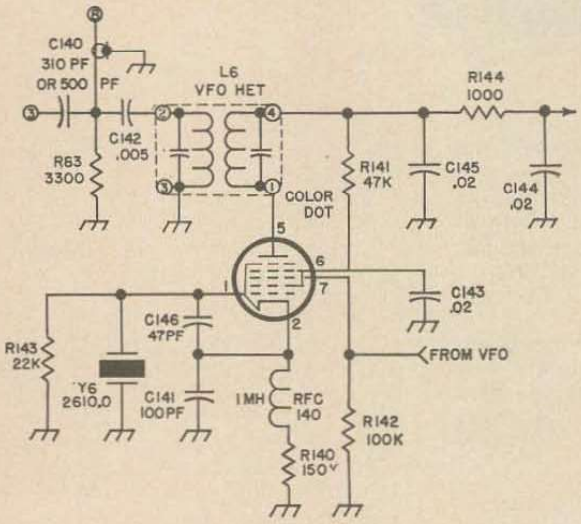
Putting the HW-12 on 160 Meters

Dean W. Manley W8FGB
P.O. Box 217
Escanaba, Michigan 49829



Carrier oscillator and heterodyne oscillator mixer

The SSB signal in the HW-12 is generated at 2.3 MHz and mixes with the 1.5-1.7 MHz VFO signal to get 3.8-4.0 MHz. After changing the VFO cathode follower, V14-6BE6 to a heterodyne oscillator mixer, the 1.5-1.7 MHz VFO mixes with the 2.6 MHz crystal oscillator. The output of the V14 Mixer is 4.1-4.3 MHz. When transmitting, the 2.3 MHz SSB signal is mixed with the 4.1-4.3 MHz in the V4-6AU6 xmtr mixer producing 1.8-2.0 MHz. When receiving, the incoming 1.8-2.0 MHz mixes with the 4.1-4.3 MHz from the V14 stage producing the *if* of 2.3 MHz. This conversion to 160 meters inverts the SSB signal. If we didn't change the crystal in the V11B-½12AT7 carrier oscillator stage, the converted HW-12 would respond only to upper sideband signals. This is easily remedied by changing the V11B stage crystal from 2306.7 kHz to 2303.3 kHz and the modified unit will respond to lower sideband (LSB) signals, both transmitting and receiving.

Transmitter driver and receiver rf

Modification of this part of the HW-12 only involves changing the L2-DRIVER GRID and L3-DRIVER PLATE coils. These coils also serve as *rf* stage coils in the receive mode. The coils are removed and modified, and then re-installed.

Transmitter pi-net

This portion of the modification affects only the transmitter section. The Pi-network tank variable C65, capacitors C66 and C67 (68 pf each), tank coil L4, and loading capacitor C77 are removed and their 160 meter equivalents are installed.

Whether you obtained your HW-12 new or used, the 160 meter modification should not be undertaken without reference to the Assembly Manual supplied with the kit. Not only is the manual helpful during the process of the modification, but it should be used to check the performance and alignment of the HW-12.

It is strongly suggested that time be taken before modification to measure and make a written record of voltages. Reference is particularly made to Figure 12 on page 52 and Figure 13 on page 53 of the HW-12 manual. Before the actual modification is started, make sure that the HW-12 performs normally on 3.8-4.0 MHz. This could very well save time and headaches later.

Parts needed for 160 meter modification

Besides the HW-12 and it's power supply, the following lists of parts is required for the 160 meter modification: (One of each required, unless otherwise specified)

2303.3 kHz crystal, Heath 404-196
80 Meter Driver Grid Coil, Heath 40-516
33 pF mica or ceramic capacitor
47 pF disc capacitor
56 pF, 4kv disc capacitor
100 pF disc capacitor

220 pF, 4kv disc capacitor
2000 pF (.002 mF), 500 volt mica capacitor
.02 mF disc capacitor
150-ohm, ½ watt, 10% resistor
1000-ohm, ½ watt, 10% resistor
22K, ½ watt, 10% resistor
1 mH *rf* choke
B&W Miniductor 3019 (see text)
Hammarlund MC-140-S transmitting variable
2610.0 kHz crystal, JAN Crystals (HC6/U holder)

Also, a small quantity of small size wire suitable for rewinding coils L2 and L3 is required. Sizes between #30 and #36 is suggested. The winding from an old 2.5 mH *rf* choke or a broadcast oscillator coil may be used. If it is decided that total coverage of the 160 meter band will not be used for transmitting, then the new 140 pF variable capacitor will not be required. The present final tank capacitor C65, 50-50 pF will cover at least one 25 kHz segment of the band. In this case, experimentation may be required for the exact values of the capacitors in parallel with the final tank variable to cover the desired 25 kHz segment of the 160 meter band.

It should be noted here that the new 80 meter Driver Grid Coil will be used for the Heterodyne Oscillator Mixer Coil L6 for 160 meter operation.

Modification

Carrier oscillator and heterodyne mixer

Remove the present carrier oscillator crystal Y1-2306.7 kHz and install the new crystal 2303.3 kHz. Remove the following parts from the V14-6BE6 VFO cathode follower: R140-1000, C141-310 pF, RFC-140-15 μH, and the jumper wire connecting V14-Pin 1 and Pin 7. Remove R141-47k and temporarily set aside for later installation.

Locate the new 80 meter driver grid coil (Heath 40-516) to be modified for use as L6 heterodyne oscillator mixer. Remove the coil from the shield can and then remove the 390 pF capacitor. Remove one end of the 100 pF capacitor and coil lead from pin 2. Remove the coil lead from pin 4 and solder it to pin 2. Now solder the free end of the 100 pF capacitor and the remaining coil lead to pin 4. Install a 33 pF capacitor between pin 2 and pin 3. Re-install the coil in the can and the install the completed L6 on the printed board between V13 and V14. Pin 1 of L6 goes to V14-pin 5.

See **Fig. 1** for the installation of the parts in the het osc mixer. Double check to be sure of the proper location of each part before installing the part. Then install the part and check again for possible errors! It is easy to make errors, especially if you're not familiar with printed boards.

Locate C142-.005 on the printed board and remove the lead going to V14-pin 2. Connect this free end to L6- pin 2. Now locate C140-310 pF and remove the lead nearest V14. Connect the free end of coaxial cable, and R83-3300. Install the following parts: R140-150, R141-47K, R144-this capacitor to the junction of C142.005, 1000, R143-22k, C141-100 pF, C146-47 pF, C145.02, RFC140-1mH, and Y6-2610.0 kHz.

Driver coils L2 and L3

Remove L2 from the printed board and remove the shield can. Carefully add approximately 35 turns "Scramble-wound" to each winding. Wind over the present winding and away from the adjacent winding. Do not wind in the space between the primary and secondary windings. Check the windings with an ohmmeter and then reinstall in the shield can noting the position of the color dot. Re-install L2 on the printed board.

Remove L3 from the printed board and remove the coil from it's can. Remove the windings, noting the pin connections. Wind a 6-turn link to pin 2 and pin 3 in the same location on the form as the original winding. Now wind approximately 85 turns over the link using the "scramble-winding" method and connect to pin 1 and pin 4. Check with an ohmmeter and then re-install in the shield can noting the color dot. Install L3 on the printed board.

Transmitter pi-net

Remove the following parts from the HW-12: 80 meter tank coil L4; final tank capacitors C65-Variable, C66-68 pF, C67-68 pF; and the loading capacitor C77-1000 pF.

Install the new C77-2000 pF capacitor in place of the old C77. Install the entire B&W 3019 Miniductor or wind 36½ turns of No. 16 enamel closewound on a 1¼-inch

diameter form 3-inches long. The winding will take up about 2-inches. Install the variable capacitor at the final tune location on the front panel. Install the fixed capacitors from the hot side of the variable capacitor to ground. The fixed capacitors are 220 pF and 56 pF at 4kv. Solder a lead from the top of coil L4 to the hot side of the tank capacitor combination C65-C66-C67.

Alignment

Follow the procedure outlined in the HW-12 manual for the alignment of the VFO dial calibration, bias setting, *if* amplifier adjustment, and balanced modulator adjustment.

Het OSC mixer alignment

1. With the VFO dial set to 1.8 (3.8), turn the function switch to the tune position and the meter switch to tune operate.

2. Adjust the upper slug of coil L6 for maximum output.

3. Set the VFO dial for 2.0 (4.) and adjust the bottom slug of L6 for maximum output.

4. Repeat steps 1, 2, and 3. If results are not satisfactory, try adjusting the upper slug at 2.0 and the bottom slug at 1.8

Driver alignment

1. Adjust the upper slug of driver grid coil L2 for maximum output at 1.8.

2. Adjust the bottom slug of L2 for maximum output at 2.0.

3. Adjust the slug of Driver plate coil L3 for maximum output at 1.9.

4. Repeat the steps as necessary for the desired results. If flat response across the entire band is not obtainable, then try for response across the desired 100 kHz portion of the band. For example: adjust one slug of L2 at 1.8, the other slug of L2 at 1.9. Adjust L3 at 1.85.

Now go back to L6 and adjust if necessary for response across the desired portion of the band.

Gratifying reports were received on 160 meters saying that the rig sound every bit as good as an unmodified unit on 75 meters.

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