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Hammarlund Manufacturing Company

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SERVICE BULLETIN



September 21, 1962

Dear HX-500 Owner:

With the increasing number of HX-500's in operation, it has come to our attention through contacts on the air, and as a result of inquiries that operating features not originally incorporated in this unit would be desirable. A number of design improvements have also been incorporated in the HX-500 unit since its inception. In an effort to answer inquiries as quickly and as efficiently as possible, this bulletin has been prepared which will provide you with the information requested, and in addition, some general information which should be of interest.

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The Hammarlund Manufacturing Co.

Bulletin No. 5001-1

1. PUSH-TO-TALK /

One of the most popular inquiries concerns the use of a push-to-talk circuit. If you wish to employ a microphone with this feature, substitute an Amphenol type 80PC2F chassis receptacle (or equivalent) for the present connector. Connect one of the insulated terminals and the common ground from this new connector to the input of the first audio stage as originally wired. The second insulated terminal now available on the new connector should be wired to the junction of R55 and the contacts on SO-2A, rear section of the operation switch. This connection may be made directly to the proper contact on said switch or to the terminal strip located near the V8 relay tube on the exciter chassis sub-assembly.

As a result of this change closing the push-to-talk switch will ground the cathode of the relay tube through R55 (470 ohms) energizing both the VOX and antenna relays. In order to operate the transmitter with push-to-talk, the operation switch must be placed in the VOX position and the front panel VOX sensitivity control should be set at the extreme counter-clockwise position to avoid undesired VOX tripping.

In the event you wish to use external control or a foot switch, the above information will also be applicable, except that the rear chassis connector may be used for this connection rather than replacement of the microphone connector. This push-to-talk lead should be brought out to terminals 1, 7 or 13 at J11 located on the rear chassis apron after removing the ground lead.

2. PHONE PATCH /

Because of the wide variety of phone patches in use, some difficulty may be encountered when this form of operation is attempted. The phone patch jack on the front panel of the HX500 has been designed for use with units having an output of 0 db reference at 500/600 ohm impedance (unbalanced). If insufficient modulation is obtained when the patch is connected to the phone patch jack, it is suggested that the output of your unit be connected to the microphone input. This will provide the additional gain which might be required depending upon the design of your particular unit. Many phone patch units now have the internal wiring and interconnections providing this type of connection to the unit and also provide for automatic switching of the microphone.

GENERAL OPERATION λ

Do not snap the transmitter on and off (standby to off) rapidly, failure to observe this precaution may result in blowing fuses, possibly arcing in the high voltage rectifiers and damage to the 6146's.

If the fuse blows, replace it with one of the same slow-blow current ratings. If the fuse continues to blow check for arc-over in the 12AX4's, and also check the 6AL5 bias rectifier--replace if necessary.

If the cathode current of the final amplifier is observed (using a voltmeter or 0-300 milliammeter as recommended in the instruction manual), excessive current peaks will be apparent if the above precaution is not followed. This is caused by the 6AL5 bias rectifier not conducting as rapidly as the high voltage rectifiers and the 6146 final stage tubes, with the resultant removal, or less than normal bias voltage being available. If, for any reason, the transmitter is turned off, allow approximately one minute for the tubes to cool before again turning the transmitter on. Also see the paragraph designated 6146 bias modification.

3. ALC ACTION λ

The ALC adjustable control located at the rear of the transmitter chassis applies more ALC action in a counter-clockwise rotation of same. Maximum clockwise rotation minimizes ALC action but does not completely remove it. Refer to the page and paragraph on Sideband operation in the Instruction Manual for proper adjustment. The function switch may be placed in the DSB position, instead of CW in the absence of a key. Maintain the audio control at "O" with the transmitter in MOX position while this adjustment is being made. Depending upon the band in use and the actual reflected impedance from the antenna, it may not be possible to obtain a full -1 db of ALC action. This situation may be further aggravated when driving a linear amplifier whose impedance varies over wide limits. Even under these conditions, however, there will still be ALC action and -1/2 db or thereabouts as indicated on the relative output meter should be sufficient, and will provide improved performance over no ALC action. This is a relative indication and does not necessarily imply that the 1/2 db of ALC action is a finite value. NOTE: When driving a linear amplifier whose impedance varies over wide limits, it may be desirable to eliminate the ALC action. If the unit has been modified in accordance with the 6146 bias modification section it will only be necessary to remove the 6AL5 tube from its socket. If this modification has not been made it will be necessary to clip pins 1 and 7 from the 6AL5 tube.

4. DRIVING LINEAR AMPLIFIERS λ

Refer to the comments in the previous paragraph designated "ALC ACTION". It is highly desirable that some matching unit be used between the HX500 and the linear amplifier so as to provide for a low and uniform SWR over a large dynamic operating range. The popular grounded grid amplifier circuitry may often be improved in this respect by using a tuned circuit, particularly on the higher frequency bands. Another compromise may be achieved by pruning the transmission line length between the HX500 and the linear amplifier so as to provide a low SWR (as measured at the rear antenna terminal of the HX-500).

5. AUDIO DISTORTION *check*

As a result of employing the mike input connector for phone patch operation or utilizing relatively high level output high impedance microphones, (such as D104 or similar) audio distortion of the transmitted signal may occur. In order to increase the input signal handling capabilities of the first audio stage, the following modification should be made. 1) Lift the cathode pin #3 of V5A and 100 mmf capacitor C144 from ground. 2) Connect a 3900 ohm, 1/2 watt resistor from pin 3 of V5A to ground. 3) Connect C44 to a new ground point in the vicinity of the original ground. 4) Replace the 4.7 meg. R32 resistor with a 470K, 1/2 watt resistor. It is permissible to shunt R32 with this new resistor. 5) Depending upon your particular voice qualities and the mike employed, it may be desirable to replace the 1000 mmf coupling capacitor C45 with a .01 disc ceramic capacitor. This last change will improve low frequency response.

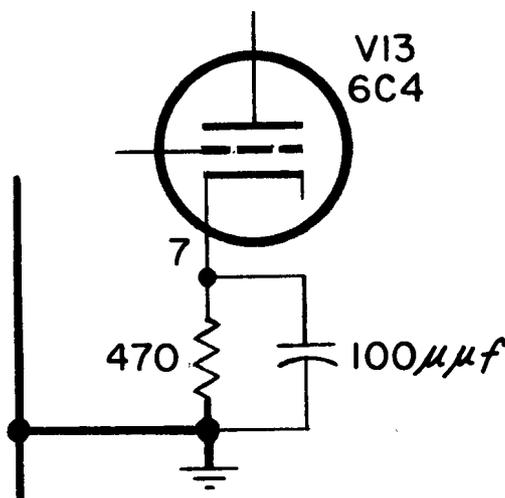
6. INTERMITTENT OR NON CRYSTAL ACTIVITY (ON ONE OR MORE BANDS)

Under certain conditions (particularly where maximum trimming capacity is required) the heterodyne oscillator stage will fail to oscillate or will oscillate intermittently. If such is the condition the 6C4 circuit (V13) should be modified to provide a small amount of feedback as follows:

- (a) Lift terminal (cathode) of the 6C4 from ground.
- (b) Install a 470 ohm, 1/2 watt resistor between cathode (terminal 7) and ground.
- (c) Add a 100 uuf ceramic or mica capacitor directly across this 470 ohm resistor with the leads as short as possible.

After making the above change the individual band crystals should oscillate immediately upon proper band selection. If a particular crystal fails to oscillate after making this change, the crystal should be suspected of low activity and should be replaced. In some instances a temporary repair may be achieved by reducing the capacity of the particular frequency trimming capacitor. This will upset the frequency calibration slightly for that particular band.

MODIFIED HETERODYNE OSCILLATOR

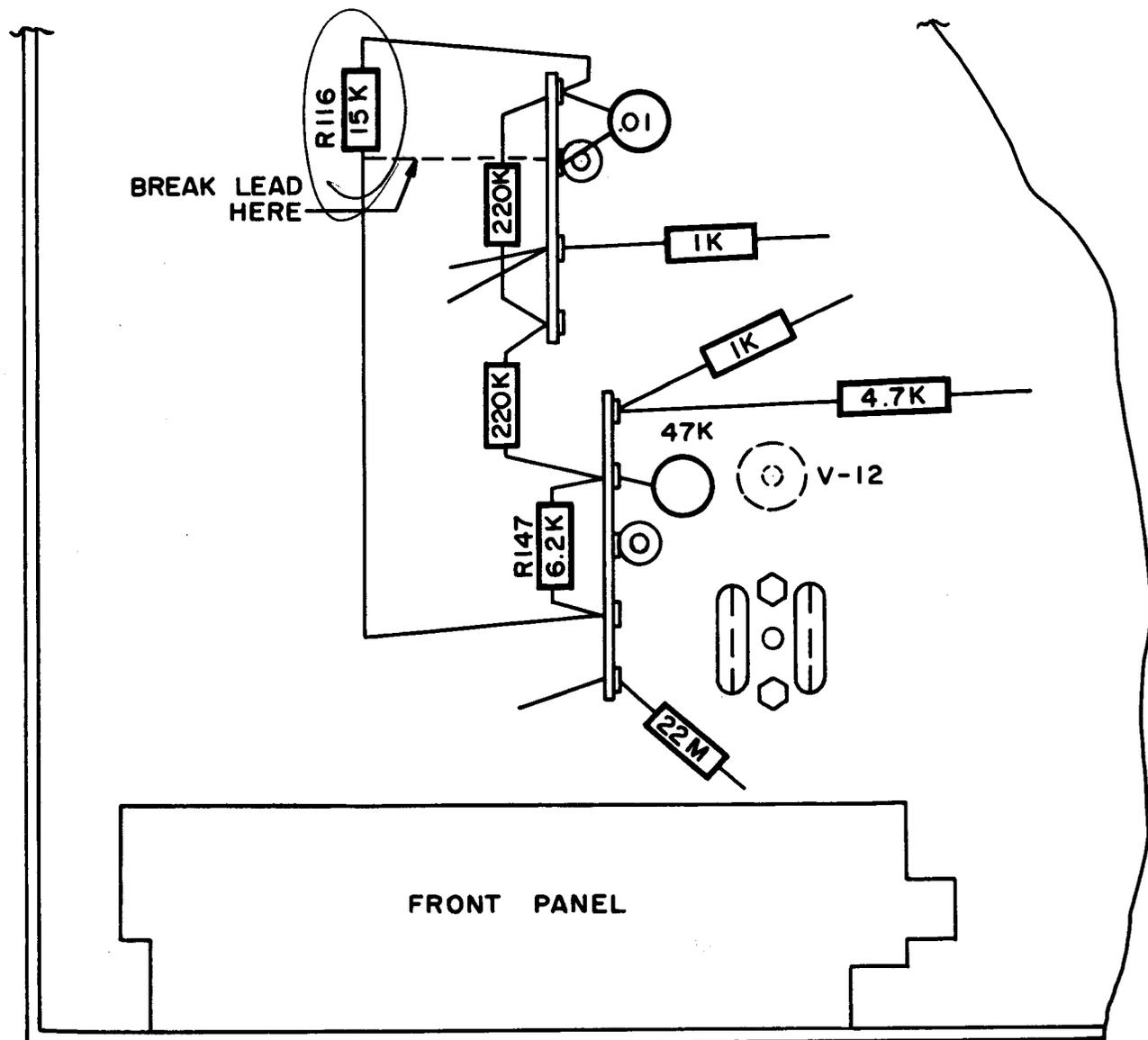


7.

NOISE OR HASH ELIMINATION

Check 15K Resistor on sum strip

In order to minimize if not completely eliminate noise or hash which you may have noticed in your receiver, (particularly on the higher frequency bands) while the transmitter is on standby, we suggest the following remedy; 1) Lift the ground end of R116, the 15K resistor in the V14 driver grid circuit and connect to the bottom end of R147, the 6.2K resistor in the third mixer grid circuit. 2) The two terminal strips on which these resistors are mounted are located near to each other so that a new 15K resistor can be connected between these two terminal strips, or a short length of insulated wire connected to the now ungrounded end of R116 and to the proper tie point for the 6.2K, R147 resistor. 3) The diagram following indicates this circuit change and as a result of this modification, the driver stage will be biased to cut-off, effectively blocking any drive to the final when in standby.



BOTTOM VIEW OF HX-500 CHASSIS

NOTE: MAIN CHASSIS PARTS LIST CHANGE - RESISTOR R-132, 220 OHM TEN WATT RESISTOR, REPLACED WITH 15 OHM 2 WATT RESISTOR. FIELD USE INDICATES THAT THIS RESISTOR IS OPERATING TOO CLOSE TO ITS DISSIPATION RATING.

8. SELF OSCILLATION DURING STANDBY X

If self oscillation is evident during standby as indicated by RF output on the DB meter, refer to the paragraph above "Noise or Hash Elimination". Incorporating this change should cure the problem assuming that the 6146 stage has been neutralized in accordance with the Instruction Book directions. If the 6146's in the output stage will not neutralize, re-check that this modification has been properly incorporated.

9. LOW OR SAGGING POWER OUTPUT, SIDEBAND OPERATION X

In all instances to date, indications of this type have been caused by a poor type 6EW6 tube in socket V2 of the exciter chassis sub-assembly. During AM and CW modes of operation this stage is out of the circuit and, therefore, the condition only shows up on SSB operation.

10. CW CHIRP X

This condition can be cured by improving the regulation of the power supply (low voltage sections) in accordance with the following instructions. 1) R132 currently a 220 ohm, 10 watt resistor should be replaced with a 15 ohm $\pm 10\%$ 2 watt resistor. This resistor is located, at the rear right hand corner of the chassis between a solder lug terminal in that vicinity and C166A. 2) R137 currently 1500 ohms, 10 watt should be replaced with a 3000 ohm $\pm 10\%$, 10 watt resistor. If some chirp still persists try replacement of the 6CB6 tubes in sockets V10 and V11.

11. CW VOX OPERATION *All Sup #1*

The use of the VOX circuitry to provide semi "break-in" operation may be achieved by a relatively simple modification. When this change is made and the function switch is in the CW position, with the operations switch in the MOX position, the first touch of the key will cause the transmitter and its associated relay circuitry to go from the standby mode to operate. The transmitter will stay in the operate mode for a period of time after the key is released, depending upon the time constant selection (adjustable). In normal operation the transmitter will remain in the operate position thereby muting the associated receiver during the course of a sending cycle. A short interval after the sending has ceased, the transmitter will automatically go back to standby and the receiver will become alive, thereby providing a form of "break-in" operation, which does not require the throwing of any switches, etc. To make this modification the following steps are required:

1. Install a 10 megohm linear taper potentiometer on the exciter assembly sub-chassis between V8 and T3/T4. It will be necessary to drill a 3/8" hole in the chassis to accept this part. (Obtain same from local dealer).

2. Be sure that all loose metal particles are removed and do not get hidden in blind areas, etc.

3. Wire the center connection (arm) of this control to Pin 5 of V7A.

4. Connect a 4.7 megohm, 1/2 watt resistor from the terminal of the 10 megohm potentiometer as shown in the sketch below.

5. Connect the other end of this 4.7 megohm resistor to Pin 2 of V7.

Add a lead from terminal 9 of the chassis connector J2 (keying circuitry) to terminal 2 of V7. NOTE: Refer to page 21 of the Instruction Manual for a top view photograph of the exciter assembly sub-chassis for major component location.

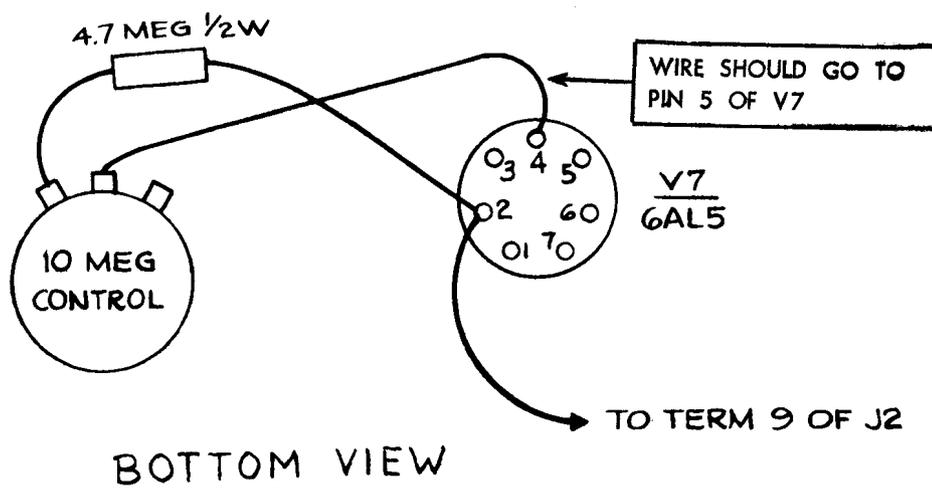
After making the modification it will be found that the setting of this new control will have very little effect upon the VOX circuit time constant during AM or SSB operation. Therefore, this form of operation should be re-checked first. Next the function switch should be set to the CW position and the operation switch should be set to the MOX position (make sure that the operations switch is in the MOX and not the VOX position). With the new 10 megohm control (CW Delay) in its full clockwise rotation, both the antenna relay and the VOX relay will hold in for the longest time period after the key has been closed and opened. Turning this new control counter-clockwise will shorten this time delay permitting faster break-in.

It is suggested that the Voice-VOX operation and the CW-VOX operation adjustments be re-checked several times so as to minimize the slight amount of interaction. In some instances it may be found that the relays will hold in at full clockwise rotation of the CW delay control when the VOX delay control (front panel) is at its extreme counter-clockwise rotation. In this instance the CW delay control should be turned counter-clockwise until both the VOX and the antenna relays drop out.

To restore normal CW operation the 10 megohm control should be turned to its maximum clockwise position and the VOX delay turned to its counter-clockwise position. The setting of this control need not be changed when going to the VOX mode of DSB or SSB operation.

It is not necessary to change the setting of the CW delay control (10 megohm) when using MOX-DSB or MOX-SSB.

NOTE: It is suggested that the station receiver is used to indicate drop out of the antenna relay as it normally lags behind the VOX relay slightly.



12. FAN VIBRATION MODULATING CARRIER *Check*

In early production the VFO shield was modified by the addition of a stiffener "lip" at the edge nearest the chassis and closest to the fan. If your particular unit does not incorporate this feature order Hammarlund part number P42339-1.

13. IMPROVED AM PERFORMANCE X

Improved performance on AM may be had by disabling the ALC action as discussed under the "ALC ACTION" section previously referenced.

14. INCIDENTAL FM ON AM AND FSK OPERATION X

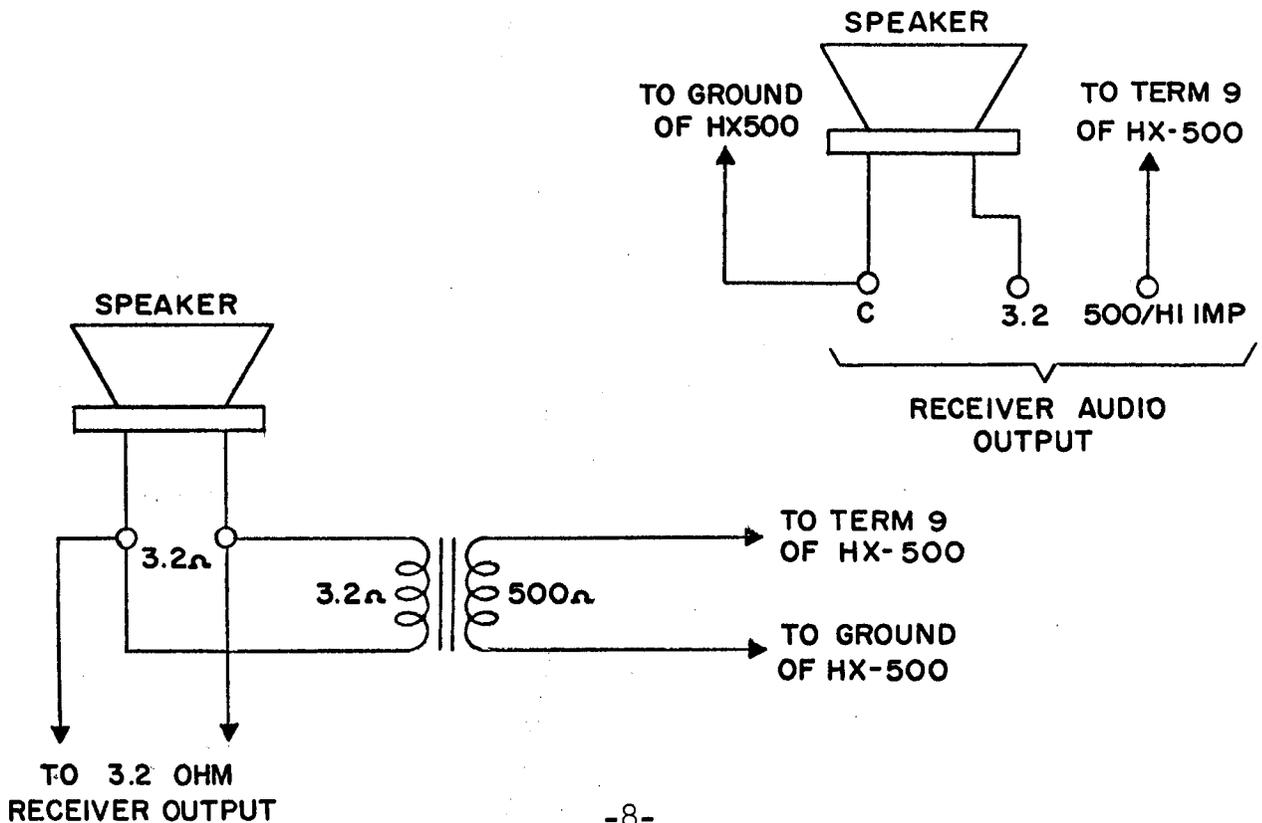
Make the modification referenced under CW Chirp.

15. VOX RELAY HANG-ON X

In all instances reports of VOX operation hang-on have been cured by replacement of the 6U8A tube designated V8. When this condition occurs the relays will usually drop out when the VOX timing control is rotated completely counter-clockwise. With a good 6U8A tube this control may be advanced fully clockwise without encountering relay "hang-on" beyond the normal time constant.

16. ANTI TRIP PERFORMANCE X

Under certain conditions (depending on microphone, speaker and room acoustics) insufficient anti trip action may be present. Additional anti trip gain may be achieved by increasing the value of R52 (screen circuit of V8A-6U8) to 820,000 ohm - 1/2 watt. If your receiver has a 500 ohm or high impedance audio output, same should be used to feed the anti trip signal to the receiver. In this instance the station speaker should be connected directly across the receiver output. A transformer may be employed as shown below in lieu of a high impedance receiver audio output.

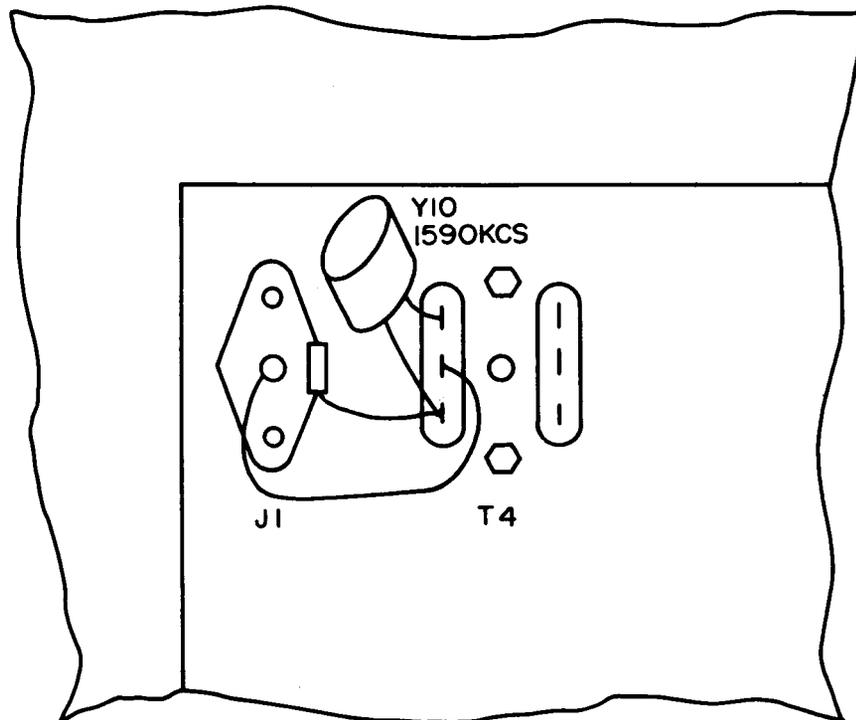


17. 6146 BIAS MODIFICATION *Already Done*

The use of a silicon diode rectifier in the bias section of the power supply is highly recommended as it provides instant bias when the unit is turned on thereby eliminating the possibility of high current surges of the 6146 in the final stage (see chapter titled "GENERAL OPERATION"). To make this change, disconnect the wiring from pin 2 and 5 of V17 (6AL5). Connect the now blank pin 2 to pin 7 and pin 5 to pin 1 thus paralleling both sections of the 6AL5 which is now used solely for the ALC function. A 400P1V silicon rectifier (Hammarlund part no. K41212-1) is wired so that its cathode terminal (+) connects to the lead that formerly went to pin 5 of the 6AL5 and the other terminal connects to the lead that formerly connected to pin 2 of the 6AL5.

18. SPURIOUS SIGNAL 60 KC REMOVED FROM DESIRED FREQUENCY ✓

Although this spurious response is down in excess of 50 db, under certain conditions additional attenuation may be desirable. Approximately 20 db of additional attenuation may be achieved by the use of a 1590KC trap crystal, Hammarlund part no. K42345-1 should be installed as follows; 1) Assuming that the unit has been removed from the cabinet, remove the bottom cover of the exciter chassis. 2) Clip the pigtail leads of the new crystal leaving approximately 1/2" in length. Solder the crystal across the bottom winding of T4. The crystal should be soldered to the lugs either side of center as indicated in the diagram below:

EXCITER CHASSIS FRONTBOTTOM VIEW

The installation of this crystal will not affect the setting of the present 1590KC trap. However, it is advisable to re-check this trap for maximum suck-out in accordance with the appropriate section of the Instruction Book.

19. PRESENCE OF CONTINUOUS INTERFERENCE SIGNAL ON 3950KC ✓?

In all HX500's produced, with serial numbers under 1000, the frequency range of the VFO was such that at 3950KC (75 meter band) it's frequency crossed over the signal frequency resulting in an annoying signal in the associated receiver. This condition only occurs at this precise frequency and under most conditions will not be bothersome. If necessary, however, the unit may be re-aligned so that the VFO frequency never crosses over an operating frequency in the amateur bands. This is basically achieved by re-aligning the 1650KC section to 1530KC. No electrical parts are required to make this change, however, the revised alignment procedure will reverse the upper and lower sidebands, therefore, the function switch selector knob must be replaced with Hammarlund part no. K42414-G2. This knob differs from the original knob only in that the USB and LSB positions are reversed. The following re-alignment procedure is recommended:

1. Make up a piece of transmission line (RG58U) about 36" long with a phono type plug at one end and terminals at the opposite end suitable for use with the receiver that will be used for the alignment test.
2. Allow the HX500 and the associated receiver (capable of tuning the range of 1500KC to 1700KC) to warm up for at least thirty minutes.
3. Remove the cable from the J1 output jack of the exciter chassis in the HX500 and insert the cable referenced in step 1, connecting the other end to the antenna input terminals of the receiver.
4. Tune the receiver in the vicinity of 1530KC which is the image frequency of the 1650KC section of the exciter. It will probably be necessary to use most of the RF gain in the receiver to find this signal. The RF gain control of the receiver should be set so that it's "S" meter or other indicating-device is below the overload point, but in a region where noticeable difference in output can be detected. Also be sure that the receiver is tuned to 1530KC and not 1650KC.
5. Adjust the bottom slug of transformer T3 for maximum indication on the receiver. Readjust the RF gain control as required to prevent overloading.

20. WARNING: DO NOT TOUCH TOP TUNING OF T3 (1590KC TRAP) AT THIS TIME.

6. Adjust top and bottom slugs of transformer T4 for maximum indication reducing the sensitivity of the associated receiver as desired.
7. Remove transmission cable from J1 and insert original cable connecting exciter chassis to VFO.
8. Remove tube shield and tube V9, 6U8 oscillator-mixer from VFO.

9. Wrap a small piece of bare wire around end of phone connector cable coming from receiver and insert in pin 2 of V9 socket.

NOTE: It may be necessary to increase RF gain control sufficiently to get a usable output from the receiver.

10. Adjust top and bottom slugs of transformer T6 for maximum indication on meter. Repeat the foregoing steps to make sure that all transformers are peaked for maximum output while simultaneously reducing the gain of the receiver so as to prevent overloading, which would result in false alignment indication.
11. Remove cable and re-insert tube V9 in it's socket and replace tube shield. This completes shifting the frequency of the exciter from 1650KC to 1530KC. It now becomes necessary to move the VFO frequency over so as to produce the original heterodyned output. For this portion of the work, it will be necessary to remove the HX500 from its cabinet if same has not already been done.
12. Remove cable from J7 output of VFO and insert cable from receiver.
13. Set receiver to the 4 megacycle band and tune to 4020KC. Turn VFO of receiver on. For the highest degree of accuracy it is desirable to use some secondary frequency standard to insure proper calibration of the receiver.
14. Set the HX500 VFO dial to 4.0 megacycles. Locate L17 (VFO coil on bottom of chassis directly below VFO assembly and situated between relay and two electrolytics). Very carefully loosen binding nut which unlocks slug adjustment.
15. Tune very slowly clockwise approximately two turns or until "O" beat of the new frequency of the VFO is obtained.
16. Set the HX500 dial to 3.5 megacycles. Shift the receiver dial 500KC higher in frequency (4520KC). This should coincide with the output frequency of the VFO directly. If it does not, it may be necessary to slightly adjust trimmer capacitor C92 and re-check the 4020KC position by re-adjustment of the slug. A slight amount of rocking back and forth may be required to bring the individual unit into calibration.

NOTE: The accuracy of the dial readings as related to carrier output frequency will be a function of the accuracy of the receiver used during the above tests. A frequency meter such as the BC221 or a secondary frequency standard having 10KC markers should be employed if at all possible. It is also well to locate the original high and low frequencies of the VFO on the receiver before making the actual frequency shift.

After making the above changes there will be no crossover point between the VFO on the output frequency, on the 75 meter or any other band. The upper and lower sidebands will be reversed as indicated earlier under this section and is taken care of by replacement of the knob previously referenced.

HX-500 MODIFICATION
PARTS LIST

Reference Paragraph Number	Description	Hammarlund Part Number	Cost Each
5.	Resistor, fixed 3900 ohm $\pm 10\%$, 1/2w	K19309-63	.10
5. R32	Resistor, fixed 470k $\pm 10\%$, 1/2w	K19309-113	.10
5. C45	Capacitor, disc ceramic .01 mfd $\pm 20\%$, 500v	M23034-28	.20
6.	Capacitor, dur-mica DM-15 100 mmf $\pm 2\%$, 500v	K23006-112	.30
6.	Resistor, fixed 470 ohm $\pm 10\%$, 1/2w	K19339-1	.10
7.	Resistor, fixed 15k $\pm 10\%$, 1/2w	K19309-77	.10
10. R132	Resistor, fixed 15 ohm $\pm 10\%$, 2w	K19304-156	.20
10. R137	Resistor, fixed 3000 ohm $\pm 10\%$, 10w	K19337-2	.61
11.	Resistor, variable 10 meg. $\pm 20\%$, 1/4w	K15368-11	.93
11.	Resistor, fixed 4.7 meg. $\pm 10\%$, 1/2w	K19309-137	.10
12.	* VFO shield modified	P42339-1	1.14
16.	Resistor, fixed 820k $\pm 10\%$, 1/2w	K19309-119	.10
17.	Rectifier, silicon 400 PIV	K41212-1	1.05
18.	* Crystal, trap 1590 kc	K42345-1	3.75
19.	* Knob (function switch selector)	K42414-G2	.50

These parts are available from the Hammarlund Manufacturing Company, Mars Hill, Madison County, North Carolina, or your local distributor.

* Available only from Hammarlund.