Heath HW-99 Transceiver

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Heath Company
Dept. 011-442
Benton Harbor MI 49022
Price class: $300

Enter Heath's latest Novice transceiver, the HW-99, complete with an integral power supply and a solid 50 Watts on 10, 15, 40, and 80 meters. The rig is solid state and ruggedly designed, and should see years of trouble-free service. The minimal controls will simplify life for the Novice, but will utterly frustrate just about anyone else.

The front-panel controls consist of a power on/off rocker switch, a four-position rotary band switch, a large tuning dial, a volume adjust for output to speaker/phones, and a level adjust which varies the drive to the transmit amplifier chain. The level control is functional only up to the nominal 50-W output limit, provided that output vswr is low; otherwise, an automatic-level-control (ALC) circuit derived from a directional coupler at the output of the transmitter overrides the front-panel level control and cuts back the transmit drive.

A 10-segment LED bar graph is used to display receive signal strength relative to a no-antenna (all segments off) condition. In the receive mode, the display source is the agc detector tapped off the i-f amp. In transmit, the display is driven by a relative power amp which obtains a voltage from the ALC pickup, the directional coupler. No tuning controls are provided since the PA is a broadbanded linear and no tuning is necessary.

The forward and reflected components are summed at the output of the coupler. If either forward or reflected power (or both) increases, so does the display indication; hence, a greater number of lights on the display does not necessarily mean more power out. Operating into a high vswr load can easily light up the whole bar graph, giving the illusion of higher power output even though little or none is actually getting out.

The transceiver is executed on three single-sided boards: an oscillator board, a transmit/receive (T-R) board, and a power-amplifier (PA) board. Single-sided boards for rf kits have characteristics worthy of note for the uninitiated. On the plus side, they are less costly. The components are usually more spread out (i.e., less dense) than double-sided or multilayered boards to make room for more routes, since almost all of the tracks must be crammed into a single layer.

This allows for simpler kit building and troubleshooting. Most of the components are easily accessible, and the chances of shorting something while poking about are reduced since those pesky traces and pads are hidden on the less-accessible underside of the board.

On the other hand, since the traces are all on one side, they necessarily are arranged more densely even though the components are more spread out. Inevitably this means that many traces and pads at substantially different dc levels will end up adjacent to each other, increasing the probability of a catastrophic solder bridge during construction. Equally detrimental is the loss of a ground plane which would improve amplifier stability and harmonic suppression by providing an ultra-low impedance/inductance return for supply current as well as an effective shield.

Building the Kit

Construction of the kit is straightforward although not necessarily simple. Take the time to familiarize yourself with the instructions. No fewer than 10 (count 'em . . . 10!) double-sided pages of instruction-manual changes are included. To avert disaster, read over the changes carefully and enter them all in the manual. Don't delude yourself into thinking that just by having the errata handy you will catch all of the goofs . . . you won't! And do this *before* beginning construction, not as you go along.

The time estimate for completion of the kit as given by Heath is 16 hours. It took me about twice that to complete the job, and a good deal more time to track down the ouches.

Oscillator Board

This is the largest board and the simplest to construct. I recommend that L218 be installed before capacitors C269 and C271–C274 to make it easier to push L218 lugs into the board.

T-R Board

This is somewhat smaller than the oscillator board, but it is more densely arranged and contains a number of hand-wound transformers and inductors which no doubt will prove challenging to the novice kit builder. Carefully note the position of the color dots and notches on rotary switch SW101 in the instruction manual *changes* or you will be lost in space later. Expect a battle from D123 and D124 as the leads are just barely small enough to be inserted into their designated circuit-board holes.

Before building this board, check for a foil-to-foil short to ground at the junction of C134 and C137 (about the middle of the board). My board *was* shorted there after construction. I thought it was a solder bridge, but after removing all of the components in that section and meticulously cleaning all the solder off that part of the board, it still showed a dead short. A trusty X-acto® knife made "short" work of the problem.

PA Board

The power amp board is the smallest but not the least challenging. Several hand-wound transformers make construction interesting. A special word of caution concerning the broadband output transformer T304: Bare wires are soldered to printed-circuit-board (PCB) pieces to serve as leads to connect the transformer to the PA board. Make sure that no part of these wires protrudes over the top of transformer PCB ends, since there is almost no clearance between the transformer and the PA shield. A sharp edge of a wire will easily penetrate the paper insulator on the PA shield and potentially short the 30-V supply to ground. You may wish to check up on that situation with an ohmmeter following installation of the PA board.

The Chassis

The ac wiring, 12-V supply, controls, and input/output jacks are all chassis mounted. Exclusive of the 12-V regulator (U1), the entire 12-V supply is mounted on a 7-lug terminal strip. With board-to-board interconnects here as well, this lug strip gets to be pretty busy, and, if difficulty arises, it is not easy to repair. Circuit-board mounting of this section would simplify life greatly.

A word of caution: Configured as it is, U1 is not blow-out proof. Output capacitor C12 (100 uF) has ample energy storage to destroy U1 should the *input* to U1 become shorted to ground. The schematic is somewhat deceptive at the 12-V supply. Circuit board ground and chassis ground are shown as isolated. In fact, they are made common in at least two places here: first at the center tap of T1's secondary (the red/yellow wire) and the tab of 3-terminal regulator U1.

The board-to-board interconnects are molex® terminals and are time-consuming to crimp without the proper tool.

Finally, the headphone jack is a mono jack. If you have stereo phones (who doesn't?) and don't fancy listening with just one ear, you either will need a mono/stereo adapter or you will need to replace J1 with a stereo phone jack and tie P206-1 (center conductor) to both left and right channel phone lugs.

Alignment

Following repair of all the boo-boos, alignment was a snap. Goofs: two diodes incorrectly inserted; three board shorts (two ours, one theirs); SW101 installed correctly, but shaft notch 180° reversed (see previous comments concerning instruction manual changes); bad

C246; L210 up in a glorious puff of smoke; and J1 soldered incorrectly (don't rely on the pictorial, 4-8, as it does not clearly show the lug hook-ups; you must rely on the schematic).

However, the manual calls for equipment that the average Novice probably doesn't have: a 10-MHz frequency counter and an rf wattmeter capable of measuring 75 Watts. Finding C246 bad would have been difficult without a scope, since rf voltages at the hfo are pretty low and would scarcely show up on the built-in rf detector. A 50-MHz scope came in handy here showing a beautiful low-level sine wave (on all bands) at the hfo side of C246, but only dc present at the hfo buffer side.

It may be of interest to note that resistance readings given in the manual were obtained using a Heath IM-5218 VTVM. The manual notes that readings taken with other ohmmeters (because of different measuring voltages and currents) may be considerably different. We found this to be true.

Don't rely on your Heathkit® store for replacement parts. I promptly ordered (paid up front) a list of all necessary replacement parts as none were in stock. I was told that a two-week lead time was typical. I then ordered the same (equivalent) replacement parts from the will-call desk of a local electronics wholesaler and subsequently picked up the parts three days later. It has been two months, and I haven't heard from Heathkit yet.

One disquieting feature I noted during alignment of the vfo and in subsequent operation thereafter was the lack of a positive end stop on the tuning vernier. The mechanical end stop is supposed to be created by the end of a semi-circular groove on the tuning dial within which ride two screw heads contained in the vernier assembly. It is difficult to tighten the vernier assembly sufficiently on the tuning dial to prevent the dial from slipping as pressure is exerted against the stop. This knocks the vfo out of calibration and puts you off frequency. Because you are on the easy end of a gear reduction, you may not even notice that an end stop has been encountered, and you will be merrily knocking your rig out of calibration repeatedly.

Operation

For a Novice sitting down to use a transceiver for the first time, the HW-99 would be one of the least intimidating radios to operate. With such a simple and uncomplicated front panel, there isn't much to adjust or misadjust. Heathkit understood the obvious inexperience and jitters that go along with those early QSOs. This basic rig will help the Novice to gain confidence as s/he enjoys those first contacts.

However, as the new ham gains experience, the realization will come that there are some features that Heath could have included that wouldn't have complicated the front panel too much. We've already discussed how easy it is to change the vfo alignment by dialing the tuning vernier past the end stop. A crystal calibrator would come in handy to help the operator maintain correct alignment or at least know how far off the dial is. It's always better to be sure of your frequency rather than to guess if your dial reading is accurate. As you gain new operating privileges by upgrading to a General-class license or higher, it will become more apparent that the dial may be 10–15 kHz off at one band edge—and the FCC frowns upon people who operate where they don't have privileges.

Another complaint is the lack of a meaningful meter. The 10-segment LED bar graph looks impressive (all those tiny red lights), but can be giving you misleading information. The manual cautions you to never turn the level control past a point where more than eight segments are lit. It explains that if you do, rf power output will not increase because the ALC circuit will automatically reduce the carrier level from the transmitter.

We checked this with a Bird 4410A wattmeter. The ALC worked as it should, but not at the indicated number of LED segments lit. For example, on 80 meters with seven segments lit, we measured 42 Watts output. We increased to 10 segments lit and obtained a peak power output reading of 58 Watts. As we continued to turn the level control, 10 segments remained lit and the power did cut back as it was designed to do.

On 15m, 40m, and 80m, the power peaked at 10 LED segments lit. On 10m, four segments lit was the maximum that would light and was the maximum power output. The maximum forward power we measured on each band was: 10m, 42 W; 15m, 71 W; 40m, 62 W; and 80m, 58 W. We also found the level control to be very touchy. It didn't take much of a turn to dramatically increase/decrease power output.

The tuning dial is marked in 5-kHz increments and numbers indicating frequencies are every 50 kHz. Markings every 1 kHz and numbers every 10 kHz would have been nice.

One problem that I've encountered has to do with the volume control. For most QSOs, it's fine. But when you're listening to a strong signal, it doesn't turn down far enough. More than once, I've been blasted out of my headphones because of this. (Or, if you're using the speaker, the sleeping kids could get blasted out of their beds.)

Being a radio designed for the Novice, it doesn't have 20m, nor does it have the WARC bands. Adding the capability of having those bands would have necessitated extra circuitry (obviously) and may have meant using double-sided circuit boards. Since the object of this radio was to give the Novice a good start in amateur radio, to keep the kit building as easy as it could be, and to keep the price down, it probably isn't reasonable to expect it to include the other amateur HF bands. Nor is it reasonable to expect lots of other features that are found on more expensive HF rigs. This is a good, basic HF transceiver.

Conclusion

Using the HW-99 was fun. The receiver was clean sounding and sensitive. Most of the comments I received about the transmitter were good. Some of them were "Rig sounds great," "Doing a good job," "You can be proud of it," "Sounds FB to me," and "Very good."

On the whole, the rig is a well-conceived, straightforward piece of work. An experienced builder will not be at all intimidated by it. The first-time builder probably will be. In use, with a good antenna, the rig performs admirably with minimal fiddling, no doubt much as the designers at Heathkit had imagined. The lack of adjustment and meaningful information about power output or state of tune given by the rig are its biggest flaws.

For more information about the Heath HW-99 transceiver, circle number 206 on your Reader Service card.■