUTPUT jack on the rear connector strip of the Mini Moog to an input on your amplifier. If you are using a monitor amplifier, you will need to use the other cord. Plug the phone plug end into the HIGH level MAIN OUTPUT jack of the synthesizer, and run the small phono-plug at the other end into the high level input of the monitor amplifier (or into the line level input of a tape recorder).

The following sections of this guide will be devoted to a systematic description of individual control functions in relation to the synthesizer's component circuits.

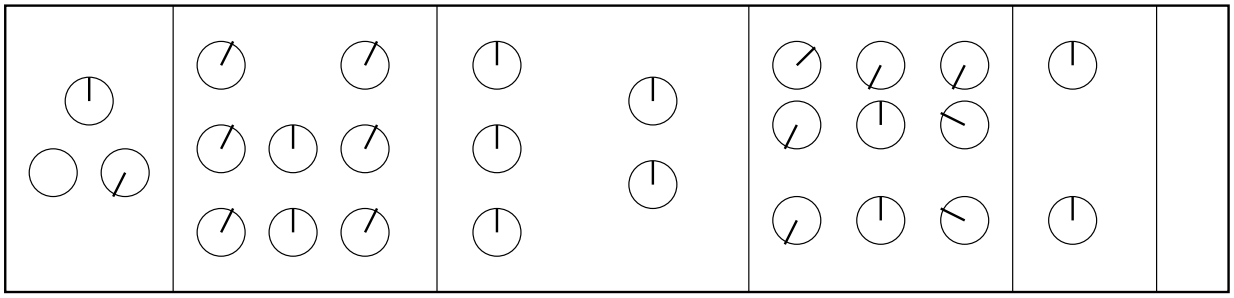


Fig. 1

output section

The Output section of the front panel includes two basic switches: the POWER switch, which turns the instrument on and off, and the MAIN OUTPUT switch, which sends the final audio signal out the MAIN OUTPUT jacks at the rear and into your amplifier. In addition, there are volume controls for the MAIN OUTPUT and HEADPHONE signals, and an A-440 switch, all of which will be described below.

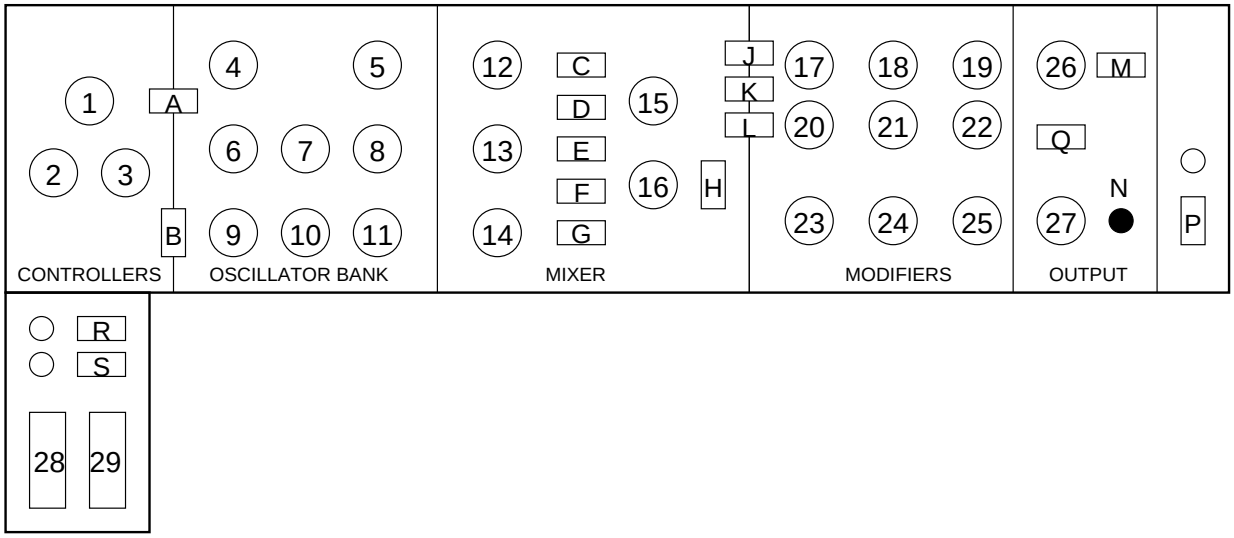
1. Turn on the POWER switch (P). The instrument should generally be given about ten minutes to warm up before tuning and playing. Once warmed up, there is practically no limit to the length of time it may be kept on and in use.

2. Turn on switches (B) and (C) and the MAIN OUTPUT switch (M). Adjust the volume control on your amplifier so that, as you play the keyboard, fairly loud tones are heard. Further adjustments in the overall volume may be made with the MAIN OUTPUT VOLUME control (26)

3. Briefly turn on the A-440 switch (Q). This signal will be used for tuning the instrument, and is not used during actual performance. The tuning procedure will be described in the controllers section, step 11.

4. A separate output is available for headphones, in addition to the MAIN OUTPUT. For quiet practice, or for tuning up prior to performance, the MAIN OUTPUT switch may be turned off, so that the audio signal is not fed into the amplifier. A pair of low impedance headphones with a *stereo* plug may be plugged into the jack labelled PHONES (N). The HEADPHONE VOLUME control (27) is then used to regulate the volume of the headphone signal.

Front Panel Diagram



oscillator bank

This group of circuits contains three separate and independent oscillators. Each oscillator produces a waveform which repeats regularly, thereby giving rise to a tone of definite pitch. The audio signal outputs of the three oscillators are activated by turning on mixer switches (C), (E), and (G). Since switch (C) is now on, we are hearing the output of oscillator 1, which is the top row of controls (4, 5, and 12).

1. The RANGE switch (4) determines the pitch range in which the oscillator functions. Press down a key in the middle of the keyboard, and turn the RANGE switch through its 6 positions. You will hear that all positions except the lowest are separated by one octave. The LO position produces sub-audio clicks which may be used for rhythmic effect. Return the switch to its 8´ position.

2. The WAVEFORM switch (5) selects one of six waveforms, each of which has a different overtone spectrum, and therefore produces a different basic tone quality. From left to right, the available waveforms are: triangular, sawtooth-triangular, sawtooth, square, wide rectangular, and narrow rectangular. (Oscillator 3 substitutes a reverse sawtooth for the sawtooth-triangular.)

   Hold a key down and run the WAVEFORM switch through its positions, noticing how the tone quality changes. The triangular waveform has the least harmonic content; the narrow rectangular has the most. Generally your ear will be your best guide in deciding which waveform to use for a particular quality.

3. The VOLUME control (12) adjusts the amount of Oscillator 1 signal which is fed to the mixer, while switch (C) instantly turns the oscillator on or off. Oscillators 2 and 3 may be heard by turning on switches (E) and (G) respectively, and their relative volumes may be adjusted with VOLUME controls (13) and (14).

4. FREQUENCY controls (7 and 10) are found only on Oscillators 2 and 3. These controls raise or lower the pitch of their oscillator by as much as a major sixth with respect to Oscillator 1. To hear this, turn on switches (C) and (E), turn off (G), and depress a key. Adjust control (7) until the pitches of Oscillators 1 and 2 are nearly in unison. As you move up and down the keyboard, the pitches of the two oscillators will move together. Now turn control (7) clockwise while depressing a key, until a perfect fifth is made. Once again, this interval will remain constant as you play different notes on the keyboard. Any intervals within the range of the oscillators may be set up simply by setting the RANGE switches and FREQUENCY controls appropriately.

5. By turning off the OSCILLATOR 3 CONTROL switch (B), Oscillator 3 may be disconnected from the control of the keyboard. To observe this, turn off switches (B), (C), and (E), and turn on switch (G). The pitch of the oscillator will not change as different keys are struck. You will also observe that Oscillator 3's FREQUENCY control has a much wider range when switch (B) is off. If you hold down one key and turn control (10) through its range, you will hear a frequency sweep of 6 octaves rather than one octave.

controllers

This section will demonstrate the use of the controls located to the left of the Oscillator Bank (used in tuning and setting up a sound), as well as the keyboard and the manual controls on the panel to its left (used during performance). All of these controls have an effect on the oscillators' pitches, while the Modulation Mix and keyboard may also be used to control the filter.

modulation mix

Oscillator 3, unlike Oscillators 1 and 2, is available as a control signal in addition to functioning as an audio signal. As a control signal, it may be mixed with the output of the Noise Source using the MODULATION MIX control (3) and introduced whenever the performer wishes, using the MODULATION wheel (29). The procedure described below will familiarize you with the use of the Modulation Mix in controlling the pitch of Oscillator 1:

1. Turn off switch (B), so that the pitch of Oscillator 3 is not affected by the keyboard.

2. Turn off switch (G) and turn on switch (C). Now you are hearing Oscillator 1, but not Oscillator 3, when a key is depressed.

3. Set Oscillator 3's RANGE switch (9) to the LO position, its FREQUENCY control (10) to mid (0) position, and its WAVEFORM switch (11) to the triangular (extreme left) setting. This produces a very low frequency triangular waveform which oscillates only a few times a second.

4. Set the MODULATION MIX control to 0, so that its signal is that of Oscillator 3. Turn on the OSCILLATOR MODULATION SWITCH (A). This switch directs the Modulation Mix signal to control the oscillators' pitches.

5. The slowly varying output voltage of Oscillator 3 is now going through the MODULATION wheel (29) at the left of the keyboard, and from there may be applied to periodically change the oscillators' pitches (we will hear its effect on Oscillator 1). The MODULATION wheel is in effect a level control for the Modulation Mix. Slowly move the MODULATION wheel back and forth with your left hand while holding down a key with your right hand. The position of the Modulation wheel will determine the amount of variation you hear in the pitch of Oscillator 1.

6. Change the setting of Oscillator 3's FREQUENCY control and notice the resulting increase and decrease in the speed of the modulation

7. Change the setting of Oscillator 3's WAVEFORM switch and you will notice the change in the shape of the modulation. You should actually be able to *hear* the contours of the different waveforms − the alternation of high and low tones in the square wave, the repeated upward glissandi of the sawtooth, etc.

8. The setting of the MODULATION MIX control determines the proportions of the mixture of Oscillator 3 and Noise Source. As you slowly turn this control clockwise, you will hear less periodic modulation and more random modulation.

9. Before continuing, defeat the oscillator modulation by turning off switch (A).

other controllers

10. The PITCH wheel (28), located next to the MODULATION wheel to the left of the keyboard, is used to *bend* the pitch determined by the keyboard (as much as half an octave up or down) when the performer wishes to introduce expressive nuances to individual notes during performance. Depress a key, and move the PITCH wheel back and forth with your left hand. Notice that you can reset the control by feel − a detent mechanism holds it in its normal center position.

11. The TUNE control (1) is used to tune up the Mini Moog oscillators to the pitch of the ensemble in which it is being used, or to its A-440 reference tone. Check to see that switch (C) is on, and notice that, when a key is depressed, the pitch moves up and down by a few tones as the TUNE control is turned through its range. Make sure the PITCH wheel is in its center position, and turn on the A-440 switch (Q). Depress an A key on the keyboard, and adjust the TUNE control so that the two A's are in tune with each other. Turn off the A-440. The other two oscillators may now be tuned to Oscillator 1 using their FREQUENCY controls.

12. The GLIDE control (2) regulates the amount of portamento, or glide, heard between pitches as first one key and then another is depressed. This control is activated by turning on the GLIDE switch (R). Setting the GLIDE control at various levels, play a scale or arpeggio, first with the GLIDE switch on, then using the switch to introduce glide selectively between certain notes only. Notice that the further to the right control (2) is set, the longer it will take a tone to move from one pitch to the next.

13. Finally, the KEYBOARD itself functions as a controller. It produces a control signal which varies according to the position of the key struck. If more than one key is held down, only the lowest one has effect. The control output of the KEYBOARD is permanently connected to Oscillators 1 and 2. Switch (B) couples it to Oscillator 3. Switches (K) and (L) couple it to the filter, and are discussed in the section titled modifiers, step 8. The KEYBOARD also produces a timing signal each time a key is depressed. This will be discussed in the modifiers section in connection with filter and loudness contour controls.

mixer

Audio signals produced by the three oscillators, noise source, and microphone preamplifier are combined and balanced by the Mixer section's switches and volume controls. It is this composite signal, the output of the mixer, which is then modified by the filter and loudness contour controls and appears as the audio output signal of the Mini Moog.

1. The OSCILLATOR VOLUME controls (12, 13, and 14) are used to regulate the relative levels of the audio signals produced by the three oscillators. Switches (C), (E), and (G) instantly turn the individual audio signals on and off. Switch (G) does not affect the control signal produced by Oscillator 3 via the Modulation Mix. The operation of these controls and switches has been discussed earlier.

2. The EXTERNAL INPUT VOLUME control (15) is connected to a microphone preamplifier. The input to this preamplifier is the phone jack on the rear panel labelled EXT. SIGNAL INPUT. Any sort of high impedance microphone signal or sound source may be fed into this input. This includes guitar microphone, voice microphone, wind instrument microphone, tape recorder output, radio, etc. Control (15) is adjusted so that the OVERLOAD light blinks on and off occasionally when loud sounds come through the external input. Switch (D) feeds this source into the mixer.

3. The NOISE VOLUME control (16) regulates the level of the signal produced by the Noise Source. This source generates a random waveform producing pitch-less sound. Two *colors* of noise are available − white, or high-pitched, and pink, or low-pitched. These are selected by the Noise Quality switch (H), labelled WHITE/PINK. As an audio signal, the Noise Source may be fed into the mixer by turning on switch (F). As a control signal, it is available through the Modulation Mix, as described in the controllers section.

modifiers

The Modifiers section of the front panel features controls for the two sound modifiers, the Filter and the Loudness Contour, which respectively shape the overtone content and loudness/time contour of the audio signal as it passes through the modifying circuitry from the mixer. In order to hear the effect of these controls, begin by setting the controls in the oscillator and mixer sections as follows:

Control	***Setting***
Oscillator MODULATION SWITCH (A)	off
Oscillator 1 RANGE (4)	16´
Oscillator 1 WAVEFORM (5)	narrow rectangular (extreme right)
Oscillator 1 VOLUME (12)	7
Oscillator 1 MIXER switch (C)	on
Other mixer switches (D, E, F, G)	off
Switches (J) (K) (L)	off

The controls on the Modifiers section should still be set as shown in Fig. 1 of the section titled setting up the instrument.

filter and filter contour

The Mini Moog features a wide-range lowpass filter. This filter attenuates, or cuts out, those frequency components of an audio signal which lie above a variable cutoff frequency, while passing those components which lie below it.

1. The CUTOFF FREQUENCY control (17) is used to set the filter's cutoff frequency. Hold down a key and turn this control first clockwise, then counter-clockwise. You will hear the tone become more shrill and then more muted, as the higher overtones are first allowed to pass and then attenuated. If control (17) is moved all the way to the left, the entire signal will be cut out.

2. The AMOUNT OF CONTOUR control (19) determines the amount of filter contour applied to the filter's cutoff frequency. Each time a key is depressed, a contour generator attached to the filter is actuated, and sends a control signal to the filter. The control signal rises at one rate, then falls at a second rate, and finally levels off at a certain level. This results in a corresponding rise, fall, and leveling off of the filter cutoff frequency, which we call the *filter contour*.

   Set the CUTOFF FREQUENCY to -2 and repeatedly depress and hold down a key while setting the AMOUNT OF CONTOUR at various levels. The more this control is turned up, the greater will be the increase and decrease in the brightness of each note. Controls (17) and (19) have an additive effect on the cutoff frequency.

3. The ATTACK TIME control (20) determines the duration of the initial segment of the filter contour. The initial rise of the filter cutoff frequency can be as short as 10 milliseconds or as

long as 10 seconds. (The frequency at which the contour begins is determined by control (17), while the peak which it reaches is determined by controls (17) and (19) combined.) Repeatedly depress a key while varying the setting of the ATTACK TIME control from left to right. You will hear the brightness of the note increase sharply at first, and then more gradually as the attack time increases.

4. The DECAY TIME control (21) determines the duration of the second segment of the contour, the fall from the initial peak to the sustain level. The range of this control is about the same as that of the previous control. Set the DECAY TIME control at various levels moving slowly from left to right, while repeatedly depressing a key. At first you will hear the brightness drop sharply after the initial attack; the drop will become more gradual as the decay time increases.

5. The SUSTAIN LEVEL control (22) determines the frequency at which the contour levels off after the initial rise and fall. The frequency of the sustain level can be as high as the initial peak, in which case there is no decay after the initial rise, or it can be as low as the frequency at which the contour began. To hear this most effectively, set the filter controls for CUTOFF FREQUENCY of -2, high AMOUNT OF CONTOUR, and medium DECAY TIME. Now repeatedly depress and hold down a key while setting control (22) at various levels. Set at 0, the contour decay effectively wipes out the signal; set in the middle, the brightness levels off at a frequency somewhere below the initial peak, and set at 10, the brightness of the note rises to an initial peak and remains there.

6. The EMPHASIS control (18) introduces a sharp resonance in the response of the filter at the cutoff frequency. The effect of this control can be heard very easily. To observe it, turn the AMOUNT OF CONTOUR fully to the left to shut off the contour signal, and turn the EMPHASIS control to 7. Depress a key, and turn the CUTOFF FREQUENCY control slowly throughout its range. You should hear the individual overtones of the oscillator waveform being emphasized one by one as the resonance passes over them. Now set the CUTOFF FREQUENCY to about -2, turn the AMOUNT OF CONTOUR all the way up, and repeatedly hold down a key while changing the settings of controls (20), (21), and (22). Notice how the filter contour is now heard as a sweep of the overtone series when (20) and (21) are turned up to about 7 seconds and (22) is set low.

   We have seen how the filter cutoff frequency may be controlled manually and using the filter contour controls. These are in addition to other means of controlling the filter.

7. The MODULATION MIX (3) of Oscillator 3 and the Noise Source may be used to modulate the filter cutoff frequency in exactly the same way it is employed to modulate the pitches of the oscillators. To direct the Modulation Mix to the filter, the FILTER MODULATION switch (J) must be turned on. Then the MODULATION wheel (29) can be moved forward with the left hand to introduce the desired amount of modulation as the keyboard is played with the right hand. To test this, turn (18) and (19) all the way down and set (17) to about 1 or 2. Make sure that the Oscillator Modulation switch (A) and Osc. 3 Control Switch (B) are off, and turn on switch (J). Set the MODULATION MIX control all the way to the left. Oscillator 3's RANGE switch should be set to LO. You will observe as you did when applying the Modulation Mix to the oscillators that the modulation contour depends on the settings of

the FREQUENCY and WAVEFORM controls of Oscillator 3. A more complex sound can be made by adding the effects of controls (18) and (19).

8. The two KEYBOARD CONTROL switches (K) and (L) apply the control signal produced by the keyboard to move the filter cutoff frequency up and down. This is important in setting up a sound, for if there is no keyboard control of the filter, the higher notes on the keyboard will sound duller than the lower ones, having more of their overtones attenuated. To observe the effect of these switches, turn off Oscillator 1 (C) and the Filter Modulation switch (J), and set control (17) to 0. Turn on the NOISE SOURCE (F) and set the Noise Quality switch (H) to WHITE. This feeds white noise through filter and amplifier. Turn on switches (K) and (L) and play up and down the keyboard. You will hear the brightness of the white noise increase and decrease according to the position of the key which you have depressed. Switch (K) couples a small amount of keyboard control; switch (L) couples a larger amount. When (K) and (L) are both on, the filter cutoff frequency moves in full response to the keyboard control signal.

NOTE:

When the EMPHASIS control is set to 10, the filter breaks into oscillation, and produces a pure sine wave tone. It thus is available as a sixth sound source within the Mini Moog. The pitch of this additional oscillator may be controlled by the five other controls on the keyboard. The sixth sound source may be used alone or mixed with the other sound sources to achieve a variety of complex effects.

To hear the sixth sound source alone, set up the instrument as follows:

Control	***Setting***
All Mixer switches (C,D,E,F,G)	off
Filter Modulation switch (J)	off
Keyboard Control switches (K & L)	on
Cutoff Frequency (17)	-2
Emphasis (18)	10
Amount of Contour (19)	0

Now hold down or repeatedly strike a key, while experimenting with the following means of controlling pitch:

1. Manually, using CUTOFF FREQUENCY control.
2. Using Filter Contour Controls (19-22).
3. Using the Modulation Mix (see step 7 above).
4. Using the Keyboard. Differently tempered scales will result from different settings of (K) and (L).

loudness contour

The volume of the audio signal which passes through the Modifiers section of the Mini Moog is contoured by the Loudness Contour controls. These controls are connected to a contour generator which supplies a control signal to the amplifier. Like the filter contour signal, the loudness contour signal is composed of three segments − initial rise, decay, and sustain level. Each time a key is struck, the contour generator is activated, and a note is *shaped* according to the settings of the contour controls.

9. The ATTACK TIME control (23) determines the duration of the initial rise in volume to a peak. Turn off the Noise Source (F) and turn on Oscillator 1 (C). Move control (23) back and forth while repeatedly pressing down a key. Notice the different qualities which a note takes on as a sharp attack becomes a slow crescendo.

10. The DECAY TIME control (24) determines the duration of the drop in volume from the initial peak to the sustain level. The decay can be sharp or gradual.

11. The SUSTAIN LEVEL control (25) determines the volume level at which the contour levels off after attack and decay. Set at 0, no sustain level is heard. Set at 5, the contour diminishes to a low volume. Set at 10, no drop in volume is heard after the initial peak is reached.

12. Finally, a DECAY switch (S) to the left of the keyboard allows the sound to fade out at the decay time set by control (24), rather than immediately upon release of a key. This *final decay* then, takes effect after the sustain level segment of the contour. To review the phases of the overall loudness contour: a key is first pressed down. This produces an initial rise in volume, a decay, and a leveling off. The key is then lifted, and the sound is either cut off immediately, or if the DECAY switch is on, fades at the rate set by control (24). Turning on the DECAY switch can impart a life-like quality to notes which seem to terminate too abruptly.

13. For sustained sounds and textures, a SHORTING PLUG is provided with the Mini Moog. If this plug is inserted in the TRIGGER INPUT jack at the rear of the instrument, the filter and loudness contours will be triggered and remain at the sustain level. The mixer output will then be amplified at a sustained volume whether or not a key is held down. The keyboard will continue to provide a control signal for determining the oscillators' pitches and the filter's cutoff frequency, according to the settings of switches (B), (K), and (L).

STANDARD ACCESSORIES SHIPPED WITH MINI-D SYNTHESIZER

1. Mini brochure & 1971 Catalog
2. Mini Instruction Manual
3. Warrantee (Reg. Postcard)
4. Shorting S-Trig Plug
5. "Back Panel Adjustment" Pamphlet
6. 6’ Phone Cord
7. 6’ Phone - Phono Cord
8. Optional Accessories List

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OPTIONAL ACCESSORIES NOW AVAILABLE
FOR USE WITH MINI MOOG MODEL D

1. 958 FOOT PEDAL

   This controller can be used to control the volume of the output, pitch of the oscillators, or the cutoff frequency of the filter (timbre). Up to three may be used simultaneously to control all of these functions.

2. 959 X-Y CONTROLLER

   This "joystick" simultaneously controls any two of the functions mentioned above. For instance, it can be used to produce vowel-like sounds by controlling the filter and pitch.

3. SEQUENTIAL CONTROLLER SYSTEM

   a. 960 Sequencer
   b. 961 Interface (optional)
   c. 962 Sequential Switch (optional)
   d. 910 Power Supply for above units
   e. Cabinet (portable or walnut console)

   This system will automatically and simultaneously control all three functions (pitch, timbre, and volume) in a repeating eight-event sequence. It also triggers the contour generators at the onset of each event. The 962 allows one to extend a sequence of one function to up to 24 events (example: 24 note repeating bass line). The 961 extends flexibility in triggering the contour generators and can be used to synchronize the MINI MOOG with external equipment (example: tape recorded click track).

AVAILABLE SOON

1. FOOT SWITCH

   A pair of these will allow the performer to engage momentarily GLIDE and DECAY functions.*

2. DUAL FOOT PEDAL

   Essentially this device will contain two 958 Foot Pedals for simultaneous control of timbre and volume.

* With a different plug the foot switch will supply an external S-Trigger.

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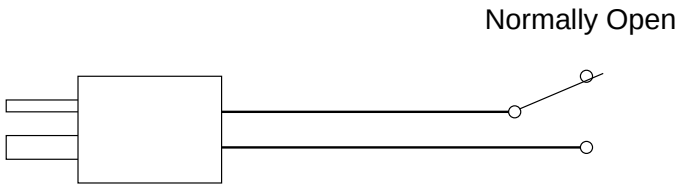
S-TRIG PLUG FOR MINI MOOG MODEL D

When inserted, this plug keeps the contour generators "on" continuously. It can be wired to an accessory foot switch for manual external triggering of notes.



WIRING OF SWITCH TO S-TRIG PLUG

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LEFT HAND CONTROLLER

EXTERNAL CONTROL OF GLIDE AND FINAL DECAY.

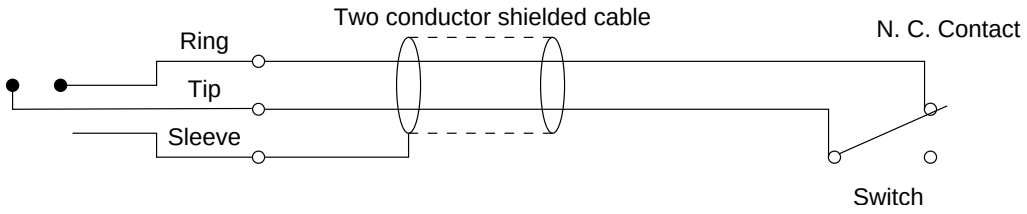
The rocker switches in the left hand controller section have replaced the momentary push buttons used previously. Jacks have been added so that the performer can connect foot switches to engage GLIDE and DECAY functions. R. A. Moog will soon make these momentary switches available as an accessory.

With no external switch connected and the GLIDE switch turned *off* there will be no portamento. When the GLIDE switch is turned *on* the pitch will glide between notes at a rate set by control (2) (see controllers section, paragraph 12). When the performer connects the external foot switch, he can momentarily engage portamento when the GLIDE switch is off by depressing the switch button. The foot switch has no effect if the GLIDE switch is already on. The external control of the DECAY function works in an analogous fashion.

To prevent confusion of the external foot switch cords with input and output audio and control voltage cords, the jacks for DECAY and GLIDE are 0.206" dia. instead of 0.250" dia. The jacks mate with Switchcraft S-260 plugs instead of ordinary 1/4" phone plugs.

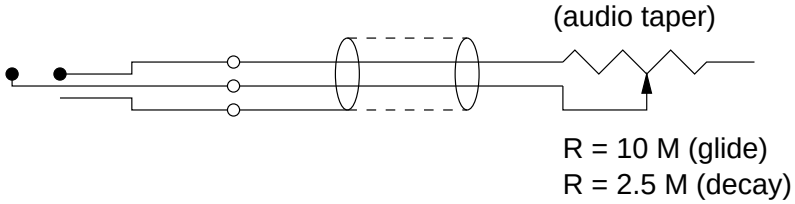
The external switch is a normally closed type. It opens when the button is depressed.

TYPICAL S-260 JACK



It is possible to connect a foot pedal rather than foot switch to the GLIDE jack. With the GLIDE switch set to "off" one can adjust the portamento speed to any value faster than that set by control (2). (The foot pedals used for volume, filter, and oscillators will not work for this purpose.)

Similarly one can wire an external foot pedal to adjust DECAY to any value faster than the time set by control (21) or (24).



A photoresistor can be used in place of a potentiometer.

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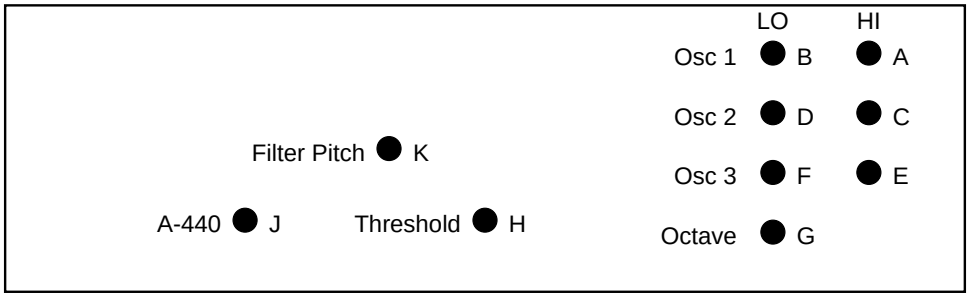
Mini Moog Model D Back Panel Adjustments
(on instruments with serial number 1237 and higher)

As with any fine musical instrument, the Mini Moog may require periodic tuning and adjustment. Holes in the back panel provide access to internal trim potentiometers for necessary adjustments. DO NOT ATTEMPT TO REMOVE THE BACK PANEL. This should be removed only by a qualified service technician.

location of rear panel adjustments



how to tune the oscillators

1. Turn on POWER switch to allow instrument to warm up for 10 minutes before making adjustments.

2. Set front panel controls as shown in Figure 1 and make sure Pitch Bender Wheel is in center position.

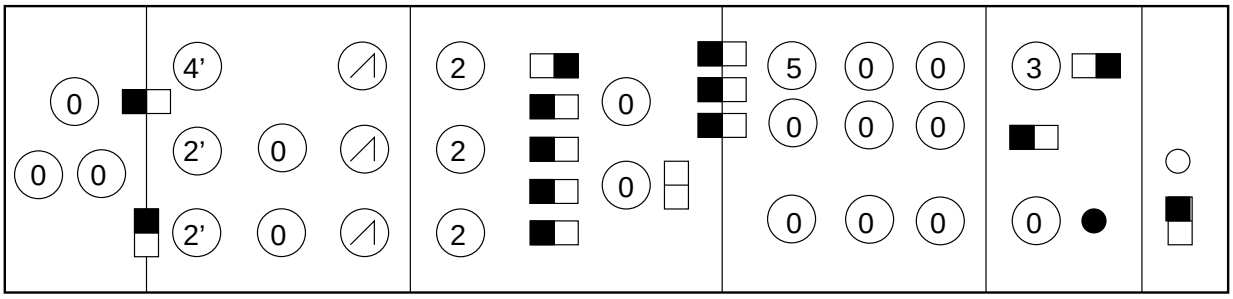


Figure 1

3. Turn on A-440 reference oscillator.

4. Hold down highest A on keyboard, using a pencil or similar device to keep the key depressed throughout the entire oscillator tuning procedure.

5. Using a small screwdriver with an insulated handle, turn OSCILLATOR 1 high end adjustment (A) and tune OSCILLATOR 1 using zero beat method two octaves above the reference oscillator. (Do not touch metal shaft of screwdriver as this will affect tuning).

6. Depress lowest A on keyboard and zero beat one octave below reference oscillator, using OSCILLATOR 1 low end adjustment (B).

7. Set OSCILLATOR 1 range to 32´ and adjust using octave tune adjustment (G) zero beat one octave below reference oscillator.

8. Turn off reference oscillator.

9. Set OSCILLATOR 1 to 2´ range.

10. Turn on OSCILLATOR 2.

11. Tune OSCILLATOR 2 to OSCILLATOR 1, using OSCILLATOR 2 high end adjustment (C) .

12. Depress lowest A key and zero beat OSCILLATOR 1 with OSCILLATOR 2 using OSCILLATOR 2 low end adjustment (D).

13. Repeat steps 9 through 12 tuning OSCILLATOR 3 to OSCILLATOR 1.

how to tune the filter

(This is factory set and rarely, if ever, needs adjustment)

1. Set the front panel controls as shown in Figure 2.

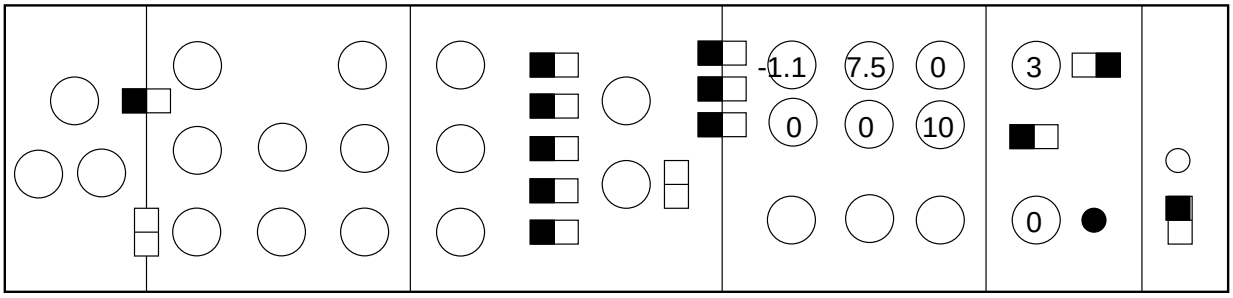


Figure 2

2. Insert S-TRIG Shorting Plug supplied with the instrument.

3. Adjust filter resonance threshold adjustment (H) until tone is barely audible.

4. Turn FILTER EMPHASIS control on front panel to 10.

5. Turn on A-440 reference oscillator.

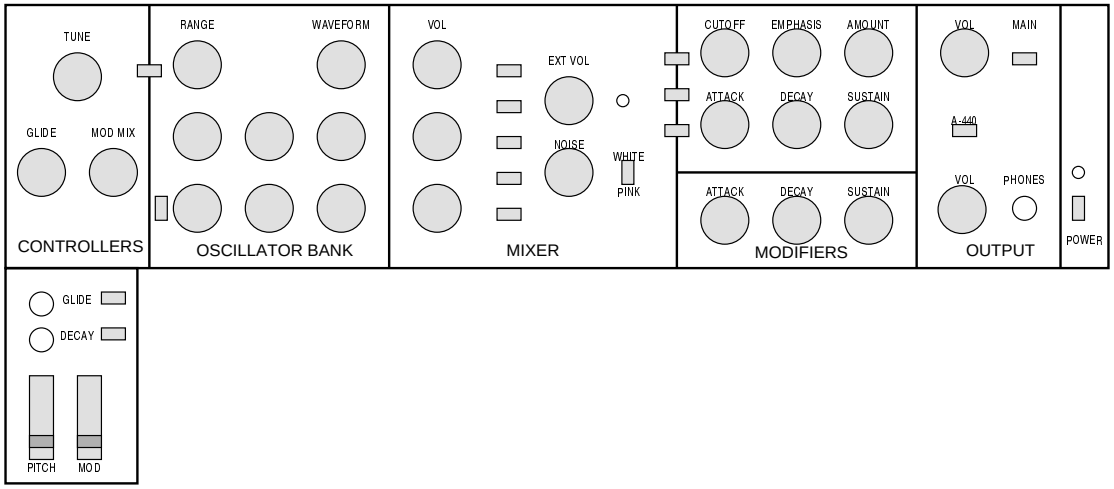
6. Tune filter resonance to A-440 tone using filter pitch adjustment (K).

The

minimoog

MODEL D
TECHNICAL SERVICE MANUAL

by R. J. Folkman



moog

MUSIC INC.

the first sound in synthesizers

MINI-MOOG
Field Service Manual

CONTENTS

7/73 RJF

Section I: Precautionary Measures

In the **Mini-Moog**, as in any electrical device, shock hazards exist. All lethal voltages are confined to the area around the power switch and the A.C. fuseholder. Always unplug the instrument while servicing the electronics. Keyboard cleaning and adjusting may be done with the unit turned on.

When a fuse blows, replace it only with the proper size as indicated on the label directly below the fuseholder. If the fuse continues to blow, it is an indication that a definite electrical problem has developed. Never try a larger fuse; this will only result in further internal damage.

Avoid making adjustments at random. Each adjustment is critical and should be made in accordance with the procedures outlined herein. If a sub-assembly is found to be defective, we recommend exchanging it rather than attempting to repair it. Unless a qualified technician is available, with special test fixtures, more harm than good may result and possibly void any remaining warranty.

Section II: Sub-assembly Description

93-113 Oscillator (Board 1)

This assembly contains three tone oscillators, summing amplifiers, exponential current generators, waveshaping circuits and a -5 volt reference source. The three oscillators are independent and non-synchronous. Each oscillator is voltage controlled from external sources such as the keyboard. Linear input voltages are converted to exponential currents which are used to control the frequency or pitch of the tone produced. The basic sawtooth signal is processed to derive triangle and variable width rectangular waveforms. Oscillator #3 has a wide range capability which enables it to be used for modulation purposes. The -5 volt reference source is used to establish the precise voltage steps on the octave range switches.

93-114 Contour Generator (Board 2)

This assembly contains two identical contour or envelope generators, and the keyboard circuitry. Upon triggering, the contour generators produce a voltage envelope with variable attack, decay, and sustain. The output is used to control the gain of the first voltage controlled amplifier or the cutoff frequency of the voltage controlled filter.

The keyboard circuit contains a constant current source which feeds the keyboard resistor string. This insures the proper voltage drop across each of the 43 keyboard resistors. Also contained on this assembly is the sample-hold circuit which measures the voltage from the keyboard and maintains it until a different key is depressed. The output of this circuit is the control voltage for the oscillators and the filter. The glide feature is a function of the sample-hold circuit.

93-115 Power Supply (Board 3)

This assembly contains the plus and minus 10 volt regulators, the headphone amplifier, the noise generator and the modulation mix amplifier. The plus supply uses a temperature compensated zener diode for a voltage reference. The minus supply is referenced to the regulated plus voltage causing the two supplies to "track". Both supplies employ remote voltage sensing for optimum stability.

The headphone amplifier is an A.C. coupled emitter follower with a push-pull output. The noise generator uses a reverse biased transistor junction for a noise source. The output of this transistor is processed through three filter circuits to derive the white, pink, and red noise outputs. The modulation mix amplifier takes signals from Oscillator #3 and the noise generator, sums them and supplies an output which is used for modulation.

93-116 Filter (Board 4)

This assembly contains the voltage controlled filter, the external input pre-amplifier, the overload lamp driver, the first and second voltage controlled amplifiers and the A-440 reference oscillator. The filter is a voltage controlled low pass type which employs the Moog patented ladder network. It is capable of regenerating (oscillating) over a wide frequency range. The scale is adjustable so the filter can be set to track the keyboard.

The external pre-amp is a three transistor high-gain amplifier. The output of the pre-amp is monitored by an overload indicator. The overload driver circuit is a Schmitt trigger which turns the overload light on when external signal levels become excessive.

The first and second voltage controlled amplifiers are two nearly identical circuits. Their gain is controlled by varying the voltage which supplies the current source transistors. A buffer or output amplifier follows the second VCA stage.

The A-440 reference source is a highly stable Wein Bridge oscillator circuit. It produces a somewhat imperfect sinewave which increases its harmonic content. These harmonics or overtones assist in tuning to the reference, especially when the source being tuned is one or two octaves away from the reference frequency. The output of this circuit is coupled to the VCA buffer amplifier.

93-118 Rectifier Board

This assembly contains the input bridge rectifier diodes and the unregulated D.C. filter capacitors.

93-060 Left Hand Controller

This assembly contains the PITCH wheel, MODULATION wheel, GLIDE and DECAY switches, and two jacks for remote switching of glide and decay. The PITCH wheel has a mechanical detent which allows it to be easily returned to a pre-set tune point.

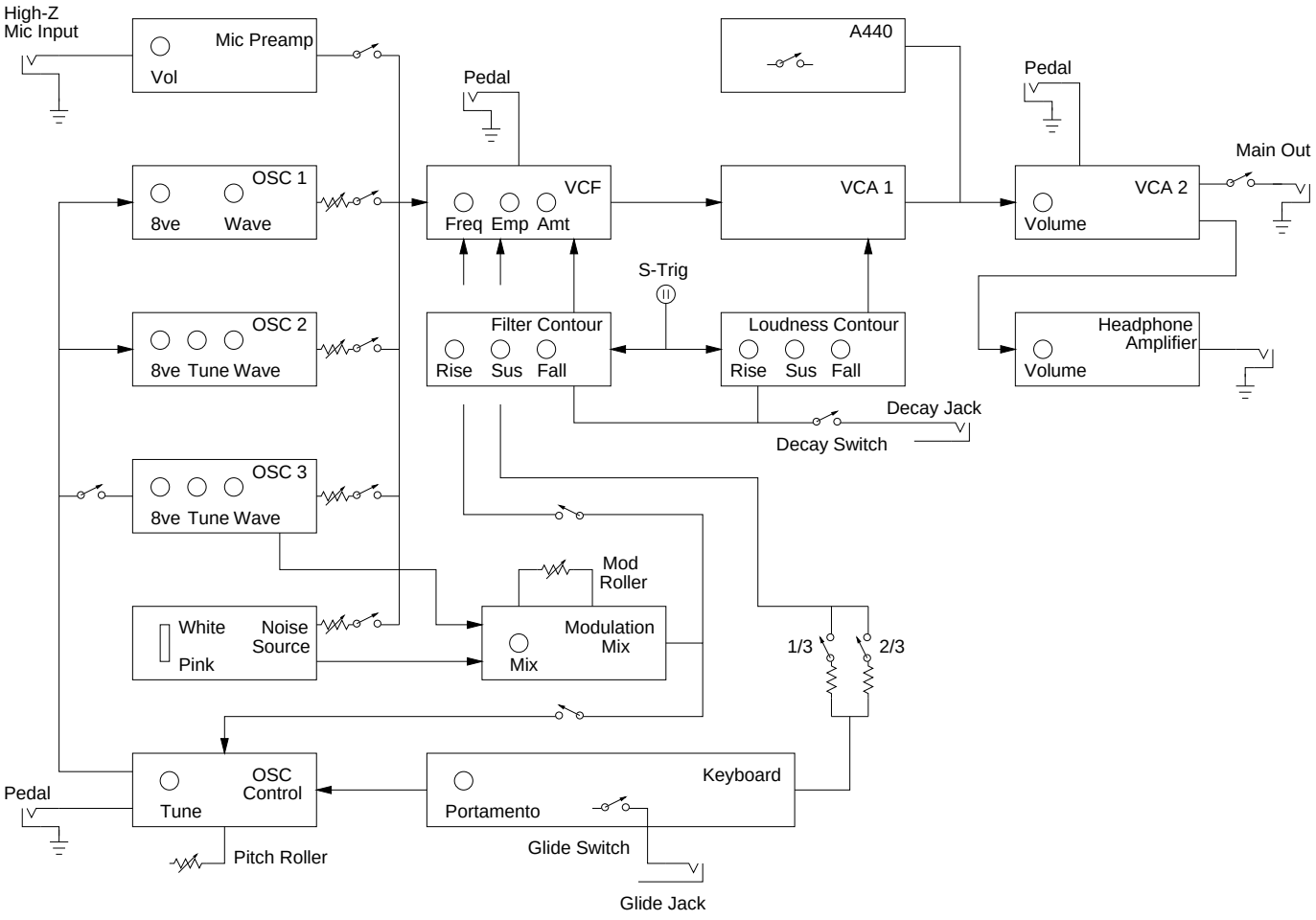
To service this assembly, remove the two mounting screws and lift the unit out. All connections to this assembly are through a 12 prong plug to simplify servicing and replacement.

93-061 Keyboard

The Mini-Moog keyboard is a standard three and one-half octave removable sub-assembly. All electrical contacts are gold plated for high reliability. The keyboard is held in place by four (4) mounting screws which are accessible when the bottom cover is removed. All connections to this assembly are through a 6 prong plug to simplify servicing and replacement.

Section III: Block Diagram

(This block diagram is a simplified version of the one from the User's Manual. The diagram from the service manual fits on a single 11"x17" sheet.)



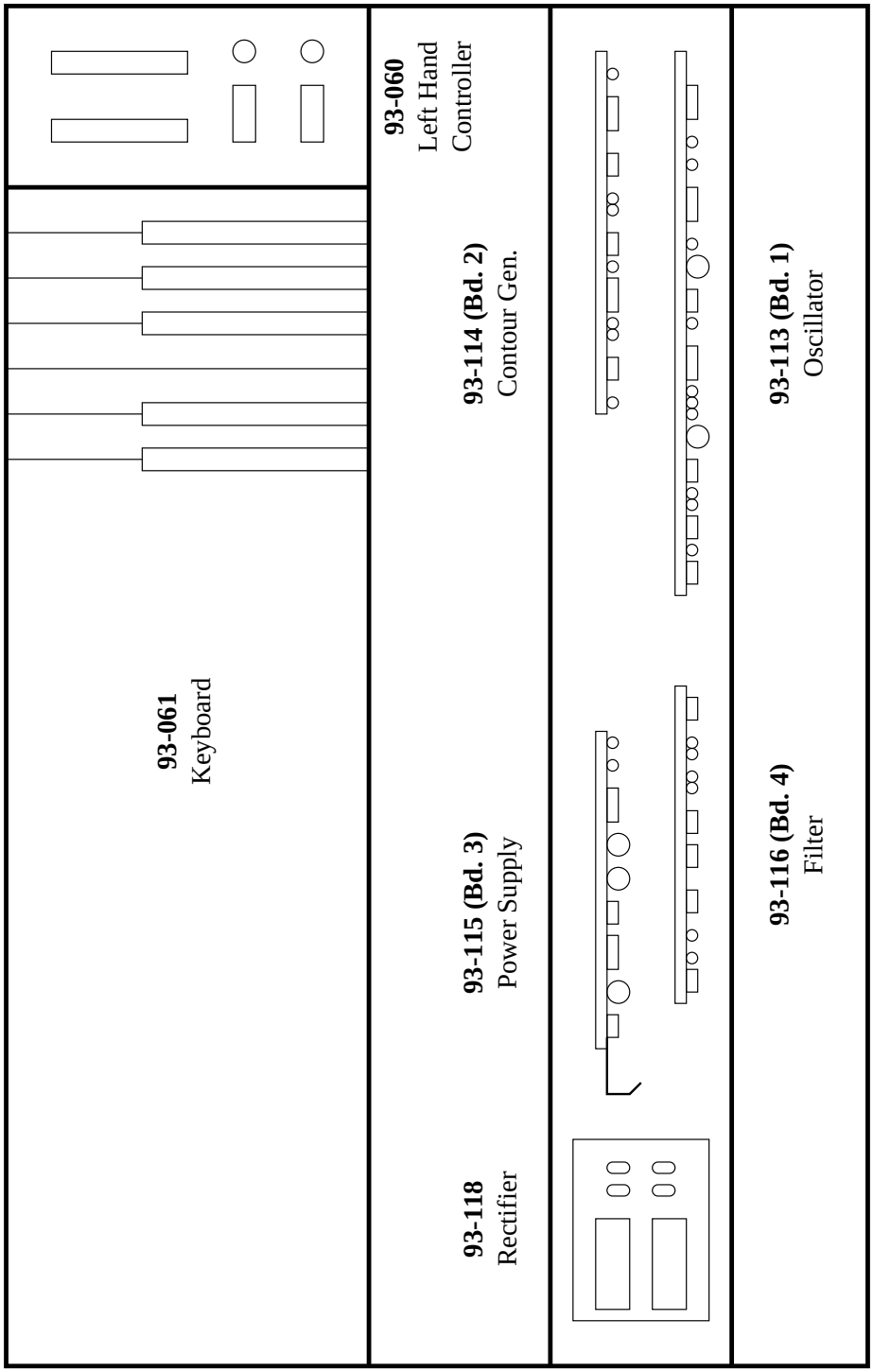
Section IV: Trouble Analysis Guide

Use this chart along with the block diagram (Section III) to determine which assembly or component is defective.

MALFUNCTION	PROBABLE CAUSE AND CURE
Unit dead (no pilot light)	1. Blown A.C. fuse 2. Defective power switch 3. Defective line cord or plug
Unit dead (pilot light on, overload light off)	1. Defective power supply (board 3) 2. Defective power transformer 3. Defective output amplifier (change filter board 4)
Unit dead (pilot light and overload light on)	1. Blown D.C. fuse 2. Defective power supply (board 3)
Excessive hum and constant modulation of all signals	1. Defective rectifier diode on 93-118 assembly 2. Defective filter cpacitor on 93-118 assembly 3. Defective power supply (board 3) 4. Broken ground wire
No output from any mixer source (A-440 output works)	1. Defective contour generator (board 2) 2. Defective VCA or filter (replace filter board 4)
No oscillator output (noise works)	1. Defective oscillator (board 1)
One oscillator dead or malfunctioning, other two operating normally	1. Defective oscillator (board 1)
Oscillators drift and exhibit poor tracking	Refer to Section XII - Modifications under Oscillator Assembly
Oscillator 3 modulates oscillator 1 or 2 with modulation switches off	Refer to Section XII - Modifications under Power Supply Assembly
Improper or missing waveform (any oscillator)	1. Defective oscillator (board 1) 2. Defective waveform switch
Noise source dead or producing poor quality noise	1. Defective noise transistor (Q15 on board 3) 2. Defective noise generator (replace power supply board 3)
External input dead	1. Defective pre-amp (replace filter board 4)
Filter inoperative or malfunctioning	1. Defective filter board 4
Filter regeneration weak or absent (EMPHASIS at 10)	1. Defective filter (board 4) 2. Regen. Cal. not adjusted properly

MALFUNCTION	PROBABLE CAUSE AND CURE
Excessive drift or pitch change after key is released (greater than 1 semitone per minute)	1. Defective keyboard circuit (replace board 2)
Loudness and/or filter contour generator operate improperly	1. Defective contour generator (board 2)
No output at phones headphone jack (main output normal)	1. Monaural plug in stereo jack 2. Defective headphone amp (replace power supply board 3)
Overload light fails to operate when excessive signal is applied	1. Defective bulb 2. Defective lamp driver circuit (replace filter board 4)
Thumping sound heard when depressing a key (AMOUNT OF CONTOUR at 0)	1. First VCA out of balance Refer to Section VII - Adjustments 2. Defective VCA (replace filter board 4) 3. Refer to Section XII - Modifications, under contour generator assembly
Keyboard glides when glide is off	1. Defective keyboard circuit (replace contour generator board 2)
Unit cannot be tuned (A-440 on frequency, within 1 Hz)	1. Defective oscillator (board 1) 2. Defective keyboard circuit (replace board 2)
Unit cannot be tuned (A-440 off frequency more than 5 Hz)	1. Power supply voltages improperly adjusted 2. Defective power supply (board 3)
A-440 reference oscillator dead (other outputs normal)	1. Defective reference oscillator (replace filter board 4)
No modulation (filter or oscillator)	1. Defective mod. mix amp. (replace power supply bd. 3) 2. Defective MODULATION wheel control
Range switches have little or no effect	1. Octave Range misadjusted 2. -5 volt source defective (replace oscillator board 1)
Noise or static when turning a control	1. Control dirty − spray clean 2. Control worn-out; replace
Noisy or intermittent switch	1. Switch dirty − spray clean 2. Switch worn-out; replace
Intermittent operation or loss of some functions	1. Clean circuit board contacts with a pencil eraser 2. Tighten tension on circuit board sockets

Section V: Sub-Assembly Locations



Section VI: Cover Removal and Sub-assembly Replacement

In order to service the Mini-Moog circuitry, it is necessary to remove the rear cover assembly.

CAUTION:

Be sure the unit is unplugged before removing the cover.

Remove 18 screws (5 top, 5 lower back, and 4 each end of cover); then lift the cover off.

Circuit boards are plugged into sockets at the bottom and secured at the top with two mounting screws. To remove a circuit board, first remove the screws then unplug from the connector.

When replacing, be sure board is firmly seated in the connector before tightening the mounting screws. Remember to re-install the fiber washers between the boards and the frame.

After board replacement, refer to Section VII: Adjustment Procedures and Locations, to determine which adjustments should be made.

Section VII: Adjustment Procedures and Locations

Each time a Mini-Moog is serviced, it should be tuned. When a board has been replaced it will be necessary to make additional adjustments. Refer to the table below to determine which adjustments must be made according to the board that has been replaced.

WHEN REPLACING	MAKE THESE ADJUSTMENTS
93-113 (Board 1) Oscillator	1. Oscillator 1, 2, and 3 tuning 2. Octave range trimmer
93-114 (Board 2) Contour Generator	1. Check tuning (adjust if necessary)
93-115 (Board 3) Power Supply	1. +10 volts 2. -10 volts 3. Noise level 4. Check tuning (adjust if necessary)
93-116 (Board 4) Filter	1. VCA balance (1 and 2) 2. A-440 frequency 3. Regeneration cal. 4. Filter range 5. Filter scale
93-060 Left Hand Controller	1. Check tuning (adjust if necessary)
93-061 Keyboard	1. Check tuning (adjust if necessary)

ADJUSTMENT PROCEDURES

NOTE:

The tuning and other functions rely heavily on accurate power supply voltages.
Always be sure the + and - 10 volt supplies are properly set before making other adjustments.

* Digital voltmeter with 0.1% accuracy

TO ADJUST . . .	FOLLOW THIS PROCEDURE . . .
+10 volts	Connect an accurate D.C. voltmeter* to pins 1A and 2A on the oscillator (board 1). Adjust the +10 volt trimpot on the power supply (board 3) for +10.00 volts.
-10 volts	Connect an accurate D.C. voltmeter* to pins 2A and 3A on the oscillator (board 1). Adjust the -10 volt trimpot on the power supply (board 3) for -10.00 volts.
A-440 Ref. Oscillator	Turn on A-440 and allow to warm up for two minutes. Adjust A-440 trim-pot on the filter (board 4) for zero beat with an "A" tuning fork. By bringing the struck tuning fork in physical contact with the shell of a pair of headphones, while listening to the A-440 output, the beat note becomes more audible.
Oscillator Tuning (With Equipment)	Connect a frequency counter to the High Main Output jack. Set the PITCH WHEEL to center, TUNE control to 0, RANGE switches to 2 ft., WAVE-FORM switches to SAWTOOTH. Set MIXER VOLUME controls to 4, turn OSCILLATOR MODULATION switch off, and OSCILLATOR 3 CONTROL switch on. Set Oscillator 2 and 3 FREQUENCY controls to mid-position. Turn on OSCILLATOR 1 mixer switch. Adjust Oscillator 1 Range Trimpot for 3520 Hz while holding high "A" key down. Depress low "A" and hold while adjusting Oscillator 1 Scale Trimpot for 440 Hz. Repeat until no further improvement is attainable. Turn off OSCILLATOR 1 Mixer switch. Turn on OSCILLATOR 2 and repeat the procedure -- then OSCILLATOR 3. Finally, check tracking between any two oscillators and make any necessary touch-up adjustments to improve tracking.

TO ADJUST . . .	FOLLOW THIS PROCEDURE . . .
Oscillator Tuning (Without Equipment) "Visualign"	Turn all MIXER switches off. Set MIXER VOLUMES at 1. Turn on MAIN OUTPUT switch and set OUTPUT VOLUME to 8. Set ATTACK and DECAY times to 0, SUSTAIN to 10. Turn FILTER MODULATION and KEYBOARD CONTROL switches off. Set EMPHASIS and AMOUNT OF CONTOUR to 0. Set PITCH WHEEL to center, TUNE control to 0, RANGE switches to 2 ft., WAVEFORM switches to TRIANGLE. Turn OSCILLATOR MODULATION switch off, and OSCILLATOR 3 CONTROL switch on. Set OSCILLATOR 2 and 3 FREQUENCY controls to mid-position. Connect a short patch cord from the HIGH MAIN OUTPUT jack to EXTERNAL SIGNAL INPUT jack. Turn on A-440 and rotate EXTERNAL INPUT VOLUME control slowly clockwise until the OVERLOAD light is just visible. Turn OSCILLATOR 1 Mixer switch on. Depress low "A" key and hold, OVERLOAD light should be blinking. Depress and hold high "A" key. Adjust OSCILLATOR 1 Range Trimpot (on oscillator board) for slowest possible blink rate. Depress and hold low "A" key. Adjust OSCILLATOR 1 Scale Trimpot (on oscillator board) for slowest possible blink rate. Monitor the output with headphones while tuning. Repeat this procedure for OSCILLATOR 2 and 3. Then check tracking between any two oscillators.
Octave Range Trimmer	Turn OSCILLATOR 1 Mixer switch on and set RANGE to 2 ft. Turn on A-440. Depress and hold second "A" key from the bottom. Adjust TUNE control for zero beats. Switch RANGE to 8 ft. Depress same key and adjust Octave Range trimpot (on oscillator board) for zero beats.
Noise Level	Noise level is factory-set to yield -5dB maximum in the white position. If the level becomes low it may be increased by counterclockwise rotation of the Noise Level Trimpot (on Power Supply board). It may be necessary to use an offset screwdriver to reach this trimpot.
VCA Balance	Turn all MIXER switches off. Connect headphones and set VOLUME fully CW. Connect a jumper from point "A" on the Filter Board (see Fig. 3) to point "A" on the oscillator board (see Fig. 1). While listening to the headphones, adjust the 2nd VCA Balance trimpot (on the filter board) for the minimum audio signal. Depress and hold a key. Adjust the lst VCA Balance trimpot for minimum audio signal. Remove the jumper.

TO ADJUST . . .	FOLLOW THIS PROCEDURE . . .
Regeneration Cal.	Turn all MIXER switches off. Monitor output with headphones. Set CUTOFF FREQUENCY control to -1. Insert an S-Trigger plug. Rotate EMPHASIS control clockwise. Regeneration should start when the EMPHASIS control is between 7 and 8. If it does not, set EMPHASIS control to 7.5 and rotate the Regeneration Cal. trimpot (on filter board) slowly clockwise until regeneration starts.
Filter Range	Turn KEYBOARD CONTROL switches 1 and 2 off. Set CUTOFF FREQUENCY at -1, EMPHASIS at 10. Turn on A-440 and adjust filter Range Trimpot (on filter board) for zero beats.
Filter Scale	Set CUTOFF FREQUENCY to -1, EMPHASIS at 10, AMOUNT OF CONTOUR at 0. Turn KEYBOARD CONTROL switches 1 and 2 on. Turn on A-440 and depress third "A" key from the bottom. Adjust CUTOFF FREQUENCY for zero beats (two octaves above 440). Depress low "A" key and adjust filter Scale Trimpot (on filter board) for zero beats. Repeat these adjustments until the filter will track three octaves.
Pitch Wheel	Loosen the Allen head set screw in the PITCH wheel. Rotate PITCH wheel until it drops into the center detent. Unplug the Left Hand Control connector. Connect an ohmeter to the orange and green wires on the pitch potentiometer. Adjust the pitch potentiometer for a reading of 15.3 kilohms. Tighten the set screw and check to see that the resistance is still between 15 and 15.6 kilohms when in detent.
Modulation Wheel	Loosen the Allen head set screw in the modulation wheel. Rotate the modulation potentiometer fully counterclockwise. Turn modulation wheel down to its physical limit. Re-tighten the set screw.

93-113 Oscillator: Adjustment Locations

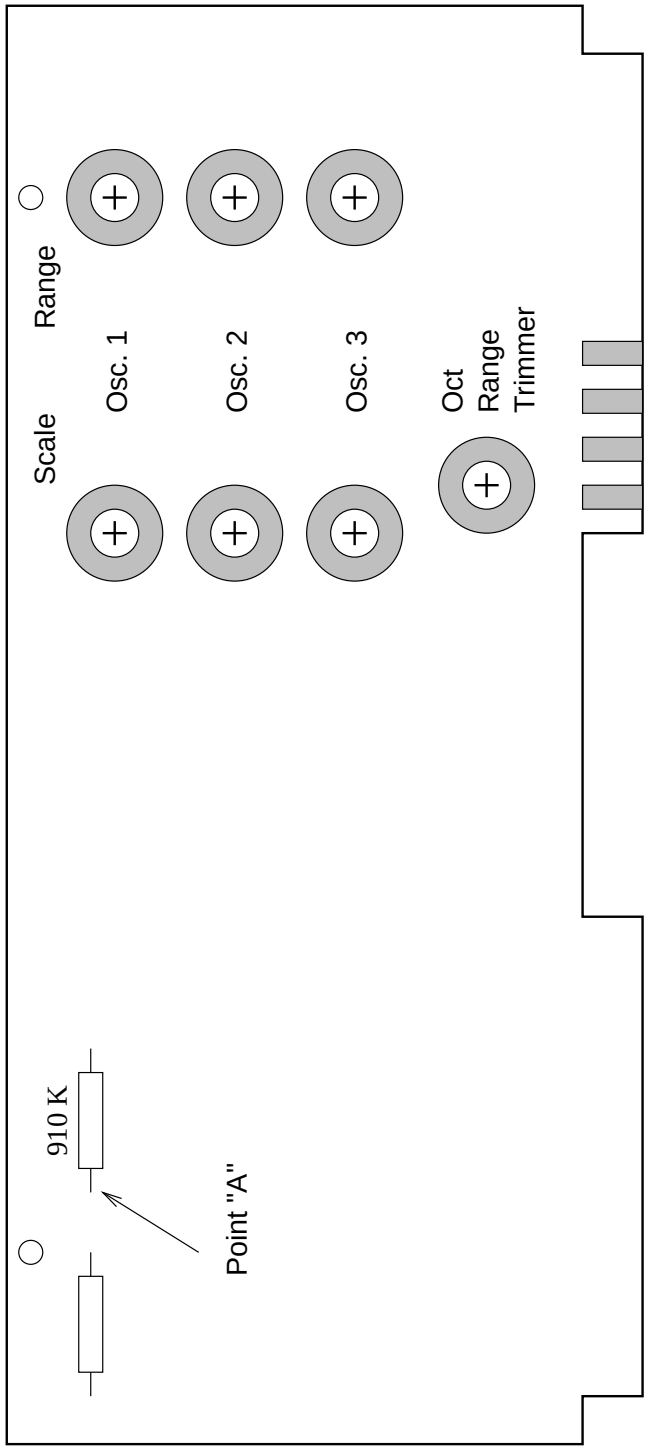


Fig. 1

93-115 Power Supply: Adjustment Locations

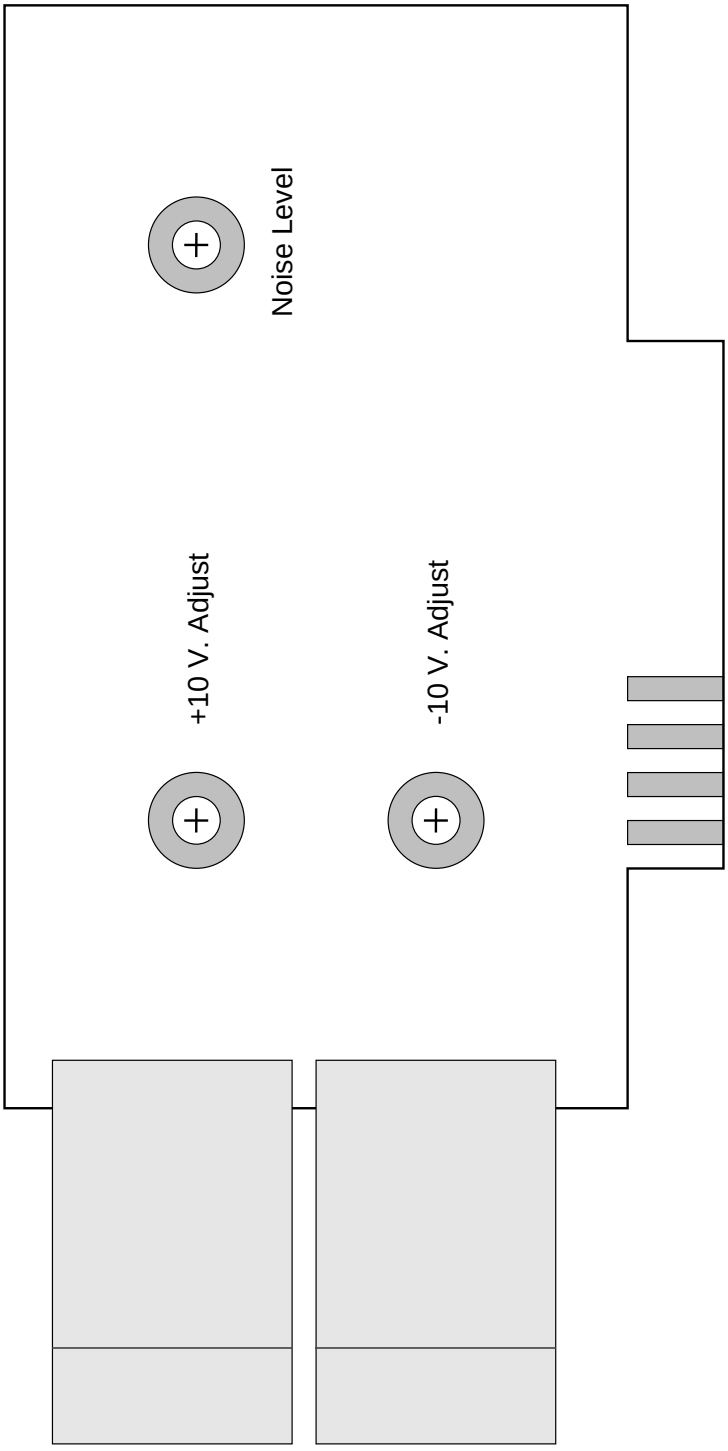


Fig. 2

93-116 Filter: Adjustment Locations

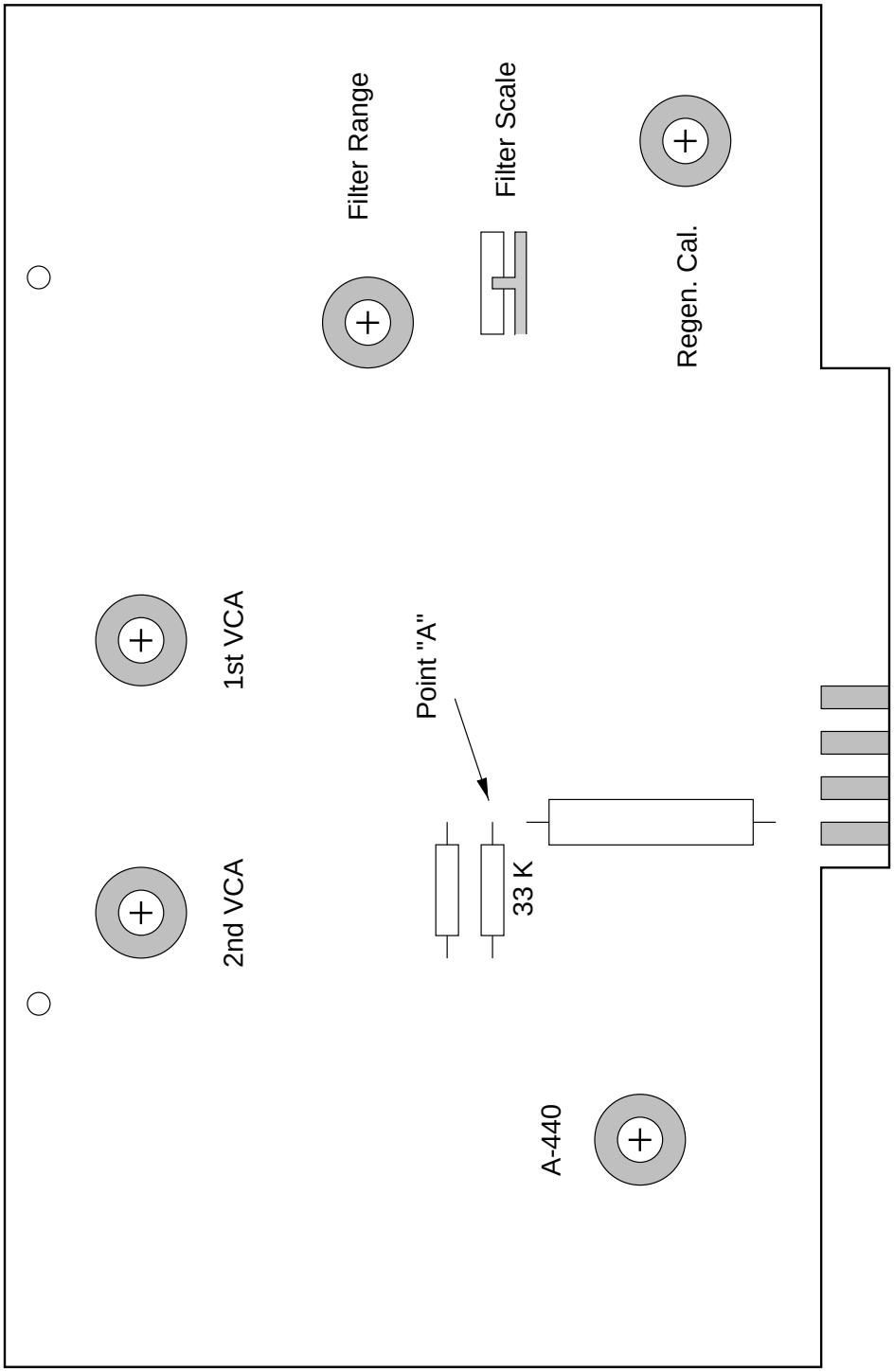


Fig. 3

Section VIII: Keyboard Maintenance

Occasionally it will become necessary to clean and adjust the keyboard. The contacts, although gold plated, may become dirty, contaminated, or corroded. When contacts become poor, noises and erratic sounds may be generated while playing the instrument.

To service the keyboard, the bottom cover must be removed. This cover is held on with 8 wood screws. If the keyboard compartment is found to be excessively dirty, it should be blown out with air first.

Avoid touching the buss bars or the spring contacts with the fingers since hand oils and perspiration will cause corrosion. Under normal conditions, any dirt can be removed by spraying the assembly with a light coating of a high grade contact cleaner. At the factory, we use and recommend Cramolin®. If this is not available, TV tuner spray may be used. Do not under any circumstances use abrasives or abrasive tools, since this will destroy the gold plating. If spraying does not cure the problem, try wiping the buss bar with a cotton swab in the area of the problem key or keys.

Sometimes it is necessary to adjust the spring contacts for more tension. This is done by bending the spring so that it is closer to the buss bar. It is easiest to bend at the end nearest the mounting board. In all cases, the "pitch" contact must occur before the "trigger" contact. The pitch buss bar is nearest the front of the instrument. The trigger buss bar is in the center, and the third buss bar nearest the rear of the instrument is not used and therefore need not be cleaned or adjusted.

To clean the keys, use a soft cloth moistened with a mild soap solution. Never allow solutions or spray cleaners to run down between the keys. Avoid harsh solvents, since the keys are made of plastic and may be dissolved. Scratches may be removed with a plastic or automotive polishing compound. Waxing the keys is not recommended.

Section IX: Schematics

(The circuit schematics are not available at this time.)

Section X: Component Locations

(The component location diagrams are not available at this time.)

Section XI: Replacement Parts

Moog Part Number	Description
93-113	Board No. 1 Oscillator
93-114	Board No. 2 Contour Generator
93-115	Board No. 3 Power Supply
93-116	Board No. 4 Filter
93-060	Left Hand Controller (Complete)
93-061	Keyboard (Complete Assembly)
99-104	Wooden Case With Bottom Cover
95-570	Back Cover Assembly
74-004	Power Cord
57-051	Fuse, 1/2 Amp slo-blo
57-026	Fuse, 1/4 Amp slo-blo
53-110	Lamp, Overload Indicator (16ESB)
43-160	Transformer, Power
37-010	Capacitor, 500 MFD 50 volts
61-112	Diode (Rectifier) IN4004
57-004	Fuseholder, A.C. Power
57-001	Fuseholder, D.C. Power
53-002	Knob, Standard
53-003	Knob, Large
53-021	Knob, Pointer
53-107	Pilot Lamp
65-005	Noise Transistor
51-20X	Switch, Rocker (Specify color)
93-067	Prop, Support
94-001	Modification Kit, Oscillator Board
94-002	Modification Kit, Filter Board
94-004	Modification Kit, Transformer Mounting

* Order unlisted parts by description

Section XII: Modifications

93-113 Oscillator Assembly (Board 1)

To improve tracking and pitch stability on Mini-Moog oscillator boards with serial numbers above 1300, make the following changes:

1. Change R-69, R-105, and R-141 from 6.8K to 15K 1/2 W 5% carbon
2. Replace R-78, R-106, and R-128 with RC Network, part number 65-032
3. Change R-181 from 56K to 51K 1/2 W 5% carbon
4. Change R-170 from 15K 5% to 15K 1% Metal Film
5. Change R-162 from 3K 5% to 3.01K 1% Metal Film
6. Change C-3, C-5, and C-7 from 47 pf to 100 pf

All parts listed above are available in kit form, part number 94-001.

93-114 Contour Generator Assembly (Board 2)

To reduce thumping which may occur when a key is depressed, add a 10 pF capacitor from pin 4B to pin 5B on the Contour Generator board.

93-115 Power Supply Assembly (Board 3)

To reduce oscillator bleed through and cross modulation, replace 10 ohm resistor next to the +10 V ADJ trimpot with a straight wire. Be sure wire does not touch the body of +10 V ADJ trimpot.

93-116 Filter Assembly (Board 4)

To reduce intermodulation distortion which occurs when mixing two or more signals:

1. Change R2 from 47K ohms to 160K ohms
2. Change R8 and R28 from 27 ohms to 4.7 ohms
3. Change R40 from 1K ohms to 10K ohms

Section XIII: Ordering and Shipping Instructions

Ordering Parts

Most commonly used parts are listed in Section XI. When ordering, please include the Moog part number. If the part is not listed, order by description. Be as accurate as possible when describing what you want.

Example: Transistor, Q8 on board 2
or: Control, amount of contour

Returning Parts

All parts being returned should be accompanied with a "Return Material Tag". Eight of these tags are supplied with this manual; additional tags are free upon request. Fill the tag out as neatly and accurately as possible. Package the part being returned so that it will not be damaged in shipment. Circuit boards should be double wrapped and enclosed in a rigid cardboard box. Attach the "Return Material Tag" to the part, not to the shipping carton. If the entire unit is being returned, it must be shipped in the original carton.

Address

Use the following address for all orders and returns:

Moog Music, Inc.
Academy Street P.O. Box 131
Williamsville, New York 14221

MOOG MUSIC, INC.
SERVICE DEPARTMENT POLICY

MINIMUM CHARGE (for non-warranty service) − is 1 hour ($15.00). Additional charge per 1/2 hour ($7.50). Update parts are free; all other parts are charged to the customer.

WARRANTY ON REPAIR − is issued as of date stamped on pink copy; only for parts or malfunction repaired. Warranty period is 90 days−we pay shipping both ways.

DEALER WARRANTY SERVICE − is to be reimbursed when we receive copy of his Service Report and defective components in the amount of $10.00 for each unit so serviced. Units requiring the same service within 90 days are the responsibility of the authorized service center.

SPEED OF SERVICE − All units are to be repaired before the end of the second normal business day following the date of the receiving record. (Exceptions include case damage and large modular systems.)

CUSTOMER HAND CARRY − Units may be repaired at the factory while the customer waits only if appointment is made with Customer Service Manager at least one day in advance.

MODIFICATION − All units returned for whatever reason are to be updated to the latest or final design of their respective configurations.

WARRANTY PERIOD − All labor and parts are free for warranty service only if warranty card was received within one year preceding date of service.

SHIPPING − All shipping costs on warranty service are to be paid by Moog Music, Inc. Customer is responsible for freight to factory.

RETURN TO STOCK − All return to stock units are to be repaired and reconditioned to new specifications. Unreasonable damage is to be charged to dealer.

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