

INSTRUCTION MANUAL

DRAKE

MODEL

L-4



LINEAR AMPLIFIER

STANDARD WARRANTY

R. L. DRAKE COMPANY warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use, and service discloses such defect, provided the unit is delivered by the owner to us or to our authorized radio dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgement that it is thus defective. Should a malfunction be suspected, write in detail to our Service Department for suggestions concerning the operation, repair or return of your unit if it should prove necessary.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside our factory, nor in cases where the serial number thereof has been removed, defaced or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

The R. L. DRAKE COMPANY reserves the right to make any improvements to its products which it may deem desirable without obligating itself to install such improvements in its previously manufactured products.

TABLE OF CONTENTS

	<u>PAGE</u>
GENERAL SPECIFICATIONS -----	1
DESCRIPTION -----	3
INSTALLATION INSTRUCTIONS -----	4
A. Unpacking -----	4
B. Tube and Chimney Installation -----	4
C. Location -----	5
D. Power Requirements - 115 V and 230 V Operation -----	5
E. Jumper Connection Diagrams -----	6
F. Low Pass Filter -----	7
G. Antenna Requirements -----	7
H. Ground Requirements -----	7
I. Exciter Requirements -----	7
J. Transmitting AGC -----	8
K. VOX -----	8
L. Initial Connection Diagrams -----	9
M. Viewing Angle Options -----	10
TUNING PROCEDURE -----	11
A. CW, RTTY -----	11
B. SSB, AM -----	13
OPERATION -----	14
A. CW, RTTY -----	14
B. SSB -----	14
C. AM -----	15
THEORY OF OPERATION -----	16
SERVICE DATA -----	17
A. Amplifier -----	17
1. Removing Top Cover -----	17
2. Removing Bottom Cover -----	17
3. Removing Front Panel -----	17
4. Cleaning Amplifier Compartment -----	17
5. Tube Replacement -----	18
6. Input Switch Drive Belt Replacement -----	18
7. Troubleshooting -----	18
B. Power Supply -----	19
1. Circuit Breaker Reset -----	19
2. Removing Bottom Cover -----	19
3. Removing Top Cover -----	19
4. Troubleshooting -----	19
ALIGNMENT -----	21
A. Input Coil Adjustment -----	21
B. Meter Adjustment -----	21
C. Knob Pointer Alignment -----	22
SCHEMATICS -----	

GENERAL SPECIFICATIONS

FREQUENCY COVERAGE - Ham bands 80 through 10 meters. All frequencies 3.5 to 30 MHz may be covered with some retuning of input coils.

PLATE INPUT - 2000 watts PEP - SSB, 1000 watts DC on CW, AM and RTTY.

DRIVE REQUIREMENTS - 100 watts PEP - SSB, 75 watts CW, AM and RTTY.

INPUT IMPEDANCE - 50 ohms.

OUTPUT IMPEDANCE - Adjustable pi-network matches 50 ohm line with SWR not to exceed 2:1.

POWER REQUIREMENTS - 230 volts 50 - 60 cycles 15 amperes, or 115 volts 50 - 60 cycles 30 amperes.

DIMENSIONS - Amplifier 13-15/16 W x 7-7/8 H x 14-5/16 D;
Power Supply - 6-3/4 W x 7-7/8 H x 11 D.

WEIGHT - Amplifier 32 lbs; Power Supply 43 lbs.

TUBE COMPLEMENT - Two 8163 or Two 3-400Z.

FRONT PANEL CONTROLS:

ON-OFF - Rocker Switch

SSB-CW/TUNE - Rocker Switch changes plate voltage for different modes of operation.

BAND - Switch selects desired ham bands (See Frequency Coverage).

PLATE and LOAD - Tuning adjust pi-network capacitors in tank circuit for proper resonance and loading on all bands.

METER - Switch selects monitoring either grid current, plate voltage, or relative output on the lower meter.

REAR CONTROLS - Transmitting AGC threshold, and relative output meter reading adjustment.

REAR JACKS - Power (connects L-4 to power supply), high voltage, VOX (for turning on L-4 with exciter VOX contacts), transmitting AGC (for connecting transmitting AGC to exciter), R.F. input (for connecting to exciter R.F. output), R.F. output (for connecting L-4 to an antenna).

METERS - Plate Current, Grid Current/Plate Voltage/Relative Output (switch selected).

POWER SUPPLY controls - Two circuit breaker reset buttons.

DESCRIPTION

The R L DRAKE Model L-4 Linear Amplifier offers continuous 2000 watt PEP-SSB, and 1000 watt D.C. CW, AM and RTTY operation covering the ham bands 80 through 10 meters. All frequencies 3.5 to 30 MHz may be covered with some retuning of the input coils.

The L-4 Linear Amplifier was designed to match the TR-3 and TR-4 Transceivers and T-4/T-4X Transmitters in appearance and drive requirements to run the maximum legal input power.

The L-4 uses two 8163 or two 3-400Z zero bias triodes in a Class B grounded grid circuit configuration that utilizes R.F. negative feedback for lowered odd order distortion products.

A transmitting AGC circuit controls the exciter gain to allow the highest average power without peak clipping. An internal changeover relay feeds the antenna through when the L-4 is turned off. A pair of relay contacts bias the output tubes to cutoff, eliminating unwanted heat and diode noise when receiving.

The output tubes are forced-air cooled by a very quiet low velocity, high volume internal blower. Two taut-band suspension meters indicate plate current, grid current, plate voltage, and relative R.F. output power.

The separate solid state power supply requires no warm up period and provides excellent dynamic and static voltage regulation.

INSTALLATION INSTRUCTIONS

The L-4 has been designed incorporating several interlocks to prevent dangerous electrical shock. However, it is possible to disconnect the high voltage terminal while the L-4 is turned on. This is a potentially dangerous situation and should never be attempted for any reason. When disassembling the L-4, the high voltage terminal should be disconnected last and upon reassembly the high voltage terminal should be connected first. The L-4 and its power supply can be installed and serviced in complete safety if the instructions in this manual are followed explicitly.

A. UNPACKING

Carefully remove your L-4 Amplifier, tubes and chimneys, and power supply from their packing cartons and examine them closely for signs of shipping damage. Should any damage be apparent, notify the delivering carrier immediately, stating the full extent of the damage.

Fill out and mail the enclosed registration card so that your warranty will be effective.

Save the packing material, you may need it later for reshipment or storage.

Inspect the packing material closely before putting it away to be sure you have not overlooked the cables or other hardware shipped with the L-4.

B. TUBE AND CHIMNEY INSTALLATION

Tubes and chimneys can be installed after removing the top cover (see Service Data, Removing Top Cover).

The tubes are installed first. Notice that base Pin 3, the pin with no immediately adjacent pins, face in either socket, the ends of the amplifier case. When installing the tubes, push straight down to insert them and do not rock the tubes or the base pins may break.

The chimneys are installed after the tubes and extra care must be exercised while handling them because they are fragile. The chimneys should be installed by pushing two clips outward with the chimney until the opposite clips will be cleared when the chimney is lowered onto the chassis. Check to be sure that both chimneys are flush with the chassis and that

no clips are inside of the chimneys. The parasitic chokes are packed in the tube boxes and are installed after the tubes and chimneys. Remove the screw at the top of the plate connector and use this screw to fasten the parasitic choke to the plate connector. The parasitic choke coil should hang downward from the supporting leads. The free ends of both parasitic chokes can then be connected to the top of the plate R.F. choke with the 1/4 - 20 round head aluminum machine screw already in the top of the plate choke. Do not overtighten this screw when connecting the parasitic chokes; a snug fit is adequate. After replacing the top cover, the amplifier can be connected for operation.

It is not absolutely necessary to operate the L-4 with chimneys, however, they do provide cooling in excess of the tube manufacturers requirements and their use is recommended.

C. LOCATION

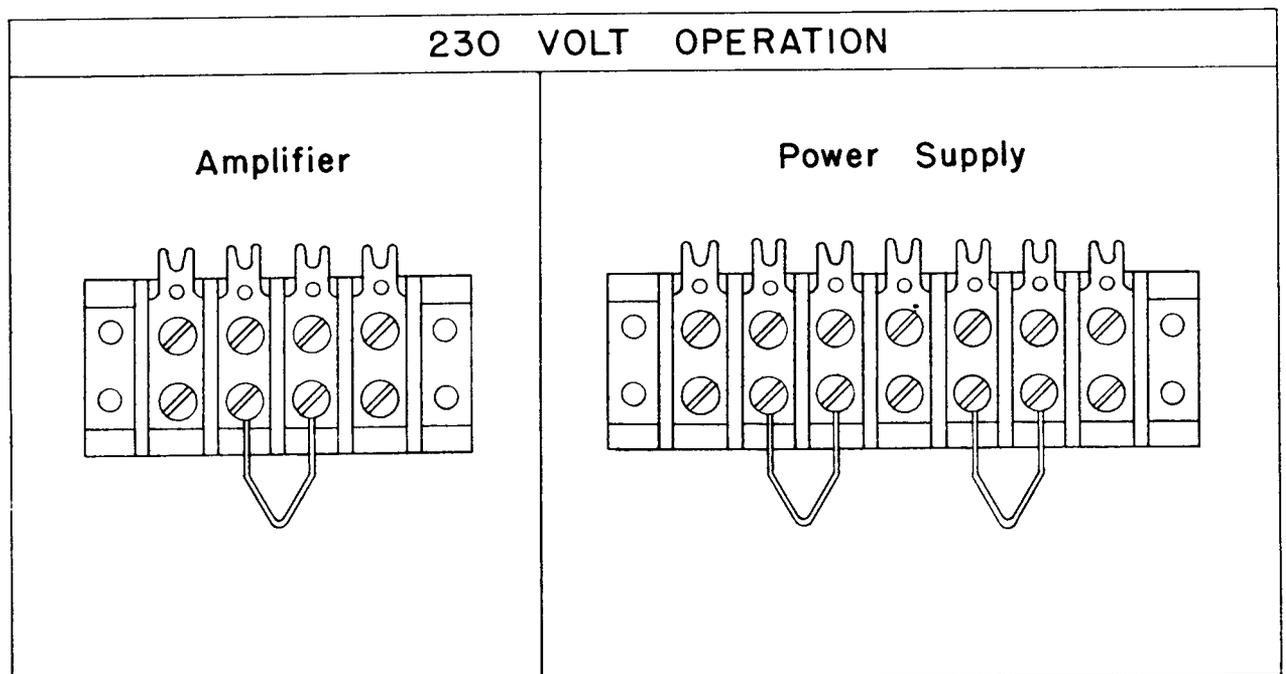
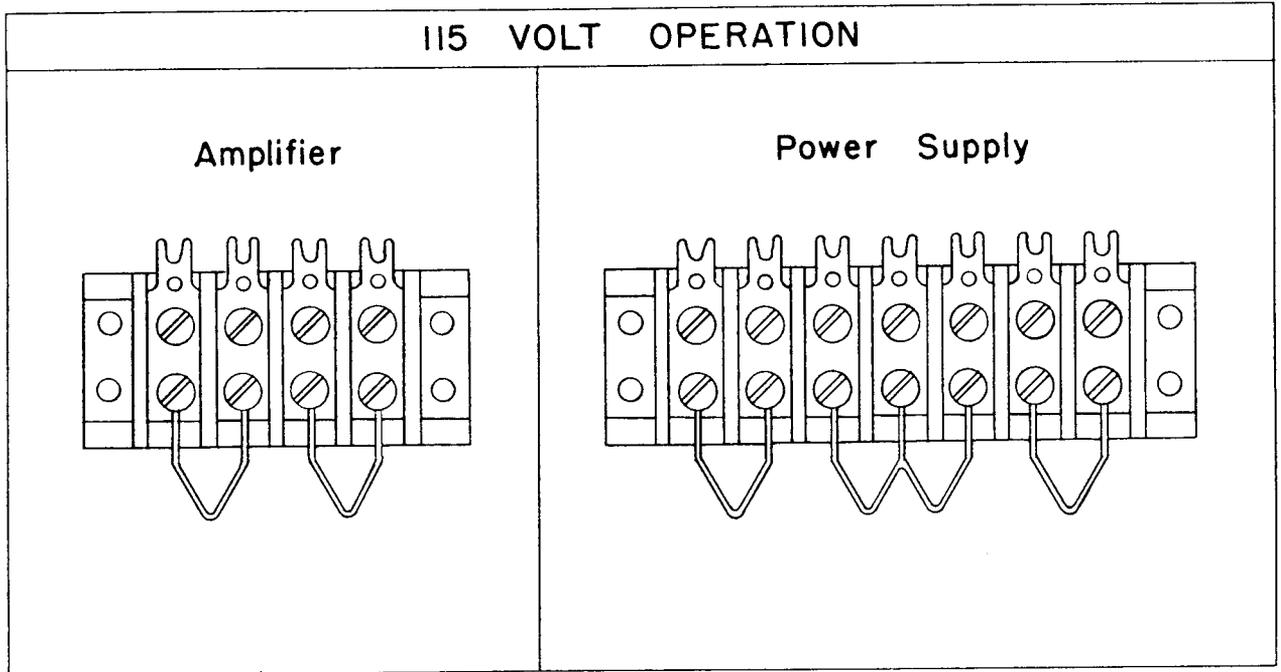
In general, the location of the L-4 is not critical, however, there are certain considerations which must be given to insure optimum performance. Care should be taken to insure that space is allowed around the amplifier and power supply cases to allow adequate air circulation. Extremely hot locations, such as near radiators or heating units should be avoided. Do not cover the tops of the amplifier or power supply cases with books, papers or other pieces of equipment or overheating may result. The back of the amplifier case must not be obstructed and should not be placed closer than 1 inch from a wall or the air inlet for the blower will be blocked and overheating of the amplifier tubes may occur.

D. POWER REQUIREMENTS

The L-4 is included with its own separate power supply which can be operated from either 115 VAC or 230 VAC 50 - 60 cycles. Because of the large variety of plug and socket configurations for 230 volt service, and because the L-4 can be operated from either 115 volts or 230 volts, a line plug is not furnished with the L-4. The L-4 is shipped from the factory with jumpers connected to operate on 230 VAC. It is highly recommended that the L-4 be operated from its own 230 volt 15 amp or greater, circuit. If a 115 V circuit is all that is available, it should be fused for 30 amps and the circuit conductors should not be less than #10 and no other equipment should be operated from this circuit. Do not under any circumstances operate the L-4 from a 115 volt lighting circuit because the circuit conductors are not large enough to safely carry this load.

E. JUMPER CONNECTION DIAGRAMS

Below are pictorials of jumper connections for both 230 V and 115 V operation. The jumpers in both the amplifier and power supply must be connected as shown or serious damage to the L-4 components may result.



F. LOW PASS FILTER

The L-4 has been designed in accordance with good engineering practices and second harmonic content is attenuated from the fundamental by at least 45 db. Because of the possibility that you may be using a multi-band antenna or have a feed line that is resonant at a harmonic frequency, it is highly recommended that a suitable low pass filter such as our model TV-1000-LP be used with the L-4.

G. ANTENNA REQUIREMENTS

The L-4 has been designed for use with antennas resonant at the operating frequency and having approximate impedances within the limits of 25 to 100 ohms. The nominal output impedance of the L-4 is 50 ohms and the SWR of this load should never exceed 2:1. Although there are many types of antennas which will meet these requirements, the simplest is a one half (1/2) wave dipole center fed with 52 ohm coax. For a detailed discussion on antennas, we suggest referring to an appropriate antenna book.

Most practical antennas exhibit an SWR range over a complete amateur band that exceeds 2:1. For this reason we recommend using an antenna matching network which will allow the L-4 to work into a 50 ohm load for maximum power transfer into the antenna.

CAUTION: NEVER ATTEMPT TO OPERATE THE L-4 WITHOUT FIRST CONNECTING IT TO AN ANTENNA OR 50 OHM DUMMY LOAD OF SUFFICIENT POWER HANDLING CAPACITY OR SERIOUS DAMAGE MAY RESULT.

H. GROUND REQUIREMENTS

The L-4 should be attached to a good earth ground through as short and as large a ground strap as possible for best results. A binding post is provided on the rear of the L-4 chassis for this purpose.

It is always a good idea to connect the chassis' of all associated equipment together and ground them at one point to avoid ground loops. We recommend that all of the equipment in your station be connected together and grounded at the L-4 amplifier chassis.

I. EXCITER REQUIREMENTS

To operate the L-4 at the maximum legal input, it will be required of the exciter to deliver to the L-4 input connector, 100 watts PEP-SSB R.F.

power and 75 watts R.F. power on CW, AM, RTTY and TUNE. The TR-3, TR-4, T-4/T-4X Transmitters all have adequate power to drive the L-4 to the maximum legal input allowed on SSB, CW, RTTY and AM. The exciter should be placed as close to the L-4 amplifier as practical so that the coax and ground strap will be short.

J. TRANSMITTING AGC

A jack on the rear of the L-4 amplifier is provided for connection to the exciter of a transmitting AGC voltage which controls the gain of the exciter so that any power level can be run up to 2000 watts PEP without peak clipping. The L-4 is supplied with a cable to connect this jack to a similar jack on our Model AC-4 Power Supply which terminates in the particular transmitter the AC-4 is powering.

A connector is available for AC-3 Power Supplies that brings out the vox contacts and a transmitting AGC connector from the transmitter that the AC-3 is powering.

K. VOX

A two pin jack on the rear of the L-4 amplifier is provided for connection to a pair of normally open relay contacts in the exciter which close on transmit and thus turn on the L-4 at the same time. The L-4 is supplied with a cable to connect this jack to a similar jack on our Model AC-4 Power Supply which terminates in the particular transmitter the AC-4 is powering.

Some exciters (except TR-3, TR-4, T-4/T-4X) ground one of the extra relay contacts made available to key a linear amplifier. For these exciters it will be necessary to plug the two pin connector into the L-4 vox socket in the correct position. With the exciter in standby, if plugging in the vox connector causes the L-4 plate current to read up scale. Reverse the vox connector in its socket so that the L-4 plate current is zero.

L INITIAL CONNECTION DIAGRAMS

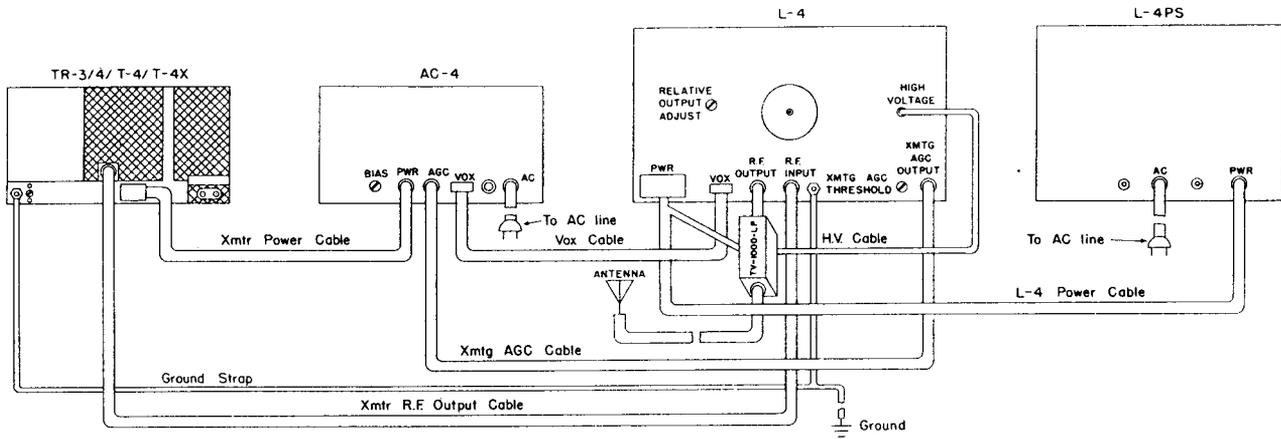


FIG. 1 CONNECTING THE TR-3/TR-4/T-4/T-4X AND AC-4 TO THE L-4 LINEAR AMPLIFIER

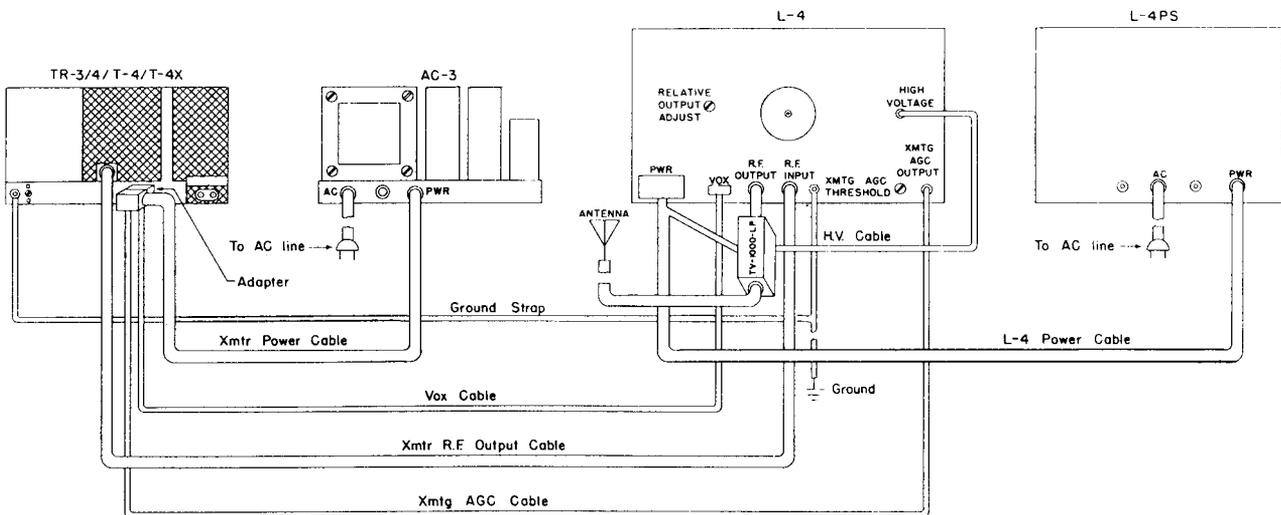
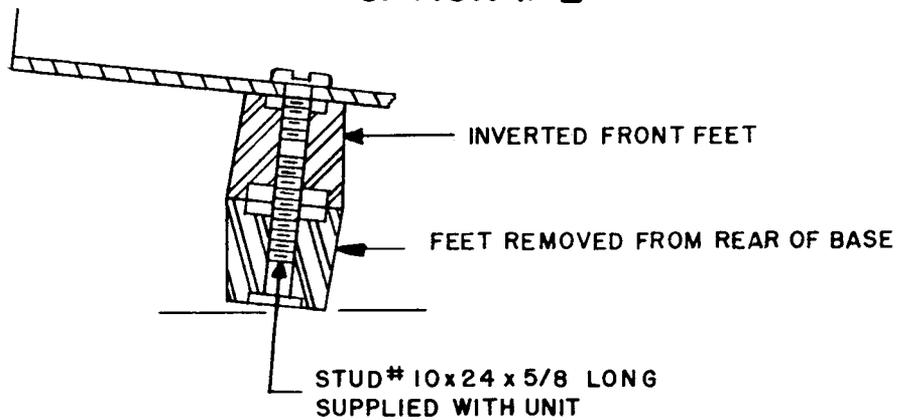
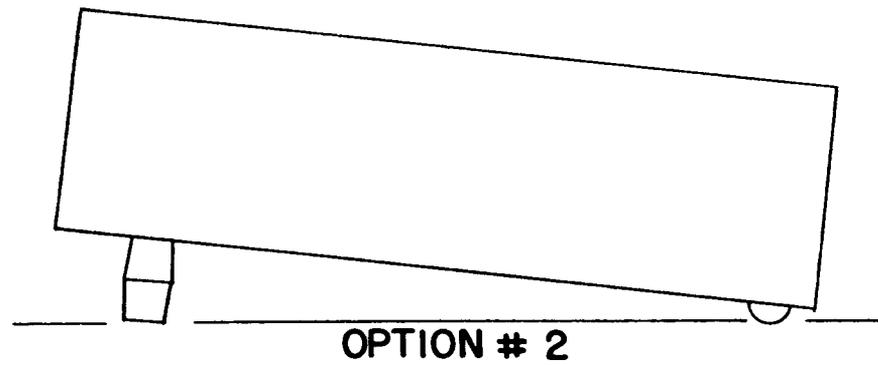
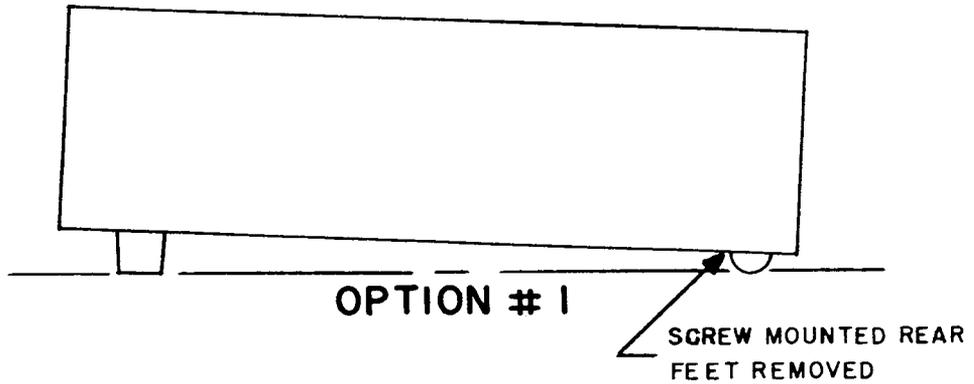
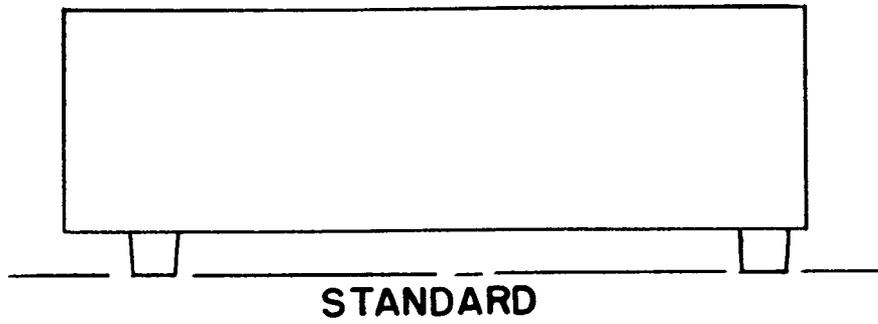


FIG. 2 CONNECTING THE TR-4/TR-3/T-4/T-4X AND AC-3 TO THE L-4 LINEAR AMPLIFIER

M. VIEWING ANGLE OPTIONS



TUNING PROCEDURE

WARNING -- Be sure that the L-4 is connected to a 50 ohm antenna or 50 ohm dummy load and that the proper jumpers have been installed in BOTH the power supply and linear amplifier for the line voltage that is to be used. (See 115 V and 230 V Jumper Connections, Page 6).

For all modes of operation, the L-4 is tuned up with a single R.F. frequency driving it and with the plate voltage switch in CW-TUNE position. The exciter may be tuned up on CW into the antenna connected to the L-4 by leaving the L-4 power turned off. The exciter should be checked to be sure that it is tuned up when driving the L-4 since the antenna connected to the L-4 may not be 50 ohms.

After the exciter has been tuned up, turn the exciter to standby and turn the L-4 on and the plate voltage switch (red rocker switch) to CW-TUNE position. The red light that indicates high plate voltage for SSB operation should be off.

Some exciters utilize transmitting AGC, sometimes called ALC, during all modes of operation. During tune up, transmitting AGC will have to be defeated by either unplugging the transmitting AGC connector, or turning the transmitting AGC threshold control fully counter-clockwise. TR-3, TR-4, T-4/T-4X Transmitters switch off AGC in TUNE, CW, and AM modes; it is unnecessary to externally defeat AGC on these transmitters.

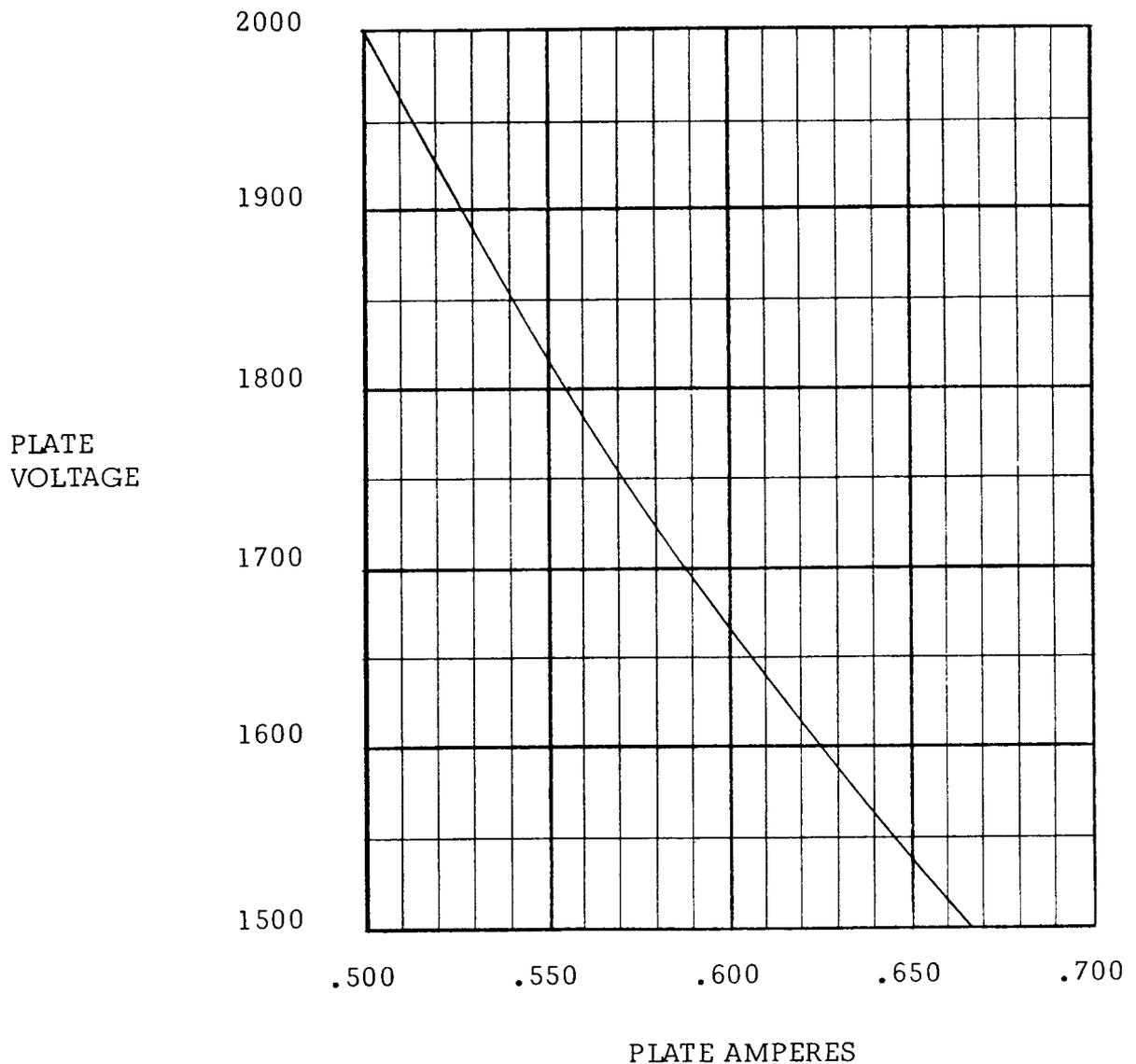
A. CW, RTTYPRESET THE CONTROLS AS FOLLOWS:

1. Plate voltage switch in CW-TUNE.
2. Band switch to desired band.
3. Meter switch to Relative output.
4. Load fully counter-clockwise (CCW) on the number zero.
5. Plate control in the arc provided for the desired band.
6. Turn transmitting AGC threshold control fully counterclockwise (CCW) (facing rear of L-4 Amplifier).

Turn on the exciter and increase the exciter output while not exceeding .4 plate amps and tune the plate control for a dip in plate current. Alternately adjust the load and plate controls while increasing the exciter power in small increments until maximum R.F. output occurs at .565 plate amps. If the relative output meter goes off scale during tune up, reduce the meter sensitivity by turning the relative output adjust control on the rear of the Linear Amplifier chassis in a counter-clockwise (CCW) direction. Because of variations in line voltage a graph is supplied below

which correlates plate voltage and plate current for 1000 watts D.C. plate input power and should be used to be sure that the L-4 is operating at or under the maximum legal input power. In case maximum legal input cannot be obtained because of low exciter power, tune the L-4 for maximum R.F. output power.

1000 Watts D.C. Input
VS
Plate Voltage and Plate Amperes



B. SSB, AMPRESET THE CONTROLS AS FOLLOWS:

1. Plate voltage switch in CW-TUNE position.
2. Band switch to desired band.
3. Meter switch to grid current.
4. Load fully counter-clockwise (CCW) on the number zero.
5. Plate control in the arc provided for the desired band.
6. Turn transmitting AGC threshold control fully counter-clockwise (CCW) (facing rear of L-4 Amplifier).

Turn on the exciter and increase the exciter output while not exceeding .4 plate amps and tune the plate control for a dip in plate current. While increasing the exciter power, maintain 220 ma of grid current with the load control until .565 plate amps is reached. Leave the exciter power at this level and re-dip the plate current with the plate control and then bring the grid current back to 220 ma with the load control. The L-4 will now be very close to being tuned up and only small adjustments of the driving power, and plate and load controls will be necessary to obtain .565 plate amps with 220 ma grid current at resonance.

The relative output meter is a more sensitive indication of plate tank resonance than plate current dip, and the plate control should be adjusted for maximum relative output while still maintaining the relationship of .565 plate amps to 220 ma grid current. If the relative output meter goes off scale during tune up, reduce the meter sensitivity by turning the relative output adjust control on the rear of the linear amplifier chassis in a counter-clockwise (CCW) direction. In case .565 plate amps cannot be reached because of low exciter power, tune the L-4 for maximum R.F. output power.

OPERATION

In the following information concerning operation on various modes, it is assumed that the L-4 and its exciter has been tuned up on the desired operating frequency as described in the Tuning Procedure.

While transmitting with the L-4 over extended periods of time, the 8163 plates may show a dull red color. This is normal and does not detract from the life of the tubes. If the plates display a very bright orange color it is advised that the L-4 be checked to determine that it is not being over-driven and that it is tuned up properly. The L-4 should not be turned off immediately after long periods of transmitting, but should be left on standby with zero plate amps for several minutes to allow the 8163 tubes to cool down.

A. CW, RTTY

For CW and RTTY operation the plate voltage switch should be in CW-TUNE position. With the exciter on and the key depressed, adjust the drive level until the product of plate voltage and plate current is at or under 1000 watts as indicated on the graph on Page 12 in the Tuning Procedure.

B. SSB

For SSB operation the plate voltage switch should be in SSB position and the red light that indicates high plate voltage should be on. The transmitting AGC threshold must be set before using the L-4.

With the plate voltage switch in CW - TUNE position the transmitting AGC threshold is adjusted by applying a large single audio tone into the microphone input of the exciter by either an oscillator or by whistling a single tone into the microphone with the exciter adjusted for maximum output. With this single tone applied, turn the transmitting AGC threshold control clockwise until the plate current is .580 amps. If you desire to run less than 2 kilowatts PEP, turn the transmitting AGC threshold control clockwise until the single tone plate current decreases to the power level you desire. Return the plate voltage switch to SSB. The AGC threshold control needs only to be set once on each band. When making large changes in frequency within a band, the L-4 should be checked for plate tank resonance while still maintaining the relationship of .565 plate amps to 220 ma grid current on CW - TUNE. Under normal voice operating conditions, the exciter should be adjusted to run the L-4 plate meter between .250 to .300

amps. .400 amps of plate current is the maximum legal input allowed and this level should be reached only occasionally and never exceeded.

If the exciter has no provisions for transmitting AGC, the output from the L-4 should be monitored with an oscilloscope to check for peak clipping.

C. AM

For AM operation the plate voltage switch should be in SSB position and the red light that indicates high plate voltage should be on. The L-4 works quite favorably with the TR-3, TR-4, T-4/T-4X on AM since these transmitters use controlled carrier modulation. Transmitting AGC is not used on AM with the TR-3, TR-4, T-4/T-4X Transmitters and the L-4 output should be monitored with an oscilloscope to check for peak clipping. If the L-4 is to be used with a 100% modulated AM transmitter, the exciter should be adjusted to run the L-4 at 500 watts D.C. input with an unmodulated carrier.

THEORY OF OPERATION

The 50 ohm input is matched to the 8163 cathodes by a pi-network on each band which is selected by the input switch S1a, S1b. The input switch is ganged to the bandswitch S2. Negative feedback in the L-4 amplifier is obtained by slightly raising the grids above ground with capacitors C24, C29, C30, C31, C32 and C37.

When the negative going peak RF voltage from the capacitor divider C23, C25 exceeds the positive bias set by R3, the transmitting AGC threshold control, D1 conducts and a negative voltage proportional to the R.F. signal applied to the input appears at the transmitting AGC output connector.

D3 rectifies the R.F. voltage from the capacitor divider C55, C56 to operate the lower meter in relative output position. Changing the value of R14 causes a change in the sensitivity of the relative output meter. A positive voltage from the resistor divider, R8 in the power supply and R3 in the amplifier, is applied to the cathode during standby which cuts off the plate current.

The plate circuit is matched to the 50 ohm output by the adjustable pi-network consisting of C46, L6, L7, C49, C50, C53 and C54.

SERVICE DATA

WARNING - - EXTREME CAUTION SHOULD BE EXERCISED WHENEVER MAKING ANY ADJUSTMENTS INSIDE EITHER THE AMPLIFIER OR POWER SUPPLY. BEFORE MAKING ANY ADJUSTMENTS TO THE L-4 UNPLUG THE POWER SUPPLY FROM THE POWER LINE, UNPLUG THE POWER CONNECTOR GOING FROM THE POWER SUPPLY TO THE L-4, AND LAST ; DISCONNECT THE HIGH VOLTAGE TERMINAL FROM THE AMPLIFIER.

A. AMPLIFIER :

1. Removing top cover -

After completely disconnecting the L-4 from all sources of power, the top cover can then be safely removed by taking out the top row of three screws on both sides of the amplifier.

2. Removing bottom cover -

After completely disconnecting the L-4 from all sources of power, the bottom cover can then be safely removed by taking out the bottom row of three screws on both sides of the amplifier.

3. Removing front panel -

The front panel can be removed only after first removing the top and bottom covers of the amplifier. The knobs should be removed next followed by removal of the six screws that hold the front panel to the chassis. Finally, unsolder the leads of the front panel indicator lights from their terminal strip. Be careful to note the terminals that each lamp was connected to so replacement will be made easier.

4. Cleaning amplifier compartment -

Since the amplifier compartment is forced-air cooled, it will collect particles of dust which must be removed periodically. The frequency of cleaning will be governed by how many hours the L-4 is operated, and by how clean its environment is. When the blower wheel accumulates a large amount of dust, the amplifier should be cleaned. The best way to clean the amplifier is to remove the top and bottom covers and blow the dust out with compressed air. If compressed air is not available, a soft bristled 1 inch paint brush can be used to brush the amplifier clean.

5. Tube replacement -

If it becomes necessary to replace the tubes in the L-4, the same brand should be used or it may be necessary to tune the input coils (See Input Coil Adjustment). If one tube needs replacement, it should be replaced by the same brand of tube as originally supplied.

6. Input Switch Drive Belt Replacement -

The input switch is linked to the bandswitch by two pulleys and a bead belt. If the belt ever needs replacement, it should be done in the following manner. Set the bandswitch to 20 meters and remove the top and bottom covers of the amplifier and remove the front panel. Loosen the setscrews in the pulley that is on the bandswitch shaft and remove the pulley. Hold the input switch shaft and remove only the pulley on this shaft. If the input switch shaft has been removed, great caution in replacing this shaft must be taken to insure that the input switch rotors are aligned and are not damaged by the shaft insertion forces. Set the input switch on 20 meters and with the new belt connecting both pulleys, install the pulleys on their respective shafts at the same time. The copper sleeve on the chain should be midway between the two switch shafts. Before tightening the setscrews on the bandswitch pulley, check that the input switch is still aligned for 20 meters. Tighten the set screws, replace the front panel and amplifier covers.

7. Troubleshooting -

Careful consideration has been given to the design of the L-4 to keep maintenance problems to a minimum. However, it is quite possible that some problem will arise which cannot be cured by tube substitution. If this occurs, we suggest that you either return your unit to your dealer, or write direct to our Service Department describing your problem in detail. Include full information concerning external connections, control settings, associated equipment, antenna, etc.

DO NOT RETURN EQUIPMENT TO THE FACTORY WITHOUT PRIOR AUTHORIZATION.

SERVICE DATAB. POWER SUPPLY:

1. Circuit breaker reset - There are two buttons on the power supply which are provided for resetting the circuit breakers in case they should trip from overloading.

If the circuit breakers trip, turn off the L-4 and wait for one minute before resetting. If the circuit breakers trip immediately after resetting and turning the L-4 on, an investigation should be made to determine the cause of the overload.

2. Removing bottom cover -

After completely disconnecting all sources of power, the bottom cover of the power supply can be removed by taking out all of the screws around the bottom of the power supply chassis.

3. Removing top cover -

The top cover cannot be removed until the bottom cover has first been removed. After the bottom has been removed, check to be sure that the line cord has been unplugged and then disconnect the line cord from its barrier strip. The top can then be removed by taking out the remaining screws holding the top cover to the chassis.

4. Troubleshooting -

Careful consideration has been given to the design of the L-4 Power Supply to keep maintenance problems to a minimum. However, if the power supply fails to function, first check the circuit breakers and reset them if it is necessary. If the circuit breakers continually trip, check for short circuits in the high voltage line. Especially be certain that the high voltage interlock in the amplifier is not shorting the high voltage to ground as it is supposed to do when the top cover is taken off the amplifier. If the circuit breakers have been tripped because of a short in the high voltage line, a continuity check should be given to each silicon diode bank to determine if either or both banks have failed. In the event of a

short circuit, resistor R12 in the power supply will be destroyed. This resistor protects the diodes in the power supply and it should be replaced with an IRC .82 ohm 2 watt type BWH resistor ONLY. In the event of difficulty, we recommend that you return your unit to your dealer, or write direct to our Service Department describing your problem in detail. Include full information concerning the circumstances during the failure and any measurements that were made.

DO NOT RETURN EQUIPMENT TO THE FACTORY WITHOUT PRIOR AUTHORIZATION.

ALIGNMENT

A. INPUT COIL ADJUSTMENT:

If the final amplifier tubes are replaced with a brand other than originally supplied, the input coils may have to be retuned.. The input coils can be retuned if it is desired to operate the L-4 outside of the amateur bands.

Input coil adjustment is done with a 50 ohm SWR bridge inserted between the exciter output and the L-4's R.F. input coax jack.

To tune the input coils, first disconnect the L-4 Power Supply from the power line, remove the bottom cover of the power supply (See Page 19) and remove the jumpers from the 7 terminal barrier strip (See Page 6). Removing these jumpers allows the filaments, relay power, and the blower to operate without the high voltage on. After removing the jumpers in the power supply, remove the top cover of the amplifier and DO NOT defeat the high voltage interlock. The amplifier should be connected to the exciter as for normal operation (See Page 9) with the exception of the SWR bridge in the input line. Preset the controls as follows:

1. Bandswitch on desired band to be tuned.
2. Load fully counter-clockwise (CCW) on the number zero.
3. Plate control in the arc provided for the desired band.

With the exciter tuned up on CW in the middle of the band to be tuned, turn on the L-4 and increase the output from the exciter until the plate meter reads .4 amps. Tune the plate control for a dip in plate current and turn the slug on the correct input coil for a minimum reflected power reading on the SWR bridge that is connected between the exciter output and the L-4's R.F. input. The input coils are adjusted at the factory for the center of each band and are broad enough to cover the entire band. When the coils are tuned on the amateur bands the slugs are close to the top of their travel.

B. METER ADJUSTMENT

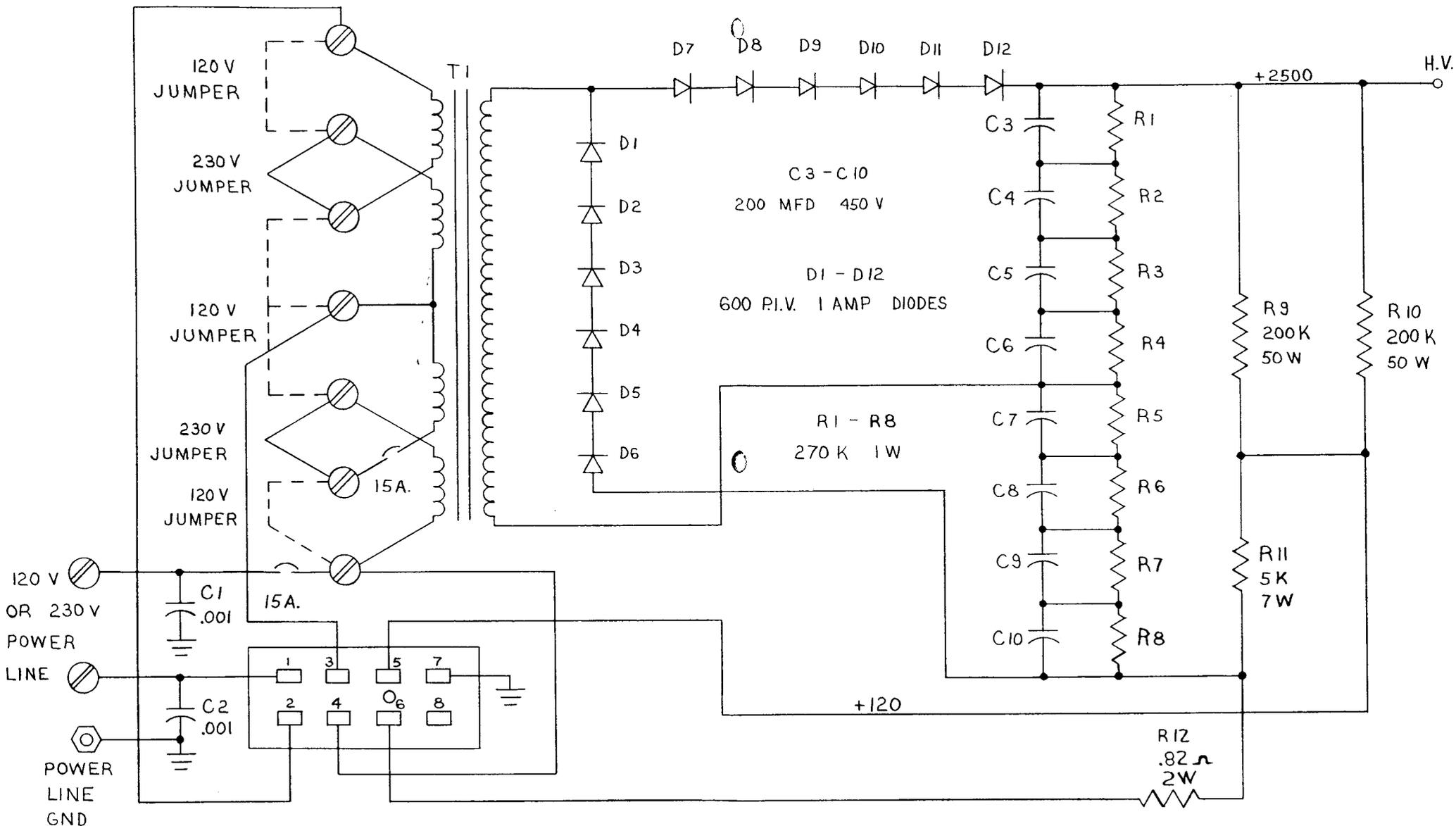
The two meters on the front panel can be set to zero if it should become necessary by removing the top and bottom covers, knobs, and front panel on the amplifier (See Service Data). The meters are set to zero by a conventional zero-setting screw adjustment on

the lower face of the meter. The shunt for the grid current meter is adjusted in production and should normally never need calibration. If the lower meter or R8 is ever replaced, the grid current shunt will have to be calibrated. This can be done by completely disconnecting the amplifier and removing the top cover. Defeat the high voltage interlock by setting a book on top of the operating rod only after all connectors have been removed from the amplifier. Place the meter switch in grid current position. The grid current meter can be calibrated against a standard meter in series with a 1-1/2 volt battery in series with a 10 ohm potentiometer. The negative battery terminal connects to the L-4 chassis and the positive lead should be connected at the junction of R5, R11, R16 and C40. When the standard meter reads .400 amps, adjust R16 until the grid current meter reads 400 ma. If no standard meter is available, reverse the wires going to the plate meter terminals and connect the positive terminal of a 1-1/2 volt battery in series with a 10 ohm potentiometer to pin 6 of the power connector on the rear of the amplifier. Connect the negative lead to ground. Adjust the 10 ohm potentiometer until the plate meter reads .400 amps and then make the grid current meter agree at 400 ma by rotating R16. Replace the wires on the plate meter to their original posts and replace the top cover on the amplifier.

C. KNOB POINTER ALIGNMENT

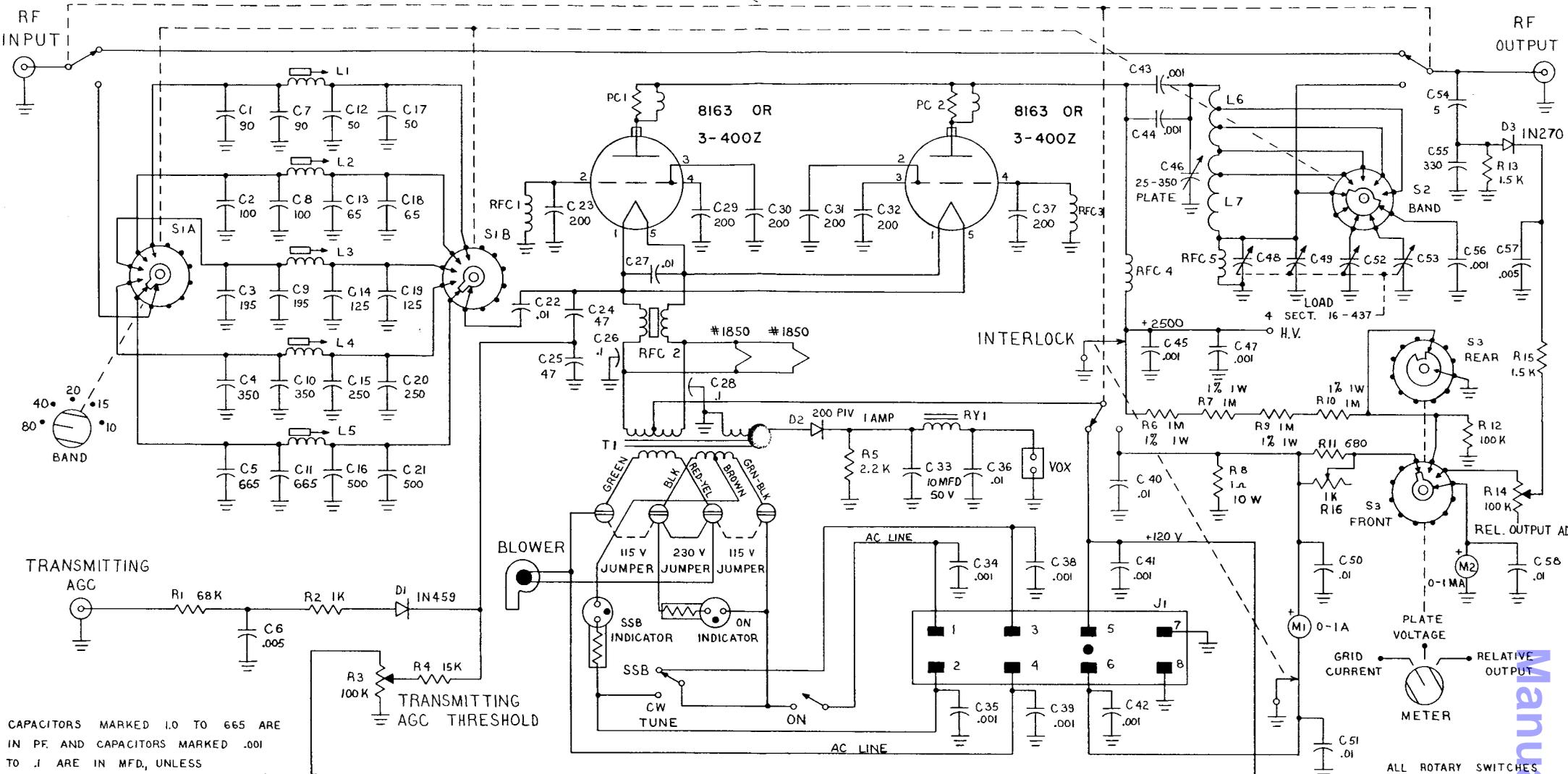
When replacing the knobs on the L-4 amplifier, correct alignment of the plate and load controls is important. All of the other controls have flats on the control shafts and the setscrews in the knobs should press against the flat.

The load control shaft should be rotated fully counter-clockwise (CCW) and the knob pointer resting on the number zero before the setscrew is tightened. The plate control shaft should be rotated so that the plates of C46 are fully meshed and the pointer on the knob should be resting in a nine o'clock position at the end of the tuning arc. The plate control knob is set by tuning up the L-4 on 21.225 MHz 1000 watts CW. After tune-up loosen the set screw in the plate control knob and tighten it with the pointer in the middle of the 15 meter arc.



POWER CONNECTOR SHOWN FROM SOLDER CONNECTION END

SCHMATIC DIAGRAM
MODEL L-4 PS POWER SUPPLY



CAPACITORS MARKED 1.0 TO 665 ARE IN PF. AND CAPACITORS MARKED .001 TO .1 ARE IN MFD, UNLESS OTHERWISE NOTED. RESISTORS ARE 1/2 WATT 10% EXCEPT WHERE NOTED. J1 SHOWN OUTSIDE VIEW.

ALL ROTARY SWITCHES ARE SHOWN LOOKING INTO SHAFT AND IN FULLY CCW POSITION.

SCHEMATIC DIAGRAM MODEL L-4 LINEAR AMPLIFIER

