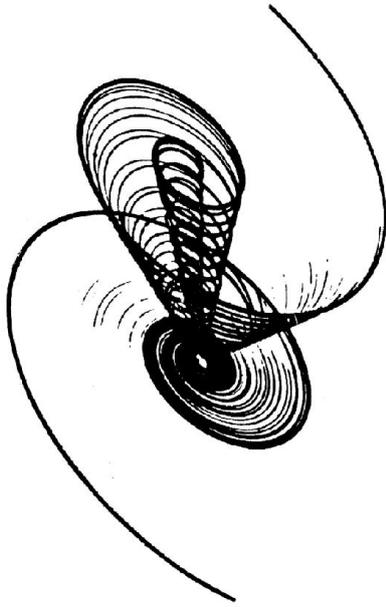


*Editor's Note:*  
The following pages are taken from the original **Tonus Series 2600**  
**Synthesizer Owner's Manual (1971)**. It only shows chapter 6,  
which deals with **CALIBRATION & ALIGNMENT PROCEDURES**.



# OWNER'S MANUAL

THE  SYNTHESIZER  
SERIES 2600

“ *Most of what you should be concerned with here is  
merely preventive: do not expose your Model 2600  
to extreme heat or cold, don't leave it out in the rain,  
or set it down in the middle of busy intersections.* ”

## 6.0 ADJUSTMENT AND MAINTENANCE.

Your Model 2600 was carefully adjusted and tested before it left the factory. Like any musical instrument, however, it will need periodic adjustment, tuning, and cleaning. If you follow carefully the procedures we give you in this section, you can bring your 2600 back to factory-perfect alignment and calibration whenever it becomes noticeably out of tune. In general, ARP Synthesizers are extremely stable and will not need tuning for weeks at a time or even longer, performance that is unequalled by any other synthesizer. Maintenance is absolutely minimal. The only critical task here is occasionally to clean the keyboard contacts if they become obstructed by dirt or dust. Noncritical maintenance includes ordinary cleaning of control surfaces and protection from extremes of temperature and mechanical shock. Should you experience any difficulty in operating the Model 2600, contact your dealer or the nearest factory-authorized distributor. He will be able to advise you. Refer to the TONUS warranty statement for information on servicing.

### 6.1 THE CALIBRATION AND ALIGNMENT PROCEDURES

outlined in the following pages can be carried out without going inside the 2600 and without using any external test instruments other than your own ears. Adjustments are made by means of the semi-fixed trimmers recessed behind the small holes in the front panel. Use the small screwdriver supplied with your instrument. If you are uncertain of your ability to perform any of these alignments without help, your nearest factory authorized servicing distributor will assist you or perform them for you without charge within the warranty period of 90 days; after that you will be charged for his assistance and/or service. Note that throughout the alignment procedure the keyboard PORTAMENTO, TUNING, and TONE INTERVAL switches should always be in their right-hand position. The PANPOT slider may remain centered.

#### 6.11 BEGIN with the VCO's.

Each oscillator must be set so that its output frequency corresponds at least roughly with the markings on the INITIAL FREQUENCY slider and so that it tracks in unison with the other VCO's over a wide range of frequencies. In addition, the square wave output from VCO-1 must be adjusted so that it is exactly symmetrical.

##### 6.111 VCO FREQUENCY CALIBRATION.

1. Set all SLIDE CONTROLS to their MINIMUM, i.e. down or left position.
2. On the KEYBOARD, all switches should be set to their RIGHT-HAND position.
3. On VCO-1, the FINE TUNE slider should be centered, and the range switch set to AUDIO.
4. Insert a dummy plug or the end of a patch cord into the KBD CV jack input to VCO-1.

5. Now set the INITIAL OSCILLATOR FREQUENCY slider to the 100Hz panel marking.
6. Advance VCO-1 input on Filter to maximum; advance Filter INITIAL FILTER FREQUENCY to maximum; advance Filter input to Mixer, and Speaker Volume controls, so that a tone is audible.
7. ADJUST THE VCO-1 TRIMMER LABELLED "FREQ CAL" UNTIL PITCH IS SLIGHTLY FLAT OF A-110Hz, TWO OCTAVES BELOW A-440Hz. (A-440 is the first A above middle C.)
8. Repeat steps 3 through 7, substituting VCO-2 for VCO-1.
9. Repeat steps 3 through 7, substituting VCO-3 for VCO-1.

##### 6.112 VCO TRACKING ADJUSTMENTS.

1. All sliders should be at their MINIMUM (down or left) position.
2. Insert a dummy plug into the KBD CV jack input to VCO-3.
3. Advance the VCO-3 input to the Filter, the Filter input to the Mixer, and the two Speaker Volume controls to a comfortable level.
4. Set the VCO-3 INITIAL FREQUENCY to 100Hz and the FINE TUNE to center.
5. Open partially the VCO-2 input to the Filter and, while holding down the lowest note on the keyboard, tune VCO-2 to unison with VCO-3 by "zero-beating" the two oscillators. (In using the FINE TUNE slider for precise tuning of this sort, the best method is to press in one direction with your thumb at the base of the slider, resting on the panel, while the index finger holds the top of the slider back in the other direction, as in the drawing.)
6. Holding down the C three octaves above the lowest note on the keyboard, ADJUST THE TRIMMER LABELLED "1V/OCT" UNTIL VCO-2 EXACTLY ZERO-BEATS WITH VCO-3'S EIGHTH (which is three octaves above the fundamental) HARMONIC. This will be made easier if you adjust the Filter inputs so that VCO-3 is considerably louder than VCO-2.
7. Repeat steps 5 and 6 substituting VCO-1 for VCO-2.
8. Remove the dummy plug from the KBD CV input to VCO-3.
9. While holding down the lowest note on the keyboard, tune VCO's 2 and 3 to unison by zero-beating them.
10. Holding down the C three octaves above the lowest note on the keyboard, ADJUST THE VCO-3 TRIMMER LABELLED "1V/OCT" UNTIL VCO-3 ZERO-BEATS WITH VCO-2.
11. Insert a dummy plug into the KBD CV input to VCO-3, and set the VCO-3 INITIAL FREQUENCY control at 1KHz.
12. Holding down the lowest note on the keyboard, tune VCO-2 to unison with VCO-3 by zero-beating the two oscillators.

13. Holding down the C two octaves above the lowest note on the keyboard, ADJUST THE VCO-2 TRIMMER LABELLED "HI-FREQ TRACK" UNTIL VCO-2 EXACTLY ZERO BEATS WITH VCO-3's FOURTH (two octaves above the fundamental) HARMONIC.
14. Repeat steps 12 and 13, substituting VCO-1 for VCO-2.
15. Remove the dummy plug from VCO-3's KBD CV input.
16. Holding down the lowest note on the keyboard, tune VCO-3 and VCO-2 to unison by zero-beating them.
17. Holding down the C two octaves above the lowest note on the keyboard, ADJUST THE VCO-3 TRIMMER LABELLED "HI-FREQ TRACK" UNTIL VCO-3 EXACTLY ZERO BEATS WITH VCO-2.

### 6.113 VCO-1 SQUARE WAVE SYMMETRY ADJUSTMENT.

1. Begin with all sliders at minimum (down or left).
2. With a patch cord, connect the VCO-1 SAWTOOTH output to the VCO-1 input jack on the Filter. Raise the attenuator for this input to maximum.
3. Raise the VCF Mixer input to maximum and the Speaker Volume controls to maximum.
4. Set the VCO-1 INITIAL OSCILLATOR FREQUENCY control to a little under 1 KHz.
5. Set the INITIAL FILTER FREQUENCY control to 1KHz and the Filter RESONANCE control to just below oscillation.
6. Tune the Filter to the 2nd harmonic of the VCO-1 sawtooth. (If you have any difficulty, tune first to the fundamental and then find its octave. The Filter will peak sharply at each harmonic.)
7. REMOVE THE PATCHCORD CONNECTION AND ADJUST THE "SYMMETRY" TRIMMER UNTIL THE 2ND HARMONIC DISAPPEARS COMPLETELY.

## 6.12 ADJUSTING THE VOLTAGE-CONTROLLED FILTER.

Here the "offset" adjustment minimizes any DC in the Filter output, and the "gain" adjustment sets the Filter gain to exactly unity. The frequency calibration and tracking adjustments are the same as for the VCO's but are somewhat less critical.

### 6.121 OUTPUT OFFSET ADJUSTMENT.

1. Begin with all controls at minimum (down or left).
2. With a patch cord, connect the VCO-2 SINE output to the Mixer VCA input. Raise the attenuator over this input to maximum and raise the Speaker Volume controls until the sine tone is comfortably audible.
3. With another patch cord, connect the VCF output to the first attenuator-governed FM input to VCO-2, interrupting the S/H connection to that input. Raise the attenuator over that input to maximum. You should hear a change in the pitch of the sine tone.

4. ADJUST THE "OUTPUT OFFSET" TRIMMER FOR MINIMUM PITCH CHANGE WHEN THE PATCH CORD CONNECTING THE FILTER TO VCO-2 IS ALTERNATELY REMOVED AND INSERTED AGAIN.
5. Remove all patch cords.

### 6.122 GAIN ADJUSTMENT.

1. Set all controls to minimum.
2. Make the following patch connections with patch cords: VCO-3 SAWTOOTH to VOLTAGE PROCESSOR INPUT No.1, FIRST PROCESSOR OUTPUT to second MIXER INPUT (interrupting the VCA connection to that input).
3. Raise to maximum the VCO-3 input to the Filter, the Filter INITIAL FREQUENCY control, and the two Mixer input attenuators. Raise the Speaker Volume controls to a high listening level.
4. ADJUST THE "GAIN" TRIMMER FOR MINIMUM VOLUME THROUGH THE SPEAKERS. If necessary raise the Speaker Volume controls to maximum.
5. Remove all patch cords and return all controls to minimum.

### 6.123 FREQUENCY CALIBRATION.

1. Begin with all control sliders at minimum, i.e. down or left.
2. With a patch cord, connect the VCO-2 SINE output to the Mixer, interrupting the VCA connection.
3. Insert dummy plugs into the KBD CV input jacks on VCO-2 and on the Filter.
4. Set VCO-2 frequency at 1 KHz; set the Filter frequency at 1KHz.
5. Advance the Filter RESONANCE to maximum.
6. Raise both of the Mixer input attenuators halfway. Raise the Speaker Volume controls to a comfortable level.
7. ADJUST THE "FREQ CALIBRATE" TRIMMER ON THE VCF UNTIL THE VCF AND VCO-2 OUTPUTS ZERO BEAT.

### 6.124 1V/OCTAVE CALIBRATION.

1. Begin with all control sliders at minimum, i.e. down or left.
2. With a patch cord, connect the VCO-2 SINE output to the second MIXER input, interrupting the VCA connection to that input.
3. Set VCO-2 and the Filter both to about 500Hz.
4. Advance the Filter RESONANCE to maximum.
5. Open the Mixer input attenuators about halfway and set the Speaker Volume controls to a comfortable level.
6. Holding down the lowest note on the keyboard, tune the Filter to unison with VCO-2 by zero-beating them.
7. Holding down the C three octaves above the lowest note on the keyboard, ZERO-BEAT THE FILTER AND VCO-2 BY ADJUSTING THE "1V/OCT" TRIMMER ON THE FILTER.

- Repeat steps 6 and 7 as needed for precise tracking.

### 6.13 ADJUSTING THE VOLTAGE-CONTROLLED AMPLIFIER.

Here we are concerned with high-frequency and control-signal rejection and with adjusting both the LINEAR and the EXPONENTIAL gain factor to unity.

#### 6.131 HIGH FREQUENCY REJECTION.

- Set all control sliders to their minimum, i.e. down or left, position.
- With patch cords, connect the VCA output to the MIC PREAMP input, and connect the MIC PREAMP output to the PAIMPOT input.
- Set the MIC PREAMP "RANGE" at x1000 and GAIN at maximum.
- Set the VCO-3 frequency to 1KHz.
- Raise the Filter input from VCO-3 to maximum, the Filter initial frequency to maximum, and the Filter input to the VCA to maximum. Center the panpot and raise the two Speaker Volume controls to maximum.
- NOW ADJUST THE VCA TRIMMER LABELLED "HI FREQ REJ" UNTIL THE HIGH FREQUENCIES HEARD THROUGH THE SPEAKERS ARE AT A MINIMUM.

#### 6.132 CONTROL REJECTION.

- Set all controls to minimum.
- With a patch cord, connect the VCO-2 SINE OUTPUT to the VCA LINEAR CONTROL input. Set VCO-2 to 1KHz.
- Raise the LINEAR CONTROL input attenuator to maximum and the Mixer VCA input to maximum, and the Speaker Volume controls to maximum.
- ADJUST THE VCA TRIMMER LABELLED "CONTROL REJ" FOR MINIMUM SIGNAL THROUGH THE SPEAKERS.

#### 6.133 GAIN ADJUSTMENTS.

- Set all control sliders at minimum, i.e. down or left, position.
- Advance Filter RESONANCE to maximum and INITIAL FREQUENCY to 1KHz.
- With patch cords, connect the Filter output to INVERTER INPUT No. 1 in the Voltage Processor section; connect the inverter OUTPUT to the first MIXER input, interrupting the VCF connection to that input.
- Raise to maximum both Mixer inputs and the Filter input to the VCA.

#### 6.1331 LINEAR GAIN ADJUSTMENT:

- continued through from 6.133.*  
Raise the VCA INITIAL GAIN to maximum. Raise the Speaker Volume controls to a comfortable listening level.

- NOW ADJUST THE VCA "LINEAR GAIN" TRIMMER FOR MINIMUM AUDIBLE SIGNAL THROUGH THE SPEAKERS. Raise the speaker volume controls to maximum if necessary.
- Return the VCA INITIAL GAIN control to minimum.

#### 6.1332 EXPONENTIAL GAIN ADJUSTMENT:

*continued through from 6.133.*

- Raise the EXPONENTIAL CONTROL input to the VCA to maximum.
- On the ADSR Envelope Transient Generator, raise the SUSTAIN VOLTAGE control to maximum.
- Holding down the lowest note on the keyboard, ADJUST THE VCA TRIMMER LABELLED "EXP'L GAIN" FOR MINIMUM SIGNAL THROUGH THE SPEAKERS.

### 6.14 ADJUSTING THE RING MODULATOR,

for positive and negative nulling and proper gain.

#### 6.141 NULL ADJUSTMENTS.

- Set all controls to minimum.
- Set VCO-1 to 1KHz.
- Advance to maximum the VCO-1 input to the Ring Modulator, the RING MOD input to the VCA, and the VCA input to the Mixer. Raise the Speaker Volume controls to maximum.
- ADJUST THE RING-MODULATOR TRIMMERS LABELLED "POS NULL" AND "NEG NULL" ALTERNATELY, TUNING FOR MINIMUM SIGNAL THROUGH THE SPEAKERS.

#### 6.142 GAIN ADJUSTMENT.

- Set all controls to minimum.
- With patch cords, connect the KEYBOARD CONTROL VOLTAGE output to the Ring Modulator left input, interrupting the VCO-1 connection to that input; connect the VCO-1 SQUARE output to the Ring Modulator right input, interrupting the VCO-2 connection to that input; and connect the RING MODULATOR OUTPUT to VCO-2's unattenuated control input, interrupting the KBD CV connection to that input.
- Set VCO-2 INITIAL FREQUENCY to about 500Hz.
- Set the VCO-1 INITIAL OSCILLATOR FREQUENCY control to about 1KHz and switch it to its LOW-FREQUENCY range.
- Set the Ring Modulator coupling to DC.
- Advance to maximum: both Ring Modulator inputs, the Filter input from VCO-2, the Filter frequency, and the Mixer input from the Filter. Raise the Speaker Volume controls to a comfortable level.

7. Holding down the lowest F-sharp on the keyboard, ADJUST THE RING MODULATOR "GAIN" TRIMMER UNTIL THE TONE FROM VCO-2 IS SHIFTING EXACTLY ONE OCTAVE.

## 6.2 MAINTENANCE.

Most of what you should be concerned with here is merely preventive: do not expose your Model 2600 to extreme heat or cold, don't leave it out in the rain, or set it down in the middle of busy intersections. If after extended use the exposed surfaces of the 2600 begin to get dirty, they may be cleaned with a soft damp cloth. If you decide to wax it, take great care to prevent the wax from entering the control slider slots where it could build up and eventually affect the sliders' contact surfaces. Take care in general that wax does not build up in any crevices, or between the keys of the 3604 controller. Don't try to take the 2600 apart to get inside; doing so will void your warranty. All possible interconnections can be made externally; we have designed the 2600 specifically so that all user-adjustable trimmers are available without disassembly.

**This concludes the calibration and alignment procedure.**