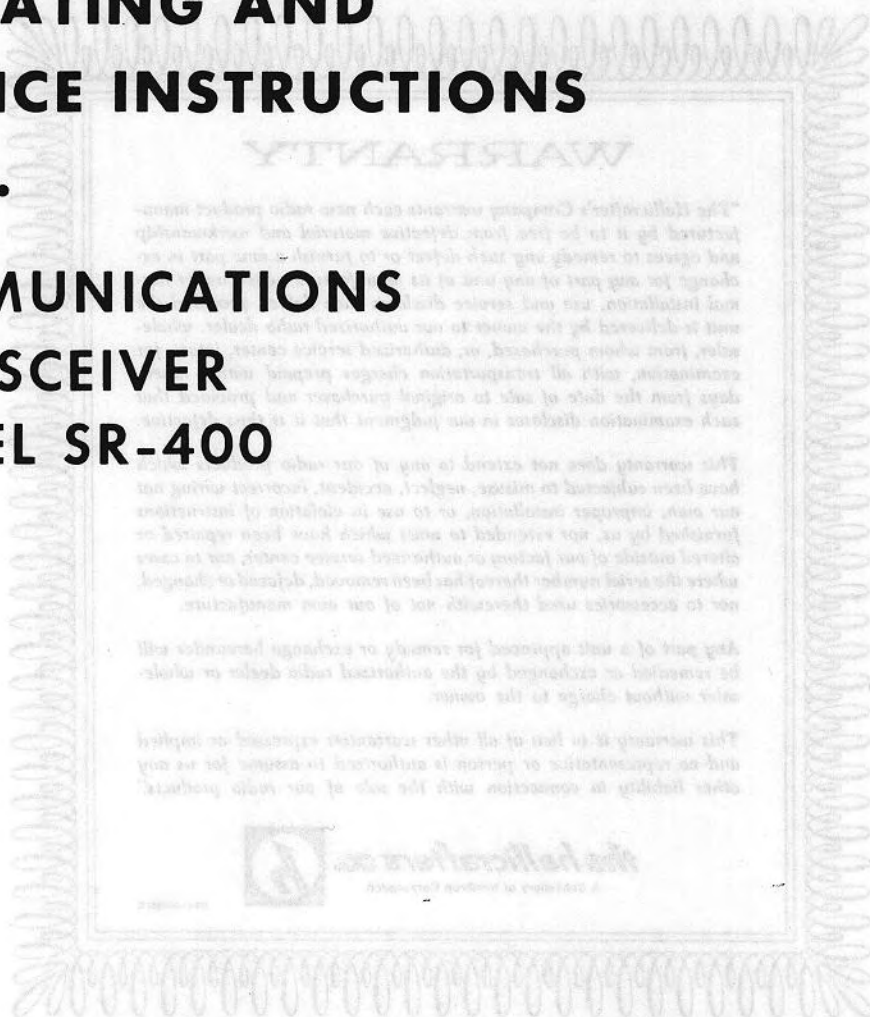


OPERATING AND SERVICE INSTRUCTIONS FOR...

COMMUNICATIONS TRANSCIVER MODEL SR-400



the hallicrafters co.



A Subsidiary of Northrop Corporation

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."

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092-014557B



Figure 1. Hallicrafters Model SR-400 Transceiver

156-011250B

SECTION I GENERAL DESCRIPTION

1-1. INTRODUCTION.

The Hallicrafters Model SR-400 Transceiver is a precision built, compact, high performance transceiver of advanced design. The transceiver utilizes 19 tubes plus one voltage regulator and 26 diodes in a double conversion heterodyning system for transmission and reception of single sideband (SSB) and continuous wave (CW) code signals on the 80, 40, 20, 15 and 10 meter amateur bands.

With the Model PS-500A-AC Power Supply (fixed station) or PS-500-DC Power Supply (mobile) and an antenna, key and microphone, the equipment represents a complete desk top or mobile amateur station.

A special feature of the Model SR-400 Transceiver is the Receiver Incremental Tuning (RIT) control. This control enables the operator to unlock the receiver frequency and tune the receiver approximately 3 KC either side of the transmitter frequency without disturbing the transmitter tuning. Flipping the RIT switch OFF automatically returns the equipment to the transceiver condition.

Another desirable feature of the Model SR-400 is the Amplified Automatic Level Control (AALC) which functions in the transmit mode. The AALC circuitry prevents splatter due to severe flat-topping of the final amplifier signal by providing about 15 DB of compression at the point when flat-topping begins to occur.

Other features of the Model SR-400 Transceiver include:

- Noise blanker circuit operating ahead of IF filter for effective noise blanking action.

- Choice of VOX or PTT control for SSB operation and a choice of manual or automatic break-in control for CW operation.

- Upper and lower sideband operation with common suppressed carrier frequency on all bands.

- Smooth gear driven tuning mechanism with one kilocycle read out display.

- A sharp selectivity position for CW reception, 200 CPS Bandwidth at 6 DB.

An adjustable rejection notch filter to attenuate interfering heterodynes and CW signals.

An accurately calibrated VFO with excellent mechanical and temperature stability.

Constant tuning rate on all bands.

Crystal lattice 1650 KC filter with 6 poles for optimum selectivity and single sideband response.

Product detector with crystal controlled beat frequency oscillator injection for maximum stability.

Keyed sidetone for monitoring CW transmissions.

Excellent cross modulation and overload characteristics.

"S" meter for receiver and RFO, AALC, and plate current metering for transmitter tuning and operating convenience.

Built-in 100 KC crystal calibrator for exact dial calibration.

IMPORTANT

Do not attempt to operate the Model SR-400 equipment before becoming completely familiar with the instructions contained within this manual.

CAUTION

The PS-500A-AC Power Supply is shipped ready to operate on 117 volts AC. Refer to Section 3-9 or 9-2 before operating on 234 volts AC.

1-2. TVI (TELEVISION INTERFERENCE) SUPPRESSION.

The Model SR-400 Transceiver has been designed and constructed to suppress spurious radiation that may cause television interference. The TVI problem was given full consideration in the design and layout of the chassis. Components specifically selected to avoid undesired resonances and arranged to prevent parasitic oscillation have been used throughout.

There are, however, some types of TVI that cannot be prevented within the transmitter itself. This is particularly true in fringe reception areas. In such cases, a good commercial low-pass filter connected at the transceiver antenna connector is recommended. For a more complete discussion of measures that may be used to handle special problems of this type, refer to the "Radio Amateur's Handbook" published by the American Radio Relay League.

SECTION II TECHNICAL SPECIFICATIONS

TUBES AND FUNCTIONS

V1	12DK6	Receiver RF Amplifier	V10	OA2	Voltage Regulator
V2	7059	Receiver and Transmitter 1st Mixer	V11	6AW8A	2nd Transmitter Mixer and 100 KC Crystal Oscillator
V3	7059	IF Amplifier and AALC Amplifier	V12	7056	Heterodyne Oscillator
V4	12AT7	2nd Receiver Mixer and VFO Amplifier	V13	12BA6	VFO
V5	7059	Noise Amplifier and Pulse Amplifier	V14	12AT7	BFO/Carrier Oscillator and 3rd Mic. Amplifier
V6	6GX6	1st 1650 KC IF Amplifier and Blanker	V15	6AQ5A	Audio Output
V7	7059	2nd 1650 KC IF Amplifier and Side Tone Amplifier	V16	6HF5	Transmitter Power Amplifier
V8	7059	AGC Amplifier and Meter Amplifier	V17	6HF5	Transmitter Power Amplifier
V9	12AT7	Product Detector and 1st Audio Amplifier	V18	12BY7A	Transmitter Driver
			V19	12AT7	1st Mic. Amplifier and 2nd Mic. Amplifier
			V20	12AT7	VOX Amplifier and Relay Amplifier

GENERAL

Tuning Ranges Full frequency coverage of the amateur bands in eight ranges as follows:

80M	3.5 to 4.0 MC
40M	7.0 to 7.5 MC
20M	14.0 to 14.5 MC
15M	21.0 to 21.5 MC
10M	28.0 to 28.5 MC
10M	28.5 to 29.0 MC
10M	29.0 to 29.5 MC
10M	20.5 to 30.0 MC

Heterodyne Oscillator Crystals Type CR-18A/U in HC-6 holder

Band	Frequency
3.5	10,000.000 KC
7.0	13,500.000 KC
14.0	10,250.000 KC
21.0	13,750.000 KC
*28.0	17,250.000 KC
28.5	17,500.000 KC
*29.0	17,750.000 KC
*29.5	18,000.000 KC

*(Crystal not supplied with transceiver.)

Types of Emission SSB - Selectable USB/LSB with suppressed carrier.
CW - Keyed RF carrier.

Frequency Control Self-contained VFO for transmit and receive modes.
Separate transmitter frequency control available with Model HA-20 DX Adaptor unit.

Transmission Control Single Sideband Operation

MOX - Manual (Push-to-talk)

VOX - Voice control

CW Operation

MOX - Manual

VOX - Automatic break-in

Dial Calibration One KC increments, 500 KC tuning range.

Calibration Accuracy Less than 2 KC error across the dial after indexing at high frequency end of the dial. Band to band calibration error less than ± 2 KC.

Internal 100 KC crystal controlled calibrator.

Frequency Stability Less than 250 cycles drift in first hour, after a fifteen minute warm-up, and less than 100 cycles per hour thereafter.

Tube and Diode Complement 19 tubes plus one voltage regulator and 26 diodes. See table of Tubes and Functions.

Cable Connector Data Front Panel

MIC connector - Amphenol type 80-MC2M

PHONES jack - Standard 1/4-inch two conductor phone plug.

Rear Cabinet

KEY jack - Standard 1/4-inch two conductor phone plug.

COMMON OR TRANS ONLY ANTENNA connector - Mil. No. PL-259 (49190) UHF series or standard RCA type phono plug.

REC ONLY ANTENNA connector - Standard RCA type phono plug.

AUDIO (500 OHMS) connector - Standard RCA type phono plug.

POWER connector - Cinch-Jones type S-312-CCTL (12-pin plug)

ACCESSORY connector - Amphenol type 86-PM11. (11-pin plug)

Power Supply Requirements Model PS-500A-AC for 117/234V 50-60 CPS AC base station operation

Model PS-500-DC for 12 VDC mobile operation.

Construction Light weight aluminum

Dimensions (HWD) 6-1/2 X 15 X 13 inches

Net Weight 18 pounds

Shipping Weight 22 pounds

TRANSMITTER

Power Input* SSB - 400 watts PEP.

CW - 360 watts maximum.

Power Output* SSB - 200 watts PEP.

CW - 200 watts

*Slightly lower on 15M and 10M bands.

Output Impedance 50 ohms nominal. Adjustable, 40 to 70 ohms essentially non-reactive.

Type of Sideband Generation Solid state modulator with 1650 KC, 6 pole crystal filter. (Nominal 3 DB BW = 2.1 KC.)

Microphone Input High impedance. Input sensitivity of 5 millivolts RMS or less for PEP output.

Audio Response Overall 500 to 2400 CPS (6 DB).

Distortion Products	30 DB signal to distortion ratio.
Unwanted Sideband Rejection	50 DB below desired output at 500 to 2500 CPS input.
Carrier Suppression Capability	60 DB below PEP output.
Spurious Emission	50 DB or more below PEP output.
CW Side Tone	800 CPS nominal.
RECEIVER	
Antenna Input	50 ohms nominal.
Audio Output Impedance	3.2 ohms and 500 ohms.
Sensitivity	One microvolt or less for 20 DB signal to noise ratio.
Audio Output	One watt with less than 10% distortion.
Dual Conversion System	First IF = 6 MC to 6.5 MC Second IF = 1650 KC with crystal lattice filter.
Crystal Lattice Filter	Six pole, symmetrical passband. Center frequency = 1651.4 KC. B/W = 2.1 KC (3 DB). B/W = 4.2 KC (50 DB). Sharp CW filter, 200 CPS @ 6 DB. Notch Rejection, up to 30 DB. Carrier frequencies: USB = 1652,800 KC LSB = 1650,000 KC
AVC Figure of Merit	60 DB or more RF input change for less than 10 DB change in audio output.
RIT Frequency Range	4 KC minimum.
In Band Tweets	Less than one microvolt equivalent CW signal.
First IF Rejection	Better than 56 DB at all frequencies.
Image and Spurious Rejection	Better than 50 DB.

ACCESSORIES

Model HA-20 DX Adapter

Styled to complement the Model SR-400 Transceiver, the DX adapter contains a VFO unit equal to the VFO in the Model SR-400 and a VSWR bridge.

The HA-20 provides the following functions when used in conjunction with the SR-400:

1. The HA-20 controls the transmit frequency while the transceiver VFO controls the receive frequency.

2. The HA-20 controls both transmit and receive frequencies (transceive).

3. The HA-20 allows the operator to select a position that will provide a dual simultaneous receive function. This feature permits the operator to monitor any two frequencies on any given band simultaneously.

The VSWR bridge metering and forward/reverse RF power switching are contained within the DX adapter. The bridge module connected into the antenna transmission line is designed to handle the full PEP output of the Model SR-400.

With a continuous VSWR check available, the operator knows at all times whether his antenna system is functioning properly.

The DX adapter receives power from its own 117 VAC line cord. The control and signal circuits are carried to the Model SR-400 through the ACCESSORY cable connector.

Power Supply Requirements —
117 VAC, 60 cycles, 20 watts.

Dimensions (HWD) —
7 X 10-5/8 X 8 inches.

Net Weight — 9 pounds.

Shipping Weight — 12 pounds.

Model PS-500A-AC Power Supply

Styled as a companion unit to the Model SR-400 Transceiver, the power unit provides for base station operation of the transceiver from a nominal 117/234 volt, 50/60 cycle AC power source. The power unit also contains a 4 X 6-inch speaker having a voice frequency response tailored to communications requirements.

All power and audio circuits are carried between units by a multi-conductor cable with a 12-pin power plug.

Solid state silicon rectifiers are employed throughout for cool, maintenance free operation.

Diode Complement — Nine silicon diodes

Fuse Rating —
5 amperes, 125V type 3 AG size (Slow-blow)
3 amperes, 250V type 3 AG size (Slow-blow)

Power Supply Requirements —
105-125V, 50/60 cycles AC, single phase.
or 210-250V, 50/60 cycles AC, single phase.

Input Power Requirements —
Transmit — 700 Watts maximum
Receive — 170 watts

Dimensions (HWD) —
6-1/4 X 7-1/2 X 10 inches

Net Weight — 22 pounds

Shipping Weight — 28 pounds

Model PS-500-DC Power Supply

Designed for out-of-the-way engine compartment installation, the power supply permits operation of the Model SR-400 Transceiver in a mobile installation having a 12-volt DC power source available.

The power supply is designed for operation from a negative-grounded power source supplying a nominal potential of 13.6 volts DC under load.

Solid state devices are employed throughout for cool maintenance free operation.

Transistor Complement — Four

Diode Complement —

Two silicon bridge rectifier units, one silicon diode bias rectifier, and one protective diode.

Power Supply Requirements —
11.6V - 15.6 VDC (13.6V nominal)

Input Power Requirements —
Transmit — 14 to 40 amperes maximum
Receive — 10 amperes

Dimensions — (HWD) —
3-3/4 X 8-1/4 X 6 inches

Net Weight — 8-1/4 pounds

Shipping Weight — 10 pounds

Model MR-400 Mobile Mounting Rack

Designed to facilitate mobile installation of the Model SR-400 Transceiver, the mounting rack permits transmission hump, floor, and/or under dash mounting of the transceiver. The quick release design of the mobile mounting rack provides an excellent facility for quickly installing or removing the transceiver unit. All electrical interconnections are provided in the rack. The side panels of the rack fold down and lock in place when the transceiver is removed from the vehicle for fixed station use.

Dimensions (HWD) —
7 X 15-3/4 X 8-1/2" (open) 3" (closed)

Net Weight — 11 pounds

Shipping Weight — 13 pounds

SECTION III

INSTALLATION

3-1. UNPACKING.

Carefully remove the equipment from its carton and packing material and examine it carefully for possible damage that may have occurred in transit. If the equipment has been damaged, file a claim immediately with the carrier, stating the extent of the damage. Carefully check all shipping labels and tags for special instructions before removing or destroying them.

3-2. LOCATION.

The Model SR-400 Transceiver and Model PS-500A-AC Power Supply are, for operating convenience, designed to be placed side by side. The power supply may be located on either side of the transceiver unit as desired. It is very important that the transceiver be placed in an operating position that provides unobstructed circulation of air around the sides and at the top of the unit. Under no circumstances should any object be placed on top of either cabinet which would obstruct normal flow of the cooling air. The Model PS-500-DC Power Supply, for mobile operation, is designed for engine compartment operation close to the battery supply.

3-3. ANTENNA.

The Model SR-400 Transceiver is designed to terminate in a 50-ohm unbalanced transmission line.

While a non-reactive 50-ohm load is preferred for optimum results, a VSWR of 2:1 can be accommodated by the transmitter with acceptable results. Many of the popular di-pole or beam antennas using 50-ohm transmission lines will give excellent results.

For more detailed information on the subject of antennas, refer to the "Radio Amateur's Handbook" or the "ARRL Antenna Book", both published by the American Radio Relay League.

IMPORTANT

Some form of lightning protection should be provided which will comply with local code requirements.

Antenna connections are provided at the rear of the transceiver, as shown in Figure 2. If a common antenna is used for transmit and receive, the antenna switch (S8) must be in the COMMON (down) position and the antenna connected to either

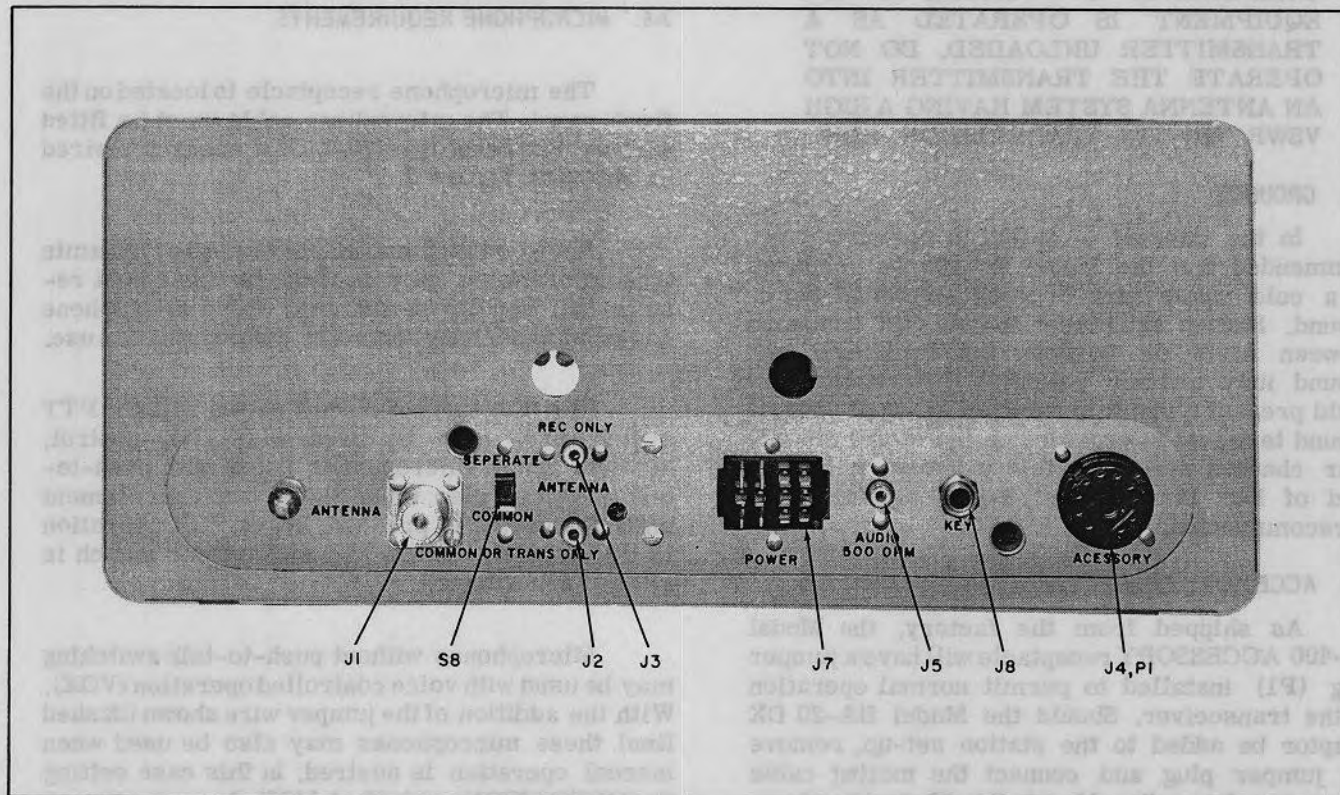


Figure 2. Model SR-400 Transceiver, Rear View.

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of the COMMON OR TRANS. ONLY antenna connectors (J1 or J2). If separate antennas are used, the switch must be in the SEPARATE (up) position, and the receiver antenna connected to the top REC. ONLY connector (J3), and the transmitter antenna connected to either of the COMMON OR TRANS. ONLY connectors (J1 or J2).

Antenna connectors J2 and J3 mate with RCA type phono connectors and connector J1 mates with Mil. No. PL-259 (49190) UHF series co-axial connectors. Use 50-ohm Mil. No. RG-58/U co-axial cable or equivalent for the feed line to the station antenna system or linear power amplifier.

Station antenna systems with terminating impedances other than 50 ohms will require an impedance matching device capable of safely handling at least 250 watts of RF power.

CAUTION

NEVER OPERATE THE MODEL SR-400 TRANSCEIVER AS A TRANSMITTER WITHOUT A MATCHED ANTENNA OR ADEQUATE DUMMY LOAD TERMINATION. ILLUMINATING LAMPS WILL NOT PRESENT A CONSTANT LOAD IMPEDANCE. DAMAGE TO THE POWER AMPLIFIER TUBES AND PI NETWORK COMPONENTS IS POSSIBLE IF THE EQUIPMENT IS OPERATED AS A TRANSMITTER UNLOADED. DO NOT OPERATE THE TRANSMITTER INTO AN ANTENNA SYSTEM HAVING A HIGH VSWR ON ITS TRANSMISSION LINE.

3.4. GROUNDS.

In the interest of safety it is strongly recommended that the Model SR-400 be grounded to a cold water pipe or good electrical earth ground. Station equipment that is left unbonded between units or between the equipment and ground may assume potential differences that could present a shock hazard. An external chassis ground terminal is provided on the Model SR-400 rear chassis apron for this purpose. A ground lead of No. 14 wire or 1/8-inch tubular braid is recommended.

3.5. ACCESSORY CONNECTOR.

As shipped from the factory, the Model SR-400 ACCESSORY receptacle will have a jumper plug (P1) installed to permit normal operation of the transceiver. Should the Model HA-20 DX Adaptor be added to the station set-up, remove the jumper plug and connect the mating cable connector from the Model HA-20 in its place. For more detailed information concerning the Model HA-20 DX Adaptor, refer to SECTION XII.

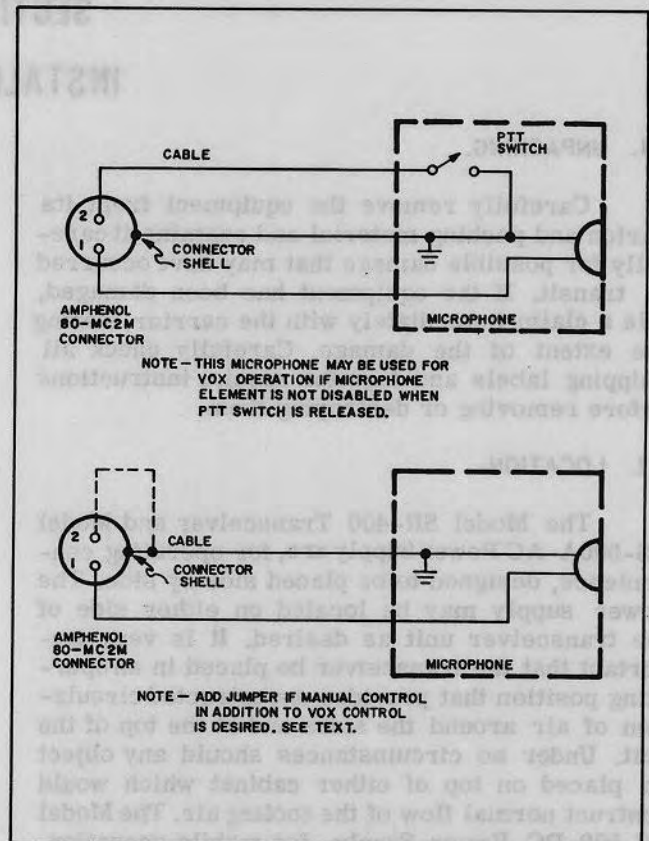


Figure 3. Microphone Wiring, With and Without Push-To-Talk Switch.

3.6. MICROPHONE REQUIREMENTS.

The microphone receptacle is located on the front panel. The microphone cable must be fitted with an Amphenol type 80-MC2M connector wired as shown in Figure 3.

Any good high impedance crystal or dynamic type microphone may be used, however best results will usually be achieved with a microphone designed especially for voice communication use.

The microphone circuit shown with the PTT switch may also be used with VOX control, however some microphones fitted with push-to-talk switches also mute the microphone element until the switch is pressed, hence VOX operation is not possible unless the microphone switch is altered accordingly.

Microphones without push-to-talk switching may be used with voice controlled operation (VOX). With the addition of the jumper wire shown (dashed line) these microphones may also be used when manual operation is desired. In this case setting the OPERATION control at MOX places the transmitter on the air and returning the control to REC puts the transceiver back in the receive mode.

3-7. KEYER CONNECTION.

The station keyer is connected to the transceiver at the KEY jack located on the rear chassis apron. The key jack accepts a standard 1/4-inch phone plug. Wire the plug so that the key base connects to the plug sleeve which is at ground potential.

3-8. HEADPHONE CONNECTION.

Headphone reception may be had by connecting headphones to the PHONES jack located on the front panel of the transceiver. The headset cord must be fitted with a standard 1/4-inch phone plug to mate with the panel jack.

The speaker unit in the Model PS-500A-AC Power Supply is disabled when headphones are plugged into the PHONES jack. High or low impedance headphones may be used. A station speaker with a voice coil impedance of 3 to 4 ohms may be connected to the transceiver through the PHONES jack if desired. Connect the ground side of the speaker or headphones to the sleeve terminal of the phone plug.

3-9. BASE STATION INSTALLATION.

The Model SR-400 Transceiver as a base station may be operated with or without a linear power amplifier.

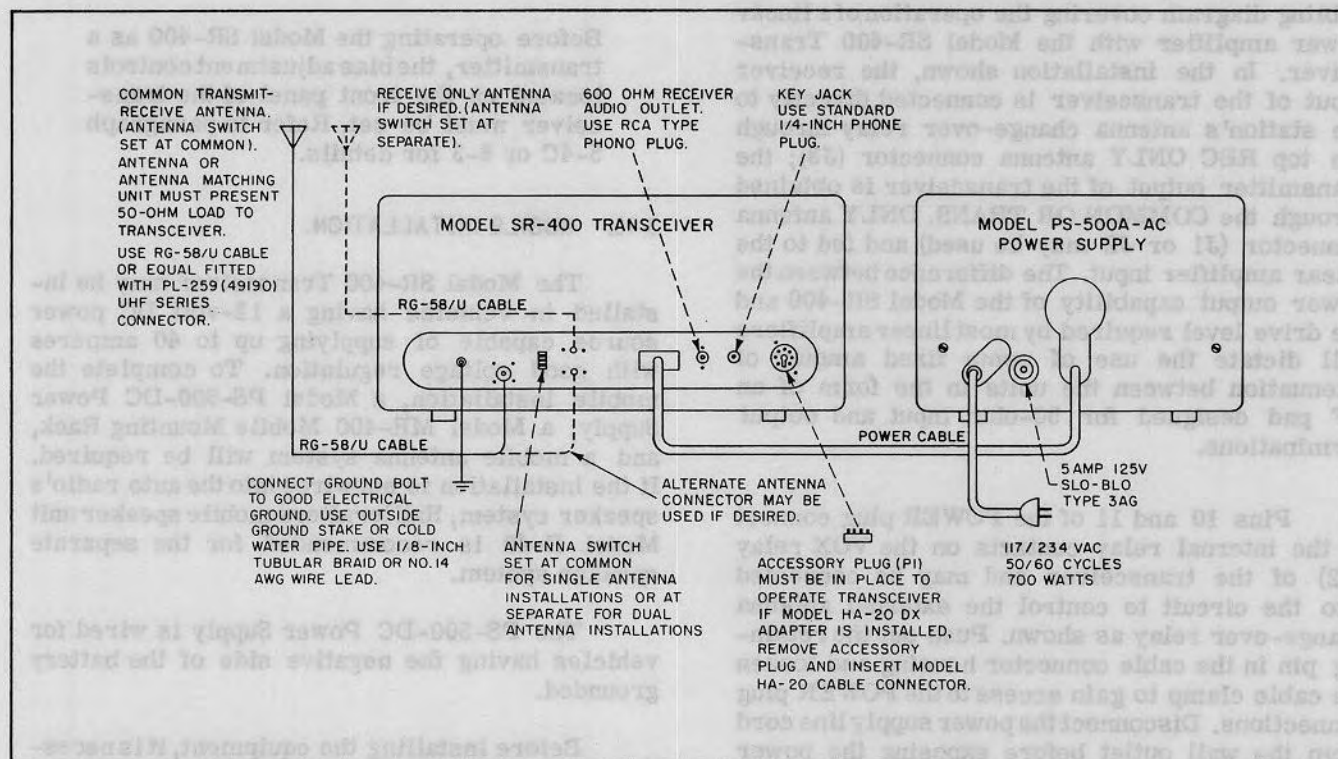
The Model PS-500A-AC or an equivalent power supply is required to operate the Model

SR-400 Transceiver from 117/234 volt 50/60 cycle single phase AC mains.

Connect the multi-conductor plug, attached to the power supply, to the POWER receptacle at the rear of the transceiver (figure 4).

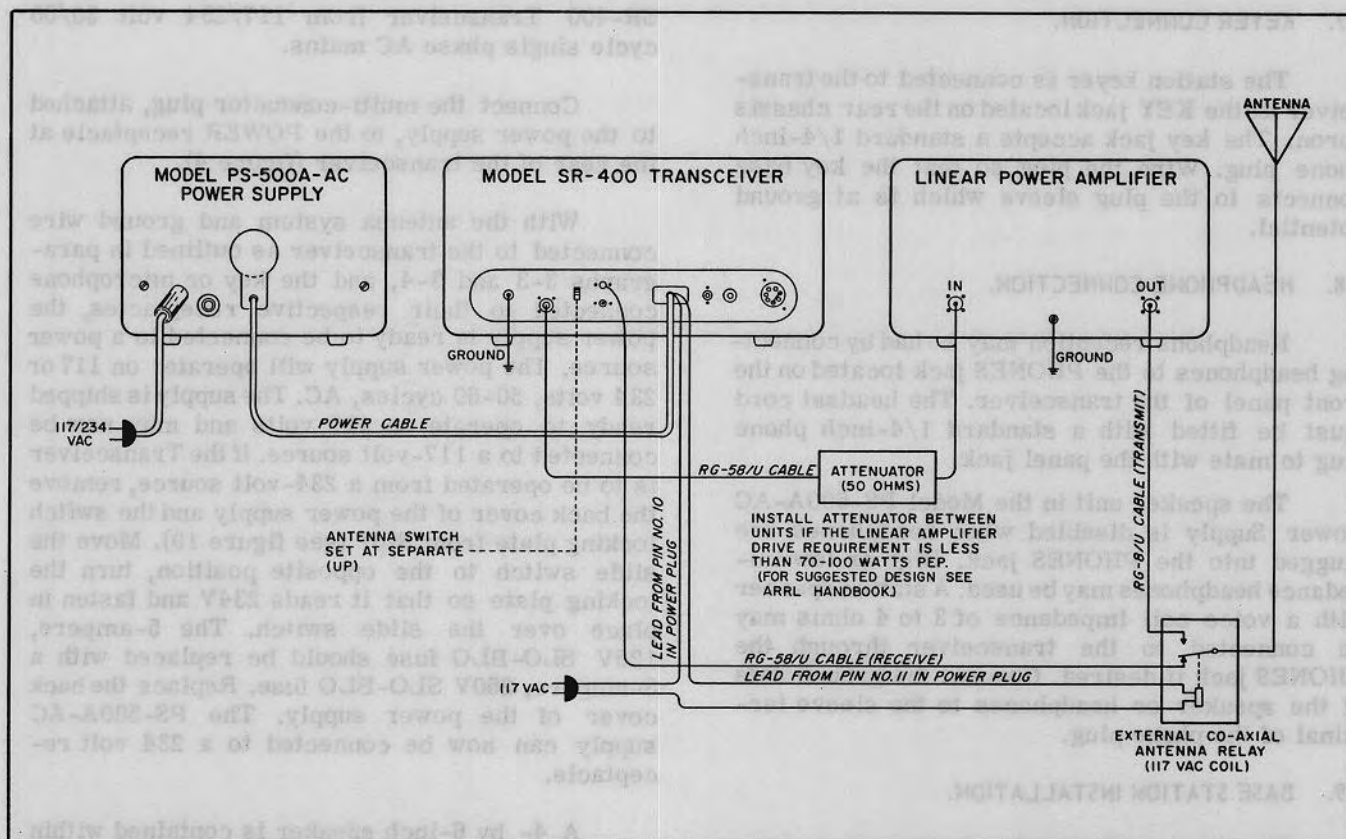
With the antenna system and ground wire connected to the transceiver as outlined in paragraphs 3-3 and 3-4, and the key or microphone connected to their respective receptacles, the power supply is ready to be connected to a power source. The power supply will operate on 117 or 234 volts, 50-60 cycles, AC. The supply is shipped ready to operate on 117 volts and may now be connected to a 117-volt source. If the Transceiver is to be operated from a 234-volt source, remove the back cover of the power supply and the switch locking plate from S201 (see figure 19). Move the slide switch to the opposite position, turn the locking plate so that it reads 234V and fasten in place over the slide switch. The 5-ampere, 125V SLO-BLO fuse should be replaced with a 3-ampere, 250V SLO-BLO fuse. Replace the back cover of the power supply. The PS-500A-AC supply can now be connected to a 234 volt receptacle.

A 4- by 6-inch speaker is contained within the power supply unit and is interconnected to the transceiver through the power cable. This speaker is automatically disabled when headphones are connected to the PHONES jack located on the front panel of the transceiver.



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Figure 4. Typical Base Station Installation.



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Figure 5. Base Installation Using a Linear Amplifier.

Figure 5 presents a typical base installation cabling diagram covering the operation of a linear power amplifier with the Model SR-400 Transceiver. In the installation shown, the receiver input of the transceiver is connected directly to the station's antenna change-over relay through the top REC ONLY antenna connector (J3); the transmitter output of the transceiver is obtained through the COMMON OR TRANS. ONLY antenna connector (J1 or J2 may be used) and fed to the linear amplifier input. The difference between the power output capability of the Model SR-400 and the drive level required by most linear amplifiers will dictate the use of some fixed amount of attenuation between the units in the form of an RF pad designed for 50-ohm input and output terminations.

Pins 10 and 11 of the POWER plug connect to the internal relay contacts on the VOX relay (K2) of the transceiver and may be connected into the circuit to control the external antenna change-over relay as shown. Push out the retaining pin in the cable connector housing and loosen the cable clamp to gain access to the POWER plug connections. Disconnect the power supply line cord from the wall outlet before exposing the power plug wiring.

IMPORTANT

Before operating the Model SR-400 as a transmitter, the bias adjustment controls located on the front panel of the transceiver must be set. Refer to paragraph 5-4C or 8-3 for details.

3-10. MOBILE INSTALLATION.

The Model SR-400 Transceiver may be installed in vehicles having a 12-volt DC power source capable of supplying up to 40 amperes with good voltage regulation. To complete the mobile installation, a Model PS-500-DC Power Supply, a Model MR-400 Mobile Mounting Rack, and a mobile antenna system will be required. If the installation is not wired into the auto radio's speaker system, Hallicrafters mobile speaker unit Model R-49 is recommended for the separate speaker system.

The PS-500-DC Power Supply is wired for vehicles having the negative side of the battery grounded.

Before installing the equipment, it is necessary to set the exact position of the connectors

at the rear of the mounting rack to properly index with the connectors of your transceiver unit. This may be accomplished as follows:

1. Set the mounting rack, back side down, on a work bench and place the side panels in the open position. Make sure the four nuts securing the power and antenna connectors have been loosened to permit the connectors to "float".

2. Remove the transceiver chassis from its cabinet (paragraph 7-1,c) and attach the two strike fittings to the cabinet sides with the 4-40 X 5/16 machine screws, nuts and lock washers supplied with the Model MR-400 Mobile Mounting Rack. Reinstall the transceiver chassis in the cabinet.

3. Hold the transceiver with the front panel up and very carefully slide the transceiver into the rack until the power and antenna connectors mate with those in the mounting rack. Use care in performing this step to avoid damaging the connectors through misalignment.

4. Snap the side fasteners in place to hold the transceiver securely in position. Turn the equipment on its side and tighten the four nuts that secure the connectors to the mounting rack.

5. Unsnap the side fasteners, carefully remove the transceiver from the mounting rack and proceed with the installation.

A base bracket and mounting straps are supplied for installing the Model MR-400 Mobile Mounting Rack under the dash or on the transmission hump (see Figure 6). When selecting a location for installing the mounting rack, an open space should be allowed at the top or bottom to provide adequate ventilation for the transceiver. Before bolting the mounting rack in place, make the required antenna and power cable connections to the mounting rack connectors.

The Model PS-500-DC Power Supply may be installed in any convenient location. In the installation shown, the power supply has been installed in the engine compartment close to the primary source of power.

It is recommended that the length of the primary leads to the power supply be kept short to minimize the voltage drop between battery and power supply (see Figure 7). Mount the power supply securely, using thread forming screws or conventional hardware. Position the power supply in such a manner that the side with the terminal strip and bias adjustment control is readily accessible.

Run the multi-conductor power cable attached to the mounting rack through the fire wall to the power supply. Since this cable is weather-proof, it may be threaded underneath the vehicle if desired. Cut the cable to the desired length, attach the terminal lugs supplied and connect these wires to the terminal strip on the power supply. (See Figures 8 and 22 for color coding and terminal numbering.)

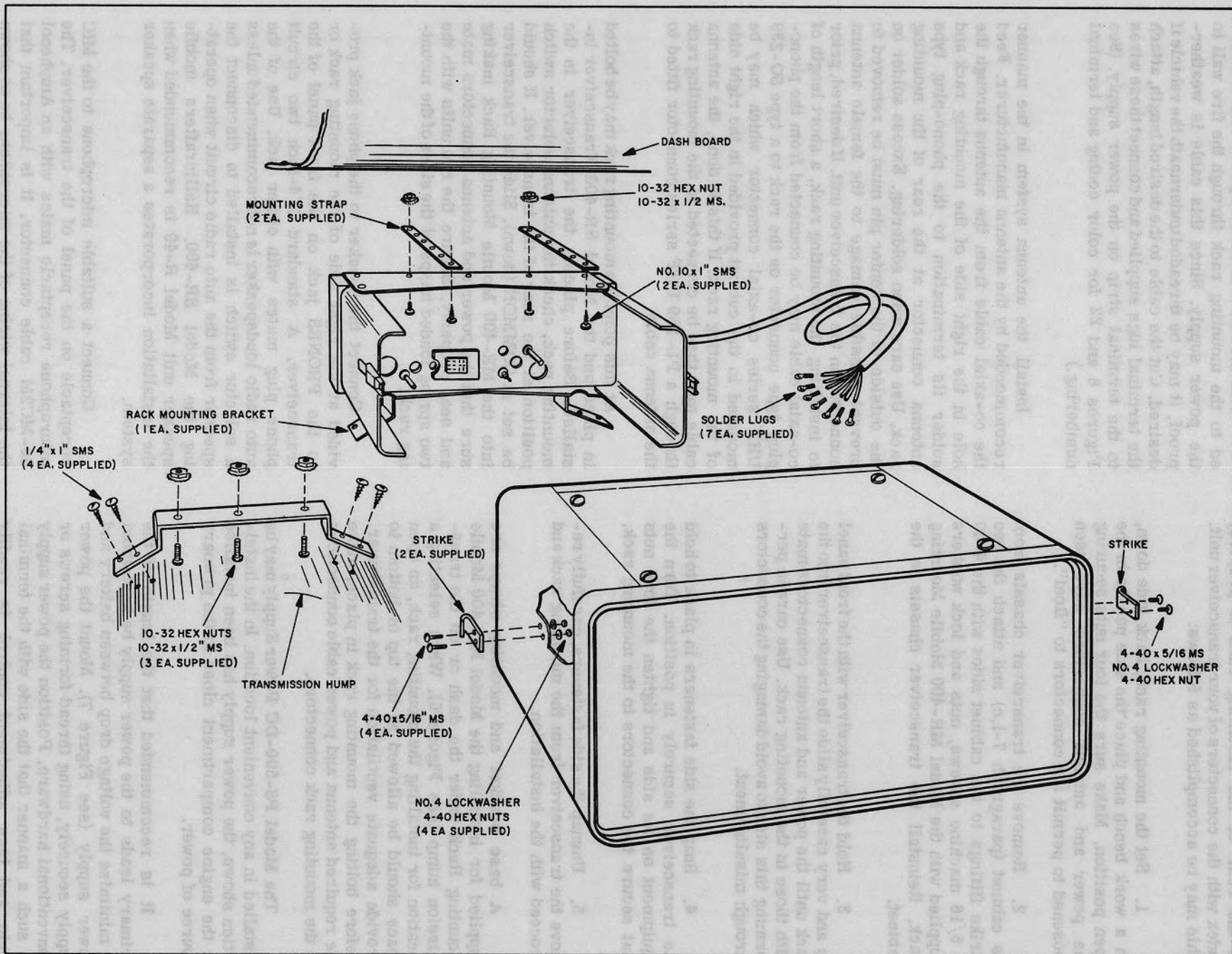
Install the antenna system in the manner recommended by the antenna manufacturer. Feed the co-axial cable from the antenna through the hole in the right side of the mounting rack and solder its termination to the phono-plug type antenna connector at the rear of the mounting rack. Use care when soldering. Excess solder on the outside of the center pin must be removed to prevent possible damage to the female antenna connector in the transceiver unit. If desired, prior to installing the mounting rack, a short length of co-axial cable may be connected from the phono-plug type connector on the rack to a type SO-239 UHF series co-axial connector which may be mounted in the cut out provided in the right side of the mounting rack. If this is done, the antenna cable may then be connected to the mounting rack through a PL-259 UHF series connector fitted to the antenna cable.

At this point the mounting rack may be bolted in place and the Model SR-400 Transceiver installed. Before placing the transceiver in the mounting rack, check the antenna selector switch position at the rear of the transceiver. It should be set at COMMON (down). Slide the transceiver into the MR-400 Mobile Mounting Rack making sure that the power and antenna connectors mate and seat properly. Secure the two units with the two spring loaded hasps at the sides of the mounting rack.

Connect the speaker to the phone jack provided at the right side of the mounting rack or to the PHONES jack on the front panel of the transceiver. A standard 1/4-inch two circuit phone plug mates with either jack. Use of the auto radio loudspeaker is not recommended unless a selector switch is installed to disconnect the speaker from the auto radio circuit when operating the Model SR-400. Hallicrafters mobile speaker unit Model R-49 is recommended when the installation incorporates a separate speaker system.

Connect a suitable microphone to the MIC receptacle on the panel of the transceiver. The microphone receptacle mates with an Amphenol 80-MC2M cable connector. It is important that the internal wiring of the microphone be as shown in figure 3.

Figure 6. Mobile Installation of Transceiver Using MR-400 Installation. Kir.



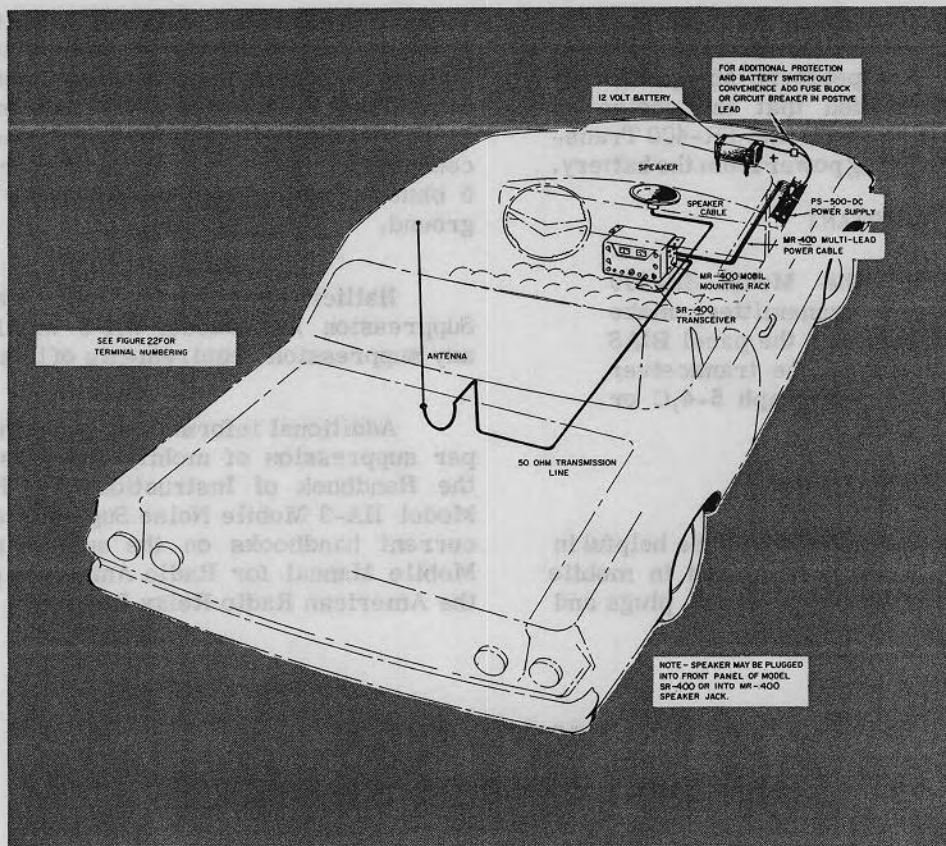


Figure 7. Wiring Diagram of Mobile Installation.

IMPORTANT

Install the battery connections to the car battery last. Before connecting to the vehicle's battery, check the transceiver to ascertain that the OPERATION switch is set at OFF. Make one final wiring check for possible errors.

Connect the two No. 8 AWG wires, supplied with the PS-500-DC Power Supply, to the battery. Connect the red wire to the positive (+) terminal of the battery and the brown wire to the negative (-) terminal of the battery. As a circuit refinement, the positive lead should be connected to the battery through a fuse block or circuit breaker (not supplied) with current capacity in excess of 30 amperes to protect the battery from accidental shorts and to provide a convenient means of switching out the battery supply.

CAUTION

USE CARE WHEN MAKING CONNECTIONS TO THE BATTERY IN THE VEHICLE. THE POWER IN A BATTERY CAN CAUSE DANGEROUS BURNS AND EVEN EXPLOSION IF SHORT CIRCUITED.

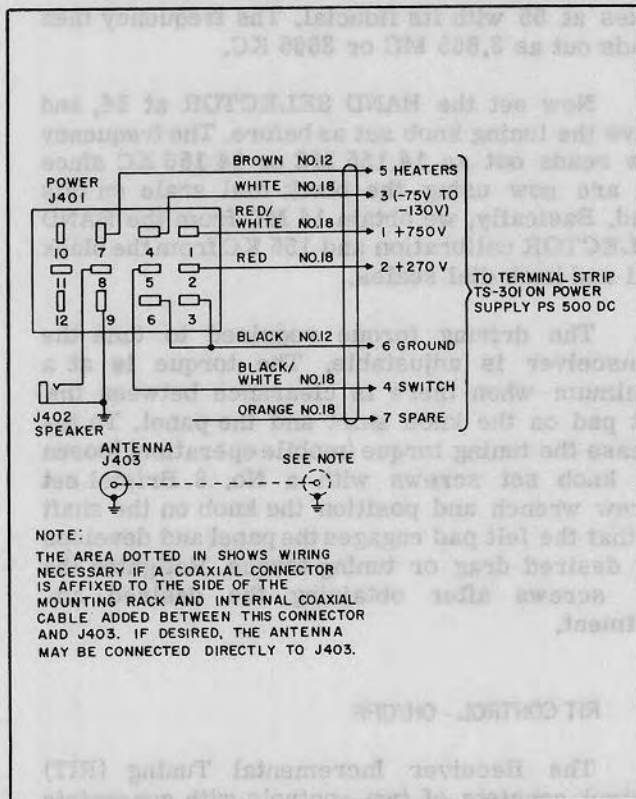


Figure 8. Wiring Diagram of Model MR-400 Interconnecting Cable.

Only after familiarizing yourself with the controls and their functions, as outlined in Sections IV and V, should you perform an operational check. It is recommended that the engine be running while operating the Model SR-400 Transceiver to prevent draining power from the battery.

IMPORTANT

Before operating the Model SR-400 Transceiver as a transmitter, make the bias adjustment with the panel BIAS ADJ. control (R115) of the transceiver unit as outlined in paragraph 5-4,C or 8-3.

3-11. MOBILE NOISE SUPPRESSION.

The following suggestions may be helpful in the suppression of noise encountered in mobile operation. Install resistor-type spark plugs and

coaxial bypass capacitors in the ignition coil primary, and generator armature leads. At the voltage regulator, install bracket-mounted coaxial capacitors in the armature and battery leads to the voltage regulator and connect a series connected 0.002 UF mica or disc capacitor and 5 ohm resistor from the generator field lead to ground.

Hallicrafters has available a Mobile Noise Suppression Kit, Model HA-3 which will fulfill any suppression requirements of this installation.

Additional information, concerning the proper suppression of mobile noise, is available in the Handbook of Instructions for Hallicrafters Model HA-3 Mobile Noise Suppression Kit and in current handbooks on the subject such as The Mobile Manual for Radio Amateurs published by the American Radio Relay League.

SECTION IV

FUNCTIONS OF OPERATING CONTROLS

All controls utilized during normal operation of the Model SR-400 Transceiver (see Figure 9) are located on the front panel.

4.1. TUNING CONTROL.

The tuning control knob is located at mid panel just below the dial escutcheon. The control drives the VFO capacitor which is the frequency determining element of the transceiver. The frequency to which the unit is tuned is displayed in the left hand window and in the window above the knob. Metering information is displayed in the right hand window.

The frequency dial in the left hand window has two calibrated scales. The black scale is calibrated from 0 to 500 KC and the red scale is calibrated from 500 to 1000 KC. The dial scales are color coded to the BAND SELECTOR calibrations which also display the first digits of the operating frequency to the left of the decimal point.

By rotating the tuning knob and watching the two dial displays you will observe that the knob scale divides the 100 KC increments of the main dial scale into one kilocycle increments.

The following examples will aid in developing the read out technique:

Set the BAND SELECTOR at 3.5(Red), and set the tuning knob so that the red scale indicates 650 near the fiducial and the knob dial scale indexes at 55 with its fiducial. The frequency then reads out as 3.655 MC or 3655 KC.

Now set the BAND SELECTOR at 14, and leave the tuning knob set as before. The frequency now reads out as 14.155 MC or 14,155 KC since we are now using the black dial scale on this band. Basically, we obtain 14 MC from the BAND SELECTOR calibration and 155 KC from the black dial and knob dial scales.

The driving torque required to tune the transceiver is adjustable. The torque is at a minimum when there is clearance between the felt pad on the knob skirt and the panel. To increase the tuning torque (mobile operation) loosen the knob set screws with a No. 8 Bristol set screw wrench and position the knob on the shaft so that the felt pad engages the panel and develops the desired drag or tuning torque. Retighten the set screws after obtaining the desired adjustment.

4.2. RIT CONTROL - ON/OFF.

The Receiver Incremental Tuning (RIT) control consists of two controls with concentric shafts. The ON/OFF function of the lever control either places the variable-element RIT control

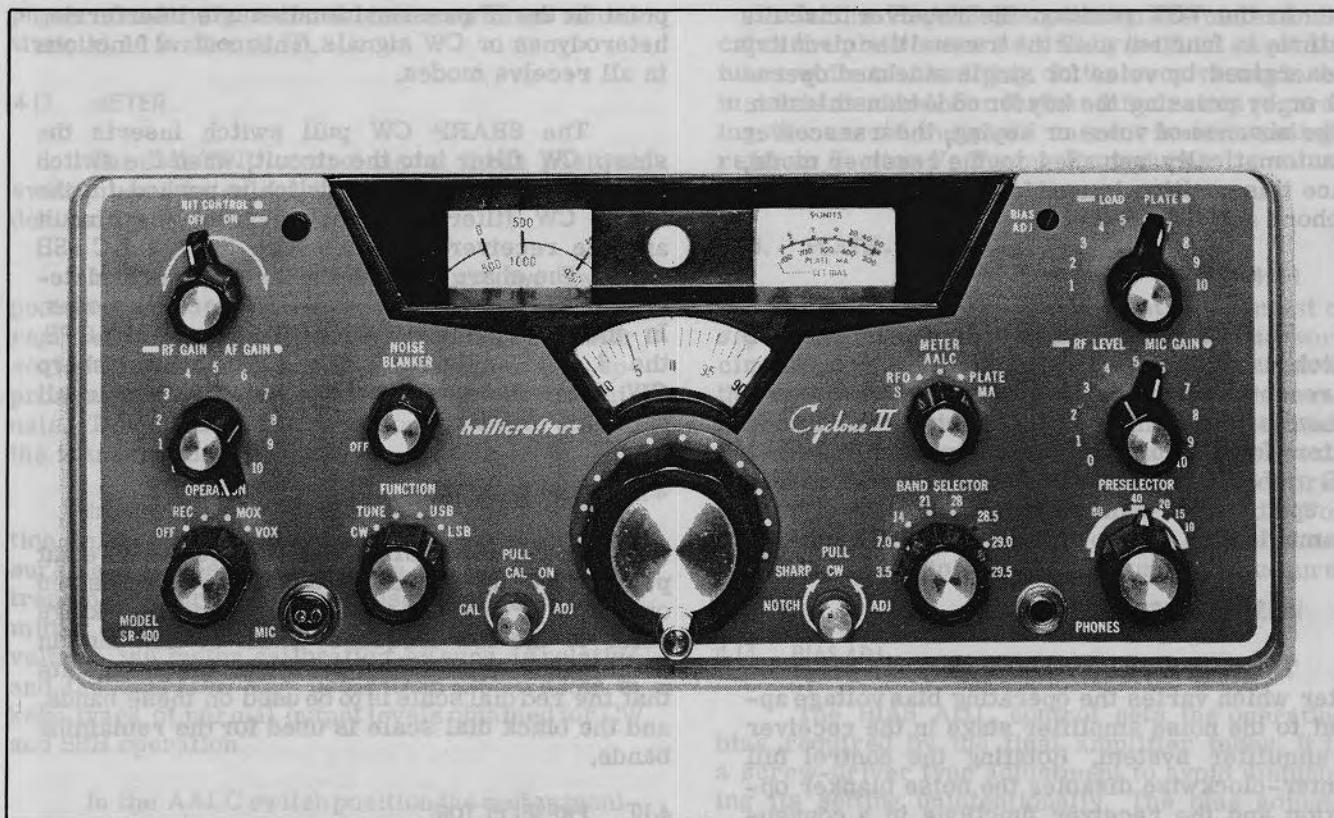


Figure 9. Front Panel View of SR-400 Transceiver.

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in or out of operation. This control, in the ON position, enables the operator to fine-tune the receiver plus or minus two KC or more by means of the RIT potentiometer (round knob) without disturbing the initial receiver or transmitter frequency. Returning the control to the OFF position again locks the receiver frequency to the transmitter frequency. RIT must be turned OFF to calibrate the dial or to operate the transmitter and receiver on a common frequency. The warning lamp to the right of the RIT control serves to call attention to the fact that the RIT control is in operation.

43. RF GAIN - AF GAIN.

The RF GAIN and AF GAIN controls located in the left hand group, are two potentiometers mounted on concentric shafts. The RF GAIN control (lever knob) varies the gain of the receiver RF amplifier stage. Maximum receiver sensitivity is obtained with the lever knob set at 10 (fully clockwise).

The AF GAIN control (round knob) adjusts the audio output level from the speaker or head phones (PHONES jack). Clockwise rotation of the control increases the audio signal level applied to the first audio amplifier stage of the receiver audio amplifier stages.

44. OPERATION.

The OPERATION control is a four-position switch used to select the method of transceive control.

In the OFF position, all power is disconnected from the transceiver.

In the REC (Receiver) position, the receiver portion of the transceiver is placed in operation and all circuits common to both receiver and transmitter are in the receive condition, while circuits used only in the transmit mode are either biased off or switched off by the control.

In the MOX position, when operating SSB, the receiver circuits remain in effect until the microphone (push-to-talk) button is pressed. Closing the microphone switch transfers the circuitry from receive to transmit mode through the bias and relay switching. Releasing the microphone button again restores receiver operation. When operating the transceiver as a CW station the receiver circuits are disabled when the control is set at MOX and the transmitter circuits are then keyed for code transmission.

Returning the operation control to REC restores receiver operation.

In the VOX position the receiver circuits continue to function until the transmitter circuitry is energized by voice for single sideband operation or by pressing the key for code transmission. In the absence of voice or keying, the transceiver is automatically returned to the receiver mode, hence this position is used for automatic or break-in phone and CW control.

4.5. FUNCTION.

The FUNCTION control is a four position switch used to select the mode of transmission or reception. The control is set at CW for code transmission; at TUNE when tuning the transmitter for CW or SSB operation; and at either USB or LSB for single sideband operation depending upon which sideband is selected for voice communication.

4.6. NOISE BLANKER/OFF.

The NOISE BLANKER control is a potentiometer which varies the operating bias voltage applied to the noise amplifier stage in the receiver IF amplifier system. Rotating the control full counter-clockwise disables the noise blanker operation and the receiver functions in a conventional manner without noise immunity.

When noise immunity is desired the NOISE BLANKER control is turned clockwise from its OFF position until the noise level drops to an acceptable signal to noise ratio.

4.7. CAL. ON-CAL. ADJ.

The CAL. ON-CAL. ADJ. control is a potentiometer with a pull switch mounted on its shaft.

The CAL. ADJ. potentiometer is used to correct the dial calibration error of the tuning dial. The dial calibration mark and the frequency of reception or transmission may be made to coincide with the use of this control, adjustment and the 100 KC crystal marker oscillator.

The CAL. ON pull switch is mounted on the CAL. ADJ. potentiometer. When pulled out, this switch turns on the 100 KC crystal oscillator when the operator wishes to check the dial calibration accuracy at the 100 KC points on the dial.

4.8. SHARP CW-NOTCH ADJ.

The SHARP CW and NOTCH ADJ. control is a potentiometer with a pull switch mounted on its shaft.

The NOTCH ADJ. potentiometer is used to set the notch frequency. It may be set at any

point in the IF passband to attenuate interfering heterodynes or CW signals. This control functions in all receive modes.

The SHARP CW pull switch inserts the sharp CW filter into the circuit, when the switch is pulled-out. When the switch is pushed-in, the sharp CW filter is removed from the circuit and the receiver functions with the 2.1 KC SSB filter. The sharp CW filter peaks at approximately 800 CPS in the CW and USB receive modes. In the LSB mode the filter peaks at 1600 CPS, the 6 DB bandwidth is 200 CPS, and the sharp CW filter is automatically switched out in all transmit modes.

4.9. BAND SELECTOR.

The BAND SELECTOR control is an eight position rotary switch used to select the desired operating frequency range. The panel markings refer to the low frequency limit of that band in megacycles. The switch positions in red indicate that the red dial scale is to be used on these bands, and the black dial scale is used for the remaining bands.

4.10. PRESELECTOR.

The PRESELECTOR control drives a three section variable capacitor which tunes both receiver and transmitter circuits to frequency within a given band. In the receive mode the receiver RF amplifier and first mixer stages are tuned to frequency, while in the transmit mode, the control tunes the transmitter second mixer and driver stages to frequency. The segmented dial scale provides for an initial setting when changing bands.

For general receiver tuning, the control is adjusted for maximum receiver sensitivity, however, for transceive operation the control is adjusted for maximum transmitter output during transmitter tune-up and left at this setting for the receive mode.

4.11. RF LEVEL - MIC GAIN.

The RF LEVEL and MIC GAIN controls, located in the right hand group, are two potentiometers mounted on concentric shafts. The RF LEVEL control (lever knob) varies the RF carrier level for CW operation or for tune up purposes for both CW and SSB operation. Maximum CW output is obtained as the knob is turned clockwise toward 10 on the panel.

The MIC GAIN control (round knob) adjusts the audio level to the balanced modulator stage from the microphone amplifier stages. Clockwise rotation of the control knob increases the micro-

phone sensitivity and reaches maximum sensitivity at 10 on the panel.

4-12. METER.

The METER control is a three position switch used to select the metering information desired by the operator.

In the receive mode the first two switch positions provide "S" meter information about the received signal strength. At S-9 on the meter scale, the received signal level represents approximately 50 microvolts at the antenna terminals. The third switch position functions only in the transmit mode.

In the transmit mode the first switch position, marked RFO, provides an RF voltage measurement across the antenna terminals of the transmitter for tune up purposes. Since the transmitter will always be tuned for maximum RF voltage, the meter calibration, as such, is relative and the operator may use either meter scale to keep track of normal output levels obtained for CW and SSB operation.

In the AALC switch position the meter monitors the amplified automatic level control voltage developed to control the final amplifier drive level for SSB operation. A meter deflection in this position indicates that the voice peaks are approaching the point of flat topping of the output signal. Excessive deflection during SSB transmission is normally corrected by backing off the setting of the microphone gain control until a pointer deflection of S-5 is obtained on voice peaks.

In the PLATE MA position the meter indicates the plate current drawn by the final amplifier tubes while transmitting. In the receive mode the meter is disabled. For further information regarding the use of the plate current meter readings refer to Section V, Tuning Procedure.

4-13. PLATE - LOAD (Final Tuning).

The PLATE and LOAD controls consist of separate variable air capacitors in the PInetwork circuitry of the final amplifier. They are driven through concentric shafts by two knobs, the round knob drives the plate capacitor and the lever knob drives the load capacitor. A 1 to 10 panel scale provides the operator with a logging scale for pre-setting the capacitors when changing bands. For more specific information on the use of these controls, refer to Section V, Tuning Procedure.

4-14. BIAS ADJ.

The BIAS ADJ. control sets the operating bias required by the final amplifier tubes. It is a screw-driver type adjustment to avoid disturbing its setting unintentionally. The bias adjustment must be made when the transmitter is first placed in operation, and then only an occasional check and possible adjustment will be required thereafter.

NOTE

Refer to paragraph 5-4c or 8-3 for details.

SECTION V TUNING PROCEDURE

5-1. GENERAL.

The operating procedure for the Model SR-400 Transceiver is not complicated; however, normal care should be exercised when operating the gear to realize the true performance designed into the equipment. Before applying power to the equipment for the first time, it would be well to recheck the critical items of the installation.

Is the station antenna system connected and is it compatible with the load impedance requirements of the transceiver?

Is the interconnecting cable between the transceiver and power supply in place? If the installation is mobile, are the power cable leads correctly connected to the DC power supply.

Is the equipment bonded to a good electrical ground?

IMPORTANT

Before operating the transmitter portion of the transceiver, the bias adjustment control (BIAS ADJ.), located on the transceiver panel must be correctly set. Refer to the basic transmitter tune-up procedure (paragraph 5-4,C) or to the bias adjustment procedure in Section VIII (paragraph 8-3).

5-2. RECEIVER OPERATION.

The transmitter group of controls, not specifically mentioned below, have no direct bearing

on receiver operation and may be disregarded for the moment.

A. Pre-set the Model SR-400 panel controls as follows:

RIT CONTROL. OFF
RF GAIN. 10 (Full CW)
AF GAIN. As required
OPERATION. OFF
FUNCTION. USB or LSB as desired
NOISE BLANKER. OFF (Full CCW)
PULL/CAL. Off (push-in)
PULL/SHARP CW. Off (push-in)
BAND SELECTOR. Desired band
PRESELECTOR. Set at band segment in use
METER. RFO/S

Connect the line cord plug to the power source outlet.

B. Set the OPERATION control at REC. The dial and meter faces on the transceiver will become illuminated. Allow a few minutes for the equipment to reach operating temperature and stabilize.

C. Use of the PRESELECTOR control — As the receiver is tuned across the band an occasional readjustment of the PRESELECTOR control will be found necessary. Always adjust it for maximum "S" meter reading on signal or for maximum background noise without signals present. When the PRESELECTOR control has been set during transmitter tune-up on frequency, it must then be left at that setting for receive. The exact setting is more critical for transmitter operation than for the receiver mode.

D. Use of the RF GAIN control — Normally the RF GAIN control is set at 10 or full clockwise to obtain full AGC (Automatic Gain Control) action for uniform speaker output while tuning in stations of varying signal strengths across the band. While AGC is customarily employed for SSB reception, it may also be used to advantage

for CW code reception. The RF GAIN control must be set at its full clockwise position to obtain normal "S" meter operation, as you will notice the "S" meter deflection falls off on signal as the RF GAIN control is backed off from its maximum setting.

Manual control of the receiver sensitivity, at times, is desirable and the operator may set the RF GAIN control as required for these occasions.

E. Tuning with the RIT CONTROL — There are contacts wherein the operator finds it advantageous to be able to tune his receiver a few kilocycles either side of the operating frequency without disturbing his own transmitter frequency. The Model SR-400 transceiver has the capability to do just that. To tune the receiver a few kilocycles (2 to 3 KC) either side of the operating frequency without disturbing the transmitter frequency, switch the RIT CONTROL ON (lever knob) and then tune the receiver with the RIT CONTROL (knob). The transmitter frequency will remain at the dial frequency. Turning the RIT knob clockwise increases the receiver frequency. Switching the RIT CONTROL OFF returns the receiver to the dial frequency.

One word of caution. Don't leave the receiver in the RIT position when true transceiver operation is desired, since it would be a matter of chance if the two modes happened to be operating on the same frequency. The warning lamp serves to call attention to the fact that the RIT system is active.

F. How to use the NOISE BLANKER control — Receiving conditions disrupted by severe impulse type noise may be improved measurably with the use of the NOISE BLANKER control. As with all noise silencers, the situation can generally be improved but not cured. When severe impulse noise (ignition, electrical appliances, etc.) is encountered, turn the BLANKER control clockwise until the noise level drops. The control is a noise amplifier stage gain adjustment and must be set on a threshold basis, that is, at the point where the noise pulses appear to be cancelled. An increase in gain setting beyond this point will not improve the signal to noise ratio, but can introduce undesirable side effects such as cross modulation products resulting in spurious signal reception.

The noise blanker works equally well for SSB or CW code reception.

5.3. DIAL CALIBRATION.

A. Preset the Model SR-400 panel controls as follows:

RIT CONTROL OFF

RF GAIN 10 (Full CW)

AF GAIN As required

OPERATION REC

FUNCTION USB or LSB as required

NOISE BLANKER OFF (Full CCW)

PULL/CAL CAL (pull out)

PULL/SHARP CW Off (push in)

BAND SELECTOR Desired band

PRESELECTOR Tune for maximum "S"
meter deflection

METER RFO/S

B. To calibrate the dial for average accuracy over the entire band, set the dial to the highest 100 KC point on the band. (4000 KC on 80M, 7500 KC on 40M, etc) and use the LSB FUNCTION control position while calibrating.

For better than average dial calibration accuracy, set the dial at the 100-KC point on the dial nearest the desired frequency and leave the FUNCTION control set for the sideband in use.

In either case the knob dial scale will read zero when correctly set to the 100 KC point on the main dial.

C. Adjust the CAL ADJ control for zero beat. It may be necessary to advance the AF GAIN control setting to recover sufficient audio near zero beat. The RIT CONTROL must be set at OFF when calibrating the dial.

D. After calibrating the dial, shut the calibrator off. Switch it on for dial calibration checks only.

5.4. BASIC TRANSMITTER TUNE-UP.

The Model SR-400 Transceiver can be tuned up on several frequency segments that are outside the amateur bands. Care must be exercised not to transmit on these frequencies. The receiver group of controls, not specifically mentioned below, have no direct bearing on the transmitter tune-up procedure and may be disregarded for the moment.

A. Pre-set the panel controls for transmitter tune-up as follows:

OPERATION REC

FUNCTION SSB

BAND SELECTOR Desired band

PRESELECTOR Set at band segment in use

Tuning dial Set to desired frequency

METER PLATE MA

RF LEVEL At zero (Full CCW)

MIC. GAIN At zero (Full CCW)

*PLATE (Final tune
capacitor) (Nominal chart setting)

*LOAD (Final load-
ing capacitor) (Nominal chart setting)

*IMPORTANT

Presetting the PLATE and LOAD controls per the chart will avoid incorrect control settings and minimize plate dissipation in the final amplifier tubes during the tune-up procedure.

MODEL SR-400 CONTROL SETTINGS FOR 50 RESISTIVE OHM LOAD

FREQUENCY	PLATE		LOAD	
	NOMINAL	ACTUAL	NOMINAL	ACTUAL
3.5 MC	2-1/4		4	
3.75 MC	3		6	
4.0 MC	3-1/2		8	
7.0 MC	3-1/2		4-1/2	
7.3 MC	4		5	
14.0 MC	5		5	
14.35 MC	5-1/2		5-1/2	
21.0 MC	6-1/2		4-1/4	
21.45 MC	7		4-1/2	
28.0 MC	7-1/2		5-1/2	
29.7 MC	8		7	

The data above are based on average Model SR-400 PLATE and LOAD control settings when operated into a purely resistive 50-ohm load. These settings will, of course, vary slightly with the loading variations presented by your installation and it is suggested that you note in the appropriate column the final control settings required for use with your antenna to facilitate a rapid initial adjustment when changing bands or frequency within the band.

B. If the transceiver has just been turned on allow a few minutes for the equipment to reach operating temperature before proceeding with the transmitter tune-up.

With the METER selector switch set at PLATE MA the meter pointer will normally rest to the left of the meter scale zero when the transceiver is in the receive mode. This is normal for the type of meter circuit used in the transceiver.

C. Set the OPERATION control at MOX and close the PUSH-TO-TALK switch on the microphone. The idle plate current of the final amplifier stage should cause the meter pointer to index with the SET BIAS arrow of the meter. If the plate current is above 100 milliamperes set the OPERATION control at REC to disable the transmitter. Check to see that the RF LEVEL control is set at zero. Reset the OPERATION control at MOX and without delay rotate the BIAS ADJ control (screw driver adjustment) located on the panel of the transceiver until the meter pointer lines up with the SET BIAS arrow on the meter scale (70 MA).

D. Set the METER selector at RFO/S and check to see that the final amplifier PLATE and LOAD controls are preset per the tuning chart. Watch the meter and turn the RF LEVEL control clockwise slowly until the RFO meter indicates a low output level, say S-3 to S-5 on the "S" meter scale. Adjust the PLATE control first and then the PRESELECTOR control for maximum RFO meter reading. Turn the RF LEVEL control counterclockwise if the RFO meter indicates above S-7 while tuning. The driver and final amplifier stages are now resonated, but the final amplifier stage still requires a loading check and possible adjustment.

NOTE

During the next step of the transmitter tuning procedure the final amplifier tubes will operate at their highest plate dissipation. The plate dissipation at this time will be higher than for continuous operation on either SSB or CW at full power output. For this reason it is recommended that full carrier power be applied only for the length of time needed to evaluate the loading adjustment required.

E. Set the METER switch at PLATE MA. Watch the PLATE current and slowly turn the RF LEVEL control clockwise until the plate current reaches 350-400 milliamperes. Turn the RF LEVEL control counterclockwise to zero and consider the loading adjustment required as follows:

1. Loading too light — If the RF LEVEL control reached 10 (full clockwise) with the plate current refusing to rise to 350-400 milliamperes the loading is too light and the LOAD control must be turned clockwise to increase the coupling or loading on the final amplifier stage.

2. Loading too heavy — If the plate current rise exceeded 350-400 milliamperes as the RF LEVEL control setting was advanced, the loading is too heavy. To correct this condition, turn the LOAD control counterclockwise to reduce the loading.

3. Loading normal — When the plate current rises 350-400 milliamperes and levels off at this value as a maximum as the RF LEVEL control is turned clockwise, the loading is considered normal. Each time the LOAD control setting is changed, the PLATE control must be returned to resonance or the loading check will not be valid.

F. As the operating frequency is changed within the band, retune the transmitter with the PRESECTOR and PLATE controls for maximum RFO voltage to keep the driver stage and final amplifier stage plate circuits at resonance. When a major change in frequency is required which may effect the final amplifier loading, the load check and possible LOAD control adjustment should be made. Some idea of the variation in LOAD control setting with frequency within a given band may be obtained from the nominal settings shown in the tuning chart.

G. Set the OPERATION control at REC to restore receiver operation.

5-5. CW OPERATION.

A. Before switching the OPERATION control from REC to MOX, check to see that the following controls are correctly set for CW operation:

FUNCTION TUNE
METER PLATE MA
RF LEVEL Zero (Full CCW)
MIC GAIN Zero (Full CCW)
PLATE Adjusted per paragraph 5-4
LOAD Adjusted per paragraph 5-4
PRESECTOR.. Adjusted per paragraph 5-4

BAND SELECTOR Desired band
Tuning dial Set to desired frequency

B. Assuming that the transmitter has been properly loaded and tuned to frequency as described in the basic transmitter tune-up procedure, switch the OPERATION control from REC to MOX. The plate current meter should indicate at SET BIAS arrow. Advance the RF LEVEL control until the plate current reaches maximum. If the plate current levels off at 350-400 milliamperes the loading is correct. Make one final adjustment of the PLATE control and PRESECTOR control for maximum RFO voltage (METER control at RFO/S) to be sure that transmitter is in tune. Make this a habit — it saves tubes and puts a cleaner signal on the air.

C. Leave the RF LEVEL control set for 350-400 milliamperes and switch the FUNCTION control to CW. The transmitter output will drop to zero, provided the keyer circuit is open. Press the key. The plate current should be 350-400 milliamperes. While transmitting, the RFO voltage may be monitored if an "S" meter reading is also desired while in the receive mode. (METER switch set at RFO/S.)

D. Return the transceiver to the receive mode by switching the OPERATION control back to REC. This is your manual control over the transmit-receive function. If automatic control is desired, set the OPERATION control at VOX. The receiver will continue to operate until the key is closed. Open the key and observe the delay before the receiver is again active. This delay may be set as desired with the DELAY control, located under the cabinet cover (see Figure 16). The delay period increases as the DELAY control is turned clockwise.

E. The Model SR-400 Transceiver also provides a CW side-tone signal through the speaker or headphone output, which is keyed along with the transmitter, for monitoring purposes. The level may be varied as desired with the SIDE TONE control located under the cabinet cover. (See Figure 16.)

5-6. PUSH-TO-TALK SSB OPERATION.

A. Before switching the OPERATION control from REC to MOX, check to see that the following controls are correctly set for SSB operation.

FUNCTION SSB
METER PLATE MA
RF LEVEL Zero (Full CCW)
MIC GAIN Zero (Full CCW)
PLATE Adjust per paragraph 5-4

LOAD Adjusted per paragraph 5-4
PRESELECTOR.... Adjusted per paragraph 5-4
BAND SELECTOR Desired band
Tuning dial Set to desired frequency

B. Assuming that the transmitter has been properly loaded and tuned to frequency as described in the basic transmitter tune-up procedure, switch the OPERATION control from REC to MOX. The plate current meter should indicate at SET BIAS arrow. Advance the RF LEVEL control until the plate current reaches maximum. If the plate current levels off at 350-400 milliamperes the loading is correct. Make one final adjustment of the PLATE control and PRESELECTOR control for maximum RFO voltage (METER control at RFO/S) to be sure the transmitter is in tune. Make this a habit — it saves tubes and puts a cleaner signal on the air. Return the RF LEVEL control to zero (full CCW).

C. Switch the FUNCTION control to either USB or LSB depending upon the sideband to be used for transmission and reception. The plate current meter will now indicate to the left of zero and the receiver is back in operation.

D. Switch the METER control to the AALC position. Press the microphone push-to-talk button. Speak into the microphone at a normal voice level and advance the MIC GAIN control until the meter pointer on the transceiver panel begins to kick up to about S-5 on voice peaks. This is the correct working level. Use this meter switch position when operating SSB to monitor the SSB transmissions. The microphone gain control setting will be found to be less critical because of the compression action of the AALC circuitry; however, the actual control setting still depends upon the type of microphone, the operator's voice characteristics, and his operating habits. Sufficient microphone gain has been built into the Model SR-400 Transceiver to handle the usual range of levels associated with communications type microphones.

E. Release the microphone switch button. The transceiver returns to the receive function. The meter on the transceiver now monitors the strength of the incoming signals in the usual "S" units of measurement; S-9 represents approximately a 50-microvolt signal.

5-7. VOICE CONTROLLED SSB OPERATION.

The operating procedure outlined for basic transmitter tune-up (paragraph 5-4) and push-to-talk sideband operation (paragraph 5-6) also apply for voice controlled single sideband operation. The following adjustments, therefore, are intended to apply only to the adjustment of the VOX control system.

To avoid unintentional transmission while adjusting the VOX system controls set the MIC GAIN control at zero (Full CCW).

A. Turn the four transceiver cabinet cover screws 1/4 turn CCW to loosen the fasteners and lift the top cover clear to gain access to the VOX controls.

B. Initially set the VOX, DELAY and ANTI-TRIP controls fully counterclockwise.

C. Set the OPERATION control at VOX and the FUNCTION control at either the USB or LSB position.

D. Turn the VOX control clockwise, while talking into the microphone, until the VOX control relay closes on the first syllable of speech. The transceiver will transfer from receive mode to transmit mode when the relay closes. Use just enough VOX gain to accomplish the desired results, too much gain will make the system over sensitive to speaker feedback and to little sensitivity will place a relatively high signal level at the antenna change-over relay contacts at the time it switches over to transmit.

E. Adjust the DELAY control for the desired drop-out delay. The delay period increases as the DELAY control is turned clockwise. The delay period should be long enough to prevent change-over between words but not long enough to miss the other operator's quick reply.

F. Set the receiver AF GAIN control for the desired listening level and advance the ANTI-TRIP control (clockwise) until the received signals do not actuate the VOX control relay. Excessive anti-trip gain or a major increase in the established listening level may lock out the voice control system.

G. With the VOX controls adjusted, either method of control may be selected by setting the OPERATION control at MOX for manual control or at VOX for voice control. To place the transmitter in operation, reset the transmitter MIC GAIN control watching the AALC metering as you speak into the microphone.

H. Replace the cabinet cover and turn the screws 1/4 turn clockwise to lock the cover in place.

NOTE

Some microphones, equipped for push-to-talk control, have shorting contacts in the switch to disable the microphone element when the push button is released. VOX operation will not be feasible unless this circuitry is disconnected within the microphone.

SECTION VI

THEORY OF OPERATION

6-1. GENERAL.

The Model SR-400 Transceiver consists of a double conversion receiver and double conversion transmitter. To achieve true on frequency transceiver operation, the VFO, heterodyne crystal oscillator, and carrier frequency oscillators all contribute to the transmit and receive functions. In addition, the 6.0 — 6.5 MC IF amplifier and 1650 KC IF amplifier stage associated with the crystal lattice filter all function for both modes.

Circuitry that would be compromised, performance wise, to accomplish common usage between the transmit and receive function is avoided in the design of the Model SR-400 Transceiver.

Refer to Figure 10 for the block diagram of the system and to figure 31 for schematic details.

6-2. RECEIVER SECTION.

The signal (f_1) at the antenna connector is fed to the receiver RF amplifier stage (V1) through the antenna change-over relay (K1) located in the transmitter final amplifier section. The signal is amplified and passed on to the first receiver mixer (V2A), where it is heterodyned to frequency (f_2) which is the difference between the heterodyne crystal oscillator (V12) frequency (X1) and the signal frequency (f_1). The resulting variable IF signal (f_2) falls between 6.0 MC and 6.5 MC. The RF amplifier and first receiver mixer tuned circuits are selected by the BANDSELECTOR switch and tuned by the PRESELECTOR control capacitor.

The variable IF signal (f_2) is amplified by a broadband IF amplifier (V3A) and then heterodyned to the second IF frequency of 1650 KC (f_3) by mixing with the VFO (variable frequency oscillator) (V13 and V4B) in the second receiver mixer (V4A).

With the NOISE BLANKER control set at OFF, the second IF signal (f_3) is amplified by the first 1650 KC IF amplifier and blanker stage (V6) in a conventional manner. When the NOISE BLANKER control is adjusted for maximum noise rejection, the noise amplifier stage (V5A) samples and amplifies the 6.0 to 6.5 MC noise and signal (f_2). The signal and noise pulses in this path are then detected and shaped into positive going pulses with diode CR7. The detected signal, which is now predominantly noise pulses, is amplified by the pulse amplifier stage (V5B). The negative going pulses are then fed to grid No. 3 of the pentagrid type first 1650 KC IF amplifier and blanker tube (V6) with the diode CR6 acting as a steering diode to prevent positive pulses from reaching grid No.

3. Pulse modulation of the IF amplifier and blanker stage, momentarily interrupts the second IF signal (f_3) during noise bursts with no apparent discontinuity of reception because of the relatively short pulse duration.

The output of the first 1650 KC IF amplifier (V6) is connected to a single tuned circuit (L15) which is the crystal filter (FL1) input termination. Before reaching the crystal filter, the signal passes through a 1652.200 KC quartz crystal (Y12), the SHARP CW filter, or a diode (CR23) that is connected across the crystal. In the case of normal SSB reception, the diode is made to conduct and thereby effectively short out the crystal (Y12) so that the IF passband is 2.1KC wide, as determined by the crystal lattice filter (FL1). When the SHARP CW switch is pulled out, (on) the diode (CR23) does not conduct. This places the crystal (Y12) in series with the crystal lattice filter. The IF passband then is 200 CPS at the 6 DB points.

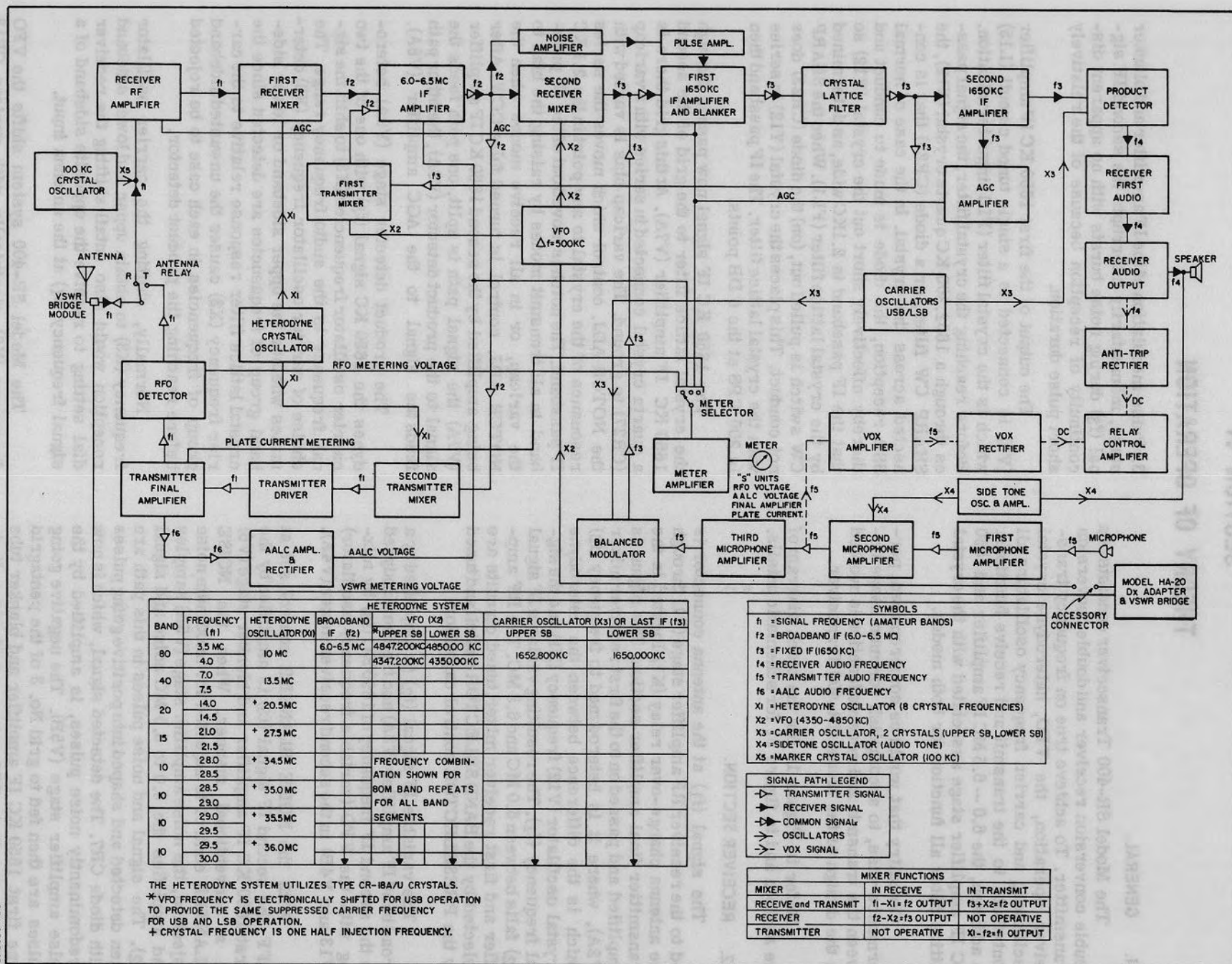
The 1650 KC IF signal now passes through the crystal lattice filter to the grid of the second 1650 KC IF amplifier (V7A). At this grid there is a quartz crystal connected in series with a varicap (CR27) to ground. The varicap bias is varied with the NOTCH ADJ. control which moves the series resonance of the crystal to any point in the 2.1 KC IF passband. The notch is moved out of the IF passband in all transmit modes by raising the bias to the varicap, or in all receive modes when the NOTCH ADJ. control is turned fully CCW. After being amplified by the second 1650 KC IF amplifier (V7A) the signal path is split, one path feeds the signal to the product detector (V9A), the other path feeds the signal to the AGC amplifier (V8A).

The product detector stage (V9A) heterodynes the 1650 KC signal (f_3) with one of the two carrier oscillator frequencies (X3) to shift the signal frequency to the audio frequency range. The choice of carrier oscillator frequency (X3) determines whether the upper sideband or lower sideband group of frequencies are detected since the crystal lattice filter response relative to the carrier frequency (X3) causes the unwanted sideband group of frequencies in each case to be rejected before reaching the product detector.

Normally, shifting the carrier oscillator frequency (X3) to obtain upper and lower sideband reception would also entail shifting the receiver dial setting to receive the opposite sideband of a signal frequency (f_1) at the antenna input.

The Model SR-400 system shifts the VFO frequency (X2) electrically with varicap CR13 when the 1652.800 KC carrier oscillator frequency

Figure 10. Block Diagram of Transceiver.



is switched on for upper sideband reception (or transmission). Shifting the VFO frequency by an amount equal to the difference between the two carrier oscillator frequencies (X3), or 3 KC, the received suppressed carrier frequency (f1) is received at the same dial setting for both upper and lower sidebands.

The 1650 KC IF signal (f3) fed to the AGC amplifier stage (V8A) is amplified and detected to supply the negative DC bias voltage (AGC) used to control the gain of the receiver RF amplifier stage (V1) and first 1650 KC IF amplifier and blanker stage (V6). The signal level at which gain control takes effect is controlled by the AGC THRESHOLD control (R46).

The detected audio frequency signal amplitude is controlled by the AF GAIN control (R4B) and amplified to speaker level by the first audio amplifier stage (V9B) and audio output stage (V15). Two audio output impedances are available for external use; 500 ohms at the phono jack at the rear chassis apron or 3.2 ohms at the PHONES jack on the front panel.

6-3. TRANSMITTER SECTION.

The audio frequency signal (f5) generated by the microphone is amplified with a three stage audio amplifier (V19A, V19B and V14B). The audio frequency signal (f5) then modulates the selected (USB/LSB) carrier oscillator signal (X3) in the balanced modulator stage (CR19 and CR20) to produce a double sideband suppressed carrier signal (f3) near 1650 KC. The double sideband signal (f3) is then amplified by the first 1650 KC IF amplifier and blanker stage (V6) with the blanker system disabled during the transmit function.

The unwanted sideband of the double sideband signal is attenuated by more than 50 DB as the signal passes through the crystal lattice filter (FL1) hence a single sideband suppressed carrier signal results. The signal is blocked, for the transmit function, at the second 1650 KC IF amplifier stage (V7A) with bias voltage switching and the signal proceeds on to the first transmitter mixer stage (V2B).

At the first transmitter mixer stage the signal (f3) is heterodyned with the VFO frequency (X2) to produce a signal frequency (f2) in the 6.0 to 6.5 MC frequency range. The signal frequency filters through the band pass circuits of the 6.0 - 6.5 MC IF amplifier (V3A) and on to the second transmitter mixer (V11A) because in the transmit mode it is blocked with switching bias at the second receiver mixer (V4A).

The intermediate frequency signal (f2) is now heterodyned with the heterodyne crystal oscillator frequency (X1) to produce the final transmitter output signal frequency (f1). The signal at output frequency (f1) is amplified by the transmitter driver stage (V18) and final amplifier stage (V16 and V17) to the desired power level.

The output signal is fed through the PI network in the final amplifier stage to transform its impedance to the antenna transmission line impedance (50 ohms nominal), and from the output of the PI network it is conducted through the antenna change-over relay (K1) to the common antenna connector.

6-4. RIT CONTROL.

Receiver Incremental Tuning is applied at the VFO stage since this stage is one of the three frequency determining elements in the system for both the transmit and receive function.

The varicap (CR13) in the VFO stage is a solid state device whose effective capacity varies with the DC bias potential applied across its terminals. By carefully regulating the bias supply potential with the zener diode (CR14) to obtain frequency stability, the VFO frequency may be varied a small amount with a potentiometer type control.

For normal operation as a transceiver system, the CAL ADJ, potentiometer (R90) is used to set the VFO frequency as a dial calibration control. When Receiver Incremental Tuning (RIT) is desired, the VFO frequency is controlled by setting the varicap bias with the RIT panel control (R91). The varicap bias voltage is switched by the VOX relay (K2) so that the CAL ADJ. potentiometer (dial calibration) sets the VFO frequency when transmitting, regardless of the RIT ON/OFF panel switch (S7) setting. This, of course, keeps the transmitter at the dial frequency but allows independent tuning of the receiver for a few kilocycles either side of the dial frequency when desired.

6-5. METERING.

The transceiver circuits are metered by one multipurpose meter in the Model SR-400 unit.

The multipurpose meter (M1) in the Model SR-400 Transceiver unit has a three position selector switch (S2) which provides for metering the system as follows:

In positions No. 1 and No. 2 the meter is connected into a bridge circuit with the meter amplifier tube (V8B) forming one arm of the bridge and the METER ZERO control (R120) providing the meter zero adjustment arm for bridge balance.

When the transceiver is in the receive mode, the AGC voltage developed on signal is fed to the meter amplifier tube grid to unbalance the bridge and provide a log scale deflection for metering antenna signal levels. The meter is calibrated in the customary "S" units up to S-9 and in DB over S-9 with S-9 representing approximately 50 microvolts at the antenna terminals.

When the transceiver is in the transmit mode, switch position No. 1 connects the meter amplifier tube grid to the diode detector (CR16) circuit in the output of the final amplifier stage which rectifies a portion of the RF voltage developed across the antenna transmission line. (Diode CR17 in this circuit is a directional gate to keep the resistor R103 from loading the AGC buss.) The meter scale is not calibrated in volts RMS for this application since the tune-up procedure requires only that the operator know when he has obtained maximum RF voltage across the antenna terminals.

When the transceiver is in the transmit mode, switch position No. 2 connects the meter amplifier tube grid to the AALC control grid voltage buss. The meter then measures the AALC grid voltage developed when the final amplifier stage is driven into the grid current levels during SSB operation.

In switch position No. 3 the meter circuit is active only in the transmit mode. The switch has now taken the meter out of the meter amplifier tube bridge circuit and connected it into a second metering bridge circuit consisting of the final amplifier tube cathode resistors (R106 and R109) and the reference voltage divider resistors (R121 and R118). When the correct idle plate current flows in the final amplifier tubes, the voltage across the cathode resistors R106 and R109 equals the voltage drop across R48 of the reference voltage divider and the meter then indicates zero current and pointer rests at the SET BIAS arrow reference mark. When the final amplifier tubes are driven, the increase in plate current flowing through the cathode resistors unbalances the bridge and the resulting meter current then indicates the plate current flowing through the final tubes. This technique eliminates some of the relatively large metering error incurred when measuring the idle plate current at 10% of full scale of the meter.

6-6. AALC SYSTEM.

The Amplified Automatic Level Control circuits are in effect only in the transmit mode. To properly employ the peak power capability of the linear power amplifier, the stage must be driven up to and slightly into the control grid current region and yet not overdriven into unwanted distortion known as "flat-topping" the envelope.

AALC action goes into effect when transmitting single sideband signals at peak levels where control grid current begins to flow in the final amplifier tubes (V16 and V17). The grid current pulses generate a small signal voltage across the resistance in the bias supply BIAS ADJ. control (R115). The signal voltage is amplified to useable levels by the AALC amplifier tube (V3B) and then rectified by diodes CR4 and CR5 to become a varying DC bias voltage. The bias voltage is then fed to the 6.0 - 6.5 MC IF amplifier stage (V3A) grid to reduce the stage gain as the AALC bias voltage increases. The control voltage is also fed to the meter amplifier tube (V8B) grid to actuate the meter as a warning device (METER switch set at AALC). The "AVC" action on the IF amplifier stage makes the transition from desired drive level to over-driven less critical and a smoother more powerful signal results.

6-7. VOX CONTROL.

The Model SR-400 Transceiver features automatic control of the receive-transmit change-over function for either SSB phone or CW code operation. For either mode of operation, automatic control is placed in operation when the OPERATION control is set at VOX. When operating SSB the change-over from receive to transmit starts with the first syllable spoken into the microphone. The audio signal (f5) is amplified by the first and second microphone amplifier stages (V19A and V19B) and the VOX amplifier stage (V20A). The amplified audio signal (f5), with its gain adjusted by the VOX control (R150), is then rectified with diodes CR21 and CR22. The positive DC control voltage developed is applied to the grid of the relay amplifier stage (V20B) to actuate the VOX control relay K2 placing the transmitter on the air.

The diode load resistors R154 and R155 (DELAY control) and the storage capacitor C210 determine the drop-out time or delay available to keep the transmitter active between the spoken words by sustaining the positive DC control voltage supplied to the relay tube grid.

The sound from the receiver's speaker that reaches the microphone would normally trigger the VOX relay when it wasn't wanted. To avoid this condition, a sample of the receiver audio (f4) is taken from the plate of the receiver audio output tube (V15) and rectified with diode CR15 to develop a negative DC anti-trip voltage.

This potential when adjusted for correct amplitude by the ANTI-TRIP control (R93) and fed to the grid of the relay tube (V20B) cancels the positive DC control voltage generated by the VOX diodes in the microphone amplifier stages. As a

result the relay does not close when the microphone picks up sound from the speaker. When the operator adds his voice to the system, however, the positive DC control voltage developed by the VOX amplifier diodes increases and exceeds the established anti-trip potential and the relay closes as desired.

When operating with keyed CW, the change-over from receive to transmit starts with the closing of the key. The keying system operates on the blocked-grid keying principle, therefore when the key is closed, several stages in the transmitter are keyed ON simultaneously; namely the transmitter driver stage (V18), the second transmitter mixer stage (V11A) and the side tone amplifier stage (V7B). The keyed side tone signal (X4) is fed into the second microphone amplifier stage

(V19B) as well as to the speaker, through the output transformer (T5), for sidetone monitoring purposes. The side tone signal fed to the second microphone amplifier stage (V19B) passes through the VOX amplifier and rectifier circuits to actuate the VOX control relay (K2) in the same manner as for SSB VOX control. The anti-trip circuit is disabled by the OPERATION switch (S4A) in the CW position since its function is not required for CW operation.

The VOX delay circuits, for CW operation, hold the transmitter in the active state between short breaks during CW keying but will release the control relay for receiver operation at the end of transmission. The delay period for CW control is adjusted, as for SSB, by the DELAY control (R155).

SECTION VII

SERVICE DATA

7-1. COVER AND CHASSIS REMOVAL.

A. Top Cover Removal.

Loosen the four top-cover screws 1/4 turn only and lift cover clear. To replace the cabinet cover, line up the plastic nuts with the cabinet slots, seat the cover and tighten the cover screws 1/4 turn only. The plastic nuts can be damaged by over tightening.

B. Bottom Cover Removal.

Remove the four bottom cover screws located near the cabinet feet and remove the cover. Should the mounting screws be misplaced - use 6-32 X 3/16 replacement screws. Screws longer than 3/16 will bottom against the chassis before securing the bottom cover.

C. Chassis Removal.

Disconnect all rear chassis cables. Remove both top and bottom cabinet covers. Remove the four cabinet screws at the bottom of the cabinet near the corners of the chassis and carefully slide the chassis and panel assembly out the front of the cabinet.

7-2. TUBE AND DIAL LAMP REPLACEMENT.

Access to all tubes except the two final amplifier tubes may be had by removing the top cabinet cover. See paragraph 7-1A.

To service the dial lamps, the panel and chassis assembly must also be released from the cabinet and shifted forward far enough to expose the dial lamp assemblies. Remove the four cabinet screws at the bottom of the cabinet in the corners of the chassis to release the chassis assembly.

7-3. FINAL AMPLIFIER TUBE REPLACEMENT.

Access to the final amplifier tubes may be had by removing the top cabinet cover (paragraph 7-1A) and removing the final amplifier compartment cover, held in place by three screws. Note that the rear edge of the cover is clipped to the rear lip of the compartment structure. When replacing the cover, be sure to engage the clip properly before replacing the mounting screws.

The power tubes may be lifted straight up out of their sockets after disengaging the plate clips and moving the parasitic suppressors to one side.

7-4. FINAL (6HF5) TUBE MATCHING.

If either or both 6HF5 tubes are replaced, tube matching will be required. This may require access to a number of tubes in order to select those with the desired characteristics. Matched pairs of tubes are available through Hallicrafters Service Department for customer convenience.

The procedure for tube matching is as follows:

CAUTION

It will be necessary to come into contact with circuits which normally have high voltage applied to them. Use extreme care while performing the following operations. Use a well insulated screw driver or other suitable tool to short circuit the 6HF5 plate caps to the chassis before handling the tubes.

1. Set the OPERATION switch at OFF.
2. Turn the four top cabinet cover retaining screws one-quarter turn counterclockwise and lift off the top cover.
3. Remove the top cover from the final amplifier cage (three screws).
4. Remove the bottom cover of the cabinet (four screws).
5. At the socket of tube V16, (socket nearest center of the chassis) unsolder the orange lead and resistor R104 from pin 11 (screen). Reconnect the orange wire to resistor R104 and dress the wire and resistor so that they do not short to chassis during the matching operation to follow.

The disconnecting operation can be avoided if a discarded 6HF5 tube with a working heater is available. Simply clip off pin 11 close to the tube base and substitute it temporarily for tube V16 during the matching operation.

6. Disconnect the plate cap from tube V16. Tube V16 now only serves as a heater circuit for the matching operation.

7. Install one of the tubes to be matched in the socket for tube V17 (socket nearest outside edge of chassis) and connect plate cap. The unused plate cap for tube V16 must not touch nearby components.

8. Connect a voltmeter (1.0 to 3.0 VDC range) to the tip jacks at the top, rear of the power supply chassis (TP201, TP202), (Model PS-500A-AC). (Connect the positive lead from the meter to the red jack.) Caution — The voltmeter must be well insulated since it will be at plate potential when the equipment is turned on.

9. Set the FUNCTION control at TUNE and RF LEVEL control at zero (full CCW).

10. Set OPERATION control at REC. and allow at least two minutes for warm-up.

11. Set OPERATION control at MOX and adjust BIAS ADJ. control on the transceiver panel for 0.5 volt (50 MA) reading on the voltmeter.

12. Set OPERATION control at OFF.

13. Short circuit the 6HF5 plate cap to the chassis and remove the tube from its socket.

14. Insert a second 6HF5 into the same socket and connect the plate cap.

15. Set the OPERATION control at REC and again allow at least two minutes for warm-up.

16. Set the OPERATION control at MOX and observe the voltmeter reading. (Do not change the bias setting.) If this tube causes the voltmeter to read between 0.4 volt (40 MA) and 0.6 volt (60 MA), it can be considered as being matched to the original tube. If the difference in the readings exceeds 0.1 volt (10 MA), other tubes must be checked until the difference in readings of the pair to be matched is less than 0.1 volt (10 MA).

17. Install the matched pair of tubes, reconnect resistor R104 and the orange lead if they were disconnected for the matching operation, and reset the BIAS ADJ. control on the transceiver panel as described in BIAS ADJUSTMENT, paragraph 8-3.

18. The final amplifier will require a neutralization check and possible adjustment after the new tubes are installed. Refer to paragraph 8-7 for the neutralization check and adjustment procedure.

7-5. LOAD CONTROL RESTRINGING PROCEDURE.

Remove the cabinet top cover (paragraph 7-1A) and final amplifier compartment cover (three screws) to gain access to the control drive mechanism. Note that the rear edge of the cover is clipped to the rear lip of the compartment structure. The restringing operation may be more readily carried out if the final amplifier cage is lifted from the chassis. It is secured to the chassis with three spade bolts and to the right side plate with four sheet metal screws.

Restring the loading capacitor drive system with 50 lb, test dacron cord or equal, following the arrow and letter sequence in figure 11. Maintain a spring expansion of approximately 1/2-inch on the dial cord spring. Pay particular attention to the pulling orientation shown.

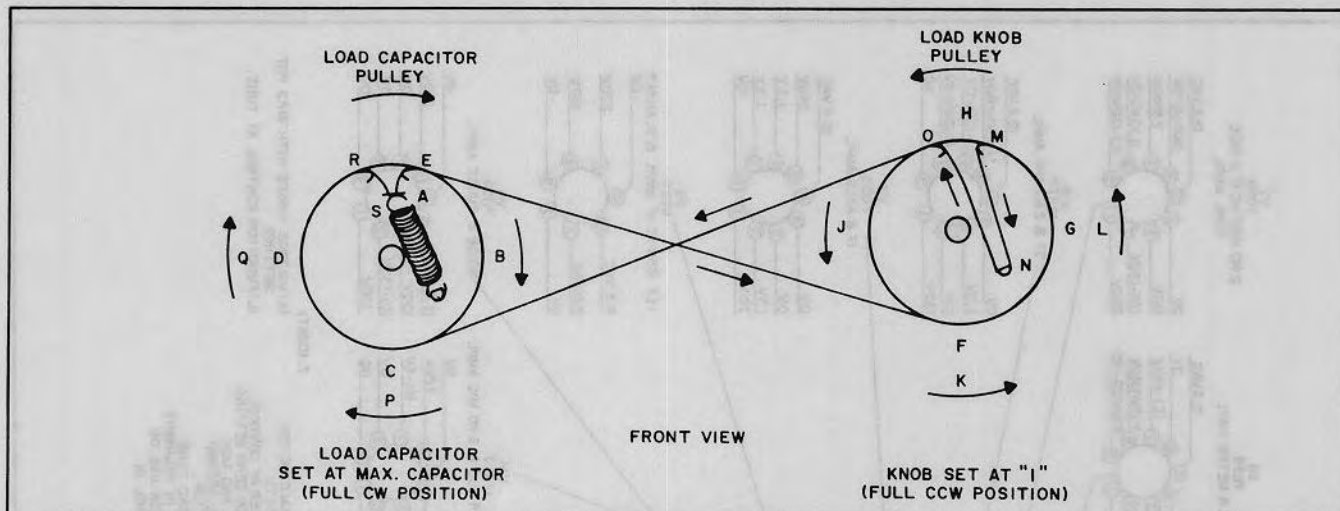


Figure 11. Load Control Restraining Diagram.

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After completing the stringing operation, rotate the LOAD control lever counterclockwise to 1 and check to see that the loading capacitor is completely meshed (maximum capacity).

7-6. TROUBLE SHOOTING.

In the design of this transceiver, full consideration was given to keep maintenance problems at an absolute minimum. As in all well designed electronic equipment, maintenance and repair problems are generally confined to the checking and replacement of tubes and semi-conductor devices which may become defective. Malfunctions of this nature are usually easily isolated and corrected. However, it is entirely possible that a more obscure malfunction may arise. In this event, only thoroughly trained technical personnel should attempt to service equipment of this complexity.

A recommended aid to troubleshooting the Model SR-400 Transceiver is a general-coverage receiver which can be used to provide a quick check on the various oscillator circuits within the transceiver. A lead connected to the antenna of this receiver, when placed in the proximity of the oscillator tube in the circuit to be checked, can determine the presence or absence of signal from the stage in question.

If a malfunction occurs when operating on one particular band and/or mode of operation, the unit should be checked on all other bands and in all other modes of operation to isolate the difficulty. A careful study of the block diagram (figure 10) will give a quick clue as to which tubes should be checked. The voltage and resistance charts (figures 12 and 13) and schematic diagram (figure 31) will also aid in isolating and correcting a malfunction.

7-7. SERVICE AND OPERATING QUESTIONS.

For further information regarding operation or servicing of the Model SR-400 Transceiver,

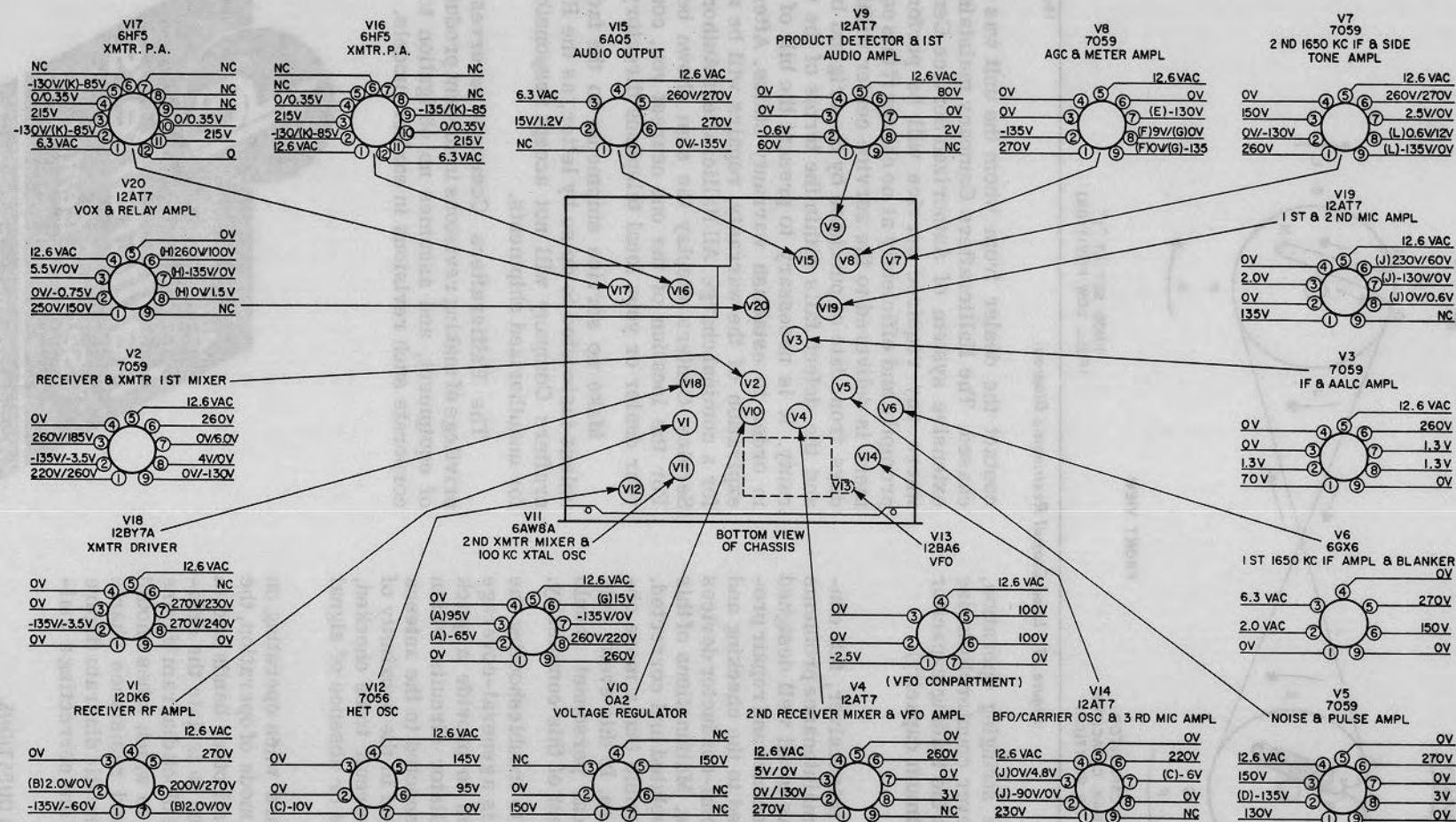
contact the dealer from whom the unit was purchased. The Hallicrafters Company maintains an extensive system of Authorized Service Centers where any required service will be performed promptly and efficiently at no charge if this equipment is delivered to the service center within 90 days from date of purchase by the original buyer and the defect falls within the terms of the warranty. It is necessary to present the bill of sale in order to establish warranty status. After the expiration of the warranty, repairs will be made for a nominal charge. All Hallicrafters Authorized Service Centers display the sign shown below. For the location of the one nearest you, consult your dealer or your local telephone directory.

Make no service shipments to the factory unless instructed to do so by letter, as the Hallicrafters Company will not accept responsibility for unauthorized shipments.

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



Figure 12. Model SR-400 Voltage Chart.



NOTES:

1. POWER SOURCE - MODEL PS-500A-AC LINE VOLTAGE = 117 VAC OR 234 VAC
2. MEASUREMENTS TAKEN FROM TUBE SOCKET PIN TO CHASSIS.
3. VOLTAGES SHOWN ARE POSITIVE DC UNLESS OTHERWISE SPECIFIED.
4. VOLTAGES TAKEN WITH ELECTRONIC TYPE VOLTMETER. AL READINGS EXCEPT GRID VOLTAGES MAY BE OBTAINED WITH A 20,000 OHM/VOLT METER.
5. NC - NO CONNECTION (CAUTION - CIRCUIT VOLTAGES APPEAR ON SOME UNUSED PINS).

6. UNLESS OTHERWISE SPECIFIED, THE FIRST VOLTAGE LISTED IS FOR RECEIVE CONDITION AND THE SECOND VOLTAGE IS FOR TRANSMIT CONDITION (ZERO SIGNAL). ALL TRANSMIT VOLTAGES EXCEPT FOR FINAL AMPLIFIER TUBES MAY BE CHECKED WITH H.V. TURNED OFF.
7. DATA SHOWN FOR SPECIFIED CONTROL SETTINGS.
 - (A) PULL/CAL. SET AT CAL.
 - (B) VOLTAGE VARIES WITH RF CONTROL (R4A) SETTING. VOLTAGE SHOWN FOR MAX. RF GAIN.
 - (C) VOLTAGE VARIES WITH CRYSTAL ACTIVITY.
 - (D) VOLTAGE VARIES WITH NOISE BLANKER CONTROL SETTING. VOLTAGE SHOWN FOR OFF POSITION.
 - (E) VOLTAGE VARIES WITH AGC THRESHOLD CONTROL SETTING.

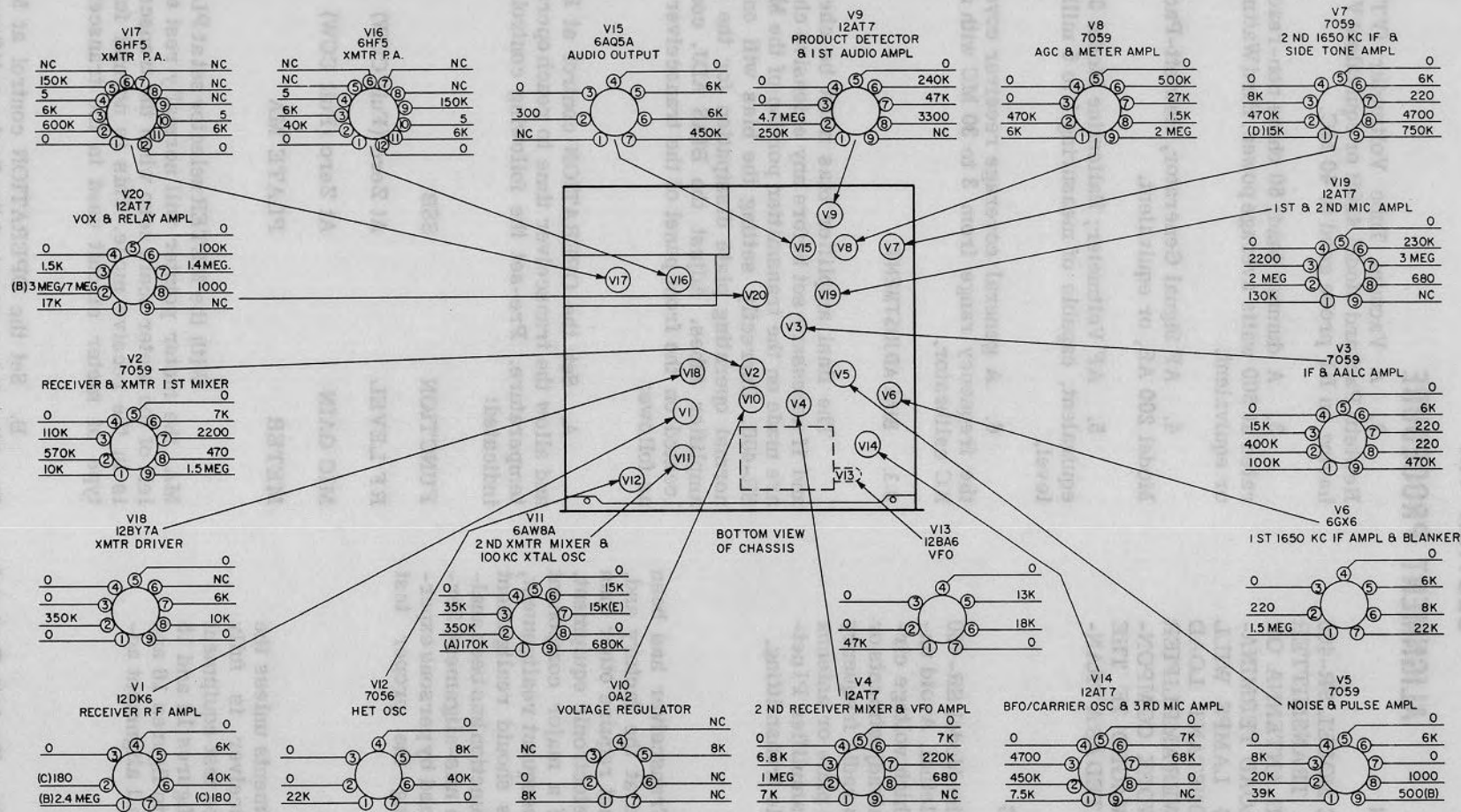
7. (CONT.)

- (F) VOLTAGE SHOWN FOR RFVOS AND AALC METER SWITCH POSITIONS (METER ZERO SET)
- (G) VOLTAGE VARIES WITH TRANSMITTER RF CONTROL SETTING (R64A). VOLTAGE SHOWN FOR ZERO SETTING.
- (H) FIRST VOLTAGE SHOWN IS FOR REC AND MOX POSITIONS. SECOND VOLTAGE SHOWN IS FOR SECOND VOLTAGE SHOWN IS FOR VOX POSITION.
- (J) FIRST VOLTAGE SHOWN IS FOR CW AND TUNE POSITIONS OF FUNCTION CONTROL IN TRANSMIT MODE. SECOND VOLTAGE SHOWN IS FOR USB OR LSB POSITION OF FUNCTION CONTROL IN TRANSMIT MODE.

7. (CONT.)

- (K) VOLTAGE VARIES WITH BIAS POT SETTING.
(L) FUNCTION CONTROL AT TUNE.

Figure 13. Model SR-400 Resistance Chart.



NOTES:

1. RESISTANCE MEASUREMENTS MADE WITH LINE CORD AND POWER SUPPLY DISCONNECTED.
2. ALL MEASUREMENTS ARE MADE FROM TUBE SOCKET PIN TO CHASSIS. READINGS LESS THAN ONE OHM ARE SHOWN AS ZERO.

3. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE SHOWN FOR THE FOLLOWING CONTROL SETTINGS.

RIT CONTROL	OFF
RF GAIN/AF GAIN	10
OPERATION	REC
FUNCTION	LSB
NOISE BLANKER	OFF
CAL ADJ	CENTERED
PULL/CAL	OFF
BAND SELECTOR	3.5
METER	RFO/S
RF/AF (TRANS GROUP)	0
PRESELECTOR	OPTIONAL
PLATE LOAD	OPTIONAL
BIAS ADJ	SET

4. NC = NO CONNECTION
OC = OPEN CIRCUIT

5. SPECIAL CONDITIONS

- (A) - OFF/CAL SET AT CAL
- (B) - RESISTANCE DEPENDS ON POLARITY OF VOM.
- (C) - VARIES WITH RECEIVER RF GAIN CONTROL SETTING.
- (D) - VARIES WITH SIDETONE CONTROL SETTING.
- (E) - VARIES WITH TRANSMITTER RF CONTROL SETTING AND BAND SELECTOR CONTROL SETTING.

SECTION VIII

ALIGNMENT PROCEDURE

CAUTION

NEVER OPERATE THE MODEL SR-400 TRANSCEIVER AS A TRANSMITTER WITHOUT A MATCHED ANTENNA OR ADEQUATE DUMMY LOAD TERMINATION. ILLUMINATING LAMPS WILL NOT PRESENT A CONSTANT LOAD IMPEDANCE. THE POWER AMPLIFIER TUBES AND PI NETWORK COMPONENTS CAN BE DAMAGED IF THE EQUIPMENT IS OPERATED AS A TRANSMITTER UNLOADED.

WARNING

The voltages used in the Model SR-400 and Power Supply are lethal. Avoid unnecessary exposure to high voltage circuits when making circuit adjustments or voltage checks. Serious radio frequency burns will result if the plate or antenna output ends of the final amplifier PINetwork are contacted while transmitting.

8-1. GENERAL.

The Model SR-400 Transceiver has been carefully aligned and tested at the factory and, with normal usage, should not require other than the usual attention given to electronic equipment. Service or replacement of a major component or circuit may require subsequent realignment, but under no circumstances should realignment be attempted unless the malfunction has been analyzed and definitely traced to mis-alignment. Service work should be performed by persons experienced in this work, using the proper test equipment.

NOTE

Do not make any adjustments unless the operation of the transceiver is fully understood and adequate test equipment is available. Refer to figures 14 and 15 for parts locations and to figures 16 and 17 for the location of all alignment adjustments.

8-2. EQUIPMENT REQUIRED.

1. RF Signal Generator; Hewlett-Packard Model 606A or an equivalent signal generator having up to one volt output at an impedance of 50 to 70 ohms and a frequency coverage to 30 MC.

2. A Vacuum Tube Voltmeter (VTVM); Hewlett-Packard Model 410B or equivalent VTVM having an RF probe good to 40 MC.

3. A dummy load; 50 ohms non-reactive; rated at 500 watts average power. Bird Wattmeter or equivalent.

4. AF Signal Generator, Hewlett-Packard Model 200 AB, or equivalent.

5. AF Voltmeter; Ballentine Model 300 or equivalent, capable of measuring 1 to 5 millivolt level.

6. A general coverage receiver covering the frequency range from 3 to 30 MC with a 100 KC calibrator.

8-3. BIAS ADJUSTMENT.

The final amplifier bias must be checked and if necessary set before any extensive checks are made on the transmitter portion of the Model SR-400. Correctly setting the bias will ensure normal operating plate dissipation for the final amplifier tubes. Adjust the BIAS ADJ. control located on the front panel of the transceiver unit as follows:

A. Set the OPERATION control at REC. and allow the transceiver time to reach operating temperature. Pre-set the following controls as indicated:

FUNCTION	SSB
RF LEVEL	At Zero (Full CCW)
MIC GAIN	At Zero (Full CCW)
METER	PLATE MA

With the METER selector set at PLATE MA, the meter pointer will normally rest to the left of the meter scale zero when the transceiver is in the receive mode. This is normal for the type of meter circuit used in the transceiver.

B. Set the OPERATION control at MOX. The idle plate current of the final amplifier stage should cause the meter pointer to index with the SET BIAS arrow of the meter if the bias voltage is correct.

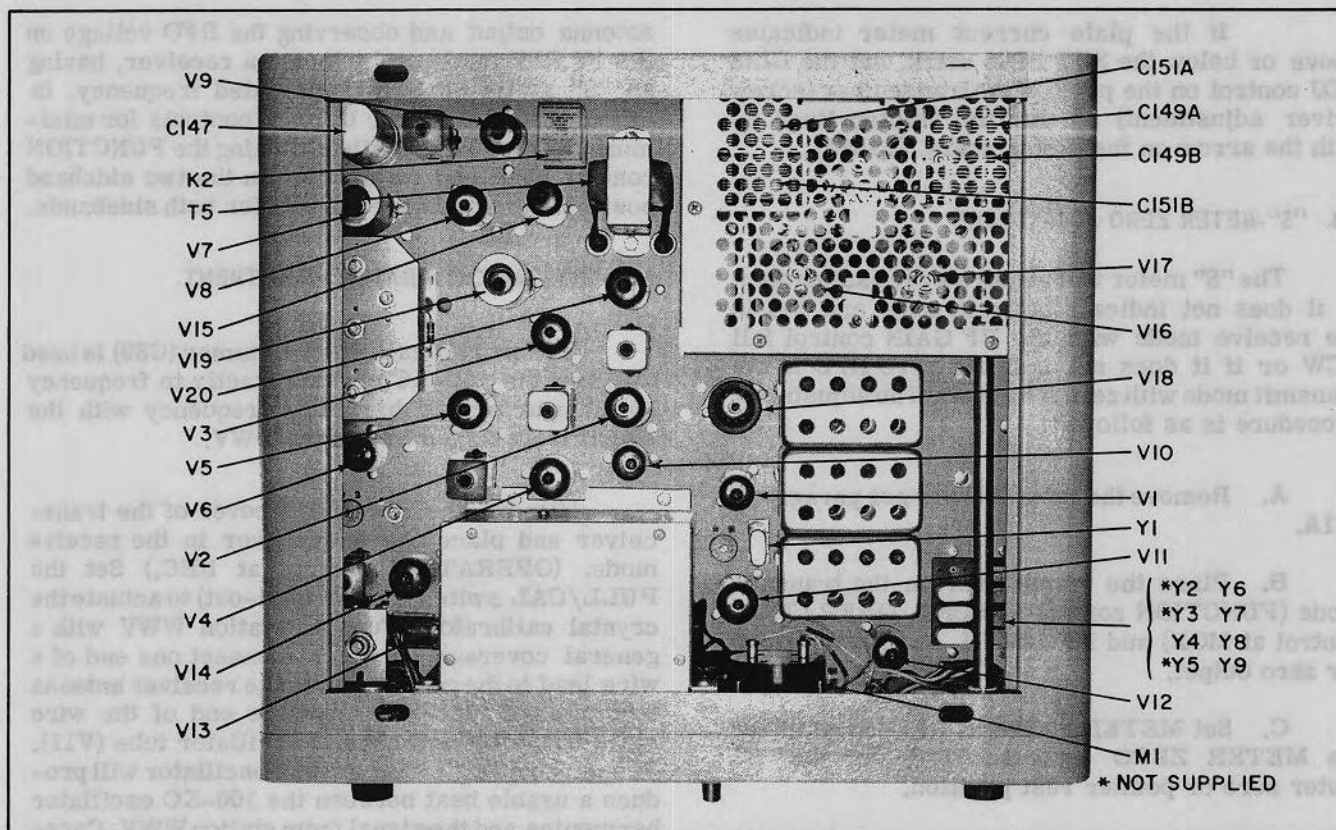


Figure 14. Model SR-400 Top View, Component Location.

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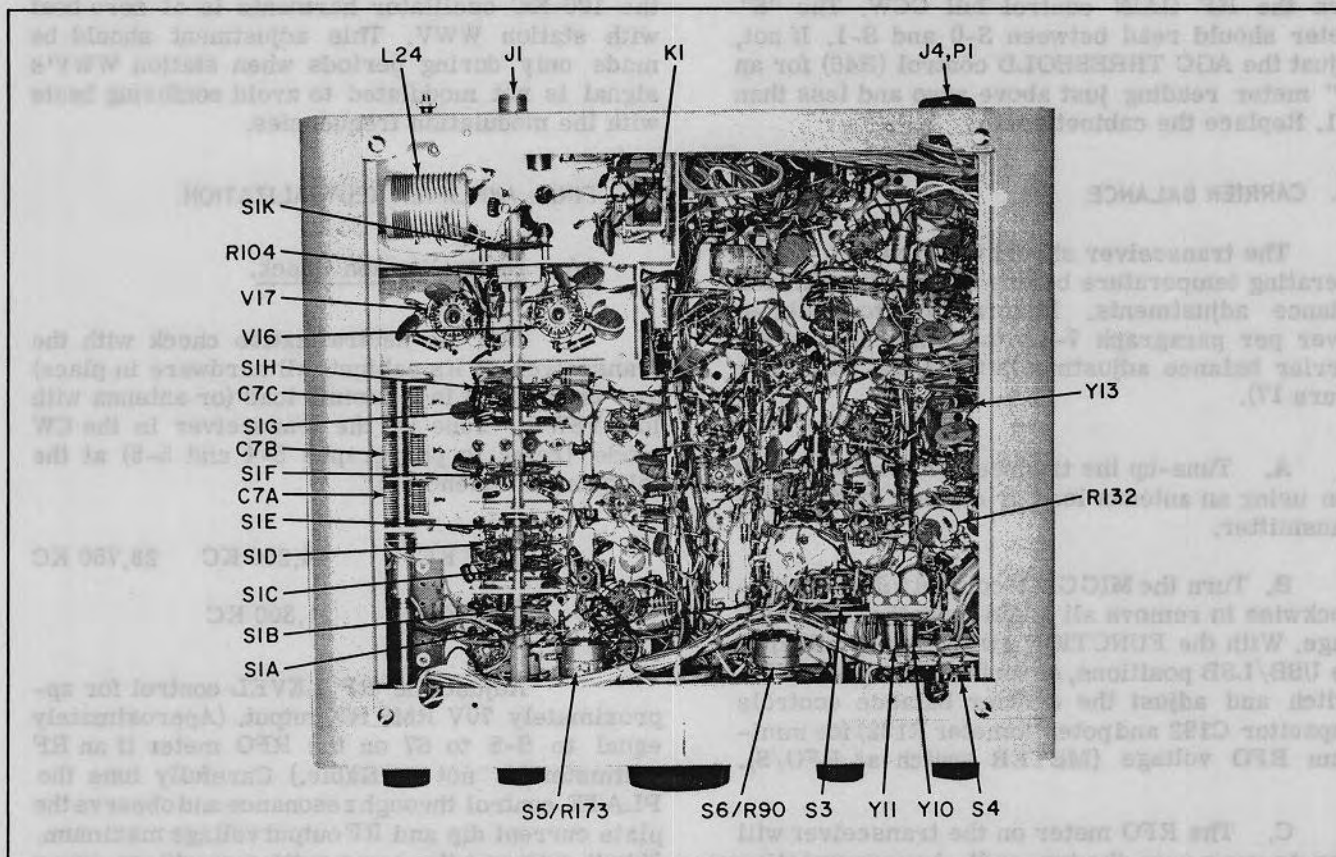


Figure 15. Model SR-400 Bottom View, Component Location.

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If the plate current meter indicates above or below the SET BIAS mark, set the BIAS ADJ control on the panel of the transceiver (screw driver adjustment) so that the pointer lines up with the arrow on the meter scale, (70 MA).

8-4. "S"-METER ZERO ADJUSTMENT.

The "S" meter will require a zero adjustment if it does not indicate between zero and S-1 in the receive mode with the RF GAIN control full CCW or if it does not indicate zero RFO in the transmit mode with zero RF output. The adjustment procedure is as follows:

A. Remove the cabinet cover per paragraph 7-1A.

B. Place the transceiver in the transmit mode (FUNCTION control at TUNE, OPERATION control at MOX) and RF LEVEL control full CCW for zero output.

C. Set METER switch at RFO/S and adjust the METER ZERO control (R120) for the "S" meter zero or pointer rest position.

D. Set OPERATION control at REC and turn the RF GAIN control full CCW. The "S" meter should read between S-0 and S-1. If not, adjust the AGC THRESHOLD control (R46) for an "S" meter reading just above zero and less than S-1. Replace the cabinet cover.

8-5. CARRIER BALANCE.

The transceiver should be allowed to reach operating temperature before making the carrier balance adjustments. Remove the top cabinet cover per paragraph 7-1A to gain access to the carrier balance adjustments C192 and R132 (see figure 17).

A. Tune-up the transceiver for SSB operation using an antenna load or dummy load for the transmitter.

B. Turn the MIC GAIN control fully counter-clockwise to remove all audio from the modulator stage. With the FUNCTION switch set at either of the USB/LSB positions, close the microphone PTT switch and adjust the carrier balance controls (capacitor C192 and potentiometer R132) for minimum RFO voltage (METER switch at RFO/S).

C. The RFO meter on the transceiver will drop to zero near the true null. A more exacting balance may be obtained by connecting the Model HP-410B VTVM RF probe across the transceiver

antenna output and observing the RFO voltage on the 1V RMS scale or by tuning a receiver, having an "S" meter, to the transmitted frequency. In either case, adjust the balance controls for minimum carrier level while switching the FUNCTION control back and forth between the two sideband positions to obtain a good null for both sidebands.

8-6 CRYSTAL CALIBRATOR ADJUSTMENT.

The crystal calibrator trimmer (C89) is used to warp the 100-KC crystal exactly to frequency by comparing its harmonic frequency with the signal transmitted by station WWV.

Remove the top cabinet cover of the transceiver and place the transceiver in the receive mode. (OPERATION control at REC.) Set the PULL/CAL switch at CAL (pull-out) to actuate the crystal calibrator. Tune in station WWV with a general coverage receiver. Connect one end of a wire lead to the general coverage receiver antenna terminal and place the opposite end of the wire close to the 100 KC crystal oscillator tube (V11). Proper coupling to the crystal oscillator will produce a usable beat between the 100-KC oscillator harmonics and the signal from station WWV. Carefully adjust the calibrator trimmer (C89) until the 100-KC oscillator harmonic is at zero beat with station WWV. This adjustment should be made only during periods when station WWV's signal is not modulated to avoid confusing beats with the modulation frequencies.

8-7. FINAL AMPLIFIER NEUTRALIZATION.

A. Neutralization Check.

Run the neutralization check with the transceiver in its cabinet (all hardware in place) and terminated in a dummy load (or antenna with low VSWR). Tune up the transceiver in the CW mode (refer to paragraphs 5-4 and 5-5) at the following frequencies:

3900 KC	14,250 KC	28,750 KC
7250 KC	21,300 KC	

Adjust the RF LEVEL control for approximately 70V RMS RF output. (Approximately equal to S-5 to S7 on the RFO meter if an RF voltmeter is not available.) Carefully tune the PLATE control through resonance and observe the plate current dip and RF output voltage maximum. If both occur at the same setting or with an error of less than 5V RMS out of the 70V RMS reference level, the amplifier stage is neutralized.

NOTE

If a VTVM is not available, set the meter selector at RFO/S to observe RFO voltage and connect a 0-500 milliamper meter to test point terminal TP201 and TP202 (Red terminal to meter +) on the Model PS-500A-AC power supply or connect the meter in series with the HV lead (Terminal No. 1) on the Model PS-500-DC power supply. For either power supply, the milliammeter must be well insulated from ground.

B. Neutralizing the Model SR-400

If the neutralization check outlined above indicates a need for adjustment, remove the top cabinet cover and the cover over the final amplifier compartment to gain access to the neutralizing capacitor (C171) located between the final amplifier stage tubes. Refer to paragraph 7-3 for cover removal details.

Proceed as outlined for the neutralization check and adjust the neutralizing capacitor until the plate current dip and the RF output voltage maximum coincide at each of the frequencies shown in step A.

The top cabinet cover does not have to be in place for the neutralization check, however the final compartment cover must be in place to provide the RF shielding required.

CAUTION

DO NOT OPEN THE FINAL AMPLIFIER COMPARTMENT WITH THE HIGH VOLTAGE CIRCUITS ENERGIZED. HIGH VOLTAGE IS PRESENT AT ALL SETTINGS OF THE OPERATION CONTROL EXCEPT OFF.

The PRESELECTOR control calibration has an effect on the neutralization pattern. If only one or two check frequencies indicate a neutralization problem, a PRESELECTOR calibration correction may be indicated rather than a neutralizing capacitor adjustment. Refer to paragraph 8-12 for the mixer and driver stage alignment details.

8-8. VFO CALIBRATION ALIGNMENT.

A. Mechanical Index.

As each 100-KC mark on the main dial indexes with its fiducial, the zero mark on the knob

dial should also index with its fiducial. If there is a fixed error between these dials, remove the tuning knob with a No. 8 Bristol set screw wrench to expose the knob dial bushing. Set the main dial to any 100-KC mark. Loosen the knob dial set screw with a No. 6 Bristol set screw wrench and rotate the knob dial with respect to the knob shaft until the zero mark lines up with its fiducial. Tighten the set screw. Replace the knob with clearance between the felt brake pad and the panel for minimum tuning torque (base station operation) or position the knob on the shaft so that the felt brake pad engages the panel and increases the turning torque as desired for mobile operation.

If a service operation involved disconnecting the VFO gang from the gear drive, re-index the gang as follows:

1. Rotate the tuning knob clockwise to the mechanical stop.

2. Loosen the two No. 6 Bristol set screws holding the drive gear to the VFO gang shaft.

3. Rotate the gang capacitor to fully mesh the capacitor and tighten one of the set screws.

4. Rotate the knob exactly 30 KC in the counterclockwise direction.

5. Loosen the set screw again and without disturbing the VFO gang setting, turn the tuning knob clockwise to the knob dial zero. (The main dial will now also be indexed at the high frequency end of the dial.)

6. Tighten both set screws securely and replace the VFO compartment cover before recalibrating the VFO electrically.

B. VFO Calibration (Trimmer Adjustment Only).

A trimmer capacity correction is indicated if the dial calibration check across the dial, at the 100-KC check points, consistently falls to one side of the fiducial and cannot be corrected by the CAL ADJ. control. The main dial and knob dial must be correctly indexed as outlined in paragraph 8-8A and the calibration check should be run with the FUNCTION control set at LSB. Recalibrate the VFO as follows:

1. Remove the bottom cabinet cover per paragraph 7-1B to gain access to the adjustment screw of trimmer C122. See figure 17 for location of the trimmer.

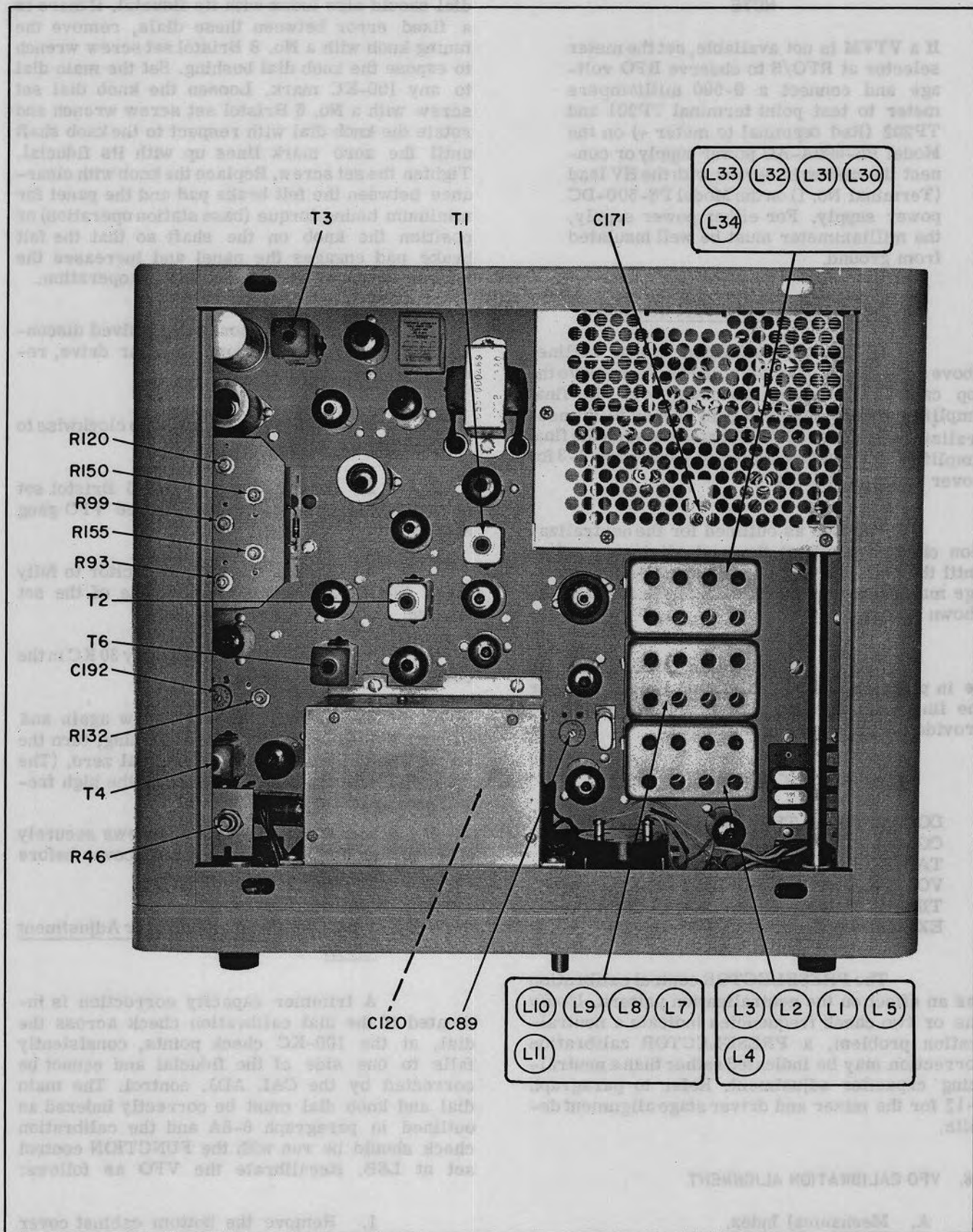


Figure 16. Model SR-400 Top View, Alignment Adjustment.

156-011247-2

2. Set the BAND SELECTOR at 3.5, OPERATION at REC., FUNCTION at LSB, PRE-SELECTOR at 80M, segment, PULL/CAL. at CAL, NOISE BLANKER at OFF, and RIT CONTROL at OFF.

3. Center the CAL ADJ control. The dot on the knob should fall at top dead center.

4. Set the dial for exactly 3500 KC. (Red 500 on main dial and black zero on knob dial.) Carefully adjust trimmer C122 for zero beat.

5. Check calibration across the dial at the 100-KC check points. If the frequency error is less than approximately 2000 CPS, the calibration is within acceptable limits. If the error increases and exceeds 2000 CPS at the high frequency end of the dial, the VFO will require a coil adjustment in addition to the trimmer adjustment.

C. VFO Calibration (Trimmer and Coil Adjustment).

If the dial error progressively increased in the same direction with the high frequency end of the dial running out more than 2000 CPS, both coil L21 and trimmer C122 will require adjustment. Recalibrate the VFO as follows:

1. Set the transceiver controls per steps 2 and 3 in paragraph 8-8B.

2. Set tuning dial for exactly 4000 KC (VFO = 4350,000 KC) and adjust coil L21 for zero beat.

3. Set tuning dial for exactly 3500 KC (VFO = 4850,000 KC) and adjust trimmer C122 for zero beat.

4. Repeat steps 2 and 3 until both the 3500 KC and 4000 KC settings are exactly on frequency.

5. Check the calibration across the dial at the 100-KC points. If the frequency error is less than 2000 CPS, the calibration is within acceptable limits. If the error is in excess of 2000 CPS at any of the mid-points, with the end limits at zero error, the VFO capacitor C120 should be "knifed". This operation should not be attempted by other than qualified personnel thoroughly familiar with the technique.

6. Set the dial at 3800 KC and tune to exact zero beat with the marker crystal. Switch the FUNCTION control from LSB to USB. If the frequency shifts more than 15 CPS, the VFO corrector trimmer C127 must be adjusted per paragraph 8-8D.

D. VFO Corrector Adjustment.

The VFO corrector trimmer, C127, shifts the VFO frequency approximately 3000 CPS to correct for the difference in frequency between the upper and lower sideband BFO/carrier crystal frequencies. The trimmer is switched into the VFO circuit in the upper sideband mode. To check the corrector trimmer setting, tune the transceiver, in the LSB mode, to zero beat with the 3800 KC marker frequency. Switch to USB mode. There should be less than a 15 CPS change in frequency. If the change is more than 15 CPS, carefully adjust trimmer C127 until the difference between USB and LSB is less than 15 CPS.

8-9. IF ALIGNMENT (1650 KC).

This operation consists of adjusting transformers T3 and T6 only. Do not adjust the filter terminations (L15 and L16) at this time. See paragraph 8-10 for the crystal filter alignment.

The signal source for alignment may be obtained from an RF signal generator (at 1650 KC) or the transceiver can be tuned to the 100-KC crystal calibrator signal in the 20M band. (Any 100-KC marker.) If an RF signal generator is used, connect its output to pin 2 of the second receiver mixer tube (V4A). (Test point C see figures 17 and 31.)

Set the OPERATION control at REC., FUNCTION control at either USB or LSB, NOISE BLANKER at OFF and METER switch at RFO/S. Adjust the RF GAIN control or signal generator output (No modulation) for about S-7 on the "S" meter and tune either the transceiver or signal generator (which ever method is used) for maximum "S" meter deflection.

With the signal now centered in the crystal filter pass band, adjust transformer T3 (top and bottom cores) and transformer T6 (single core) for maximum "S" meter deflection. Maintain the S-7 level to avoid overloading effects. Do not run the cores through the individual transformer windings (T3) so that either core rests between the windings and upsets the design coupling.

8-10. CRYSTAL FILTER ALIGNMENT.

A. The filter response should be checked as follows to determine whether or not the filter termination coils L15 and L16 need adjustment.

1. Tune up the transceiver, in the transmit mode, into a 50-ohm dummy load (3800 KC is recommended).

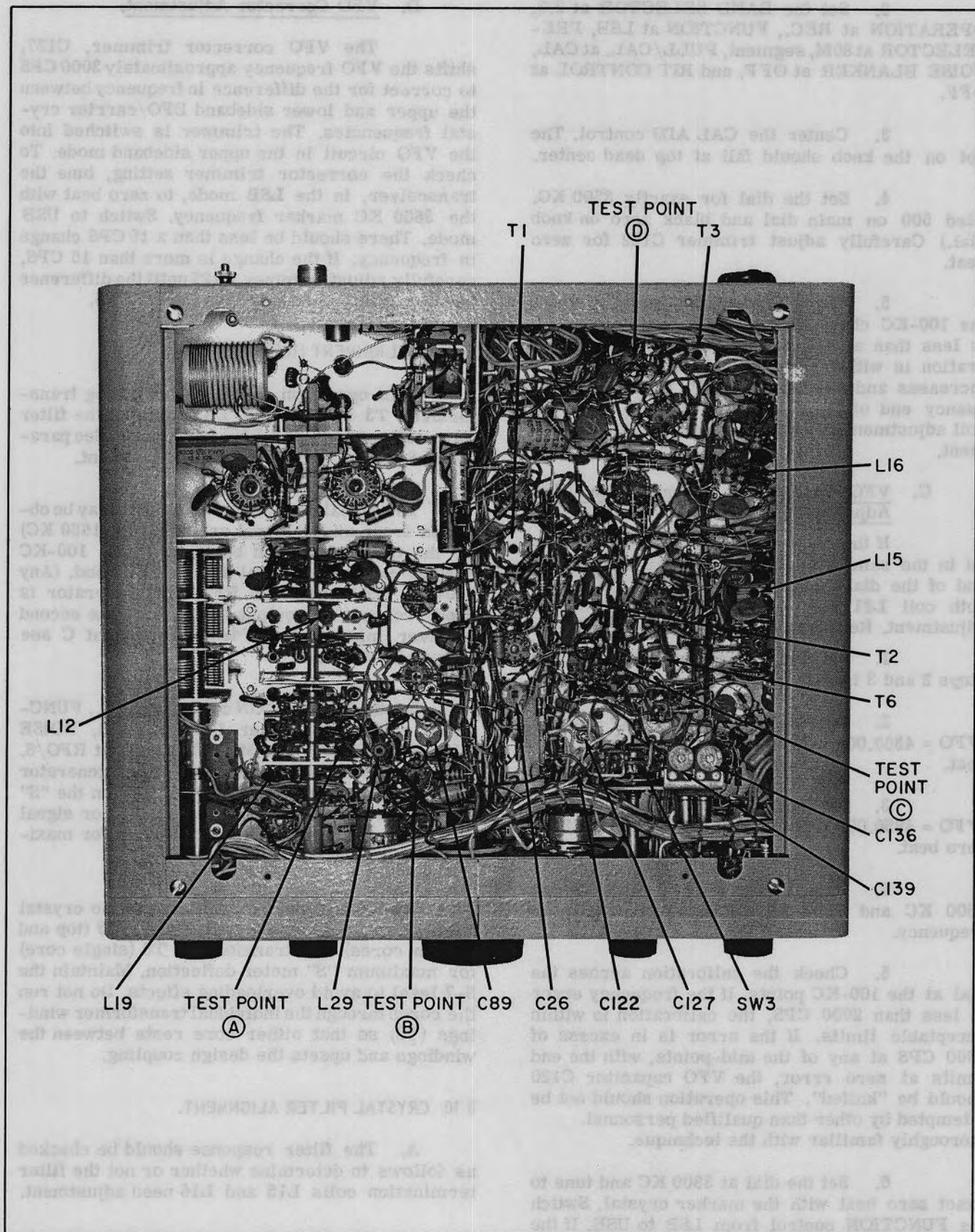


Figure 17. Model SR-400 Bottom View, Alignment Adjustment.

2. Connect the AF signal generator to the microphone input and monitor the input voltage with the Ballantine voltmeter. Set the AF signal generator at 1000 CPS and adjust the generator level for 50 volts RMS RF output with the MIC GAIN control set near maximum (approximately 9).

3. Set the FUNCTION control at LSB.

4. Maintain constant AF signal generator input voltage and change the frequency of the generator above and below 1000 CPS, recording the two frequencies at which the transmitter RF output voltage drops to 25 volts RMS (-6 DB). Also note the maximum and minimum RF voltage excursions between these two frequencies. A normal 6 DB frequency response will run 500 CPS or less at the low end, 2400 CPS or more at the high end, and less than 2 DB variation (10 volts RMS change) in the pass band.

5. Repeat the check made in step 4 with the FUNCTION control set at USB.

B. If the check in paragraph 8-10, A above indicates a need for filter termination adjustment, use the following procedure.

1. With the test arrangement used for the evaluation, set the audio frequency to 1000 CPS and adjust for 50 volts RMS RF output. Adjust terminating coils L15 and L16 for maximum output.

2. The response may then be checked again by changing the audio frequency from 500 to 2400 CPS and observing the output variation. The best response should coincide with the peaking of L15 and L16 at 1000 CPS.

8-11. IF ALIGNMENT (6.0 - 6.5 MC).

This operation consists of adjusting transformers T1 and T2 as follows:

A. Remove the heterodyne oscillator tube (V12) and connect the HP410B VTVM RF probe to test point B. (Pin 7 of the second transmitter mixer tube V11A.) See figures 17 and 31.

B. Place transceiver in transmit mode. Set OPERATION control at MOX, FUNCTION control at TUNE, BAND SELECTOR at 3.5 and adjust RF LEVEL control for 1V RMS at VTVM at the peak of the response.

C. Tune the VFO across the band and note the VTVM readings. If the response is essentially flat, with no more than 2 DB to 3 DB roll off at each end of the band, the alignment is OK.

D. If adjustment is required, adjust transformers T1 and T2 (top and bottom cores) for maximum grid voltage as well as a flat response across the band. Avoid a tilted response or a response that rolls off beyond the 2 DB to 3 DB limit at the edges of the VFO dial settings. Do not sacrifice gain by stagger tuning the transformers to obtain a constant grid voltage across the band or run a core through the winding which would upset the design coupling. A properly aligned amplifier will have equal drop in the response at each end of the band but will not exceed 3 DB (0.7 V RMS.).

E. Replace the heterodyne oscillator tube V12 and disconnect the VTVM.

8-12. ALIGNMENT OF TRANSMITTER MIXER/DRIVER AND RECEIVER ANTENNA STAGES.

The final amplifier bias adjustment must be properly set per paragraph 8-3 before extensive operation of the transmitter is attempted. It is assumed that the signal generating stages of the Model SR-400 are functioning properly. Use the internally generated signal of the transceiver to align the transmitter mixer and driver stages and the RF signal generator (no modulation) to align the receiver antenna stage as follows:

A. Connect the 50-ohm dummy load and VTVM RF probe to the ANTENNA jack (J1 or J2). Connect the RF signal generator termination to test point A (see figures 17 and 31). Connect the signal lead to the receiver antenna coaxial cable termination at switch wafer S1D (4th wafer from front) and the ground lead to the first shield plate. Connect the AF voltmeter across the 500-ohm audio output transformer winding at the AUDIO 500 ohm jack (J5) located at the rear chassis apron. This arrangement will now permit transmitter and receiver operation without connecting and disconnecting test equipment repeatedly during alignment.

B. If the trimmer capacitors on the three section gang (C7) have not been previously aligned at the factory, preset trimmers C7D and C7E approximately one half turn from tight.

C. Set the RF LEVEL control at zero, OPERATION control at MOX and function control at TUNE.

D. Set the BAND SELECTOR control at 28, the VFO at 28000 KC, the PRESELECTOR control at the left edge of the 15-10M segment, and the final amplifier LOAD control at 5-1/2. Advance the RF LEVEL control and adjust the final amplifier PLATE control for resonance. Maintain an output signal level of 50 volts RMS at the VTVM with the RF LEVEL control and adjust coils L7 and L30 for maximum output at the dummy load. Reduce the transmitter output to zero with the RF LEVEL control.

E. Set the OPERATION control at REC., RF GAIN and AF GAIN controls at maximum (10), RIT control at OFF and NOISE BLANKER at OFF. Do not change the VFO setting and PRESELECTOR control setting set up in step D. Tune the RF signal generator to 28,000 KC and adjust it for approximately 1000 CPS beat note. Use just enough signal generator output (approximately one microvolt for an aligned unit) to keep from developing AVC voltage (no "S" meter indication). Adjust coil L5 for maximum audio output without developing AVC voltage.

F. Set the BAND SELECTOR control at 29.5, the VFO at 30,000 KC, and the final amplifier LOAD control at 7 and set the OPERATION control at MOX. Advance the RF LEVEL control and tune the final amplifier PLATE and PRESELECTOR controls to resonance. Maintain an output signal level of 50 volts RMS at the VTVM with the RF LEVEL control and adjust trimmer C7E for maximum output at the dummy load. Reduce the transmitter output to zero with the RF LEVEL control.

G. Set the OPERATION control at REC. and without changing the VFO or PRESELECTOR control setting, tune the RF signal generator to 30,000 KC and obtain the 1000 CPS beat note. Control the signal generator output and adjust trimmer C7D for maximum audio output at the AF voltmeter without developing AVC voltage (No "S" meter indication).

H. Repeat steps C, D and E to peak out the coil adjustments for the 10 meter band.

I. Set the BAND SELECTOR at 3.5, the VFO at 3500 KC and the PRESELECTOR at the left edge of the 80M segment. Set the final amplifier LOAD control at 4. Set the OPERATION control at MOX, advance the RF LEVEL control and adjust the final PLATE control for resonance. Maintain the 50-volt RMS output signal level with the RF LEVEL control and adjust coils L11 and L34 for

maximum output at the dummy load. Reduce the output to zero with the RF LEVEL control.

J. Set the OPERATION control at REC, and without changing the VFO or PRESELECTOR control settings, tune the RF signal generator to 3500 KC and obtain the 1000 CPS beat note. Control the signal generator output and adjust coil L4 for maximum audio output at the AF voltmeter without developing AVC voltage.

K. Repeat the procedure given in steps I and J for the 40M, 20M, and 15M bands. Refer to the RF ALIGNMENT CHART for specific control settings and adjustments for each of the bands. For each band, set the PRESELECTOR control at the left edge of the band segment when adjusting the coils for that band.

L. Set the BAND SELECTOR at 7.0, the OPERATION control at REC., the VFO at 7000 KC. Tune the RF signal generator at 7000 KC for the 1000 CPS beat note and tune the PRESELECTOR control for maximum AF voltage. Reset the RF signal generator frequency to 6.5 MC, increase the signal generator output by approximately 40 DB, and adjust its frequency for the 1000 CPS beat note. Set the signal generator output to develop approximately 10 volts RMS audio output and adjust the 6.5 MC trap coil L12 and trimmer C26 for minimum audio output. If the core adjustment in trap coil L12 is shifted considerably to achieve rejection, the setting of coil L10 may be affected. Repeat the alignment procedure shown in step K for coils L10, L33, and L3 in the 40M band to insure correct alignment.

M. Set the BAND SELECTOR at 7.0, the OPERATION control at REC, and the VFO control at 7250 KC. Tune the RF signal generator to 7250 KC for maximum audio output and peak the PRESELECTOR control for maximum audio. Use a low level output from the signal generator (approximately one microvolt) so that no AGC voltage is developed. Without changing any of the transceiver controls, reset the signal generator frequency to 6250 KC and increase its output approximately 60-70 DB. Adjust its frequency for maximum audio output. Now adjust the 6.25 MC trap coil (L29) for minimum audio output.

8-13. BFO/CARRIER OSCILATOR ALIGNMENT.

This operation consists of adjusting the core of carrier oscillator transformer T4 and setting the crystal warping trimmers C136 and C139 to place the oscillator exactly on frequency.

A. Set the core of transformer T4 before setting the oscillators to frequency. Connect the VTVM RF probe at test point D (Pin 8 of the product detector tube V9A), (see Figures 17 and 31). Set the OPERATION control at REC and check the injection voltage at test point D for both LSB and USB settings of the FUNCTION control.

RF ALIGNMENT CHART (MIXER-DRIVER STAGES)

BAND SELECTOR	TRANSCEIVER VFO SETTING	FINAL AMPL. LOAD SETTING	ADJUST FOR MAXIMUM RF OUTPUT IN TRANSMIT	
3.5	3500 KC	4	L11	L34
7.0	7000 KC	4-1/2	L10	L33
14	14000 KC	5	L9	L32
21	21000 KC	4-1/4	L8	L31
28	28000 KC	5-1/2	L7	L30
29.5	30000 KC	7	C7E	--

RF ALIGNMENT CHART (RECEIVER ANTENNA STAGE)

BAND SELECTOR	TRANSCEIVER VFO SETTING	RF SIGNAL GENERATOR	ADJUST FOR MAXIMUM AF VOLTAGE IN RECEIVE
3.5	3500 KC	3500 KC	L4
7.0	7000 KC	7000 KC	L3
14	14000 KC	14000 KC	L2
21	21000 KC	21000 KC	L1
28	28000 KC	28000 KC	L5
29.5	30000 KC	30000 KC	C7D

If the injection voltages measured are approximately 1.5 volts RMS and the crystal oscillators start without hesitation in either sideband position, no adjustment should be necessary. If adjustment is required, set the core of transformer T4 for maximum background noise, setting the core on the high frequency side of the peak injection voltage setting of the core. That is, when adjusting from the top of the transformer turn the core counterclockwise from the peak injection voltage setting until the received background noise is maximum. Switch the FUNCTION control between USB and LSB to check the starting capabilities of the oscillators. If the core is set as described, both oscillators will start without hesitation and the injection voltage will be about 1.5 volts RMS.

B. The BFO/carrier oscillator frequencies have been accurately set at the factory to 1652,800 KC (USB) and 1650,000 KC (LSB) with the aid of an electronic counter connected to test point D. If an electronic counter is available set the OPERATION control at REC and the FUNCTION control at LSB. Set trimmer C136 for exactly 1650,000 KC. Set FUNCTION control at USB and set trimmer C139 for exactly 1652,800 KC. Following the frequency adjustment, recheck the VFO corrector adjustment per paragraph 8-8D.

Without the electronic counter it would be well to leave trimmers C136 and C139 untouched. If it is necessary to replace crystals Y10 and Y11 for any reason, make the VFO corrector adjustment per paragraph 8-8D.

8-14. HETERODYNE CRYSTAL OSCILLATOR ALIGNMENT.

The heterodyne crystal oscillator injection may be checked in the following manner to determine whether or not the core of coil L19 requires adjustment. Connect the VTVM RF probe to test point B (pin 7 of the second transmitter mixer tube V11A). (See figures 17 and 31.) Disable the VFO injection by removing VFO tube V13. Set the OPERATION control at MOX and the FUNCTION control at TUNE. Record the RMS injection voltage for all settings of the BAND SELECTOR control. Injection is normal if the injection voltage measures 2.0 to 2.5V RMS on 80M and 40M, 1.0 to 1.2V RMS on 20M and 15M, and 0.75 to 1.0V RMS on the 10M segments.

If adjustment is required, set the core of coil L19 to obtain 2 volts RMS or more on 80M and 40M and 0.75 volts or more on the 10M segments. The 15M and 20M bands will automatically fall into line around the 1 volt RMS level.

SERVICE REPAIR PARTS LIST

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
CAPACITORS			CAPACITORS (CONT)			*RESISTORS (CONT)			DIODES			MISCELLANEOUS (CONT)		
C1,17	18 PF, 5%, 500V, Mica	493-110180-231	C123,124	39 PF, 5%, 500V, N150, Ceramic	047-002503-005	R68	33K Ohm, 1 Watt	451-252233	CR2,3,4,5	Diode, Type 1N456	019-002964	FL1	Filter, Crystal, 1650 KC	049-000851
100,175	82 PF, 5%, 500V, Mica	493-110820-233	C126	5 PF, 5%, 500V, NPO, Ceramic	047-002503-001	R73,80,84	68K Ohm	451-252283	15,17,21	Diode, Type 1N295	019-301980	Foot, Rubber (4)	018-201072	
C2,18,177	15 PF, 5%, 500V, Mica	493-121350-234	C127,171	Variable, 0.8 PF - 13.0 PF, Piston Trimmer	044-000520	R81,135	680 Ohm	451-252681	22,23,24	Diode, Type 1N295	019-301980	Front Panel Assembly	150-009808	
C3,19	15 PF, 5%, 500V, Mica	493-110150-231	C128	82 PF, 5%, 500V, N150, Ceramic	047-002503-008	R89	150K Ohm, 1 Watt	451-252154	25,26,28	Diode, Type 1N295	019-301980	Gear, Idler	026-001173	
C4,22	15 PF, 5%, 500V, Mica	493-110150-231	C129,133	47 PF, 5%, 500V, N150, Ceramic	047-002503-006	R90,173	Variable, 50K, 30%, with Pull Switch	025-003307	CR6,7,10	Diode, Type 1N295	019-301980	Gear, Idler	026-001170	
C5,99	22 PF, 5%, 500V, Mica	493-110220-231	C146	25 μ F, 25V, Electrolytic	045-001431	R91	Variable, 25K Ohm, (5% with R90)	025-002510	CR13,27	Diode, Type 1N3182	019-003318	Gear, Idler Spur	026-001002	
C6,80	880 PF, 5%, 300V, Mica	493-110681-234	C147A,B	2 x 30 μ F, 350V, Electrolytic	045-000902	R93,150	Variable, 1 Megohm, 30%, 2/10 Watt	025-002067	CR14	Diode, Zener, Type VRI30	019-003407	Gear, Pinion Drive	026-001171	
C7A,B,C	Variable, PRE-SELECTOR	047-100471	C149A,B	Variable, PLATE	048-000839	R99,120	Variable, 50K Ohm, 20%, 2/10 Watt	025-002065	CR19,20	Diode, Type 1N87	019-002841	Gear, Spur	026-001089	
C8,35,45	0.02 μ F, 10%, 600V, Ceramic	047-100471	C150,160	0.001 μ F, 3KV, Ceramic	047-100397	R100	47 Ohm, 1 Watt	451-252470		CRYSTALS		Gear, Spur, Dial	026-001174	
C9,10,16	47 PF, 10%, 500V, Mica	493-110470-133	C151A,B	Variable, LOAD	048-000667	R102	1500 Ohm, 2 Watt	451-252152	Y1	Crystal, 100.000 KC	019-002712	Gear, Spur, Pinion	026-001088	
C11,13,14	0.01 μ F, 20%, 500V, Ceramic	047-100354	C153	500 PF, 10%, 500V, Mica	493-110501-134	R104	3300 Ohm, 5 Watt	445-012332	Y6	Crystal, 17.5 MC	019-003769-006	Handle, Knob	030-000793	
C12,22	22 PF, 5%, 500V, Mica	493-110470-133	C155,223	180 PF, 10%, 500V, Mica	493-110181-134	R106,109	12K Ohm, 1 Watt	445-012323	Y7	Crystal, 10.25 MC	019-003769-003	Indicator, Light, Neon	086-000690	
C13,34,35	40,41,45,47,52,57,65,67, 75,77,82,92,93,96,109, 115,116,140,143,150,161, 166,170,180,181,186,187, 194,198,200,206,207,209, 225,228,229	047-001428	C163,164	120 PF, 5%, 500V, Mica	493-110121-234	R110	10 Ohm, 1 Watt	451-252150	Y8	Crystal, 13.5 MC	019-003769-002	Indicator, Knob, PRE-SELECTOR	082-000578-001	
C14,23	0.1 μ F, +80%, -20%, 45,51,56, 100V, Ceramic	047-001428	C174,175	270 PF, 5%, 500V, Mica	493-110271-234	R115	Variable, 5K Ohm, 20%, 1/2 Watt, RIAS ADJ	025-002698	Y9	Crystal, 10.0 MC	019-003769-001	Jack (2), Key, Phones	036-000210	
C15,21	100 PF, 10%, 500V, Mica	493-110101-134	C185,195	0.47 μ F, 250V, Mica	047-002141-011	R116	27K Ohm	451-252273	Y10	Crystal, 1650.000 KC	019-003323	Jack, Phone (3) Audio, (Common and Separate)	036-100041	
C16,17	22 PF, 10%, 500V, Mica	493-110220-131	C205	220 PF, 10%, 500V, Mica	493-110221-134	R118	5000 Ohm, 1 Watt	451-252562	Y11	Crystal, 1652.800 KC	019-005044	Knob Assembly, Main	015-001929	
C17,18	18 PF, 10%, 500V, Mica	493-110180-231	C210	0.22 μ F, 10%, 200V, Paper	046-001298-004	R119,159	82K Ohm, 1 Watt	451-252562	Y12	Crystal, 1652.800 KC	019-005044	Knob, Bar, LOAD	015-001914-001	
C18,19	18 PF, 10%, 500V, Mica	493-110180-231	C214	50 PF, 5%, 300V, Mica	493-110500-221	R132	Variable, 50 Ohm, 10%, 3/10 Watt	025-002064	Y13	Crystal, 1651.700 KC	019-005042	Knob, Bar, RIT control	015-001740-001	
C19,20	18 PF, 10%, 500V, Mica	493-110180-231	C216	1500 PF, 2%, 300V, Mica	493-110162-124	R155	Variable, 10 Megohm, 20%, 5, 9 Watt	025-002066	J1	Jack, Antenna	019-100056	Knob, Bar, RIT control	015-001740-001	
C20,21	18 PF, 10%, 500V, Mica	493-110180-231	C227	82 PF, 10%, 500V, Mica	493-110820-133	R156	6.8 Megohm	451-252685	J2,3,5	Jack, Phone, 500 Ohm	036-100041	Knob, Bar, RIT control	015-001740-001	
C21,22	18 PF, 10%, 500V, Mica	493-110180-231				R157	3.3 Megohm	451-252335	J4	Socket, 11-Pin	006-200707	Knob, Bar, RIT control	015-001740-001	
C22,23	18 PF, 10%, 500V, Mica	493-110180-231				R158	15 Ohm	451-252162	J6,8	Jack, Key and Accessory	036-200210	Knob, Bar, RIT control	015-001740-001	
C23,24	18 PF, 10%, 500V, Mica	493-110180-231				R159	1500 Ohm	451-252162	J7	Connector, Power, 12-Pin Jones Plug	010-002586	Knob, Bar, RIT control	015-001740-001	
C24,25	18 PF, 10%, 500V, Mica	493-110180-231				R160	15 Ohm	451-252162	J9	Connector, MIC, w/hardware	010-015689	Knob, Bar, RIT control	015-001740-001	
C25,26	18 PF, 10%, 500V, Mica	493-110180-231				R161	8.2K Ohm	451-252282	P1	Plug, 11-Pin Accessory	010-002332	Knob, Bar, RIT control	015-001740-001	
C26,27	18 PF, 10%, 500V, Mica	493-110180-231				R162	470 Ohm, 1 Watt	451-252154		SWITCHES		Knob, Bar, RIT control	015-001740-001	
C27,28	18 PF, 10%, 500V, Mica	493-110180-231				R163	150K Ohm	451-252154	S1A,E	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C28,29	18 PF, 10%, 500V, Mica	493-110180-231				R164	120 Ohm	451-252154	S1B	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C29,30	18 PF, 10%, 500V, Mica	493-110180-231				R165	10 Megohm	451-252108	S1C,D,F	Wafer, RF and Driver	062-000266	Knob, Bar, RIT control	015-001740-001	
C30,31	18 PF, 10%, 500V, Mica	493-110180-231				R166	10 Megohm	451-252108	S1D,E,F	Wafer, RF and Driver	062-000266	Knob, Bar, RIT control	015-001740-001	
C31,32	18 PF, 10%, 500V, Mica	493-110180-231				R167	10 Megohm	451-252108	S1G	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C32,33	18 PF, 10%, 500V, Mica	493-110180-231				R168	10 Megohm	451-252108	S1H	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C33,34	18 PF, 10%, 500V, Mica	493-110180-231				R169	10 Megohm	451-252108	S1I	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C34,35	18 PF, 10%, 500V, Mica	493-110180-231				R170	10 Megohm	451-252108	S1J	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C35,36	18 PF, 10%, 500V, Mica	493-110180-231				R171	10 Megohm	451-252108	S1K	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C36,37	18 PF, 10%, 500V, Mica	493-110180-231				R172	10 Megohm	451-252108	S1L	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C37,38	18 PF, 10%, 500V, Mica	493-110180-231				R173	10 Megohm	451-252108	S1M	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C38,39	18 PF, 10%, 500V, Mica	493-110180-231				R174	10 Megohm	451-252108	S1N	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C39,40	18 PF, 10%, 500V, Mica	493-110180-231				R175	10 Megohm	451-252108	S1O	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C40,41	18 PF, 10%, 500V, Mica	493-110180-231				R176	10 Megohm	451-252108	S1P	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C41,42	18 PF, 10%, 500V, Mica	493-110180-231				R177	10 Megohm	451-252108	S1Q	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C42,43	18 PF, 10%, 500V, Mica	493-110180-231				R178	10 Megohm	451-252108	S1R	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C43,44	18 PF, 10%, 500V, Mica	493-110180-231				R179	10 Megohm	451-252108	S1S	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C44,45	18 PF, 10%, 500V, Mica	493-110180-231				R180	10 Megohm	451-252108	S1T	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C45,46	18 PF, 10%, 500V, Mica	493-110180-231				R181	10 Megohm	451-252108	S1U	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C46,47	18 PF, 10%, 500V, Mica	493-110180-231				R182	10 Megohm	451-252108	S1V	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C47,48	18 PF, 10%, 500V, Mica	493-110180-231				R183	10 Megohm	451-252108	S1W	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C48,49	18 PF, 10%, 500V, Mica	493-110180-231				R184	10 Megohm	451-252108	S1X	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C49,50	18 PF, 10%, 500V, Mica	493-110180-231				R185	10 Megohm	451-252108	S1Y	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C50,51	18 PF, 10%, 500V, Mica	493-110180-231				R186	10 Megohm	451-252108	S1Z	Wafer, PA	062-000266	Knob, Bar, RIT control	015-001740-001	
C51,52	18 PF, 10%, 500V, Mica	493-110180-231				R187	10 Megohm	451-252108	S1A	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C52,53	18 PF, 10%, 500V, Mica	493-110180-231				R188	10 Megohm	451-252108	S1B	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C53,54	18 PF, 10%, 500V, Mica	493-110180-231				R189	10 Megohm	451-252108	S1C	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C54,55	18 PF, 10%, 500V, Mica	493-110180-231				R190	10 Megohm	451-252108	S1D	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C55,56	18 PF, 10%, 500V, Mica	493-110180-231				R191	10 Megohm	451-252108	S1E	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C56,57	18 PF, 10%, 500V, Mica	493-110180-231				R192	10 Megohm	451-252108	S1F	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C57,58	18 PF, 10%, 500V, Mica	493-110180-231				R193	10 Megohm	451-252108	S1G	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C58,59	18 PF, 10%, 500V, Mica	493-110180-231				R194	10 Megohm	451-252108	S1H	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C59,60	18 PF, 10%, 500V, Mica	493-110180-231				R195	10 Megohm	451-252108	S1I	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C60,61	18 PF, 10%, 500V, Mica	493-110180-231				R196	10 Megohm	451-252108	S1J	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C61,62	18 PF, 10%, 500V, Mica	493-110180-231				R197	10 Megohm	451-252108	S1K	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C62,63	18 PF, 10%, 500V, Mica	493-110180-231				R198	10 Megohm	451-252108	S1L	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C63,64	18 PF, 10%, 500V, Mica	493-110180-231				R199	10 Megohm	451-252108	S1M	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C64,65	18 PF, 10%, 500V, Mica	493-110180-231				R200	10 Megohm	451-252108	S1N	Wafer, RF and Heterodyne	062-000266	Knob, Bar, RIT control	015-001740-001	
C65,66	18 PF, 10%, 500V, Mica	493-110180-231				R201								

