LAFAYETTE

TWO METER 120 WATT MOBILE LINEAR AMPLIFIER

Model HA-260

(Stock No. 40-0108WX)

INSTALLATION AND OPERATING MANUAL

LRE

1M-452 7/67 2M

GENERAL DESCRIPTION

The Lafayette HA-260 is a compact, completely self-contained 120-watt PEP Two-Meter Mobile Linear RF Power Amplifier. The HA-260 is designed to amplify the output of any low power transmitter/transceiver (AM, CW and FM) in the 1 to 5 watt output class. The link coupled, tuned grid input makes the HA-260 easily driven to full power with low excitation levels (Minimum RF input drive 1 watt). The grid input circuit and antenna output link coupling will effectively match driver input and antenna output loads of 50 ohms impedance.

The HA-260 is a companion unit for the Lafayette HA-144 two-meter transceiver, but may also be operated with similar units of other manufacturers. The HA-260 operates over the entire two-meter amateur band from 144 to 148 Mc. The duty cycle of the HA-260 is continuous and is made possible by the use of large convection heat sinks around the power supply transistors, as well as heavy-duty components being used throughout the unit.

The HA-260 employs an RF sensing circuit which automatically actuates the B+ power supply whenever the driver transmitter is activated. The front panel tuning meter measures relative RF current and provides an indication of when the antenna is properly loaded, and the plate and grid circuits are tuned. When the HA-260 is switched "off", the meter also reads relative RF antenna current of the driver transmitter, thus permitting the driver transmitter to be matched to the antenna "through the linear".

The power supply is fully transistorized and designed around a highly efficient toroidal power transformer. The use of a toroidal power transformer permits the linear to operate with extreme efficiency and a minimum of input power consumption.

Signal amplification is accomplished by an Amperex DX296/8637 dual-tetrode. The linear amplifier is designed to operate from 11.5 to 14.5 volts DC, Negative Ground ONLY.

TECHNICAL SPECIFICATIONS

FREQUENCY RANGE	144-148 Mc
MODE	AM, FM and/or CW
POWER INPUT	120 watts PEP
INPUT IMPEDANCE	50 ohms
OUTPUT IMPEDANCE	50 ohms
DRIVE REQUIREMENTS	1-5 watts
DUTY CYCLE	Continuous
POWER REQUIREMENTS	12 volts DC (negative ground only)
INPUT CURRENT:	
STANDBY	1 Ampere
FULLY LOADED	14 Amperes
DIMENSIONS	7" D x 9" W x 2" H
WEIGHT	3 lbs.

OPERATION

The function of controls, indicators and connectors necessary for operation of the HA-260 are listed below.

FIG. 1

FRONT PANEL CONTROLS

ANT LOAD ..... Tunes the link coupled output to the antenna for maximum RF power output.

PLATE TUNE..... Tunes linear amplifier's power amplifier push-pull plate circuit for resonance, or otherwise, maximum RF power output.

GRID TUNE..... Tunes the push-pull grid circuit for maximum energy transfer from the driver transmitter.

POWER SWITCH ..... Turns unit "on" or "off".

RELATIVE POWER INDICATOR ..... When the linear amplifier is switched "on", the relative power indicator serves as an indication for proper tuning. When linear amplifier is switched "off", the meter will indicate relative power from the driver transmitter.

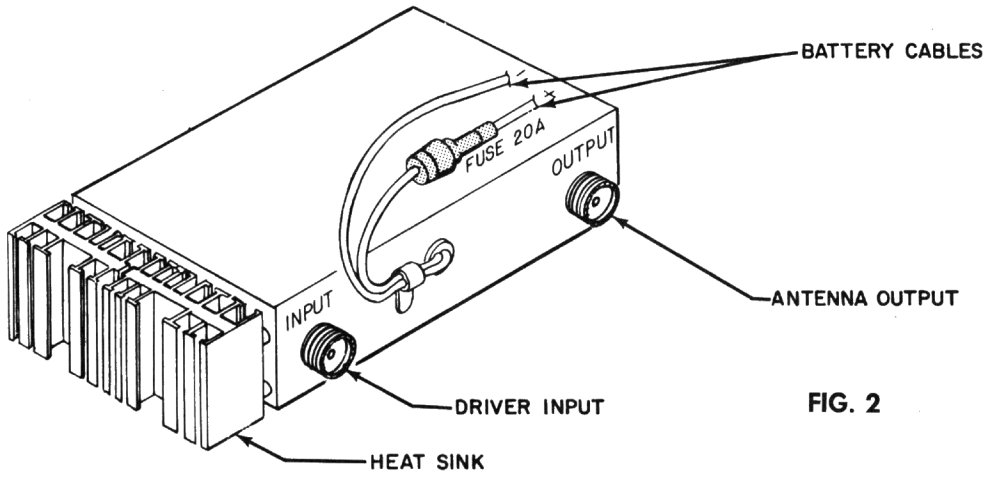


FIG. 2

REAR CHASSIS CONNECTORS

DRIVER INPUT..... Driver transmitter's RF output connects to the link input circuit of the linear through this connector.

ANTENNA OUTPUT..... For connection of antenna transmission line.

BATTERY CABLES..... Connects to 12 volt DC power source.

HEAT SINK..... Individual double layer convection heat sinks for efficient cooling of both power transistors.

MOBILE INSTALLATION

LOCATION

The HA-260 may be placed in any location that will permit free air circulation through the ventilation holes and openings in the cabinet. Direct air blasts from heaters or air conditioning units should be avoided. Some typical locations are under the dash, the underside of the driver transmitter, etc.

MOUNTING

Figure 3 illustrates the correct mounting procedure. The linear amplifier has holes on the right and left sides on the top cover and underside of chassis to facilitate mounting with the brackets and hardware supplied. For bottom mounting of linear amplifier, simply invert the mounting brackets and attach them to the underside of chassis.

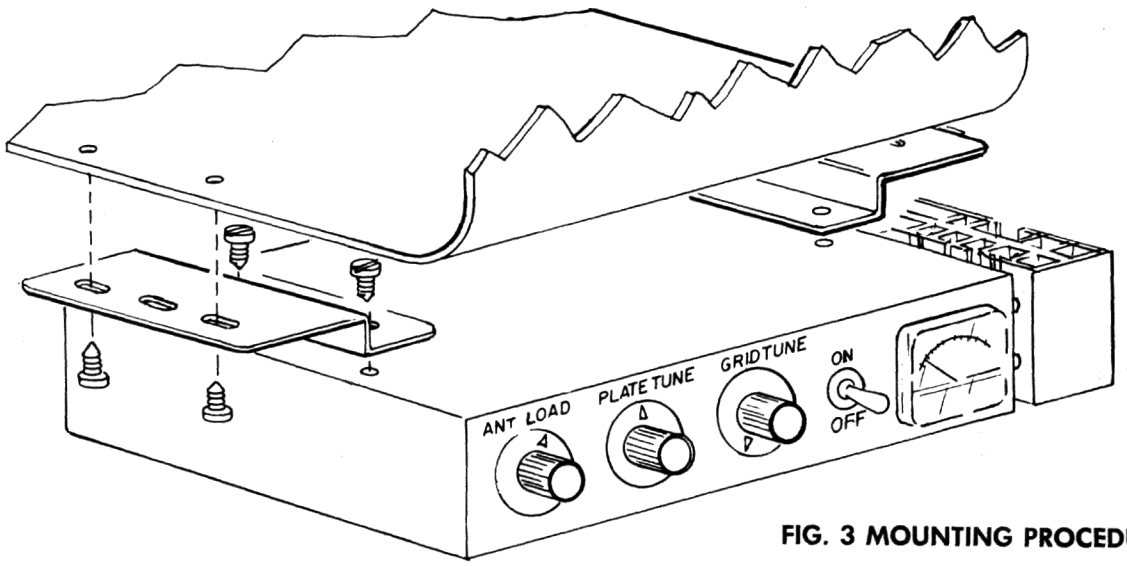


FIG. 3 MOUNTING PROCEDURE

DC POWER CONNECTION

CAUTION: The solid state DC power supply incorporated in the HA-260 is designed to operate within an input voltage range of 11.5 to 14.5 volts DC with negative ground vehicle only. To avoid possible failure of the power transistors make sure the vehicle supply voltage does not exceed 14.5 volts DC at any time. If necessary, adjust the voltage regulator in the vehicle to cut out at 14.5 volts DC. DO NOT USE IN POSITIVE GROUND VEHICLES.

The fused red lead (Positive) of the linear should be connected to the 12 volt battery source. Since the linear amplifier will draw up to 14 amperes under fully loaded conditions, it is recommended that this lead be connected directly to the battery's positive terminal.

The black lead (Negative) should be connected directly to the battery's negative terminal for best results. Connection of the black wire to the metal firewall or any other point that is connected to the vehicle chassis is another method that also may be used.

LINEAR AMPLIFIER HOOK-UP

The linear contains two standard female coaxial connectors (SO-239). Connection to these connectors must be made with 50 or 52 ohm coaxial cable terminated with standard male (PL-259) coaxial connectors. The PL-259 connectors are available from Lafayette Radio Electronics under stock number 32-2005.

Connect the driver transmitter to the driver input connector on the HA-260 by using a 2-foot length of RG58/U coaxial cable. Using a length of cable other than that specified may cause a loss of grid drive to the linear amplifier.

ANTENNAS

Due to the power level involved, it is important that the standing wave ratio (SWR) be held to an absolute minimum. The HA-260 is designed for 50-ohm termination; therefore, any two-meter antenna presenting a 50-ohm impedance may be used.

The antenna should be connected to the antenna output connector by using RG-58/U. It is recommended that RG-8/U be used in lengths in excess of 25 feet.

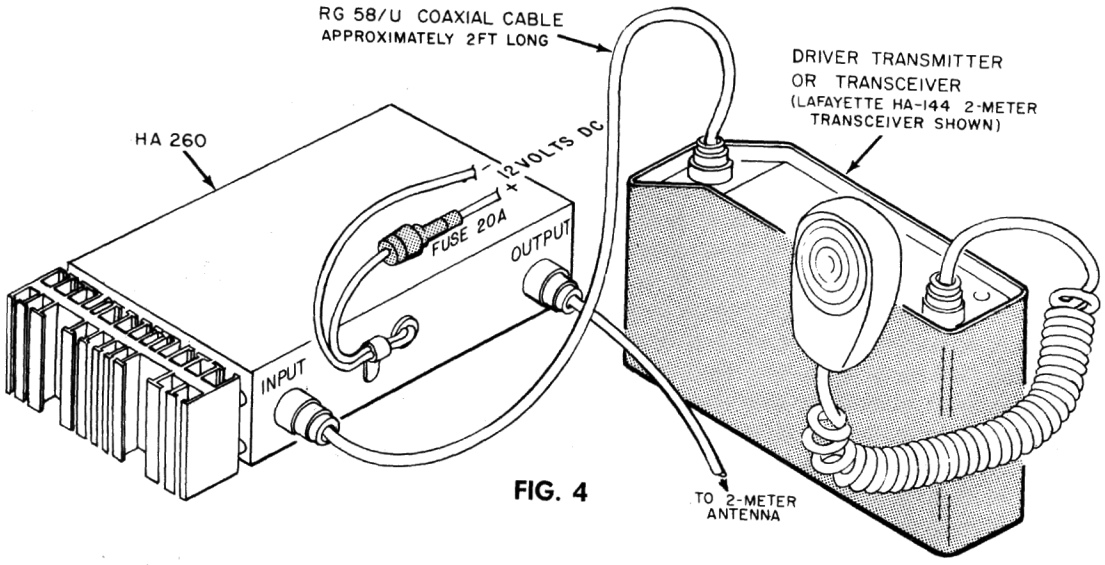


FIG. 4

TUNE-UP PROCEDURE

NOTE: The HA-260 comes from the factory set for AM (amplitude modulated) phone operation and adjusted to be used with driver transmitters supplying approximately 1-2 watts RF output. If other than the AM mode of operation is desired, or driver transmitter puts out in excess of 2 watts, refer to the section in this manual under "Adjustments".

1. Connect driver transmitter, antenna and DC power source to the linear amplifier as mentioned previously.

2. With the power switch on the linear switched "off" and the driver transmitter activated, adjust tuning controls on the driver transmitter for maximum meter deflection on the HA-260 relative power indicator.

3. Set driver transmitter to stand-by (transmitter circuit not energized).

4. Switch the linear "on". Allow approximately 1-2 minutes for warm-up. The relative power indicator should become illuminated.

5. Activate the driver transmitter. Adjust the Grid Tune, Plate Tune and Ant. Load on the HA-260, and repeak the driver transmitter for maximum relative power indication.

   NOTE: Activating the driver transmitter should automatically key the RF sensing circuit, in turn cause the B+ power supply to be switched on. This will be noted by a slightly audible high frequency tone (approximately 1 Kc). If it does not appear that the B+ circuits are being keyed, it will be necessary to adjust the RF sensing trimmer on the inside of the amplifier chassis. Refer to "Adjustment" section for location and adjustment of the RF sensing trimmer.

When the linear amplifier is switched "off", and all associated equipment connected, the antenna is connected to the driver transmitter "through" the linear. Thus, for local work where higher power may not be needed, you can operate your equipment "barefoot" with a minimum of interference to others. However, due to the frequencies involved and the small capacitive load effect of the RF sensing circuit, it is recommended that with transmitters supplying less than two watts of output power, the antenna cable be connected directly to the antenna input on the transmitter.

THEORY OF OPERATION

INTRODUCTION

This section of the manual discusses the theory of operation for the HA-260 VHF Linear Amplifier. This section is divided into four parts. The first part discusses the RF power amplifier, the second part discusses the power supply, the third part the RF sensing circuit, and the fourth part the relative power indicator. While reading refer to the block diagram, or if greater detail is desired refer to the schematic diagram in the rear of the manual.

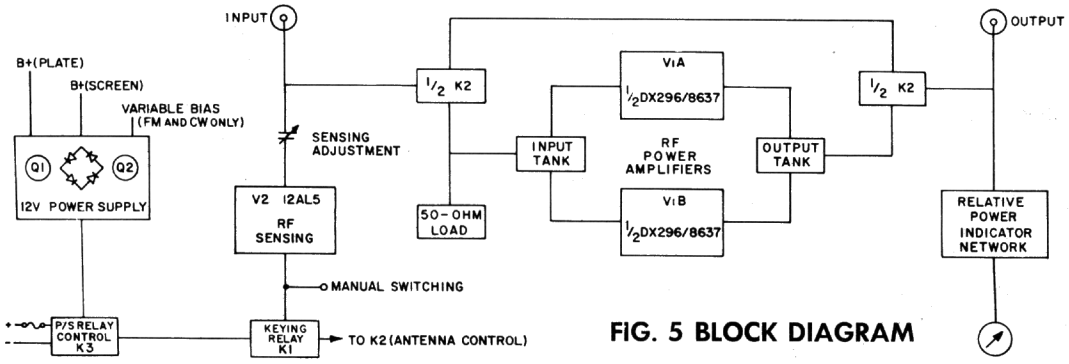


FIG. 5 BLOCK DIAGRAM

POWER AMPLIFIER

When the antenna relay (K_2) is energized by the presence of a carrier from the driver transmitter, or switched on manually, the input to the amplifier is terminated in a "fixed" 8-watt 50 ohm resistive load.

A voltage sample is taken from the load and fed to the RF input of the DX-296/8637 through an inductively coupled link to the push-pull grid input coil. A variable "butterfly" capacitor in the grid circuit serves as a peaking adjustment and assures for maximum selectivity and harmonic rejection. The butterfly capacitor effectively tunes the reactance out of the connecting coaxial cable between the driver transmitter and the linear amplifier and affords an almost perfect match.

The 50 ohm load is always present during the energized cycle of the linear and presents a measure of constant stability to the driver transmitter being used. When the linear amplifier is not energized, the load is switched out of the input circuit.

The RF power amplifier consists of an Amperex DX-296/8637 (V_1) radiation cooled beam power twin-tetrode. Built-in cross neutralization within the tube eliminates the need of having to incorporate any neutralization circuitry in the linear. The amplifier is capable of producing 120 watts (PEP) on AM, FM and CW with a minimum of driving power.

Proper linear operation for all operating modes is dependent on the level of bias voltage supplied to the control grids. A variable bias voltage is made available for the control grids for FM and CW operation. For AM operation the bias supply is not utilized and the control grids are "fixed" biased through a 15K resistor.

The "push-pull" output circuit tunes 144-148 Mc by means of a double-spaced variable "butterfly" capacitor. The RF energy from the tank coil is inductively coupled to the antenna output link where the degree of coupling to the antenna load is adjustable. Maximum RF energy transfer from the tank coil to the output link is obtained when the reactance of the link is equal to the resistance of the antenna load. The output link is designed to match 50 ohm loads.

POWER SUPPLY

The switching transistors (Q1, Q2) rated at 50 amperes each are mounted on oversized heat sinks for cool operation under the most adverse conditions. This massive excess current handling capacity gives the assurance the supply will not fail at a usually, inopportune time. The supply is designed for 12 volt DC negative ground systems only, and at no time should be connected to any other type systems.

The high voltage secondaries of T_1 are connected across a full wave bridge configuration (D1, D2, D3, D4) to produce the necessary high voltage for the plate supply of the DX296/8637. The high voltage secondary is center-tapped so a screen grid supply of a lower voltage may be used without the use of heat dissipating power dropping resistors. This same system also maintains a measure of regulation on the screen grid, thereby providing good linear operation.

The low voltage, or bias secondary windings provide the necessary bias voltage when operating the linear in the FM or CW mode of operation. The bias supply voltage is fully adjustable to provide a means of adjusting the bias voltage for possible tube variations.

RF SENSING CIRCUIT

The sensing circuit, through a resistive and capacitive network, samples a small portion of the RF input from the exciter. The RF sensing adjustment provides added flexibility so that the sensing circuit may be operated at different power levels.

V2 (12AL5), acting as a voltage doubler, rectifies the sampled RF input. The resulting DC voltage obtained from this circuit keys the "sensing relay" (K1) which in turn keys the power and antenna relays (K2 and K3 respectively).

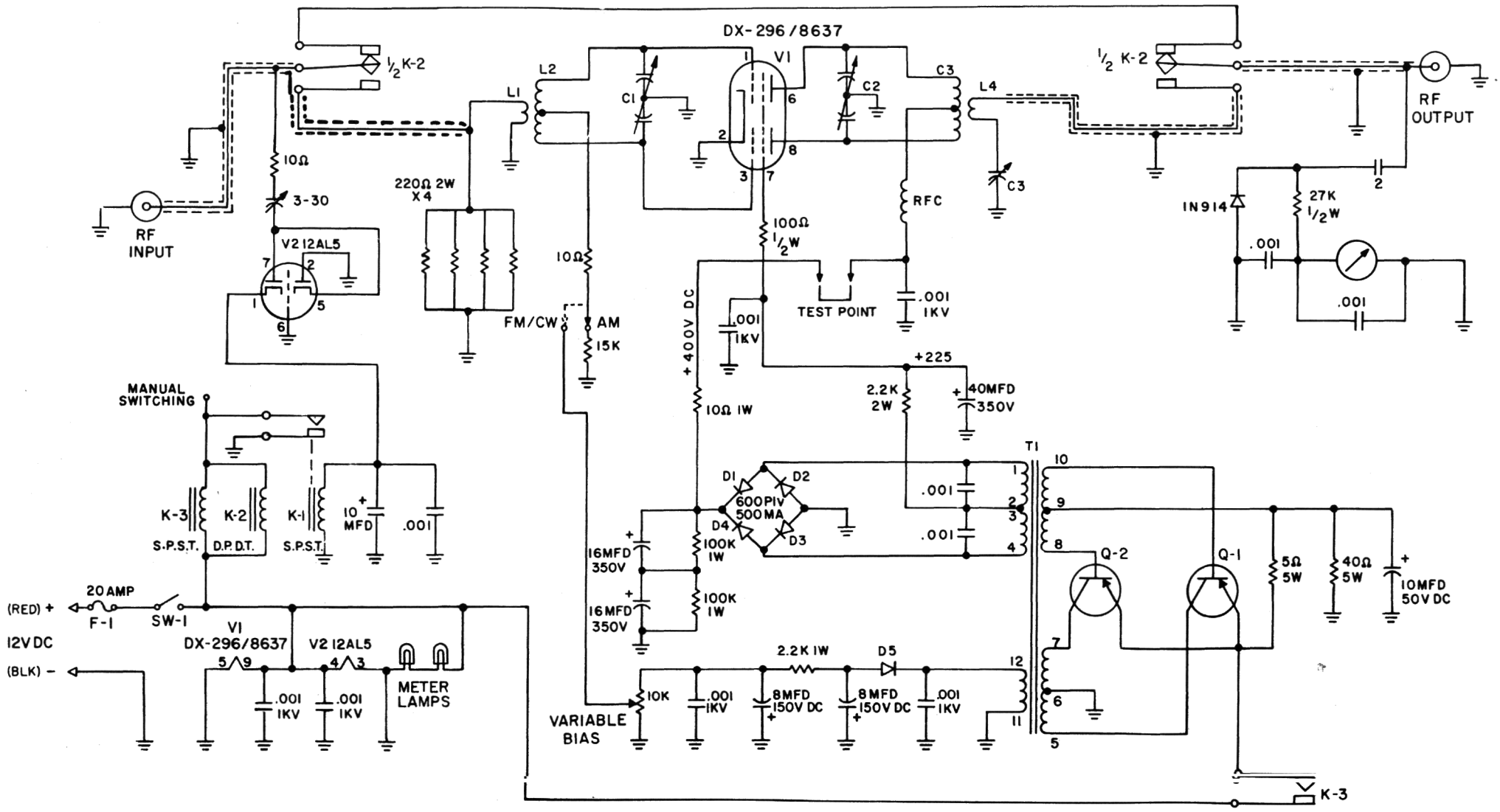
Since the RF sensing network provides all of the required switching functions for the power and antenna relays, no external switching connection from the driver transmitter is necessary. If, however, some installations require a manual switching arrangement, provisions are also made for manual switching of the keying system.

RELATIVE POWER INDICATOR

A unique metering circuit is incorporated within the linear amplifier to provide an indication of maximum RF power output. This "dual-purpose" metering circuit gives an indication of maximum RF power output for both the linear amplifier as well as the driver transmitter.

When the linear is switched "on" and in full operation, a small portion of the RF output is rectified and filtered. This rectified voltage is indicated on the front panel meter and gives an indication of relative RF power output of the linear.

When the linear is switched "off", relay K_2 bypasses the linear circuitry and the relative power indicator will give an indication of RF output power from the driver transmitter.



SCHEMATIC DIAGRAM

ADJUSTMENT

NOTE: All adjustments other than the front panel controls are made internally. It will therefore be necessary to remove the top cover plate when performing any of the adjustment procedures listed. Refer to Figure 6 for location of all adjustment points.

WARNING

LETHAL HIGH VOLTAGE IS PRESENT WITHIN THIS UNIT. EXTREME CARE SHOULD BE TAKEN WHEN MAKING THESE ADJUSTMENTS.

FM AND CW OPERATION

Prior to conversion to FM and CW operation the output connector must be terminated with a 50 ohm load. It is not necessary to connect driver transmitter during these procedures.

1. Remove jumper wire at point "X".

2. Connect a 0-300 milliampere meter to terminal strip "A". Positive lead wire from meter connects to lug A_1; Negative lead wire to lug A_2.

3. Locate terminal strip "B". Disconnect the 10 ohm resistor from lug B_1 and resolder the resistor lead wire to lug B_2.

4. Locate lug C_1 on terminal strip "C". Temporarily connect a jumper wire from lug C_1 to a ground point anywhere on the metal chassis. The connection of lug C_1 to ground potential will turn on the B+ power supply. Quickly adjust bias control for 40 ma. of static plate current as indicated on the 0-300 ma. meter.

5. Remove jumper wire at lug C_1, milliammeter at terminal strip A, and reconnect the jumper wire at point "X" to lugs A_1 and A_2 of terminal strip "A".

The HA-260 will now operate on FM (Frequency Modulation) or CW (Continuous Wave Telegraphy) operation. Tune-up procedure for FM or CW operation is identical to that as outlined previously.

RF SENSING TRIMMER ADJUSTMENT

Connect driver transmitter as outlined previously and connect a 50 ohm load to the output connector on the linear.

1. Turn sensing trimmer screw fully clockwise (plate fully compressed). Care should be taken not to damage porcelain on the trimmer.

2. Turn sensing trimmer screw counter-clockwise approximately 5 turns.

3. With the driver transmitter activated, slowly turn the sensing trimmer screw clockwise to a point where the keying and changeover relays (K1, K2, K3) become energized (pull in).

4. Turn the sensing trimmer screw an additional one-half turn clockwise from the point where the relays first pull in.

5. Turn driver transmitter "off". This completes the RF sensing circuit adjustment.

The HA-260 should automatically be keyed every time the driver transmitter is activated.

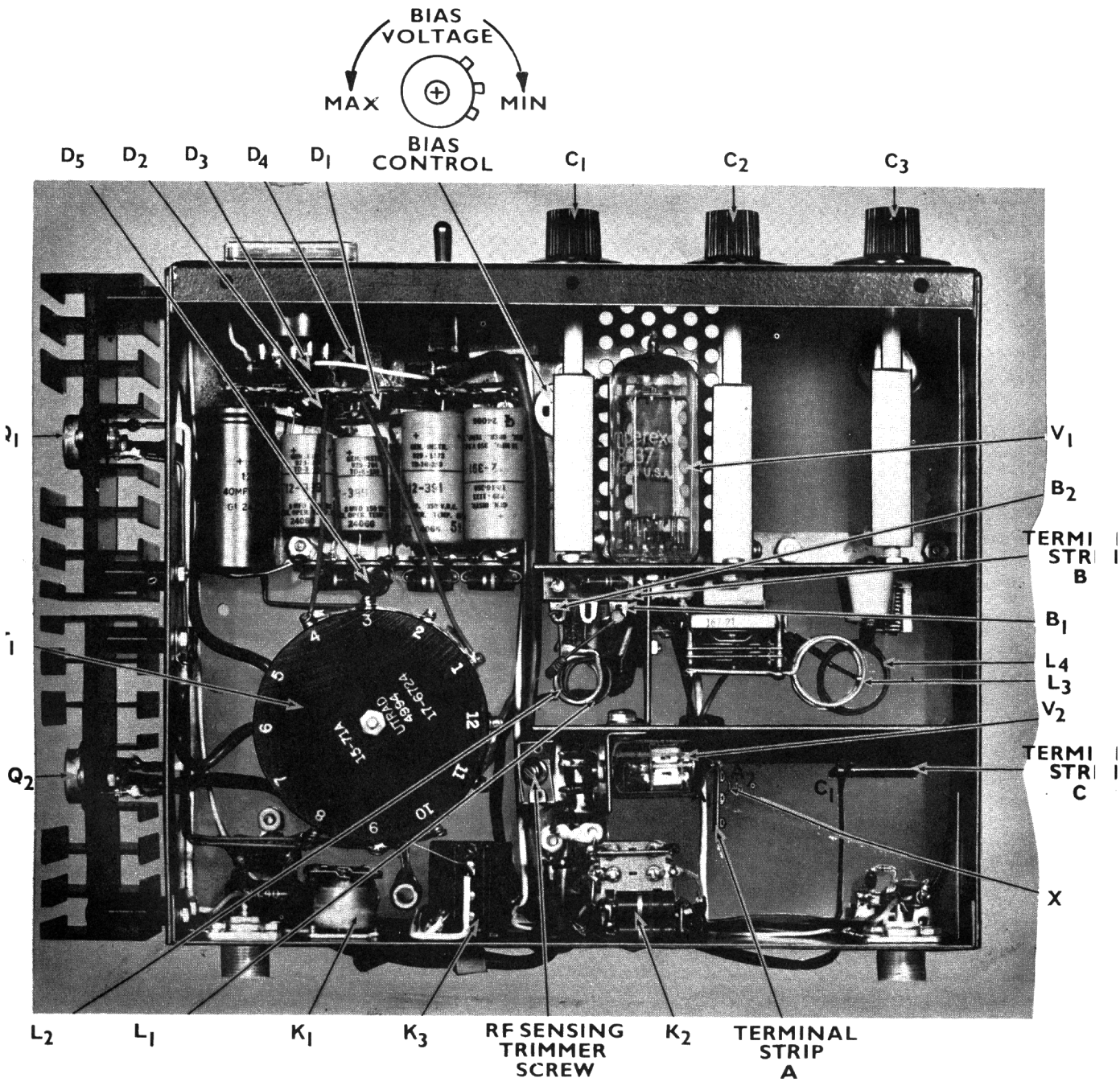


FIG. 6 COMPONENT AND ADJUSTMENT POINT LOCATION

RETURNING THE UNIT FOR SERVICE

In the event that repair is necessary (either in or out of warranty), we recommend that you return the HA-260 Linear Amplifier to the Lafayette store from which it was purchased. If the unit is to be shipped to our main office for service, please read the instructions which follow.

Shipping Instructions

Pack the unit very carefully to avoid damage in transit, preferably in its original carton. If the original carton is not available, use a sturdy carton with at least 3 inches of shredded paper or excelsior around the unit. In the latter case, wrap the unit in paper first to avoid particles of packing material getting into it. Include with the unit a letter explaining exactly what difficulties you have encountered (remember to add an extra 5¢ postage and indicate on the outside of the carton that First Class Mail is enclosed). Ship by prepaid express if possible and mark ELECTRONIC EQUIPMENT – FRAGILE. Clearly address the carton as follows:

SERVICE DIVISION
LAFAYETTE RADIO ELECTRONICS CORP.
111 JERICHO TURNPIKE
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