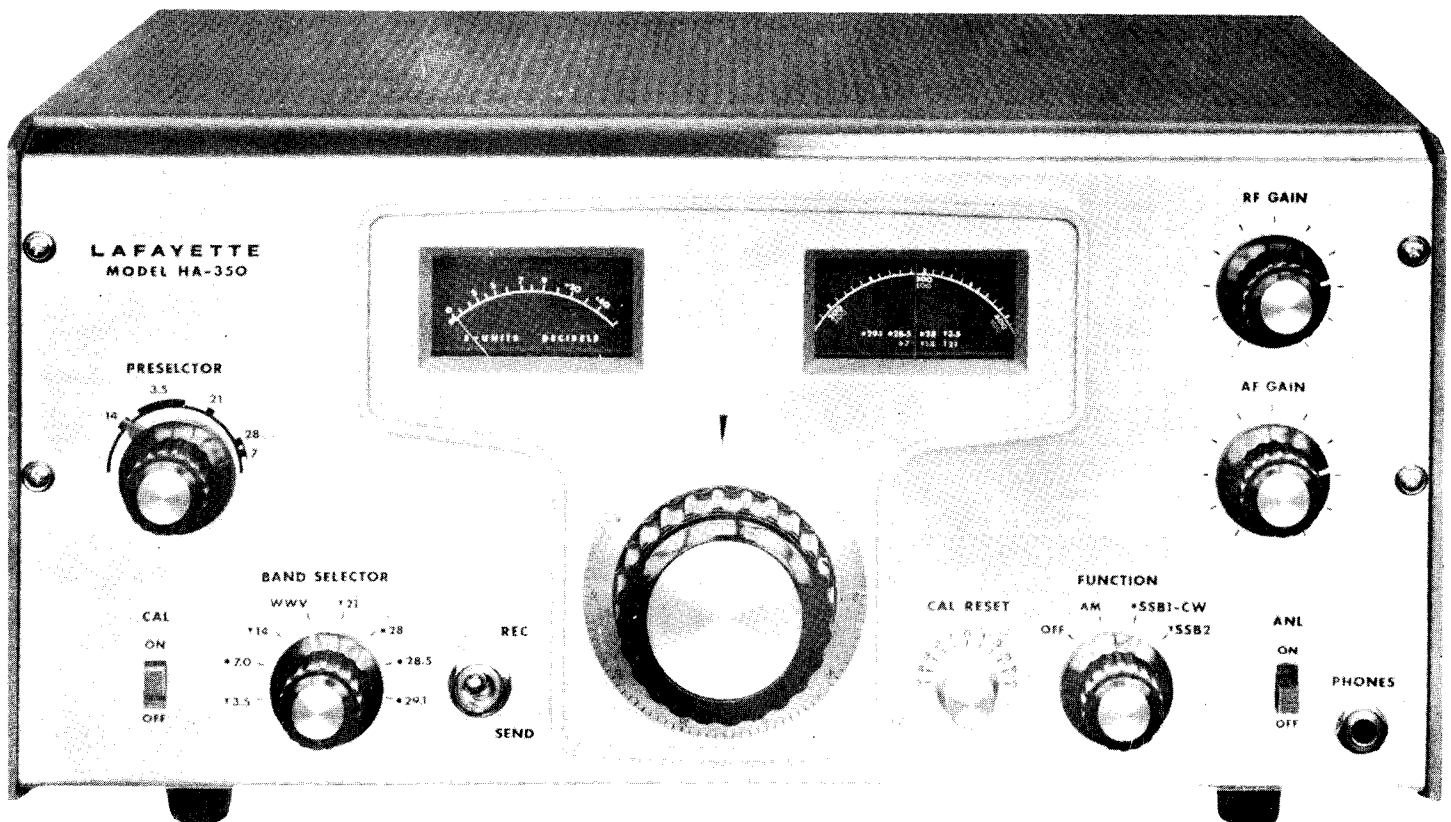


# AMATEUR COMMUNICATIONS RECEIVER

Stock No. 99-2524WX



# TECHNICAL SPECIFICATIONS

FREQUENCY COVERAGE .....	3.5 — 4.0 Mc 80 m 7.0 — 7.5 Mc 40 m 14.0 — 14.5 Mc 20 m WWV on 51 Mc 21.0 — 21.5 Mc 15 m 28.0 — 28.5 Mc 10 m 28.5 — 29.1 Mc 10 m 29.1 — 29.7 Mc 10 m
RECEIVING MODES .....	AM, CW and Selectable Single-Sideband
ANTENNA INPUT .....	50 — 75 ohms unbalanced (with coaxial connector)
SENSITIVITY .....	Better than 1 $\mu$ V for 10 db S/N ratio
SELECTIVITY .....	Bandwidth 2 Kc at 6 db down; 6 Kc at 60 db down.
IMAGE REJECTION .....	Better than 40 db.
IF REJECTION .....	Better than 40 db.
INTERMEDIATE FREQUENCIES .....	1st IF: Variable 3.5 — 4.1 Mc. 2nd IF: 455 Kc.
AUDIO OUTPUT .....	1 watt (max.)
OUTPUT IMPEDANCE .....	500 and 8 ohms
AUXILIARY CIRCUITS .....	(1) 100 Kc Calibrator Circuit (2) Automatic Noise Limiter (3) Automatic Volume Control
TUBE COMPLEMENT .....	V 1 — 6BZ6 RF Amplifier V 2 — 6BL8 Crystal-controlled 1st OSC, & 1st Mixer V 3 — 6BE6 2nd Mixer V 4 — 6BA6 VFO (2nd OSC) V 5 — 6BA6 455 Kc IF Amplifier V 6 — 6BA6 455 Kc IF Amplifier V 7 — 6AL5 AVC Rectifier and Noise Limiter V 8 — 6AQ8 Product Detector and Crystal Calibrator V 9 — 6AV6 1st Audio Amplifier V10 — 6AQ5 Audio Output V11 — 6BA6 Crystal-controlled BFO V12 — OB-2 Voltage Regulator
POWER REQUIREMENTS .....	110 — 120 volts, 50/60 cycles AC.
POWER CONSUMPTION .....	60 watts
DIMENSIONS .....	15" wide × 7½" high × 10" deep.
NET WEIGHT .....	25 lbs.

ENTIRE CONTENTS COPYRIGHTED 1964 BY LAFAYETTE RADIO ELECTRONICS CORPORATION • 111 JERICHO TURNPIKE, SYOSSET, L. I., N. Y.

## GENERAL DESCRIPTION

The Lafayette Model HA-350 is a dual-conversion superheterodyne communications receiver covering the 80, 40, 20, 15 and 10 meter amateur bands with provision for tuning WWV on 15 Mc. The receiver provides for the reception of CW (code), AM voice and SSB signals. During SSB operation, either the upper or lower sideband may be readily selected by means of a front panel control, a feature that greatly simplifies tuning of these signals.

The receiver employs dual-conversion on all bands (except 80 meters) and thus offers high image rejection. A crystal-controlled first conversion oscillator and a VFO-type second conversion oscillator ensure extreme accuracy and stability. Tuned RF and 1st mixer stages (Preselector) assure maximum sensitivity and a high signal-to-noise ratio. A 455 Kc mechanical filter plus two IF stages provide a high degree of selectivity — bandwidth is 2Kc at 6 db down, 6 Kc at 60 db down. A product detector operating with a crystal-controlled BFO is employed for improved CW and Single Sideband operation, while a separate diode detector is used for AM reception.

Tuning in this receiver is accomplished by a precision vernier mechanism that operates smoothly without backlash or other undesirable effects. The tuning method employed permits high accuracy. A single tuning dial, calibrated in kilocycles, is used to tune over all amateur

bands. For even greater accuracy, the receiver incorporates a 100 Kc Crystal Calibrator circuit (crystal available as an optional extra), plus a Calibration Reset control which permits accurate calibration of the tuning dial at every 100 Kc point.

Other features include an "S" meter calibrated in "S" units from 1 to 9 and in decibels above S9, RF Gain control, Automatic Noise Limiter on AM, Receive-Send switch and a full-time AVC circuit which is automatically set to provide a characteristic most suitable for the mode of operation — "standard" on 9M, "fast attack — slow decay" on CW and SSB. The antenna input connector is of the coaxial type and is designed for use with unbalanced lines of 50 to 75 ohms impedance. The receiver has output terminals for connection of 8 ohm speakers, plus provision for 500 ohm connections. A front panel jack provides for headphone listening, the insertion of a headphone plug automatically silencing any speaker connected to the 8 ohm output terminal.

The receiver is designed to operate from an input power source of 105-120 volts, 50/60 cycles AC, the power transformer being fused in the primary for 2 amps. Full-wave rectification is employed, using silicon rectifiers. A voltage regulated B+ supply is provided for the BFO, 1st Conversion Oscillator and 2nd Conversion Oscillator to assure maximum stability.

# INSTALLATION

## POWER SOURCE

The receiver is designed to operate from 110 — 120 volts, 50/60 cycles AC. Attempting to operate the receiver from any other power source will result in serious damage to the unit.

## SPEAKER CONNECTIONS

A 3-terminal strip is provided at the rear of the receiver for connection of the loudspeaker.

These terminals are marked "0", "8" and "500". Any permanent magnet type of loudspeaker with an impedance rating of 4, 8 or 16 ohms may be connected between the "0" and "8" ohm terminals. The 500 ohm terminal may be used for the connection of high impedance headphones or for speakers having an impedance other than 4, 8 or 16 ohms. In the latter case, an output transformer having a 500 ohm primary may be connected between "0" and "500", and the speaker (or speakers) connected to the secondary tap which corresponds to the speaker impedance.

# ANTENNAS

The antenna input of the receiver is designed to operate from any antenna with a transmission line impedance of 50-75 ohms. The antenna input circuit is of the unbalanced type and ideally suited for use with a coaxial line. An SO-239 coaxial connector is therefore provided on the receiver for use with such a line which should be terminated with a PL-259 type plug.

## SINGLE-WIRE ANTENNA

The Single-wire antenna (or inverted L) will provide satisfactory reception over the entire tuning range of the receiver. This type is shown in Figure 1. For best results the antenna should be installed as high as possible; the horizontal section should preferably be a half-wavelength long at the lowest frequency of operation and end-fed, as shown in Figure 1. Since the lowest frequency on this receiver is 3.5 Mc, the correct length would be:

$$\text{Length (ft)} = \frac{468}{3.5 \text{ Mc.}} = \text{Approx. 134 ft.}$$

However, lengths shorter than 134 ft. may be used if space is limited, with some loss in efficiency. Generally, this type of antenna provides maximum pick-up at right angles to its entire length. This should be borne in mind when installing the antenna. In some locations, reception may be improved by connecting a ground wire from the receiver chassis to a coldwater pipe or outside ground rod. For protection against lightning, a lightning arrestor should be included in any outdoor antenna system.

## DOUBLET ANTENNA

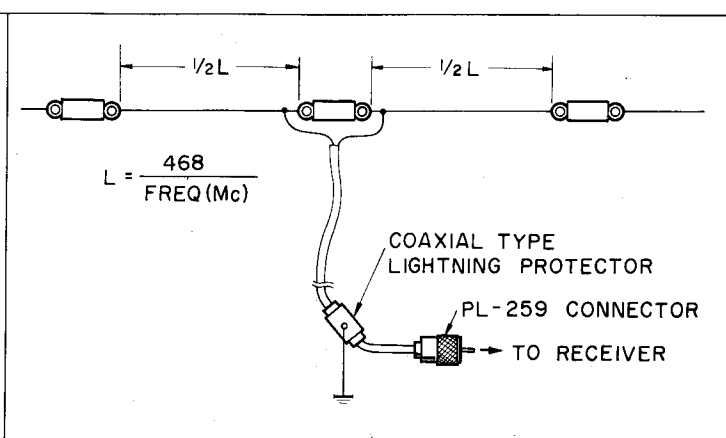
A doublet antenna will give excellent results, especially on amateur bands. A 75 ohms coaxial transmission line should be used (as shown in Fig. 2). Since the doublet antenna provides optimum performance only at a given frequency, it should be cut to the length for the most often used band of frequencies. The overall length of a doublet antenna can be determined by using the following formula:

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

It should be remembered that since the doublet antenna provides maximum pickup at right angles to its length, it should be oriented in such a manner that maximum signal pickup can be realized. A height of 30 to 50 feet is recommended for good reception of weak signals.

## OTHER ANTENNA SYSTEMS

More elaborate antenna systems may be installed to provide better performance. Information on a number of different types can be obtained by referring 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.



**FIG. 2 Doublet Antenna (Half-Wave Dipole)**

An auxiliary 8-pin socket has been provided for use with any auxiliary equipment that you may wish to use with the receiver. Figure 3 shows the connections that are made from the socket pins to various points in the receiver. Pins 1 and 8 may be used for external receive-send switching since these pins are wired across the REC-SEND switch in the receiver. When so used, this switch is left in the SEND position. Pin 3 is connected to the AVC line in the receiver and may be used to supply AVC bias to external equipment when required. Pin 4 is connected to the antenna terminal and may be used in conjunction with a converter, preselector, etc. Pin 5 is connected to the receiver chassis. Pin 6 is connected to the 500 ohm speaker terminal and may be used for connection to an external speaker etc. For convenience, an 8-pin plug has been provided which may be used for the connection of the leads from the auxiliary equipment.



## OPERATING CONTROLS

### "S" METER

Acts as a tuning indicator — reads relative signal strength. Illuminated.

### TUNING DIAL

Illuminated dial calibrated in kilocycles. Full scale used for tuning over each selected amateur band.

### RF GAIN CONTROL

Adjusts the RF and IF gain — used as gain control for CW-SSB operation.

**AF GAIN CONTROL**  
Adjusts the audio output.

**PRESELECTOR**  
Tunes the RF and 1st Mixer stages to incoming signal frequency.

**100 KC CALIBRATOR**  
Switches in 100 kc Calibrator to permit accurate calibration of tuning dial (100 Kc crystal not normally supplied — optional at extra cost).

**ANL SWITCH**  
Switches in Automatic Noise Limiter during AM operation.

**BAND SELECTOR**  
Selects 80 through 10 meter bands plus WWV on 15 Mc.

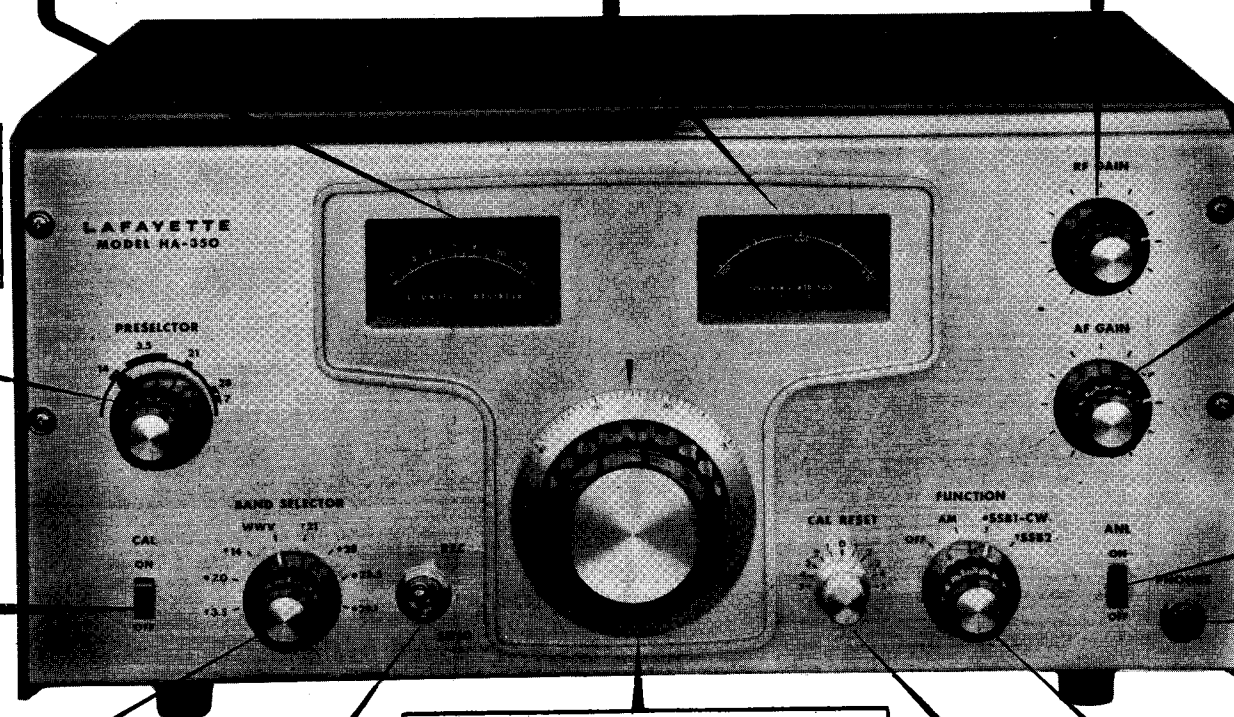
**RECEIVE-SEND SWITCH**  
Send position removes B+ to 1st & 2nd Mixer, and 1st IF

**MAIN TUNING CONTROL**  
Tunes receiver over the selected Amateur Band

**CALIBRATION RESET**  
Used in conjunction with 100 Kc Calibrator to permit accurate tuning dial calibration.

**FUNCTION SWITCH**  
Switches receiver on and selects mode of operation.

**PHONE JACK**  
Standard phone jack for low impedance headphones (8 ohms).



# OPERATING CONTROLS

## PRESELECTOR

This control tunes the grid circuits of the RF and 1st Mixer stages to the frequency of the incoming signal. The general area for the initial setting of this control on each frequency band has been indicated on the panel. Thereafter, it should always be adjusted for maximum background noise or signal. Each setting will be good only over a very limited range of frequencies, and the control should therefore be re-peaked for maximum whenever tuning is changed.

## BAND SELECTOR

This switch selects the desired band of operation. The 80, 40, 20 and 15 meter bands are each selected by one position of the switch. The 10 meter band, however, is covered by three positions — "28" (covering 28 — 28.5 Mc), "28.5" (covering 28.5 — 29.1 Mc) and "29.1" (covering 29.1 — 29.7 Mc).

**Note:** On some receivers, the switch may rotate beyond the marked positions. These are unused positions and should be disregarded.

Position "WWV" permits tuning in the general area of 15 Mc and thus allows reception of WWV on 15 Mc.

## FUNCTION

This switch selects the mode of operation for the receiver. In detail each position does the following:

**OFF** — In this position, AC input power to the primary of the AC power transformer is removed. In all other positions, AC input power is applied to the primary.

**AM** — This provides for normal reception of AM signals using diode detection. AVC is applied and the Automatic Noise Limiter may be employed if necessary.

**SSB1-CW** — This position is used for CW operation and also for selection of one sideband during SSB reception. In this position a product detector is employed for demodulation, and the AVC delay changed to provide a characteristic that is more suitable for CW or SSB reception (the changed action of the AVC may be observed in the reaction of the "S" meter).

The BFO is also activated and provides a crystal-controlled frequency of 453.5 Kc in this position. This offers the necessary beat frequency for CW. During SSB operation the BFO signal is used for carrier reinsertion, permitting selection of one of the sidebands (either upper or lower, depending upon the band in use).

**SSB2** — This position is used for SSB reception, providing selection of one of the sidebands either upper or lower, depending upon the band in use). The only difference between this position and the SSB1-CW position is in the frequency of the BFO, which now provides a frequency of 456.5 Kc for carrier reinsertion and thus permits selection of the sideband opposite to the one selected by SSB-CW.

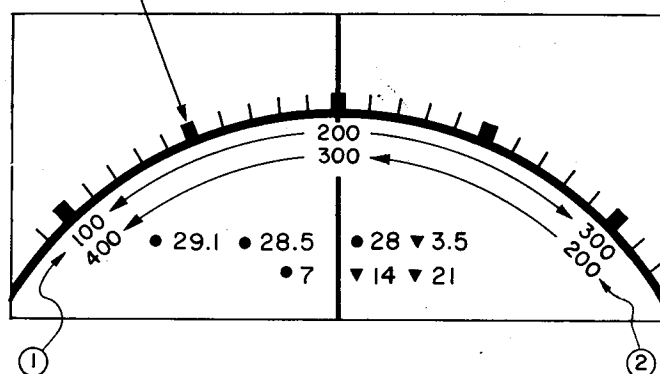
## CAL RESET (Calibration Reset)

This control is used in conjunction with the 100 Kc Calibrator to permit precise calibration of the receiver tuning dial. The normal position for this control is the "0" or mid-position. Calibration of the tuning dial should be performed prior to operating on each band, using the procedure given in "Calibrating The Tuning Dial".

## TUNING DIAL

The tuning dial is calibrated from 0 to 500 Kc in one direction (yellow numbers) and 0 to 600 Kc in the other direction (white numbers). This coverage permits calibrated tuning over any of the amateur bands. The calibrations applicable to each frequency band are indicated in Figure

MAJOR DIVISIONS EVERY  
50Kc (0.05Mc)



- ① FOR 29.1, 28.5, 28 & 3.5 Mc (WHITE)  
USE UPPER CALIBRATIONS  
(ALSO WHITE)
- ② FOR 7, 14 & 21 Mc (YELLOW)  
USE LOWER CALIBRATIONS  
(ALSO YELLOW)

FIG. 4

4. However, a simple system of color coding permits this same information to be obtained directly from the receiver. For all frequency bands shown in white on the dial glass, use the tuning scale with white numbering; for all frequency bands shown in yellow, use the scale with yellow numbering.

Figure 5 provides some examples of how the tuning dial is used in conjunction with the Band Selector. You simply add the number of Kc indicated on the applicable scale to the frequency shown on the Band Selector position.

## CALIBRATING THE TUNING DIAL

The procedure for calibrating the tuning dial is simple and should be employed whenever a check of the receiver tuning accuracy is required. Switch to the band you intend to operate on, and set the CAL switch "on". Make sure a 100 Kc crystal has been inserted into the receiver — the 100 Kc crystal is optional at extra cost with this receiver. Now set the tuning dial to the edge of the band (0 or 500 on the scale — 0 or 600 if you are on 28.5 or 29.1 Mc band, and adjust the CAL RESET for zero beat or a peak calibrator signal. The dial calibration can be checked for accuracy by comparing the dial calibrations with the marker signals which appear at every 100 Kc on the dial.

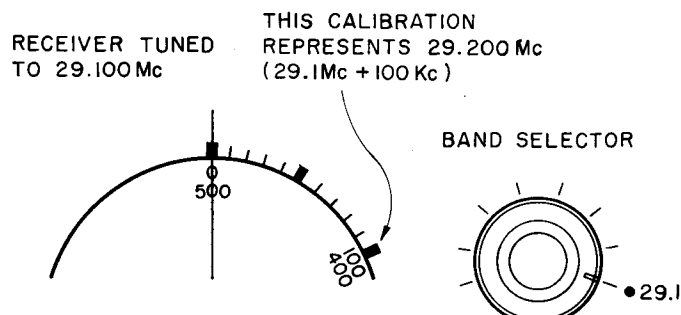
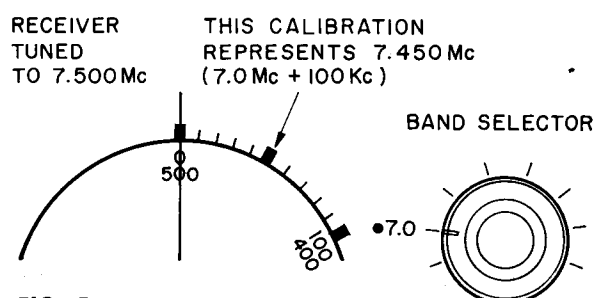
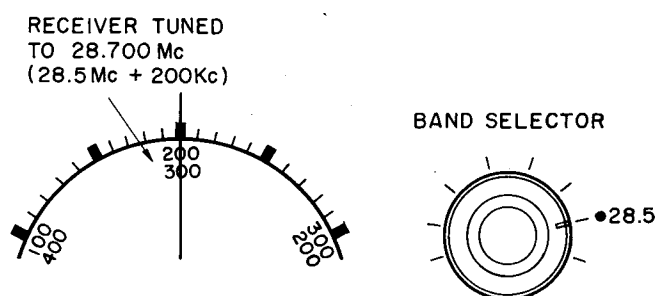
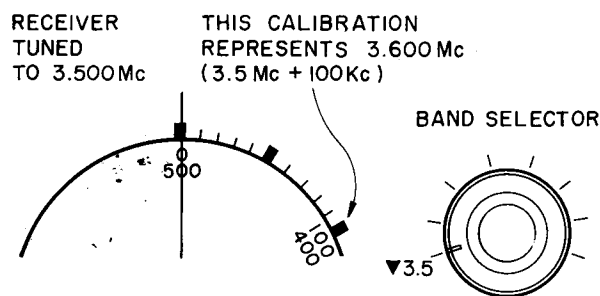
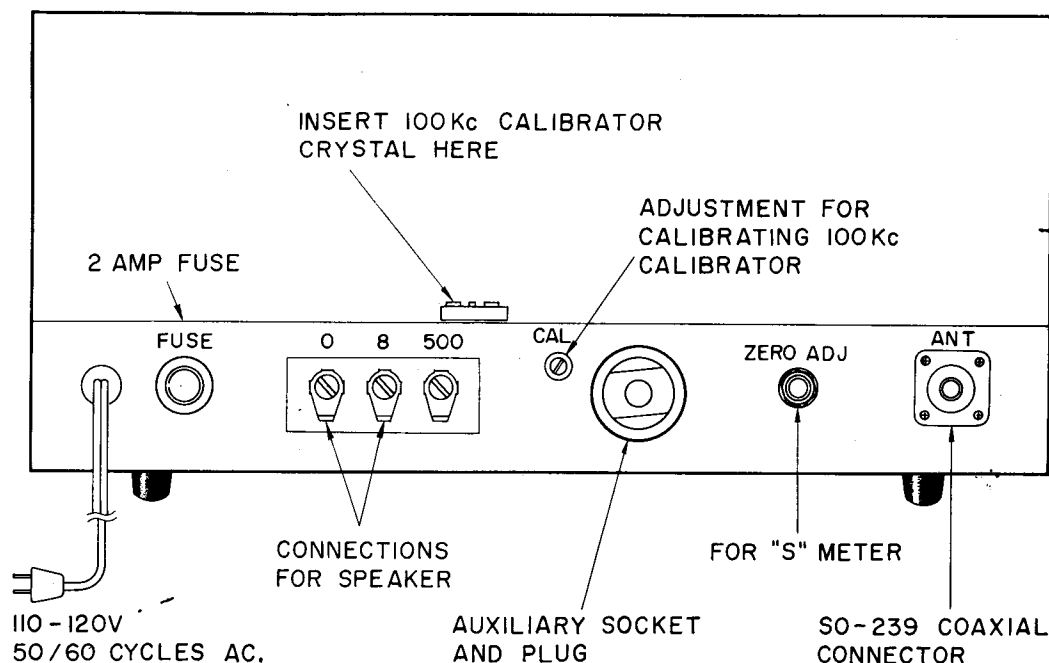


FIG. 5





**FIG. 6 Rear of Receiver**

## RF GAIN

This is a variable resistor in the cathode of the RF amplifier and 1st IF amplifier that varies the gain of these tubes. As a general rule, the RF gain control is set to maximum for AM operation, the audio output being adjusted by means of the AF GAIN control. During CW or SSB operation however, the AF GAIN should be set to about the mid-position and the output level adjusted by means of the RF GAIN control.

## AF GAIN

This is a variable resistor in the grid circuit of the 1st Audio Amplifier which provides control of the audio input to this stage and thus permits adjustment of the audio output of the receiver.

## 100 KC CRYSTAL CALIBRATOR

The 100 Kc Calibrator circuit will provide accurate signal markers every 100 Kc over the full tuning range of the receiver and can thus be used to calibrate the receiver tuning dial (see section "Calibrating The Tuning Dial"). The 100 Kc crystal is not normally supplied with the receiver unless so ordered (Lafayette Stock No. for the 100 Kc crystal is 40-0901L).

## INSTALLING THE 100KC CRYSTAL

The crystal can be inserted into its socket from the rear of the receiver. The location of the socket is shown in Figure 6.

## CHECKING THE CALIBRATOR FOR ACCURACY

The calibrator has been adjusted at the factory and will not therefore require readjustment unless extreme accuracy is required. A trimmer capacitor at the rear of the receiver (marked CAL) has been provided to permit readjustment when necessary. The procedure is as follows:

Tune to WWV on 15 Mc by simply setting the Band Selector to "WWV" and tuning the receiver to the general area of the WWV indicator mark (500 on white upper scale). When WWV is tuned in, switch the calibrator on and adjust the "CAL" control for a "zero beat" when no tone modulation is applied to the WWV carrier.

## "S" METER ADJUST

The ZERO ADJ control at the rear of the receiver is provided for zeroing the "S" meter electrically. This is carried out with antenna disconnected and RF GAIN at maximum.

## OPERATION

The following chart indicates the initial settings of the various controls for each type of operation. Thereafter, the degree of strength or

clarity with which signals will be received will depend upon proper readjustment of the various controls.

### INITIAL CONTROL SETTINGS

CONTROL	AM OPERATION	CW OPERATION	SSB OPERATION
RF Gain	Max	Adjust for desired output level	Adjust for desired output level
AF Gain	Adjust for desired output level	1/2 maximum	1/2 maximum
Function	AM	SSB1-CW	SSB1-CW or SSB2*
Band Selector	Set to desired band	Set to desired band	Set to desired band
Preselector	Set to area indicated for selected band	Set to area indicated for selected band	Set to area indicated for selected band
ANL	Off	Off	Off
Cal Reset	Zero	Zero	Zero
Rec-Send	Rec	Rec	Rec
CAL	Off	Off	Off

\* Setting will depend upon band in use. See chart headed "Single Sideband Selection".

### AM OPERATION

Place all controls in the positions indicated in the chart for AM operation. Tune to the desired frequency. If you wish to check scale calibrations, follow the procedure outlined under "Calibrating The Tuning Dial". Always use the Preselector control to peak for maximum background noise or signal. If excessive noise from auto ignition, etc., make reception difficult, switch ANL "on".

### CW OPERATION

Place all controls as indicated in the chart for CW operation. In the SSB1-CW position, AVC is still in operation, but the time constant in the circuit is changed to provide an AVC characteristic that is more suitable for CW and SSB reception. For reception of CW, the RF GAIN control is used as a volume control with AF GAIN control set to its mid-position (approximately). After peaking the Preselector for maximum background noise, tune the CW signal until the desired pitch is obtained.

## SINGLE SIDEBAND OPERATION

Control settings for sideband reception are virtually the same as for CW. However, two positions on the Function switch are provided to permit selection of either the upper or lower sideband, as necessary. The sideband that must be selected will depend upon the band in use. As indicated in the chart of Figure 7, the lower sideband is usually required for SSB reception on 80 and 40 meters, the upper sideband for SSB reception on 20, 15 and 10 meters. Note that positions SSB1 and SSB2 on the Function switch can each be either upper or lower, depending upon the band selected. On 40 meters for example, position SSB1 will select the lower sideband (the one usually required on this band), and position SSB2 will select the upper sideband.

On 20 meters, however, position SSB1 will now select the upper sideband and SSB2 the lower sideband. In detail, the chart shows the sideband selected by each position of the Function switch on every band. For operating convenience, however, a system has been devised (see Fig. 8) that will permit you to quickly determine which sideband position to select for each frequency band. Notice that each frequency band shown on the Band Selector switch and Tuning dial glass has been designated with a symbol, either "•" or "▼". Each of the two sideband positions on the Function switch has been marked with one of these symbols. For example, if you are operating on a band designated with the symbol "•", simply set the Function switch to the SSB position also designated with this symbol. This will provide selection of the correct sideband in each case.

FIGURE 7. SINGLE SIDEBAND SELECTION CHART

METERS	BAND SELECTOR SWITCH	FREQUENCY	SELECTION USUALLY REQUIRED			
			FUNCTION SWITCH	SIDEBAND SELECTED	FUNCTION SWITCH	SIDEBAND SELECTED
80	▼ 3.5	3.5 - 4.0 Mc	▼ SSB2	Lower	• SSB1-CW	Upper
40	• 7.0	7.0 - 7.5 Mc	• SSB1-CW	Lower	▼ SSB2	Upper
20	▼ 14.0	14.0 - 14.5 Mc	▼ SSB2	Upper	• SSB1-CW	Lower
15	▼ 21.0	21.0 - 21.5 Mc	▼ SSB2	Upper	• SSB1-CW	Lower
10	• 28.0	28.0 - 28.5 Mc	• SSB1-CW	Upper	▼ SSB2	Lower
10	• 28.5	28.5 - 29.1 Mc	• SSB1-CW	Upper	▼ SSB2	Lower
10	• 29.1	29.1 - 29.7 Mc	• SSB1-CW	Upper	▼ SSB2	Lower

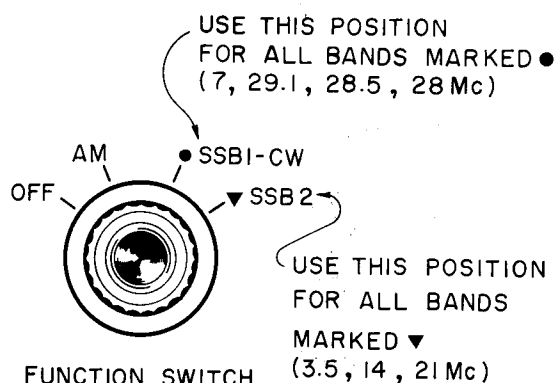
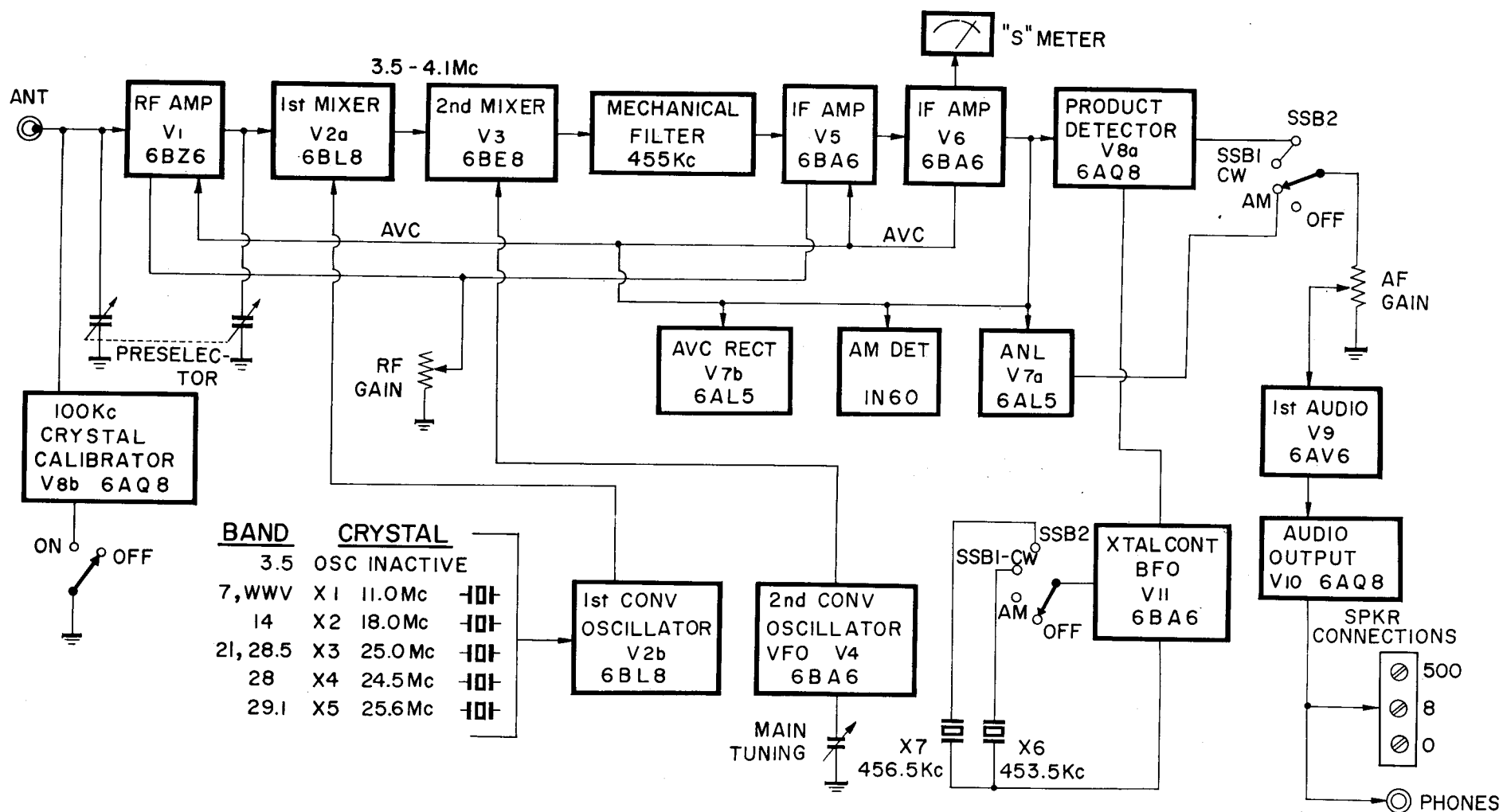


FIG. 8 Sideband Selection

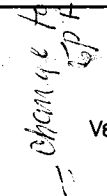
## SINGLE SIDEBAND TUNING

Set all controls as required for SSB operation with the FUNCTION switch in the proper position for the band in use. Tune slowly across the SSB signal with the main tuning control until clarity of speech is achieved, adjusting the RF GAIN control as necessary. If the speech remains garbled and cannot be clarified, select the other sideband position and retune slowly. You may have made an error in sideband selection, or the station may be transmitting a sideband other than the one normally used in the band.

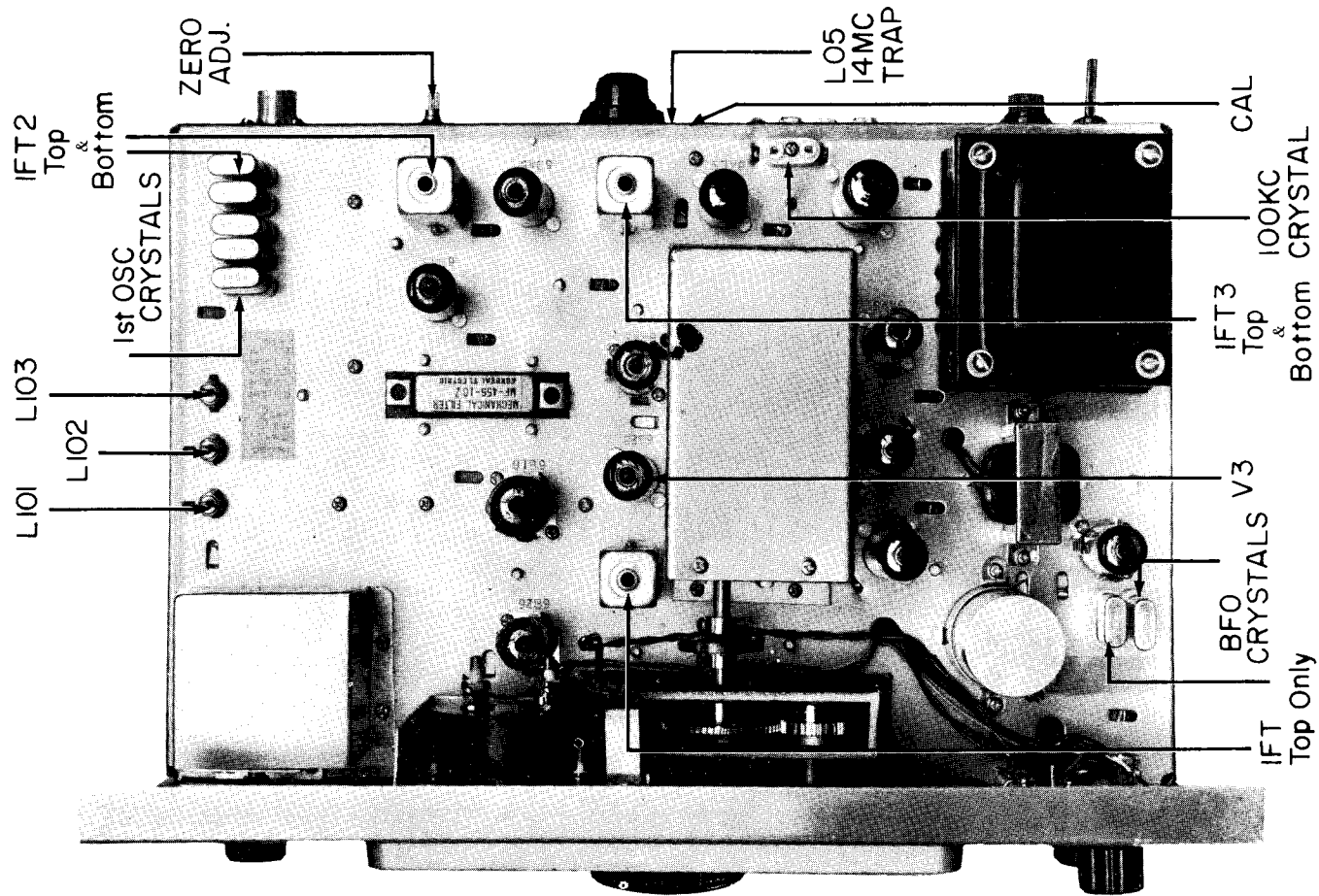
# FUNCTIONAL BLOCK DIAGRAM MODEL HA-350



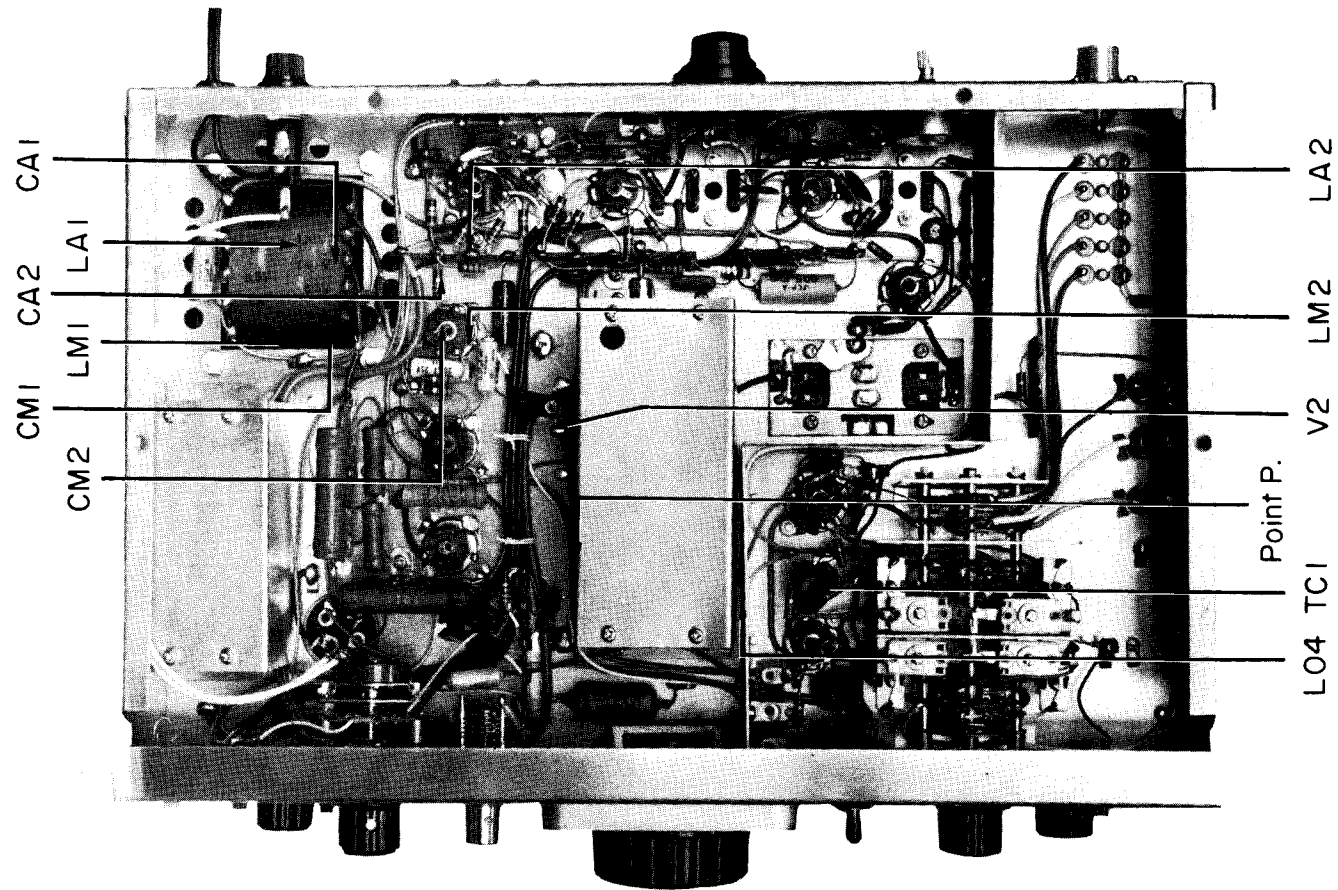
Change to  
2pA



(FIG. A)



(FIG. B)



## COMPLETE ALIGNMENT INSTRUCTIONS

The receiver has been fully aligned at the factory before shipment to you and does not normally require further adjustment. When necessary, however, the receiver may be aligned as indicated.

### CHASSIS REMOVAL

To withdraw the chassis from the cabinet, remove four screws on the underside, four screws on the front panel, and slide the chassis out from the front of the cabinet.

EQUIPMENT REQUIRED: VTVM  
Calibrated RF Signal Generator  
Non-metallic Alignment Tools

### SET CONTROLS AS FOLLOWS:

REC-SEND switch to REC  
FUNCTION to AM  
ANL to OFF  
CAL to OFF  
RF GAIN to MAX

STEP	S. G. COUPLING AND INPUT SIGNAL	BAND SELEC-TOR	DIAL SETTING	ADJUSTMENT	OUTPUT INDICATION	VIEW
"S" Meter	No Signal - RF Gain at max			"Zero Adj" at rear of chassis	Zero reading on "S" Meter	Fig. A
2nd IF Alignment	455 Kc., mod. 30% at 400 cps. Connect S.G. from point P (input to mech filter) to chassis			IFT2 IFT3	Connect VTVM to AVC line (pin 3 of Aux Socket). Adjust for max. negative DC	Fig. A & B
1st Conv. OSC Alignment	No Signal. Connect VTVM from pin 9 of V2 to chassis	(a) 21 (b) 14 (c) 7		(a) LO1 (25 Mc) (b) LO2 (18 Mc) (c) LO3 (11 Mc)	Max. deflection on VTVM (negative DC), then back off from peak slightly	Fig. A & B
2nd Conv. OSC Alignment	(a) Connect S.G. to ANT terminal. Set Cal Reset to zero - leave in this position hereafter	3.5	3.5 Mc (0 on white scale	Set Preselector at left side of 3.5 Mc mark	Connect VTVM to AVC line. Adjust for max. negative DC	Fig. B  Fig. B
	(b) Input signal 3.5 Mc	3.5	"	LO4	"	
	(c) Input signal 4.0 Mc		4.0 Mc (500 on white scale	TC1	" Repeat (b) and (c)	
1st IF Alignment	3.5 Mc. Use as low an input level as possible	3.5	3.5 Mc (0 on white scale	IFT1	Max. deflection of VTVM first, then re-peak Preselector and readjust IFT1 again for peak	Fig. A

RF Alignment	(a) 3.5 Mc	3.5	3.5 Mc. Set Preselector at right side of 3.5 Mc mark	LA1 LM1	Max. deflection of VTVM. Repeat until no further improvement is noted	Fig. B
	(b) 7.0 Mc	7.0	7.0 Mc (0 on yellow scale). Set Preselector at left side of 7 Mc mark	CA1 CM1	"	Fig. B
	(c) 14.0 Mc	14	14.0 Mc (0 on yellow scale). Set Preselector at left side of 14 Mc mark	LA2 LM2	"	Fig. B
	(d) 28.0 Mc	28	28.0 Mc (0 on white scale). Set Preselector at left side of 28 Mc mark	CA2 CM2	"	Fig. B
100 Kc Calibrator	Connect antenna to receiver	WWV	Set dial to WWV mark (500 on white scale). Set Preselector slightly above 14 Mc	TC2 (CAL at rear of chassis)	Adjust for zero beat. After this, check that marker signals appear every 100 Kc on dial	
14 Mc Trap	No Signal, antenna disconnected	14	Set dial to 14.07 Mc and then peak Preselector for max. noise	LO5 (14 Mc Trap)	Adjust for <u>minimum</u> deflection of VTVM	Fig. A

This completes the alignment. Disconnect equipment and re-insert the receiver chassis into the cabinet.