Feature

# It's a Classic!

# The Heathkit HW101

It's often said that to be a success, you have to be in the right place at the right time. This was certainly true of the Heathkit HW-101, which was undeniably Heath's most popular transceiver of all time.

The 'Hot Water 101', as it was affectionately known, was released just before Christmas 1970. It was a refinement of the HW-100, its immediate predecessor, which had gone on sale in 1968 as a low-cost alternative to the SB-101.

The HW-100 proved to be very popular, Heath proudly advertising it as 'the world's fastest selling transceiver'. But it did have a few minor flaws, which the company soon became aware of!

The minor flaws were effectively rectified some two years later with the appearance of the even more successful HW-101. Like the HW-100, the rig was a lower-cost version of one of Heath's up-market SB-series transceivers, in this case, the SB-102. However, it long outlived the SB-102, which was discontinued in 1975, remaining in production until late 1983. Because the SB-102 is electrically so similar to the HW-101, it's only proper that I include it here.

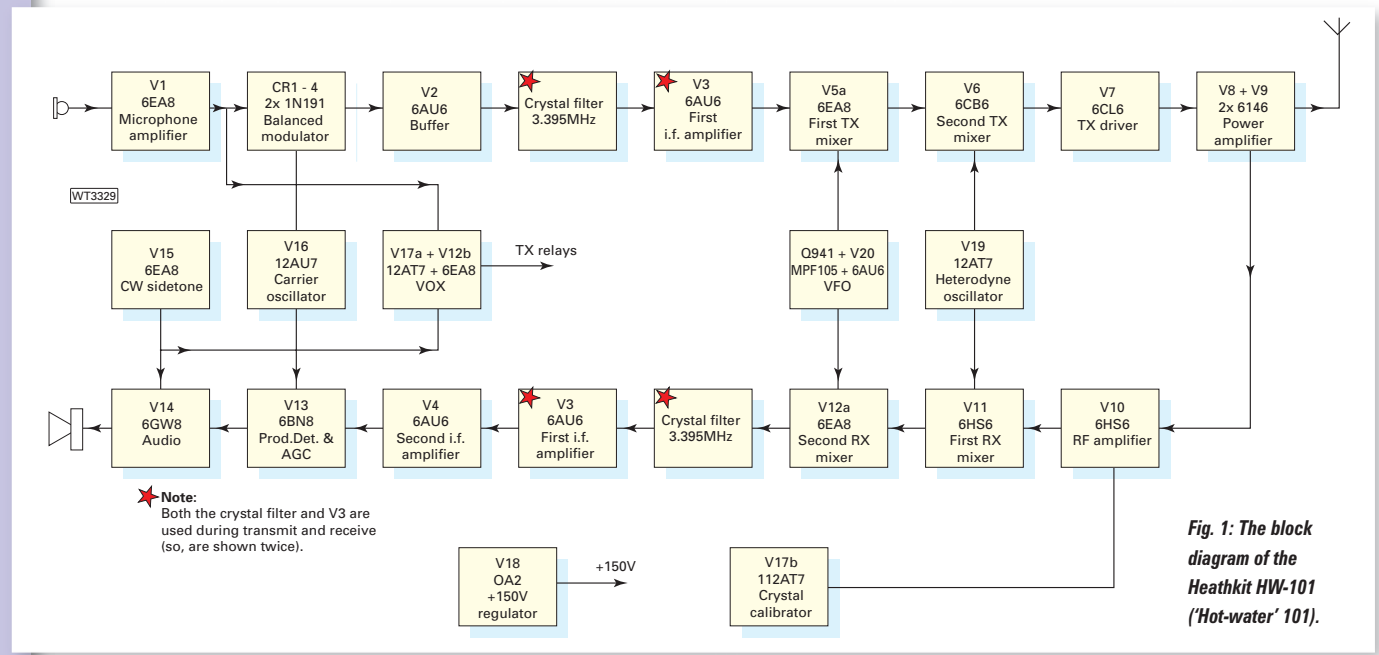


*Fig. 1: The block diagram of the Heathkit HW-101 ('Hot-water' 101).*

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**Phil Cadman G4JCP takes a break from his Valve & Vintage researches to look at an old favourite from the Heathkit stables. The HW-101 was one of the most popular kits to be developed by the Heathkit factory in Benton Harbor, Michigan, USA.**

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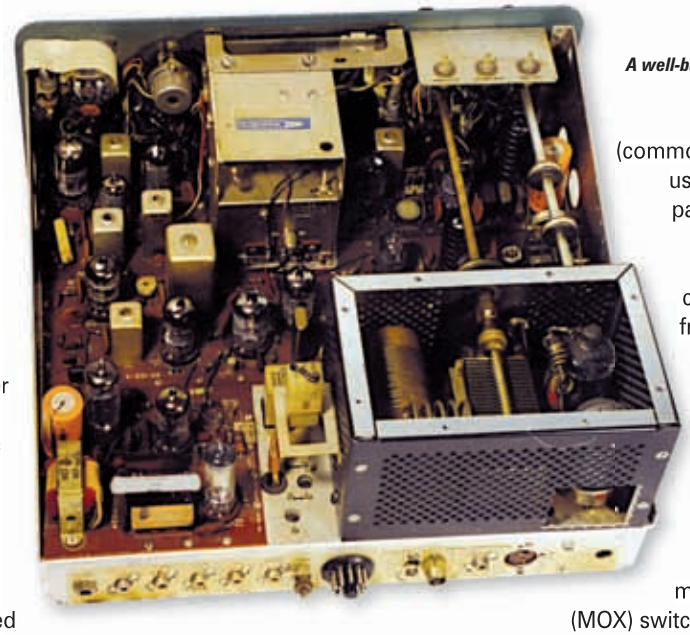
## Final Advertisement

When the final advertisement for the HW-101 appeared in the Winter 1983 catalogue, Heath announced that more than 30,000 transceivers had been sold. However, it's likely that the final combined figure for both the HW-100 and HW-101, was actually closer to 40,000. Whichever figure you choose, the '101 was easily the most popular transceiver Heath ever made.

The HW-101 is certainly a classic on numbers alone, but it's also based on the classic transceiver design, as can be seen from the block diagram shown in Fig. 1. Interestingly, the HW-101 and its up-market sibling were the last tubed (valved) type transceivers Heath ever made.



*A well-built HW101.*

There were a few semiconductors used in the design and they were mostly diodes. The exception was the v.f.o. which employed an MPF105 field effect transistor (f.e.t.) as the oscillator (buffered by a 6AU6).

The v.f.o. supply was also stabilised by a 2N3393 transistor acting as a Zener diode! (The v.f.o. in the SB-102 was one of Heath's excellent semiconductor Linear Master Oscillators). At least purists will be happy to know that in both transceivers, the received signal only ever passed through 'tubes'.

For the time (and at the price it sold for) the HW-101 had a very respectable specification. It covered all the (then) Amateur bands between 3.5 and 28MHz, including all of 28MHz (in four 500kHz segments) and was dual-conversion with a genuine crystal filter.

The transceiver ran 180W p.e.p. input on s.s.b. and 170W (50% duty cycle) on c.w. The p.a. produced 100W p.e.p. output on 3.5MHz through 21MHz, and 80W on 28MHz. The Pi–tank output was designed to match a 50Ω load with 2:1 or better s.w.r.

Unusually, for a low-cost transceiver, the HW-101 had built-in voice operated change-over (VOX) and c.w. side tone (this keyed the rig on c.w. transmit through the VOX circuitry). The transceiver required a high-impedance microphone fitted with a rather strange connector.

## Very Clean

By today's standards, the transmitter was very clean, with third order products at least 30dB down (the book doesn't say with respect to one tone or both tones). Drift was good; at only 100Hz per hour after 45 minutes warm up. And the receiver was lively too, with only 0.3$\mu$V required for a 10dB signal-to-noise ratio on s.s.b. (Much better than the early SB–series rigs).

The supplied 3.395MHz crystal filter was 2.1kHz wide at 6dB down and 7kHz wide at –60dB. Not quite up to modern standards but with no noisy synthesiser to mess things up, the receiver sounded quite clean!

The corresponding figures for the optional c.w. filter were 400Hz (–6dB) and 2kHz (–60dB). The audio output stage gave 2W of audio and (as it was a valve operating in class-A) it was much better than a class-B transistor output stage!

## Restyled Front Panel

To distinguish the new transceiver from the HW-100, Heath restyled the front panel. It's quite distinctive and quite different to the SB-102, despite all the controls present on the HW-101 also being on the SB-102.

The SB-102 has Heath's elegant single-colour scheme (common to all the SB series rigs) and uses rotary controls for all front-panel switches (the HW-101 has two slide switches). The SB-102 does has an extra 'frequency control' switch but basically, the front-panel controls are the same.

All the usual operating controls are present: main tuning, band switch, pre-selector tuning, mode, audio frequency (a.f.) and radio frequency (r.f.) gain, microphone gain/c.w. level, meter function, VOX and manual transmit/receive switching (MOX) switching and tune and load controls.

The HW-101/SB-102 had the option of a c.w. filter, so there's a front panel switch to select either the s.s.b. filter or the narrower c.w. filter.

Controls that only require infrequent adjustment, such as the VOX settings and bias adjustment, are accessible with a screwdriver along the bottom right hand-side of the transceiver.

I very much like the completely separate a.f. gain and r.f. gain controls. I'm not keen on dual-concentric controls for such important functions, although with modern physically small transceivers, I appreciate that compromises have to be made.

One quite serious oversight was the omission of a receiver incremental tuning (RIT) control. Given that synthesised rigs were still some way off in the Amateur Radio market, almost everyone was using free-running variable frequency oscillators (v.f.o.s), which were apt to drift much more than modern rigs.

Unfortunately, because of the lack of RIT is was possible for a pair of stations – not to mention a net – to 'chase each other' up the band. An RIT control would have been a big help. Still, if you were keen you could have added one yourself!

On a personal note, I very much like the large size of the front panel controls. Miniaturisation was not appropriate to a kit of this kind, and a physically large front panel demanded physically large controls. But they are a pleasure to use and they don't constantly give you the feeling that they're going to break at the slightest touch! That said, there are no 'bells and whistles' on the HW-101, so there's no need for any extra controls over and above those I've mentioned.

Oh, there's one good point regarding the ALC meter I should mention. Although the meter, which measures ALC, p.a. current and relative power output is quite small, the face is black with white lettering. The pointer is also white and this makes the meter very easy to read, especially when monitoring a.l.c., as the merest flick is easily noticed – even in subdued lighting.

## Main Tuning Control

What could be better on the HW-101 is the 'feel' of the main tuning control. But at least it used a conventional ball-bearing dial, unlike the HW-100, which had used Heath's patented Harmonic Drive, and which some operators claimed was full of wobble and backlash. Perhaps this kind of criticism is a little unfair, after all, it was a low-cost transceiver. And Amateur Radio equipment manufacturers are still quite capable of producing tuning controls with an dreadful feel, even to this day.

On the rear there are connectors for a loudspeaker, Morse key, antenna, automatic level control (ALC) input, power and a ground terminal. There's a spare connector too. Apart from the power plug and key jack, all connectors are phono sockets. This

is unheard of today but back then, Heath (amongst others) did seem rather to like phono connectors.

There's no internal loudspeaker, which is both good and bad. An internal loudspeaker is useful but has limited volume and frequency response, a situation that's still largely true today. A half-decent external loudspeaker is a great improvement, so Heathkit owners had no excuse not to use one.

More importantly, there's no internal power supply either. Heath sold the HP-23 (for a.c. mains) and the HP-13 (for operation from a 12V d.c. source) to power both the HW and SB ranges of transceivers. Both supplies delivered the necessary 700V at 250mA, 300V at 150mA, and –115V at 10mA. The HP-23 also provided 12.6V a.c. at 5.5A (The HW-101 only requires 4.75A).

Again, having no internal supply has both advantages and disadvantages, particularly with regard to a kit. Clearly, you could provide your own power supply, probably at a lower cost than buying one from Heath. And if you only wanted to use the transceiver mobile, then you didn't have to pay for a mains p.s.u. that wouldn't be needed.

Cost aside, the absence of a large lump of iron in the transceiver at least made the set relatively light - an important consideration when used mobile. The disadvantage was the thick multicore cable connecting the transceiver to the power supply. Still, one effective solution was to build a combined p.s.u. and loudspeaker, a option favoured by several companies supplying the Amateur Radio market.

## Boards & Valves

Inside the transceiver, there are five main printed circuit boards (p.c.b.s) plus four band switch p.c.b.s. There's a total of 20 valves – including two 6146s in the power amplifier (p.a.) and an OA2 regulator – plus an f.e.t., numerous diodes, and a transistor. The circuit design was conventional – for the time – as you can see from the block diagram, Fig. 1.

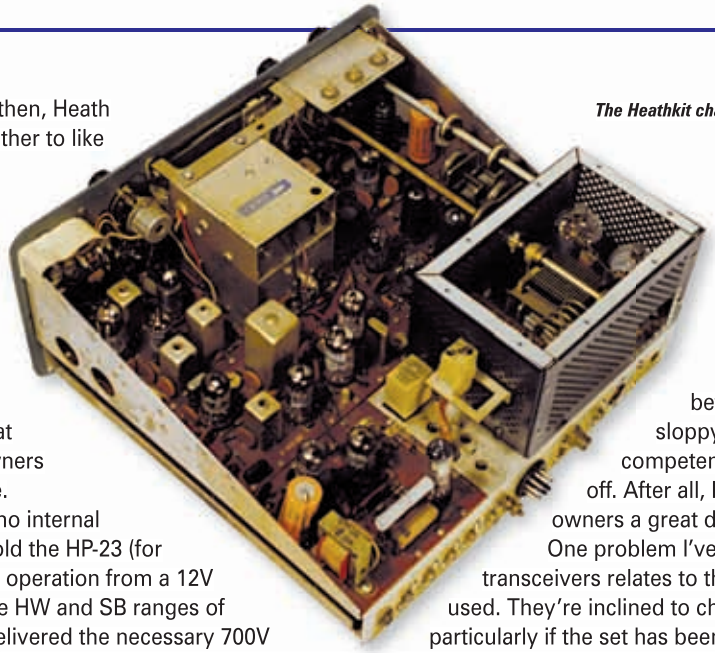
The diagram tells most of the story but I have a couple of comments! There's a band-pass filter (not shown for the sake of clarity) between the first and second transmit mixers. The same filter is also used between the first and second receive mixers, just as you'd expect. Similarly, the crystal filter and V3 are also used on both transmit and receive.

Some of the valves are not terribly common, particularly the 6HS6 (earlier Heathkit rigs used the 6AU6 in the front end), so it would be wise to obtain a spare set of valves if you ever get hold of a HW-101 or SB-102 (or any similar transceiver). At least Heath chose 6146s (still available at sensible prices) for the p.a. and not some television 'sweep' (television time-base) valves.

## Not Rare

The HW-101 is not a rare transceiver (not with over 30,000 having been sold) although they're not as numerous in this country as in the USA. From comments I've come across, there were many teenage American Radio Amateurs who were thrilled to find a HW-101 under the Christmas tree, or given to them on their birthday.

It seems many such Amateurs regret selling their 'Hot Water 101s' as they got older and were able to afford more expensive gear. Some are even buying and restoring HW-101s because it was their first serious transceiver. Perhaps they want to relive their youth a little?



*The Heathkit chassis provided a stable frame for the HW101.*

## What To Look For

So what do you look for if you want a HW-101? Build quality (very few were supplied as factory assembled kits) can vary enormously, so please do look 'under the covers' before purchase. Similarly, look for sloppy modifications. However, don't let competently executed modifications put you off. After all, Heathkit rigs were modified by their owners a great deal – just be cautious.

One problem I've come across with the HW transceivers relates to the carbon composition resistors they used. They're inclined to change in value after all these years, particularly if the set has been used regularly. A poorly-performing set may need a few resistors changing.

Similarly, paper capacitors can go leaky, and electrolytic capacitors can go both leaky and low in value. Fortunately, I've not found any real problem with Heath equipment in this respect. Most low-value capacitors used in these sets are ceramic discs, not paper types.

It seems the carrier-null potentiometer can cause trouble and replacement is the only satisfactory option. Additionally, the rubber drive bands can rot, although replacements can usually be found in shops that carry drive belts for video recorders. Corrosion can affect some sets but cleaning all the switch contacts and the v.f.o. capacitor should help.

Expect to have to do some work on any set. If a set looks clean, well cared-for and competently built, then you shouldn't have much trouble. If there isn't a manual with the set, then you can get a copy – at a price. The amazing thing is, these sets can still give a remarkably good account of themselves on the bands today. They're not museum pieces, they can be used every day.

## Power Supply

You will need a power supply and with luck, there'll be an HP-23 with the HW-101. As well as the original HP-23, there were also -A, -B and -C variants. All can power the HW-101 (and SB-102) so, the exact model is not important. However, The HP13 d.c. inverter is rather rare here in the UK.

For anyone who wants to copy the HP-23, the specification was as follows: Full-wave voltage doubler in the 750V 250mA (820V no-load) supply (why do the Americans love voltage doublers so much?). There's another voltage doubler in the 250/300V 150mA (275/350V no-load, switchable) supply, with a half-wave rectifier in the –130V 10mA bias supply. The heater winding can supply up to 5.5A at 12.6V. The mains transformer had twin 120V primaries for both 120V and 240V operation.

## Very Warm!

One final point regarding the cooling. The p.a. compartment runs warm, very warm! A little forced-air cooling will help prolong the life of both the p.a. valves and their associated components. However, there's no matching fan for the HW-101 so you'll have to improvise. An externally-mounted, 12V computer-type fan ought to suffice, although you'll have to experiment to find the best spot. Whatever you do, don't hack dirty great holes in the case! Many people comment that owning a HW-101 or SB-102 (usually for the second time around) brings back memories of a simpler and more enjoyable time. It's going back to the days when you could fix your own equipment if it went wrong. Maybe these sets are just relics of the 'Golden Age' of Amateur Radio but that's no bad thing. As someone said, "Long live the Green Machine!" ●