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Heath HW-99 Novice CW Transceiver

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Assistant Technical Editor

Heath HW-99 Novice CW Transceiver

About a year ago, the Heath Company introduced a new rig that is truly elegant in its simplicity. The HW-99 CW transceiver is a thoroughly modern, HF, CW-only radio that owes much to the lessons learned in developing the HW-9 QRP transceiver. This is *not* a warmed-over HW-16 from the 1960s. The Heath HW-99 is VFO controlled, tuning the bottom 250 kHz of the 80, 40, 15 and 10-meter bands (sorry, *no* 20-meter coverage!). It seems to be targeted primarily for Novice and Technician class operators using CW on the four HF Novice bands, but it should appeal to veteran brass pounders who think 50-W output is enough to work the world.

Like any good CW rig, no matter how simple or complex, the HW-99 has a sensitive and stable receiver, a solid and comfortable tuning dial with no apparent backlash, a tuning rate that is neither too slow nor too fast, a mellow-sounding sidetone and a well-keyed waveform. We have one major complaint about the documentation on the HW-99: We looked through the ½-inch-thick manual several times and never did find a block diagram of the circuit. Reading the more-detailed schematic diagram is no problem for the experienced person, but the block diagram is crucial for the beginner to get a handle on how the circuits interact.

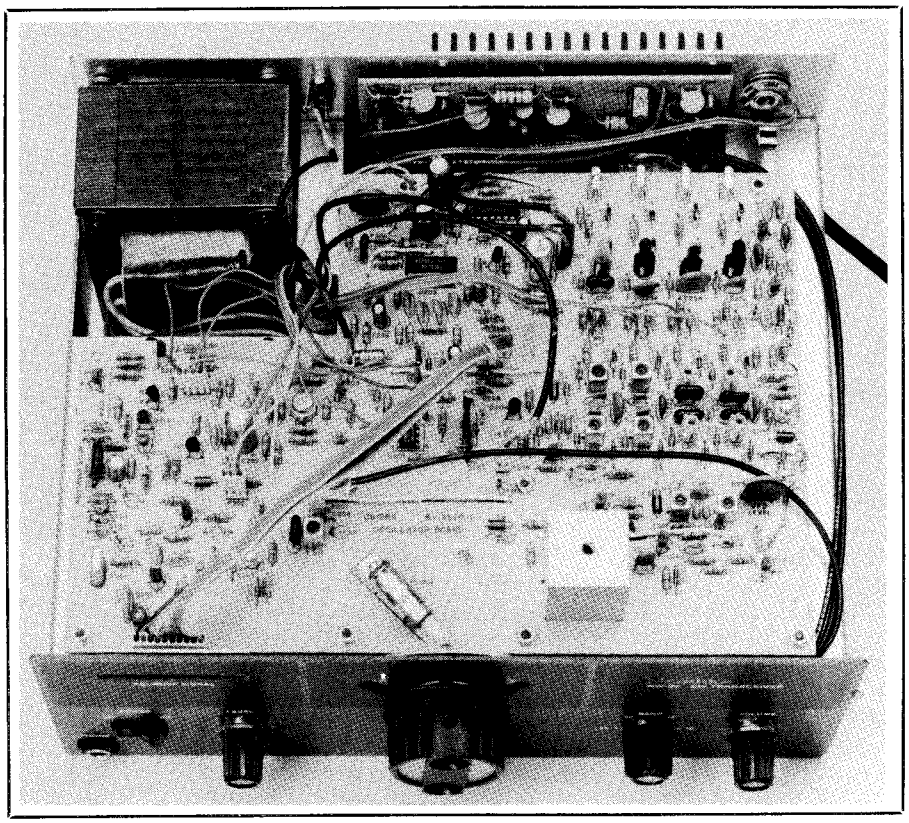


Fig 1—Top view of the Heath HW-99 transceiver. The main oscillator circuit board is on top of the chassis, the small power-amplifier board is on the rear wall (with shield removed), and the T-R board and power supply (not shown) are accessed from the bottom. All circuit boards are spaciously arranged, making assembly easy.

Circuit Description

Both the transmitter and receiver feature broadband circuitry so that no user-actuated preselector or final tuning are required during normal operation. This makes the rig simple to use—a nice feature for Novices. A transmitter using a solid-state output stage, however, requires a low SWR for proper operation. Therefore, the industry trend to broadband rigs brings with it the requirement for antenna matching networks and SWR meters, and thereby adds costs and complexity to setting up a beginner's Amateur Radio station. An ALC circuit in the HW-99, however, does provide protection to the transmitter power amplifier if the antenna SWR is too high.

The HW-99 may look simple on the outside, but some very sophisticated circuitry lies within the dark-brown case. A separate low-pass filter is included for each band in both receive and transmit modes, providing optimum rejection of received spurious signals and transmitted harmonics. The receiver features a doubly balanced ring mixer, for a cleaner mixer-stage output. This results in fewer spurious responses (known as "birdies," those mysterious carrierlike signals that sometimes appear here and there on the band). The receiver's IF strip does an excellent job of rejecting signals on one side of zero beat, but isn't particularly sharp otherwise. We have no problem receiving and understanding Canadian USB phone stations operating on the low end of 40 meters. Even in weak-signal situations, we rarely have to run the volume control more than two-thirds of the way up before the speaker is overdriven! This rig has plenty of gain.

Heath claims that the HW-99 can be used in the full-break-in mode up to 30 WPM. Our experience indicates this may be the upper limit. There is a noticeable audio thump in switching from transmit to receive, but even when using earphones it is not objectionable. A relay disconnects the antenna from the receiver and solid-state switching handles all other functions when the key is closed. An internal variable resistor sets the time delay for return to the receive mode.

Building the Kit

Since Heath plugs the HW-99 as a Novice rig, we gave it the acid test—we let a relative newcomer to Amateur Radio build it. Edie, N1CZC, has been licensed less than three years, although she already holds an Advanced class license. Her busy life-style prevents her from spending much time inside ham gear, however. She was the perfect candidate to see if the HW-99 is truly a kit for the Novice builder.

Heath's reputation for high-quality instructions continues in the thick manual that comes with the HW-99. Heath's packaging of components is better than ever, which really helps inexperienced builders succeed. There is always that necessary step of getting the parts out and arranging them in some orderly fashion. *Do not skip this step!* The HW-99 kit has a lot of parts, and the time and care of checking though the parts list will be of great help later during the assembly process.

Since the HW-99 is a new product, and ours was shipped during the first two months of production, we were not too surprised at a fairly extensive list of corrections and modifications to the manual. It is important to incorporate this information into the manual carefully before assembly begins.

The HW-99 circuitry is fairly sophisticated, and the kit takes a long time for a beginner to build, but the inside of the radio is spacious enough for inexperienced hands to have little trouble during the construction phase. See Fig 1. Even if you're a veteran tinkerer, don't expect to grab this kit from the mail on Friday afternoon and have it on the air by Sunday evening. Edie spent 30 hours unpacking and building about two-thirds of the kit before she ran out of time—I needed another 20 hours to finish the job.

Alignment was relatively easy, although for accurate dial calibration a 10-MHz frequency source is *required.* The instructions caution the builder to not push down on the slugs

Heath HW-99 Novice CW Transceiver, Serial No. 01-55615

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 80 m, 3.5-3.75 MHz; 40 m, 7.0-7.25 MHz; 15 m, 21.0-21.25 MHz; 10 m, 28.0-28.25 MHz.	As specified.
Modes of operation: CW.	As specified.
Frequency display: Analog dial.	As specified.
Frequency resolution: Not specified.	5 kHz per division.
Frequency stability: Less than 200 Hz/h drift after 30-minute warm-up.	2.5 kHz after 1 h.
Transmitter	*Transmitter Dynamic Testing*
Power output: 50 W, except on 10 m; 40 W on 10 m.	80 m, 50 W; 40 m, 45 W; 15 m, 30 W; 10 m, 22 W.
Spurious signal and harmonic suppression:	See Fig 3.
Keying waveform: Not specified.	See Fig 4.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity: Less than 1.0 μV for 10 dB signal + noise/noise.	Minimum discernible signal (noise floor) (dBm): *80 m* −123, *15 m* −116
Receiver dynamic range: 70 dB.	Blocking dynamic range (dB): *80 m* 117, *15 m* 112
	Two-tone, third-order intermodulation distortion dynamic range (dB): *80 m* 91, *15 m* 87
	Third-order input intercept (dBm): *80 m* 13.5, *15 m* 14.5
Receiver audio output at 10% total harmonic distortion: 1.0 W.	1.16 W.
Color: Dark brown.	
Size (height, width, depth): 4-5/8 × 11-1/2 × 10-3/4 in.	
Weight: 13 lb.	

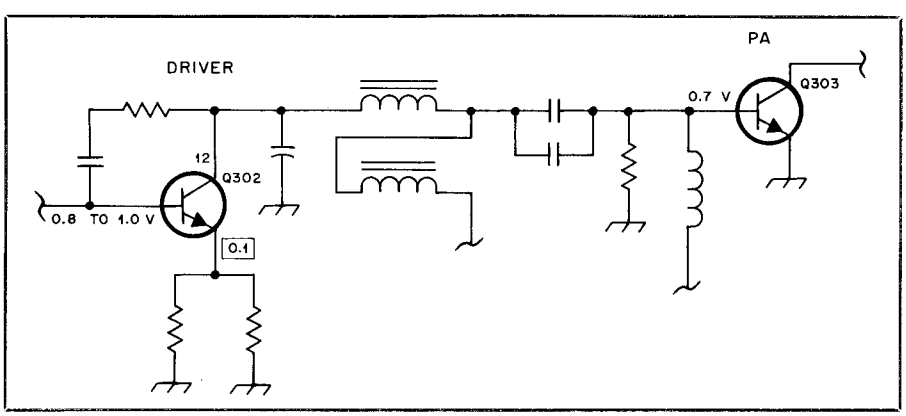


Fig 2—Schematic diagram of the HW-99 power-amplifier stage showing correct voltages.

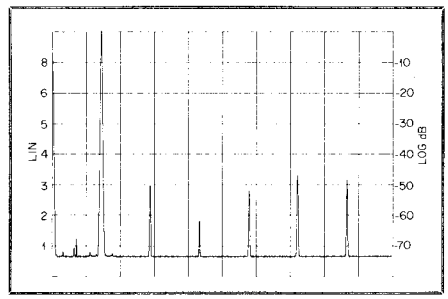


Fig 3—Worst-case spectral display of the HW-99 transmitter. Power output is 45 W at 7 MHz. Horizontal divisions are each 5 MHz; vertical divisions are each 10 dB. All spurious and harmonic emissions are at least 46 dB below the fundamental output. The HW-99 meets current FCC requirements for spectral purity.

while adjusting the coils. They're *not* kidding! The slugs are quite delicate, and I managed to crack two of them; be very gentle.

Some Problems

Take special care when assembling the large tuning capacitor for the VFO. When you put the shield around the capacitor, be sure the metal can does not short circuit the wire coming out of the capacitor housing. Another problem: When shipped, the band-switch wafers were rotated 180° from their proper orientation. Once the band-switch wafers were reoriented, however, the receiver sprang to life, and we could proceed with alignment. The errata sheet from Heath corrects this problem on the drawing, but makes no mention of the correction in the step-by-step instructions.

After the power-supply subassembly was wired, we did the chassis subassembly tests prescribed in the book. The fuse blew immediately upon applying line voltage. It turned out that instead of the 2.2-megohm resistor that goes from the power-supply line cord to ground, a 220-ohm unit had been supplied on the component part strip. Of course, 220 ohms to ground on the line cord *will* cause the fuse to blow. We installed the correct resistor, and the power-supply checkout continued with no apparent problems. We then proceeded to install the large oscillator board. We still don't know why, but a filter capacitor in the power supply began to smoke, and finally went SNAP! That power-supply breakdown caused the 12-V regulator to fail—in addition, an IC and a transistor were lost on the oscillator board. All components were easily replaced after a quick trip to Radio Shack. The power-supply problems did not return with the new components, although some additional ICs failed over time, probably from the stress of the initial problem.

We found an error in the transmitter's power-amplifier circuit board and the associated voltages on the schematic. The 220-ohm resistor that ended up in the power supply came back to haunt us when we noticed that the transmitter had no output. It turned out that the 220-ohm resistor belonged in the power-*amplifier* circuit, but the power supply's 2.2-megohm resistor was there instead. Once we corrected that problem, the transmitter output was fine. Moral: Check the values of the components as you install them, don't depend on the strip packaging of components. Murphy's law applies everywhere!

In troubleshooting the power-amplifier problem, we discovered that the voltages, as indicated on the schematic, were wrong. A quick call to Heath's excellent technical information service confirmed the error. The proper voltages are noted in Fig 2.

The HW-99 worked perfectly with our old keyer using a relay output, but a newer transistor-output keyer caused the keying circuit to hang up halfway between the transmit and receive modes. The fault is in our keyer, not in the HW-99. The manual says to use a contact to ground for transmit—our homemade transistor output keyer was designed for grid-block keying and applied 5 V to the keying line. We will have to add a relay to that keyer to use it with the '99.

Some Modifications

We live in an apartment where space is limited. The HW-99 appeals to us because of its small size—therefore we did not buy the matching speaker. Instead, we installed a small 3-inch speaker in the grillwork on the cabinet top. It works and sounds just fine.

To make the HW-99's key jack compatible with our other ham gear, we used a ¼-inch headphone jack instead of the phono jack furnished by Heath. No modification of the hole is required. Just be sure to connect the wiring to the tip-contact lug, not to the ground lug.

Another HW-99 owner felt that the dial illumination was inadequate, and devised an ingenious solution. He used the reflector from

a camera flashcube to focus more light on the dial (see Hints and Kinks, Feb 1986 *QST*).

Heathkits have always been fair game for those who would modify their ham gear because the owner can so easily become acquainted with the insides of the radio. Our HW-99 is likely to see two modifications: The 10-meter band is ripe for conversion to the much-missed 20-meter band; another possibility is to do something about the 30-V final output transistor so the rig can operate off a 12-V battery supply.

Using the Rig

On-the-air QSOs resulted in good signal reports. Everyone we contacted said the keying sounded fine, with no clicks or chirp. Once the rig has about an hour to stabilize, drift is not a problem. The front-panel controls are easy to use. I have fat fingers, though, and sometimes I turn the volume up while changing the band switch.

As mentioned earlier, the HW-99 needs some kind of antenna matching network and SWR meter to be useful throughout its full range of frequencies. If you don't roam around the bands too much, however (as in the case of Novices who must stay inside the Novice bands), you can probably fine-tune your antenna for your favorite frequency and do without the matching network and SWR meter.

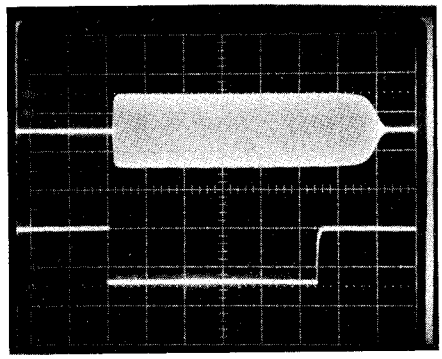


Fig 4—CW keying waveform of the HW-99. The lower trace is the actual key closure, the upper trace is the RF envelope. Each horizontal division is 5 ms.

By the way, Edie and I live two blocks from W1AW. The code-practice and bulletin schedules, sometimes with over 6000 W total being transmitted on several bands, make it a tough situation for many receivers. Not so with the HW-99—we get on the air and enjoy QSOs while the code practice and bulletins are hammering along only a few kilohertz away.

The hams at Heath have made a good move with the HW-99, satisfying those who like the smaller HW-9 QRP rig, but who wish for a bit more output power. Perhaps, someday, there will be a HW-99A with 20 meters and a WARC-band expansion option. Other than that, Edie and I are really enjoying this latest addition to the Heathkit stable of Amateur Radio equipment.

The HW-99 is available from the Heath Company, Benton Harbor, MI 49022, tel 616-982-3411. Price class: HW-99 transceiver, $300; SP-99 station speaker, $30. (Special offer for Novices: Get a $100 gift certificate good on any Heathkit product when you mail Heath Co a photocopy of your license and the HW-99 registration card.)—*Curt Holsopple, K9CH, and Edith Holsopple, N1CZC*

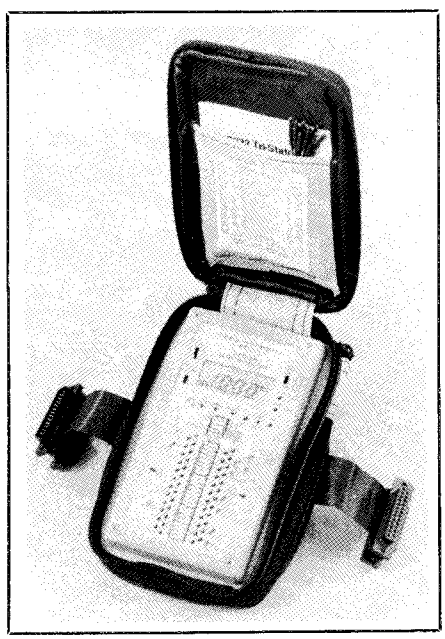
New Products

MODEL 650 DC/VOM TEST SET FROM DATACOM

☐ In addition to all of the features of their industry-standard Model 600 Tri-state test set, the self-contained Datacom Model 650 includes accurate dc-voltage measurements with an easily read, built-in, digital VOM for easy logic level analysis and a full RS-232-C breakout in one compact, rugged instrument.

Twenty-four center-mounted DIP switches allow any of the interface signals, except pin 1 (frame ground) and pin 7 (signal ground), to be interrupted. Two special function switches reverse pins 2 and 3 to create a null modem. Line-monitoring functions are isolated from the data/control lines so the possibility of line loading or disturbance is completely eliminated. Four-state signal status (Mark, Space, Clock, OFF) is provided by 12 tristate (red, green, off) LEDs. There are 25-pin dual-gender connectors on each side of the Model 650 for easy in-line connection with the DTE and DCE.

Suggested retail price is $299. The unit is packaged in a unique Soft-Pak for a lifetime of protection to go with the lifetime guarantee. For information, contact Datacom Northwest, Inc, 3303 112th St, SW, Bldg 100, Everett, WA 98204, tel 206-355-0590.—*Bruce O. Williams, WA6IVC*



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☐ The MFJ-1702 two-position coaxial switch has one pole, two output positions and a claimed low insertion loss—less than 0.2 dB. Designed for high performance at a reasonable price, its maximum frequency range is 500 MHz. It has a VSWR of 1:1.2 and exhibits better than 60-dB isolation at 300 MHz and better than 50 dB at 450 MHz. Power rating is 2.5-kW PEP, 1-kW CW. Unused terminals are automatically grounded for static/lightning/RF protection.

Priced at $19.95, the '1702 has an unconditional one-year guarantee, with an additional 30-day money-back guarantee if the product is purchased directly from MFJ. MFJ Enterprises, Inc, PO Box 494, Mississippi State, MS 39762.—*Bruce O. Williams, WA6IVC*