

## THE HW-17A MODIFIED FOR IMPROVED PERFORMANCE ON TWO METRES

DISCUSSING THE PRACTICAL DETAILS

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THE *Heathkit* HW-17A two-metre transceiver kit is no longer listed, having been withdrawn from the U.K. market in January 1971. However, during the time that it was available in its original HW-17 and later HW-17A form a large number of units were sold and are still in use, for both fixed station and also for mobile and portable operation with the accessory HW-17-1 DC inverter power supply from a 12-volt battery.

The transceiver unit is compact (14½ in. wide, 8½ in. deep and 6½ in. high) and weighs 13 pounds. It has a built in 240v. AC/PSU. The receiver section is completely transistorised and the Tx side had three valves and a transistor modulator. Four internal switched crystal sockets are provided and also connectors for the *Heathkit* HG-10 VFO.

### Shortcomings of the Original Design

The transmitter circuitry of the HW-17A in general performs tolerably well in the standard form (the original severe lack of PA drive of the HW-17 having been largely eliminated by component changes in the later model) the only remaining transmitter fault being lack of modulation. The receiver is generally considered to be short on sensitivity and to have a tendency to frequency drift due to temperature variations affecting the first oscillator, which is a single tuned transistor arrangement.

The suggested modifications are divided into three sections: (1) Transmitter, (2) Receiver, and (3) Minor general modifications.

### The Transmitter

A useful improvement in modulation can be achieved by replacing the ceramic microphone insert in the p-t-t microphone by an *Acos* Mic. 40 crystal insert and dispensing with the paxolin disc and all but the decorative metallic fabric in front of the insert when fitted in the case.

A more substantial increase in depth of modulation was obtained by increasing the value of the PA screen resistor (R115 in the original circuit) from 12K ohms to 22K ohms, a 2-watt resistor being required. This has the effect of reducing the DC input to the PA from 30 watts to about 25 watts and while the reduction in carrier strength is not detectable the available audio produces more modulation.

A final increase in depth of modulation was obtained by replacing the rectifiers supplying the 15-volt DC line (D307, D308, D309, D311 in the handbook circuit) by rather more adequate plastic encapsulated 1N4002 types and by adding a further 2000 µF capacitor in parallel with the smoothing/reservoir capacity for the

15-volt supply (C325). The effect of these changes was that the 15v. line fell from a no-load of 15 volts to a value of 13.5v. with a sustained loud whistle into the microphone, whereas with the original components the voltage fell to 8.0 volts under the same conditions.

It has been suggested to the writer that substitution of AD149 transistors for the standard audio output transistors (Tr14 and Tr15) could be of benefit but no improvement in modulation could be obtained in this way.

### Receiver Modifications

Various attempts were made initially to obtain adequate sensitivity from the receiver section by careful adjustment of the existing circuitry without the addition of pre-amps. or other devices. Reasonable performance was obtained by very carefully following the handbook on "Receiver Alignment" for the IF stages, and carrying out a modified version of the "Tuner Alignment" procedure—this was to align at 144 and 146 MHz instead of as recommended (who needs a flat response from 143.2 to 148.2 MHz?) and by increasing the 2nd oscillator injection by reducing the value of the emitter resistor (R207). The original 680-ohm resistor can be reduced to less than 100 ohms to produce noticeably more gain—but a compromise is needed as too much injection can greatly increase noise; a value of 270 ohms appears to be suitable.

With these preliminary modifications carried out the receiver seemed much more lively, the AVC began to work and hence the squelch, and tuning meter circuits also started to function. But even at that more sensitivity is obviously needed for other than cross-town type contacts.

To obtain further sensitivity more amplification is required. This may take the form of either an additional RF stage or more IF gain. Both alternatives will be described.

### RF Pre-Amplifier

Attempts to add a pre-amplifier within the case of the transceiver were unsuccessful due to the limited space available and the most promising solution was an external unit mounted on the right-hand side of the cabinet, the input and output coax and power leads being

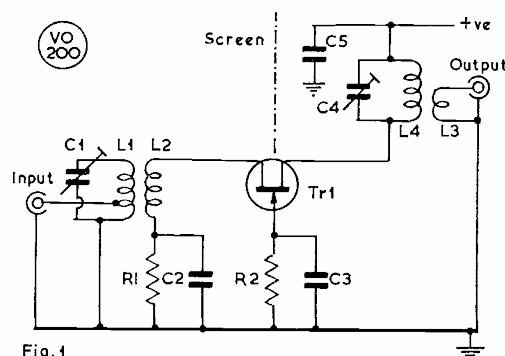


Fig. 1

Fig. 1. Pre-amplifier for the HW-17A Rx section. Values can be: C1, C4, 2-8 pF trimmers; C2, C3, C5, .001 µF feed through; R1, 330 ohms; R2, 100K; L1, L4, 6 turns, ¼ in. diameter; L2, L3, single-turn coupling to L1, L4; Tr1, T1S88.

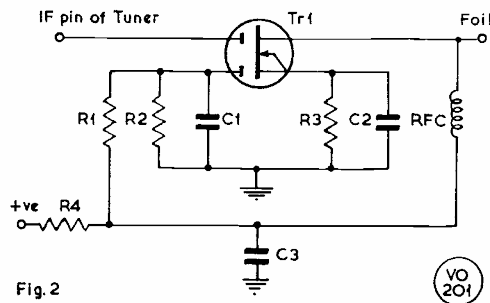


Fig. 2

Fig. 2. Circuit of the IF amplifier discussed in the text. C1, C2, C3, .002  $\mu$ F; R1, 100K; R2, 33K; R3, 120 ohms; R4, 560 ohms; RFC, 19 inches of 30g. enam. wound on 1-megohm resistor as former; transistor Tr1, 40673.

taken through holes in the side of the lower half of the case. A circuit such as that shown in Fig. 1 can be used or a ready-made unit (which must be negative earth!) such as the *Solid State Modules Sentinel* pre-amplifier would be suitable. The DC supplies may be taken from any suitable earth point (-ve) and from the positive end of C325 on the underside of the receiver partition. The 100 pF disc capacitor should be unsoldered from lug 2 of terminal strip AP (the other end being left connected to the Ant. pin on the underside of the receiver printed circuit board) and the inner of the coax input lead to the pre-amplifier connected to lug 2 of strip AP instead. The inner of the coax output lead from the pre-amplifier should then be taken to the free end of the 100 pF disc capacitor. The two coax braids should be earthed to lug 3 of terminal strip AP. If connections to the pre-amplifier are made with coax plugs and sockets re-assembly of the unit is made easier and it is possible to use an external converter and tunable IF strip with the transmitter and aerial switching of the HW-17A if this should ever be required.

The result of this modification is a really worth-while increase in receiver gain up to the level to be expected from a conventional FET converter and tunable IF arrangement, the tuning meter deflecting to full scale on strong signals, with the AVC and squelch circuits working in a most satisfactory manner. In the "spot" mode the transmitter oscillator produces a half-scale meter reading for netting purposes instead of the previous slight deflection only.

#### Additional IF Amplifier—Alternative Arrangement

This modification was originally described by WASPWX as an alternative to the use of a pre-amplifier and its attraction is the small number of components required. The circuit is shown as Fig. 2, above.

The IF pin underneath the tuner section of the receiver printed circuit board is unsoldered from the "island of foil" and insulated from it. Gate 1 of the 40673 is soldered directly to the pin and the drain lead goes to the island of foil originally connected to the pin and the other components are hung on the remaining transistor leads and the adjacent large area of earthy foil below the tuner. (Voltage supplies can be obtained as previously described for the pre-amplifier.) After fitting the amplifier T1 (in the tuner) and L6 require re-alignment as described

in the HW-17A handbook.

#### Receiver Drift

It was observed that the frequency drift of the receiver, previously mentioned, occurred only when the transmitter was in use and appeared to be due to heating of the tuner unit by radiation from the Tx valves. The rate of drift was greatly reduced by lagging the sides and top of the tuner unit box with the thickest polystyrene foam sheeting which could be accommodated. The foam was cut from ceiling tiles and taped into position.

#### Minor General Modifications

Other modifications are mainly minor points of detail and are listed briefly:

- (1) A standard *Belling-Lee* coaxial aerial socket can be mounted directly using the original holes provided for the "phono" socket,
- (2) For safety a three-core mains lead should be used with "live" connected to pin 3 of the 11-pin power socket, neutral to pin 10 and earth to pin 8 and a fused plug fitted to the other end of the lead,
- (3) The VFO position of the crystal switch can be used to connect a further crystal socket mounted on the back wall of the case to provide one crystal which can be changed without removing the top of the case. If one side of the crystal socket is connected to the inner of the VFO input "phono" socket and the other side to the common point for the internal crystal sockets it is possible to use either an external crystal or a VFO as required,
- (4) The arrangement by which the dial light is switched off in the "Batt. Saver" position of the function switch as well as the valve heaters seems to be carrying economy *too* far. By joining together lugs 1 and 2 of the function switch the dial light will remain lit as long as the transceiver is switched on—a great convenience when operating mobile or portable at night,
- (5) If it is desired to add a coaxial aerial change-over relay to replace the diode switching system originally used it will be found that one of the relays available from surplus commercial R/T equipment with a 12-volt, comparatively high-current, operating coil can be wired in series with the HT supply to the anode and screen of the PA stage and will provide superior aerial switching performance,
- (6) A final point, though not a modification, is the fact that 12 MHz crystals can be used in place of the usual 8 MHz ones without any circuit modifications at all (and with no re-tuning required). Slightly more drive to the PA should be obtained.

#### Conclusion

If the principal receiver and transmitter modifications described in this article are carried out the result should be a transceiver of greatly improved performance, which should provide many more contacts than could be expected in the unmodified condition.