

TECHNICAL MANUAL

HG-303

MULTIBAND TRANSMITTING EQUIPMENT

MANUFACTURED BY
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A DIVISION OF
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ROCKFORD, ILL.

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I. FORWARD

I. Purpose

The purpose of this manual is to provide the owner and/or serviceman with detailed information for the installation, operation, and maintenance of the equipment. It is suggested that this manual be thoroughly read and understood before any attempt is made to place the equipment in operation.

2. Production Changes

From time to time, electrical and/or mechanical changes are made as they become necessary to further improve the product. When a sufficient number of changes have been incorporated to justify a model number change, an A, B, C, etc., is added to the model number, ie, HG-303A. When and if such a change is made, a modification kit will be made available to enable the purchaser to up-date his equipment.

3. Manual Revision Bulletins

As production changes are made in the equipment, manual revision bulletins are printed and inserted in the manuals which are packed with the equipment. Authorized service stations are also supplied with current bulletins as they appear.

The manual revision bulletins contain such information as type of change, reason for change, circuits affected, parts added, and/or deleted, and a revised schematic.

4. Service Organizations

Located throughout the United States, are authorized service stations which are qualified to repair all equipment manufactured by Globe Electronics. All service stations are also qualified to perform warranty repairs on all equipment. Each service organization has been carefully selected for their competence, quality of service, necessary test equipment, and interest to service our products.

Globe Electronics also maintains an efficient service department within the plant for those who wish to return their equipment directly to the factory for modification or servicing.

5. Replacement Parts Ordering.

When ordering replacement parts from Globe dealers or authorized service stations, always include the Globe part number, description, model number and serial number of the equipment, and also the method of shipment desired.

IMPORTANT

UNDER NO CONDITIONS WILL GLOBE ELECTRONICS ACCEPT DAMAGED OR DEFECTIVE GOODS FOR WARRANTY EXCHANGE UNLESS PROPER AUTHORIZATION FROM OUR CUSTOMER SERVICE DEPARTMENT HAS BEEN ISSUED.

II DESCRIPTION OF EQUIPMENT

1. Introduction

The HG-303 Transmitter consists basically of a bandswitching five-band, 75-watt R. F. section, a power supply unit, and a control section. The transmitter is completely self-contained and may be used directly as a C. W. transmitter as supplied. It provides R. F. output on the five major amateur radio bands, i. e., 80, 40, 20, 15 and 10 meters.

2. Design

A. R. F. Section

A two stage R. F. section is employed in the HG-303. A Pierce harmonic oscillator utilizing a 6CL6 tube, functions as a crystal controlled oscillator in the three crystal positions. In the V. F. O. position, this stage is converted to a harmonic amplifier, by proper switching, to provide proper harmonic selection and amplification to the output from a VFO.

Employed in the power amplifier stage, is a 6146 beam tetrode tube running as a Class C amplifier with a DC power input of 75 watts. A PI section matching network is used to match the plate impedance of the power amplifier to the load impedance of the antenna. The PI network is capable of matching antenna impedances in the range of approximately 50 to 600 ohms.

Bandswitching is accomplished by the selection of the proper final grid and plate impedances by a single, multi-section switch.

B. Power Supply Section

The power supply section contains three separate power supplies. One provides 600 volts DC to operate the power amplifier; another, 225 volts DC to operate the oscillator, and a bias supply that provides -65 volts DC operating and protective bias for the power amplifier and also -130 volts DC cutoff bias for keying purposes.

A separate winding on the low voltage power transformer supplies filament power to the tube heaters.

Solid state silicon rectifiers are used in all three supplies to increase efficiency and reliability, reduce heating and to conserve space. The high voltage supply incorporates eight .5 amp. silicon diodes in a full wave bridge configuration.

All external connections to the power supply unit are made by removable push-on connectors. This permits removal of the power supply or other sections to facilitate maintenance.

C. Control Section

All necessary metering and external and internal control functions are included in this section.

A three position lever switch and a meter on the front panel permit monitoring either final grid or plate current. Also, an off position is provided for the meter.

Another three position lever switch provides the necessary circuit switching for the tune, stand-by, and operate modes. In the operate mode, 117 volts AC is provided at the external control receptacle for relay operation. Also available at the external control receptacle, are provisions for plate modulation of the transmitter by an external modulator, and external control of the operate mode.

A jack on the rear apron and also a pin on the external control receptacle facilitates keying the transmitter by either a telegraph key or keying relay for telegraphy operation or either a switch or relay for telephony operation.

3. Equipment Complement

The HG-303, as supplied, contains the following equipment: RF, power supply, and control sections self-contained in one cabinet, technical manual, and a pre-wired plug in the external control receptacle.

4. Equipment Specifications

Bands Covered -----	80 Meters 40 Meters 20 Meters 15 Meters 10 Meters
Power Input to Power Amplifier -----	75 Watts
Primary Power Source -----	110/120 Volts AC 50/60 Cycles Single Phase
Primary Power Consumption-----	Tune-----75 Watts Stand-By-----50 Watts Operate----- 150 Watts
Weight -----	16 Pounds
Height -----	4-1/2 Inches
Width -----	9 Inches
Depth -----	9-1/2 Inches

III. INSTALLATION AND OPERATION OF EQUIPMENT

1. Preliminary

A. Unpacking and Inspection

Carefully unpack and inspect the equipment for any visible damage that may have occurred during shipment, such as a dented cabinet, broken tubes, etc. Should any damage be apparent, report it to the carrier, not to Globe Electronics. The carrier will supply you with the proper forms, and assist you in obtaining repairs or replacements.

Proceed with caution when placing the equipment in initial operation as some hidden damage may have occurred.

2. Installation

A. Location and Function of Controls

1. Antenna Loading: Located on the front panel in the lower left-hand corner, this control provides an adjustable means to match and load the antenna to the power amplifier stage.
2. Plate Tuning: Located directly above the antenna loading control, this control provides a means of resonating the PI section to the operating frequency.
3. Drive Control: Located directly to the right of the antenna loading control, this control provides a means of controlling the grid drive (ie., grid current) to the power amplifier stage. Also connected to this control, is a switch which removes or applies AC power to the equipment.
4. Band Switch: Located on the front panel directly to the right of the drive control, this control provides a means for changing bands and controls both the grid and plate inductances of the power amplifier.
5. Grid Tuning: Located on the front panel directly to the right of the band switch, this control provides a means of resonating the grid inductances of the power amplifier to the operating frequency.
6. Crystal selector Switch: Located on the front panel in the upper right hand corner, this control provides a means of selecting the method of frequency control of the transmitter, (ie., external VFO, External Crystal, or Internal Crystals A or B).
7. Meter Switch: Located on the front panel directly to the right of the grid tuning control, this control provides a means of inserting the panel meter in either the grid or cathode circuit of the power amplifier to monitor the

current flowing in these circuits.

8. **Function Switch:** Located on the front panel directly to the right of the meter switch, this control provides the necessary switching to place the transmitter in the tune, standby or operate positions.

B. Location and Function of Jacks and Sockets

1. **Crystal Number 1:** Accessible from the front panel, this socket provides a means of crystal controlling the transmitter when the crystal switch is in the XTAL 1 position.
2. **Crystals A and B:** Located inside the cabinet on the RF deck. This socket provides for an additional two crystals, selected via the crystal switch, for crystal control of the transmitter.
3. **Key Jack:** Located to the far left of the rear apron, this jack is provided for the connection of a telegraph key or keying relay.
4. **VFO Input Jack:** Located directly to the right of the key jack on the rear apron, this jack provides a means of connecting an external VFO for frequency control of the transmitter.
5. **Fuse:** Located on the rear apron directly to the right of the VFO input jack. The equipment requires a 3AG, 3 AMP, 250 volt fuse.
6. **Power Cord:** Located on the rear apron to the right of the fuse holder, requires insertion into a suitable receptacle providing 110 to 120 volts AC, 50/60 cycle, single phase power.
7. **Ground Post:** Located on the rear apron directly below the power cord and provides a convenient connection to the chassis for grounding purposes.
8. **External Control Receptable:** Located on the rear apron directly to the right of the power cord and provides the following connections to the transmitter.

<u>Pin</u>	<u>Connection</u>
1	117 volts AC from the function switch
2	One end of HV power transformer primary
3	Keying circuit
4	600 volts DC from power supply
5	DC input to power amplifier
6	Key jack shorting contact
7	Ground
8	117 volts AC common to both transformer primaries

9. Antenna Receptacle: Located directly to the right of the external control receptacle on the rear apron, and provides a means of connecting the antenna transmission line to the transmitter.

C. Necessary Connections

1. A satisfactory antenna for the band or bands to be operated must be connected to the antenna receptacle.

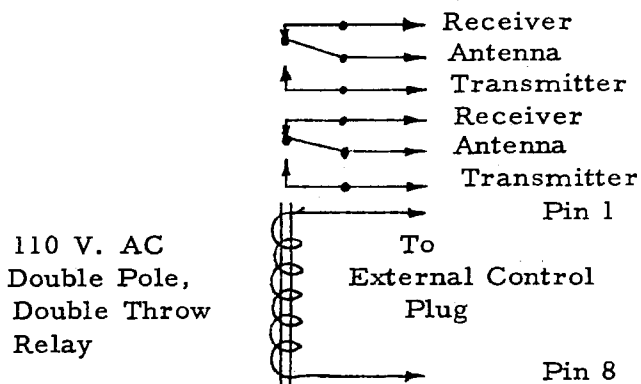
CAUTION!

Under NO circumstances should the equipment be tuned up or attempted to be placed in operation without a suitable antenna or dummy load connected to the antenna receptacle as severe damage to the equipment could result.

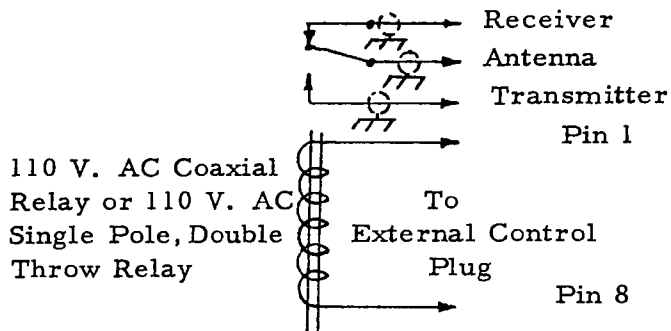
In the case where the same antenna is to be used for both transmitting and receiving, an antenna change-over relay should be installed to switch the antenna from the receiver to the transmitter during periods of transmission.

Below are schematics showing the proper connections.

BALANCED TRANSMISSION LINE (TWIN LEAD)



UNBALANCED TRANSMISSION LINE (COAX)



NOTE: For best results and maximum efficiency when using a balanced transmission line such as 300-ohm twin lead, a set of Balun Coils should be used to convert the unbalanced output from the transmitter to the balanced transmission line.

2. Ground Connection

A ground connection from a good ground such as a cold water pipe or an eight-foot rod driven in the ground should be made to the transmitter chassis via the ground post on the rear apron. Care should be taken so as not to make the length of the ground wire an even multiple of the wave length of any of the amateur bands. This assures that no resonant lengths are present thereby insuring the transmitter chassis to be at ground potential.

3. For CW operation, no other connections to the external control receptacle are necessary, unless remote operation is desired. If remote is desired, the jumper wire between Pins 1 and 2 on the external control plug must be removed and the remote control "Operate" switch or relay connected between these pins. The antenna relay, in this case, must be connected to Pin 2 instead of Pin 1 on the external control plug.
4. A telegraph key or keying relay must be connected to the key jack for CW operation. An alternate for this connection would be to connect the key or relay to Pin 3 of the external control plug as this pin parallels the key jack connection. If the latter connection is used, the jumper between Pins 6 and 7 must be removed as this grounds the keying circuit when the plug is removed from the key jack. The other connection to the key should be made to ground via Pin 7 when the key jack is not used.
5. A crystal or crystals must be inserted in the sockets provided, if crystal control is desired. The two crystal sockets inside the unit provide for two commonly used crystals for net operation, frequency spotting, etc. If VFO operation is desired, its connection must be made to the VFO input jack on the rear apron. DO NOT use the front panel crystal socket, as no means are provided for converting the oscillator tube to an amplifier when the crystal switch is in the crystal No. 1 position.

IMPORTANT

ALWAYS KEEP THE INTERCONNECTING CABLE BETWEEN THE VFO AND THE TRANSMITTER AS SHORT AS POSSIBLE AS THIS COULD AFFECT THE PROPER OPERATION OF THE VFO.

6. Power Cord

The power cord should be inserted into a suitable outlet providing 110 to 120 volts AC, 50/60 cycle, single phase power only. Outlets in most homes today provide this power.

NOTE:

The power cord should not be inserted into an outlet until the section on operation is thoroughly read and understood.

7. Telephony Operation

Telephony or "phone" operation can be obtained by an external modulator providing 35 to 40 watts of audio power. To install a modulator, the jumper between pins 4 and 5 in the external control plug, must be removed and the modulator output connected to these pins. Refer to the modulator manual for impedance matching, proper connections, etc.

3. Operation

A. To turn equipment on

NOTE:

It is important that a particular sequence be followed when turning the equipment on so as not to damage any of the components.

1. Before inserting the power cord in an outlet, place the drive control in the "Off" position, the function switch in the standby position, and the meter switch in the off position. When the controls are in the above positions, the power cord may be inserted in the outlet.
2. Rotate the drive control in a clockwise direction until a "click" is heard, indicating the power switch has functioned. The green indicator light should now be lit.
3. Allow the equipment to warm up a few minutes until the tubes have reached operating temperature.
4. Place the meter switch in the "Grid" position.
5. Place the function switch in the "Tune" position. The blue indicator light should now be lit.

NOTE

The above steps should be followed in the order indicated each time the equipment is placed in operation. When turning the equipment off, the above steps should be followed in the reverse order.

B. Oscillator Adjustment

1. Before placing the function switch in the "Tune" position, select the band to be operated with the band switch.
2. Insert the proper crystal for the frequency to be operated. See chart below for proper crystal selection for each band.

Band	Band Coverage	Crystal Coverage	Xtal Multiplication Factor
80M	3.5 to 4.0 MC	3.5 to 4.0 MC	X1
40M	7.0 to 7.3 MC	7.0 to 7.3 MC	X1
20M	14.0 to 14.35 MC	7.0 to 7.175 MC	X2
15M	21.0 to 21.45 MC	7.0 to 7.15 MC	X3
10M	28.0 to 28.7 MC	7.0 to 7.425 MC	X4

To determine the proper crystal frequency, divide the operating frequency by the proper crystal multiplication factor as found in the above chart.

3. Place the function switch in the "Tune" position after the proper crystal and band have been selected.
4. Rotate the drive control fully clockwise or until about a mid-scale reading is obtained on the meter, indicating grid current.
5. Rotate the grid tuning control until a peak in grid current is reached.

NOTE

It may be necessary to reduce the drive by a counter-clockwise rotation of the drive control, so as to keep the meter pointer from going off scale.

6. After a peak in grid current is obtained, rotate the drive control until a grid current of approximately 2.5 MA is indicated.

NOTE:

On ten meters, better efficiency can be obtained in some cases, by reducing the drive to 1.5 to 2.0 MA.

7. The same adjustment procedures apply when a VFO is used for transmitter frequency control.

C. Power Amplifier Adjustment

1. Before placing the function switch in the operate position, set the pointer on the plate tuning knob to the maximum arrow and the pointer on the antenna loading knob to the minimum arrow.
2. Place the meter switch in the plate position.
3. Place the function switch in the operate position. This should extinguish the blue indicator and light the red indicator.
4. Close the key or keying circuit. Plate current should be indicated on the meter.
5. Rotate the plate tuning control in a clockwise direction until a sharp reduction or dip in plate current occurs, indicating resonance. Continue rotating the control until the plate current increases very slightly.

CAUTION!

Never allow the transmitter to run in the non-resonant condition for more than the few seconds needed to make the adjustment. If allowed to operate in the non-resonant condition for more than 10 seconds, severe damage may result in the 6146, meter, and other components due to the large amount of current being drawn and the large amount of heat being dissipated as a result.

Again, DO NOT allow the transmitter to run in the non-resonant condition for more than the few seconds it requires to resonate the circuit.

6. Place the meter switch in the grid position and readjust the drive and grid tuning controls for proper grid current as tuning the plate circuit has an effect on the grid circuit.
7. *Hold Key Closed*
Return the meter switch to the plate position and rotate the antenna loading control in a clockwise direction until a plate current of 160 MA is obtained.

CAUTION!

This step removes the plate circuit from resonance.

8. Repeat steps 5, 6, and 7 until the dip in plate current occurs at 160 MA, indicating the transmitter is loaded to 75 watts input power. Heavier loading may be accomplished, but will result in lower efficiency and in most cases, reduced output power.
9. Open the key or keying circuit and place the function switch in the standby position, extinguishing the red indicator light. The transmitter is now ready for operation.
10. For phone operation, the grid current should be increased approximately 0.5 to 1.0 MA above that shown in Step 6 in the section on oscillator adjustment.

D. Operating the Equipment

1. Once the transmitter has been properly adjusted, all that is necessary to place the equipment on the air, is to place the function switch in the operate position and operate the key.
2. Although opening the key will remove the transmitter signal from the air, high voltage is still present on the power amplifier. It is always good practice to place the function switch in the standby position during receiving periods.
3. When changing frequency or band of operation, it will be necessary to readjust the transmitter as per Sections B and C.

Master Parts List

Sym.	Part No.	Description	Sym.	Part No.	Description
C-1	1101-011	10MMFD 1000V.	L-3	1400-144	Coil, 20 Meter
C-2	1101-046	.01MFD 150V	L-4	1400-145	Coil, 15 Meter
C-3	1101-061	150MMFD 500V	L-5	1400-146	Coil, 10 Meter
C-4	1101-019	.001MFD 1000V	L-6	1400-095	Coil, Final
C-5	1101-037	.01MFD 600V	FS-1	1500-002	3 Amp Fuse
C-6	1101-019	.001MFD 1000V	SO-1	1602-001	Socket, Crystal 2 Unit
C-7	1101-017	18MMFD 600V	SO-2	1602-004	Socket, Crystal
C-8	1101-046	.01MFD 150V	P-1	2001-003	Phono Plug
C-9	1101-919	.001MFD 1000V	J-1	2000-011	Phono Receptacle Panel Mtg.
C-10	1101-048	.1MFD 10V	J-2	2000-004	Coax Receptacle
C-11	1101-028	.001MFD 3000V	J-3	2000-002	Phono Receptacle
C-12	1101-028	.001MFD 3000V	SW-1	2100-017	2 Pole 4 Position Switch
C-13	1101-028	.001MFD 3000V	SW-2	2100-042	Lever Function Switch
C-14	1101-019	.001MFD 1000V	SW-3	2100-043	Meter Switch
C-15	1101-019	.001MFD 1000V	SW-4A	2100-040	Band Selector Switch Frt.
FC-1	1106-018	10MFD 500V	SW-4B, C,		
FC-2	1106-018	10MFD 500V	& D.	2100-041	Band Selector Switch, Rear
FC-3	1106-014	20MFD 150V	M-1	2500-014	0-1 MA. Meter
FC-4	1106-024	40MFD 450V	DI-1	3700-061	Silicon Rectifier 400 Piv.
FC-5	1106-024	40MFD 450V	DI-2	3700-061	Silicon Rectifier 400 Piv.
VC-1	1105-022	2.3-14.2MMFD Variable	BR-1	3700-153	.5A 600 Piv. Diode
VC-2	1105-036	11-200MMFD Variable	PL-1, 2, 3	3800-007	Pilot Light 6.3 Volt
VC-3	1105-021	3-365MMFD Variable	V-1	6146	Tube
R-1	1000-009	100K, 1/2 Watt 20%	V-2	6CL6	Tube
R-2	1000-018	4.7K 1/2 Watt 10%			
R-3	2300-015	500K Control w/Switch	Qty.	Part No.	Description
R-4	1000-016	6.8K 1/2 Watt 20%	1	1500-006	Fuse Holder
R-5	1000-016	6.8K 1/2 Watt 20%	1	1600-016	Tube Shield
R-6	1010-008	Meter Shunt	1	1600-023	Tube Socket, 8-pin Black
R-7	1002-019	100K 2 Watt 20%	1	1600-024	Tube Socket, 8-pin Mica
R-8	1002-019	100K 2 Watt 20%	1	1700-040	Cabinet
R-9	1002-019	100K 2 Watt 20%	1	1800-031	Name Plate
R-10	1000-018	4.7K 1/2 Watt 10%	1	1800-045	Decorative Front Panel
R-11	1000-015	15K 1/2 Watt 20%	1	2003-011	Strip Pack
R-12	1000-004	27 Ohm 1/2 Watt 20%	1	2008-018	Terminal Connector
R-13	1003-001	25K 10 Watt 10%	1	2400-009	Pilot Bulb Socket
R-14	1003-001	25K 10 Watt 10%	3	2600-028	Lever Switch Knob Gray
R-15	1001-018	68K 1 Watt 20%	2	2600-030	Black Knob
R-16	1001-018	68K 1 Watt 20%	5	2600-031	Red Knob
R-17	1002-026	5.6K 2 Watt 10%	1	2700-042	Power Cord
R-18	1001-001	22 Ohm 1 Watt 20%	1	2703-019	Wiring Harness
T-1	1200-022	LV Power Trans.	2	3300-010	Rear Rubber Feet
T-2	1201-013	HV Power Trans.	2	3300-038	Coupling Connector
CH-1	1300-023	Filter Choke	1	3300-078	Coupling Connector 3/16 to 1/4
PC-1	1301-009	Parasitic Choke	2	3300-103	Plastic Extension Feet
RFC-1	1301-012	1.2MF R. F. Choke	2	3300-104	Front Rubber Feet
RFC-2	1301-012	1.2MH R. F. Choke	3	3300-116	Pilot Light Jewel
RFC-3	1301-023	Choke	1	3300-143	Decorative "G"
L-1	1400-142	Coil, 80 Meter	3	3300-209	Shaft 3-5/8 Lg.
L-2	1400-143	Coil, 40 Meter			

HG-303 SCHEMATIC DIAGRAM

