hy-gain

ORDER NO. 600

INSTALLATION & OPERATION INSTRUCTIONS

BI-LINEAR RF DECK

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

SECTION I

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Hy-Gain Model 600 Bi-Linear Amplifier is a precision built, compact amplifier of advanced design. It utilizes an integrated circuit, two tubes, two transistors, two diodes and a tuned grid, tuned plate circuit for amplification for AM, FM, CW and SSB signals.

A special feature of the Amplifier is its dual-purpose versatility. It requires an external power supply, either AC supply for base station use or DC supply for mobile station use. This, together with a quick-release mobile mount, allows the Amplifier to be easily transported between base and mobile stations.

The Amplifier has a built-in automatic antenna change over relay, which operates without special external connections, making it perfect for operation with low power transceivers having no external amplifier control circuits.

The amplifier also amplifies the received signal, utilizing an integrated circuit amplifier. The variable plate tuning capacitor, [illegible] is accessible through a hole in the top cover, allows for the tuning of the amplifier. An internal load capacitor has been used to offer impedance matching for maximum output into a 50 ohm antenna system.

The Amplifier has been designed and constructed to suppress radiation that may cause television interference. TVI problem has been given full consideration in the design and the layout of the chassis. There are, however, some types of TVI that cannot be prevented within the amplifier. This is particularly true in weak signal areas. In such cases, a good commercial low pass filter is recommended.

Operation of this equipmer requires a FCC license. Failure to comply is punishable by penalties set forth in the Rules and Regulations of the FCC. A copy of these Rules, for use under the appropriate section, is available from the U.S. Government Printing Office and should be in the possession of the operator.

1.2 TECHNICAL SPECIFICATIONS

MECHANICAL

Height (including feet)	3 inches
Width	7 1/8 inches
Depth	11 3/4 inches
Net Weight	4 1/4 pounds
Shipping Weight	6 pounds
Construction	Lightweight aluminum chassis with rugged steel case

ELECTRICAL

Frequency Range	26–35 MHz
Types of Emission	AM, FM, CW, SSB, DSB
Power Output	150 AM with full upward modulation 300 Watts CW (with 3.5 watts drive)
Amplification of Received Signal	20 db
Drive Required 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 Suppression	Exceeds FCC requirements
Input Impedance (unbalanced)	50 ohm nominal Less than 2 : 1 VSWR
Output Impedance (unbalanced)	50 ohm fixed
Antenna Switching	Automatic provided by RF sensing network
Tube and Semiconductor Complement	2 Tubes 2 Transistors 1 Integrated Circuit

Power Requirements	+800v @ 700 mA
	+300v @ 50mA
	—100v @ 10mA
	12VAC or DC at 2.5 amps

(obtained from either Model 601 Base AC Power Supply or Model 602 Mobile DC Power Supply)

Cable Connector Data ..... Input and Output requires MIL PL-259

SECTION II

2.1 UNPACKING

Carefully remove the Model 600 Bi-Linear RF Deck from the carton. Examine it closely for signs of shipping damage. If inspection [illegible] damage the delivering carrier must be contacted immediately [illegible] a claim filed.

The responsibility for safe delivery rests with the carrier. The responsibility in obtaining reimbursement rests with you. Prompt action will speed adjustment. Our warranty does not cover malfunction or damage which is a result of improper handling by a carrier.

2.2 WARRANTY REGISTRATION

Fill out the enclosed Warranty Card and mail immediately.

SECTION III
INSTALLATION AND OPERATION

3.1 The location of the mounting is not critical, but consideration must be given to provide adequate ventilation. The amplifier may be used as either a base or mobile station when used with the appropriate power supply.

When used as a mobile station the amplifier may be mounted under the dash using a Hy–Gain Model 494 quick release mobile mounting bracket and the Model 602 DC Power Supply. (Refer to the 602 instruction manual for installation.)

For base station operation use the Hy-Gain Model 601 AC Power Supply. When the 600 amplifier and its power supply has been suitably mounted in a convenient position connect a length of RG58/U coaxial cable between the transceiver and XCVR socket (Next to the power plug). Connect a 50 ohm antenna to the ANT socket (on the left viewed from the back.)

NOTE

The antenna system should be checked for VSWR of less than 2 : 1 before the Model 600 Amplifier is used.
For best performance of your communication system, the VSWR should be as low as possible.

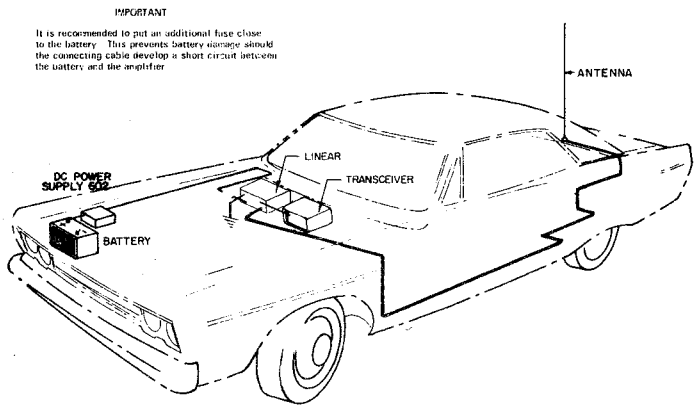


FIGURE 1 — Typical mobile mounting

3.2 CONTROLS AND FUNCTIONS:

ON-OFF Switch ..... Controls power to amplifier

AM-FM & SSB Switch ..... Adjusts delay constant of automatic antenna relay

XMT-Standby Switch ..... Controls the automatic antenna circuit and also supplies power to the receive amplifier circuit.

Rec Amp ON-OFF Switch ..... Controls the integrated circuit receive amplifier.

NOTE:

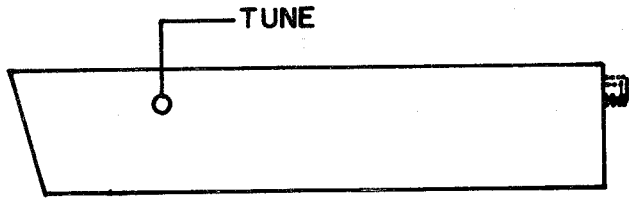
An integrated circuit amplifier increases the level of the incoming signals from the antenna before it is applied to the transceiver. This amplifier is controlled by the XMT Standby switch and the REC AMP switch. With the XMT Standby switch in the XMT position the receiving amplifier can be switched ON or OFF as required. With the switch in the Standby position, the receive amplifier is disabled and the receive amplifier switch should be in the OFF position.

Output Meter ..... Visual indication of relative RF power output.

Tune-Operate Switch (Rear Panel) .... Provides for low power tune-up during initial tuning.

Drive Control (Rear Panel) .... Controls power output for optimum operation.

The side control in the cover is used for tuning the amplifier. The amplifier is pretuned at 27.575 MHz and the tune control will allow tuning the amplifier to some other frequency. The LOAD control is not accessible from the outside. It is preset to provide a correct match to 50 ohm antenna system. This control should not be adjusted. It is factory preset.



WARNING

When the amplifier is used in the Business Band, adjustments must be made by a FCC licensed technician.

3.3 USAGE BETWEEN 31 MHz AND 35 MHz

The 600 Bi-Linear Amplifier is factory adjusted for the range of 26 to 31 Mhz. Operation over the range of 31 to 35 MHz requires a change in the number of turns in the RF Tank Coil. A shorted tap is placed on the end of the coil adjacent to the loading capacitor and tapped one turn.

This Amplifier must be used with a transmitter or transceiver capable of at least 1 watt output.

3.4 TUNING FOR AM USE: (Requires Wattmeter)

WARNING

THIS SECTION SHOULD BE READ THOROUGHLY BEFORE OPERATING THE AMPLIFIER.

Place the function switch in the AM-FM position. Push the ON-OFF switch to ON. The meter illumination light will come on. After allowing approximately 60 seconds for warm-up, push the XMT Standby switch to XMT. This will energize the automatic antenna relay control circuitry and provide power to the integrated circuit receive amplifier.

Set the Slide switch on the rear panel to the Tune position. Adjust the drive control for midway position. Apply 3.5 watts drive power by keying the exciter (transceiver) microphone and quickly adjust the tune control for maximum reading on the output meter. Remove the 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.

Apply drive power and adjust the drive control (on the rear panel) so that the amplifier produces approximately 100 watts output.

The input tuning coil is preset for the 26–31 MHz range. If operated outside this range it should be reset. To reset the input tuning coil (accessible from bottom), first place a VSWR bridge between the linear and the exciter. Apply drive power and reset the coil slug with a hex shaped non–metallic alignment tool for lowest SWR and maximum output in the "tune" position of the switch.

Set the Tune–Operate slide switch to the Operate position, re–apply drive power and adjust the drive control for 150 watts output on the watt meter. A re–adjustment of the input tuning coil may be necessary to produce minimum input VSWR.

Readjust the tune control for maximum output and reset the drive control for 150 watts carrier output.

The amplifier is now adjusted to provide 150 watts carrier and 300 watts with full upward modulation. If the average output power decreases with modulation then either the transmitter (exciter) is incapable of upward modulation or the Amplifier has not been tuned up correctly and the above procedure should be re-checked. If this does not correct the situation, the drive control (on the rear panel) should be adjusted for a slightly lower power level necessary to produce upward modulation. It is far better to have reduced carrier power with upward modulation than a carrier power of a higher level with downward modulation, this will increase your communication range and provide a clearer signal with much less distortion.

The automatic antenna change-over operation in the amplifier is provided by a special transistorized input sensing circuit. Should you desire to hold the amplifier in a ready position, but not use it until needed, simply place the XMT-Standby switch in the Standby position. The sensing circuit will be disabled and the antenna connected to the exciter (transceiver) at all times. (The Rec Amp switch must be in the off position).

3.5 TUNING FOR AM WITHOUT WATTMETER (26–31 MHz)

After proper installation and attachment of a nominal 50 ohm antenna, place the function switch in the AM–FM position and push the ON–OFF Switch to ON.

The meter illumination light will come on. After allowing approximately 60 seconds for warm–up, push the XMT Standby switch to XMT. This will energize the automatic antenna relay control circuitry and provide power to the integrated circuit receive amplifier.

Set the Slide switch on the rear panel to the Tune position. Adjust the drive control for midway position. Apply 3.5 watts drive power by keying the exciter (transceiver) microphone and quickly adjust the tune control for maximum reading on the output meter. Remove the 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.

Re–apply drive power and adjust the drive control for a meter reading of "6". Remove drive power.

Set the Tune–Operate switch to the Operate position, reapply drive power and adjust the drive control for a meter reading of "7". Readjust the Tune Control for maximum reading on the meter. Reset the drive control for a meter reading of "7", if necessary.

The amplifier is now adjusted to provide approximately 150 watts carrier output with full upward modulation to 300 watts. If the meter reading decreases with modulation, either the exciter is incapable of upward modulation or the amplifier has not been tuned correctly and the procedure should be re–checked. If this does not correct the situation the drive control (on the rear panel) should be adjusted for a slightly lower power level necessary to produce upward modulation.

3.6 BEST AM OPERATION

For best AM operation the linear must be tuned according to above procedures. Many misconceptions regarding linear operation exist among linear users. Reviewing a few points regarding proper linear operation will help to provide better tune–up and communications for the user.

1. The linear amplifies the Radio Frequency (RF) signal.
2. If the output signal reproduced is identical to the input, except stronger, the amplifier is said to be linear. If not, the amplifier is non–linear.
3. Non–linear operation produces spurious outputs and distortion of the signal.
4. All spurious signals use up power.
5. All power used to produce distortion and spurious signals is power not being used for communication.
6. The Model 600 provides a 300 watt RF envelope maximum power output.
7. Any attempt to operate AM at the 300 watt carrier level will produce downward modulation with distortion, and spurious signals.
8. Distortion and spurious signals (lost power) will occur in all linear amps if operation at maximum carrier power is attempted.
9. All linear amplifiers should be operated at about one half the maximum carrier output to allow for modulation expansion of the carrier.
10. Operation without leaving room for modulation expansion will not provide good communication. The carrier contributes nothing toward intelligibility, only good modulation can carry intelligence. Running higher carrier power and lower modulation is a detriment rather than an asset.

11. At a carrier level output of 150 watts you will see approximately 15% to 25% increase in output on a watt meter while talking. The modulation peaks are expanding to 300 watts, however, the watt meter is incapable of measuring these modulation peaks. A steady tone, like a whistle, will produce a higher indication approximately 25% to 50% increase in watt meter reading.
12. If your watt meter does not show 25% to 50% increase with tone or whistle your linear is not working properly and should be readjusted for upward modulation. Full modulation expansion to 100% should be your major concern not carrier output.

    Downward modulation will not permit communication at its best.

Example:

150 watts carrier with 100% mod 150 watts talkpower

vs

300 watts carrier with 10% mod 30 watts talkpower

OPERATE LINEAR ONLY –
DON'T WASTE POWER IN DISTORTION

Printed in USA

3.7 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 "dropout" approximately one second. This will prevent the relay "chattering" and erratic operation.

If the exciter (transceiver) has provision for either carrier insertion or a tune position adjust it for 3.5 watts output and then follow the procedure in Section 3.4 or 3.5 for AM Tune Up.

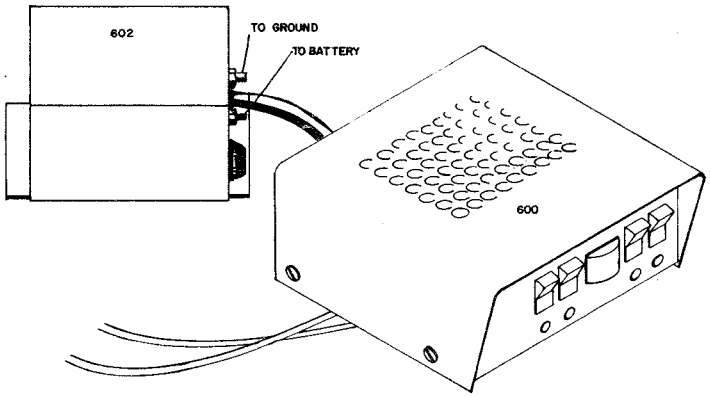
If the exciter (transceiver) does not have provision for carrier insertion a steady whistle will produce a carrier. The Model 600 should then be tuned as specified in Section 3.4 or 3.5.

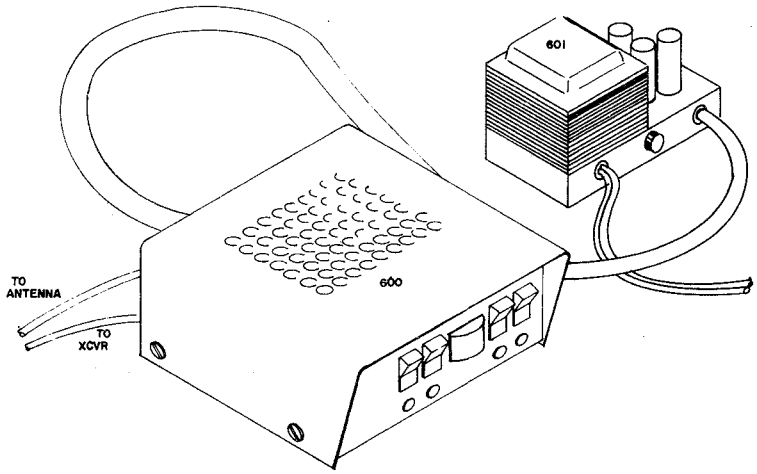
NOTE

The power output level will be affected slightly by the Rec Amp. The drive control should be adjusted to maintain output at the correct level when using the Rec Amp.

PN 800241

TYPICAL MOBILE SET-UP





SECTION IV
SERVICE INFORMATION

4.1 RETURNING EQUIPMENT FOR SERVICE:

DO NOT ship equipment to the Manufacturer without prior authorization. We prefer to send special shipping labels which will avoid the delay of unexpected shipment.

If time is extremely important, wire or call for approval and we will rush labels to you. When a shipment is expected, even the time of sending the labels is less than that lost when an unexpected shipment is received.

It is VERY IMPORTANT that the shipment be well packed and fully insured. Damage claims must be settled between you and the carrier and will greatly delay any returns. Proper packing normally avoids this trouble.

ALL SHIPMENTS MUST BE SENT TO US PREPAID. We do not accept collect shipments. All returns should be made in our standard cartons only — so save your carton when unpacking the unit. When a shipment is returned it will be handled in one of three ways . . . .

1—Where all service is in warranty the shipment will be returned prepaid by a carrier of our choice.

2—If there are any charges not covered by warranty we will hold the shipment and advise you of costs, which you can then send.

3—Or, upon your written authorization, we will ship C. O. D. for any charges not covered by warranty, then the carrier will collect these charges and the transportation costs on arrival. Unclaimed or refused C. O. D. shipments will not be reshipped until payment of service and transportation charges is received. Shipment will then be made collect for reshipment transportation charges. Unclaimed equipment automatically becomes the property of the Manufacturer 60 days after date of refusal or return and will be disposed of for payment of charges due.

NOTE

We WILL NOT ship by means of a carrier that will not fully insure the shipment. Some carriers have a $200.00 limit. The exception to this is when there is no other means (APO-FPO-etc.) of shipment than parcel post, and then we will ship by this means with your written agreement that you assume any loss over that which the carrier will insure. C. O. D. shipments cannot be made to APO-FPO addresses.

4.2 REPLACEMENT PARTS ORDERING:

All replacement parts orders must be prepaid or C. O. D. only.

Replacement part price quotes will be furnished on request for those who desire prepaid shipment or cannot accept C. O. D. shipments.

4.3 SHIPPING ADDRESS:

All requests, inquiries, warranty claims or equipment returns should be made to:

Hy-Gain Electronics Corporation
Rural Route 3
Lincoln, Nebraska 68505

Attn: Customer Service Manager

SECTION V
WARRANTY

Hy-Gain Electronics Corporation warrants each new product manufactured to be free from defects in material and workmanship and agrees to remedy any such defect, or to furnish a new part, in exchange for any part of any unit which under normal installation, use, and service discloses such defect within ninety days from the date of purchase by original owner. The unit serial number must be registered by the original owner at the time of purchase to validate the warranty.

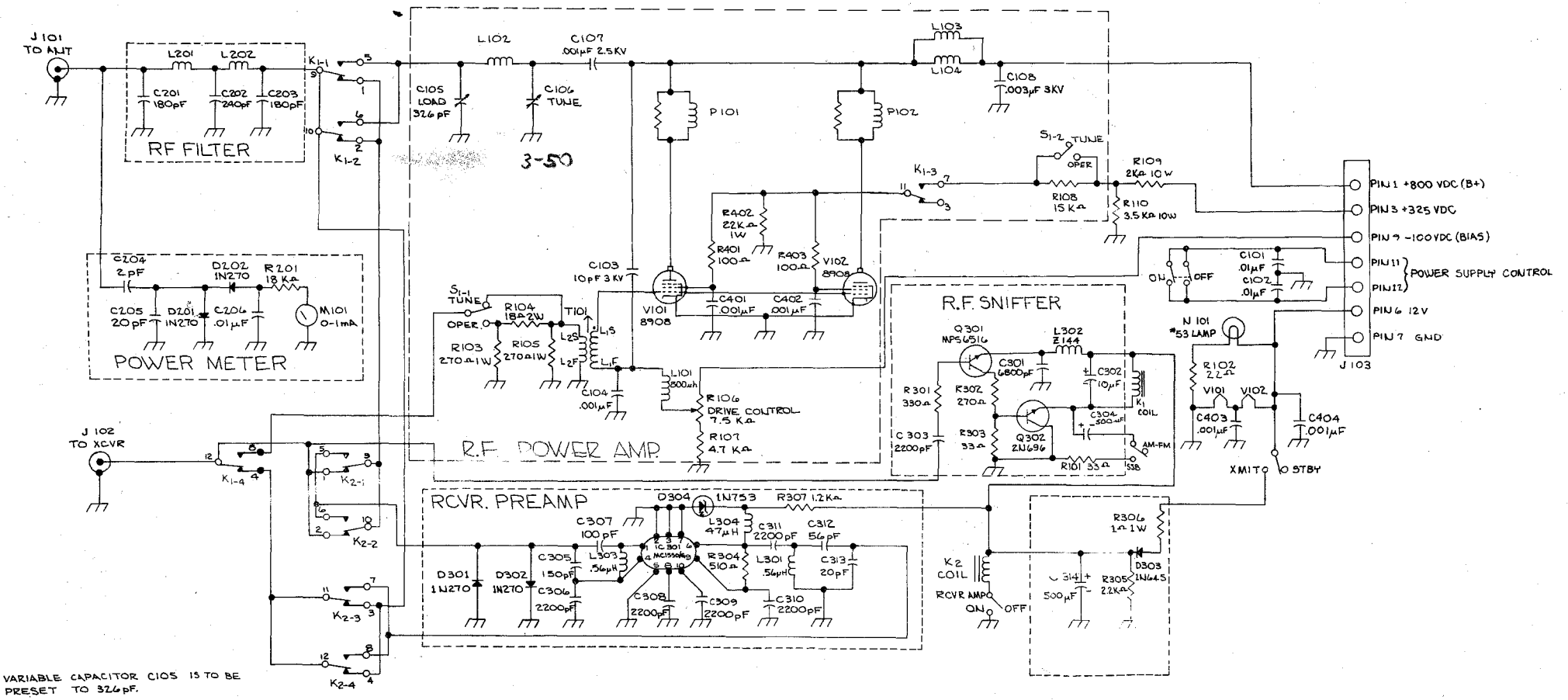
This warranty does not extend to any of our products which have been subjected to mis-use, neglect, accident, incorrect wiring not our own, improper installation or to use in violation of instructions furnished by us. Nor does it extend to units which have been repaired or altered outside of our factory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

Hy-Gain Electronics Corporation reserves the right to make any changes deemed necessary or desirable without advance notice or incurring any obligation to make like changes in units previously manufactured or sold.

This warranty does not cover transportation or installation costs that may be incurred. Hy-Gain Electronics Corporation's sole liability is the remedy of any defect for ninety days. Hy-Gain Electronics Corporation is not responsible for personal injury or property damage resulting from improper or careless installation not intended by the manufacturer.

No person is authorized to assume for us any other liability in connection with the sale of our products.

All warranties are void and terminated one year after the last unit of its type and design has been manufactured by us.



8. VARIABLE CAPACITOR C105 IS TO BE PRESET TO 326 pF.
7. TUBES V101 & V102 ARE MATCHED PAIRS.
6. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE ½ WATT
5. ALL SERIES 400 COMPONENTS ARE MOUNTED ON THE POWER BOARD ASSY
4. ALL SERIES 300 COMPONENTS ARE MOUNTED ON THE RELAY BOARD ASSY
3. ALL SERIES 200 COMPONENTS ARE MOUNTED ON THE LPF ASSY
2. ALL 100 SERIES COMPONENTS ARE CHASSIS MOUNTED
1. ALL RELAYS ARE SHOWN IN THE RELAXED POSITION

NOTES:

SYMBOL	DESCRIPTION	PART NO.
	CHASSIS MOUNTED COMPONENTS	
C101	.01 mfd Disc Cap	721550
C102	.01 mfd Disc Cap	721550
C103	10 pf 3KV Cap	721613
C104	560 pf DSM Cap 500v	721677
C105	Load Cap	720015
C106	Tune Cap	721157
C107	.001 mfd 2.5KV Cap	721660
C108	.003 3KV Disc Cap	721159
K1	4PDT Relay	730006
K2	4PDT Relay	730006
L101	800 uh Choke	721902
L102	Tank Coil	270014
L103	Plate Choke	721124
L104	Plate Choke	721124
M101	0-1 ma Meter	795680
N101	#53 Lamp 12V	715665
P101	Parasitic Choke	721950
P102	Parasitic Choke	721950
R101	33Ω 1/4W Resistor	721103
R102	22Ω 1/2W Resistor	725639
R103	270Ω 1W Resistor	720016
R104	18Ω 2W Resistor	720017
R105	270Ω 1W Resistor	720016
R106	7.5KΩ Lin Pot	721451
R107	4.7KΩ 1W Resistor	721367
R108	15KΩ 1/2W Resistor	721340
R109	2KΩ 10W Resistor	721527
R110	3.5KΩ 10W Resistor	721515
T101	Input Coil	720018
V101	Beam Pentode Tube	760004
V102	Beam Pentode Tube	760004
	LOW PASS FILTER ASSEMBLY	
C201	180 pf SM Cap	720013
C202	240 pf SM Cap	720004
C203	180 pf SM Cap	720013
C204	2 pf Disc Cap	721609
C205	20 pf Disc Cap	725717
C206	.01 mfd Disc Cap	721178
D201	1N270 Diode	765722
D202	1N270 Diode	765722
L201	LPF Choke	720003
L202	LPF Choke	720003

SYMBOL	DESCRIPTION	PART NO.
R201	18KΩ 1/2W Res	721339
	RELAY BOARD COMPONENTS	
C301	6800 pf Disc Cap	721160
C302	10 mfd Ele Cap	721121
C303	2200 pf Disc Cap	721161
C304	500 mfd Ele Cap	721120
C305	150 pf Disc Cap	727980
C306	2200 pf Disc Cap	721161
C307	100 pf Disc Cap	721016
C308	2200 pf Disc Cap	721161
C309	2200 pf Disc Cap	721161
C310	2200 pf Disc Cap	721161
C311	2200 pf Disc Cap	721161
C312	56 pf Disc Cap	725711
C313	20 pf Disc Cap	725717
C314	500 mfd Ele Cap	721120
D301	1N270 Diode	765722
D302	1N270 Diode	765722
D303	1N645 Diode	761113
D304	1N753 Diode	765721
IC301	MC1550/G Inter-grated Amp	765724
L301	.56 uh Coil	725679
L302	Z 144 Coil	728025
L303	.56 uh Coil	725679
L304	47 uh Coil	725710
Q301	MPS6516 Transistor	761115
Q302	2N696 Transistor	761114
R301	330Ω 1/2W Res	721167
R302	270Ω 1/4W Res	721112
R303	33Ω 1/4W Res	721103
R304	510Ω 1/4W Res	725727
R305	2.2KΩ 1/4W Res	721116
R306	1Ω 1/2W Res	720020
R307	1.2KΩ 1/4W Res	725728
	POWER BOARD COMPONENTS	
C401	.001 mfd Disc Cap	721158
C402	.001 mfd Disc Cap	721158
C403	.001 mfd Disc Cap	721158
C404	.001 mfd Disc Cap	721158
R401	100 1/2W Res	720005
R402	22K 1W Res	721373
R403	100 1/2W Res	720005