

SARTORI ASSOCIATES

Engineering Services for Communicators

P. O. Box 2085 • Richardson, Texas 75080 • Phone (214) 494-3093

SOLID STATE TUBE REPLACEMENTS ARE AVAILABLE FOR

DRAKE R-4/T-4X AND COLLINS 75A-4 EQUIPMENT

Vacuum tube receivers continue to provide extremely good sensitivity with dynamic range performance in comparison with many solid state receivers. In addition, they offer easy maintenance that can be accomplished by most amateurs. Another advantage now appears. For receiver and transmitters with good system and circuit design, solid state replacement of the vacuum tubes make it possible for you to "plug-in" state-of-the-art performance at a nominal cost. Complex solid state circuit equipment cannot be easily upgraded. As new semiconductor technology is developed, plug-in solid state replacements can simply and quickly upgrade your receiver and transmitter performance!

These devices are smaller than the vacuum tubes they replace. As with vacuum tubes, variability in parameters may require some realignment. Size is greatly reduced by high reliability microelectronic components and advanced solid state technology. A solid epoxy compound encapsulates the entire circuit into a rugged attractive module.

Features:

- directly replaces the vacuum tube
- increases R-4C sensitivity on high bands by up to 7 dB
- increases 75A-4 sensitivity on high bands by typically 10 dB
- eliminates filament dissipation in the tube and power transformer
- effectively reduces hum and audio impulse noise
- decreases intermodulation products as much as 15 dB
- provides injection voltage to drive frequency counters on all bands
- improves electrical stability
- eliminates microphonics

Types available:

<u>T-4X/A/B</u>	<u>T-4XC</u>	<u>Stage</u>	<u>R-4</u>	<u>R-4A/B</u>	<u>Early</u>	<u>Late</u>	<u>Stage</u>
SAX7-1	SAX7-1	mic amp	SBA6	SBA6	SBA6	SBA6	rf amp
SAX7-2	SAX7-2	osc/alc	-	-	SBA6	-	1st if
SAU6	SAU6	am mod	not avail	SHS6	SHS6	SEJ7	premix
SEV7	SEV7/ SFQ7/ S1Q8	VOX	SHS6	SHS6	SHS6	SEJ7	1st mix
			SBE6A/B	SBE6A/B	-	SBE6C	2nd mix
SBA6	SBA6	if amp	SBA6(2)*	SBA6(2)*	SHS6	SEJ7	3rd mix
SHS6	SHS6 or SEJ7	pre mix	SBA6	SBA6	SBA6	SBA6	if amp
SAU6	SAU6	rf mix			-	-	blanker

* AVC upgrade parts supplied.

@ some mid-models use 6HS6 instead of 6EJ7 tubes.

Your choice --- \$23.00 each ppd.

- Collins 75A-4 6BA7 first and second mixers --- \$23.00 each ppd.

Warranty: 90 days limited, proper operation. Do not install with power "ON".

Order your solid state tubes by check or money order.

Add sales tax in Texas.

Indicate your receiver model number with your order.

Overseas orders, add \$8.50 for AIR MAIL, please.

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DRAKE R-4 RECEIVER IMPROVEMENT KITS AVAILABLE (all models A-B-C)

The Basic Improvement Kit was described in the 73 Magazine, June 1979. Parts are included to

- add a solid state wide dynamic range doubly balanced demodulator for improvement of the noise and audio quality as well as the signal tuning characteristics
- add a solid state 12 volt regulator to clean-up the audio system quality and reduce excessive heating of the receiver
- re-wire the third mixer of the late model 6EJ7 circuit to improve the signal leak-through and reduce noise
- improve the audio distortion, as developed by Sherwood Engineering

Price is \$25.00 ppd
Add sales tax in Texas.
Article reprint is included.

An Integrated Circuit Audio Amplifier Kit contains all the parts to build the solid state amplifier described in Ham Radio, April 1979.

Price is \$25.00 ppd.
Add sales tax in Texas.
Article reprint is included.

An Audio SSB Low Pass Filter connects between the SSB detector and the audio amplifier. Noise generated in the third mixer, i.f. amplifier, and detector is effectively eliminated. The filter response is essentially flat between 300 and 2200 Hertz. It's constructed on a small printed circuit board, which mounts with double-back mounting to the chassis. Connected in minutes.

Price is \$25.00 ppd.
Add sales tax in Texas.
Article reprint is included.

As an Extra, several changes are described in an Addendum enclosed with the Basic Improvement Kit. These improvements apply to the early R-4A/B/C models to

- improve spurious signal performance
- reduce hash on the audio
- improve audio quality of the audio amplifier, and AVC action
- widen the adjustment range of the S-meter

Since parts are minimal and not required in most cases, they are not included. They're available in most junk boxes.

Order your improvement kits by mail with a check or money order.

Overseas orders add \$8.50 for AIR MAIL service.

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Solid State Tubes

DRAKE R-4, T-4X and COLLINS 75A-4 owners: Protect your investment from scarce supplies and increasing costs of vacuum tubes. Get all of the advantages of solid state technology! W5DA Solid State Tubes directly replace the vacuum tubes in your radios.

FEATURES



- Improved receiver sensitivity
- Reduced heat
- Greater dynamic range
- Fully encapsulated for rugged mechanical and electrical performance



<p>T-4X (A-B-C)</p> <p>6AU6A 12AX7A 6EJ7/ 6EV7/ 6HS6 6FQ7/ 12BA6 6AQ8</p> <p>75A-4 — 6BA7</p>	<p>R-4 (A-B-C)</p> <p>6EJ7/ 6HS6 6BE6/ 12BE6</p> <p style="text-align: center;">NEW! 6BA6/6BZ6</p> <p style="text-align: center;">Your Choice \$23 each ppd.</p>
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ALSO

<p>Improvement Kit Solid State I.C. AF Kit Audio Low Pass Filter Kit</p>	<p>UPGRADE your R-4 (A-B-C) with these kits. \$25 each ppd.</p>
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SARTORI ASSOCIATES, W5DA
Engineering Services for Communicators
PO Box 2085
Richardson, TX 75080
(214) 494-3093

Dear Drake Owner,

We are glad to assist amateurs to upgrade the Drake line of fine equipment.

To keep our costs to a minimum, and give you the best service, we ask that the following improvements be incorporated as a special package:

Basic improvement kit		
	parts	\$ 20*
	labor	90
Six solid state tubes		120*
Complete alignment, minor repairs		20
Shipping (UPS in conus) & handling		<u>15</u>

Please enclose check, money order, Visa, Master Card plus tax on parts if you live in Texas: \$265

* Supplied at discount.

Please ship UPS to

Howard J. Sartori, W5DA
1714 Goliad Drive
Garland, Texas 75042

Select additional kits and filter systems from this list:

R-4 Audio SSB Low Pass Filter, parts	\$25
installation.	10
R-4 Audio Integrated Circuit Amplifier, parts.	25
installation	20
Sherwood Engineering Filter Systems	
Select components from list on reverse side	
Filter pair installation.	60
Single filter installation.	50
Multiple filter combinations, each additional relay set, installation.	45
Special design, installation, and repairs.quoted

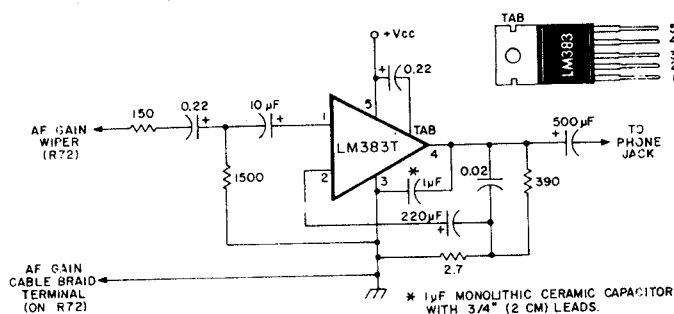
R-4C AUDIO AMPLIFIER

One Drake R4-C circuit that needs improvement is the audio strip, which has both unnecessary buzz and higher than desirable distortion; it also dissipates 7 to 10 watts of heat nearby the PTO. The suggested replacement audio amplifier eliminates these problems, and while intended as a retrofit for R4-C receivers, the circuit performs so well we recommend it for other communications uses as well.

The communications audio amplifier is designed around the National Semiconductor LM383T which, with the R-4C low-voltage power supply, can deliver in excess of 2 watts into a 4 ohm load. The LM383T IC and other components can be mounted on a 1-3/4 inch (45 mm) square perf board; it should be installed just behind the front-panel phone jack, between the passband tuning capacitor and long i-f shield. This location provides access to the speaker lead and audio feed at the audio gain control pot; this site is also well away from power transformer hum fields on the chassis.

The secret of making the LM383 IC an unconditionally stable audio amplifier suitable for field installation in various layout configurations is the use of the stabilization network designed by Sherwood Engineering Inc. Proper stabilization is accomplished by connecting a 1 μ F monolithic ceramic capacitor with 3/4 inch (2 cm) leads directly between pin 3 and pin 4 of the LM383; use of a lower value capacitor with significantly longer or short leads will virtually guarantee oscillation problems. Also, tantalum or aluminum electrolytic capacitors cannot be substituted for the monolithic capacitor.

All circuit values in the audio amplifier below have been carefully chosen to tailor the audio response for optimum radio communications intelligibility. As in the original Drake R4-C, the low frequencies are rolled off at the lower end of the voice spectrum; high frequency shaping is similar to that suggested by Sherwood and Heidelman.¹ The feedback network has been designed to provide nearly 40 dB rejection of power supply ripple, thereby eliminating the need for extraordinary amounts of power supply filtering. Gain of the amplifier at 1000 Hz is 40 dB.



As with any high gain amplifier, feedback and hum loops between the input and output must be avoided. Return all signal and power leads to pin 3 of the LM383, except for the V_{CC} bypass capacitor, which should be returned to the IC tab with a solder lug. Also, the phone jack should be bypassed with a 0.01 μF ceramic disc.

To disable the existing amplifier in the R4-C, lift the collector lead of the output transistor at the solder lug; then remove the output transistor's base or emitter wire or disconnect one end of the driver transistor'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 (this secondary is still used to provide the needed voltage step-up for the anti-vox feed).

The only ground return should be a short, thick, insulated wire, run from LM383 pin 3 directly to the cable braid terminal of the audio gain control (rear section of the dual control). Do not allow any of the components on the circuit board to contact any other part of the receiver ground. Next, add a short wire between the audio gain control braid terminal and a nearby chassis ground. Disconnect the existing wire from the audio gain control center wiper and connect the input to the new amplifier to this lug. Connect the V_{CC} to the original audio strip printed-circuit board terminal with the blue wire from the audio output transformer primary. This completes the installation in the R4-C receiver.

For best results, this improved audio amplifier should be used in conjunction with the power supply modification designed by Sherwood Engineering (kit available from RADIOKIT).

Reference

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

R-4C IMPROVED POWER SUPPLY

The 14-volt power supply originally built into the Drake R-4C Amateur Communications Receiver is inefficient in two ways: it provides only mediocre filtering and, along with the original audio amplifier, produces 15 watts of excess heat. The availability of compact, low cost three-terminal monolithic voltage regulators makes them the obvious choice for updating the R-4C low voltage supply (circuit designed by Howard Sartori, W5DA, and recommended by Sherwood Engineering).

The main advantages of this modification of the regulator circuit, however, can be realized only if it is accomplished in conjunction with a new and improved audio amplifier (kit available from Radiokit). The new audio amplifier draws much less current than the original, which results in a rise of approximately two volts at the output of the unregulated power supply; this is very important in older R-4C receivers which had 12 volt outputs (as opposed to 14 volts in later models). The LM340T-12 (7812) three-terminal voltage regulator will operate satisfactory in all R4-C receivers without the addition of a voltage-boosting circuit. (Be sure to remove C201, the 20 μ F, 150 volt electrolytic capacitor in later vintage receivers -- located between the 6.3 volt accessory socket terminal and the output of the 14 volt rectifier diodes.)

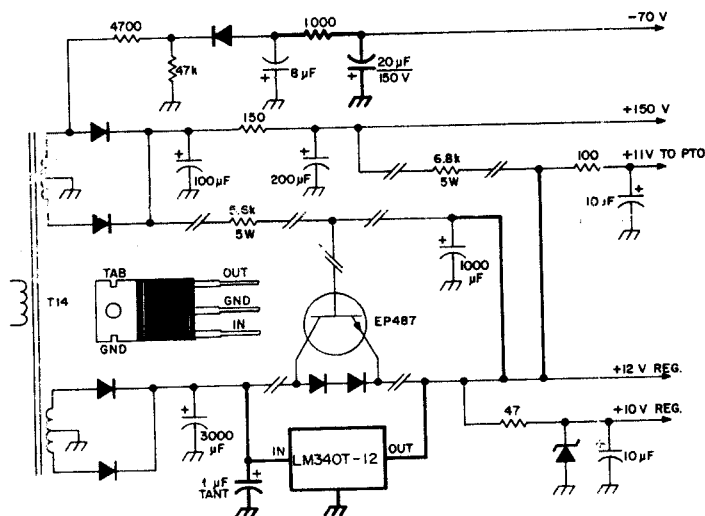


Fig. 1. Improved voltage regulator circuit for the Drake R4-C communications receiver. Circuit modifications are shown with heavy lines; disconnections are denoted by two diagonal lines (//).

R-4C IC PRODUCT DETECTOR

As pointed out in a recent magazine article,¹ the original product detector in the Drake R-4B and R4-C receivers has one very serious deficiency: it allows audio to leak back into the last i-f stage, where it is detected, causing the AGC to vary at an audio rate. This is corrected by the simple product detector shown below; this circuit was designed by W5DA and recommended by Sherwood Engineering Inc.²

To begin the installation, it is first necessary to remove Drake components CR2, CR3, C83, and R60. Next, the wires which connect the output of T11 and the printed-circuit board are removed. The 0.01 μF coupling capacitor should be installed between the transformer pins and the IC socket; there should be no connections on the board for either the BFO or i-f inputs. Completing the modification requires only that the TL442 IC, socket, and other components be mounted on a small section of perf board; this board is installed between the audio output transformer and the adjacent PC board.

Audio output with the new product detector is slightly higher than the original. The combination of R61 and C81 provide the proper high-frequency rolloff. The product detector will accept a 20 dB increase in signal level before it overloads. Some receivers may need a 500 μF decoupling capacitor at pin 2 of the TL442 to reduce hum if the improved power supply circuit is not installed.

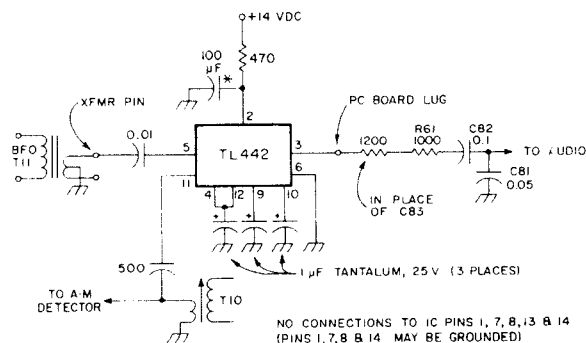


Fig. 1. Improved product detector for the Drake R4-C. Remove both T11 leads closest to the audio output transformer from T11 and PC board lugs. Input coupling capacitors to pin 5 and pin 11 of the TL442 are connected directly to transformer pins.

References

1. R. Sherwood and G. Heidelman, "Present-Day Receivers — Some Problems and Cures," ham radio, December, 1977, page 10.
2. R. Sherwood and G. Heidelman, "New Product Detector for the Drake R-4C," ham radio, October, 1978, page 94.

SHERWOOD ENGINEERING FILTER SYSTEMS AND EQUIPMENT

Drake R-4- and R-4C filters and Kits (* denotes R-4/A/B application):

CF-2K/16 16-pole extra sharp SSB filter	\$135
*CF-2K/8 USB/LSB pair first i.f. filters	\$150
Switchkit with PCB Mounting	\$ 65
*CF-5K/8 5KHz first i.f. <u>sharp</u> skirt filter-NEW!!!#	\$ 80
*CF-600/8 600-Hz first i.f. CW filter	\$ 80
Switchkit with PCB & mounting plate	\$ 49
*4-filter switch kit with two PDBs (for first i.f.)	\$175
*2-filter switch kit for any two first i.f. filters	\$ 49
CF-3K/8 extra-narrow AM filter	\$ 80
Two AM filter relay switch kit	\$ 49
*R-4/A/B receivers can be retrofitted with R-4C first i.f. filters. Replace transformers T5/T6 with R-4C direct replacements.	\$ 25

Drake R-4C standard-bandwidth filters:

CF-6K/8	CF-4K/8	CF-1.5/8	\$ 80
CF-1.0K/8	CF-500/8	CF-250/8	

Drake TR-7 or R-7 filters:

CD-10K/8	extra-wide AM filter	\$ 80
CD-8K/8	wide AM filter	\$ 80
CD-6K/8	standard-bandwidth AM filter	\$ 80
CD-4K/8	narrow AM filter	\$ 80
CD-3K/8	extra-narrow AM, wide SSB filter	\$ 80
CD-1K/8	wide CW, RTTY filter	\$ 80
CD-500/8	500-Hz CW filter	\$ 80

4-SP MKII RF speech processor for Drake T-4XC \$380

7-SP RF speech processor for Drake TR-7 \$325

7-SP MKII with CD-1.6K/8 in extra filter position \$380

SE-1 microphone equalizer/pre-processor \$100

SE-2 microphone in-line equalizing RF speech processor (16 pole filter) \$380

Notes: # - width is now 9-KHz at -60 dB. Original Drake filter is over 35-KHz wide at -60 dB. Ultimate rejection of new filter exceeds -100 dB! This new filter virtually eliminate intermod in the transistor amplifier and 6BE6C mixer that follow this filter.