



OPERATING AND SERVICE INSTRUCTIONS

**COMMUNICATIONS
TRANSMITTER
MODEL HT-40 MARK I**

WARRANTY

"The Hallicrafter's 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 our authorized radio dealer, wholesaler, from whom purchased, or, authorized service center, intact, for examination, with all transportation charges prepaid within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

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 extended to units which have been repaired or altered outside of our factory or authorized service center, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

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 hallicrafters CO.

092-014555



Figure 1. View of Transmitter.

SECTION I

GENERAL DESCRIPTION

1-1. INTRODUCTION.

The Hallicrafters Model HT-40 MK1 or HT-40K MK1 kit is a four-tube, self-contained transmitter capable of AM (amplitude modulated) and CW (continuous wave) transmission on the 80, 40, 20, 15, 10, and 6 meter bands. The only requirements for immediate "on-the-air" operation are a 50-ohm to 75-ohm terminated antenna, a crystal or external VFO, a key or microphone and a 117-volt, 60-CPS, AC power source.

1-2. T.V.I. SUPPRESSION.

The transmitter has been designed and constructed to suppress spurious radiations that may cause television interference (T.V.I.). The T.V.I. problem has been given full consideration in the circuit design and in the selection and layout of parts. Adequate filtering has been provided for control circuits and AC power lines. Components were specifically selected to avoid undesired re-

sonances and arranged to prevent parasitic oscillation.

Another important T.V.I. proofing feature is employed in the output coupling circuit to the final amplifier. The tuned output circuit is a pi network which has excellent inherent harmonic suppression capability. The pi network is connected to a coaxial connector and permits the use of all antenna systems having an impedance of 50 ohms to 75 ohms.

The transmitter, as received from the factory, has every advantage of Hallicrafters advanced engineering to minimize television interference. There are, however, some types of T.V.I. which cannot be prevented within the transmitter itself. Therefore, it is recommended that, for maximum T.V.I. free operation of your transmitter, a low-pass filter be installed between the transmitter output connector and the coaxial antenna feed line.

TECHNICAL SPECIFICATIONS

TYPES OF EMISSION

- AM Amplitude modulation
- CW Continuous wave

FREQUENCY SELECTION Crystal controlled or external VFO

FREQUENCY COVERAGE 80, 40, 20, 15, 10, and 6 meter bands

POWER INPUT

- AM 75 watts peak power
- CW 75 watts maximum

AUDIO INPUT 0.004 V minimum at input to microphone jack

DISTORTION 8% at 75% modulation

HUM AND NOISE OUTPUT 40 DB or more below maximum output

TUBES Four, plus two silicon rectifiers

POWER SOURCE 105-125 volts, 60 CPS, AC

OUTPUT COUPLING Pi network

POWER CONSUMPTION 175 watts

RF OUTPUT IMPEDANCE 50 to 75 ohm coaxial connector accepts Amphenol 83-1SP connector

CW KEYING Panel mounted key jack accepts standard 2-connector 1/4" plug

MICROPHONE INPUT Rear chassis mounted microphone receptacle Amphenol 75-MC1F connector

DIMENSIONS 7-3/16" high, 13-3/8" wide, 8-1/4" deep

NET WEIGHT 17 pounds

SHIPPING WEIGHT 19 pounds

FREQUENCY COVERAGE

Band	Transmitter Frequency Range	Crystal or VFO Frequency Range
80	3.5 MC to 4 MC	3500 KC to 4000 KC
40	7 MC to 7.3 MC	7000 KC to 7300 KC
20	14 MC to 14.35 MC	7000 KC to 7175 KC
15	21 MC to 21.45 MC	7000 KC to 7150 KC
10	28 MC to 29.7 MC	7000 KC to 7425 KC
6	50 MC to 54 MC	8333 KC to 9000 KC

Note: 1000 KC = 1 MC

SECTION II

INSTALLATION

2-1. UNPACKING.

After unpacking the transmitter, examine it closely for any possible damage which may have occurred during transit. Should any sign of damage be apparent, file a claim immediately with the carrier stating the extent of damage. Carefully check all shipping labels and tags for special instructions before removing or destroying them.

2-2. LOCATION.

The unit should be placed in a location that provides adequate space around it to permit free circulation of air through the cabinet openings. Avoid excessively warm locations such as those on or near radiators and heating vents.

2-3. POWER SOURCE.

The transmitter is designed to operate on 105-volt to 125-volt, 60 cycle, AC current. Power consumption is 175 watts.

IMPORTANT

If in doubt about the power source, contact your local power company prior to inserting the power plug into an AC power outlet. Plugging the power cord into the wrong power source can cause extensive damage to the unit, requiring costly repairs.

2-4. CRYSTAL-VFO RECEPTACLE.

The CRYSTAL-VFO receptacle consists of two pin jacks, mounted on the front panel, to accommodate .093 "diameter pins with 1/2" center separation (similar to type FT-243 crystal holder).

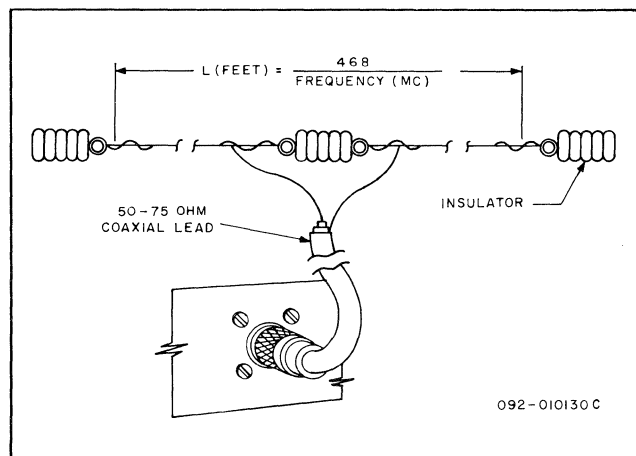


Figure 2. Coaxial Fed Half-Wave Dipole Antenna.

When an external VFO is used, connect the high (hot) side of the VFO output to the red pin jack and the ground side to the black pin jack.

2-5. KEY RECEPTACLE.

The KEY jack, a standard two-conductor, closed circuit type jack located on the front panel, provides for the connection of a handkey, a bug, or an automatic keyer (T.O. Keyer). In addition to the KEY jack, the keying instrument may be connected to terminals 3 and 4 of the four-terminal strip located on the rear of the chassis. These contacts are connected in parallel with the KEY jack when the plug is removed from the jack (see para. 2-8).

2-6. MICROPHONE CONNECTOR.

The microphone connector, located on the rear of the chassis, is an Amphenol type 75-PC1M bulkhead receptacle and will accept an Amphenol type 75-MC1F microphone plug.

2-7. ANTENNAS.

It is suggested that a half-wave dipole antenna fed with a 50-ohm coaxial cable be used to radiate maximum power from the transmitter (see figure 2). Refer to the ARRL ANTENNA HANDBOOK or similar publications for detailed information concerning transmitting antennas.

2-8. ACCESSORY TERMINAL STRIP.

A four-terminal strip on the rear of the chassis permits connecting the transmitter to auxiliary equipments.

The FUNCTION switch in the AM or CW position electrically connects terminals 1 and 2. When the FUNCTION switch is in either the OFF, TUNE, or STANDBY position, these terminals are not electrically connected. When terminals 1 and 2 are connected to auxiliary equipment such as an antenna changeover relay, the FUNCTION switch controls the operation of the relay (see figure 3).

Terminals 3 and 4 connected across (in parallel with) the KEY jack terminals, when the plug is removed from the KEY jack, permit the transmitter to be connected to a remote control switching device such as the SX-140 Receiver, a remote control switch, or separate leads from the push-to-talk switch on the microphone (see figure 4). The transmitter may be keyed by connecting a key to terminals 3 and 4. For remote control operation or keying from these terminals, the key plug must be removed from the KEY jack and the shorting wire removed from terminals 3 and 4.

SECTION III

OPERATING CONTROLS

3-1. FUNCTION CONTROL.

The FUNCTION control, a five-position rotary switch, is used to select the transmitter mode of operation as indicated.

1. OFF position: AC power is disconnected from the power transformer primary.
2. TUNE position: power is applied to the oscillator and buffer stages but not to the modulator and final amplifier stages. Grid current is adjusted with the DRIVE control for maximum indication on the RF OUTPUT - GRID CURRENT meter.
3. STANDBY position: the negative side of the DC power supply is disconnected from the internal circuitry. Provision is made for remote control switching, refer to paragraph 2-8.

NOTE

A unique feature of the power supply allows current to be constantly fed through the bleeder when in the STANDBY position, thus providing better voltage regulation when switching from STANDBY to AM or CW.

4. AM position: power is applied to the oscillator, buffer, speech amplifier, final amplifier and modulator stages.
5. CW position: power is applied directly to the buffer and final amplifier plate, and to the oscillator and final amplifier screen grid through the 6DE7 modulator tube which, in the CW position functions as a series regulator tube.

3-2. BAND SELECTOR CONTROL.

The BAND SELECTOR is a six-position, multi-section rotary switch used to select the pro-

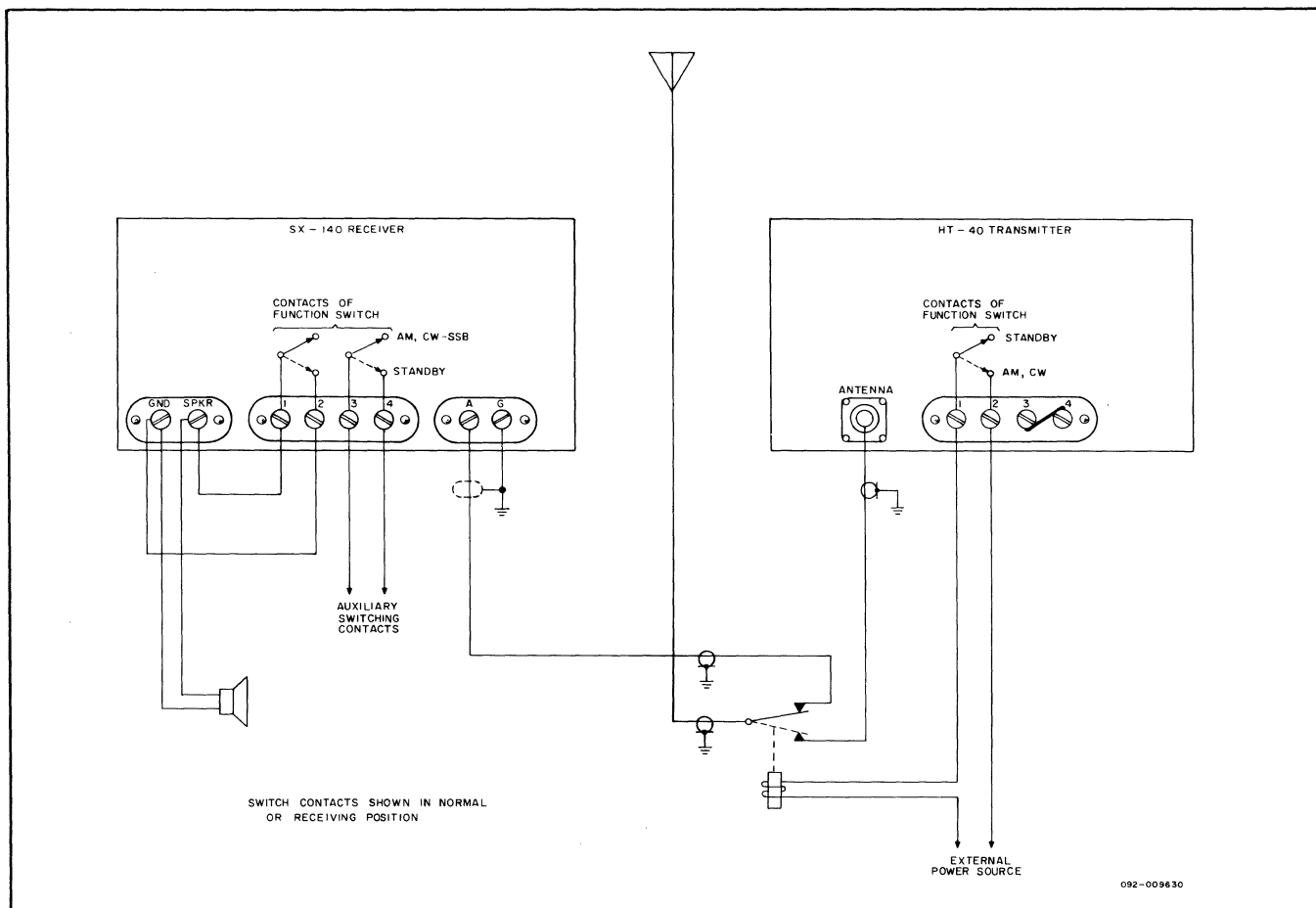


Figure 3. Transmitter Controlling an Antenna Relay.

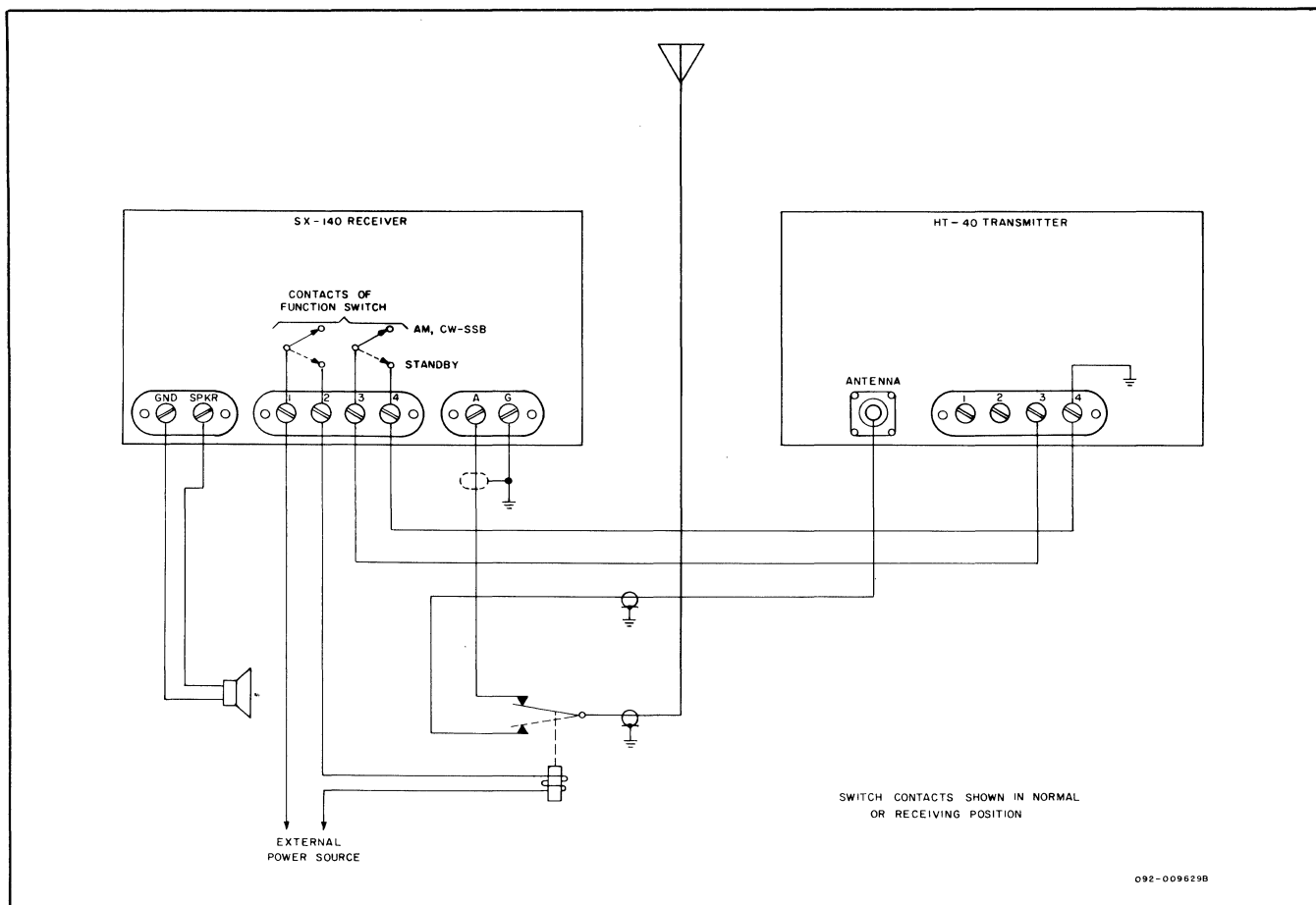


Figure 4. Transmitter Controlled by Station Receiver.

per inductance in the driver and final amplifier pi network for each band.

3-3. DRIVE CONTROL.

The DRIVE control is a variable capacitor used to tune the plate circuit of the buffer stage. This control also functions as the input tuning capacitor of the pi network between the output of the buffer stage and the input to the final amplifier stage. Operation of this control is such that it is impossible to tune to a harmonic of the desired output frequency.

3-4. CRYSTAL-VFO SWITCH.

The CRYSTAL-VFO switch is a SPDT slide switch which permits the transmitter to operate either crystal controlled or to operate from an external VFO.

3-5. RF OUTPUT-GRID CURRENT SWITCH.

The RF OUTPUT-GRID CURRENT switch is a DPDT slide switch which permits the operator to switch the meter either into the grid circuit of the final amplifier (6DQ5) or across the RF output load.

3-6. PLATE LOADING CONTROL.

The PLATE LOADING control is a variable capacitor in the output of the pi network section which adjusts the plate load impedance, thus matching the transmitter to the antenna.

3-7. PLATE TUNING CONTROL.

The PLATE TUNING control is a variable capacitor which tunes the plate circuit of the final amplifier (6DQ5) to the desired operating frequency.

3-8. MIKE GAIN CONTROL.

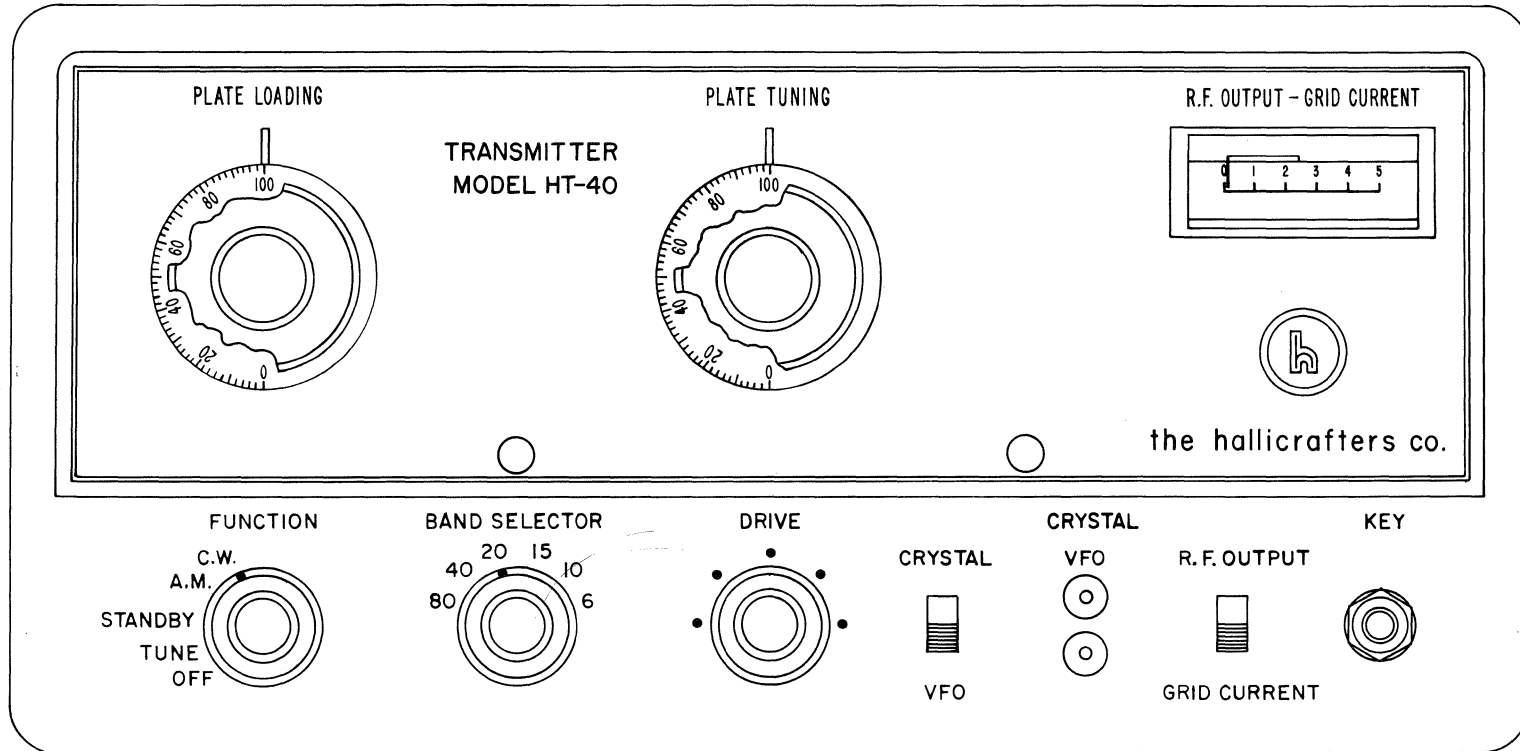
The MIKE GAIN control, a 1-megohm potentiometer located on the rear of the chassis, controls the audio signal applied to the grid of the audio amplifier tube V3B.

3-9. MODULATION AND KEYING INDICATOR.

The modulation and keying indicator lamp functions as a voltage reference device for the grid of the 6DE7 regulator tube and will dim as the transmitter is keyed.

In AM operation, the indicator has been set to indicate 80% modulation when the lamp is just flickering on and off.

Figure 5. Transmitter Front Panel Controls.



SECTION IV OPERATION

4-1. GENERAL.

The tuning procedure for the transmitter has been simplified in design to permit rapid adjustment to the desired frequency. However, this does not mean that the transmitter may be operated successfully when only rough tuning adjustments are made. A clean signal from any transmitter requires good operating technique.

4-2. TUNING PROCEDURE FOR CW OPERATION.

The following tuning procedure must be performed prior to operating the transmitter in the CW mode.

EQUIPMENT REQUIRED

1. 50-ohm, non-inductive dummy load or a 40-watt light bulb (see figure 6).
2. Crystal with its fundamental or harmonic frequency corresponding to the desired transmitting frequency or an external VFO.

PROCEDURE

1. Set the controls as indicated:

MIKE GAIN Maximum counter-clockwise

FUNCTION OFF

BAND SELECTOR Desired band

DRIVE Center of range

CRYSTAL-VFO CRYSTAL

RF OUTPUT-GRID GRID CURRENT CURRENT

PLATE LOADING

80 to 20 meter bands Near 100

10 and 6 meter band Near 0

PLATE TUNING

80 to 20 meter bands Near 100

10 and 6 meter band Near 0

2. Insert crystal of desired frequency into the CRYSTAL-VFO socket.

3. It may be desirable to insert the key plug into the KEY jack and close the key at this time to allow the operator to tune the transmitter. However, this is not necessary since the jack is a normally closed circuit type when the key plug is removed.
4. Connect the dummy load to the antenna connector on the rear chassis panel and plug the line cord into a 117-volt, AC utility outlet.
5. Set FUNCTION control to STANDBY, allow approximately 5 minutes to warm up, then set FUNCTION control to TUNE.
6. Adjust DRIVE control for maximum deflection on the RF OUTPUT-GRID CURRENT meter.
7. Set RF OUTPUT-GRID CURRENT switch to the RF OUTPUT position.
8. Rotate FUNCTION control to CW.

NOTE

In steps 9, 10, and 11 the final settings of the PLATE LOADING and PLATE TUNING controls will be the setting which is nearest the 100 mark on the Tuning knob dials. These settings will be near 100 on the 80 and 40 meter bands and progressively lower on the 20 to 6 meter bands. On 6 meters, the correct setting will be between 0 and 20.

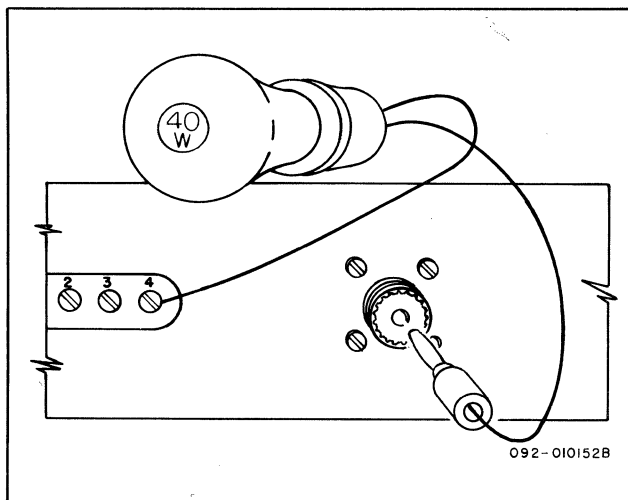


Figure 6. Light Bulb Used as Dummy Load.

9. Adjust PLATE TUNING control for maximum output indication on the meter.
10. Adjust PLATE LOADING control for maximum output indication on the meter.
11. Repeat steps 9 and 10 until maximum output is obtained; note the approximate meter reading.
12. Turn transmitter off with the FUNCTION control, disconnect the dummy load and connect the transmitting antenna.
13. Rotate the FUNCTION control to CW and note output indication. If the antenna impedance is approximately the same as that of the dummy load, the meter indication will be approximately the same as that noted in step 11. If antenna line is open, a higher indication will be noted; if antenna line is shorted, approximately zero indication will be noted.
14. If the proper indication is obtained on the meter, the transmitter is ready for CW operation.

4-3. TUNING PROCEDURE FOR AM OPERATION.

The procedure for tuning the transmitter for AM operation is identical to the tuning procedure

for CW operation in Paragraph 4-2, step 1 through step 12 except that the CW key need not be plugged in. The following procedure will complete the tuning of the transmitter for AM operation:

1. Connect the microphone to the MIKE connector on the rear of the chassis.
2. Rotate the FUNCTION control to AM; note the meter indication, it should be approximately one fourth the indication noted in step 11 of paragraph 4-2.
3. While talking in a normal voice level at the desired distance from the microphone and observing the modulation indicator lamp, advance the MIKE GAIN control clockwise until the indicator lamp just flickers on and off. This provides 75% to 90% AM modulation.

CAUTION

Never over-modulate the transmitter. Over-modulation will be indicated by continuous bright flickering of the modulation indicator lamp.

4-4. SERVICE OR OPERATING QUESTIONS.

For any further information regarding operation of the transmitter, contact your Hallicrafters dealer. The Hallicrafters Company maintains an extensive system of authorized service centers where any required service will be performed promptly and efficiently at a nominal

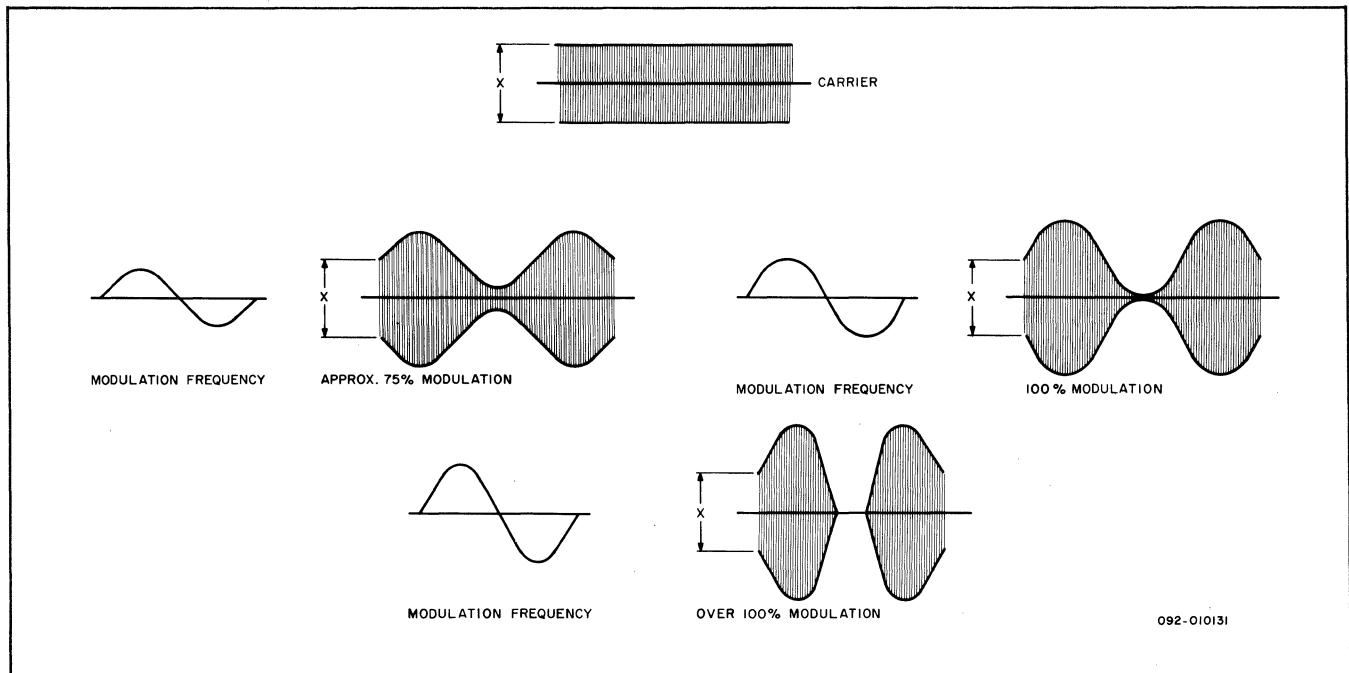


Figure 7. Carrier Modulation Patterns.

charge. All Hallicrafters Authorized Service Centers display the sign shown at the right. For the location of the one nearest you, consult your dealer or telephone directory.

Do not make any service shipments to the factory unless instructed to do so by letter. The Hallicrafters Company will not accept the responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production of equipment and assumes no obligation to incorporate these revisions in earlier models.



SECTION V

THEORY OF OPERATION

5-1. GENERAL.

The transmitter utilizes a built-in oscillator circuit or external VFO for generating the desired fundamental signal that is to be amplified straight through, or operated as a harmonic generator to produce the desired output frequency on each band. Circuits are employed in the transmitter to permit operation at any desired frequency in the 80, 40, 20, 15, 10, and 6 meter bands on CW (continuous wave) or AM (amplitude modulation). Screen injection or carrier control modulation is employed for phone transmission.

5-2. CRYSTAL-OSCILLATOR.

The triode section of V1 (6CX8) is used in a modified Pierce Type of crystal oscillator circuit. In this circuit, feedback energy is fed from the plate to the grid by means of a 5000 mmf capacitor in series with the crystal. The grid circuit elements consist of a 100K ohm grid return resistor shunted by a 50 mmf capacitor loading capacity. The plate circuit utilizes a 2.5 MH choke as a common fixed plate load for all frequencies of operation. Coupling from the oscillator plate to buffer grid is accomplished with a 50 mmf capacitor.

When operating the transmitter with external VFO, the crystal is removed from the pin jacks and the VFO output terminals are connected to the pin jacks. The high side of the VFO output is connected through the red jack to the grid of V1B (6CX8) and the ground side of the VFO output is connected through the black jack and switch S1 in the VFO position to RF ground. When S1 is in the VFO position, the triode section (V1A) is switched to STANDBY and does not operate.

5-3. BUFFER-MULTIPLIER.

The pentode section of V1 (6CX8) is operated as a buffer multiplier. The signals are fed from the oscillator circuit to the grid of the buffer and amplified or multiplied by this stage operating in class C. The buffer plate load consists of a shunt fed 100 UH choke coupled to the grid of the final amplifier tube V2 (6DQ5) by means of a pi network with separate inductances for each band. The network input is tuned with the DRIVE capacitor and the network output is terminated with a 9 mmf capacitor connected to the 6DQ5 grid circuit. Because of the proper selection of coils in each band, it is impossible to tune to a harmonic of the output frequency with the DRIVE capacitor. This reduces the possibility of undesirable signals being fed to the antenna and keeps television interference to a minimum.

5-4. FINAL AMPLIFIER STAGE.

The final amplifier stage, utilizing a 6DQ5 beam powered pentode tube, operates as a straight through amplifier on the 80 through 10 meter bands and as a frequency doubler on the 6 meter band. The final amplifier plate load consists of a shunt-fed RF choke capacitively coupled to the pi section network. The input of the network is tuned with the PLATE TUNING capacitor, and is terminated with the PLATE LOADING capacitor for matching the plate impedance to the impedance of the antenna. A tapped coil (L10) is used for the 80 through 10 meter bands; the 6 meter band uses a separate coil (L9) connected at right angles to L10 so that a minimum of mutual inductance exists between them. A sensitive meter (M1) is used in this circuit to measure grid current and output power.

5-5. RF OUTPUT-GRID CURRENT METER.

The RF OUTPUT-GRID CURRENT meter is a basic 5 mil movement graduated in 5 units (0-5). The meter and its circuitry perform two important functions:

1. With the switch S4 in the GRID CURRENT position, the final amplifier grid current can be measured; each division indicates approximately 1 milliamperere.
2. With switch S4 in the RF OUTPUT position, the output power delivered to the antenna can be measured. Each division on the meter represents approximately 18 watts when the VSWR is 1 to 1. Therefore, if a deflection of 2 is indicated, 36 watts are being delivered to the antenna ($2.0 \times 18 = 36$).

5-6. SPEECH AMPLIFIER, MODULATOR, & SERIES VOLTAGE REGULATOR.

The speech amplifier section of the audio system consists of the two triode sections of V3 (12AX8) and one triode section of V4 (6DE7) RC coupled and operated in cascade to develop an adequate signal input to the modulator (second triode section of V4). The modulator has a low plate resistance and acts as a high level cathode follower. The screen impedance of the 6DQ5 (the modulated element) becomes an appreciable portion of the cathode follower impedance. The audio frequency component of the cathode follower is applied in full to the screen of the final amplifier (6DQ5) tube through a .5 mfd capacitor to permit modula-

tion of the screen. An RF filter between the microphone jack and the grid of the MIKE preamplifier (V1A) eliminates distortion in the system which could be caused by RF across the microphone jack.

During CW operation, the modulator (V4B) section of the 6DE7 is connected as a series Voltage Regulator Tube and supplies Regulated Voltage to the crystal oscillator and final amplifier screen circuits.

5-7. POWER SUPPLY.

The DC voltage to operate the transmitter is obtained by rectifying the AC voltage across the secondary of the power transformer T1 with a full-wave voltage doubler circuit using two silicon diode rectifiers. Adequate filtering of the power supply is accomplished by the voltage doubler circuit, together with the choke and output filter capacitors.

Another secondary winding of the power transformer furnishes filament voltage for all of the tubes in the transmitter.

To prevent television interference from being conducted back through the power cord to the power line, an LC filter is connected across the power transformer primary.

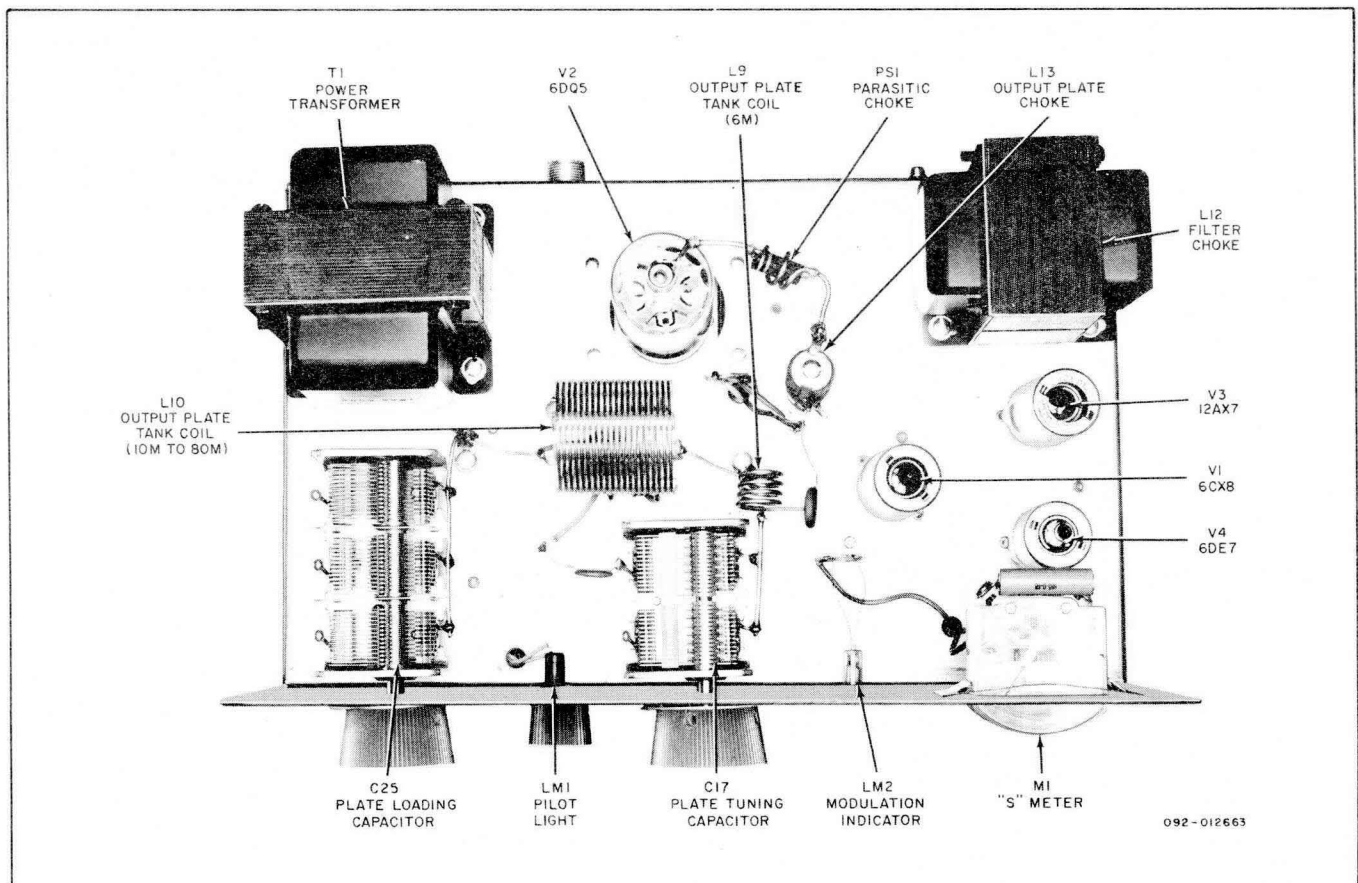


Figure 8. Top View of Transmitter Chassis.

SECTION VI

SERVICE DATA

6-1. CHASSIS REMOVAL.

Remove the 10 No. 6 threadforming screws from the rear of the cabinet. Slide the chassis, including the front panel, out the front of the cabinet.

6-2. TUBE AND PILOT LIGHT REPLACEMENT.

Access to the tubes and pilot light may be obtained by removing the chassis from the cabinet (see para. 6-1). For tube and pilot light location refer to figure 8.

6-3. TROUBLE SHOOTING.

In this transmitter, as in all well-designed communications equipment, maintenance and re-

pair problems are generally confined to checking and replacing defective tubes. Malfunctions of this nature are easily isolated and corrected by tube substitution. Should malfunctions other than faulty tubes occur, refer to the schematic diagram for proper voltage, resistance, and capacity values.

Table 1 provides suggestions for servicing the transmitter. It is possible that this table is incomplete as there are numerous causes for improper operation of any piece of equipment which can only be determined with elaborate instruments and a complete knowledge of the entire circuit. However, each component of the transmitter is pretested before it is placed in the unit, thus the table will provide adequate servicing information in most instances.

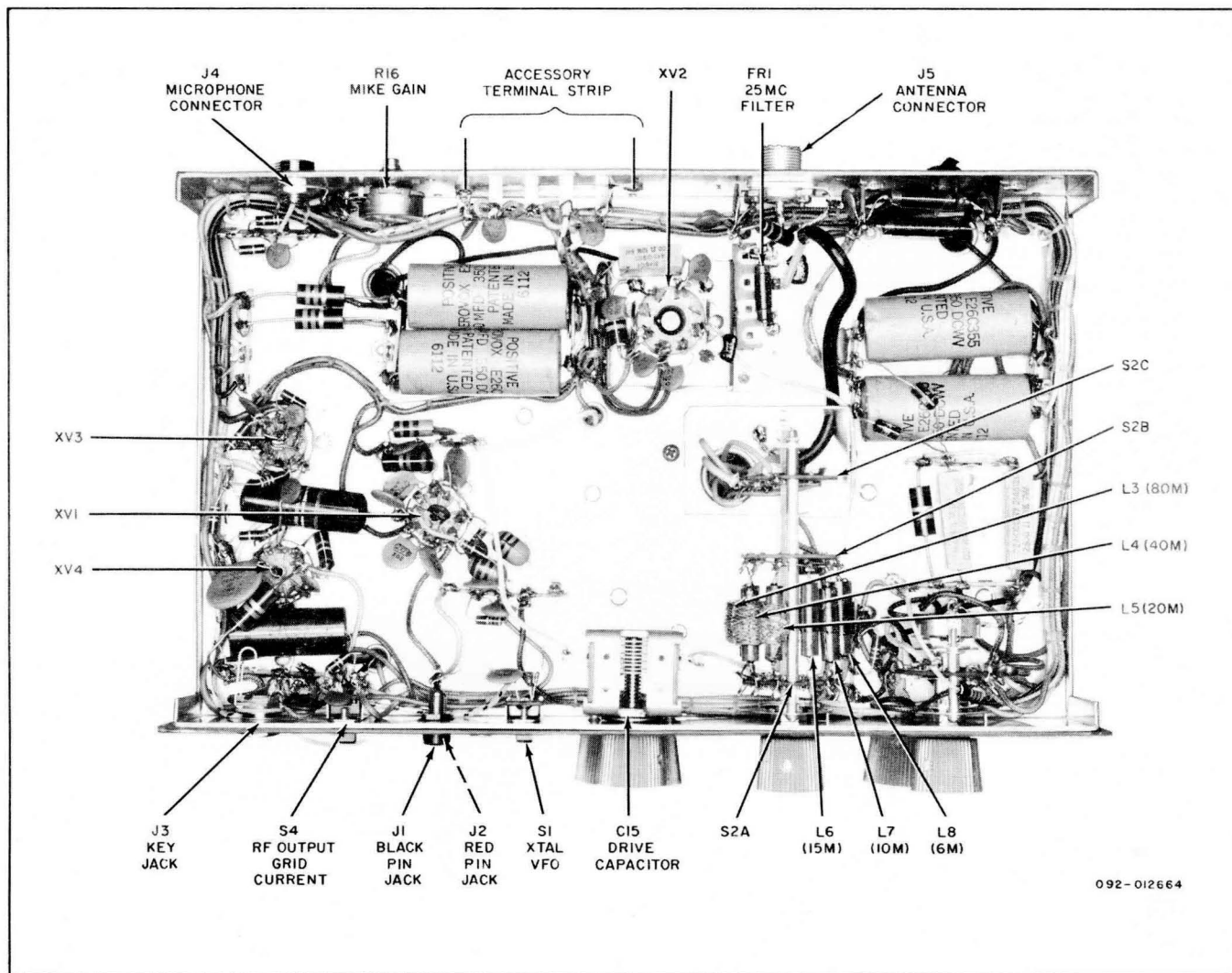


Figure 9. Bottom View of Transmitter Chassis.

Figure 10. Schematic Diagram of Transmitter.

