hallicrafters

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 resonances 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).

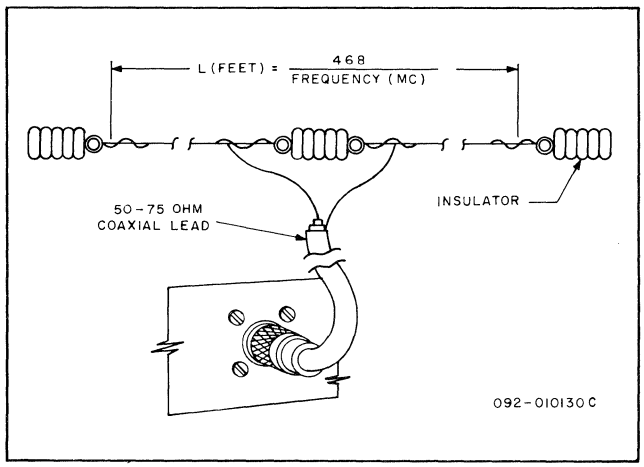

Figure 2. Coaxial Fed Half-Wave Dipole Antenna.

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 hand keyer, 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-

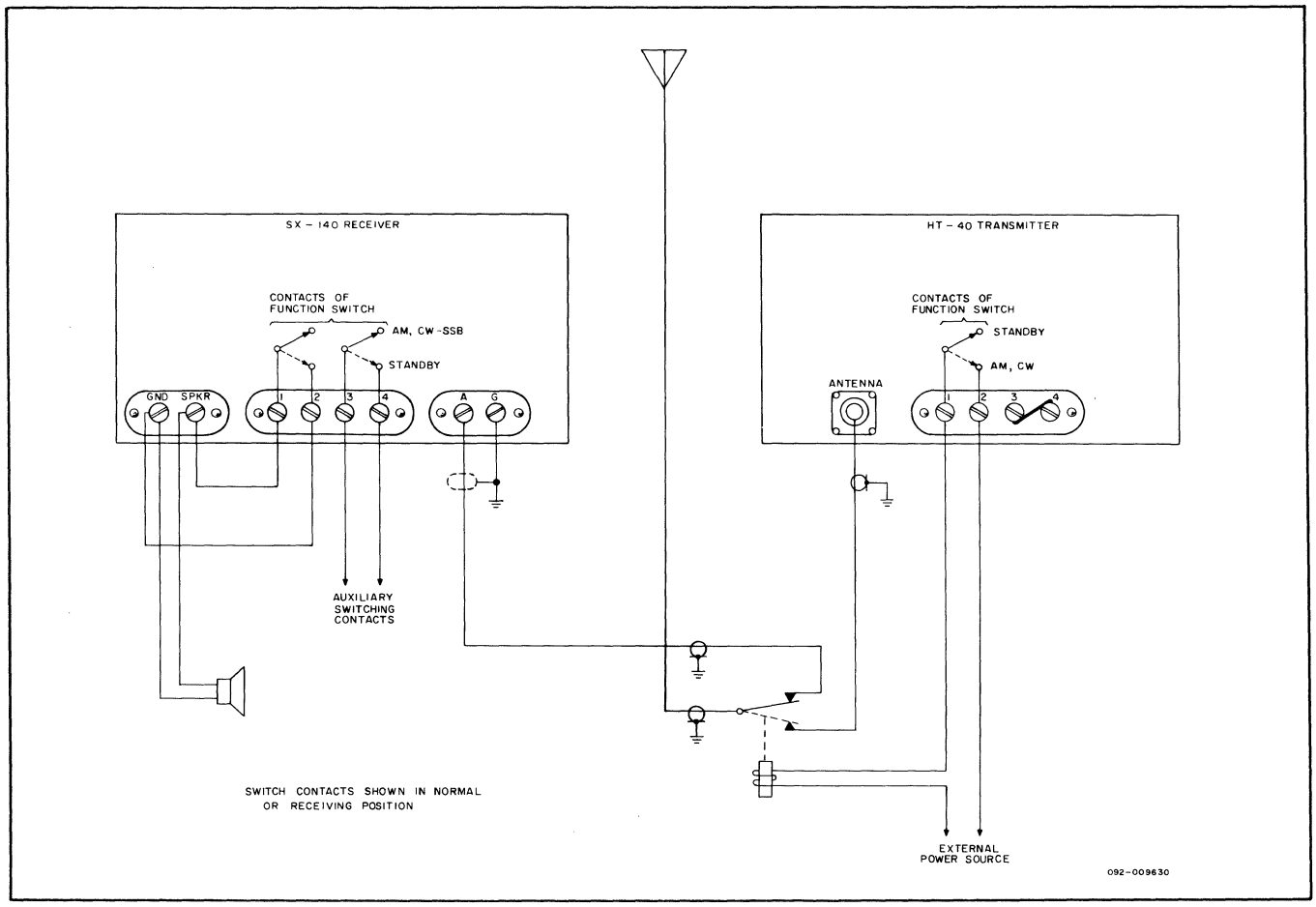

Figure 3. Transmitter Controlling an Antenna Relay.

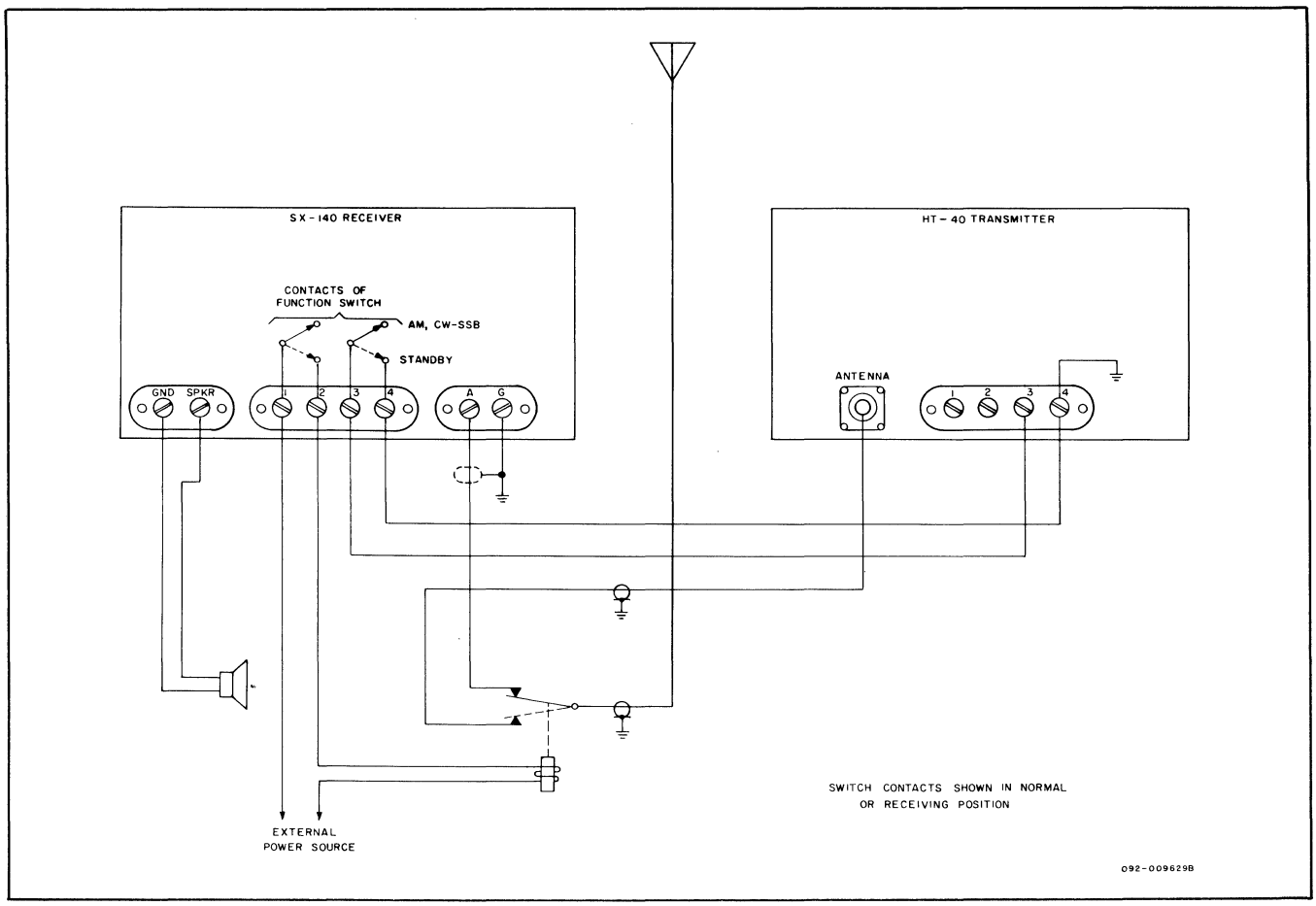

Figure 4. Transmitter Controlled by Station Receiver.

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.

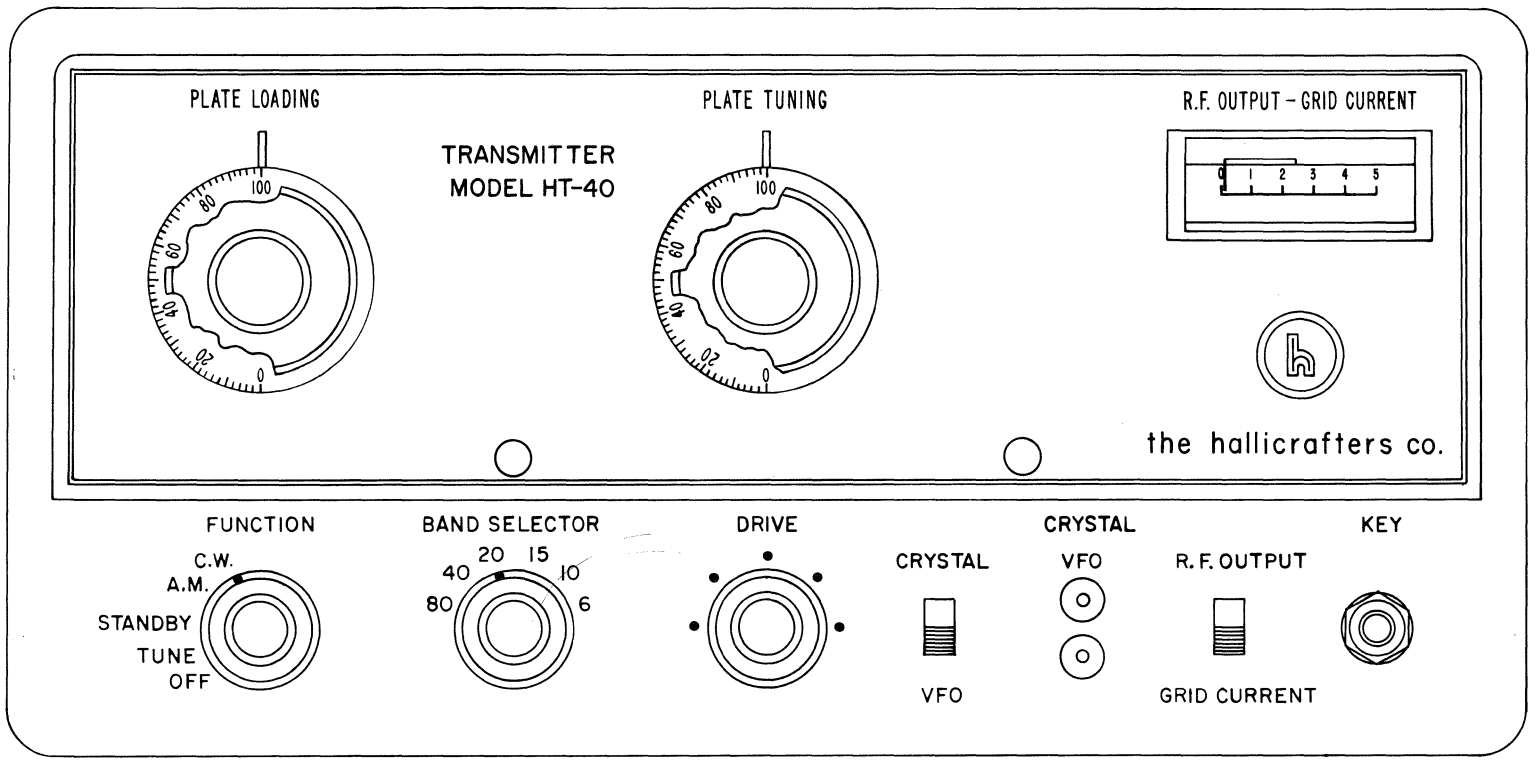

Figure 5. Transmitter Front Panel Controls.

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 CURRENT . .	GRID 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.

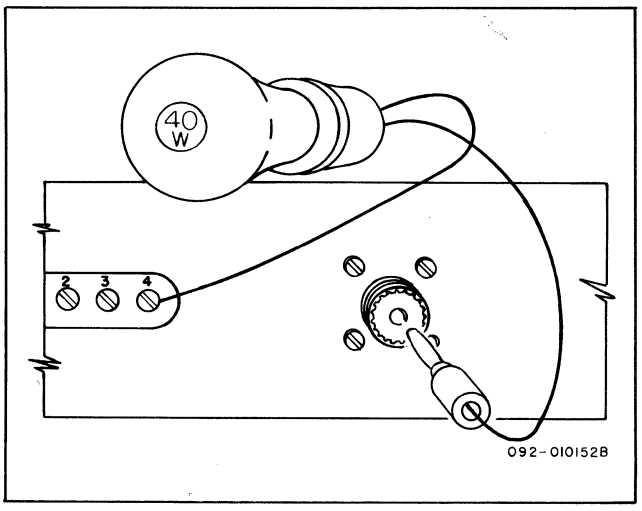

Figure 6. Light Bulb Used as Dummy Load.

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

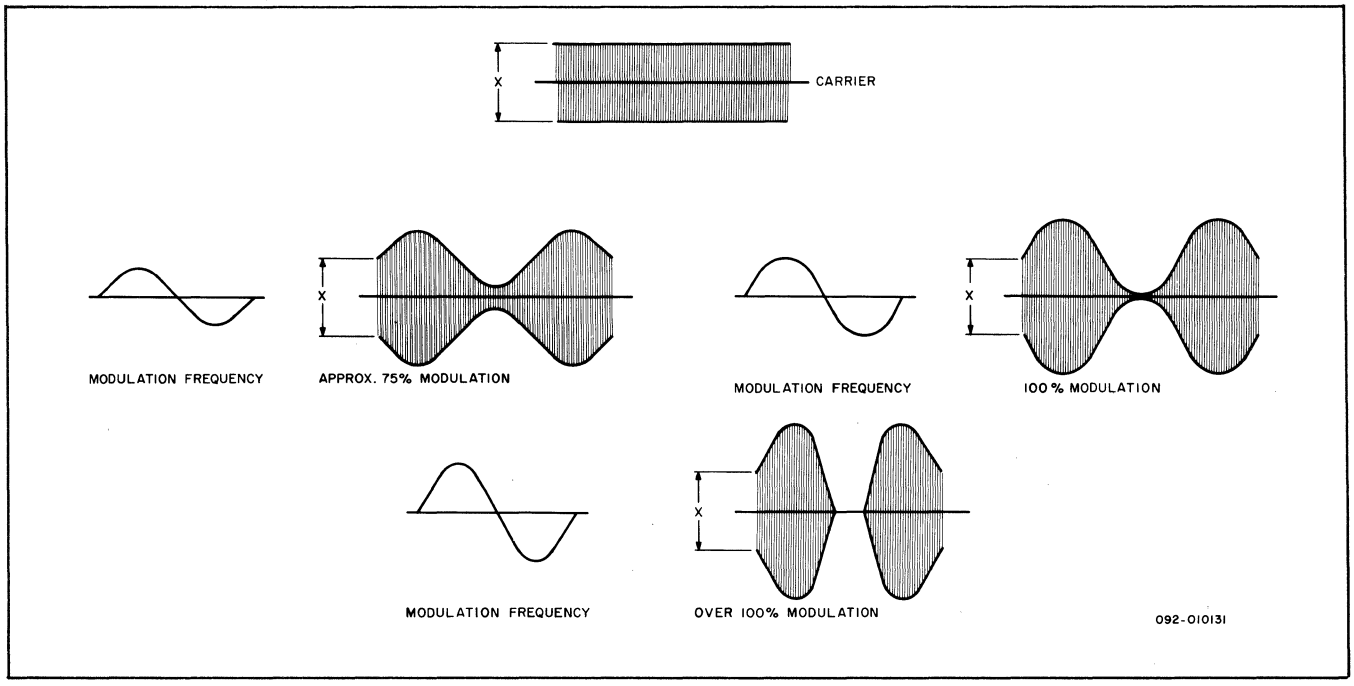

Figure 7. Carrier Modulation Patterns.

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 milliampere.

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 x 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 modulation 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.

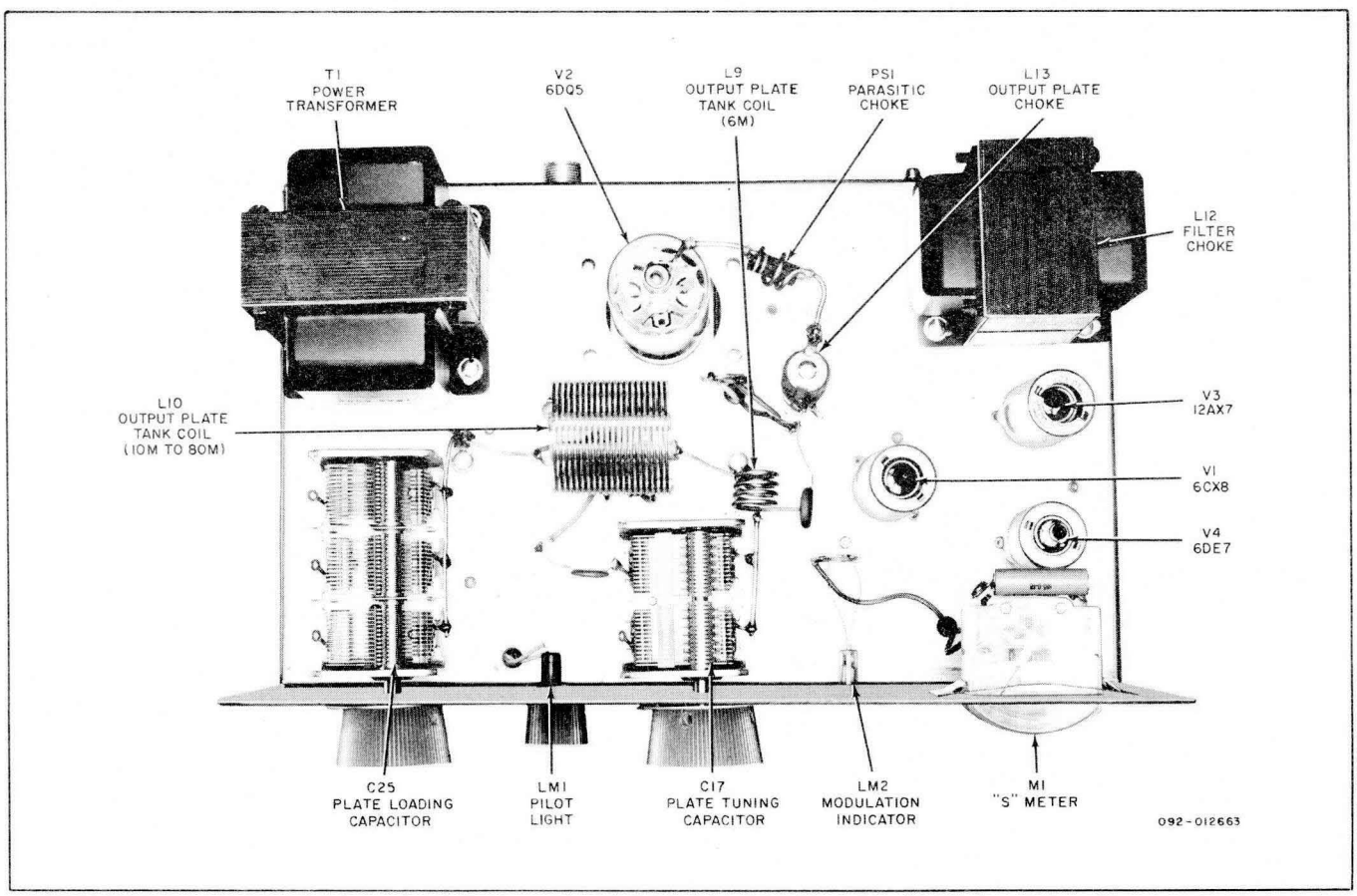

Figure 8. Top View of Transmitter Chassis.

SECTION VI
SERVICE DATA

6-1. CHASSIS REMOVAL.

Remove the 10 No. 6 thread forming 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 repair 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.

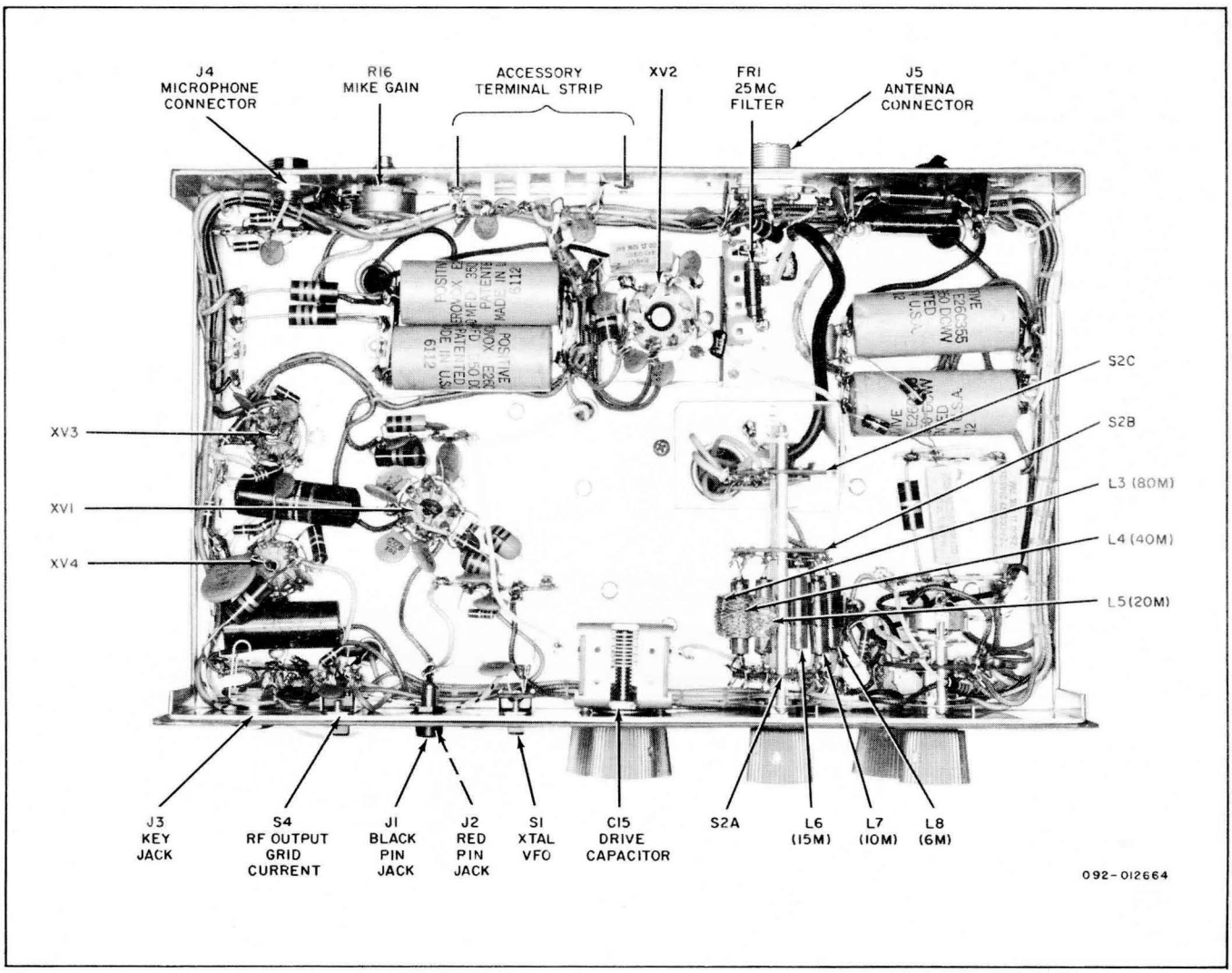

Figure 9. Bottom View of Transmitter Chassis.

Table 1. Trouble Shooting Information.

Symptom	Possible Cause
No output on any band (AM or CW)	1. V1 or V2 defective. 2. T1, L16 and/or associated power supply components defective. 3. Shorted antenna.
No AM modulation on any band; CW operation functions properly	1. V3 or V4 defective. 2. Microphone and/or associated components in the audio system defective.
No output on any one band.	1. Defective interstage coil for particular band. 2. BAND SELECTOR defective. 3. Oscillator Crystal defective.

SERVICE REPAIR PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number
	CAPACITORS	
C1, 3, 8, 10, 11, 12, 31, 39, 48, 49	0.005 mfd., 500V, GMV, Cer. Disc	047-100442
C2, 9, 14	50 mmf., 600V, 10% Cer. Disc	047-100744
C4, 5, 6, 13, 16, 20, 21, 23, 24, 27, 28, 30, 33, 40, 41, 42, 43	0.001 mfd., 1000V, GMV, Cer. Disc	047-101172
C7	0.01 mfd., 500V, +80-20% Cer. Disc	047-100224
C15	6-37 mmf., Variable, DRIVE	048-000499
C17	14-140 mmf., Variable, PLATE TUNING	048-000496
C18	0.001 mfd., 3000V, 20%, Cer. Disc	047-100397
C19	9 mmf., 300V, 2%, Duramica	481-131090
C22	100 mfd., 12 VDC, Electrolytic	045-100619
C25	33-1290 mmf., Variable, PLATE LOADING	048-000519
C26	100 mmf., 2000V, 10%, Cer. Disc	047-001601
C29, 35	100 mmf., 1000V, 20%, Cer. Disc	047-001397
C32	0.1 mfd., 600V, 10% Molded Paper	499-031104
C34	0.01 mfd., 1400V, GMV, Cer. Disc	047-200752
C36	0.47 mfd., 400V, 10%, Molded Paper	046-001337
C37	0.005 mfd., 1000V, 20%, Cer. Disc	047-100523
C38	0.05 mfd, 50V, Ceramic Disc	047-001144
C44, 45, 46, 47	40 mfd., 350 WVDC, Electrolytic	045-000723
C50	750 mmf., 300V, 2%, Duramica	481-161751
C51	22 mmf., 300V, 2%, Duramica	481-151220
	*RESISTORS	
R1, 4	100K ohm	451-252104
R2	47K ohm	451-252473
R3, 11	22K ohm, 2W	451-652223
R5	470 ohm	451-252471
R6, 20	12K ohm, 2W	451-652123
R7	2.5K ohm, 7W, Wirewound	024-001357
R8, 13	1 megohm	451-252105
R9	39K ohm, 1W	451-352393
R10	10K ohm	451-252103
R12	4.7K ohm	451-252472
R14	2.2 megohm	451-252225
R15, 17, 19	470K ohm	451-252474
R16	1 megohm, Variable, MIKE GAIN	025-001949
R18	10 megohm	451-252106
R21	100K ohm, 1W	451-352104
R22	2.2K ohm	451-252222
R23	5.6K ohm, 1W	451-352562
R24	1K ohm	451-252102
R25	56K ohm	451-252563
R26	20 ohm, 7W, Wirewound	024-001356
R27, 28	56K ohm, 2W, 20%	451-653563
R29	68K ohm	451-252683
R30	100 ohm	451-252101
R31	100 ohm, 5W, Wirewound	445-012101

*RESISTORS (cont.)

*RESISTORS are 10%, 1/2 watt, carbon type unless otherwise specified.

Schematic Symbol	Description	Hallicrafters Part Number
	COILS AND TRANSFORMERS	
L1	2.5 MH, 125 MA; RF choke	053-000597
L2	100 UH, 200 MA; RF choke	053-000644
L3	Coil, Interstage Pi Network (80 M)	051-003296
L4	Coil, Interstage Pi Network (40 M)	051-003297
L5	Coil, Interstage Pi Network (20 M)	051-003298
L6	Coil, Interstage Pi Network (15 M)	051-003299
L7	Coil, Interstage Pi Network (10 M)	051-003300
L8	Coil, Interstage Pi Network (6 M)	051-003301
L9	Coil, Output Tank (6 M)	051-003308
L10	Coil, Output Tank (80 thru 10 M)	051-003302
L11	1 MH, 200 MA, RF Choke	053-000598
L12	Choke, Filter	056-000446
L13	0.425 MH; Plate Output Choke	053-200426
L14, 15	3.8 UH; Line Choke	053-000607
L16	Coil, 25 MC, Parallel Filter	051-003257
L17	25 MC, Series Filter	051-003256
PS1	Parasitic Choke Assy	053-000645
T1	Transformer, Power	052-000852
	SWITCHES	
S1	Switch, SPDT; XTAL-VFO	060-200967
S2A, B, C	Switch, Rotary; BAND SELECTOR	060-002413
S3	Switch, Rotary; FUNCTION	060-002417
S4	Switch, DPDT; RF OUTPUT - GRID CURRENT	060-002260

Schematic Symbol	Description	Hallicrafters Part Number
	JACKS, SOCKETS AND CONNECTORS	
J1	Jack, Pin; Black	036-000295
J2	Jack, Pin; Red	036-000294
J3	Jack, Phone; KEY	036-100002
J4	Connector, Microphone	029-100566
J5	Connector, Coaxial (Antenna)	010-100056
XV1,3,4	Socket, Tube; 9-Pin Miniature	006-000947
XV2	Socket, Tube; Octal	006-000948
TA1	Terminal Board, Accessory (4 contacts)	088-002411
	TUBES, LAMPS AND RECTIFIERS	
CR1, 2	Diode, Silicon (Voltage Doubler Circuit) Type 1N3255	019-002939-03
CR3	Diode, Germanium (Meter Circuit) Type 1N295	019-301980
V1	6CX8; Oscillator and Buffer	090-901418
V2	6DQ5; RF Output	090-901420
V3	12AX7; Microphone Pre-Amplifier 1st and 2nd Audio Amplifier	090-900038
V4	6DE7; 3rd Audio Amplifier and Modulator	090-901419
LM1	Pilot Lamp, Neon	039-000613
LM2	Modulation Indicator Lamp, Neon	039-000673
	MISCELLANEOUS	
	Base, Tube Shield (V1, 3, 4)	069-001417
	Bracket, Tube Mtg. (V2)	067-008881
	Cabinet	150-901138
	Cable, Coaxial, RG-58/U	087-100960
	Foot, Plastic	016-201072
	Insulator, Stand Off (L9 and L10 mtg.)	008-006149
	Knob, FUNCTION and BAND SELECTOR	015-001725
	Knob, DRIVE	015-001724
	Knob, PLATE LOADING AND PLATE TUNING	015-001735
PL1	Line Cord	087-100078
	Lock, Line Cord	076-200397
M1	Meter, RF OUTPUT - GRID CURRENT	082-000493
N1	Neon light, type NE-2H	039-000671
	Panel, Front	068-001232
	Shield, Electrical	069-001402
	Shield, Tube (V1, 3, 4)	069-100430
	Spacer (C17 and C25 mtg.)	073-003691
	Washer, Flat Fiber (Stand Off Insulator Mtg.)	004-200522

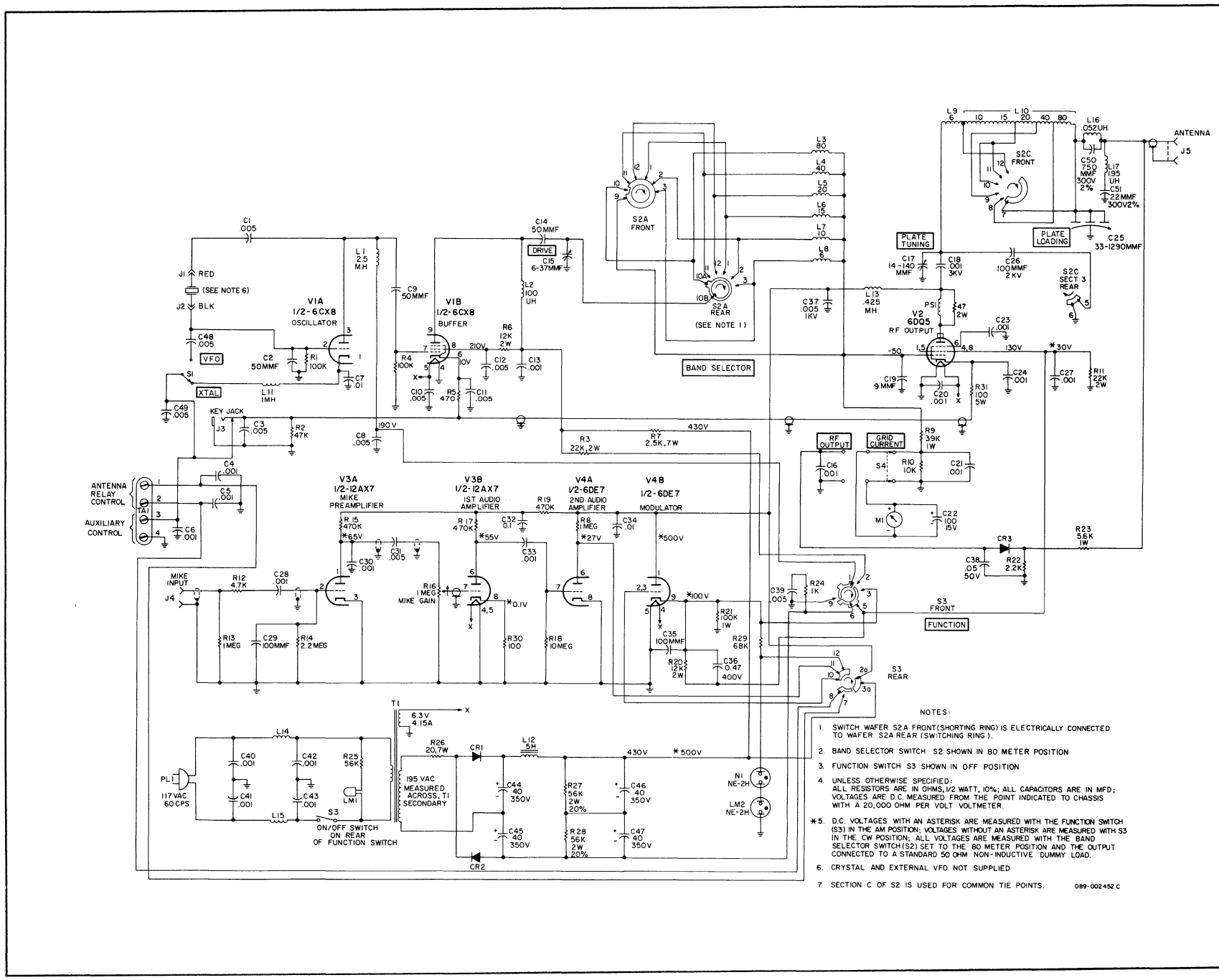

Figure 10. Schematic Diagram of Transmitter.

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PRINTED IN U.S.A.

HT-40

the hallicrafters co.
MANUFACTURERS OF ELECTRONIC EQUIPMENT, CHICAGO 24, U. S. A

Ser. # 105093

FEATURES AND 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	.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-MCIF 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	3500 KC to 3650 KC 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

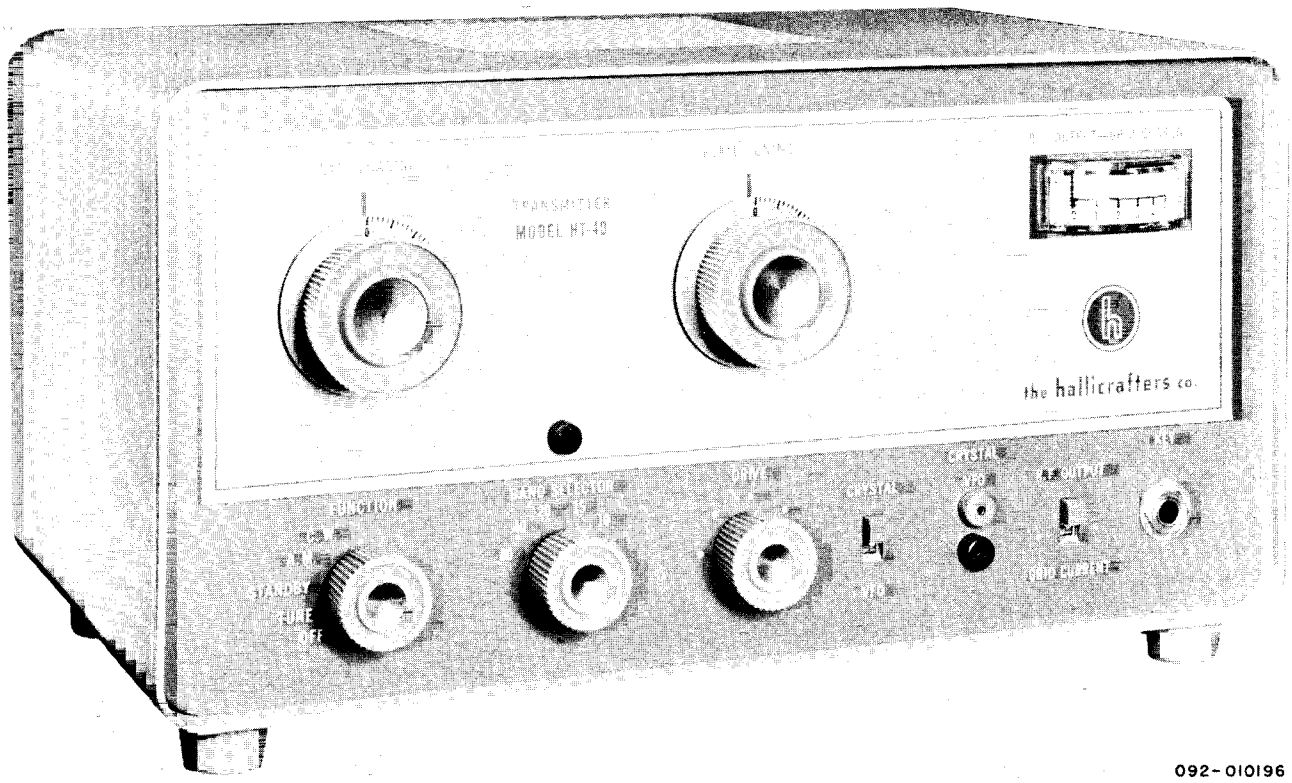


Figure 1. Model HT-40K Transmitter.

INTRODUCTION

GENERAL

The Hallicrafters Model HT-40K Transmitter Kit is designed to operate on the 80, 40, 20, 15, 10, and 6 meter bands.

A few of the features of the HT-40K include: 75 watts input with high efficiency output capability, either crystal or external VFO control, full carrier-controlled amplitude modulation (AM) and Continuous Wave (CW) transmission. Internal switching connected to a terminal board on the rear of the HT-40K permits the Transmitter to control or be controlled by accessory equipment such as the SX-140 or the SX-140K Receiver. Special attention was given in the selection of the components and the internal circuit arrangement to reduce Television Interference (T.V.I.) to a minimum.

It is assumed for all practical purposes that many kits will be constructed by people new to the radio and electronic field or who pursue other fields and construct kit items for a diversion. Because of this, extreme care has been exercised in the preparation of the manual in the step-by-step procedure for mounting the parts, soldering, and final testing of the kit so that questionable meanings of the steps do not exist. IT IS TO BE EMPHASIZED THAT THE BUILDER CAREFULLY READ THE MANUAL BEFORE ATTEMPTING TO BUILD THE KIT SO THAT MISTAKES DIFFICULT TO CORRECT WILL NOT OCCUR.

A kit which is wired and soldered neatly and correctly will afford the builder complete satisfaction in operation. To achieve this result, we suggest that a particular space be used for the building of the kit and the arrangement of parts and tools. Parts which are easily scratched or marred should be placed on a soft cloth away from the construction area. By setting up the construction space in this order, you minimize the possibilities of using incorrect parts and insure successful construction of the kit.

CIRCUIT DESCRIPTION

GENERAL. - The HT-40K 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.

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 4700 mmf capacitor in series with the crystal. The grid circuit elements consist of a 47K ohm grid return resistor shunted by a 22 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 1000 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 V1 (6CX8) and the ground side of the VFO output is connected through the black jack and switch S1 in the VFO position, to ground. When S1 is in the VFO position the 4700 mmf feedback capacitor is disconnected from the circuit.

During CW operation the cathode of this tube is switched to and from ground with the operation of the key.

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 1 MH 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 33 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 keeping television interference to a minimum.

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.

RF OUTPUT-GRID CURRENT METER. - The RF OUTPUT-GRID CURRENT meter, a basic 5 mil movement graduated in 5 units (0-5), 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 milliampere.

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 10 watts, therefore if a deflection of three and a half divisions is indicated, 35 watts are being delivered to the antenna (3.5 x 10 = 35).

SPEECH AMPLIFIER AND MODULATOR. - The speech amplifier section of the audio system consists of the two triode sections of V3 (12AX7) 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 ampli-

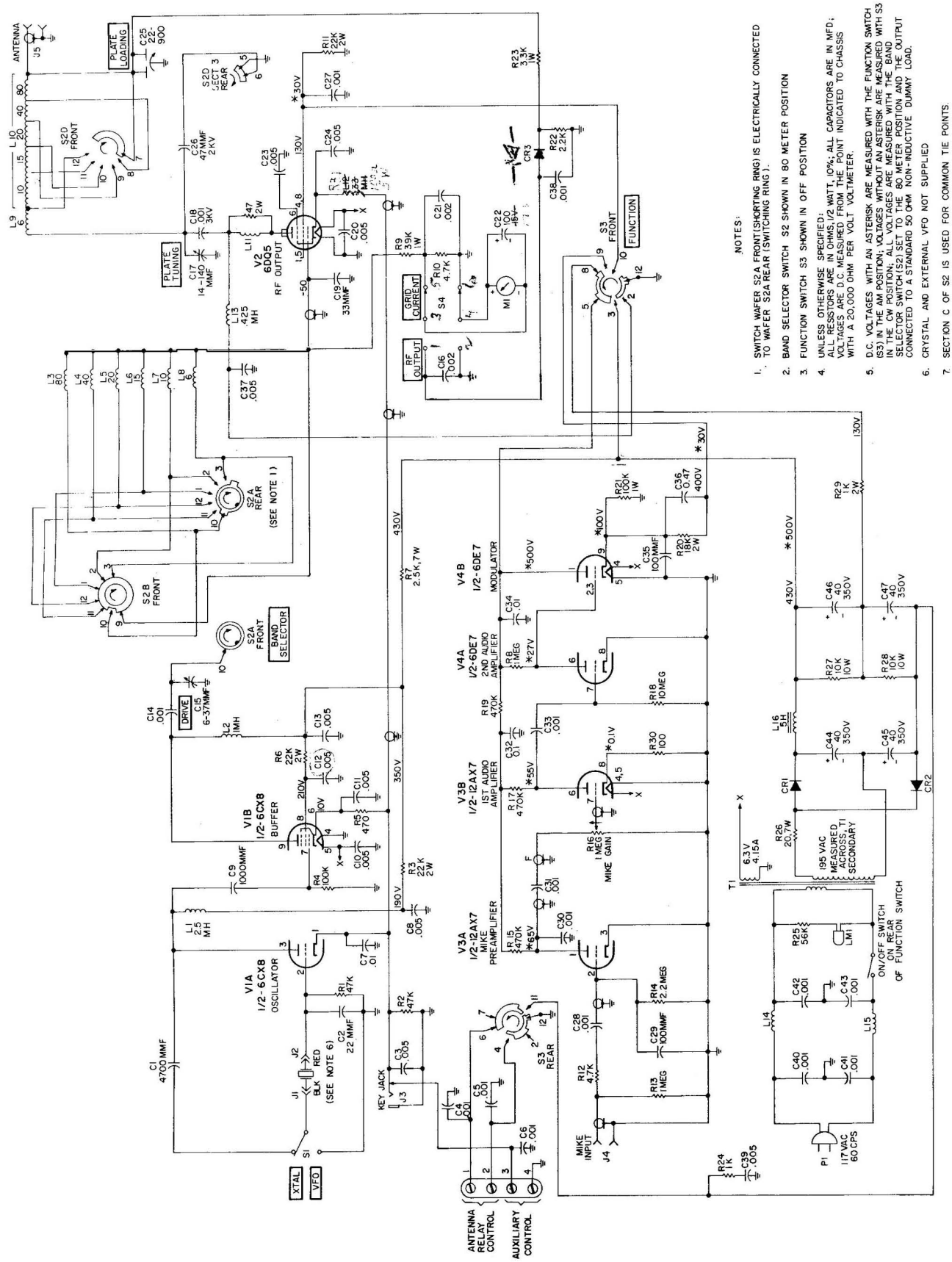


Figure 2. Model HT-40K Schematic Diagram.

fier (6DQ5) tube through a .5 mfd capacitor to permit modulation 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.

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.

OPERATOR CONTROLS

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.

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 to the oscillator, buffer and final amplifier stages but is removed from the modulator stage. Screen voltage for the 6DQ5 is obtained from the tap on the bleeder connected across the power supply.

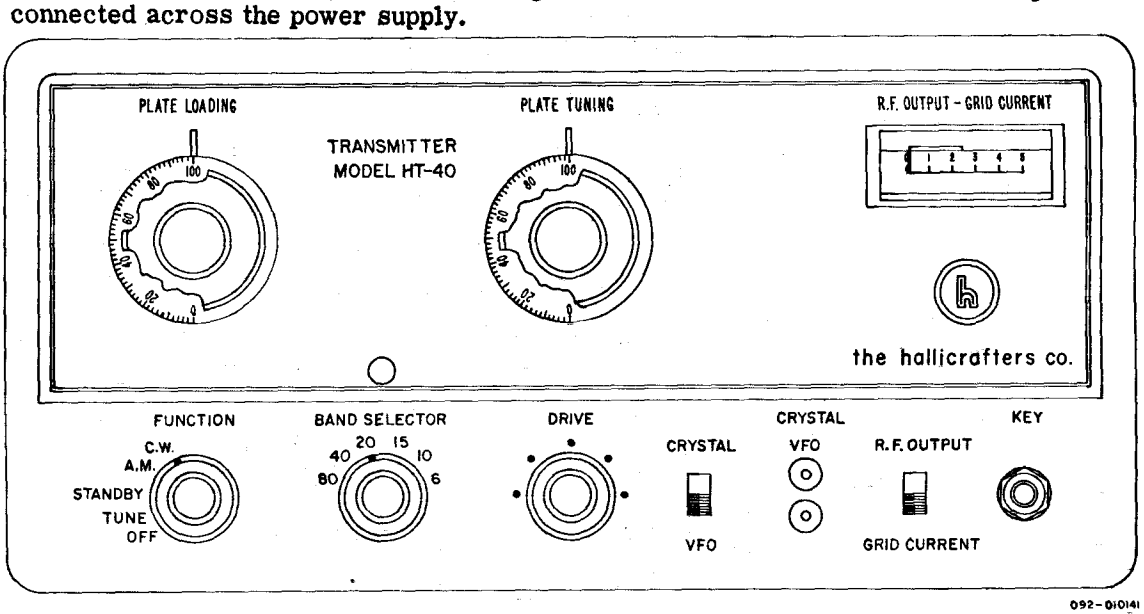


Figure 3. Model HT-40K Front Panel Controls and Indicators.

BAND SELECTOR CONTROL. - The BAND SELECTOR is a six-position multi-section rotary switch used to select the proper inductance in the driver and final amplifier pi network for each band.

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.

CRYSTAL-VFO SWITCH. - The CRYSTAL-VFO switch is a SPDT slide switch which permits the HT-40K to operate either crystal controlled or to operate from an external VFO.

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.

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.

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.

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

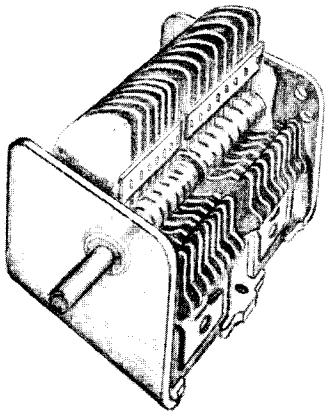
UNPACKING

After carefully reading the manual unpack the items of the Model HT-40K Transmitter Kit. Check the quantity and value of each component against the parts list and accompanying illustrations. It is suggested that each package of parts be checked as they are removed from the carton. Should missing, incorrect, or broken parts be discovered, notify the dealer from whom the kit was purchased or The Hallicrafters Company for proper authorization for returning broken parts or obtaining missing parts.

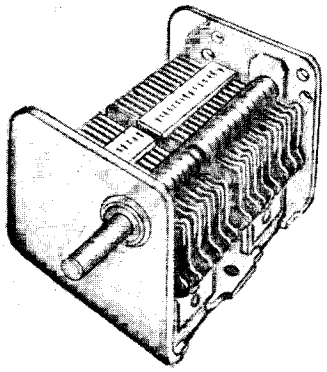
NOTE

The variable capacitors are packed with their plates fully meshed (see figure 4). To prevent damage or bending of the plates it is important that they be fully meshed at all times during construction of the kit. If the plates are accidently bent they will rub or short against the stationary plates when the capacitor is tuned.

In the design of the Hallicrafters HT-40K Transmitter Kit only the highest quality components were used throughout. To ensure neat wiring and eliminate obscure electrical problems, a prefabricated cable harness has been prepared for easy wiring. Critical lead placement is automatically taken care of with the use of this pre-fabricated cable.



CAPACITOR HALF OPEN
(HALF MESHED)



CAPACITOR CLOSED
(FULLY MESHED)

Figure 4. Variable Capacitor, Open and Closed.

INSTALLATION

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.

POWER SOURCE.- The HT-40K Transmitter is designed to operate on 105 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.

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

KEY RECEPTACLE.- The KEY jack, a standard two conductor closed ciruit type jack located on the front panel, provides for the connection of a hand keyer, 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.

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.

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 HT-40K (see figure 25). Refer to the ARRL ANTENNA HANDBOOK or similar publications for detailed information concerning transmitting antennas.

ASCCESSORY TERMINAL STRIP.- A four-terminal strip on the rear of the chassis permits connecting the HT-40K 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 change-over relay the FUNCTION switch controls the operation of the relay (see figure 26).

Terminals 3 and 4 connected across (in parallel with) the key jack terminals, when the plug is removed from the KEY jack, permits the HT-40K to be connected to a remote control switching device such as the SX-140 Receiver, SX-140K Receiver, a remote control switch or separate leads from the push-to-talk switch on the microphone (see figure 27). The HT-40K 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.

OPERATION

GENERAL.- The tuning procedure for the Model HT-40K Transmitter has been simplified by design to permit rapid adjustment of the Transmitter 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.

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 28). SEE SPECIAL NOTE #1
2. Crystal with its fundamental or harmonic frequency corresponding to the desired transmitting frequency or an external VFO.

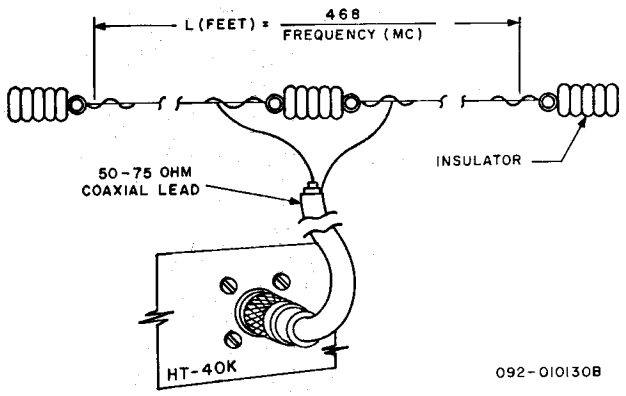


Figure 25. Coaxial Fed Half-Wave Dipole Antenna.

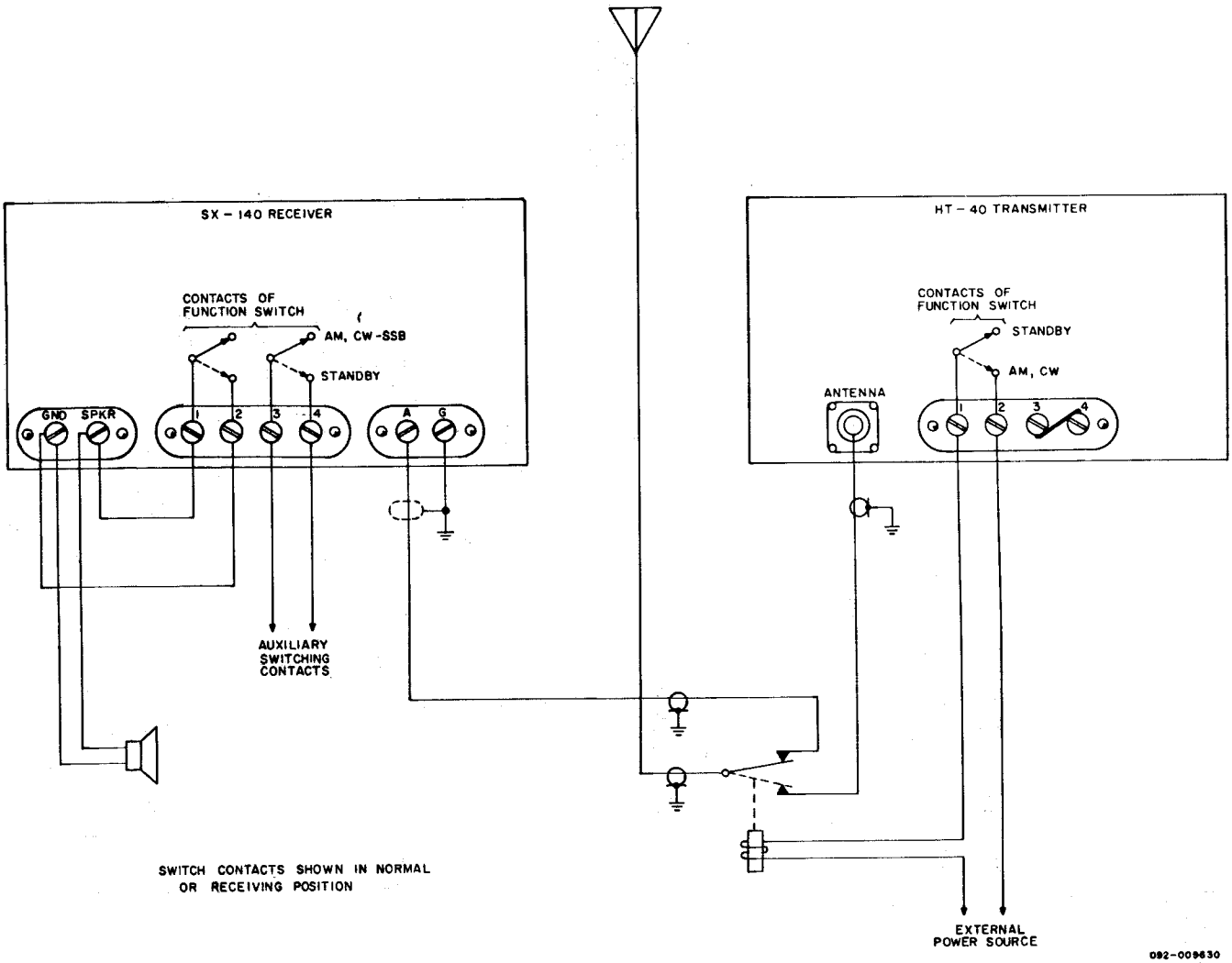


Figure 26. Model HT-40K Controlling Antenna Relay.

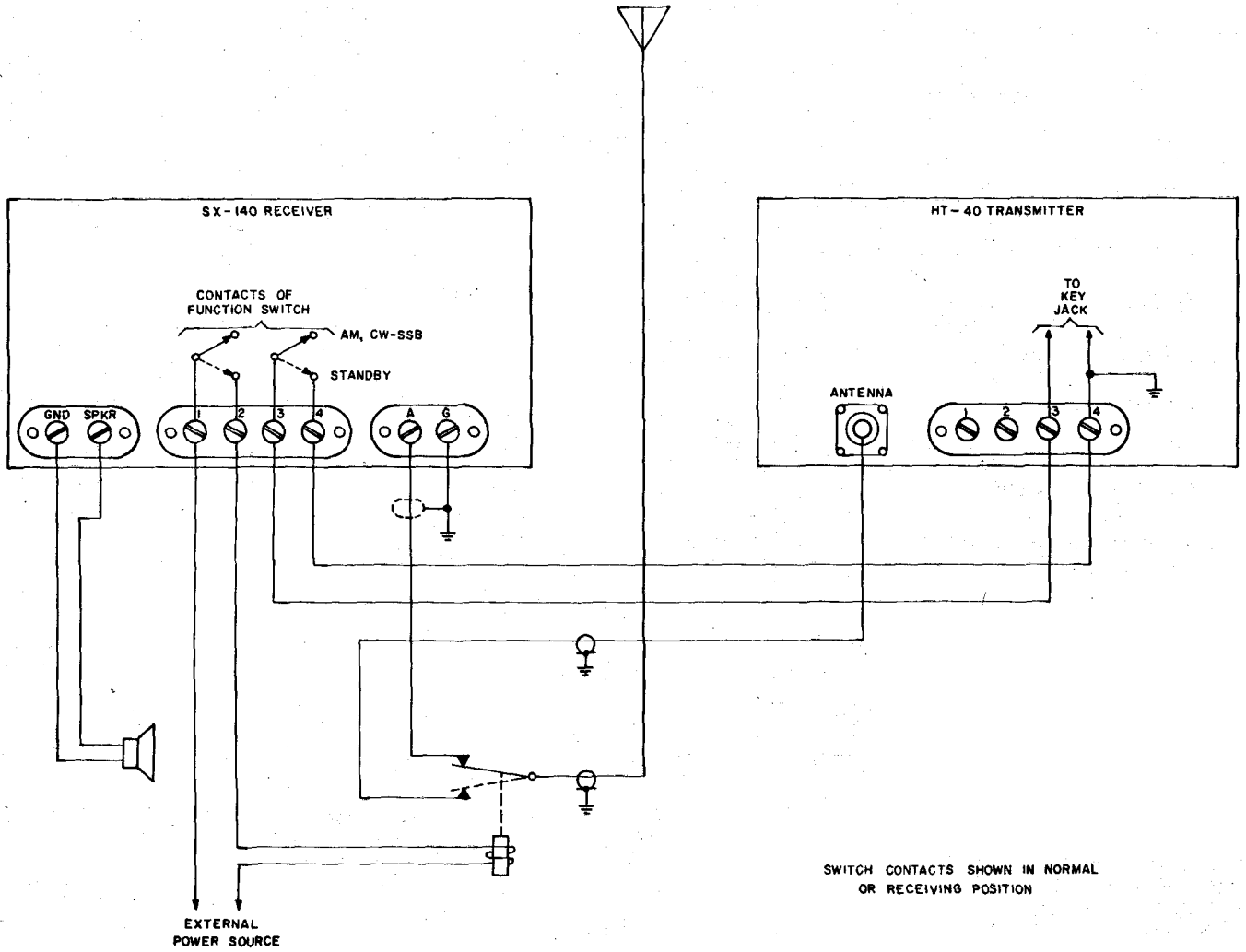


Figure 27. Model HT-40K Controlled by Station Receiver.

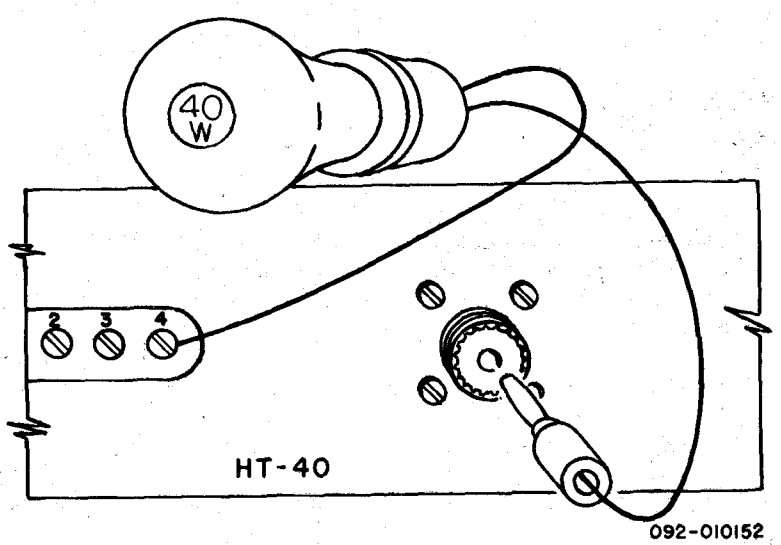


Figure 28. Light Bulb Used as Dummy Load.

50 -Ω load
68- 73

PROCEDURE

1. Set the controls as indicated:

MIKE GAIN . . . . . Maximum counterclockwise

FUNCTION . . . . . OFF

BAND SELECTOR . . . . . Desired band

DRIVE . . . . . Center of range

CRYSTAL-VFO . . . . . CRYSTAL

RF OUTPUT-GRID CURRENT . . . . . GRID CURRENT

PLATE LOADING

80 to 10 meter bands . . . . . Near 100
6 meter band . . . . . Near 0

PLATE TUNING

80 to 10 meter bands . . . . . Near 100
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 normal 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 and 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 setting of the PLATE LOADING and PLATE TUNING controls will be near 100 on the 80 meter band and progressively lower on the 40 to 6 meter bands. On the 6 meter band two maximum output indications can be obtained. The correct setting will be between 0 and 20.

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 the antenna line is open a higher indication will be noted: if the antenna line is shorted approximately zero indication will be noted.

14. If the proper indication is obtained on the meter the HT-40K is ready for CW operation.

TUNING PROCEDURE FOR AM OPERATION. - The procedure for tuning the Transmitter for AM operation is identical to the tuning procedure for CW operation, 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.

3. While talking in a normal voice level two or three inches from the microphone and observing the meter, advance the MIKE control clockwise until a peak indication is observed during "talk" periods which is slightly below the indication noted in step 11. This provides 75% to 90% AM modulation as shown in figure 29, if it is desired to use a scope.

SERVICE

SERVICE POLICY

Facilities of the Hallicrafters Service Department are available for repair, service, and technical consultation by mail. If continued operational difficulties result with completed kit, a letter to Hallicrafters may help solve the problem.

REPAIR PROCEDURE

Hallicrafters Model HT-40K Transmitter Kit may be returned for inspection and repair at a special service charge of $12.50 during the first year after purchase. This special price applies only to kits that have been completed and wired according to the instructions contained within this material. Any kits that are not completed or that have been modified will not be accepted for repair. Charges for replacement parts will be determined by the warranty status of the equipment when it is received for service. The builder is to be reminded that the registration card furnished with each Hallicrafters Kit must be completed and returned to The Hallicrafters Company immediately after purchase. The warranty is applicable only to equipment that is registered with Hallicrafters factory.

After the first year, service charges will be based on the labor time required to make repairs and the cost of any parts or material needed to complete the repairs.

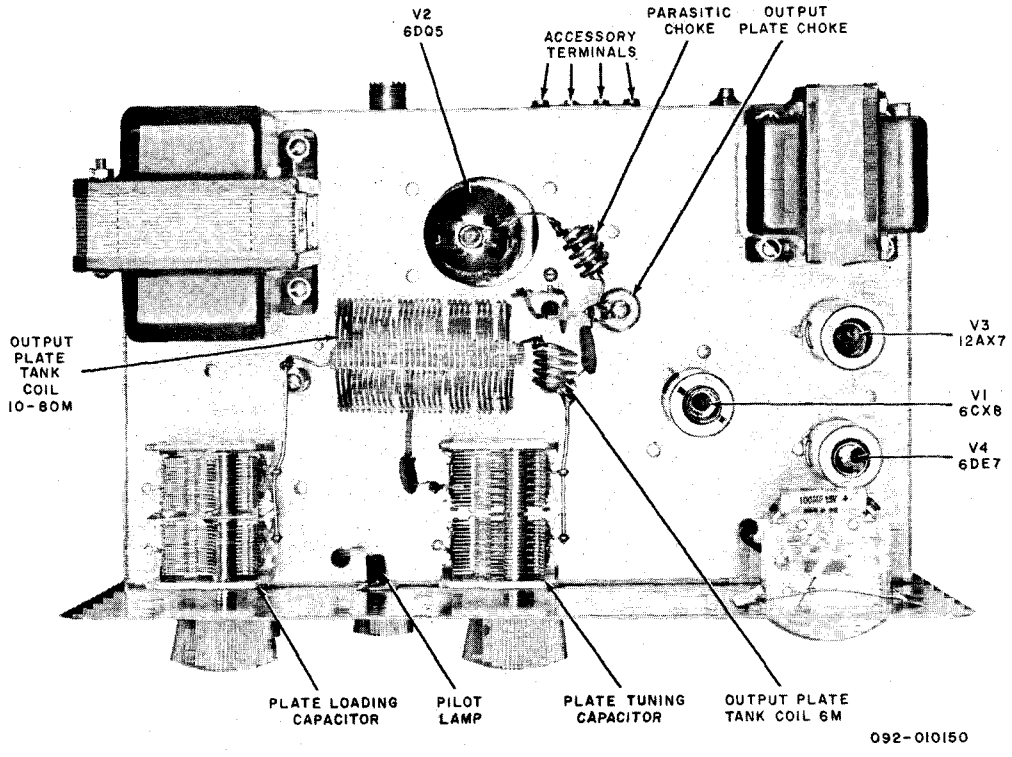
NOTE

KITS SHOWING EVIDENCE OF WIRING WITH ACID CORE SOLDER OR PASTE FLUXES WILL NOT BE ACCEPTED FOR REPAIR OR SERVICE AND WILL BE RETURNED UNREPAIRED.

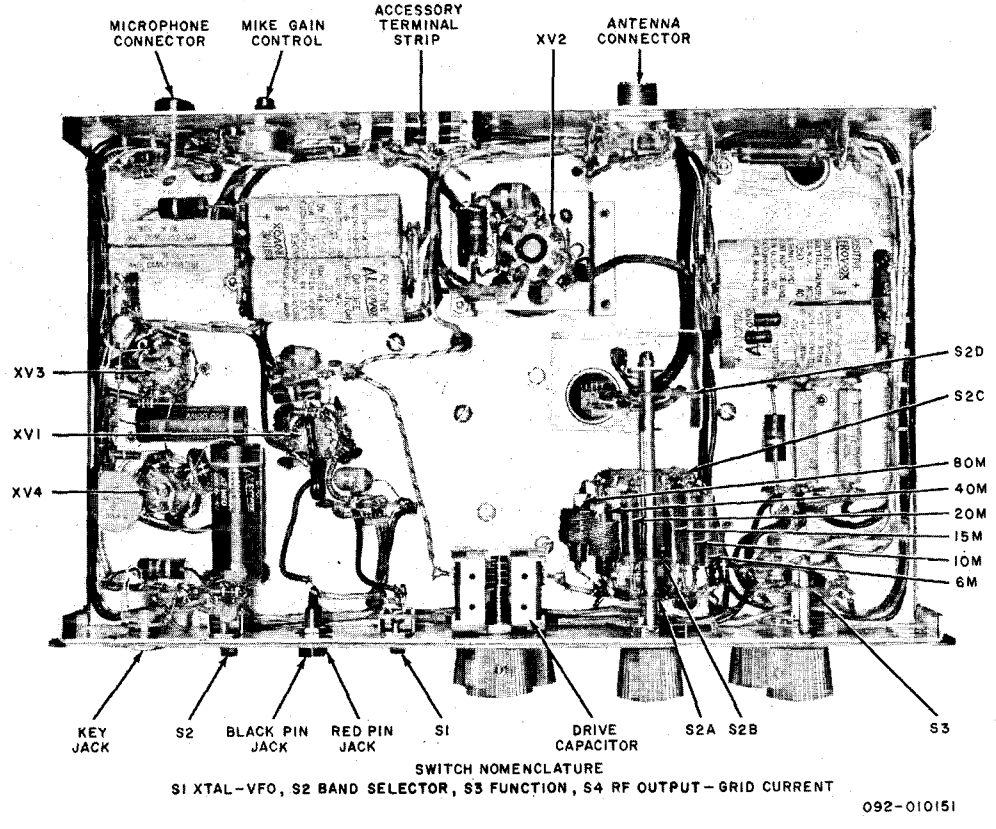
Before returning a kit for service or repair, please notify The Hallicrafters Company and a shipping label and a return authorization will be mailed to the requester.

When writing, include the following information:

1. Model number of kit.
2. Serial number.
3. Date of purchase
4. Description of trouble.



Top View



Bottom View

COMPLETED TRANSMITTER CHASSIS