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EFFECTIVE FEB. 1980

M **HAMMOND**
W **MANUFACTURING™**
COMMUNICATION
PRODUCTS DIVISION

SERIES

HL

HF LINEAR AMPLIFIER HL-2000A



Fig. 2



**HF LINEAR AMPLIFIER
HL-2000A**

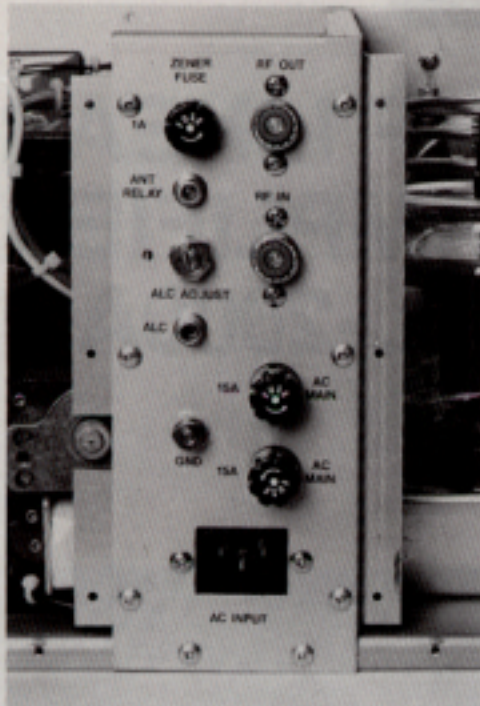


Fig. 3

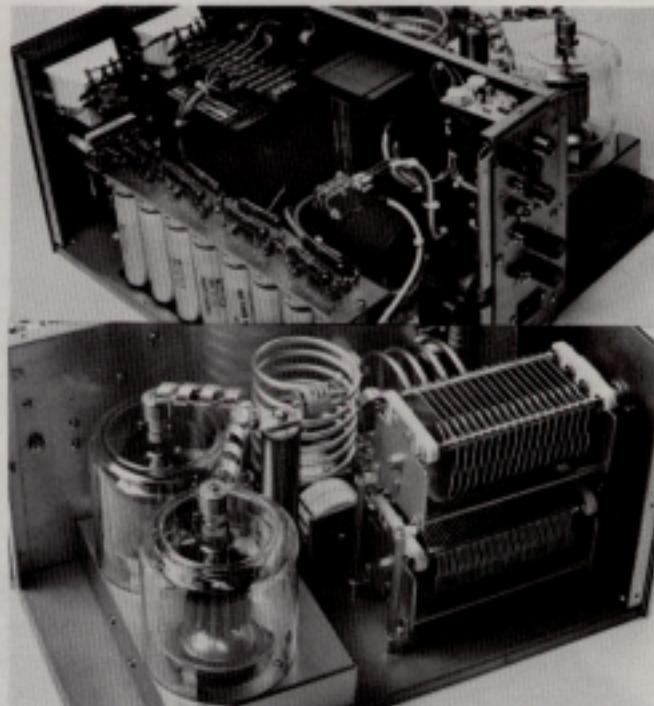


Fig. 4

FEATURES

BAND COVERAGE	10M, 15M, 20M, 40M, 80M, Amateur Bands May be expanded for Mars, Government or other services (Consult Factory)
TUBE COMPLIMENT	(2) 3-500Z Zero Bias Triodes
COOLING	Forced Air Chimney Cooling (Continuous Duty Squirrel Cage Blower)
ALC	Adjustable, (Negative)
SAFETY	Interlock for Input AC 100% Fused AC Line and Cathode Circuit
POWER TRANSFORMER	Special Hammond Transformer designed for continuous duty operation rated at 1100VA — 60 Hz — Weight 28 Lbs.
POWER SUPPLY	Computer Grade Capacitors for Max. Reliability
INPUT CIRCUIT	PI—Input Circuitry for each band
OUTPUT CIRCUIT	Full Pi-L Network
LINE VOLTAGE	120VAC or 240VAC (240VAC recommended)
METERING	Plate Current Grid Current Plate Voltage Wattmeter, FWD/REF.
TRANSIENT PROTECTION	Primary, HV and Filament Surge Suppression

SPECIFICATIONS

FREQUENCY RANGE	3.5 MHz to 29.5 MHz (Amateur Bands)
DRIVE POWER	75W to 125W
MODE & DUTY CYCLE	SSB CW Continuous RTTY
RF INPUT POWER	SSB 2 KW PEP Continuous CW 1 KW Continuous RTTY 1 KW Continuous
PLATE VOLTAGE	SSB With Resting Current 2900VDC CW With Resting Current RTTY 2100 VDC
CIRCUIT CONFIGURATION	AB ₂ Grounded Grid
INPUT MATCH	50 Ω (16 dB Return Loss)
HARMONIC SUPPRESSION	Depending on Exciter -40dB Utilize RF Inverse Feed-Back
INTERMODULATION DISTORTION PRODUCTS	In excess of -33dB
ALC	Negative, Adjustable (-8VDC Max.)
TUBES	Two 3-500Z Zero Bias Triodes
POWER REQUIREMENTS	120/240VAC, 15 Amps (120VAC Not Recommended)
DIMENSIONS	8" High x 16" Wide x 15 3/4" Depth
WEIGHT	75 Lbs. or 34 Kg.

Introduction

The Hammond HL-2000A HF Linear Amplifier is a one-stage linear amplifier using two glass envelope 3-500Z Eimac Triodes. The unit is a completely self contained table top unit capable of 2000 watts Pep input. In keeping with the past tradition of the HL-500 and HL-750 series amplifiers, only the highest quality components were used in the design of this amplifier. The amplifier is designed for SSB, CW, RTTY or Am operation on the amateur bands between 3.5 and 30 MHz. The amplifier can be factory modified for frequencies outside the amateur bands for commercial or military applications.

The HL-2000A comes factory wired for 230 vac but can be re-wired for 115 vac operation (not recommended unless a 25 - 30 amp 115 vac source is available.

PLEASE READ INSTRUCTIONS carefully and fully before attempting to operate the amplifier.

CAUTION: There are very dangerous voltages present inside the amplifier when the power is in on position. Removing the top cover while the AC power is connected must be done cautiously and with the utmost care.

Installation

1. Remove the amplifier from the shipping carton and examine for damage, (notify the transport company immediately if any damage is present.)

2. Save carton for future shipment to another location or storage.
3. The 3-500Z triode tubes are shipped separately and must be installed before operating amplifier in any way.
4. The following accessories should be included with your HL-2000A amplifier:
 - (a) Instruction Manual
 - (b) Warranty Card
 - (c) Shielded Control Cable
 - (d) Extra Fuses (Cathode 1A) (ABC-15)

Operating Location

The amplifier must be located in an open area such that the flow of air from the top is unrestricted. Location should be as close as possible to a reliable 115/230 vac AC source to minimize any AC voltage drop.

Installing Tubes (See Figure 4)

1. Remove 4 bolts from bottom of linear cabinet and carefully slide the inner part of the unit from the rear of the cabinet.
2. Remove the perforated top cover of the amplifier giving access to the interior of the RF section of the amplifier.
3. Put the two 3-500Z tubes in their respective sockets. Be very careful not to exert any lateral or twisting pressure on the glass portion of the tubes. They are easily damaged. Fasten each plate lead to its appropriate anode connector. Remove the screw in the top of each anode connector on top of the tube and flex the parasitic choke and plate lead until the mounting hole in the plate is positioned directly above the screw hole in the anode connector. Insert the screw and hold the plate lead firmly while tightening the screw.

CAUTION: Do not, under any circumstances, exert too great a pressure or twisting, bending motion in the anode connector or glass portion of the tubes. Excessive pressure can cause a hair-line fracture in the tubes' glass envelope, destroying the tube. The tubes' pins are also particularly delicate, and can easily break if the tube is not inserted and removed very carefully.

4. Replace the top shield but leave the outside cabinet off until the amplifier has been connected and tested.

Cabling

All the following cables must be connected before the amplifier is operated.

AC Power Cable: The HL-2000A amplifier comes from the factory wired for operation from a 230 vac single phase, 60 Hz power source. The green wire in the power cord is the ground wire and must be connected to the neutral primary of the plug that you select for connection into the power line. The black and white wires must be connected to the other two pins for the 230 vac operation. The other lead of the Belden AC cord plugs directly into the rear panel AC input socket.

For 115 vac operation, it is only necessary to change several jumper connections on the terminal strip located on the power transformer in the power supply compartment.

See Figure 1.

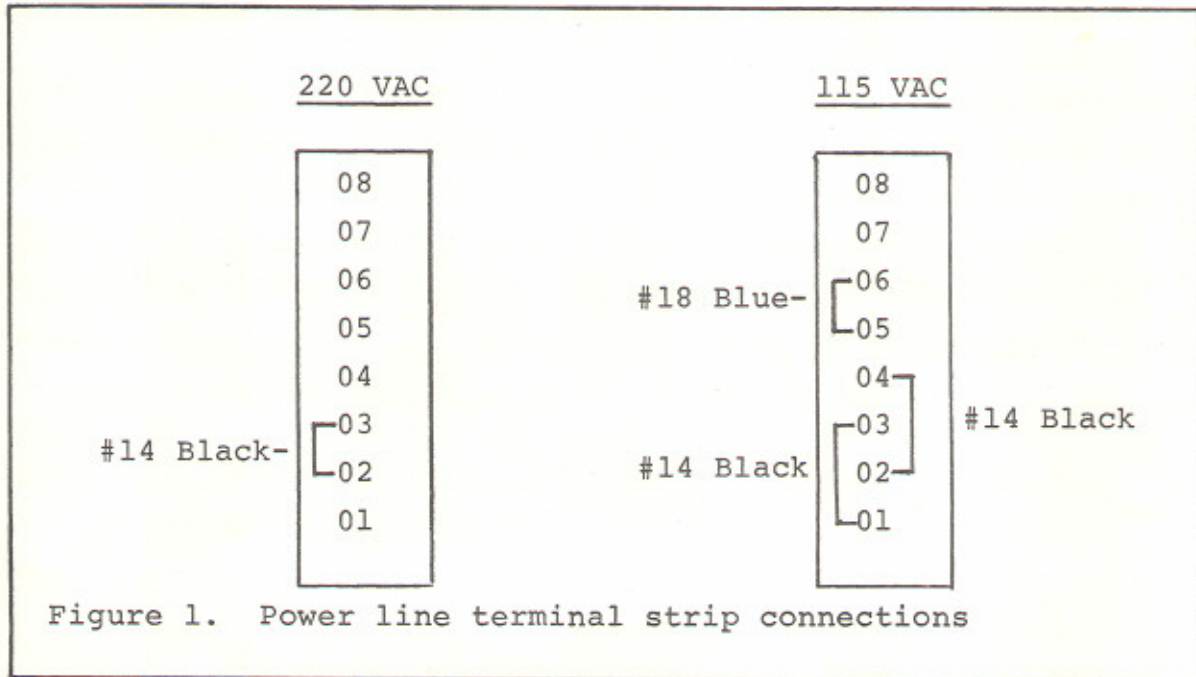


Figure 1. Power line terminal strip connections

CAUTION: The amplifier will be damaged if the green wire is connected incorrectly. Be sure to disconnect AC plug from the amplifier before changing jumpers on the terminal strip.

Antenna Coax: Use only RG 8/u coax (or its equivalent) to connect the HL-2000A to the antenna. The antenna connector mates with the amphenel connector marked RF out, on the rear panel of the amplifier.

CAUTION: Do not operate the amplifier without a load or into a load with SWR greater than 2:1. Measure the antennas' SWR with an SWR meter or in-line Watt-meter and determine that the SWR is in fact less than 2:1.

With standby/operate switch in the standby position, the exciter output will pass through the amplifier directly to the antenna. The amplifier does not have to be off to accomplish this bypass.

Input Cable: A cable must be connected from the output of your exciter to the S0-239 RF input connector on the rear panel of the amplifier.

ALC (automatic level control) Cable: Plug the ALC cable into the phono jack located on the rear panel (marked ALC) and into the ALC feedback connection (or equivalent) on the exciter. If the exciter does not have provision for feedback of ALC voltage from the amplifier, than simply omit the use of the cable.

Antenna Relay: A control cable should be plugged into the phono socket marked ant. relay on the rear panel of the amplifier. This cable connects the keying signal from the exciter to switch the amplifier to the transmit condition and must be plugged into the socket or connector marked antenna relay (or equiv.) on the exciter. The exciter need only supply a shorting relay contact (during transmit) to key the amplifier.

CAUTION: Do not apply any voltage to the antenna relay phone jack. The internal relay is activated by a self-contained power supply.

Operating Controls: Refer to Figure 2.

Off/On Power Switch: This switch is used for turning the amplifier on and off.

Multimeter Switch: This 4 position pushbutton switch selects the function of the multimeter as described below.

HV: With the switch in this position, the meter monitors the amplifiers' plate voltage. The full scale reading in this position is 4000 VDC. Normal plate voltage with the amplifier in the standby position (unkeyed) is about 3200 VDC for SSB operation and 2500 VDC for CW operation. Line voltage variations will cause corresponding variations in the plate voltage. (Note: Reading for plate volts is X10).

Grid: With the switch in this position, the meter monitors the amplifiers' grid current. The full scale meter reading in this position is 400 ma DC. The nominal grid current during SSB on peaks is approximately 100 ma. Maximum tune-up grid current in SSB or CW single tone is 240 ma marked on the dial as a red bar.

Wattmeter

FWD: In this position, the meter monitors the output power of the linear - maximum reading is 2000 watts.

REFL: The meter monitors the reflected power. The full scale reading of the reflected power scale is 200 watts.

SSB/CW Switch: This 2 position switch selects the two plate voltages to ensure correct loading and output for each type of emission.

Standby/Operate Switch: This switch allows the exciter bypass feature i.e. in the standby position, the power of the exciter feeds through the linear and appears at the output connector. In the operate mode the linear is ready for transmitting.

Standby/Operate Lights: These pilot lights marked standby and operate indicate the status of the standby/operate switch. In the standby mode the light is red and in the operate mode green.

Zener Fuse: This 1 amp fast-blo fuse is the cathode fuse. Never use a higher amperage fuse than the one specified.

Tune Control: The tune control is a vernier dial connected to an air variable in the RF section. The disc dial is screened 100 to 0 indicating that maximum capacitance is at 100 and minimum at zero. Approximate settings for the tune control settings for the amateur bands are given in Figure 3 for your convenience.

Load Control: This control matches the amplifiers output network to the load. Refer to Figure 3 for the approximate initial settings for the frequency range desired. A load setting of 100 corresponds to maximum load capacitor mesh and 0 represents minimum capacitor setting.

Band: The bank switch selects the applicable input and output circuits for the HL-2000A to operate in any one of the following bands:

- (a) 80 meters 3.5 to 4.0 mHz
- (b) 40 meters 7.0 to 7.3 mHz
- (c) 20 meters 14.0 to 14.35 mHz
- (d) 15 meters 21.0 to 21.45 mHz
- (e) 10 meters 28.0 to 29.7 mHz

NOTE: The amplifier has the capability to transmit on many frequencies outside the above bands by switching the amplifier to the band closest in frequency to the desired operating frequency. For services, other than amateur use, this may be applicable.

CAUTION: Never move the band switch while the linear amplifier is keyed or operating.

Rear Panel Controls (See Figure 3)

RF Out: Nominal output impedance is 50 ohms. Do not operate this equipment without a load or into a load where the SWR is greater than 2:1. Use only RG-8/u coax or its equivalent to connect to an appropriate antenna or dummy load.

RF In: This amphenol type S0-239 connector accepts the drive coax from an exciter.

Zener Fuse: This fuse protects the cathode circuit from over-current. It is a 1 amp fast-blo type of fuse.

Ant Relay: This is a phono jack input that when shorted to ground the amplifier antenna relay closes.

ALC Adjust: This potentiometer controls the sensitivity of the HC-2000A's ALC circuit.

ALC: The ALC feedback (negative) to the exciter is available to this socket.

AC Main: These are the two fuses for the main 115/230 VAC mains. They are ABC ceramic type and must not be substituted for any other types.

GND: This lug is provided to ground the amplifier. This should be connected to a good earth ground to minimize radiated interference or the danger of electrical shock.

AC Input: This the main input AC socket that accepts a heavy duty Belden power cord. Note the 3 pin arrangement on the socket and the fact that the centre pin is ground. Push the plug of the power cord when ready for use until it is fully seated in the socket. No other cord is recommended for use with this socket.

Operation:

<u>Preliminary Settings</u>	<u>Setting</u>
(1) Standby/operate switch	Standby
(2) SSB/CW switch	CW
(3) Multimeter switch	Grid
(4) On/Off switch	On

As soon as the ON switch is activated the standby pilot lamp should light RED and the meter's a soft yellow. Look into the interior of the linear to make sure that the tube filaments are lit and that there is a flow of air from the top of the cabinet. This can be done by putting your hand over each tube from the top to feel the flow of air.

The 3-500Z require no warm-up time.

- (5) Push HV on the multimeter switch. It should read approximately 240-260 indicating a plate voltage of 2400 - 2600 in the CW mode.

- (6) Pushing the SSB/CW switch to SSB should give a corresponding reading of 2900 - 3100 vdc.
- (7) Switch SSB/CW switch back to CW position.
- (8) Switch multimeter switch to GRID.
- (9) Switch "band" switch to desired band.
- (10) Pre-set tune and load vernier dials to that referred to in calibration chart figure 3.

SSB Operation:

- (11) Switch and standby/operate control to operate. Operate light should be GREEN.
- (12) With exciter adjusted for zero output press the PTT switch of the exciter causing the HL-2000A and the exciter to go into the transmit mode.
- (13) The amplifier's plate current meter should register approximately 60 ma. (Note SSB/CW switch in CW). Switching SSB/CW to SSB will show a plate current reading of approximately 135 ma. Switch SSB/CW back to CW.
- (14) Increase the RF output of the exciter until the amplifier's grid current is about 90 ma. Adjust the tune control for a minimum plate current reading indicating resonance. If the load control is set properly, the plate current will be approximately 400 ma. If the plate current is less than 400 ma, increase the load slightly by moving the load control to a higher number on the dial. If the plate current is say more than 420 ma decrease the load slightly by moving the load control to a lower number.

Do not forget to re-dip the tune control each time the load control is changed.

Check that the grid ma reading is approximately 80 - 90 ma, if not, re-adjust the exciter output to give the required 80 ma \pm 10% grid current reading.

NOTE: The tuning, loading and exciter control adjustments may have to be repeated several times until the ratio of 80 ma grid to 400 ma plate current is obtained. Note that the higher the frequency the more precise these adjustments will become apparent. Also the lower the frequency, the broader are these adjustments.

(15) To verify the peak power condition increase, the RF output of the exciter for a plate current reading of 800 ma. With the full drive the grid current should be approximately 240 ma (red mark on dial). Single tone adjustments while tuning should be made such that the grid current never exceeds 240 ma. This very quickly reduces the life of the tubes. (Use dummy load only for these measurements.)

NOTE: The 3-500Z tubes should show colour, glowing a dull cherry red with 400 ma of plate current and possibly a brighter orange at 800 ma. When operated in this manner, the tubes are within their ratings and can be operated in this way only if the plate circuit is a resonance (plate current dipped to a minimum with tune control). The amplifier should never be operated for any length of time in an off resonance condition.

(16) Release the PTT switch of the exciter to allow the amplifier and exciter to go into the unkeyed status. Switch SSB/CW switch to SSB. Place the exciter into the SSB mode and while speaking into a microphone, adjust the audio gain control for voice peak plate current readings of around 350 ma. The grid current peaks, should be around 50 - 100 ma. Check for proper drive with a monitor scope if one is available.

CW Operation: Adjust the SSB/CW switch to CW and tune amplifier as above except that the plate current should be no greater than 500 ma. Grid current will be approximately 120 ma.

AM Operation: Tune and load as above except that

- (a) grid current = 100 ma
- (b) plate current to give approximately 400 watts output.

FSK Operation: The HC-2000A is designed to operate the 1 kilowatt input level continuously and tune adjust as required for 120 ma grid current and 500 ma of plate current.

ALC Adjustment: Drive the amplifier to 800 ma of plate current and then rotate the alc control until the grid current just begins to decrease. If the exciter cannot drive the HC-2000A to 800 ma of plate current (single tone) it is not necessary to adjust or use the ALC control.

NOTE: All the above adjustments must be made into a dummy load. Adjustments into an antenna with the amplifier adjusted to give 800 ma plate current generates not only illegal out power levels, but interference on the amateur bands.

Your amplifier is equipped with a time delay tube that allows the blower to continue for 20 seconds \pm 10% to cool the pins and seals of the 3-500Z tubes. This feature assists in longer life of the tubes.

Warranty

All goods sold hereunder are warranted to be free from defects in material and workmanship, for a period of one year from date of shipment, and this express warranty is in lieu of and excludes all other warranties whether expressed or implied by operation of law or otherwise including any warranty on the merchantability or fitness for a particular purpose. Defective material may be returned to the seller after inspection by the seller and upon receipt of definite shipping instructions by the seller. Goods so returned will be replaced or repaired without charge, but the seller shall not be liable for loss, damage or expense directly or indirectly arising from the use of material or from any other cause, the exclusive remedy against the seller being to require the replacement or repair of defective material. Every claim on account of defective material or workmanship or from any other cause shall be deemed waived by the purchaser unless made in writing prior to the expiry date of the warranty.

Note:

The 3-500Z tubes are warranted on a one year pro-rated basis. Any warranty claims must be accompanied by the Eimac warranty claim form packaged with your new tubes. All claims must be filed with the company from which you bought the tubes. Warranty claims on the amplifier must be accompanied by proof of purchase and purchase date.

Tune and Load Settings

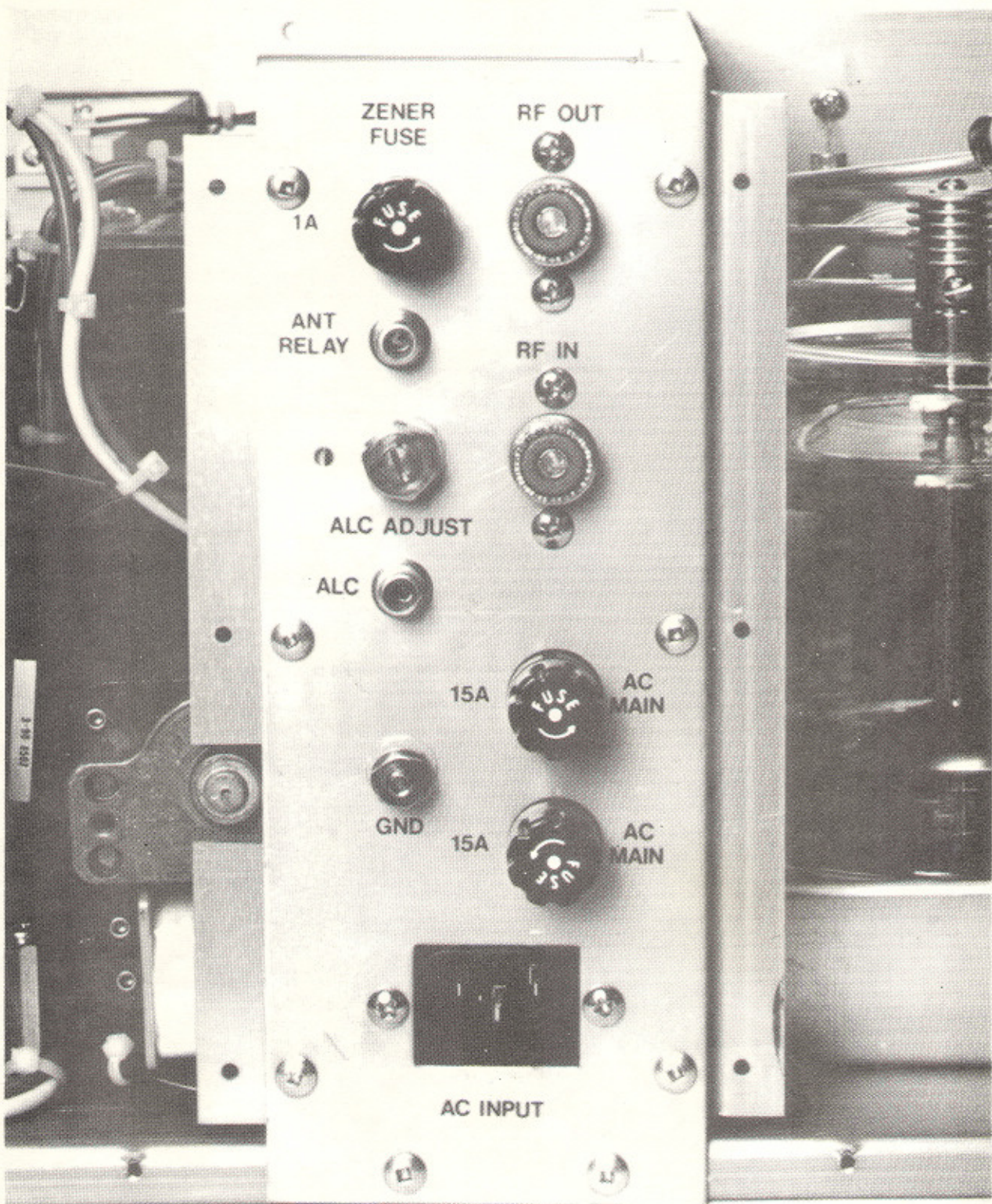
Serial Number _____

These are approximate settings for a 52 ohm load.

FACTORY DATE SSB Settings $I_p = 800 \text{ ma}$

Figure 3

BAND	TUNE	ACTUAL READING	LOAD	ACTUAL READING
80	77		80	
40	45		45	
20	25		30	
15	15		15	
10	13		15	



ZENER
FUSE

RF OUT

1A

ANT
RELAY

RF IN

ALC ADJUST

ALC

15A

AC
MAIN

GND

15A

AC
MAIN

AC INPUT

