



OPERATING AND SERVICE INSTRUCTIONS

RADIO RECEIVER
MODEL SX-88

Tuning is accomplished by a precision anti-backlash gear-train mechanism to insure extremely close calibration and accurate resetability. The ratio of each tuning control to its associated tuning dial is 24 to 1, i.e., 24 complete revolutions are made by the control while the dial makes one complete hand coverage. A logging scale on each dial, calibrated from 0 to 24, indicates the revolutions made by the control. Since the metal skirt of each control is calibrated from 0 to 100, this system of tuning makes it possible to divide each frequency band on the main and handsread tuning dials into 2400 readable settings. A lock on each tuning dial provides positive locking action without affecting its frequency setting. Smooth fumble-free tuning assures maximum traverse speed and operating ease.

A built-in 100 kc crystal calibrator provides marker signals at every 100 kc on the dial for checking the calibration accuracy. Any calibration adjustment required can be made from the front panel, by means of the adjustable dial pointers. A trimmer capacitor, accessible from the top of the chassis, permits adjustment of the calibrating crystal to exactly 100 kc by comparison with the frequencies transmitted by station WWV.

The amplified and delayed AVC circuit in the receiver functions on both AM and CW signals to keep the output level of the receiver constant regardless of input-signal variations. This type of AVC circuit is advantageous in that it provides excellent control over a wide range of signal strengths and yet maintains full receiver sensitivity on weak signals.

An automatic series noise limiter circuit, controlled by a switch on the front panel, eliminates interference from electrical equipment and other sources of pulse type noise such as ignition noise.

A tuned buffer amplifier stage isolates the beat frequency oscillator from the detector and provides for two levels of injection, low level injection for CW reception and high level injection for single-side band reception. A three-position toggle switch on the front panel permits selection of either level, and also turns the beat oscillator off for AM reception. The frequency of the beat oscillator is controlled by the Pitch control on the front panel which varies the audible beat note from zero to plus or minus 2500 cycles.

An "S" meter is used when receiving AM signals to indicate the accuracy of tuning and the relative strength of received signals. The meter is calibrated in microvolts, "S" units from 1 to 9, and in decibels above S-9 to +40 db.

The Receive-Standby switch on the front panel silences the receiver but leaves the power on to provide instant reception between transmission periods. Provision has also been made in the receiver for remote receive-standby control, and for transmitter control with the standby switch. An auxiliary sensitivity control, located on the top of the chassis, is switched in the circuit when the receiver is in the "standby" position to permit monitoring of your transmitter signal. A neon lamp, connected across the secondary of the antenna coil, protects the receiver against possible damage from excessive r-f voltage at the antenna terminals during transmission. Protection is provided for terminal voltages up to 50 volts.

A push-pull 6V6 audio output stage with inverse feedback delivers 10 watts of audio power. Audio output connections include terminals for 3.2 and 8 ohm speakers as well as a 500/600-ohm line or speaker output. A front panel jack for headphones is also provided, and the speaker is automatically disabled when the headphones are plugged in. The response of the audio amplifying system is essentially flat from 20 to 20,000 cycles. A 5-position full range tone control provides responses for normal, communications, and full fidelity reception.

The SX-88 operates from a 105-125 volt, 50-60 cycle AC power source. The universal model, the SX-88U, operates from 25-60 cycle AC sources at voltages ranging from 100 to 250 volts. Both models also have provisions for operation from an external power supply or batteries for emergency service in areas where AC power is not available.

This receiver is certified by the FCDA under Specification M6-1, Item #R12.

SECTION 2. INSTALLATION

2-1. UNPACKING

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

CAUTION

When removing the receiver from the carton be extremely careful not to place any strain on the tuning knobs. Failure to observe this precaution may result in serious damage to the precision tuning mechanism.

2-2. LOCATION

The receiver may be placed in any location that will permit free air circulation through the ventilation holes and openings in the cabinet. Avoid excessively warm locations such as those near radiators and heating vents. The external speaker may be located in any convenient position although it is recommended that it not be placed on top of the receiver for reasons of ventilation.

If rack mounting is desired, the receiver may be removed from the cabinet by removing the two screws at each side of the front panel, the four screws at bottom of the cabinet, and then sliding the receiver out of the cabinet. The 8-3/4" x 19" front panel of the receiver has holes suitably spaced to fit the standard 19-inch radio relay rack.

2-3. ANTENNAS

The r-f input of the receiver is designed for operation from either a single-wire antenna, or a half-wave doublet or other tuned antenna with transmission line impedances from 52 to 600 ohms. Antenna connections are made to a three terminal strip at the rear of the receiver marked "A1", "A2", and "G". Mounting holes are also provided, adjacent to the antenna terminals, for installation of an AN type SO-239 connector for coaxial cable installations.

A. SINGLE WIRE ANTENNA

The simplest antenna and one which will provide satisfactory results throughout the entire tuning range is a conventional single-wire antenna, 50 to 100 feet long. This type of antenna should be erected as high as possible and kept free from surrounding objects. When using a single-wire antenna, attach the antenna lead-in to terminal "A1" and connect the jumper link between terminals "A2" and "G". In some locations, reception may be improved by connecting a ground wire between terminal "G" and a cold water pipe or outside ground rod.

B. HALF-WAVE DOUBLET

For top performance, especially on the shortwave ranges, the use of a half-wave doublet or other type of antenna employing a 52 to 600-ohm transmission line is recommended. The doublet antenna should be cut to the proper length for the most used frequency or band of frequencies. The overall length in feet of a half-wave doublet is determined by the following formula:

$$\text{Length in feet} = \frac{468}{\text{Frequency in megacycles}}$$

The doublet antenna may be fed with either a balanced or unbalanced transmission line. When a balanced transmission line such as "twin-lead" or a twisted pair is used, the two leads are connected to terminals "A1" and "A2", and the jumper link between terminals "A2" and "G" is disconnected. When using an unbalanced transmission line such as coaxial cable, the inner conductor connects to terminal "A1", the outer braid connects to "A2", and the jumper link connects between "A2" and "G".

The doublet antenna provides optimum efficiency only at the frequency for which it is cut. Therefore, it may be desirable for reception on frequencies remote from the antenna frequency to utilize the antenna as a single wire type. This is accomplished by connecting the two transmission line leads together and connecting them to terminal "A1". The jumper link in this case should be connected between terminals "A2" and "G".

In an installation where the receiver is used in conjunction with a transmitter, it may be advantageous to use the same antenna for receiving as for transmitting. This is especially true when a directive antenna is used since the directive effects and power gain of the transmitting antenna are the same for receiving as for transmitting. Switching of the antenna from the transmitter to the receiver may be accomplished with a double-pole, double-throw antenna changeover relay or knife switch connected in the antenna leads.

For further information regarding antennas, refer to the "Radio Amateur's Handbook" or the "A.R.R.L. Antenna Book", both published by the American Radio Relay League; West Hartford, Conn., U.S.A.

CAUTION: When using the SX-88 receiver in close proximity to transmitting equipment, avoid excessive r-f voltage at the antenna terminals of the receiver during transmission. Nearby antennas or even short lengths of transmission line between the receiver and antenna relay can pick up high r-f potentials. Voltages in excess of 50 volts at the receiver antenna terminals can destroy the protective neon lamp and antenna stage coils.

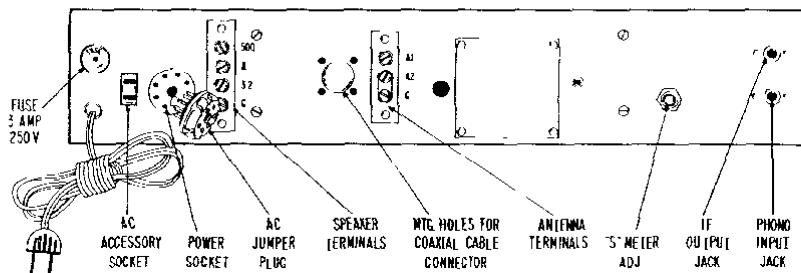


Fig. 1. Rear View of Receiver

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2-4. POWER SOURCE

The SX-88 receiver is designed for operation on 105-125 volt, 50-60 cycle AC current while the universal model, the SX-88U, operates on 100-250 volt, 25-60 cycle AC current. The normal power consumption of each receiver is 138 watts. Each receiver is also equipped with a DC power input socket to permit operation on an external power supply or batteries for portable or emergency service in areas where AC power is not available. This socket is located at the rear of the receiver and is marked "POWER SOCKET". In addition to equipping the receiver for DC operation, the POWER SOCKET also supplies 300 volts DC at 10 ma between pins 1 and 3, and 6.3 volts AC at 6 amp between

Insert the line cord plug into any convenient AC power outlet of the proper rating. If in doubt about your power source, call your local power company before plugging in the receiver.

CAUTION: When operating the SX-88U, it is essential that the power selector switch (located on the rear of the power trans-

NOTE: The receiver will not operate from an AC source unless the AC JUMPER PLUG is inserted in the POWER SOCKET at the rear of the receiver. (See Fig. 1.)

B. DC OPERATION

The receiver may be operated from an external DC source, such as a vibrator power supply or batteries, by removing the AC JUMPER PLUG normally located in the POWER SOCKET at the rear of the receiver, and replacing it with a similar octal plug wired as shown in Fig. 2. Note that pins 7 and 8 of the DC plug are connected together by a jumper wire so that the 4H4 current regulator tube is automatically disconnected to supply the correct heater voltage to the 6U8 tube when operating from an external 6-volt source. The voltage and current requirements for DC operation are as follows: "B" supply, 300 volts at 200 ma; "A" supply, 6 volts at 6 amps.

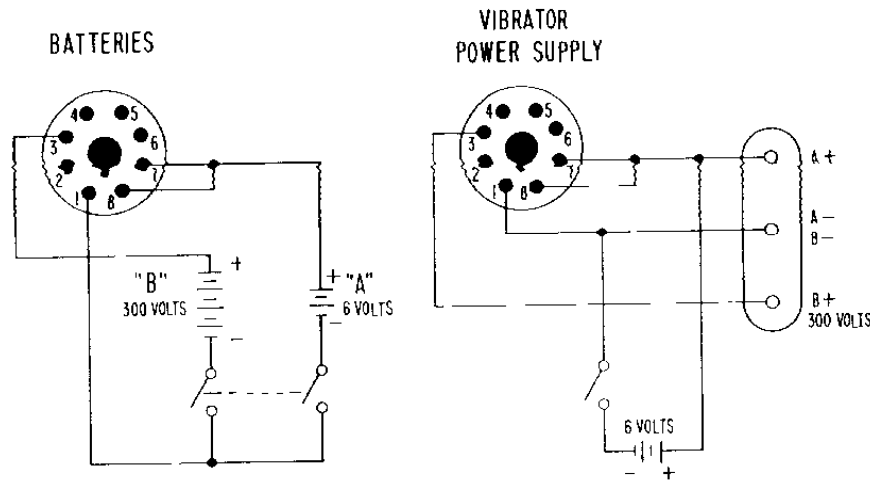


Fig. 2. Wiring Diagram for DC Operation

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2-5. SPEAKER CONNECTION

A four-terminal strip, marked "G-3.2-8-500", is provided at the rear of the receiver for the speaker connections. Approximately 10 watts of audio power are available at these terminals. Any speaker having an impedance of either 3.2 or 8 ohms can be used with the receiver by simply connecting one lead from the speaker to the common ground terminal marked "G" and the other lead to the numbered terminal which corresponds to the speaker voice coil impedance. For optimum results, the use of the Hallicrafters R-46 or R-46A speaker is recommended. The R-46 speaker has a built-in matching transformer and connects to terminals "G" and "500" while the R-46A, which has no matching transformer, connects to the terminals marked "G" and "3.2". When using a speaker with an impedance other than 3.2 or 8 ohms, a matching transformer should be used to insure optimum performance. The matching transformer should have a 10-watt power rating, a 500-ohm primary impedance, and a secondary impedance to match the impedance of the speaker being used.

2-6. HEADPHONES

The headphone jack, marked PHONES, is located on the front panel of the receiver and is wired so that the speaker is automatically disabled when the headphones are plugged in. The headphone output load impedance is not critical and any commercial type headphones may be used, including crystal types as no direct current flows in the headphone circuit. For maximum headphone output, the use of high-impedance magnetic or crystal phones is recommended.

2-7. RECORD PLAYER CONNECTIONS

An audio input jack, marked PHONO, is provided at the rear of the receiver for attachment of a record player using either a crystal pickup, or a magnetic pickup with a suitable pre-amplifier. Connection to the PHONO jack is made with a standard single-pin phono plug. Shielded type cable should be used to prevent hum, connecting the inner conductor to the center prong of the plug, and the outer metal braid to the shell of the plug.

For phono operation, set the BAND WIDTH control on the front panel at "PHONO" and operate the VOLUME and RESPONSE controls as explained under Sections 3-7 and 3-12. The remaining controls are inoperative and will have no effect on phono operation.

2-8. RELAY AND TRANSMITTER SWITCHING

One half of the dpdt REC-STANDBY switch on the front panel connects to pins 2 and 5 of the POWER SOCKET at the rear of the receiver, and is available for transmitter switching. (See Fig. 3) This half of the switch is wired so that it is closed when the REC-STANDBY switch is set at "STANDBY" and open when set at "REC". To reverse the switching sequence (i.e., to have the switch open when the REC-STANDBY switch is set at "STANDBY" and closed when set at "REC") disconnect the lead on the switch which connects to pin 5 of the POWER SOCKET and connect it to the unused terminal on the switch.

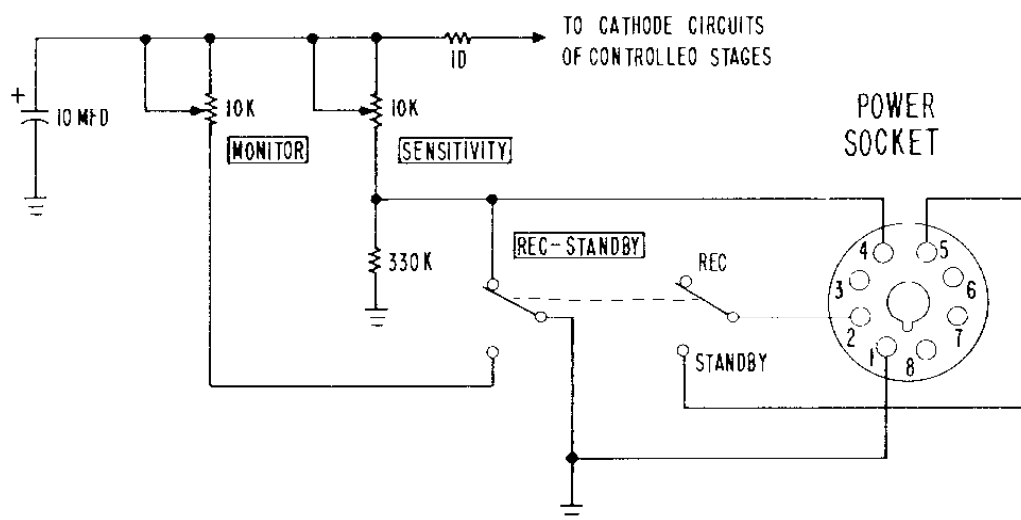


Fig. 3. Schematic Diagram of Sensitivity and Monitor Control Circuits, and Rec-Standby Circuit.

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2-9. REMOTE REC-STANDBY SWITCH

The receiver may be disabled remotely by connecting a remote spst switch between pins 1 and 4 of the AC JUMPER PLUG located in the POWER SOCKET at the rear of the receiver. (See Fig. 3). To operate the receiver from a remote location, set the REC-STANDBY switch on the front panel at "STANDBY" and use the remote switch to place the receiver in "receive" or "standby" operation.

2-10. AC ACCESSORY OUTLET

An AC outlet is provided at the rear of the receiver for operating a record player, oscilloscope, or accessories.

2-11. IF OUTPUT JACK

The IF OUTPUT jack at the rear of the receiver provides a low impedance cathode follower output at the second intermediate frequency of 50 kc for feeding a teletype converter, oscilloscope, etc. The i-f output signal is obtained from the grid of the 3rd 50 kc IF amplifier, amplified by the AVC amplifier, coupled to the cathode follower, and then fed through a DC blocking capacitor to the IF OUT-

with respect its cathode. When a noise peak is higher in amplitude than the signal, it instantaneously swings the plate negative with respect to the cathode, conduction ceases, and that portion of the signal is automatically cut off from the audio amplifier. The point at which the limiter diode becomes non-conducting is made sufficiently high so that the diode will not clip modulation peaks and thus impair intelligibility appreciably, but low enough to limit the noise peaks effectively.

3-4. AVC SWITCH

The AVC switch, when set at "ON", places the AVC circuit in operation to maintain the output

In the conventional AVC circuit, which uses the rectified carrier voltage developed at the detector, the use of AVC for CW reception results in a loss of sensitivity when the BFO is switched on. This occurs because the beat oscillator output acts exactly as a strong received signal, and causes the AVC circuit to put high bias on the controlled stages, thus reducing the receiver sensitivity. In the SX-88 receiver, this undesirable effect is eliminated by completely isolating the AVC circuit from the second detector by means of an AVC amplifier stage which obtains its input signal ahead of the detector stage, (and BFO), thus permitting the reception of CW signals with AVC functioning.

3-5. CAL. OFF-ON SWITCH

The CAL. OFF-ON switch controls the operation of the built-in crystal calibrator. When the switch is set at "ON", the crystal calibrator is turned on to provide marker signals at every 100 kc on the dial for checking the dial calibration accuracy. The crystal calibrator employs a crystal controlled, pentode oscillator circuit. The output of the crystal calibrator is capacitively coupled to the antenna input circuit. A trimmer capacitor, adjustable by the CRYSTAL ADJ control on the top front of the chassis, permits adjustment of the calibrating crystal to exactly 100 kc by comparison with the frequencies transmitted by WWV. This capacitor has been set at the factory and should normally not require periodic readjustment unless extreme calibration accuracy is required. If adjustment is required, proceed as outlined in Section 7-7.

3-6. REC-STANDBY SWITCH

The REC-STANDBY switch, normally set at "REC", permits disabling of the receiver during transmission periods, at the same time maintaining the heater and plate supplies operative for instant use when reception is again resumed. The receiver is disabled by setting the REC-STANDBY switch at "STANDBY".

NOTE: When the REC-STANDBY switch is set at "STANDBY", the receiver may still be made operative, if desired, by means of the MONITOR control on the top rear of the chassis. This permits monitoring of your own transmitter signal when the REC-STANDBY switch is being used to control the transmitter. Only when the MONITOR control is rotated fully counterclockwise (zero sensitivity position) will the receiver be completely disabled when the REC-STANDBY switch is set at "STANDBY".

One section of the REC-STANDBY switch may be used for relay or transmitter switching, if desired. For connections and details, refer to Section 2-8.

3-13. MAIN TUNING DIAL

The main tuning dial has six calibrated scales and a 24-division logging scale. Each division on the logging scale represents one complete revolution of the MAIN TUNING control. Since the metal skirt of the MAIN TUNING control is calibrated from 0 to 100, this method of tuning divides each scale on the main tuning dial into 2400 readable settings. Thus, by recording the settings of the logging scale and MAIN TUNING control, the receiver may be accurately reset to any desired frequency. A tuning lock to the right of the MAIN TUNING control permits positive locking action without affecting the frequency setting of the main tuning dial. To lock the main tuning dial, simply turn the locking knob clockwise.

IMPORTANT: The calibration on the main tuning dial will be accurate only if the band spread tuning gang is set at minimum capacity. This is accomplished by rotating the BAND SPREAD TUNING control counterclockwise until the dial pointer is aligned with the index marks at the high frequency end of the dial. If the band spread tuning gang is set at any setting other than minimum capacity, the additional band spread capacity, added to the main tuning capacity, would throw off the main tuning dial calibration because the receiver is calibrated with the band spread tuning gang set at minimum capacity.

The dial settings for the amateur bands are indicated on the main tuning dial by white dots and wavelength in meters (160, 80, 40, etc.). When tuning the amateur bands with the band spread dial, the main tuning dial must be set and locked at the setting corresponding to the desired amateur band.

3-14. BAND SPREAD TUNING DIAL

The band spread tuning dial contains a 24-division logging scale and six scales calibrated for the 160, 80, 40, 20, 15, and 11-10 meter amateur bands. The six scales are calibrated to read receiver frequency directly when the main tuning dial has been set to the index dot of the desired amateur band. If precise calibration accuracy is desired on the amateur bands, the main tuning dial should be more accurately set the means of the built-in 100 kc crystal calibrator as outlined in Section 4-4A, "Calibration of the Band Spread Dial".

Each division of the 24-division logging scale on the band spread dial represents one complete revolution of the BAND SPREAD TUNING control. Since the metal skirt of the BAND SPREAD TUNING control is calibrated from 0 to 100, this method of tuning divides each scale on the band spread dial into 2400 readable settings. Thus, by recording the settings of the logging scale and the BAND SPREAD TUNING control, the receiver may be accurately reset to any desired frequency. A tuning lock to the left of the BAND SPREAD TUNING control permits positive locking action without affecting the setting of the band spread tuning dial. To lock the band spread tuning dial, simply turn the locking knob clockwise.

In addition to its use on the amateur bands, the band spread tuning dial may also be utilized as a fine tuning adjustment over any portion of the frequency range on bands 2, 3, 4, 5, and 6. Fine tuning is accomplished as follows:

- (a) Set the band spread tuning gang at minimum capacity by rotating the BAND SPREAD TUNING control counterclockwise until the dial pointer is aligned with the index marks at the high frequency end of the dial.
- (b) Set the main tuning dial at the high frequency end of the range of frequencies to be covered and then slowly tune through the range using the BAND SPREAD TUNING control.

3-15. MONITOR CONTROL

The MONITOR control on the top rear of the chassis permits adjustment of the receiver sensitivity when monitoring your own transmitter signal. The MONITOR control is an auxiliary sensitivity control switched in the circuit only when the REC-STANDBY switch is set at "STANDBY", it replaces the SENSITIVITY control on the front panel which is switched out of the circuit during standby operation. When monitoring your transmitter signal, the receiver antenna should be disconnected by relay or switching device so the signal will not "block" or damage the receiver. As a further precaution against overloading, the MONITOR control should not be advanced any further than necessary to hear the transmitter signal. When it is not desired to monitor the transmitter signal, the MONITOR control should be set fully counterclockwise (zero sensitivity position) so that the receiver will be completely disabled when the REC-STANDBY switch is set at "STANDBY".

SECTION 4. OPERATION

4-1. AM RECEPTION

1. Set the front panel controls to their starting positions as outlined below.

VOLUME OFF
BAND SELECTOR At the desired band. (Band in use will be illuminated when receiver is turned on.)
SENSITIVITY 10 (maximum sensitivity)
BAND WIDTH 5 KC (2.5 KC or 10 KC if desired)
CW-AM-SSB AM
ANL OFF-ON OFF
AVC ON-OFF ON
CAL OFF-ON OFF
REC-STANDBY REC
ANTENNA TRIMMER . . . 0 (zero)
RESPONSE NORMAL (or as desired)

2. Loosen the tuning locks at the sides of the MAIN TUNING and BAND SPREAD TUNING controls by turning the LOCK knobs counterclockwise.

IMPORTANT

Before making any tuning adjustments with the MAIN TUNING or BAND SPREAD TUNING controls, it is essential that the dial pointers be properly indexed by means of the small knob located directly below each dial. This is accomplished by rotating the MAIN TUNING and BAND SPREAD TUNING controls fully clockwise and aligning the dial pointers with the index marks at the low frequency end of the dial.

3. Turn the receiver on by rotating the VOLUME control clockwise. The band in use on the main tuning and band spread tuning dials will light up indicating the receiver is operative. Adjust the VOLUME control for the desired volume level.
4. Set the band spread tuning gang at minimum capacity by rotating the BAND SPREAD TUNING control counterclockwise until the dial pointer is aligned with the index marks at the high frequency end of the dial. The band spread tuning dial may now be locked in position, if desired, to avoid disturbing its setting. The band spread tuning dial is calibrated for the 160, 80, 40, 20, 15, and 11-10 meter amateur bands. For convenience in tuning, the AM phone bands are indicated on the band spread dial by a wide line directly above their location on the dial. For fine tuning of the amateur and shortwave bands with the BAND SPREAD TUNING control, see Section 3-14. The BAND SPREAD TUNING control has no effect on standard broadcast reception (Band 1).

IMPORTANT

The frequency calibration of the main tuning dial will be correct only if the band spread tuning gang is set at minimum capacity as specified above.

5. Tune in the desired signal with the MAIN TUNING control, tuning for maximum indication on the "S" meter. The dial calibrations on all bands are located above the frequency markings. After the signal has been accurately tuned in, adjust the ANTENNA TRIMMER control for maximum indication on the "S" meter, and then set the VOLUME control for the desired volume level.

NOTE

The "S" meter indications will be correct only when the AVC switch is set at "ON", and the SENSITIVITY control is set at 10 (maximum sensitivity setting). If the SENSITIVITY control is set at a setting other than "10", AVC action will also be somewhat restricted.

6. Set the **BAND WIDTH** control for the desired degree of selectivity. For standard broadcast reception (Band 1), the control is normally set at "10 KC" for maximum fidelity. The positions marked "5 KC", "2.5 KC", "1.25 KC", ".5 KC", and ".25 KC" provide progressively increasing steps of selectivity. Note that as the selectivity of the receiver is increased, the background noise and interference from adjacent signals is reduced. Too much selectivity,
7. Set the **RESPONSE** control for the desired tonal quality.
8. If it is desired to operate with **AVC** off, set the **AVC** switch at "OFF", set the **VOLUME** control to a well advanced position, and vary the receiver volume level by means of the **SENSITIVITY** control to avoid "blocking" by strong signals.
9. If severe electrical disturbances or ignition or other types of pulse-type noise interfere with reception, set the **ANL** switch at "ON" to place the automatic noise limiter circuit in operation.
10. The receiver may be disabled without turning it off by setting the **REC-STANDBY** switch at "STANDBY". In this position, the r-f and i-f stages are cut off but the heater and plate supplies remain operative for instant reception. To resume reception, simply return the switch to the "REC" position.

4-2. CW RECEPTION

For CW reception, set the **VOLUME** control at a well advanced position and vary the volume level of the receiver by means of the **SENSITIVITY** control, taking care not to advance the control to a point where strong signals will cause excessive "thumping" (overloading). The receiver may be operated with **AVC** on or off, as desired. (See Section 3-4.) Operation of the receiver with **AVC** on is highly desirable since it not only minimizes fading but also prevents blasting when tuning from a weak to a strong signal.

CW signals are made audible by the heterodyning action of the beat oscillator with the incoming signal. The beat oscillator is set at a frequency slightly different from the second-intermediate frequency of 50 kc, the difference being equal to the pitch of the audible note desired. To adjust the beat oscillator frequency, first tune in a steady, unmodulated carrier with the beat oscillator turned off (CW-AM-SSB switch set at "AM"), the **AVC** switch set at "ON", and the **BAND WIDTH** control set at ".25 KC" (the sharpest selectivity position). If desired, the built-in crystal calibrator may be used as the signal source as it provides a suitable carrier at every multiple of 100 kc on the dial. The crystal calibrator is made operative by setting the **CAL OFF-ON** switch at "ON". Adjust the receiver tuning to the carrier frequency as indicated by a maximum indication on the "S" meter. (This centers the carrier in the i-f passband.) Then turn on the beat oscillator by setting CW-AM-SSB switch at "CW" and adjust its frequency by means of the **PITCH** control (leaving the receiver tuning unchanged) to give a pleasing beat note. The beat oscillator may be set on either the high- or low-frequency side of zero beat. (The beat oscillator operates on the high side when the **PITCH** control is set at a position to the right of "0", and on the low side when the **PITCH** control is set at a position to the left of "0".) After the **PITCH** control is set, turn off the crystal calibrator by setting the **CAL OFF-ON** switch at "OFF", tune in a CW signal, and adjust the **ANTENNA TRIMMER** control for maximum loudness. With the receiver in the sharpest selectivity position, CW signals will drop in and out rapidly as the receiver is tuned across a band, and a slow rate of tuning is highly desirable. Once the **PITCH** control has been set, it need not be reset for each CW signal.

NOTE

If a CW signal is tuned in with the **BAND WIDTH** control at a setting other than ".25 KC", it may be necessary to slightly readjust the receiver tuning when changing to a narrower response in order to properly position the signal in the i-f pass-band.

The setting of the **BAND WIDTH** control for CW reception is generally best determined by receiving conditions. Note that as the selectivity of the receiver is increased (**BAND WIDTH** control varied in steps from the "10 KC" to the ".25 KC" position), the background noise and adjacent-channel interference is considerably reduced. For CW reception, the sharpest selectivity position may be used without loss of intelligibility experienced in AM reception.

The RESPONSE control and automatic noise limiter (ANL) circuit can be used to great advantage on CW reception, just as on AM reception, to reduce the effects of background noise and electrical interference. For CW reception, the "COMM 1" and "COMM 2" positions of the RESPONSE control can prove very effective in improving the signal-to-noise ratio by attenuating both the lower and higher audio frequencies. Maximum attenuation of these frequencies is obtained with the RESPONSE control set at "COMM 2".

4-3. SINGLE SIDEBAND RECEPTION

Single-sideband signals are transmitted with little or no carrier, and it is necessary to reinsert the carrier in the receiver before proper reception is obtained. In the SX-88 receiver, this is accomplished in the 50 kc i-f system by injecting the beat oscillator signal at the input of the second-detector. A single-sideband signal can be identified by its unintelligibility, and by a severe variation in the "S" meter indication corresponding to the speech modulation.

For single-sideband reception, set the AVC switch at "ON", the CW-AM-SSB switch at "SSB", RESPONSE control at "COMM 1" or "COMM 2", and the BAND WIDTH control at either "1.25 KC" or "2.5 KC", depending upon adjacent-channel interference and noise. Set the SENSITIVITY control at a well advanced position and vary the receiver volume level by means of the VOLUME control. Initially set the PITCH control at either "0", or the position marked "4" to the right of "0". The single-sideband signal will be intelligible at only one of these two settings, the proper setting depending upon the sideband being transmitted. If the signal is not intelligible after tuning is completed as outlined below, set the PITCH control to the other setting and repeat the tuning procedure.

Tune in the single-sideband signal for maximum loudness with as good intelligibility as possible. (This centers the signal in the i-f passband.) After the signal is properly tuned in, adjust the ANTENNA TRIMMER control for maximum loudness and then very carefully adjust the PITCH control for best intelligibility. If the PITCH control is improperly set, the speech will sound high- or low-pitched, or very distorted. Best intelligibility will be obtained with the PITCH control set very close to its initial setting, usually not more than 1/2 division on either side of the initial setting.

The "1.25 KC" position of the BAND WIDTH control permits reception of modulating frequencies up to about 1500 cycles. For reception of modulating frequencies higher than 1500 cycles, set the BAND WIDTH control to the positions marked "2.5 KC", "5 KC", or "10 KC", depending on the degree of fidelity desired; maximum fidelity is obtained in the "10 KC" position.

4-4. USE OF CRYSTAL CALIBRATOR

The built-in 100 kc crystal calibrator permits accurate dial calibration over any portion of the main and band spread tuning dials by a comparison of the dial calibrations with the marker signals which appear at every multiple of 100 kc on the dial. Any calibration adjustment required can be made by adjustment of the dial pointer from the front of the receiver.

IMPORTANT

Before making any calibration adjustment, it is essential that the main tuning and band spread

A. CALIBRATION OF THE BAND SPREAD DIAL

1. Set the band spread tuning dial at a convenient multiple of 100 kc at the high frequency end of the band in use. For example: 2000 kc on 160M, 4000 kc on 80M, 7300 kc on 40M, 14,400 kc on 20M, 21,500 kc on 15M and 29,800 on 10M. (The band spread tuning dial is calibrated in kc.)
2. Set the main tuning dial to the index dot of the desired amateur band.
3. Set the CW-AM-SSB switch at "CW", the PITCH control at "0", and the CAL OFF-ON switch at "ON".

4. Very carefully adjust the MAIN TUNING control for exact frequency as indicated by "zero beat" and then lock the main tuning dial in place to avoid disturbing its setting. The band spread tuning dial is now accurately calibrated and a "zero beat" should be obtained at every multiple of 100 kc on the band in use. For example, on the 80 meter amateur band, a "zero beat" should be obtained at 3500, 3600, 3700, 3800, 3900, and 4000 kc.
5. The procedure outlined in Steps 1 through 4 above provides average calibration accuracy over the entire frequency range of the band in use. For precise calibration accuracy over a particular section of the band, the procedure is identical except that the band spread dial is set at a multiple of 100 kc near the desired frequency or range of frequencies, instead of at the high end of the band as in Step 1.

B. CALIBRATION OF THE MAIN TUNING DIAL

1. Turn the BAND SPREAD TUNING control counterclockwise until the dial pointer is aligned with the index marks at the high frequency end of the dial. Then lock the band spread dial in place to avoid disturbing its setting.
2. Set the main tuning dial at a convenient multiple of 100 kc near the desired frequency or range of frequencies. (The main tuning dial is calibrated in mc.) To determine the nearest 100 kc multiple, simply remember that 100 kc is equal to one-tenth mc. For example, from 2.0 to 3.0 mc on band 2, the 100 kc multiples are 2.0 mc, 2.1 mc, 2.2 mc, 2.3 mc, etc.
3. Set the CW-AM-SSB switch at "CW", and the PITCH control to "0". Then set the CAL OFF-ON switch at "ON" and very carefully adjust the MAIN TUNING control for a "zero beat". After "zero beat" is obtained, very carefully index the main tuning dial pointer (by means of the small knob directly below the dial) with the nearest 100 kc multiple on the dial.

4-5. USE OF "S" METER

The "S" meter provides a visual means of determining whether or not the receiver is properly tuned, as well as an indication of the relative signal strength. The "S" meter circuit consists of a DC milliammeter connected in series with the plate lead to the 1st RF amplifier tube, the grid of which is controlled by AVC voltage. Since the plate current of this tube varies with the strength of the incoming signal, the meter will indicate relative signal strength. The "S" meter is calibrated in microvolts, "S" units from 1 to 9, and in decibels above S-9 to +40 db. The indications on the "S" meter will be correct only when the SENSITIVITY control is set at "10" (maximum sensitivity), and the AVC switch is set at "ON".

The limitations of the microvolt scale should be fully appreciated before any assumption as to the indicated signal voltages is accepted. The meter has been calibrated in microvolts of signal strength as developed at the antenna input terminals when terminated in a 52-ohm load, on bands 2 and 3. The microvolt scale will be somewhat less accurate under other load conditions and on bands 1, 4, 5, and 6.

4-6. SERVICE OR OPERATING QUESTIONS

For further information concerning operation or servicing of your receiver, contact your Hallicrafters dealer. The Hallicrafters Co. maintains an extensive system of Authorized Service Centers where any required service can be performed promptly and efficiently at a nominal charge. For the location of the one nearest you, consult your local dealer or telephone directory. Make no service shipments to the factory as the Hallicrafters Co. will not accept the responsibility for unauthorized shipments.

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

SECTION 6. PERFORMANCE DATA FOR SERVICE ENGINEERS

MEASUREMENT CONDITIONS

1. POWER SOURCE: 117 volts, 60 cycles AC
2. STANDARD AUDIO
OUTPUT: .5 watt into 500 ohms
3. MODULATION: 30% at 400 cycles
4. DUMMY ANTENNA:
Band 1: RTMA Dummy
Bands 2-6: 47 ohms
5. Oscillator frequency higher than signal frequency on all bands.
6. CONTROL SETTINGS:
Sensitivity - 10 (max)
Volume - 10 (max)
ANL, AVC, and CAL - Off
CW-AM-SSB - AM
Band Width - 5 KC
Band Selector - Band 1
Response - Normal
Main Tuning Dial - gang half open
Band Spread Dial - index marks at high end

** IF REJECTION

BAND	MIN DB	BAND	MIN DB
1	50	4	80
2	80	5	80
3	80	6	80

** Band Spread gang fully open

* IF BANDWIDTH (2075 KC)

BAND WIDTH CONTROL SETTING	6 DB (X2)	60 DB (X1000)
.25 KC	.15 - .25 KC	1.0 KC (Max)
.5 KC	.38 - .57 KC	1.8 KC "
1.25 KC	1.0 - 1.5 KC	3.8 KC "
2.5 KC	2.0 - 3.0 KC	7.9 KC "
5 KC	4.0 - 6.0 KC	15.0 KC "
10 KC	8.0 - 12.0 KC	24.0 KC "

* IF performance thru 1550 KC channel (Band 2) is essentially the same as 2075 KC channel.

AUDIO PERFORMANCE

POWER OUTPUT: 10 watts (max)
 FREQUENCY RESPONSE: ± 2 db from 20 to 20,000 cycles thru Phono input with Response at Hi Fid (500 ohm output)
 HARMONIC DISTORTION: Less than 10% at 10 watt output with 400 cycles at Phono input.
 HUM: Less than 15 uw with Volume at min. and Response at Hi Fid.
 BASS BOOST: Not less than 8 db at 70 cycles.

BAND	FREQ. (MC)	RF SENSITIVITY		IMAGE RATIO (MIN DB)
		MAX. UV FOR .5 WATT OUTPUT	MAX. UV FOR 10 DB SIG/NOISE	
1	.56	8.0	12.0	100
	1.0	6.0	12.0	80
	1.5	5.0	12.0	80
2	1.8	1.0	2.0	100
	2.3	1.0	1.5	100
	2.8	1.0	1.5	90
3	3.2	1.0	1.5	100
	4.1	1.0	1.5	90
	5.1	1.0	1.5	80
4	5.6	1.0	1.5	90
	7.3	1.0	1.5	80
	9.0	1.0	1.5	80
5	10.3	1.0	1.5	90
	13.4	1.0	1.5	80
	16.5	1.0	1.5	70
6	18.7	1.5	2.0	70
	24.0	1.5	2.0	60
	30.0	1.5	2.0	58

SECTION 7. SERVICE DATA

7-1. TECHNICAL SPECIFICATIONS

TUBES: 20 tubes including current regulator, voltage regulator, and rectifier.

SPEAKER OUTPUT: 3.2, 8, and 500 ohms

HEADPHONE OUTPUT: High impedance

ANTENNA INPUT: For single wire or 52-600 ohm balanced or unbalanced line.

PHONO INPUT: High impedance

***POWER SOURCE:**

Model SX-88 . . . 105-125 volts, 50-60 cycles

Model SX-88U . . . 100-250 volts, 25-60 cycles.

POWER CONSUMPTION: 138 watts

RECEPTION: AM, CW, and SSB

AUDIO OUTPUT: 10 watts (maximum)

INTERMEDIATE FREQUENCIES (Double Conversion):

Band 1, 3-6 50 KC & 2075 KC

Band 2 50 KC & 1550 KC

FREQUENCY COVERAGE

Band	Frequency Range	Calibrated Band Spread
1	.535 - 1.7 MC	-
2	1.69 - 3.0 MC	160M
3	2.98 - 5.5 MC	80M
4	5.4 - 10.0 MC	40M
5	9.8 - 18.3 MC	20M
6	17.8 - 33.0 MC	15M, 11-10M

* Provisions are also included for operation from an external DC power source.

7-2. CHASSIS REMOVAL

To remove the chassis from the cabinet, remove two screws at each side of the front panel and four screws at the bottom of the cabinet.

7-3. TUBE and DIAL LAMP REPLACEMENT

To gain access to the tubes and dial lamps, raise the hinged top cover of the cabinet. The tube locations, as well as their functions, are shown in Fig. 10.

7-4. 50 KC IF SYSTEM

Fig. 12 shows the type of coupling used in the 50 kc IF stages. Note that inductive coupling is avoided by careful shielding of the IF coils and signal transfer occurs only through capacitance and resistance. By increasing the value of "C" and "R", the selectivity is made more broad while by decreasing their values, the selectivity is made more sharp. The proper values of "C" and "R" are switched in the circuit by means of the BAND WIDTH control. "R" varies the "Q" of the circuit and "C" varies the coupling. This R-C coupling arrangement affords a more accurate means of selectivity control than that readily obtainable by any other method.

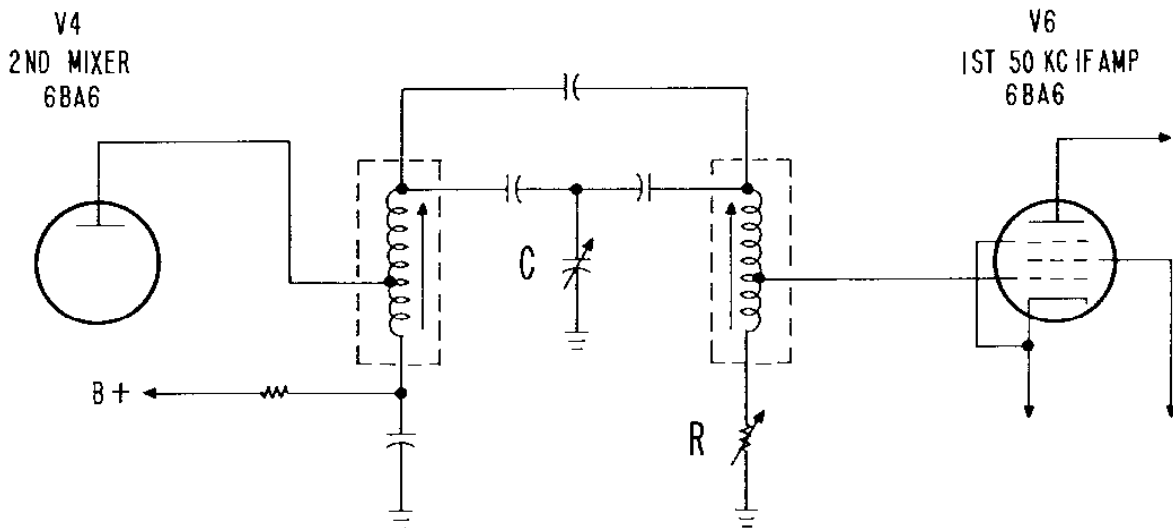


Fig. 12. Portion of 50 KC IF System

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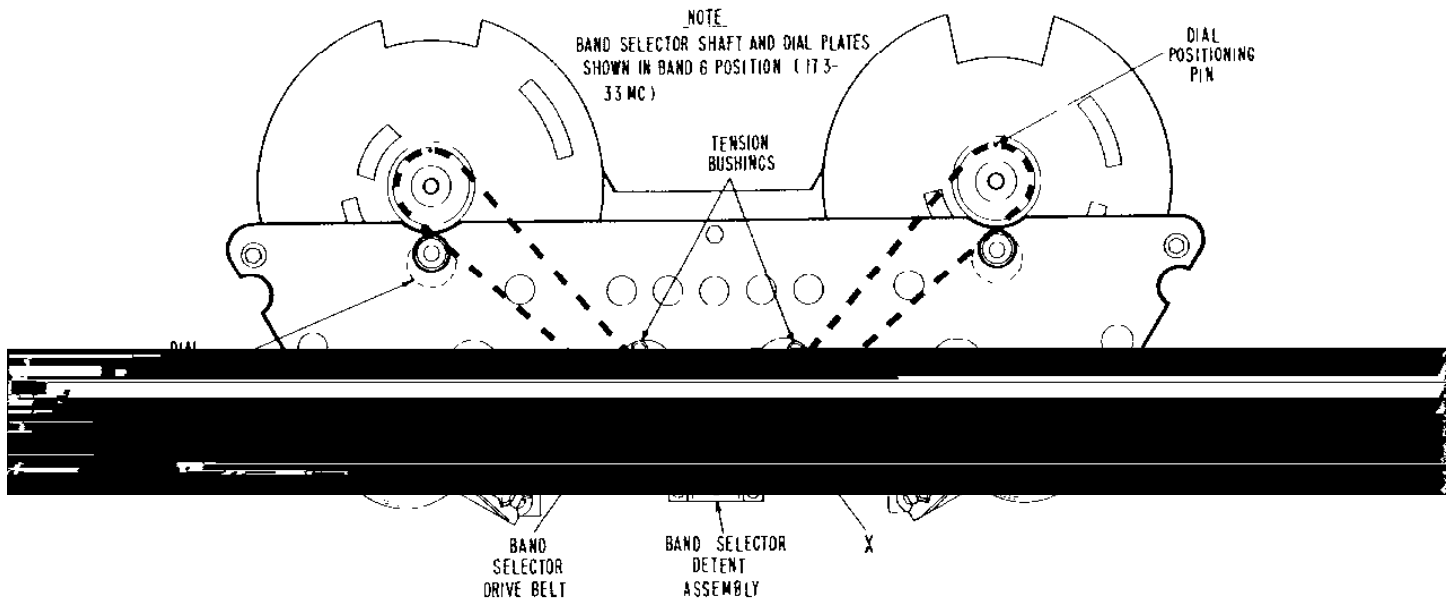


Fig. 13. Front View of Gear Drive Mechanism

99C2777

7-5. BAND SELECTOR DRIVE BELT REPLACEMENT (Refer to Fig. 13)

1. Set Band Selector control to Band 6 (17.8 - 33 mc).
2. Remove chassis from cabinet by removing four screws at bottom of cabinet and two screws at each side of front panel.
3. Remove all front control knobs and PHONES jack mounting nut.
4. Remove front panel from chassis by removing three screws at each side of front panel.
5. Remove dial lamp brackets by removing two self-tapping hex head screws at rear and binding head screw and nut at side.
6. Remove "S" meter by removing two Phillips head screws directly below meter (at the front).
7. Remove toggle switch mounting nuts and then remove switches from gear mechanism.
8. Loosen flexible coupling on Band Selector shaft and slide toward rear on shaft.
9. Loosen couplings on main tuning and band spread gangs and slide toward rear on shaft.
10. Remove gear mechanism from chassis by removing three self-tapping hex head screws marked "X" in Fig. 13.
11. Remove dial pointers by removing retaining clip at front of pointer.
12. Remove large hex nut from front of both dials and then remove dials.

CAUTION: To prevent scratching the dials, position the dial pointer cams downward as shown in Fig. 13 and bend the dials sufficiently when removing to provide clearance between the dial and dial pointer cams.

drive belt up over bushings.

14. Remove Band Selector detent assembly from gear mechanism by removing hex nut at front.
15. Remove drive belt by slipping up over dial plate and rotating dial plate as required to provide clearance for removal.
16. To replace drive belt, reverse sequence used above for removing belt. When replacing belt, position both dial plates so that cutout at outer edge of dial plate is vertical as shown in Fig. 13. This is correct position of dial plates when the Band Selector is set at Band 6.
17. Before tightening the main tuning and band spread couplings in place, fully mesh the main tuning and band spread gangs and rotate the MAIN TUNING and BAND SPREAD TUNING controls fully clockwise.

7-6. "S" METER ADJUSTMENTS

The "S" meter has two adjustments, one mechanical and the other electrical. The mechanical adjustment, accessible by removal of the "h" insignia directly below the meter, has been accurately set at the factory and will normally not require any further adjustment. Adjustment can be made, if required, by turning off the receiver and carefully rotating the adjustment screw until the meter pointer is in line with the right-hand index mark.

The electrical adjustment of the "S" meter is made by carefully turning the "S" METER ADJ control at the rear of the receiver, until the meter pointer is in line with the left-hand index mark. The electrical adjustment should be made with the receiver on, antenna terminals shorted, SENSITIVITY at "10", CW-AM-SSB switch at "AM", AVC switch at "ON", CAL OFF-ON switch at "OFF", REC-STANDBY switch at "REC", and BAND SELECTOR at Band 3. The settings of the remaining controls do not affect the "S" meter reading.

7-7. ADJUSTMENT OF CRYSTAL ADJ CONTROL

The CRYSTAL ADJ control on the top front of the chassis operates a trimmer capacitor connected across the 100 kc calibrating crystal. This trimmer capacitor permits adjustment of the calibrating crystal to exactly 100 kc by comparison with the frequencies transmitted by station WWV. This capacitor has been set at the factory and should normally not require periodic readjustment unless extreme calibration accuracy is desired. If adjustment is required, proceed as outlined below

quency, by means of the CRYSTAL ADJ control, until the crystal calibrator signal "zero beats" with the signal received from WWV. If adjustment is attempted during periods that WWV is modulated, zero beat may be obtained with the modulating frequency rather than the desired carrier frequency

7-8. CONTROL KNOB POSITIONING

SENSITIVITY "0" at full counterclockwise rotation
BAND WIDTH "10 KC" at full counterclockwise rotation
MAIN TUNING "0" at full clockwise rotation
BAND SELECTOR As required by flat on shaft
ANTENNA TRIMMER "5" to right of "0" with antenna trimmer variable capacitor fully meshed
RESPONSE BASS BOOST at full counterclockwise rotation
VOLUME Align "0" with index line at full counterclockwise rotation
LOCK As shown in Fig. 4 at full clockwise rotation
PITCH Tune in a steady, unmodulated carrier with the CW-AM-SSB switch at "AM", AVC switch at "ON", and the BAND WIDTH control at ".25 KC". (If desired, the built-in crystal calibrator may be used as the carrier source.) Then set the CW-AM-SSB switch at "CW", adjust the PITCH control for "zero beat", and set the knob at "0" with approx 3/32" clearance between the front panel and rear of knob.

7-9. SERVICING OF GEAR DRIVE TUNING MECHANISM

The gear drive tuning mechanism in your receiver is precision built to Hallicrafters most exacting standards. If not tampered with, this mechanism will provide long, trouble free performance. No attempt should be made to service this mechanism in the field other than to replace the band selector drive belt (Section 7.5). If service is required, consult the Hallicrafters dealer, distributor, or Authorized Service Center in your locality. Make no service shipments to the factory as the Hallicrafters Company will not accept the responsibility for unauthorized shipments. Removal of the mechanism from the receiver can be accomplished by following Steps 1 through 10 of Section 7.5. After reassembling the mechanism in the receiver, synchronize the tuning mechanism with the gangs as outlined in Step 17 of Section 7.5.

SERVICE PARTS LISTS

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
CAPACITORS			CAPACITORS (Cont)		
C-1	Tuning gang, 7 section (Main Tuning)	48D314	C-94	1000 mmfd. 5%, N2200 ± 500 PPM, ceramic	47B441
C-2	Tuning gang, 12 section (Bandspread Tuning)	48D315	C-95	2200 mmfd. 5%, 500 V., silver mica	47X30E222J
C-3	1000 mmfd. 5%, 500 V., silver mica	47X20D102J	C-96,97,98	443 mmfd. 2%, N330, 500 V., ceramic	47B407
C-4	4-50 mmfd., variable air (Antenna Trimmer)	48B313	C-100,101	3.9 mmfd. 10%, N1500 ±250 PPM; ceramic	47D20V039C
R1 R83-C f P175-F	C-5,17,36,87,128,132	46BR473L2	C-103,104,106	310 mmfd. 2%, N80, 500 V.; ceramic	47X45LG311G
	C-6	46BR103L6	C-105	68 mmfd. 1%, N150, 500 V.; ceramic	47X32PG680F
	C-7,19,40,41,46,48,49,56	46BR473L6	C-108	5.1 mmfd. ± .5 mmfd., N750, 500 V., ceramic	47X20U1051D
	146	47A242		ceramic	47X35CG141F
C-9	15 mmfd. 10%, N750, 500 V., ceramic	47X20UK150K	C-112	10 mmfd. 10%, N470, 500 V., ceramic	47X20TH100F
C-10,13	3 3 mmfd. 10%, 500 V., bakelite	47B403-5	C-113	12 mmfd. 10%, N470, 500 V.; ceramic	47X20TH120K
C-11-12	Trimmer assembly, two section, 5-50 mmfd. each section	44C436	C-116	1.0 mmfd. 10%, N1500 ± 250 PPM, 500 V.; ceramic	47D20V010B
C-14-15-16, 26-27-28	Trimmer assembly, three section; 5-50 mmfd. each section	44C435	C-118	1.0 mmfd. 10%, N750, 500 V., ceramic	47X20UJ010B
C-18,37,38, 39,88,121, 122,144	.01 mfd. +80-20%, 450 V.; ceramic disc	47A224	C-119	.047 mfd. 10%, 600 V.; molded paper	46BR473E6
C-20	15 mmfd. 10%, N750, 500 V., ceramic	47X20UJ150K	C-120	10 mfd. 10%, 150 V., electrolytic	45A097
C-21	3.3 mmfd. ± .25 mmfd., N750, 500 V., ceramic	47X20UJ033C	C-123A-B-C-D	30 mfd. 450 V., 10 mfd. 450 V., 20 mfd. 25 V., electrolytic	45A041
C-22,147	15 mmfd. 10%, NPO, 500 V.; ceramic	47X20CG150K	C-126,137	.022 mfd. 20%, 200 V., molded paper	46BR223L2
C-23-25-29	Trimmer assembly, three section; 2-18 mmfd., 2-18 mmfd., 3-30 mmfd.	44C440	C-127	68 mmfd. 10%, NPO, 500 V.; ceramic	47X25CK680K
C-24	20 mmfd. 10%, NPO, 500 V., ceramic	47X20CG200K	C-129,133	.022 mfd. 20%, 600 V., molded paper	46BR223L6
SI PI	C-31,117	47X20UJ101K	C-130	220 mmfd. 10%, 500 V., silver mica	47X20D221K
	C-32,33,35	47X30B472K	C-131	560 mmfd. 5%, 500 V., silver mica	47X20E561J
	C-34	47B403-4	C-134	1500 mmfd. 10%, 500 V.; silver mica	47X30D152K
	C-42	47CA20A101K	C-135	.22 mfd. 20%, 600 V., molded paper	46BR224L6
	C-44,46,54, 56,64,66,79, 81,84	47X20E391J	C-136	470 mmfd. 10%, 500 V., mica	47X20A471K
	C-45,55,80	47B403-3	C-138	10 mfd. 50 V., electrolytic	45B211
	C-47,85,124, 125	47CA20A221K	C-139	.033 mfd. 20%, 600 V.; molded paper	46BR333L6
	C-48,49,58, 59,68,69, 74,75	46BR332E4	C-141	680 mmfd. 10%, 500 V.; mica	47X20A681K
	C-50,60,70,72	46BR473E2	RESISTORS		
	C-51,61,71,73	46BR103E4	R-1,2,73,100	470,000 ohms 10%, 1/2 W.	23X20X474K
	C-52,63,77, 82	46BR224L2	R-3,11	22 ohms 10%, 1/2 W	23X20X220K
	C-65	47B403-0	R-4,12,102	100 ohms 10%, 1/2 W.	23X20X101K
	C-89	44B437	R-5	68,000 ohms 10%, 1 W	23X30X683K
	C-90	47X20B151K	R-6,77,80	10 ohms 10%, 1/2 W	23X20X100K
	C-92	47D20W047C	R-7,16,28, 34,49,58, 67,93,99, 103,104	2200 ohms 10%, 1/2 W	23X20X222K
	C-93,99,102, 107,111,114	48B316	R-8	33 ohms 10%, 1/2 W.	23X20X330K
			R-9	500 ohms, variable ("S" Meter Adj.)	25C022
			R-10,22,23, 24,25,26,27, 75,95	100,000 ohms 10%, 1/2 W.	23X20X104K
			R-13	18,000 ohms 10%, 1/2W	23X20X183K
			R-14,79	1000 ohms 10%, 1/2W	23X20X102K

N neg temp coef

NPO - zero temp. coef

PPM parts/million/°C

SERVICE PARTS LISTS (Cont.)

Schematic Symbol	Description	Hallcrafters Part Number	Schematic Symbol	Description	Hallcrafters Part Number
TUBES AND DIAL LAMPS			MISCELLANEOUS (Cont)		
V-1,10	6CB6: 1st RF Amp, AVC Amp	90X6CB6		Grommet, rubber, "S" meter	16B362
V-2,4,6,7,8 16,20	6BA6: 2nd RF Amp, 2nd Mixer, 1st 50 KC IF Amp, 2nd 50 KC IF Amp, 3rd 50 KC IF Amp, BFO Amp, Xtal Cal.	90X6BA6		Grommet, rubber, tuning gang rear support	16A180
V-3	6U8: 1st Oscillator-Mixer	90X6U8		Holder, fuse	6A451
V-5	12AT7: 2nd conv. oscillator	90X12AT7		Insignia, "h"	7B485
V-9	6AL5: Detector and ANL	90X6AL5		Knob assembly, MAIN TUNING and BAND SPREAD TUNING	41B25314
V-11	12AU7: AVC Rect. and 50 KC Cath. Fol.	90X12AU7		Calibrated plate (0-100)	83B454
V-12	12AX7: Audio Amp and Phase Inv.	90X12AX7		Knob, phenolic	15B693
V-13,14	6V6GT: Audio Output	90X6V6GT		Spring	75B294
V-15	6C4: BFO	90X6C4		Button plug	17B138
V-17	5U4G Rectifier	90X5U4G		Hub	77B717
V-18	OD3: Voltage Regulator	90XOD3		Knob, ANTENNA TRIMMER	15A061
V-19	4H4: Current Regulator	90X4H4		Knob, BAND SELECTOR	15C743
LM-1,2	Lamp, pilot; type 44	39A003		Knob, BAND WIDTH	15B679
LM-3	Lamp, pilot; type 47	39A004		Knob, LOCK	15B699
				Knob, PITCH	15B677
				Knob, pointer set	15B676
				Knob, RESPONSE	15B678
				Knob, SENSITIVITY and VOLUME	15A097
	MISCELLANEOUS		NE-2	Lamp, neon glow, GE type NE2, 1/25 W., 65V AC starting	39A012
	Belt, drive; Band Selector	14B374	PL-1	Line cord and plug	87A3644
	Cabinet, complete	41X25313		Logging scale, tuning dial	83C475
	Clip, gang shield; top section	76B148		Lock, line cord	76A397
	Clip, gang shield; bottom section	76B149	M-1	Meter, "S", 0-5 ma	82C248
	Coupling flexible (for Band Selector shaft)			Panel, front	68D241
	3-5/8" overall	29B222		Retainer, tube, V-17	76A1032
	3-1/8" overall	29B224		Shaft, extension, Antenna Trimmer	74B635
X-1	Crystal, 1500 KC	19B1890		Shaft, Band Selector	
X-2	Crystal, 2125 KC	19B1891		10-3/4" long	74B636
X-3	Crystal, 100 KC	19B1886		11-1/4" long	74B702
	Detent, Band Selector switch	62C073		Snap-in tri-mount	5A006
	Dial, band spread tuning	83D466		Terminal board, stealite, 3 post type lugs (used as tie strip for oscillator padders)	41X25346
	Dial, main tuning	83D470		Terminal strip, antenna (A1-A2-G)	88B935
	Dial pointer assembly	41C25327		Terminal strip, speaker (G-3.2-8-500)	88B936
	Escutcheon, front panel	7D466			
	Foot, mtg.; rubber	16A029			
F-1	Fuse, 3 amp 250V; type 3AG	39A301			
	Gear drive assembly, complete	41X25311			
	Glass, band spread tuning dial	22B413			
	Glass, main tuning dial	22B412			

