Drake Mods

TR3 to the TR7

July 16th, 1997

Drake Mods

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1.0 DRAKE MODS

Enclosed are a number of mods available for various pieces of Drake equipment of the 4 series and later. Some of these changes I have personally implemented and some are collections from other sources. I've stayed on 'the straight and narrow' in providing nothing radical and kept the changes to the refinement level.

What I've tried to do here is not only list the mods that I know of, but to share some of my experiences with the equipment. I've included some historical information and some thoughts on what the B and C series are about. A large part of the reason for this is that I've had to find this out myself - the hard way. A lot of the data is what I would of liked to have known before I started to acquire some of this gear. What surprised me most about this equipment is that there is almost no data external from Drake available. No mods - and I searched every where. No knowledge of what makes a particular example a good one.

This is the sixth in the series and likely to be the last one for quite a while. Originally, I wanted to list items associated with Drake in general, but confined primarily to the B and C series receivers and transmitters. It obviously has grown well beyond that concept. I am not prepared to take this into the more obscure - the R7, TR5 and linear amplifier realm. These items are much less common and have their own cult following. Additionally, having never owned one of these devices I'm not going to detail changes that I'm unfamiliar with.

I have two comments about DRAKEMOD. First - a thank you to all that have sent me E/Mail. It helps keep this going. Second - I look at the E/Mail going through the Drake User group - the questions that get asked - and I think "Hell - thats in Drakemod". It is sometimes discouraging.

Such is life, I guess.

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2.0 SOME NOTES REGARDING V6

Included in this version are some schematics and a simple drawing program, SKEM. SKEM is a DOS program and prints to an HP LASER printer only. I encourage you to support this simple and inexpensive program. Please distribute this version of Drakemod in its entirety.

These are not all the 'mods' available - I know there are more out there. It would be a career to even attempt acquiring them all. I've also tried to avoid mentioning any changes that I have not had experience with or at least verified. For that reason, the information on the TR5, the linears and the R7 is going to remain 'light'. When I started this treatise I decided I would not distribute rumors or hearsay.

I've also accomplished, I think, what I originally set out to do. Originally, I only wanted to cover 'the twins', but as the popularity of Drakemod and my inventory increased, additional information was added. With but few exceptions, I decided to keep any changes to those items I had personal involvement in.

I received critique regarding organization of this material and how difficult it is to find specific items and the 'philosophy section'. Point noted. Yes, it is a work in progress. It is 'organized', though, in its own bizarre fashion. The general section is used to find 'common' items like PTOs, speakers, Drake service data, finals and such. There is a problem with association. If there is comment to be made regarding final tubes, where do I put it? Does it belong with the transceiver or the transmitter? What about the power supplies?

While there is now an index, please do not rely upon it. If there is an area concerning, say, T/R relays in the TR4, don't assume that this may not be applicable to your T4B. If I say something about input capacitance of generic final tubes in the transmitter section, then *of course* it could apply to the transceivers.

I've softened the tone of this release for a number of reasons. Foremost is this is how I wish DRAKEMOD and myself to be remembered. I've softened also over the last (almost) 2 years in that while I am still a proponent of Drake equipment, I am not a zealot. The world is big enough for everyone. There is a place for everything regardless of the country of origin. The marketplace holds the final vote that sometimes voices a very harsh and brutal verdict.

Have I 'given up'? Oh no - not at all. At one point I had enough Drake gear to almost open a dealership. When I tripped over a T4XC downstairs and almost put my face into the concrete floor, I realized I had too much .... STUFF for someone that never said he was a collector.

Here's DRAKEMD6. Enjoy.

Some Notes Regarding V6 2
Authored by VE3EFJ

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3.0 GENERAL

Comments in this section are generally common to all Drake 4 line equipment.

o Swap Nets

Do not expect these nets to specialize entirely in Drake equipment. Some nets have specific rules regarding acceptable equipment to advertise. In general, no CB equipment unless modified to Amateur bands.

The times mentioned are local Toronto time.

- Old Gear Swap Net (15 years or older)

  3865 kHz Saturday 19:30

- Traders Net (all gear)

  3898 kHz Monday 20:00

- Joe's Swap Net (all gear, no CB)

  3755 kHz Sunday 19:30

- Larry's Swap Net (all gear)

  3750 kHz Sunday 12:00

  Net Manager has changed.

- North Bay Swap Net

  3768 kHz Sunday 09:30

o Drake User_Group

For those on the Web the Drake user group is listserv@fablotz.min.net Send E/Mail to this group with the message 'SUBSCRIBE DRAKE'. No quotes. Expect about 20 messages/day.

Tech tips and some equipment trading takes place.

o How Drakes Age

Gracefully.

All kidding aside, most Drake equipment will not self destruct unless provoked. After all this time, just about any component that is

going to fail, has. Here is a brief list of what is likely to happen with a Drake over time:

- Electrolytics dry out

- PTO end play needs adjustment

- PTO lubricant dried out

- Some ceramic capacitors fry from excessive heat.

- Preselector verniers wear
- Worn switches - selector tabs
- Tube failures
- Switches and controls corroded/dirty
- Alignment
- User modifications
- Dirt and dust
- Chassis pitting
- Brittle line cords
- Worn control shafts
- Knob discolored/white line missing
- Blue filters wash out
- R4C power supply resistors discolor (bake) circuit board
- Dial plates scrape/discolored
- Clear plastics are scratched
- Some lost screws
- Front panel spacers get lost
- T4B - R4B neon bulbs die
- Scrapes, dings and some enclosure rust

Not much, really. You can use this as a check list of what to look for or what to service when you buy your 'new' Drake. The first 8 items or so are operational and not cosmetic.

Drake Mods

o Equipment Maintenance

One of the tricks that I've learned regarding equipment in long term use is the value of a service log. It is never too late to start one, and it will prove invaluable to you. It likely will also assist in the sale of the equipment in the future, as it indicates to the potential buyer a dedicated owner and a radio with few potential surprises.

3.1 PTO SERVICE NOTES

By the time the R4B appeared, Drake had a solidly designed master oscillator - PTO (permiability tuned oscillator). From that time forward and with the exception of the TR5, Drake used pretty well the same PTO in all their equipment. Largely, the major difference was in the dial plates and gear box, but the *PTO* remained much the same. The PTO in the TR7 is much the same PTO in the TR4 which is much the same PTO in the RV7 which is ... you get the idea.

The great news about this piece of trivia is that you can swap the PTOs around quite a bit, *providing* you can deal with the dial plates.

o PTO End Play

If the tuning knob can be wiggled from side to side, chances are the end play needs adjustment.

End play can be adjusted by tightening the ball bearing on the PTO tuning worm gear. Some Drake equipment might have an extra hole on the PTO cover for this purpose. For those that do not, you must re-move the PTO cover. Use a long 3/32" allen (hex) wrench. The adjust-ment 'nut' in question is recessed below the coil form. Do not overtighten or you will ruin the dial drive ball bearings and race. Do not disturb any placement of components or you will affect the PTO dial tracking.

o PTO General Notes

Most of the PTO units are much the same throughout the 4 line, but the drive mechanisms and indicator plates are not. The worst things you can do to a Drake PTO is to continue tuning past the STOP indication or clean the dial plates with something that dissolves the plastic. Be very careful with cleaner on those Lexan dial plates! If in doubt, use mild soap and warm water. Dial plate replacement is impossible (there are no dial plates to be had). Drake will service the PTO for you - they have the gears and other mechanical parts and can reset the PTO for drift and linearity spec. It would be most wise, however, to not lunch the PTO gears and dial plate.

o PTO Evolution

The PTO stayed basically the same over the years. It is a good, solid design. Early model PTO assemblies had a brass pin that was driven into a slot in the gear to provide a stop. As these assemblies wore, sometimes the pin would not extract itself and the PTO drive would end up in a locked state. If this was forced, the pin will snap, leaving no dial stop at all and the dial plate will go around and around until the slug bottoms.

Later assemblies used nylon gears and dual dial plates on a concentric shaft. Some of these dial plates are 3 pin and some are 2 pin. The number of pins refers to the brass rivets that hold the dial plates to the gear faces. There is no stop to speak of in these assemblies and turning past the mechanical resistance of the drive assembly will lunch the gears. These PTO drive assemblies may have 'ears' and there may be 2 ears just behind the gear assemblies. The purpose of these ears is to allow the dial plates to be rotated for proper mechanical orientation with the dial window gradical.

o PTO Mechanical Instability

This is usually caused by either the worm gear tension spring not hooked to the aluminium PTO cover or by the end cap on the end of the PTO coil form being loose. If the problem is not the tension spring, remove the PTO cover and look at the end of the PTO coil form. You will see a cap on the end of it. It should not be loose. If it is loose, carefully remove it, apply some glue and stick it back on. The coil form is delicate! The end cap just has a square hole through which the tuning slug brass rod goes through. For glue, I use GOOP.

See also PTO End Play above.

o PTO Warble

Sometimes the PTO will warble slightly while tuning. This is usually caused by dried out grease on the drive mech ball bearings. This is the ground path for the PTO slug drive which has a brass rod inside. Fix the dried out grease problem first. Use Teflon lube or Lubriplate. Run a flexible ground strap from the PTO drive yoke to ground. Do not grease or lube the top guide pin for the PTO slug yoke.

o PTO Lockup - B Series

Sometimes the brass pin will insert into the gear at the 'STOP' area, but it will not extract itself, causing the PTO assembly to lock up. Wear will cause this, but in a lot of cases its caused by the gear timing being off a little bit. What happens is that you'll buy a used 'B' and use it. One day, you'll hit the stop, and the pin will lock the PTO.

Unlock the PTO first by pushing the stop pin back and rotate the tuning knob. Looking at the front of the radio, you'll notice a ny-

lon gear thats spring loaded. Gently push this gear back and rotate the tuning knob ever so slightly (which way? take your pick). Now run the PTO to the stop again and see if the pin extracts. No? You went the wrong way or there are more serious problems.

o PTO Lubrication

Given the age of these unit, the grease is starting to dry out. Its possible that it may even has run away slightly after seeing God knows what use in a car or in a hot tent on Field Day many years ago. Most important is to lubricate that worm gear. I use Teflon spray lube. Just use the slightest bit. Too much is much worse than too little. The dial mech should offer only slight resistance to the tuning knob. You should be able to fast spin the tuning knob by placing your index finger on the outside of the knob and rotating your hand. If you cannot do this, then you have some kind of a problem in the PTO dial mech.

o PTO Backlash

Inspect the brass rod that extends from the rear of the PTO cover as the unit is tuned. It may be discolored, but it should not be covered in grease and guck. This rod and the end of the PTO tuning coil comprise the end bearing. Clean with alcohol and a paper towel. Sometimes 'junk' will accumulate in this area and actually cause some binding in the tuning slug. You'll tune the PTO and in about 5 minutes, it will 'jump' frequency up to a few hundred cycles.

o PTO Drift

All Drakes drift. Once warmed up and settled down, they are satisfactory for all modes but RTTY. For all practical purposes, the PTO from the B series to the TR7 (excluding the TR5) are identical with the exception of the dial plates and the markings on the aluminium cover box.

In very general terms, the PTO should settle down within about 5 minutes after turn on and be usable. It will still shuffle around a bit after that, but you should not be chasing it continuously.

There are no PTO adjustments available to compensate for drift; components were 'selected in production'. In extreme cases, you will either replace the PTO from a junker or send the unit to Drake for a rebuild. Expect to pay for 4 quarter hours labor minimum.

Drake PTOs are stable, but the temperature compensation is not perfect. The PTO in the SPR4 is quite a bit more stable than the R4C. The reason is heat. The heat inside an SPR4 is neligible, but the R4C heats the PTO slightly from the audio output transistor. Thr TR7 and R7 will shuffle around a bit from the heat from the dial lamp, and the TR4any transceivers are much more stable when a fan is installed.

o PTO Skipping/Hysteresis - C series

Inability to have the C line dial plates to indicate exactly the same frequency after moving away 100 kHz or so and returning to the same frequency is usually caused by the rubber collar under tuning knob and dish. After all these years, the rubber has hardened or has worn. Replace the PTO rubber. The C clip should not be tight against the aluminum washer and the washer should be installed such that the groove around the perimeter is on the outside.

While you've got the knob and dish off, inspect the shaft for burrs.

Sometimes when you push a new rubber collar on you'll displace one of the gear sets. This is easy to fix, but you'll have to remove the top cover, push the left hand ear to the right while gently rocking the tuning shaft and pulling out. Then align the dial plates again. A new collar should last for years.

o PTO Seizure

I had one report of a PTO that locked up solid on a TR4. This apparently happened very suddenly. The clue is the knowledge that the transceivers run very warm, and the lubricant is 20 to 27 years old.

All the PTOs are essentially the same. There is a shaft that turns a worm gear; the worm gear moves a yoke follower back and forth that moves the tuning slug. Running off this shaft is a gearbox that turns one (2 in the case of the C line) dial plate that has a bearing collar that is around the tuning shaft. The grease in that bearing area had cooked off. With the dial plate now 'locked' to the tuning shaft the shaft is locked since the dial plate is driven by the gear box and the gear box is driven by the shaft.

The cure is to flush out the grease and replace it with Teflon lube. Teflon will not cook off, but the TR4 also needs a fan to resolve the heat 'problem' caused by vaccuum tube density.

o 4 Line Dial Plate Dish, Knobs etc.

Personally, I don't like the plain dial skirt on the C line. I replace them with TR4 dial dishes. This does nothing except for appearance and is a matter of personal taste.

The TR7 dial dish is different than the 4 dial dish.

Some dial knobs are thicker than others depending on the PTO assembly. Most knobs are available for replacement except for TR7 band switch knobs. Unobtainium.

o Dial Plates and Plastic

These are not available from Drake any more. Use cleaning materials with extreme caution.

Most minor scratching of clear plastics can be polished out with toothpaste, a touch of water and a paper towel. This works amazingly well. If you use this trick on the dial plates, be careful you do not rub the lettering off. Gel does not work nearly as well as toothpaste.

o C Line Dial Alignment

The C line allowed for dial indication alignment through the use of idler gears in the dial drive mech. Just to the left and right of the drive transmission you will find one or two 'ears'. Pushing these ears towards the PTO shaft will allow the indicator plates to be rotated such that the plates align to display the correct frequency. Depending upon the age of the C line unit in question, there may only be one ear. In order to reseat the idler gear, push the lever over and let go such that it snaps into place. If you do not do this, it will take some rotation of the tuning knob until the idler seats and your alignement will be off (again!).

On the B, you can rotate the Lexan dial plate a little with a touch of brute force. Place a small screwdriver on the edge of the dial plate and flick it the few necessary degrees. Do not to this with the C line (see above).

o Dial Plate Scraping

The dial plates are fairly large diameter Lexan disks. On the C line, there are 2 of them. One knob turn tunes the receiver 25 kHz. Sometimes the dial plates will scrape as they are rotated usually somewhere around the front panel. Over the years, some heat warping should be expected. Quite often though the scraping is caused by poor assembly after removing the front panel for cleaning. If the whole PTO had been removed, there is a little positioning adjustment available if the 3 PTO nuts are loosened.

Ensure the dial gradical plastic is on the outside of the sub chassis with the red line on the inside of the window (C line).

On all radios, the blue filter mounts on the back of the white plastic dial backing. Make sure the dial light wires are positioned away from the dial plates.

If you have warped dial plates, I would not try flattening them by any method. The simple, expedient answer is to go to a craft store and buy some felt. Attach a strip of felt to the back of the sub front panel with double sided cellophane tape.

There is no such thing as replacement dial plates except from a junker. Every time a plate scrapes, you are grinding it away. Fix the scraping as soon as it is noticed.

3.2 GENERAL MECHANICS

o Recommended Reading

One of the best books I've ever encountered is 'Solid State Design' published by the ARRL. Yes, it says 'solid state' and the Drake stuff uses toobs. What gives?

This book will provide you with an excellent background in receiver AGC, performance measurement, power supplies (R4C reference), noise figure, product detectors - an almost endless, PRACTICAL application of electronics to amateur radio. My copy is so ragged and worn, I need to replace it, just for that reason.

The 'aether' knows not if you are using transistors, glassFETS or even a coherer. Physics is physics. Far better to learn for $15 why .1 uV on 80 meters is a useless achievement rather than spend hours 'improving' your R4B for nothing.

Considerable detail is presented about receivers and multiple conversion designs. This can be applied to the R4B and R4C in that there need not be any difference in sensitivity and noise figure of a double conversion compared to triple or even quad. It all depnds on design goals, cost, engineering preference and other factors.

A highly recommended publication, even if you don't build. Do not let the title intimidate you.

o R4any and T4any Tuning Rack

Leave the slugs alone! There should never be a valid reason to pull a tuning rack apart except under the most unusual of circumstances. These slugs are color coded for permeability - mix them up during reassembly and you'll have a fun time getting the receiver to track - if ever. There should be ample adjustment available in the trim capacitors to set up the front end on the individual bands.

Sometimes you may find a particular receiver will not peak properly when the preselector is set to the indicated value. Generally, don't worry about it. There is no law that says you cannot move the preselector a bit to accomodate the compression trimmers. Ideally, you want the compression trimmers set about 1 to 1 1/2 turns from 'snug'. If the trimmers are backed off too far to accomodate the (arbitrary) preselector setting, they won't hold long term alignment. In this case, rotate the preselector a bit to raise the slugs and try again.

o Rotary Switches

Sometimes you may encounter either a dead radio or an intermittent one and just can't find the sore spot. Check the rotary switches for a sawed off selector tab. Sometimes just enough of a stub is left to

select some positions - just barely. This is just wear and tear and is simply the rubbing action of the selector tab going past the fingers.

o T4any Microphone Connector

The microphone connector plug is a Switchcraft S230 and has a diameter of .210". This was used so you couldn't plug the microphone into the earphone connector and have the output fry the element. These plugs are a little rare. The reason why the PTT line is the tip and not the ring is simple. If it were the other way around, you'd put the keyed line across the mic element as you pushed the connector in. In desperation, I've seen a standard 1/4" stereo socket used and it could be an expensive expedient. Microphones don't make good speakers or speakers for very long.

o S230 Part II (from I/Net)

"I just sent off for two of these last week. Have not got them back but he said they are NOS Switchcraft S-230 right angle plugs. Danny in VA has them for sale. He said he got about 200 a few years back. Had 20 or 30 left. He sells them for $8 each or 2 for $15. No connect with him, just heard him on the Drake Net. His phone number is 804-448-3008."

73s Mike WD5xxx The DRAKE Collector

Another potential source is:

Mouser has them (502-S-260, $7.08 ea.), so does Digi-Key You can usually find them at swap meets ....

Mark AA7TA

(I have referred a few folks to Danny for the S/230 and there have been no reports of any problems whatsoever <wm>)

o Radio Miscellaneous

For trim paint, Collins trim rings and related items that may prove to be hard to find, you can try:

R and R Designs
1-800-372-4287
1-608-255-0400

o Cinch Jones Plugs

Modern radios tend to use the Molex style plugs. The other style plugs commonly used up to the late 70's were the Cinch Jones connectors. These are becoming a little more difficult but not impossible to find. Try the following:

Authored by VE3EFJ

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Try Allied Electonics 1-800-433-7500. I got a couple of plugs for my TR7 from them, Vinnie N2TAI

The S-300 and P-300 series are available from Digi-Key, and in the past I have gotten the S-400 series of Cinch Jones connectors from Newark Electronics. I would suggest looking in Digi-Key for the S-400 series as well as Newark tends to be rather costly.

Harvey, N6MM.

o AM Operation

The transmitters and transceivers will operate AM. But why is it so 'different'?

During reception, Drake wants you to treat an AM signal as 'Single sideband *Reduced* Carrier'. The sideband filter chops a sideband off and reduces the carrier. You detect it by zero beating the carrier thats left.

The transceivers and transmitters were designed to be operated with a linear. A true AM signal through a linear amplifier is not only very inefficient, its really rough on the linear, especially when operated improperly. Instead of simply unbalancing the balanced modulator to get sorta AM, Drake made a terrific compromise and went 'controlled carrier AM'. This mode has a small carrier at idle and the amplitude of *both* the carrier and sidebands goes up as you modulate. Its easy on the PA tubes and it works well. It is superior to unbalancing the SSB balanced modulator to generate AM and reasonable in terms of trade off to 'real' plate modulated AM.

This is similar in principle to the AM mode in the Heath DX60, Knight T60 and Knight T150.

o T4 and TR4 Relay Cycling

With the age of these units some of the electrolytics are starting to dry out. Sometimes they'll go leaky from cell to cell if there are multiples in the can. If you have problems with the T/R relay chattering or cycling, quite likely it could be one of these filter cans. The only way to roughly suspect an element has gone is to clip in a 100 Uf 300 volts across an element. If the cycling stops or slows down this is the likely problem. Beware of some funny problems you may get with cell to cell leakage, however. These can be tricky to nail.

These canned capacitors are dated and largely unavailable as replacements. Due to their age, even if replacements were available, I would advise some caution. Whether in use or not, they've been sitting on the shelves for too long. Modern capacitors are much better. My recommendation is to replace the whole can with discrete electrolytics. You can either leave the old cap in there for appearances or pull it and put in a hole plug.

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In the receivers, weak power supply electolytics are characterized by hum, low B+ and 'funny' audio on SSB. The funny audio is caused by harmonic mixing of the 60/120 cycle hum and the detected audio. In this case, sometimes there is not enough hum out the speaker to be too objectionable, but the speaker audio sounds 'funny' for some reason or another. You can verify this with the calibrator on SSB. As you sweep across the calibrator slowly, you'll hear some spots where the audio goes muddy. Once you detect it, and have your ears trained, its very obvious.

o Schematic Date Codes

On the 4 line B series and above you'll notice a series of numbers in small print on the schematic. I have an T4C schematic with the numbers 10077626470. This is in mmddyy/serial no format. It means that this schematic was revised on October 7, 1976 and applies to serial numbers above 26470. I do not see this notation after the TR4Cw-RIT.

o Drake Equipment Wiring

Drake did not color code their wiring to any appreciable degree. In most cases, their hook up wiring seems to be white colored and some wires may have a color trace. More than one wire may have the same color trace, so be careful and verify with an ohm meter from end to end.

Additional care should be used when soldering to Drake hook up wire. The insulation melts very, very easily and will crawl up the wire and peel off while doing so. When replacing items like those canned filter caps, sometimes it causes less damage and is more expedient to simply cut the wires. One can easily and quickly loose 3/4" of insulation just in desoldering.

o Line Cords

Some line cords will be 2 wire - no ground pin. This may appear on the receivers or on the AC4 transmitter power supply. Users are urged to change the line cord to a 3 wire configuration with a grounded centre pin. Without this centre pin, the chassis leakage will float to about 50 volts AC. In the event of the primary windings shorting to the chassis, this can prove to be lethal.

o Loose Knobs

On some controls it may be difficult to keep the knobs tight to the shaft. Overtightening will split the knob. Quite often the problem is simply caused by the knob not being exactly square to the shaft flat when the set screw is being tightened. Rock the knob slightly while tightening the setscrew. The knob setscrews are not all that easy to deal with in the long term. A better setscrew is an Allen (hex) head screw. This type of setscrew will provide better torque control.

Some knobs have no set screw and instead are held in place by a piece of bent flat spring steel. Sometimes it is these knobs that always fall off, because the spring steel gets flattened just before the shaft rotates. In this case, try that particular knob in a location with less torque such as a volume control. Just swap the knobs.

o Source for Knobs (K4OAH)

1. Drake still has them, but they are $4.03, plus shipping and handling.

2. The knob is made by "DAKAWARE", but is not shown in the latest

Allied or Mouser catalogs.

3. A local distributor has them on a peg board display under the name of "Caltronics" for about $3 each. I think this is a popular brand among independent distributors.

The "B" knobs are of two types. One is a set-screw type (as in number 2 and 3 above,) and the other is a slip-on type with the little metal spring like Collins uses. The set-screw type will work to replace either of the originals.

o Sensitivity Check - all Drake 4 line

All Drake receivers and transceiver should provide a noise peak as the preselector is passed across the tuning range, even on 10 meters. If your equipment does this with no antenna connected, you have all the sensitivity you can use. If it fails to provide a peak, alignment is immediately suspect. Generally, the calibrator should provide an S9 meter reading on 10 meters, progressively increasing as the band switch is rotated to 80 meters.

o Front Panel

The 4 line has spacers in the 4 corners of the front panel. Be careful when you remove the front panel. The thickness of the spacers seems to be 1/16" or so and they are, of course, black. They disappear as soon as they hit the ground.

o Screws and fittings

There are no metric fittings that I know of. Most of the machine screws are 4/40, the case cover screws are 6/32 and the chassis sheet metal screws are usually #4. The foot screws are 10/24.

o Speakers

All Drake equipment is standardized to 4 ohm speakers. This impedance is important. Use of 8 ohm speakers will produce considerably less audio output and is not recommended.

On all the Drake C line and before, as in all audio power stages that have an output transformer, never crank up the audio gain without a speaker attached. Never connect an A/C volt meter across the primary. Transients generated in the output transformer, especially without a load, will create very high voltage spikes through the collapsing magnetic field. This is how output tubes arc, output transformers short and volt meter rectifiers get punctured.

o Replacement Speakers (KD6VK)

The speaker that I have used in several Collins speaker enclosures is a standard RS 5 x 7 replacement unit with 40-1261C as a part number. I have never used it with a Drake unit, but the sound should be similar if the speaker is any good. The key component is the spacing of the mounting holes and I believe that these are standard.

o Power Supplies

The Drake vaccuum tube transmitters and transceivers use the same AC/3 or AC/4 supply. When using alternate supplies such as the Heath HP-20 or HP-23 ensure that the low voltage 250 volt supply is indeed this level. Do not provide more than 265 on this power line.

o Transmitter Meter PA Current Resistor

When you buy your 'new' Drake, check the value of the cathode resistor in the final circuit. The value of this resistor will depend upon the model of transmitter or transceiver. I've seen a number of these cooked. Usually they go higher in value, causing a number of problems. With the resistor higher in value, the meter will read You'll end up setting the bias too low, causing poor transmitted audio.

It would be wise to verify the meter calibration against the idling current. Using the T4C for example, it has its PA bias set for 70 ma and has a meter resistor of 3.3 ohms. Set to 70 ma, you should measure E=I*R, or .07*3.3 or .231 volts across this resistor. Measure across the resistor and NOT at the meter terminals.

Similar problems with setting the proper idling current will be observed if the PA current meter needle is not resting at zero.

o Intermittents

Some intermittents may be difficult to find and somewhat hard to explain. Inspect the bottom of the chassis carefully and you will observe screws holding down terminal strips and circuit boards. All the screws that you can easily access should be backed off 1/2 turn and retightened.

A TR3 suffered the above problems and was cured by the above approach. Most of this equipment is 20 years old or older. In the case of the TR3, it was 33 years. The obvious suspect is corrosion.

3.3 TRANSMITTING (GENERAL)

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o Low Transmitted Output

Many things can cause this, of course. With a low capacity 'scope probe, you should have about 45 to 50 V P/P on the 6JB6 control grids for full output on either the T4any or TR4any.

Have a look at the following. This might help:

- Not all the finals are connected.

  Sometimes when you replace a final tube, you'll fatigue the parasitic suppressor solder joint at the plate choke. This will, of course disconnect a tube. It is also very bad, as the disconnected tubes' screen will draw much, much more current than it was designed to. All that cathode current has to go someplace ....

- The units meter is lying

  All the B and C line meters seem to be about 5 ma. in movement. Age may make them go non linear, not rest at zero or cause them to lose their damping.

- The watt meter is lying

  Does the measured output correspond to the indicated current?

- The cathode meter resistor is cooked

Usually they cook high in value (ref prev item).

- The power supply is soft

The filter caps are immediately suspect or the supply is set to 220 VAC.

- Alignment

Pick ONE band - 80 meters and adjust. If you can substantially improve the output, then chances are the rest of the set needs some set up attention.

- BFO off frequency

If the BFO falls on the Filter slope on CW or tune, the output will be low. In either sideband position, a counter will tell you if its off. Set the crystal trimmer to 5645 kHz in either sideband position. The crystal is pulled in the tune and CW positions.

- Band Sideband Filter

This will also apply to the TR3 and TR4 series transmitters. There are no replacement filters available. In the TR3 and early TR4 the sideband filter is composed of discrete crystals inside the square can. You might be able to get a replacement crystal cut, but finding the offending crystal in the first place will prove to be a bit challenging.

o Drake Tube Transmitters - ALC

On all Drake Tany and TRany radios, the transmitter ALC is very aggressive. In use, you won't see the output meter kick up that much or the PA current on the meter of the transceivers move as much as you think it should. Usually an output meter will 'only' indicate about 50 watts or so. This is 'OK' and is *not* an indication of low sideband output. Actually, this is normal behavior and if your transmitters do not behave this way, expect some ALC problems.

For a typical Sure 444 or Heath HDP-21 microphone, the transmit audio gain/drive control should be set around the 11 o'clock position and the PA current meter should kick up to about 50% full current (175 ma, T4; 250 ma, TR4).

o Transmitter Keying

For all receivers and transmitters in the 4 series the keyed voltage level is negative. The TR7 has a positive switch line.

o Transmitter Driver Alignment

Drake goes into considerable detail on use of a loading network to align the 4 series transmitters. Don't bother. Just align carefully for maximum transmitter output at a low drive level.

The reason for this network is to simulate the loading when the units are used in transceive. The better method is to slave the units with the covers off both the receiver and transmitter and align. This is much faster and much safer than playing with the loading network method. There is some serious voltage inside these units. Align each individual unit and then align in transceive both ways - active PTO in the receiver for the transmitter and conversely. When setting up in transceive, you really only need to touch up the most rear trimmer bank in the receiver and the front bank in the transmitter. It is not as much a pain as you would think and once set, you're done almost for life.

The loading network method is a waste of time. Information relayed to me from the Drake User group indicates that even Drake themselves does not bother with the loading network any more.

o Transmitter Neutralization

Proper set up of the neutralization is important for a stable, easy to tune, low spur transmitter. I've seen numerous methods over the years, but this works best for me.

What you want to do is set the neutralization capacitor such that the plate current dip and output occur at the same point in the final tuning controls. You need a decent dummy load.

Start on 20 meters and feed enough drive in the tune position for about 200 ma of current. With the LOAD capacitor at maximum (lightly loaded), tune for maximum output on the watt meter. Now watch the plate current meter as you rotate it off resonance. Does it dip lower? Take the transmitter (transceiver) out of 'tune' and adjust the neutralization trimmer about 10 degrees. Repeat until dip and maximum output occur at the same time. Once you have it set up on 20, then move to 10 (or 15).

The reason for starting on 20 meters is for safety. If the neutralization is far out to begin with, the PA stage will oscillate. It is also easier to adjust initially on a lower frequency.

WARNING: The neutralization trimmer has a lethal voltage on it! DO NOT adjust with the transmitter in operation. DO NOT touch the blade of the screwdriver while adjusting.

o Transmitter Tuning

The best final tubes to use are Sylvania. The 'generic' 6JB6 are OK, but they can present alignment problems.

The 6JB6 tubes will draw considerable current. On the TR4, they can draw upwards to 450 ma. The T4 will draw 325 or so. When tuning up, keep the drive level on either unit to 150 ma or less until you're close to the final settings.

Low PA tube life is usually caused by bias setting, operator, SWR, heat or PA neutralization. The 6JB6 tubes are being pushed a bit, but they should offer a good service life if properly set up, operated and kept reasonably cool. I've heard that tubes don't need cooling since its the glass that's getting hot, but the real heat is on the plate, insulated by a vaccuum. Nice theory, but my experience indicates otherwise. Besides, if for no other reason, all that heat cannot be good for component life.

o 'A' Tubes

Some have asked about the 'A' designation on vaccuum tubes. Specifically, whats the difference between a 6JB6 and a 6JB6A? What makes an 'A' tube different from a 'blank' tube?

In almost all cases, we are dealing with vaccuum tubes that had a television application. The 'A' usually indicates "controlled heater warm-up". Tubes do not come active until the filament heats the

cathode to dull incandescence. There is a time specification - usually 11 seconds. The 'A' usually means this figure is guarantee'd.

Note that this designation does not necessarily apply to transmitting tubes such as the 6146, the 829 and others.

o 6JB6

These are sweep tubes used in the horizontal driver in television sets. They are rated for 17 watts plate dissipation. These are high pervience tubes (high cathode current with relatively low plate voltage). The tubes are not designed for RF work. Drake made a reasonable tube selection and at the time, picked an inexpensive, very common tube. The basing diagram is such that there are few direct substitutes. The FT101 uses 6JS6 (not pin for pin to 6JB6).

Some folks have modified the transmitters to use the 6146, but this requires considerable work, for the tube sockets require changing and the holes enlarged. Then there is the matter of recessing the sockets. To run 6146s, you also need a plate voltage around 800 volts. What all this serves, I have no idea.

Final amplifier tubes are becoming expensive. It is this fact that will be the one item that will kill off tube equipment as the years go by. Vaccuum tubes will be available well into the 21st century, but the price has no place to go but 'up'. When you replace the finals in your Drake, you can slow down the inevitable for quite a while by installing a fan. If the equipment is a genuine keeper, you should purchase a new set tubes, plus a spare set at the same time.

The following is a reasonable list of sources for the 6JB6 and other tubes used in Drake equipment:

- RF Parts (see QST ads)

- Antique Electronic Supply (1-602-820-5411)

- International Vaccuum Tube ('generic', see QST ads)
- Radio Shack (oh, you'll pay for this)
- Radio Shack "Life Time" (yessss!)
- Try Fair Radio (its worth a shot)
- Swap Nets
- Boat_Anchors
- Flea Markets
- Drake User Group

General 19
Authored by VE3EFJ

Drake Mods

At one time Radio Shack was selling 'Life Time' tubes. And yes, they were selling 6JB6. If you see a set at a flea market, buy them. Do not hesitate. Even if they are bad, any Radio Shack dealer will get you a brand new set, but they really try to avoid this, for obvious reasons. You will not get 'life time', but you will get a brand new tube without paying a cent more.

The kid behind the counter ('You got questions, we got blank stares'), likely will not have a clue what you are talking about, but stand your ground and go for it. Do not leave the store without having your new replacement tubes on order. Radio Shack will honor their 'life time' replacement policy. Its now one shot. Its not your life time - its *that* tubes life time.

This applies to any Radio Shack tube marked "Life Time". Its a great deal. Buy the tube at the flea market and use it. If its shot, or when it goes, take it to Radio Shack and get a new tube for free.

My only regret is that Radio Shack never sold 8877's ....

o Transceive Operating

Any of the 4 line separates will transceive amongst themselves but only within the same band and only within about 50 kHz, depending on the band. When there is a difference in the series set to transceive some minor inconveniences will be suffered such as loss of active PTO indication and the requirement of BFO netting prior to operation.

But it will work.

o T4B/R4B Transceive Set Up

Since this equipment does not have a separate BFO injection line, you must net them manually in order for them to transceive properly. The C line provided a separate line. There is more to this, however.

Before netting the two together, you should verify that the BFO frequency of the T4any is on frequency. It is shifted for CW operation. If it is off frequency, then netting the two together may cause the offset to be quite wrong on CW.

Proper netting on the T4any is best done with a receiver that does not shift frequency between upper and lower sidebands (like a Drake). Talk into the TX on a dummy load while tuning a known properly set up receiver using headphones. Switch to the opposite sideband and adjust the BFO trimmer on the transmitter to exactly the same pitch/frequency. You may have to do this a few times.

o C Line Meter Switching

The C line used an articulated LOAD control shaft that, when pushed in, would switch the meter from PA cathode current to relative out-

put. The push required is considerable and is a result of the spring strip tension and the spring in the return switch. Never try to adjust the tension of the shaft spring strip by squeezing it. The bend in the metal strip is a stress point and the strip will fracture at the bend. There are no replacement shafts to be had. If the tension is abnormally high, ensure that the shaft coupler and the shaft itself are completely seated to the LOAD variable capacitor.

o Transmitter Filament Fuse

Most Drake transmitters and transceivers have a fuse in the filament power. This fuse may be a strand of copper wire or a pig tail fuse. It is a wise safety feature and prevents the wiring harness from going up in smoke should a tube filament short. Pig tail fuses are hard to find and single strands are cheap, but a pain to create. Should your fuse open, install a fuse block for a 3AG fuse holder by bolting through one of the chassis perf holes. This is a no holes mod and worth while. Don't forget to find out why the fuse opened in the first place.

o Carrier Balance (all transmitters and transceivers)

The procedure in the manual is to use the relative output meter for carrier balance adjustment. The output meter is not sensitive enough to do this adjustment properly. Use an external receiver and make sure the mic gain is fully CCW. You should be able to almost null the carrier out completely.

3.4 R4ANY RECEIVERS

o Mixing Scheme

First mixer injection on all T4/R4 is premixed from the PTO and the band crystal. The crystal is always 11.1 MHz higher than the low end of the band edge in question. For example, the 80 meter band will have 3.5 + 11.1 = 14.6 MHz crystal. The PTO is mixed with the band crystal and the difference is used and injected into the first mixer. A lower PTO frequency correlates to a higher received frequency in the band range.

Using 160 meters with a 12.6 MHz band crystal for example, the 0 scale band edge is 1.5 MHz. The first mixer injection frequency is Fin + Fif = 1.5 + 5.645 = 7.145. This is made from the difference of the PTO = Fxtal - Finj = 12.6 - 7.145 = 5.455 MHz. If you apply the above scenario to a 2.0 MHz incoming signal you will see that the PTO oscillator frequency tuning is inverted.

Both the R4any and SPR-4 are remarkably low in spurs and mixing products once aligned properly. On all of these receivers, I've always

Drake Mods

noticed a quickly tuning spur at 3.897 MHz. This tunes very fast, so a VFO harmonic is involved.

Because of the PTO frequencies and mixing scheme there are some forbidden zones of operation on some band segments that will produce very foul mixing products. Obviously the band range covered by the PTO is a no-no. 10 MHzoperation is possible, but pay attention to the transmitter manual, for the PTO second harmonic is an important consideration when the twins are set up for transceive operation. None of these zones fall into current amateur band assignments.

This also explains why strange settings of the preselector control produce receive peaking - you are likely finding a mixer output that could be PTO, crystal or the sum of the PTO/crystal product that coincides with the rack slugs for the front end tuning.

o R4any and T4any Transceive Operation

Transceive selection and muting is accomplished through the INJ line. This is done by supplying a high negative voltage along this line from the unit with the active PTO. This line is routed to the link on the preselector and to the control grid of the PTO/xtal LO premixer. There is also a diode on the preselector mixer more or less from screen grid to plate. This forms an electronic switch to kill the premix on the unit that is having the external PTO premix signal.

On the R4C/T4C there is also a separate BFO line. The oscillators on both units will fall into sync with each other naturally just from being linked together, providing they were pretty close together to begin with. If the BFOs won't sync, make sure you are using RG/62U cable and that the oscillators individually are pretty close. Since it is the receiver that syncs to the transmitter, failure to sync or an off frequency BFO is likely caused by the transmitter.

If you find that the receiver acts funny when the BFO line is linked - there is a sub audible beat note and the S meter cycles up and down, this is a sure that the injection level is wrong, likely from the transmitter. The BFO line is being mixed, rather than sync'd. Check the BFO level from the transmitter. You should have 1V P/P, minimum, open circuit, at the receiver input plug of the cable.

o Digital Dials

Once in a while I have had requests for digital dials for the older transceivers. This also applies to Atlas and some Japanese units such as the Kenwood 520. I bought an R4C once that had a Yaesu DYC-221 hooked into the PTO. It worked, but this is not the way to go.

What you *really* want to do is to read the INJ line and count the RF signal on the line, accounting for the IF frequency before display. If you do it this way, you get a true read out in MHz, real

time. After doing considerable research for a related product, I found such a device that is near perfect.

Out of all the units on the market, the Radio Adventures A2K is without any doubt THE way to go. It will interface with almost anything and is programmable for just about any offset. And, it will work with the inverse PTO tuning Drake without a hitch. "All ya gotta do" is, once programmed, is connect the A2K into the INJ line of the transceived B's or C's with a Radio Shack Y cable. Since this line is hot with INJ no matter who is slaved, Bob's your uncle. When you build the kit, do not install R1.

I have not tried the A2K with the TR4, but it will work even though 20 tunes backwards. It will/should work because the A2K contains programmable memories. On 20, you'd use a different memory setting and tell him to count the other way.

The website is at www.radioadv.com or call 814-437-5355.

o Noise Blanker Set Up

Both the R4C and TR4 noise blankers are very effective. The alignment of either is not difficult except in the case of the TR4 where access to some tuning adjustments can be a challenge.

You'll need a 'scope to completely set one up and/or an analogue meter. Digital meters are OK, but they don't show relative measurements very well.

The components in parenthesis are TR4 part tags for the 34PNB.

Turn equipment on (what else?), turn noise blanker and calibrator on. Tune calibrator in on 10 meters and misadjust preselector for about an S3 reading. Adjust C3 and C6 (C10 and C19) for maximum S meter reading. Place a 'scope probe to the base of Q12 (Q12) or a volt meter to the emitter of Q14 (Q14). Peak preselector. Adjust C19 and C25 (C8 and C21) for maximum. Turn off calibrator. Set the 'scope probe for 1/10 (low capacity probe). All tuning adjustments are finished. No more trimmer twiddling from this point! Place 'scope probe to drains of Q7 and Q8 (Q6 and Q7) and adjust R28 for minimum. Finally, on the R4C only, adjust the gain balance for similar S meter reading on the calibrator with and without the noise blanker and the jumper plug.

If you do not have a 'scope to adjust R28, leave it alone or more or less centre the control.

o Crystal Filters - Hope

Section deleted.

Consider your sources today to be either the used market or International Fox Tango in Florida. ***

They are the only supplier that I know of for Drake filters. If you decide your R4C, TR7, R7 etc is a keeper and an additional filter is desirable, then what ARE you waiting for?

*** The June issue of QST states that IRCI has been bought out.

o R L Drake Inc

Drake has in stock replacement parts for most of their equipment. For items that are in excess of 15 years old, this is very good. In most cases their prices are good. One can obtain coils, crystals, tubes, meters and relays. Final variable capacitors are available, but expensive. Most front panels are available for around $15.00 but Drake won't sell you a new one unless you return the old one. I do not know why, but Drake is adament on this policy. If you write

Drake a letter they will ship off a computer listing of current parts stock for a particular radio. As of the Summer of 1995, considerable parts were available for the 4 line et al. Parts for the TR7 were few except for ICs and transistors.

There are no accessories available of any consequence. You will not be able to buy noise blankers or crystal filters for any of the C Line. If you want crystal filters, there is only one known source - International in Arizona. Their filters are at least equal to what Drake supplied and expensive. Well, maybe not that expensive considering current KenYaeCom prices.

Essential parts are still available (until the stock is gone) at reasonable prices. If you need accessories for your R4C or TR7, best to get them with the radio.

Drake still services all of their amateur equipment, but they do not stock the PA tubes. They charge by the 1/4 hr. The current rate is about $19 US. I have heard some 'mutterings' about the labor cost, but have yet to hear ANY complaint about the quality of the work done. Consider Drake your only commercial repair service area, especially in the case of the TR7. The TR7 (and possibly other equipment in the '7' series) requires a fairly high skill set to service properly. Most, if not all 'dealers' of the, uh, other equipment won't touch it. Use this as a warning also for some Drake equipment on the dealer shelves, again, especially the TR7. Most are consignment sales. Consider its status as 'indeterminate'.

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Franklin, OH

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3.5 WHAT DISTINGUISHED THE C LINE?

The differences between the B and C line receivers will be discussed in separate detail. Even the C line receivers were different as the years progressed. There is an overall difference between the C line and much of went before, however.

The B line employed copper plated chassis. In the C, this was done away with. The C series also employed dual concentric dial plates where the B series and even the T4X used a single dial plate. The knob skirt on the C line was plain; on the B it was calibrated in kHz and on the TR4 this dial skirt just had radial markings with no numbers.

Generally, in the receivers, Drake made optional on the C a number of things that were standard on the B. The B was a complete receiver out of the box; the C was not. The B automatically switched the AGC as the modes were changed; the C receiver had a 3 position AGC decay time constant setting that was independant of mode. Additionally, the C receiver allowed for more optional band select crystals. The primary reason for the triple conversion on the C was to allow for crystal filter selection and a notch filter. Pundits could argue the necessity of this, but regardless, thats what Drake did.

In the transmitters, Drake switched from a 6HS6 LO premixer to a 6EJ7 on the C line. This is a higher gain tube, but still, the B series did not suffer from a lack of drive. The 12BY7 was used as a driver tube throughout the 4 line. Drake used 6JB6 tubes for the final PA in all of their C and B line transmitters. In the transceivers 3 of these tubes were used to produce 200 watts output. On the separate transmitters, 2 of these tubes were used to produce about 150 watts on 80.

Most of the changes in the C transmitter were for operator convenience. The C series most notably moved the switch for PA current from a separate control on the B to a switch that was activated by pushing the load control in.

The C line also improved upon transceive operation of the separates by providing a separate line for the BFO. This alleviated the requirement to set the receiver and transmitter oscillators exact by the 'canary chirp' method. Additional switch lines were also provided to the dial lamps to indicate the active VFO when slaved together in the C line.

Despite these changes, the B and C series could be slaved together. While the TR7 and TR4 were not transceive compatible with the separate receivers, they still provided for external receive antenna switching and external RX mute. Drake took measures to provide for an intermix of their equipment despite improvements to the gear as the years progressed.

3.6 R4B AND R4C

You could liken the Drake twins operationally to the Heath SB301 and SB401 from the fact that they would transceive. Stand alone SSB transmitters are all pretty much the same. The T4C is a bit like an SB401 functionally. In regards to the SB301, the Drake 4 line receiver, especially the R4C, is in a completely different league.

All Drake receivers in this series are sensitive and selective. On either series, a healthy receiver should exhibit noise peaking on all bands as the preselector is adjusted with no antenna connected. It will not be an extreme increase in noise level, but it should definitely be there on all bands.

Drake enthusiasts generally prefer the B series receiver. The B series has built in a number of items that were options on the R4C. There are few mods for the R4B. When you buy an R4B, there is not much else to get - EVERYTHING is there that you need - noise blanker, calibrator and 4 selectivity settings. The B series was dual conversion, the last IF at 50 kHz determined the selectivity and provided notch filtering. The B receiver is noted for its clean recovered audio, good signal handling and solid engineering. Because the selectivity is determined by LC filters, the skirt selectivity is not on par with crystal filter radios. Since the B receiver was dual conversion and the C receiver is triple, it is generally assumed that the B receiver is 'quieter'. This will appear from time to time throughout this treatise and I'm skeptical whether this is in fact true or yet another example of theory not born out in practice.

The noise blanker in the B receiver works quite well, but not as good as the R4C or TR4 blanker. The B blanker is more sensitive to noise 'quality' - duration, period and rise time. Some noise will be nearly eliminated and yet other noise which sounds the same won't be touched. The R4C and TR4 blankers are more effective across broader noise characteristics. The R4B blanker is a 'Lamb IF Noise Silencer'. Detail on its workings can be found in most Handbooks dated around 1972. Intermod characteristics are not degraded in either receiver with the noise blanker turned on.

The R4C is in fairly high demand. It is a triple conversion receiver and completely different from an R4B. While the R4B does contain some semi conductors, the R4C is more of a hybrid design. There were at least 3 different types of R4C receivers. Generally an early R4C has a 4 position crystal filter switch and a later model has a 5 position switch. In the later model, the AM filter location was moved inside the chassis and mounted on an extra bracket.

There is no discernible performance difference amongst ANY of the Drake R4C series receivers. Collectors want the later model; practical owners shouldn't care.

The R4C - in all models - came with an 'OK' sideband filter. You will need to upgrade the filters and add some filters if you want to get this receiver to perform. There is only one source of filters for the R4C - International Radio in Florida (***). These filters are expensive (about $110 ea. US) and excellent. The most important filter is the 8 kHz first IF filter known as a GUF-1. Replacing the stock Drake filter with the GUF-1 transforms the receiver. If you have the 6 kHz GUF-1 installed, noise blanker performance is compromised. The GUF series filter is difficult to obtain and they are not drop in replacements. You will be required to drill holes in the chassis or build an adaptor board from double sided G10 and mount the assembly underneath using some stand offs. The results are worth it, however. (ref Letters)

A stock R4C is a bit of a waste. Under those covers is goodness just dying to get out. When the R4C came out, there were some compromises that had to be made to keep the price point. The trade offs were mostly in the area of filters and no noise blanker. The first IF amp crystal filter is a pretty sad excuse and unfortunately sets the character of the receiver. What you have to do to make it what it could of been is to make some investments that Drake could not afford to do. With decent filtering and maybe some mods, the receiver is as good as and maybe better than just about anything available to date. Some aspects of the R4C design cause one to question the engineers at Drake. The audio amp in the R4C is frankly terrible. The 12 volt regulated power supply is an incredibly BAD design. Drake had this 'thing' about running transistors from the plate B+ supply using huge dropping resistors and zener diodes. The above causes an inordinate amount of heat to be generated. Regarding the R4C audio amp, it is reminiscent of a 60's car radio what with its class A output stage. Except for some cost savings it was an unnecessary design and using the SPR-4 as an example, Drake knew better.

Given all these things to be said about an R4C, why would anyone want one? It depends if the C in question is loaded or not. The stock audio and power supply is offensive from a design aspect, but it does work. The transformation of the receiver with decent filtering is phenomenal. What really happened to the C is that Drake held costs and left the underlying receiver alone. That receiver base is extremely strong but the strengths are buried by the cost cutting.

In all fairness, the C must have been very expensive to produce. Crystal filter technology was no where near what it is today. In the glory days of the R4C, band conditions were nothing like they are today, so in the area R4C filters, we'll call it 'adequate for the time period." But not today. A GUF-1 or similar filter from Sherwood Engineering as a substitute for the first crystal filter in the R4C is a tremendous improvement.

Aside from nostalgia what makes this equipment attractive is that it works, works well, is reliable and of high quality. The AGC on most of the receivers is superior to most foreign equipment. Considerable thought went into its design. It is overbuilt - you cannot break this equipment through age or use. While it may not have been built with the intent for it to still be working 20 years later, most of the Drakes

I've seen have had a minimum of repair. All 'old' equipment suffers some abuse as it trades from hand to hand. Surprisingly, the Drake equipment seems to survive at the same level as Collins. Rarely is it butchered and then usually this happens from an inexperienced person attempting repair.

Amongst Drake receivers a stock B is vastly superior to a stock C. Compared side by side in stock form, The B sounds MUCH better and has all the goodies right there. Your priorities and opinions may differ. Some folks insist on having a late model C - "high serial number" without perhaps knowing what they're asking for and willing to pay a premium for. Fine, if you're a collector. They don't even care what options its got, yet if you were to filter up a C and find a noise blanker, it will cost more than the radio. The strange thing is all that stock C's have is not much more than 'potential'. All work pretty well the same. The B requires no work at all and can be had for a song, but don't expect to wade through a pile up on 20 SSB with a B - it can't do it, at least not very well. The B represents balance. It comes from a period where commercially available, cost effective crystal filters where yet to be widely available. If you're inclined to have a B after reading this, I'm flattered - its an excellent receiver, but it is not Excalibur. The C receiver is an incredibly good receiver, but ONLY if it is loaded up with filters and some cost cutting problems are attended to. The International filters are better than the filters that Drake supplied. The recovered audio on a stock R4C receiver is quite bad without some change. Just changing the value of 1 capacitor makes a considerable improvement. Once loaded up, the R4C becomes a real DX receiver and can 'slice and dice' with the best. The only way to overload a properly set up R4C is to connect the antenna terminal directly to the transmitter, its that good. In stock form, you'd have no idea what is there.

3.7 R4C EVOLUTION

The information contained here is accurate but not necessarily a complete dossier on the R4C as it changed over the years. Updates will be made to this section as additional information is acquired.

o R4C ser no above 16121

Revision date - Feb 1973

All mixer tubes 6HS6. First and 3rd mixers cathode injected. Second mixer is a dual gate MOSFET. The IF chain following the first crystal filter is 6BA6 1st IF, Noise blanker and then 2nd mixer. 4 position filter select.

o R4C ser no above 18726

Revision date - March 1974

Drake Mods

All mixer tubes 6HS6. First and 3rd mixers cathode injected. Second mixer is a 6BE6 with a JFET (2N5949) buffer. 5 position crystal filter selection. 3 diodes in series across the S Meter to compress the meter range. 2 S Meter zero pots were employed - one internal and one external.

o R4C ser no above 21000

Revision date - Nov 1974

All mixer tubes 6EJ7. First and 3rd mixers grid injected. Second mixer is a 6BE6 with an JFET (2N5950) buffer. 5 position crystal filter selection. Some intermediate models in this transition period may not have installed the new tapped IF transformer, T7C.

o R4C ser no above 25900

Revision date - Jan 1976

All mixer tubes 6EJ7. First and 3rd mixers grid injected. Second mixer is a 6BE6 with an JFET (2N5950) buffer. 5 position crystal filter selection. T7C IF transformer. Very little electronic difference to the above model except a 125 volt zener diode at the junction of R12 and R13 (regulated B+ to the plate of the 6BE6 mixer).

This could be the latest model in the series before production was halted. From the schematic, the differences between this model and the 21000 previous is little.

Amongst the 4 series known, Drake spent considerable effort changing the mixers with particular interest in the IF chain following the 1st crystal filter. While no direct measurements have been taken, there appears to be little operational difference between the first in this list and the latter other than the extra filter position and the tapped T7C IF transformer.

As can be expected, it is considered that the later model is superior to the early model. There is a natural tendency to want to believe that this is true, but practical application does not seem to back this up. One of the attractions for some enthusiasts is the vaccuum tube processing of the RF signal in the belief that the early model dual gate MOSFET is automatically inferior. The fact that all models in the later series have an JFET in the RF chain is somehow strangely irrelevant to this position.

Some later model R4C receivers may have metal gears in the PTO gearbox instead of nylon.

3.7.1 Sources of Commercial Mods

A number of sources did exist for mods to this equipment. Amateurs like to change equipment around. If the equipment is popular, it is not unusual for a cottage industry to develop for some enhancements and goodies. Consider the following as reference only:

o Sartori Associates (W5DA)

Sartori offered for sale a number of accessories for the R4C and TR7 including solid state tubes (a 6BA6 was called a SBA6), crystal filters, audio low pass filters and such.

No current data exists to my knowledge indicating that Sartori Associates is still providing any accessories.

o Sherwood Engineering

Similar to the above, they provide R4C rework services and crystal filters. This company is still alive and very well. Sherwood Engineering has a reputation for quality, well thought out solutions to communications problems. They were at one time quite involved with Drake equipment and specialized in the R4C and R7.

Sherwood is back in the Drake business and has a Web sight. I encourage R4C owners to have a look.

www.sherweng.com

o Fox Tango

Fox Tango was bought out by International in the early 90's. F/T originally was noted for their Yaesu FT101 filters and first mixer kit changes. Regarding the Drake R4C, they offered add-ons known as GUF-1, GUF-2 and GUD. The first 2 were filters replacements for the first IF crystal filter in the Drake R4C and were for SSB and CW respectively. The GUF-1 came in 8 and 6 kHz bandwidths. The GUD was a solid state product detector kit replacement.

A filter switch kit for both the GUF-1 and '2 was available that mounted above the chassis where the first crystal filter resided. The object of the exercise was to provide switchable filters for CW and the 'other' modes. Sherwood might have done something similar also.

o International Radio

This company deals in after market crystal filters for a number of radios. The filters are about $110 and are good. Their filters for the Japanese radios are better than factory and much cheaper. This is especially true for the Icom FL-44 455 kHz model. Some of their

filters are not 'drop in replacements' such as the GUF-1. The R4C optional filters are size and pin compatible.

It is difficult to find a better filter for a radio than from these folks. Most of their filters for all of the radios that you could buy for are drop in replacements.

Some models of the GUF-1 are not drop in replacements, but the work required to install the filter is not all that difficult. International's filters are made in Japan and subject to delivery and order delays. If you catch International between orders for new shipments, expect to wait 3 months minimum.

These people are the only source for optional filters for older equipment that I am aware of. They DO NOT have AM filters for any of the 7 line. Since they are the only source, readers that want a filter for their Drakes (or older 'other') are advised very strongly NOT to hesitate.

*** International Radio has been bought out.

3.8 SOME NOTES ON RECEIVER GAIN AND AGC

Periodically you will read concern regarding 'gain balance' in a receiver and how mucking with the blanker gain, for example, can upset the gain balance in the receiver. It is a concern. One should not confuse gain with sensitivity. Although both are related, a sensitive receiver is noted for high gain and low internally generated noise. Once the receiver is sensitive enough to increase its white noise on preselector peaking more gain just makes the noise louder, but the ratio of noise increase will remain much the same. The various RF stages that comprise a receiver (RF amp, mixers and IF) act as a unit. Each stage acts as a signal conditioner as the desired and undesired signals are amplified and filtered prior to detection. With a properly designed receiver, increasing the gain in one unique area through modification ultimately affects the AGC'd stages since they are part of this entire loop. One typically mistakes a higher S meter reading after modification to mean 'more sensitivity'. This quite often is the receiver attempting to compensate through the AGC. With the AGC now more active on weaker signals and with the different AGC characteristics of the vaccuum tubes now receiving AGC sooner than designed, the receiver is actually now partially shut down.

AGC is very important in a receiver. Factors that affect AGC performance are loop gain, hysteresis, decay time and filtering. Close inspection of the R4 series receivers will reveal use of vaccuum tubes with different Gm curves (sharp and remote cut off) and different AGC filter time constants to each section. This accounts for the excellent AGC characteristics of the receivers.

If one dives into this equipment making mods 'for more RF gain' or 'reduce the AGC pumping with sharp filters', these AGC relationships in the receiver as a whole get skewered and your Drake will not be any better. Neither will it sound like a Drake anymore. While almost any AGC is better than no AGC, excellent AGC requires attention to detail. The results are worth the design and R&D effort.

For fun, place an R4B next to any mid priced foreign transceiver and try an A/B comparison. Now, an R4B cannot compete in the selectivity sweepstakes against a radio 20 odd years younger, but have a listen to what the B sounds like and watch/hear the AGC do its thing. If you listen carefully you can hear the AGC recover and the receiver open up and recover from a strong SSB or CW signal. It actually 'breathes'. This is good, well engineered AGC.

3.9 THE R4A

Just before V6 was published, data was received regarding this receiver. Over the course of the last year there have also been requests for mods and detail on the 'A' line.

The R4A was the companion receiver for the T4X. Functionally, there is little difference to the 'B' line. Appearance wise, it is easy to confuse the two at first glance. The R4A receiver can be looked upon as a cross between the R4B and a TR3. The R4A and R4B are very similar up to the last IF amplifier. Even the noise blanker is much the same between the two receivers. Where the major differences occur are in the AGC detector and the product detector. These areas are similar to the TR3.

Two major differences between the A and the B receivers have been observed. First, the R4A uses bipolar transistors in the PTO and they tend to drift a bit more than the B. Second, it has been said that the A sounds even better than the B. This is highly subjective, but if it is true, the likely cause is the use of a vaccuum tube product detector in the A and germanium diodes in the B.

I know of one chap that had a B and an A receiver. He liked the A receiver so much, he swapped the PTOs.

Like the R4B, there are very few mods that are necessary or recommended. Like the R4B, the R4A was complete out of the box.

4.0 R4B AND R4C MODS AND TECH

I've had a few folks ask me which is the most desirable Drake receiver? Well, it depends. First, its a personal item and therefore open for debate. I've had folks from various backgrounds provide personal reasons for the R4A, B or C.

For reasons that are contained within this document, I prefer the B or the early model C - the one with the MOSFET mixer.

o Voltage Regulation

Early R4C receivers employed a 12 VAC secondary power transformer. Later model R4C used a 14 volt power supply by changing the power transformer. The early model supplies could fall out of low limit spec with marginal 110 VAC. While there is a Drake fix for this, the best option is to use an IC audio amp and fix the 12 volt regulator.

o R4B Manual Trivia

The front cover depicts the operation of the noise blanker.

o Low TX output in Transceive

This may also show up as low(er) sensitivity of the receiver when transceived with the transmitter (B and C series). The cause is usually alignment or the injection cables. All RF cables (the C series had 2) must be RG/62 low capacitance cable. It is best to align the receiver and the transmitter when slaved together.

o T4any/R4any Intermittent Transceive

Sometimes the crystal/VFO switch on the side of the R4B can become faulty. In most cases it is left in the VFO position 'forever' and is easily overlooked. As a matter of course, it should be cleaned and cycled a few times.

Pay some attention to the quality of the female RCA jacks on the back of the receiver and transmitter. Quite often these connectors no longer make firm contact with the cables due to wear or abuse. Make sure that the center pin of the interconnect pin is pinched by the socket. In some other cases, you may find that the outside ring of the cable is similarly loose.

Cable quality may also be a factor, especially if you are using the original cables. Remember - in most cases you are using cables that are about 20 years old.

o Notch Filter

The notch filter should take the calibrator completely out of indication on the S Meter and almost completely out of the audio. When you get the notch at this point, the trim pot gets quite touchy.

Adjustment is not at all difficult, but initially you can walk right by the T Notch null point if the trimmer is way off. Rather than try and see it at this point, listen for the null by a change in 'character' of the background noise or the calibrator. Start with the trim pot at about center.

If you get no null at all, more than likely someones been mucking with the slug in the notch can and the coil is not resonating at 50 kHz.

o R4C Audio (all series)

Change C100 from .22 uF to .68 uF. Do not use a higher value. This will remove a lot of the raspy audio and clean up a fair bit of distortion. Use a tantalum and observe polarity.

o R4C Audio Resonance

The antiVOX line output resonates with the output transformer secondary at a frequency outside of the receivers passband range creating a high frequency hiss sound. Bypass this line with a .005 uF capacitor. You may need to touch up the anti VOX adjustment after this change.

This change has been done by a number of people and is said to improve the audio considerably, especially when combined with the C100 change mentioned else where.

o R4C Pass Band Bleed Through

Replace first IF crystal filter with 8 kHz GUF-1. HIGHLY recommended. The stock Drake filter is 4 pole with 65 db stopband and a very poor shape factor. The replacement International filter has a stop band greater than 80 db and a good shape factor. This one simple change will improve the receiver considerably.

o Crystal Filters

A stock R4C came with 2 crystal filters - an 8 kHz wide first IF and a 2.4 kHz second IF SSB filter. The first IF filter does not do the R4C justice. Replace this filter with the GUF-1 if at all possible. You can add a sharper SSB filter. I use 2.1 kHz. Why not a 1.8? Well, the 2.1 has nice 6/60 db figures. It puts up a nice flat bandwidth plateau without killing fidelity. For CW, a 250 Hz width is about right. The 125 Hz is just a bit too narrow and the 500 Hz is too wide for current band conditions. The 125 Hz makes the tuning and PBT control somewhat touchy. It rings surprisingly little and is a good CW filter. The 250 Hz is not all that much different except that the tuning requirements are more relaxed.

Contact:

------------ deleted -------------

In mid May, word was received that International Fox Tango had been bought out. The above detail has been deleted.

International Radio
13620 Tyee Rd.
Umpqua, OR. 97486

(541-459-5623) 9AM to 1PM Pacific Time
E/Mail inrad@rosenet.net
www.qth.com/inrad

o Crystal Filters - Tech

- TR3

The TR3 does not use filters similar to the TR4. Crystal filters used in the TR3 are held in a metal box under the chassis. I've only had one TR3 cross my path and that was for service for a friend. I therefore took no liberties and did not 'crack' the box.

Based upon the behavior of the filter and the age of the unit, I suspect that the filter used in the TR3 is composed of discrete crystals.

- TR4 et al

These are 500 ohm 9 MHz filters. The TR4any are single conversion transceivers. A dedicated SSB filter is used for USB and LSB, although either filter may be used depending upon the band. The reason for two filters is to not have the transmit frequency shift between the sideband selection.

- R4C

The first IF crystal filter is 5645 kHz at 1000 ohms. The second IF frequency is 5695 at 50 ohms.

- TR7/R7

The crystal filters are 5645 at 50 ohms. For this reason, you can't put in the R4C first IF crystal filter into a TR7 for an AM filter. It would of been so nice if the TR7 etc took R4C crystal filters, but noooooooo. It looks like this was purposely done in the TR7. The PTO/frequency on this radio is not inverted ala R4any and the lower band edge corresponds to 5.05 MHz on the PTO. The TR7 PTO is essentially the same PTO used in the 4 line.

o R4C S Meter Balance (early model)

Some early R4C receivers could not balance the S meter after properly setting the AGC threshold (sensitivity control). Early model R4C receivers have only one trim pot for setting the S meter zero.

Replace R33, a 470 ohm 1/4 watt with 680 ohm 1/4 watt.

o Sensitivity - Late Model R4C (26K and higher)

Poor sensitivity on this series receiver can be attributed to lack of PTO signal. On some series late model R4C a pi network on the output of the PTO line had a 620 pf cap. Replace this cap with a 390 pf. (W8CS)

o Sensitivity - R4B

The sensitivity adjustment affects S meter balance and sensitivity. Ensure it is no higher than -1.35 volts and no lower than -1.2.

o BFO Bleed through R4C

Early models could deflect the S meter while the passband tuning was moved across the IF frequency. Ensure all tube shields are in place.

In extreme cases, check wiring harness layout and add a 47K 1/8 or 1/4 watt resistor from the base of Q5 to ground.

o R4C Intermittent Crystal Calibrator

The mounting screws for the blanker brackets are held by two #4 sheet metal screws from underneath the chassis. One of these is a short screw. Ensure that this screw is positioned for the plate near the chassis edge towards the back of the receiver. A normal length screw will short the calibrator when the calibrator is seated down.

o R4C T7C IF Transformer

The purpose of tapping the IF transformer from the output of the third mixer is to reduce noise bandwidth on the narrower filters. You'll notice a difference in the S meter reading of the calibrator should you have another SSB filter installed in one of the CW positions. The S meter will increase in reading when this filter is selected. The difference could be as much as 20 db indicated. While it may be annoying, it is not an indication of reduced sensitivity so long as you can get a noise peak from the preselector as outlined further in the text.

o 50 kHz filter (late model)

Seems to be applicable to serial nos 21000 and higher. Make a a 50 kHz network of a 10 mH choke and 1000 pf capacitor in parallel. Add a .01 uF 250 volt cap in series with one end. Install this network from pin 7 of V6 to ground. This should be the plate pin. The receiver in question should have a T7C (not a T7 IF can).

Drake Mods

Lead dress for this mod can be critical and is noted by an increase in audio hash and hum.

This change is applicable ONLY to R4C receivers that feed B+ to the plate of the 3rd mixer through the notch filter. My own experience is that this change seems to do little, but it does no harm either. Its a very popular 'secret mod' that you may want to try, just for the hell of it.

Its *supposed* to act like a tuned IF transformer for the plate of the 3rd mixer to minimize mixing products.

o 50 kHz IF Coax (late model, early series)

Late model R4C (tapped IF transformer T7C) could have some additional CW crystal filter loss due to use of high capacitance shielded cable running from T7C. Replace this audio cable with RG/174 and change the value of C49 to 430 pf.

You don't need this change if there is no CW filter installed in the radio. Your receiver is eligible for this change IF you have a T7C (NOT a T7) IF transformer and if C49 is currently 390 pf in your radio. In this case, the coax in question will have a slightly larger diameter than the replacement RG/174 and will have a white colored center conductor.

o R4C Audio (all)

The audio stage in all R4C receivers is out of context with the rest of the reciever. It causes a lot of heat to be generated, distorts, and has terrible frequency response. There really isn't much you can do about this except substitute an audio IC for this. Some minor updates can be made by changing C100 (detailed elsewhere) that will provide improvement.

An LM380 could be mounted on one of the support brackets for the noise blanker or, if you build a circuit board for it and use ground lugs ala Drake, you could use the 2 audio output transistor mounting screw holes.

Some folks have used the LM383 and this chip will provide a bit more audio output. I have no personal experience with this chip, but I've heard that it can be tricky to deploy without having it oscillate. Commercial users of this chip should not have this problem, but home constructors using the LM383 should be aware that the LM383 is a high gain, high current and high output linear audio power amplifier.

o Sartori Passive L/C Filter

Sartori provided an L/C filter that was inserted between the volume control wiper arm and the input of the audio amp ostensibly to cure 3rd mixer noise and audio amp frequency response. I had one in an

R4C that I had purchased and I removed it. I didn't like what it did to the recovered audio at all. If your receiver has this after market change, you may wish to make some of the changes - particularly the C100 value change if your receiver is stock. Bypass the Sartori audio filter and see which you prefer.

o Power Supply - R4C

This is another R4C weakness. It is not a good design. The 2 resistors at the right hand edge of the board get very hot and will eventually cook the circuit board. One of these is the dropping resistor from B+ 150 for the PTO(!) Drake does this all the time in their equipment and it is a terrible design philosophy.

You cannot properly fix the power supply unless you make the audio changes because the class A audio output stage draws 1/2 amp (!!) and hauls the power supply down. Once you replace the audio stage, the low voltage supply will climb and you can use the EP487 as a pass transistor or install an electronic regulator.

Once you have made the audio amp AND regulator change, eliminate some of the heat generated from the PTO dropping resistor by powering the PTO from the low voltage 12/14 line instead of the 150 volt line. The PTO already has a series 100 ohm 1/2 watt dropping resistor so .... no problem to run with the 7812 regulator.

There is another mod circulating that uses the filament supply as a voltage boost for the low voltage line. Do not do this mod and if your receiver has had this change I strongly recommend you remove it and revert the supply to original. This mod cures nothing and actually generates as much, if not more, heat. What it was supposed to have done was raise the input voltage above the 7812 input threshold so the regulator can work with the 1/2 amp load of the stock audio amp. While this does work and does reduce hum and noise considerably, it also creates a lot of additional heat from the regulator. This mod is on the right track, but the 'cure' is as bad as the disease.

o Accessory Crystals

Band crystals for the Drake and just about any other radio ever made may be purchased from:

LesMith Crystals Ltd.
Oakville, Ontario,
(905)-844-4505

These folks do small - read single - quantities and have historically dealt with amateurs since Day 1. They offer a high quality product at a reasonable price (abt $17 Cdn).

Crystal specs are series, 20 pf and HC6/U for band tuning. You can also use the crystal positions for fixed frequency operation, but

this would most likely be used for MARS etc and I won't bother with detail. The crystal specs are different between these two applications.

The TR4any uses overtone crystals.

Band range crystals are interchangeable between the entire R4any and T4any and even between the receiver and transmitter.

Another source is Jan Crystals in Fort Meyers, FL.

o CW Operation

If you intend on operating the 4 line on CW only, service life of the 6JB6 finals may be extended by turning the idle bias down to the point that the PA cathode current meter just moves. Please do not run SSB at this setting. Be a pal.

o R4C LM380

I enclose this for those that wish to experiment a bit. For those that want to solve this problem using commercial avenues, Sherwood Engineering offers an audio kit, or they will upgrade and service the receiver as per your requirements.

The National LM380 is near perfect for this application and will, together with the voltage regulator change, clean the audio and reduce current consumption.

LM380 Pin outs

Pin	Use	Pin	Use
1	bypass	8	aud out
2	+ve input	9	N/C
3	grd	10	grd
4	grd	11	grd
5	grd	12	grd
6	-ve input	13	N/C
7	grd	14	Vcc

I have included a schematic drawing program - SKEM. This program is evaluation software only - you can load it up under DOS and view and print enclosed schematics. This version of SKEM demonstrates a lot of potential. Its most frustrating area of operation is in the 'undo', for it backs out the schematic in reverse order to input. A lot of input gets wiped out to fix an earlier mistake.

All electrolytics have -ve terminal on the ground unless stated otherwise. Observe good wiring practices, as this is a high gain, high current and high output IC. None of the parts are especially critical except perhaps the 2.2 and 220 ohm reststors. If all you have is a 4.7 K resistor instead of a 5.6K, then by all means use

Authored by VE3EFJ

Drake Mods

it. Instead of a 2.2 ohm, if all you have is a 2.7, then use it. Value changes such as this will not stop the circuit from working. Much the same applies to the voltage regulator changes.

Remove the audio output transistor and socket from the R4C. You could mount it on brackets right where the original transistor was. If you do this, simply connect the volume control center pin to the 4.7 uF input coupling capacitor. Connect B+ to the LM380 from pin 14 to the 12 volt line on the original BFO/audio board. Output from the LM380 (through that 220 uF coupling cap) goes to the headphone jack where the black wire is.

I suggest you build the circuit on Radio Shack perf board and run it stand alone from a seperate 12 volt supply. If more gain is re- quired, you can increase the value of the 2.2 ohm resistor slightly. If the ratio of the 220 and 2.2 ohm resistors exceed the gain of the LM380, it will oscillate. And loudly! Parts layout is not critical so long as you keep in mind that this is a high gain, broad band power amplifier.

Next, on to that 'voltage regulator'. You may as well use the EP487 as it was intended - as a regulator. Remove R116 from the circuit board. Remove CR18 and CR19. Remove C201. Connect a 12.6 volt 1 W zener from one of resistor pin holes that went to the base of Q12 and ground. Cathode going to base, anode to ground. Please don't use the wrong R116 hole. The 'wrong' side has 160 volts on it! Zener di- odes make very smelly firecrackers. Last, install a 180 ohm resistor from base to collector of the EP487 'regulator'.

The above changes make a useful difference in the R4C audio and will clean it up nicely. You need to make both of these changes at once. The LM380 needs clean DC to operate from. The regulator change for the pass transistor will not work with the stock audio amp because it draws too much current.

Some have noted that an LM380 produces 'cross over distortion'. This is simply not true. The distortion of an LM380 at 13 volts nominal is around 1%. The TR7 uses this IC for its audio output and I can testify that the audio is *clean*. What an LM380 is prone to do, though, is oscillate at super audio frequencies. You may not hear the oscillation, but you will hear its effect on the normal audio frequencies. That is why there is considerable bypassing in the above design.

Included SKEM files:

OLDR4C.SKM - original EP487 regulator (reference)
NEWR4C.SKM - revised R4C EP487 regulator
LM380R4C.SKM - LM380 replacement audio

All of the above are in SKM.ZIP, plus the original sample files.

The schematic drawing program is in SKEM.ZIP.

Drake Mods

o 160 Meter Operation

160 meters on the R4any/T4any was an option and enabled through installation of a 12.6 or 12.9 MHz crystal. The crystal to use depends on operator preference. It all depends where you want the band edge and what you want the frequency readout to display. If you want '8' to indicate 1.8 MHz, use the 12.6; if you want the band edge to be '0', use the 12.9.

Some R4any that allow for 160 operation may have either the 12.6 or the 12.9 installed - I've seen both. If your R4 and T4 both included 160 but use different 160 meter crystals, it can cause some confusion until you get used to it.

o AGC Transients R4C (early model)

Verify that there is a network of a .01 uF and 1 Meg ohm resistor connected in series installed on the AGC board between the wire connect points on the board. This network is installed between the green/white wire and the yellow/white wire on the foil side.

o AGC Pumping With Sharp Filters

When good shape factor crystal filters are employed the AGC will pump when the calibrator is tuned right on the filter edge and the AGC is set to 'fast'. Excerpt July, 1976 Ham Radio pg 12:

".... designs with shape factors between 1.4:1 and 1.2:1 have two unpleasant side effects:

1. The extremely sharp skirt selectivity presents a problem for the AGC circuit because of high group delay and phase shift, which cannot be compensated for. In almost all cases strong interfering signals at the edges of the filter response band will make the AGC pump. This instability introduces distortion and overshoot.

2. Because of their high Q and ... the filters ring."

Continuing, Rohde says ".... SSB reception should be between 1.9 and 2.4 kHz to limit operator fatigue .... (The) bandwidth on the famous KWM-2 was restricted to 2.1 kHz for this reason."

Ignore it. You can't fix this without hurting the otherwise wonderful AGC.

Many theory books show 'ideal' filter passband as an oblong box on its edge. This is not inaccurate when confined to desirable IF bandpass characteristics. 'Practical' filters have skirts. Some filters with sharp skirts will not cause severe AGC pumping but they may have quite severe ripple, depending on the response type. In general, the 90's approach is for large stopband attenuation and filter shape factors of around 2:1. IF DSP can clean up the skirt

problem. This is overkill for Amateur applications, but does illustrate the move away from 1980-think of severe skirt roll off being desirable.

There will always be trade offs.

o 3rd Mixer Noise R4C

Amateur 're-engineers' have claimed that an R4C weakness is 3rd mixer noise. Some of these amateur engineers have had a considerable 'go' at the third mixer inventing theoretical problems that generally do not exist.

It is the 1st mixer that sets the sensitivity of the receiver. It is the third IF amp that provides a significant amount of the receiver gain. By the time the signal gets to the 3rd mixer it should be processed enough to easily overcome 3rd mixer noise. And it does. If your receiver works well, leave the 3rd mixer alone.

Drake employed considerable changes over the years to this area throughout the R4C series. Improvement in an early R4C can be rendered by installing a pair of back to back diodes from the junction of C53 and C52 to ground. Use 1N4148.

When Drake employed the 6EJ7s as mixers, the injection was moved from the cathode of the 3rd mixer to the control grid. It is this connection that some Drake enthusiasts assume to be 'noisier'. This connect point isn't 'noisier' (white noise). It *is* very capable of creating hash and is much less tolerant of sloppy lead dress. I have a mod for this further on with much greater detail.

There was also a Sartori mod that injected the LO signal into the third mixer from the bottom end of the secondary of the 3rd mixer grid input transformer. This mod follows good engineering practices and one of my R4C receivers has had this change. My other R4C, an early one, has the injection to the cathode of the 6HS6. I cannot tell much difference.

o R4C Noise Blanker

Do not use the blanker gain trim pot to make the receiver 'more sensitive'. It won't. Ensure the S meter deflection on the calibrator is exactly the same on 10 meters both with the blanker and with the 9 pin jumper plug. Excessive blanker gain will degrade the AGC by compromising the gain balance in the receiver and possibly allow the BFO to bleed into the IF strip.

o Blue Dial Filters

The heat from the dial lamps will eventually turn the blue dial and meter filters clear. You can restore the color by dipping the bulbs in nail polish, specifically Artmatic USA #163 Peacock Blue Nail Enamel (With Hardener) (Dec 1993 QST pg 86, A. Ross W2NXC).

The file 'NEWR4C.SKM' contains a schematic of the changes to use the EP487 as a real voltage regulator.

o R4C IF and RF Amp Resistor Changes

There have been previously published mods to change screen grid resistor values to improve sensitivity and allow for S Meter zero on early R4C receivers. This is a bad mod. It does not improve sensitivity and is overkill as a method for S meter balance. It increases the receiver gain and consequently alters the good AGC characteristics of the receiver. Do not do this mod and if your receiver has been modified, revert to original factory values.

o R4C Late Model 3rd Mixer

As explained above, this 'flavour' of R4C with the 6EJ7 3rd mixer is claimed to be noisier. Well, it isn't noisier. My late model R4C was not original in this area; it had been modified to inject the LO through the bottom of T6 into G1 of V6. It worked well, but there was a lot of hash - power supply 120 Hz spikes in the audio. When I placed a screw driver blade near G1 (or C199) of the 6EJ7, the garbage increased. This is no good. No good at all.

The following will not cure white noise in the 3rd mixer, but if you have the above problems, it will kill this hash, buzz and assorted garbage once and for all. All mixers make white noise - consider it incurable. Basically, this mod changes the 3rd mixer to cathode injection and allows G1 to be DC grounded. The verbal text describes the end result of the circuit changes and is not a step by step procedure.

Change CR20 and CR21 to 1N4148. Change C52 to .005 uF. Remove C200 and C199. Replace C199 with a straight piece of wire. Where C52 connected to pin 1 of V6, connect it to pin 3. This essentially reverts the 3rd mixer of late model R4C with the 6EJ7 to the circuit used in the early models.

I cannot give you a before and after comparison, for I never have had a chance to play with a stock late model R4C. However, after this mod my '6EJ7' R4C is dead quiet with the stock audio amp and power supply. With no antenna and normal volume I'd swear the speaker was disconnected. Additionally, the problem with the S meter moving as the PBT control was rotated was all but eliminated. Signals literally jump out of the speaker from nowhere. This change will not make the receiver more sensitive, but it did clean up significantly the garbage in the audio (for me). The reason for this change revolves around the need for a DC path for G1; cathode injecting the LO is the easiest way of provide injection. Additionally, the concept is proven from the earlier R4C designs. Indications are that the 6EJ7 is a pretty 'hot' pentode mixer.

I cannot testify to what an original late model R4C was like. Before you try this change, I'd expect that you have some audio hash that

gets almost unbearable in the AM position. When you place a screwdriver near C199, the hash and 'junk' increases in amplitude. If you do not suffer these symptoms than rule 1 of modifications takes precedence ....

"If it ain't broke, don't fix it."

o R4C 3rd Mixer 6EJ7

In the later series of R4C a 6EJ7 was used in the 3rd mixer. It is this tube and surrounding circuit that can be responsible for a considerable amount of hash. Try substituting another 6EJ7 in this circuit location.

o R4C Audio Oscillation

Some R4C audio pre amplifiers will oscillate in the 100 kHz range contributing to audio fuzzyness and other problems that you think are sourced in the RF stages.

Connect a series network of 4.7K 1/4 W and .0012 uF across R83.

o R4C Audio Hash

R4C receivers are notorious for making not only harsh audio, but also having some hum and power supply hash thrown in for good measure. Most of this is curable, but not without some effort. The later model using the 6EJ7 3rd mixer can be the worst of the lot.

Noticeable improvement can be made by returning the power supply secondary grounds to the canned filter caps. Some folks have put a copper strap under the circuit board ground lugs on the circuit boards, running a strip of copper under the whole length, grounding the lugs. I'm skeptical about the long term. Copper corrodes.

The low voltage supply/regulator/audio is marginal, at best. Measure the voltage on the audio output transistor emitter. If its above about .5 volt (assuming the proper emitter resistor), the transistor could be drawing too much current or be going into thermal runaway, hauling that marginal supply down.

The previously listed mod changing the 3rd mixer 6EJ7 to cathode injection helps considerably, for it grounds G1 to DC. This (original) floating grid can be responsible for an incredible amount of crud.

For a simple solution to the inherently lousy audio response in the stock audio amp, the C100 change makes it much more pleasant.

For the price this receiver sold for, it shouldn't have these problems in the first place. What makes it worthwhile is how good the receiver becomes once these marginal and frankly unacceptable characteristics are attended to.

R4B and R4C Mods and Tech 44
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Drake Mods

o R4B Sensitivity

Tune in the calibrator and then pull V10, the 12AX7 noise blanker clamp. If the S meter rises, replace the tube. A gassy 12AX7 will drive the NB clamp diode partially on, killing IF gain.

If a new 12AX7 still does not cure the problem, it could be caused by the clamp diode. An acceptable substitute is a 1N270.

o R4B Crystal Filter

An R4C first crystal filter can be used if T5 and T6 in the R4B are replaced with R4C part number 251-9285. The filter would be installed on the preselector bracket and coax run from the low impedance windings of the replacement transformer to the filter. T6 in the R4B is part of the crystal filter. There would be some sheet metal work involved for brackets and shielding to insure that the filter stop band attenuation was not compromised. You'd do this if you were to purchase a GUF-1 for your R4B.

4.1 R4C CHANGE SUMMARY

There are many changes previously outlined for the R4C, and it can get confusing. There is a reason for this, for there are a number of alternatives, and what you do depends upon how radical you want to get. This is complicated by the serial number of your receiver. Early model R4C had a lower voltage transformer, and it isn't easy to get the secondary voltage up high enough for a voltage regulator IC. That won't happen unless something is done in the audio section to drop the current consumed by the audio output stage.

R4C Audio Section Summary

If you want to 'improve' the audio ....

o C100 Change

o Bypass the anti-VOX line with a .005 uF

o Route secondary transformer grounds to the filter caps.

The first 2 items may be all you need.

If you want to improve the audio and limit heat

o EP487 and zener diode regulator/pass transistor

o C100 change

o Bypass the anti-VOX line with a .005 uF

o Route secondary transformer grounds to the filter caps.

o LM380/LM383

And last, if you have a later model R4C ....

- o Sherwood audio board and reguletor
- o Bypass the anti-VOX line with a .005 uF
- o Route secondary transformer grounds to the filter caps.

5.0 AC4 POWER SUPPLIES

There is little difference between the AC4 and the AC3 power supplies. If you need new rectifier diodes, 1N4007 will do nicely. For the price of these diodes, there is little point in buying anything else other than the '7s. I would also advise shunting each diode with a 1 meg 1/2 watt resistor to voltage balance the diodes.

Pay particular attention to the -ve bias supply in these units, for it is critical to the operation of the transmitters and ESPECIALLY the transceivers. A weak bias supply will adversely affect the receive section of the transceivers, for it is used for the AGC. The bias supply is not used on the transceivers for cut off bias to the unused sections between receive and transmit. The cathodes are lifted off ground by the T/R relay.

If you are stuck for a supply, a Heath HP20 or HP23 will work with some minor changes.

NEVER ship a power supply inside an MS/4. The weight of the supply combined with the typical banging around packages get will trash the MS/4.

The connector on the side of the power supply is an external relay contact for such things as power amplifier switching. This connector is no longer available and Drake will supply a phono connector and adaptor plate for it, or you can make one up yourself. If you use a phono connector, note that one side of the switch contact will be on ground (chassis).

6.0 T4 SERIES TRANSMITTERS

All of the Drake 4 line will transceive amongst themselves. Between the T4X and the T4C there was little difference. Most of the changes in the T4C from even the T4X were cosmetic or for better operator convenience. The B series used neon bulbs to indicate the active PTO when set up for transceive; the C line turned the dial lights on and off.

A properly working T4any will give about 150 watts output on 80 meters, dropping to 80 or 90 watts on 10. The audio should be really clean and with properly operating ALC you should not be able overdrive the finals. There should be LOTS of drive on all bands.

6.1.1 T4 Evolution

The T4X and the T4B differ very little, except mostly in the PTO dial plates. The T4C functionally was not much different from the T4B, except in areas of operator convenience. The T4C is noted for the following major differences:

o Separate BFO Line

o FETs in the BFO oscillator

o Different method of ALC detection

o VOX on/off from front panel

o Controls moved to back of set

o Dual concentric PTO dial plates

o Plain chassis

o Meter switch activated by pushing LOAD control shaft

o Active PTO indication by dial light

o Blank RCA jack holes for VHF transverter drive kit

o Separate VOX delay controls for SSB and CW

6.1.2 T4any Mods and Tech

o Can't Tune 10 Meter Driver Plate

This is characteristic of 'generic' 6JB6 tubes. Replace with Sylvania 6JB6. Problem caused by high input capacitance of tube(s).

o VOX Gain - T4X and T4B

In cases where more VOX gain is required pick up the VOX input from the mic gain control instead of from the plate of V9b pin 6. When re-routing the audio pickup point, bypass pin 6 with a .05 uF cap.

- T4C TX Lock up

Lock up on a T4C is usually caused by a gassy mixer or 12BY7 driver tube. Other causes include leakage either to ground or B+ of the TX keyed line. This is a high impedance line. In extreme cases the cause can be T6. Inside T6 is a rubber washer that can contact the coil pins internally. The fix is to remove T6 and the shield and install a fish paper washer between the bottom of the rubber washer and the bottom of the transformer base.

- T4C Side Tone - Elimination

Standby CW sidetone may be eliminated by placing a 22 Meg ohm resistor between the pin in the centre of the circuit board in front of V7 (the one with the wire going to pin 1 of V7) and the lug at the top left of the board (the one with the 150K resistor).

- Substitute VOX relay tube

A 6AQ8 will replace the 6EV7 if a 47 ohm 2 watt resistor is added across pins 4 and 5 of V10. The tube change is applicable across the entire 4 line (and TR3). The resistor IS NOT needed in any of the transceivers. Just swap the tube, in this case.

- Fan

The PA cage area gets quite hot when in use and some forced air cooling is desirable. The easiest way of accomplishing this is to use a small 1 1/2" 12 volt DC fan. Mount the fan on the outside of the PA cage through the perf holes on the back of the PA cage. Power the fan from a half wave rectifier filtered with about 100 uF derived from the 12 volt filament supply. Route the fan wires through a chassis hole along back top of the chassis. The rectifier can be connected between the filament fuse and an insulated standoff. This mod can be done without drilling any holes or destroying the units originality. Orient the fan to blow in.

These types of fans are CPU coolers and can be bought for less than $10. They do not move a lot of air and move even less through the perf holes. What is necessary is not cooling, but circulation, and this simple expedient helps a lot.

This mod will greatly extend the service life of the 6JB6 tubes at the expense of faster accumulating radio dust bunnies.

6.1.3 T4 Reciter

This is a T4X with the PTO and crystal deck removed. It was intended to provide a transmit function in conjunction with the R4A and R4B receivers. The only other similar device that I know of is the Atlas 210 series. A similar series of devices was the Atlas RX-110 receiver and TX-110 transmitter. The TX-110 used the VFO signal of the receiver in a way similar to the Drake R4B/T4 Reciter combination.

Obviously, the Reciter is duplicated whenever you slave a separate T4any completely to the receiver.

I've never seen one. This is an item for the curious or the collector and may sell for either next to nothing or might demand a high price from its 'rare' nature. For the practical, and with the used Drake 4 line so readily available, it does not serve much of a purpose other than its novelty value. Any modifications or service notes that generally apply to the Drake T4 series transmitters would apply to this unit.

7.0 TR3 TRANSCEIVER (CIRCA 1963)

This transceiver is best described as a 'sleeper'. It is a 5 band SSB transceiver that predated the TR4, placing it in the mid 60's. Most of the units available are pretty weather beaten, but I have seen one or two that were in beautiful shape. All of them are relatively inexpensive. If you want a nice, inexpensive glassFET transceiver, a TR3 is hard to beat. They work as well as a TR4 and look very much like one. I doubt if you'd mistake the two, but if you did, little harm would be done. The TR3 has styling similar to a T4X, the precursor to the T4B.

As is not unusual for the Drake transceivers, most of what is mentioned for the TR4 is applicable for the TR3.

Make sure you get the manual with the radio!

Basic differences to the TR4:

- o 12JB6 tubes in the PA (3)
- o Vaccuum tube PTO
- o No rel output indication
- o No CW sidetone
- o No CW filter
- o IF Filtering not as sharp as the TR4
- o No provision for a blanker
- o No external mute or RX antenna relay

If all you wanted was a TR4 to play retro radio with, a good clean TR3 would do almost as well and can be had for a song. Be careful in this area. Radios this old will suffer from use, and pay careful attention to the switches, controls and the operation of the two meters.

Drake Mods

8.0 RV3 AND RV4 REMOTE VFOS

These units are functionally compatible to both the TR3 and 4. To have the RV4 work with TR3 only a minor change is required. Both units use a 12AU7 in the buffer stage. The RV3 uses a 6AU6 for the oscillator; the RV4 is solid state using an FET. The RV4C uses the dual dial plates common to all the C line and the SPR4.

The RV3 will work with the TR4any, but the RV4 will not work with the TR3 unless the TR3 is modified. On the remote VFO plug on the TR3, cut the jumper wire running between pin 2 and 8. If in the future you remove the remote VFO, you must restore the jumper or make up a dummy plug from a Cinch Jones connector.

Summary of Remote PTOs

o RV3

All vaccuum tube. Will work with the TR4 series.

o RV4

Remote VFO for the TR4. Single dial plate.

o RV4C

Essentially an RV4 with C series dial plates. It and the RV4 will work with the TR3 with slight TR3 modification.

o RV7

Remote VFO for the TR7. Uses standard PTO. Seems to come or have been adaptable to 'full' length (TR7 depth) or 'half' length. Dedicated Cinch cable for use with the TR7.

o RV75

Consider it a remote VFO for the TR5. Will not work with the TR7 without the harness cable adaptor. Rare and expensive. This is a digital VFO and can be considered 'driftless'.

9.0 TR4ANY TRANSCEIVERS

The TR4 series represent possibly the BEST vaccuum tube transceivers ever made. The transceiver will easily put out 200 watts on 80 meters and 100 watts on 10. For comparison purposes, the unit is somewhat SB100 series like, but the TR4 receiver is much more sensitive on 15 and 10. Unlike the Heathkit, a noise blanker could be installed. It was only the very last TR4 that had an RIT circuit. The TR4Cany had a plug in relay; on the TR4, the relay was open frame and hard wired.

All TR4 have a 9 MHz IF that is incompatible with other C line. They will not transceive with an R4any, but they will mute and T/R switch the antenna line. Because a 9 MHz IF and a 5 MHz VFO is used, 20 meters is generated 'free' but tunes backwards as a consequence. If you suspect the crystal oscillator having a fault, check for output on 20 or 80.

The TR4 had full 10 meter coverage; on the TR4Cany only 28.5 was included - the other 2 band crystals were options.

There were 4 different series of transceivers that I am aware of:

o TR4 (circa 1970)

The basic transceiver. No RIT or CW filter. There were 2 models of this first transceiver. An 'early' model and a 'later' one. The early model was a transitional model from the TR3.

The AGC characteristics in the TR4 seem different than other transceivers in the 4 line, but the differences are subtle. After this model, Drake made some subtle changes in the AGC amplifier, V13. Full 10 meter coverage.

o TR4C

The basic C transceiver. No RIT or CW filter. Dual dial plates. Some minor changes in the tube line up and 1 pf caps on the IF transformers to get some more gain. The audio output stage in this and subsequent models employed negative feedback. Basically a plain TR4 with C line PTO.

o TR4Cw

Some subtle internal changes. Dual dial plates. Has a 500 Hz CW filter. No RIT. Basically a TR4C with a 500 Hz CW filter

o TR4Cw-RIT

The final model, sold for a period of time against the TR7. This model had it all - CW filter and RIT. It is distinguished by having the RIT control positioned in the lower right hand corner where the

NB switch resided and having 2 pushbuttons in the lower center of the front panel for activation of the NB and the RIT.

The TR7 uses a very similar RIT circuit.

Over the years, the TR4 didn't change all that much. All models are noted for high TX output, sensitive receivers and for running hot. You need a fan.

Most of the TR4any I see do not have the noise blanker. Pity. The 34PNB works very well. Typical for a transceiver of that era, there is no selectivity available other than the SSB crystal filter (or the CW filter, depending upon model). Just about any flavor of a TR4 will serve you well on sideband, but to get the RIT function, you need to purchase a TR4Cw-RIT or have a remote VFO. In this day and age, RIT is not as important as it was, for the people you are most likely to work will be more stable than you are. It is *they* that will be using RIT. The DC3 or DC4 will allow the TR3 or TR4 to go mobile, but the radio is just too big for most modern cars. There is no reason why you cannot operate one mobile, but you'll need a mindset for installation that goes beyond connecting a 2 wire 12 volt cable to the back of the radio. The filaments alone consume as much power as a Scout puts out.

It is possible to install an RIT circuit into the earlier model series transceivers by duplicating the Drake RIT circuit. Your greatest challenge will be to add in the appropriate controls without butchering the front panel, unless you don't care about it. Within 10 ms of taking your Black and Decker to the front panel, that TR4 of yours is worth .... nothing. You cannot make a homebrew RIT by rubbering the band crystals because 80 and 20 do not use band crystals. An alternative RIT is to find an RV4 or RV4C. The chance of finding a TR4Cw-RIT is real slim and expect to pay if you find one. It is not too practical to attempt to retrofit the CW filter, however, since this requires replacing the sideband switch and building mounting brackets. I have heard that Drake will upgrade a TR4C to a TR4Cw for $105. This is a good deal.

9.1 EARLY AND LATE MODEL TR4

I copied this from the Drake list server in early April. Consider the following quoted text. I left Tom's name in here simply because he should get credit for it and the message was sent publicly.

I have two different TR-4's. These are plain TR-4's; not TR-4C's or later models. I was surprised to find a number of differences in these two radios. The early TR-4 has many characteristics of the TR-3, while the later TR-4 shares features with the TR-4C.

By comparing your TR-4's serial number with mine and your radio's features with the list below, we might be able to figure out when each feature was introduced in the TR-4.

The serial number of my early TR-4 is 1965. I noticed that the rear view picture of the radio in the TR-4 manual (Fig. 7, p. 17), shows a TR-4 with a serial number of 16050. My early TR-4 has these characteristics that differentiate it from the later TR-4:

o Has a TR-3 style main tuning knob

o The 9 mc sideband filters are sealed inside a soldered box. Bill Frost of Drake calls this the "soup can" model and says that the filters inside are four pole filters.

- The tubular capacitors in the radio are white, larger, and made by CD.

- The "Plate" and "Load" markings on the front panel are printed in silver letters on a gray background.

- The red dial indicator is the full vertical height of the frequency plastic window.

- There is no noise blanker knob on the lower right front panel.

- There is no receptacle for a 34PNB noise blanker on the chassis

The serial number of my later TR-4 is 31985. It has these differentiating characteristics from its younger sibling:

- Has a TR-4C (or R-4C) style main tuning knob.

- Has a VFO "in use" light above the main tuning knob. The indicator is driven by a two transistor board mounted behind the noise blanker switch.

- Has an open sideband switch (versus the sealed "soup can") and two blue Tyco filters. Bill Frost says these are eight pole filters.

- The tubular capacitors are yellow, smaller, and made by CDE.

- There's a little circuit board behind V17, the 6AQ5 audio output tube. The circuit board is labeled, "TR-4 audio" and it is an audio pre-amp.

- "Plate" and "Load" markings on the front panel are printed in black letters on a gray background.

- The red dial indicator is the one third the vertical height of the frequency plastic window.

- There is a noise blanker switch on the lower right front panel.

- There is a receptacle for a 34PNB noise blanker on the chassis

I'm sure there are other differences.

Authored by VE3EFJ

Drake Mods

Tom Taylor, N7TM

9.2 TR4 MODS AND TECH

The changes or mods for this equipment are few. The tube line up changed a bit - different 100 kHz oscillator tubes and such, but for all practical purposes the radios performed about the same.

o TR4 Manual Trivia

The front cover of the manual depicts the 2 crystal filters in the radio showing the skirt selectivity and bandwidth.

o Increase IF Gain

The TR4Cw had 1 pf capacitors across the IF transformer hot side (T11 and T12) to increase the IF gain. Since bandwidth is determined by the crystal filter, this had no effect on the receiver.

o Different TX and RX Preselector Peaking

Especially noticeable on 10 meters, its 'normal'. There is not much you can do about it.

o Sick Receiver

In instances of a weak receiver or where the transceiver shows a very low sensitivity receiver after transmit, check the AC4 negative bias supply. This bias supply is used principally for final bias and receive AGC.

In some cases, 'funny' receive AGC problems can be sourced to the 12AX7 AGC amplifier, but check the bias supply first.

o 9 MHz BFO

Imagine the passband curves of the two sideband filters together as the capital letter 'M'. The BFO is set dead center in that middle valley between them. Proper setting of the BFO is to listen to the receiver with no antenna and switch the sideband selection, adjusting C130 for the same pitch. Sometimes you'll adjust it and 5 minutes later, the adjustment has drifted.

In almost every case, this is caused by C130 losing its temperature characteristics. Two things will cause this - the ceramic has a hairline crack or there is crud in the trimmer.

The following is not for the heavy handed ....

All of these Centralab trimmers are held together from the bottom by a tripod clip that fits into a ring machined on the rotor shaft. Grab the long pin firmly with some needle nose (bottom chassis) and GENTLY pull and push down at the same time. At the same time, push very gently on the tripod clip with a small screwdriver just behind the center of the clip where you see the rotor pin . If you get this just right, the little ceramic disk on the top will fall out as the clip extracts. Don't apply so much force that the trimmer is smashed or, when the clip lets go the pliers run amuck.

Now, inspect both inside surfaces for cracks. If its cracked, replace the trimmer. If it looks OK, clean both surfaces with alcohol and a fresh J-Cloth. Don't touch the surfaces! Oil from your fingers will ruin the repair and you'll be punished by having to do this over again.

Now put it back together (heh heh).

Allow the radio to heat soak for 15 minutes with the top cover on and then adjust C130. I've done this a number of times over the years with these trimmers on various radios (NCX-5, most Heath). Oh yes - NEVER put a pencil mark on the side of these trimmers to indicate calibration. Guess where the graphite goes in about 3 months?

o C130 TR4Cw and TR4Cw/RIT

The adjustment of the above trimmer is somewhat critical for proper CW reception, for the CW filter frequency is specifically designed for the 9 MHz BFO to be precisely on frequency. The sideband balance adjustment of C130 will affect the CW reception of the transceivers - the place where the note peaks to a *very* large degree.

Be careful setting this BFO trimmer, for there is a filter match procedure to follow also. Without the filters properly loaded, the BFO adjustment using the 'hiss pitch' will be colored by a poor filter match setup.

o TR4any VOX Delay

The TR4any has a fixed VOX delay. There is no adjustment for this delay; it has been set at the factory. The delay is about a second. The manual outlines a simple procedure for setting this delay to other than factory default. In most cases, the delay is about right.

o Antenna Fuse Bulb

This is located inside the final cage and is a #12 bulb. A #12 is 6 volts at 150 ma - exactly the same as a #47, but with a different base. This bulb is a bit silly, for it will take well over a watt of RF to open it. By then, the receivers ruined anyway, most likely.

If you really want this protection (its good Stupid Insurance), pull the bulb and put a Radio Shack peanut bulb (6 V at 50 ma or so)

across the terminals. The cold resistance of this bulb will not affect the receiver adversely.

o TR4 Improved RX Audio

On the TR4, C212, a .0015 uF on G1 of V17, a 6AQ5, should be paralleled with a .01 uF 300 volt cap. This will remove a lot of the brassyness and distortion.

Following the TR4, Drake made some changes around the audio output stage, but they employed negative feedback to recover the frequency response of the sharp roll off of the coupling cap and grid resistor of V17.

o External Antenna Switch

The switch on the side of the TR4 allows for an external antenna to be connected. Whenever you move the transceiver, the switch moves to external by mysterious cosmic forces. You connect the antenna and wonder why the receiver is dead. To prevent this, you can lock the switch by placing a 4-40 nut in the exposed slot where the tab slides back and forth. Cover the nut with some tape to prevent it

o Mixing Scheme - TR4any

The TR4 uses the same PTO as the rest of the 4 line, but it has a 9 MHz IF. It covers 80 to 10 meters. Hetrodyne mixer crystals are not used on 80 or 20 meters. For these two bands, either the sum of the IF and PTO is used (20 meters) or the difference (80 meters). Thats why 20 meters has its unique dial markings that are backwards to the rest of the bands. All other bands have premix crystals and follow the formula of Fxtal = f + 9 + 5.5. The injection into the first mixer is 9 MHz ABOVE the lower band edge and is made up from the band crystal frequency MINUS 5. In the case of 80 meters, there is no crystal and the formula is simply f + 5.5. All crystals are HC/6U 3rd overtone. This is accurate for all bands but 80/20. In this case no crystal is used and the 5-ish MHz PTO is used directly. The 6EA8 PTO premix circuitry is diabolically ingenious in how it uses and does without a crystal oscillator depending upon the band switch.

Having a TR4 operate on different bands is more of an operation than simply changing crystals. The front end is tuned by a variable capacitor, not by slug racks as in the case of the R4any.

Moving a TR4 to the WARC bands, say 18 MHz in exchange for 20 cannot be done (no crystal, remember?). Generally, what you see is what you're going to have.

o What Happened to 15 Meters?

There is no 15 meter adjustments in the radio aside from the band crystal. Make sure you place the preselector where the manual tells you to during alignment of the various bands.

If you inspect the band switch, you'll see some small air wound coils about 1/4" in diameter. These coils are used for the three 10 meter crystal oscillators and for 15 meters. Now that you know this, that does not give you an excuse to muck with them if you have trouble in these areas. Those coils have sat there for 20 years. If you have trouble in any of these areas in your radio, it will never, ever be with these coils.

o Low Sensitivity 40, 15 or 10 Meters

First, check for sensitivity on 20 meters. Is it OK?

What you've just done is verify that the front end is just fine and that the problem is in the VFO premixer - the 6EA8. Quite often people will twiddle the transceiver - see "15 Meter Osc Inj" on the coil can and tune for max S meter. This is OK, but they forget that there is a similar slug on the bottom of the coil can too. Of course one slug affects the other.

And, again, you needn't bother with the loading network.

o Relay Cycling

Especially on the transceivers, sometimes when you put the unit in TUNE, it will drop out or cycle as you advance the DRIVE control. Nothing is wrong - its caused by having the RX audio set too high in relation to the anti VOX. Its actually the sidetone signal thats doing it. Turn down the audio gain, pull the mic or adjust the antivox.

Another cause of relay cycling can be the filter can as mentioned in the general comments section.

o Relay Specifications

The relay changed from year to year, from open frame to enclosed, depending upon the model of the transceiver, but the relay coil specifications did not. The relay is 120 volt and 15,000 ohm coil.

What if I can only find a 120 VAC relay? Measure the resistance and if its 12K to 18K, use it. In most cases, AC relays are the same as the DC relays except for a shorting turn. In all likelihood you can use one and never notice the difference.

o Ventilation

All Drake vaccuum tube equipment that transmits should be placed in such a way that adequate air flow is provided. This is especially true for the transceivers. If there is adequate airflow, you'll find Drake equipment to be quite gentle on components. Conversely, if you choke a TR4 off from free air circulation, you'll eventually cook the components. The first to go usually are ceramic disk capacitors.

If you have to replace more than one or two of these, it is a sure sign that someone cooked the radio.

o Fan

The PA cage area gets quite hot when in use and some forced air cooling is desirable. There is quite a lot of heat trapped in that final cage that is trying to escape by convection. The answer is a fan, not so much for cooling, but to help purge the hot air inside the final cage.

The only place to mount a fan is on the back of the final cage. A small 12 volt 70 ma 2 1/4" fan just fits nicely. If you route the leads through one of the corner chassis holes, they will come out in the final compartment. You can pick off the 12 VAC from the junction of the feed through and the filament choke. Do not go to the final tube filament pins - they are RF isolated by the chokes. Power the fan from a half wave rectifier filtered with about 100 uF at 20 volt. This mod can be done without drilling any holes or destroying the units originality. Orient the fan to blow in. I use a larger fan on the TR4 than a T4any simply because the TR4 needs some good air movement. With the 2 1/4" fan on the TR4, the unit can be used in-definitely and does not give any signs of doing a mini-Chernobyl.

Please note that the TR4 is not unique regarding heat. Almost all other radios of this era used convection cooled finals. They too need some forced air cooling or circulation. This is true of all Heathkits (inc HW12 series), Collins, Galaxy - the list is endless.

This mod will greatly extend the service life of the 6JB6 tubes. For the most part Drake did a good job designing the chassis for venti-lation. An inspection of the radio from this aspect will reveal thoughtful placement of power resistors and discrete chassis holes.

o   TR4 Noise Blanker

This blanker is very similar to the blanker on the R4C and is similarly very effective. Note that there is a different blanker model for TR4 serial numbers before 31321.

Quite a few transceivers were sold without noise blankers. As with other Drake accessories, the 34PNB is difficult to find by itself. The R4C noise blanker is unique from an TR4 blanker and cannot be modified to operate in the transceiver for the following basic reasons:

- Different IF frequency

- Different on/off switching

- TR4 blanker has bidirectional signal path

10.0 SPR-4

This all solid state receiver is a essentially a solid state general coverage R4B. It is extremely sensitive and stable. The frequency is 'programmed' by installing the appropriate crystal - one of up to 23 into the sockets behind the band selector switch. Options for the SPR4 included a noise blanker and various adaptor boards to allow it to transceive with the T4XB. The noise blanker is nearly impossible to find on the used market and it is best to get one with the receiver.

There are few weaknesses or vices in this receiver. The AGC design is weird and in certain points, very high impedance. An 11 meg ohm input meter will drag the AGC down.

The SPR-4 uses the same PTO and dial plates as the R4C. Some models were specially constructed for the FCC when they cared about the mess on CB and had the CB channels marked on the dial plates in red. It is done in an ingenious way and is fascinating to watch in action.

There was an 'early' model SPR-4 and a 'late' model. The exact differences are sketchy at time of writing. One definite difference is in the audio board around the area of the power output transistors. Late model SPR-4 used a pair of EP-487 TO220 transistors. Early model SPR-4 used transistors with unique mounting, similar to the X style UHF transistors such as an MRF901. The audio boards are interchangeable and new ones still available in 1996. If you have an early SPR-4 with audio troubles, replace the board, for the unique audio output transistors on the 'old' are NLA.

10.1 SPR-4 MODS AND TECH

o Sensitivity

Measure the input resistance with an ohm meter at the antenna terminals on any band but 'A' or 'B'. It should be about 2 ohms. If it is not, likely the ground pin on the input matching coil has become unsoldered. This will be hard to get to and you'll be required to unscrew the slide switch on the back panel immediately above it. For some reason this solder connection seems to fatigue over the years; perhaps the area is stressed during assembly. On 40 meters and above an SPR-4 will still 'hear' a lot of signals with the input link coil ungrounded. All thats coupling the antenna in this case is just stray capacitance and is surprisingly adequate. If you have this problem, you'll notice 80 and 160 not to be too perky, yet the receiver aligns OK.

o IF alignment

The 50 kHz IF transformers tune broadly.

The 50 kHz bandpass network coils accessible from the rear chassis panel tune sharply and are critical for proper sensitivity. Align with the bottom plate in place. It isn't easy, but this is the only way to get a good alignment. Do not disturb any of the wiring around this area of the receiver.

o AGC

The AGC in the SPR-4 is somewhat unique. The AGC controls on the back of the S Meter affect its strong signal performance. The AGC line is very high impedance. You cannot measure it successfully without dragging it down.

The board behind the S meter contains the delayed AGC for the RF amplifier and the S Meter driver logic. If you have problems setting up the AGC in exact accordance with the instructions, replace Q14, the AGC FET amp. The AGC bus goes right to the gate of Q14 - any leakage at all will ruin the AGC. An MPF102 will work fine.

The AGC in the SPR4 reduces the IF amplifier gain by setting gate 2 of the IF amplifiers from slightly positive, through zero and then negative. On extremely strong signals, gate 1 of the RF amplifier is driven positive from the S Meter circuitry. This positive voltage in gate 1 causes the RF amplifier to draw more current and increase the voltage drop across the source resistor, cutting the device off. Its a technique called 'forward AGC' and aids in reducing overloading on strong signals. The noise blanker in the TR7 uses a similar technique.

The AGC S Meter transistor is an FET. An MPF102 will work nicely, providing you device select. Essentually you need to select an FET that provides a minimum of 2.25 volts across a 4.7 K source resistor. The following IC that drives the S Meter (and eventually the RF amp AGC) is a CA3053. You can readily substitute a CA3028, A or B into this circuit.

Nominal AGC voltage to the gate of Q14 is around .6 volt. If it is higher than this, the receiver will appear to be 'hotter', but it will overload on strong signals. Most of the gain control AGC in the receiver comes from the RF amplifier past a certain threshold.

o AGC CW Time Constant

Later model SPR4 receivers allowed for an owner to use a faster time constant on CW than the default SSB one. On about the middle of the function switch gang you will see two pin connectors at the top with the radio on its back. If you short the two pins, the AGC decay time is extremely fast. There are options other than shorted or open, however.

Across the AGC time constant pins install a 1 Meg 1/4 watt resistor. This seems about right, but you may want to play a bit by sweeping the receiver in the CW position across the crystal calibrator. Check the decay time by watching the S meter.

o Alignment Tricks

Drake wants you to measure the AGC bus during alignment. A volt meter will drag the bus down. Don't bother - there already is a volt meter there - the S meter. Use it instead during alignment, but keep the input signal level to the S3 to 5 level.

10.2 VARIATIONS

The SPR4 also had some variations from the desk top model marketed as marine back up receivers known as the RR1 and RR2 receivers.

The RR1 was a rack mount white SPR4.

Thr RR2 was an RR1 with a 500kHz step synthesizer (consider it an RR1/SPR4 with an FS4).

11.0 TR5

There is a natural expectation that incrementing series numbers from a manufacturer imply that the higher number is a later model. In the case of Drake HF radios, the TR7 followed the TR4Cw and the TR5 came after the TR7. Despite this, the TR5 is a good interpretation by Drake of a solid state TR4Cw-RIT. There is a marked resemblance of a TR5 to a TR7.

Most notable in the TR5 is a digital VFO, although the radio still employed band crystals.

The TR5 followed the TR7 and was announced for general market around 1982. It is a ham band only transceiver with a real synthesizer. It could best be described as being similar functionally to a TS-120. It can also be described rather accurately as being a solid state TR4Cw-RIT. It came with few accessories - there really wasn't all that much to add. It was an SSB and CW transceiver and did not cover the AM and RTTY modes offered in the TR7. The TR5 allowed for optional WARC band coverage of the 10, 18 and 24 MHz sub bands. There is no PBT or IF Shift. It could be looked upon as a 'baby TR7' for it is very similar in appearance. Instead of two rows of push buttons on the '7, the '5 has a single row of rocker switches, but the basic layout is much the same.

The TR5 also had its 'own' line of accessories, most notably the L75 linear (single 3-500) and RV75 digital remote VFO. The RV75 would of course work with the TR7. The companion power supply, the SP75 will of course work with the TR7. This supply provides an unregulated high current 12 volts for the transmitter PA and a low current supply for the low level electronics. There is *nothing* wrong with this. Atlas did this too. There is no need to provide a lot of filtering, or regulation to the PA stage.

12.0 TR7

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By the mid 1970's it was obvious that a new generation transceiver was required. Vaccuum tube equipment was being replaced by solid state radios - especially for those that wanted to operate mobile. The solid state equipment was obviously the way of the future. Drake answered this challenge with the TR5 and TR7 transceivers. There also was an R7 receiver. This receeiver is not that common due to its intial expense and the fact that those that have them tend to keep them.

Yes, there was a TR6. That was a 6 meter SSB transceiver circa 1970 in much the same vein as an SB-110.

Yes, there was an 'A' model of the TR7. This is around a 1982 flavor. What the 'A' model of the TR7 and R7 really was all about is that the equipment contained standard such as noise blankers and crystal filters that were options on the earlier model.

The TR7, as is common for most Drake equipment, is over built. This is characteristic of most well made American equipment. While a TR7 may not have all of the useless 'features' of foreign equipment, it is as reliable as a rock and solidly built. Drake made sure it was a quality piece of radio and not intended to be disposable. An example - the TR7 generates 150 watts (250 in or so) output, yet the PA is capable of at least 225 out. At its nominal power rating, the final transistors are under utilized. The transceiver is big and heavy at 17.5 lbs despite an aluminium chassis. Glass epoxy boards are employed throughout the radio. The receiver is dead quiet and almost immune to overload. A large part of the reason for this is the lack of an RF amplifier and a strong passive DBM in the front end (ala Atlas 210). The TX SSB audio is rich and clean. The AGC switches with the mode setting for near optimum tailoring. The only item to be missed is an IF notch filter. You'd look at a TR7 today perhaps with some distain if you didn't know any better.

A TR7 is a classic example of old ham gear easily overlooked since it is 'old tech'. Yet quite a few of the same amateurs will get very excited over a Racal or other piece of 'commercial' equipment. At the end of this document is a readers comment regarding the flexibility of the TR7 design for commercial applications. You see, Drake just didn't make amateur gear.

A well working TR7 is a treat to use. Transmitted audio is excellent and the receiver is a gem. The AGC is typical Drake - peerless. It can be used for hours and hours without operator fatigue as the audio is clean and near hiss free. The transmitter PA stages are constructed for heavy use. The major downside of the radio is its current requirements. Nominal drain on receive is about 3 A, on transmit, it could run to about 22 to 25 A. Both of these figures are considered slightly excessive today. The size of the radio rules out mobile operation in most of todays cars and the red LED frequency display washes out in sunlight.

12.1 TR7A/TR7 DIFFERENCES

The TR7A was an early 80's transceiver that had some subtle differences to a TR7. Not that many were made and it is a bit of a collectors item. Practically, it isn't all that much different to a TR7 except in the following areas:

- o Came with noise blanker
- o Came with SSB, CW and AM filter
- o Came with DR7
- o Mic audio appears on back panel
- o TR7A displayed on front panel.
- o Some RX front end protection

12.2 TR7 MODS AND TECH

I have encountered few mods for this radio. This could be caused by the difficult nature of performing them or by the very fact that a stock TR7 is pretty good as it is. What makes this radio difficult to modify is the plug in board modules. This is good. This means that a TR7 is unlikely to be mucked with too severely. Your worst problem is likely to be alignment if your 'new' TR7 is a little sour.

o Servicing

A TR7 is a robust transceiver that is almost impossible to kill. It holds its alignment extremely well and generally is overbuilt and 'over designed'. Once brought up to specifications, it should stay that way almost indefinitely.

However, should your TR7 require service, you are in a bit of a dilemma. To service a TR7 beyond the superficial, one needs a good oscilloscope, volt meter, service manual and the extender boards. The latter two are no longer available from Drake. A service manual may be purchased from:

Antique Manuals, K7FG
1-800-807-6146

The telephone number is ... interesting.

This organization sells manuals for a considerable number of examples of old(er) gear and a lot of BoatAnchors. The current price of the TR7 manual is about $34 US. Its not a bad deal.

A TR7 is not difficult to set up, but one must be aware of what to tune and what not to touch. DO NOT align the first crystal filter unless you are prepared to go at it with a sweep generator. Quite a number of slugs, trimmers and trim pots are involved in an alignment and not all of the adjustments are immediately accessible.

Especially in the case of a TR7, if it works, don't fix it.

o Set Up

The outlined procedures in the service manual are very well thought out and are presented in a linear progression. Follow them. The synthesizer set up is a bit tricky. Most important is to ensure that the 40, 13.695 and 8.05 MHz oscillators are exactly on frequency. If each one of these is within 100 Hz, then the readout, PBT and CLAR will 'naturally' fall very close to spec. Proper test equipment is essential to set up a TR7.

o All Band Transmit

Included with this article are additional TIF and TXT files outlining Drake synthesizer changes for full receive coverage and full frequency coverage transmit.

o Digital Display

For a while the DR7 digital display was an option. A TR7 is significantly less without the DR7 display. If you are looking at a TR7 to purchase, make sure that it does indeed at least have this option installed. Of all the 'options' available for the TR7, it is unlikely you'll ever find a loose DR7 unless someone is cutting up a TR7 for parts.

o Early and Late Models

The very early model TR7 was sold without the DR7 board. It is unlikely you will encounter one of these - few were made. ASK if it has digital display before purchase!

The early model TR7 had a 3 transistor predriver on the PA heat sink. Additionally, the adjustment for TX/RX frequency required you to remove the DR7 and use extender boards. Very inconvenient.

The later model TR7 uses a 2 transistor predriver. You need to pull the top cover and look at the circuit board closest to the front panel. If you see a U shaped aluminium heat sink, it is the later model. Additionally, this model TR7 had an access hole on the motherboard for the TX/RX frequency adjustment.

AF/RF Gain Control

Is unavailable from Drake.

This is the same control as used on the SPR4, which was available, although I don't know the current status. The one difference is that the TR7 control has a double switch for both AC and DC. Depending on what is gone on the TR7 control - anything but the switch, basically, you can graft the old control switch onto the replacement control. This requires careful disassembly of the controls, but it can and has been done.

As for replacement switches, about the best you can do is rummage through someones surplus parts bin. These types of switches were used in old AC/DC televisions and AM/FM radios.

o TR7 Mixing Scheme

The TR7 and TR7A is a dual conversion transceiver using a first IF of 48 MHz and a second IF of 5.645 MHz. The same path is used in reverse on transmit. For the BFO, there is no 5.645 MHz crystal as such, for it is synthesized from 2 crystal oscillators at 8.05 and 13.695. The first mixer is a DBM followed by a grounded gate post amplifier in to a 48 MHz 4 pole crystal filter. On transmit, the 48 MHz transmit signal is routed through the 48 MHz filters, through the post amplifier and into the DBM. The post amplifier has its inputs and outputs reversed through steering diodes. Output on transmit is taken directly from the DBM into the 3 stage high gain PA section (predriver, driver and PA functional blocks). ALC is achieved on transmit by use of a diode attenuator in a previous low level stage. In receive, there is a dedicated board for the IF filters followed by a 3 stage IF MOSFET amplifier employing forward AGC. The crystal filters are treated all the same - there is no gain compensation for bandwidth.

The primary reason for the mixing scheme is so full coverage from .5 to 30 MHz can be achieved with a 5 to 5.5 MHz VFO.

The synthesizer in the TR7 is a tracking synthesizer. The PTO at 5 to 5.5 MHz is used in the PLL with the divider chain to control a VCO operating at 48 to 78 MHz. If the PTO drifts, then the synthesizer will drift in step with it.

o RF Tightness

The radio cannot be aligned when extender boards are in use. Some adjustments must be done with the cover plate off. For the other adjustments, there are holes in the cover plate for access. These can only be accurately adjusted with the cover plate in place. Make sure the cover plate is screwed down snugly with all those screws - not just a few.

Some boards have grounding fingers. While re-installing these boards, make sure the fingers and tabs make chassis contact.

If the above is not adhered to, mediocre alignment and operation will result. There will be RF leakage into the IF section of the receiver. This will have a dramatic effect on S meter, AGC and spurious responses.

o AUX 7 Programming

See the separate section covering this option in detail.

o The FA7 Fan

Some manufacturers do not provide for forced air cooling of their PA stages. Ten Tec is a good example. Their PA stages can run so hot that it really hurts to grab the heat sink. I've never seen one 'melt', but having them get that hot gives me the willies. Heat and electronics do not happily co exist (ref TR4 above). While the transistors may take it and good design compensates for it, thermal run away is a concern. Its an ugly event to watch and once started, the event is catastrophic and usually expensive.

The FA7 was an option on the TR7 for heavy duty cycle use. Experience has shown that without a fan, even on SSB, the PA gets inordinately warm. Regardless of mode, some form of forced air cooling should be employed. The requirement is to provide air circulation, not necessarily air cooling. The fan should be set up to blow in, not out. This is contrary to the FA7 direction, but seems to afford much better cooling. I mount the fan so it blows in, under the theory fans move more air on the blow side than the draw side. It does seem to be noisier blowing in, though. I really do not think it matters all that much, so long as you can get the temperature down and the hot air out. If you mount it to draw, you should feel warm air coming out and the top of the cabinet 'cool'.

The FA7 fan runs from 110 VAC and is meant to be run 'through' the PS/7. If you have a PS/7, a 110 VAC 'muffin' fan will bolt right on. If you use a generic power supply use a 12 volt version and power the fan off the TX Vcc from the PA stage. 24 volt DC fans will push a fair bit of air quietly and these are readily available surplus.

o Digital Operation

All Drakes with the exception of the TR5 use a free running VFO. This may not be stable enough for RTTY as the long term drift is a few hundred cycles. If you must use a Drake for digital operation, your best bet is a TR5 or a TR7 with an RV75 remote VFO (not the RV7).

I have no T/R switching times for any of the Drake equipment, but it is reasonable to assume that none of it switches fast enough for AMTOR.

* note readers comment on TR7 switching times

o Receiver Sensitivity Check

Properly aligned, the S Meter should rest just off zero, for the AGC detector must be in the 'on' state slightly, otherwise the AGC will pop. The calibrator should provide an S9 signal on 10 meters with no antenna attached if the alignment is close. Without an antenna, a properly operating TR7 should appear almost to be dead. If the RF gain is rotated fully CCW, the S meter should rest at the S9 +80 db mark - no higher or lower.

Since there is no preselector to peak, the calibrator test assumes the S Meter is set up in accordance with the alignment instructions. The other alternative 'sign of life' tests you can do is to scratch the center pin of the SO/239 with a metallic anything. The S Meter should respond and you should hear the scritch noises most plainly in the speaker. You can also connect almost any antenna to the SO/239 and you should hear an increase in background noise, however slight - even on 10.

o 8.05 MHz Osc Won't Net

This oscillator is varicap controlled and is used in conjunction with the 13.995 fixed oscillator to develop the BFO. In doing it this way, there is little chance that there will be BFO leakage, or what leakage there is, can be controlled.

There is a trimmer adjustment to net the 8.05 MHz crystal, but what the manual fails to tell you is that this adjustment is also affected by the trim pots for the injection frequencies for the BFO.

If you try to set this trimmer up and it just won't trim, try an arbitrary setting of the trimmer screw and see if, say, on LSB you can get it to the proper frequency with the trim pot for that mode.

o Receiver AGC Set Up Notes

Aside from alignment, set up in this area has considerable affect on the receivers sensitivity and AGC 'personality'. Also important is the 10 volt regulator adjustment, for it too will have an effect on oscillator alignment, AGC and sensitivity. Tests indicate that at 9 volts, the receiver and AGC setup is quite 'mushy'. For all practical purposes, the 10 volt regulator adjust is the one adjustment that will determine how 'crisp' the radio is.

Adjust the 10 volt regulator from measurements taken on the motherboard.

o Transmitter Output Check

A TR7 should produce 150 watts output on 80 meters if set up properly. Current draw will be 22 amps at 13.6 volts. Use no smaller power cable than #12 for short runs and #10 for 15 feet or more.

You should be able to disconnect the transmitter load and key the transmitter to full output. Properly set up ALC will limit the output 'power' to 20 watts or so.

If you pull the blue wire from the ALC board (the one between the shielded cable and the red wire on the LHS), the PA stage will run wide open and I've measured over 225 watts output on 80 meters. Not recommended as a normal practice, but this is a good test of final transistor health. Set to its nominal 150 watt output, a TR7 is definitely loafing along.

o Won't Transmit

The TR7 has a separate pin on the power connector for +13 volts to the PA. Out of the 4 pin power connector pins, 2 are ground and one pin each is for the radio proper and the PA. Ensure that the PA stage does have 13 volts. The transceiver will make all the right noises (relay closure, etc), but won't generate any RF.

This is a common oversite. Its comparable to not having plate voltage for the PA stage in the TR4.

o Accessory Filters

The TR7 filters are not interchangeable with the R4C filters. The R4C accessory filters are 5695 kHz and the TR7 are 5645 kHz. The factory supplied SSB filter is a 'fidelity' filter. Your transmitted audio with a properly set up radio and a microphone should sound like FM broadcast. The skirt roll off is just a little 'soft'. You need to go to a 1.8 kHz filter to get much RX improvement. The stock SSB filter is quite good in receive.

The TR7 always transmits through the SSB crystal filter supplied with the radio. You can put the other 3 filters where ever you want, but don't mess with this filter in this position.

o AM Filter

An AM filter is almost impossible to find. You can fake an AM 'filter' by putting a 390 ohm resistor through the input and output pins of any blank crystal filter position. It actually isn't bad. What is determining the selectivity is the 48 MHz first IF filter.

o Transmit Power

Pay particular attention to the SWR balance trimmer, C1901. ALC action is affected adversely by an improper null. This null trimmer also affects the watt meter calibration, so if you change the trimmer setting, R2001 and R2002 will need adjustment also. Essentially, the FOR output is used for ALC and the REV output is used for shutdown. This is independant of the watt meter setting. When you set up the ALC null, use a high impedance analogue meter, a non metallic alignment tool and a good 50 ohm load.

There are 2 control settings that affect the ALC. The obvious one is the 'ALC' control on the ALC board in the bottom of the transceiver. The other setting control is the gain pot on the predriver. This control sets the gain by setting the feedback on one of the driver stages (old driver board) or the current in the preamp stage (newer driver board). Properly set, you should have just enough ALC on 10 and as expected, a controllable abundance on 80 meters. Improper set up of the ALC usually means no ALC or will make the mic gain setting overly sensitive and the ALC clamp early on the lower bands. There is additional ALC/drive compensation from the band switch for the 10 and 15 meter bands. Extra resistors are switched in on these band settings to provide more drive/higher ALC threshold to provide gain compensation. These resistors have only a very minor effect on drive compensation. If you are having upper band drive problems, these resistors should not be the first suspects.

For proper transmitter ALC action it is essential for the PA driver and final stages to be in good condition. 150 watts output should be easily attained on 40 and 80 meters.

o External Speakers

Unlike the '4 line, the TR7 employs an LM380 audio power stage. This IC is load tolerant and 8 ohm speakers may be used without problem.

o Microphone

Later series TR7 provided for both high and low impedance microphnes through the use of different pins on the connector.

High impedance mics may be connected to pin 4. Input Z is about 750K, but this port is much less sensitive than pin 1. High Z mics are expected to be high output (> 100 mv).

The above is a factory change on the later series TR7. Early models had a jumper on the circuit board for microphone impedance.

o PA Driver Stage

At least 2 different sets of boards were used in the driver stage next to the power amplifier. Early TR7s used 3 transistors; the late model board used 2 transistors. In this board, the last transistor is an MRF476. The final amplifier board seems to have remained much the same, but the components around the PA input and output transformers were different.

The board with the MRF476 predriver most likely was changed because it was much cheaper to make. This in itself is not a fault, but the way it was executed presents some problems that will be dealt with in a separate area. On this board the driver is an MPS-H20. I've used the MRF237 as a replacement because the transistor is biased for about 20 ma - about .3 watt. In my mind this is a little heavy for a TO92 transistor. The MRF237 may also be used as replacements

for the SRF2331. These transistors are somewhat unique - the case is the emitter and the collector and emitter pins are interposed. If you orient the transistor so the base (center lead is furthest away from you) is in the centre and the transistor is held by the leads underneath, the emitter is the left hand lead, NOT on the right where you would expect a TO5 to be. The case in question is a TO39.

If it is necessary to change any of the transistors in this area, you must use heat sink compound on the mounting bases. Most folks use far too much of this stuff. The purpose of this compound is to ensure a good thermal contact between the transistor and the heat sink by filling in the (natural) pits in the metal faces. Thats all its used for. Too much is just as bad as none - its a metal filler only. Do not over goop this stuff!

o Late Model Driver Boards

The problem with the later model board is the bias network on the MRF476. Its bias level is such that the transistor will go into thermal runaway or may latch up by itself. The 270 ohm resistor from base to ground is not enough to prevent this. The 300 ohm resistor and 1N4005 diode is an acceptable method of providing bias, but with the grounded emitter, there is no way to guarantee thermal stability around the transistor. You'll notice this if all of a sudden the transmitter output drops or, on the lower bands, the ALC is gone and more mic gain is required. You let up on the mic for a few minutes and all is well. If you were to feel the heatsink on the MRF476, it will be very, very hot. It may also be possible that the predriver board 'eats' MRF476s. You find its bad - usually leaky and low gain - replace it, and soon the new one dies an inglorious death also.

The cure is to lift the emitter off ground with a resistor. Make a tight bundle of 3 - 1.8 ohm 1/8 watt resistors in parallel. Cut the emitter lead of the MRF476 about where the lead changes width. Remove the stub from the circuit board and put this resistor network between the emitter and where the the stub went into the circuit board. Removing the stub can be interesting for its soldered on both sides of the board.

Yes, raising the emitter will decrease the gain. The degenerative feedback also makes the MRF476 easier to drive, so the net result is a wash. This one change for this specific board type is highly recommended, especially if you're thaving problems with MRF476 longevity.

o PA Stage

Co incident with the different driver boards, Drake changed the PA stage around the ferrite transformers. These changes look like they were done to improve stability, and the differences are minor.

o PA Stage Bias Setting

There isn't any. There is no bias adjustment for any of the stages in this amplifier chain. If your final or driver transistors have suffered catastrophic failure, before installing replacements and after removal of the transistors, measure the base voltage on transmit. Nominal reading is about .6 volts. If higher than .7 volts, further inspection of the bias supply is in order. Failure to do so will likely cause the new set to be compromised immediately upon use.

o PA Transistors

MRF421MP will replace the SRF2337 final transistors. The MP indicates Matched Pair, so order one of these or two MRF421 and ask them to be beta matched. At this power and current level, it is wise to have current balance in this stage.

MRF475/2SC2092 will replace the SRF2338 driver transistors. The collector is the mounting tab, so don't forget the insulating wafer.

MRF476/2SC2166 will replace the TO220 predriver. The driver board changed over the years. The collector is the mounting tab, but its board placement is isolated from the circuit board. Do not use tab isolation hardware. The collector choke makes collector contact through the bolt.

The cost of all of the above is about $90 from RF Parts. One final transistor alone is over $63 from Drake.

The TR7 will shut down 50% at a 4:1 SWR. This provides more than adequate protection. However, the transmitter draws considerable current from a 13 volt supply. The supply should be rated at 30 AMP ICAS minimum. Marginal supplies and DC power cords will not provide enough current under load and likely will drop in and out under full carrier condition jeopardizing the PA. It is important that a stiff high current supply be employed with the TR7.

o ALC Time Constant

On the ALC board, the ALC decay time constant is over 1 second. This can be decreased to about 1/2 this value without any ill effects and will allow the ALC to track voice input a little better. Change R1618, a 1 meg resistor, to 470K.

o VOX - Transmit Generator Board

The VOX requires about 50 mv of microphone input to trigger reliably from pin 1 on the mic connector. On the TR7, it takes a very high setting on the VOX Gain control to make the VOX trip. This is in contrast to the mic gain, where not much is needed at all. C304, a .01 uF capacitor coupling the voltage doubler has a reactance of 15K at 1 kHz. Its value is much too low, especially when the applied mic input signal is divided in half by C320, another .01 (transient sup-

pression). Change C304 to a .1 uF. The improvement is such that it will take barely adequate VOX gain to 'acceptable'.

I recommend this change for those SSB operators that would like to operate VOX on their TR7's but haven't for lack of VOX gain.

13.0 AUX7

You can make the all band transmit mod by just cutting one trace for the TX band inhibit line. The other, official way of getting additional bands is through the AUX7. This was an option board on the TR7 series that allowed one to operate the TR7 either crystal controlled or allow one to buy program modules for any .5 MHz segment. Special program modules were ordered for transmit. Use of an AUX7 is a nice touch, for by just rotating 2 switches, you can get to any band you want without modifying the transceiver. The option modules were all the same - you 'programmed' the modules by cutting off the appropriate pins from a chart.

Drake no longer provides the AUX7 optional band modules, but you can make your own from a 14 pin DIP header and a batch of 1N4148 diodes. Each of these modules will consume less than 13 diodes, depending upon the frequency. Yes, its a lot of diodes. Typically, you'll need 7 or 8 diodes per module. You must use the diodes, for the band modules are matrixed.

The AUX7 is not easy to install or gain access to for it involves opening the TR7. The front panel will flip down, but to do this, you need to extract the band switch shaft. If you are not careful, you can rip the wafer rotors out when you extract or reinsert the shaft. This will cause REAL trouble and given the age of the unit and replacement parts availability (don't count on it!),

The AUX7 band module has a separate pin for TX enable. Obviously, this pin must be enabled for any of the WARC amateur bands you need or want to enable. The band switch must be set to the appropriate filter range.
If it is set to a range that does not match the module programming, the SETBAND light will come on.

When you set up the DIP header with the 1N4148 diodes, use the following programming chart. The pin numbers are as if it were an IC. Make sure you do not wire it backwards! This is a very common mistake:

PIN	USE	PIN	USE
1	Select 5V	8	Range B2
2	Range A0	9	Range B3
3	Range A1	10	TX enable
4	Range A2	11	Band A
5	Range A3	12	Band B
6	Range B0	13	Band C
7	Range B1	14	Band D

Essentially the AUX7 programming is divided into 2 halves - BAND and RANGE. BAND sets the band as if it were coming from the band switch. RANGE sets the .5 MHz offset as if you were to hit the UP/DOWN buttons on the front panel. The BAND programming is compared against the BCD band switch wafer. If there is no match against these two, the SETBAND

light comes on. This is used to tell the operator that the band switch setting does not correspond to the programming and the band switch should be rotated until the light extinguishes.

13.1 BAND PROGRAMMING

Band programming is done in BCD to indicate the band switch setting through the SETBAND indicator. If this is not programmed, the unit will not transmit. If pin 10 is not made high, the unit will not transmit.

Band Range	BA	BB	BC	BD
1.5 - 2.0	-	x	-	-
2 - 3	x	x	-	-
3 - 4.5	-	-	x	-
4.5 - 7	x	-	x	-
7 - 10	-	x	x	-
10 - 15	x	x	x	-
15 - 22	-	-	-	x
22 - 30	x	-	-	x

The band range pins BA to BD correspond to the previous 14 pin chart. This programming sets the band switch data/SETBAND light. If this is not programmed, the unit will receive, but it will not transmit, even if pin 10 is high.

13.2 SYNTHESIZER PROGRAMMING

The synthesizer requires programming in order to set the correct 1/2 MHz range. This requires some calculation. The pins A0 to B3 comprise a 1 byte field to indicate the correct .5 MHz chunk. You simply cannot assume that 18 MHz is the 36th 1/2 MHz chunk and program '0011,0110', for there is a modulus to be accounted for.

The formula is 86 - (f*2), where f is in MHz at 500 kHz settings. To set the synthesizer to 27.0 MHz, you would calculate 86-(27*2) = 32 = 0011,0010.


```
0 0 1 1, 0 0 1 0        PIN
|   | |   |             ===
|   | |   |___ A0    2
|   | |__________ A3    5
|   |_____________ B0    6
```

|___________________ B3   9

To program this 27.0 matrix, you would connect diodes from pin 1 to pins 3,6,7 for the synthesizer, diodes to pins 11 and 14 for the band switch, and a diode to pin 10 to enable transmit. (but we'd NEVER do that, would we?).

The TR7 has 2 master oscillators that are selected by the band switch, NOT the frequency programming. Although it is not obligitory for reception, you should also program the band switch data so the SETBAND light will come on. A common error is to do the diode programming, fire it up and the synthesizer won't lock. This is usually caused by the band switch in the wrong position. The band programming and the SETBAND light is designed to prevent this.

13.3 CRYSTAL CONTROL

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Crystal control on the TR7 is independant of the programming matrix., The PTO tunes up and is offset 50 kHz, so finding the right crystal is f + 5.05 - f(MHz). To crystal control to 7.055 MHz, you'd order a crystal for 7.055 + 5.05 - 7 or 5.105 MHz. For bands that are on a .5 MHz boundary, you'd subtract an extra .5 to put the crystal within the 5 to 5.5 MHz range. The above crystal would put you on 3.555 MHz on 80 meters (3.5 + 5.105 - 5.05).

Since crystal control is related to a specific band, you should program the AUX7 as documented above. This is not mandatory.

I do not have specs on the crystal, but an educated guess would be HC/25U, 20 pf, series, fundamental.

14.0 R7 RECEIVERS

The receiver is very similar functionally to an Icom R71A or Kenwood R5000. The R71A is an excellent communications receiver. The R71A shares this functional equivelency in the areas of PBT, IF Notch, excellent noise blanker and 100 cycle display. The recovered audio of the Icom is not equal to the R7(A).

The R7(A) is still considered to this day to be an exceptional receiver. Its only negative is drift, for it uses the same synthesizer basically as the TR7. Its a VHF/PTO tracking synthesizer and consequently is no more stable than the PTO that drives it as a reference. The RV75 PTO is the method of choice to tame this drift. It is generally considered that the R7 is about as the best as it gets without reverting to more exotic, much higher priced units.

A more modern version, sort of, on a functional basis is the current day Drake R8A. In ultimate terms, the R7 is the better receiver, but the two are very specification close. It is the R7 that has the charisma, how- ever. The R8A does not drift and has a real syncronous detector, but the notch circuitry is audio, not IF.

R7 receivers are not too rare, but they are not often seen because they are hoarded and cherished. When one comes up on the market, it usually goes for the asking price unless the seller is greedy. As per the TR7, it is best if you buy the receiver as loaded up as possible. Be warned that this receiver was expensive in its day, holds its value, is 'rare' and is in high demand. If you want one, you'll find one, most likely, but be prepared to open your wallet.

This is a triple conversion receiver, somewhat like an R4C. The last IF frequency is at 50 kHz in order to encorporate a notch filter. The sig- nal flow is crudely similar to the receive section of a TR7 with the following exceptions:

o Notch Filter

o Provision for 5 filters

o Will transceive with the TR7

o DR7 digital display was optional

o Built in AC power supply

o Receiver covers from 0 to 30 MHz w/DR7 o Selectable AGC (off)

o Selectable 10 db pre amp

o Came without noise blanker **

** The R7A did have the NB7A noise blanker installed, additional crystal filters and some minor rear panel changes.

In order to use the ECSS AM detector properly, the optional 4 kHz filter needs to be present.

The R7/R7A is a superlative receiver that has genuine charisma. It has one area of inconvenient operation in the area of the UP/DOWN buttons (500 kHz shift from the band switch setting) and it 'drifts' in that it has a free running PTO. The latter is rectified when using the RV75 remote VFO, since the RV75 is digital.

14.1 VARIATIONS

The R7 and R7A was also used as a base for commercial applications. These units comprised the RR3 and the R4245. The latter receiver used a synthesizer instead of a PTO. Both of these receivers were commercial grade. The R4245 had a companion transceiver, the TR4310. This *likely* is the TR7 or TR7A in disguise.

The R7 used the NB7A Noise Blanker. I have had enquiries asking what the difference is to the NB7 used in the transceivers. I do not know for sure, but my guess would be that the NB7A was marketed for the receivers only and did not include the components to enable the signal path for transmit.

**************************** END ***********************************

R7 Receivers 80
Authored by VE3EFJ

Drake Mods

15.0 DRAKE PRICES

The following represent a sampling of the prices of various Drake equipment at the time they were sold. These are actual dealer prices and therefore there will be some variation.

Unit	Description	Price hi/lo
TR4	Transceiver	599
TR4Cw	Transceiver	799/699
34PNB	Noise Blanker	100
FF1	Crystal Control	47
MMK3	Mobile Mount TR Series	7
RV4	Remote VFO	150
TR5	Transceiver (1983)	695
TR7	Transceiver	1100
TR7/DR7	Transceiver	1295/1195
TR7A	Transceiver (1983)	1445
DR7	TR7 Digital Display	195
PS7	TR7 AC Power Supply	195
MMK7	Mobile Mount kit	50
FA7	Fan	25
RV7	Remote VFO	195
MS7	Speaker	33
NB7	Noise Blanker	90
MN7	250 watt coupler	165
WH7	160-6 M watt meter	89
AUX7	Range pgm board	45
RRM7/RTM7	Range RX/TX module	8
385-0004	Service Manual (NLA)	30
SLxxxx	TR7 Crystal Filters	52
MN2700	1000 Watt Coupler	279

2NT	Transmitter - CW	129
T4X	Transmitter	399
T4B	Transmitter	495
T4C	Transmitter	699/599
AC4	Power Supply	150/120
DC4	DC Power Supply	195/165
DC3	DC Power Supply	149

Drake Prices (cont'd)

Unit	Description	Price hi/lo
1A	Receiver (1957)	299
2-A	Receiver	270
2-B	Receiver	270
2-C	Receiver	299
R4	Receiver (1964)	379
R4A	Receiver	399
R4B	Receiver	475
R4C	Receiver	699/599
MS4	Speaker	33/30
FLxxxx	R4C Crystal Filters	52
NB4	Noise Blanker	70
FS4	R4C Synthesizer	300/250
R7A	Receiver (1983)	1395
SW4	SW Receiver (1966)	299
SPR-4	Receiver	699
DSR-2	Receiver	3200/2950
SSR-1	Receiver	350
MN4	300 Watt Coupler	120
MN2000	2000 Watt Coupler	250
B1000	4:1 BALUN	25
W4	watt meter	79

L4B	Linear Amplifier	995
L7	Linear Amplifier	995
7072	Hand Held Mic	19
7073	Hand Held Mic	19
7075	Desk Mic	39
7077	Desk Mic	45
DL300	300 watt dry dummy load	20
DL1000	1000 " "	40
UV3	VHF transceiver	595
UV3	220 or 440 module	175
PS3	UV3 power supply	90
UMK3	UV3 Remote trunk kit	70
1525EM	Hand Held Mic w/TT	49
WV4	VHF watt meter	89

Price hi/lo represents the extremes of price range I've seen within the same time frame between dealers. This is in US $.

16.0 BIBLIOGRAPHY

Enclosed is a list of Drake related articles, reviews and publications:

o A Crystal Filter for the R4B

QST, Jan, 1972

o Drake TR7 Review

QST, May, 1979

o Drake TR4 Review

QST, Dec, 1965

The unit in question is the 'early' model TR4.

o Drake SPR4 Review

"Receivers - Chance or Choice", Grove Press

o Drake R7 Review

"Receivers - Chance or Choice", Grove Press

o New Audio Amp for the R4C

Ham Radio, Apr, 1979

o Sticky VOX Relay on the T4X

QST, Jan, 1983

o Easy Drift Cure - TR7

QST, May, 1982

o SWR Drift Sensor - TR7

QST, Jun, 1981

o Curing Inverter Spurs on the TR7

QST, Feb, 1991

o TR5 Mods

QST, Jun, 1989

o Solid State Tubes

QST, Apr, 1977

o Solid State Tubes - Questions

QST, Sept, 1977

o Receiver Problems and Cures

Ham Radio, Dec, 1977

o Drake R4C Modifications

Ham Radio, Mar, 1977

o Receivers Past and Present

Osterman, 1997. A compendium of .1 to 30 MHz receivers manufactured throughout the world in the last 50 years. Fascinating reading and highly recommended.

17.0 AUTHOR'S NOTES

Anyone who contacts me for assistance will get it. I cannot say I'll make the badness go away, but I will give it a good shot. Past experience has shown that trouble shooting at a distance is frustrating at best, but if you're stuck, I'm available.

If you've found an error in this document or if its caused you grief, then I WANT to hear from you.

Please.

Where comparisons were made to other equipment or statements of 'functionally like' were indicated, they were done for illustrative purposes only. I've had a few people on the Drake side get quite upset with me for even mentioning Japanese gear. The R71A/R7 comment got me in trouble. I've owned many a piece of Japanese equipment, and its good stuff. Its just different. Most of it is treated as a disposable commodity, but that does not make it inferior or the engineers stupid. I will readily admit that my current equipment inventory includes Drake, Ten Tec, some Icom and a Yaesu FT/707. I see virtues in all of this equipment to varying degrees. None of it would I call inferior. In some cases its a matter of necessity - Drakes don't operate 10 FM. In other cases its just a simple case of my personal affliction with HF receivers, transmitters and transceivers regardless of the country of origin.

I have heard manys a time Drake to be referred to as a "poor man's Collins." While I understand what is implied here, it is in a way an insult. Collins never really did make equipment for the Amateur. What amateurs got from Collins was commercial/military gear. Its similar to saying a Kenwood TS570 is a poor man's SG2000. Its almost a meaningless statement. Drake, with the 4 line, made the best amateur market equipment available at that time in the whole world. So good, as a matter of fact, a large percentage of this equipment is in service today and will hold its own despite 25 years, 2 sunspot cycles and much more hostile band conditions since its inception. There is not one piece of Drake equipment that I know of (R4C excepted) that was not the best it could be.

The American equipment of the era of the 70's had a different engineering and marketing philosophy than today's commodities. I've stated before that Drake equipment is well built. Additionally, just about every product in their HF line would work together in some form despite the changes and progress made over the years. You could connect an RV4C to a TR3 with but only a very minor change. One can connect an R4B to a TR7 and get antenna switching and mute. This is from the same manufacturer using two entirely different levels of technology manufactured over 10 years apart. This is in contrast to todays commodities that are replaced constantly with a whole line of new accessories. Rather than improve upon a radio, todays gear is replaced by the manufacturer en mass. While the parts availability from Drake won't last forever, you can still get them for a 25 year old radio. An S meter for an R4B is less than $8. And Drake hasn't made amateur equipment in over 12 years. I'll allow them their front panel policy as silly as it sounds, for their support is absolutely top notch and every bit as good as the other highly respected manufacturer of amateur products. Drake is America's best kept other secret.

I too lament Drakes departure from amateur radio. I suspect they, like others, got out of it for the reasons that have come true today. Selling ham gear is a cut throat business left to the big 'dealers'. There is not much brand allegance, but price allegance given to the lowest bidder with a 1-800 number. A $20 difference in price will kill the sale on a $2000 transceiver. To stay in the game you have to be a player with an army of engineers and a 'new' product line every year. Drake and others saw this coming and went for a more stable market for their electronics. I hear stories of people asking Drake to 'come back'. Look at what the amateur market has become today and ask why any domestic manufacturer would bother.

What started my Drake exploits was pure accident of fate. I went out looking for something different and discovered how good Mr. Drake's wares were. I also discovered and confirmed that what you really need for some enjoyment of this hobby isn't all that much. The arms dealers will try their best to sell you a $6000 Death Star, but unless you're trying to run communications intercepts for the NSA, you don't need this stuff. My apologies to Mr. D. Vader.

But I may be preaching to the converted.

I do not profess this to be 'the' definitive Drake bible, but it is at least not a bad start. I would like to think, and I do hope, that someone that wrote off a Drake with a bad PTO has been able to dust it off and fix it with a bit of glue. Unfortunately far too much old gear gets written off because fewer people have any idea just how well it really works. It ends up rotting in someones garage for lack of just a little TLC.

I wrote this article for a few reasons. First, I wanted to publish whatever maintenance tricks I had learned. I wouldn't want someone else to learn the hard way as I did. Life's too short. Second, I believe that it is important that mods and data regarding this equipment should be available. The intent of this paper is not only to put on paper some mods - I wanted to have some kind of a record indicating what this gear was like. Not only is this equipment part of our heritage, Drake and others made some excellent products. An increasing percentage of amateurs every year have no idea what Drake, Collins, Hallicrafters or even Heath were all about.

More than anything else, I guess, was the initial frustration I had getting information. Drake equipment and its expert enthusiasts were hard to find and were somewhat akin to visiting the Great Owl. I decided that anyone that wanted to follow my path shouldn't have to go through this. One may read into this that I am a 'Drake expert'. This, I do not pro-

fess to be. All I've done is kept my eyes and ears open, had some experiences, and wrote them down for those that are interested.

"I blew it up. I had to"

Wayne Montague, VE3EFJ
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18.0 READER FEEDBACK

Included here is some of the feedback I've received. I've included what I think is most interesting and what provides some additional information. Where no originator indicated, it is because I've edited it out. The "...." indicates further editing that I felt was not pertinent to the subject at hand.

18.1 THE TR7

(someone with MUCH more experience than I have)

Wayne,

I have read with interest the three versions of your drakemod.txt file and appreciate the time and effort you have obviously put into it. I have no knowledge or experience of the Drake 4-line, and that makes up much of your document. However I can offer some comments and amplification on the portion of your work that deals with the 7-line and its commercial derivatives (more about that later).

First, let me introduce myself and detail my association with Drake equipment. I am very active in HF digital work and have run an APLink/WinLink MBO system for many years. My first piece of Drake gear was a TR7A that I bought new in the mid-80s. I feel the same way as you do about the quality of construction and performance of this gear. The R7 and derivatives have just about the best receiver I have ever seen, and that is saying a bit. My daytime job is with a commercial maritime service provider (HF) and we have evaluated many expensive receivers with names like Harris, WJ and Racal. I always bring them home and compare them with my Drake R4245 (an R7 inside, see below). The Drake stands up to all of them. Yes, they are fancier, computer controllable, DSP based and all of that, but in basic receive performance the best that they can do is equal the Drake.

My radio shack consists of several 'systems', separated by functionality. In the descriptions below I have ommitted the details of the digital hardware software and concentrated on the radios.

Twenty Meter MBO system - a TR7A (w/PS7) slaved to an R7A, both driven by the same RV75. I have modified the RV75 to scan eight channels on the

14 MHz. band.

The transmit antenna is a Butternut vertical on the carport, and a dipole serves as a separate receive antenna ....

Thirty Meter MBO system - a TR7 (w/PS7) driven by another RV75 with similar mod, scans ....

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Authored by VE3EFJ

Drake Mods

HF Intercept system - a Drake R4245, an Icom R71A and various digital modems and decoders. This system ....

In addition I also have a complete marine test 'ship' setup with with Raytheon and Furuno radios where I do software and hardware testing for the day job.

Drake also sold a commercial version of the 7-line. The transceiver was called a TR4310 and the receiver a R4245. I have little knowledge of the TR4310 except a description in a four page brochure. (I would be happly to fax you a copy.) However, I do own an R4245 and can describe it briefly for you. It is in a rack mount cabinet. Upon removing the top and bottom covers, one finds an R7 mother board and card cage. The major change is that the PTO is gone, as is the DR7. In place of the DR7 is a board that contains circuitry similar in function to the outboard RV75. This makes it fully synthesized, very stable radio! Other changes include different style knobs (but everything is in the same place as on an R7) and a light beige paint job on the front panel. The default frequency ranges when you switch bands are not the ham bands, but the maritime bands. The radio will run from 12VDC, 24VDC or 110VAC. I obtained the unit, new, during last months of operation of the old Harvey Radio store on 45th Street in Manhattan. I passed up a TR4310 at the same time and have been kicking myself ever since!

Your comments on the TR7's capability for digital operation need a bit of detail added. First, you are correct that the internal PTO is not adequate (stability-wise), that is why I use the RV75s. However, these radios turn around very quickly and are ideal for AmTOR use. I TR7 is a bit slower for some reason, but still under 10 ms. Yes, there is a bit of noise from the clacking relay.

In fact, I had several years ago purchased two replacement relays, anticipating failure, but both transceivers are using their original relays, believe it or not.

Several articles have been published with improvements for the 7 line over the years. My library is not organised at the moment, so I will mention what I can from memory. Given some time, I can dig out either a reference or a copy for you, if you are interested.

There was an article from an author in Switzerland detailing a stabilization mod for the PTO in the TR7. It consisted of a board, mounted under the mother board, that sensed a change in the least significant digit of the counter on the DR7 board and 'bumped' the PTO back on frequency if it drifted far enough for that digit to change. It 'bumped' in 10 Hertz steps, as I recall, which I thought might be too much for digital work, so I never tried it. Also, I had acquired the RV75s by that time.

There have been many mods published over the years to allow full frequency transmit with the TR7. Most simply leave the transmit enable line high at all times by cutting a trace. Because internal signals like PLL unlock can drive this line low, I developed a mod that left this impor-

tant protection in place. I have not looked at the mod you got from Drake to see if it also does this, but I will.

One author claimed that he had seen low level spurs on both transmit and receive caused by the 23 kHz. oscillator in the +24 volt supply getting back into the +10 volt line. He suggested adding additional filtering to supress it. I have never seen this problem, but do have the parts on hand if I want to make this mod in the future. Similar circuits are used for this supply in the TR7, R7 and R4245.

Another article included several unrelated TR7 mods. The ones I recall were a temperature sensing fan driver and replacement of the TR relay with PIN diode switches. Circuit boards were available.

Your comments on fans are interesting. I have an FA7, or homemade equivalent, installed on both TR7s and on both PS7s, but using the Drake approach, blowing out in all cases. Also, on the subject of heat and fans, I run both the R7 and the R4245 from external 12VDC, which reduces the internal heat somewhat. In spite of that, the regulator on the rear panel runs quite warm, so I have arranged a fan to move air in that area also.

I could go on and on, about such things as changes to the Drake transceive cable kit, a mod to remotely switch between 10 MHz. and 14 MHz. operation. however, I suspect that this is enough for you to chew on for the moment.

73, Craig (writer detail omitted)

18.2 A 2B OWNER

Date: 08-Jan-96 09:05 EST From: Max Lockwood > Awesome Drake article

Hello Wayne, Thru Dave (deleted) and with your permission, a copy of your treatise on Drake radios has been made available to members of the "boatanchors" mailing list. I've read it. Great stuff!!!

I noticed a relative lack of information on the 2B in particular and the 2 series in general. Are you interested in adding anything about these radios?

I don't have much info, but what I do have could be useful to someone someday. For example:

One of the weak areas in the 2B seems to be in the crystal oscillator circuit. It's apparently common for the crystals to cease working. If you have multiple 2Bs (as I do), you can frequently play "musical crystals" and come up with combinations of rocks and radios that still work. Failing that, JAN crystals still has design data for the 2B and will custom grind crystals for about $13.

Another weak area is the Sensitivity control on the back of the 2B. A 2 meg pot used to adjust the AGC bias, it's not uncommon for it to develop a high resistance short to ground. Such a short can be the same order of magnitude as the value of the pot itself, 2 meg. It completely upsets the AGC circuit and results in an inability to mute the receiver completely.

If it is necessary to paint the cabinet of a 2B, an extremely good color and texture match can be had by using Rustoleum Satin Black, available in spray cans or in bulk.

If this kind of information would be welcome in your article, feel free to incorporate. All I ask in return is credit for the information be included with the article. One other comment: I was really glad to see your remarks about the R4B. I have two of theses and am just blown away by their performance and their sound. (further comments deleted)

73 and thanks,

Jim Lockwood - km6nk

ps. 'boatanchors' is a special interest group of 'vintage' radios. There is heavy interest currently in the R/390 series. Boatanchors is located at 'boatanchors@theporch.com'. You subscribe by sending E/mail to that address - 'SUBSCRIBE BOATANCHORS (your name)'. A TR7, R7 or a TR5 is NOT a boatanchor, by the way. If you don't know what an ART-13, Sky Buddy or an SX-101 is, this site may not be for you.

18.3 JUST SAYING 'HI'

Date: 08-Feb-96 18:18 EST From: Tim (deleted)

Wayne, just read your article Drakemd3.zip. I am just coming back to Ham Radio after an absence of 30 years...gave it up when I went to college. I was talking to my old Ham chum and classmate of the 50's and he mentioned that he had an old Drake from the 70's that he would let me use when I get my license. Think he said it was a Drake 3B but i'll find out for sure tomorrow. Anyway, I was fascinated with your piece on the Drake's and I thought I would drop you a note of appreciation for you fine effort on everyone's behalf. I too have felt something lacking in the current breed of xcvr's when you actually try to sit in front of one for a few hours. My brother-in-law is a first time, enthusiastic, about-to-be Novice ham who plunked down about 1200-1500 bucks for an assortment of Kenwood stuff including a TS450/AT. Scanning the bands with it left me wondering what was missing. Maybe it is the wide open spaces of 1958 sunspot peak etc but I suspect your opinion hits closer to the mark.

Thanks for a great read.

Drake Mods

regards, Tim (deleted)

18.4 EXPERIENCES ....

Date: 10-Feb-96 17:40 EST From: Garey (deleted) Subj: Drakemd3 File

Wayne: I really enjoyed reading your Drake "Masterpiece" file. I became a convert in about 1961 when after being out of Ham Radio for a brief period I fell victim to a QST ad from (an amateur dealer) in Milwaukee for a Hammarlund HQ-170 at a "closeout" price. After about a week I got a letter from them saying that they were all out of 170's, but would be happy to sell me a "new 170A" for only a few more dollars!! My only excuse was that my last commercial receiver was an HQ-129X that served me well. Anyway, I fell for it.

When it arrived, I set it up on the kitchen table in my apartment. The first night it never stopped drifting. I noticed that Hammarlund had arranged the vfo tube filament to be on "all the time," and so I left it plugged in and went off to work the next morning. When I came home from work, it was still drifting!! The thing is probably up past S-Band by now!! Anyway, I took it to my friendly local ham emporium and traded it for a 2-B. Smartest move I ever made.

Since that time, I have owned the R-4, A, B, and C lines in approximate chronological order. I never owned a T-4 however. I have never owned a "bad" piece of Drake equipment. My first T-4X, which I drove Drake crazy for after it was first announced, had a serial number of 10102. I found three unsoldered connections in the carrier oscillator area, but once they were soldered, the tx worked for many years with no problem. When I talked to Drake's service department they said I couldn't have that serial number because they never shipped anything below 10200. So maybe they just got tired of me bugging them and sent me a prototype or pre-production model!!

I used these rigs for RTTY autostart for years, 24 hour duty cycle with sometimes 30 minute key-down times. I always used a small "Sprite" fan bolted to the back of the TX cage and would get 3-4 years out of a set of 6JB6's. Sylvania only, of course.

Anyway, now that I have worn out your eyes, I will say that of all the equipment I have owned, I always go back to the Drake. I currently have two C Lines with all Drake filters and NB installed. The only mods I have done were the Sherwood audio amp replacement with the LM-383. They were quite specific about the layout and bypassing of the chip, and I never had a problem with either one. I built the amp on a small (1.5" X 1.5") piece of copper flashing, and RTV'ed it to the shield divider behind the AF Gain control.

Finally, (whew!,) I spent some time working part-time for a Ham equipment retailer in the 60's and spent many "working" hours comparing the

S-Line and the C-Line trying to decide whether to abandon the Drakes for the Collins mystique.

At that time the Manufacturers of ham gear would sell their wares to sales people for 50% of list price rather than the "normal" wholesale of 75% and that brought the Collins down into the "possible" range for the working man! I couldn't convince myself that the Collins was worth the price, and stayed with the Drake. Today the C-Line is on the operating desk and the S-Line is on the storage shelves with the "back-up" C-Line.

I know that many (most) of us fail to recognize the work of people like you who take the time to chronicle this sort of information for the "ingrates" of today and tomorrow!! I am as guilty as most, and after wading through all this, (if you get this far!,) you will wish I had kept quiet!!

Again, thanks and 73. Garey

18.5 JAPAN

In 1978 I was in Japan for an extended visit. Of course, I went to the electronic district in Tokyo. It is a fascinating place! Anything electronic is sold there. The biggest problem is refinding a shop that has what you want after leaving!. And of course there is Ham gear there.

Stuff I've never seen in North America.

I wander into this dealer and there is all the STUFF. More or less on one side of his shop is rows and rows of Japanese gear. I wander up and down the line. Occaisionally, I go over to a transceiver and flick some switches, rotate the VFO .... Sometime later 3 Japanese hams come in and go to the other side of shop - where all the American gear is - Swan, Collins, Drake. I can only make out a bit of what they're saying, but overall, they seem pretty excited as they pull this Drake off the shelf and start flicking switches and spinning the VFO ....

I'm spinning the dial on this Yaesu and talking to myself, occaisionally letting out oooooooooH! Hmmmmmmmmmmmm! Aaaaah! Across the room, these 3 guys are poking this Drake saying OooooooooH! Aaaaah so .... Hmmmmmmmmmmm!

Suddenly the room goes completely silent.

We all turn around s-l-o-w-l-y and look at each other, then look at the radio in front of us and then look at each other again ....

All of us burst out laughing over the irony of the moment.

Wayne, VE3EFJ

Drake Mods

18.6 THE GUF/1
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Gary -

Per your request here's my experience on replacing the 8KHz first IF filter in my R4C with the FT/International replacement GUF1:

Physical Installation: This is a much smaller physical package than the original Piezo filter. It seemed to me that the easiest way to install this was to locate the filter in approximately the same place on the chassis, and drill 4 new holes for the two mounting screws and two I/O leads. I made a cardboard template of the holes required and marked them with permanent marker, then drilled 'em out. The one lead from the transformer needed to be lengthened, and it was installed within an hour.

Operational Differences: In Wayne's words the filter "transforms the receiver". Now, what I lack from Wayne's experience is a ton of time behind this receiver so I'd have a better feel of the change........so I can't give a very good A vs. B comparison. You might want to anticipate some tests to conduct BEFORE you replace the filter so you have something objective to compare it to. Let me at least tell you about some of the things I noticed after surgery.....

When you turn the receiver back on....it still sounds the same. Not much difference there....however what I started to get a real appreciation for was its' selectivity near to loud stations. This is something that plays real havoc with my Yaesu FT757Gx...if I am within 20 KHz of a very loud station I can still hear him creating intermod and splatter or clicks. Not so with the Drake....I think that this was pretty good pre-filter change, but now I am astounded in how well it handles loud QRM.

Just a quick test....I found a 40dB over S9 SSB signal on 75M I could not hear him 3KHz later on the high end of his signal, and he disappeared after 2KHz on the low end of his signal. (I have the stock 2.4KHz filter installed). I found a 30dB over S9 signal on CW, and he was completely gone within 500Hz using the 500Hz filter.

In a way, using this receiver is really strange now, since when you're on a particular frequency....that's it. You're not going to hear the rest of the band along with it. You have to FIND stations now.

Let me know how it goes if you decide to go for it.

73......Craig/W8...

18.7 DRAKE STORY

I just finished a second reading of DRAKEMODv5. Very good job in deed. I decided in November to get back into Ham after a 10 year absence. I found your DRAKEMOD file soon after I made that decision. The first reading prompted me to take a good look at two transceivers TR4Cw and TR7. The third week of January, at 0 degrees my wife and I headed off to Baltimore from home in Lexington KY and picked up a "close to perfection" TR7. I bought it from the original owner who had very nicely included every option available. He had also done most of the mods you list in DRAKEMOD. I could not be happier. I have always been a big Drake fan. The listening post consisted of a SW4A, R8 and SW8. The addition of the TR7 filled most available space and rounded out a good set of radios. Never had a problem with any of them. The SW4A is one owner (me) as is the SW8.

The one complaint I have with DRAKEMOD is that I am now in search of a SPR4. I have always had a thought of getting one in the back of my mind and your document set it to the front. My wife says thank you (I think it was Thank you). Insert smile here. Thanks for all of your work. Now its time to prepare for Dayton and finding a SPR4.

Mark

(I do not know if Mark found his SPR4, <wm>)

18.8 THIS MAKES IT ALL WORTHWHILE

Date: 19-Dec-96 16:38 EST

Wayne-

Thanks a ton for putting together your latest DRAKEMOD5 file! I have a personal reason for reading it - back in 1976 when my Dad and I first got into this hobby, THE station at the time was the Drake "C" Line...I think he went into debt but a year later he had a set while I briefly left the hobby to pursue the usual teenage interests.

Now, 20 years later, my Dad has terminal cancer. I'm trying to restore his C-Line back to original working order.....I know I'm misguided, but somehow I feel that if I can get them working again then my Dad will be 20 years younger, sitting next to me as we nervously fired up those rigs for the first time. Real radios glow blue at night.

I echo your experiences with the TR7A, as well. I had a chance to use a Yaesu FT767Gx and a TR7A over two days of a contest weekend recently. I never had much respect for the TR7A previously, since the Yaesu had lots more knobs and a slicker package...what a wonderful receiver that TR7A had! It was sooooo smooth and quiet compared to that grainy intermod-

laden Yaesu! The only problem that I'll have to look into is that the unit shuts down when keyed at full power. Had to power cycle unit and run it at about 125 watts output to prevent this. I'll have to dig out the power supply schematic and see if there is a current sensor shutdown protection circuit. Any tips appreciated....

I found a box with four untouched Sherwood Engineering kits in it...your comments would be appreciated on these if you know anything about them:

o Product Detector kit for R4C - solid state (was R4C product detector via tube?)

o Third Mixer kit - changes it to solid state mixer, plugs right into tube socket.

They claim that this third mixer tube fries early and causes crackling, and other noise. Audio Amp kit - per your notes looks like an LM383 & a good mod Power supply mod - goes with above audio amp mod.

Just a few points that might be worth including in your next version:

o The front panels are no longer available for the R4C and T4XC.

o The R4C used a 150 ohm resistor in place of the AM crystal filter - plugged into the crystal sockets. This can easily fall out and make the AM mode useless.

o International Parts and RF Parts (both advertise in QST) have great prices on tubes...most are $3 to $4 apiece still. Got almost a full set (minus matched pair of 6JB6 finals) for the C-Line for about $65.

Thanks again and keep up the good work!

73.........Craig/W8...

18.9 COMMENTS BY ROB SHERWOOD

(01 June, 1997)

Dear Thom,

I just read through most of your 60 pages of Drake info. It was interesting to see that much detail in one place. I will digest the rest of it later. If you are interested, I am noting some errors in your information that you may wish to correct in your manuscript. This info is from Rob Sherwood, NC0B, president of Sherwood Engineering, Inc. My company was started in 1974 with our first after market Drake accessory.

I can't take any credit for the material....it was written by Wayne Montague, VE3EFJ montaw@inforamp.net

I forwarded your comments to him

If you'd allow me, I would like to post your message on the web page, to let Drake Owners get more information about you, your operation and how it affects Drake Equipment.

thank for your feedback

73 thom lacosta k3hrn --

Dear Thom,

I just read through most of your 60 pages of Drake info. It was interesting to see that much detail in one place. I will digest the rest of it later. If you are interested, I am noting some errors in your information that you may wish to correct in your manuscript. This info is from Rob Sherwood, NC0B, president of Sherwood Engineering, Inc. My company was started in 1974 with our first after market Drake accessory.

Howard Sartori is an excellent engineer, and his published articles delt with his solid tubes, and some mixer mods. He also was a dealer for me, Sherwood Engineering, for about 8 years. He did not, however, make any crystal filters. We sold the 16-pole filter you refer to, not Howard, W5DA. There were actually several iterations of the filter. The originals were 2.1 kHz wide, with shape factor of about 1.35, but were later pulled down to 1.8 to 1.9 kHz, and finally some 1.6 kHz were manufactured. My dealers at the height were Howard Sartori W5DA, Tim Duffy K3LR, Doc Sheller near Columbus Ohio, and Ingoimpex in Germany. Any of these people resold my filters/kits. (Sartori acutally never bought my kits, as he made his own without pc boards.)

The first IF filters in the C-Line is actually 1000 ohms, not 500 ohm. The transmitter had 500 ohm filters.

The BFO bleed seen as you turn the passband tuning is actually the third mixer signal on the same frequency as the first IF. This 5645 kHz signal gets back into the first IF, and gets phase shifted in and out of phase as you electrically tune the 2nd IF crystal filter with the dual-injected 50 kHz BFO.

The real purpose of T-7C tap was to reduce the noise bandwidth of the third mixer in the 500 and 250 Hz positions. The higher Q in the tapped mode narrowed the bandwidth of this stage to about 1 kHz. You are correct on the cable difference, the white audio cable being much higher C than the later RG-174. There was extra loss in the narrow CW positions

until this error was corrected by Drake somewhere in the 23,000 s.n. range.

Origianlly the filter insertion loss spec for the C-Line was 9 dB +1 -2 dB. (i.e. 8 db to 11 dB insertion loss) There were pads in the wider filters to bring them up to the loss of the narrow ones. Heath Dynamics and Piezo Technology followed this spec, but Network Sciences under Howard Fulk did not. Howard later sold N.S. to Darryl Kemper and his sons. I do not know if the tail-end Japanese filters were loss equalized or not.

The LM-383 audio amp, again, was a Sherwood design, not Howard Sartori. Howard, did however, design in the TL-442 for Drake mods, an IC that we used for many years in our PD-4 product detector mod kit. It was a great chip for its day, though overshadowed now by the NE-602A. The solid tubes were totally Sartori designs, which we resold for some years.

When Howard discontinued his business, Sherwood invented the MIX-4 solid state 3rd mixer replacement. It ran on 12 volts, however, not 150 as did the Sartori solid tubes. Howard later had to quit using the solid tube moniker, as it turned out to be trademarked by some other company.

The power supply that bootstraps the 1/2 wave rectified filament DC into the center tap of the 12 volt suppy is needed on old 16K to 18K radios. Those 12 volt supplys do not perform well with the 7812 and LM-383 as there is not enough input/output differential for the 7812. While only a small percentage of the hundreds of C-lines we have modified over the years need that boost, it is occasionally necessary. For that matter the set that is here now for mods had to have that mod added to it.

The later vintage mixer tube that replaced the 6HS6 is a 6EJ7, not a 6EH7. While Sartori's modified 3rd mixer injection was interesting, I feel the only real solution is our MIX-4 mod. It goes back to seperate inputs for signal and LO, runs FB on 500 MV diode-limited 5645 kHz LO injection, and doesn't go noisy (crackly) micorphonic. The hash that gets in via the power line into the floating grid is in deed awful; a terrible design on Drake's part. Light dimmers, acquarium heaters, motors, etc. really get into the 50 kHz floating grid. A good shielded isolation xfmr usually killed the crud, as did a ferro-resonant voltage regulating xfmr, but the real answer was to go back to T-6 feeding right into a tuned signal port that was a short circuit at 50 kHz.

The best answer to the buzz in power supply/audio was our PS-4 (like your 7812) and our AMP-4. It was not in the ground loop field as was the stock amp. The changed filter cap return grounding did help, but getting the amp right behind the headphone jack out of the chassis currents was the answer.

Yes the LM-383 can oscillate, but we have sold over 500 AMP-4s and over 300 SE-3 phase-locked detectors/amplfiers that use the same chip, and none of them oscillate with our compensation circuit. Without the right compensation, you are correct in saying that the chip can turn into a oscillator drawing upwards of 2 amps!

So that's it. Hope you do not take all this info as an insult. It is simply information from being in the Drake mod biz for 23 years.

Check out our WEB page at www.sherweng.com. It is new, and is still being built. My E-Mail address is Rob@sherweng.com. (Any name acutally works, as all email to sherweng.com gets to me.)

Sherwood also originated the 600 Hz first IF cw mod, the CF-600/6. It is still available today. Unfortunately we did not develope a good PC board/relay switching kit until Fox Tango came out with their GUF-2. I was engineer for KOA radio at the time, and Sherwood Engineering was a sideline business until 1987.

Our first product was the CF-125/8 2nd IF crystal filter. Ours was typically 115 Hz by 270 Hz, with a 8 dB insertion loss. The Japanese copies were 135 Hz, later 150 Hz, and near the end as wide as 175 Hz at -6 dB.

Enough trivia.

73

Rob Sherwood President NC0B

(authors comments follow)

The above was forwarded to me by Thom LaCosta, the Major Domo of the Drake web sight, as received from Rob Sherwood. Sherwood Engineering, for those that are unaware, was a major force in Drake modifications in the 70's. I say 'was', as I lost record of his company's involvement in Drake equipment roughly in the mid 1980's. Its only in the last 6 weeks I was aware that Sherwood Engineering was still offering Drake modification kits.

Rob has much more insight into the history of Drake than I do, and I will let the above speak for itself. I consider it a priveledge to be able to encorporate Rob's comments.

I will make only two comments and we will let it go at that. Rob is an engineer with extensive background. I am NOT an engineer. My reference to the LM383 was merely to indicate 'Don't do this at home' (unless you know what you are doing). The LM383 kit by Sherwood is of course solid. Regarding the 12 volt boost, Rob is correct. I'd prefer to go to solid state audio and regulator and raise the 12 volt line by lightening the load rather than using the filament line. National also offers low headroom regulators in the LM29xx series that could be appropriate.

<wm>

Reader Feedback 99
Authored by VE3EFJ

Drake Mods

18.10 B LINE TRIVIA

The following appeared on the Drake User Group in July:

Wed Jul 2 18:14:13 1997 ;p.I am not a Drake expert, but in selling, owning and repairing Drake gear since the 1-A, I have had quite a few discussions with Drake service over the past 40 years. Yikes! ;p.The transceive system used in the 4A and B lines relies on the relative stability of the carrier oscillators in the receiver and transmitter. Somewhere in the life of the A series, Drake began color coding the carrier oscillator crystals in an attempt to match their frequency vs. temperature characteristics. There were at least three color coded sets of crystals. Red, Blue, and Green. There may have been others, but I have owned all of the above. The serial numbers marked on the rear of the receiver and transmitter each end in a letter, R, B, or G. There is also a color stripe of paint on the crystal under the chassis. For best temperature tracking, you need to have the same "color" crystal in both the receiver and transmitter.

I am not absolutely certain about the following, but to the best of my recollection the Red crystals were a positive TC, (increase in frequency with increase in temperature,) the Blue were approximately zero TC, and the Green were negative TC. I think this information came from Drake some years ago. IF this is true, the worst "mixed" case would be a Red/Green pair, with a Red/Blue or Green/Blue better. Obviously, a matched pair is the optimum, but we don't always have that choice these days. Many years ago, when I first ran into this situation, I was able to exchange a crystal for the receiver in my pair with Drake. I had a Blue/Green set, and exchanged the Green for a Blue at no charge with Drake. SO.... Don't rely on the letter on the serial number. You may get the receiver I modified, or one of the many others that were probably similarly done. Look at the color stripe on the crystal to be sure.

Maybe we could start a "color exchange" via the Drake list !!

The C-Line of course eliminated this problem by patching the two oscillators together, enabling a sort of phase lock between them.

Hope this helps.

Reader Feedback 100
Authored by VE3EFJ