

This fine receiver
has been the target
of many design improvements:
here's another

Drake R-4C receiver improved power supply

In keeping with our policy to provide the most recent information on updating equipment, we present this article on improvements to the popular Drake R-4C communications receiver. As author Klinman points out, the perfect receiver has yet to put in an appearance. The R-4C by Drake with its many features comes close to the perfect receiver. These modifications to the R-4C are easy to make, result in a significant operational improvement, and use a minimum of mechanical modifications to preserve resale value of the radio.

Editor

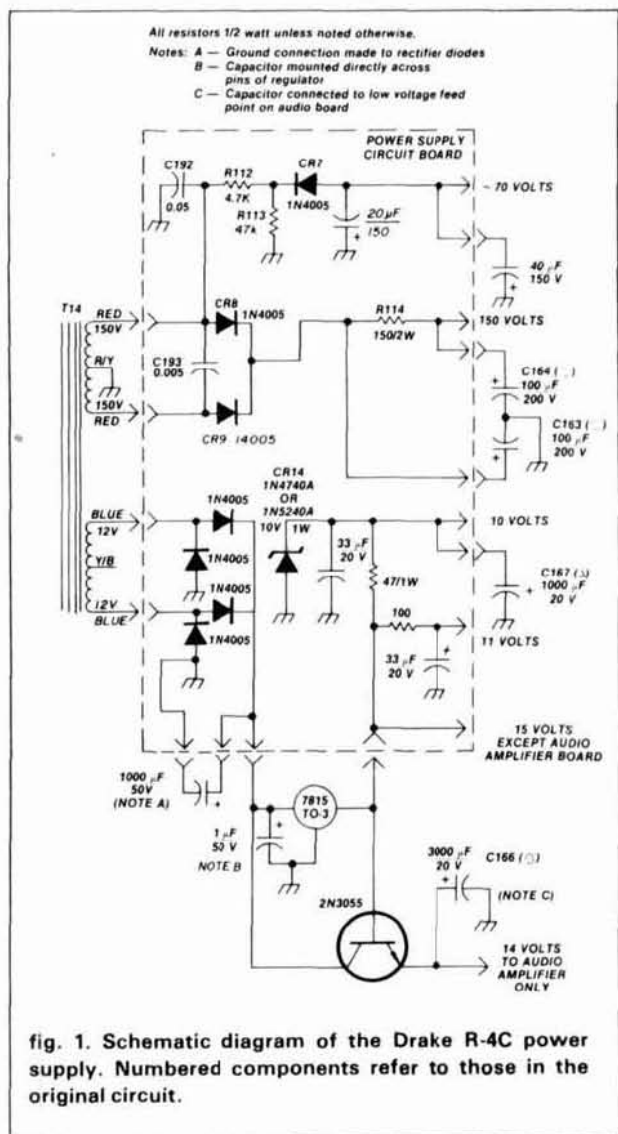
The perfect communications receiver has yet to be produced. The Drake R-4C approaches this ideal. With certain modifications it can be made into a real "performance" receiver. Among these are the addition of selective first i-f filters, improved product detector and audio modifications as described by

Sherwood,¹ third mixer redesign with solid-state tube replacement,* an audio lowpass filter by Sartori,^{2,3,4} and agc modification by Klinman.⁵ I recommend that those using the Drake R-4B/C obtain the excellent summaries of updates to these receivers available from Sherwood Engineering and Sartori Associates.[†]

*While the "Solid Tube," a product of Sartori Associates, used as replacement for the 6EJ7 mixers in the R-4C does effectively eliminate the severe noise generated by the vacuum tubes in these circuits, it does noticeably reduce large-signal-handling capacity of the receiver.

[†]Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210; Sartori Associates, P.O. Box 2085, Richardson, Texas 75080.

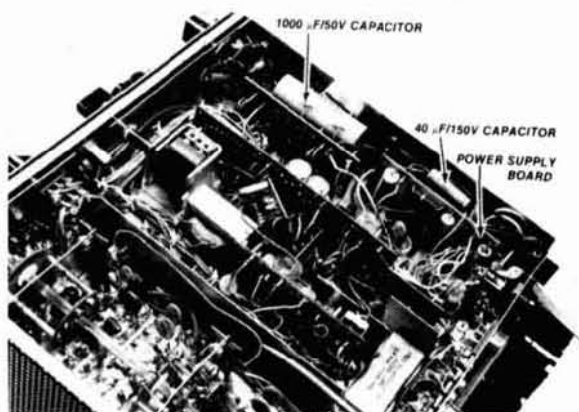
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A problem yet unresolved is the presence of excessive hum in the audio output. As pointed out by Sartori,³ the original Drake power supply also generates significant heat under the R-4C chassis. In that article, Sartori described modifications to the power supply, but the suggested circuit produces marginal voltage for proper operation of the recommended monolithic voltage regulator. In addition, the circuit yields a regulated low voltage 2 volts lower than the original 14-15 volts.

Complete replacement of the R-4C audio amplifier with a monolithic audio power amplifier, as suggested by Sherwood,⁶ will reduce the audio-amplifier average current drain on the low-voltage supply and

*The circuit may be stabilized by using Sherwood's output stabilization network, which is part of their audio-amplifier kit. Editor



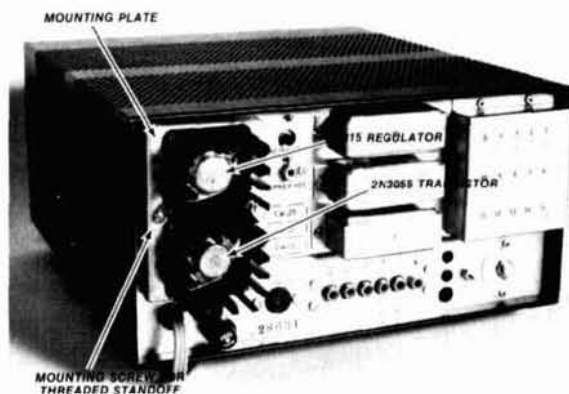
Underside of the Drake R-4C receiver chassis showing revised power-supply board and component layout.

regulator, but the monolithic circuit is difficult to stabilize and it can still require considerable peak current when driving a low-impedance load.* An advantage of the monolithic audio power amplifier is that it provides a significant amount — on the order of 30 dB — of power-supply ripple rejection.

As described here, it's a relatively simple matter to retain the original R-4C audio amplifier and upgrade the power supply.

revised power supply

Fig. 1 is the schematic diagram. A full-wave bridge rectifier with single-stage capacitor-input filter produces 25-30 volts, which is sufficient to power the 7815, a 15-volt monolithic voltage regulator. While increasing the average power dissipated by the power transformer, T14, no additional temperature rise of the transformer is noticeable. Because this supply voltage exceeds the voltage rating of the



Rear apron of the Drake R-4C receiver showing the voltage regulator and pass transistor, heat sinks, and homebrew mounting plate.

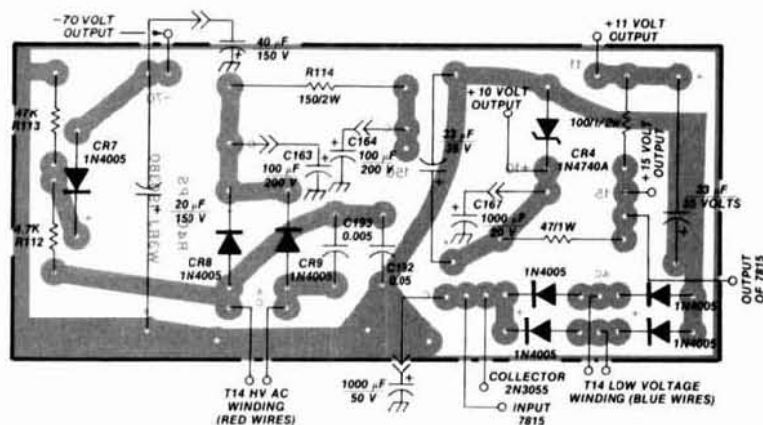
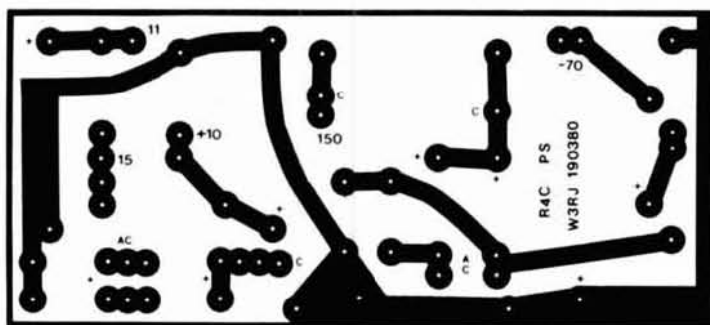


fig. 2. Circuit-board details. Full-size PC-board mask is shown in (A). Illustration (B) shows component layout.

existing filter capacitors, C166 and C167, an additional 1000 μ F 50-volt electrolytic filter capacitor is required. The output of the TO-3-cased 7815 (or equivalent) 1-amp 15-volt regulator powers all 15-volt circuits *except the audio output stage*.

Power for the audio amplifier cannot be taken directly from the 7815 because of severe instability caused by the large inductive load of the audio output stage. A common base 2N3055* pass transistor provides the required isolation in addition to reducing the thermal load on the 7815 voltage regulator. One of the unused sections of the R-4C filter capacitor, C166, is used to further reduce the impedance of the 14-volt supply to the audio amplifier. A series resistor provides 11 volts for the PTO, and a zener diode provides 10 volts for the BFO and HFO circuits.

The remainder of the power supply is similar to the

original circuit in the R-4C. An exception is additional filtering of the -70 volt supply to eliminate the last trace of hum in the receiver audio.

hardware

A board containing all components except the pass transistor, voltage regulator and 1- μ F bypass capacitor, and the 1000- μ F, 50-volt and 40- μ F 150-volt filter capacitors replaces the original R-4C power supply board. The board mask and component placement are shown in fig. 2. Solder lugs, bent 90 degrees in the center and soldered to the board at the indicated locations, serve as mounting feet similar to those on the original board. Noteworthy details of construction are:

1. The low-voltage filter capacitor (a small size 1000- μ F, 50-volt electrolytic) is mounted between the power supply or audio circuit board and the side of the chassis. It is secured to the chassis side wall with a plastic stick-on cable tie anchor. The ground lead

*Any NPN power transistor with V_{ce0} of at least 40 volts and collector current rating of 1 ampere will work in this circuit. (The 2N3055 is available for less than a dollar from several mail-order parts houses.)

of this capacitor must be returned to the ground foil of the power-supply board. A chassis ground to the filter capacitor cans, C163 through C167, while mechanically convenient, will lead to audio hum.

2. The 40- μ F, 150-volt miniature electrolytic capacitor filtering the - 70 volt supply is mounted between the power-supply board and the side of the chassis. It is soldered from the - 70 volt output pad to the ground on the foil side of the board and is supported by its axial leads.

3. The centertap of the low-voltage winding (yellow/blue) of the power transformer, T14, is disconnected from ground, covered with heat-shrink tubing at the end to avoid short circuits to ground, and tucked out of the way along the chassis.

4. Connection between C166 and the 14-volt supply to the audio board is made to the low voltage supply solder lug directly on the audio board. The photograph shows the new power-supply board and component layout under the chassis.

The 7815 monolithic voltage regulator and 2N3055 pass transistor are mounted to the rear apron of the Drake R-4C on a small homebrew 2-1/2 x 3-3/4 x 1/2-inch (63.5 x 95 x 12.5-mm) open-bottom box.* This shallow box is fastened to the rear of the Drake R-4C with a pair of 1/2-inch (12.5-mm) threaded standoffs (photo). In this way, only two small, inconspicuous holes need to be drilled in the Drake R-4C. Wires are cabled and routed through a grommet inserted into one of the slots in the back apron and through the power transformer grommet, to the underside of the chassis. Small, finned heatsinks of the Walefield 680 type cool both voltage regulator and pass transistor.

references

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4. H.J. Sartori, "Technical Notes — R4 Receiver," Sartori Associates, P.O. Box 2085, Richardson, Texas 75080.
5. R. Klinman, "Improved AGC for the Drake R-4C," *CQ*, March, 1980, pages 44-46.
6. J.R. Sherwood, "New R-4C Audio Amplifier," *Application Note*, Sherwood Engineering, Incorporated, 1268 South Ogden Street, Denver, Colorado 80210.

*This miniature open-bottom chassis can be easily fabricated from 1/16-inch (1.5-mm) aluminum sheet. Alternatively, the regulator and transistor may be mounted on a flat rectangular 2-1/2 x 3-3/4-inch (63.5 x 95-mm) plate. The 1/2-inch (12.5-mm) lip covers the electrical connections to the regulator circuit.

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