hallicrafters

OPERATING AND SERVICE INSTRUCTIONS

COMMUNICATIONS RECEIVER MODEL SX-101A

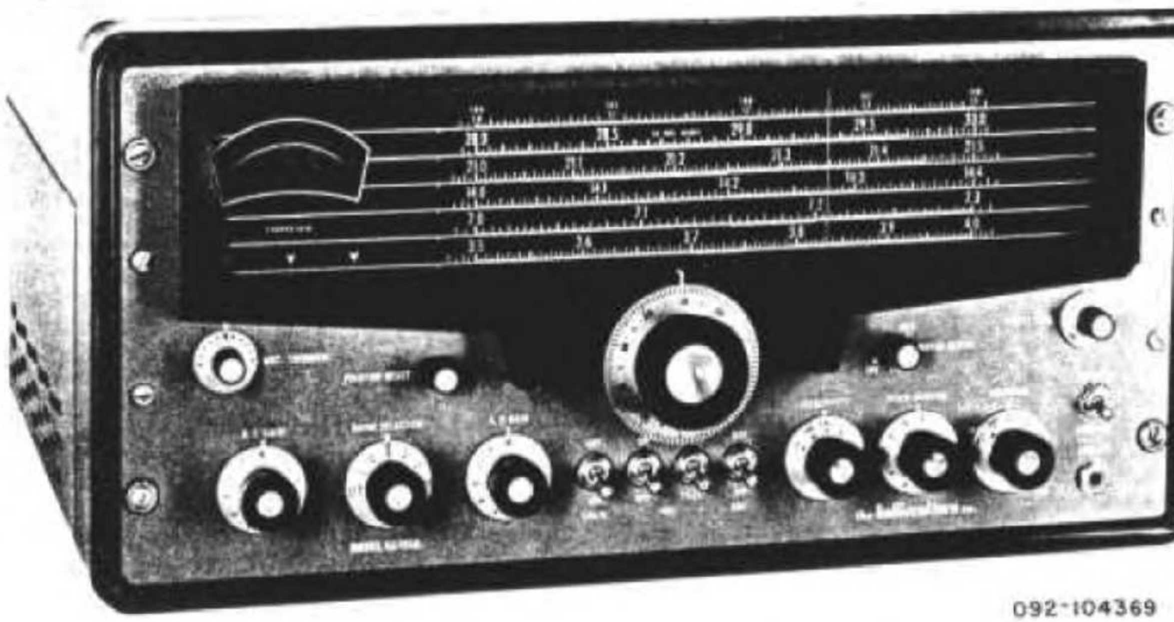

Figure 1. Hallicrafters SX-101A Receiver

SECTION I
GENERAL

Your new Hallicrafters SX-101A Selectable Sideband Receiver is precision built to bring you the finest in radio reception. This fifteen tube (including rectifier and regulator) dual conversion superheterodyne receiver tunes the Converter (30.5 MC to 34.5 MC), 80, 40, 20, 15 and 10 meter bands, plus several of the MARS frequencies on a large 10-1/2 inch slide-rule type dial. For operating convenience, only the band in use is illuminated. You'll hear many signals which would not be readable on most other receivers. The receiver provides for the reception of CW, AM, and single-sideband signals on all bands, the upper or lower sideband being readily selectable by means of a front panel control. This selectable sideband feature not only greatly simplifies tuning of single-sideband signals but is also useful in eliminating heterodyne interference when receiving AM signals.

Unlike the ordinary dual-conversion receiver, your SX 101A receiver employs dual conversion on all bands. As a result, images are practically non-existent. A high order of selectivity is made possible by the use of an adjustable 50.75 KC second IF with four high-Q, permeability-tuned circuits. Receiver selectivity is variable in five steps from 500 cycles to 5 KC at 6 DB down and from 5 to 20 KC at 60 DB down.

A tuned RF stage assures maximum sensitivity and a high signal-to-noise ratio for outstanding reception of weak and distant signals. An antenna trimmer, adjustable from the front panel, permits peaking of the RF stage to compensate for loading effects of various antennas. A notch filter circuit allows rejection of an extremely narrow portion of the IF passband. With the notch filter, an interfering signal can easily be "notched out". The position and the degree of notch rejection are adjustable from the front panel.

Outstanding frequency stability is achieved by the use of concentric air trimmers and ceramic coil forms in the 1st conversion oscillator, extensive temperature compensation, voltage regulation of all oscillators, and the use of a crystal-controlled 2nd conversion oscillator.

Tuning is accomplished by a precision gear drive tuning mechanism to insure extremely close calibration and accurate resetability. Smooth flywheel tuning affords maximum traverse speed and operating ease. The tunable portion of the receiver is designed to spread each band over most of the dial, for easy and accurate tuning. Dial graduations are provided for every 5 KC on the 80, 40, 20, and 15 meter bands. On the 10 meter band there is a dial graduation for every 25 kilocycles and every 50 KC on the converter band. A built-in 100 KC crystal calibrator provides marker signals at every 100 KC on the dial for checking calibration accuracy. A trimmer capacitor, accessible from the top of the chassis, permits adjustment of the calibrating oscillator to exactly 100 KC by comparison with the frequency transmitted by station WWV on ten megacycles. Band 7 of this receiver is for tuning in WWV for the purpose of zero-beating the 100 KC crystal calibrator.

A product detector is incorporated in the receiver for detection of SSB and CW signals. When the conventional diode detector is used for AM reception, the product detector tube serves as an additional audio amplifier.

An automatic series noise limiter circuit, controlled by a switch on the front panel, effectively reduces interference from electrical equipment, ignition and other forms of pulse type noise. The noise limiter circuit is effective for all types of reception.

Selection of either fast or slow AVC time constants is made by a switch mounted on the front panel. This feature provides a means of adjusting the receiver response time to suit varying band conditions and various types of transmission. The attack time in either switch position is suitably fast to provide AVC action on SSB signals.

An "S" meter is used 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 S9 to +80 DB. The "S" meter is operative when AVC is turned off, and may be used as a tuning indicator.

The RECEIVE-STANDBY switch on the front panel silences the receiver but leaves the heater and plate 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 switching from the front panel.

Audio output connections include terminals for a 3.2-ohm speaker and a 500/600-ohm output for line or speaker. A front panel jack for headphones is also provided.

Band 1 (Converter) tunes from 30.5 to 34.5 MC and is calibrated directly in frequency for both the 2 and 6 meter bands. It is intended to be used as a variable IF for broad band crystal controlled converters having an output frequency from 30.5 to 34.5 MC.

A separate converter input is provided so that the regular low frequency antenna may remain connected at all times.

Converter power is available at the accessory socket - See paragraph 3-7, "CONVERTER OPERATION".

Band 7 on the receiver is used to check and adjust the 100 KC calibration oscillator. This is accomplished by tuning in the ten-megacycle WWV signal and comparing it with the calibration oscillator signal.

A heating element has been incorporated in the receiver to provide optimum performance by reducing the effects of moisture and humidity.

Electrically, the heating element and oscillator filament transformer are wired across the AC line. Thus, both will be on at all times while the receiver is connected to a 117 VAC outlet, even when the RESPONSE control is in the POWER-OFF position.

NOTE

IT IS IMPORTANT THAT THE RECEIVER BE PLUGGED IN A LIVE OUTLET AT ALL TIMES IN ORDER TO OBTAIN OPTIMUM RESULTS FROM THE HEATING ELEMENT. THE EXCELLENT DESIGN INCORPORATED IN THIS SET WILL BE REALIZED ONLY AFTER IT HAS BEEN PLUGGED INTO SUCH AN OUTLET A MINIMUM OF 24 HOURS.

SECTION II
SPECIFICATIONS

RECEPTION........... AM, CW and SSB

INTERMEDIATE FREQUENCIES.. (Double Conversion): 50.75 KC and 1650 KC

FREQUENCY COVERAGE

BAND	CALIBRATED RANGE
Converter	30.5 - 34.5 MC (Dial scale marked 50-54 MC for 6 meters and 144-148 MC for 2 meters)
80 Meters	3.5 - 4.0 MC
40 Meters	7.0 - 7.3 MC
20 Meters	14.0 - 14.4 MC
15 Meters	21.0 - 21.5 MC
10 Meters	28.0 - 30.0 MC
WWV (10 MC)	

SENSITIVITY .... Less than 1 microvolt for a 10 DB signal to noise ratio except for converter band which is 4 microvolts.

SELECTIVITY .... Five position switch providing .5, 1, 2, 3 and 5 KC selectivity at 6 DB down.

POWER SOURCE .... 105 - 125 volts, 50/60 cycles

POWER CONSUMPTION. 115 watts

NUMBER OF TUBES.... 15 (including voltage regulator and rectifier).

SPEAKER OUTPUT..... 3.2 and 500 (See Section 3-5). Rear chassis mounted 3 contact screw type terminal strip.

HEADPHONE OUTPUT.... 50 to 5000 ohms (See Section 3-6). Panel mounted phone jack accepts standard 1/4" phone plug.

ANTENNA INPUT...... 50 - 70 Ohms (See Section 3-3). Rear chassis mounted 3 contact screw type terminal strip for balanced or unbalanced lines, and an SO-239 receptacle accepting an Amphenol 83-1SP connector for coaxial inputs.

CONVERTOR INPUT... 50 - 70 Ohms. Rear chassis mounted socket accepts standard R.C.A. type phono plug.

ACCESSORY SOCKET . . . Control and auxiliary power. Rear chassis mounted Octal socket accepts standard 8P Octal plug (supplied).

DIMENSIONS (Overall) . . 20" wide, 10-1/2" high, 16" deep.
SHIPPING WEIGHT . . . . . Approximately 74 LB.
NET WEIGHT . . . . Approximately 70 LB.

SECTION III
INSTALLATION

3-1. 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.

3-2. 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.

3-3. ANTENNAS.

The RF input of the receiver is designed for operation from either a single-wire antenna, or a half-wave doublet or other tuned antenna. The design of the input circuit is versatile to permit the use of transmission lines having an impedance up to 600 ohms. Optimum matching will be effective however, when using transmission line having an impedance in the range of 50 to 70 ohms. Antenna connections are made to a three-terminal strip at the rear of the receiver marked "A1", "A2", and "G". An AN type SO-239 connector for coaxial cable installations is also provided.

3-3-1. SINGLE WIRE ANTENNA.

The simplest antenna and one which will provide satisfactory results throughout all bands is a conventional single-wire antenna. (See Fig. 2.) Simply attach one end of this wire to terminal "A1", connect the jumper link between terminals "A2" and "G", and then run the wire about the room in any convenient manner. If the receiver is operated in a steel constructed building or where receiving conditions are exceptionally poor, an outside antenna, 50 to 100 feet long may be necessary. The outside antenna should be erected as high as possible and kept free from surrounding objects. In some locations, reception may be improved by connecting a ground wire (ordinary copper wire) from terminal "G" to a cold water pipe. While the use of an outside ground rod installed in accordance with Insurance Underwriter's Laboratories requirements is adequate protection against lightning, we strongly recommend an additional connection to the nearest cold water pipe to eliminate any shock hazard.

3-3-2. HALF-WAVE DOUBLET ANTENNA.

For top performance on a particular band, the use of a half-wave doublet or other type of antenna employing a 50 to 70 ohm transmission line is recommended. A typical doublet antenna installation is shown in Fig. 3.

The doublet antenna is directional and should be erected with its entire length facing a desired station for maximum signal pickup.

The doublet antenna may be fed with either a balanced or unbalanced transmission line. When a balanced line such as "twin-lead" or a twisted pair is used, the line connects to terminals "A1" and "A2" and the jumper link between "A2" and "G" is disconnected (See Fig. 3). When using an unbalanced line such as coaxial cable, the inner conductor connects to terminal "A1", the outer metal braid to terminal "A2", and the jumper link connects between terminals "A2", and "G". A ground wire may improve reception when using an unbalanced type line.

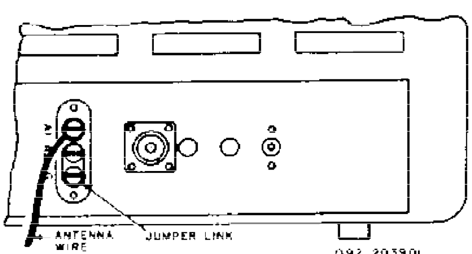

Figure 2. Single Wire Antenna

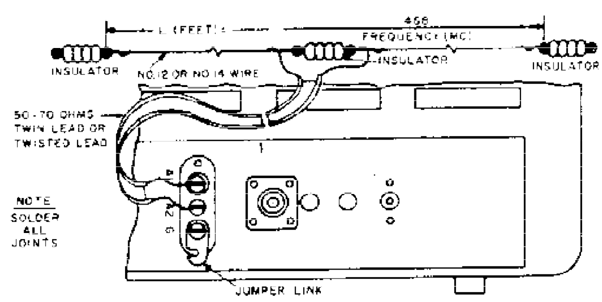

Figure 3. Doublet Antenna Using Twin-Lead Transmission Line

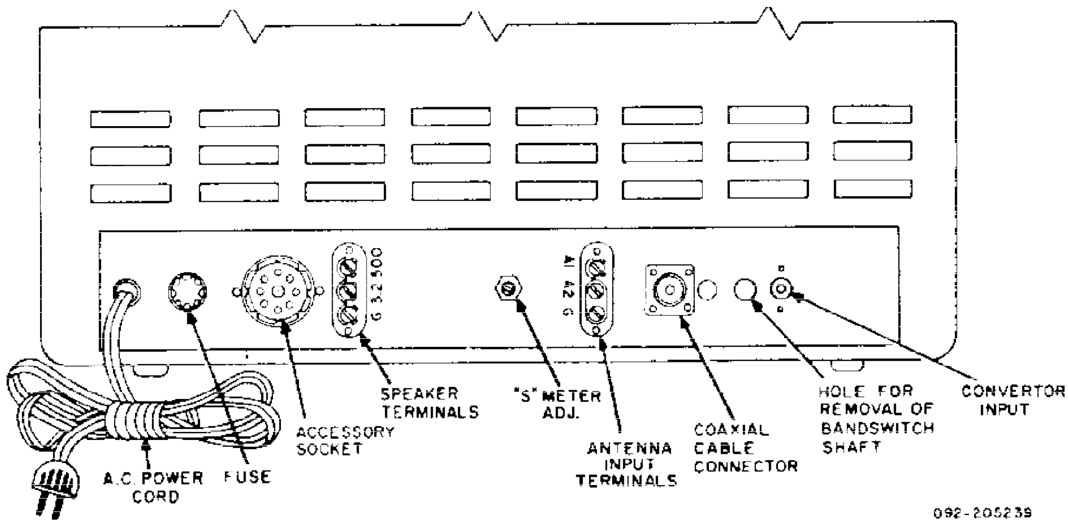

Figure 4. Rear View of Receiver

The doublet antenna provides optimum performance only for the band for which it is cut. Therefore, when using such a doublet antenna, it may be desirable for reception on other bands 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 receiving antennas and antenna matching schemes, 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.

3-4. POWER SOURCE.

The receiver is designed to operate on 105 to 125 volt, 50/60 cycle AC current. Power consumption is 115 watts.

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

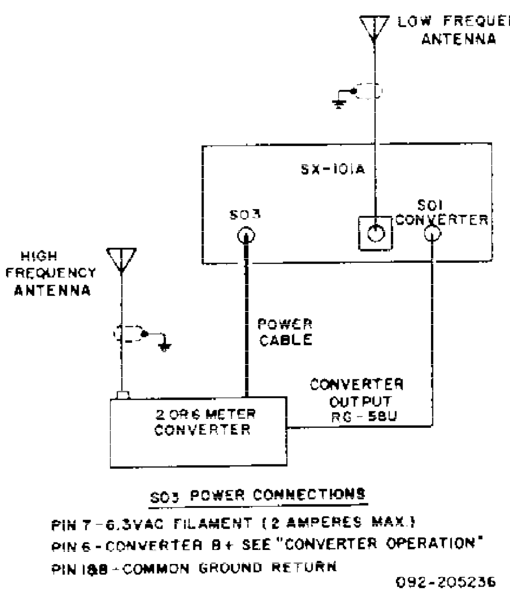

Figure 5. Converter Hookup

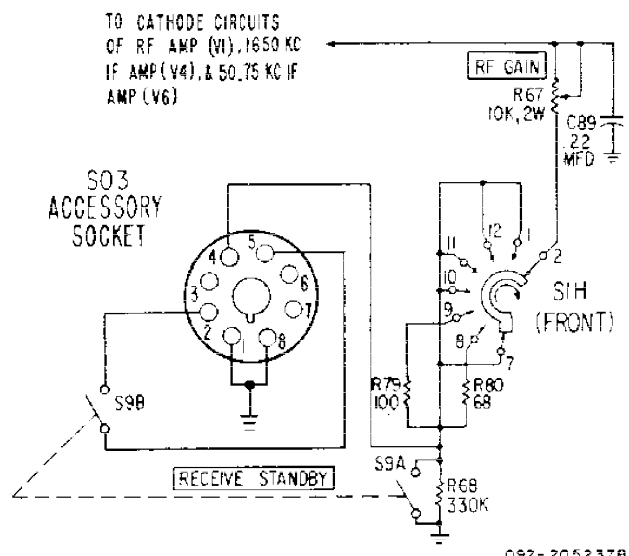

Figure 6. Simplified Sensitivity and Receive-Standby Circuits

3-5. SPEAKER.

A three-terminal strip, marked "G", "3. 2" and "500", is provided at the rear of the receiver for connecting the external speaker that is required with the receiver. (See Fig. 4.) Any permanent magnet speaker with a 3. 2-ohm voice coil can be used by simply connecting the two leads from the speaker voice coil to the terminals marked "3. 2" and "G". If it is desired to use a speaker with a voice coil impedance other than 3. 2 ohms, a matching transformer should be employed to insure optimum performance. The transformer should be mounted on or near the speaker, and should have a 5-watt power rating, a 500-ohm primary impedance, and a secondary impedance to match the impedance of the speaker voice coil. Connect the primary of the transformer to the terminals marked "500" and "G" and the secondary to the speaker voice coil terminals.

The Hallicrafters R-46B and R-47 speakers are both designed for use with your receiver. Either speaker may be connected to the terminals marked "3. 2" and "G".

3-6. HEADPHONES.

The headphone jack, marked "PHONES", is located on the front panel of the receiver and is so wired that the 3. 2 ohm speaker terminal is automatically silenced when the headphones are inserted. The headphone output impedance is not critical, and any commercial low-impedance headphones ranging from 50 ohms to 5000 ohms will provide satisfactory performance. The 500 ohm speaker tap is connected at all times.

3-7. CONVERTER OPERATION.

Band 1 (Converter) is designed for use with broad band crystal controlled 2 or 6 meter converters having an output frequency from 30. 5 to 34. 5 MC. The SX-101A receiver is used to tune to the desired signal in the 30. 5 to 34. 5 MC converter passband.

A separate converter input is supplied so that the regular low frequency antenna may remain connected at all times. Also, filament voltage is applied to the converter whenever the receiver power switch is on, providing instantaneous converter operation.

Generally speaking, receiver operation will be the same as on all other bands; however, with some high gain converters it may be found desirable to reduce the receiver sensitivity by rotating the "RF GAIN" control counterclockwise on very strong signals. See Fig. 5 for typical converter installation and connection.

Converter power is available at the accessory socket (6. 3 VAC at 2 amps maximum). B+ voltage is available through a 2000 ohm current limiting resistor. With the bandswitch in positions other than "CONV" a 100K ohm resistor is connected in series with the converter B+ lead maintaining a small amount of standby plate voltage for the converter tubes. For continuous operation of converters requiring in excess of 30 MA, a separate power supply is recommended. B+ will be approximately 180 volts with a 30 MA load.

3-8. RELAY AND TRANSMITTER SWITCHING.

One half of the dpst RECEIVE-STANDBY switch on the front panel connects to pins 2 and 5 of the ACCESSORY SOCKET at the rear of the receiver, and is available for transmitter switching. (See Fig. 6.) This half of the switch is in the open position when the RECEIVE-STANDBY switch is set at "STANDBY" and closed when set at "RECEIVE".

3-9. REMOTE RECEIVE-STANDBY SWITCH.

The receiver may be disabled from a remote location by connecting a remote spst switch between pins 1 and 4 of the plug located in the ACCESSORY SOCKET at the rear of the receiver. (See Figs. 4 and 6.) To operate the receiver with the remote switch, the RECEIVE-STANDBY switch on the front panel must be left at "STANDBY".

SECTION IV

FUNCTION OF OPERATING CONTROLS

4-1. RF GAIN CONTROL.

The RF GAIN control varies the gain of the RF amplifier, 1650 KC IF amplifier, and the 6DC6 50. 75 KC IF amplifier stage. Maximum sensitivity is obtained with the control set at "10" (fully clockwise). In this position, the tubes being controlled are operated at maximum gain with minimum cathode bias. As the control is rotated counterclockwise, the bias on the tubes increases with a resultant decrease in gain.

4-2. BAND SELECTOR CONTROL.

The BAND SELECTOR control operates the band switch to place the proper set of coils and capacitors into the circuit to cover the desired band. The band covered by each position of the BAND SELECTOR control is indicated directly on the control. The first six positions are the Converter, 80, 40, 20, 15 and 10 meter bands, respectively. The seventh position tunes in the 10 MC WWV signal, and is indicated on the 10 meter scale with a special marking. This band is available for calibrating the 100 KC crystal calibrator.

4-3. ANTENNA TRIMMER CONTROL.

The ANT. TRIMMER control operates a variable capacitor connected across the secondary of the antenna coil of the band in use. This capacitor adjustment compensates for loading effects of various types of antenna installations. The control is adjusted for maximum signal after the tuning control is adjusted to the desired frequency. Once adjusted, the ANT. TRIMMER control usually requires no further adjustment until the BAND SELECTOR control is operated to select another band.

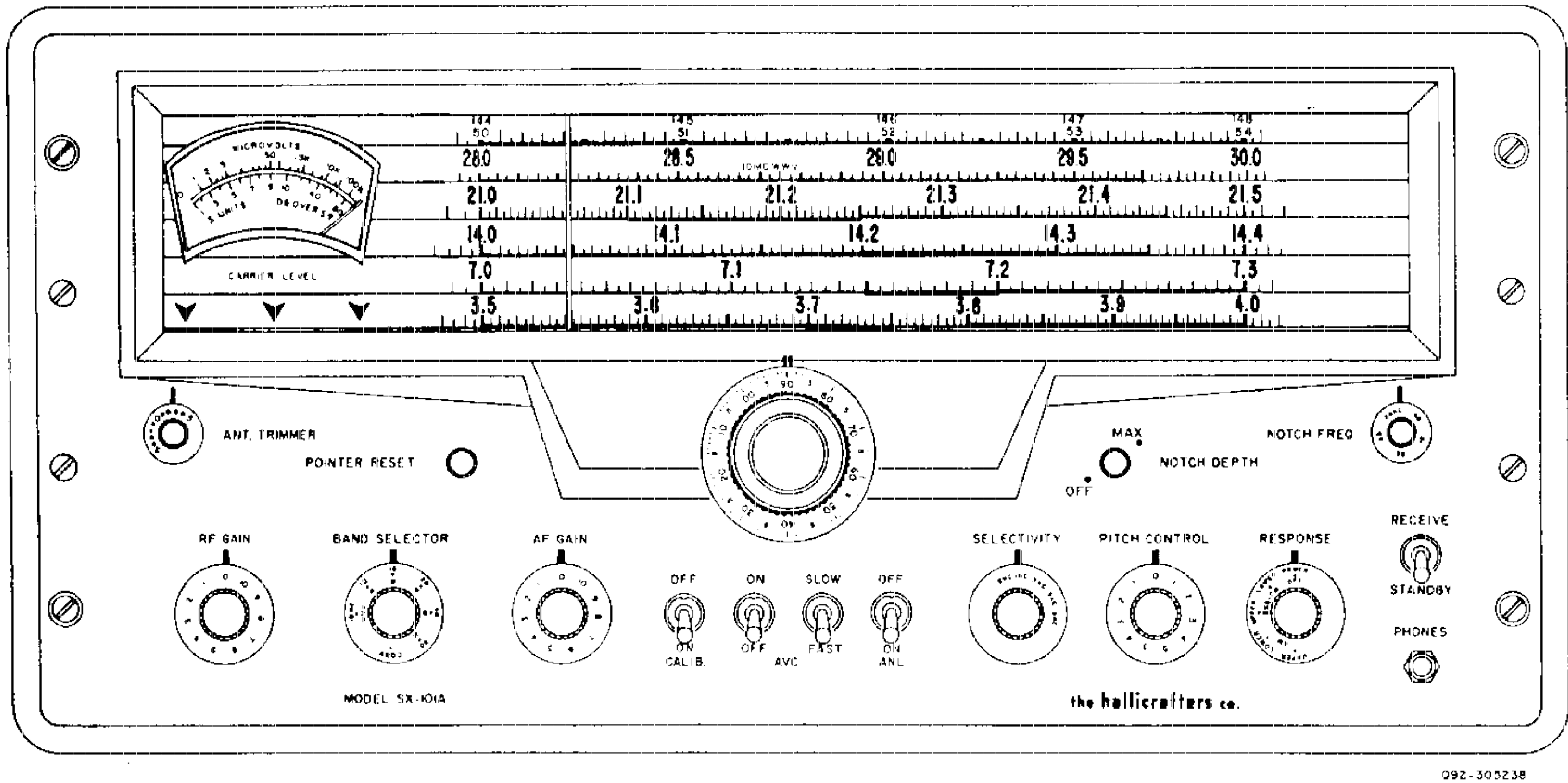

Figure 7. Operating Controls

4-4. AF GAIN CONTROL.

The AF GAIN control adjusts the audio level at the speaker terminals and "PHONES" jack. Clockwise rotation of the control increases the signal applied to the grid of the audio amplifier tube, thus increasing receiver volume; counterclockwise rotation decreases volume. In some cases when receiving CW or SSB signals, it may be advantageous to advance the AF GAIN control one-half to three-quarters clockwise, and control receiver volume with the RF GAIN control.

4-5. AVC SWITCH.

The AVC switch, when set at "ON", places the AVC circuit in operation to maintain the output level of the receiver constant regardless of normal input-signal variations. AVC voltage is applied to the RF amplifier stage, 1st mixer, the 1650 KC IF amplifier stage, and the "S" meter stage.

4-6. FAST-SLOW AVC SWITCH.

The FAST-SLOW AVC switch permits selection of either of two time constants for the AVC system. The "SLOW" position provides a release duration approximately 10 times as long as that in "FAST".

4-7. AUTOMATIC NOISE LIMITER SWITCH.

This switch, when set at "ON", places the automatic series noise limiter circuit in operation to reduce pulse type noises such as ignition noise and electrical interference. The limiter circuit is effective on all types of reception, allowing the signal to pass through the receiver unaffected, but making the receiver inoperative for noise amplitudes greater than those of the signal.

The noise limiter circuit "chops" noise peaks received at the detector by means of a biased diode which becomes non-conducting above a predetermined signal level. When the limiter circuit is in operation, the audio output of the detector must pass through the limiter diode to the grid of the audio amplifier. The limiter diode normally acts as a conductor for the audio signal as long as the diode plate is positive with respect to its cathode. When a noise peak is higher in amplitude than the signal, it instantaneously swings the cathode positive with respect to the plate, 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, but yet low enough to limit the noise peaks effectively.

This type of efficient noise limiter circuit greatly reduces "listening fatigue" which can accompany long periods of reception.

4-8. SELECTIVITY CONTROL.

The SELECTIVITY control is used to vary the selectivity of the receiver to fit receiving conditions. Five degrees of selectivity are available, ranging from 500 cycles, for CW reception under crowded band conditions, to 5 kilocycles for maximum fidelity when band conditions permit. The five selectivity positions are indicated on the SELECTIVITY control and indicate receiver selectivity at 6 DB down (See Fig. 8).

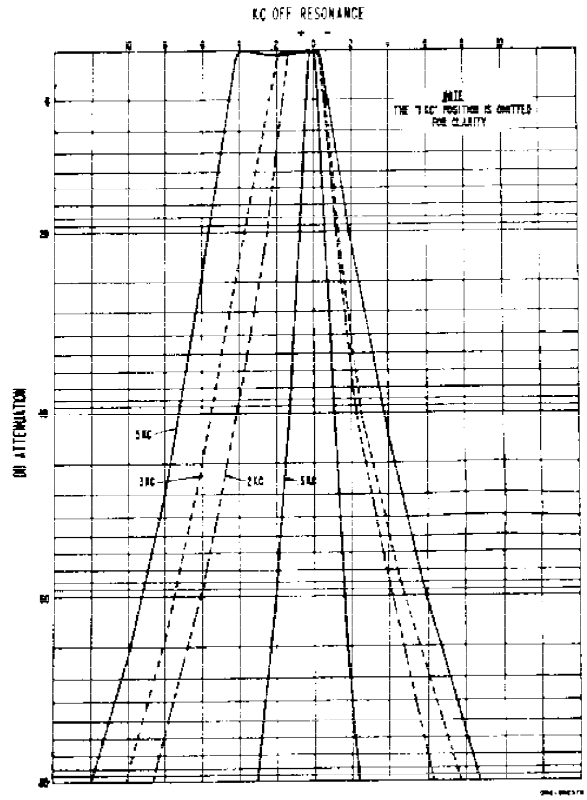

Figure 8. IF Selectivity Curves

As mentioned above, and when conditions permit, the SELECTIVITY control is normally set at 5 KC, the position affording broadest selectivity. Selectivity may be progressively increased and passband decreased by turning the control to the positions marked "3 KC", "2 KC", "1 KC", and ".5 KC". For reception of the crowded amateur bands, it is generally advisable to sacrifice some fidelity for greater selectivity, since the added selectivity reduces both adjacent-channel interference and background noise by attenuating the higher audio frequencies. Too much selectivity on AM signals, however, will attenuate the high audio frequencies to such an extent that the signal may become unintelligible as a result of excessive sideband cutting. When receiving CW signals, the sharpest selectivity position may be used without the loss of intelligibility experienced in AM reception.

4-9. "T" NOTCH FILTER.

The notch filter circuit provides a means of eliminating or reducing the interfering effect of certain types of heterodynes or CW signals. To obtain maximum results from this feature of your receiver the use of the two controls associated with the notch filter circuit are fully explained in the following.

GENERAL

The manner in which the notch filter will affect the IF selectivity of the receiver is illustrated in Fig. 9. The filter will suppress an extremely narrow band of frequencies within the IF bandpass range of the receiver. The effectiveness of this notch is many times greater than the notch of a quartz crystal filter at 400

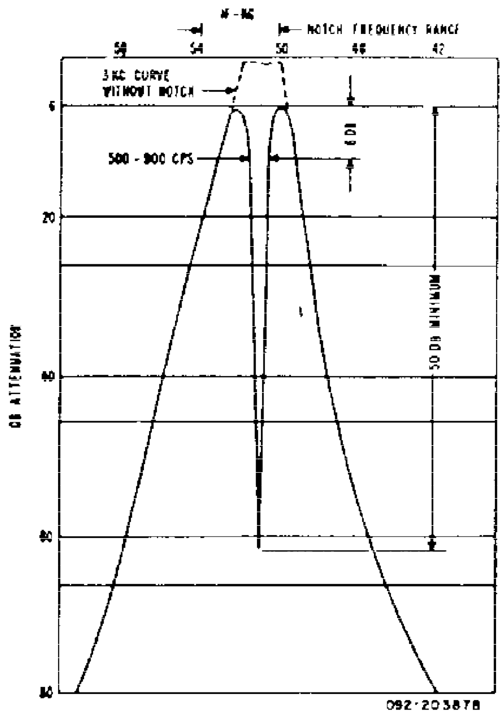

Figure 9. IF Selectivity Curve With Notch

KC to 2 MC. The NOTCH FREQ. control will move the band of suppressed frequencies represented by the notch in the selectivity curve, to any point within the IF passband. The NOTCH DEPTH control will vary the depth of the notch in the selectivity curve to control the degree of rejection of the interfering signal.

Extensive field testing of this feature has shown that the notch filter is highly effective in suppressing the type of interference for which this type of circuit is intended. It must be appreciated, however, that any selective IF filter circuit, including the phasing notch of quartz crystal circuits, affects only a limited range of interfering frequencies. The effectiveness of the notch filter is therefore somewhat dependent upon the exact nature of the interfering signal. For example: a heterodyne within the IF range that is less than 900 cycles in width and has little harmonic content is readily notched out. If the same interfering heterodyne is rich in harmonics it would only be possible to completely suppress the fundamental frequency and the remaining harmonic content may remain almost equally objectionable. It logically follows that if two interfering heterodynes should appear within the IF passband that are separated in frequency by more than 500 to 900 cycles it would be possible to notch out only one of the heterodynes. The interfering signal may also vary in frequency beyond the range of the notch filter and thus reduce the effectiveness of the circuit. Under these conditions, increasing selectivity will generally eliminate its heterodyne. If this heterodyne interference varies in frequency about some mean value it may be necessary to adjust the NOTCH DEPTH control to increase the broadness of the notch. It has been found, however, that the notch filter is sufficiently effective in many instances to make an otherwise useless signal entirely readable.

4-10. NOTCH FREQ. AND DEPTH CONTROLS.

To activate the Notch Filter circuit advance the NOTCH DEPTH control from the "OFF" position.

NOTCH FREQ. CONTROL - This control tunes the notch in the IF passband and may be set anywhere in the range of from 50 KC to 54 KC. The approximate frequency is calibrated on the knob skirt. While tuning this control for maximum suppression of the interfering heterodyne with minimum distortion to the desired signal, try to visualize the notch moving across the selectivity curve (See Fig. 9). It is then readily apparent that improper tuning may notch out the desired signal instead of the heterodyne. It may be necessary to move the notch across the desired signal in order to reach the heterodyne that you desire to suppress. The important consideration is to tune the NOTCH FREQUENCY control for maximum heterodyne suppression with minimum distortion to the desired signal.

NOTCH DEPTH CONTROL - As the position of the NOTCH FREQ. control is changed, the depth of the notch will vary. The NOTCH DEPTH control is provided to readjust the notch for maximum depth at any setting of the NOTCH FREQ. control. Maximum notching occurs at the "MAX" settings of the NOTCH DEPTH control when the frequency is set to the center of the IF passband. The use of the NOTCH DEPTH control is simply a matter of tuning it for maximum suppression each time the position of the NOTCH FREQ. control is changed.

4-11. PITCH CONTROL.

The PITCH control operates the tuning slug in the BFO coil to vary the frequency of the beat frequency oscillator approximately 2 KC each side of its center frequency of 50 KC. The primary function of the PITCH control is to vary the pitch of the audible beat note when receiving CW signals. It should be set at zero when receiving single-sideband signals.

4-12. RESPONSE CONTROL.

The RESPONSE control performs four functions: (1) it turns the receiver on and off; (2) it switches the 2nd conversion oscillator to operate at the required frequency for reception of CW, SSB, and AM signals. (1600 KC in the LOWER sideband positions and 1700 KC in the upper sideband positions); (3) it turns on the receiver BFO in both positions of SSB-CW to provide the heterodyning carrier for reception of these types of signals; and (4) selects either the product detector circuit (in SSB-CW) or the diode detector circuit connecting the product detector tube as an additional audio amplifier (AM).

In the "POWER OFF" position, the receiver is completely shut down except for the heating element and oscillator filament transformer. As the control is turned clockwise to any of the other four positions, the receiver power is turned on.

The SSB-CW positions of the control, "LOWER" or "UPPER" sideband, are used for reception of these types of signals. The AM positions, "UPPER" or "LOWER" sidebands, permit selection of one or the other sideband of an AM signal.

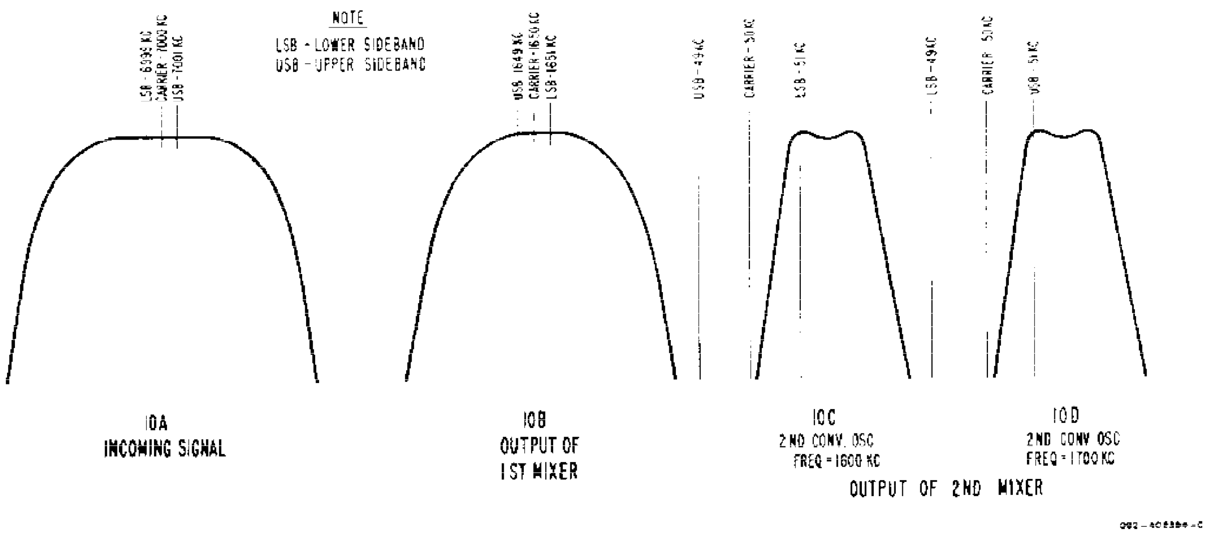

Figure 10. Selectable-Sideband Response Curves

To illustrate how selectable sideband reception is accomplished in the receiver, a numerical example is given. Consider an incoming signal at 7000 KC, modulated 1 KC. Since modulation of a carrier causes the generation of sideband frequencies numerically equal to the carrier frequency plus or minus the modulation frequency, the incoming signal consists of the carrier at 7000 KC, a lower sideband at 6999 KC, and an upper sideband at 7001 KC. (See Fig. 10A.)

The incoming signal is first heterodyned with the output of the 1st conversion oscillator in the 1st mixer stage. The 1st conversion oscillator operates at a frequency higher than the incoming signal by an amount equal to the first-intermediate frequency of 1650 KC. As a result of the frequency conversion process, three new lower frequencies are produced in the output of the 1st mixer: the carrier at 1650 KC, the lower sideband at 1651 KC, and the upper sideband at 1649 KC. (See Fig. 10B.) These signals are amplified by the 1650 KC IF amplifier stage and then heterodyned with the output of the 2nd conversion oscillator in the 2nd mixer stage. The 2nd conversion oscillator is crystal controlled and can be set to operate at either 1600 KC for reception of the lower sideband, or 1700 KC for the reception of the upper sideband, selection being made by means of the RESPONSE control. When the RESPONSE control is set at a "LOWER" sideband position, the 1600 KC signal from the 2nd conversion oscillator is heterodyned with the incoming signal at the first-intermediate frequency of 1650 KC to produce three new frequencies: the carrier at 50 KC, the lower sideband at 51 KC, and the upper sideband at 49 KC. By referring to Fig. 10C, it can be seen that the lower sideband falls within the IF passband and the upper sideband falls outside of the passband. Thus the lower sideband is accepted and the upper sideband is rejected. When the RESPONSE control is set at an "UPPER" sideband position, the 1700 KC signal from the 2nd conversion oscillator is heterodyned with the incoming signal. In the frequency conversion process, the carrier still remains at 50 KC, but now the upper sideband appears at 51 KC, and the lower sideband appears at 49 KC. (See Fig. 10D.) Thus, the upper sideband is accepted and the lower sideband is rejected.

Under conditions of crowded bands, the sideband which is most affected by other interfering signals can be rejected, thereby greatly eliminating much of the interference or "QRM". When receiving an AM signal from a station, it is possible to change sidebands during the course of reception, in order to offset changing "QRM" conditions due to adjacent signals disappearing and reappearing within the band.

4-13. CALIB.-OFF SWITCH.

The CALIB.-OFF switch controls the operation of the built-in 100 KC crystal calibrator. When the switch is set at "CALIB.", the crystal calibrator is turned on to provide marker signals at every 100 KC point on the receiver. 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 (CRYSTAL ADJ) on the top of the calibrator unit permits adjustment of the calibrating crystal to exactly 100 KC by comparison with the 10 MC signal (band 7, WWV 10 MC) 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 paragraph 5-8.

4-14. RECEIVE-STANDBY SWITCH.

The RECEIVE-STANDBY switch, when set at "STANDBY", 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 operates normally when the RECEIVE-STANDBY switch is at "RECEIVE".

One section of the RECEIVE-STANDBY switch is available for relay or transmitter switching. For connections and details, refer to paragraph 3-8.

4-15. TUNING CONTROL.

The TUNING control is used to tune the desired sig-