



# TECHNICAL MANUAL

**SEQUENTIAL  
CIRCUITS INC**

MODEL 100  
Manual No. TM100A

**PRO-ONE SYNTHESIZER  
TECHNICAL MANUAL**

by Stanley Jungleib

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- CA3280 DUAL OPERATIONAL TRANSCONDUCTANCE AMPLIFIER
- CEM 3310 VOLTAGE CONTROLLED ENVELOPE GENERATOR
- CEM 3320 VOLTAGE CONTROLLED FILTER
- CEM 3340/3345 VOLTAGE CONTROLLED OSCILLATOR

## SECTION 1

### FUNCTIONAL TESTS

#### 1-0 INTRODUCTION

This section contains procedures for complete functional testing of the Pro-One. The functional tests check all signal paths and the range of the oscillators. A flow-chart for selectively checking tuning is on page 1-12. To correct oscillator tuning, see the Service procedures in Section 5.

Instruments to be serviced should be completely tested beforehand. This will reveal related or unrelated malfunctions, and provide a basis for troubleshooting. If a trim can't be achieved service will certainly be required. In such cases, consult the theory of operation and diagrams in Section 2, and schematics in Section 3 to isolate the failure.

Mechanical procedures are in Section 4. When operating disassembled it can be difficult to read the controls: Figure 3-1 may be of help. Also, when disassembled it is often convenient to leave the wheel cable disconnected. The Pro-One will operate normally, that is, without pitch bend or modulation.

These procedures are presented in the order recommended for a Pro-One assumed to be completely operational. Real-world problems may require you change the order of some tests. Therefore each is written to be performed independently.

You must play the Pro-One throughout these tests (or use the ascending and descending scales preprogrammed into SEQ 1 and SEQ 2 on power-up). All tests are performed by ear, the object generally being that the knobs adjust smoothly and switches work. Toggle the panel switches repeatedly to check for intermittents.

#### 1-1 PREPARATION

1. Connect headphones, or mono cable between back panel AUDIO OUT jack and power amplifier.
2. Check back panel 115/230 line voltage selector.
3. Check that back panel power switch is off.
4. If operating disassembled, testing may be facilitated by placing the knobs lightly back on their shafts.
5. Connect power cable to properly-grounded outlet.
6. Switch power on.

**WARNING! LETHAL VOLTAGE IS PRESENT IN THE POWER SUPPLY AREA ON THE PCB (IN EARLIER MODELS) OR ON THE BACK PANEL (IN LATER MODELS).**

7. Center MASTER TUNE and PITCH wheel and set MOD wheel to minimum (unless the wheel cable is disconnected).

8. Adjust VOLUME as required, below.

## 1-2 KEYBOARD TEST

1. Patch according to Figures 1-1 or 1-2. The essential features of these patches are a fully "open" AMPLIFIER and FILTER, the sawtooth of one oscillator is on, and there is no modulation.

2. Check that all keys work. Make a note of scratchy, intermittent, or inoperative keys. Oxidation, particularly of lesser-used keys, can cause keys to go "dead," and may be aggravated by ambient conditions or handling. Check also for contact bounce by hitting each key hard and repeatedly while listening for break-up or double triggering.

For either condition, cleaning or careful readjustment of the "J-wires" is often all that is necessary. After the top panel is removed, the keyboard can be detached from the bottom panel for cleaning by simply removing four screws. Wipe the contacts carefully with an alcohol- or freon-wetted cotton swab. Don't use any abrasive techniques, as this will simply remove the gold plating. Replacement J-wires can be ordered as SCI #S-051.

3. If the keyboard doesn't work at all, check its connector. The GATE LED should light whenever a key is pressed. If still there is no sound, check Final VCA (para. 1-8).

4. Switch DRONE on. You should hear a continuous tone. The frequency will change as you play various keys, but the tone itself is not interrupted. Switch DRONE off.

5. Switch REPEAT/EXT on. The frequency of the last key played repeats at a rate set by the LFO/CLOCK FREQUENCY knob. Keys will not be heard when played, but repeated pitch will change. Switch REPEAT/EXT back to NORMAL.

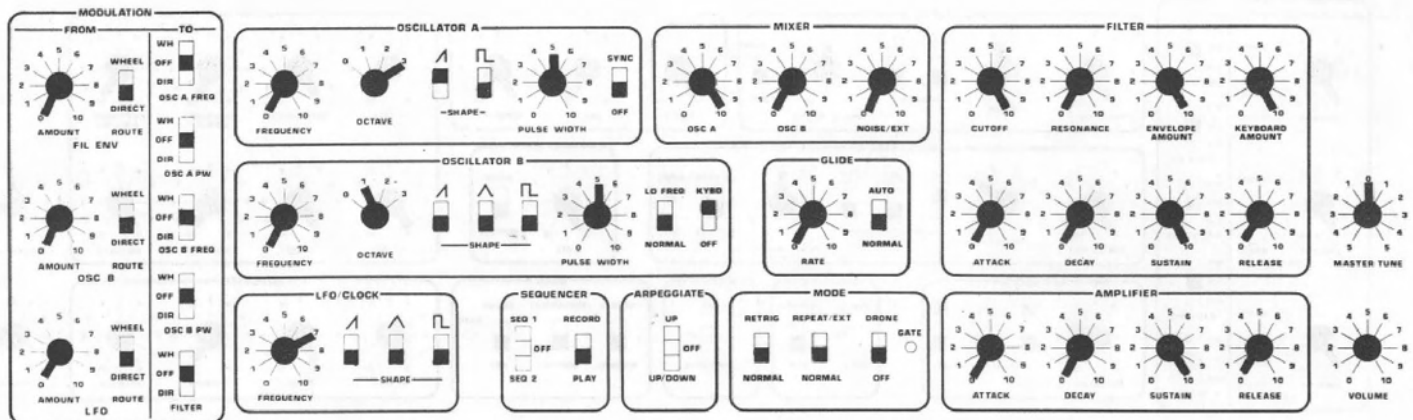
6. To check or demonstrate low-note priority, hold a key and hit one above it. The higher key will not sound. Now hold the higher key and hit the lower one. The lower key sounds when pressed.

5. Switch MODE from NORMAL to RETRIG. Note that this switches from low-note to last-note priority. The newest key sounds though a lower key may be held.

6. Hold several notes and switch ARPEGGIATE UP, then UP/DOWN to check function. While arpeggiating, switch up SEQUENCER RECORD and remove hand from keyboard. The arpeggiator should remain "latched." Switch ARPEGGIATE off.

7. With SEQUENCER RECORD still on, select SEQ 1 and record a sequence. Play it back. Repeat for SEQ 2.

## 1-3 OSCILLATOR A TEST

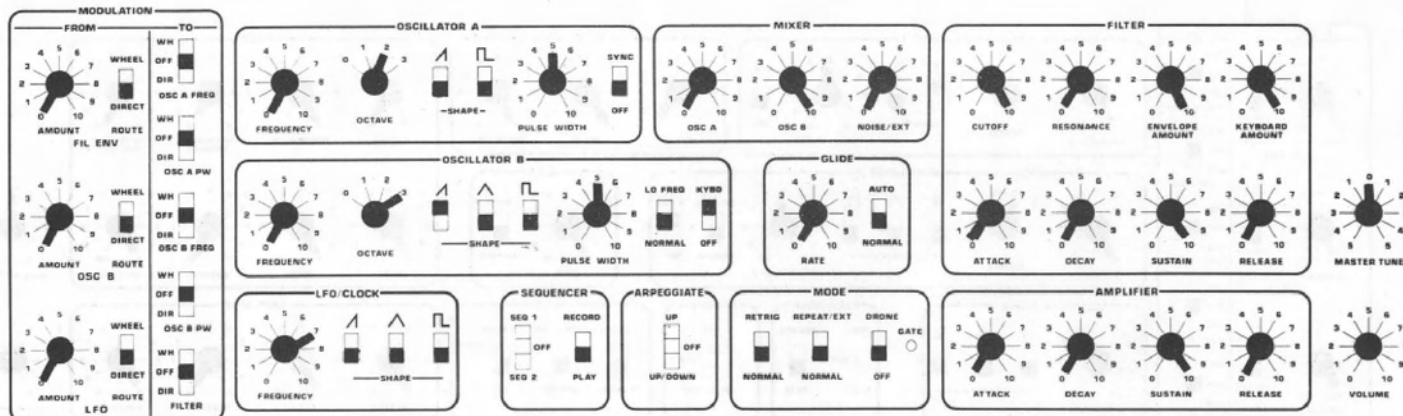


**Figure 1-1**  
**OSC A TEST PATCH**

1. Patch according to Figure 1-1.
2. Check that OSC A FREQUENCY knob range exceeds one octave. For reference, play C2 (which is one octave below the highest key, C3) and remember pitch. Then hold C1 and raise OSC A FREQ. The pitch should increase smoothly, approaching the reference pitch at 7 - 8 on the dial. At 10 the pitch should be at least a whole step above the reference.
3. Turn OSC A FREQ to 0. Check OSC A OCTAVE switch function by playing C2 and switching octaves down to 2, 1, and 0. NOTE: When switching octaves with a key depressed, it is normal to hear the pitch "jump" between octaves.
4. Switch OSC A OCTAVE to 2, and switch OSC A SYNC on. Rotate OSC A FREQ knob 0 - 10 to check sync function.
5. Switch OSC A SYNC off. Switch OSC A SAWTOOTH off. Switch OSC A PULSE on. The difference between the "brassy" sawtooth and "woody" pulse should be obvious. Rotate OSC A PULSE WIDTH knob 0 - 10, listening for the timbral effect of varying harmonics. The pulse will degenerate to dc (or very nearly dc--99% duty cycle) at the extreme knob settings, resulting in no (or very little) sound. Find the setting where the second harmonic drops out (50% duty cycle). This normally occurs between dial markings 5 and 6.



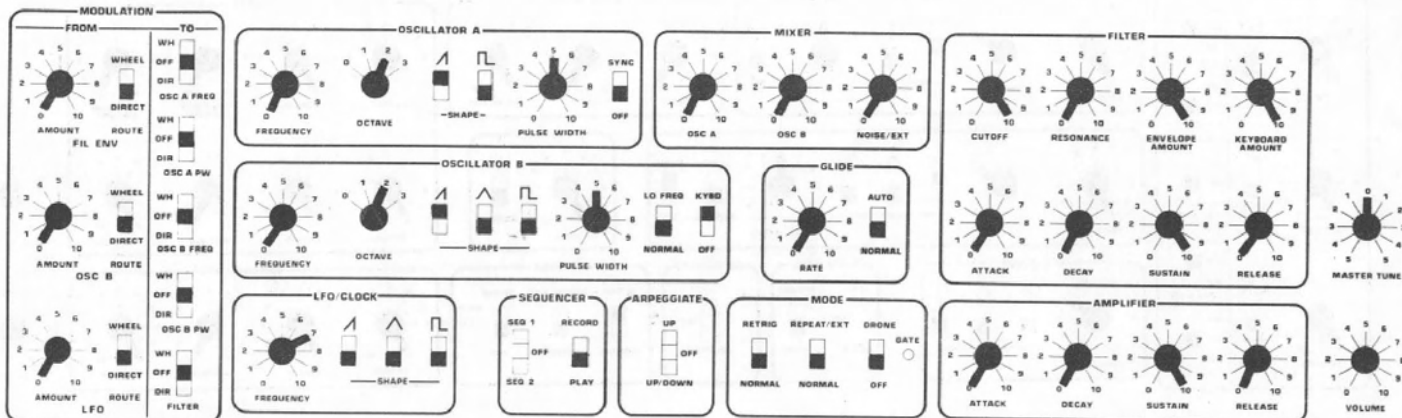
## 1-4 OSCILLATOR B TEST



**Figure 1-2**  
**OSC B TEST PATCH**

1. Patch according to Figure 1-2.
2. Check that OSC B FREQUENCY knob range exceeds one octave. For reference, play C2 and remember pitch. Then hold C1 and raise OSC B FREQ. The pitch should increase smoothly, approaching the reference tone at 7 - 8 on the dial. At 10 the pitch should be at least a whole step above the reference.
3. Turn OSC B FREQ to 0. Check OSC B OCTAVE switch by playing C2 and switching octaves down to 2, 1, and 0. NOTE: When switching octaves with a key depressed, it is normal to hear the pitch "jump" between octaves.
4. Switch OSC B OCTAVE to 2. Switch OSC B SAWTOOTH off. Switch OSC B TRIANGLE on. The difference between the "brassy" sawtooth and "dull" triangle wave should be obvious. The triangle waveshape has very little harmonic energy. Switch OSC B TRIANGLE off.
5. Switch OSC B PULSE on. Rotate OSC B PULSE WIDTH knob 0 - 10, listening for the timbral effect of varying harmonics. The pulse will degenerate to dc (or very nearly dc--99% duty cycle) at the extreme knob settings, resulting in no (or very little) sound. Find the setting where the second harmonic drops out (50% duty cycle). This normally occurs between dial markings 5 and 6.
6. Switch OSC B LO FREQ on. Raise OSC B FREQ to about 6 to more easily hear OSC B "track" the keyboard at low frequencies. NOTE: The OSC B LO FREQ switch extends OSC B's FREQ range to sub-audio. It is therefore normal that if OSC B FREQUENCY is set to 10, the LO FREQ switch will appear to have no effect. Switch OSC B LO FREQ to NORMAL.
7. Switch OSC B KYBD off and check that OSC B ceases "tracking" the keyboard.

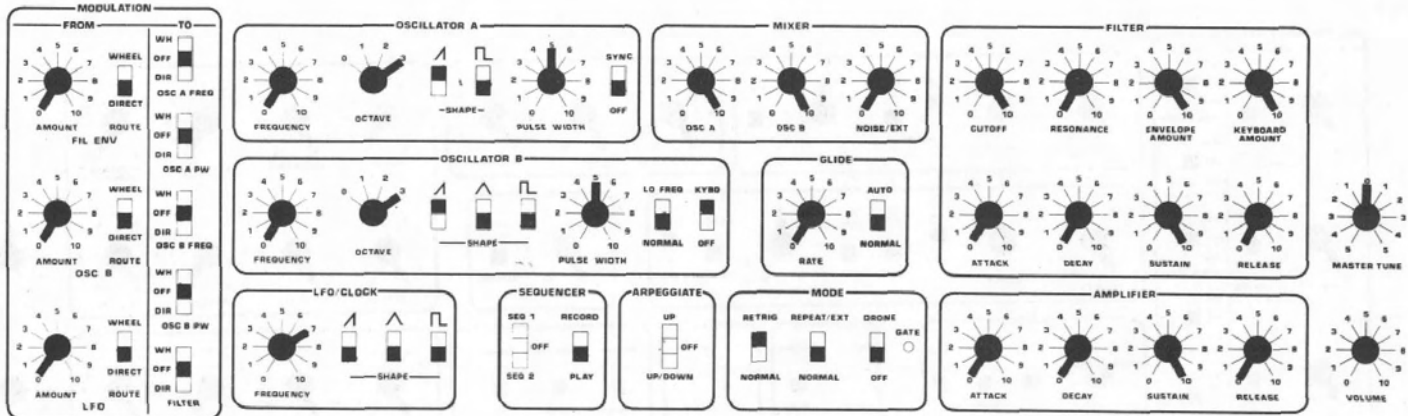
# 1-5 MIXER and NOISE TEST



**Figure 1-3  
MIXER and NOISE TEST PATCH**

1. Patch according to Figure 1-3.
2. Hold a key and turn MIXER OSC A knob 0 - 10. Check for smooth volume increase. Leave knob set to 0.
3. Turn MIXER OSC B knob 0 - 10. Check for smooth volume increase. OSC B should be as loud as OSC A. Leave knob set to 0.
4. Turn MIXER NOISE/EXT knob 0 - 10. Check for smooth noise volume increase. (Since noise is unpitched, it does not track the keyboard). Leave knob set to 0.
5. External audio input is checked during the BACK PANEL test (para. 1-10).

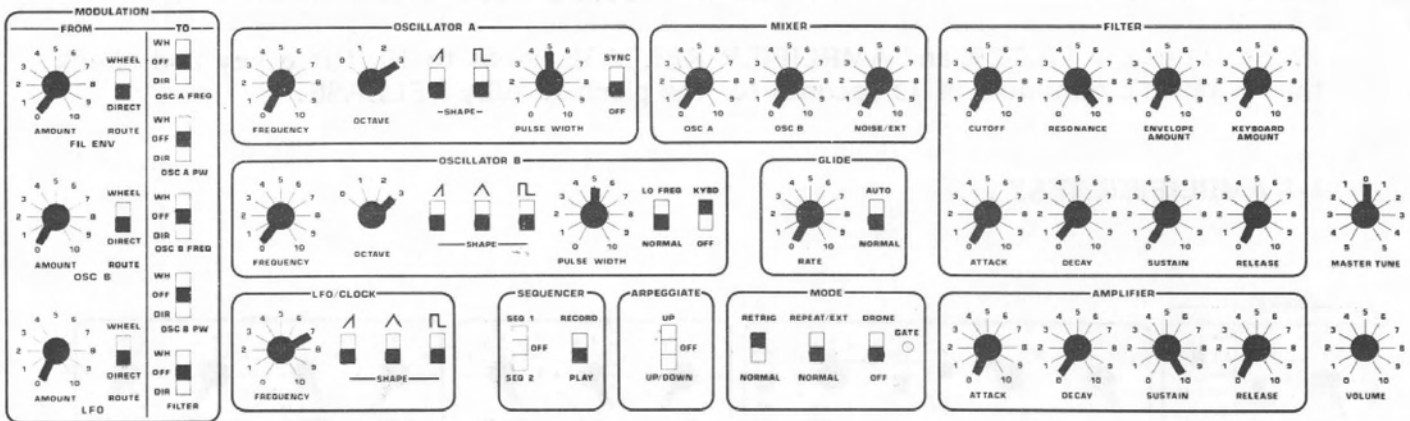
## 1-6 PITCH WHEEL AND GLIDE TEST



**Figure 1-4**  
**PITCH WHEEL and GLIDE TEST PATCH**

1. If the wheel cable has been disconnected, switch power off and reconnect to test PITCH wheel. Otherwise, skip steps 3 and 4.
2. Patch according to Figure 1-4.
3. At this point you will probably hear "beats" resulting from the slight difference between OSC A and OSC B pitch. To "zero-beat," raise OSC A FREQUENCY (if OSC B is sharp) or OSC B FREQUENCY (if OSC A is sharp). It is not possible to maintain absolute zero-beat over more than a few seconds--but get as close as you can.
4. Slowly raise the PITCH wheel while listening for beats, then lower the wheel. Beating should not increase significantly as the pitch is raised or lowered. Increased beating probably indicates a difference in oscillator scaling, which can be corrected by retuning. The wheel range should be at least a fourth above and below the center pitch.
5. Check that the PITCH wheel is centered. Alternately play C3 and C0. There should be no detectable GLIDE. Now advance GLIDE RATE to 5 and repeat. This should yield a medium glide. Turn GLIDE RATE to 10 and repeat. It should take a minimum of 3 seconds to slew 3 octaves.
6. Switch AUTO-GLIDE on. Alternately play C3 and C0. There should be no GLIDE. Now hold C3 and play C0. This should activate GLIDE.

## 1-7 FILTER TEST



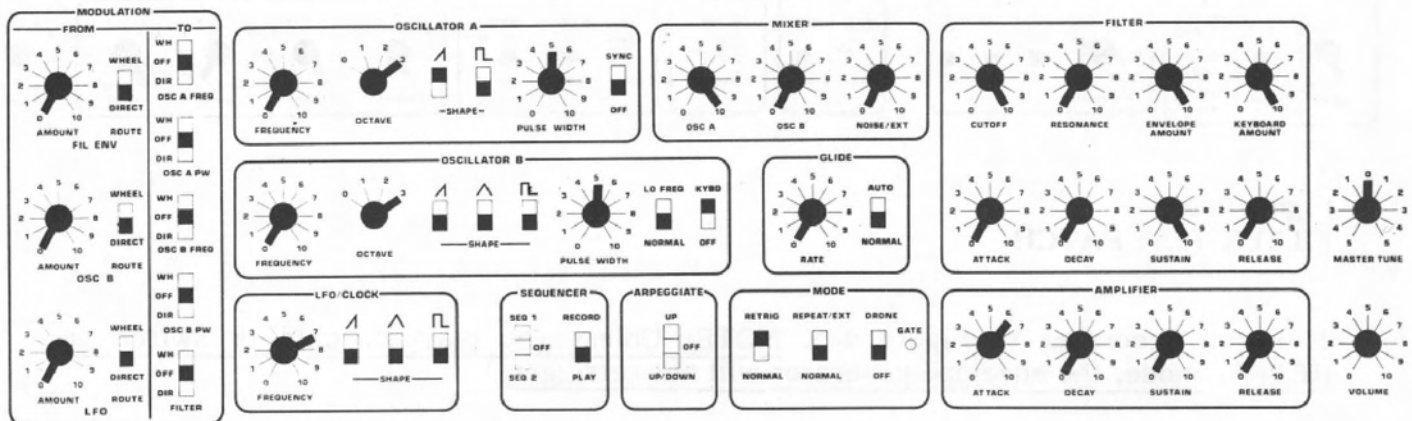
**Figure 1-5**  
**FILTER TEST PATCH**

1. Patch according to Figure 1-5. NOTE: Unless you play staccato or switch to RETRIG mode, the envelope generator will not retrigger
2. Rotate FILTER CUTOFF knob 0 - 10, listening for sine-wave oscillation. The superaudio range is encountered at about 7 on the dial.
3. Set FILTER CUTOFF to 3. Raise FILTER KEYBOARD AMOUNT. As this knob is advanced, the notes heard will approach the diatonic scale tones. With KEYBOARD AMOUNT set to 8, the scale should be fairly accurate. Leave knob set to 8.
4. Hold a key and rotate FILTER ENVELOPE AMOUNT 0 - 10. This should not detune the pitch. If it does detune the filter, look into the Filter Envelope Generator circuit for the source of the offset. It is normal to hear an increasing transient as you advance ENVELOPE AMOUNT. This is the voltage peak between the ATTACK and DECAY periods--which becomes audible because the Envelope Generator is being triggered. Although the knobs are set to 0, it still takes a finite time to cycle through the ATTACK and DECAY periods. Leave knob set to 2.
5. Decrease FILTER RESONANCE to the point where oscillation stops and note dial indication. It should be between 5 and 6. Return knob to 10.
6. Increase FILTER ATTACK knob to 6. This should give about 1-sec attack time, as indicated by the pitch which gradually rises then "snaps back" to its starting pitch. Return to 0.
7. Increase FILTER DECAY knob to 6. This should give about 1-sec decay time. Return knob to 0.
8. Rotate FILTER SUSTAIN knob 0 - 10. It should smoothly increase filter frequency. Leave knob set to 10.

9. The next step requires increasing the AMPLIFIER RELEASE time so you can hear the FILTER RELEASE time. Start with AMPLIFIER RELEASE set to about 8. Set FILTER RELEASE knob to 6. This should give about a 1-sec release time.

10. Set both the FILTER and AMPLIFIER RELEASE knobs to 10. Hit a key and check that it takes a minimum of 15 seconds for the pitch to fully RELEASE.

## 1-8 AMPLIFIER TEST



**Figure 1-6**  
**AMPLIFIER TEST PATCH**

1. Patch according to Figure 1-6.
2. With AMPLIFIER ATTACK set to 6, the attack time should be about 1 second, heard as a rising volume which then "snaps back" to silence. Return knob to 0.
3. Increase AMPLIFIER DECAY knob to 6. This should give about 1-sec decay time. Return knob to 0.
4. Rotate AMPLIFIER SUSTAIN knob 0 - 10. It should smoothly increase amplitude. Leave knob set to 10.
5. Increase AMPLIFIER RELEASE knob to 6. This should give about a 1-sec release time.
6. Set the AMPLIFIER RELEASE knob to 10. Hit a key and check that it takes a minimum of 15 seconds for the note to fully RELEASE.

## 1-9 MODULATION TEST

This test checks the LFO waveshapes, the three MODULATION FROM AMOUNT knobs and ROUTE switches, and the five destination (TO) switches. (The FIL ENV and OSC B modulation sources were tested above.) Since this test includes the LFO, don't use the arpeggiator or sequencer.

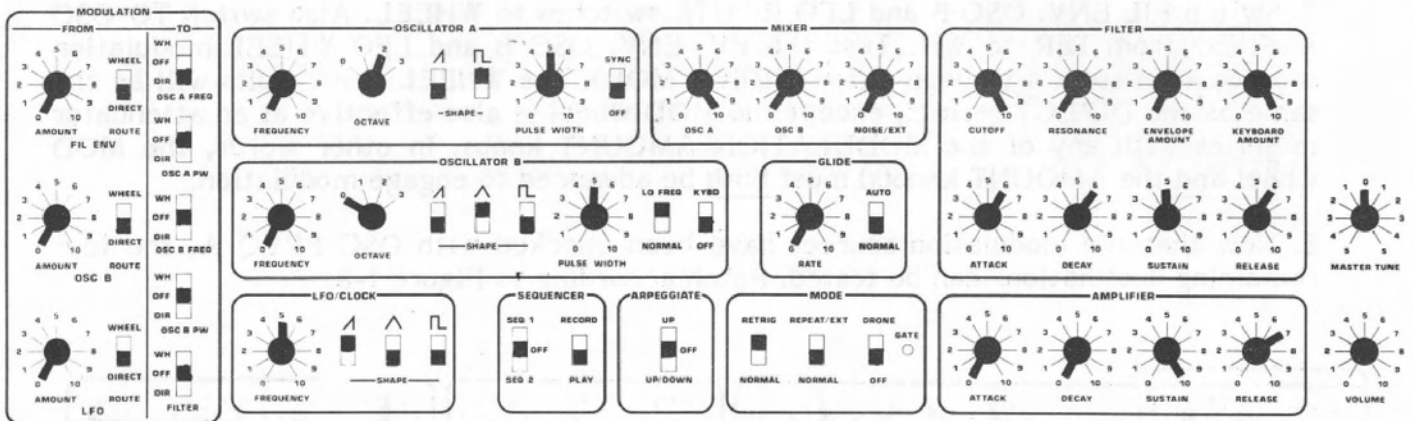


Figure 1-7  
MODULATION SOURCE TEST PATCH

1. Patch according to Figure 1-7. (AMPLIFIER RELEASE must be greater than FILTER RELEASE to hear the complete filter envelope.)
2. Hold a key or use DRONE. Raise the LFO AMOUNT knob and note increasing frequency sweep of OSC A. Since OSC A frequency is being controlled by the LFO sawtooth, the frequency rises consistently, then snaps back to the "initial" frequency (para. 2-19).
3. Switch LFO SAWTOOTH off and LFO SQUARE on. This will give a "trill" effect, with the interval expanding with increased LFO AMOUNT. At 4 - 5 on the dial the higher note will be an octave above the initial frequency. At about position 8 the range will be two octaves. (para. 2-19)
4. Switch LFO SQUARE off and LFO TRIANGLE on. A symmetrical vibrato should be heard. Adjust LFO FREQUENCY 0 - 10 to explore the range of vibrato available (which is from about 1/4 to about 25 Hz). Leave LFO FREQUENCY set to about 6. Return LFO AMOUNT to 0.
5. Adjust OSC B AMOUNT 0 - 10 to check OSC B as modulation source. The effect will be a vibrato similar to that produced by the LFO. Adjust OSC B FREQUENCY to hear the range. Leave OSC B FREQUENCY and OSC B AMOUNT set to 0.









































































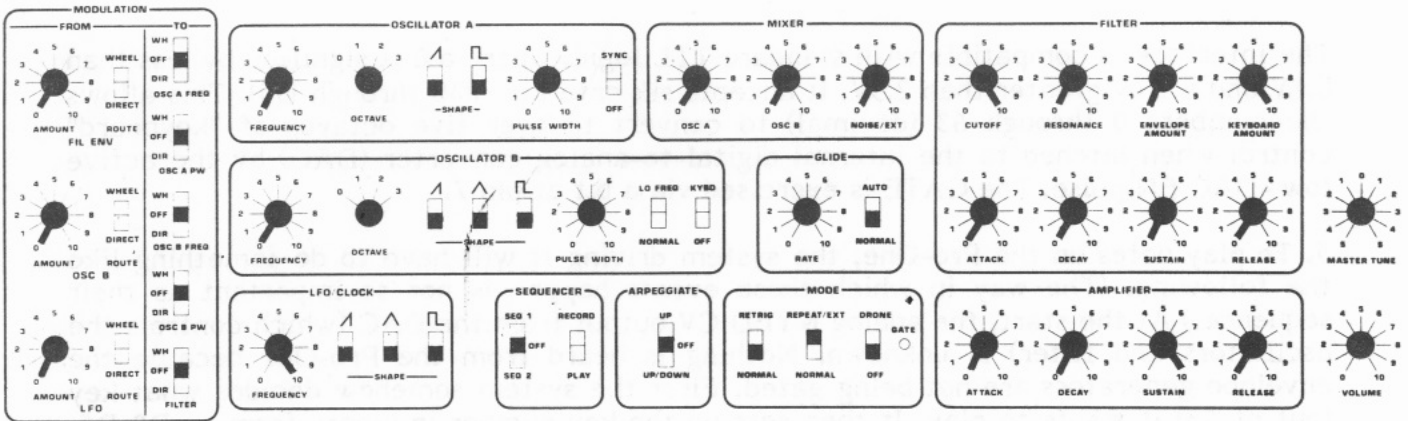












**Figure 5-2  
AMPLIFIER BALANCE PATCH**

**5-4 DIGITAL INTERFACE**

Use of the digital interface for external computer control requires both some simple hardware modifications to the Pro-One and the creation of software for your system. If you doubt your technical ability to install the interface, please see an SCI Authorized Service Center or contact our Service Department. However please note that we must leave all questions of programming your system to you.

1. Remove U113 (see Figure 5-1) 8021 microcomputer from its socket. Keep it safe. Note that with the 8021 removed, the Pro-One's keyboard cannot operate.
2. Jumper pin 2 of the 8021's socket to J101-7. Pads are provided on the printed circuit board (PCB) for this purpose.
3. Add R1182, 10K-ohm, 1/4W, 5% resistor where shown on Figure 5-1.
4. Table 5-0 lists pin assignments. Mate J101 with a 14-wire ribbon cable terminated in a DIP plug. (There are six spare lines.)

**Table 5-0  
J101 DIGITAL INTERFACE PINS (J101)**

1	D5
2	D4
3	D3
4	D2
5	D1
6	D0
7	GATE
8	-DAC EN
9-14	GROUND











































































