



ORDER NO.  
480

# INSTALLATION & OPERATION INSTRUCTIONS

BASE STATION LINEAR AMPLIFIER 115 VAC

HY-GAIN ELECTRONICS CORPORATION  
Rural Route 3 Lincoln, Nebraska 68505

## GENERAL DESCRIPTION:

This linear amplifier is a precision built, compact, high output amplifier of advanced design. It utilizes two tubes, two transistors and three diodes in a grounded grid, tuned plate circuit for amplification of AM, FM, CW and SSB signals

The 480 Linear Amplifier will operate over the frequency range 25-54 MHz. However, it is F.C.C. Type Accepted under Parts 89, 91, and 93 over the frequency range 25-40 MHz.

Operation of this equipment requires a FCC license. Failure to comply is punishable by penalties set forth in the Rules and Regulations of the FCC. A copy of the Rules is available from the U.S. Government Printing Office and should be in the possession of the operator.

This model Linear Amplifier complies with FCC regulation when shipped from the factory, and must be used with a transceiver which is FCC Type Accepted under Parts 89, 91, and 93 for the system to be valid.

A special feature of this linear amplifier is the automatic antenna change over relay which operates without special external connections making it perfect for operation with low power transceivers not having external amplifier control circuits.

Variable plate tune and load capacitors offer impedance matching for maximum output to varying antenna loads, in the 40 to 70 ohm range.

The front panel indicator lights provide reliable visual indications of proper amplifier operation without complicated metering circuits.

The linear amplifier has been designed and constructed to suppress spurious radiation that may cause television interference. The TVI problem was given full consideration in design and layout of the chassis.

There are, however, some types of TVI that cannot be prevented within the amplifier. This particularly true in weak signal areas. In such cases, a good commercial low-pass filter is recommended.

## MECHANICAL SPECIFICATIONS:

Height . . . . . 4 1/8"  
Width . . . . . 7 1/8"  
Depth . . . . . 10 3/8"  
Net Weight . . . . . 11 Pounds  
Shipping Weight . . . . . 12 Pounds  
Construction . . . . . Light weight aluminum chassis  
with rugged steel case

## ELECTRICAL SPECIFICATIONS:

Power Requirements . . . . . 120 VAC/3 amps  
Frequency Range . . . . . 25-54 MHz\*  
Types of Emission . . . . . AM, FM, CW, SSB, DSB  
Power Output (ave.) Slightly less at 50 MHz . . . . . 220 Watts  
PEP, minimum 80 watts carrier  
Drive Requirement for Rated Carrier Output . . . . . 3.5 Watts  
Drive Requirement to Trigger Antenna Relay . . . . . 1 Watt  
Max Drive (unmodulated carrier and FM). . . . . 15 Watts  
(amplitude modulated carrier). . . . . 3.5 watts  
(amplitude modulated peak). . . . . 14 watts PEP  
Harmonic Supression . . . . . suppressed more than 60 db  
Input Impedance (unbalanced) . . . . . .50 Ohms  
nominal, less than 2:1 VSWR 25-54 MHz\*  
Output Impedance (unbalanced) . . . . . .50 Ohms  
nominal, Adjustable 40-70 ohms, non-reactive  
Antenna Switching . . . . . Automatic provided by RF  
sensing network  
Tube and Diode Complement . . . . . 2 Tubes, 2 Transistors, 3 Diodes  
Cable Connector Data . . . . . Input and output require  
MIL PL-259

\*F.C.C. Type Accepted for frequency range 25-40 MHz only

## UNPACKING:

Carefully remove the Linear Amplifier from the packing carton. Examine it closely for signs of shipping damage. Remove the four screws holding the top cabinet and remove all hold down tape and packing materials. Check to insure tubes are seated in the sockets. Install the plate caps on the tubes and the fuse in the holder. Inspect for any signs of internal damage.

## ASSEMBLY AND INSTALLATION:

### NOTE

*Do not attempt to operate your Linear Amplifier or make any connections until you have read this entire manual and understand your amplifier fully.*

*The location is not critical but care should be taken to insure adequate ventilation.*

### IMPORTANT

DO NOT SET ANY EQUIPMENT ON TOP OF THE CASE OR COVER THE AMPLIFIER WITH BOOKS, PAPERS, ETC., OR OVERHEATING WILL RESULT. ALLOW AT LEAST FOUR INCHES OF CLEARANCE ON ALL SIDES OF THE CABINET FOR GOOD AIR CIRCULATION.

The primary power connector is a standard 120 VAC line plug.

A fuse holder is mounted on the rear panel with a 3 amp 3AG fuse provided. Do not use a larger capacity fuse or the amplifier transformer and power supply may be damaged due to simple secondary component failure.

The AC line in the amplifier is bypassed and the lack of a ground will result in a "shock hazard". Make sure the chassis is connected to ground or other equipment.

The chassis should be connected to a good earth ground. Water pipes and other house fixtures are not recommended.

Also, lack of a good ground can result in improper operation in several respects, including TVI problems.

### ANTENNAS:

The Linear Amplifier will work with the common antenna systems designed for the 25-54 MHz\* range, provided the antenna has a resistive input impedance between 40 and 70 ohms. The SWR should be kept to a minimum 2:1 or less.

The output connector provided is an SO 239. For connection of your antenna you will need a PL 259 plug.

### FRONT PANEL CONTROLS AND FUNCTIONS:

ON-OFF Switch . . . . . Controls 120 VAC power to amplifier  
Standby-Operate Switch . . . . . Activates the automatic antenna relay circuit  
AM-FM & SSB-CW Switch . . . Adjusts time constant of automatic antenna relay  
Green Indicator Light . . . . . Visual indication of applied 120 VAC power  
Red Indicator Light . . . . . Visual indication of RF energy output  
Tune Control . . . . . Adjusts resonant frequency of output circuit.  
Load Control . . . . . Adjusts coupling of output circuit to antenna

### OPERATION:

#### WARNING

WHEN THE AMPLIFIER IS USED IN THE BUSINESS BAND, ADJUSTMENTS MUST BE MADE ONLY BY A FCC LICENSED TECHNICIAN.

The 480 Linear Amplifier is factory adjusted for the range 25-32 MHz. Operation over the range 32-40 MHz requires a change in the number of turns in L1 (RF Tank Coil). A shorting tap is placed on the end of the coil, from the left-hand side as viewed from the front panel (see fig. 2) to the first turn, counting from the left side.

This Amplifier must be used with a transmitter or transceiver capable of at least one watt output.

Remove Controls cover for tuning and loading.

Install knobs supplied in separate parts pack. Fully mesh both the Tune and Load Capacitors, then install the small knob on the Tune and the big knob on the Load capacitor shaft, insuring that the marking on the knobs are horizontal and pointing to the left when viewed from the front.

### WARNING

Before applying any RF power to the linear, pretune the tune control to the desired frequency at which you wish to operate. See illustration.

For example, if your desired operating frequency is 31 MHz then set the tune knob at midpoint between 29 and 33 as shown.

### NOTE

For operation on the 50 to 54 MHz band set tune control to the 29 MHz position. Then refer to 50 to 54 MHz Operation.

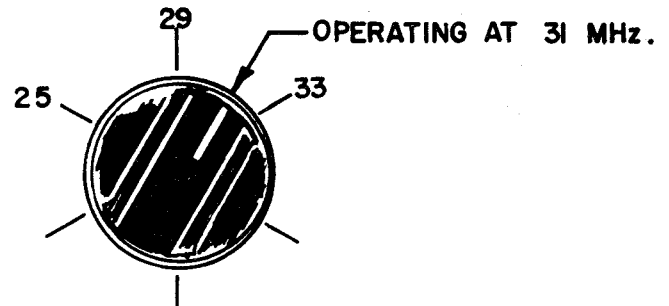


FIGURE 1 TUNE CONTROL KNOB

### TUNING FOR AM USE:

First place the function switch in the AM-FM position. Set tune control in accordance with the warning in "Operation" section. The load control should be positioned so that the capacitor is fully meshed.

Now push the ON-OFF Switch to ON, the green visual indicator will light.

After warm-up, push the Stby-Oper to OPER. This will energize the automatic antenna relay control circuitry.

Apply drive power by keying the exciter (transceiver) microphone and quickly adjust the tune control for maximum brilliance of the red visual output indicator. Remove drive power after adjustment.

### NOTE

Do not apply drive power for more than five seconds without adjusting the tune control or damage to the tubes can result.

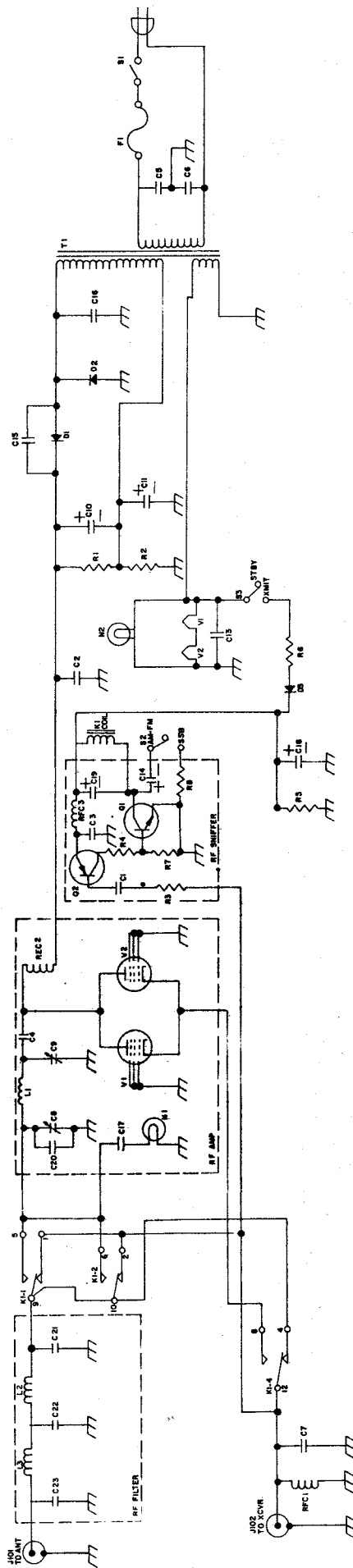
Reapply drive power and advance (clockwise) the load control, note the increase in brilliance of the red output indicator. Adjust the load control for maximum brilliance of the output indicator. Now, go back to the tune control and reset for maximum output. Remove drive power.

### NOTE

Readjustment of the tuning and loading controls several times will produce maximum output.

SCHEMATIC LEGEND FOR PRODUCT 480

<u>Symbol</u>	<u>Description</u>	<u>Part No.</u>
C1	2200 pf 1Kv Disc Ceramic	721161
C2, 3, 15, 16	6800 pf 1Kv Disc Ceramic	721160
C4	3300 pf 3Kv Disc Ceramic	721159
C5, 6, 13	1000 MMF Kv Disc Ceramic	721158
C7	100 uf Kv Disc Ceramic	721016
C8	10.5-313.9 pf Variable	721173
C9	3.2-50 pf Variable	721157
C10, 11	40 uf 450 VDC Electrolytic	721156
C14, 18	500 uf 15 WVDC Electrolytic	721120
C17	15 pf 1Kv Disc Ceramic	725746
C19	10 mfd 25-35 WVDC Electrolytic	721121
C20	100 pf Silver Mica	725748
C21, 23	180 pf Silver Mica	720013
C22	240 pf Silver Mica	720004
D1, 2	1N5054 Diode	765713
D3	1N645 Diode	761113
K1	4PDT 12 VDC Relay	730006
L1	Pi-Network Coil	750006
N1	#1815 Lamp	715701
N2	#53 Lamp	715665
Q1	2N696 Transistor	761114
Q2	MPS 6516 Transistor	761115
R1, 2	270K 1W 10%	721162
R3	330K 1/2W 10%	721167
R4	270K 1/4W 10%	721112
R5	2200 $\Omega$ 1/4W 10%	721116
R6	1 $\Omega$ 1/2W 10%	720020
R7, 8	33 $\Omega$ 1/4W 10%	721103
RFC1, 3	100 uf Choke	721155
RFC2	Z 28 Ohmite	721124
S1, 2, 3	SPST Switch	701147
T1	117v / 800v / 12v Power Xformer	731164
V1, 2	6JU6 Tube	761166
F1	3 Amp Fuse	718055
L2, 3	Filter Coil	720003



SCHEMATIC DIAGRAM

To provide for the extra power contained in the AM signal modulation it is necessary to "over-couple" the output circuit. This is necessary to insure an undistorted output with a minimum of adjacent channel "bleeding". (Spatter)

Reapply drive power and advance the load control until the red visual output indicator dims perceptibly, ( about 15 per cent more rotation). Readjust the tune control for maximum output. The output circuit is now "over-coupled".

If a relative power output indicator is available (SWR bridge on forward, etc.) the output signal can be quickly checked to insure upward modulation. If the meter does not "flick" upward on voice peaks, the load control is improperly set, (or the exciter is not capable of 100 per cent modulation or may have "downward modulation").

Always the last adjustment should be the tune control.

Your amplifier is now tuned and ready for operation.

Automatic antenna change over and amplifier operation is provided for by a special transistorized input sensing circuit. Should you desire to hold the amplifier in a "ready" condition, but not use it until needed, simply place the Stby-Oper Switch in the Stby position. The sensing circuit will be disabled and the antenna connected to the exciter (transceiver) at all times.

## TUNING FOR FM:

The amplifier is tuned for FM service in a manner identical to AM except the load and tune controls are set for maximum output. No change in brilliance of the output indicator will be noted with modulation.

## TUNING FOR SSB & DSB:

Place the function switch in the SSB position. This will connect a delay circuit to the automatic relay control and extend the "drop-out" approximately one second. This will prevent relay "chattering" and erratic operation.

If the exciter (transceiver) is capable of carrier output equal to the peak power of the voice SSB or DSB signal, simply adjust the tune and load controls for maximum brilliance of the output indicator while applying carrier.

If the exciter (transceiver) cannot supply a carrier equal to the peak power of the voice SSB or DSB signal then the tune and load controls must be set for maximum output while modulating. In this case, a modulation envelope indicator (monitor scope) is the most reliable method for adjustment of the amplifier.

## TUNING FOR CW:

Place the function switch in the SSB position, apply drive power and adjust the tune and load controls for maximum output.

The delay circuit for SSB prevents "drop-out" of the automatic antenna relay between characters.

Remove knobs and replace controls cover before putting the Amplifier into business radio service.

## 50-54 MHz OPERATION:

For operation on the six meter amateur band is necessary to short out three turns (from the left hand side as viewed from the front panel) of the Pi-network output coil, L1. The 100 pf silver mica capacitor across C8, (load capacitor) must be removed. C17 should be reduced to 5pf also.

The low pass filter on the output must be shorted out. This can be done by soldering a wire from the input to the output and removing the three silver mica capacitors (180pF and 240pF) from the small circuit board connected to the output socket.

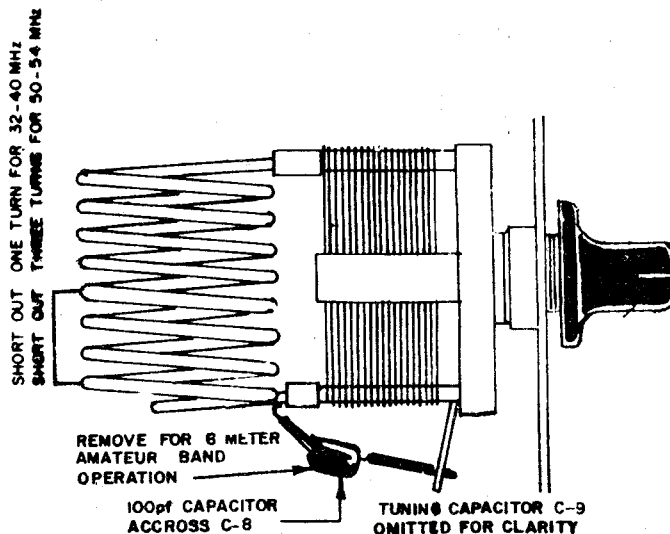


FIGURE 2

## CIRCUIT ANALYSIS:

A portion of the incoming signal is coupled to the base of Q2, sensing transistor. This causes Q2 to conduct and change the bias on Q1, relay transistor, Q1 conducts heavily and closes relay K1.

Relay K1 connects the input signal to the cathodes of V1 and V2, applies plate voltage to V1 and V2, and connects the output circuit to the antenna.

C9 is the Pi-net tune capacitor, sets the operating frequency to the antenna.

C8 is the Pi-net load capacitor and controls the coupling to the antenna.

For SSB operation, C14 is added to the relay transistor circuit to extend the "drop out" time.

## WARRANTY POLICY

The manufacturer guarantees to remedy for a period of 90 days from the date of purchase any defect in material or workmanship existing in this model at no cost to the owner, exclusive of shipping charges, provided:

1. The defect is not the result of misuse, neglect, accident, incorrect wiring not our own, improper installation or use contrary to instructions.
2. The unit serial number has been registered by the original purchaser.
3. The unit or part that appears defective is delivered prepaid to the manufacturer or authorized service center that we may designate.
4. Examination discloses, in our judgement, a defective part or workmanship.

This warranty does not extend to any units which have been

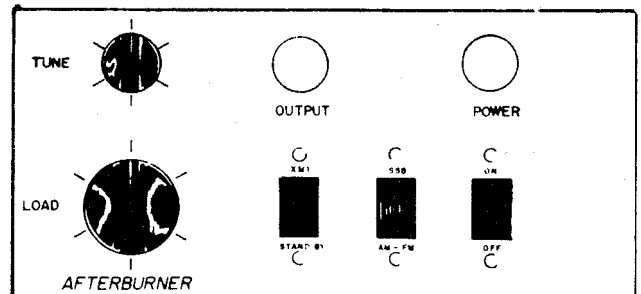
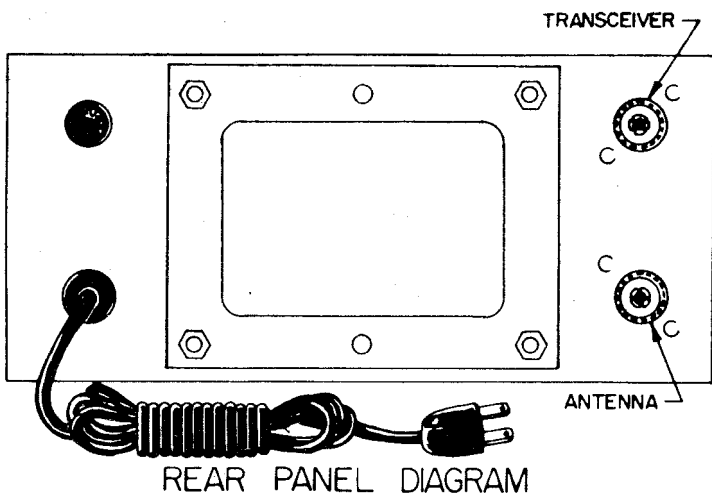
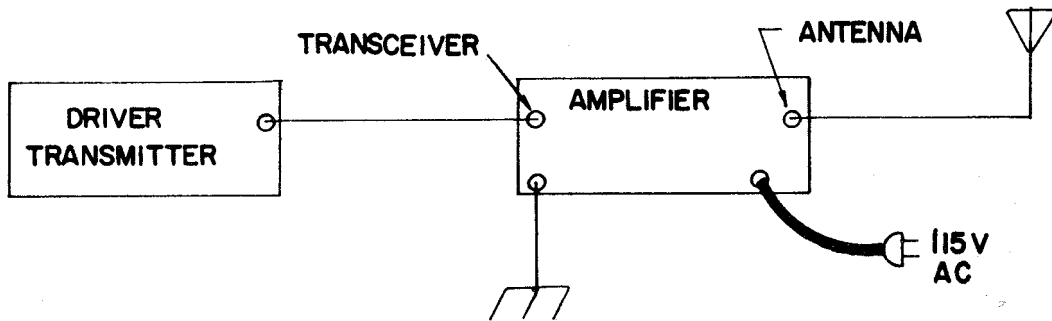
repaired or altered outside of our factory nor to cases where the serial number has been removed, defaced or changed.

All labor, tubes, semi-conductors and other parts are included in this warranty. Any transportation costs, or similar charges, that may be incurred are not included. The manufacturer's sole liability is the repair at no charge of any defect for the period stated.

This written warranty is in lieu of all 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 products.

The manufacturer reserves the right to make any changes deemed necessary or desirable to improve the product without incurring obligation to make (or furnish parts for) like changes in units previously manufactured or sold.

All Warranties are void one year after the last model has been manufactured.



FRONT PANEL DIAGRAM