SUPPLEMENTAL TECHNICAL INFORMATION

FOR

HALLICRAFTERS

SR-160 AND SR-500

TRANSCEIVERS

The little radios that could

STUFF NOT IN THE BOOK

By WDØGOF **August 2010(updated 9/30/2012)**

HALLICRAFTERS, HAM RADIO, & WDØGOF

I was working for Wilcox Avionics in the 60’s & 70's when Hallicrafters became part of Northrop/Wilcox. I was taken by the Hallicrafters gear so much so that I went and took the test and got my call sign. I left Wilcox in 79 and due to business travel requirements I became a dormant ham, but kept the ticket alive. In '95 I retired (at 54) and spent 5 years RV’ing the USA. With that out of our systems my wife and I settled down to retired life with church and family. I became an active ham again. I had a bunch of old "H" stuff around. I sold all the old tube junk. This funded the purchase of top of the line MODERN equipment. I still have **nightmares** over that act of stupidity. It only took me a year to realize, that was a mistake. I sold all the Taiwan and Japanese gear and started re-collecting Hallicrafters SR series "tech units" and "parts units". To date I have not purchased a single working rig although I have bought several ***“it worked fine the last time I used it***” rigs. I have a complete collection of the full production SR series HF transceivers in operation in the shack. There are 7 full production rigs in this series and I have restored many of each from the 100watt SR-150 to the 1000watt SR-2000. I have at least 1 of each on the "to be restored" shelves. I have to admit that I enjoy repair and restoration more than operation. Of the series, my go to rig is the SR-500. It has only two "bells or whistles" xtal cal and RIT so it is truly nostalgic operation. It is quick to tune, very stable (now) and enough punch to get through the noise. I don’t contest and if I ever make a DX contact, well that’s nice. I’ll have to admit that it is not a CW rig, no narrow filter, no VOX (unless you add the HA16 VOX unit) and no break-in keying. But then I have a hearing condition that runs the dots and dashes together at about 9 wpm so that makes me a **nuisance** on cw.

Why a paper on the SR-160 and SR-500? Well I like the little guys. Any time I would bring them up in conversation I would hear “Oh that’s the little tri-bander that drifts all over the place.” I have to admit if they haven’t been cleaned up that is exactly what they do. But with a little TLC they are great communicators. So after several years of working on them I thought I would share what I have learned.

73’s Walt WDØGOF

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SR-160 OVERVIEW

This SR-160 dressed up with a VFO tuning knob from the SR-150

Contrary to many reviews of the SR-160 Transceiver it is not a scaled down SR-150. It was designed specifically to fill a perceived market niche. The frequency synthesis is totally different and it is a single conversion receiver. The xtal filter in the 150 is 1650 KHz and 5200 KHz in the 160. It is a tri-bander covering the complete 80, 40, and 20 meter ham bands. Power input of 150 watts for SSB and 125 watts for CW. The receiver section has a sensitivity of 1 microvolt for 20 db signal-to-noise ratio, a 5200 Khz IF, and a crystal lattice filter for selectivity. It has a 100 Khz crystal calibrator. The power requirements are: 12V ac at 4.5 amps, -125V dc at 6.5 ma, 150V DC at 175 ma, and 575V DC at 200 ma. Production year 1961-63.

SR-500 OVERVIEW

The Hallicrafters SR-500 Tornado is a ham radio transceiver designed for 500 watts input PEP on SSB and 300 watts input for CW on 20, 40 and 80 meters. Introduced in 1965 at a price of $395 plus $119.95 for the AC power supply. It is in fact a beefed-up SR-160 using a matched pair of 8236 power output tubes in place of the 12DQ6B pair in the SR-160. The 8236 is a heavy-duty carbon-plate tube and is not that common. The PS-500AC power supply (on the right) is specifically designed for the greater power requirements of the SR-500. A matching mobile supply, PS-500DC, was available at $149.95. The 12AU6 tube and the 100 KHz crystal for the crystal calibrator were extra-cost options (installed in this set).

In comparing the schematics for the SR-500 and the SR-160, only a few differences are noted. R92 is 220K ohm in the SR-500 and 180K in the SR-160. R96 is 56K in the SR-160 but removed from the SR-500. These resistors are in the grid bias line, shown as -55 volts on the SR-160 schematic and -85 for the SR-500. The external bias power supply input requirement for both sets is -100 volts. The 12DQ6B pair operates at 575 volts on the plate and the 8236 pair is supplied with 800 volts from its external power supply (750 under load). The 8236 requires more filament current (and more plate current!). Nearly all other requirements and specifications appear to be similar in the two sets. There is a zener diode switched in to stabilize the voltage on the VFO tube when in DC or mobile service.

160/500 basics

The SR-160 and 500 are basically the same radio The biggest change was in the transmitter PA section. They went with stronger tubes in the finals and made a few bias changes. The 500 uses the PS-500 series of power supplies where the 160 uses the PS-150 series power supplies. We will discuss the tubes later. The RX, although being single conversion does a remarkable job. It manages to provide ½ watt audio out with 0.6 to 0.9 uv input and s+n:n of around 20db at 1.5 uv. The AGC flattens out at about 3 to 8uv and provides about 3 to 3.5 watts of audio up to around 8 or 10 thousand uv before the audio out starts to rise again. Although I have never heard a 160 or 500 on the air all the reports on mine are good. People report "clean, clear, good sounding audio". Some are actually amazed that an old 60's vintage rig sounds so good. Aside from the lack of features the most offensive problem with the little guys was they tended to be drifty. This too will be covered later.

SR-160 TO SR 500 EVOLUTION

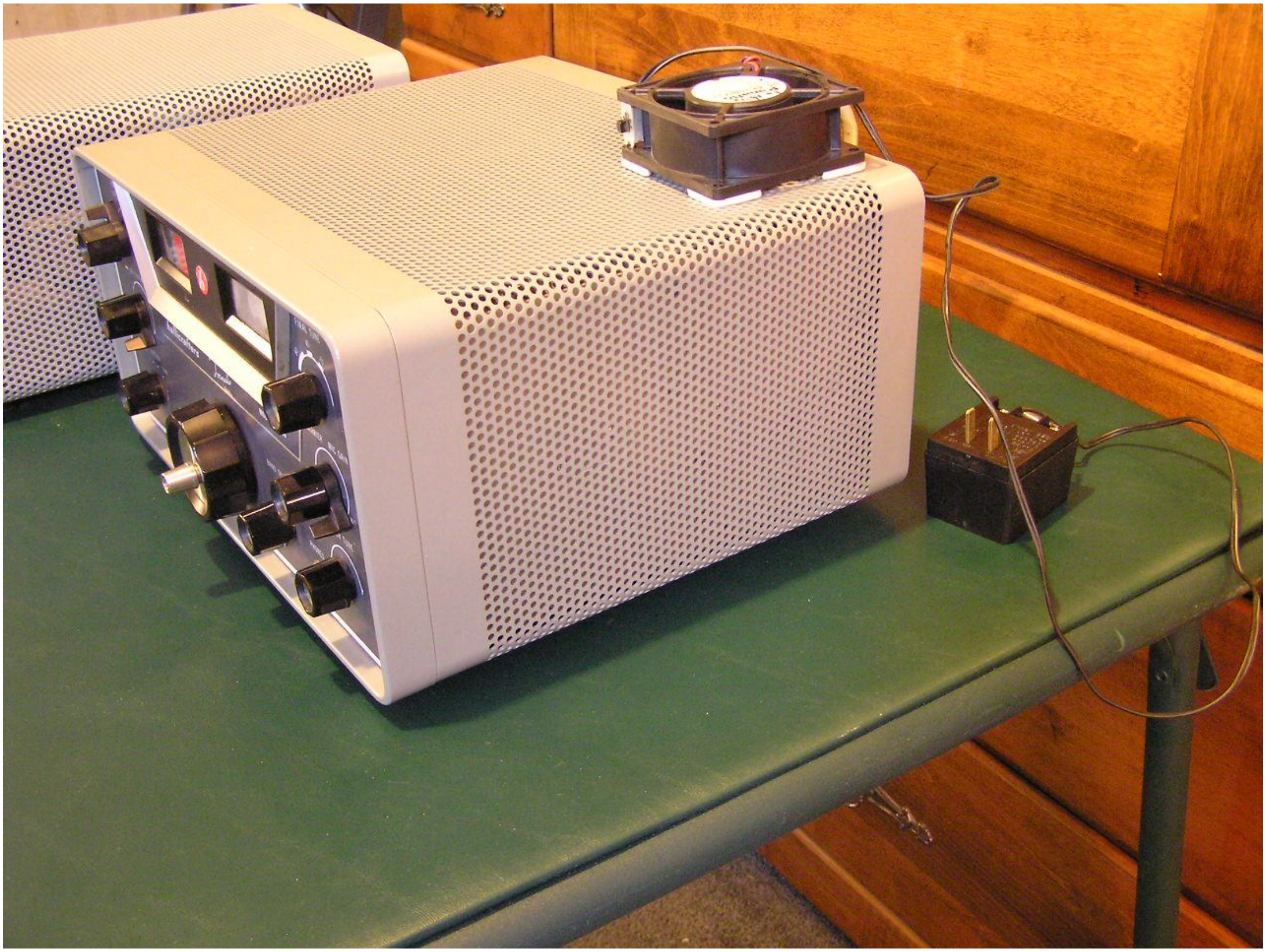
The following is based on a little fact, some conjecture and rumors. By its third year of production sales of the 160 had dropped significantly. The reasons were many. It was drifty. In mobile operation the drift problems were even more noticeable and mobile operation was a major marketing hook. The power output, watts per $ was low. However the marketing people at Hallicrafters believed the niche was there. So the engineers set about to clean up and power up the 160. They stabilized the VOX/Cal circuitry. They added a voltage regulator for the VFO tube filament for DC mobile operation. Most significant, they gave it a PA that would put out a true 250 to 300 watts of power to the antenna. Of course the marketing ploy of **"500 watts of input power"** was used. Unfortunately they did nothing to the VFO and as the little tri-bander accumulated hours it became drifty again. Later in this writing "we gonna fix that".

SR-500 finals

Hallicrafters selected the 8236 for the final amps. This is a truly remarkable tube. As long as it is not gassy or shorted it's good. The solid carbon block plates are indestructible. With a plate dissipation of 50 watts each they will take a lot of misuse and a very heavy duty cycle. The prime user of this tube was the Navy and Coast Guard. When they did away with the equipment that used the tube all production of the tubes halted. When I checked with my Navy contacts I found that the Navy cleared all their stock of 8236's around 1985. You can still find NOS tubes. I suspect that some one bought the navy stock and is slowly selling them to keep the price up. You can find them on ham classified sites and ebay. I buy "cheap" singles and pairs and very seldom get duds. I seldom resort to ebay. I plug a single tube in the rig with no RF drive. Then I record the bias voltage for 35ma and 150ma of plate current. Then I match tubes with similar readings.

There is an alternative. The 8236 is a beefed up direct replacement for the 6DQ5. The 6DQ5 has a plate dissipation of 24 watts. So you have to be cautious of the duty cycle. I also use a muffin fan with stick-on felt pads, placed on top of the rig over the finals sucking hot air out. The power output with a good matched pair of 6DQ5 tubes is equal to the 8236. Some of the 6DQ5 tubes are taller than the 8236 so you may have to dimple the PA cover for clearance. Careful, dimple too high and the case will not go back on.

I would expect the life to be shorter for the 6DQ5 but have no verification of that. There is an $80.00 difference in the rig price between the rig with the 8236 and 6DQ5 finals. I have sold several 500's, at the buyer's choice, with the 6DQ5 finals and have not received any negative comments. But then, once the deal is done you seldom hear from them again.



This one was rescued from the loft of a barn. Restored, striped and painted.

POWER SUPPLY NOTES

When recapping power supplies there seems to be an uncontrollable erg for most people to install a three-wire power cord. Don't do it. The PS-150-120 and the PS-500 power supplies do not like three wire power cords. The system will have a 60/120 HZ hum. A keyed 2 wire cord should be used. On the PS-150 the wide pin (the neutral wire) of the plug will connect to C202. The narrow pin connects to the fuse. Use the same format for the PS-500. Capacitors C201 and C202 ***are safety*** capacitors. "Line-to-ground" line filter capacitors should be replaced with Y2 or X1/Y2 safety capacitors. (Do not use X2 type). All caps should be replaced with modern caps not NOS parts. NOS parts were made with old methods and old materials. Modern methods and modern materials are far superior. The only good use of NOS parts is in museum radios that will never be turned on.

ALIGNMENT TIPS

TEST EQUIPMENT CONSIDERATIONS.

No exotic test equipment is required for repair and alignment of the SR160 and the SR500. The following test equipment is the minimum requirement.

1, **Signal generator**: URM25 or spec similar RF generator.
2, **O'scope:** At least 100MHZ bandwidth. 1X, 10X and 100X probes.
3, **Audio output meter:** The General Radio Model 1840A is perfect. The meter is calibrated for power and DB measurements.
4, **Audio oscillator:** It must cover 500HZ to 4KHZ with a **600 ohm output Z_o** and provide .005 to 10v output.
5, **RF wattmeter:** A 500 watt full scale wattmeter is recommended. Highest accuracy is achieved in the middle third of the scale. The SR-500 will normally provide 200 to 275 watts.
6, **VOM, DVM:** Don't spend too much money hear. The Harbor Freight $4 seven function meter is good.
7, **RF rms voltmeter:** This is optional, I use the scope and mentally convert from rms to pp. If you like the Meter, you will need a range from 5mv to 300v.

NOTE: If you intend to move on to the rest of the SR series you will need a spectrum analyzer and a sweep generator.

VFO AND XTAL OSCILLATOR CONSIDERATIONS.

Before starting any receiver or transmitter RF or I.F. alignment it is **imperative** that the xtal oscillators and the VFO are **precisely** on frequency. If you will devote the time to these considerations you will be rewarded with a rig that performs as well as any modern rig. A frequency counter is a must. The procedure in the book will work ok, but will compound errors. If you get all the oscillators "on freq" individually then all else will fall into place. Do not make any adjustments until the rig has been on for at least 30 minutes. Do the VFO last to insure it is stable.

HETERODYNE OSCILLATOR

The heterodyne oscillator functions only on the 40 meter band and does not effect the operation of the 80 and 20 meter bands. **There is no frequency adjustment for this oscillator.** The spec is + or – 1KHZ. If it is off frequency then you will have to live with it and "CAL" any time you go the 40 meter band. **Or,** there are a few things you can do to shift the frequency.

Connect your frequency counter to test point A. On the 80 meter band set the dial to 3.8MHZ and fine tune the frequency to exactly 9.000MHZ on the counter. Then switch to 40 meters. The counter should now read exactly 12.400 MHZ. If it is not then try the following:

1) You can hand select the tube V11, this can shift as much as 500HZ.
2) T8 will shift the frequency of the oscillator, but care must be taken to insure you do not detune too far off peak. No more than 15% off peak.
3) In my personal rig I replaced C79 with a 9-35pf variable cap. (T8 and C79 adjustments will interact)
4) The crystal is the last resort. If the oscillator is way out of spec or won't oscillate, and you can find no other part at fault, then try to find another xtal. After replacing the xtal you may still need to correct the frequency.

This oscillator will take more time to get right than the others but it is worth every bit of the effort.

CARRIER OSCILLATOR

This oscillator has a trimmer adjustment, C48. Simply connect the frequency counter to test point B and adjust C48 for exactly 5.200MHZ. The adjustment of C48 and T6 do interact. So anytime you change the tuning of T6, recheck the oscillator frequency.

ALTERNATE VFO ALIGNMENT

I prefer to use a freq. counter to align the VFO. Using X10 scope probe connected to the freq. counter and test point A. Set the band switch to 80 meters. At 4.00 on the dial the VFO is 9.200 Mhz. At 3.500 on the dial The VFO is 8.700 Mhz. At 3.800 on the dial the VFO is 9.000 Mhz. **When aligning the VFO insure that the RIT is OFF and the CAL control is in the center of its rotation.** The adjustment of C127 and L18 interact and a *feel* for rocking the two adjustments in for the band ends will need to be developed. Use the procedure as described in the manual. Do the mechanical index adjustment first (section 8-8 in the manual). Now read sections 8-9 and 8-10. Once you have read these sections and have an understanding of what is going on you can start. These adjustments are simple but **critical** if you don't understand them, find an Elmer. When using the frequency counter method you will **not** turn the calibrator on. Make the following changes to steps in section 8-10

Step 2. Set the BAND SELECTOR at 80M, the OPERATION control to REC ONLY, and the RIT control OFF.

Step 4. Set the dial at 4000 KC and adjust C127 for exactly 9.200 MHZ on the counter.

Step 5. Set the dial at 3500 KC and adjust L18 for exactly 8.700 MHZ on the counter.

NEVER DO STEP 7 UNLESS YOU ARE VERY SKILLED IN THE KNIFING PROCEDURES. C130 IS VERY FRAGILE AND THE UTMOST CARE IS REQUIRED TO PREVENT THE CAPACITOR BLADES FROM FALLING OUT…………..!!!!!!!!!!!!!!!!!!!!!!!!!!

RX ANTENNA & DRIVER INPUT & OUTPUT

The procedure in the factory manual is good. I offer the following suggestions for your consideration. Sections 8-14 and 8-15 are good procedurally but some clarification is needed. Start by setting the PRESELECTOR to the center of its rotation and LEAVE IT THERE. Do not readjust it at any time during the entire alignment process. On each band set the VFO Main Tuning to the center of the band you're tuning. If you are a General class doing 80 meter band set the VFO to 3.900 Mhz, ok, get my drift. Then do not move the VFO until you finish that band. Always tune the driver input and output coils first. Then tune the receiver antenna coils. When aligning the antenna coils tune your signal generator to your VFO setting, don't tune the VFO to the generator The procedure in the manual has you tune all bands on TX first and then tune the RX. However, in order to get the TX peak and the RX peak to coincide they both need to be done without changing the settings of the VFO or the PRESELECTOR. Align all three bands WITHOUT moving the PRESELECTOR knob, keep it in the center of its rotation (I seem to be repeating myself but this is important). On each band you will have to tune the VFO to the center of that ham band, but once you start on a band the VFO should not be moved. If you cannot get the RX and TX to track you have a circuit problem and a part has failed. Read the procedure, look at the schematic and think about it a little before you start.

BAND ALIGNMENT INTERACTIONS.

The 80 meter coils, L1, L5 and L8 are in the circuit on all three bands. Therefore you must start the alignment on the 80 meter band first. The 20 meter band driver grid coil L7 and plate coil L10 are greatly affected by the alignment of the 80 meter coils. The process should be: align 80 meters RX L1, TX L5 and L8; align 40 meters RX L2, TX L6 and L9; align 20 meters RX L3, TX L7 and L10. If the power is low on 20 meters then, while transmitting on 20 meters adjust the 80 meter coils L5 and L8 to see if the power will come up. If it does and takes less than ½ turn on either 80 meter coil go back to 80 meters and check power out. If 80 meters has **not** dropped off too much you are good to go.

If however it takes more than ½ turn on the 80 meter coils or 80 meter power has been significantly reduced then you have a component failure or degradation. It is time for some ***intuitive logic reasoning.*** Go back and realign 80 meter L5 and L8 for max. On 40 meters recheck alignment of L6 and L9 then test the effect of L5 and L8 on the 40 meter power out. If there is little or no effect then suspect C94, 95, 103, 106 L7, or L10.

If the 40 meter test shows significant interaction then C8B, C8C, C107, C91, L5, L8, L19 and neutralization may all be considered as possible causes along with V14.

Also note that the driver grid coils also act as the RX RF amp (V1) plate tuning. So some ***intuitive logic reasoning*** needs to be applied when aligning the RX.

T7 AGC AMP

Be careful here, read section 8-17-4 closely. A common error is the tune T7 for a peak in audio output from the receiver. T7 should be tuned for peak AGC action (most negative agc voltage) which will cause the audio output to drop several db from peak. The AGC is monitored by the S meter or it can be measured at the junction of R65 and R67. I prefer to hang an X10 probe on the junction of the resistors and observe the AGC action on the scope. Miss-tuning of T7 will also cause the AALC to malfunction. Proper alignment of T7 and T4 is essential to successful alignment of the radio. Once again read the entire alignment procedure carefully before starting.

T3 RX/TX INTERACTION

T3 is the plate loading coil for V3 the receiver First IF Amp. V3 also functions as the RF amp for the carrier osc after passing through the lattice filter in the transmit mode. Prior to performing T3 alignment (8-16 in the manual) **insure** that the 5200KC oscillator is **exactly** on frequency. After aligning the T3 and T4 - T7 (8-17 in the manual) and performing the lattice filter checks and alignment in paragraph 8-18 check and record the receiver sensitivity at 3800KC.

NOTE: The procedure in 8-18-2 is precise and sweeping the filter is not necessary. If you encounter problems then you have a failed component

To properly check the sensitivity, tune the signal generator and the rig to 3800KC. Then adjust the generator level for 0.5 watts audio output with the RF and AF gain at max. The signal level should be around 1/2uv (Spec states 1.0uv but most receivers will provide 0.5 watts output at between 0.5 and 0.7uv). Now readjust T3 for max audio output. If you get more than 3db increase in audio output when T3 is readjusted then there is a problem. Go back and realign steps 8-15 thru 8-18 again. If this does not help then, most likely, one of the following is bad: V3, T3, C23, R19, R23, C21 or C20.

The S Meter

S-reading	HF µV (50Ω)	Dbm	Signal Generator emf dB above 1uV
S9+10dB	160.0	-63	44
S9	***50.2***	***-73***	***34<***
S8	25.1	-79	28
S7	12.6	-85	22
S6	6.3	-91	16
S5	***3.2***	***-97***	***10 <***
S4	1.6	-103	4
S3	0.8	-109	-2
S2	0.4	-115	-8
S1	0.2	-121	-14

The S unit is a reflection of signal level at the antenna. So what in the typical receiver has a direct relationship to the input signal? Simple, the AGC, right, well almost. There is a hole in this concept. In almost all receivers AGC threshold is about .1 to .3uv and doesn't reach linearity until around 3 to 5 uv. This has become a de-facto standard, as is the case with the SR-160/500. The most linier area of SR160/500 AGC circuits is from 3 to 200 uv. So we try to get S-5 at 3 uv in and S-9 with 50 uv in. Ok, this should be easy; all we need to do is develop the algorithm to match the AGC curve to the current curve of a meter circuit. The designers accomplish this with resistor networks and the characteristics of a tube. As these rigs age components change in value and the algorithm is no longer true. So we have to select tubes to match the curves and correct the algorithm. However in the 160/500 half the tube is the meter amp the other half of the tube is the 2nd IF amp. This is characteristic for most of the SR line of transceivers. The best tube for the meter is not always the best for RX gain. To get it right you need a bunch of tubes and a few minutes to sit and hand select the tube that makes both work. Since gain is most important we usually shoot for good gain and S-9 close to 50 uv. I think this was Hallicrafters attitude when they wrote the spec. "**A signal at the antenna of between 25 uv and 50 uv will produce a meter reading of S9**" pretty broad spec.

S METER AMP TUBE SELECTION

V4B is the Meter amp. Unfortunately, as stated above, the other half of the tube is the second IF amp. The meter amp ckt is extremely sensitive to the tube characteristics. If you have a double handful of 6EA8's you can select for one that will give you S5 at 3 uv and S9 at 50 uv. You need to allow 5 minutes for warm up with each tube. You will need to re-zero the meter with each tube. You will find some tubes that flat won't work even though they are perfectly good. I have three tube testers so I set them up to preheat the tubes. That speeds up the process. I try to find several tubes that will work because next I'll have to find one that also works well in the second IF slot. If it just won't come in then get a hand full of 2% carbon film resistors and replace R68, 69, 70, 71,72, and R77. Or forget the S meter pick a good tube for the second IF and have fun with your radio.

AGC CONSIDERATIONS

The AGC measured at the junction of R65 and R67 should be around +0.1 to +0.3 volts with no signal in. This is a high impedance line so I prefer to use a scope with an X10 probe to make this measurement. At 0.1 to 0.3 uv of signal at the antenna jack you should start to see movement in the negative direction this is the AGC threshold. At 1 to 3 uv the AGC should be around -1 volt. At about 10,000 uv the AGC will saturate at about 14 to 15 negative volts. The factory spec for the AGC figure of merit is**:** With a signal at the antenna terminal from 5uv to 1500uv no more than a 10 db variation in audio output shall occur. The actual figure of merit for the 160 and 500 for a 10 db change commonly runs from 5 uv to 50,000 uv. Due to the high impedance of the circuit the component tolerance drift due to age will cause the threshold and figure of merit to vary greatly from rig to rig but they will very rarely fail to meet spec.

MISC NOTES

TUNING FOR PLATE I DIP

In order to operate the finals in the most efficient manner the plate loading should be adjusted for plate current dip. When the rig is properly neutralized the power out **peak** and the plate I **dip** will occur concurrently. The only way to monitor the plate dip is to use an external meter connected to TP-201 and TP-202 in the power supply. *See paragraph 8-3 in the manual.* I keep a meter attached to the power supply when ever operating an SR-150, SR-160 or an SR-500. *See page 5 of this document.* **Also, I always tune for the plate I dip, regardless of the peak power point.** When the plate dip and power peak differ by more than 15 or so watts I re-neutralize. Be very suspicious any time the plate I dip exceeds 450 mills on the SR-500 and 300 mills on the SR-160. This is of extreme importance when using 6DQ5's in place of the 8236's in the SR-500. To keep plate dissipation at a minimum you must be tuned to the plate dip.

RX RF AMP MOD

The receiver gain on the 160 and 500 is ok, but does not quite match the gain of the rest of the SR series. This is a simple fix. Simply replace V1 the 12BZ6 with a 12DK6, it's a direct replacement. This will provide from 3 to 6 db more gain. The AGC tracking normally runs in the order of 5 to 8 times wider than spec. So even with the additional gain in the front end it will still meet the AGC figure of merit spec

RIT/CAL

The RIT/CAL ckt is virtually the same for the SR series gear from the SR-150 thru the SR-2000. The advertised purpose of the RIT was to allow you correct for contacted station RX/TX off set of up to 3Khz.

The RIT (receiver incremental tuning) function is used to offset the transmitter and receiver frequencies. Even if your rig is perfectly tuned and on frequency those you operate with may not be. A difference of just a few cycles can cause you to walk up or down the band. When the RIT function is turned on the transmitter is still controlled by the CAL control but the receiver frequency is varied by the RIT CONTROL. This allows you to fine tune your receiver without moving your transmitter.

The CAL function in the SR-160 and 500 is needed to correct any slight error in the HET osc. The 3400Khz heterodyne oscillator is switched on when the 40 meter band is selected. This xtals has no trim adjustment. During assembly and test, at the factory, xtals were hand selected for minimum error. However any error of a few cycles or more can be detected by the ear. If everything is aligned and tracked correctly the CAL operation corrects for the entire band. The CAL operation must be performed each time you change bands and should hold until the band is changed again. As long as the carrier oscillator (the 5200Khz) is on frequency, then once either the 80 meter or 20 meter band is calibrated the other will be calibrated. If you calibrate on the 80 meter band and the 20 meter band is off frequency you have a circuit failure.

NOTE: The specs are a little vague on the tolerance for the oscillators in the SR series. The overall spec for maximum band to band shift is ***2 kHz*** which seems like a lot. However I did find one spec sheet that stated that the minimum swing on the CAL and RIT controls is +/- 3 kHz another stated +/- 4.5 kHz. This is more than ample to off-set any osc differences if they are within these specs.

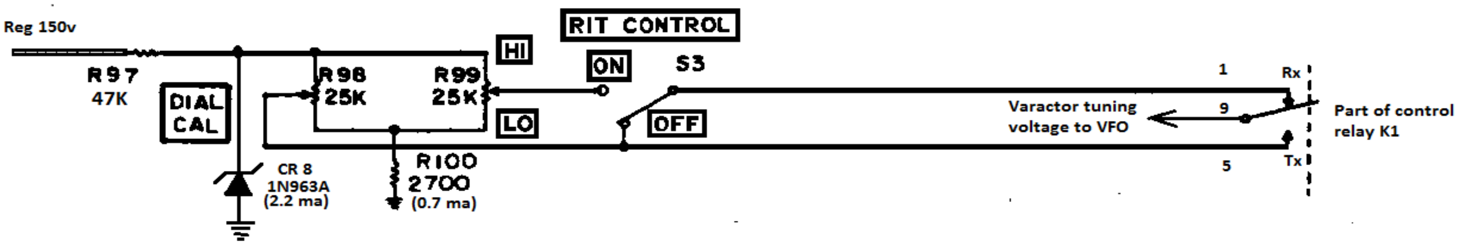
The CAL ADJ and the RIT CONTROL are both used to fine tune the bias voltage on the vari-cap (also referred to as a veractor diode) in the VFO. With the RIT off both the TX and RX are fine tuned by the CAL ADJ pot. With the RIT ON the RIT CONTROL fine tunes the RX and the CAL ADJ controls the TX. These two pots are in parallel in the vari-cap voltage divider network and are switched by K1. On a perfectly aligned band when the CAL ADJ pot is in its electrical center position then the RIT CONTROL will also be in the center of its rotation.

SR-160/500 DRIFT

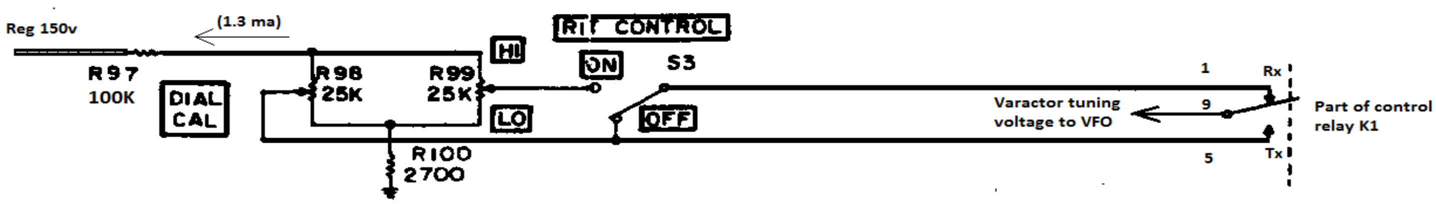
CAL/RIT CIRCUIT CONSIDERATIONS

The SR-160 and the SR-500 have been plagued with drift problems as they have aged. The 160 had minor drift problems from its inception. When the 500 came along an attempt was made to correct part of the problem with the inclusion of a zener diode in the RIT/CAL circuitry. I have found two problem areas contributing to the drift problem. The first is ageing of critical parts in the VFO and second is DC instability in the RIT circuitry.

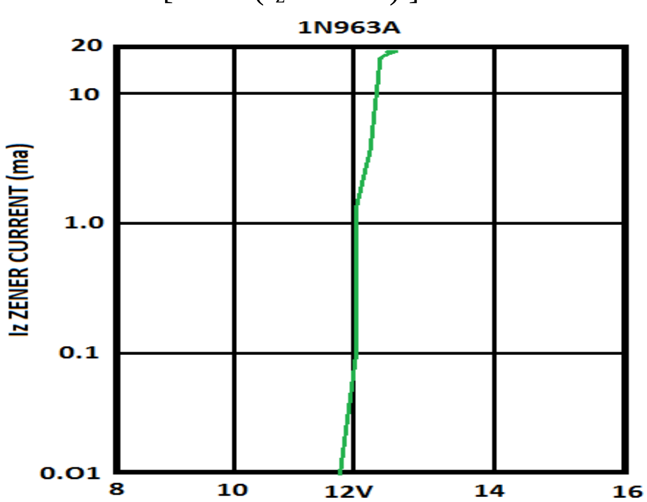
SR-500 RIT



SR-160 RIT



The linier range for the 1N963A is from 0.1 ma to 2 ma. The original design of the zener ckt has the zener drawing 2.2 ma. That puts the zener just above the knee of the flattest part of the curve. Under normal circumstances this would still function properly. But this does explain why it takes longer for the 500 to stabilize after turn on. If you operate in an uncontrolled environment such as field day in the fall, chances are, it'll never stabilize. If you stick with the 1N963A then R97 should be a 75K 1% or 2% resistor. If you go with a different zener diode pick a current level between ½ and 2/3 up the flattest part of the curve. The zener current + resistor network current (0.7ma @ 12vzv) will be used to calculate the value of R97. [150V – V_z /(Iz + (Vz/15.2k)] or for 12 v zener ~ [138v/(I_z +0.7ma)]



There is nothing magical about 12v, that's just what they used on the SR-500. On the SR-160 the voltage at the top of the resistor network is 19v. There are two things to be concerned about when changing the voltage at the top of the network. First, the higher the voltage the wider the tuning range of the CAL and RIT controls. At first that sounds like a good thing. However the wider the range the more unstable the vfo and the more difficult it is to track the Rx and Tx. Note also any change in the voltage will require re-tracking and alignment of the VFO.

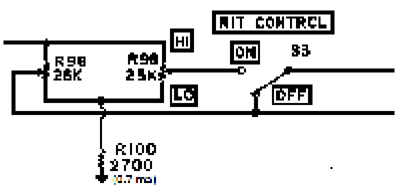
Use metal or carbon film 1% or 2% for R97. There is not much you can do to improve the resistor network, R98, R99 and R100. There is not much point in replacing R100 with a more stable type. The pots R98 and R99 with an equivalent resistance of 12.5K swamp out any effect caused by R100. The pots should be cleaned and lubed with a suitable control lubricating/cleaning spray. If R98 and, or R99 have been replaced you should check to insure they are of equal value and have the same taper. Differences in these two pots will effect the operation of the RIT.

Cleaning of the relay contacts and S3 is also important.

The addition of a zener and replacement of R97 is highly recommended for improving the operation of the SR-160. The same process is used to determine the value of components on the 160 as used on the 500.

RIT OFFSET AND RANGE TEST

To test the range of the Cal/Rit circuit turn the RIT off. Set the CAL control to the center of its rotation. Set the band switch to 80 meters and the frequency dial to 3.8Mhz. Connect a frequency counter to pin 1 of V2. Fine tune the frequency dial for 9.000Mhz on the frequency counter (If the dial is off do not be concerned at this time, tracking and alignment of the VFO later will correct for any error). Now rotate the CAL control and note the frequency shift in both directions. It should shift + and – 4Khz or a total shift of 8Khz.



If the total shift is more than 8Khz then the voltage at the top of R98 and R99 is too high. If you do not get enough shift the voltage is too low. Nominally the voltage should be from 9 to 11 volts. If the frequency shift is not equal in both directions from the mechanical center of rotation then R98 is at fault.

Now return the CAL control to the mechanical center and readjust the main tuning for 9.000Mhz. Turn the RIT control ON. Adjust RIT HI/LO control for 9.000Mhz. The index line on the HI/LO knob should be within 15^{o} of top dead center. If not then you may have a problem with R99.

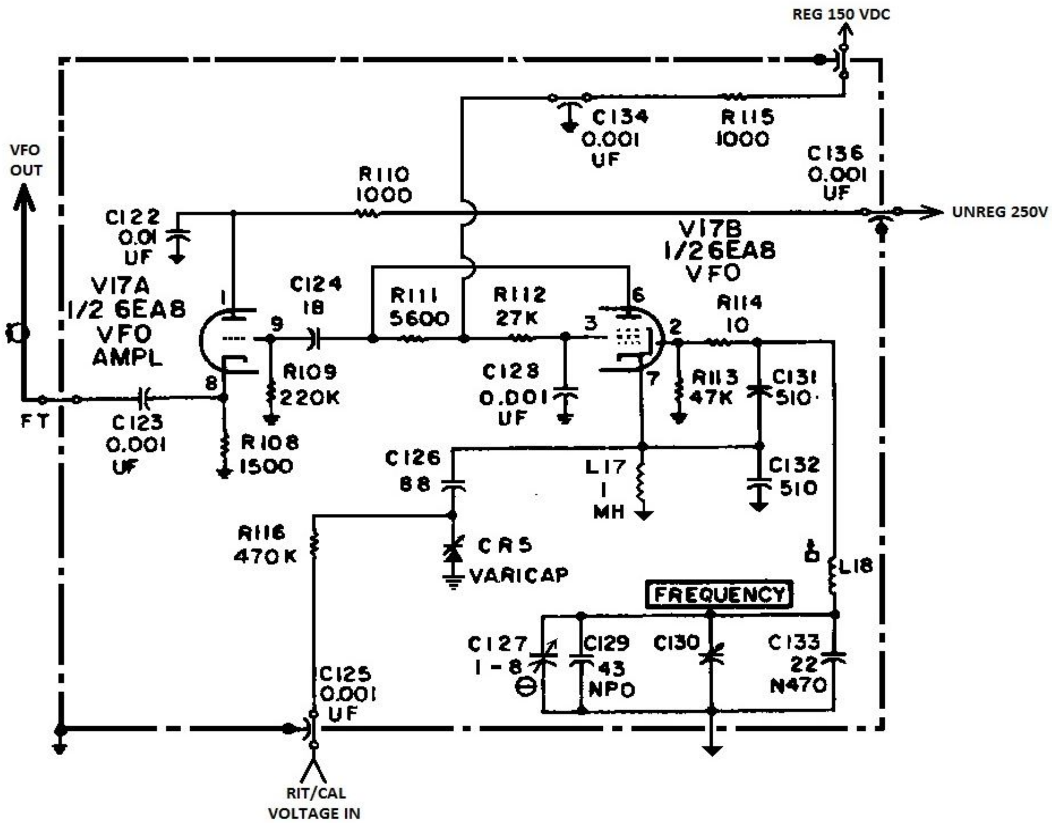
NOTE: R98 and R99 are not linier taper pots. I do not know why Hallicrafters used audio taper pots in this application. The result is that the shift is not centered. You will see about 3Mhz to the low side and 5Mhz shift to the high side. (This will vary depending upon the level of voltage at the top of R98 and R99.)

To test the divider network, disconnect the wire to the wiper of each pot. Disconnect the wire to the top of R99. Set both pots to the mechanical center of their rotations. Measure the resistance from the top of each pot to the top of R100 to insure they are both 25k pots. Measure the resistance from the wiper of both pots to the top of R100, you should read very close to 9K. If they are not within a couple hundred ohms of each other then that will explain the offset between the CAL and the RIT controls. At this point you must determine if the offset is offensive enough to warrant the trouble finding matched pots that will fit and the work involved in making the repair.

VFO CONSIDERATIONS

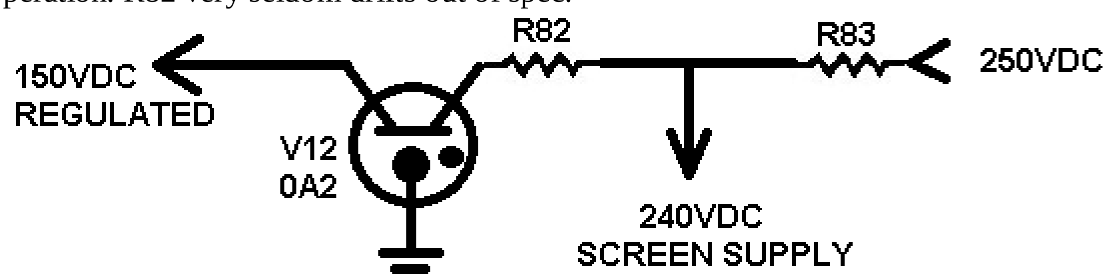
The VFO in the SR-160 and the SR-500 are identical.

IMPORTANT NOTE FOR ALIGNMENT OF THE VFO: The CAL control shifts the VFO for TX and RX when the RIT is off. The CAL control shifts the TX only when the RIT is on. With the RIT on the RIT control shifts the RX. ***It is important*** to insure that the CAL and RIT pots are in the center of their rotation during all alignment and tracking operations. You can test proper alignment by setting both controls to center. Then tune in a signal and switch the RIT on and off. There should be no change in the receiver tone.



CRITICAL NOTE 150V REGULATOR & 240v SCREEN SUPPLY

The resistor R83 (470ohm 2w) is almost always 150 to 250 ohms high. This caused a drop in the +240 volt line and current starvation for the 0A2 150v regulator. When you monitor the voltage at the input to the VFO you may see from 5 to 15 volt shift from TX to RX mode. This will pull the VFO off frequency in the tx mode and cause chirp in the CW mode. The 240 volt line provides screen voltage for the RX rf amp and first mixer. It is also the screen voltage for the TX driver and PA tubes. A drop in the 240v line will have negative impact on both RX and TX operation. R82 very seldom drifts out of spec.



THE PROBLEM

Over the last 5 years every single SR-160 and SR-500 I have had in the shop has suffered from freq. drift. I reviewed the repair files and eliminated the obvious random component failures. I found that a combination of at least two of 4 specific components was involved in all restorations. These components are R113, R114, C129, and C133. The exact nature of the failure mode is unknown. Whether it was crystallization of the carbon resistors causing noise or dielectric breakdown generating drift really doesn't matter at this point.

THE TEST

For this test I collected three rigs two SR-500's and one SR-160 all of which demonstrated the drift problems. I cleaned, lubed, aligned and cleared all other problems. When I pre-tested the three units I found roughly the same for all three:

> After 30 minutes of warm up the drift was about 150 Hz per minute and random in direction.

> After another 30 minutes the drift trend was upward about 900 Hz per ½ Hr. with the short term drift of about 100 Hz per minute.

> After three hours it was +2200Hz and still going up, still had short term drift. All three rigs displayed similar characteristics.

FIRST CORRECTION

I performed the RIT/CAL ckt changes on all three rigs. I went with 12 v zeners and 75K metal film 1% resistors. Following the changes I re-ran the test. The short term random drift was gone. All three rigs were then drifting in the upward direction from 10 to 30 HZ per minute and around 800 Hz to 1100HZ per hr.

SECOND CORRECTION

I replaced the 4 suspect components in all three rigs. CAUTION stay away from NOS parts. If you use NOS parts you are getting old technology and outdated manufacturing processes and materials which were the root of the problems. Better materials, technology and processes are available today therefore producing better products. Be sure the C129 is an NPO cap and that C133 is N470.

Re-test proved that the continual upward drift had been eliminated. The specs on the radios states that after 30 minutes of warm-up no more than 300 Hz drift should occur. The spec is vague and no further time limits are stated. I'm assuming that the intent is that once warm-up is achieved then the drift total +/- should not ever exceed 300 Hz.

One 500 and the 160 took 45 minutes to stabilize but from that point on the drift was from -20 Hz to +130 Hz for the 500. The 160 drift was from 0 Hz to +230 Hz. Both rigs remained within that range for 2 hrs at which time I terminated the test. The other 500 stabilized in 15 minutes and the drift went from -110 Hz to +90 Hz.

SUMMATION

Due to the small population of the units tested this cannot be considered a definitive test with irrefutable results. However due to the consistency of the results and the repairs made over the last 5 years I believe that it does warrant a look here first approach when you encounter similar problems.

SR-160 / SR-500

RECEIVER FAULT ISOLATION

EVOLVED BY WDØGOF

EQUIPMENT REQUIRED:

HF RF signal generator capable of .5 microvolts to 200 millivolts.
Audio output meter (similar to General Radio 1840A).
Scope 10 MHZ or better. 1:1 and 10:1 probes or switchable probe.
Audio oscillator.

PROCEDURE: There is not anything inherently clever about this process. What it does offer is signal injection levels and output results gathered from dozens of tests performed on both the 160 and the 500. For those who wish to expound on the evil effects of probe loading and ckt miss-matches, I concede you are correct, it does happen. But the process works, it is repeatable and simple to follow.

STEP 1: We will start in the middle of the receiver. Connect the audio output meter to the speaker jack on the front of the rig. Tune the RF generator to 5200 kHz. Turn the rf and af gain on the rig to max. Disable the AVC by grounding the junction of R65 and R67 using a clip lead. Connect the 10:1 probe to the rf generator and inject 200 microvolts at the output of FL-1. Tune the frequency of the generator for max audio output. Audio output should be .5 watt. If this test is good then the back half of the receiver is ok go to STEP 6 if not go to STEP 2. Before you precede to STEP 6 temporarily un-ground the AVC. If the audio reduces to little or no output you most likely have an AVC problem, the fault will most likely be in V10.

STEP 2: Using the 1:1 probe inject 4 millivolts of 5200 kHz into pin 2 of V4. Retune the RF gen. for max audio out. If you get ½ watt or better of audio out then the problem is in the first IF amp V3. If not go to STEP 3.

STEP 3: Using the 1:1 probe inject 0.1 volts of 5200 kHz into pin 7 of V5. Retune the RF gen. for max audio. If you get ½ watt or better of audio out then the problem is in the second IF amp V4. If not go the STEP 4.

STEP 4: Using a tee connector connect the audio oscillator and the 1:1 probe to the scope. Set the audio oscillator to 1khz. Connect the probe to pin 2 of V5 and adjust the injection level to .3 Vpp on the scope. . If you get ½ watt or better of audio out then the problem is in the product detector V5A. If not go to STEP 5.

STEP 5: Move the 1:1 probe to pin1 of V6 and increase the audio signal to 12 Vpp. If you get ½ watt or better of audio out then the problem is in first audio amp V5B. If not the problem is in the audio output stage V6.

STEP 6: Tune the rig and the RF signal generator to 3900 khz. With the 1:1 probe connected to the generator inject 150 microvolts into pin 7 of V2. Adjust the generator or the rig for max audio output. If you get ½ watt of audio out go to STEP 7. If not the problem is in the receiver mixer V2. *HINT FOR LATER If you have good audio in this step you can test the xtal filter bandpass tuning. Connect a freq counter and the audio out put meter to the audio output. Adjust your rf generator for a1000Hz tone and note the audio output level. Now adjust for a 500Hz tone the level should not drop more than 3db. Now adjust for a 2900Hz tone the output should not drop more 3db from the 1000Hz ref. If it is ok then you will not have to worry about it later.*

STEP 7: Reduce the generator output to 7.5 microvolts and move the 10:1 probe to pin 1 of V1. If you get 1 watt of audio output then the problem is in S1, L1, K2 or associated circuitry. If not, then V1 the receiver RF amp is the likely problem stage.

NOTE: If the receiver is working properly a 1 microvolt signal at the antenna input will produce a minimum of ½ watt of audio output. Once properly aligned ½ watt output can be achieved with from 0.4 to 0.8 uv input.

LOW LEVEL AUDIO CONSTANT IN RECEIVER

Over the years I have seen and added comments to a lot of posts concerning gain in the mic amp of the SR-150, 160 and 500. Some of these have involved placing a cathode bypass capacitor on the 2nd mic amp. I'll have to admit that I to thought this was a cleaver idea, but not any more. This **is not** a good idea. Recent discoveries indicate it should not be done. The problem is there in all three rigs but was noticed first in the SR-150. In the RX mode with the audio gain turned fully CCW there will be a faint 2500 Hz to 4500 Hz tone in the speaker. When measured, it will run from 10 to 150mw. I have had four 150's recently with this problem. Needless to say the first time I noted the problem it was quite puzzling. When I pulled the 2nd 1650 I.F. tube which killed all the Rx noise I found that the level of the objectionable tone was not changed by the setting of the AF Gain control. Now how exactly I ended up in the VOX circuit I can't quite remember. But I noted that if I turned the VOX gain control all the way down the tone went away. I connected the scope to the plate of V18B the second mic amp, and to my surprise I found a 75v peak to peak audio oscillation. I also noted at that time a 10uf/50v capacitor had been added from the cathode of V18B to gnd. When I removed the capacitor the oscillation stopped. I have run into oscillation problems on 4 rigs in recent months and in each case a bypass capacitor has been added to the cathode of the second mic amp. In one case I did not have a tone in the RX but was unable to properly set up the VOX gain and delay. The oscillation, on this one turned out to be about 18 kHz, which is out side the range of my old ears and the response of T5. So the tone did not appear in the speaker.

Why was it noticed in the 150 receiver audio and not the 160 and 500? Well the 150 has VOX and the VOX ckt provided the feedback path to the audio output. Due to low level of the signal in the speaker I believe the feedback path is from the mic amp to the VOX ckt then thru cr5, r98, c117 and directly into the secondary of T5.

The oscillation is there in the SR-160 and SR-500 rigs. The only indication you get is the carrier balance does not quite meet spec and receivers on the other end report a low level squeal or tone in your audio.

I have come to the conclusion that the un-bypassed cathode resistors in the mic amp ckts do serve the intended purpose of the original design. That is, to degenerate the high frequency response of the mic gain train, and that's a good thing. The original design is good and if all the “parts” are good it will work well. One of the most miss-matched parts is the microphone. The 150, 160 and the 500 all want to see a **high Z dynamic** mic with an output in the range of 5 to 10 millivolts. High Z dynamic microphones in 1963, in the published words of Hallicrafters were in the order of 600-1200 ohms. Ceramic and xtal mics have far too much output in the 3 KHz to 4 KHz range with the level at 500 Hz usually 3 to 8db lower. Since the audio response of the SSB circuitry is from around 500 to 2700 HZ, depending on the rig, putting a mic on the radio that over drives the system in the 3 Khz to 4 Khz range does nothing but screw up the spectrum.

So in conclusion if you cannot drive SSB to full power check your mic or fix your broken radio. But don't compromise the design by adding bypass caps.

Best regards, Walt, WDØGOF

SR-160/500 NEUTRALIZATION PROCESS

PROPER NEUTRALIZATION WILL ENHANCE THE PROPER OPERATION, EFFICIENCY AND LIFE OF YOUR FINAL TUBES. THEORY AND OPINIONS ON THE EFFECTS OF INTERELECTRODE CAPACITANCE ARE AS NUMEROUS AS THE WRITERS OF SUCH ARTICLES. SO TO BE VERY BASIC, WE ARE ATTEMPTING TO NEUTRALIZE THE EFFECTS OF THE INTERELECTRODE CAPACITANCE OF THE PA FINAL TUBES.

HERE IS A GOOD SITE FOR A DISCUSSION ON NEUTRALIZATION.
HTTP://WWW.W8JI.COM/NEUTRALIZING_AMPLIFIER.HTM

THE NEUTRALIZING PROCESS IN THE BOOK IS OK, BUT NOT VERY PRECISE. IT WILL WORK, BUT I PREFER A MORE PRECISE PROCESS. THERE IS NOTHING NEW OR REVOLUTIONARY ABOUT THIS PROCESS. IT IS A PROVEN PROCESS THAT HAS BEEN IN USE FOR OVER 50 YEARS. ALL I HAVE DONE IS SPECIFICALLY ADAPTED IT TO THE SR-160/500. BEFORE STARTING THE PROCESS, YOU NEED TO TUNE THE TX AS BEST AS YOU CAN AT 21.3 MHZ. AFTER TUNE UP TURN THE POWER OFF AND DO NOT RE-ADJUST THE PRESELECTOR OR FINAL TUNE THROUGHOUT THIS PROCESS. POWER DOWN AND REMOVE UNIT FROM IT'S CASE AND REMOVE THE PA COVER.

1, DISCONNECT THE PLATE VOLTAGE AT THE BOTTOM OF L16 BE SURE THE LEAD IS OUT OF HARMS WAY.

2, DISCONNECT THE SCREEN VOLTAGE AT THE BOTTOM OF R102 BE SURE THE LEAD IS OUT OF HARMS WAY

3, TURN THE CARRIER FULLY CCW.

4, CONNECT THE TRANSMITTER OUTPUT TO THE SCOPE OR TO AN RF VOLTMETER (I PREFER A SCOPE).

5, WITH THE CASE REMOVED AND THE COVER REINSTALLED ON THE FINAL AMP ENCLOSURE TURN ON THE RIG AND LET IT HEAT UP FOR AT LEAST 20 MINUTES.

6, IN THE CW-TUNE POSITION KEY THE TX.

7, ADVANCE THE CARRIER CONTROL UNTIL YOU GET ANY WHERE FROM 1 TO 5 VOLTS PP ON THE SCOPE.

8, ADJUST C110 FOR MINIMUM SIG ON THE SCOPE. ADJUST SCOPE SENSITIVITY AND CARRIER LEVEL UNTIL YOU GET A REAL GOOD PRESENTATION OF THE MINIMUM POINT.

THIS PROCESS OF NEUTRALIZATION HAS SERVED ME WELL. THIS PROCESS CAN BE ADAPTED TO MOST ANY TRANSMITTER. THIS IS THE MOST PRECISE METHOD OF NEUTRALIZATION I HAVE FOUND. IF IT DOESN'T WORK THEN YOU HAVE SOMETHING ELSE WRONG.

CLEANING

Step 1. I have found all forms of foreign matter in rigs emerging from long term storage. My favorite of cleaning method is the bathtub, Scrubbing Bubbles bathroom cleaner, and the shower hand wand. I set the rig in the tub, back side down, front panel up. With the rig leaning against the side of the tub I spray it full of Scrubbing Bubbles and let it set 3 to 5 minutes. Then I spray it full again and after 5 minutes I rinse it using the shower hand wand. I do this on the top and bottom side of the chassis. I keep the Scrubbing Bubbles away from the front panel, dials and meters, just use common sense. All the brown residue, smoke odor and filth literally run down the drain. Very seldom is any scrubbing needed if it is I do it with a ¾" wide paint brush with half the length of the bristles cut off. I rinse it a second time then it sets in front of a fan for a day.

Step 2. Now that it is squeaky clean the potentiometers need the application of a suitable control cleaner/lubricant.

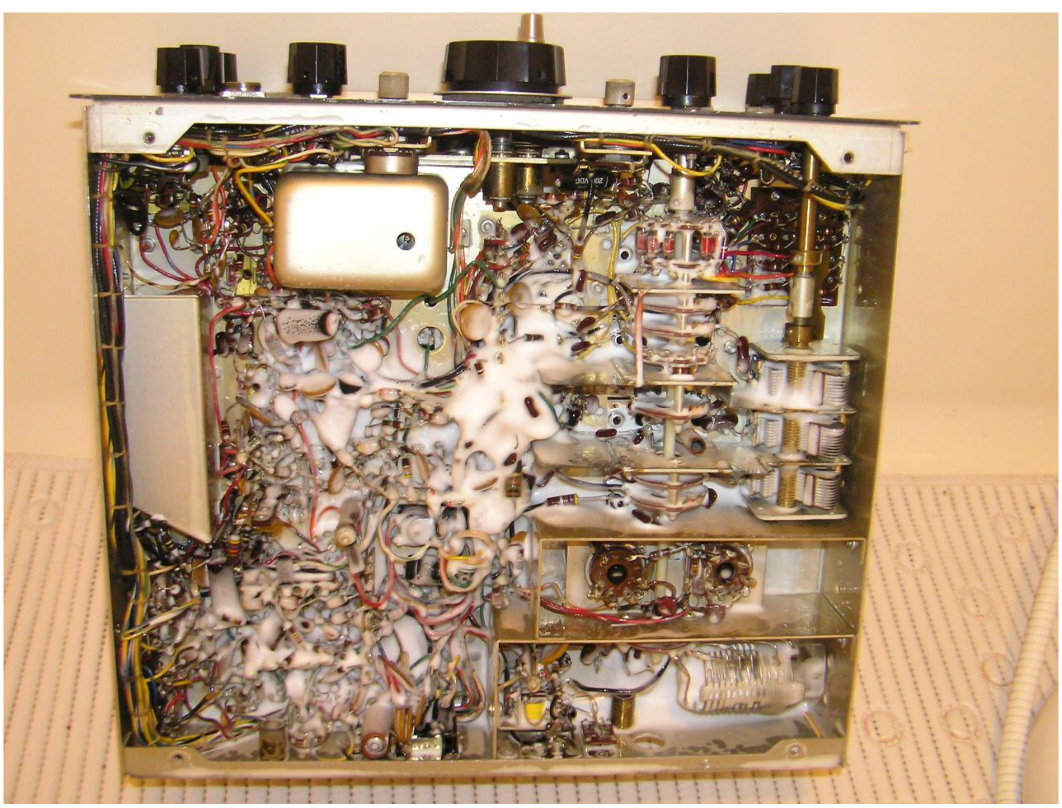
Step 3. Some mechanical drive trains to tuning devices require special lube so don't forget them.

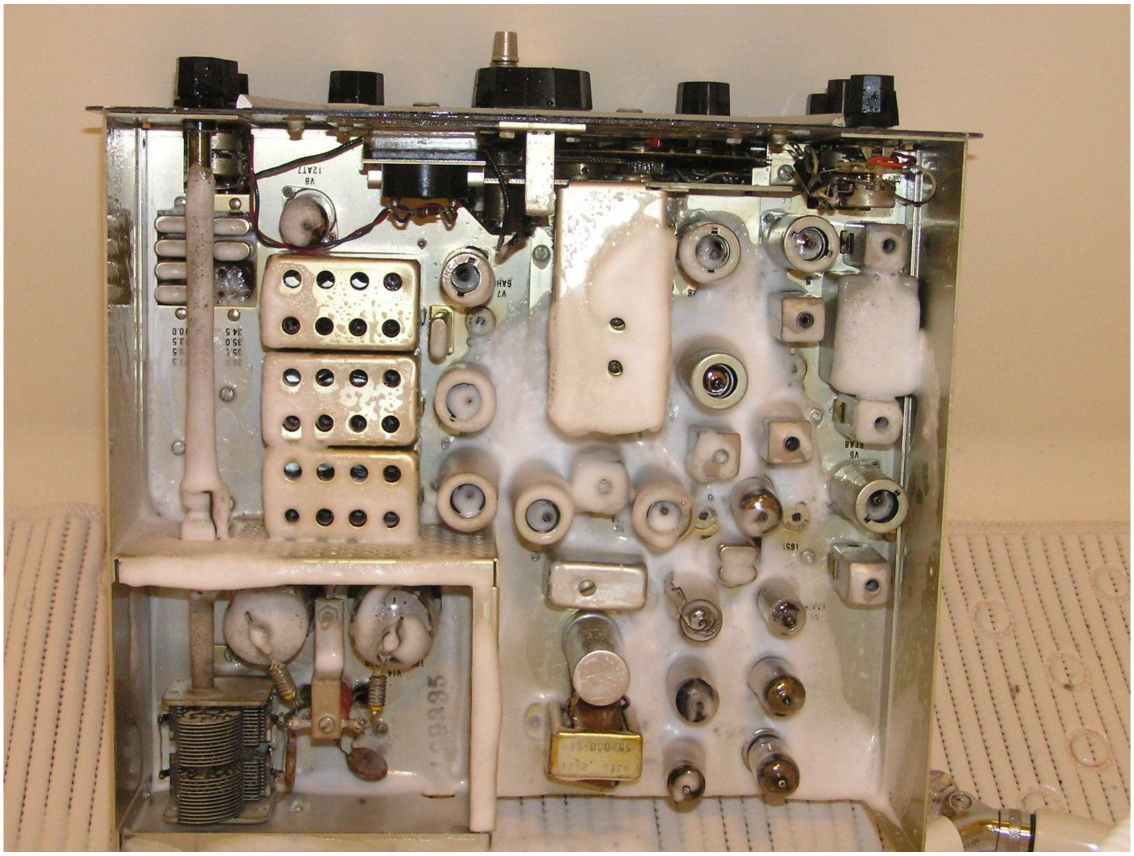
Step 4. The relays are next. I use thin strips of card paper, about 3" long and 3/16" wide. Place a drop of DeOxit on the paper and slide it back and forth between the contacts. Manually energize the relay and clean the normally open contacts as well. A pair of hemostats simplifies this step. NEVER USE SANDPAPER.

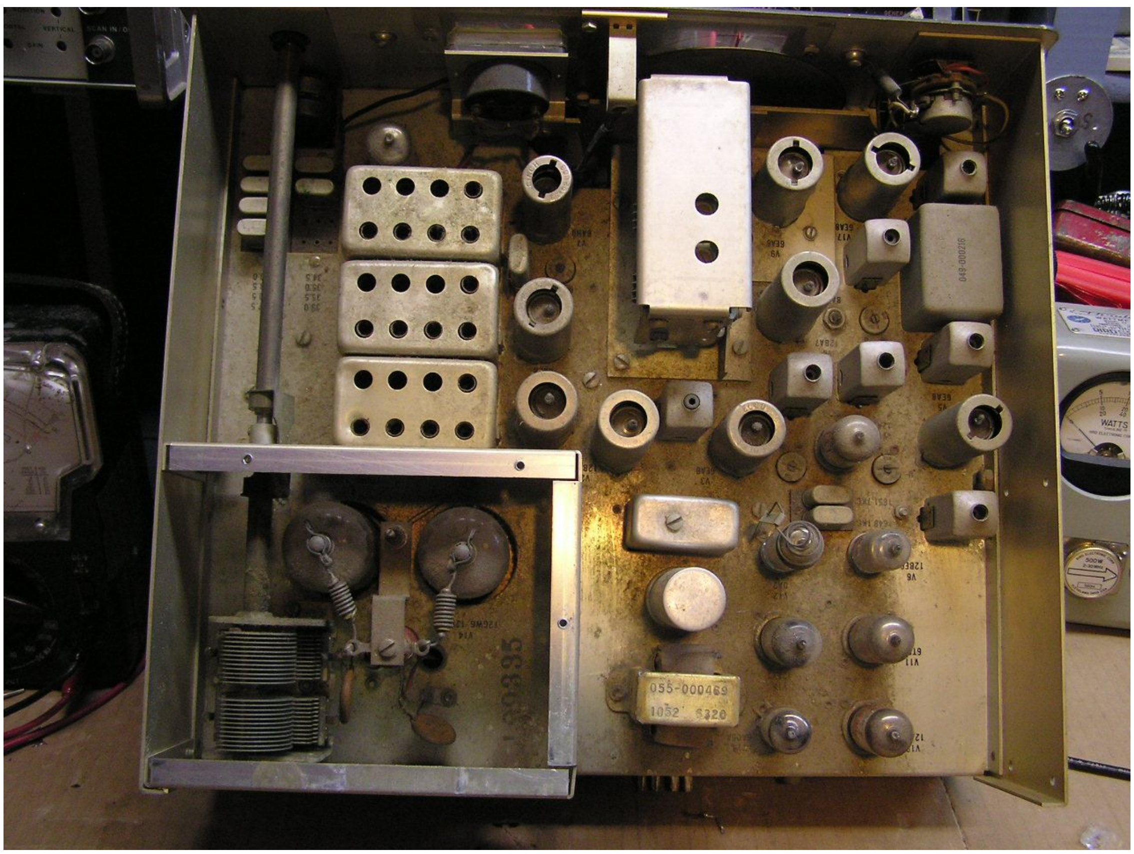
Step 5. Now for the controversy, The Wafer Switches! Every three months or so on one of the ham forums a wafer switch cleaning war breaks out. No minds are changed, no territory is conquered. Hostilities subside only to be resurrected a few months later when the "new be" asks How do I clean my wafers. There are at least 3 regulars out there that vehemently oppose my method and that is ok. It works for me and I have not to date suffered any loss due to it. First I take a cotton swab and cut a little cotton off the tip. I spray a little DeOxit in a small glass bowl. I dip the swab in the DeOxit and clean the switch. It's pretty simple and no over spray. I ***NEVER*** spray DeOxit into a rig.

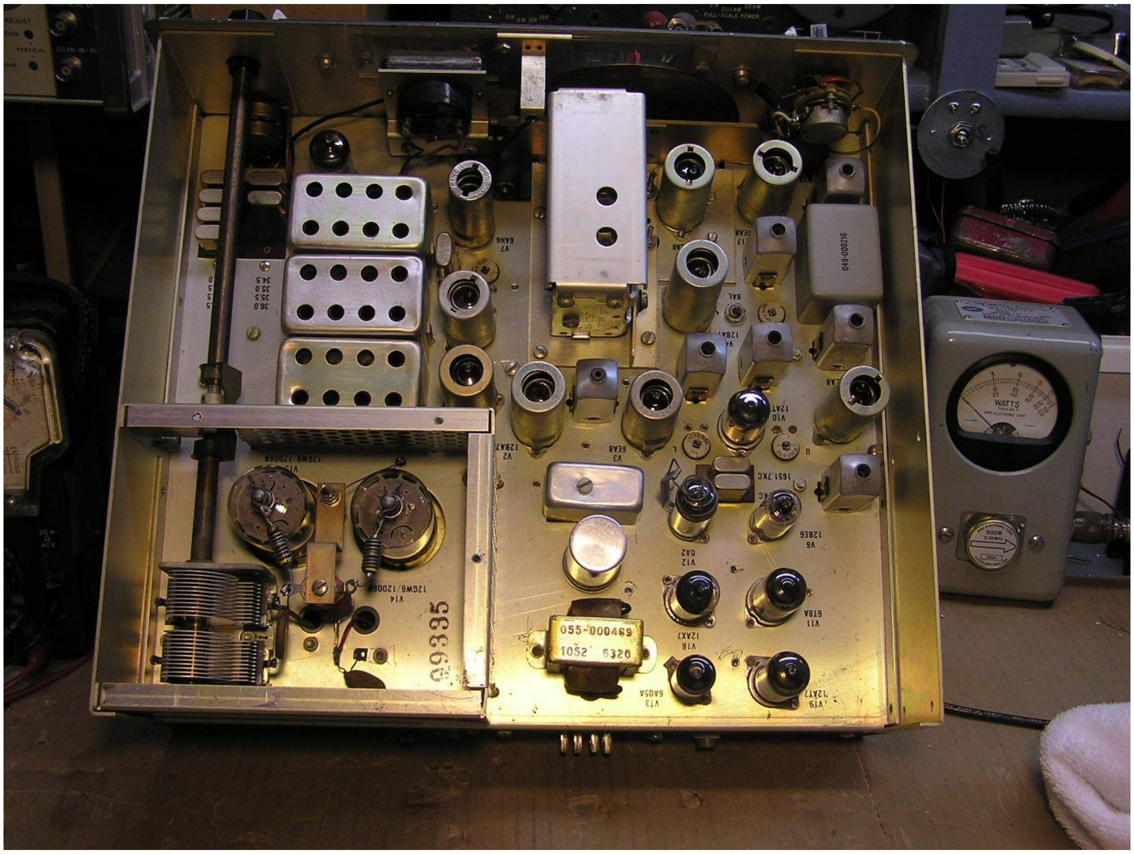
Step 6. Now we have to clean the tube sockets. Some where around the tooth brushes at you local store you will find very small round brushes used to clean between teeth. There are usually 10 or 20 to a package. Once again I use DeOxit in the glass bowl. Dip the brush, insert the brush, spin the brush, repeat 150 times or so and you're done.

these photos are of an SR-150 but they should make the point. This was after second spray of bubbles. You can see that as the bubbles run down the chassis it is clean and shiny




BEFORE CLEANING


CLEAN CHASSIS



HALLICRAFTERS

SR-500 PERFORMANCE DATA

RECEIVER PERFORMANCE:

Overall Sensitivity (gain)
The receiver will produce 500 mw audio out with 1.5 uv RF signal at the antenna terminal.
Tests performed at center of General Class bands

BAND	TEST FREQ	SIG REQ FOR 500mw
80		
40		
20		

Overall Sensitivity (S+N:N)
A 1.0uv signal at the antenna terminal will produce a minimum 20db s+n:n.

BAND	TEST FREQ	SIGNAL LEVEL	S+N:N MEASURED
80			
40			
20			

AGC Figure of merit
With a signal at the antenna terminal from 5uv to 1500uv no more than a 10 db variation shall occur.

MEASURED CHANGE	

"S" METER CAL
The S meter will read S-9 when between 25 and 100uv are injected at the antenna terminal.

LEVEL FOR S-9	

TRANSMITTER PERFORMANCE

Tests performed with 50ohm resistive load. Measurements made with BIRD avg power and PEP power meter. Bench power __ VAC

Final amplifier bias set to 100 ma SSB mode zero drive. _____

Neutralization performed @ 14.150 MHZ. _____

Carrier balance null _____ db below full power output level.

Microphone input sensitivity at 1000HZ. A signal level not more than 8 mv rms shall produce the minimum specified SSB output at specified freq. Mic gain set just below flat-topping and should occur between 60% and 80% of rotation.

Flat-topping occurred at __% of mic gain rotation with 8 mv audio input.

CW power output with RF level set just to saturation level.

FREQ	**MIN SPEC**	**AVG POWER**
3.9mhz	190 W min	
7.23mhz	220 W min	
14.28mhz	200 W min	

SSB PEP power output mic gain set just at saturation.

FREQ	**MIN SPEC**	**PEP**
3.9mhz	190 W min	
7.23mhz	220 W min	
14.28mhz	200 W min	

SSB TX AUDIO RESPONSE.

From 600 Hz thru 2700 Hz there will be no more than 3 db change in output power.
Tune transmitter at 3.900 MHz. Do not exceed the duty cycle of the TX.
Mic audio input set for 8 millivolts at 1000Hz, LSB, Set mic gain for 100 watts output.
Set audio freq to 600Hz, 8 mv. Tx PEP not less than 50 or greater than 65 watts ___________watts
Set audio freq to 2700Hz 8 mv. Tx PEP not less than 50 or greater than 65 watts ___________watts
Manually sweep audio osc from 600 HZ to 2700 HZ if multiple peaks occur within the pass band there will be no more than 2db from the peak to valley between. ________ Db

HALLICRAFTERS

SR-160 PERFORMANCE

RECEIVER PERFORMANCE

Overall Sensitivity (gain)
The receiver will produce 500 mw audio out with 1.5 uv RF signal at the antenna terminal.
Tests performed at center of General Class bands

BAND	TEST FREQ	SIG REQ FOR 500mw
80		
40		
20		

Overall Sensitivity (S+N:N)
A 1.0uv signal at the antenna terminal will produce a minimum 20db s+n:n.

BAND	TEST FREQ	SIGNAL LEVEL	S+N:N MEASURED
80			
40			
20			

AGC Figure of merit
With a signal at the antenna terminal from 5uv to 1500uv no more than a 10 db variation shall occur.

MEASURED CHANGE	

“S” METER CAL
The S meter will read S-9 when between 25 and 100uv are injected at the antenna terminal.

LEVEL FOR S-9	

SR-160

TRANSMITTER PERFORMANCE:

Tests performed with 50ohm resistive load. Measurements made with BIRD avg power and PEP power meter.
Hi voltage __vdc B+ __vdc Bias -__vdc

Final amplifier bias SR-160 set to 60 ma SSB mode zero drive. ________

Neutralization performed @ 14.150 MHZ. _______

Carrier balance null _____ db below full power output level.

Microphone input sensitivity at 1000HZ. A signal level not more than 5 mv rms shall produce the minimum specified SSB output at specified freq. Mic gain set just below flat-topping and should occur between 60% and 80% of rotation.

Flat-topping occurred at __% of mic gain rotation.

FREQ	MIN SPEC	PEP @ 4mv
3.8mhz	75 W min	
7.3mhz	75 W min	
14.3mhz	70 W min	

CW power output with RF level set just to saturation level.

FREQ	MIN SPEC	AVG POWER
3.8mhz	70 W min	
7.3mhz	70 W min	
14.3mhz	70 W min	

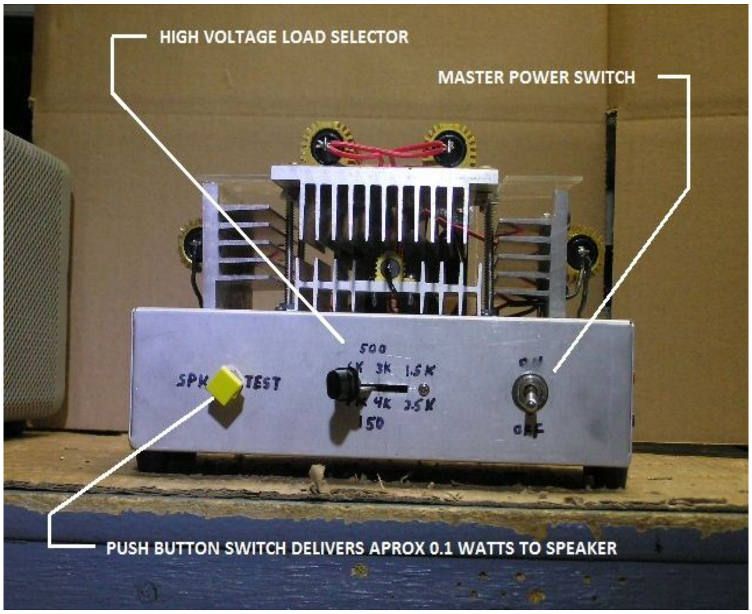
SSB TX AUDIO RESPONSE.

From 600 Hz thru 2700 Hz no more than 3 db change in output power. ______
If multiple peaks occur within the pass band there will be no more than 2db from the peak to valley between. _______

Hallicrafters Power Supply Test Fixture

I restore or repair 10 to 15 Hallicrafters P and PS series power supplies a year. Not wanting to risk a rig or run a power supply without a load I built this test fixture. It was specifically built to test the PS-150, PS-500 and P-500 AC and DC power supplies. However, with the properly wired interconnect any power supply with the following voltages can be tested: HIGH VOLTAGE from 550 to 965 vdc, B+ from 200 to 400 vdc, BIAS from -60 to -150 vdc and filament voltage 12.6 vac.

*



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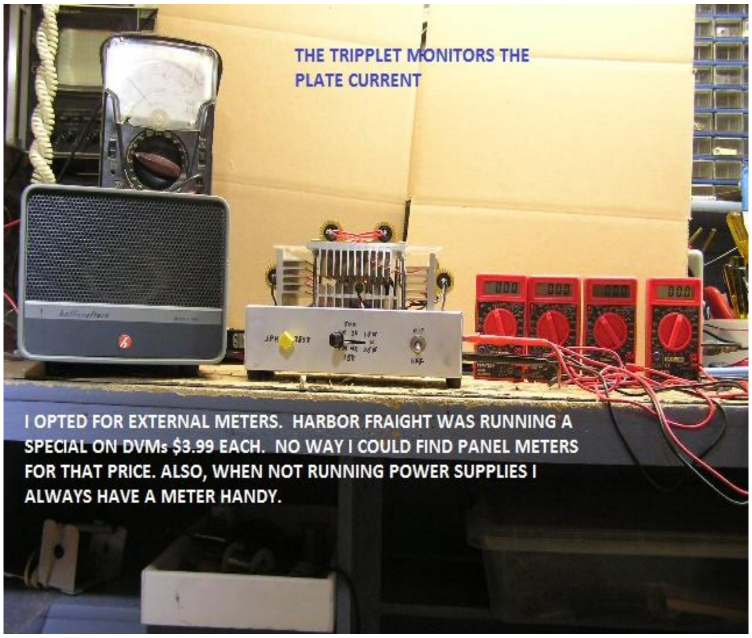

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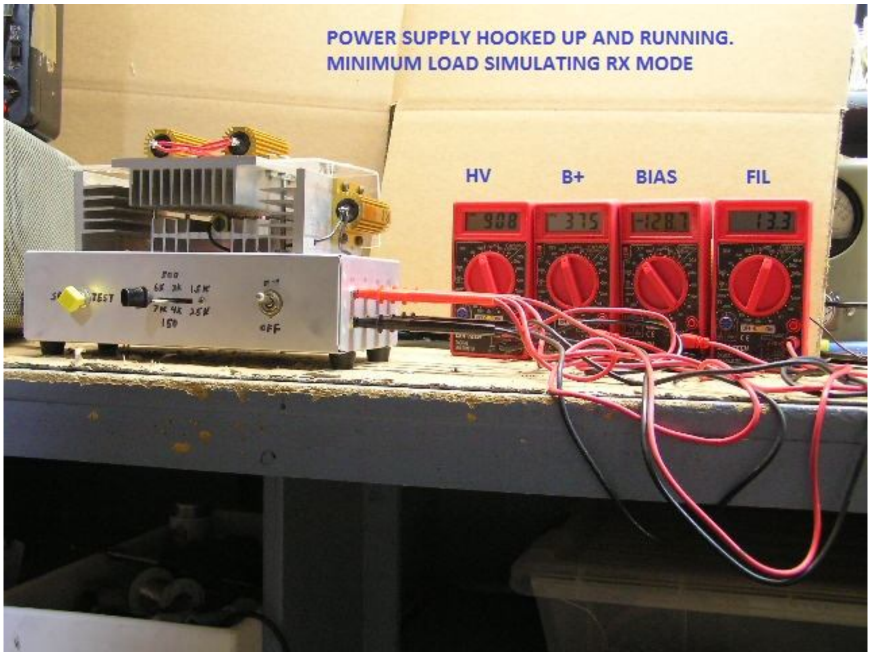
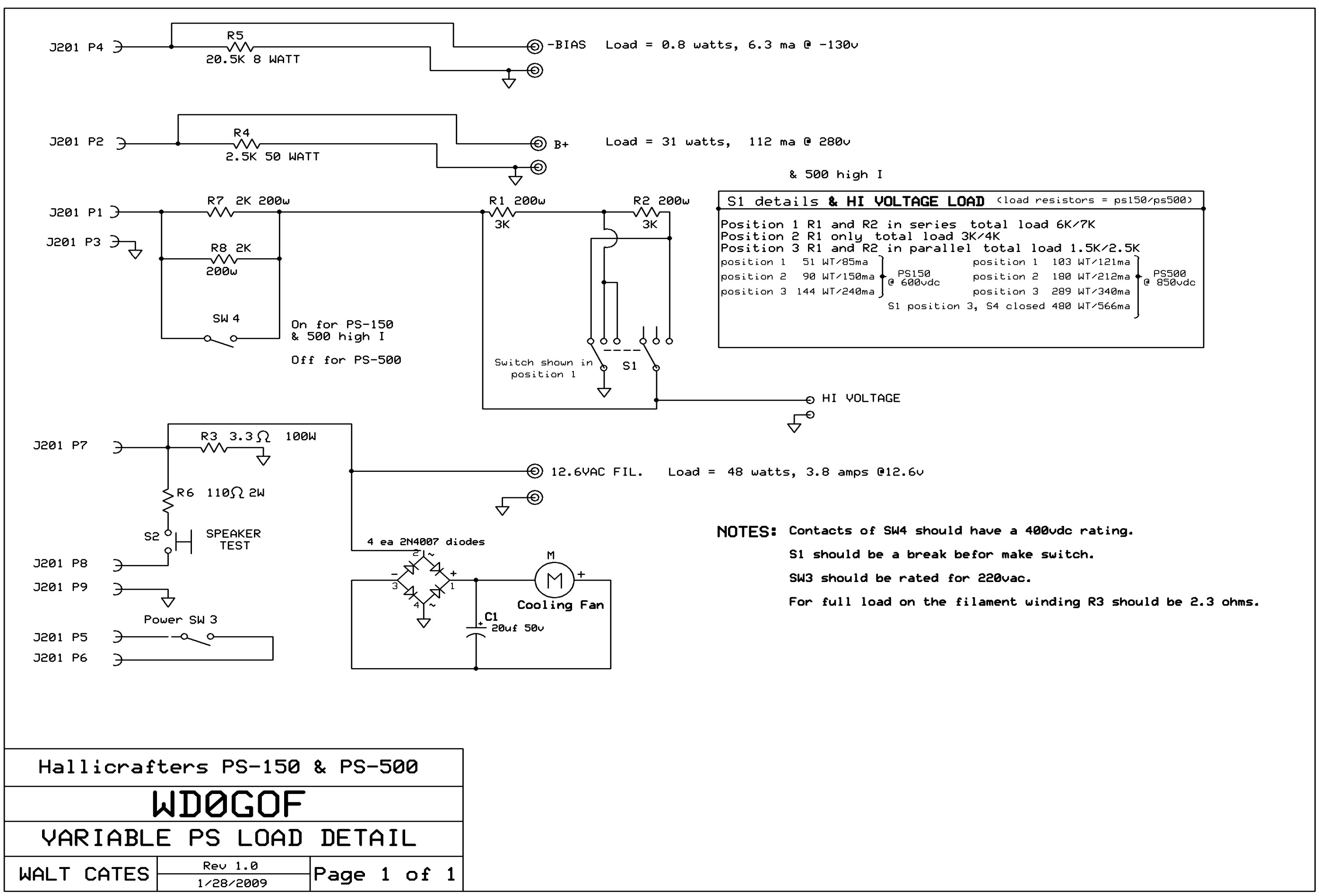

POWER SUPPLY HOOKED UP AND RUNNING.
MINIMUM LOAD SIMULATING RX MODE
HV
B+
BIAS
FIL
*


J201 P4
R5
20.5K 8 WATT
-BIAS
Load = 0.8 watts, 6.3 ma @ -130v
J201 P2
R4
2.5K 50 WATT
B+
Load = 31 watts, 112 ma @ 280v
& 500 high I
J201 P1
J201 P3
R7 2K 200w
R8 2K
200w
SW 4
On for PS-150
& 500 high I
Off for PS-500
R1 200w
3K
R2 200w
3K
Switch shown in
position 1
S1
HI VOLTAGE
S1 details & HI VOLTAGE LOAD (load resistors = ps150/ps500)
Position 1 R1 and R2 in series total load 6K/7K
Position 2 R1 only total load 3K/4K
Position 3 R1 and R2 in parallel total load 1.5K/2.5K
position 1 51 WT/85ma
position 2 90 WT/150ma
position 3 144 WT/240ma
PS150
@ 600vdc
position 1 103 WT/121ma
position 2 180 WT/212ma
position 3 289 WT/340ma
PS500
@ 850vdc
S1 position 3, S4 closed 480 WT/566ma
J201 P7
R3 3.3Ω 100W
12.6VAC FIL.
Load = 48 watts, 3.8 amps @12.6v
R6 110Ω 2W
S2
SPEAKER
TEST
J201 P8
J201 P9
Power SW 3
J201 P5
J201 P6
4 ea 2N4007 diodes
M
Cooling Fan
C1
20uf 50v
NOTES: Contacts of SW4 should have a 400vdc rating.
S1 should be a break befor make switch.
SW3 should be rated for 220vac.
For full load on the filament winding R3 should be 2.3 ohms.
Hallicrafters PS-150 & PS-500
WD0GOF
VARIABLE PS LOAD DETAIL
WALT CATES
Rev 1.0
1/28/2009
Page 1 of 1
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