2. Turn both input level controls fully counter-clockwise.

3. Connect the amplifier to the preamplifier or electronic crossover, using only the highest grade audio interconnect cables.

4. Connect the power line cord to the AC power, observing Paragraph 2 under USE CAUTIONS on Page 2 of this manual.

5. Proper adjustment of the input level controls can be accomplished very simply. Turn your preamplifier level control to 12 to 1 o'clock while playing a record. Then, advance (from the previously counter-clockwise settings) the amplifier level controls to your normal listening level. This provides optimum "bandspread" of adjustment at the preamplifier, as well as providing optimum signal-to-noise ratio. (The D160 will normally perform best sonically with its level controls at or near maximum.)

   CAUTION

   Make certain the amplifier is installed according to the instructions under INSTALLATION on Page 3 of this manual.

D160 ADJUSTMENT PROCEDURE AND DISCUSSION

The D160 utilizes very high quality commercial grade components and this, together with conservative operation of all components and tubes, should provide long adjustment-free service life.

After long service, or after vacuum tube failure and replacement, or in a location with consistently low line voltage, it may be desirable to readjust the amplifier for optimum performance.

CAUTION: The following procedures should not be attempted by the owner unless he is technically qualified. There are high voltages and currents within this unit which can be lethal under certain conditions. Refer all such adjustment to a qualified individual.

There are eight parameters in the D160 which may be adjusted in the following sequence. However, only the output tube bias and AC balance adjustments are likely to need checking as tubes age. All other adjustments are essentially permanent, except in the event of component failure.

1. BIAS REGULATOR VOLTAGE
2. SCREEN REGULATOR VOLTAGE
3. DRIVER B+ REGULATOR VOLTAGE
4. INPUT B+ REGULATOR VOLTAGE
5. OUTPUT TUBE IDLE CURRENT ("BIAS")
6. DC BALANCE (INPUT DIRECT COUPLED STAGE)
7. AC BALANCE (DRIVER)
8. LEVEL INDICATOR SENSITIVITY

The output tube bias adjustments, test switching and test points are accessible at the rear of the unit without removing the covers. In many cases a simple "tune-up" may be accomplished with only the output tube bias adjustments. USE THE PLASTIC ADJUSTMENT TOOL PROVIDED WITH THE UNIT TO AVOID CONTACT WITH DANGEROUS VOLTAGES. Other adjustments require removal of top or bottom covers, and should not be attempted by other than a qualified technician.

1. BIAS REGULATOR VOLTAGE

This adjustment is located on top of the output tube board, just behind regulator tube V16. Connect a voltmeter to the negative (lower) end of the 50uF 150V electrolytic capacitor at the far right rear of the unit (on the vertically mounted PWB) and measure to chassis. Adjust RV18 for -48 VDC at this test point.

CAUTION: If there is any question of malfunction of the bias supply, perform tests and adjustments with the front screen fuse removed. This will prevent any damage from excessive output tube current. REMEMBER THAT WITH NO LOAD ON THE +600V SUPPLY, IT MAY STORE LETHAL ENERGY FOR UP TO 30 MINUTES OR MORE.

For safety after turning the D160 off, discharge the +600V supply with a 1000 to 2000 ohm 10W resistor to chassis. This voltage is accessible at the rear of 270K 2W resistor R59 at the right of the large capacitor bank.

Replace the screen fuse after the voltage has discharged. This fuse (F2) supplies current to all 3 high-voltage regulators.

2. SCREEN REGULATOR VOLTAGE

This adjustment is located on top of the unit next to output tube V11. Connect a voltmeter to the rear of the 270K 1W resistor R70 at the left of the large capacitor bank, and measure to chassis. Adjust RV17 for +350VDC at this test point. (Be certain not to connect to the wrong end of R70 which has only a nominal 90 volts and bears no relation to the +350 volt adjustment.)

CAUTION: If there is any question of malfunction of the bias or screen supplies, or if the output tube bias adjustments are not close to their proper settings, remove all 8 output tubes V7-14 before making adjustments or tests. This will prevent any damage from excessive output tube current. (Mark output tubes with V numbers so they may be returned to their original positions.)

3. DRIVER B+ REGULATOR VOLTAGE

This adjustment is located at the rear of the unit just below regulator tube V17. Connect a voltmeter to the top of the 1000pF styrene capacitor C65 below V17, and measure to chassis. Adjust RV19 for +450VDC at this test point.

4. INPUT B+ REGULATOR VOLTAGE

This adjustment is located at the rear of the unit just below regulator tube V18. Connect a voltmeter to the top of the 1000pF styrene capacitor C66 below V18, and measure to chassis. Adjust RV20 for +325VDC at this test point.

5. OUTPUT TUBE IDLE CURRENT ("BIAS")

The output stages of the D160 are partially cathode-coupled "push-pull-parallel" class AB_1, utilizing our tightly-coupled output transformers, which provide low distortion and sonic accuracy. It is important to maintain proper output tube idle current to insure proper sonic results.

As shipped from the factory, the output tube bias adjustments are set for a nominal 65 mA. per tube with a stable AC line voltage of 120 Volts from a low-impedance "solid" power source. Under these conditions the tubes are dissipating approximately 39 watts of their 50 watt rating (44 watt plate and 6 watt screen). This point of operation provides optimum "enriched" class AB_1 performance. Operation at higher currents will shorten tube life.

5A. "BIAS" ADJUSTMENT PROCEDURE

Connect a digital voltmeter capable of .001 volt DC resolution at +.050VDC to the "bias test" jacks at the rear of the unit. Select the desired tube with the "bias test" switch, and set the corresponding adjustment as indicated by V numbers on the back of the top cover. Measurement is across one ohm cathode resistors, so a +.065 VDC reading indicates the proper 65 mA. cathode current for each tube. The proper adjustment is near the clockwise end of each pot. Observe the following:

1. It is important that all 8 output tubes be reasonably matched (within 5%) for highest performance. If the cathode current for any tube has changed significantly compared to the others, check tubes before proceeding with bias adjustments. (Matched sets are available from Audio Research.)

2. These adjustments should be accomplished under no signal conditions with line voltage at its "normal" for the intended location. If this is not known, adjust line voltage for +610 VDC at the rear of 270K 2W resistor R59 at the right of the large capacitor bank, measure to chassis. Maintain this voltage during bias adjustments.

3. The D160 should be thoroughly "warmed up" (thermal equilibrium) prior to adjustment (typically 2 hours).

4. Move each adjustment slowly, allowing time for voltage stabilization as you make your reading. Line voltage instability will cause fluctuating cathode current readings.

6. DC BALANCE (INPUT DIRECT COUPLED STAGE)

Because of the nature of the push-pull direct couple input circuit, the bias of the driver stage following is determined by the DC balance of the input stage. Best sonic operation occurs when these DC voltages are the same within 0.05 VDC or better. The actual voltage is not critical at +105V $\pm$5 VDC. It is the balance within each channel that is important.

6A. DC BALANCE ADJUSTMENT

A battery-operated digital voltmeter with a 10 megohm or higher input impedance and 3½ digit resolution is best for this adjustment.

RV3 and RV5 adjust the left channel (TP1 and TP3)
RV4 and RV6 adjust the right channel (TP2 and TP4)

RV3 is located above V5, and TP1 is the inside end of the upper 47K 2W resistor by V3.

RV5 is located above V3, and TP3 is the outside end of the lower 47K 2W resistor by V3.

RV4 is located above V6, and TP2 is the outside end of the upper 47K 2W resistor by V4.

RV6 is located above V4, and TP4 is the inside end of the lower 47K 2W resistor by V4.

Adjust RV3 and RV5 to achieve identical voltages at TP1 and TP3. Allow time for the servo to settle to its final voltage. There is some interaction between adjustments because of the nature of the circuit. Make final trim adjustment for as close to 0 DVC difference between TP1 and TP3 with the DVM connected between TP1 and TP3.

Repeat the above using RV4 and RV6 to achieve identical voltages at TP2 and TP4.

It is not required that the left channel voltages be exactly equal to the right channel voltages. It is important that each channel's two TP voltages match and that they be within the range of 100 to 110 Volts DC.

It should not be necessary (except in the event of component failure) to readjust DC balance once it is set. The servo balance circuits compensate for tube aging, tube changing and line voltage variations.

7. AC BALANCE (DRIVER)

Normally the AC balance does not require readjustment unless the output or driver tubes are changed. This adjustment should not be attempted unless the previous adjustments are checked first.

Adjust RV7 and RV8 for minimum 2nd harmonic distortion at about 2 watts 1 kHz output into a 16 ohm load, typically less than .003%. As an approximation, the adjustments can be made for minimum 1 kHz total harmonic distortion and noise, typically less than .03%.

RV7 is located under V5, and RV8 is located under V6.

8. LEVEL INDICATOR SENSITIVITY

These adjustments are located below the chassis (remove bottom cover) just behind the corresponding LED peak power indicator arrays. Adjust each for the right hand "160W" red LED to just achieve full brilliance with 160W (50.6V RMS) into a 16 ohm load at 1kHz. (Balanced 25.3V RMS each side to chassis.) Make sure the line voltage is sufficient so that the output waveform is not clipping.

D160 FEATURES

1. Direct coupled push-pull input driver circuitry "servo" coupled with "IC" error correction for long term stability and minimum dynamic distortion.
2. Individual initial bias adjustments for all 8 output tubes.
3. Power supplies for input circuitry, driver circuitry, screen and bias are all individually, electronically regulated.
4. On-off switch (with low-surge start relay circuit).
5. Front panel line and screen fuses with "out" indicators.
6. Meter jacks and switch on rear chassis for easy output tube bias adjustment.
7. True "instantaneous" peak power LED readout.
8. Turn-on surge controlled by thermistor.
9. Built-in fans.
10. Input level controls (rear chassis).