new audio amplifier for the Drake R-4C

A new audio amplifier for the Drake R-4C, suitable for direct substitution in all R-4C versions

Improvements in the Drake R-4C receiver, up to now, have been confined mainly to the i-f and detector systems.[1,2,3] One remaining area which needs improvement is the audio strip, which suffers from buzz and higher-than-desirable distortion; it also dissipates 7 to 10 watts of heat near the PTO. The audio amplifier, diagramed in **fig. 1**, eliminates these problems. While intended as an R-4C retrofit, this circuit performs so well that we also recommend it for other communications uses.

Our circuit is designed around National Semiconductor's LM383T, which, with the R-4C low-voltage supply, can deliver in excess of 2 watts into a 4-ohm load. The LM383 and associated components* can be mounted on a copper-clad board 3.8 cm (1½ inches) square, or another appropriate small heatsink (for a V_{cc} of 16 volts or less). It should be installed just behind the front-panel phone jack, between the passband-tuning capacitor and long i-f shield on which the Sherwood CF-600/6 may be mounted. This location provides access to the speaker lead and detected signal at the audio gain pot. It also keeps the circuit away from power transformer hum fields in the chassis.

circuit precautions

The secret of making the LM383 an unconditionally stable audio amplifier (suitable for field installation in various layout configurations) is our output stabilization network. Proper stabilization is accomplished by connecting a 1.0-μF monolithic ceramic capacitor (such as Sprague 5CZ5U105X0050C5) with 19-mm (3/4-inch) leads directly between pins three and four of the LM383. Use of a lower-value capacitor with significantly longer *or* shorter leads will virtually guarantee oscillation problems. Tantalum or aluminum electrolytics *cannot* be substituted for the monolithic capacitor.

Other circuit values have been chosen to tailor the audio response for greatest communications intelligibility. As in the original R-4C circuit, low frequencies are rolled off at one end of the needed spectrum; high-frequency shaping is similar to that of our suggested modification.[1] The feedback network has been chosen to provide nearly 40 dB of power-supply ripple rejection, minimizing the need for abnormal amounts of filtering. Gain at 1 kHz is 40 dB.

component selection

As with any high-gain amplifier, feedback and hum loops between the input and output should be avoided. Return all signal and power leads to pin 3, except for V_{cc} bypass, which should be returned to the IC tab with a solder lug.

To reduce component size, the 0.22-μF and 10-μF capacitors can be 16-volt (or greater) tantalums. The 200-μF electrolytic at pin 2 can have a 3-volt rating. The 300-μF output capacitor should have a minimum rating equal to V_{cc} (20 volts maximum). Sixteen volts is adequate for the R-4C. As mentioned above, a small heatsink is used for a V_{cc} less than 16 volts; above 16 volts a large heatsink. Never exceed a V_{cc} of 20 volts.

installation

To disable the existing amplifier, lift the output

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*A parts kit will be available from G. R. Whitenouse, Newbury Drive, Amherst, New Hampshire 03031.

transistor's collector lead at its solder lug. Also, remove its base or emitter wire, and/or disconnect one end of the driver's 100-ohm collector resistor. Connect the new amplifier's output to the phone jack terminal *with* the sleeved wire from the audio output transformer, and bypass with a 0.01-μF capacitor. This secondary is still used to provide the needed step-up for anti-vox system.

The only ground return should be a short, thick, insulated wire, run from pin 3 directly to the cable-braid terminal of the audio gain pot (rear section of

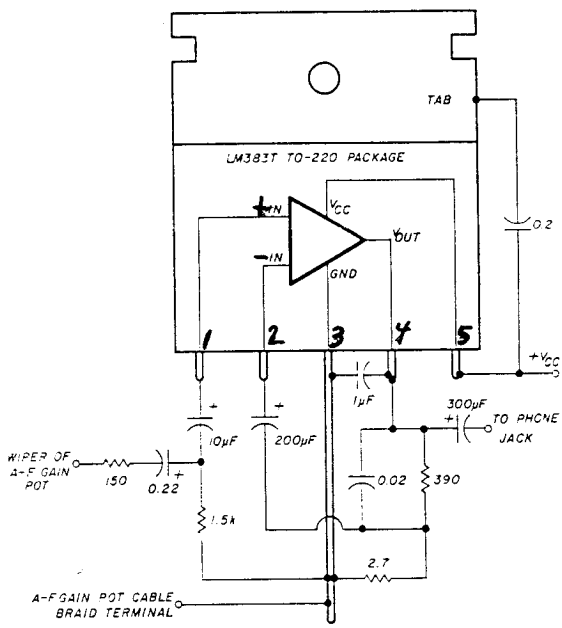


fig. 1. Schematic diagram of the new audio amplifier for the R-4C, based upon the LM383T audio amplifier IC. Resistors are ¼ watt. As pointed out in the text, all ground returns must be made through the connection to pin three to eliminate hum and feedback problems. The 1-μF monolithic ceramic capacitor *must* have 19-mm (¾-inch) leads (see text).

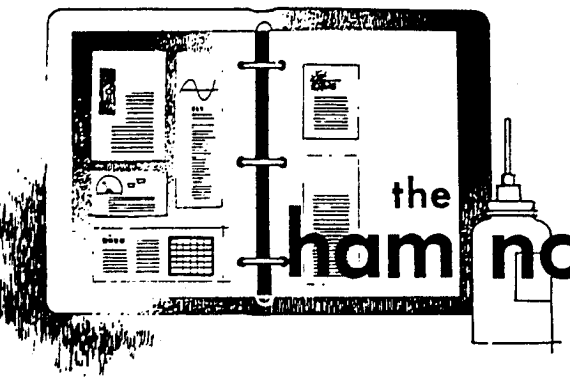
the dual control.) Do not allow the board or heatsink to touch any other part of the receiver ground. Next, add a small wire between the audio gain-control braid terminal and a close chassis ground. Disconnect the existing wire from the gain pot center wiper terminal, and connect the new amplifier input to this lug. Connect V_{cc} to the original audio-strip printed circuit board terminal with the blue wire from the audio-output transformer primary.

references

1. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "Present-Day Receivers — Some Problems and Cures," *ham radio*, December, 1977, page 10.

2. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (ham notebook), October, 1978, page 94.

3. R. Sherwood, WB0JGP, G. Heidelman, K8RRH, "New Product Detector for the R-4C," *ham radio*, (short circuits), February, 1979, page 94.



the ham notebook

improving the Drake R-4C product detector

The single-ended diode product detector used by Drake is typical of the type designed into many present-day receivers. Its simplicity and small number of parts make it a good performer in the Drake R-4C receiver.

However, the 1N270 diode used in this circuit creates large harmonic currents because of its nonlinear nature. This harmonic energy is generated by the BFO and appears as a constant hissing sound in the audio output. It's not noticeable on fairly strong signals but can become annoying if you're listening to a weak signal.

Some time ago I replaced the PN diodes in another receiver with hot-carrier diodes and noted an improvement in performance. Hot-carrier diodes differ from the usual PN diodes in that they switch very fast and don't suffer from the charge storage effect of the junction diode, which creates the high order of harmonics appearing in the audio output.

I replaced the 1N270 diodes in my R-4C with Hewlett-Packard HP5082/2800 hot-carrier diodes (**fig. 1**). The results were quite pleasing. Although the hiss was not completely eliminated, it was significantly reduced. The audio output level also increased.

A word of caution in replacing the 1N270 diodes: They're difficult to remove from the PC board because they are on the bottom of the board, which is mounted in a vertical position with other parts around it. A little extra care and a small pencil-type soldering iron should do it. Before replacing, note the polarity of the removed diodes.

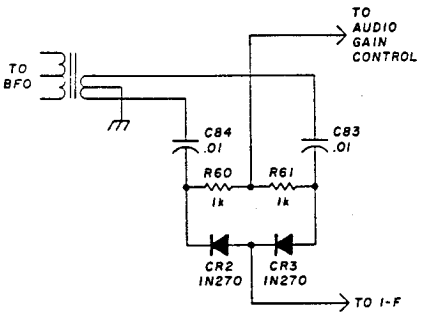


fig. 1. Diodes CR2, CR3 in the Drake R-4 receiver were replaced with H-P 5802/2800 hot-carrier diodes to reduce product-detector noise.

The HP5082/2800 diodes are very small and have a glass body. They crack easily if the leads are pulled too thightly through the holes in the PC board.

If the HP5082/2800 diodes are difficult to obtain, a suitable replacement is the Sylvania ECG519.

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