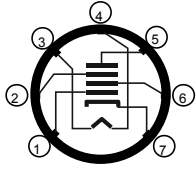


HOLLOW STATE NEWSLETTER

"For lovers of vacuum tube radios"



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CONTENTS

Feature Articles

- Hammarlund SP-600 Review (Part 2 of 2) Phil Bytheway Pg 2
Fixing the GFI Problem in the R-390/390A. Paolo Viappiani Pg 7

Departments

- Questions and Answers from Our Readers Nothing this issue
Short Subjects – a new e-mail reflector for R-390 family Pg 8
Publications of Interest – R-390A Video Tapes Pg 8
Buy/Sell/Trade Items Nothing this issue

EDITOR'S AND PUBLISHER'S CORNER

Frequent HSN contributor Geoff Fors continues to provide us with new material. I would like to share some of his comments included in a recent submittal: "Via HSN, I met several enthusiasts around the world with whom I regularly correspond, including Neil Clyne of England. That's more than I can say for any other publication I subscribe to! By the way, I frequently recommend HSN to people and invariably get a response of something like "oh, that's defunct, isn't it?" I know the newsletter has no advertising budget, but I would like to suggest that all subscribers spread the word to those they talk to, and otherwise promote the publication. This can increase readership as well as article submissions." I couldn't put more eloquently myself – thanks, Geoff.

HAMMARLUND SP-600 REVIEW (Part 2)

by Phil Bytheway

Adapted from the article that was originally published in *Fine Tuning's Proceedings 1994-95* and with the permission of the author.
Part 1 appeared in HSN # 42

CIRCUIT DESCRIPTION

Figure 2 shows a simple block diagram. Four band dependent tuned circuits are switched in for the 95 ohm balanced antenna input (before first RF), first and second RF (both 6BA6) and first VFO (HFO-6AC7) circuits. In the fixed crystal controlled mode, the crystal controlled oscillator is connected in place of the first VFO (thus implying that the fixed crystal frequency is not the same as the desired frequency). Depending on band selection, the first mixer (6BE6) produces a 455 kHz signal for bands 1-3 - below 7.4 MHz, or 3955 kHz signal for bands 4-6 - above 7.4 MHz. The second VFO (6C4) generates a crystal-controlled 3.5 MHz signal for the 2nd mixer (6BE6). On some sets, this second VFO is selectable from the front panel to an input on the rear chassis. This all means the set is single conversion below 7.4 MHz and double conversion above, with 455 kHz as the final IF frequency.

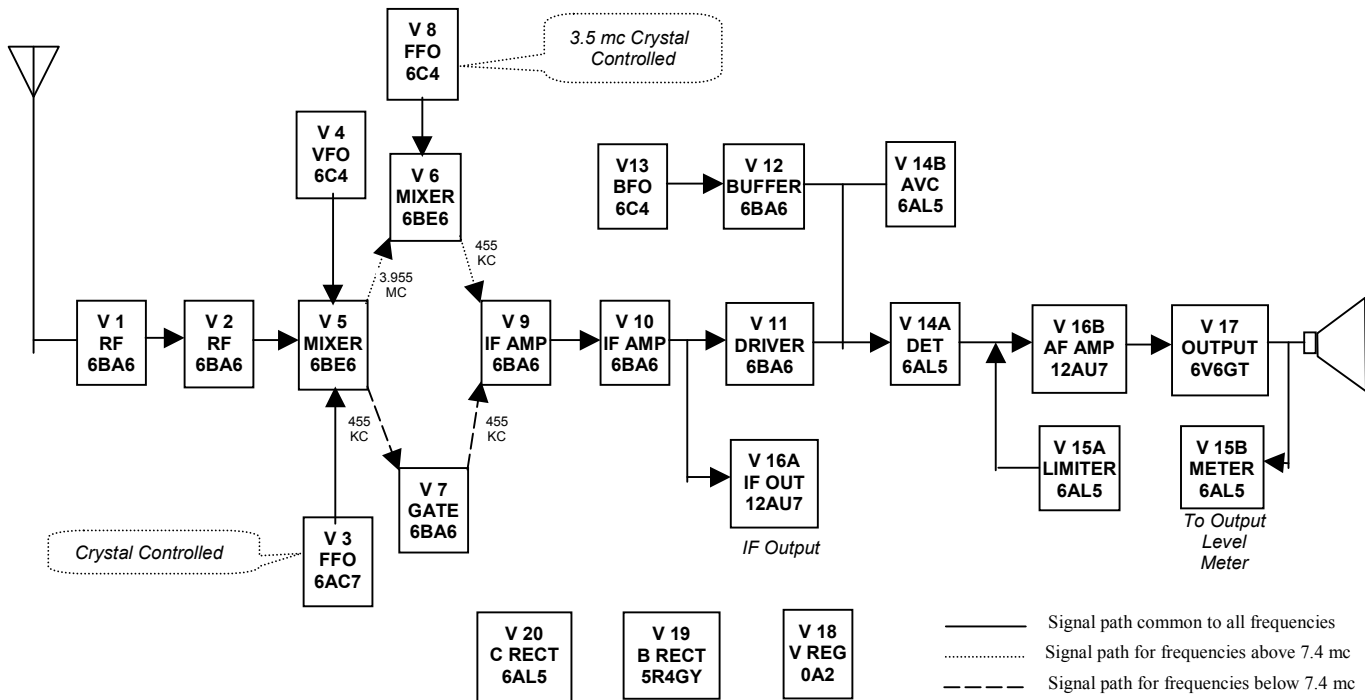


Figure 2 - SP-600-JX-17 Block Diagram

The 455 kHz signal via the gate (6BA6 - below band 4) or 455 kHz output of the 2nd mixer (band 4 and above) is selected for injection into 2 IF stages (both 6BA6). The selectivity switch adjusts all 3 IF coils (before 1st IF, between 1st and 2nd IF and following 2nd IF) with the first (before the 1st IF) being the location of the crystal filter and phase adjustment. The output of the 2nd IF is buffered (12AU7) to a connector on the rear chassis. This output can be used with a matching panadaptor for viewing post-filtered IF behavior. The RF gain potentiometer controls grid voltages of the 2 RF and to a lesser extent the 2 IF tubes. Following the driver (6BA6), the audio is extracted with a diode detector (6AL5). The BFO circuit (6V4 LC controlled oscillator followed by 6BA6 buffer) is coupled at the driver. Once again, in some receivers, the BFO is selectable to a rear chassis connector via a front panel switch (which also adjusts AVC attack speed). The AVC is buffered (6AL5) and drives the gain of the 2nd mixer/gate and both IF amplifiers, as well as the S-meter (when in the RF mode).

The output of the detector is clipped by the noise limiter (6AL5 - when enabled) and fed into the Audio gain controlled AF amp (12AU7) and presented to the single, class A output driver (6V6) which

drives the 600 ohm (at 2 watts) and headphone outputs and the S-meter (when in the AF mode). The B+ is regulated to 150 volts (OA2).

THE THREE S's AND MORE

SENSITIVITY. The SP-600 manual rates sensitivity at 2.3 μV or better over the entire tuning range for a signal to noise ratio of 10 dB at 20 mw output with RF at maximum (1 μV for CW). For John Bryant, "The intelligibility of weak signals is EXCELLENT. It was far better than my NRD-525 in many careful comparisons. When using the 525 and MAP combination to compare to the SP-600, the SP-600 was almost always better or tied with 'the best solid state can do'. The SP-600 is very sensitive and then the tube audio quality really improves intelligibility."

Bill Kleronomos says

"Comparing it head to head with the R-390A, HQ-180, SPR-4 and R-70, using similar antenna, I did not find any situations in which the SP-600 was unable to receive a signal the others had. Sensitivity was measured using a 30% modulated carrier to check the 10db S+N/N rating of this receiver. For those of you not familiar with this test, it takes into account the thermal and other noise produced within the receiver and provides a figure of merit used by the electronics industry. Merely hearing a signal is not good enough if it is masked by a high internal noise level! The sensitivity was checked at 1, 4, 14 and 50 MHz and measured 0.6, 0.6, 0.7 and 1.5 μV , respectively. This is not bad for AM sensitivity. CW signals were readable at 0.1 μV or less throughout the range. Overall, this receiver has very good sensitivity with somewhat high thermal background noise." ²

SELECTIVITY. Selectivity is variable: 13, 8 and 3 kHz bandwidths are available without the crystal filter. With the crystal filter, bandwidths are 1.3, 0.5 and 0.2 kHz. The filter's phasing knob allows for the frequency adjustment of the single notch. When properly adjusted, the single pole crystal filter provides very, very good single signal CW reception using the narrow bandwidths.

For domestic BCB DX, the SP-600 performs well. I typically use the 3 kHz position, as the 1.3 kHz was too narrow for my tastes. Foreign splits are readable in the 3 kHz bandwidth. What with domestic broadcasters squeezing every kHz out of their bandwidth, a loop antenna is almost mandatory for adjacent channel reception, even with the best of selectivity enhancements. I sometimes used the 1.3 kHz position to DX. However, in my SP-600, there appears to be quite a bit of loss associated with the crystal filter... perhaps mine is not perfectly aligned.

John Bryant adds

"For use on shortwave, either listening on the International Bands or DXing on the Tropical Bands, the selectivity of the SP-600 - stock - is not up to modern standards and almost makes this otherwise wonderful receiver unusable. The L-C IF filters are not well suited for AM reception on the modern densely packed International Bands. The 13 kHz filter was always too wide for anything except local powerhouse MW reception. The 8 kHz filter can be used to a degree on the International Bands, but the shape factor is so bad that all sorts of 'trash' comes in under the skirts of the filter. There is also a continual 5 kHz whine from adjacent channel signals even when tuned to the strongest International signals. The 3 kHz filter also has such wide skirts that the continual weak 5 kHz heterodyne is present. The 6 dB width of this filter is, however, too narrow for really good audio when SWLing. For casual listening, a low pass audio filter would clear up the heterodyne, but rob you of the higher audio frequencies. The 3 kHz filter is marginally useful as a DX setting, however, the terribly wide filter skirts still let in a lot of trash. The 1.3 kHz crystal filter is a good DX setting for the Tropical Bands, but very careful tuning is required. I have no experience DXing with the narrower crystal settings.

"My experience leads me to strongly recommend some modification of the IF situation if this otherwise wonderful receiver is to reach its full potential as both a DX and listening receiver on shortwave.

"One approach to this problem is adding one or two more modern IF filters to the set... possibly the new add-on filters from KIWA Electronics which are reviewed in Proceedings 1992. I have not done this, but James Godwin has. Refer to his article in Proceedings 1992.

"Currently, I am using a Hammarlund HC-10 unit in conjunction with the SP-600 (a 2700 ohm or so dropping resistor is best for this interface). This unit receives a 455 kHz signal from the output port on the rear panel of the SP-600 and then processes it through what is, essentially, the IF and AF sections of an HQ-180A. It provides a tunable IF notch filter, passband tuning, selectable sideband AM and SSB reception and sports excellent IF filters (at 60 kHz). The HC-10 and SP-600 combination provides excellent selectivity and a nice wide (6 kHz) setting with steep filter skirts, perfect for SWLing."

STABILITY. Per the manual, frequency drift after a 15 minute warm up period ranges from 0.001-0.01%. I can't really argue as I've never noticed any stability problems. Bill Kleronomos notes

"A series of stability tests were conducted after a 1 hour warm-up. Due to the thermal inertia exhibited by the massive silver-plated cast front end assembly, I observed that stability continued to improve until thermal equilibrium was reached. This took about six hours! For the most critical applications, I recommend leaving this receiver on all the time in standby mode. I also noted that stability was greatly improved by using the 130 volt tap in my area (versus the 117 volt tap typically used) where the nominal line voltage is 123 volts. After warm up, I measured the stability over a 10 minute period. This receiver held to within 30 Hz at 14 MHz and 10 Hz at 7 MHz. The BFO drifted less than 1 Hz over the same period. In crystal control at 10 MHz, drift was less than 2 Hz over 12 hours. Mechanical stability was checked at 14 MHz. Shaking the operating desk produced no change. Frequency only jumped a few Hz when a sharp blow was applied to the cabinet." ²

IMAGES: There is a weak birdie on 910 kHz, and the normal expected mixing spurs from locals are evident across the BCB. Using a loop antenna only alleviates the problem if you null the offending dominant station. The preselection provided by the loop's tuning doesn't seem to help. The two RF stages are perhaps more a problem than a blessing in the SP-600 (many signals get into the first mixer). Image and Spurious responses are rated at better than 74 db. Bill Kleronomos again "These were checked at 40MHz and were unmeasurable due to test equipment limitations, which means 90 db or better; an outstanding figure." ²

AUDIO DISTORTION: Measured distortion at 1kHz ranged from 3% at 100mw, 6% at 500 mw and 10% at 1 w. Audio response was basically flat from 100 Hz up to the selectivity limit. ((2)) The only audio distortion I noted was when the Noise Limiter was switched on. Although the limiter works very well on noise, it also distorts the audio, often making signals difficult to understand.

PRACTICAL USE AND STUFF

ANTENNAS: John Bryant has used 90 meter full wave deltas, an array of 450' Beverages and an amplified ferrite bar loop (for MW). All are impedance matched to 50 ohms. All seem to work well with the SP-600's antenna input (95 ohm) on Tropical Bands. John does not own an antenna tuner, however, with impedances already closely matched, he feels that a tuner would not improve matching. On the other hand, my experiences with various MW loops (4-5) has been somewhat different. I was unable to get my 'Wedge' loop to perform well with the SP-600. The Wedge has a single ended FET input amplifier with a 50 ohm emitter-follower output stage. The Space Magnet loop (with a similar, but different emitter-follower output stage) was the best of the bunch, as it appeared to have little or no loss. There is no

antenna trimmer on the SP-600. Those surveyed indicated a preference for one and most users indicated that they used an external tuner. It is a clear necessity if interfacing with a wide variety of antennas.

TUNING: I've found tuning on the BCB to be very nice with this set. Naturally, the BCB has the largest distance between stations... I can imagine the serious SW DXer having problems in crowded bands where the space between 5 kHz stations is a breath away. Using the variable BFO, it is fairly easy to nail BCB stations within a kHz; even eyeballing to 0.1 kHz when appropriate, although I really don't have much experience using the SP-660 to hear 'off frequency' foreign stations. Since the BCB is broken into two pieces (breaks at 1350 kHz), the flywheel action is a MUST for bandscanning. The entire BCB readout is to 10kHz, including the portion on band 2 from 1350 to 1600. Above 1600, marking moves up to every 20 kHz as noted above.

John Bryant adds

"From an aesthetic point of view, I love the SP-600 tuning. However, from a practical point of view, it leaves much to be desired. The commitment to a single tuning rate, rather than main and band spread, forced the designers to compromise on gear ratios; this is one receiver that really needs a stick-shift transmission. The counter-weighted flywheels do make moving from one part of the dial to a distant point a fairly easy and rapid task. However, for fine tuning or slowly sweeping across one of the Tropical Bands, the gear ratio is wrong... you truly need the touch of a safe cracker. I find that I always need to throw on the BFO to make sure that I am exactly tuned to the signal. I do wish that there were either gear-driven or electrical incremental tuning. On the other hand, tuning the SP-600 is FUN... you are aware of controlling a real radio and you are aware that it takes practice and skill to get the most out of this beauty. It is sort of the feeling that F-16 pilots must have... it ain't easy, but is sure the heck is fun.

"I have only used the logging scale a few times just to see if it would work. It works like a charm. The receiver is stable enough that I can return to the same signal days later very easily and very predictably. If I was not lazy, I would have developed the frequency charts necessary to be able to read frequencies to the kilohertz. Instead, I have installed the digital frequency readout by CCI which is reviewed in Proceedings 1992. I feel very guilty about this, I should be a purist and use charts. I have both a 200 Hz and a 1 MHz crystal calibrator on board my SP-600. Using those to judge how much the dial is 'off' in a particular area, I can read the main dial to +/- 5 kHz. Not bad. It is also rather easy to see that the dial itself is not quite linear with the radio. It is quite close, however."

SPEAKER: I never got a speaker for the set because it has a 600 ohm output. The scarcity of 600 ohm speakers is one of the drawbacks to buying any surplus receiver. I have used the SP-600 as a Trans-Pacific parallel checking set; it gets the stronger NHK stations easily enough when using a 150' longwire. I switch it into my 'audio system' consisting of a multiple selection switch feeding the input of a reel-to-reel tape recorder always kept in the 'record' mode. Volume adjustments are easily made with the audio gain knob on the SP-600 or the record level knob on the tape recorder.

COMPARISONS

David Clark rates the SP-600 better than an HQ-180 on BCB, but gives the edge to the HQ-180 on Tropical Bands, and generally prefers the SP-600 over an R-390A. Jef Jaisun notes that it outperforms a GE Superadio II and Sony ICF-SW7600 on MW. Bill Kleronomos prefers his SP-600 for casual listening and fast tuning, something impossible to do with his R-390A. Hank Holbrook prefers the HQ-129X which is far superior for crystal tuning. Shawn Merrigan prefers the tuning of the SP-600 when bandscanning and against the R-390A and NRD-525 it compared favorably, though harder to find a specific station.

MODIFICATIONS - ELECTRICAL PROBLEMS

BLACK TUBULAR CAPACITOR: This is documented over and over; they simply must all be replaced. These black tubular capacitors (39 - 0.01 uF, 14 - 0.02 uF) are famous for developing leaks and shorts thus clobbering the performance of this set. And a potential fire hazard as well! They should be replaced with 1 kV disc ceramics. Unfortunately, a number of space problems will arise when doing so, as the circuitry is often cramped. People used to doing this kind of work usually spend about 100 hours at it! It is an exercise in dexterity and perseverance and should not be attempted by any but the most experienced people. An excellent technique is to make small drawings of the circuitry BEFORE removing the tubulars, then, with the help of the schematic few errors are made. It's also a good idea to test your replacement capacitors BEFORE installing them. Interesting descriptions of the task can be found in Hollow State Newsletter #19, p 7-8, #20, p 2.³ Thanks to Bob Kulow for pointing this out to SP-600 owners... and yes, all users surveyed had either replaced their capacitors or had problems with 'blown' ones (and have their fingers crossed!).

FILTER CHOKE LEAKAGE: Remove all wires from both filter power supply filter chokes and measure the resistance to ground. Many are less than 15 kohm indicating poor internal isolation from ground. It's best to insulate the chokes from ground by enlarging the base plate mounting holes, and then remount the chokes using insulated step washers. Don't forget to remeasure the resistance after mounting to be sure they are completely isolated. Hollow State Newsletter #18, p 4.³

SELECTIVITY ENHANCEMENT: Dallas Lankford describes a technique for adding Collins mechanical filters within the filter preceding the first IF in the Hollow State Newsletter #15, p 4-7.³

Three excellent and interesting articles by Bill Kleronomos in Electric Radio #20, 21 and 22 describe several additional receiver 'tweaks' and modifications. These include: frequency drift due to poor B+ and filament voltage regulation (vastly improved SSB and CW reception), construction of a high performance product detector (everyone needs a product detector... although quite a bit of reworking the set is required), and tube exchanges to improve performance. The third of these is worth mentioning further because it is the most useful. It's also the easiest to do.

Tube substitution of the RF amplifiers with tubes of lower noise figures greatly improves the overall noise figure of the SP-600. Replace the RF 6BA6s with a 6DC6, 6DK6, 6GM6, 6JK6 or 6GU5. The list of tubes is in descending order of equivalent noise resistance; even the 6DC6 change is a vast improvement.

OVERALL OPINION

John Bryant

"My SP-600 is a completely remanufactured unit which was stripped to parts and then re-assembled using as many new components (including tube sockets, all caps and resistors, etc). It also has a new audio section (design similar to the Collins 75A4) and a new SSB module and two crystal calibrators. It's RF and IF sections for AM are stock, however. For all purposes, it is an electrically brand new unit with better audio. I am using an HC-10 unit with my SP-600.

"With the SP-600/HC-10 combination, I have found the main receiver that I will use for fixed base DXing and for program listening for as long as I continue in radio. I have spent many hours comparing the SP-600/HC-10 with my highly modified NRD-525 and MAP combination. In almost every DX situation, the SP-600/HC-10 either wins or ties the NRD combo. Besides being as sensitive, more or less, and as selective, more or less, the vastly superior audio quality of the SP-600/HC-10 is extremely useful when trying to understand audio that is at the noise floor.

"What this system CAN NOT offer, however, is the convenience and nimbleness that the memories and other fruits of automation bring to the major solid state receivers of the late 1980s. Personally, I think that I will continue to use something like the 525 to FIND the DX and the SP-600/HC-10 to HEAR and UNDERSTAND it."

Having used many receivers over the years, I can truly say I enjoyed the many hours spent in front of my SP-600. As John has pointed out, it is a wonder to tune. I originally purchased my SP-600 shortly after I was married in 1976 and it was set up for DX in the 'spare room' of our house until my son was born in 1980 (thus terminating the designation 'spare room'). I did have some problems interfacing my loops with the set, and you all know that loops are a BCB DXers best friend! So I drifted away from the set in favor of an R-392, which had a built in antenna tuner; and better readout too. The SP-600 was soon sold in favor of a smaller, more compact set that fit my slightly revised DX style. In preparation for this article I obtained another set and used it head-to-head with the other radios in the shack, including two solid state sets. I was once again impressed with the performance of the SP-600; it's definitely a 'keeper'... I'm glad it's back!

I would like to thank the many SP-600 owners/users that assisted me with this article including: John Bryant, David Clark, James Goodwin, Hank Holbrook, Jef Jaisun, Bill Kleronomos, Dallas Lankford, John Leary, Pat Martin, Shawn Merrigan, Rick Setliff and Jack Woods.

² 'Hammarlund Super-Pro: SP-600JX-17' and 'Update That Super-Pro' (series) by Bill Kleronomos KD0HG, "Electric Radio" issues 20, 21 and 22 [PO Box 57, Hesperus CO 81326]

³ Hollow State Newsletter reprints are available from HSN, PO Box 1831, Perris CA 92572-1831.

FIXING THE GFI PROBLEM IN THE R-390/390A

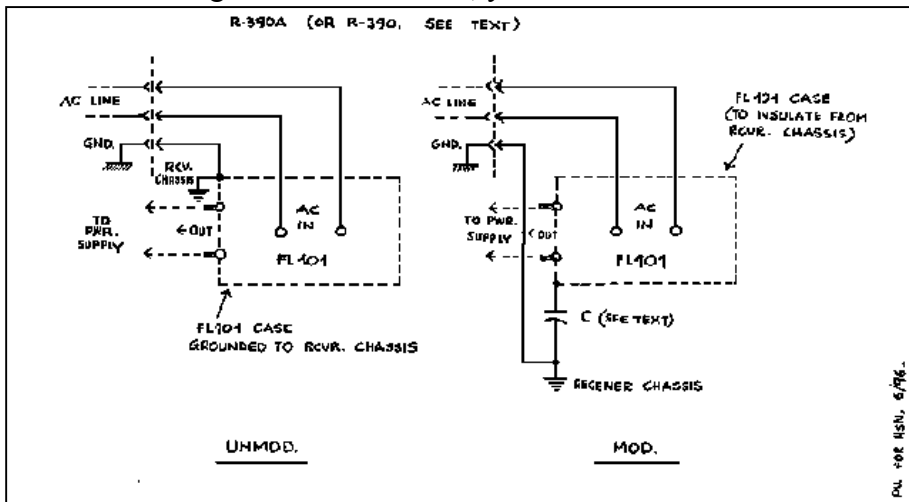
by Paulo Viappiani

A most of us R-390 and R-390A users know, the presence of a sealed AC Line Filter (FL101 in both the R-390 and R-390A) can be a problem with the often leaky internal capacitors causing the line (or house) Ground Fault Interrupter (GFI) to 'trip'. For this reason, many users choose to remove the AC Line Filter from the receiver and discard it. It's really a pity; FL101 is an original part of these receivers and I do not agree with the need for removal.

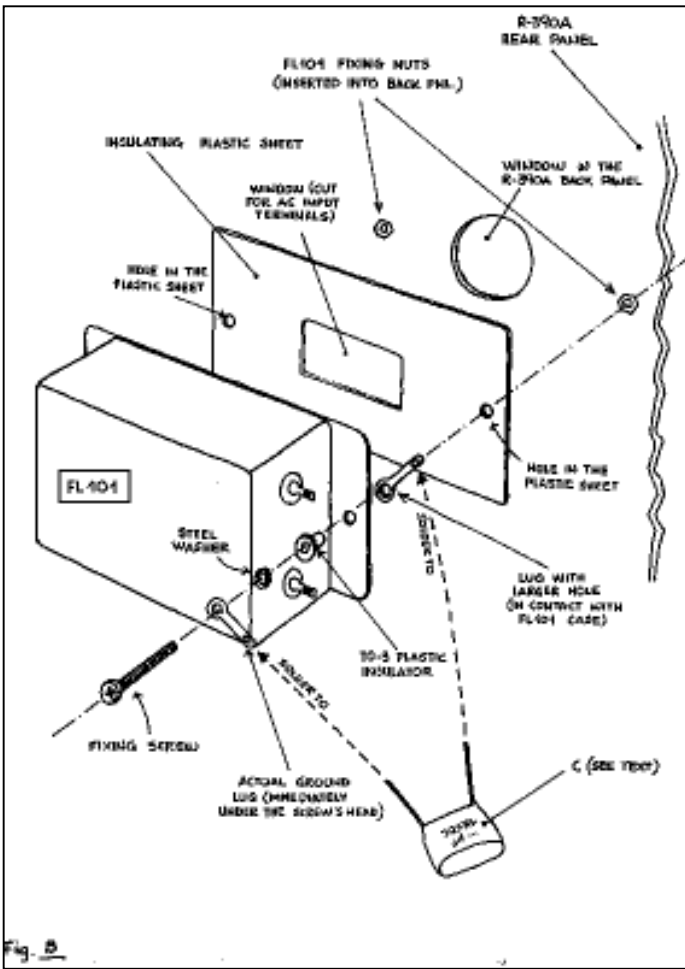
A simple fix to the problem is to adequately insulate the filter can from the chassis ground. This can be done by interposing a thin sheet of stiff plastic (available at stationary/office supply stores) between the FL101 can and the rear panel of the receiver.

Obviously you have to properly cut holes in the plastic sheet for the AC input terminals and the FL101 mounting screws. Moreover, you have to insert insulated feed-throughs (I used the ones specifically

made for TO-3 transistor mounting) into the screw holes before reinstalling the AC filter. While you are in there, it is also convenient to insert two soldering lugs: one for the actual ground, directly facing the head of the mounting screw (but insulated from the FL101 case) and the other (with a larger hole) between the filter case and the insulating sheet. The schematic and Figure B on pg. 8 show the schematic diagram (before and after



modification) and the layout regarding the R-390A. In the R-390 such a mod is also possible, but it is more difficult and requires a bit more skill. You have to provide insulation from ground not only to the FL101 case and to all its mounting screws, but also to the outer threads of the power connector socket and to its



mounting nuts (and to the body of the power connector itself. It has to be entirely covered with insulating varnish or plastic tape and must remain disconnected from the ground lead !!). After reinstallation of the “insulated” FL101 you can solder in the mylar or poly capacitor (safety rated for 1,000 VDC) of the greatest capacitive value that does not cause the GFI action (I always use 0.01 μ F). Of course the filtering action of FL101 is substantially reduced with this mod, but this preserves the original parts and you can easily use an external filter connected to the power cord. This mod is particularly important for European user due to the high AC line voltages currently available here (more than 240 VAC in Great Britain, about 220-230 VAC here in Italy).

QUESTIONS AND ANSWERS FROM OUR READERS

This section will present questions from subscribers for which responses are solicited. If you can help in providing answers, suggestions or just plain good advice - please send them to the editor for inclusion in the next issue of HSN.

Nothing this issue

SHORT SUBJECTS

For you internet/e-mail clients, there is a new mail reflector called the R-390 Mailing List. The co-administrators are Chuck Ripple, WA4HHG and Michael Crestohl, W1RC. Send e-mail to majordomo@qth.net with the command subscribe r-390 in the message body. This is brand new as of October and is dedicated to the R-390 family of receivers.

PUBLICATIONS OF INTEREST

If video tapes are ‘publications’ then those of you who are well-heeled might want to get the 7-hour set of R-390A videos featuring boatanchor veteran Chuck Rippel. As per information from Hi-Res Communications, these tapes cover such topics as “How to pick out an R-390A”, its “Modules”, “Circuit Description”, “PTOs”, “Performance Evaluation and Modifications”, “Troubleshooting” and “Restoration”. I haven’t seen them, nor am I aware of anyone who has. . . . so I don’t have any informed recommendations. They are a bit ‘pricy’ at \$109.95 + shipping, but probably interesting, especially for someone fairly new to the R-390A. Contact Hi-Res Communications, Inc., 8232 Woodview Dr., Clarkston MI 48348-4058. Call or fax to (248) 391-6660; E-mail to hires@rust.net; website <http://www.rust.net/~hires>. Anyone venture-some enough to get them, how about a review for HNS??? [editor]

WANTED TO BUY / SELL / TRADE / WHATEVER

Nothing this issue

43 43 43 43 43 43 43 43 43